



# Installation Manual

Cummins **Onan**

Performance you rely on.™



## Marine Generator Set

MDKUB (Spec E-J)

MDKWB (Spec E-J)

## **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 attained when equipment is operated and maintained properly.

Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards shall remove, dismantle and dispose of the generator set. See service manual.

Some generator set installation procedures present hazards that can result in severe personal injury or death. Only trained and experienced personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set installation procedures.

The following symbols in this manual alert you to potential hazards to operators, service personnel and equipment.

**⚠ DANGER** *Used to alert you to an immediate hazard which will result in severe personal injury or death.*

**⚠ WARNING** *Used to alert you to a hazard or unsafe practice which can result in severe personal injury or death.*

**⚠ CAUTION** *Used to alert you to a hazard or unsafe practice which can result in personal injury or equipment damage.*

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

## GENERAL PRECAUTIONS

- Keep children away from the genset.
- 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, 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 and cause severe burns.

- Do not use evaporative starting fluids. They are highly explosive.
- 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 having consumed 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-purpose fire extinguishers handy. Multi-purpose fire extinguishers are used for fires that involve ordinary combustible material such as wood and cloth; combustible and flammable liquid fuels and gaseous fuels; live electrical equipment. (North America or US ref. NFPA No. 10)
- Genset installation and operation must comply with all applicable local, state and federal codes and regulations.
- Engine components can be hot and cause severe burns. Hot coolant under pressure can spray and cause severe burns.
- Use personal protective equipment when maintaining or installing the generator set such as gloves, safety glasses, etc.

## THE HAZARDS OF CARBON MONOXIDE

Engine-driven generators can produce harmful levels of carbon monoxide that can injure or kill you. The nature of boating is such that you can be

harmful by this poisonous gas despite good generator set maintenance and proper ventilation.

### **ONLY YOU CAN PROTECT YOURSELF FROM CO POISONING!**

- Watch constantly for swimmers when the generator set is running.
- Make sure exhaust cannot get under the deck, between hulls or enter the living quarters through a window, vent or door.
- Make sure all CO detectors and audible alarms are working properly.
- Pay attention to the signs of CO poisoning.
- Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.

### **GENERATOR VOLTAGE IS DEADLY**

- Generator electrical output connections must be made by a trained and experienced electrician in accordance with applicable codes.

**⚠WARNING** *Interconnecting the generator set and shore power can lead to electrocution of utility line workers, equipment damage and fire. Use an approved switching device 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 every startup and after every eight hours of operation.
- For more information about carbon monoxide see 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.

### **GASOLINE IS FLAMMABLE AND EXPLOSIVE**

- Because this generator set is an *Ignition Protected* device, no substitutes are permitted for the parts listed in the *Critical Parts Index* of the generator set Parts Catalog. They must be purchased from Onan and be installed in accordance with the generator set Service Manual by those who are trained and experienced in marine generator set service.

### **BATTERY GAS IS EXPLOSIVE**

- Wear safety glasses while servicing batteries and 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**

**⚠WARNING** *Do not operate a diesel-powered generator set where a flammable vapor environment can be created by fuel spill, leak, etc*

Flammable vapor can cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and

death. The owners and operators of the generator set are solely responsible for operating the generator set safely.

## **SUBSTANCE HAZARDS TO HEALTH**

Generator sets use substance, and emit and create wastes that can cause health risks. Generator set operators must use appropriate personal protective equipment (such as clothing, gloves, protective glasses/goggles, and respiration equipment) when exposed to fuel, oil, coolant, wet batteries, grease, cleaning agents, or other substances exposed to lungs, eyes, or skin. Use appropriate containers for transport, storage, and disposal of waste substances. Follow local regulations for disposal and recycling.

### **ANTIFREEZE (FLEETGUARD – ES COMPLEAT/EG PREMIX)**

This antifreeze is also known as an ethylene glycol based coolant; summer coolant; coolant additive. It is purple coloured, viscous liquid, with a mild chemical odour, is soluble in water and harmful. It contains ethylene glycol, and diethylene glycol. Ethylene glycol is a potentially hazardous constituent.

The substance has a boiling point of 107°C, and a flash point of 121°C.

It is used as an engine coolant additive, and can be found in the engine cooling systems, and heat exchangers. Installers, operators and maintainers are likely to encounter this substance.

## **HAZARDOUS REACTIONS**

Ethylene glycol is combustible when exposed to heat or flame and can react vigorously with oxidants. Moderate explosive hazard in form of vapour when exposed to heat or flame. Hazardous products resulting from combustion or decomposition include carbon monoxide, carbon dioxide and acrid smoke. Self-contained breathing apparatus must be worn in the event of fume build up.

Avoid strong oxidizing agents – incompatible with sulfuric acid, nitric acid, caustics and aliphatic amines.

It may cause neurological signs and symptoms, and kidney damage. It is also a skin and eye irritant. Very toxic in particulate form upon inhalation. Harm-

ful if swallowed, lethal dose for humans reported to be 100ml.

## **PROTECTIVE MEASURES**

Refrain from eating, drinking or smoking when using the product. Adopt a high standard of personal hygiene. In case of skin contact, wash immediately with soap and water.

Ensure good ventilation and avoid heat sources. Avoid breathing mist, if there is a risk of vapour, or particulate, use a suitable organic vapour mask.

Eye protection, gloves, overalls, impervious apron should be used. Avoid contaminated, discontinue use and clean thoroughly.

## **STORAGE/TRANSPORT**

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight, away from naked flames and strong acids, do not freeze. Store well away from food-stuffs and drinking water. Take special care to avoid discharge into drains, sewers and water-courses.

Contain leak/spill with sand, earth or non-combustible, absorbent material to prevent entry of substance into drainage/sewerage system, water-courses and land. Eliminate all ignition sources, use plastic shovel to transfer to suitable container and dispose of unwanted or absorbed substance through and authorized contractor to a licensed site.

## **EMERGENCY ACTION**

- Fire  
Extinguishing media: CO<sub>2</sub> alcohol resistant foam, dry powder, or water spray.  
Fire fighters to use self contained breathing apparatus. Keep fire exposed containers cool. Prevent run-off from entering waterways, drains and drinking water supplies.
- Ingestion  
Toxic by ingestion. If swallowed induce vomiting only under the advice of a Doctor or poison control centre. Delayed treatment may result in fatality.
- Inhalation (of vapour)  
Remove from further exposure. In case of irritation to lungs or throat, seek medical advice.

- Aspiration (inhalation of liquid)  
Obtain immediate medical assistance.
- Eyes  
Flush copiously with water or preferable eye-wash solution for at least fifteen minutes. Seek medical advice.
- Skin  
Wash thoroughly with soap and water, and seek medical attention if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage  
Soak-up using an absorbent material and dispose of this as directed under Storage/Transport.

## **GAS OIL**

This product is also known as Red Diesel, Fuel Oil, and type A1 or A2. It can be pale red or a clear liquid with a characteristic mild odour. It contains catalytically cracked oil, petroleum distillates, quinizarin, and gas oil maker dye red. The catalytically cracked oil and petroleum distillates are potentially hazardous constituents.

The substance has an initial boiling point of 180°C, a flash point greater than 56°C, and a vapour pressure less than 0.7mm Hg at 20°C and has negligible solubility in water.

It is used as a fuel for off-road diesel powered vehicles and stationary engines, and can be found in fuel tanks, pipes and injection systems. The substance should not be used for any other purpose without contacting the manufacturer or supplier. Installers, operators and maintainers are likely to encounter this substance.

## **HAZARDOUS REACTIONS**

This liquid is flammable. Avoid smoking, heat sources, such as welding and naked flames, sparks and static electricity build-up. Thermal decomposition products are hazardous, containing CO<sub>x</sub>, NO<sub>x</sub> and SO<sub>x</sub> compounds.

The vapour is explosive. High vapour concentrations can cause respiratory irritation, dizziness, nausea, and loss of consciousness. Excessive and prolonged exposure to the mist can cause chronic inflammatory reaction of the lungs and a form of pulmonary fibrosis.

Avoid strong oxidizing agents, e.g. chlorates which may be used in agriculture.

Gas oil is slightly irritating to the skin and has a de-fatting action. Toxicity following single exposure to high level of gas oil is of low order. Prolonged, repeated skin contact may de-fat the skin resulting in possible skin irritation and dermatitis. In some cases warty, cancerous growths have occurred.

## **PROTECTIVE MEASURES**

Ensure good ventilation and avoid heat sources. Observance of good housekeeping rules will ensure general safety. Do not smoke. Avoid breathing mist.

When working on, or testing, injection equipment, special care is required to avoid perforation of skin by high pressure fuel. Use eye protection in the event of suspected high pressure leak.

Adopt a high standard of personal hygiene. In the case of skin contact, wash well with soap and water.

Use glove and overalls, and eye protection goggles if there is a risk of splashing. Use oil impervious gloves and avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly. Contaminated clothing should be removed, soaked with water, and laundered before re-use.

No special respiratory precautions are necessary in normal use.

DO NOT use as a solvent for removing dirt/grease etc, from skin.

## **STORAGE/TRANSPORT**

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep cool, out of sunlight and away from naked flames. Electrical continuity is required between the transport and storage vessels during product transfer.

Contain leak/spill with sand, earth or other suitable material, and prevent entry of substance into drainage/sewerage system, water-courses and land. Dispose of unwanted or absorbed substance through an authorized contractor to a licensed site.

Inform local and fire authorities should the product reach waterways, drains etc.



## EMERGENCY ACTION

- Fire  
Extinguishing media:  
Large fire – Foam/water fog. Never use water jet.  
Small fire – foam/dry powder, AAF, CO<sub>2</sub>, sand, earth.  
Avoid making sparks. Fire fighters to use self-contained breathing apparatus. Keep fire exposed containers cool, using water fog/spray. Prevent run-off from entering waterway, drains and drinking water supplies.
- Ingestion  
Do not induce vomiting. Wash the mouth out with water, and send to hospital immediately.
- Inhalation (of vapour)  
Remove from further exposure. Obtain medical assistance immediately.
- Aspiration (inhalation of liquid)  
If, following ingestion of gas oil, vomiting occurs, there is danger of aspiration into the lungs. This would cause intense local irritation and chemical pneumonias that can be fatal. Obtain immediate medical assistance.
- Eyes  
Irrigate copiously with water or preferably eye-wash solution for at least five minutes. If irritation persists seek medical advice.
- Skin  
Wash thoroughly with soap and water. Change clothing if necessary.  
If high pressure injection has occurred prompt surgical attention is required.
- Spillage  
Absorb using sand, earth or other suitable material. Dispose of unwanted or absorbed flammable material as directed under Storage/Transport (Section 5.7.3).

## LUBRICATION OIL – PREMIUM BLUE E 15W40

Also known as oil, lube oil, sump oil, new oil is dark, viscous liquid with a slight, characteristic odour. The base oil contains: distillates (petroleum), solvent-dewaxed heavy paraffinic. It is not classified as dangerous according to Directive 1999/45/EC and its amendments, and is not classified according to the EU regulations.

It has a boiling point greater than 150°C, a flash point Open Cup of 220°C (Cleveland), and is insoluble in cold water.

It is used in engine lubricant oil systems, sump pan and filters, make-up tanks and piping systems as a lubrication oil for use in wide range of diesel engines operating under severe conditions. Installers, operators and maintainers are likely to encounter this product.

## HAZARDOUS REACTIONS

This product is stable although slightly re-active with oxidizing agents. Results of decomposition are carbon oxides (CO, CO<sub>2</sub>) and water.

Although harmful if swallowed or aspirated (breathed in), repeated or prolonged exposure is not known to aggravate medical conditions.

Used oil may contain harmful combustion by-products and unburnt fuel that will cause skin reactions as detailed for fuel. Particular care must be taken if oil from a severely overheated engine is handled – use impervious gloves, lab coat and safety glasses.

Do not breathe vapour/spray.

## PROTECTIVE MEASURES

Ensure good ventilation and avoid heat sources.

Adopt a high standard of personal hygiene. In case of skin contact, wash thoroughly with soap and water.

Use safety glasses, impervious gloves and lab coat. Avoid contamination inside the gloves. If overalls become contaminated, discontinue use and clean thoroughly.

No special respiratory precautions are necessary in normal use. Do not breathe vapour/spray when handling hot materials.

## STORAGE/TRANSPORT

Store and transport only in correctly marked containers. Keep containers closed when not in use. Keep in a cool, well ventilated area, out of sunlight and away from naked flames. Store well away from food-stuffs and drinking water.

Wear splash goggles, full suit, boots and gloves. Absorb leak/spill with an inert material and dispose of unwanted or absorbed substance through an au-





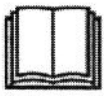




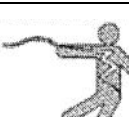
thorized contractor to a licensed site. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

### EMERGENCY ACTION

- Fire  
Extinguishing media:  
Large fire – Use water spray, fog or foam. Do not use water jet.  
Small fire – Use dry chemical powder or CO<sub>2</sub>  
Fire-fighters to use self contained breathing apparatus and full turnout gear. Keep fire exposed containers cool.
- Aspiration (inhalation of liquid)  
Obtain immediate medical assistance
- Eyes  
Flush copiously with water or preferably eye-wash solution for at least fifteen minutes. Obtain medical advice.
- Skin  
Wash thoroughly with soap and water. Obtain medical advice if irritation develops. Change clothing if necessary and wash before re-use.
- Spillage  
Absorb with an inert material and dispose of this as directed under Storage/Transport (Section 5.13.3).
- Ingestion  
Do not induce vomiting, Obtain medical advice immediately.

## Generator Set Warning Labels

Warning signs are provided on the generator set at or near the point of risk. To avoid injury, always take the necessary precautions – as indicated on the sample signs shown below:

	Caution / Warning. Indicates a risk of personal injury.
	Caution / Warning of Temperature Hazard. Indicates a risk of personal injury from high temperature.
	Caution / Warning of High Voltage Hazard. Indicates a risk of personal injury from electric shock/electrocution.
	Caution / Warning of Engine Coolant Pressure Hazard. Indicates a risk of personal injury from hot pressurized engine coolant.
	Caution / Warning. Indicates to read Operator manual for additional information.
	Caution / Warning of No Step. Indicates a risk of personal injury or equipment damage from stepping on equipment.
	Caution / Warning of Combustion/Explosion Hazard. Indicates a risk of personal injury from explosion.
	Caution / Warning of Belt and Rotating Part Hazard. Indicates a risk of personal injury from entanglement in moving parts.
	Caution / Warning of Chemical (ingestion/burn) Hazard. Indicates a risk of personal injury or asphyxiation from poisonous fumes or toxic gases.
	Caution / Warning of High Voltage or Current Source Hazard. Indicates a risk of personal injury from electrical shock/electrocution.

# 1. Introduction

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## ABOUT THIS MANUAL

This manual is a guide for the installation of the generator sets 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
- generator set room ventilation
- Fuel connections
- Electrical connections
- Batteries
- Bonding for grounding
- Accessibility for operation and maintenance
- Noise and vibration.

See the generator set Operator 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 generator set should be used as a guide for the installation.

## STANDARDS FOR SAFETY

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

**⚠ WARNING** *This generator set shall not be the main source of power for communication and steering systems. It can stop without warning.*

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 of 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.  
613 Third Street, Suite 10  
Annapolis, MD 21403

Particular attention should be paid to ABYC P-1, *Installation of Exhaust Systems for Propulsion and Auxiliary Machinery*, ABYC E-11, *AC and DC Electrical Systems on Boats* and ABYC A-27, *Alternating Current (AC) Generator Sets*.

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## COMPONENT LOCATIONS

The preheat/on/off switch and routine maintenance items are located behind the front access cover. See Figures 1-1 and 1-2.

**To remove the front access cover:** Open the latches on the front access cover until the cover is released. Pull the cover away from the housing.

**To replace the front access cover:** Drop the cover into the lip at the bottom of the front opening and center it horizontally. Close and secure the cate-

ches at the top two corners of the cover. Make certain that the sealing strip around the edge of the housing is tightly compressed. **The cover must be fastened tightly for adequate set ventilation and sound reduction to take place.**

Figure 1-3 shows the attachment of the front baffle using the attached elastic T-handles. Normal installation should not require its removal; however, **the front baffle must be tightly fastened for adequate set ventilation and sound reduction to take place.**

**⚠WARNING** *Operation of the generator set with the access cover removed can result in severe personal injury or equipment damage. Hot components are exposed when the access cover is removed and generator set cooling air does not circulate properly. Do not operate the generator set with the access cover removed.*

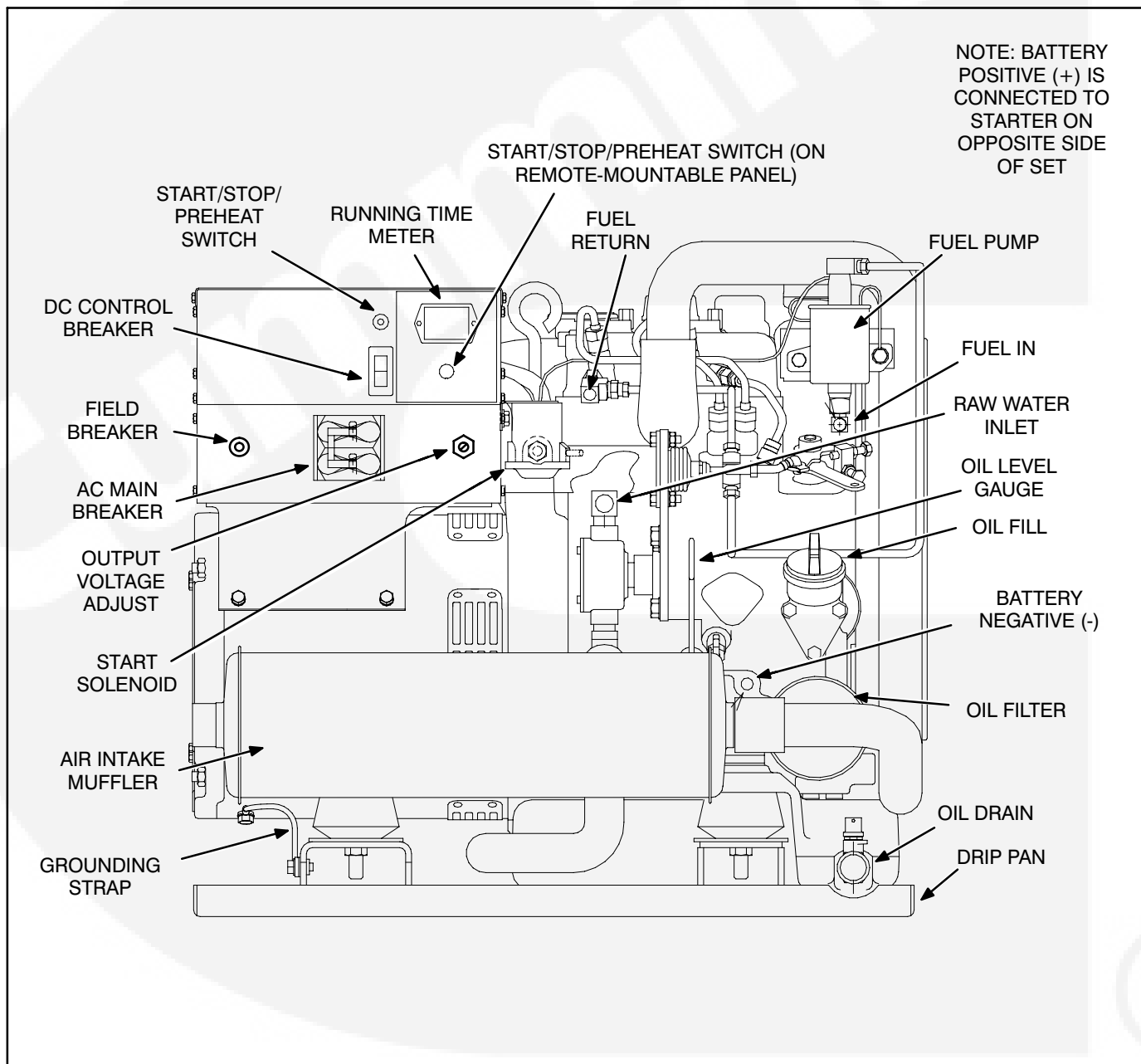
## NOISE

Generator sets emit noise. As noise level and time of exposure increases, risk of hearing damage increases. The Specifications page in the operator manual states noise level for this generator set. Select and use personal hearing protection appropri-

ate for your exposure to generator set noise.

Note for use in countries where compliance to the EU Noise directive is required: This generator set has not been evaluated and is not marked for use in open air. Install the generator set in accordance with the installation manual. Obey local noise restrictions when you operate the generator set.





**FIGURE 1-1. GENERATOR SET COMPONENT LOCATIONS (MDKUB SHOWN WITHOUT HOUSING)**

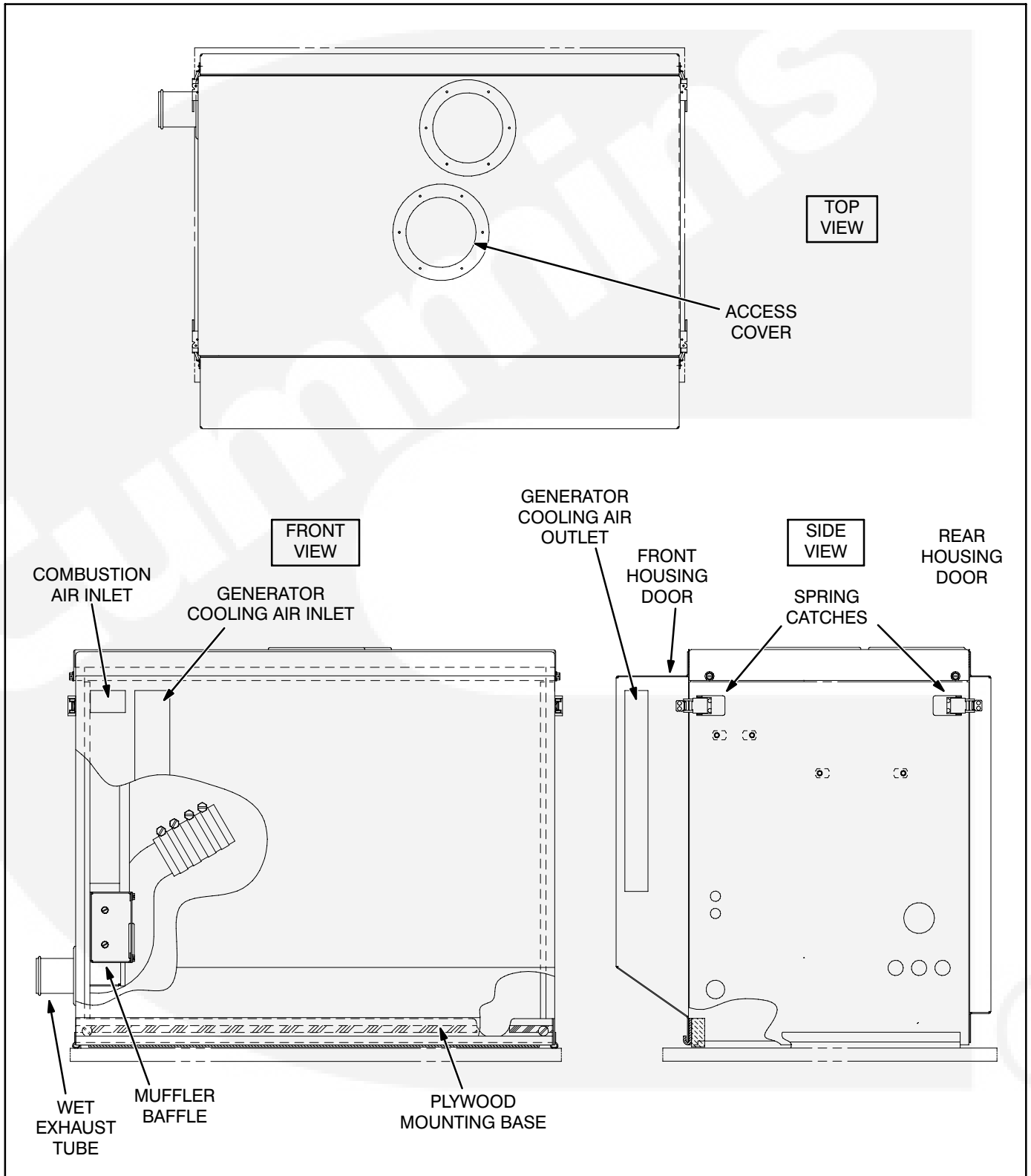
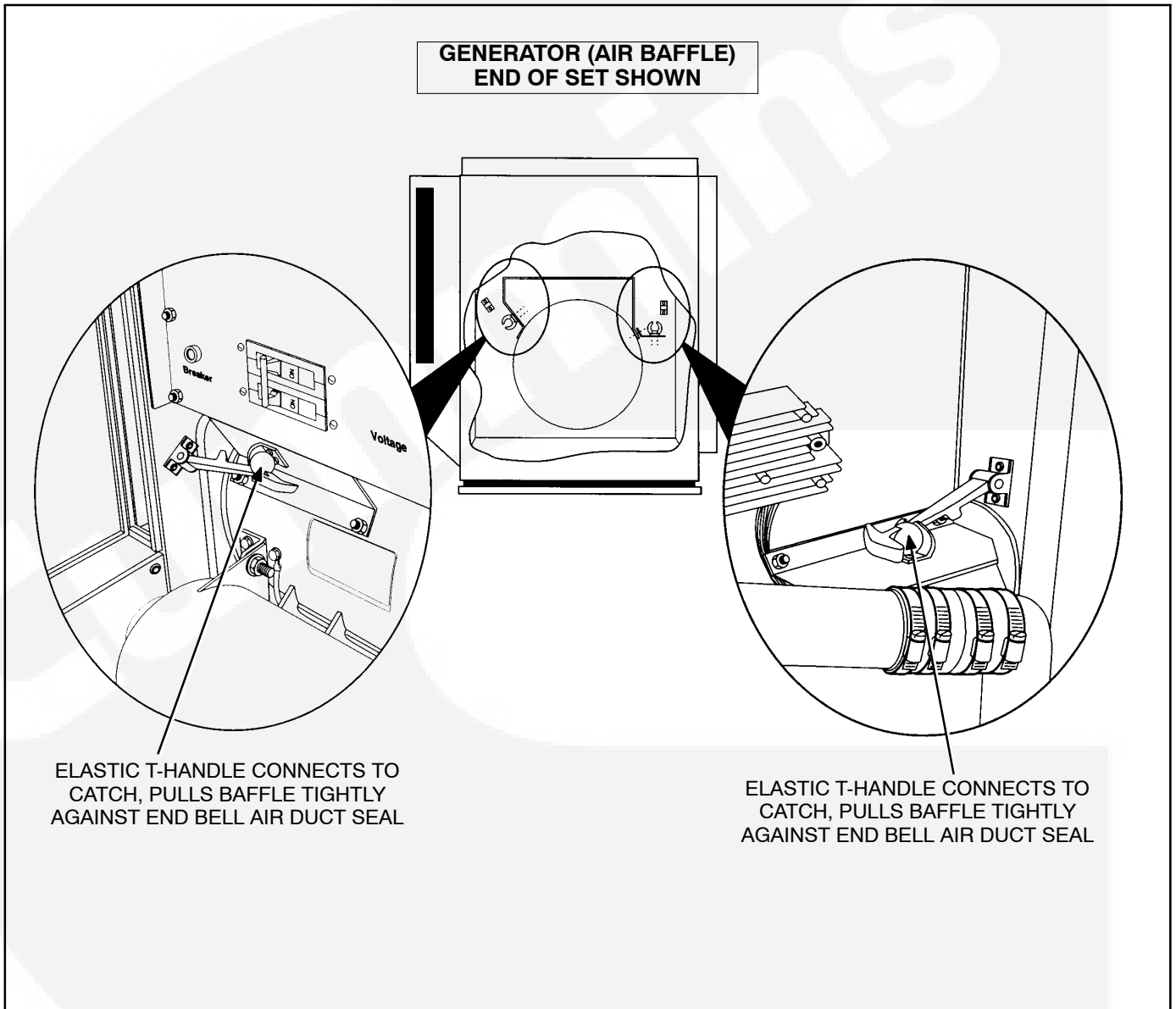


FIGURE 1-2. GENERATOR HOUSING



**FIGURE 1-3. ATTACHMENT OF FRONT HOUSING WALL/BAFFLE WITH T-HANDLES**





## 2. Specifications

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### DIMENSIONS AND WEIGHT

MDKUB:	Weight (with housing) .....	172.4 kg (380 pounds)
	Height .....	595.8 mm (23.46 inches)
	Length .....	709.7 mm (27.94 inches)
	Width .....	545.4 mm (21.47 inches)
MDKWB:	Weight .....	204.1 kg (450 pounds)
	Height .....	595.8 mm (23.46 inches)
	Length .....	816.7 mm (32.15 inches)
	Width .....	545.4 mm (21.47 inches)

### GENERATOR

Type: .....	2-pole revolving field, 4-wire reconnectible
Standby ratings: .....	See Genset Nameplate
Frequency regulation, no load-rated load: .....	5 percent
Voltage regulation, no load-rated load: .....	±2 percent

### ENGINE

Engine type:	MDKUB .....	Kubota Z482B, diesel, 2 cylinder, vertical in-line
	MDKWB .....	Kubota D722B, diesel, 3 cylinder, vertical in-line
Bore and stroke: .....	67 x 68 mm (2.64 x 2.68 inches)	
Total displacement:	MDKUB .....	479 cc (29.23 cubic inches)
	MDKWB .....	719 cc (43.89 cubic inches)
Combustion chamber: .....	Spherical type	
Engine speed:	60 Hz sets: .....	3600 rpm
	50 Hz sets: .....	3000 rpm
Fuel: .....	No. 2 diesel	
Oil capacity with filter:	MDKUB .....	3.78 liters (4 quarts)
	MDKWB .....	4.73 liters (5 quarts)
Fuel consumption (No. 2 diesel fuel) liters/hour (gallons/hour) average @ half load:		
MDKUB @ 60 Hz .....		1.75 (0.46)
MDKUB @ 50 Hz .....		1.4 (0.37)
MDKWB @ 60 Hz .....		2.5 (0.65)
MDKWB @ 50 Hz .....		2.0 (0.52)
Fuel consumption, (No. 2 diesel fuel) liters/hour (gallons/hour) average @ full load:		
MDKUB @ 60 Hz .....		2.65 (0.7)
MDKUB @ 50 Hz .....		2.1 (0.55)
MDKWB @ 60 Hz .....		3.7 (0.98)
MDKWB @ 50 Hz .....		3.0 (0.79)
Fuel pump lift (self-priming) .....	1.2 meters (48 inches)	
Fuel inlet .....	1/8-27, NPT, Female	
Fuel return .....	1/8-27, NPT, Female	
Total air per minute required (cooling and combustion): .....	4.25 m <sup>3</sup> /min. (150 ft <sup>3</sup> /min.)	
Battery charge alternator maximum output (regulated) .....	10 amperes	
Battery voltage (nominal) .....	12 volts	
Battery recommendation minimum cranking performance @ 0° F (-18° C) .....	360 ampere	
Coolant capacity:	MDKUB .....	2 liters (2.1 qt.)
	MDKWB .....	3.5 liters (3.7 qt.)



# 3. Location and Mounting

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## LIFTING

The generator set has a single lifting eye, which is accessible through an access cover. Ref to the Specification page (p. 2-1) for the weight of the generator set and make provisions accordingly for safe handling.

**⚠WARNING** *Installation of the generator set requires lifting apparatus. Ensure that correctly rated lifting slings with suitable attachments are available prior to commencing work. Lifting and lowering operations should only be carried out by properly trained personnel. Do not exceed the rating of any lifting component. Wear head, eye, hand and foot protection during lifting operations.*

## LOCATION

The genset location must be a well ventilated area, insulated, close to the fuel supply and the center of electrical load distribution. Usually those conditions are in the same room or compartment as the propulsion engine. However, a genset cannot be installed in the propulsion engine compartment unless specific conditions are met.

USCG regulation 33CFR183 pertains to gasoline fuel systems, and requires a genset operating in a gasoline fuel environment to be "ignition protected." This means a genset capable of operating in an explosive environment without igniting that environment.

The MDKUB/MDKWB gensets are not "ignition protected" and cannot be operated in a gasoline-fueled environment. They can, however, be operated in a diesel-fuel environment.

**⚠WARNING** *Gasoline fire or explosion can result in severe personal injury or death. Do not install a diesel generator set in the same room or compartment of a gasoline propulsion engine or generator set. The diesel unit may not be ignition protected and can ignite gasoline fumes.*

Mount the set on and parallel with the keel or vessel center line if possible. Keep the genset away from

living quarters, and away from bilge splash and vapors.

## MOUNTING

The mounting area must be flat and give adequate support for the genset weight directly under the genset vibration isolator mounts (Figures 3-1, 3-2). This will maximize the usefulness of the vibration isolator system.

Adequate space must be left on all sides of the genset for service access as well as ventilation and air flow. The service side door of the sound housing requires several inches minimum for removal and may require more space so as not to impede access for routine inspection and maintenance. Two inches minimum clearance is recommended on the other sides.

The set comes from the factory attached to a 3/4" plywood base. This base may be drilled or clamped in any way necessary to mount the set.

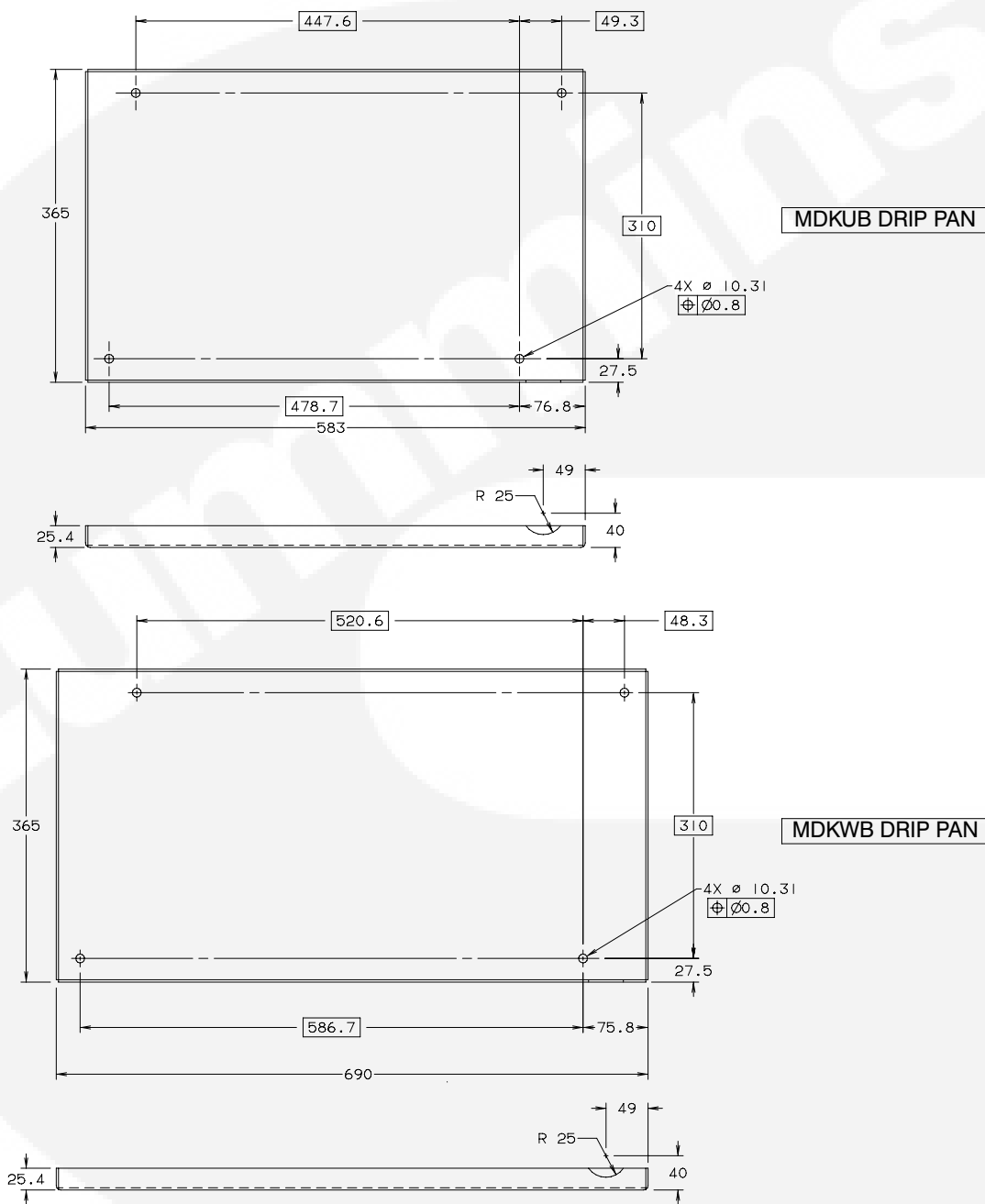
Refer to Page A-5 or A-6, respectively, for copies of the Outline Drawings. Pay particular attention to the locations of the various service points on the generator set:

- Battery positive and negative connections
- Fuel inlet and outlet connections
- Oil fill and drain
- Raw (cooling) water inlet and outlet

**Make certain that these points can be easily accessed without removing the generator set.** Plastic plugs at the ends of the set provide access for fuel and electrical connections.

## Genset Mounting Holes

Figure 3-1 (below) illustrates the MDKUB and MDKWB drip pans and mounting holes. The set drip tray is attached to the plywood base by four carriage bolts in the positions indicated. To mount the set, remove the carriage bolts, nuts and washers and drill holes in the floor or deck in the positions indicated. Use 3/8" bolts or the nearest metric equivalent to mount the generator set.

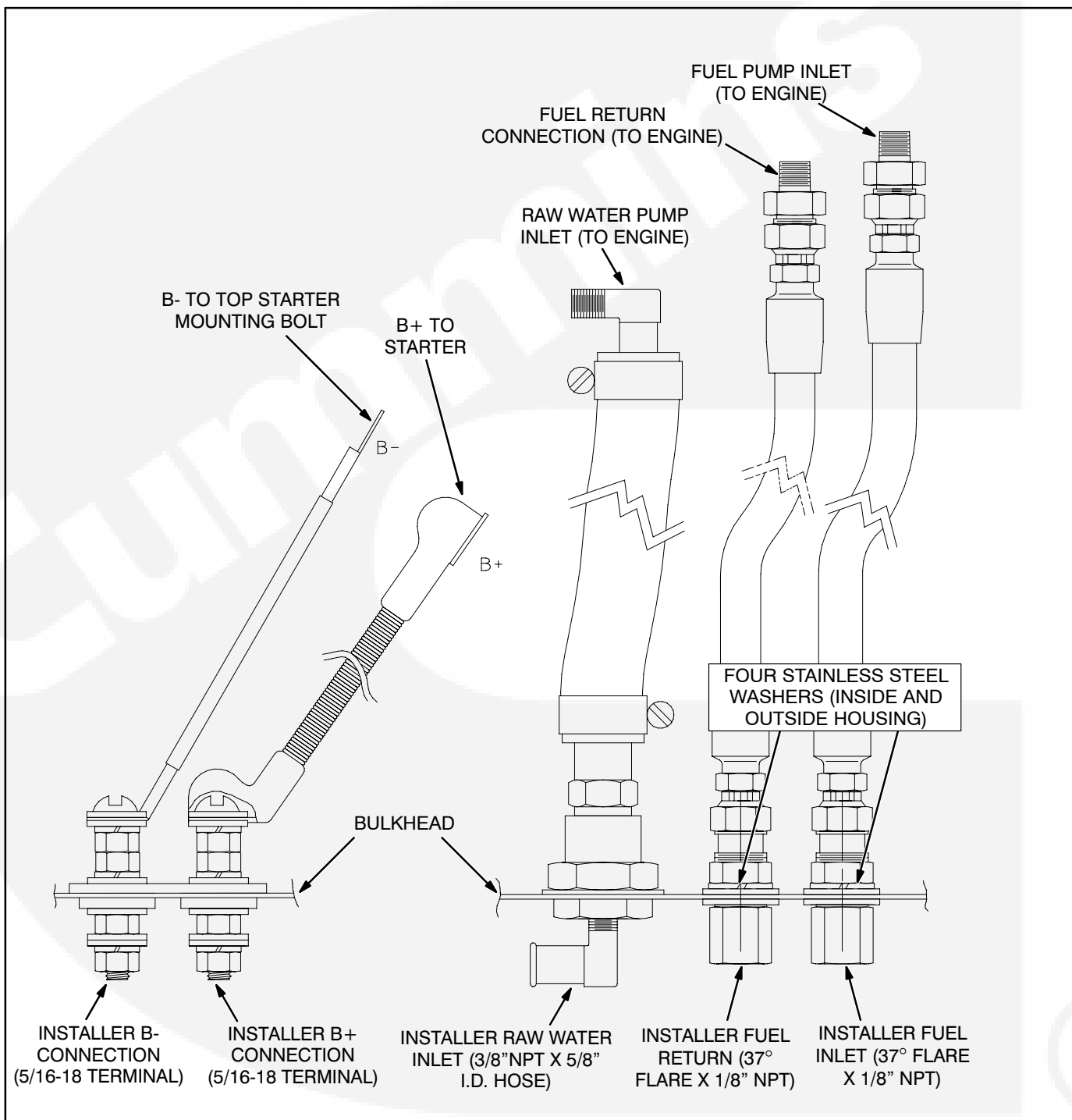


**FIGURE 3-1. MDKUB, MDKWB DRIP PANS WITH MOUNTING HOLES**

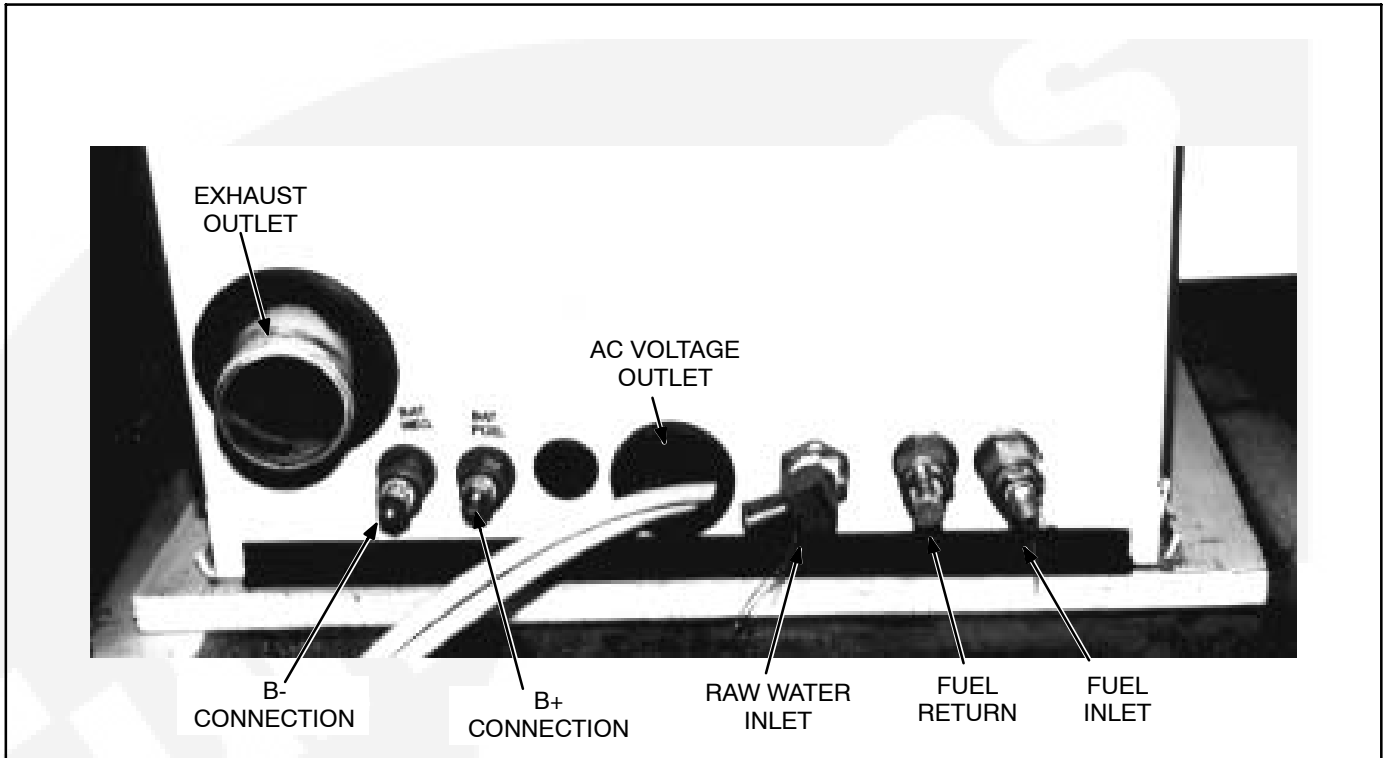
### **CABLE AND FUEL LINE ROUTING**

Bulkhead connectors are provided in the front of the generator set housing for the passage of fuel and electrical lines. Fuel and electrical lines are usually

run forward, toward the front of the vessel. However, openings are also provided at the rear of the genset; these are sealed by removable plastic plugs. Figure 3-2 illustrates these connectors.



**FIGURE 3-4. DETAIL OF BULKHEAD FITTINGS**



**FIGURE 3-5. BULKHEAD FITTINGS ON INSTALLED HOUSING**

## 4. Ventilation

### **⚠ WARNING**

**INCORRECT SERVICE OR REPLACEMENT OF PARTS CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

### **⚠ WARNING**

#### **EXHAUST GAS IS DEADLY!**

**Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:**

- Dizziness
- Nausea
- Headache
- Weakness and Sleepiness
- Throbbing in Temples
- Muscular Twitching
- Vomiting
- Inability to Think Coherently

**IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.**

**Never sleep in the vessel with the generator set running unless the vessel interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.**

### **GENERAL**

The installation of boat ventilation systems must meet all Coast Guard and NFPA requirements. Establishing the correct air flow quantity is particularly important with small compartments under 1000 cubic feet (28 m<sup>3</sup>), or installations in close quarters. Ventilation systems meeting Coast Guard requirements for passenger vessels (Table 4-1) will normally suffice for operation under all conditions.

**TABLE 4-1. PASSENGER VESSEL VENTILATION REQUIREMENTS**

<b>SIZE OF COMPARTMENT Cu. Ft. (m<sup>3</sup>)</b>	<b>MINUTES REQUIRED TO EXCHANGE TOTAL AIR VOLUME</b>
Less than 500 (14) .....	2
500 to 1000 (14 to 28) .....	3
1000 to 1500 (28 to 42) .....	4
1500 and Up (42 and Up) .....	5



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## REQUIREMENTS

Marine gensets must have air ventilation for three very important reasons:

1. **To remove flammable or other harmful gases.** Coast Guard regulations require power blowers in the genset and propulsion engine rooms be run at least four minutes prior to starting the engine and during operation. The operator must also inspect the engine room for the presence of fuel vapors prior to starting, especially when gasoline fueled equipment is used (see text under Coast Guard and NFPA Requirements).
2. **To provide engine combustion air and generator cooling air.** Coast Guard regulations require power exhausters in all installations, and one blower in each exhaust duct. Exhausters must have an air capacity 1 1/2 to 2 times the minimum genset total air requirements (see Specifications section).
3. **To control compartment temperature during genset operation.** This will avoid overheating which can result in shutdown, engine and related control component damage, and power loss. As a general rule, the operating environment for a diesel marine genset should not be maintained beyond a maximum of 160° F (71° C). While marine gensets can operate for extended periods at higher temperatures, maintaining a lower maximum will result in better performance and longer life. Often an operating power blower is required to maintain temperature when the genset is operating, especially when the boat is not moving.

The compartment must have air inlets and outlets to provide this air. Inlet ducts should have cowls or equivalent fittings of twice the area of the duct, larger if the opening is screened. Do not use recessed or flushed inlets, or louvered-transom outlets.

## COAST GUARD AND NFPA REQUIREMENTS

The Coast Guard requires that diesel gensets have at least one ventilation air inlet and one outlet. The total inlet area must not be less than one square inch per foot (21.2 cm<sup>2</sup>/m) of boat beam.

A separate diesel tank compartment must be ventilated with a large gooseneck vent, or by some similar means. The ventilating system must meet current Coast Guard and NFPA requirements.

Boats classified as pleasure vessels by the Coast Guard must have sufficient ventilation to eliminate accumulation of flammable gases. Boats under 65 feet (20 m) long classified as passenger vessels require ventilation be sufficient to change the compartment air within a given time interval (Table 4-1).

For passenger vessels, the Coast Guard recommends a mechanical exhausting system to meet the requirement in Table 4-1. To prevent movement of fumes between living quarters and any compartment containing an engine or its exhaust system, seal all cracks, feed-through holes, and conduit ends.

A carbon monoxide (CO) detector listed for marine use should be installed in the living quarters of the vessel. The many ventilation variables (such as wind shifts, boat in motion, at dockside where there can be exhaust gas from other vessels, etc.) make a CO detector an important accessory.

# 5. Cooling System

## GENERAL

Throughout this manual, flotation water drawn into the boat for engine cooling is called sea water. Thus, confusion is avoided with other generic terms describing water origin and use. The MDKUB/MDKWB generator sets use a heat exchanger for engine cooling.

## SYSTEM PLUMBING

To adequately cool the genset under all conditions, the plumbing system must be properly planned and installed. Excess plumbing length increases flow resistance and results in reduced cooling. An air leak in the sea water intake will reduce cooling, cause corrosion, and can even destroy the neoprene impeller in the sea water pump. The neoprene impeller must never be run dry, and the pump should be primed before initial start.

Water lines should be SAE 20R3 hose or equivalent, or better. The water line must be capable of withstanding a slight suction vacuum without collapse. The entire length should be supported and secured with clamps. A length of hose at the genset must be free to allow for set movement.

Because sea water is not always clean, Cummins Onan recommends a water strainer or filter to protect the engine cooling system. See Figure 5-1.

Cummins Onan has a hull strainer (furnished with some muffler kits) that can be used with a flush through-hull fitting. The strainer (Figure 5-1), installed with the slots parallel to the keel, helps prevent pressure or vacuum when the boat is underway. Always use a flush-type inlet with a hydrodynamic marine muffler.

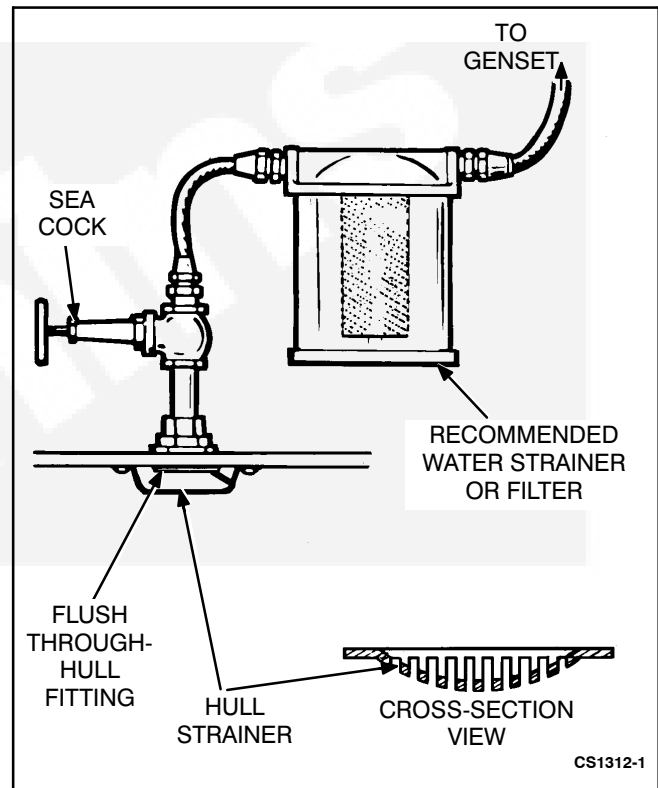


FIGURE 5-1. SEA WATER INLET

**⚠ CAUTION** *Restriction in the sea water inlet line can cause engine overheating and shutdown. The flush-type, through-hull water inlet must have an opening at least as large as the water inlet line.*

Stagger the genset water inlet so it is not directly in line with other inlets. Not doing so can reduce the amount of sea water available to the genset when underway and cause overheating. Never use scoop type water inlet fittings with a hydrodynamic muffler.

**⚠ CAUTION** *DO NOT USE SCOOP TYPE WATER INLET FITTINGS WITH A HYDRODYNAMIC MUFFLER. Forward facing scoops can develop sufficient ram pressure to force water past the generator set sea water pump. This can flood the exhaust system and the engine cylinders. This happens when the generator set is not running and the boat is underway. Rear facing scoops develop vacuum which can impede cooling water flow.*

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## HEAT EXCHANGER COOLING

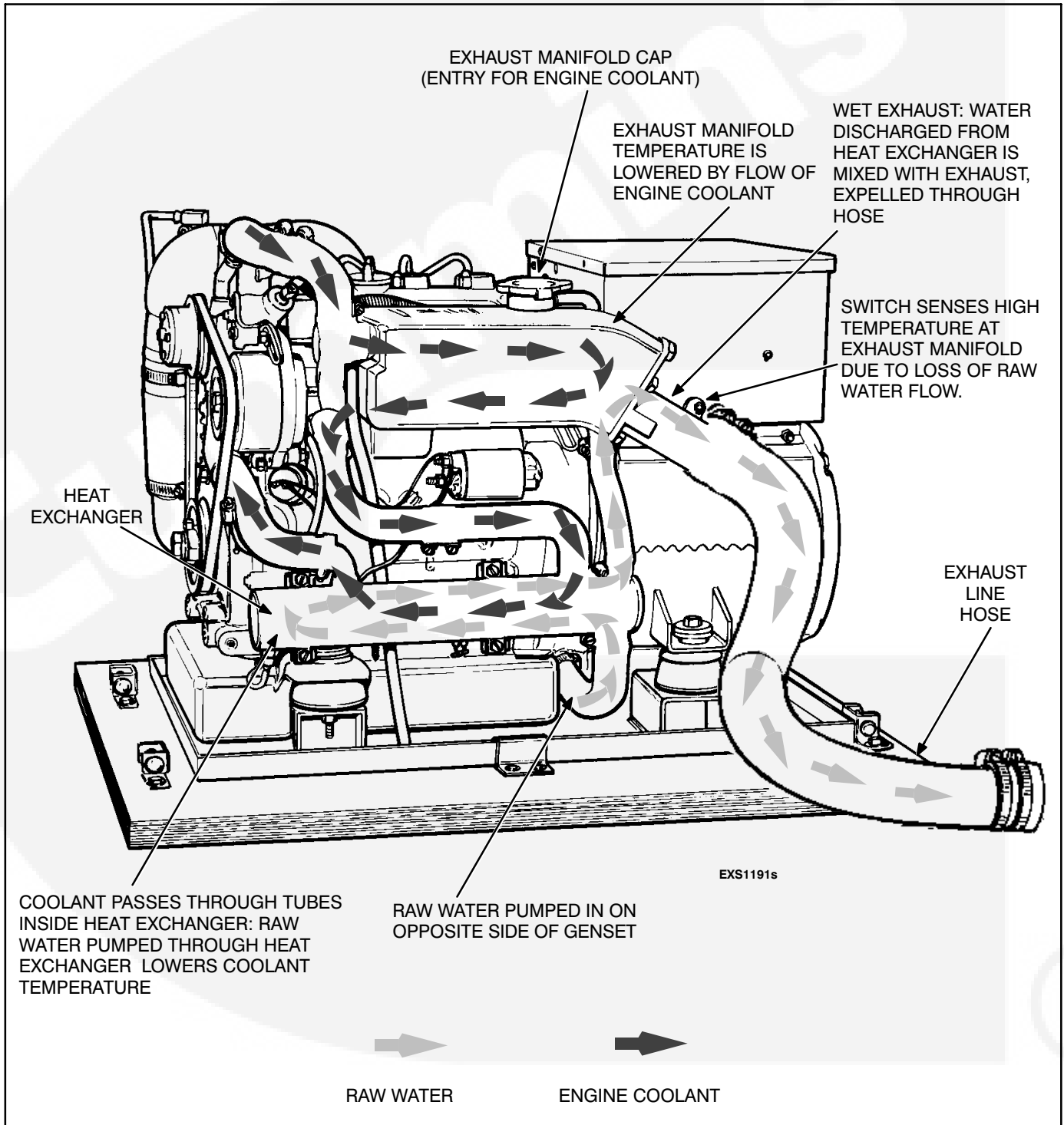
The cooling system keeps sea water and any sediment deposits (salt, silt, etc.), away from the engine cooling jacket. As a result, the engine water jacket stays clean for optimum heat transfer. Figure 5-2 shows the flow direction of sea water and engine coolant.

The sea water pump constantly renews the sea water in the heat exchanger, then dumps it into the exhaust elbow. The exhaust water flow cools the elbow, connecting hoses, and muffler in the exhaust system.

The engine coolant is circulated by a pump through the engine block, heat exchanger, and the exhaust

manifold. The engine coolant temperature and flow rate are controlled by a thermostat. The engine cooling system should always use a 50-50 mixture of ethylene glycol and distilled water to help prevent corrosion. See the Installation Checkout section for filling instructions.

**⚠ CAUTION** *Some propulsion engines use scoop-type water inlet fittings which must not be used on a generator set with a hydrodynamic muffler. When the set is not operating, ram pressure may force water past the generator set's raw water pump and flood the exhaust system. From there it can flow back, flooding the engine cylinders and possibly the engine compartment.*



**FIGURE 5-2. COOLANT FLOW, HEAT EXCHANGER COOLING SYSTEM**

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## COOLING SYSTEM CHECK

Before initial operation, some cooling system checks must be performed. These are outlined in the following text.

### Raw Water System

Before initial operation, the sea water pump should be primed. This lubricates the neoprene impeller and prevents dry operation, especially on above-water-line installations. Prime the pump by removing the outlet hose at the pump connection. Fill the pump with water and replace components. When the genset is started, check the exhaust outlet for delivery of water to the system. Flow should be as listed in the Specifications.

**⚠ CAUTION** *Do not operate the generator set if the cooling system is faulty. Doing so can result in damage to water-cooled exhaust system components and engine.*

### Engine Coolant System

The genset has a high coolant-temperature shut-down switch. This switch can prevent engine damage only if the cooling system is kept clean and properly maintained.

A coolant-recovery tank kit is supplied with the genset and must be connected per the instructions. Be sure the system is full of coolant, and the recovery tank filled to the COLD mark before delivery to the customer.

## Installing Coolant Recovery Tank

A coolant recovery tank is in the accessory kit furnished with each generator set. Figure 5-3 shows a typical installation with the tank accessible on the service side of the engine. It should be located so the hose between the radiator and tank is pitched slightly downward.

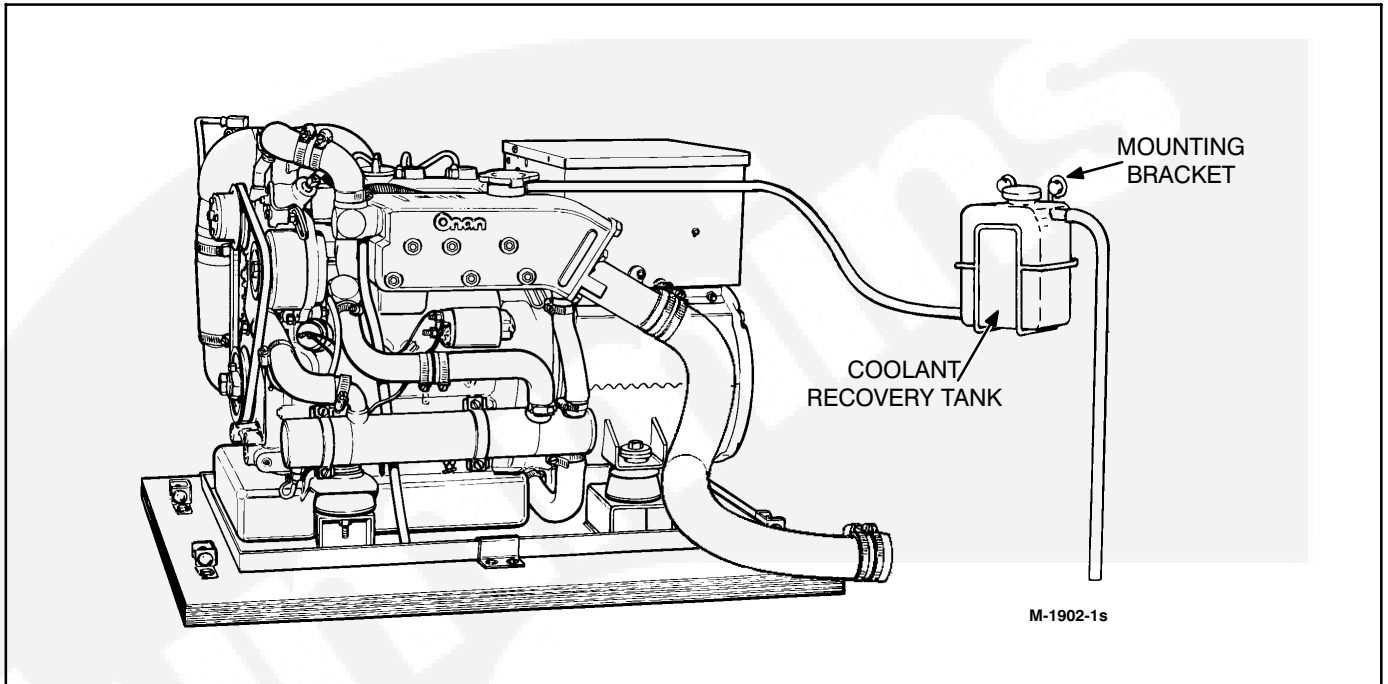
Use the bracket as a template to locate mounting holes. Allow a minimum of 2 inches (51 mm) from the top of the tank to any upper structure so the tank can be lifted off the bracket for servicing. Mount with two 5/16 inch (8mm) bolts.

Use a length of hose from the kit between the radiator overflow and the dip-tube connector on the recovery tank. This hose is heavier and resists collapse from vacuum. The original hose may be used on the overflow side to the drain. Allow sufficient hose lengths so the tank can be easily removed from the bracket to add coolant.

Engine coolant is at proper level when the recovery tank level is between Full and Low (engine cold).

Use a 50-50 mixture of ethylene glycol and distilled water as an engine coolant—even when freezing temperatures are not expected. In addition to lowering the freezing point, it contains rust inhibitors that help prevent corrosion and scale, and lubricate the raw water pump.

**⚠ CAUTION** *Do not exceed a 50-50 mixture of ethylene glycol and water. A stronger mixture of ethylene glycol will alter heat transfer properties of the coolant.*



**FIGURE 5-3. COOLANT RECOVERY TANK INSTALLATION**

### **Filling the Cooling System**

Verify that all drain cocks are closed and all hose clamps secure. Remove the cooling system pressure cap and slowly fill the cooling system with the coolant mixture referenced in the preceding paragraph.

Leave the pressure cap off and start the engine. As trapped air is expelled, the coolant level will drop

and additional coolant should be added. Replace the pressure cap when the coolant level is stable.

At the recovery tank, add coolant mixture to the COLD mark. Operate the genset for approximately 15 minutes, until normal operating temperature is maintained. Shut off the genset and let it cool down. Add coolant to the recovery tank until the level stabilizes at the COLD mark. This may require several operation cycles until air is purged from the system.



## 6. Exhaust System

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### GENERAL

The installation of two water-cooled exhaust systems are covered in this section. They are below-load waterline and above-load waterline, and are covered under separate headings. All marine water-cooled exhaust systems must meet each of the following requirements.

**⚠ WARNING** *Failure to meet these requirements and any applicable codes can result in severe property damage, personal injury or death.*

- The entire exhaust system must be accessible so a periodic visual and audible leakage-check can be done by the operator.
- The exhaust system must be water cooled, and the water injected as near to the genset as possible.
- The exhaust line must be installed to prevent back flow of water to the engine under any conditions; and the exhaust outlet must be above the load waterline. Water backflow into the engine will damage it.
- The genset exhaust system must not be combined with the exhaust system of another engine.
- A flexible section of marine exhaust hose must be used near the engine to allow for engine movement and vibration during operation. All exhaust system hoses must be CERTIFIED for marine use.
- The exhaust system must be of sufficient size to prevent excessive back pressure. See Back Pressure data in this section.
- Make sure all sink, shower or other cabin drains are properly trapped to prevent entrance of exhaust gas.

**⚠ WARNING** *Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.*

***Never sleep in the vessel with the generator set running unless the vessel interior is equipped with an operating carbon monoxide detector. Protection against carbon monoxide inhalation also includes proper exhaust system installation and visual and audible inspection of the complete exhaust system at the start of each generator set operation.***

**⚠ CAUTION** *Backflow of water can cause severe engine damage and possible flooding of the boat. Make sure the hose from the exhaust manifold to the muffler slopes a minimum of 1/2 inch per linear foot (42 mm/m). An uphill section between the exhaust manifold and muffler can cause backflow of water and is not permissible—NO EXCEPTIONS.*

Be sure that the vertical rise of the exhaust hose measured from the bottom of the muffler to its peak is not more than 48 inches (1.2 m) as shown in Figures 6-1 and 6-2. The vertical rise must not slope—it must be vertical in relation to the base of the hydrodynamic muffler.

The exhaust tubing (on both above and below load-waterline installations) must be pitched downward to the through-hull outlet fitting at a minimum down-grade of 1/2 inch per linear foot (42 mm/m). There must also be a 12-inch (305 mm) minimum drop from this peak to the through-hull outlet fitting as shown.

Provide adequate support for hose lengths to prevent sagging, bending, and formation of water pockets. The use of automotive-type vibration-isolated pipe hangers will help stop noise transmission to the boat hull.

Allow space between the marine muffler and its mounting surface by using spacers under the mounting flanges. This allows air circulation under the muffler and discourages condensation.

### Material

Use material recommended by ABYC in "Safety Standard for Small Craft," Section P1. The exhaust line must be at least as large as the engine exhaust manifold outlet. See the following section on Back Pressure.



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**⚠ WARNING** *Exhaust gas contains carbon monoxide, an odorless, colorless, highly-poisonous gas that presents the hazard of severe personal injury or death. Place special emphasis on the following:*

- *Be sure the flexible exhaust hose is designed and certified for marine exhaust-line use.*
- *Use two clamps at each end of all flexible exhaust hose connections.*
- *Do not make sharp bends in the exhaust hose.*
- *Position exhaust outlet to prevent backflow of exhaust gases into the vessel.*

Use flexible hose designed and CERTIFIED for marine exhaust-line use to ease installation, and for flexibility. The muffler must be at the lowest point of the entire exhaust system. The muffler inlet should be at least 12 inches (305 mm) below the engine exhaust manifold outlet. If this distance is less, backflow of water toward the manifold is more likely.

Use two clamps at each end of exhaust hoses as shown in Figures 6-1 and 6-2. The clamps must be corrosion resistant metal, and a minimum of 1/2 inch (12.7 mm) wide. They should be spaced at least one clamp-width apart, and at least one clamp-width from the end of the hose. Clamps depending solely on spring tension must not be used.

## Back Pressure

Exhaust back pressure is an important measure of an adequate exhaust system. If the exhaust installation requires a long run of pipe (more than 30 feet [9 m] overall), back pressure should be checked.

Exhaust back pressure of the genset should not exceed 3.0 inches (76 mm) of mercury (10 kPa).

Increase the exhaust pipe diameter from the muffler to the hull outlet one standard pipe size for every 10 feet (3 m) beyond 30 feet (9 m) of overall length.

## Exhaust Cooling Water Injection

The neoprene impeller pump moves the raw water through the cooling system and into the exhaust elbow. The injected water cools the exhaust and prevents exhaust system damage. A temperature operated switch on the exhaust mixing manifold shuts down the genset if overheating occurs. The switch closes if temperature reaches 221° to 239° F (105° to 115° C) and actuates the stop relay in the control box.

If high exhaust-temperature shutdown occurs, the entire exhaust system should be checked for any signs of overheating, especially the exhaust hoses. Replace defective components immediately, and do not operate the genset until system is repaired.

**⚠ WARNING** *Inhalation of exhaust gas can cause severe personal injury or death. Do not operate the generator set after a high exhaust temperature shutdown until the entire exhaust system has been checked and serviced as required.*

**⚠ WARNING** *DO NOT USE SCOOP TYPE WATER INLET FITTINGS. Forward facing scoops can develop sufficient ram pressure to force water past the generator set's sea water pump. This can flood the exhaust system and the engine cylinders. This happens when the generator set is not running and the boat is underway. Rear facing scoops develop vacuum which can impede cooling water flow.*

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## BELOW LOAD-WATERLINE INSTALLATION

Figure 6-1 shows details of a recommended below-load waterline installation. Review and apply data from the preceding GENERAL section, plus the following.

### Siphon Break

Install a siphon break (anti-siphon) if the sea water injection port on the exhaust mixing manifold is below, *or less than 6 inches (152 mm) above*, the load-waterline. The siphon break is a vacuum-operated vent valve that opens the exhaust water discharge line to the atmosphere when the engine is not operating. The open vent valve prevents raw water (floitation water) from being siphoned into the exhaust manifold and engine cylinders installed at or below load-waterline.

The siphon break hose ends connect to the exhaust mixing manifold water-injection port and the sea water outlet on the heat exchanger.

Locate the siphon break in a vertical position at least 12 inches (305 mm) above the load-waterline. See Figure 6-1. Remote mounting is permissible within a 5 foot (1.5 m) radius of the injection port. The vertical position and height of the valve must be maintained.

The siphon break must be mounted vertically with the hose fitting pointing down. Use pipe strap material to secure the assembly to the frame or bulk-head. Be sure the slotted-opening in the siphon break valve is open to atmospheric pressure. The valve will not function if the opening is closed in any way.

**⚠ CAUTION** *Failure to use a siphon break when the exhaust manifold injection-port is at or below the load-waterline will result in sea water damage to the engine and possible flooding of the boat.*

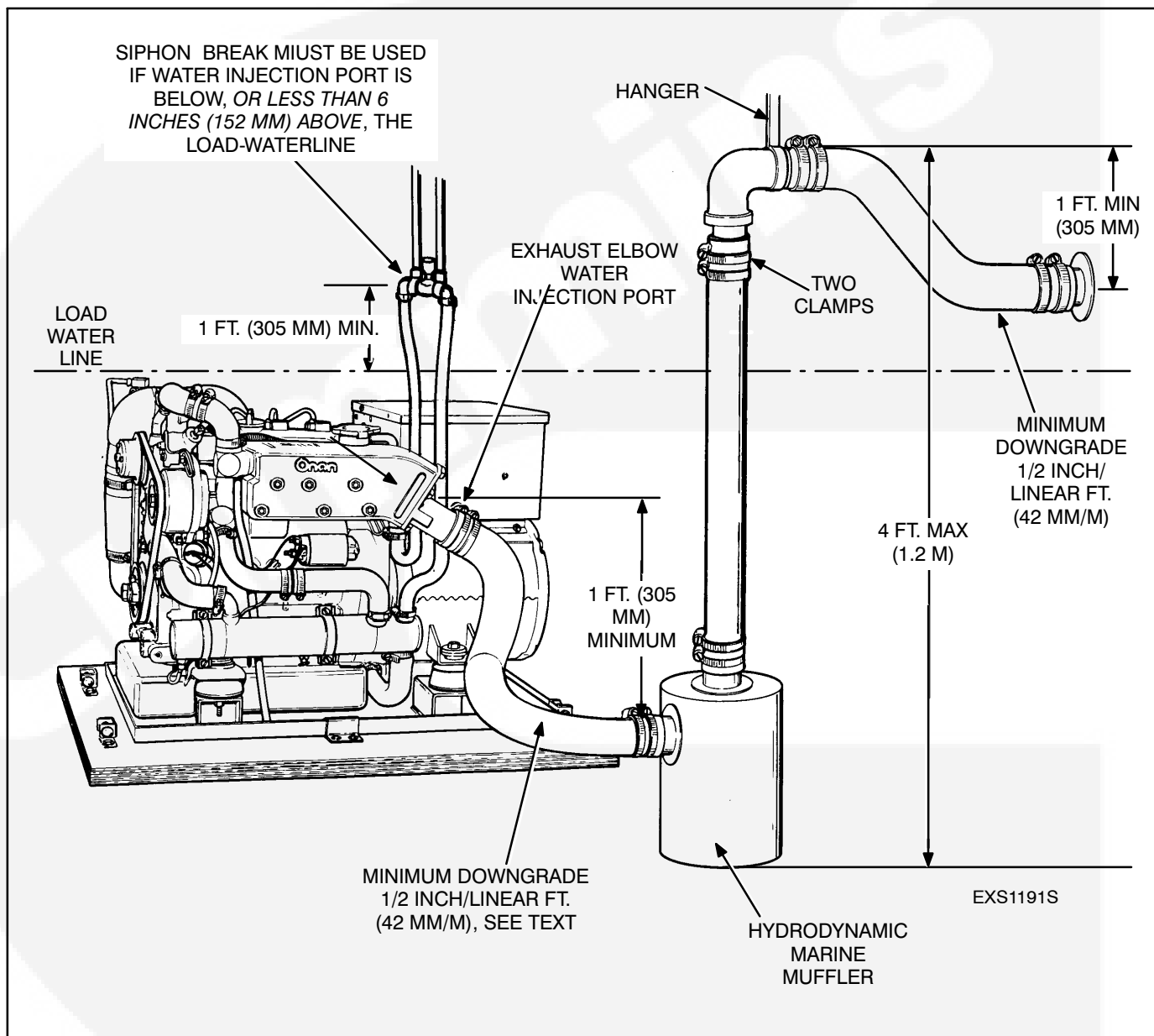


FIGURE 6-1. BELOW LOAD-WATERLINE INSTALLATION

## ABOVE LOAD-WATERLINE INSTALLATION

Figure 6-2 shows a recommended above load-waterline installation. A siphon break valve is not required when the sea water injection port is 6 inches

(152 mm) or more above the load water line. Review and apply data from the preceding GENERAL section. Be sure the minimum drop and downward pitch of exhaust runs are applied as shown, and that all hose end connections have two clamps.

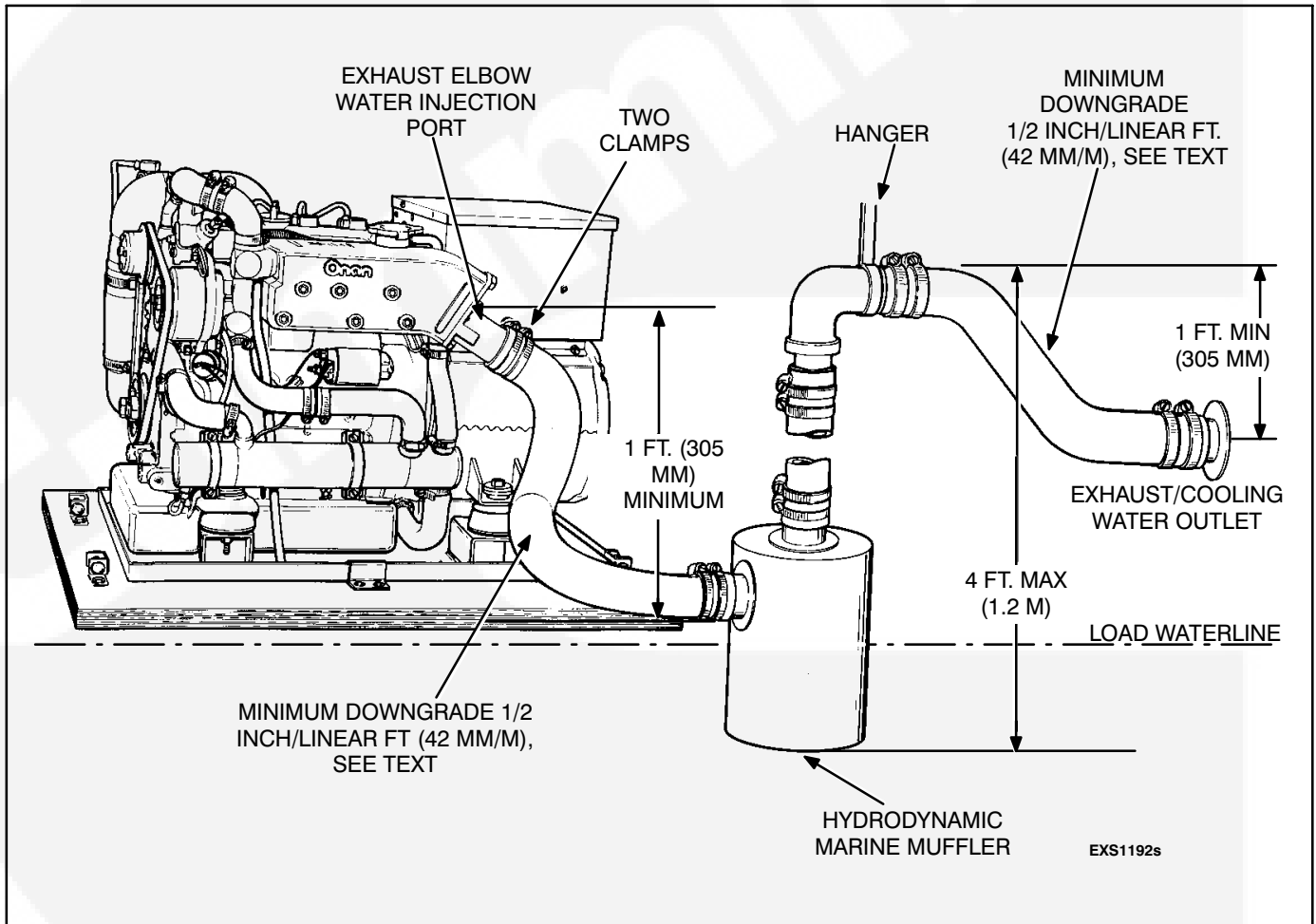


FIGURE 6-2. ABOVE LOAD-WATERLINE INSTALLATION



# 7. Fuel System

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## GENERAL

In all diesel engine installations, fuel system cleanliness is of utmost importance. Make every effort to prevent entrance of moisture or other contaminants. Carefully clean all diesel fuel system components before installation and putting the genset into operation.

**⚠ CAUTION** *Dirt or water in the fuel system is the major cause of diesel engine failure. A tiny piece of dirt or a few drops of water in the injection system can stop the genset.*

**⚠ WARNING** *Fuel leakage in boats presents fire and explosion hazards that can result in severe personal injury or death. For this reason, it is important that the material, design, construction and installation of all fuel system components meet the highest possible standards. Use only products specified for marine application.*

If the propulsion engine uses diesel fuel, it is possible to use the same fuel tank for the genset. However, before that decision is made, the following factors must be considered:

- Adequate fuel capacity for both engines. See Specifications section for genset requirements.
- The fuel returned to the tank after cooling the injectors is warm. To obtain maximum engine efficiency, fuel delivered to the injectors must be cool. The fuel tank volume must be adequate to cool the returned fuel.
- Distance of tank from the genset. The pump self-priming lift capacity is 44 inches (1.1 m). If this height is exceeded, either an additional fuel pump or a separate tank will be required.

## FUEL LINES

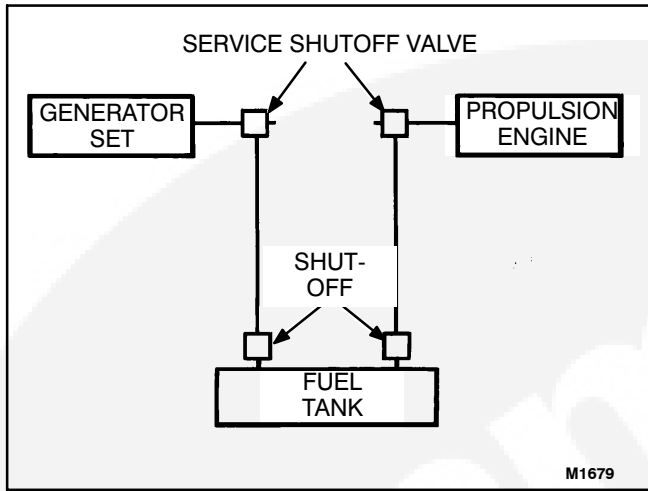
Make sure all fuel lines are properly supported and connections tightened securely. The line should be supported throughout its length with clips or straps spaced no more than 14 inches (355 mm) apart. Use a pipe-joint compound approved for use with diesel fuel at all thread fittings. Fuel lines must have as few connections as possible, and be protected against mechanical injury and vibration.

A flexible fuel line installed between the fuel tank and the genset must meet USCG requirement 33CFR183.558 and be stamped “USCG TYPE A”. There cannot be an electrical connection between the hose end fittings. A bad ground in the cranking circuit will cause a wire reinforced hose to become hot, and ignite the fuel during cranking. If a metallic fuel line is run into the genset compartment, a length of flexible hose meeting the above specifications must be installed to absorb vibration of the genset.

**⚠ WARNING** *Ignition of fuel can cause fire and severe personal injury or death. Be sure the flexible section of fuel line used at the generator set meets USCG requirement 33CFR183.558 and is stamped “USCG TYPE A”.*

**⚠ WARNING** *Leakage of fuel in or around the generator set compartment presents a hazard of fire or explosion and can cause severe personal injury or death. Do not permit any flame, spark, cigarette, pilot light, arcing equipment, or other ignition source near the generator set. The ventilation system must provide a constant flow of air to safely expel all fuel vapors.*

The fuel line should be run at- or above-level of the tank top to a point close to the engine connection to prevent siphoning. See Figure 7-1. A separate fuel line is recommended for the genset as shown.



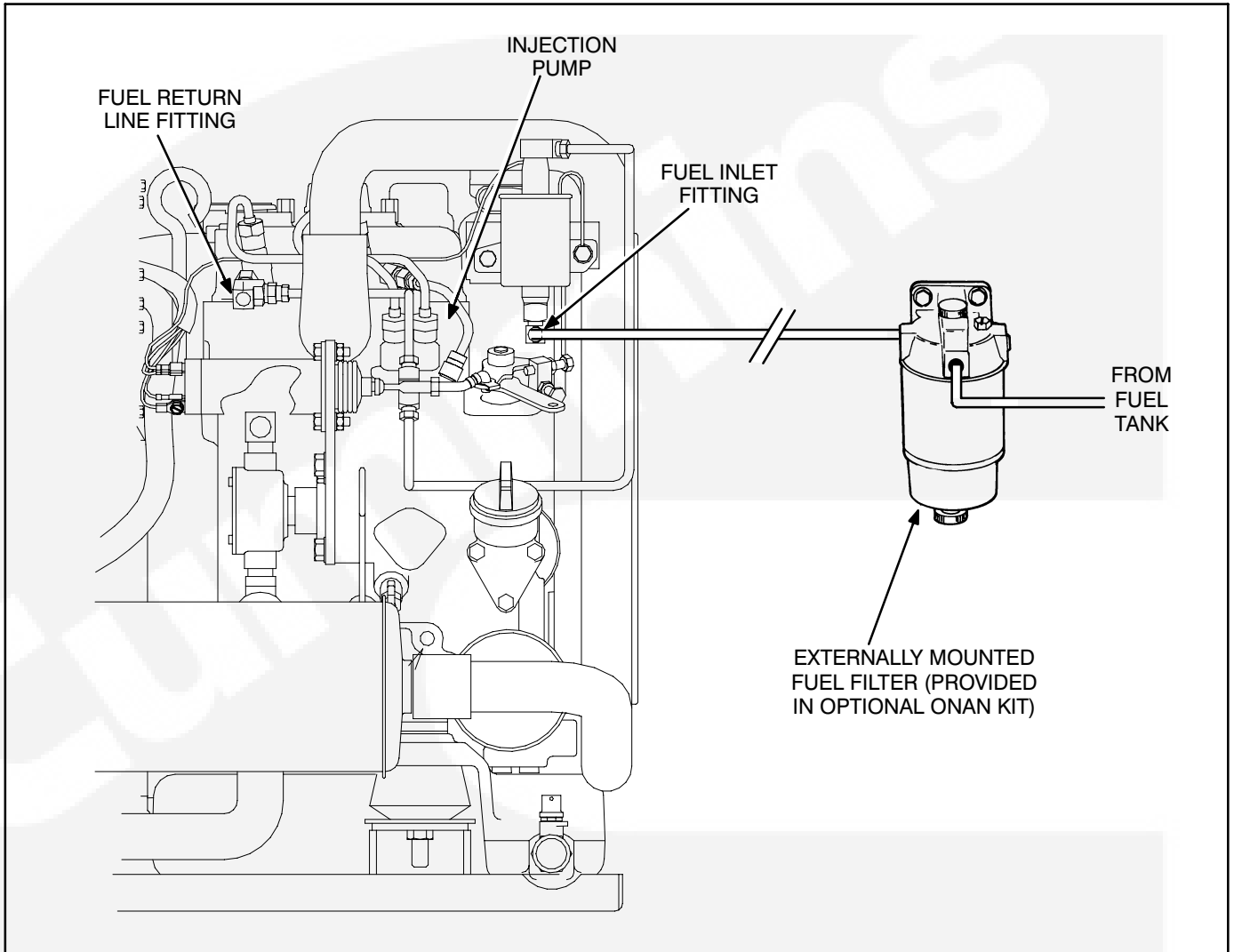
**FIGURE 7-1. INSTALLATION ABOVE TANK LEVEL**

If a fuel tank is shared, a fuel line tee is not recommended. A tee can cause erratic genset operation due to fuel starvation. The genset's fuel pump does not have the capacity to overcome the draw of the propulsion-engine fuel pump.

This is true also of the return lines. Pressure from one engine could be higher than the other and force return fuel back into the lower-pressure engine injector. The return line should enter the tank as far as possible from the supply lines. Maximum back pressure at the injector fuel return line fitting, shown in Figure 7-2, should not exceed 15 psi (103 kPa). This pressure is a function of fuel flow rate, tank height, line size and length.

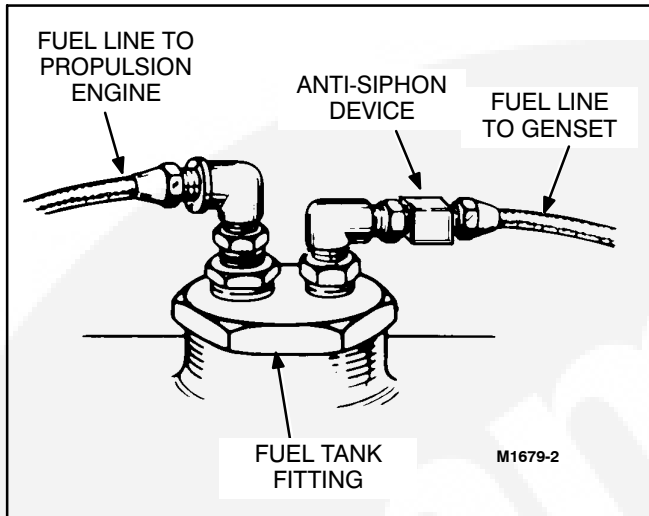
**⚠ CAUTION** *Never use galvanized or copper fuel lines, fittings or fuel tanks with diesel fuel systems. Condensation in the tank and lines combines with the sulfur in diesel fuel to produce sulfuric acid. The molecular structure of the copper or galvanized lines or tanks reacts with the acid and contaminates the fuel.*

If the fuel tank fitting is large enough, a second, shorter dip tube may be installed as shown in Figure 7-3. The required fittings can be built by a machine shop. Install an anti-siphon device at the tank fitting as shown.



**FIGURE 7-2. ENGINE FUEL SYSTEM COMPONENTS**





**FIGURE 7-3. TWO FUEL LINES IN TANK FITTING**

If the tank does not have an unused outlet, a new outlet can be installed. The metal tank must be removed to braze or weld a new outlet fitting. This procedure requires the service of a welder familiar with the essential safety measures.

**⚠ WARNING** *Ignition of fuel vapors can cause severe personal injury or death. Welding a fuel tank, empty or not, is extremely dangerous! Vapors may ignite causing an explosion and fire. Have welding done only by experienced personnel.*

### FUEL FILTER

Note that a fuel filter must be supplied by the installer of the set: a filter is not included on the generator set.

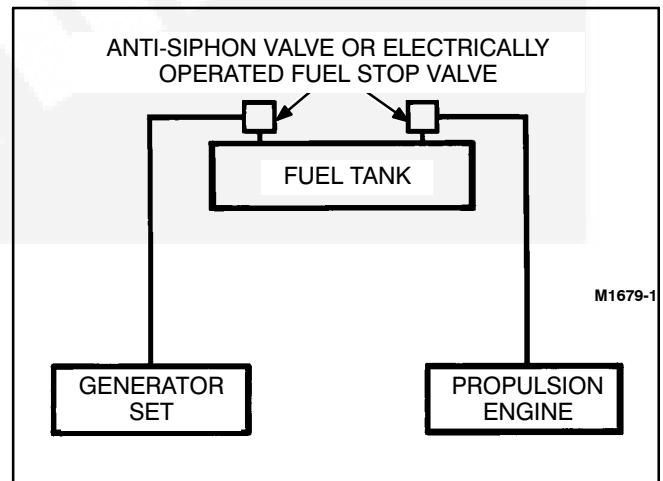
Cummins Onan recommends a fuel filter that includes a water separator, such as the filter shown in Figure 7-2. Mount the filter in a secure, protected area close to the generator set. Consult your Cummins Onan distributor for fuel filters and kits.

The Operator's Manual contains information on cleaning/draining the filter and replacing the filter element.

### SIPHON PROTECTION

When the fuel tank is installed above the engine level, an anti-siphon device is needed to prevent si-

phoning if the line breaks at a point below the fuel level. See Figures 7-3 and 7-4. This device can be installed at the tank withdrawal fitting, or at a location where the line from the tank will no longer remain above the fuel tank top level. The device can be either a mechanical check valve, or an electric valve with mechanical override. The electric valve is connected to open only when the engine fuel solenoid is on.



**FIGURE 7-4. SIPHON PROTECTION**

### FUEL TANKS

A valve must be installed directly at the tank connection to shut off fuel flow. This valve may be electrically or manually operated. If electrically operated, it must be energized only during engine operation, and have a manual override to comply with USCG regulations. This electric valve can be purchased from Onan and is listed in the parts manual.

The manual valve must have an arrangement for operating it outside the compartment in which the tank is located, preferable from above deck.

A USCG approved service shutoff valve must be installed at the engine end of the fuel line under conditions listed below. This valve stops fuel flow when the genset is serviced.

- When fuel tanks are located in a compartment other than the engine.
- When the engine and fuel tanks are separated more than 12 feet (3.7 m).

---

If the propulsion engines and genset use different fuels, a separate fuel tank will be required. Use only an approved fuel tank designed for marine application. Be sure that the compartment is well ventilated (see Ventilation System section). Fuel consumption data in the Specifications section is useful for determining the tank size.

When installing a separate tank, locate it as close as possible to the genset compartment. Be sure it is accessible and can be removed for inspection.

**⚠ CAUTION** *Fuel starvation can cause marginal operation of the generator set. Fiberglass fuel tanks can present a problem if the fuel pickup tube is too close to the tank bottom. Fiberglass fibers can settle and form a mat with time. Make a diagonal cut on the bottom of the pickup tube and install 1/2 to 2 inches (13 to 51 mm) from the tank bottom.*

Mount the fuel tank and secure into position. The NFPA recommends that flat bottom tanks be installed on slatted wooden platforms to help prevent moisture condensation. Cylindrical tanks should be set in chocks or cradles and securely fastened.

Small fuel tanks can be suspended from deck beams. Support and brace the tank to prevent any movement. Line up braces with the tank internal

baffle plates. Insulate all wood or metal surfaces from the tank surface with a non-abrasive and non-absorbent material. Heavy rubber-impregnated cotton fabric or oil- and acid-resistant plastics work well.

**⚠ WARNING** *Ignition of fuel when filling the tank can result in severe personal injury or death. All metallic fuel tanks **MUST** be electrically bonded to the boat common ground. Also bond the filler neck or opening to the tank if a hose is used between them. This helps prevent static spark when filling that can ignite the fuel.*

Position the tank fill and vent pipes so fuel or vapor cannot escape into the bilge. Run the vent and fill pipes from separate openings in the tank. If the fill pipe has a flexible section of fuel hose, install a separate grounding wire between the deck fuel plate and tank. Install the vent opening as far from other hull opening as possible, and with a gooseneck so water cannot enter. Install a flame arrester on the vent opening.

## FUEL SYSTEM TEST

After installation, test the fuel system for tightness per USCG specification 33CFR183.542. Any leak must be found and corrected before putting the fuel system into service.





## 8. Electrical System

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### GENERAL

**⚠WARNING** **HAZARDOUS VOLTAGE!** *Touching uninsulated live parts inside the generator set 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.*

**⚠WARNING** **IMPROPER WIRING** *can cause fire or electric shock resulting in severe personal injury or death.*

**⚠WARNING** **ACCIDENTAL/REMOTE STARTING** *of the generator set 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 generator set.*

Installing the genset electrical system includes the following steps:

- Connecting the load

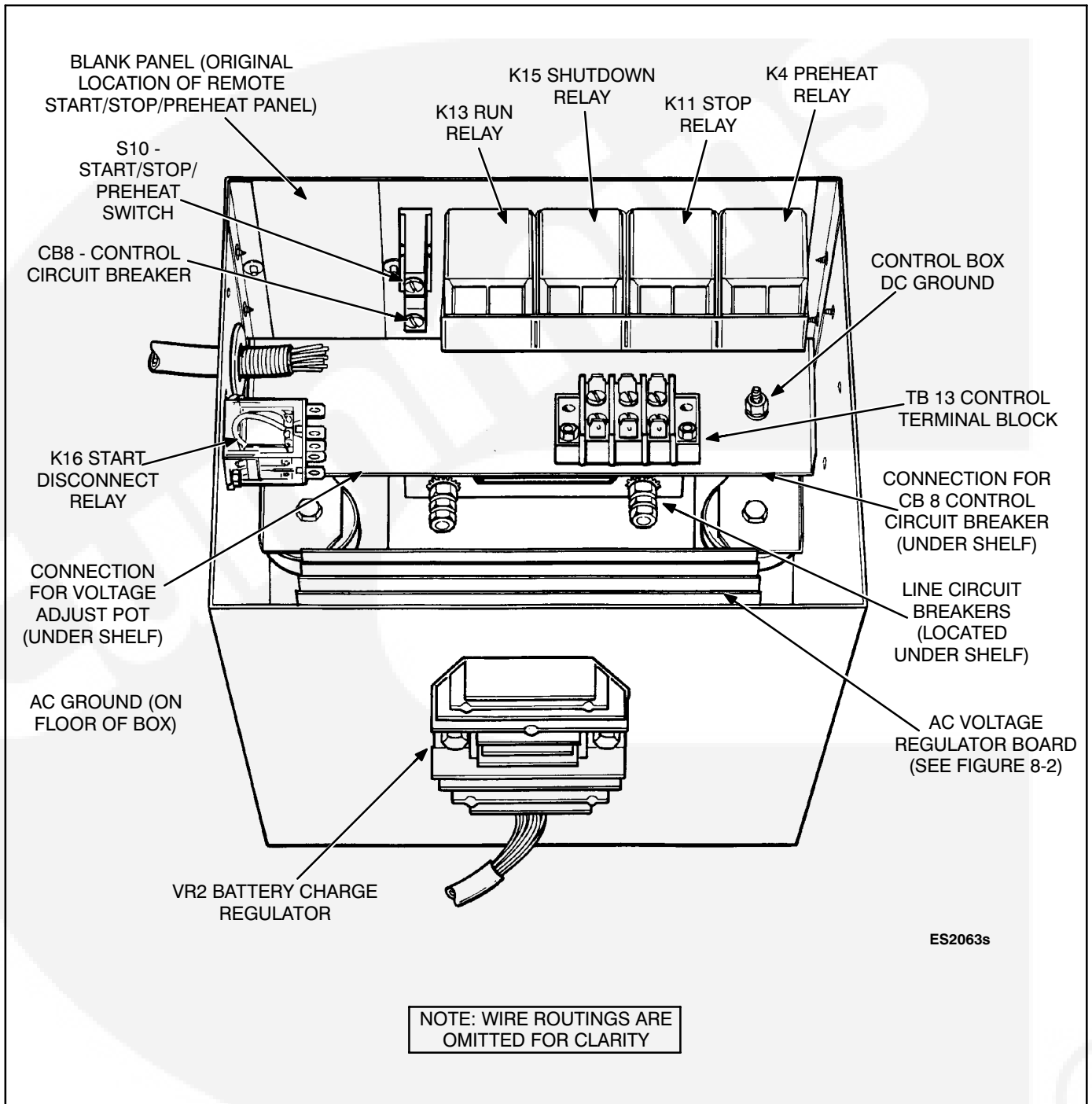
- Installing the remote start/stop/preheat control
- Connecting the battery
- (Optional) Installing the remote meter package

The battery must always be connected last to avoid accidental genset starting during the installation.

All wiring must meet Coast Guard, NFPA, and all other applicable codes. Have all wiring installed by a qualified electrician. Wiring diagrams do not include customer-added components.

**⚠WARNING** **Inhalation of exhaust gas or ignition of fuel vapor can cause severe personal injury or death.** *Be sure to vapor-seal flexible metal conduit, and all openings made during installation of the generator set, with a silicone/rubber-based sealant.*

**⚠WARNING** **Faulty electrical equipment can cause shock and severe personal injury or death.** *Use only approved power supply assemblies, and never remove the grounding pin from the power cord. No ground, or an incorrect ground, can cause the vessel to become electrically "hot".*



**FIGURE 8-1. COMPONENTS INSIDE GENSET DC CONTROL BOX**

## OUTPUT VOLTAGE ADJUSTMENTS

Coarse voltage adjustments are made by turning a trimmer pot on the voltage regulator board (see Service Manual, publication #981-0512). Fine adjustments are made by turning the trimmer pot on the control panel (see Figure 1-1).

**NOTE:** If major adjustment to the output voltage is needed, consult the Service Manual [publication #981-0512]).

### Voltage Adjustment Procedure (Faceplate)

1. Connect a voltmeter to the set output.
2. Power the set.
3. Loosen the lock nut and set the faceplate voltage adjustment trim pot to mid range.
4. Lock the pot into position by tightening the lock nut.

## LOAD CONNECTIONS

**⚠ CAUTION** **INSTALLERS NOTE:** *Low power factor loads connected to the generator set require the generator to work harder to produce a kilowatt of output power. This extra stress on the generator can cause equipment damage. This Onan generator is rated at 1.0 power factor. If your electrical load has a total power factor of less than .97, or you have questions about sizing the generator set for your application, consult your local Onan distributor.*

While at dock, most boats have a dockside connection for use of commercial power. These installa-

tions must have a transfer switch to isolate the genset and the commercial power. The two power sources must never be connected together. A single-phase, manual shoreline-transfer switch is available from Onan for this function. See Figure 8-2.

Use a section of flexible conduit at the genset to absorb movement and vibration. Flexible, multi-strand wire must be used throughout to reduce the danger of breakage due to boat movement or vibration. Grounding must comply with wiring codes.

Single-phase 120/240-volt series and parallel connections are shown on the AC wiring and schematic diagrams in Section 10 of this manual. The output schematic is duplicated in Figure 8-4. These generators are electronically regulated. The load leads are connected to the circuit breakers in the control box.

Generator output is taken from the T1, T2, T3 and T4 windings of the generator. These may be connected for either a series or a parallel output. See Figure 8-3.

When output is taken from two generator windings (such as 120/240 volts), the load must be balanced across the windings. Taking full load from one winding can cause poor voltage regulation and damage to the equipment or generator. The AC output breaker must be sized according to the AC output current.

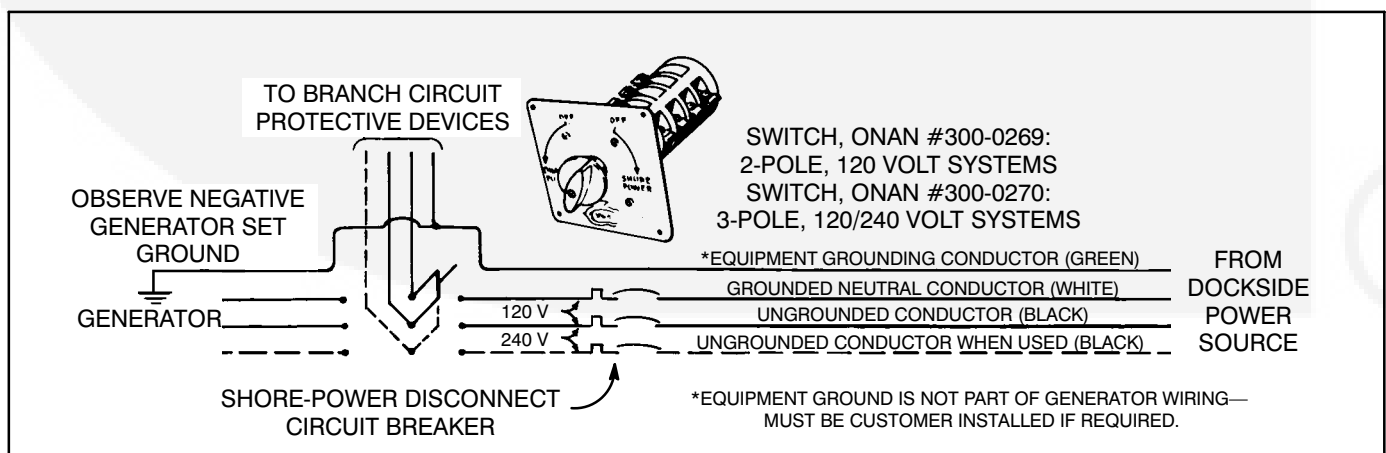


FIGURE 8-3. TYPICAL SINGLE-PHASE MANUAL SHORELINE-TRANSFER SWITCH CIRCUIT

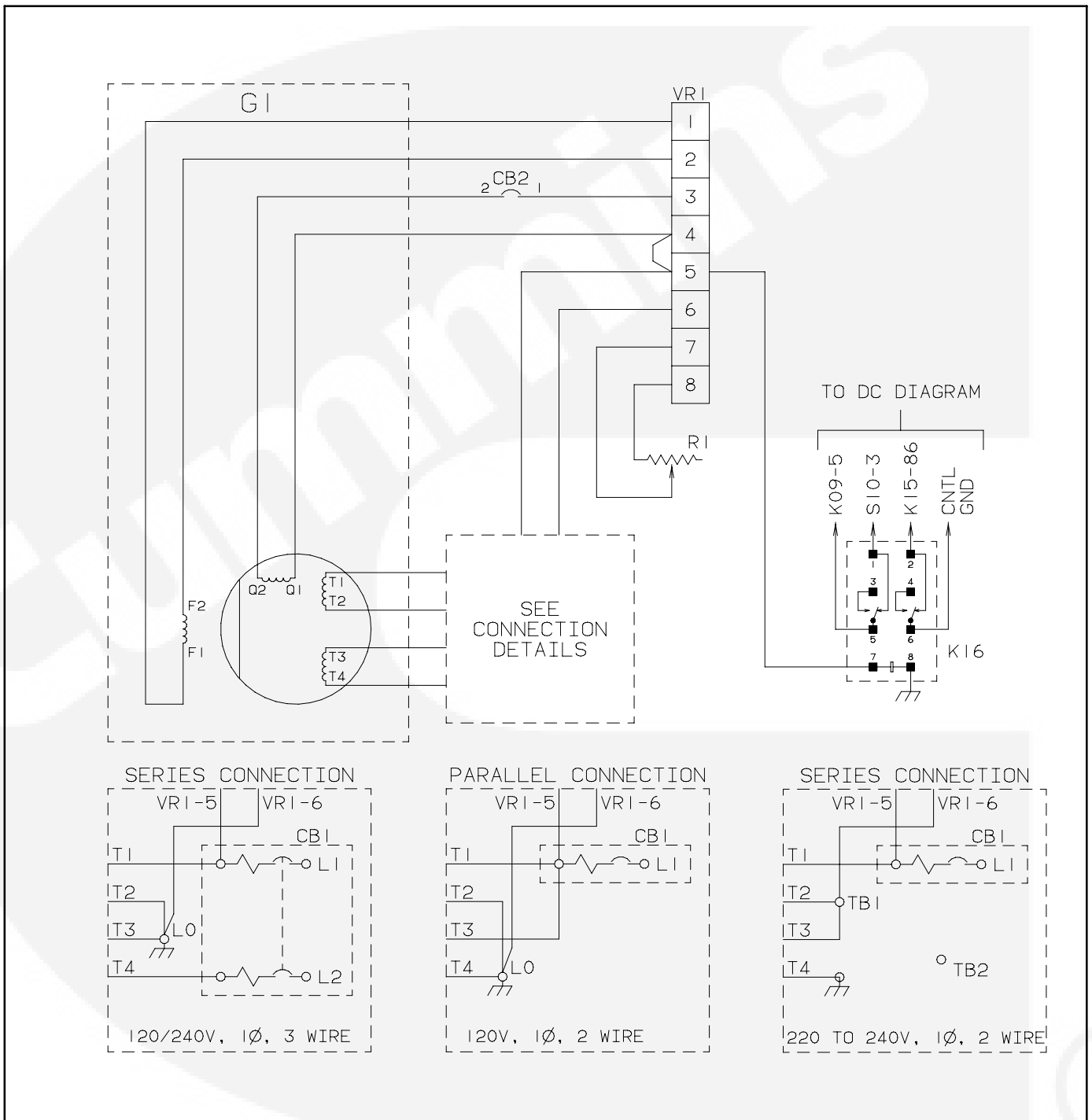
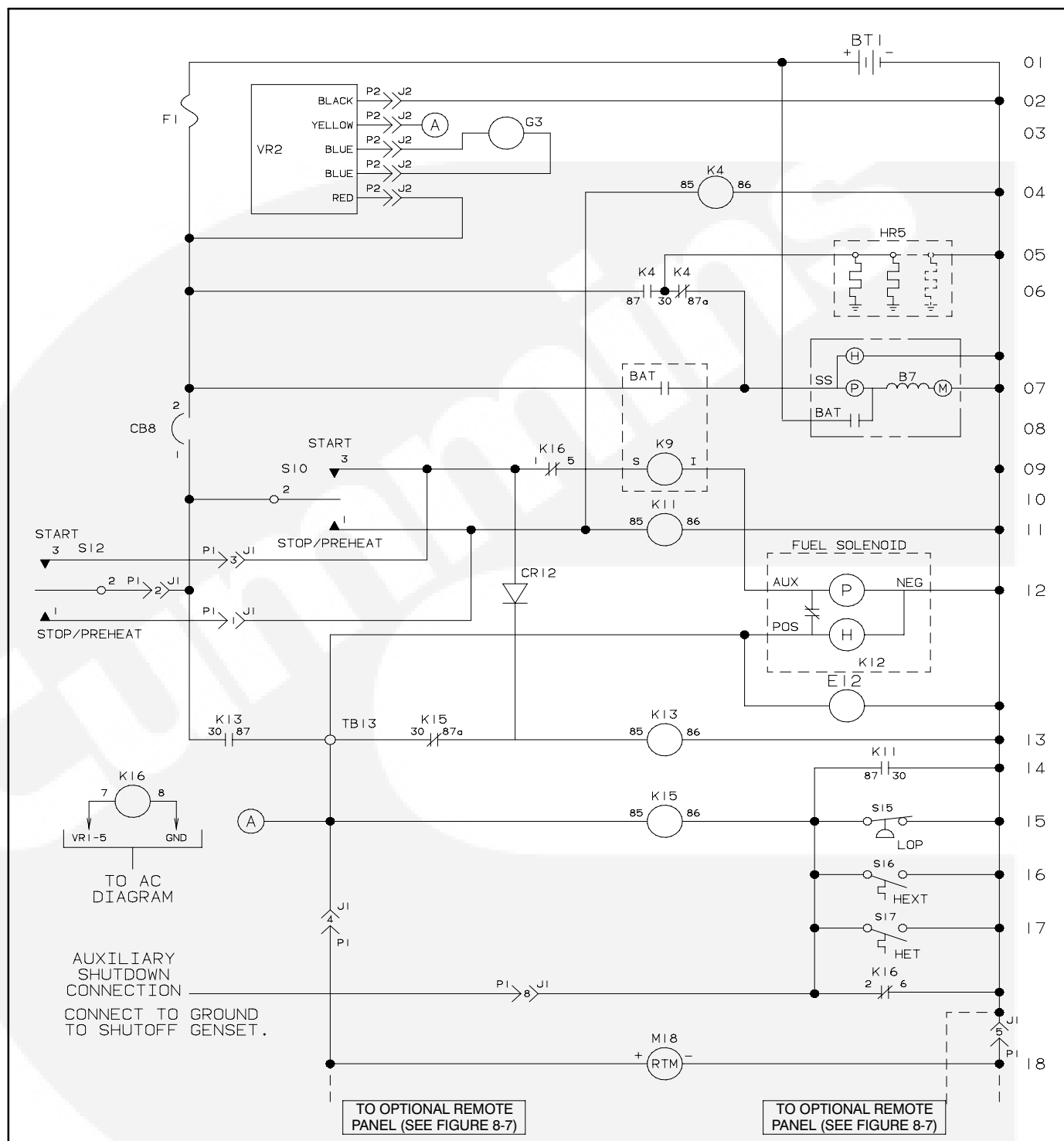


FIGURE 8-4. AC WIRING DIAGRAM (from 612-6621)



01 BT01	BATTERY	10 S10	START-STOP/PREHEAT SWITCH	15 K15	SHUTDOWN RELAY - 13
02 VR02	DC VOLTAGE REGULATOR	11 K11	STOP RELAY - 14	S15	LOW OIL PRESSURE SWITCH
03 GO3	ALTERNATOR	12 S12	REMOTE START-STOP/PREHEAT SWITCH	16 S16	HIGH EXHAUST TEMPERATURE SWITCH
04 K04	PREHEAT RELAY - 06, 06	CR12	DIODE	K16	START DISCONNECT RELAY 09, 17
05 HR05	GLOW PLUGS	K12	FUEL SOLENOID	17 S17	HIGH ENGINE TEMPERATURE SWITCH
07 B07	STARTER	E12	FUEL PUMP	18 M18	RUNNING TIME METER
08 CB08	CONTROL - CIRCUIT BREAKER	13 K13	RUN RELAY - 13		
09 K09	START SOLENOID	TB13	TERMINAL BLOCK		

FIGURE 8-5. DC CONTROL SCHEMATIC (from 612-6604)



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## REMOTE CONTROLS

### Remote Start-Stop-Preheat Panel (Standard)

A detachable control panel is held on the front of the genset by two screws. Consult the DC wiring schematic (Figure 8-5) and the illustration of component positions (Figure 8-1) before continuing this procedure.

To mount the panel remotely, perform the following steps:

1. Unscrew the two hold-down screws that hold the panel in place.
2. A short (6") wiring harness connects the control panel (P1) to the genset (J1); remove and discard this short harness.
3. Disconnect the leads that connect the running time meter to the terminal block inside the control box: the new wiring harness connections will power the running time meter.
4. Replace the short harness removed in Step 2 with a longer harness that will reach the control panel mounting location. Cummins Onan provides complete harness assemblies with end connectors in 15, 25 and 45-foot lengths. Call the Cummins Onan dealer or distributor for assistance in securing these items.

(A J1 connector with unstripped, color-coded 12" leads is shipped loose with the set: connect it to the genset and splice into it if you wish to run the set from installer-supplied switches or panel. See the DC wiring diagram for correct color code references to this connector and leads.)

5. Route the harness through the opening at the side of the control box (see Figure 8-6).

6. Use the blank panel provided with the set to cover the space where the removable control panel had been.

**The electrical code does not allow the remote-control harness or wiring to be routed in the same conduit with AC wiring.**

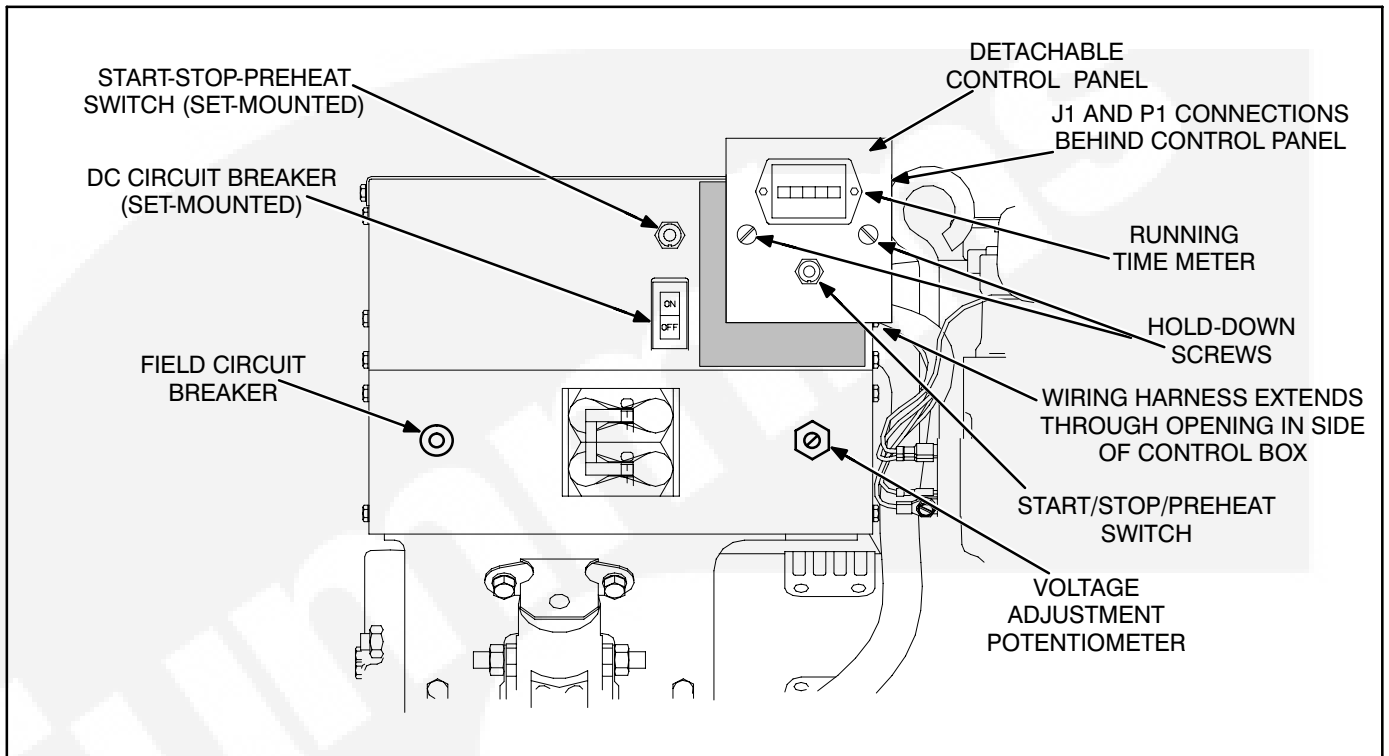
**⚠ CAUTION** *Interchanging the connections shown in the generator set wiring diagram can cause equipment damage.*

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

**⚠ WARNING** *Inhalation of exhaust gas or ignition of fuel vapor can cause severe personal injury or death. Be sure to vapor-seal flexible metal conduit and all openings made during installation of the generator set with a silicone/rubber-based sealant.*

### Auxiliary Fault Shutdown (Extinguishing System Connection)

A wiring harness connection is provided for connection into an automatic fire extinguishing system on the vessel. Grounding the lead marked AUXILIARY SHUTDOWN CONNECTION on the schematic/wiring diagram (Figure 8-5) automatically shuts the generator set down. In typical use, a relay contact on the extinguishing system is closed as the extinguishers are actuated, and the generator set is shut off while the fire is being extinguished. Consult your Onan distributor for further information on this feature.



**FIGURE 8-6. REMOTE CONTROL PANEL**

Remote Meter Panel (Optional)

A remote meter panel is available for the generator set. It contains a panel and wiring harness, and comes with installation instructions and wiring diagrams for connection.

The meter panels are prewired and terminate with a plug connector. See Figure 8-7. Cummins Onan has prewired harness assemblies in 15, 25 and 45 foot lengths (4.6, 7.6 and 13.7 m) with plug connec-

tors that connect to the generator set control box and the remote panel.

If prewired harnesses are not used, number 16-gauge wire is acceptable if runs do not exceed 25 feet (7.6 m) between the remote switch and the genset. Use number 14-gauge wire for longer runs.

**CAUTION** *Interchanging connections other than shown on the generator set wiring diagrams can cause equipment damage.*

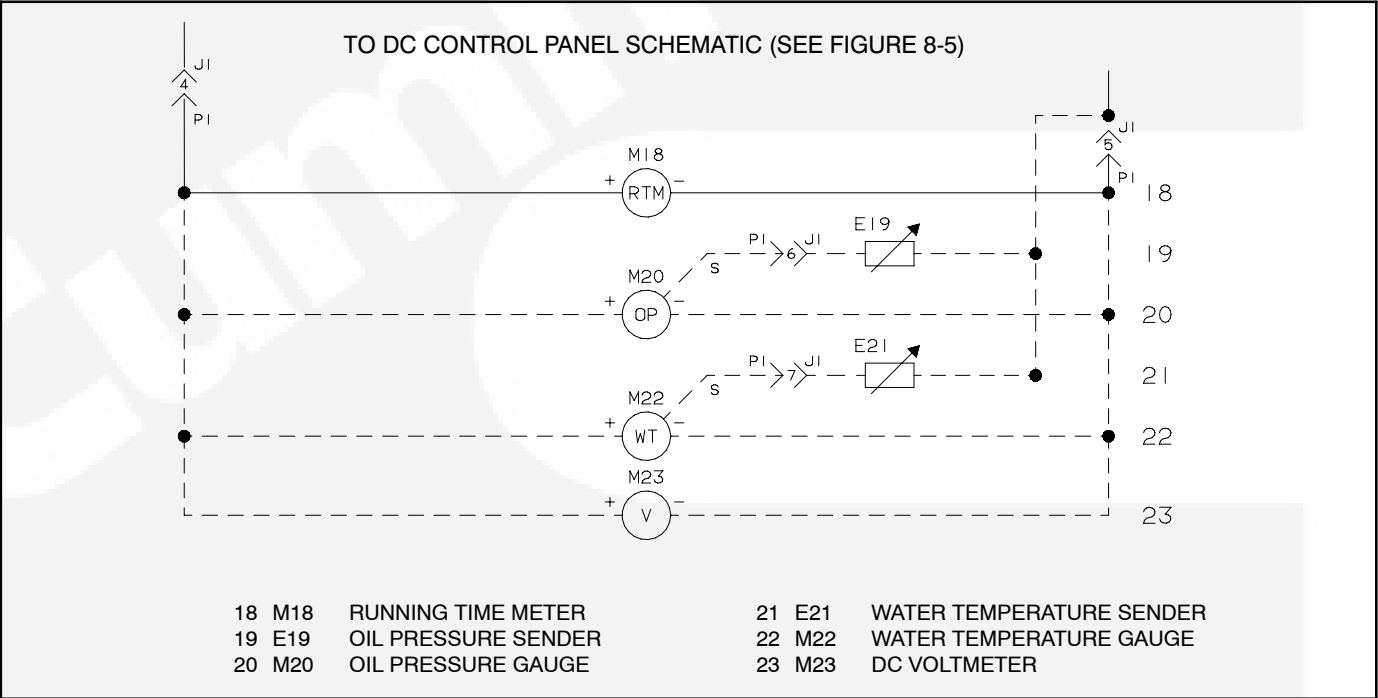


FIGURE 8-7. REMOTE METER PANEL CONNECTIONS

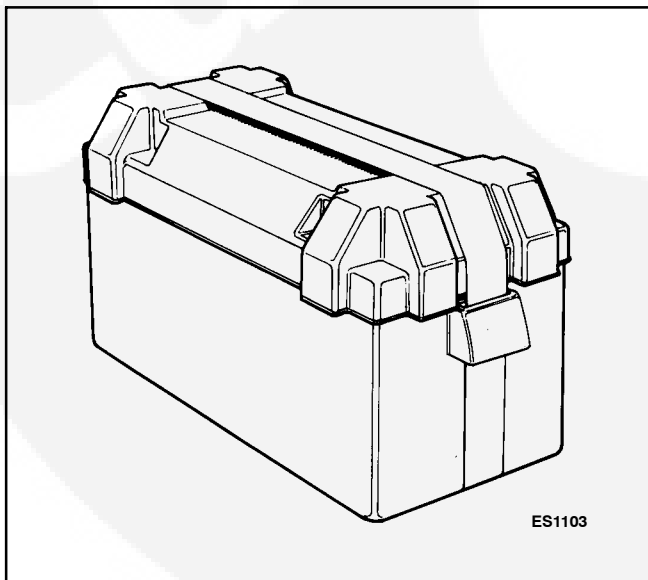
## BATTERY

### General

Use a battery with a minimum cranking performance of at least 360 amperes capacity at 0° F (-18° C). Install the battery close to the genset, preferably in a separate compartment. The compartment must be well ventilated to prevent accumulation of explosive battery gases.

Mount the battery in an acid-resistant tray on a platform above the floor. It must be secured to prevent shifting. If mounted in an engine compartment, always install a non-metallic cover to prevent battery damage and arcing from accidentally dropped tools. Figure 8-8 shows a typical battery tray and cover.

**⚠ WARNING** *The ignition of diesel fuel or fumes or battery gases can result in severe personal injury or death. Connect the generator set battery ground (-) lead only at the location shown.*



**FIGURE 8-8. TYPICAL BATTERY TRAY AND COVER**

Sealed, maintenance-free batteries should be considered for marine application. They offer higher output ratings (CCA), and better durability. Consult your Onan distributor for recommendations.

**⚠ WARNING** *Leakage of fuel in or around the generator set compartment presents a hazard of fire or explosion that can cause severe personal injury or death. Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the compartment thoroughly with the bilge blowers or power exhausters.*

Connect the battery cables to the bulkhead connectors shown in Figure 8-9. Also see Figure 3-4 of this manual for bulkhead connection details.

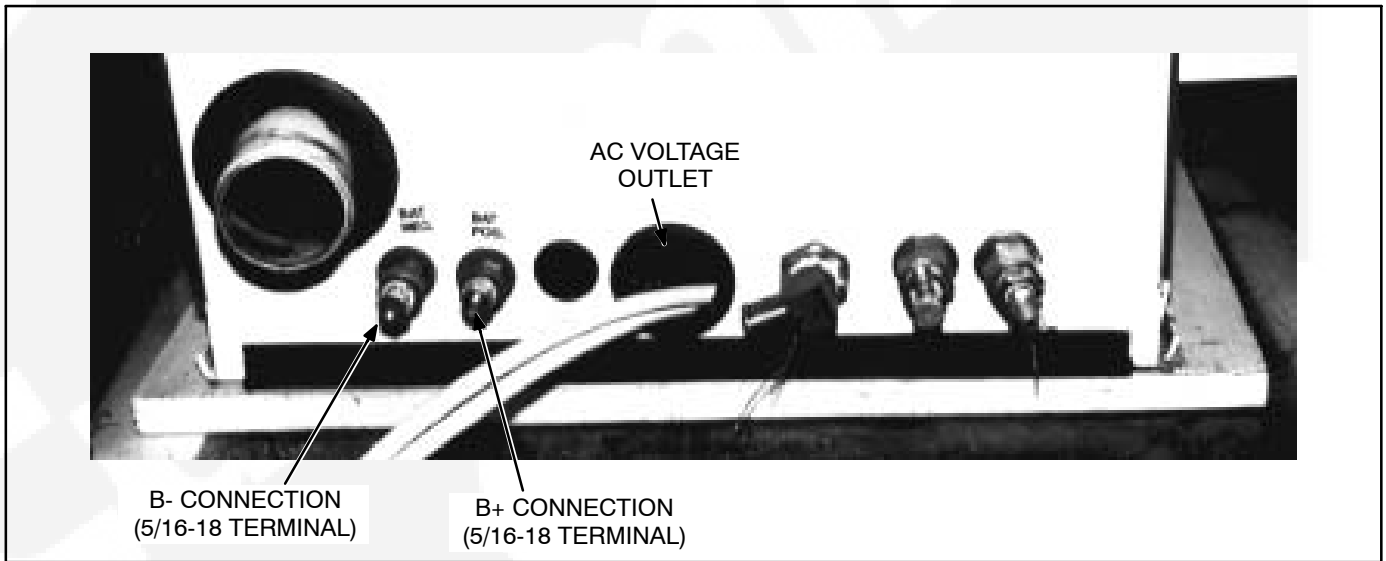
Battery cables are pre-connected between the bulkhead and the genset if the set has a sound shield. If it is necessary to connect a battery lead inside the sound shield, or if the set does not have a sound shield, the positive (+) lead is connected to the positive terminal on the starter motor, and the negative (-) lead is connected to one of the starter motor hold-down bolts. See Figure 8-10.

Use the cable size specified in Table 8-1 to connect the battery negative (-) lead to the genset. The wrong cable or the wrong connection location can cause arcing or resistance in the cranking circuit. Connect the battery positive (+) lead to the start solenoid as shown.

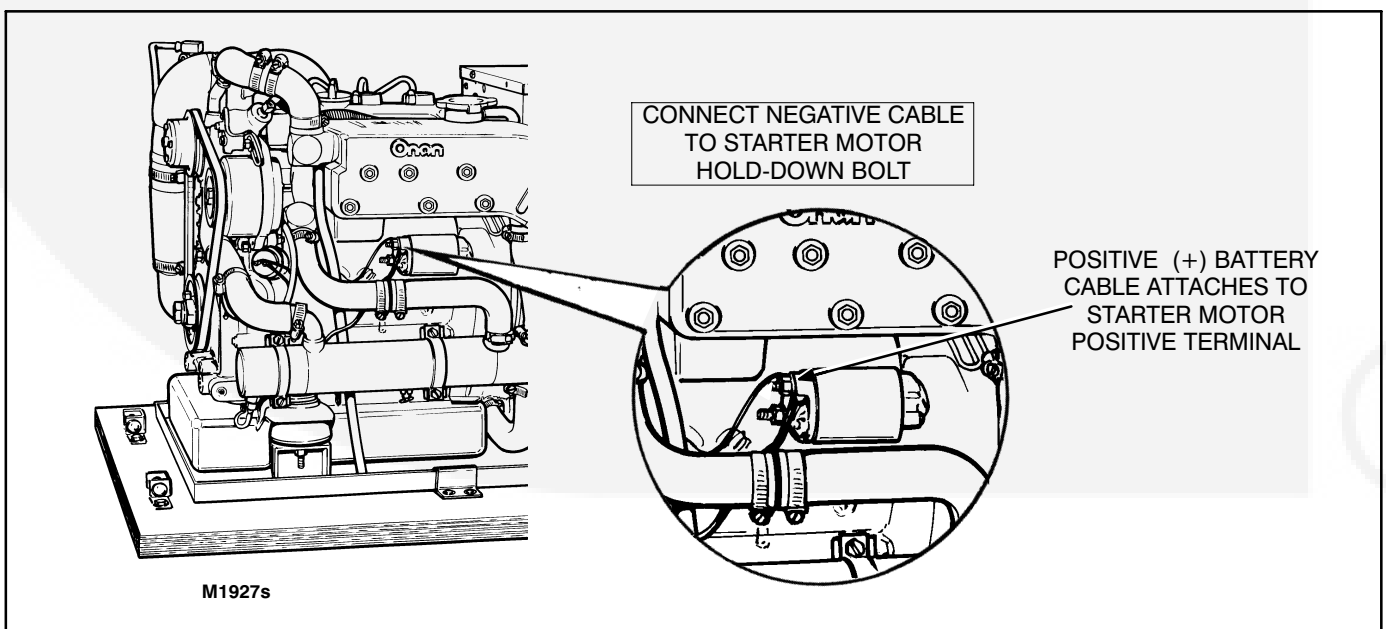
Connect the cables to the battery as shown, the negative (-) battery terminal last. Be sure the battery connections are clean and tight; then cover the battery terminals with a dielectric grease to retard corrosion.

**TABLE 8-1. BATTERY CABLE SIZE REQUIREMENTS**  
(Maximum Length of One Cable)

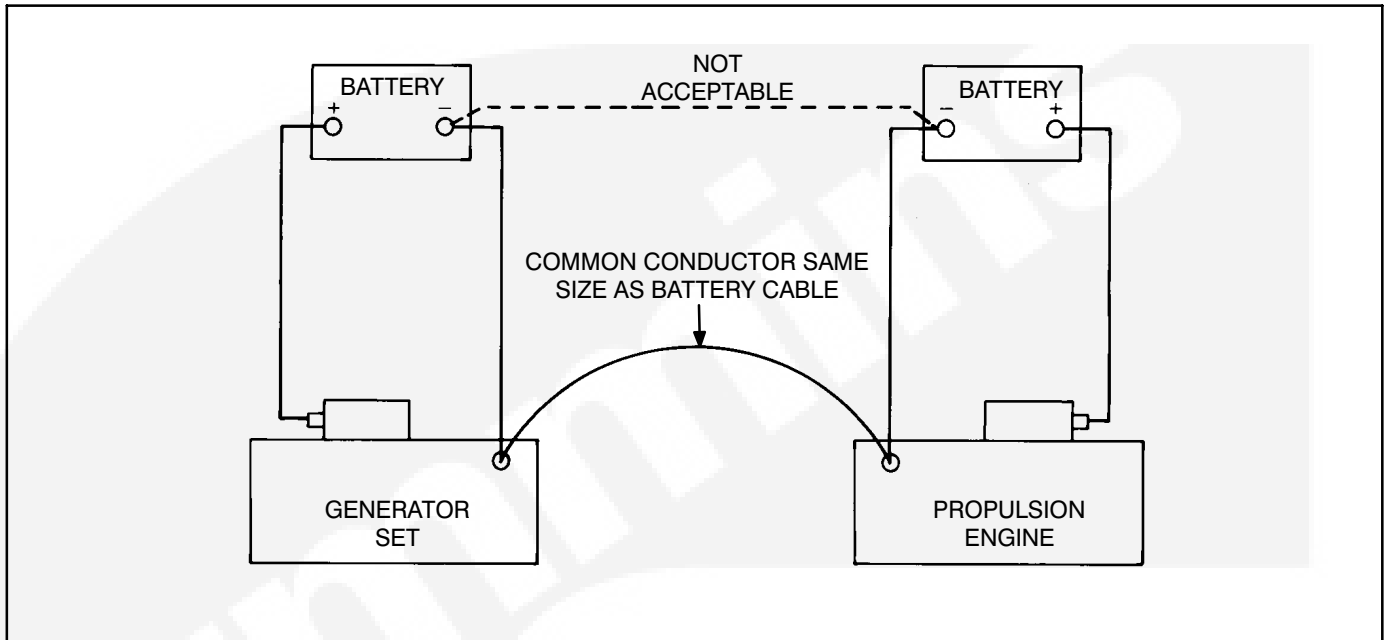
Cable Size	2	1	0	00	000	0000
Length	4 ft. (1.2 m)	5 ft. (1.5 m)	7 ft. (2.1 m)	9 ft. (2.7 m)	11 ft. (3.4 m)	14 ft. (4.3 m)



**FIGURE 8-9. BATTERY CONNECTIONS ON SOUND SHIELD BULKHEAD**



**FIGURE 8-10. BATTERY CABLE CONNECTIONS INSIDE SOUND SHIELD**



**FIGURE 8-11. COMMON GROUND CONDUCTOR**

## Grounding

The genset requires the battery connected negative ground. Most propulsion engines and vessel electrical equipment have negative ground systems.

The genset and propulsion engine/s must be grounded in accordance with USCG regulation 33C FR183.415. The regulation requires a common ground conductor connected between the genset and propulsion engine cranking motor circuits. The conductor must be the same size as the largest battery cable. See Figure 8-11.

The conductor prevents accidental passage of cranking current through the fuel systems and smaller electrical conductors common to the engines. This can happen if a cranking motor ground circuit becomes resistive or opens from corrosion,

vibration, bad cable, etc. Do not connect the battery negative lead at a genset location other than shown in Figures 8-9 or 8-10.

**⚠️WARNING** *Improper ground can cause severe personal injury or death from fire or explosion. Be sure to install a common ground conductor between all on-board cranking circuits.*

## BONDING

The genset must be bonded to the vessel common-bonding conductor with a bonding lead or strap attached to the engine block (same location as the negative battery cable). If a metallic fuel line is installed between the fuel tank and the genset shutoff valve, it too must be bonded to the vessel common-bonding conductor.



# 9. Final Installation Checks

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## INSTALLATION CHECKS

Before trying to start the genset, determine that the installation is complete by answering affirmatively the following questions:

- Is the exhaust system secure and all connections tight?
- Is a flexible section of exhaust hose used between the genset and muffler?
- Is all exhaust hose certified for marine exhaust application, and adequately supported and protected?
- Is the exhaust outlet terminated away from windows, vents or other openings that might allow exhaust gases to enter the vessel, or be pulled into the vessel when in motion?
- Are the AC generator and load wires securely and correctly connected to the circuit breaker?
- Is the line circuit breaker the correct size for selected voltage and frequency?
- Are the battery cables connected correctly and securely at the genset and battery?
- Has engine coolant been added? (50/50 water/antifreeze mix)
- Has crankcase oil been added to the engine, and at the correct level? See the Maintenance section of the Operator's Manual.

**⚠ CAUTION** *Oil, coolant, and fuel have been drained from the engine at the factory prior to shipment. Operation without oil and coolant will damage the engine.*

## INITIAL STARTING AND CHECKS

Refer to the Operator's Manual before trying to start the genset. Make sure the fuel shutoff valve and raw water cock are open. Operating the raw water pump without water will ruin the neoprene impeller.

- Start the genset by holding the Start/Stop switch in Start position. (Use the Preheat switch if needed: see Operator's Manual for details.) The genset should start within a few seconds. If not, check fuel supply and shutoff valve/s.
- Check water flow at the hull exhaust outlet, and operation of the genset. Refer to Operator's Manual for proper parameters.
- Check the exhaust system for leaks-visually and audibly. Note the security of the exhaust system supports. If any leaks are found, shut down the genset immediately and repair.

**⚠ WARNING** *Exhaust gas is deadly. For this reason, shut down the generator set immediately if an exhaust leak or exhaust component needs repair. Do not run the generator set until the exhaust system is repaired.*

- Check the genset for fuel, oil and coolant leaks. If any are found, shut down the genset and repair the leak before making any more checks.
- Connect an accurate AC voltmeter and frequency meter across two line terminals. Apply load to the generator and check the output.

Output frequency is determined by engine speed and normally does not require adjustment. Verify that frequency is correct before making voltage adjustments. Call an authorized Onan® distributor or dealer for assistance if needed.

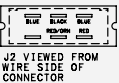
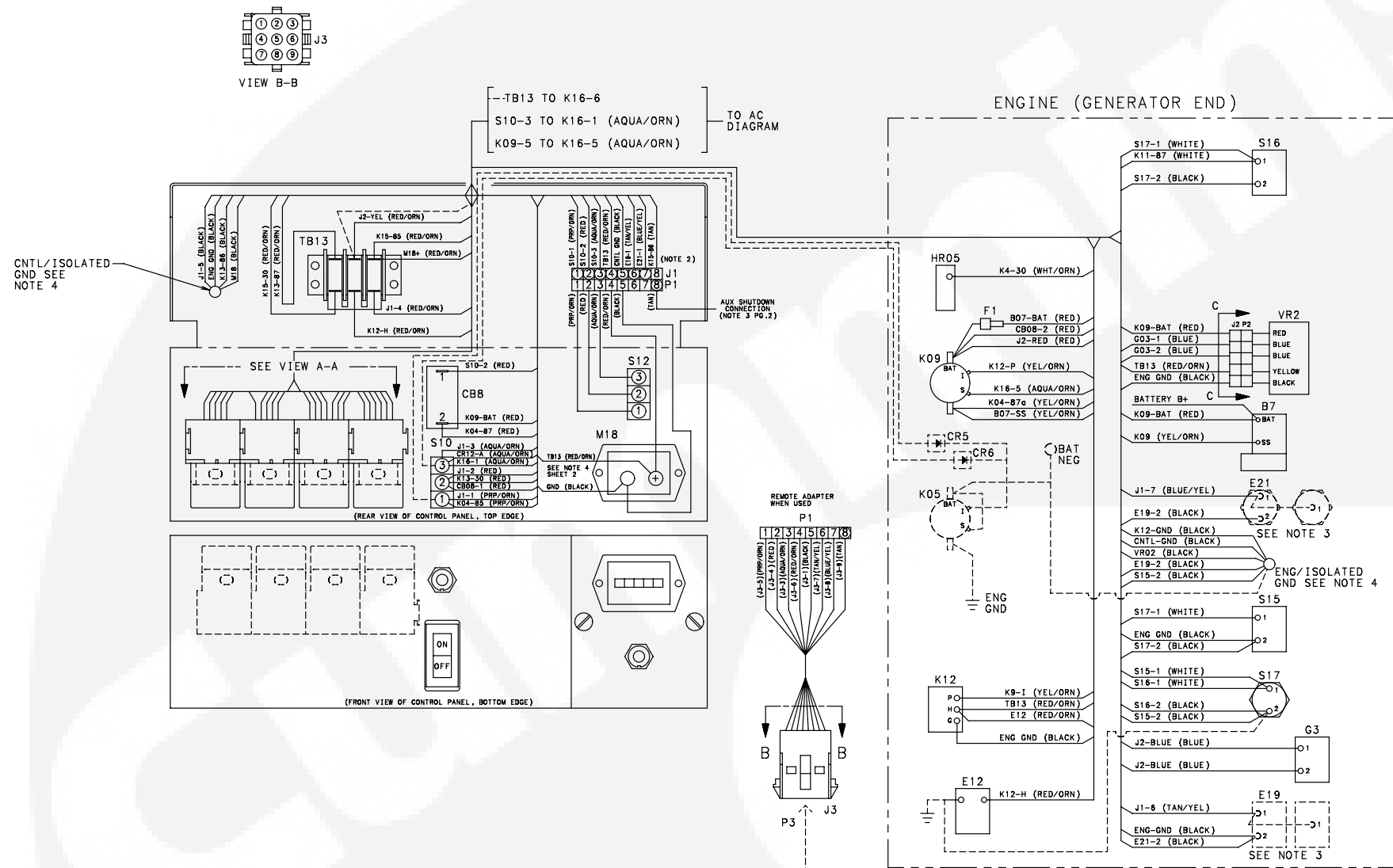
## VOLTAGE ADJUSTMENT

If the voltage is not within specs, it can be adjusted using the procedure listed in Section 8 of this manual.

**⚠ WARNING** *High voltages within the control cabinet can cause severe personal injury or death. Proceed with care and do not touch electrical contacts with any tool, clothing, jewelry or body part.*



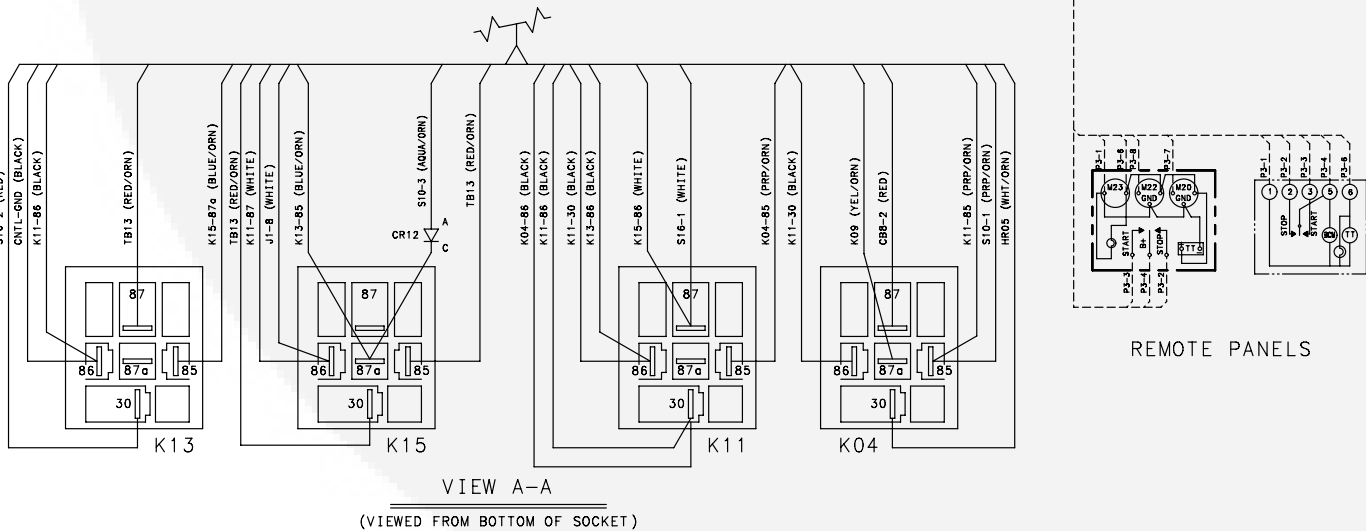




- NOTE:
- ALL COMPONENTS SHOWN IN THE DE-ENERGIZED POSITION.
  - PIN-----  
SOCKET-----
  - IF SENDER HAS ONLY 1 TERMINAL, #2 (GND) DOES NOT GET CONNECTED.
  - .03 VERSION IS A FIELD INSTALLED ISOLATED DC CONTROL MODIFICATION. REF KIT 300-4960. NOTED GROUND LEADS REQUIRE RELOCATION TO ISOLATOR IN CONTROL PANEL.

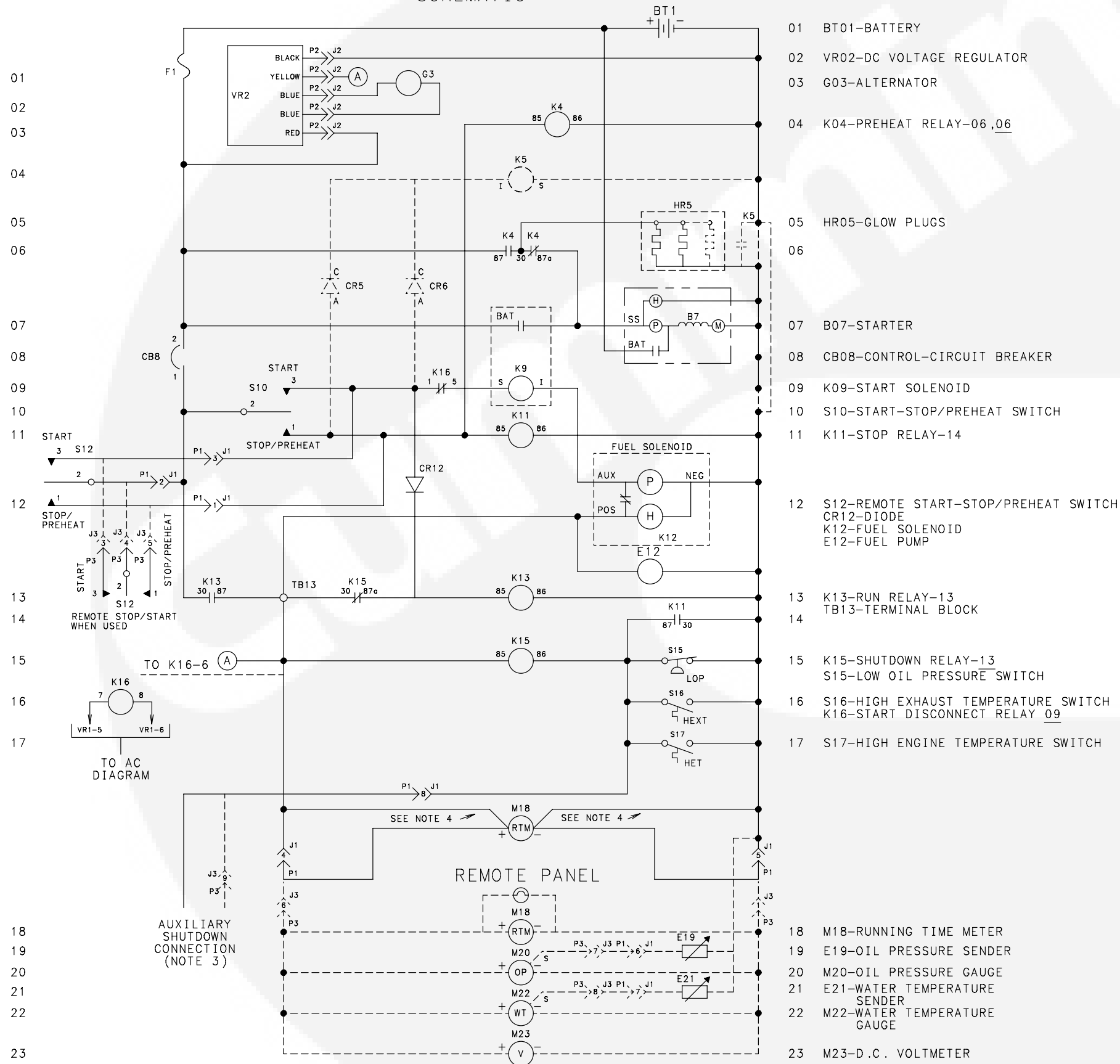
1	1	1	1	42	REF	-	DC VOLTAGE REGULATOR	VR02
1	1	1	1	41	REF	-	HIGH ENGINE TEMPERATURE SWITCH	S17
1	1	1	1	40	REF	-	HIGH EXHAUST TEMPERATURE SWITCH	S16
1	1	1	1	39	REF	-	LOW OIL PRESSURE SWITCH	S15
1	1	1	1	38	REF	-	FUEL SOLENOID	K12
1	1	1	1	37	REF	-	START SOLENOID	K09
1	1	1	1	36	REF	-	PLUG-MATING (VOLT REQ)	J2
1	1	1	1	35	REF	-	GLOW PLUGS	HR05
1	1	1	1	34	REF	-	ALTERNATOR	G03
1	1	1	1	33	REF	-	WATER TEMPERATURE SENDER (OPTL)	E21
1	1	1	1	32	REF	-	OIL PRESSURE SENDER (OPTL)	E19
1	1	1	1	31	REF	-	ELECTRIC FUEL PUMP	E12
1	1	1	1	30	REF	-	STARTER	B07

ENGINE PARTS LIST								
1	1	1	1	29				
1	1	1	1	28				
1	1	1	1	27				
1	1	1	1	26	338-3518	C	HARNES-ISOLATED GND	
1	1	1	1	25	98-6580-01	B	SILKSCREEN-PNL BACK	
1	1	1	1	24	98-6578-01	B	SILKSCREEN-PNL FACE	
1	1	1	1	23	226-4500-02	A	LEAD - SEE NOTE 4 SHEET 2	(W18, GND)
1	1	1	1	22	98-6577-01	C	SILKSCREEN-DC FACE	
1	1	1	1	21	338-2785	D	HARNES-PANEL	
1	1	1	1	20	853-0040-53	C	WASHER-ET LK (W5)	(GND)
1	1	1	1	19	860-2020	-	NUT-HMS (M5 X 0.8)	(GND)
8	8	8	8	18	800-3022	-	SCREW-HH CRES C (M5 X 0.8 X 14)	(PHLS,K4,K13)
1	1	1	1	17	226-4500-01	A	LEAD - SEE NOTE 4 SHEET 2	(TB13, W18)
1	1	1	1	16	508-0258	P	GROMMET	
2	2	2	2	15	800-3021	-	SCREW-HH CRES C (M4 X 0.7 X 16)	(TB13)
2	2	2	2	14	860-2053	-	NUT-HMS (M3 X 0.5)	(W18)
2	2	2	2	13	853-0040-51	C	WASHER-ET LK (W3)	(W18)
2	2	2	2	12	800-3019	-	SCREW-HH CRES C (M3 X 0.5 X 14)	(W18)
1	NA	1	NA	11	338-2803	D	HARNES-ENGINE	
NA	1	NA	1	11	338-2792	D	HARNES-ENGINE	
1	1	1	1	10	318-1660-02	D	WRAPPER-CONTROL	
1	1	1	1	9	318-1658-02	D	PANEL-CONTROL	
1	1	1	1	8	318-1458-02	B	PANEL-CONTROL	
1	1	1	1	7	357-0030	A	RECTIFIER	CR12
1	1	1	1	6	332-3136	A	TERMINAL BLOCK	TB13
2	2	2	2	5	308-1017	B	TOGGLE SWITCH	S10,12
1	1	1	1	4	302-0885	A	METER-TIME TOTALIZING	W18
4	4	4	4	3	323-1563	C	SOCKET-RELAY	K04,11,13,15
4	4	4	4	2	307-2787	C	RELAY-SPDT (12 VDC)	
1	1	1	1	1	320-1738	C	CIRCUIT BREAKER	CB08
CONTROL BOX PARTS LIST								
QTY	REF	QTY	REF	QTY	REF	QTY	REF	QTY
ITEM	NO.	ITEM	NO.	ITEM	NO.	ITEM	NO.	ITEM
DESCRIPTION OR MATERIAL								

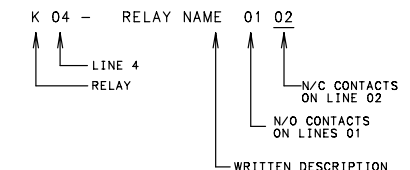


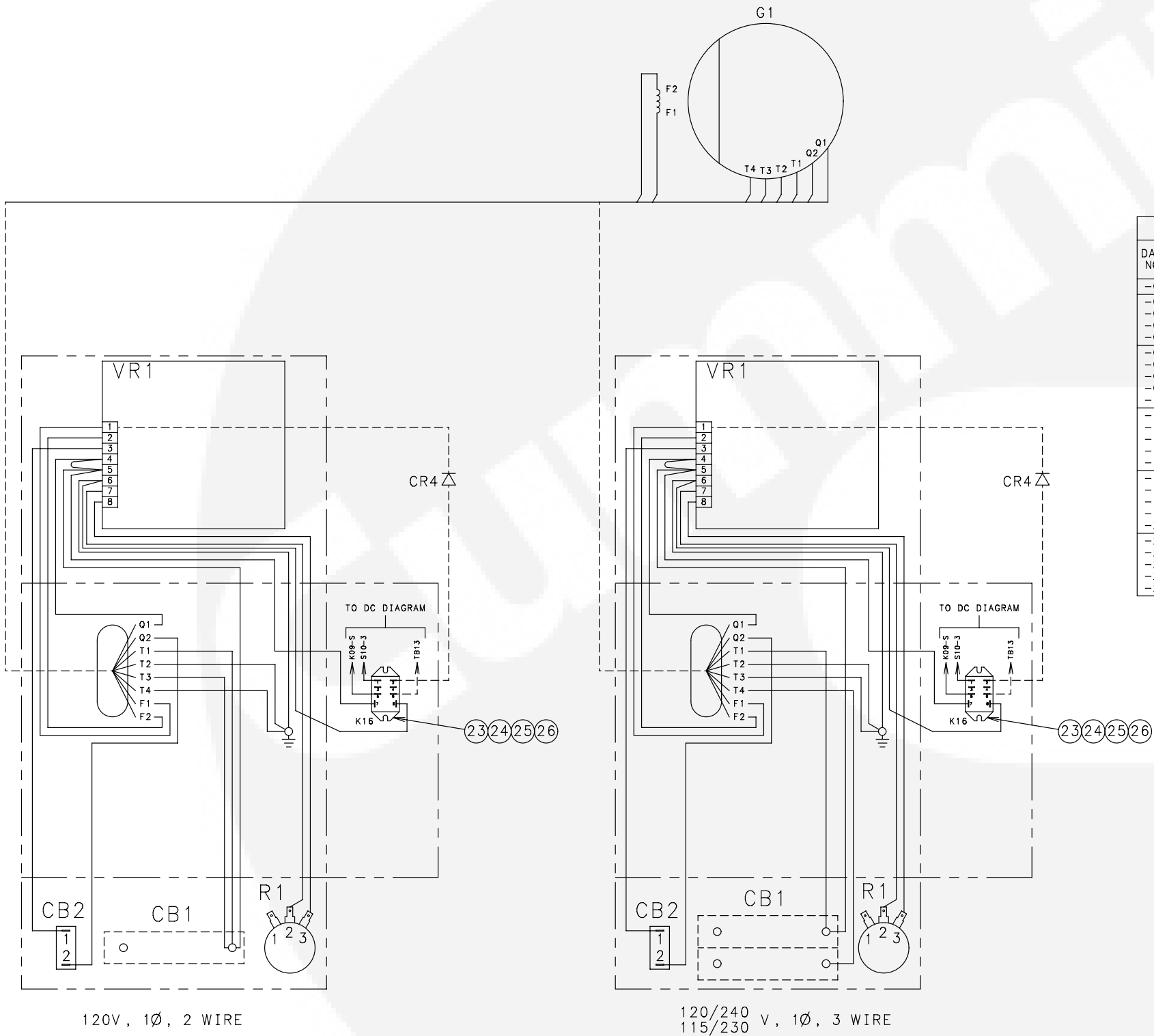
DC WIRING DIAGRAM SHEET 1

# SCHEMATIC



- NOTES:
1. SCHEMATIC KEY:  
EACH COMPONENT IS LOCATED BY ITS DESIGNATION. ITS DESCRIPTION AND ITS COMPONENTS ARE LISTED TO THE RIGHT OF THE SCHEMATIC.
  2. DASHED COMPONENTS ARE OPTIONS AND ARE SHOWN FOR IDENTIFICATION AND LOCATION.
  3. AUXILIARY SHUTDOWN: CONNECT TO GROUND TO SHUTOFF GENSET.
  4. DISCONNECT THESE TWO LEADS AND DISCARD THEM ONLY WHEN M18 IS USED IN A REMOTE LOCATION



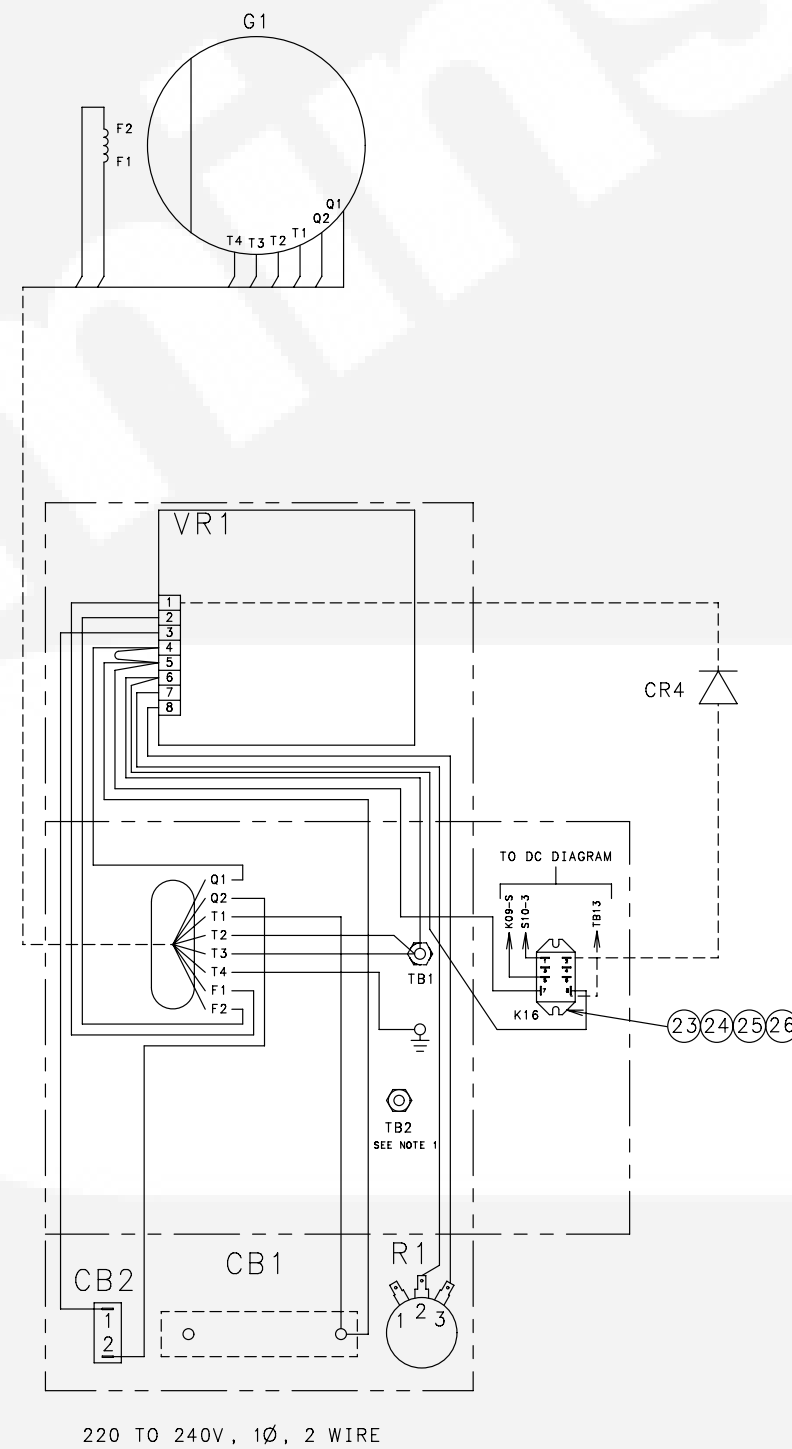
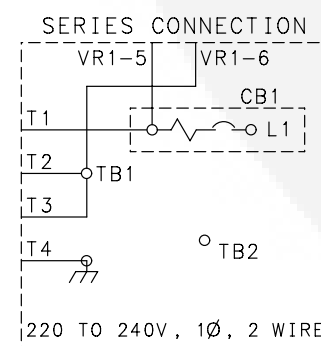
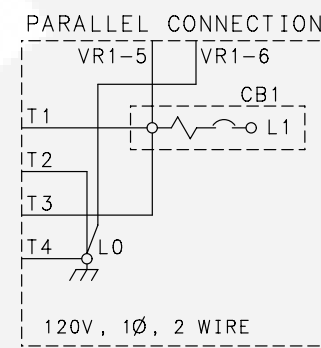
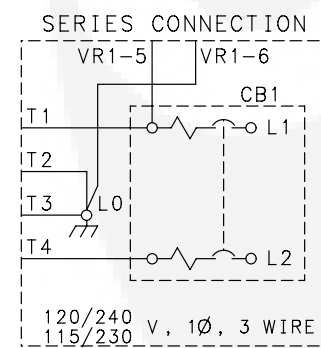
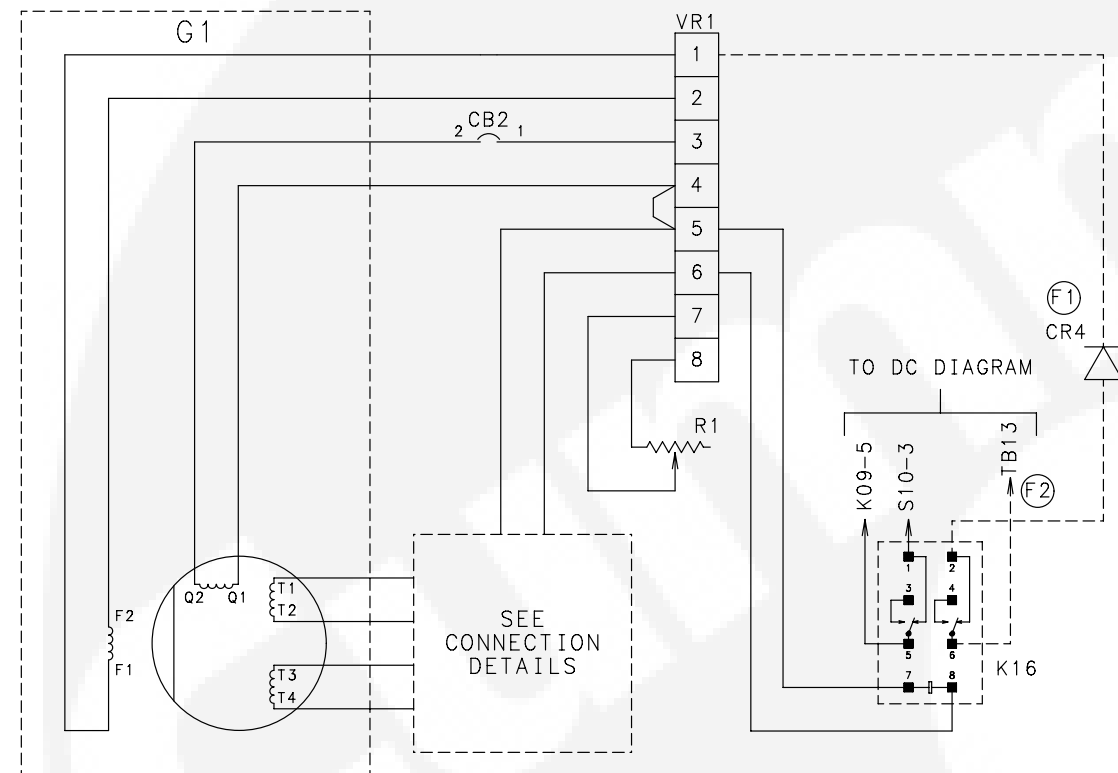


TABULATION									
DASH NO.	VOLTAGE CONNECTION	MAIN LINE BREAKER	MAX. BREAKER VOLTAGE	NO. OF POLES	AMPS	ITEM 1 BREAKER NO.	ITEM 7 SCREW NO. (QTY)	ITEM 8 WASHER-LK NO. (QTY)	ITEM 29 COVER PLT NO.
-01	RECONNECTABLE	NO	---	---	---	---	---	---	320-1813-02
-02	110 OR 120 VAC	YES	240	1	35	320-1690-51	812-0061 (4)	850-0020 (4)	320-1813-02
-03		YES	240	1	40	320-1690-52	812-0061 (4)	850-0020 (4)	320-1813-02
-04		YES	240	1	45	320-1690-59	812-0061 (4)	850-0020 (4)	320-1813-02
-05		YES	240	1	50	320-1690-58	812-0061 (4)	850-0020 (4)	320-1813-02
-06		YES	240	1	55	320-1690-60	812-0061 (4)	850-0020 (4)	320-1813-02
-07		YES	240	1	60	320-1690-53	812-0061 (4)	850-0020 (4)	320-1813-02
-08		YES	240	1	65	320-1690-61	812-0061 (4)	850-0020 (4)	320-1813-02
-09		YES	240	1	70	320-1690-54	812-0061 (4)	850-0020 (4)	320-1813-02
-10	220 THRU 240 VAC	YES	240	1	75	320-1690-62	812-0061 (4)	850-0020 (4)	320-1813-02
-11		YES	240	1	80	320-1690-55	812-0061 (4)	850-0020 (4)	320-1813-02
-12		YES	240	1	25	320-1690-66	812-0061 (4)	850-0020 (4)	320-1813-02
-13									
-14	110/220 VAC OR 120/240 VAC	YES	240	2	18	320-1689-51	812-0061 (4)	850-0020 (4)	
-16		YES	240	2	20	320-1689-52	812-0061 (4)	850-0020 (4)	
-17		YES	240	2	25	320-1689-53	812-0061 (4)	850-0020 (4)	
-18		YES	240	2	30	320-1689-54	812-0061 (4)	850-0020 (4)	
-19		YES	240	2	35	320-1689-55	812-0061 (4)	850-0020 (4)	
-20									
-21		240	240	2	40	320-1689-56	812-0061 (4)	850-0020 (4)	
-22		240	240	2	45	320-1689-57	812-0061 (4)	850-0020 (4)	
-23									
-24									
-25									

	30	821-0009	-	2	SCREW - 1/4-20 X .38 (TO MT ITEM 27)
	29	SEE TAB	B	1	PLATE - COVER
	28	821-0008	-	2	SCREW - 1/4-20 X .31 (TO MT ITEM 27)
	27	332-2370	P	2	STANDOFF - INSULATING
	26	860-2053	-	2	NUT-HMS (M3 X 0.5)
K16 W7 W6	25	853-0001	-	2	WASHER-ET LK (.12)
	24	800-3019	-	2	SCREW- CRES C (M3 X 0.5 X 14)
	23	307-2594	B	1	RELAY (START DISC)
	22	226-4398-08	A	1	LEAD (VR1-6,K16-8)
	21	226-4398-07	A	1	LEAD (VR1-5,K16-7)
	20	98-6582-02	C	1	LABEL-AC BACK
	19	98-6581-02	C	1	LABEL-AC FACE
	18	853-0040-05	-	1	WASHER-ET LK (1/4)(GND STUD)
	17	862-0013	-	1	NUT-HEX (1/4-20) (GND STUD)
	16	226-4398-06	A	1	JUMPER (VR1-4,VR1-5)
W5	15	226-4398-05	A	1	LEAD (VR1-3,CB2-1)
W4	14	226-4398-04	A	1	LEAD (VR1-8,R1-3)
W3	13	226-4398-03	A	1	LEAD (VR1-7,R1-2)
W2	12	226-4398-02	A	1	LEAD (VR1-6,L0)
W1	11	226-4398-01	A	1	LEAD (VR1-5,L1)
CR4	10	319-1665-02	D	1	PANEL-CONTROL
	9	800-3022	A	7	SCREW-HH CRES C (M5 X 0.8 X 14)(PNL,VR1)
	8	SEE TAB	-	TAB	WASHER-LK .250Dx.042ID (BREAKER MTG)
	7	SEE TAB	-	TAB	SCREW-RHM 6-32x3/8 (BREAKER MTG)
	6	REF	A	1	RECTIFIER
VR1	5	REF	A	1	REGULATOR-VOLTAGE
R1	4	303-0285-01	A	1	POTENTIOMETER
G1	3	REF	D	1	GENERATOR (AC)
CB2	2	320-1769	C	1	CIRCUIT BREAKER (FIELD)
CB1	1	SEE TAB	C	1	CIRCUIT BREAKER (MAIN LINE)
REF DES	ITEM	PART NO.	*RULX	QTY	DESCRIPTION OR MATERIAL

AC WIRING DIAGRAM SHEET 1

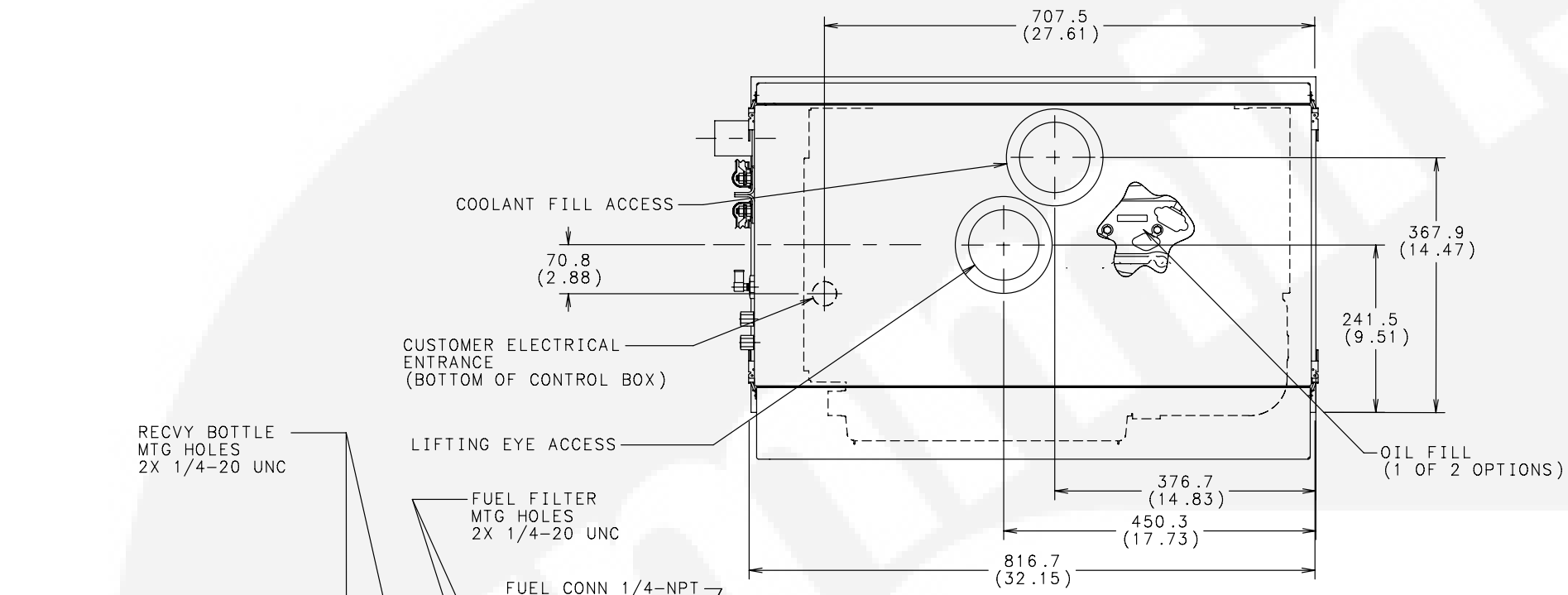
# AC SCHEMATIC-HIGH SPEED MARINE



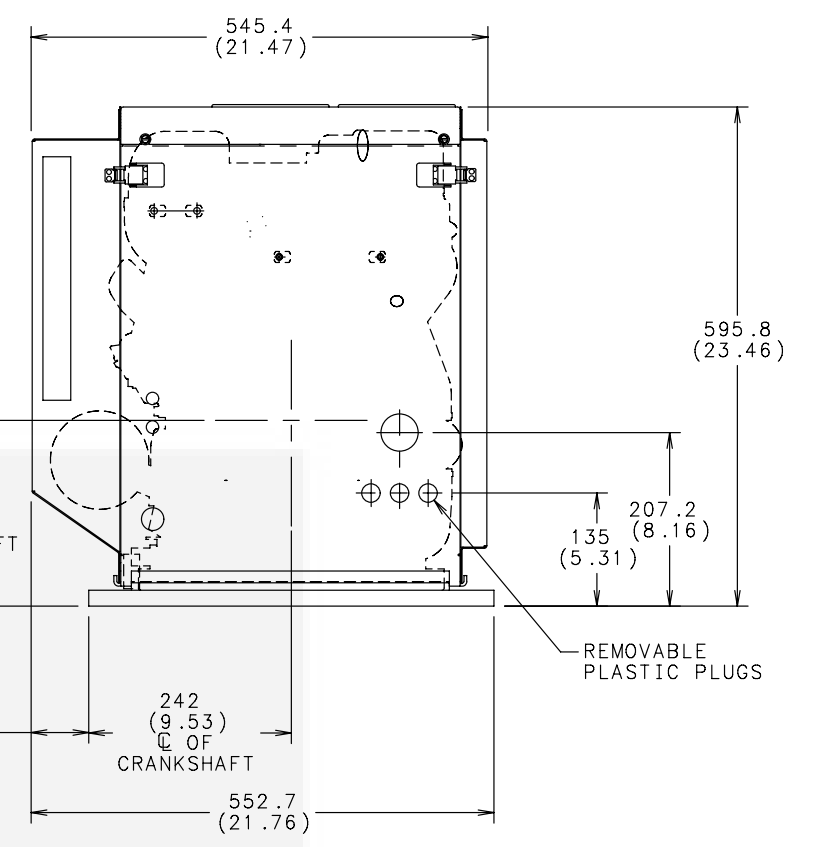
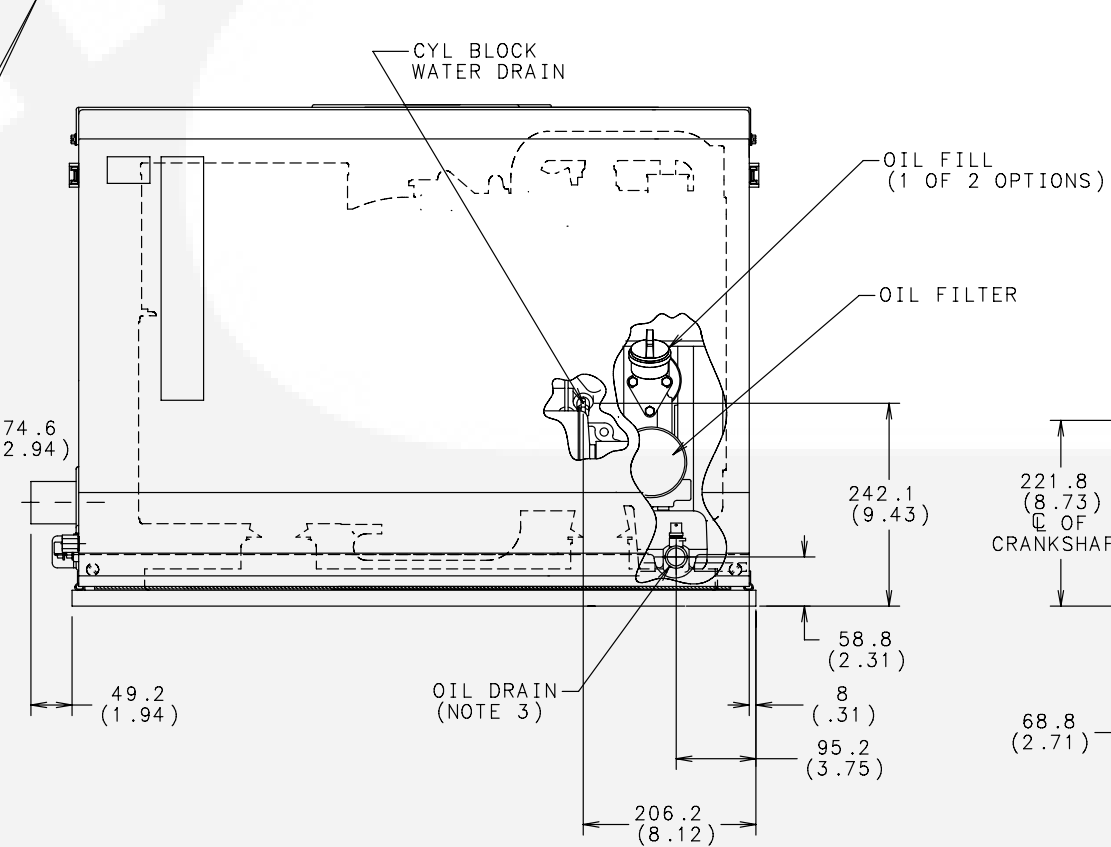
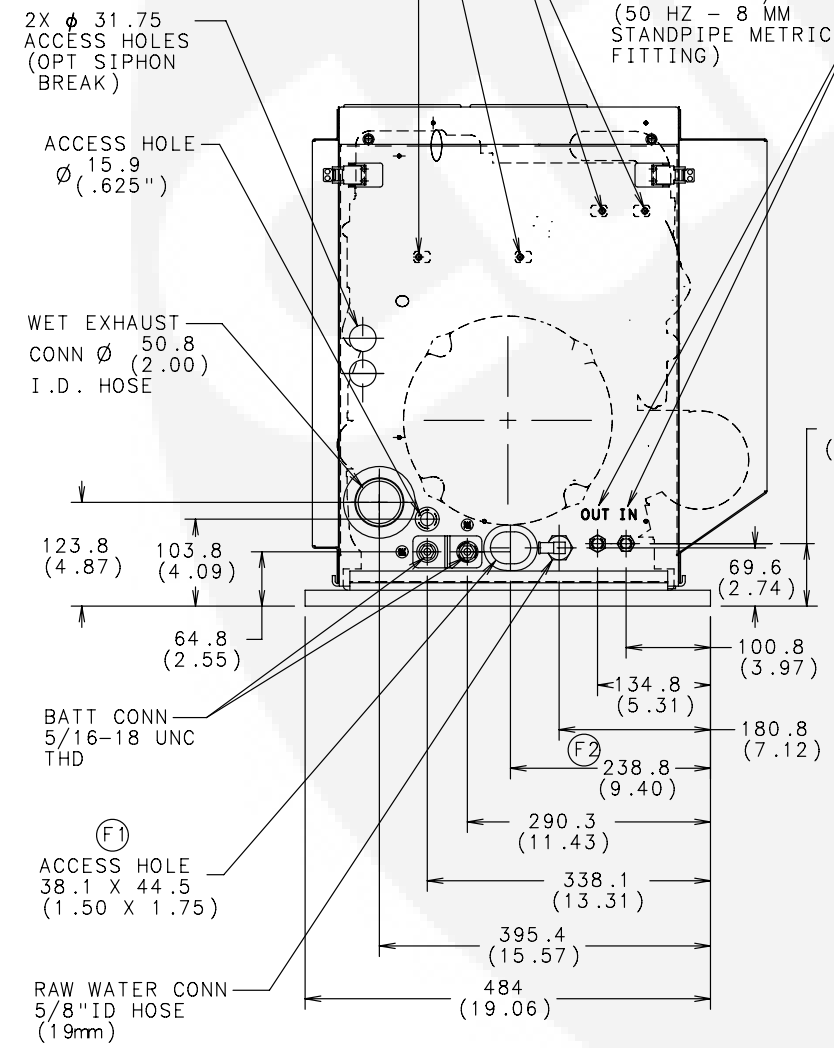
NOTE :

1. WHEN NEUTRAL CONNECTION IS TO BE ISOLATED FROM GROUND, CONNECT AC NEUTRAL CONNECTION TO TB2.





- NOTES:
1. DIMENSIONS IN ( ) ARE INCHES.
  2. CONNECT BATTERY B+ TO STARTER POST.
  3. 1/2 NPTF THD ON VALVE.



MDKWB OUTLINE DRAWING





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