Cummins **Onan**

Installation Manual

RV Generator Set

HDKAH (Spec A–N)
HDKAJ (Spec A–K)
HDKAK (Spec A–N)
HDKAT (Spec A–R)
HDKAU (Spec A–R)
HDKAV (Spec A–R)

English
Original Instructions
3-2014
981–0623 (Issue 11)

Table of Contents

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Safety Precautions

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

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

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

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

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

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

ENGINE EXHAUST IS DEADLY

- Inspect for exhaust leaks at every startup and after every eight hours of running.
- Prior to every startup and after every eight hours of running, all carbon monoxide dectectors must be tested and confirmed to be working in accordance with the manufacture's instructions or owners manual.
- Learn the symptoms of carbon monoxide poisoning in the 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 in a confined space, such as a garage.
- Disable the automatic genset starting feature 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 working or living spaces or compartments.

GENERATOR VOLTAGE IS DEADLY

- Disable the automatic genset starting feature of an inverter-charger or other automatic starting device before servicing the genset.
- 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 the public utility or any other source of electrical power. Back-feed could lead to electrocution of utility personnel 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 of an inverter-charger or other automatic starting device before servicing the genset.
- Do not wear loose clothing or jewelry near moving parts such as PTO shafts, fans, belts and pulleys.
- Keep hands away from moving parts.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses.
- Do not smoke.
- 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

- 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 handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires, combustible and flammable liquid fuels and gaseous fuels; Class C fires, live electrical equipment. (ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.
- Keep guards in place over fans, belts, pulleys, and other moving parts.

Introduction

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 genset 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 genset 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 (gensets) listed on the front cover. Proper installation is essential for top performance. Read through this manual before starting the installation. Leave this manual in the vehicle.

This manual addresses the following aspects of the installation:

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

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

⚠CAUTION ***The Commercial Genset Warranty applies only when the genset is installed in a Commercial or Recreational Vehicle. The RV Genset Warranty applies only when the genset is installed in a Recreational Vehicle.***

The installer 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:

- ANSI A1192 (NFPA No. 501C)—Recreational Vehicles
- NFPA No. 70, Article 551—Recreational Vehicles and RV Parks
- CSA Electrical Bulletin 946—Requirements for Internal Combustion Engine-Driven Electric Generators for Use in Recreational Vehicles

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. Obtain the standards in Table 1 for reference.

TABLE 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 470 Atlantic Avenue Boston, MA 02210
ANSI/RVIA-EGS-1	Recreational Vehicle Industry Association 14650 Lee Road Chantily, VA 22021
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 Bulletin 946	Canadian Standards Association Housing and Construction Materials Section 178 Rexdale Blvd. Rexdale, Ontario, Canada M9W 1R3

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Location, Mounting and Ventilation

LOCATION

Typical genset locations on a vehicle are illustrated in Figure 1. Commercial Model gensets are suitable for typical commercial vehicles applications, as shown, as well as RV-style applications.

1. Provide access to the operator's console and to the bottom of the genset for access to the air filter, oil drain and coolant drain and oil and fuel filter access door so that all periodic maintenance can be performed in accordance with the Operator's Manual. The oil and fuel filter access door must be able to swing wide open. For commercial Models provide access also to the side service door and optional remote air filter (Kit 541-0531).
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 or air intake and discharge openings or the oil and fuel filter access door. These are the shaded areas on Figure 2.
4. Provide access for removing the two fuel pump mounting screws so that the genset does not have to be removed to replace the fuel pump. See Figure 2.
5. Make sure the genset clears the ground by at least 12 inches (305 mm) to provide adequate ventilation and reduce the amount of dust pulled in by the cooling fan.
6. Protect the air inlets in the bottom of the genset from road splash, especially when the genset is located in line with the road wheels. It is preferable to mount the genset in front of, rather than behind, the road wheels.
7. Locate or shield the genset such that condensate from air conditioners will not drip on it.
8. Provide a vapor and fire resistant barrier between the genset and the interior of the vehicle. Use approved materials (26 gauge galvanized steel or equivalent). See NFPA 1192 for details.

   ⚠WARNING ***EXHAUST GAS IS DEADLY. Construct a suitable vapor barrier of approved materials between the genset and vehicle interior to keep out exhaust gas.***
9. A genset compartment must be large enough to provide at least 1/2 inch (12.7 mm) clearance at the top of the genset and 1/4 inch (6.4 mm) clearance at the sides. These minimum clearances apply to the thermal or acoustic insulation with which the compartment may be lined. Minimum compartment dimensions are:

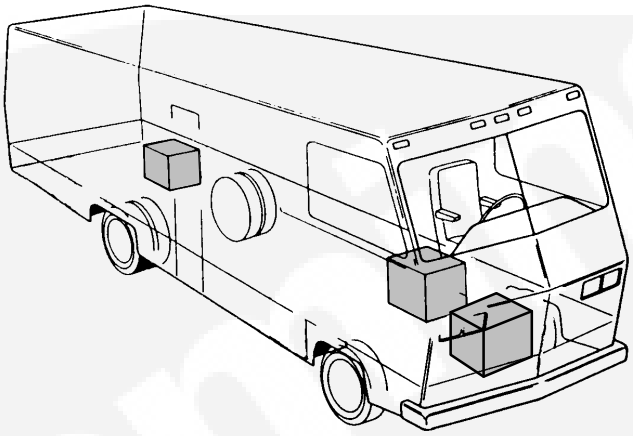
   Height: 22.78 inches (578.6 mm)
   Width: 24.73 inches (628.1 mm)
   Length: 36.85 inches (936 mm)
10. Acoustic/thermal insulation and adhesive must be Classified as "Self-Extinguishing" at not less than 200°F (90°C). Do not line the bottom of the compartment with insulation, which absorbs spilled fuel and oil.

MOUNTING

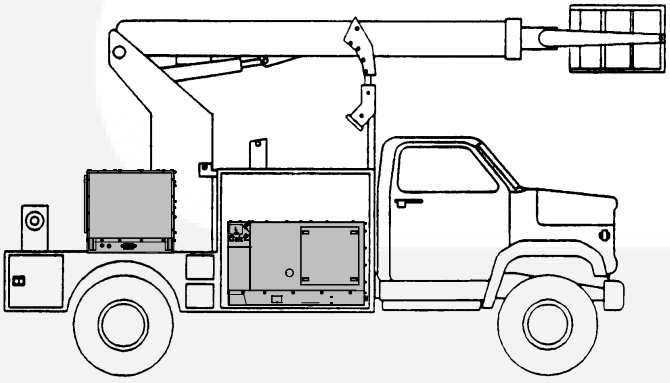
Support the genset on a structure able to resist the dynamic weight of the genset (420 lbs [191 kg]): ±3 g-force (±1260 lbf) vertical and ±1 g-force (±420 lbf) horizontal. The genset is shipped with four 3/8-16 by 1-1/2 inch thread-forming screws to secure it to the supporting frame or floor. Torque the mounting screws to 31 lb-ft (42 N-m).

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

—TYPICAL RV INSTALLATIONS—



—TYPICAL COMMERCIAL VEHICLE INSTALLATIONS—



TYPICAL “HIGH MOUNT”

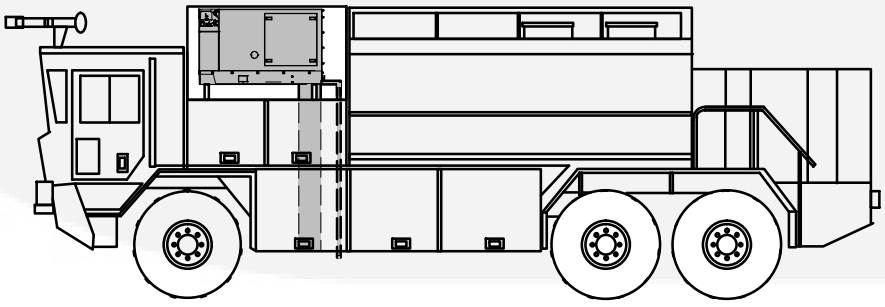


FIGURE 1. TYPICAL GENSET INSTALLATIONS

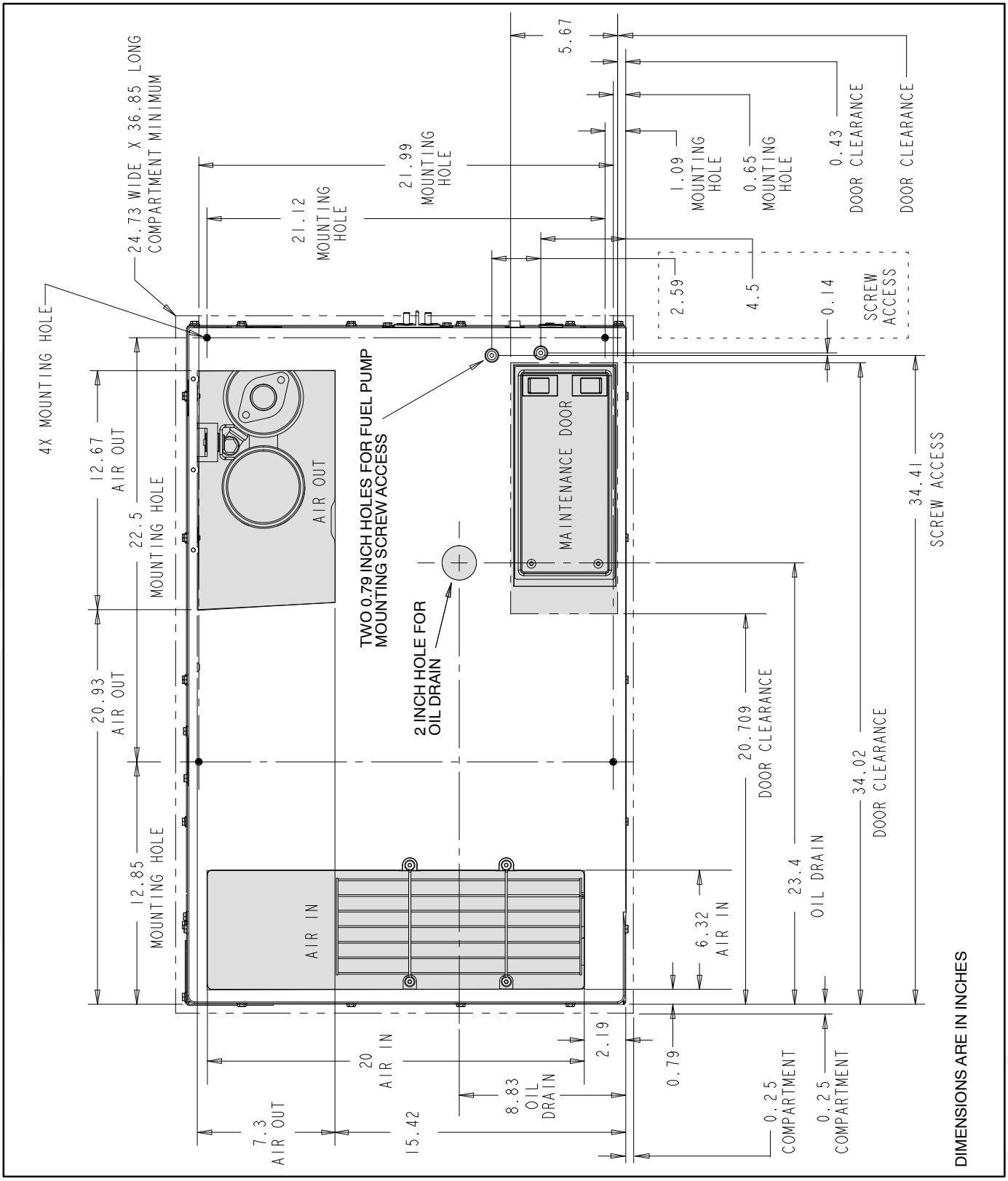


FIGURE 2. FLOOR PLAN

VENTILATION

All Installations

⚠WARNING ***EXHAUST GAS IS DEADLY! Do not duct cooling air discharged from the genset into the vehicle.***

Unrestricted air flow for cooling, ventilation and combustion is essential for proper genset performance and service life (Figure 3). The air intake and discharge openings are in the bottom of the genset. These are the shaded areas on Figure 2. See also HOT AIR RECIRCULATION TEST (Page 27).

If the genset is installed on a floor, cut out openings in the floor that are at least as large as the openings in the genset. The openings must line up so that the air can flow straight through the space between the genset opening and the floor cutout opening. *If necessary, duct the hot discharge air through the floor to prevent recirculation inside the compartment.*

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 genset to overheat.*

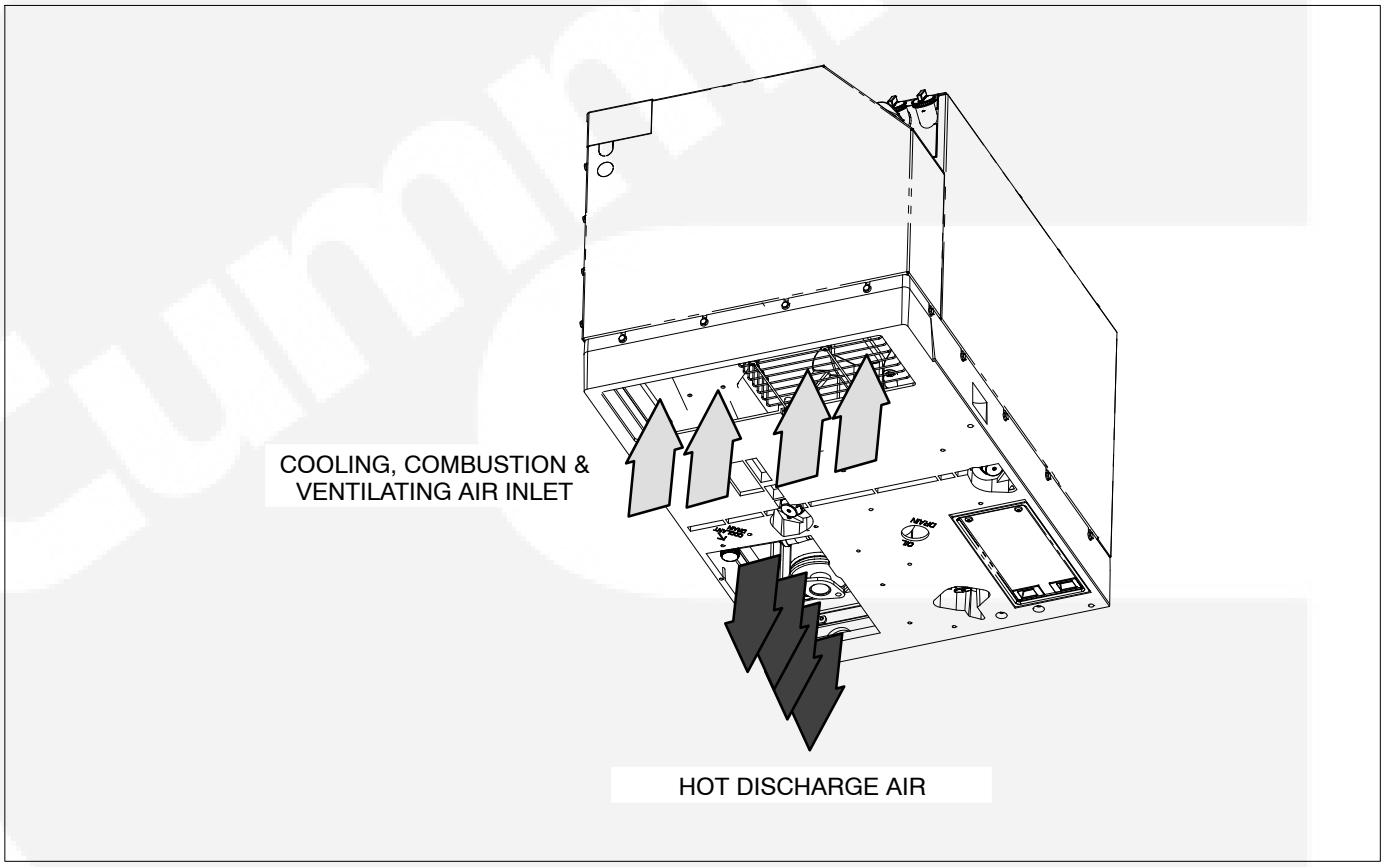


FIGURE 3. COOLING, VENTILATION AND COMBUSTION AIR FLOWS

High Mount Installations

If the genset is to be mounted high on the vehicle (Commercial Models only), consider the following:

1. The maximum fuel pump lift is 36 inches (914.4 mm). An additional fuel pump must be used for generator sets mounted more than 36 inches (914.4 mm) above the fuel source. Auxiliary Fuel Pump Kit 541-0530 is available from Onan.
2. Provide 2.5 inches (63.5 mm) minimum clearance to the sides and rear of the genset, and 0.25 inch (6.35 mm) clearance to the front of the genset. This area provides the genset's intake air for cooling.
3. Risers must be fabricated to raise and support the genset above the compartment floor. This area provides the genset's intake air for cooling (Figures 4 and 5). At these clearances, minimum compartment dimensions are:

   Width: 24.98 inches (634.5 mm)

   Length: 41.35 inches (1050.3 mm)
4. Ducting must be fabricated to exhaust hot air from the genset. Foam or gasket material must be used between the duct and the base of the set to prevent recirculating of exhausted hot air. See Figures 5 and 6.
5. The exhaust tailpipe must be routed down and underneath the vehicle and terminate at least 1 inch (25.4 mm) beyond the perimeter of the vehicle (Page 14). The tail pipe may be routed inside the hot exhaust duct (Page 11), but not through the interior of the vehicle. The tail pipe must be visible and accessible along its entire length for inspection and replacement.

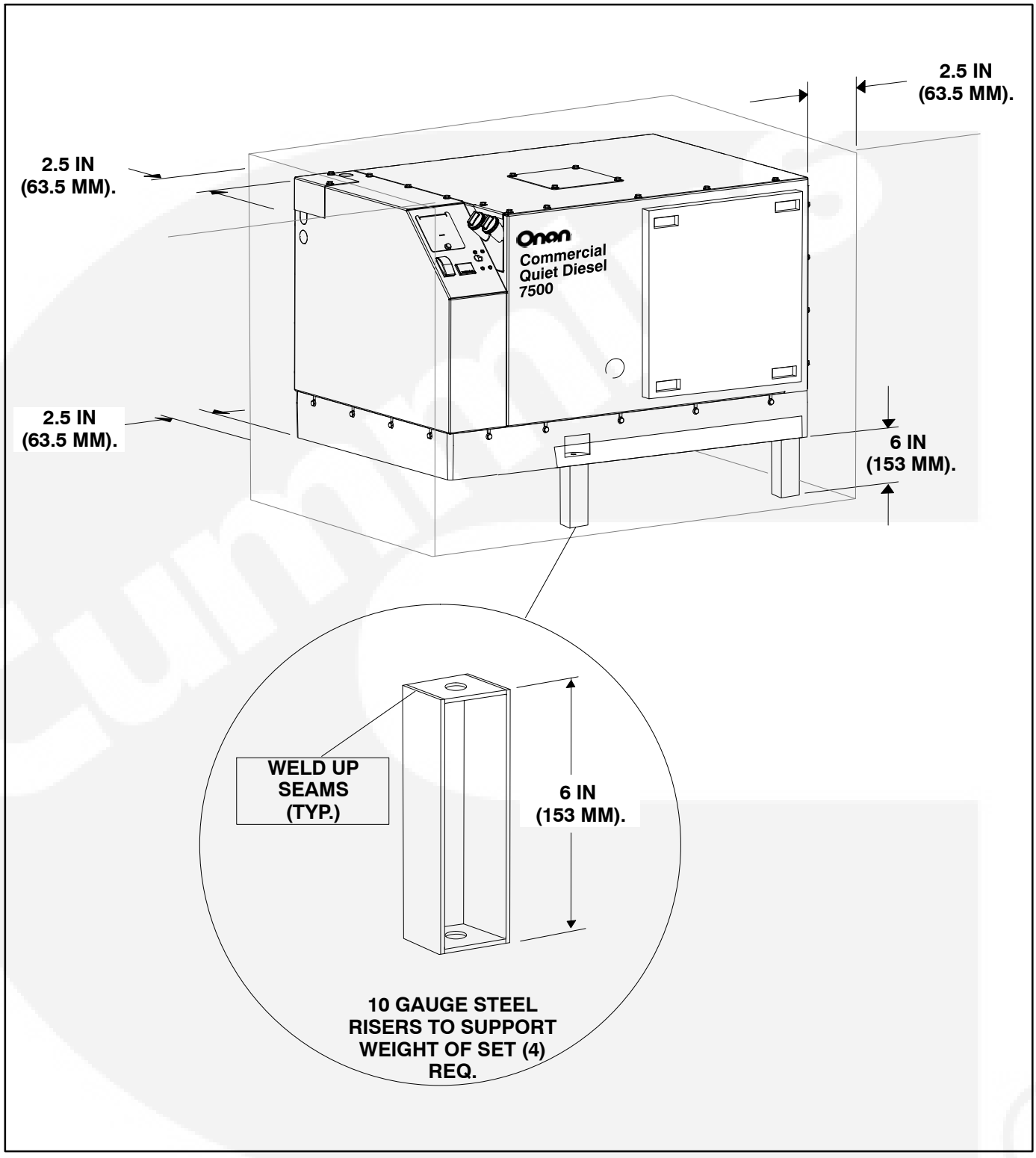
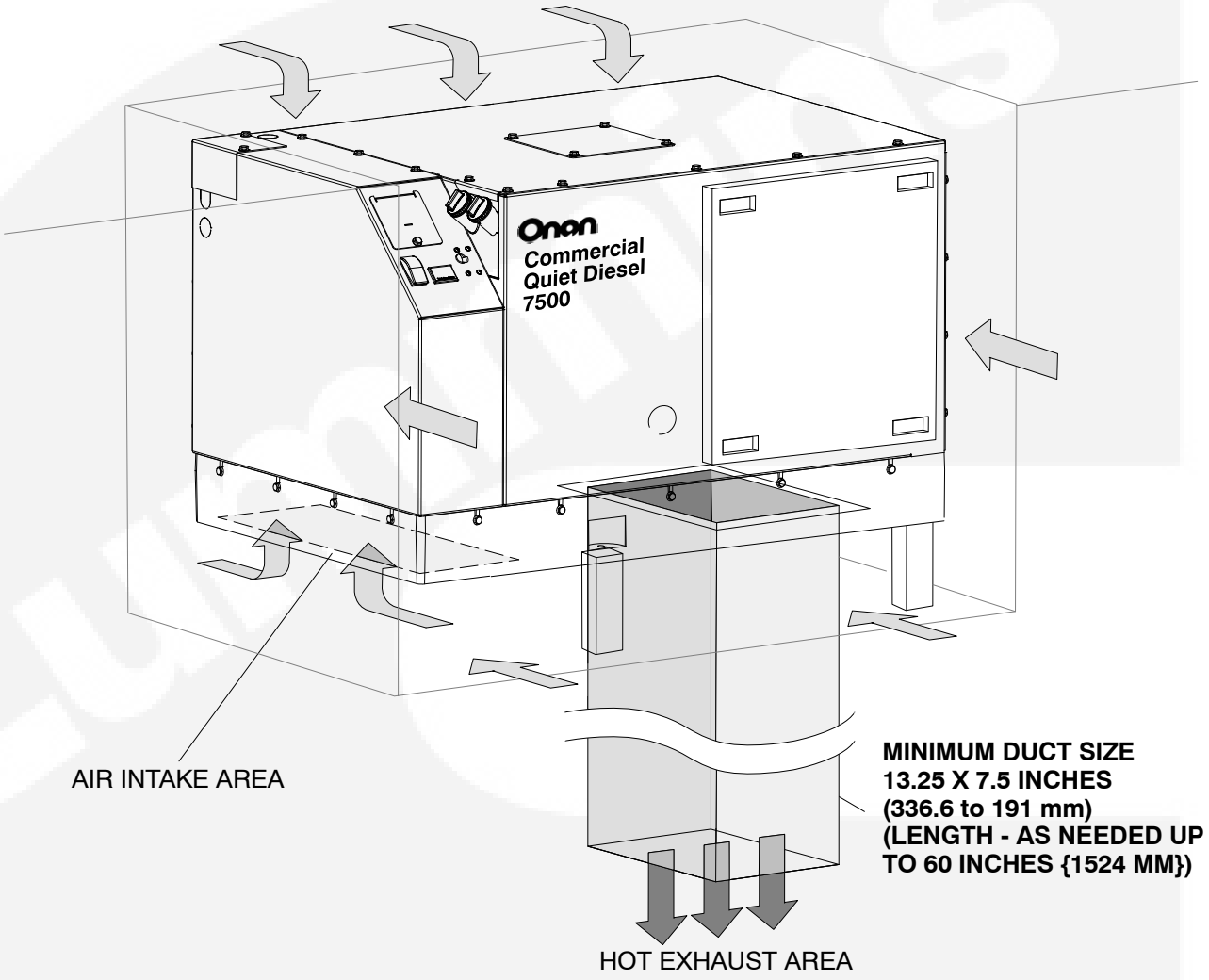


FIGURE 4. HIGH MOUNT INSTALLATION (COMMERCIAL MODELS ONLY)



NOTES:
D Keep exhausted air away from intake air.
D Test for recirculating air (See Onan Installation Manual 981-0632).
D Use foam/gasketing material to seal duct to base of set.

FIGURE 5. INTAKE AIR – EXHAUST AIR DUCTING (COMMERCIAL MODELS ONLY)

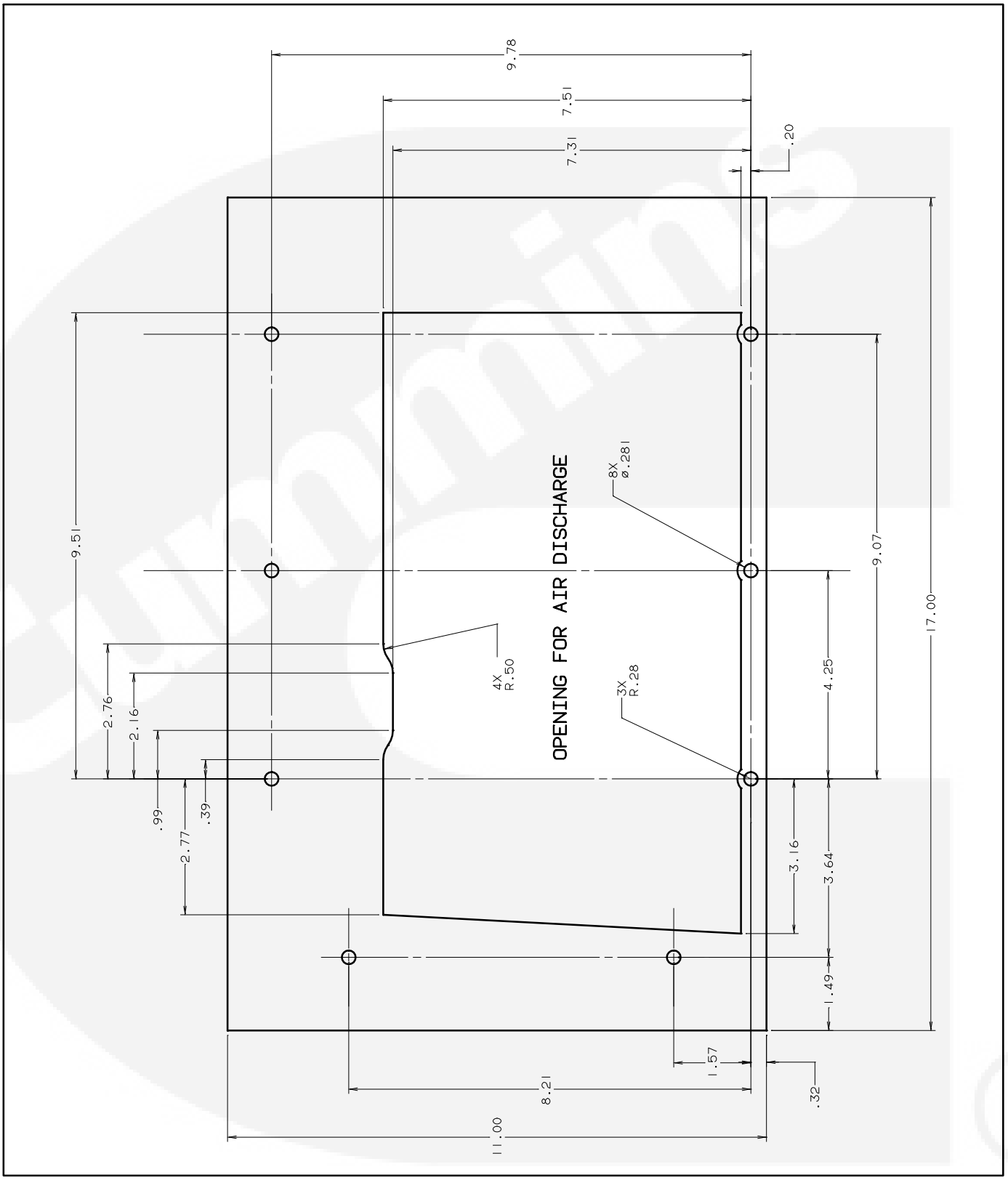


FIGURE 6. EXHAUST AIR OUTLINE DRAWING

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! Keep exhaust gases from entering the vehicle. Do not terminate the exhaust tailpipe underneath the vehicle or closer than specified to openings into the vehicle (Figure 10) or route it such that it is likely to be damaged (Figure11). 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 inside the genset housing. It has a USDA (Forest Service) spark arrestor and meets RVIA EGS-1 construction requirements.(Figure 7). See the Outline Drawing for the dimensions of the exhaust outlet flange.

A genset without a properly installed and maintained spark arresting exhaust system can cause a forest fire. It is illegal 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 an Onan distributor for approved exhaust system parts.

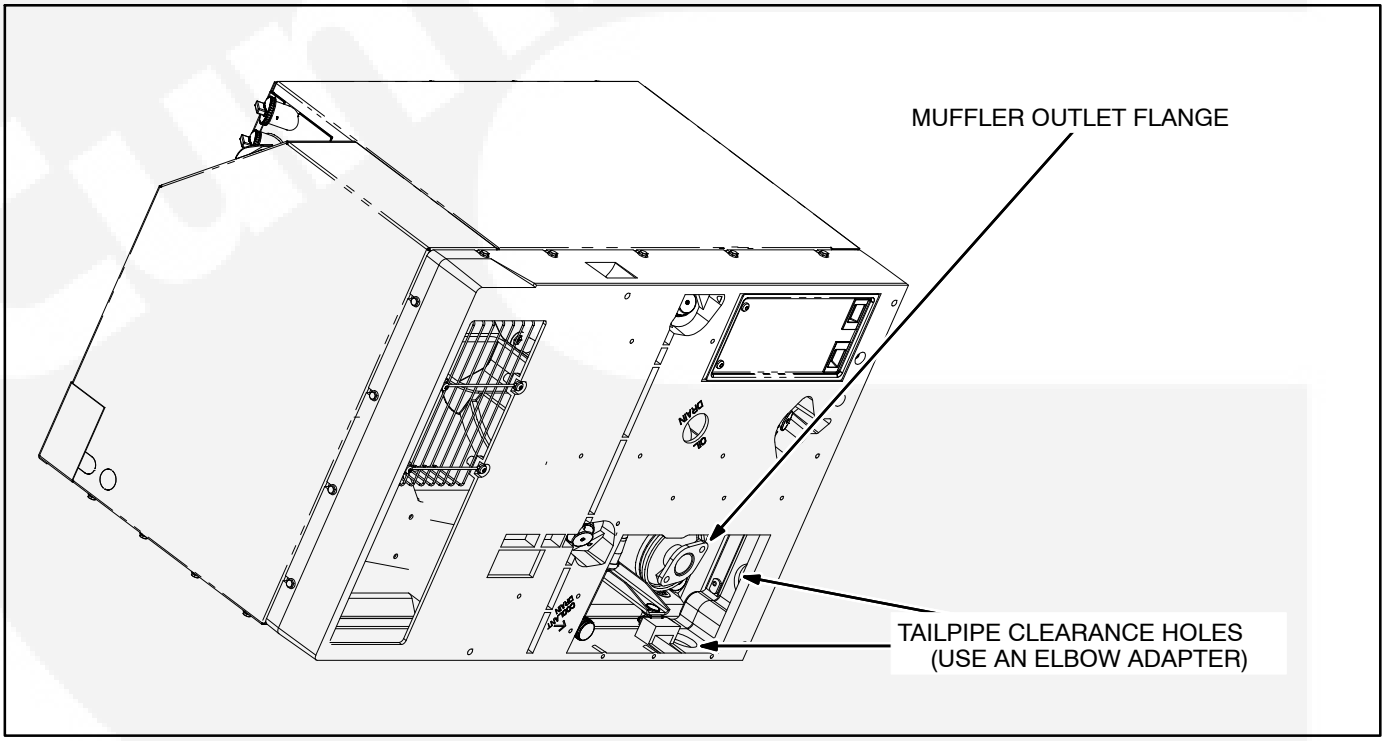


FIGURE 7. EXHAUST CONNECTION AT GENSET

TAILPIPE

Tailpipe adapter kits are separately available. Use a straight adapter for a tailpipe routed up from below the genset. Use an elbow adapter for a tailpipe routed through the clearance hole in the right or back side of the base of the genset. When connecting and routing the tailpipe:

1. Use 1-3/8 inch ID aluminized steel tubing or equivalent 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 two 5/16-18 bolts.
3. Use U-bolt muffler clamps to connect sections of tailpipe. It is recommended that the overlapping pipe be slotted as shown in Figure 8.
4. Use automotive-type tailpipe hangers every 2 to 3 feet (610 to 914 mm). 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 9). 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.

   Note: Do not terminate the tailpipe underneath a slide-out room (Figure 11), 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 opening the maintenance door or 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 rise (above ambient) on adjacent combustible material must not exceed 117°F (65°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 10.

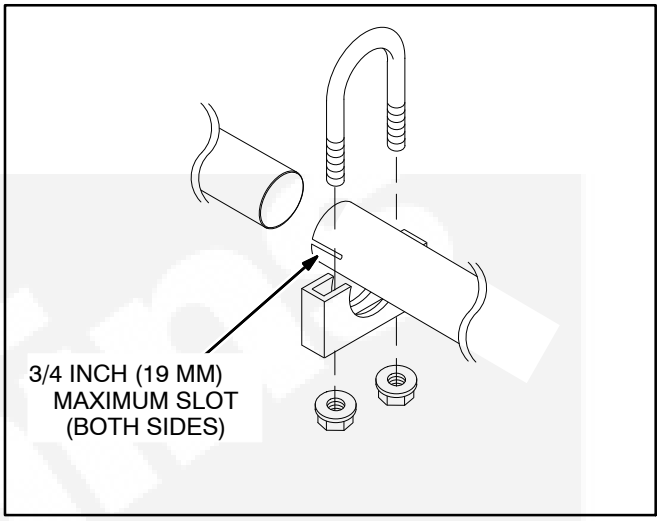


FIGURE 8. EXHAUST TAILPIPE CONNECTIONS

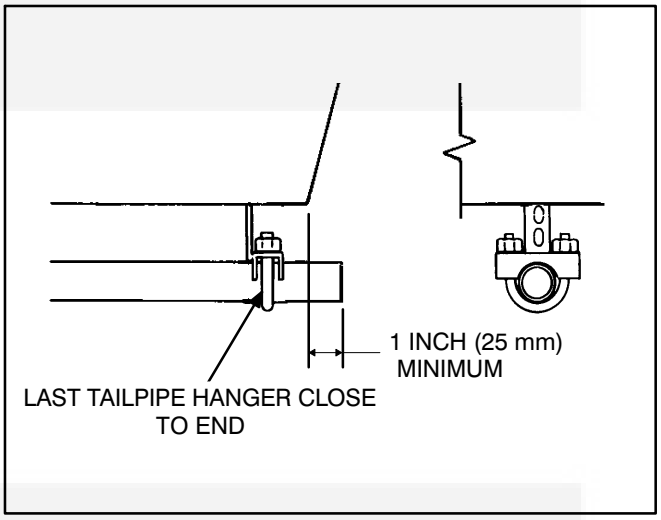


FIGURE 9. TERMINATING THE EXHAUST TAILPIPE

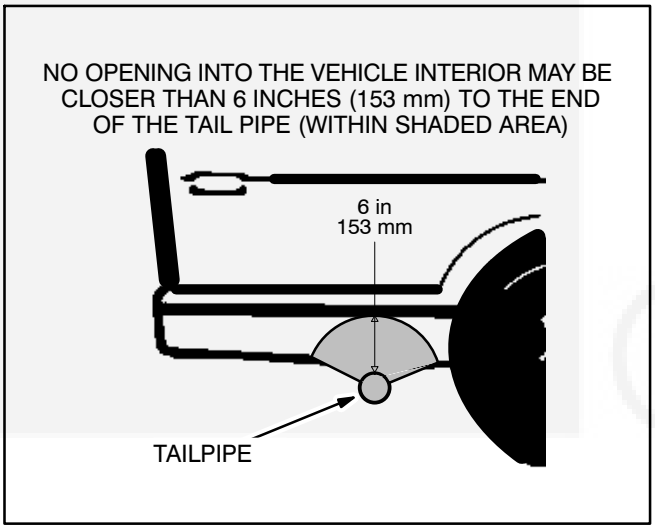


FIGURE 10. MINIMUM DISTANCES TO OPENINGS

10. In “high-mount” applications (Commercial Models only), the exhaust tailpipe must be routed down and underneath the vehicle and terminate at least 1 inch (25.4 mm) beyond the perimeter of the vehicle (Figure 9). The tail pipe may be routed inside the hot exhaust duct (Page 11), but not through the interior of the vehicle. The tail pipe must be visible and accessible along its entire length for inspection and replacement.

11. Route the tailpipe such that it will not likely be struck when the vehicle is moving. At least keep it out of the approach and departure angles of the vehicle and above the axle clearance line (Figure 11).

12. Do not connect the genset to the vehicle engine exhaust system.

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

13. *Exhaust back pressure under full load must not exceed 2 inches (51 mm) water column (WC) as measured within 6 inches (154 mm) of the muffler outlet flange.*

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

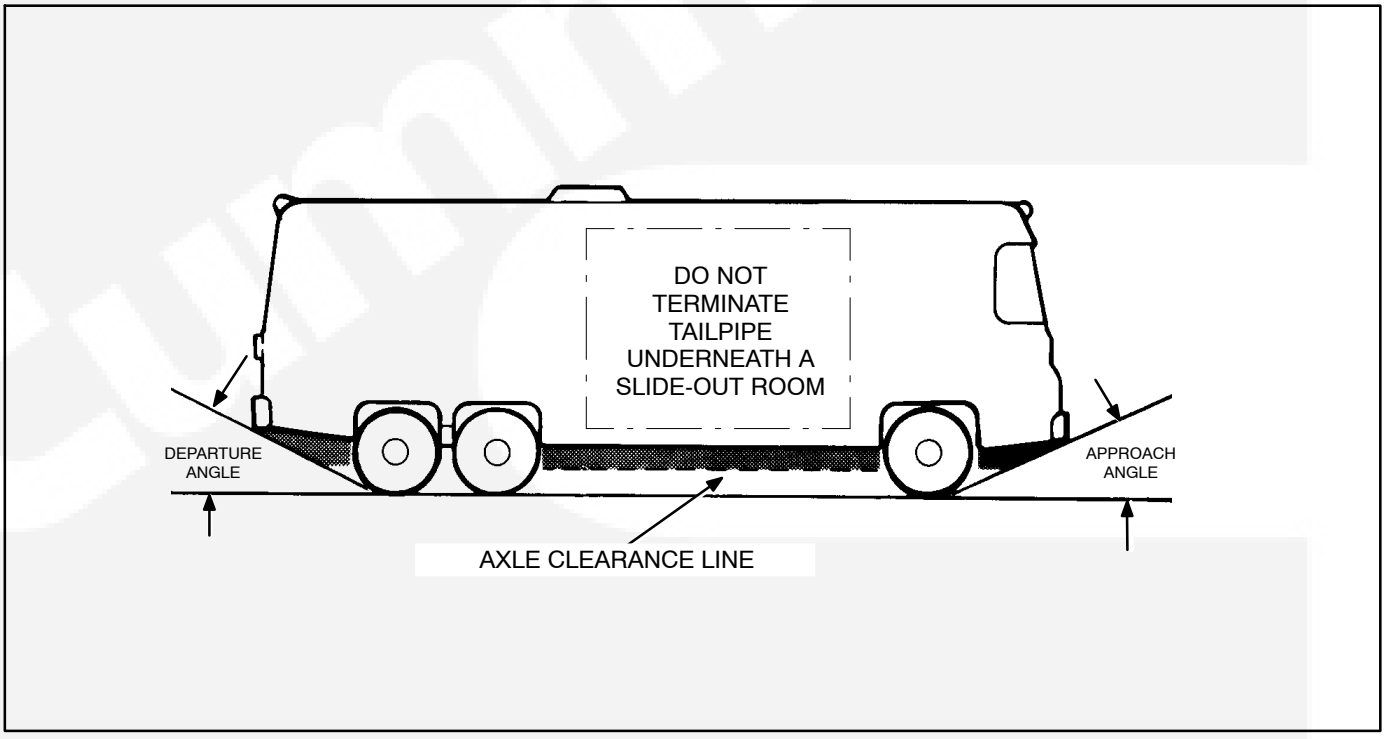


FIGURE 11. APPROACH AND DEPARTURE ANGLES AND AXLE CLEARANCE LINE

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Fuel Connections

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

Do not interconnect genset 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 genset and vehicle engine fuel lines are interconnected. Always use separate fuel lines or a separate fuel tank for the genset.***

To prevent the genset from running the vehicle out of fuel, do not extend the genset fuel pickup tube down into the fuel tank as far as the pickup tube for the vehicle engine.

Fuel lines (supply and return) must have at least a 1/4 inch (6.4 mm) ID. See Figure 12 for connections at the genset.

Run the fuel line 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 (914 mm). An auxiliary fuel pump kit (Kit 541-0530) is available from Onan for generator sets mounted more than 36 inches (914 mm) above fuel source.

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

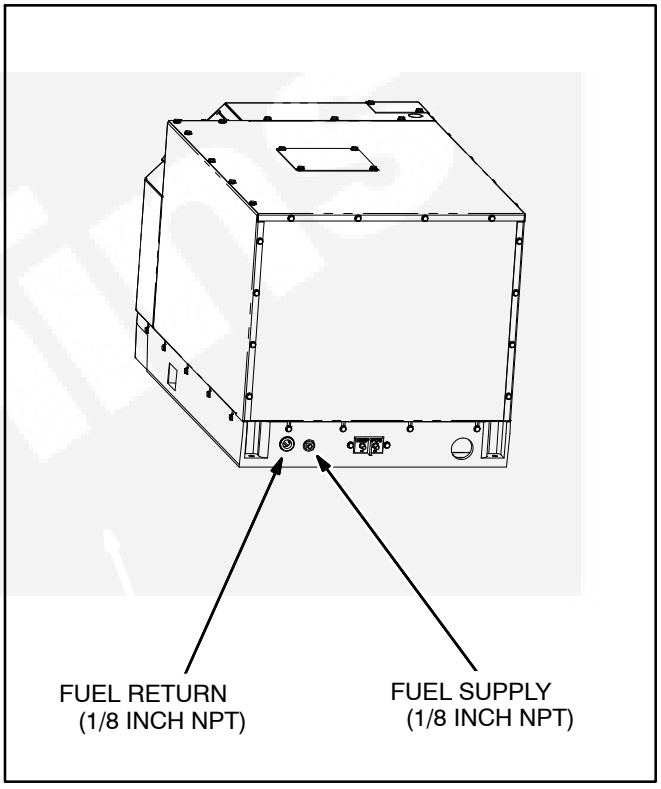

FIGURE 12. FUEL CONNECTIONS

BIO−DIESEL FUELS B5 − B20

Approved Bio−Diesel Fuel:

For biodiesel blends above B5 and up to B20, Cummins Onan requires that the fuel meet the specifications outlined in ASTM D7467. The biodiesel 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. Also, 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, flourinated polyethylene, flourinated 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 excercised 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 1-1. CUMMINS ONAN BIO−DIESEL RECOMMENDATIONS

APPLICATION	RECOMMENDATION FOR BIO−DIESEL BLENDS	RECOMMENDATIONS	COMMENTS
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.

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Electrical Connections

AC POWER OUTPUT

⚠WARNING ***Accidental starting of the genset 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 genset starting system is disabled.***

The genset is equipped with a terminal block and conduit connector knockouts for AC power output connections (Figure 13). See Figure 14 for typical connections.

Wiring Methods

Follow the National Electrical Code, especially noting 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 are suitable for wire sizes up to No. 6 AWG. Torque the terminals to 13 in-lbs (1.5 N-m).
3. Use vibration-proof switches and controls to prevent the opening and closing of circuits while the vehicle is in motion.
4. Use rain-tight conduit, conduit connectors and junction boxes for all exterior wiring.
5. Provide ground fault circuit interrupters (GFCIs) for all convenience power receptacles.
6. 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. (Flexible conduit is not vapor-tight and will allow exhaust gas to enter along the wires if not sealed.)

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

7. 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.***

8. Connect the grounding terminal (Terminal TB2-5, Figure 14) 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.***

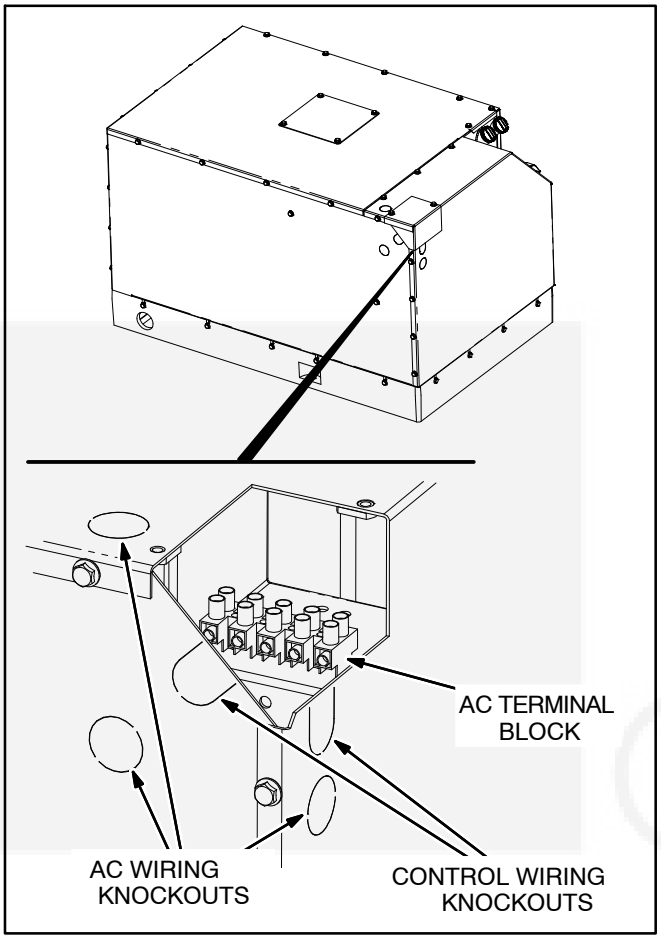


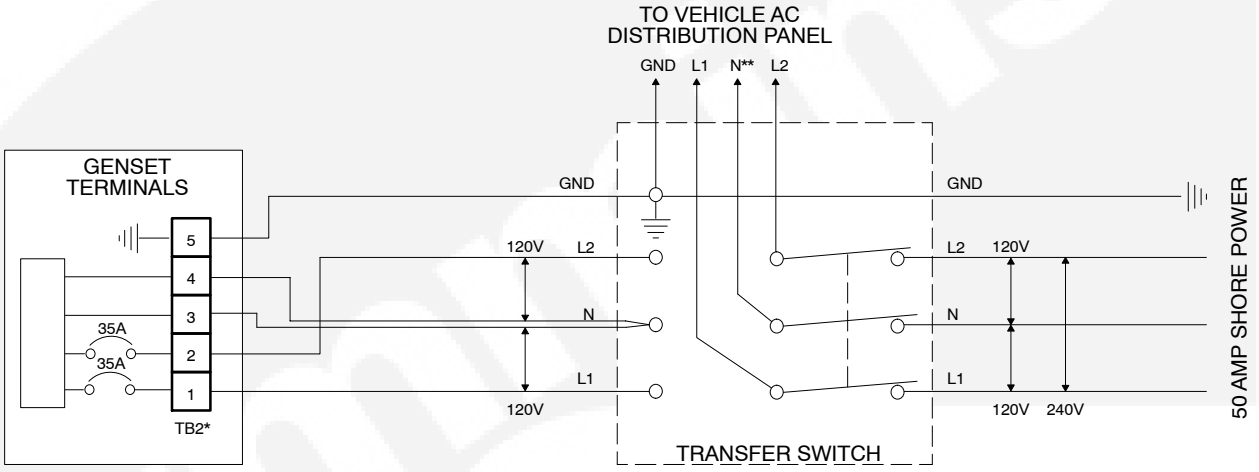
FIGURE 13. AC OUTPUT BOX

Connecting the Vehicle to Utility Power

When the vehicle has provision for connecting utility power it must have an approved device to keep the genset and utility from being interconnected. See Figure 14 for typical connections.

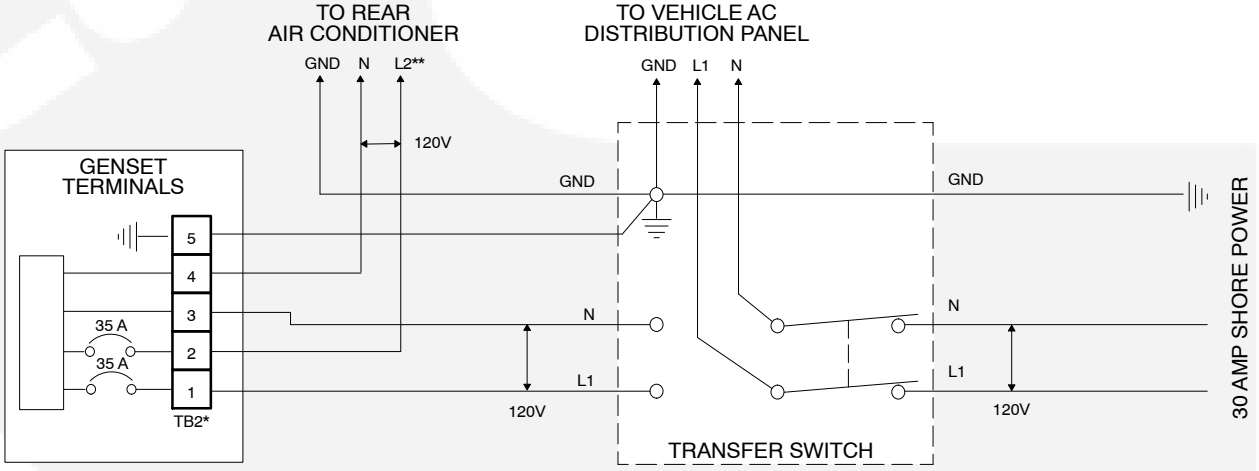
⚠WARNING ***Interconnecting the genset and the public utility (or any other power source) can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device to prevent interconnections***

50 AMP SHORE POWER AND TRANSFER SWITCH



*DO NOT SECURE MORE THAN ONE CONDUCTOR AT ANY TERMINAL ON TB2
**Because L1 and L2 from the genset are in phase, current in the Neutral conductors is the sum of the currents in L1 and L2. Wiring and equipment must be sized accordingly.

30 AMP SHORE POWER AND TRANSFER SWITCH AND SEPARATE AIR CONDITIONER CIRCUIT



*DO NOT SECURE MORE THAN ONE CONDUCTOR AT ANY TERMINAL ON TB2
**This circuit has a 30 or 35 amp circuit breaker. Wiring and equipment must be sized and protected accordingly.

FIGURE 14. TYPICAL CONNECTIONS

REMOTE CONTROL

Figure 15 shows the 10-pin plug on the end of the remote control leads and typical connections to a remote control panel. The plug and leads are stowed inside the AC terminal enclosure when the genset is shipped from the factory. Harnesses of various lengths with mating receptacles are available separately.

Wiring Methods

1. Remove the AC terminal access cover and remove one of the control wiring knockouts.
2. Pull out the remote control connector plug, fit the bushing around the connector leads into the knockout slot and secure the access cover.
3. Snap the connector plug and harness receptacle together.
4. If the harness does not have a plug for connections at the control panel, use solder-type butt connectors and heat-shrink insulation tubing to connect to the wiring from the remote panel. Use insulated 18 AWG copper conductors for the wiring from the remote panel.
5. Keep control leads away from AC power leads to reduce the possibility of erratic operation due to induced signals.
6. 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.***

Remote Control Panels

1. The control switch should be a two-pole, momentary-contact, center-return/center-off type of switch with an indicator light.
2. The engine oil pressure and water temperature gauges should be compatible with the genset. See your Onan dealer for makes and models.
3. The total load connected to **P8-F** (Switched B+) should not exceed 2 amp.
4. The total load connected to **P8-B** (Status Light) should not exceed 2 amp.

Note: To obtain genset status and diagnostics indication, the remote panel status light must be connected to P8-B—not to P8-F.

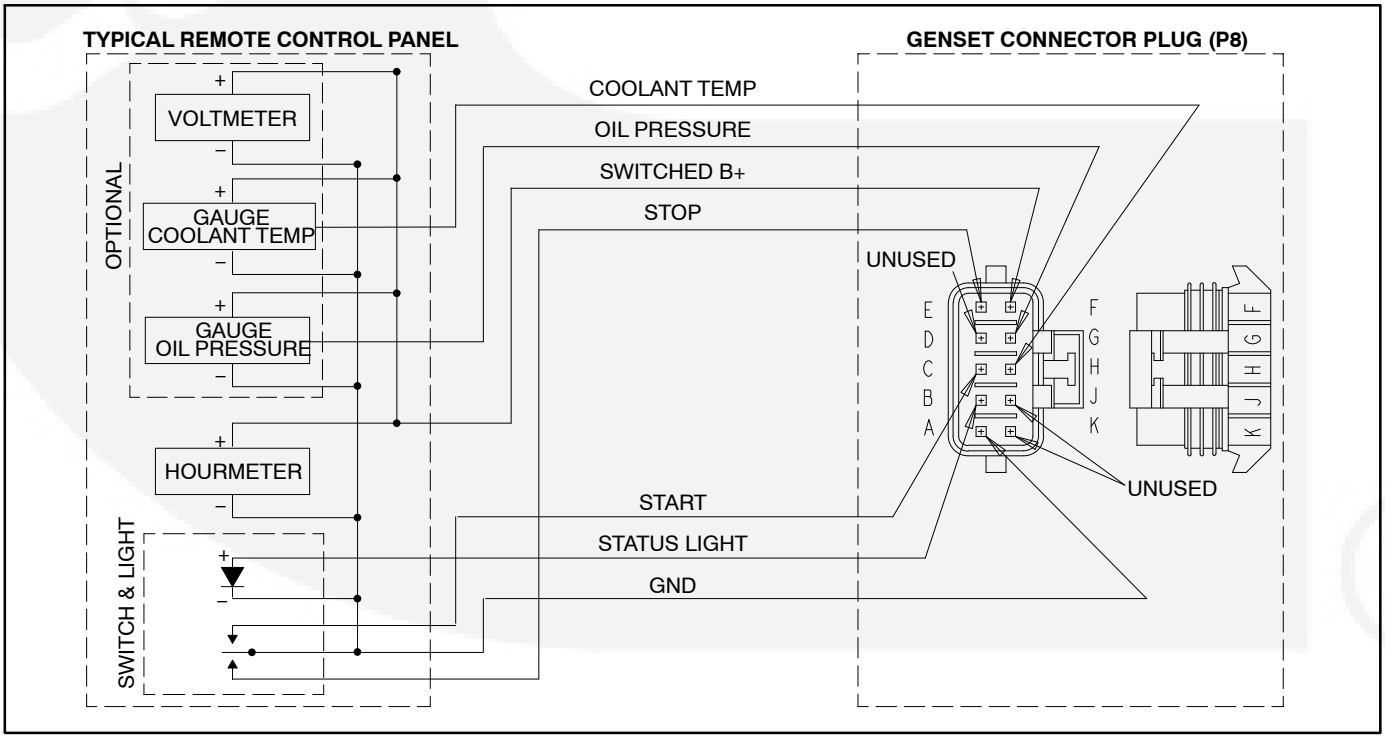


FIGURE 15. REMOTE CONTROL CONNECTOR PLUG AND TYPICAL CONNECTIONS

BATTERY

⚠WARNING ***Accidental starting of the genset 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 genset starting system is disabled.***

Battery Capacity

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

Battery Recharging

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

Battery Compartment

Batteries must be mounted in a separate compartment from that of the genset and away from spark-producing equipment. A compartment must have openings of at least 1.7 square inches (11 square centimeters) at the top and bottom for ventilation of battery gasses. It 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

Cable Size: Size battery cables according to Table 2. 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 2. BATTERY CABLE SIZES FOR TEMPERATURES DOWN TO –20° F (–29°C)

TOTAL CABLE LENGTH* FEET (METERS)	CABLE SIZE AWG
0 to 25 (0 to 7.6)	0
26 to 70 (8 to 21.3)	00
73 to 90 (22.25 to 27.4)	000

* – Battery cable lengths are total lengths from the battery to the generator back to the battery.

Based on 300 amp cranking amperage.

Current Path From Negative (–) Terminal: The current path between the genset 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 genset to the negative (–) battery terminal (Figure 16). Note also that codes may require bonding conductors from the genset and the battery to the vehicle frame.

If a full-length negative (–) cable is not run from the battery (Figure 17), all vehicle frame members in the path of battery cranking currents must have substantial crossections. 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 must be used to connect the frame to the designated negative (–) terminal on the genset (Figure 18). The cable must be sized according to Table 2. ***The genset mounting bolts are not considered adequate means for bonding the genset to the vehicle frame, either for the purpose of carrying cranking currents or for complying with requirements for genset/system grounding.***

Cable Routing: 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.***

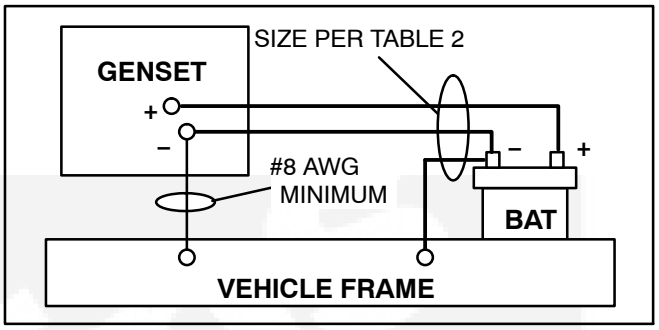


FIGURE 16. FULL-LENGTH CABLE FROM BATTERY NEGATIVE (–) TERMINAL

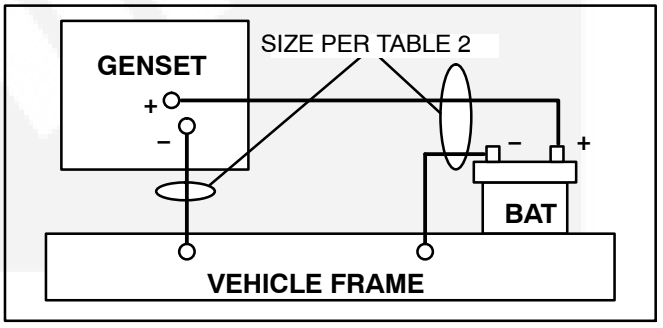


FIGURE 17. VEHICLE FRAME AS PATH FROM BATTERY NEGATIVE (–) TERMINAL

Genset Bonding Terminal

The negative (–) battery cable terminal shown in Figure 18 is also the bonding terminal for grounding the genset 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

⚠ CAUTION ***Reversing battery connections can lead to battery charger failure (if so equipped).***

Terminate the battery cables with ring terminals sized for the 5/16 inch genset terminal screws (Figure 18). 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 genset starting system is disabled, connect the battery and grounding cables to the genset. Torque the terminals to 7.5 lb-ft (10 N–m).

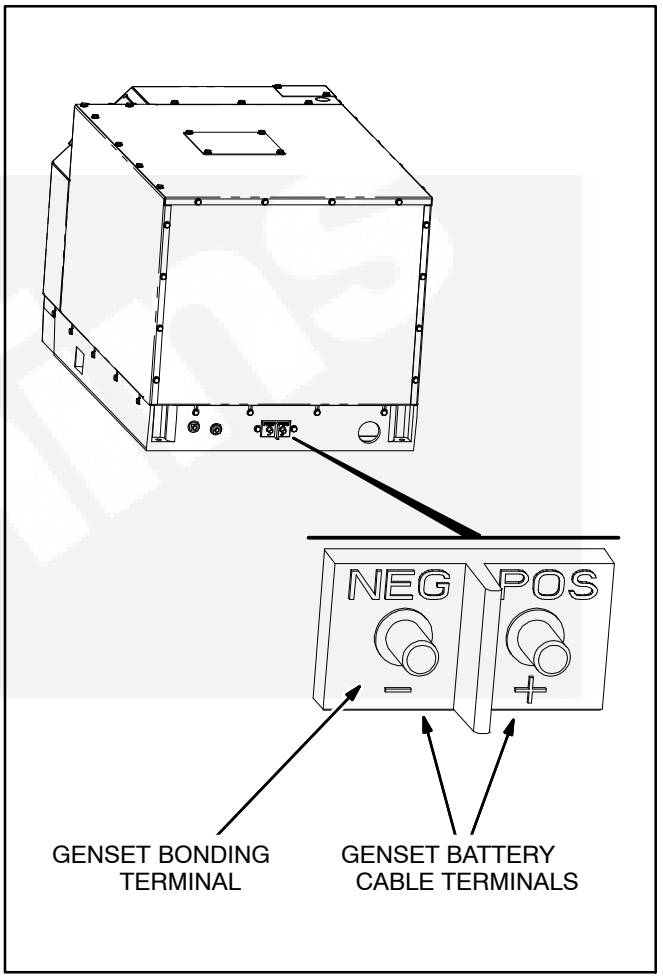


FIGURE 18. BATTERY CABLE CONNECTIONS

Installation Review and Startup

HOT AIR RECIRCULATION TEST

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

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 genset. 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 genset 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 (0.21 mm^2).
5. Measure genset inlet air temperature with one or two thermocouples tied about 1 inch away from the face of the radiator in the intake air opening (Figure 19). Make sure the thermocouples don't touch the radiator.
6. Measure ambient air temperature with a shielded thermocouple within 4 feet (1.2 meters) of the genset and at approximately the same height. Make sure the thermocouple will not be affected by warm air discharged from the genset or by sunlight. Use 2 inch diameter white PVC piping at least 6 inches long as a thermocouple shield.
7. Close all genset compartment doors and run the genset for at least 90 minutes. Record temperatures at 15 minute intervals. See Table 3 for an example of how the data can be arranged for recording and analysis.

TABLE 3. TEMPERATURE DATA

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

Test Requirement

The rise in inlet air temperature over ambient air temperature must not exceed 15°F (8.3°C). A rise in inlet air temperature indicates hot air recirculation. If the rise exceeds the requirement, steps must be taken to reduce recirculation to an acceptable level. Review VENTILATION (Page 8).

⚠ CAUTION ***High ambient operating temperatures could reduce maximum genset power output if the air temperature rise measured in this test is on the high end of the acceptable range.***

Power Output Ratings

It should be noted that genset power output (nameplate rating) is rated in an ambient temperature of 85°F (29°C). Models rated at 7500 watts or 8000 watts must be de-rated to 6000 watts in an ambient temperature of 120°F (50° C)—the maximum ambient operating temperature.

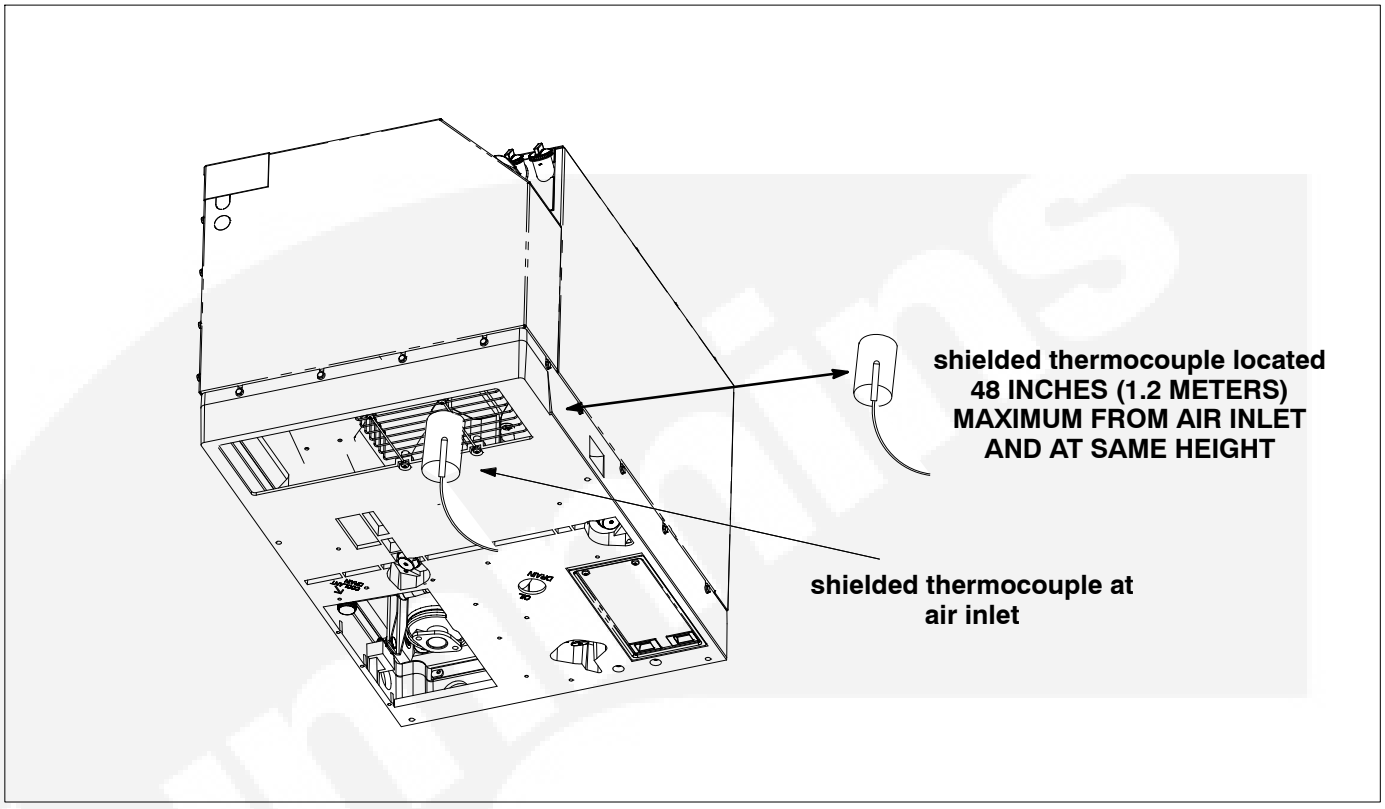


FIGURE 19. THERMOCOUPLE LOCATIONS

INSTALLATION REVIEW

Before starting the genset inspect the installation and check (√) each of the following questions if it can be answered "YES". If an item cannot be checked, provision must be made to satisfy the requirement.

[ ] Is the operator's console easily accessible for starting and stopping the genset, resetting circuit breakers, checking and adding engine coolant and oil?

[ ] Is the genset securely bolted in place?

[ ] Are all specified clearances provided?

[ ] Are the air inlet and outlet openings free of obstructions?

[ ] Does the maintenance access door in the bottom of the genset swing all the way open for fuel and oil filter replacement?

[ ] [Is there easy access for draining engine oil?

[ ] Is there easy access for draining engine coolant?

[ ] 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?

[ ] Is the genset located outside the vehicle interior or separated by approved vapor-tight and fire-resistive materials?

[ ] Are all openings into the vehicle, such as for AC wiring, sealed to keep out engine exhaust? Are AC conduit connectors sealed inside and outside?

[ ] Have all AC connections been inspected and approved?

[ ] Has a properly sized battery been installed in a ventilated compartment isolated from the genset?

[ ] Have battery cables been installed and secured at sufficient intervals to prevent chaffing and contact with sharp edges, fuel lines and hot exhaust parts?

[ ] Is the genset 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 chaffing and contact with sharp edges, electrical wiring and hot exhaust parts?

[ ] Is the genset protected from direct road splash?

[ ] Is the genset located or shielded such that condensate from air conditioners will not drip on it?

[ ] Does the genset clear the ground by at least 12 inches (305 mm)?

[ ] Has the HOT AIR RECIRCULATION TEST been conducted, and are the results acceptable?

STARTUP

When all the items on the Installation Review check list have been checked, 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 genset and disconnect charger before disconnecting battery cables—Disconnect negative (–) cable first and reconnect last.***

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

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

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

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Specifications

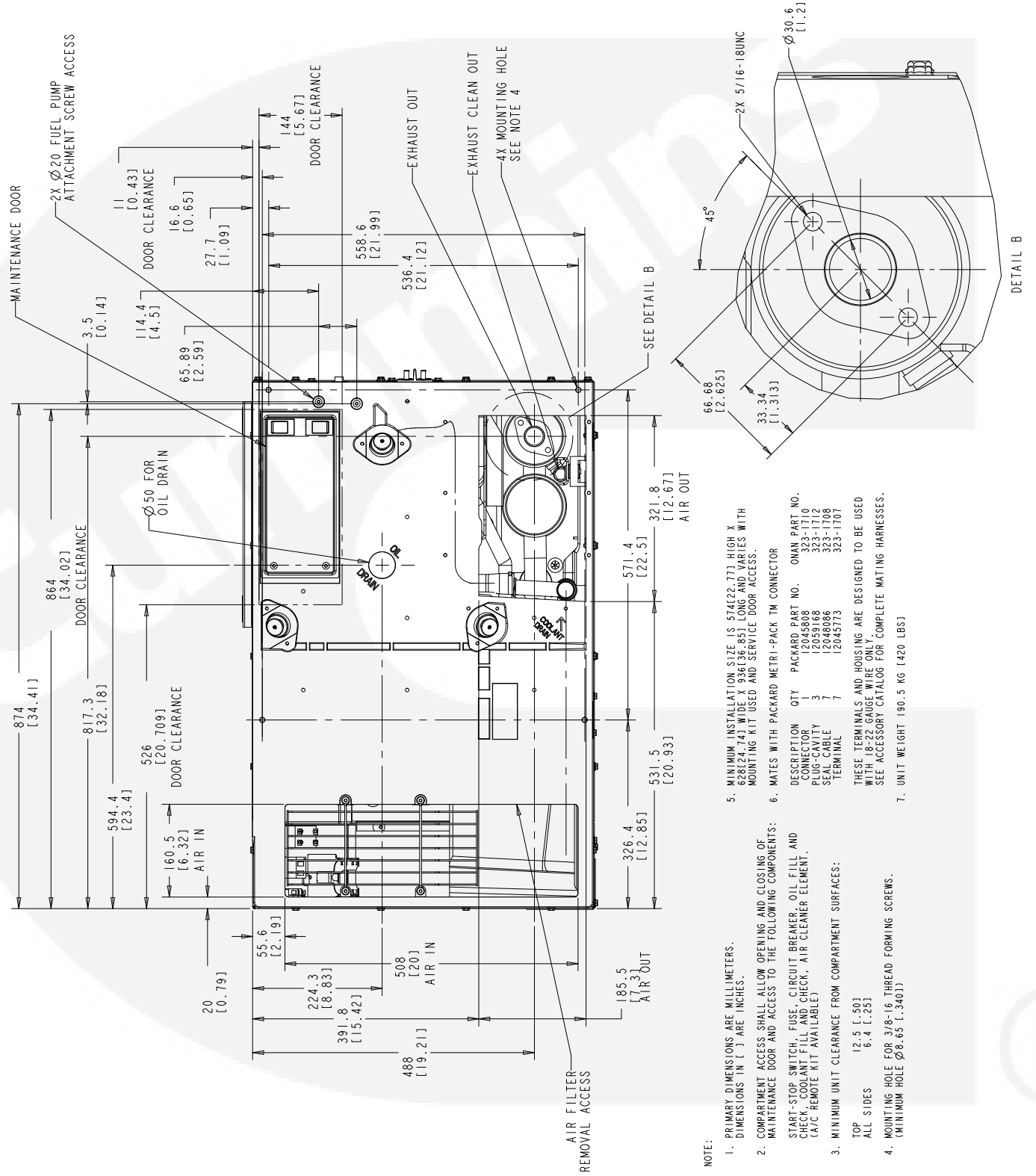
	HDKAH	HDKAJ	HDKAK
GENSET CONTROLLER: Integrated Microprocessor Based Engine and Generator Controller			
GENERATOR: Brushless, Exciterless, Bearingless, Permanent Magnet Alternator			
AC OUTPUT RATINGS:			
Power (@1.0 power factor)	6000 W	7500 W	8000 W
Voltage	120 volts	120 volts	120 volts
Frequency	60 Hz	60 Hz	60 Hz
Number of Phases	1	1	1
Current	50.0 ampere	62.5 ampere	66.7 ampere
Line Circuit Breaker(s)	2-pole, 30 amp	2-pole, 30 or 35 amp	2-pole, 30 or 35 amp
ENGINE: 3-Cylinder In-Line, Water-Cooled, Indirect-Injection, 4-Stroke Cycle Diesel			
Bore	2.64 inch (67 mm)		
Stroke	2.68 inch (68 mm)		
Displacement	44 inch^3 (719 cc)		
Compression Ratio	23 : 1		
Oil Capacity (with filter)*	3 quart (2.6 l)		
Cooling System Capacity**	4.2 quart (4 l)		
Intake and Exhaust Valve Lash (Cold)	0.0065 inch (0.165 mm)		
OPERATING SPEED RANGE:	1600 to 2900 RPM	1600 to 3200 RPM	1600 to 3300 RPM
FUEL CONSUMPTION:			
No-load Half-load (4000 W) Full-load	.13 gph (.49 l/h) .49 gph (1.85 l/h) .80 gph (3.03 l/h)	.13 gph (.49 l/h) .49 gph (1.85 l/h) .96 gph (3.63 l/h)	.13 gph (.49 l/h) .49 gph (1.85 l/h) 1.02 gph (3.86 l/h)
DC SYSTEM:			
Nominal Battery Voltage	12 volts		
Minimum Battery Capacity	450 CCA*** down to 05 F (–175 C) 650 CCA*** down to –205 F (–295 C)		
Maximum Regulated-Voltage Battery Charging Current (Optional)	10 ampere		
Fuse F1 (control circuit)	10 ampere mini-bayonet		
Fuse F2 (starter solenoid circuit)	10 ampere mini-bayonet		
Fuse F3 (glow plug circuit)	25 ampere		
WEIGHT AND SIZE:			
Weight (wet) Length x Width x Height	420 lbs (191 kg) 36.3 x 23.6 x 22.3 inch (922 x 599 x 566 mm)		

* See oil filling instructions.
** Includes coolant recovery tank.
*** Cold Cranking Amps @ 0° F (–17° C)

	HDKAV	HDKAT	HDKAU
GENSET CONTROLLER: Integrated Microprocessor Based Engine and Generator Controller			
GENERATOR: Brushless, Exciterless, Bearingless, Permanent Magnet Alternator			
AC OUTPUT RATINGS:			
Power (@1.0 power factor)	6000 W	7500 W	8000 W
Voltage	120 volts	120 volts	120 volts
Frequency	60 Hz	60 Hz	60 Hz
Number of Phases	1	1	1
Current	50.0 ampere	62.5 ampere	66.7 ampere
Line Circuit Breaker(s)	2-pole, 30 amp	2-pole, 30 or 35 amp	2-pole, 30 or 35 amp
ENGINE: 3-Cylinder In-Line, Water-Cooled, Indirect-Injection, 4-Stroke Cycle Diesel			
Bore	2.64 inch (67 mm)		
Stroke	2.68 inch (68 mm)		
Displacement	44 inch^3 (719 cc)		
Compression Ratio	23 : 1		
Oil Capacity (with filter)*	3 quart (2.6 l)		
Cooling System Capacity**	4.2 quart (4 l)		
Intake and Exhaust Valve Lash (Cold)	0.0065 inch (0.165 mm)		
OPERATING SPEED RANGE:	1600 to 2900 RPM	1600 to 3200 RPM	1600 to 3300 RPM
FUEL CONSUMPTION:			
No-load Half-load (4000 W) Full-load	.13 gph (.49 l/h) .49 gph (1.85 l/h) .80 gph (3.03 l/h)	.13 gph (.49 l/h) .49 gph (1.85 l/h) .96 gph (3.63 l/h)	.13 gph (.49 l/h) .49 gph (1.85 l/h) 1.02 gph (3.86 l/h)
DC SYSTEM:			
Nominal Battery Voltage	12 volts		
Minimum Battery Capacity	450 CCA*** down to 0° F (–17° C) 650 CCA*** down to –20° F (–29° C)		
Maximum Regulated-Voltage Battery Charging Current (Optional)	10 ampere		
Fuse F1 (control circuit)	10 ampere mini-bayonet		
Fuse F2 (starter solenoid circuit)	10 ampere mini-bayonet		
Fuse F3 (glow plug circuit)	25 ampere		
WEIGHT AND SIZE:			
Weight (wet) Length x Width x Height	420 lbs (191 kg) 36.3 x 23.6 x 22.3 inch (922 x 599 x 566 mm)		

* See oil filling instructions.
** Includes coolant recovery tank.
*** Cold Cranking Amps @ 0° F (–17° C)

Outline Drawings



NOTE:

1. PRIMARY DIMENSIONS ARE MILLIMETERS. DIMENSIONS IN [ ] ARE INCHES.
2. COMPARTMENT ACCESS SHALL ALLOW OPENING AND CLOSING OF MAINTENANCE DOOR AND ACCESS TO THE FOLLOWING COMPONENTS:
   START-STOP SWITCH, FUSE, CIRCUIT BREAKER, OIL FILL AND CHECK, COOLANT FILL AND CHECK, AIR CLEANER ELEMENT. (A/C REMOTE KIT AVAILABLE)
3. MINIMUM UNIT CLEARANCE FROM COMPARTMENT SURFACES:

TOP	12.5 [.50]
ALL SIDES	6.4 [.25]

4. MOUNTING HOLE FOR 3/8-16 THREAD FORMING SCREWS. (MINIMUM HOLE Ø8.65 [.340])
5. MINIMUM INSTALLATION SIZE IS 574[22.77] HIGH X 628[24.74] WIDE X 936[36.85] LONG AND VARIES WITH MOUNTING KIT USED AND SERVICE DOOR ACCESS.
6. MATES WITH PACKARD METRI-PACK TM CONNECTOR

DESCRIPTION	QTY	PACKARD PART NO.	ONAN PART NO.
CONNECTOR	1	12045808	323-1710
PLUG-CAVITY	3	12059168	323-1712
SEAL CABLE	7	12048086	323-1708
TERMINAL	7	12045773	323-1707

THESE TERMINALS AND HOUSING ARE DESIGNED TO BE USED WITH 18-22 GAUGE WIRE ONLY. SEE ACCESSORY CATALOG FOR COMPLETE MATING HARNESSES.

7. UNIT WEIGHT 190.5 KG [420 LBS]

FIGURE 20. OUTLINE DRAWING—BOTTOM (NOT A PLAN VIEW)

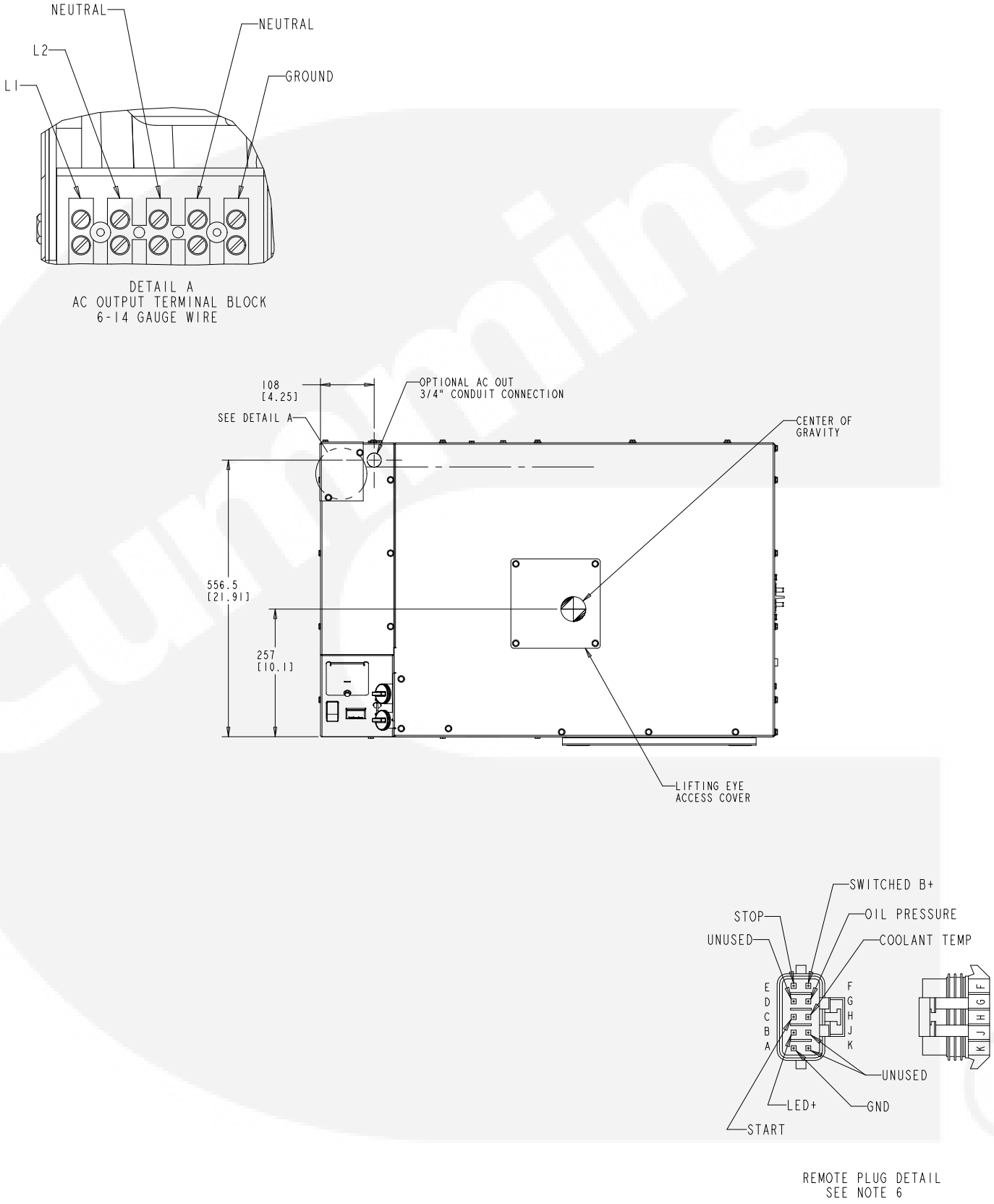


FIGURE 21. OUTLINE DRAWING—TOP

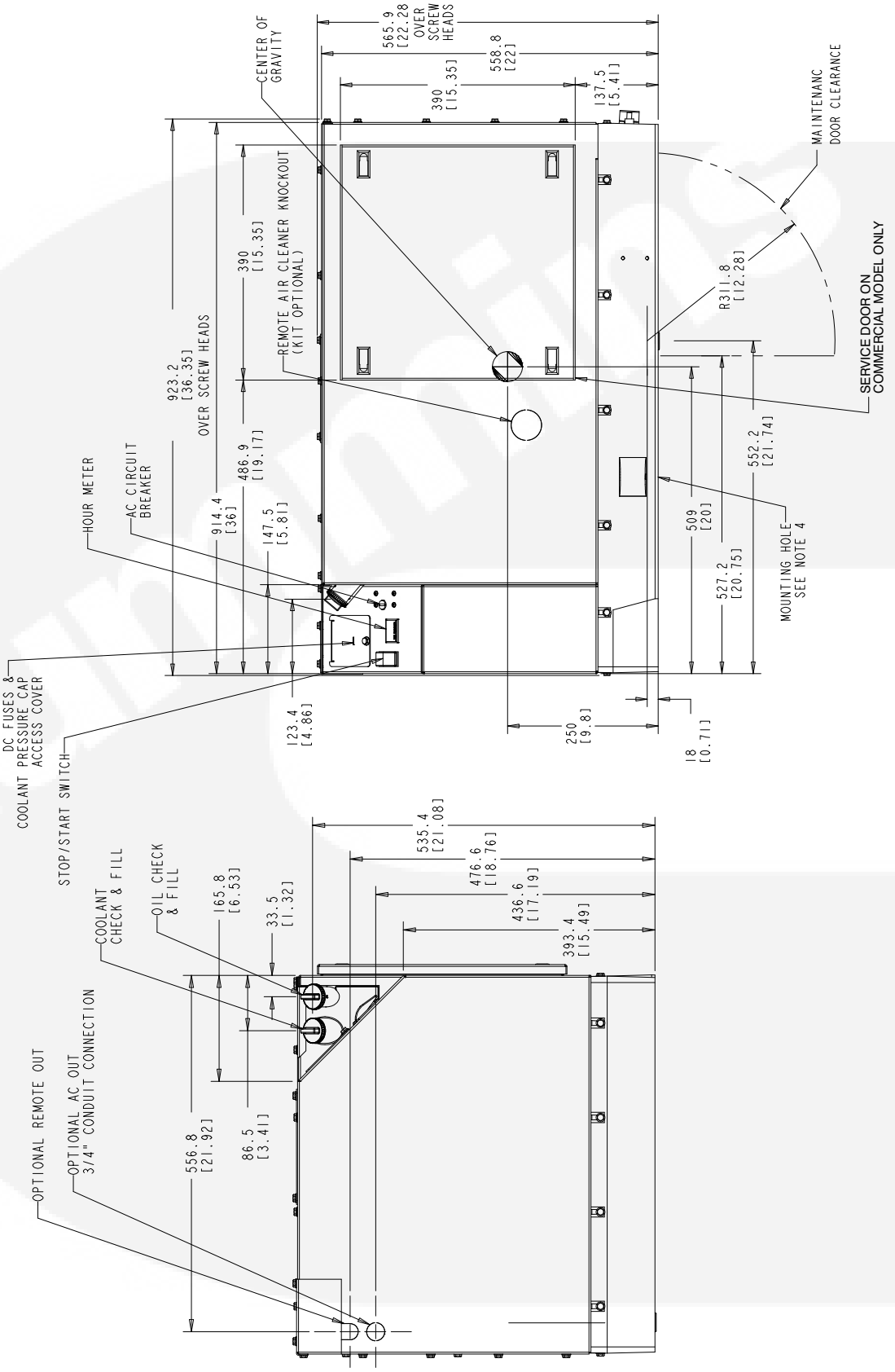


FIGURE 22. OUTLINE DRAWING— FRONT AND LEFT SIDES

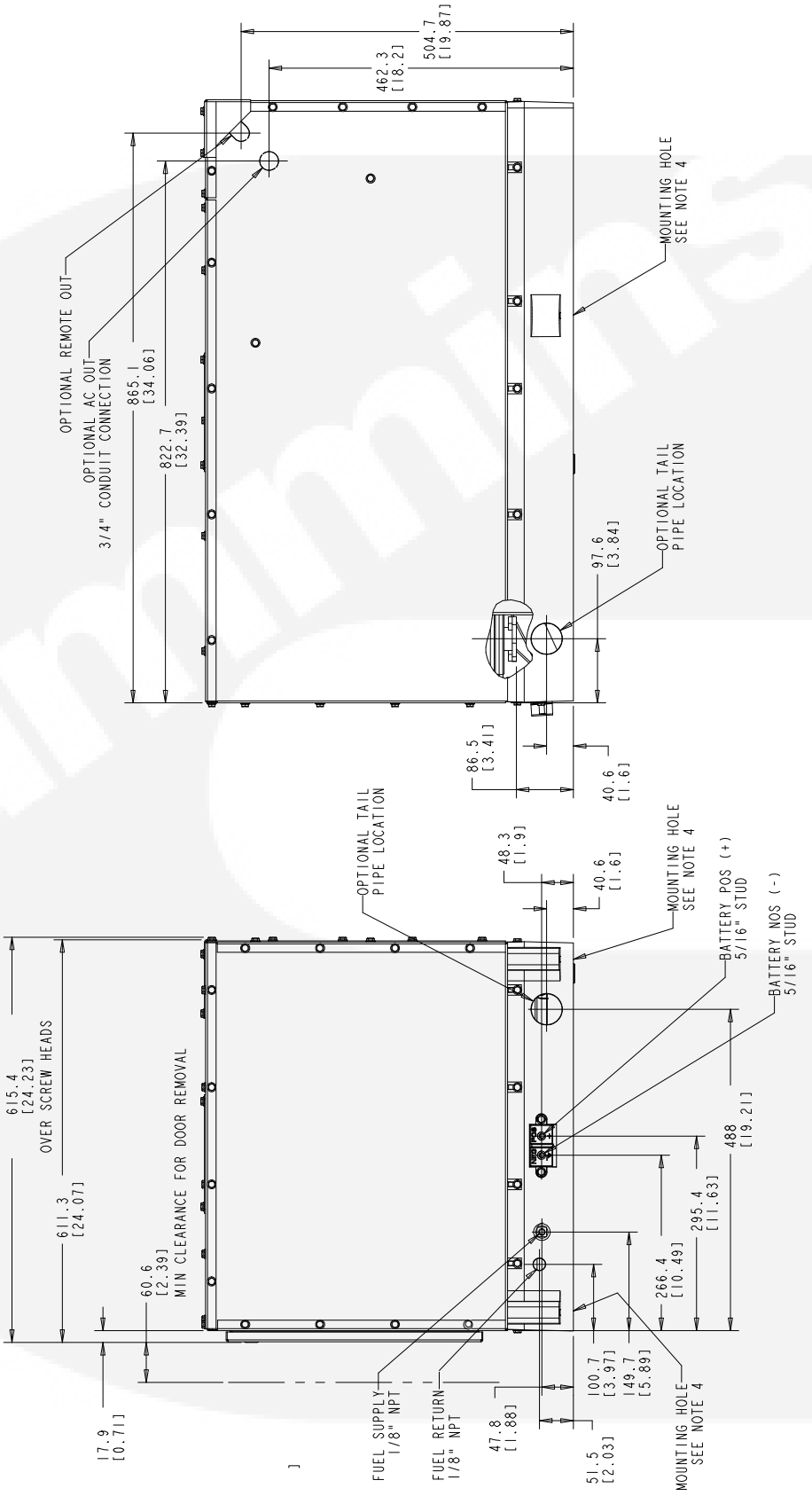


FIGURE 23. OUTLINE DRAWING—RIGHT AND BACK SIDES

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