Installation

Marine Generator Sets

Models:

4EOZ/3.5EFOZ
6EOD/4.5EFOD
8–32EOZD/6.5–27EFOZD

ISO 9001
KOHLER POWER SYSTEMS
NATIONALLY REGISTERED

KOHLER®
POWER SYSTEMS

TP-6253 1/08c

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. SAVE THESE INSTRUCTIONS.

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that ***will cause severe personal injury, death***, or ***substantial property damage***.

WARNING

Warning indicates the presence of a hazard that ***can cause severe personal injury, death,*** or ***substantial property damage***.

CAUTION

Caution indicates the presence of a hazard that ***will*** or ***can cause minor personal injury*** or ***property damage***.

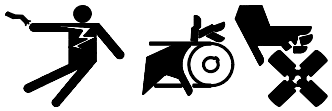
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or equipment connected to the set, disable the generator set as follows: (1) Press the generator set on/off button to shut down the generator set. All indicator lamps dim. (2) Disconnect the power to the battery charger, if equipped. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent the starting of the generator set by the remote start/stop switch.

Engine Backfire/Flash Fire

WARNING

Fire.
Can cause severe injury or death.

Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel injection system, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or fuel system.

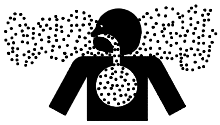
Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner/silencer removed.

Combustible materials. A sudden flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the generator set. Keep the compartment and the generator set clean and free of debris to minimize the risk of fire. Catch fuels in an approved container. Wipe up spilled fuels and engine oil.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

Operating the generator set. Carbon monoxide can cause severe nausea, fainting, or death. Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings.

Fuel System

⚠ WARNING

Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Hazardous Noise

⚠ CAUTION

Hazardous noise.
Can cause hearing loss.

Never operate the generator set without a muffler or with a faulty exhaust system.

Hazardous Voltage/ Moving Parts

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by turning off the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Testing the voltage regulator. Hazardous voltage can cause severe injury or death. High voltage is present at the voltage regulator heat sink. To prevent electrical shock do not touch the voltage regulator heat sink when testing the voltage regulator. *(PowerBoost™, PowerBoost™ III, and PowerBoost™ V voltage regulator models only)*

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is turned off. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. *(600 volts and under)*

Hot Parts

⚠ WARNING

Hot coolant and steam.
Can cause severe injury or death.

Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.

Notice

NOTICE

This generator set has been rewired from its nameplate voltage to

246242

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Fuse replacement. Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

NOTICE

Saltwater damage. Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

Notes

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

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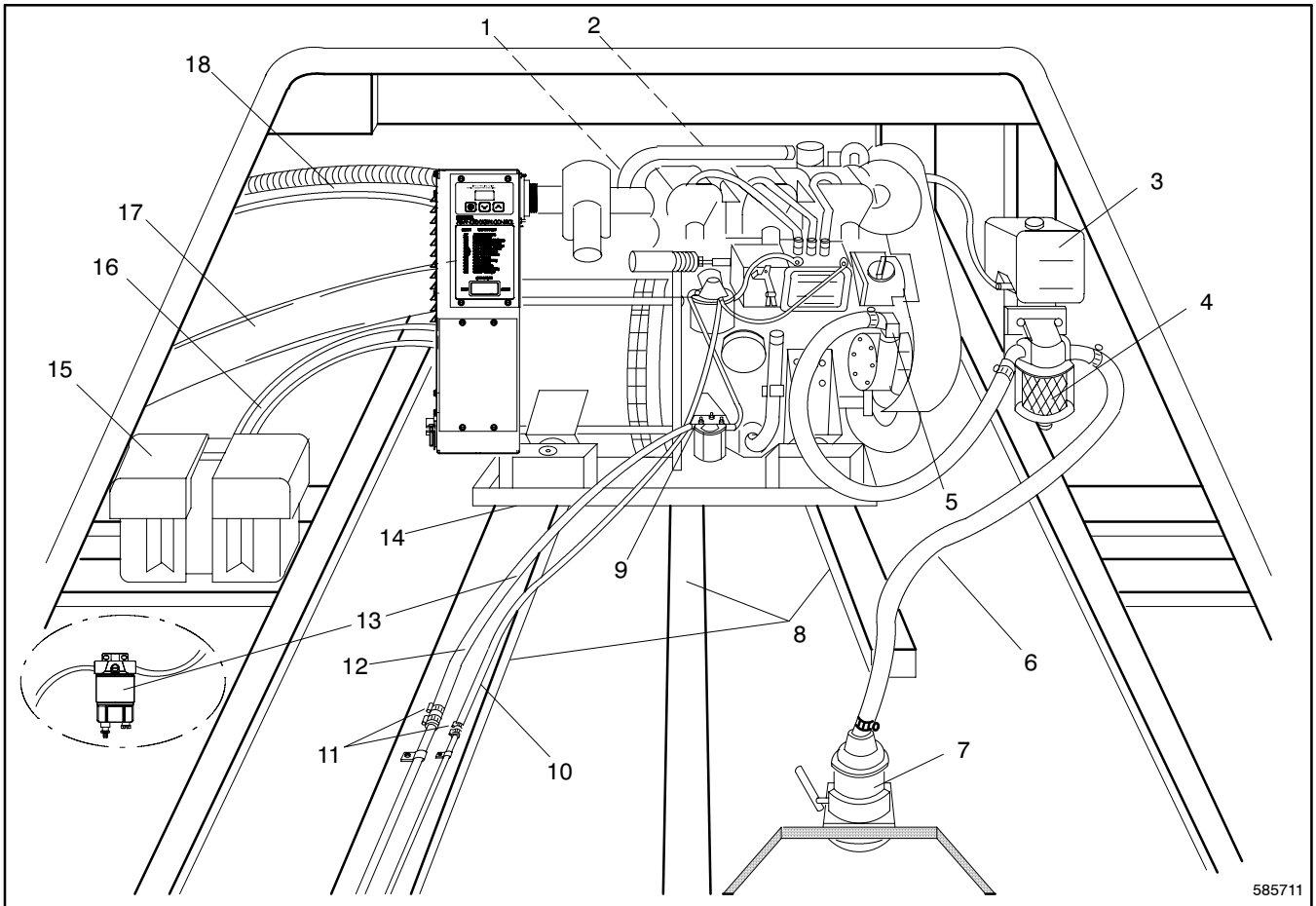
The safe and successful operation of a marine power system depends primarily on the installation. See Figure 1-1. Use this manual as a guide to install the marine generator set. For operating instructions, refer to the operation manual.

Marine generator set installations must comply with all applicable regulations and standards.

Use the specification sheets as a guide in planning your installation. Use current dimension drawings and wiring diagrams.



1. Exhaust mixer elbow (exhaust/water outlet) (not shown)
2. Heat exchanger (not shown)
3. Coolant recovery tank (located on the unit on some models)
4. Seawater strainer *
5. Seawater pump (seawater inlet)
6. Seawater line *
7. Seacock *
8. Craft stringers
9. Fuel feed pump (fuel inlet) *
10. Fuel return line *
11. Hose clamps
12. Fuel supply line *
13. Fuel/water separator (see Section 5 for more information)
14. Mounting tray
15. Battery/battery storage box
16. Battery cables
17. Exhaust hose or exhaust line *
18. Electrical leads (AC output leads/remote start panel leads)

* Indicated components must conform to USCG regulations.

Figure 1-1 Typical Generator Set Location and Mounting (Without Sound Shield)

Note: See text for complete explanation of installation requirements.

Note: Use two hose clamps on each end of all flexible exhaust hose connections.

Notes

2.1 General Considerations

The key to installation is location. Before making final plans for locating a generator set, consider the following.

Installation Location Considerations

1. Choose a location that allows adequate space for cooling and exhaust system installation, fuel system installation, ventilation, and service access to the generator set (engine and generator).
2. Use craft stringers or other available structural members capable of supporting the generator set's weight.
3. Seal the generator set's engine room from the cabin to prevent exhaust gases and fuel vapors from entering the cabin.

See the current generator set specification sheet or Section 7 of this manual for generator set dimensions and weights. See Figure 1-1 for a typical installation.

2.2 Location

Locate the generator set to allow easy service access to the generator set's engine, controller, cooling, and fuel system components. The engine compartment is often the ideal location for the generator set if the propulsion engine(s) does not obstruct access to the generator set and controller.

Marine Generator Set Installations in European Union Member Countries

This generator set is specifically intended and approved for installation below the deck in the engine compartment. Installation above the deck and/or outdoors would constitute a violation of European Union Directive 2000/14/EC noise emission standard.

Allow clearance for vibration and cooling during operation. Allow a minimum of 38 mm (1.5 in.) clearance on all sides (top, front, rear, and sides) of a generator set without an optional sound shield. Refer to the instruction sheet for minimum clearances for sound-shielded units. Also, allow space for the power takeoff (PTO) option, if equipped.

Kohler ignition-protected generator sets carry a UL1500 marine mark (decal). Check for this mark to ensure that your specific model is ignition protected. USCG Regulation 183.410 requires ignition-protected devices only in gasoline/gaseous-fueled environments.

2.3 Mounting

Mount the generator set as high as possible to avoid contact with bilge splash and lower-lying vapors and to allow for downward pitch of the exhaust line toward the exhaust outlet.

Kohler Co. recommends mounting the generator set on a flat board attached to the craft stringers. Craft stringers generally provide the best generator set support. Ensure that the structural members can support the generator set's weight and withstand its vibration.

The generator set includes vibration mounts and a mounting tray or skid. If desired, install additional vibration isolating pads underneath the generator set's base.

Use the four mounting holes in the mounting tray to mount the generator set securely to the craft.

For angular operating limits, consult the operation manual.

Notes

3.1 Ventilation

Engine combustion, generator cooling, and expulsion of flammable and lethal fumes require ventilation. Provide ventilation compliant with USCG Regulations governing sizing of vents and other considerations.

As a rule, size each inlet- and outlet-vent area to a minimum of 13 sq. cm/30.5 cm (2 sq. in. per ft.) of the craft's beam. Should this rule conflict with USCG Regulations, follow USCG Regulations. For applications with screened inlets, double the size (4 sq. in. per ft.) of the hull/deck openings. Extend the vent ducts to bilges to expel heavier-than-air fumes.

For generator sets mounted in the engine compartment, increase the air flow to allow for the generator set's requirements. Install optional detection devices to cause alarm, warning, or engine shutdown should dangerous fumes accumulate in the compartment.

See the generator set specification sheet that shipped with the generator set for air requirements. The air intake silencer/cleaner provides combustion air to the engine. Do not compromise the recommended minimum clearance of 38 mm (1.5 in.) between a duct opening and enclosure wall. The engine/generator performance will decline if you compromise these guidelines. See Figure 3-1 for allowable intake restriction.

Note: ISO 3046 derates apply. See Appendix C.

Model	Allowable Intake Restriction
4EOZ/3.5EFOZ	200 mm H_2O (1.96 kPa) or less
6EOD/4.5EFOD 8-32EOZD/6.5-27EFOZD	635 mm H_2O (6.23 kPa) or less

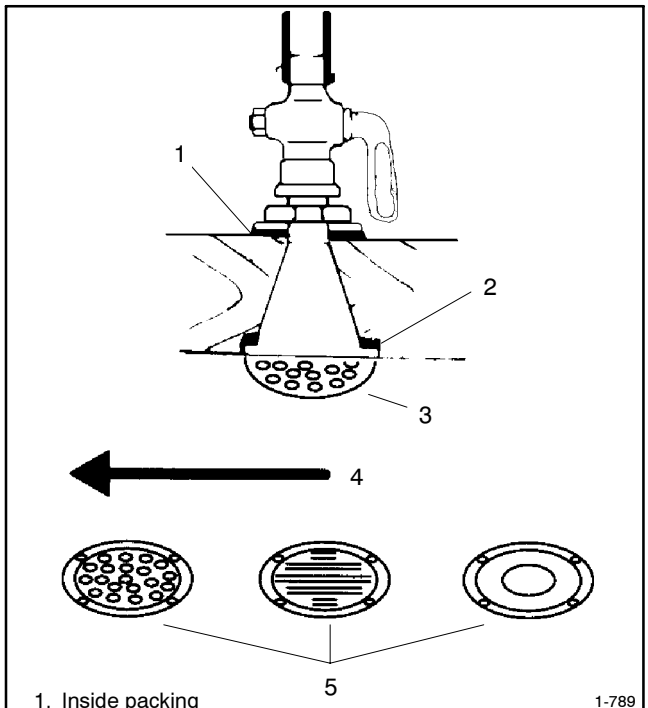
Figure 3-1 Combustion Air Intake Restriction

3.2 Cooling System Components

The marine generator set's cooling system requires the following components.

3.2.1 Intake Through-Hull Strainer (Seacock Cover)

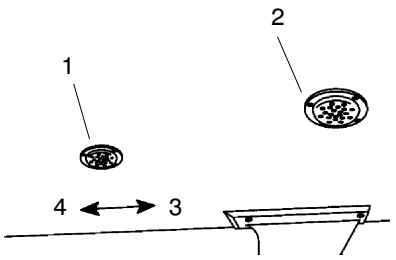
Install a screened-intake, through-hull strainer to prevent entry of foreign objects. Use perforated, slotted-hole, or unrestricted-hole design strainers. See Figure 3-2 for examples of typical strainers. The inner diameter of the strainer opening must be equal to or greater than the inner diameter of the water-line hose to the seawater pump.



1. Inside packing
2. Outside packing
3. Seacock cover
4. Direction of vessel movement
5. Typical intake through-hull strainers

Figure 3-2 Seacock Installation

Do not align the strainer (in relation to the craft's direction of travel) with any other through-hull intakes. See Figure 3-3. Flush mount the recommended through-hull strainer. Install slotted-hole-design strainers with the slots parallel to the direction of the vessel's movement.



Note: Position the intakes in relation to the vessel's travel so neither is in the wake of the other. 1-789

1. Generator set intake
2. Main engine intake
3. Aft (rearward)
4. Fore (forward)

Figure 3-3 Intake Strainer

Do not use a speed scoop or cup design intake through-hull strainer because it can cause a ramming effect and force water upward, past the seawater pump, and into the engine cylinders when the vessel is moving and the generator set is shut down.

Do not use hulls incorporating sea chests or other designs that provide a positive pressure to the raw water pump for the intake through-hull strainers. Positive pressure forces water past the raw water pump and into the engine. A sea chest is a concave molded-in-the-hull chamber that aligns to the vessel's direction of travel. A sea chest configuration applies positive pressure similar to a scoop-type through-hull strainer.

3.2.2 Seacock

Mount the seacock to the hull, assemble it to the intake, and ensure that it is accessible for operation. Figure 3-2 shows a typical installation.

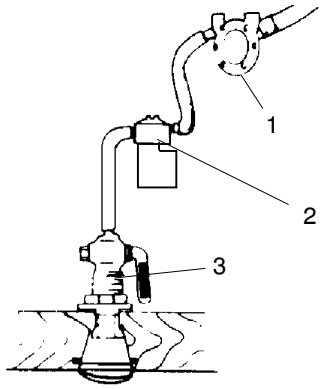
Avoid overcaulking the seacock. Excess caulk reduces water flow and, in some cases, develops a barrier that can force water upward, past the seawater pump, and into the engine cylinders when the vessel is moving and the generator set is shut down.

3.2.3 Seawater Strainer

Mount the seawater strainer to the seacock or permanent structure at a point not higher than the seawater pump. Ensure that the strainer is accessible for service. See Figure 3-4 for a typical installation.

Some seawater strainers include a seacock and an intake through-hull strainer.

Maximum seawater inlet pressure at the seawater pump is 34.5 kPa (5 psi). Excessive pressure will cause water ingestion.



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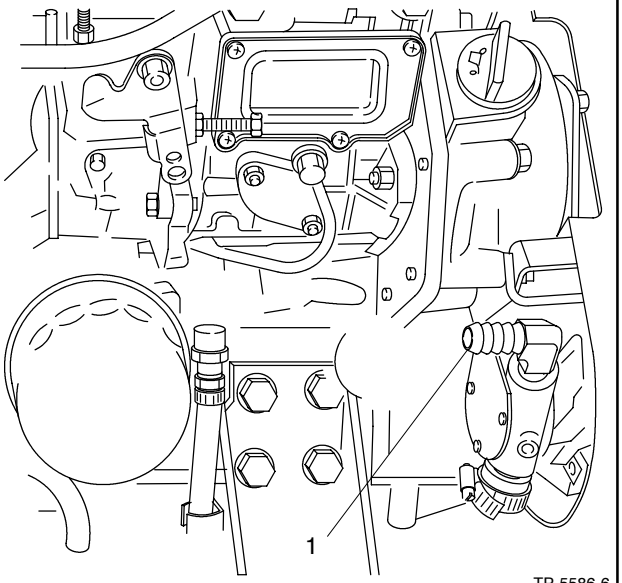
1. Seawater pump
2. Seawater strainer
3. Seacock

Figure 3-4 Seawater Strainer

3.2.4 Water Lines

Water lines from the seacock to the engine-driven seawater pump are usually constructed of flexible hose. Connect a flexible section of hose to the seawater pump to allow the generator set to vibrate during operation. Support a nonflexible water line within 102 mm (4 in.) of its connection to the flexible section.

Keep the seawater hose as straight and short as possible. If the hose is too long, usually over 4.6 m (15 ft.), water suction problems may occur. See Section 7 for the inlet water line hose size and the seawater connection to the seawater pump inlet. Avoid running the inlet pipe above the generator. See Figure 3-5 for the seawater hose connection to the seawater pump inlet.



1. Seawater pump inlet

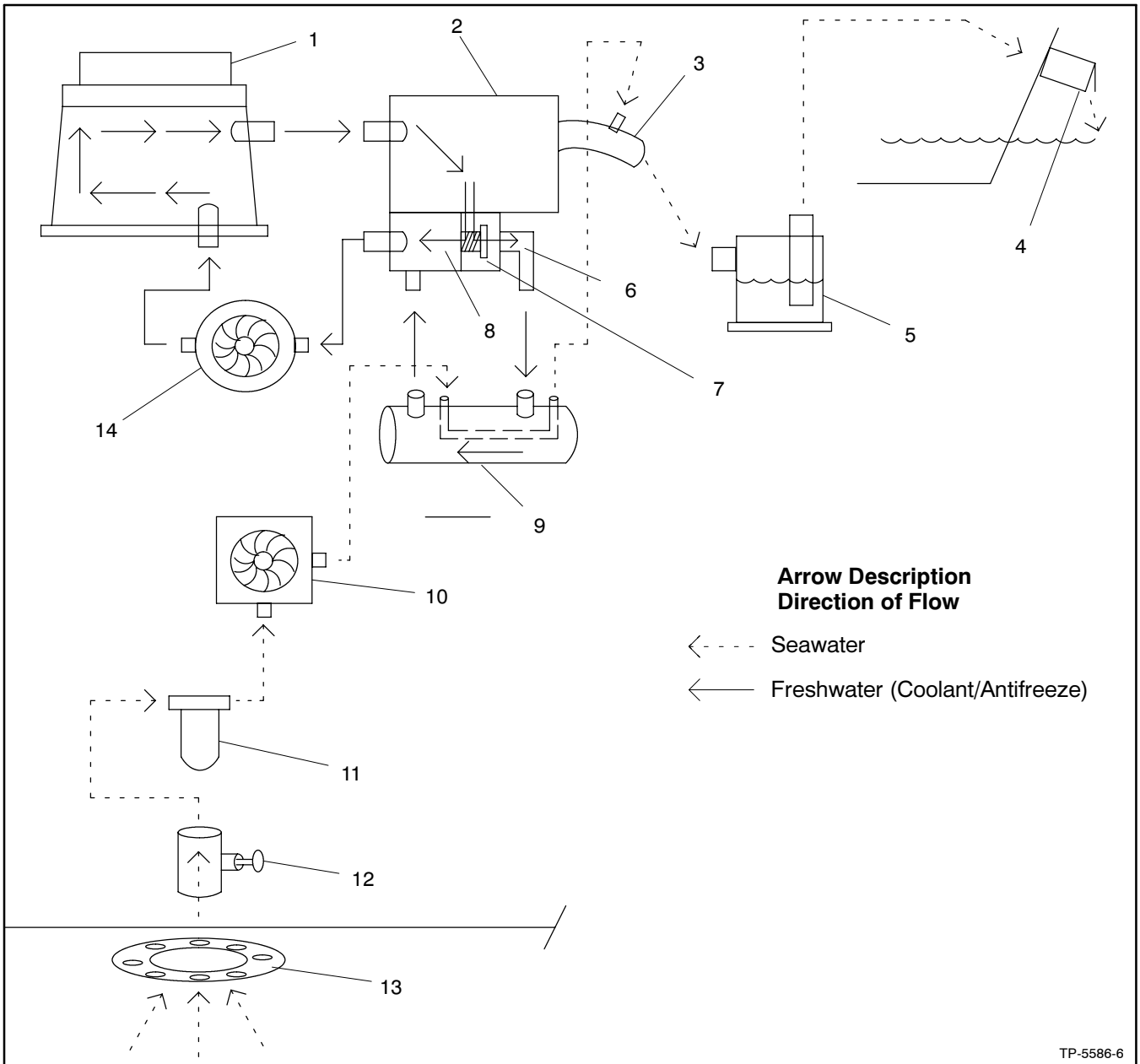
Figure 3-5 Seawater Inlet Connection (Located at the Inlet to the Seawater Pump), Typical

3.2.5 Closed Heat Exchanger (6EOD/4.5EFOD and 8–32EOZD/6.5–27EFOZD Models)

A closed heat exchanger is the best cooling method for most applications. See Figure 3-6 or Figure 3-7 for a typical installation. Provide space to access the water-cooled exhaust manifold pressure cap.

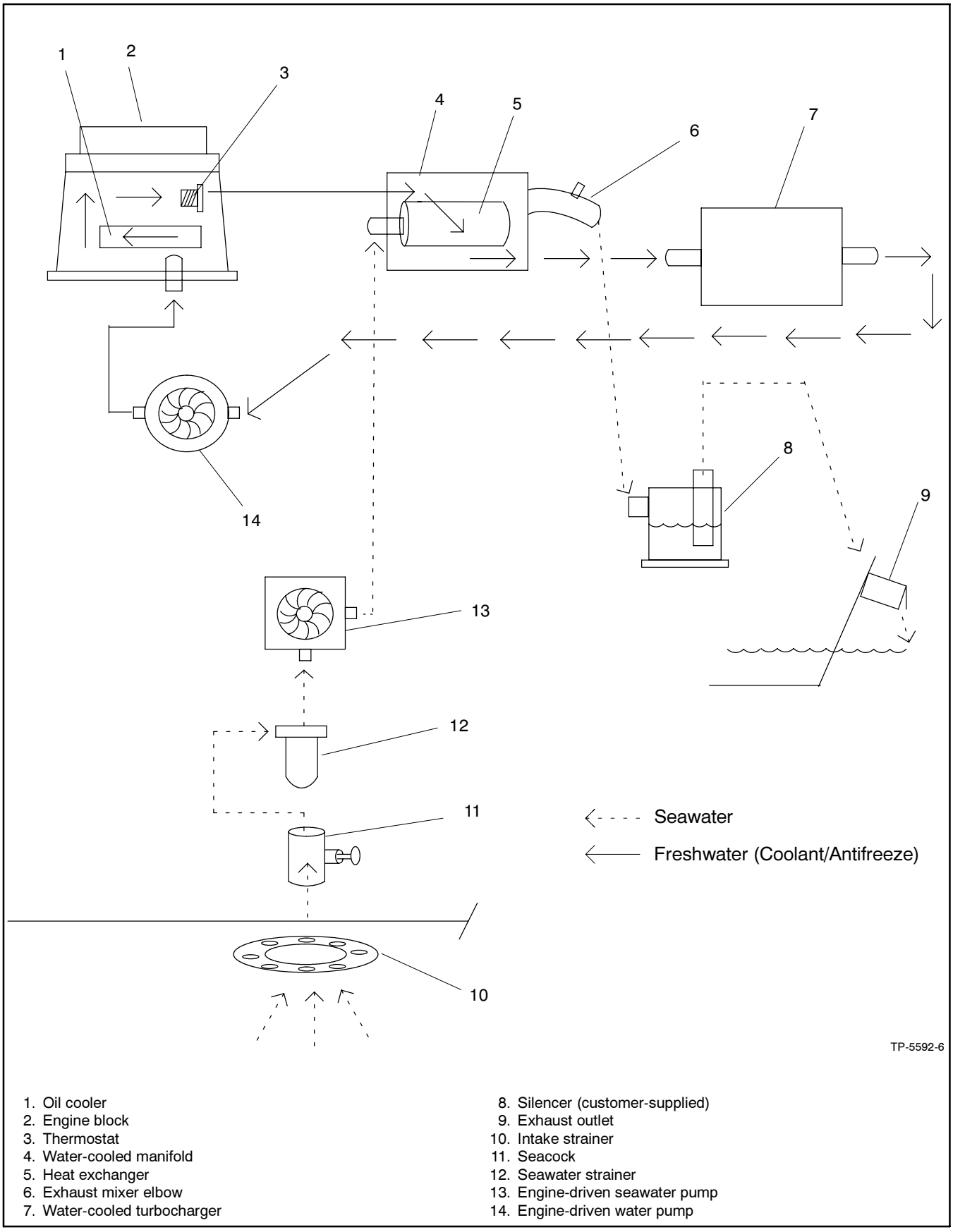
3.2.6 Direct Water Cooled (4EOZ/3.5EFOZ Models)

In a direct seawater cooling system, the impeller pump circulates the seawater around the cylinder and through the cylinder head. A thermostat controls the cooling water circuit temperature. Consult Figure 3-8 and the engine operation manual for the cooling water circuit diagrams.



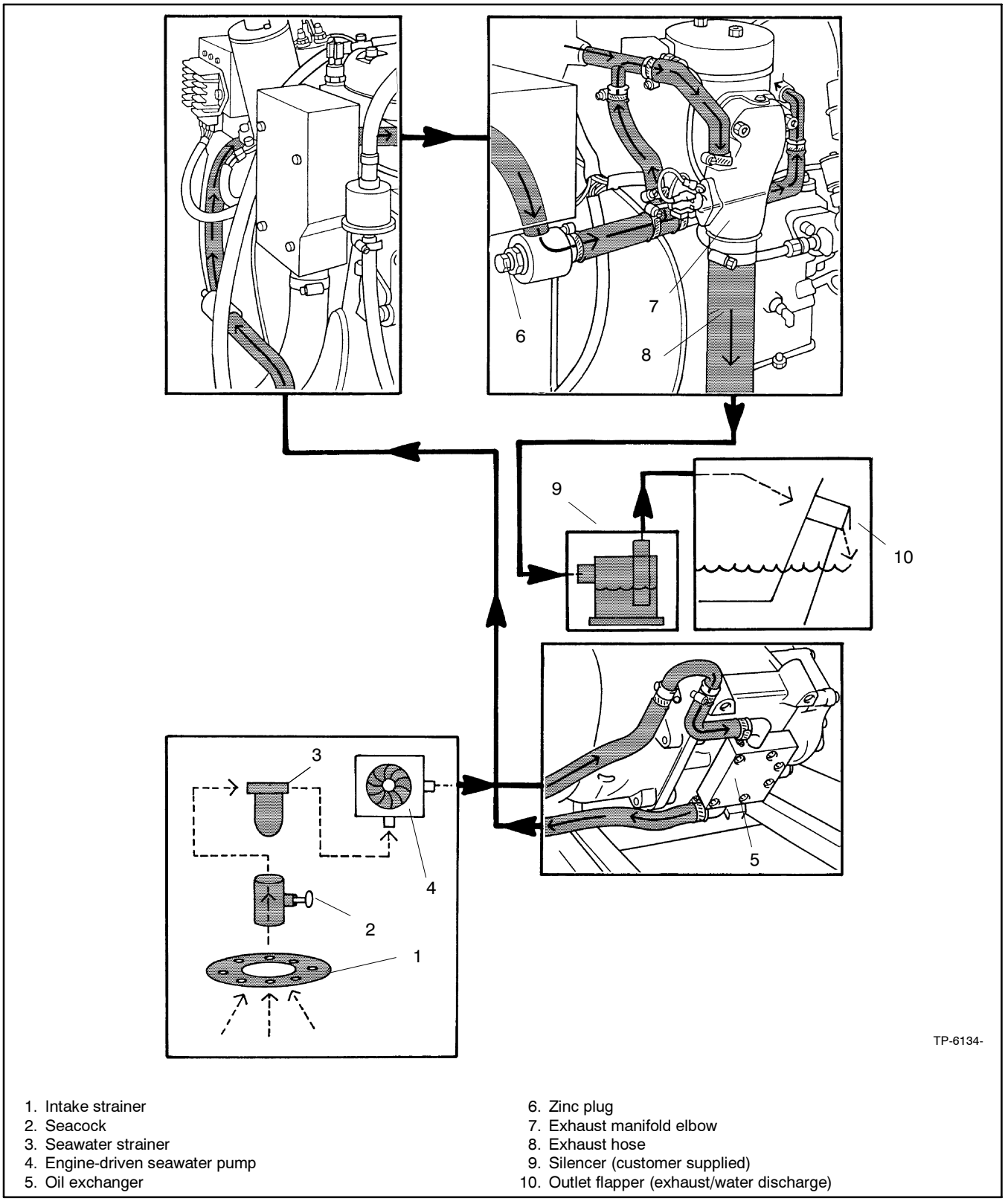
1. Engine block
2. Exhaust manifold
3. Exhaust mixer elbow
4. Outlet flapper (exhaust/water discharge)
5. Silencer (customer supplied)
6. Thermostat open
7. Thermostat
8. Thermostat closed
9. Heat exchanger
10. Engine-driven seawater pump
11. Seawater strainer
12. Seacock
13. Intake strainer
14. Engine-driven water pump

Figure 3-6 Typical Closed/Heat Exchanger Cooling System (6EOD, 4.5EFOD, 8/9/10/28/32EOZD, and 6.5/7/9/23/27EFOZD Models)



1. Oil cooler
2. Engine block
3. Thermostat
4. Water-cooled manifold
5. Heat exchanger
6. Exhaust mixer elbow
7. Water-cooled turbocharger
8. Silencer (customer-supplied)
9. Exhaust outlet
10. Intake strainer
11. Seacock
12. Seawater strainer
13. Engine-driven seawater pump
14. Engine-driven water pump

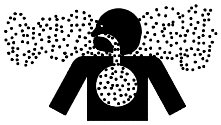
Figure 3-7 Typical Closed/Heat Exchanger Cooling System (13–24EOZD and 11–20EFOZD Models)



1. Intake strainer
2. Seacock
3. Seawater strainer
4. Engine-driven seawater pump
5. Oil exchanger
6. Zinc plug
7. Exhaust manifold elbow
8. Exhaust hose
9. Silencer (customer supplied)
10. Outlet flapper (exhaust/water discharge)

Figure 3-8 Direct Water-Cooled Cooling System (4EOZ and 3.5EFOZ Models)

⚠ WARNING



Carbon monoxide.
Can cause severe nausea, fainting, or death.

The exhaust system must be leakproof and routinely inspected.

Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death. For the safety of the craft's occupants, install a carbon monoxide detector. Never operate the generator set without a functioning carbon monoxide detector. Inspect the detector before each generator set use.

Operating the generator set. Carbon monoxide can cause severe nausea, fainting, or death. Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings.

Note: Do not use copper tubing in diesel exhaust systems. Sulfur in diesel exhaust causes rapid deterioration of copper tubing exhaust systems, resulting in exhaust/water leakage.

4.1 Types

Kohler® generator sets covered in this manual use either wet or dry exhaust systems. Dry exhaust systems are common in commercial applications. See the engine manual for specifications.

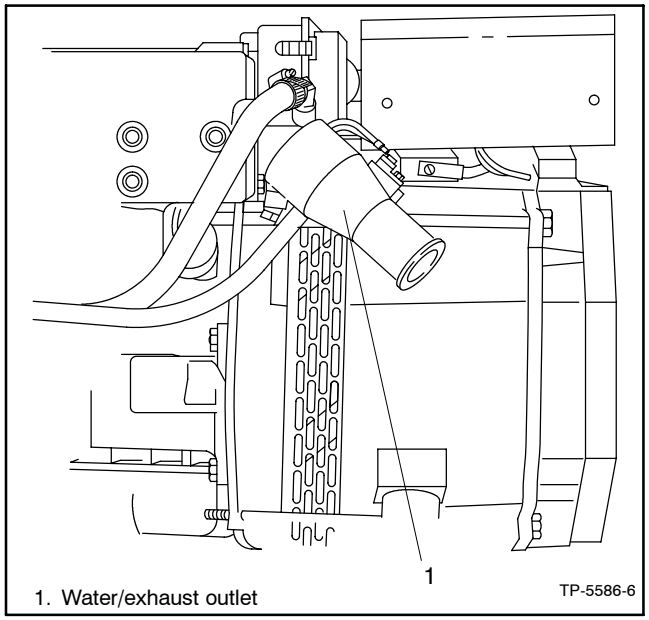
4.2 Exhaust Lines

Use water-cooled exhaust lines in all marine installations. Keep the lines as short and straight as possible. NFPA 302 Fire Protection Standard for Pleasure and Commercial Motor Craft, Clause 4-3, recommends using two corrosion-resistant hose clamps with a minimum width of 13 mm (1/2 in.) on each end of the flexible exhaust hose connections. Kohler Co. requires a downward pitch of at least 13 mm per 30.5 cm (1/2 in. per running foot). Use a flexible exhaust hose that conforms to UL Standard 1129 for the engine's wet exhaust components between the mixer elbow and the exhaust outlet.

4.3 Exhaust System Location, Mounting, and Installation

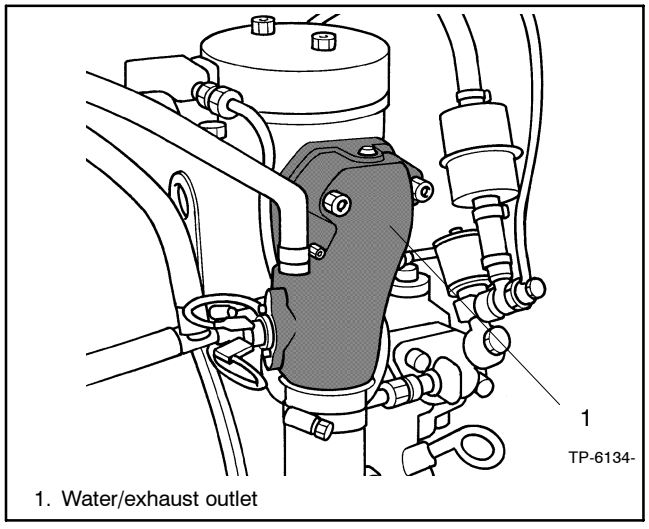
Note: Should any information regarding installation conflict with USCG Regulations, follow USCG Regulations.

Mount the silencer independently to eliminate stress on the exhaust system and the exhaust manifold/mixer elbow. See Section 7 for the mixer elbow water line hose size. See Figure 4-1 for the exhaust connection to the mixer elbow. Provide an adequate hose length from the exhaust mixer to the silencer to allow for generator set movement.



1. Water/exhaust outlet

Figure 4-1 Mixer Elbow/Exhaust Connection, Typical



1. Water/exhaust outlet

Figure 4-2 Mixer Elbow/Exhaust Connection, 4EOZ/3.5EFOZ Model Only

Locate the exhaust outlet at least 10 cm (4 in.) above the waterline when the craft is loaded to maximum capacity. Install an exhaust port with the flap at the exhaust (transom) outlet to prevent water backup in following seas or when moving astern (backward). A lift in the exhaust piping before the piping exits the craft prevents backwash. See Figure 4-4, item 1. Support the exhaust lines to prevent the formation of water pockets.

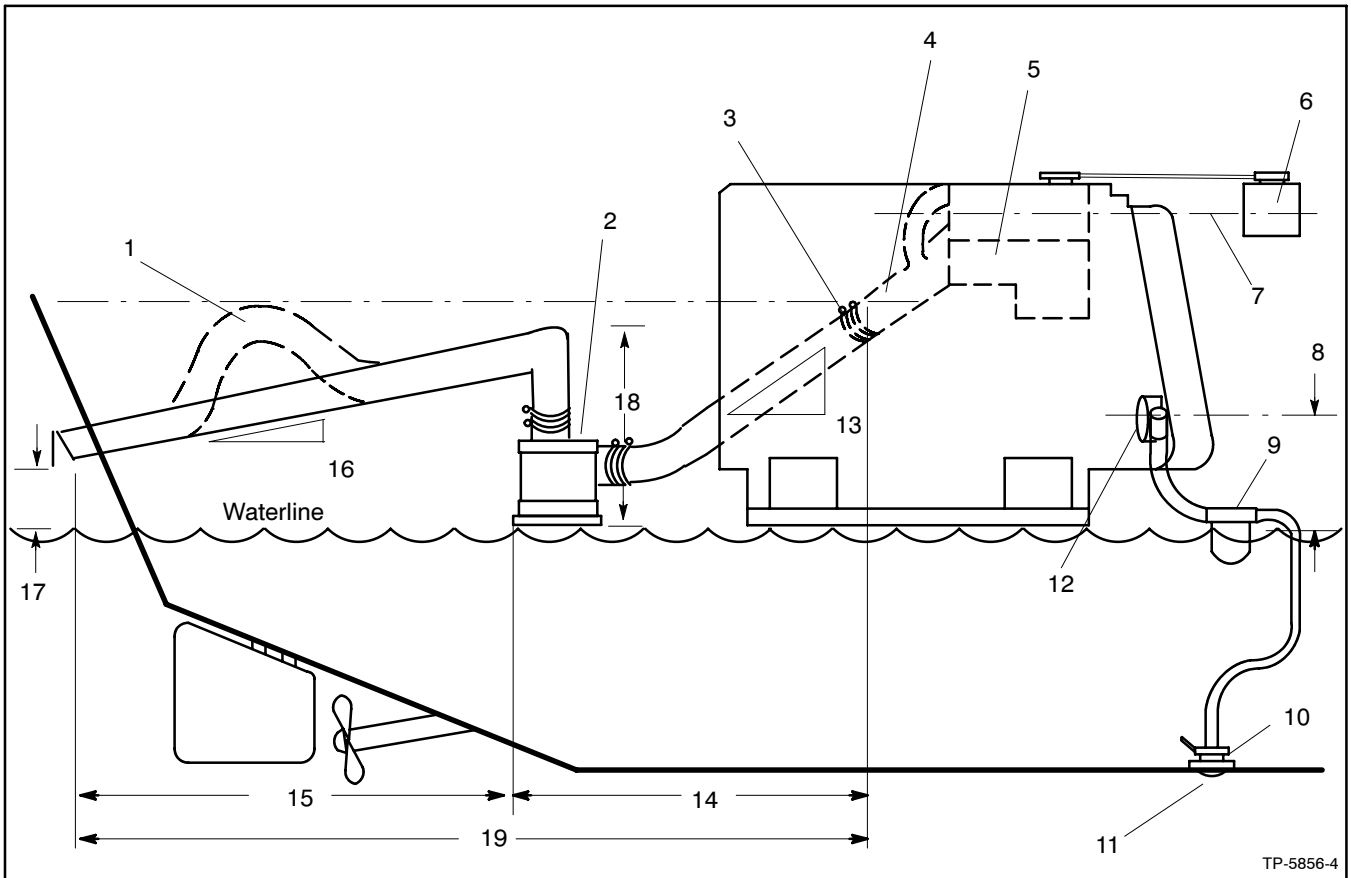
Exhaust system installation guidelines for various generator set locations follow. Information and illustrations of stern- (rear) exhaust installations also apply to side-exhaust installations. Where exhaust lines require passage through bulkheads, use port (left)- or starboard (right)- side exhaust outlets, also in applications in which long exhaust lines to the transom (rear) could cause excessive back pressure. See Figure 4-3 for allowable back pressures.

Model	Allowable Exhaust Back Pressure, ≤ kPa (mm H_2O)
4EOZ 3.5EFOZ	4.90 (500)
14/15.5EOZD 11.5/13EFOZD	9.81 (1000)
6EOD 4.5EFOD	10.14 (1034)
8/9/23/24EOZD 6.5/7/20EFOZD	11.77 (1200)
10/13/20/28/32EOZD 8.5/9/11/17/17.5/23/27EFOZD	15.30 (1560)

Figure 4-3 Allowable Exhaust Back Pressures

4.3.1 Above-Waterline Installation

Install a customer-supplied silencer with the silencer's outlet at a maximum of 3 m (10 horizontal ft.) from the center of the engine's exhaust outlet. See Figure 4-4. Mount a typical silencer with the inlet and outlet horizontal and with the drain plug down. Use an exhaust hose pitch of at least 13 mm per 30.5 cm (0.5 in. per running foot). Some silencers require two support brackets or hanger straps for installation to stringers or other suitable structure. Follow the instructions provided with the silencer. Install any lift (see Figure 4-4, item 1) in the exhaust line below the engine exhaust manifold outlet.



1. Slight lift improves silencing and prevents water backwash into the silencer (keep below the level of the exhaust manifold outlet)
2. Silencer (customer-supplied)
3. Exhaust manifold outlet
4. Exhaust mixer elbow
5. Heat exchanger (locations vary by model)
6. Coolant recovery tank (located on the unit on some models)
7. Locate the coolant recovery tank at the same height as the heat exchanger
8. Maximum seawater pump lift of 1 m (3 ft.)
9. Seawater strainer
10. Seacock
11. Intake strainer
12. Engine-driven seawater pump
13. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
14. Maximum distance between silencer and exhaust mixer elbow of 3 m (10 ft.)
15. Maximum distance between silencer and exhaust outlet of 1.5 m (5 ft.)
16. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
17. Minimum exhaust outlet distance above waterline of 10 cm (4 in.). Note: Vessel fully loaded.
18. Maximum silencer vertical lift of 1.2 m (4 ft.)
19. If the total exhaust length exceeds 4.6 m (15 ft.), Kohler recommends increasing the exhaust hose to the next larger diameter. See Figure 4-3 and Figure 4-6.

Note: Data applies to both rear- and side-exhaust installations.

Note: Use two hose clamps on each end of all flexible exhaust hose connections.

Note: Read the text for complete explanation of dimensions and other installation considerations.

Figure 4-4 Typical Above-Waterline Installation

4.3.2 Mid/Below-Waterline Installation

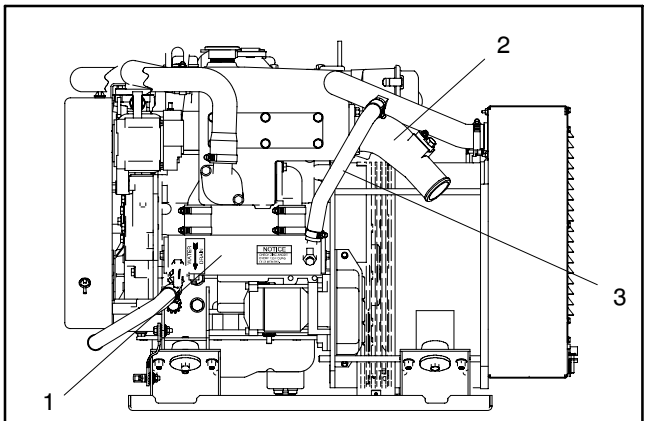
Follow USCG Regulations for installing an antisiphon provision to prevent raw water entry into the engine. Use the siphon break if the exhaust manifold outlet is located less than 23 cm (9 in.) above the waterline when the craft is loaded to maximum capacity. Install the siphon break at least 31 cm (1 ft.) above the waterline using the instructions provided with the siphon break kit.

Note: An improperly installed siphon break will cause engine damage and may void the warranty.

Install the siphon break above the highest point in the exhaust line between the heat exchanger and the exhaust mixer. See Figure 4-5 for the siphon break connection. Support the siphon break and hoses to maintain their position and function. Allow a slight offset to clear the stringers or other permanent structures. Protect the siphon break air inlet from dirt and debris.

Note: To prevent water leakage on the generator set, do not mount the siphon break directly over the generator set.

Note: Ensure that the siphon break's cap is tight before operating the generator set.



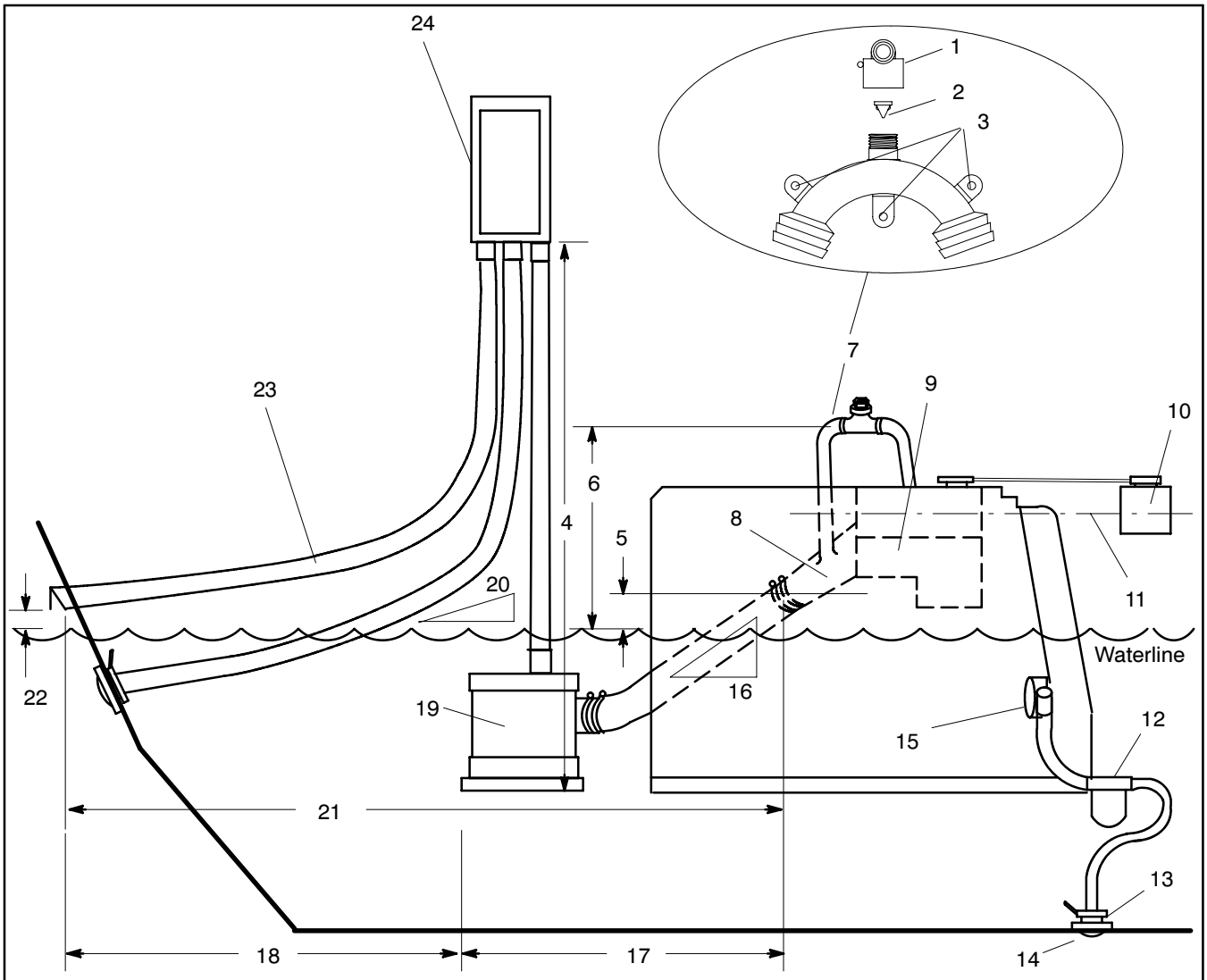
1. Heat exchanger
2. Exhaust mixer
3. Cut hose and connect siphon break and hardware

Figure 4-5 Siphon Break Connection, Typical

Mount a typical silencer's base no more than 1.2 m (4 ft.) below the highest point in the exhaust line. Attach a separate wood mounting base to the hull stringers or other suitable structures. Use the silencer manufacturer's recommendation for securing the silencer to the hull. Mount the silencer with the outlet not more than 3 m (10 horizontal ft.) from the engine's exhaust manifold outlet. Use a USCG-type certified marine exhaust hose.

Models without Sound Shield	Models with Sound Shield	Exhaust Hose Diameter mm (in.)
6EOD 4.5EFOD 8/9/10EOZD 6.5/7/9EFOZD	4EOZ 3.5EFOZ 6EOD 4.5EFOD 8/9/10EOZD 6.5/7/9EFOZD	51 (2.0)
13/14/15.5/20/23/24/28/32EOZD 11/11.5/13/17/17.5/20/23/27EFOZD	13/14/15.5/20/23/24/28/32EOZD 11/11.5/13/17/17.5/20/23/27EFOZD	76 (3.0)

Figure 4-6 Exhaust Hose Sizes



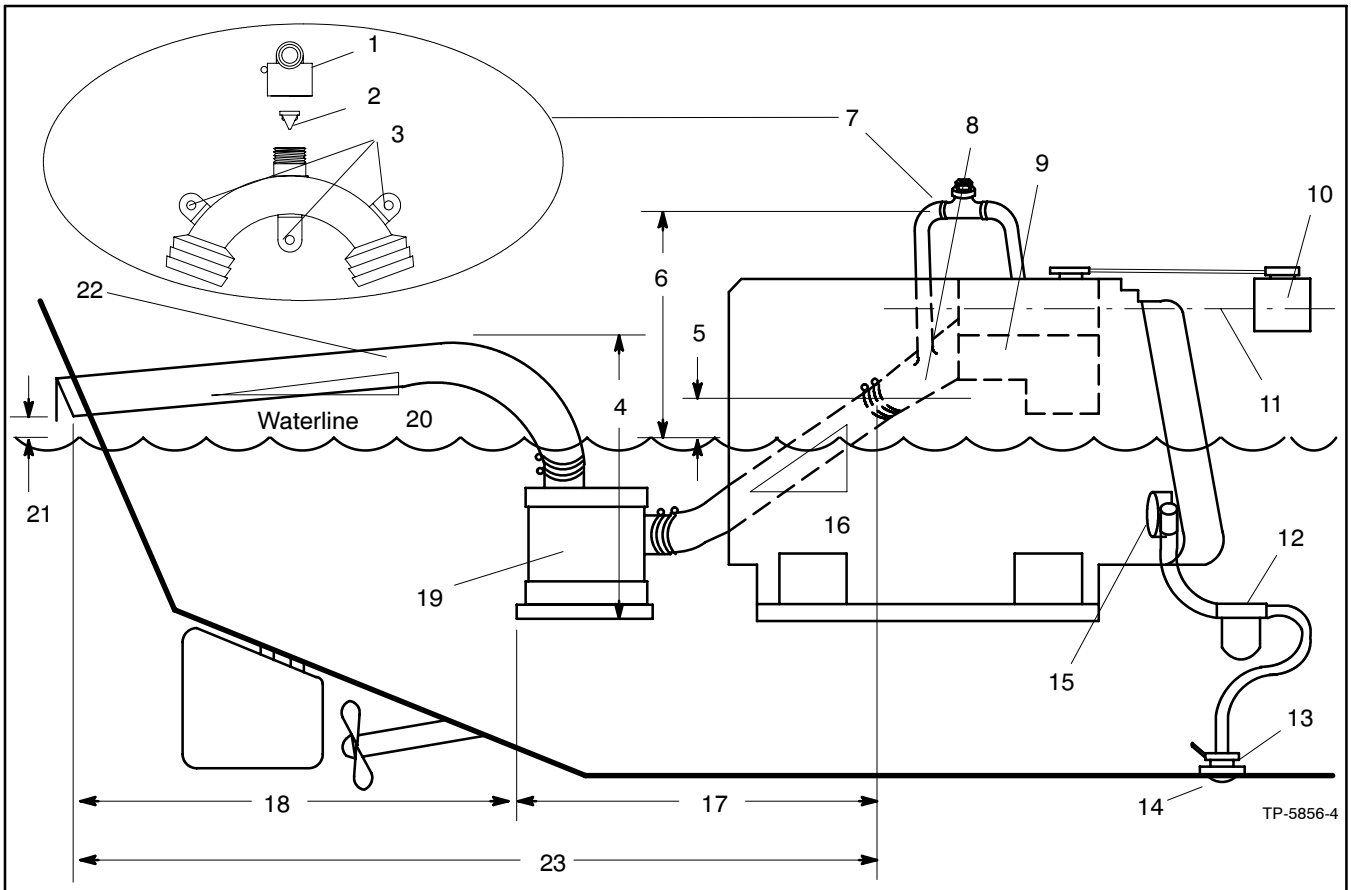
1. Cap
2. Reed valve
3. Mounting base
4. Maximum silencer vertical lift of 1.2 m (4 ft.)
5. Exhaust mixer elbow distance above waterline; if less than 23 cm (9 in.), a siphon break is required
6. Minimum siphon break distance above waterline of 30.5 cm (1 ft.)
7. Siphon break
8. Exhaust mixer elbow
9. Heat exchanger (locations vary by model)
10. Coolant recovery tank (located on the unit on some models)
11. Indicates the coolant recovery tank is at the same height as the heat exchanger
12. Seawater strainer
13. Seacock
14. Intake strainer
15. Engine-driven seawater pump
16. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
17. Maximum distance between silencer and exhaust mixer elbow of 3 m (10 ft.)
18. Maximum distance between silencer and exhaust outlet of 1.5 m (5 ft.)
19. Silencer (customer-supplied)
20. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
21. Maximum distance between exhaust outlet and generator of 4.6 m (15 ft.). If the total exhaust length exceeds 4.6 m (15 ft.), Kohler recommends increasing the exhaust hose to the next larger diameter. See Figure 4-3 and Figure 4-6.
22. Minimum exhaust outlet distance above waterline of 10 cm (4 in.)
23. Exhaust hose (see Figure 4-6 for hose sizes)
24. Gas/water separator (optional). Install directly above the canister muffler.

Note: Read the text for complete explanation of dimensions and other installation considerations.

Note: Use two hose clamps on each end of all flexible exhaust hose connections.

Note: Data applies to both rear- and side-exhaust installations.

Figure 4-7 Typical Mid- and Below-Waterline Installation with Optional Gas/Water Separator



1. Cap
2. Reed valve
3. Mounting base
4. Maximum silencer vertical lift of 1.2 m (4 ft.)
5. Exhaust mixer elbow distance above waterline; if less than 23 cm (9 in.), a siphon break is required
6. Minimum siphon break distance above waterline of 30.5 cm (1 ft.)
7. Siphon break
8. Exhaust mixer elbow
9. Heat exchanger (locations vary by model)
10. Coolant recovery tank (located on the unit on some models)
11. Indicates the coolant recovery tank is at the same height as the heat exchanger
12. Seawater strainer
13. Seacock
14. Intake strainer
15. Engine-driven seawater pump
16. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
17. Maximum distance between silencer and exhaust mixer elbow of 3 m (10 ft.)
18. Maximum distance between silencer and exhaust outlet of 1.5 m (5 ft.)
19. Silencer (customer-supplied)
20. Minimum exhaust hose pitch of 1.3 cm per 30.5 cm (0.5 in. per ft.)
21. Minimum exhaust outlet distance above waterline of 10 cm (4 in.)
22. Exhaust hose (see Figure 4-6 for hose sizes)
23. If the total exhaust length exceeds 4.6 m (15 ft.), Kohler recommends increasing the exhaust hose to the next larger diameter. See Figure 4-3 and Figure 4-6.

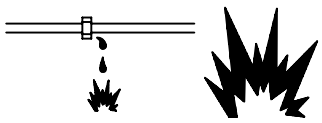
Note: Read the text for complete explanation of dimensions and other installation considerations.

Note: Use two hose clamps on each end of all flexible exhaust hose connections.

Note: Data applies to both rear- and side-exhaust installations.

Figure 4-8 Typical Mid- and Below-Waterline Installation

⚠ WARNING



Explosive fuel vapors.
Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

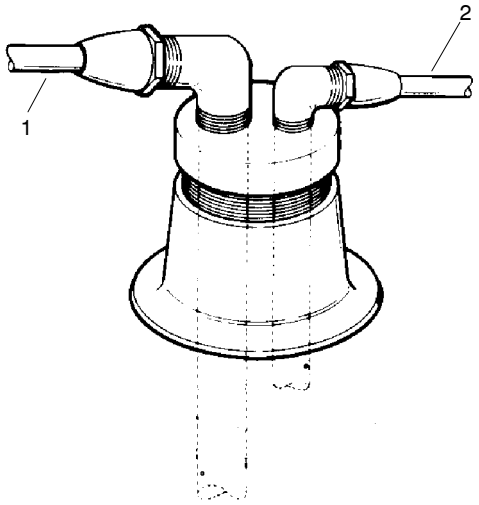
Note: Do not modify the tank or the propulsion engine fuel system. Equip the craft with a tank that allows one of the two pickup arrangements.

Note: Fuel system installations must conform to USCG Regulations.

Note: Use pipe sealant on all threaded fittings to prevent fuel leakage. Use pipe sealant that resists gasoline, grease, lubrication oil, common bilge solvents, salt deposits, and water.

5.1 Fuel Tank

Most marine generator sets draw fuel from the same fuel tank as the craft's propulsion engine(s). If the tank's fuel pickup opening allows a multiple dip tube, use a multiple dip tube arrangement. See Figure 5-1. The multiple dip tube arrangement incorporates a shorter dip tube for the generator set and a longer dip tube for the propulsion engine. With this arrangement, the generator set runs out of fuel before the propulsion engine during a low fuel supply situation. Equip the fuel system with a fuel/water separator to remove any accumulated dirt and water.



1. Fuel line to propulsion engine
2. Fuel line to generator set

Figure 5-1 Multiple Dip Tube Arrangement

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5.2 Fuel Lines

Return the generator set fuel return line to the fuel tank. Locate the fuel return line as far as practical from the fuel pickup to allow the tank fuel to cool the return fuel before delivery back to the fuel injectors. Incoming fuel cools the injectors to achieve maximum engine efficiency.

Note: Do not tee into the main propulsion engine's fuel line.

Note: Fuel Return Dip Tube (8-32EOZD/ 6.5-27EFOZD Models). Kohler Co. recommends utilizing a fuel return dip tube located below the fuel supply dip tube. This will prevent air from entering the return lines, draining the fuel injection pump, and thus causing starting failure or hard starting of the generator set. The dip tube depth should be at least as deep as the main engine fuel pick-up dip tube.

Under no circumstances should the propulsion engine and generator set share pickup or return lines (through a tee arrangement) that would allow the larger engine to starve fuel from the smaller engine. It is possible that the operation of either engine could completely drain the fuel line of the other engine and make starting difficult.

Use a flexible hose section to connect the metallic line from the fuel tank to the engine's fuel pump inlet connection point. Also, use a flexible hose section to connect the metallic line from the fuel tank to the fuel return connection point. The flexible section allows the generator set to vibrate during operation.

Model	Fuel Line ID Size mm (in.)
4EOZ and 3.5EFOZ	6.4 (1/4)
6EOD and 4.5EFOD 8-32EOZD and 6.5-27EFOZD	9.7 (3/8)

Figure 5-2 Fuel Line ID Size (Max.)

See Figure 5-2 for the ID size of the customer-supplied fuel line that connects to the fuel pump and fuel return. Route the fuel lines from the fuel tank in a gradual incline to the engine—do not exceed the height of the generator set and do not route fuel lines above the generator set. Comply with USCG Regulation 46CFR182.20 regarding fuel lines and supports.

See Section 7 for fuel feed pump inlet connection and fuel return line connection.

5.3 Fuel Filters

Conform to USCG Regulations regarding inline fuel filters or strainers.

5.4 Fuel/Water Separator (8-32EOZD/6.5-27EFOZD Models Only)

For 8-32EOZD and 6.5-27EFOZD models, install a fuel/water separator between the fuel tank and the electric fuel pump. The fuel/water separator must contain a primary filter of 30-50 micron filtration capability, sized for at least 15 gph to allow for the return fuel flow.

5.5 Fuel Pump Lift

See Figure 5-3 for fuel pump lift capabilities.

Model	Fuel Pump Lift m (ft.)
4EOZ 3.5EFOZ 8-32EOZD 6.5-27EFOZD	1.2 (4)
6EOD/4.5EFOD	0.9 (3)

Figure 5-3 Fuel Pump Lift

5.6 Fuel Consumption

Consult the current generator set specification sheets for generator set fuel consumption rates.

⚠ WARNING

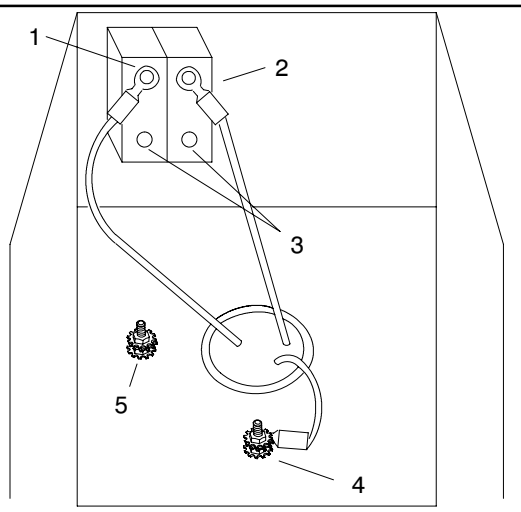
Hazardous voltage. Moving parts. Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is turned off. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

6.1 AC Voltage Connections

Make AC connections to the generator set inside the junction box. Typically, the generator set connects to a ship-to-shore transfer switch that allows the use of shore/utility power when docked or generator set power when docked or at sea. The wiring then connects to a main circuit breaker box (panel board) that distributes branch circuits throughout the craft. See Figure 6-1 for AC voltage connections to the generator set. See Section 8 for reconnection of the generator set.



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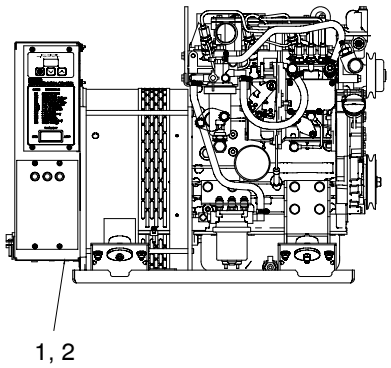
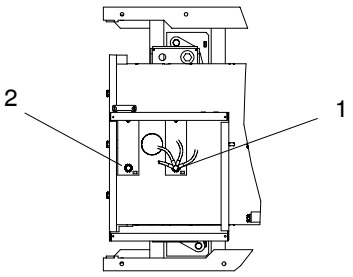
1. Line side connections from generator
2. AC circuit breaker
3. L1/L2 phase (black) leads. Load side customer connection points.
4. L0 neutral (white) lead
5. GRD ground (green) lead

Figure 6-1 AC Voltage Connections in Junction Box

6EOD and 8–24EOZD Models



Top View
(Shown with junction box cover removed)
28/32EOZD Models



1. Neutral (L0) connection
2. Ground (GRD) connection

Figure 6-2 Neutral and Ground Connections (6EOD and 8–32EOZD Models Shown)

6.2 Circuit Protection

The AC circuit breakers (optional) protect the wiring from the AC circuit breakers to the vessel's distribution panel. AC circuit breakers trip when they detect a fault in the output circuit.

After correcting the fault, reset the AC circuit breaker(s) by placing them in the ON position. Restart the unit. Do not start the unit under load. See Figure 6-3 for AC circuit breaker ratings. The unit's voltage configuration determines the circuit breaker selection.

Note: Circuit breaker ampere rating and availability are subject to change.

6.2.1 Circuit Breaker Considerations

Mounting location. Mount the circuit breakers in the generator set's junction box. See Section 6.2.2.

Note: 4EOZ and 3.5EFOZ models already have circuit breakers installed.

Sizing. Use the generator set voltage/frequency configuration to determine the circuit breaker amperage. If the generator set voltage configuration changes, change the circuit breaker to provide optimum protection.

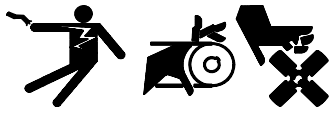
For circuit breaker application and selection information, contact an authorized distributor/dealer.

Have a qualified electrician or technician install circuit breakers and reconnect the generator set. Comply with all governing standards and codes.

Amps	Voltage	Number of Poles	Model(s)
18	480	3	8.5EFOZD, 10EOZD (3 ph.)
22	240	1	4.5EFOD
25	240	2	6EOD
30	240	1	6.5EFOZD
		2	6.5EFOZD
	480	3	10EOZD (3 ph.)
	600	3	11.5EFOZD, 14EOZD, 17.5EFOZD, 20EOZD (3 ph.)
33	240	2	7EFOZD, 8EOZD
35	240	1	7EFOZD
		2	8EOZD
	480	3	10EOZD (3 ph.)
40	600	3	11.5EFOZD, 17.5EFOZD, 20EFOZD, 23EFOZD, 24EOZD (3 ph.)
42	240	1	9EFOZD
		2	9EOZD, 9EFOZD, 10EOZD
50	240	1	11EFOZD
		2	11EFOZD
	480	3	11.5EFOZD, 14EOZD (3 ph.)
	600	3	23EFOZD, 27EFOZD, 28EOZD, 32EOZD (3 ph.)
55	240	1	6EOD
60	240	1	13EFOZD
		2	13EOZD, 13EFOZD
	600	3	17.5EFOZD, 20EOZD, 27EFOZD (3 ph.)
70	240	1	8EOZD
		2	15.5EOZD
	600	3	17.5EFOZD, 20EOZD, 20EFOZD (3 ph.)
80	240	1	9EOZD, 17EFOZD (1 ph.)
		2	17EFOZD (1 ph.)
	480	3	20EFOZD, 23EFOZD, 24EOZD (3 ph.)
85	240	1	10EOZD
90	240	1	20EFOZD (1 ph.)
		2	20EOZD (1 ph.), 20EFOZD (1 ph.)
	480	3	23EFOZD, 24EOZD, 27EFOZD, 28EOZD (3 ph.)
100	240	2	23EOZD (1 ph.), 23EFOZD (1 ph.)
	480	3	27EFOZD, 28EOZD, 32EOZD (3 ph.)
125	600	2	27EFOZD (1 & 3 ph.), 28EOZD (1 ph.)
		3	27EFOZD (3 ph.), 32EOZD (3 ph.)
150	600	2	32EOZD (1 ph.)

Figure 6-3 AC Circuit Breaker Ratings, Listed By Amps

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is turned off. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

6.2.2 Circuit Breaker Installation

Note: 4EOZ and 3.5EFOZ models already have circuit breakers installed.

1. Place the generator set master switch in the OFF position.
2. Disconnect the generator set engine starting battery, negative (-) lead first.
3. Remove the screws and remove the access cover.
4. Remove the screws and nuts to remove the circuit breaker cover plate. Save the mounting hardware.
5. Install the circuit breaker from the inside of the cutout panel and mount it using existing screws removed in step 4. Position the circuit breaker with the ON in the normal upright position or to the left side. Cover the cutout opening, if applicable, with the circuit breaker cover plate. Use existing screws to mount the cover plate. See Figure 6-4.
6. See Section 8 for voltage reconnection.

   Note: Kohler® marine diesel generator sets are fully frequency adjustable and voltage reconnectable. To determine reconnection options, check the model's specification sheet.

7. Install insulation boots over stator lead terminals if the kit includes insulation boots.

   Note: See Section 8 for wiring instructions.

8. Make the recommended connections for the following four reconnection systems using circuit breakers:

   Two-pole circuit breaker with a single-voltage system (example: 120-volt, 3-wire). Attach stator leads marked 2 and 4 to the side of the circuit breaker marked LINE. Install the jumper lead across the LINE side of circuit breaker terminals (see Section 8). Attach stator leads 1 and 3 to L0.

   Single-pole circuit breaker with a 120-volt, 2-wire, single-voltage system. Attach stator leads marked 2 and 4 to the side of the circuit breaker marked LINE (see Section 8). Attach stator leads 1 and 3 to L0.

   Two-pole circuit breaker with a dual-voltage system (example: 120/240-volt, 3-wire). Attach stator leads marked 1 and 4 to the side of the circuit breaker marked LINE. Do not use a jumper lead (see Section 8). Attach stator leads 2 and 3 to L0.

   EOZ/EFOZ Models Only:
   Single-pole circuit breaker with a 240-volt, 2-wire, single-voltage system. Attach the stator lead marked 2 to the side of the circuit breaker marked LINE (see Section 8). Bolt together leads 1 and 4 and tape to insulate from ground. Attach the stator lead marked 3 to L0.

   EOD/EFOD and EOZD/EFOZD Models Only (with ADC 2100):
   Single-pole circuit breaker with a 240-volt, 2-wire, single-voltage system. Attach the stator lead marked 1 to the side of the circuit breaker marked LINE (see Section 8). Bolt together leads 2 and 3 and tape to insulate from ground. Attach the stator lead marked 4 to L0.

9. Connect the stator lead(s) used for neutral connection to the L0 stud. See the illustrations in Section 8.

10. Connect the side of the circuit breaker marked LOAD to the ship-to-shore switch or craft wiring. Attach insulation boots to the black leads if the kit includes insulation boots. With a single-pole circuit breaker use one black lead (L1). With a two-pole circuit breaker use two black leads, L1 and L2. Connect the neutral (white) lead to the L0 stud. Connect the equipment ground (green) lead to GRD stud.

    Note: Wire material. Use stranded copper for all wiring. Use wire gauges and insulation, conductor temperature ratings, sheath stripping, conductor support and protection, conductor terminals and splices, and overcurrent protection (circuit breakers, fuses) that conform to standards and codes.

    Note: Follow USCG Regulations CFR33, Part 183 (Pleasurecraft) and CFR46 (Commercial Craft) for marine applications.

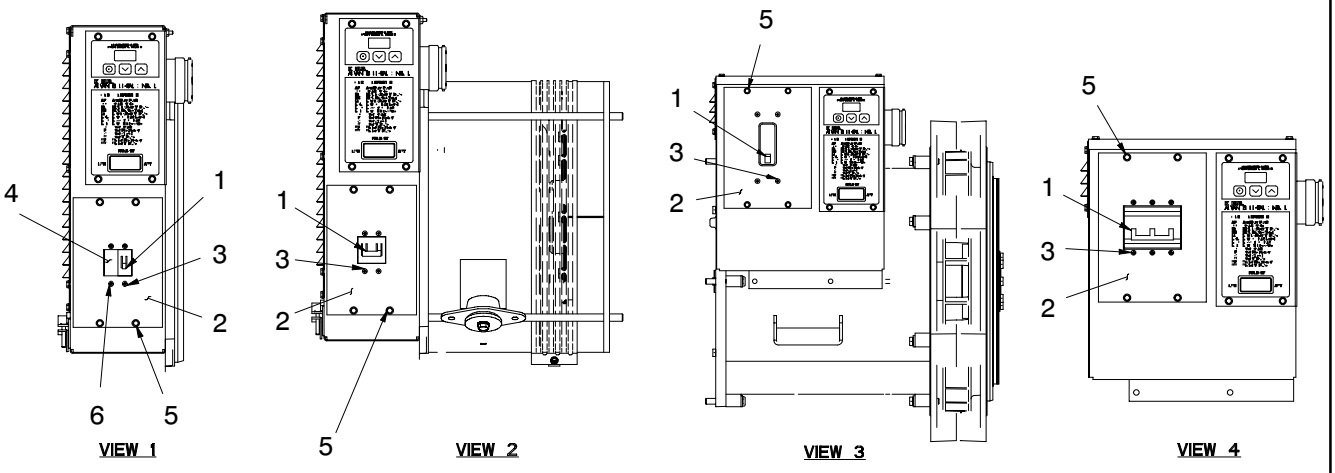
    Note: Wire protection. Use plastic bushings, rubber grommets, and/or cable ties as necessary to protect and secure wiring from sharp objects, the exhaust system, and any moving parts.

11. Replace the controller cover or circuit breaker box access panel.

12. Reconnect the generator set engine starting battery, negative (–) lead last.

13. Make voltage or frequency adjustments according to Section 8.

    Note: Voltage/frequency adjustable. Some four-lead generator sets are not voltage/frequency adjustable. To determine adjustment possibilities, check the model's specification sheet or service manual. If you are reconnecting the generator set from a single-voltage to a dual-voltage configuration (example: from 120-volt to 120/240-volt) or a dual voltage to a single voltage (example: from 120/240-volt to 120-volt) with the same primary voltage, do not adjust the voltage/frequency adjustment. Adjust the voltage/frequency for frequency changes or setting changes of the primary voltage (example: from 120-volt to 100-volt). Refer to the model's specification sheet for reconnection capability.



1. Circuit breaker
2. Circuit breaker plate
3. Circuit breaker mounting hardware
4. Cover plate
5. Use existing hardware
6. Screw (qty. 2) and nut (qty. 2)

Figure 6-4 Circuit Breaker Mounting (8–32EOZD and 6.5–27EFOZD Models)

6.3 Installation In Steel or Aluminum Vessels

Installation of a generator set in a vessel constructed of a material capable of conducting current (e.g., steel or aluminum) is subject to considerations not normally encountered in fiberglass or wood vessels. These differences include equipment grounding, grounding of neutral conductors, ground-fault protection, and isolation of galvanic currents.

Note: Isolated ground kits are available as options for steel- or aluminum-hulled vessels. Consult your local dealer/distributor for more information.

The scope of these topics is too extensive to be fully discussed here. Consult your local marine authority for more information.

Before installing the generator set, check the available wiring diagrams in the operation manual to become familiar with the electrical system.

6.4 Installation Regulations

The U.S. Coast Guard governs generator set installation in U.S. pleasurecraft and commercial vessels. Refer to the applicable regulations below:

U.S. Pleasurecraft Installation Regulations

Title 33CFR, Chapter I, U.S. Coast Guard, Part 183

1. Subpart I—Electrical Equipment
2. Subpart J—Fuel Systems

U.S. Commercial Vessel Installation Regulations

Title 46CFR, Chapter I, U.S. Coast Guard

1. Part 111—Electrical Systems
2. Part 182—Machinery Installation

m:sc:001:001

6.5 Battery

Batteries and their installation must conform to USCG Regulations 183.420 (a) through (g). Provide generator sets with batteries separate from the propulsion engine's whenever possible. The starting/charging systems of both the generator set and the engine must have a common negative (-) ground.

USCG Regulation 183.415, Grounding, requires connection of a common conductor to each grounded cranking-motor circuit. Size the conductor to match the larger of the engine's two battery cables. Figure 6-5 lists recommended minimum cable sizes for generator set battery connections at various generator set-to-battery distances. Connecting a common conductor to each grounded cranking motor circuit prevents the starting motor current from using alternative electrical paths should the cranking motor ground circuit be restricted or open because of oxidation or loose hardware. Alternative electrical paths include metallic fuel lines that can pose a hazard. See Section 7 for locations of the battery connections to the generator set.

	Required Battery Cable (Minimum)			
Distance (from battery to generator set)	2.5 m (8.3 ft.)		5 m (16.4 ft.)	
Battery Voltage	12V	24V	12V	24V
4EOZ/3.5EFOZ	# 4	----	# 2	----
8-9EOZD/6.5-7EFOZD 6EOD/4.5EFOD	# 2	----	# 1	----
10-24EOZD/9-20EFOZD	# 2	# 4	# 1/0	# 2
28-32EOZD/23-27EFOZD	# 2	# 4	# 1/0	# 2

Figure 6-5 Battery Cable Sizing Recommendations

Kohler Co. recommends using one 12-volt battery (or two for 24-volt systems, as the spec requires) to start the generator. See Figure 6-6 for minimum cold cranking amps (CCA) recommendations.

12-Volt Starting Battery Size CCA at -18°C (0°F) or 100 Amp. Hr.	
Models	**CCA**
4EOZ, 3.5EFOZ, 6EOD/4.5EFOD, 8-15.5EOZD, and 6.5-13EFOZD	500
20/23/24EOZD, and 17/17.5/20EFOZD	650
28/32EOZD, 23/27EFOZD	800

Figure 6-6 Battery Recommendations

6.6 Wiring

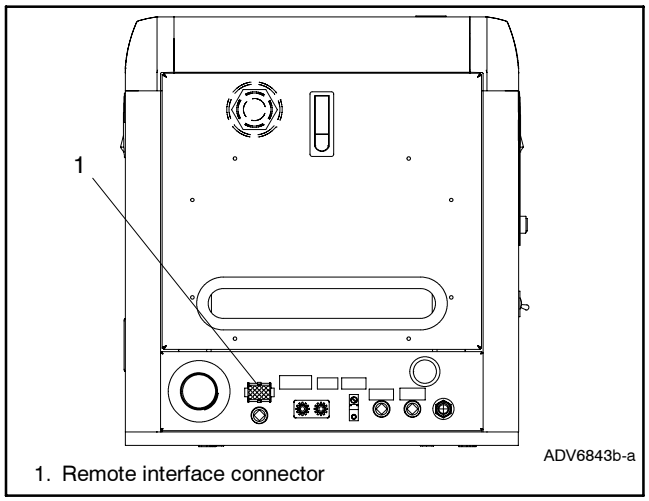
Use only stranded copper wire. Conform to USCG Regulations 183.425 through 183.460 for wire gauges and insulation, conductor temperature ratings, sheath stripping, conductor support and protection, conductor terminals and splices, and over-current protection (circuit breakers, fuses). Use rubber grommets and cable ties as necessary to protect and secure the wire from sharp objects, the exhaust system, and moving parts.

6.7 Remote Connection

Kohler Co. offers several remote panels for connection to the generator set. Contact your local Kohler® distributor/dealer for detailed descriptions. See Figure 6-7 for the location of the remote start panel connection to the generator set controller. Kohler Co. also offers wiring harnesses in various lengths with a connector keyed to the controller box connector. A “pigtail” harness is also offered which includes the appropriate connector on one end and has pigtails that the installer can use to connect to a customer-supplied start/stop switch or separate lights and hourmeter. Consult wiring diagrams, ADVs, and instruction sheets for connection information/details.

4EOZ/3.5EFOZ Models: See Figure 7-3 for the optional remote panel wiring.

6EOD, 4.5EFOD, 8–32EOZD and 6.5–27EFOZD Models. These models use a 12-pin connector for the remote interface connection. See Figure 6-7 for the connector’s location. See Figure 6-8 for the correct customer-supplied plug and pin part numbers.



1. Remote interface connector

Figure 6-7 Remote Interface Connector, EOD/EFOD and EOZD/EFOZD Models, Typical (Shown on Sound-Shielded Units)

Component	Amp Part No.	Kohler Part No.
Plug	350735-1	229998
Pin	350218-6	241618
Cable Seal	794280-1	GM29252
Interface Seal	794279-1	GM29507
Cavity Plug	770377-1	GM28769

Figure 6-8 Connector Components (EOD/EFOD and EOZD/EFOZD Models)

Note: Gauge senders. Gauge senders are available for most generator sets. If using customer-supplied gauges, be sure they are compatible with generator set senders. Contact an authorized Kohler® service distributor/dealer. Gauges and senders are available as service items from an authorized Kohler® service distributor/dealer.

Notes

Section 7 Installation Drawings

Use the drawings in this section for installation purposes. Consult the supplier and verify that the drawings are the most current for your specifications. Installation drawings show exhaust outlet locations, fuel inlet and return connections, siphon break locations, and battery connections. See Figure 7-1 for installation drawing identification.

Model No.	Drawing	Page
4EOZ and 3.5EFOZ	ADV-6652A-C	36
with remote options	ADV-6652B-C	37
6EOD and 4.5EFOD	ADV-7093A-D	38
with sound shield	ADV-7093B-D	39
8EOZD and 6.5EFOZD	ADV-6843A-D	40
with sound shield	ADV-6843B-D	41
with keel cooling	ADV-6843C-D	42
9EOZD and 7EFOZD	ADV-6967A-A	43
with sound shield	ADV-6967B-A	44
with keel cooling	ADV-6967C-A	45
10EOZD and 8.5/9EFOZD	ADV-6847A-E	46
with sound shield	ADV-6847B-E	47
with keel cooling	ADV-6847C-E	48
13EOZD and 11EFOZD	ADV-6896A-B	49
with sound shield	ADV-6896B-B	50
with keel cooling	ADV-6896C-B	51
14/15.5EOZD and 11.5/13EFOZD	ADV-6897A-B	52
with sound shield	ADV-6897B-B	53
with keel cooling	ADV-6897C-B	54
20EOZD and 17/17.5EFOZD	ADV-6898A-B	55
with sound shield	ADV-6898B-B	56
with keel cooling	ADV-6898C-B	57
23/24EOZD and 20EFOZD	ADV-6899A-B	58
with sound shield	ADV-6899B-B	59
with keel cooling	ADV-6899C-B	60
28/32EOZD and 23/27EFOZD	ADV-6900A-D	61
with sound shield	ADV-6900B-D	62
with keel cooling	ADV-6900C-D	63
with electric clutch	ADV-6900D-D	64

Figure 7-1 Installation Drawings (3.5–32 kW Models)

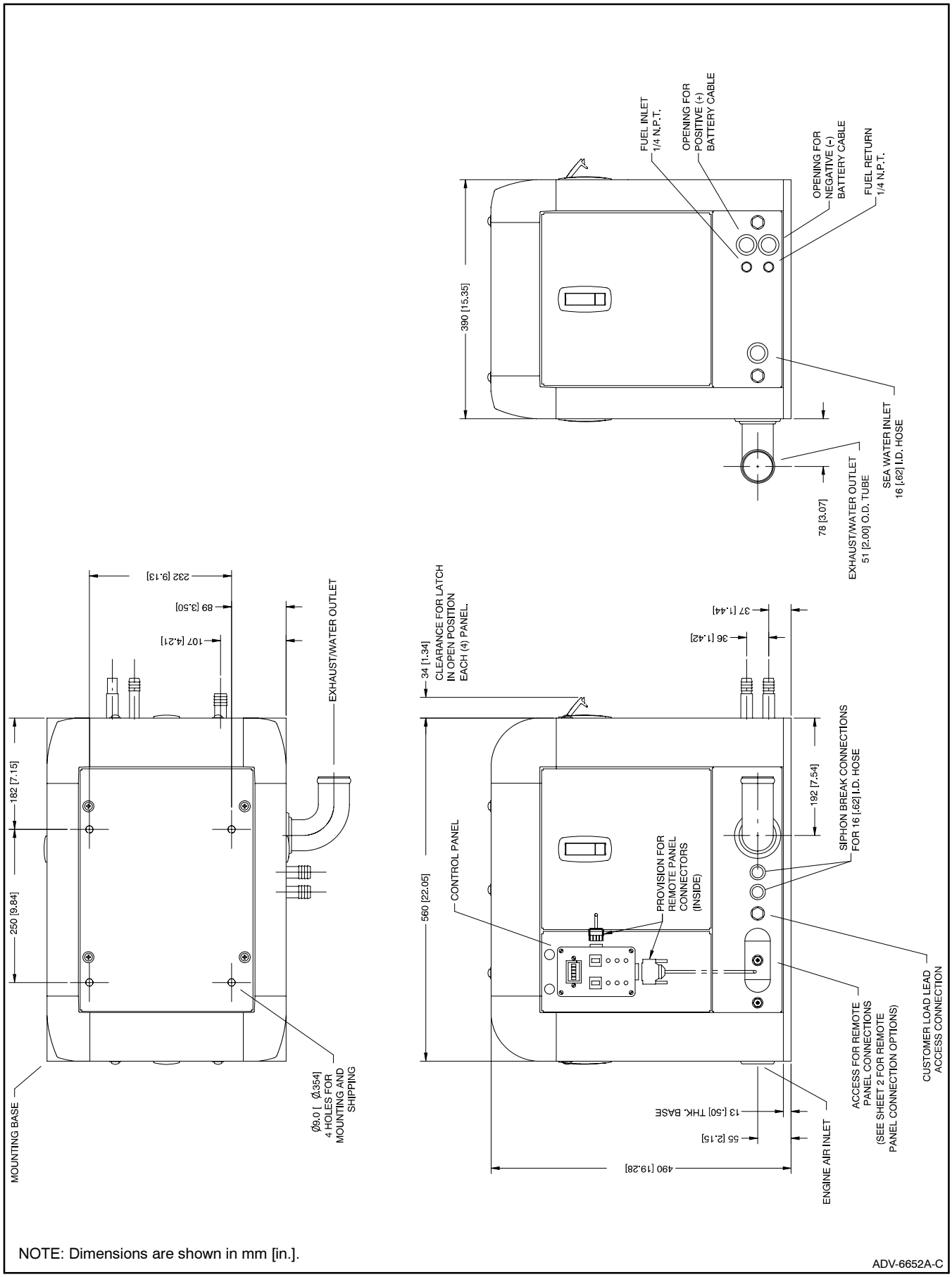
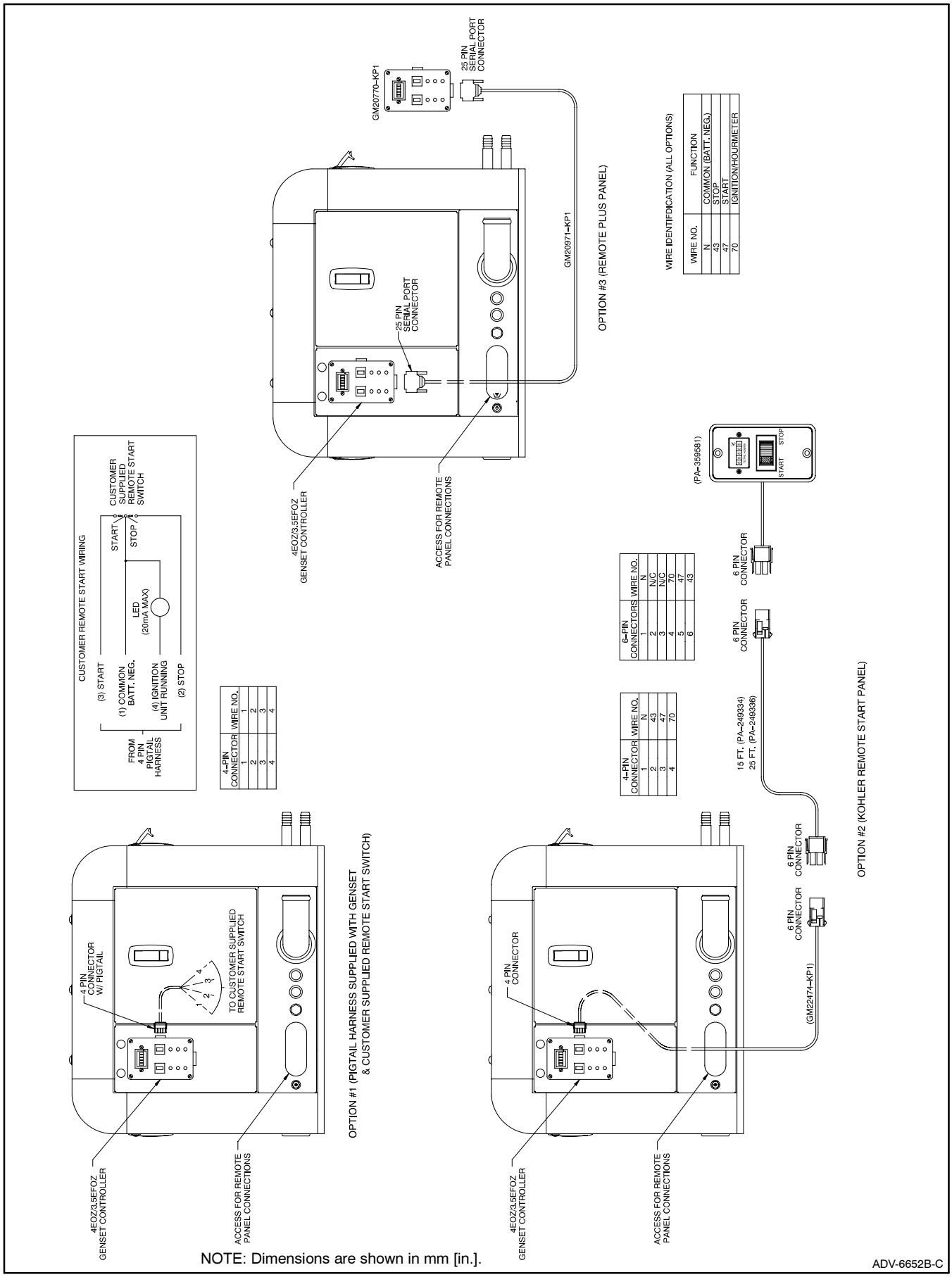


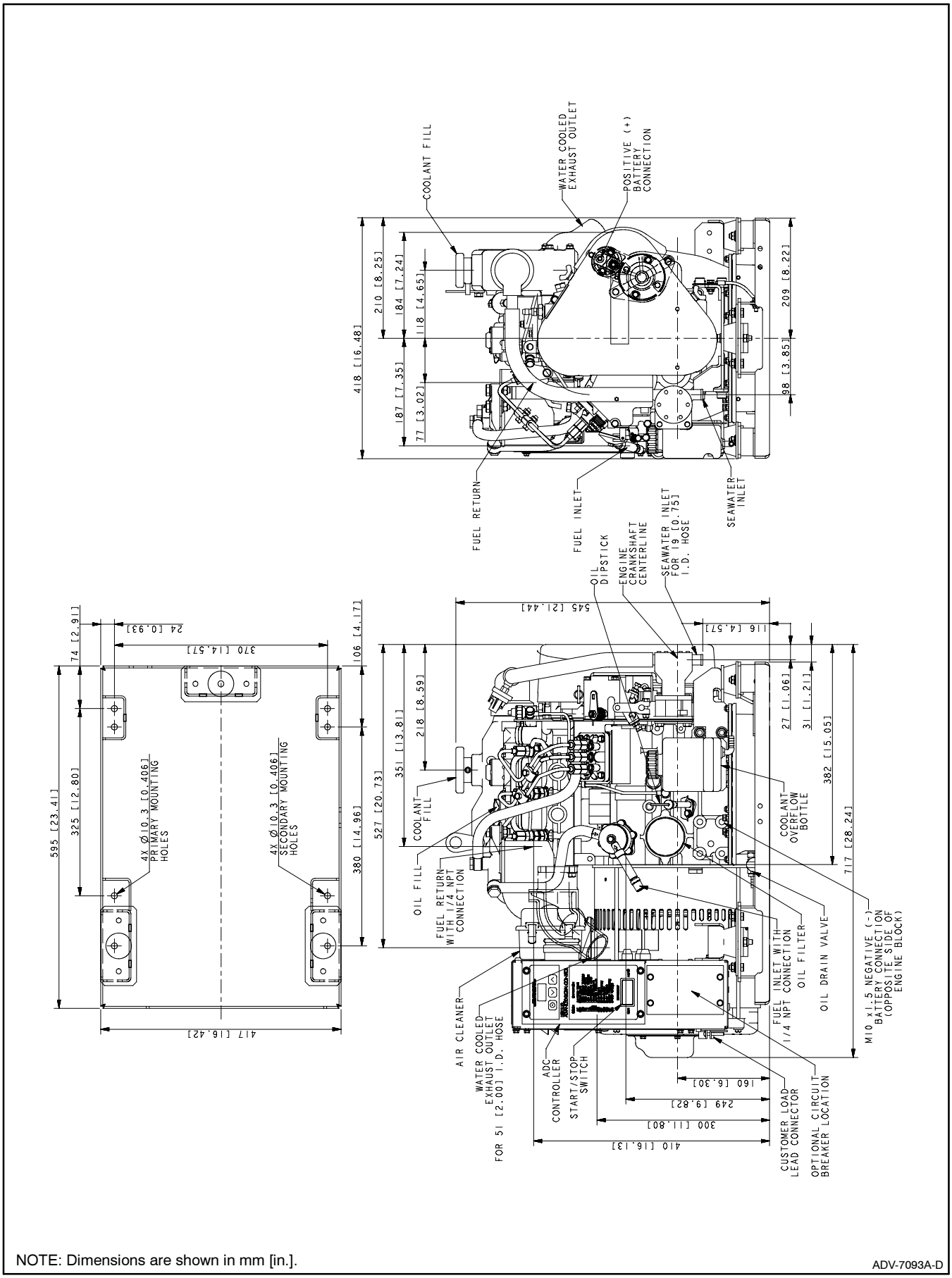
Figure 7-2 Dimension Drawing, 4EOZ/3.5EFOZ



NOTE: Dimensions are shown in mm [in.].

ADV-6652B-C

Figure 7-3 Remote Options, 4EOZ/3.5EFOZ



NOTE: Dimensions are shown in mm [in.].

ADV-7093A-D

Figure 7-4 Dimension Drawing, 6EOD/4.5EFOD

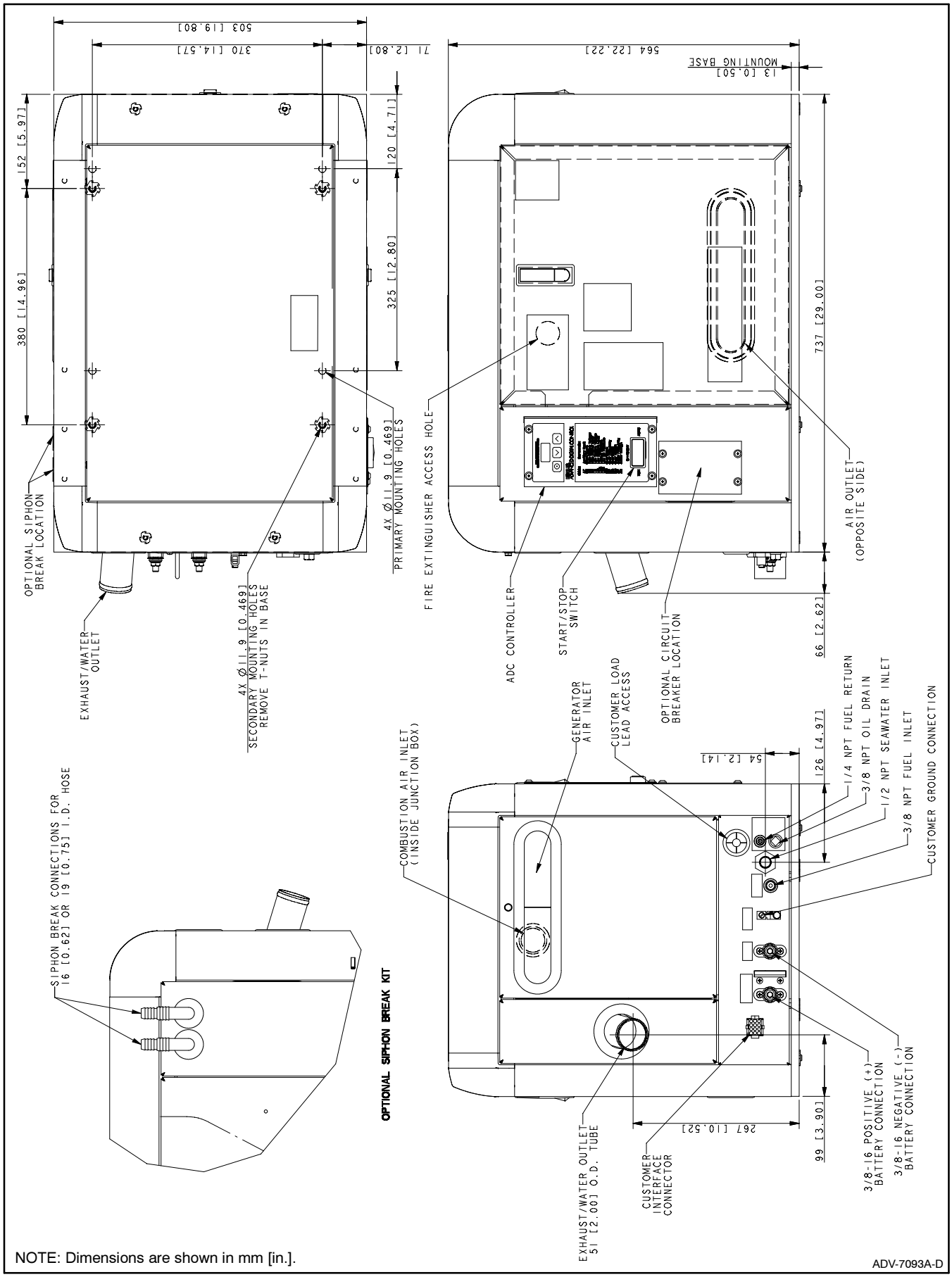


Figure 7-5 Dimension Drawing, 6EOD/4.5EFOD with Sound Shield

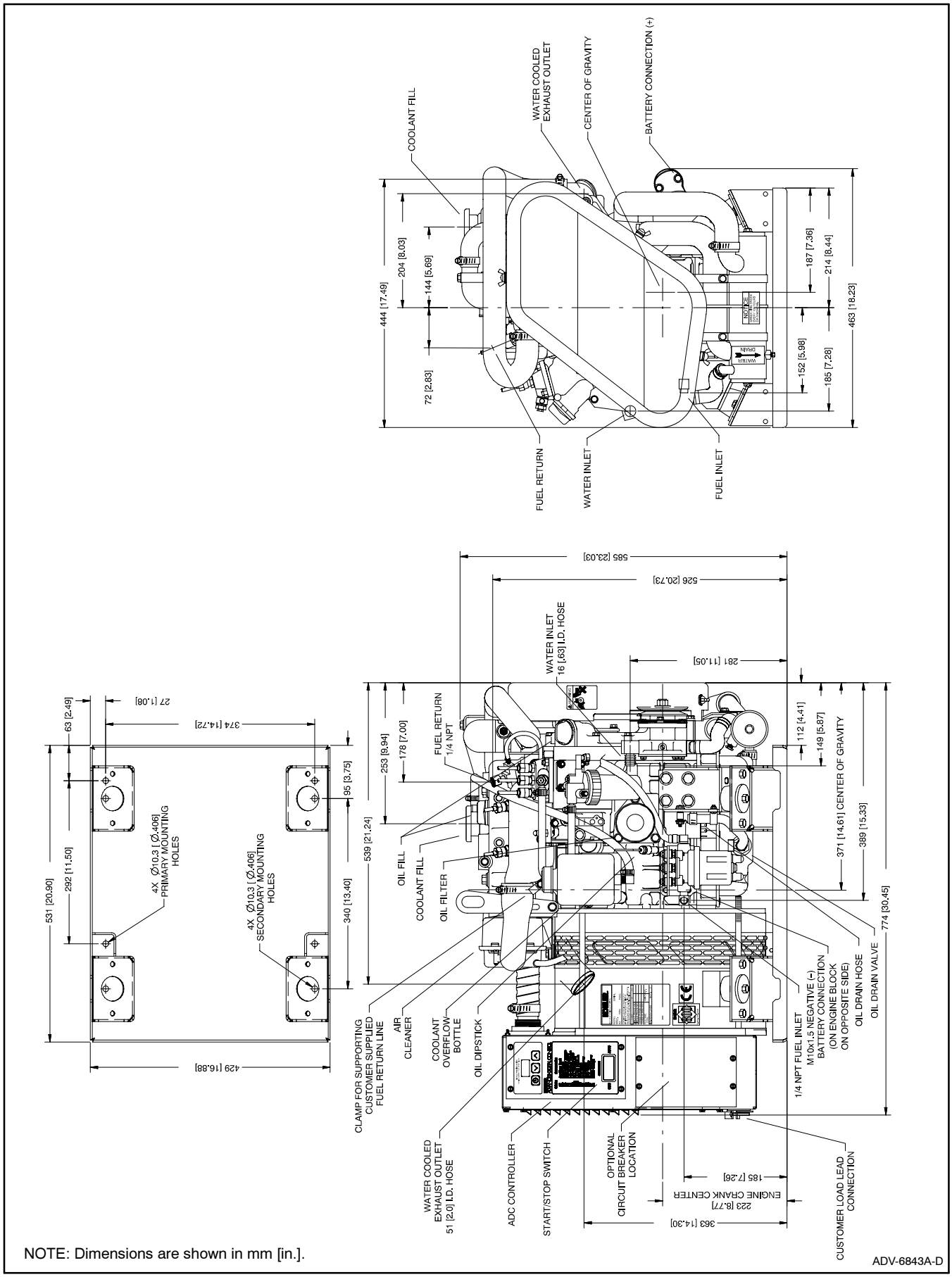


Figure 7-6 Dimension Drawing, 8EOZD and 6.5EFOZD

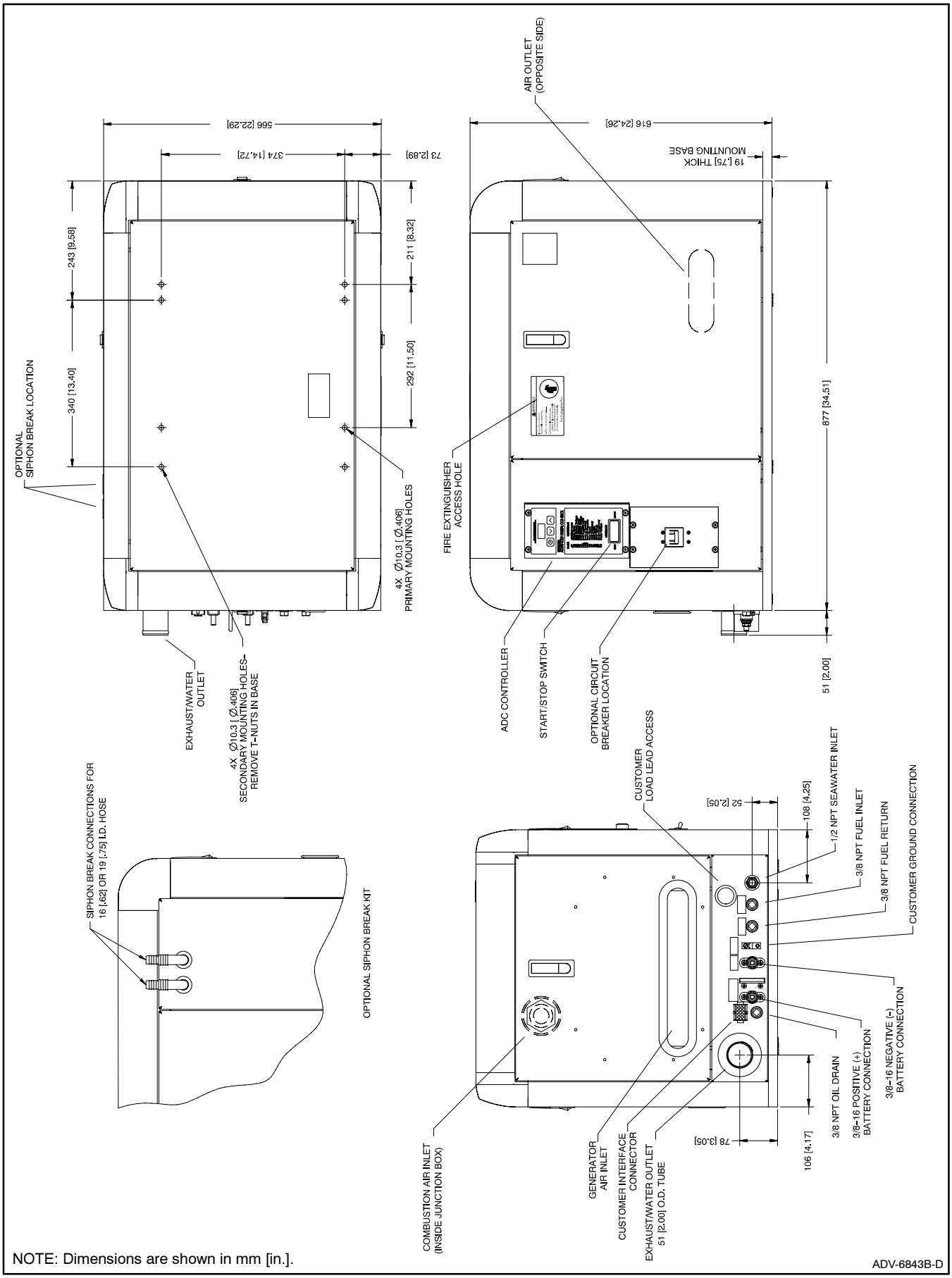
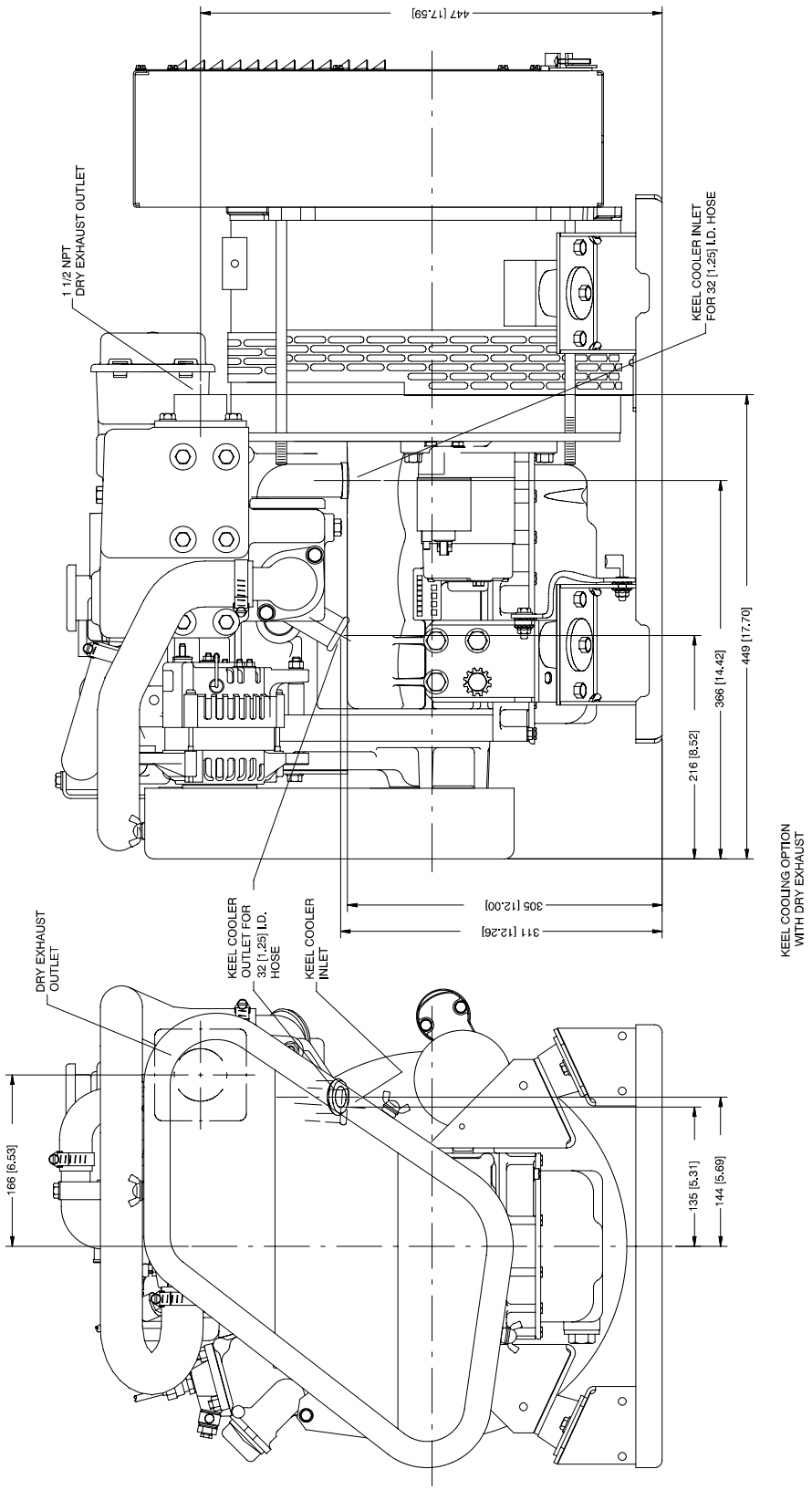


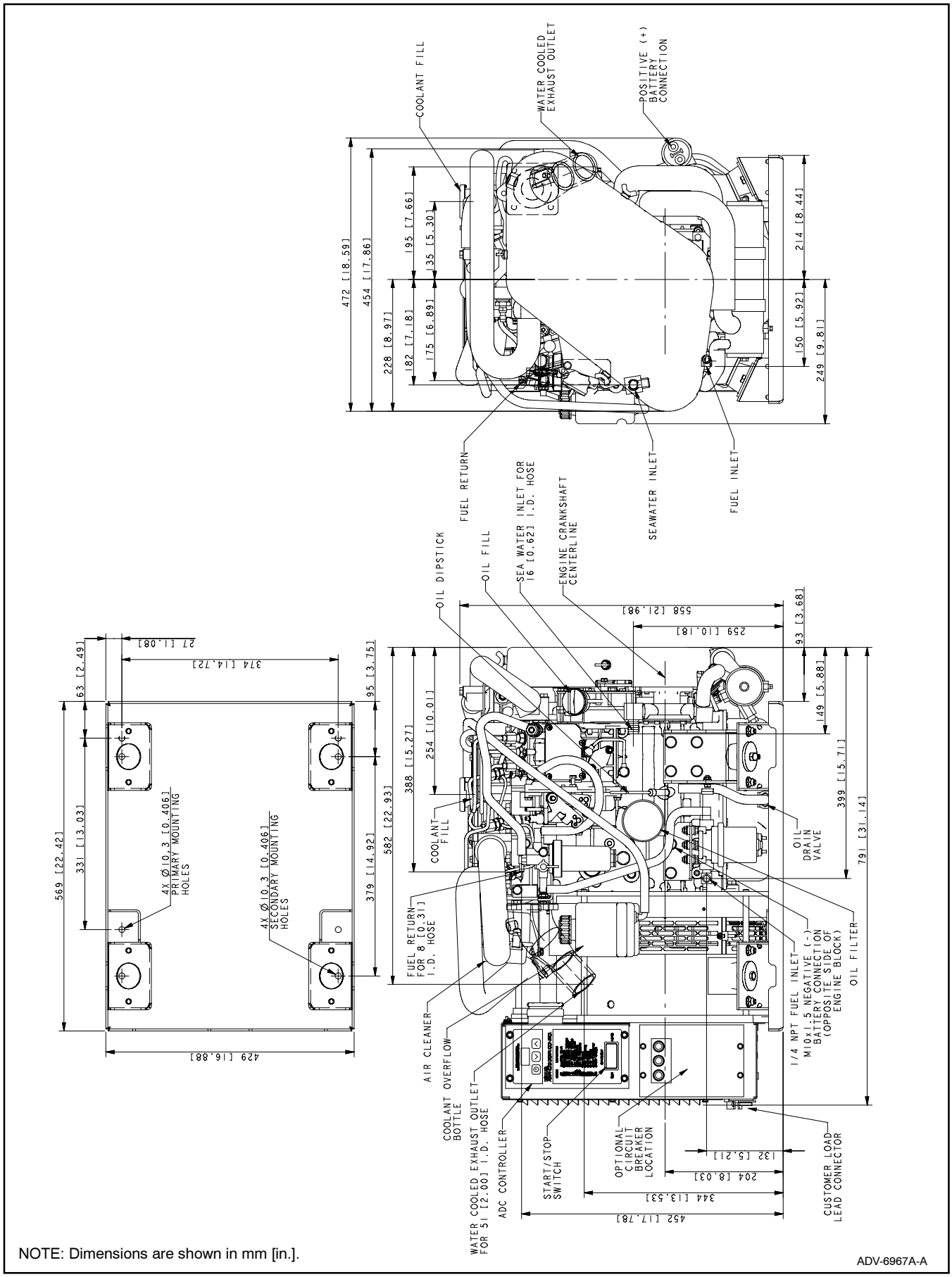
Figure 7-7 Dimension Drawing, 8EOZD and 6.5EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6843C-D

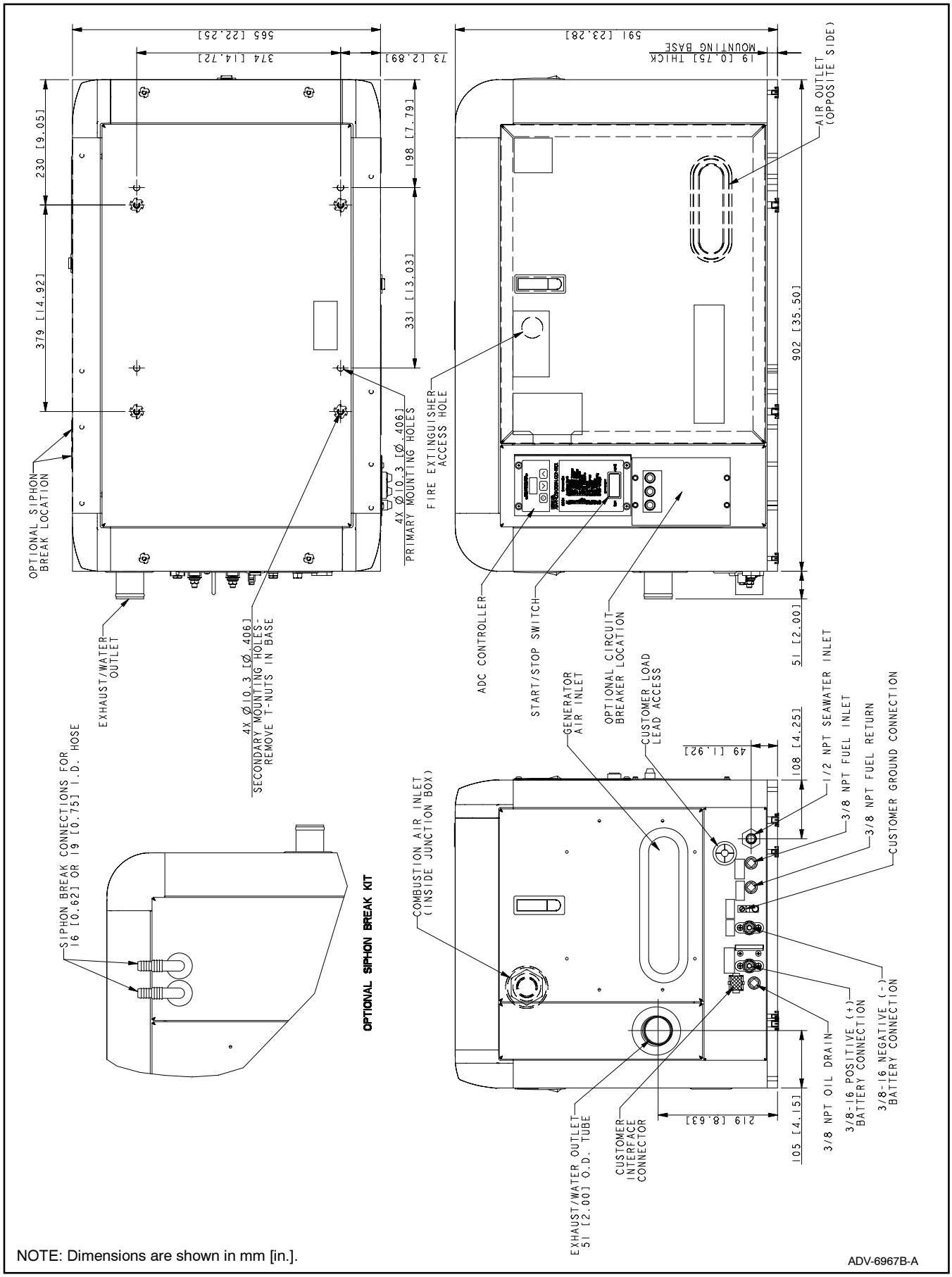
Figure 7-8 Dimension Drawing, 8EOZD and 6.5EFOZD with Keel Cooling



NOTE: Dimensions are shown in mm [in.].

ADV-6967A-A

Figure 7-9 Dimension Drawing, 9EOZD and 7EFOZD



NOTE: Dimensions are shown in mm [in.].

ADV-6967B-A

Figure 7-10 Dimension Drawing, 9EOZD and 7EFOZD with Sound Shield

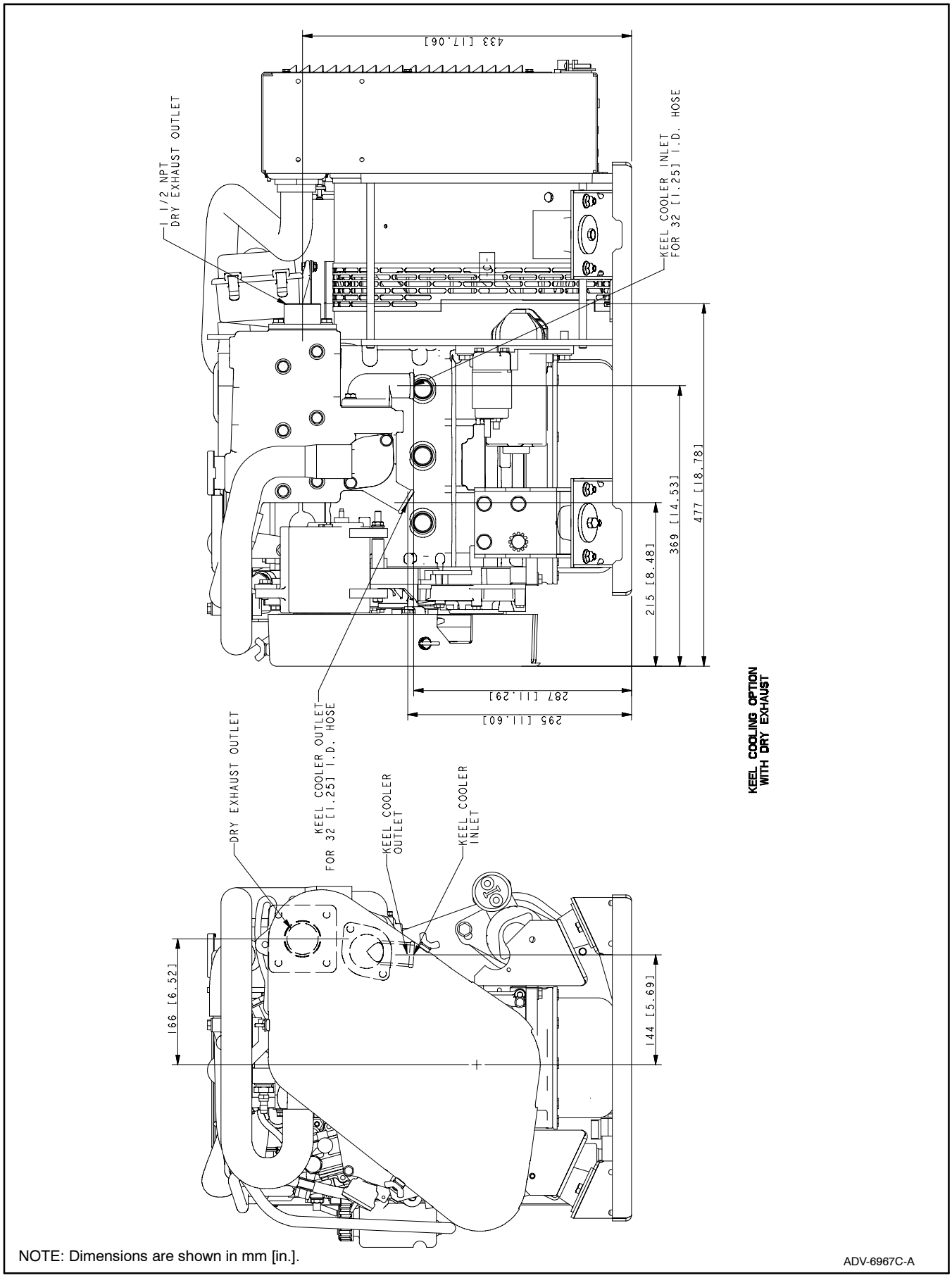


Figure 7-11 Dimension Drawing, 9EOZD and 7EFOZD with Keel Cooling

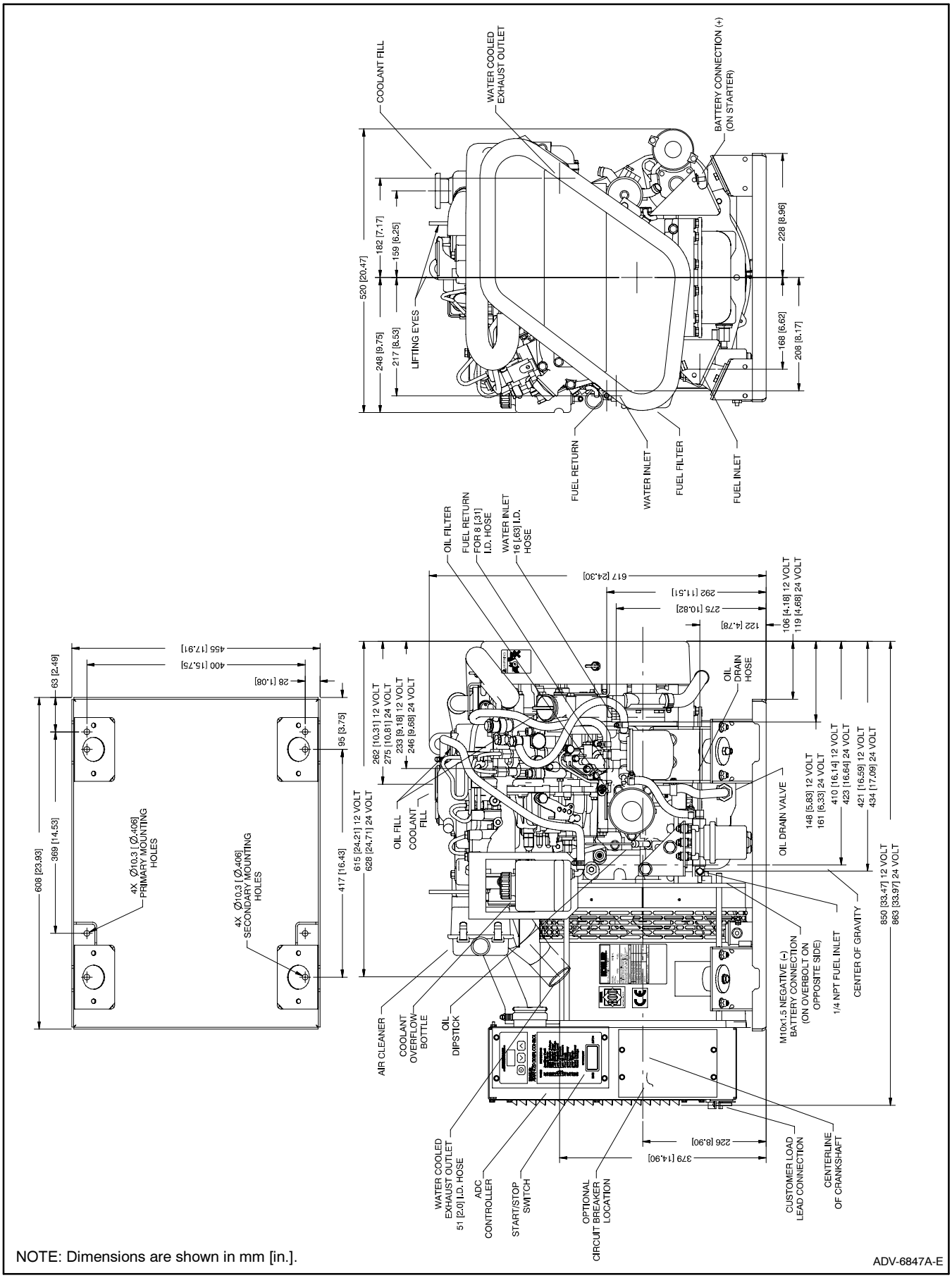


Figure 7-12 Dimension Drawing, 10EOZD and 8.5/9EFOZD

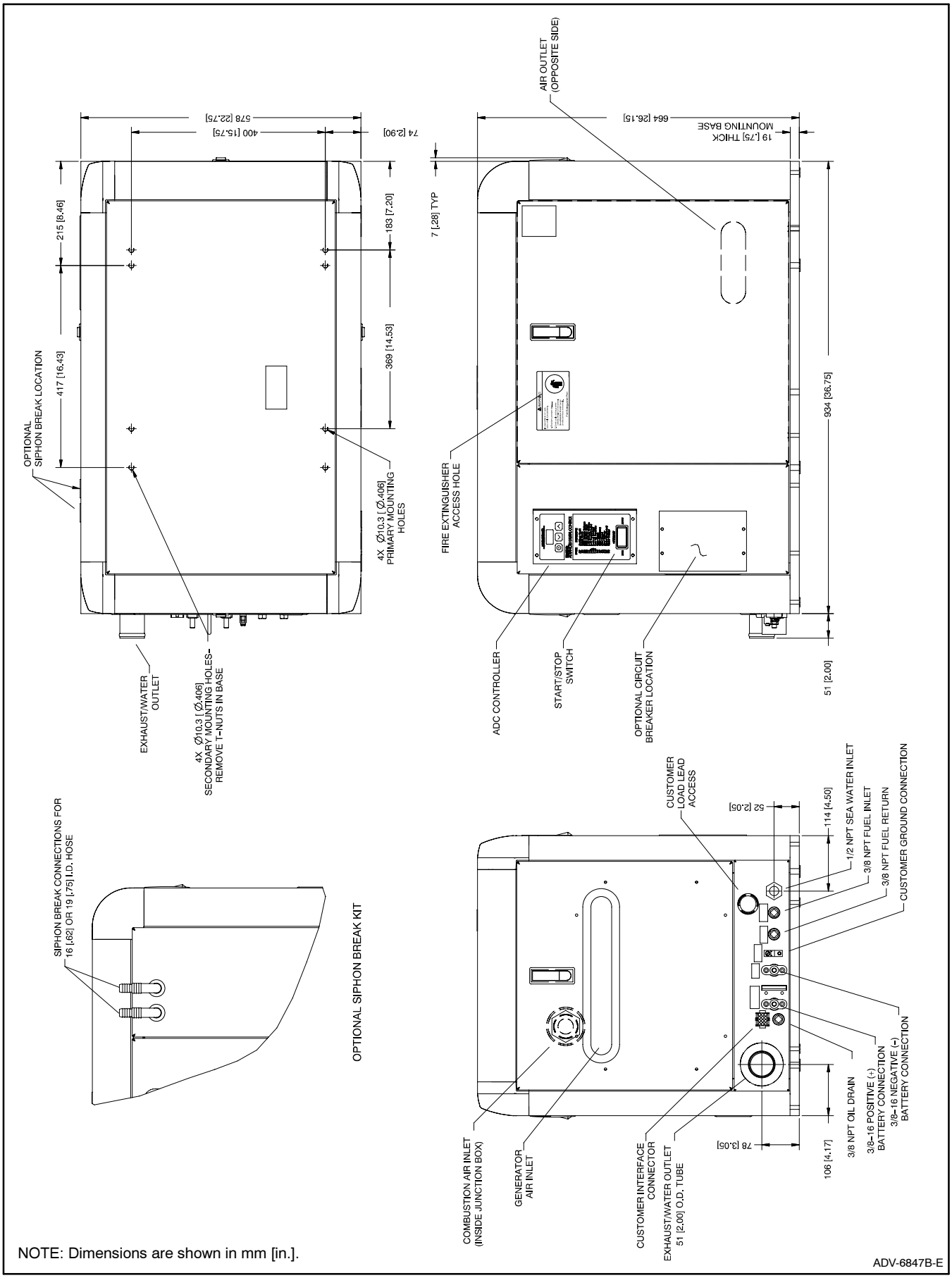
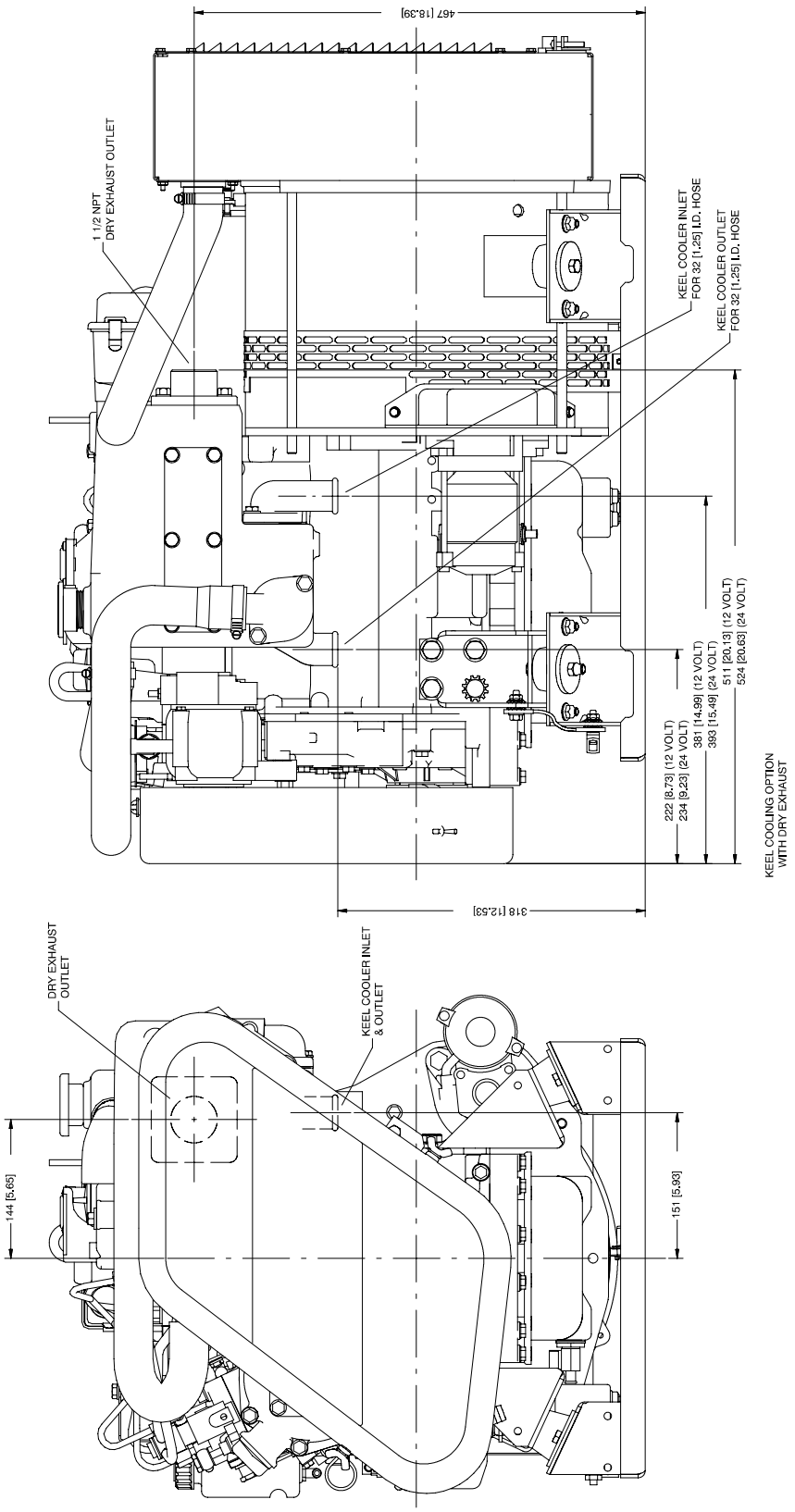


Figure 7-13 Dimension Drawing, 10EOZD and 8.5/9EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6847C-E

Figure 7-14 Dimension Drawing, 10EOZD and 8.5/9EFOZD with Keel Cooling

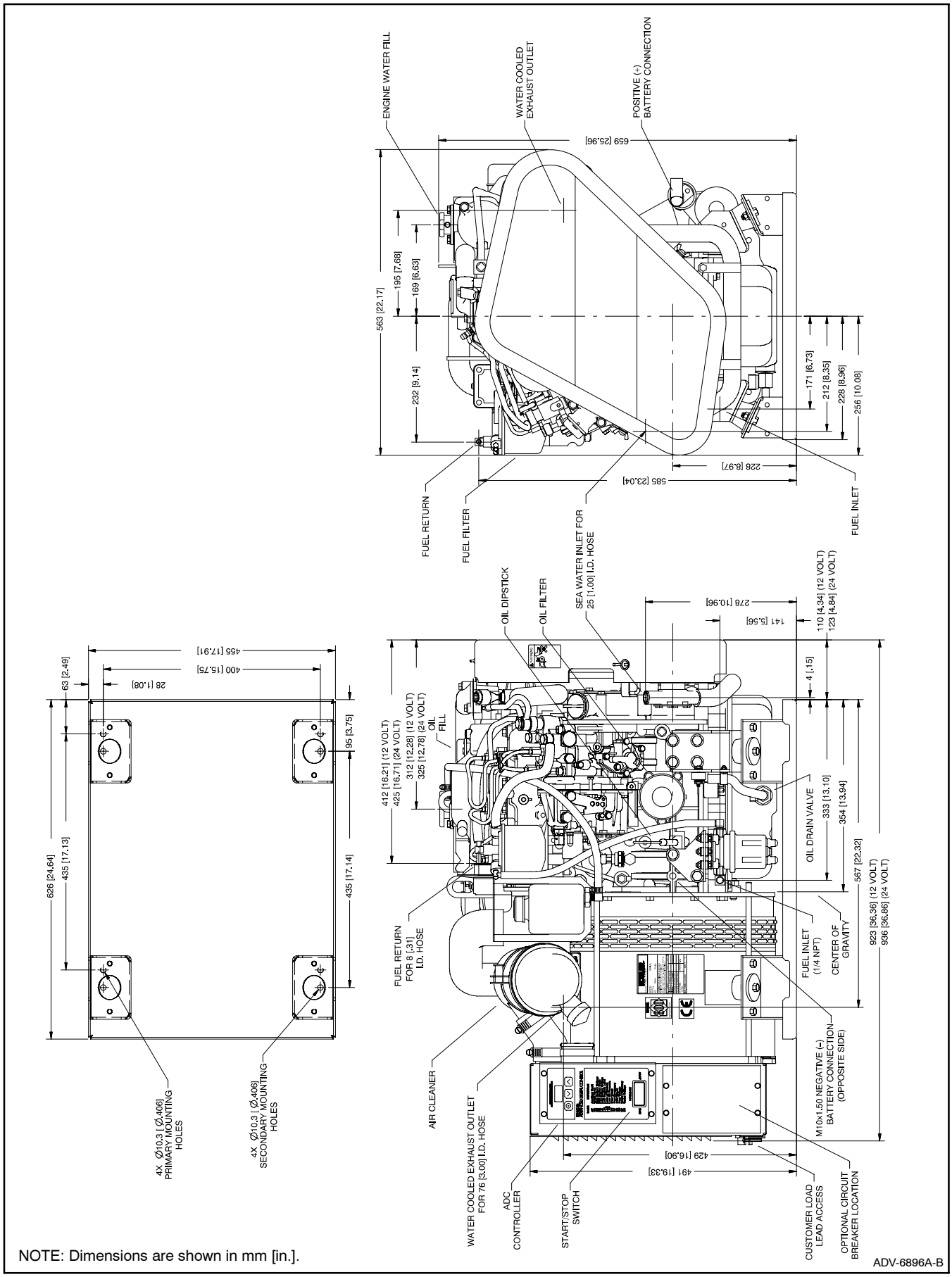


Figure 7-15 Dimension Drawing, 13EOZD and 11EFOZD

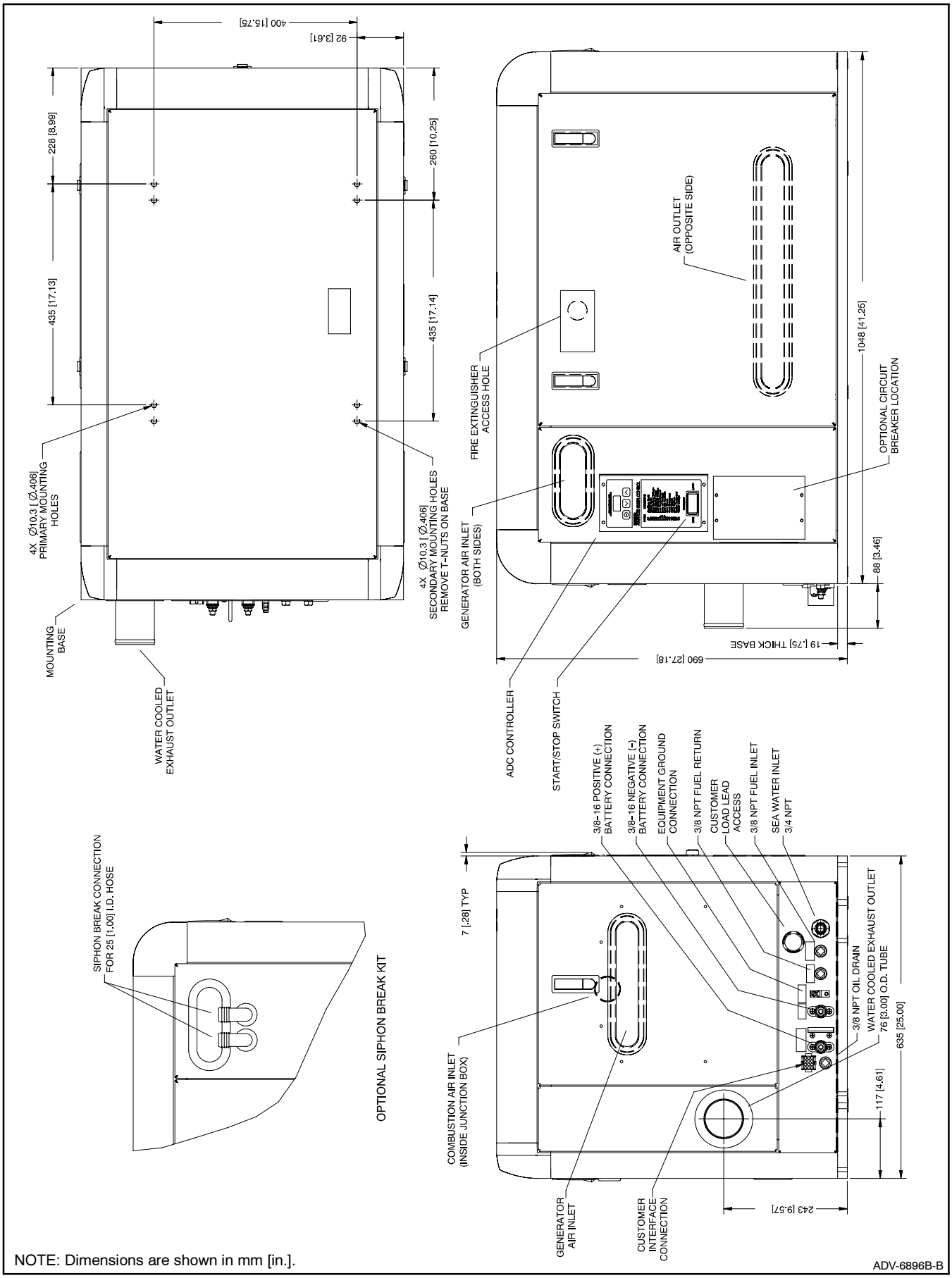
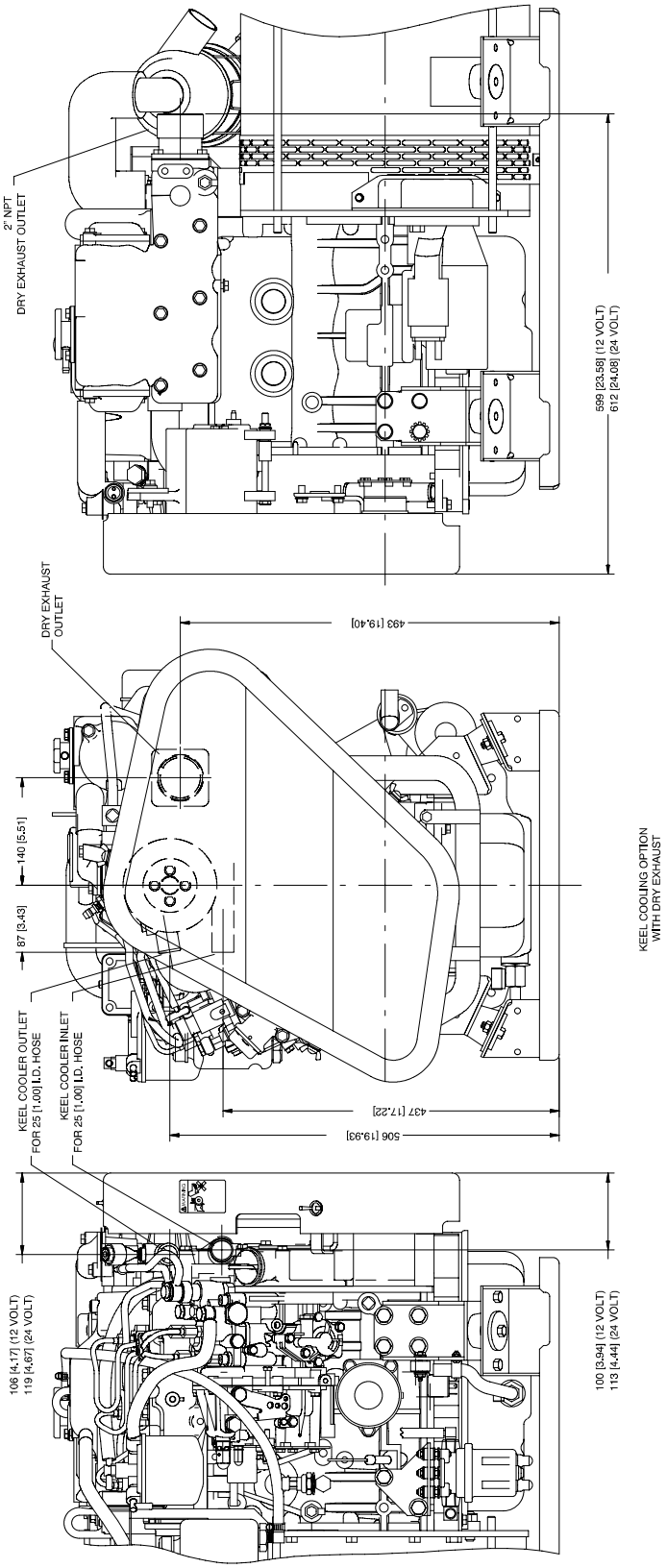


Figure 7-16 Dimension Drawing, 13EOZD and 11EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6896C-B

Figure 7-17 Dimension Drawing, 13EOZD and 11EFOZD with Keel Cooling

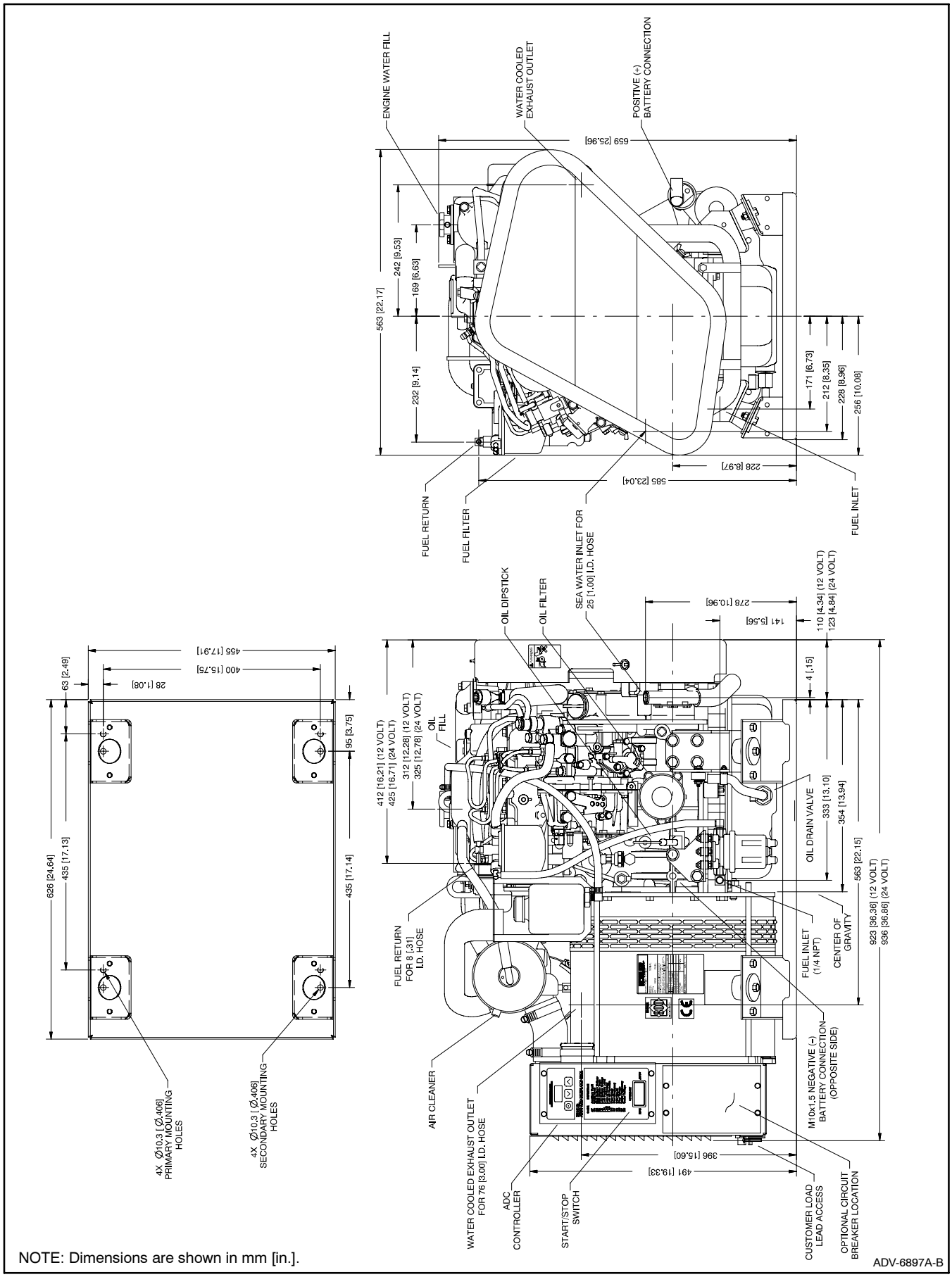


Figure 7-18 Dimension Drawing, 14/15.5EOZD and 11.5/13EFOZD

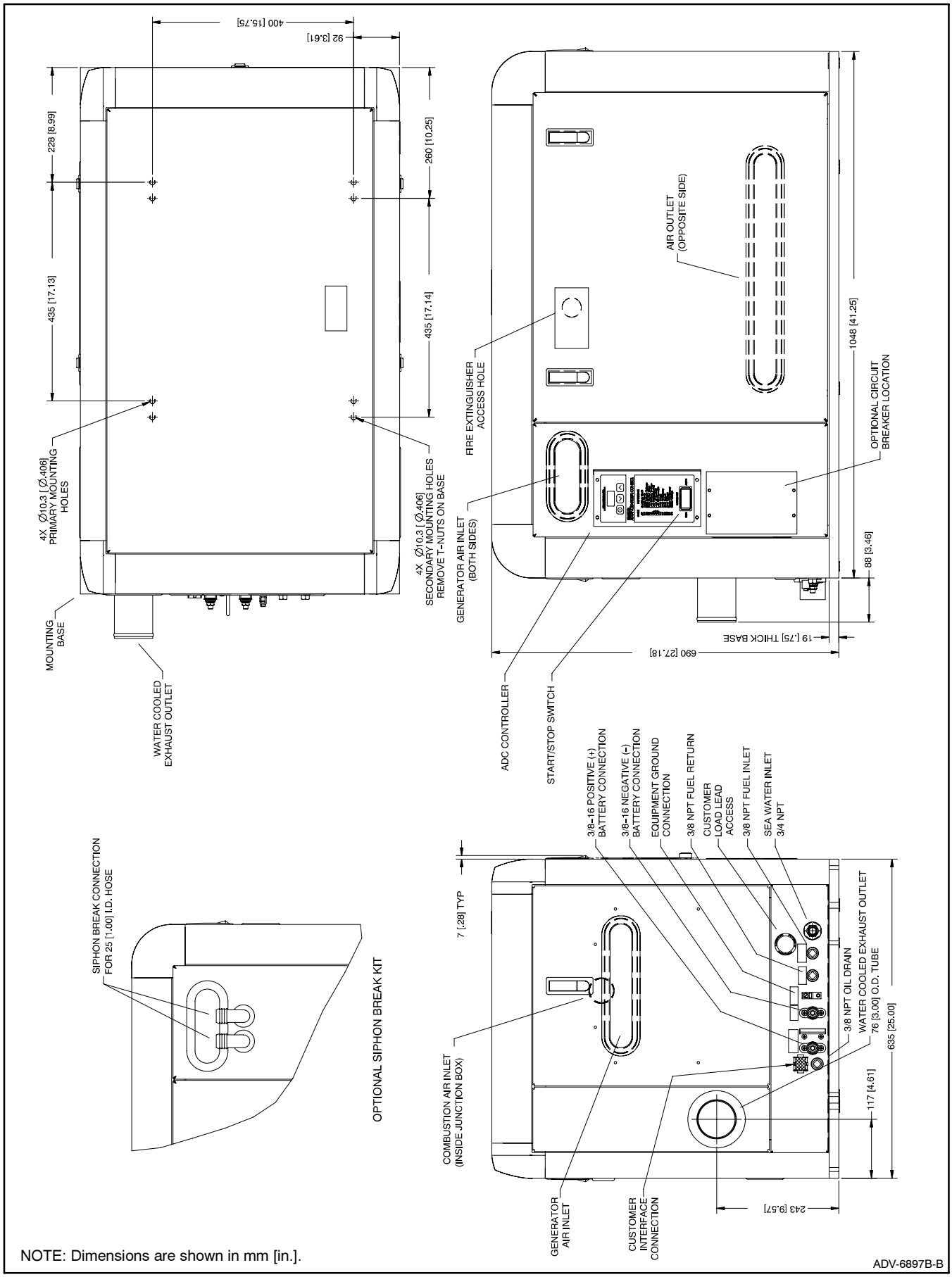
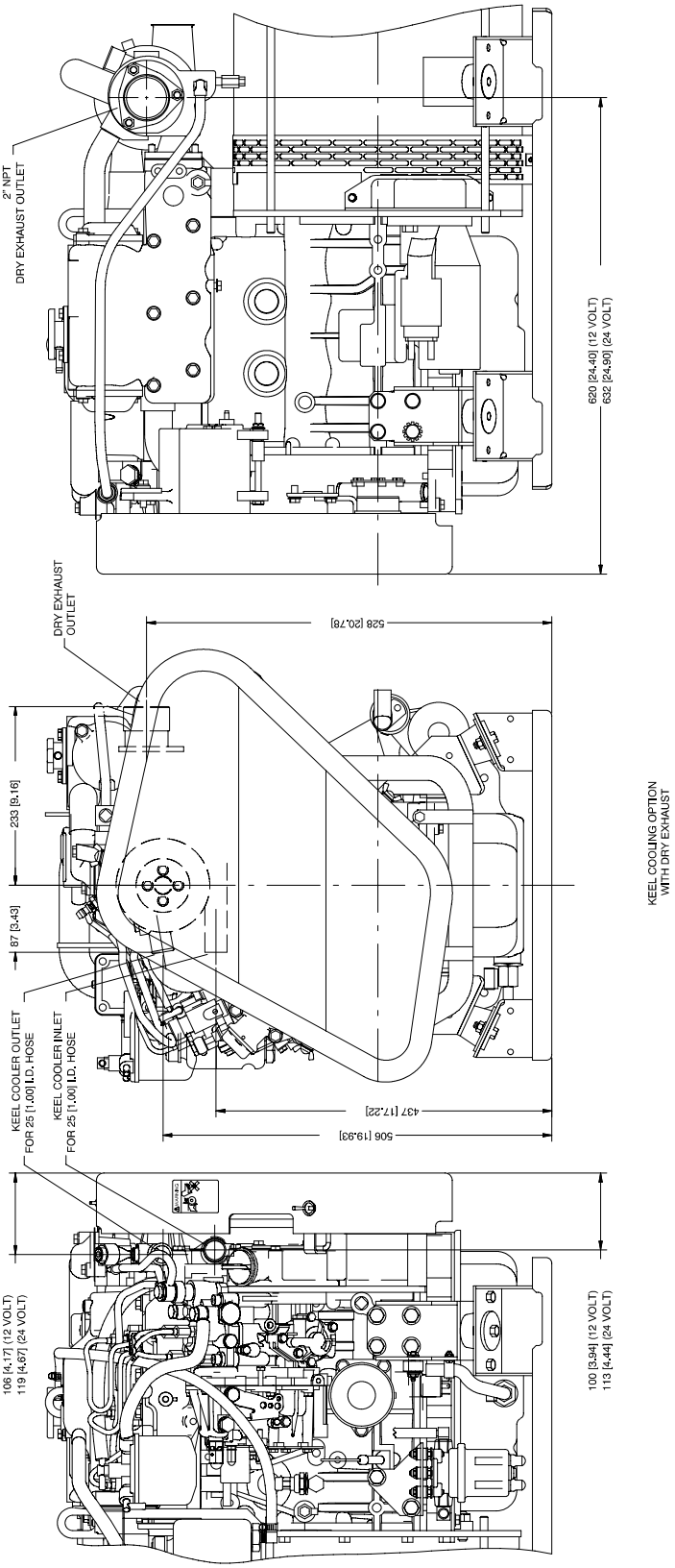


Figure 7-19 Dimension Drawing, 14/15.5EOZD and 11.5/13EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6897C-B

Figure 7-20 Dimension Drawing, 14/15.5EOZD and 11.5/13EFOZD with Keel Cooling

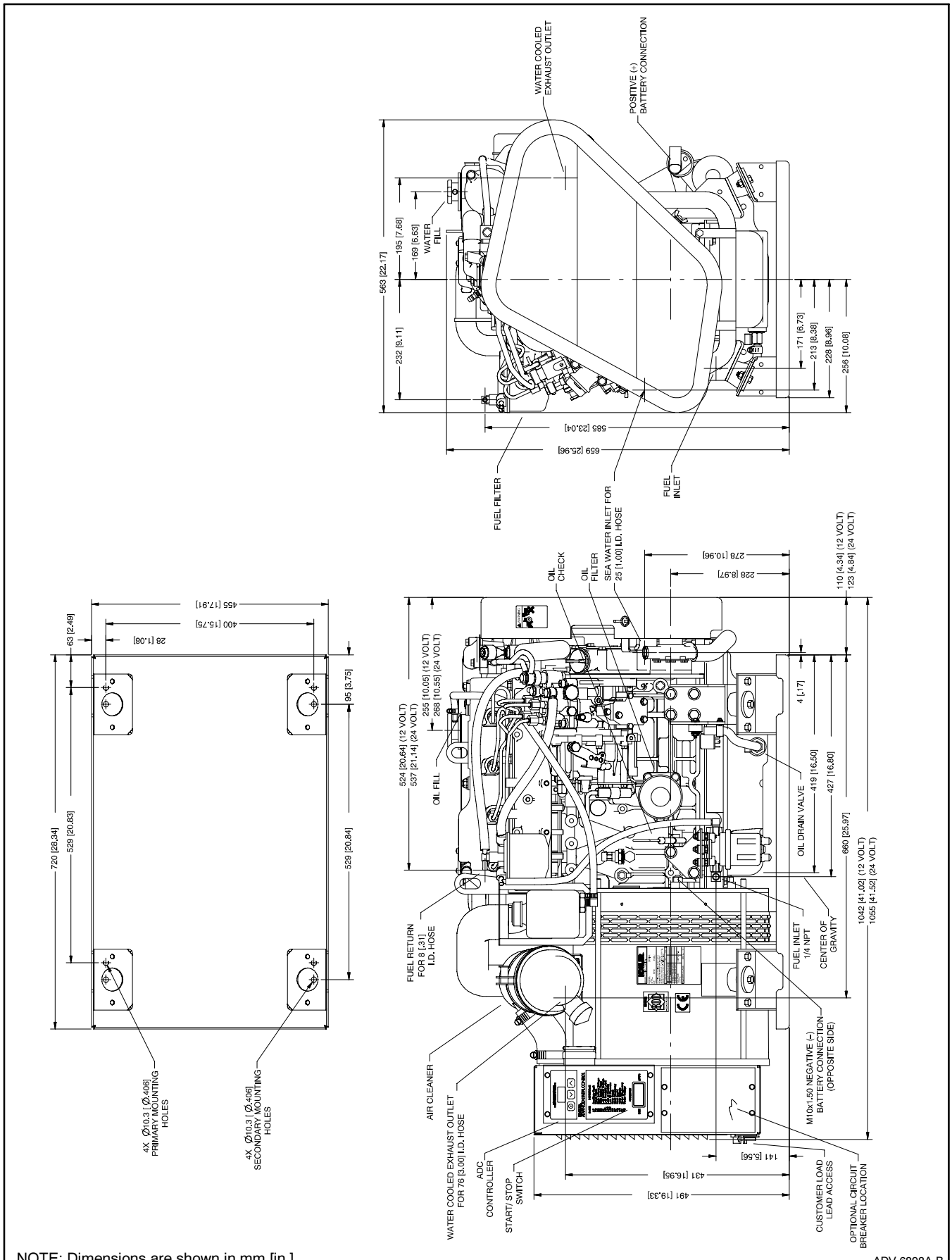


Figure 7-21 Dimension Drawing, 20EOZD and 17/17.5EFOZD

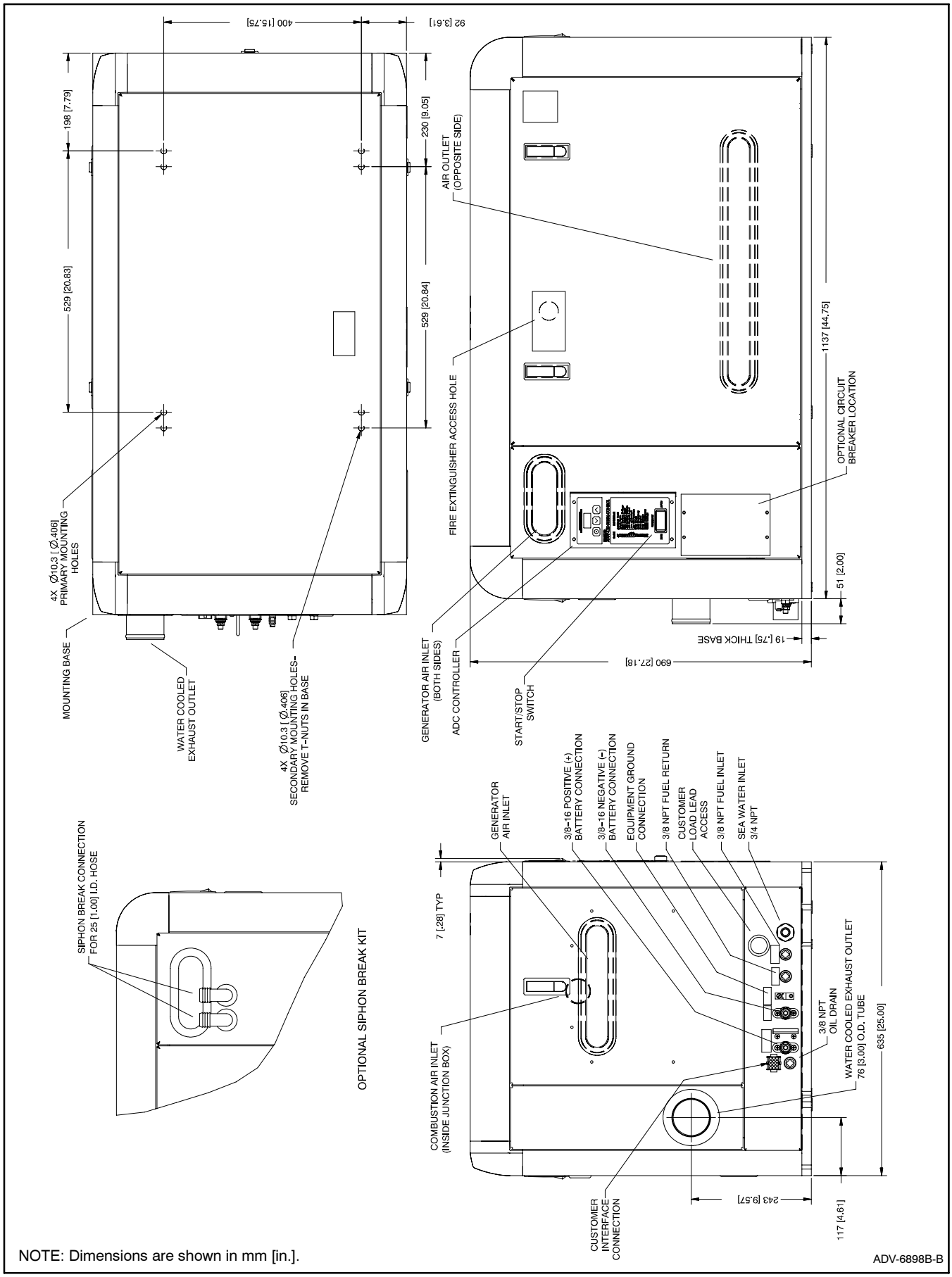
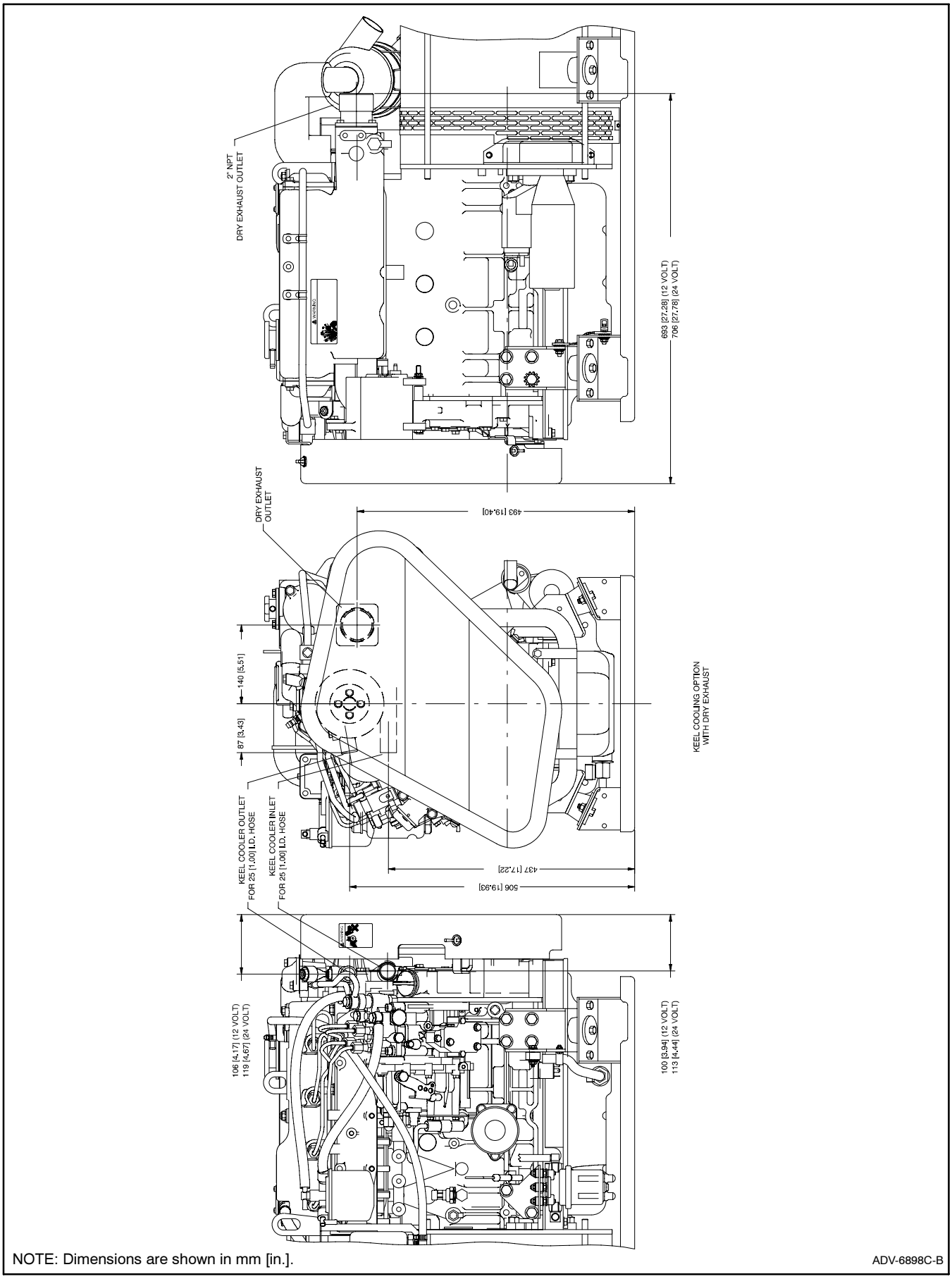


Figure 7-22 Dimension Drawing, 20EOZD and 17/17.5EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6898C-B

Figure 7-23 Dimension Drawing, 20EOZD and 17/17.5EFOZD with Keel Cooling

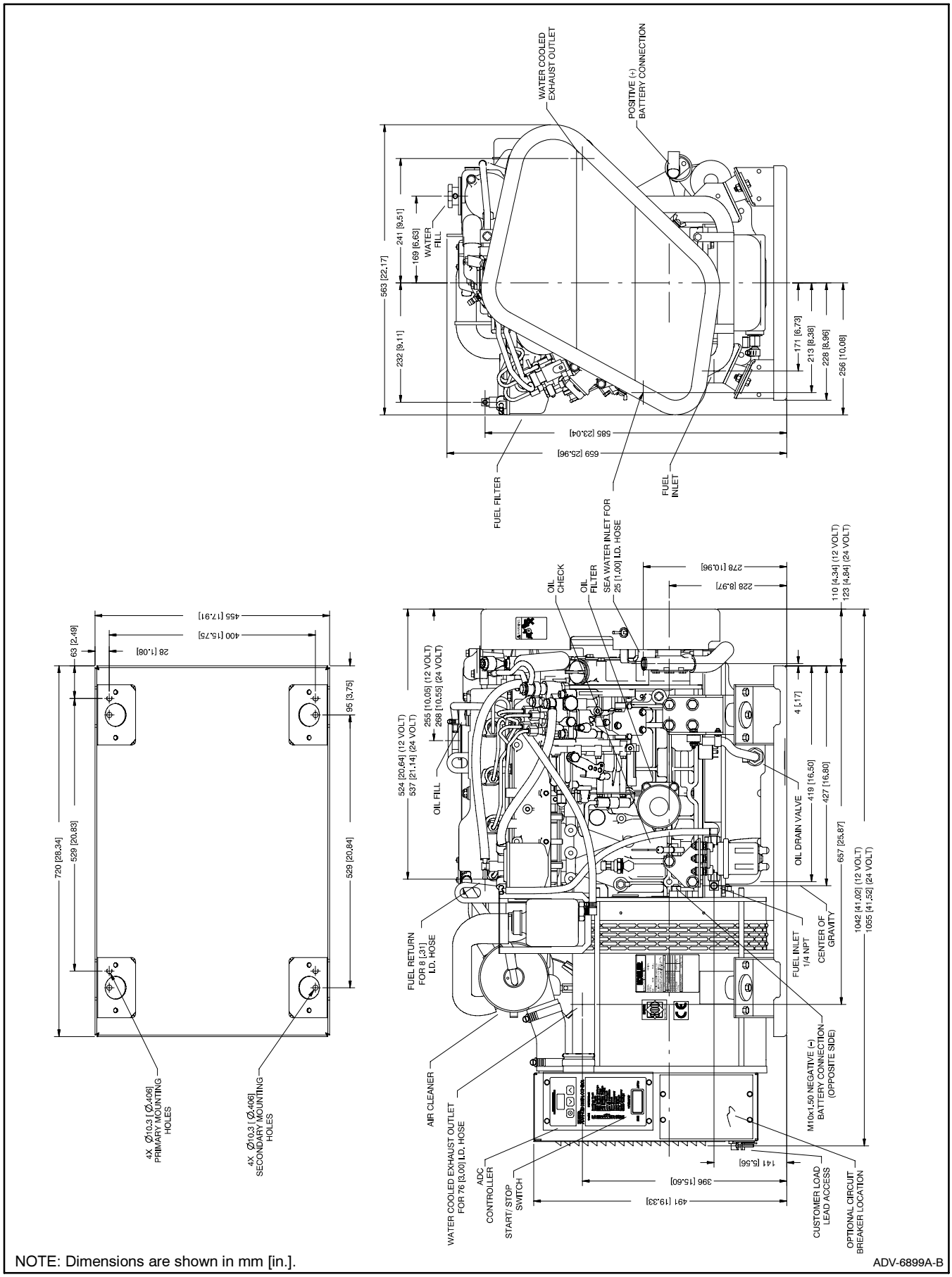


Figure 7-24 Dimension Drawing, 23/24EOZD and 20EFOZD

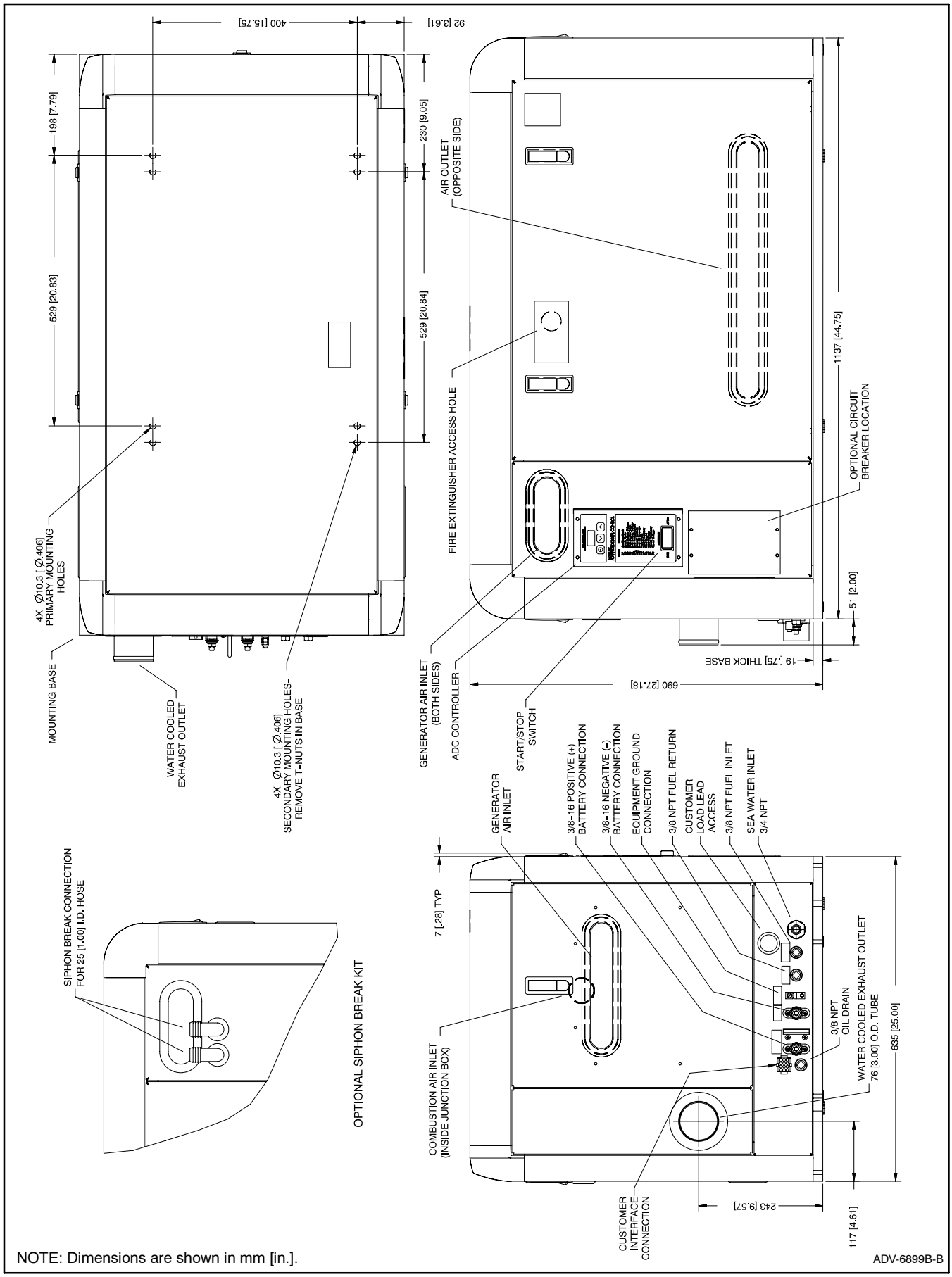
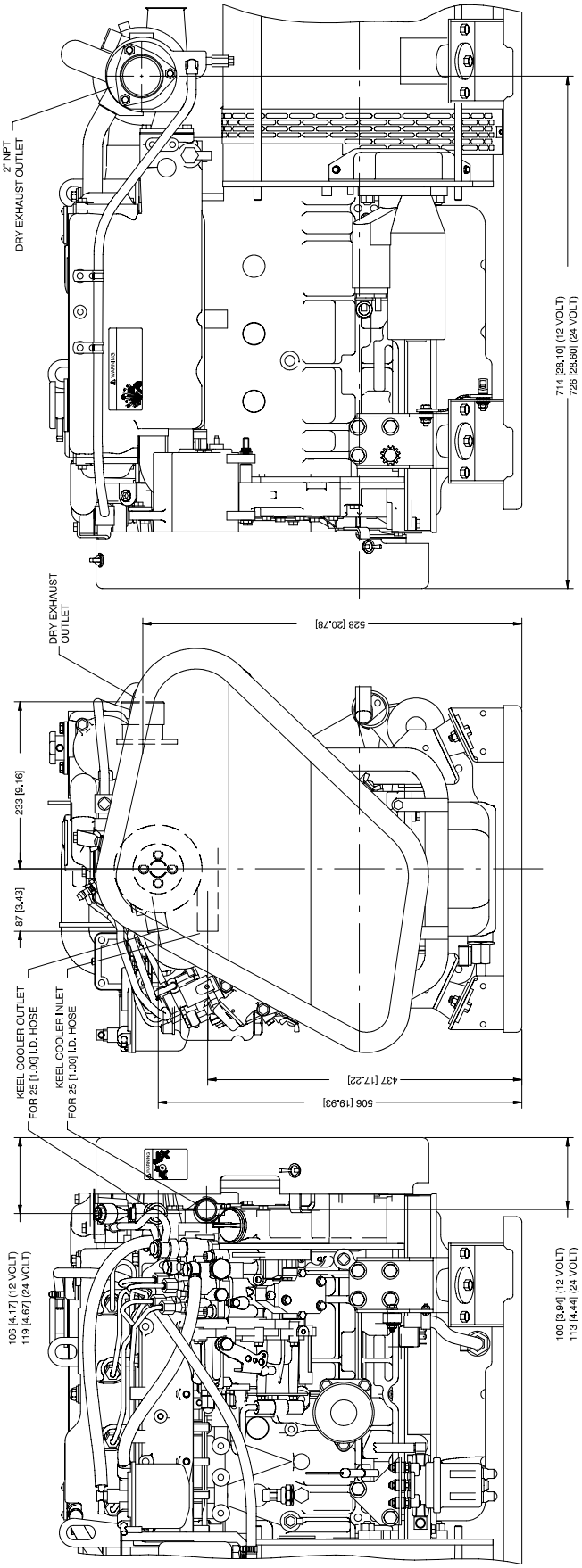


Figure 7-25 Dimension Drawing, 23/24EOZD and 20EFOZD with Sound Shield



NOTE: Dimensions are shown in mm [in.].

ADV-6899C-B

Figure 7-26 Dimension Drawing, 23/24EOZD and 20EFOZD with Keel Cooling

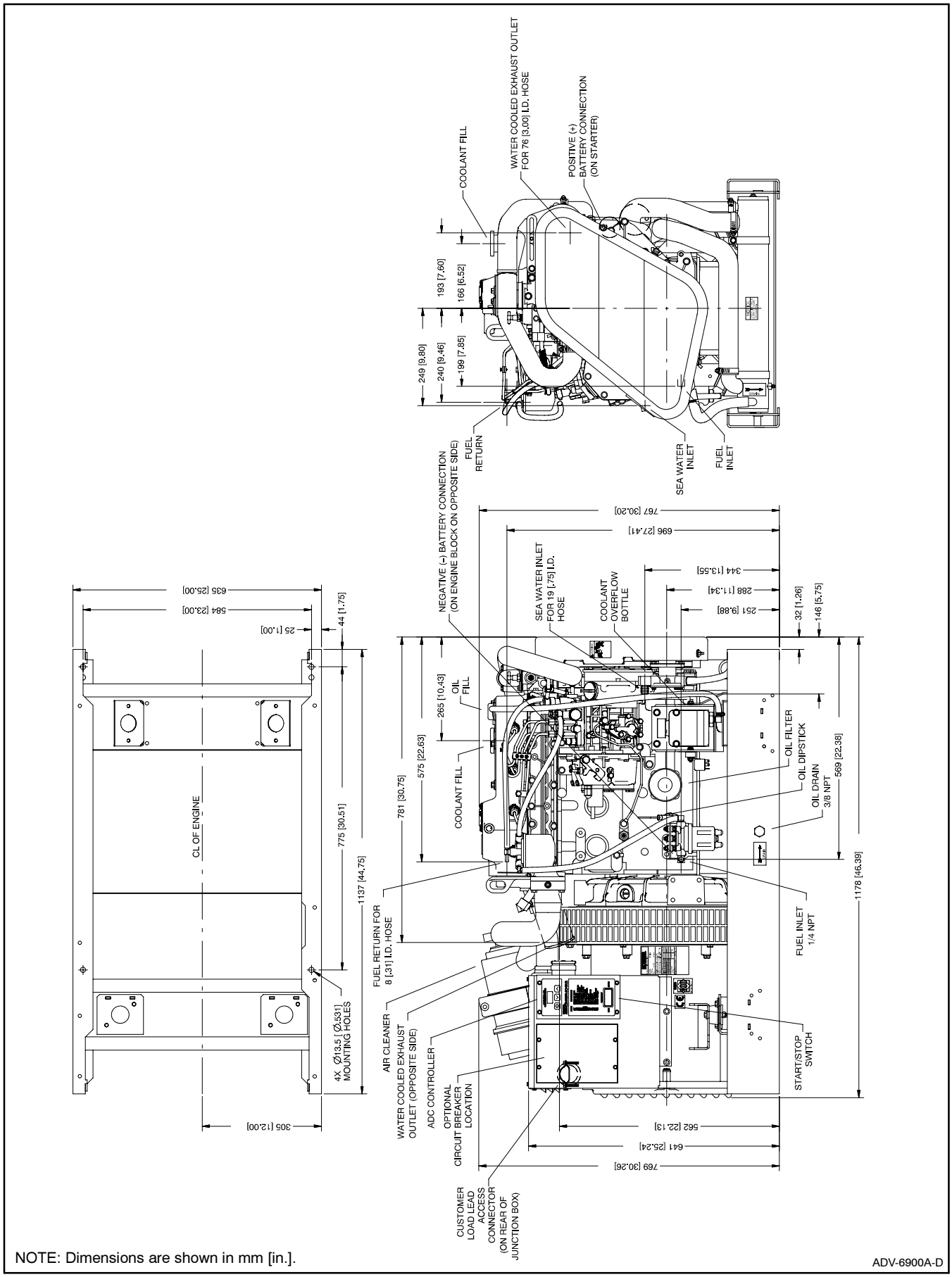


Figure 7-27 Dimension Drawing, 28/32EOZD and 23/27EFOZD

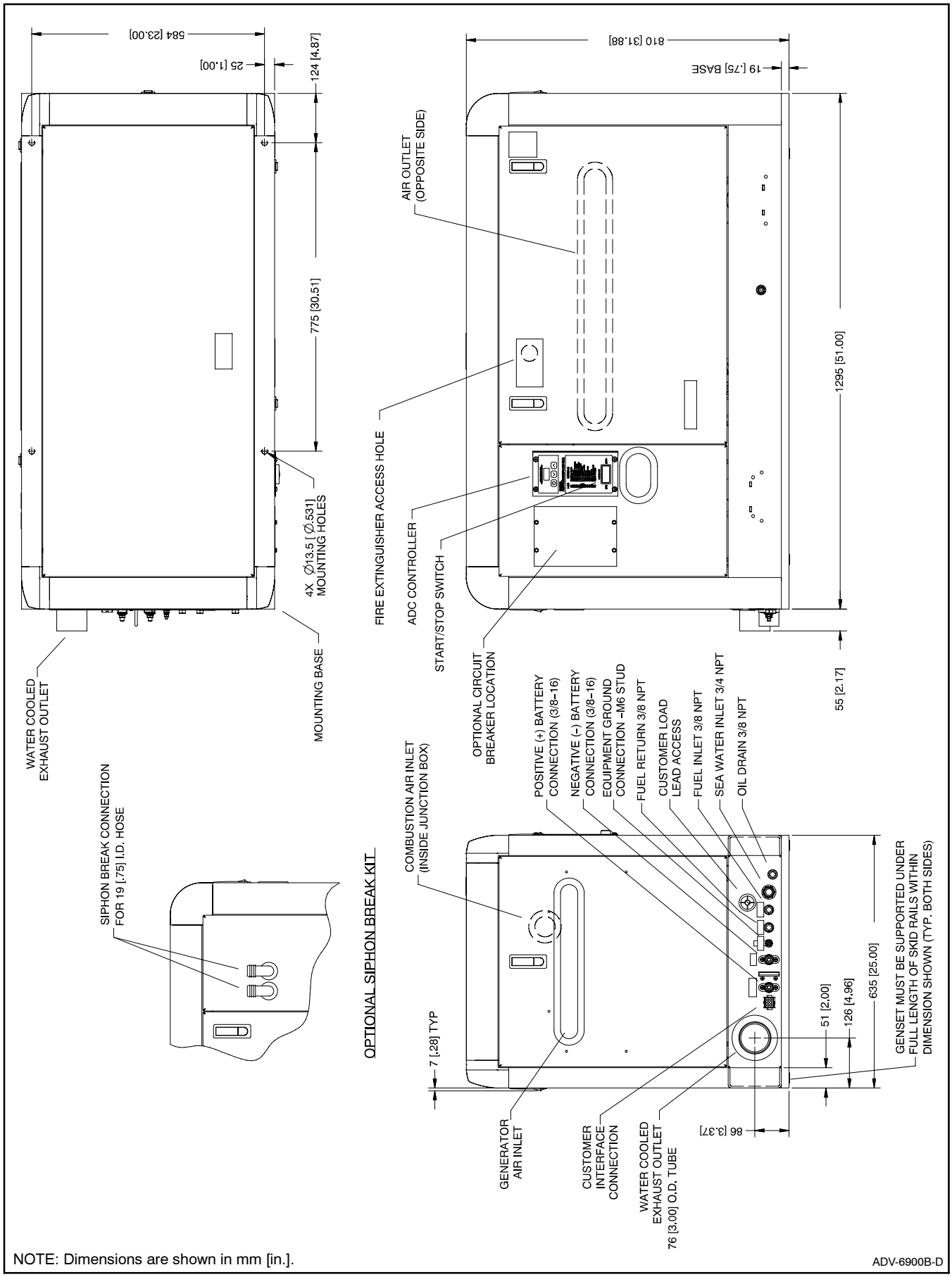


Figure 7-28 Dimension Drawing, 28/32EOZD and 23/27EFOZD with Sound Shield

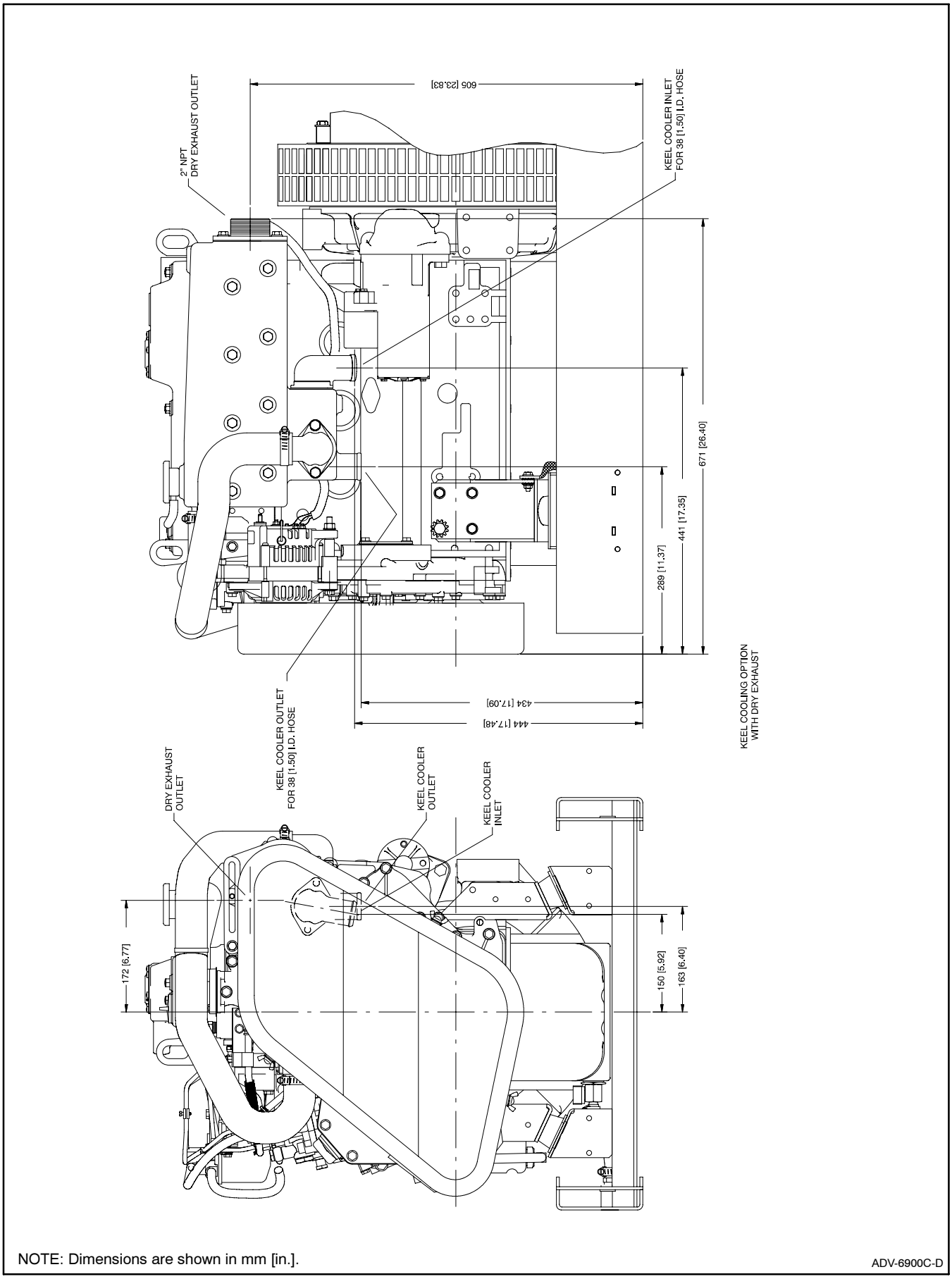
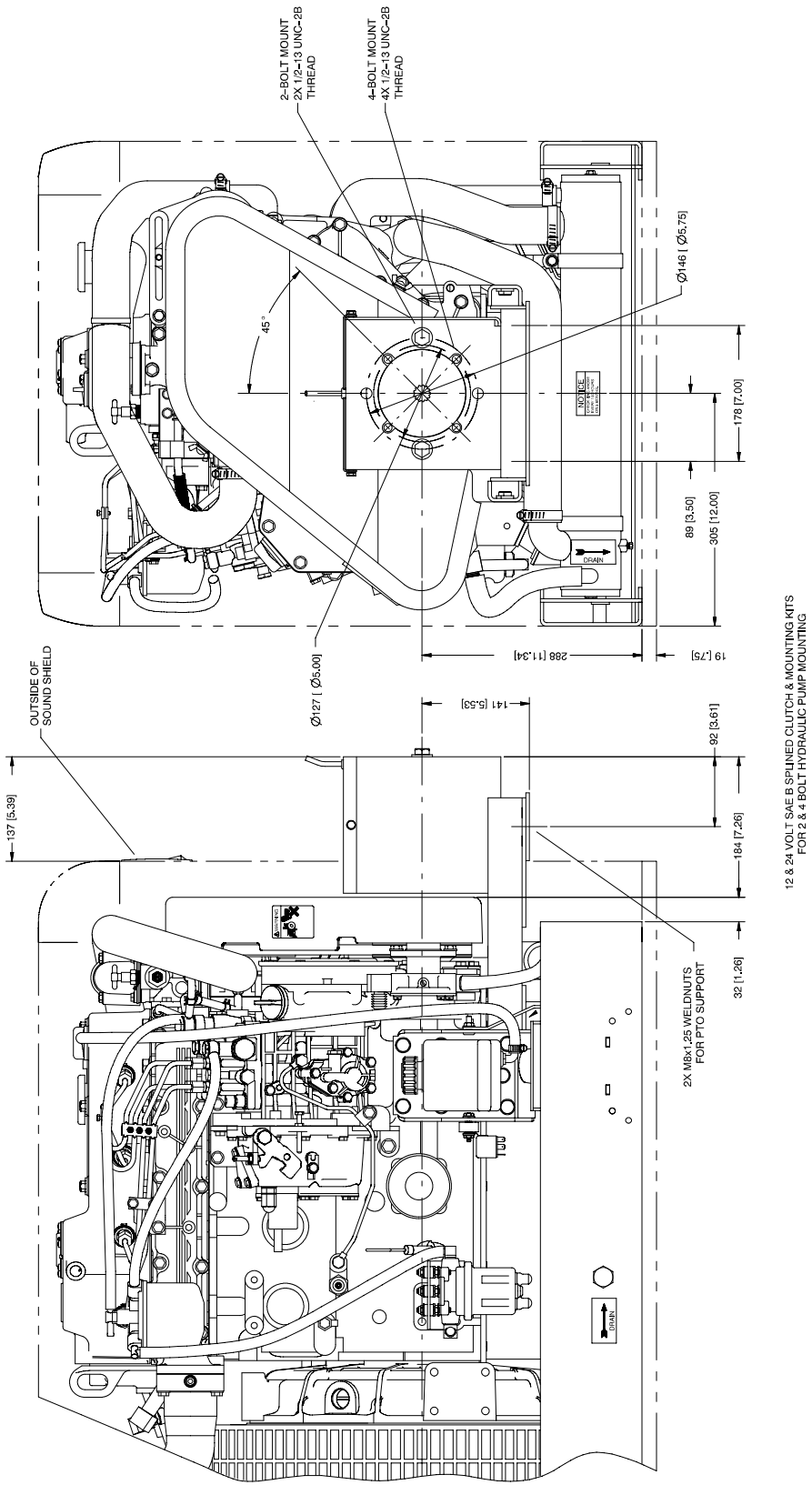


Figure 7-29 Dimension Drawing, 28/32EOZD and 23/27EFOZD with Keel Cooling

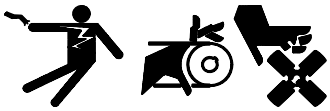


NOTE: Dimensions are shown in mm [in.].

ADV-6900D-D

Figure 7-30 Dimension Drawing, 28/32EOZD and 23/27EFOZD with Electric Clutch

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ WARNING

Hazardous voltage. Moving parts.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

8.1 Four-Lead Reconnection

The following information illustrates the reconnection of four-lead generator sets. In all cases, conform to the National Electrical Code (NEC).

Note: The 4EOZ and 3.5EFOZ models are not reconnectable.

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

8.1.1 100–120-Volt Configurations

If the installation requires a factory two-pole circuit breaker, do not connect the load-side terminals of the circuit breaker together; see Figure 8-1. If the installation requires a 100–120-volt, 2-wire system, use a single-pole circuit breaker. See Figure 8-2. When connecting stator phase leads together, size the output lead (L1) to handle the amperage. Use a jumper lead on the *line* side of the circuit breaker to balance the load of the generator set.

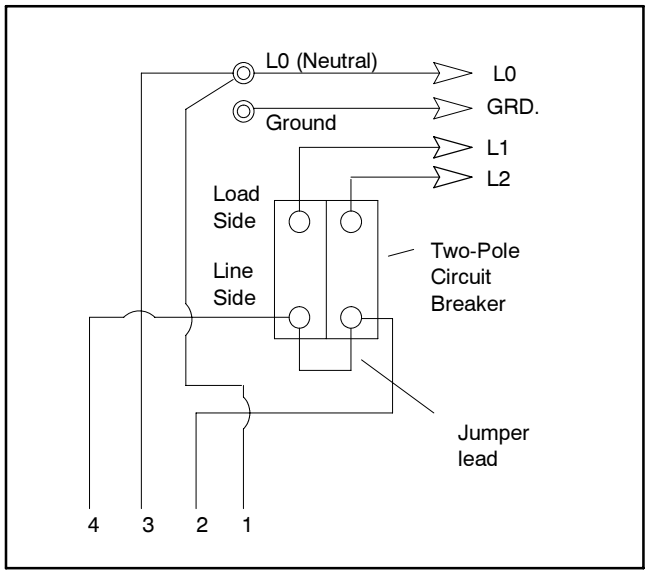


Figure 8-1 100–120-Volt, 3-Wire Configuration

8.1.2 100–120/200–240-Volt Configurations

The 100–120/200–240-volt configuration does not use a jumper lead. If the unit was originally wired for straight 100–120 volt, 3-wire, remove the jumper lead (see Figure 8-1 for location). Select a two-pole circuit breaker. Application of two single-pole circuit breakers does not conform to NEC requirements for supplying a 200–240-volt load, even if the breakers are mechanically attached together. Leads L1 and L2 are for different phases; *never* connect them together.

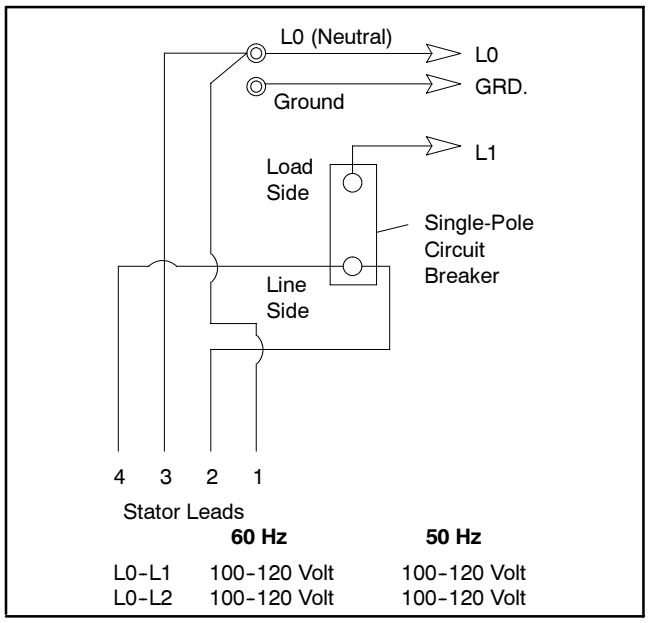


Figure 8-2 100–120-Volt, 2-Wire Configuration

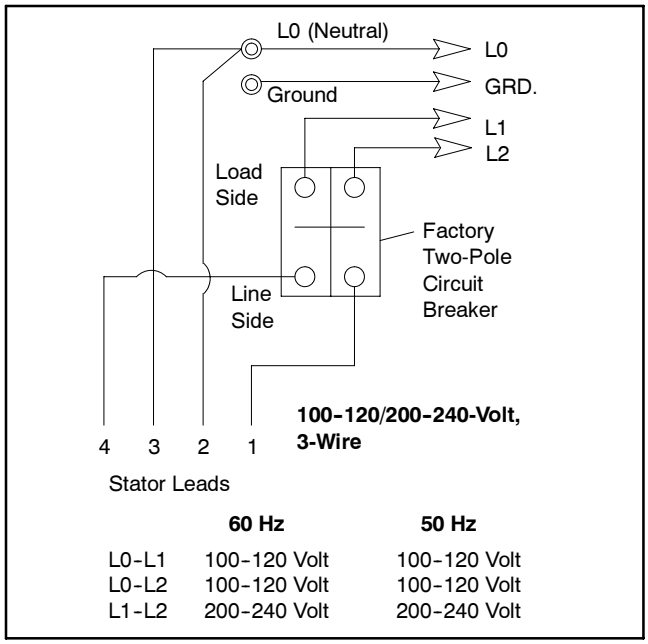


Figure 8-3 100–120/200–240-Volt, 3-Wire Configuration

8.1.3 200–240-Volt Configurations

The 200–240-volt configuration does not use a jumper lead. If the unit was originally wired for straight 100–120 volt, 3-wire, remove the jumper lead (see Figure 8-1 for location). See Figure 8-4 for EOZ/EFOZ models or Figure 8-5 for EOD/EFOD and EOZD/EFOZD models equipped with the ADC 2100.

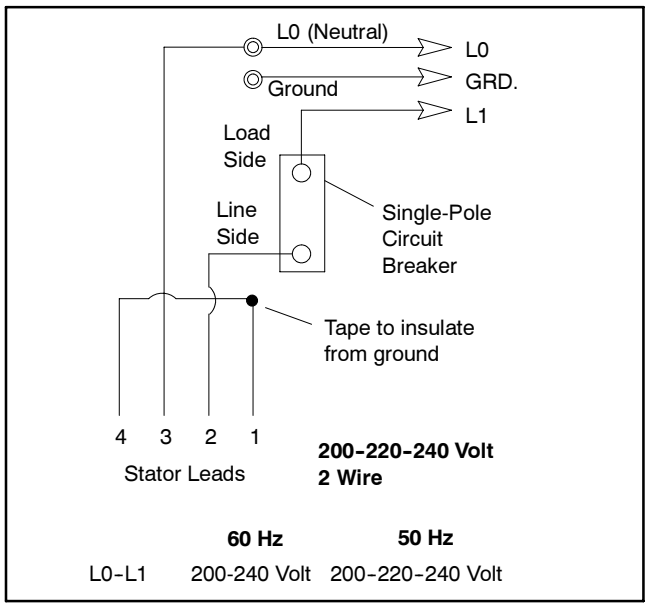


Figure 8-4 200–220–240-Volt, 2-Wire, Configuration for ***EOZ/EFOZ Models Only***

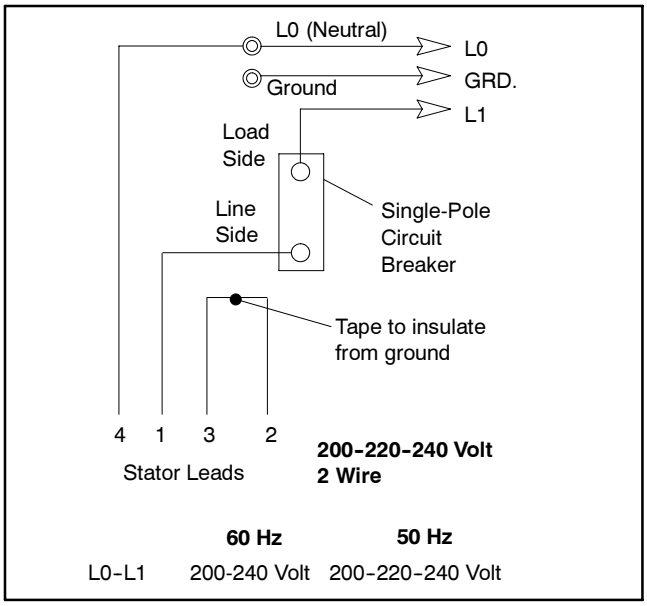


Figure 8-5 200–220–240-Volt, 2-Wire Configuration for ***EOD/EFOD and EOZD/EFOZD Models Only with ADC 2100***

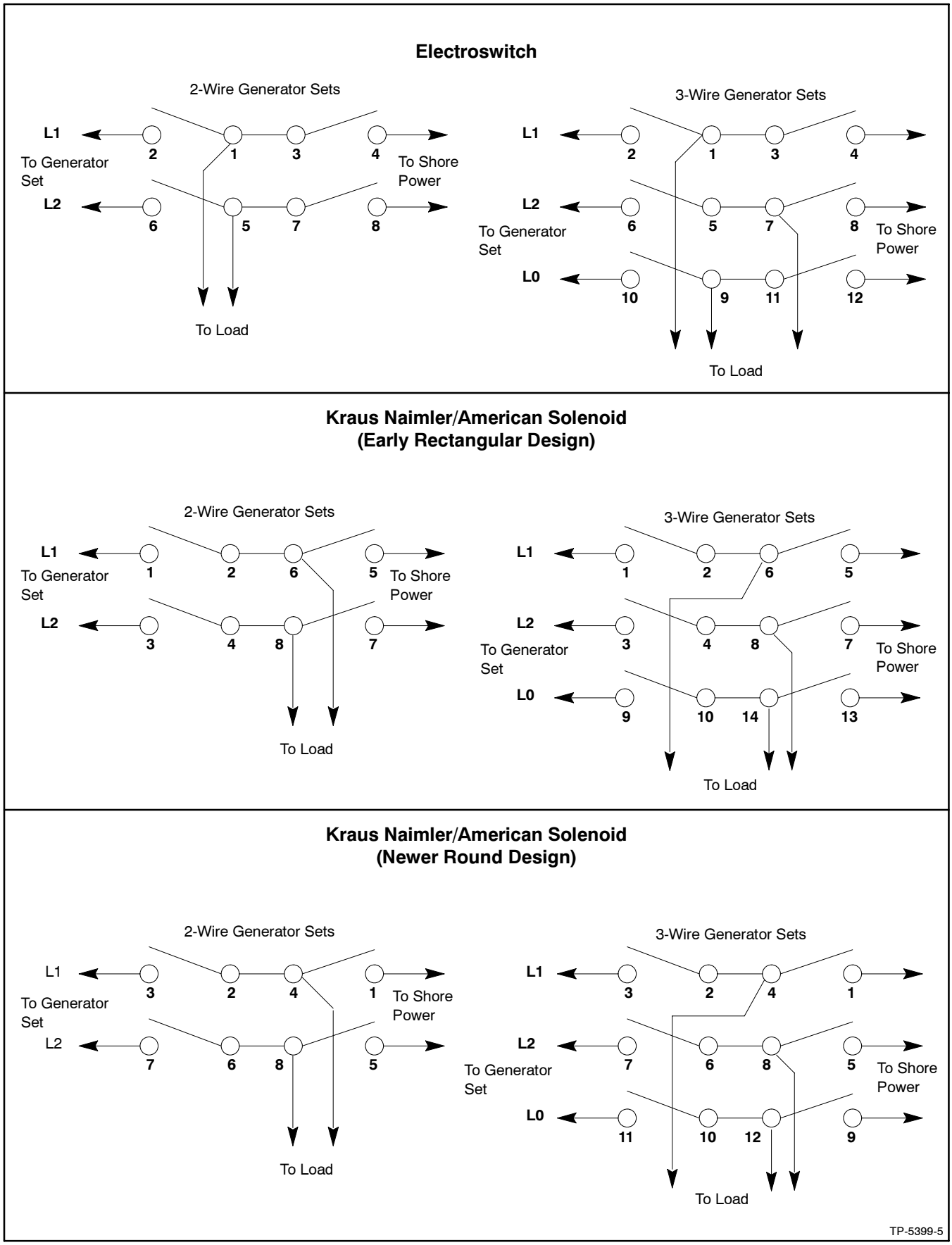


Figure 8-6 Marine Manual (Ship-to-Shore) Transfer Switch

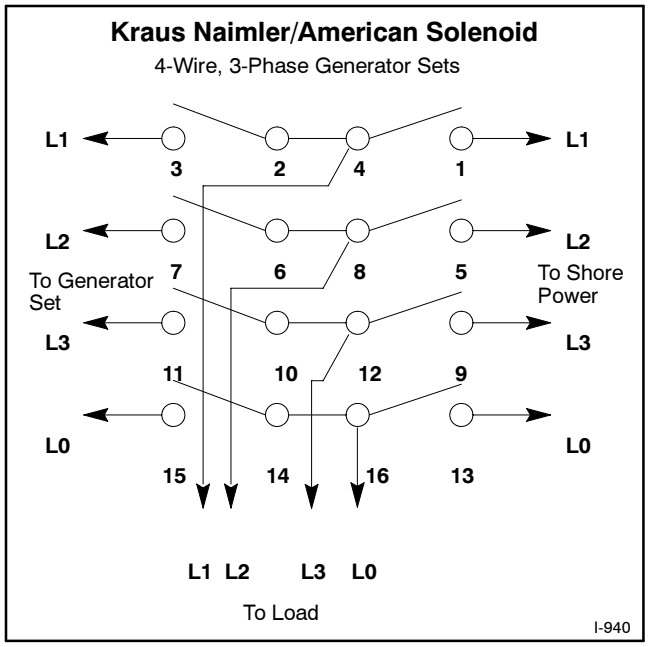


Figure 8-7 Marine Manual (Ship-to-Shore) Transfer Switch, continued

8.2 Twelve-Lead Reconnection

The reconnection procedure details voltage reconnections only. If the generator set requires frequency changes, adjust the governor and voltage regulator. See the generator set service manual for information regarding frequency adjustment.

The following information illustrates the reconnection of twelve-lead generator sets. In all cases, conform to the National Electrical Code (NEC).

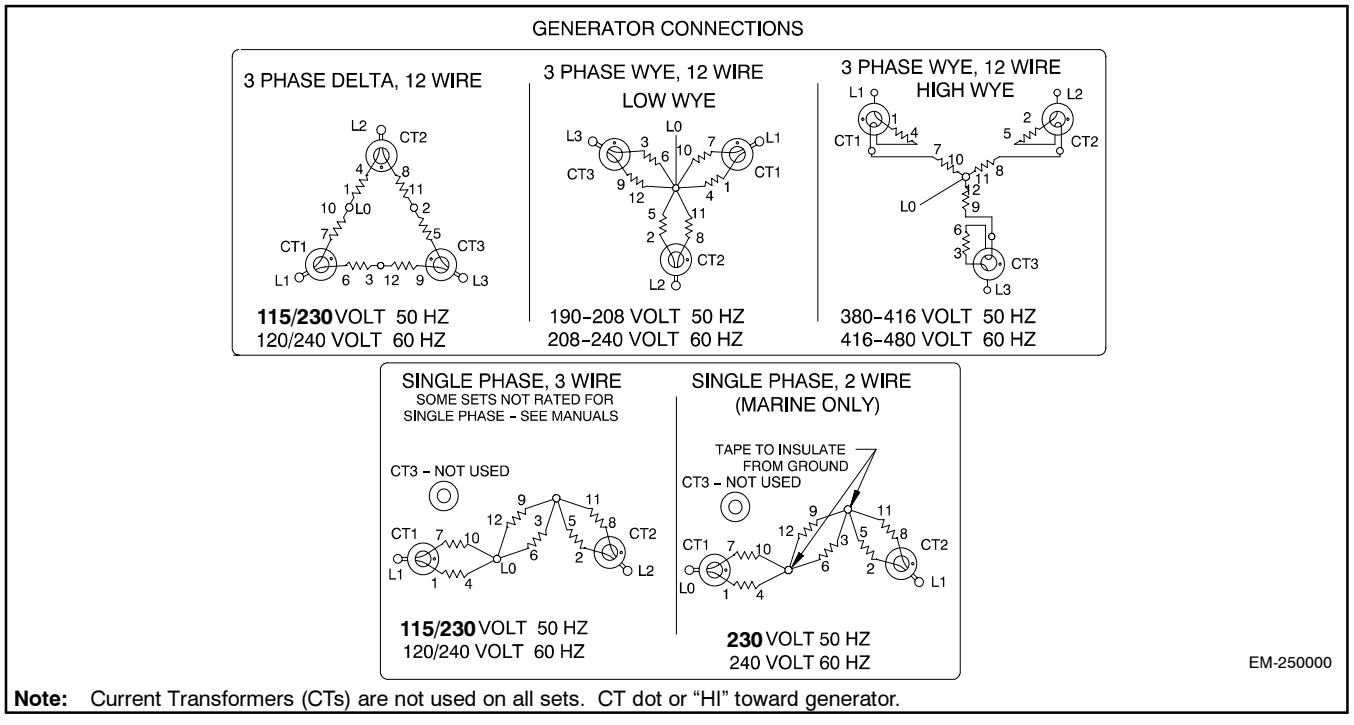
Reconnect the stator leads of the generator set to change output phase or voltage. Refer to the following procedure and connection schematics. Follow all safety precautions at the front of this manual and in the text during the reconnection procedure.

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

Twelve-Lead Reconnection Procedure

1. Place the generator master switch in the OFF position.
2. Disconnect generator set engine starting battery, negative (–) lead first.
3. Disconnect power to battery charger, if equipped.
4. Use Figure 8-8 to determine the generator set voltage configuration. Note the original voltage and reconnect the generator set as needed.



Note: Current Transformers (CTs) are not used on all sets. CT dot or "HI" toward generator.

Figure 8-8 Generator Reconnection

8.3 ADC 2100 Adjustment after Reconnection (6EOD/4.5EFOD and 8–32EOZD/6.5–27EFOZD Models)

The controller is factory-set for the generator set voltage and frequency. If the generator set is reconnected to a different voltage and frequency, follow the procedures in this section to reconfigure the controller to the new voltage and/or frequency. Set the system voltage and frequency and then adjust the voltage, gain, and engine speed.

8.3.1 Configuration Mode Time Out

The controller will automatically exit the configuration mode without saving any changes after about 11 seconds if no buttons are pressed. Start the configuration procedure over again from the beginning if the controller exits the configuration mode before the settings have been saved.

8.3.2 Controller Software Version Number

The application software for controller operation is factory-loaded onto the Advanced Digital Control. At times, it may be necessary to check the software version number for troubleshooting purposes.

The controller's application software version number is displayed on the LED screen during the key sequence to enter the configuration mode, after the Select button has been pressed and held for about five seconds. For example, 01.00 will be displayed for software version 1.00.

Note: The engine type (EC) and the engine data input type (ED) are factory set and should only be changed by an authorized Kohler dealer/distributor. Incorrect settings will make your unit non-functional.

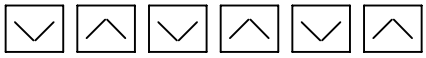
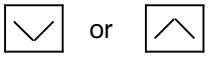
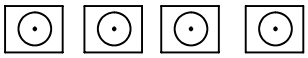
8.3.3 Setting the System Voltage and Frequency

Follow the instructions in Figure 8-9 to enter the configuration mode while the engine is not running and select the new voltage and frequency setting. The settings are shown in Figure 8-10. An X in the Display column in Figure 8-9 indicates a number from 0 to 9.

Press the Select button to step through to the Save mode as shown in Figure 8-9. Do not change any other parameters. If any other parameters are changed inadvertently while navigating the controller menus, reset them to the settings shown in Figure 8-10 and then save the settings. When SAVE is displayed, press the up arrow to save the new settings or the down arrow to discard the changes and exit the configuration mode without saving.

Pressing the Select button when SAVE is displayed returns to the first parameter, system voltage/frequency (Uu).

With the generator set engine stopped, hold the Select button while moving the generator set master switch to the RUN position. (The generator set engine will not start.)

Button Sequence	Notes	Display *
Hold the Select button:  **Wait 5 seconds, then press:** 	To enter the configuration mode. Hold the select button until the display shows the software version number(approximately 5 seconds), and continue to hold while pressing the up and down arrows as shown.	XX.XX
Press: 	To select the nominal system voltage/frequency according to Figure 8-10.	Uu0**X**
Press: 	To step through the other parameters to the SAVE mode. (Do not change any other parameters.)	SAVE
Press: 	To save changes.	YES
or 	To discard changes without saving.	no

TP6195

* X in this display indicates a number from 0 to 9. See Figure 8-10. A bold **X** indicates the digit that changes during adjustment.

Figure 8-9 Setting the Nominal System Voltage and Frequency (only) after Generator Reconnection

Marine Diesel Model		Freq. Hz	Voltage, Phases	Volts, Hz	Market	Engine Type	Data Inputs	Battery Voltage	CANbus Comm.
				Uu*	Uc	Ec	Ed†	Bt	Cn‡
EOD EFOD	4.5EFOD	50	230 V, 1 Ph, 2 W	2	0	1	1 (std.) or 3 (ops) †	12	0 (No Can) or 1 (J1939)‡
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	6EOD	60	120/240 V, 1 Ph, 3 W	1	0	1			
			120 V, 1 Ph, 3 W	0					
			120 V, 1 Ph, 2 W	0					
EOZD EFOZD	6.5EFOZD	50	230 V, 1 Ph, 2 W	2	0	1	1 (std.) or 3 (ops) †	12	0 (No Can) or 1 (J1939)‡
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	7EFOZD	50	230 V, 1 Ph, 2 W	2	0	1			
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	8EOZD	60	120/240 V, 1 Ph, 3 W	1	0	1			
			120 V, 1 Ph, 3 W	0					
			120 V, 1 Ph, 2 W	0					
	8.5EFOZD (3 Ph)	50	230/400 V, 3 Ph, 4 W, Wye	3	0	2	1 (std.) or 3 (ops) †	12 or 24	
	9EFOZD (1 Ph)	50	230 V, 1 Ph, 2 W	2	0	2			
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	9EOZD	60	120/240 V, 1 Ph, 3 W	1	0	1	1 (std.) or 3 (ops) †	12	
			120 V, 1 Ph, 3 W	0					
			120 V, 1 Ph, 2 W	0					
	10EOZD (1 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	2	1 (std.) or 3 (ops) †	12 or 24	
			120 V, 1 Ph, 3 W	0					
			120 V, 1 Ph, 2 W	0					
	10EOZD (3 Ph)	60	120/240 V, 3 Ph, 4 W, Delta	10	0	2			
			127/220 V, 3 Ph, 4 W, Wye	16					
			220/380 V, 3 Ph, 4 W, Wye	19					
			240/416 V, 3 Ph, 4 W, Wye	20					
	11EFOZD	50	230 V, 1 Ph, 2 W	2	0	2			
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	11.5EFOZD (3 Ph)	50	115/230 V, 1 Ph, 3 W	6	0	2			
			115/230 V, 3 Ph, 4 W, Delta	14					
			110/190 V, 3 Ph, 4 W, Wye	17					
			120/208 V, 3 Ph, 4 W, Wye	18					
			220/380 V, 3 Ph, 4 W, Wye	21					
			230/400 V, 3 Ph, 4 W, Wye	3					
			240/416 V, 3 Ph, 4 W, Wye	22					
	13EOZD	60	120/240 V, 1 Ph, 3 W	1	0	2			
	13EFOZD	50	230 V, 1 Ph, 2 W	2	0	2			
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					

* Use voltage/frequency parameters Uu07–Uu23 only with ADC application program version 1.20 or higher.

† See Figure 8-11 for Ed settings with optional sender kits.

‡ See Figure 8-12 for Cn settings with optional digital gauges (gauges are available on selected models only).

Note: Replacement controllers from Kohler Aftermarket Parts are shipped with factory settings for the 8.5/12RES.

Note: Setting the Ec parameter automatically selects the Ed parameter for the standard data inputs for that engine. If you change Ec, check the Ed setting.

Marine Diesel Model		Freq. Hz	Voltage, Phases	Volts, Hz	Market	Engine Type	Data Inputs	Battery Voltage	CANbus Comm.
				Uu*	Uc	Ec	Ed†	Bt	Cn‡
EOZD EFOZD	14EOZD (3 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	2	1 (std.) or 3 (ops) †	12 or 24	0 (No Can) or 1 (J1939)‡
			120/208 V, 3 Ph, 4 W, Wye	11					
			127/220 V, 3 Ph, 4 W, Wye	16					
			120/240 V, 3 Ph, 4 W, Delta	10					
			139/240 V, 3 Ph, 4 W, Wye	10					
			277/480 V, 3 Ph, 4 W, Wye	4					
	15.5EOZD	60	120/240 V, 1 Ph, 3 W	1	0				
	17EFOZD (1 Ph)	50	230 V, 1 Ph, 2 W	2	0				
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	17.5EFOZD (3 Ph)	50	115/230 V, 1 Ph, 3 W	6	0				
			115/230 V, 3 Ph, 4 W, Delta	14					
			110/190 V, 3 Ph, 4 W, Wye	17					
			120/208 V, 3 Ph, 4 W, Wye	18					
			220/380 V, 3 Ph, 4 W, Wye	21					
			230/400 V, 3 Ph, 4 W, Wye	3					
			240/416 V, 3 Ph, 4 W, Wye	22					
	20EOZD (1 Ph)	60	120/240 V, 1 Ph, 3 W	1	0				
	20EOZD (3 Ph)	60	120/240 V, 1 Ph, 3 W	1	0				
			120/208 V, 3 Ph, 4 W, Wye	11					
			127/220 V, 3 Ph, 4 W, Wye	16					
			120/240 V, 3 Ph, 4 W, Delta	10					
			139/240 V, 3 Ph, 4 W, Wye	10					
			277/480 V, 3 Ph, 4 W, Wye	4					
	20EFOZD	50	230 V, 1 Ph, 2 W	2	0	2 w.o. preheater or 9 w/ preheater	1 (std.) or 3 (ops) †	12 or 24	
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	20EFOZD (3 Ph)	50	115/230 V, 1 Ph, 3 W	6	0				
			115/230 V, 3 Ph, 4 W, Delta	14					
			110/190 V, 3 Ph, 4 W, Wye	17					
			120/208 V, 3 Ph, 4 W, Wye	18					
			220/380 V, 3 Ph, 4 W, Wye	21					
			230/400 V, 3 Ph, 4 W, Wye	3					
			240/416 V, 3 Ph, 4 W, Wye	22					
	23EOZD	60	120/240 V, 1 Ph, 3 W	1	0				
	24EOZD (3 Ph)	60	120/240 V, 1 Ph, 3 W	1	0				
			120/208 V, 3 Ph, 4 W, Wye	11					
			127/220 V, 3 Ph, 4 W, Wye	16					
			120/240 V, 3 Ph, 4 W, Delta	10					
			139/240 V, 3 Ph, 4 W, Wye	10					
			277/480 V, 3 Ph, 4 W, Wye	4					

* Use voltage/frequency parameters Uu07–Uu23 only with ADC application program version 1.20 or higher.

† See Figure 8-11 for Ed settings with optional sender kits.

‡ See Figure 8-12 for Cn settings with optional digital gauges (gauges are available on selected models only).

Note: Replacement controllers from Kohler Aftermarket Parts are shipped with factory settings for the 8.5/12RES.

Note: Setting the Ec parameter automatically selects the Ed parameter for the standard data inputs for that engine. If you change Ec, check the Ed setting.

Marine Diesel Model		Freq. Hz	Voltage, Phases	Volts, Hz	Market	Engine Type	Data Inputs	Battery Voltage	CANbus Comm.
				Uu*	Uc	Ec	Ed†	Bt	Cn‡
EOZD EFOZD	23EFOZD (1 Ph)	50	230 V, 1 Ph, 2 W	2	0	7	1 (std.) or 3 (ops) †	12 or 24	0 (No Can) or 1 (J1939)‡
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	23EFOZD (3 Ph)	50	115/230 V, 1 Ph, 3 W	6	0	7			
			115/230 V, 3 Ph, 4 W, Delta	14					
			110/190 V, 3 Ph, 4 W, Wye	17					
			120/208 V, 3 Ph, 4 W, Wye	18					
			220/380 V, 3 Ph, 4 W, Wye	21					
			230/400 V, 3 Ph, 4 W, Wye	3					
			240/416 V, 3 Ph, 4 W, Wye	22					
	27EFOZD (1 Ph)	50	230 V, 1 Ph, 2 W	2	0	7			
			115/230 V, 1 Ph, 3 W	6					
			240 V, 1 Ph, 2 W	13					
	27EFOZD (3 Ph)	50	115/230 V, 1 Ph, 3 W	6	0	7			
			115/230 V, 3 Ph, 4 W, Delta	14					
			110/190 V, 3 Ph, 4 W, Wye	17					
			120/208 V, 3 Ph, 4 W, Wye	18					
			220/380 V, 3 Ph, 4 W, Wye	21					
			230/400 V, 3 Ph, 4 W, Wye	3					
			240/416 V, 3 Ph, 4 W, Wye	22					
	28EOZD (1 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	7			
	28EOZD (3 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	7			
			120/208 V, 3 Ph, 4 W, Wye	11					
			127/220 V, 3 Ph, 4 W, Wye	16					
			120/240 V, 3 Ph, 4 W, Delta	10					
			139/240 V, 3 Ph, 4 W, Wye	10					
			277/480 V, 3 Ph, 4 W, Wye	4					
	32EOZD (1 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	7			
	32EOZD (3 Ph)	60	120/240 V, 1 Ph, 3 W	1	0	7			
			120/208 V, 3 Ph, 4 W, Wye	11					
			127/220 V, 3 Ph, 4 W, Wye	16					
			120/240 V, 3 Ph, 4 W, Delta	10					
			139/240 V, 3 Ph, 4 W, Wye	10					
			277/480 V, 3 Ph, 4 W, Wye	4					

* Use voltage/frequency parameters Uu07–Uu23 only with ADC application program version 1.20 or higher.

† See Figure 8-11 for Ed settings with optional sender kits.

‡ See Figure 8-12 for Cn settings with optional digital gauges (gauges are available on selected models only).

Note: Replacement controllers from Kohler Aftermarket Parts are shipped with factory settings for the 8.5/12RES.

Note: Setting the Ec parameter automatically selects the Ed parameter for the standard data inputs for that engine. If you change Ec, check the Ed setting.

Figure 8-10 Controller Parameter Settings, Marine Diesel Models

Optional Sender Kits and Ed Setting

The installation of optional sender kits may require a change to the Ed (engine data inputs) setting. See Figure 8-11 for the Ed settings with optional sender kits. “No Change” means the installation of the kit does not require a change to the Ed setting.

Note: The Ec setting can affect the Ed setting. If you change the Ec setting, check the Ed setting and change it if necessary to match the value shown in the tables for your unit.

Note: Installation of an optional electronic governor kit with a magnetic pickup does not require a change to the Ed setting.

Model	Sender Kit	Ed
6EOD 4.5EFOD	None	1
	GM32112-KA1 and -KP1 †	3
	GM50552-KA1 *	No Change
	GM47164-KP1 ‡	No Change
8-32EOZD 6.5-27EFOZD	None	1
	GM32112-KA1 and -KP1 *	3
	GM50552-KA1 †	No Change
* OP and WT sender kits † Oil pressure sender kits ‡ Electronic governor kit		

Figure 8-11 Ed Settings with Optional Sender Kits

Cn Communication Parameter

See Figure 8-12 for communication parameter settings. If your generator set is connected to a remote digital gauge, refer to Figure 8-12 or the instruction sheet provided with the gauge to determine the communication parameter Cn setting.

Gauge Kit	Gauge Description	Cn Setting	Communication Description
None	—	Cn00	No CAN
GM32337-KP1	Remote Digital Gauge for Marine	Cn01	J1939 CAN

Figure 8-12 Communication Parameter Cn Settings (optional gauges are available on selected models only)

8.3.4 Adjusting the Voltage, Gain, and Volts/Hz, and Engine Speed

After setting the system voltage and frequency, check the output voltage and frequency and adjust, if necessary, using the following procedures. Follow the instructions in Figure 8-18 and Figure 8-19 to adjust the voltage, gain, volts/Hz, and governor gain while the engine is running. An X in the Display column in Figure 8-18 and Figure 8-19 indicates a number from 0 to 9. Use the up arrow to increase a setting or the down arrow to decrease the setting.

Pressing the Select button when SAVE is displayed returns to the first parameter, voltage adjust (1P).

Note: A digital multimeter that measures voltage and frequency is required for these adjustments.

8.3.5 Voltage Adjustment

⚠ WARNING

Hazardous voltage. Moving parts. Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage**.** Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocution is possible whenever electricity is present. Ensure you comply with all applicable codes and standards. Electrically ground the generator set, transfer switch, and related equipment and electrical circuits. Turn off the main circuit breakers of all power sources before servicing the equipment. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Voltage Adjustment Procedure

1. With the generator set off, connect a digital voltmeter to the output leads or an electrical outlet on the load side of the generator set. Set the meter to measure voltage.

2. Start the generator set by moving the generator set master switch to the RUN position.

3. Use the ADC controller to adjust the voltage (parameter 1P) until the output voltage reaches the desired value. See Figure 8-13.

Measured Voltage, VAC	Approximate Voltage Change per Step, VAC	
	Coarse Adjust	Fine Adjust
85–132	5	0.5
180–251	7	0.7

Figure 8-13 Voltage Adjustment

4. Adjust the voltage stability (gain, parameter 2P) to minimize light flicker.

5. Readjust the voltage, if necessary.

Volts per Hertz (Hz) Adjustments

The cut-in frequency is pre-set for 58 Hz (60 Hz system) or 48 Hz (50 Hz system). When the frequency falls below the cut-in, output voltage is reduced to relieve the engine. The amount of the voltage reduced is set by the 3P parameter. Monitor engine speed and output voltage as loads are applied.

- If there is excessive droop in engine speed and little droop in voltage, increase the 3P value.

- If there is little engine speed droop but excessive voltage droop, decrease the 3P value.

The amount of voltage droop is approximately 0.5% of system voltage for each step of 3P, including each cycle (Hz) below the cut-in frequency.

3P	Voltage Droop for Each Engine Below Cut-in Frequency
0	0
1	0.5%
2	1.0%
3	1.5%
4	2.0%
5	2.5%
6	3.0%
7	3.5%
8	4.0%
9	4.5%

Figure 8-14 Voltage Droop Adjustments

1. Readjust the voltage stability (gain, parameter 2P), if necessary.

2. Readjust the voltage (parameter 1P), if necessary.

3. Stop the generator set.

8.3.6 Frequency Adjustment

The engine speed determines the generator output frequency; 60 Hz units operate at 1800 rpm and 50 Hz units run at 1500 rpm. Adjust the engine governor to change the output frequency using the following procedure.

Frequency Adjustment Procedure

1. Attach a frequency meter to the AC output leads or an electrical outlet on the load side of the generator set.

2. Start and run the generator set until it reaches normal operating temperature (at least 10 minutes).

3. Adjust the electronic governor speed (parameter 4P) to obtain a frequency reading of 60 Hz (or 50 Hz on 50 Hz models). Each step changes the engine speed about 3.6 RPM, which changes the output frequency about 0.06 Hz.

4. Check stability with the generator set running and with no load applied. If the generator set speed is unstable, hunts, or surges, adjust the governor stability (gain, parameter 5P) until the generator set becomes stable with no hunting or surging. (Increasing the gain slows the governor response.)

5. Check the frequency reading. Repeat steps 3 and 4 if necessary to obtain the rated frequency and stable operation.

Controller Configuration Mode *(Use with Figure 8-10, Controller Parameters)*:

Hold the Select button:

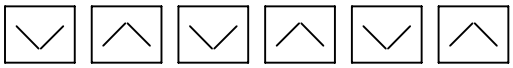
Move the generator set master switch to the RUN position. (The generator set engine will not start.)

Display: . 0

Wait about 5 seconds until the display shows the program version number. (The number may be different than the one shown here.)

Display: 104

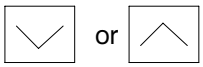
Press the down arrow key and then the up arrow key 3 times to enter the configuration mode. (This is the controller "password.")



Display: U u 0 *x*

Now release the Select button.

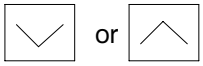
Press:



To set the voltage/frequency setting see Figure 8-10.

Display: U u 0 *x*

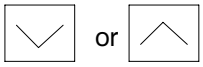
To step to the next parameter, unit configuration Uc.



To set the unit configuration setting to Uc00, if necessary.

Display: U c 0 0

To step to the next parameter, engine type Ec.



To set the engine type, if necessary.

Display: E c 0 *x*

To step to the next parameter, advanced configuration mode or save mode selection.

Display: A d n c

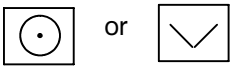
Now either save your settings or enter the Advanced Configuration Mode to set the engine data inputs, battery voltage, and communications.

Press:

To enter advanced configuration mode. **Go to Figure 8-16.**

Display: E d 0 *x*

OR:



To proceed to the save mode without entering the advanced configuration mode. **Go to Figure 8-17.**

Display: S A V E

Note: Shaded boxes show which number in the controller display changes when the up or down arrow key is pressed. *"x"* denotes any number from 0 to 9.

Figure 8-15 Configuration Mode (system voltage/frequency, unit configuration, and engine type parameters)

Pressing the up arrow key at the Adnc display (See Figure 8-15) puts you into the Advanced Configuration Mode.

Press:

or — To set the engine data input type. — **E d 0 *x***

To enter battery voltage selection mode.

or — To toggle between 12 and 24 VDC. — **12-volt models** **B t 1 2**; **24-volt models** **B t 2 4**

To enter communications selection mode.

or — To set the communications parameter. — **C n 0 *x***

To enter SAVE mode. **Go to Figure 8-17.** — **S A V E**

Note: Shaded boxes show which number in the controller display changes when the up or down arrow key is pressed. *"x"* denotes any number from 0 to 9.

Figure 8-16 Advanced Configuration Mode (engine data input types, battery voltage, and engine communications)

There are 3 options when the display says SAVE: — **S A V E**

Press:

To return to the first parameter, system voltage/frequency Uu, to check or change settings before saving. See Figure 8-15. — **U u 0 *x***

or

To save changes. — **Y E S**

or

To discard changes without saving. — **n o**

"Yes"or "no" flashes when the up or down arrow is pressed and then the controller exits the configuration mode. The display returns to the runtime hours. — ***x x x x***

Note: Be sure to save your settings before exiting the configuration mode. The controller reverts to the last *saved* settings when the master switch is moved to the OFF/RESET position.

* *x* in the runtime hours display above denotes any number from 0 to 9.

Now move the master switch to OFF/RESET.

Figure 8-17 Save Mode (after configuring generator set parameters)

Output Voltage and Frequency Adjustment Mode:

Display :*

Move the generator set master switch to the RUN position. The generator set engine starts and the controller display shows the engine runtime hours.

Display: x x x x

Hold:

Wait about 5 seconds until the display changes from runtime hours to the program version number.

Display: x. x x

Press the down arrow key and then the up arrow key 3 times to enter the adjustment mode. (This is the controller "password.")

Display: 1 P x x

The controller is now in the voltage coarse adjustment mode.

Press:

or — To raise or lower the voltage in large increments (approximately 5–7 volts per step).

Display: 1 P x x

To enter fine voltage adjustment mode.

Display: 1 P x x

or — To raise or lower the voltage in smaller increments (approximately 0.5–0.7 volts per step).

To enter coarse voltage stability (gain) adjustment mode.

Display: 2 P x x

or — To raise or lower the voltage stability (gain) in large increments.

To enter fine voltage stability (gain) adjustment mode.

Display: 2 P x x

or — To raise or lower the voltage stability (gain) in smaller increments.

To enter volts/Hz adjustment mode.

Display: 3 P 0 x

or — To raise or lower the volts/Hz:
0.5% per step 00 = 0; 09 = 4.5%

Continued on Figure 8-19.

* Shaded boxes show which character in the controller display changes for each adjustment. *"x"* in the examples above denotes any number from 0 to 9. The actual values may vary from model-to-model.

TP6196

Figure 8-18 Output Voltage and Frequency Adjustments

Continued from Figure 8-18:

Display : *

Press:

⊙	To enter engine governor speed coarse adjustment mode.	4 P x x
﹀ or ﹀	To raise or lower the engine speed in large increments.	
⊙	To enter engine governor speed fine adjustment mode.	4 P x x
﹀ or ﹀	To raise or lower the engine speed in smaller increments.	
⊙	To enter engine governor stability (gain) coarse adjustment mode.	5 P x x
﹀ or ﹀	To raise or lower the engine governor stability (gain) in large increments.	
⊙	To enter engine governor stability (gain) fine adjustment mode.	5 P x x
﹀ or ﹀	To raise or lower the engine governor stability (gain) in smaller increments.	
⊙	To enter SAVE mode. **Go to Figure 8-17.**	S A V E

***** Shaded boxes show which character in the controller display changes for each adjustment. “x” in the examples above denotes any number from 0 to 9. The actual values may vary from model-to-model.

Figure 8-19 Output Voltage and Frequency Adjustments, Continued

Appendix A Generator Selection and Wattage Requirements

Consider total wattage requirements (lights, motors, appliances) when selecting a generator set or when sizing wattage usage in which available space and construction limit the size of the generator set.

Motors

When figuring generator set capacity requirements for loads that include electric motors, consider the high current demanded by the motors during startup. The inrush or starting current is typically 2–3 times higher than that required when the motor reaches normal operating speed. Allow reserve for inrush demands plus other loads which could be on the line as the electric motor starts. Use Figure 1 as a guide when selecting generator set capacity requirements involving motor loads.

Motor HP	Starting (Inrush) Watts	Running Watts
1/4	750	330
1/3	1000	400
1/2	1500	600
3/4	2000	750
1	3300	1100
2	4000	2000
3	5000	3000

Figure 1 Motor Requirements

Lighting

To calculate lighting load, add the wattage of each generator set-operated lamp. Note that not all of the lights or lamps are on the generator set AC circuit; some are DC powered by a 12-volt battery. Make sure the calculated total wattage includes only lights actually on the generator set AC circuit.

Air Conditioners

The starting characteristics of air conditioners vary greatly; one 12,000 Btu unit has, for example, lower starting requirements than a 10,000 Btu unit of another variety. When using only one unit, there is usually no starting problem, provided the lighting and appliance load is not too high when starting the unit.

Simultaneous starting of two air conditioning units, however, can present problems if the generator set capacity is marginal. Because of the variation in starting characteristics among air conditioners, this publication makes no statements regarding multiple-motor starting capabilities of the generator set covered. Consider delayed starting or use of easy-starting devices on air conditioner units whenever simultaneously starting more than one motor.

See Figure 2 for typical air conditioner requirements. Information will vary with manufacturer.

Appliances

Generator sets often furnish AC for appliances such as TV, stereo, electric water heater, etc. With the exception of the resistance-type loads such as the water heater, requirements for appliances are usually low. Do not overlook such loads when figuring total requirements. Allow reserve capacity for anticipated appliance loads to avoid overloading a generator set.

Air Conditioner Size (Btu/Hr.)									
	7,000		9,000		12,000		16,000		24,000
Voltage	115	230	115	230	115	230	115	230	230
Full load amps	9.3	4.8	9.9	5.0	11.8	6.3	16.3	8.0	11.6
Rated load amps	7.7	4.0	7.0	3.5	8.9	4.8	13.0	6.2	10.2
Locked rotor amps	34.0	20.0	40.0	20.0	50.0	31.0	75.0	36.0	56.0
Starting (inrush) watts	3910	4600	4600	4600	5750	7130	8630	8280	12,900
Running watts	886	920	805	805	1020	1100	1500	1430	2350

Figure 2 Typical Marine Air Conditioner Requirements, 60 Hz

Appendix B Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere
ABDC	after bottom dead center
AC	alternating current
A/D	analog to digital
ADC	analog to digital converter
adj.	adjust, adjustment
ADV	advertising dimensional drawing
AHWT	anticipatory high water temperature
AISI	American Iron and Steel Institute
ALOP	anticipatory low oil pressure
alt.	alternator
Al	aluminum
ANSI	American National Standards Institute (formerly American Standards Association, ASA)
AO	anticipatory only
API	American Petroleum Institute
approx.	approximate, approximately
AR	as required, as requested
AS	as supplied, as stated, as suggested
ASE	American Society of Engineers
ASME	American Society of Mechanical Engineers
assy.	assembly
ASTM	American Society for Testing Materials
ATDC	after top dead center
ATS	automatic transfer switch
auto.	automatic
aux.	auxiliary
A/V	audiovisual
avg.	average
AVR	automatic voltage regulator
AWG	American Wire Gauge
AWM	appliance wiring material
bat.	battery
BBDC	before bottom dead center
BC	battery charger, battery charging
BCA	battery charging alternator
BCI	Battery Council International
BDC	before dead center
BHP	brake horsepower
blk.	black (paint color), block (engine)
blk. htr.	block heater
BMEP	brake mean effective pressure
bps	bits per second
br.	brass
BTDC	before top dead center
Btu	British thermal unit
Btu/min.	British thermal units per minute
C	Celsius, centigrade
cal.	calorie
CARB	California Air Resources Board
CB	circuit breaker
cc	cubic centimeter
CCA	cold cranking amps
ccw.	counterclockwise
CEC	Canadian Electrical Code
cfh	cubic feet per hour
cfm	cubic feet per minute
CG	center of gravity
CID	cubic inch displacement
CL	centerline
cm	centimeter
CMOS	complementary metal oxide substrate (semiconductor)
cogen.	cogeneration
Com	communications (port)
conn.	connection
cont.	continued
CPVC	chlorinated polyvinyl chloride
crit.	critical
CRT	cathode ray tube
CSA	Canadian Standards Association
CT	current transformer
Cu	copper
cu. in.	cubic inch
cw.	clockwise
CWC	city water-cooled
cyl.	cylinder
D/A	digital to analog
DAC	digital to analog converter
dB	decibel
dBA	decibel (A weighted)
DC	direct current
DCR	direct current resistance
deg., °	degree
dept.	department
dia.	diameter
DI/EO	dual inlet/end outlet
DIN	Deutsches Institut fur Normung e. V. (also Deutsche Industrie Normenausschuss)
DIP	dual inline package
DPDT	double-pole, double-throw
DPST	double-pole, single-throw
DS	disconnect switch
DVR	digital voltage regulator
E, emer.	emergency (power source)
EDI	electronic data interchange
EFR	emergency frequency relay
e.g.	for example (*exempli gratia)*
EG	electronic governor
EGSA	Electrical Generating Systems Association
EIA	Electronic Industries Association
EI/EO	end inlet/end outlet
EMI	electromagnetic interference
emiss.	emission
eng.	engine
EPA	Environmental Protection Agency
EPS	emergency power system
ER	emergency relay
ES	engineering special, engineered special
ESD	electrostatic discharge
est.	estimated
E-Stop	emergency stop
etc.	et cetera (and so forth)
exh.	exhaust
ext.	external
F	Fahrenheit, female
fglass.	fiberglass
FHM	flat head machine (screw)
fl. oz.	fluid ounce
flex.	flexible
freq.	frequency
FS	full scale
ft.	foot, feet
ft. lbs.	foot pounds (torque)
ft./min.	feet per minute
g	gram
ga.	gauge (meters, wire size)
gal.	gallon
gen.	generator
genset	generator set
GFI	ground fault interrupter
GND, ⏚	ground
gov.	governor
gph	gallons per hour
gpm	gallons per minute
gr.	grade, gross
GRD	equipment ground
gr. wt.	gross weight
H x W x D	height by width by depth
HC	hex cap
HCHT	high cylinder head temperature
HD	heavy duty
HET	high exhaust temperature
hex	hexagon
Hg	mercury (element)
HH	hex head
HHC	hex head cap
HP	horsepower
hr.	hour
HS	heat shrink
hsg.	housing
HVAC	heating, ventilation, and air conditioning
HWT	high water temperature
Hz	hertz (cycles per second)
IC	integrated circuit
ID	inside diameter, identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMS	improved motor starting
in.	inch
in. H_2O	inches of water
in. Hg	inches of mercury
in. lbs.	inch pounds
Inc.	incorporated
ind.	industrial
int.	internal
int./ext.	internal/external
I/O	input/output
IP	iron pipe
ISO	International Organization for Standardization
J	joule
JIS	Japanese Industry Standard
k	kilo (1000)
K	kelvin
kA	kiloampere
KB	kilobyte (2^{10} bytes)

kg	kilogram
kg/cm^2	kilograms per square centimeter
kgm	kilogram-meter
kg/m^3	kilograms per cubic meter
kHz	kilohertz
kJ	kilojoule
km	kilometer
kOhm, kΩ	kilo-ohm
kPa	kilopascal
kph	kilometers per hour
kV	kilovolt
kVA	kilovolt ampere
kVAR	kilovolt ampere reactive
kW	kilowatt
kWh	kilowatt-hour
kWm	kilowatt mechanical
L	liter
LAN	local area network
L x W x H	length by width by height
lb.	pound, pounds
lbm/ft^3	pounds mass per cubic feet
LCB	line circuit breaker
LCD	liquid crystal display
ld. shd.	load shed
LED	light emitting diode
Lph	liters per hour
Lpm	liters per minute
LOP	low oil pressure
LP	liquefied petroleum
LPG	liquefied petroleum gas
LS	left side
L_{wa}	sound power level, A weighted
LWL	low water level
LWT	low water temperature
m	meter, milli (1/1000)
M	mega (10^6 when used with SI units), male
m^3	cubic meter
m^3/min.	cubic meters per minute
mA	milliampere
man.	manual
max.	maximum
MB	megabyte (2^{20} bytes)
MCM	one thousand circular mils
MCCB	molded-case circuit breaker
meggar	megohmmeter
MHz	megahertz
mi.	mile
mil	one one-thousandth of an inch
min.	minimum, minute
misc.	miscellaneous
MJ	megajoule
mJ	millijoule
mm	millimeter
mOhm, mΩ	milliohm
MOhm, MΩ	megohm
MOV	metal oxide varistor
MPa	megapascal
mpg	miles per gallon
mph	miles per hour
MS	military standard
m/sec.	meters per second
MTBF	mean time between failure
MTBO	mean time between overhauls
mtg.	mounting
MW	megawatt
mW	milliwatt
μF	microfarad
N, norm.	normal (power source)
NA	not available, not applicable
nat. gas	natural gas
NBS	National Bureau of Standards
NC	normally closed
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
Nm	newton meter
NO	normally open
no., nos.	number, numbers
NPS	National Pipe, Straight
NPSC	National Pipe, Straight-coupling
NPT	National Standard taper pipe thread per general use
NPTF	National Pipe, Taper-Fine
NR	not required, normal relay
ns	nanosecond
OC	overcrank
OD	outside diameter
OEM	original equipment manufacturer
OF	overfrequency
opt.	option, optional
OS	oversize, overspeed
OSHA	Occupational Safety and Health Administration
OV	overvoltage
oz.	ounce
p., pp.	page, pages
PC	personal computer
PCB	printed circuit board
pF	picofarad
PF	power factor
ph., ∅	phase
PHC	Phillips head crimptite (screw)
PHH	Phillips hex head (screw)
PHM	pan head machine (screw)
PLC	programmable logic control
PMG	permanent-magnet generator
pot	potentiometer, potential
ppm	parts per million
PROM	programmable read-only memory
psi	pounds per square inch
pt.	pint
PTC	positive temperature coefficient
PTO	power takeoff
PVC	polyvinyl chloride
qt.	quart
qty.	quantity
R	replacement (emergency) power source
rad.	radiator, radius
RAM	random access memory
RDO	relay driver output
ref.	reference
rem.	remote
RFI	radio frequency interference
RH	round head
RHM	round head machine (screw)
rly.	relay
rms	root mean square
rnd.	round
ROM	read only memory
rot.	rotate, rotating
rpm	revolutions per minute
RS	right side
RTV	room temperature vulcanization
SAE	Society of Automotive Engineers
scfm	standard cubic feet per minute
SCR	silicon controlled rectifier
s, sec.	second
SI	*Systeme international d'unites,* International System of Units
SI/EO	side in/end out
sil.	silencer
SN	serial number
SPDT	single-pole, double-throw
SPST	single-pole, single-throw
spec, specs	specification(s)
sq.	square
sq. cm	square centimeter
sq. in.	square inch
SS	stainless steel
std.	standard
stl.	steel
tach.	tachometer
TD	time delay
TDC	top dead center
TDEC	time delay engine cooldown
TDEN	time delay emergency to normal
TDES	time delay engine start
TDNE	time delay normal to emergency
TDOE	time delay off to emergency
TDON	time delay off to normal
temp.	temperature
term.	terminal
TIF	telephone influence factor
TIR	total indicator reading
tol.	tolerance
turbo.	turbocharger
typ.	typical (same in multiple locations)
UF	underfrequency
UHF	ultrahigh frequency
UL	Underwriter's Laboratories, Inc.
UNC	unified coarse thread (was NC)
UNF	unified fine thread (was NF)
univ.	universal
US	undersize, underspeed
UV	ultraviolet, undervoltage
V	volt
VAC	volts alternating current
VAR	voltampere reactive
VDC	volts direct current
VFD	vacuum fluorescent display
VGA	video graphics adapter
VHF	very high frequency
W	watt
WCR	withstand and closing rating
w/	with
w/o	without
wt.	weight
xfmr	transformer

Appendix C Generator Set Output Ratings Procedure

Kohler Co. develops the kilowatt output rating of a Kohler® marine generator set based upon the calculations specified in ISO 3046 and ISO 8528-1. The calculations *correct* for environmental variables encountered in a generator set installation. Figure 1 outlines the calculations. Figure 2 contains examples of how heat variables affect generator set ratings.

Generator Output $_{corrected}$ = Generator Output $_{observed}$ x Correction Factor
Output power is expected to be within ±5% of the specified rating when corrected to reference conditions. Correction factors are determined using the following formulas:
1. For naturally aspirated compression-ignition engines (power limited by excess air): C.F. = [1.175 (29.2 / Dry Barometer in. Hg)^{1} (Temperature °F + 460/537)$^{.75}$ – .175] x Alternator Efficiency $_{Reference}$ / Alternator Efficiency $_{Observed}$
2. For turbocharged compression ignition engines: C.F. = [1.175 (29.2 / Barometer $_{Observed}$ in. Hg)$^{.7}$ (Temperature °F + 460/537)^{2} – .175] x Alternator Efficiency $_{Reference}$ / Alternator Efficiency $_{Observed}$
3. For turbocharged and intercooled compression ignition engines: C.F. = [1.175 (29.2 / Barometer $_{Observed}$ in. Hg)$^{.7}$ (Temperature °F + 460/537)$^{1.2}$ – .175] x Alternator Efficiency $_{Reference}$ / Alternator Efficiency $_{Observed}$
Reference conditions: Temperature: 77°F; Pressure: 29.2 in. Hg dry barometer. Kohler sound shield increases ambient intake air approx. 12°F Approximate derates: Temperature: approximately 1% per 10°F (turbocharged engines have a greater derate); Pressure (altitude): approximately 4% per 1000 ft. (1 in. Hg)

Figure 1 Generator Output

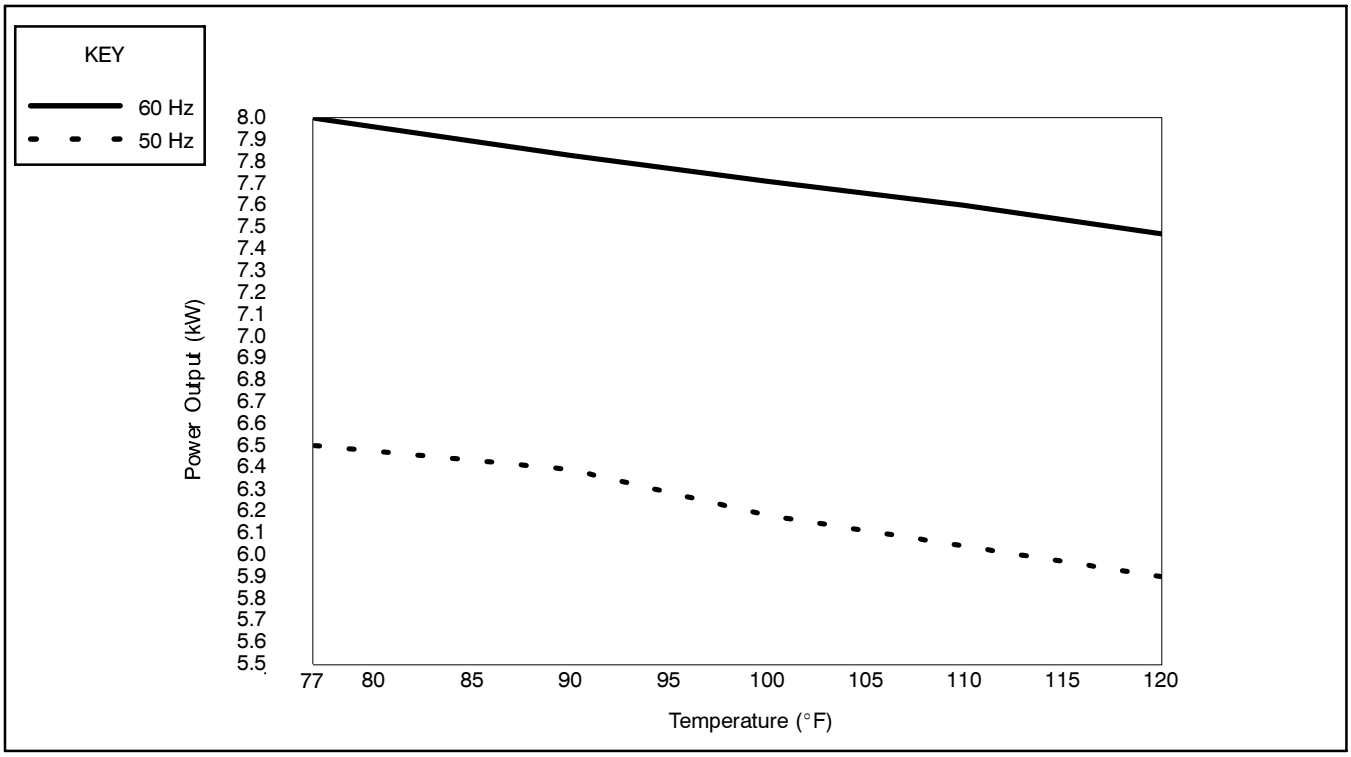


Figure 2 Example: 6.5EFOZ/8EOZ kW Derates (ISO 3046/ISO 8258-1)

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