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# **Installation Manual**

**MDDCA, MDDCB  
MDDCC, MDDCD  
MDDCE, MDDCF  
MDDCG, MDDCH  
MDDCJ**

**California**

**Proposition 65 Warning**

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

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# SAFETY PRECAUTIONS

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

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

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

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

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

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

## GENERAL PRECAUTIONS

- Keep children away from the genset.
- Do not use evaporative starting fluids. They are highly explosive.
- Do not step on the genset when entering or leaving the generator room. Parts can bend or break leading to electrical shorts or to fuel, coolant or exhaust leaks.
- To prevent accidental or remote starting while working on the genset, always disconnect the negative (–) battery cable at the battery.
- Let the engine cool down before removing the coolant pressure cap or opening the coolant drain. Hot coolant under pressure can spray out and cause severe burns.
- Keep the genset, drip pan and compartment clean. Oily rags can catch fire. Gear stowed in the compartment can restrict cooling.
- Make sure all fasteners are secure and properly torqued.
- Do not work on the genset when mentally or physically fatigued or after consuming alcohol or drugs.
- You must be trained and experienced to make adjustments while the genset is running—hot, moving or electrically live parts can cause severe personal injury or death.
- Used engine oil has been identified by some U. S. state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale, or contact used oil or its vapors.
- Ethylene glycol, used as engine antifreeze, is toxic to humans and animals. Clean up spills and dispose of used engine coolant in accordance with local environmental regulations.
- Keep multi-class ABC fire extinguishers readily at hand. Class A fires involve ordinary combustible materials such as wood and cloth. Class B fires involve combustible and flammable liquids and gaseous fuels. Class C fires involve live electrical equipment. (ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.

## GENERATOR VOLTAGE IS DEADLY

- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.
- The genset must not be connected to shore power. Back-feed to shore power can cause electrocution and damage to equipment. An approved switching device must be used to prevent interconnections.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry, stand on a dry wooden platform or rubber insulating mat and use tools with insulated handles.

### ENGINE EXHAUST IS DEADLY

- Never sleep in the boat while the genset is running unless the boat is equipped with properly working carbon monoxide detectors.
- The exhaust system must be installed in accordance with the genset Installation Manual and be free of leaks.
- Make sure the bilge is adequately ventilated with a power exhauster.
- Inspect for exhaust leaks at every startup and after every eight hours of operation.
- For more information about carbon monoxide poisoning see the American Boat and Yacht Council (ABYC) publication TH-22—*Educational Information About Carbon Monoxide*.

### DIESEL FUEL IS COMBUSTIBLE

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

### BATTERY GAS IS EXPLOSIVE

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

### MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

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

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

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

# 1. Introduction

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## ABOUT THIS MANUAL

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

This manual addresses the following aspects of the installation:

- Location and mounting
- Engine exhaust discharge and silencing
- Engine cooling
- Genset room ventilation
- Fuel connections
- Batteries
- Electrical connections
- Bonding for grounding
- Accessibility for operation and maintenance
- Noise and vibration

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

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

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

## STANDARDS FOR SAFETY

You must find out which standards for safety are applicable. Compliance with United States Coast Guard (USCG) regulations is mandatory for boats in U. S. waters. The American Boat and Yacht Council

(ABYC) and the National Fire Protection Association (NFPA) are typical U. S. agencies that publish safety standards for the construction and installation of marine equipment. It is suggested that you obtain the following standards:

- USCG regulations are under Titles 33 and 46 of the Code of Federal Regulations (CFR),

U.S. Government Printing Office  
Washington, D.C. 20404

- NFPA No. 302, *Pleasure and Commercial Motor Craft*,

National Fire Protection Association  
Batterymarch Park  
Quincy, MA 02269

- *Standards and Recommended Practices For Small Craft*,

American Boat and Yacht Council, Inc.  
3069 Solomons Island Road  
Edgewater, MD 21037

Pay particular attention to:

- ABYC P-1 – *Installation of Exhaust Systems for Propulsion and Auxiliary Machinery*
- ABYC E-11 – *AC and DC Electrical Systems on Boats*
- ABYC A-27 – *Alternating Current (AC) Generator Sets*

## OUTLINE DRAWINGS

See the applicable OUTLINE DRAWINGS (p. A-5 and following) for installation details: mounting bolt hole locations, connection points (fuel, battery, raw water, exhaust, remote control and AC output), sizes and types of fittings, overall dimensions and so forth. See your Onan® dealer for a large-scale copy of the applicable drawings.

**⚠WARNING** *Improper installation can result in severe personal injury, death or damage to equipment. The installer must be trained and experienced in performing the installation of electrical and mechanical equipment.*



## 2. Location and Mounting

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The genset has a single lifting eye. Refer to *Section 10. Specifications* regarding the weight of the genset and make provisions accordingly for safe handling.

### LOCATION

See the other sections titled *Ventilation, Fuel Supply, Engine Cooling* and *Engine Exhaust* for additional considerations that bear on location.

The genset is not “ignition protected” and therefore not permitted under USCG regulation 33CFR183 to be located in a gasoline fuel environment. If the boat has gasoline-fueled propulsion engines, the genset will have to be located where it can be isolated from the gasoline fuel system by approved methods.

**⚠WARNING** *The genset can ignite gasoline fumes causing severe personal injury or death. Approved methods must be used to isolate the genset from a gasoline fuel environment.*

Because of noise, vibration and fumes, the generator compartment should be located as far from living quarters as practical.

Locate the genset where there will be enough room to perform periodic maintenance and service. Non-service sides should have at least 2 inches (50 mm) of clearance. The engine end of the genset should have at least 12 inches (305 mm) of clearance for replacing the serpentine belt. The air inlet and outlet openings should have at least 5 inches (127 mm) of clearance. ***When a heat exchanger is provided, enough space must be provided at the engine end of the genset to withdraw the heat exchanger for periodic cleaning.*** See the applicable OUTLINE DRAWINGS (p. A-5 and following).

Make sure there is access for:

- Starting and stopping the genset
- Resetting the line circuit breakers (when provided)
- Checking, filling and draining engine oil
- Changing the engine oil filter
- Changing the engine air filter
- Changing the fuel filters
- Checking, filling and draining engine coolant
- Making fuel connections
- Making battery and ground connections
- Replacing coolant and exhaust hoses
- Replacing the raw water pump impeller (when provided)
- Replacing the serpentine belt
- Withdrawing the heat exchanger (when provided).

### MOUNTING

The genset has integral vibration isolators. The supporting structure underneath should be level and able to support the weight of the genset. Floor or frame stiffness should be greatest under the vibration isolators. Secure the genset with four bolts. See the applicable OUTLINE DRAWINGS (p. A-5 and following) to locate the mounting bolt holes.

Secondary vibration isolators are available from Onan as a kit for an increased degree of vibration isolation. The four (4) isolators are secured under the genset at each mounting bolt hole. Install them in accordance with the instructions in the kit.

# 3. Ventilation

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**⚠WARNING** ***EXHAUST GAS IS DEADLY—FUEL VAPORS ARE EXPLOSIVE! Failure to provide proper ventilation can result in asphyxiation, fire and explosion. The ventilation system must meet applicable standards and regulations, including USCG, NFPA and ABYC (p. 1-1).***

## VENTILATION

Ventilation is required to prevent dangerous concentrations of fuel vapors and exhaust fumes, hold down compartment temperatures and provide combustion air. The highest engine compartment temperatures can occur just after the boat has been docked and the engines have been shut down.

Operating a genset in ambient temperatures higher than 122° F (50° C) will result in noticeable loss of power and reduction in the life of electrical components, generator windings, rubber and other construction materials.

When calculating air flow required for combustion and ventilation, refer to *Section 10. Specifications* for data regarding air flow and heat radiated to the room.

## CARBON MONOXIDE

All openings and feed-through holes for wiring, conduit, pipe and hose must be sealed to prevent exhaust gases from entering the rest of the boat. Wiring conduit must be sealed inside as well as outside.

Cabin plumbing drains must have approved traps to prevent the entrance of exhaust gases from outside.

Carbon monoxide (CO) detectors, listed for marine applications, should be installed in the living quarters of the boat. Note that wind shifts, boat motion, exhaust from other docked boats and other conditions can cause exposure to harmful concentrations of carbon monoxide even though the boat has proper ventilation and isolation of engine rooms.

## 4. Fuel Connections

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**⚠WARNING** *Improper storage and handling of Diesel Fuel can lead to fire. Fuel tank construction, location, installation, bonding for grounding, ventilation, piping, inspection and leak testing must be in accordance with applicable standards and regulations, including USCG, NFPA and ABYC (p. 1-1).*

**⚠CAUTION** *Do not use galvanized steel fuel tanks or piping. The trace of sulfur in diesel fuel can attack the galvanization (zinc) causing debris that clogs fuel filters, pumps and injectors.*

### Fuel

See Section 10. Specifications.

### Fuel Filters

The genset engine is equipped with a primary and a secondary fuel filter. The primary filter has a water separator accessible for periodic draining. When the genset is equipped with an auxiliary fuel lift pump a 50 to 75 micron filter should be installed in the supply line to protect the pump.

### Fuel Fittings

Two 1/4-18 NPTF fittings are provided for fuel supply and return connections. See the appropriate OUTLINE DRAWING (p. A-5 and following). Fuel hose adapter fittings are available from Onan.

### Fuel Hoses

Use USCG TYPE A1 or ISO 7840-A1 fuel hoses. See Fuel Line Sizing in this section for recommended sizing.

Flexible fuel hoses must be used for connections at the genset because of the movement allowed by the vibration isolators.

The fuel hoses connected at the genset must also be non-conductive so that the fuel lines do not become paths for cranking current. (Because the fuel tanks are required to be bonded to the common negative [–] grounding system of the boat, conductive fuel lines will carry cranking currents.)

**⚠WARNING** *Fire can result when fuel lines carry cranking current. Use non-conductive fuel hoses for connections at the genset to prevent the fuel lines from becoming paths for cranking current.*

The fuel hoses connected at the genset can be routed through holes in the sides and bottom of the base. Use the rubber grommets provided to protect the hoses from chaffing and seal noise inside when an enclosure is provided. Make sure all of the unused hose and cable entrance/exit holes around the base are capped or sealed.

## Fuel Line Sizing

An inside diameter of 5/16 inch (8 mm) is recommended for fuel lines and hoses. An inside diameter of 1/4 inch (7 mm) should be considered in applications where fuel lines are short and lift minimal. See Fuel Lift in this section. *Larger diameter fuel lines are harder to prime and keep primed and are thus more likely to cause disruption of genset service.*

Run fuel lines as directly as possible avoiding dips and crests that trap air and cause hard priming.

## Fuel Pickup Tube

A separate fuel pickup tube and supply line is recommended for each genset. Shared pickup tubes and distribution manifolds can lead to fuel starvation and difficult priming.

See Fuel Line Sizing in this section for recommended sizing.

In a common fuel supply tank the genset pickup tubes should be shorter than the propulsion engine pickup tubes to prevent the gensets from being able

to empty the fuel tanks. Make sure the fuel tanks are large enough to cool the returning fuel.

## Fuel Shutoff Valves

A fuel shutoff valve is required at the fuel tank if the end of the fuel line is located below the highest level of fuel in the tank.

An approved method is required to prevent flow when the engine is not running if the highest level of fuel in the supply tank is more than 10 feet (3 meters) above the fuel injectors.

## Fuel Lift

The fuel lift pump on the engine has a lift capability of 8 inches Hg (27 kPa). With the optional auxiliary pump the lift capability is 18 inches Hg (60 kPa). The fuel lift should be calculated, especially when the end of the fuel dip tube is 4 feet (1.2 meters) or more below the lift pump. The calculations must account for pipe, fitting, valve and filter friction, as well as elevation. Base lift calculations on total fuel flow. See *Section 10. Specifications*.

## 5. Engine Cooling

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The engine is cooled by a pressurized, closed-loop liquid cooling system in which coolant is pumped through passages in the engine block, head, exhaust manifold and turbocharger housing. Heat is carried away from the coolant by a keel cooler or raw water (sea water) heat exchanger mounted in the exhaust manifold. A gear-driven raw water pump is provided if the genset has a heat exchanger or wet exhaust. For connection points and fitting sizes see the appropriate OUTLINE DRAWING (p. A-5 and following).

### SYSTEM COMPONENTS

#### Raw Water Pump

The raw water pump can deliver the required flow of cooling water against a maximum lift (suction) of 10 feet (3 meters). Lift is a combination of the actual vertical lift and the resistance to flow caused by the hoses, strainer, sea cock and through-hull fitting.

#### Raw Water Hose

Use SAE 20R4 or equivalent hose that is able to resist a vacuum of 4.35 psi (30 kPa) without collapsing. The fitting on the raw water pump inlet is sized for 1-1/4 inch (31.8 mm) internal diameter hose. This size should be used for all hoses and pipes in the raw water pickup line.

The raw water hose can be routed through holes in the sides and bottom of the base. Use the rubber grommets provided to protect the hose from chaffing and seal noise inside when an enclosure is provided. Make sure all of the unused hose and cable entrance/exit holes around the base are capped or sealed.

#### Raw Water Strainer

The raw water strainer should be located below and as close to the raw water pump as practical. The strainer basket must be removeable for cleaning. *If the sea water strainer is located above the water line, fill it at startup for faster priming.*

#### Sea Cock

Install a bronze, full-flow sea cock on the through-hull fitting.

#### Through-Hull Fitting and Strainer

The through-hull fitting should be as close to the genset as possible. If the strainer has slotted openings, the slots must be parallel to the keel for best flow when the boat is under way. Through-hull fittings should be staggered along the keel so that downstream fittings are not starved.

**⚠ CAUTION** *Do not use a scoop-type through-hull fitting. A forward-facing scoop can develop enough ram pressure to flood the engine. A rear-facing scoop can develop enough suction to impede flow.*

#### Wet Exhaust Elbow

The wet exhaust elbow is secured at the factory to point straight down, but can be turned to point 45 degrees forward or 45 degrees rearward. To change the orientation: remove the formed raw water hose, loosen the support bracket, turn the elbow in the desired direction and retighten the bracket screw. Select and install the proper formed hose from among the three provided. Discard the unused hoses.

#### Siphon Break

**⚠ CAUTION** *Engine damage due to flooding as a result of failing to install a required siphon break is not covered by Warranty.*

Conduct the RAW WATER PICKUP TEST to determine whether a siphon break is required to prevent the muffler and engine from being flooded with floatation water (Figure 6-2). A siphon break kit is available from Onan. The top panel of an enclosed genset has knockouts for the hoses to pass through. The kit has the hole grommets.

**Note:** A 1-1/2 inch (38.1 mm) internal diameter hose is required to connect the heat exchanger to the siphon break and a 1-1/4 inch (31.8 mm) hose to connect the siphon break to the exhaust-water mixer at the siphon point. See Figure 6-2.

## Coolant Recovery Tank

The coolant recovery tank kit shipped with the genset must be installed for proper operation of the cooling system. Follow the instructions in the kit.

The tank must be accessible for daily inspection and refilling. The genset enclosure (if provided) has holes for mounting the tank on either end. For gensets not provided with an enclosure, mount the tank on a bulkhead within reach of the hoses and slightly above or at the same height as the pressure cap. Fill the tank in accordance with the Operator's Manual.

### Initial Coolant Fill

**⚠ CAUTION** *Running the engine without coolant can cause damage not covered by Warranty.*

The genset is normally shipped from the factory with coolant, unless prohibited by shipping regulations. Fill the system, if necessary, in accordance with the Operator's Manual.

**Note:** Keel-cooled gensets are only partially filled with coolant. Coolant must be added to fill the keel cooler and expansion tank.

## RAW WATER PICKUP TEST

### Objective

The objective of this test is to determine the elevation of the water line relative to the genset under all anticipated uses and speeds of the boat.

### Method

When the boat is ready for its sea trials and loaded to its maximum rated capacity:

1. Close the sea cock and disconnect the raw water pickup hose from the genset. Alternatively, connect a clear plastic hose to the strainer or sea cock.
2. Raise the end of the hose above expected water level and open the sea cock. *The water line is at the level visible in a clear plastic hose or where water just begins to spill as the end of the hose is lowered.* While the boat is still docked, mark the level on the genset.

3. Operate the boat through its speed range, forward and reverse. While the boat is operating, have someone monitor the water level in the hose and mark the highest level on the genset.

### Requirement

A siphon break must be installed if the siphon point (Figure 6-2) is not at least 6 inches (152 mm) above the highest marked water line (docked or moving).

**Note:** If the water line when the boat is moving is much higher than when the boat is docked, the difference could be due to the through-hull fitting or its location. If the through-hull fitting is of the forward-facing scoop-type designed to create ram pressure, replace it with a flush fitting. Another possibility might be to move the fitting to a location where the dynamic hull pressure is less.

## KEEL COOLING

### Sizing Keel Cooler

When sizing the keel cooler, refer to *Section 10. Specifications* for data regarding engine coolant capacity, coolant flow rate, heat rejected to coolant, thermostat full-open temperature, pressure cap rating and maximum permissible pressure drop across the keel cooler.

### Sizing Expansion Tank

Expansion tank volume must be at least 20 percent of total coolant system volume.

**Onan Expansion Tank Kit:** The engine-mounted coolant expansion tank available from Onan as a kit has a volume of 4 gallons (15.7 liters). See Page A-7 or A-11 for an illustration of the installation. Follow the instructions in the kit. The kit is available only for unhoused gensets.

**Non-Onan Expansion Tanks:** To connect an expansion tank, use the adapter fitting for 1-1/4 inch (31.75 mm) I. D. hose available from Onan. The adapter replaces the coolant fill neck, which is discarded. The expansion tank must be the highest point in the coolant system for proper deaeration.

# 6. Engine Exhaust

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## WET EXHAUST SYSTEMS

**⚠ WARNING** ***EXHAUST GAS IS DEADLY! The exhaust system must be leak-free and convey all exhaust outside, away from windows, doors and vents.***

Figure 6-1 illustrates a typical exhaust system where the raw water fitting on the exhaust-water mixer (siphon point) is above the load water line and Figure 6-2 where it is below. See *Section 5. Engine Cooling* regarding raw water connections. The installation must comply with applicable standards and regulations, including those of the USCG and ABYC (p. 1-1).

A separate engine exhaust system must be installed for each genset, isolated from all other engine exhaust systems.

Mufflers, water separators and siphon breaks are available as kits from Onan.

### Hose and Hose Fitting Diameters

*No hose or hose fitting in the exhaust system may have a smaller inside diameter than the engine outlet. If the total run of exhaust hose is more than 20 feet (6 meters), measure exhaust back pressure and use larger diameter hose if back pressure exceeds specifications. See *Section 10. Specifications*.*

### Exhaust Hose

Use hose that has been approved for wet exhaust systems. Approved hose and stainless steel elbows are available from Onan. Horizontal runs of hose must slope down at least 1/2 inch per foot (42 mm/meter) and be supported such that there are no sags. *The entire run of hose must be accessible for visual inspections and replacement.*

### Hose Clamps

Use two stainless steel hose clamps at least 1/2 inch (12.7 mm) wide to clamp each end of each hose.

### Muffler

Install an approved muffler as close a practical to the engine. For optimum silencing the length of hose between the engine and muffler should not exceed 6 feet (2 meter). The muffler inlet should be a minimum of 1 foot (305 mm) below the exhaust-water mixer and the outlet should be vertical.

The base of the muffler should not be more than 54 inches (1.4 meter) below the top of the water separator (Figure 6-1) or 48 inches (1.2 meter) below the crest in the piping (Figure 6-2).

Mount the muffler such that air can circulate underneath to prevent condensation and mold.

### Exhaust Water Separator

When an exhaust water separator is used (Figure 6-1), *the muffler outlet and water separator inlet diameters must be the same size.* The water separator should be installed directly above the muffler to maintain a vertical lift. The through-hull fitting for the drain hose should not be more than 6 inches (152 mm) below the load water line. It must have a sea cock. An EXHAUST WATER SEPARATOR BACKFLOW TEST must be conducted during the sea trials to determine that there is no backflow that could flood the engine.

## Exhaust Through-Hull Fitting

The exhaust through-hull fitting must be above the load water line under all anticipated uses and speeds of the boat. To reduce wave wash-in when a water separator is used (Figure 6-1), the top of the water separator must be at least 18 inches (450 mm) *above the load water line*. When an elbow is used at the top of the muffler outlet hose, the elbow must be at least 12 inches (305 mm) above the through-hull fitting (Figure 6-2).

**⚠ CAUTION** *Backflow into the engine can cause major damage. The sea trials must verify that there is no backflow through either the exhaust hull fitting or the water separator drain hose fitting.*

## Siphon Break

See Page 5-1.

## EXHAUST WATER SEPARATOR BACKFLOW TEST

### Objective

To determine that there is no backflow through the exhaust water separator under any operating condition (Figure 6-1).

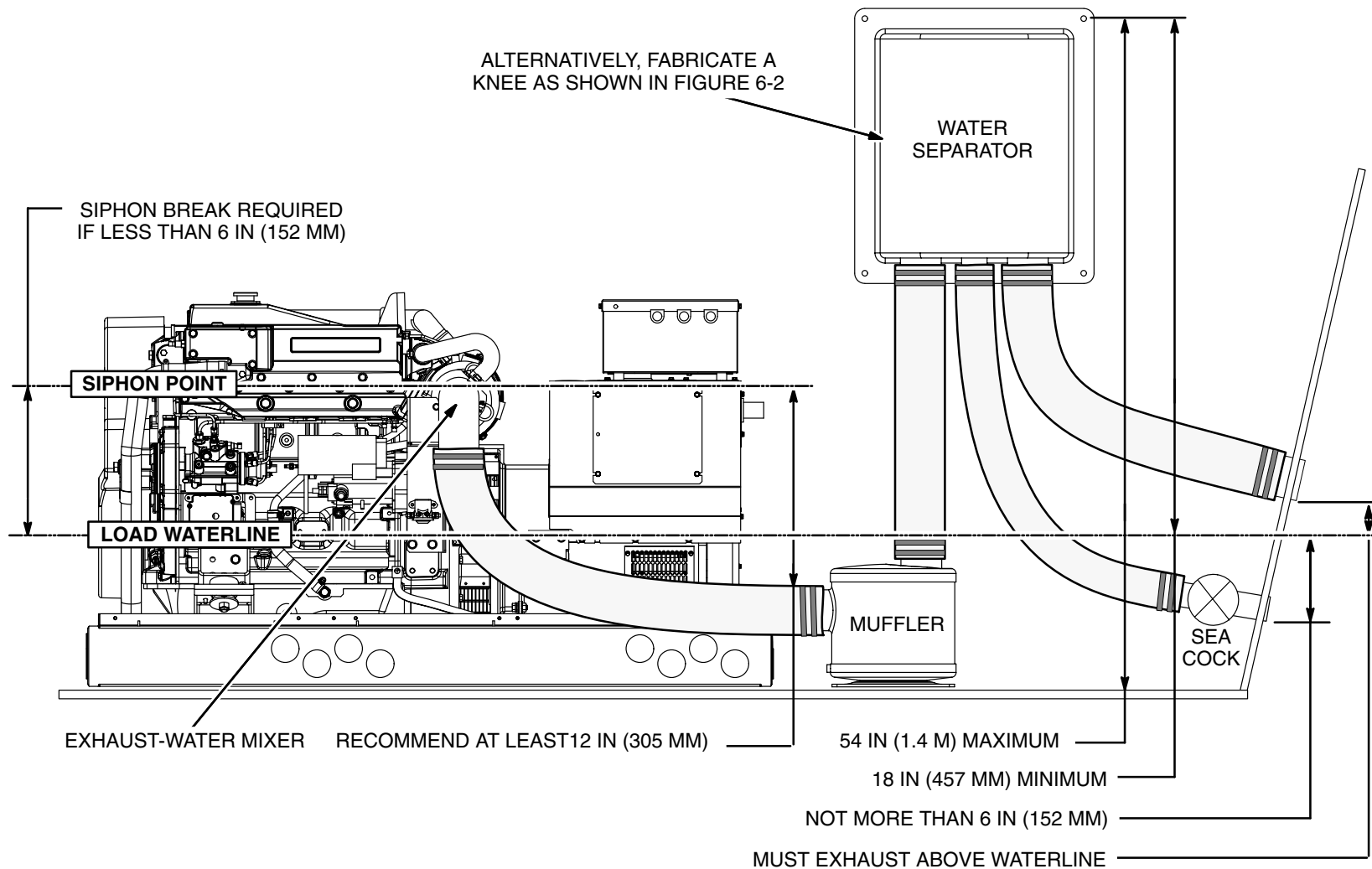
### Method

Conduct this test during the sea trials in conjunction with the RAW WATER PICKUP TEST. Prepare by closing the drain hose sea cock and disconnecting the hose from the water separator. Conduct the test by opening the sea cock while keeping the hose raised to its fitting on the water separator.

### Requirement

There must not be any back flow while operating the boat throughout its speed range. If there is, relocate the through-hull fitting.

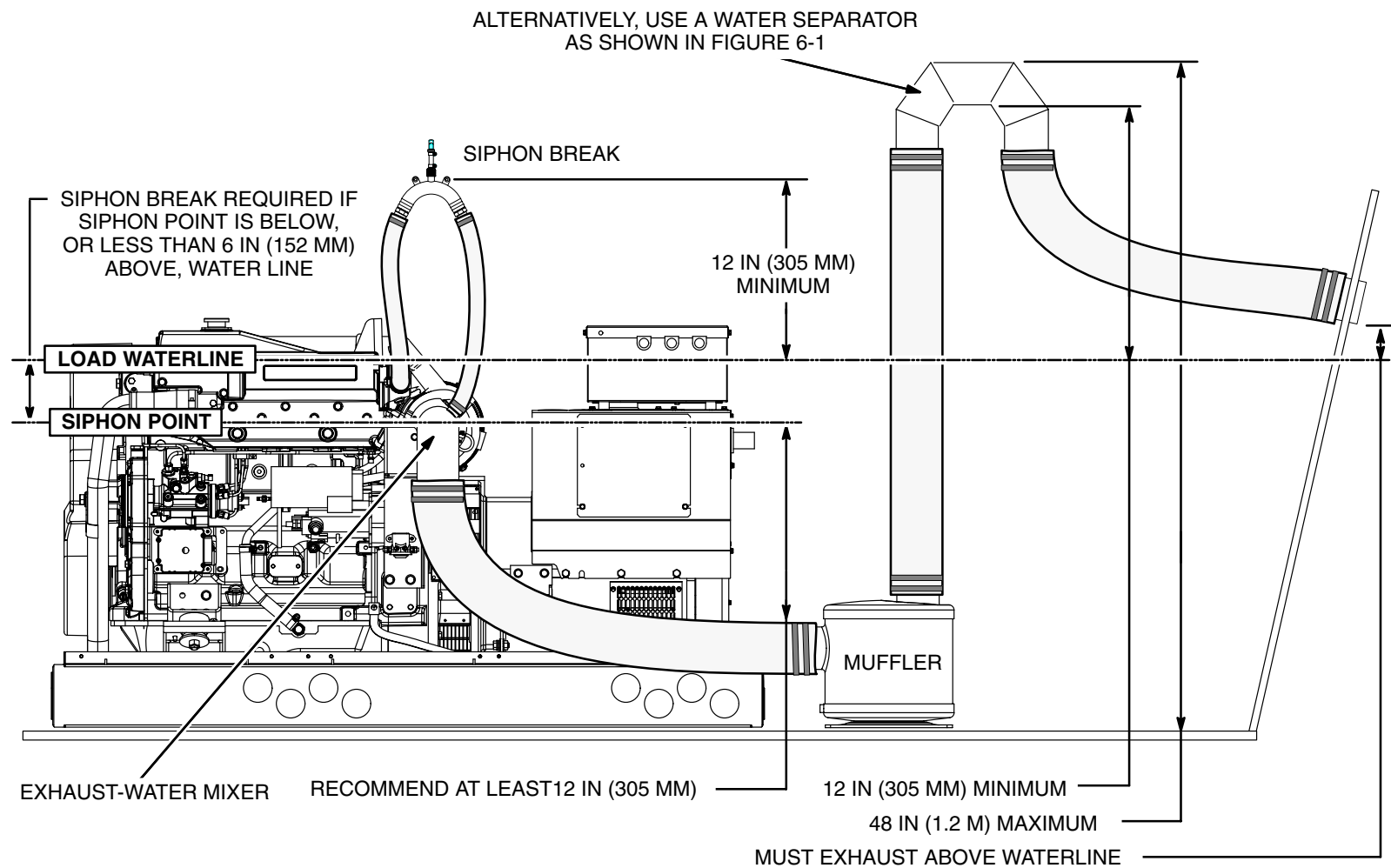




Notes:

1. All exhaust hose and pipe must slope, without sagging, at least 1/2 inch per foot (42 mm/meter).
2. The operator will not be able to look for water discharging from the hull to tell whether engine cooling water is flowing. However, the genset will shut-down if water stops flowing (Code No. 7) or exhaust temperature becomes too high (Code No. 58). See *Troubleshooting* in the Operator's Manual.

**FIGURE 6-1. TYPICAL WET EXHAUST INSTALLATION ABOVE LOAD WATERLINE—WITH WATER SEPARATOR**



**FIGURE 6-2. TYPICAL WET EXHAUST INSTALLATION BELOW LOAD WATERLINE—WITH SIPHON BREAK**

## DRY EXHAUST SYSTEMS

Figure 6-3 shows a typical dry exhaust system. A separate exhaust system must be provided for each engine. Soot, corrosive condensate and high gas temperatures can damage idle engines served by a common exhaust system.

The exhaust system must be supported independently of the engine. Supporting the weight of exhaust piping at the turbocharger outlet can lead to turbocharger failure.

A flexible, bellows-type stainless steel section at least 18 inches (300 mm) long must be connected at the engine exhaust outlet to take up thermal expansion and engine movement.

Long runs of exhaust pipe (vertical or horizontal) should include a flexible, bellows-type stainless steel section to take up thermal expansion. Flexible exhaust sections must not be used to compensate for misaligned piping or to form bends.

Horizontal runs of exhaust piping should slope downwards from the engine to a drain trap and plug,

which should be located where the piping turns to rise vertically.

To prevent overheating that can lead to fire, route exhaust piping at least 9 inches (229 mm) away from combustible construction. Where a 9 inch (229 mm) clearance cannot be maintained, the pipe may be insulated with material rated to withstand at least 1000°F (538°C). The surface of the insulation must not exceed 160°F (71°C).

To prevent burns, shield or insulate exhaust piping and mufflers where accidental contact is likely. The surface of the shield or insulation must not exceed 200°F (93°C).

The entire exhaust system must be accessible for visual inspection and repair.

See *Section 10. Specifications* for maximum allowable exhaust back pressure.

**⚠ CAUTION** *Excessive exhaust back pressure can result in reduced power, smoke, high exhaust temperature and reduced engine life.*

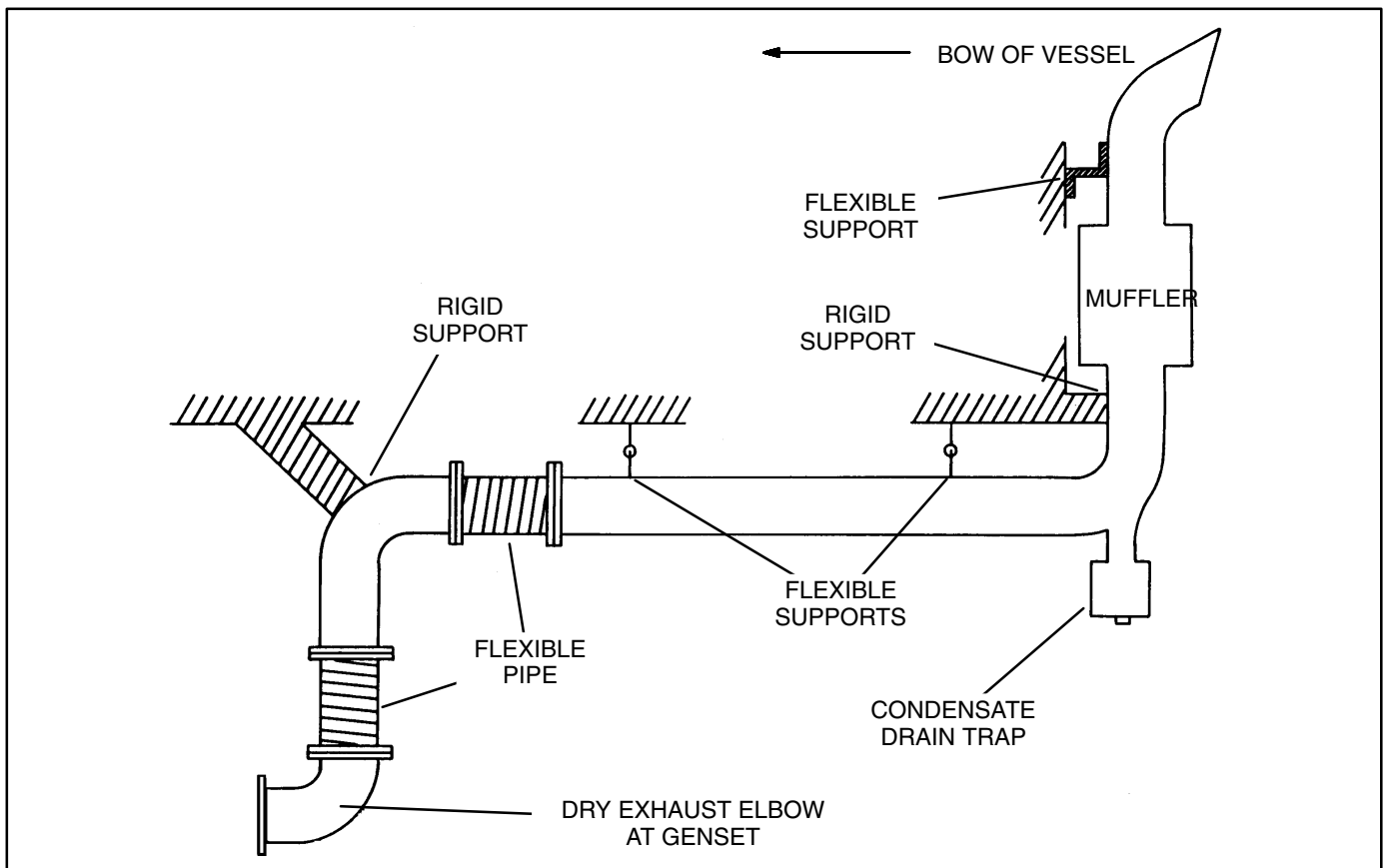


FIGURE 6-3. SCHEMATIC OF TYPICAL DRY EXHAUST SYSTEM

# 7. Electrical Connections

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**⚠WARNING** ***HAZARDOUS VOLTAGE! Touching uninsulated live parts inside the genset and connected equipment can result in severe personal injury or death. For your protection, stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry from your hands and use tools with insulated handles. Secure protective covers when completing the installation.***

***IMPROPER WIRING can cause electrocution or fire.***

***ACCIDENTAL / REMOTE STARTING of the genset can cause severe personal injury or death. To prevent unintended starting, do not connect the starting battery until it is time to start up the genset.***

## AC CONNECTIONS

### Wiring Methods

All wiring methods, connections, wire ampacities, equipment grounding and materials must be inspected and comply with applicable regulations. Use flexible conduit and stranded conductors for AC output connections at the genset because of the movement allowed by the vibration isolators.

The AC output cables can be routed through holes in the sides and bottom of the base. Use the rubber grommets provided to protect the cables from chafing and seal noise inside when an enclosure is provided. Make sure all of the unused hose and cable entrance/exit holes around the base are capped or sealed.

All feed-through holes in decks and bulkheads for wiring must be sealed to prevent exhaust gases from entering the living spaces of the boat. Wiring conduit must be sealed inside as well as outside.

**⚠WARNING** ***CARBON MONOXIDE IS DEADLY! Feed-through holes in decks and bulkheads for wiring must be sealed to prevent carbon monoxide (CO) from entering the living spaces of the boat.***

### Generator (Alternator) Connections

Make generator AC output connections and reconnections as required at the generator terminals or line circuit breakers (if provided) in accordance with the reconnection diagram (p. A-3). The generator and circuit breaker terminal access covers and conduit knockouts are located as shown on the appropriate OUTLINE DRAWING (p. A-5 and following).

The circuit breakers may need to be replaced to obtain required protection or full genset power if voltage reconnections are made. Voltage may also need to be readjusted. See *Section 8. Adjusting AC Output Voltage*.

### Grounding

The genset and all connected electrical equipment must be bonded to the common AC grounding system of the boat in accordance with applicable regulations.

**⚠WARNING** ***Faulty grounding of AC circuits and equipment can lead to electrocution or fire.***

### Transfer Switch

Use an approved transfer switch if provision is made for connecting the boat to shore power.

**⚠WARNING** ***Backfeed to shore power can cause electrocution or damage to equipment. Use an approved device to prevent the genset from being interconnected with shore power.***

### Load Balancing

The electrical loads should be balanced as closely as possible between the AC output phases so that maximum power can be utilized from the genset. Redistribute the loads as necessary.

## BATTERY CONNECTIONS

The DC voltage rating for genset control and engine cranking is on the genset nameplate. It is either 12 volts or 24 volts. Battery negative (–) must be grounded. Some models are equipped for applications requiring isolated ground.

### Batteries

See *Section 10. Specifications* for recommended battery capacity.

### Battery Recharging

See *Section 10. Specifications* for the battery charging capacity of the engine-driven battery charging alternator.

### Battery Location and Mounting

Locate the battery where spills and leaks will not drip acid on fuel lines, wiring or other equipment and where ventilation is adequate to prevent the accumulation of explosive gases. Secure the battery so that it cannot shift. Provide an insulating boot for the positive (+) terminal to protect against accidental contact.

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

### Battery Cables

See *Section 10. Specifications* for the maximum permissible starting current resistance and size the battery cables, connectors, contactors and switches accordingly.

**⚠WARNING** *Sparks can ignite fuel leading to severe personal injury or death. Do not run battery cables and fuel lines together. Separate cables and fuel lines with conduit or tubing if run through the same opening. Do not tie together.*

Bolt the cables to the engine starter solenoid and engine block. See the appropriate OUTLINE DRAWING (p. A-5 and following). Provide an insulating boot for the positive (+) terminal to protect against accidental contact.

The battery cables can be routed through holes in the sides and bottom of the base. Use the rubber grommets provided to protect the cables from chafing and seal noise inside when an enclosure is provided. Make sure all of the unused hose and cable entrance/exit holes around the base are capped or sealed.

### GENSET GROUND (VESSEL BOND)

The genset DC circuits must be bonded to the common grounding system of the boat in accordance with applicable regulations. Bolt the bonding cable to the engine block. See the appropriate OUTLINE DRAWING (p. A-5 and following).

**⚠WARNING** *Faulty bonding of the genset DC circuits to the common grounding system of the boat can result in fire or damage to equipment.*

## REMOTE CONTROL CONNECTOR

Connector **J34** for remote control connections is stowed inside the control box (p. A-4). It mates with a Deutsch® Part Number **DT06-08S** sealed 8-pin connector plug.

**Note:** The connector designated **J1** is for remote connections when the Digital Display on the genset control box is replaced by a control switch. See Page A-4 for connections.

### Onan e-Series Digital Display

Up to three (3) Onan *e-Series Digital Displays* may be connected for remote control and monitoring of the genset. Follow the installation instructions in the display kit.

A panel with a control switch is also available as a kit to replace the *e-Series Digital Display* on the genset so that it can be moved to a remote control station.

### Remote Control Switch and Meter

**Onan Remote Control Panel Kits:** Remote control panels with a control switch or control switch and hour meter are available as kits. Follow the installation instructions in the kit.

**Non-Onan Remote Control Panels:** Refer to the wiring diagrams on Page A-4 to select and connect the remote control panel components. Use momentary-contact switches for Start and Stop.

### Remote Control Wiring Harnesses

**Onan Harnesses:** Eight-conductor plug-in wiring harnesses of various length are available for connecting *e-Series Digital Displays* and/or remote switch panels. “Y” harnesses are also available for applications requiring more than one remote control station.

**Non-Onan Harnesses:** Use 16 AWG wiring. For harnesses 45 to 150 feet (14 to 46 meters) long, use 14 AWG wiring at connector pins 2, 3 and 4.

**Routing Control Wiring:** All feed-through holes in decks and bulkheads for wiring must be sealed to prevent exhaust gases from entering the living spaces of the boat. Wiring conduit must be sealed inside as well as outside.

**⚠WARNING** **CARBON MONOXIDE IS DEADLY!** *Feed-through holes in decks and bulkheads for wiring must be sealed to prevent carbon monoxide (CO) from entering the living spaces of the boat.*

Do not route remote control wiring near AC wiring. AC can induce false signals that can cause erratic operation of the genset.

## EXTERNAL CONNECTOR J12

Connector **J12** is for external connections and is stowed inside the genset control box (p. A-1). The connector is shipped from the factory plugged into its mating receptacle (**P12**), which has two jumpers. A mating receptacle with 8 inch (203 mm) long pig-tails is available.

Connector **J12** also mates with a Deutsch® Part Number **DT04-12P** sealed 12-pin connector receptacle.

### Auxiliary Engine Shutdown

Pins **1** and **2** are provided to enable engine shutdown by means of an external shutdown device. The device must close the circuit to cause shutdown.

### Common Alarm

Dry contacts across Pins **3**, **4** and **5** are provided for an external common alarm circuit. Current must not exceed 13 amps or voltage 50 VDC.

The *e-Series Digital Display* will display **ENGINE F** (Code No. 16) if the auxiliary device causes shutdown. See the Operator's Manual.

### Fault Bypass

**⚠ CAUTION** *Damage to the genset as a result of bypassing fault shutdown protection is not covered under Warranty.*

Pins **6** and **7** are provided to enable operation during a fault shutdown condition. The fault bypass switch must close the circuit to prevent shutdown. This feature is available for applications that require the genset to be kept running to supply a critical load, *regardless of possible damage to the genset.*

The PRE-ALARM status lamp blinks rapidly while the genset is running in fault bypass mode. See the Operator's Manual.

### Speed Bias

PMG excited gensets are capable of parallel operation. Pin **8** provides for connection of a speed bias signal (0.5 to 4.5 VDC) from an external load sharing module.

### External Stop

Remove the jumper across pins **9** and **11** and connect the external stop circuit. The device must have normally closed (NC) contacts. *The combined maximum load of the CO and external stop devices must not exceed 0.5 amps.*

Leave the jumper across pins 9 and 11 in place if an external stop device is not to be connected, otherwise the genset will not run.

The *e-Series Digital Display* will display **EXTERNAL SHUTDOWN (Code No. 61)** if the external device causes shutdown. See the Operator's Manual.

### CO Detector Shutdown

Remove the jumper across pins **10** and **12** and connect the remote CO detection and shutdown circuit. The device must have normally closed (NC) contacts. *The combined maximum load of the CO and external stop devices must not exceed 0.5 amps.*

Leave the jumper across pins 10 and 12 in place if a CO detector is not to be connected, otherwise the genset will not run.

The *e-Series Digital Display* will display **SHUTDOWN DUE TO VESSEL CO (Code No. 5)** if the CO detector causes shutdown. See the Operator's Manual.

## J1939 DATA LINK CONNECTOR J14

Connector **J14** is for external SAE J1939 data link connections and is stowed inside the genset control box (p. A-1). It mates with a Deutsch® Part Number **DT04-4P** sealed 4-pin connector receptacle.

## NIM CONFIGURATION JUMPERS

The NIM (Network Interface Module) board is mounted on the left wall inside the control box and is connected as shown on Page A-1. It has five jumpers to configure the board for the specific application (Figure 7-1).

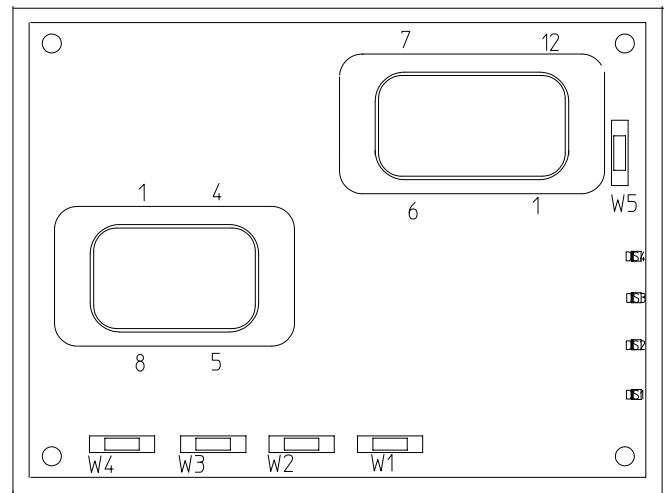
1. Jumper **W1** has no function at this time.
2. Jumper **W2** is cut for these genset models.
3. Jumpers **W3** and **W4** are used to assign the J1939 network address of the genset in a multiple-genset installation. To assign an address, cut the jumpers as scheduled in Table 7-1.

**TABLE 7-1. J1939 ADDRESSES**

JUMPER W3	JUMPER W4	ADDRESS
Not Cut	Not Cut	234
Not Cut	Cut	158
Cut	Not Cut	179
Cut	cut	203

4. Cut Jumper **W5** if the bus termination resistor on this NIM board is not required to terminate the network bus.

See your Onan distributor for more information. Onan Publication D-3315, *Supported Messages on SAE J1939*, must be used when designing the interface for genset monitoring and diagnostics.



**FIGURE 7-1. NIM CONFIGURATION JUMPERS**



## 8. Adjusting AC Output Voltage

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### NON-PMG EXCITED ALTERNATORS

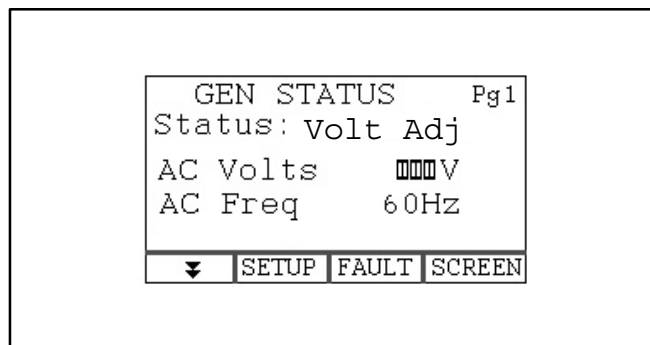
#### Using Digital Display to Adjust Voltage

**Note:** The GEN STATUS screen will not display AC Voltage while the genset is in voltage adjust mode. The line for displaying the voltage is filled in as shown in Figure 8-1. A separate voltmeter is required for voltage adjustment.

1. Start the genset and let voltage and frequency stabilize for 5 to 10 seconds. Make sure all loads have been disconnected.
2. Rapidly press **START** 6 times *during the first minute after startup* to put the genset controller into *voltage adjust mode*. The green status lamp will blink rapidly and the Display will change Status from *Running* to *Volt Adj* (Figure 8-1).
3. **To adjust voltage up**, press and quickly release **START**. Voltage will increase approximately 0.6 volts each press and release.
4. **To adjust voltage down**, press and hold **START** for about 1 second. Voltage will decrease approximately 0.6 volts each press and release.
5. When satisfied with the adjustment, wait about 20 seconds for the Display to change Status from *Volt Adj* to *Running* and then press **STOP** to stop the genset and save the adjustment.
6. Restart the genset and check voltage.

#### Using Control Switch to Adjust Voltage

1. Start the genset and let voltage and frequency stabilize for 5 to 10 seconds. Make sure all loads have been disconnected.
2. Rapidly press **START** 6 times *during the first minute after startup* to put the genset controller into *voltage adjust mode*. The amber status lamp will begin blinking about once every second to indicate the change to voltage adjust mode. The green status lamp will remain on.



**FIGURE 8-1. VOLTAGE ADJUSTMENT SCREEN**

3. **To adjust voltage up**, press and quickly release **START**. Voltage will increase approximately 0.6 volts each press and release.
4. **To adjust voltage down**, press and hold **START** for about 2 second. Voltage will decrease approximately 0.6 volts each press and release.
5. When satisfied with the adjustment, wait about 20 seconds for the amber lamp to stop blinking and then press **STOP** to stop the genset and save the adjustment.
6. Restart the genset and check voltage.

## PMG EXCITED ALTERNATORS

**⚠WARNING** **HAZARDOUS VOLTAGE!** *Touching uninsulated live parts inside the genset and connected equipment can result in severe personal injury or death. For your protection, stand on a dry wooden platform or rubber insulating mat, make sure your clothing and shoes are dry, remove jewelry from your hands and use tools with insulated handles. Secure protective covers when completing installation or adjustments.*

### Adjusting Voltage

Refer to Figure 8-2.

1. If the genset has a sound shield enclosure, remove the front access panel below the control box.
2. Remove the voltage regulator access cover.
3. Push the Single/Parallel Operation Switch up to **SINGLE**. The switch is located below the voltage regulator access opening.
4. Start the genset and let voltage and frequency stabilize. Make sure all loads have been disconnected.
5. Using a small flat-bladed screwdriver, turn the *Voltage Trimmer* clockwise to increase voltage or counterclockwise to decrease voltage.

### Adjusting Reactive Droop Compensation

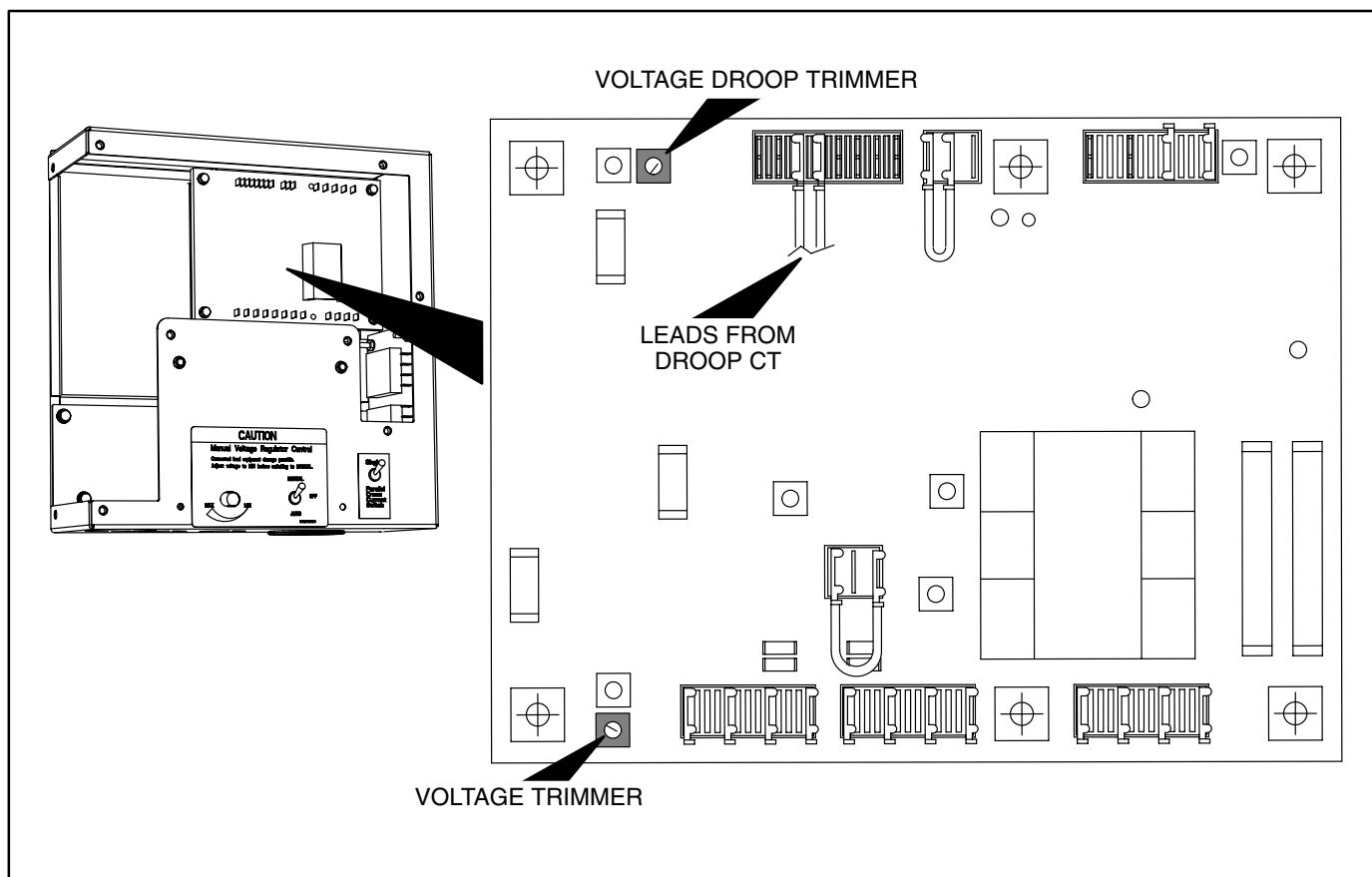
This procedure applies only to gensets being set up for paralleling. Refer to Figure 8-2.

1. Check for correct droop CT connections and polarity, especially if the generator has been re-connected (p. A-2 and A-3).
2. Adjust voltage in accordance with the preceding procedure.
3. Push the Single/Parallel Operation Switch down to **PARALLEL**. The switch is located below the voltage regulator access opening.
4. Start the genset and connect at least 1/2 rated load.
5. Measure voltage at the voltage regulator terminals to which the droop CT leads are connected. You may expect less than 5 VAC.
6. Multiply the reciprocal of the voltage measured in Step 5 ( $1 \div \text{VAC}$ ) by 100. This value is the percentage of full rotation required of the *Voltage Droop Trimmer*.

*Example Calculation:* If 1.4 VAC was measured in Step 5, the trim required is:

$$(1 \div 1.4) \times 100 = 71\% \text{ of full rotation.}$$

7. Turn the *Voltage Droop Trimmer* fully counterclockwise to zero and then clockwise the percentage of full rotation determined in Step 6 (approximately).



**FIGURE 8-2. VOLTAGE REGULATOR ON PMG EXCITED ALTERNATORS**

## 9. Installation Review and Startup

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**Before starting the genset**, review the installation checklist below for those items that do not require the genset to be actually running. Make necessary reconnections, modifications and repairs. Then start and operate the genset in accordance with the Operator's Manual, observing all of its instructions and precautions. Continue working through the installation checklist with the genset running, making necessary reconnections, modifications and repairs. Check off (✓) each item that can be answered positively. Do not place the genset in service until each item has been checked off.

- ☐ The RAW WATER PICKUP TEST was conducted during the sea trials to establish the water line and a siphon break was installed, if found necessary.
- ☐ The sea trials established that at all boat speeds enough raw water is picked up for genset engine and exhaust cooling.
- ☐ The sea trials established that there is no back-flow through the exhaust through-hull fitting or water separator drain hose (when provided) when the boat is under way, forward or reverse.
- ☐ Genset compartment ventilation meets regulations and the sea trials established that ventilation is sufficient to maintain acceptable genset compartment temperatures, even while "heat soaking" after returning to dock.
- ☐ The living quarters are sealed against leaks from spaces where exhaust and fuel vapors can accumulate.
- ☐ The genset is securely mounted.
- ☐ There is adequate clearance for conducting all maintenance specified in the Operator's Manual.
- ☐ The coolant recovery tank is mounted properly and is accessible for inspection and filling.
- ☐ The entire exhaust system is accessible for inspection and replacement.
- ☐ Fuel tanks, piping, hoses and filters comply with regulations and are accessible for inspection and replacement.
- ☐ The genset is bonded to the boat grounding system in accordance with regulations.
- ☐ All grounded cranking motor circuits are connected by properly sized common bonding conductors.
- ☐ An approved transfer switch prevents interconnections between shore power and genset.
- ☐ AC wiring methods, materials and bonding for grounding meet regulations.
- ☐ A properly sized battery has been installed, serviced and charged. The battery is securely mounted in an adequately ventilated space and the positive (+) terminal is shielded from accidental contact.
- ☐ Remote *e-Series Digital Displays* and control switches function as intended.
- ☐ Emergency and/or CO detection and shutdown devices have been connected and have been tested to determine that the genset shuts down as intended.
- ☐ The genset is properly sized for the application, the voltage and frequency are correct and the loads are balanced across the phases.
- ☐ Exhaust back pressure is acceptable.
- ☐ The exhaust system is leak-free and conveys all engine exhaust outside, away from windows, doors and vents.
- ☐ The fuel supply system is leak-free.
- ☐ The engine coolant and raw water systems are leak-free.
- ☐ The engine has the proper levels of oil and coolant.
- ☐ The raw water pump has been primed and the sea cock is open.
- ☐ All operators have been thoroughly briefed on the Operator's Manual and its safety precautions—especially concerning the dangers of Carbon Monoxide—and can demonstrate how to operate, maintain and troubleshoot the genset as explained therein.

# 10. Specifications

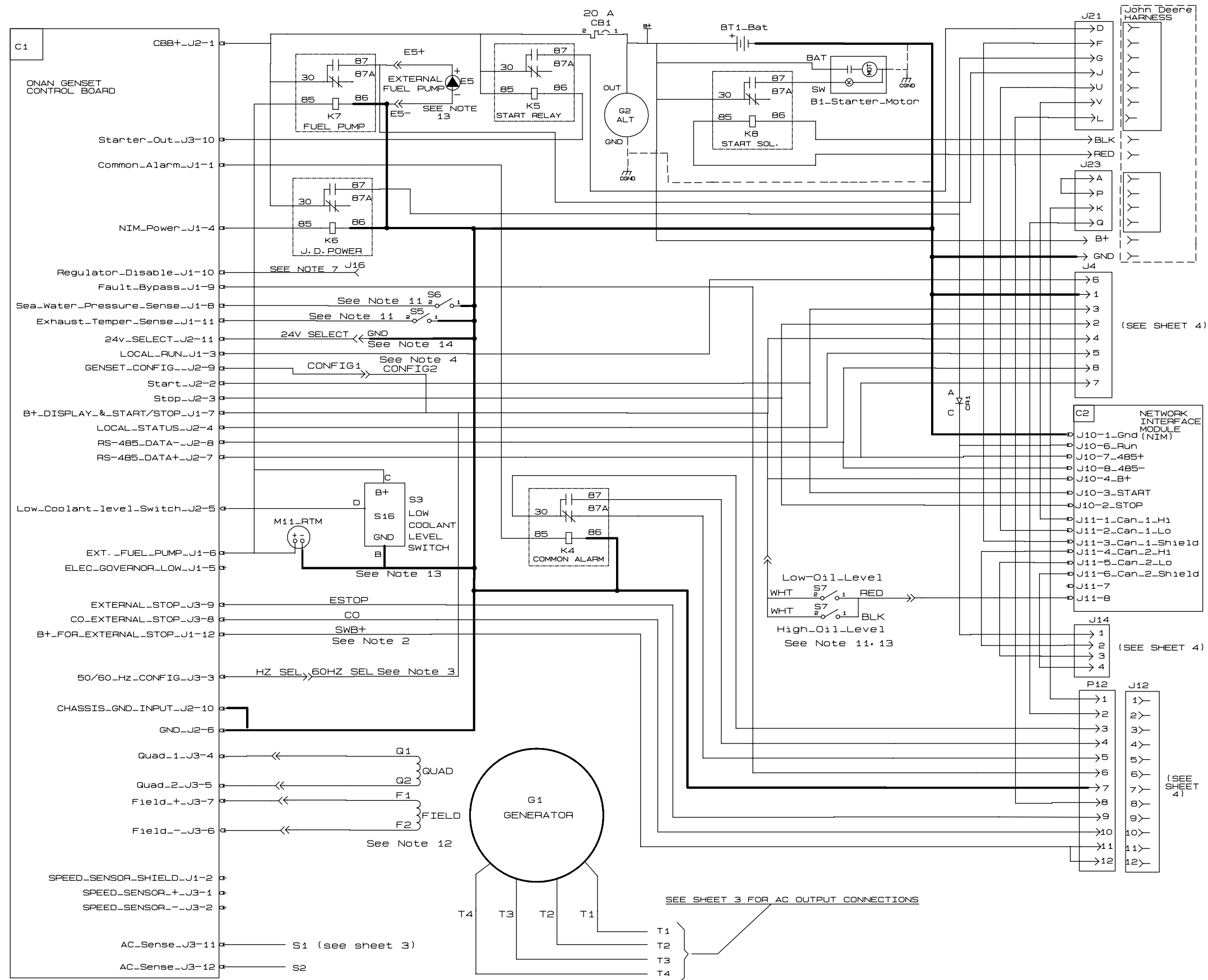
	60 HERTZ MODELS				
	MDDCA	MDDCB	MDDCC	MDDCD	MDDCE
Genset Output Ratings – See Nameplate					
General Genset Data					
Size without Sound Shield – inches (mm)					
Length	68.3 (1734)	70.0 (1779)		84.3 (2142)	
Width	32.4 (822)				
Height	39.1 (994)				
Size with Sound Shield – inches (mm)					
Length	68.4 (1738)	70.2 (1783)		84.5 (2146)	
Width	33.1 (840)				
Height	40.9 (1039)				
Weight – Lbs (kg)					
Weight of Base Unit – Dry	2143 (972)	2352 (1067)	2352 (1067)	2910 (1320)	2910 (1320)
Weight of Base Unit – Wet	2200 (998)	2410 (1093)	2410 (1093)	3019 (1370)	3019 (1370)
Additional Weight for Various Options:					
Sound Shield	220 (100)	220 (100)	220 (100)	251(113)	251(113)
Single Phase Alternator	57 (26)	55 (25)	55 (25)	0	84 (38)
Sound Level – Housed (1 meter)					
Sound Level	72 dB(A)	72 dB(A)	72 dB(A)	72 dB(A)	72 dB(A)
Engine Detail					
Engine	4-Stroke Cycle Diesel, Direct Injection, Turbocharged, Microprocessor Controlled				
Operating Speed	1800 rpm				
10% Overload Engine Power	107 hp (80 kW)			162 hp (121 kW)	
Number of Cylinders (in-line)	4			6	
Firing Order	1–3–4–2			1–5–3–6–2–4	
Compression Ratio	17.6 : 1			17.0 : 1	
Displacement	275 in <sup>3</sup> (4.5 L)			415 in <sup>3</sup> ( 6.8 L)	
Bore	4.2 in (106.5 mm)				
Stroke	5.0 in (127 mm)				
Maximum Angularity, any direction	30 Degrees				
Lubrication System					
Lube Oil Capacity, including filters	13.3 qt (12.6 L)			20.5 qt (19.4 L)	
Lube Oil Drain Connection	3/8 inch NPT				
DC Electrical System					
Recommended Battery Capacity @ 32° F (0° C)	12V – 640 CCA / 24V – 570 CCA			12V – 800 CCA / 24V – 570 CCA	
Starter Rolling Current @ 32° F (0° C)	12V – 780 Amps / 24V – 600 Amps			12V – 920 Amps / 24V – 600 Amps	
Maximum Starting Current Resistance	12V – 0.0012 Ohm / 24V – 0.002 Ohm				
Battery Charging Output – Neg Gnd	12V – 60 Amps / 24V – 40 Amps				
Battery Charging Output – Iso Gnd	12V – 70 Amps / 24V – 45 Amps				

	60 HERTZ MODELS (CONTINUED)				
	MDDCA	MDDCB	MDDCC	MDDCD	MDDCE
Air Flow					
Combustion Air Flow	184 ft³/min (m³/min)			378 ft³/min (m³/min)	
Maximum Air Intake Restriction	Clean Element – 12 inches H₂O (3.0 kPa) Dirty Element – 25 inches H₂O (6.25 kPa)				
Alternator Cooling Air Flow ft³/min (m³/sec)	530 (0.25)	1090 (0.514)	1090 (0.514)	1090 (0.514)	1090 (0.514)
Heat Radiated to Room Btu/min (kW)	965 (17.0)	1116 (19.6)	1216 (21.4)	1651 (29.0)	1842 (32.4)
Fuel System					
Recommended Fuel	No. 2 Diesel Fuel specified to EN 590 or ASTM D975				
Minimum Required Fuel Line ID	0.25 inch (6 mm)				
Fuel Supply and Return Connection Size	1/4 – 18 NPTF				
Total Fuel Flow	212 lb/hr (96 kg/hr) 30 gal/hr (113 L/hr)				
Maximum Leak–off Line Pressure	3 psi (20 kPa)				
Maximum Leak–off Return Height	8 ft (2.5 m)				
Maximum Fuel Height above Inj. Pump	10 ft (3 m)				
Maximum Fuel transfer pump suction	8 in Hg (27 kPa)				
Max. Fuel transfer suction with Auxiliary Pump	18 in Hg (60 kPa)				
Fuel consumption: Gal/hr (L/hr)					
1/4 load	1.2 (4.5)	1.4 (5.5)	1.5 (5.8)	2.0 (7.6)	2.4 (9.2)
1/2 load	1.9 (7.2)	2.4 (9.3)	2.8 (10.7)	3.5 (13.2)	4.1 (15.5)
3/4 load	2.6 (9.9)	3.4 (13.0)	4.0 (14.3)	4.9 (18.7)	6.0 (22.9)
full load	3.4 (12.7)	4.4 (16.8)	5.2 (19.7)	6.4 (24.2)	7.8 (29.4)
Cooling System					
Coolant Flow Rate	25 gal/min (94 L/min)			33 gal/min (125 L/min)	
Heat Rejection to Coolant	3523 Btu/min (62 kW)			5863 Btu/min (103 kW)	
Coolant Capacity – engine only	15 qt (14 L)			32 qt (30 L)	
Recommended Pressure Cap	10 psi (70 kPa)				
Thermostat Start To Open	180 F (82 C)				
Thermostat Fully Open	203 F (95 C)				
Max. Pressure Drop Across Keel Cooler	4 psi (30 kPa)				
Sea Water System					
Raw Water Inlet Connection Size (OD)	1.25 in (31.8 mm)				
Sea Water Pump Flow	22 gal/min (84 L/min)				
Maximum Pump Inlet Restriction	120 inches H₂O (30 kPa)				
Maximum Pump Suction Lift	10 ft (3 m)				
Maximum Outlet Pressure	20 psi (135 kPa)				
Exhaust System					
Exhaust Gas Flow	463 ft³/min (13.1 m³/min)			848 ft³/min (24 m³/min)	
Exhaust Temperature	889° F (476° C)			745° F (396° C)	
Maximum Back Pressure	30 inches H₂O (7.5 kPa)				

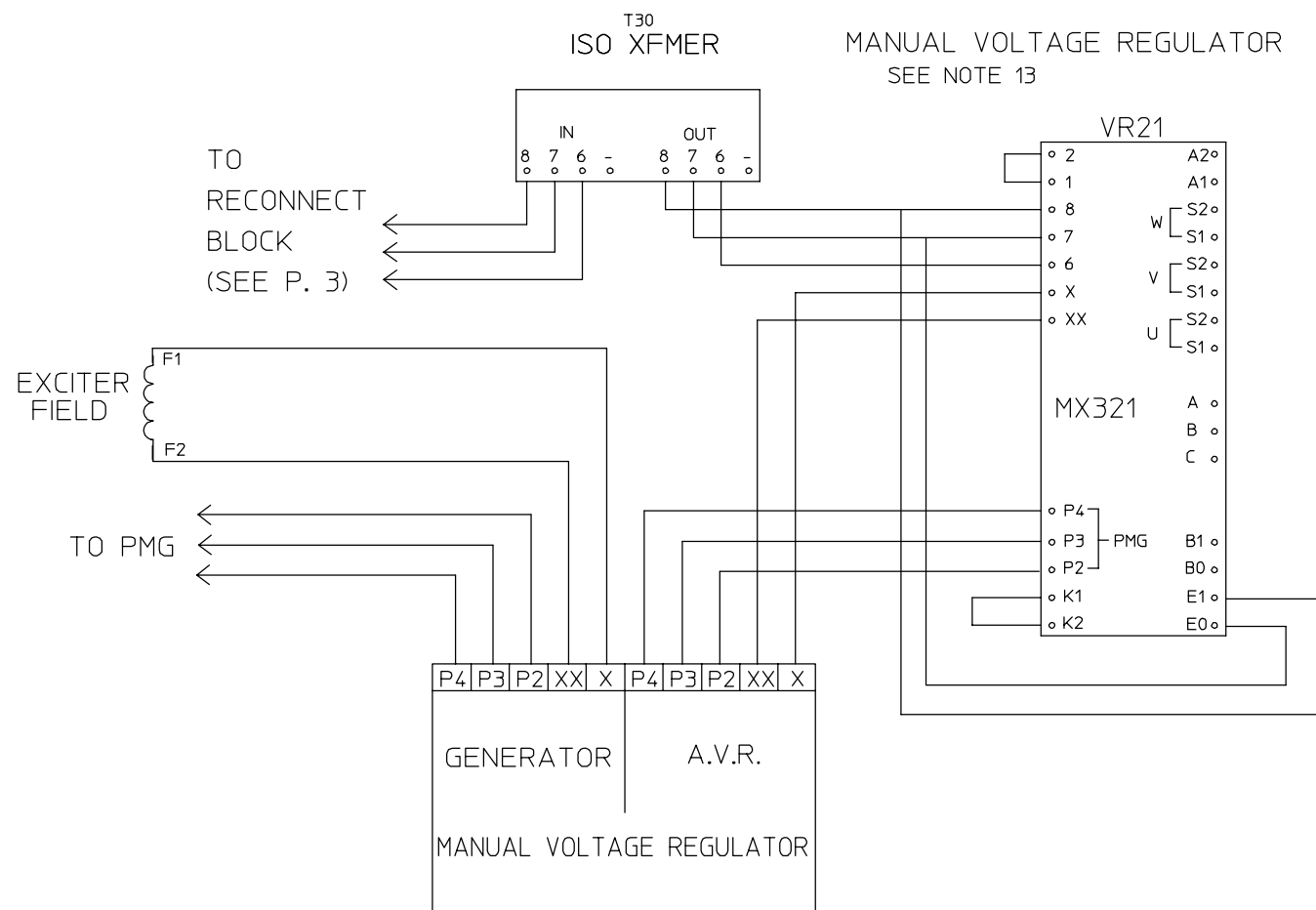
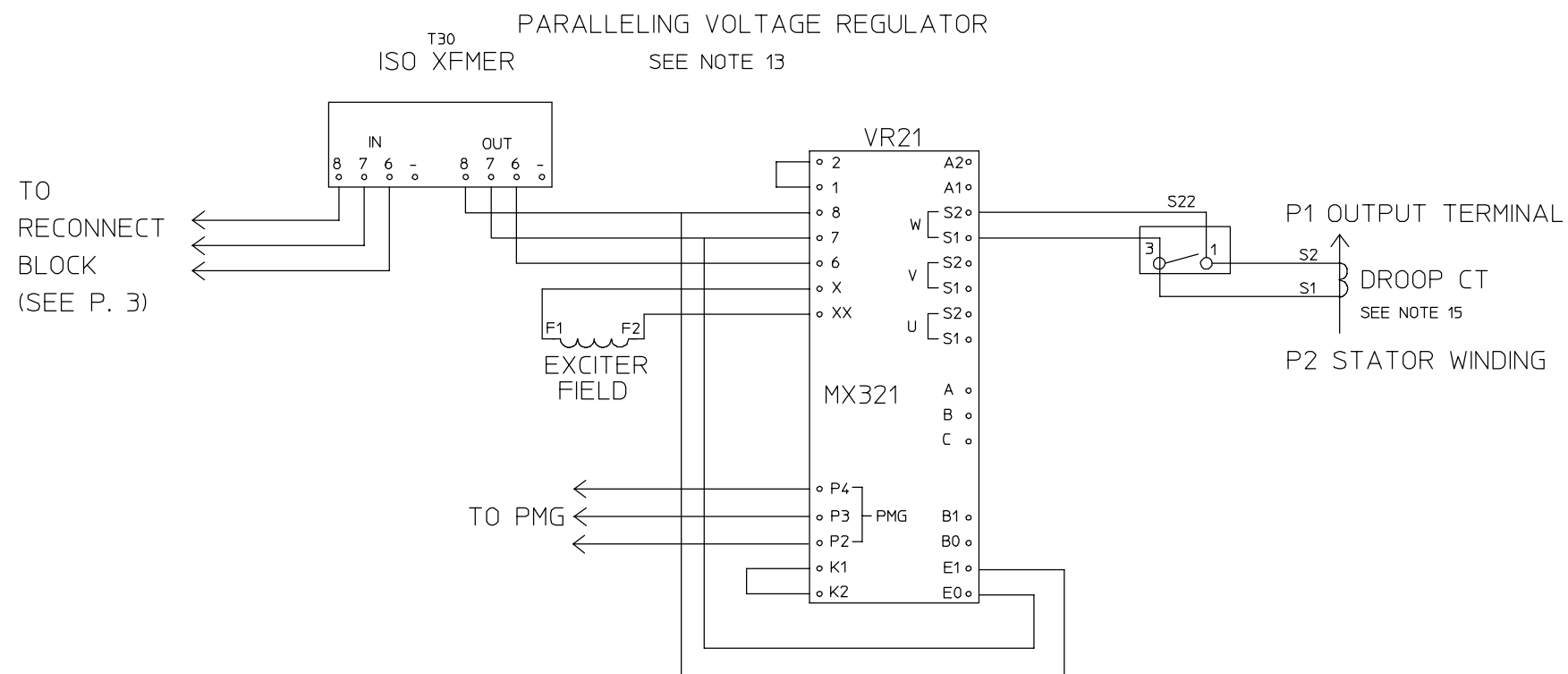
	50 HERTZ MODELS			
	MDDCF	MDDCG	MDDCH	MDDCJ
Genset Output Ratings – See Nameplate				
General Genset Data				
Size without Sound Shield – inches (mm)				
Length	68.3 (1734)	70.0 (1779)	84.3 (2142)	
Width	32.4 (822)			
Height	39.1 (994)			
Size with Sound Shield – inches (mm)				
Length	68.4 (1738)	70.2 (1783)	84.5 (2146)	
Width	33.1 (840)			
Height	40.9 (1039)			
Weight – Lbs (kg)				
Weight of Base Unit – Dry	2200 (998)	2352 (1067)	2910 (1320)	2910 (1320)
Weight of Base Unit – Wet	2213 (1004)	2430 (1102)	3019 (1370)	3019 (1370)
Additional Weight for Various Options:				
Sound Shield	220 (100)	220 (100)	251(113)	251(113)
Single Phase Alternator	0	55 (25)	0	84 (38)
Sound Level – Housed (1 meter)				
Sound Level	72 dB(A)	72 dB(A)	70 dB(A)	70 dB(A)
Engine Detail				
Engine	4-Stroke Cycle Diesel, Direct Injection, Turbocharged, Microprocessor Controlled			
Operating Speed	1500			
10% Overload Engine Power	82 hp (61 kW)		131 hp (98 kW)	
Number of Cylinders (in-line)	4		6	
Firing Order	1–3–4–2		1–5–3–6–2–4	
Compression Ratio	17.6 : 1		17.0 : 1	
Displacement	275 in3 (4.5 L)		415 in3 ( 6.8 L)	
Bore	4.2 in (106.5 mm)			
Stroke	5.0 in (127 mm)			
Maximum Angularity, any direction	30 Degrees			
Lubrication System				
Lube Oil Capacity, including filters	13.3 qt (12.6 L)		20.5 qt (19.4 L)	
Lube Oil Drain Connection	3/8 inch NPT			
DC Electrical System				
Recommended Battery Capacity @ 32° F (0° C)	12V – 640 CCA / 24V – 570 CCA		12V – 800 CCA / 24V – 570 CCA)	
Starter Rolling Current @ 32° F (0° C)	12V – 780 Amps / 24V – 600 Amps		12V – 920 Amps / 24V – 600 Amps	
Maximum Starting Current Resistance	12V – 0.0012 Ohm / 24V – 0.002 Ohm			
Battery Charging Output – Neg Gnd	12V – 60 Amps / 24V – 40 Amps			
Battery Charging Output – Iso Gnd	12V – 70 Amps / 24V – 45 Amps			

	50 HERTZ MODELS (CONTINUED)			
	MDDCF	MDDCG	MDDCH	MDDCJ
Air Flow				
Combustion Air Flow	124 ft³/min (m³/min)		244 ft³/min (m³/min)	
Maximum Air Intake Restriction	Clean Element – 12 inches H <sub>2</sub> O (3.0 kPa) Dirty Element – 25 inches H <sub>2</sub> O (6.25 kPa)			
Alternator Cooling Air Flow ft3/min (m3/sec)	530 (0.25)	1090 (0.514)	1090 (0.514)	1090 (0.514)
Heat Radiated to Room Btu/min (kW)	805 (14.2)	906 (15.9)	1290 (22.7)	1441 (25.3)
Fuel System				
Recommended Fuel	No. 2 Diesel Fuel specified to EN 590 or ASTM D975			
Minimum Required Fuel Line ID	0.25 inch (6 mm)			
Fuel Supply and Return Connection Size	1/4 – 18 NPTF			
Total Fuel Flow	205 lb/hr (93 kg/hr) 29 gal/hr (109 L/hr)			
Maximum Leak–off Line Pressure	3 psi (20 kPa)			
Maximum Leak–off Return Height	8 ft (2.5 m)			
Maximum Fuel Height above Inj. Pump	10 ft (3 m)			
Maximum Fuel transfer pump suction	8 in Hg (27 kPa)			
Max. Fuel transfer suction with Auxiliary Pump	18 in Hg (60 kPa)			
Fuel consumption: Gal/hr (L/hr)				
1/4 load	1.0 (3.9)	1.2 (4.6)	1.5 (5.7)	1.8 (6.7)
1/2 load	1.7 (6.4)	2.0 (7.6)	2.6 (9.9)	3.1 (11.8)
3/4 load	2.4 (9.0)	2.9 (10.8)	3.7 (14.1)	4.5 (16.9)
full load	3.0 (11.5)	3.7 (14.1)	4.9 (18.4)	5.9 (22.4)
Cooling System				
Coolant Flow Rate	14 gal/min (53 L/min)		31 gal/min (116 L/min)	
Heat Rejection to Coolant	2681 Btu/min (47 kW)		4554 Btu/min (80 kW)	
Coolant Capacity – engine only	15 qt (14 L)		32 qt (30 L)	
Recommended Pressure Cap	10 psi (70 kPa)			
Thermostat Start To Open	180 F (82 C)			
Thermostat Fully Open	203 F (95 C)			
Max. Pressure Drop Across Keel Cooler	3 psi (20 kPa)			
Sea Water System				
Raw Water Inlet Connection Size (OD)	1.25 in (31.8 mm)			
Sea Water Pump Flow	18 gal/min (70 L/min)			
Maximum Pump Inlet Restriction	100 inches H <sub>2</sub> O (25 kPa)			
Maximum Pump Suction Lift	10 ft (3 m)			
Maximum Outlet Pressure	20 psi (135 kPa)			
Exhaust System				
Exhaust Gas Flow	300 ft³/min (9.0 m³/min)		558 ft³/min (16 m³/min)	
Exhaust Temperature	851° F (455° C)		772° F (411° C)	
Maximum Back Pressure	30 inches H <sub>2</sub> O (7.5 kPa)			



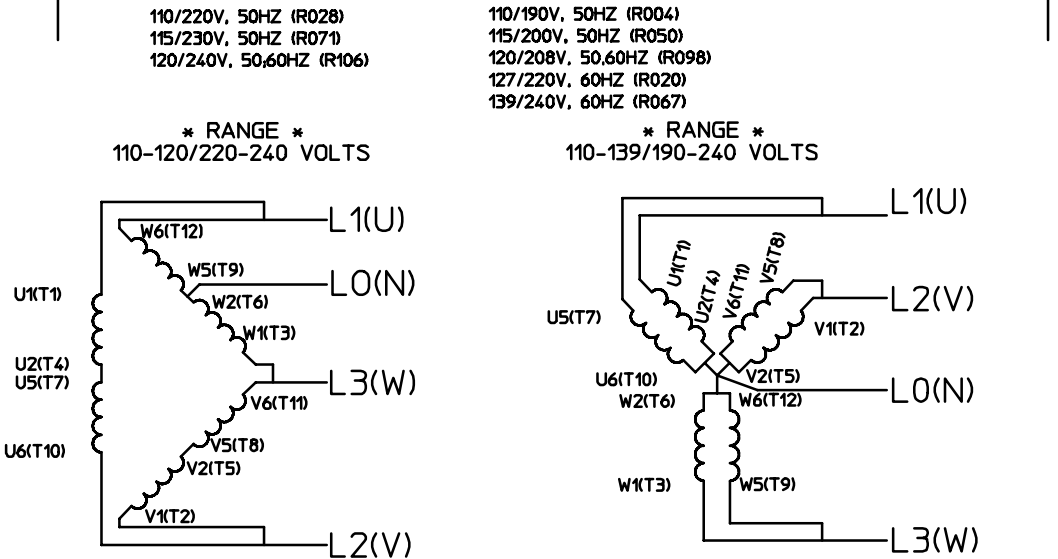


WIRING DIAGRAM (SHEET 1)



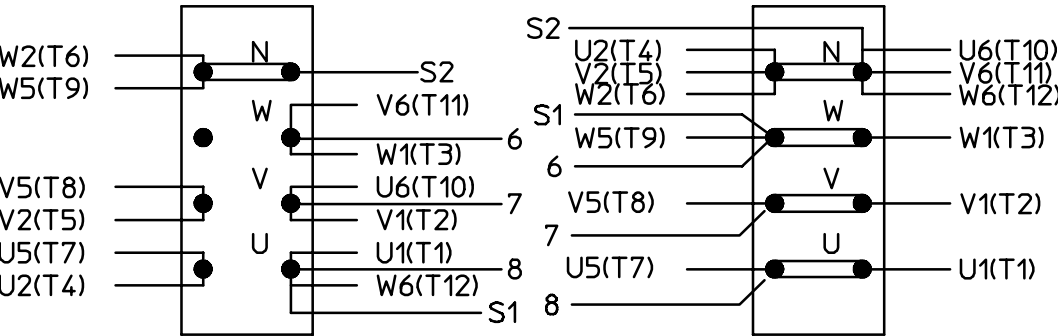
WIRING DIAGRAM (SHEET 2)

3 PHASE RECONNECTABLE, 12 LEAD



SERIES DELTA  
3 PHASE 4 WIRE  
OUTPUT TERMINALS  
U.V.W.N.

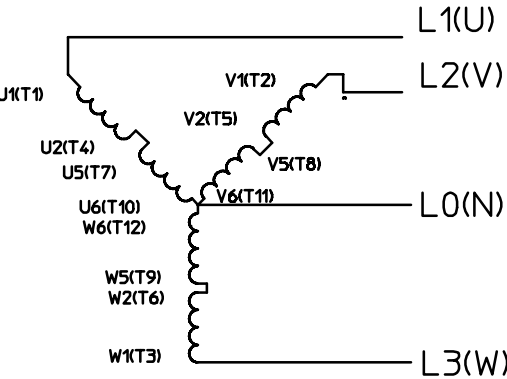
PARALLEL STAR  
3 PHASE 4 WIRE  
OUTPUT TERMINALS  
U.V.W.N.



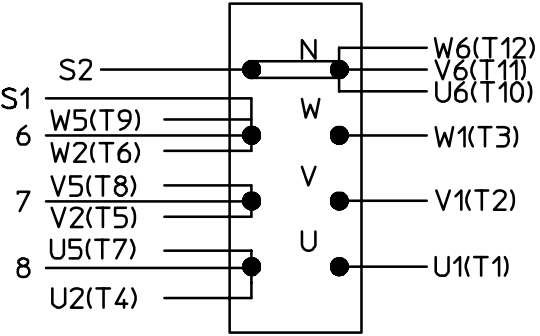
220/380V, 50HZ (R099)  
240/416V, 50,60HZ (R003)  
255/440V, 50HZ,60HZ (R023)

230/400V, 50HZ (R029)  
277/480V, 60 HZ (R002)

\* RANGE \*  
220-277/380-480 VOLTS



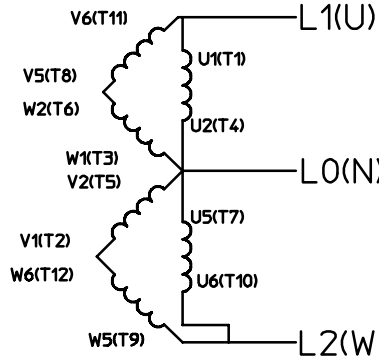
SERIES STAR  
3 PHASE 4 WIRE  
OUTPUT TERMINALS  
U.V.W.N.



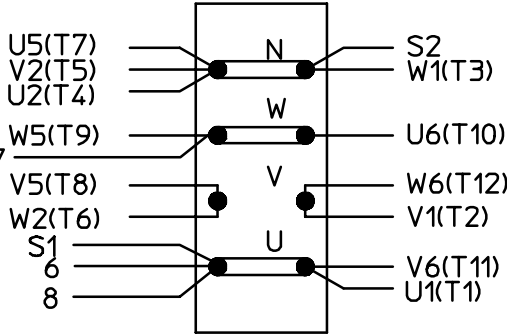
1 PHASE RECONNECTABLE, 12 LEAD (NOTE 20)

110/220V, 50HZ (R046)  
115/230V, 50HZ (R041)  
120/240V, 60HZ,50HZ (R104)

\* RANGE \*  
110-120/220-240 VOLTS



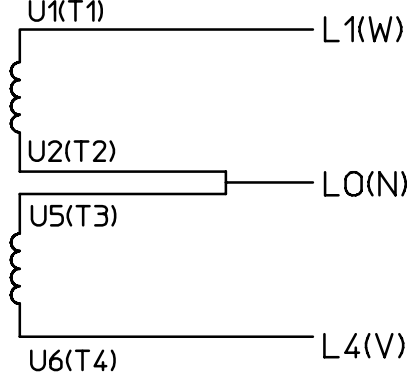
DOUBLE DELTA  
1 PHASE 3 WIRE  
OUTPUT TERMINALS  
U.W. CENTER TAP N.



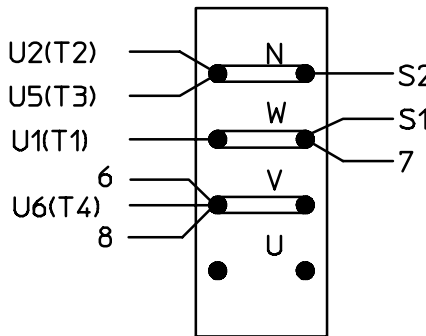
1 PHASE NON-RECONNECTABLE, 4 LEAD

110/220V, 50HZ (R046)  
115/230V, 50HZ (R041)  
120/240V, 60HZ,50HZ (R104)

\* RANGE \*  
110-120/220-240 VOLTS

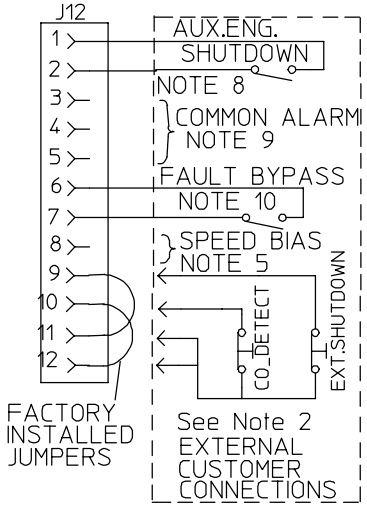
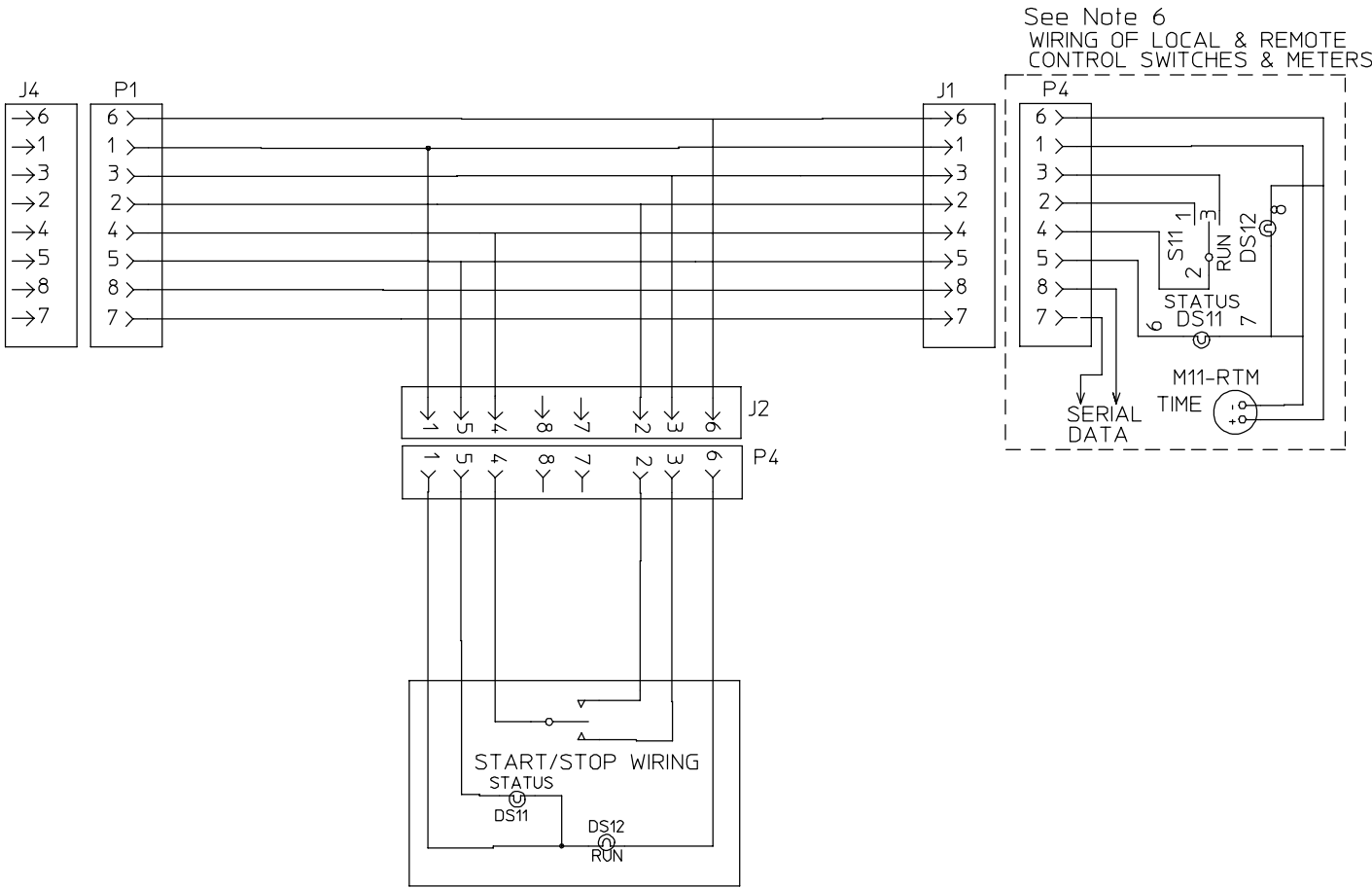
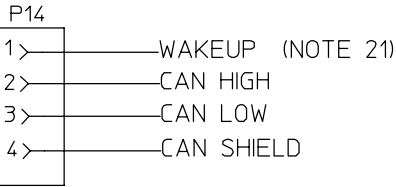
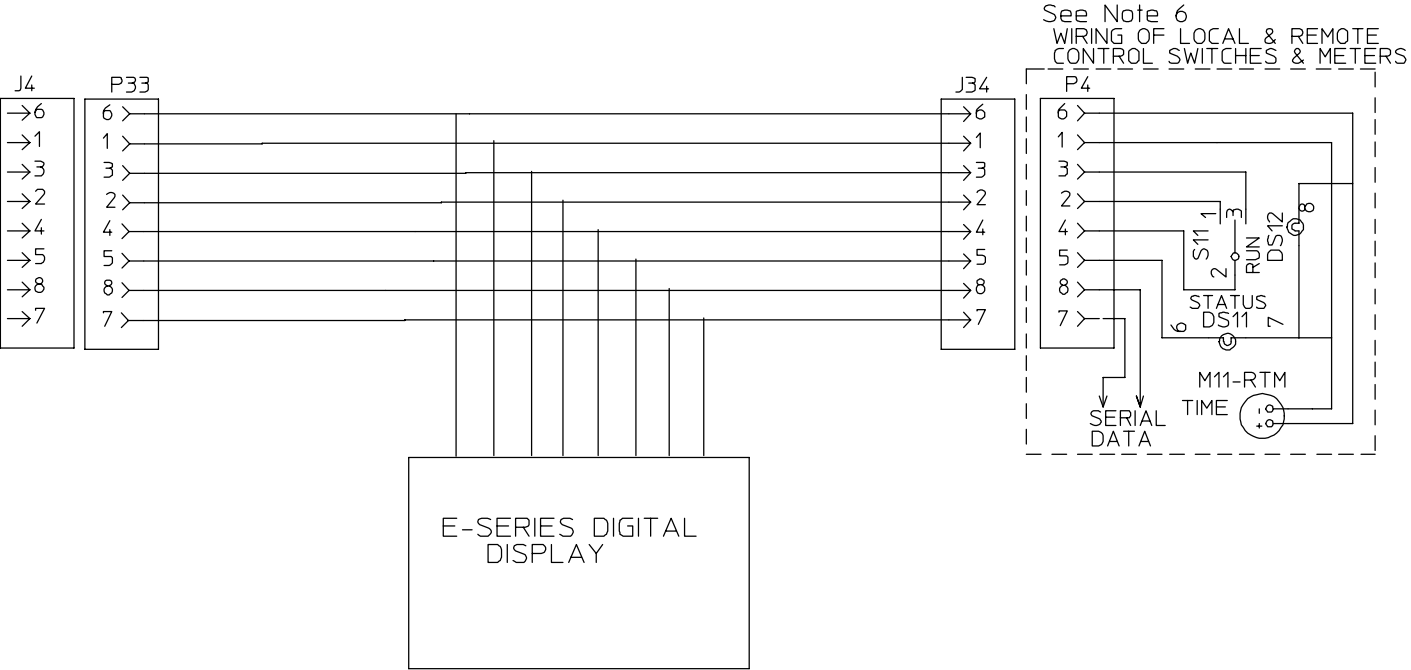


1 PHASE 3 WIRE  
OUTPUT TERMINALS  
W, V, CENTER TAP N  
SEE NOTE 17

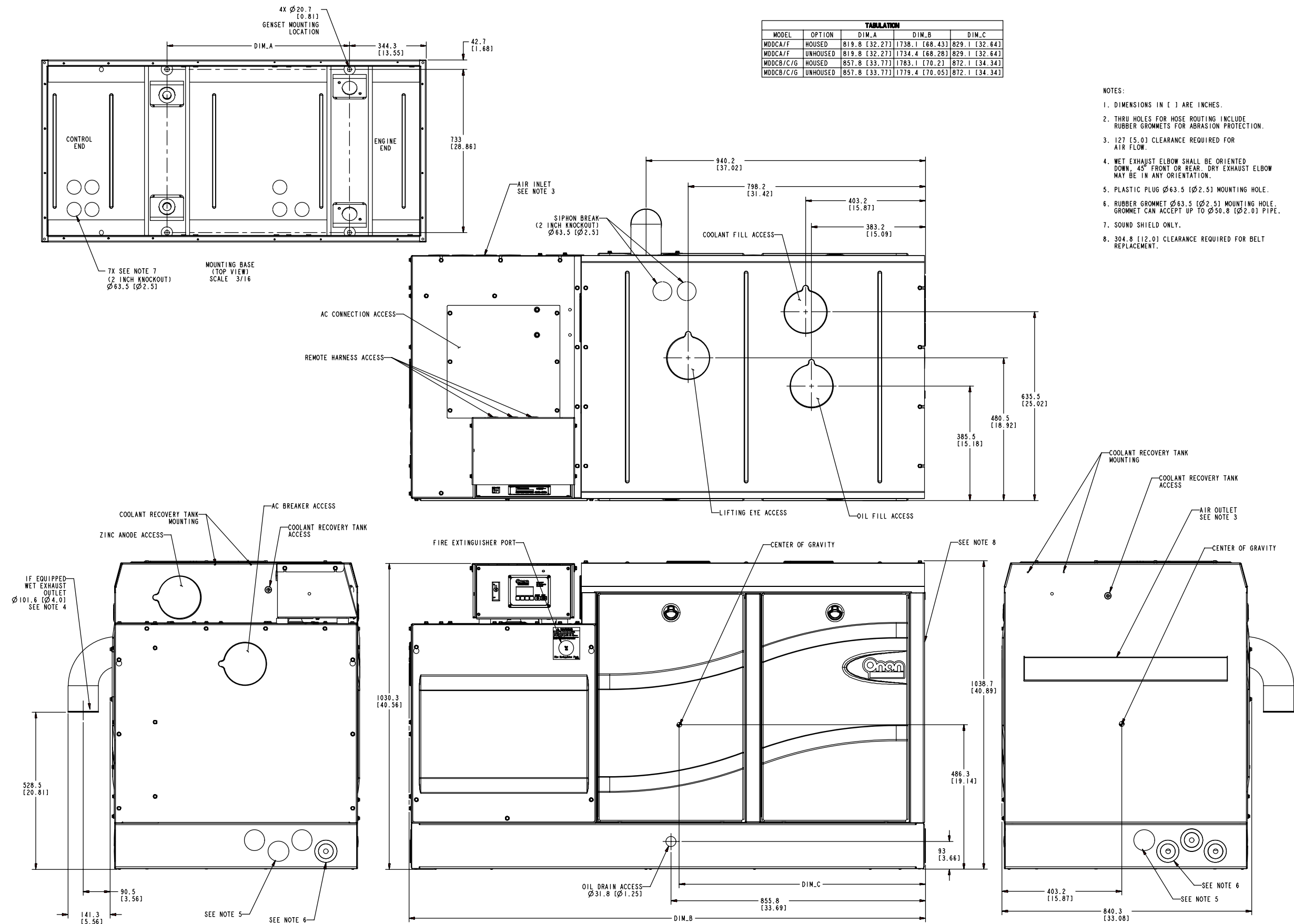


NOTES:

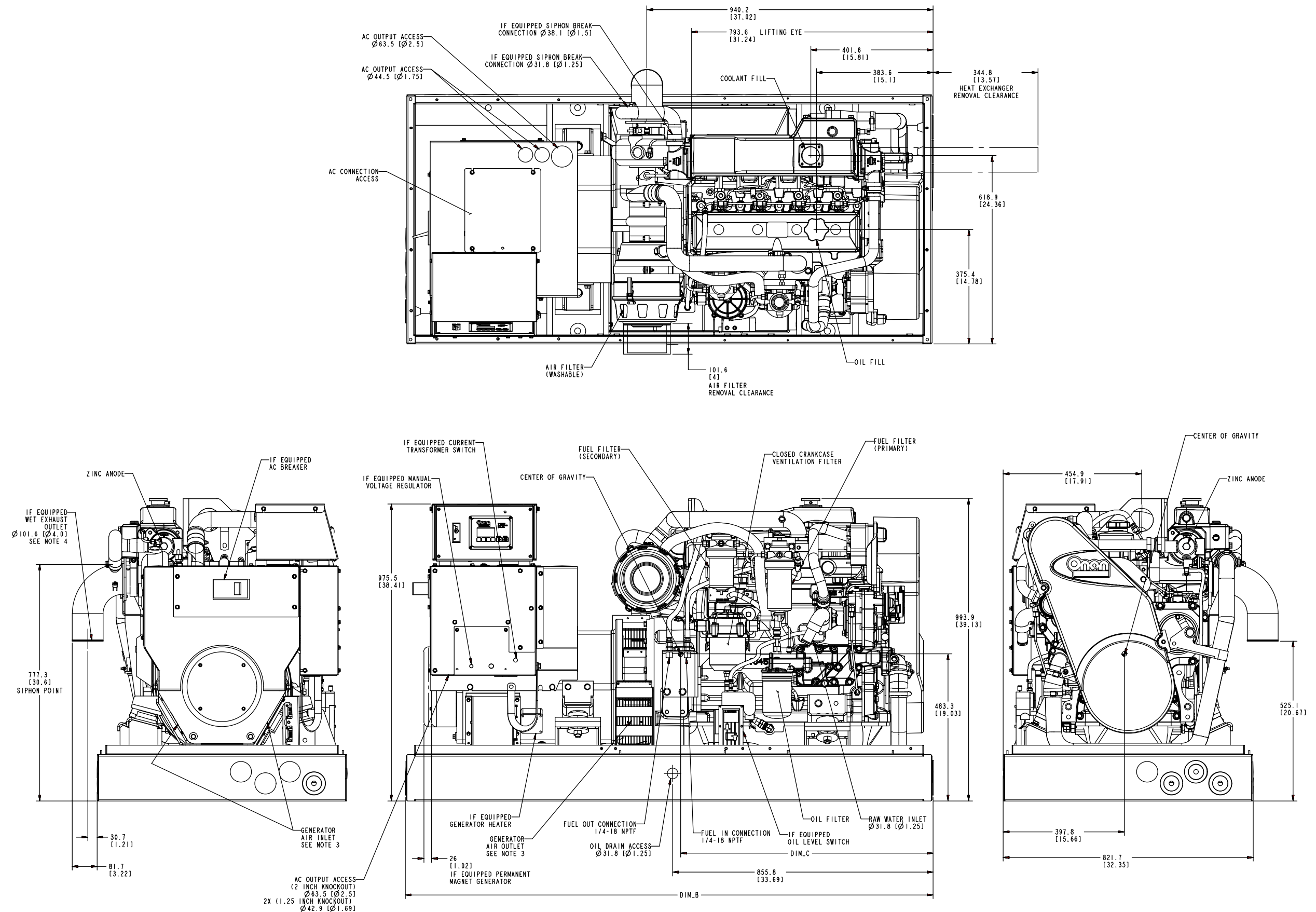
16. UVW PHASE SEQUENCE WITH C.W. ROTATION FACING DRIVE END.
17. 1 PHASE NON-RECONNECTABLE: LARGER KW GENSETS HAVE 8 OUTPUT TERMINALS SMALLER KW HAVE 4.
18. WHEN RECONNECTING GENERATOR LEADS, BOLTS SHOULD BE TORQUED AT 22 ±2 FT-LBS.
19. SENSING LEADS 6, 7,& 8 ARE ONLY USED WITH THE MX321 REGULATOR.
20. OUTPUT POWER REDUCED TO 2/3 OF NAMEPLATE RATING.
21. APPLY B+ FOR SERIAL COMMUNICATIONS WHEN GENSET IS NOT RUNNING.



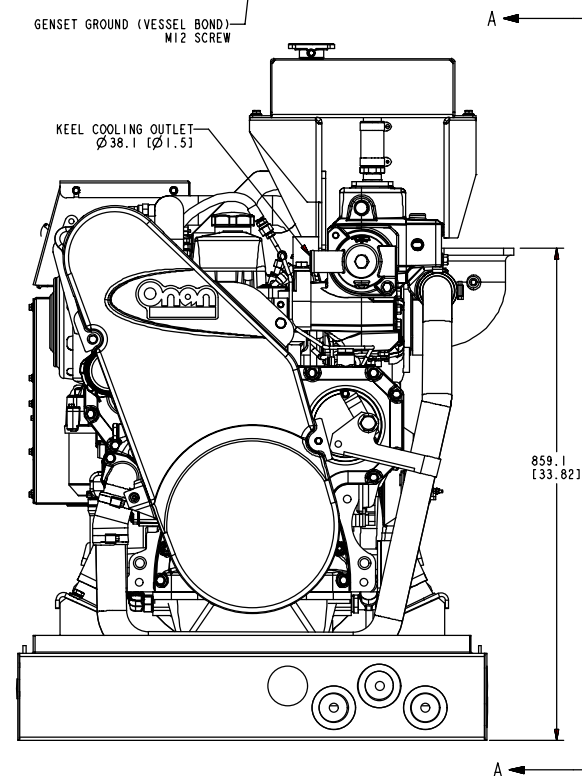
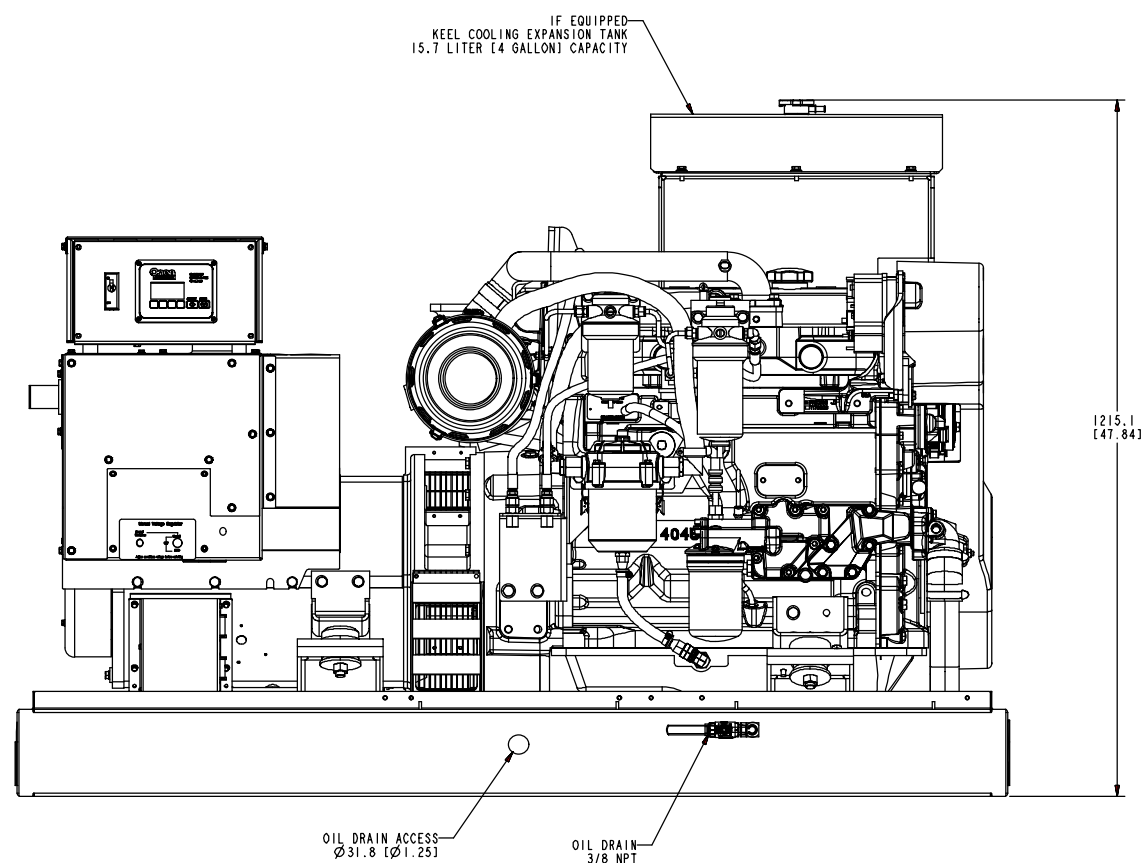
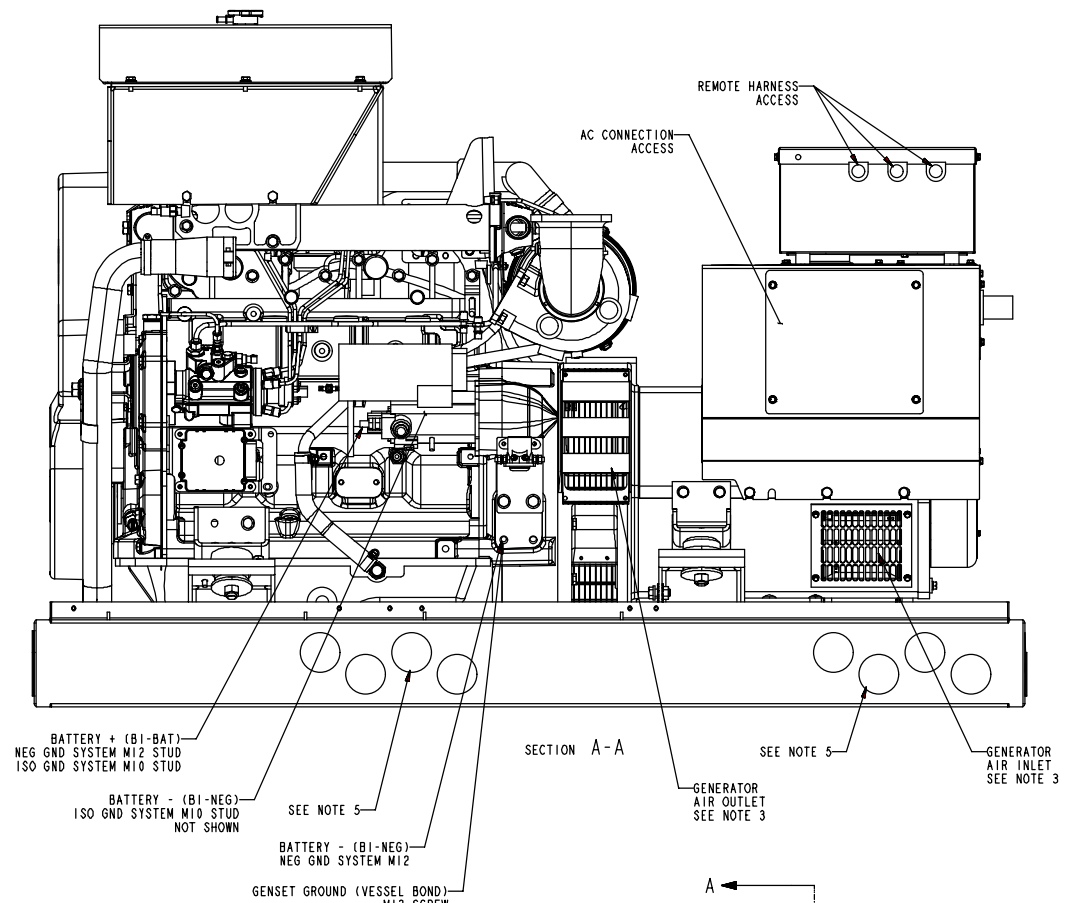
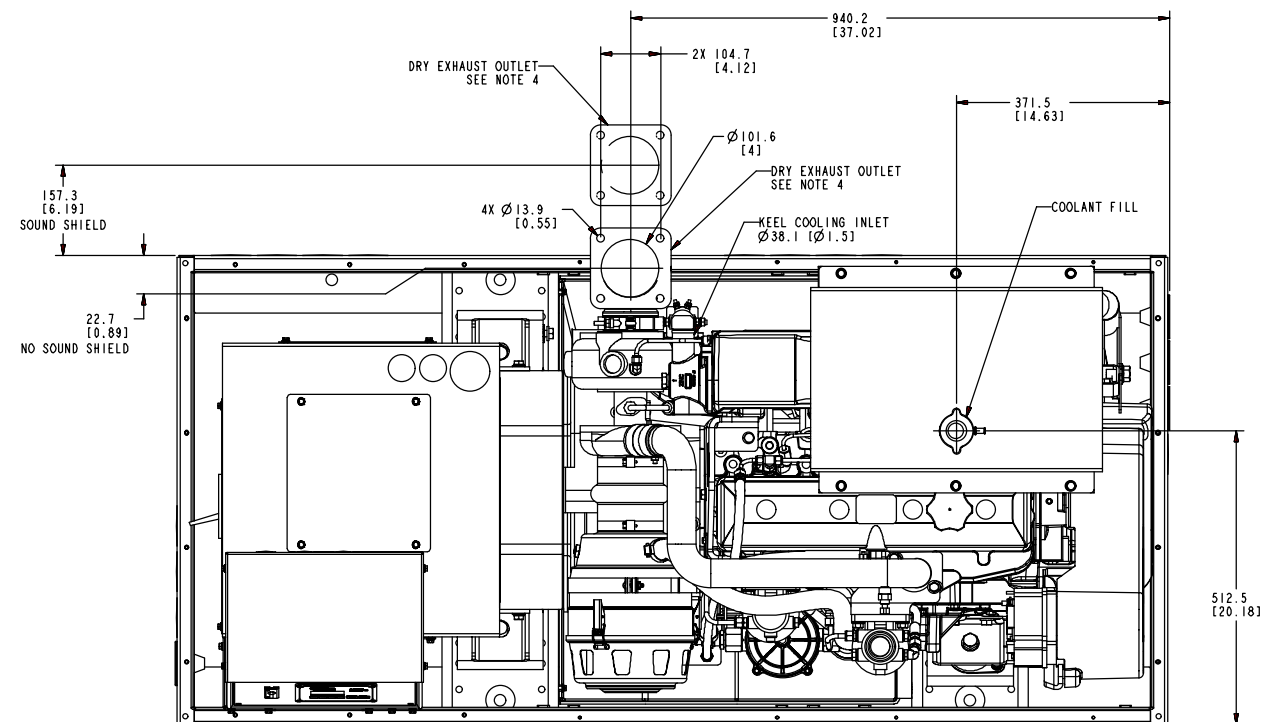
WIRING DIAGRAM (SHEET 4)



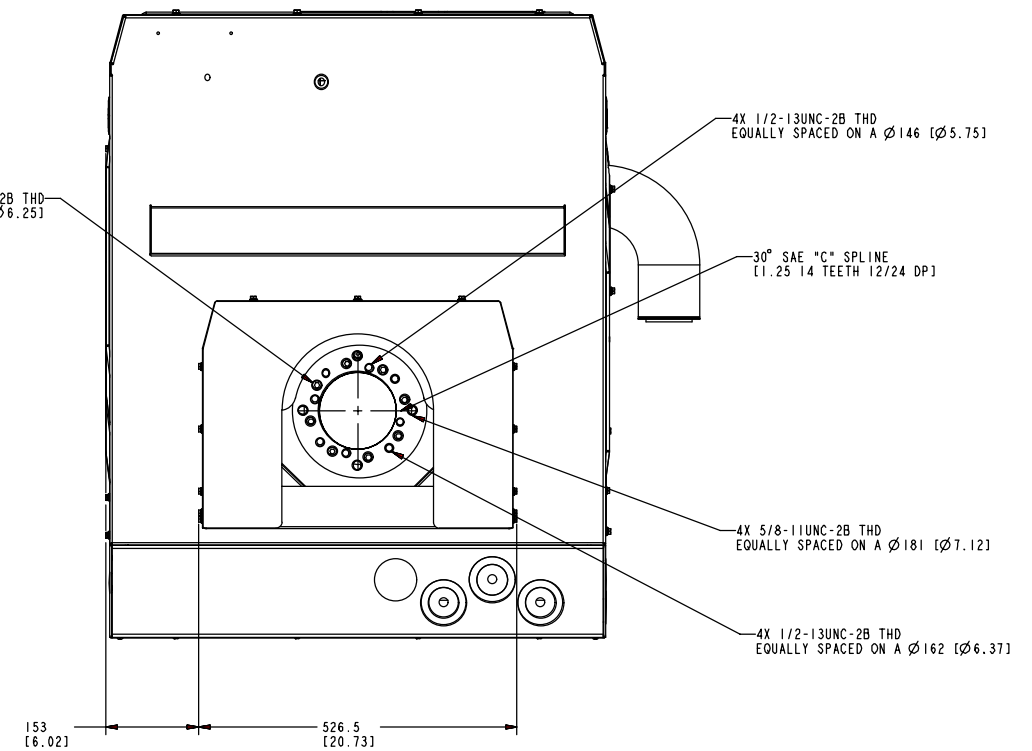
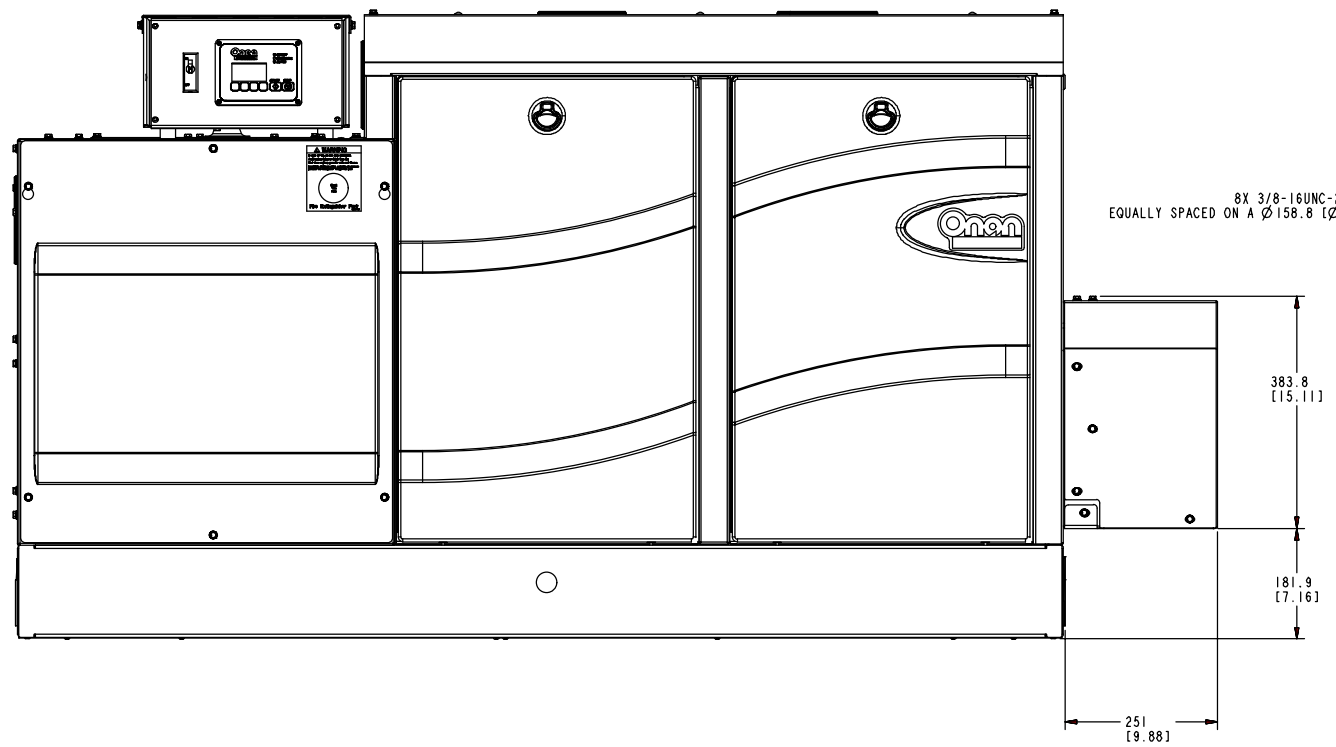
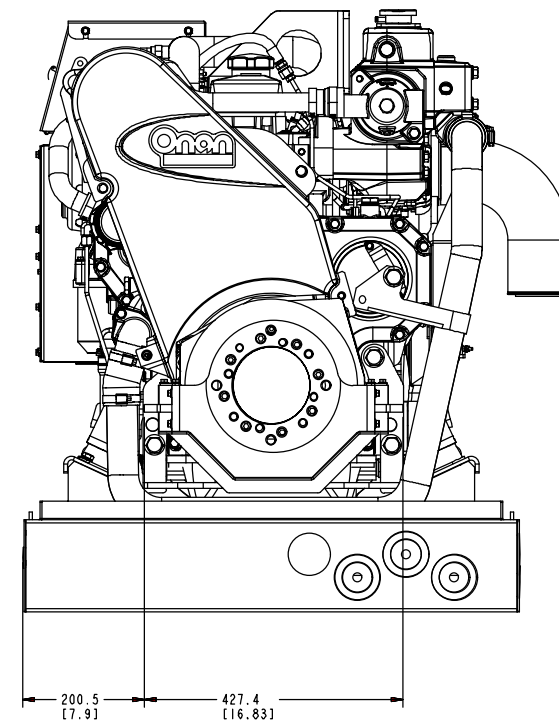
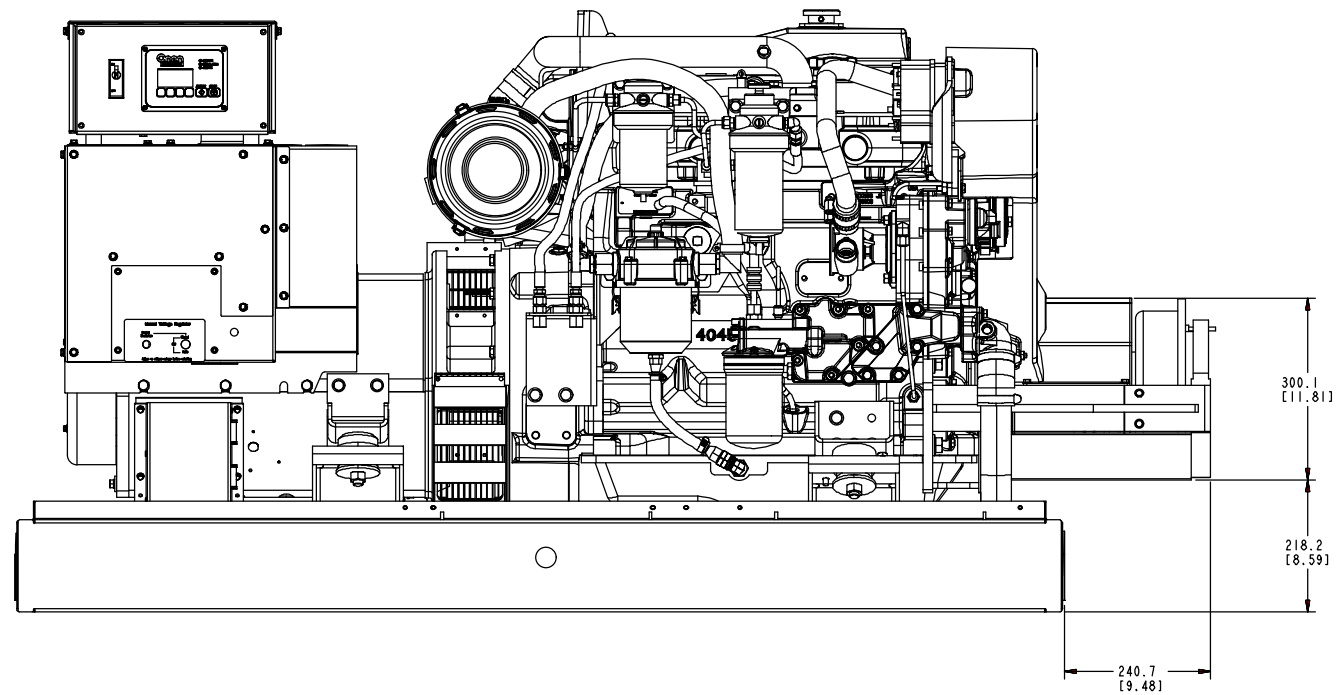
OUTLINE DRAWING—MDDCA, MDDCB, MDDCC, MDDCF, MDDCG (SHEET 1)



OUTLINE DRAWING—MDDCA, MDDCB, MDDCC, MDDCF, MDDCG (SHEET 2)



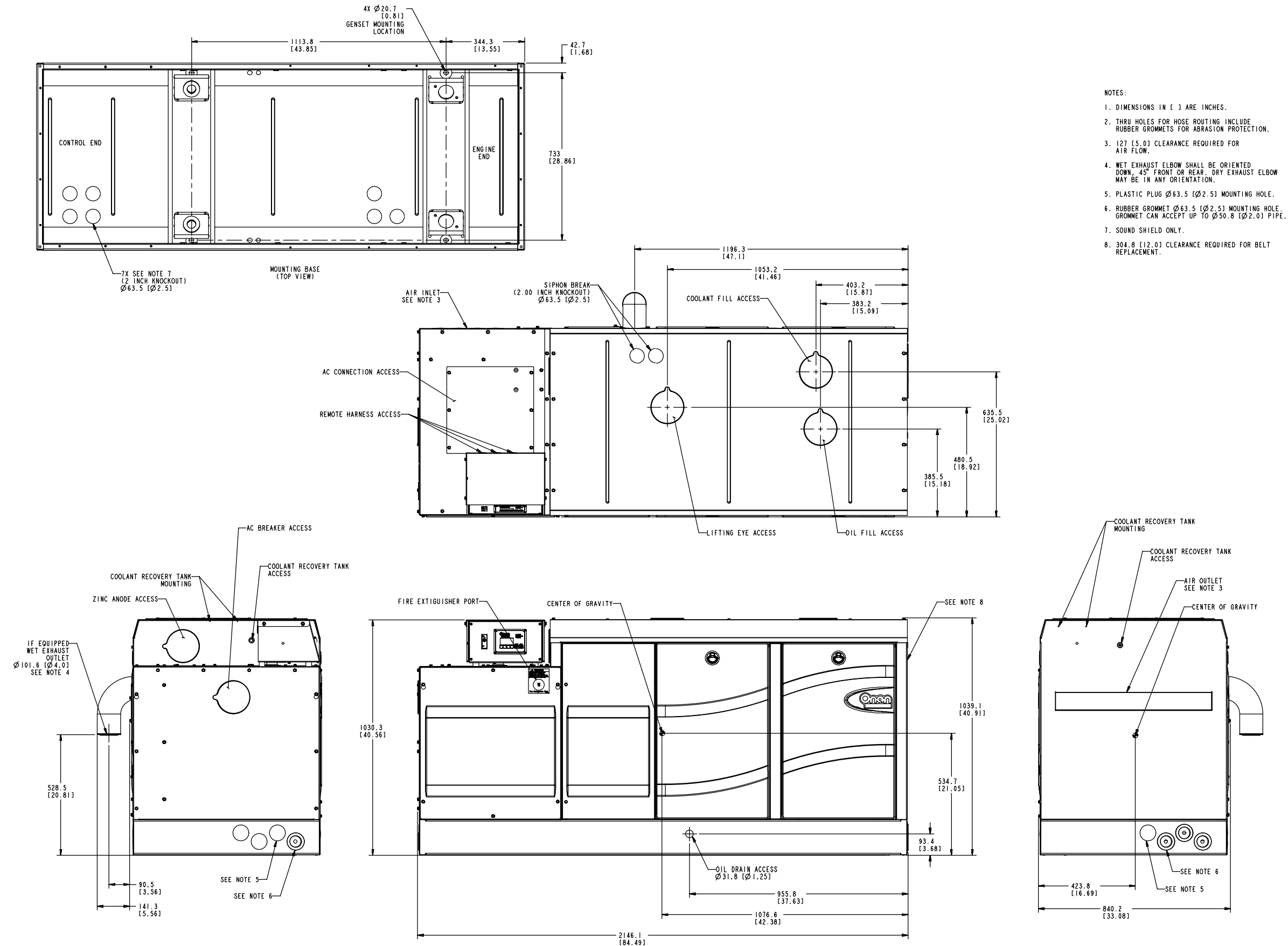
OUTLINE DRAWING—MDDCA, MDDCB, MDDCC, MDDCF, MDDCG (SHEET 3)



IF EQUIPPED  
POWER TAKE OFF

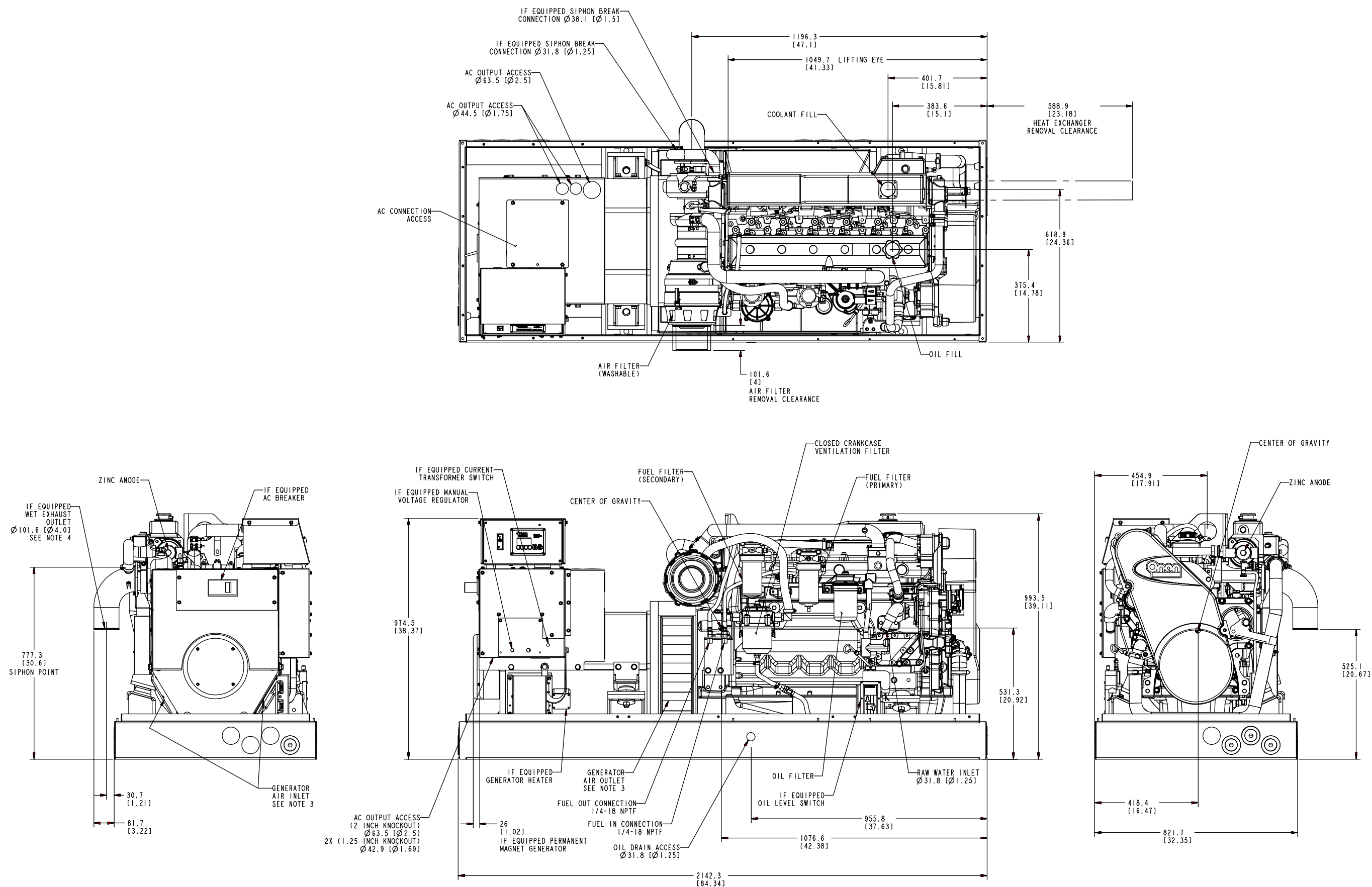
OUTLINE DRAWING—MDDCA, MDDCB, MDDCC, MDDCF, MDDCG (SHEET 4)



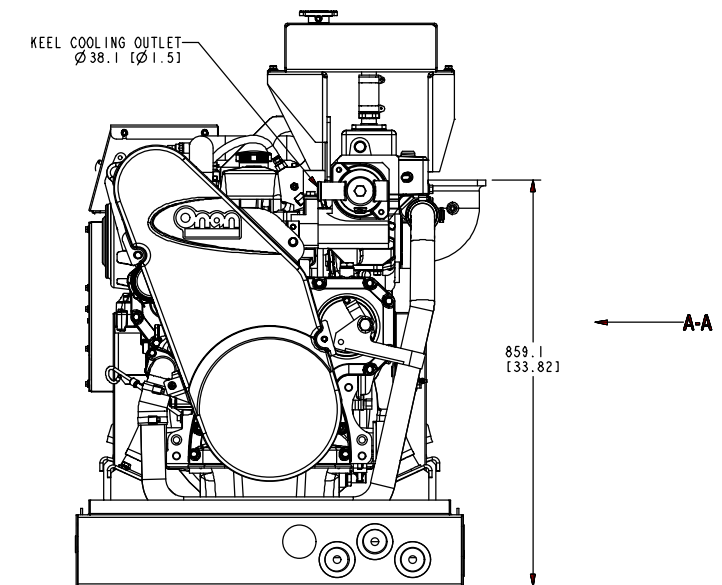
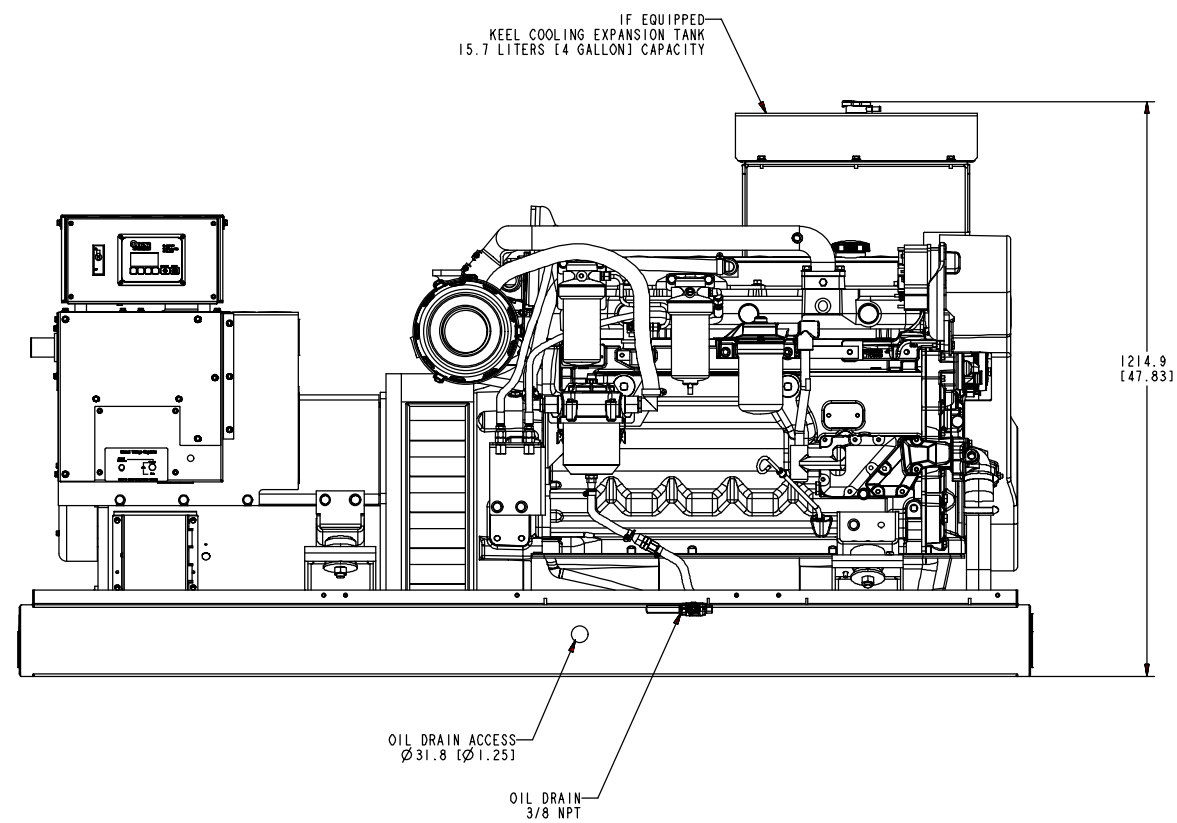
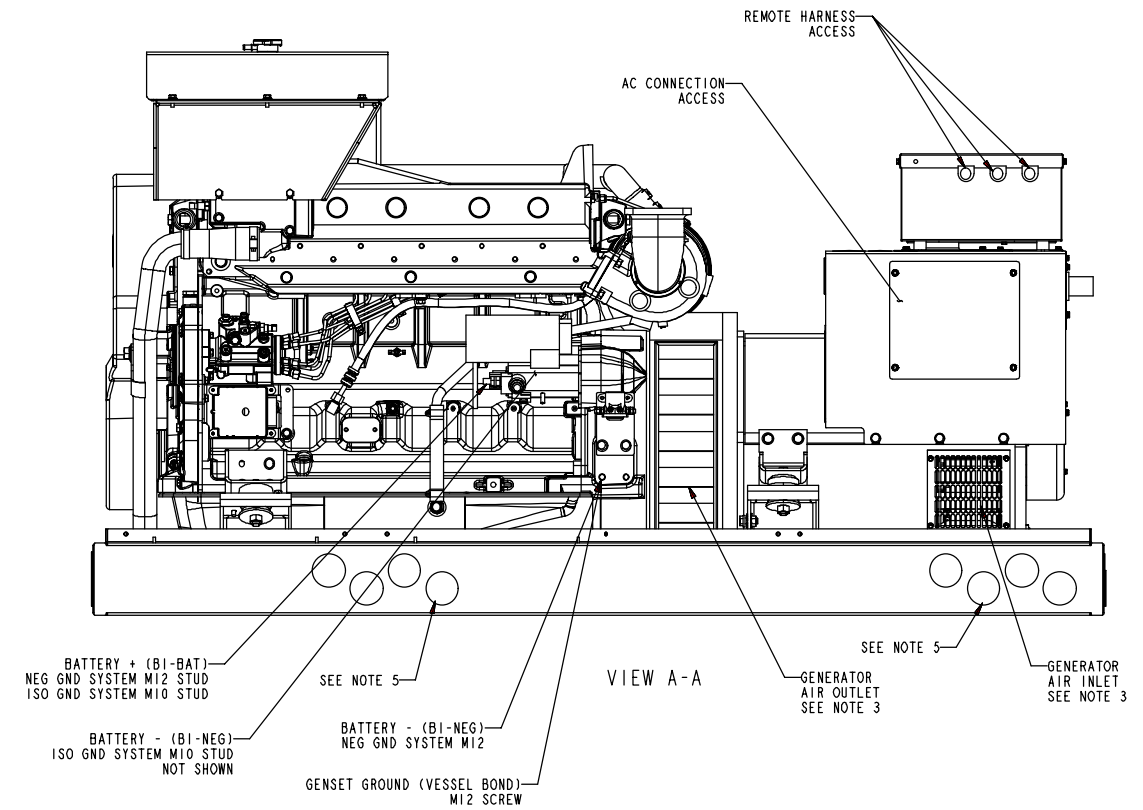
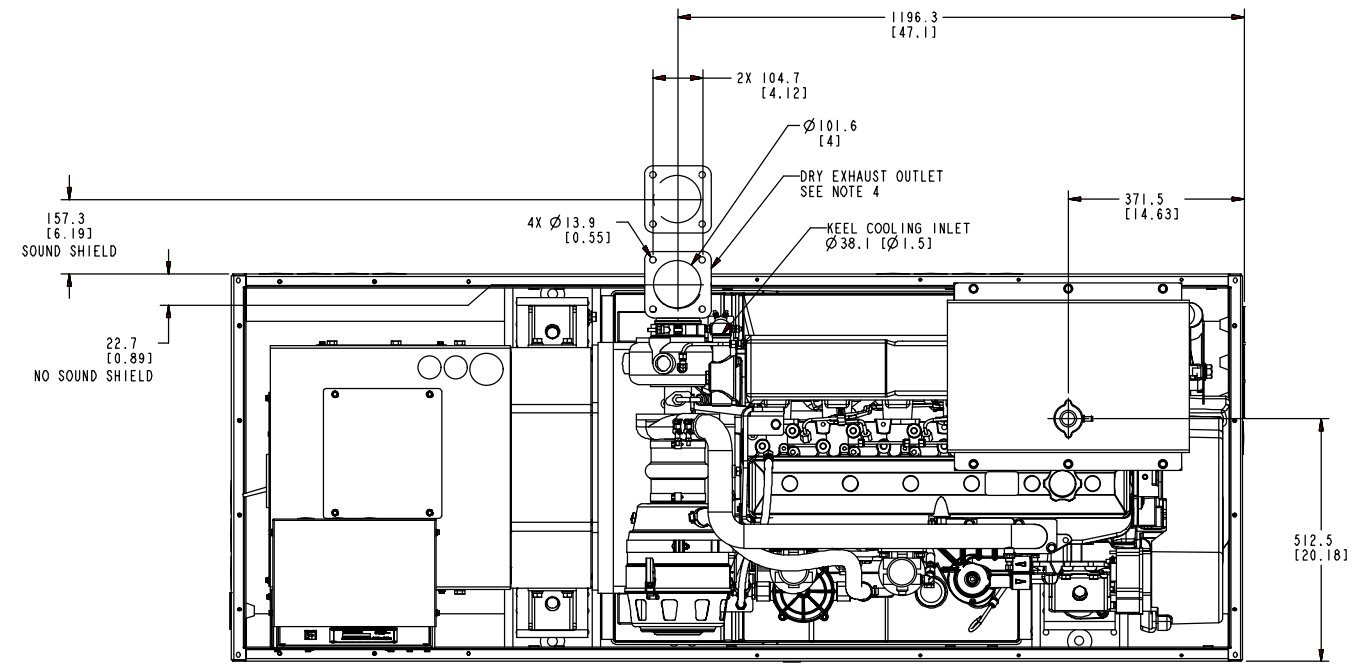


- NOTES:
1. DIMENSIONS IN [ ] ARE INCHES.
  2. THRU HOLES FOR HOSE ROUTING INCLUDE RUBBER GROMMETS FOR ABRASION PROTECTION.
  3. 127 [5.0] CLEARANCE REQUIRED FOR AIR FLOW.
  4. WET EXHAUST ELBOW SHALL BE ORIENTED DOWN, 45° FRONT OR REAR. DRY EXHAUST ELBOW MAY BE IN ANY ORIENTATION.
  5. PLASTIC PLUG Ø63.5 [Ø2.5] MOUNTING HOLE.
  6. RUBBER GROMMET Ø63.5 [Ø2.5] MOUNTING HOLE. GROMMET CAN ACCEPT UP TO Ø50.8 [Ø2.0] PIPE.
  7. SOUND SHIELD ONLY.
  8. 304.8 [12.0] CLEARANCE REQUIRED FOR BELT REPLACEMENT.

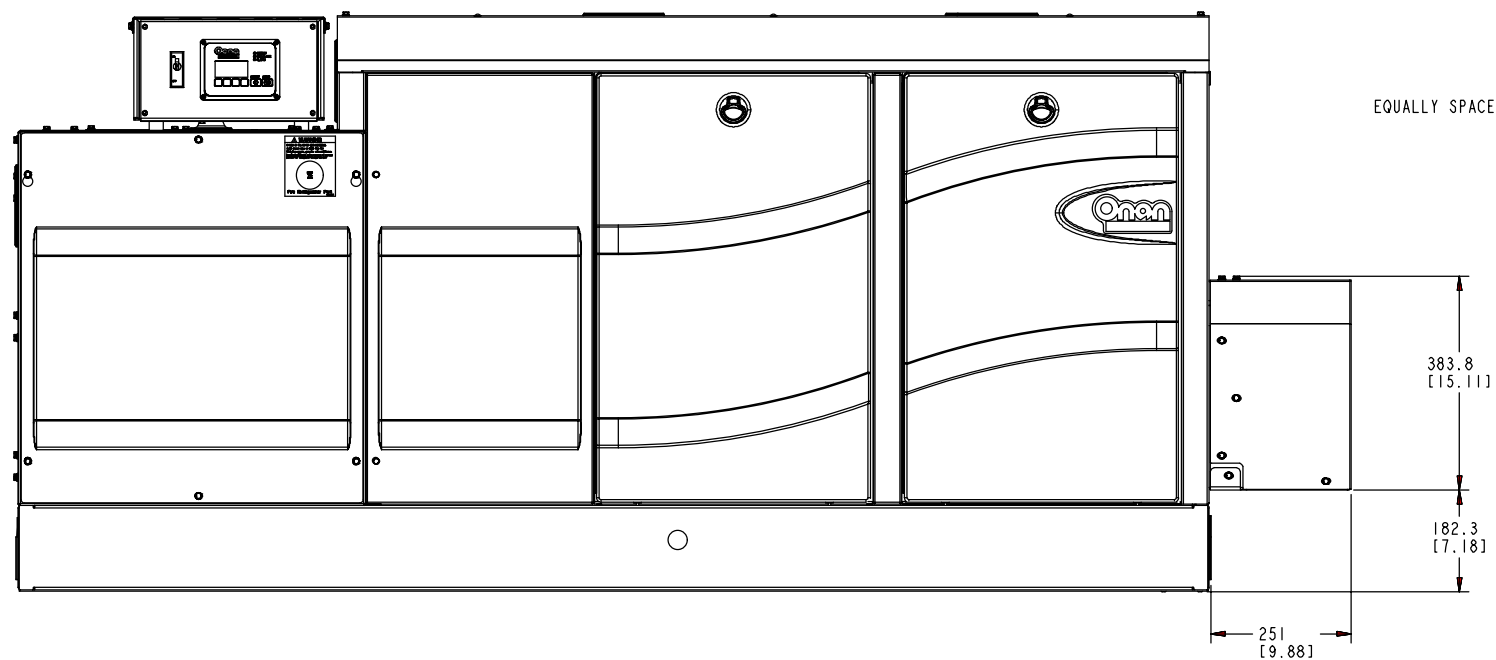
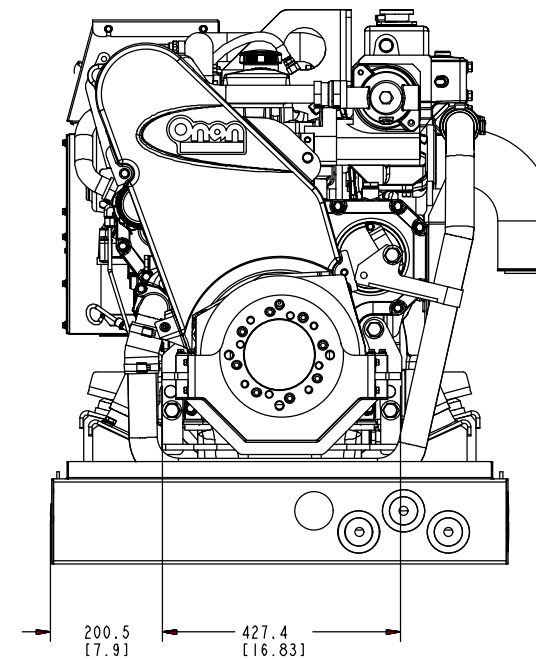
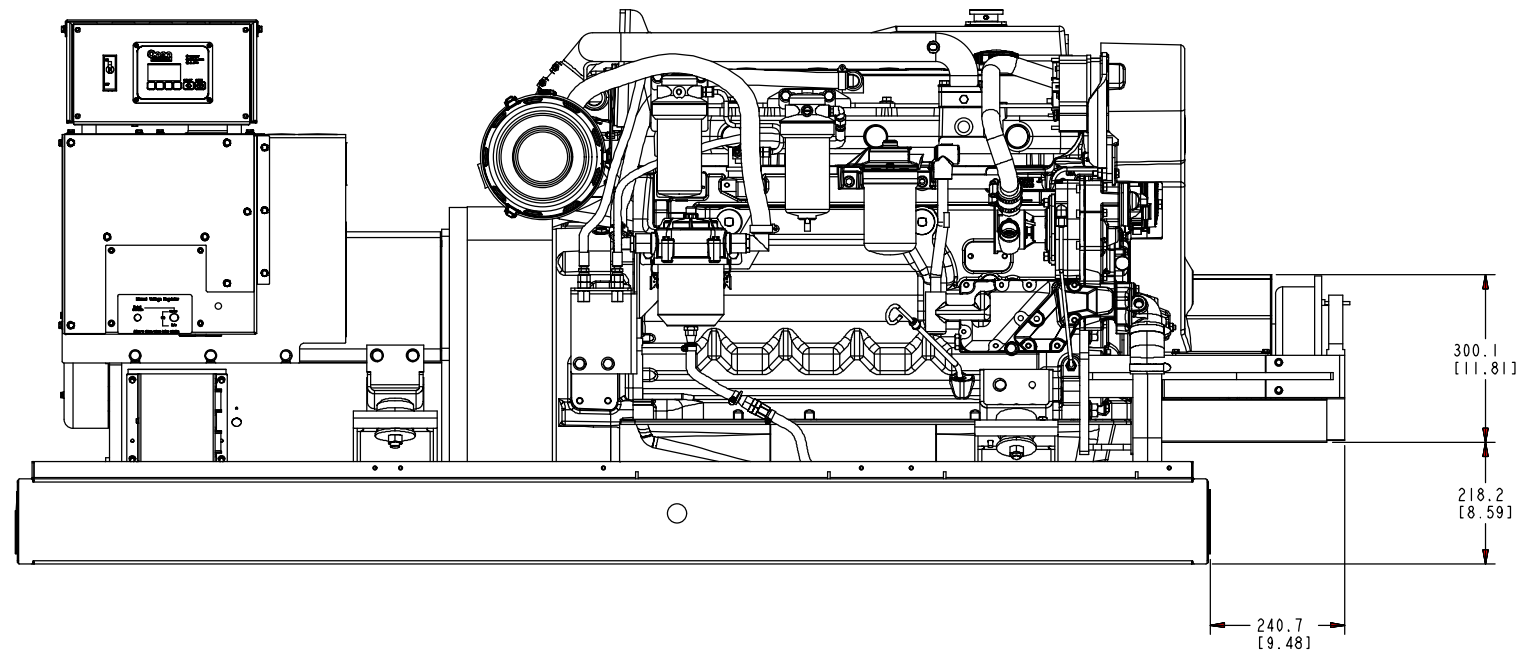
OUTLINE DRAWING—MDDCD, MDDCE, MDDCH, MDDCJ (SHEET 1)



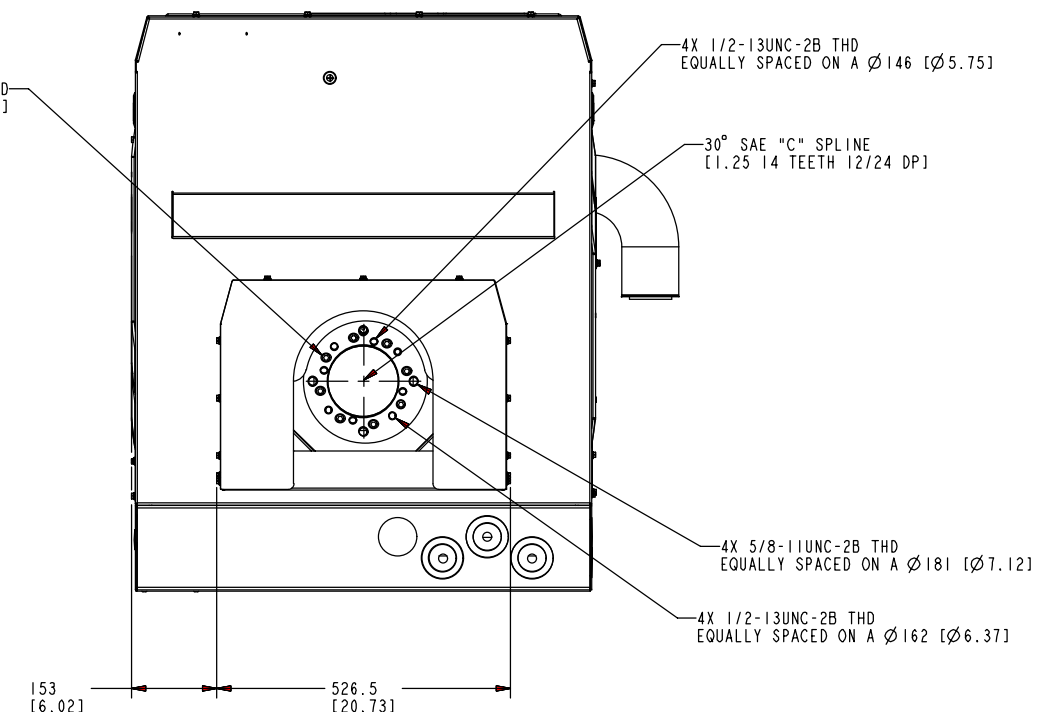
OUTLINE DRAWING—MDDCD, MDDCE, MDDCH, MDDCJ (SHEET 2)



OUTLINE DRAWING—MDDCD, MDDCE, MDDCH, MDDCJ (SHEET 3)



8X 3/8-16UNC-2B THD  
EQUALLY SPACED ON A  $\varnothing 158.8$  [ $\varnothing 6.25$ ]



OUTLINE DRAWING—MDDCD, MDDCE, MDDCH, MDDCJ (SHEET 4)