

Caution: This document contains mixed page sizes (8.5 x 11 or 11 x 17), which may affect printing. Please adjust your printer settings according to the size of each page you wish to print.

Installation Manual

01-07

Model DKHA

981-0644

California

Proposition 65 Warning

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



WARNING



**Do not use this genset on a boat
Such use may violate U. S. Coast Guard
regulations and can result in
severe personal injury or death from
fire, electrocution, or
carbon monoxide poisoning**

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SAFETY PRECAUTIONS

Thoroughly read the OPERATOR'S MANUAL before operating the APU. Safe operation and top performance can only be obtained when equipment is properly operated and maintained.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

⚠ DANGER *alerts you to an immediate hazard that will result in severe personal injury or death.*

⚠ WARNING *alerts you to a hazard or unsafe practice that can result in severe personal injury or death.*

⚠ CAUTION *alerts you to a hazard or unsafe practice that can result in personal injury or equipment damage.*

Electricity, fuel, exhaust, moving parts and batteries present hazards which can result in severe personal injury or death.

ENGINE EXHAUST IS DEADLY

Engine exhaust gases include CARBON MON-OXIDE (CO), an odorless, colorless, poisonous gas that can cause severe personal injury or death. Symptoms of CO poisoning include:

- Dizziness, Headache or Throbbing Temples
- Weakness or Muscular Twitching
- Sleepiness or Confusion
- Nausea or Vomiting

If you or anyone else experiences any of these symptoms, get out into fresh air immediately and seek advice from poison control, medical center

or 911. Do not operate the APU again until it has been repaired and inspected.

To reduce the risk of CO poisoning:

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Never sleep in the vehicle while the APU is running unless the vehicle is equipped with a working carbon monoxide detector.
- Do not operate the APU when the vehicle is parked in a confined space, such as a garage.
- Disable AUTO before storing the vehicle or parking it in a garage or other confined space.
- The exhaust system must be installed in accordance with the APU Installation Manual.
- Do not use engine cooling air for heating the vehicle.

GENERATOR VOLTAGE IS DEADLY

- Disable AUTO, stop the APU and disconnect the battery cables (negative [-] first) from the batteries before servicing the APU.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with the APU Installation Manual and applicable codes.
- The improper transfer of loads between APU and shore power can lead to electrocution of utility line workers and damage to equipment. Connections must be made by a trained and experienced electrician in accordance with applicable codes.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable AUTO, stop the APU and disconnect the battery cables (negative [-] first) from the batteries before servicing the APU.
- Do not wear loose clothing or jewelry near moving parts such as fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

BATTERY GAS IS EXPLOSIVE

- Do not smoke near batteries.
- Wear safety glasses when servicing batteries.
- Disable AUTO, stop the APU and disconnect the battery cables from the batteries before servicing the batteries.
- Always disconnect negative (-) first and reconnect last to prevent sparks between tools and vehicle frame.
- Secure battery terminal protective covers to prevent accidental shorting with metal tools.

DIESEL FUEL IS COMBUSTIBLE

- Do not smoke or turn electrical switches ON or OFF where fuel fumes are present or in areas sharing ventilation with fuel tanks or equipment. Keep flames, sparks, pilot lights, arc-producing equipment and all other sources of ignition well away.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.

FLAMMABLE VAPORS CAN BE IGNITED BY VEHICLE ELECTRICAL SYSTEMS AND CAN CAUSE A DIESEL ENGINE TO OVERSPEED

- Disable AUTO and stop the APU before fueling the vehicle.
- Do not operate the diesel-powered APU where there are or can be flammable vapors created by fuel spills, gas leaks, etc. Flammable vapors drawn into a diesel engine air

intake system can cause the engine to overspeed, which can result in fire, explosion and equipment damage. The owners and operators of the APU are solely responsible for safe operation.

GENERAL PRECAUTIONS

- Keep children away from the APU.
- Do not use evaporative starting fluids. They are highly explosive.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray out and cause severe burns.
- Keep the APU and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Make sure all fasteners are secure and torqued properly.
- Do not perform APU maintenance or service when mentally or physically fatigued or after having consumed alcohol or drugs.
- You must be trained and experienced to make adjustments while the APU is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep a multi-class ABC fire extinguisher in the vehicle. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquids and gaseous fuels. Class C fires involve live electrical equipment. (ref. NFPA No. 10)
- APU installation and operation must comply with all applicable local, state and federal codes and regulations.

1. Introduction

ABOUT THIS MANUAL

This is an instruction manual for the installation of the auxiliary power unit (APU) listed on the front cover. Proper installation is essential for top performance and safe operation. Read through this manual before starting the installation.

See the Operator's Manual for operation and maintenance instructions.

Note: Manuals are updated from time to time to reflect changes in the equipment and its specifications. For this reason, only the copy of the installation manual supplied with the genset should be used as a guide for the installation.

INSTALLATION APPROVALS

The builder of the vehicle bears sole responsibility for the selection of the appropriate equipment, for its proper installation and for obtaining approvals from the authorities (if any) having jurisdiction over the installation.

⚠ WARNING *This genset is not a life support system. It can stop without warning. Children, per-*

sons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if genset operation is critical.

OUTLINE DRAWINGS

See the Outline Drawings beginning on Page A-3 for installation details: mounting bolt hole locations, connection points (fuel, battery, exhaust, remote control, AC output), sizes and types of fittings, weight, service access points and overall dimensions.

⚠ WARNING *Improper installation can result in severe personal injury, death and equipment damage. The installer must be qualified to perform the installation of electrical and mechanical equipment.*

⚠ CAUTION *Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.*

2. Location and Mounting

LOCATION

The APU is designed for mounting up to the vehicle frame rail on either side. See Pages A-3 through A-5. There must be clearance on the sides of the APU for making exhaust, coolant, fuel, battery, AC and control connections, and access from the front for removing the top and bottom access panels to perform scheduled maintenance in accordance with the Operator's Manual.

MOUNTING

Use both lifting eyes on the engine head or a forklift under the shipping pallet to raise the APU to its mounting position. Raise the elevation of the APU so that the mounting bolts pull straight across the top and bottom of the frame rail flanges (Figure 2-1). After all four bolts have been snugged up even and straight, torque the nuts to 260 ft-lb (352 N-m).

Offset spacers (two) with hardware are available as Kit 541-1425 if it is necessary to clear bolt heads and other protrusions on the frame rail.

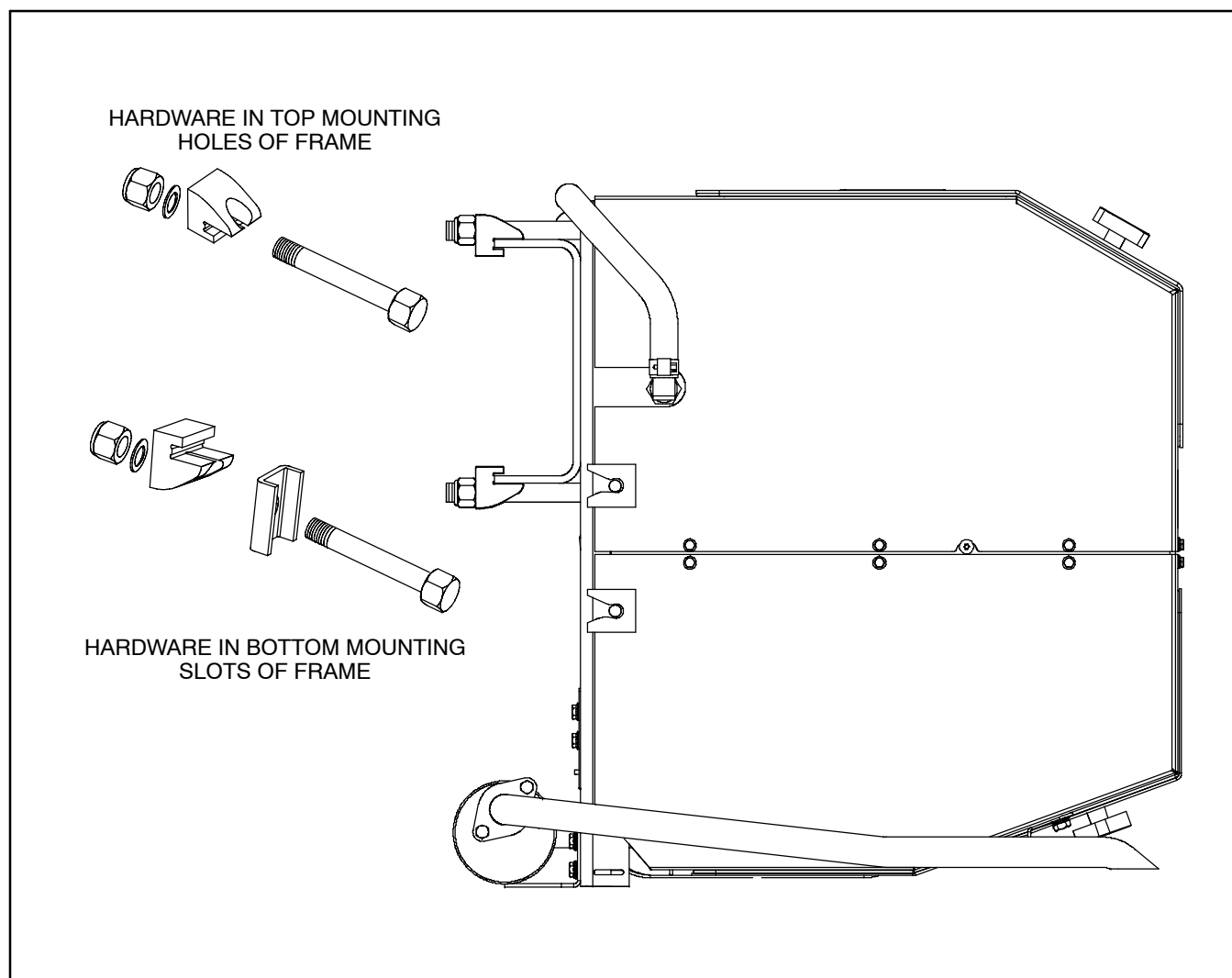


FIGURE 2-1. MOUNTING APU

3. Exhaust Connections

GENERAL

⚠ WARNING *EXHAUST GAS IS DEADLY! The APU must be installed with a tailpipe to direct exhaust gases away from the vehicle.*

⚠ CAUTION *Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.*

The APU must be installed with the standard tailpipe or with a customer fabricated tailpipe using tailpipe adapter PN 155-2610 (Figure 3-1).

STANDARD TAILPIPE

The standard tailpipe can be installed on the muffler outlet flange after mounting the APU and removing the shipping pallet. The flange gasket and screws are packaged with the tailpipe. Torque the flange and bracket screws to 19 ft-lb (26 N-m). The flange gasket must be used.

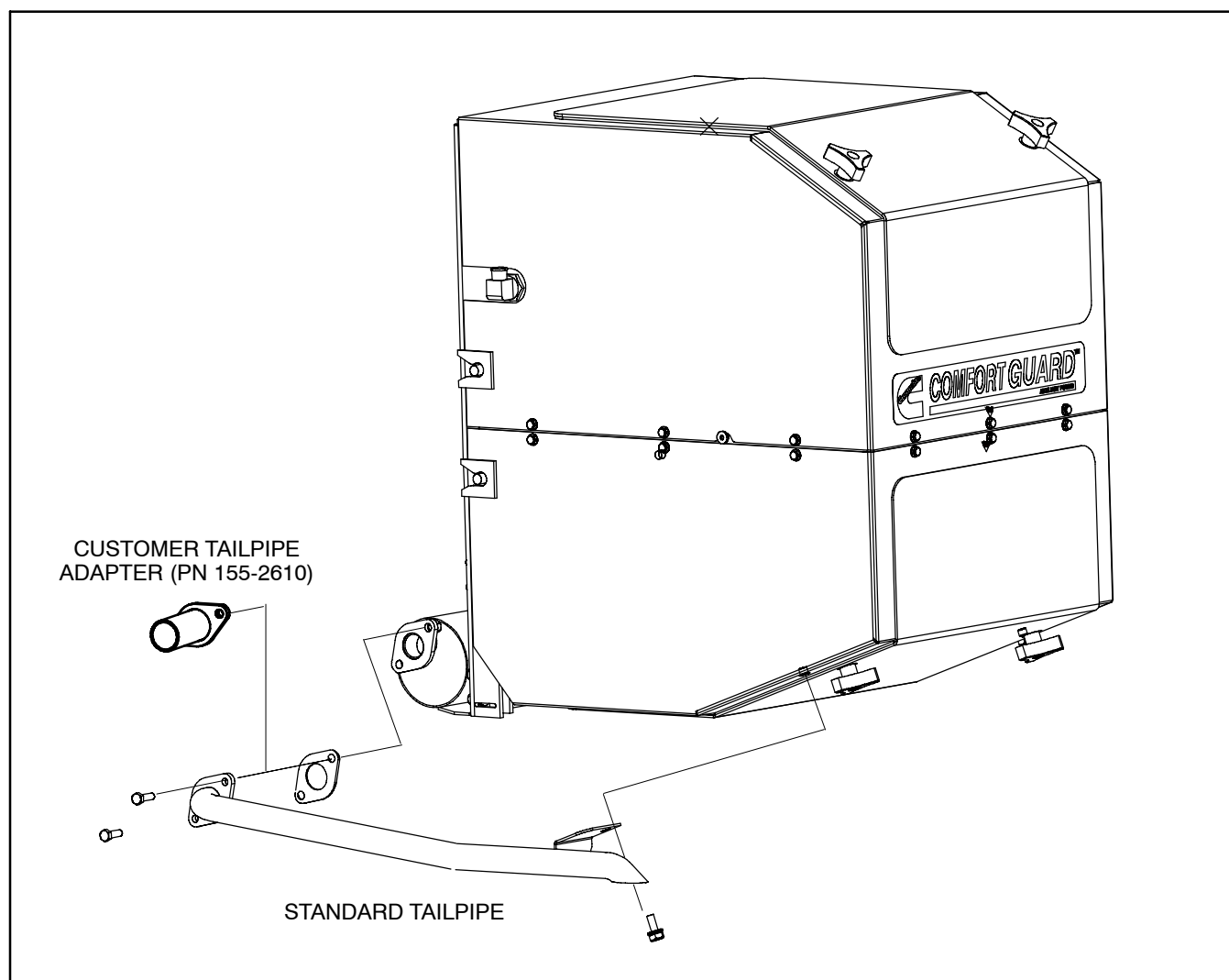


FIGURE 3-1. EXHAUST TAILPIPE

CUSTOMER FABRICATED TAILPIPE

Tailpipe Adapter

Tailpipe adapter 155-2610 must be used with a customer fabricated tailpipe. Mount the adapter on the muffler outlet flange using the flange gasket and screws packaged with the tailpipe adapter. Torque the flange and bracket screws to 19 ft-lb (26 N-m). The flange gasket must be used.

Tailpipe

1. For the tailpipe, use 1-3/8 inch I. D. aluminized steel tubing or equivalent .
2. Use U-bolt muffler clamps to connect sections of tailpipe. It is recommended that the overlapping pipe be slotted as shown in Figure 3-2.
3. Support the tailpipe every 2 to 3 feet (60 to 90 cm).
4. Do not terminate the tailpipe underneath the vehicle cab or living space.
5. Do not route the tail pipe near fuel lines or fuel tanks or terminate it below or near a fuel fill opening.
6. Route the tailpipe such that it is visible along its entire length and accessible for replacement.
7. Route the tailpipe such that it will not likely be struck when the vehicle is moving.
8. *Exhaust back pressure under full load must not exceed 2 inches (51 mm) water column (WC) as measured within 6 inches (154 mm) of the muffler outlet flange.*

▲ CAUTION *Excessive back pressure can cause loss of performance and engine damage.*

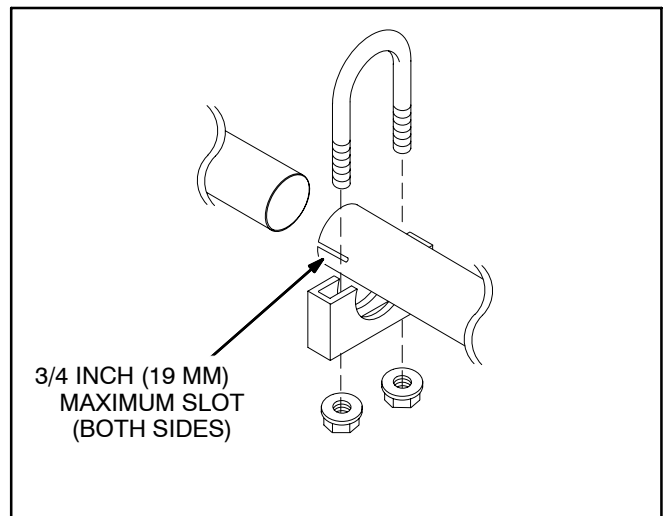


FIGURE 3-2. EXHAUST TAILPIPE CONNECTIONS

4. Coolant Connections

Only models with external coolant fittings (one on each side) require coolant connections to the vehicle engine. Figure 4-1 illustrates typical connections. Coolant must flow from the APU to the inlet of the vehicle engine coolant pump so that the pumps work together, and not against each other.

The fittings at the vehicle engine should have ball valves to isolate the APU if it is necessary to run the vehicle engine while servicing the APU.

Use 3/4 inch I. D. SAE 20R3 Class D2 coolant hose. Route and secure the hoses to keep them away

from hot engine exhaust components. They should be accessible for inspection and replacement, protected from damage and secured to prevent kinking, contact with sharp edges and chafing due to vibration.

There must be enough slack in the hoses at the vehicle engine to take up engine movement without stretching or compressing the hoses.

Fill and bleed the coolant system in accordance with the Operator's Manual.

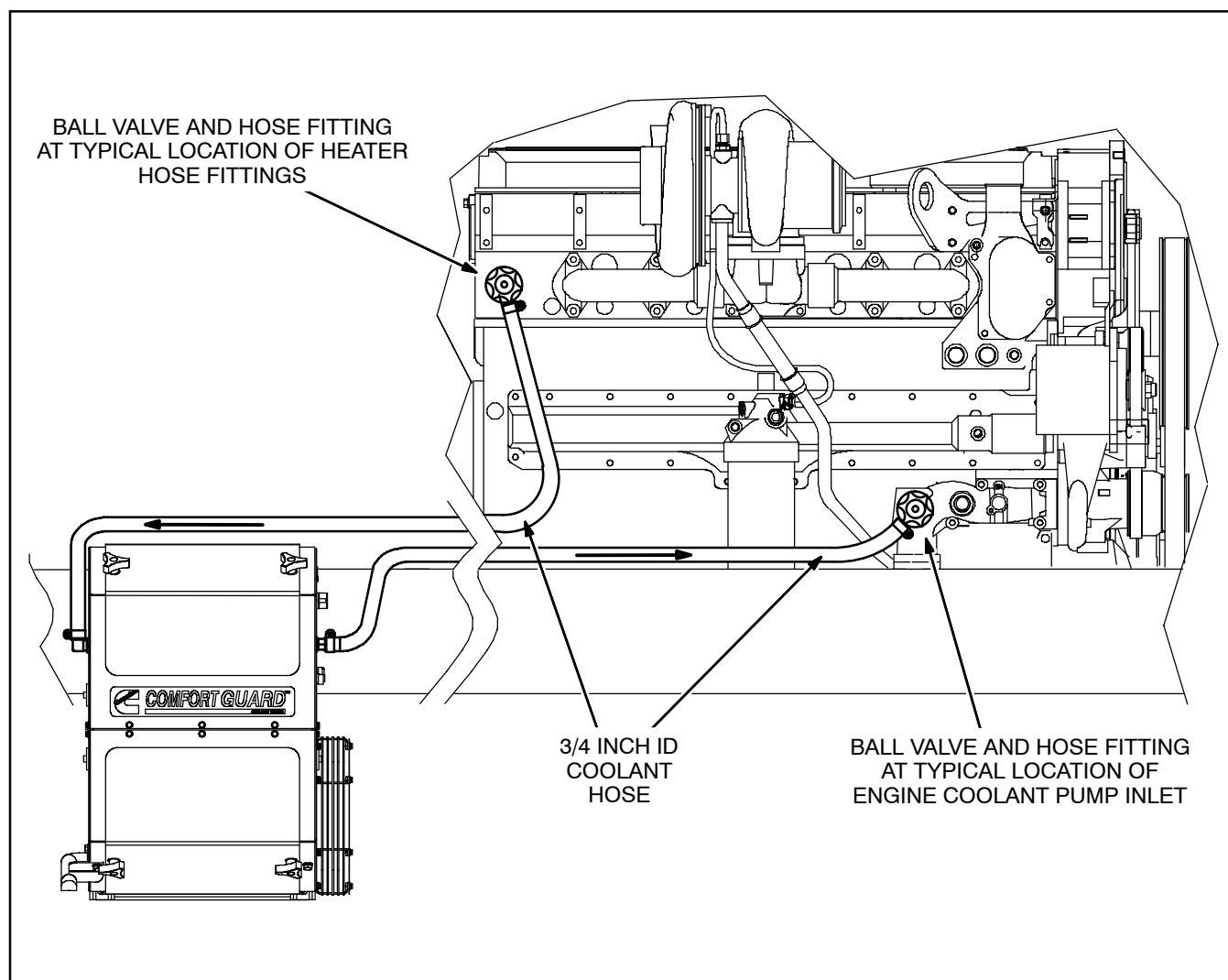


FIGURE 4-1. TYPICAL SHARED COOLANT CONNECTIONS

5. Fuel Connections

⚠ WARNING Diesel fuel is a combustible and can cause severe personal injury or death. Do not smoke or allow any flame, spark, pilot light, arc-producing equipment, electrical switch or other ignition source around fuel or fuel components, or in areas sharing ventilation. Keep a type ABC fire extinguisher handy.

Do not interconnect APU and vehicle engine fuel lines.

⚠ CAUTION Either or both engines could starve for fuel if the APU and vehicle engine fuel lines are interconnected. Always use separate fuel pickup tubes and fuel lines.

Install the fuel kit (Figure 5-1) in the top of the closest fuel tank. The longer 5/16 inch pickup tube is for fuel supply and the shorter 1/4 inch dip tube is for fuel return. Follow the instructions in the kit. Also see Page A-5.

If the tank has a five-bolt sender port, use adapter plate 541-1425 for mounting the pickup tube assembly.

In a 24 inch diameter fuel tank, the pickup tube extends down to approximately 3 inches from the bottom. To prevent the APU from running the vehicle out of fuel, it is recommended that the pickup tube be cut, if necessary, so that it is shorter than the vehicle engine pickup tube. If it is necessary to extend the fuel pickup tube, use 5/16 inch SAE J30R7 hose and a stainless steel hose clamp.

Route the fuel hoses away from hot engine exhaust components, electrical wiring and battery cables. They should be accessible for inspection and replacement, protected from damage and secured to prevent kinking, contact with sharp edges and chafing due to vibration.

⚠ WARNING Routing battery cables and AC wiring with fuel lines can lead to fire and severe personal injury or death. Keep battery cables and AC wiring away from fuel lines.

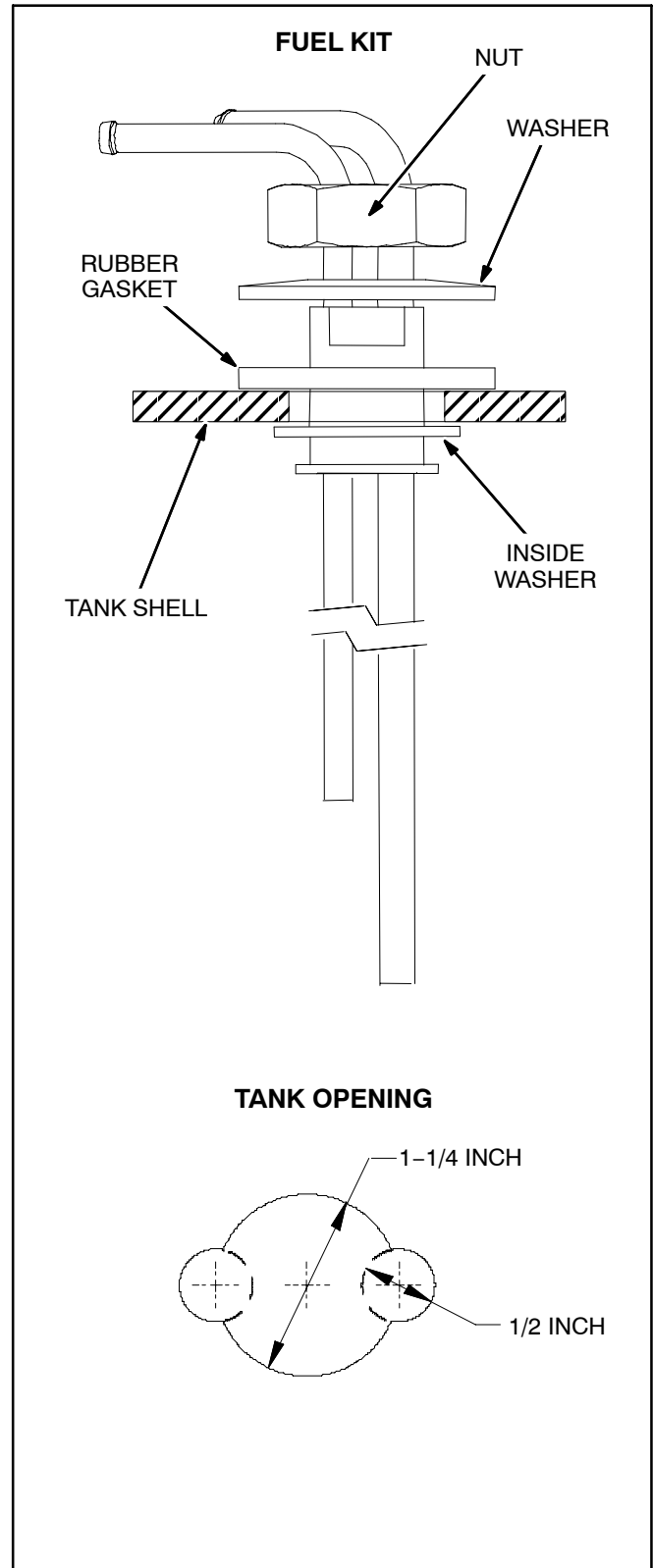


FIGURE 5-1. FUEL PICKUP TUBE ASSEMBLY

6. Electrical Connections

AC POWER OUTPUT

General

⚠WARNING *Accidental starting of the APU can cause severe personal injury or death. Until the APU is ready for startup, ensure that the APU's remote control connector is disconnected, the circuit breaker is OFF and that both negative (-) and positive (+) battery cables are disconnected at the batteries.*

The APU has a sealed connector for AC power output connections. Packaged with the APU is a 30 amp load center breaker box with a 16 foot cord and APU connector mate. All APU power is distributed through the load center breaker box. The HVAC unit power cord and all convenience outlets plug into the load center breaker box. See Figure 6-1.

Wiring

Mount the load center breaker box in a compartment that affords protection from rain and road splash and that is within reach of the power cord (48 inches) from the HVAC unit. There must be access for making connections and resetting the circuit breakers.

Two convenience outlet boxes and wiring harnesses are available for connection to the load center breaker box.

Seal all wiring openings into the vehicle interior to keep out exhaust gas. Apply silicone rubber or equivalent sealant.

⚠WARNING *EXHAUST GAS IS DEADLY! Seal all wiring openings into the vehicle interior to keep out exhaust gas.*

Route or protect AC wiring so that it will not be cut or abraded, exposed to hot surfaces or damaged by road debris. Keep AC wiring away from fuel lines, control wiring and battery cables.

⚠WARNING *Routing AC wiring with fuel lines can lead to fire and severe personal injury or death. Keep AC wiring away from fuel lines.*

The load center breaker box has a grounding lead which should be grounded to the vehicle chassis as required by code.

Shore Power

A vehicle with provisions for connecting shore power must have an approved device to keep the APU and shore power from being interconnected.

See REMOTE CONTROL (p. 6-3) regarding shore power interlock connections.

⚠WARNING *Interconnecting the APU and shore power can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.*

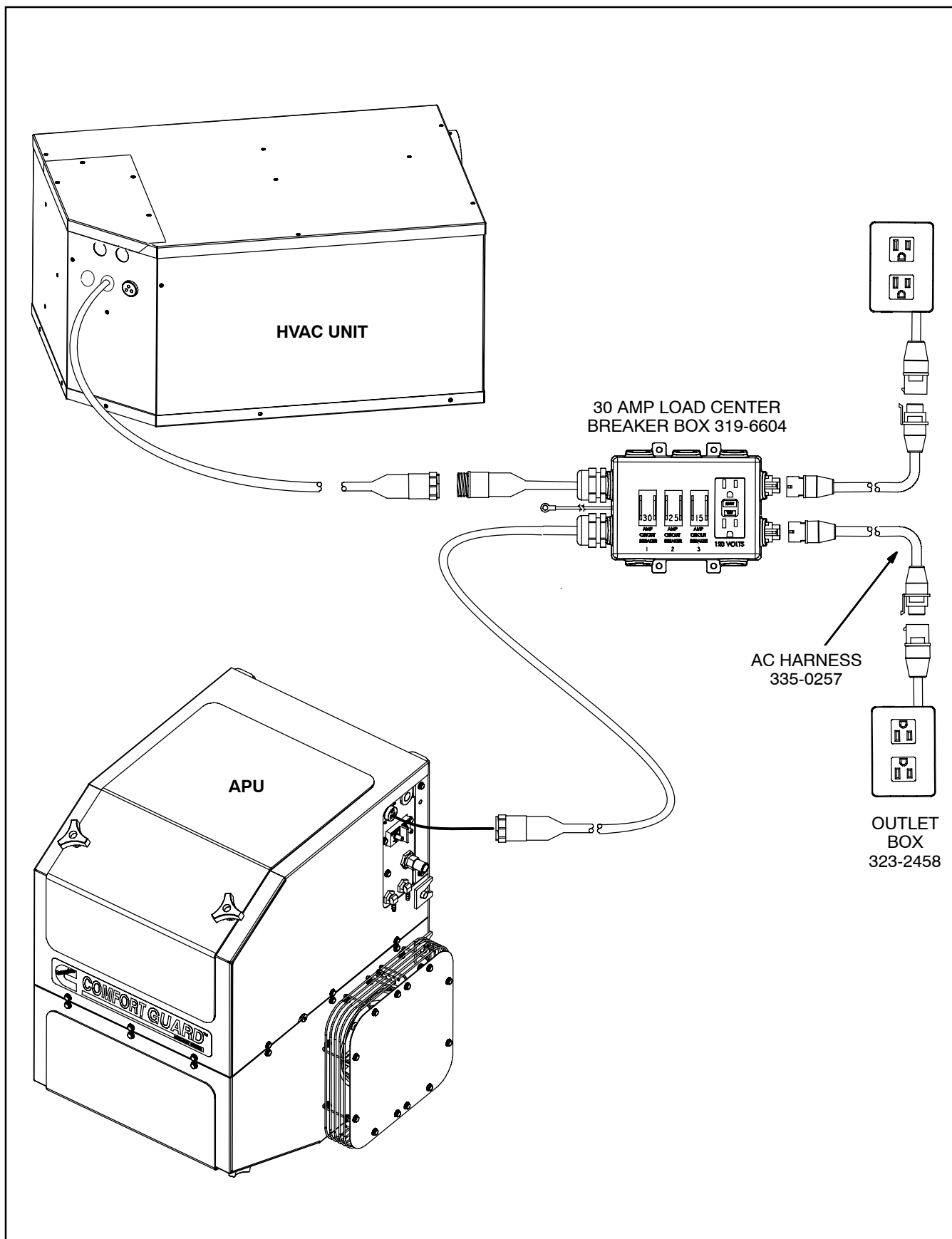


FIGURE 6-1. AC CONNECTIONS

REMOTE CONTROL

General

Two wiring harnesses are packaged with the APU for remote control connections (Figure 6-2). They:

- Connect the APU to the operator panel
- Provide **B+** and **B-** for HVAC unit control through connector **P7** and the APU
- Provide for a start signal from the HVAC unit to the APU when there is a demand for heating or air conditioning.
- Provide for shutting down the APU with ignition and shore power interlocks.

For further reference see the Control Schematics on Pages A-1 and A-2.

⚠WARNING *Accidental starting of the APU can cause severe personal injury or death. Until the APU is ready for startup, ensure that the APU's remote control connector is disconnected, the circuit breaker is OFF and that both negative (-) and positive (+) battery cables are disconnected at the batteries.*

Operator Panel

Mount the Operator Panel at a convenient location for the user, preferably on the same panel as the HVAC control panel. Follow the instructions in the kit.

Shore Power Interlock

If provision has been made for connecting shore power, provide a normally open relay to shut down the APU when shore power is connected. Connect the shore power interlock relay to the yellow leads in the APU remote harness. See Page A-2 for details.

⚠WARNING *Interconnecting the APU and shore power can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.*

Ignition Interlock

If it is desired to always shut down the APU when the vehicle engine is started, connect a normally open ignition relay or switch to the blue leads in the APU remote harness. See Page A-2 for details.

Wiring

Open the wiring junction box in the upper corner of the HVAC unit. Route the wiring harnesses through their respective bulkhead bushings and plug the mating connectors together as illustrated in Figure 6-2.

The insulated, color-coded, crimp-on butt connectors in harness 338-4874 are for connection of the ignition and shore power interlock circuits. They need not be connected for the APU to run. See Shore Power Interlock and Ignition Interlock. Secure the junction box cover when all connections inside have been made.

Route or protect control wiring so that it will not be cut or abraded, exposed to hot surfaces or damaged by road debris. Keep control wiring away from AC power leads to reduce the possibility of erratic operation due to induced signals.

Seal all wiring openings into the vehicle interior to keep out exhaust gas. Apply silicone rubber or equivalent sealant.

⚠WARNING *EXHAUST GAS IS DEADLY! Seal all wiring openings into the vehicle interior to keep out exhaust gas.*

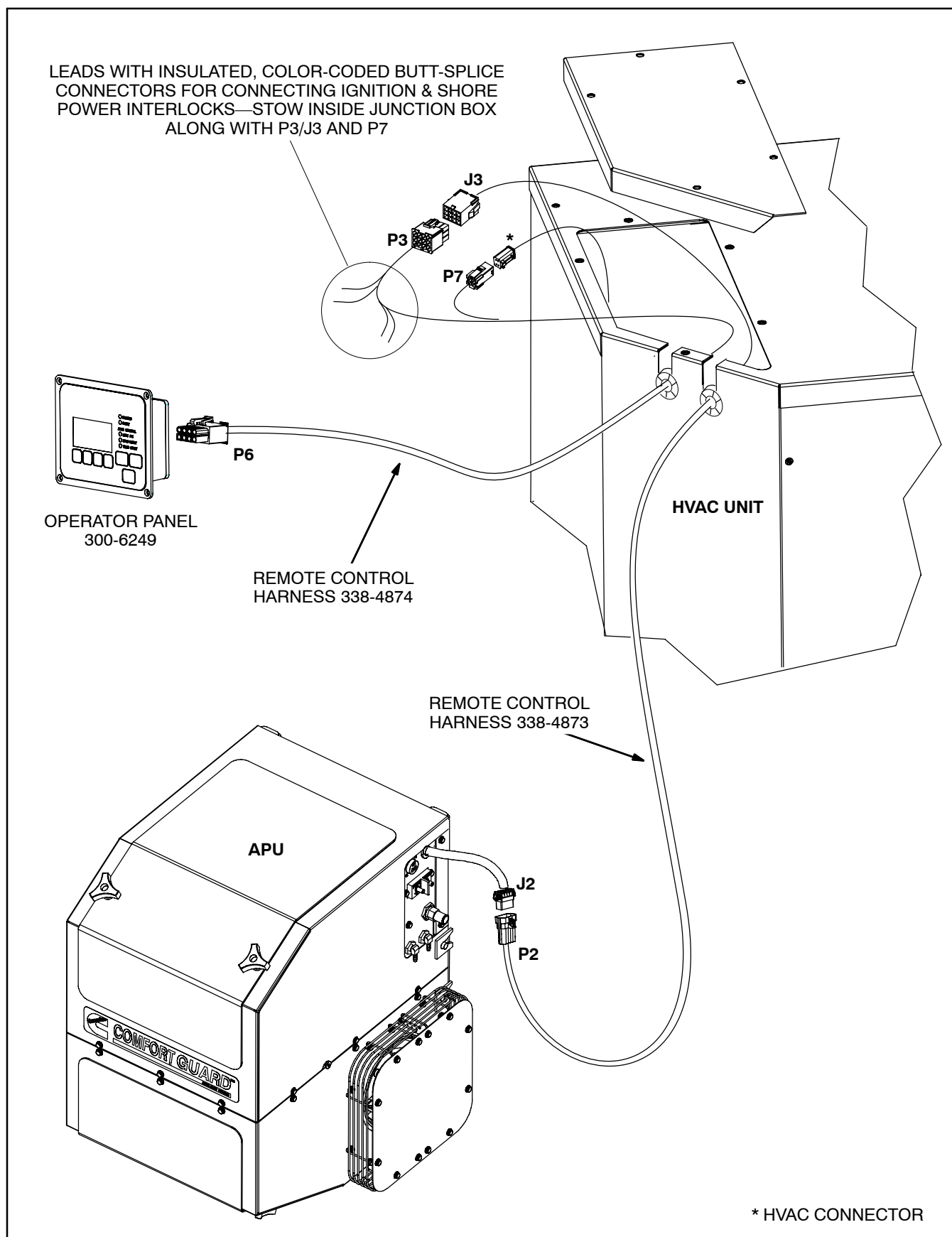


FIGURE 6-2. REMOTE CONTROL CONNECTIONS

BATTERY CONNECTIONS

General

One of the functions of the APU is to maintain vehicle battery charge when the vehicle engine is not running. If AUTO is enabled, the APU will start and recharge the batteries when it senses that voltage has dropped to a preset level.

Battery Cables

The battery cables with ring terminal connectors and protective convoluted sheathing are packaged with the APU (Figure 6-3).

Route battery cables away from fuel lines, AC wiring and hot engine exhaust components. Battery cables should be accessible for inspection and replacement, protected from damage and secured to prevent chafing due to vibration.

⚠WARNING *Routing battery cables with fuel lines can lead to fire and severe personal injury or death. Keep battery cables away from fuel lines.*

If the cables are too long to stow safely, they may be cut to proper length. Use a proper crimping tool to crimp on the extra terminals. Insulate the terminal shanks with heat-shrink insulating tubing so that loose cable strands will not contact other terminals. Mark cable polarity: positive (+) or negative (-).

Note: *Connect the APU cables at the same terminals as the main engine cables so that all batteries are recharged uniformly when the APU is running.*

Connecting Battery Cables

Connect the battery cable harness to the terminals on the APU (Figure 6-3). Torque the terminals to 7.5 ft-lbs (10 N-m) and cover the positive (+) terminal with its boot.

Do not connect the cables to the vehicle batteries until the APU is ready for startup.

⚠WARNING *Accidental starting of the APU can cause severe personal injury or death. Until the APU is ready for startup, ensure that the APU's remote control connector is disconnected, the circuit breaker is OFF and that both negative (-) and positive (+) battery cables are disconnected at the batteries.*

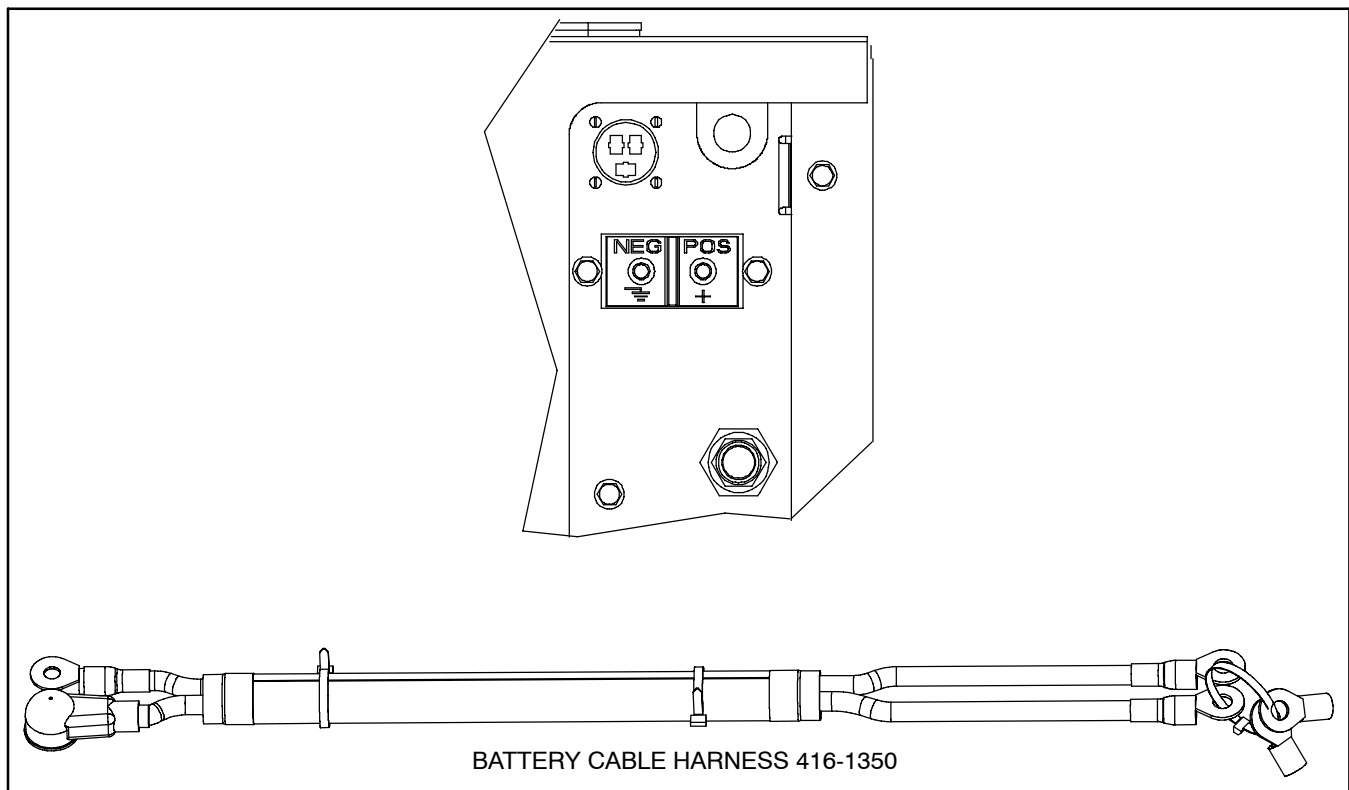


FIGURE 6-3. BATTERY CABLES

7. Installation Review and Startup

⚠WARNING *Accidental starting of the APU can cause severe personal injury or death. Until the APU is ready for startup, ensure that the APU's remote control connector is disconnected, the circuit breaker is OFF and that both negative (-) and positive (+) battery cables are disconnected at the batteries.*

First

Review the following items that can be checked before the APU is started up. Make necessary repairs and reconnections.

Second

Read the Operator's Manual and perform the maintenance and pre-start checks instructed. If the APU shares the cooling system with the main vehicle engine fill and bleed the system in accordance with the Operator's Manual. The APU is shipped from the factory with the proper level of engine oil.

⚠WARNING *EXHAUST GAS IS DEADLY! Do not operate the APU when the vehicle is indoors unless there is ample fresh air ventilation.*

Third

Connect the battery cables to the batteries, positive (+) cable first, and start the APU. It may take several tries until the fuel line is primed.

Forth

Connect the APU's remote control connector and push the circuit breaker ON. Continue testing the system with power available from the APU.

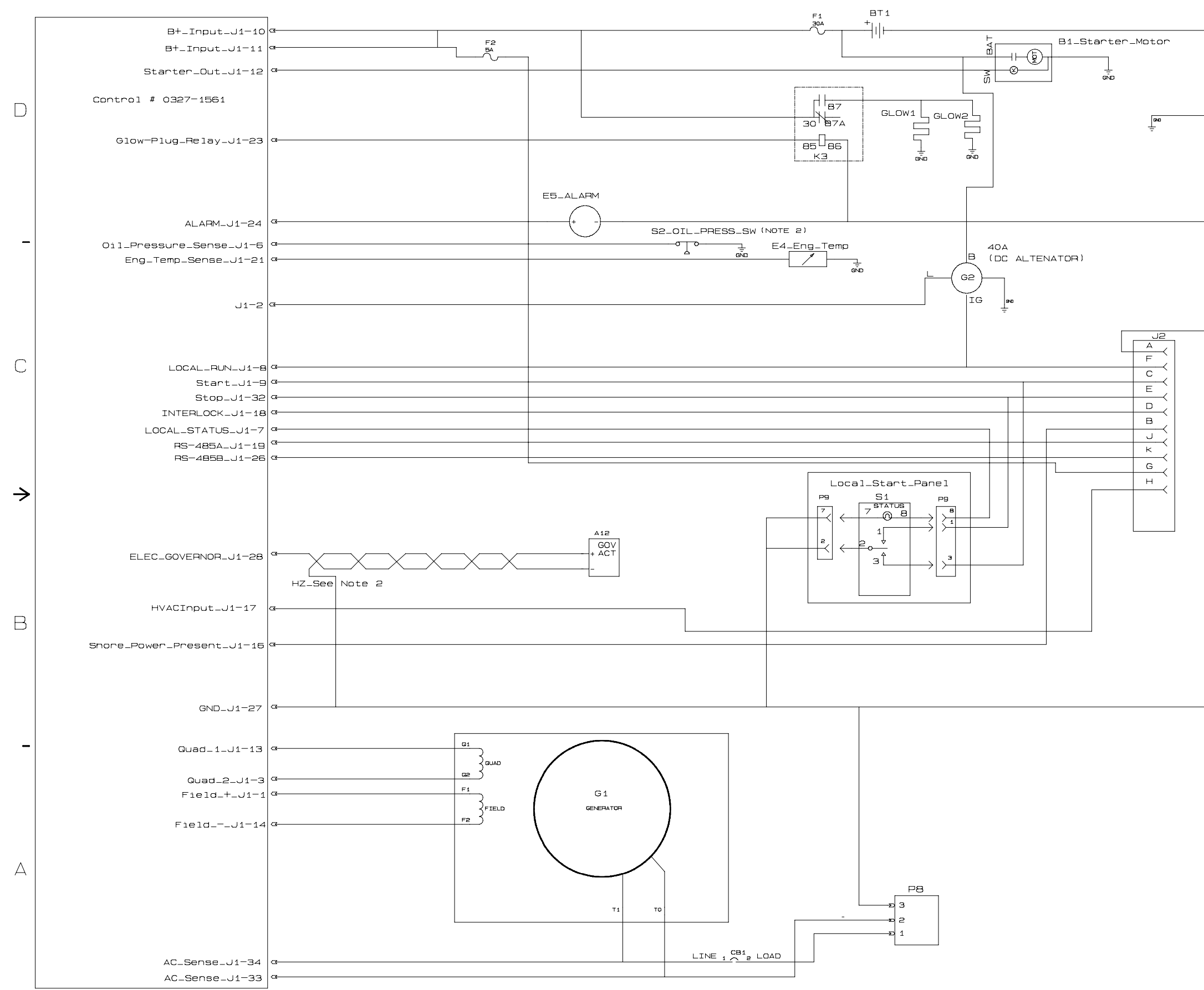
Do not place the APU in service until all installation review items have been checked off.

Check List

- [] The APU is securely bolted to the left or right vehicle frame rail ahead of the rear wheels.
- [] There is clearance to connect and disconnect coolant lines, fuel lines, AC wiring, remote control wiring and battery cables.
- [] The control panel on the APU is accessible for starting and stopping the APU and resetting the circuit breaker.
- [] There is access for checking, adding and draining engine oil and coolant.
- [] There is access for replacing the oil, fuel and air filters.
- [] The air inlet and outlet openings are free of obstructions.
- [] The exhaust tailpipe is connected and secure.
- [] The fuel dip tubes in the main fuel tank have been properly installed and the fuel lines have been secured at sufficient intervals to prevent chaffing and contact with sharp edges, electrical wiring and hot exhaust parts.
- [] AC wiring, remote control wiring and battery cables have been routed and secured at sufficient intervals to prevent chaffing and contact with sharp edges and hot exhaust parts.
- [] The Operator Panel is properly mounted and communicates with the APU.
- [] (Optional) The ignition key is connected to the APU's remote control circuit to cause the APU to shut down when the main vehicle engine is started.
- [] If provision has been made to connect shore power, the transfer switch is connected to the APU's remote control circuit to cause the APU to shut down when shore power is connected.
- [] The HVAC unit is connected to the APU's remote control circuit to cause the APU to start when the cab thermostat calls for heating or cooling (AUTO enabled).
- [] AC power is available to the HVAC unit when the APU is running.
- [] AC power is available to all power outlets in the cab when the APU is running.
- [] If the main engine is so equipped, AC power is available to the block heater when the APU is running.
- [] All fuel, coolant, oil and exhaust leaks have been repaired and there are no unusual noises.

8. Specifications

APU CONTROLLER: Integrated Microprocessor Based Engine and Generator Controller	
GENERATOR: Two-Bearing, Two-Pole Rotating Field, 3600 RPM, "Poly-Vee" Belt Drive	
Power (@1.0 power factor)	4000 W
Voltage	120
Frequency	60 Hz
Number of Phases	1
Current	33 amps
Line Circuit Breaker	30 amps
FUEL CONSUMPTION:	
No-load	0.25 gph (0.93 lph)
Half-load	0.35 gph (1.32 lph)
Full-load	0.55 gph (2.08 lph)
ENGINE: 2-Cylinder In-Line, Water-Cooled, Indirect-Injection, 2374 RPM, 4-Stroke Cycle Diesel	
Bore	2.64 in (67 mm)
Stroke	2.68 in (68 mm)
Displacement	29.23 in ³ (479 cc)
Compression Ratio	23 : 1
Fuel Injection Timing (BTDC)	18°–20°
Injection Order	1–2
Fuel Nozzle Injection Pressure	1991 psi (13.73 mPa)
Valve Lash: Intake & Exhaust (cold)	0.0059 – 0.0073 inch (0.145 – 0.185 mm)
Oil Capacity (with filter)	3.2 quart (3.0 liter)
Cooling System Capacity	2.5 quart (2.4 liter)
Lubricating Oil Pressure	14 to 64 psi over speed range
Cylinder Compression Pressure	414 to 469 psi, 327 psi minimum
DC SYSTEM:	
Nominal Battery Voltage	12 volts
Minimum Battery Capacity CCA (Cold Cranking Amps)	475 amps down to 0° F (–17° C) 650 amps down to –20° F (–29° C)
Battery Charging Capacity	40 Amperes
Fuse F1 (control, start and glow plug circuits)	30 amp mini-bayonet
Fuse F2 (Remote B+)	5 amp mini-bayonet
WEIGHT: 375 lbs (170 kg)	
SIZE (L x W x H): 25 x 21.2 x 28.8 in (635 x 539 x 732 mm)	
SOUND LEVEL: TBD dB(A) @ 10 ft (3m) in typical installation	

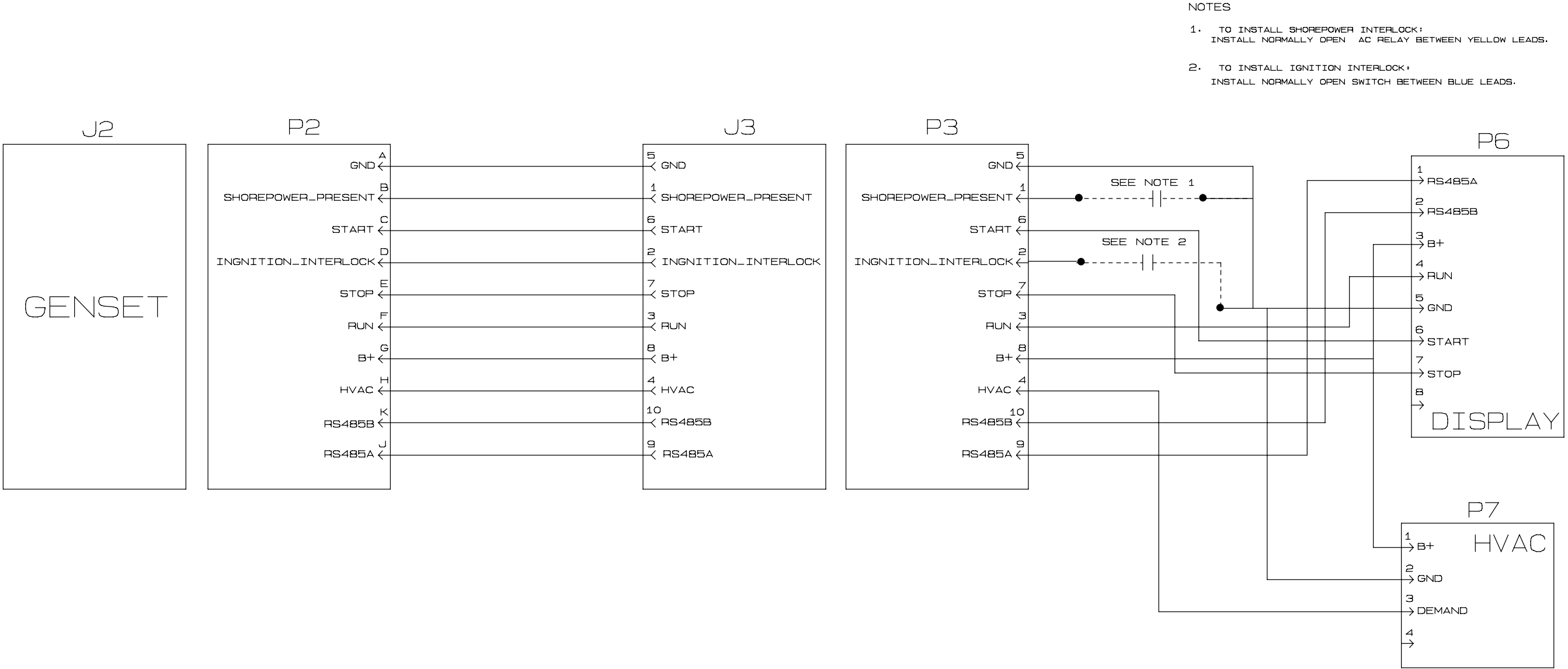


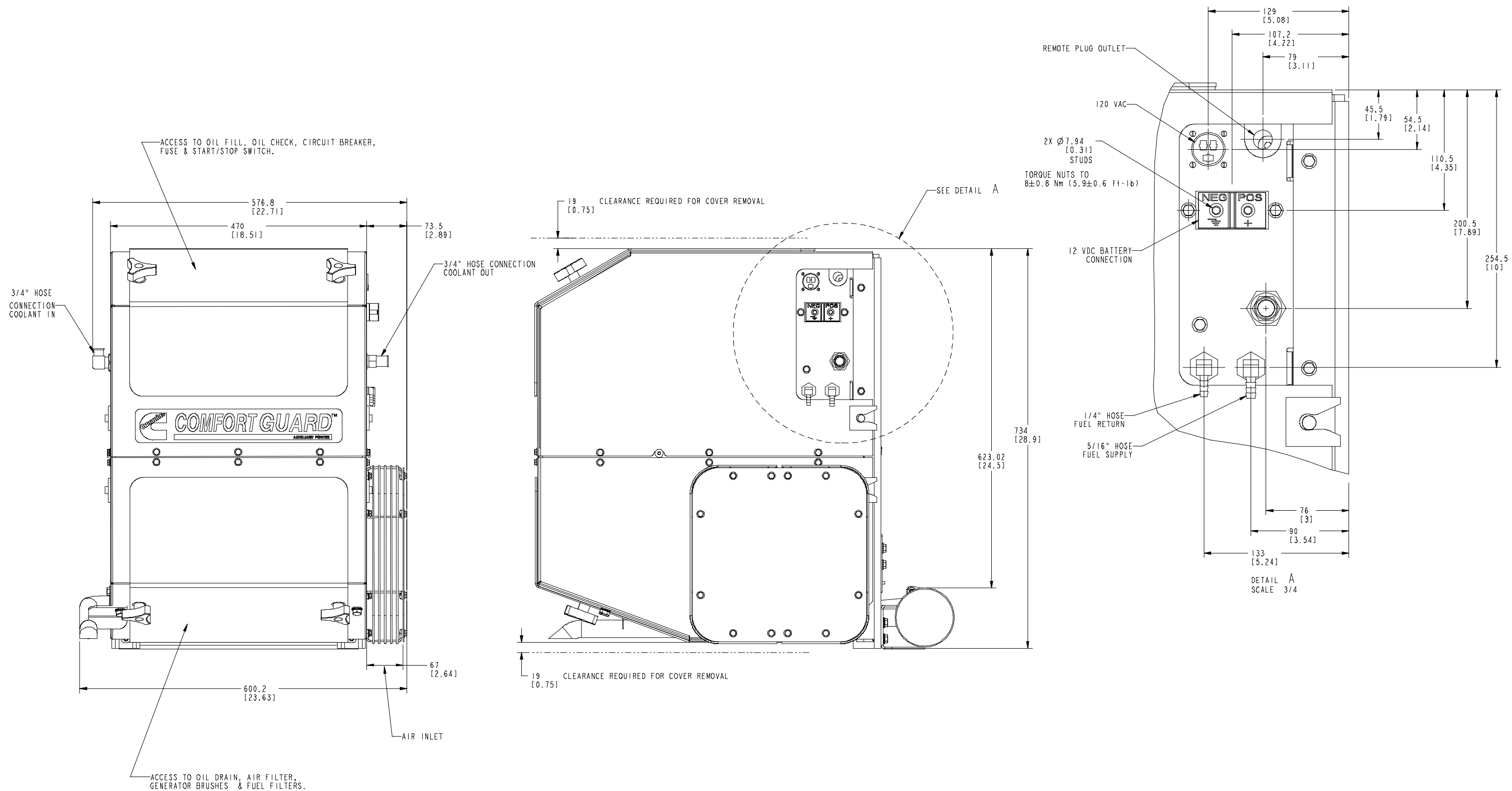
NOTES

- TO ADJUST OUTPUT VOLTAGE:
WITHIN 1 MINUTE OF START DISCONNECT,
PRESS AND RELEASE THE START SWITCH 6 TIMES WITHIN
10 SECONDS. THE STATUS LIGHT WILL BEGIN BLINKING
AT 1HZ. EACH PRESS AND RELEASE OF THE START SWITCH WILL
INCREASE THE VOLTAGE BY APPROXIMATELY 0.5 VOLTS.
VOLTAGE IS DECREASED (0.5V/SECOND) BY HOLDING THE START
SWITCH ON CONTINUOUSLY.
- SWITCH OPENS CB1 PRESSURE.

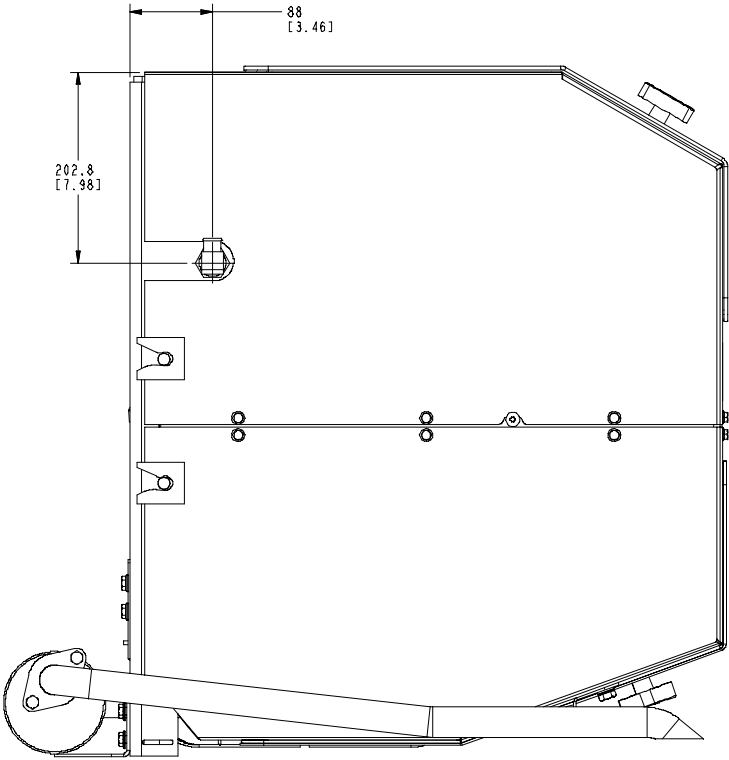
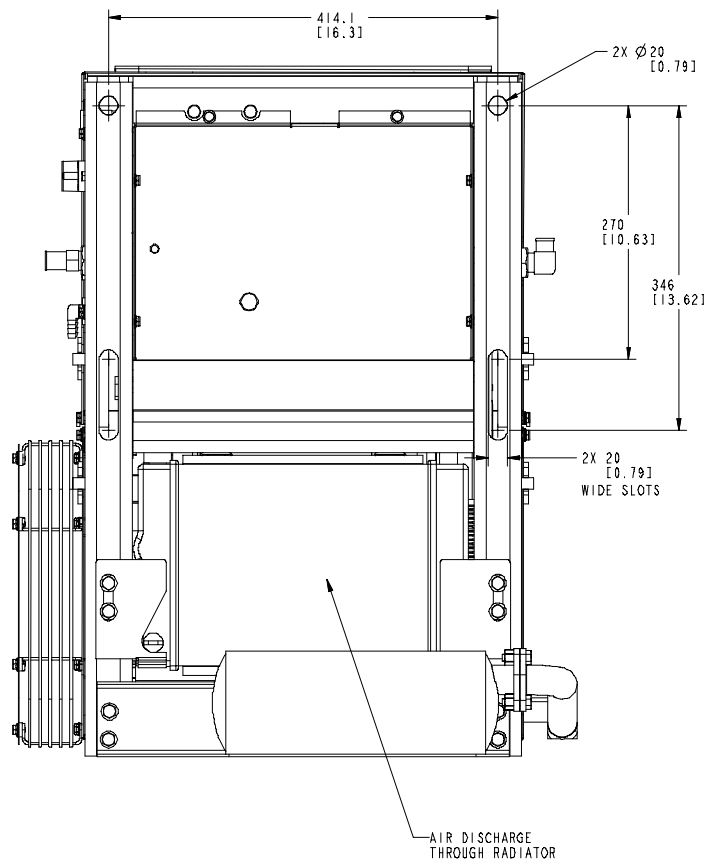
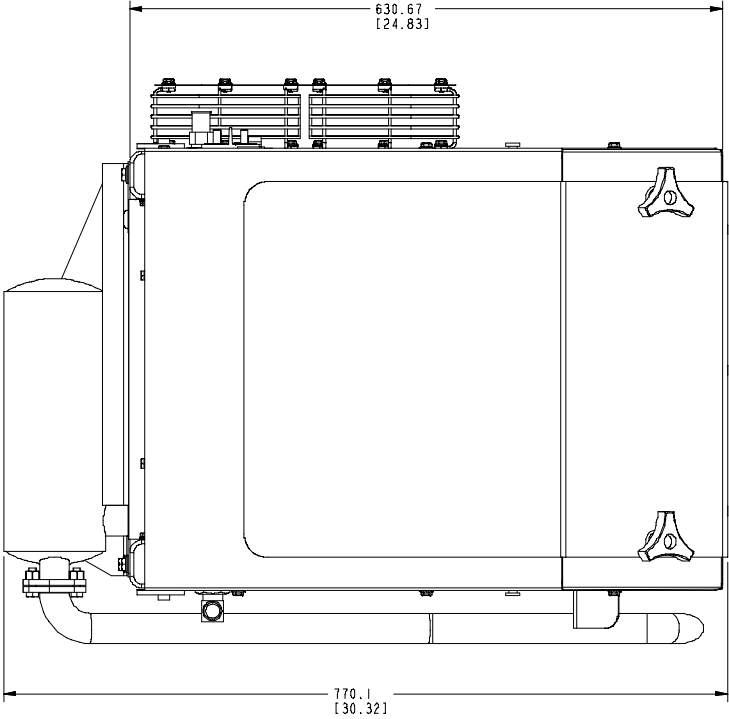
CONTROL SCHEMATIC—SHEET 1

A-1

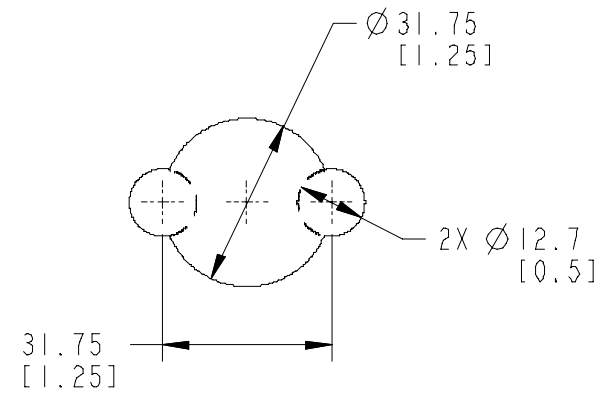




OUTLINE DRAWING—SHEET 1

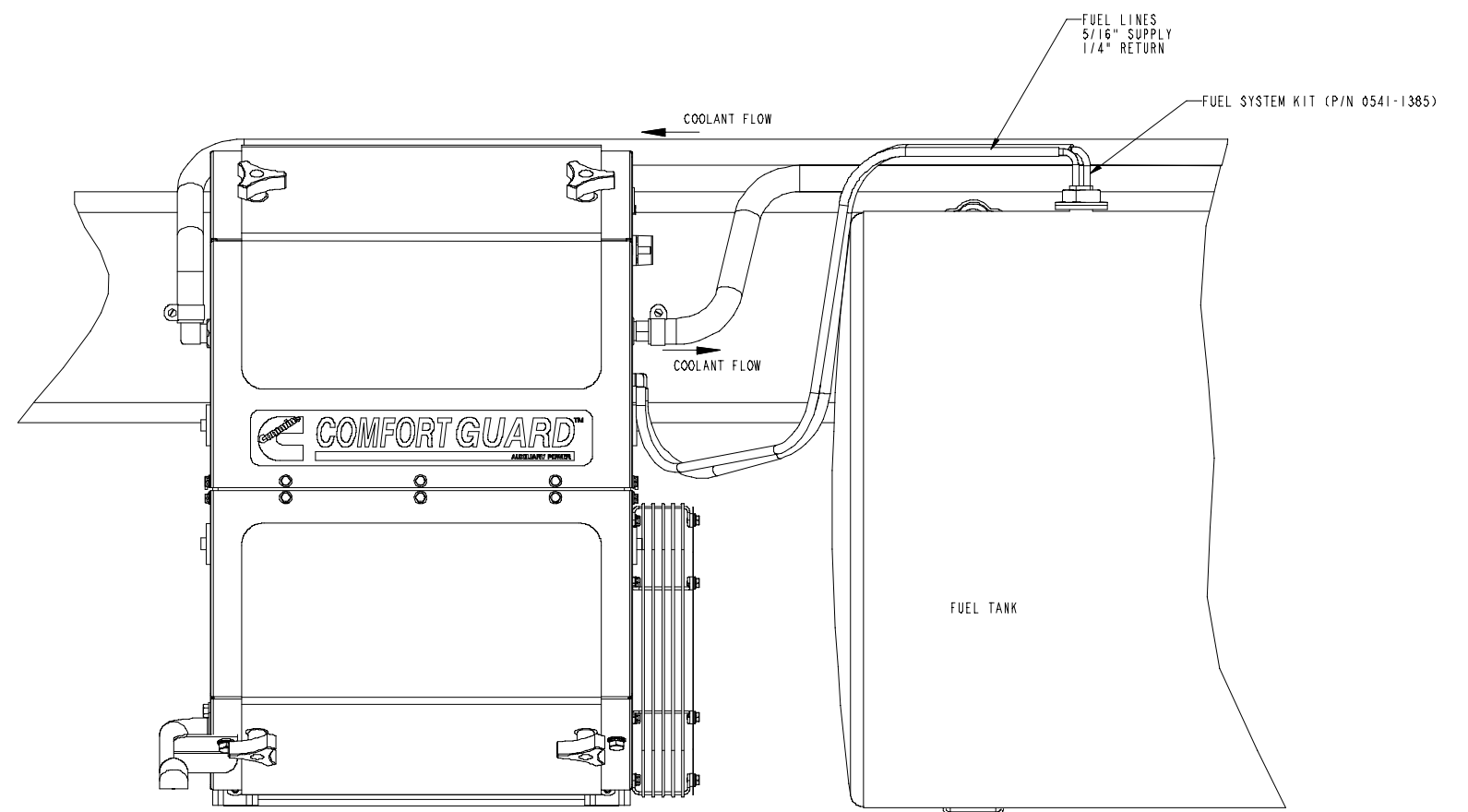
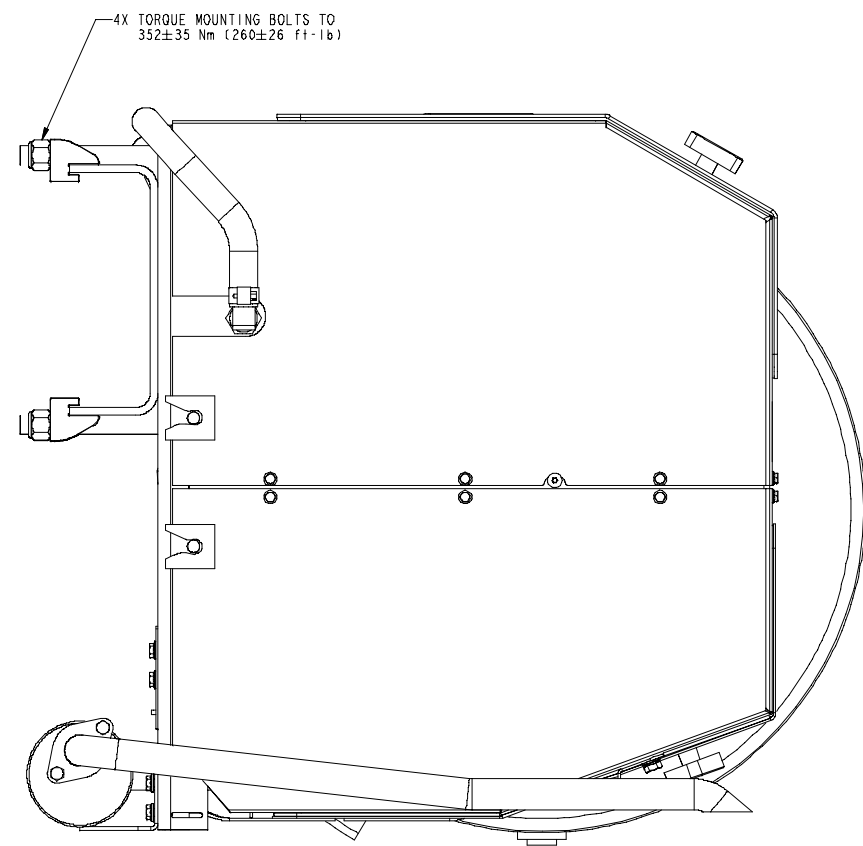


OUTLINE DRAWING—SHEET 2



FUEL TANK CUTOUT
FOR FUEL PICKUP TUBE

NOT TO SCALE, SEE FUEL KIT INSTRUCTION SHEET



OUTLINE DRAWING—SHEET 3

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