

Cummins **Onan**



# Installation Manual

## Generator Set

HDKAW (Spec A–B)

## **California**

### **Proposition 65 Warning**

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



## **WARNING**



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

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# SAFETY PRECAUTIONS

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

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

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

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

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

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

When equipped with an integral or add-on Automatic Generator Starting System (AGS) control, exhaust carbon monoxide (CO), electric shock, and moving parts hazards are possible due to unexpected starting. Turn off AGS whenever performing maintenance or service, when the vehicle is stored between uses, is awaiting service, or is parked in a garage or other confined area.

## ENGINE EXHAUST IS DEADLY

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Prior to every startup and after eight hours of running, all carbon monoxide detectors must be tested and confirmed to be working in accordance with the manufacturer's instructions or owners manual.
- Learn the symptoms of carbon monoxide poisoning in the genset Operator's Manual.
- Never occupy the vehicle while the genset is running unless the vehicle is equipped with a working carbon monoxide detector.

- Do not operate the genset when the vehicle is parked in a confined space, such as a garage.
- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before storing the vehicle or parking it in a garage or other confined space.
- The exhaust system must be installed in accordance with the genset Installation Manual.
- Engine cooling air must not be used for heating the vehicle.

## GENERATOR VOLTAGE IS DEADLY

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset to avoid electric shock from an unexpected start.
- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.
- The genset must not be connected to shore power (utility). Back-feed to shore power can cause electrocution 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, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

## DIESEL FUEL IS COMBUSTIBLE

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

## MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disable the automatic genset starting feature (AGS) of an inverter-charger or other automatic starting device before servicing the genset to avoid unexpected starting.

- 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, and other moving parts.

### BATTERY GAS IS EXPLOSIVE

- Wear safety glasses.
- Do not smoke near the batteries or near the generator set.
- To reduce arcing when disconnecting or reconnecting battery cables, always disconnect the negative (-) battery cable first and reconnect it last.

### FLAMMABLE VAPOR CAN CAUSE A DIESEL ENGINE TO OVERSPEED

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. ***Do not operate a diesel-powered genset where a flammable vapor environment can be created by fuel spill, leak, etc.*** The owners and operators of the genset are solely responsible for operating the genset safely.

### GENERAL PRECAUTIONS

- To prevent equipment damage or personal injury, do not store items in the clearance area around the generator set, especially near the belt guard end of the generator set.
- Keep children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- To prevent accidental or remote starting while working on the genset, disconnect the negative (-) battery cable at the battery.

- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray out and cause severe burns.
- Keep the genset and its compartment clean. Excess oil and oily rags can catch fire. Dirt and gear stowed in the compartment can restrict cooling air.
- Make sure all fasteners are secure and torqued properly.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- You must be trained and experienced to make 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 U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-class ABC fire extinguishers readily at hand. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquids and gaseous fuels. Class C fires involve live electrical equipment. See NFPA No. 10 or equivalent—BS EN 3-7:2004 [Portable Fire Extinguishers].
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.

# 1. Introduction

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## ABOUT THIS MANUAL

**⚠ 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.*

**⚠ WARNING** *This generator set is not a life support system. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if generator set operation is critical.*

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

This manual is a guide for the installation of the generator sets (generator sets) listed on the front cover. Proper installation is essential for top performance. Read through this manual before starting the installation. Leave this manual with the vehicle.

This manual addresses the following aspects of the installation:

- Location and Mounting
- Exhaust Connections
- Fuel Connections
- Electrical Connections
- Startup

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

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

## OUTLINE DRAWINGS

See the Outline Drawing (Page A-2) for installation details: mounting bolt hole locations, connection points (fuel, battery, exhaust, remote control, AC output), sizes and types of fittings, cooling air openings, weight, service access points and overall dimensions. See your Cummins Onan dealer for a large-scale Outline Drawing.



## INSTALLATION CODES AND STANDARDS FOR SAFETY

**⚠ CAUTION** *The Commercial generator set Warranty applies only when the generator set is installed in a Commercial or Recreational Vehicle.*

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

Federal, State and local codes, such as the California Administrative Code—Title 25 (RV installation), could apply. 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**

Code of Federal Regulations, Title 49: Chapter III and Chapter V	Superintendent of Documents P. O. Box 371954 Pittsburgh, PA 15250-7954
NFPA No 70, 1192	National Fire Protection Association 1 Battery March Park Quincy, MA 02169-7471
ANSI/RVIA-EGS-1	Recreational Vehicle Industry Association 1896 Preston White Drive Reston, VA 20191
California Administrative Code—Title 25, Chapter 3	State of California Documents Section P.O. Box 1015 North Highlands, CA 95660
CAN/CSA-Z240 Recreational Vehicles TIL RV-06	Canadian Standards Association Housing and Construction Materials Section 178 Rexdale Blvd. Rexdale, Ontario, Canada M9W 1R3
IEC60364-7-708: Electrical Installations in Caravan Parks & Caravans	International Electrotechnical Commission 3, Rue de Varembe Geneva, Switzerland



## 2. Location, Mounting, and Ventilation

### LOCATION

Typical generator set locations on a vehicle are illustrated in Figure 2-1.

1. Provide access to the operator's console, the generator set service side, oil drain (bottom and service side) and coolant drain (lower left front) so that all periodic maintenance can be performed in accordance with the Operator's Manual.
2. Provide access for connecting and disconnecting fuel lines, battery cables, remote control wiring and AC wiring.
3. Make sure that frame cross members, exhaust tail pipes and other equipment do not cross underneath the oil drain plug, coolant drain, or air intake and discharge openings. These areas are indicated on the Outline Drawing (Page A-2).
4. Make sure the generator set clears the ground by at least 12 inches (305 mm) to provide adequate ventilation.
5. Protect the air openings in the bottom and side of the generator set from road splash with mud flaps and shields, especially when the generator set is located in line with the road wheels. It is preferable to mount the generator set in front of, rather than behind, the road wheels.
6. Provide vapor-resistive and fire-resistive barrier between the generator set and the interior of the vehicle in accordance with NFPA 1192.

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

7. A generator set compartment must have the clearances indicated in Table 2-1. These minimum clearances apply to the distance between the generator set surface and the thermal or acoustic insulation with which the compartment may be lined, or the compartment itself if this insulation is not used.

**⚠ WARNING** For fire safety, maintain the minimum clearances between generator set surfaces and any insulation as indicated in Table 2-1.

TABLE 2-1. MINIMUM CLEARANCES

SURFACE	MINIMUM CLEARANCE
Belt Guard Surface	5 in (127 mm)
Fan Inlet	Zero (physical contact)
Top and Back Surfaces	2 in (50.8 mm)
Front Surfaces	1 in (25.4 mm)
Muffler	2 in (50.8 mm)*

\* – In addition, use a heat shield (24 x 16 inches, minimum) to protect the compartment and insulation from the muffler.

**⚠ WARNING** The generator set compartment must be vapor-resistant to prevent fire or noxious fumes from entering occupant spaces.

**⚠ WARNING** To prevent fires, nothing should be stored in the generator set compartment.

8. Acoustic/thermal insulation and adhesive must be rated as "Self-Extinguishing." Do not line the bottom of the compartment with insulation, which can absorb spilled fuel and oil.

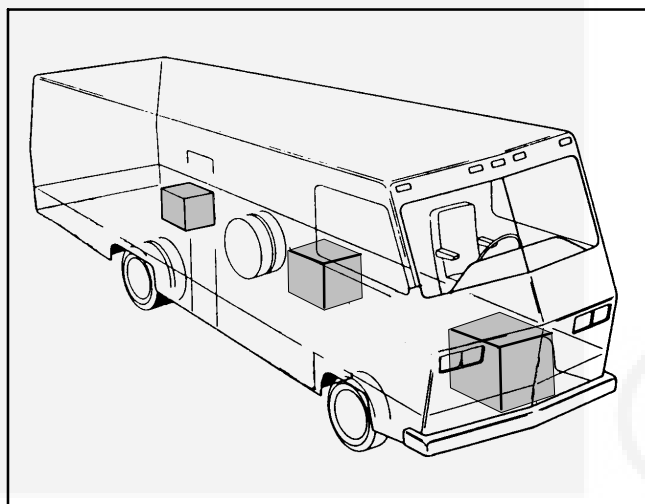


FIGURE 2-1. TYPICAL GENERATOR SET LOCATIONS

## MOUNTING

Support the generator set on a structure able to resist the dynamic weight of the generator set:  $\pm 3$  g-force vertical and  $\pm 3$  g-force horizontal. See *Section 7. Specifications* for the weight of the generator set. Use four Grade 5, 3/8"-16 UNC screws to secure the generator set frame to the floor or frame. The mounting holes (Figure 2-2) have 3/8"-16 UNC weld nuts in the pan. Torque the screws to 35 lb-ft (41 N-m).

Mounting holes are also available on the front and back side rails to mount angle iron tabs for forklift use. These tabs can be used to slide the generator set into the compartment in the direction indicated in Figure 2-2. In this case, however, fuel connections

must use the "Optional Fuel Connections" on the back of the generator set (Figure 4-1), not the fuel connections on the side. Similarly, battery connections must also use the back of the generator set.

**CAUTION** *The base pan is not strong enough for a slideout configuration. To avoid equipment damage, do not attempt to support the generator set from the ends. All of the service points can be accessed from the service side.*

**WARNING** *The generator set support structure must be designed and installed to support and restrain the dynamic weight of the generator set. Failure to do so can result in the generator set dropping onto the roadway causing property damage, severe personal injury and death.*

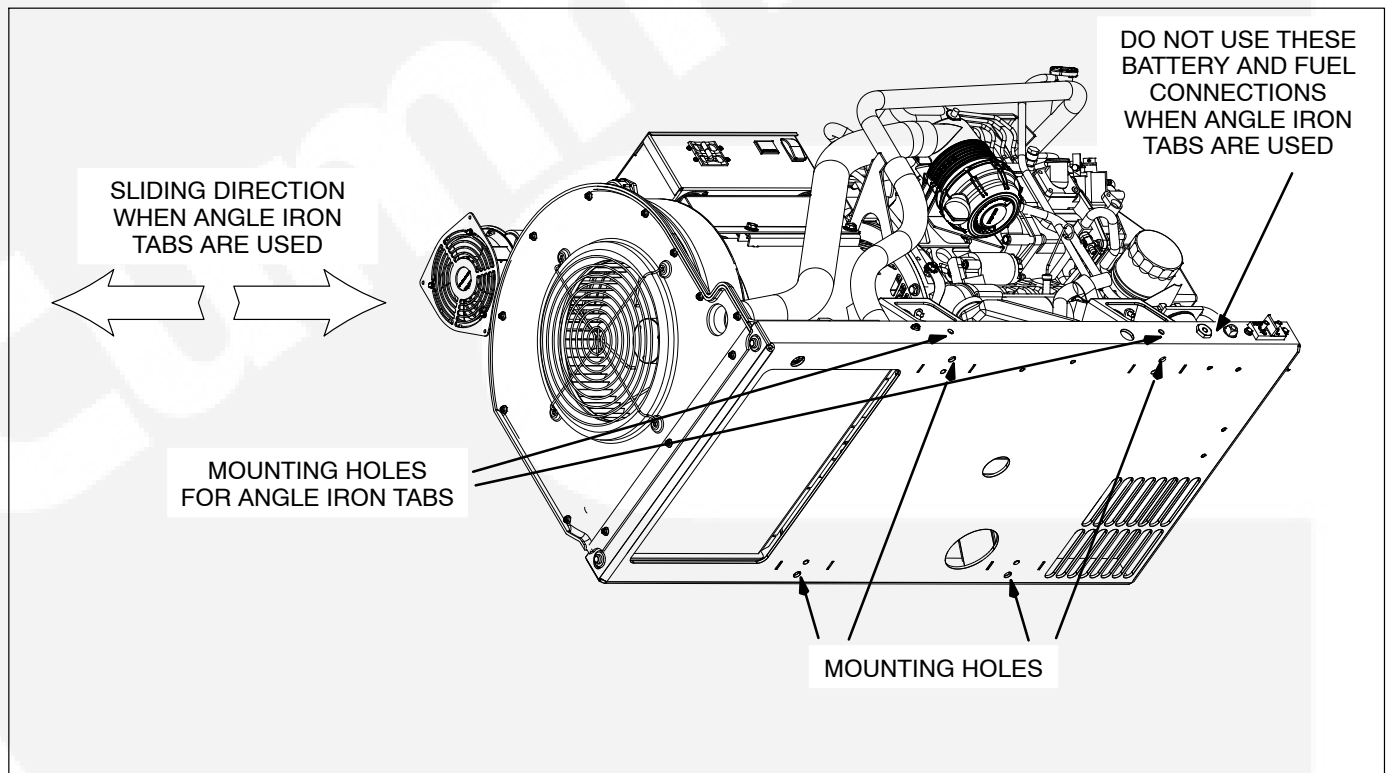


FIGURE 2-2. GENERATOR SET MOUNTING HOLES

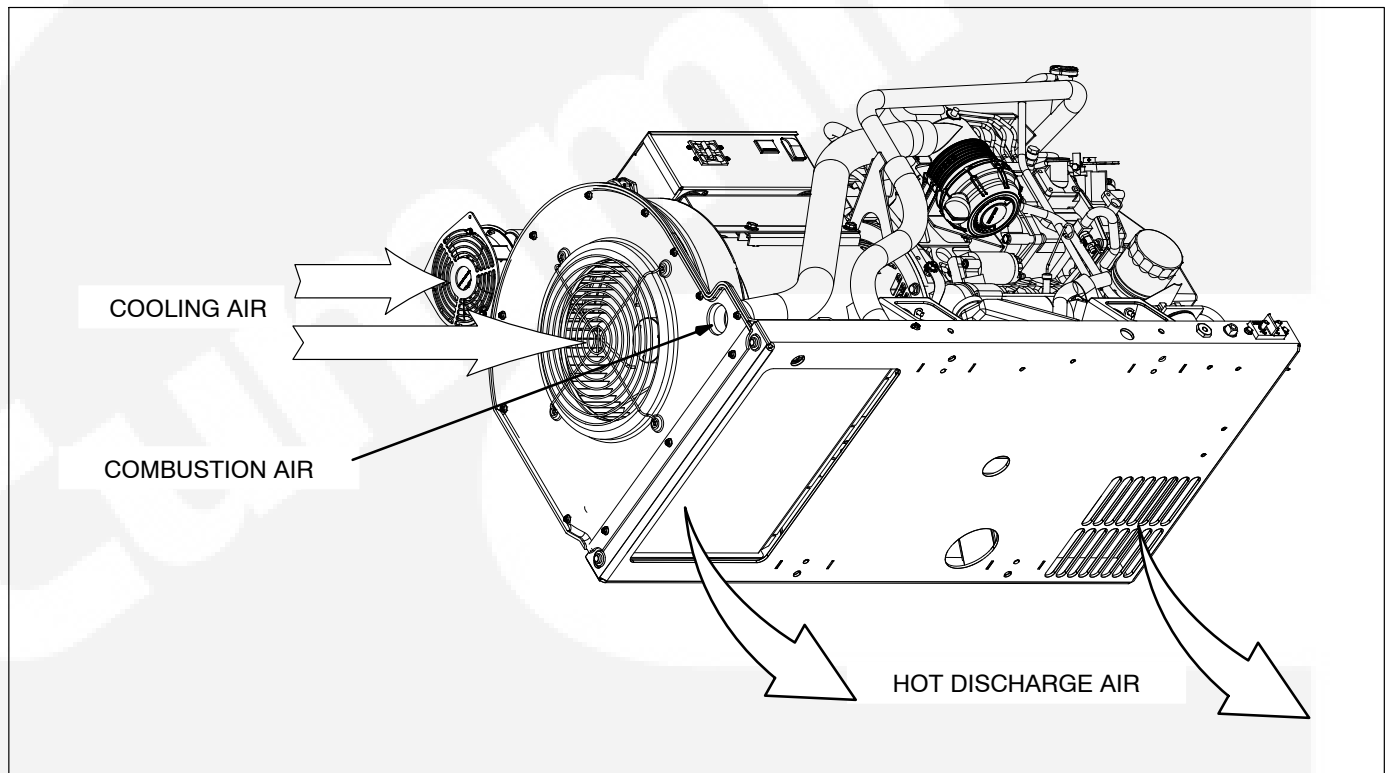
## VENTILATION

Unrestricted air flow for cooling, ventilation and combustion is essential for proper generator set performance and service life (Figure 2-3). The air intake openings are at the front of the generator set. The discharge openings are at the bottom of the generator set. These areas are indicated on the Outline Drawing (Page A-2). See also HOT AIR RE-CIRCULATION TEST (Page 6-1).

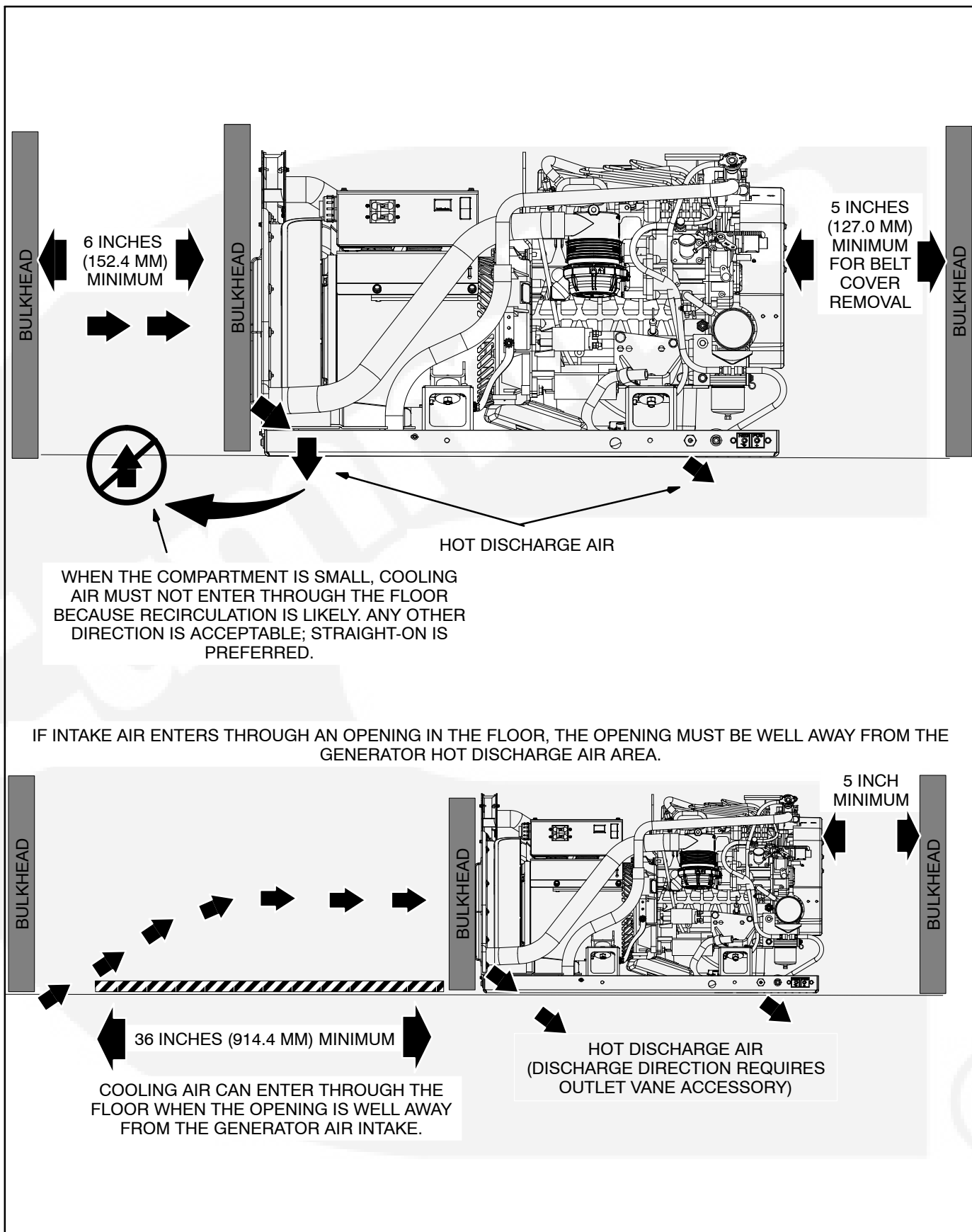
If the generator set is installed on a floor, cut out openings in the floor that are at least as large as the

openings in the generator set for discharge. Cooling air must not enter from an opening in the floor unless the compartment is large enough to keep the inlet opening a sufficient distance from the generator set air outlet (Figure 2-4).

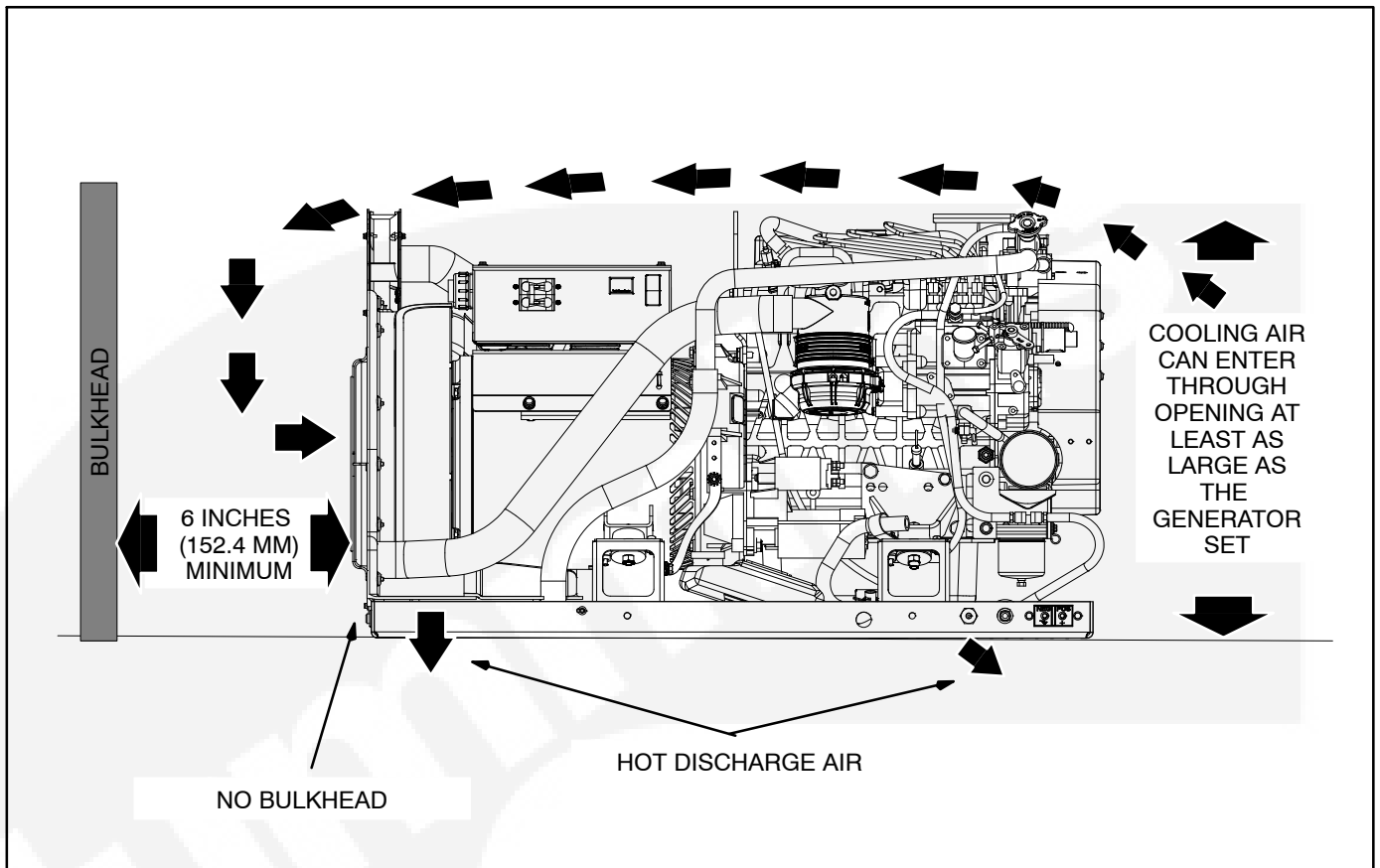
Make sure frame cross members, exhaust tail pipes and other equipment do not cross underneath the air intake and discharge openings. *Do not block the air inlet and outlet openings with screens, expanded metal or the like; they restrict air flow and could cause the generator set to overheat.*



**FIGURE 2-3. COOLING, VENTILATION AND COMBUSTION AIR FLOWS**



**FIGURE 2-4. AIR FLOW THROUGH A COMPARTMENT**



**FIGURE 2-5. AIR FLOW THROUGH A COMPARTMENT (ALTERNATIVE)**

## Compartment Cooling Fan

This fan is required for proper ventilation.

**Note:** The control box must have air blowing through it. Even if air is blowing over the generator set, this air does not provide enough ventilation for the control box.

This fan is not connected to the generator set when it is shipped from the factory. It must be mounted in

the position shown in Figure 2-6, unless the alternative ventilation approach (Figure 2-5) is used, in which case this fan can be mounted facing forward or backward. In either case, make sure the tube is connected from the compartment cooling fan to the control box for control card cooling.

The bulkhead should touch the back of the fan housing.

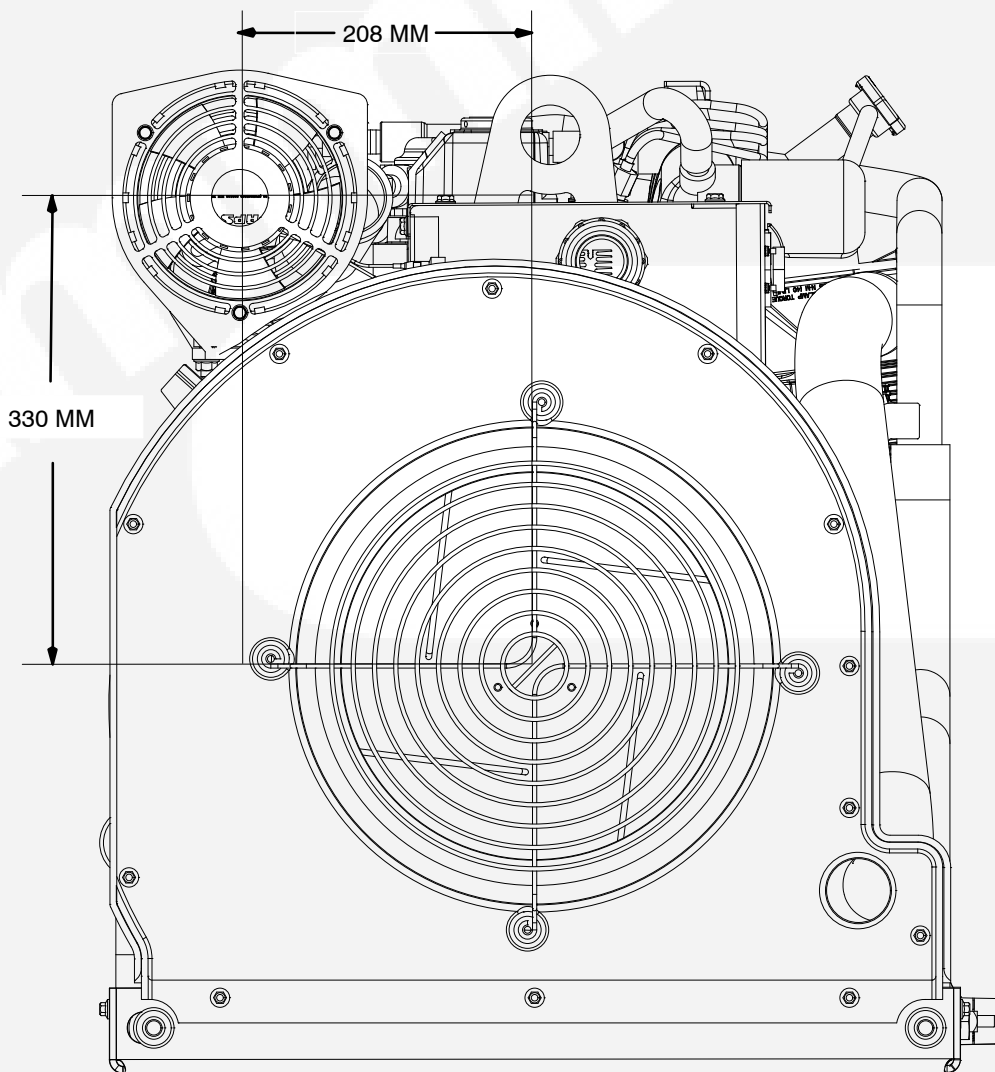


FIGURE 2-6. REMOTE FAN MOUNTING

### Vane Kit (Optional)

An optional vane kit (part number A028V210) is available to direct hot discharged air away from the

air inlets. Depending on the installation, this change in direction may be required to prevent the hot discharged air from re-entering the generator set and causing the generator set to overheat.

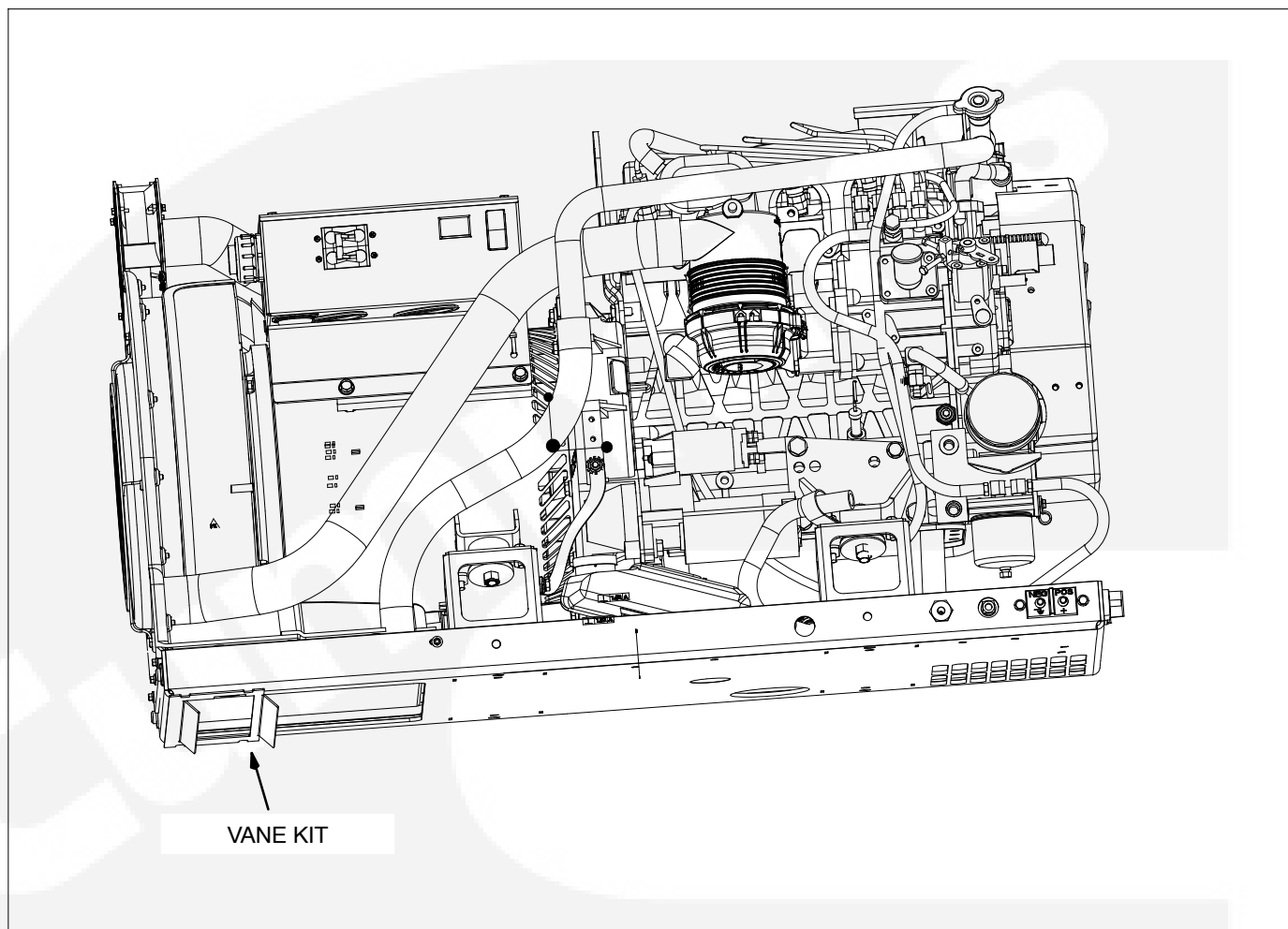


FIGURE 2-7. VANE KIT (OPTIONAL)

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### 3. Exhaust Connections

The exhaust system must be gas-tight and designed to limit entry of exhaust gases into the vehicle.

**⚠ WARNING** *EXHAUST GAS IS DEADLY! To keep exhaust gases from entering the vehicle do not terminate the exhaust tailpipe underneath the vehicle or closer than specified in Figure 3-7 for openings into the vehicle. Route tubes where they are unlikely to be damaged (Figure 3-8). Use approved materials and parts only.*

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

#### MUFFLER

The muffler is mounted on the side of the generator set (opposite to the service side). It has been qualified as a USDA (Forest Service) spark arrestor and meets RVIA EGS-1 construction requirements.

Figure 3-1 shows the muffler location. A compartment cooling fan mounted on the side of the generator set prevents the build-up of excess heat from the muffler.

**Note:** Install thermal insulation on the back non-service enclosure wall for added protection.

**⚠ WARNING** *The muffler surface is very hot. There should be a minimum clearance of 2 in (50.8 mm) to any surface. Non-combustible insulation, such as one-half inch (12.7 mm) foil covered by fiberglass, may be placed on the compartment wall.*

A generator set without a properly installed and maintained spark arresting exhaust system is illegal to operate on federal lands. Liability for damage, injury and warranty expense due to the modification of the exhaust system or to the use of unapproved parts is the responsibility of the person performing the modification or installing the unapproved parts. Contact your Cummins Onan distributor for approved exhaust system parts.

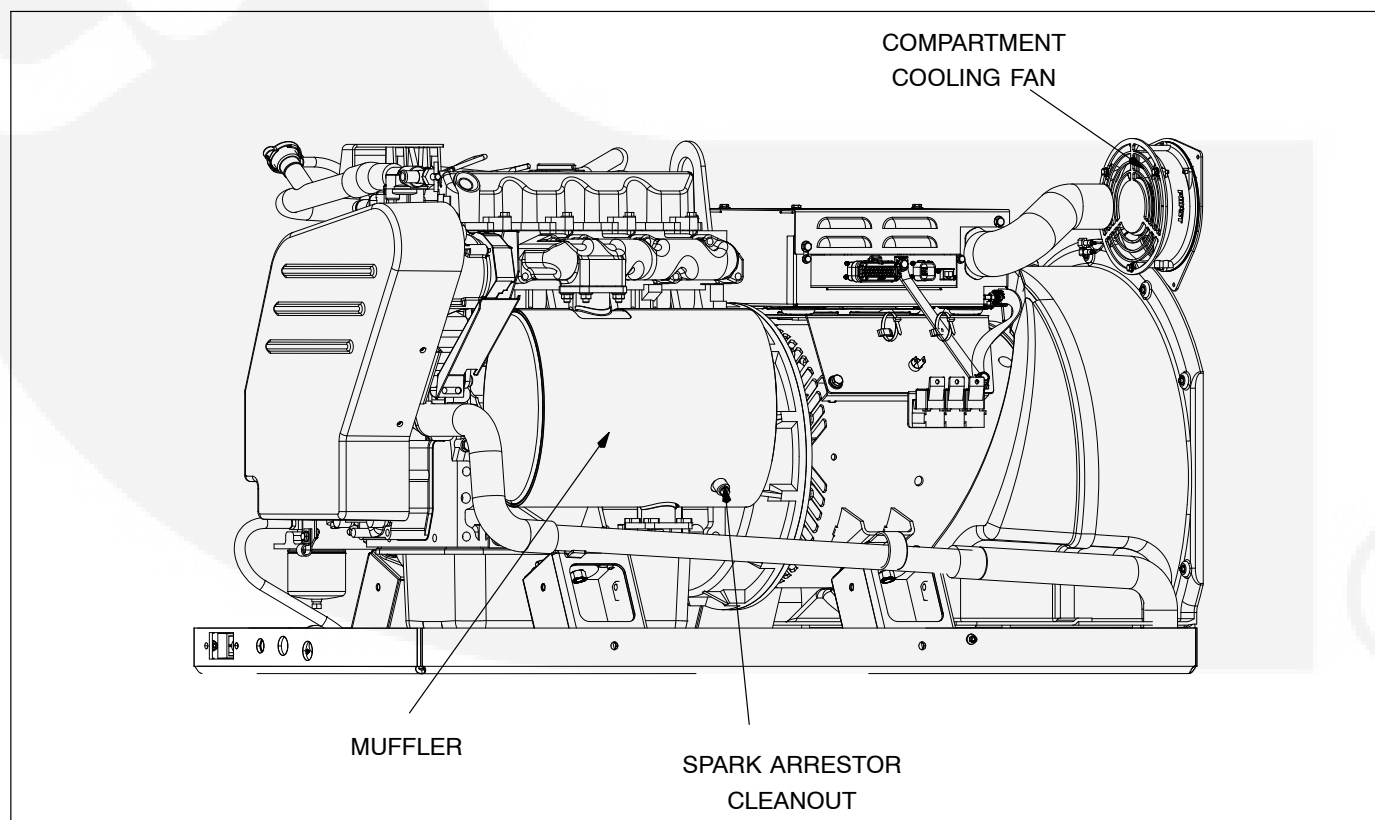
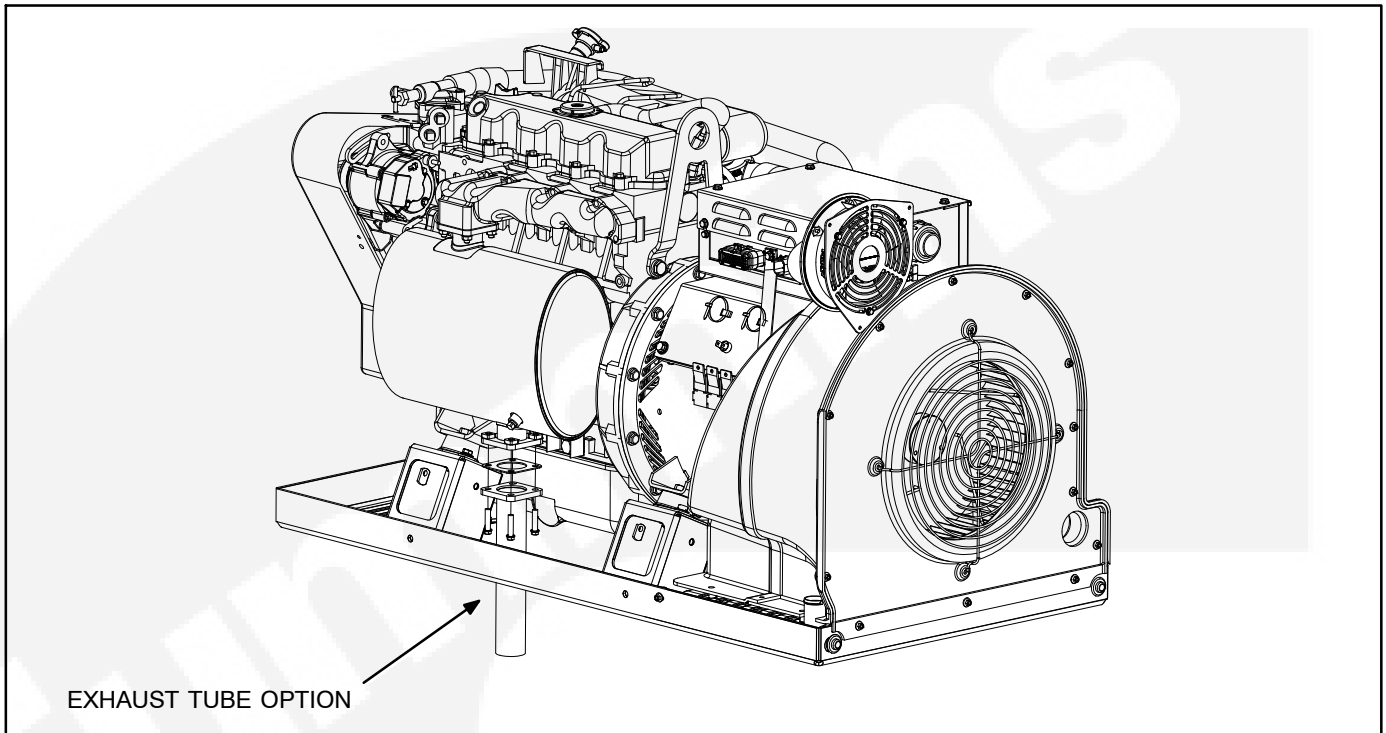


FIGURE 3-1. GENERATOR SET EXHAUST AND EXHAUST COOLING FAN

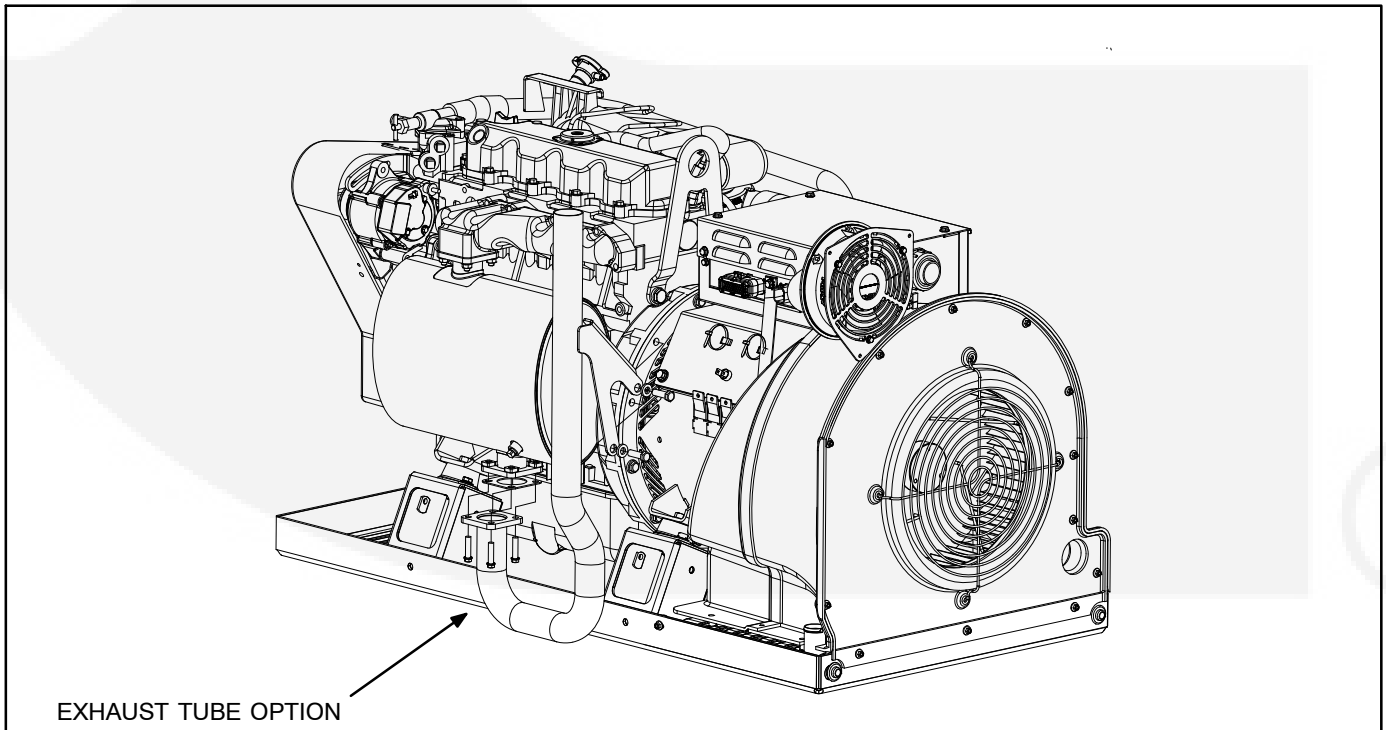
## TAILPIPE

Tailpipe adapter kits are separately available. Use a straight adapter for a tailpipe routed through the bot-

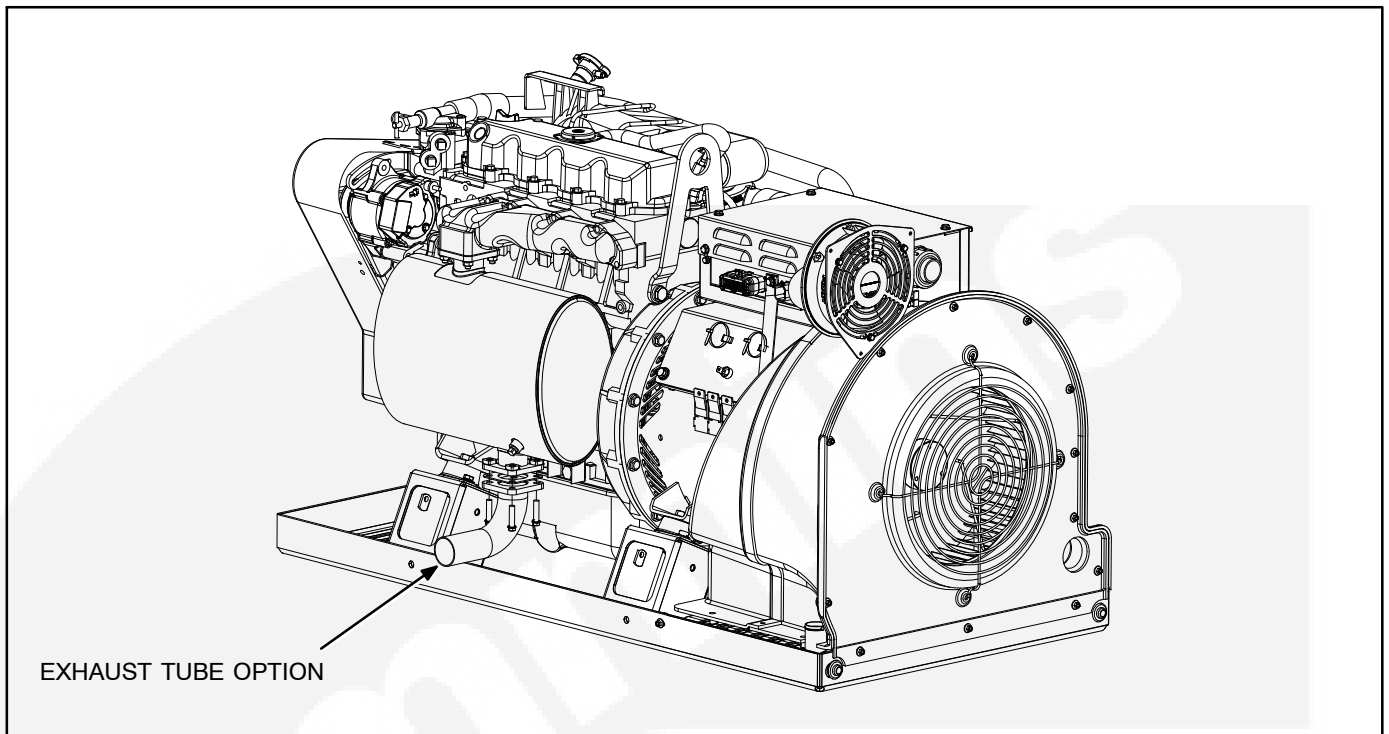
tom clearance hole (Figure 3-2). Use an uptube accessory to route exhaust upwards (Figure 3-3). Use a side tube accessory to route the exhaust out the back of the compartment (Figure 3-4).



**FIGURE 3-2. EXHAUST ROUTED DOWNWARDS (PART NUMBER 0155-4976)**



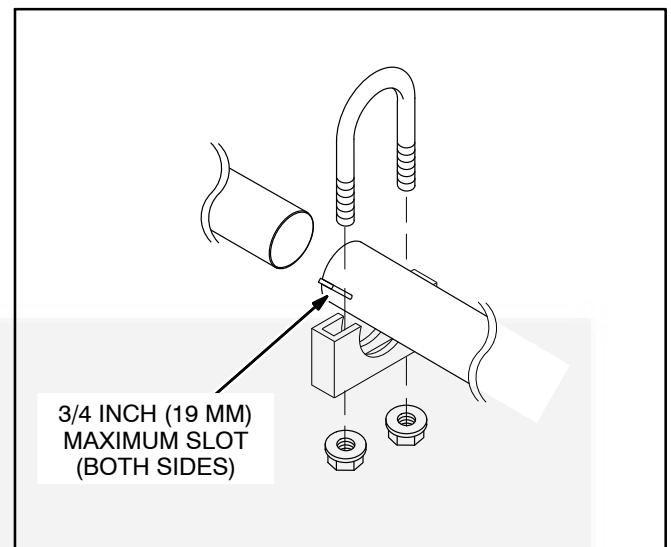
**FIGURE 3-3. EXHAUST ROUTED UPWARDS (PART NUMBER A026D359)**



**FIGURE 3-4. EXHAUST ROUTED SIDEWAYS (PART NUMBER A028W811)**

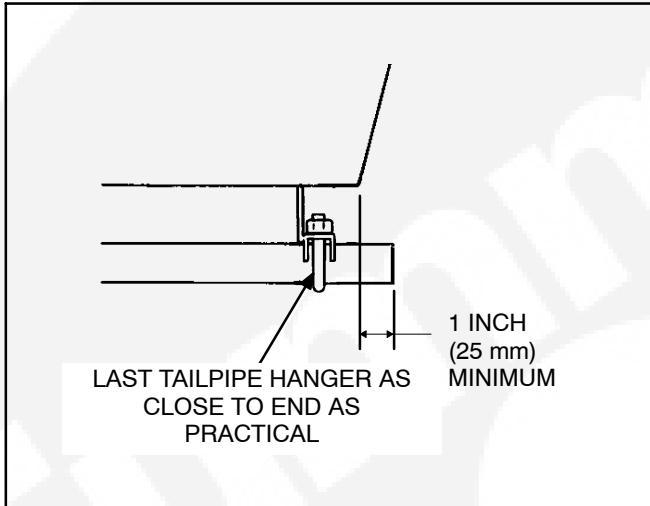
When connecting and routing the tailpipe:

1. Use 1-3/4 inch ID (or larger) aluminized steel tubing for the tailpipe. (Do not use flexible pipe. Flexible pipe is not gas tight or durable.)
2. Secure the tailpipe or adapter flange to the muffler flange with a gasket and four stainless steel 5/16-18UNC bolts, which are supplied in the literature package.
3. Use U-bolt muffler clamps to connect sections of tailpipe. It is recommended that the overlapping pipe be slotted as shown in Figure 3-5.



**FIGURE 3-5. EXHAUST TAILPIPE CONNECTIONS (SWEDGE STYLE PREFERRED)**

4. Use flexible automotive-type tailpipe hangers every 2 to 3 feet (0.6 to 0.9 m). Attach the hangers to steel framework, not to wood or other combustible material.
5. Do not terminate the tailpipe underneath the vehicle. Extend it a minimum of 1 inch (25 mm) beyond the perimeter of the vehicle (Figure 3-6). Support the end of the tailpipe such that it cannot be pushed inward and up under the skirt of the vehicle by backing up into a curb or other obstacle.

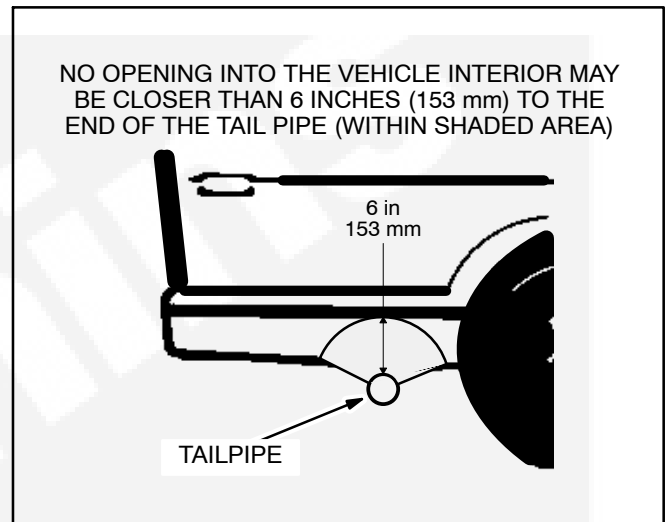


**FIGURE 3-6. TERMINATING THE EXHAUST TAIL-PIPE**

**Note:** Do not terminate the tailpipe underneath a slide-out room (Figure 3-8), unless the bottom of the slide-out, including skirts and moldings, is at least 3 feet above the end of the tailpipe.

6. Do not route the tailpipe such that it will interfere with draining engine oil or coolant or restrict the air inlet.
7. Do not route the tailpipe closer than 3 inches (76 mm) to combustible material (wood, felt, cotton, organic fibers, etc.) unless it is insulated or shielded. The temperature on adjacent combustible material must not exceed 194°F (90°C).
8. Do not route the tail pipe near fuel lines or fuel tanks or terminate it below or near a fuel fill opening.

9. Do not terminate the tailpipe such that it is closer than 6 inches (153 mm) to any opening into the vehicle interior (door, window, vent). See Figure 3-7.



**FIGURE 3-7. MINIMUM DISTANCES TO OPENINGS**

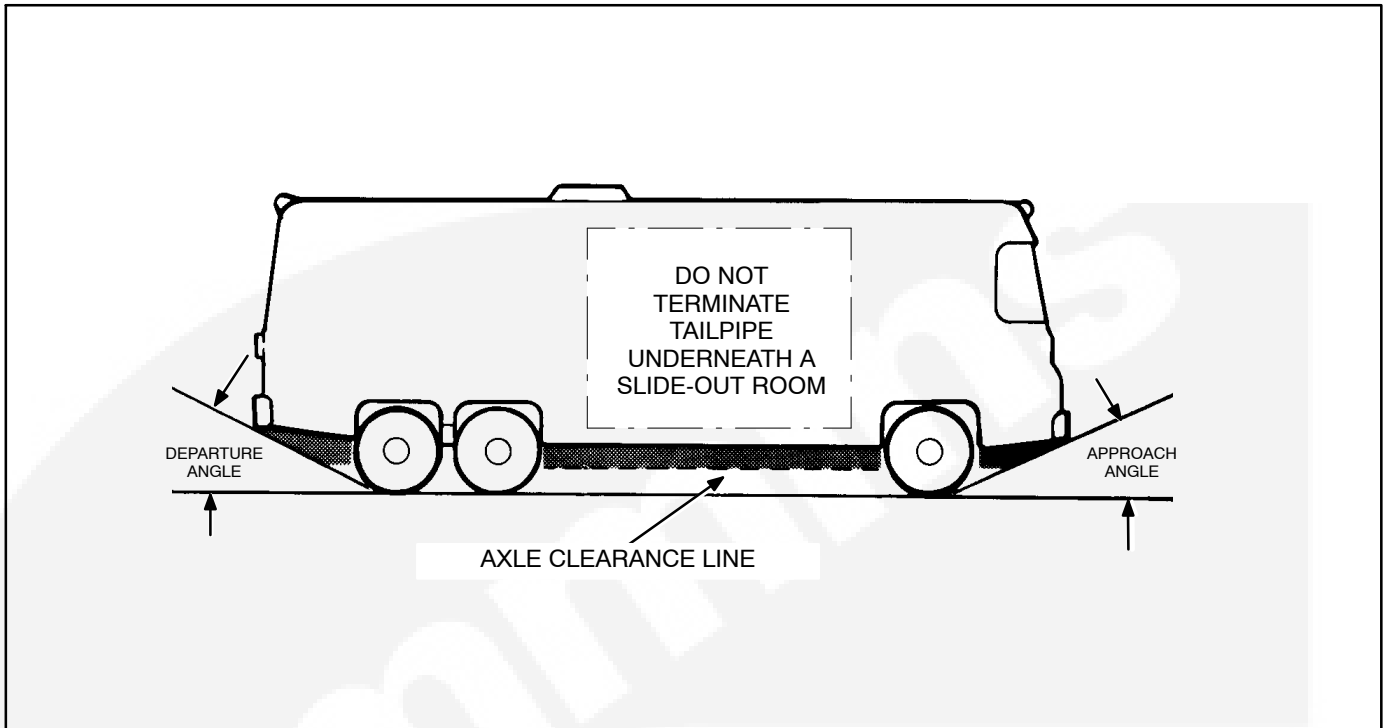
10. Route the tailpipe such that it will not likely be struck when the vehicle is moving. If possible, keep it out of the approach and departure angles of the vehicle and above the axle clearance line (Figure 3-8).

**⚠ CAUTION** *Interconnecting the engine exhaust systems will allow exhaust condensates and soot to migrate into the engine that is idle, causing engine damage.*

11. Do not connect the generator set to the vehicle engine exhaust system.

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

12. System exhaust back pressure under full load must not exceed 28 inches (711.2 mm) water column (WC) as measured at the engine exhaust manifold. To minimize back pressure, minimize the length of the tailpipe and the number of elbows. Consult the factory if you plan to use over 6 feet of tailpipe and/or two or more elbows.



**FIGURE 3-8. APPROACH AND DEPARTURE ANGLES AND AXLE CLEARANCE LINE**

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## 4. Fuel Connections

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

Do not interconnect generator set and vehicle engine fuel lines. Follow the vehicle chassis manufacturer's instructions when making connections to the vehicle engine fuel tank.

**⚠ CAUTION** *Either or both engines could starve for fuel if the generator set and vehicle engine fuel lines are interconnected. Always use separate fuel lines or a separate fuel tank for the generator set.*

To prevent the generator set from running the vehicle out of fuel, do not extend the generator set's fuel pickup tube into the fuel tank as far as the pickup tube for the vehicle engine.

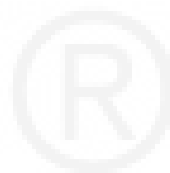
Supply fuel lines must have at least a 5/16 inch (7.9 mm) ID. Return fuel lines must have at least a

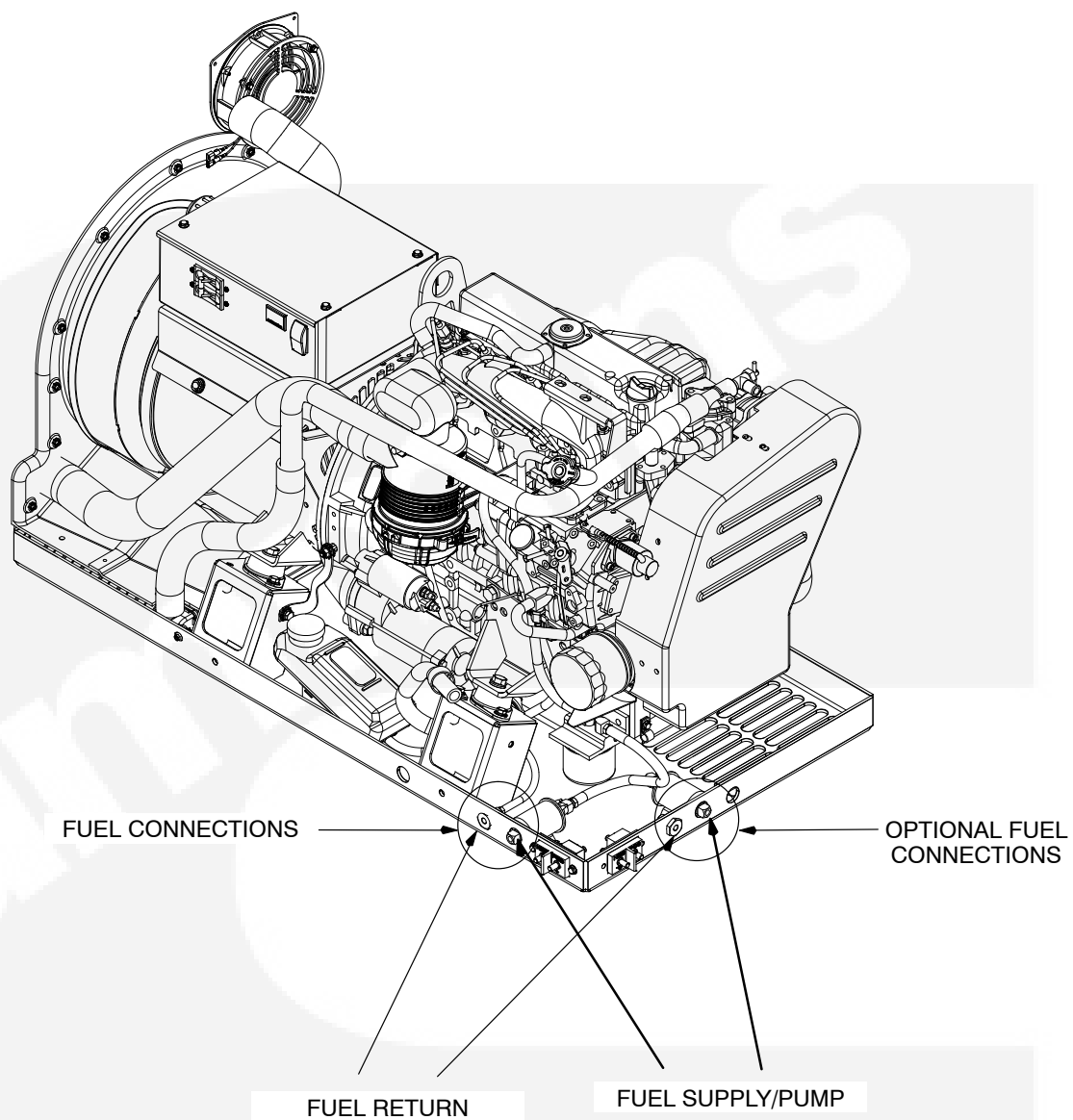
3/16 inch (4.8 mm) ID. See Figure 4-1 for connections at the generator set. If B20 fuel will be used, the hoses must meet SAE J30R9 specifications.

Run the fuel lines at or above the top of the fuel tank to reduce the risk of siphoning fuel out of the tank if the line should break. The maximum fuel pump lift is 36 inches (1 meter) from the generator set pump. If the generator set is more than 36 inches above the lowest point on the tank, then an auxiliary fuel pump, such as the one provided in kit 541-0530, should be used. An auxiliary pump is placed near the fuel tank and is wired in parallel with the generator set pump. See kit 541-0530 for more wiring information and detailed instructions.

Route fuel lines away from electrical wiring and hot engine exhaust components. Fuel lines should be accessible for inspection and replacement, and secured at intervals of 18 inches to prevent damage from kinking, contact with sharp edges, and chafing due to vibration.

If moisture in the fuel becomes a problem, fuel water vapor separators are available.





**FIGURE 4-1. FUEL CONNECTIONS**



## BIO-DIESEL FUELS B5 – B20

### Approved Bio-Diesel Fuel:

- For bio-diesel blends above B5 and up to B20, Cummins Onan requires that the fuel meet the specifications outlined in ASTM D7467.
- The bio-diesel component of this fuel blend must meet ASTM D6751 or EN14214 and the petroleum-diesel component must meet ASTM D975.

For bio-diesel blends above B5 and up to B20 the following installation requirements must be met:

- Natural rubber, butyl rubber, and some types of nitrile rubber may be particularly susceptible to degradation when exposed to biodiesel. Copper, bronze, brass, tin, lead, and zinc can cause deposit formations. The use of these materials and coatings should be avoided for vehicle fuel tanks and fuel lines. Always check with component manufacturers to confirm compatibility with B20.
- Fuel tanks must be made from the following materials: aluminum, steel, fluorinated polyethylene, fluorinated polypropylene or Teflon (PTFE).
- Verify the vehicle propulsion engine is capable of using B20 when sharing the same fuel tank with the generator set.
- A bio-diesel compatible fuel water separator is required. Because water separators do not work as well with bio-diesel as they do with petroleum-based diesel, it is very important to prevent water from entering the fuel supply.

Place the fuel water separator in a location that is accessible for service by as close the generator set as possible. Locating the separator

ahead of the generator set fuel pump is acceptable.

### Additional information:

- Bio-diesel blends have higher pour and cloud points than standard diesel fuels. Generator set locations far from the fuel tank combined with low fuel flow rates can make the generator set fuel system very susceptible to fuel starvation related to gelling in cold weather (below 23°F/ -5°C). In addition to electric or coolant tank heaters, consideration to routing and possible heating or insulation of the fuel lines to the generator set may be needed.
- Bio-Diesel blends can oxidize more quickly than standard diesel fuels; more frequent fuel filter service intervals are required and shorter fuel storage life in tanks is likely.

**⚠WARNING** It is highly recommended that specific market applications are avoided or exercised with extra care due to some of the properties of bio-diesel fuel blends such as cold weather operation, long term storage, material incompatibilities and other effects on engine operating characteristics. Such applications that should use standard fuels include applications that will experience seasonal usage, storage for periods exceeding 90 days, and extreme temperatures or humidity.

### Storage requirements:

- If using bio-diesel for seasonal applications (stored more than 90 days), the generator set must be purged before storage by running the engine on pure diesel fuel meeting ASTM D975 for a minimum of 30 minutes.

**TABLE 4-1. CUMMINS ONAN BIO-DIESEL RECOMMENDATIONS**

<b>APPLICATION</b>	<b>RECOMMENDATION FOR BIO-DIESEL BLENDS</b>	<b>RECOMMENDATIONS</b>	<b>COMMENTS</b>
Emergency Standby RV Seasonal/Commercial with low annual hour accumulation	Not Recommended	Use petroleum diesel only.	Low fuel usage and critical start nature of Emergency Standby make bio-diesel impractical.
Limited Time Prime	Approved with Recommendations	Use fuel within 6 months of manufacture. Flush fuel system with petroleum diesel prior to storage.	Bio-diesel is suitable for constant high load operation with proper precautions.
Unlimited Time Prime	Approved with Recommendations	Use fuel within 6 months of manufacture. Flush fuel system with petroleum diesel prior to storage/transport.	Bio-diesel is suitable for variable load operation with proper precautions.
Continuous	Approved with Recommendations	Use fuel within 6 months of manufacture.	Bio-diesel is suitable for base load operation with proper precautions.

## 5. Electrical Connections

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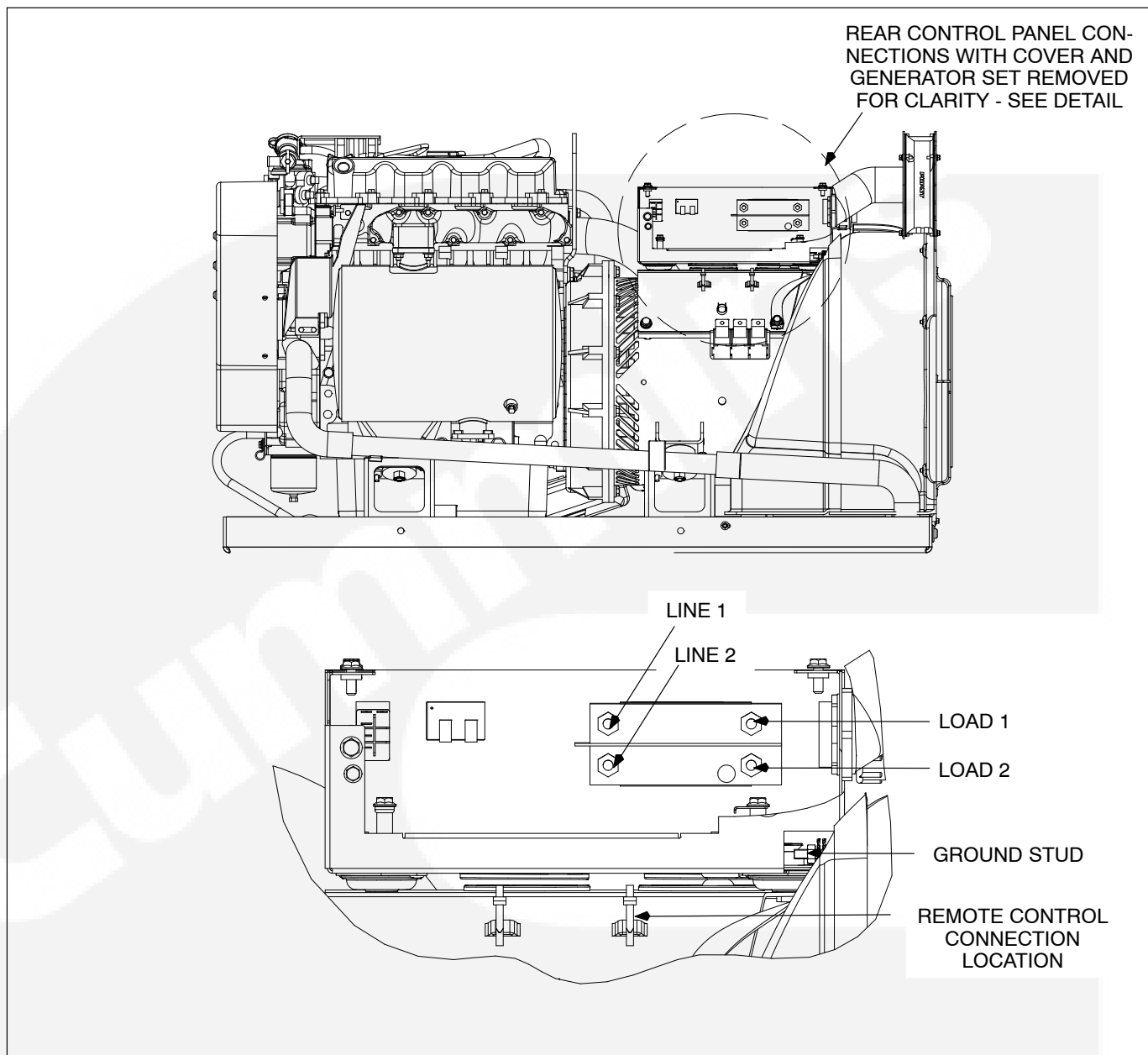
### AC POWER OUTPUT

**⚠WARNING** *Accidental starting of the generator set can cause severe personal injury or death. Do not connect the starting battery until so instructed in Installation Review and Startup. Make sure any automatic generator set starting system is disabled.*

### Wiring Methods

AC wiring methods must be in accordance with the National Electrical Code or IEC 60364-7-708, as appropriate. Note especially the following:

1. Have a trained and experienced electrician supervise and inspect the installation of all AC wiring.
2. Secure only one lead at each AC output terminal. The terminals have 1/4-inch studs which require 1/4-inch ID ring terminals crimped to no smaller than No. 4 AWG (21.6 mm<sup>2</sup>). Torque the terminals to 40–45 in-lbs (4.52–5.08 N-m).
3. Use sealed conduit, conduit connectors and junction boxes for all exterior wiring. The generator set is equipped with a straight (1-1/4 inch trade size) non-metallic conduit connector.
4. Use ground fault circuit interrupters (GFCIs) or residual current devices (RCDs) for all convenience power receptacles.



**FIGURE 5-1. ACCESS FOR AC OUTPUT AND REMOTE CONTROL CONNECTIONS**

- Seal all conduit openings into the vehicle interior to keep out exhaust gas. Apply silicone rubber or equivalent sealant inside and outside each conduit connector. (Conduit is not vapor-tight and will allow exhaust gas to enter the living space if not sealed.)

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

- Route or protect AC wiring so that it will not be cut or abraded, exposed to hot surfaces or damaged by road debris. Keep AC wiring away from fuel lines and control wiring (see Remote Control).

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

- Connect the grounding stud (shown in Figure 5-1 and Figure 5-2) in accordance with applicable codes.

**⚠ WARNING** **Faulty grounding can lead to fire or electrocution and severe personal injury or death. Grounding must be in accordance with applicable codes.**

## Connecting the Vehicle to Utility Power

A vehicle with provisions for connecting utility (shore) power must have an approved device to keep the generator set and utility from being interconnected. See Figure 5-2 for typical connections.

**⚠ WARNING** **Interconnecting the generator set and the public utility (or any other power source) can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections.**

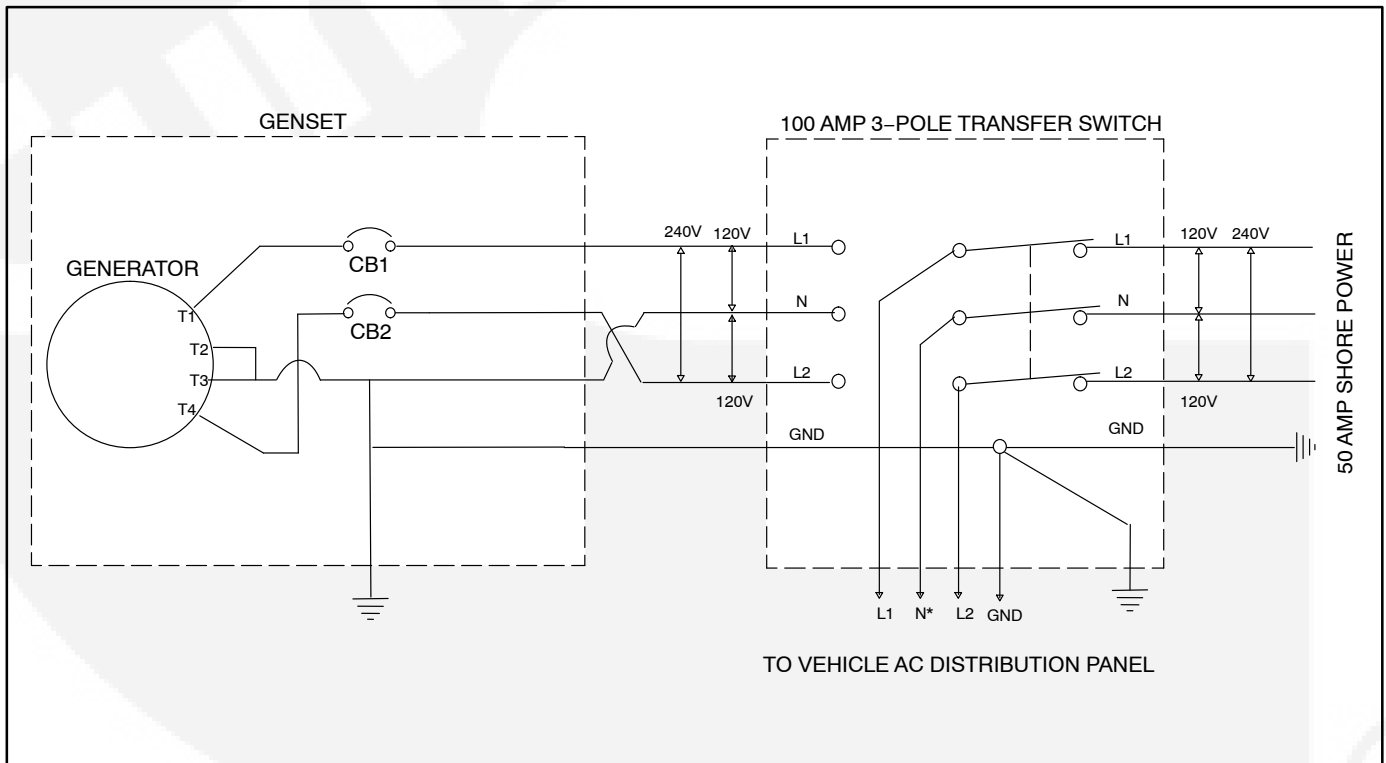
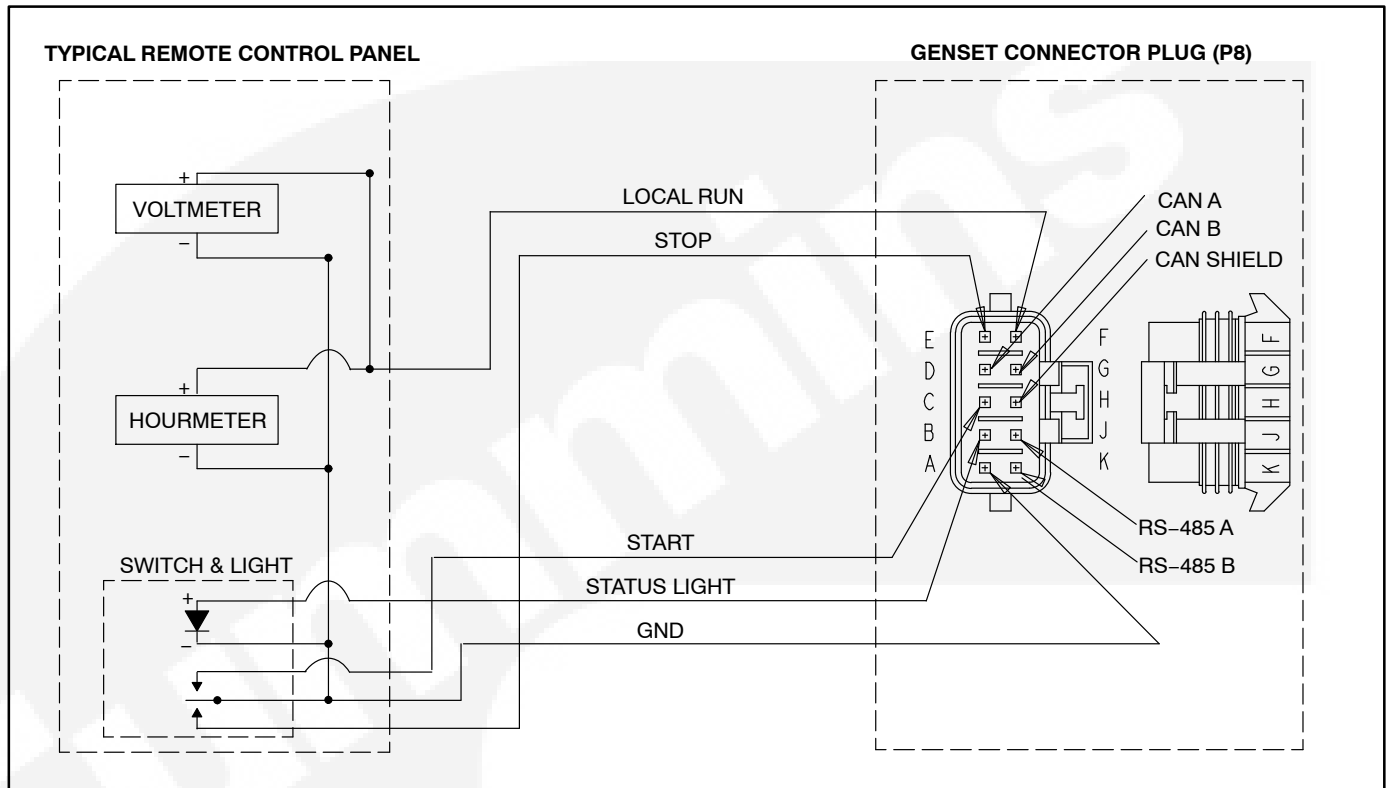


FIGURE 5-2. TYPICAL AC CONNECTIONS

## REMOTE CONTROL

Leads for connection to a remote control panel are terminated in a 10-pin sealed connector and are tied

down behind the control box when the generator set leaves the factory. Refer to Figure 5-3 for pin connections. For further reference also see the Wiring Schematic (Page A-1).



**FIGURE 5-3. REMOTE CONTROL CONNECTOR PLUG AND TYPICAL CONNECTIONS**

## Remote Control Panels

Cummins Onan offers harnesses of various lengths with mating receptacles and three remote control kits as follows:

- Remote switch / status lamp
- Remote switch / status lamp and hour meter
- Remote switch / status lamp and DC voltmeter

If another source is used for the remote panel:

1. The control switch should be a two-pole, momentary-contact, center-return/center-off type of switch with an indicator light.
2. The total load connected to **P8-F** (Switched B+) should not exceed 2 amp.

3. The total load connected to **P8-B** (Status Light) should not exceed 2 amp.

## Wiring Methods

1. Snap the connector plug and harness receptacle together. It is located behind the control box.
2. Keep control leads away from AC power leads to reduce the possibility of erratic operation due to induced signals.
3. Seal the hole where the leads enter the interior of the vehicle to keep out exhaust gas. Use silicone rubber or an equivalent type of sealant.

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

## BATTERIES

To prevent accidental starting of the generator set during installation, do not connect the battery cables at the battery until so instructed in *Section 6. Installation Review and Startup* and make sure an automatic generator set starting system is disabled.

**⚠️WARNING** *Accidental starting of the generator set can cause severe personal injury or death. Do not connect the starting battery until so instructed in Installation Review and Startup. Make sure an automatic generator set starting system is disabled.*

### Battery Capacity

The generator set has a 12 VDC, negative-ground control and starting system. See *Specifications* for the requirements for cranking batteries.

### Battery Recharging

The generator set is equipped with an engine-driven battery charging alternator. See *Section 7. Specifications* regarding charging capacity.

The battery charger can be disabled by disconnecting the field connector and making sure it is isolated. Tie down the connector after it is disconnected.

### Battery Compartment

Batteries must be mounted in a separate compartment from that of the generator set and away from spark-producing equipment. An enclosed compartment must have openings of at least 1.7 square inches (11 square centimeters) at the top and bottom for ventilation of battery gasses. Batteries should be mounted such that spills and leaks will not drip acid on fuel lines, wiring and other equipment that could be damaged.

**⚠️WARNING** *Arcing can ignite the explosive hydrogen gas given off by the battery, causing severe personal injury. The battery compartment must be ventilated and must isolate the battery from spark-producing equipment.*



Battery Cables

Battery wiring methods must be in accordance with the National Electrical Code or IEC 60364-7-708, as appropriate.

Size battery cables according to Table 5-1. The current path between the generator set and the negative (-) battery terminal must also be able to carry full cranking current without causing excessive voltage drop. It is highly recommended that a full-length cable be used to connect the generator set to the negative (-) battery terminal (Figure 5-4). Note also that codes may require a bonding conductor between the generator set and vehicle frame and between the battery and vehicle frame.

If the vehicle frame is used as the path between the negative (-) battery terminal and the generator set (Figure 5-5), all frame members in the path of battery cranking currents must have substantial cross sections. The electrical resistance of riveted or bolted frame joints must also be carefully considered, especially if the joints will be exposed to corrosive conditions. A cable sized according to Table 5-1 must be used to connect the frame to the designated negative (-) terminal on the generator set (Figure 5-5). ***The generator set mounting bolts are not considered adequate means for bonding the generator set to the vehicle frame, either for the purpose of carrying cranking currents or for complying with requirements for genset/system grounding.***

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

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

TABLE 5-1. BATTERY CABLE SIZES FOR AMBIENT TEMPERATURES TO -20° F (-29° C)

TOTAL CABLE LENGTH, FEET (METERS)	CABLE SIZE, AWG (mm²)
0 to 15 (0 to 4.5)	0* (50)
16 to 20 (4.5 to 6)	000 (95)

\* – A total length of up to 25 feet (7.6 meters) may be used in warmer climates or when battery capacity totals at least 1200 CCA (Cold Cranking Amps).

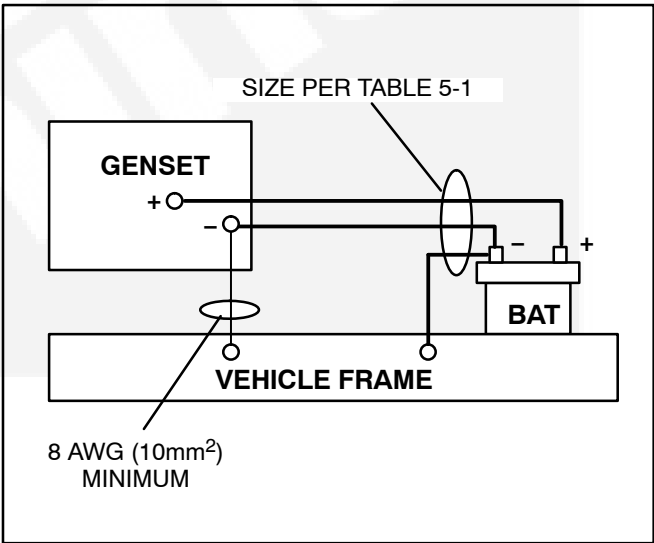


FIGURE 5-4. FULL-LENGTH CABLE FROM BATTERY NEGATIVE (-) TERMINAL

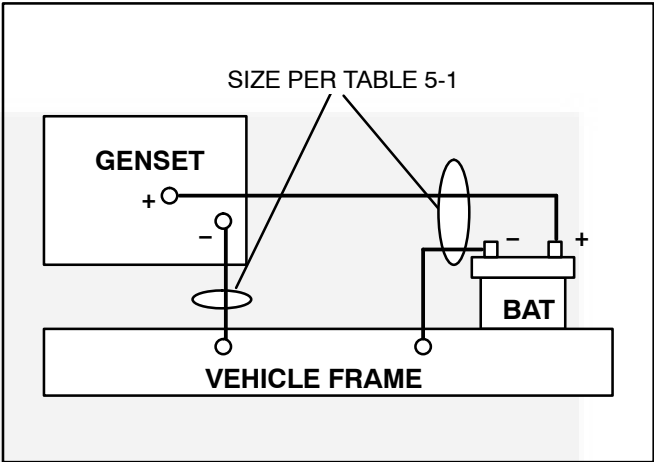


FIGURE 5-5. VEHICLE FRAME AS PATH FROM BATTERY NEGATIVE (-) TERMINAL

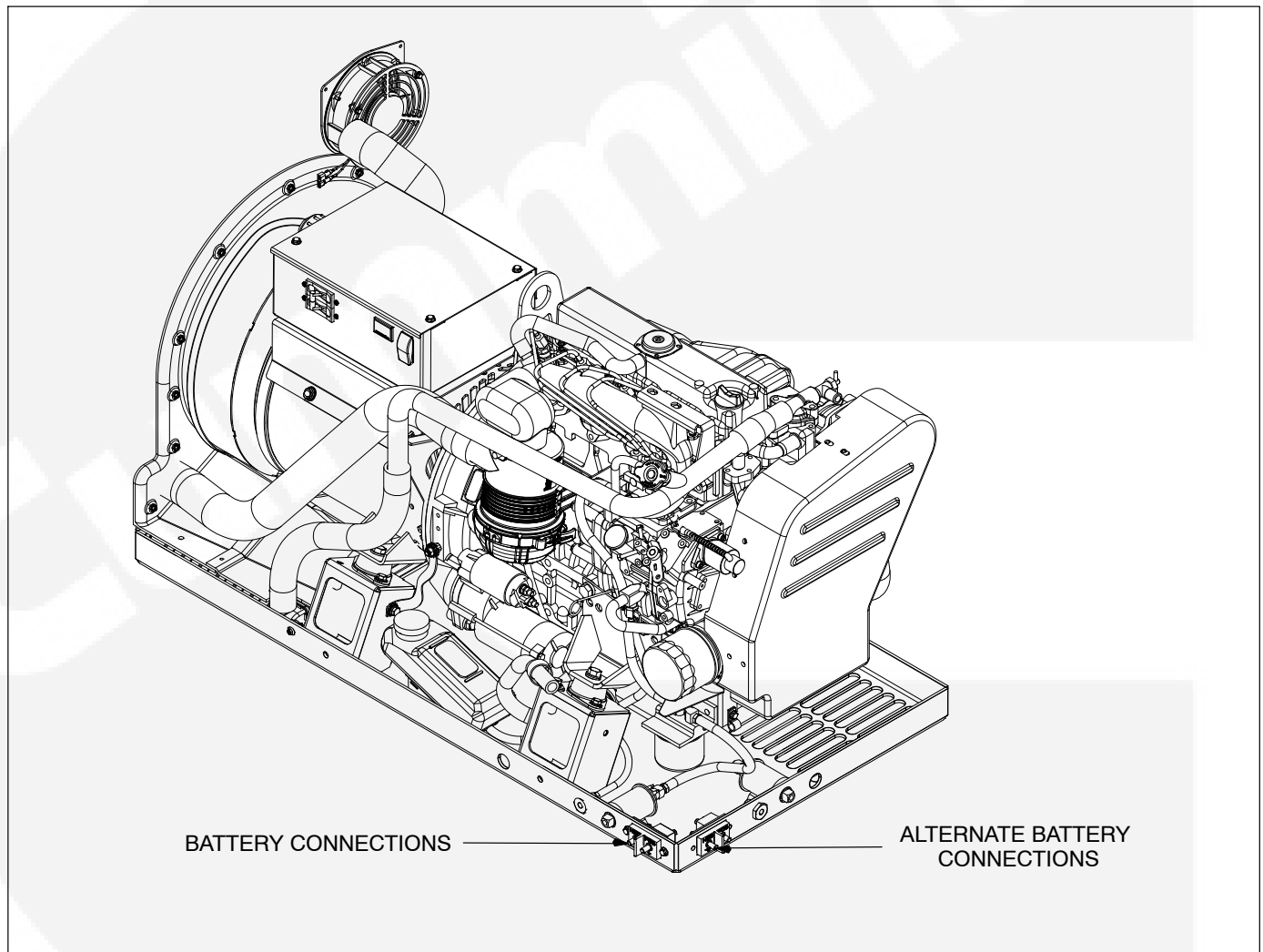
## Generator Set Bonding Terminal

The negative (-) battery cable terminal shown in Figure 5-6 is also the bonding terminal for grounding the generator set to the vehicle chassis. If the grounding cable is also going to carry starter motor current, it must be sized the same as the battery cables.

## Connecting Battery and Bonding Cables

Terminate the battery cables with ring terminals

sized for the 5/16 inch generator set terminal screws (Figure 5-6). Permanently mark each end of each cable as to its polarity, positive (+) or negative (-). After making sure the battery cables are not connected at the battery and that an automatic generator set starting system is disabled, connect the battery and grounding cables to the generator set. Torque the terminals to 8–10 lb-ft (11.3–14.1 N-m).



**FIGURE 5-6. BATTERY CABLE TERMINALS**

# 6. Installation Review and Startup

## HOT AIR RECIRCULATION TEST

A representative installation of the generator set must be tested to determine that the generator set will not overheat due to recirculation of hot air back into the generator set.

### Test Method

1. Complete a representative installation.
2. Conduct the test in a well ventilated space in which carbon monoxide cannot accumulate, but that is protected from cross drafts that could affect temperature measurements.
3. Connect a large, constant load to the generator set. If a load bank is available, connect at least 3/4 full load. If not, connect and run the largest combination of constant loads that can be kept on during the test without tripping the generator set circuit breaker. For example, run a combination of air conditioners, hair dryers and lights. Make sure the air conditioners stay on and do not cycle during the test.
4. Measure temperatures with thermocouples not heavier than No. 24 AWG (0.25 mm<sup>2</sup>).
5. Measure generator set intake air temperature with one or two thermocouples attached to the finger guard of the main intake fan (Figure 6-1). Make sure the thermocouples don't touch the fans.
6. Measure ambient air temperature with a shielded thermocouple some distance away from the generator set and at approximately the

same height. Make sure the thermocouple will not be affected by warm air discharged from the generator set or by sunlight. Use 2 inch diameter white PVC piping at least 6 inches long as a thermocouple shield.

7. Close all generator set compartment doors and run the generator set for at least 90 minutes. Record temperatures at 15 minute intervals. See Table 6-1 for an example of how the data can be arranged for recording and analysis.

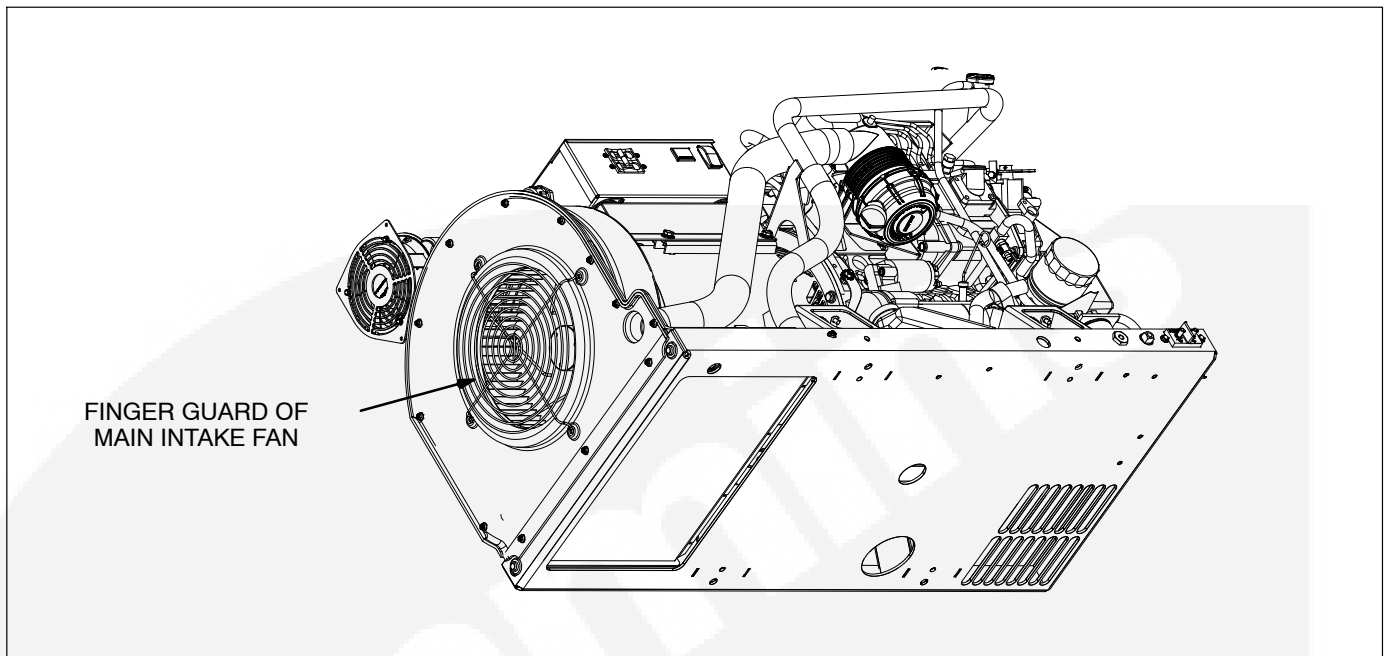
TABLE 6-1. TEMPERATURE DATA

THERMOCOUPLE LOCATION	TEMPERATURE °F (°C)				
	Time of Reading				
AMBIENT AIR					
INLET AIR					

### Test Requirement

The rise in inlet air temperature over ambient air temperature must not exceed 10° F (5.6° C). A rise in inlet air temperature indicates hot air recirculation or hot air from some other source, such as the propulsion engine. If the rise exceeds the requirement, steps must be taken to reduce recirculation to an acceptable level. Review VENTILATION (Page 2-3), and consider the vane kit accessory to reduce recirculation.

**Note:** High ambient operating temperatures can reduce maximum generator set power if the air temperature rise in this test is on the high end of the acceptable range.



**FIGURE 6-1. THERMOCOUPLE LOCATIONS**

## INSTALLATION REVIEW

Before starting the generator set inspect the installation and check off (✓) each of the following questions if it can be answered "YES". If a question cannot be checked off, review the appropriate section in the manual.

- ☐ Is the operator's console easily accessible for starting and stopping the generator set, resetting circuit breakers and checking and adding engine coolant?
- ☐ Is the generator set securely bolted in place?
- ☐ Is there proper clearance all around the generator set? (See Table 2-1.)
- ☐ Are the cooling and combustion air inlet and outlet openings free of obstructions and screens?
- ☐ Is there easy access for draining the engine oil?
- ☐ Is there easy access for draining the engine coolant?
- ☐ Is there easy access for changing the air filter, checking oil level and adding oil?
- ☐ Is there access (back side of the generator set) for cleaning out the spark-arrest muffler?
- ☐ Are all tailpipe connections tight and all hangers and support straps secure?
- ☐ Does the tailpipe terminate at least 1 inch (25 mm) beyond the perimeter of the vehicle and at least 6 inches (153 mm) away from any opening into the vehicle and not under a slide-out room or near a fuel fill opening?
- ☐ Is the tailpipe routed such that it is not likely to be struck while the vehicle is moving and not interfere with oil and coolant drains?
- ☐ Is the generator set located outside the interior space of the vehicle and separated by approved vapor and fire-resistive materials?
- ☐ Are all wiring holes into the vehicle interior (inside and outside conduit connectors) sealed to keep out exhaust gas?
- ☐ Have the AC output connections to the circuit breaker been made properly?
- ☐ Have properly sized batteries and battery cables been installed?
- ☐ Have the battery cables been secured at sufficient intervals to prevent chafing and contact with sharp edges, fuel lines and hot exhaust parts?
- ☐ Is the generator set bonding terminal (negative [-] battery cable terminal) properly grounded to the vehicle chassis?
- ☐ Are all fuel connections tight?
- ☐ Have the fuel lines been secured at sufficient intervals to prevent chafing and contact with sharp edges, electrical wiring and hot exhaust parts?
- ☐ Is the generator set protected from road splash?
- ☐ Does the generator set clear the ground by at least 12 inches (305 mm)?

- [ ] Has the HOT AIR RECIRCULATION TEST been conducted? Are the results acceptable? If the HOT AIR RECIRCULATION TEST was not passed, have the proper steps been taken to reduce hot air recirculation?
- [ ] Are the coolant level and oil level sufficient?

## STARTUP

When all installation requirements have been met, connect the battery cables to the battery, positive (+) cable first.

**⚠WARNING** *Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury—Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch work light ON or OFF away from battery—Stop generator set and disconnect charger before disconnecting battery cables—Disconnect negative (–) cable first and reconnect last.*

Read through the Operator's Manual and perform the maintenance and pre-start checks instructed. The generator set is shipped from the factory with proper levels of engine oil and coolant, which should nevertheless be checked before the generator set is started. Start and operate the generator set, following all the instructions and precautions in the Operator's Manual.

**⚠WARNING** **EXHAUST GAS IS DEADLY! Do not start or operate the generator set unless the vehicle is located where exhaust gases will be safely dispersed.**


Check for fuel, coolant and exhaust leaks and unusual noises while the generator set is running under full and intermediate loads. To calculate electrical loads see POWERING EQUIPMENT in the Operator's Manual. Do not place the generator set in service until all leaks have been fixed and operation is satisfactory.

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# 7. Specifications

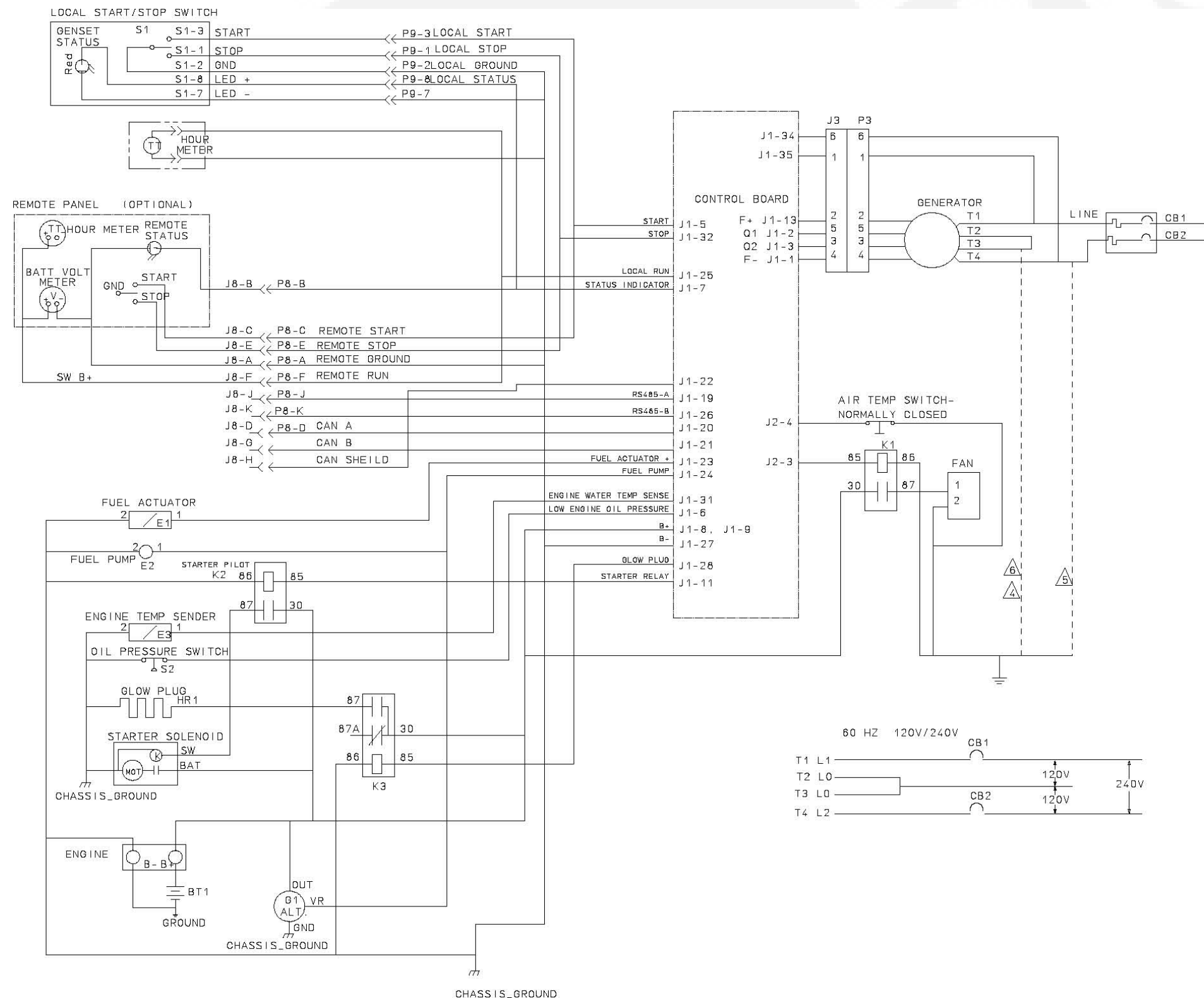
**⚠ CAUTION** Do not convert the generator set from 60 Hz to 50 Hz. Attempting to do so will damage the equipment.

<b>MODEL:</b>	<b>HDKAW</b>
<b>GENERATOR SET CONTROL:</b> Integrated Microprocessor-Based Engine and Generator Controller	
<b>GENERATOR:</b> Single-Bearing, 4-Pole Rotating Field	
Power (@1.0 power factor)	20,000 W
Voltage	120 / 240
Frequency	60 Hz
Number of Phases	1
Current	83.3 amps per leg
Line Circuit Breaker	2-pole, 85 amp
<b>FUEL CONSUMPTION:</b>	
No-load	0.54 gph (2.04 lph)
Half-load	1.12 gph (4.24 lph)
Full-load	1.95 gph (7.39 lph)
<b>ENGINE:</b> 4-Cylinder In-Line, Water-Cooled, Indirect-Injection (IDI), 4-Stroke Cycle Diesel	
Bore	3.43 in (87 mm)
Stroke	4.03 in (102.4 mm)
Displacement	148.53 in <sup>3</sup> (2,434 cc)
Compression Ratio	24.3 : 1
Fuel Injection Timing (BTDC)	13.5°  15°
Firing Order (Clockwise Rotation)	1-3-4-2
Fuel Nozzle Injection Pressure	1991 psi (13.73 MPa)
Cylinder Compression Test	370 psi (2.55 MPa) minimum
Valve Lash: Intake & Exhaust (cold)	0.0071 to 0.0087 in (0.18 to 0.22 mm)
Oil Capacity (with filter)	10 quart (9.5 liter)
Cooling System Capacity	7.8 quart (7.4 liter)
<b>DC SYSTEM:</b>	
Nominal Battery Voltage	12 volts
Minimum Battery Capacity CCA (Cold Cranking Amps)	650 amps down to 0°F (-17°C) 875 amps down to -10°F (-23°C) 1000+ amps down to -20° F (-29°C)
Maximum Regulated Charging Current	40 amps
<b>WEIGHT:</b>	890 lbs (404 kg)
<b>SIZE (L x W x H):</b> 48.9 x 23.6 x 29.7 in (1241 x 600 x 708 mm)	

<b>MODEL:</b>	<b>HDKAW</b>
<b>SOUND LEVEL:</b>	
60 Hertz Models	81.9 dB(A) @ 10 ft (3m) before installation @ full load

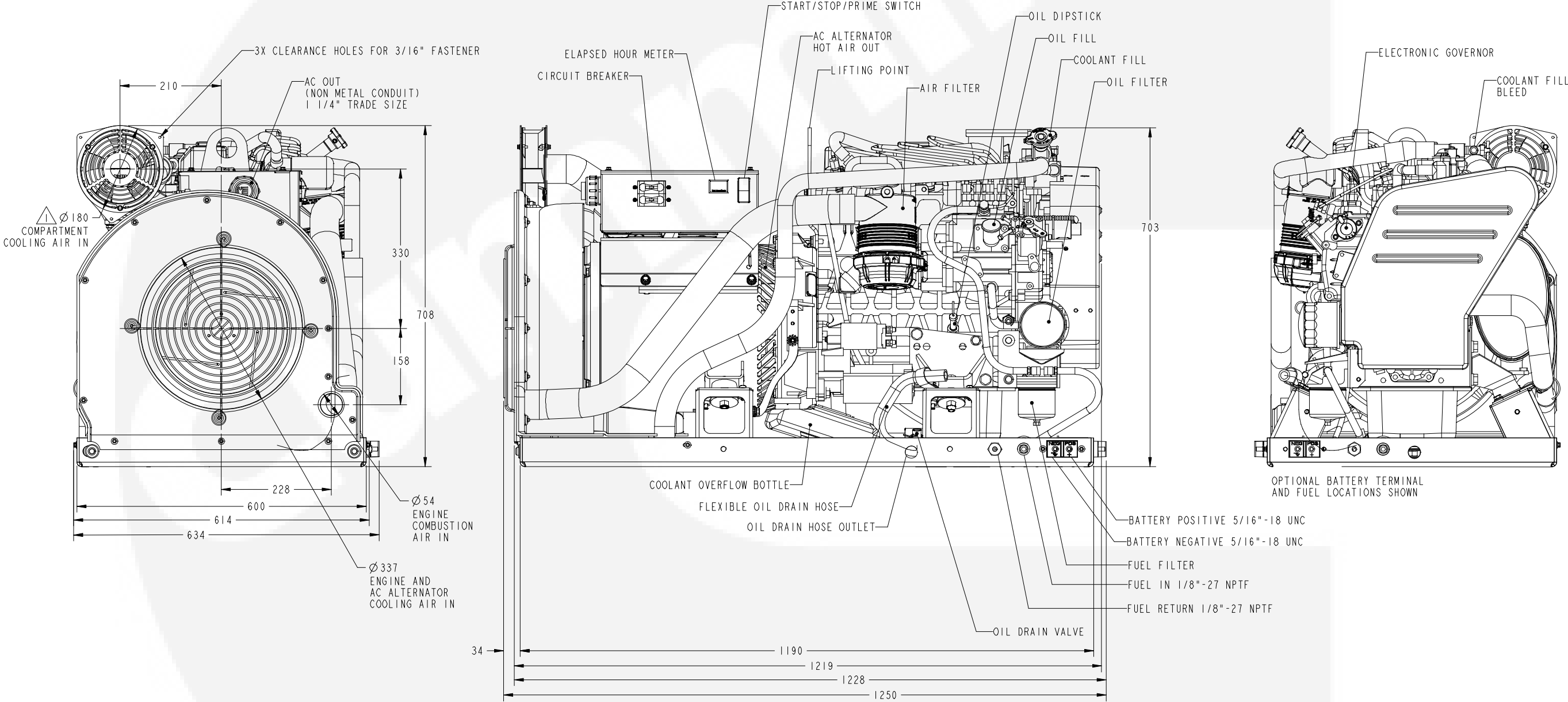






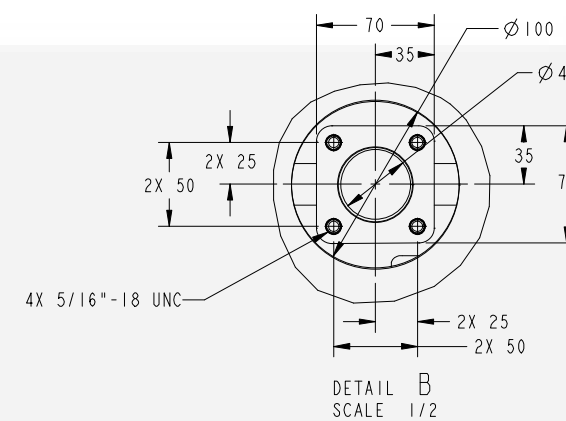
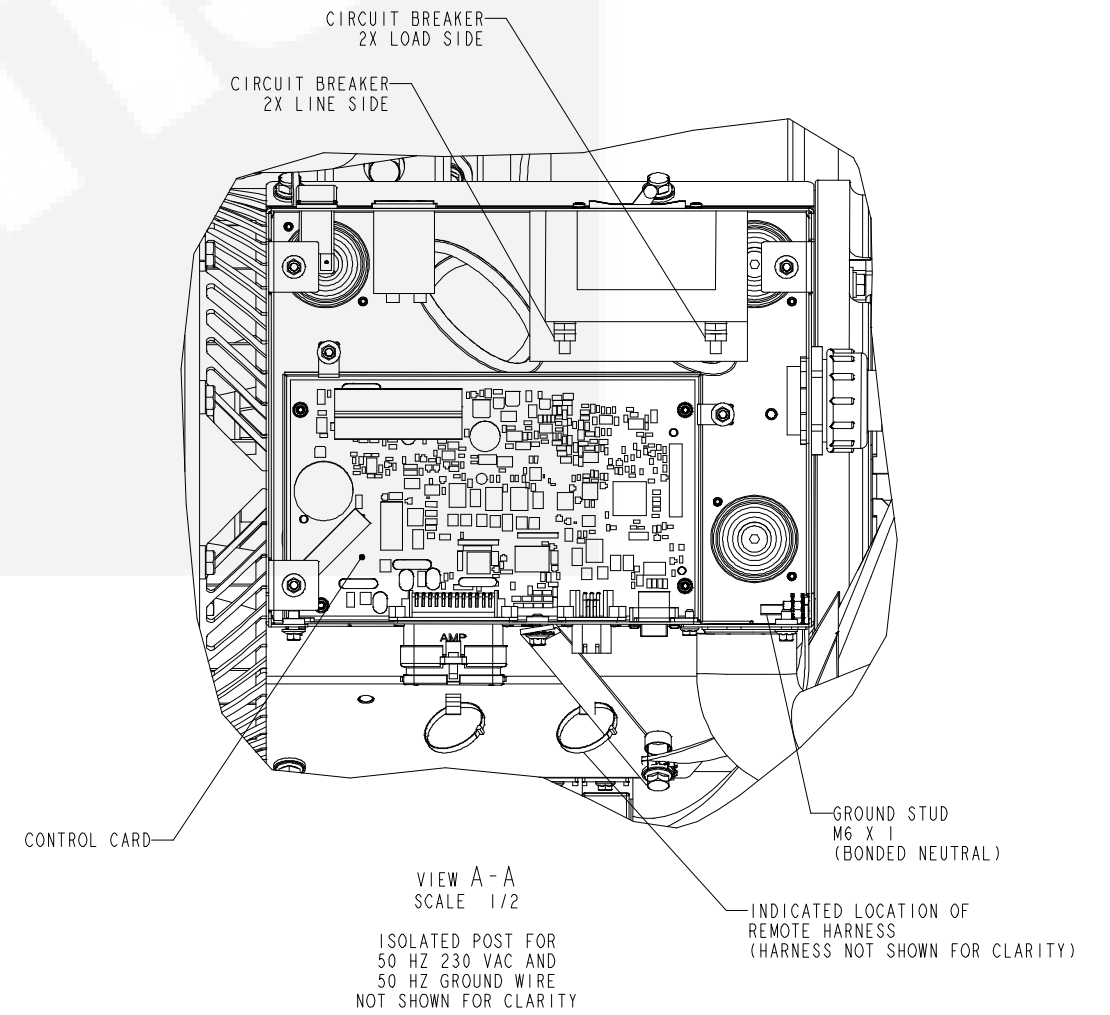
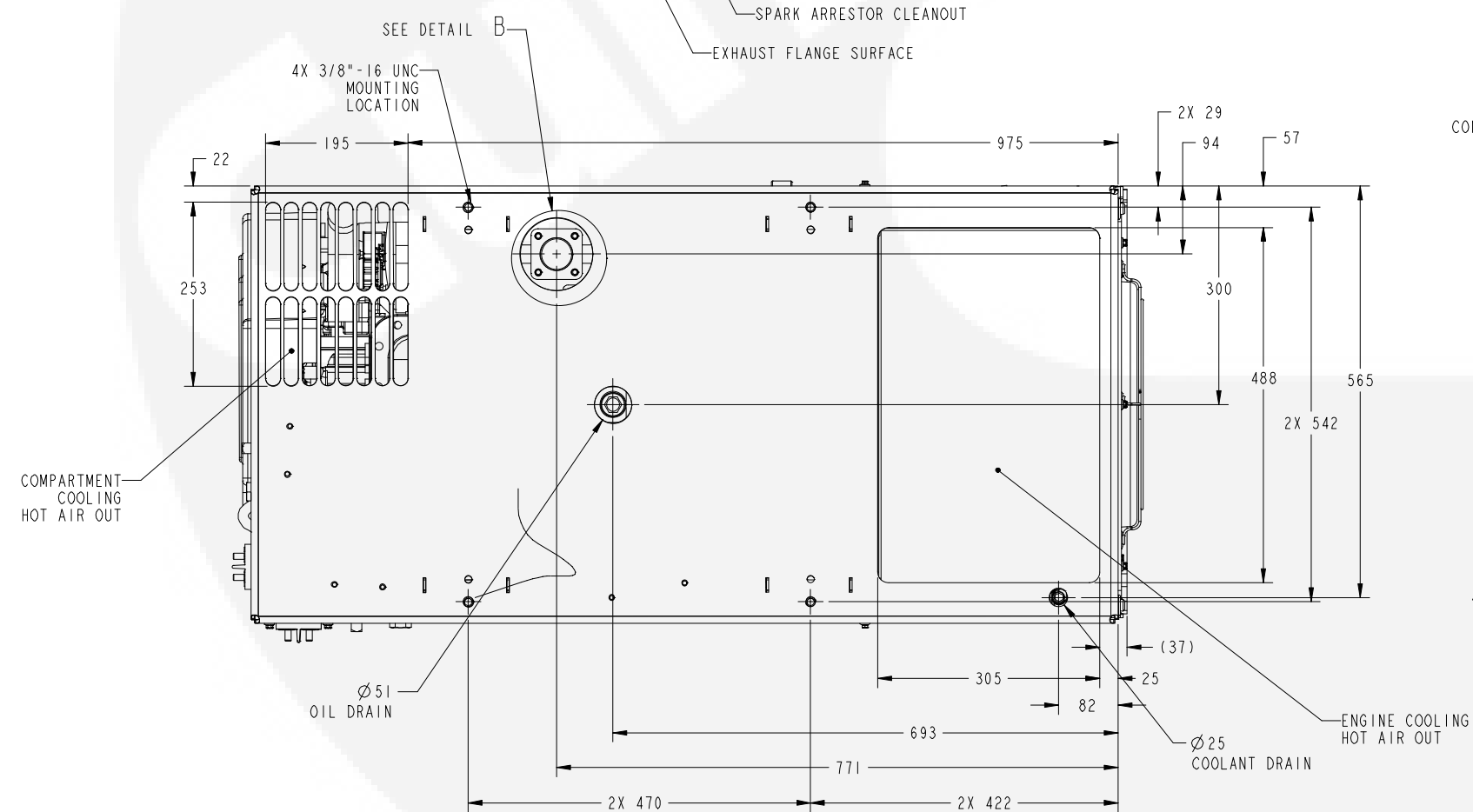
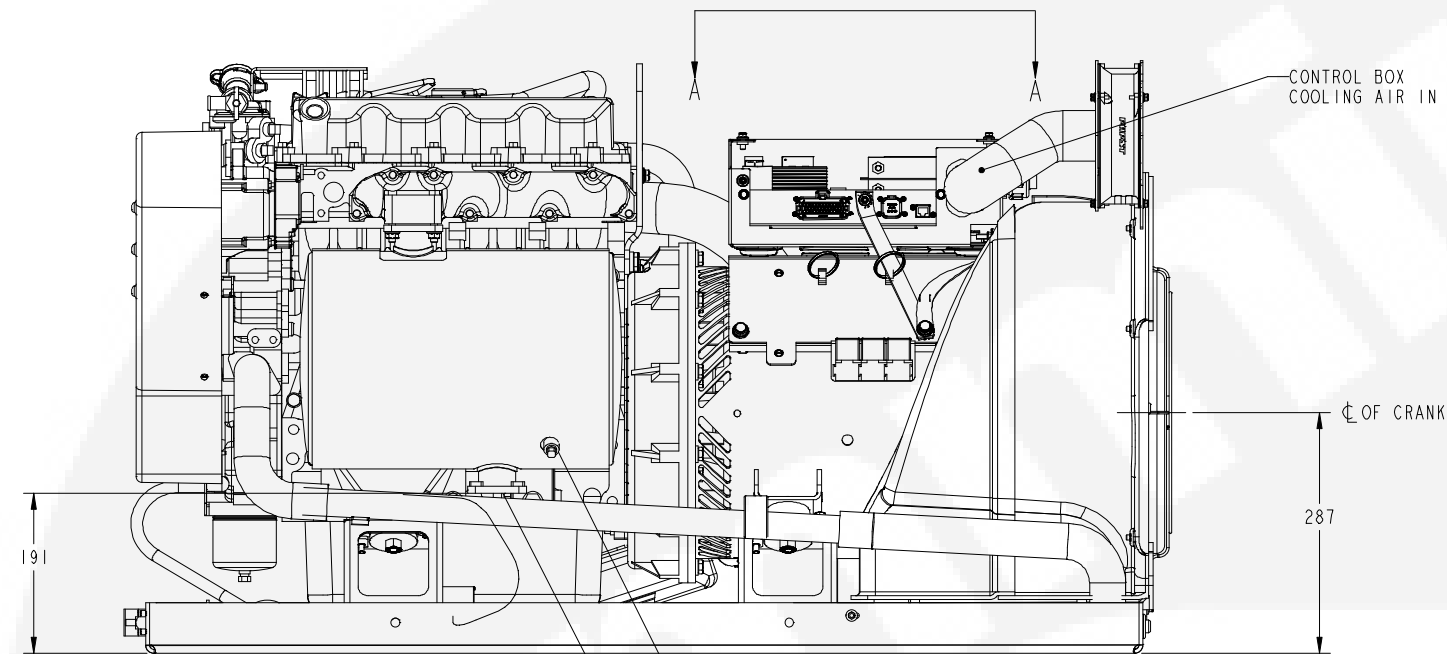
CONTROL SCHEMATIC

NOTES:  
△ COMPARTMENT COOLING FAN KIT  
INSTALLED AT TIME OF GENERATOR  
SET INSTALLATION.



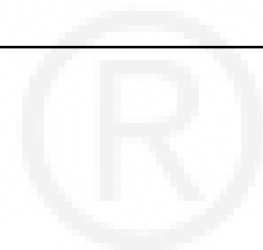
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Rev. A  
Modified 10/08

OUTLINE DRAWING



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