

Onan® AUX™

Installation Manual

AUX DKX Series

Auxiliary Power Unit

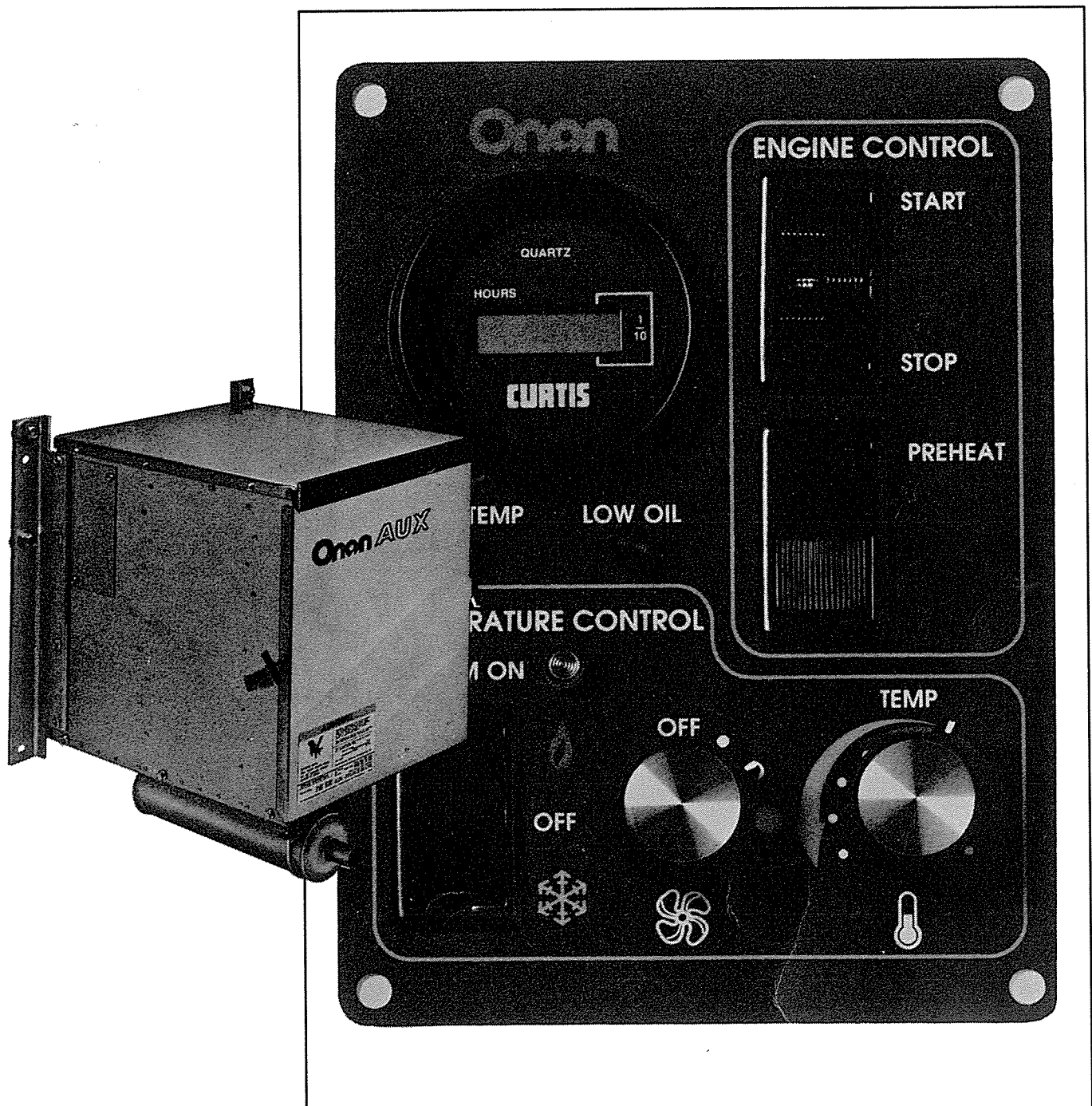


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Safety Precautions

Before operating the Auxiliary Power Unit (APU), read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the unit is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator or service personnel, and to potential equipment damage.

⚠ DANGER *This symbol warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

Read and observe each of the following safety precautions.

EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases. Make sure that exhaust components are in good condition and that all connections are secure. Do not use exhaust gases to heat a compartment.
- Inspect the exhaust system daily for leaks per the maintenance schedule. Do not use engine cooling air to heat a compartment.

AIR CONDITIONING SYSTEMS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Refrigerant released into the air creates the hazard of frostbite and severe eye damage. Have all air conditioning service work performed by a qualified service person.
- Inhalation of refrigerant R-134a can induce anesthetic effects such as giddiness, weakness, dizziness, nausea and unconsciousness. It can cause asphyxiation by limiting available oxygen. In susceptible individuals, epinephrine-like compounds can result in fatal cardiac arrhythmia. Do not release refrigerant R-134a into the air. Use a recovery system to remove refrigerant from the system. Make sure that the shop area has fresh air ventilation.
- The AC system is under high pressure. Be extremely careful not to open any part of the system (hoses, valves, etc.) or severe personal injury could result.

FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury can result from improper practices.

- DO NOT fill fuel tanks while the engine is running. Fuel contact with hot engine or exhaust is a potential fire hazard.
- Do not smoke or allow an open flame or spark producing equipment near the fuel system.
- Fuel lines must be adequately secured and free of leaks. Inspect the fuel lines and connections daily for leaks per the maintenance schedule.

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before starting work on the APU, disconnect all negative (–) cable(s) at the battery. This will prevent accidental arcing or starting.
- Do not remove any belt guards or covers while the power unit is running.
- Make sure that fasteners are secure. Tighten supports and clamps, keep guards in position over fans, etc.
- Keep your hands away from moving parts.
- Do not wear loose clothing or jewelry while working on equipment, because they can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect the negative (–) cable(s) at the starting battery before removing protective shields or touching electrical equipment.
- Tag remote or open switches to avoid accidental closure or starting.

GENERAL SAFETY PRECAUTIONS

- Wear safety glasses and protective clothing when servicing batteries. **DO NOT SMOKE** while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.
- Have a fire extinguisher rated ABC nearby. Maintain the fire extinguisher properly and become familiar with its use.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating, engine damage, and a potential fire hazard.
- Do not store anything in the power unit such as oil or gas cans, oily rags, chains, wooden blocks, portable propane cylinders, etc. A fire could result or the operation may be adversely affected. Keep the power unit floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

ADW-2

1. Introduction

GENERAL

This manual provides installation guidelines for the AUX (DKX) auxiliary power unit (APU). The AUX APU must be installed in conformance with these guidelines for the unit to operate reliably and safely. Figure 1-1 shows where the main components are located in a typical installation.

Review the *Pre-Installation Checks* section (3) before starting the installation. This section will help to determine if there is adequate space for a proper

installation. This section will also help identify each of the kits, parts and tools necessary to begin the installation.

For operation and maintenance procedures, refer to the Operator's Manual (981-0135) that accompanies each power unit.

This manual contains information that is subject to change. For this reason, use only the installation manual supplied with the auxiliary power unit for installation instructions.

⚠ WARNING

Incorrect installation, service, or replacement of parts can result in severe personal injury, death and/or equipment damage. Service personnel must be qualified to perform electrical, mechanical and air conditioning component installation.

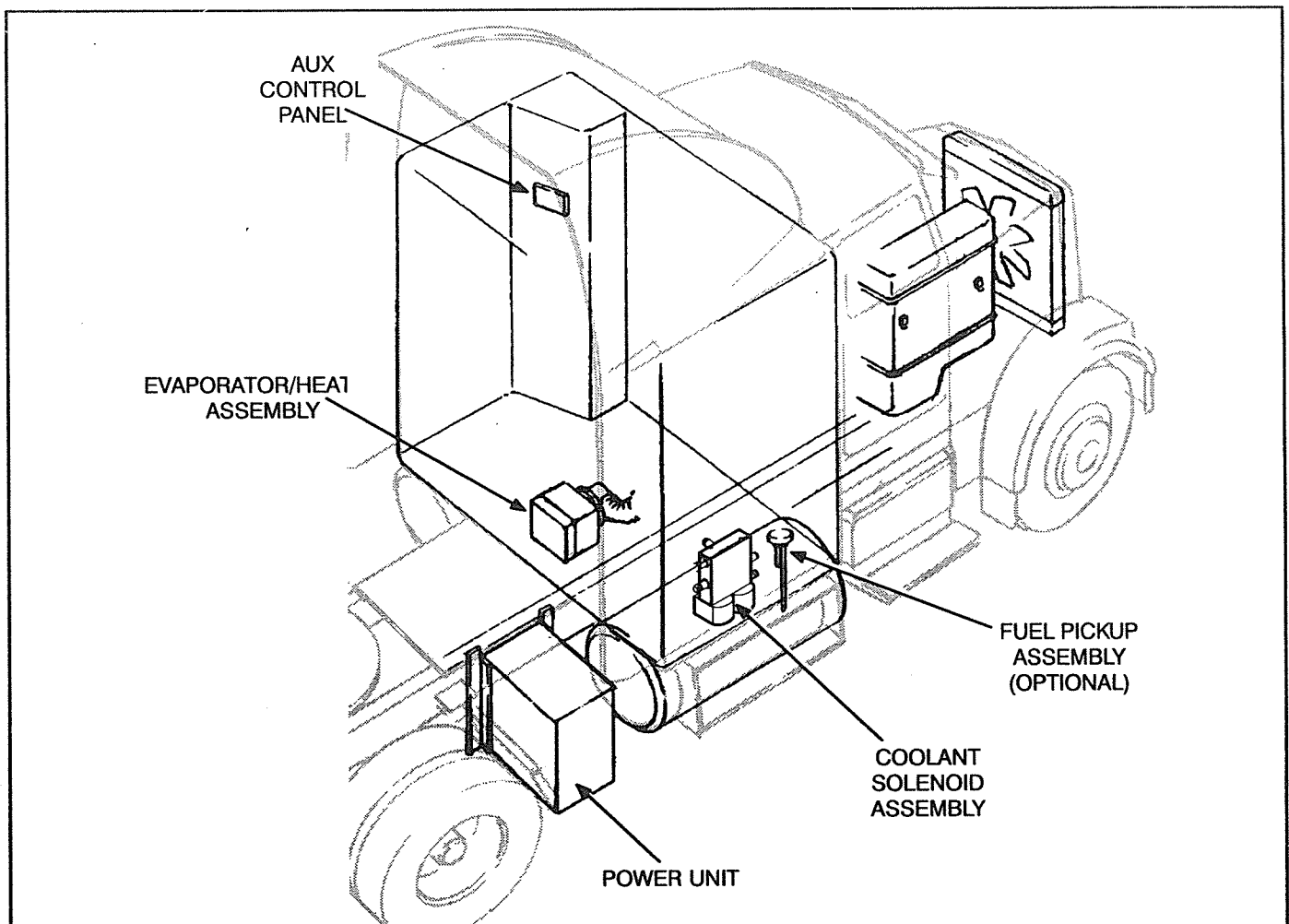


FIGURE 1-1. TYPICAL AUXILIARY POWER UNIT COMPONENT LOCATIONS

2. Specifications

MODEL	DKX-AUXA 2A
ENGINE Engine Model Engine Type Engine Speed Fuel Fuel Pump Lift Average Fuel Consumption: Air Conditioning Mode Heating Mode Engine Oil Capacity (with Oil Filter) Coolant Capacity (Engine and Radiator)* Starting System	Kubota® Z482B Two Cylinder, Vertical, 4-Cycle Diesel, Water Cooled 2600 rpm Diesel Fuel No. 2 (No. 1 Below 32°F [0°C]) 3 ft (914 mm) 0.32 - 0.38 gph (1.21 - 1.44 L/h) 0.25 gph (0.95 L/h) 5 qt (4.73 L) 3 qt (2.8 L) 12-Volt Electric Start
ALTERNATOR OUTPUT (12 VDC)	35 Amp
HEATING CAPACITY Heater Hose Size	12,500 btu/hr 3/4 in.
COOLING CAPACITY Refrigerant Type High Pressure Hose/Fitting Size Low Pressure Hose/Fitting Size	9,000 btu/hr R-134a #6 #10
POWER UNIT DIMENSIONS** Length Width Height Weight	25.5 in. (647.7 mm) 18 in. (457.2 mm) 23 in. (584.2 mm) 260 lb (118 kg)

*Coolant capacity does not include hose and heater core capacity.

**For Evaporator unit and control dimensions refer to section 3.

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3. Pre-Installation Checks

GENERAL

The following checks must be made to determine if the tractor is suitable for installation of the auxiliary power unit. This unit is designed for use on class 8 long-haul trucks. Adequate space is needed for mounting and servicing the the auxiliary power unit components. Check each of the following items:

- Power Unit Space Requirements
- Sleeper Evaporator/Heater Assembly
- Control Mounting Location
- Fuel Pickup Location
- Installation Kits
- Installation Tools and Supplies

Refer to each of the following sections and make the necessary measurements and checks before proceeding to the next section.

POWER UNIT SPACE REQUIREMENTS

The power unit is mounted on the side of the tractor rails with mounting brackets. The unit requires 19.5 inches (495 mm) of rail width (Figure 3-1). Additional clearance of 2 inches (50.8 mm) is required at the air inlet on the right side of the power unit (additional clearance may be needed for connections).

The unit requires 27.5 inches (698.5 mm) of space between the rail and any side obstructions (sleeper wall, fairing, etc.) See Figure 3-2. A minimum of 2 inches (50.8 mm) clearance is needed in front of the power unit radiator. The radiator is located at the back of the power unit.

Inspect the rails and make sure that rail cross members do not obstruct the mounting bracket locations. The mounting brackets are 3 inches (76 mm) wide and they can be mounted either within the 18-inch unit width or outside the 18-inch width, to avoid cross members.

In some cases, accessories can be removed or re-located in order to make room for the power unit. If the tractor has side fairings, clearance between the fairings and the power unit must be adequate to allow for service and routine maintenance.

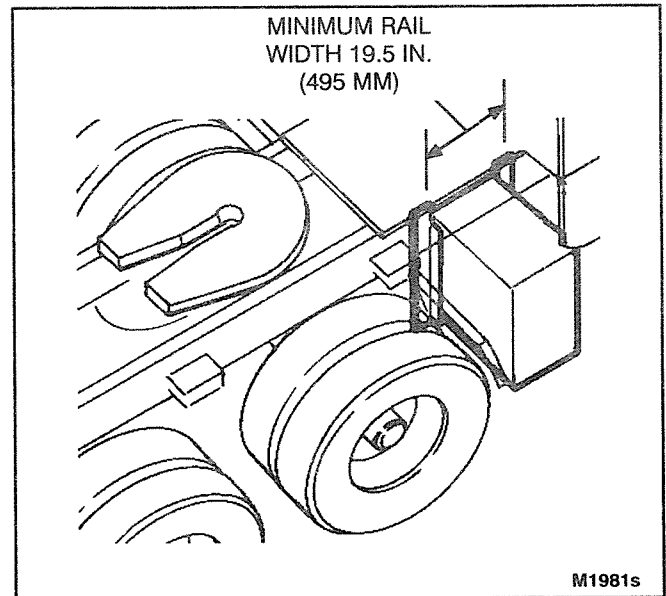


FIGURE 3-1. RAIL SPACE

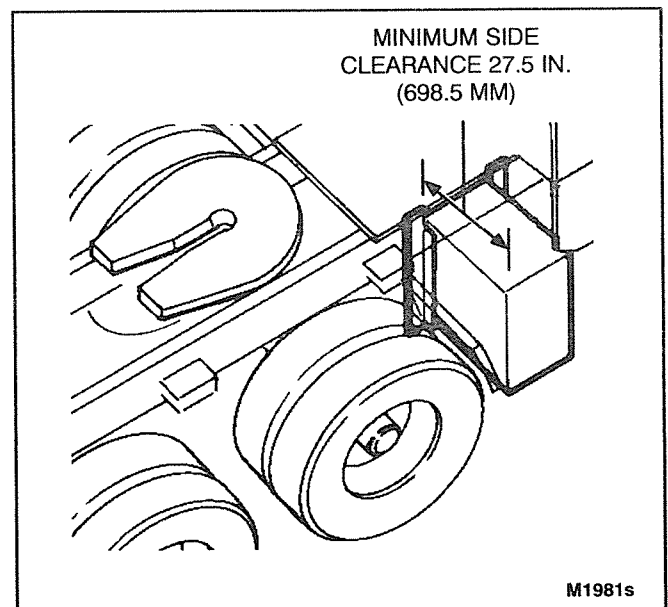


FIGURE 3-2. POWER UNIT SIDE CLEARANCE

SLEEPER EVAPORATOR/HEATER ASSEMBLY

Check the sleeper for an evaporator/heater assembly. This assembly is normally located under the bunk and will have an air outlet vent in the sleeper area. Refer to the following applicable section on sleepers with and without evaporator/heater assemblies.

Sleepers with Evaporator/Heater Assembly

A piggyback evaporator will be added to the existing evaporator/heater assembly. Identify the brand name of the evaporator/heater unit in the sleeper. Use this information to obtain the correct piggyback evaporator kit.

Make sure that there is adequate clearance between the existing evaporator/heater assembly and any obstruction. Figure 3-3 shows a typical installation and the space requirement for the add on evaporator and clearance for the air inlet.

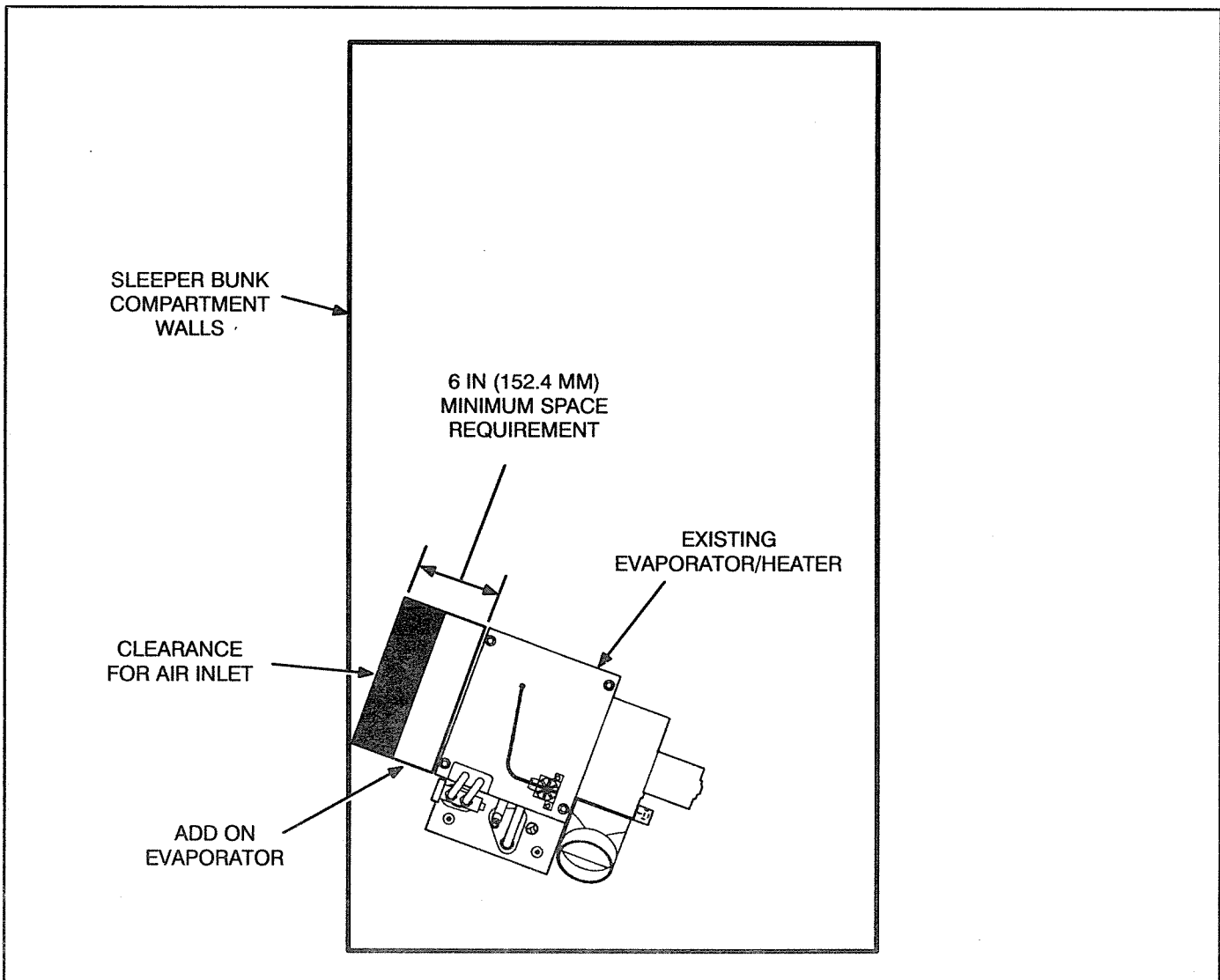


FIGURE 3-3. PIGGYBACK EVAPORATOR AND AIR INLET SPACE REQUIREMENTS

Sleepers without Evaporator/Heater Assembly

An evaporator/heater assembly will be installed on the floor of the sleeper. Refer to Figure 3-4 for the outline dimensions of the evaporator/heater unit. Make sure that there is adequate space for install-

ing this unit. Locate the assembly so there is a minimum of 1-1/2 inches (38 mm) of clearance to the nearest wall or obstruction on the air inlet side. This space requirement is necessary to prevent airflow restriction. Note that the location must allow space for service and/or replacement of the fan motor.

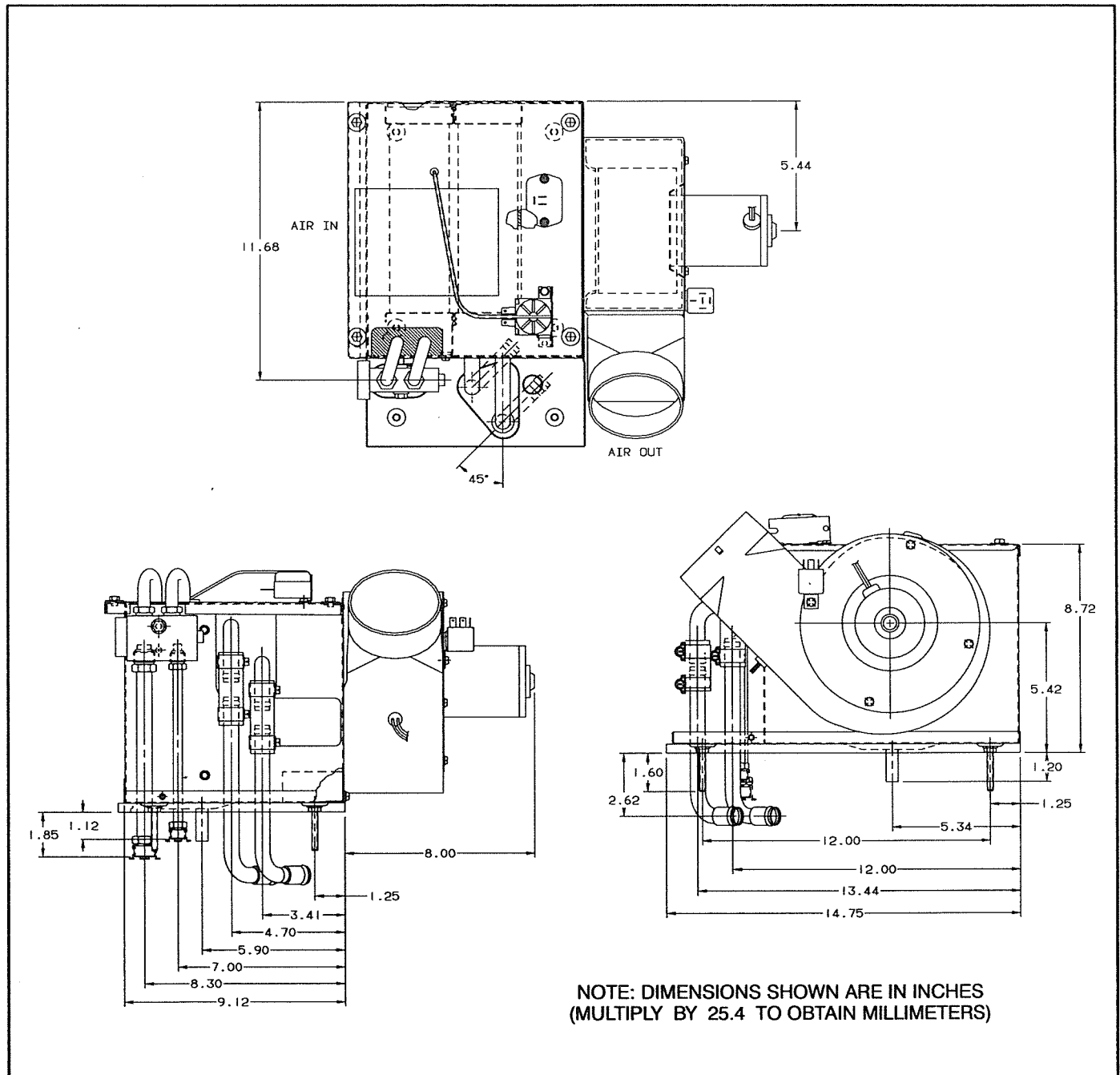


FIGURE 3-4. EVAPORATOR/HEATER ASSEMBLY DIMENSIONS

CONTROL PANEL LOCATION

The control panel should be located inside the sleeper compartment. A typical location is on the drivers side of the sleeper as shown in Figure 1-1.

Plan for the harness routing path to the control. The harness is typically routed between the wall covering and the wall. Routing from the control to the evaporator/heater unit and power unit can be done under the bunk. Be careful to choose a path that will offer maximum protection for the wire harness.

FUEL SUPPLY

Examine the fuel tank(s) for a fuel pickup location. Check the fuel tank(s) for a 1/2-NPT fitting or gauge sending unit mount. Kits are available to fit either of these types of openings. The gauge mount fuel pickup kit is available in two types: a gauge opening for tanks with the gauge installed or without the gauge installed. Make sure you have the appropriate corresponding fuel pickup kit.

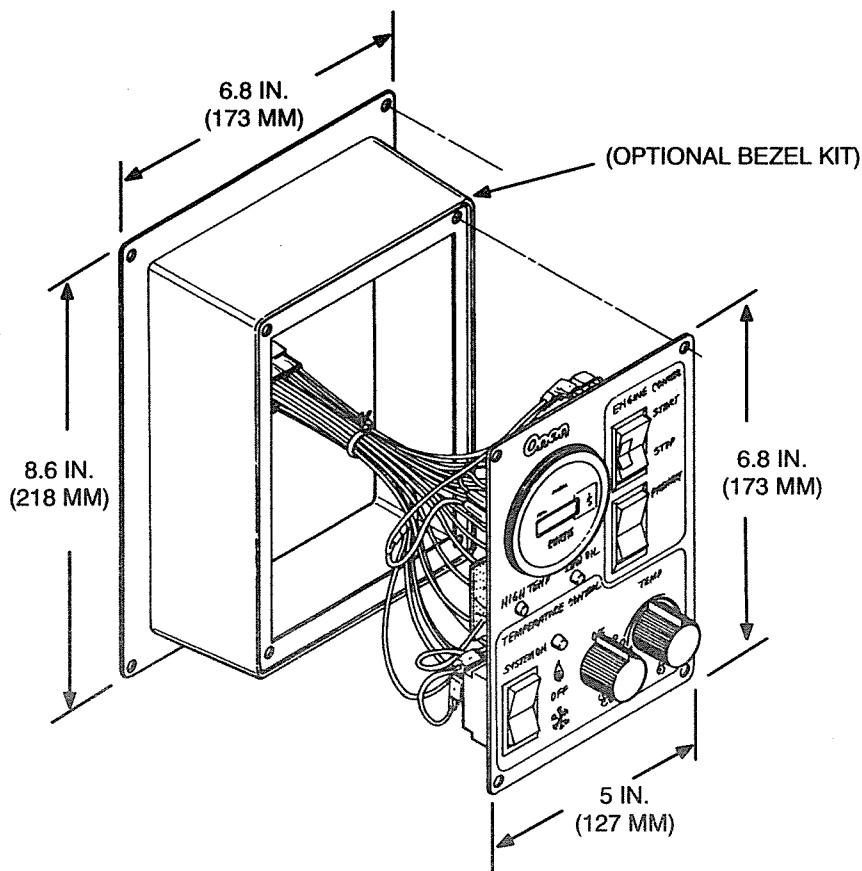


FIGURE 3-5. CONTROL PANEL AND BEZEL DIMENSIONS

INSTALLATION KITS

There are eight mandatory kits that are required for installation. Make sure that you have one each of the following kits:

- Side Rail Mounting Kit
- Control Assembly Kit
- Exhaust Muffler Kit
- Fuel Hose Kit
- Coolant Hose and Solenoid Kit
- Refrigerant Hose Kit
- Fuel Pickup Assembly Kit
- Evaporator or Evaporator/Heater Assembly Kit

The Fuel Pickup Kit and Evaporator, Evaporator/Heater Kit require inspection of the tractor in order to choose the correct optional kits. This inspection is described in this section under Sleeper Evaporator/heater and Fuel Supply. Refer to these sections and make sure that the correct kit is available.

Cabover Kit

A special kit is available for cabover installations to provide:

- Longer wire harness
- Longer coolant hose
- Longer refrigerant hose

INSTALLATION TOOLS AND SUPPLIES

A complete set of metric and english shop tools will be required. In addition, the following unique tools and supplies are required.

Tools:

- AC service gauges
- Refrigerant scale
- Refrigerant leak detector (electronic)
- Tool kit for crimping refrigerant hose fittings
- Multimeter
- Large hole saw set
- Hose cutter
- Floor jack or forklift truck
- Temperature measurement device
- Battery cable terminal crimping tool

Supplies:

- Refrigerant R-134a
- Sealing caulk and sealing tape
- Refrigerant oil (for use with R-134a refrigerant only)

If the tractor is suitable for installation and each of the kits, tools, and supplies are present, proceed to Mounting the Power Unit, section 4.

4. Mounting the Power Unit

PREPARATION

This section describes instructions for mounting the power unit to the side rail. Carefully follow each step and observe all safety precautions.

⚠ WARNING *The vehicle electrical system can cause severe personal injury or equipment damage. Disconnect the vehicle batteries negative (-) ground connection(s) before starting the installation.*

1. Remove the shipping carton by pulling out the four long staples from the bottom corners (see Figure 4-1). Carefully lift the carton off the power unit and discard.
2. Collect loose shipped literature, like the Operator's Manual, and add them to the vehicle documentation package.
3. Leave the power unit skid base on the unit until it has been mounted on the rails. The skid protects the exhaust pipe that extends below the base of the power unit. The exhaust manifold will be damaged if the power unit is allowed to rest on a flat surface without the skid base or other protection. Remove the shipping skid base and discard.

⚠ CAUTION *Setting the Power unit on a flat surface can damage the exhaust manifold. Leave the skid base on the power unit until it is mounted on the rails.*

4. The power unit is heavy and it must be handled with care. Carefully raise the power unit onto a forklift or floor jack. Make sure the unit is stable before moving it into position for installation.

⚠ WARNING *Dropping the power unit can cause severe personal injury or death. Be careful when lifting the power unit. Keep feet and hands clear when lifting the power unit.*

5. Remove or relocate accessories from the rail that interfere with mounting of the power unit.

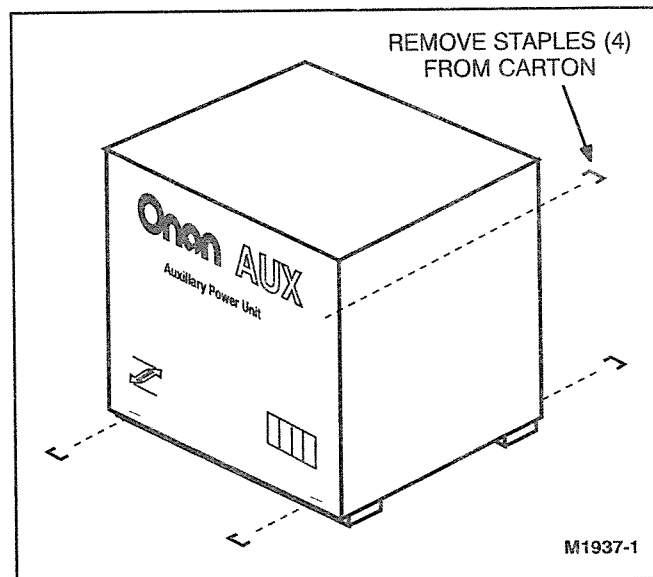


FIGURE 4-1. CARTON REMOVAL

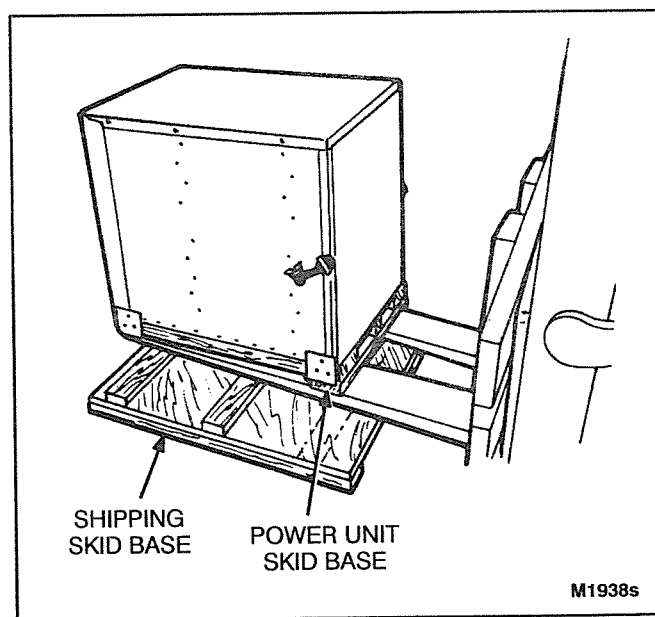


FIGURE 4-2. USING FORKLIFT TO MOVE POWER UNIT

POWER UNIT MOUNTING

Mount the power unit to the truck rail with the Side Rail Mounting Kit. A minimum of 19.5 inches (495 mm) of rail width is required. Read through this entire section before starting the installation.

The angle brackets can be installed in two ways. They can be mounted to the power unit with the mounting flanges to the sides of the power unit or behind the power unit (see Figure 4-3). Mounting the angle brackets with the mounting flanges to the side of the power unit provides easier access to the lower mounting clamp, but more rail space is required.

Rail Inspection

Make chalk marks on the rail 18 inches (457 mm) apart, to indicate where the power unit will be mounted. Inspect the rail for interference by holding the angle brackets (long side against the rail) to the outside of the marks or to the inside of the marks, if rail space is limited. Also hold the mounting clamps against the inside of the rail directly behind the angle brackets to check for interference. If interference is found, relocate the power unit on the rail.

Make sure that a clearance of 2 inches (50.8 mm) is available at the air inlet on the right side of the power unit and in front of the power unit radiator. The radiator is located at the back side of the power unit.

NOTE: Although 2 inches is all that is required for air flow, make certain to allow enough clearance to make connections (usually 8 to 12 inches).

Existing holes in the rail that align with the mounting brackets can be used for additional mounting strength. To utilize existing holes, pre-assemble the brackets to the rails and mark the hole locations on the brackets. Drill holes of the same diameter in the mounting brackets.

⚠WARNING *Damage to the rail can cause it to bend or break resulting in severe personal injury or death. Do not drill holes into the tractor rail. Drilling the tractor rail will damage it and cause it to bend or break.*

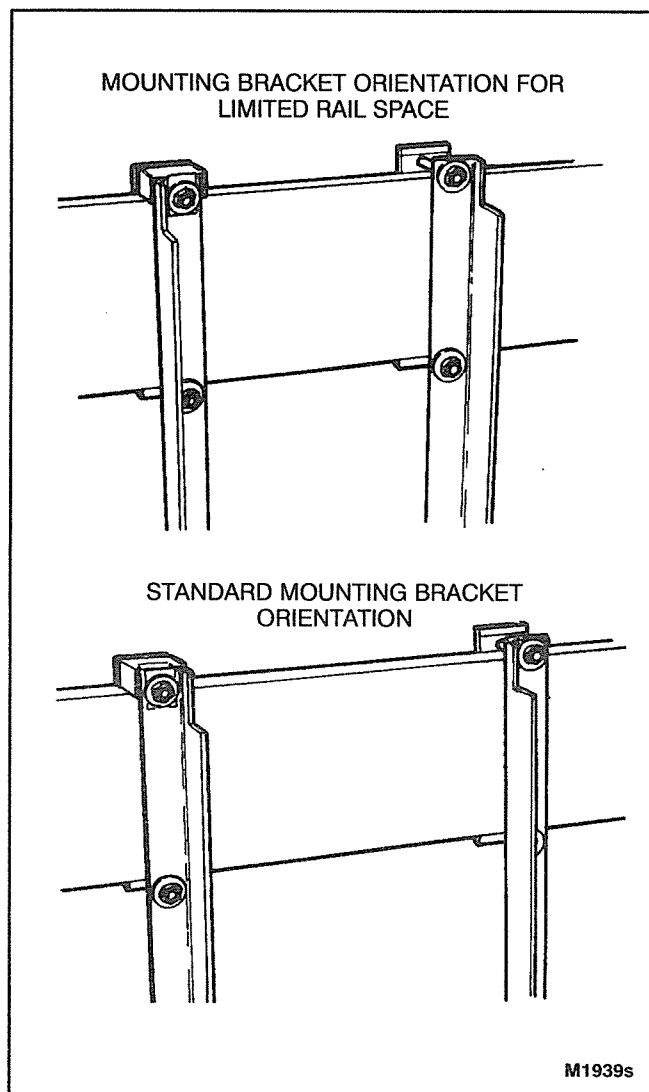


FIGURE 4-3. ANGLE BRACKET MOUNTING

Power Unit Mounting

The top cover must be installed on the power unit during installation. This will keep the power unit square and prevent uneven angle bracket mounting to the rail.

1. Remove the mounting screws from the back of both side panels on the power unit.
2. Assemble the spacer and then the angle bracket to the side panels. (Face angle bracket mounting flanges to the side or behind the power unit as required [Figure 4-3].) Tighten angle bracket mounting bolts to 32 ft lbs (43 N•m).

⚠ WARNING *Dropping the power unit can cause severe personal injury or death. Be careful when lifting the power unit. Keep feet and hands clear when lifting the power unit.*

3. Use a the forklift or floor jack to raise the power unit into position.
4. The mounting clamps have three mounting flanges of different widths to accommodate various rail thicknesses. Orient the mounting clamps so the mounting bolts lay flat on the the rail. If the slotted holes in the angle bracket do not align with the bottom mounting bolts, Modify the angle brackets by filing or drilling the holes so the mounting bolt will lay flat on the rail. **NOTE: if this modification is performed on the truck, take care not to damage the rail.** Secure the clamps to the rails with the 5/8-inch bolts, flat washers and lock nuts. Do not tighten the mounting bolts at this time.

If existing holes in the rail are being used for additional mounting supports, install mounting bolts, washers and lock nuts of the appropriate size and length (not supplied). Tighten mounting bolts to the correct torque for the bolt size and grade.

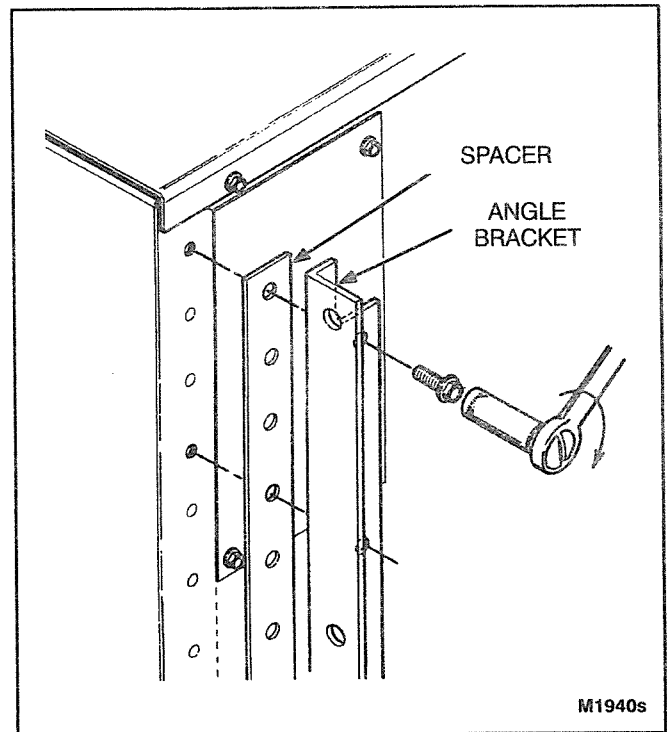


FIGURE 4-4. MOUNTING ANGLE BRACKET TO POWER UNIT

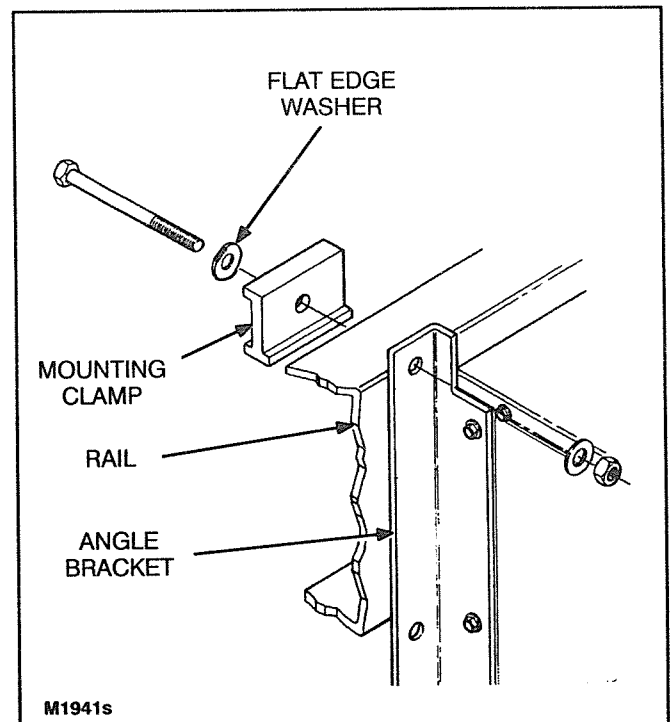


FIGURE 4-5. MOUNTING CLAMPS TO RAIL

5. Tighten the top mounting bracket bolts to 50 ft lbs (68 N•m). Then tighten the bottom mounting bracket mounting bolts to 50 ft lbs (68 N•m).

⚠ CAUTION *Over tightening the mounting bracket bolts can damage the angle brackets and cause equipment damage. Be careful not to torque the mounting bracket bolts more than 50 ft lbs (68 N•m).*

6. Lower the floor jack or forklift. Remove the four mounting bolts that secure the skid base corner brackets to the power unit. Save these bolts for reinstallation. Remove the skid base and discard. Reinstall the four mounting bolts to the power unit and torque to 32 ft lbs (43 N•m).
7. Remove the cardboard covering the radiator/condenser outlet. Check the installation to make sure that the U-joint is not aligned with the power unit radiator/condenser outlet. If this condition exists, install a splatter shield between the U-joint and the radiator/condenser to prevent grease splatter from covering the outlet. The splatter shield must be rigidly mounted a minimum of 2 inches (50.8 mm) from the power unit.

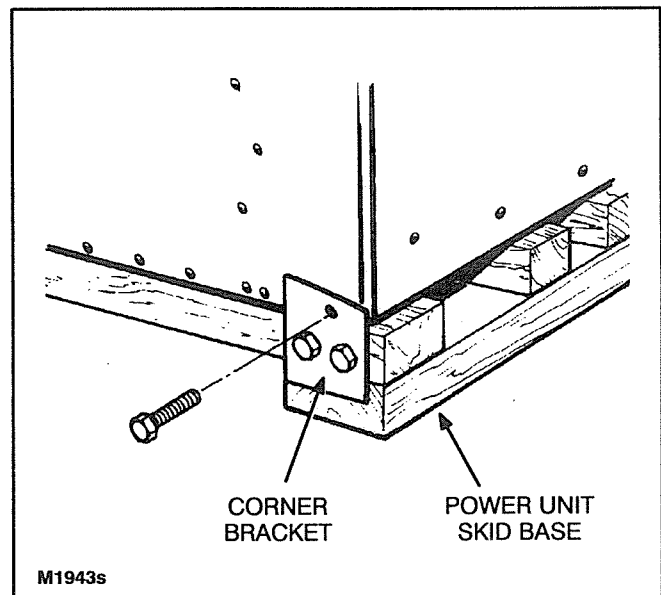


FIGURE 4-6. SKID BASE REMOVAL

5. Exhaust System

EXHAUST KIT INSTALLATION

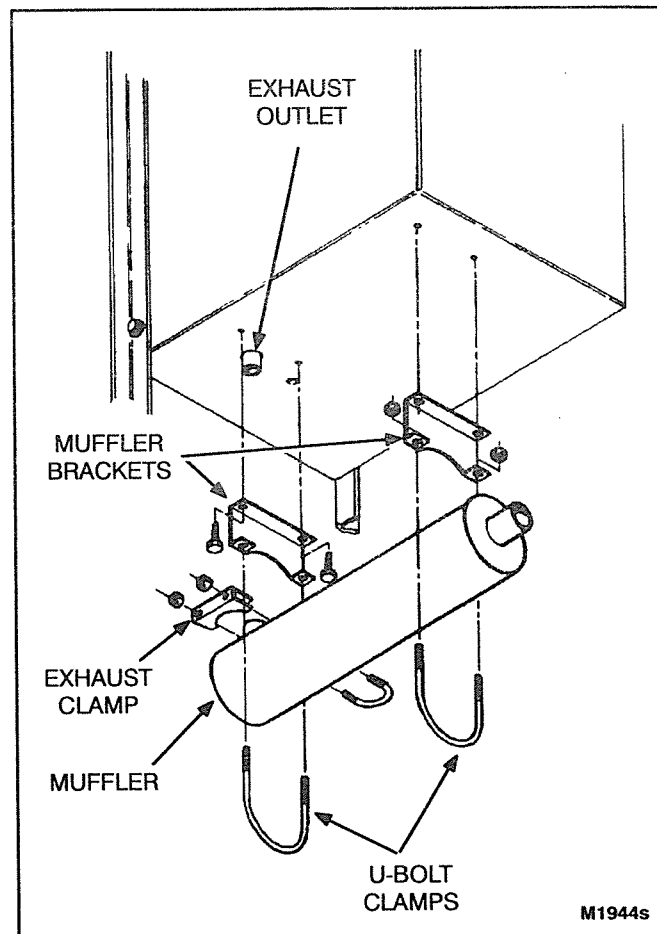
The Exhaust Muffler Kit contains the muffler and associated mounting hardware. The exhaust system installation must comply with all standards, codes and regulations.

Do not terminate the exhaust tailpipe under the cab or sleeper.

⚠ WARNING Exhaust gas presents the hazard of severe personal injury or death. The tailpipe must terminate so that exhaust gases will expel away from any vent, window, or opening into the cab or sleeper.

Use the following steps to install the muffler for a standard installation. If the exhaust must be directed away from the side of the truck, also refer to the Tailpipe Recommendations section.

1. Assemble the two exhaust mounting brackets to the bottom of the power unit with 1/4-20 mm bolts (Figure 5-1).
2. Install the muffler and secure it to the mounting brackets with U-bolts, washers, lock washers, and mounting nuts.
3. Secure the muffler inlet pipe to exhaust manifold outlet with the exhaust clamp.



**FIGURE 5-1. MUFFLER INSTALLATION
(POWER UNIT BOTTOM VIEW)**

TAILPIPE RECOMMENDATIONS

An exhaust tailpipe is not supplied with the Exhaust Muffler Kit because it is not required for a standard installation. If a unique exhaust installation is required, a tailpipe can be added to the end of the muffler.

Use 1-3/8 inch I.D. 18-gauge aluminized steel or stainless steel tubing for tailpipe. Use U-bolt type automotive muffler clamp to connect the exhaust tailpipe to the muffler outlet.

If the tailpipe extends more than 1-1/2 feet (0.46 m) from the muffler, attach a tailpipe hanger for additional support. Also use additional tailpipe hangers every 2 to 3 feet (0.6 to 0.9 m) of tailpipe run.

⚠ CAUTION *Excessive exhaust back pressure can cause engine damage. If a tailpipe deflector is used, make sure it is large enough to prevent back pressure.*

6. Evaporator or Evap./Heater Installation

GENERAL

This section describes the installation of piggyback evaporators and evaporator/heater assemblies. Refer to section 3, Sleeper Evaporator/Heater Assembly for kit identification.

Refer to the appropriate section for sleepers with evaporator/heaters or for sleepers without evaporator/heaters.

SLEEPERS WITH EVAPORATOR/HEATER ASSEMBLY

Carefully follow these steps to install the piggyback evaporator unit on an existing evaporator/heater assembly (Figure 6-1). The piggyback evaporator mounts on the evaporator end of the existing evaporator/heater assembly.

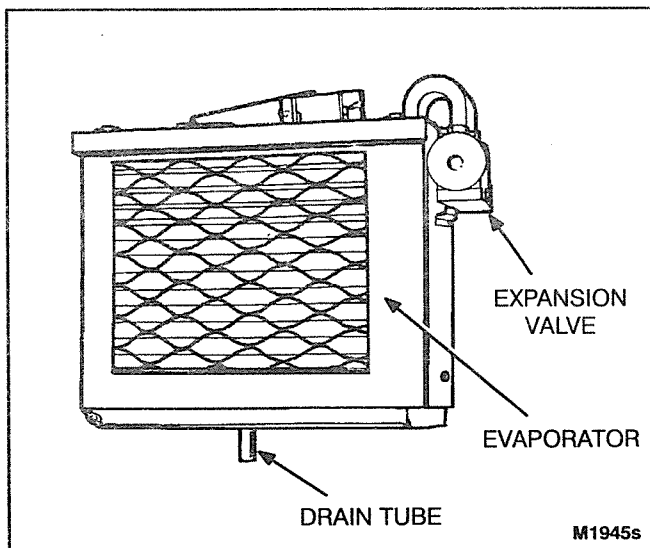


FIGURE 6-1. PIGGYBACK EVAPORATOR

1. Remove the mattress, mattress support and other items that interfere with the installation.
2. Place the template on the sleeper floor next to the evaporator. Locate and mark the drain tube hole and the sleeper floor mounting holes.
3. Locate an area on the sleeper floor for the refrigerant lines. Locate the lines a minimum of 7 inches (177.8 mm) away from the piggyback evaporator expansion valve (refrigerant line connection point). This space is required to accommodate the 90° hose fittings. Mark a 2-inch

diameter circle on the compartment floor or use a knockout hole if available.

⚠ WARNING Fuel and electrical systems present the hazard of severe personal injury or death if damaged. Be careful when drilling into the compartment floor to avoid hitting the fuel tank, fuel lines, or electrical lines. Also do not drill into frame members or the vehicle frame could be damaged.

4. Drill a 5/8-inch clearance hole for the 1/2-inch drain tube. Drill two 5/16-inch holes in the sleeper floor for evaporator mounting.
5. Use a hole saw to drill a 2-inch diameter hole in the sleeper floor (or use knockout if available) for the refrigerant line grommet. Install the 2-inch grommet supplied with the evaporator into the compartment floor.
6. Remove the two top cover mounting screws from the evaporator end of the existing evaporator/heater assembly.

Bergstrom[®] Unit: Remove the top cover from the existing evaporator/heater and install the baffle as shown in Figure 6-2. Use the baffle as a template. Mark and drill two 9/64-inch holes in the side panel for mounting the baffle. Install the baffle and put the cover back on the evaporator/heater.

Kenworth[®] Unit: Later model Kenworth sleeper heaters with built-in control and valve must have these (non-removable) components disabled before OEM wiring is disconnected from the sleeper heater, as follows:

- a. Turn truck ignition switch on.
- b. Set OEM sleeper heater controls to MAX HEAT position.
- c. Switch truck ignition off and disconnect the OEM wiring from the electronic control (on the top of the sleeper heater).
- d. Disconnect OEM wiring from control valve (back side, between the heater unit and the rear of the sleeper).

NOTE: The valve is operated by a worm gear and will remain open even after wiring is disconnected.

- e. Proceed with the rest of the AUX installation.

7. Install the piggyback evaporator and secure it to the evaporator/heater assembly and to the compartment floor. Seal the mating surfaces between the piggyback evaporator and the evaporator/heater assembly with sealant (use silicon or other suitable duct sealant).
8. If the evaporator drain tube does not terminate below the sleeper floor or if it will cause moisture to drip on components, wiring, etc., install a 7/16-inch I.D. vinyl drain hose on the drain tube. Route drain tube to a suitable location away from components.

Bergstrom is a registered trademark of the Bergstrom manufacturing company.

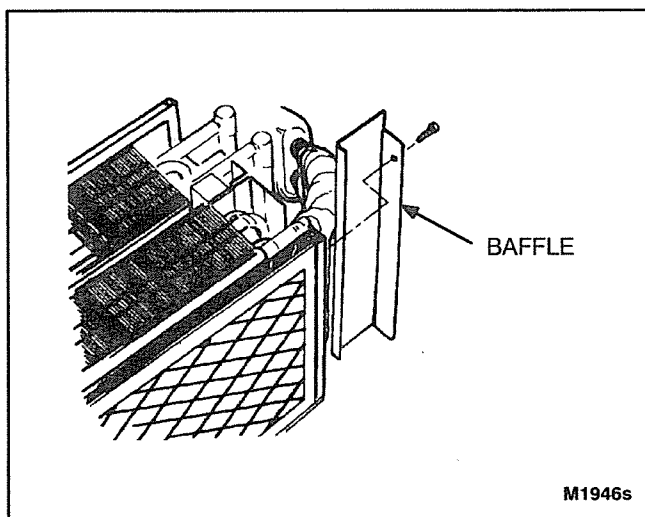
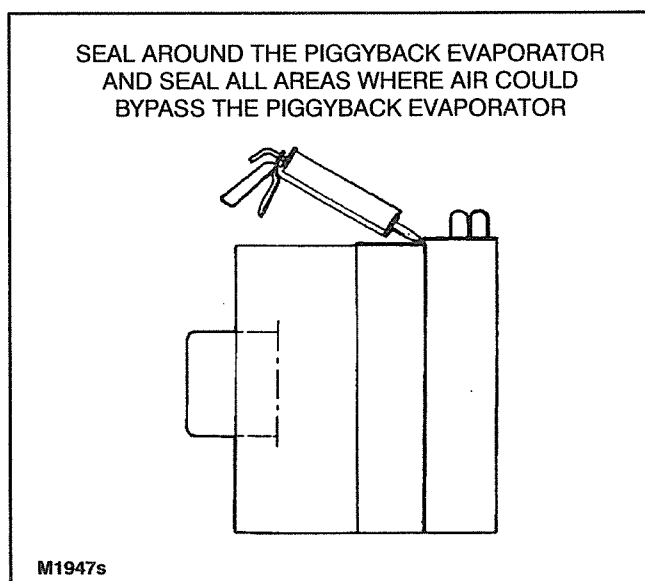


FIGURE 6-2. BERGSTROM BAFFLE INSTALLATION



**FIGURE 6-3. SEALING JOINTS BETWEEN
PIGGYBACK EVAPORATOR AND
EVAP/HEATER ASSEMBLY**

SLEEPERS WITHOUT EVAPORATOR/HEATER ASSEMBLY

Carefully follow these steps to install a complete evaporator/heater assembly (Figure 6-4). Examine the sleeper to determine the best location for the assembly. The area under the bunk usually provides the most room and the best access for routing both refrigerant and coolant lines. This section will describe a typical installation under a bunk.

1. Remove the sleeper bunk and other items that interfere with the installation.

⚠ WARNING *Fuel and electrical systems present the hazard of severe personal injury or death if damaged. Be careful when drilling into the compartment floor to avoid hitting the fuel tank, fuel lines, or electrical lines. Also do not drill into frame members or the vehicle frame could be damaged.*

2. Trim the template that comes with the kit and tape it to the floor of the compartment. **NOTE:** Allow room to service/remove the fan motor before drilling holes. Mark each of the hole locations and drill 1/8-inch pilot holes to check for clearance with frame members and other obstructions.
3. Drill each of the mounting and routing holes to size.
4. Install the evaporator/heater assembly and secure it to the compartment floor.

NOTE: If no heating/air conditioning unit was previously installed, it may be necessary to provide a path for air recirculation. This can usually be done by drilling or cutting openings in an inconspicuous location in the compartment.

5. The air outlet from the blower can be directed into the existing sleeper air outlet or a new outlet can be installed. The ducting hose is supplied. If a new outlet is needed, it is not supplied due to the variations in sleeper designs.
6. If the evaporator drain tube will cause moisture to drip on components, wiring, etc., install a 7/16-inch I.D. vinyl drain hose (not supplied) on the drain tube. Route drain tube to a suitable location away from components.

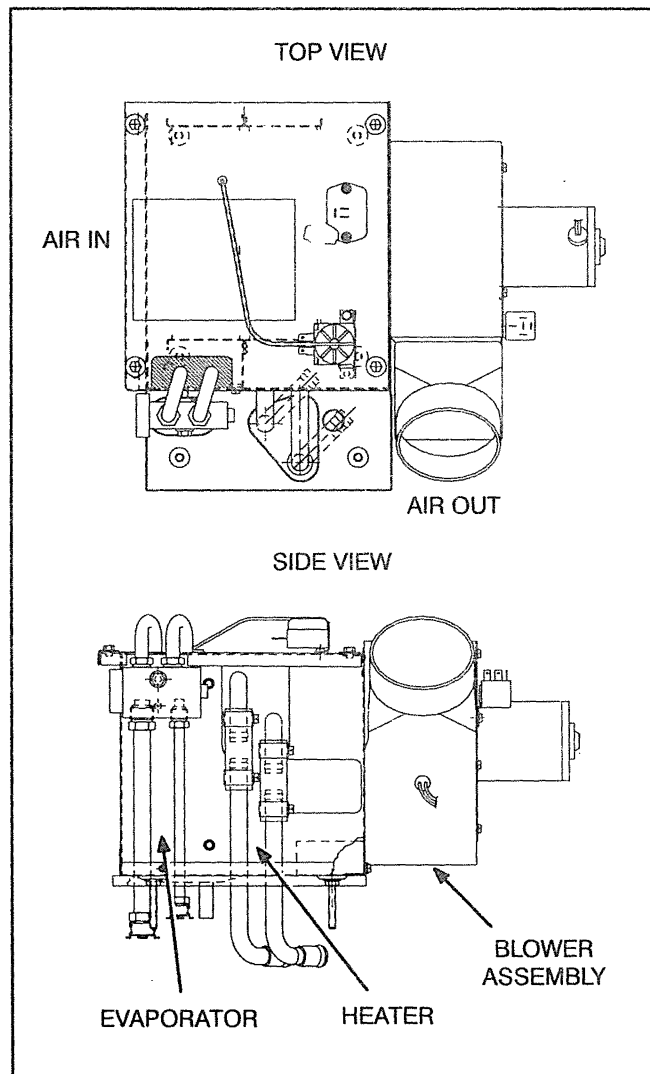


FIGURE 6-4. COMPLETE EVAPORATOR/HEATER ASSEMBLY

7. Control Installation

CONTROL ASSEMBLY KIT

This section describes installation of the auxiliary power unit control panel. The control mounts inside the sleeper and is used for starting the power unit and for selecting the heating and air conditioning features. A control panel mounting standoff (located inside the coolant accessory kit) is provided for hard to wire control locations. The temperature control module mounts to the outside of the evaporator housing as described in the Temperature Control Module Mounting section.

CONTROL MOUNTING

The main consideration for control panel mounting is access to the control for wire harness routing. The harness is typically routed under the bunk and behind the wall covering to the back of the control panel. Be careful to choose a location that will offer maximum protection for the wire harness.

If the sleeper has an existing heating and air conditioning control panel, its location can be used if it is suitable for wire routing. If the existing control location will be used, remove the old control and insulate each of the control wires to prevent them from shorting out.

The new control panel can be flush mounted if there is access behind the mounting surface (like a closet or compartment) to route and connect control wires. With this type of mounting, protect the back of the control from contact that could cause shorts (coat hangers or other closet contents). If there is no access to the back of the control, use the standoff (Figure 7-1) for mounting the control. The standoff provides space behind the control for wiring.

1. Layout the control harnesses from the evaporator/heater unit to the proposed control mounting location. Make sure the harness will reach and that the routing path that will not subject the harness to chaffing or pinching.

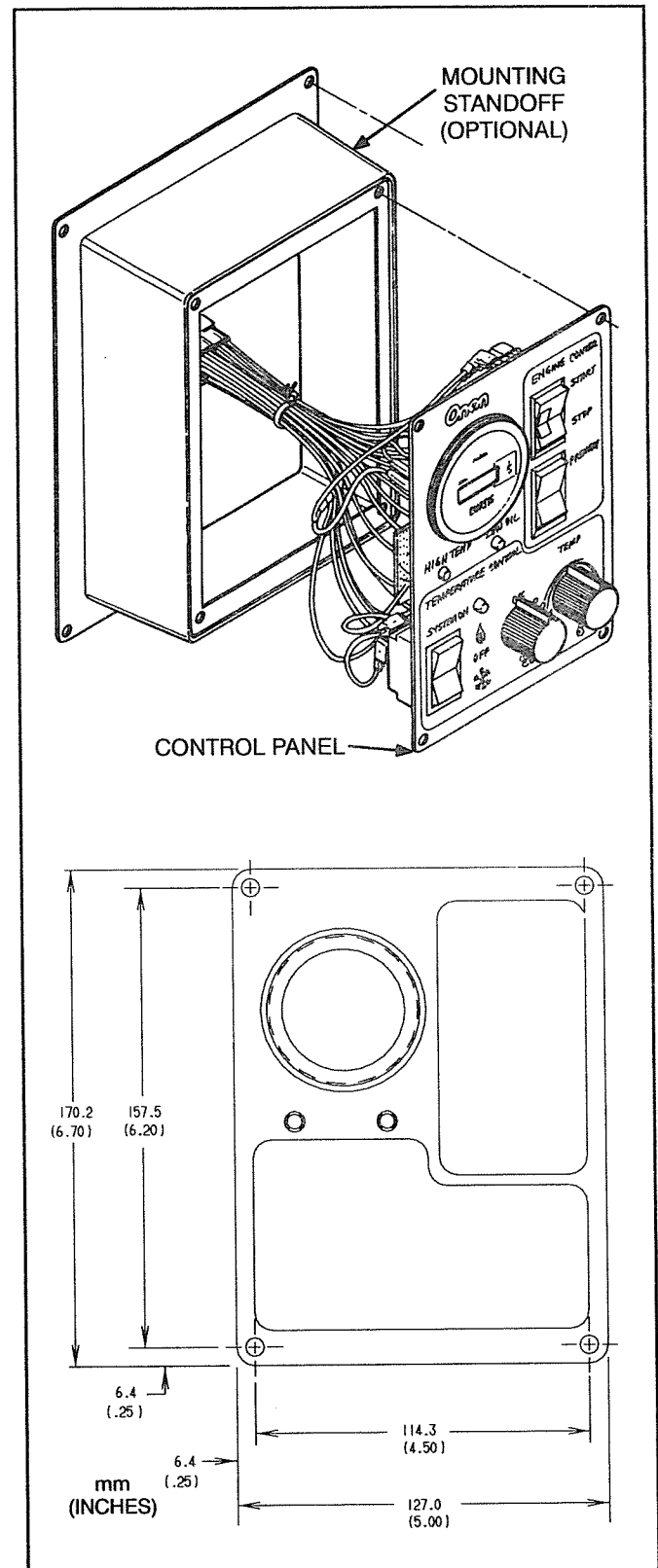


FIGURE 7-1. CONTROL AND STANDOFF

-
2. Use the optional control panel standoff as a template to mark the mounting holes. If the standoff is not used, reverse the standoff and use the small hole pattern for the template to mark the mounting holes and cutout or see Figure 7-1.
 3. Center punch mounting holes and drill four

9/64-inch diameter holes. If the standoff will not be used, cutout the clearance hole for the control components.

4. If the standoff is used, secure the control panel to the standoff with the enclosed screws.
5. Do not mount the control panel at this time.

TEMPERATURE CONTROL MODULE MOUNTING

The temperature control module and the thermistor are preinstalled on the standalone unit. Mount these parts on the piggyback installations as follows:

Bergstrom Unit: Mount the temperature control module in the location provided on the top of the evaporator housing with two 10-32 mounting screws.

⚠ CAUTION *Drilling into the heater coil or evaporator will cause equipment damage. Be careful to locate the mounting holes so adequate clearance is provided for drilling and mounting screws.*

⚠ CAUTION *Accidental electrostatic discharge from handling or touching control components can cause them to fail. During installation, DO NOT TOUCH bare electrical termination points on the module and/or wire harness. During troubleshooting or service operations, do not remove the protective enclosure (plastic box) around the module: contact with printed circuits presents opportunity for failure.*

Behr Unit: Position the temperature control module on the the air inlet side of the existing heater/evaporator assembly. Make sure that mounting screws will not interfere with the heater or evaporator coils. Mark the the mounting location and drill 9/64-inch mounting holes. Install the temperature control module with 10-32 mounting screws.

Thermistor Mounting (Piggyback Units)

1. Drill a 31/64-inch diameter hole in the heat duct 6 to 24 inches from the fan outlet (Figure 7-3).
2. Insert the thermistor so the tip of the thermistor extends one inch (25 mm) into the duct. Secure the thermistor with the grommet.

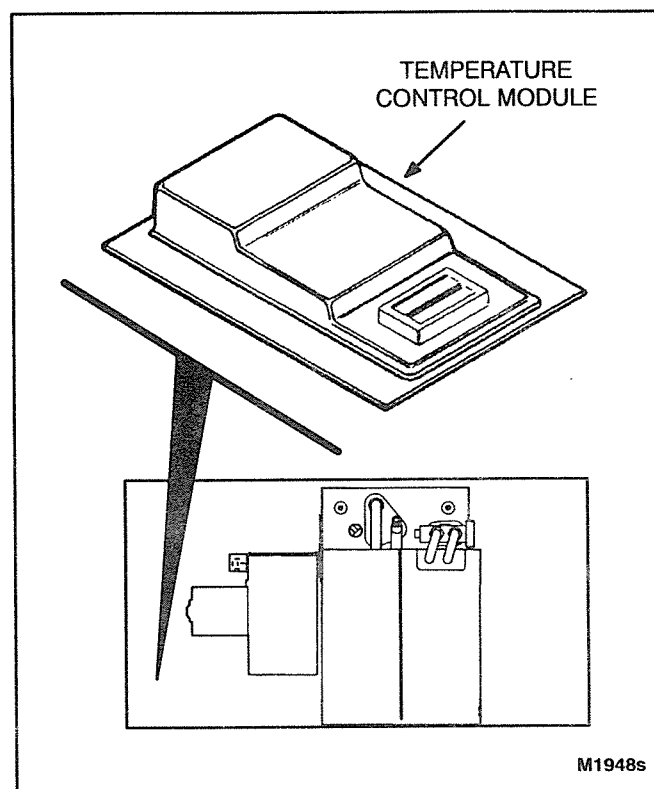


FIGURE 7-2. TEMPERATURE CONTROL
MODULE

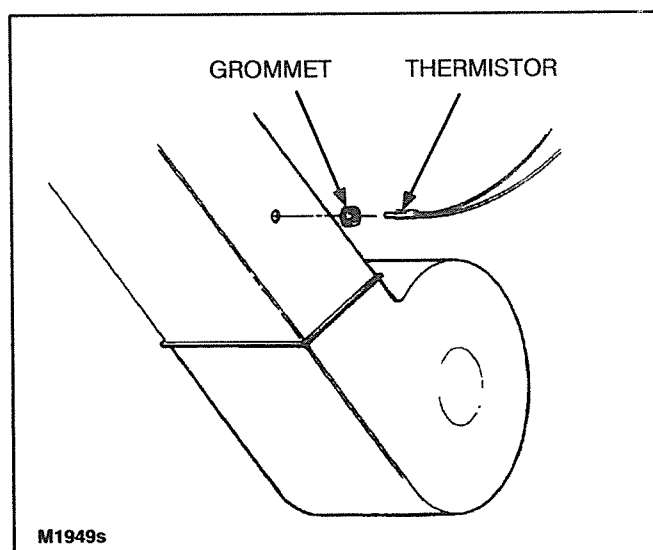


FIGURE 7-3. THERMISTOR MOUNTING

8. Heating System Connections

GENERAL

This section describes installation of the solenoid valve assembly and connection of the coolant hoses. The coolant accessory kit contains 3/4-inch heater hose and the components and hardware for this installation. The solenoid valve assembly routes coolant to the appropriate location for each operating mode.

Install the solenoid valve assembly before starting the hose connections. Figure 8-1 illustrates a typical heating system.

COOLANT SOLENOID VALVE MOUNTING

Standard Cab Configuration

1. The solenoid valve assembly mounts beneath the sleeper (Figure 8-1). Select a location that allows access for coolant hose routing to the power unit, sleeper heater and main truck engine. Also consider access to install the mounting fasteners for the solenoid valve assembly.
 2. Hold the solenoid valve assembly in position with the TE (to engine) hose connections facing the front and the AUX connections facing the back of the truck. Use the reinforcement plate as a template to mark the three mounting holes on the mounting surface. Make certain that the template is positioned correctly. Remove the template and drill three 7/16-inch diameter holes.
 3. Secure the solenoid valve assembly to the mounting surface with the three 3/8-16 x 7/8-inch screws and washers.
- NOTE:** Increase the fastener length if the mounting surface is over .15 inch thick. Thread engagement should be at least .56 to .75 inches.
4. Connect the wiring harness to the solenoid valve assembly.

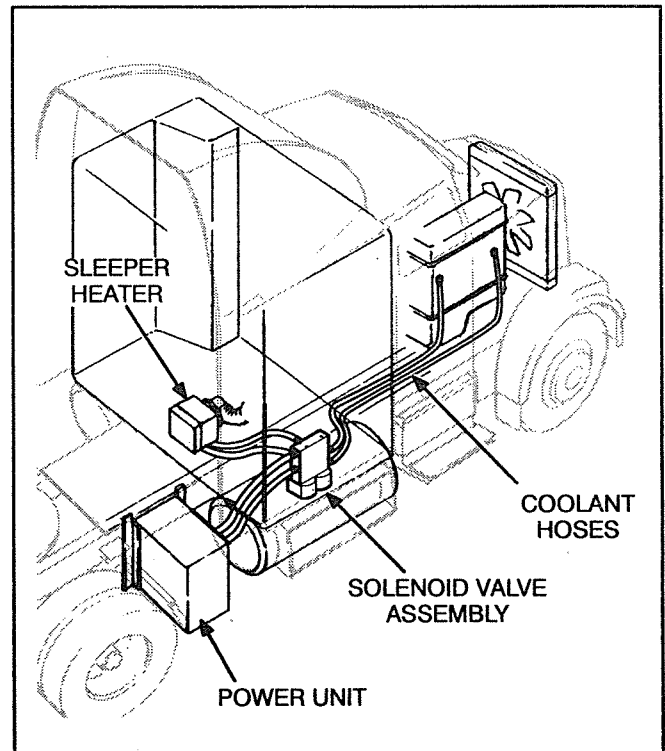


FIGURE 8-1. COOLANT SYSTEM COMPONENTS (STANDARD CAB CONFIGURATION SHOWN)

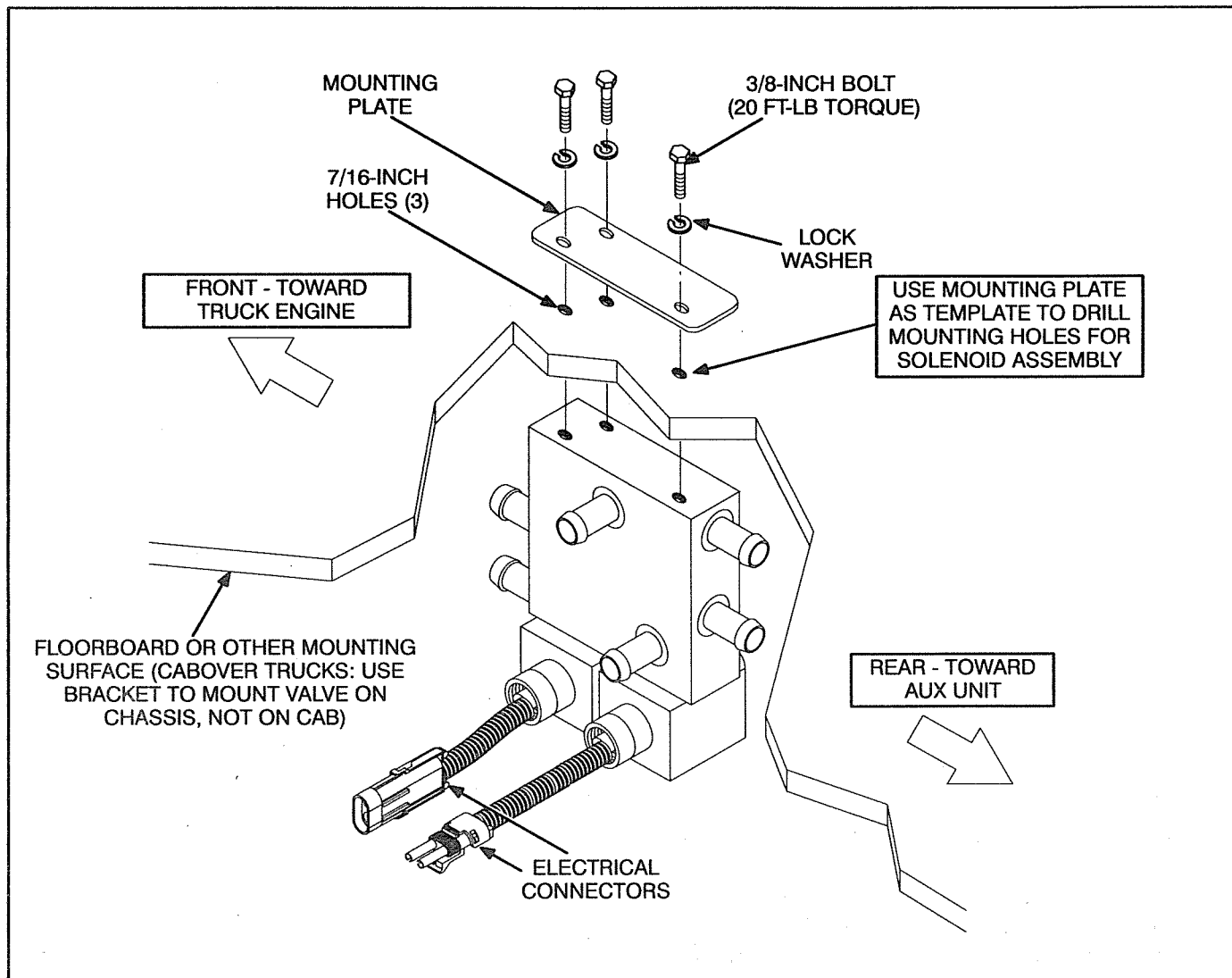


FIGURE 8-2. MOUNTING THE SOLENOID VALVE ASSEMBLY

Cabover Trucks

1. Find a suitable mounting location on the truck chassis between the power unit and the main truck engine (Figure 8-1). Select a location that allows good access for coolant hose routing. Avoid areas where hoses could contact sharp, abrasive, or hot surfaces. A location closer to the main truck engine will reduce hose lengths.

NOTE: To avoid excessive hose routing, do not mount the solenoid valve assembly to the sleeper/cab floor.

2. Fabricate a mounting bracket using the solenoid valve assembly reinforcement as a template.

NOTE: Increase the fastener length if the mounting surface is over .15 inch thick. Thread engagement should be at least .56 to .75 inches.

- 3 Check to make certain that no fuel, coolant, or electrical lines are behind the bracket mounting surface before drilling or using screws that could cause damage. Mount the solenoid assembly with the TE (to engine) hose connec-

tions facing the front and the AUX connections facing the back of the truck.

4. Secure the solenoid valve assembly to the mounting surface with three 3/8-16 x 7/8-inch screws and washers (see Figure 8-2).
5. Connect the wiring harness to the solenoid valve assembly.

EXISTING HOSE CONNECTIONS

Examine the existing heating system in the truck. If there is no existing sleeper heater, proceed to Heater Hose Connections. If there is an existing sleeper heater, determine if its return and supply hoses are connected directly to the main engine in a parallel system. If either the supply or return hose come from the cab heater, the truck has a series connection.

If the the truck has a sleeper heater that is connected in series with the cab heater, convert the cab heater to a parallel system before starting the Heater Hose Connections section. Refer to Figure 8-3. Determine which lead is supply and which is return, then remove the supply and return lines from the heater and run the cab heater supply and return lines directly to the truck engine supply and return fittings on the solenoid valve assembly. The sleeper heater plumbing will be performed in the following sections.

Trucks with fuel tank heaters must have the fuel tank heaters plumbed directly to the truck engine supply and return connections: they must not be incorporated into the AUX system. If the tank heater is connected in series with the sleeper heater, run the tank heater supply and return lines directly to the truck engine supply and return fittings.

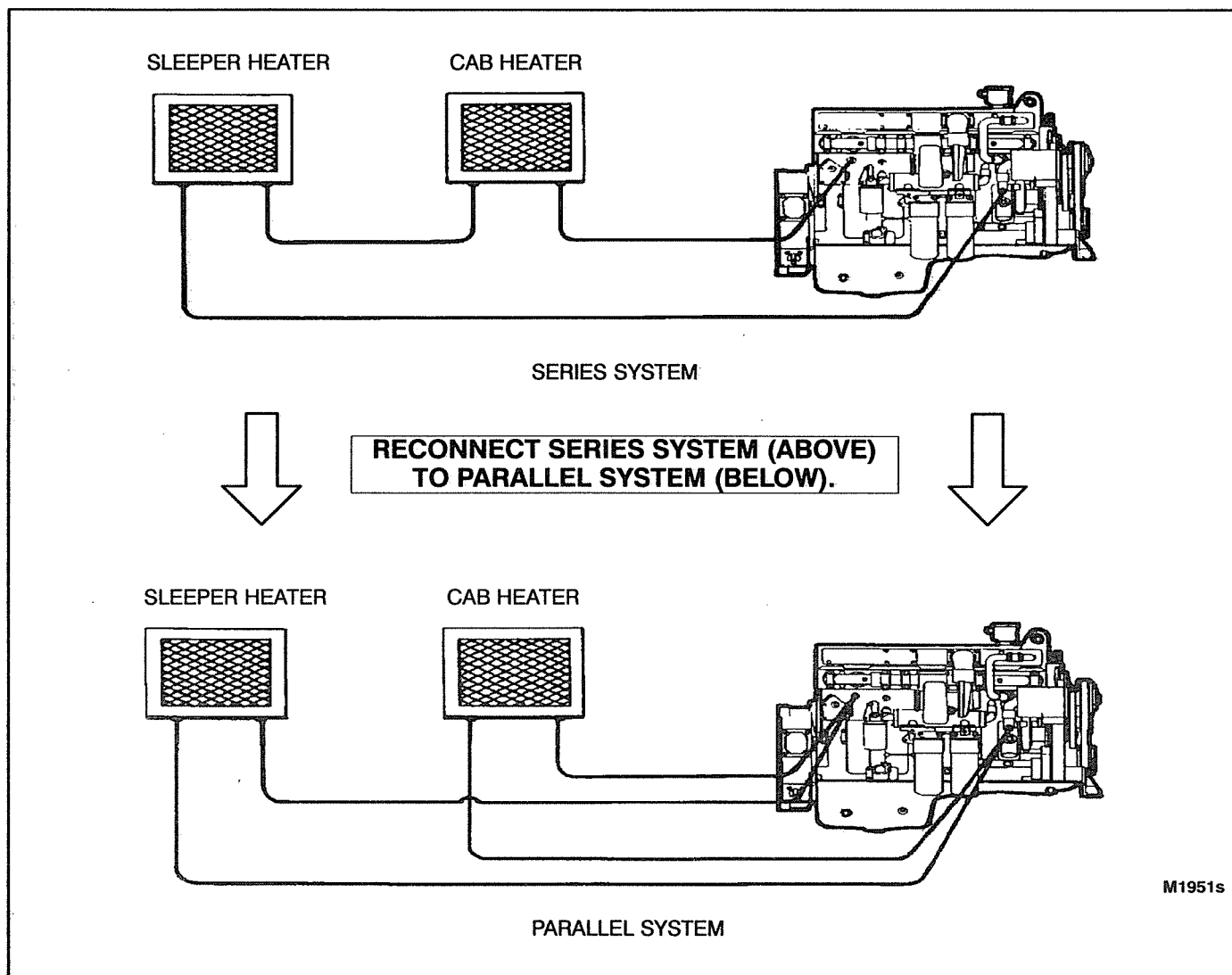


FIGURE 8-3. HEATING HOSE ROUTING

HEATER HOSE CONNECTION GUIDELINES

All Installations

Study the solenoid valve hose connection diagram (Figure 8-4) and the coolant hose routing diagram (Figure 8-5). Become familiar with each of the components and plan the physical hose routing to minimize hose length and avoid exposure to the elements. Allow room for the insulation that will be used to cover the hoses. Route hoses near the bottom of the sleeper or frame members so they can be used to secure the hoses.

Do not substitute a different hose for the 3/4-inch hose supplied in the kit. If additional hose is required, order it through the Cummins service center. Use 3/4-inch I.D. reinforced heater hose only.

Plumbing directly to the engine block supply and return is recommended. Also the use of shutoff valves

(available as an option) is recommended to aid future coolant system service.

Cabover Trucks

Study the typical cabover truck installation diagram (Figure 8-6). Become familiar with each of the components and plan the physical hose routing to minimize hose length and avoid exposure to the elements. Allow room for the insulation that will be used to cover the hoses. Route hoses near the bottom of the sleeper and near frame members so they can be used to secure the hoses. Avoid areas where hoses could contact sharp, abrasive, or hot surfaces.

Provide a minimum bend radius at the cabover pivot point of 5 inches (127 mm) to prevent kinking of the hoses when the cab is in the down position. After the hoses are routed and before the insulating tubing is added, lower the cab and check the hoses for kinking or pinching.

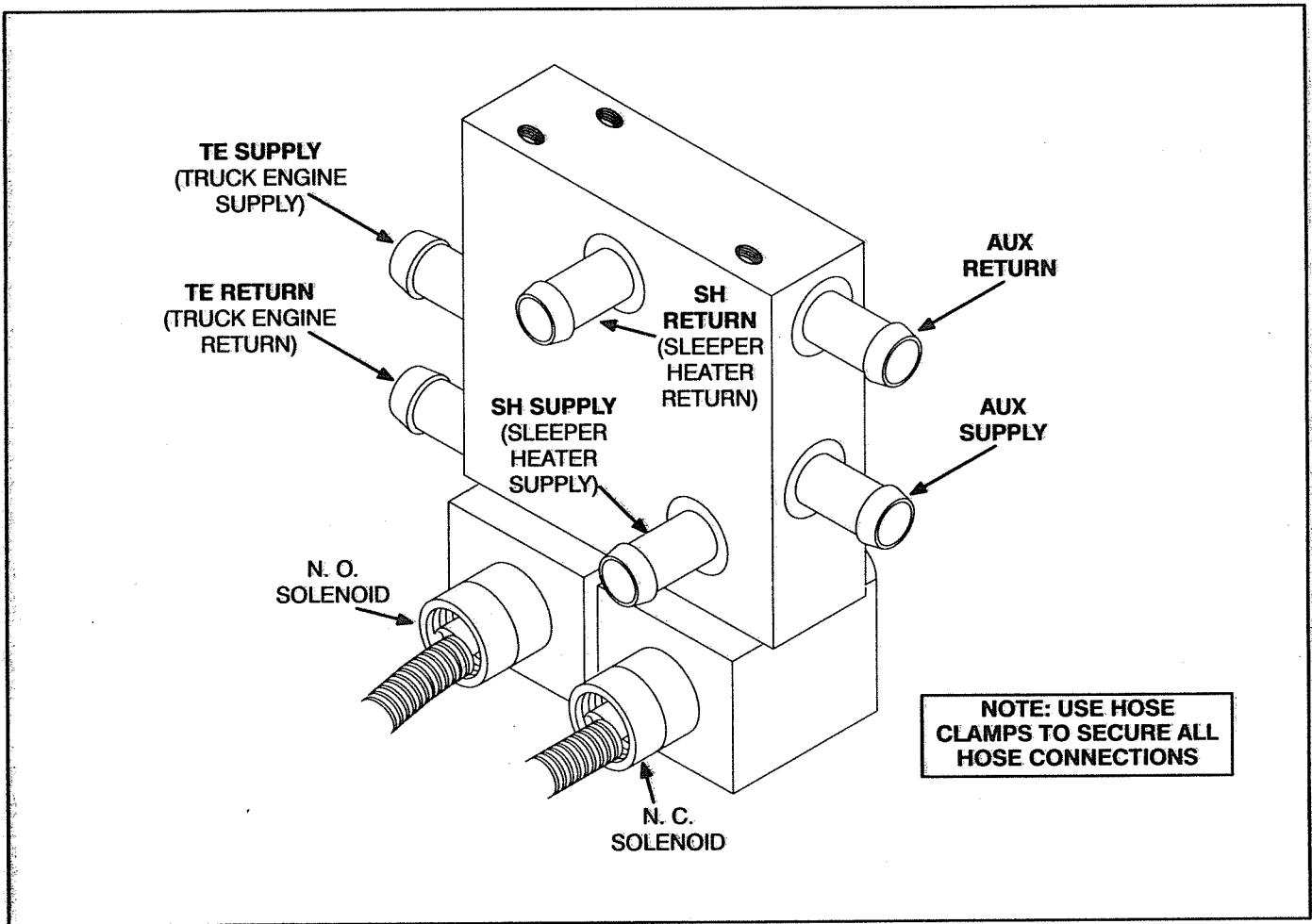
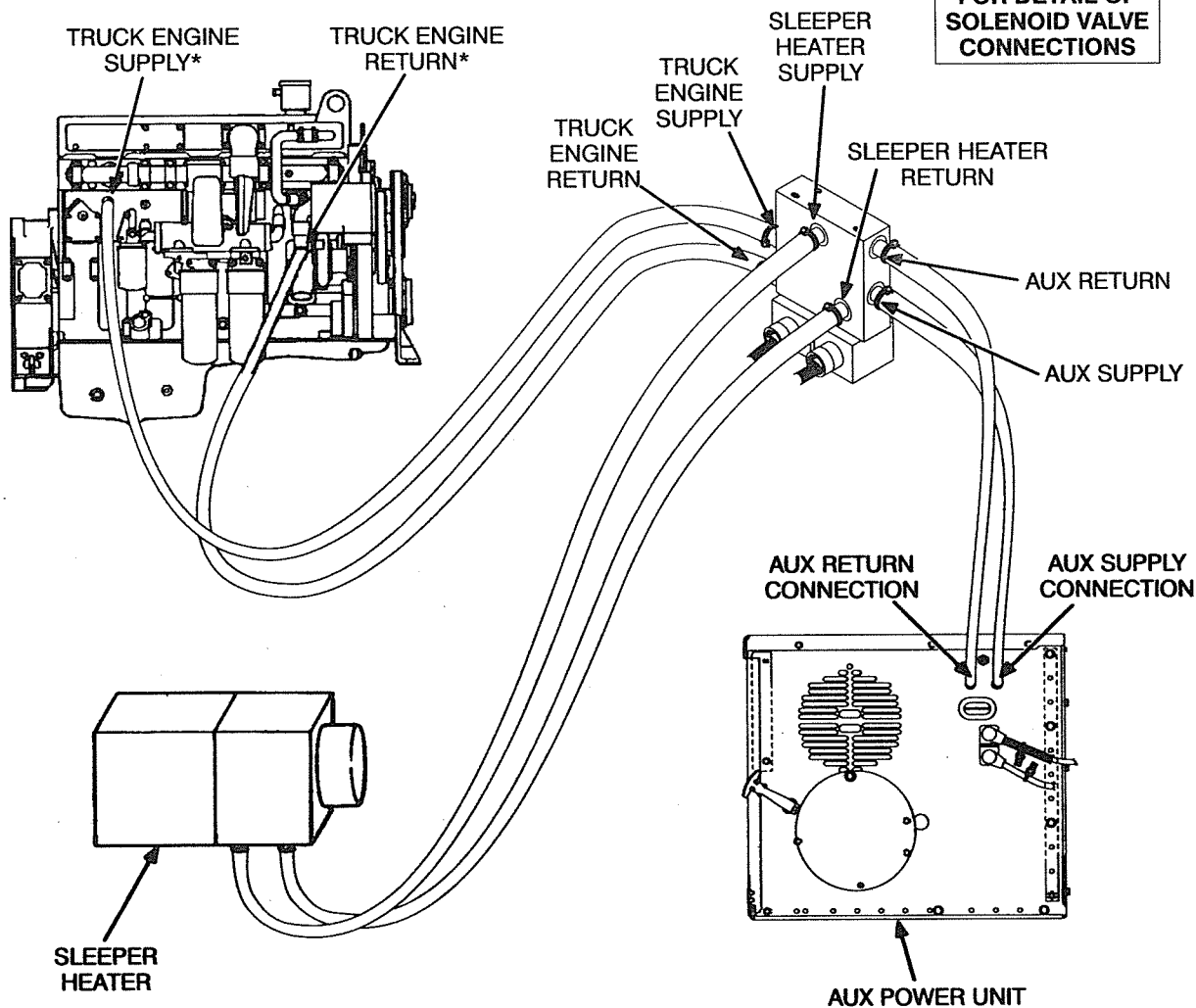


FIGURE 8-4. SOLENOID VALVE ASSEMBLY HOSE CONNECTIONS

NOTE: ACTUAL HOSE LENGTHS WILL VARY BY
VEHICLE TYPE AND MOUNTING LOCATIONS

SEE FIGURE 8-4
FOR DETAIL OF
SOLENOID VALVE
CONNECTIONS



*NOTE: SUPPLY AND RETURN LOCATIONS VARY BY
ENGINE MAKE - REFER TO ENGINE SHOP MANUAL

FIGURE 8-5. TYPICAL COOLANT HOSE ROUTING

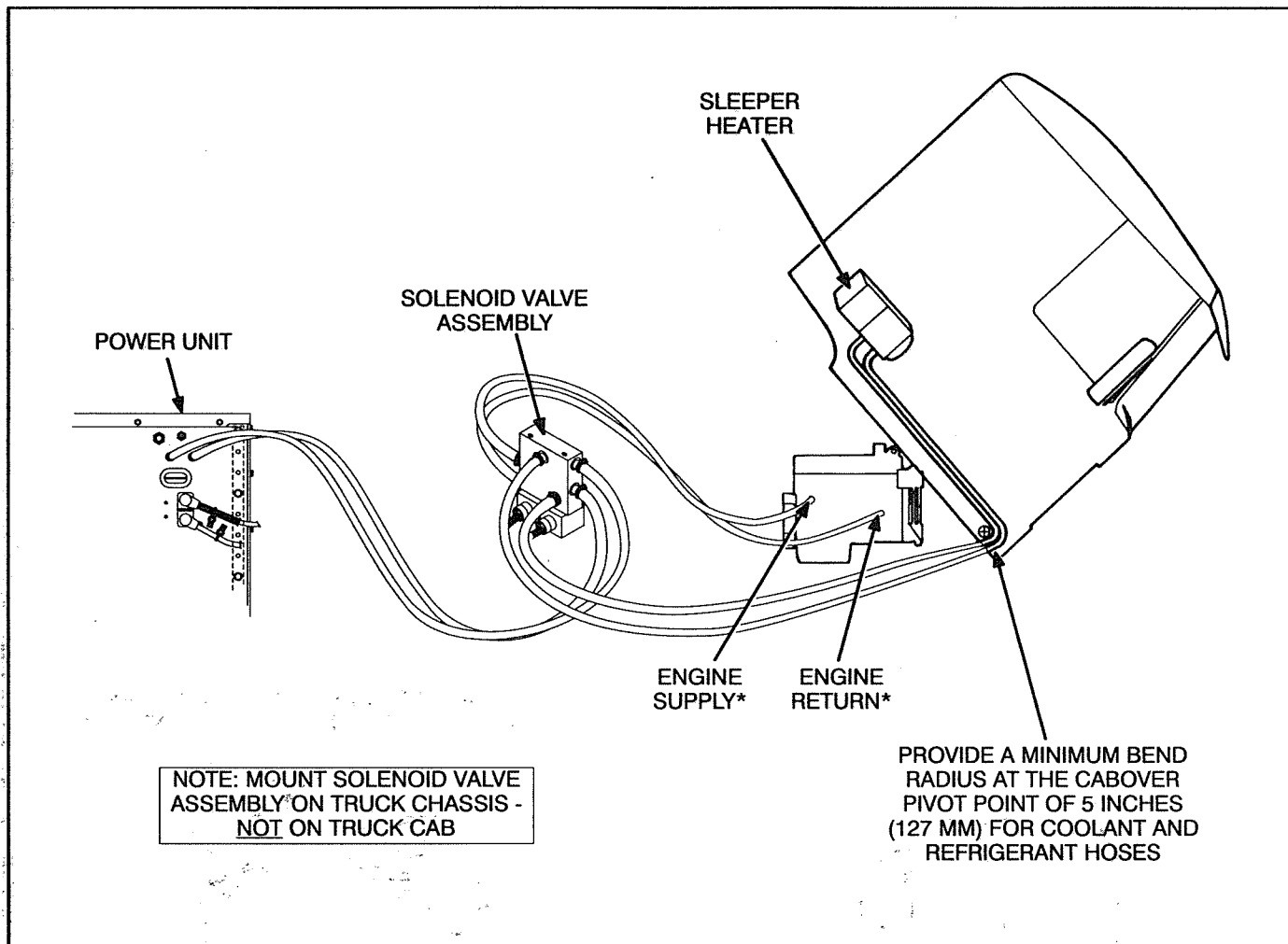


FIGURE 8-6. TYPICAL CABOVER COOLANT HOSE INSTALLATION

Main Truck Engine Connections

The truck engine make and model must be identified to correctly locate the coolant supply and return points. Refer to the engine repair or shop manual before making hose connections.

If new supply and return fittings will be installed on the engine, drain the engine coolant. If connecting to existing supply and return hoses that do not both have shutoff valves, drain the engine coolant or use hose clamps designed to compress the hoses to prevent coolant loss. If the truck has a sleeper heater, drain it by removing the supply and return hoses.

Connections vary for **piggyback installations** (sleepers with an existing heater) and **stand-alone installations** (sleepers without an existing heater).

Supply/Return Connections

Piggyback Installations:

On a piggyback installation (sleeper with an existing heater), the stock sleeper heater core is used. Disconnect the engine supply and return lines to the sleeper heater core and reconnect them to the solenoid valve assembly TE SUPPLY and TE RETURN connections. **NOTE: Make certain to identify and connect to the correct connections.** If these are 5/8" hose, use adapters to fit to the 3/4" valve connections.

Secure all hose fittings with hose clamps.

Stand-Alone Installations:

Connect new 3/4" hoses from the engine supply and return connections to the TE SUPPLY and TE RETURN ports on the solenoid valve assembly.

Secure all hose fittings with hose clamps.

Sleeper Heater Connections

Run new 3/4" hoses from the solenoid valve assembly SH SUPPLY and SH RETURN connections to the sleeper heater. Use adapters if necessary. See Figures 8-4 and 8-5.

Secure all hose fittings with hose clamps.

Auxiliary Power Unit Connections

The power unit has bulkhead fittings for the coolant return and supply connections.

1. Install a new coolant hose on the right side bulkhead hose fitting (coolant supply). Run the other end of the hose to the AUX SUPPLY fitting on the solenoid valve assembly (see Figure 8-4).
2. Connect a new coolant hose to the left side bulkhead hose fitting (coolant return). Run the other end of the hose to the AUX RETURN fitting on the solenoid valve assembly (see Figure 8-4).
3. Secure all hose fittings with hose clamps.

Coolant Hose Protection

Install foam insulation on each of the coolant hoses to protect them from road debris, abrasion and temperature extremes.

Secure the hoses to the frame and cab members with plastic wire ties. Locate tie points to prevent excessive vibration and to alleviate stress on the hose fittings.

9. Refrigerant Hose Connections

GENERAL

This section describes installation of the refrigerant lines. The air conditioning accessory kit contains the refrigerant hose and fittings. A refrigerant fitting tool kit is need to install fittings on the refrigerant hoses.

REFRIGERANT HOSE FITTINGS

The refrigerant hoses have fittings and refrigerant quick connect access valves pre-assembled to the power unit ends (the cabover kit has no pre-assembled fittings). The evaporator (sleeper) ends are not pre-assembled due to length variations between trucks. Keep the ends of hoses and fittings covered to keep them clean.

⚠ CAUTION *Dirt and debris cause blockage and contamination of the AC system. Handle hoses and fittings with care to prevent the entrance of dirt or debris. Keep the ends of the hoses and fittings covered. Cut hose with a hose cutter only, do not use a saw.*

1. Determine hose length by temporarily routing the hoses between the power unit fittings and the evaporator fittings (see Cabover Refrigerant Hose Routing). Allow additional hose length for play in each hose between the power unit and the sleeper.
2. Mark each hose length. Remove hoses and take them to a clean work area. Cut the hoses to length and install the #6 fitting on the 5/16-hose and #10 hose fitting on the 1/2-inch hose.
3. Apply appropriate refrigeration oil on the O-rings and the fittings.

Cabover Refrigerant Hose Routing

Route the refrigerant hoses near the bottom of the sleeper and near frame members so they can be used to secure the hoses. Avoid areas where hoses could contact sharp, abrasive, or hot surfaces. Provide a minimum bend radius at the cabover pivot point of 5 inches (127 mm) to prevent kinking of the hoses when the cab is in the down position. After the hoses are routed, lower the cab and check the hoses for kinking or pinching.

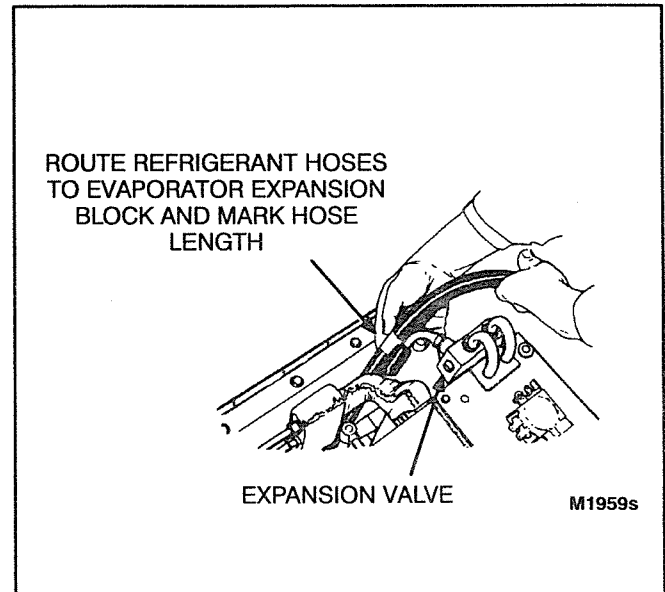


FIGURE 9-1. REFRIGERANT HOSE ROUTING

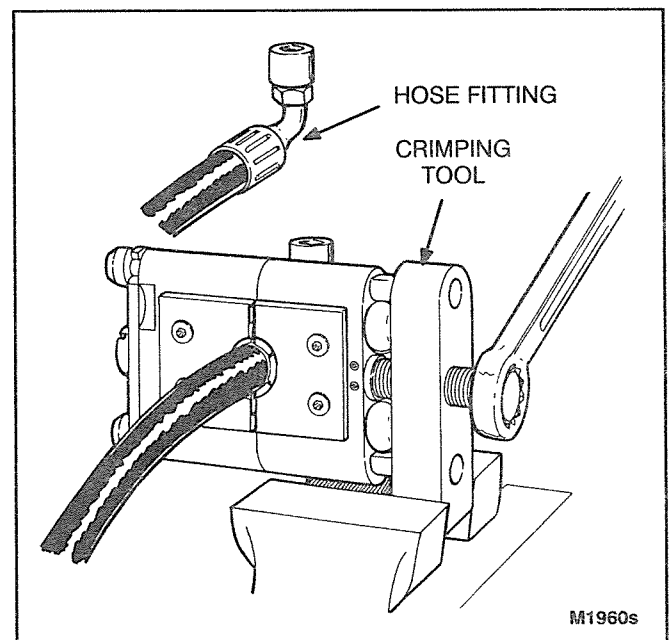


FIGURE 9-2. REFRIGERANT HOSE FITTINGS

REFRIGERANT HOSE CONNECTIONS

1. Route the hoses and temporarily secure them in place.
2. Connect the hoses to the expansion valve fittings on the evaporator. Screw the hose fittings into the expansion block by hand to prevent cross threading, then secure the fittings with a wrench.
3. Connect the hose fittings to the power unit. Orient the refrigerant access valves for service access. **NOTE: This must be determined BEFORE the expansion valve ends are crimped in place.** Screw the hose fittings into the power unit fittings by hand to prevent cross threading, then secure the fittings with a wrench.

⚠ CAUTION *Refrigerant connections can be stressed and damaged if the hose lengths are too short. Allow 32 inches (813 mm) or more between the power unit and the first mounting restraint.*

3. Use plastic wire ties to secure the refrigerant lines to the bottom of the sleeper. Allow 32 inches (813 mm) or more between the power unit and the first mounting restraint. Also tie the refrigerant hoses together to reduce vibration.

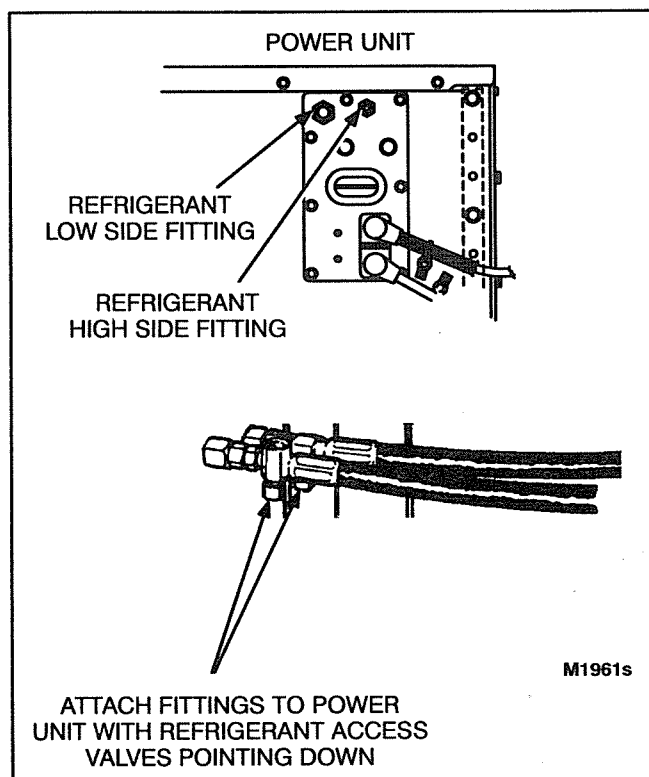


FIGURE 9-3. ACCESS VALVE ORIENTATION

10. Fuel Connections

GENERAL

This section describes installation of the fuel tank pickup assembly and the fuel hose connections. The fuel pickup assembly mounts to the fuel tank and contains both a fuel supply tube and a fuel return tube. The Fuel Accessory kit contains fuel hose, protective sleeving and mounting hardware.

Fuel for the power unit must be supplied through a separate fuel pickup assembly. Do not tie into the main truck engine fuel supply line.

⚠ WARNING *Fuel presents the hazard of fire or explosion that can result in severe personal injury or death. Do not smoke or allow any flame, spark, pilot light, arc-producing equipment or other ignition sources near fuel system, or in the installation area. Keep a type ABC fire extinguisher nearby.*

FUEL PICKUP KIT INSTALLATION

Kits are available to fit either a 1/2-NPT fitting or a gauge sending unit mount. The gauge mount kit may be used with the fuel gauge installed or without the fuel gauge installed. Make sure you have the appropriate corresponding fuel pickup kit. Refer to the appropriate installation section depending on the type of fuel pickup kit used.

⚠ WARNING *Fuel presents the hazard of explosion or fire, which can result in severe personal injury or death. Do not connect the power unit fuel line to the pressurized part of the vehicle fuel system. Install a separate fuel pickup assembly. Flooding of the power unit can result in a fire hazard.*

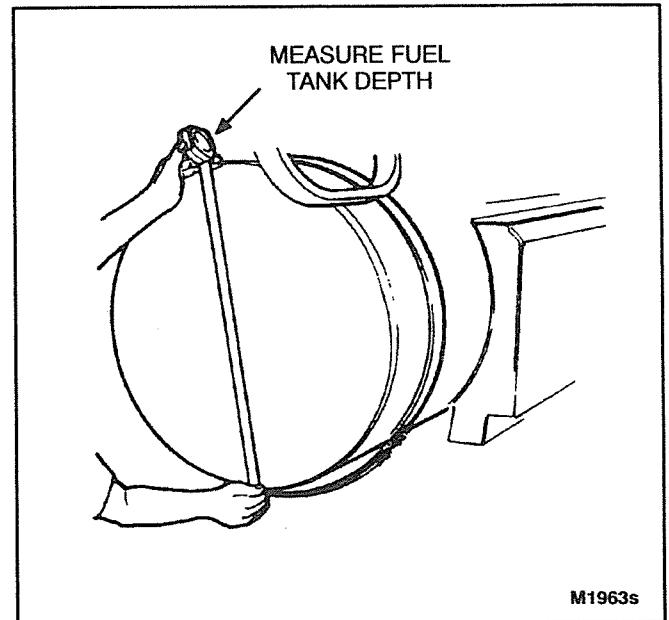


FIGURE 10-1. FUEL TANK MEASUREMENT

Installation of 1/2-Inch NPT Pickup Assembly

1. Remove the plug from the 1/2-inch NPT fitting.
2. Measure the end of the tank to determine its depth (Figure 10-1). Use a tube cutter to shorten the long (fuel supply) tube so it will be 2 inches (50.8 mm) shorter than the depth of the tank.
3. Apply pipe sealer (or sealant tape) that is suitable for diesel fuel connections to the NPT threads. Install the pickup tube assembly (Figure 10-2) and tighten the fittings securely to prevent leakage.

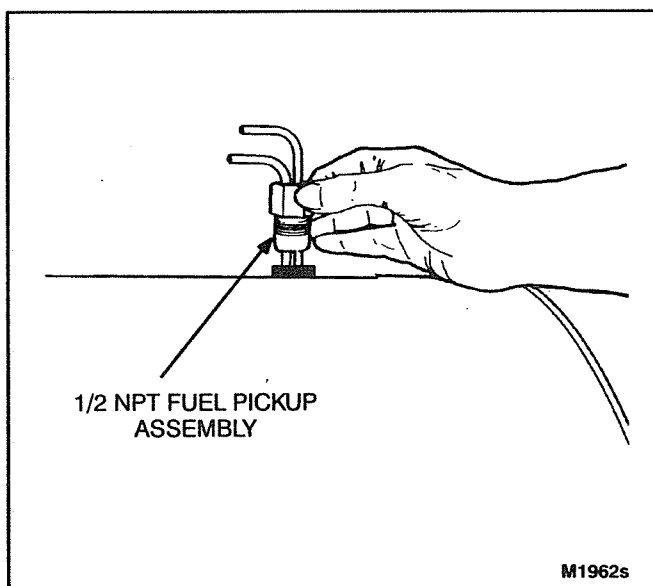


FIGURE 10-2. 1/2-INCH NPT PICKUP ASSEMBLY

Installation of Gauge Sending Unit Pickup Assembly (With Fuel Gauge)

1. Remove the fuel gauge. Save the gasket and discard the mounting screws.
2. Measure the end of the tank to determine its depth (Figure 10-1). Use a tube cutter to shorten the long (fuel supply) tube so it will be 2 inches (50.8 mm) shorter than the depth of the tank.
3. Install the fuel pickup assembly as shown in Figure 10-3. Install the gaskets as shown and tighten each of the mounting screws securely to prevent fuel leakage.

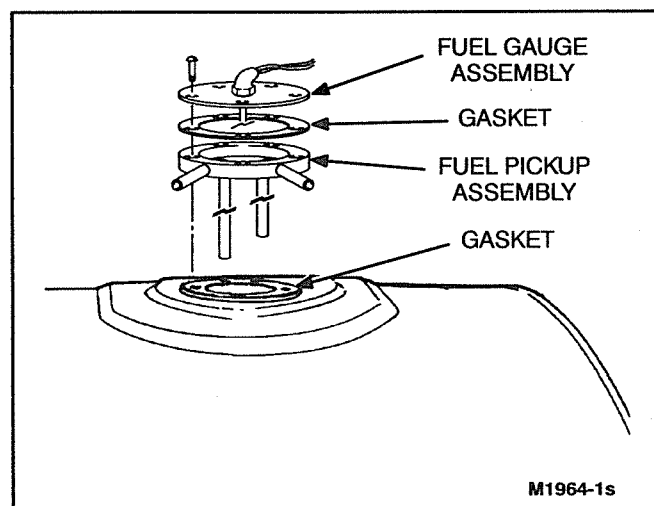


FIGURE 10-3. GAUGE SENDING UNIT PICKUP ASSEMBLY

FUEL HOSE ROUTING

⚠WARNING *Electric sparks can ignite fuel, leading to fire that could cause severe personal injury or death. Therefore, run electrical wiring and fuel lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

Determine the best route for the fuel hoses between the power unit and the fuel tank pickup assembly. Avoid hot exhaust areas, sharp or rough surfaces, or sharp bends where the hoses may become kinked. The fuel hoses must be covered with a protective sleeving to protect them from abrasion and the elements. Fuel hoses must be long enough to allow power unit movement without binding or stretching.

1. Measure the required hose length. allow for movement of the power unit. Cut both hoses to length and mark one hose supply on each end. Install protective sleeving over both hoses, leave 3 inches (76 mm) of exposed hose at each end. Secure the protective sleeving every 18 inches (457 mm) with plastic tie wraps.
2. Route the fuel supply hose to the fuel supply connection on the the power unit (Figure 10-5). Connect the supply hose with a hose clamp to the supply fitting (supply hose routes to the fuel pump). Route the other end of the supply hose to the fuel tank pickup tube assembly. Connect it to the supply line of the pickup assembly.
3. Connect the return hose with a hose clamp to the return fitting on the power unit. Connect the other end of the return hose to the return line of the pickup assembly.

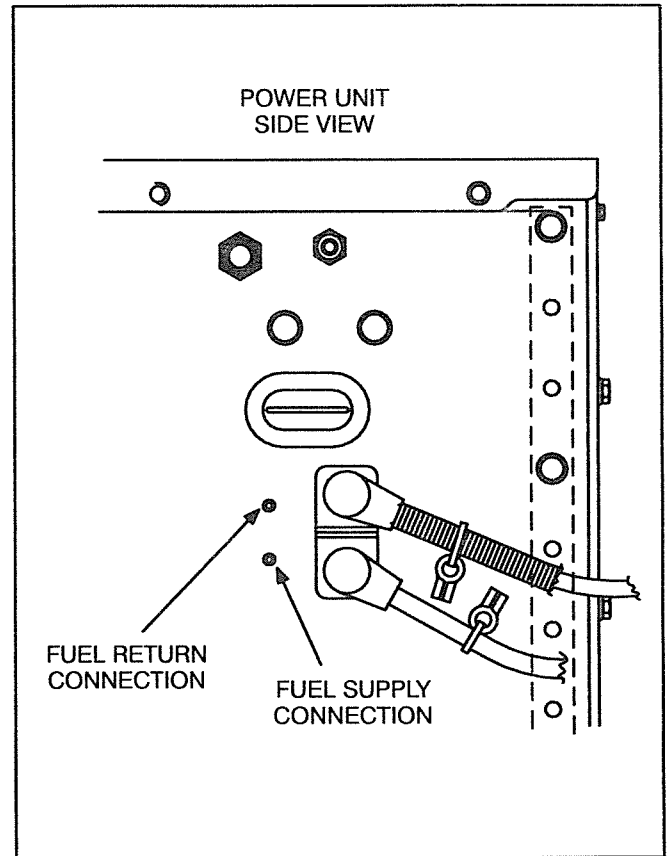


FIGURE 10-4. FUEL HOSE ROUTING

⚠WARNING *Electric sparks can ignite fuel, leading to fire that could cause severe personal injury or death. Therefore, run electrical wiring and fuel lines as far apart as possible or separate them by physical barriers. If they must be run through the same opening, separate them physically by running them through separate pieces of tubing or conduit. Do not tie them together.*

4. Make sure the fuel supply and return hoses are secure. Do not over tighten clamps or hose could be damaged.
5. Secure fuel hoses to the bottom of the sleeper or tractor frame with plastic wire ties to prevent excessive vibration.

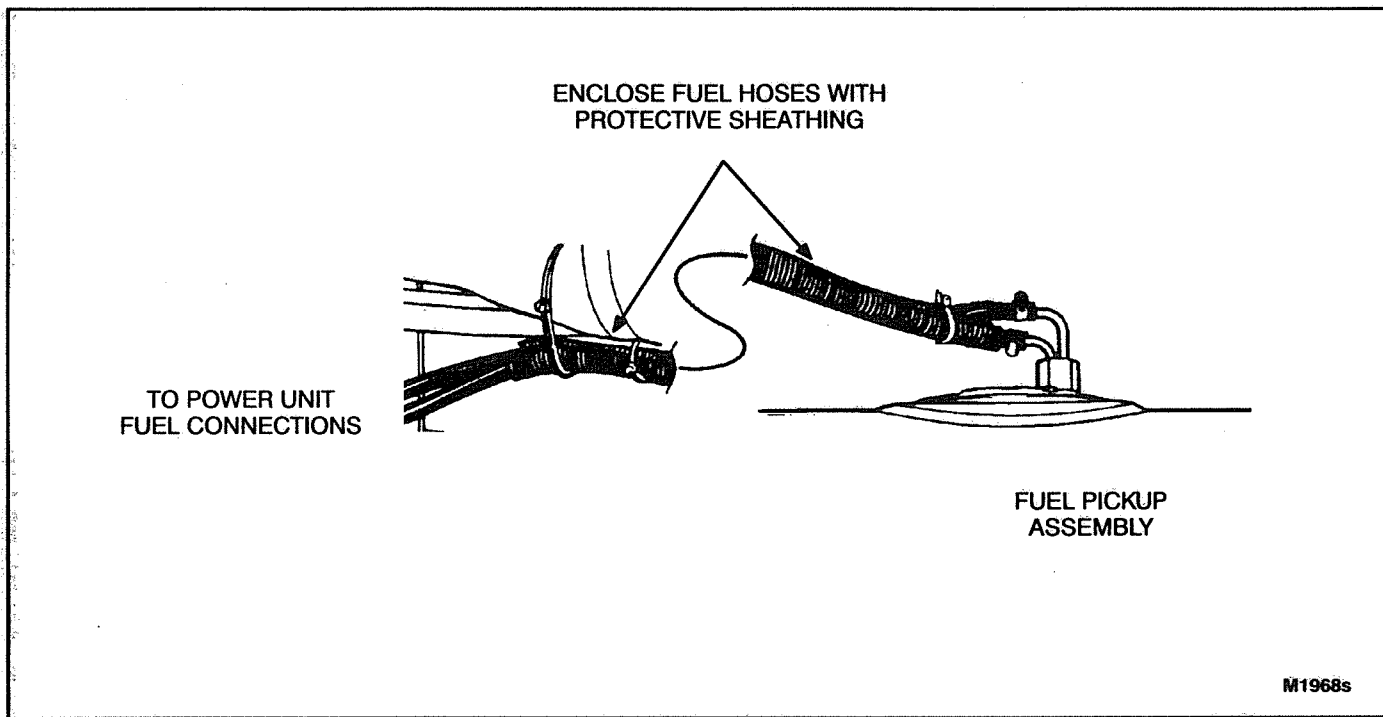


FIGURE 10-5. FUEL HOSE PROTECTION

11. Electrical Connections

GENERAL

This section describes the wiring harness connections for:

- Wiring Harness Routing
- Sleeper Component/Control Wiring
- Solenoid Valve Wiring
- Power Unit Wiring
- Battery cable connections

Perform the battery cable connections last to avoid accidentally starting or short-circuiting the set during installation.

⚠ WARNING *Accidentally starting the power unit while working on it can cause severe personal injury or death. Do not connect the battery cable until instructed to do so in the Battery Cable Connection section. Make sure that the vehicle batteries negative (-) ground connection(s) are disconnected before proceeding.*

The harnesses and battery cable lugs needed to perform this wiring are included in the control kit, the battery cable kit and the piggyback evaporator kit (if applicable).

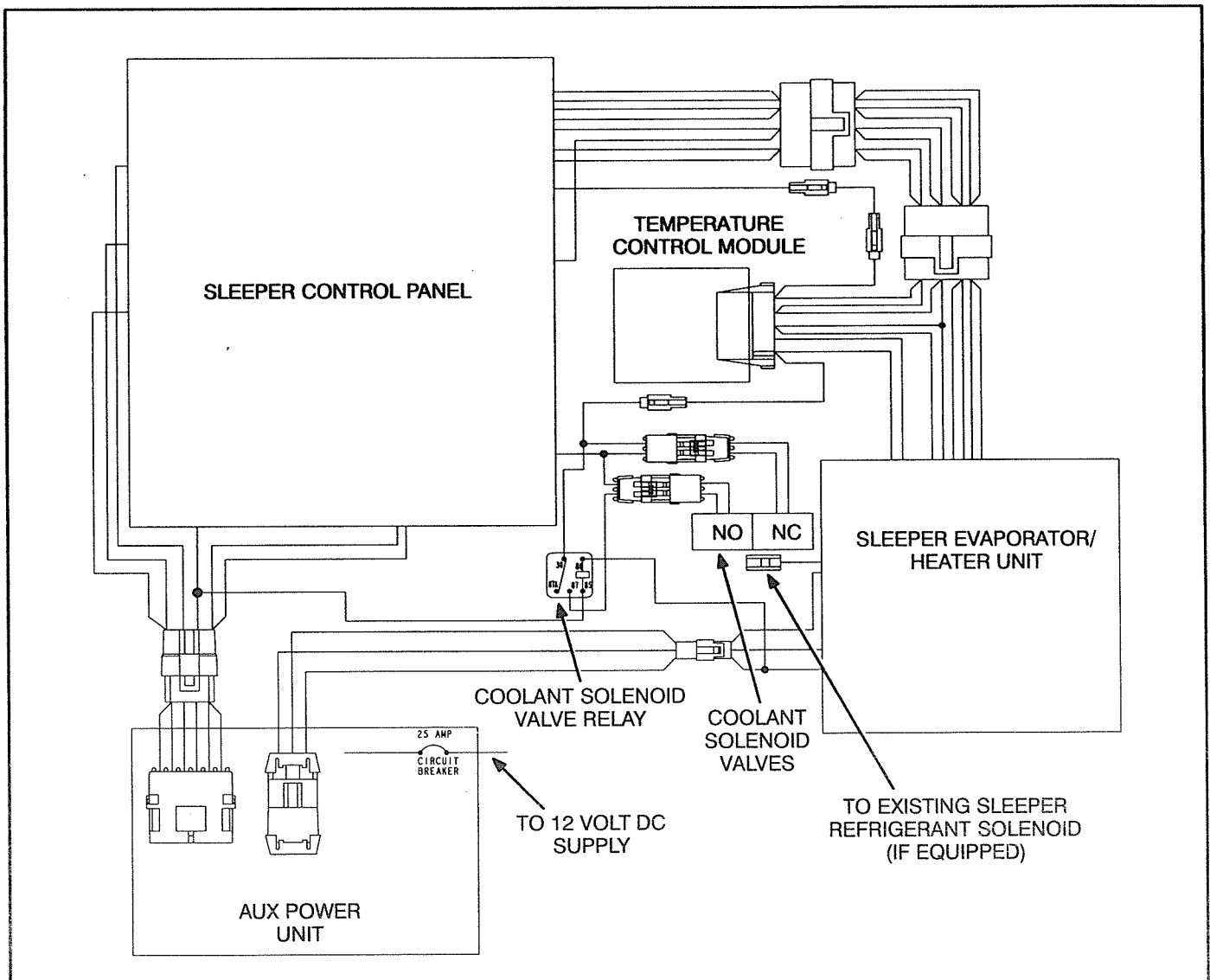


FIGURE 11-1. WIRE HARNESS ROUTING BETWEEN COMPONENTS

WIRING CONNECTIONS

Piggyback Installations

If the sleeper has an existing evaporator/heater assembly (piggyback evaporator type installation), remove all of the wires from the evaporator/heater assembly. Insulate each of the terminals to prevent them from shorting to one another or grounding to the vehicle. An adapter harness is supplied with the piggyback evaporators.

Harness Routing

The harness routes through a hole in the sleeper floor. Locate the hole near the evaporator/heater assembly. Use a knockout hole, or drill a 1-3/8 inch hole in the sleeper floor. Install a grommet from the coolant kit to protect the wire harness.

Begin with the harness at the evaporator/heater assembly. Route the end of the harness with the bare pin connectors through the hole in the sleeper floor to the power unit. Route the control harness with the six- and eight-pin connectors to the control panel. Refer to the wiring diagram in Figure 15-1 for individual wiring connections.

Make sure that the harness will reach the connection points inside the power unit, inside the sleeper and to the solenoid valve assembly before making individual connections.

Cabover Harness Routing

Route the control harness between the sleeper and power unit near the bottom of the sleeper and near frame members so they can be used to secure the harness. Avoid areas where the harness could contact sharp, abrasive, or hot surfaces. Provide an adequate amount of harness at the cabover pivot point to prevent pulling and chafing the harness when the cab is in the down position. After routing the harness and before making the final connections, lower the cab and check the harness to make sure it is not pinched, pulled or chafed.

Evaporator/Heater Wiring

1. Install the adapter harness on the piggyback units, refer to the Wiring Schematic/Diagram section for the adapter harness wiring diagram.
2. Connect the main harness to the evaporator/heater assembly adapter harness.
3. Secure the wire harness with wire ties to prevent abrasion.

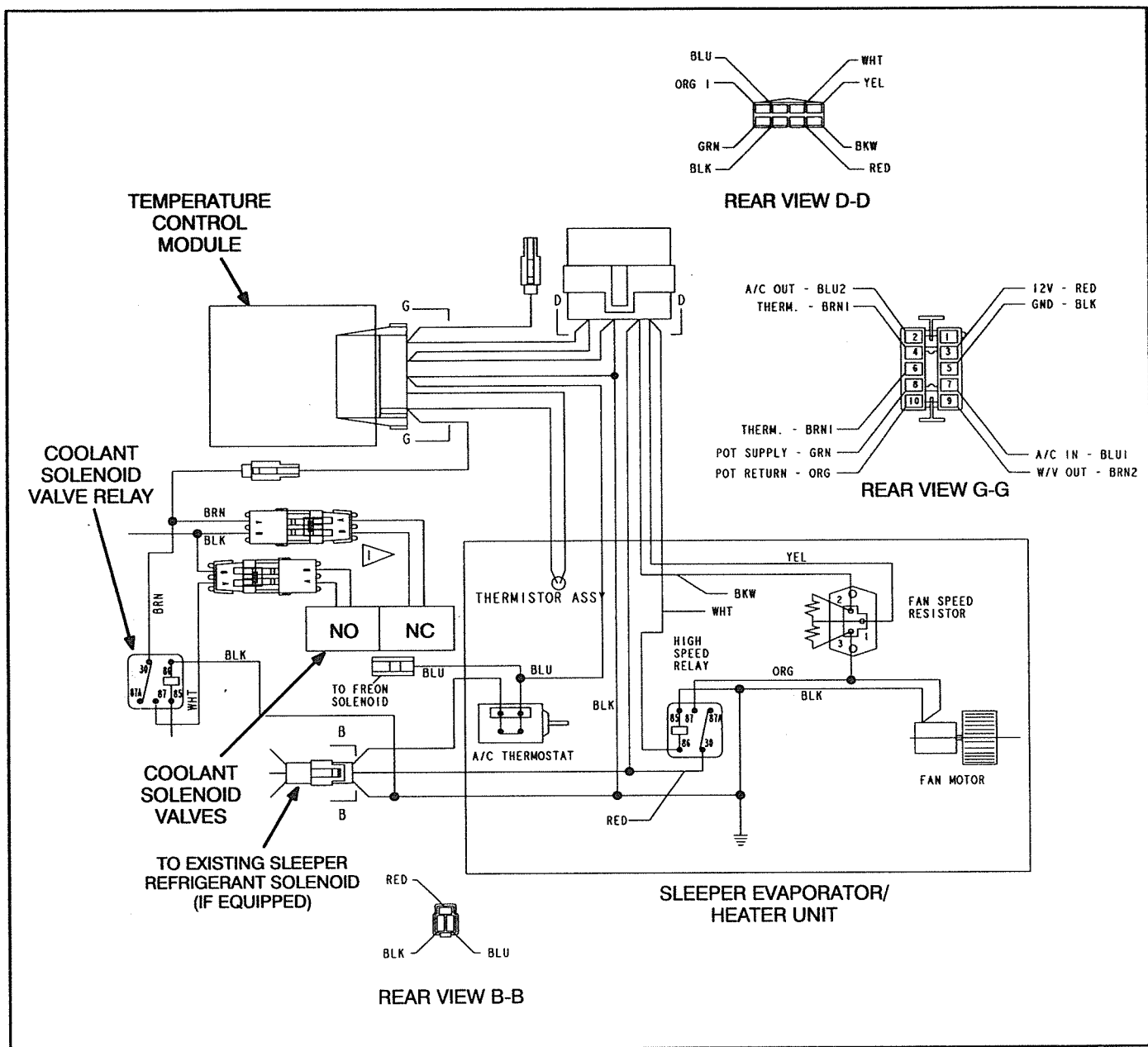


FIGURE 11-2. EVAPORATOR/HEATER HARNESS CONNECTIONS

Temperature Control Module Wiring

Attach the 10-pin connector to the temperature control module.

⚠ CAUTION *Accidental electrostatic discharge from handling or touching control components can cause them to fail. During installation, do not touch bare electrical termination points on the module and/or wire harness. During troubleshooting or service operations, do not remove the protective enclosure (plastic box) around the module: contact with printed circuits presents opportunity for failure.*

Control Panel Wiring

1. Cover the harness with protective sleeving to prevent abrasion from sharp edges.
2. Route the control panel connectors to the back of the control panel. Plug the one-, six- and eight-pin connectors to the control connectors. Tie the eight-pin connectors together with a wire tie to prevent disengaging.

If the harness cannot be routed without removing the connectors, use a small screw driver to remove the connectors. Refer to Figure 15-1 for reconnection diagram. Spread connectors slightly before reinserting to provide a tight fit.

3. Mount the control panel and secure the wire harness with wire ties to restrict movement.

Solenoid Valve Assembly Wiring

1. Route the pair of connectors in the middle of the harness to the solenoid valve assembly.
2. Connect the 2-pin connectors to the solenoid valve harness connectors (see Figure 11-5).
3. Secure the wire harness with wire ties to the bottom of the sleeper or tractor frame. Make sure the the harness is covered with sheathing tubing to protect it from the elements.

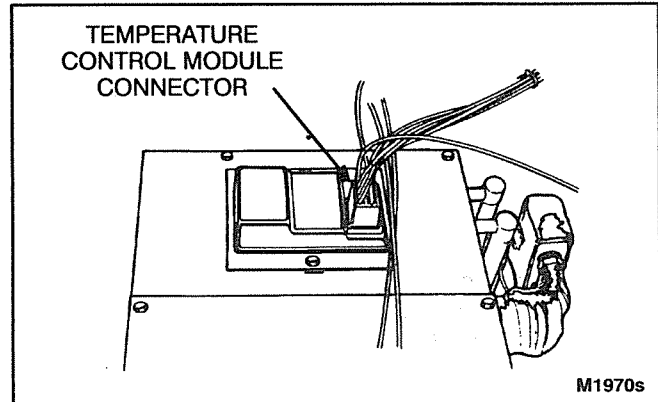


FIGURE 11-3. TEMPERATURE CONTROL MODULE HARNESS CONNECTION

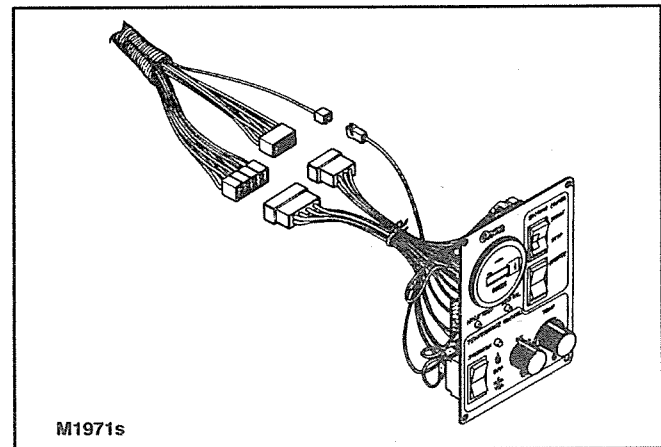


FIGURE 11-4. CONTROL PANEL WIRING HARNESS CONNECTIONS

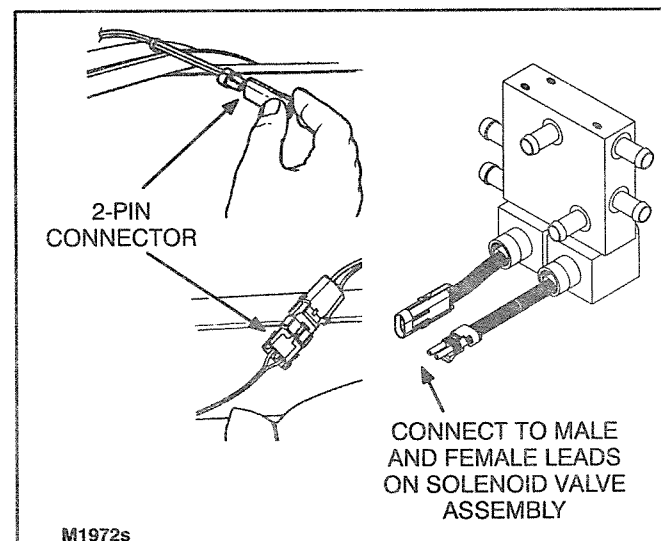


FIGURE 11-5. SOLENOID VALVE ASSEMBLY HARNESS CONNECTIONS

Power Unit Wiring

1. Route the end of the harness with the bare pin connectors through the grommet in the side panel of the power unit (Figure 11-6).
2. Insert six harness leads into the back of the six-pin connector housing. Wire the connector according to Figure 11-6.
3. Remove rubber plugs from the connector, if provided. Insert remaining three harness leads into the back of the three-pin connector housing. Wire according to Figure 11-6.
4. Secure the wire harness with a wire tie inside

the power unit to restrict movement. Attach the wire tie to a convenient point near the grommet in the side panel.

5. Seal all routing holes in the sleeper, so exhaust or fuel vapor cannot enter the sleeper or cab.

⚠ WARNING Exhaust gas and fuel fumes present the hazard of severe personal injury or death. To prevent exhaust gas and fuel fumes from entering the vehicle interior, seal all openings made for conduit, wiring, etc. Also seal the wiring within the conduit itself. Use a silicone/rubber based sealant.

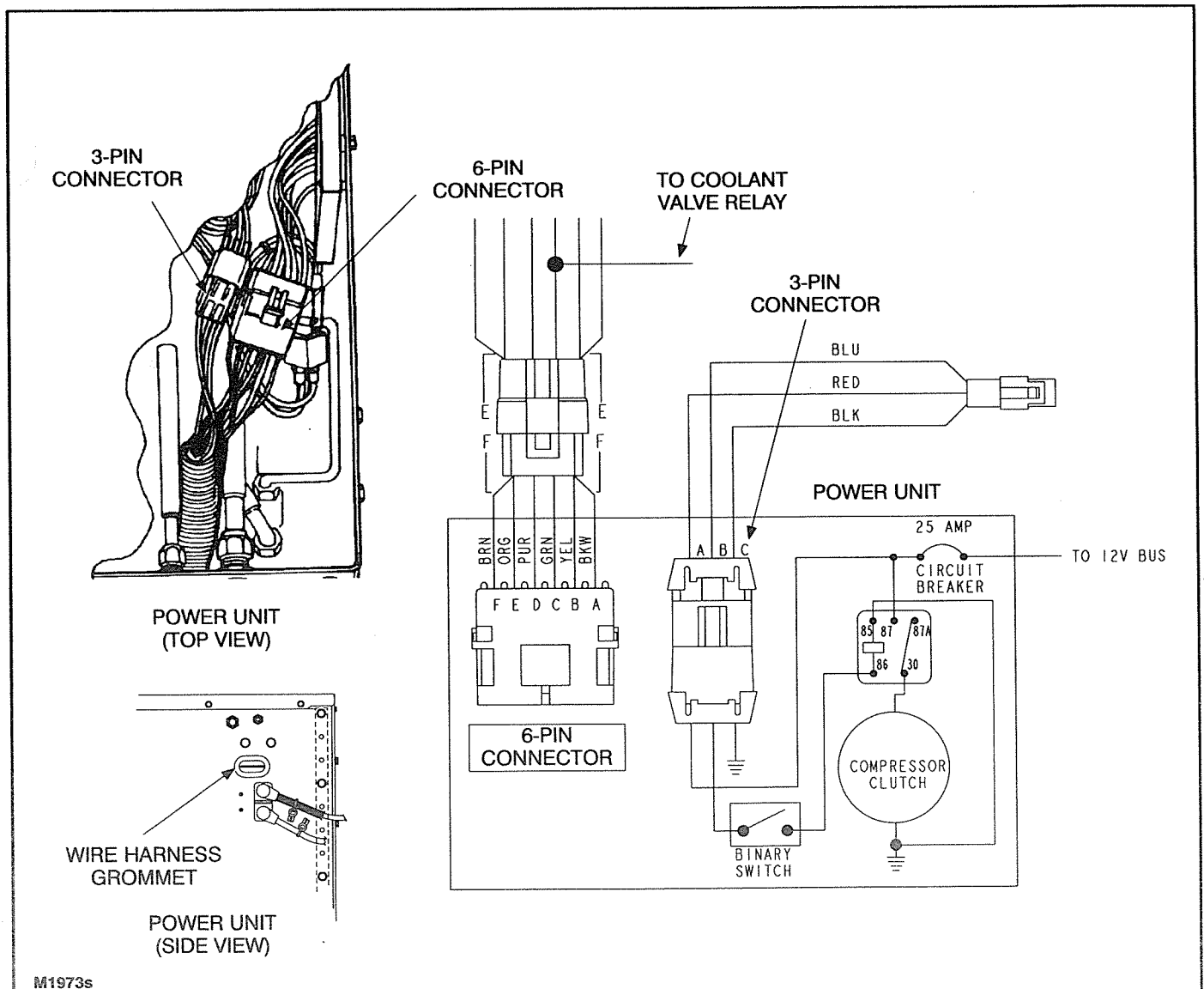


FIGURE 11-6. POWER UNIT WIRING

BATTERY CABLE CONNECTIONS

The power unit requires a 12 VDC supply voltage for engine starting. The battery cables also serve for battery charging when the power unit is operating.

Use the sheathed battery cable on the side of the power unit for making the battery positive (+) connection (Figure 11-7). Use the unsheathed battery cable from the side of the power unit for making the battery negative (-) cable connection.

⚠ WARNING *Electrical shock can cause severe personal injury. Remove rings, watches and other jewelry when working on electrical equipment to reduce the chance of electrical shock.*

⚠ WARNING *Batteries present the hazard of explosion, which can result in severe personal injury. Because batteries give off explosive gas, always disconnect the negative (-) cables first, and connect them last to reduce the risk of arcing.*

1. Remove the negative (-) battery cable connection(s) at the battery tray.
2. Route both battery cables to the battery compartment. Use a path that will allow tie points to secure the cables and avoid abrasion.
3. Cut the battery cables to the correct length. Allow adequate length for cable routing and power unit movement.
4. Install the 3/8-inch ring terminals to the battery cables, using a good crimping tool.
5. Connect the positive (+) battery cable to the battery positive (+) terminal. Connect the negative (-) battery cable to the battery negative (-) terminal. Tighten the connections securely.
6. Provide adequate support for the battery cables to avoid abrasion wear due to vibration, when the vehicle is in transit.
7. Reconnect the other negative (-) battery cable connections(s) at the battery tray.

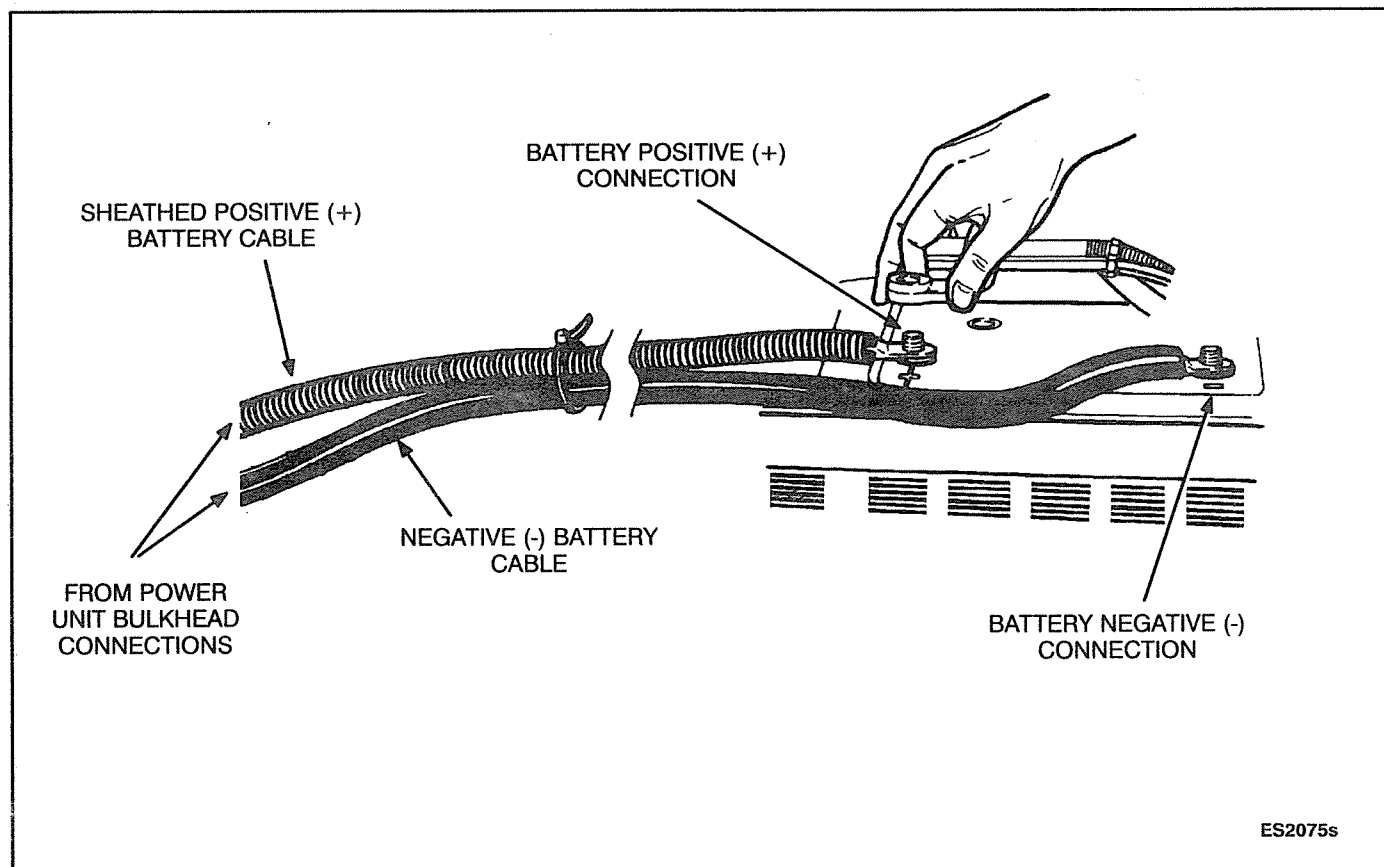


FIGURE 11-7. BATTERY CABLE CONNECTIONS

12. Priming the Fuel System

FUEL SYSTEM

The fuel system needs to be primed before the initial start. Figure 12-1 illustrates the fuel system.

⚠ WARNING *Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, pilot light, spark or other ignition source near the fuel system.*

Keep the fuel tank(s) full when operating the power unit. The power unit will run out of fuel when the tank goes below the fuel pickup tube (approximately one-quarter full).

The fuel system consists of a high pressure side and a low pressure side.

High Pressure Fuel System: The injection pump, fuel injection lines and fuel injectors make up the high pressure fuel system. The high-pressure system is self-priming; trapped air is forced out through the injection nozzles.

Low Pressure Fuel System: The electric fuel pump, fuel filter and injection pump inlet comprise the low pressure fuel system. To prime these components (remove the trapped air), see the following section).

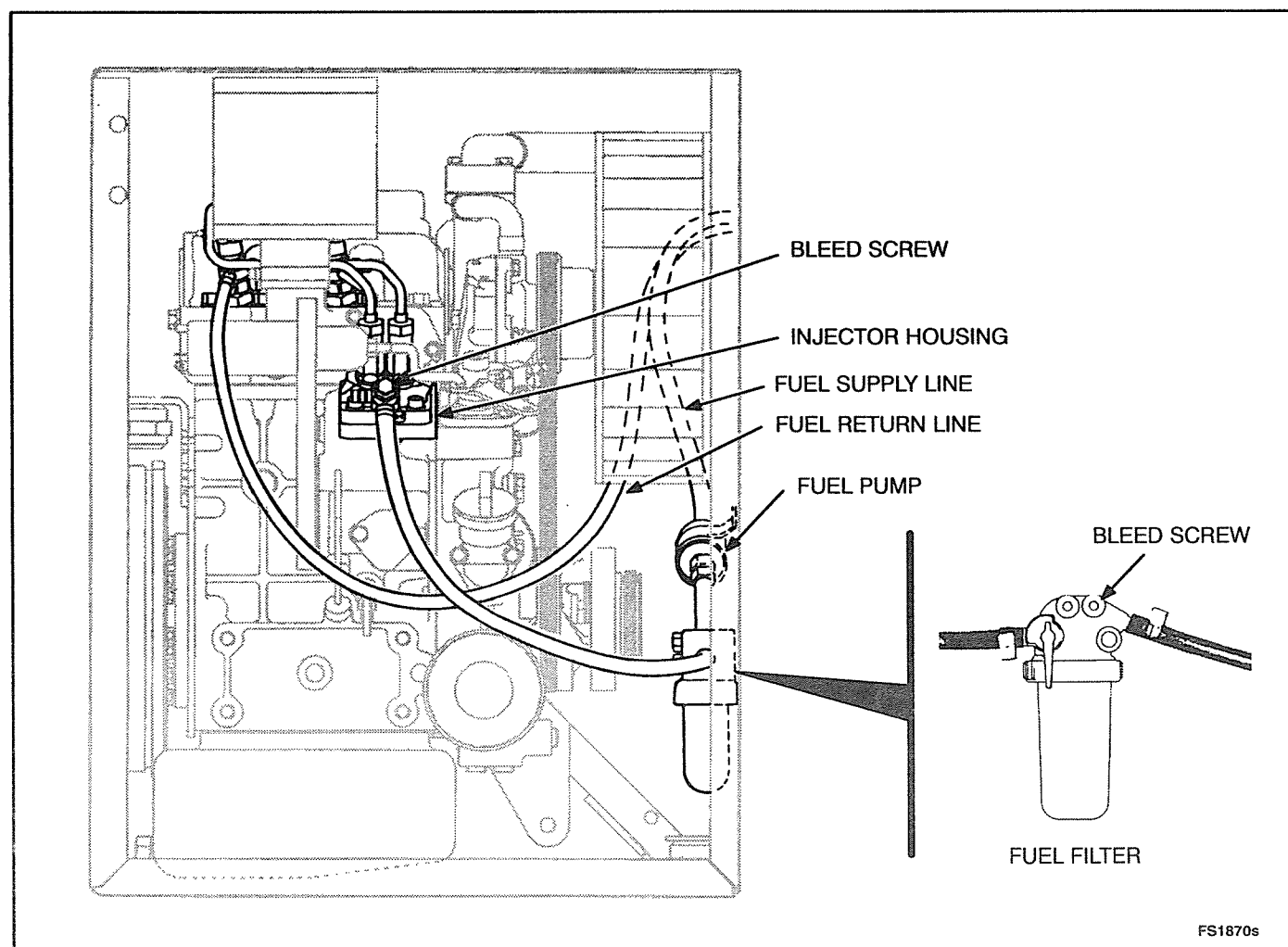


FIGURE 12-1. FUEL SYSTEM

Priming the Fuel System

To prevent accidental starting of the power unit, do not allow anyone inside the sleeper during this operation.

⚠WARNING *Accidentally starting the power unit can cause severe personal injury or death. Do not allow anyone inside the sleeper during this operation.*

1. Make sure that the fuel shutoff valve is in the open position (Figure 12-2).
2. Place a container under the fuel filter to collect fuel. Loosen fuel filter assembly bleed screw (Figure 12-2).
3. Disconnect the tan positive lead from the fuel pump at the inline harness connector.
4. Wire a jumper lead with a normally open switch, between the alternator B+ terminal (large top terminal) or battery positive (+) terminal and the tan fuel pump lead.
5. Close the jumper switch to energize the fuel pump until fuel purges at fuel filter bleed screw opening.
6. Secure bleed screw in the fuel filter housing. Place a container under the injector pump to collect fuel.
7. Loosen bleed screw on the injector pump housing (Figure 12-3). Close the jumper switch to energize the fuel pump until fuel purges from the bleed screw opening at the injector pump housing.
8. Secure bleed screw in injector pump housing.
9. Remove the jumper lead from the alternator B+ terminal or the battery positive + terminal. Remove the jumper lead from the tan fuel pump lead.
10. Reconnect the fuel pump tan positive lead in-line connector to the harness.

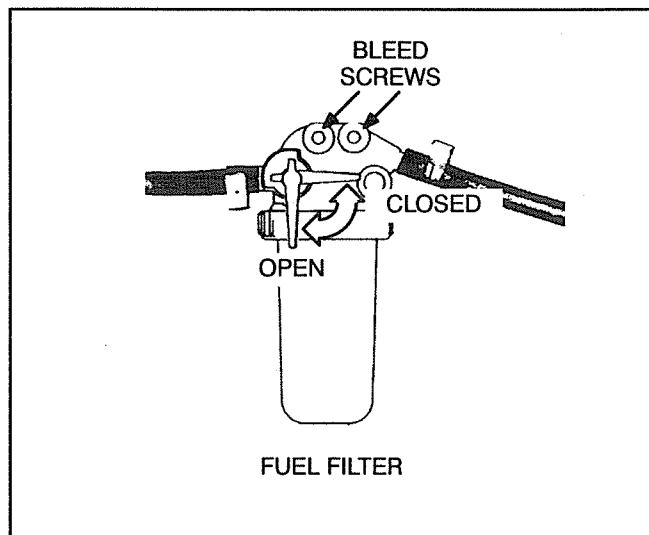


FIGURE 12-2. FUEL SHUTOFF

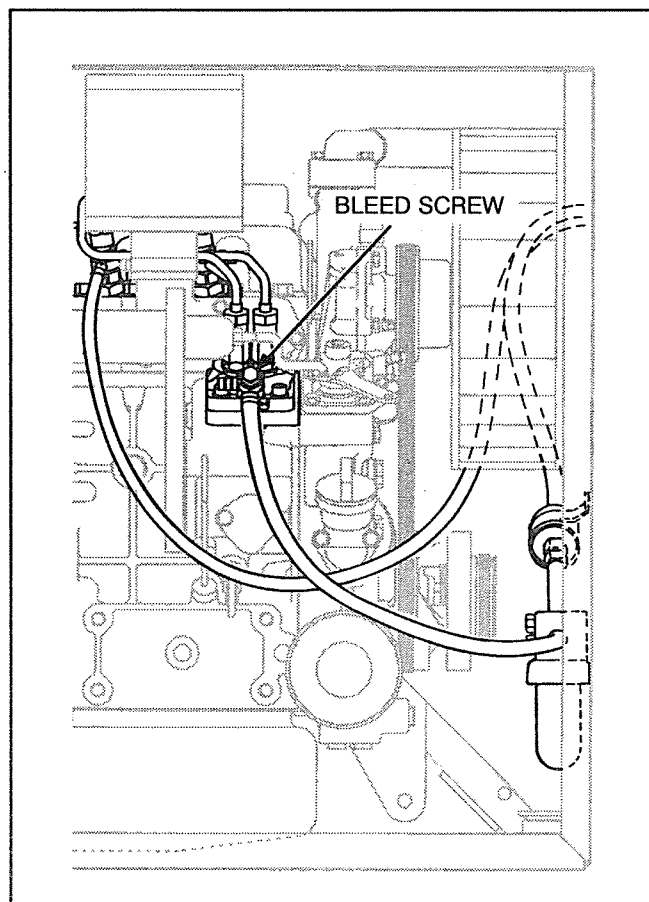


FIGURE 12-3. BLEED SCREW ON THE INJECTOR HOUSING

13. Filling Refrigerant and Coolant Systems

GENERAL

Perform each of the steps in this section in sequence. Some refrigerant will be installed prior to operating the power unit and filling the coolant system, this is done to protect the compressor.

This system uses R-134a refrigerant.

Evacuating and charging the air conditioning system must be performed by a certified air conditioning service technician. Before starting, make sure that all the necessary equipment is available.

⚠WARNING *Inhalation of refrigerant R-134a can induce anesthetic effects such as giddiness, weakness, dizziness, nausea and unconsciousness. It can cause asphyxiation by limiting available oxygen. In susceptible individuals, epinephrine-like compounds can result in fatal cardiac arrhythmia. Do not release refrigerant R-134a into the air. Use a recovery system to remove refrigerant from the system. Make sure that the shop area has fresh air ventilation.*

Perform a preliminary check on the power unit and the systems installed to this point.

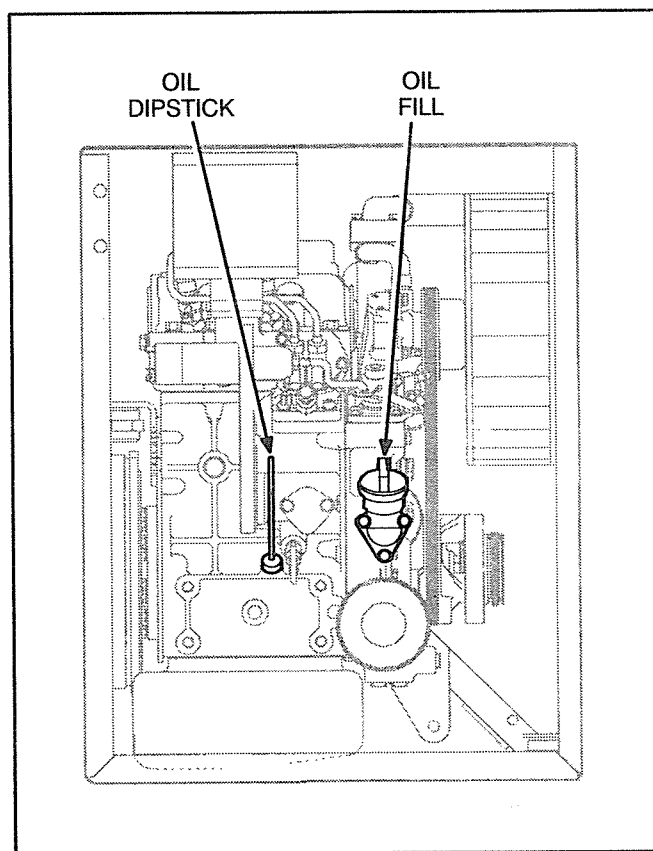


FIGURE 13-1. OIL LEVEL CHECK

PRELIMINARY CHECKS

1. Check the oil level in the power unit engine. Remove and clean the oil level indicator. Fully insert the oil level indicator and then remove it to check oil level. If low, add oil very slowly until the Full mark is reached. Insert the oil level indicator securely to prevent oil leakage.
2. Make sure all of the electrical connections are made including the battery connection (described in section 11).
3. Make sure the fuel valve on the fuel filter is open and that the fuel system has been primed (described in section 12). Also make sure the fuel tank is adequately filled.
4. Check each of the coolant hose connections to make sure they are secure.
5. Check each of the refrigerant hose connections to make sure they are secure.

CABOVER INSTALLATION COMPRESSOR OIL REQUIREMENTS

Cabover installations use longer refrigerant lines that require more refrigerant and more compressor oil. Refer to Table 13-1 to determine approximately how much additional compressor oil must be added to the system. Measure only the length of the number 10 hose to obtain oil requirements.

CAUTION Refrigerant R-134a uses a special lubricant, mixing lubricant intended for R-12 or other systems will cause equipment damage. Only use lubricant designed for use with refrigerant R-134a.

TABLE 13-1. ADDITIONAL COMPRESSOR OIL REQUIREMENTS FOR CABOVER INSTALLATIONS

#10 HOSE LENGTH IN FEET	ADDITIONAL OIL IN FLUID OUNCES (ml)
8	0 (0)
9	0.20 (5.92)
10	0.31 (9.18)
11	0.41 (12.14)
12	0.51 (15.1)
13	0.61 (18.06)
14	0.72 (21.31)
15	0.82 (24.27)
16	0.92 (27.23)
17	1.03 (30.49)
18	1.13 (33.45)
19	1.23 (36.41)
20	1.34 (39.66)
21	1.44 (42.62)
22	1.54 (45.58)
23	1.64 (48.54)
24	1.75 (51.8)
25	1.85 (54.76)

Adding Compressor Oil

WARNING Opening the oil fill on the compressor when the system is charged can cause severe personal injury or death. Refrigerant and oil are released under pressure. If a charged system is opened. Do not open the oil fill in a charged system. Evacuate the system per the instructions in the Air Conditioning Service Manual if the system is charged.

Before operating the power unit or evacuating and charging the AC system, add compressor oil to the system as follows:

1. Measure the length of the larger #10 refrigerant hose from the power unit to the evaporator in the sleeper. (Do not include the length of the smaller #6 hose in this calculation.)
2. Refer to Table 13-1 to determine the amount of oil to add to the system.
3. Remove the top cover from the power unit and locate the AC compressor. Carefully remove the oil fill cap (Figure 13-2). Use a clean syringe to add the required amount of oil. Securely reinstall the oil fill cap.

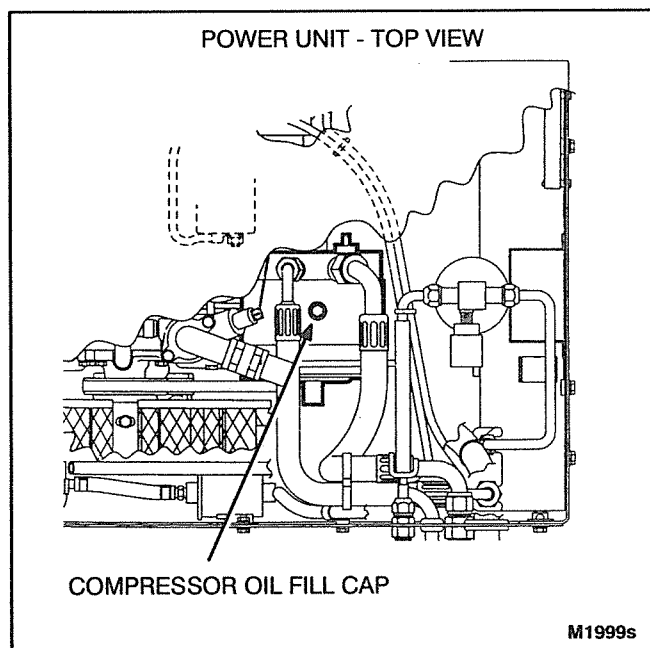


FIGURE 13-2. COMPRESSOR OIL FILL

EVACUATING THE AC SYSTEM

Make sure that the AC hose fittings are secure at the evaporator and at the power unit. Attach a gauge set to the high pressure (HP) and low pressure (LP) sides of the system at the refrigerant quick connect access valves next to the power unit. Attach a vacuum pump to the center hose of the gauge set. Figure 13-3 shows the gauge set and vacuum pump connected to the system.

Note: It is very important to run the vacuum pump long enough to remove the moisture from the system.

Open the fitting on the pump housing to operate the vacuum pump no load. Start the pump and open the hand valves on the manifold, then close the no load fitting on the pump housing. Run the pump for five minutes and then close the hand valves and shut off the pump.

Observe the gauge readings for a few minutes. If the gauge needles move up, it means there is a leak, air and moisture are being sucked into the system by the vacuum. Check all of the fittings and tighten all connections that may be loose, re-start the pump and open the hand valves on the gauges again. If a leak was indicated and repaired, run the vacuum pump for five more minutes and repeat the leak check.

Run the vacuum pump for an hour to remove the moisture from the system. The moisture must turn to gas before the pump can pull it out. It takes time for the moisture to boil away and be drawn out of the system; therefore, it is important to allow enough time to evacuate the system.

After one hour, observe the gauge readings, the LP side should read a minus (-) 29 inches Hg and the HP side should read less than zero PSI. (Reading may vary ± 1 depending on the accuracy of the gauge set. Altitude may cause the reading to vary; -29 inches may not be possible in high altitudes.) Close the hand valves and proceed to Charging the Air Conditioning System section.

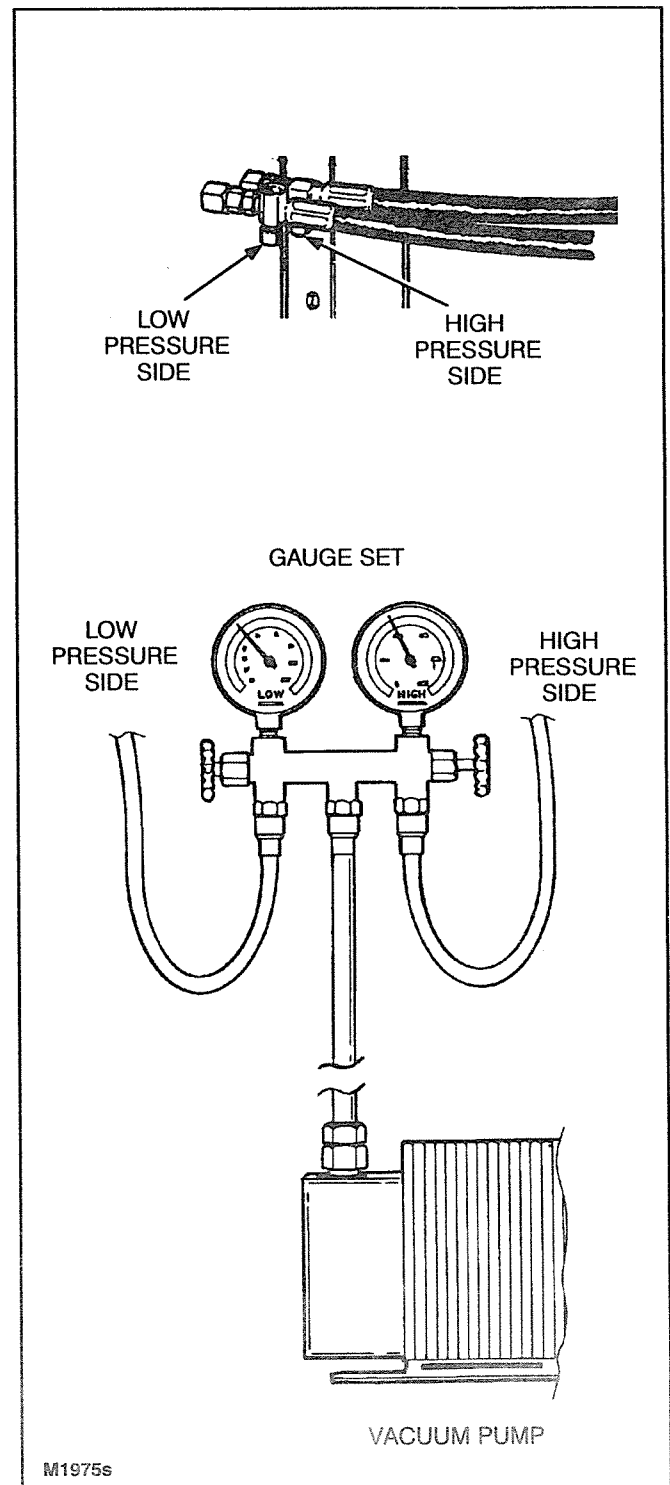


FIGURE 13-3. GAUGE AND VACUUM PUMP CONNECTIONS

CHARGING THE AIR CONDITIONING SYSTEM

After the system has been evacuated, the AC system can be charged. Fill the system part way with liquid R-134a through the HP side. The rest of the charge will be added as vapor through the LP side after the coolant system is filled. Adding R-134a as a liquid can damage the compressor if not done correctly. Follow the procedures carefully and observe all safety precautions.

A normal installation of approximately eight feet of refrigerant hose will use approximately two pounds and six ounces of R-134a refrigerant. With a charging meter or station you can select the exact amount of R-134a required. The alternative is to use a refrigerant container and a scale to measure refrigerant charge weight.

CHARGING THE HIGH PRESSURE SIDE WITH LIQUID R-134a

⚠ CAUTION *Improper system filling can cause equipment damage. Do not operate the power unit engine. No more than one pound of refrigerant R-134a charge should be added at this time.*

⚠ WARNING *Refrigerant can cause frostbite and severe eye damage. If inhaled, Refrigerant can cause respiratory problems that can lead to death. Wear protective clothing including gloves and goggles when working with refrigerant. Also be careful not to discharge refrigerant into the air.*

Begin by connecting the center service hose from the gauge set to the R-134a container dispensing valve. Always purge the hose of any air using R-134a gas pressure from the container.

R-134a liquid is added through the refrigerant access valve on the HP side of system. Turn the refrigerant

erant container upside down and open the R-134a dispensing valve and HP side hand valve on the gauge set. Liquid R-134a will flow into the system. Figure 13-4 illustrates how the manifold gauge set is connected when adding liquid R-134a at the compressor (or accumulator).

When you have added approximately one pound of R134-a liquid, close the R134-a supply. Proceed to the Filling the Coolant System section.

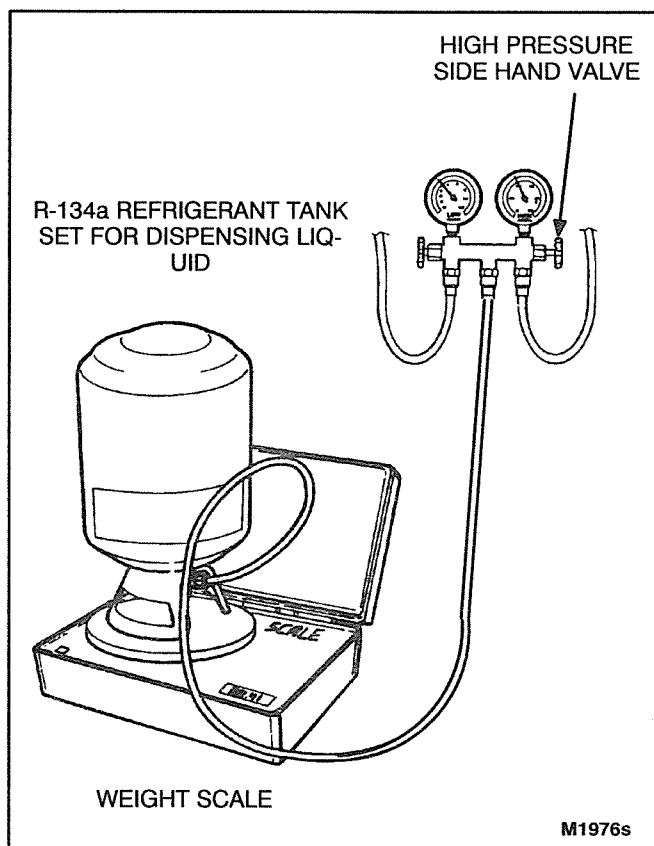


FIGURE 13-4. FILLING THE HIGH PRESSURE SIDE WITH R134-a LIQUID

FILLING THE COOLANT SYSTEM

Cabover and Standard Installations:

The coolant system will be filled through the main truck engine radiator or expansion tank. Refer to the main truck engine Operator's manual for antifreeze type, mixture and engine coolant filling procedure.

A special access valve is located on top of the power unit radiator and on some standalone sleeper heaters to bleed air from the system (Figures 13-5 and 13-6).

⚠ WARNING *Accidentally starting the power unit while working on it can cause severe personal injury or death. Disconnect the 3-pin connector inside the power unit any time the top cover is removed.*

1. Remove the power unit top cover. Disconnect the 3-pin connector inside the power unit to prevent accidental starting during this procedure.
2. If the coolant was not drained from the main truck engine, proceed to step three.
If the coolant was drained from the main truck engine, close all coolant drain valves. Close coolant hose supply and return shutoff valves (keep cutoff clamps on hoses, if used). Fill the main truck engine coolant system according to the main truck engine Operator's manual.
3. Check all hose fittings to make sure they are tightly secured with a hose clamps. If shutoff valves are used to isolate the power unit plumbing from the main engine, open the supply valve. Keep the return valve closed.
4. Start the main truck engine and run it at a minimum speed of 1000 rpm. **NOTE: In some applications it may be necessary to increase engine speed to high idle (governed speed) to purge the heater core of air.**
5. Bleed the power unit engine by loosening the hose clamp at the thermostat housing. Loosen the hose from the fitting just far enough to bleed the system. Resecure the hose clamp.

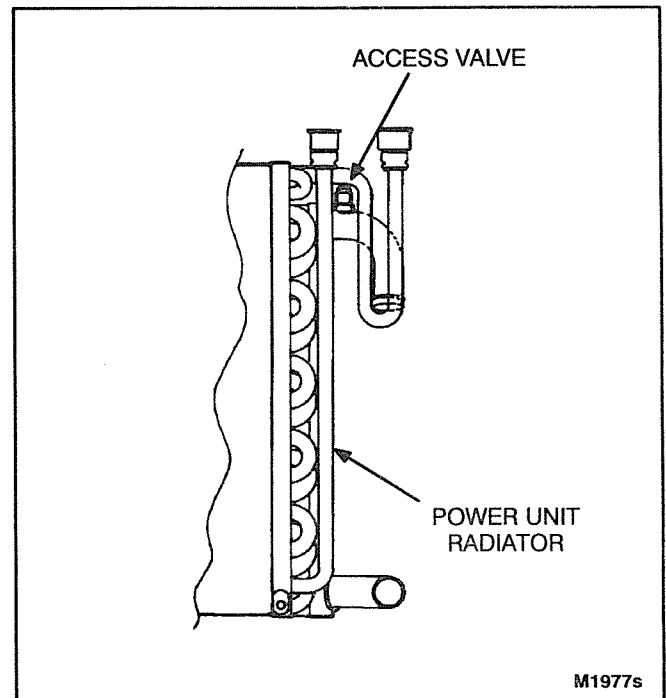


FIGURE 13-5. BLEEDING THE POWER UNIT RADIATOR

6. Remove the cap from the access valve on the top of the power unit radiator (located in the top right hand corner of the power unit). A 14 mm flexible socket with adhesive tape can be used to remove and install the valve cap. Depress the valve pin with a screw driver to bleed the air from the radiator. Reinstall the valve cap.
7. Reconnect the 3-pin connector inside the power unit and install the power unit top cover.
8. Open the main engine coolant return valve, if equipped. Add coolant to the main coolant system. Lower the cab on cabover models.
9. Put the sleeper Temp control to the hottest setting and cycle the Heat/Off/AC switch between the Heat and Off position or until the heater blows warm air.
10. Refer to the Power Unit Starting Procedure section for starting instructions and important safety precautions. Check to make sure the covers are installed on the power unit. Start the auxiliary power unit.

11. After the Power unit has run for five minutes, cycle the Heat/Off/AC switch between the Heat and Off position for three one minute cycles.
12. Turn off the main truck engine and monitor the power unit operation. If the power unit shuts down by itself, the most likely cause is air trapped in the system. If this happens proceed to step 13 and then repeat this procedure.
13. Allow the cooling system time to cool down and fill the coolant system.

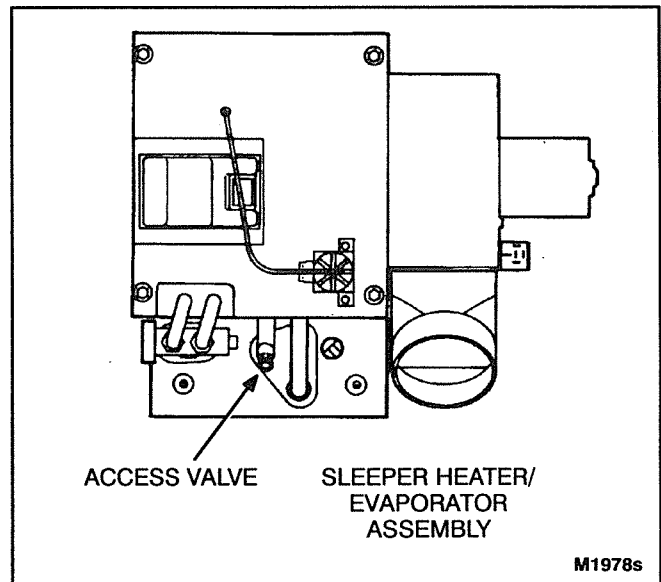
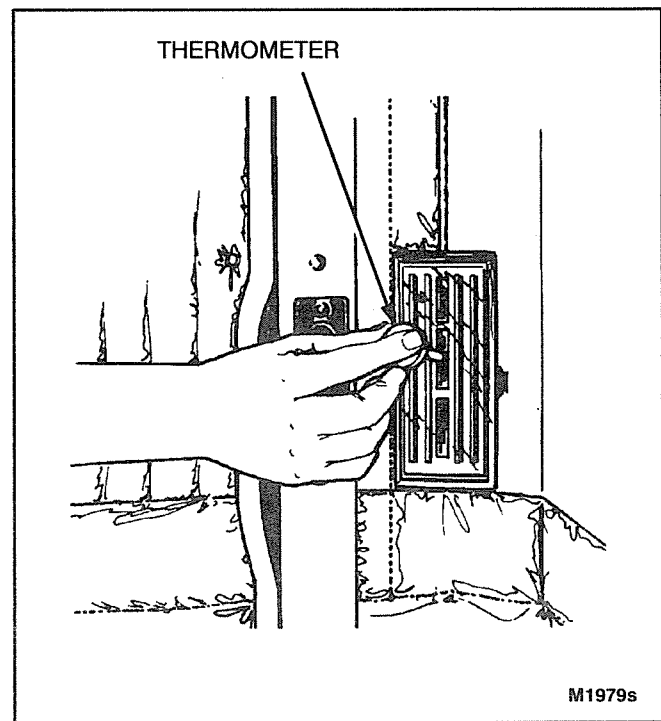


FIGURE 13-6. BLEEDING THE SLEEPER HEATER

HEATING SYSTEM PERFORMANCE CHECK

1. Put the Heat/Off/AC switch in the Heat position. Set the Temp control to the hottest setting and set the Fan switch to High.
2. Allow the power unit to operate for 5 more minutes. Measure the heat output from the sleeper duct. The temperature at the air outlet should be 120°F (49°C) or more.
3. If no heat is produced, the solenoid valve assembly may not be operating or the coolant level may not be adequate. If heat output is low, the coolant level may be low or the heater hoses may have a restriction.
4. If service is required, press the sleeper control Start/Stop switch to Stop. Disconnect the battery negative (-) cable(s) from the battery pack, to prevent accidental start-up.
5. Allow the coolant system time to cool down. Check for coolant leaks and repair any leaks immediately. Check the main truck coolant level and add coolant, if necessary.



**FIGURE 13-7. MEASURE HEAT OUTPUT
FROM THE SLEEPER DUCT**

⚠ WARNING

EXHAUST GAS IS DEADLY!

Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:

- *Dizziness*
- *Nausea*
- *Headache*
- *Weakness and Sleepiness*
- *Throbbing in Temples*
- *Muscular Twitching*
- *Vomiting*
- *Inability to Think Coherently*

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.

Be sure to park in open areas where exhaust gases can not accumulate and enter the sleeper or cab. A carbon monoxide detector with an audible alarm is recommended. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each power unit operation.

AUX-1

POWER UNIT STARTING PROCEDURE

⚠ WARNING *Contact with hot parts and moving parts can cause severe personal injury. Do not operate the power unit with the access cover or top cover removed.*

⚠ WARNING *Do not use ether or any starting fluid as a starting aid. Use of ether or starting fluid can cause an explosion resulting in severe personal injury and equipment damage.*

⚠ CAUTION *Operating the power unit with the access cover removed will cause overheating, engine shutdown and can result in reduced engine life. Make certain that the access cover is in place during operation.*

1. Put the Heat/Off/AC switch in the center Off position. Press the Start/Stop switch to Start. Release the switch when the engine starts. The indicator light on the switch lights up when the engine is running.

For starting at temperatures below 50°F (10° C) refer to Operator's manual for preheat use.

⚠ CAUTION *Excessive cranking can overheat the starter, damaging it. Do not engage the starter longer than 10 seconds. Wait 30 seconds between starting attempts to allow the starter to cool down.*

2. If the engine does not start after cranking for 10 seconds, release the switch. Wait for 30 seconds, then press the Start switch again.
3. If the engine still does not start, wait for 30 seconds, hold the Preheat switch and the Start switch in at the same time.
4. If the engine does not start on the third try:
 - Check the fuel supply
 - Make sure the fuel system has been primed
 - Check the oil level

If the engine stops running shortly after starting, check the oil, fuel and coolant level. Make sure that the access cover is securely installed and see that nothing is blocking the air inlet. See the *Troubleshooting* section in the Operator's manual for additional checks.

Proceed to the System Checks section.

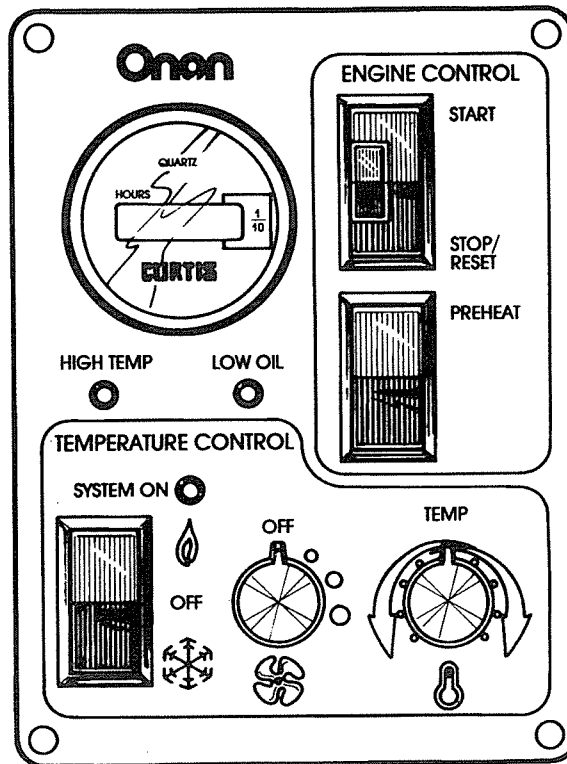


FIGURE 13-8. AUX CONTROL PANEL

SYSTEM CHECKS

1. Check for fuel leaks. If any leaks are found, stop the power unit immediately and repair the leak.

⚠ WARNING Fuel presents the hazard of explosion or fire that can result in severe personal injury or death. If a fuel leak is found, stop the power unit and have the leak repaired immediately.

⚠ WARNING A hot power unit can cause severe burns. Always allow the power unit to cool down before performing service.

2. Check for coolant leaks. If any leaks are found, stop the power unit immediately and repair the leak.
3. Examine the exhaust system for leaks. If any leaks are found, stop the power unit and repair the exhaust system.

⚠ WARNING Exhaust gas presents the hazard of severe personal injury or death. Inspect the exhaust system audibly and visually. Do not operate the power unit if it leaks or is excessively noisy. Repair any exhaust problems.

4. If service is required, press the Start/Stop switch to Stop. Disconnect the battery negative (-) cable from the battery pack, to prevent accidental start-up.

⚠ WARNING Accidental starting of the power unit during maintenance procedures can cause severe personal injury or death. Disconnect the power unit starting battery, negative (-) cable first, before performing service.

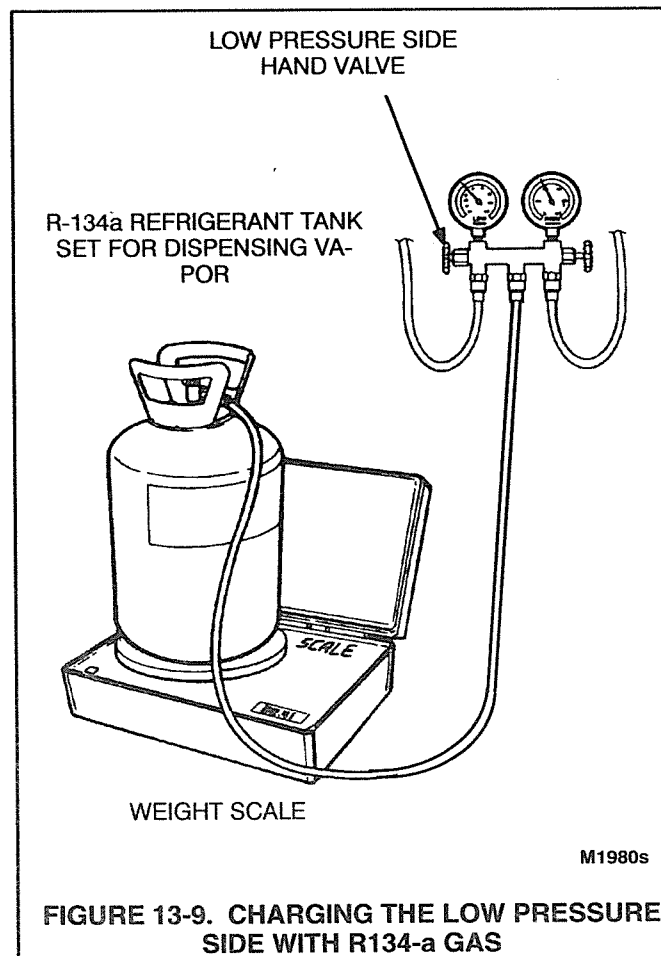
5. If no problems are found, proceed to Charging the LP Side with R134-a Gas.

CHARGING THE LOW PRESSURE SIDE WITH R-134a GAS

⚠ WARNING *Refrigerant can cause frostbite and severe eye damage and when inhaled, it can cause respiratory problems that can lead to death. Wear protective clothing including gloves and goggles. Also be careful not to discharge refrigerant into the air.*

Start the power unit engine and set the Heat/Off/AC switch to AC. Set the Fan Speed switch to High.

Place R134-a container in an upright position so no liquid is drawn into the system. R134-a vapor is added through the refrigerant access valve on the LP (suction) side of system. Open the dispensing valve and then the LP side hand valve on the manifold. Figure 13-9 illustrates system charging with R134-a gas entering the compressor on the LP (suction) side of the system.



Cabover Refrigerant Requirements

Cabover installations use longer refrigerant lines that require more R-134a refrigerant. Refer to Table 13-2 to determine approximately how much refrigerant will be required. Measure only the length of the number 10 hose to obtain oil requirements.

**TABLE 13-2. REFRIGERANT R-134a
REQUIREMENTS FOR CABOVER INSTALLATIONS**

#10 HOSE LENGTH IN FEET	TOTAL R-134a, WEIGHT IN OUNCES (kg)
8	38 (1.06)
9	38.82 (1.09)
10	39.65 (1.11)
11	40.47 (1.13)
12	41.29 (1.16)
13	42.12 (1.18)
14	42.94 (1.2)
15	43.76 (1.23)
16	44.59 (1.25)
17	45.41 (1.27)
18	46.24 (1.29)
19	47.06 (1.32)
20	47.88 (1.34)
21	48.71 (1.36)
22	49.53 (1.39)
23	50.35 (1.41)
24	51.18 (1.43)
25	52.00 (1.46)

Gas Charging Instructions

When you are close to adding two pounds and six ounces of R-134a (or approximate total weight from Table 13-2), check the pressure gauge, air duct outlet temperature and ambient temperature. When readings compare with readings in Table 13-3, close the dispensing valve on the R134-a container. Close the hand valve on the gage set and check the gauge readings. The HP gauge should read approximately ten times the LP gauge reading.

TABLE 13-3. TEMPERATURE/PRESSURE CHART

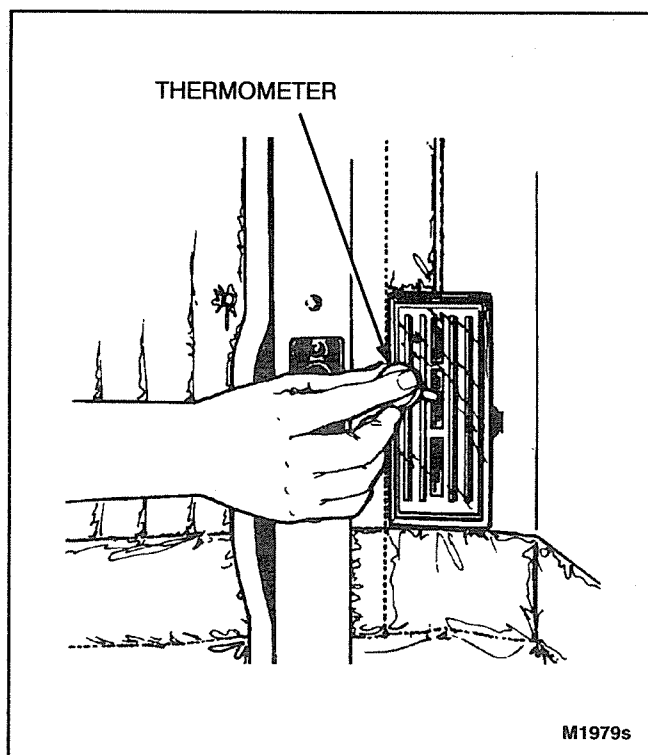
AMBIENT AIR TEMPERATURE	AIR INTO THE EVAPORATOR	AIR OUT OF THE EVAPORATOR	MAXIMUM HIGH SIDE PRESSURE	MAXIMUM LOW SIDE PRESSURE
110°F (43°C)	70°F (21°C)	45-55°F (7-13°C)	250 psi (1724 kPa)	24 psi (165 kPa)
100°F (38°C)	70°F (21°C)	45-55°F (7-13°C)	220 psi (1517 kPa)	22 psi (152 kPa)
90°F (32°C)	70°F (21°C)	45-55°F (7-13°C)	200 psi (1379 kPa)	20 psi (138 kPa)
80°F (27°C)	70°F (21°C)	45-55°F (7-13°C)	180 psi (1241 kPa)	18 psi (124 kPa)

AC SYSTEM PERFORMANCE CHECK

Monitor the temperature of the air outlet in the sleeper. Close the doors to the sleeper and allow the power unit to run for 20 minutes. Check the air outlet temperature. The temperature at the air outlet should be 45°F to 55°F (7.2°C to 10°C) with an ambient air of 65°F to 75°F (18°C to 24°C).

If the air outlet temperature is not satisfactory, check for pinched or kinked AC hose. Also check for refrigerant leaks with a leak detector. Make sure that heated coolant is not flowing through the heater core.

Set the Heat/Off/AC switch to the Off position and turn the Fan Speed switch Off. Turn off the AUX power unit engine. Check for refrigerant leaks with a leak detector. If the system checks OK, remove the manifold gage set hose fittings. Remove the manifold hose fittings quickly and carefully. Use a glove or shop towel to protect your hand and wear goggles. Replace the protective caps on the refrigerant access valves.



**FIGURE 13-10. MEASURE COOLING OUTPUT
FROM SLEEPER DUCT**

14. Installation Review

INSTALLATION REVIEW

Check (✓) each of the following items before turning this equipment over to the end user.

- ☐ Check all mounting fasteners on the power unit to make sure they are secure.
- ☐ Make sure all routing holes into the sleeper are sealed to prevent entrance of exhaust gases.
- ☐ Make sure all fuel connections and hose clamps are tight.
- ☐ Make sure all coolant hose clamps are tight.
- ☐ Make sure all refrigerant hose fittings are tight.
- ☐ Make sure that all coolant hoses are covered with insulating foam wrap and that they are secure to the vehicle to prevent excessive movement.
- ☐ Make sure fuel lines and electrical wires are protected from chafing and damage.
- ☐ Make sure fuel lines are not routed near electrical wires or batteries.
- ☐ Make sure all electrical leads are connected securely and that unused leads are insulated to prevent an electrical short.
- ☐ Make sure all hoses and electrical leads are routed and secured to prevent contact with surfaces that could cause abrasion.
- ☐ Make sure the exhaust system is properly installed and that exhaust connectors are tight.
- ☐ Make sure the power unit radiator outlet is not blocked.
- ☐ Make sure that the power unit covers are securely in place.
- ☐ Allow the coolant system time to cool down. Check to make sure that the system coolant level is full and that the radiator cap is installed securely.

Enter the date in service next to the serial plate inside the left side panel.

15. Wiring Diagrams

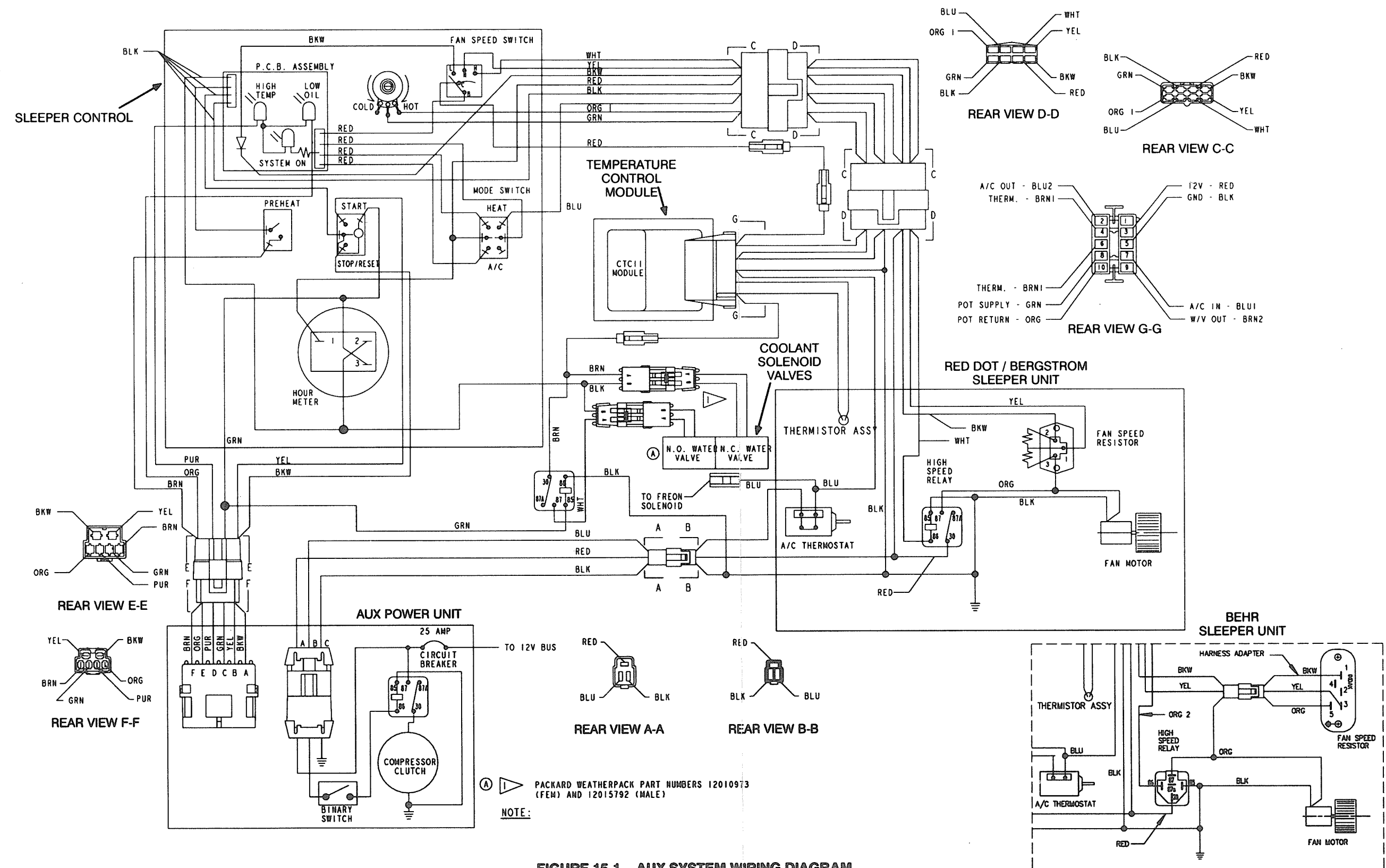
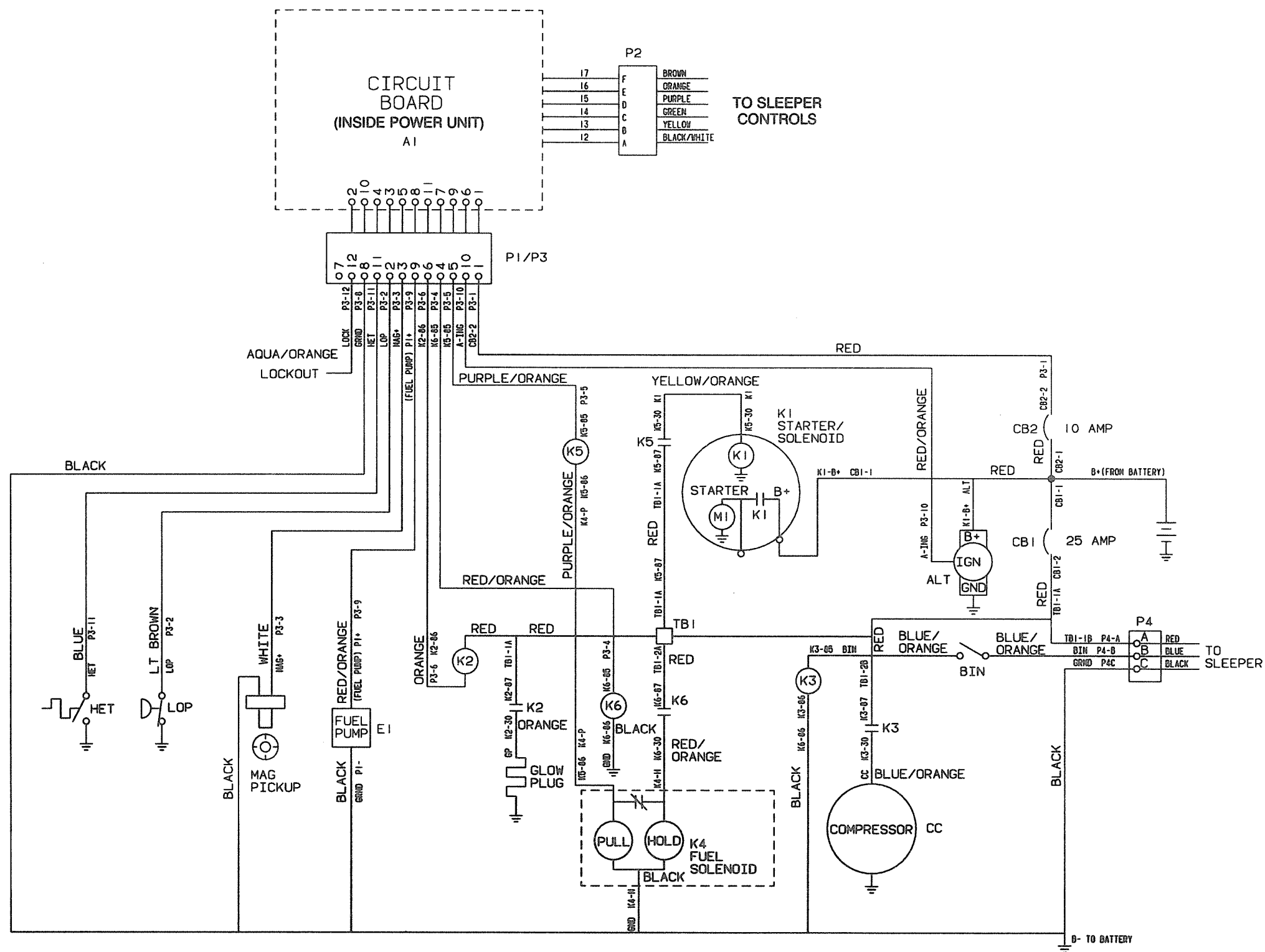


FIGURE 15-1. AUX SYSTEM WIRING DIAGRAM



BIN	BINARY SWITCH
A1	CONTROL ASSY-ECOMAX (REF)
CB1,2	CIRCUIT BREAKER
LOP	SWITCH-LOW OIL PRESSURE
HET	SWITCH-HIGH ENGINE TEMPERATURE
MAG	MAGNETIC PICKUP
K2,3,5,6	RELAY
K1	STARTER/SOLENOID
K4	FUEL SOLENOID
E1	FUEL PUMP
ALT	ALTERNATOR
TB1	TERMINAL BLOCK
GP	GLOW PLUG
CC	COMPRESSOR (CLUTCH)
P1,2,3,4	CONNECTORS

FIGURE 15-2. POWER UNIT WIRING DIAGRAM



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