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Onan

RV GenSet

Installation Manual

KY

MicroLite™ 4000 Series



Printed in U.S.A.

981-0607
7-96



WARNING:



The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

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Safety Precautions

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

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 which will result in severe personal injury or death.*

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

⚠ CAUTION *alerts you to a hazard or unsafe practice which 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.

GENERAL PRECAUTIONS

- Keep ABC fire extinguishers handy.
- Make sure all fasteners are secure and torqued properly.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Before working on the genset, disconnect the negative (-) battery cable at the battery to prevent starting.
- Use caution when making adjustments while the genset is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.

- Benzene and lead in some gasolines have been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not to ingest, inhale or contact gasoline or its vapors.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.

GENERATOR VOLTAGE IS DEADLY!

- Generator output connections must be made by a qualified electrician in accordance with applicable codes.
- The genset must not be connected to the public utility or any other source of electrical power. Connection could lead to electrocution of utility workers and damage to equipment. An approved switching device must be used to prevent interconnections.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry and stand on a dry wooden platform.

FUEL IS FLAMMABLE AND EXPLOSIVE

- 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 flame, 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.
- Leaks can lead to explosive accumulations of gas. Natural gas rises when released and can accumulate under hoods and inside housings and buildings. LPG sinks when released and can accumulate inside housings and basements and other below-grade spaces. Prevent leaks and the accumulation of gas.

ENGINE EXHAUST IS DEADLY!

- Learn the symptoms of carbon monoxide poisoning in this Manual.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Do not use engine cooling air to heat a room or compartment.
- Make sure there is ample fresh air when operating the genset in a confined area.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.

- When disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last to reduce arcing.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.
- Keep guards in place over fans, belts, pulleys, etc.

1. Introduction

GENERAL

This manual provides installation guidelines for the MicroLite™ (KY) generator set (referred to as genset). The genset must be installed properly to operate reliably, quietly, and safely. Read this entire manual before starting the installation.

For operation and maintenance procedures, see the Operator's Manual (981-0139) that accompanies each genset.

When properly installed, this genset meets or exceeds the following requirements:

- National Electrical Code, NFPA 70-Article 551
- ANSI/RVIA EGS-1, Generator Set Standard
- ANSI A119.2/NFPA 501C Standard for Recreational Vehicles
- CSA Electrical Bulletin 946

The RV manufacturer and/or the genset installer must comply with local codes such as California administrative Code title 25, which applies to genset installations. The RV installer bears sole responsibility for the selection of the appropriate genset, installation design, and installation.

Consider the following requirements before installing the genset. Each topic is covered in the following text.

- Level and supportive mounting surface
- Accessibility for maintenance and service
- Adequate cooling and induction air
- Discharge of circulated air
- Noise levels
- Exhaust connections
- Fuel supply
- Electrical connections


MicroLite is a trademark of the Onan Corporation.

INSTALLATION CODES AND SAFETY RECOMMENDATIONS

The following list of Installation Codes and Safety Recommendations applies to the installation and operation of RV gensets. The address of each agency is listed so that copies of the codes may be obtained for reference. Installation codes and recommendations are subject to change, and may vary by location or over time. The RV manufacturer and the genset installer bear sole responsibility for following all applicable codes and regulations.

- | | |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1. ANSI-A119.2
FMVSS 301 | Recreational Vehicle
Industry Association
14650 Lee Road
Chantilly, VA 22021 |
| 2. NFPA 70 (N.E.C.)
NFPA-501C | National Fire Protection
Association
470 Atlantic Avenue
Boston, MA 02210 |
| 3. CSA Electrical
Bulletin #946
Construction Materials | Canadian Standards
Association, Housing and
Section
178 Rexdale Blvd.
Rexdale, Ontario,
Canada M9W 1R3 |
| 4. California
Administrative
Code - Title 25
Chapter 3 | State of California
Documents Section
P.O. Box 1015
North Highlands, CA
95660 |

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

 *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 and/or mechanical component installation.

COMPONENT LOCATIONS

The standard control panel and routine maintenance items are located behind the access cover (Figure 1-1).

To remove the access cover: Rotate the latches one-quarter turn counterclockwise. Pull the top of the cover away from the housing and lift to remove.

To secure the access cover: Position the bottom of the cover over the base. Push the top of the cover in and rotate the latches one-quarter turn clockwise. Inspect the access cover to make sure it is mounted flush with the housing and secure.

⚠ WARNING Operation of the genset with the access cover removed can result in severe personal injury or equipment damage. Hot components are exposed when the access cover is removed and genset cooling air does not circulate properly. Do not operate the genset with the access cover removed.

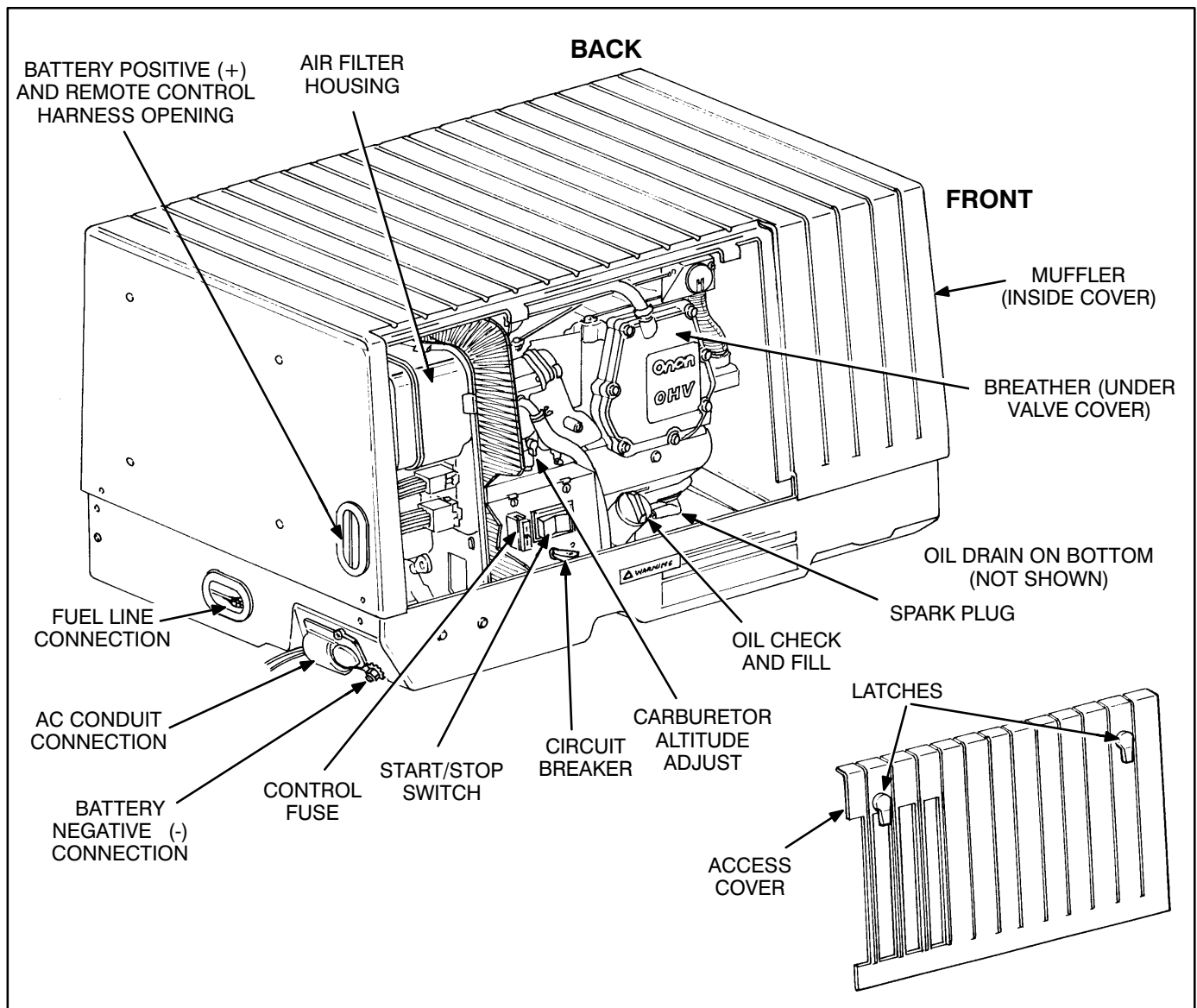


FIGURE 1-1. MICROLITE (KY) GENERATOR SET COMPONENT LOCATIONS

2. Specifications

MODEL	GASOLINE MODELS		LPG MODELS	
	4.0 KY	3.6 KY	3.6 KY	3.3 KY
GENERATOR: 2-Pole Revolving Field, Self-Excited, Electronically Regulated, 1-Phase				
Power	4000 watts	3600 watts	3600 watts	3300 watts
Frequency	60 Hertz	50 Hertz	60 Hertz	50 Hertz
Voltage	120 volts	220 volts	120 volts	110/220 volts
Current	33.3 amperes	16.4 amperes	30 amperes	30/15 amperes
Speed	3600 rpm	3000 rpm	3600 rpm	3000 rpm
FUEL CONSUMPTION:	Gasoline		LPG	
No load	0.29 gph (1.1 l/h)	0.21 gph (0.8 l/h)	1.5 lbs/h (0.7 kg/h)	1.1 lbs/h (0.5 kg/h)
Half load	0.48 gph (1.8 l/h)	0.37 gph (1.4 l/h)	2.4 lbs/h (1.1 kg/h)	2.2 lbs/h (1.0 kg/h)
Full load	0.71 gph (2.7 l/h)	0.58 gph (2.2 l/h)	3.1 lbs/h (1.4 kg/h)	2.9 lbs/h (1.3 kg/h)
ENGINE: 1-Cylinder, 4-Cycle, Spark-Ignited, OHV, Air Cooled				
Bore	3.11 inch (79 mm)		3.11 inch (79 mm)	
Stroke	2.44 inch (62 mm)		2.44 inch (62 mm)	
Displacement	18.5 inch ³ (304 cc)		18.5 inch ³ (304 cc)	
Compression Ratio	8.5 : 1		8.5 : 1	
Oil Capacity*	1.6 quart (1.5 l)		1.6 quart (1.5 l)	
Intake Valve Clearance (Cold)	0.002 inch (0.05 mm)		0.002 inch (0.05 mm)	
Exhaust Valve Clearance (Cold)	0.002 inch (0.05 mm)		0.002 inch (0.05 mm)	
Spark Plug Gap	0.025 inch (0.64 mm)		0.020 inch (0.51 mm)	
Spark Plug Tightening Torque	13 lbs-ft (17 N-m)		13 lbs-ft (17 N-m)	
Ignition Timing (magneto type ignition)	25° BTDC, non-adjustable		25° BTDC, non-adjustable	
LPG Vapor Supply Pressure (Range)	-		9 to 13 inch (229 to 330 mm) W.C. (water column)	
DC SYSTEM:				
Nominal Battery Voltage	12 volts		12 volts	
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes		360/450 amperes	
Control Fuse	5 amperes		5 amperes	
Maximum Regulated-Voltage Battery Charging Current	-	10 amperes	-	10 amperes
* -See <i>Periodic Maintenance</i> for oil filling instructions.				

3. Step-By-Step Installation Outline

INTRODUCTION

This section is a step-by-step overview of a typical installation. This section includes:

- Preparation
- Compartment Mounting
- Under-Floor Mounting
- Connecting to Vehicle Systems
- Exhaust System

Review this section, then refer to the detailed instructions that are given in sections four through eight for specific procedures and important safety precautions before starting the installation. The installer is responsible for complying with all applicable installation codes and safety requirements.

PREPARATION

1. Remove the wooden shipping crate by prying the bottom of the crate's sides and ends out from the wooden skid base. Carefully lift the crate off the genset and discard.

Remove the plastic bag covering the genset and collect loose shipped items, like the Operator's Manual, and add them to the vehicle documentation package.

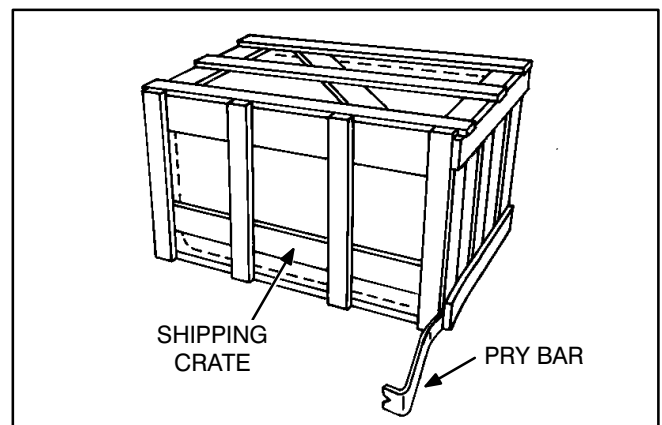


FIGURE 3-1. CRATE REMOVAL

2. Remove the mounting bolts that secure the shipping bracket to the wooden skid. Raise the set with a lift truck or tilt the genset backwards to access the mounting bolts. Do not tip the genset forward or oil may spill into the breather. See Figure 1-1 on Page 1-2.

⚠ CAUTION *Do not tip the genset forward or oil may spill into the breather. Raise the set with a lift truck or tilt the genset backward to access the shipping skid mounting bolts.*

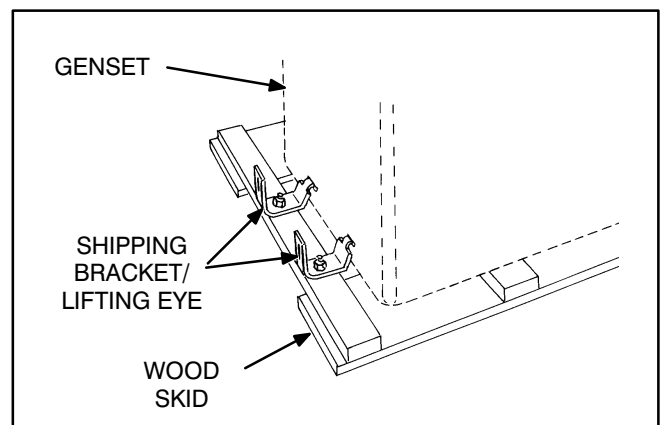


FIGURE 3-2. SKID BASE REMOVAL

COMPARTMENT MOUNTING

Install the genset in its own compartment. If any part of the compartment is above the vehicle floor, separate the compartment from the living quarters with vapor-tight walls. Refer to the *Mounting* section for compartment construction details.

⚠ WARNING *Exhaust gases present the hazard of severe personal injury or death. Compartment walls must be vapor tight to the interior of the vehicle.*

The genset requires an unobstructed air inlet of at least 40 square inches (258 cm²). Refer to the *Mounting* and *Ventilation* section for details.

Provide an adequate genset access for maintenance (11.25 x 19.5 inch minimum opening) and service removal either through the door or out the bottom.

1. Carefully measure the compartment size to make sure there will be proper clearance for the genset. Figure 3-3 shows the compartment dimensions. Add 1/2 inch to compartment depth if 1/2-inch insulation is used inside the door.

Allowing one to two inches of added space on the left side of the compartment will make electrical and fuel connections easier. See Figure 3-5.

2. Put holes in the bottom of the compartment for genset mounting, air outlet and oil drain (Figure 3-4). If the bottom of the compartment is wooden, remove the wooden section under compartment and replace it with a sheet metal floor and an adequate steel support frame. (Refer to Onan template number 539-1546).

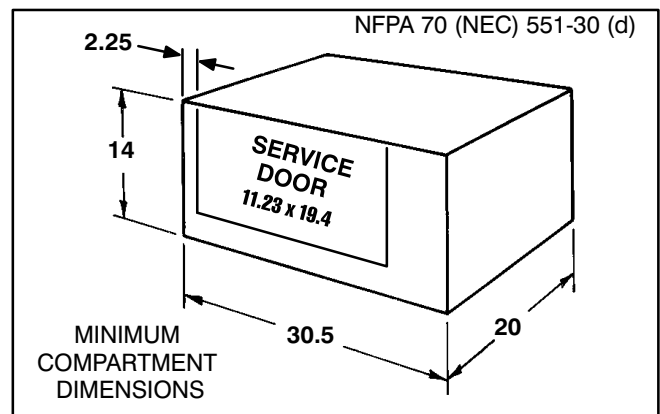


FIGURE 3-3. COMPARTMENT DIMENSIONS

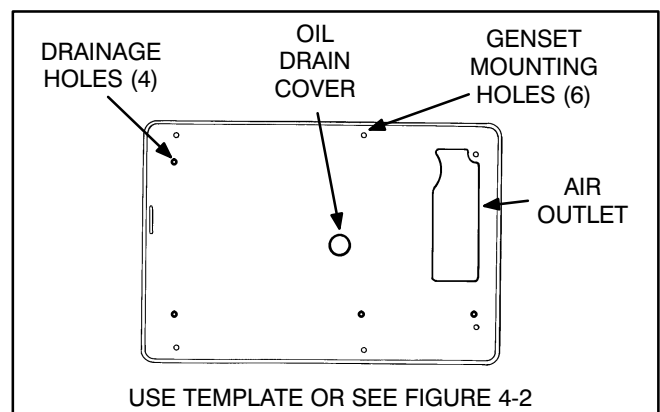


FIGURE 3-4. COMPARTMENT FLOOR TEMPLATE

- Put holes in the compartment to run connections for the fuel line, battery cable, remote control harness and AC conduit. Make the holes large enough so they do not pinch or chafe the lines. Use grommets and sealant around the lines to prevent damage to the lines and leakage of deadly exhaust gas.

If the remote control harness or AC conduit go directly into the interior of the vehicle, seal around the wires and inside the conduit to prevent the passage of exhaust gases. The fuel line must not be routed through the interior of the vehicle.

- Mount the genset in the compartment with six 5/16-18 screws. Screw length must not protrude more than 1/2-inch (13 mm) through the genset base.
- Proceed to Connecting To Vehicle Systems (page 3-5).

UNDER-FLOOR MOUNTING

An optional under-floor mounting kit is available for under-floor mounting. Support brackets are used to suspend the genset below the floor of the vehicle. Refer to the instructions that are supplied with the kit for specific installation instructions and important safety precautions. For additional under-floor mounting information refer to the *Mounting* section.

- Use the template to locate the holes in the vehicle support structure. (Reference Onan template number 539-1535).

⚠ WARNING *Failure to provide an adequate support structure can result in severe personal injury, death, and/or equipment damage. Carefully follow the Under-Floor Housing kit installation instructions and provide an adequate support structure. Use specified hardware and tighten all mounting hardware to the recommended torque settings.*

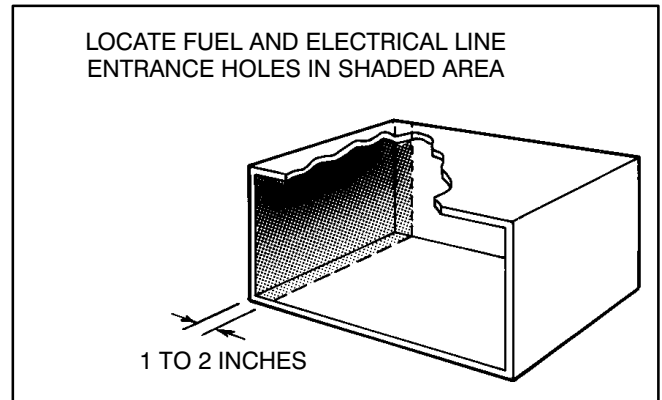


FIGURE 3-5. GENSET TO VEHICLE SYSTEMS CONNECTIONS

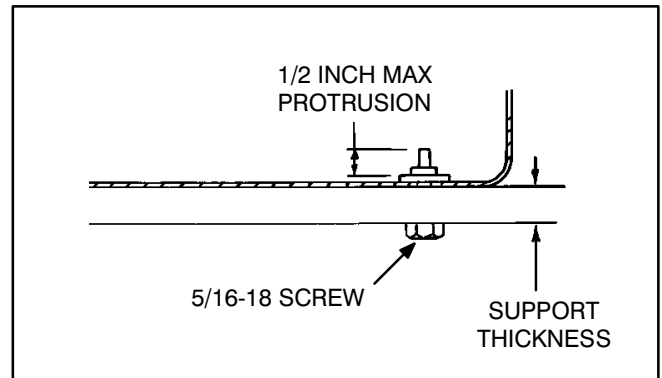


FIGURE 3-6. COMPARTMENT MOUNTING

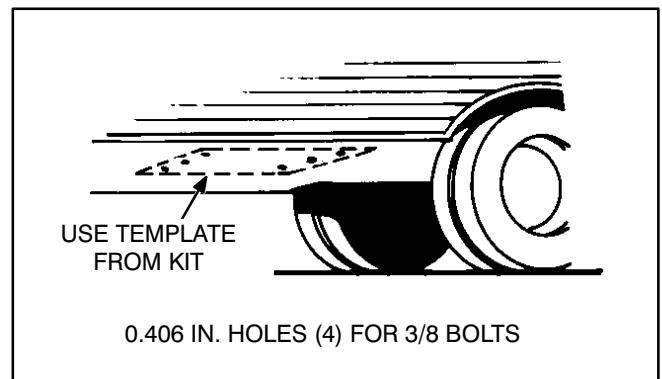


FIGURE 3-7. UNDER-FLOOR MOUNTING TEMPLATE

2. If the area above the compartment is made of a wood product, you must install a 26-gauge (0.02-inch) galvanized metal plate (or equivalent) above the genset.

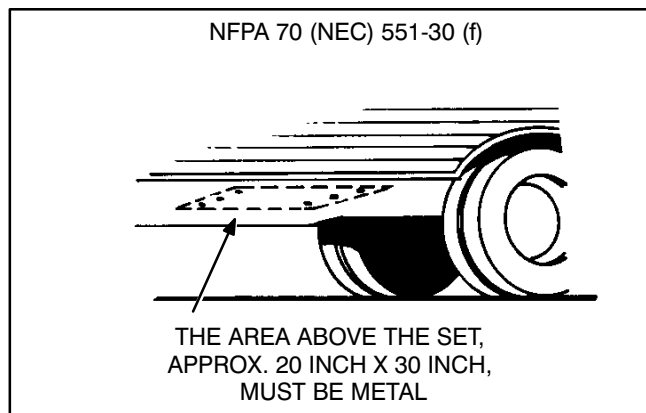


FIGURE 3-8. UNDER-FLOOR MOUNTING KIT WITH METAL CEILING (NOT SUPPLIED WITH KIT)

3. Assemble the Under-Floor Housing kit according to the instructions supplied with the kit.

⚠ WARNING *Dropping the genset can cause severe personal injury or death. Make sure no one moves the vehicle during installation by removing the keys and disconnecting the negative (-) battery cable. Keep feet and hands clear during installation.*

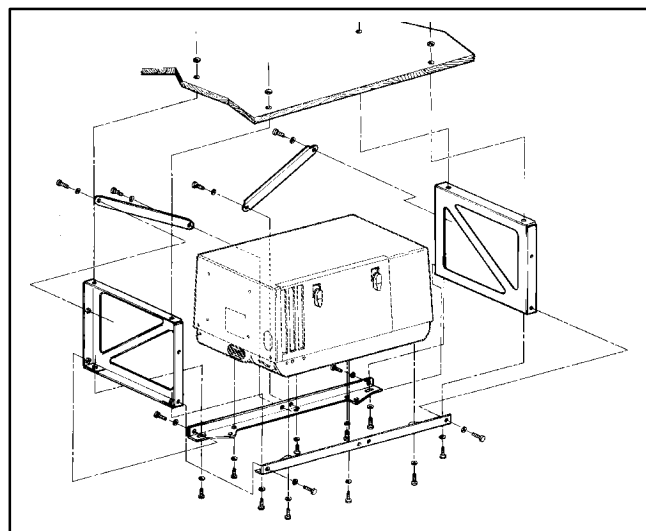


FIGURE 3-9. UNDER-FLOOR MOUNTING KIT

4. Use a forklift to carefully raise the genset into position and mount the side panels to the support frame.
5. Proceed to the next section on connecting to the vehicle systems.

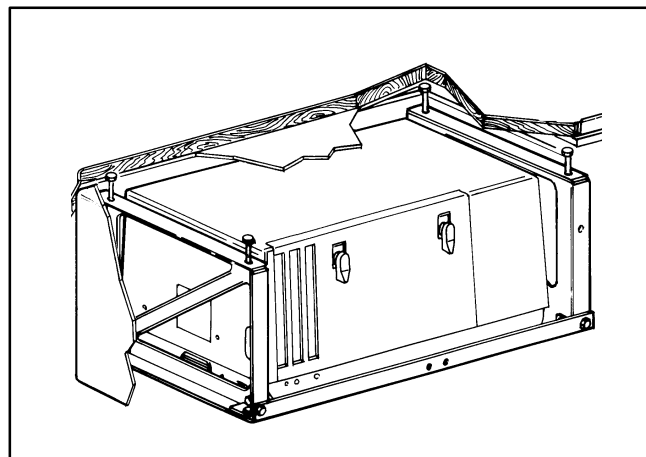


FIGURE 3-10. UNDER-FLOOR INSTALLATION

CONNECTING TO VEHICLE SYSTEMS

1. Route fuel line separate from electrical wires or separate them with conduit or other sheathing.

⚠ 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 switch or equipment, or other ignition sources near fuel or in the installation area. Read the important safety precautions in the Fuel Systems section.*

2. **Gasoline Fuel:** Connect a 1/4-inch I.D. fuel hose (type SAE 30-R7) to the barb fitting on the genset.

Secure fuel hose to barb fitting with a stainless steel clamp (worm-gear type). Do not over-tighten clamp or hose could be damaged.

LPG Fuel: Connect a fuel line (see LPG Fuel system) to the 5/8-18 45° flare fitting on the genset.

3. Assemble the enclosed conduit clamp to the genset base. Install a listed 1/2-inch flexible conduit over the AC wiring. (Use water-tight conduit for under-floor mounting.) Secure the conduit to the fitting on the genset. Make certain that lines do not contact sharp, hot or abrasive edges.

⚠ WARNING *Accidental starting can cause severe personal injury or death. Do not connect the battery cables to the genset starting battery until instructed to in the Initial Start and Checks section.*

4. Remove the access cover. Route the battery positive (+) cable through the access hole in the left side of the housing. Connect the battery positive (+) cable (with a 3/8-inch ring terminal) to the B+ connection on the start solenoid. Refer to the Electric Connections section for cable sizing requirements.

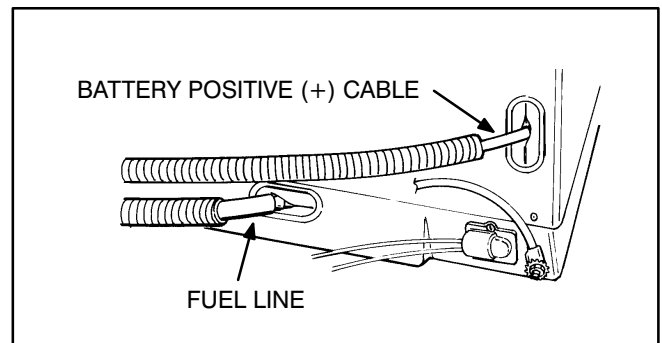


FIGURE 3-11. FUEL AND ELECTRIC LINES

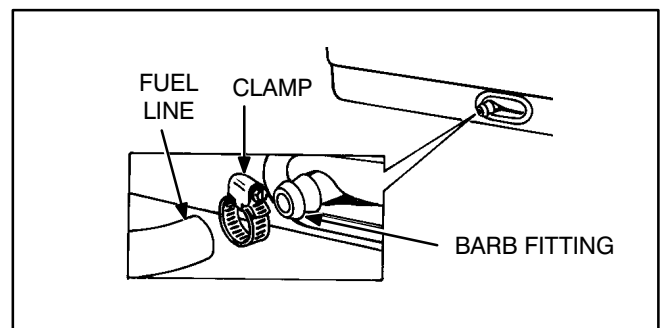


FIGURE 3-12. GASOLINE FUEL LINE CONNECTION

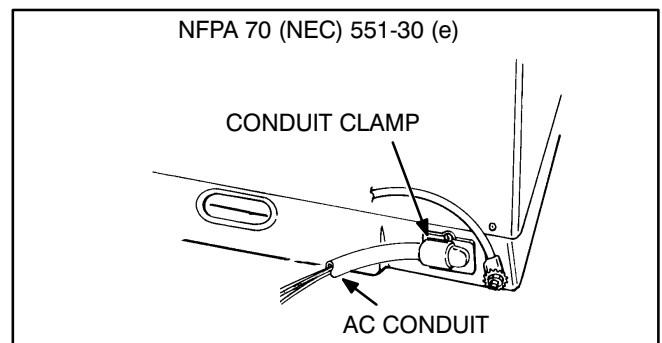


FIGURE 3-13. AC CONDUIT CONNECTION

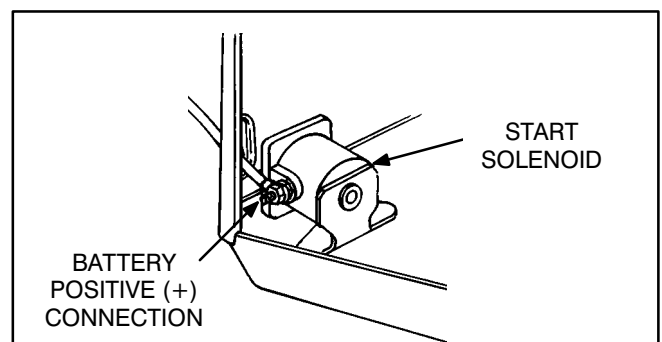


FIGURE 3-14. BATTERY POSITIVE (+) CONNECTION

5. Connect the battery negative (-) cable (with a 3/8-inch ring terminal) to the ground connection on the left side of the genset base. Refer to the Electrical Connections section for important genset grounding and battery cable sizing instructions.

⚠ WARNING *Failure to ground the genset properly can result in injury or death. If the genset is not grounded to the vehicle chassis through the battery negative (-) cable, attach an 8 AWG equipment ground wire between the vehicle chassis and the battery negative (-) connection.*

6. Route the remote control connector through the access opening in the left side of the housing. Connect the remote control connector to the mating connector inside the genset. Keep the connector inside the genset to keep it clean.
7. Proceed to the next section on connecting the exhaust system.

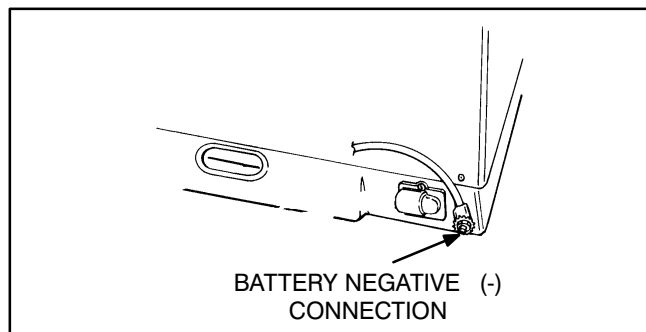


FIGURE 3-15. BATTERY NEGATIVE (-) CONNECTION

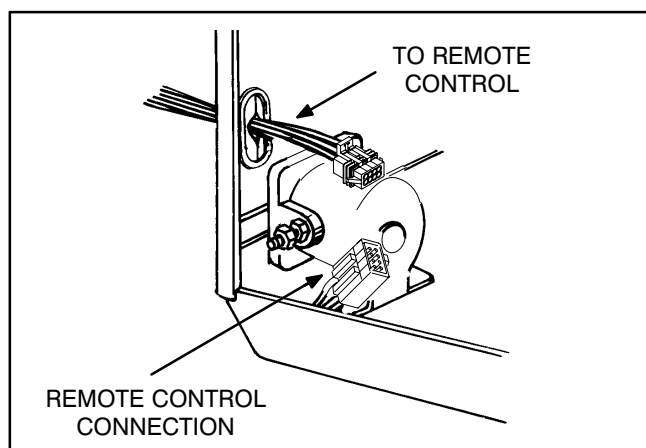


FIGURE 3-16. REMOTE CONTROL CONNECTION

EXHAUST SYSTEMS

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Do not terminate the exhaust pipe under the vehicle. The exhaust pipe must not terminate so that any vent, window, or opening into the living area is within the circular area shown in Figure 3-21. Read the important safety precautions in the Exhaust Systems section.*

1. Connect the exhaust pipe (1 1/4-inch O.D. or 1 1/8-inch I.D., installer-supplied) to the genset with a U-bolt clamp.

Refer to the Onan accessory catalog for optional exhaust kits.

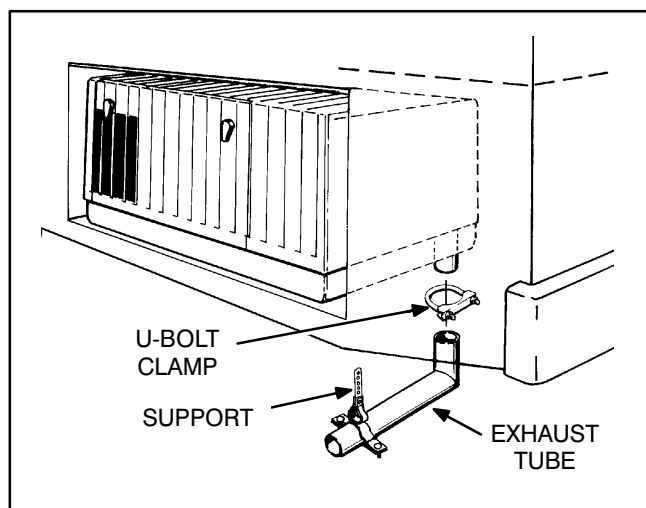


FIGURE 3-17. EXHAUST PIPE CONNECTION

2. Do not terminate the exhaust tail pipe under the vehicle. The exhaust tail pipe must terminate 1 inch (25.4 mm) beyond the side or end of the vehicle.

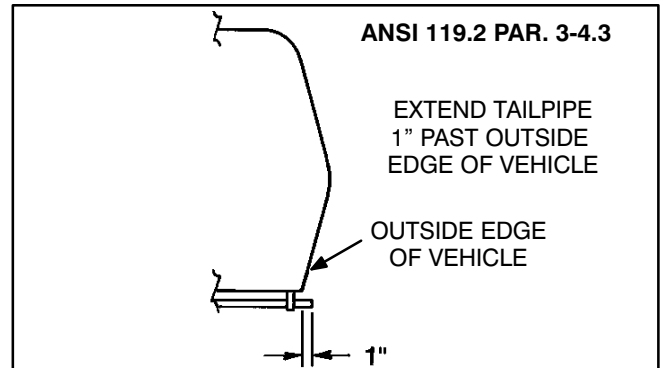


FIGURE 3-18. TAILPIPE EXTENSION BEYOND VEHICLE

3. Support the tail pipe as close to the outside of the vehicle as possible. The tailpipe hanger should include a flexible (rubber) member for isolation.

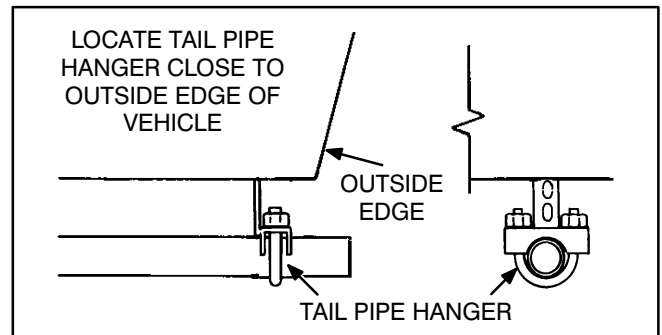


FIGURE 3-19. EXHAUST PIPE SUPPORT

4. Termination of the exhaust tail pipe below the angle of departure (lowest point on rear of vehicle to the tire ground contact point) must be protected by a skid bar, trailer hitch, or some frame member.

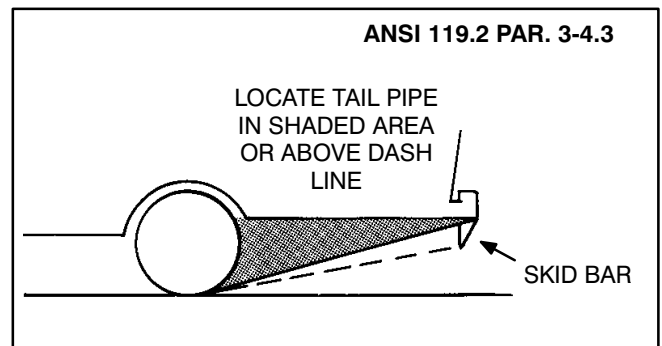


FIGURE 3-20. TAIL PIPE PROTECTION

5. Be aware that any vent, window, or opening that can be opened and that is not permanently sealed from the vehicle living space, can be an avenue for carbon monoxide.

The tail pipe must not terminate so that any vent, window, or opening into the living area is within the shaded area shown in Figure 3-21.

6. Refer to each of the sections in this manual for detailed installation instructions and for important safety precautions. Always follow the procedures in the Initial Start and Checks section when the installation is complete.

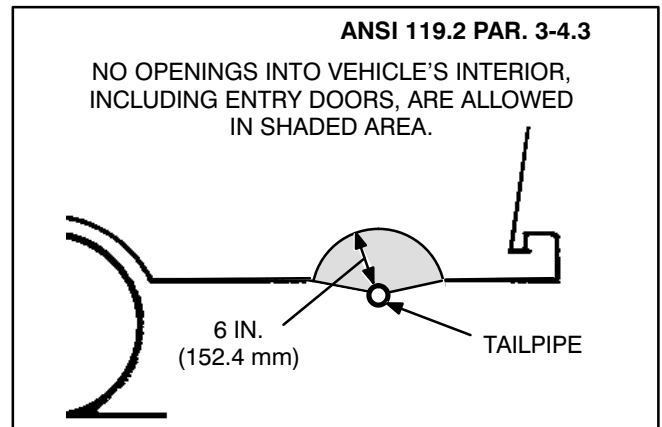


FIGURE 3-21. TAIL PIPE LOCATION

4. Mounting

GENERAL

MicroLite gensets are designed for either compartment or underfloor mounting. Installations must comply with all applicable Installation Codes and Safety Recommendations (see the Introduction section). Choose the appropriate section and carefully follow the instructions. Read any applicable kit instructions before installing the genset.

COMPARTMENT MOUNT

In a compartment mount, the genset is installed in a frame that is part of the vehicle. This frame must be constructed according to safety-approved specifications (see Compartment Construction).

The compartment support structure must be able to support the weight of the genset in a dynamic environment. The dynamic conditions imposed on the support structure should not exceed cyclic vertical forces of ± 516 lb (± 3 g-force) and cyclic horizontal forces of ± 172 lb (± 1 g-force).

⚠ WARNING *Failure to provide an adequate support structure can result in the genset falling from the vehicle, which can result in severe personal injury, death, and/or equipment damage. Carefully follow installation instructions and provide an adequate support structure. Use specified hardware and tighten all screws and nuts to the recommended torque settings.*

Unless the genset will be removed from underneath the vehicle, make the access opening large enough to remove the genset. Allow enough clearance for removal of the access cover for periodic maintenance. See Figure 1-1.

Minimum compartment dimensions are shown in Figure 4-1. Clearances between the genset and the compartment are included in these dimensions.

Allow for air intake at the front left side of the genset and air discharge at the bottom of the genset. Air in-

lets to the genset compartment must not allow dirt, rocks, water, or slush to reach the genset. Minimize dust and salt entrance into the compartment. (See *Ventilation* section.)

Exposed above-floor section of exhaust pipe must be shielded with the Onan-supplied exhaust shield.

Compartment Construction

1. Install the genset in its own compartment. Allow a minimum of 1/4-inch (6.4 mm) clearance at the front, sides, back and top of the genset. See Figures 4-1 and 4-2.

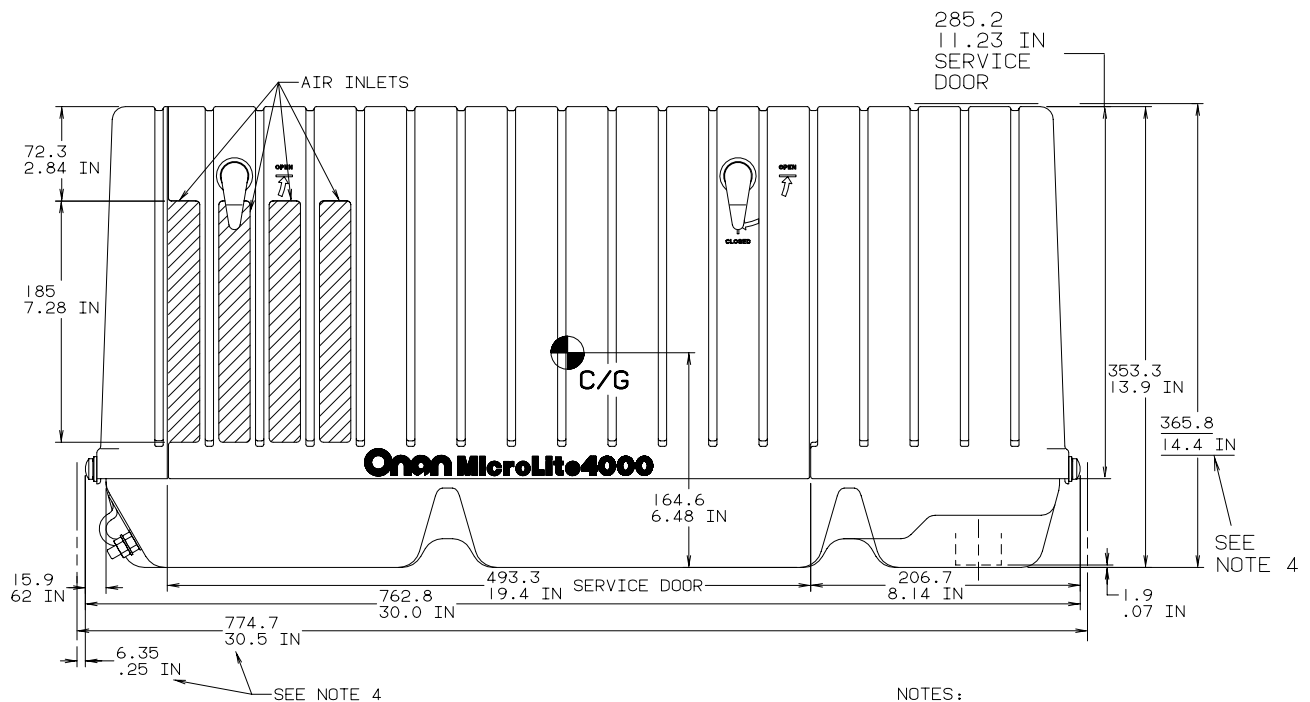
Allow additional front (service side) clearance if the vehicle air inlet is not aligned with the genset air inlet, to obtain the minimum free air inlet of 40 in² (258 cm²).

Example: If the air inlet is along the entire bottom front edge of the compartment, increase the front clearance to 1-1/3 inches (34 mm).
40 in² ÷ 30 in (air inlet length) = 1-1/3 in.

If insulation is used to line the compartment, increase the compartment size to include the width of the insulation. (See Acoustics section for insulating material specifications.)

2. Use template 539-1546 to cut the opening in the compartment floor for the oil drain and air outlet (refer to Figure 4-2).
3. If any part of the compartment is above the vehicle floor, separate the compartment area from the living quarters and fuel supply with vapor-tight walls.
4. Line the compartment walls with 26-gauge galvanized steel or a material of comparable strength and fire resistance (see NFPA 70, NEC and California Title 25 for complete details).

⚠ WARNING *Exhaust gases present the hazard of severe personal injury or death. Make the compartment walls vapor-tight to the interior of the vehicle to prevent exhaust fumes from entering.*



NOTES:

1. PRIMARY DIMENSIONS ARE MILLIMETERS.
2. COMPARTMENT ACCESS SHALL ALLOW REMOVAL AND REPLACEMENT OF SERVICE DOOR AND ACCESS TO THE FOLLOWING SERVICEABLE COMPONENTS:

START-STOP SWITCH, FUSE
CIRCUIT BREAKER
OIL FILL AND CHECK
AIR CLEANER ELEMENT
CARB AND CHOKE ADJUSTMENTS
SPARKPLUG, VALVE COVER
START SOLENOID

3. MIN UNIT CLEARANCE FROM COMPARTMENT SURFACES:

TOP	12.5	.50 IN
ENGINE END	6.4	.25 IN
GEN END	6.4	.25 IN
SERVICE SIDE **	6.4	.25 IN
BACKSIDE	6.4	.25 IN
MIN FREE AIR INLET	258CM ²	40IN ²
UNIT WEIGHT	172 LB	

- ** SERVICE SIDE CLEARANCE OF .25 IN REQUIRES DIRECT ALIGNMENT OF SET AIR INLET AND OPENING IN ACCESS DOOR.

IF COMPARTMENT AIR INLET IS LOCATED ELSEWHERE, 1.50 IN MIN IS REQUIRED BETWEEN SET AND ACCESS DOOR TO MAINTAIN 40 IN² FREE AIR INLET

FOR DETAILED INSTALLATION SIZE REQUIREMENTS SEE:
539-1546 TEMPLATE-COMPARTMENT
539-1535 TEMPLATE-UNDERFLOOR

4. MINIMUM INSTALLATION SIZE IS 14.4 X 20 X 30.5 IN AND VARIES WITH MOUNTING KIT USED AND SERVICE DOOR ACCESS.

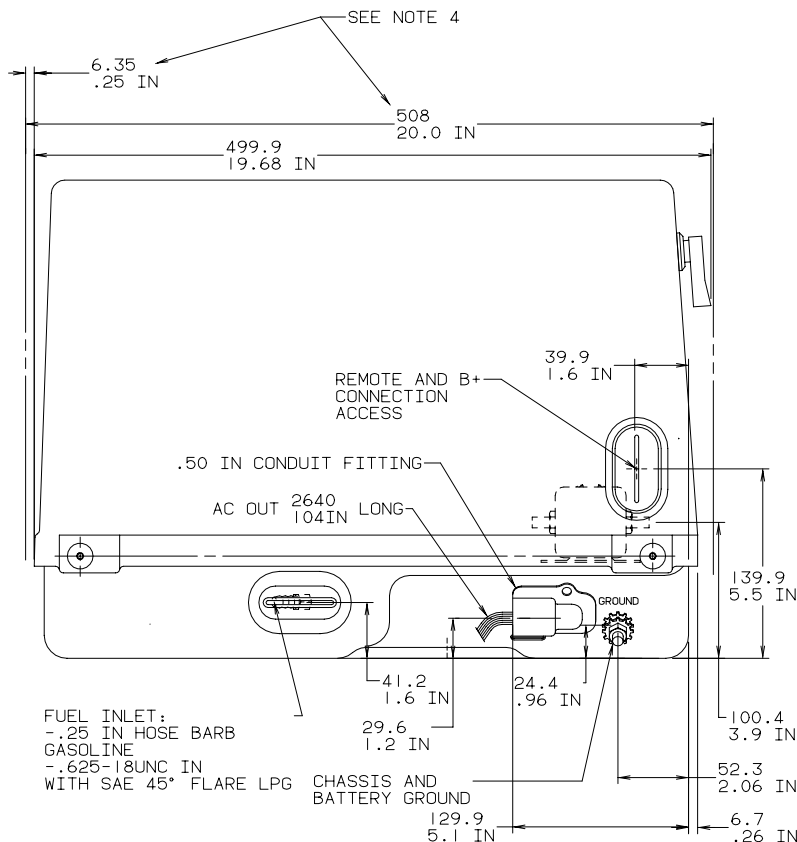


FIGURE 4-1. COMPARTMENT OUTLINE DRAWING

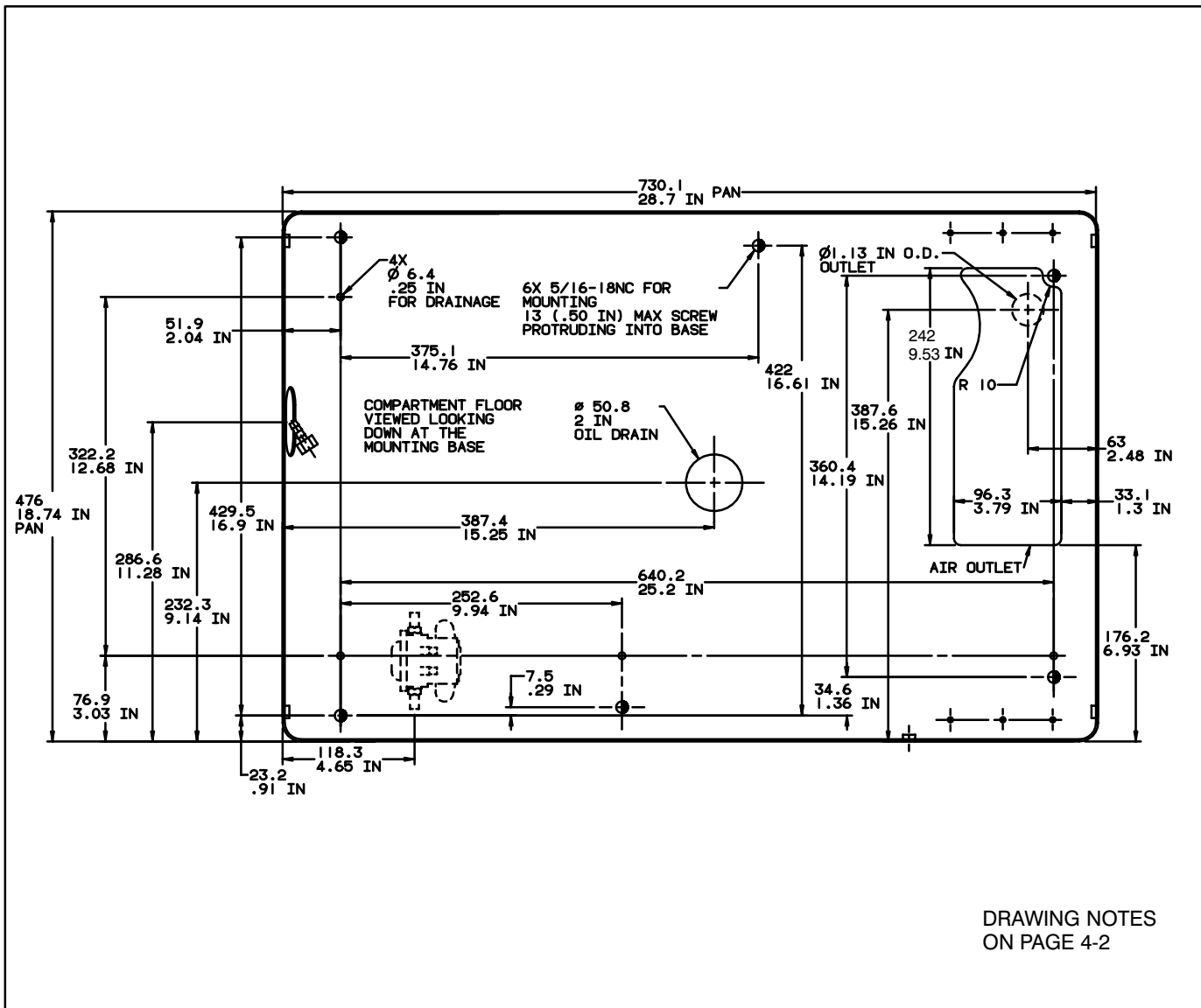


FIGURE 4-2. COMPARTMENT FLOOR PLAN (TOP VIEW)

-
4. Construct a compartment floor that will prevent oil, fuel or water accumulation. Provide openings in the compartment floor according to the Compartment Floor Plan, Figure 4-2.

Do not use absorbent soundproofing material on the compartment floor or oil and gas could cause a fire hazard. The floor should have as few openings as possible, to reduce the noise level.

5. Equip the base with an oil drain hole to the outside of the compartment. Do not mount the exhaust pipe below the oil drain hole.

⚠ WARNING *Fire presents the hazard of severe personal injury or death. Do not position the exhaust pipe directly below a drain hole. Hot exhaust can ignite fuel or oil.*

6. Secure the genset mounting base to the support frame with six 5/16-18 UNC grade 5 screws. The mounting bolts must not extend more than 1/2 inch (13 mm) into the base. See Figures 4-1 and 4-2. Torque 5/16 inch mounting screws to 15 ft lbs (20 N•m).

⚠ CAUTION *If the mounting base is not fastened securely to the vehicle compartment, road vibration will damage the genset components. Use long enough screws for at least 1-1/2 threads to extend through the weld nut. The mounting bolts must not extend more than 1/2 in. (13mm) into the base.*

UNDER-FLOOR MOUNT

In an under-floor installation, the genset is mounted below the floor and outside the passenger compartment of the vehicle. Read this section for general application information, and study the under-floor housing kit instructions for more information on under-floor installations and important safety precautions.

The vehicle support structure must be able to support the weight of the genset in a dynamic environment. The support structure must be capable of withstanding cyclical vertical forces of ± 516 lb (± 3 g-force) and cyclical horizontal forces of ± 172 lb (± 1 g-force).

⚠ WARNING *Failure to provide an adequate support structure can result in the genset falling from the vehicle, which can result in severe personal injury, death, and/or equipment damage. Carefully follow installation instructions and provide an adequate support structure. Use specified hardware and tighten all screws and nuts to the recommended torque settings.*

Carefully follow the design parameters in the instructions provided with the under-floor housing kit.

The vehicle manufacturer and/or the installer must provide a structurally sound support frame, using tubing, angle brackets, or steel-reinforced plywood or other composition board. Plywood or particle board can be reinforced with 3-inch (76 mm) or larger washers or a full metal plate.

If the genset will be installed below a wooden floor, a metal barrier must be installed between the wooden floor and the genset.

Use 26-gauge (0.0217 inch) painted or galvanized sheet metal or a material of comparable strength and fire resistance (see NFPA 70, NEC and California Title 25 for complete details).

⚠WARNING *Fire presents the hazard of severe personal injury or death. Install a metal barrier between the genset and any wooden or flammable parts of the vehicle.*

Figure 4-3 shows the most common mounting areas for a genset. Protect the genset from road splash and debris. If possible, drive the vehicle through mud and slush to test the installation.

Leave a minimum space of 1-1/2 inches (38.1 mm) between the genset and the vehicle skirt for an air inlet if a side air inlet is not aligned with the genset

air inlet. Provide a minimum back, top, and side clearance of 0.25 inches (6.4 mm).

The air inlet opening to the genset compartment must not admit dirt, rocks, water or slush. The entrance of dust and salt into the compartment must be minimized. Baffles may be needed to protect certain areas. See the *Ventilation* section of this manual for more detailed information.

Review the *Exhaust System* section. Plan clearances for moving or removing exhaust components when the genset is removed for service.

Access Opening: Provide an access opening to the genset on the side of the vehicle. Make the access large enough to allow for removal of the genset access cover. Also allow access to the oil drain located at the bottom of the genset, so the genset does not have to be removed for servicing (see Figure 1-1 for service locations).

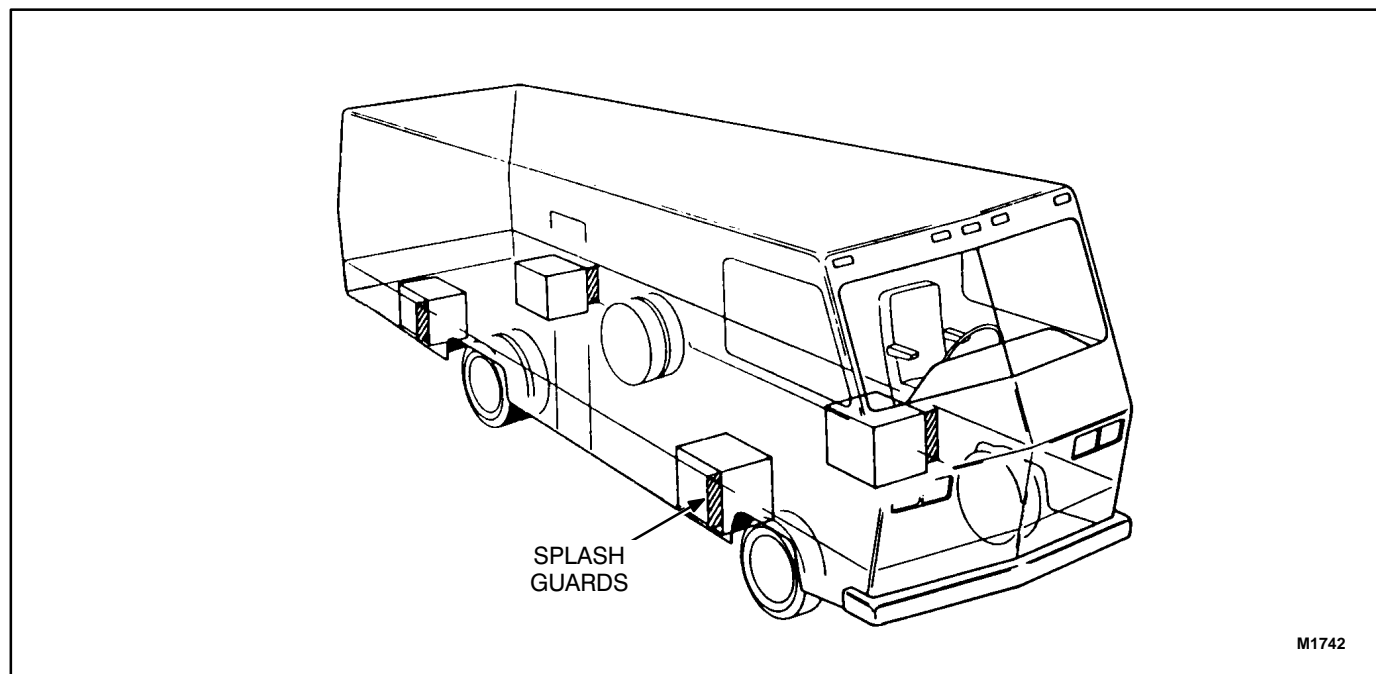


FIGURE 4-3. COMMON GENERATOR SET MOUNTING AREAS

5. Ventilation and Acoustics

VENTILATION

The most important factors of ventilation for an air cooled generator set are sufficient incoming air (for combustion and cooling) and adequate exhausting of heated air.

A fan draws cooling air through the inlet on the generator end and pushes it across the generator and engine cooling fins. The heated air is expelled through the air outlet on the bottom of the genset. See Figure 5-1.

Make certain that nothing obstructs or restricts the air intake and air outlet. Air recirculation must be minimized. If a noise or dust deflector is added to the genset, it must be located a minimum of 6 inches (150 mm) below the genset and it must be open on three sides.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Because discharged cooling air can contain deadly exhaust gas, never use discharged cooling air to heat the vehicle.*

⚠ CAUTION *Operating the genset with the cover removed can cause equipment damage. Genset cooling air does not circulate properly with the access cover removed. Do not operate the genset with the access cover removed.*

When designing the air inlet and outlet for the genset compartment (see Figures 4-1 and 4-2), allow for the restriction of grilles and ductwork: some expanded metal grilles provide only 60 percent free-air inlet area per square foot. The most efficient grille provides only 90 percent free inlet area per square foot. Obtain the free inlet area of the grille material from the material supplier. Multiply the grille area by the free area percentage to get the free inlet area. The minimum size of the free air inlet is 40 in² (258 cm²). The compartment size, air inlet opening size and grille design must meet the minimum air inlet opening requirements.

Air ducting must provide a direct free-airflow path to the genset, with minimal bends. The duct must be smooth and non-restrictive to airflow.

Air inlet openings should be located as high as possible to allow for convection cooling of heated air

from the genset compartment after unit shutdown. Otherwise, hard starting could result from vapor locking, hot combustion air, etc.

Locating the free air inlet opening in the vehicle skirt is acceptable. Inlet air taken from below the vehicle must come from the skirt side of the compartment.

⚠ WARNING *Fuel and fuel leakage present the hazard of fire or explosion, which can cause severe personal injury or death. The ventilation system should provide a constant flow of air to expel any accumulation of fuel vapor. The genset compartment must be vapor-tight to the vehicle interior, to keep fumes from entering the vehicle.*

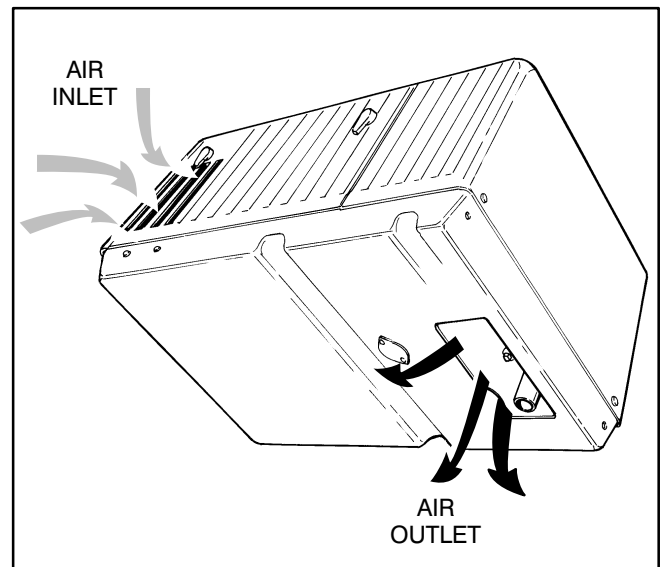


FIGURE 5-1. COOLING AIRFLOW

ACOUSTICS

The genset is designed to minimize noise levels. If additional noise reduction is required, line the top and sides of the genset compartment with a 1 inch (25.4 mm) thickness of sound absorbing material. Locating the air inlet away from the genset air inlet opening will reduce the noise level; however, additional compartment space will be required (see Compartment Mounting in the *Mounting* section). See the following guidelines to construct the housing.

- Lining the compartment is less effective if openings, cracks, doors and joints are not

sealed. Seal the compartment door edge to eliminate noise leaks around the door perimeter.

- Cover the back, top and sides of the compartment (not the compartment base) with fiberglass or other self-extinguishing, sound-absorbent material. Sound insulation and adhesive must be rated at 200°F (90°C) minimum. See Figure 5-2 to design the genset compartment for optimum noise reduction.
- A combination of materials can reduce noise

more than a single material can. For instance, a sheet of lead combined with a layer of acoustical material is more effective than either one alone.

⚠ WARNING *High temperatures in the compartment can present the hazard of fire, which can result in severe personal injury or death. To meet ANSI and CSA temperature rise requirements for vehicles, the layer of insulation must not reduce the minimum compartment size specified in Figure 4-1.*

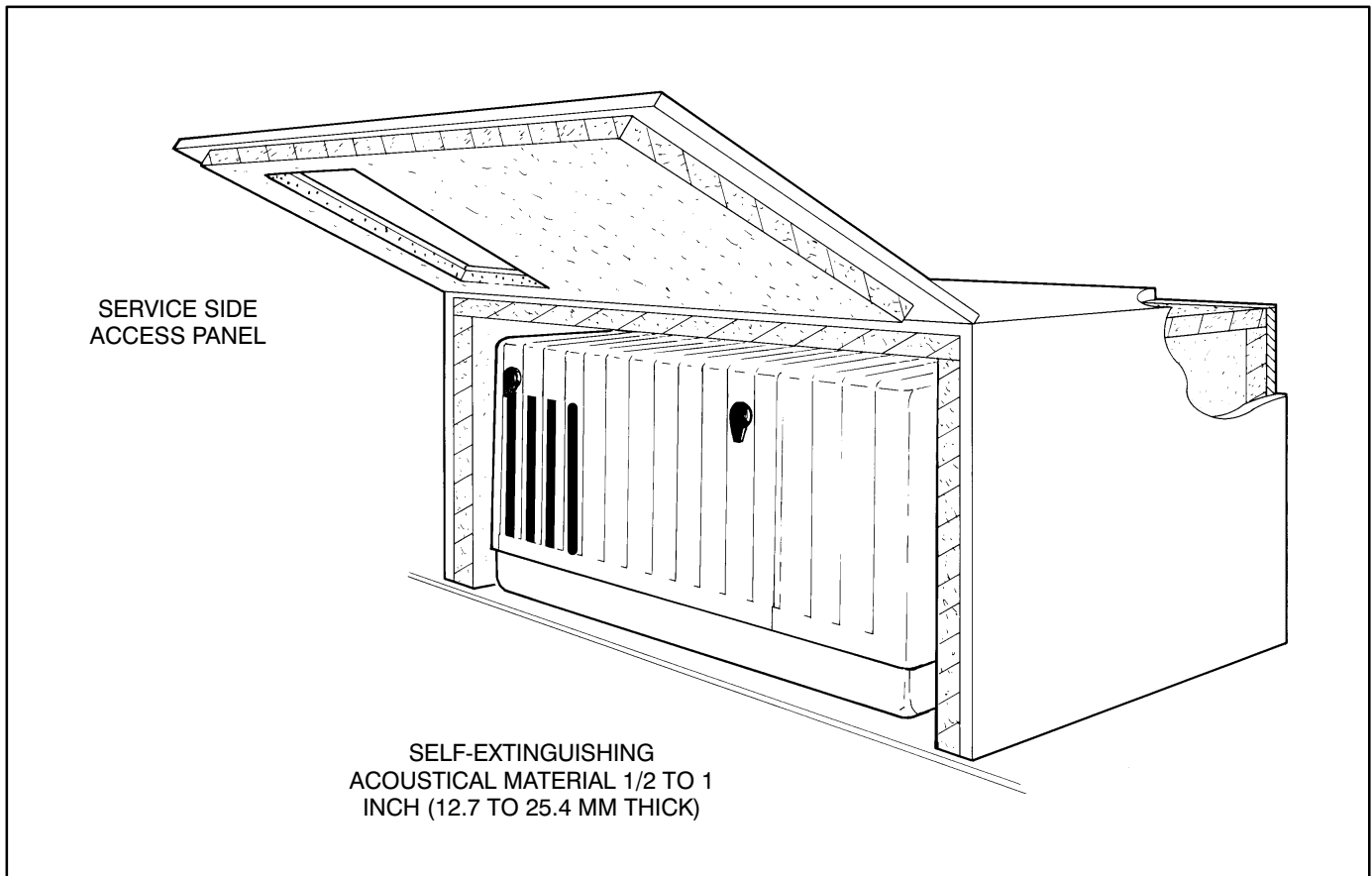


FIGURE 5-2. NOISE REDUCTION COMPARTMENT DESIGN

6. Exhaust System

GENERAL

Plan the exhaust system carefully. A proper installation is vapor-tight and quiet. The exhaust system installation must comply with all applicable standards, local codes and regulations. Study the following recommendations. See the instructions supplied with the exhaust kit for specific mounting procedures.

MUFFLER RECOMMENDATIONS

The Onan-installed spark arrester muffler is U.S. Forest Service-approved, and meets code requirements. Failure to provide and maintain a spark arrester can be a violation of the law.

Liability for damage or injury, and warranty expenses due to use of unapproved mufflers or installation modifications becomes the responsibility of the person installing the substitute muffler or performing the modifications. Contact an Onan distributor for approved exhaust system parts.

EXHAUST INSTALLATION GUIDELINES

The exhaust system must be placed no closer than 3 inches (76 mm) from combustible material (wood, felt, cotton, organic fibers, etc.), or be so located, insulated or shielded that it does not raise the temperature of any combustible material more than 117°F (65°C) above the ambient air inlet temperature.

The exhaust system must extend a minimum 1 inch (25 mm) beyond the perimeter of the vehicle. Do not terminate the exhaust tailpipe under the vehicle. Be aware that any vent, window, storage compartment or opening that can be opened and that is not permanently sealed from the vehicle living space can be an avenue for carbon monoxide.

The tailpipe must not terminate so that any vent, window, or opening into the living area is within a six inch (152.4 mm) radius of the tail pipe as shown in Figure 6-1.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Do not terminate an exhaust pipe under the vehicle. The tailpipe must not terminate so that any vent, window, or opening into the living area is within a six inch (152.4 mm) radius of the tail pipe as shown in Figure 6-1. Keep all openings closed when the genset is running.*

To reduce the chance of damaging the tailpipe and emitting exhaust gases under the vehicle, make certain that no part of the exhaust system intrudes into the departure angle or approach angle of the vehicle, unless it is protected by a skid bar or other protection device. The shaded areas in Figure 6-1 illustrate typical mounting locations.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Do not mount any portion of the exhaust system into the approach or departure angle unless it is adequately protected. Use only Onan-specified exhaust equipment with the genset. Use a sufficient number of hangers to prevent dislocation of the system.*

TAILPIPE RECOMMENDATIONS

An exhaust tailpipe is not supplied with the genset because length requirements vary between vehicle manufacturers. Optional exhaust kits are available, refer to the Onan accessory catalog. Refer to the following recommendations for information and safety considerations.

Use 1-1/4 inch O.D. (1-1/8 inch I.D.) 18-gauge aluminumized steel or stainless steel tubing for tailpipe.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Do not use flexible exhaust tailpipe, because it can leak or break from road shock or vibration. Do not terminate the exhaust system under the vehicle. Direct exhaust gases away from any window, door, or compartment openings. Do not operate the genset without an exhaust tailpipe.*

Use a U-bolt type automotive muffler clamp to connect the exhaust tailpipe to the muffler.

If the tailpipe extends more than 1-1/2 feet (0.46 m) from the muffler connection, attach a double-rubber automotive tailpipe hanger for additional support.

Always support the exhaust system at or near the perimeter of the vehicle to prevent the pipe from being damaged and pushed up under the vehicle skirt. Use additional tailpipe hangers every 2 to 3 feet (0.6 to 0.9 m) of tailpipe run. Attach hangers to steel framework, not wood or other floor materials. Refer

to Figure 6-2 for typical tailpipe installations.

⚠ 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.*

⚠ CAUTION *Water vapor can cause engine damage. Do not connect the genset exhaust to the vehicle exhaust system, because water vapor from one engine can damage the other.*

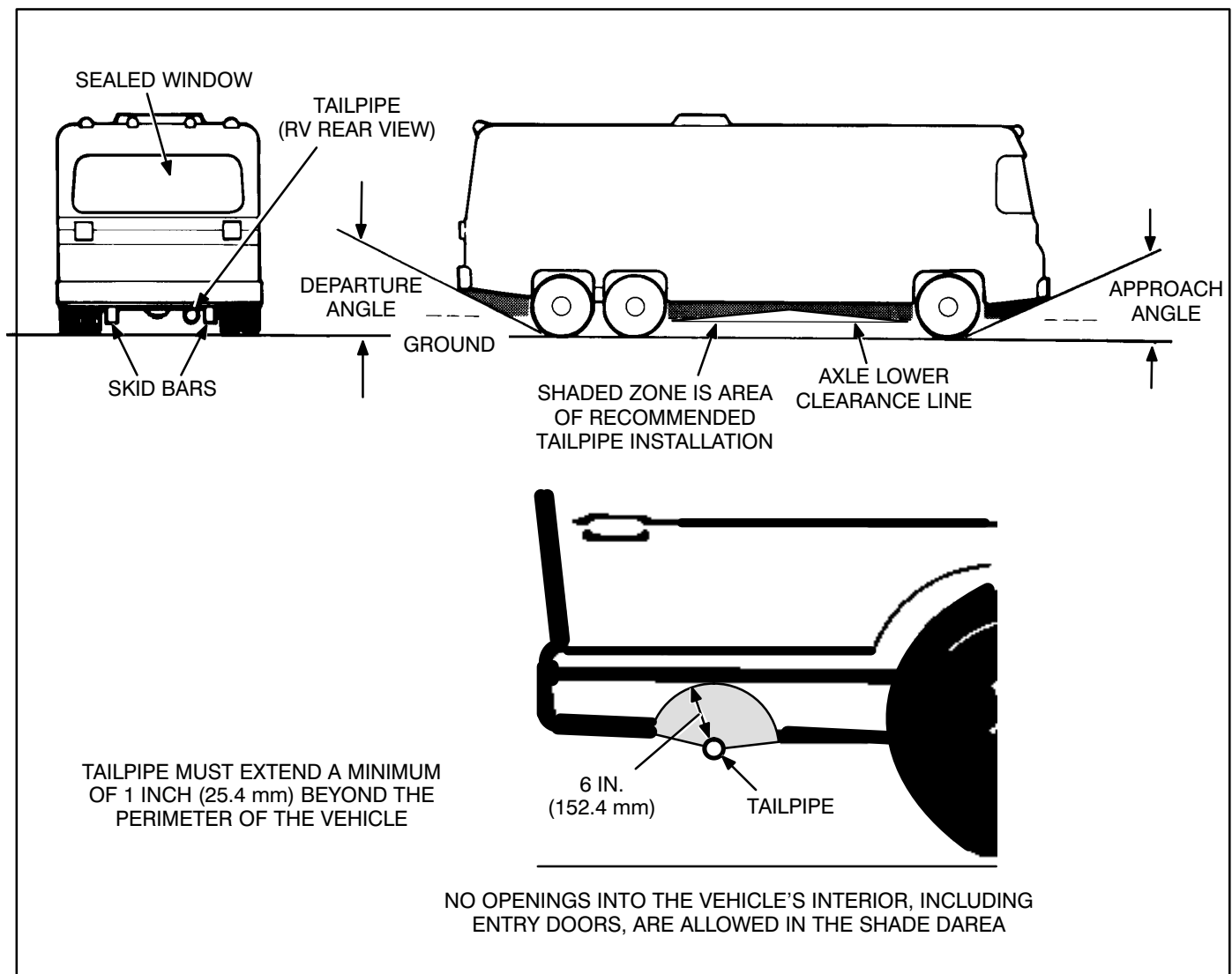


FIGURE 6-1. TAILPIPE INSTALLATION

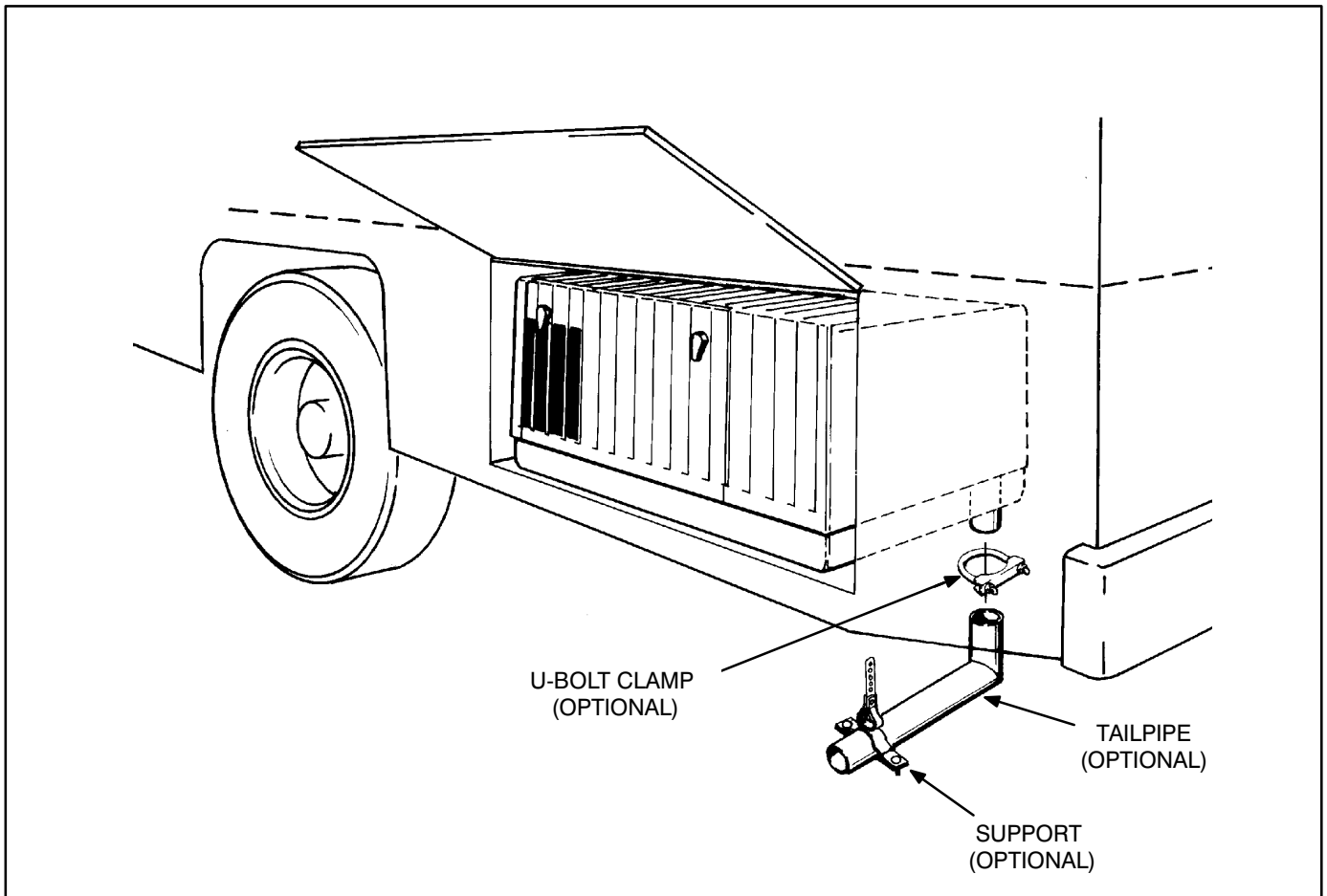


FIGURE 6-2. TYPICAL EXHAUST SYSTEM INSTALLATION

7. Fuel System

GENERAL

This section describes fuel system installations for recreational vehicles.

⚠ 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 switch or equipment, or other ignition sources around fuel or fuel components, or in the installation area. Keep a type ABC fire extinguisher nearby. The ventilation system must provide a constant flow of air to expel any accumulation of fuel vapor while the vehicle is in transit. Compartments must be vapor-tight to the vehicle interior to prevent any fumes from entering these areas.*

GASOLINE FUEL SYSTEM

Fuel System Provisions

Use a separate fuel pickup tube or a separate fuel tank. Do not tie into the vehicle fuel supply line. On some vehicles, the genset can share the vehicle fuel supply tank with the vehicle engine. Connection to the vehicle fuel tank must be made according to the chassis (vehicle) manufacturer's detailed instructions. See Fuel Line Installation, in this section.

The fuel pump has an integral fuel shutoff valve as a safety feature. If the vehicle fuel tank becomes pressurized (3 psi maximum), the positive fuel shutoff prevents the engine from being flooded when the genset is not running. The vehicle fuel tank gas cap should relieve pressure at 1-1/2 psi.

Recommended Fuel

⚠ WARNING *Gasoline is highly flammable fuel and can cause severe personal injury or death. Do not smoke if you smell gasoline or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher in the vehicle.*

Use clean, fresh unleaded gasoline having a minimum octane rating (Anti-Knock Index) of 87.

During some times of the year only mandated "oxygenated" gasolines may be available. These are acceptable for use, but not preferable. Leaded gasoline may be used but will result in the extra maintenance required for removing combustion chamber and spark plug deposits. Do not use gasoline or gasoline additives (de-icers) containing methanol because methanol can be corrosive to fuel system components.

⚠ CAUTION *Do not use gasoline or gasoline additives containing methanol because methanol can be corrosive to fuel system components.*

Avoid using highly leaded gasolines and lead additives because of the extra engine maintenance that will be required.

Fuel Consumption

Genset fuel consumption varies with the amount of electrical load. Refer to the *Specifications* section for approximate fuel consumption at no load, half load, and full load.

Fuel Line Installation

Vehicle fuel systems operate at a specified fuel pressure. For this reason, do not change or remove the fuel fill tube, fill limiter vent, vapor canister, vapor lines, filler cap and all parts of the fuel system without the approval of the vehicle manufacturer. Check the filler cap to make sure that the pressure vacuum relief valve functions properly at 1-1/2 psi: replace it if necessary.

Do not tie the genset fuel line into the vehicle fuel supply line. Unauthorized fuel system modifications can cause dangerous operating conditions.

- Tying the genset fuel line into a **vacuum** supply line (vehicle fuel pump at the engine) can cause the genset to starve for fuel at highway speeds or during acceleration.
- Tying the genset fuel line into a **pressure** supply line (vehicle fuel pump in the fuel tank) can cause poor generator set operation and create a hazard of fire or explosion caused by fuel leakage.

Some vehicle manufacturers permit tying into the fuel **return line** on high pressure fuel systems. Contact the vehicle manufacturer for details and approval. The fuel return line pressure at the point of connection must not exceed 1-1/2 psi, or carburetor flooding could result.

⚠WARNING *Gasoline presents the hazard of explosion or fire, which can result in severe personal injury or death. Do not connect the genset fuel line to the pressurized part of the vehicle fuel system. Flooding of the genset engine and compartment can occur, resulting in a fire hazard.*

⚠CAUTION *The genset could starve for fuel when the vehicle is operated at highway speeds if its fuel line is connected to the main fuel line with a tee. The genset fuel pump has neither the capacity nor the power to overcome the draw of the vehicle engine fuel pump. For this reason, use a separate fuel line to the genset, or use a separate fuel tank.*

If a separate connection is not supplied for the genset, add a second fuel pickup in the tank. This pickup should not extend below the bottom 1/4 of the tank, so the vehicle will run after the generator runs out of fuel.

Connect 1/4-inch I.D. fuel hose (type SAE 30-R7) to the barb fitting on the genset (Figure 7-1). Secure fuel hose to barb fitting with a stainless steel clamp (worm-gear type). Do not over tighten clamp or hose could be damaged. Fuel hose must be long enough to allow genset movement, and prevent binding, stretching or breaking.

Onan recommends copper or hot dip coated seamless steel tubing (conforming to ASTM A-254) and double flared connections for long runs between the fuel tank and the flexible connector to the genset.

Run fuel line at the same height as the top of the fuel tank (or above the tank) to a point as close to the genset as possible. This reduces the danger of fuel siphoning out of the tank if the line should break.

The maximum fuel pump lift of the genset is 3 feet (0.91m).

Keep fuel lines away from hot engine or exhaust areas, to reduce the chance of vapor lock. Fuel lines should be accessible and protected from damage. Use metal straps without sharp edges to secure fuel lines. Do not run fuel lines where they may contact sharp or rough surfaces, or where they may be kinked, pinched, chafed, or struck.

⚠WARNING *Gasoline fuel may be accidentally ignited by electrical sparks, presenting the hazard of fire or explosion, which can result in severe personal injury or death. For this reason, when installing the genset:*

- *Do not tie electrical wiring to fuel lines.*
- *Do not run electrical lines and fuel lines through the same compartment openings.*
- *Keep electrical and fuel lines as far apart as possible.*
- *Place a physical barrier between fuel lines and electrical lines wherever possible.*
- *If electrical and fuel lines must pass through the same compartment opening, make certain that they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.*

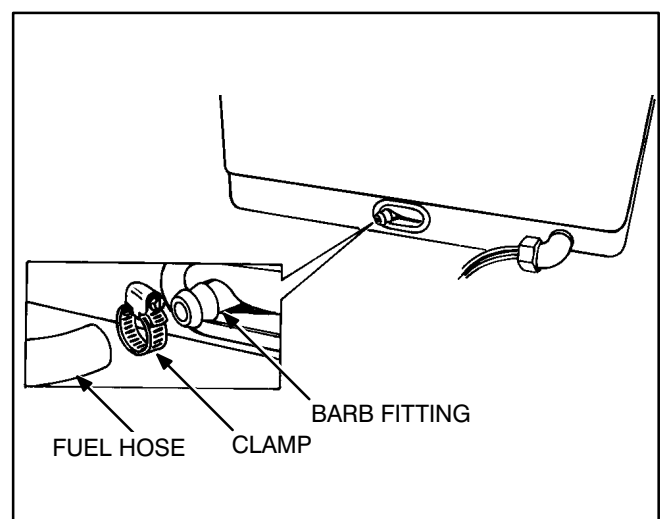


FIGURE 7-1. GASOLINE FUEL LINE CONNECTION

LPG FUEL SYSTEM

Fuel System Provisions

Service personal must be trained and certified to perform LPG installations (refer to NFPA 58, 1-6).

LPG models are designed for a low-pressure vapor-withdrawal type of LPG supply system. See Figure 7-2. *LPG supply pressure at the inlet to the demand regulator must be 9 to 13 inches (229 to 330 mm)*

water column (WC) when the genset is running under full load.

⚠WARNING *LPG fuel presents the hazard of explosion or fire that can result in severe personal injury or death. Do not connect the genset fuel line directly to the LPG fuel cylinder or fuel leakage could result from excessive fuel inlet pressure. A regulator must be used between the genset and the fuel cylinder that reduces cylinder pressure to 11 inches of water column.*

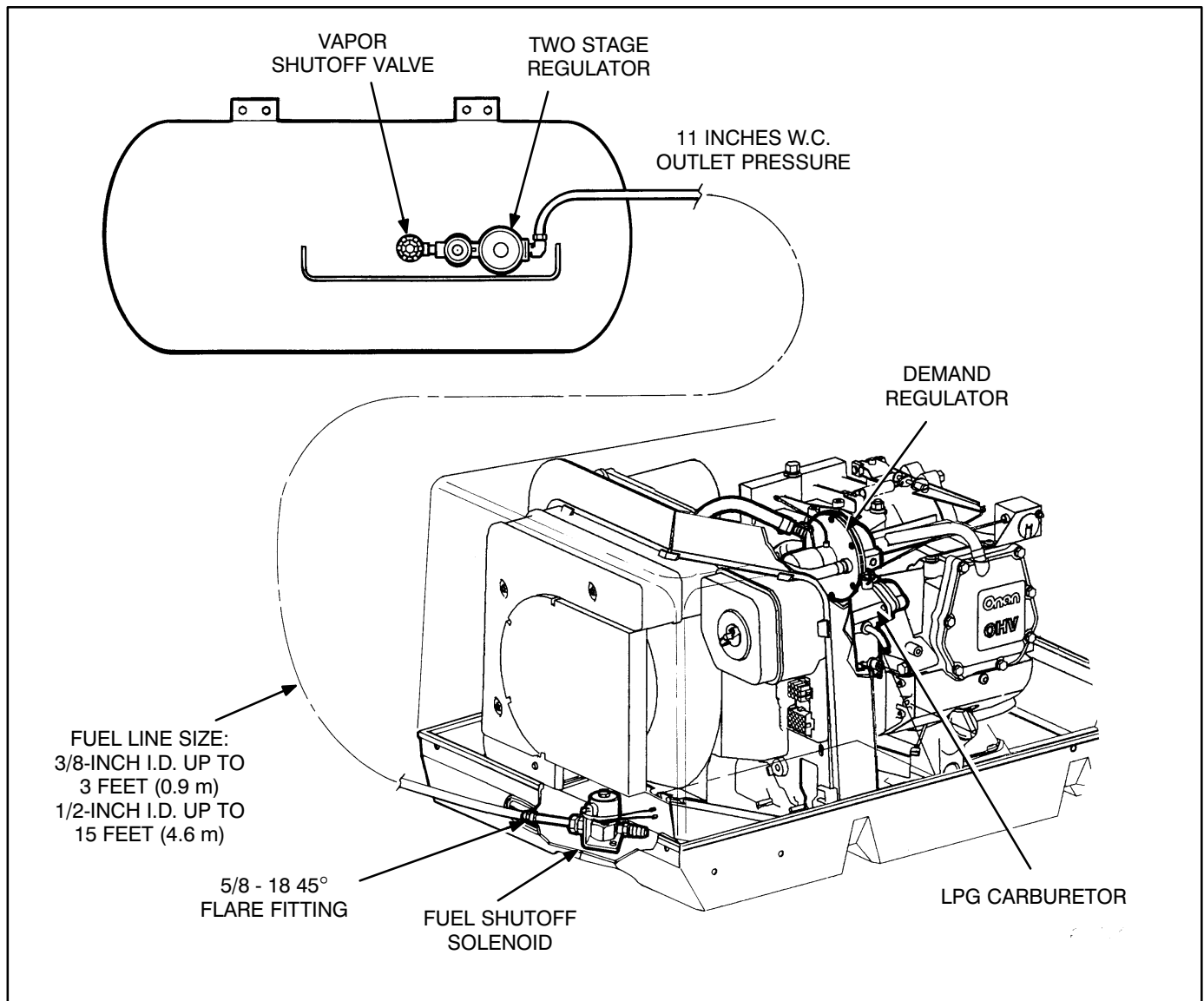


FIGURE 7-2. TYPICAL LPG VAPOR WITHDRAWAL FUEL SYSTEM

LPG genset operation is highly sensitive to variations in altitude, temperature, and fuel BTU content. For this reason, the fuel system may need to be adjusted after installation. Refer to the Service Manual if adjustments are required.

Recommended Fuel

Use clean, fresh HD-5 grade liquified petroleum gas (LPG) or equivalent product consisting of at least 90 percent propane. Commercial liquified petroleum gas fuels may contain more than 2.5 percent butane which can result in poor fuel vaporization and poor engine starting in low ambient temperatures (below 32° F (0° C)).

Fuel Consumption

Genset fuel consumption varies with the amount of electrical load. Refer to the *Specifications* section for approximate fuel consumption at no load, half load, and full load.

Propane Fuel Lines and Supply Tank

⚠️WARNING *LP gas (Propane) presents the hazard of fire or explosion that can cause severe personal injury or death. Do not permit any flame, spark, arcing switch or equipment, pilot light, cigarette, or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.*

Review each of the codes that apply to LPG genset installation. Paragraph 2-11 (LP-Gas Engine Fuel installations) of NFPA Pamphlet 501C and paragraph 3-6.2.5 of NFPA 58 (piping hose and fittings). These sections deal with fuel tanks and lines, but does not cover all applicable codes and regulations. Obtain this pamphlet by writing to the address listed in the beginning of this manual.

For a long fuel line run, use seamless steel tubing with flared ends. Make flexible hose connections at the fuel tank and at the genset. Use 3/8-inch I.D. fuel line for runs up to 3 feet (0.9 m) and 1/2-inch I.D. up to 15 feet (4.6 m).

Mount a manual shutoff valve on the fuel supply tank. When installing the fuel lines, keep these factors in mind:

- Install LPG fuel lines to be accessible, but protected from damage.
- Use metal straps without sharp edges to secure fuel lines.
- Keep fuel lines away from hot engine or exhaust.
- Do not run fuel lines next to electrical wiring.

Do not connect the genset fuel supply line to any appliance fuel supply line. The genset can draw fuel away from other appliances and cause a flame out. To prevent the possibility of flameout, the fuel supply system must be designed to deliver sufficient fuel for normal operation of the genset and other appliances at the expected temperature conditions. It may be necessary to use a separate fuel tank for the genset if sufficient fuel cannot be supplied with a single tank system.

⚠️WARNING *LPG fuel presents the hazard of explosion or fire which can result in severe personal injury or death. If flameout occurs with an unvented appliance, LP gas can accumulate inside the vehicle and create a safety hazard. Do not connect the genset fuel supply line to an LP gas supply line that is supplying another appliance.*

Testing Fuel System for Leaks

Before operating the genset, test the LPG fuel system for leaks. Testing must conform to procedures listed in NFPA-58, or to the UL recommended test procedure, as follows:

After assembly and before initial operation, all fuel system connections, hose, valves, regulators, and fittings must be tested and proven free of leaks using a soap-and-water (or equivalent) solution while the system is under gas or air pressure of at least 90 psi (620 kPa).

Other approved methods of detecting leaks may be used if appropriate. This test shall NOT be made with a flame.

⚠️WARNING *LPG fuel presents the hazard of explosion or fire which can result in severe personal injury or death. Do not smoke or allow any flame, spark, pilot light, arc-producing switch or equipment, or other ignition sources around fuel or fuel components.*

8. Electrical Connections

GENERAL

This section covers installing the genset electrical system for:

- Connecting the load
- Connecting a remote control
- Connecting the battery

Connect the battery last, to avoid accidentally starting or short-circuiting the genset during installation.

⚠WARNING *Accidentally starting the genset during installation can cause severe personal injury or death. Do not connect the starting battery until instructed to do so in the Initial Start and Checks section.*

The wiring must meet all applicable electrical codes. For this reason, a qualified electrician should install and inspect the wiring.

Mount switches and controls securely, to prevent damage from vibration and road shocks. All switches must be vibration-proof to prevent accidental opening or closing while the vehicle is in motion.

AC WIRING

Wire Types

The leads attached to the genset output must have a current rating not less than 115 percent of the nameplate current rating of the genset. The Onan-supplied AC feeder conductor insulation is rated at 125°C. Wires connected to the Onan feeder conductors must either meet this insulation rating, or be a larger size (see National Electrical Code, NFPA 70).

Use stranded wire for all load connections. Load wiring must be appropriately sized and insulated for the specified current rating. Grounding must comply with all codes.

Conduit

Install the generator load conductors in a flexible conduit. Cut the conduit to length, leaving extra wire for the junction box connections. Connecting wires must be correctly sized and insulated for the current rating. Round off or cover the ends of the conduit, to prevent its sharp edges from cutting the insulation. Secure the conduit to the genset with the 1/2-inch conduit fitting that is supplied separately (Figure 3-13).

Use a waterproof conduit if it will be exposed to moisture.

Seal all openings made for conduit into the vehicle interior, so exhaust or fuel vapor cannot enter the living quarters. Flexible metal conduit must be sealed internally at the end where it terminates inside the junction box or panel board (flexible conduit is not vapor-tight along its length).

⚠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.*

Wiring Disconnect Method

There must be no chance that an outside power source be connected to the genset. Feeder conductors from the genset compartment must terminate in a 120-volt double-pole, double-throw, positive-off switching device mounted ahead of the vehicle distribution panel: or they must connect to a genset receptacle box. Figures 8-2 and 8-3 show examples of the wire connection.

Line Circuit Breaker

The genset has a line circuit breaker mounted on the front of the set mounted control panel. The breaker provides short circuit and overload protection for the generator.

Load Connections

The generator output voltage and maximum current rating are specified on the generator nameplate.

Load wiring must be appropriately sized and insulated for the specified current rating. Grounding procedure must comply with codes.

A lead to be connected to an output feeder conductor shall not be more than two AWG sizes smaller than the output lead conductor and the insulation shall be:

- Rubber (with braid), neoprene, or thermoplastic, with a wall thickness of at least 0.030 inch (0.76 mm).
- Other material having the same or better electrical and mechanical properties.

⚠WARNING *Electrical shock can cause severe personal injury or death. Use only approved power supply assemblies. Never remove the grounding pin from assemblies. Incorrect ground or no ground can cause the vehicle to become electrically "hot". Equip the vehicle with adequate Ground-Fault Circuit Protection devices to meet the National Electrical Code (NFPA 70, 551-9[C]) and for personal safety.*

⚠WARNING *Gasoline fuel can be accidentally ignited by electrical sparks, presenting the hazard of fire or explosion, which can result in severe personal injury or death. For this reason, when installing the genset:*

- *Do not tie electrical wiring to fuel lines.*
- *Do not run electrical lines and fuel lines through the same compartment openings unless they are physically separated by running them through individual channels, or by passing each line through a separate piece of tubing.*
- *Keep electrical and fuel lines as far apart as possible.*
- *Place a physical barrier between fuel lines and electrical lines wherever possible.*

Voltage Reconnection (50 Hertz Models Only)

Refer to Figure 8-4 for voltage reconnection information. The circuit breaker contains two sets of contacts. The output leads and the circuit breaker can be accessed through the service access panel.

If the outer housing needs to be removed for any reason, carefully remove and label each of the wires connected to the battery charge assembly (VR2). The battery charge assembly is mounted to the housing on the left side (as viewed from the service access panel opening).

***IMPORTANT!**

GROUND-FAULT CIRCUIT INTERRUPTERS (GFCIs) ARE REQUIRED BY THE NATIONAL ELECTRICAL CODE (NFPA 70, 551-9 [C]) IN ALL EXTERNAL AND SOME INTERNAL OUTLETS. TO PROPERLY EQUIP YOUR RECREATIONAL VEHICLE WITH THESE PROTECTION DEVICES, CONTACT YOUR RV MANUFACTURER OR DEALER FOR RECOMMENDATIONS.

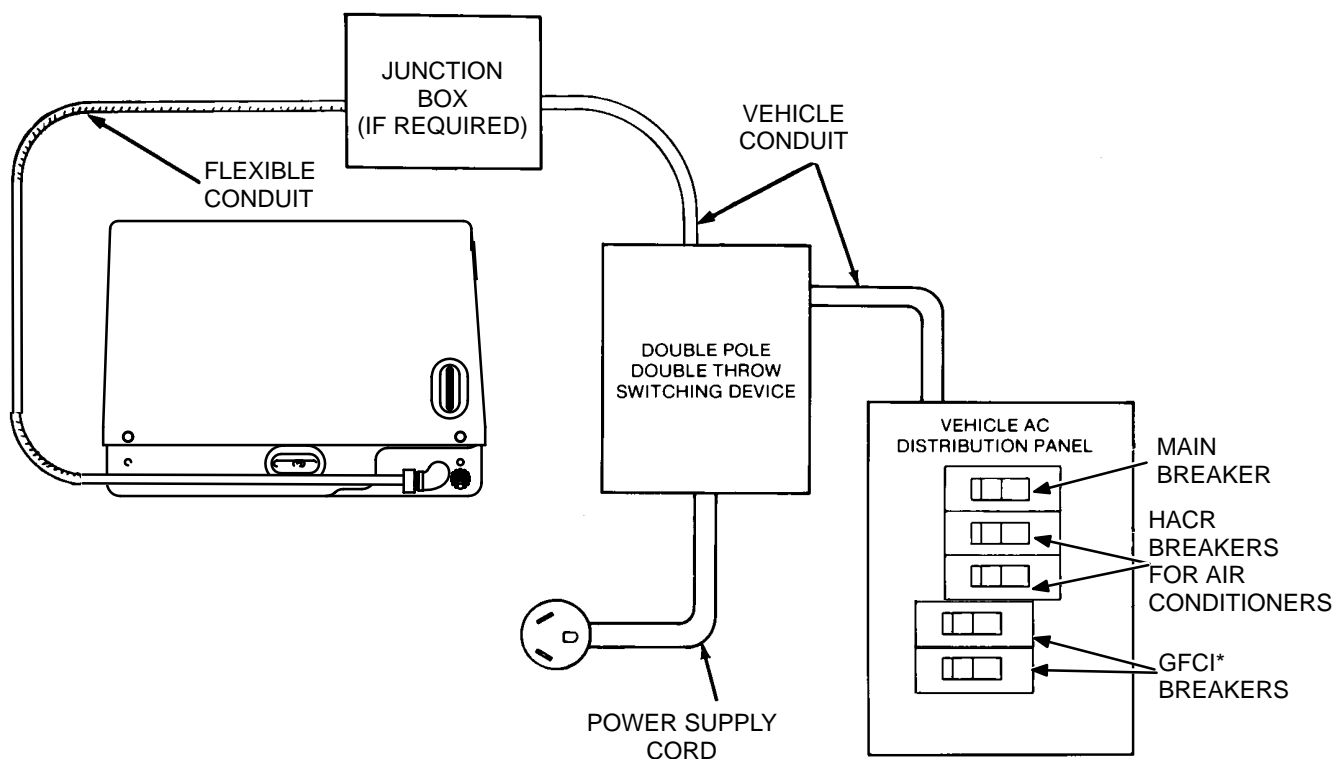


FIGURE 8-2. SWITCHING DEVICE WIRING FOR UTILITY POWER

***IMPORTANT!**

GROUND-FAULT CIRCUIT INTERRUPTERS (GFCIs) ARE REQUIRED BY THE NATIONAL ELECTRICAL CODE (NFPA 70, 551-9 [C]) IN ALL EXTERNAL AND SOME INTERNAL OUTLETS. TO PROPERLY EQUIP YOUR RECREATIONAL VEHICLE WITH THESE PROTECTION DEVICES, CONTACT YOUR RV MANUFACTURER OR DEALER FOR RECOMMENDATIONS.

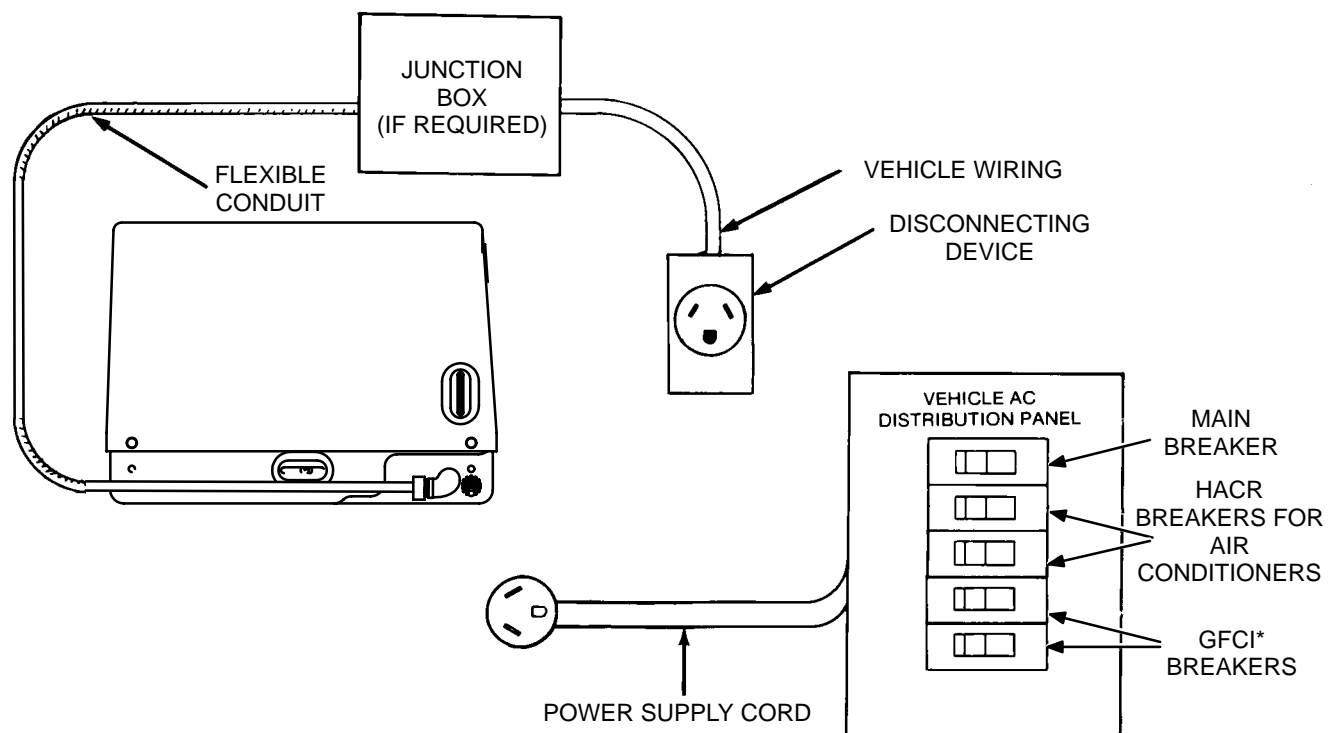


FIGURE 8-3. UTILITY POWER CORD FOR SWITCHING

RECONNECTION CHART FOR MICROLITE 4000 60 HZ/100V

FROM:	TO:	2 WIRE 100				2 WIRE 200	
		NEUTRAL GROUNDED	NEUTRAL ISOLATED	NEUTRAL GROUNDED	NEUTRAL ISOLATED	LINE TO GND=100V NEUTRAL GROUNDED	LINE TO GND=100V NEUTRAL ISOLATED
T1-LINE T2-LINE T3-LINE T4-LINE	3 WIRE 100/200	CBI-LINE GROUND SPLITTER CB2-LINE	CBI-LINE SPLITTER GROUND CB2-LINE	CBI-LINE GROUND SPLITTER CB2-LINE	CBI-LINE SPLITTER GROUND CB2-LINE	CBI-LINE GROUND SPLITTER CB2-LINE	CBI-LINE SPLITTER GROUND CB2-LINE
		CBI-LOAD GROUND CB2-LOAD GROUND	CBI-LOAD SPLITTER CB2-LOAD GROUND	CBI-LOAD SPLITTER CB2-LOAD GROUND	CBI-LOAD SPLITTER CB2-LOAD GROUND	CBI-LOAD OPEN CB2-LOAD GROUND	CBI-LOAD OPEN CB2-LOAD GROUND
SPECIAL INSTRUCTIONS	SPLITTER NOT USED		CONNECT L1-L2 AT JUNCTION BOX SPLITTER NOT USED		CONNECT L1-L2 AT JUNCTION BOX	SPLITTER NOT USED	
100V 200V	L1-N, L2-N L1-L2		(L1, L2) -N N/A		(L1, L2) -N N/A	N/A L1-L2	N/A L1-L2
RECONNECTION DIAGRAMS							

FIGURE 8-4. VOLTAGE RECONNECTION DIAGRAM 611-1246

RECONNECTION CHART FOR MICROLITE 3600 50 HZ

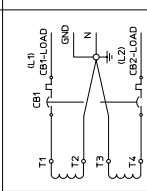
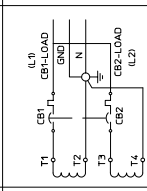
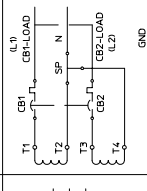
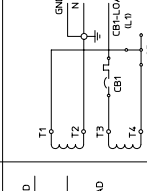
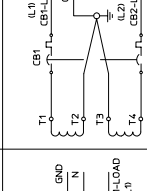
FROM:	TO:	2 WIRE 220 OR 240V			
		3 WIRE 110/220 OR 120/240V	2 WIRE 110 OR 120V	LINE TO GND-220V NEUTRAL GROUNDED	LINE TO GND-110V NEUTRAL GROUNDED
T1-LINE T2-LINE T3-LINE T4-LINE	NEUTRAL GROUNDED	NEUTRAL ISOLATED	NEUTRAL GROUNDED	SPLITTER GROUND CB1-LINE SPLITTER	CB1-LINE GROUND GROUND CB2-LINE
CB1-LINE GROUND GROUND CB2-LINE	NEUTRAL ISOLATED	NEUTRAL ISOLATED	NEUTRAL ISOLATED	CB1-LINE GROUND GROUND CB2-LINE	CB1-LINE GROUND GROUND CB2-LINE
CB1-LOAD GROUND CB2-LOAD GROUND	NEUTRAL ISOLATED	NEUTRAL ISOLATED	NEUTRAL ISOLATED	CB1-LOAD GROUND GROUND CB2-LOAD GROUND	CB1-LOAD GROUND GROUND CB2-LOAD GROUND
CB1-LOAD (L1) NEUTRAL(N) CB2-LOAD (L2) GROUND (GND)	NEUTRAL ISOLATED	NEUTRAL ISOLATED	NEUTRAL ISOLATED	CB1-LOAD GROUND GROUND CB2-LOAD GROUND	CB1-LOAD GROUND GROUND CB2-LOAD GROUND
SPECIAL INSTRUCTIONS	SPLITTER NOT USED	CONNECT L1-L2 AT JUNCTION BOX SPLITTER NOT USED	CONNECT L1-L2 AT JUNCTION BOX	SPLITTER NOT USED	SPLITTER NOT USED
110 OR 120V 220 OR 240V	L1-N, L2-N L1-L2	L1-N, L2-N L1-L2	(L1,L2)-N N/A	N/A L1-N	N/A L1-L2
RECONNECTION DIAGRAMS					

FIGURE 8-5. VOLTAGE RECONNECTION DIAGRAM 611-1245

DC WIRING

Remote Control (Option)

Onan offers optional remote control kits that can be connected to the genset. There are three models available:

- Remote panel with start/stop switch and indicator lamp only (see Figure 8-6).
- Remote panel with start/stop switch, indicator lamp, and hour (elapsed time) meter (see Figure 8-7).
- Remote panel with start/stop switch, indicator lamp, and battery DC voltmeter (see Figure 8-8).

The location of the remote control panel can vary by application. Refer to the instructions supplied with the remote control kit for more installation information and important safety precautions.

Be sure to seal all openings made for wiring so exhaust or fuel vapors cannot enter the living quarters. If flexible metal conduit is used, it must be sealed internally at the end where it terminates. Flexible metal conduit is not vapor-tight along its length due to its construction.

⚠ WARNING *Inhalation of exhaust gas or ignition of fuel vapor can cause severe personal injury or death. Be sure to vapor-seal flexible metal conduit and all openings made during installation of the genset with a silicone/rubber based sealant.*

A remote control connector is located inside the housing (see Figure 8-9). Keep the connector inside the genset housing to keep it clean. Contact an Onan dealer for the proper remote connector plug and wiring harness assembly.

For non-Onan remote control panels, refer to Figure 8-10 for a typical remote control wiring diagram. The connector which mates with the genset connector can be ordered from Onan. Refer to the Onan Accessory Catalog.

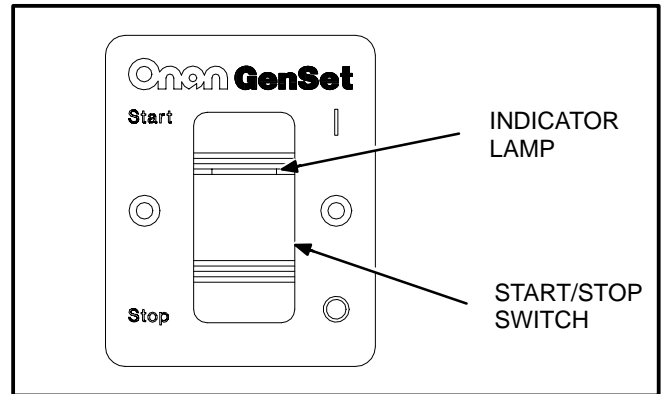


FIGURE 8-6. REMOTE PANEL WITH START/STOP SWITCH ONLY

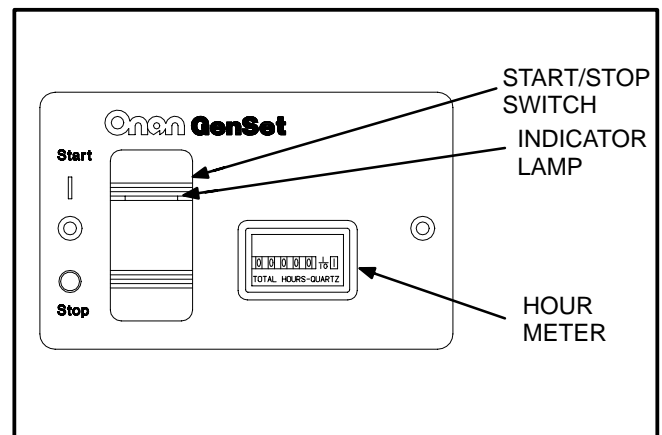


FIGURE 8-7. REMOTE PANEL WITH START/STOP SWITCH AND HOUR METER

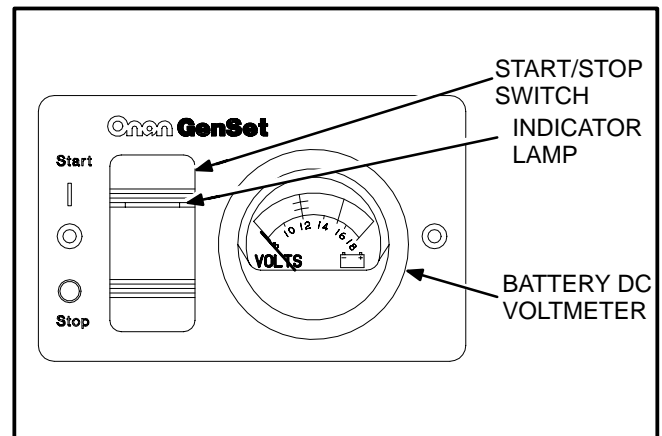


FIGURE 8-8. REMOTE PANEL WITH START/STOP SWITCH AND DC VOLTMETER

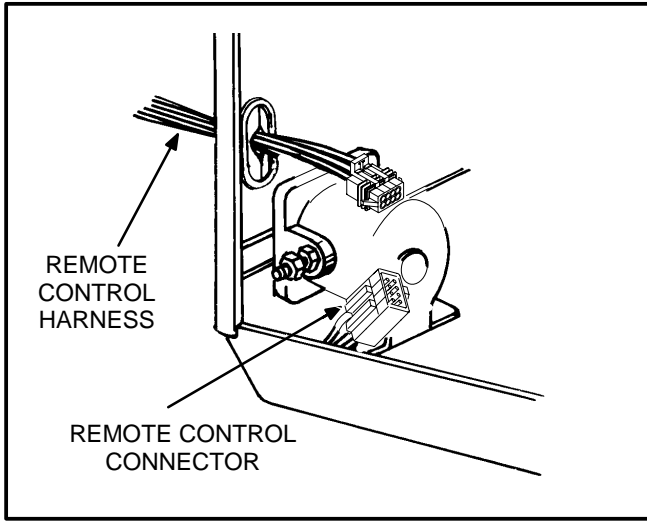


FIGURE 8-9. REMOTE CONTROL CONNECTION

BATTERIES

To prevent accidental starting of the genset during installation, do not connect the battery cables at the battery until so instructed in the Initial Start and Checks section.

⚠ WARNING *Accidental starting of the genset can cause severe personal injury or death. Do not connect the starting battery until so instructed in the Initial Start and Checks section.*

Onan does not recommend that the vehicle starting battery be used to operate the genset. Doing this can discharge the battery under some operating conditions.

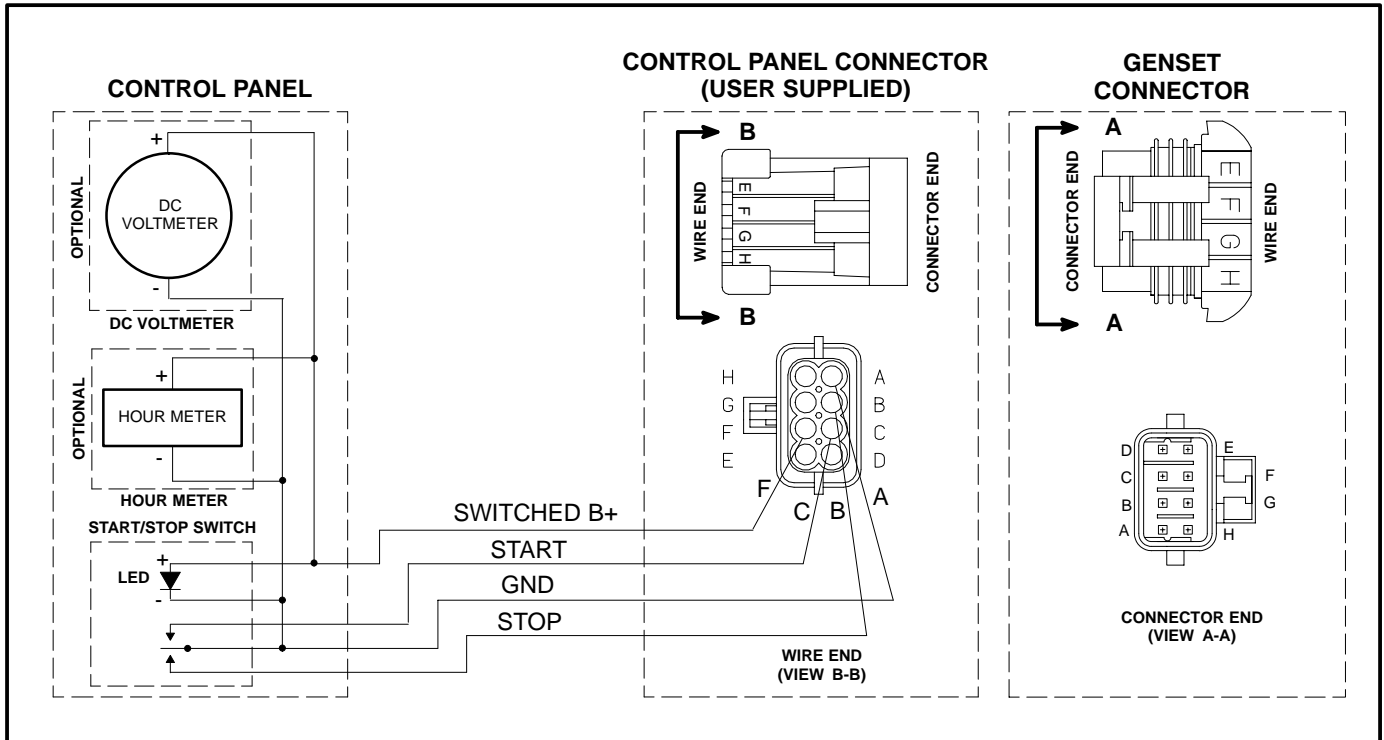


FIGURE 8-10. TYPICAL REMOTE CONTROL WIRING DIAGRAM

Battery Capacity

The genset has a 12 VDC, negative-ground control and starting system. See Table 8-1 for minimum battery capacity requirements.

TABLE 8-1. COLD CRANKING AMPS FOR MINIMUM 12-VOLT BATTERY

ABOVE 32° F (0° C)	BELOW 32° F (0° C)
360 Cold Cranking Amps (Approx. 70 amp/hour)	450 Cold Cranking Amps (Approx. 95 amp/hour)

Battery Recharging

The genset is equipped with a 10-amp, regulated-voltage battery charger if electrical option **B183** was ordered. If the option was not ordered, other means will have to be provided for recharging the genset battery.

Battery Compartment

Mount the battery in its own compartment, away from the genset and any spark-producing device. For ventilation, provide the battery compartment with an opening of at least 1.7 in² (11 cm²) at the top and 1.7 in² (11 cm²) at the bottom.

Mount the battery on a rigid support structure, where leaks and accidental spills cannot damage the genset, fuel lines, and wiring.

⚠ WARNING *Batteries present the hazard of explosion, which can result in severe personal injury. Because batteries give off explosive gas, install the battery in a separate compartment from the genset and away from all flames, pilot light, arcing, or spark-producing devices.*

Battery Cables

Because of the high cranking currents involved, it is highly recommended that a negative (-) battery cable be run with the positive (+) battery cable between the battery and the genset. Size the cables according to Table 8-2. Total cable length is the sum of the lengths of the positive (+) and negative (-) cables. In other words, total cable length will be approximately twice the distance between the battery and the genset.

Alternatively, use rated cranking current as the basis for calculating battery cable size. Rated cranking current for these gensets is 180 amperes at 0° F (-18 °C). The cables should be sized so that voltage across the cranking motor terminals will be within 1 volt of the voltage across the battery terminals.

TABLE 8-2. CABLES FOR COLD WEATHER STARTING TO -20°F (-29°C)

*CABLE LENGTH IN FEET (METERS)	CABLE SIZE
0-10 (0-3)	2
11-15 (3-4.5)	0
16-20 (4.5-6)	000**

* Total battery cable length including both positive (+) and negative (-) cables.

** #2 cable is acceptable up to 20 feet (6.1 m) if the battery capacity exceeds 1000 CCA.

Negative (-) Battery Connection. Connect one end of the negative (-) battery cable to the genset ground. Tighten the ground connection securely (see Figure 8-11).

Alternate Negative (-) Battery Connection. In cases where the distance from the battery to the genset is quite long, the vehicle frame (ground) can be used for the return cranking current:

1. Connect one end of a short, negative (-) battery cable (of the same size as the positive (+) battery cable) to the vehicle frame near the battery. (Do not connect the other end to the battery at this time.)

2. Connect one end of a short, negative (-) battery cable (of the same size as the positive (+) battery cable) to the vehicle frame near the genset. Connect the other end to the genset ground. See Figure 8-11.

NOTE: Make sure that the frame (ground) connections (to major frame members, if possible) are secure enough to minimize electrical resistance. Avoid making these connections at welds or mechanical joints.

Positive (+) Battery Connection. Connect one end of the positive (+) battery cable to the start relay B+ post. Tighten the B+ connection securely (see Figure 8-11).

Route battery cables away from fuel lines and hot engine exhaust components. Battery cable 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.*

⚠ CAUTION *Failure to secure the battery cable terminals can result in personal injury and/or equipment damage from an electrical short. See that terminal connections are secure. If necessary, secure cables to prevent abrasion.*

Genset Bonding Terminal

The genset ground, as shown in Figure 8-11, is also the bonding terminal for grounding the genset to the vehicle frame (ground) when a continuous negative (-) battery cable is used from the battery directly to the genset. Connect an 8 AWG grounding wire from the vehicle frame to the genset ground.

NOTE: Make sure that the frame (ground) connections (to major frame members, if possible) are secure enough to minimize electrical resistance. Avoid making these connections at welds or mechanical joints.

⚠ WARNING *Failure to ground the genset properly can result in injury or death. The genset must be grounded to the vehicle frame.*

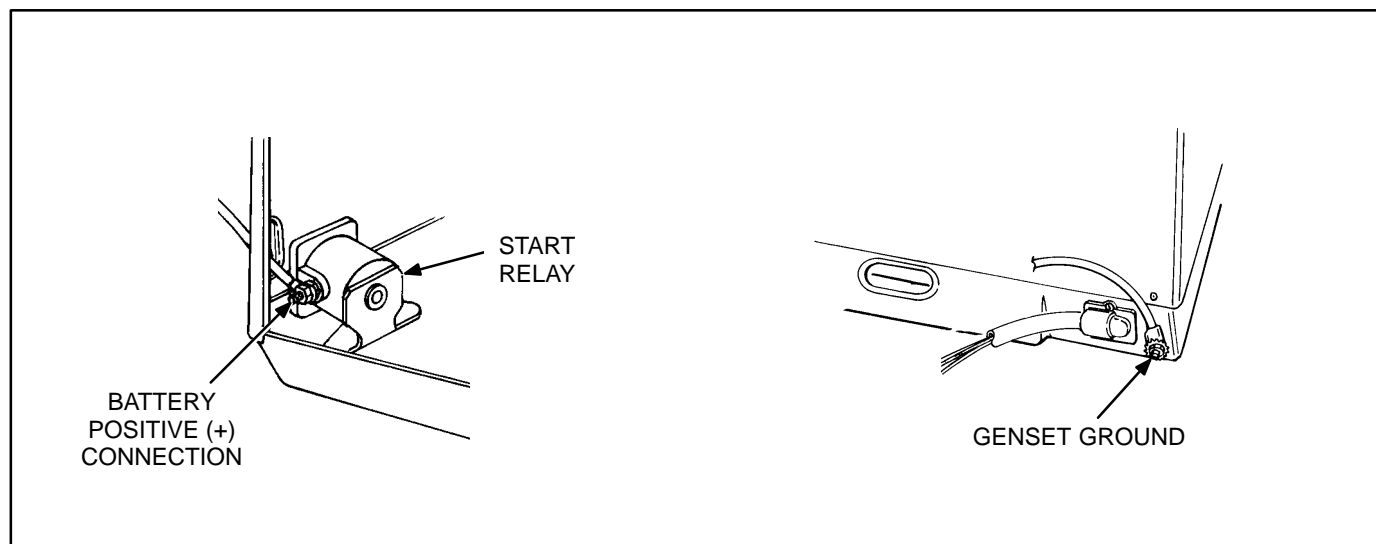


FIGURE 8-11. BATTERY CONNECTIONS

9. Initial Start and Checks

⚠ 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.

Never sleep in vehicle with the generator set running unless the vehicle interior is equipped with an operating carbon monoxide detector. 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 generator set operation.

1-RV

PRE-START CHECKS

Before starting the genset, perform these steps:

1. Perform the Installation Review described in this section.
2. With the vehicle parked on a level surface, check the engine oil level. Remove and clean the oil level indicator. Insert the oil level indicator into the oil fill neck. Screw the oil level indicator in to obtain an oil level reading. If low, add oil very slowly until the Full mark is reached. Screw the oil level indicator into the filler neck securely to prevent oil leakage.

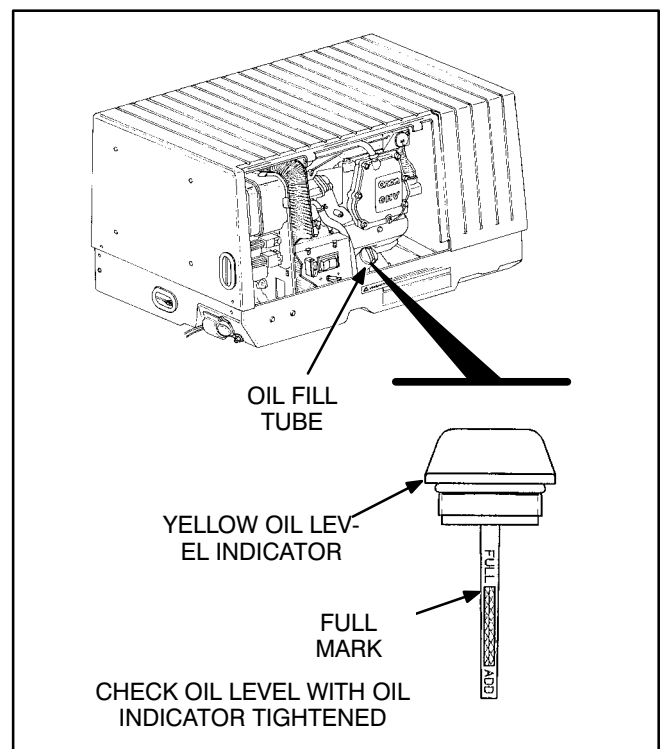


FIGURE 9-1. OIL LEVEL INDICATOR

3. Check that battery terminals and cable connectors are clean and dry. Connect the positive (+) battery cable to the POS. (+) battery post first, then connect the negative (-) battery cable to chassis ground or the NEG. (-) battery post if the battery has a separate vehicle chassis ground cable. Always connect the negative (-) battery cable last to reduce the risk of arcing.

⚠ WARNING Batteries present the hazard of explosion, which can result in severe personal injury. Because batteries produce explosive gas, do not smoke or allow any arc-producing devices in the battery area. Do not disconnect cables from the battery while the genset is cranking or running. This causes arcing and can result in an explosion.

4. Review the Operator's Manual, and note the features of the genset. Open the fuel supply valve to the genset (if equipped).

INITIAL STARTING AND CHECKS

⚠ WARNING Exhaust gas presents the hazard of severe personal injury or death. Do not operate the genset inside any room or building.

Starting from the Set Mounted Control

1. Move the Start/Stop switch to the start (I) position (Figure 9-2). The engine should crank and start. The genset may need more cranking during the initial start, to prime the fuel system. If the genset fails to start, see the *Troubleshooting Guide* in the Operator's Manual.

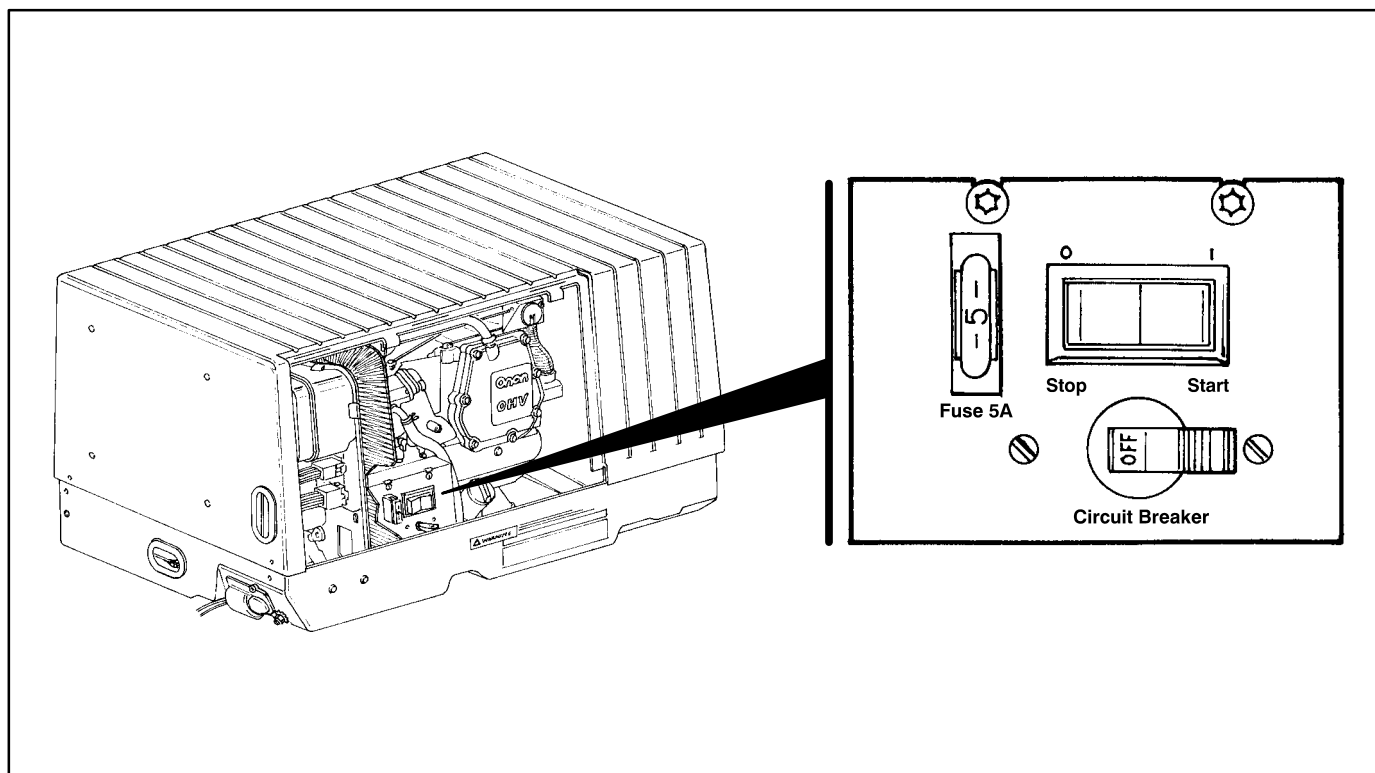


FIGURE 9-2. STANDARD CONTROL PANEL

-
2. After the genset starts, check for fuel leaks. If any leaks are found, stop the genset immediately, close the fuel supply valve (if equipped) and have the leak(s) repaired. Make sure that the fuel lines do not touch anything that can damage them. Do not operate the genset for more than a few minutes with the access cover removed or the genset will overheat.

⚠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 genset and have the leak repaired immediately.*

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

3. Examine the exhaust system for leaks. If any leaks are found, stop the genset and have the exhaust system repaired immediately.

⚠WARNING *Exhaust gas presents the hazard of severe personal injury or death. Inspect the exhaust system audibly and visually. With the genset running, and the service access cover removed, inspect the muffler. Do not operate the genset if it is excessively noisy. Have any leaks repaired immediately.*

4. Operate the genset with a normal load, monitoring fuel supply connections, exhaust system,

genset performance, and amount of noise reduction. If genset performance is not acceptable, see the Service Manual for adjustment procedures, or contact an authorized Onan service center for assistance. If the genset requires adjustment or repair, disconnect the starting battery, negative (-) cable first, to prevent accidental start-up.

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

5. Move the Start/Stop switch to the stop (O) position to stop the genset.

Starting from the Remote Control

1. Move the Remote Start/Stop switch to the start (I) position. The engine should crank and start as indicated by indicator light on the switch. If it does not, see the *Troubleshooting Guide* in the Operator's Manual. Check all remote control connections, repair if necessary, and restart the genset.
2. After the genset starts, check the battery condition meter (if equipped) to confirm its proper operation.
3. Move the Start/Stop switch to the stop (O) position to stop the genset.

INSTALLATION REVIEW

Prior to initial start-up of the genset, check (✓) each of the following items. For a proper installation, each answer must be yes; if not, that aspect of the installation should be reworked or provision made to satisfy the requirement.

- ☐ If installed in a compartment, Is the compartment metal-lined and sealed around all edges?
- ☐ Are wiring holes into the inside of coach (including the inside of AC conduit) sealed to prevent passage of exhaust gases?
- ☐ Can the following routine maintenance items be performed through the vehicle access panel? Refer to Figure 3-3.
 - ☐ Change oil
 - ☐ Adjust carburetor
 - ☐ Start/Stop the unit
 - ☐ Change air filter
 - ☐ Adjust governor
 - ☐ Access AC circuit breaker and control fuse
 - ☐ Change spark plug
- ☐ Are air inlet and exhaust openings clear and large enough (see *Mounting* section) for proper airflow?
- ☐ If the installation is for an under-floor kit, is there a metal barrier between the genset and a combustible floor? See Figure 3-8.
- ☐ Are fuel lines and electrical wires protected from chafing and damage and are they insulated from each other? Refer to Figure 3-11.
- ☐ Are all fuel connections and hose clamps tight? Refer to Figure 3-12.
- ☐ Is a flexible section of non-conducting fuel line installed between the fuel inlet and the fuel line from the tank? Refer to Figure 3-12.
- ☐ Are all electrical leads connected and protected, and is the conduit adequately supported? Refer to Figure 3-13, -14, -15, and -16.
- ☐ Does the exhaust system extend beyond the perimeter of the vehicle a minimum of 1 inch (25 mm)? See Figure 3-18.
- ☐ Are there operable windows, doors or storage compartments within a triangle formed by a base one foot on either side of the exhaust pipe and 3 feet above the exhaust pipe? Refer to Figure 3-21.
- ☐ If the exhaust system is run into the angle of approach or departure (see Figure 3-20), is it protected from bottoming out by use of skid bars, rollers, etc.?
- ☐ Is the exhaust system secure and are all connections tight? Are all required exhaust clamps, hangers, and support straps in place per the *Exhaust System* section of this manual and the kit instructions?
- ☐ Is the genset protected from direct road splash from vehicle wheels?

10. Wiring Schematic/Diagram

DRAWING NO.	DESCRIPTION	PAGE
611-1225	Wiring Schematic - MicroLite (60 Hertz/120 VAC)	10-2
611-1225	Wiring Diagram - MicroLite (60 Hertz/120 VAC)	10-3
611-1228	Wiring Schematic - MicroLite (60 Hertz/100 VAC)	10-4
611-1228	Wiring Diagram - MicroLite (60 Hertz/100 VAC)	10-5
611-1228	Voltage Reconnection Chart - MicroLite (60 Hertz/100 VAC)	10-6
611-1226	Wiring Schematic - MicroLite (50 Hertz)	10-7
611-1226	Wiring Diagram - MicroLite (50 Hertz)	10-8
611-1226	Voltage Reconnection Chart - MicroLite (50 Hertz)	10-9

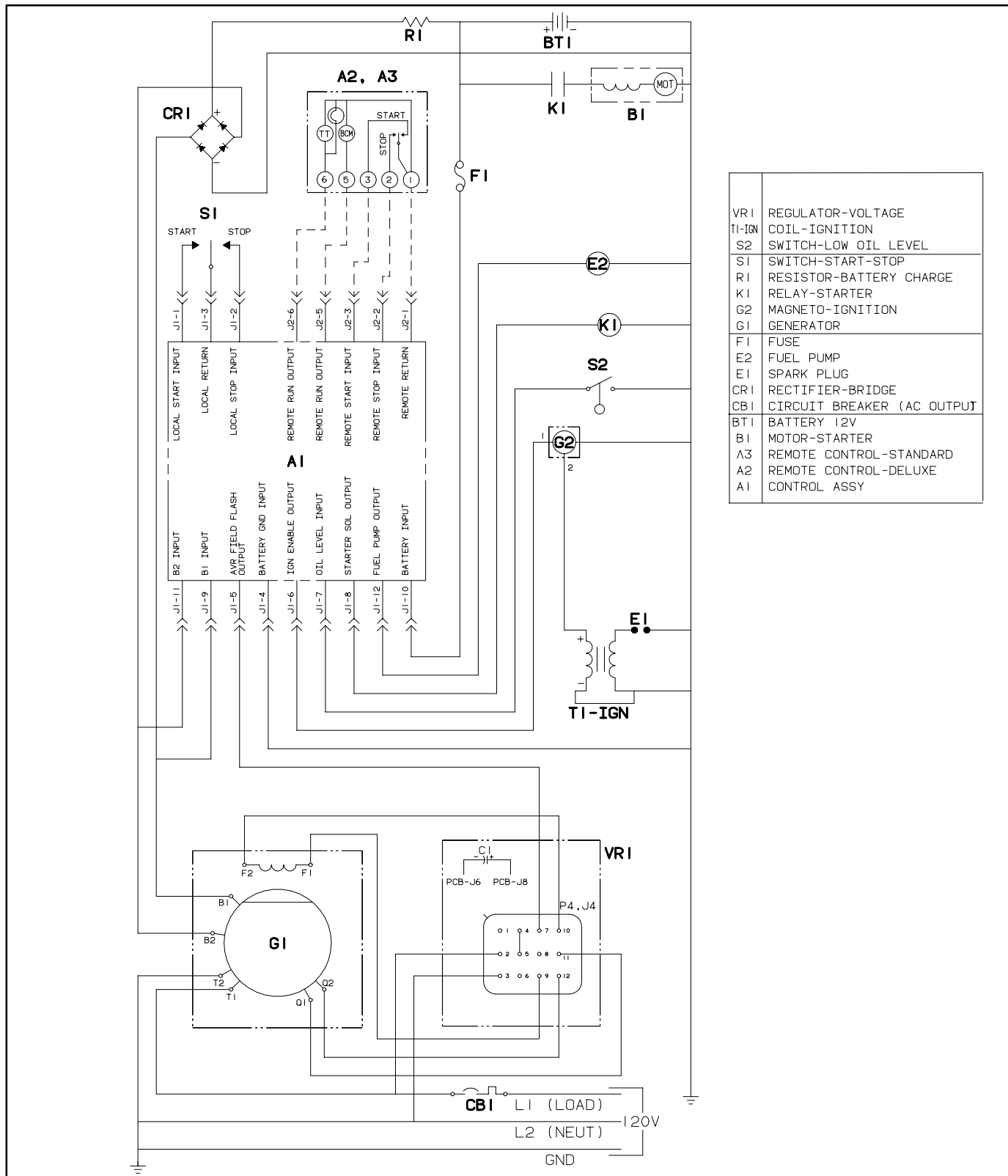


FIGURE 10-1. WIRING SCHEMATIC 611-1225

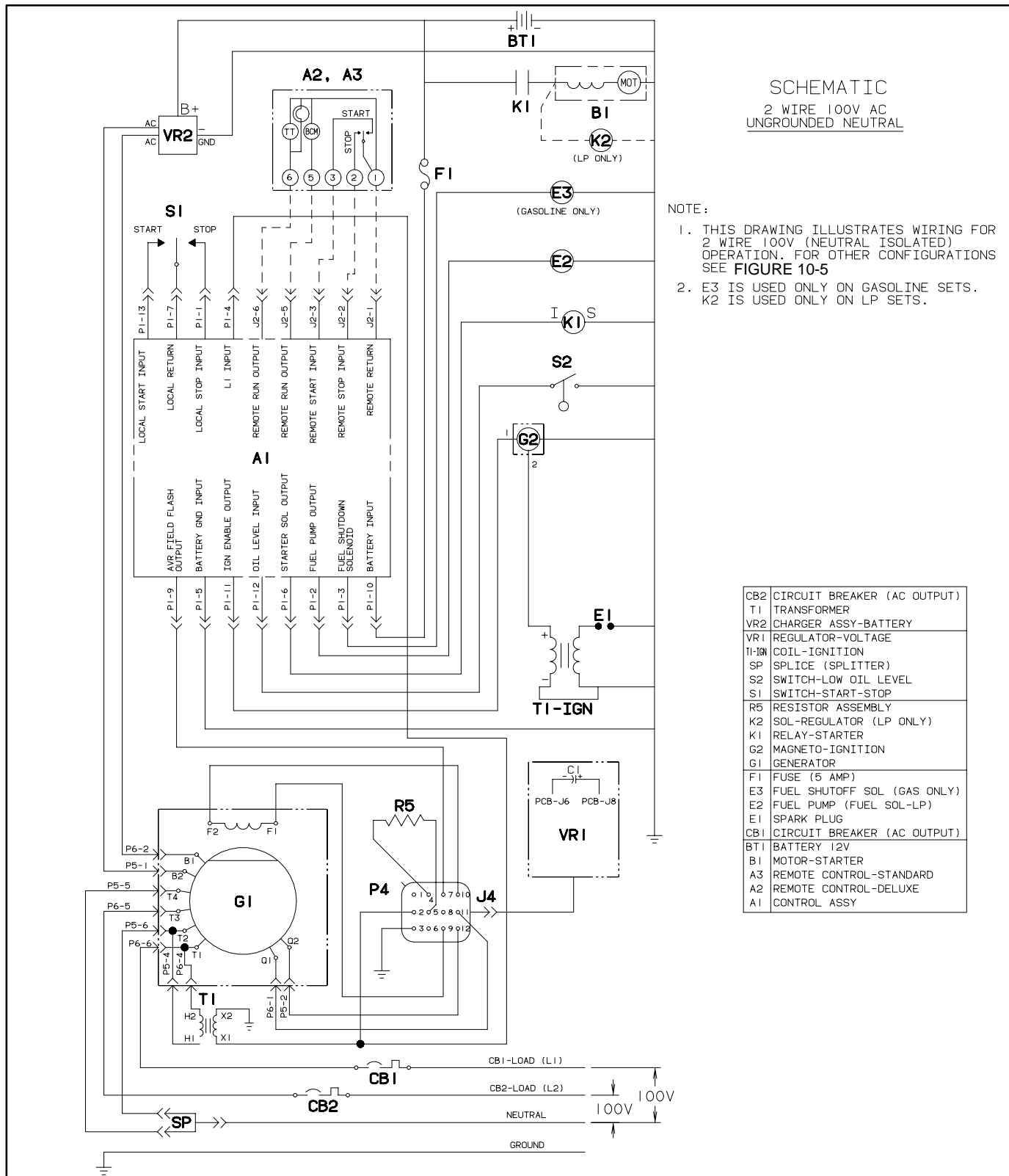
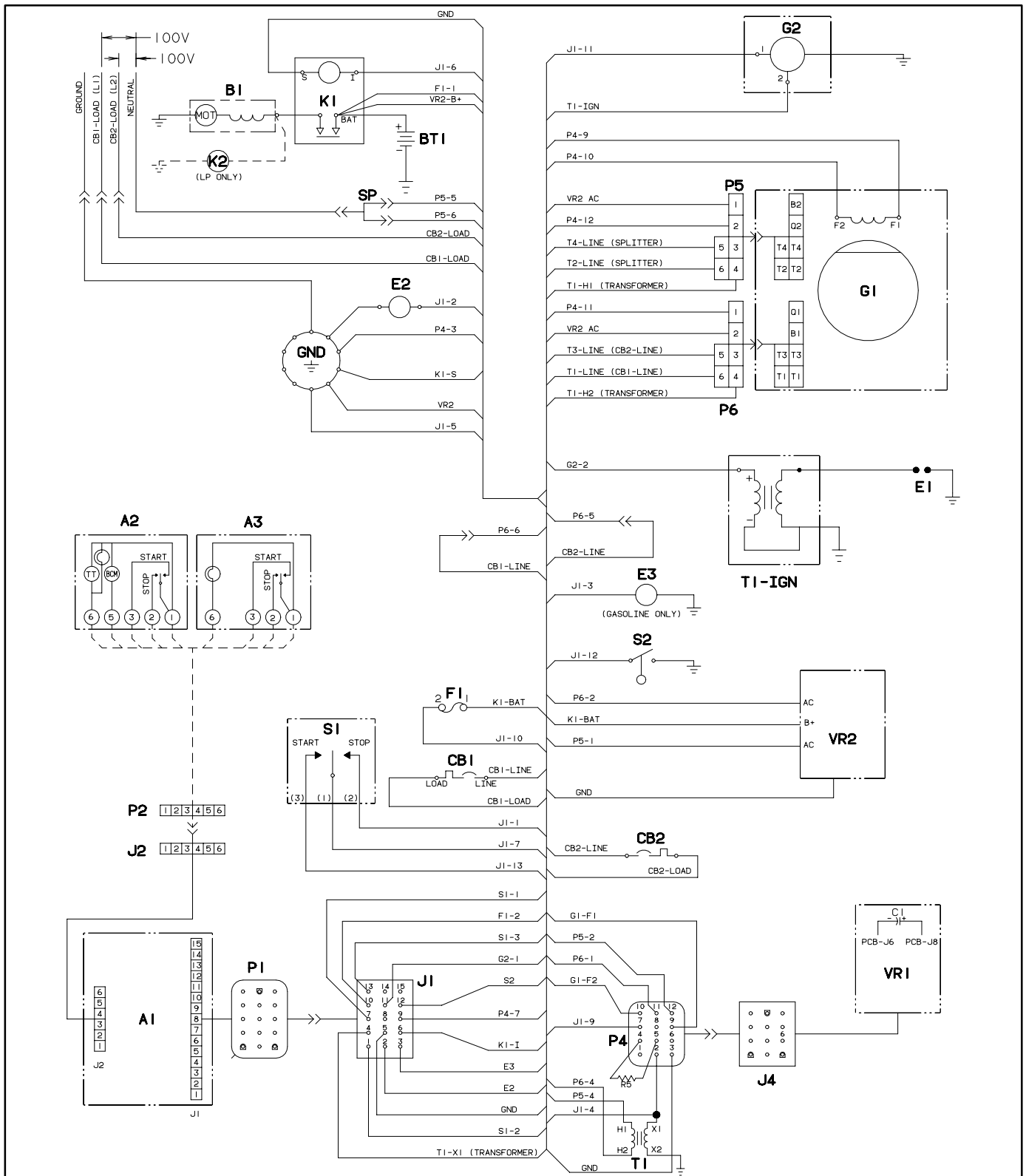


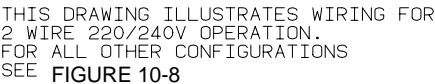
FIGURE 10-3. WIRING SCHEMATIC 611-1228



RECONNECTION CHART FOR MICROLITE 4000 60 HZ/100V

FROM:	TO:					
	3 WIRE 100/200		2 WIRE 100		2 WIRE 200	
	NEUTRAL GROUNDED	NEUTRAL ISOLATED	NEUTRAL GROUNDED	NEUTRAL ISOLATED	LINE TO GND=200V NEUTRAL GROUNDED	LINE TO GND=100V NEUTRAL GROUNDED
T1-LINE T2-LINE T3-LINE T4-LINE	CB1-LINE GROUND SPLITTER CB2-LINE	CB1-LINE SPLITTER CB2-LINE	CB1-LINE GROUND CB2-LINE GROUND	CB1-LINE SPLITTER CB2-LINE SPLITTER	SPLITTER GROUND CB1-LINE SPLITTER	CB1-LINE GROUND CB2-LINE
CB1-LOAD (L1) NEUTRAL (N) CB2-LOAD (L2) GROUND (GND)	CB1-LOAD GROUND SPLITTER CB2-LOAD GROUND	CB1-LOAD SPLITTER CB2-LOAD GROUND	CB1-LOAD GROUND CB2-LOAD GROUND	CB1-LOAD SPLITTER CB2-LOAD GROUND	CB1-LOAD GROUND OPEN CB2-LOAD GROUND	CB1-LOAD OPEN CB2-LOAD GROUND
SPECIAL INSTRUCTIONS	SPLITTER NOT USED		CONNECT L1-L2 AT JUNCTION BOX SPLITTER NOT USED	CONNECT L1-L2 AT JUNCTION BOX	SPLITTER NOT USED	
100V 200V	L1-N, L2-N L1-L2	L1-N, L2-N L1-L2	(L1, L2)-N N/A	(L1, L2)-N N/A	N/A L1-N	N/A L1-L2
RECONNECTION DIAGRAMS						

FIGURE 10-5. VOLTAGE RECONNECTION DIAGRAM 611-1228



10-7

RECONNECTION CHART FOR MICROLITE 50 HZ

FROM:	TO:						
	3 WIRE 110/220 OR 120/240V		2 WIRE 110 OR 120V		2 WIRE 220 OR 240V		
	NEUTRAL GROUNDED	NEUTRAL ISOLATED	NEUTRAL GROUNDED	NEUTRAL ISOLATED	LINE TO GND=220V NEUTRAL GROUNDED	LINE TO GND=110V NEUTRAL GROUNDED	NEUTRAL ISOLATED
T1-LINE T2-LINE T3-LINE T4-LINE	CB1-LINE GROUND GROUND CB2-LINE	CB1-LINE SPLITTER SPLITTER CB2-LINE	CB1-LINE GROUND CB2-LINE GROUND	CB1-LINE SPLITTER CB2-LINE SPLITTER	SPLITTER GROUND CB1-LINE SPLITTER	CB1-LINE GROUND GROUND CB2-LINE	CB1-LINE SPLITTER SPLITTER CB2-LINE
CB1-LOAD (L1) NEUTRAL (N) CB2-LOAD (L2) GROUND (GND)	CB1-LOAD GROUND CB2-LOAD GROUND	CB1-LOAD SPLITTER CB2-LOAD GROUND	CB1-LOAD GROUND CB2-LOAD GROUND	CB1-LOAD SPLITTER CB2-LOAD GROUND	CB1-LOAD GROUND OPEN GROUND	CB1-LOAD OPEN CB2-LOAD GROUND	CB1-LOAD OPEN CB2-LOAD GROUND
SPECIAL INSTRUCTIONS	SPLITTER NOT USED		CONNECT L1-L2 AT JUNCTION BOX SPLITTER NOT USED	CONNECT L1-L2 AT JUNCTION BOX	PLUG UNUSED TAB ON SPLITTER WITH SEPERATE TERMINAL SUPPLIED.	SPLITTER NOT USED	PLUG UNUSED TAB ON SPLITTER WITH SEPERATE TERMINAL SUPPLIED.
110 OR 120V 220 OR 240V	L1-N, L2-N L1-L2	L1-N, L2-N L1-L2	(L1,L2)-N N/A	(L1,L2)-N N/A	N/A L1-N	N/A L1-L2	N/A L1-L2
RECONNECTION DIAGRAMS							

NOTE: OUTPUT VOLTAGE CAN BE ADJUSTED BY USE OF THE ADJUSTMENT POT ON THE FRONT OF THE CONTROL PANEL. CLOCKWISE ROTATION WILL INCREASE THE VOLTAGE BY A MAXIMUM INCREASE OF 20 VAC.

FIGURE 10-8. VOLTAGE RECONNECTION DIAGRAM 611-1226



Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
763-574-5000
Fax: 763-528-7229

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