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RV GenSet

Installation Manual

BGE, NHE

Emerald Plus™ Series





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 **INSTALLATION MANUAL** before installing the genset. Safe operation and top performance can be obtained only with proper genset installation.

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 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, damage to equipment and fire. 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 on the ground or floor.

FUEL IS FLAMMABLE AND EXPLOSIVE

- Keep flames, cigarettes, sparks, pilot lights, electrical arc-producing equipment and switches and all other sources of ignition well away from areas where fuel fumes are present and areas sharing ventilation.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.
- Use approved non-conductive flexible fuel hose for fuel connections at the genset.

ENGINE EXHAUST IS DEADLY!

- Learn the symptoms of carbon monoxide poisoning in this Manual.
- Never sleep in the vehicle while the genset is running unless the vehicle has a working carbon monoxide detector.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Do not use engine cooling air to heat the vehicle interior.
- Make sure there is ample fresh air when operating the genset in a confined area.

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.

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.

MBL-1

1. Introduction

ABOUT THIS MANUAL

This manual is a guide for the installation of the generator set (genset) models listed on the front cover. Proper installation is essential for top performance. Read through this manual before starting the installation.

This manual addresses the following aspects of the installation:

- Location and Mounting
- Exhaust Connections
- Fuel Connections
- Electrical Connections (AC power output, control and battery)
- Startup

⚠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.*

See the Operator's Manual for operation and maintenance and the Service Manual for service.

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 CODES AND STANDARDS FOR SAFETY

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

installation. These sets meet the basic requirements of the Standard for Safety for Engine Generator Sets for Recreational Vehicles, ANSI/RVIA EGS-1. They are suitable for installation in accordance with:

- The National Electrical Code, NFPA No. 70, Article 551
- The Standard on Recreational Vehicles, NFPA No. 501C

Federal, State and local codes, such as the California Administrative Code—Title 25 (RV installation), might also be applicable. Installation codes and recommendations can change from time-to-time and are different in different countries, states and municipalities. It is recommended that the standards in Table 1-1 be obtained for reference.

TABLE 1-1. REFERENCE CODES AND STANDARDS

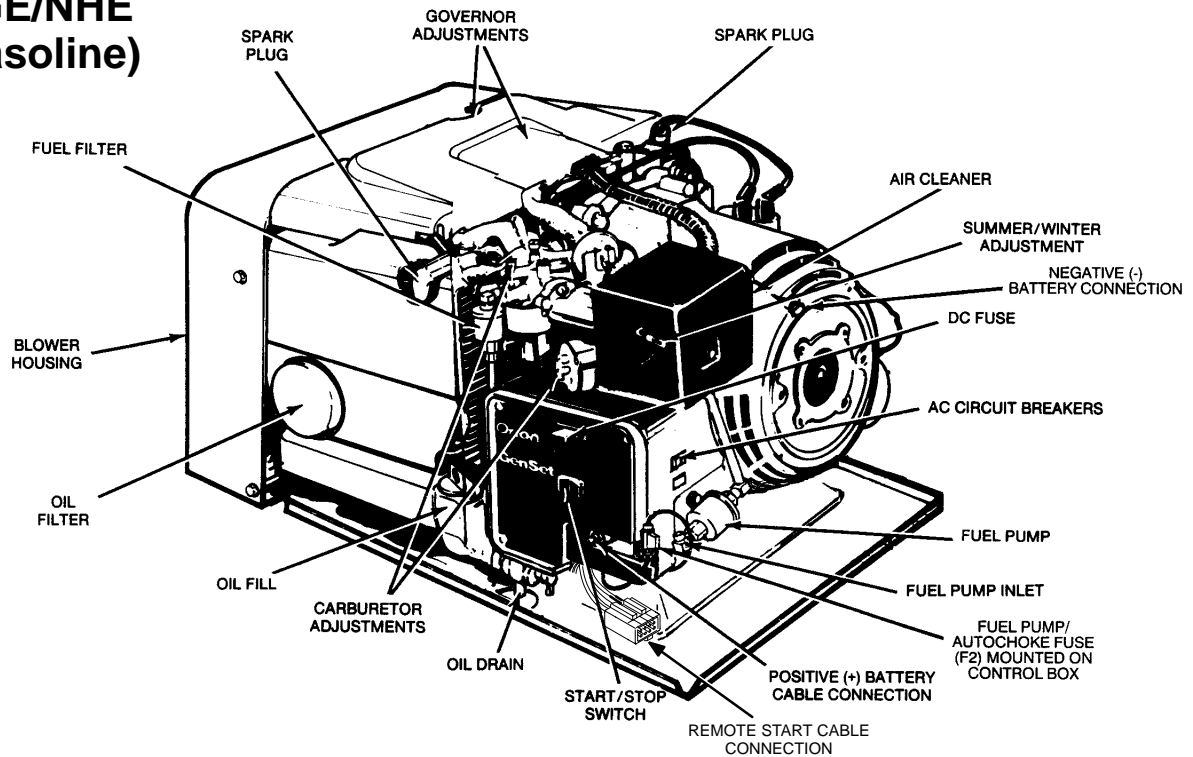
NFPA Nos. 70 & 501C	National Fire Protection Association 470 Atlantic Avenue, Boston, MA 02210
ANSI/RVIA-EGS-1	Recreational Vehicle Industry Association 14650 Lee Road, Chantilly, VA 22021
California Administrative Code—Title 25, Chapter 3	State of California Documents Section P.O. Box 1015, North Highlands, CA 95660

GENSET OUTLINE DRAWINGS

See *Outline Drawings* for the dimensions of the genset and the locations of the mounting bolt holes, inlet and outlet air openings, oil drain plug, maintenance access door and connection points (fuel, battery, remote control, AC, exhaust).

See your Onan dealer for large-scale drawings and a floor template to locate the opening cutouts.

BGE/NHE (Gasoline)



BGE/NHE (LPG)

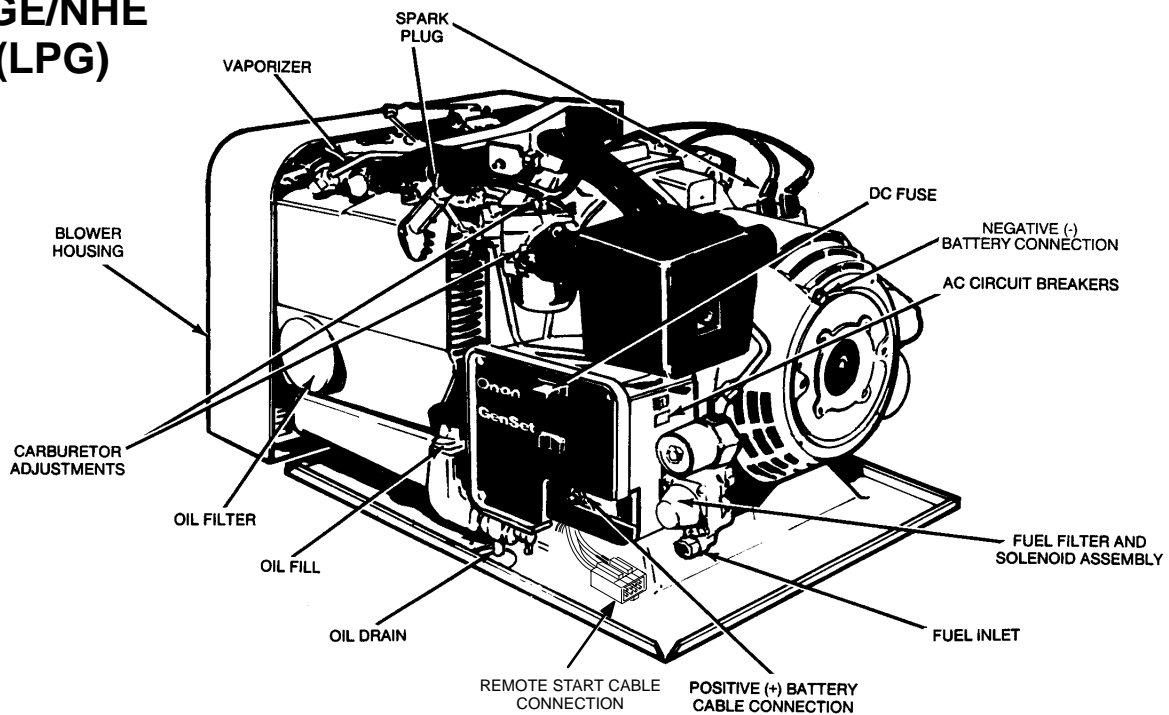


FIGURE 1-1. TYPICAL EMERALD PLUS GENERATOR SETS

2. Specifications

	GASOLINE MODELS				
	BGE			NHE	
GENERATOR: 4-Pole Revolving Field, Self-Excited, Electronically Regulated, 1-Phase					
Power (watts)	4000	5000	4000	6500	5000
Frequency (Hertz)	60		50	60	50
Voltage	120	120	110/220 or 120/240	120	110/220 or 120/240
Current (amperes)	33.3	41.7	36.4/18.2 or 33.3/16.7	54.2	45.5/22.7 or 41.7/20.8
Speed (RPM)	1800	1800	1500	1800	1500
FUEL CONSUMPTION:					
No load gph (l/h)	0.4 (1.5)	0.4 (1.5)	0.3 (1.1)	0.4 (1.5)	0.4 (1.5)
Half load gph (l/h)	0.6 (2.3)	0.7 (2.6)	0.5 (1.9)	0.7 (2.6)	0.7 (2.6)
Full load gph (l/h)	0.8 (3.0)	1.0 (3.8)	0.8 (3.0)	1.3 (4.9)	1.0 (3.8)
ENGINE: 2-Cylinder Opposed, 4-Cycle, Spark-Ignited, Side-Valve, Air Cooled					
Bore	3.250 inches (83 mm)			3.563 inches (90 mm)	
Stroke	2.875 inches (73 mm)			3.000 inches (76 mm)	
Displacement	48 inches ³ (782 cc)			60 inches ³ (980 cc)	
Compression Ratio	7.0 : 1			7.0 : 1	
Oil Capacity (with filter)*	3.5 quarts (3.3 l)			3.5 quarts (3.3 l)	
Intake Valve Clearance (Cold)	0.005 inches (0.13 mm)			0.005 inches (0.13 mm)	
Exhaust Valve Clearance (Cold)	0.013 inches (0.33 mm)			0.013 inches (0.33 mm)	
Spark Plug Gap	0.025 inches (0.64 mm)			0.025 inches (0.64 mm)	
Spark Plug Tightening Torque	8 lbs-ft (10 N-m)			8 lbs-ft (10 N-m)	
Ignition Timing (electronic ignition)	12° BTDC, non-adjustable			12° BTDC, non-adjustable	
CONTROL AND CRANKING SYSTEM: 12 VDC					
Nominal Battery Voltage	12 volts			12 volts	
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes			360/450 amperes	
Fuse F1 (control circuit)	5 amperes			5 amperes	
Fuse F2 (autochoke/fuel pump)	10 amperes mini-bayonet			10 amperes mini-bayonet	
WEIGHT:	216 lb (98 kg)			230 lb (105 kg)	
* -See <i>Periodic Maintenance</i> for oil filling instructions.					

	LPG MODELS			
	BGE		NHE	
GENERATOR: 4-Pole Revolving Field, Self-Excited, Electronically Regulated, 1-Phase				
Power (watts)	4000	4000	6300	5000
Frequency (Hertz)	60	50	60	50
Voltage	120	110/220 or 120/240	120	110/220 or 120/240
Current (amperes)	33.3	36.4/18.2 or 33.3/16.7	52.5	45.5/22.7 or 41.7/20.8
Speed (RPM)	1800	1500	1800	1500
FUEL CONSUMPTION:				
No load lbs/h (kg/h)	1.8 (0.8)	1.5 (0.7)	2.2 (1.0)	2.0 (0.9)
Half load lbs/h (kg/h)	2.6 (1.2)	2.6 (1.2)	3.8 (1.7)	3.5 (1.6)
Full load lbs/h (kg/h)	4.0 (1.8)	4.0 (1.8)	6.6 (3.0)	5.1 (2.3)
ENGINE: 2-Cylinder Opposed, 4-Cycle, Spark-Ignited, Side-Valve, Air Cooled				
Bore	3.250 inches (83 mm)		3.563 inches (90 mm)	
Stroke	2.875 inches (73 mm)		3.000 inches (76 mm)	
Displacement	48 inches ³ (782 cc)		60 inches ³ (980 cc)	
Compression Ratio	7.0 : 1		7.0 : 1	
Oil Capacity (with filter)*	3.5 quarts (3.3 l)		3.5 quarts (3.3 l)	
Intake Valve Clearance (Cold)	0.005 inches (0.13 mm)		0.005 inches (0.13 mm)	
Exhaust Valve Clearance (Cold)	0.013 inches (0.33 mm)		0.013 inches (0.33 mm)	
Spark Plug Gap	0.025 inches (0.64 mm)		0.025 inches (0.64 mm)	
Spark Plug Tightening Torque	8 lbs-ft (10 N-m)		8 lbs-ft (10 N-m)	
Ignition Timing (electronic ignition)	12° BTDC, non-adjustable		12° BTDC, non-adjustable	
LPG Vapor Supply Pressure (Range)—Vapor-Withdrawal Models Only	9 to 13 inch (229 to 330 mm) W.C. (water column)		9 to 13 inch (229 to 330 mm) W.C. (water column)	
CONTROL AND CRANKING SYSTEM: 12 VDC				
Nominal Battery Voltage	12 volts		12 volts	
Minimum Battery Cold Cranking Capacity: Above/Below Freezing	360/450 amperes		360/450 amperes	
Fuse F1 (control circuit)	5 amperes		5 amperes	
Fuse F2 (fuel solenoid)	10 amperes mini-bayonet		10 amperes mini-bayonet	
WEIGHT:	216 lb (98 kg)		230 lb (105 kg)	
* -See <i>Periodic Maintenance</i> for oil filling instructions.				

3. Location and Mounting

GENERAL

Read the entire manual and housing/exhaust kit instructions before installing the genset. The genset is designed for two very different types of installation: conventional compartment mount installation and under-floor mount installation. Choose the appropriate section and carefully follow the instructions given.

COMPARTMENT MOUNT

In a conventional installation, the genset is installed on a framework that is part of the vehicle. This framework must be constructed in accordance with the safety-approved specifications contained in the *Compartment Construction* section following.

Unless the genset is to be removed from underneath the vehicle, plan the location for an access opening to be large enough to permit genset removal. Typical locations are illustrated in Figure 3-1. Allow additional clearance for easy access to the oil fill, drain, filter, and oil dipstick, as well as the air cleaner element, circuit breaker, governor adjustments, carburetor adjustments, spark plugs, Start/Stop switch, and DC fuse. The locations of each are shown in Figure 1-1 on Page 1-2.

Design the compartment large enough for the genset to have a minimum clearance of 0.6 inch (15 mm) between the genset and compartment walls and ceiling (and acoustical material, if used). See Figures 9-4, 9-5, 9-7, and 9-9 on Pages 9-4, 9-5, 9-7, and 9-9 in Section 9. *Outline Drawings* for general information when reviewing the following and refer to the specific Outline Drawing when performing installation.

Compartment Construction

1. It is imperative that the genset compartment be separated from the living quarters and any fuel (gasoline or propane) supply with a vapor-tight, fire-resistant barrier. See the appropriate figures in Section 9. *Outline Drawings* (and specific Outline Drawing) for minimum clearances and compartment size.

⚠ WARNING **EXHAUST GAS IS DEADLY.** Construct a suitable vapor barrier of approved materials between the genset and vehicle interior to keep out exhaust gas.

2. Line the compartment with 26-gauge galvanized steel or a material of comparable strength, durability, and fire resistance (see NFPA 70, NEC and California Title 25 for complete details).
3. Construct the compartment floor in a manner so as to prevent oil, fuel, or water accumulation. Compartment drainage to the outside of the vehicle can be accomplished by 1/2-inch (13 mm) diameter holes as shown on the compartment floor drawings in Section 9. *Outline Drawings*.

NOTE: Do *not* use absorbent sound proofing material on compartment floor. The floor should have minimal openings to reduce sound level.

4. Equip the base with an oil drain hole to the outside on the compartment. Do not mount the muffler below the oil drain hole.

⚠ WARNING **Fire presents the hazard of severe personal injury or death.** To prevent a fire hazard, do not position the muffler directly below the drain hole.

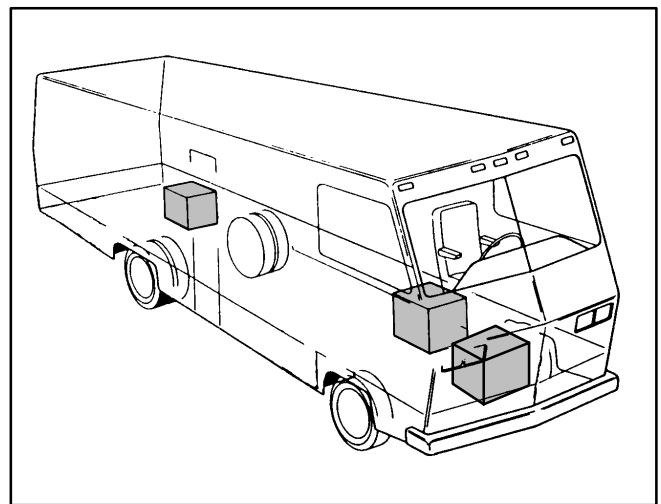


FIGURE 3-1. TYPICAL GENSET LOCATIONS

5. Secure the genset mounting plate to the support frame using 3/8-16 UNC, grade 5 screws. The back two mounting holes are supplied with

weld nuts to facilitate installing screws. The front two holes can be secured with 3/8-16 screws, lock-washers, and nuts. The front holes are square to allow the use of 3/8-16 cage nuts, if desired. See the appropriate figure in Section 9. *Outline Drawings*.

⚠ CAUTION *Road vibrations can cause component damage to the genset if the unit mounting plate is not fastened securely to the vehicle compartment. Use screws of sufficient length to allow a minimum of 1½ threads to extend through the nut for maximum holding power.*

UNDER-FLOOR MOUNT

In an under-floor mount installation, the genset is mounted in a housing below the floor and outside the vehicle coach. This housing assembly should be as supplied or reviewed by Onan, and must be installed in accordance with the Installation Codes and Safety Recommendations list in the *Introduction*. Review the following text for general application information, and review the proper housing/ex-

haust kit instructions for further specifics regarding under-floor mount instructions.

The vehicle construction must be able to support the weight of the genset (see *General Specifications*). It is the vehicle manufacturer's and the installer's responsibility to provide a structurally sound support frame, by using tubing, angle brackets, or steel reinforced plywood or other composition board. Reinforcement of plywood or other composition board can be accomplished with 3-inch (76 mm) or larger washers or a full metal plate.

⚠ WARNING *Design the genset support structure carefully to prevent the genset from falling from the vehicle and possibly causing a serious road accident.*

General

Genset Location. When choosing a location for mounting the under-floor mount genset, consider the following not only for mounting, but for protection of the genset, as well. Figure 3-2 shows the most common mounting areas of an RV genset in a recreational vehicle.

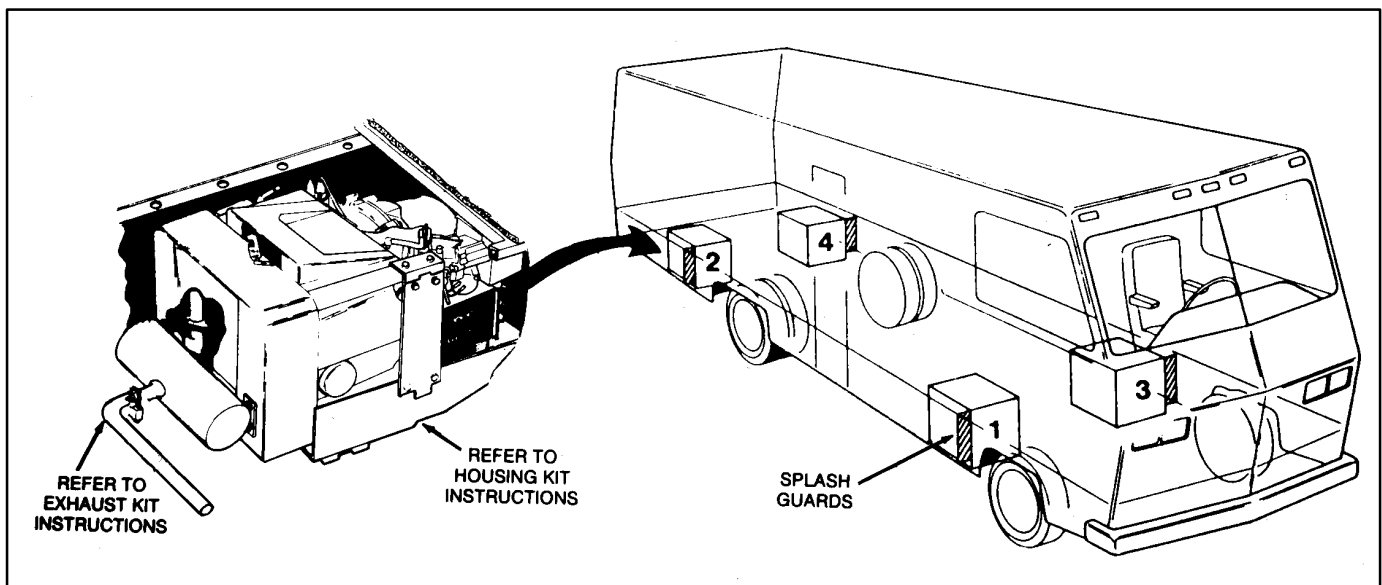


FIGURE 3-2. COMMON UNDER-FLOOR MOUNTING AREAS OF GENSET

-
- If the genset is mounted on the curb side (location 1 or 2), protect the generator end of the genset from road splash and debris.
 - If the genset is mounted on the driver's side (location 3 or 4), protect the engine end of the genset from road splash and debris.
 - Leave an area between the genset and the recreational vehicle skirt for an air inlet if it is not subjected to road splash. See Section 4. *Ventilation and Acoustics* for more detailed information.

NOTE: Air inlet openings to the genset compartment must not allow dirt, rock, water, or slush to directly hit the genset. Dust and salt entrance into the compartment must be minimized. Pay special attention to protection of the generator, control, choke, and governor areas. Baffles might be required to protect certain areas.

Access Opening. Provide an access opening on the side of the recreational vehicle for the genset. Make it large enough to allow for checking or adding oil, for adjusting the governor and carburetor, and for access to the control panel and AC circuit breaker. The opening should also provide access for oil and air filter replacement so that the genset does not have to be lowered for these procedures. See Figure for location of genset components.

Mounting Clearances. If the compartment door does not open the full width of the genset and to the bottom of the vehicle skirt, provide 2 inches (51 mm)

minimum between the tray and the skirt of the recreational vehicle. This distance allows lowering the genset without hitting the vehicle skirt. Figure 9-4 on Page 9-4 shows basic dimensions of the under-floor mount genset. Refer to specific Outline Drawing when performing installation.

Housing Assembly

The recreational vehicle must be adapted for the under-floor housing. The vehicle frame must support the weight of the genset. It is the vehicle manufacturer's responsibility to provide a structurally sound frame and carriage bolts or equivalent to attach the housing kit.

⚠ CAUTION *Failure to meet Onan review for modifications of housing kits or for non-Onan kit housing installations may void intent of NCT/CSA approval. Liability for damage or injury and warranty expenses becomes the responsibility of the person making the modifications.*

Use the template supplied with the housing kit so that panels are installed square to each other. Failure to mount panels square may result in spark plug breakage.

Review *Exhaust System* section and exhaust system kit installation instructions and component parts. Plan clearance for movement or removal of exhaust components when the genset is lowered for inspection or maintenance purposes.

4. Ventilation and Acoustics

⚠WARNING *EXHAUST GASES ARE DEADLY! Never sleep in the vehicle with the genset running unless the vehicle is equipped with an operating carbon monoxide detector with an audible alarm.*

⚠WARNING *Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Check that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment.*

⚠WARNING *Be sure the unit is well ventilated.*

VENTILATION

The most important factors of ventilation for an RV air-cooled genset are sufficient incoming air (for combustion and cooling) and adequate exhausting of heated air. The BGE/NHE genset uses Vacu-Flo® cooling.

A centrifugal fan in a scroll housing on the engine (Figure 4-1) draws air from the generator end of the compartment, through the generator (the generator also has a cooling fan), and over the cooling surfaces of the engine. Then, it discharges the heated air out through the Vacu-Flo discharge opening.

Make sure nothing obstructs or restricts discharged airflow and that recirculation of air is minimal. A dust or noise deflector, if added, must be a minimum of 3 inches (76 mm) below the genset and open on three sides.

⚠WARNING *Exhaust gas presents the hazard of severe personal injury or death. Because discharged cool air can contain some exhaust gas, never use discharged cooling air for heating.*

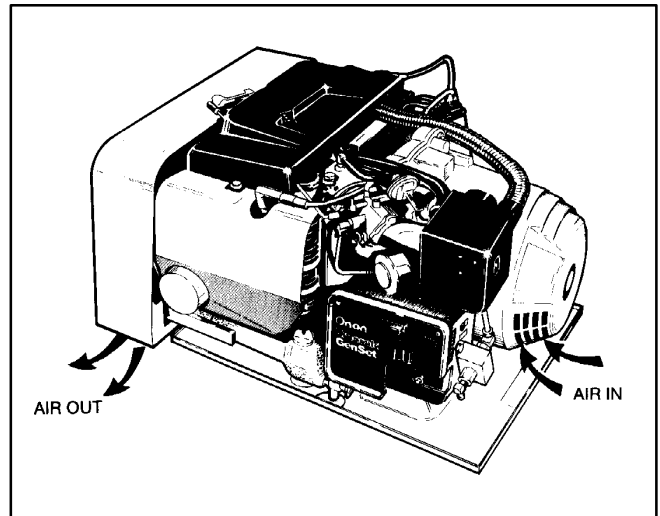


FIGURE 4-1. VACU-FLO® COOLING SYSTEM

The air inlet area is critical for proper genset operation and cooling. A minimum air inlet area of 85 in² (548 cm²) with no restrictions is required. Reference: the genset air discharge rate is 480 ft³/min (13.6 m³/min).

When planning the air inlet to the genset, allow for airflow restrictions caused by grilles and duct work. Some expanded metal grilles provide only 60 percent free air inlet area per square foot. Even the most efficient grille only provides about 90 percent free inlet area per square foot. The free air inlet area of the material can be obtained from the material supplier. Multiply the grille area times the percent of free area of the grill to obtain the free inlet area.

Inlet air ducting should provide a direct, free, airflow path to the genset, with minimal bends. Materials used should 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 might result due to vapor locking (gasoline fuel), hot combustion air, etc.

⚠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.*

To obtain the 85 in² (548 cm²) free air inlet area, Onan recommends bringing in cooling air through the recreational vehicle skirt. This can be accomplished by using the access door, ducting into the generator end from the side wall, or using the hori-

zontal area between RV skirt and the genset along with the vertical area (if road splash is not a problem—see the *Location and Mounting* section). See Figure 4-2 for reference to these areas. If the skirt of the RV does not extend to or below the top of the genset drip tray, provide an extension.

Air can be brought from under the RV for cooling. However, run tests while the RV is both parked and while moving at highway speeds to make sure of proper cooling with this method. A temperature rise between the outside ambient and air in the top openings of the genset housing should not exceed 8°F (4.4°C).

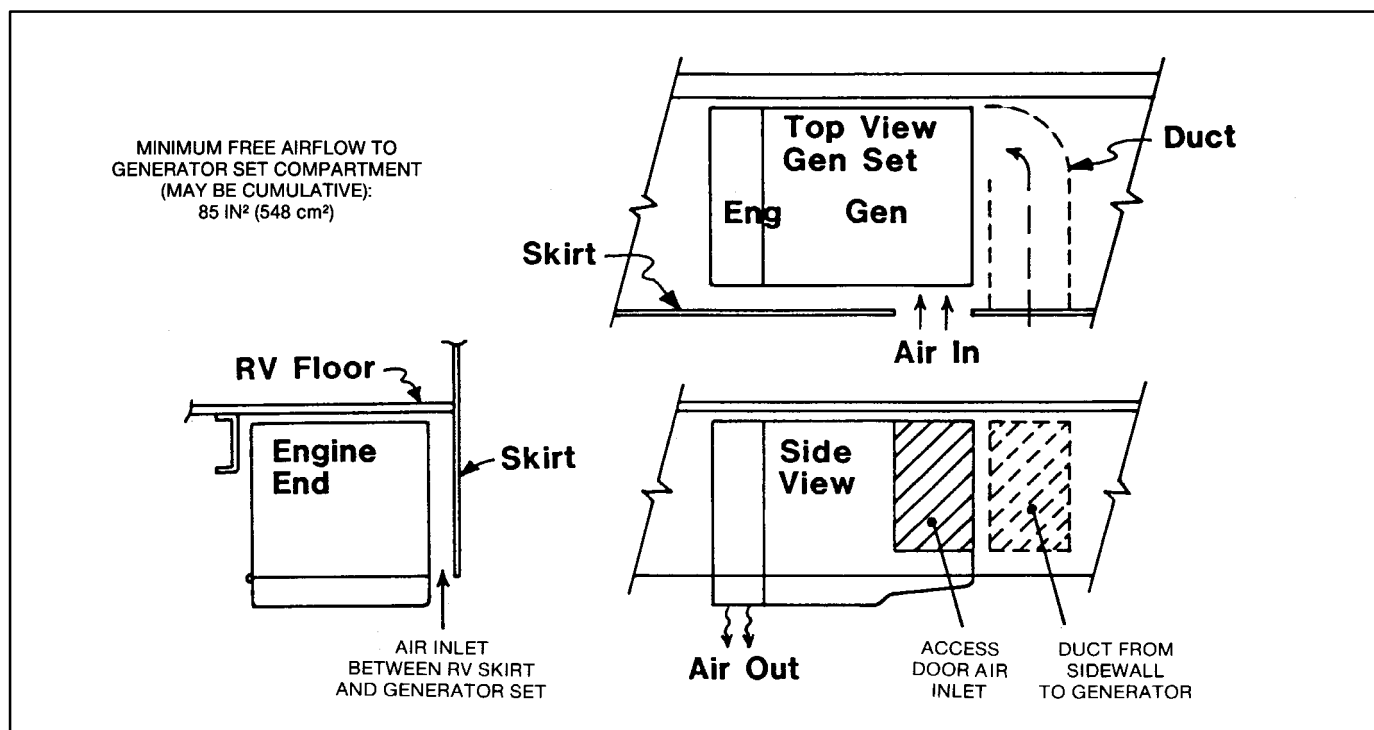


FIGURE 4-2. AIR INLET ALTERNATIVES FOR UNDER-FLOOR MOUNT GENSET

ACOUSTICS

The Onan housing kit for the under-floor mount genset contains acoustical material to minimize noise. Additional insulation is not necessary. If, however, you are constructing your own compartment or housing, use the following guidelines.

For the conventional compartment mount, if compartment penetrates floor, be sure all joints and corners of the compartment are vapor-tight to the interior. 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 sound reflective surfaces, back, top, and sides (not the compartment base) with fiberglass or other self-extinguishing acoustical material. Acoustical material and adhesive should be rated for use at 200°F (90°C) minimum.

Rather than using one single material, a combination of materials can reduce noise considerably. For

instance, a sheet of lead or viscoelastic material and a layer of acoustical material is more effective than either alone.

To reduce line-of-sight noise, a sound panel (baffle) should be added behind the air inlet. The panel must be spaced to allow for minimum free air inlet of 85 in² (548 cm²).

Refer to Figure 4-3 on Page 4-4 to aid your genset compartment design and noise reduction plans. Size ducting to make sure that minimum free airflow of 85 in² (548 cm²) is still attained after acoustical material is added.

⚠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 recreational vehicles, insulation must not reduce the 0.6-inch (15-mm) clearance specified.*

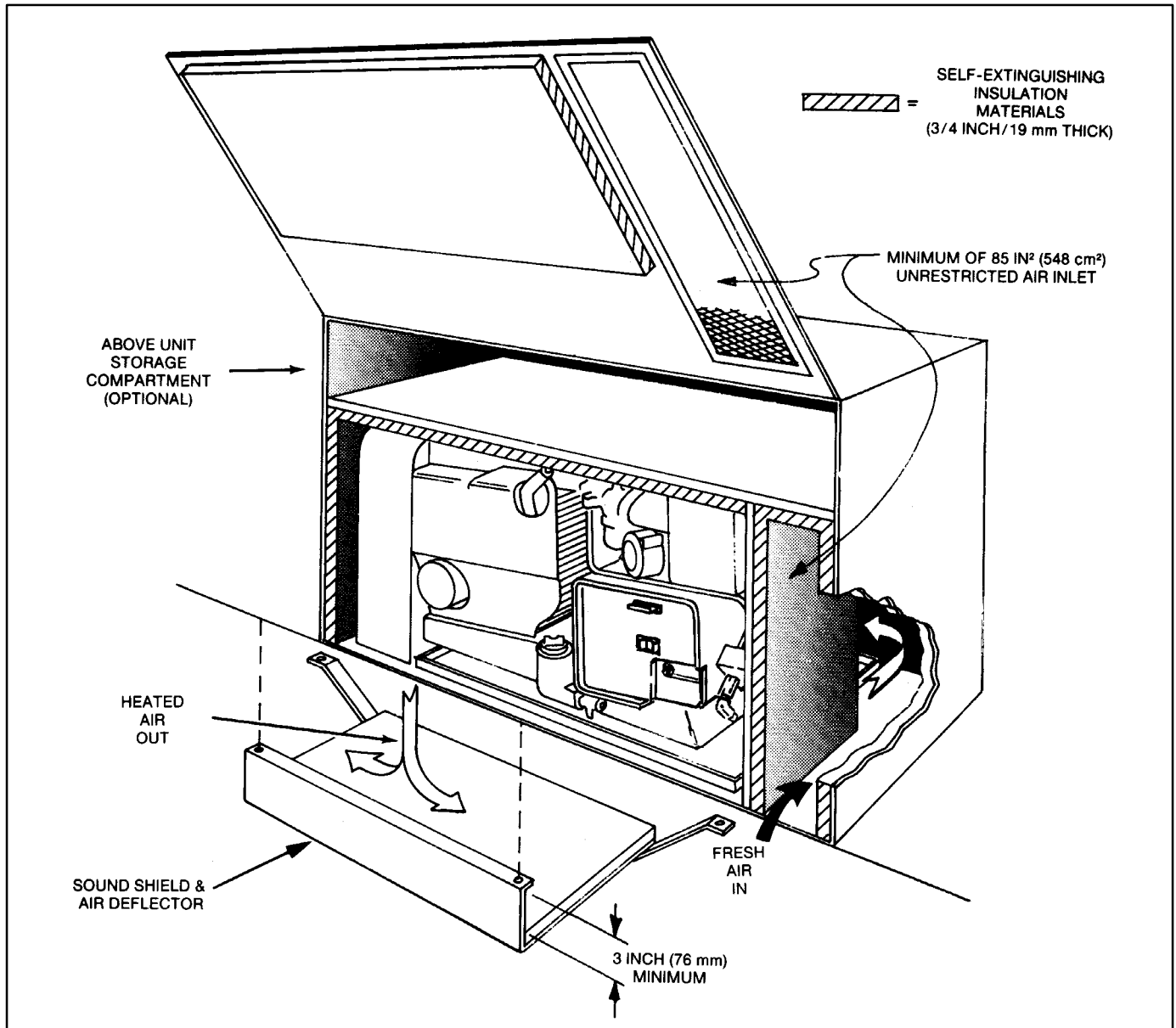


FIGURE 4-3. NOISE REDUCTION - COMPARTMENT DESIGN RECOMMENDATION

5. Exhaust System

⚠ WARNING *EXHAUST GASES ARE DEADLY! Never sleep in the vehicle with the genset running unless the vehicle is equipped with an operating carbon monoxide detector with an audible alarm.*

⚠ WARNING *Provide an adequate exhaust system to properly expel discharged gases. Inspect exhaust system daily for leaks per the maintenance schedule. Check that exhaust manifolds are secure and not warped. Do not use exhaust gases to heat a compartment. Be sure the unit is well ventilated.*

GENERAL

Plan each individual exhaust system carefully. A proper installation is not only vapor tight, but is also quieter and safer. Be sure to check all applicable standards, local codes, and regulations.

Refer to the following text and figures for recommendations to follow when installing the exhaust system. Refer to the installation instructions supplied with the exhaust system kit for specific mounting procedures. See Figures 5-4 and 5-5 on Pages 5-4 and 5-5 for exhaust kit options.

MUFFLER

If the genset was supplied without a muffler we recommend that you purchase an Onan RV spark arresting muffler approved by RVIA and USDA. The RVIA/ANSI EGS-1 standard requires that the muffler be constructed of aluminized steel or equivalent corrosion resistant material and be of welded or crimped construction. The spark arrestor must be USDA approved. It may be integral to the muffler or of the add-on type. The muffler back pressure rating must not exceed 35 inch water (2.57 inch mercury) for Model BGE or 65 inch water (4.78 inch mercury) for Model NHE.

⚠ CAUTION *Failure to use and maintain a spark arresting exhaust system is illegal on federally owned lands and could lead to a brush or forest fire.*

Liability for damage or injury, and warranty expenses due to use of unapproved mufflers or instal-

lation modifications becomes the responsibility of the person installing substitute muffler or performing the modifications. Contact an Onan distributor for approved exhaust system parts and installation instructions.

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 of 1 inch (25 mm) beyond the perimeter or bumper of the vehicle. If the genset tailpipe is on the same side of the vehicle as the compartment, try to terminate the tailpipe aft of the genset air intake to reduce the possibility of exhaust recirculation. Direct the exhaust down and to the rear. See Figure 5-1.

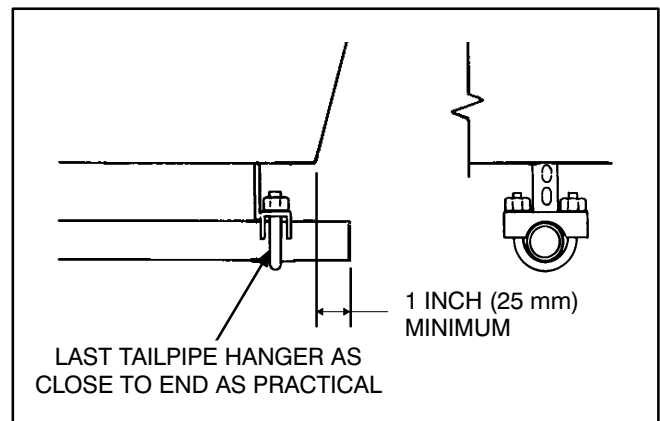


FIGURE 5-1. EXHAUST TAILPIPE TERMINATION

To reduce the possibility of damaging the tailpipe and emitting exhaust gases under the vehicle, be sure no part of the exhaust system intrudes into the departure angle or approach angle unless it is adequately protected by a skid bar or other protection device. See shaded areas in Figure 5-2 on Page 5-2 for typical mounting locations.

⚠ WARNING *Exhaust gas presents the hazard of severe personal injury or death. Use only Onan specified exhaust equipment with generator set and support the system per kit instructions.*

⚠ WARNING Exhaust gas presents the hazard of severe personal injury or death. Do not terminate exhaust gas under vehicle. Do not terminate exhaust system directly under any vent, window, or opening that can be opened and that is not permanently sealed from the vehicle living space. Keep all openings closed when the generator set is running.

⚠ CAUTION Excessive exhaust back pressure can cause engine damage. If 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 generator set exhaust to the vehicle exhaust system, because water vapor from one engine can damage the other.

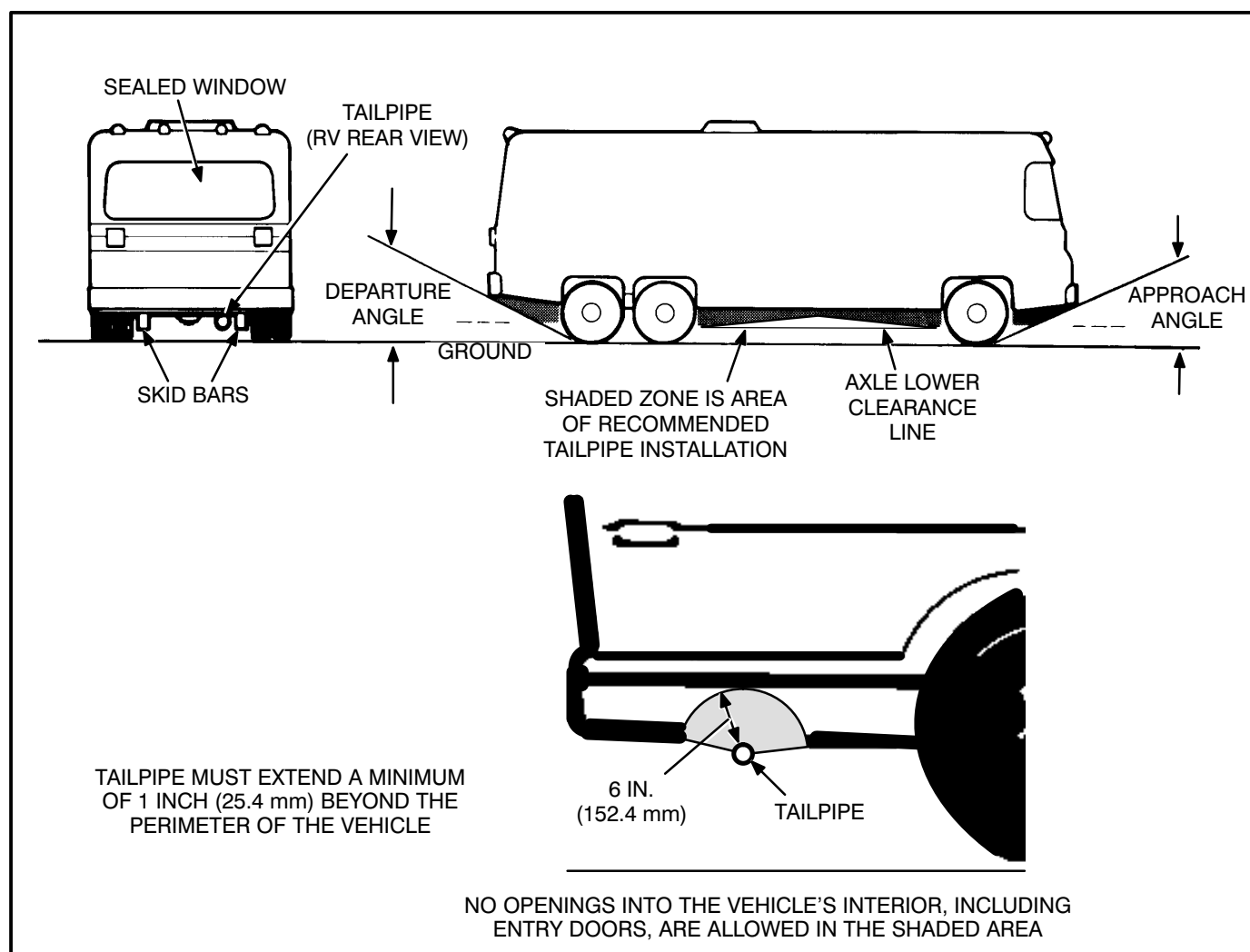


FIGURE 5-2. APPROACH AND DEPARTURE ANGLES AND AXLE CLEARANCE LINE

TAILPIPE RECOMMENDATIONS

An exhaust tailpipe is *not* supplied because of variation in length requirements between RV manufacturers. Prior to installing an exhaust tailpipe, refer to the following recommendations for additional tips and safety considerations.

Use 1-1/2-inch O.D. (1-3/8-inch I.D.) 18 gauge aluminized steel or stainless steel tubing for the tailpipe.

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

Use U-bolt type automotive muffler clamps marked 1-3/8 and double rubber, U-shaped shock mounted hangers for supporting the exhaust system. (See Figure 5-3.) If the tailpipe extends beyond 1-1/2 feet (0.46 m) from the muffler, attach one or more automotive tailpipe hangers every 2 to 3 feet (0.6 to 0.9 m) of tailpipe run. 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. Attach hangers to steel framework, not wood or other floor materials. Refer to Figures 5-4 and 5-5 on Pages 5-4 and 5-5 for a typical tailpipe installation.

⚠ 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.*

⚠ CAUTION *Angular mounting of muffler and tailpipe hanger brackets can result in exhaust system damage. Properly mounted hanger brackets will absorb much road shock vibration and prolong the usefulness of exhaust system components. Mount muffler and tailpipe hanger brackets directly above the component support, not at an angle. Do not twist the rubber sections of any hangers.*

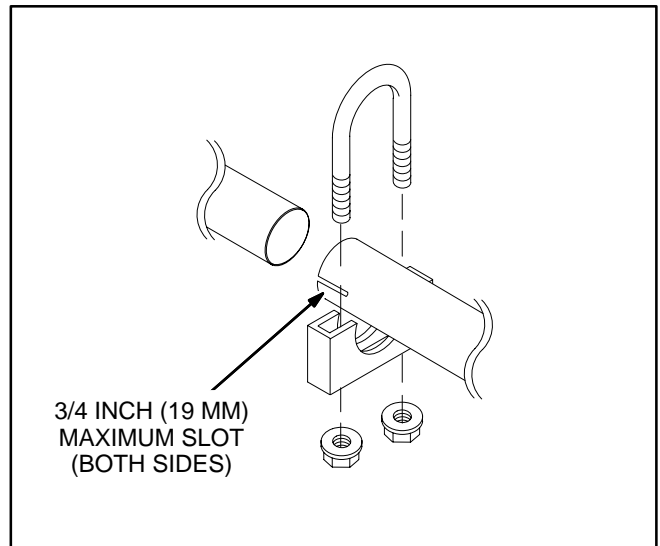


FIGURE 5-3. EXHAUST TAILPIPE CONNECTIONS

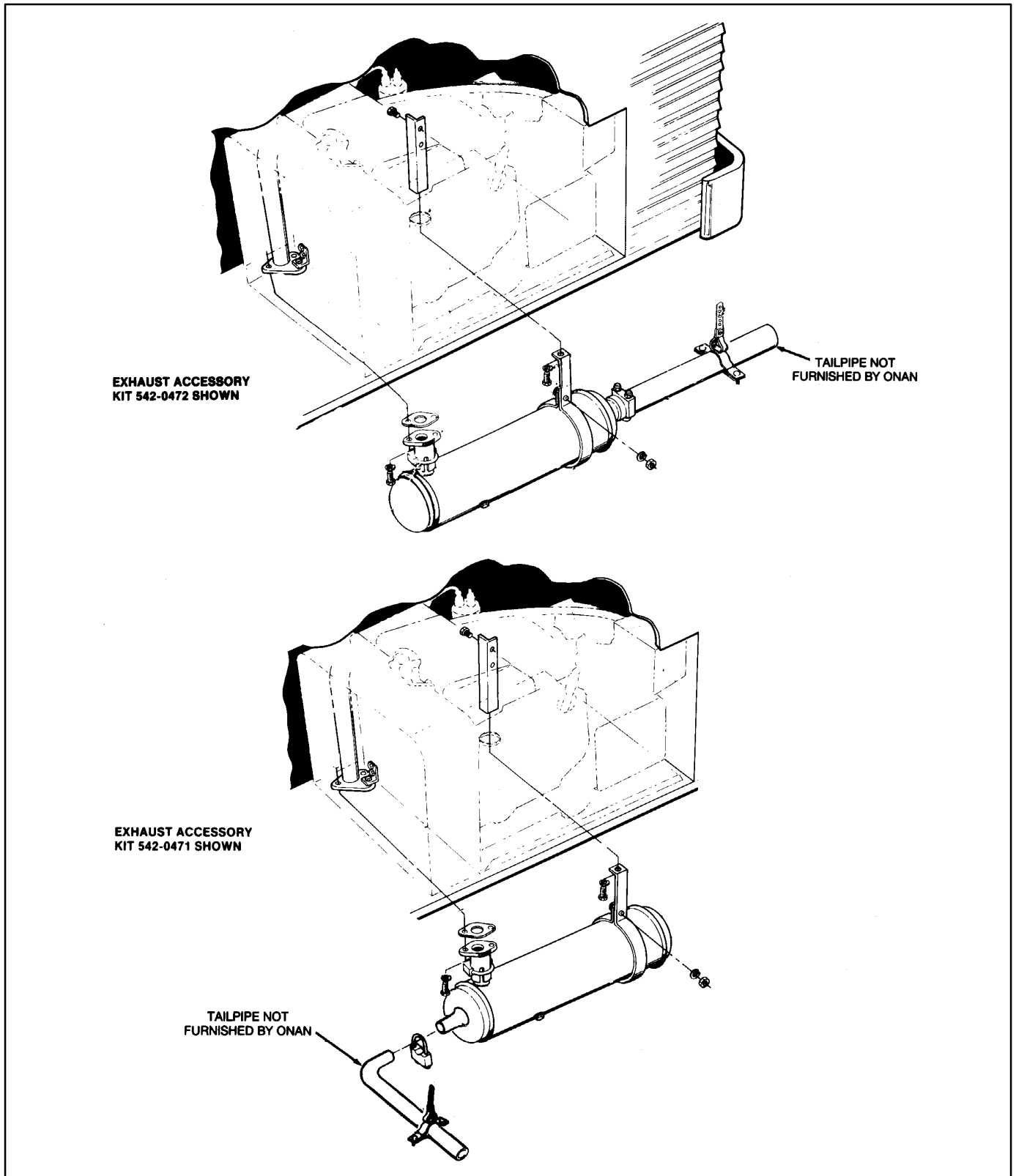
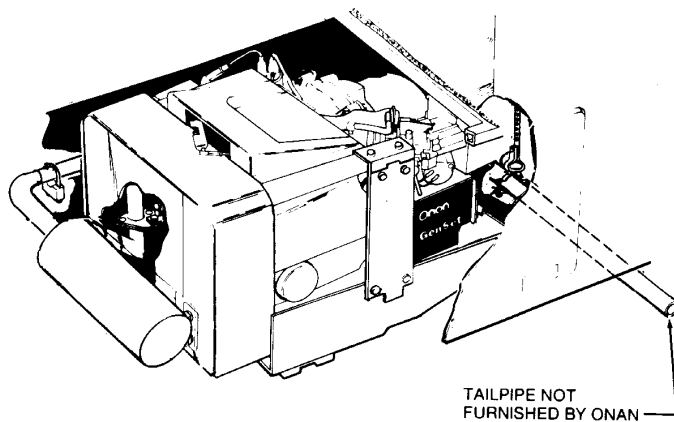
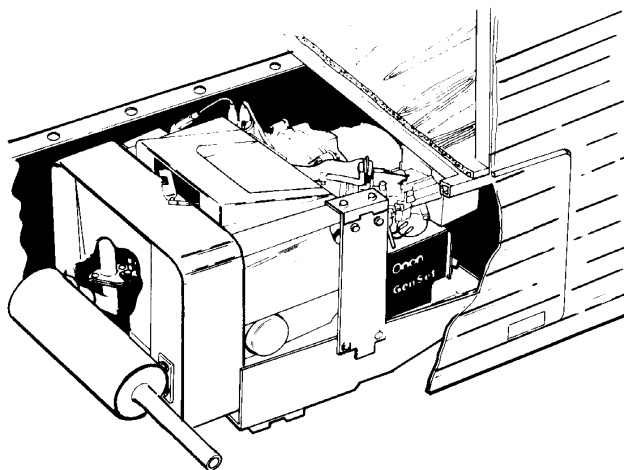


FIGURE 5-4. EXHAUST SYSTEM KIT EXAMPLES FOR CONVENTIONAL COMPARTMENT MOUNT GENSETS

**EXHAUST ACCESSORY
KIT 542-0482 SHOWN**



**EXHAUST ACCESSORY
KIT 542-0469 SHOWN**



**EXHAUST ACCESSORY
KIT 542-0470 SHOWN**

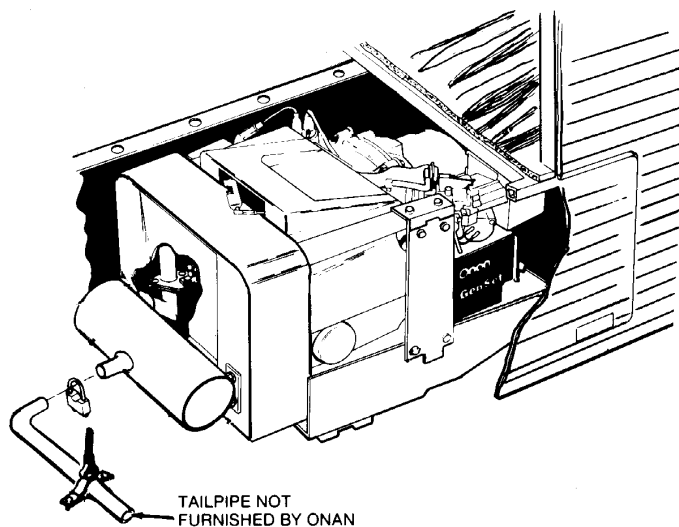


FIGURE 5-5. EXHAUST SYSTEM KIT EXAMPLES FOR UNDER-FLOOR MOUNT GENSETS

6. Fuel System

GENERAL

This installation manual covers gasoline and LPG (liquid propane gas) fuel systems. Separate procedures are given for each.

⚠ WARNING *Fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Do not smoke or allow any spark, pilot light, arcing switch or equipment, or other ignition sources in the installation area or areas sharing ventilation. Keep a type ABC fire extinguisher nearby. The ventilation system of the installation area 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 the vehicle interior.*

GASOLINE FUEL SYSTEM

Fuel System Provisions

On some vehicles, genset installations may be designed to share the vehicle fuel supply tank with the vehicle engine. Use a separate fuel pickup tube in the vehicle tank, or use a separate tank. Do not tie into the vehicle engine fuel supply line. See *Fuel Line Installation* in this section.

The genset includes a fuel shut-off valve as a safety feature and is an integral part of the fuel pump. Should the vehicle fuel tank become pressurized, the positive fuel shut-off valve prevents flooding of the genset when the set is not operating.

Recommended Fuel

Use clean, fresh, unleaded or regular grade gasoline. Using unleaded gasoline results in extended periods between service, longer spark plug life, and reduced carbon clean-out maintenance. If regular gasoline is used, lead deposits must be removed from the cylinder heads as required to alleviate en-

gine power loss. Unleaded gasoline may be safely used after lead deposits have been removed.

⚠ CAUTION *Lead deposits can cause engine damage if they are not removed before using unleaded gasoline. Do not alternate between leaded (regular) and unleaded gasoline.*

⚠ WARNING *Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Never fill the fuel tank when the engine is hot or is running. Do not permit any flame, spark, pilot light, cigarette or other ignition source near the fuel system.*

Fuel Consumption

See Section 2. *Specifications* in this manual.

Fuel Line Installation

Vehicle fuel systems are designed to operate within a particular range of fuel pressure. It is very important that the vehicle fuel supply system not be altered when the genset is being installed. The fuel fill tube, fill limiter vent, vapor canister, vapor lines, and gas fill cap should not be changed, removed, or replaced without the approval of the vehicle manufacturer. Check the filler cap and see that the pressure vacuum relief valve is functioning properly—replace if it is necessary.

If a separate connection is not supplied for the genset, add a second fuel pickup in the tank. Onan recommends a separate fuel pickup tube in the vehicle fuel tank to provide a proper and safe fuel pressure at the genset carburetor. The opening of this pickup tube should not extend into the bottom 1/4 of the tank so that the last 1/4 tank of gasoline is reserved for vehicle operation only.

Do not tie the genset fuel line into the vehicle fuel supply line.

- Tying a genset fuel line into a **vacuum** supply line (vehicle fuel pump at the tank side of the pump) may cause the genset to starve for fuel at highway speeds or during acceleration.

⚠ CAUTION *If the genset fuel line is connected to the main fuel line with a tee, the genset may starve for fuel when the vehicle is operated at highway speeds. 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 a separate fuel tank.*

- Tying a genset fuel line into a **pressure** supply line (vehicle fuel pump at the engine side of the fuel pump) may cause poor genset operation and create a hazard of fire or explosion caused by fuel leakage.

⚠ 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 with gasoline can occur, resulting in a fire hazard.*

Some vehicle manufacturers permit tying into the fuel *return line* on high pressure fuel systems. Contact the vehicle manufacturer for details and approval.

Install an approved, flexible, non-metallic, non-conductive, and non-organic fuel line between the vehicle fuel system and the genset, to absorb vibration. The flexible fuel line must be long enough to allow genset movement, to prevent binding, stretching, or breaking. Onan recommends seamless steel tubing and flared connections for long runs between the fuel tank and the flexible connector to the genset.

Run fuel lines at the same height as the top level of the tank to a point as close to the engine as possible. This reduces the danger of fuel siphoning out of the tank if the line should break.

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 become kinked, pinched, chaffed, or struck.

PROPANE (LPG) FUEL SYSTEM

Fuel System Provisions

Onan LPG gensets contain a filter cartridge and magnet connected to the fuel solenoid valve to protect the solenoid valve and regulator valves from dirt and contaminants. The solenoid valve and filter are shown in Figure 6-1. Figure 6-2 on Page 6-3 shows the flow diagram for the LPG fuel system components used on the genset.

Genset operation using LPG is very sensitive to altitude, temperature, and BTU content of the gas. Variation in any one of these factors directly affects the performance on the genset. Because of this, minor adjustments might be required after the installation. Refer to the Generator Set Service Manual if adjustments are required.

Recommended Fuel

Use clean, fresh commercial propane or HD-5 grade liquid propane gas in a mixture of at least 90 percent propane. Propane fuels other than HD-5 grade can contain more than 2.5 percent butane and can result in poor fuel vaporization and poor engine starting in low ambient temperatures (below 32°F or 0°C).

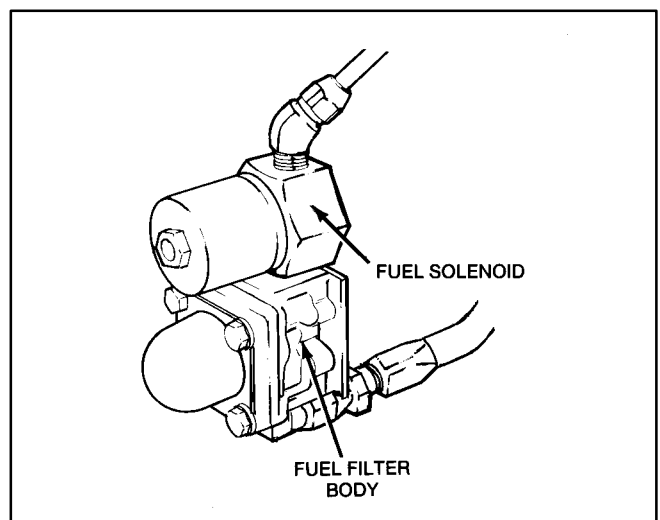


FIGURE 6-1. FUEL SOLENOID VALVE AND FILTER

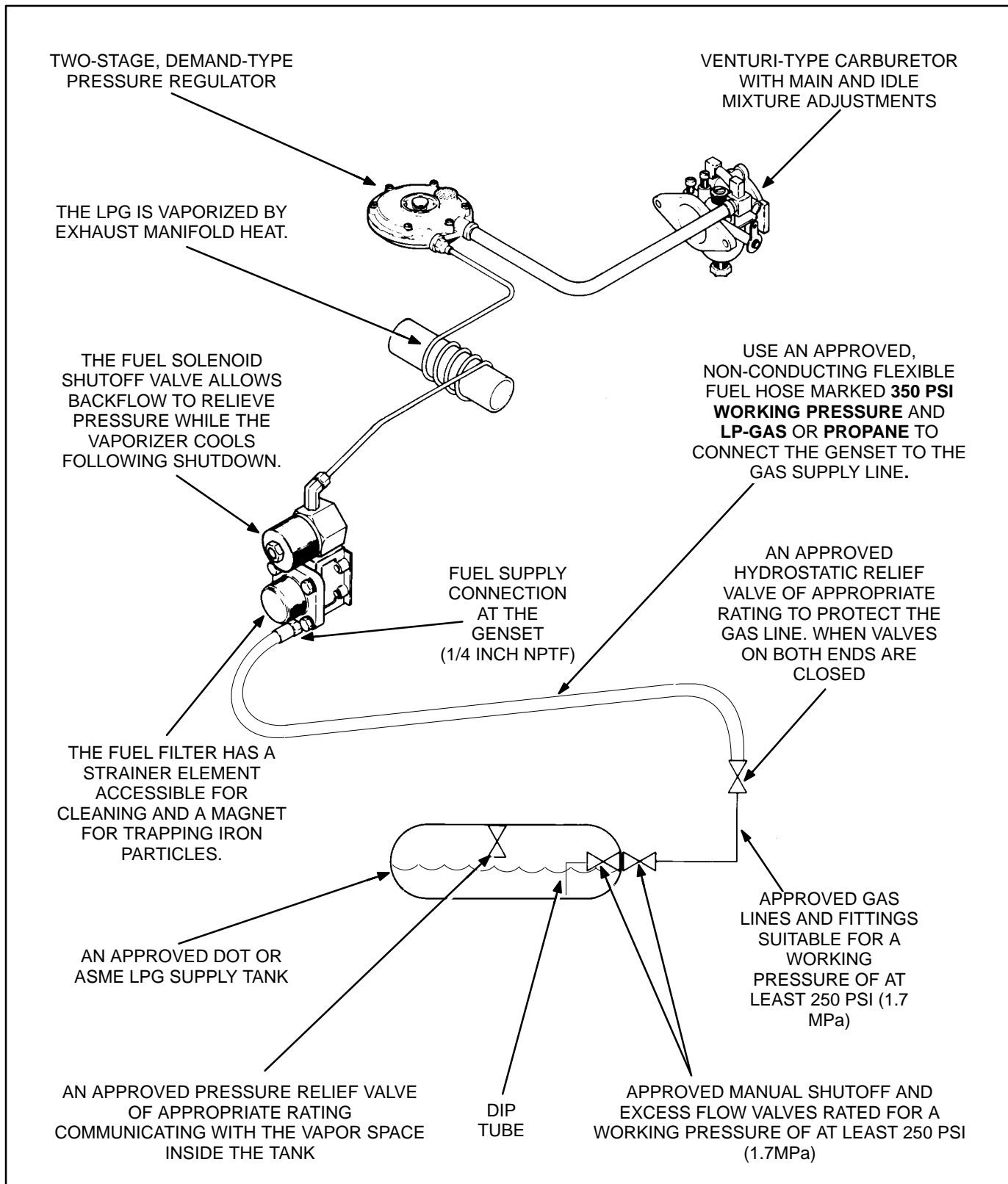


FIGURE 6-2. FLOW DIAGRAM OF LPG FUEL SYSTEM

Fuel Consumption

See Section 2. *General Specifications* in this manual.

Propane Fuel Lines and Supply Tank

Review each of the codes that apply to LPG genset installation. Refer to 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 do not cover all applicable codes and regulations. Obtain this literature by writing to the address listed in the beginning of this manual.

When installing the fuel lines, keep the following in mind:

1. Install all propane fuel lines so they are accessible, yet protected from damage.
2. Use metal straps without sharp edges to secure fuel lines.
3. Keep fuel lines away from hot engine or exhaust areas.
4. Do NOT run fuel lines in conjunction with electrical wiring.

Most LPG liquid withdrawal gensets are designed to share the vehicle propane fuel supply tank(s). The vehicle propane fuel supply tank MUST have a dip tube for liquid withdrawal.

An excess flow valve MUST be mounted internal to the propane fuel supply tank(s) per NFPA 501C, Paragraph 2-2.7.7. This excess flow valve and propane fuel lines MUST be sized so the excess flow valve will close with a completely severed (broken) propane fuel line. For operation at the lowest ambient temperature, a valve rated at 2.6 gallons per hour (9.9 l/hr) flow rate and 6.5 pounds per square inch (45 kPa) differential pressure is recommended. Consult the Natural LP Gas Association for the limitations of excess flow valves.

Install an approved flexible non-metallic, non-conductive, and non-organic fuel line between the vehicle fuel system and the genset to absorb vibration. Onan recommends using a seamless steel tubing

and flared connections for long runs between the fuel tank and the genset location. A short length of the flexible fuel line should be used to complete the connection between the end of the steel tubing and the genset itself.

A manual shut-off valve MUST be mounted on the propane fuel supply tank. This supply valve MUST be fully open when operating the genset to ensure the excess flow valve will close with a severed (broken) propane fuel line.

A hydrostatic pressure relief valve MUST be installed between the propane fuel supply tank manual shut-off valve and the propane fuel solenoid valve and filter assembly. This relief valve protects the propane fuel line from pressure buildup if both the supply tank manual shut-off valve and the fuel solenoid valve are closed at the same time.

Testing Fuel System for Leaks

The completed propane fuel system installation MUST be checked and tested for leaks before the genset is operated. The fuel solenoid valve MUST be energized from a separate 12-volt DC source before testing the fuel system for leaks. The test MUST conform to procedures listed in NFPA-58, Paragraph 318, or NCTI (US Testing) recommended test procedure as follows:

After assembly and prior to initial operations, all fuel system connections, hose, valves, regulators, and fittings must be tested and proven free of any leaks using a soap and water or equivalent solution while the system is under a gas or air pressure of not less than 90 pounds per square inch (620 kPa).

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

⚠ WARNING Liquid LPG fuel presents the hazard of explosion or fire which can result in severe personal injury or death. Do not smoke or allow any spark, pilot light, arcing switch or equipment, or other ignition sources in the installation area or areas sharing ventilation.

PROPANE (LP-VAPOR) FUEL SYSTEM

Before installing a genset converted to an LPG fuel system, refer to the Conversion Kit Instruction Sheet included with the kit components for further information regarding compartment design and component location requirements. Follow the procedures outlined in the kit instruction sheet to install the genset.

7. Electrical Connections

GENERAL

Installing the genset electrical system includes connecting the load, remote control (if used), and connecting the battery. The battery should always be connected last to avoid accidental starting or short circuiting the unit during installation. Connect the negative (-) battery cable last to reduce the risk of arcing.

⚠️WARNING *Accidental starting of the generator set while working on it can cause severe personal injury or death. Do not connect the starting battery until instructed to in the Installation Checks and Start-Up section.*

All wiring must meet applicable local 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 shock. All switches must be vibration-proof to prevent accidental opening or closing while the vehicle is in motion.

Do not run wiring where it may contact sharp, rough, or hot surfaces or where it may become kinked, pinched, or chaffed.

AC WIRING

Wiring Methods

Wiring methods must be in accordance with applicable codes, such as the National Electrical Code (NFPA No. 70).

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

Line Circuit Breaker

The genset has line circuit breakers mounted on the side of the control panel. The breakers provide short circuit and overload protection for the generator.

Genset Rating

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

Conduit

Install the generator load conductors supplied with the genset in a flexible metallic conduit. Cut the conduit to the desired length, leaving extra wire as required for the junction box (connecting wires must be appropriately sized and insulated for the specified current rating). Prepare the ends of the conduit, to prevent its sharp edges from cutting the wire insulation.

Run the conduit in such a way as not to interfere with the movement of the set.

Use waterproof conduit whenever conduit is exposed to the elements.

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

⚠️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 opening made for conduit, wiring, etc. Also seal the wiring within the conduit itself. Use a silicone/rubber-based sealant.*

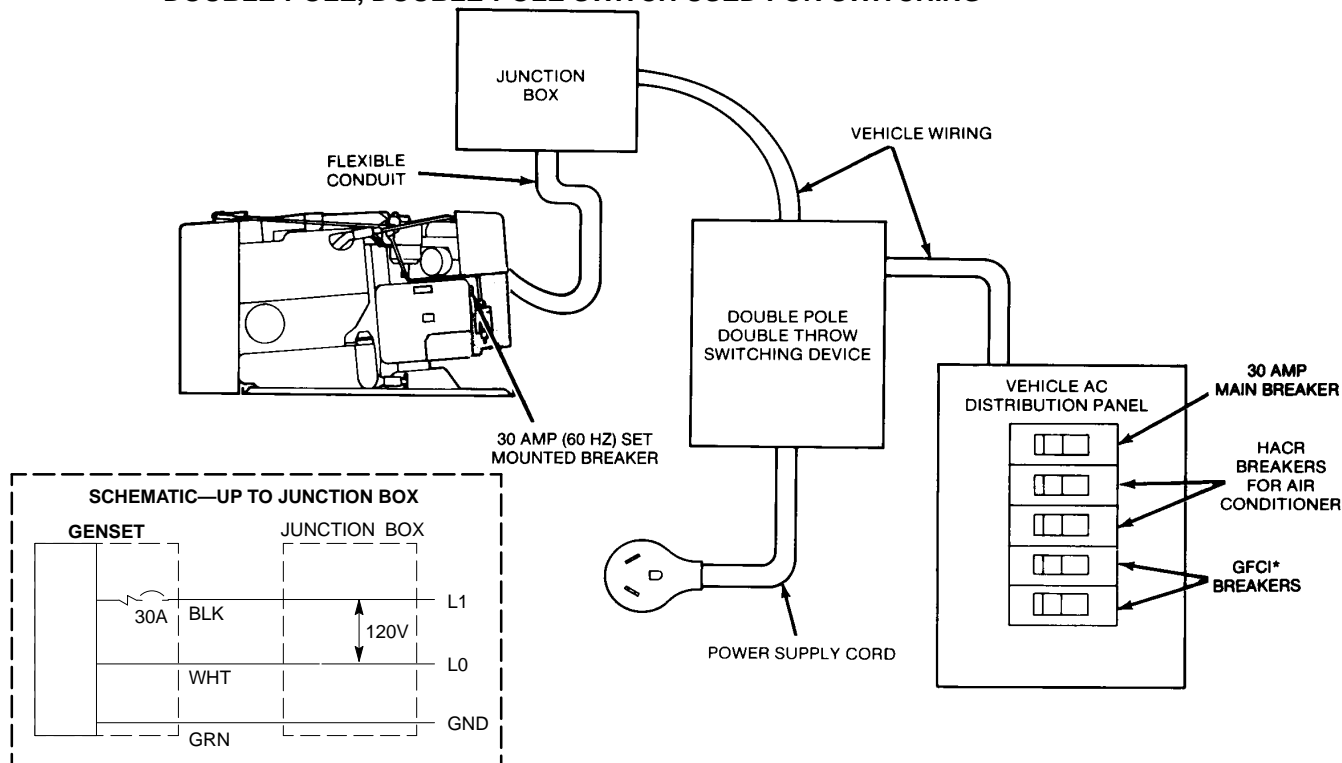
Wiring Disconnect Method

There must be no possibility of the outside power source being connected to the genset. The feeder conductors from the genset compartment must terminate in a 120-volt, 2- or 3-pole, double-throw, positive-off switching device mounted ahead of the vehicle distribution panel; or must connect to a generator set receptacle box. Refer to Figures 7-1 through 7-3 on Pages 7-3 and 7-4 for examples of the wire connections.

⚠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 *Fuel presents the hazard of fire or explosion, which can result in personal injury or death. Do not tie electrical wiring to fuel lines.*

DOUBLE-POLE, DOUBLE-POLE SWITCH USED FOR SWITCHING



UTILITY POWER CORD USED FOR SWITCHING

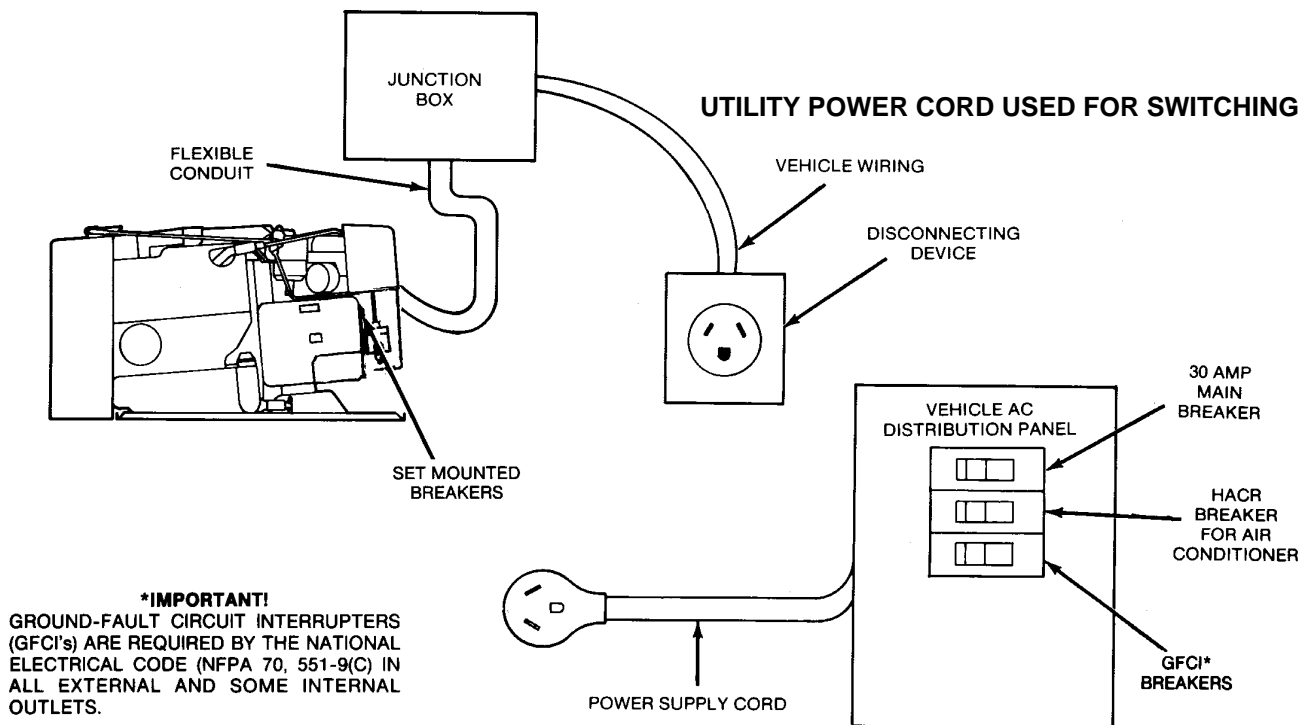


FIGURE 7-1. CONNECTIONS—4.0 KW GENSET AND 30 AMP SHORE POWER

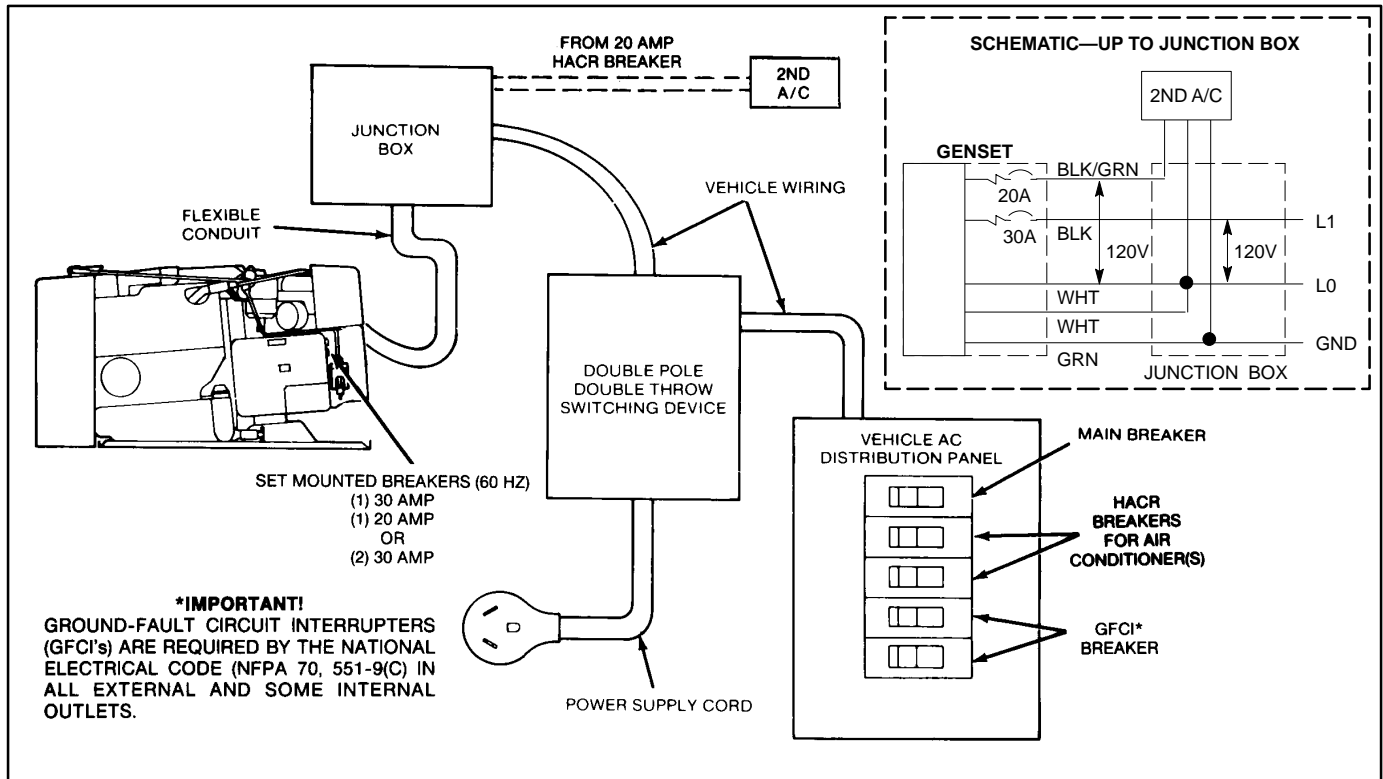


FIGURE 7-2. CONNECTIONS—5.0-6.5 KW GENSET, 30 AMP SHORE POWER, 2ND AIR CONDITIONER

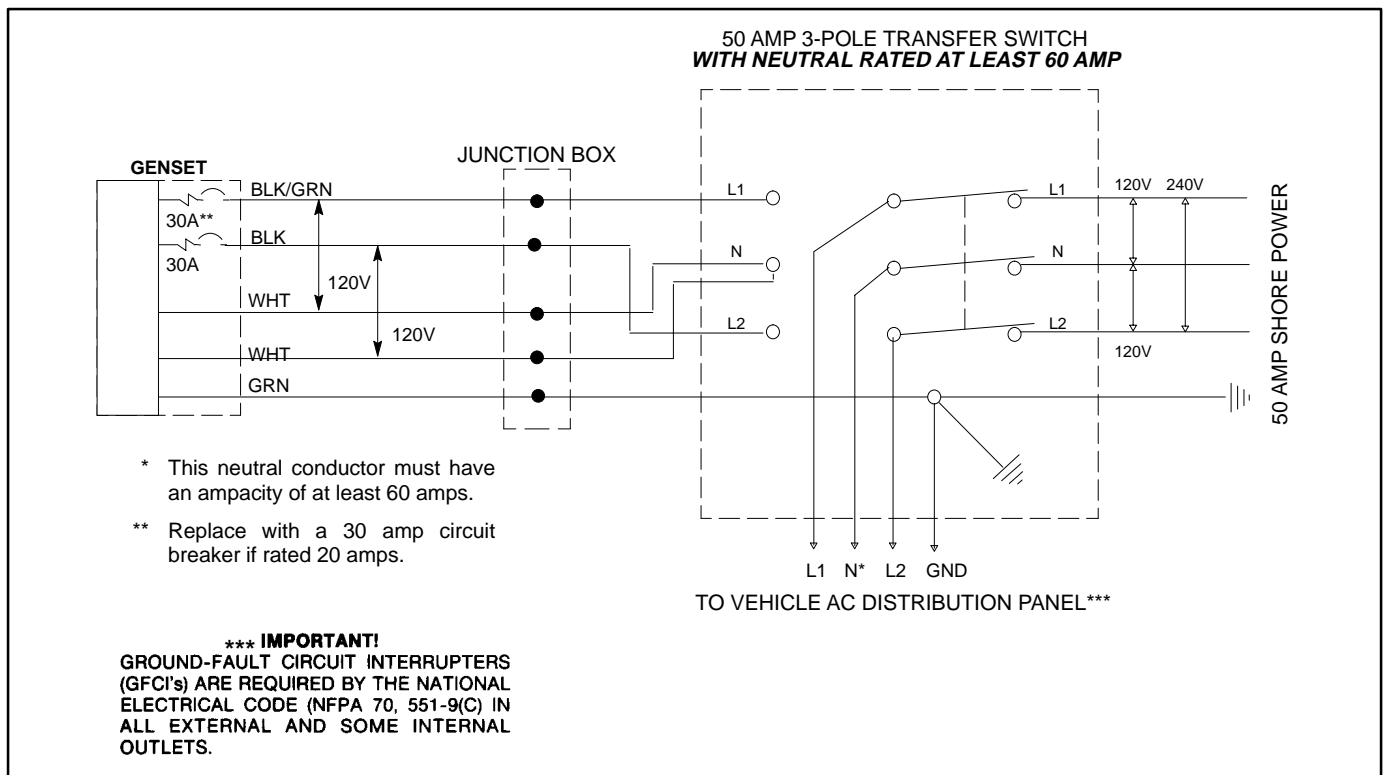


FIGURE 7-3. SCHEMATIC—5.0-6.5 KW GENSET AND 50-AMP SHORE POWER

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 7-4).
- Remote panel with start/stop switch, indicator lamp, and hour (elapsed time) meter (see Figure 7-5).
- Remote panel with start/stop switch, indicator lamp, and battery DC voltmeter (see Figure 7-6).

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 1-1 on Page 1-2). 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 7-7 on Page 7-6 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.

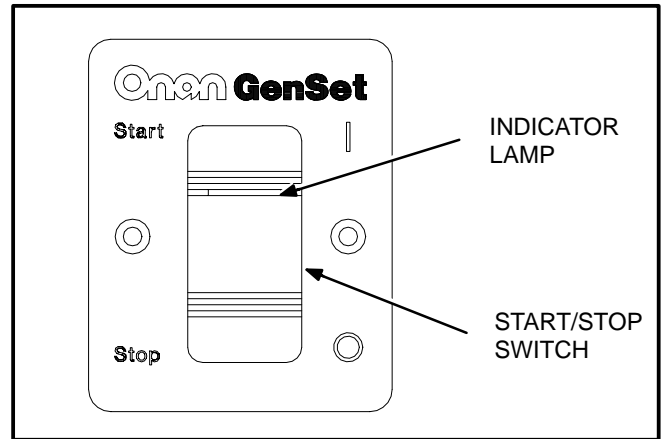


FIGURE 7-4. REMOTE PANEL WITH START/STOP SWITCH ONLY

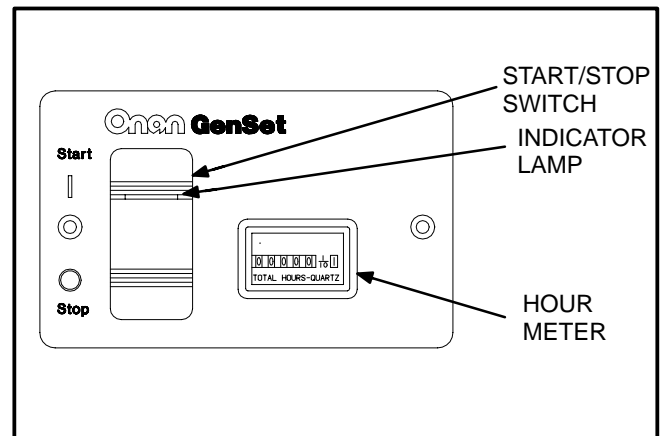


FIGURE 7-5. REMOTE PANEL WITH START/STOP SWITCH AND HOUR METER

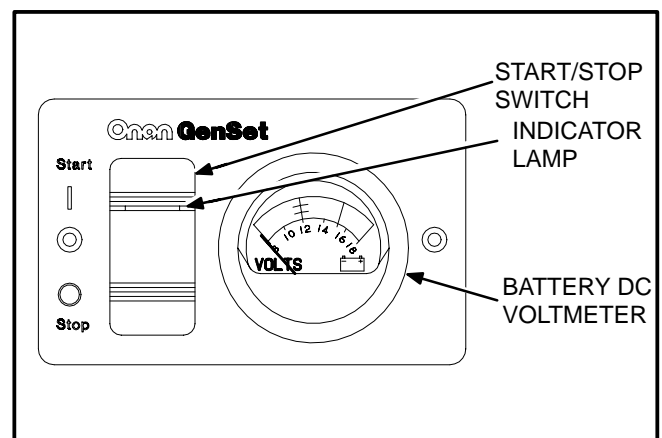


FIGURE 7-6. REMOTE PANEL WITH START/STOP SWITCH AND DC VOLTMETER

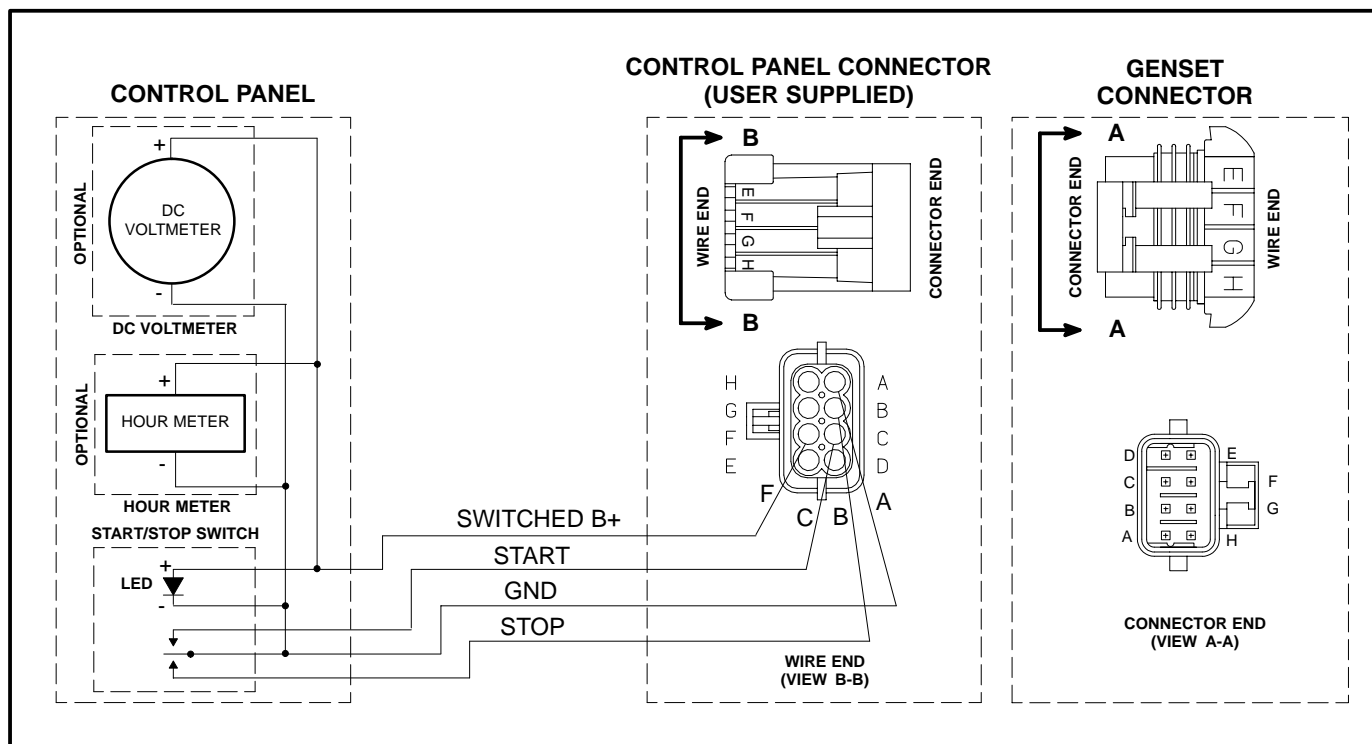


FIGURE 7-7. TYPICAL REMOTE CONTROL WIRING DIAGRAM

BATTERIES

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

Battery Capacity

The genset has a 12 VDC, negative-ground control and starting system. See Table 7-1 for minimum battery capacity requirements.

TABLE 7-1. 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 majority of gensets are not equipped with a battery charger. Other means will have to be provided for maintaining the battery charge level.

A kit is available for field installation of the battery charger. See your Onan distributor for information.

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 7-2. 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 7-2. 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 7-8). (Do not connect the other end to the battery at this time.)

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 7-8.

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.

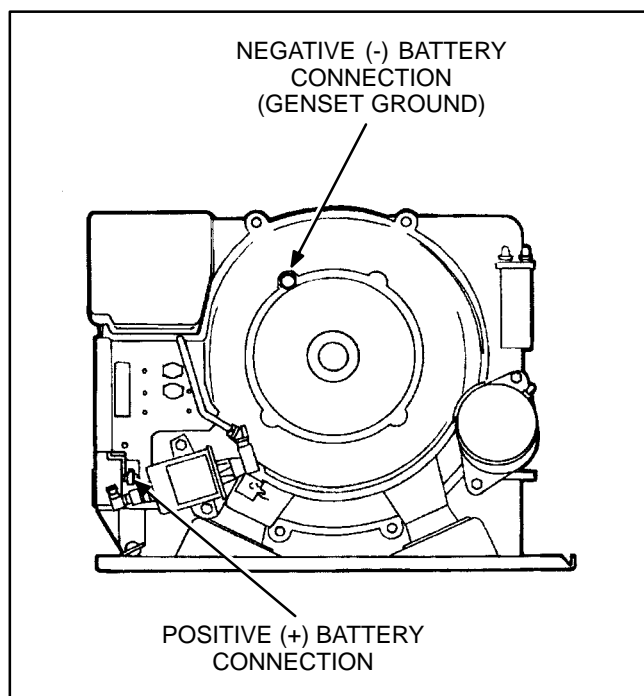


FIGURE 7-8. BATTERY CABLE CONNECTIONS

Positive (+) Battery Connection. Connect one end of the positive (+) battery cable to the genset B+ post. Tighten the B+ connection securely (see Figure 7-8 on Page 7-7).

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 7-8 on Page 7-7, is also the bonding terminal for grounding the genset to the vehicle frame (ground). This connection must be made for proper and safe operation of the genset. Onan recommends that this connection be made in one of two ways based on which negative battery connection method was used.

Method 1. If the genset negative battery connection is made with a single cable connected between the genset ground and the negative (-) battery terminal (see *Negative (-) Battery Connection* on Page 7-7), an additional bonding connection must be made. Connect an 8-AWG (minimum) cable between either:

- the genset ground (see Figure 7-8) and the vehicle frame (ground).
- the negative (-) battery terminal and the vehicle frame (ground).

Method 2. If the vehicle frame (ground) is used as a path for the negative (-) genset-battery circuit (see *Alternate Negative (-) Battery Connection* on Page 7-7), the negative cable between the genset and the vehicle frame (ground) serves as the bonding connection. However, this cable must be of the same size as the positive (+) battery cable.

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.*

8. Installation Checks and Start-Up

⚠ 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 with an audible alarm. 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.

2-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. See the Operator's Manual for the oil type and quantity. When finished, screw the oil level indicator into the filler neck securely to prevent oil leakage.
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 the NEG. (-) battery post. 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 Genset Control

1. Move the Start/Stop switch to the **START (I)** position. 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.

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.

⚠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. Make sure the exhaust pipe terminates outside the perimeter of the vehicle.

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

4. Perform the Break-In Procedure described in the Operator's Manual.

⚠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, correct if necessary, and restart the genset.
2. After the genset starts, check the battery DC voltmeter or hour meter (if equipped) to confirm 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?
 - ☐ Change oil
 - ☐ Adjust carburetor
 - ☐ Start/Stop the unit
 - ☐ Change air filter
 - ☐ Adjust governor
 - ☐ Access AC circuit breaker and control fuse
 - ☐ Change spark plugs
- ☐ 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?
- ☐ Are fuel lines and electrical wires protected from chafing and damage and are they insulated from each other?
- ☐ Are all fuel connections and hose clamps tight?
- ☐ Is a flexible section of non-conducting fuel line installed between the fuel inlet and the fuel line from the tank?
- ☐ Are all electrical leads connected and protected, and is the conduit adequately supported?
- ☐ Does the exhaust system extend beyond the perimeter of the vehicle a minimum of 1 inch (25 mm)?
- ☐ If there are any windows, doors or storage compartments within a portions of an arc with a radius of 6 inches from the exhaust pipe and covering the vehicle between boundaries formed by the vehicle skirt (see Figure 5-2 on Page 5-2), are they permanently closed?
- ☐ If the exhaust system is run into the angle of approach or departure, 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?
- ☐ Do the hanger straps located at the perimeter and along the centerline of the genset have double U-shaped rubber isolators?
- ☐ Does the installation allow 1/2 inch (13 mm) of free movement of genset on its mounts?
- ☐ Has rubber boot been installed on the positive (+) battery connection at the start solenoid connection in the control?
- ☐ On an LPG fueled genset, has the system been tested for leaks?
- ☐ If the installation uses under-floor hinge kit, is there 2 inches (51 mm) clearance between front of tray and vehicle skirt (or is skirt part of door) to allow genset to swing down for service?

9. Outline Drawings

The genset outline drawings in this manual are subject to change and are included for reference only. See Table 9-1 for a list of the drawings in this section. If necessary, contact your Onan distributor for a detailed outline drawing.

NOTE: Fuel pump appearance may differ from those shown in these outline drawings.

The negative (-) battery connection on all BGE/NHE gensets is now the location shown in Figure 9-1.

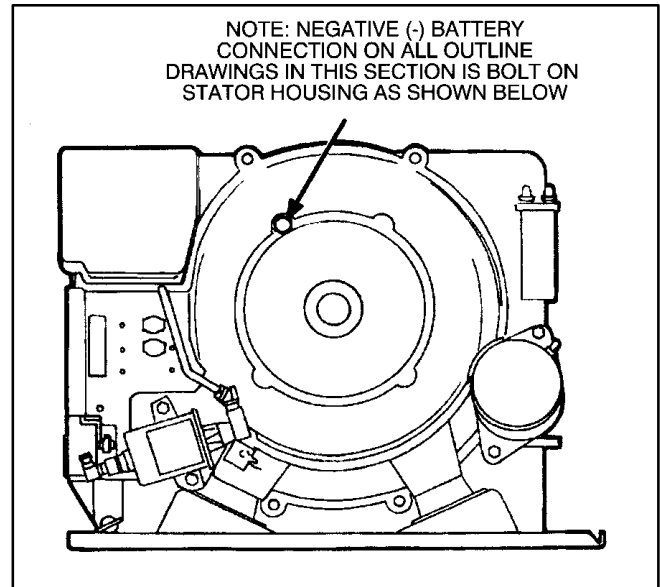


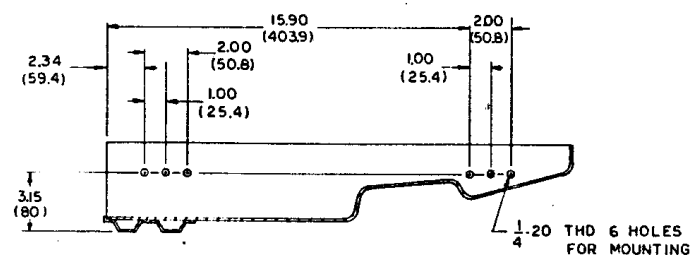
FIGURE 9-1. BATTERY NEGATIVE (-) CONNECTION ON ALL BGE/NHE GENSETS

TABLE 9-1. OUTLINE DRAWINGS

Figure No.	Drawing No.	Description	Page No.
9-2	500-2179	BGE (Gasoline) - Below Floor	9-2
9-3	500-2180	BGE (Gasoline) - Below Floor (with NHE Pan)	9-3
9-4	500-2181	BGE (Gasoline) - Above Floor/Compartment	9-4
9-5	500-2184	BGE (LPG) - Above Floor/Compartment	9-5
9-6	500-2185	BGE (LPG) - Below Floor	9-6
9-7	500-2177	NHE (Gasoline) - Above Floor/Compartment	9-7
9-8	500-2178	NHE (Gasoline) - Below Floor	9-8
9-9	500-2186	NHE (LPG) - Above Floor/Compartment	9-9
9-10	500-2187	NHE (LPG) - Below Floor	9-10

500-2179

D



SECTION A-A

Rev	No	Description	By	Chk	Appr	Date
27756	A	PROD RLSE	RA	AS	AS	5-7-86
28246	B	REV NOTE	RA	AS	AS	10-2-86
	1	ADDED SHROUD AND COIL	RA	AS	AS	10-2-86
	2	ADDED SWING DIMENSION	RA	AS	AS	10-2-86
	3	11.18 WAS 8.78	RA	AS	AS	10-2-86
	4	ADDED EXHAUST FLANGE DETAIL	RA	AS	AS	10-2-86
	5	1.32 WAS 0.68	RA	AS	AS	10-2-86
28318	C	ADDDOWNTUBE LOC TO (178)	RA	AS	AS	1-4-86
30233	D	PICTURE CHANGE FUEL PUMP	RA	AS	AS	12-1-81
37830	E	PICTORIAL CHNG TO FUEL PUMP	RA	AS	AS	4-18-81
3854	F	ADD NEG (-) BATTERY CONNECTION	RA	AS	AS	2-18-82
	1	25.06 DIM WAS 25.00	RA	AS	AS	2-18-82
	2	6.4 DIM WAS 5.0	RA	AS	AS	2-18-82
40098	G	ADD (SPEC A THRU M)	RA	AS	AS	6-10-96
	1	ADD REMOTE CABLE CONNECTOR	RA	AS	AS	6-10-96

- (B) 1. DIMENSIONS INCLUDE REQUIRED CLEARANCE BETWEEN SET B ONAN UNDERFLOOR KIT PANELS (405-3402). FOR ALL OTHER APPLICATIONS, ALLOW 0.6 INCH CLEARANCE BETWEEN SET B COMPARTMENT WALL OR SET AND INSIDE OF INSULATION.

2. IF COMPARTMENT IS LARGER THAN MIN SHOWN, ALLOW EXTRA SPACE AT OIL FILL SIDE AND EQUALLY ON BOTH ENDS.
3. WEIGHT = 214 LB (97.1kg)
4. DIMENSIONS IN () ARE IN mm

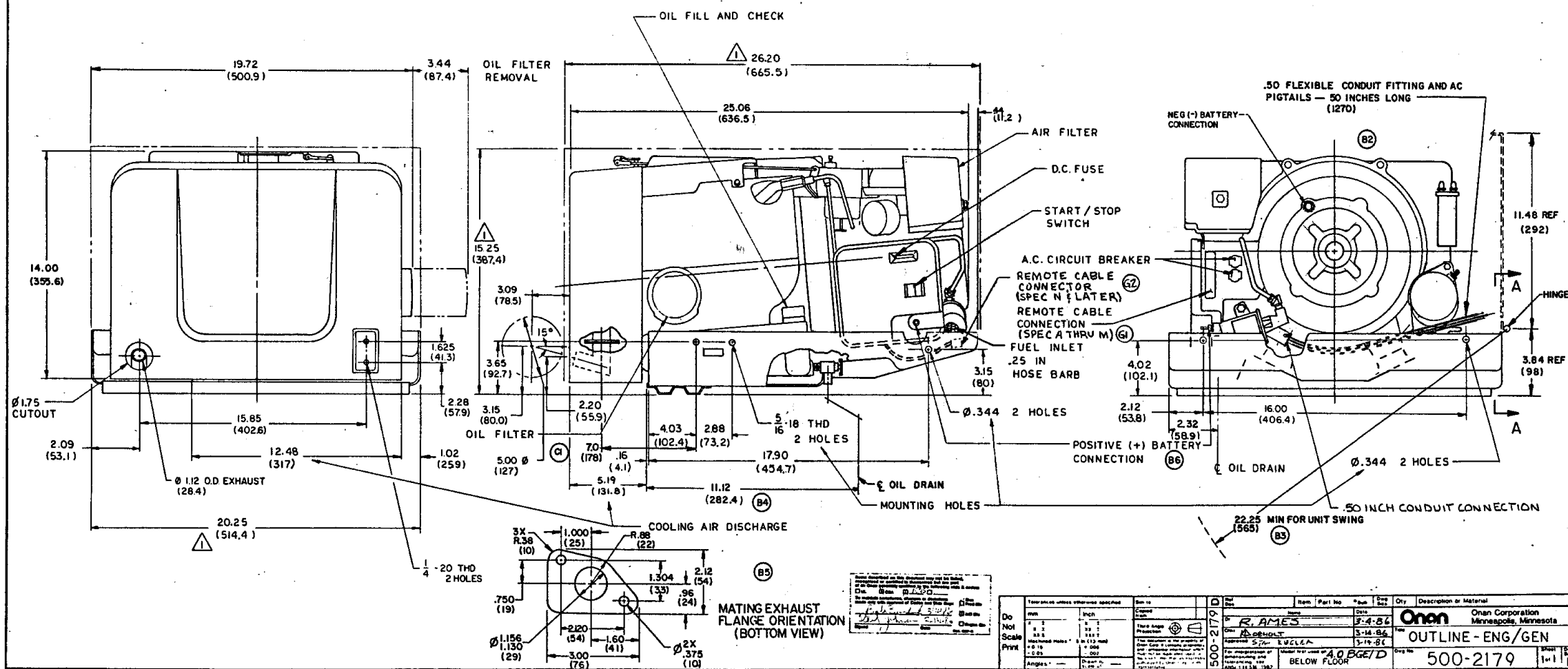
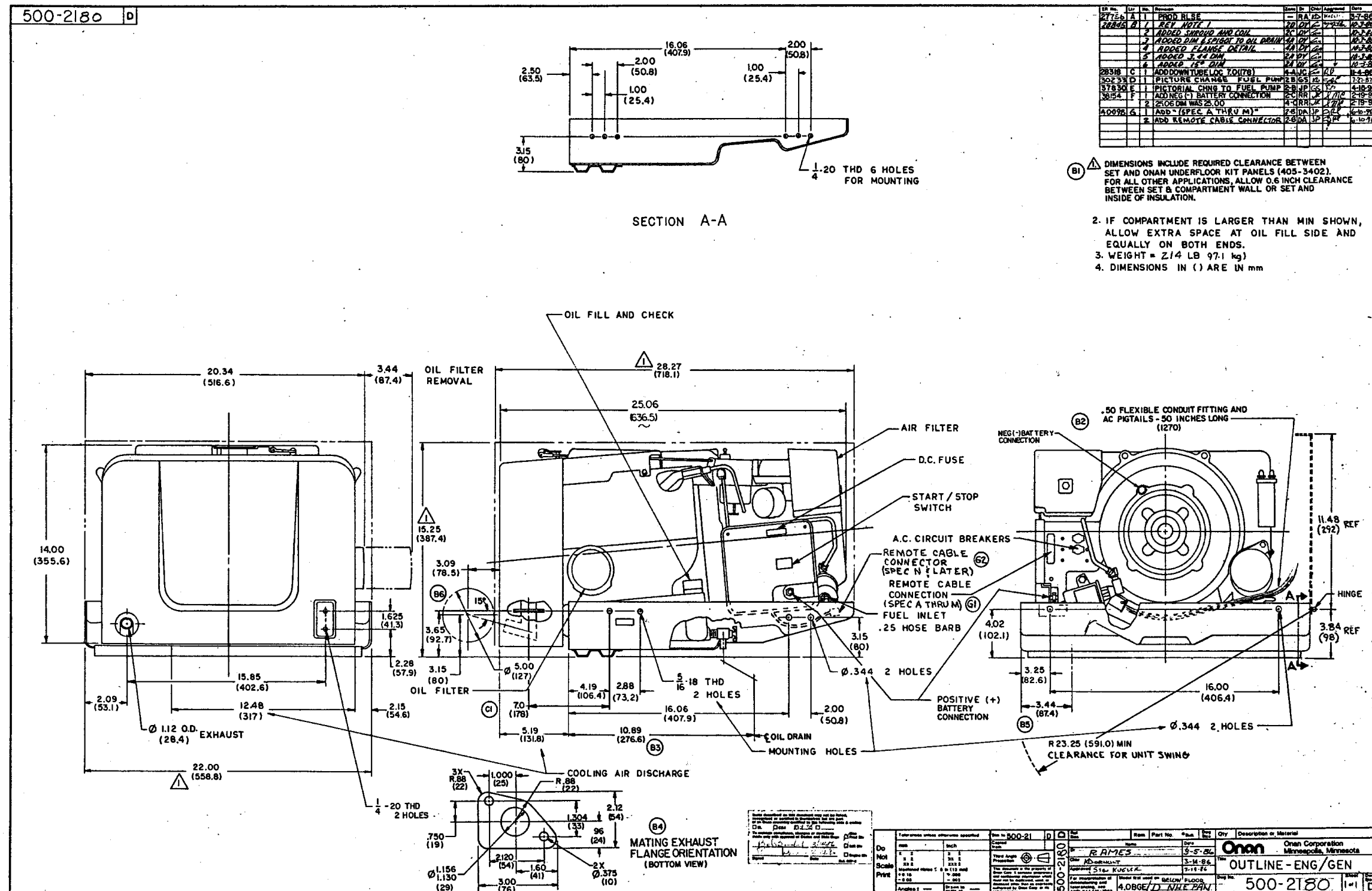


FIGURE 9-2. BGE (GASOLINE) - BELOW FLOOR



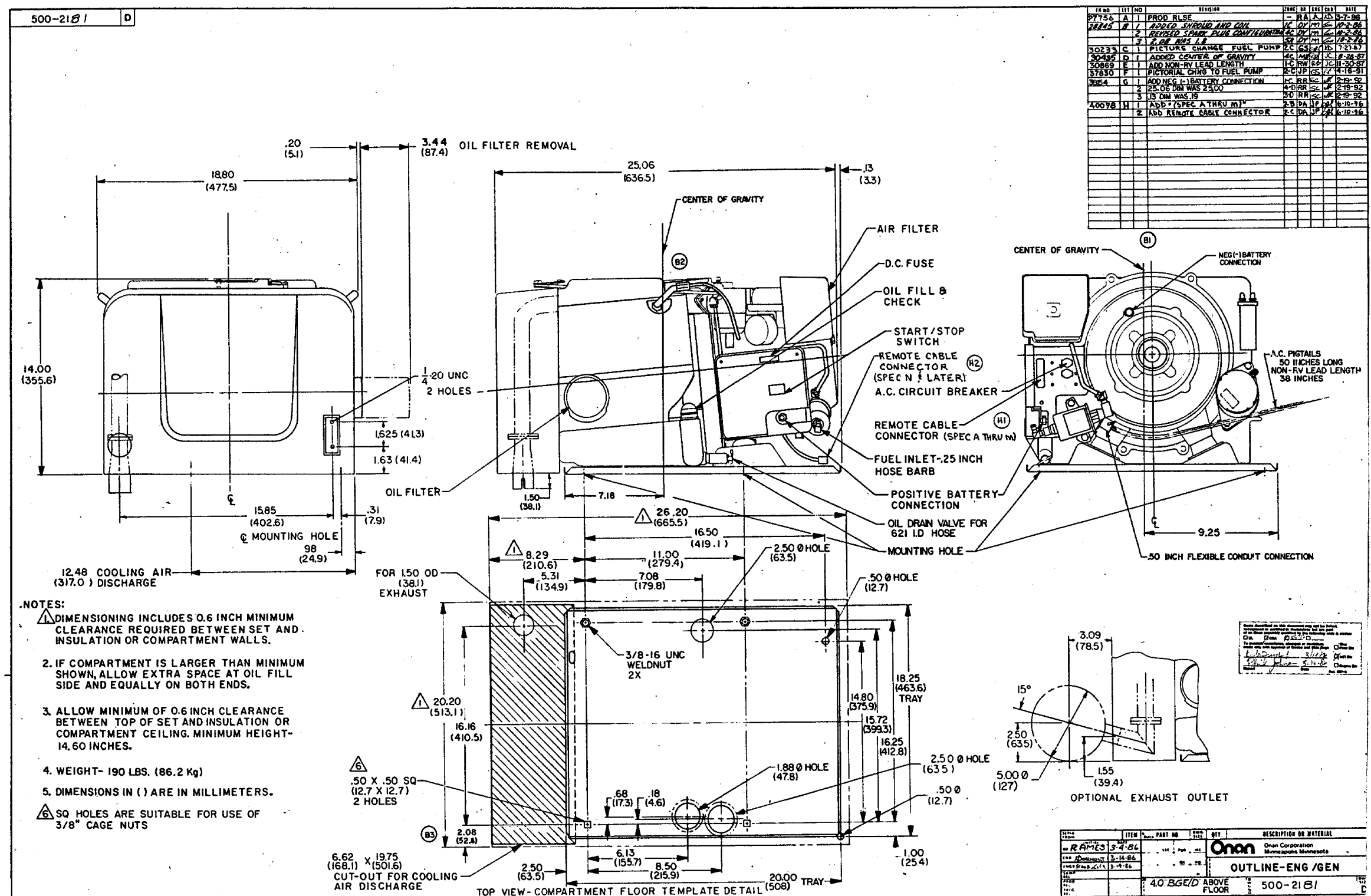


FIGURE 9-4. BGE (GASOLINE) - ABOVE FLOOR/COMPARTMENT

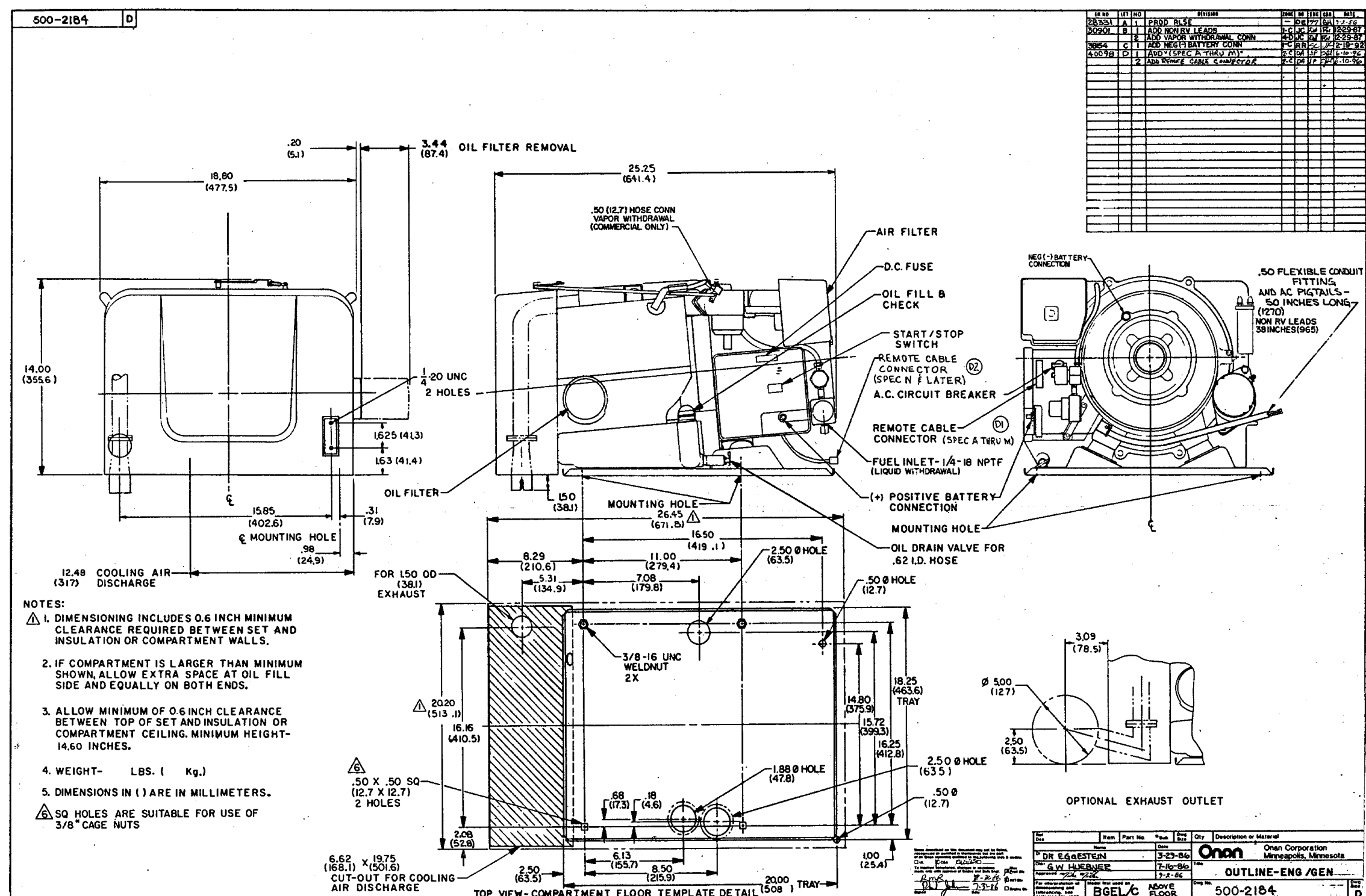


FIGURE 9-5. BGE (LPG) - ABOVE FLOOR/COMPARTMENT

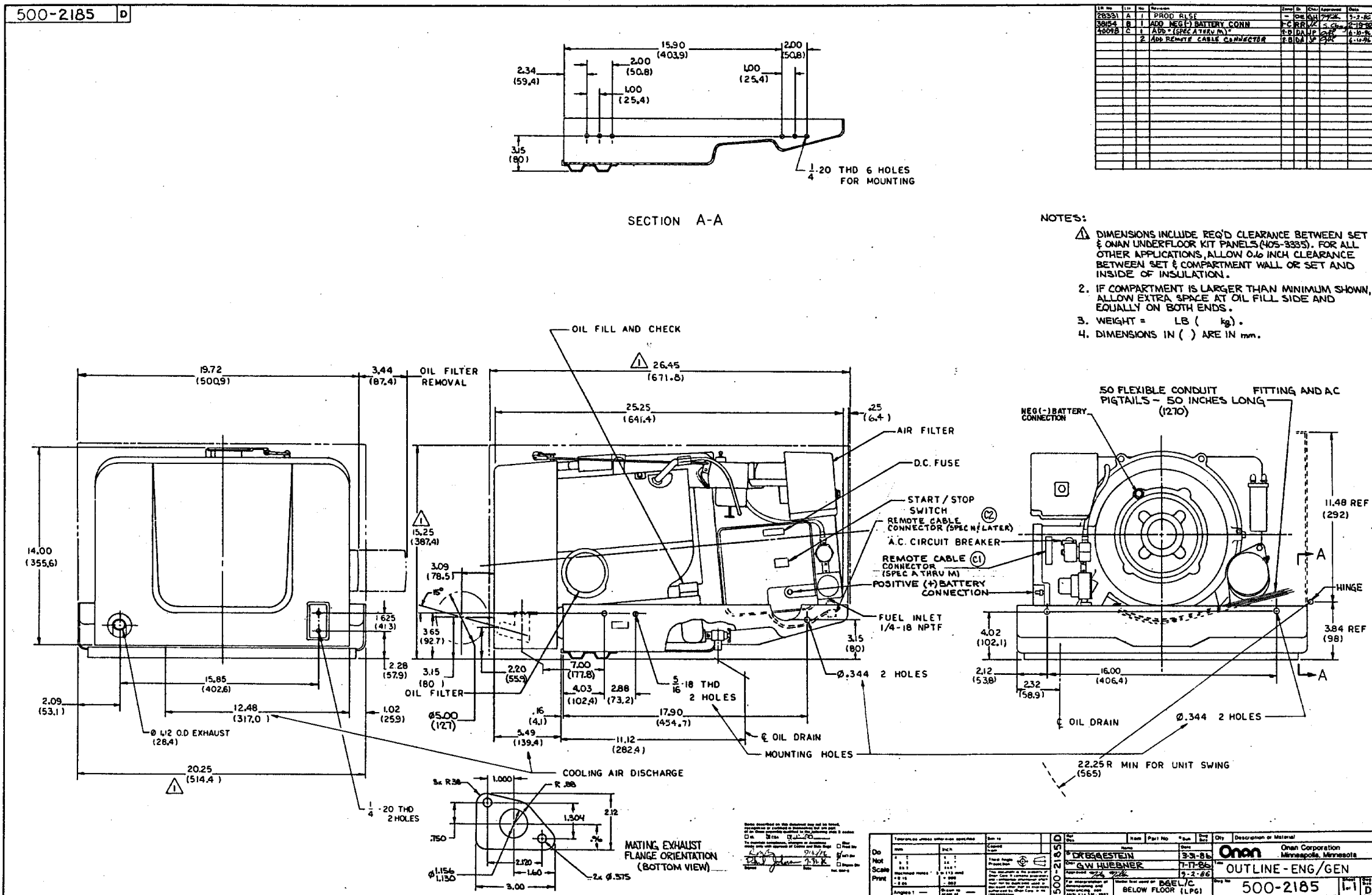


FIGURE 9-6. BGE (LPG) - BELOW FLOOR



2. IF COMPARTMENT IS LARGER THAN MIN SHOWN,
ALLOW EXTRA SPACE AT OIL FILL SIDE AND
EQUALLY ON BOTH ENDS.
3. WEIGHT = 242 LB (119.6kg)
4. DIMENSIONS IN " ARE IN mm



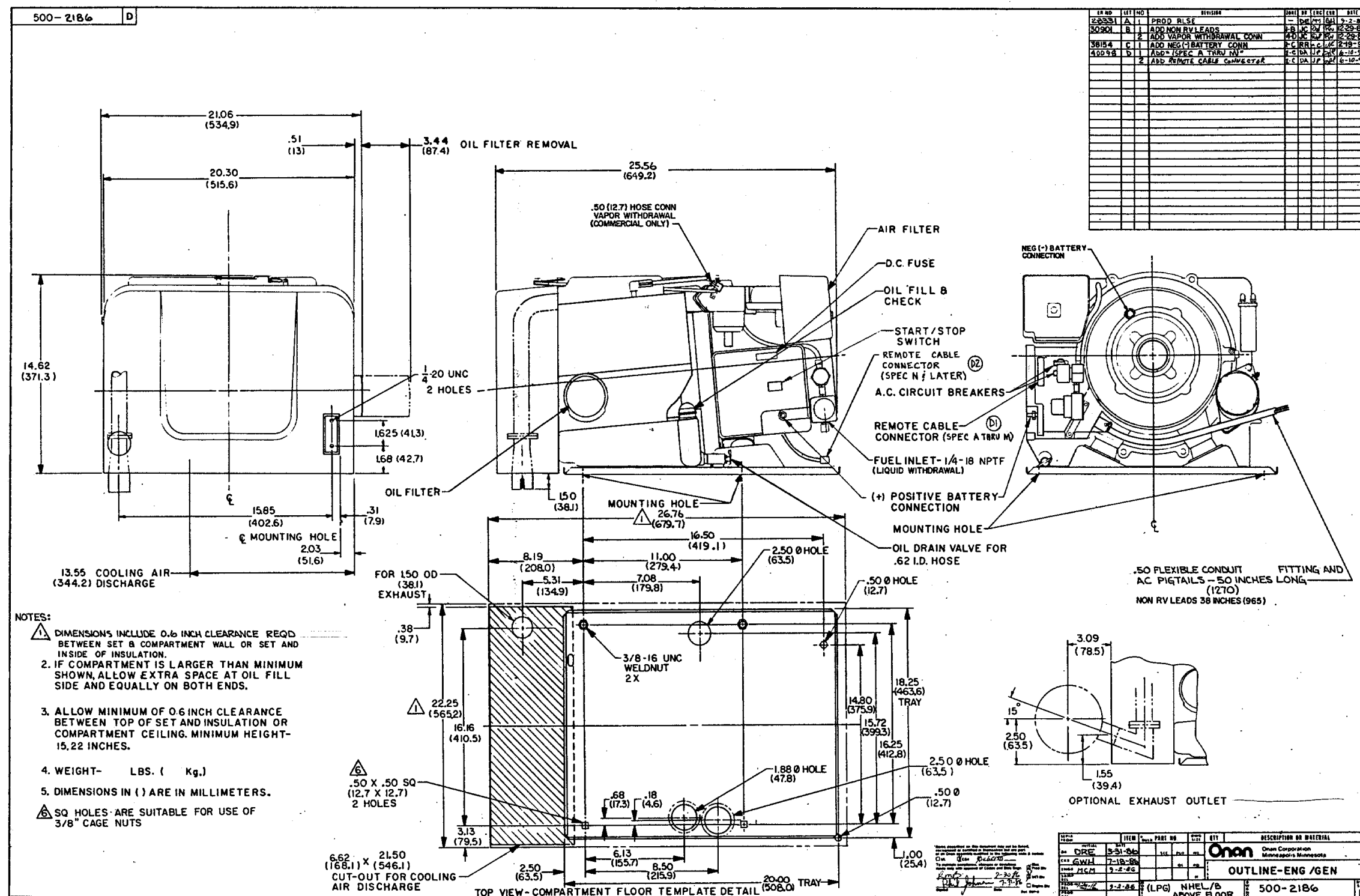


FIGURE 9-9. NHE (LPG) - ABOVE FLOOR/COMPARTMENT

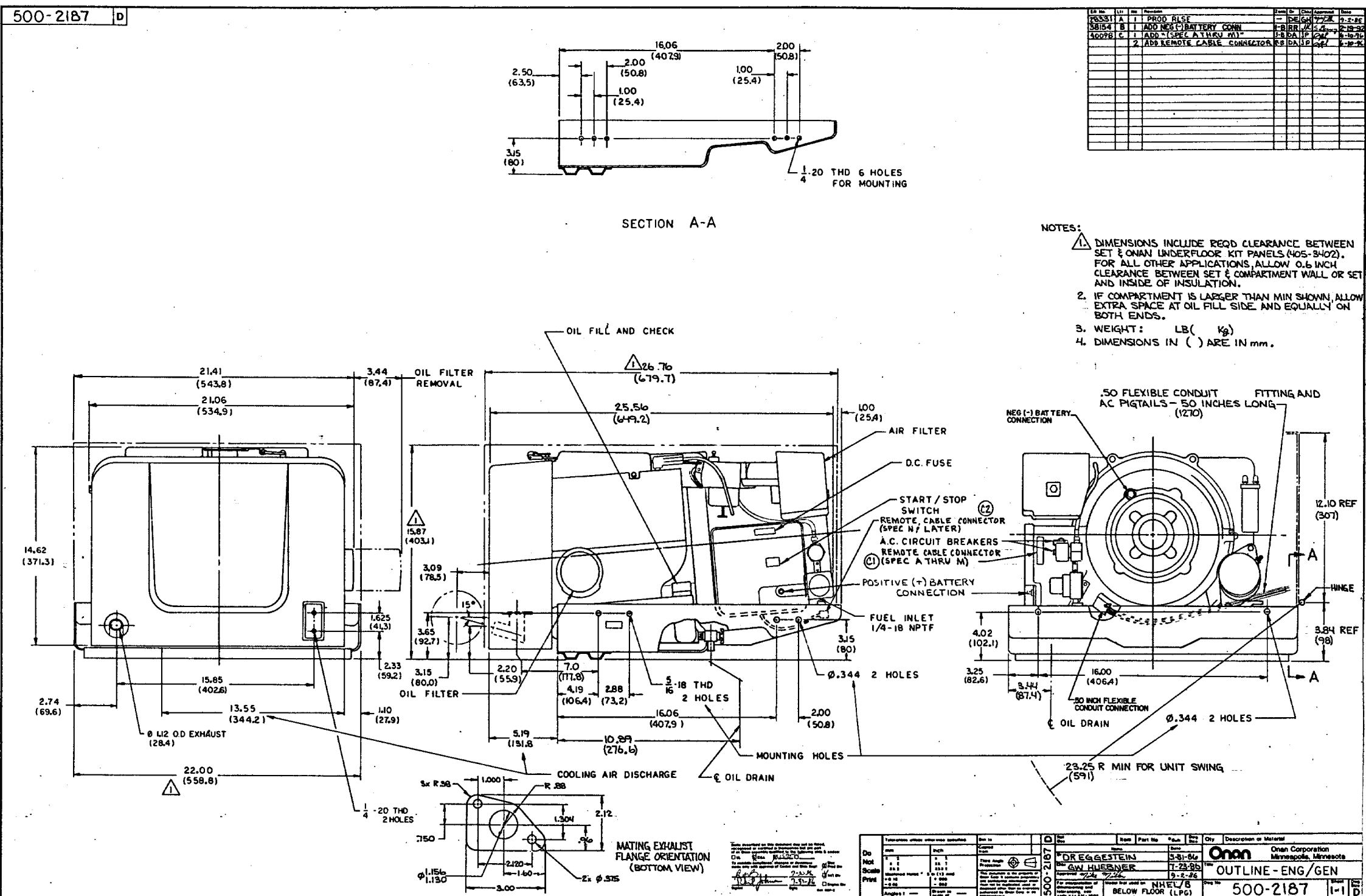


FIGURE 9-10. NHE (LPG) - BELOW FLOOR



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