



**INSTALLATION AND SERVICE MANUAL
PROHEAT X30**

PROHEAT

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A. SAFETY

Throughout this manual, you will see notes labeled **DANGER**, **WARNING**, **CAUTION** and **NOTICE** to alert you to special instructions or precautions concerning a particular procedure that would be hazardous if performed incorrectly or carelessly.

Observe them carefully!

These safety alerts alone cannot eliminate all hazards. Strict compliance with these special instructions and common sense are major accident prevention measures.

▲ DANGER

Immediate hazards that will result in severe injury or death.

▲ WARNING

Hazards or unsafe practices that could result in severe personal injury or death.

▲ CAUTION

Hazards or unsafe practices that could result in minor injury or product or property damage.

NOTICE

Information that is important to proper installation or maintenance, but is not hazard-related.

SAFETY CONSIDERATIONS

▲ WARNING

Exhaust

Inhalation of exhaust gas (containing carbon monoxide) may cause severe personal injury and/or death. Anyone suspected of suffering from CO inhalation should be removed from the hazardous area and given medical assistance immediately.

▲ WARNING

Explosion Hazard

Do not operate heater where combustible fumes or airborne particles, such as sawdust, are present.

▲ WARNING

Fuel

Exercise extreme caution when working near fuel or fuel-filled equipment. Do not operate heater during fueling operations. In addition, do not smoke or handle open flame equipment, such as a blowtorch, around fuel.

▲ WARNING

Fire Hazard

Do not place any flammable items around the heater and exhaust pipe.

▲ WARNING

Batteries

Wear hand and eye protection when working near batteries. Do not smoke or use open flames near batteries.

▲ WARNING

Electrical

Electric shock can cause severe personal injury, burns, and death. Before working on any unit, disconnect the batteries. Use only approved materials and methods when working on the electrical system and follow local electrical codes. Never work with electricity in wet conditions or when you are feeling fatigued.

▲ WARNING

Poisons/Toxins

Fuel and coolant are toxic and in some cases, carcinogenic. Wear eye and hand protection at all times. Remove contaminated clothing immediately and wash contaminated skin. Do not breathe in vapors.

▲ WARNING

Moving/Hot Parts

Moving/hot parts can cause severe injury and or death. Before working on any unit, shut it off. Do not operate any unit until protective covers have been replaced. Always ensure bolts and clamps are correctly torqued and secured. Inspect mechanical components periodically for damage and corrosion.

▲ WARNING

Coolant

Never remove the filler cap when the engine is hot – escaping steam or scalding water could cause serious personal injury. The coolant level in the expansion tank should be checked at least weekly (more frequently in high mileage or arduous conditions). Always check the level *when the system is cold*. Unscrew the filler cap slowly, allowing the pressure to escape before removing completely. *Never* run the engine without coolant.

Prevent anti-freeze coming in contact with the skin or eyes. If this occurs, rinse immediately with plenty of water. Anti-freeze will damage painted surfaces.

Never top-up with salt water. Even when travelling in territories where the water supply contains salt, always ensure you carry a supply of fresh (rain or distilled) water.

▲ DANGER

California Proposition 65 Warning

Do not operate heater in garages or in other closed or unventilated areas.

Diesel exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Electrical components in this product may contain lead, a chemical known to the State of California to cause cancer and birth defects and other reproductive harm.

B. INTRODUCTION

PROHEAT Model X30



This manual is provided to assist authorized PROHEAT dealers install and service PROHEAT X30 heaters. The X30 can be configured for a variety of applications and for either 12V or 24V power supply.

Please refer to the X30 Parts Book at www.proheat.com for detailed part descriptions and part numbers. The parts book also provides information on optional equipment, such as timers, sleeper fan control kit, impact switch (for school bus applications), and associated installation and maintenance tools.

B.1 HEATER APPLICATIONS

Although trucks have been used in the examples, PROHEAT heaters are designed to be used on any diesel-equipped vehicle including trucks, buses (school, transit, and coach), construction equipment, off road equipment, military equipment, and cargo carriers.

PROHEAT heaters can be used in a variety of applications including:

Engine block heat – PROHEAT will preheat an engine block to ensure reliable starting in cold weather. When used throughout the year, it helps to reduce the wear associated with cold starts.

Cab or sleeper heat (with the engine off) – PROHEAT will supply heat to a vehicle cab or sleeper so drivers can sleep in comfort during cold weather without idling the engine, which reduces fuel consumption.

Supplemental heat (with the engine running) – as the efficiency of modern diesel engines improves, there is less reject heat available to heat the vehicle's interior, particularly for buses. PROHEAT can be used while the vehicle is operating to provide supplemental heat for the vehicle interior and to maintain optimum engine temperature.

Cargo heat – PROHEAT can be used to provide heat to protect valuable cargo, such as produce or beverages, from damage due to freezing.

Marine applications – Marine applications typically involve the engineering and installation of a complete hot-water heating system of which PROHEAT is one component. PROHEAT recommends that only an expert in marine hot-water heating systems install a PROHEAT on a boat. The installer is responsible for ensuring that the installation complies with all applicable regulations.

1.0 TECHNICAL SPECIFICATIONS

X30 10–30 V	
RATING	15,000 – 31,000 BTU (4.4 – 9.1 KW)
OPERATING VOLTAGE RANGE	10–30 VDC
POWER CONSUMPTION	90 Watts max. (7.5A @ 12VDC, 3.8A @ 24VDC)
FUEL CONSUMPTION	0.1 – 0.31 gal./hr (0.4 – 1.17 L hr)
COOLANT FLOW	3.0 gal./min (11.4 L/min)
COOLANT TEMPERATURE (at heater)	150°F to 185°F (65°C to 85°C)
OPERATING TEMPERATURE RANGE	-40°F to 185°F (-40°C to 85°C)
IGNITION TYPE	Electronic spark ignition
HEAT EXCHANGER CAPACITY	0.36 qt. (0.34 L)
WEIGHT Heater ONLY	36 lb. (16.3 kg)
WEIGHT Heater with enclosure	44 lb. (20 kg)
DIMENSIONS – HEATER (L x W x H)	12.3 x 10.2 x 9.9 inches (312 x 256 x 251 mm)
DIMENSIONS – ENCLOSURE (L x W x H)	13.25 x 11.25 x 11 inches (337 x 286 x 279 mm)
WARRANTY	Two years parts and labor

▲ DANGER

DO NOT use gasoline.

FUEL TYPES	
COMPATIBLE	Diesel (ULSD #1, #2 and Arctic Blend), Kerosene (K-1), Jet (A, A-1 and JP8), Bio fuels (up to B20*)

**For biofuels higher than B20, contact PROHEAT www.proheat.com*

SYSTEM OUTPUTS	
SWITCH/TIMER POWER	Same as system voltage Maximum 1 A draw (overload shutoff protection) High-side switched
INDICATOR LIGHT	Same as system voltage Maximum 1 A draw (overload shutoff protection) High-side switched

SYSTEM INPUTS	
SWITCH	12–24 V Standard mode Preheat mode (momentary) Supplemental mode Antifreeze mode Supplemental Priority, Supplemental Max Heat, Global Low Temperature mode
POWER	10–30 VDC
CAN Bus	Meets SAE J1939-11

1.1 PHYSICAL – X30

1.1.1 X30 HEATER

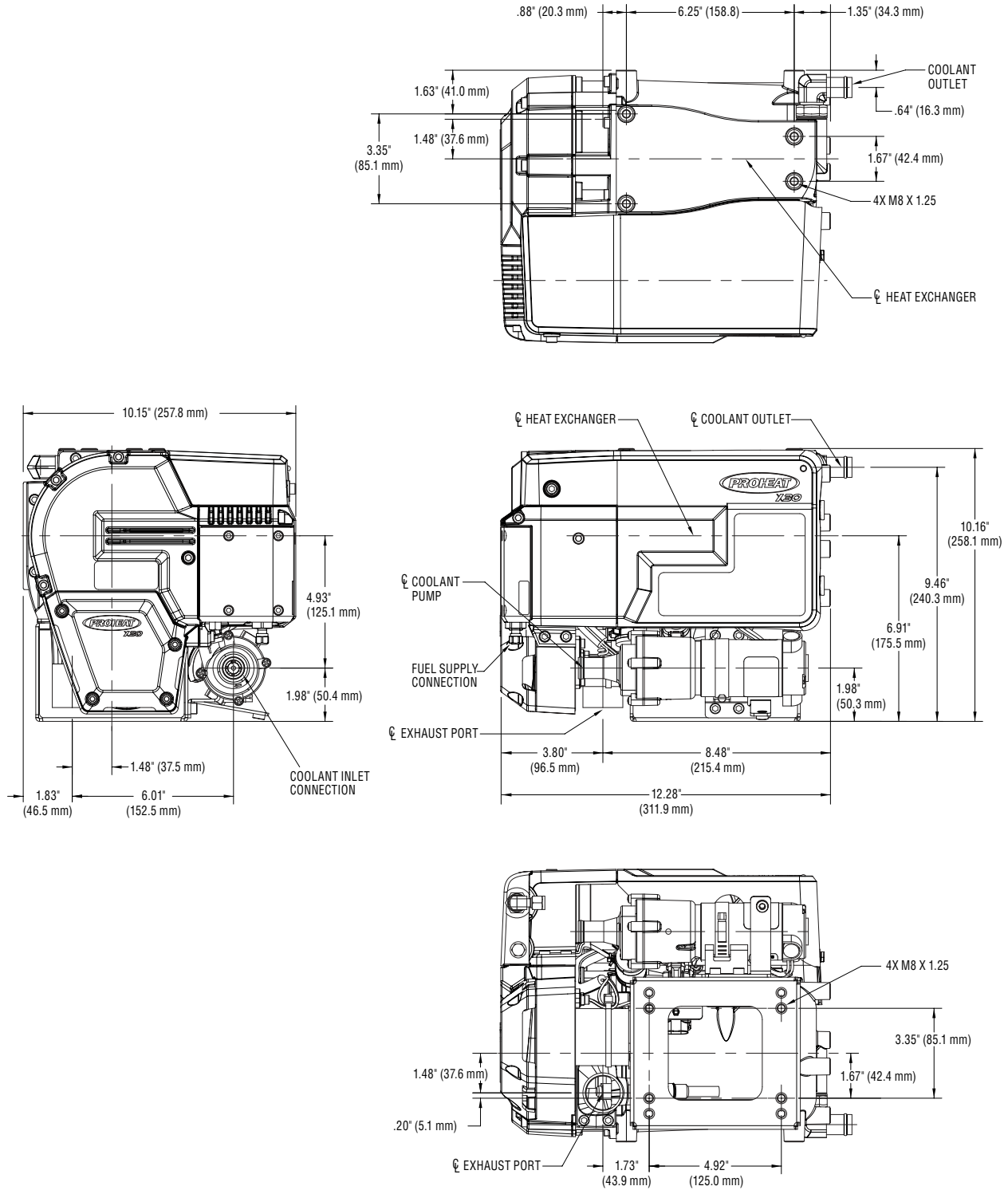


Figure 1-1. Heater Dimensions – X30.

1.1.2 X30 WITH ENCLOSURE

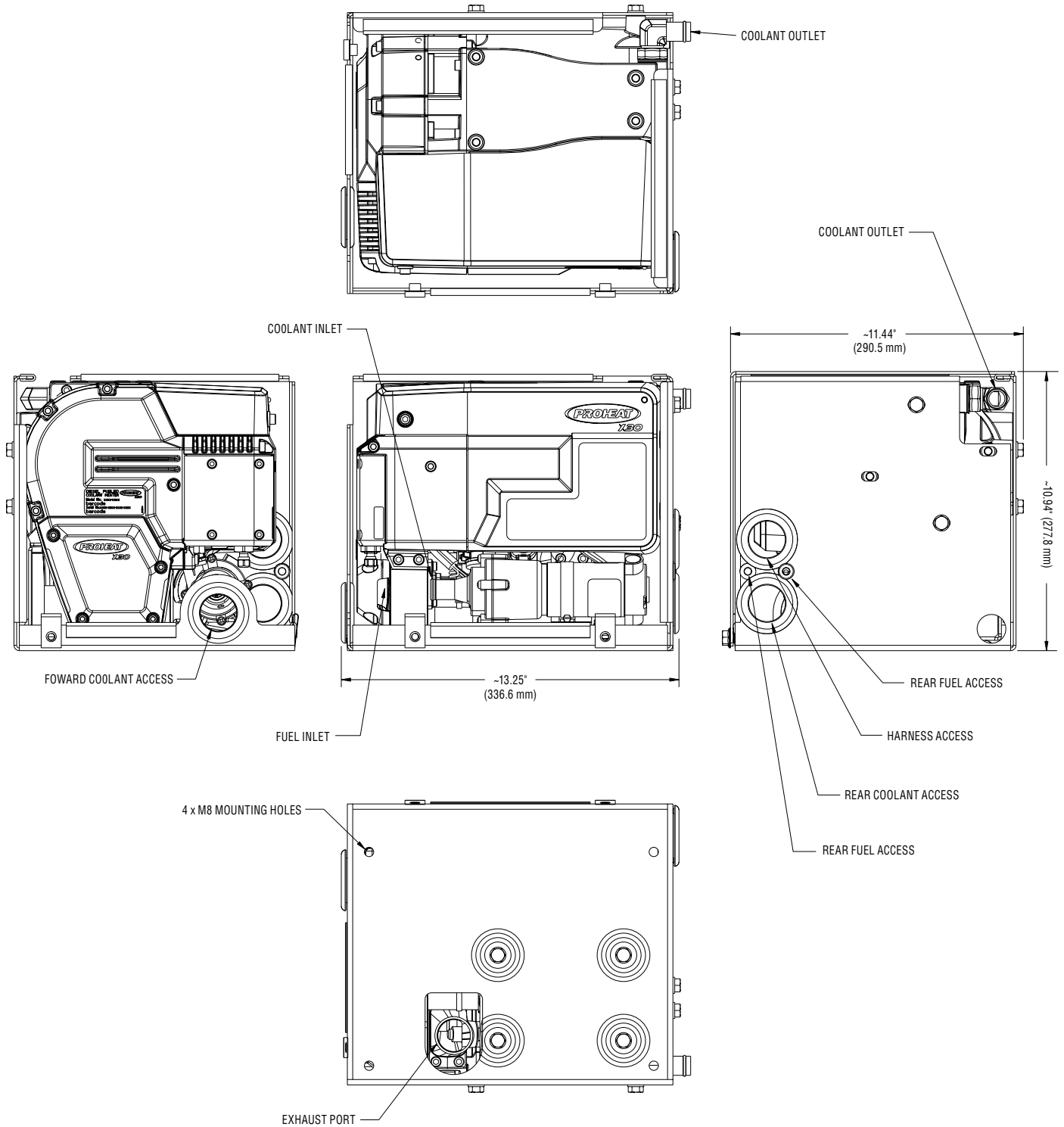
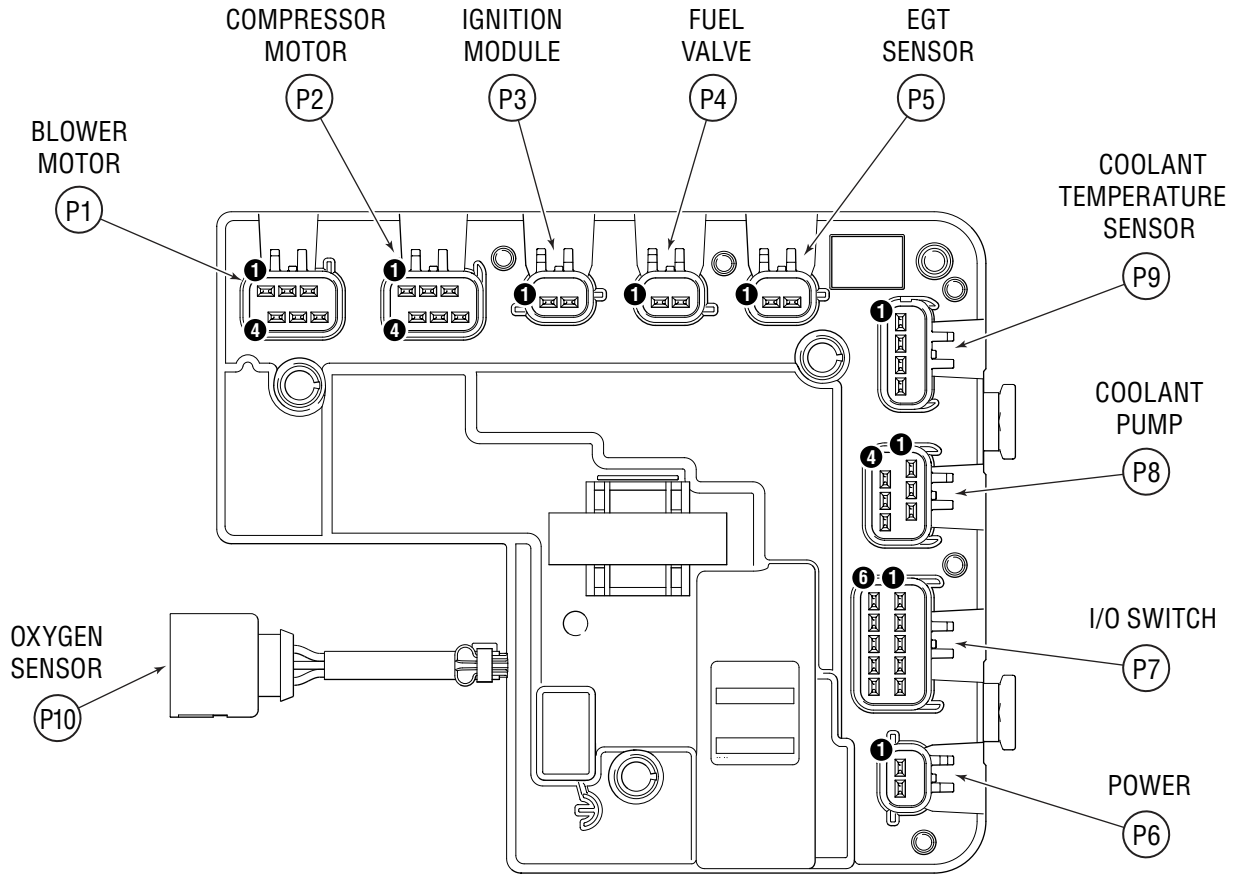


Figure 1-2. Heater Dimensions including Enclosure – X30.

1.2 ELECTRICAL – X30



● PIN Number Ref.

NOTICE

All control signal input voltages must match heater supply voltage.
All heater output signals will match heater supply voltage.

Figure 1-3. PCM Electrical Connections – X30.

P1 – BLOWER MOTOR

Mating Connector: Delphi 15412914 – Female 6-Way, Light Gray

Terminal: Delphi 10757690 – Female 18-20AWG Tin Plated

Cavity Plug: Delphi 15316894 – Cavity Plug

Pin 1 – Blower Speed Sensor (+) RED

Pin 2 – Blower Speed Sensor Signal return WHITE

Pin 3 – Plugged

Pin 4 – Blower Speed Sensor (-) GREEN

Pin 5 – Blower (-) BLACK

Pin 6 – Blower (+) PURPLE

P2 – COMPRESSOR MOTOR

Mating Connector: Delphi 33500106 – Female 6-Way, Dark Gray

Terminal: Delphi 10757690 – Female 18-20AWG Tin Plated

Cavity Plug: Delphi 15316894 – Cavity Plug

Pin 1 – Plugged

Pin 2 – Plugged

Pin 3 – Plugged

Pin 4 – Plugged

Pin 5 – Compressor (-) BLACK

Pin 6 – Compressor (+) ORANGE

P3 – IGNITION MODULE

Mating Connector: Delphi 15380781 – Female 2-Way, Light Gray

Terminal: Delphi 10757690 – Female 18-20AWG Tin Plated

Pin 1 – Ignitor (+) RED

Pin 2 – Ignitor (-) BLACK

P4 – FUEL VALVE

Mating Connector: Delphi 54200208–Female 2-Way, Dark Gray

Terminal: Delphi 10757690 - Female 18-20AWG Tin Plated

Pin 1 – Valve (+) GREEN

Pin 2 – Valve (-) GREEN

P5 – EGT SENSOR

Mating Connector: Delphi 13768919 Female 2-Way, Natural (Clear)

Terminal: Delphi 10757690 Female 18-20AWG Tin Plated

Pin 1 – Sensor (+) GREY

Pin 2 – Sensor (-) WHITE

P6 – POWER*

Mating Connector: Delphi 33500084 Female 2-Way, Black

Terminal: Delphi 15512740 Female 10-12AWG Gold Plated

Pin 1 – Battery (+) RED (15 AMP FUSE at source)

Pin 2 – Battery (-) BLACK (must be fused (15 AMP) if using a ground side battery disconnect)

P7 – I/O SWITCH*

Mating Connector: Delphi 15316895 Female 10-Way, Black

Terminal: Delphi 15422510 Female 16-18AWG Gold Plated

Cavity Plug: Delphi 15316894 - Cavity Plug

Pin 1 – Plugged or optional add in Supplemental Mode harness

Pin 2 – Plugged or optional add in Preheat harness

Pin 3 – On Signal Input – Standard Mode (+) GREEN

Pin 4 – Accessory Output (+) RED (1 AMP MAX)

Pin 5 – Indicator Output (+) WHITE or YELLOW (1 AMP MAX)

Pin 6 – Plugged or optional add in Anti-Freeze harness

Pin 7 – Ground Output (-) BLACK (1 AMP MAX)

Pin 8 – Plugged or CAN Bus High YELLOW

Pin 9 – Plugged or CAN Bus Low GREEN

Pin 10 – Plugged or CAN Bus Shield BLACK

P8 – COOLANT PUMP

Mating Connector: Delphi 15419838 Female 6-Way, Black

Terminal: Delphi 10757690 Female 18-20AWG Tin Plated

Cavity Plug: Delphi 15316894 - Cavity Plug

Pin 1 – Plugged

Pin 2 – Plugged

Pin 3 – Plugged

Pin 4 – Plugged

Pin 5 – Coolant Pump (-) BLACK

Pin 6 – Coolant Pump (+) BLUE

P9 – COOLANT TEMP SENSOR

Mating Connector: Delphi 15425692 Female 4-Way, Black

Terminal: Delphi 10757690 Female 18-20AWG Tin Plated

Pin 1 – Digital Outlet Temp Power/Signal (+) BLUE

Pin 2 – Digital Outlet Temp Ground (-) BLACK

Pin 3 – Analog Outlet Temp Positive (+) YELLOW

Pin 4 – Analog Outlet Temp Negative (-) BROWN

P10 – OXYGEN SENSOR

PCM Connector: Bosch 1 928 404 669 Female 6-Way, Black

Wire Seal: TE 964972-1 17AWG, Yellow

Terminal: TE 1241380-2_Female 17-20AWG Tin Plated

Pin 1 – Pump current APE / IP RED

Pin 2 – Virtual ground IPN / VM YELLOW

Pin 3 – Heater voltage H- / Uh WHITE

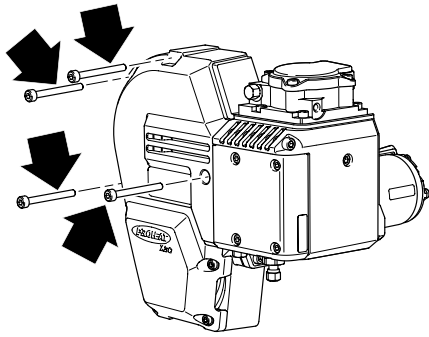
Pin 4 – Heater voltage H+ / Uh+ GREY

Pin 5 – Trim resistor RT / IA GREEN

Pin 6 – Nernst voltage UN / RE BLACK

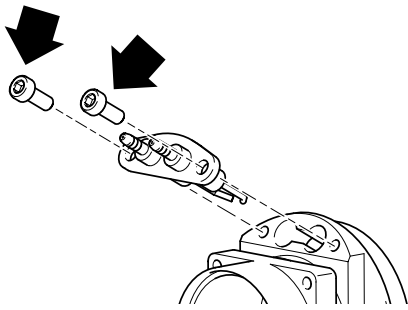
* **NOTE: IMPORTANT** – only mating gold terminals should be used.

1.3 TORQUE SPECIFICATIONS



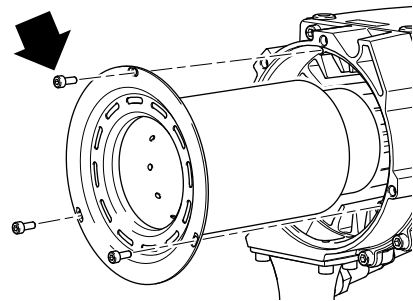
Burner Head Assembly

- Apply Loctite® (Blue) to bolts (4)
- Torque bolts (4) to 100±7 in/lbs (11.3±0.8 Nm)



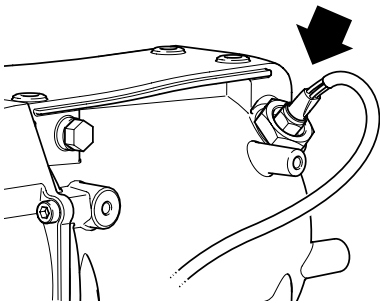
IGNITER

- Apply Loctite® (Blue) to igniter threads
- Ensure gasket is present before installing
- Torque igniter to 27±3 in/lbs (3.0±0.3 Nm)



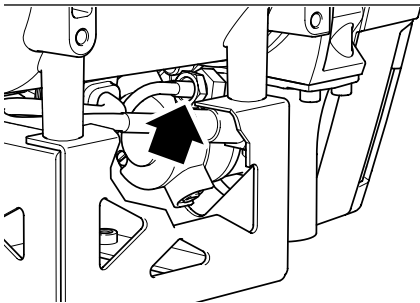
COMBUSTION TUBE

- Apply anti-seize to cap screws
- Torque cap screws (4) to 12±3 in/lbs (1.4±0.3 Nm)



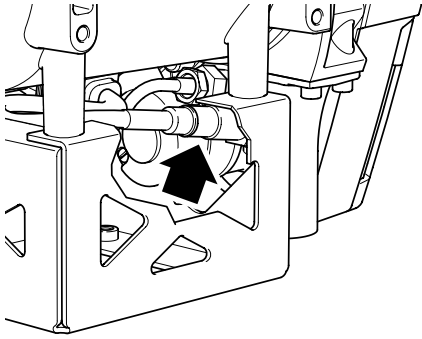
DUAL MODE OUTLET TEMPERATURE SENSOR

- Lubricate O-ring with O-ring lubricant
- Torque sensor to 500±50 in/lbs (56±5.6 Nm)



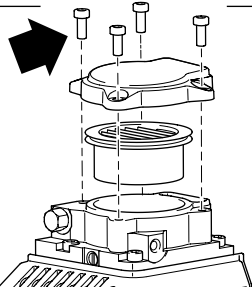
EGT SENSOR

- Apply anti-seize compound to sensor threads
- Torque sensor to 200±25 in/lbs (22.6±2.8 Nm)



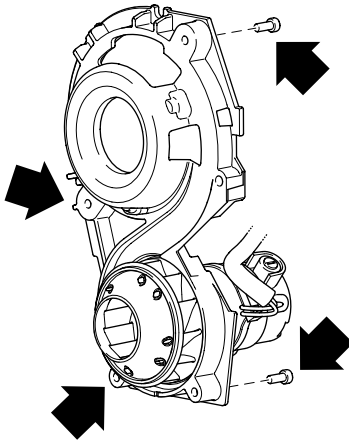
O₂ SENSOR

- Apply anti-seize compound to sensor threads
- Torque sensor to 100±12 in/lbs (11.3±1.4 Nm)



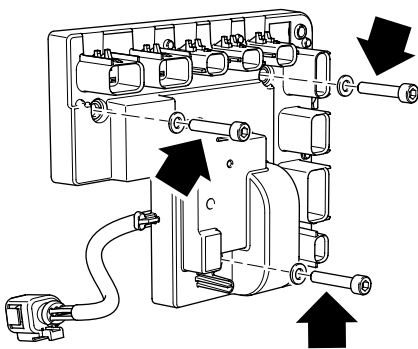
AIR FILTER

- Torque cap screws (4) to 27±3 in/lbs (3.0±0.3 Nm)



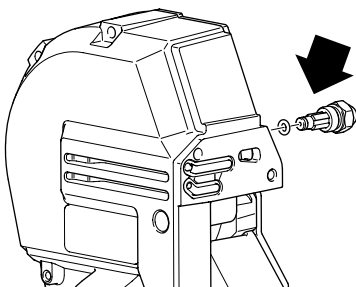
BLOWER ASSEMBLY

- Apply anti-seize to bolts (4)
- Torque bolts (4) to 27±3 in/lbs (3.0±0.3 Nm)



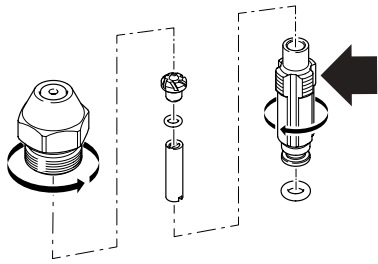
X30 PROHEAT CONTROL MODULE (PCM)

- Apply anti-seize to bolts (3)
- Torque bolts (3) to 75±7 in/lbs (8.5±0.8 Nm)



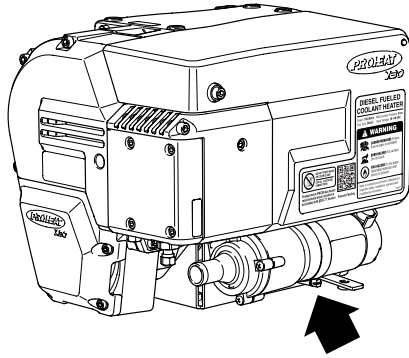
NOZZLE TO FAN END

- Lubricate O-ring on nozzle with diesel
- Torque nozzle to 150±10 in/lbs (17±1.1 Nm)



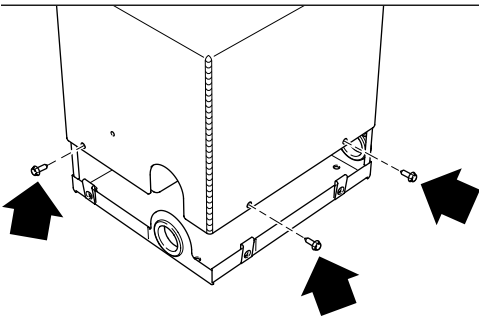
NOZZLE REASSEMBLY

- Torque nozzle (1) to 25–30 in/lbs (2.83–3.39 Nm)



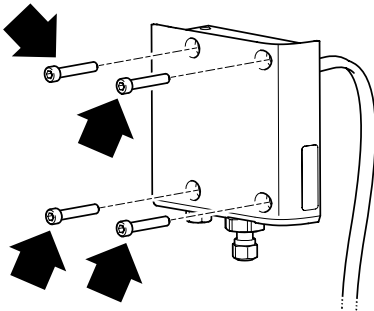
BAND CLAMP

- Torque clamp to 35±3 in/lbs (4.0±0.3 Nm)



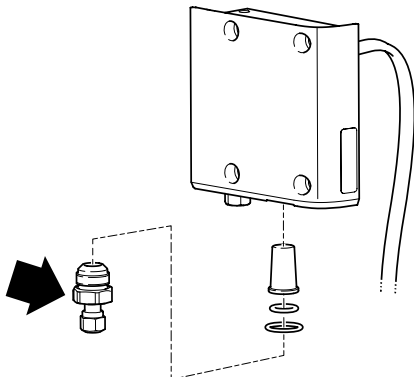
ENCLOSURE LID (Optional)

- Anti-seize recommended on bolts
- Torque bolts (3) to 30±3 in/lbs (3.4±0.3 Nm)



FUEL PUMP ASSEMBLY

- Apply Loctite® (242) to threads
- Torque bolts (4) to 27±3 in/lbs (3.0±0.3 Nm)



FUEL FILTER

- Lubricate O-ring with diesel fuel
- Torque nut (1) to 150±10 in/lbs (17±1.1 Nm)

2.0 INSTALLATION

NOTICE

If additional installation information is required, please contact your PROHEAT dealer regarding your specific application.

For more technical information, please contact PROHEAT Product Support at www.proheat.com

The installation details described in this manual focus on truck applications and do not cover all of the possible installations. As seen in the figures below, the PROHEAT X30 can be installed on a variety of equipment including trucks, school buses, coaches, drill rigs, mine dump trucks, and excavators. In these cases, the manual should be used as a guideline only.

There are eight major steps that must be completed to successfully install the PROHEAT heater:

- 2.1** LOCATING THE HEATER..... page 2-2
- 2.2** MOUNTING THE HEATER page 2-4
- 2.3** EXHAUST PIPE CONNECTION page 2-10
- 2.4** COMBUSTION AIR SUPPLY page 2-12
- 2.5** PLUMBING THE SYSTEM page 2-13
- 2.6** WIRING & ELECTRICAL CONNECTIONS page 2-17
- 2.7** FUEL SYSTEM page 2-28
- 2.8** FIRST TIME STARTUP page 2-32

Prior to the installation of your PROHEAT, consult your engine owner's manual or engine manufacturer for any restrictions or changes that may apply to plumbing into the engine coolant system.

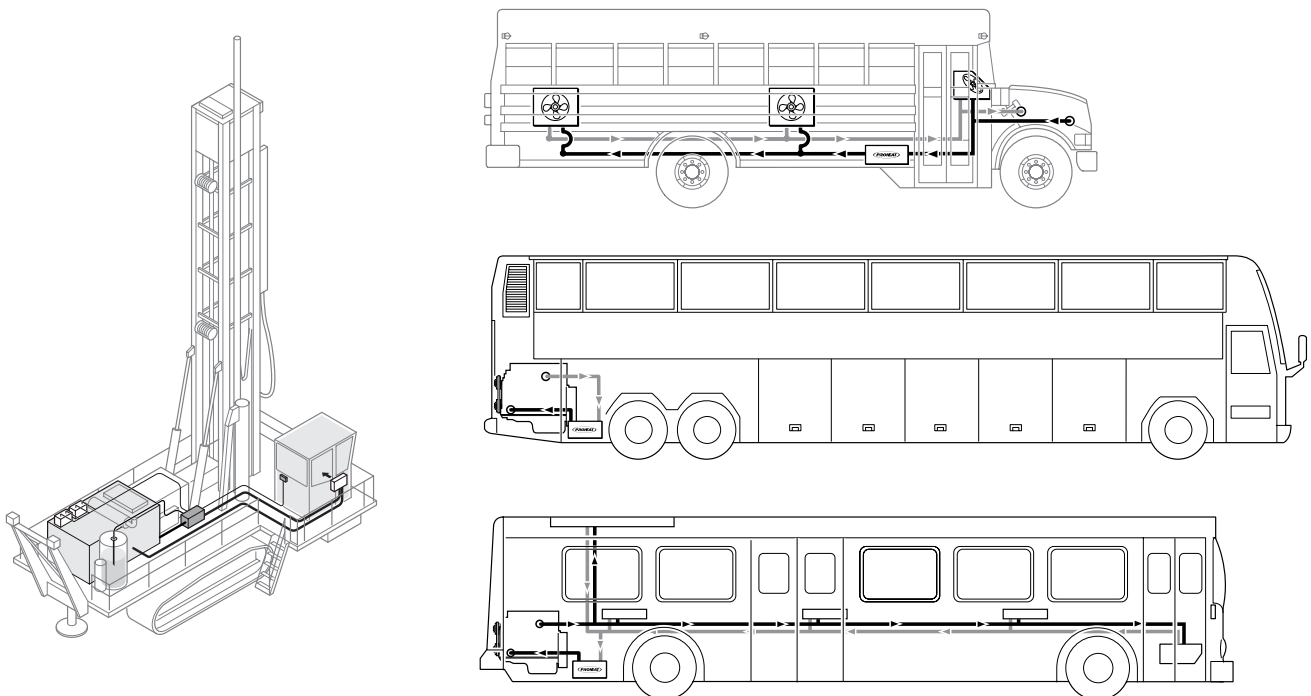


Figure 2-1. Other Applications.

2.1 LOCATING THE HEATER

2.1.1 SELECT YOUR LOCATION

You Choose 

⚠ CAUTION

Do not weld PROHEAT heater mounting brackets to the vehicle frame.

If repairs to the vehicle require welding, disconnect the PROHEAT power cable at the PCM. This will prevent damage to the PROHEAT electronics.

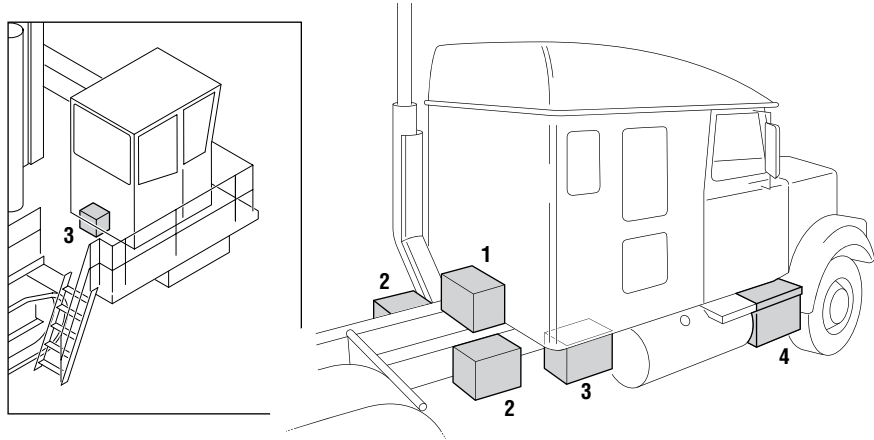


Figure 2-2. Recommended Mounting Positions.

2.1.2 GENERAL CONSIDERATIONS

⚠ WARNING

Never locate the heater inside the vehicle cab. (See figure 2-3)

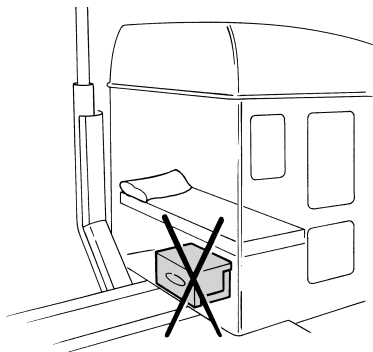


Figure 2-3.

- Never mount the heater to two separate parts of the vehicle.
- Avoid mounting the heater in areas of excessive vibration.
- Do not mount the heater directly to the engine.
- Do not mount the heater beneath a wood floor without a proper fire wall above the heater.
- Avoid mounting the heater in areas of excessive dust, dirt, and moisture accumulation.
- Use mud flaps to protect the heater from road spray.
- The heater must be easily accessed for service.

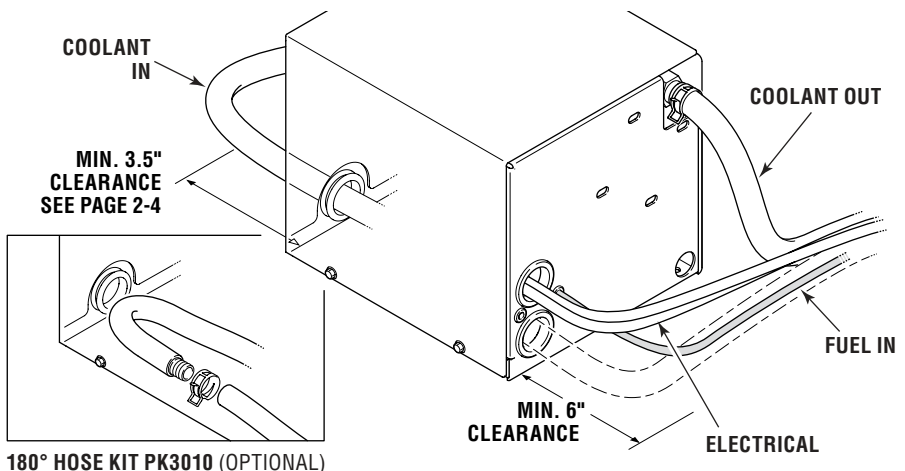


Figure 2-4. Allow minimum 6" clearance for hose connections.

Heater must be mounted below the highest point in the cooling system. An expansion tank may be added to the coolant system above the heater if this is not possible.

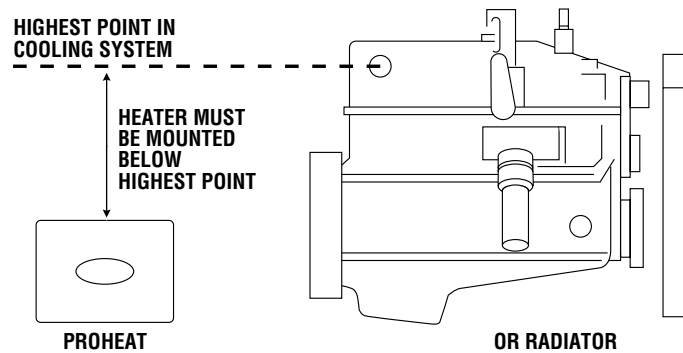


Figure 2-5. Height Requirement.

2.1.3 MOUNTING THE PROHEAT HEATER IN AN ENCLOSURE

Do not locate the heater in an airtight enclosure. If the heater is to be mounted in an enclosure other than the PROHEAT enclosure, adequate air flow must be provided to ensure proper combustion. The enclosure must also be adequately ventilated so that the ambient temperature inside the enclosure does not exceed 185°F (85°C).

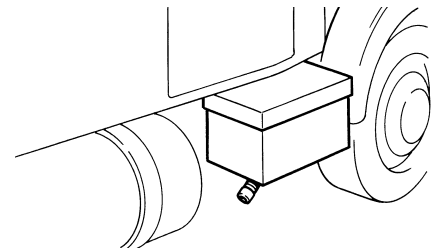


Figure 2-6. Adequate Air Flow.

The openings must be positioned to prevent moisture, dirt, and snow from accumulating in the enclosure. The heater enclosure must be easily accessed for servicing of the heater.

Heater must be mounted within 5° of horizontal, as shown.

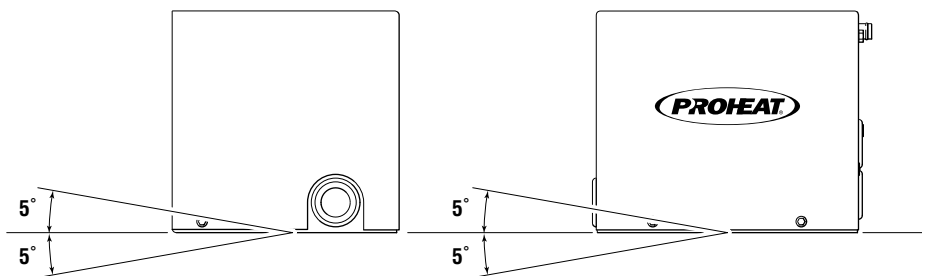


Figure 2-7. Mounting Angle.

2.2 MOUNTING THE HEATER

2.2.1 HEATER MOUNTING OPTIONS

Proheat offers several mounting kit options to help you install the X30 faster. Please see the X30 parts book SL9212 for more information.

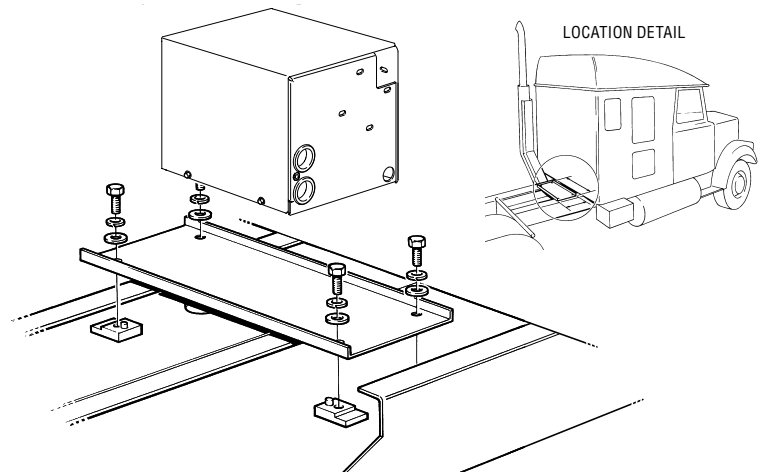


Figure 2-8. Proheat Cross Frame Mounting Kit # PK3006.

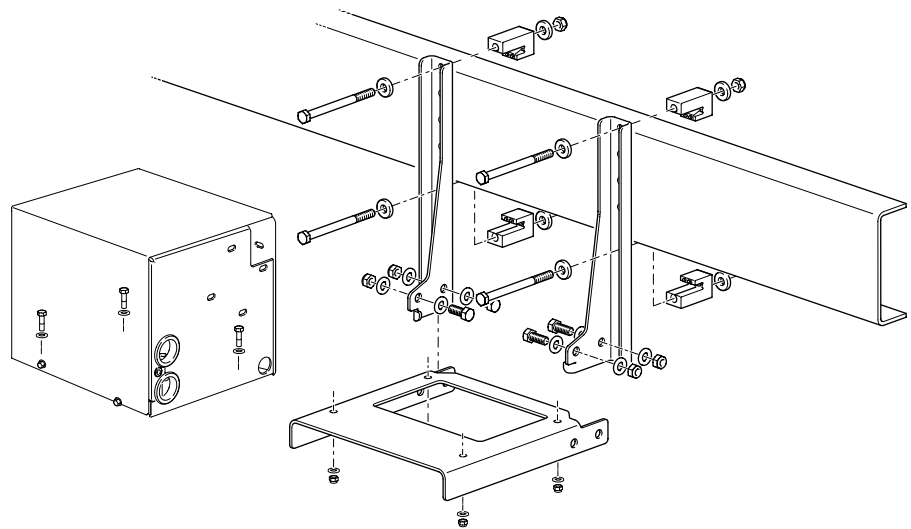


Figure 2-9. Proheat Side Frame Mounting Kit # PK3016 — No Drill.

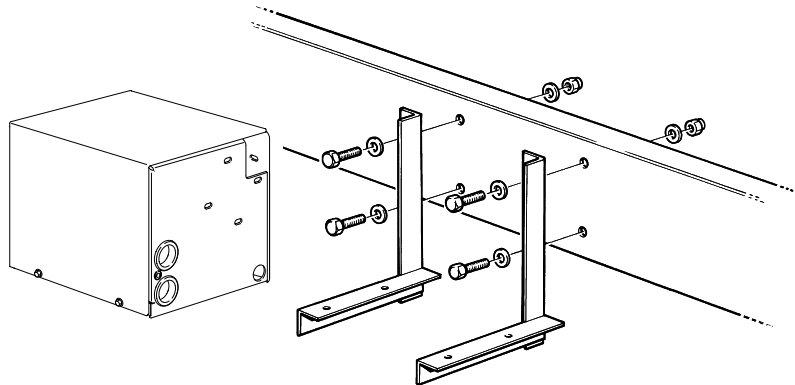


Figure 2-10. Proheat Side Frame Mounting Kit # PK0152.

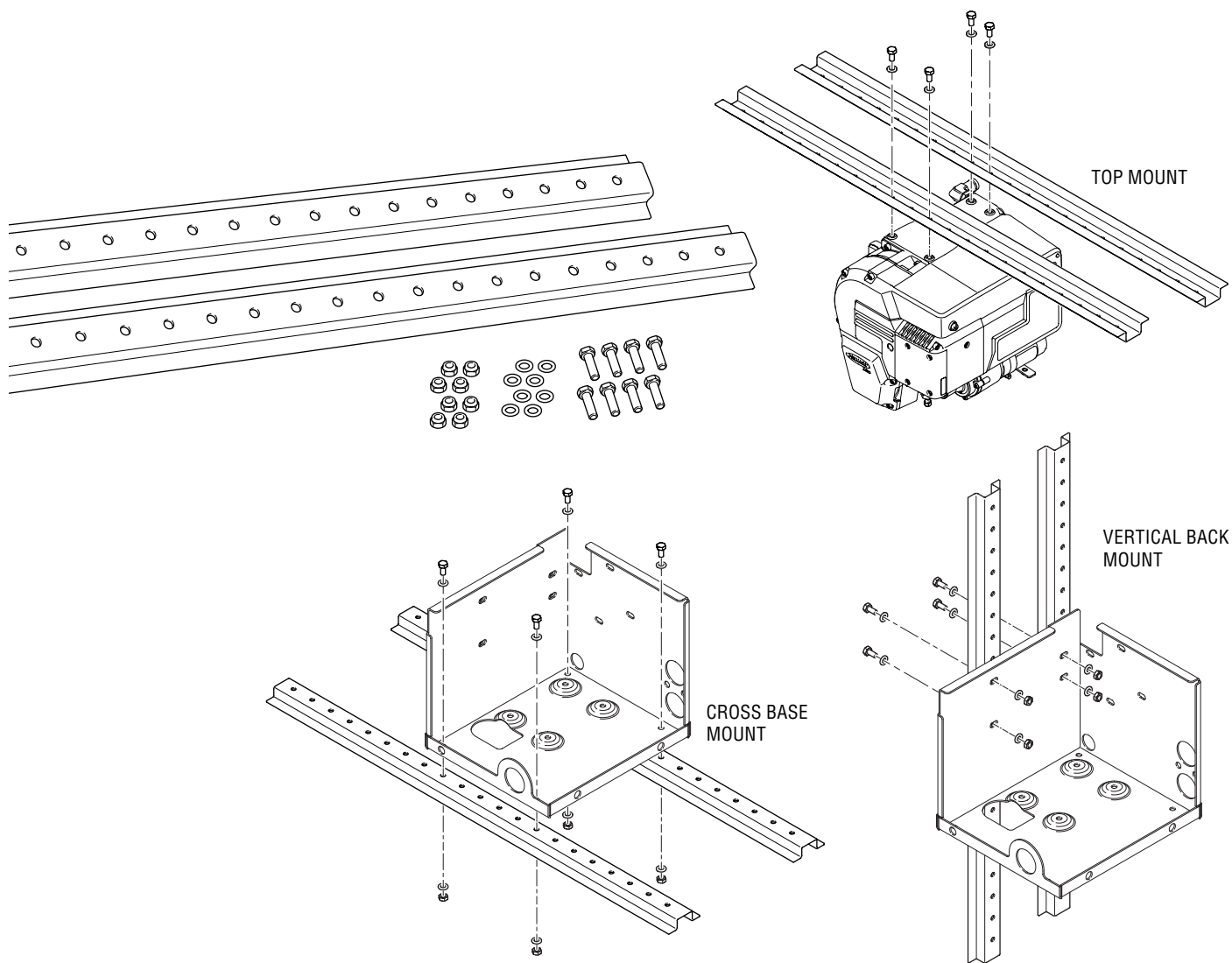


Figure 2-11. Proheat Universal Mounting Kit # PK3005, c/w fasteners.

OPTIONS

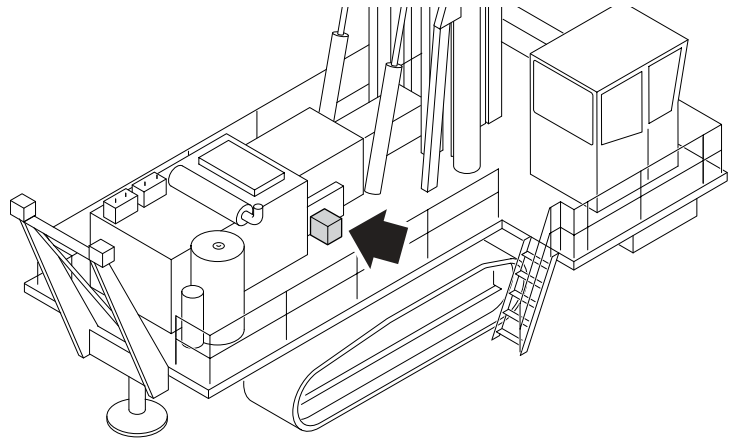


Figure 2-14. Surface mount.

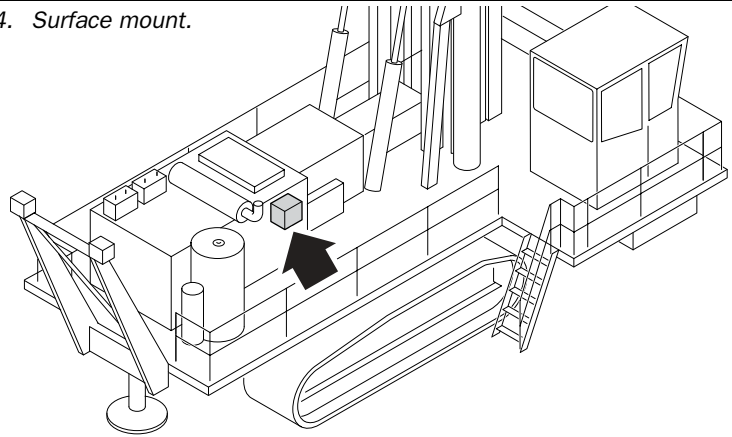


Figure 2-15. Wall mount using PK3005.

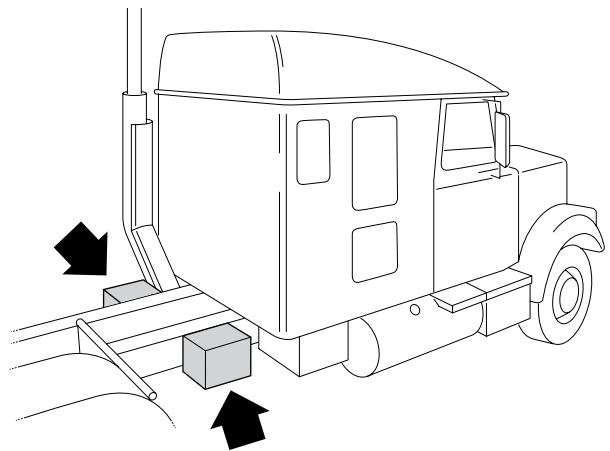


Figure 2-16. Side frame mount using PK0152.

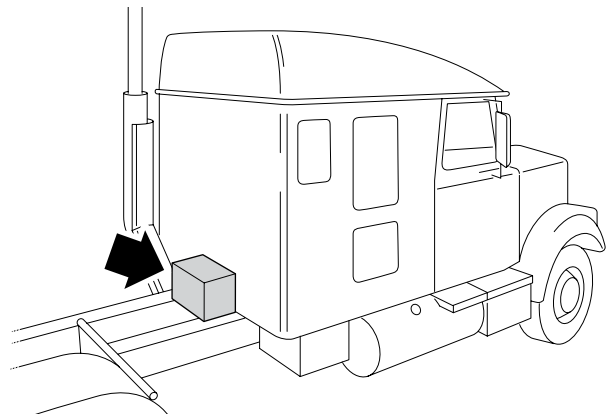


Figure 2-17. Cross frame mount using PK3006.

2.2.3 Mounting Heater Without Enclosure

NOTICE

Use anti-seize compound on fasteners to prevent galling and corrosion.

Heaters supplied without an enclosure need to be mounted in a protected area or be mounted in an existing enclosure on the vehicle, such as a tool box. Heater supplied with an auxiliary mounting plate.

When mounting the heater without an enclosure select a location that is away from road debris, direct road spray and areas that collect dirt and grease. Use a mud flap or similar to protect the heater if needed.

When mounting the heater below the floor, ensure there is a metal firewall above the heater. Ensure the exhaust pipe directs the exhaust gases away from the underside of the floor.

1. Ensure that the proposed enclosure is big enough for the heater. 13.25" L x 11.5" W x 12" H (337 x 292 x 305 mm).
2. Using the indicated dimensions, drill the (4) mounting holes and exhaust pipe clearance hole.

NOTE: Ensure that the combustion tube can be removed for service. See figure 1-2 on page 1-3 for service space requirements.

OPTION A – Surface (base)

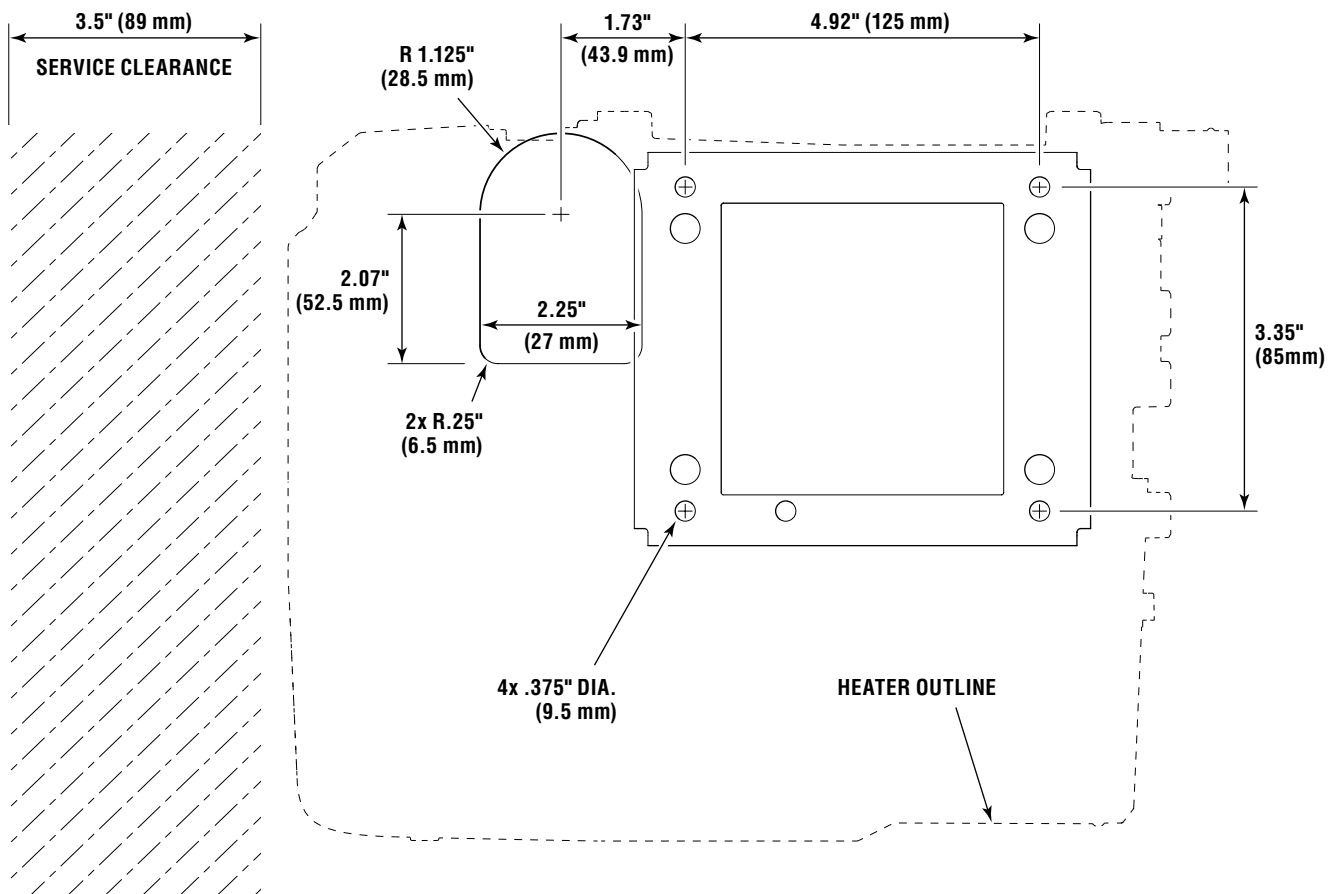


Figure 2-18. X30 Mounting Plate Dimensions & Exhaust Hole.

OPTIONS

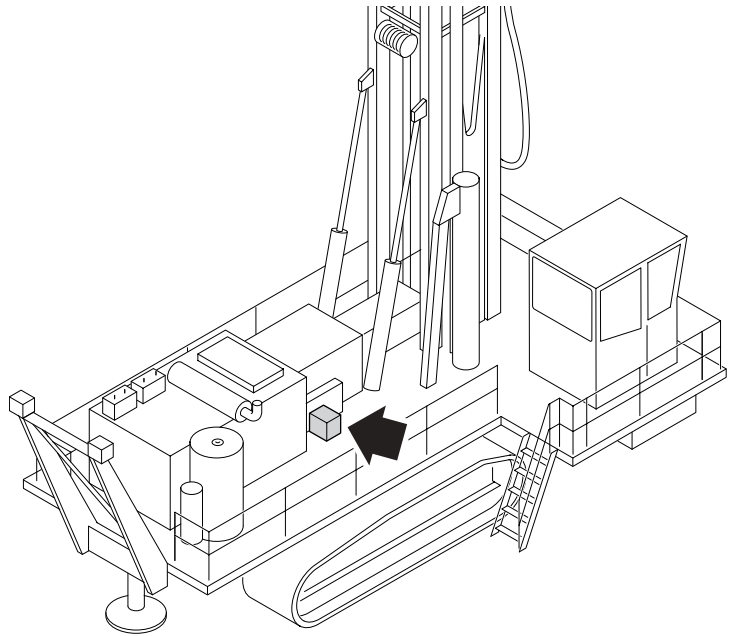


Figure 2-19. Surface mount.

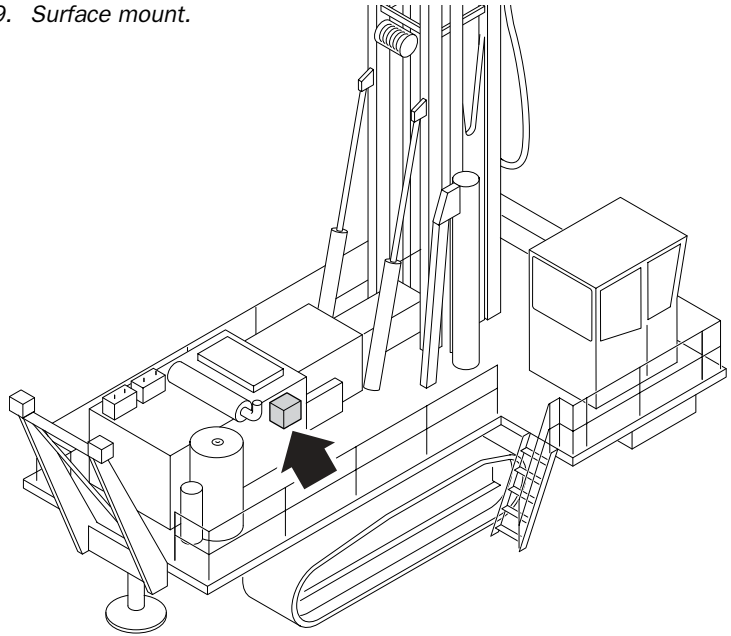


Figure 2-20. Wall mount using PK3005.

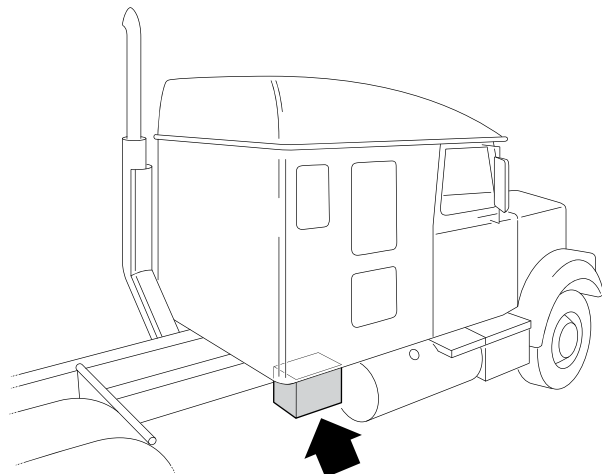


Figure 2-21. Under Floor mount using PK3005.

2.3 EXHAUST PIPE

2.3.1 EXHAUST PIPE OPTIONS

In addition to the 2' flexible exhaust pipe supplied in the X30 installation kit (PK3014) Proheat also offers several optional exhaust kits to help you install the X30 faster. Please see the X30 parts book SL921.2 for more information.

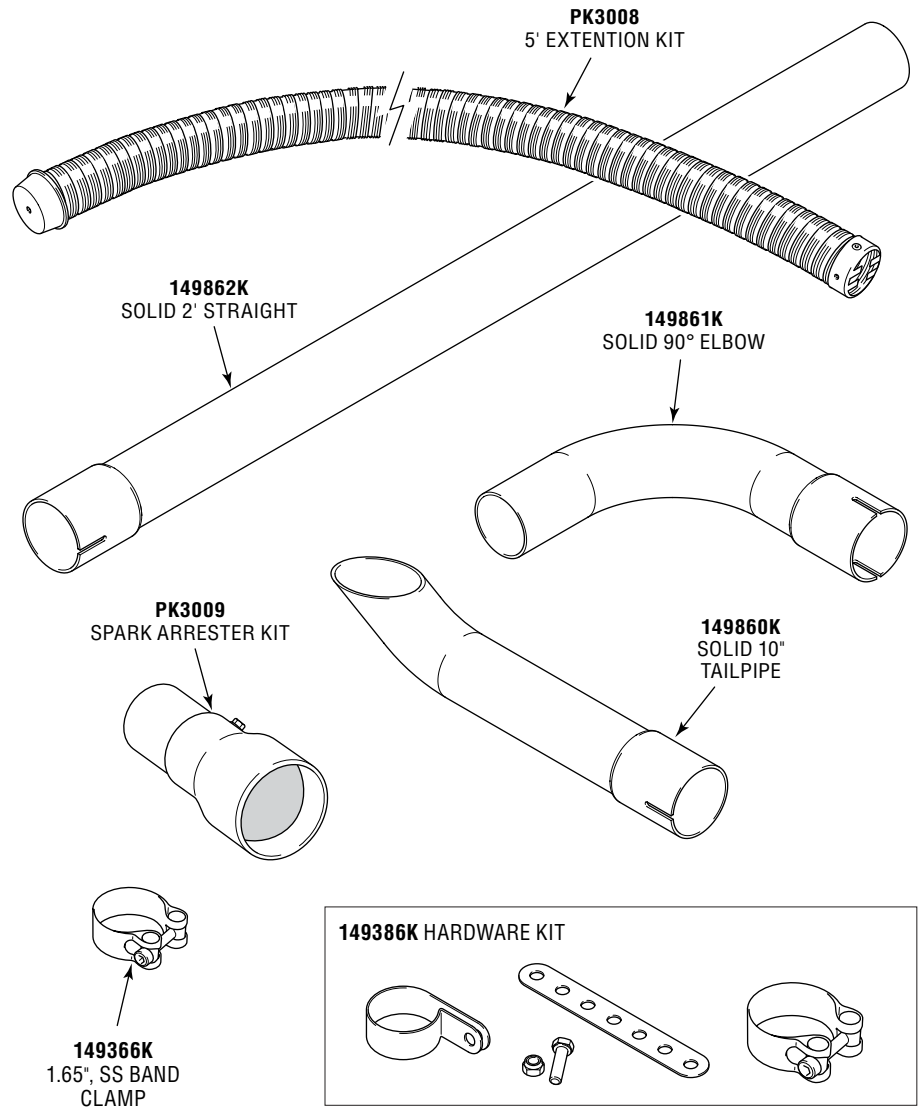


Figure 2-22. Exhaust Pipe Options.

2.3.2 EXHAUST PIPE CONNECTION

NOTICE

If additional information is required, please contact your PROHEAT dealer regarding your specific application. Alternatively, please contact PROHEAT Product Support at www.proheat.com.

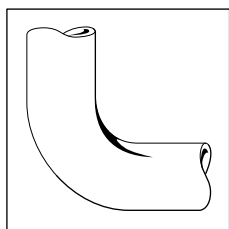
NOTICE

Use of muffler or other restrictions in the exhaust system is not recommended.

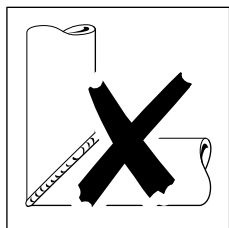
1. Push the supplied flexible exhaust pipe through the hole in the enclosure and onto the exhaust outlet port of the heater. Ensure that the pipe is pushed onto the heater's exhaust outlet at least 1-1/2" (38 mm).
2. Route the exhaust pipe such that:
 - exhaust gasses do not enter the passenger compartment
 - exhaust gasses do not enter the heater's combustion air inlet
 - exhaust system does not rest against or be directed toward any parts of the vehicle that may be damaged by heat (such as brake lines, seals, wires, rubber hoses, or bumpers). The exhaust pipe may have to be insulated if it's within 6" of combustible materials or composite body parts
 - the exhaust outlet does not face the same direction as vehicle travel
 - debris and snow will not plug the outlet
 - the exhaust pipe is protected from curb damage
 - the exhaust system should have a downwards slope for condensation to drain.
3. Assemble the exhaust clamp over the exhaust pipe (clamp goes inside the enclosure) and tighten the nut.
4. Secure the end of the exhaust pipe with the provided support bracket, clamp and nut and bolt.

NOTE: An extended exhaust kit PK3008 is available to lengthen the exhaust pipe up to 5' (152 cm). For forestry equipment, a spark arrester kit PK3009 is available for the end of the exhaust pipe.

When using custom ridged exhaust pipe, the exhaust pipe should have no more than 180° of bends. The bends must be formed for best results. Do not use 90° welded pipe to turn corners. The exhaust pipe length should not exceed 6' (183 cm) in length. For longer requirements please contact PROHEAT product support.



Use formed elbows.



Do not use welded 90° elbows.

⚠ WARNING

Exhaust gases must not accumulate under vehicle or enter the vehicle's interior. Direct exhaust pipe away from vehicle cab, sleeper etc.

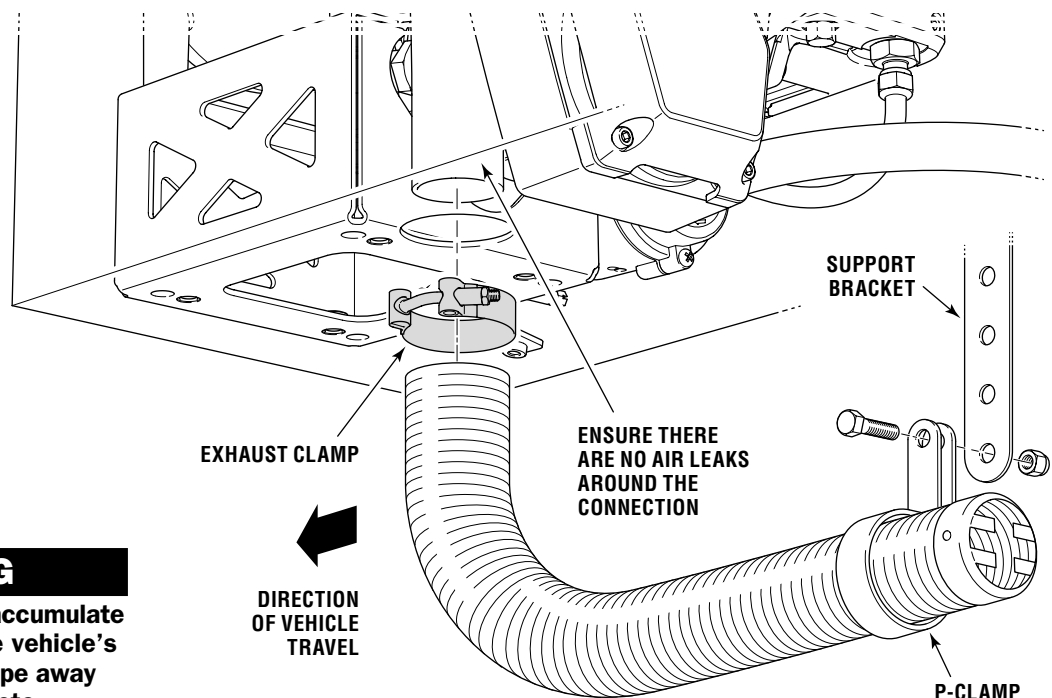


Figure 2-23. Exhaust Pipe.

2.4 COMBUSTION AIR SUPPLY

The heater's combustion air intake must be in an area of calm, clean and dry air. If this is not possible, a 5' (152 cm) snorkel hose kit PK3007 may be used to draw combustion air from a remote source.

An air intake snorkel hose may be required to prevent the Proheat from drawing dust, dirt and moisture into the combustion chamber.

2.4.1 GENERAL CONSIDERATIONS

- Combustion air must not be drawn from any passenger compartments.
- The hose length should not exceed 5 ft.
- No more than 270° of total bends.
- The center line bend radius must be 3.5" or greater to prevent kinking of the hose.
- Route to an area of calm, clean and dry air.
- Clamps must be installed so they support the snorkel hose but do not kink or crimp snorkel hose.
- The use of an air filter is not recommended.

2.4.2 AIR INLET SNORKEL HOSE OPTION

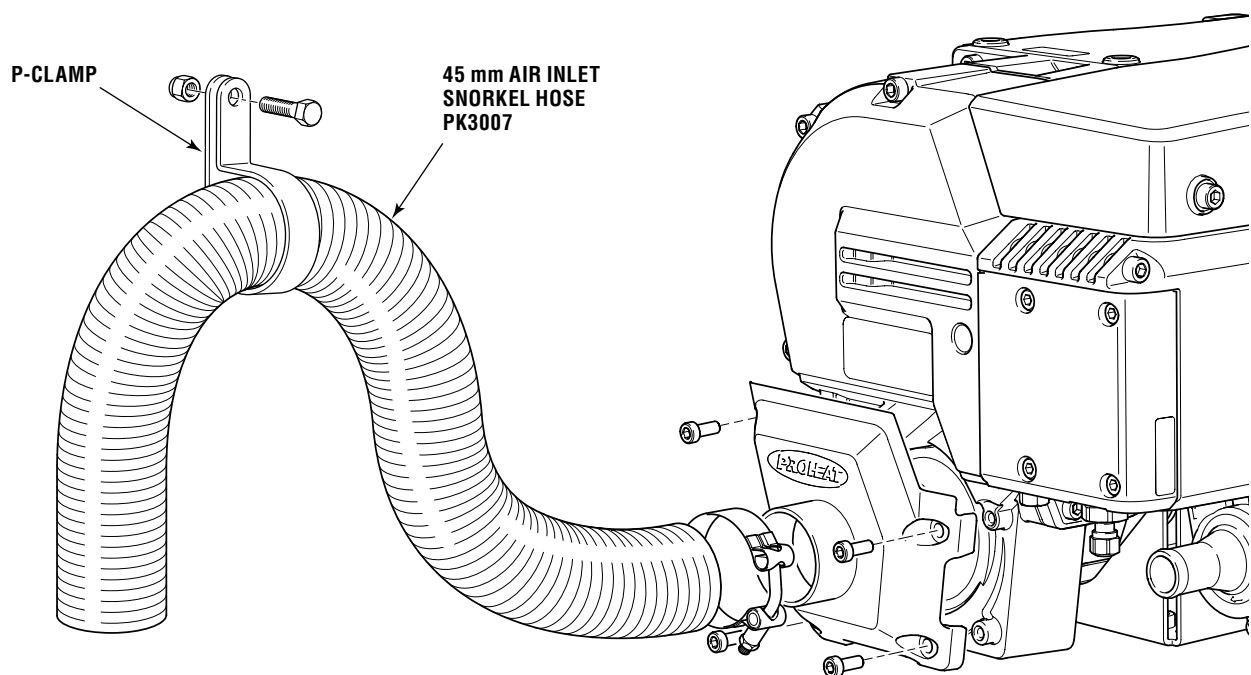


Figure 2-24. Air Inlet Snorkel Hose (optional).

2.5 PLUMBING THE SYSTEM

2.5.1 PLUMBING FITTING OPTIONS

Proheat offers several plumbing kit options to help you install the X30 faster. Please see the X30 parts book SL9212 for more information.

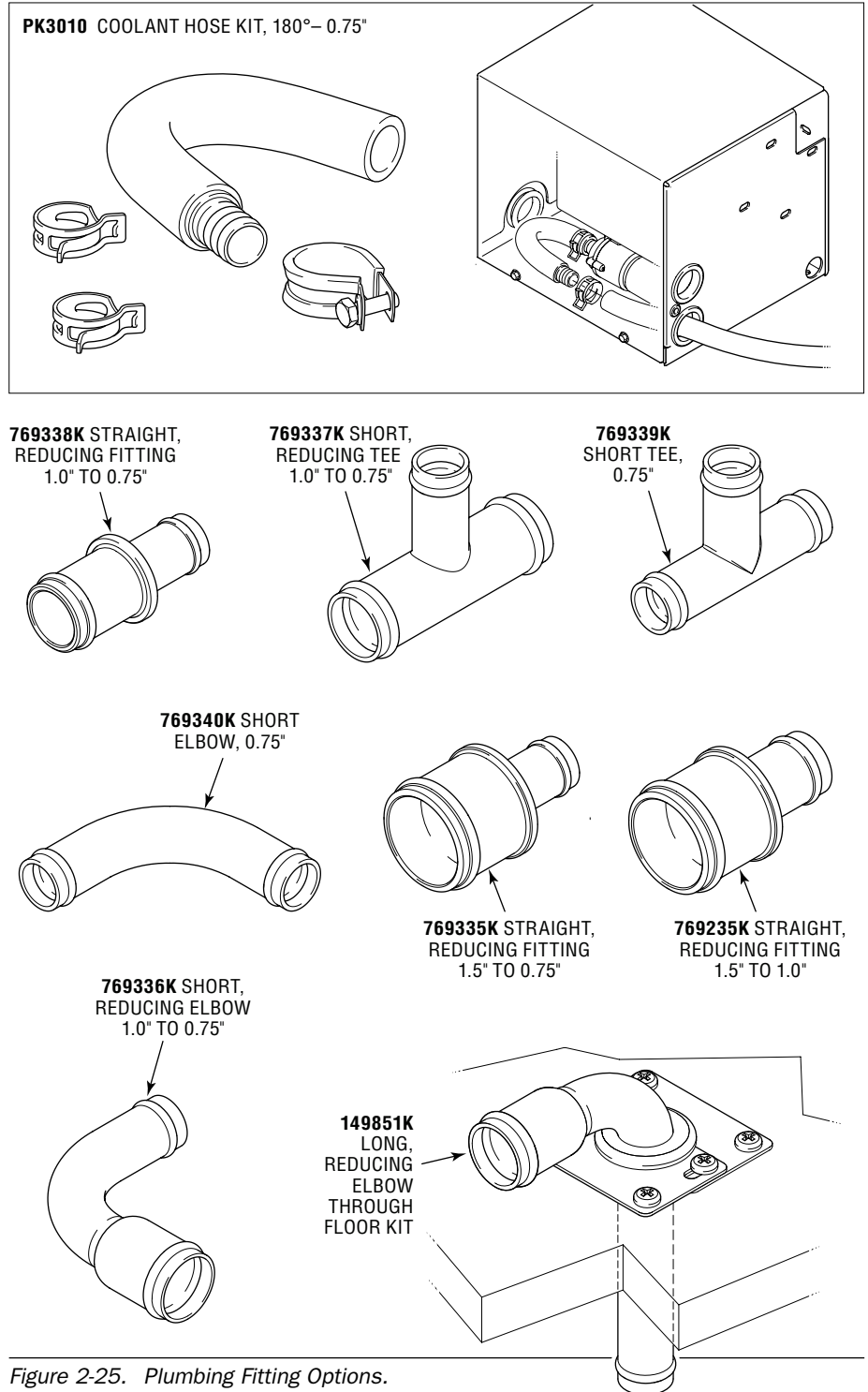


Figure 2-25. Plumbing Fitting Options.

2.5.2 GENERAL CONSIDERATIONS

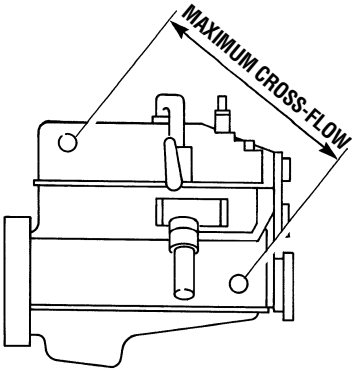


Figure 2-26. Maximum Cross-flow.

Coolant flow must be maintained throughout the coolant system under all conditions.

- Keep the engine inlet and outlet ports as far apart as possible to maximize cross-flow through engine.
- Coolant pump and engine water pump must flow in the same direction.
- Ensure that no sharp kinks or bends exist in the hoses which may restrict coolant flow.
- Avoid high points in the hose routing to prevent air traps.
- For systems requiring more than 50 feet of coolant line, contact PROHEAT Product Support at www.proheat.com for coolant pump recommendations.

For plumbing the system use:

- ½" NPT pipe fittings or bigger
- ¾" ID heater hose

NOTE: Use of silicone hose requires special hose clamps.

Shut-off valves are not required at the engine inlet and outlet connections but may be used if desired. They should be left open at all times so that the heater can be operated throughout the year.

You Choose

NOTICE

Supplemental heat may be used with options A and B.

Select Your Plumbing Option

Option A: Engine heat only

The PROHEAT heats the engine block only.

NOTE: When the engine block is preheated, you will have nearly instant heat from the dash heat exchanger.

Option B: Engine and sleeper heat

The PROHEAT heats the engine block and the sleeper, using auxiliary heater core and fan kit PK3004 or similar.

NOTE: Plumbing the PROHEAT through the dash fan is not recommended.

Option C: Cargo heat only

The PROHEAT heats the cargo space only using an auxiliary heater core and fan kit PK3004 or similar and a 5 gallon surge tank with radiator cap.

WARNING

Opening the radiator cap when the engine is hot may cause serious injury.

Instructions for Options A and B

1. Remove the radiator cap to release the system pressure.
2. Drain the coolant system.
3. Plumb the system as per figure 2-27 or figure 2-30.
4. Add engine coolant to the system as per the specific engine manufacturer's recommendations and re-install the radiator cap.

NOTE: Plumbing the PROHEAT through the dash fan is not recommended.

2.5.3 OPTION A – Engine Heat Only

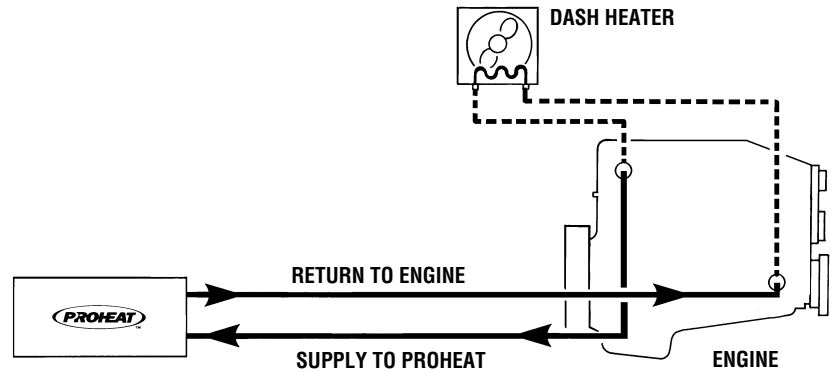


Figure 2-27. Engine Heat or Supplemental Heat.

NOTE: On coolant systems where the return from the PROHEAT is plumbed to the bottom of the main coolant supply line from the radiator to engine pump, the return line must be moved to avoid loss of heat through the radiator.

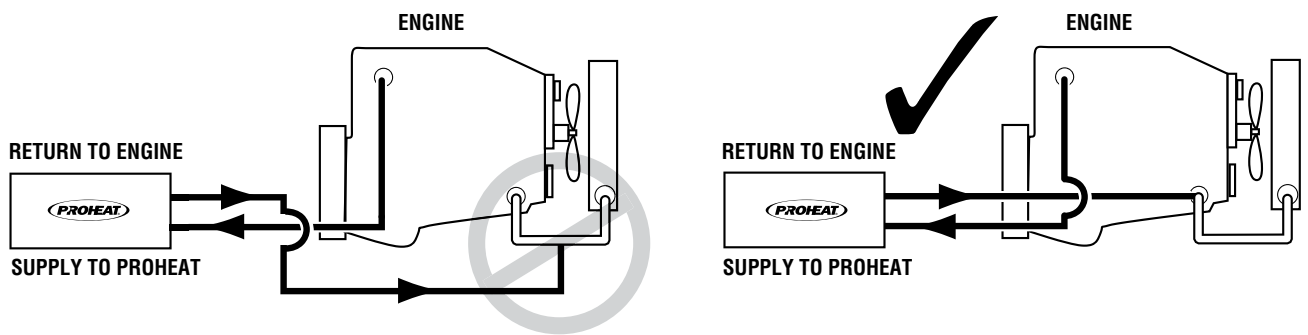


Figure 2-28. Correct Return Line Plumbing.

2.5.4 OPTION B – Engine and Sleeper Heat

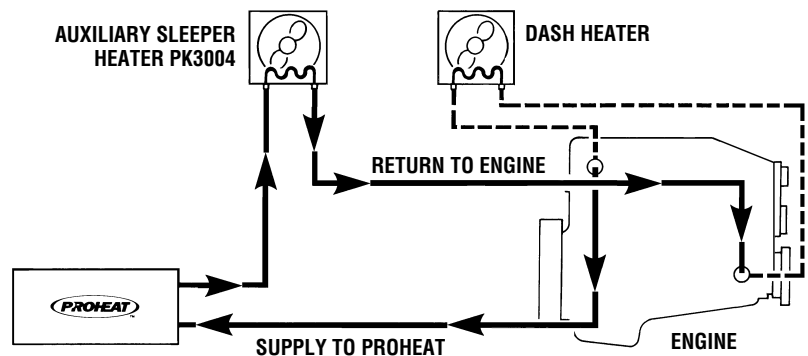


Figure 2-29. Engine and Sleeper Heat.

2.5.5 OPTION C – Cargo Heat Only

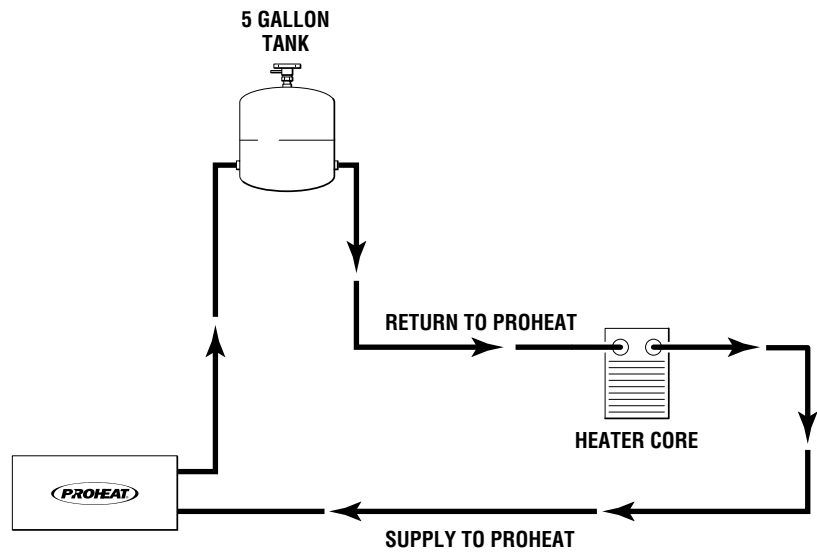


Figure 2-30. Cargo Heat only.

2.6 WIRING & ELECTRICAL CONNECTIONS

2.6.1 GENERAL CONSIDERATIONS

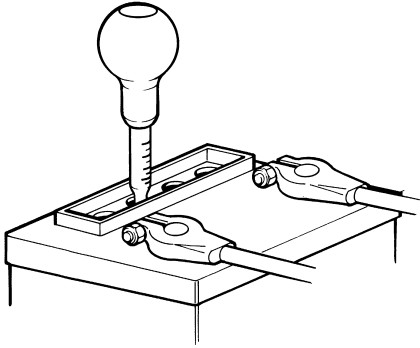


Figure 2-31. Test Battery.

⚠ CAUTION

Ensure the harness and wires are routed away from all heat sources and sharp edges.

⚠ WARNING

Do not use on positive ground vehicles.

⚠ CAUTION

If repairs to the vehicle require welding, disconnect the PROHEAT power cable at the PCM. This will prevent damage to the PROHEAT electronics.

⚠ CAUTION

Vehicles using ground side battery disconnect switches must install a 15 Amp fuse on the battery ground connection (PROHEAT part # 97888K). This will prevent damage to the harness and PCM. (Refer to page 2-18).

NOTICE

Only use Proheat supplied Harnesses.

- Prior to installation of the PROHEAT heater system, ensure that the batteries are in good condition.
- Do not kink or abrade wires when routing them through the vehicle during installation.
- Ensure wires are well supported and secured with tie-wraps every 16" – leave proper slack when passing from the frame into the cab.
- Do not use acid core solder if making solder connections.

Major Electrical Connections Required

- Power connection to batteries page 2-18
- Timer or ON/OFF switch connections page 2-21
- Optional add in harness page 2-24
- Optional add in Sleeper fan harness..... page 2-27

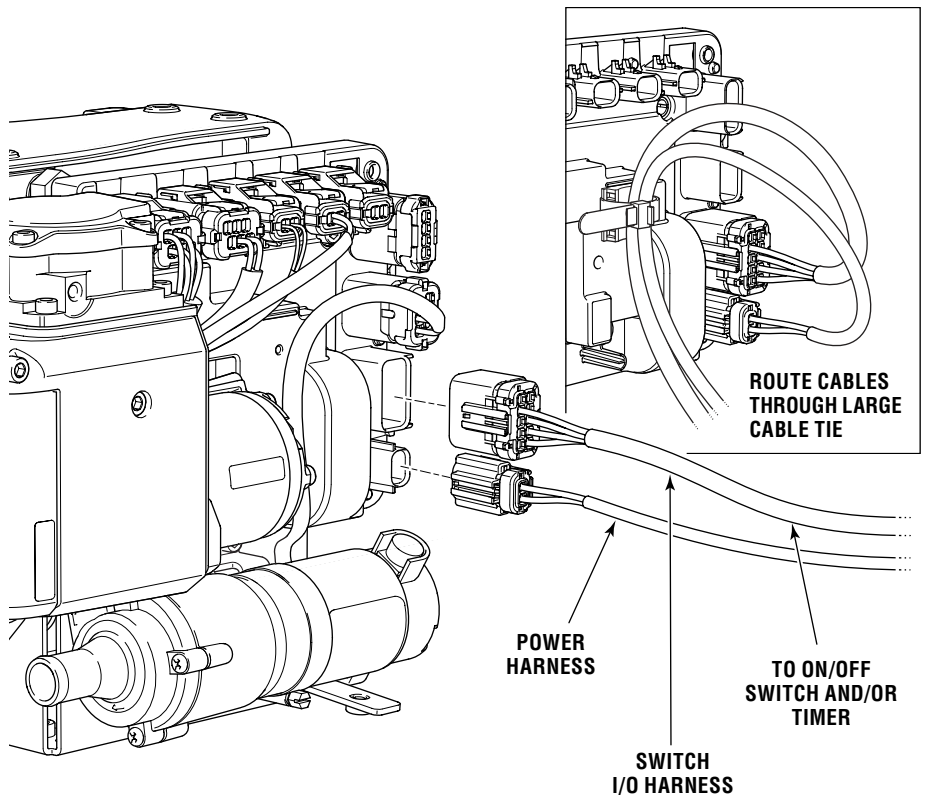


Figure 2-32. Major Electrical Connections.

2.6.2 POWER CONNECTION TO BATTERIES

The X30 requires a fuse to be installed on the positive power supply cable at the battery or power source.

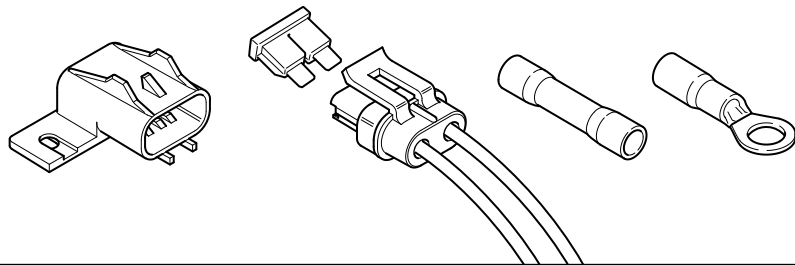


Figure 2-33. Fuse kit.

NOTICE

If batteries are equipped with a ground side disconnect, a second fuse kit must be installed on the power harness negative wire.

NOTICE

Remove and clean battery terminals. Prior to re-connecting, grease terminals with electrically conductive grease.

Installation Instructions

1. The fuse kit comes with a 15 amp ATO fuse and a pre wired fuse holder, one crimp and heat shrink ring terminal and one crimp and heat shrink butt splice.
2. Strip outer wire jacket of the power harness back to expose the positive (red) lead (figure 2-34). Strip the lead as shown in figure 2-34, using the provided crimp and heat shrink butt splice connect the fuse to the end of the red wire, then crimp and heat shrink as per instructions on page 2-19. On the other side of the fuse connect the provided crimp and heat shrink ring terminal, then crimp and heat shrink as per instructions on page 2-19. Connect the leads to the battery terminals. (See figure 2-34.)
3. Secure the fuse holder in place with a tie wraps.

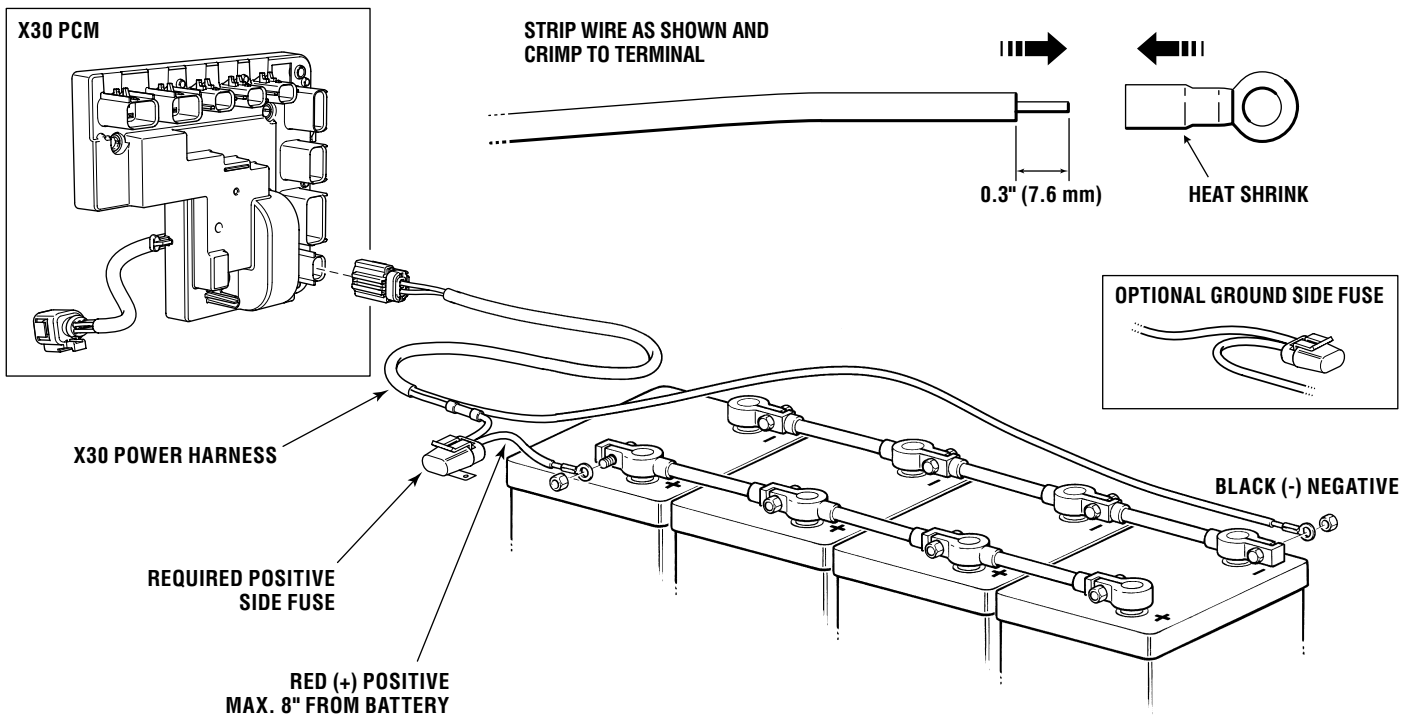
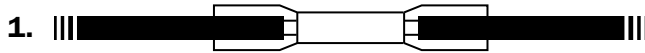
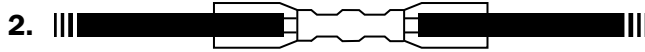


Figure 2-34. Power Connection to Battery.

Crimping & Heat Shrinking Instructions



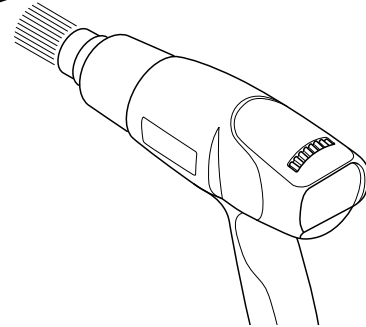
Strip the wires 0.3" (7.6 mm) from the end and insert into the crimp barrel.



Making sure the wire end is properly seated, make the crimp connection using a tool designed for insulated splices.



Apply heat directly to the splice working from the center out to the edges, using a hot air gun, until the tubing shrinks and the adhesive flows. Allow to cool before inspecting splice and checking integrity.



⚠ WARNING

BATTERIES. Wear hand and eye protection when working near batteries. Do not smoke or use open flames near batteries.

2.6.3 HEATER MODES

NOTICE

There are special OEM versions for supplemental heat mode. For example, temperature thresholds may have a low threshold of 160°F (71°C) rather than 150°F (65°C). Please contact PROHEAT Technical Support for more information.

The X30 has four basic modes of operation:

Standard Mode

(Engine OFF or RUNNING) (Pre wired for included switch or optional T-II Timer)

Coolant temperature is monitored via a built-in sensor. When the temperature at the PROHEAT is below 150°F (65°C) the PROHEAT operates, heating the coolant to 185°F (85°C) at which point it stops burning fuel and goes into standby with only the coolant pump running. Standard heat mode is typically activated by use of a toggle switch or optional timer. Since the coolant pump runs continuously in this mode, it's possible to accumulate a high number of coolant pump operating hours vs. heater run hours when used with the engine running. Use of supplemental mode is recommended if the heater is going to be used with the engine running). Please refer to the wiring diagrams on page 2-21 and page 2-23.

Supplemental Mode

(Engine RUNNING) (Optional add in harness needed)

This mode is generally used to help heat the engine and passenger compartment all year round. This mode is typically automatically enabled any time the engine is running.

When heat is not required, the PROHEAT puts itself into supplemental standby, shutting off the coolant pump, thereby avoiding additional run hours on the pump. This is ideal for transit and coach applications.

To simplify heater operation, this function is fully automatic and invisible to the operator. The PROHEAT receives a signal that the engine is running, and then monitors the coolant temperature via a built-in sensor. If the coolant temperature at the PROHEAT is below 150°F (65°C) the coolant pump is activated for 30 seconds. This causes coolant in the engine to be circulated through the PROHEAT. If after 30 seconds the coolant temperature is above 150°F (65°C), the PROHEAT will turn off the coolant pump and return to supplemental standby. If

the coolant temperature remains below 150°F (65°C), the PROHEAT will operate and continue to supply heat to the system until the coolant temperature reaches 185°F (85°C). The PROHEAT then shuts itself off, returns to supplemental standby, deactivates the coolant pump and waits for the coolant temperature to fall below 150°F (65°C), and the cycle is repeated.

The PROHEAT switches off when the engine stops so that the heater can't be accidentally left running overnight.

Supplemental heat mode has priority over the preheat mode and will cause the preheat mode to drop out.

Please refer to the wiring diagram on page 2-25.

Supplemental Max Heat Feature *(Optional add in harness & programing needed)*

- To use this feature one of the I/O's must be reprogrammed and the supplemental mode must also be enabled, the cycle on/off temperature range shifts up to between 170–190°F (77–88°C) to push the average coolant temperature higher.
- This mode is useful for Tier 4 engines to help maintain higher engine temperatures to reduce emissions and resulting regens, or when more heat is needed such as high HVAC demands.

Please contact Proheat if you wish to use this feature.

Supplemental Priority Feature *(Optional add in harness & programing needed)*

To use this feature one of the I/O's must be reprogrammed and the supplemental mode must also be enabled, when active this gives priority to supplemental mode over standard mode. When both standard and supplemental modes are active, the heater will run in supplemental mode.

Please contact Proheat if you wish to use this feature.

Preheat Mode (Engine off) *(Optional add in harness needed)*

Preheating the engine coolant is often essential to start engines in cold weather. And since much of an engine's wear occurs during cold start-ups, preheating also reduces the wear and contributes to longer engine life and reduced operating costs.

The preheat mode is usually activated an hour or so before starting the engine using a momentary contact switch. The PROHEAT then runs in a mode similar to standard heat mode, heating the coolant, which is circulated through the engine block. The advantage of this mode is it's switched off automatically. No operator input is required. The PROHEAT has a built-in time-out feature to prevent the heater from running indefinitely. The PROHEAT will switch itself off after 90 minutes of operation. Starting the engine will also cause the preheat mode to end (if supplemental mode is wired). To manually end preheat mode, simply press the momentary contact switch again.

Please refer to the wiring diagram on page 2-25.

Anti-freeze Heating Mode (Battery Save Mode) *(Optional add in harness needed)*

The anti-freeze heating mode is designed to minimize battery consumption and keep the coolant system warm or from freezing over a longer period of time such as a weekend. Anti-freeze mode is generally activated by a toggle switch. This mode is similar to the supplemental mode and only runs the coolant pump while heating and checking the temperature during the pre-run cycle. The difference is that when the heater is in standby (coolant pump off) the coolant pump is run every 20 minutes to sample the system coolant temperature to ensure the coolant temperature is maintained throughout the system. In Anti-freeze mode the coolant temperature will be maintained between 41°F and 60°F (5°C and 20°C).

When Anti-freeze mode is enabled and another heating mode becomes active it will override Anti-freeze heating mode but will not cancel it. Once the other heating mode is turned off the heater will return to Anti-freeze heating mode.

Please refer to the wiring diagram on page 2-25.

Global Low Temperature Feature (Optional add in harness & programing needed)

To use this feature one of the I/O's must be reprogrammed and a heating mode needs to be enabled. This feature shifts all the cycle on/off temperature of all operating modes (Preheat, Standard and Supplemental) down to between 73–108°F (40–60°C) so the overall average coolant temperature is lower.

This shift saves fuel and battery power over a longer period of time as well as reducing heater maintenance due to sooting up.

The X30 Switch/Control harness comes pre wired to run the heater in Standard mode with the included toggle switch or the optional T-II Timer.

Please contact Proheat if you wish to use this feature.

For additional features or operating modes an add in harness kit is needed. See section 2.6.7 for optional connections.

2.6.4 ON/OFF SWITCH CONNECTIONS

⚠ CAUTION

The switch input circuit should only be used to supply power to the ON/OFF switch, the timer, or as a signal to trip a relay. Failure to follow this installation practice will result in damage to the PCM.

⚠ CAUTION

The switch is not waterproof and must be mounted in a dry location only.

NOTICE

Do not connect an ON/OFF switch and a timer in the same circuit.

NOTE: The PROHEAT comes with a 10–30 Volt rocker switch. (older versions may have come with a 12V and a 24V toggle switch. If you have the toggle switch use the appropriate switch for your vehicles voltage.

1. Select a suitable location in the vehicle dash for the ON/OFF switch. Switch is for dry locations only.

NOTE: Many dash panels have switches that are not used. It may be convenient to remove one and replace it with the PROHEAT switch.

2. If needed cut a hole as per the template below to mount the switch. Make sure you have clearance behind the dash for the switch wires and connections. Install the switch as per the diagram. (Figure 2-36.)
3. Route the switch wire harness from the PCM to the dash panel. You will have to pass the wire harness through the vehicle firewall. If possible use an existing hole. Use a grommet to prevent the wire from being damaged when it is passed through the hole.
4. Cut the harness to length.
5. Strip outer wire jacket of harness back to expose the 4 wires. Strip the wires as shown and crimp the supplied 1/4" spade terminals.

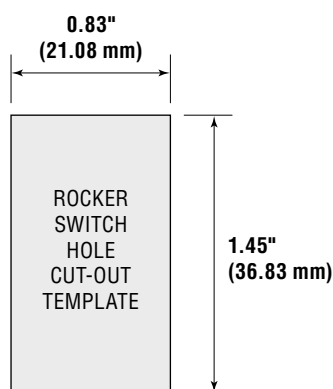


Figure 2-35. ON/OFF Rocker Switch.

NOTE: Use fully insulated disconnects when connecting switch.

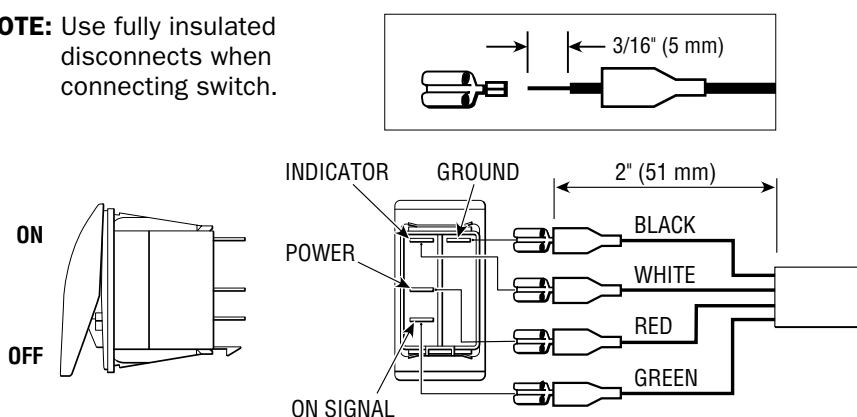


Figure 2-36. ON/OFF Rocker Switch Connections.

6. Connect the terminals to the switch as shown. (Figure 2-36.)

NOTE: Connecting an ON/OFF switch and a timer in the same circuit will cause the indicator light to flash incorrectly.

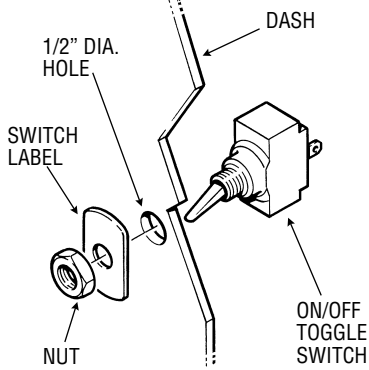


Figure 2-37. ON/OFF Toggle Switch.

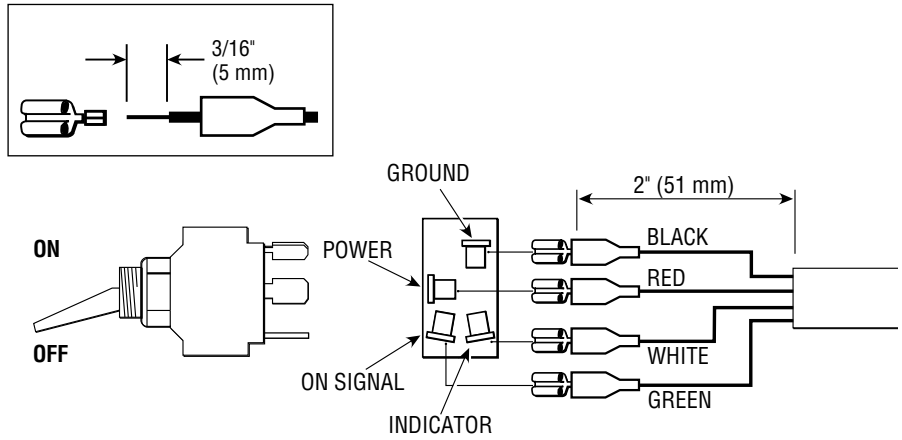


Figure 2-38. ON/OFF Toggle Switch Connections.

2.6.5 OPTIONAL PROHEAT FUNCTION CONTROLLER (PFC)



The Proheat Function Controller (PFC) is the next generation device to operate and configure your X30 heating system to the way you need it. The multifunction PFC provides heater control, programmable timers, system status indication, and interface to accessory products enabling you to get the most out of your heating system. Simple and intuitive to use, the PFC features an illuminated display and large buttons that make for easy operation in all conditions.

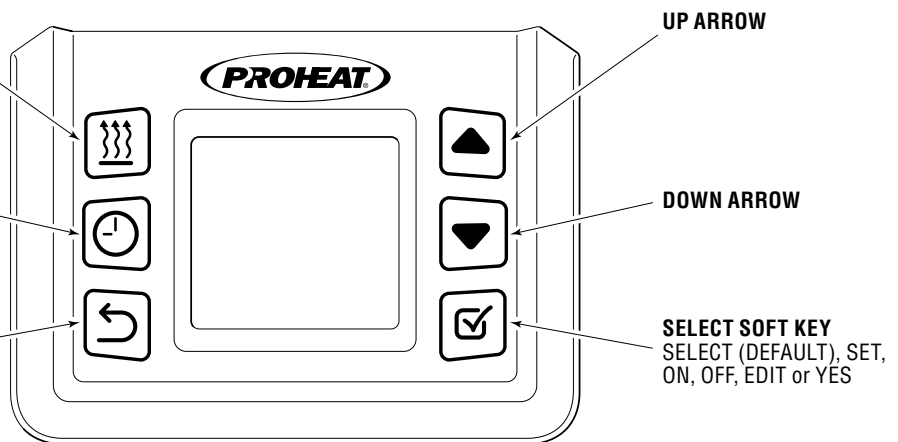
Features

- Quick and intuitive user interface
- Easy to use digital timer
- Set up to 3 future operation events
- LCD Display with backlight
- Operational status and diagnostic display
- Field upgradeable
- Networkable with other Proheat accessories
- J1939 CAN Bus communication
- Downloadable profile for fleet distribution
- Illuminated buttons
- Adjustable brightness and dimmer setting

MANUAL MODE
SOLID RED LED = HEATER ACTIVE
FLASHING RED LED = HEATER FAULT

TIMER MODE
SOLID GREEN LED = TIMER ACTIVE

BACK SOFT KEY
BACK (DEFAULT) or NO



UP ARROW

DOWN ARROW

SELECT SOFT KEY
SELECT (DEFAULT), SET,
ON, OFF, EDIT or YES

NOTICE

Refer to part # 94900 for PFC installation and operation instructions.

Figure 2-39. PFC screen and icons.

2.6.6 OPTIONAL T-II TIMER CONNECTIONS

⚠ CAUTION

The switch power circuit should only be used to supply power to the ON/OFF switch, the timer, or as a signal to trip a relay. Failure to follow this installation practice will result in damage to the PCM.

NOTICE

Do not connect an ON/OFF switch and a timer in the same circuit.

NOTICE

Refer to part # 949905 for Digital Thermostat installation and operation instructions.

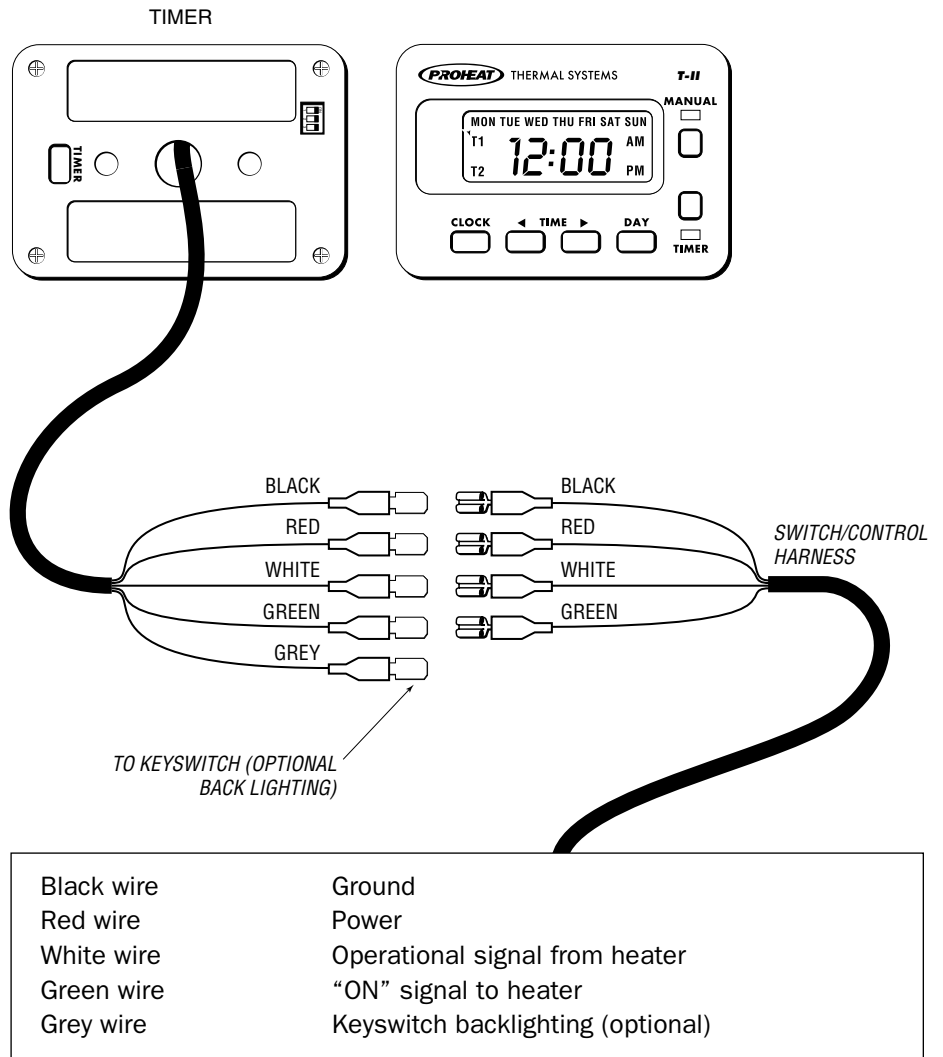


Figure 2-40. Timer Connections.

2.6.7 OPTIONAL MODES AND FEATURES WIRING

To enable optional modes and features the add in harness must be added to the corresponding pin on the switch/control harness and the PCM I/O programed for the mode or feature.

PIN#	DESCRIPTION
1.	Optional Supplemental switch input – active high.
2.	Optional Preheat momentary switch input – active high.
3.	Green – main switch input (standard “ON” signal or pre-heat unlatch) – active high.
4.	Red – power output (constant power. Timer/switch remote panel) (1 amp max).
5.	White or Yellow – indicator output (high side switched. Dash or Proheat toggle switch light) (1 amp max).
6.	Optional Anti-freeze switch input – active high.
7.	Black – ground (indicator ground) (1 amp max).
8.	Optional CAN Bus high – Yellow.
9.	Optional CAN Bus low – Green.
10.	Optional CAN Bus shield – Black.

NOTE: Pins 3, 4, 5, 7 are pre populated from the factory.

1. Carefully grasp the Blue wedge lock as shown and pull the wedge lock free from the connector body.

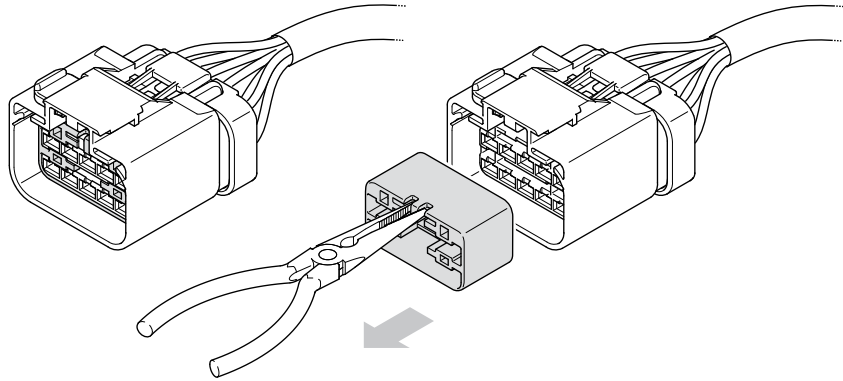


Figure 2-41.

2. From the wire side of the connector, remove the cavity plug from the corresponding terminal(s) and discard.

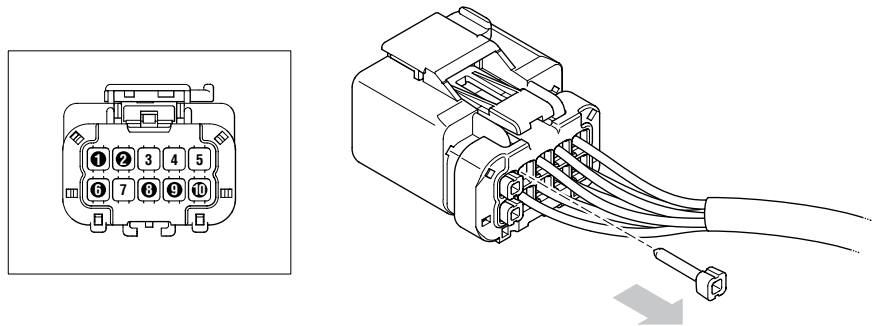


Figure 2-42.

NOTICE

DO NOT attempt to insert any contacts with the blue wedge lock in the closed position.

CAUTION

The PCM I/O Switch connection and all Proheat supplied I/O Switch harness have gold terminals. Use of non gold terminals is not recommended in the I/O Switch connection.

3. Next align the wire with the cavity. Insert until there is an audible and tactile click. DO NOT force the wires. If you encounter difficulty inserting the wires, rotate the terminal 90° and try again. Repeat steps 2 & 3 for each option you selected.

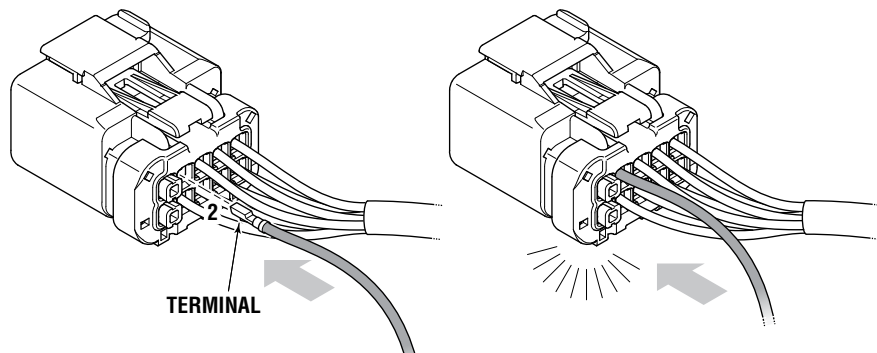
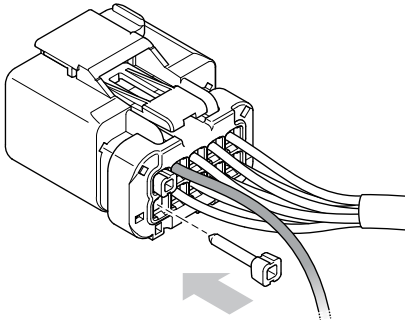


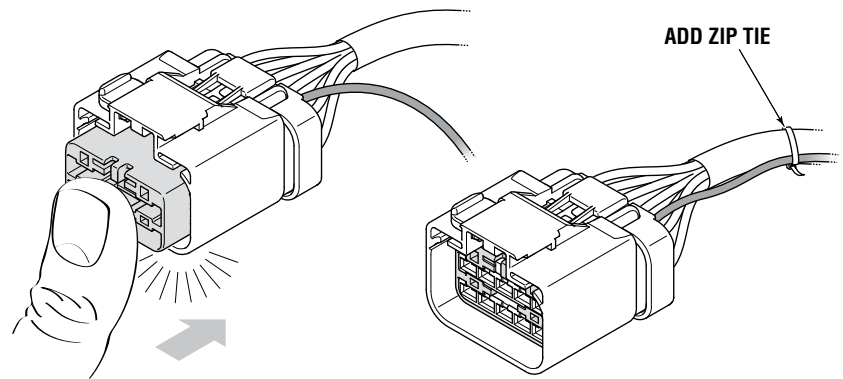
Figure 2-43.

NOTICE

All unpopulated cavities must have cavity plugs installed.



4. Push the blue wedge lock in all the way until it's in the locked position. Then pull slightly on wires to ensure they are fully seated and locked.



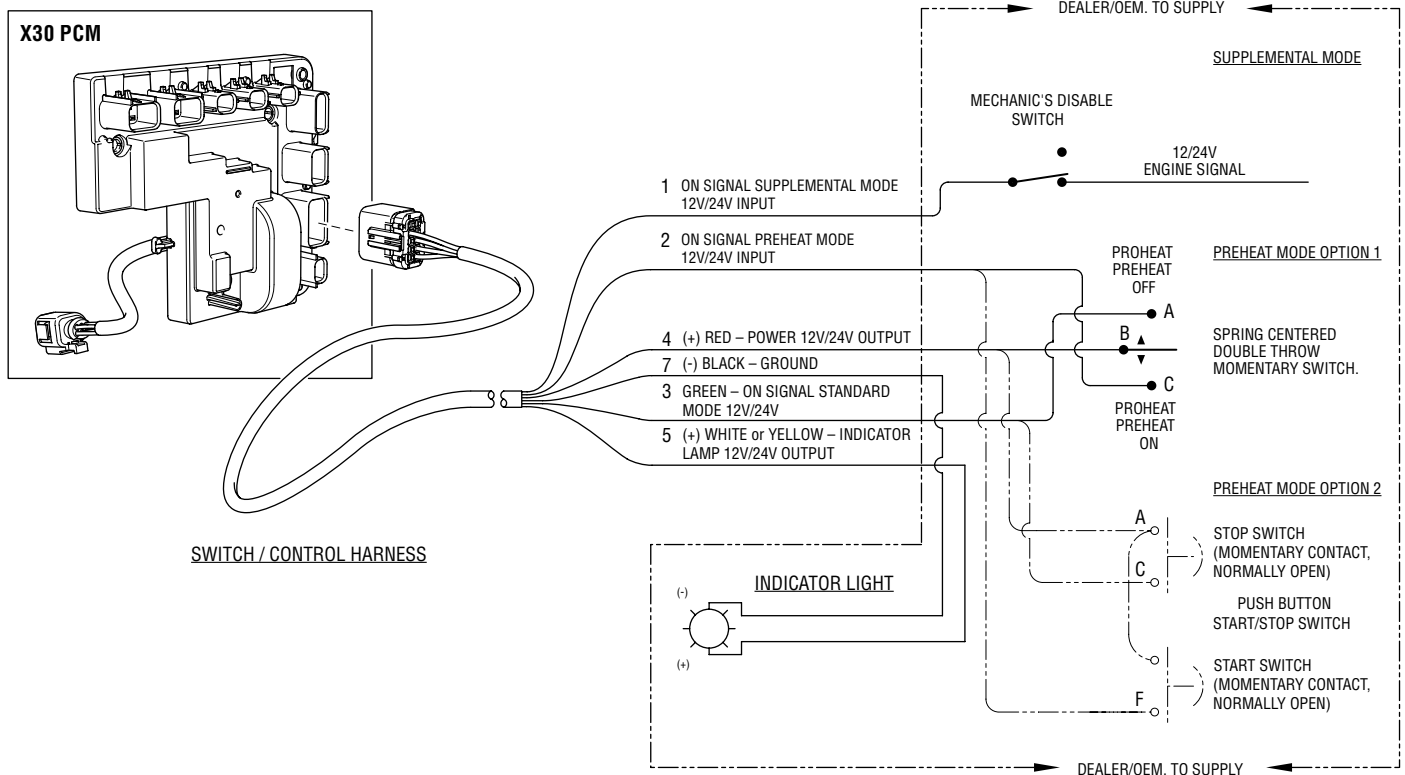
NOTICE

If the wire needs to be removed. Remove the Blue wedge lock. Next gently prying up on the lock tab and pull the wire and out the back (wire side) of the connector. until the contact and wire is removed from the connector. Ensure all open cavities are plugged.

Figure 2-44.

5. Add a loop of tape or zip tie to tie the harnesses together.

The harness is now ready to be connected.



See page 2-21 for wiring.

Figure 2-45. Preheat and Supplemental Wiring Diagram Examples.

2.6.8 OPTIONAL PROHEAT DIGITAL THERMOSTAT FOR BUNK HEATER KITS PK3012 & PK3004



The Proheat Thermostat is a CAN bus enabled, thermostat that controls a fan in the heated space. It can also turn the Proheat coolant heater ON or OFF.

The Proheat Thermostat will cycle the connected fan ON/OFF to maintain the desired air temperature.

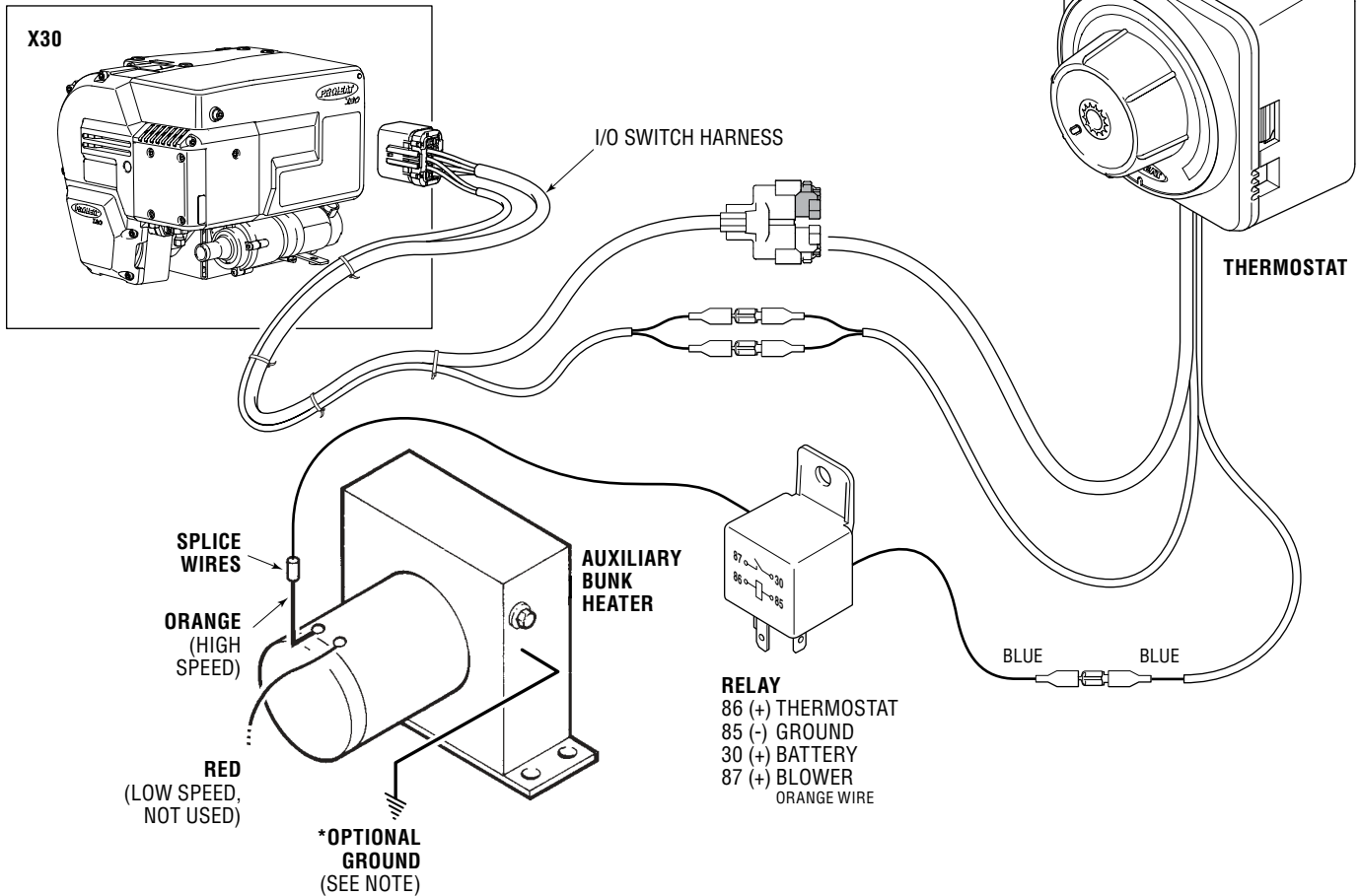


Figure 2-46. CAN Bus thermostat.

NOTICE

Refer to part # 949905 for Digital Thermostat installation and operation instructions.

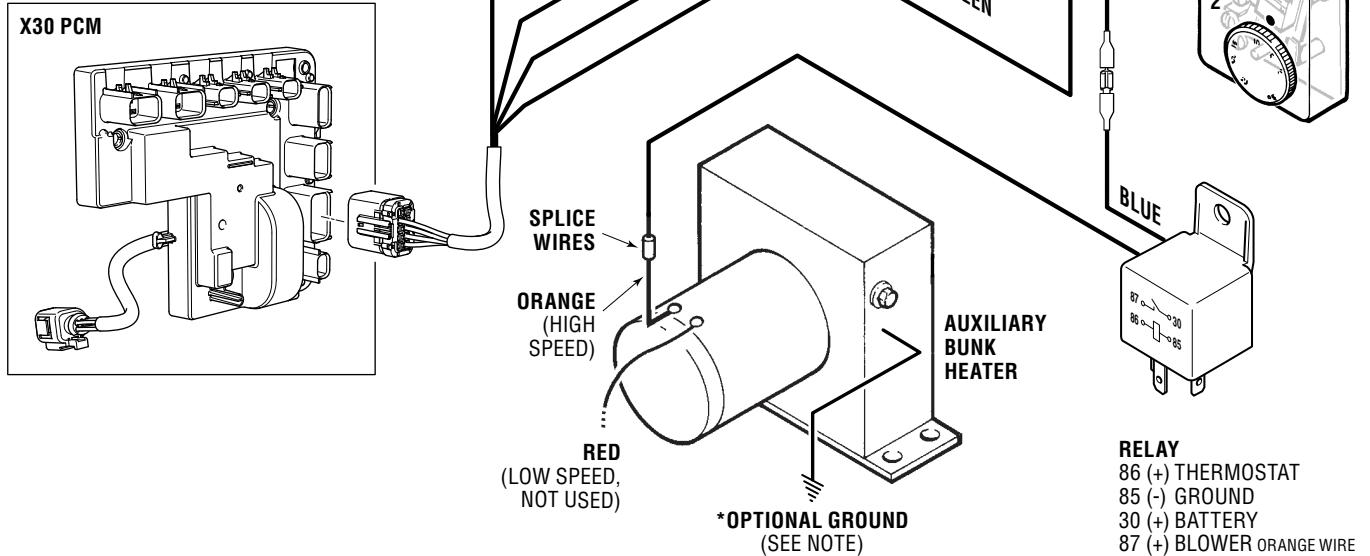
*** NOTE** The blower motor is grounded internally through the case. If the case is not connected to chassis battery ground then a dedicated ground wire must be installed from the case to battery ground.

OPTIONAL ANALOG THERMOSTAT FOR BUNK HEATER KITS PK3012 & PK3004

2.6.9

⚠ WARNING

Systems using a ground side battery disconnect must install a 10 amp fuse to protect the sleeper fan harness.



Thermostat Wire Connection Detail

Screw #	Wire Colour
1	Green (from PCM)
2	White (to Relay 86 [+])
3	Not used
4	Not used

Figure 2-47. Auxiliary Sleeper Heater Installation

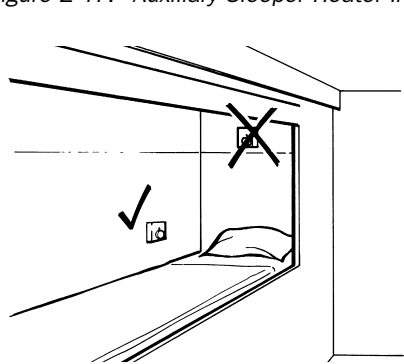


Figure 2-48. Thermostat Location

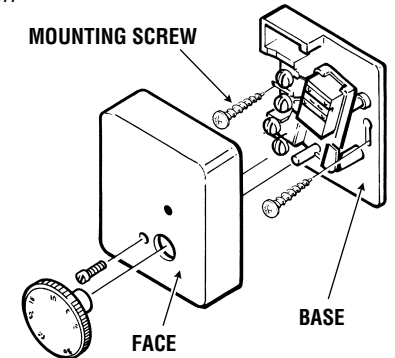


Figure 2-49. Thermostat Detail

1. Make sure the vehicle ignition is switched "OFF."
2. Locate the auxiliary heater in a suitable area of the vehicle.
3. Locate the PROHEAT thermostat in a central area of the sleeper, approximately 12" above the bunk. Avoid direct air flow from sleeper fan ducts. (Figure 2-48)
4. Remove the adjusting knob and face cover. Mark and drill mounting holes. Mount thermostat using the screws provided. (Figure 2-49)
5. Route sleeper fan harness from the Toggle Switch Green wire terminal to PROHEAT thermostat. Cut to length. Connect Green wire to terminal 1 of the thermostat using the fork terminal provided. Black wire is not used.
6. Route a wire from terminal 2 of the thermostat terminal 86 (+) on relay.
7. Route a wire from a constant fused source or battery power to terminal 30 (+) of the relay.
8. Route a wire from terminal 87 (+) of the relay to an appropriate wire on the sleeper fan motor. Orange = Low Speed. Red = High Speed. Make a splice connection and seal the splice with tape or heat shrink.
9. Run a ground wire from terminal 85(-) on the relay to a solid chassis ground.

NOTICE

The electrical operation in this option is controlled by the PROHEAT.

2.7 FUEL SYSTEM – SINGLE LINE

Single Fuel Line Heaters S/N X3H18017001 and above.

2.7.1 GENERAL CONSIDERATIONS

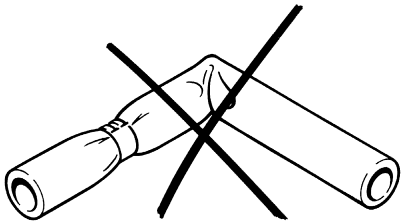


Figure 2-50. Do not kink or pinch fuel line when routing lines

- Use only the 3/16" OD (1/8" ID) fuel line provided with the X30. (Fuel line length is not to exceed 40' with a maximum rise of 5'.)
- Ensure fuel line is routed away from all heat sources, well secured and will not abrade.
- Ensure compression fitting at fuel pump and hose at fuel pick-up are installed correctly as per the instructions.
- Use of a fuel filter is not recommended. All models have a built in fuel filter at the fuel inlet fitting on the heater.

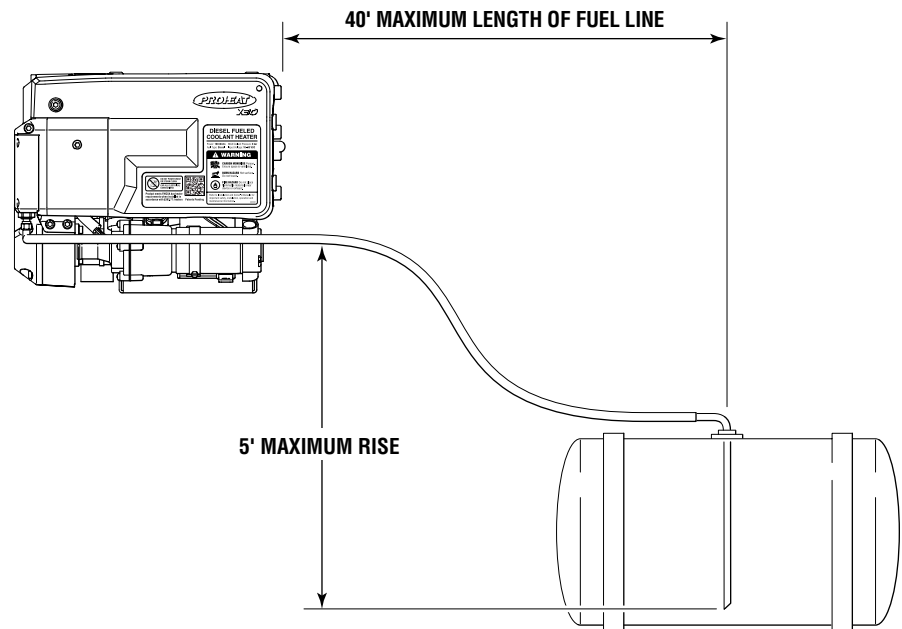


Figure 2-51. Fuel Supply Height Requirement

You Choose

Select Your Fuel Pick-up Installation Option

Option A: Fuel pick-up to be installed in an existing 1/4" NPT port in fuel tank.

Option B: Fuel pick-up to be installed in an existing blank fuel sender cover plate.

2.7.2 OPTION A – 1/4" NPT Port

Locate an existing 1/4" pipe thread port in the vehicle fuel tank.

⚠ CAUTION

Do not use teflon tape as this will contaminate the heater and engine fuel system.

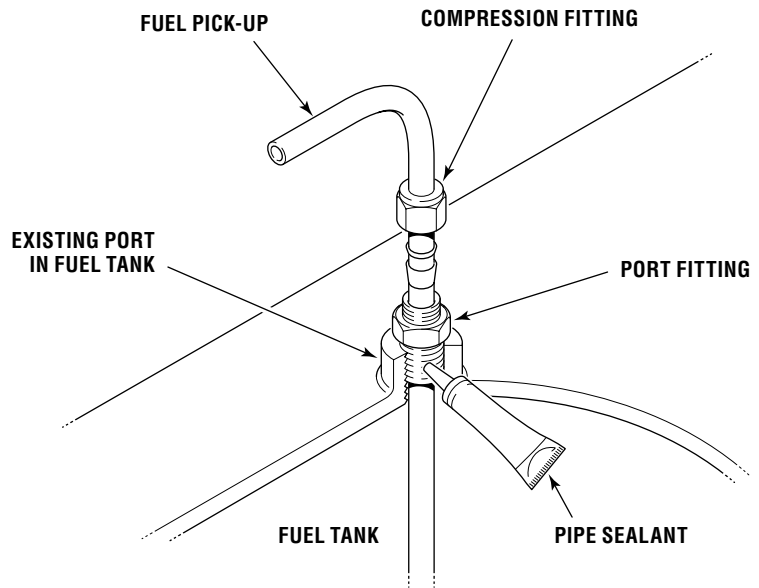


Figure 2-52. 1/4" NPT Port

2.7.3 OPTION B – Existing Blank Fuel Sender Cover Plate

Locate an existing, blank fuel sender port in the vehicle fuel tank. Remove the cover plate, check thickness (recommended Min. 1/4" or 6.35 mm) of plate then drill and tap using 7/16 drill bit and 1/4" x 18 NPT tap.

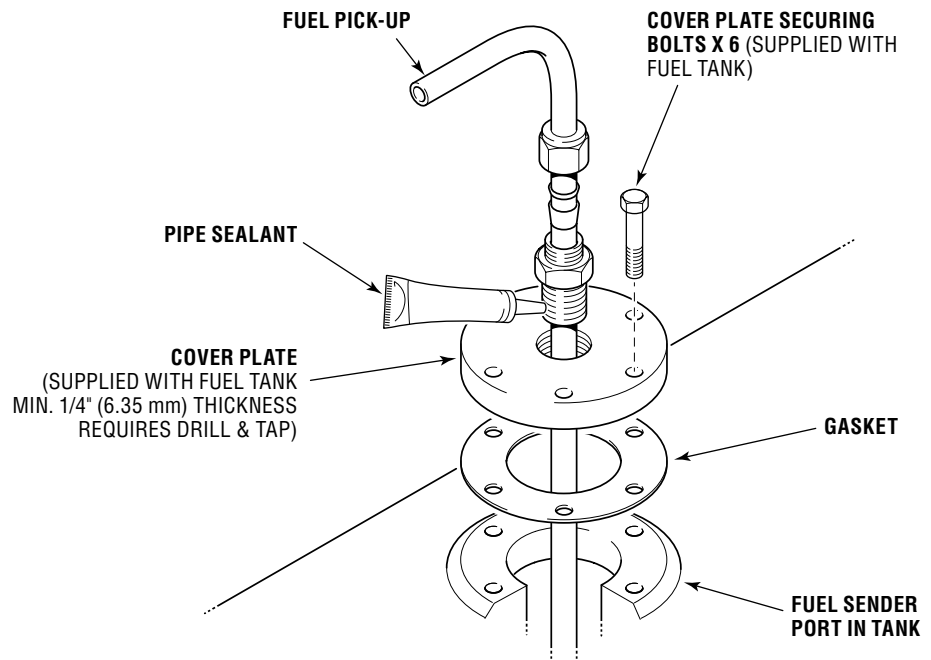


Figure 2-53. Blank Fuel Sender Port

2.7.4 INSTALLATION

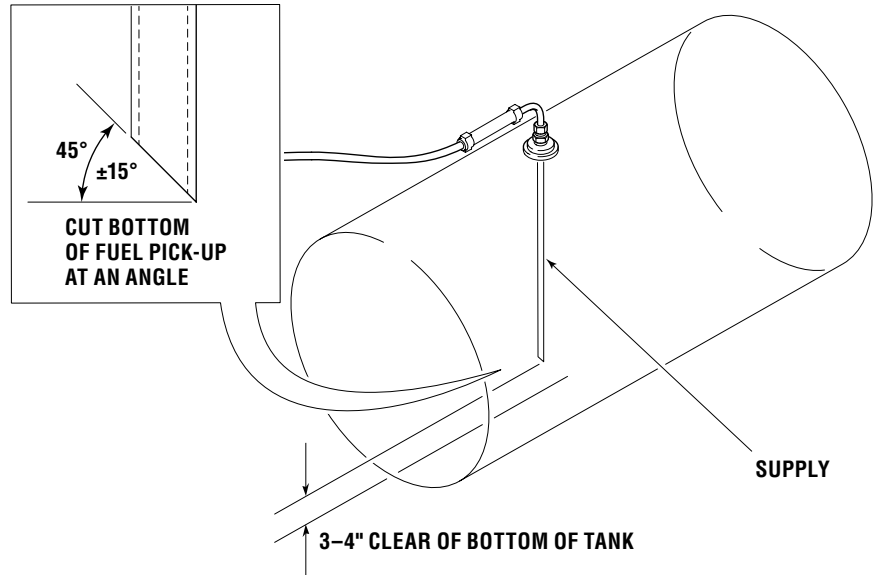


Figure 2-54. Fuel Pick-up Depth

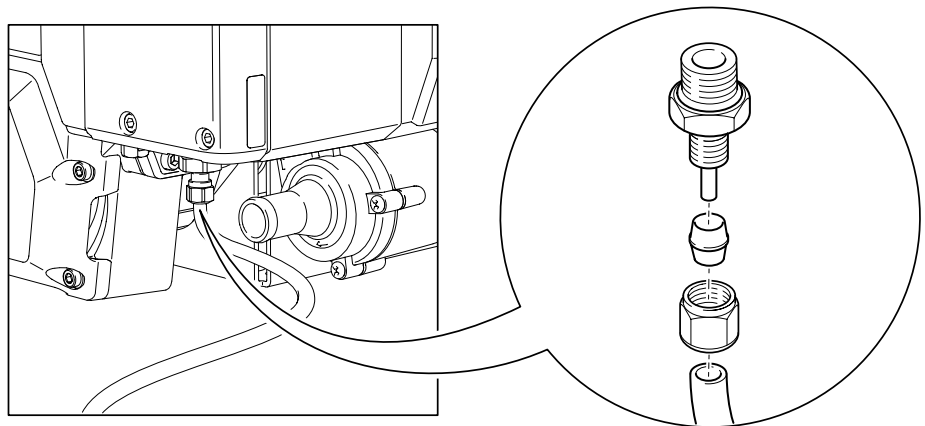


Figure 2-55.

1. Determine the depth of the fuel tank at the desired fuel pick-up location. Cut the fuel pick-up 3 to 4" shorter as shown in figure 2-54.
2. Install the pick-up into the fuel tank as per selected option.
Apply a pipe sealant paste to the fuel pick-up pipe threads prior to installation.
3. Route the fuel line from the heater to the fuel pick-up. Ensure the fuel line is well secured and will not abrade.
Using a sharp knife Cut the fuel line to length. The cut must be square and burr free.
4. Attach the fuel line to the heater fuel pump inlet fitting
 - a) Put the fitting together loosely (see figure 2-55).
 - b) Slide the fuel line into the fitting until it bottoms out.
 - c) Tighten the nut finger tight and with a wrench hold the body of the fitting, and tighten the nut another **two and a half turns**.
5. Attach the fuel line to the fuel pick up using the supplied rubber hose and two crimp clamps. The end of the fuel line and the end of the fuel stand pipe must be pushed close to each other inside the connection. See figure 2-56.

▲ WARNING

Over-tightening will damage the fitting stem. When reattaching the fuel line during service tighten the nut until snug.

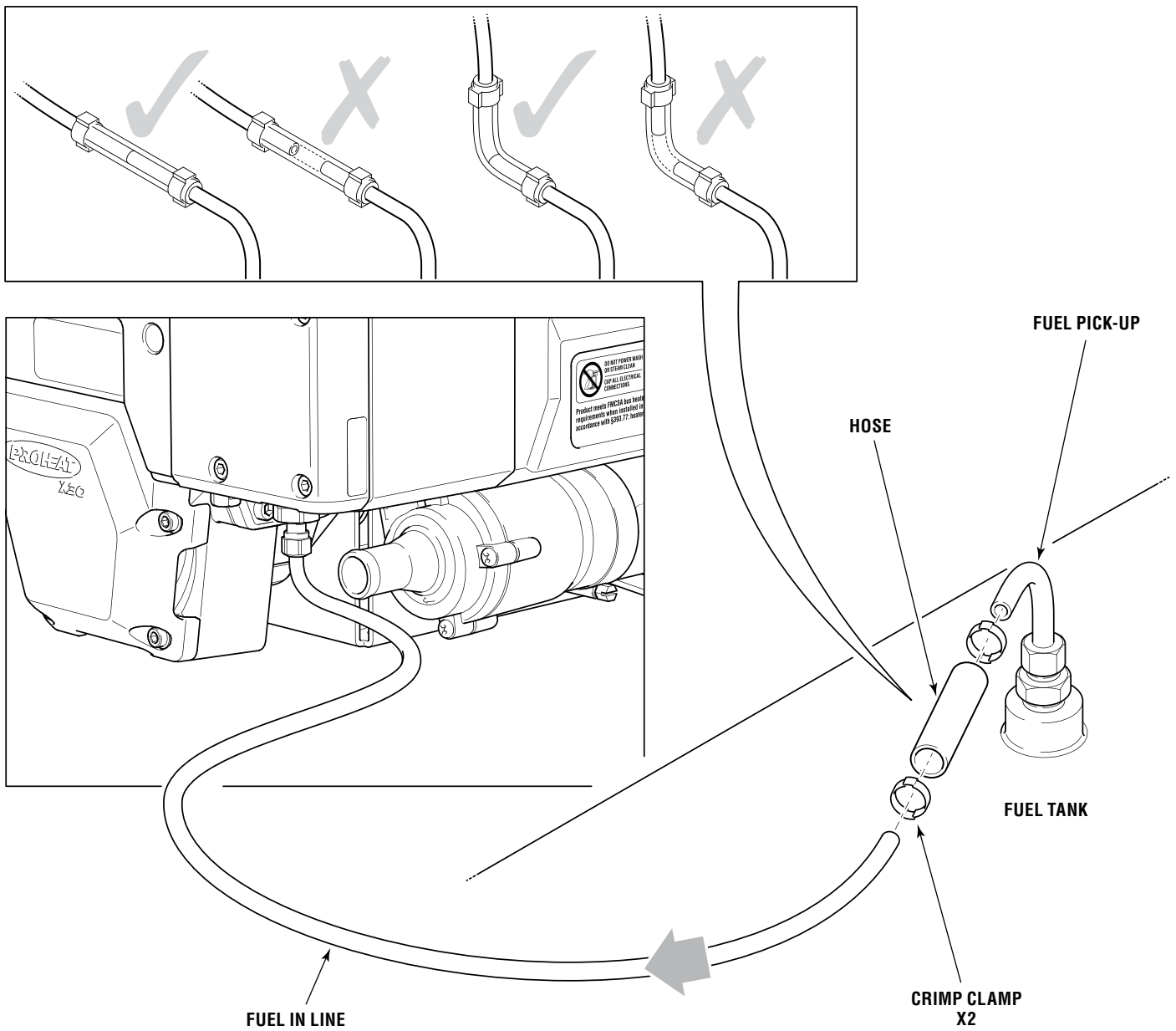


Figure 2-56. Fuel Line Connection Detail

2.8 FIRST TIME STARTUP

1. Do not apply power to Proheat at this time.
2. Inspect the entire installation for:
 - loose bolts
 - loose hoses and hose clamps
 - loose wires and wire connections
 - kinked or pinched hoses or wires
 - battery connection for correct polarity, and
 - coolant supply and return location on the engine
3. Fill the vehicle cooling system with coolant as per owner's manual or engine manufacturer's recommendations.
4. Place dash heater control in the full "HOT" position. Turn air conditioning "OFF."

NOTE: If shut-off valves are installed, make sure they are fully "OPEN."

5. Start the vehicle engine and run it at a fast idle for 5 to 10 minutes to purge air from the heater and coolant system. While the engine is running:
 - make sure the coolant is flowing freely
 - inspect hoses and fittings for leaks
 - check the coolant level in the radiator and add coolant as necessary

For installations without a engine ensure the coolant pump is flooded prior starting the Proheat for the first time.

6. Shut the engine "OFF."
7. Connect the power harness. The LED will Flash once, GREEN then RED and all segments of the digital display will flash once on the PCM followed by the configuration code number and then go blank. This indicates that power has been supplied. See page 4-2 for more information.
8. Start the PROHEAT heater using the ON/OFF switch. The indicator lamp should be lit with a solid red light. Go to the heater and observe its operation. Test preheat and supplemental mode operation if equipped. Refer to page 3-7 for more information.

Sequence of Events:

- Coolant temperature must be less than 150°F (65°C).
- "ON" light on PCM should be lit.
- You should hear the coolant pump, blower, and compressor start.
- The spark will stop after 60 seconds and the heater will continue to run.

NOTE: If the indicator lamp in the ON/OFF switch flashes upon initial startup – **WAIT**. The heater will attempt a restart in 3 minutes. In some cases it takes longer for the fuel pump to prime the empty fuel lines during the initial start. This is usually the case if the fuel lines are long (it may take a few restarts). If the light continues to flash after the restart, then there is a problem. See *Troubleshooting & Repair Manual*.

9. Once the heater is started it will continue to run until the coolant temperature reaches 185°F (85°C) at heater outlet, then it will cycle off.

NOTE: The vehicle dash temperature gauge may read significantly less depending on the location of the sender unit on the engine.

Sequence of Events for Cycle Off

- a) Fuel pump and compressor shut off.
 - b) The blower will run for 3 minutes on Cool Down (Purge) cycle then shut "OFF."
 - c) The water pump will continue to run.
10. The heater will cycle on when the coolant temperature falls below 150°F (65°C) at heater outlet, as long as the ON/OFF switch is left "ON."
 11. If the vehicle has been equipped with the sleeper heat option then:
 - a) Adjust the PROHEAT sleeper thermostat to highest heat position.
 - b) The sleeper heat exchanger fan will start blowing warm air.
 12. Switch the ON/OFF switch to "OFF." The red light will go out and the heater will Cool Down (Purge) for 3 minutes.
 13. Inspect the installation again for leaks.
 14. Install the enclosure cover.

NOTICE

To ensure full warranty coverage, complete the warranty card and mail to PROHEAT.

Note: *This page left blank intentionally.*

3.0 PRINCIPLES OF OPERATION

3.1 COMPONENT DESCRIPTION

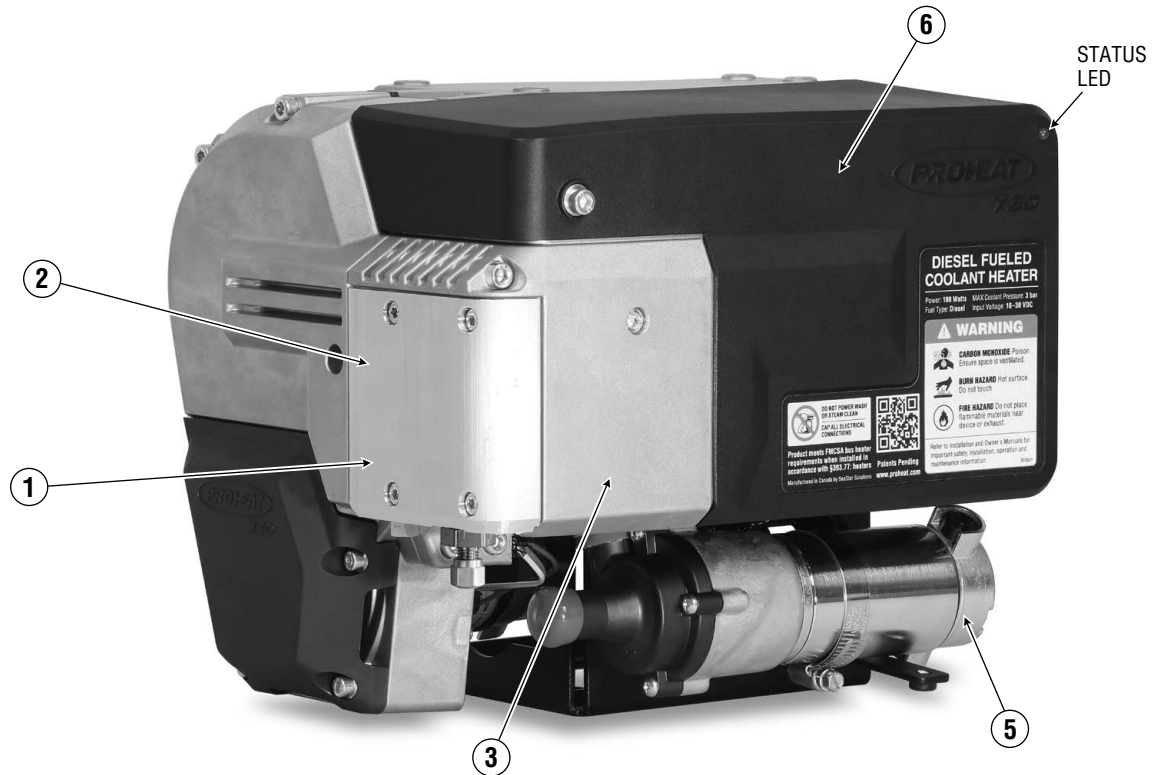


Figure 3-1. PROHEAT X30 Heater

1. Fuel Supply Pump

A positive displacement, gerotor gear-type pump that draws fuel from the vehicle tank and supplies it to the fuel valve. The pump is magnetically driven from the compressor motor. The fuel is filtered at the fuel pump inlet. Pressure is regulated by means of an internal relief valve.

2. Fuel Valve

Electronically meters fuel flow that is allowed to pass onto the nozzle.

3. Air Compressor

A diaphragm type compressor supplies air to the fuel nozzle.

4. Ignition Module

A spark type ignition coil supplies high voltage to the ignition electrodes.

5. Coolant Pump

Circulates the engine coolant. An impeller style pump is used because of its low current draw and free flow during engine operation. **IT IS NOT SELF-PRIMING.** The pump must be flooded and the system must be purged of all air for it to operate. (DO NOT run dry.)

The PCM utilizes a microprocessor to monitor operating conditions and control outputs to the motors and sensors. It has powerful diagnostics to assist in troubleshooting. One of the key features is the diagnostic display on the front

6. PROHEAT Control Module (PCM)

of the PCM, which has a display LED to indicate function or component problems.

NOTE: See “Modes of Operation Section” for a description of the operating modes used.

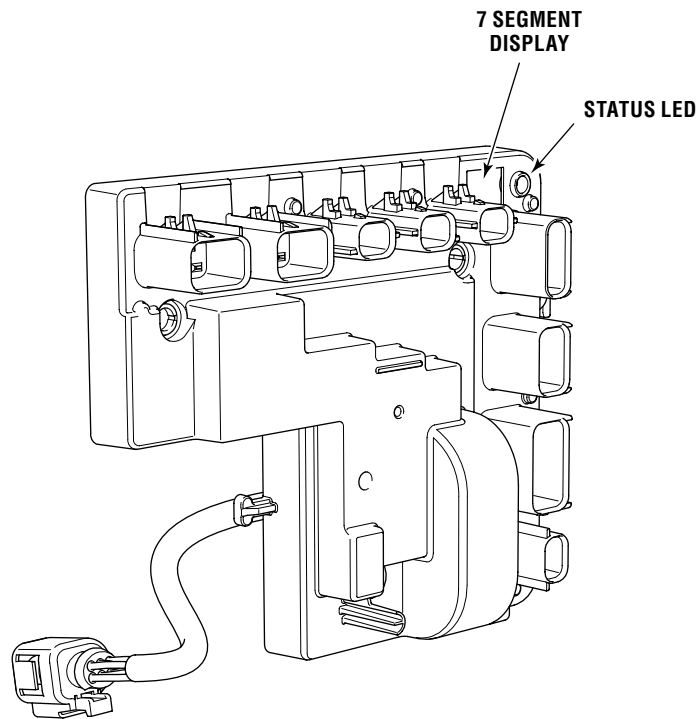


Figure 3-2. LED will light to indicate a problem. Switch or timer indicator light will flash to indicate the diagnostic code (page 4-2).

7. Fuel Nozzle

An air/fuel aspirating-type spray nozzle is located inside the burner head. The compressed air flows through the nozzle at high speed creating a venturi effect. This siphons fuel from the fuel valve and combines it with the air, creating an extremely fine mist that is sprayed out of the nozzle into the combustion chamber.

8. Combustion Air Blower

Uses an impeller-type fan to supply the combustion air at low pressure. It is also used to cool and Cool Down (Purge) the combustion chamber during the shut-down sequence.

9. Heat Exchanger

Coolant is circulated through the heat exchanger via the inlet and outlet ports. Heat is transferred from the heat exchanger through the inner wall of the exchanger into the coolant. The exhaust gases are directed out through the exhaust port.

10. Ignition Electrode

The electrode is located near the nozzle just out of the air/fuel mixture path. During the ignition sequence the spark jumps the gap between the electrodes, igniting the air/fuel mixture, and is then turned off. Spark duration is up to 60 seconds.

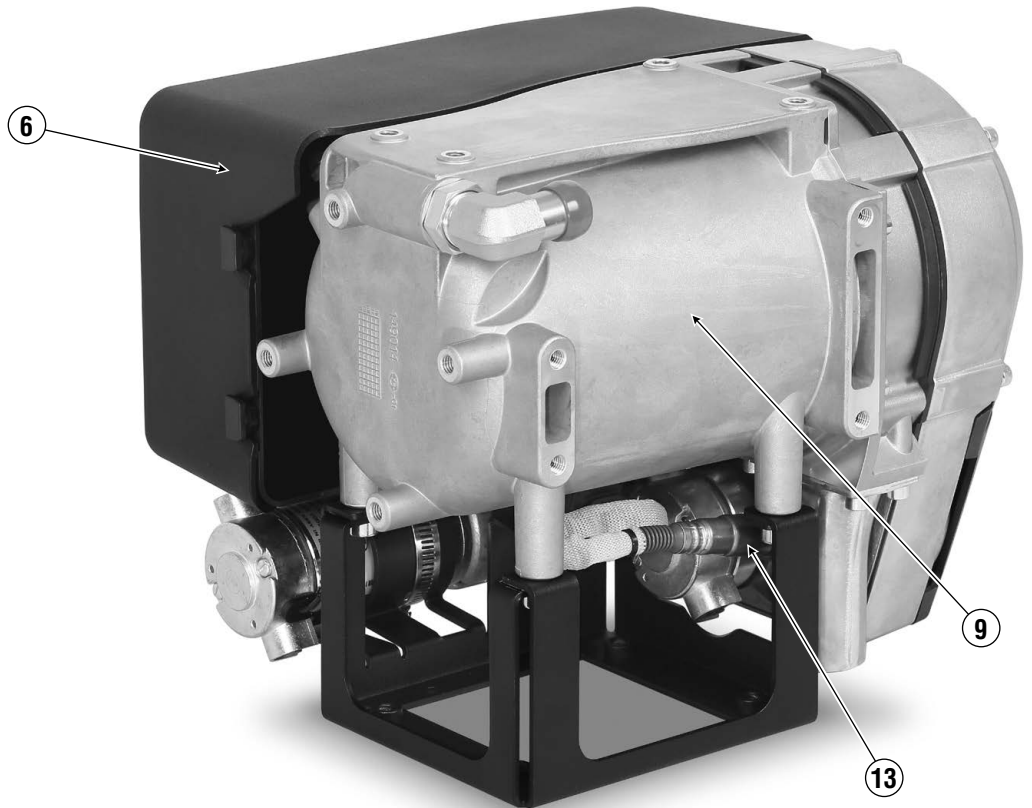


Figure 3-3. PROHEAT X30 Heater

11. Dual Mode Outlet Temperature Sensor

Measures the coolant temperature near the outlet port of the heat exchanger and sends this information to the PCM. The dual mode sensor contains both digital and analog sensing elements for more accurate and reliable measurements. The sensor also touches the inner heat exchanger surface to measure the heat exchanger temperature for an overheat condition.

WARNING

The dual mode temperature sensor must be properly installed in the heat exchanger at all times for overheat protection.

12. EGT Sensor

Located in the exhaust outlet of the X30. Measures the exhaust gas temperature.

13. Oxygen Sensor

Located in the exhaust outlet of the X30. Provides continuous feedback to the PCM.

14. On/Off Switch

Used to switch the heater “ON” and “OFF.” It has an indicator lamp that displays a red light when switched “ON.” A blinking red light indicates that a diagnostic code is being displayed on the PCM. (See page 4-2 for details.)

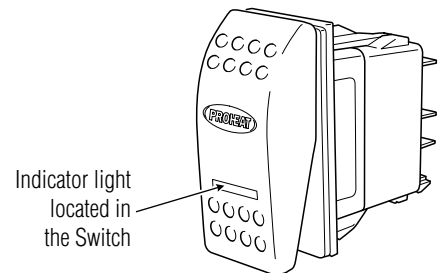


Figure 3-4. ON/OFF Rocker Switch

15. Optional Proheat Function Controller (PFC)

A CAN Bus enabled, multifunction controller that includes multiple programmable timers, error code reading and system programming.

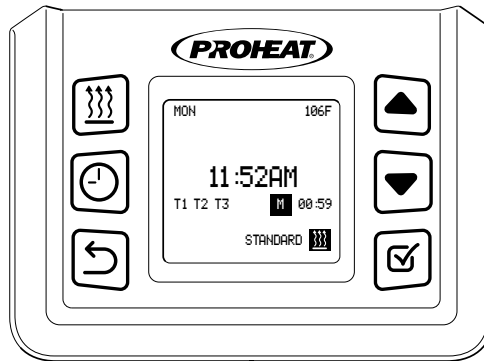


Figure 3-5. Optional Proheat Function Controller (PFC).

16. Optional 7-Day Timer

Used to switch the heater “ON” and “OFF.” This can be done manually or by a preset time and day. It has an indicator lamp that displays a red light when switched or timed “ON.” A flashing red light indicates that a diagnostic code is being displayed on the PCM. (See page 4-2 for details.)

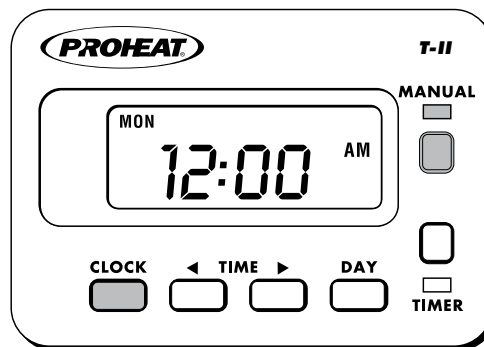


Figure 3-6. 7-Day Timer

3.2 THEORY OF OPERATION

There are five basic systems within the PROHEAT.

1. Air Compressor

The purpose of the air compressor is to deliver a metered amount of clean compressed air to the nozzle.

As the compressor motor turns, it drives a diaphragm type compressor. The compressor draws fresh air through an air filter located on the top of the compressor. It is then compressed and delivered to the nozzle in the burner head via internal passages.

2. Fuel Supply System

The purpose of the fuel supply system is to deliver clean, air-free fuel to the fuel valve.

As the compressor motor turns, it magnetically drives a positive displacement gerotor type pump. The fuel pump draws (under a vacuum) fuel from the fuel tank through the fuel line. The fuel then enters the sintered fuel filter located above the fuel inlet fitting on the bottom of the pump. The fuel then enters the fuel pump and is pressurized. This pressure is controlled via the fuel pump relief valve. The fuel then enters the fuel control valve.

The fuel control valve is electrically controlled by the PCM and meters the fuel pressure and flow that is allowed to pass onto the nozzle. The fuel is now drawn from the fuel control valve via the low pressure created by the nozzle.

3. Fuel Control System (Feedback)

The purpose of the fuel control system is to maintain optimal combustion chamber conditions.

An oxygen sensor located in the exhaust outlet of the X30 provides continuous feedback to the PCM. The PCM uses this data to continuously meter the fuel/air ratio in the combustion chamber by way of the electronic fuel control valve.

The fuel is always matched to the available oxygen in the combustion chamber.

4. Nozzle

The purpose of the nozzle is to atomize the fuel.

The compressed air (by way of the compressor's internal passage) travels over the body of the nozzle. As it reaches the end of the nozzle, it passes through a restriction. This creates a negative pressure or venturi effect. This negative pressure extends back through the center of the nozzle all the way to the fuel valve. This negative pressure causes the available fuel to be siphoned from the fuel valve. The compressed air and fuel are then mixed at the end of the nozzle into a very fine mist of fuel/air that is sprayed into the combustion chamber in the shape of a cone.

NOTE: The compressed air flowing over the nozzle is not sufficient for clean combustion.

5. Combustion Air System

The purpose of the combustion system is to deliver a metered amount of air to the combustion tube (chamber). This provides the majority of the air needed to combust the atomized fuel/air mist created by the nozzle, and to cool the combustion chamber when the heater cycles off.

As the blower motor turns, it directly drives the combustion air blower blade. The combustion air is not filtered, so it needs to come from a clean area. A snorkel hose is sometimes used to draw air from a clean source. The air is then directed into the combustion tube. The fan end casting is shaped in such a way that it causes the air to swirl into the combustion tube. The swirling air then mixes with the atomized fuel/air cone from the nozzle. Once lit, this creates an intense flame in the combustion tube. The hot gases then reach

the end of the combustion tube and make a 180-degree turn to enter the heat exchanger. The heat exchanger has fins that transfer the heat to the coolant that flows around the heat exchanger. The gases enter the exhaust system and are read by the oxygen sensor, then are directed away from the vehicle.

Examples:

All five systems must work together to produce safe, smoke-free operation of the PROHEAT. It is important for the service technician to understand the five systems and how a change in one system can result in improper combustion.

A restriction in the amount of air through the combustion chamber (restricted air intake, dirty heat exchanger plugged exhaust) could result in a rich air/fuel mixture. The Oxygen sensor will detect the lack of oxygen and the PCM will adjust the blower speed and fuel valve position to prevent a rich air/fuel mixture and possibly black smoke from the exhaust.

A restriction in the fuel line, filter, or nozzle fuel passage will reduce the atomized fuel/air flow into the the combustion tube. The Oxygen sensor will detect the increase of oxygen and the PCM will adjust the blower speed and fuel valve position to prevent a lean air/fuel mixture and possibly gray/white smoke from the exhaust.

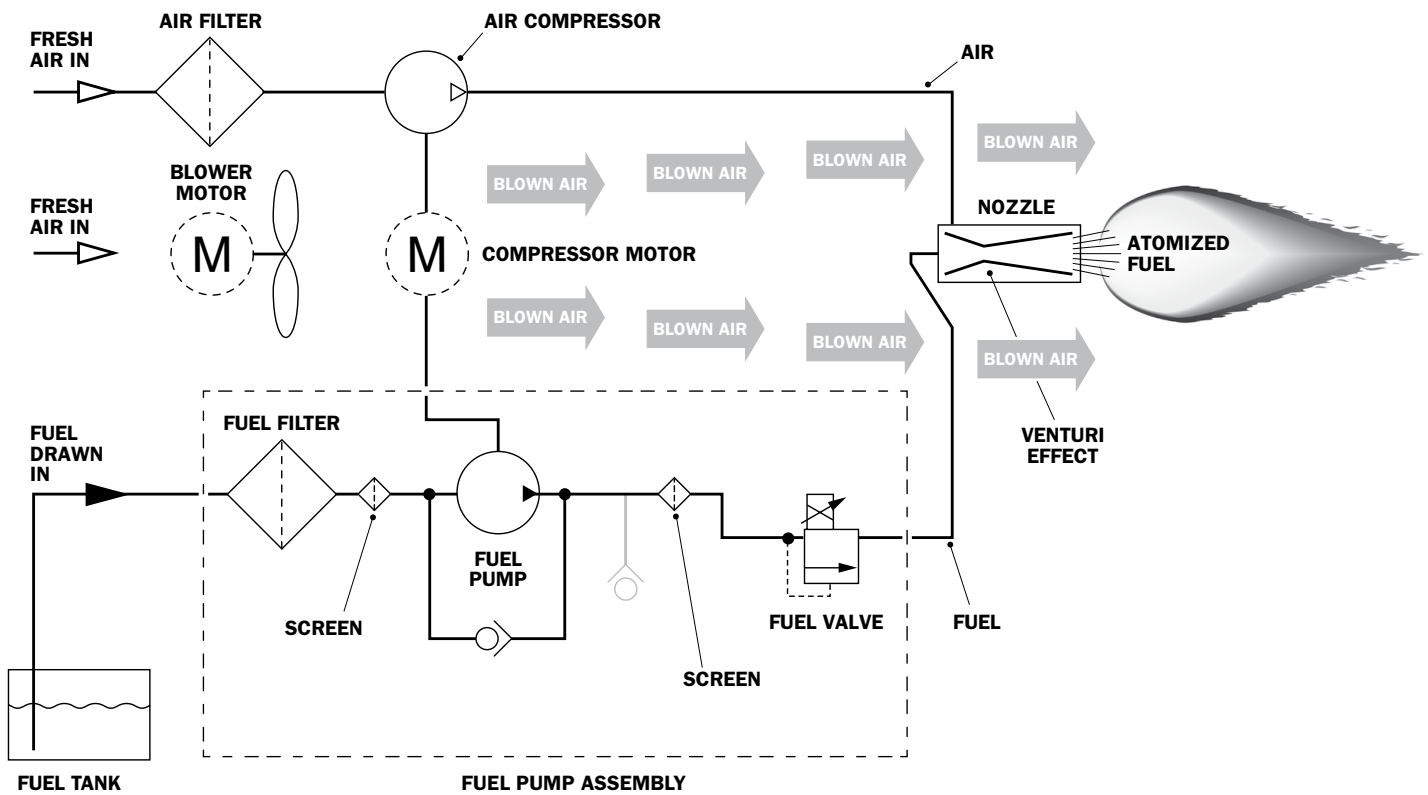


Figure 3-7. Fuel Delivery Theory of Operation

3.3 MODES OF OPERATION

The PROHEAT X30 has four modes of operation: standard, supplemental, preheat, and anti-freeze. For a general description of the modes, see Heater Modes starting on page 2-19.

STANDARD MODE

- normal operation of the Proheat
 - overrides *Supplemental Mode*
 - overrides and cancels *Preheat Mode*
 - overrides *Anti-Freeze Mode*
-
- *Optional Global Low temperature feature*

SUPPLEMENTAL MODE (engine running)

- similar to *Standard Mode* except: coolant pump does not run when Proheat is not firing
 - overrides and cancels *Preheat Mode*
 - overrides *Anti-Freeze Mode*
 - 30 second signal required before mode enabled
 - 5 second delay required for mode switch off
-
- *Optional Supplemental Max Heat feature*
 - *Optional Global Low temperature feature*
 - *Optional Supplemental Priority feature*

PREHEAT MODE (engine off)

- similar to *Standard Mode* except: 90 minute time out
 - overrides *Anti-Freeze Mode*
 - activated via momentary contact push button switch with latching internal to the PCM
-
- *Optional Global Low temperature feature*

ANTI-FREEZE MODE (engine off)

- similar to *Supplemental Mode* except: coolant pump runs at set intervals when Proheat is not firing to check actual system temperature
-
- *Optional Global Low temperature feature*

GLOBAL LOW FEATURE*

- Shifts all the cycle on/off temperature of operating modes (*Preheat, Standard and Supplemental*) down to between 73–108°F (40–60°C)

SUPPLEMENTAL MAX HEAT FEATURE*

- Changes the supplemental mode cycle on/off temperature range to 170–190°F (77–88°C)

SUPPLEMENTAL PRIORITY FEATURE*

- Overrides *Standard Mode* but does not cancel *Standard Mode*

* Optional I/O programming required for these mode features.

3.3.1 STANDARD MODE



1. Switch "ON" Standard Mode Signal

The ON/OFF switch lamp, timer or OEM indicator (installation options) will light green. In addition, the X30 PCM ON Indicator will light. If the coolant temperature is below 150°F (65°C) the PROHEAT enters **Pre-check**. If the coolant temperature is above 150°F (65°C) the PROHEAT enters **Standby**.

2. Pre-check

The PCM performs self diagnosis checking sensors for correct range, electrical components for over-load and for a flame presence. If there are no errors indicated, the PROHEAT goes to **Pre-ignition**.

3. Pre-ignition

Fuel Valve starts to cycle, followed by the heated Oxygen sensor warm-up phase. The Blower starts to turn followed by the compressor.

4. Ignition

The ignition spark is turned on and then the Blower and Compressor speed is increased. Once the heater senses a good flame, the PROHEAT goes to full output and turns the Ignition off.

5. Full Output

The PROHEAT runs at full output until the coolant temperature reaches 185°F (85°C *t) at the heater outlet. The PROHEAT shuts the flame off and goes to Cool Down (Purge), this is indicated on the PROHEAT Control Module (PCM).

6. Purge

The air compressor and fuel pump shut off immediately. The blower and coolant pump continue to run. After 3 minutes, the blower stops and the PROHEAT goes to standby.



* Factory Setting.

t In modulation the temperature may rise 9°F (5°C) past the setting



7. Standby

The coolant pump circulates the coolant through the system until the temperature drops to 150°F (65°C) at the heater outlet. Then it will enter Pre-check and repeat steps 2 to 7. The PROHEAT will continue to repeat steps 2 to 5 until it is switched “OFF.”



8. Switch “OFF”

If PROHEAT is in full output, it will Cool Down (Purge) first, then shut “OFF.” If PROHEAT is in standby, it will shut “OFF” immediately. When switched “OFF.”

NOTE: The PROHEAT will Cool Down (Purge) for 3 reasons:

- the coolant reaches 185°F (85°C *t)
- there is a function or component problem
- the PROHEAT is operating at full output when it is shut “OFF”

3.3.2

OPTIONAL SUPPLEMENTAL MODE



1. Activate Supplemental Signal for 30 Seconds

The “ON” light and heater indicator will turn “ON” after 30 seconds of receiving the signal.

2. Supplemental Standby

The PROHEAT monitors coolant temperature until it drops below 150°F (65°C), and then goes to pre-run.

3. Pre-run

The coolant pump operates for 30 seconds to circulate coolant through the system. If the coolant temperature rises above 150°F (65°C), the pump shuts off and the PROHEAT returns to supplemental standby. If the coolant temperature remains below 150°F (65°C), the PROHEAT goes to pre-check.

4. Pre-check

The PCM performs a short diagnostic cycle. This takes a few seconds to check components for proper ranges, checking for the presence of a flame, short-circuits, and open circuits. If there are no errors indicated, the PROHEAT goes to pre-ignition.

5. Pre-ignition

Fuel Valve starts to cycle, followed by the heated Oxygen sensor warm-up phase. The Blower starts to turn followed by the compressor.

6. Ignition

The ignition spark is turned on and then the Blower and Compressor speed is increased. Once the heater enters closed loop and senses a good flame, the PROHEAT goes to full output and turns the Ignition off.

7. Full Output

The PROHEAT runs at full output until the coolant temperature reaches 185°F (85°C *t) at the heater outlet. The PROHEAT shuts the flame off and goes to Cool Down (Purge), this is indicated on the PROHEAT Control Module (PCM).

8. Purge

The air compressor and fuel pump shut off immediately. The blower and coolant pump continue to run. After 3 minutes the blower and coolant pump stop and the PROHEAT goes to supplemental standby and repeats steps 2 to 8.

NOTICE

If supplemental priority is selected, supplemental mode will have priority over other modes.

* Factory Setting.

t In modulation the temperature may rise 9°F (5°C) past the setting



9. Remove Supplemental Signal for 5 Seconds

The "ON" light and the heater indicator turn off after 5 seconds of the signal being removed. If the PROHEAT is in the supplemental standby or pre-run sequence, the PROHEAT will turn off immediately. If the PROHEAT is in any other function, it will complete a Cool Down (Purge) function before turning off. When switched "OFF,"

NOTICE

There are special OEM versions for Supplemental Mode. For example, temperature thresholds may have a low threshold of 160°F (71°C) rather than 150°F (65°C).

NOTE: The PROHEAT will Cool Down (Purge) for 3 reasons:

- the coolant reaches 185°F (85°C *t)
- there is a function or component problem (See *Troubleshooting & Repair Manual*)
- the PROHEAT is operating at full output when it is shut off

3.3.3 OPTIONAL PREHEAT MODE



1. Activate Preheat Signal

Push the preheat button and the PCM "ON" LED light will turn on. The PROHEAT goes to pre-check.

2. Precheck

The PCM performs a short diagnostic cycle. This takes a few seconds to check components for proper ranges, checking for the presence of a flame, short-circuits and open circuits. If there are no errors indicated, the PROHEAT goes to pre-ignition.

3. Pre-ignition

Fuel Valve starts to cycle, followed by the heated Oxygen sensor warm-up phase. The Blower starts to turn followed by the compressor.

4. Ignition

The ignition spark is turned on and then the Blower and Compressor speed is increased. Once the heater enters closed loop and senses a good flame, the PROHEAT goes to full output and turns the Ignition off.

5. Full Output

The PROHEAT runs at full output until the coolant temperature reaches 185°F (85°C *t) at the heater outlet. The PROHEAT shuts the flame off and goes to Cool Down (Purge).

6. Purge

The air compressor and fuel pump shut off immediately. The blower and coolant pump continue to run. After 3 minutes, the blower stops and the PROHEAT goes to standby.

7. Standby

The coolant pump circulates the coolant through the system until the temperature drops to 150°F (65°C) at the heater outlet. The PROHEAT returns to precheck and repeats steps 2 to 7. The PROHEAT will continue to repeat this cycle until it is switched off, or will switch "OFF" automatically after 90 minutes.

8. After 90 Minutes or Switched Off

If PROHEAT is in full output, it will Cool Down (Purge) first, then shut off. If PROHEAT is in standby, it shuts off immediately.

NOTE: The PROHEAT will Cool Down (Purge) for 3 reasons:

- the coolant reaches 185°F (85°C)
- there is a function or component problem
- the PROHEAT is operating at full output when it is shut "OFF"

* Factory Setting.

t In modulation the temperature may rise 9°F (5°C) past the setting

3.3.4 OPTIONAL ANTI-FREEZE MODE



1. Switch "ON" Anti-freeze Mode Signal

The "ON" light and heater indicator will turn "ON" after receiving the signal.

2. Anti-Freeze Standby

The PROHEAT monitors coolant temperature until it drops below 41° (5°C), and then goes to pre-run, or every 20 minutes the heater goes to Pre run interval

3. Pre-Run

The coolant pump operates for 30 seconds to circulate coolant through the system. If the coolant temperature rises above 41° (5°C), the pump shuts off and the PROHEAT returns to anti-freeze standby. If the coolant temperature remains below 41° (5°C), the PROHEAT goes to pre-check.

4. Pre-Run Interval

Every 20 minutes the coolant pump is operated for 30 seconds to circulate coolant through the system and the temperature is again checked. If the coolant temperature rises above 41° (5°C), the pump shuts off and the PROHEAT returns to supplemental standby. If the coolant temperature remains below 41° (5°C), the PROHEAT goes to pre-check.

5. Precheck

The PCM performs a short diagnostic cycle. This takes a few seconds to check components for proper ranges, checking for the presence of a flame, short circuits, and open circuits. If there are no errors indicated, the PROHEAT goes to ignition.

6. Pre-ignition

Fuel Valve starts to cycle, followed by the heated Oxygen sensor warm-up phase. The Blower starts to turn followed by the compressor.

7. Ignition

The ignition spark is turned on and then the Blower and Compressor speed is increased. Once the heater enters closed loop and senses a good flame, the PROHEAT goes to full output and turns the Ignition off.

8. Full Output

The PROHEAT runs at full output until the coolant temperature reaches 68°F (20°C) at the heater outlet. The PROHEAT shuts the flame off and goes to Cool Down (Purge), this is indicated on the PROHEAT Control Module (PCM).



9. Cool Down Purge

The air compressor and fuel pump shut off immediately. The blower and coolant pump continue to run. After 3 minutes the blower and coolant pump stop and the PROHEAT goes to anti-freeze standby and repeats steps 2 to 9 until switched off.



10. Switch "OFF"

The "ON" light and the heater indicator turn off once the "ON" signal is removed. If the PROHEAT is in the anti-freeze standby or any pre-run sequence, the PROHEAT will turn off immediately. If the PROHEAT is in any other function, it will complete a Cool Down (Purge) function before turning off.

NOTE: The PROHEAT will Cool Down (Purge) for 3 reasons:

- the coolant reaches 41°F (5°C)
- there is a function or component problem
- the PROHEAT is operating at full output when it is shut "OFF"

4.0 TROUBLESHOOTING AND REPAIR

NOTICE

Troubleshooting and repair is to be performed by authorized PROHEAT dealers.

Problems with the PROHEAT and its operation will be indicated in two ways:

1. PROHEAT diagnostic faults are indicated by means of a blinking diagnostic indicator light on the switch, timer red manual light or OEM indicator light (installation options). See Example PROHEAT Behavior Error on page 4-5.
2. Operational problems may not be identified with a blinking diagnostic code (e.g., blown fuse, smoking exhaust, backfiring, or low heat output. Go to page 4-34.)

4.0.1 TROUBLESHOOTING A PROBLEM

1. Locate the PROHEAT, remove the enclosure lid if equipped and visually check for any problems with wiring harnesses, fuel leaks, coolant leaks, exhaust pipe damage, and environmental conditions.
2. Remove the cover of the PROHEAT Control Module (PCM) and inspect the display for the error code.
3. If no code is indicated, turn the PROHEAT off and then on again using the existing operational switches or timer.
4. Let the PROHEAT attempt to start and/or operate. Observe the operation.

NOTE: The PROHEAT will always attempt to start twice, as long as the coolant temperature is below 150°F (65°C). If a fault is detected it will shut down, go through a Cool Down (Purge) and attempt a second start. After both attempts to start or operate, the PCM will display a code and the switch, timer red manual light, or OEM indicator (installation options) will blink.

- After two consecutive start attempts, the PROHEAT will not attempt to start again and goes into a hold state. In the hold state, the switch, Timer red manual light, or OEM indicator light (installation options) will blink continuously. The PROHEAT will try again once the switch is turned “OFF” and then “ON” again.
- If the PROHEAT runs but is not performing or operating correctly, consult the Operational Problems, Section 4.2 on page 4-34.

Troubleshooting and Repair Tools Required

- **Digital Air Compressor Test Gauge** (PROHEAT P/N PK0036)
Allows the service technician to check compressor pressure in order to ensure correct fuel delivery. (**NOTE:** The analog air pressure gauge PK0067 can also be used.)

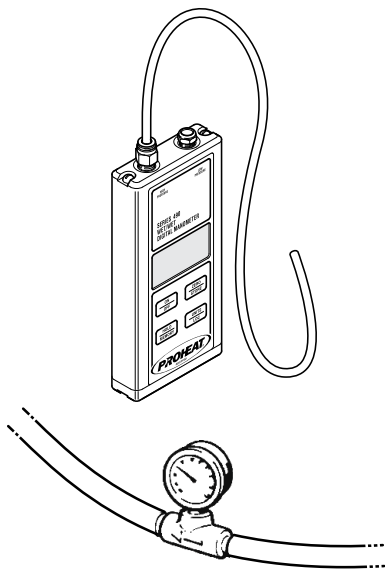


Figure 4-1. Troubleshooting Tools

4.1 OPERATION INDICATORS, FUNCTION AND COMPONENT DIAGNOSTICS

4.1.1 OPERATION INDICATORS PCM COVER INSTALLED

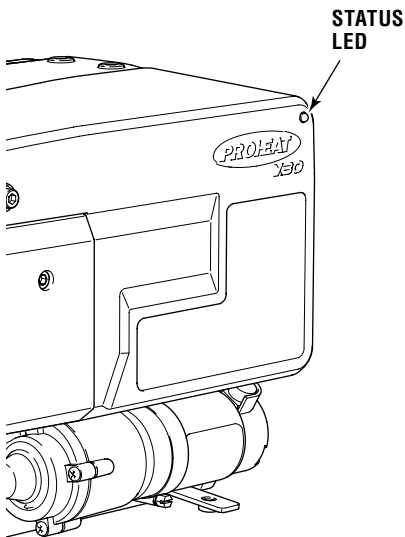


Figure 4-2. Status LED.

PCM Cover Status LED

The PCM continually monitors the PROHEAT operating conditions. If the PCM detects a problem, the PCM status LED blinks Red, indicating a diagnostic code(s) is being displayed on the PCM's 7 segment display located under the PCM cover.

The diagnostic indicator light may also be located:

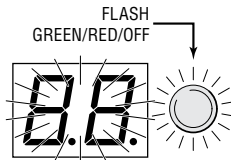
- In the ON/OFF Switch provided by PROHEAT (standard installation kit).
- In the PROHEAT T-II Timer manual ON light (red).
- PFC Manual Button LED
- In an OEM indicator light package.

PCM STATUS LED	LIGHT COLOUR	
GREEN THEN RED	Flash Green, Red then off	When power is first applied to the PCM the Status LED will flash Green/Red to indicate that the PCM has booted up
GREEN	On solid	Heater is switched on Via analog or CAN switch inputs and is operating normally
RED	On solid	Software problem detected. Contact Proheat for further information.
RED	Blinking	Indicating a diagnostic code(s) is being displayed on the PCM's 7 segment display located under the PCM cover

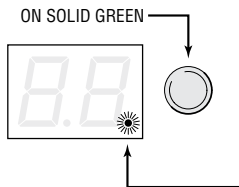
4.1.2 OPERATION INDICATORS PCM COVER REMOVED



Power Up



On/CAN



Cool Down



7 Segment Display — Operation States:

- 8.8. – Power Up
- Right (●) – On
- Left (●) – Cool Down (Purge)

The operation indicators signal normal functioning of the PROHEAT. These three states do not indicate a fault.

The power up indicator communicates that the PROHEAT power has been supplied. All segments of the LED momentarily blink “88” twice, followed by a 2-second display of the configuration code number (if configuration is set) or “CC” (if configuration is not set).

The ON indicator code communicates:

On solid – Heater is switched on via analog switch inputs and is operating normally.

Off then two blinks then off again – Heater is connected to CAN Bus network and is communicating on the network but is not switched on.

On solid with two blinks then on solid again – Heater is switched on Via Analog or CAN Bus switch inputs and is communicating on the network.

⚠ WARNING

The “ON” LED indicates that the heater can start at any time. Refer to page 3-7 to page 3-10 .

The PROHEAT will be in the Cool Down (Purge) state as defined in Modes of Operation (see page 3-7) when “Pu” is displayed.

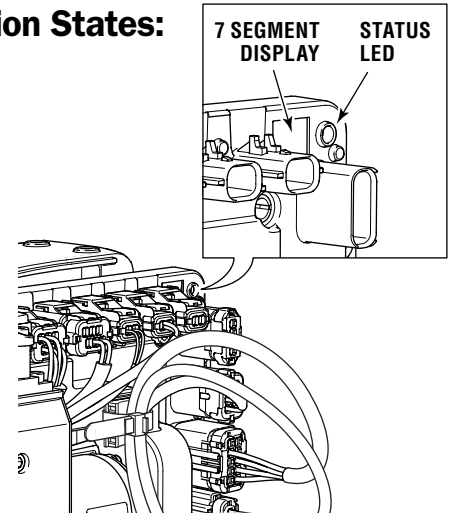


Figure 4-3. 7 Segment Display.

Diagnostic Codes:

The microprocessor in the PCM continually monitors all the PROHEAT systems. If the internal diagnostics discover a problem, a diagnostic code will be displayed on the PCM function display. The remote ON/OFF switch, timer red manual light, or OEM indicator light (installation options) will also blink. (See page 4-4 for a complete list of operation states and error codes.)

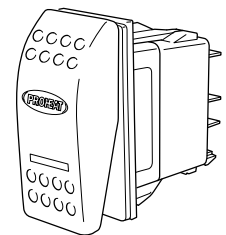
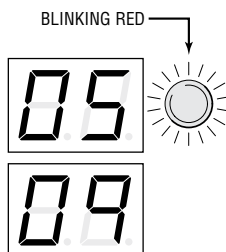


Figure 4-4. Remote On/Off Rocker Switch.



If multiple errors occur, multiple codes will be displayed. For example, if a 5 and 9 error occurs together, the PCM LED will display 5 and then 9.

NOTICE

LOCKOUT MODE

After 6 consecutive start faults (Code 01) or on the first occurrence of Overheat (Code 04) the X30 PCM will go into Lockout mode, Power to the X30 PCM must be removed and reapplied to exit Lockout mode.

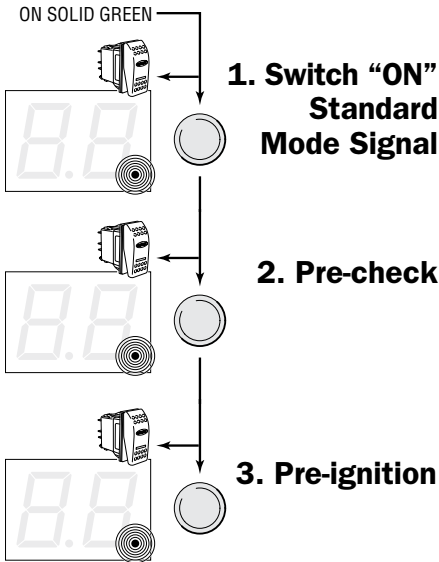
	Operating State	Display Code No.	Description
	Power Up	bL	Boot loader.
	Configuration	CC	Configuration error or not selected.
Function Diagnostics	Start	01-1	O ₂ low.
		01-2	O ₂ high.
		01-3	EGT temp low.
	Flame Out	02-1	O ₂ low.
		02-2	O ₂ high.
		02-3	EGT temp low.
		02-4	Fuel command low.
		02-5	Unstable flame.
	Coolant Flow*	03-1	Coolant flow.
	Overheat	04-1	Coolant.
04-2		Exhaust.	
Voltage	05-1	Voltage low.	
	05-2	Voltage high.	
	05-3	Voltage surge.	
Component Diagnostics	Temp Sensors	07-1	Analog – Range low (short circuit).
		07-2	Analog – Range high (open circuit).
		07-3	Digital – No communication.
		07-4	Analog/Digital – Temperature sensor mismatch.
	Fuel Valve	08-1	Electrical fault.
	Compressor	09-1	Short circuit.
		09-2	Overload.
		09-3	Open circuit.
		09-4	Speed.
		09-5	PCM damaged.
	Ignition Module	10-1	Short circuit.
		10-2	Not used.
		10-3	Open circuit.
	Coolant Pump	11-1	Short circuit.
		11-2	Overload.
	Blower Motor	12-1	Short circuit.
		12-2	Overload.
		12-3	Open circuit.
		12-4	Speed.
		12-5	PCM damaged.
	System Current	16-1	Short circuit.
		16-2	Overload.
	O ₂ Sensor	17-1	No communication.
		17-2	Out of range.
		17-3	Performance.
17-4*		Near end of life.	
CAN	18-1	Heartbeat lost.	
PCM Temp	19-1*	PCM temperature high.	
Output 1	21-1*	Short circuit.	
Output 2	22-1*	Short circuit.	
Output 3	23-1*	Short circuit.	
Output 4	24-1*	Short circuit.	
Output 5	25-1*	Short circuit.	
Output 6	26-1*	Short circuit.	
PCM Power	31-1	Supply voltage low.	
EGT Sensor	32-1	Range low (short circuit).	
	32-2	Range high (open circuit).	
Impact Switch	33-1	Active.	
PCM	34-1	Hardware failure.	

*Warning code. Heater will continue to operate.

Table 4-1. Function Display Panel Detail & Error Flash Codes

4.1.3 EXAMPLE PROHEAT BEHAVIOR ERROR – CODE 01-1

The following is an example of an X30 PROHEAT behavior during an error. The following example shows the sequence of events when the PROHEAT is switched “ON” in the standard mode (similar for other modes). This sequence of events occurs for Codes 01 through 18. Codes 19 through 26 do not put the heater into Cool Down (Purge) mode or shut down the PROHEAT. Rather, the PROHEAT reports the error and continues to run.



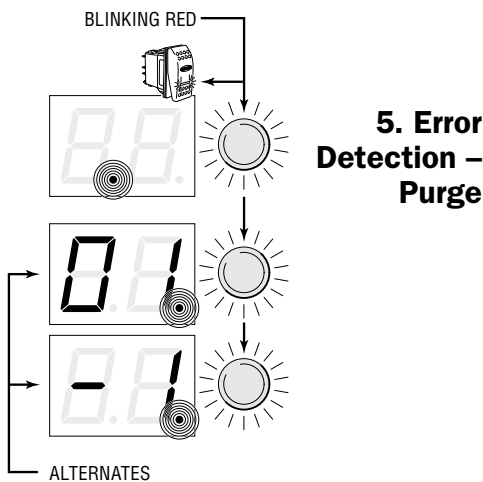
The PCM cover status LED, PCM segment “ON” LED, toggle switch, T-II timer red manual light or OEM indicator will light. The PROHEAT goes to precheck.

The PCM performs a short diagnostic cycle. This takes several seconds checking components for proper ranges, checking for the presence of a flame, short-circuits and open circuits. If there are no errors indicated, the PROHEAT goes to pre-ignition.

The Fuel Valve starts to cycle, followed by the heated Oxygen sensor warm-up phase. The Blower starts to turn followed by the compressor and fuel pump.

4. Ignition

The ignition spark is turned on and then the Blower and Compressor speed is increased. Once the heater enters closed loop and senses a good flame, the PROHEAT goes to full output and turns the Ignition off.



If the oxygen sensor does not detect a flame in 60 seconds after entering ignition, the air compressor and fuel pump shut off immediately. The blower and coolant pump continue to run.

Code 01-1 will be displayed. The PCM cover status LED, toggle switch, and timer red manual light or OEM indicator light will blink. After 3 minutes, the blower stops and the PROHEAT attempts to start again.

The PROHEAT always restarts after one error detection. After the 3-minute Cool Down (Purge), the PROHEAT will go through pre-check, pre-ignition, ignition and the error detection – Cool Down (Purge) cycle one more time.

After two consecutive Code 01 errors, the PROHEAT goes into a hold state. No further start attempts will be made. Code 01–1 will be displayed continuously and the PCM LED “ON” light will turn “OFF.”

The PCM cover status LED, toggle switch, T-II timer red manual light or OEM indicator light will continue to blink.

NOTE: To restart the heater, turn the toggle switch “OFF” and back “ON.”

4.1.4 FUNCTION DIAGNOSTICS



Function Errors:

- Start
- Flame Out
- Coolant Flow
- Overheat
- Voltage

Errors displayed on the PCM diagnostic panel will cause the heater to shut down. These diagnostic codes are usually the result of a system problem.

It is possible to have two or more diagnostic codes displayed at the same time. A function diagnostic code may be displayed in conjunction with a component diagnostic code.

Boot Loader



The Boot Loader is displayed if the PCM is powered up and is still in the factory programming mode.

- No heater operation will occur until PCM has been programmed
- No response to Analog inputs or CAN commands
- No analog outputs will occur

Contact Proheat for further assistance

Configuration



A configuration code is displayed if the PCM is powered up and no configuration is set.

- No heater operation will occur until heater has been configured
- No response to CAN commands
- No analog outputs will occur

Contact Proheat for further assistance.

1 Start



Indicates that a Flame was not detected during the FULL 60 second ignition period. The PCM can detect three types of no Starts.

- 01-1, O2 Low - Lack of combustion air
- 01-2, O2 High - Lack of fuel
- 01-3, EGT Low - O2 values look normal however the exhaust gas temperature is not rising

01-1, O₂ Low — Troubleshoot based on:

1. Combustion air supply

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

2. Fuel Valve

- Faulty fuel valve causing internal leak.

3. Ignition System

- Weak or no Spark (may cause the heater to flood with raw fuel).

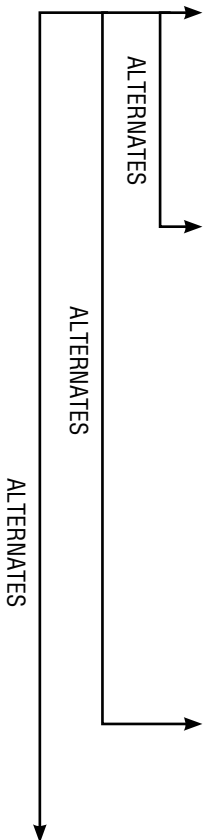
4. Oxygen Sensor

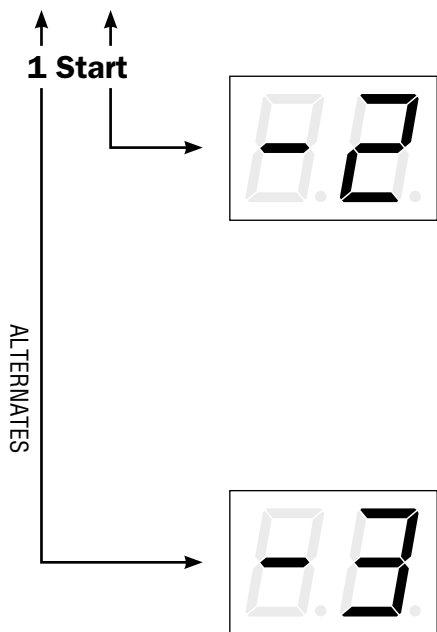
- Fuel soaked Oxygen sensor (flooded heater).
- Faulty Oxygen sensor.

01-2, O₂ High — Troubleshoot based on:

1. Weak or No Spark

- If weak or No Spark fuel vapor will be seen coming out from the exhaust. See Ignition system on page 4-12.





2. Fuel supply to the PROHEAT

Go to page 5-4 and perform fuel system check.

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

3. PROHEAT fuel delivery system

- Fuel Supply Pump.
- Air Compressor – pressure.
- Fuel valve – plugged or faulty.
- Nozzle – dirty or clogged.
- Oxygen Sensor – dirty.

01-3, EGT Low — Troubleshoot based on:

1. Combustion air supply

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

2. Exhaust Gas Temperature Sensor

- Dirty or faulty.

NOTICE

After 6 consecutive start faults the X30 PCM will go into Lockout Mode. Power to the X30 PCM must be removed and reapplied to exit Lockout mode.

Fuel System Schematic

The PROHEAT X30 fuel system operates on a venturi-style atomizing nozzle technology. It operates similarly to a compressed air paint sprayer.

As shown in figure 4-10, when the compressor/fuel pump motor is on, fuel is drawn from the tank through the fuel pump and pressurizes the high pressure side of the fuel valve. The fuel valve then meters the fuel available to the nozzle. Compressed air flowing through the nozzle creates a venturi or suction effect that siphons fuel from the fuel valve.

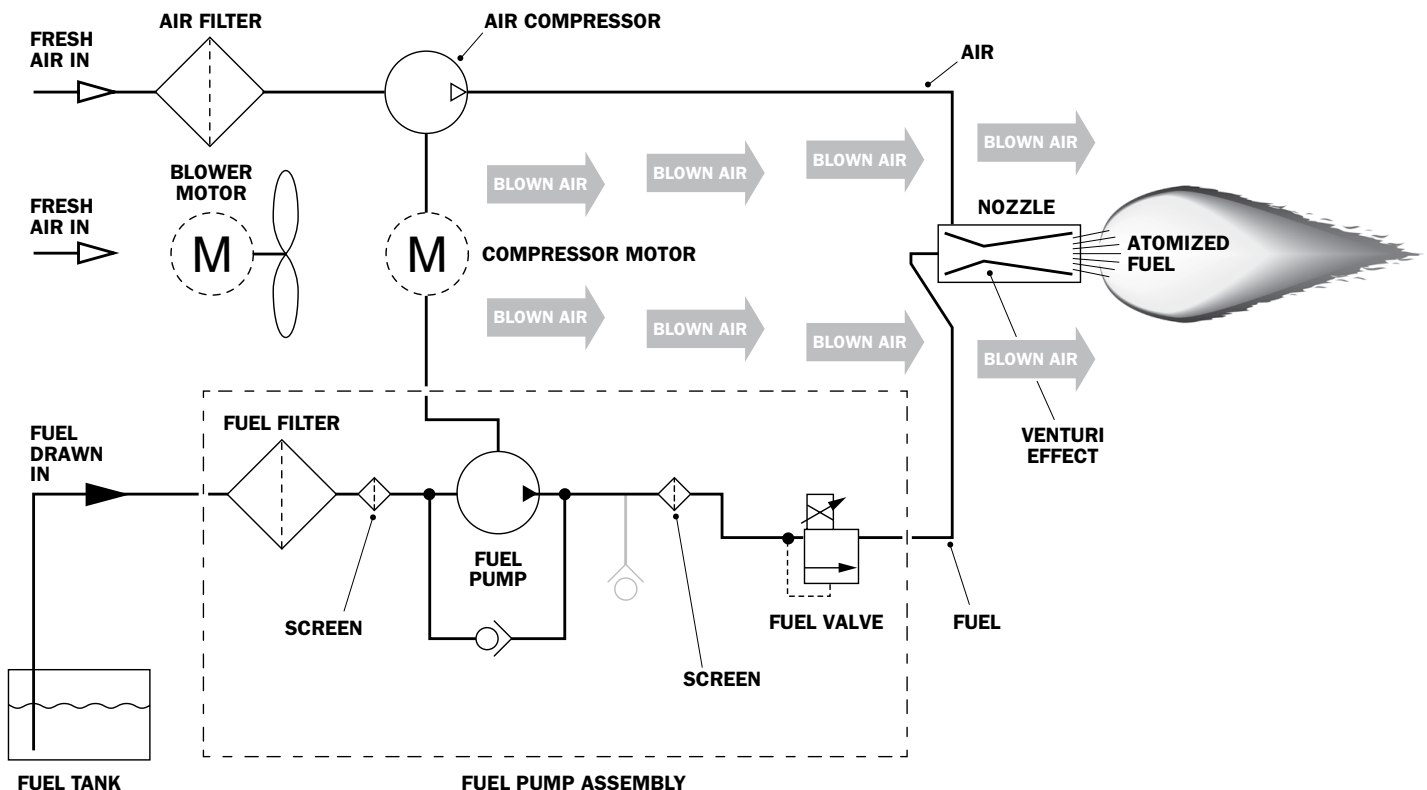


Figure 4-5. Fuel System Schematic.

START Fuel Supply

Check:

See Theory of Operation on page 3-5 for fuel system schematic and description.

- Vehicle fuel level and/or for fuel gelling during cold weather.
- Air leaks and/or restrictions in the fuel supply lines to the PROHEAT.
- The PROHEAT operation when supplying fuel from a direct source.

Check Fuel System

Test Procedure — Supplying fuel from a remote source:

- Remove the fuel line from the fuel inlet at the PROHEAT fuel pump.
- Using a length of fuel line connected from the PROHEAT fuel inlet to a direct source of CLEAN fuel, switch the PROHEAT on and operate for at least one complete cycle. Observe the operation.

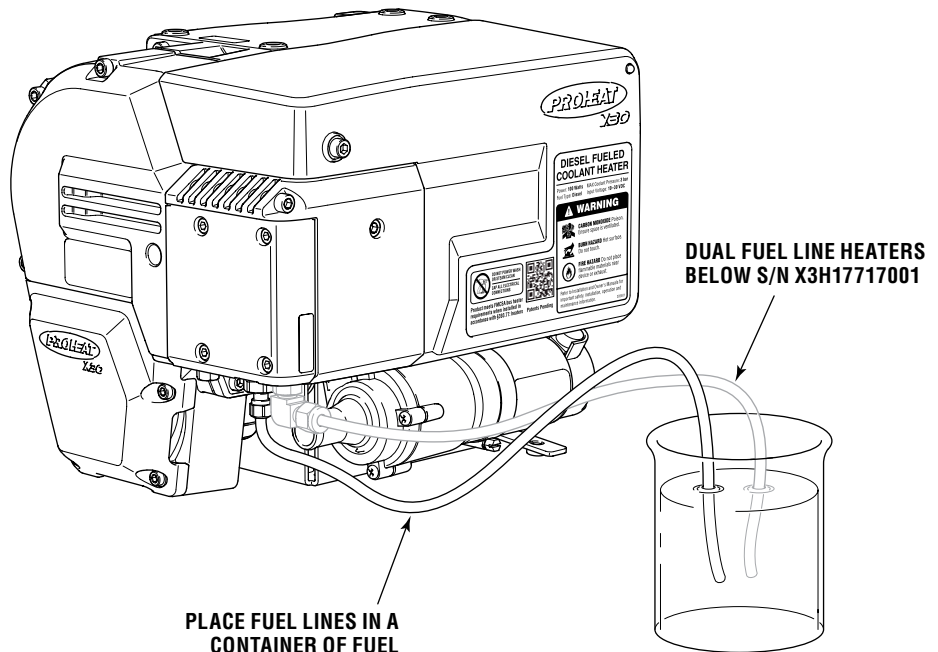


Figure 4-6. Remote Fuel Supply.

If the PROHEAT functions correctly, the fault is in the vehicle fuel system. Check fuel lines, connections and routing back to fuel tank. Consult OEM for service requirements.

If a Start diagnostic code is indicated, the problem is in the PROHEAT.

START Fuel Filter

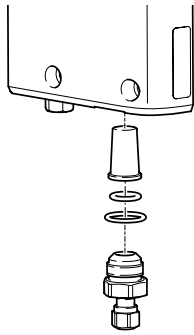


Figure 4-7. X30 Fuel Filter.

Check:

- Disconnect the fuel supply line at the PROHEAT.
- Remove the fuel filter adapter and fuel inlet fitting located in the burner head.
- Remove O-ring and filter. Inspect for contamination and/or restrictions. Clean filter using electrical contact cleaner or warm soapy water. Replace if necessary.
- Inspect the O-rings for contamination and/or damage. Clean O-rings with a cloth or replace as necessary.
- Inspect and clean the filter cavity and O-ring seat as necessary using contact cleaner.
- Reinstall filter, O-rings and inlet adapter. Tighten the adapter until it bottoms out against the face.
- Reconnect the fuel supply line.
- Switch the PROHEAT on and operate for at least one complete cycle. Observe the operation.

START Fuel Nozzle

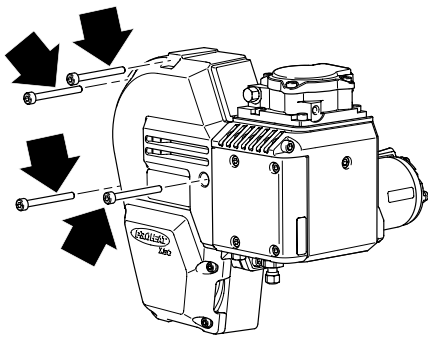


Figure 4-8. Burner Head Removal.

Check:

- For Fuel Nozzle and O-ring damage and/or contamination.
- For correct Fuel Nozzle. (*Refer to Parts Manual.*)

Test Procedure — Fuel Nozzle removal, inspection & cleaning or replacement:

- Disconnect all harnesses at the PCM.
- Disconnect the fuel lines.
- Remove the four burner head bolts, and remove burner head.
- Remove Fuel Nozzle. Verify the Fuel Nozzle number ensuring it is the correct Fuel Nozzle for the X30. Disassemble, inspect, clean, and reassemble Fuel Nozzle.

Fuel Nozzle disassembly, inspection, cleaning and reassembly:

- Hold the Fuel Nozzle stem lightly but firmly in a vise using soft jaws, take care not to cause damage. Disassembles in three pieces.
 - Inspect Fuel Nozzle stem and O-ring for contamination and/or damage. Inspect and clean distributor fuel orifice (a soft bristled brush may be used), air passages, head and stem with electrical contact cleaner or warm soapy water. Re-clamp the Fuel Nozzle stem lightly but firmly in a vise using soft jaws, take care not to cause damage. Reinstall the distributor and Fuel Nozzle head. Ensure that the distributor is seated correctly. The Fuel Nozzle assembly is self-aligning.
- Inspect the Fuel Nozzle cavity and clean as necessary using electrical contact cleaner or warm soapy water.
 - Reinstall the Fuel Nozzle using diesel fuel to lubricate O-ring.
 - Reinstall the burner head by mounting it against the heat exchanger face and installing the three mounting bolts.
 - Tighten mounting bolts. See Section 1.3 for torque.
 - Reconnect the electrical harnesses and fuel lines.
 - Switch the PROHEAT on and operate for at least one complete cycle. Observe the operation.

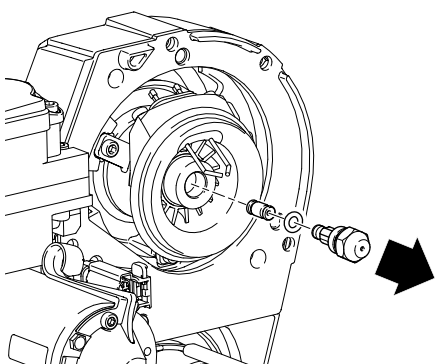


Figure 4-9. Nozzel Removal.

NOTICE

Fuel nozzle parts are a matched set and not interchangeable.

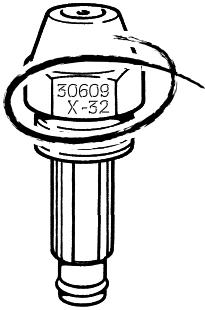


Figure 4-10. Nozzle Number Location

NOTICE

DO NOT use a tip cleaner in the fuel orifice.

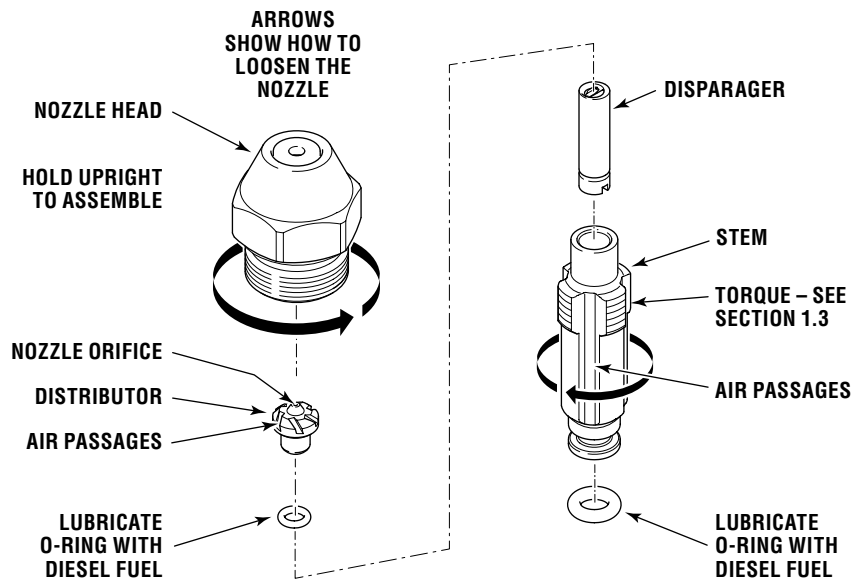


Figure 4-11. Fuel Nozzle Assembly

START Air Compressor

⚠ WARNING

To avoid the risk of shock, ensure to disconnect power to heater unit during disassembly/reassembly.

⚠ WARNING

Fire Hazard. DO NOT place any flammable items around the heater and exhaust pipe.

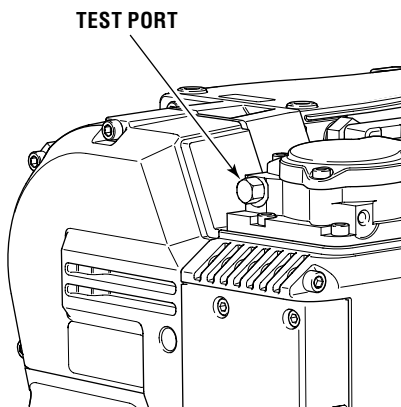


Figure 4-12. Air pressure adjustment.

Check:

- 1) Air Compressor pressure and operation.

Before checking air pressure, remove, disassemble and clean Fuel Nozzle. Go to Fuel Nozzle disassembly, inspection, cleaning and reassembly.

Air Compressor filter check:

- 1) Remove air filter housing (4) screws.
- 2) Remove the Air Compressor filter. Inspect for contamination and replace if necessary. Ensure filter is seated properly and reinstall cover.

Test Procedure — Air Compressor pressure:

Ensure fuel nozzle is clean (see page 5-5) and the air compressor filter is clean (see page 5-6) before proceeding with air compressor pressure check.

- 1) Remove the plug to the air pressure measurement port.
- 2) Thread in the Pressure Gauge and torque to 25 in-lbs \pm 3 in-lbs (2.8 Nm \pm 0.3 Nm) as shown in figure 5-11.
- 3) Switch the PROHEAT on for one full minute, then observe the air pressure:
6.5 to 8.3 \pm 0.1 PSI (44.8 to 57.2 \pm 0.7 kPa).
- 4) If the pressure is not within the above range and the air filter and fuel nozzle are clean, rebuild or replace the compressor. See www.proheat.com for the latest parts manual SL9209 for more information.
- 5) Turn heater off. Wait until Cool Down (Purge) mode is complete (approximately 3 minutes).
- 6) Remove Pressure Gauge. Lubricate air measurement port plug o-ring with diesel fuel and reinstall plug. Torque to 25 in-lbs \pm 3 in-lbs (2.8 Nm \pm 0.3 Nm).

START Fuel Supply Pump

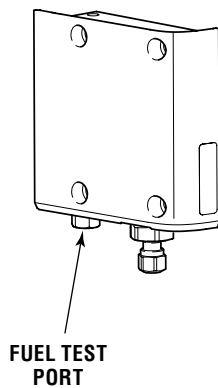


Figure 4-13. Fuel test port.

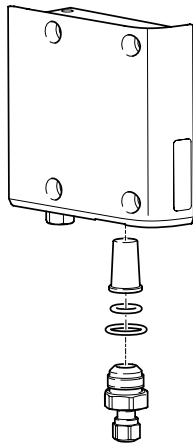


Figure 4-14. Fuel supply components.

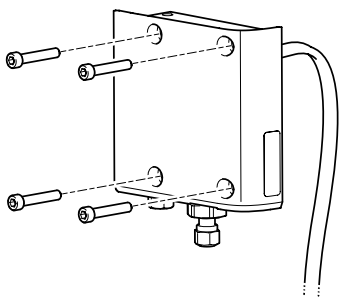


Figure 4-15. Fuel pump removal.

Check:

- Fuel Supply Pump pressure and operation.

Test Procedure — Fuel Supply Pump pressure:

- Remove the Fuel Supply Pump test port plug located beside the fuel inlet fitting.
- Thread in the Pressure Gauge PK0030 and torque to 25 in-lbs ± 3 in-lbs (2.8 Nm ± 0.3 Nm) as shown in figure 4-13.
- Switch the PROHEAT on and read the fuel pressure: X30 Range 10–14 PSI (68.9–96.5 kPa).
If the pressure is out of range, Go to Fuel Supply Pump cleaning below.
If the pressure reads OK, review Fuel System troubleshooting, page 4-7.
- Turn heater off. Wait until Cool Down (Purge) mode is complete (approximately 3 minutes).
- Remove Pressure Gauge. Lubricate fuel measurement port plug o-ring with diesel fuel and reinstall plug. Torque to 25 in-lbs ± 3 in-lbs (2.8 Nm ± 0.3 Nm).

Fuel Supply Pump cleaning:

- Disconnect all harnesses at the PCM.
- Disconnect the fuel lines.
- Remove the fuel pump mounting bolts, and carefully remove the fuel pump and fuel valve.
- Inspect and clean all components. See figure 4-14.
- Reassemble the fuel supply pump with new O-rings and lubricate all O-rings with diesel fuel prior to installation.
- Install fuel supply pump onto burner head. See page 4-9 for bolt torque settings.
- Reinstall electrical harnesses and fuel lines.
- Re-test the Fuel Supply Pump and re test pressure.
If the Fuel Supply Pump pressure is still incorrect, go to Fuel Supply Pump replacement.

Fuel Supply Pump Replacement:

- Disconnect all harnesses at the PCM.
- Disconnect the fuel lines.
- Remove the fuel pump mounting bolts, and carefully remove the fuel pump and fuel valve harness, and discard. It maybe necessary to remove the air compressor first if the fuel valve harness will not pass through the opening.
- Ensure to lubricate all O-rings with diesel fuel prior to installation.
- Install new fuel supply pump onto burner head. See page 4-9 for bolt torque settings.
- Reinstall electrical harnesses and fuel lines.
Switch the PROHEAT on. Operate for a full cycle to ensure functionality. Inspect for fuel leaks around exterior of Burner Head and fuel pump.

START Ignition System

⚠ WARNING

SHOCK HAZARD.

Check:

- Ignition operation.
- Ignition Electrode check.

Test Procedure — Ignition Module Spark Check:

- Disconnect all harnesses at the PCM.
- Disconnect the fuel lines.
- Remove the four burner head bolts, and remove burner head.
- Check Electrodes and wiring for carbon bridging and/or damage. Clean or Replace as necessary.
- Analog Standard mode must be enabled for this test before battery power is applied. Jump pin's 3* & 4* of the P7 I/O connection on the PCM together.
- With the burner head supported, reconnect ONLY the P3 Ignition module.
- Now connect ONLY the P6 Power harness to the PCM. After the PCM boots up and displays the Config code the Spark test will start and will continue sparking for 5 full seconds.

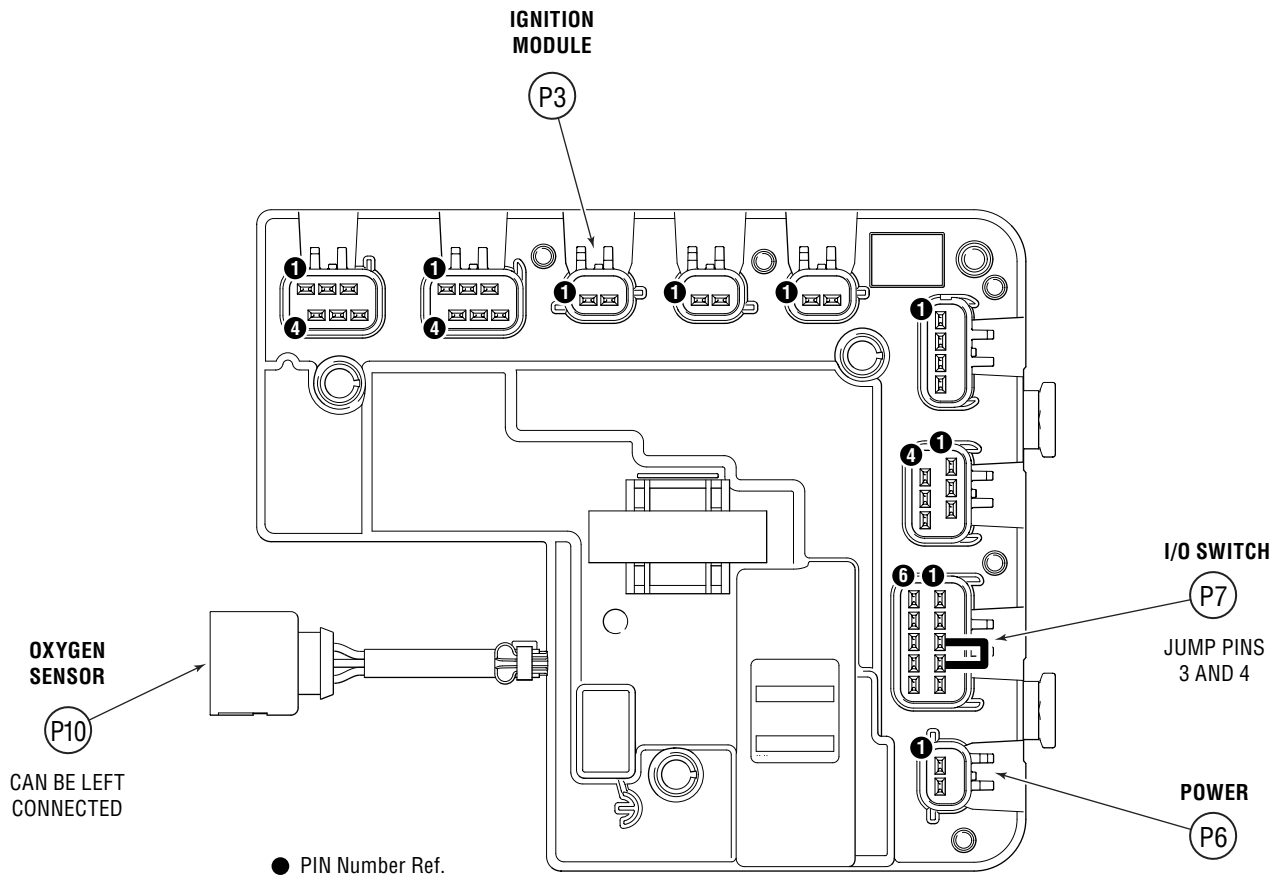


Figure 4-16.

START Oxygen (O₂) Sensor

Check:

The Proheat X30 uses a five wire heated wideband O₂ sensor.

Testing of the O₂ sensor is beyond the scope of this manual and the sensor itself is non-reparable.

If you suspect an O₂ sensor issue first preform a visual inspection of the sensors harness

- a) Inspect the PCM connector for damage and corrosion. Inspect the O₂ sensor harness and connector for damage and corrosion.

If no damage or corrosion is found, Replace O₂ sensor.

O₂ Sensor Replacement Procedure:

- a) Disconnect the power and switch harnesses at the PCM. Disconnect the first four harnesses from the top left of PCM. See figure 4-18.
- b) Disconnect the fuel line(s) — if required. See figure 4-17.

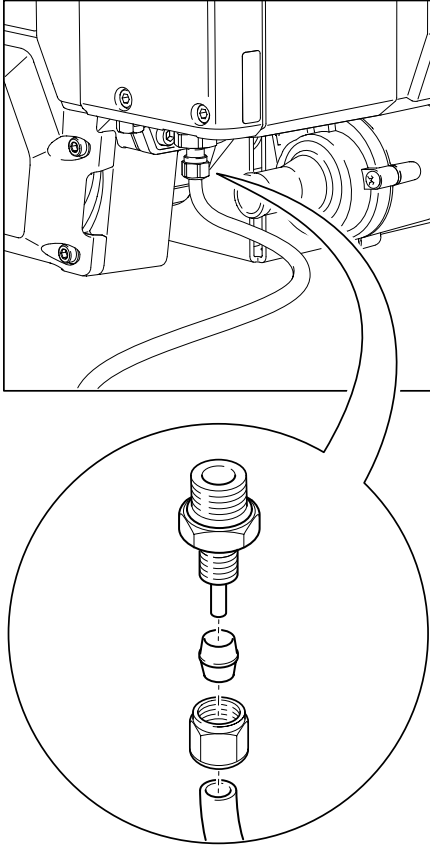


Figure 4-17. Disconnect Fuel Line(s).

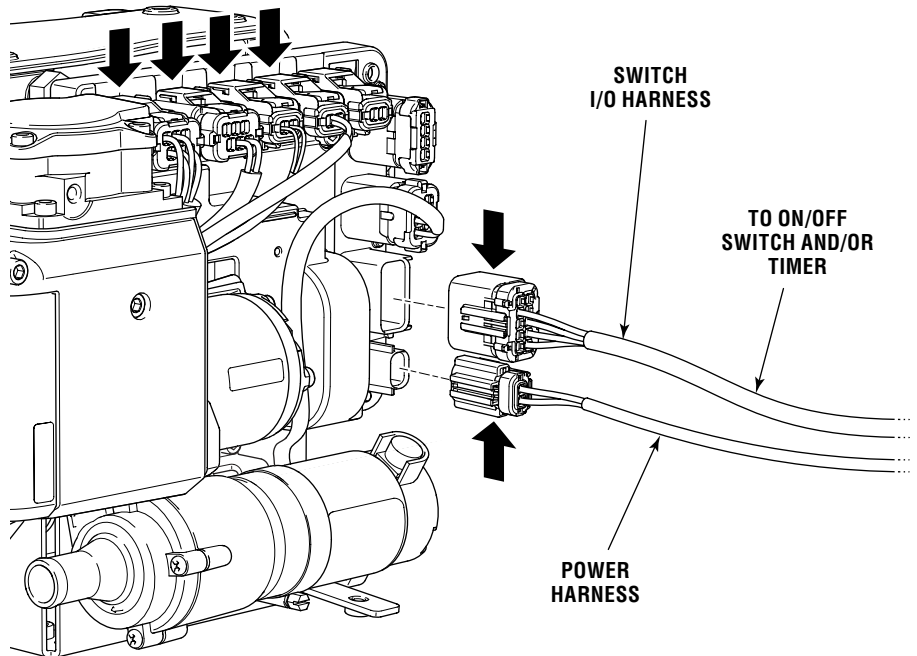


Figure 4-18. Disconnect Harnesses.

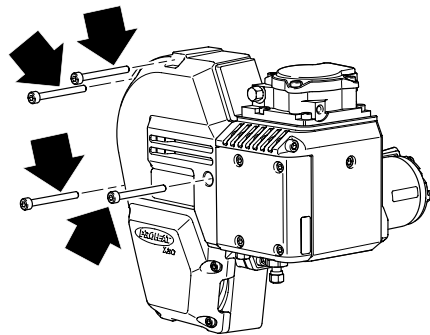


Figure 4-19. Burner Head Removal.

- c) Remove the four burner head bolts shown in figure 4-19, and remove burner head to gain access to exhaust flange and O₂ Sensor harness connector.
- d) Disconnect O₂ sensor from PCM shown as in figure 4-20.
- e) Remove O₂ sensor harness from cradle. See figure 4-21. TIP: use a long medium size flat tip screw driver and place between the cradle and the O₂ sensor connector to pry it out from its mount.

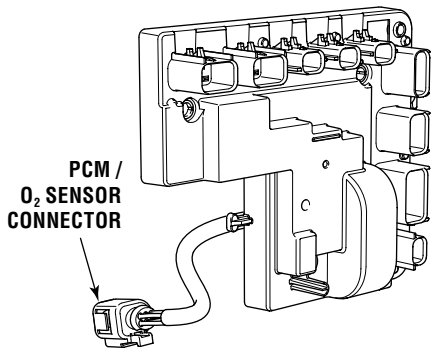


Figure 4-20.

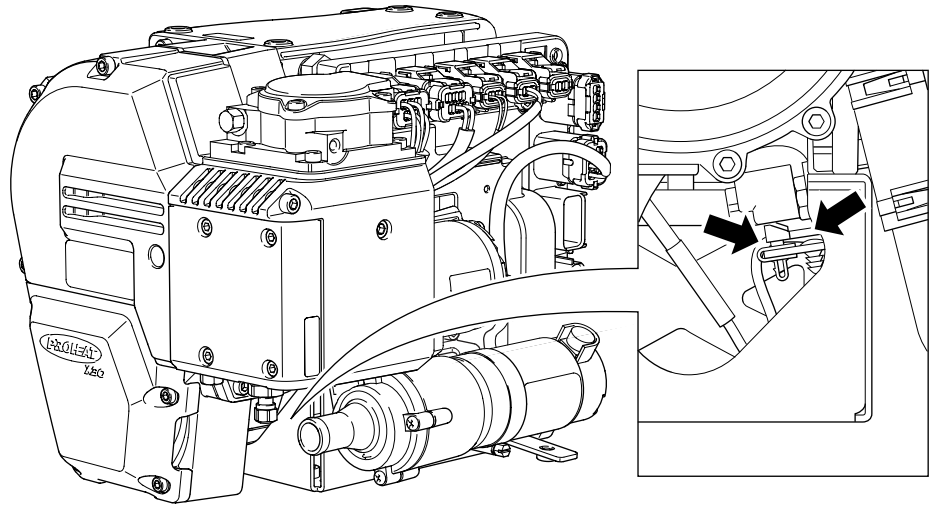


Figure 4-21. O₂ Sensor Harness Clip Removal.

- f) Remove exhaust clamp and pipe from Heater (figure 4-22).
- g) Remove the exhaust port bolts, then lower and position the exhaust port (complete removal of the exhaust port is not needed) to remove O₂ sensor from the exhaust port using a 7/8" open end wrench. Be careful not to damage the EGT sensor or wiring. See figure 4-23.

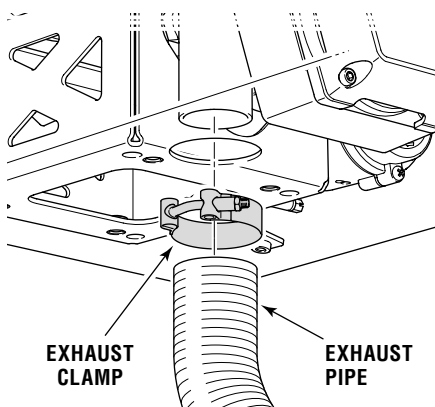


Figure 4-22. Exhaust Pipe.

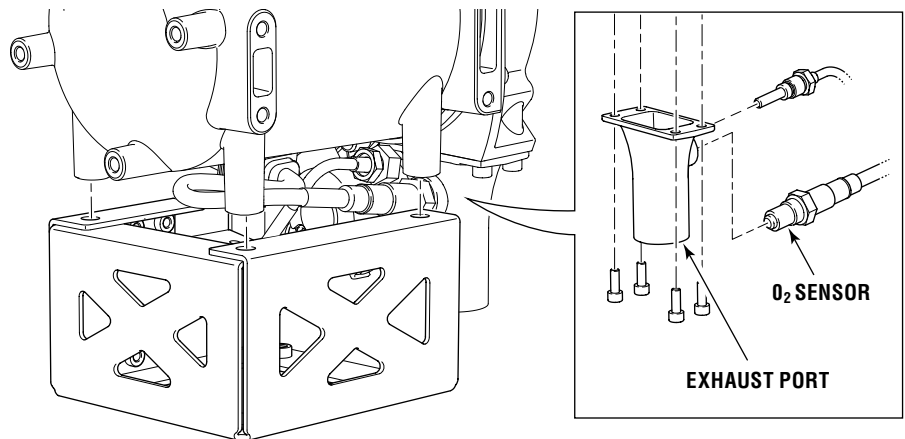
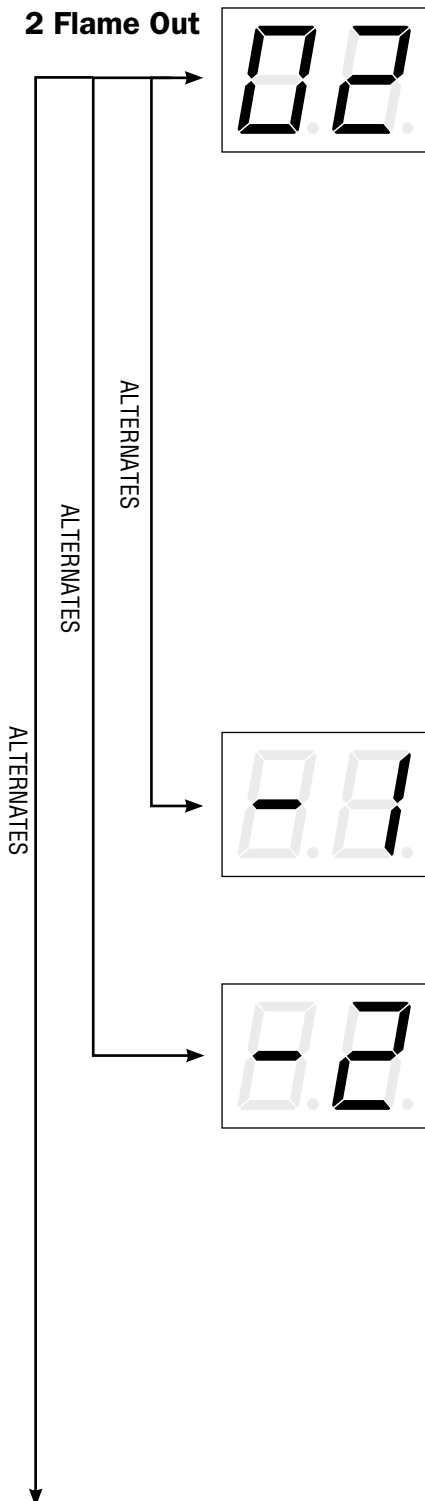


Figure 4-23. O₂ Sensor Removal.

- h) Replace O₂ sensor – **DO NOT connect new O₂ sensor harness to PCM at this time**, and reinstall the exhaust port.
- i) With the Power, Switch and O₂ sensor harnesses still disconnected from PCM, **connect only the Power harness for 30 seconds** and then remove the power harness from the PCM. (Note viewing the heater event log with either the PFC or Datalink you will now see an event called "Oxygen Sensor Replaced" this will also reset code 17-4)
- j) Connect O₂ Sensor harness from PCM to O₂ Sensor.

- k) Connect exhaust system. Note the exhaust clamp bolt must be positioned as shown or it will interfere with the burner head installation. Refer to figure 4-22.
- l) Install remaining parts in reverse order
 - O₂ sensor — torque to 100 in-lbs.
 - EGT sensor – torque to 200 in-lbs. (removal not needed)
 - Exhaust port bolts – torque to 75 in-lbs.
 - Burner head bolts – torque to 100 in-lbs.



Indicates that a flame was detected but it could not be maintained or after being established the flame went out before reaching the cycle off temperature of 185°F (85°C) and could not be re-lit.

- 02-1, O₂ low – Lack of combustion air (too rich).
- 02-2, O₂ High – Lack of fuel (too lean).
- 02-3, EGT low – O₂ values look normal but the exhaust temp is not rising.
- 02-4, Fuel Valve Below Low Range – O₂ value still low when the Fuel Valve was commanded below the lower limit (too rich).
- 02-5, Unstable Flame – Flame went out five times in a heating cycle.

Flame out sequence:

1. A flame is detected during the ignition period and during full output.
2. The flame goes out or fails to be detected.
3. The ignition is switched on for a maximum of 10 seconds to try and reestablish the flame.
4. If the flame is not detected within 10 seconds, the flame out diagnostic code is displayed.
5. The PROHEAT goes into Cool Down (Purge) mode and attempts to restart after Cool Down (Purge) is complete.

A flame out diagnostic code indicates that:

- A flame was detected therefore there was a spark and the ignition system works.
- The fault is most often with the fuel supply system or combustion air supply.

02-1, O₂ Low — Troubleshoot the combustion air supply based on:

1. Combustion air supply.

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

02-2, O₂ High — Troubleshoot the fuel system based on:

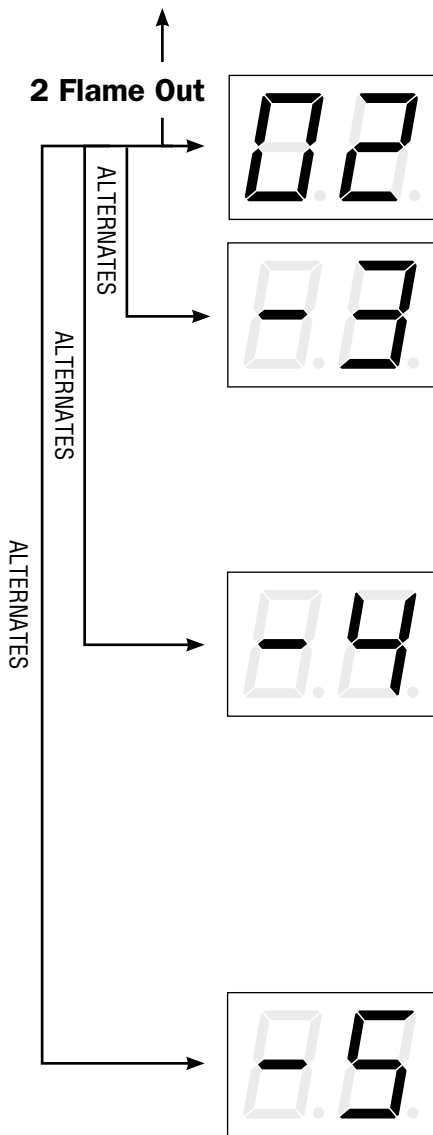
1. Fuel supply to the PROHEAT.

Go to page 5-4 and perform fuel system check.

- Fuel tank pick-up
- Fuel fittings
- Fuel lines
- OEM supplied filters and check valves

2. PROHEAT fuel and oxygen detection system.

- Fuel Supply Pump.
- Air Compressor – pressure.
- Fuel valve – faulty.
- Nozzle – dirty or clogged.
- Oxygen Sensor – dirty faulty.



02-3, EGT Low — Troubleshoot based on:

1. Combustion air supply.

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

2. Exhaust Gas Temperature Sensor

- Dirty or faulty.

02-4, Fuel Valve below Low limit — Troubleshoot based on:

1. Combustion air supply.

- Check combustion air intake for damage or restrictions.
- Check combustion air blower for damage.
- Combustion chamber – dirty or clogged.
- Exhaust pipe – dirty, clogged, or damaged.

2. Fuel Valve.

- Internal leak.

3. Oxygen Sensor.

- Dirty or faulty

02-5, Unstable Flame — The flame has gone out and been re-lit within 10 seconds more than five times in a cycle.

The heater is functioning but the flame is unstable.

Troubleshoot based on:

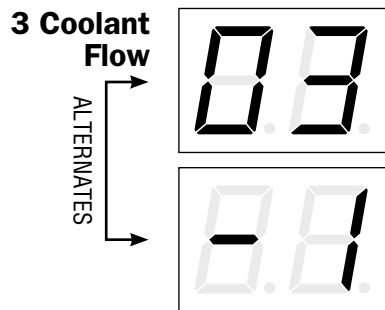
1. Fuel supply to the PROHEAT.

Go to page 5-4 and and perform fuel system check.

- Fuel tank pick-up.
- Fuel fittings.
- Fuel lines.
- OEM supplied filters and check valves.

2. PROHEAT fuel and oxygen detection system.

- Fuel Supply Pump.
- Air Compressor – pressure.
- Fuel valve – faulty.
- Nozzle – dirty or clogged.
- Oxygen Sensor – dirty faulty.



Indicates that the coolant temperature in the PROHEAT reached 185°F (85°C) within 60 seconds from the beginning of ignition. There is coolant in the system but its flow rate is too low.

An in-line flow indicator (see figure 4-24) is a valuable troubleshooting tool used to:

1. Check the coolant flow and direction.
2. Check for air in the system.
3. Check for restrictions caused by the truck systems such as shuttle valves, manual valves, air operated valves.

The coolant flow indicator shown in figure 4-24 is a service tool used to troubleshoot and test for possible flow and air problems in the coolant flow path. Flow direction during heater operation or during engine operation can then be observed.

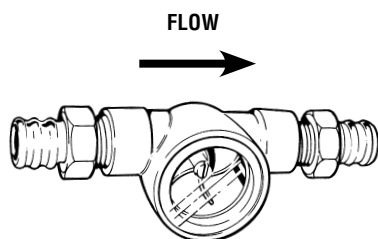


Figure 4-24. Flow Indicator – TK9002

Check: Coolant Flow

1. **Coolant Lines:** For restrictions and blockages
Are clamps tight?
2. **Shut-off Valves:** Ensure that shut-off valves are open and functioning properly.
3. **Fittings:** Recommend 1/2" NPT x 3/4" Hose Barb. Minimum size is 1/2" NPT x 5/8" Hose Barb. Avoid using 90° fittings where possible.
4. **Coolant Flow Direction:** The PROHEAT **must** be plumbed so that the coolant pump is pumping the coolant in the same direction as the engine coolant pump. The PROHEAT can be used when the engine is running.
5. **Coolant Pump:** Does the pump function properly? (See page 4-26.)
6. **Coolant System Capacity:** The coolant system must contain at least 3 gallons (11 litres) of coolant. If the system contains less, the coolant may reach 185°F (85°C) in less than one minute causing a COOLANT FLOW diagnostic code.

NOTICE

If the coolant system is contaminated with magnetic material, it may cause the impeller to stop turning.

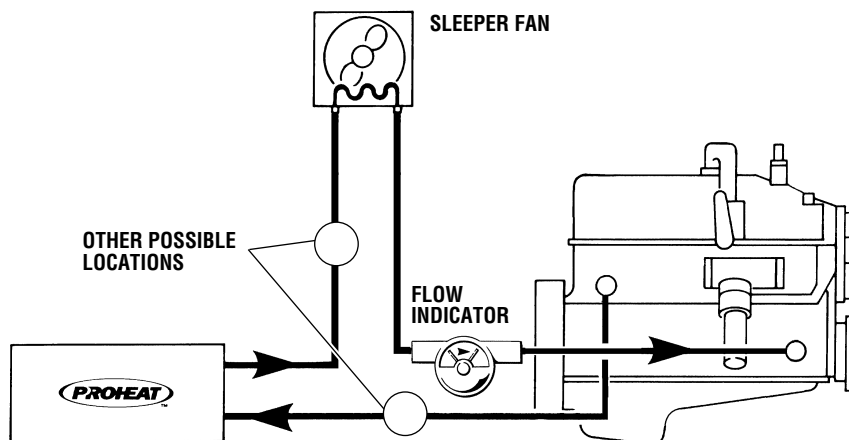
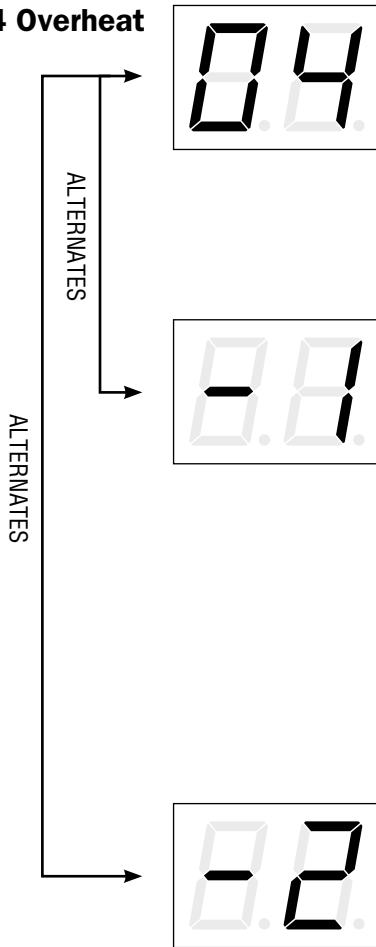


Figure 4-25. Flow Indicator – TK9002

4 Overheat



Indicates that either the heat exchanger or the exhaust gas temperature is above the normal operating range for 1 second.

An Overheat code will immediately put the heater in Lockout Mode (requires power to the X30 PCM to be removed and reapplied).

The PCM will detect overheats even if the heater is not switched on.

The PCM can detect two types of overheats

- 04-1, Dual mode coolant outlet temperature above 257°F (125°C).
- 04-2, Exhaust Gas temperature above 266°F (130°C).

04-1, Coolant Overheat — Troubleshoot based on:

Indicates that the outlet temperature sensor detected an inner heat exchanger surface temperature of 257°F (125°C).

1. Lack of coolant, air or flow problems in the coolant system.

- Go to page 4-17, Steps 1 and 2.

2. Faulty Outlet Temperature Sensor.

- Go to page 4-21.

3. Faulty X30 PCM Temperature Sensor circuit.

- Replace PCM.

An Overheat will put the heater in Lockout Mode (requires power to the X30 PCM to be removed and reapplied) on the first occurrence of an Overheat.

04-2, Exhaust Overheat — Troubleshoot based on:

Indicates that the exhaust gas temperature sensor detected an exhaust temperature of 1022°F (550°C).

1. Lack of combustion air or flooded heat exchanger.

- Go to page 4-17, Steps 1 and 2.

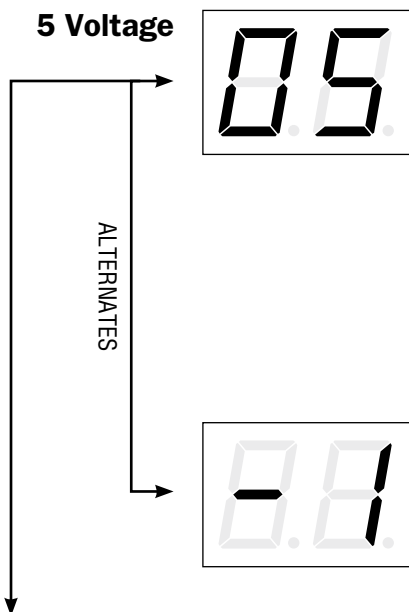
2. Dirty or Faulty Exhaust Gas Temperature Sensor.

- Go to page 4-33.

▲ CAUTION

Repeatedly resetting the PROHEAT without resolving the Overheat diagnostic code will damage the heat exchanger.

5 Voltage



A VOLTAGE diagnostic code indicates that the supply voltage to the heater is out of the normal operating range. In Pre-Check the code is displayed immediately. If the heater was operating the condition must last for more than 10 seconds before a code is displayed.

The PCM can detect three types of voltage

- 05-1, Voltage low
12V below 9.5 volts
24V below 18.0 volts
- 05-2, Voltage high
above 32 volts
- 05-3, Voltage Surge
above 40 volts

05-1, Voltage low — Troubleshoot based on:

1. Low voltage.

- Voltage supply is below the rated requirement.
- Poor or faulty electrical connections.
- Voltage supply source is OK. Voltage drop due to high amperage load while the PROHEAT is operating or trying to operate.

NOTICE

When the X30 is first connected to battery power it senses the available system voltage. If the batteries are not fully charged when you first connect power to the X30 you may get a false voltage codes.

Test Procedure — Low voltage:

- a) Inspect the wiring harnesses and connections for corrosion and proper fit. Clean if necessary.
- b) Using a multimeter set for voltage, measure across the positive and negative battery terminals or at the supply source.
If the voltage is below the required voltage, service the batteries and/or charging system as per OEM supplier recommendations. If the voltage level is within the operating range, cycle power to the Proheat for 30 seconds and test run again.

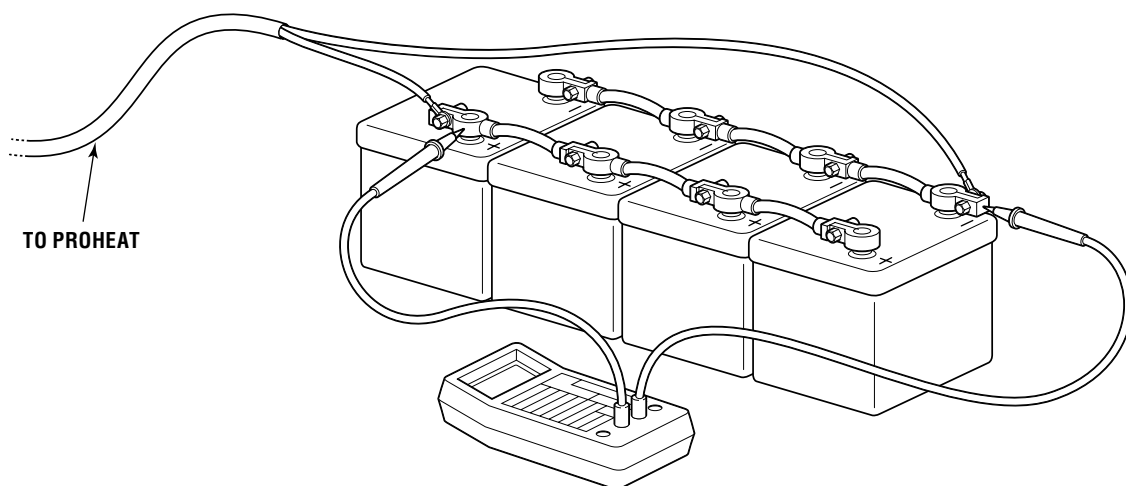


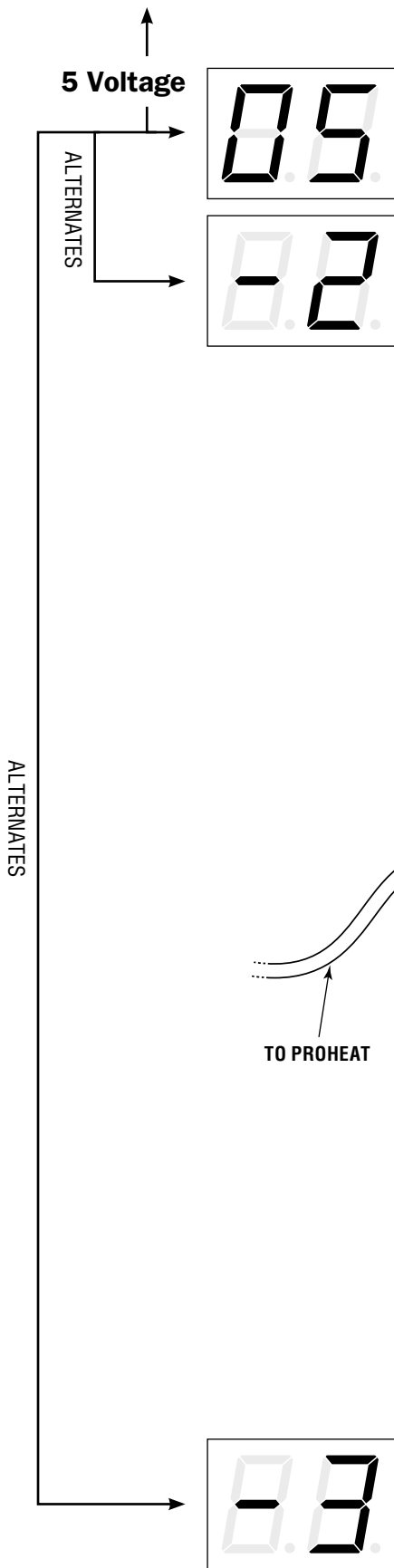
Figure 4-26. Heater Voltage Measurement.

PCM — Locate the P7 I/O Switch connector under the the PCM cover, back probe and measure voltage at pins 4 (power) and 7 (ground).

Perform this with the PROHEAT off and then switched on.

If the voltage is within the operating range and a Voltage diagnostic code is still indicated, reset the PCM's auto voltage selection by disconnecting battery power for 30 seconds then reconnecting.

If the voltage falls below the required voltage when the heater tries to start check the wiring from the supply source to the PROHEAT PCM for voltage drop.



05-2, Voltage High — Troubleshoot based on:

1. High voltage.

- Voltage supply is above the rated requirement while the engine is running.
- PCM sensed the wrong voltage at power up.
- Poor or faulty electrical connections.

Test Procedure — High voltage:

- Inspect the wiring harnesses and connections for corrosion and proper fit. Clean if necessary.
- Using a multimeter set for voltage, measure across the positive and negative battery terminals or at the supply source.
Then start the vehicles engine. If the voltage level is within the operating range, reset the heater's auto voltage selection by removing the power fuse for 30 seconds. Service the batteries and/or charging system as per OEM supplier recommendations. If the voltage level is within the operating range, cycle power to the Proheat for 30 seconds and test run again.
- Check the vehicle charging system. Consult the OEM for testing procedure.

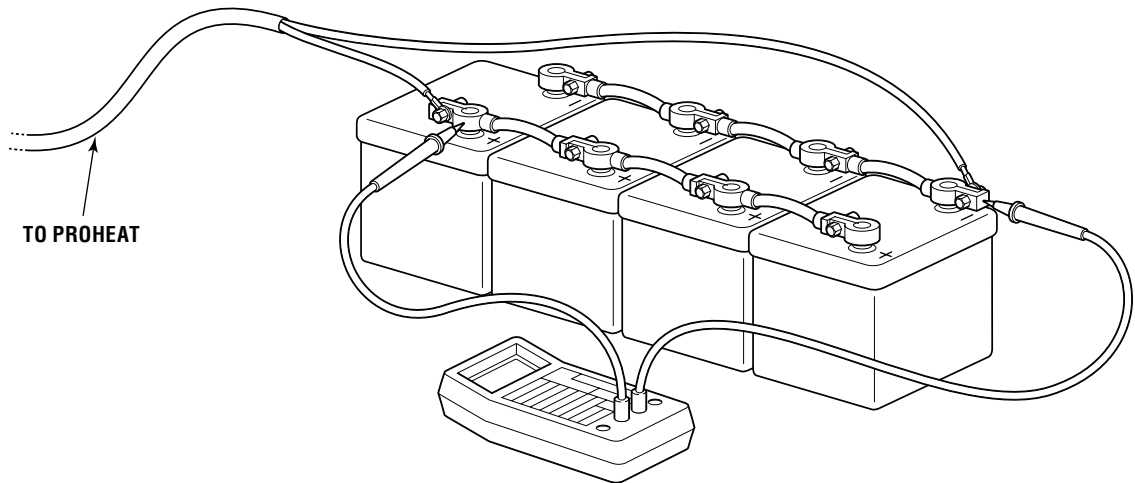


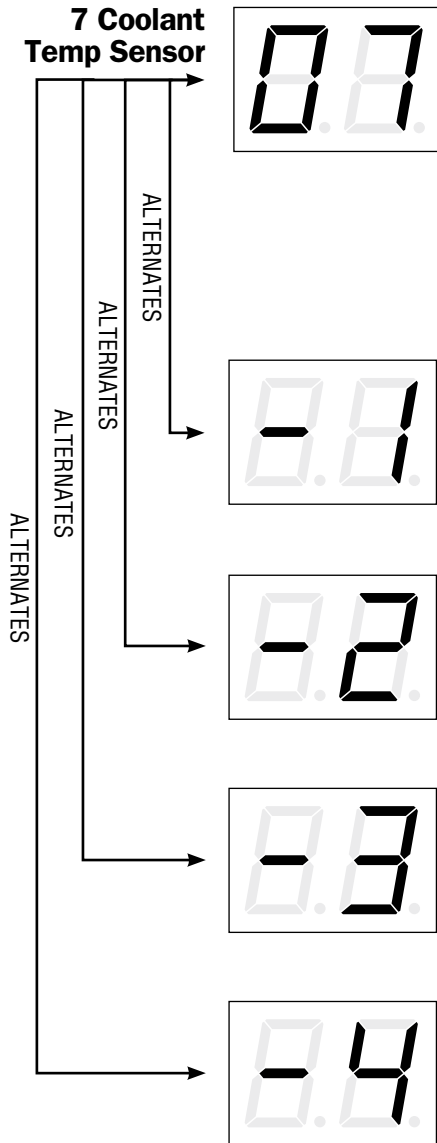
Figure 4-27. Heater Voltage Measurement.

05-3, Voltage surge — Troubleshoot based on:

1. Voltage surge.

- Using a multimeter set for voltage, measure across the positive and negative battery terminals or at the supply source. Start the vehicles engine and measure the voltage. If voltage is below 40 Volts and the code keeps recurring call Proheat for further assistance.

4.1.5 COMPONENT DIAGNOSTICS



The dual mode coolant outlet temperature sensor contains both digital and analog sensing elements a diagnostic code 7 indicates the PCM has detected one of four possible faults with the dual mode outlet sensor.

- 07-1, Range low.
- 07-2, Range high.
- 07-3, No communication.
- 07-4, Temperature mismatch.

Testing of the dual mode temperature sensor is beyond the scope of this manual and the sensor itself is non-reparable.

07-1, Analog Outlet temperature sensor below range

Inspect the PCM connector for damage and corrosion. Inspect the Dual Mode Temperature sensor harness and connector for damage and corrosion. If no damage or corrosion is found, replace dual mode temperature sensor.

07-2, Analog outlet temperature sensor above range

Inspect the PCM connector for damage and corrosion. Inspect the Dual Mode Temperature sensor harness and connector for damage and corrosion. If no damage or corrosion is found, replace dual mode temperature sensor.

07-3, Digital Outlet temperature sensor not communicating

Inspect the PCM connector for damage and corrosion. Inspect the Dual Mode Temperature sensor harness and connector for damage and corrosion. If no damage or corrosion is found, replace dual mode temperature sensor.

07-4, Analog/Digital temperature sensor mismatch — Troubleshoot the dual mode temp Sensor based on:

1. Coolant Flow.

- Go to page 4-17.

If the Coolant flow is correct and the 07-4 mismatch code is still indicated Inspect the PCM connector for damage and corrosion. Inspect the Dual Mode Temperature sensor harness and connector for damage and corrosion. If no damage or corrosion is found, replace dual mode temperature sensor.

2. Temperature Sensor replacement.

- a) Isolate the coolant system at the PROHEAT inlet and outlet ports for minimal coolant loss using valves in the system or hose clamps.
- b) Remove main sensor mount using a 1" wrench.
- c) Reinstall the new sensor. Ensure that the O-ring and O-ring seat are clean. Install the sensor until it bottoms out on the mounting boss.

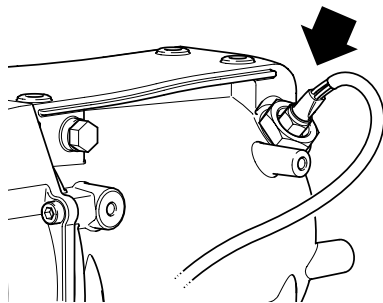


Figure 4-28. Temperature Sensor.

8 Fuel Valve

ALTERNATES



The Fuel Valve code indicates one of three possibility's depending on the mode the heater was in at the time of the error.

Fuel Valve Open circuit — Only detected in Pre-Check. If the fuel valve goes open circuit when the heater is in operation it will case a Flame Out Code 02-2 02 high (lack of fuel).

Fuel Valve Short circuit — Only detected when the heater is in operation.

Fuel Valve Over current — Only detected when the heater is in operation.

08-1, Fuel Valve — Troubleshoot based on:

1. Fuel Valve Coil or PROHEAT PCM electrical.

Test Procedure — Fuel Valve and PCM test:

- Disconnect the P4 Fuel Valve connector at the PCM.
- Inspect the PCM connector for damage and corrosion. Inspect the Fuel valve harness and connector for damage and corrosion.
- Measure the Fuel Valve coil using a multimeter set to read Ohms If the coil measures 54 ± 2.7 ohms, the coil is OK, and if no damage or corrosion is found in the PCM connector or the Fuel Valve harness replace Fuel Pump (and valve) with known good pump and test again. If code is not display again permanently replace Fuel Pump assembly with new part. If code is displayed again replace PCM.

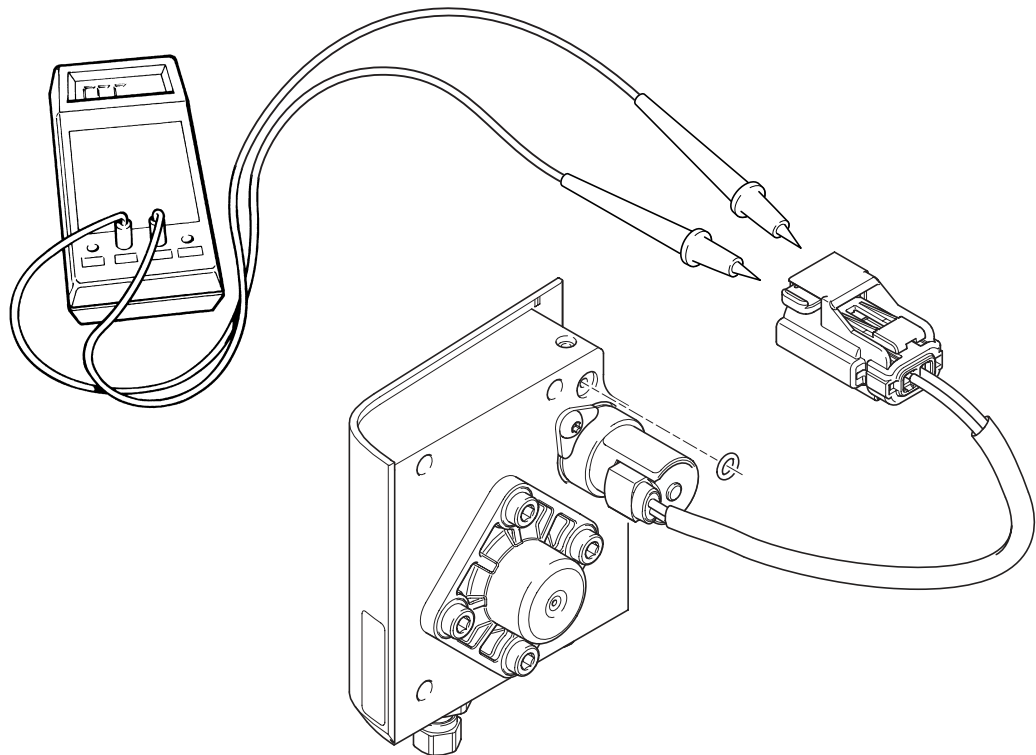
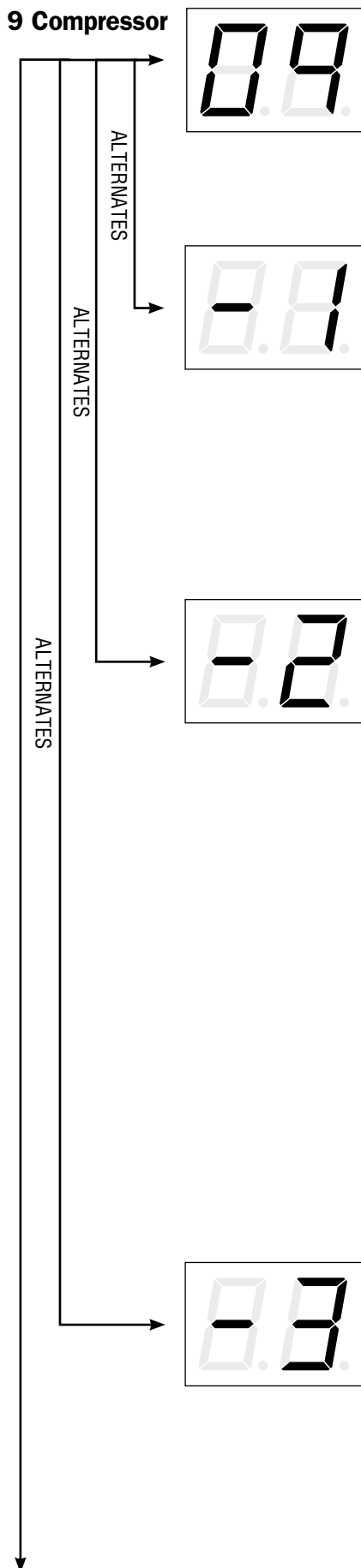


Figure 4-29. Fuel Pump with Fuel Valve.

9 Compressor



Compressor diagnostic Code 9 Indicates the PCM has detected one of five possible faults with the Compressor motor.

- 09-1, Compressor Motor Shorted
- 09-2, Compressor Motor Overload (software breaker tripped)
- 09-3, Compressor Motor Open
- 09-4, Compressor Motor Speed out of range
- 09-5, Compressor or PCM damaged (compressor is running when it shouldn't be "ON").

09-1, Compressor Motor Shorted

Indicates the compressor is drawing very high amperage (46 amps).

Test Procedure — Compressor Motor and PCM test:

- a) Disconnect the P2 compressor motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Compressor harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - i) If code 09-1 is still displayed, replace the PCM.
 - ii) If code 09-3 is displayed replace the compressor motor.

09-2, Compressor Motor Overload

Indicates the compressor is drawing high amperage and has tripped the 15A software breaker. This could be an electrical or mechanical problem.

Test Procedure — Compressor Motor and PCM test:

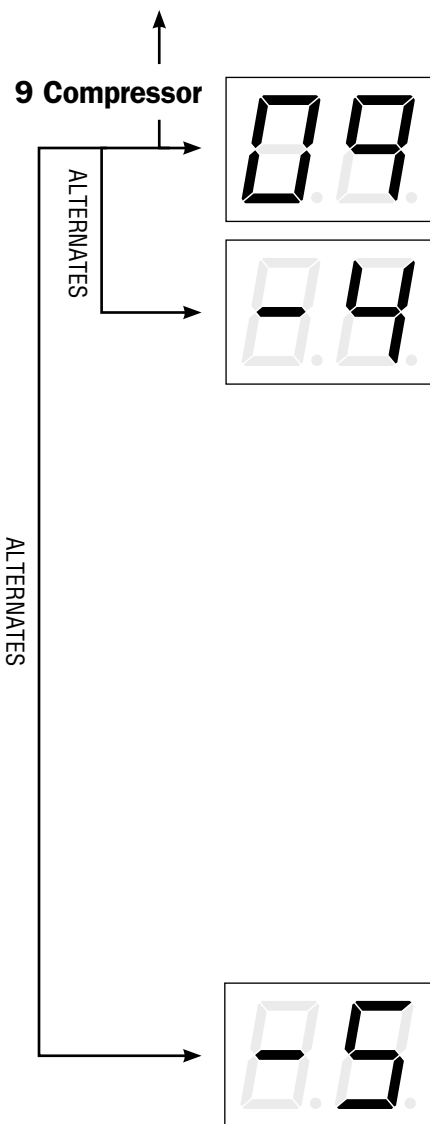
- a) Disconnect the P2 compressor motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Compressor harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - i) If code 09-2 is still displayed replace PCM.
 - ii) If code 09-3 is displayed, check the compressor motor for mechanical interference
 - Remove the speed sensor from the back of the compressor motor
 - Then By hand, rotate the motor shaft and feel for mechanical binding. If mechanical interference is felt, isolate the compressor and motor from the Fuel Supply pump.
 - Then rotate the motor shaft again by hand checking for mechanical binding.
 - If mechanical interference is still felt with the fuel supply pump removed and no obvious mechanical problems are visible, replaced the compressor and motor.

09-3, Compressor Motor Open

Indicates the compressor speed was 0 RPM for 4 seconds.

Test Procedure — Compressor Motor and PCM test:

- a) Disconnect the P2 compressor motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Compressor harness and connector for damage and corrosion. If none is found, test the compressor motor function with an alternate 12 Volt power source (**do not connect to 24V**).
 - i) If the motor turns, replace speed sensor or the PCM.
 - ii) If the motor does not turn, replace the compressor motor.



09-4, Compressor Motor Speed

Indicates the compressor speed was not reached within 4 seconds. The compressor is turning; the heater will continue to operate at a reduced BTU output.

Test Procedure — Compressor Motor and PCM test:

- a) For 12 Volt system only Check system voltage, if the voltage is low, but just above the low voltage threshold this may cause diagnostic code 09-4. Recharge batteries and run heater again.
- b) Check the compressor motor for mechanical interference
 - i) Remove the speed sensor from the back of the compressor motor.
 - ii) Then By hand, rotate the motor shaft and feel for mechanical binding. If mechanical interference is felt, isolate the compressor and motor from the Fuel Supply pump.
 - iii) Then rotate the motor shaft again by hand checking for mechanical binding.
 - iv) If mechanical interference is still felt with the fuel supply pump removed and no obvious mechanical problems are visible, replaced the compressor and motor.

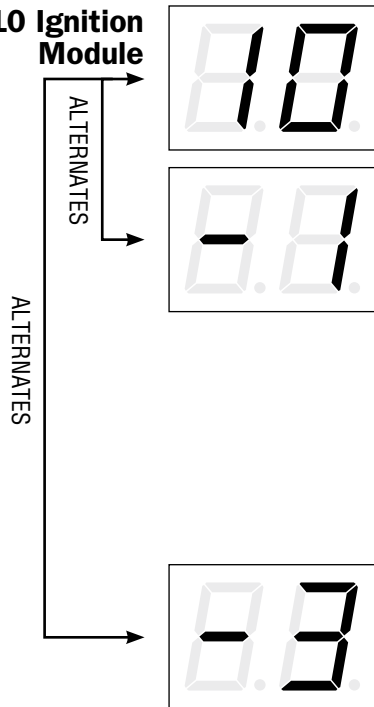
09-5, Compressor or PCM Damaged

Indicates the compressor is turning when it should be off. The PCM will cut all power to the compressor in an attempt to stop the motor. Power to the PCM must be cycled to enable the compressor motor again.

Test Procedure — Compressor Motor and PCM test:

- a) Disconnect the compressor motor harness from the PCM, with the harness still disconnected switch the heater ON
 - i) If code 09-5 is still displayed, replace the PCM.
 - ii) If code 09-3 is displayed replace the compressor motor.

10 Ignition Module



⚠ WARNING

The PROHEAT chassis is grounded from the PCM. Ensure the ground is securely connected. Failure to ensure a proper ground may result in electrical shock.

Ignition Module diagnostic Code 10 Indicates the PCM has detected one of two possible faults with the ignition Module.

- 10-1, Ignition Module Shorted
- 10-3, Ignition Module Open

10-1, Ignition Module Shorted

Indicates the Ignition Module is drawing very high amperage.

Test Procedure — Ignition Module and PCM test:

- a) Disconnect the P3 Ignition Module harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Ignition Module harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON
 - i) If code 10-1 is still displayed, replace the PCM.
 - ii) If code 10-3 is displayed replace the Ignition Module.

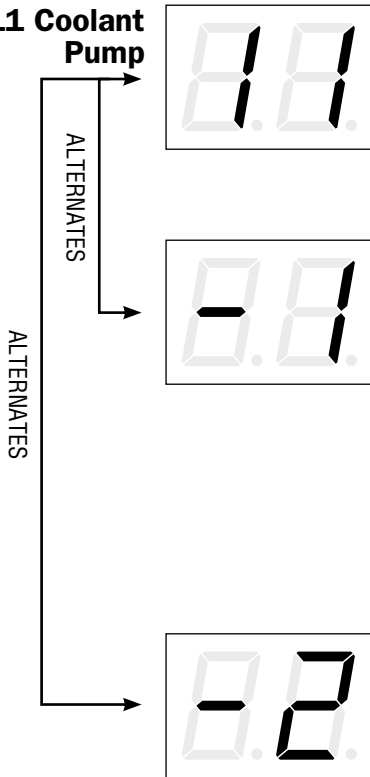
10-3, Ignition Module Open

Indicates the Ignition Module was not detected in Pre-Check.

Test Procedure — Ignition Module and PCM test:

- a) Disconnect the P3 Ignition Module harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Ignition Module harness and connector for damage and corrosion. If none is found the module is faulty, replace the Ignition Module.

11 Coolant Pump



Coolant Pump diagnostic Code 11 Indicates the PCM has detected one of two possible faults with the Compressor motor.

- 11-1, Coolant Pump Motor Shorted
- 11-2, Coolant Pump Motor Overload (software breaker tripped)

Note: The Coolant Pump is not checked for an Open. If the Pump is not connected or is open you will see code 03-1 Coolant Flow or 04-1 Overheat.

11-1, Coolant Pump Motor Shorted

Indicates the coolant pump is drawing very high amperage.

Test Procedure — Coolant Pump Motor and PCM test:

- Disconnect the P8 coolant pump motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the coolant pump harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - If code 11-1 is still displayed, replace the PCM.
 - If no code is displayed replace the coolant pump.

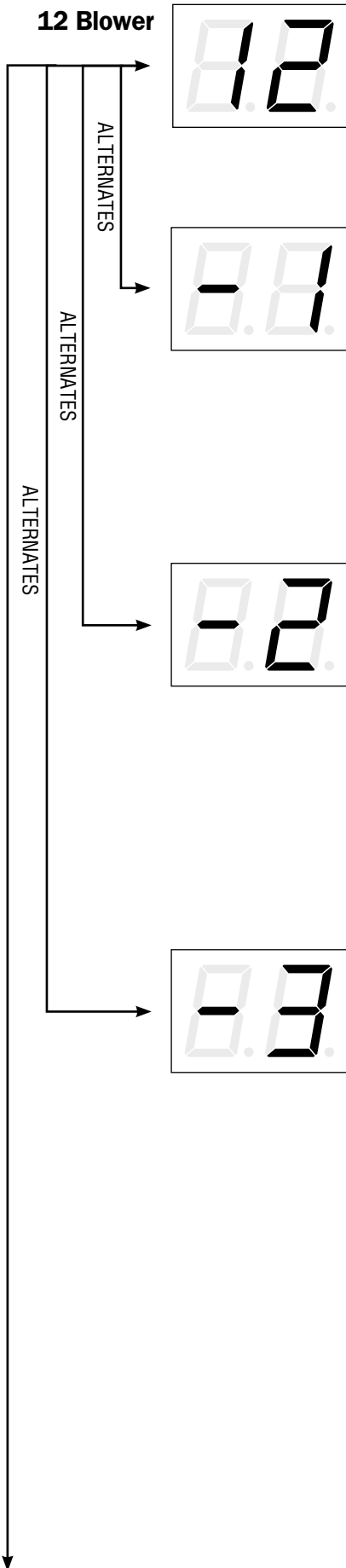
11-2, Coolant Pump Motor Overload

Indicates the coolant pump is drawing high amperage and has tripped the 15A software breaker. This could be an electrical or mechanical problem.

Test Procedure — Coolant Pump Motor and PCM test:

- Disconnect the P8 coolant pump motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Compressor harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - If code 11-2 is still displayed replace PCM.
- Check the coolant pump motor for mechanical interference with the motor. Replace Coolant pump.

12 Blower



The Blower diagnostic Code 12 Indicates the PCM has detected one of five possible faults with the Blower motor.

- 12-1, Blower Motor Shorted
- 12-2, Blower Motor Overload (software breaker tripped)
- 09-3, Blower Motor Open
- 09-4, Blower Motor Speed out of range
- 09-5, Blower or PCM damaged (Blower is running when it shouldn't be "ON")

12-1, Blower Motor Shorted

Indicates the Blower is drawing very high amperage.

Test Procedure — Blower Motor and PCM test:

- Disconnect the P1 Blower motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Blower harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - If code 12-1 is still displayed, replace the PCM.
 - If code 12-3 is displayed replace the Blower motor.

12-2, Blower Motor Overload

Indicates the Blower is drawing high amperage and has tripped the 15A software breaker. This could be an electrical or mechanical problem.

Test Procedure — Blower Motor and PCM test:

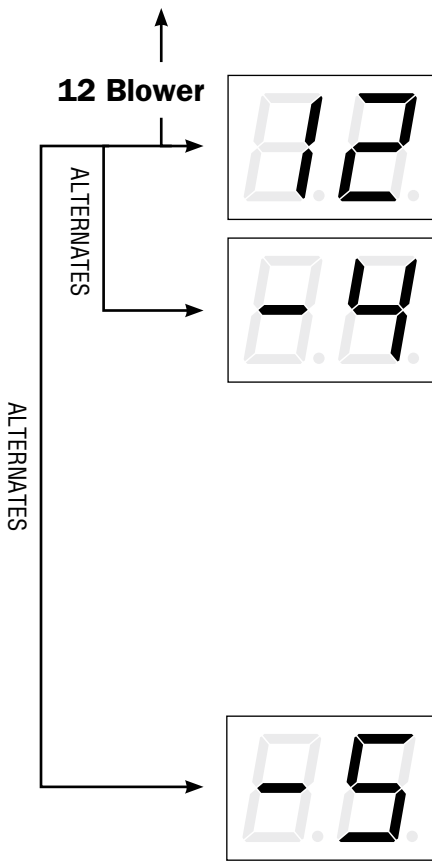
- Disconnect the P1 Blower motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Blower harness and connector for damage and corrosion. If none is found, with the harness still disconnected switch the heater ON.
 - If code 12-2 is still displayed replace PCM
 - If code 12-3 is displayed, check the Blower motor for mechanical interference, replace Blower motor.

12-3, Blower Motor Open

Indicates the Blower speed was 0 RPM for 5 seconds.

Test Procedure — Blower Motor and PCM test:

- Disconnect the P1 Blower motor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Blower harness and connector for damage and corrosion. If none is found, test the Blower motor function with an alternate 12 Volt power source (**do not connect to 24V**).
 - If the motor turns, ensure the Blower fan blade is fixed to motor shaft and the magnet is still attached to back of the fan.
 - Replace PCM.
 - If the motor does not turn, replace the blower motor.



12-4, Blower Motor Speed

Indicates the commanded Blower speed was not reached within 4 seconds. The Blower is turning; the heater will continue to operate at a reduced BTU output.

Test Procedure — Blower Motor and PCM test:

- a) For 12 Volt system only Check system voltage, if the voltage is low, but just above the low voltage threshold this may cause diagnostic code 12-4. Recharge batteries and run heater again.
- b) Check the Blower motor for mechanical interference
 - i) By hand, rotate the motor shaft and feel for mechanical binding. If mechanical interference is felt replace the Blower motor.

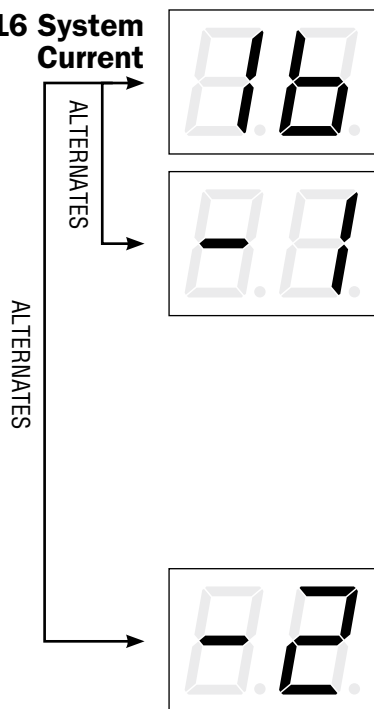
12-5, Blower or PCM Damaged

Indicates the Blower is turning when it should be off. The PCM will cut all power to the Blower in an attempt to stop the motor.

Test Procedure — Blower Motor and PCM test:

- a) Disconnect the P1 Blower motor harness from the PCM, with the harness still disconnected switch the heater ON.
 - i) If code 12-5 is still displayed, replace the PCM.
 - ii) If code 12-3 is displayed replace the Blower motor.

16 System Current



The System Current Diagnostics Code 16 Indicates the PCM has detected one of two possible faults with the total system current.

- 16-1, System Current Shorted
- 16-2, System Current Overload (software breaker tripped)

Note: In an attempt to lower the system current, the auxiliary output is turned off for the remainder of the current cycle. Troubleshoot the System Current diagnostic code based on voltage: page 4-18.

16-1, System Current Shorted

Indicates the System Current is drawing very high amperage.

Test Procedure — Component and PCM test:

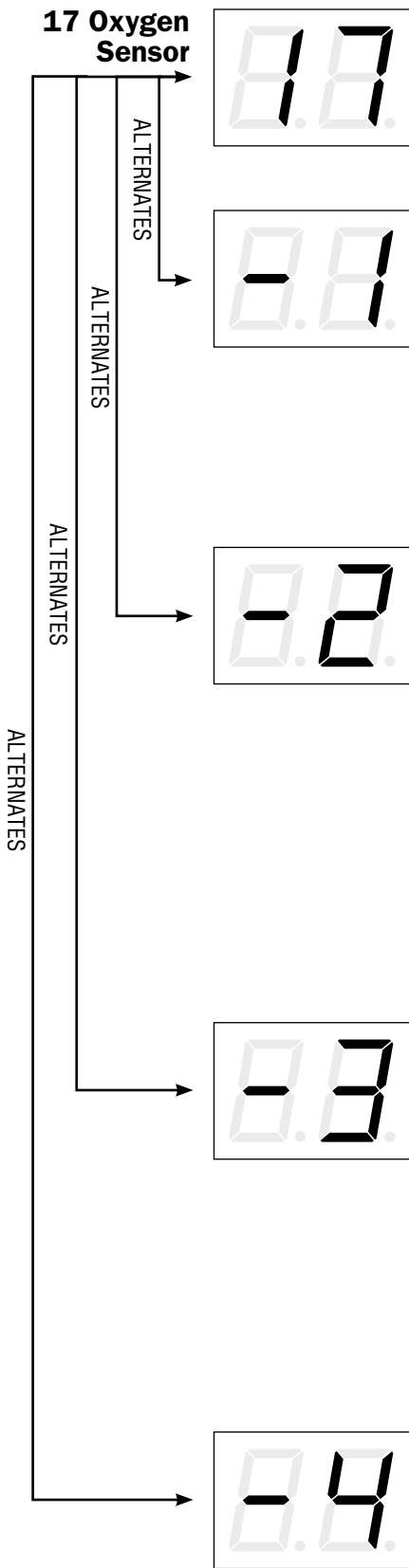
- Disconnect all the harnesses from the PCM. Inspect the PCM connectors for damage and corrosion. Inspect the harnesses and connector for damage and corrosion. If none is found measure the total system current using a clamp on Amp meter.
 - If the Amp draw measures below 25A, replace the PCM.

16-2, System Current Overload

Indicates the System Current is drawing high amperage and has tripped the 25 Amp breaker. This could be an electrical or mechanical problem with a component.

Test Procedure — Component and PCM test:

- Disconnect all the harnesses from the PCM. Inspect the PCM connectors for damage and corrosion. Inspect the harnesses and connector for damage and corrosion. If none is found measure the total system current using a clamp on Amp meter.
 - If code 16-2 is still displayed, check all the motors for mechanical interference, replace as needed.
 - If code 16-2 is still displayed replace PCM.



The Oxygen Sensor diagnostic Code 17 Indicates the PCM has detected one of four possible faults with the Oxygen Sensor.

- 17-1, Oxygen Sensor Fault
- 17-2, Oxygen Sensor Out of Range Fault
- 17-3, Oxygen Sensor Response
- 17-4, Oxygen Sensor Warning

17-1, Oxygen Sensor – Function Code

Indicates the Oxygen Sensor has invalid readings.

Test Procedure — Component and PCM test:

- a) Remove burner head
- b) Disconnect the Oxygen Sensor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Oxygen Sensor harnesses and connector for damage and corrosion. If none is found replace Oxygen Sensor. See procedure on page 4-13.

17-2, Oxygen Sensor – Function Code

Indicates the Oxygen Sensor O₂ is too low in pre-ignition.

Note: The heater will go through a full Cooldown (Purge).

Test Procedure — Inspection:

- a) Remove burner head
- b) Disconnect the Oxygen Sensor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Oxygen Sensor harnesses and connector for damage and corrosion.
- c) Check Blower fan, Combustion Air Intake, combustion chamber and exhaust for restrictions.
- d) If none is found replace Oxygen Sensor. See procedure on page 4-13.

17-3 Oxygen Sensor – Function Code

Indicates the Oxygen Sensor O₂ reading is not dropping when the exhaust temperature reading is climbing.

Note: The heater will go through a full Cooldown (Purge).

- a) Remove burner head
- b) Disconnect the Oxygen Sensor harness from the PCM. Inspect the PCM connector for damage and corrosion. Inspect the Oxygen Sensor harnesses and connector for damage and corrosion.
- c) If none is found replace Oxygen Sensor. See procedure on page 4-13.

17-4, Oxygen Sensor – Warning Code

Indicates the Oxygen Sensor O₂ is near the end of its life.

Note: The heater will continue to operate normally for some time.

Repair Procedure — Replace Oxygen sensor and reset code 17-4:

- a) See procedure on page 4-13.

18 CAN Bus Heartbeat

ALTERNATES



Indicates the heater was switched on via a CAN input and then lost the CAN Bus heartbeat message for longer than 2 seconds. The heater will go to the Cool Down (Purge) mode then turn off until valid CAN communication is restored.

18-1, CAN Bus Heartbeat

Test Procedure — PCM test:

- a) Disconnect the Switch I/O harness from the PCM Inspect the PCM connector for damage and corrosion. Inspect the CAN harnesses and connector for damage and corrosion. If none is found and code persists contact PROHEAT for more information.

19 PCM Temp High

ALTERNATES



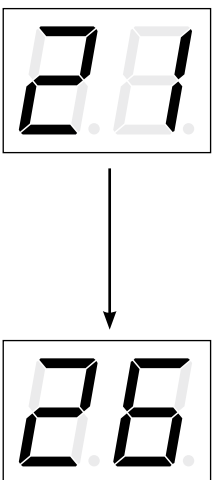
Indicates that the PCM's onboard temperature sensor reached 212°F (100°C). This is a non-critical fault and will not cause the heater to shut down.

19-1, PCM Temp High

Test Procedure — PCM test:

- a) Allow the PCM to cool down. Inspect the heater installation for the cause of the high ambient temperature. If none is found and code persists contact PROHEAT for more information.

21 through 26 Output Shorted



Indicates the PCM detected that one of the configurable output circuits is electrically shorted. This will only be detected whenever the output is powered. This is a non-critical fault and will not cause the heater to shut down. The output fault code refers to a specific hardware pin on the switch/control connector. (See wiring diagram on page 1-4.)

21-1, Pin 1 on the I/O Switch harness

22-1, Pin 2 on the I/O Switch harness

23-1, Pin 3 on the I/O Switch harness

24-1, Pin 4 on the I/O Switch harness

25-1, Pin 5 on the I/O Switch harness

26-1, Pin 6 on the I/O Switch harness

Test Procedure — PCM test:

- a) Disconnect the Switch I/O harness from the PCM Inspect the PCM connector for damage and corrosion. Inspect the corresponding harnesses and connector for damage and corrosion. Check wire for short to ground using a multimeter. If no short is found remove the wire from the cavity, reconnect the I/O Switch harness. If the same code persists replace PCM.

31 PCM Battery Power Supply

ALTERNATES



Indicates an electrical issue with the PCM's battery supply power.

31-1, Battery Supply Low — Troubleshoot based on:

Test Procedure — PCM Power Harness supply test:

- Disconnect only the P7 I/O Switch harness from the PCM and measure the battery supply voltage through the PCM. Using a multimeter set for DC voltage measure voltage at pins 4 (power) and 7 (ground) on the PCM.

If your reading is less than battery voltage troubleshoot as per code 05-1 on page 3-3.

If your reading is the same as battery voltage check the power harness and fuse for an intermittent connection.

If code persists call Proheat for further assistance.

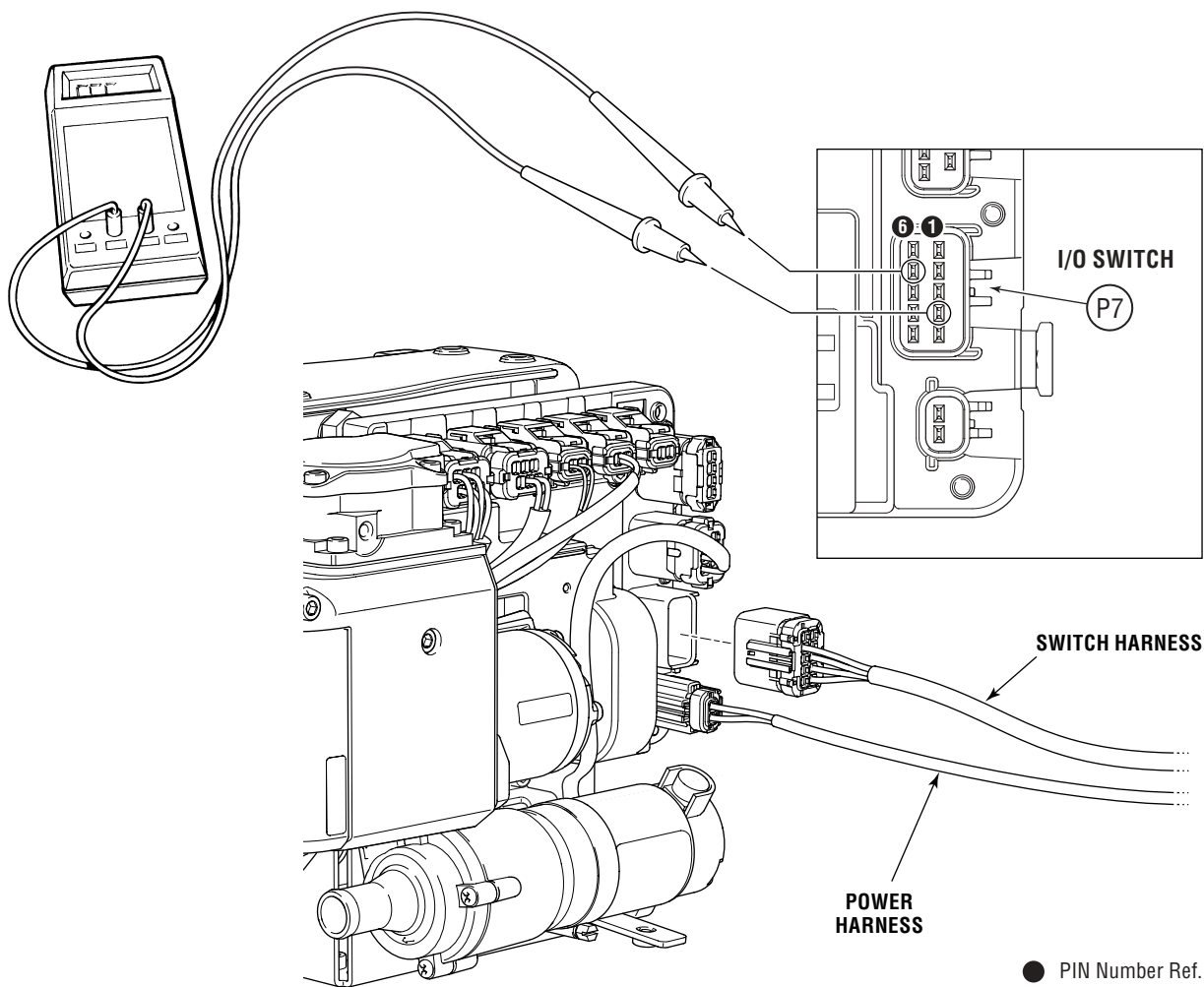
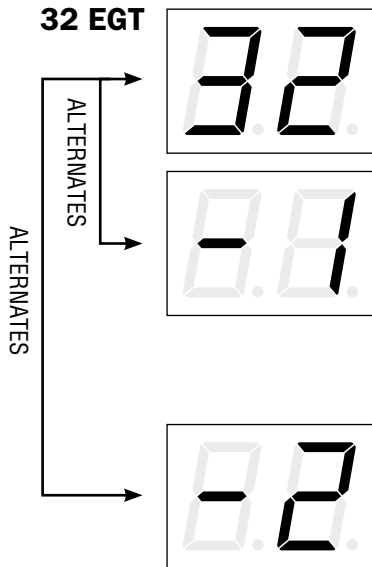


Figure 4-30. PCM Power Harness.



The exhaust gas temperature sensor diagnostic code 32 indicates the PCM has detected one of two possible faults with the sensor.

- 32-1, EGT sensor shorted.
- 32-2, EGT sensor open.

32-1, EGT sensor shorted

(less than 161.4 Ohms = -50°C)

Inspect the PCM connector for damage and corrosion. Inspect the EGT sensor harness and connector for damage and corrosion. If no damage or corrosion is found.

Measure the sensors resistance as per the test procedure below.

32-2, EGT sensor open

(greater than 848.7 Ohms = 1000°C)

Remove the EGT sensor and inspect the tip for soot build up or damage. Inspect the PCM connector for damage and corrosion. Inspect the temperature sensor harness and connector for damage and corrosion. If no damage or corrosion is found.

Measure the sensors resistance as per the test procedure below.

Test Procedure:

- Connect a multimeter (adjusted to measure resistance) to the temperature sensor as per figure 4-31. The polarity of the sensor connections to the multimeter is not important.
- Measure the sensor resistance
Range is 161.4 Ohms (@ -50°C) to 848.7 Ohms (@ 1000°C).
Replace EGT sensor if readings are outside of the this range.

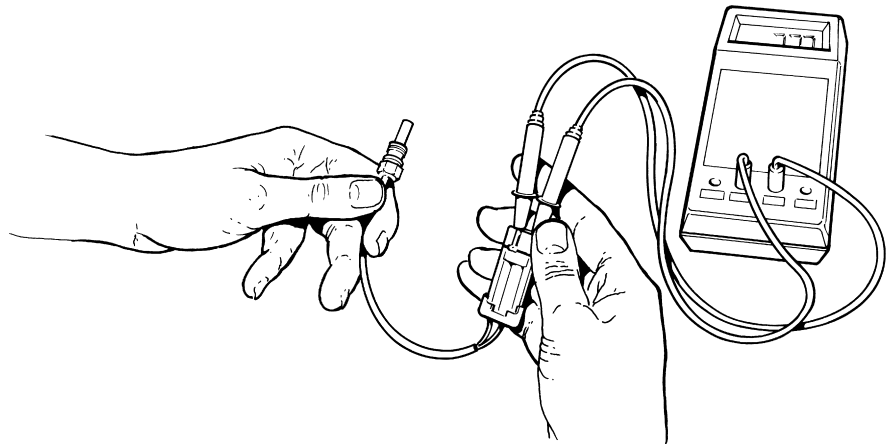
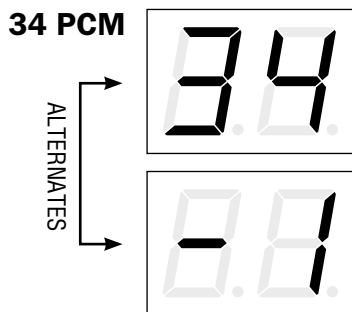


Figure 4-31. Temperature Sensor Test



Indicates an electrical issue with the PCM's battery supply power.

34-1, Hardware Failure — Troubleshoot based on voltage:

Test Procedure — PCM Power Harness test:

- Disconnect the P6 Power harness from the PCM for 30 seconds.
- Reconnect harness and switch heater on.
If code persists call Proheat for further assistance.

4.2 OPERATIONAL PROBLEMS WITH NO CODES DISPLAYED

This section describes heater operational problems that are not specifically described in the function or component diagnostic section.

4.2.1 COMPLAINT: Smoking exhaust/smelly exhaust fumes

Check

NOTICE

The heater may puff smoke on start up/shut down for a few seconds.

Normal combustion in full output (ignition off) should be smoke free.

Black Smoke = Too much fuel for the amount of combustion air.

- Is the Combustion air restricted?
- Do you have the correct nozzle?
- Is the compressor air pressure correct?
- Is the 4-20 faulty (leaking internally)?
- Is the O² sensor faulty?

Gray/White Smoke = incomplete combustion of the fuel (bad atomization).

- Heater flooded with raw fuel will smoke heavily as it vaporize away. Heater can take up to 10 minutes of running to clear a flood and stop smoking.

Check

- Is it actually smoke or steam?
- Is there air in the fuel?
- Is the heat exchanger and exhaust flooded?
- Do you have the correct nozzle?
- Is the compressor air pressure correct?
- Is the fuel valve faulty (not opening fully)?
- Is the O² sensor faulty?

4.2.2 COMPLAINT: Low heat output

If the heater appears to be functioning properly but the driver complains of low heat, this is often indicative of a coolant flow restriction. (See section on *Coolant Flow* page 4-17).

4.2.3 COMPLAINT: Engine temperature gauge reads low

Depending on its location, the engine temperature sensor may not be directly in the path of coolant flow from the heater. In these cases, the gauge may read significantly lower than actual coolant temperature.

4.2.4 COMPLAINT: Backfiring

Backfiring occurs when there is air in the fuel supply lines.

Check

- Fuel level in tank – is the pick-up submerged?
- Air leaks – are all the fuel line clamps tight?
- For severely restricted combustion air blockage at the blower inlet, in the combustion chamber, or in the exhaust system.
- Fuel line ID wrong. Please ensure only the Proheat supplied fuel line is used with the X30

5.0 MAINTENANCE

5.1 WEEKLY MAINTENANCE

Visually inspect the Proheat, mounting brackets, fuel line, harnesses, coolant lines and exhaust system for damage, loose parts and leakage.

Run the Proheat a minimum of once a week to keep new fuel in the heater's critical components.

5.2 ANNUAL MAINTENANCE

Your PROHEAT has been designed to operate with a minimum of maintenance. To ensure the efficient operation of your heater an annual maintenance tune-up is strongly recommended to be performed each year.

NOTICE

A higher duty cycle may require a more frequent maintenance schedule, such as 2 or 3 times per year.

Proper maintenance will result in the following benefits:

- Maximum heat transfer to the coolant
- Minimum battery power draw
- Long-term cost savings
- Increased reliability

Check the system annually before each heating season. There are several maintenance procedures you can perform to keep your heater in service. Read this section of the manual carefully.

Always return to your Authorized PROHEAT Dealer for major maintenance. Your PROHEAT Dealer has the specialized equipment necessary to keep your PROHEAT in new condition.

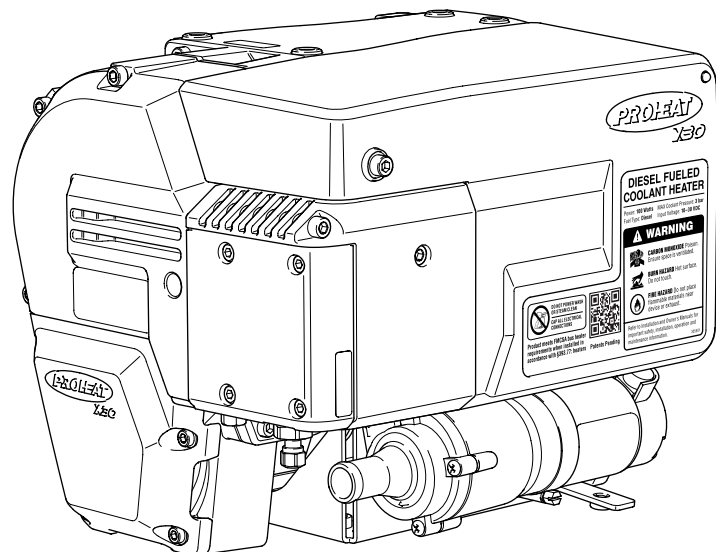


Figure 5-1. PROHEAT X30 Heater

5.2.1 CLEAN HEATER, ENCLOSURE AND AIR INTAKE

⚠ WARNING

DO NOT pressure wash or steam clean.

To clean the heater, enclosure, and air intake:

1. Remove the heater enclosure cover.
2. Clean any accumulated debris or dust from the components.
3. Blow out the compartment with compressed air.
4. Check the combustion air inlet screen for restrictions. Clean as required.
5. Make sure the opening around the exhaust pipe is clear.
6. Visually inspect all the components for wear or damage.

Clean the X30 using the following procedure:

1. Protect yourself from burns and only touch a heater after it has cooled to room temperature.
2. Clean the X30 by hand with dry or damp cloth, or with compressed air. DO NOT use chemical agents as this may damage surfaces, gaskets, boots, cabling, and/or hoses.
3. DO NOT use a pressure washer or hose down the heater. This may result in damage to the PCM or damage to the electrical system.
4. Water should not come into contact with any part of the heater when it is hot. Water can cause rapid cooling, which may damage components.

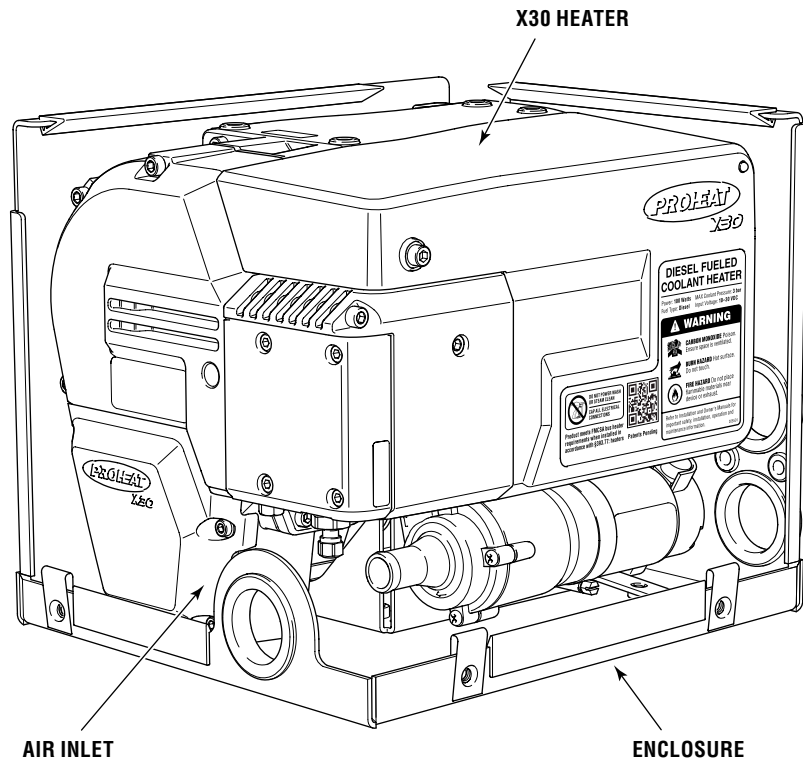


Figure 5-2. X30 Heater and Enclosure.

5.2.2 CHECK EXHAUST SYSTEM

- Make sure the exhaust pipe is vented safely away from the vehicle cab.
- Check the pipe for dents, restrictions, or severely corroded areas.
- Replace the exhaust pipe and clamps if necessary.
- Ensure the exhaust pipe clamp is tight.
- Clean exhaust pipe if there is a significant accumulation of carbon build up.

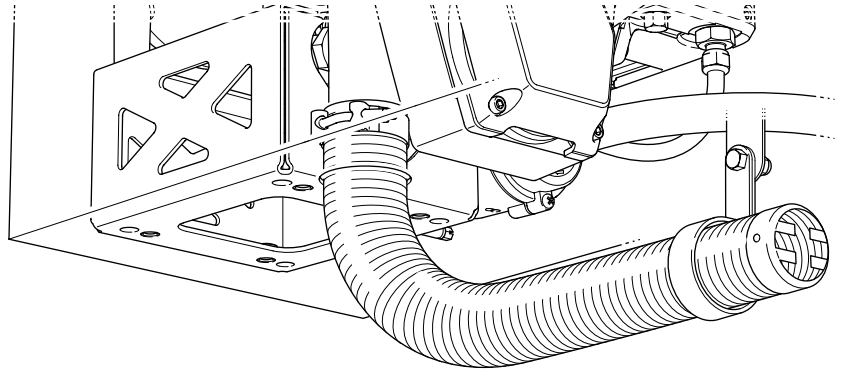


Figure 5-3. Exhaust Pipe

5.2.3 CHECK HEAT EXCHANGER

- To maintain optimum heat output, clean any combustion deposits that may have accumulated on the heat exchanger fins.
- Remove the fan end assembly and combustion tube to access the inside of the heat exchanger.
- Ensure exhaust pipe is clean and free from restriction.
- Use a wire brush to loosen the deposits and a vacuum to suck them out.
- Torque securing screws to 25 ± 3 in/lbs (2.8 ± 0.3 Nm).

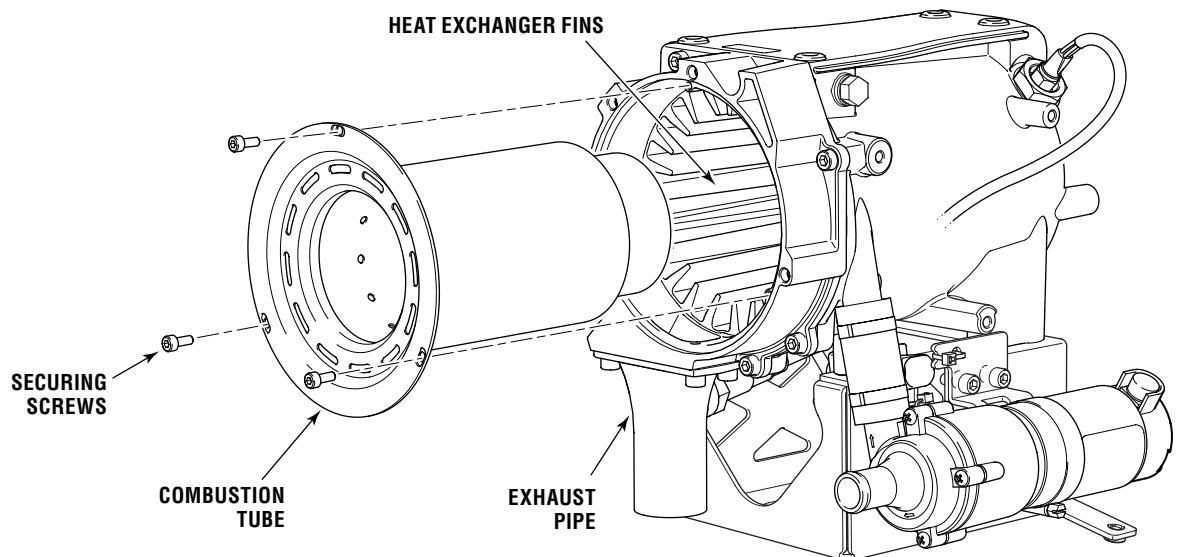


Figure 5-4. Heat Exchanger

5.2.4 CHECK COOLING SYSTEM

- Check all heater hoses and connections for signs of leakage or damage.
- Repair or replace as required.

5.2.5 CHECK BATTERIES

- Check the condition of batteries and the power connections. The heater will not function properly with weak batteries or corroded connections.

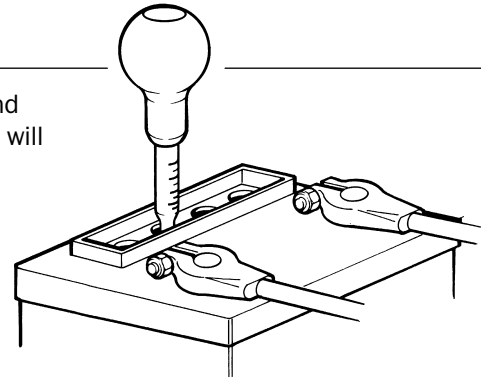


Figure 5-5. Test Battery

5.2.6 CHECK FUEL SYSTEM

- Check the fuel system for damaged fuel lines or leakage.
- Make sure the fittings on the fuel lines are secure.
- Ensure fuel lines are flexible.

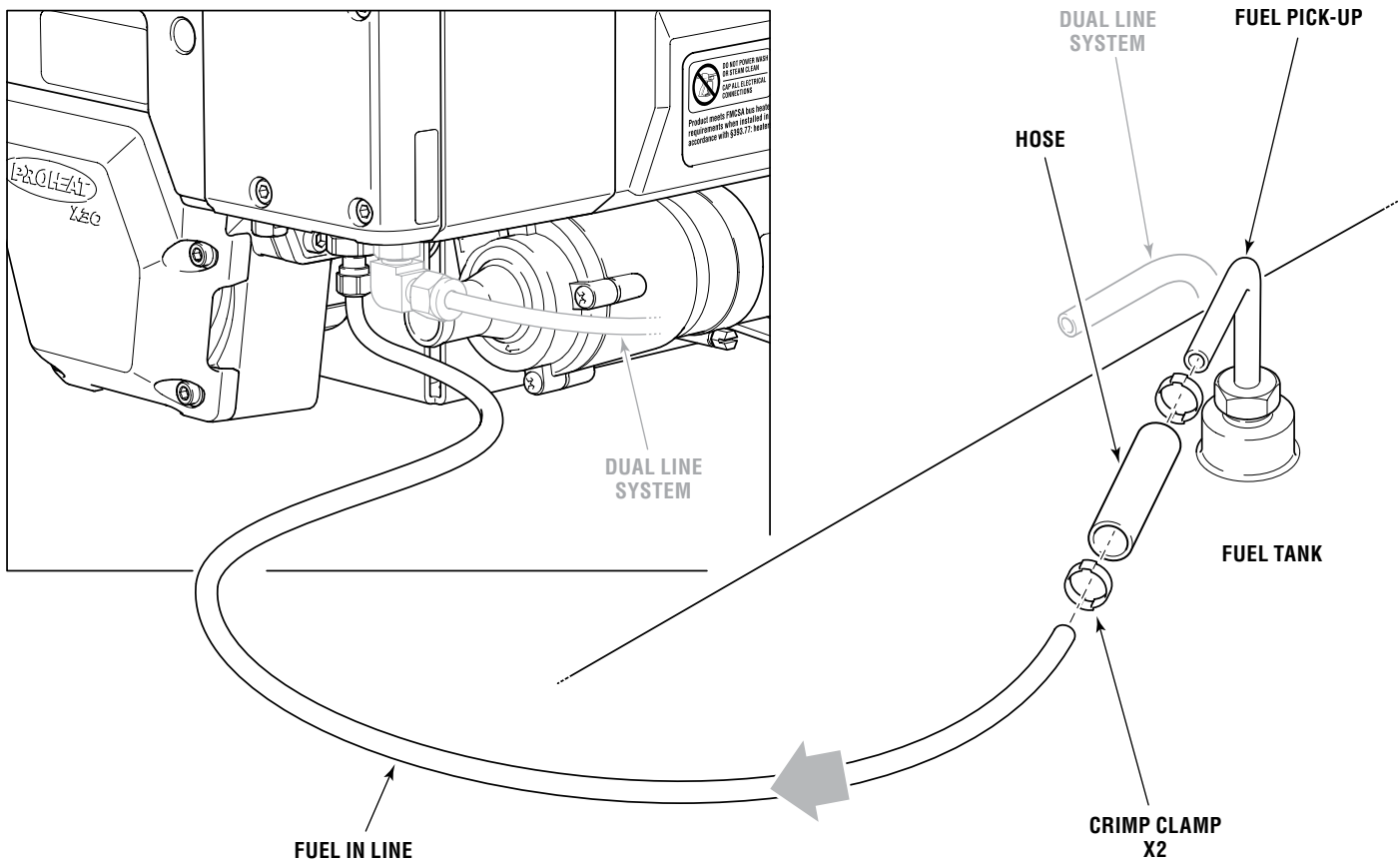


Figure 5-6. Fuel Lines.

5.2.7 CHECK FUEL FILTER

- Remove and inspect filter. Clean or replace as necessary.

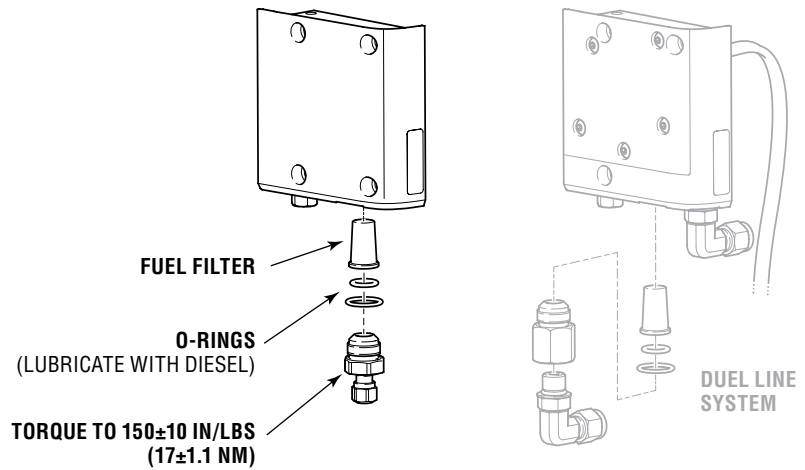


Figure 5-7. Fuel Filter Components

5.2.8 CLEAN NOZZLE

- Remove and install Nozzle as shown on page 5-6 Torque to 150±10 in/lbs (17±1.1 Nm).
- To properly clean the nozzle use electrical contact cleaner or warm soapy water. This will wash any dirt out and leave no residue. When using compressed air, blow into the nozzle orifice from the head end.

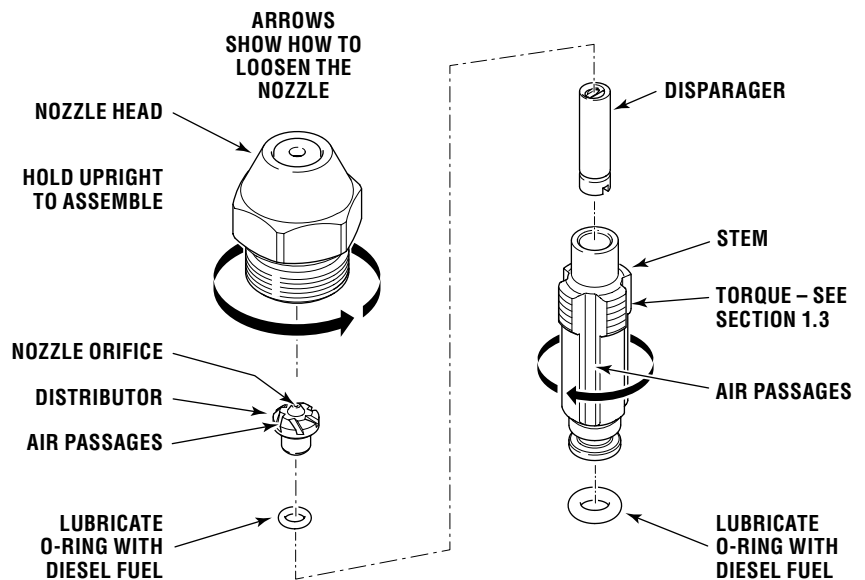


Figure 5-8. Nozzle Components.

5.2.9 REPLACE COMPRESSOR AIR FILTER

- Replace inlet air filter annually or more often if dusty conditions are encountered.

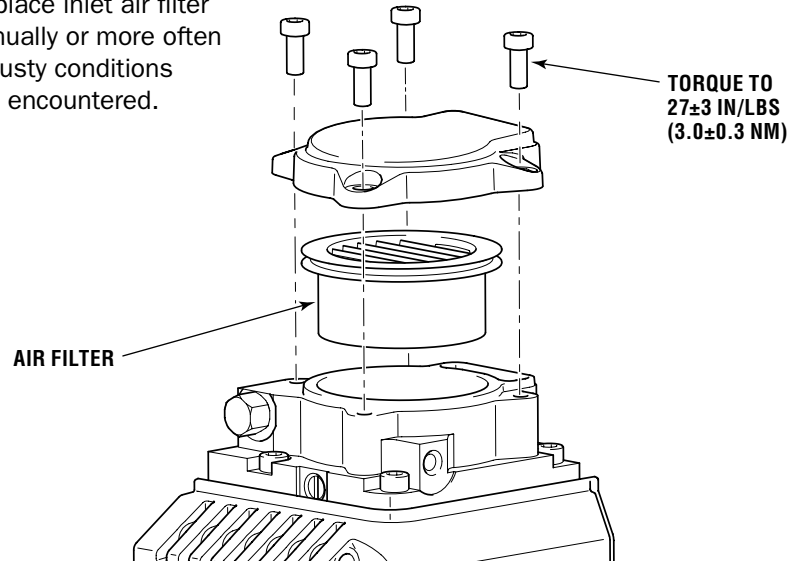


Figure 5-9. Compressor Air Filter.

5.2.10 CHECK ELECTRICAL SYSTEM

To check the electrical system:

- Check the internal and the external wire harnesses for damage. Replace if required.

⚠ CAUTION

Ensure that power is disconnected to the X30 prior to servicing the ignition lead.

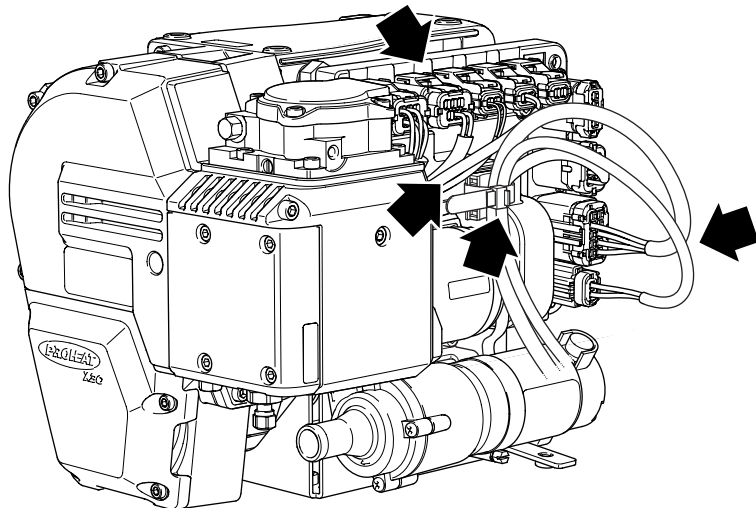


Figure 5-10. Wire Harnesses

5.2.11 CHECK AIR PRESSURE

- To check the air pressure, refer to the air compressor pressure test procedure on page 4-10.

REMOVE PLUG AND CONNECT FITTING

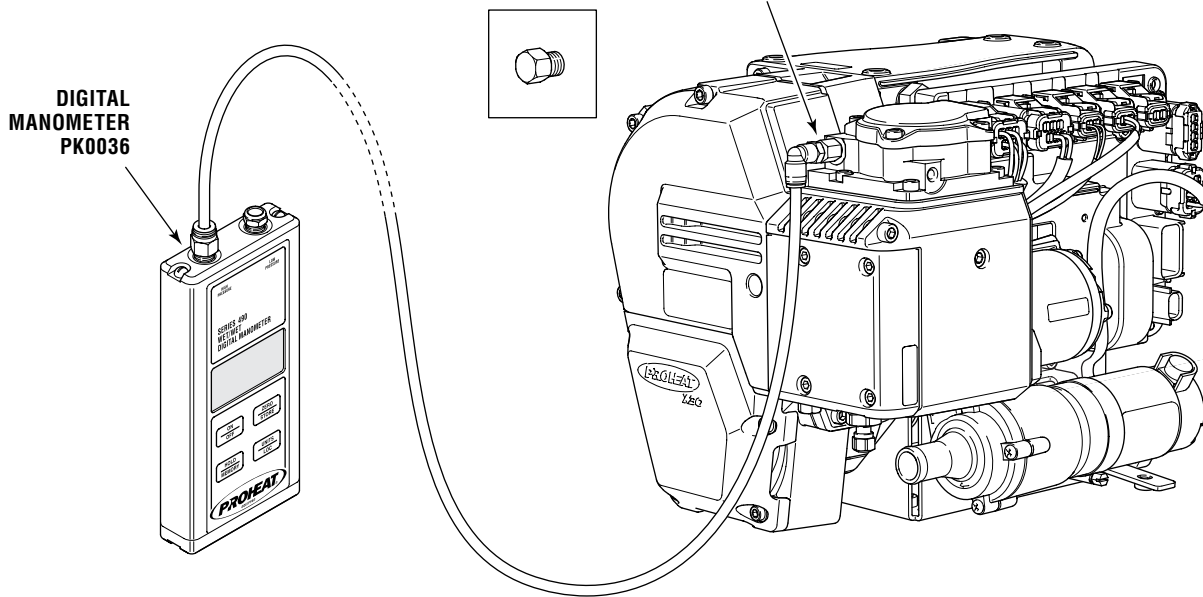


Figure 5-11. Air Compressor Pressure Test Procedure.

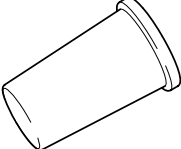
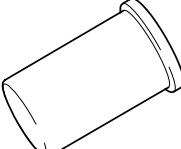
5.2.12 CHECK MODES OF OPERATION – SWITCH, TIMER OR OEM SIGNALS

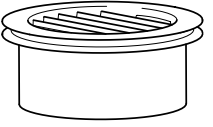
Check to see that the modes operate as described on page 3-7 to page 3-10.

Operation Test

- Run the system for at least 15 minutes or until the heater cycles “OFF” and then “ON” again.
- Alternate the thermostat for the sleeper heater (if connected) between the lowest and highest settings to ensure that the sleeper heater fan cycles “ON” and “OFF.”

Replacement Parts

PART #	QTY	DESCRIPTION
880035K All dual fuel line heaters	1	Fuel Filter, X30 
149481K All single fuel line heaters	1	Fuel Filter, X30 

PART #	QTY	DESCRIPTION
953420K	1	Air Filter, X30 

Note: *This page left blank intentionally.*

6.0 PROHEAT WARRANTY

NOTICE

This is a warranty summary. For the complete warranty manual, please go to www.proheat.com

PROHEAT warrants the PROHEAT heater to be free of defects in material and workmanship under design usage and service conditions for two (2) years on parts and labour from the date of first installation. Replacement parts are covered for the remainder of the heater's warranty or ninety (90) days, which ever is greater.

This warranty does not apply to damage or failure of the PROHEAT heater or the vehicle into which it was installed due to improper installation, assembly, maintenance, abuse, neglect, accident, or the use of parts not supplied by PROHEAT. Accessories supplied, but not manufactured by PROHEAT, shall be covered by the manufacturer's warranty only and not subject to this warranty.

Non-standard installations, that is, those requiring a departure from published installation instructions, should not be undertaken without first having consulted PROHEAT.

Coverage for warrantable parts, at the discretion of PROHEAT will be made to the claimant in the form of repair, replacement or credit. Warranty labour payments will be made only to Registered PROHEAT Service Centres in accordance with the Standard Repair Times (SRT's) as published by PROHEAT.

Marine Installations

The purchaser and installer are advised that specific rules and regulations are in effect with respect to the installation of heaters in marine applications. These rules and regulations are enforced by regional and federal agencies and/or other agencies having jurisdiction. It is the installer's responsibility to review and comply with all such rules and regulations.

In addition each marine installation must be inspected and approved by an authorized PROHEAT dealer. Only those installations which are approved, and so registered, will be eligible for warranty coverage of one (1) year on parts and labour.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY PROHEAT IN REGARD TO THE PROHEAT HEATER SYSTEM. PROHEAT MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

OWNER RESPONSIBILITIES

Before the expiration of the warranty, Owner must give notice to a registered PROHEAT dealer of failures, if any, considered to be warrantable and deliver the defective heater system to such dealer. Owner is responsible for the cost of all repairs made to the engine or equipment in which it is installed, other than the PROHEAT heater system. Owner is responsible for lodging, meals and incidental costs incurred by the Owner as a result of a warrantable failure. Owner is responsible for "down-time" expenses, and all business costs and losses resulting from a warrantable failure. **PROHEAT is not responsible for incidental or consequential damages.**

Items Covered Under This Warranty

1. Basic heater including combustion chamber components, fuel system components, air compressor, ignition components, coolant pump, air blower.
2. Electrical controls provided by PROHEAT including cab mounted controls and PCM.
3. PROHEAT supplied accessories and mounting hardware.

Items Not Covered Under This Warranty

1. PROHEAT heaters no longer within the warranty period.
2. Normal wear and maintenance parts, including fuel filter, air filter, nozzle, and clamps.
3. Parts which malfunction due to improper installation, causing inadequacies in: air, fuel or coolant flow; voltage due to wiring; shock or vibration protection.
4. Any progressive damage to the engine or vehicle arising out of failure of the PROHEAT.
5. PROHEAT heaters which have been modified or use of non-standard parts not approved by PROHEAT.
6. PROHEAT heaters that have been abused or damaged.
7. Travel time by a PROHEAT dealer.
8. Diagnosis or repairs when caused by problems not directly related to the heater or due to empty fuel tanks or poor fuel quality.

If you have any questions or concerns about the PROHEAT warranty, contact your nearest PROHEAT distributor or PROHEAT at (604) 270-6899.

PROHEAT Serial Number:

Installation Date:

Dealer:



SeaStar Solutions

3831 No.6 Road
Richmond, B.C.
Canada V6V 1P6

Tel: 604-270-6899
Fax: 604-270-7172

www.proheat.com



PID# SL9211 REV. C



Designed and Manufactured
in North America



ISO 9001

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