



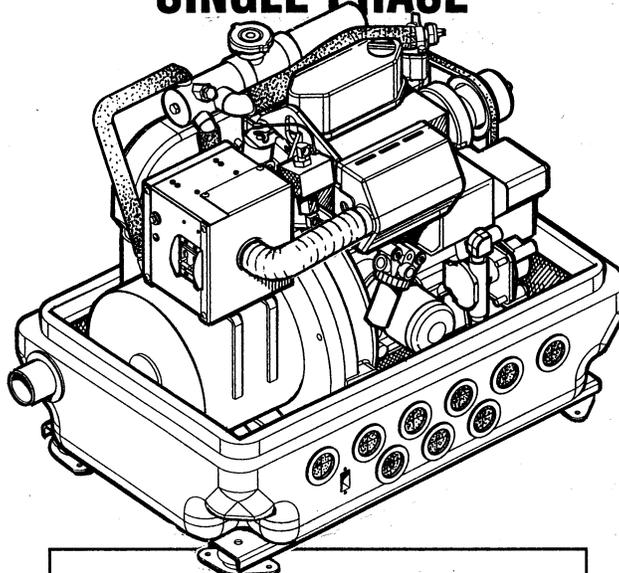
# OWNERS MANUAL

8.0 KW BCDT 60Hz

7.0 KW BCDT 50Hz

## MARINE DIESEL GENERATORS

SINGLE PHASE



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 **WESTERBEKE**

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 *Member National Marine Manufacturers Association*

**CALIFORNIA PROPOSITION 65  
WARNING**

Exhaust gas from diesel and gasoline engines (and some of its constituents) are known to the State of California to cause cancer, birth defects, and other reproductive harm.

 **WARNING:**

*Exhaust gasses contain Carbon Monoxide, an odorless and colorless gas. Carbon Monoxide is poisonous and can cause unconsciousness and death. Symptoms of Carbon Monoxide exposure 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 restart until it has been inspected and repaired.***

***A WARNING DECAL is provided by WESTERBEKE and should be fixed to a bulkhead near your engine or generator.***

***WESTERBEKE also recommends installing CARBON MONOXIDE DETECTORS in the living/sleeping quarters of your vessel. They are inexpensive and easily obtainable at your local marine store.***



# SAFETY INSTRUCTIONS

## INTRODUCTION

*Read this safety manual carefully. Most accidents are caused by failure to follow fundamental rules and precautions. Know when dangerous conditions exist and take the necessary precautions to protect yourself, your personnel, and your machinery.*

*The following safety instructions are in compliance with the American Boat and Yacht Council (ABYC) standards.*

## PREVENT ELECTRIC SHOCK

**⚠ WARNING: Do not touch AC electrical connections while engine is running, or when connected to shore power. Lethal voltage is present at these connections!**

- Do not operate this machinery without electrical enclosures and covers in place.
- Shut off electrical power before accessing electrical equipment.
- Use insulated mats whenever working on electrical equipment.
- Make sure your clothing and skin are dry, not damp (particularly shoes) when handling electrical equipment.
- Remove wristwatch and all jewelry when working on electrical equipment.
- Do not connect utility shore power to vessel's AC circuits, except through a ship-to-shore double throw transfer switch. Damage to vessel's AC generator may result if this procedure is not followed.
- Electrical shock results from handling a charged capacitor. Discharge capacitor by shorting terminals together.

## PREVENT BURNS — HOT ENGINE

**⚠ WARNING: Do not touch hot engine parts or exhaust system components. A running engine gets very hot!**

- Always check the engine coolant level at the coolant recovery tank.

**⚠ WARNING: Steam can cause injury or death!**

- In case of an engine overheat, allow the engine to cool before touching the engine or checking the coolant.

## PREVENT BURNS — FIRE

**⚠ WARNING: Fire can cause injury or death!**

- Prevent flash fires. Do not smoke or permit flames or sparks to occur near the carburetor, fuel line, filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. Use a suitable container to catch all fuel when removing the fuel line, carburetor, or fuel filters.
- Do not operate with a Coast Guard Approved flame arrester removed. Backfire can cause severe injury or death.
- Do not operate with the air cleaner/silencer removed. Backfire can cause severe injury or death.
- Do not smoke or permit flames or sparks to occur near the fuel system. Keep the compartment and the engine/generator clean and free of debris to minimize the chances of fire. Wipe up all spilled fuel and engine oil.
- Be aware — diesel fuel will burn.

## PREVENT BURNS — EXPLOSION

**⚠ WARNING: Explosions from fuel vapors can cause injury or death!**

- Follow re-fueling safety instructions. Keep the vessel's hatches closed when fueling. Open and ventilate cabin after fueling. Check below for fumes/vapor before running the blower. Run the blower for four minutes before starting your engine.
- All fuel vapors are highly explosive. Use extreme care when handling and storing fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children.
- Do not fill the fuel tank(s) while the engine is running.
- Shut off the fuel service valve at the engine when servicing the fuel system. Take care in catching any fuel that might spill. DO NOT allow any smoking, open flames, or other sources of fire near the fuel system or engine when servicing. Ensure proper ventilation exists when servicing the fuel system.
- Do not alter or modify the fuel system.
- Be sure all fuel supplies have a positive shutoff valve.
- Be certain fuel line fittings are adequately tightened and free of leaks.
- Make sure a fire extinguisher is installed nearby and is properly maintained. Be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications encountered in this environment.

# SAFETY INSTRUCTIONS

## ACCIDENTAL STARTING

**⚠ WARNING: Accidental starting can cause injury or death!**

- Disconnect the battery cables before servicing the engine/generator. Remove the negative lead first and reconnect it last.
- Make certain all personnel are clear of the engine before starting.
- Make certain all covers, guards, and hatches are re-installed before starting the engine.

## BATTERY EXPLOSION

**⚠ WARNING: Battery explosion can cause injury or death!**

- Do not smoke or allow an open flame near the battery being serviced. Lead acid batteries emit hydrogen, a highly explosive gas, which can be ignited by electrical arcing or by lit tobacco products. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.
- Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb the battery charger connections while the battery is being charged.
- Avoid contacting the terminals with tools, etc., to prevent burns or sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling the battery.
- Always turn the battery charger off before disconnecting the battery connections. Remove the negative lead first and reconnect it last when servicing the battery.

## BATTERY ACID

**⚠ WARNING: Sulfuric acid in batteries can cause severe injury or death!**

- When servicing the battery or checking the electrolyte level, wear rubber gloves, a rubber apron, and eye protection. Batteries contain sulfuric acid which is destructive. If it comes in contact with your skin, wash it off at once with water. Acid may splash on the skin or into the eyes inadvertently when removing electrolyte caps.

## TOXIC EXHAUST GASES

**⚠ WARNING: Carbon monoxide (CO) is a deadly gas!**

- Ensure that the exhaust system is adequate to expel gases discharged from the engine. Check the exhaust system regularly for leaks and make sure the exhaust manifold/water-injected elbow is securely attached.
- Be sure the unit and its surroundings are well ventilated. Run blowers when running the generator set or engine.
- Don't run the generator set or engine unless the boat is equipped with a functioning marine carbon monoxide detector that complies with ABYCA-24. Consult your boat builder or dealer for installation of approved detectors.
- For additional information refer to ABYC T-22 (educational information on Carbon Monoxide).

**⚠ WARNING: Carbon monoxide (CO) is an invisible odorless gas. Inhalation produces flu-like symptoms, nausea or death!**

- Do not use copper tubing in diesel exhaust systems. Diesel fumes can rapidly destroy copper tubing in exhaust systems. Exhaust sulfur causes rapid deterioration of copper tubing resulting in exhaust/water leakage.
- Do not install exhaust outlet where exhaust can be drawn through portholes, vents, or air conditioners. If the engine exhaust discharge outlet is near the waterline, water could enter the exhaust discharge outlet and close or restrict the flow of exhaust. Avoid overloading the craft.
- Although diesel engine exhaust gases are not as toxic as exhaust fumes from gasoline engines, carbon monoxide gas is present in diesel exhaust fumes. Some of the symptoms or signs of carbon monoxide inhalation or poisoning are:

Vomiting	Inability to think coherently
Dizziness	Throbbing in temples
Headache	Muscular twitching
Nausea	Weakness and sleepiness

## AVOID MOVING PARTS

**⚠ WARNING: Rotating parts can cause injury or death!**

- Do not service the engine while it is running. If a situation arises in which it is absolutely necessary to make operating adjustments, use extreme care to avoid touching moving parts and hot exhaust system components.

# SAFETY INSTRUCTIONS

- Do not wear loose clothing or jewelry when servicing equipment; tie back long hair and avoid wearing loose jackets, shirts, sleeves, rings, necklaces or bracelets that could be caught in moving parts.
- Make sure all attaching hardware is properly tightened. Keep protective shields and guards in their respective places at all times.
- Do not check fluid levels or the drive belt's tension while the engine is operating.
- Stay clear of the drive shaft and the transmission coupling when the engine is running; hair and clothing can easily be caught in these rotating parts.

## HAZARDOUS NOISE

 **WARNING: High noise levels can cause hearing loss!**

- Never operate an engine without its muffler installed.
- Do not run an engine with the air intake (silencer) removed.
- Do not run engines for long periods with their enclosures open.

 **WARNING: Do not work on machinery when you are mentally or physically incapacitated by fatigue!**

## OPERATORS MANUAL

Many of the preceding safety tips and warnings are repeated in your Operators Manual along with other cautions and notes to highlight critical information. Read your manual carefully, maintain your equipment, and follow all safety procedures.

## ENGINE INSTALLATIONS

Preparations to install an engine should begin with a thorough examination of the American Boat and Yacht Council's (ABYC) standards. These standards are a combination of sources including the USCG and the NFPA.

Sections of the ABYC standards of particular interest are:

- H-2 Ventilation
- P-1 Exhaust systems
- P-4 Inboard engines
- E-9 DC Electrical systems

All installations must comply with the Federal Code of Regulations (FCR).

## ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING DIESEL ENGINES

Read the following ABYC, NFPA and USCG publications for safety codes and standards. Follow their recommendations when installing your engine.

**ABYC** (American Boat and Yacht Council)  
"Safety Standards for Small Craft"

Order from:

ABYC  
3069 Solomon's Island Rd.  
Edgewater, MD 21037

**NFPA** (National Fire Protection Association)  
"Fire Protection Standard for Motor Craft"

Order from:

NFPA  
11 Tracy Drive  
Avon Industrial Park  
Avon, MA 02322

**USCG** (United States Coast Guard)  
"USCG 33CFR183"

Order from:

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

# INSTALLATION

When installing WESTERBEKE engines and generators it is important that strict attention be paid to the following information:

## CODES AND REGULATIONS

Strict federal regulations, ABYC guidelines, and safety codes must be complied with when installing engines and generators in a marine environment.

## SIPHON-BREAK

For installations where the exhaust manifold/water injected exhaust elbow is close to or will be below the vessel's waterline, provisions must be made to install a siphon-break in the raw water supply hose to the exhaust elbow. This hose must be looped a minimum of 20" above the vessel's waterline. ***Failure to use a siphon-break when the exhaust manifold injection port is at or below the load waterline will result in raw water damage to the engine and possible flooding of the boat.***

If you have any doubt about the position of the water-injected exhaust elbow relative to the vessel's waterline under the vessel's various operating conditions, ***install a siphon-break.***

**NOTE:** *A siphon-break requires periodic inspection and cleaning to ensure proper operation. Failure to properly maintain a siphon-break can result in catastrophic engine damage. Consult the siphon-break manufacturer for proper maintenance.*

## EXHAUST SYSTEM

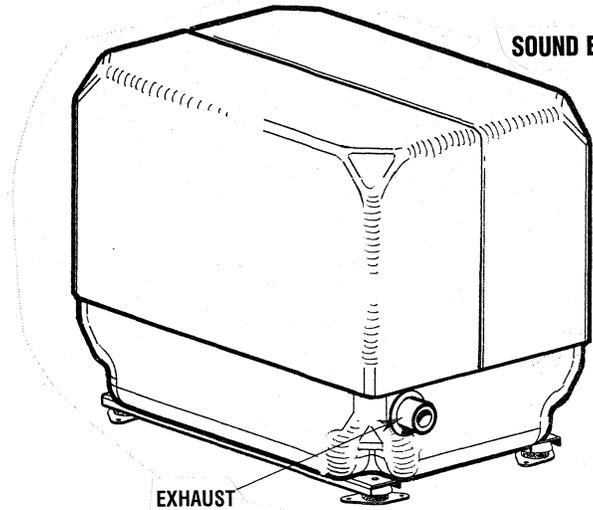
The exhaust hose must be certified for marine use. The system must be designed to prevent water from entering the exhaust under any sea conditions and at any angle of the vessels hull.

**A detailed 40 page Marine Installation Manual covering gasoline and diesel, engines and generators, is available from your WESTERBEKE dealer.**

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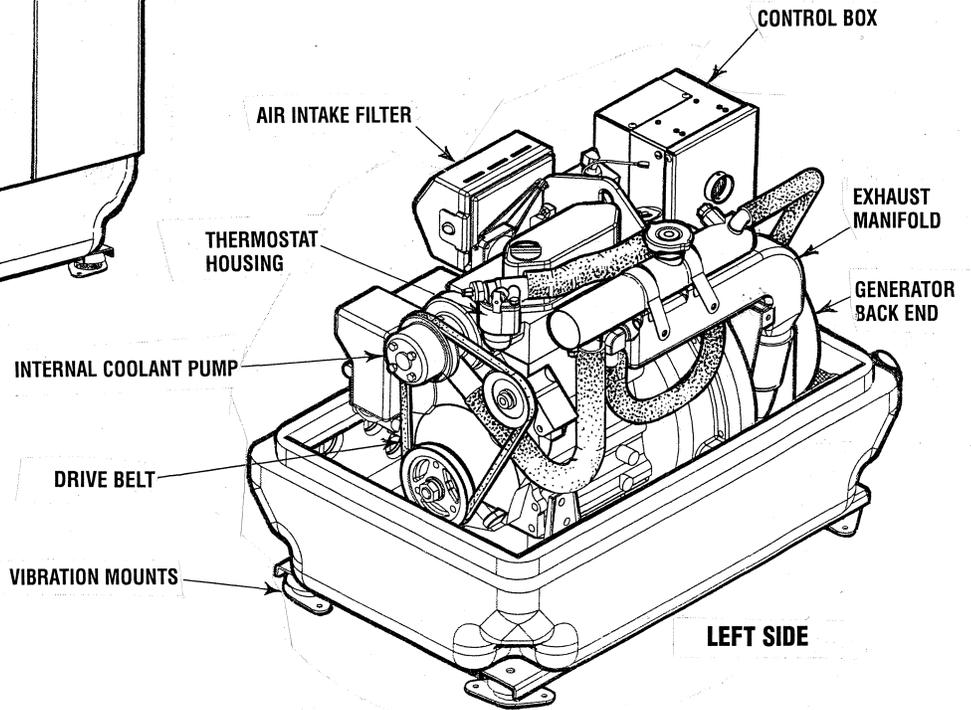
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# PARTS IDENTIFICATION



SOUND ENCLOSURE

EXHAUST



AIR INTAKE FILTER

THERMOSTAT HOUSING

INTERNAL COOLANT PUMP

DRIVE BELT

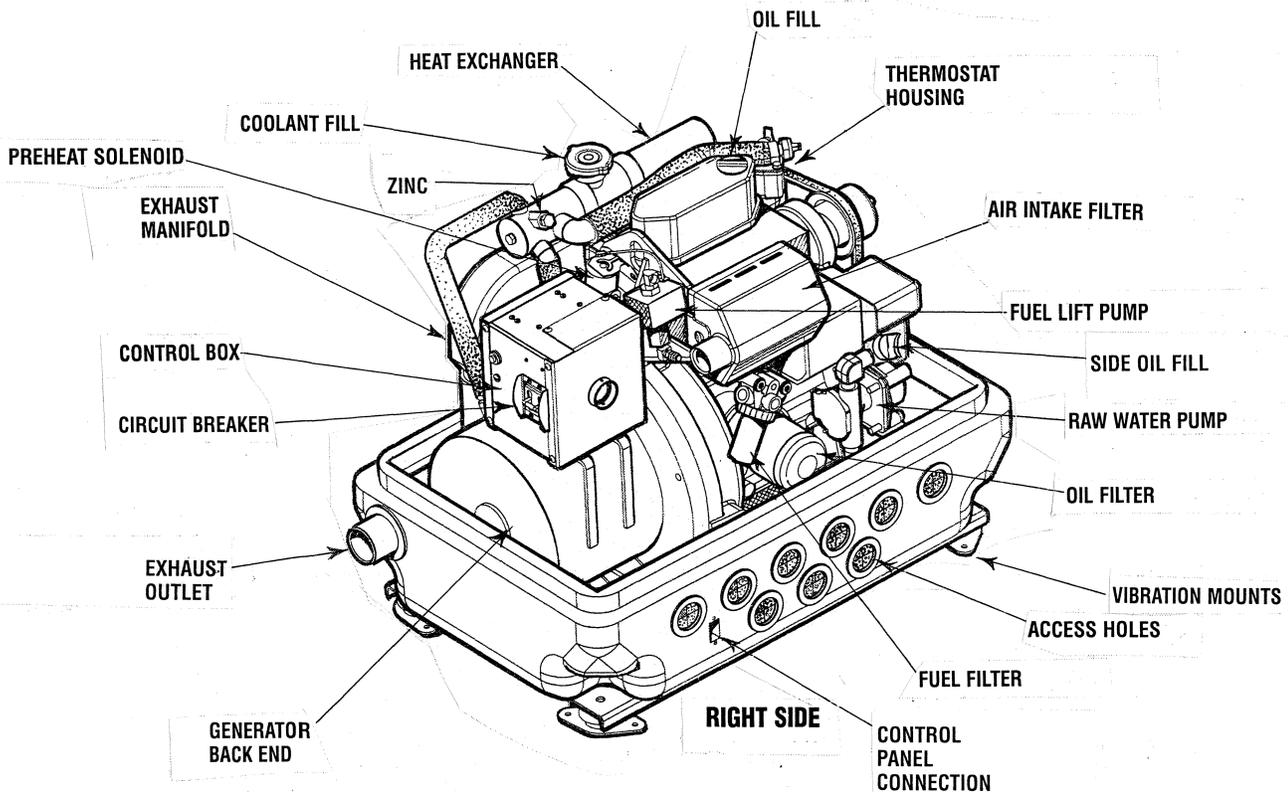
VIBRATION MOUNTS

CONTROL BOX

EXHAUST MANIFOLD

GENERATOR BACK END

LEFT SIDE



OIL FILL

HEAT EXCHANGER

THERMOSTAT HOUSING

COOLANT FILL

ZINC

AIR INTAKE FILTER

FUEL LIFT PUMP

SIDE OIL FILL

RAW WATER PUMP

OIL FILTER

VIBRATION MOUNTS

ACCESS HOLES

FUEL FILTER

RIGHT SIDE

CONTROL PANEL CONNECTION

PREHEAT SOLENOID

EXHAUST MANIFOLD

CONTROL BOX

CIRCUIT BREAKER

EXHAUST OUTLET

GENERATOR BACK END

# INTRODUCTION

This WESTERBEKE marine generator is a product of WESTERBEKE'S many years of experience and advanced technology. We take great pride in the superior durability and dependable performance of our engines and generators. Thank you for selecting WESTERBEKE.

This owner's manual contains information and instructions for the installation, operation, maintenance and service of your generator. For additional installation information, see *WESTERBEKE'S INSTALLATION MANUAL FOR MARINE ENGINES & GENERATORS*, Publication #43268.

In order to get the full use and benefit from your generator, it is important that you operate and maintain it correctly. This manual is designed to help you do this. Please read this manual carefully and observe all the safety precautions throughout. Should your generator require servicing, contact your nearest WESTERBEKE dealer for assistance.

## WARRANTY PROCEDURES

Your WESTERBEKE Warranty is included in the documentation package. If you have not received a customer identification card registering your warranty 60 days after submitting the warranty registration form, please contact the factory in writing with model information, including the unit's serial number and commission date.

### Customer Identification Card



Customer Identification

WESTERBEKE OWNER  
MAIN STREET  
HOMETOWN, USA

Model 8 KW BCDT Ser. #D703-xxxx  
Expires 9/2002

## PRODUCT SOFTWARE

Product software (tech data, parts lists, manuals, brochures and catalogs) provided from sources other than WESTERBEKE are not within WESTERBEKE'S CONTROL.

**WESTERBEKE CANNOT BE RESPONSIBLE FOR THE CONTENT OF SUCH SOFTWARE, MAKES NO WARRANTIES OR REPRESENTATIONS WITH RESPECT THERETO, INCLUDING ACCURACY, TIMELINESS OR COMPLETENESS THEREOF AND WILL IN NO EVENT BE LIABLE FOR ANY TYPE OF DAMAGE OR INJURY INCURRED IN CONNECTION WITH OR ARISING OUT OF THE FURNISHING OR USE OF SUCH SOFTWARE.**

WESTERBEKE customers should also keep in mind the time span between printings of WESTERBEKE product software and the unavoidable existence of earlier WESTERBEKE manuals. In summation, product software provided with WESTERBEKE products, whether from WESTERBEKE or other suppliers, must not and cannot be relied upon exclusively as the definitive authority on the respective product. It not only makes good sense but is imperative that appropriate representatives of WESTERBEKE or the supplier in question be consulted to determine the accuracy and currentness of the product software being consulted by the customer.

## SERIAL NUMBER

Owners may find it convenient to enter the information on the generator decal and engine identification plate shown below. These will provide quick references when seeking technical information and/or ordering parts.



Fill in the information for your reference. 

## NOTES, CAUTIONS AND WARNINGS

As this manual takes you through the operating procedures, maintenance schedules, and troubleshooting of your marine engine, critical information will be highlighted by NOTES, CAUTIONS, and WARNINGS. An explanation follows:

**NOTE:** An operating procedure essential to note.

**CAUTION:** Procedures which, if not strictly observed, can result in the damage or destruction of your engine.

**WARNING:** Procedures which, if not properly followed, can result in personal injury or loss of life.

# INTRODUCTION

## Generator Serial Number

The generator model number and specifications are located on a decal on the generator housing.

SPECIFICATION	50 HZ.	60 HZ.
MODEL _____		
RPM _____		
KW _____		
KVA _____		
VOLTS _____		
AMPS _____		
ENG. HP _____		
ENG. SER. NO.		
GEN. SER. NO.		
PF/PHASE _____	/	
WIRES _____		
RATING _____		
INSUL. CLASS _____		
TEMP. RISE _____		
BATTERY _____		
C.I.D. _____		



Fill in the information for reference.

## COMPONENT LOCATIONS

Component locations in this manual are referenced from the front of the engine which is the end at which the raw water pump is located. Left and right sides are determined as follows: imagine straddling the engine, facing the front of the engine: the left side is at your left, the right side is at your right. The left side is the service side of the generator. The engine and generator controls are located in an air-cooled air intake/control box.

## ORDERING PARTS

Whenever replacement parts are needed, always provide the generator and engine model and serial numbers. You must provide us with this information so we may properly identify your engine/generator. In addition, include a complete part description and part number for each part needed (see the Parts List). Insist upon WESTERBEKE packaged parts because *will fit* or generic parts are frequently not made to the same specifications as original equipment.

## SPARES AND ACCESSORIES

Certain spare parts will be needed to support and maintain your Westerbeke generator when cruising (see *SUGGESTED SPARE PARTS*). Often even a simple item such as a proper fuel filter can be difficult to obtain along the way.

## UNDERSTANDING THE DIESEL ENGINE/GENERATOR

The diesel engine closely resembles the gasoline engine, since the mechanism is essentially the same. The cylinder is arranged above a closed crankcase. The crankshaft is of the same general type as on a gasoline engine, and the diesel engine has the same type of valves, camshaft, piston, connecting rod and lubricating system.

Therefore, to a great extent, a diesel engine requires the same preventive maintenance as a gasoline engine. The most important factors are proper ventilation and proper maintenance of the fuel, lubricating and cooling systems. Fuel filter elements must be replaced at the time periods specified, and frequent checking for contaminants (water, sediment, etc.) in the fuel system is also essential. Another important factor is the consistent use of the same brand of high detergent diesel lubrication oil designed specifically for diesel engines.

The diesel engine does differ from the gasoline engine, however, in its method of handling and firing of fuel. The carburetor and ignition systems are replaced by a single component – the fuel injection pump – which performs the function of both.

## PROTECTING YOUR INVESTMENT

Care at the factory during assembly and thorough testing have resulted in a WESTERBEKE generator capable of many thousands of hours of dependable service. However, the manufacturer cannot control how or where the generator is installed and serviced in the field. This is up to the buyer/owner-operator.

**NOTE:** *Six important steps to ensure long generator life:*

- Proper engine and generator installation.
- An efficient well-designed exhaust system that includes an anti-siphon break to prevent water from entering the engine.
- Changing the engine oil every 100 operating hours.
- Proper maintenance of all engine and generator components according to the maintenance schedule in this manual.
- Use clean, filtered diesel fuel.
- Winterize your engine according to the *LAY-UP AND RECOMMISSIONING* section in this manual.

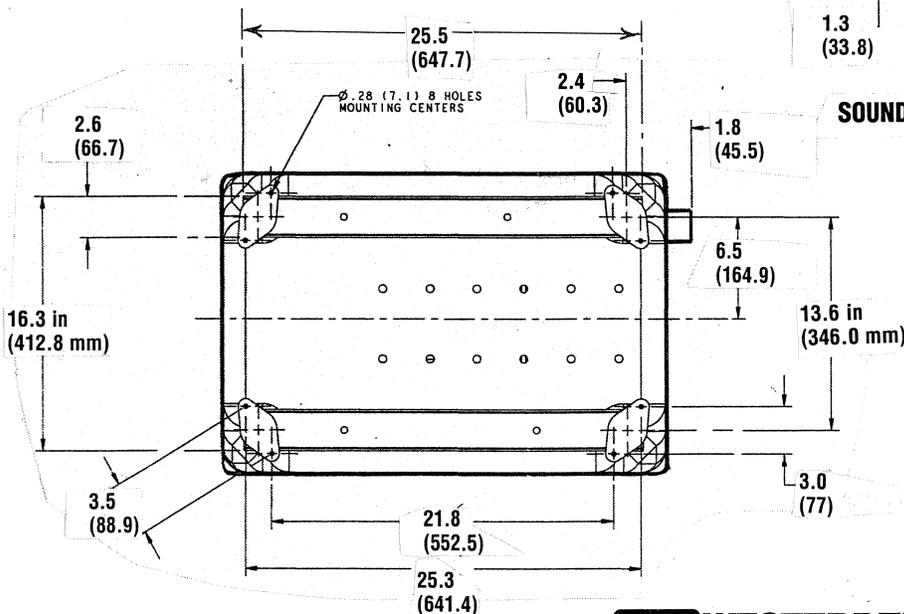
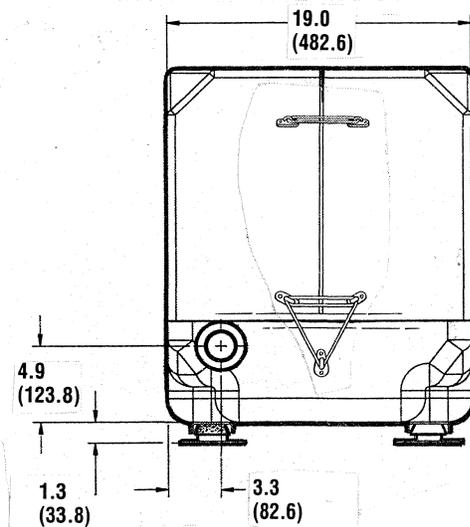
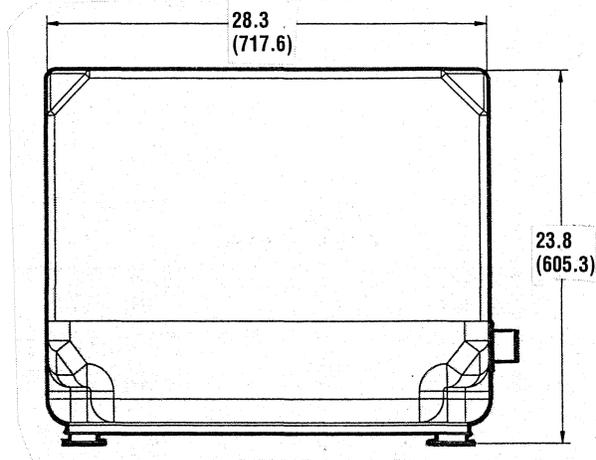
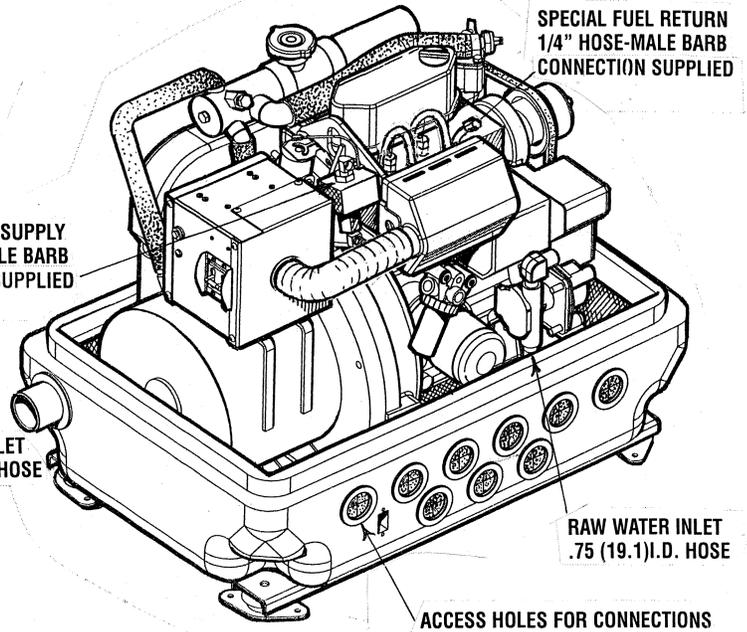
# INSTALLATION

The following installation instructions cover the Westerbeke 8 Kw Diesel Generator. Additional general information may be found in Westerbeke's *INSTALLATION MANUAL for MARINE ENGINES and GENERATORS*, Publication #43268.

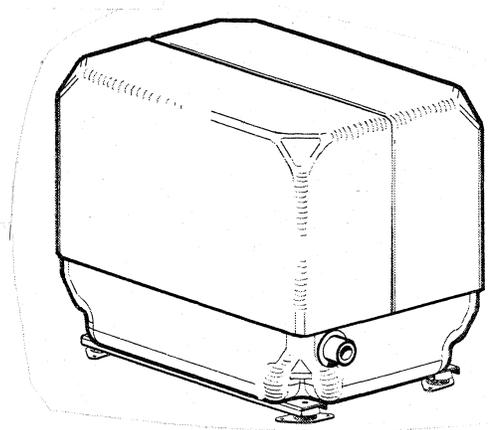
The following factors should be considered when planning the installation of your Westerbeke 8 Kw generator:

1. Size and weight of the generator.
2. Location and mounting surface.
3. Ventilation.
4. Exhaust system.
5. Fuel supply and return.
6. Raw water inlet and outlet.
7. Oil fill and oil drain hose.
8. Electrical connections.
9. Maintenance and service accessibility.
10. Accessories.

Refer to the following illustrations for the generator's overall dimensions.



## SOUND ENCLOSURE

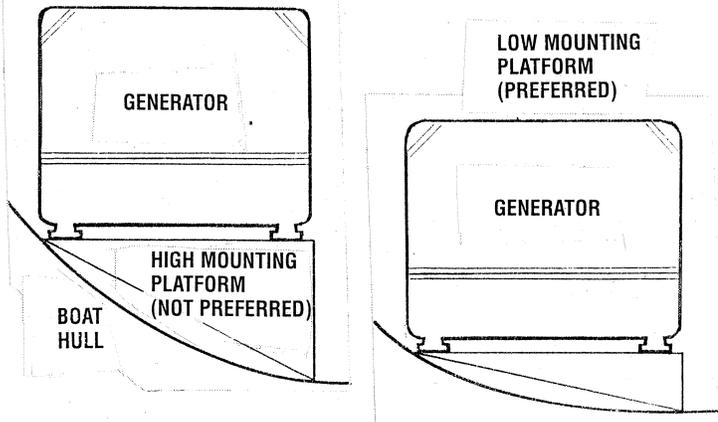


# INSTALLATION

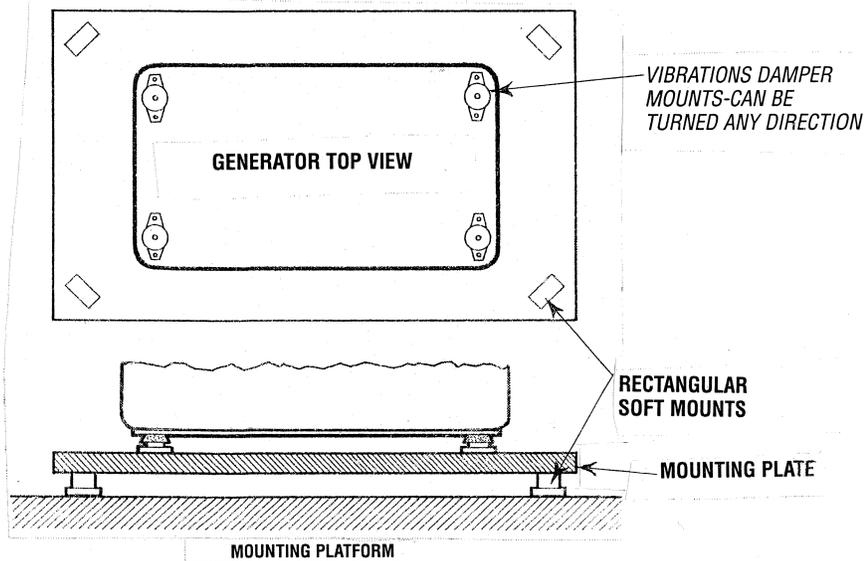
## LOCATION AND MOUNTING

A solid, level mounting platform is very important for the proper operation of your generator. Select a location that will allow adequate space on all sides for ventilation and servicing. Locate the generator away from living quarters, and away from bilge splash and vapors.

The mounting platform may be of wood, metal or fiberglass. It must be horizontal and should be as small as possible to minimize vibrations. A low mounting platform is preferred because it will be stable and easy to build; a higher mounting platform must be very sturdy to avoid resonance and vibrations (see illustrations).



If the vibration-dampening mounts furnished with the generator are not adequate to muffle vibration or resonance in an installation where the mounting surface is not ideal, then adding a plate between the generator and the boat's mounting platform is a possible solution. This will also improve the sound insulation. For this plate, use 1" (2.54cm) thick wood that weighs 22 - 33 lbs (10 - 15 kg), and soft mounts (45 durometer rating) that are rectangular. Position these mounts so they are on the diagonal and not aligned with the generator's mounts (see illustration). The generator's mounts may be turned in any direction. Mount the plate to the boat's platform, then mount the generator to the plate.



## VENTILATION

Allow for the sufficient intake of cool air for proper engine combustion and the discharge of the heated air while the generator is running. Since heated air rises, the intake of cool air should be directed into the lower area of the generator compartment and the heated air should be discharged from the upper area of the compartment.

**NOTE:** Engine combustion air enters the generator's through holes in the base of the enclosure. This area must be kept clear of obstructions to help insure air entry.

## FUEL LINES

### Fuel Supply Line

In most installations, the generator would use the same fuel tank as the vessel's propulsion engine. If this is the case, the fuel supply line to the generator should come from its own pickup in the common fuel tank and not tee off the supply line to the propulsion engine.

To assure proper suction, the generator's fuel pump should not be more than 39" (1m) above the bottom of the fuel pickup tube.

### Fuel Return Line

The fuel return line at the fuel tank should extend down to the bottom of the tank in the same manner as the fuel pickup tube. This **must** be done in an installation where the fuel tank is located below the engine's fuel system. This precaution insures against hard starting due to air displacing fuel siphoning out of the engine's fuel system through the return line when the generator is shut down.

# INSTALLATION

## EXHAUST SYSTEM

It is important to install a proper exhaust system to avoid engine flooding. The system must be designed to prevent water from entering the exhaust line under any sea conditions and at any angle of the vessel's hull. Exhaust system failures are not covered by Westerbeke's warranty. The installer should have a basic knowledge of marine installation requirements.

Westerbeke recommends installing an exhaust system having an in-line muffler (see illustration). The in-line muffler should be located below the engine's exhaust elbow. It must accumulate any water that runs back down the exhaust line after the engine is shut down. Design the system so there is an adequate drop in the line between the exhaust elbow and the through-hull discharge end of the line. The exhaust hose must be certified for marine use. Use the following illustrations as a general guide when installing an exhaust system.

**CAUTION:** An exhaust line that is too long and/or has a poor gradient can cause water to return back to the generator's engine when the generator is shut off.

Westerbeke Corporation presumes that the installer of this marine diesel generator is familiar with the safeguards a water-cooled marine exhaust system will provide for the engine. Failure to design and layout a proper exhaust system can result in catastrophic damage to the diesel engine, and possibly result in the sinking of the vessel in which the unit is installed.

For more information about exhaust system design, see Westerbeke's *INSTALLATION MANUAL for MARINE ENGINES and GENERATORS*, Publication # 43268.

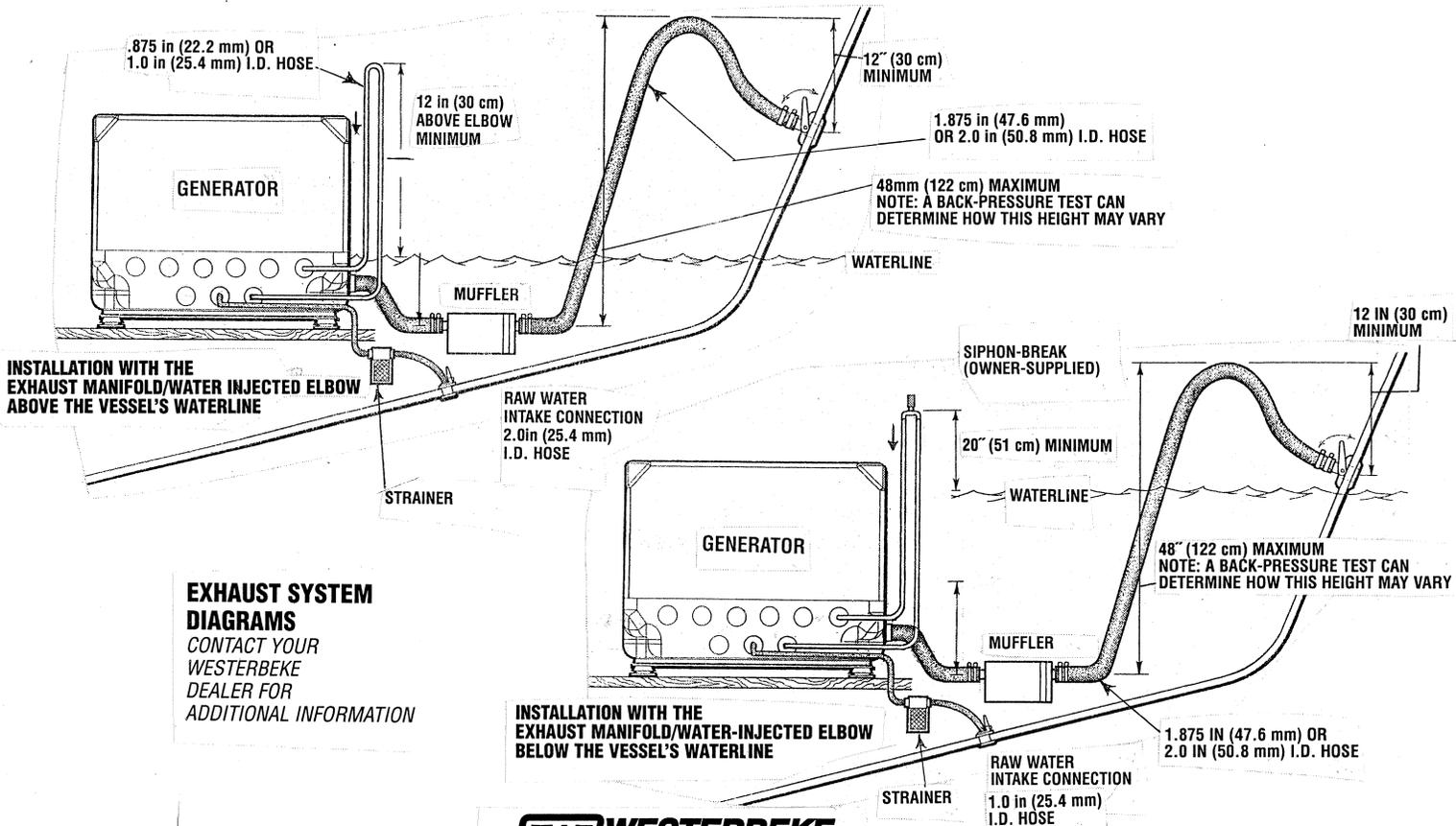
## Carbon Monoxide

The best protection against carbon monoxide poisoning is a daily inspection of the complete exhaust system. Check for leaks around manifolds, gaskets, and welds. Make sure exhaust lines are not heating surrounding areas excessively. If excessive heat is present, correct the situation immediately. If you notice a change in the sound or appearance of the exhaust system, shut down the unit immediately and have the system inspected and repaired at once by a qualified mechanic.

**WARNING:** Do not install the exhaust outlet near a swim platform! When people are in the water or in a dinghy near the boat shut the generator or engine down.

A carbon monoxide warning decal has been provided by Westerbeke. Display this decal near your engine or generator, on your cabin bulkhead, or in some other prominent location.

**NOTE:** It is extremely important that a carbon monoxide detector(s) be installed in your boat's living and/or sleeping quarters. Make sure it is manufactured for the marine industry. They are inexpensive and easily available at your marine supplier.



**EXHAUST SYSTEM DIAGRAMS**  
CONTACT YOUR WESTERBEKE DEALER FOR ADDITIONAL INFORMATION

# INSTALLATION

## RAW WATER COOLING SYSTEM

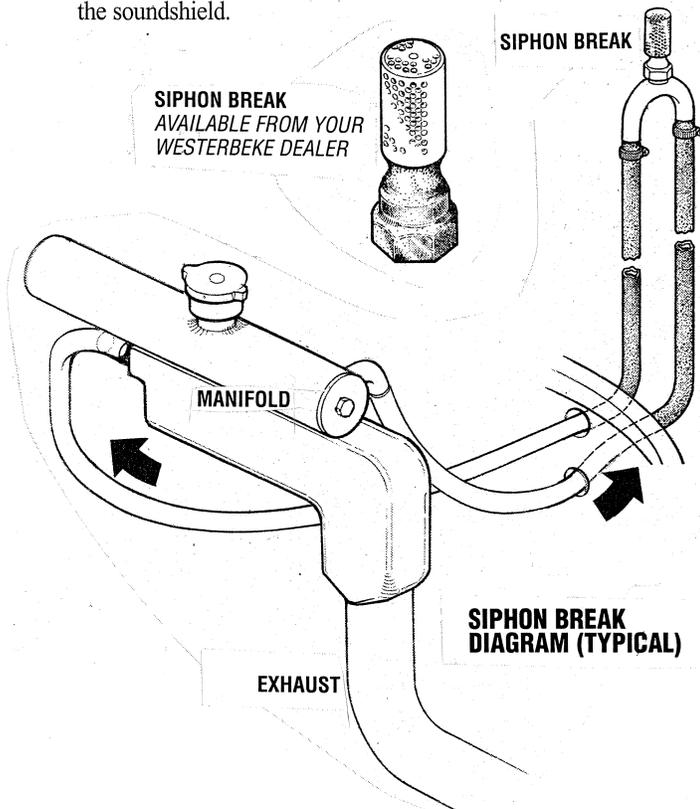
### Siphon-Break

For installations where the water-injected exhaust elbow is close to or below the vessel's waterline, provisions must be made to install a siphon-break in the raw water supply hose to the exhaust elbow. The siphon-break provides an air vent in the raw water cooling system to prevent raw water from filling the exhaust system and the engine's cylinder when the engine is shut down.

**CAUTION:** Failure to use a siphon-break when the exhaust elbow is located at or below the load waterline will result in raw water damage to the engine and possible flooding of the boat.

If you have any doubt about the position of the water-injected exhaust elbow relative to the vessel's waterline under any of the vessel's various operating conditions or when the vessel is not under way, **install a siphon-break**. This precaution is necessary to protect your engine.

The siphon-break must be installed in the high point of a hose that is looped a minimum of 20 inches (51cm) above the vessel's waterline. This siphon-break **must always** be above the waterline during all angles of vessel operation to prevent siphoning. Use a separate hose for this loop, and run it outside of the soundshield.



**NOTE:** A siphon-break requires periodic inspection and cleaning to ensure proper operation. Failure to properly maintain a siphon-break can result in severe engine damage. Consult the siphon-break manufacturer for a proper maintenance schedule.

### Raw Water Intake

A flush-type through-hull fitting is recommended for the raw water intake. It should be located on the boat's hull where it will be below the waterline during all angles of the boat's operation. See Westerbeke's *INSTALLATION MANUAL for MARINE ENGINES and GENERATORS* for complete installation guidelines.

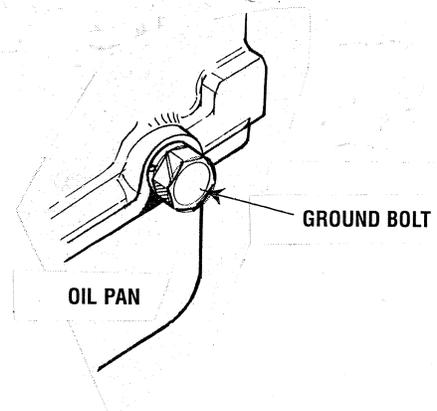
**WARNING:** Do not use a scoop-type through-hull fitting for supplying raw water to this generator. A scoop-type raw water inlet can develop substantial pressure and force water past the raw water pump, flooding the exhaust system and allowing the water to enter the engine's cylinder. Damage caused by raw water entry into the engine's cylinder via the exhaust system is not covered by Westerbeke's warranty.

Flooding of the exhaust system due to water pressure can also occur with a flush-type raw water intake on a powerboat that has its bow up. This pressure can be caused by the boat's decreased waterline before the boat reaches its final trim, or by the angle of the boat to the sea surface when it is underway.

### STARTING BATTERY CONNECTIONS

The Westerbeke 8.0 KW Generator is negative grounded. The generator should be connected to its own 12V starting battery (125A minimum).

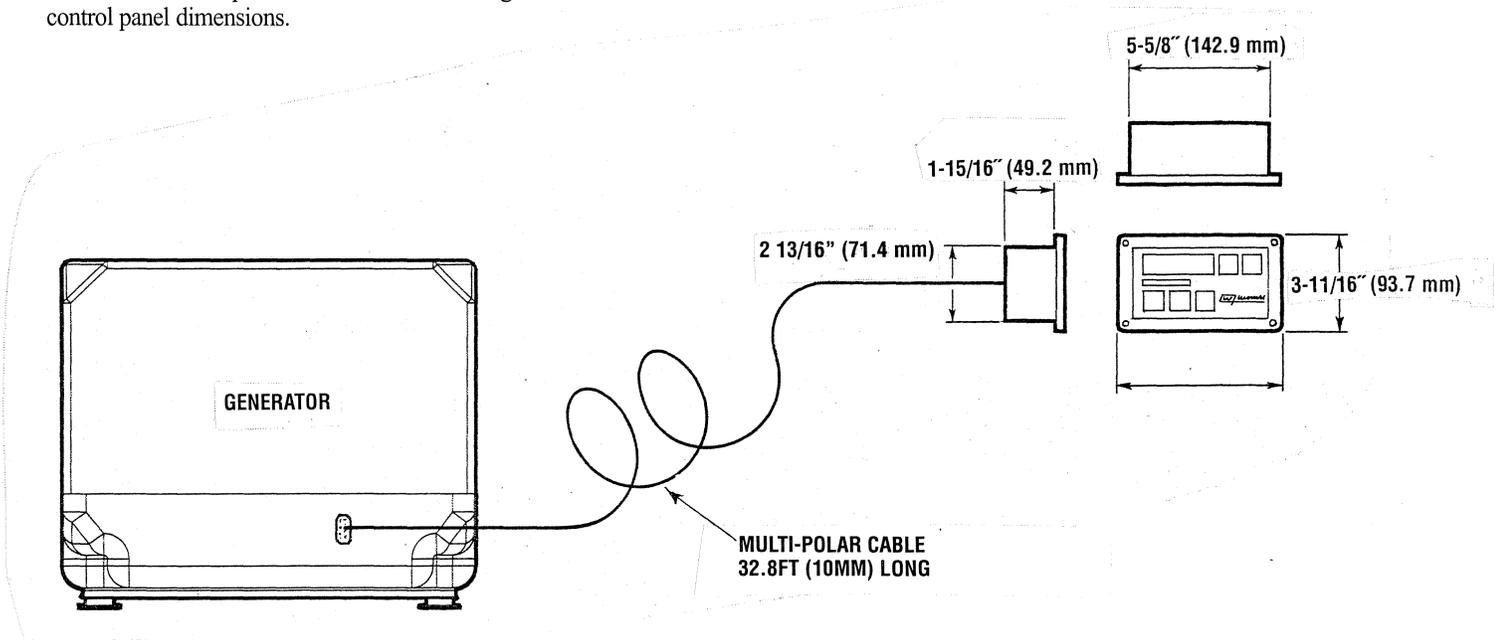
All ground wires should be tightly fastened to the ground bolt located on the lower left side of the engine below the starter motor. Make certain the ground terminals are clean.



# INSTALLATION

## CONTROL PANEL

Mount this plug-in control panel in any desired remote location. The panel is furnished with 32.8 ft. (10 m) of cable; additional cable is available if more cable length is required. When installing, pass the cable through bulkheads by disconnecting the cable at the control panel. Refer to the following illustration for control panel dimensions.



# CONTROL PANEL

## DESCRIPTION

This plug-in remote control panel provides the operator with all the necessary information and controls to use the generator. The panel has START and STOP buttons, an LED proportional load indicator, and coolant and oil pressure warning lights. The engine will shut down automatically if it overheats or there is an oil pressure failure.

The load indicator is designed to avoid an excessive current draw from the generator due to too many loads having been applied at the same time. The indicator will begin to show the load after the first half of the required current is supplied, and it will indicate that an acceptable load is being provided up to the point where all the LED's except the last one are lit (5 green LED's are lit). If the last LED (red) becomes lit, it indicates an overload. The load that caused this red LED to light up must be switched off to return the indicator to a normal position.

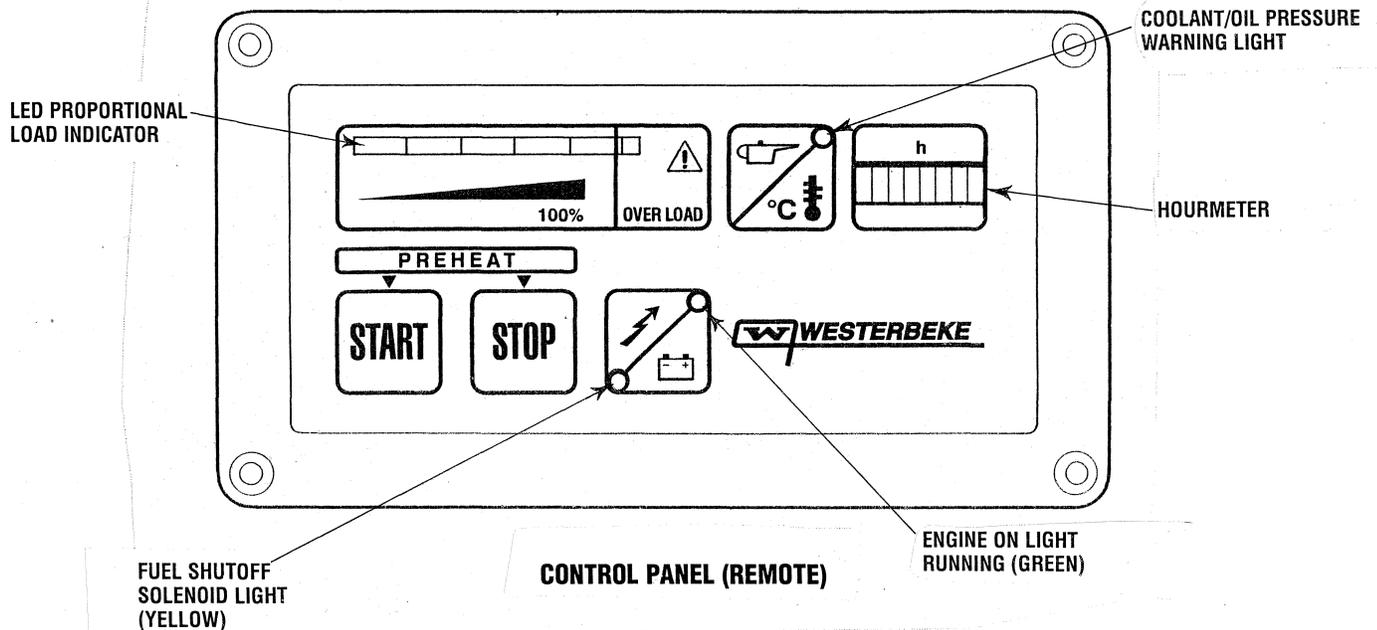
The oil pressure/coolant temperature warning light (red) lights up when either the oil pressure is too low or the engine is overheated. The engine will shut down if it overheats or there is an oil pressure failure.

The fuel shutoff solenoid light (yellow) blinks when the START button is pushed and goes off after the engine starts. If it continues to blink and the engine doesn't start, it means the starting battery is too low.

The engine/generator "ON" light (green) will be lit during normal operation.

**NOTE:** If the engine is not running and the shutoff solenoid is energized (yellow LED is blinking), the starting battery is supplying unneeded power to the engine. Reset by pushing the STOP button.

**NOTE:** If the START button is pushed by mistake while the engine is running, an electrical safety device protects the starter motor by preventing its solenoid from energizing.



# FUEL, ENGINE OIL AND ENGINE COOLANT

## DIESEL FUEL

Use fuel that meets the requirements or specifications of Class 2-D (ASTM), and has a cetane rating of #45 or better.

### Care of the Fuel Supply

Use only clean diesel fuel! The clearance of the components in your fuel injection pump is very critical; invisible dirt particles which might pass through the filter can damage these finely finished parts. It is important to buy clean fuel, and keep it clean. The best fuel can become unsatisfactory by careless handling or improper storage facilities. To assure that the fuel going into the tank for your engine's daily use is clean and pure, the following practice is advisable:

Purchase a well-known brand of fuel.

Install and regularly service a good, visual-type filter/water separator between the fuel tank and the engine. Raycor models 220 or 225 are good examples of such spin-on filters.

## ENGINE OIL

Use a heavy duty engine oil with an API classification of CF or CG-4. Change the engine oil after an initial 50 hours of break-in operation, and every 100 hours of operation thereafter. For recommended oil viscosity, see the following chart:

Operating Temperature	Oil Viscosity
Above 68° F (20° C)	SAE 30, 10W-30 or 15W-40
41° – 68° F (5° – 20° C)	SAE 20 or 10W-30
Below 41° F (5° C)	SAE 10W-30

**CAUTION:** Do not allow two or more brands of engine oil to mix. Each brand contains its own additives; additives of different brands could react in the mixture to produce properties harmful to your engine.

## ENGINE COOLANT

Westerbeke recommends a mixture of 50% antifreeze and 50% distilled water. Distilled water is free from the chemicals that can corrode internal engine surfaces.

The antifreeze performs double duty, as it allows the engine to run at proper temperatures by transferring heat away from the engine to the coolant. It also lubricates and protects the cooling circuit from rust and corrosion. Look for a good quality antifreeze that contains Supplemental Cooling Additives (SCAs) that keep the antifreeze chemically balanced, crucial to long term protection.

The distilled water and antifreeze should be premixed before being poured into the cooling circuit.

**NOTE:** Use the new environmentally-friendly long lasting antifreeze that is now available.

Antifreeze mixtures will protect against an unexpected freeze and they are beneficial to the engine's cooling system. They retard rust and add to the life of the circulating pump seal.

### ANTIFREEZE PROTECTION CHART

Antifreeze concentration	23%	30%	35%	50%
Freezing Temperature	14° F	8° F	-4° F	-40° F
	(-10°C)	(-13°C)	(-20°C)	(-40°C)

## COOLANT RECOVERY TANK

A coolant recovery tank kit is supplied with each WESTERBEKE diesel engine. The purpose of this recovery tank is to allow for engine coolant expansion and contraction during engine operation, without the loss of coolant and without introducing air into the cooling system. This kit is provided and must be installed before operating the engine.

**NOTE:** This tank, with its short run of plastic hose, is best located at or above the level of the engine's manifold but it can be located below the level of the engine's manifold if the particular installation makes this necessary.

# PREPARATIONS FOR INITIAL START-UP

## PRESTART INSPECTION

Before starting your generator for the first time or after a prolonged layoff, check the following items:

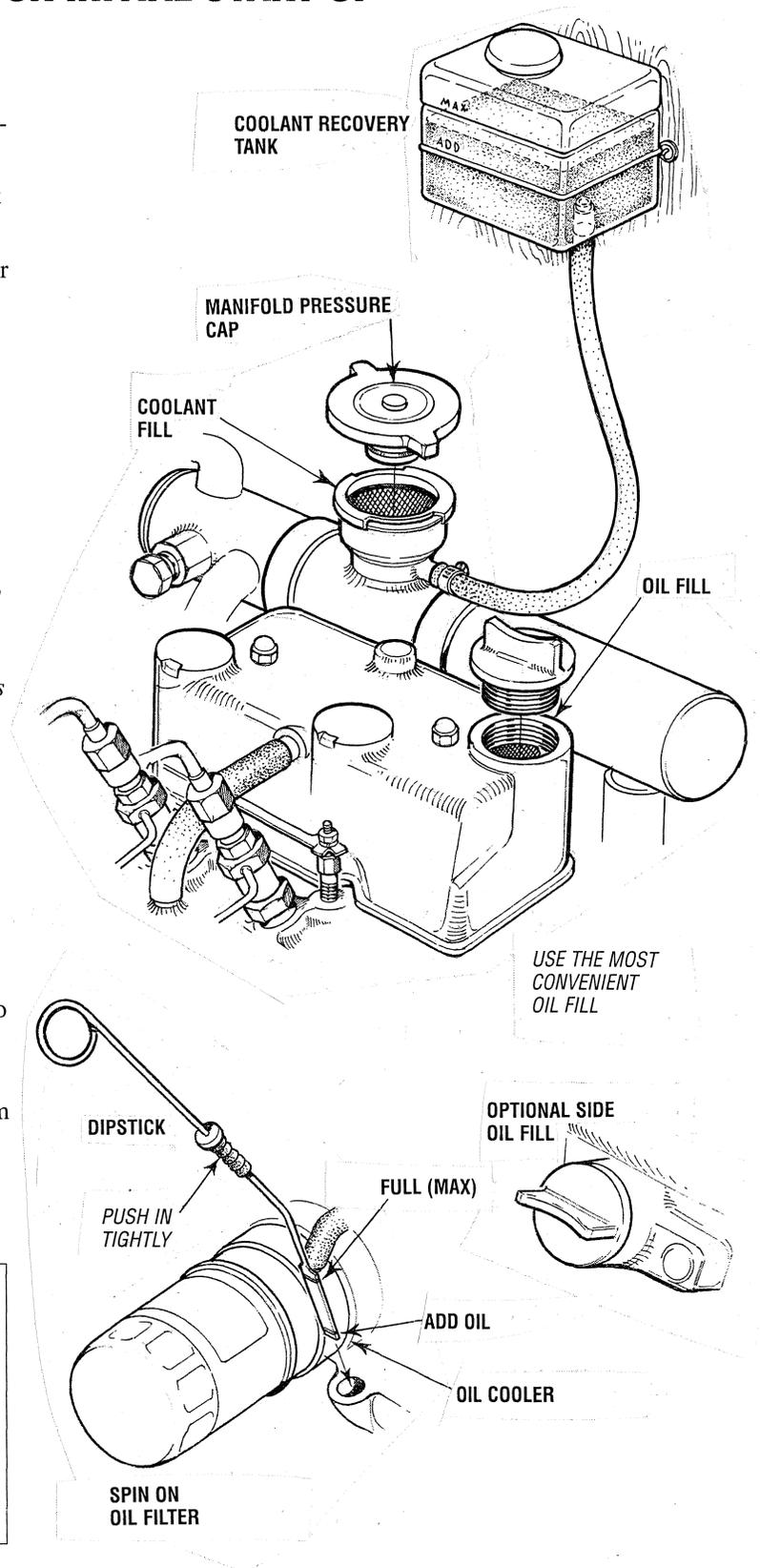
- Check the engine oil level: add oil to maintain the level at the full mark on the dipstick.
- Check the fuel supply and examine the fuel filter/separator bowls for contaminants.
- Check the DC electrical system. Inspect wire connections and battery cable connections.
- Check the coolant level in both the plastic recovery tank and at the manifold.

**NOTE:** After the initial running of the generator, the air in the engine's cooling system will be purged to the coolant recovery tank. Open the air bleed petcock to ensure that the cooling system is purged of air. After shutdown and after the engine has cooled, the coolant from the recovery tank will be drawn into the engine's cooling system to replace the purged air.

Before subsequent operation of the generator, the engine's manifold should be topped off, and the coolant recovery tank may need to be filled to the MAX level.

- Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, and check threaded connections. Search for any gasoline leaks.
- Check load leads for correct connections as specified in the wiring diagrams.
- Examine the air inlet and outlet for air flow obstructions.
- Be sure no other generator or utility power is connected to the load lines.
- Be sure that in power systems with a neutral line that the neutral is properly grounded (or ungrounded) as the system requires, and that generator neutral is properly connected to the load neutral. In single phase systems an incomplete or open neutral can supply the wrong line-to-neutral voltage on unbalanced loads.

**CAUTION:** When starting the generator, it is recommended that all AC loads, especially large motors, be switched OFF until the engine has come up to speed and, in cold climates, starts to warm up. This precaution will prevent damage caused by unanticipated operation of the AC machinery and will prevent a cold engine from stalling.



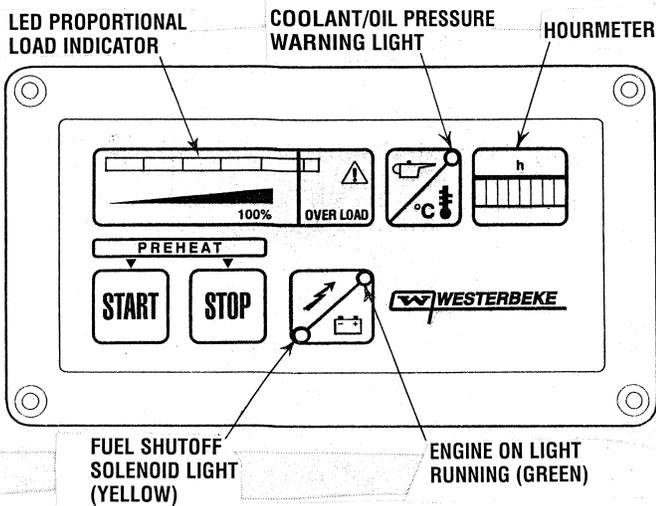
# STARTING/STOPPING PROCEDURE

## ELECTRIC START

**CAUTION:** All AC loads must be switched off before starting. This precaution will prevent damage caused by unanticipated operation of AC machinery and will prevent a cold engine from stalling.

This generator has a 12 VDC electric starter. To start the generator, push the START button on the control panel. The yellow START indicator light will come on and start to blink. Once the engine fires and runs, the yellow START indicator light will go out and the green run indicator light will come on.

**NOTE:** If a start attempt is aborted, the yellow indicator light will continue to blink. To reset the circuit, depress the stop button.



Apply a light load to the generator and allow the engine to warm up to operating temperature before applying heavy loads

**NOTE:** Some unstable running may occur in a cold engine. This condition should smooth out as the engine warms up and when the generator loads are applied.

## OPERATING THE GENERATOR

After the generator has started, run it with a medium load for warmup. If possible, apply the load in stages.

**CAUTION:** Never operate the engine for long periods of time without an amperage load being applied, otherwise carbon build-up may occur which can cause severe damage to the engine.

## STOPPING THE GENERATOR

Remove the AC loads from the generator one at a time and allow the generator to run for an additional 3 to 5 minutes (this stabilizes its operating temperature).

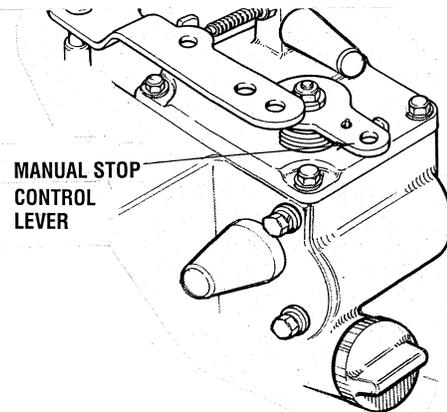
To stop the generator, press the STOP button on the control panel; shutdown is automatic.

After shutdown, carefully inspect the generator. Check for possible leaks from all the connections inside the soundshield.

## Failure to Stop

If the engine should fail to stop after pressing the STOP button, use the control lever: Push the lever all the way over and hold it until the engine comes to a stop, then release it.

**NOTE:** Only use this lever when the engine doesn't stop after pressing the STOP button.



# BREAK-IN PROCEDURE/DAILY OPERATION

## BREAK-IN PROCEDURE

After the generator has been started, check for proper operation and then encourage a fast warm-up. Run the generator between 20% to 60% of full load for the first 10 hours.

**CAUTION:** Do not attempt to break-in your generator by running without a load.

After the first 10 hours of the generators' operation, the load can be increased to the full-load rated output; then periodically vary the load.

Avoid overload at all times. An overload is signaled by a smoky exhaust with reduced output voltage and frequency. Monitor the current being drawn from the generator and keep it within the generators' rating. Since the generator operates at 3600 rpm to produce 60 hertz, or at 3000 to produce 50 hertz, control of the generator's engine break-in is governed by the current drawn from the generator.

To protect against unintentional overloading of the generator, the generator's output leads should be routed through a circuit breaker that is rated at the rated output of the generator.

**NOTE:** Be aware of motor starting loads and the high current drawn required for starting motors. This starting amperage drawn can be 3 to 5 times normal running amperage. See *GENERATOR INFORMATION* in this manual.

## CHECK LIST

Follow this checklist each day before starting your generator.

- Record the hourmeter reading in your log (engine hours relate to the maintenance schedule).
- Visually inspect the engine for fuel, oil, or water leaks.
- Check the oil level (dipstick).
- Check the coolant level in the coolant recovery tank.
- Check your fuel supply.
- Check the starting batteries (weekly).
- Check the drive belt for wear and proper tension (weekly).
- Check for abnormal noise such as knocking, vibration and blow-back sounds.
- Confirm exhaust smoke:  
When the engine is cold – White Smoke.  
When the engine is warm – almost Smokeless.  
When the engine is overloaded – some Black Smoke.

**NOTE:** Some unstable running may occur in a cold engine. This condition should abate as normal operating temperature is reached and loads are applied.

**CAUTION:** Do not operate the generator for long periods of time without a load being placed on the generator.

## STOPPING THE GENERATOR

Remove the major AC loads from the generator one at a time. Allow the generator to run for a few minutes to stabilize the operating temperature and press the STOP switch down, (see *CONTROL PANELS*).

**NOTE:** After the first 50 hours of generator operation check the maintenance schedule for the 50 hour service check.

## GENERATOR ADJUSTMENTS

Once the generator has been placed in operation, there may be governor adjustments required for engine speed (hertz) during the engine's break-in period (first 50 hours) or after this period (see *ENGINE SPEED (HERTZ) ADJUSTMENT* under *ENGINE ADJUSTMENTS*). A no-load voltage adjustment may also be required in conjunction with the engine's speed adjustment (see *GENERATOR INFORMATION*).

# SAFETY SHUTDOWN SWITCHES

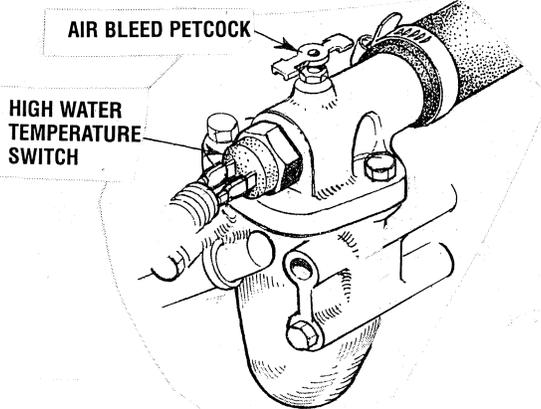
## SAFETY SHUTDOWN SWITCHES

The generator is protected by three automatic shutdown switches. Should shutdown occur, *do not attempt to restart without finding and correcting the cause. Refer to the ENGINE TROUBLESHOOTING section of this manual.*

The following is a description of these automatic shutdown switches:

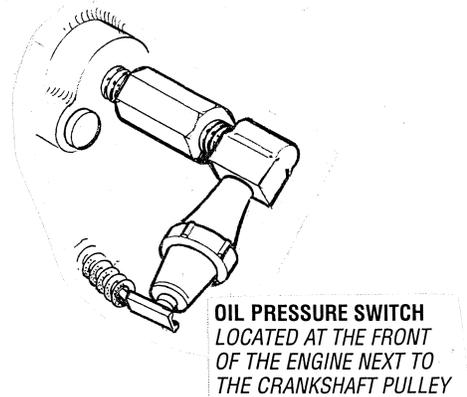
### High Water Temperature Switch

A high water temperature switch is located on the thermostat housing. Normally closed, this switch, should the fresh water coolant's operating temperature reach approximately 210°F (99°C), will open and interrupt the DC voltage to the fuel solenoid on the injection pump, thereby shutting off the engine. This switch resets at 195°F (107°C).



### Low Oil Pressure Switch

A low oil pressure shutdown switch is located off the engine's oil gallery. Normally open in a static state, this switch's sensor monitors the engine's oil pressure. Should the engine's oil pressure fall to 5-10 psi, this switch will open interrupting the DC voltage to the fuel solenoid on the injection pump, thereby shutting off the engine.



### Engine Circuit Breaker

The generator's engine is protected by an engine mounted manual reset circuit breaker (20 amps DC). Excessive current draw or electrical overload anywhere in the instrument panel wiring or engine wiring will cause the breaker to trip. In this event most generators will shut down because the opened breaker disconnects the fuel supply. If this should occur, check and repair the source of the problem. After repairing the fault, reset the breaker and restart the generator.

# MAINTENANCE SCHEDULE

In order to use this Maintenance Schedule, it will be necessary to log your engine hours. Use your engine hourmeter or record your engine hours by running time.

**NOTE:** Many of the following maintenance procedures are simple but others are more difficult and may require the expert knowledge of a service mechanic.

**⚠ WARNING:** Never attempt to perform any service while the generator is running. Wear the proper safety equipment such as goggles and gloves, and use the correct tools for each job. Disconnect the battery terminals when servicing any of the engine's DC electrical equipment.

COMPONENT	FREQUENCY						MAINTENANCE
	AFTER FIRST 50 HRS	DAILY OR EVERY 8 HOURS	WEEKLY	EVERY 100 HOURS	EVERY 600 HOURS	EVERY 2100 HOURS	
Engine oil level		■					Oil level should be between the full and low indicating marks on the dipstick. Top up if necessary.
Engine oil	■	■		■			Change the oil: see <i>LUBRICATION SYSTEM</i>
Oil filter	■			■			
Fuel supply		■					Check the fuel supply. Top up if necessary.
Fuel filter/water separator		■		■			Check for water and dirt in the fuel. Drain and replace the filter if necessary.
Fuel lift pump					■		Clean and inspect the wiring connection.
Fuel filter				■			Change the filter.
Fuel injector*					■		Check and adjust the injection opening pressure and spray condition (see <i>ENGINE ADJUSTMENTS</i> ).
Raw water pump					■		Remove the pump cover and inspect the impeller, gasket, cam and cover for wear. Check the bearings and seals (the shaft can turn, but not wobble). Lubricate when reassembling.
Thermostat						■	Check the functioning of the thermostat; see <i>THERMOSTAT</i> under <i>COOLING SYSTEM</i> .
Engine hoses			■				Hoses should be hard and tight. Replace if soft and spongy. Check and tighten all hose clamps.
Exhaust system*	■		■				Inspect for leaks. Check the anti-siphon valve operation. Check that all connections are tight. Check the exhaust elbow for carbon and/or corrosion buildup on inside passages; clean and replace as necessary. Warning: A defective exhaust elbow can cause carbon monoxide leakage!
Starting batteries and house batteries			■				Check electrolyte levels and make sure connections are very tight. Clean off excessive corrosion.
Starter motor*					■		Check the solenoid and motor for corrosion. Remove and lubricate. Clean and lubricate the starter motor pinion drive.

\*Westerbeke recommends that this service be performed by an authorized mechanic.

(continued)

# MAINTENANCE SCHEDULE

COMPONENT	FREQUENCY						MAINTENANCE
	AFTER FIRST 50 HRS	DAILY OR EVERY 8 HOURS	WEEKLY	EVERY 100 HOURS	EVERY 600 HOURS	EVERY 2100 HOURS	
Valve clearances*	■				■		Adjust the valve clearances; (see <i>ENGINE ADJUSTMENTS</i> ).
Cylinder compression*					■		Check the compression pressure (see <i>ENGINE ADJUSTMENTS</i> ).
Cylinder head bolts	■				■		Retorque the bolts (see <i>TIGHTENING THE CYLINDER HEAD</i> under <i>ENGINE ADJUSTMENTS</i> .)
Visual inspection		■					Check for oil, fuel and water leaks.
Hardware fastenings and electrical connections	■			■			Inspect and tighten all fastenings and accessible screws, bolts and nuts. Inspect all wiring and electrical connections.
Generator connections			■				Check that AC connections are clean and secure with no chafing. See <i>GENERATOR INFORMATION</i> for additional information.
Generator no-load speed				■			Check the no-load speed.
Cleaning the generator			■				Keep the generator's surface clean. Surface dirt and oil will inhibit the generator's ability to remain cool.

\*Westerbeke recommends that this service be performed by an authorized mechanic.

# COOLING SYSTEM

## DESCRIPTION

Westerbeke marine diesel engines are designed and equipped for fresh water cooling. Heat produced in the engine by combustion and friction is transferred to fresh water coolant which circulates throughout the engine. This circulating fresh water coolant cools the engine block, its internal moving parts, and the engine oil. The heat is transferred externally from the fresh water coolant to raw water by means of a heat exchanger, similar in function to an automotive radiator. Raw water flows through the tubes of the heat exchanger while fresh water coolant flows around the tubes; engine heat transferred to the fresh water coolant is conducted through the tube walls to the raw water which is then pumped into the exhaust system where finally it is discharged overboard. In other words, the engine is cooled by fresh water coolant, this coolant is cooled by raw water, and the raw water carries the transferred heat overboard through the exhaust system. The fresh water coolant and raw water circuits are independent of each other. Using only fresh water coolant within the engine allows the cooling water passages to stay clean and free from harmful deposits.

## FRESH WATER COOLING CIRCUIT

**NOTE:** Refer to the *ENGINE COOLANT* section for the recommended antifreeze and water mixture to be used as the fresh water coolant.

Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the manifold, to the heat exchanger where it is cooled, and returned to the engine block via the suction side of the circulating pump.

When the engine is started cold, external coolant flow is prevented by the closed thermostat (although some coolant flow is bypassed around the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens, allowing full flow of the engine's coolant to flow unrestricted to the external portion of the cooling system.

## Coolant Recovery Tank

A coolant recovery tank allows for engine coolant expansion and contraction during engine operation, without any significant loss of coolant and without introducing air into the cooling system. This tank should be located at or above the engine manifold level and should be easily accessible.

## CHANGING COOLANT

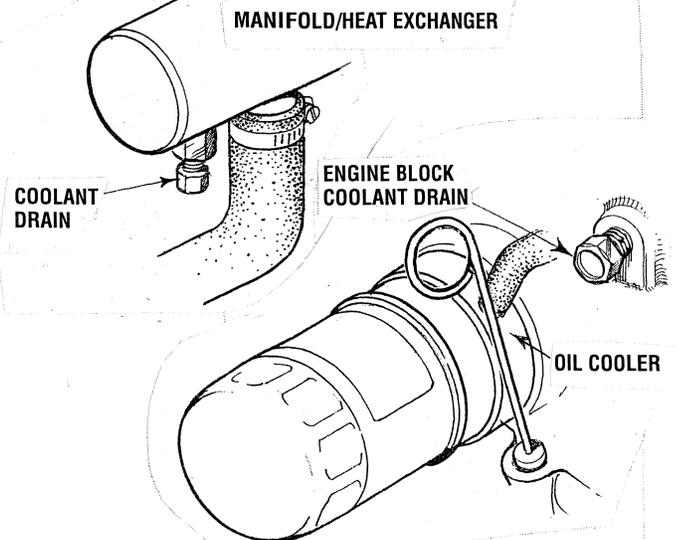
The engine's coolant must be changed according to the *MAINTENANCE SCHEDULE*. If the coolant is allowed to become contaminated, it can lead to overheating problems.

**CAUTION:** Proper cooling system maintenance is critical; a substantial number of engine failures can be traced back to cooling system corrosion.

Drain the engine coolant by loosening the drain plug on the engine block and opening the manifold pressure cap. Flush the system with fresh water, then start the refill process.

**NOTE:** The drain petcock on the heat exchanger should also be used to help drain engine coolant.

**WARNING:** Beware of the hot engine coolant. Wear protective gloves.



## Refilling the Coolant

After replacing the engine block drain plug, close the heat exchanger's coolant drain. Then pour clean, premixed coolant into the manifold and when the coolant is visible in the manifold, start the engine and run it at slow idle.

**NOTE:** Open the air-bleed petcock on the thermostat housing. When a steady flow of coolant appears at the petcock, close the petcock and fill the system until the manifold remains full.

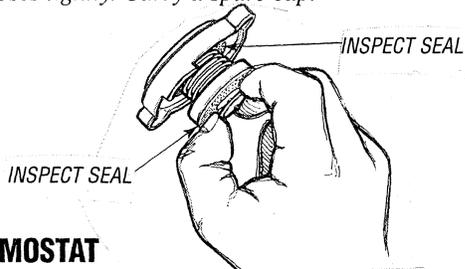
Monitor the coolant in the manifold and add as needed. Fill the manifold to the filler neck and install the manifold pressure cap.

Remove the cap on the coolant recovery tank and fill with coolant mix to halfway between LOW and MAX and replace the cap. Run the engine and observe the coolant expansion flow into the recovery tank.

After checking for leaks, stop the engine and allow it to cool. Coolant should draw back into the cooling system as the engine cools down. Add coolant to the recovery tank if needed. Clean up any spilled coolant.

# COOLING SYSTEM

**NOTE:** Periodically check the condition of the manifold pressure cap. Ensure that the upper and lower rubber seals are in good condition and check that the vacuum valve opens and closes tightly. Carry a spare cap.



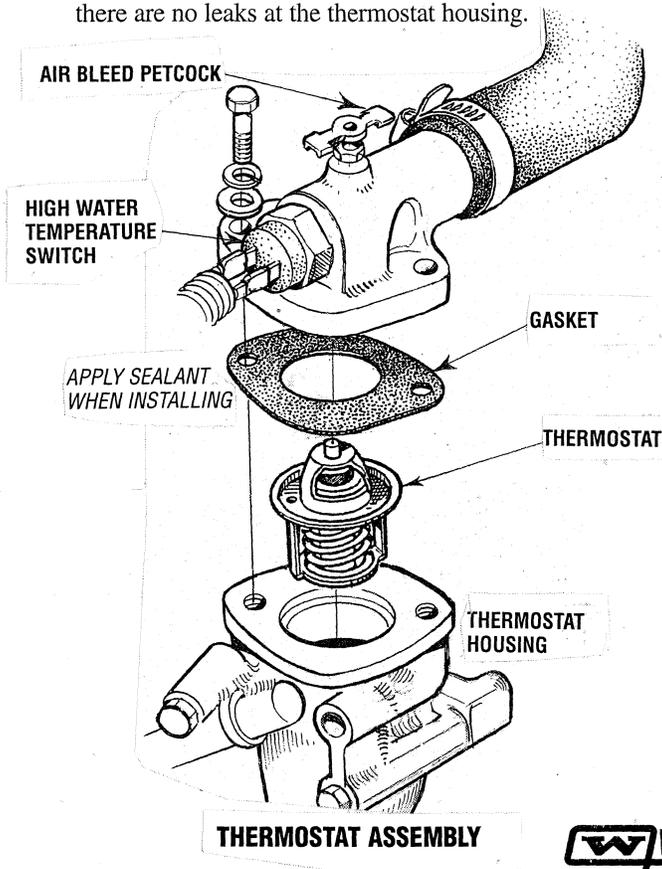
## THERMOSTAT

A thermostat, located near the manifold at the front of the engine, controls the coolant temperature as the coolant continuously flows through the closed cooling circuit. When the engine is first started, the closed thermostat prevents coolant from flowing (some coolant is by-passed through a hole in the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens. The thermostat is accessible and can be checked, cleaned, or replaced easily. Carry a spare thermostat and gasket.

## Replacing the Thermostat

Remove the cap screws and disassemble the thermostat housing as shown. When installing the new thermostat and gasket, apply a thin coat of sealant on both sides of the gasket before pressing it into place. Do not over-tighten the cap screws.

Run the engine and check for normal temperatures and that there are no leaks at the thermostat housing.

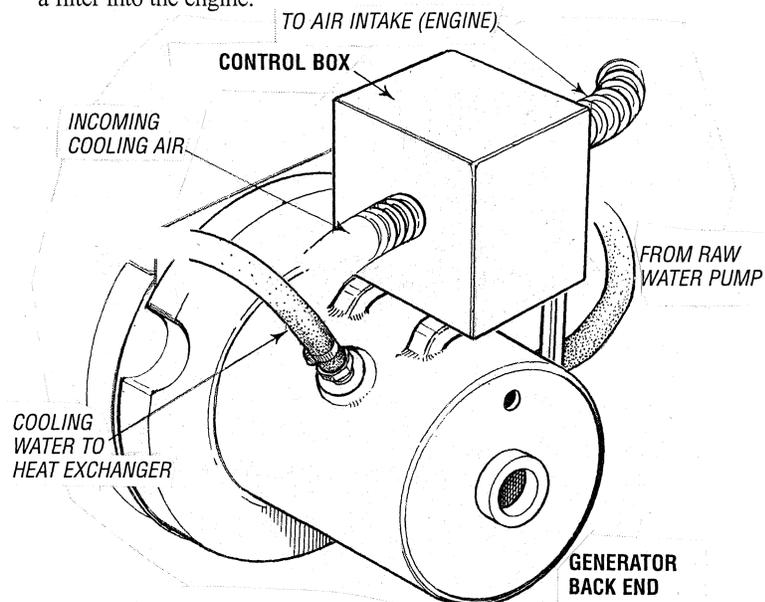


## COOLANT TEMPERATURE SWITCH

The coolant temperature switch is located near the thermostat housing (see illustration). If the coolant's operating temperature reaches approximately 210° F (99° C) this switch will light up the red (LED) engine overheat indicator on the control panel and shut down the generator.

## AIR COOLING

Cooling air is continuously circulated (by air hose) thru the control panel and around to the engine air intake where it passes thru a filter into the engine.



## RAW WATER COOLING CIRCUIT

The raw water flow is created by a positive displacement impeller pump. This pump draws water directly from the raw water source (ocean, lake, or river) through a hose to the water strainer. The raw water passes from the strainer through the raw water pump to the water cooled generator and then to the heat exchanger. The raw water passes thru the heat exchanger tubes where it cools the circulating fresh water (coolant). The raw water is then discharged into the water-injected exhaust elbow, mixing with and cooling the exhaust gasses. This mixture of exhaust gas and raw water is discharged overboard by the engine's exhaust gas discharge pressure.

# COOLING SYSTEM

## RAW WATER PUMP

The raw water pump is a self-priming, rotary pump with a non-ferrous housing and a neoprene impeller. The impeller has flexible vanes which wipe against a curved cam plate within the impeller housing, producing the pumping action. On no account should this pump be run dry as water acts as a lubricant for the impeller. There should always be a spare impeller and impeller cover gasket (an impeller kit) onboard. Raw water pump impeller failures occur when lubricant (raw water) is not present during engine operation. Such failures are not warrantable and operators are cautioned to make sure raw water flow is present at start-up. The neoprene impeller has a limited lifetime and must be inspected regularly.

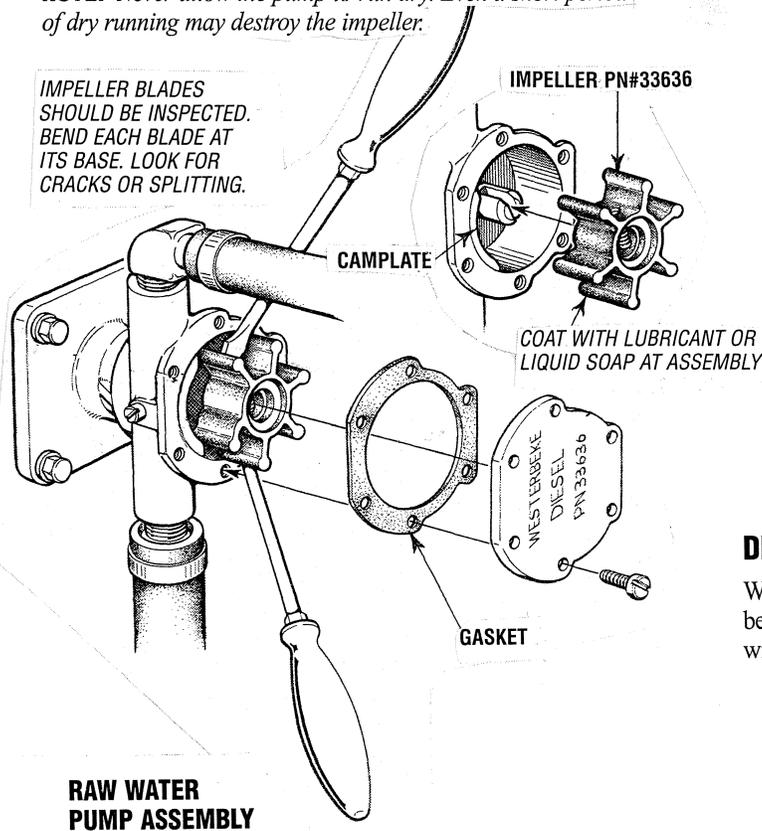
**NOTE:** Should a failure occur with the pump's internal parts (seals and bearings), it may be more cost effective to purchase a new pump and rebuild the original pump as a spare.

### Inspecting/Changing the Raw Water Pump Impeller

Close the raw water intake valve. Remove the pump cover and, with the aid of two small screwdrivers, carefully pry the impeller out of the pump. Install the new impeller and gasket. Move the blades to conform to the curved cam plate and push the impeller into the pump's housing. When assembling, apply a thin coating of lubricant to the impeller and gasket. Open the raw water intake valve.

**NOTE:** Never allow the pump to run dry. Even a short period of dry running may destroy the impeller.

IMPELLER BLADES SHOULD BE INSPECTED. BEND EACH BLADE AT ITS BASE. LOOK FOR CRACKS OR SPLITTING.



## RAW WATER INTAKE STRAINER

**NOTE:** Always install the strainer at or below the waterline so the strainer will always be self-priming.

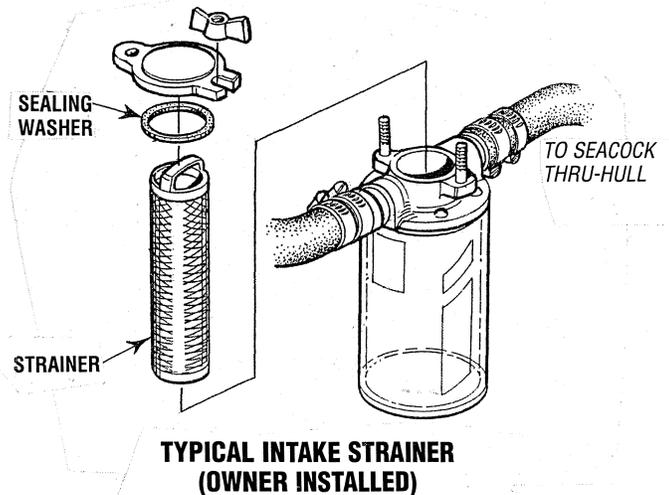
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should be clear.

Perform the following maintenance after every 100 hours of operation:

1. Close the raw water seacock.
2. Remove and clean the strainer filter.
3. Clean the glass.
4. Replace the sealing washer if necessary.
5. Reassemble and install the strainer.
6. Open the seacock.
7. Run the engine and check for leaks.

**NOTE:** Also follow the above procedure after having run hard aground.

If the engine temperature seems to be running higher than normal, the cause may be that silt, leaves or grass may have been caught up in the strainer, slowing the flow of raw water through the cooling system.



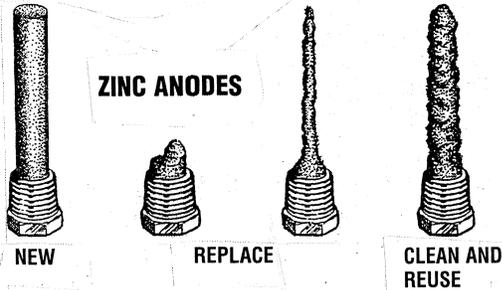
## DRAINING THE COOLING SYSTEM

When freezing temperatures are expected, the cooling system can be drained by unscrewing the pump cover. The raw water will then flush back down the inlet line.

# COOLING SYSTEM

## Zinc Anode

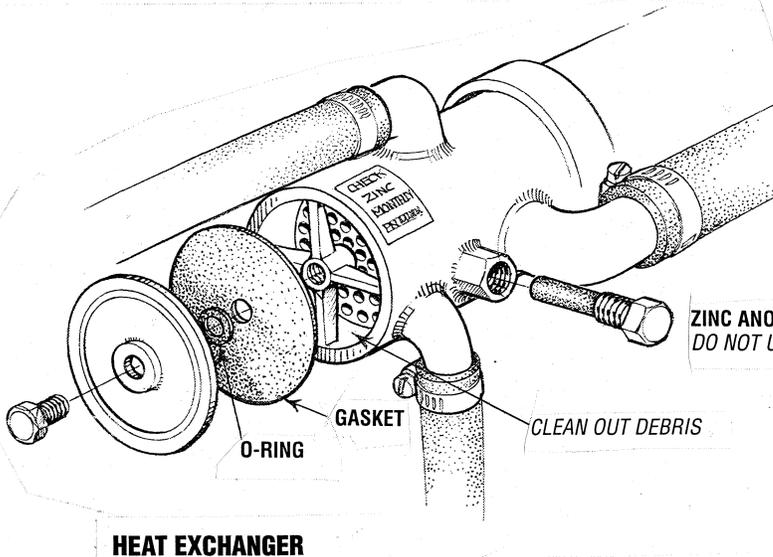
A zinc anode, or *pencil*, is located in the raw water cooling circuit within the heat exchanger. The purpose of having zinc anodes is to sacrifice them to electrolysis action taking place in the raw water cooling circuit, thereby reducing the effects of electrolysis on other components of the system. The condition of the zinc anode should be checked monthly and the anode cleaned or replaced as required. Spare anodes should be carried on board.



**NOTE:** Electrolysis action is the result of each particular installation and vessel location; not that of the engine.

If the zinc anodes need replacement, hold the hex boss into which the zinc anode is threaded with a wrench while loosening the anode with another wrench. This prevents the hex boss from possibly tearing off the exchanger shell. After removing the zinc, note the condition of it. If the zinc is in poor condition, there are probably a lot of zinc flakes within the exchanger. Remove the end of the heat exchanger and clean the inside of all zinc debris. Always have a spare heat exchanger end gasket in case the present one becomes damaged when removing the end cover. Replace the gasket (refer to your engine model's heat exchanger end gasket part number), O-ring and cover, and install a new zinc anode.

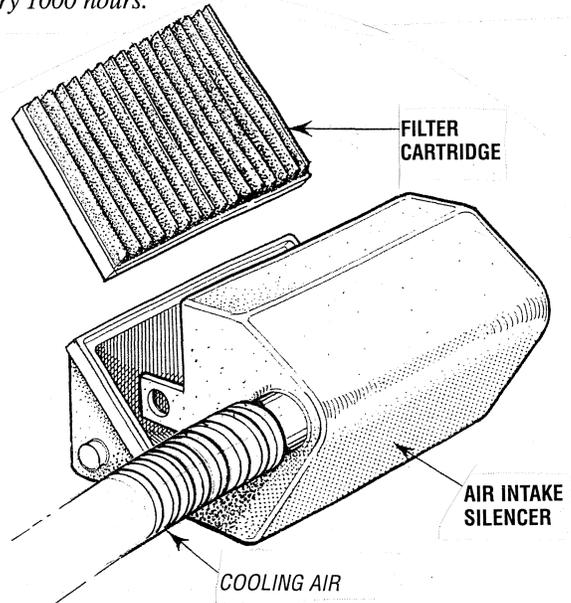
**NOTE:** The threads of the zinc anodes are pipe threads and do not require sealant. Sealant should not be used as it may insulate the zinc from the metal of the heat exchanger housing preventing electrolysis action on the zinc.



## Heat Exchanger Service

After approximately 1000 hours of operation, remove, clean and pressure test the engine's heat exchanger. (A local automotive radiator shop should be able to clean and test the heat exchanger.)

**NOTE:** Operating in silty and/or tropical waters may require that a heat exchanger cleaning be performed more often than every 1000 hours.



## AIR INTAKE/SILENCER

### Description

A marine diesel engine running at high speed will typically consume more than 6,000 cubic feet of air per hour. Not only must the engine room be well ventilated, the air flow into the engine must be unrestricted.

### Air Filter

The air filter cartridge prevents engine room dust and dirt from entering the engine, it also extends engine life, and quiets the engine.

### Maintenance

The filter should be cleaned every 100 operating hours. Tap the cartridge on a flat surface to dislodge loose dirt or clean off with compressed air. If the cartridge is badly contaminated or oily, replace it.

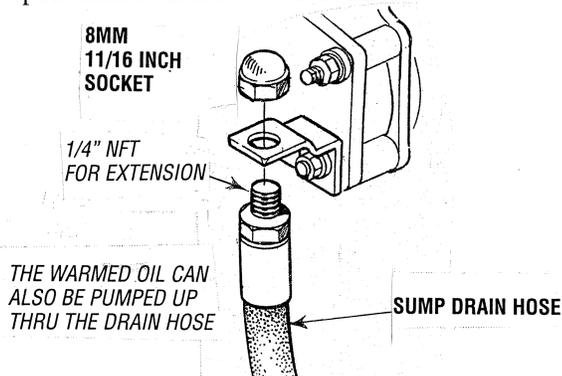
# ENGINE LUBRICATING OIL

## ENGINE OIL CHANGE

1. **Draining the oil sump.** Discharge the used oil through the sump drain hose (attached to the front of the engine) while the engine is warm. Drain the used oil completely, replace the hose in its bracket and replace the end cap securely.

**NOTE:** Thread size for the lube oil drain hose capped end is 1/4 NPT.

Always observe the used oil as it is removed. A yellow/gray emulsion indicates the presence of water in the oil. Although this condition is rare, it does require prompt attention to prevent serious damage. Call a qualified mechanic should water be present in the oil. Raw water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning of raw water through the raw water cooling circuit into the exhaust, filling the engine. This problem is often caused by the absence of an anti-siphon valve, its poor location or lack of maintenance.



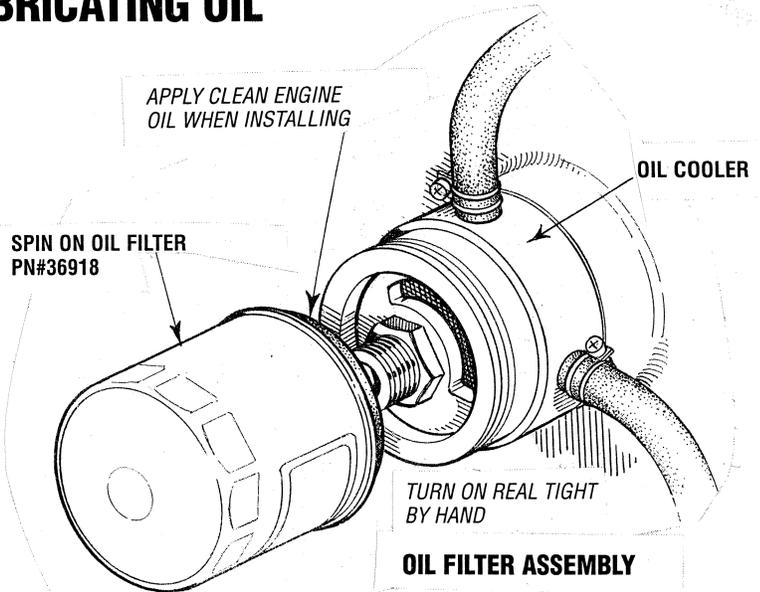
2. **Replacing the oil filter.** When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small automotive filter wrench should be helpful in removing the old oil filter.

**NOTE:** Do not punch this hole without first loosening the filter to make certain it can be removed.

Place some paper towels and a plastic bag around the filter when unscrewing it to catch any oil left in the filter. (Oil or any other fluid on the engine reduces the engine's cooling ability. Keep your engine clean.) Inspect the old oil filter as it is removed to make sure that the rubber sealing gasket comes off with the old filter. If this rubber sealing gasket remains sealed against the filter bracket, gently remove it.

When installing the new oil filter element, wipe the filter gasket's sealing surface on the bracket free of oil and apply a thin coat of clean engine oil to the rubber gasket on the new oil filter. Screw the filter onto the threaded oil filter nipple on the oil filter bracket, and tighten the filter firmly by hand.

**NOTE:** The engine oil is cooled by engine coolant flowing through passages in the oil filter bracket housing assembly.



**NOTE:** Generic filters are not recommended, as the material standards or diameters of important items on generic parts might be entirely different from genuine parts. Immediately after an oil filter change and oil fill, run the engine to make sure the oil pressure is normal and that there are no leaks around the new oil filter.

3. **Filling the oil sump.** Add new oil through the oil filler cap on the top of the engine or through the side oil fill. After refilling, run the engine for a few moments while checking the oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and stop the engine. Then check the quantity of oil with the lube oil dipstick. Fill to, but not over the high mark on the dipstick, should the engine require additional oil.

**CAUTION:** Used engine oil contains harmful contaminants. Avoid prolonged skin contact. Clean skin and nails thoroughly using soap and water. Launder or discard clothing or rags containing used oil. Discard used oil properly.

2. Remove the fuel return line in its entirety from the top of the injector. Take care not to lose the two sealing washers and banjo bolt that attaches the fuel return line to the injector.

## OIL PRESSURE

The engine's oil pressure, is constantly monitored by the control panel. The red light will illuminate and the generator will shutdown if the oil pressure fall below 5 psi. Do not restart the generator without checking the oil and finding the problem. Refer to **TESTING THE OIL PRESSURE** in this manual.

**NOTE:** A newly started, cold engine can have an oil pressure reading upwards of 60 psi. A warmed engine can have an oil pressure reading as low as 35 psi. These readings will vary depending upon the temperature of the engine and the load placed on the generator.

# FUEL SYSTEM

## DIESEL FUEL

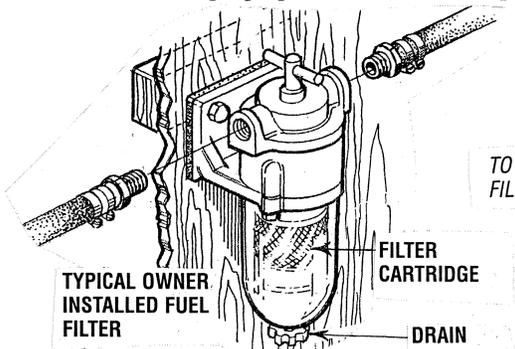
Use No. 2 diesel fuel with a cetane rating of 45 or higher. Do not use kerosene or home heating fuel.

## FUEL FILTER/WATER SEPARATOR

A primary fuel filter of the water separating type must be installed between the fuel tank and the engine to remove water and other contaminants from the fuel before they can be carried to the fuel system on the engine.

Most installers include a fuel filter/water separator with the installation package as they are aware of the problems that contaminants in the fuel can cause.

A typical fuel filter/water separator is illustrated below. This is the *Raycor Model 500 MA*. Keep in mind that if a water separator type filter is not installed between the fuel supply tank and engine-mounted fuel system, any water in the fuel will affect the fuel pump, engine filter, and injection equipment. The owner/operator is responsible for making certain the fuel reaching the engine's injection equipment is free of impurities. This process is accomplished by installing and maintaining a proper fuel filter/water separator.



## FUEL INJECTION PUMP

The fuel injection pump is a very important component of the diesel engine, requiring the utmost care in handling. The fuel injection pump has been thoroughly bench-tested and the owner-operator is cautioned not to attempt to service it. If it requires servicing, remove it and take it to an authorized fuel injection pump service facility. Do not attempt to disassemble and repair it.

The only adjustment the servicing mechanic should make to the fuel injection pump is the adjustment for engine idle speed.

## FUEL LIFT PUMP

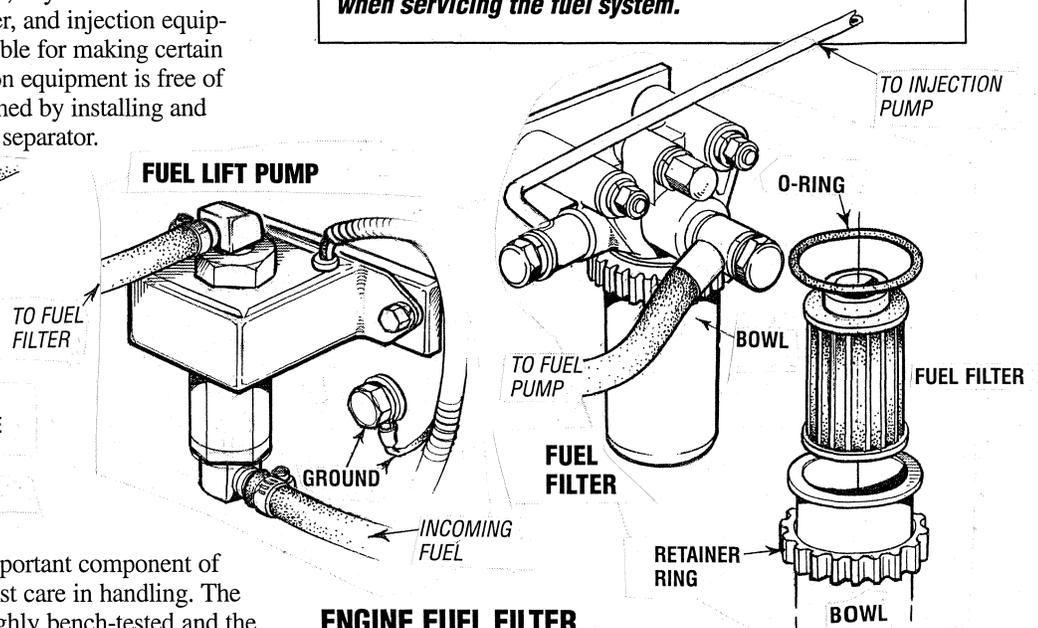
Periodically check the fuel connections to and out of the pump and make sure that no leakage is present and that the fittings are tight and secure. The DC ground connection at one of the pump's mounting bolts should be clean and well secured by the mounting bolt to ensure proper pump operations.

When energized thru the preheat circuit, the fuel lift pump will purge air from the fuel system and provide a continuous flow of fuel as the engine is running.

## FUEL FILTERS

The fuel injection pump and the fuel injectors are precisely manufactured and they must receive clean diesel fuel, free from water and dirt. To ensure this flow of clean fuel, the fuel must pass through at least two fuel filters, a fuel filter/water separator and the engine's spin-on fuel filter. Visually inspect, clean, and change these filters according to the maintenance schedule in this manual.

**⚠ WARNING:** Shut off the fuel valve at the tank when servicing the fuel system. Take care in catching any fuel that may spill. DO NOT allow any smoking, open flames or other sources of fire near the fuel system when servicing. Ensure proper ventilation exists when servicing the fuel system.



## ENGINE FUEL FILTER

Periodically check the fuel connections and the bowl for leakage. Replace the filter element after the first 50 hours then follow the *MAINTENANCE SCHEDULE*.

## Changing/cleaning the filter element

1. Shut off the fuel supply.
2. Unscrew the retainer ring that holds the filter bowl to the housing and allow the bowl to come away from the housing.
3. Remove and replace the filter element and clean the bowl.
4. Replace the sealing "O" ring and reassemble the bowl to the housing. Thread the retainer ring on carefully so as not to cross thread. When retainer contacts the "O" ring, tighten 1/4 - 1/2 turns by hand. Open the fuel supply and run the engine to inspect for leaks.

# GLOW PLUGS

## DESCRIPTION

The glow plugs are wired through the preheat solenoid. When the START button is pressed at the control panel this solenoid should "click" on and the glow plugs should begin to get hot.

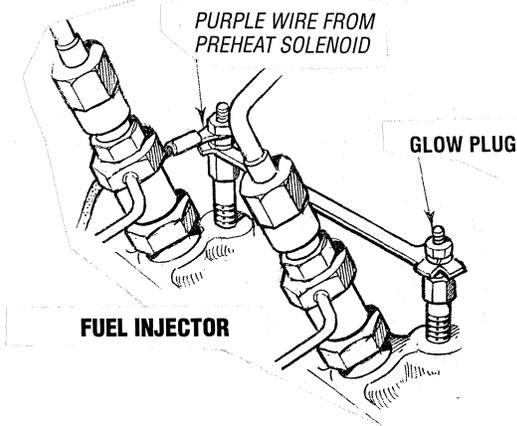
## INSPECTION

To inspect the plug, remove the electrical terminal connections, then unscrew or unclamp each plug from the cylinder head. Thoroughly clean each plug's tip and threads with a soft brush and cleaning solution to remove all the carbon and oil deposits. While cleaning, examine the tip for wear and burn erosion; if it has eroded too much, replace the plug.

## TESTING

An accurate way to test glow plugs is with an ohmmeter. Touch one prod to the glow plug's wire connection, and the other to the body of the glow plug, as shown. A good glow plug will have a 1.0 - 1.5 ohm resistance. This method can be used with the plug in or out of the engine. You can also use an ammeter to test the power drain (8 - 9 amps per plug).

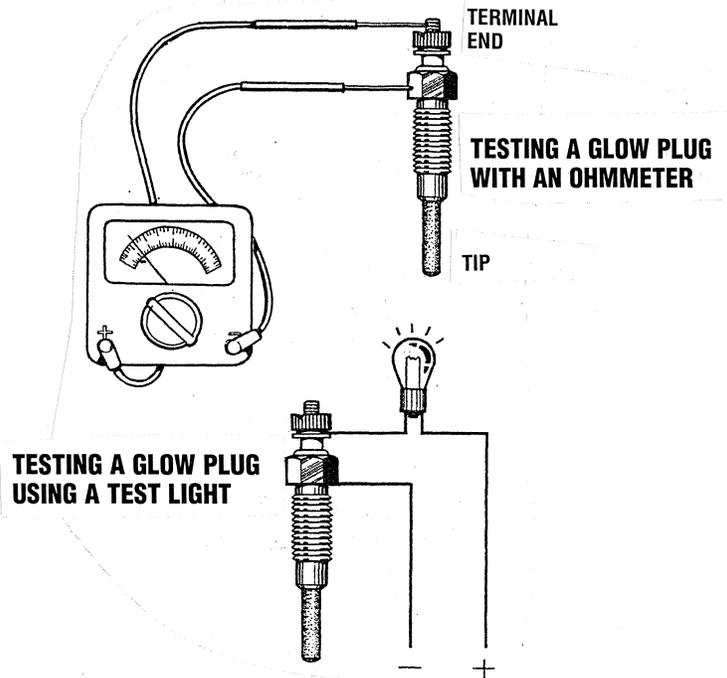
**⚠ WARNING:** *These glow plugs will become very hot to the touch. Be careful not to burn your fingers when testing the plugs.*



Re-install the plugs in the engine and test them again. The plugs should get very hot (at the terminal end) within 20 to 25 seconds. If the plugs don't heat up quickly, check for a short circuit. When reinstalling the glow plugs, use anti-seize compound on the threads.

**⚠ WARNING:** *Do not keep a glow plug on for more than 30 seconds.*

Glow Plug Tightening Torque 1.5 - 2.0 lb-ft (10-14 kg-m)



# STARTER MOTOR

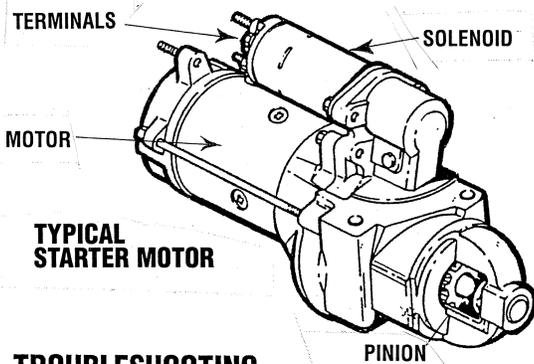
## DESCRIPTION

The starting system includes the battery, starter motor, solenoid, and starter button.

When the starter button on the instrument panel is depressed, current flows and energizes the starter's solenoid coil. The energized coil becomes an electromagnet, which pulls the plunger into the coil, and closes a set of contacts which allow high current to reach the starter motor. At the same time, the plunger also serves to push that starter pinion to mesh with the teeth on the flywheel.

To prevent damage to the starter motor when the engine starts, the pinion gear incorporates an over-running (one-way) clutch which is splined to the starter armature shaft. The rotation of the running engine may speed the rotation of the pinion but not the starter motor itself.

Once the started button is released, the current flow ceases, stopping the activation of the solenoid. The plunger is pulled out of contact with the battery-to-start cables by a coil spring, and the flow of electricity is interrupted to the starter. This weakens the magnetic fields and the starter ceases its rotation. As the solenoid plunger is released, its movement also pulls the starter drive gear from its engagement with the engine flywheel.



**TYPICAL STARTER MOTOR**

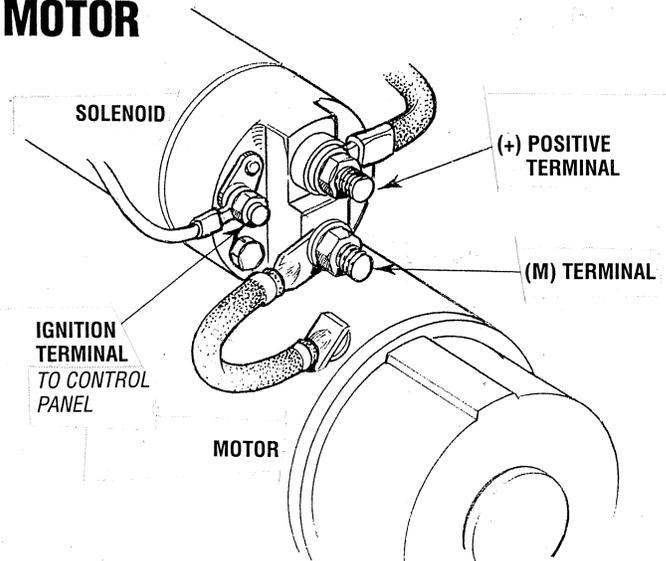
## TROUBLESHOOTING

Prior to testing, make certain the ship's batteries are at full charge and that the starting system wiring connections (terminals) are clean and tight. Pay particular attention to the ground wire connections on the engine block.

To check the wiring, try cranking the starter for a few seconds, never more than 10 seconds at a time, then run your hand along the wires and terminals looking for warm spots that indicate resistance. Repair or replace any trouble spots.

Using a multimeter, test the voltage between the positive terminal stud on the start solenoid and the engine block (ground).

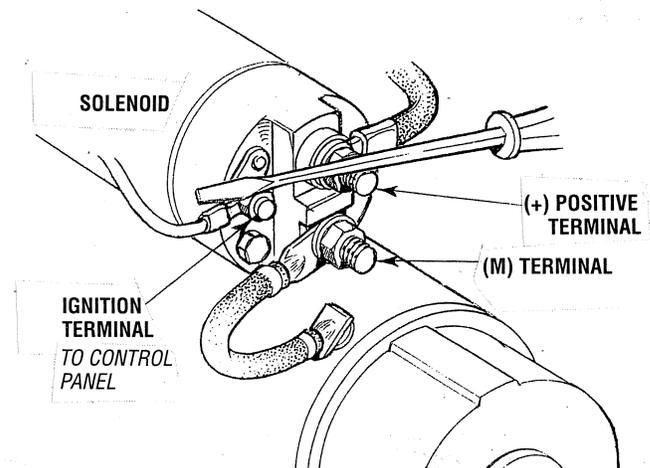
If you read 12 volts, the starter is faulty.



To test the ignition circuit, locate the ignition(s) terminal (it is one of the small terminal studs and is wired to the ignition circuit). Use a screwdriver, don't touch the blade, to jump from that ignition terminal to the positive battery connection terminal on the solenoid.

**If the starter cranks, the fault lies with the ignition circuit.**

**If the solenoid clicks but nothing else happens, the starter motor is probably faulty.**

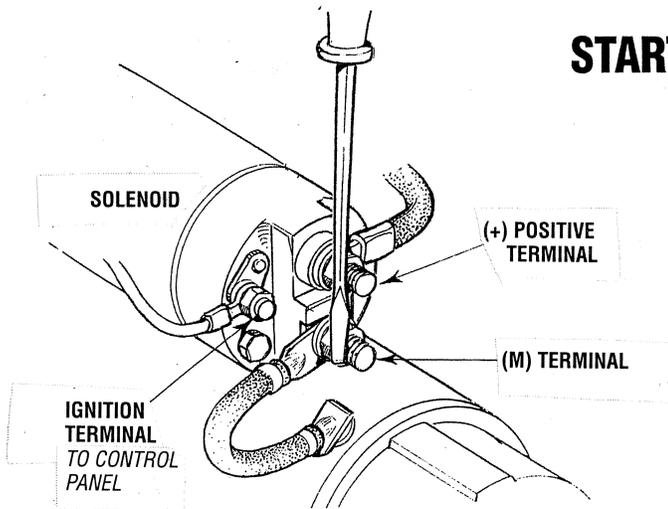


**If nothing at all happens the solenoid isn't getting current.**

Check the battery isolation switch and inspect the wiring connections. It is also possible that the solenoid is defective.

**⚠ WARNING: There will be arcing and sparks will fly when jumping terminals. Be certain the engine space is free of potentially explosive fumes, especially gasoline.**

# STARTER MOTOR



Test again by jumping the two large terminal studs. Hold the screwdriver blade firmly between the studs. Do not allow the screwdriver blade to touch the solenoid or starter casing, this would cause a short.

**⚠ WARNING:** *There will be arcing as the full starting current should be flowing thru the blade of the screwdriver.*

If the starter spins, the solenoid is faulty.

If the starter fails to spin, the motor is probably faulty.

If no arcing occurred. There is no juice reaching the solenoid.

**NOTE:** *Starter motors are either inertia type or pre-engaged. In the pre-engaged model, the solenoid also moves an arm that engages the starter motor to the flywheel of the engine. Using a screwdriver to bypass the solenoid on such a starter will run the motor without engaging the flywheel. Turn the starter switch on to provide the power to the solenoid. Hopefully it will create enough magnetic field for the arm to move even though the contacts inside the solenoid are bad.*

## SERVICE

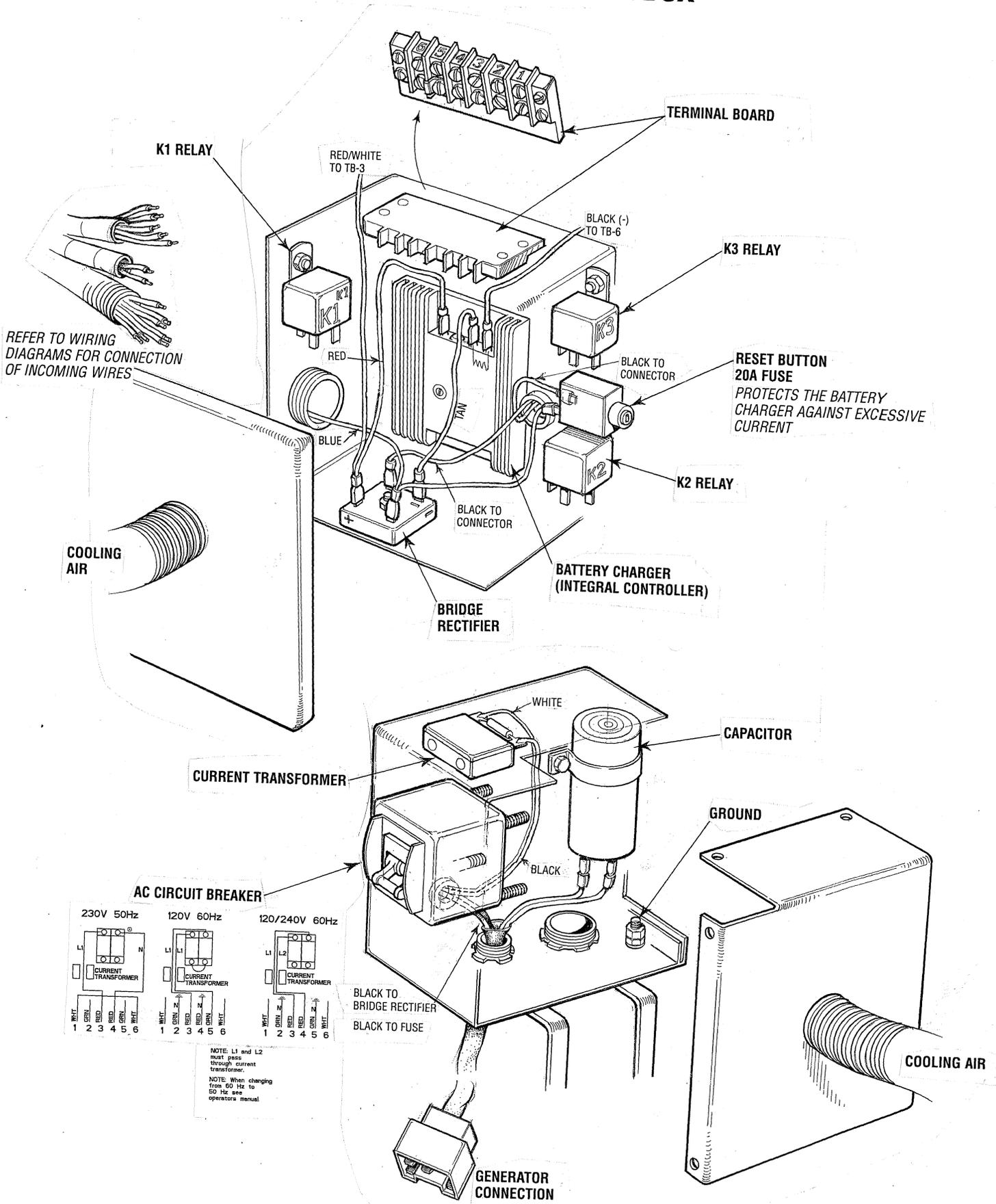
Westerbeke uses a standard marine starter motor which can be serviced or rebuilt at any starter motor automotive service center.

If replacing the starter motor, make certain the new motor is certified for marine use. Automotive starters do not meet USCG standards. If in doubt, contact your WESTERBEKE dealer.

## TO REMOVE FOR SERVICE

1. Disconnect the negative battery cable.
2. If necessary, remove any components to gain full access to the starter motor.
3. Label and disconnect the wiring from the starter. (Do not allow wires to touch, tape over the terminals).
4. Remove the starter mounting bolts.
5. Remove the starter from the engine. In some cases the starter will have to be turned to a different angle to clear obstructions.

# 8 KW BCDT CONTROL BOX



# 12 VOLT DC CONTROL CIRCUIT

## DESCRIPTION

The engine has a 12 volt DC electrical control circuit that is shown on the wiring diagrams that follow. Refer to these diagrams when troubleshooting or when servicing the DC electrical system on the engine.

**CAUTION:** To avoid damage to the battery charging circuit, never shut off the engine battery switch while the engine is running. Shut off the engine battery switch, however, to avoid electrical shorts when working on the engine's electrical circuit.

## INTEGRAL CONTROLLER (I.C.)

The Integral Controller (I.C.) is an encapsulated, solid-state unit that supplies a DC charging voltage to the generator's starting battery while the generator is operating.

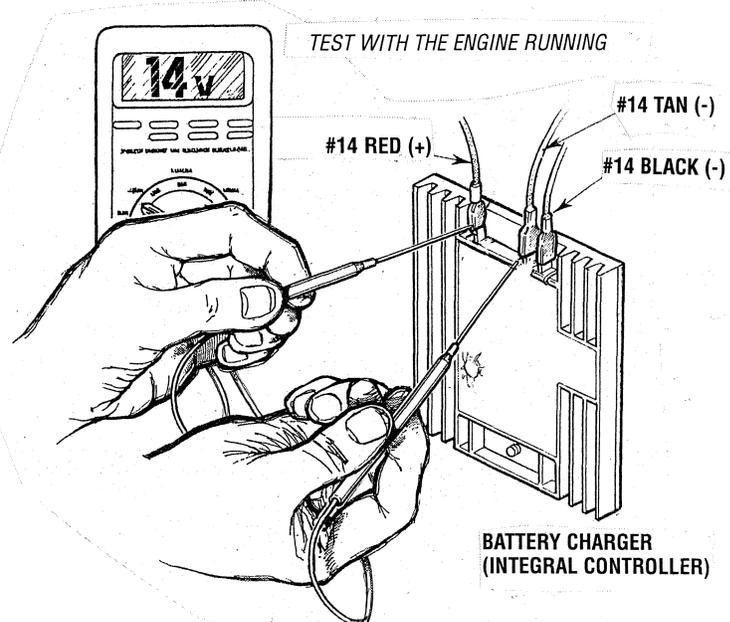
**Charging Voltage:** 13.0 - 14.0 volts DC

**Charging Amperage:** 0 - 10- amps DC

A separate group of stator windings supplies AC voltage to a bridge rectifier which converts the AC current to supply the I.C. unit. The I.C. unit senses the needs of the starting battery and supplies a DC charge when one is needed. If you suspect that the I.C. unit is faulty (that is, if the battery's charge is low), check the charging circuit and its components as described in the following steps. Check all connections for cleanliness and tightness including the ground before replacing the I.C. unit.

**NOTE:** When the generator is first started, the I.C. unit will produce a low charging rate. This charging rate will rise as the generator is operated.

The IC is mounted inside the generator control box. There is a voltage output adjustment on the controller that will allow a DC voltage output adjustment of  $\pm 2$  volts.



## TESTING THE INTEGRAL CONTROLLER (I.C.)

To test the battery charger, put a multimeter between the positive (+) and negative (-) leads to the battery. It should indicate 13.5V to 14V with the engine running. If only the battery voltage is indicated, check that the battery charger terminal connections are tight. With the unit running, test again between the (+) and (-) terminals for the 13.5V to 14V. If no charge is indicated, replace the charger.

## BATTERY SPECIFICATION

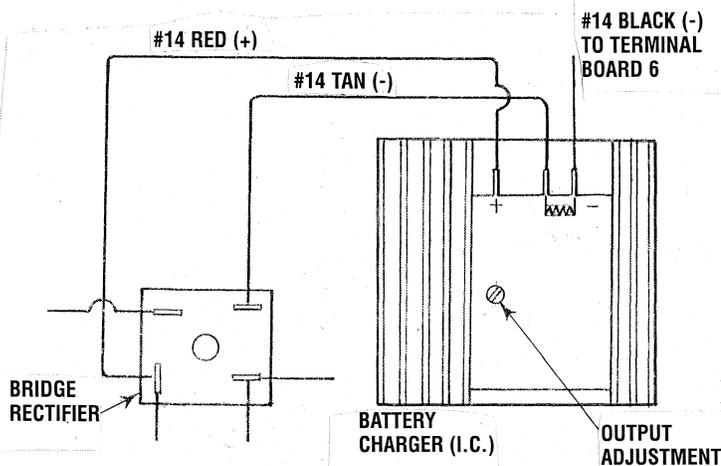
The minimum recommended capacity of the battery used in the engine's 12-volt DC control circuit is 170 Cold Cranking Amps (CCA).

## Battery Care

Review the manufacturer's recommendations and then establish a systematic maintenance schedule for your engine's starting batteries and house batteries.

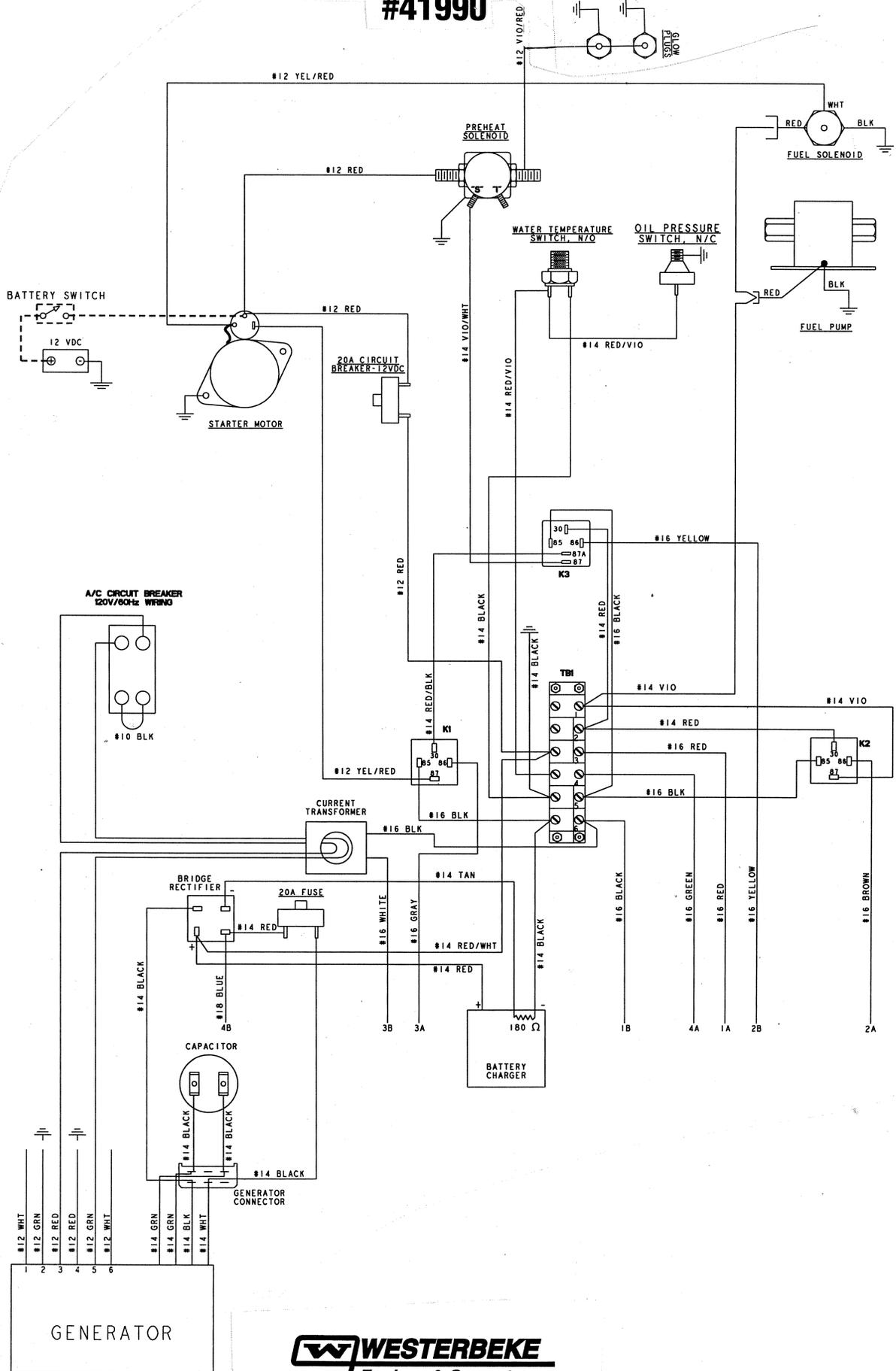
- Check the electrolyte level and specific gravity with a hydrometer.
- Use only distilled water to bring electrolytes to a proper level.
- Make certain the battery cable connections are clean and tight to the battery posts (and to your engine).
- Keep your batteries clean and free of corrosion.

**WARNING:** Sulfuric acid in lead batteries can cause severe burns on skin and damage clothing. Wear protective gear.

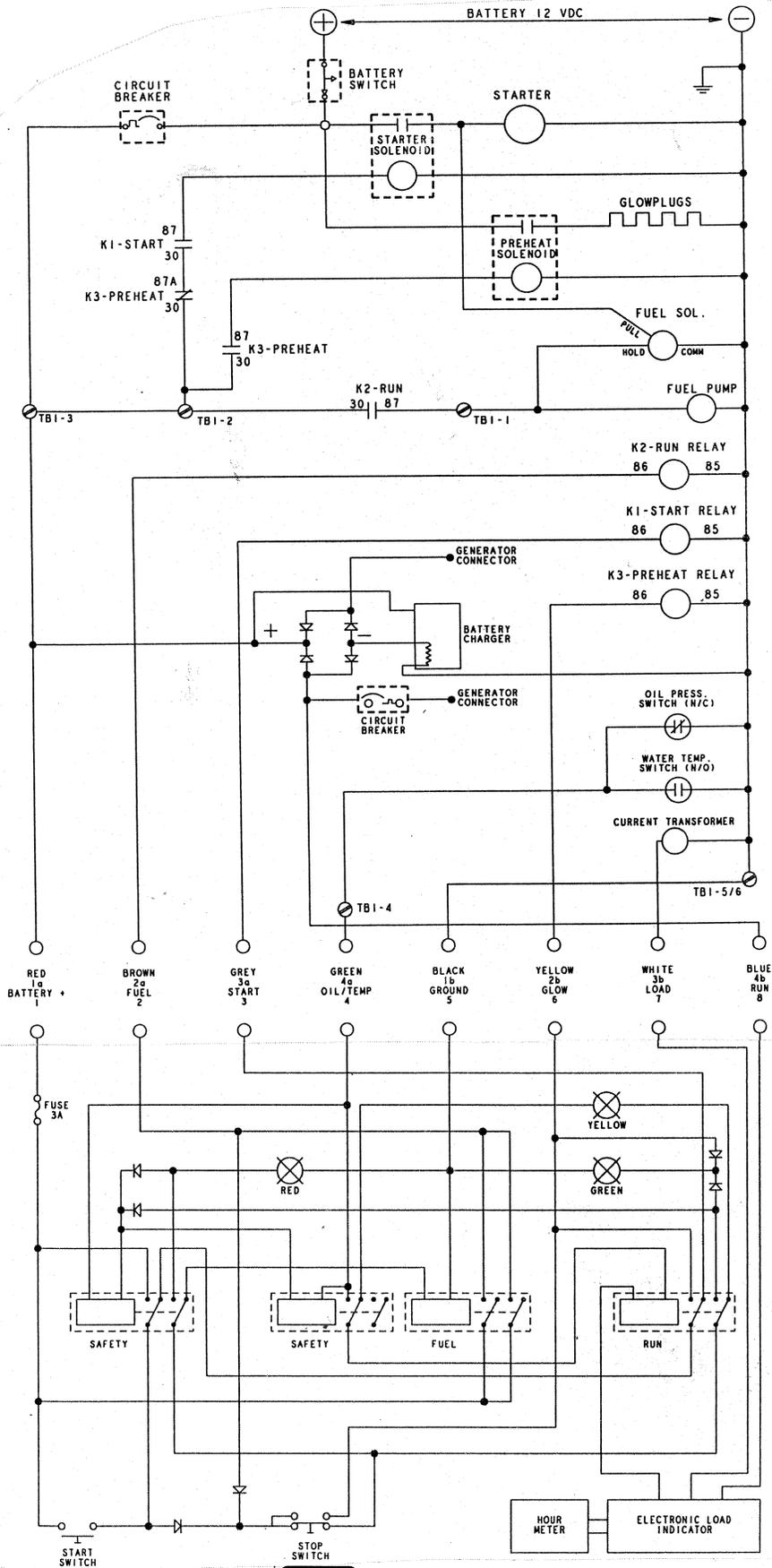


# 8 KW BCDT WIRING DIAGRAM

#41990



# 8 KW BCDT WIRING SCHEMATIC #41990



# ENGINE ADJUSTMENTS

**NOTE:** WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.

## GENERATOR FREQUENCY ADJUSTMENT (HERTZ)

Once the diesel generator set has been placed in operation, there may be adjustments required for engine speed (Hertz) during the engine's break-in period (first 50 hours) or after this period. A no-load voltage adjustment may also be required in conjunction with the engine's speed adjustment. These are not warrantable adjustments as they relate to normal break-in and maintenance.

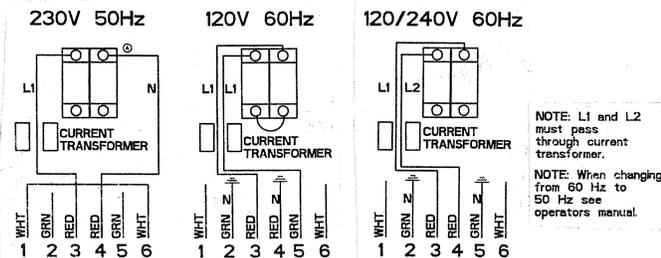
Frequency is a direct result of engine/generator speed, as indicated by the following:

**When the generator is run at 1800 rpm, the AC voltage output frequency is 60 Hertz.**

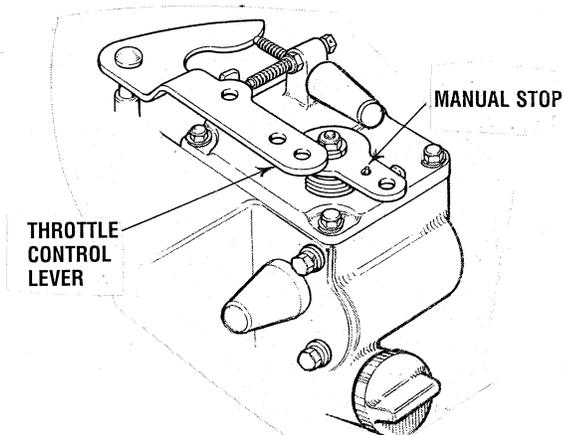
**When the generator is run at 1500 rpm, the AC voltage output frequency is 50 Hertz.**

Therefore, to change the generator's frequency, the engine speed *must* be changed. To accomplish the frequency change, perform the following:

1. With the engine stopped, connect the AC output leads to the AC terminal block in accordance with the voltage connection diagram shown here. (This diagram is also affixed inside the control box).



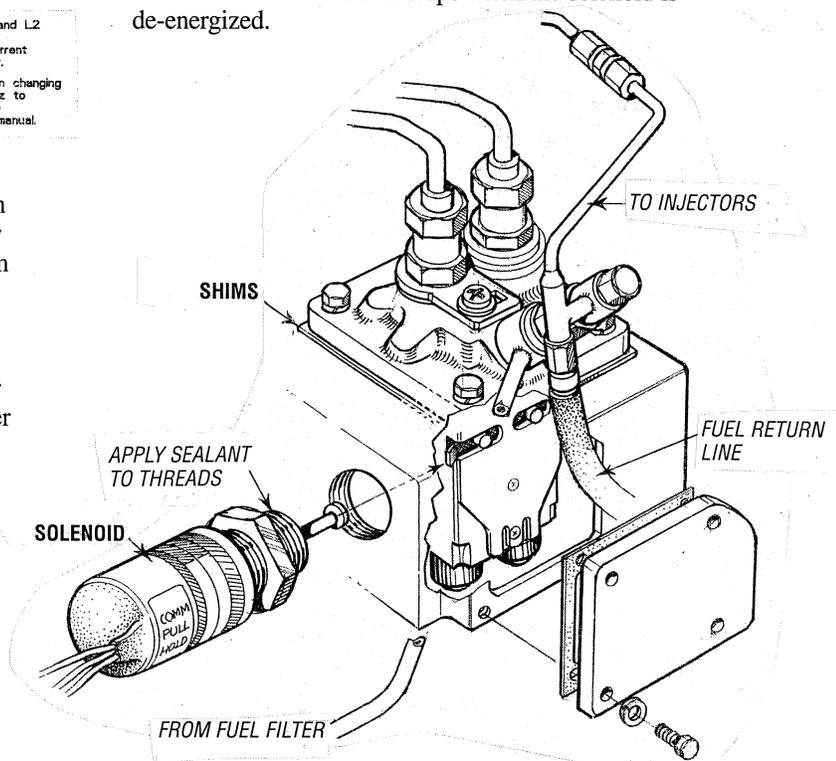
2. Start the engine and adjust the engine's speed to obtain the frequency corresponding to the voltage selected by adjusting the stop bolts and positioning the throttle arm against these stop bolts to either increase or decrease engine no-load speed to adjust the Hertz produced.
3. To arrive at the appropriate frequency, either monitor the speed of the engine/generator with a tachometer, or monitor the frequency with a frequency meter, the latter method being the more precise of the two.



## FUEL RUN SOLENOID

The fuel run solenoid is mounted in a threaded hole on the engine's block just aft of and below the engine's fuel injection pump. Proceed as follows when installing a replacement or new fuel run solenoid.

1. Visual access to the fuel injection pump's fuel rack is needed. To obtain this, remove the small square side cover and gasket just below the fuel injection pump.
2. Thread the locknut onto the solenoid and then apply a small amount of Teflon sealant to the threads on the solenoid.
3. Thread the solenoid into the hole on the engine and observe the solenoid plunger through the cover opening. Allow the plunger to contact the fuel rack and move fully into the injection pump. Do not thread further so as to push the plunger into the solenoid.
4. Back the solenoid out 1/4 - 1/2 of a turn and secure it in position with the locknut.
5. Properly connect the three electrical leads from the solenoid. Two of the connections plug into the engine harness and the third grounds to the engine block at an adjacent inboard threaded hole with a 8mm bolt.
6. Reassemble the cover and gasket and test run the unit. Make certain that the unit stops when the solenoid is de-energized.



# ENGINE ADJUSTMENTS

**NOTE:** WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.

## DRIVE BELT ADJUSTMENT

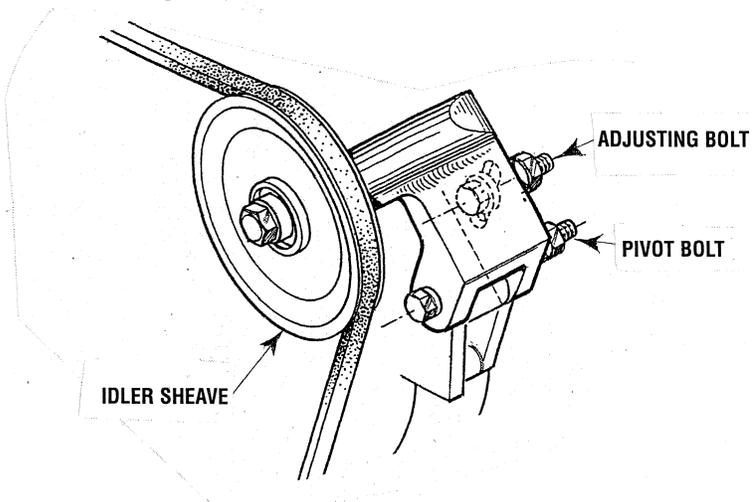
Excessive drive belt tension can cause rapid wear of the belt and reduce the service life of the fresh water pump's bearing. A slack belt or the presence of oil on the belt can cause belt slipping, resulting in high operating temperatures.

The drive belt is properly adjusted if the belt can be deflected no less than 3/8 inch (10mm) and no more than 1/2 inch (12mm) as the belt is depressed with the thumb at the midpoint between the two pulleys on the longest span of the belt. A spare belt or belts should always be carried on board.

**⚠ WARNING:** Never attempt to check or adjust the drive belt's tension while the engine is in operation.

## Adjusting Belt Tension

1. Loosen the pivot bolt that holds the idler sheave and loosen the adjusting bolt.
2. With the belt loose, inspect for wear, cracks and frayed edges.
3. Pivot the idler sheave to the left or right as required, to loosen or tighten.
4. Tighten the pivot bolt and the adjusting bolt.
5. Operate the generator for about 5 minutes and then shut the generator down and recheck the belt tension.



## TORQUING THE CYLINDER HEAD BOLTS

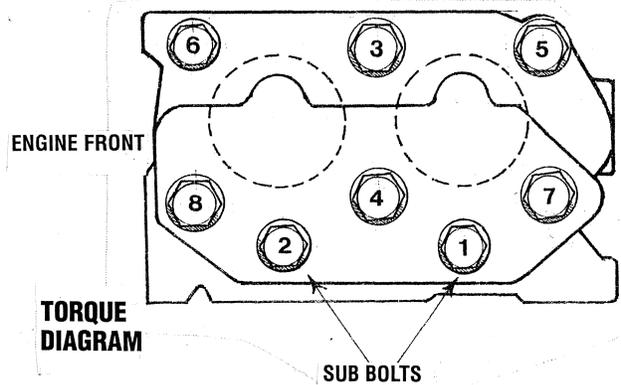
After the initial break-in period (approximately 50 hours) and every 500 hours thereafter, the cylinder head bolts should be re-torqued.

Tighten the cylinder head bolts according to the sequence shown. Make sure the engine is cold when this is done. Before applying the specified torque to the bolt, loosen it 1/4 to 1/2 of a turn and then apply the torque. Follow this procedure according to the numbered sequence shown in the illustration to the right.

Bolts #1 and #2, (12mm socket) 14 ~ 22 ft-lb.

Bolts #3, 4, 5, 6, 7, 8 (14mm socket) 54 ~ 61 ft-lb

Rockershaft Hold Down Bolts - (12mm socket) 11 ~ 16 ft-lb.



## ENGINE COMPRESSION

Check the engine's compression pressure at 600 operating hours or whenever engine performance is reduced. Remove each glow plug and check each cylinder's compression pressure. The engine's cranking speed is at 280 rpm.

Compression values:

Standard	Minimum
397.6 psi (28 kg/cm <sup>2</sup> )	312.4 psi (22 kg/cm <sup>2</sup> )

The maximum acceptable difference between cylinders is 35.5 psi (3.5 kg/cm<sup>2</sup>).

## TESTING OIL PRESSURE

Oil pressure will vary depending on the engine temperature and the load placed on the generator. If you suspect an oil pressure problem, remove the oil pressure switch and install a mechanical gauge in its place. After allowing the generator to warm up, read the gauge and it should indicate about 50 psi and steady at 3600 (or 3000) RPM.

# ENGINE ADJUSTMENTS

**NOTE:** WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.

## Injection Pump Timing Adjustment (Spill Timing)

If your engine's fuel injection timing is not properly adjusted, the engine will not operate properly, and may be difficult to start. Have the injection pump delivery rate checked by a well-established fuel injection shop. Adjust the injection as follows:

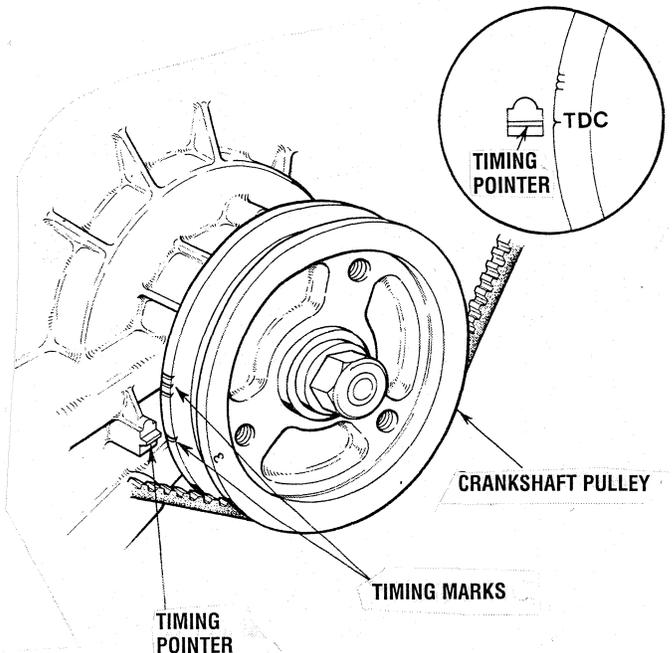
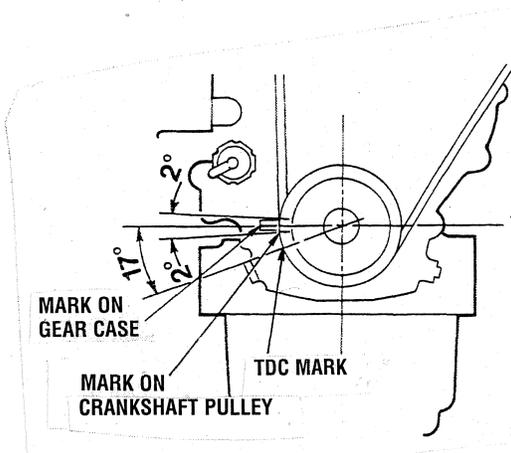
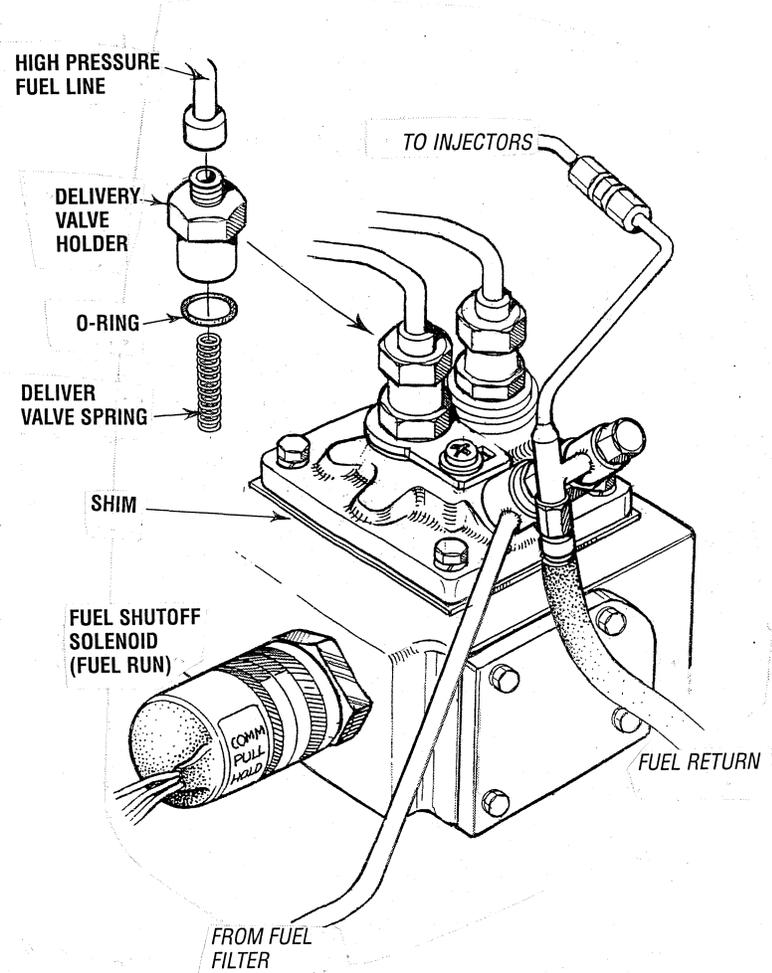
**NOTE:** The fuel shut-off lever must be in the **RUN** position while making the adjustment or no fuel will flow from the fuel injection pump.

1. Remove the high pressure fuel line from between the No. 1 injector and the No. 1 fuel delivery valve holder.
2. Remove the No. 1 fuel delivery valve holder over "O" ring and remove the delivery valve spring beneath the holder.
3. Reinstall only the delivery valve holder and reattach the high pressure fuel line to the delivery holder. Attach it so that the end that would connect to the fuel injector is pointing away from the engine fuel will flow from this line during the timing check.

Rotate the engine's crankshaft in its normal direction of rotation to position piston the No. 1 at the beginning of its compression stroke.

Move the throttle lever to its full open position and operate the electric lift pump. Slowly rotate the crankshaft clockwise (as viewed from the front), catching the fuel from the No. 1 fuel line, until the instant the fuel completely stops flowing (no drips). At this instant, the 19° BTDC timing mark on the crankshaft pulley should be directly aligned with the timing indicator on the front of the gear case  $\pm .5$  degrees.

If the specified injection timing (19° BTDC) cannot be attained, adjust the timing by increasing or decreasing the thickness of shim material under the injection pump's mounting flange to change the injection timing point. Changing the shim thickness by 0.004 inch (0.01mm) changes the injection timing by approximately one degree. To advance the timing, decrease the shim thickness, as required. To retard the timing, increase the shim thickness, as required. Refer to your generator's Parts List for shim part numbers.



# ENGINE ADJUSTMENTS

**NOTE:** WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.

## VALVE CLEARANCE ADJUSTMENT

**NOTE:** Retorque the cylinder head bolts before adjusting the engine's valves. See TORQUING THE CYLINDER HEAD BOLTS.

**⚠ WARNING:** Adjust the valve clearance when the engine is cold. Valves are adjusted by cylinder in the firing order of the engine. Tighten the cylinder head bolts to the specified torque before adjusting the valves.

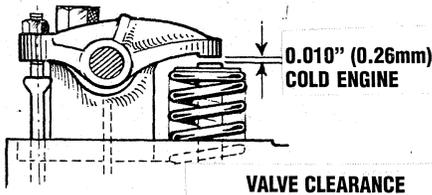
Pull off the air breather pipe from the rocker cover, and take off the rocker cover bolts and the rocker cover to expose the rocker shaft and valve assembly.

Remove the glow plugs from each of the cylinders to enable the engine to be easily rotated by hand to position each cylinder for valve adjustment.

Valves are adjusted with the piston in the cylinder being adjusted at TDC (top dead center) of its compression stroke.

**Valve adjustment beginning with cylinder #1.** Rotate the crankshaft slowly and observe the operation of the valves for cylinder #1. Watch for the intake valve to open indicating the piston is on its intake stroke (the piston is moving down in the cylinder). Continue to rotate the crankshaft slowly and look for the intake valve to close. This indicates the piston is now starting its compression stroke (the piston is moving up in the cylinder towards TDC).

Align the TDC mark on the crankshaft front pulley with the timing marker on the front gear case cover when positioning the #1 Piston at TDC of its compression stroke. Confirm this by rotating the crankshaft approximately 20 degrees before and after this point and the two valves for the #1 cylinder should not move.



Adjust the valves in #1 cylinder for both intake and exhaust. Proceed to the #2 cylinder.

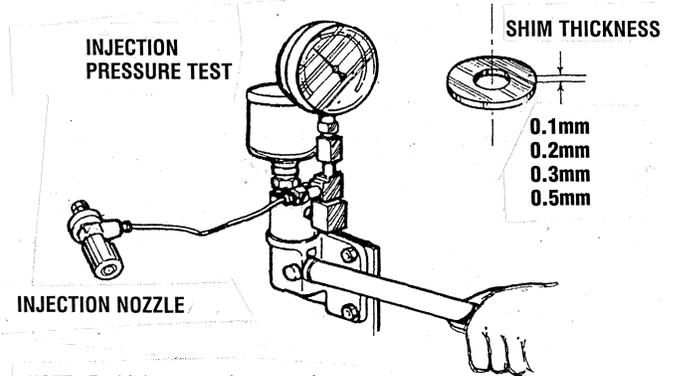
Rotate the crankshaft 240 degrees in normal direction of rotation and adjust the #2 cylinder.

Adjust each valve's clearance by inserting a 0.010 inch (0.25mm) feeler gauge between the rocker arm and the valve stem. Make sure to adjust all valves while the engine is cold.

Re-install the glow plugs (use anti-seize compound on the threads) and assemble the rocker cover and rocker cover belts. See the TIGHTENING TORQUE SCHEDULE in this manual.

## TESTING FUEL INJECTORS

Remove and check fuel injectors. The injector spray pressure should be 1991 psi  $\pm$  142 psi (140 kg/cm<sup>2</sup>  $\pm$  10 kg/cm<sup>2</sup>). Undesirable injector conditions, to include after dripping, should be eliminated.

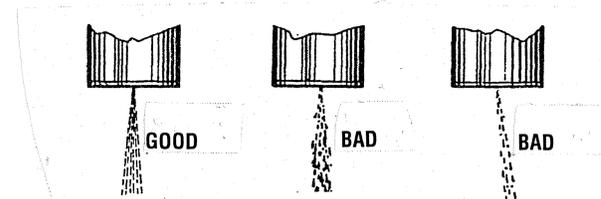


**NOTE:** Fuel injector testing must be performed in a clean room environment.



## CHATTERING TEST

For the chattering test, operate the tester level slowly. If the nozzle sprays sharply and intermittently, the nozzle is considered good. The nozzle should spray fuel straight in its axial direction. A nozzle is defective if it sprays fuel in a wrong direction, in several separate strips, or in the form of particles. These defects may sometimes be caused by clogging with dust, therefore all parts should be cleaned carefully before reassembly.



# ENGINE TROUBLESHOOTING

The following troubleshooting table describes certain problems relating to engine service, the probable causes of these problems, and the recommendations to overcome these problems.

**Note:** *The engine's electrical system is protected by a 20 amp manual reset circuit breaker located on a bracket at the rear of the engine.*

Problem	Probable Cause	Verification/Remedy
Start switch depressed, no start, no panel indications.	<ol style="list-style-type: none"> <li>1. Battery Switch not on.</li> <li>2. 20-Amp circuit breaker tripped.</li> <li>3. 10-Amp breaker tripped on preheat solenoid.</li> <li>4. Loose battery connections.</li> <li>5. Preheat solenoid not operating.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check switch and/or battery connections.</li> <li>2. Reset breaker; if breaker trips again, check preheat solenoid circuit and check circuit for shorts to ground.</li> <li>3. Check voltage at and after breaker on preheat solenoid.</li> <li>4. Check (+) connection to starter solenoid and (-) connection to engine ground stud. Check battery cable connections.</li> <li>5. Check solenoid "S" terminal for voltage.</li> </ol>
Start switch depressed, no starter engagement.	<ol style="list-style-type: none"> <li>1. Connection to solenoid faulty.</li> <li>2. Faulty switch.</li> <li>3. Faulty solenoid.</li> <li>4. Loose battery connections.</li> <li>5. Low battery.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check connection.</li> <li>2. Check switch with ohmmeter.</li> <li>3. Check that 12 volts are present at the solenoid connection.</li> <li>4. Check battery connections.</li> <li>5. Check battery charge state.</li> </ol>
START switch is depressed; panel indications OK; starter solenoid OK fuel solenoid not functioning.	<ol style="list-style-type: none"> <li>1. Poor connections to fuel solenoid.</li> <li>2. Defective fuel solenoid.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check connections.</li> <li>2. Check that 12 volts are present at the (+) connection on the fuel run solenoid.</li> </ol>
Generator engine cranks, but does not start, fuel solenoid energized.	<ol style="list-style-type: none"> <li>1. Faulty fueling system.</li> <li>2. Preheat solenoid faulty.</li> <li>3. Low battery.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check that fuel valves are open. <ol style="list-style-type: none"> <li>1a. Switch to combine house and start batteries.</li> <li>1b. Check batteries.</li> <li>1c. Fuel lift pump at injection pump may be clogged.</li> </ol> </li> <li>2. Check solenoid.</li> <li>3. Switch to combine all batteries.</li> <li>3a. Replace batteries.</li> </ol>
Battery runs down.	<ol style="list-style-type: none"> <li>1. Oil Pressure switch.</li> <li>2. High resistance leak to ground.</li> <li>3. Low resistance leak.</li> <li>4. Poor battery connections.</li> <li>5. Battery charger not charging..</li> </ol>	<ol style="list-style-type: none"> <li>1. Observe if panel lights are activated when engine is not running. Test the oil pressure switch.</li> <li>2. Check wiring. Insert sensitive (0 - .25 amp) meter in battery lines. (Do not start engine.) Remove connections and replace after short is located.</li> <li>3. Check all wires for temperature rise to locate the fault.</li> <li>4. Check cable connections at battery for loose connections, corrosion.</li> <li>5. Check connections, Test battery charger in control box.</li> </ol>
Battery not charging	<ol style="list-style-type: none"> <li>1. DC charge circuit faulty.</li> <li>2. Faulty battery charger.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform D.C. voltage check of generator charging circuit.</li> <li>2. Replace charger.</li> </ol>
Generator engine stops.	<ol style="list-style-type: none"> <li>1. Fuel lift pump failure.</li> <li>2. Switches and/or wiring loose or disconnected.</li> <li>3. Fuel starvation.</li> <li>4. 20 Amp circuit breaker tripping.</li> <li>5. Exhaust system is restricted.</li> <li>6. Water in fuel.</li> <li>7. Air intake obstruction.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fuel lift pump should make a distinct ticking sound. Replace pump with spare.</li> <li>2. Inspect wiring for short circuits and loose connections. Inspect switches for proper operation.</li> <li>3. Check fuel supply, fuel valves, fuel lift pump.</li> <li>4. Check for high DC amperage draw during operation. Ensure breaker is not overly sensitive to heat which would cause tripping.</li> <li>5. Check for blockage, collapsed hose, carbon buildup at exhaust elbow.</li> <li>6. Pump water from fuel tank(s); change filters and bleed fuel system.</li> <li>7. Check air intake filter cartridge.</li> </ol>

# ENGINE TROUBLESHOOTING

Problem	Probable Cause	Verification/Remedy
Generator engine overheats/shuts down.	<ol style="list-style-type: none"> <li>1. Raw water not circulating.</li> <li>2. Coolant not circulating.</li> </ol>	<ol style="list-style-type: none"> <li>1. Raw water pump failure. Check impeller — replace.</li> <li>2. Obstruction at raw water intake or raw water filter.</li> <li>2a. Thermostat — remove and test in hot water. Replace thermostat.</li> <li>2b. Loss of coolant — check hoses, hose clamps, drain plug, etc. for leaks.</li> <li>2c. Broken or loose belts — tighten/replace.</li> <li>2d. Air leak in system; run engine and open the pressure cap to bleed air. Add coolant as needed.</li> </ol>
Generator engine shuts down, Low oil pressure.	<ol style="list-style-type: none"> <li>1. Loss of oil.</li> <li>2. Oil pressure switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check dipstick, look for oil leaks at oil filter and at oil drain hose connection.</li> <li>2. Replace oil pressure switch.</li> </ol>
Exhaust smoking problems	<ol style="list-style-type: none"> <li>1. Blue smoke.</li> <li>2. White smoke.</li> <li>3. Black smoke.</li> </ol>	<ol style="list-style-type: none"> <li>1. Incorrect grade of engine oil.</li> <li>1a. Crankcase is overfilled with engine oil (oil is blowing out through the exhaust).</li> <li>2. Engine is running cold.</li> <li>2a. Faulty injector or incorrect injector timing.</li> <li>3. Improper grade of fuel.</li> <li>3a. Fuel burn incomplete due to high back pressure in exhaust or insufficient air for proper combustion (Check for restrictions in exhaust system; check air intake.).</li> <li>3b. Improperly timed injectors or valves or poor compression.</li> <li>3c. Lack of air — check air intake and air filter. Check for proper ventilation.</li> <li>3d. Overload.</li> </ol>

# SHORE POWER TRANSFER SWITCH

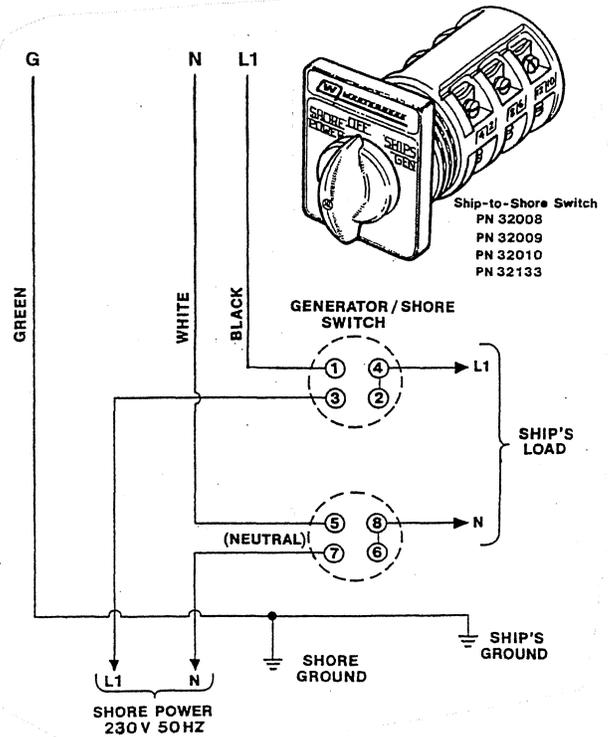
If the installer connects shore power to the vessel's AC circuit, this must be done by means of the Shore Power Transfer Switch. Set the transfer switch shown in the diagrams to the OFF position. This switch prevents simultaneous connection of shore power to generator output.

**CAUTION:** Damage to the generator can result if utility shore power and generator output are connected at the same time. This type of generator damage is not covered under the warranty; it is the installer's responsibility to make sure all AC connections are correct.

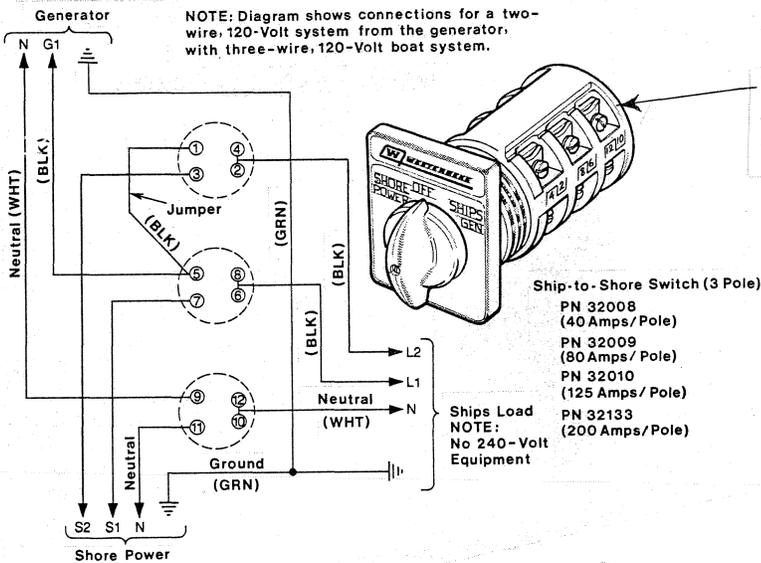
## Switching Shore Power to Generator Power

**CAUTION:** Heavy motor leads should be shut off before switching shore power to generator power or vice-versa because voltage surges induced by switching with heavy AC loads on the vessel being operated may cause damage to the exciter circuit components in the generator.

## 230 VOLT/50 HERTZ TWO WIRE CONFIGURATION



## 120 VOLT/60 HERTZ TWO WIRE CONFIGURATION



Shore power transfer switches are available from your WESTERBEKE dealer.

# GENERATOR INFORMATION

## USE OF ELECTRIC MOTORS

The power required to start an electric motor is considerably more than is required to keep it running after it is started. Some motors require much more current to start them than others. Split-phase (AC) motors require more current to start, under similar circumstances, than other types. They are commonly used on easy-starting loads, such as washing machines, or where loads are applied after the motor is started, such as small power tools. Because they require 5 to 7 times as much current to start as to run, their use should be avoided, whenever possible, if the electric motor is to be driven by a small generator. Capacitor and repulsion-induction motors require from 2 to 4 times as much current to start as to run. The current required to start any motor varies with the load connected to it. An electric motor connected to an air compressor, for example, will require more current than a motor to which no load is connected.

In general, the current required to start 115-Volt motors connected to medium starting loads will be approximately as follows:

MOTOR SIZE (HP)	AMPS FOR RUNNING (AMPERES)	AMPS FOR STARTING (AMPERES)
1/6	3.2	6.4 to 22.4*
1/4	4.6	9.2 to 32.2*
1/3	5.2	10.4 to 72.8*
1/2	7.2	14.4 to 29.2*
3/4	10.2	20.4 to 40.8*
1	13	26 to 52

**\*NOTE:** In the above table the maximum Amps for Starting is more for some small motors than for larger ones. The reason for this is that the hardest starting types (split-phase) are not made in larger sizes.

Because the heavy surge of current needed for starting motors is required for only an instant, the generator will not be damaged if it can bring the motor up to speed in a few seconds. If difficulty is experienced in starting motors, turn off all other electrical loads and, if possible, reduce the load on the electric motor.

## REQUIRED OPERATING SPEED

Run the generator first with no load applied, then at half the generator's capacity, and finally loaded to its full capacity as indicated on the generator's data plate. The output voltage should be checked periodically to ensure proper operation of the generating plant and the appliances it supplies. If an AC voltmeter or amp-meter is not installed to monitor voltage and load, check it with a portable meter and amprobe.

**NOTE:** When the vessel in which the generator is installed contains AC equipment of 120 volts only, it is recommended that the generator's AC terminal block be configured to provide one 120 volt AC hot leg for the vessel's distribution panel. This will ensure good motor starting response from the generator.

## GENERATOR FREQUENCY ADJUSTMENT

Frequency is a direct result of engine/generator speed, as indicated by the following:

- When the generator is run at 3600 rpm, the AC voltage output frequency is 60 Hertz.
- When the generator is run at 3000 rpm, the AC voltage output frequency is 50 Hertz.

Therefore, to change the generator's frequency, the generator's drive engine's speed must be changed along with a reconfiguring of the AC output connections at the generator.

## GENERATOR MAINTENANCE

- Maintaining reasonable cleanliness is important. Connections of terminal boards, relays, etc may become corroded, and insulation surfaces may start conducting if salts, dust, engine exhaust, carbon, etc. are allowed to build up. Clogged ventilation openings may cause excessive heating and reduce life of windings.
- For unusually severe conditions, thin rust-inhibiting petroleum based coatings should be sprayed or brushed over all surfaces to reduce rusting and corrosion.
- In addition to periodic cleaning, the generator should be inspected for tightness of all connections, evidence of overheated terminals and loose or damaged wires.

## Carbon Monoxide Detector

WESTERBEKE recommends mounting a carbon monoxide detector in the vessel's living quarters. **Carbon monoxide, even in small amounts, is deadly.**

The presence of carbon monoxide indicates an exhaust leak from the engine or generator or from the exhaust elbow/exhaust hose, or that fumes from a nearby vessel are entering your boat.

If carbon monoxide is present, ventilate the area with clean air and correct the problem immediately!

# GENERATOR TROUBLESHOOTING

<b>Problem</b>	<b>Probable Cause</b>	<b>Remedy</b>
Alternator excitation failure	<ol style="list-style-type: none"> <li>1. Low engine speed.</li> <li>2. Faulty capacitor.</li> <li>3. Faulty windings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check rpm and set at a nominal value of 3700 rpm without a load for 60 Hertz (3100 rpm for 50 Hertz).</li> <li>2. Check and replace.</li> <li>3. Check the windings' resistance as follows: Stator 0.65 ohms Rotor 3.90 ohms Excitation 2.60 ohms</li> </ol>
High no-load voltage (over 135V)	<ol style="list-style-type: none"> <li>1. Engine speed too high.</li> <li>2. Capacitor rating is too high.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and adjust rpm.</li> <li>2. Check/replace capacitor.</li> </ol>
Low no-load voltage (under 110V)	<ol style="list-style-type: none"> <li>1. Engine speed too low.</li> <li>2. Faulty rotating diodes.</li> <li>3. Break down in windings.</li> <li>4. Capacitor rating is too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and adjust rpm.</li> <li>2. Check/replace.</li> <li>3. Check windings resistance as follows:</li> <li>4. Check and replace from 16 to 25 mF.</li> </ol>
Proper no-load voltage but low voltage under load.	<ol style="list-style-type: none"> <li>1. Low loaded engine speed.</li> <li>2. Overload.</li> <li>3. Rotating diodes short-circuited.</li> </ol>	<ol style="list-style-type: none"> <li>1. Dirty fuel filter; replace.</li> <li>2. Check the load indicator.</li> <li>3. Check/replace.</li> </ol>
Unstable voltage	<ol style="list-style-type: none"> <li>1. Loose contacts.</li> <li>2. Uneven rotation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check connections.</li> <li>2. Check for uniform rotation speed (dirty fuel filter).</li> </ol>
Noisy generator	<ol style="list-style-type: none"> <li>1. Broken bearings.</li> <li>2. Loose coupling.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace bearings.</li> <li>2. Check and repair coupling.</li> </ol>

# LAY-UP AND RECOMMISSIONING

## GENERAL

Many owners rely on their boatyards to prepare their craft, including engines and generators, for lay-up during the off season or for long periods of inactivity. Others prefer to accomplish lay-up preparation themselves.

The procedures which follow will allow you to perform your own lay-up and recommissioning, or you may use them as a check list if others do the procedures.

These procedures should afford your engine protection during lay-up and also help familiarize you with the maintenance needs of your engine/generator.

If you have any questions regarding lay-up procedures, call your local servicing dealer; he will be more than willing to provide assistance.

## LUBRICATING SYSTEM

With the engine warm, drain all the engine oil from the oil sump. Fill the sump with the correct amount of oil for your engine (refer to the *SPECIFICATIONS* section of this manual). Use an oil with an API specification of CF or CG-4. Run the engine and check for proper oil pressure and make sure there are no leaks.

**⚠ Caution:** *Do not leave the engine's old engine oil in the sump over the lay-up period. Engine oil and combustion deposits combine to produce harmful chemicals which can reduce the life of your engine's internal parts.*

## FUEL SYSTEM

Top off your fuel tanks with No. 2 diesel fuel. Fuel additives such as *Biobor* and *Sta-Bil* should be added at this time to control algae and condition the fuel. Care should be taken that the additives used are compatible with the primary fuel filter/water separator used in the system. Change the filter element in your primary fuel filter/water separator, if the fuel system has one, and clean the separator sediment bowl. Reinstall and make certain there are no leaks. Clean up any spilled fuel.

Change the fuel filter elements on the engine (see *FUEL SYSTEM*) and bleed the fuel system, as needed. Start the engine and allow it to run for 5–10 minutes to make sure there is no air left in the fuel system. Check for any leaks that may have been created in the fuel system during this servicing, correcting them as needed. Operate the engine for 5–10 minutes. This will allow movement of the treated fuel through the injection equipment of the engine.

## RAW WATER COOLING CIRCUIT

Close the through-hull fitting. Remove the raw water intake hose from the fitting. Place the end of this hose into a bucket of clean fresh water. Clean the raw water strainer.

Start the engine and allow the raw water pump to draw fresh water through the system. When the bucket is empty, stop the engine and refill the bucket with an antifreeze solution slightly stronger than needed for winter freeze protection in your area.

Start the engine and allow all of this mixture to be drawn through the raw water system. Once the bucket is empty, stop the engine. This antifreeze mixture should protect the raw water circuit from freezing during the winter lay-up, as well as providing corrosion protection.

Remove the impeller from your raw water pump (some antifreeze mixture will accompany it, so catch it in a bucket). Examine the impeller. Acquire a replacement, if needed, and a cover gasket. Do not replace the impeller (into the pump) until recommissioning, but replace the cover and gasket.

## THROUGH-HULL EXHAUST

Place a clean cloth, lightly soaked in lubricating oil, in the opening of the through-hull exhaust to block the opening. Do not shove the cloth out of sight (if it is not visible at recommissioning, and an attempt is made to start the engine, you may need the assistance of a servicing dealer). Make a note to remove the cloth prior to start-up.

## CYLINDER AND VALVES

To protect the cylinder and valves, remove the control box side cover. Then spray fogging oil into the cylinder head air intake opening. Rotate the engine two revolutions using the hand crank. Spray fogging oil into the air intake again. Replace the control box side cover.

# LAY-UP AND RECOMMISSIONING

## STARTER MOTOR

Lubrication and cleaning of the starter drive pinion is advisable. Make sure the battery connections are shut off before attempting to remove the starter. Take care in properly replacing any electrical connections removed from the starter.

## CYLINDER LUBRICATION

If you anticipate a long lay-up period (12 months or more) Westerbeke recommends removing the fuel injectors for access to the cylinder, then squirting light lubricating oil into the cylinders to prevent the piston rings from sticking to the cylinder walls. After squirting the oil, move the piston by a quick electric start. Make sure you have replacements for the injector and return line sealing washers.

## GENERATOR END

Remove the control box cover. Check all wire connections on the AC terminal block and those running to the bridge rectifier, making sure they are secure. Should these connections appear corroded, they should be removed, cleaned and reconnected. Make sure all AC leads are properly cleaned and reconnected. Make sure all AC leads are properly supported and not chafing as they exit the generator housing.

## SPARE PARTS

Lay-up time provides a good opportunity to inspect your Westerbeke generator to see if external items such as the drive belt or coolant hoses need replacement. Check your basic spares kit and order items not on hand, or replace those items used during the lay-up, such as filters. See *SPARE PARTS*.

## BATTERIES

If batteries are to be left on board during the lay-up period, make sure they are fully charged, and will remain that way, to prevent them from freezing. If there is any doubt the batteries will not remain full charged, or that they will be subjected to severe environmental conditions, remove the batteries and store them in a warmer, more compatible environment.

## STORAGE

Thoroughly clean the outside of the generator, then store the generator in a dry place, protected against the weather.

## RECOMMISSIONING

The recommissioning of your WESTERBEKE generator after a seasonal lay-up generally follows the same procedures as those described in the *PREPARATIONS FOR INITIAL START-UP* section regarding preparation for starting and normal starts. However, some of the lay-up procedures will need to be counteracted before starting the engine.

1. Remove the oil-soaked cloth from the through-hull exhaust port.
2. Remove the raw water pump cover and gasket and discard the old gasket.

**NOTE:** *It is not necessary to flush the antifreeze/fresh water solution from the raw water coolant system. When the engine is put into operation, the system will self-flush in a short period of time with no adverse effects.*

Install the raw water pump impeller removed during lay-up (or a replacement, if required). Install the raw water pump cover with a new cover gasket.

3. Reinstall the batteries that were removed during the lay-up, and reconnect the battery cables, making sure the terminals are clean and that the connections are tight. Check to make sure that the batteries are fully charged.

**⚠ Caution:** *Wear rubber gloves, a rubber apron and eye protection when servicing batteries. Lead acid batteries emit hydrogen, a highly explosive gas, which can be ignited by electrical arcing or a lighted cigarette, cigar or pipe. Do not smoke or allow an open flame near the battery being serviced. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.*

4. Start the engine in accordance with the procedures described in the *PREPARATIONS FOR INITIAL START-UP* section of this manual.

# 8.0 KW BCDT/7.0 KW BCDT GENERATOR SPECIFICATIONS

## ENGINE SPECIFICATIONS

Engine Type	Diesel, four-cycle, two cylinder, raw water cooled, vertical, in-line overhead valve mechanism
Governor	Mechanical, centrifugal weight type
Combustion System	Direct Injection
Bore and Stroke	2.98" x 2.76" (76 mm x 70 mm)
Piston Displacement	38.75 cu. in. (0.635 liters)
Direction of Rotation	Clockwise, when viewed from the front
Compression Ratio	23:1
Maximum Torque	30.0 ft/lbs (4.15 kg-m)
Dimensions	Height: 23.8" (605.3 mm) Width: 19.0" (482.6 mm) Length: 28.3" (717.6 mm)
Dry Weight with Sound Guard	371 lbs (168.4 kg)
Max. Angle of Operation	25° continuous, 30° intermittent

## TUNE-UP SPECIFICATIONS

Compression Pressure	398 psi (128 kg/cm <sup>2</sup> ) at 280 rpm
Valve Seat Angle	Intake 45°; Exhaust 45°
Valve Clearance	Intake and Exhaust 0.010 in (0.25 mm) engine cold
Engine Timing	25° ± 1° BTDC static
Injector Pressure	1991 psi (140.0 kg/cm <sup>2</sup> )

## LUBRICATION SYSTEM

Lubrication System	Pressure driven by trochiod pump
Lubricant Capacity	3.0 U.S. gal. (2.8 liters)
Operating Oil Pressure (engine hot)	15.0 - 45.0 psi (1.0 - 3.1 kg/cm <sup>2</sup> )
Oil Grade	API specification CF or CG-4 SAE 30, 10W-30, 15W-40

## FUEL SYSTEM

Fuel System	Open flow, self-priming
Fuel	No. 2 diesel oil, cetane rating of 45 or higher
Fuel Lift Pump	4 ft. (1.22 m) lift max
Fuel Injection Pump	Bosch
Nozzle	Throttle type
Fuel Consumption (full load)	1.08 U.S. gal./hr. (4.09 liter/hr.)
Fuel Filter	Replaceable filter-spin on
Air Flow (engine combustion)	40.6 cfm (1.1 cmm)

## COOLING SYSTEM

Cooling System	Fresh water-cooled block, thermostatically controlled
Operating Temperature	170 - 190°F (77 - 88°C)
Raw Water Pump	Positive displacement, rubber impeller, gear-driven, self-priming
Raw Water Flow, at 3600 rpm	11.1 gpm (42 lpm)
Raw Water Connection	1/2 in (12.7 mm) I.D.
Capacity	2.9 qts. (2.7 Liters)

## EXHAUST SYSTEM

Emission Control Systems	Meets U.S.C.G. Regulation 33 CFR 183
Exhaust Elbow Connection	2 in (50.8 mm) I.D.

## ELECTRICAL SYSTEM

Electrical System	12 volts DC, negative ground (except when starting)
Battery Charging	4-5 amps
Starting Motor	12 volt solenoid, actuated shift
Cold Cranking Amps	125 amps @ 805 rpm minimum
Electromagnetic Interference Level	Exceeds requirements for most marine radiotelephones and standard TVs
DC No-Load Current	100 amps @ 11.5v (3000 rpm - minimum)

## AC GENERATOR

General	Brushless two pole, revolving field. Sealed lubricated single bearing design. Single phase, capacitor regulation.
Voltage	120 volts - 60 hertz (3600 rpm) 230 volts - 50 hertz (3000 rpm)
Voltage Regulation	Standard ± 7% no-load to full-load
Frequency Regulation	3Hz (5%) no-load to full-load
Rating (Volts AC)	60Hz - 120 volts; 66.0 amps 50Hz - 230 volts; 30.4 amps
Insulation	Class H as defined by NEMA MGI-1.66

## GENERATOR COOLING

Cooling	Raw water cooled
Air Requirements (60 Hertz at 3600 rpm)	450 cfm (12.74 cmm)
<b>Note:</b> Increase air supply 15% for Hertz operation 3000 rpm	
Engine Combustion Air Requirements	60 Hz - 15.397 ft <sup>3</sup> /min (0.436 m <sup>3</sup> /min) 50 Hz - 12.819 ft <sup>3</sup> /min (0.363 m <sup>3</sup> /min)
Generator Compartment Ambient Temperature Recommendations	<b>Note:</b> Forced ventilation should be provided to maintain generator compartment temperatures below 140°F (40°C)
Temperature Rise	Within NEMA MGI-22.40 operating at full load

# STANDARD AND METRIC CONVERSION DATA

## LENGTH-DISTANCE

Inches (in) x 25.4 = Millimeters (mm) x .0394 = Inches

Feet (ft) x .305 = Meters (m) x 3.281 = Feet

Miles x 1.609 = Kilometers (km) x .0621 = Miles

## DISTANCE EQUIVALENTS

1 Degree of Latitude = 60 Nm = 111.120 km

1 Minute of Latitude = 1 Nm = 1.852 km

## VOLUME

Cubic Inches (in<sup>3</sup>) x 16.387 = Cubic Centimeters x .061 = in<sup>3</sup>

Imperial Pints (IMP pt) x .568 = Liters (L) x 1.76 = IMP pt

Imperial Quarts (IMP qt) x 1.137 = Liters (L) x .88 = IMP qt

Imperial Gallons (IMP gal) x 4.546 = Liters (L) x .22 = IMP gal

Imperial Quarts (IMP qt) x 1.201 = US Quarts (US qt) x .833 = IMP qt

Imperial Gallons (IMP gal) x 1.201 = US Gallons (US gal) x .833 = IMP gal

Fluid Ounces x 29.573 = Milliliters x .034 = Ounces

US Pints (US pt) x .473 = Liters(L) x 2.113 = Pints

US Quarts (US qt) x .946 = Liters (L) x 1.057 = Quarts

US Gallons (US gal) x 3.785 = Liters (L) x .264 = Gallons

## MASS-WEIGHT

Ounces (oz) x 28.35 = Grams (g) x .035 = Ounces

Pounds (lb) x .454 = Kilograms (kg) x 2.205 = Pounds

## PRESSURE

Pounds Per Sq In (psi) x 6.895 = Kilopascals (kPa) x .145 = psi

Inches of Mercury (Hg) x .4912 = psi x 2.036 = Hg

Inches of Mercury (Hg) x 3.377 = Kilopascals (kPa) x .2961 = Hg

Inches of Water (H<sub>2</sub>O) x .07355 = Inches of Mercury x 13.783 = H<sub>2</sub>O

Inches of Water (H<sub>2</sub>O) x .03613 = psi x 27.684 = H<sub>2</sub>O

Inches of Water (H<sub>2</sub>O) x .248 = Kilopascals (kPa) x 4.026 = H<sub>2</sub>O

## TORQUE

Pounds-Force Inches (in-lb) x .113 = Newton Meters (Nm) x 8.85 = in-lb

Pounds-Force Feet (ft-lb) x 1.356 = Newton Meters (Nm) x .738 = ft-lb

## VELOCITY

Miles Per Hour (MPH) x 1.609 = Kilometers Per Hour (KPH) x .621 = MPH

## POWER

Horsepower (Hp) x .745 = Kilowatts (Kw) x 1.34 = MPH

## FUEL CONSUMPTION

Miles Per Hour IMP (MPG) x .354 = Kilometers Per Liter (Km/L)

Kilometers Per Liter (Km/L) x 2.352 = IMP MPG

Miles Per Gallons US (MPG) x .425 = Kilometers Per Liter (Km/L)

Kilometers Per Liter (Km/L) x 2.352 = US MPG

## TEMPERATURE

Degree Fahrenheit (°F) = (°C X 1.8) + 32

Degree Celsius (°C) = (°F - 32) x .56

## LIQUID WEIGHTS

Diesel Oil = 1 US gallon = 7.13 lbs

Fresh Water = 1 US gallon = 8.33 lbs

Gasoline = 1 US gallon = 6.1 lbs

Salt Water = 1 US gallon = 8.56 lbs

# METRIC CONVERSIONS

## INCHES TO MILLIMETERS

## MILLIMETERS TO INCHES

Inches	mm	Inches	mm	mm	Inches	mm	Inches
1	25.40	15	381.00	1	0.0394	15	0.5906
2	50.80	20	508.00	2	0.0787	20	0.7874
3	76.20	25	635.00	3	0.1181	25	0.9843
4	101.60	30	762.00	4	0.1575	30	1.1811
5	127.00	35	889.00	5	0.1969	35	1.3780
10	254.00	40	1016.00	10	0.3937	40	1.5748

10 MILLIMETERS = 1 CENTIMETER, 100 CENTIMETERS = 1 METER = 39.37 INCHES (3.3 FEET)

## INCHES TO METERS

## METERS TO INCHES

Inches	Meters	Inches	Meters	Meters	Inches	Meters	Inches
1	0.0254	7	0.1778	0.1	3.937	0.7	27.559
2	0.0508	8	0.2032	0.2	7.874	0.8	31.496
3	0.0762	9	0.2286	0.3	11.811	0.9	35.433
4	0.1016	10	0.2540	0.4	15.748	1.0	39.370
5	0.1270	11	0.2794	0.5	19.685	1.1	43.307
6	0.1524	12	0.3048	0.6	23.622	1.2	47.244

TO CONVERT METERS TO CENTIMETERS, MOVE DECIMAL POINT TWO PLACES TO THE RIGHT

## YARDS TO METERS

## METERS TO YARDS

Yards	Meters	Yards	Meters	Meters	Yards	Meters	Yards
1	0.91440	6	5.48640	1	1.09361	6	6.56168
2	1.82880	7	6.40080	2	2.18723	7	7.65529
3	2.74320	8	7.31520	3	3.28084	8	8.74891
4	3.65760	9	8.22960	4	4.37445	9	9.84252
5	4.57200	10	9.14400	5	5.46807	10	10.93614

MOVE DECIMAL POINT FOR HIGHER VALUES — e.g. 6,000 METERS = 6,561.68 YARDS

## POUNDS TO KILOGRAMS

## KILOGRAMS TO POUNDS

lb	kg	lb	kg	kg	lb	kg	lb
1	0.454	6	2.722	1	2.205	6	13.228
2	0.907	7	3.175	2	4.409	7	15.432
3	1.361	8	3.629	3	6.614	8	17.637
4	1.814	9	4.082	4	8.818	9	19.842
5	2.268	10	4.536	5	11.023	10	22.046

## GALLONS TO LITERS

## LITERS TO GALLONS

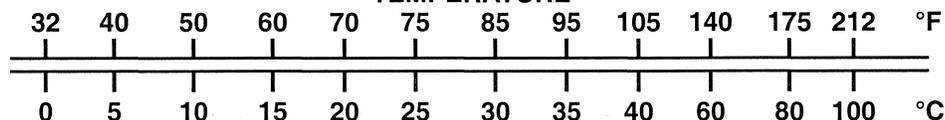
Gallons	Liters	Gallons	Liters	Liters	Gallons	Liters	Gallons
1	3.79	10	37.86	1	0.26	60	15.66
2	7.57	20	75.71	2	0.53	90	23.77
3	11.36	30	113.57	5	1.32	120	31.32
4	15.14	40	151.42	10	2.64	150	39.62
5	18.93	50	189.28	20	5.28	180	47.54

## PINTS TO LITERS

## LITERS TO PINTS

Pints	Liters	Pints	Liters	Liters	Pints	Liters	Pints
1	0.47	6	2.84	1	2.11	6	12.68
2	0.95	7	3.31	2	4.23	7	14.79
3	1.42	8	3.79	3	6.34	8	16.91
4	1.89	9	4.26	4	8.45	9	19.02
5	2.37	10	4.73	5	10.57	10	21.13

## TEMPERATURE

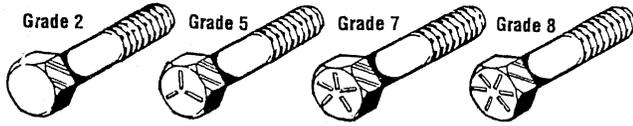


# STANDARD HARDWARE

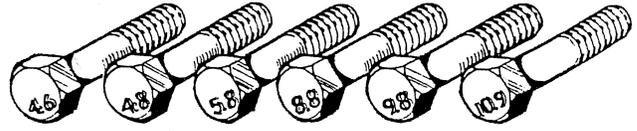
## BOLT HEAD MARKINGS

Bolt strength classes are embossed on the head of each bolt.

**Customary (inch) bolts** are identified by markings two to eight (strongest). The marks correspond to two marks less than the actual grade, i.e.; a grade seven bolt will display five embossed marks.



**Metric bolt** class numbers identify bolts by their strength with 10.9 the strongest.



- NOTES:**
1. Use the torque values listed below when specific torque values are not available.
  2. These torques are based on clean, dry threads. Reduce torque by 10% when engine oil is used.
  3. Reduce torques by 30% or more, when threading capscrews into aluminum.

STANDARD BOLT & NUT TORQUE SPECIFICATIONS			
Capscrew Body Size (Inches) - (Thread)	SAE Grade 5 Torque Ft-Lb (Nm)	SAE Grade 6-7 Torque Ft-Lb (Nm)	SAE Grade 8 Torque Ft-Lb (Nm)
1/4 - 20 - 28	8 (11) 10 (14)	10 (14)	12 (16) 14 (19)
5/16 - 18 - 24	17 (23) 19 (26)	19 (26)	24 (33) 27 (37)
3/8 - 16 - 24	31 (42) 35 (47)	34 (46)	44 (60) 49 (66)
7/16 - 14 - 20	49 (66) 55 (75)	55 (75)	70 (95) 78 (106)
1/2 - 13 - 20	75 (102) 85 (115)	85 (115)	105 (142) 120 (163)
9/16 - 12 - 18	110 (149) 120 (163)	120 (163)	155 (210) 170 (231)
5/8 - 11 - 18	150 (203) 170 (231)	167 (226)	210 (285) 240 (325)
3/4 - 10 - 16	270 (366) 295 (400)	280 (380)	375 (508) 420 (569)
7/8 - 9 - 14	395 (536) 435 (590)	440 (597)	605 (820) 675 (915)
1 - 8 - 14	590 (800) 660 (895)	660 (895)	910 (1234) 990 (1342)

METRIC BOLT & NUT TORQUE SPECIFICATIONS					
Bolt Dia.	Wrench Size	Grade 4.6 Ft-Lb (Nm)	Grade 4.8 Ft-Lb (Nm)	Grade 8.8 - 9.8 Ft-Lb (Nm)	Grade 10.9 Ft-Lb (Nm)
M3 M4 M5	5.5 mm 7 mm 8 mm	0.3 (0.5) 0.8 (1.1) 1.5 (2.5)	0.5 (0.7) 1 (1.5) 2 (3)	1 (1.3) 2 (3) 4.5 (6)	1.5 (2) 3 (4.5) 6.5 (9)
M8 M9 M10	10 mm 13 mm 16 mm	3 (4) 7 (9.5) 14 (19)	4 (5.5) 10 (13) 18 (25)	7.5 (10) 18 (25) 37 (50)	11 (15) 35 (26) 55 (75)
M12 M14 M16	18 mm 21 mm 24 mm	26 (35) 37 (50) 59 (80)	33 (45) 55 (75) 85 (115)	63 (85) 103 (140) 159 (215)	97 (130) 151 (205) 232 (315)
M18 M20 M22	27 mm 30 mm 33 mm	81 (110) 118 (160) 159 (215)	118 (160) 166 (225) 225 (305)	225 (305) 321 (435) 435 (590)	321 (435) 457 (620) 620 (840)
M24 M27 M30	36 mm 41 mm 46 mm	203 (275) 295 (400) 402 (545)	288 (390) 417 (565) 568 (770)	553 (750) 811 (1100) 1103 (1495)	789 (1070) 1154 (1565) 1571 (2130)
M33 M36	51 mm 55 mm	546 (740) 700 (950)	774 (1050) 992 (1345)	1500 (2035) 1925 (2610)	2139 (2900) 2744 (3720)

**NOTE:** Formula to convert Ft-Lbs to Nm (Newton Meters) multiply Ft-Lbs by 1.356.

## SEALANTS & LUBRICANTS

### GASKETS/SEALANTS

Oil based PERMATEX #2 and it's HIGH TACK equivalent are excellent all purpose sealers. They are effective in just about any joint in contact with coolant, raw water, oil or fuel.

A light coating of OIL or LIQUID TEFLON can be used on rubber gaskets and O-rings.

LOCTITE hydraulic red sealant should be used on oil adapter hoses and the oil filter assembly.

Coat both surfaces of the oil pan gasket with high temp RED SILICONE sealer.

When installing gaskets that seal around water (coolant) passages, coat both sides with WHITE SILICONE grease.

High-copper ADHESIVE SPRAYS are useful for holding gaskets in position during assembly.

Specialized gasket sealers such as HYLOMAR work well in applications requiring non-hardening properties. HYLOMAR is particularly effective on copper cylinder-head gaskets as it resists fuel, oil and water.

Use LIQUID TEFLON for sealing pipe plugs and fillings that connect coolant passages. **Do not use tape sealants!**

### BOLTS & FASTENERS/ASSEMBLIES

Lightly oil head bolts and other fasteners as you assemble them. Bolts and plugs that penetrate the water jacket should be sealed with PERMATEX #2 or HIGH TACK.

When assembling the flywheel, coat the bolt threads with LOCTITE blue.

Anti-seize compounds and thread locking adhesives such as LOCTITE protect threaded components yet allows them to come apart when necessary. LOCTITE offers levels of locking according to the job.

LITHIUM based grease is waterproof, ideal for water pump bearings and stuffing boxes.

Heavily oil all sliding and reciprocating components when assembling. **Always use clean engine oil!**

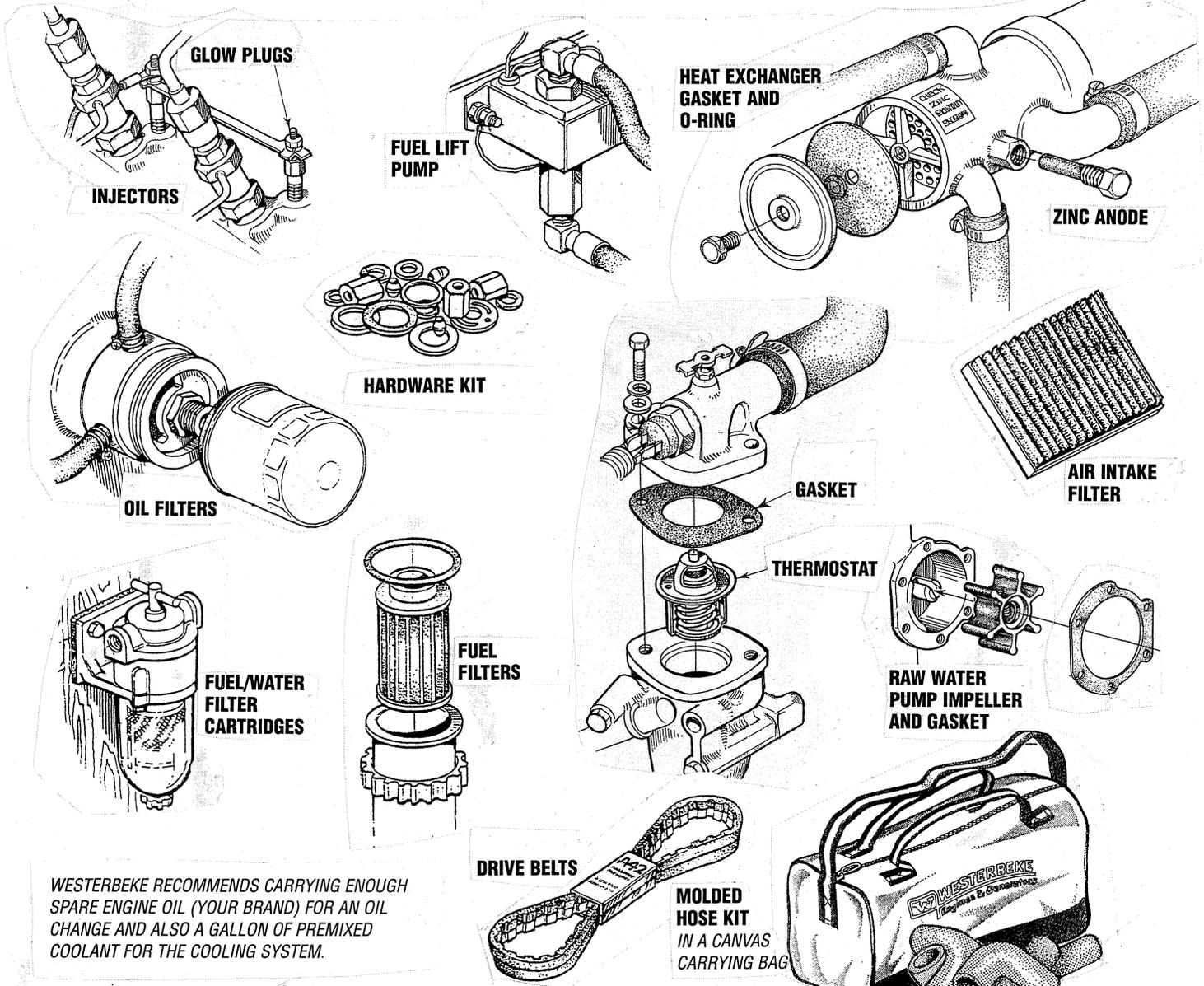
# TORQUE SPECIFICATIONS

	Lb-ft	(Kg-m)
Cylinder Head Bolt, main (wet), M10 (14)	54.36 - 61.46	(7.5 - 8.5)
Cylinder Head Bolt, sub (wet), M6 (12)	14.46 - 21.69	(2.0 - 3.0)
Connecting Rod Cap Nut, M8 (14)	23.14 - 25.31	(3.2 - 3.5)
Flywheel Bolt, M10 (17)	61.45 - 68.69	(8.5 - 9.5)
Crankshaft Pulley Nut, M16 (17)	72.31 - 86.77	(10.0 - 12.0)
Main Bearing Cap Bolt, M10 (17)	36.15 - 39.77	(5.0 - 5.5)
Rocker Shaft Hold-down Bolt, M8 (12)	10.85 - 15.91	(1.5 - 2.2)
Rocker Cover Nut, M6 (10)	3.62 - 5.06	(0.5 - 0.7)
Nozzle Holder (fitting to engine), M20 (21)	36.15 - 43.38	(5.0 - 6.0)
Nozzle Union Color Fixing Nut, M12 (17)	18.08 - 21.69	(2.5 - 3.0)
Nozzle Retaining Nut, M16 (21)	25.31 - 28.92	(3.5 - 4.0)
Fuel Injection Pipe Nut, M12 (17)	18.08 - 25.31	(2.5 - 3.5)
Delivery Valve Holder, M16 (17)	25.31 - 28.20	(3.5 - 3.9)
Injection Pump Hollow Screw, M10 (14)	7.23 - 10.85	(1.0 - 1.5)
Solenoid Locknut, M30 (36)	28.92 - 36.15	(4.0 - 5.0)
Water Temperature Gauge Joint, M16 (23)	14.46 - 21.69	(2.0 - 3.0)
Oil Filter, M20 (17)	7.95 - 9.40	(1.1 - 1.30)
Oil Relief Plug, M18 (22)	28.92 - 36.15	(4.0 - 5.0)
Oil Drain Hose Plug, M18 (19)	36.15 - 43.38	(5.0 - 6.0)
Glow Plug, M10 (12)	10.85 - 14.46	(1.5 - 2.0)
Glow Plug Lead Wire Fitting Nut, M4 (7)	0.723 - 1.08	(0.1 - 0.15)

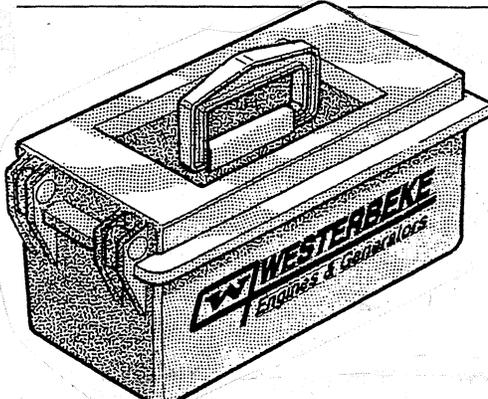
# SUGGESTED SPARE PARTS

## WESTERBEKE MARINE DIESEL GENERATORS

CONTACT YOUR WESTERBEKE DEALER FOR ADDITIONAL SUGGESTIONS AND INFORMATION



WESTERBEKE RECOMMENDS CARRYING ENOUGH SPARE ENGINE OIL (YOUR BRAND) FOR AN OIL CHANGE AND ALSO A GALLON OF PREMIXED COOLANT FOR THE COOLING SYSTEM.



### SPARE PARTS KITS

WESTERBEKE also offers engine spares in two spare parts kits. Each kit is offered in the same rugged rust proof hinged tool box. **KIT A** has basic spares. **KIT B** includes spares for more extensive off-shore cruising.

- KIT A**
- ZINC ANODES
  - DRIVE BELTS
  - OIL FILTER
  - FUEL FILTER
  - HEAT EXCHANGER GASKET
  - IMPELLER KIT

- KIT B**
- ZINC ANODES
  - DRIVE BELTS
  - OIL FILTER
  - FUEL FILTER
  - HEAT EXCHANGER GASKET
  - IMPELLER KIT
  - INJECTOR
  - GASKET KIT
  - AIR FILTER
  - GLOW PLUG



