

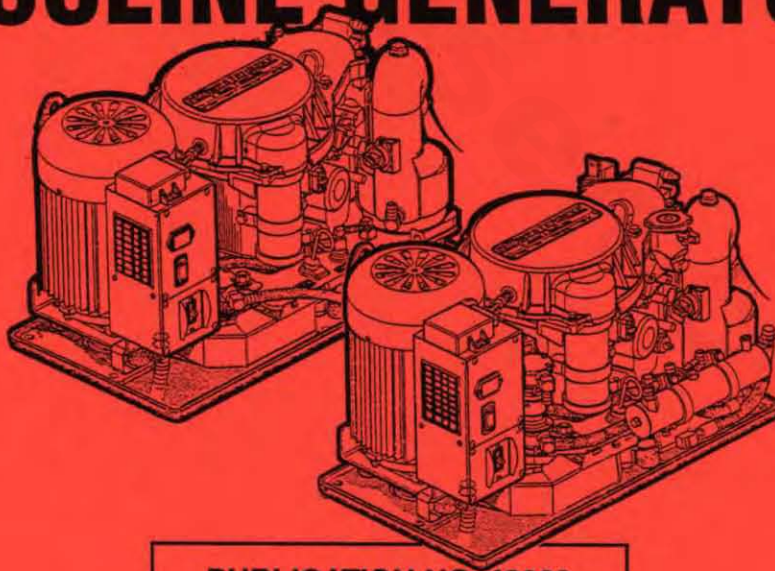


OPERATORS MANUAL

3.0KW BPMG 60Hz

SINGLE PHASE

GASOLINE GENERATORS



PUBLICATION NO. 48009
3rd Edition/December 2003



member
NMMA

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**CALIFORNIA
PROPOSITION 65 WARNING**

Marine diesel and gasoline engine exhaust 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*
- *Throbbing in Temples*
- *Nausea*
- *Muscular Twitching*
- *Headache*
- *Vomiting*
- *Weakness and Sleepiness*
- *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.



This 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 disconnecting 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 manifolds are securely attached and no warping exists. Pay close attention to the manifold, water injection elbow, and exhaust pipe nipple.
- Be sure the unit and its surroundings are well ventilated.
- In addition to routine inspection of the exhaust system, install a carbon monoxide detector. 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
 - Dizziness
 - Throbbing in temples
 - Muscular twitching
 - Intense headache
 - 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.

GASOLINE ENGINE AND GENERATOR INSTALLATIONS

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

Sections of the ABYC standards of particular interest are:

H-2 Ventilation
H-24 Gasoline Fuel Systems
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

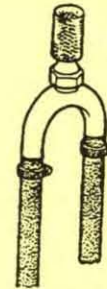
Strict federal regulations, ABYC guidelines, and safety codes must be complied with when installing engines and generators in a marine environment.

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.*



AVAILABLE FROM
YOUR WESTERBEKE
DEALER

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.



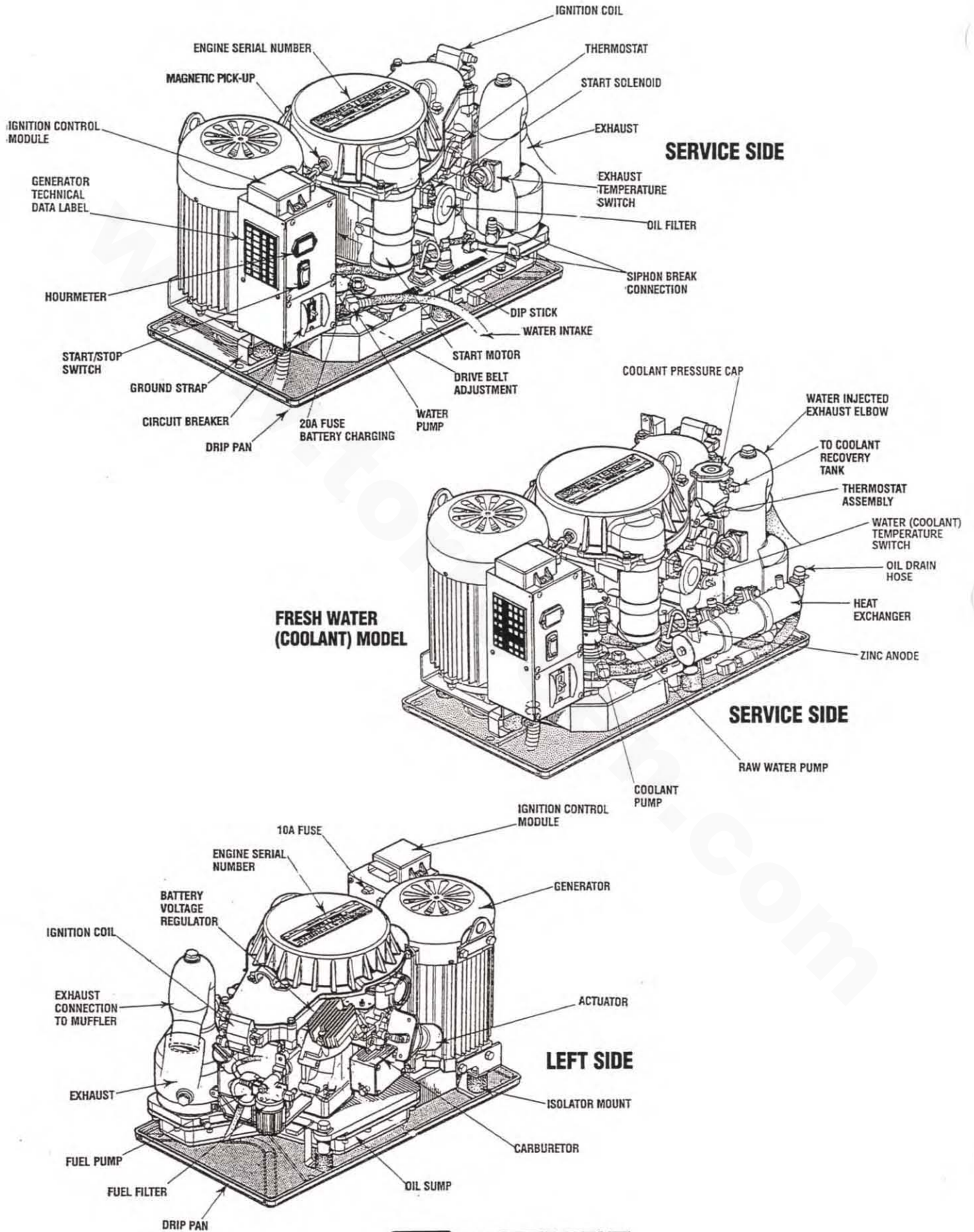
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★ Models manufactured with heat exchangers for cooling with fresh water/coolant or raw water cooled models that have been converted to fresh cooling via WESTERBEKE'S FRESH WATER COOLING KIT.



3.0 KW BPMG GENERATOR PARTS IDENTIFICATION



INTRODUCTION

These high performance marine engines are products of WESTERBEKE's long 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.


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 engine require servicing, contact your nearest WESTERBEKE dealer for assistance.

This is your operators manual. A parts catalog is also provided and a technical manual is available from your WESTERBEKE dealer. If you are planning to install this equipment, contact your WESTERBEKE dealer for WESTERBEKE'S installation manual.

WARRANTY PROCEDURES

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

Customer Identification Card



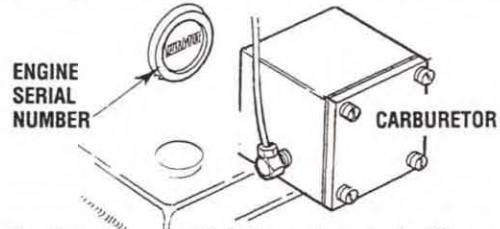
Customer Identification
 MR. WESTERBEKE OWNER
 MAIN STREET
 HOMETOWN, USA
 Model _____ Ser. # _____
 Expires _____

PRODUCT SOFTWARE

Product software, (technical 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 keep in mind the time span between printings of WESTERBEKE product software and the unavoidable existence of earlier WESTERBEKE product software. The 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.

SERIAL NUMBER LOCATION


The engine's serial and model number are etched on a nameplate located on top of the unit (flywheel cover). The engine's serial number is also stamped on the engine block.



Take the time to enter this information on the illustration of the nameplate as shown above, as this will provide a quick reference when seeking technical information and/or ordering parts.

The generator's serial number and model number is located on a decal on the the generator control panel. Take the time to enter the information on the blank decal below. This will provide a quick reference when seeking technical information and/or ordering parts.

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 your own reference. 



INTRODUCTION

ORDERING PARTS

Whenever replacement parts are needed, always provide the generator and engine model and serial numbers. In addition, include a complete part description and part number for each part needed (see the separately furnished Parts Catalog). Also insist upon WESTERBEKE packaged parts because *will fit* or generic parts are frequently not made to the same specifications as original equipment.

NOTES, CAUTIONS AND WARNINGS

As this manual takes you through the operating procedures, maintenance schedules, and troubleshooting of your generator, 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 the engine or generator.*

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

NOTE: *A carbon monoxide warning decal has been provided by WESTERBEKE. Affix this decal in a visible location in the engine room.*

SPARES AND ACCESSORIES

Certain spare parts will be needed to support and maintain your WESTERBEKE generator or engine when cruising (see *SUGGESTED SPARE PARTS*). Often even simple items such as proper fuel and oil filters can be difficult to obtain along the way. WESTERBEKE will provide you with a suggested spares and accessories brochure to assist you in preparing an on-board inventory of the proper WESTERBEKE parts.

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 in the vessel or the manner in which the unit is operated 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 and alignment.*
- *An efficient well-designed exhaust system that includes an anti-siphon break to prevent water from entering the engine.*
- *Changing the engine oil and oil filters every 100 operating hours.*
- *Proper maintenance of all engine and generator components according to the maintenance schedule in this manual.*
- *Use clean, filtered unleaded fuel.*
- *Winterize your engine according to the "Lay-up and Recommissioning" section in this manual.*

UNDERSTANDING THE GASOLINE GENERATOR

The gasoline engine driving an AC generator is in many ways similar to a gasoline automobile engine. The cylinders are in-line, and the engine's cylinder head has an overhead camshaft which is belt-driven. The engine incorporates a pressure type lubrication system, and a water-cooled engine block.

To a large degree, the generator's engine requires the same preventive maintenance that is required of a gasoline automobile engine. The most important factors to the generator's longevity are proper ventilation, maintenance of the fuel system, ignition system, and cooling system.

CARBON MONOXIDE DETECTOR

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

The presence of carbon monoxide indicated an exhaust leak from the engine or generator or from the exhaust elbow/exhaust hose, or the 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!



RIGGING AND LIFTING

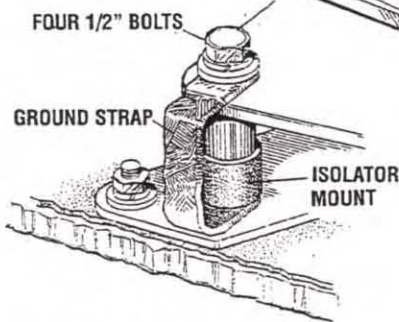
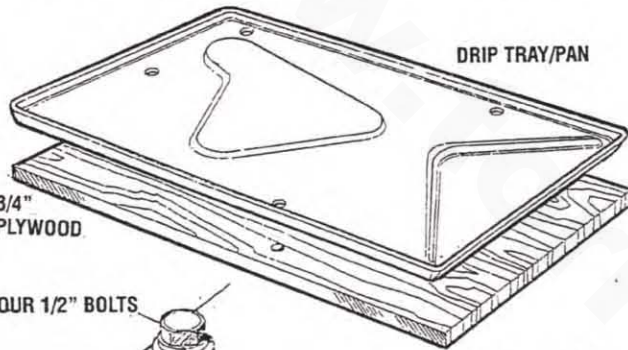
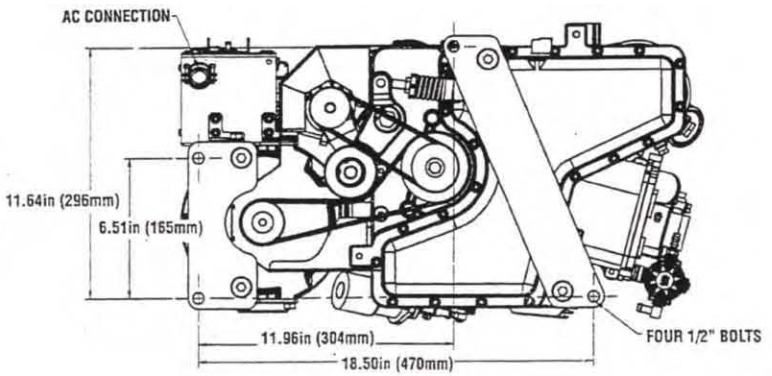
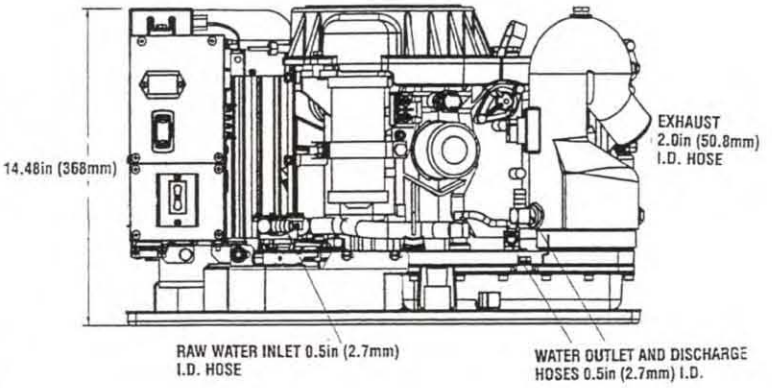
The engine/generator is fitted with lifting eyes. Attach wire rope or chain slings capable of supporting the engine/generators weight to the eyes and lift the engine/generator by means of tackle attached to these slings. The lifting eyes have been designed to carry the full weight: auxiliary slings are not necessary.

NOTE: Rigging work is best done by someone experienced and competent in handling machinery.

LOCATION AND MOUNTING

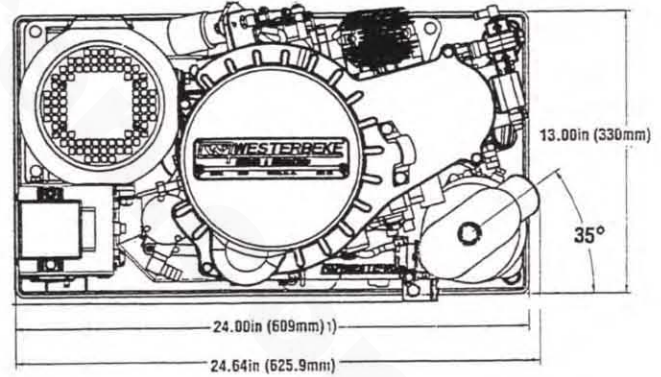
A solid, level mounting platform is very important for the proper operation of your generator. Select a location that will allow adequate space on all sides for ventilation and servicing. Locate the generator away from living quarters, and away from bilge splash and vapors.

Refer to WESTERBEKE'S installation manual for detailed information on installing a Marine Generator in a boat.



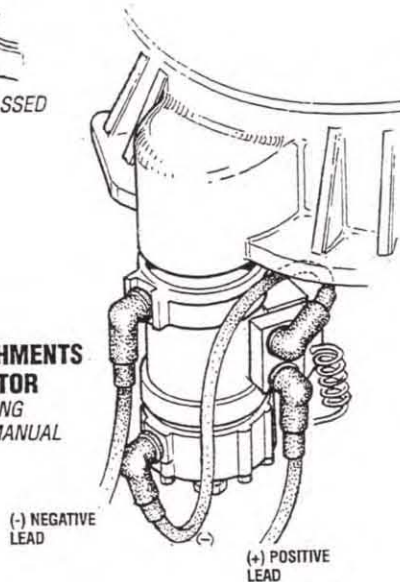
USE THE PAN AS A TEMPLATE FOR LOCATING THE PROPER MOUNTING HOLES TO THE PLYWOOD BASE

3/4" PLYWOOD-BOLTED/FIBERGLASSED IN PLACE



DIMENSION (INCHES AND MM)

BATTERY ATTACHMENTS TO STARTER MOTOR
 REFER TO THE WIRING DIAGRAM IN THIS MANUAL



INSTALLATION

RAW WATER DISCHARGE

The raw water cooled 3.0KW Generator is cooled internally by a continuous flow of raw water.

The fresh water cooled model is cooled internally by fresh water (coolant). This coolant is cooled by a continuous flow of raw water (via the heat exchanger).

Both model generators use the engine cooling raw water to cool the exhaust system as it is discharged overboard. A raw water supply hose delivers the raw water from the engine to the water injected exhaust elbow.

RAW WATER SUPPLY HOSE

The raw water supply hose from the discharge connection on the engines cooling system to the inlet connection of the water injected exhaust elbow **must be** looped a minimum of 12 inches (30cm) above the vessels loaded water line.

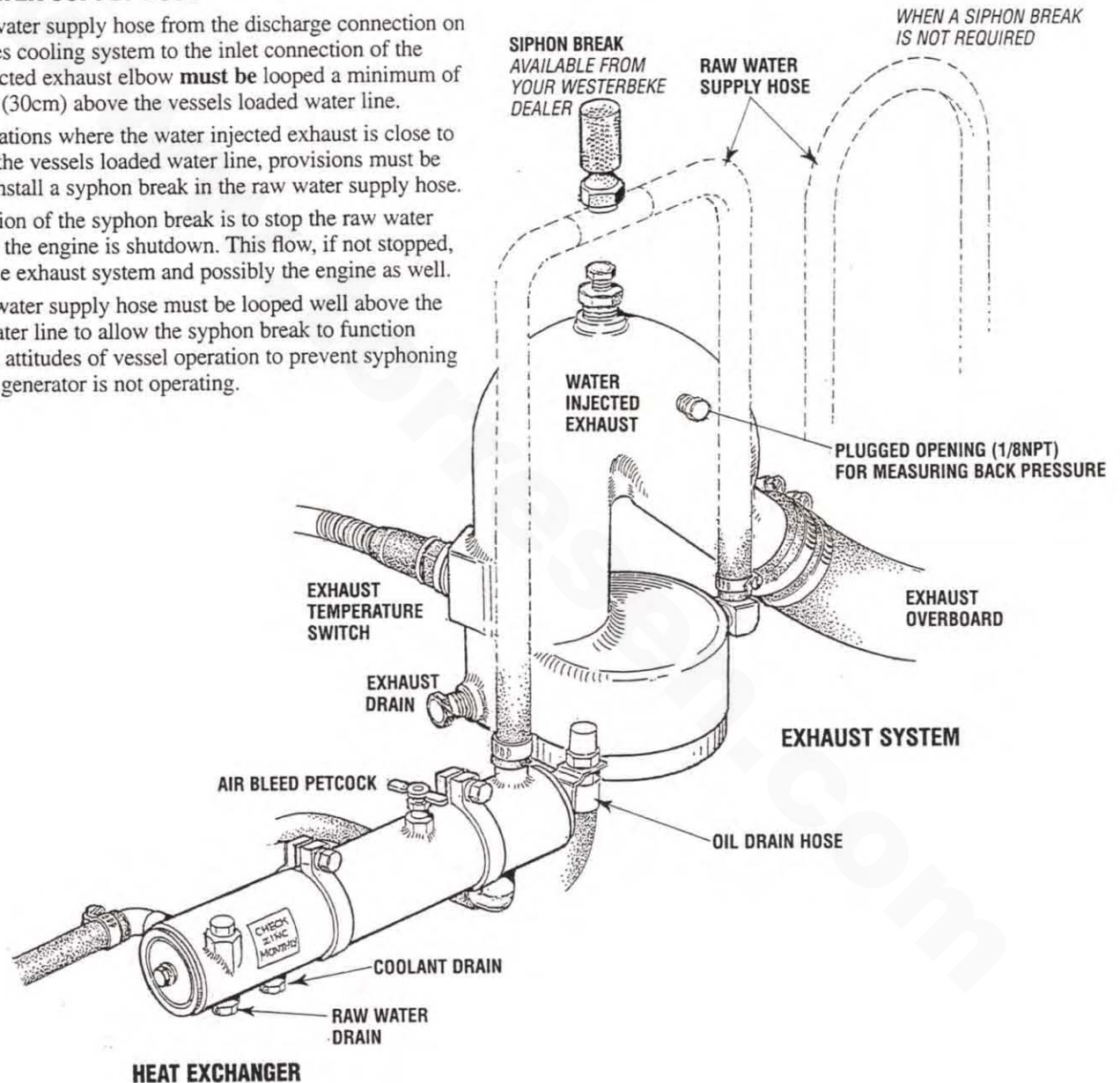
On installations where the water injected exhaust is close to or below the vessels loaded water line, provisions must be made to install a syphon break in the raw water supply hose.

The function of the syphon break is to stop the raw water flow after the engine is shutdown. This flow, if not stopped, will fill the exhaust system and possibly the engine as well.

The raw water supply hose must be looped well above the loaded water line to allow the syphon break to function during all attitudes of vessel operation to prevent syphoning when the generator is not operating.

When the generators location is above the loaded waterline of the vessel during all attitudes of vessel operation, it is still advisable to loop the raw water discharge hose at least 6 inches or more above the generator and then down to the inlet connection on the water injected exhaust elbow.

NOTE: Always use quality hose with good wall integrity or wire reinforced hose so it will maintain its shape when looped and also provide proper mechanical support for the hose.



GASOLINE

⚠ CAUTION: *Only use unleaded fuel with an octane rating of 89 or higher. Leaded fuel will cause serious harm to your engine and violate your warranty.*

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 be rendered 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, Coast Guard approved metal bowl type filter/water separator between the fuel tank and the engine.

ENGINE OIL

Use a heavy duty engine oil with an API classification of SJ. Change the engine oil and filter after an initial 50 hours of break-in operation, and every 100 hours of operation thereafter. An oil viscosity of SAE 15W-40 is recommended for this engine in all conditions.

⚠ 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 COOLING

The 3.0KW Generator is cooled by raw water. This raw water cooling system is described on the *COOLING SYSTEM* page.

A fresh water cooling system kit is available from WESTERBEKE that converts a raw water cooled model to a fresh water system. Contact your WESTERBEKE dealer for information.

FRESH WATER COOLED MODELS

The 3.0KW Generator is also manufactured as a fresh water cooled model. For operating instructions, refer to *FRESH WATER COOLED MODELS* in this manual.

CONTROL PANEL - START/STOP PROCEDURE

DESCRIPTION

The control panel provides the operator with a simple stop/start rocker switch and a hourmeter.

The plug-in connections for the engine wiring harness, governor sensor and remote panel are located on the side of the control panel along with a 10 amp fuse.

The ignition control module with it's plug-in wiring is mounted on the top of the panel.

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 starting

STARTING

The engine has a 12 VDC electric starter.

To Start: Press the rocker switch to the start position and release. The engine will crank and start electronically and the switch will show a RED light to indicate the engine is running.

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 condition. This should smooth out as the engine warms up and the generator loads are applied.

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

To Stop: Press the rocker switch to stop and release. The engine will shutdown and the LED light will turn off.

GENERATOR OPERATION

START: Depress switch to START position. START LED will light, engine will crank. RUN LED will remain on when engine is running.

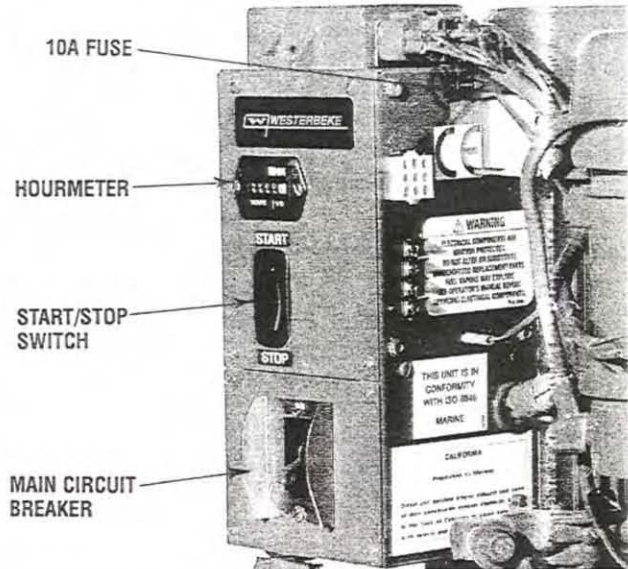
STOP: Depress switch to STOP position. Engine will stop, RUN LED will turn off.



ENGINE STOP/START DECAL

Abnormal Stop (refer to SAFETY SHUTDOWN SWITCHES)

An abnormal stop is one in which the generator ceases to run and comes to a stop as a result of an operating fault which may cause damage to the engine, the generator, or create an unsafe operating condition.



WARNING: Should the engine fail to start once the start switch has been depressed, a crank limit circuit will disengage the starter and stop the starting cycle. This will occur after approximately 15 seconds of cranking with no start. This is to prevent prolonged cranking without the engine starting which can result in the exhaust system filling with water and backing into the engine.

REMOTE PANEL

A remote panel is available that allows for remote operation of the generator. The panel comes with either a 15' or 30' plug-in extension harness. The start/stop sequence is identical. Once installed, the engine can be operated by either panel.



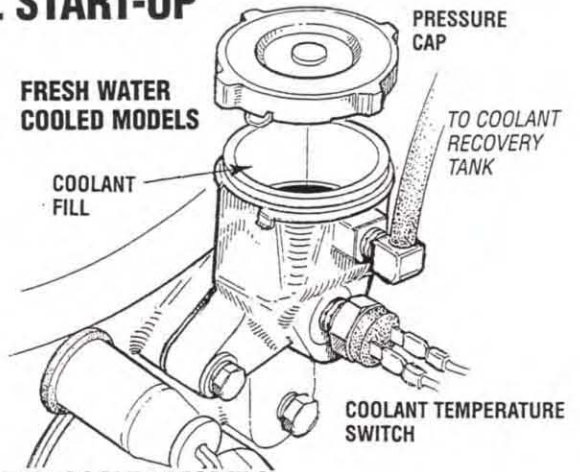
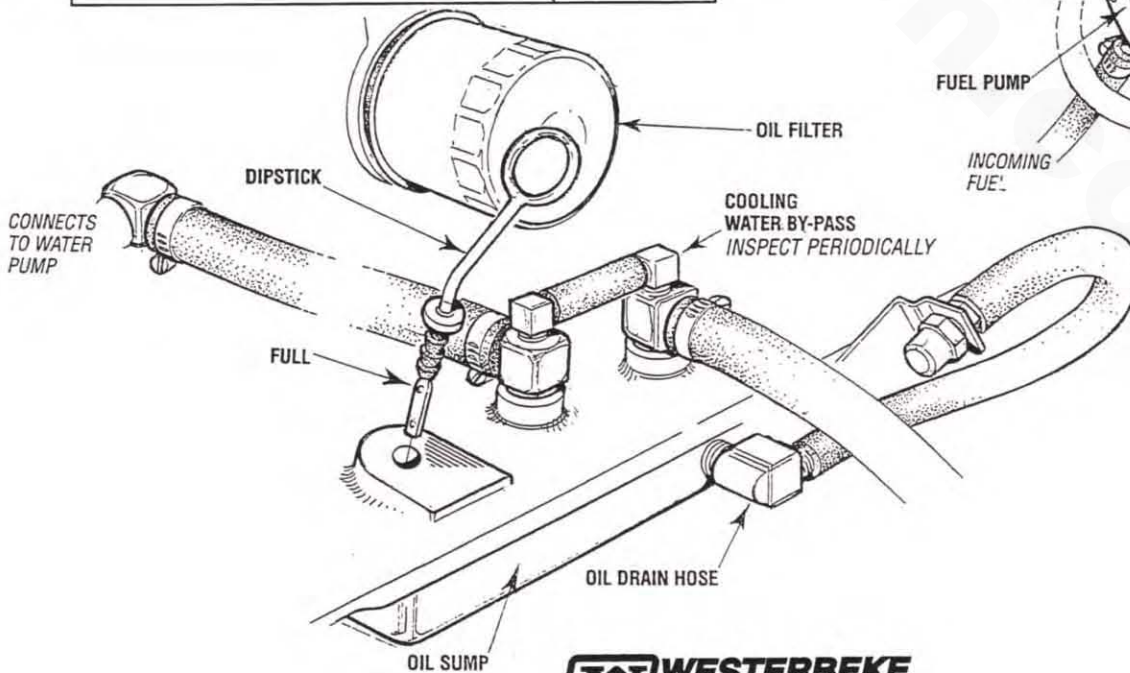
PREPARATIONS FOR INITIAL START-UP

PRESTART INSPECTION

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

- Make certain the cooling water thru-hull petcock is open.
- 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 contaminant's.
- Check the DC electrical system. Inspect wire connections and battery cable connections.
- Check load leads for correct connection as specified in the wiring diagrams.
- Examine air inlet and outlet for air flow obstructions.
- Be sure no other generator or utility power is connected to 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 the 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.
- Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, and check threaded connections. Search for any gasoline leaks.

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.

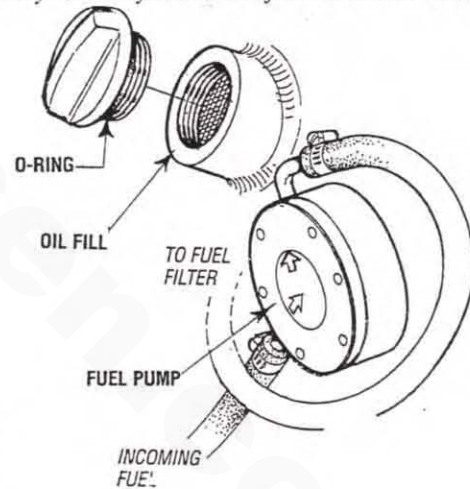


FRESH WATER COOLED MODELS

- 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.



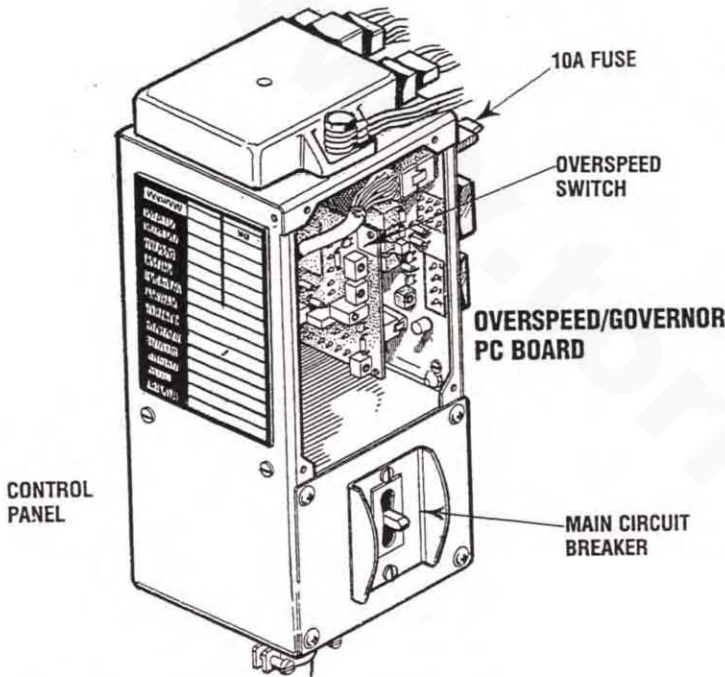
SAFETY SHUTDOWN SWITCHES

SAFETY SHUTDOWN SWITCHES

This engine is protected by three shutdown switches and two fuses. Should a shutdown occur, *do not attempt to restart without finding and correcting the cause*. Refer to the heading *Engine starts, runs and then shuts down* in the *ENGINE TROUBLESHOOTING* section of this manual.

OVERSPEED SWITCH

The overspeed PC board inside the control panel will shut the engine down if the engine speed (RPM'S) exceeds the operating speed required to run the generator. The overspeed PC board will reset itself once the engine shuts down.



MAIN CIRCUIT BREAKER AC 25A

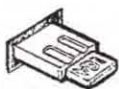
The main circuit breaker at the control panel will automatically disconnect the AC power if there is an electrical overload.

This circuit breaker should be manually switched off when servicing the engine/generator to ensure that no power is coming into the boat. The breaker is reset manually.

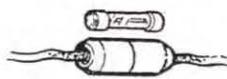
FUSES

A 10A fuse located on the side of the control panel protects the DC electrical wiring. If an electrical overload occurs the fuse will blow and shut the engine down.

An 20A in-line fuse protects the battery charging circuit. If this fuse fails, the engine will continue to run but the battery will not be charging.



10A FUSE

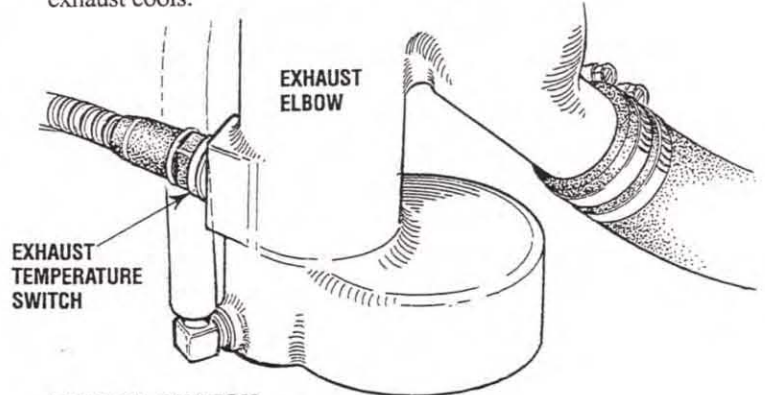


20A FUSE
BATTERY CHARGING

WESTERBEKE
Engines & Generators

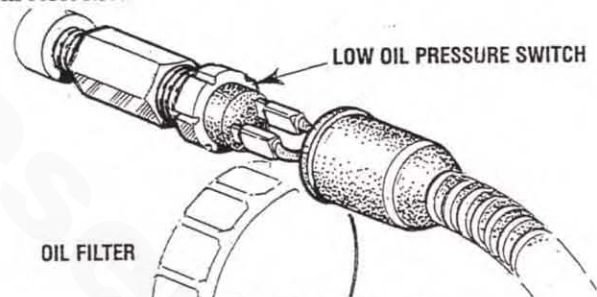
EXHAUST TEMPERATURE SWITCH

An exhaust temperature switch located at the base of the exhaust elbow sensors an excessive exhaust temperature (an inadequate supply of cooling water). A temperature above 240° F will shut the engine down. Inspect the cooling system, water pump, pump belt, seacock, water strainer, water hoses, etc. This switch will reset itself when the exhaust cools.



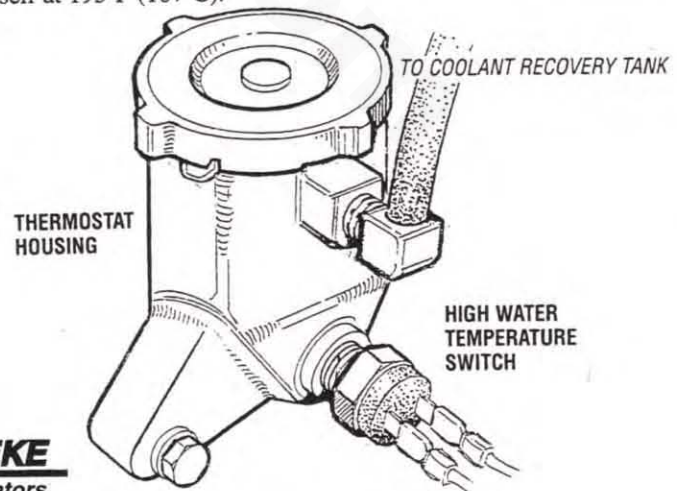
LOW OIL SWITCH

Located just to the right of the oil filter, this switch sensors the engine's oil pressure if the oil pressure falls to below 5 psi. This switch will shut the engine down. Check the angle of operation, dipstick oil level and oil filter. The switch will reset itself.



HIGH WATER TEMPERATURE SWITCH (Fresh Water Cooled Model)

A high water temperature switch is located at the thermostat housing. Normally closed, this switch, should the fresh water coolant's operating temperature reach approximately 210°F (99°C), will open and shut the engine down. This switch resets itself at 195°F (107°C).



MAINTENANCE SCHEDULE

⚠ WARNING: *Never attempt to perform any service while the engine 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.*

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

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
Fuel Supply	<input type="checkbox"/>								Unleaded gasoline with octane rating of 89 or higher
Fuel/Water Separator	<input type="checkbox"/>								Check for water and dirt in fuel (drain/replace filter if necessary).
Engine Oil Level	<input type="checkbox"/>								Maintain at the full level.
Drive Belt	<input type="checkbox"/> weekly								Inspect and adjust at first 25 hours. Measure spring tension. Inspect edges for wear. Replace every 1000 hours.
Visual Inspection of Engine	<input type="checkbox"/>	NOTE: <i>Please keep engine surface clean. Dirt and oil will inhibit the engine's ability to remain cool.</i>							Check for fuel, oil and water leaks. Inspect wiring and electrical connections. Keep bolts & nuts tight. Check for loose belt tension.
Spark Plugs		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check gap. Inspect for burning and corrosion.
Generator		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check that AC connections are clean and secure with no chafing - see <i>GENERATOR INFORMATION</i> for additional information.
Fuel Filter		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial change at 50 hrs, then change every 250 hrs.
Starting Batteries (and House Batteries)	<input type="checkbox"/> weekly								Every 50 operating hours check electrolyte levels and make sure connections are very tight. Clean off excessive corrosion.
Engine Oil/Filter		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial engine oil & filter change at 50 hrs., then change both every 100 hours.
*Adjust the Valve Clearances		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	Initial adjustment at 50 hours, then every 500 hours.
Carburetor Air Screen (Flame Arrester)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean at 50 ours, then every 100 hours.
Exhaust System		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial check at 50 hrs., then every 250 hrs. Inspect for leaks. Check siphon brake operation. Check the exhaust elbow for carbon and/or corrosion buildup on inside passages; clean and replace as necessary. Check that all connections are tight.
Engine Hoses			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hose should be hard & tight. Replace if soft or spongy. Check and tighten all hose clamps.
Engine Zinc Anode		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Inspect and replace if necessary.

*WESTERBEKE recommends this service be performed by an authorized mechanic.



MAINTENANCE SCHEDULE

NOTE: Use the engine hour meter gauge to log your engine hours or record your engine hours by running time.

*WESTERBEKE recommends this service be performed by an authorized mechanic.

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
Raw Water Pump				<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	Remove the pump cover and inspect the impeller for wear. Replace if needed. Also inspect the O-rings. Lubricate both when reassembling.
Fresh Water Pump (if applicable)					<input type="checkbox"/>		<input type="checkbox"/>		Remove raw water pump to access the fresh water pump. Remove the cover and inspect the impeller and inside cover for wear. Also inspect the sealing O-rings.
Raw Water Cooling System						<input type="checkbox"/>			At winter lay-up or if the generator is to be idle for more than 3 months, flush with fresh water.
Fresh Water Cooling System (if applicable)					<input type="checkbox"/>				Drain, flush, and refill cooling system with appropriate antifreeze mix.
Heat Exchanger		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean or replace anode. Open heat exchanger end cap and clean out debris. Remove every 1000 hours for professional cleaning and pressure testing.
*Starter Motor					<input type="checkbox"/>			<input type="checkbox"/>	Check solenoid and motor for corrosion. Remove and lubricate. Clean and lubricate the starter motor pinion drive.
*Engine Cylinder Compression		<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>	Incorrect valve clearance will result in poor engine performance. Check compression pressure and timing and adjust valve clearances.
*Exhaust Elbow					<input type="checkbox"/>				Test exhaust elbow for casting integrity. Replace if casting is corroded or deteriorated. WARNING: A defective exhaust elbow can cause carbon monoxide leakage!



ENGINE LUBRICATING OIL

DESCRIPTION

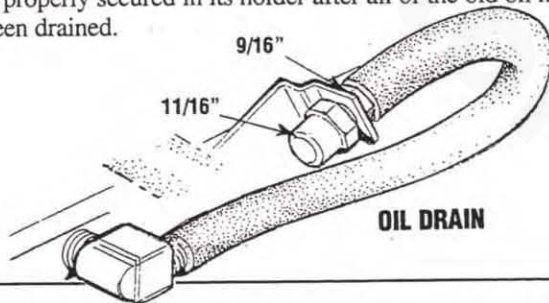
Use a heavy duty engine oil with an API classification of SJ. Change the engine oil after an initial 50 hours of break-in operation, and every 100 hours of operation thereafter. For recommended oil viscosity, see the following chart:

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.

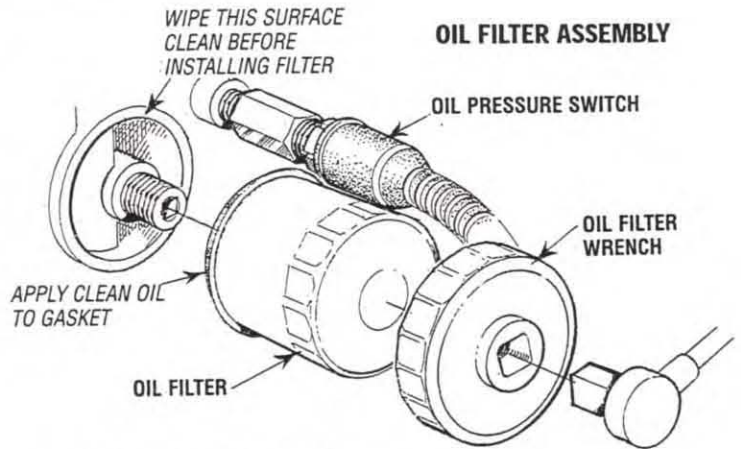
CHANGING THE ENGINE OIL

The engine oil should be warm. Remove the oil drain hose from its attachment bracket and lower it into a container and allow the oil to drain, or attach a pump to the end of the drain hose and pump the old oil out. Make sure the oil drain hose is properly secured in its holder after all of the old oil has been drained.



WARNING: 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.

Always observe the old 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 competent mechanic if water is present in the oil. Water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning through the water cooling circuit into the exhaust, filling it up into the engine.



CHANGING THE OIL FILTER

When removing the used oil filter, you may find it helpful to punch a hole in the upper and lower portion of the old filter to drain the oil into a container before removing it. This helps to lessen spillage. An automotive filter wrench should be helpful in removing the old oil filter. Place some paper towels and a plastic bag around the filter when unscrewing it to catch any oil that's in the filter. Inspect the old oil filter as it is removed to make sure that the rubber sealing gasket comes off with the old oil filter. If this rubber sealing gasket remains sealed against the oil filter adapter, gently remove it. When installing the new oil filter element, wipe the filter gasket's sealing surface on the oil filter adapter free of oil and apply a thin coat of clean engine oil to the rubber sealing gasket on the oil filter. Screw the filter onto the threaded oil filter stub, and tighten the filter firmly by hand.

NOTE: Use genuine WESTERBEKE oil filters. Generic filters are not recommended.

REFILLING THE OIL SUMP

Add fresh oil through the valve cover. After refilling the oil, run the engine for a few moments while checking the engine's oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and then stop the engine. Then check the quantity of oil with the lube oil dipstick. Fill to the FULL mark on the dipstick.

NOTE: It is important, because of the shallow oil sump to keep the oil level at the full mark.

GASOLINE

Use **unleaded** 89 octane or higher gasoline. When fueling, follow U.S. Coast Guard regulations, close off all hatches and companionways to prevent fumes from entering the boat, and ventilate after fueling.

NOTE: The generator compartment should have a gasoline fume detector/alarm properly installed and working.

⚠ 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.

GASOLINE/WATER SEPARATOR AND FILTER

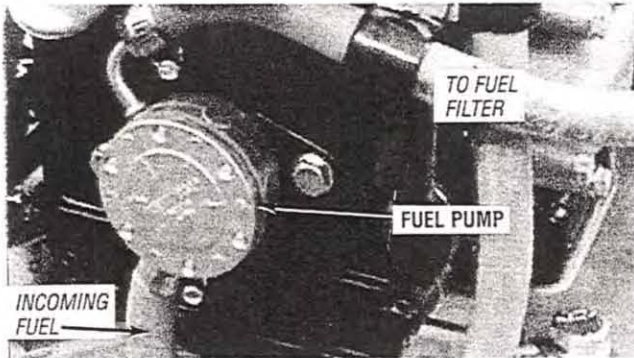
A primary fuel filter of the water separating type **must** be installed between the fuel tank and the engine to remove water and other contaminants from the fuel before they can be carried to the fuel system on the engine.

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

These gasoline filters must have **metal** bowls (not "see-through") to meet U.S. Coast Guard requirements. The metal bowls have drain valves to use when checking for water and impurities.

FUEL PUMP

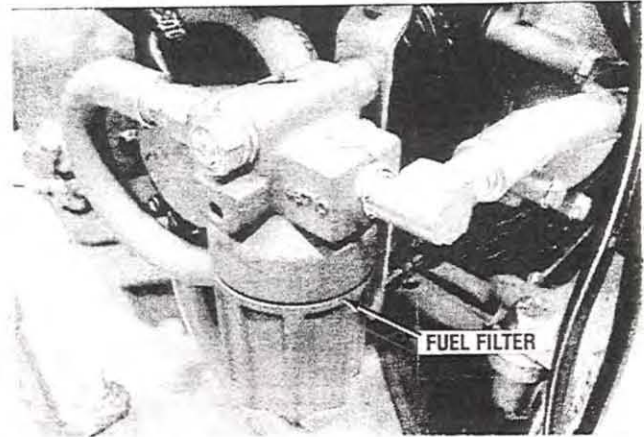
Periodically check the fuel connections to and out of the pump and make sure that no leakage is present and that the fittings are tight and secure. The engine mounted fuel pump is maintenance free.



⚠ WARNING: Fuel leakage at the fuel pump or its connections is a fire hazard and should be corrected. Make sure proper ventilation exists whenever servicing fuel system components.

ENGINE FUEL FILTER

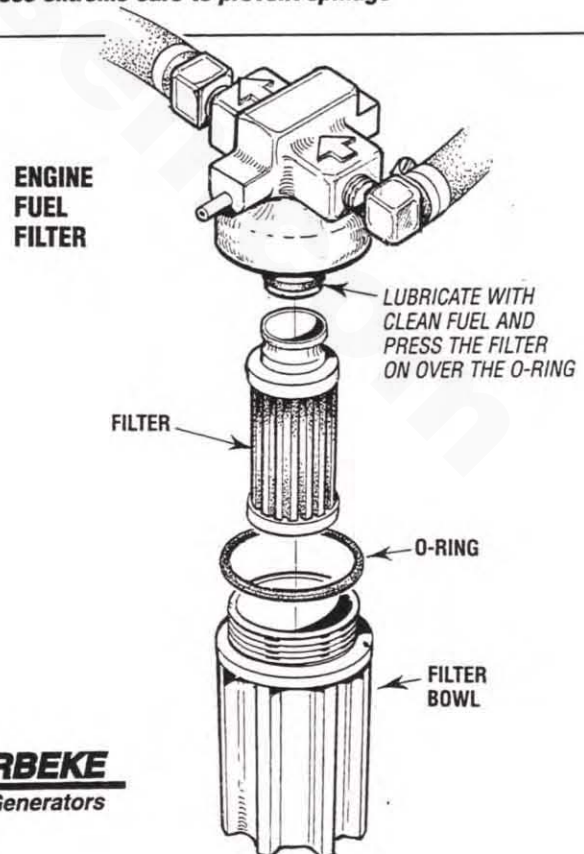
Periodically check the fuel connections and the filter bowl for leakage. Change the filter element after the first 50 hours. See the **MAINTENANCE SCHEDULE**.



Changing the Filter Element

1. Shut off the fuel supply.
2. Unscrew the filter bowl from the housing and allow bowl to come away from the housing. Remove and replace the filter element and clean the bowl.
3. Remove and replace the filter element and clean the bowl
4. Inspect both O-rings. Replace if necessary.
5. Press on a new filter and replace the filter bowl.

⚠ WARNING: Fuel is present in the hoses and lines. Use extreme care to prevent spillage



RAW WATER INTAKE STRAINER

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

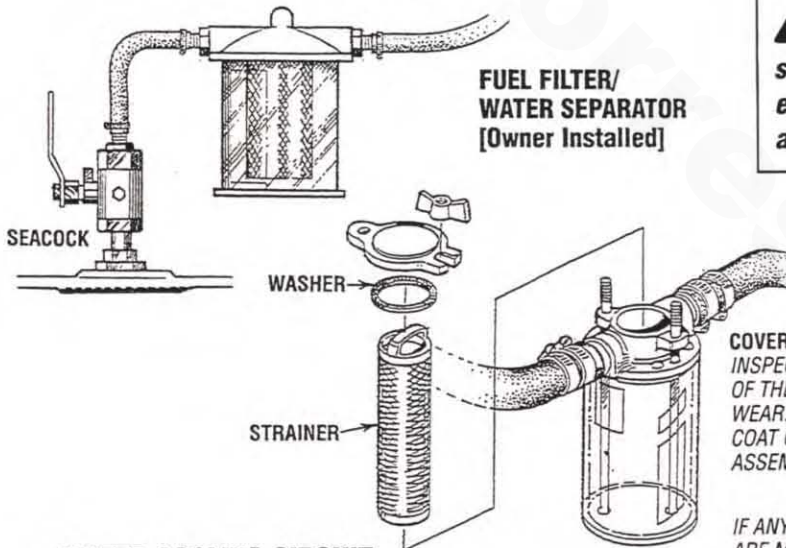
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should always be clear.

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 washer if necessary.
5. Re-assemble 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 an overheat occurs, the cause may be that silt, leaves or grass may have been caught up in the strainer, slowing the flow of water through the cooling system



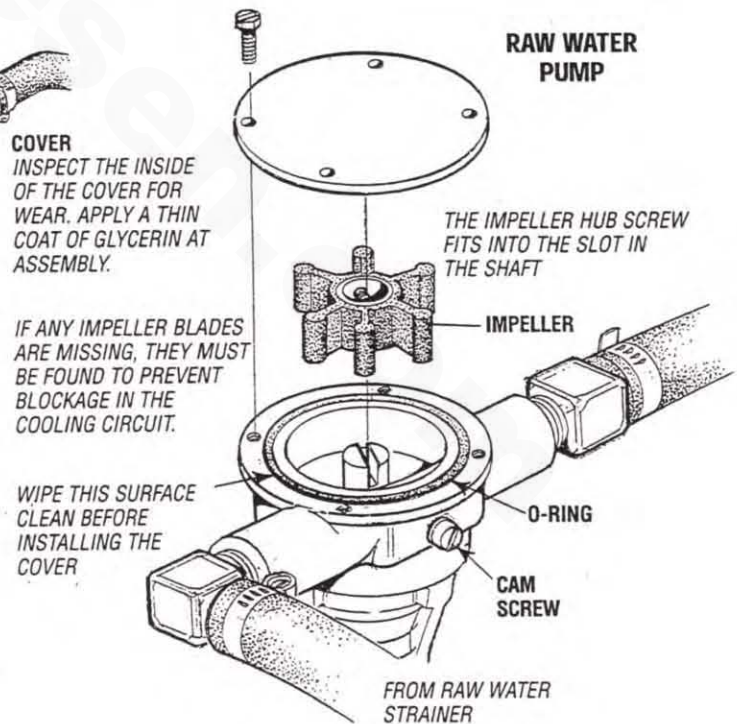
WATER COOLING CIRCUIT

The water flow is created by a positive displacement impeller pump. This pump draws water directly from the water source (ocean, lake, or river) through a hose to the water strainer. The water passes from the strainer through the water pump to the engine where it cools the engine. The water is then discharged into the water-injected exhaust elbow, mixing with and cooling the exhaust gasses. This mixture of exhaust gas and cooling water is discharged overboard by the engine's gas discharge pressure. An internal engine thermostat controls the water temperature. This thermostat is maintenance free.

CHANGING THE RAW WATER PUMP

1. Close the raw water intake valve to prevent water from syphoning from the pump.
2. Remove the pump cover. Note the direction the blades are turned (when installing the new impeller, bend the blades in the same direction).
3. Using pliers, grasp the hub of the impeller and pull it out.
4. Inspect the impeller by bending each blade looking for cracks at each base. Also inspect the inside of the cover, the cam plate, the O-ring, and the inner wear plate. Replace any worn components.
5. Wipe the inside of the pump dry and then apply a film of glycerin to the pumps interior and sealing O-ring.
6. Install the new impeller with a rotating motion so the blades are "working" in the same direction as the old impeller blades.
7. Apply glycerin to the impeller, install, and reassemble the pump making certain the cover screws are tight. Replace any hoses that may have been removed.
8. Open the water intake valve, start and run the engine and check for leaks around the pump. Also make sure raw cooling water is discharging overboard.

⚠ WARNING: When the engine is started, make sure that the pump is pumping within 30 seconds after engine start. If it does not, "stop" the engine at once and correct the problem.



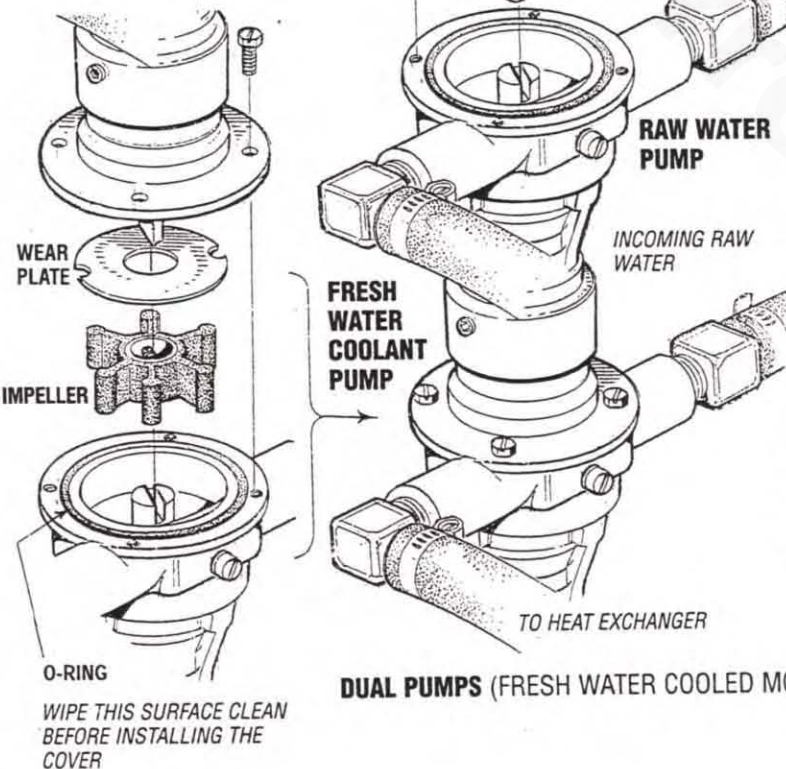
RAW WATER PUMP (Fresh Water Cooled Models)

The fresh water cooled model has the raw water pump mounted above the fresh water (coolant) pump as illustrated. This pump is a self-priming, rotary pump with a non-ferrous housing and a Neoprene impeller. The impeller has flexible blades that wipe against a curved cam plate within the impeller housing, producing the pumping action. *On no account should this pump be run dry.* There should always be a spare impeller and impeller cover gasket aboard (an impeller kit). Raw water pump impeller failures occur when lubricant (water) is not present during engine operation. Such failures are not warrantable, and operators are cautioned to make sure water flow is present at start-up. The raw water pump should be inspected periodically for broken or torn impeller blades. See *MAINTENANCE SCHEDULE*.

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

PUMP COVER
 INSPECT THE INSIDE SURFACE FOR WEAR.

IMPELLER
 FIT THE HUB SCREW INTO THE SHAFT SLOT WHEN ASSEMBLING, COAT THE IMPELLER AND O-RING WITH GLYCERIN



DUAL PUMPS (FRESH WATER COOLED MODELS)

CHANGING THE FRESH WATER (Coolant Pump) IMPELLER

Remove the cover screws and the cover will separate the upper pump (raw water) from the fresh water (coolant) pump as shown in the illustration. Close the raw water thru hull seacock. This will prevent water syphoning out of the pump while the impeller is being changed.

1. Remove the wear plate to expose the impeller. Notice the direction the impeller blades are working in so as to install the replacement impeller with blades working in the same direction.
2. Using pliers, grab the impeller hub and withdraw the impeller from the pump. Inspect the inside of the pump, the cam, the inner wear plate, and the inside surface of the cover plate for wear. Replace any worn components.
3. Wipe the inside surface of the pump dry. Apply a film of glycerin supplied in the impeller kit to the inside pump surfaces and to the exposed area of the shaft lip seal.
4. Install the new impellers with a rotating motion so the blades are working in the same direction as those of the removed impeller.
5. Apply glycerin to the O-ring, impeller, gasket, the wear plate and assemble into the pump housing. Reassemble the upper pump (raw water) making certain the fasteners are tight. Re-install any hoses that were removed.
6. Run the engine to make certain both pumps are operating properly. The engine should run at proper temperature. raw water should discharge from the exhaust and there should not be any leaks around the pumps.

WARNING: *When the engine is started, make sure that the pump is pumping within 30 seconds after engine start. If it does not, "stop" the engine at once and correct the problem.*

To increase the service life of the impeller, do not install the impeller in the pump if the engine will be in storage for longer than 3 months. Store the impeller in a dark, cool, and dry location. Replace the cover plate on the pump securely and ensure the thru hull seacock is closed.

WATER INTAKE STRAINER

A water intake strainer (raw water) is a required component when the generator is installed. Refer to the previous page for details.

FRESH WATER COOLING CIRCUIT

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 provide coolant circulation in the engine block). 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.

ENGINE COOLANT

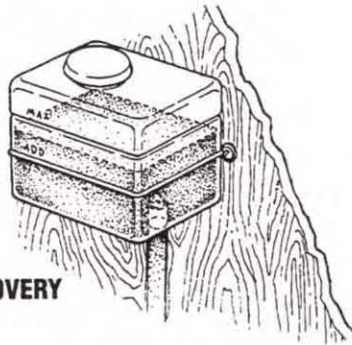
WESTERBEKE recommends a mixture of 50% antifreeze and 50% distilled water. Distilled water is free from the chemicals that can corrode internal engine surfaces.

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

NOTE: Look for the new environmentally friendly long lasting antifreeze that is now available.

The recommended 50/50 mixture will protect the engine against the most extreme temperature. The antifreeze mixture will also retard rust within the engine and add to the life of the circulating pump impeller and seals.

A proper 50/50 mixture as recommended will protect the engine coolant to temperatures of - 40°F.

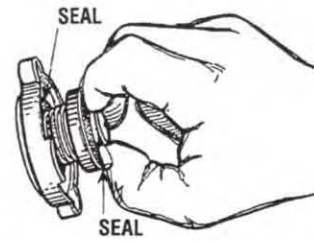


COOLANT RECOVERY TANK

Coolant Recovery Tank

The coolant recovery tank allows for the expansion and contraction of the engines coolant during engine operation without introducing air into the system. This recovery tank is provided with fresh water cooled models and with the fresh water coolant conversion kit 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.



NOTE: Periodically check the condition of the 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.

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 heat exchanger and opening pressure cap. Also loosen the air bleed petcock on the top of the heat exchanger

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

Refilling the Coolant

Tighten the heat exchanger drain plug and slowly pour clean, premixed coolant in thru the coolant fill. Leave the heat exchanger air bleed petcock loose to allow trapped air to escape. As the filling continues, start and run the engine. Close the air bleed petcock and fill until coolant tops off at the coolant fill. Install the 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 and make certain the coolant is topped off at the pressure cap. Clean up any spilled coolant.

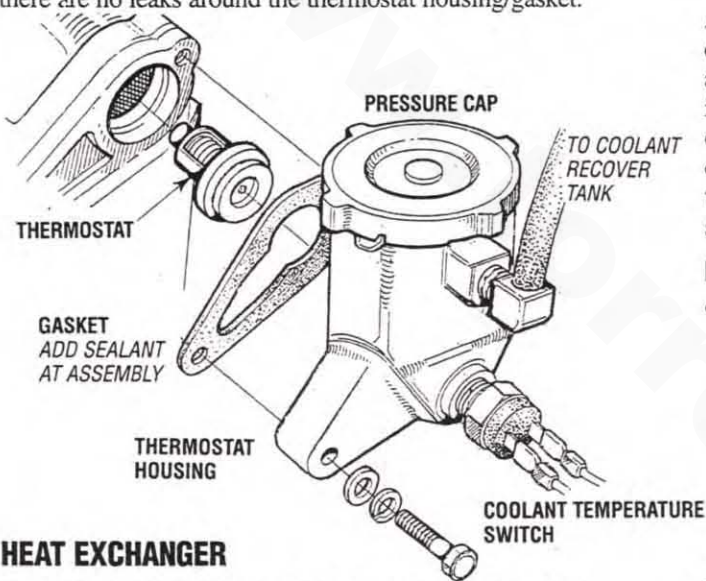
THERMOSTAT

Fresh water cooled 3.0KW generators have a thermostat that 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 around the thermostat to provide coolant circulation in the engine block). 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.

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



HEAT EXCHANGER

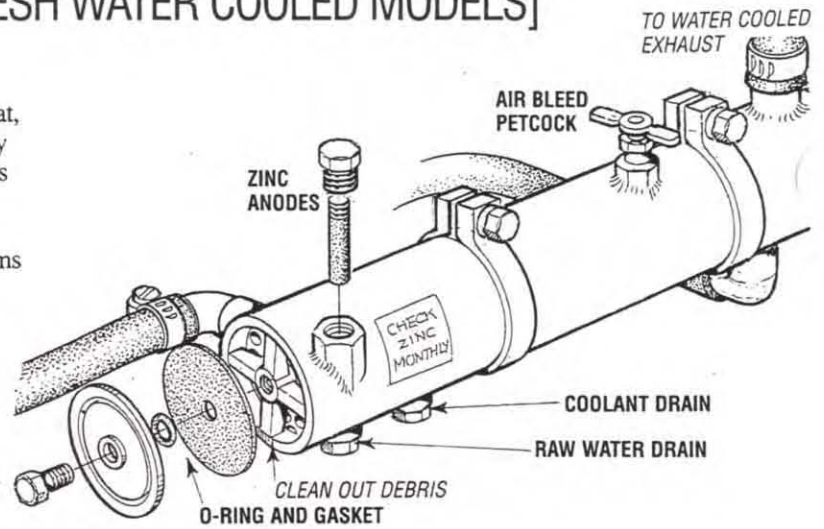
Cool raw water flows through the inner tubes of the heat exchanger. As the engine coolant passes around these tubes, the heat of the internal engine is conducted to the raw water which is then pumped into the exhaust system and discharged. The engine coolant (now cooled) flows back through the engine and the circuit repeats itself.

The engine coolant and raw water are independent of each other; this keeps the engine's water passages clean from the harmful deposits found in raw water.

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.)

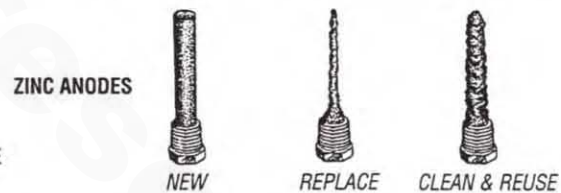
NOTE: Operating in silty and/or tropical waters may require that a heat exchanger cleaning be performed more often than every 1000 hours.



ZINC ANODE

A zinc anode, or pencil, is located in the raw water cooling circuit within the heat exchanger. The purpose of the zinc anode is to sacrifice itself 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 is the result of each particular installation and vessel location; not that of the engine.



If the zinc pencil needs replacement, hold the hex boss into which the zinc pencil 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 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, 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.

CARBURETOR

CARBURETOR

The carburetor is a single barrel, side-draft type with a cleanable metal screen air intake filter/spark arrester.

The choke is operated by a 12 VDC solenoid. The choke solenoid is activated when the start switch is depressed and is controlled by the I.C.M..

Air Screen/Flame Arrester

The air screen can easily be removed. Clean after the first 50 hours of operation and every 100 hours from then on. Clean the air screen in a water soluble cleaner such as GUNK.

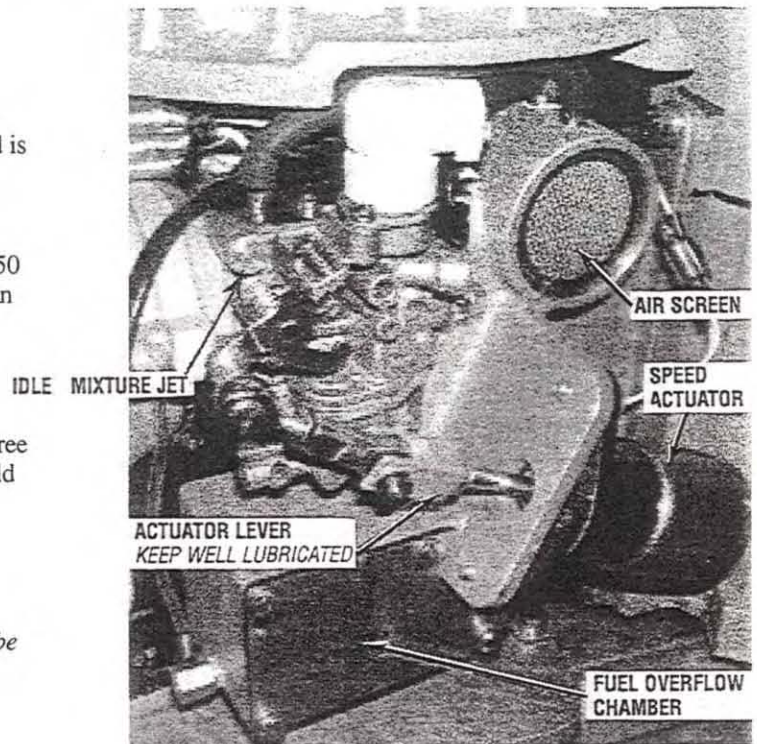
Fuel Overflow Chamber

Excess fuel drains into the fuel overflow chamber but is drawn out again at start-up. This chamber should be kept free of contaminants. Cleaning every 250 operating hours should be sufficient unless there is a fuel problem.

Idle Mixture Jet

The idler mixture jet is factory adjusted and plugged.

NOTE: Ball joint linkage between actuator and throttle. Lube periodically (use graphite lubricant) to maintain smooth operation.



CARBURETOR WITH SPEED ACTUATOR

DESCRIPTION

The DC Circuit functions to start, operate and stop the generator's engine. The circuit is best understood by reviewing the DC Wiring Diagram and Wiring Schematic. The engine's DC wiring is designed with three simple basic circuits: start, run, and stop.

The engine has a 12 volt DC electrical control circuit that is shown on the Wiring Diagrams. 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.*

Specifications

The minimum recommended capacity of the battery used in the engine's 12-volt DC control circuit is 300-900 (CCA).

Battery Charging Circuit

The engine supplies a continuous 7 amp charge from the voltage regulator to the engine's battery. This charge passes thru an 8 amp fuse (and the ships battery switch).

Testing the Circuit

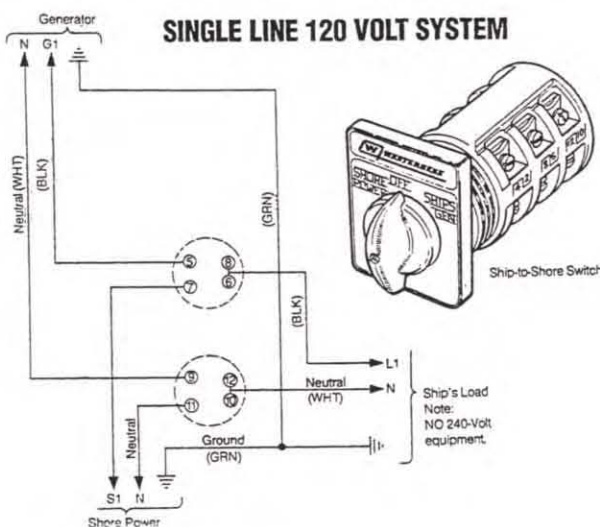
If the battery is not charging, check the fuse. To test the circuit, remove the fuse and test with a voltmeter between the fuse holder connection and ground. With the engine running, it should indicate 13-14 volts. If only battery voltage is indicated, check the terminal connections at the battery.

Battery Maintenance

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 that battery cable connections are clean and tight to the battery posts (and to your engine).
- Keep your batteries clean and free of corrosion.

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.*

Shore Power Transfer Switches are available from your WESTERBEKE dealer.

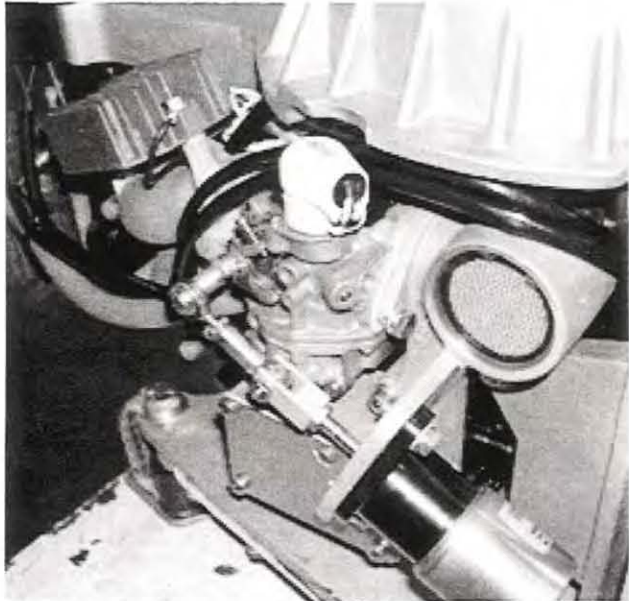
ELECTRONIC GOVERNOR

DESCRIPTION

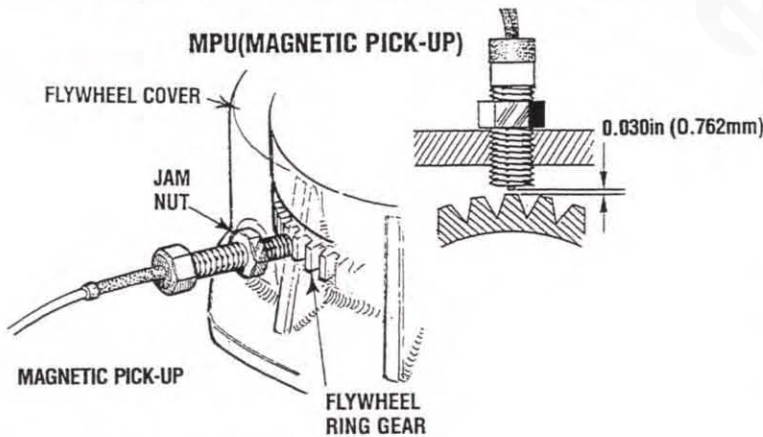
The system is composed of three basic components:

1. **Controller.** The PC board that governs the system is located in the control panel.
2. **Sensor.** Mounted on the flywheel cover, the sensor measures the speed of the engine (via the ring gear).
3. **Actuator.** Electronically controls the carburetor throttle.

The sensor and actuator are wired thru the wiring harness to the controller (PC board).



CARBURETOR WITH ELECTRONIC GOVERNOR ACTUATOR



ADJUSTMENT PROCEDURE

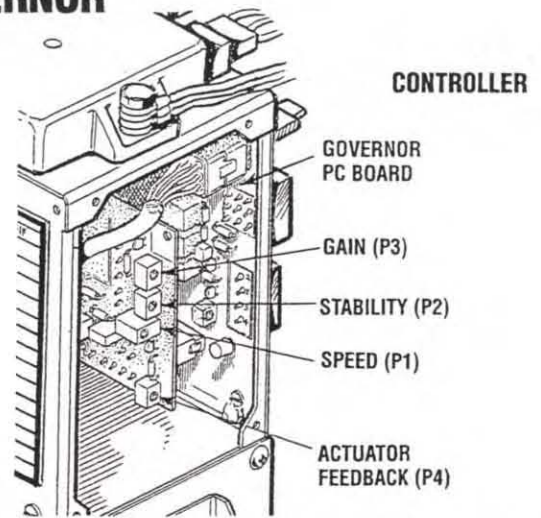
Speed. This adjustment is used to raise or lower the engine's speed. This generator engine is set to run at 2200 RPM.

Gain. Adjusts the overall set of the engine. If too low, the engine seems sluggish, to high causes the engine to hunt.

Stability. Adjusts the engine's response to generator load changes.

Actuator Feedback. Adjusts the stability of the speed signal to the throttle actuator.

NOTE: These adjustments are extremely delicate and require proper meters for measuring voltage and RPM'S.



Following are the basic procedures for adjusting the speed (P1), stability (P2), gain (P3), and actuator feedback (P4) pots.

The adjusting pots (except speed) have physical internal stops. Turn to the right (clockwise) to increase, turn to the left (counter-clockwise) to decrease.

Before starting the engine

- Remove all loads and turn off the AC circuit breaker to insure that loads will not be subjected to voltage variations while these adjustment are made.
- Decrease the speed pot to prevent overspeed at startup.
- Turn the other adjustment pots to the middle position.

Start the engine, monitor speed and adjust to 60 Hz by turning the speed adjustment pot accordingly. Verify that the AC voltage output is between 108 and 132 volts.

Decreasing the gain (P3) dampens no load hunting. With the engine running at no load and proper speed, manually bump the throttle lever to cause hunting. If necessary, decrease the gain in small increments to eliminate hunting.

After the engine's no load speed and gain are set correctly, the AC circuit breaker can be turned on and the ship's load applied. In the event of speed variations with loads applied, the stability (P2) pot may need adjustment. This adjustment also changes how the engine responds to generator load changes.

If the range of adjustment of either gain (P3) or stability (P2) pots do not correct engine hunting, the actuator feedback (P4) pot can be increased. This adjustment dampens the signals to the throttle control actuator. Increasing this adjustment will decrease the amount of throttle control resolution. Because of this, it is recommended the adjustment be made in very small increments. The gain and stability pots may now need to be readjusted.

Most hunting problems occur because of mechanical problems with the linkage between the actuator and the carburetor. Insure that the linkage is free of any debris or corrosion and that it moves freely. It is recommended that the linkage be lubricated with a graphite lubricant. Do not use oil because it tends to collect dirt and dust.

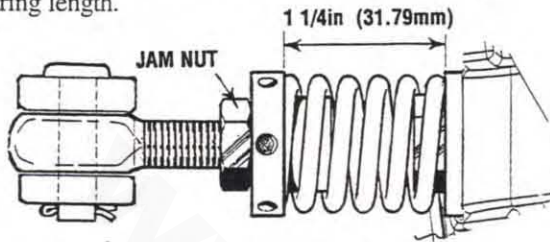
NOTE: Adjustments to one parameter may affect others, such as speed. It may be necessary to readjust some pots throughout this process.



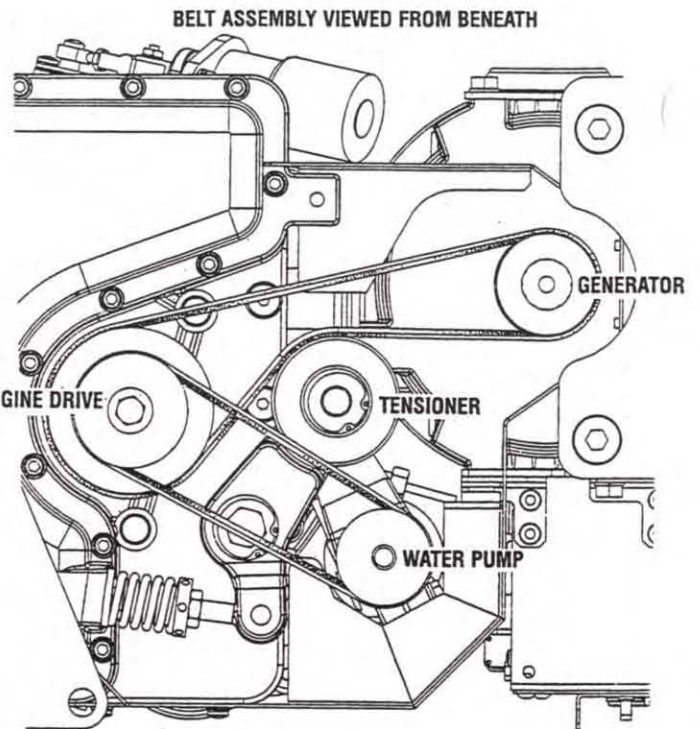
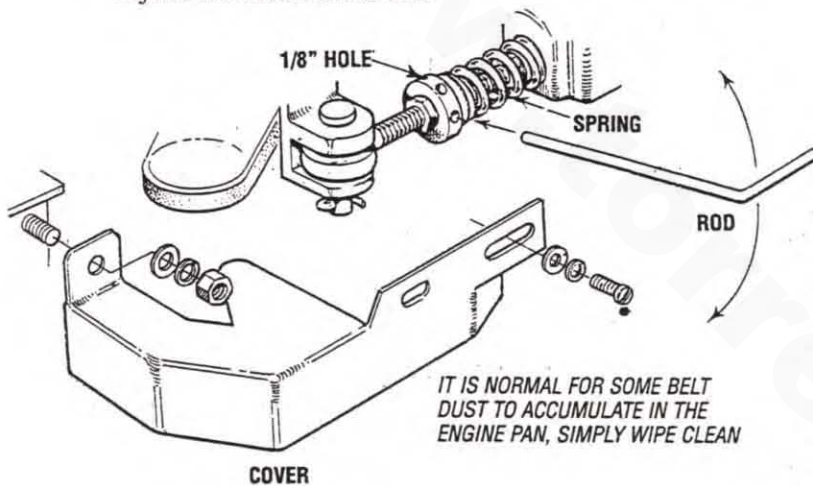
ADJUSTING THE DRIVE BELT

The engine's drive belt is located under the engine. To access the belt, for inspection and/or adjustment, remove the cover as shown. Inspect the belt for wear along the edges and for proper belt tension (belt should be tight).

The belt tension can be checked by measuring the spring length.



To set the spring tension at 1-1/4", release the jam nut and use a rod such as an allen wrench to turn the adjusting nut (as shown) to tighten or loosen the spring tension, which in turn adjusts the tension on the belt.



OIL PRESSURE

The lubricating system is a pressure feeding system using an oil pump. The engine oil is drawn from the oil sump by the oil pump, which drives the oil, under pressure, through the oil filter and various lubricating parts in the engine. The oil then returns to the oil sump to repeat the continuous cycle. When the oil pressure exceeds the specified pressure, the oil pushes open the relief valve in the oil pump and returns to the oil sump, keeping the oil pressure within its specified range.

TESTING OIL PRESSURE

To test the oil pressure, remove the oil switch and install a mechanical oil pressure gauge in its place, it will be necessary to connect the two switch wires together for the engine to run. After warming up the engine, with the engine speed at 2200 rpm, read the oil pressure gauge.

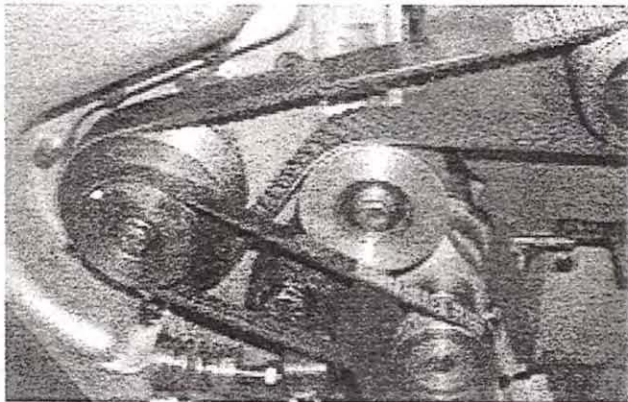
OIL PRESSURE: between 14 and 40 psi AT 2200 rpm

NOTE: A newly started (cold) engine, may have an oil pressure up to 40 psi. A warmed engine can have an oil pressure as low as 14 psi. Oil pressure will vary depending on the load placed on the generator.

OIL PRESSURE SWITCH/SENSOR

The generator is fitted with an oil pressure shutdown switch. Should the engine's oil pressure drop below the safe minimum, the switch will shut the engine down to prevent damage by interrupting the DC voltage to the ignition coil.

NOTE: The specified minimum oil pressure is 5 psi. A gradual loss of oil pressure usually indicates worn bearings. For additional information on low oil pressure readings, see the ENGINE TROUBLESHOOTING chart.



BELT ASSEMBLY VIEWED FROM BELOW

ENGINE COMPRESSION TEST

To check the engine's compression pressure, warm up the engine, then shut it down.

1. Remove both spark plug caps and both spark plugs.
2. Install a compression adapter and gauge in a spark plug hole.
3. Close the thru hull valve (seacock).
4. Crank the engine several times quickly so that the gauge pointer reaches it's maximum.

STANDARD COMPRESSION PRESSURE AT 500 RPM:

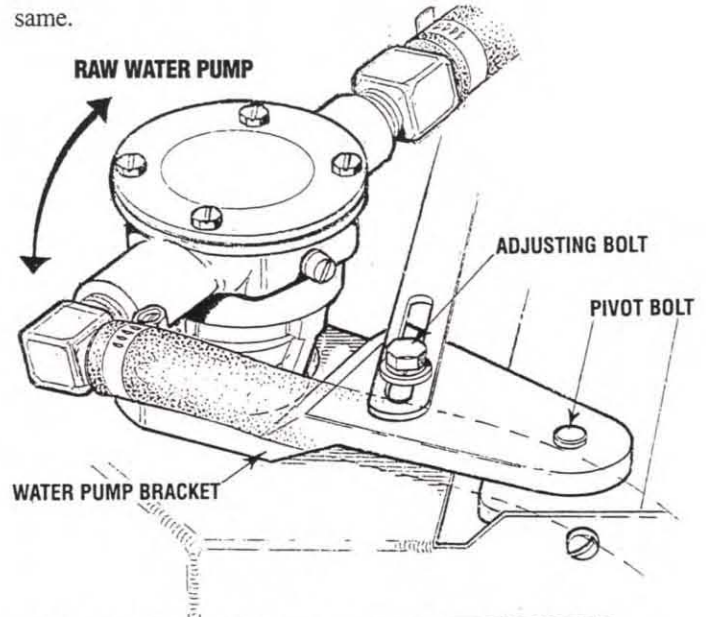
71 PSI (5 ± 1 Kg/cm²) (0.4 ± 0.1 MPa)

5. Test the compression pressure on the other cylinder. If either cylinder is below the standard try adding a small amount of engine oil through the spark plug hole and repeat the test.
 - (a) If additional oil causes an increase of pressure, the piston ring and/or cylinder may be worn or damaged.
 - (b) If additional oil does not increase compression pressure suspect poor valve contact, valve seizure or valve wear.
6. Reinstall the two plugs, connect the wires and open the thru hull valve (seacock).

WATER PUMP BELT

To remove, replace or adjust the belt, loosen the pivot bolt and release the adjusting bolt. Slide the water pump bracket to slacken the belt for removal. When replacing and adjusting the belt, set the belt very tight and tighten the bolt and nut.

The dual water pumps on the *FRESH WATER COOLED MODELS* use the same drive belt and the adjustment is the same.



NOTE: The adjustment is the same for the *FRESH WATER COOLED MODEL* dual pumps.

SPARK PLUGS

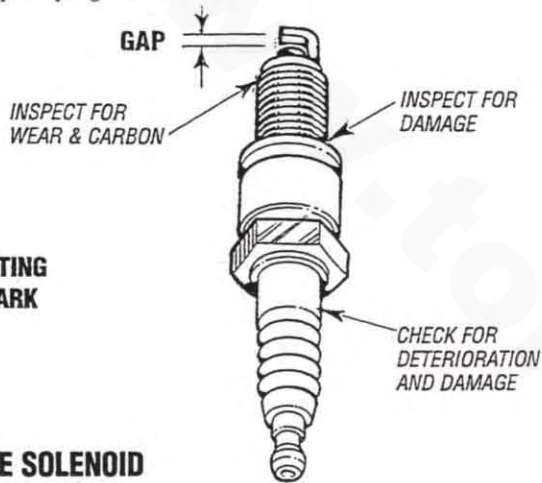
The spark plugs should be cleaned and re-gapped after the first 50 hour break-in period, then inspected every 250 hours thereafter and replaced as needed.

⚠ WARNING: Do not remove the spark plugs while the engine is hot. Allow the engine to cool before removing them.

SPARK PLUG GAP: 0.032 – 0.035in. (0.8 - 0.9mm).

SPARK PLUG TORQUE: 11 – 15 lb-ft (15 – 26 Nm).

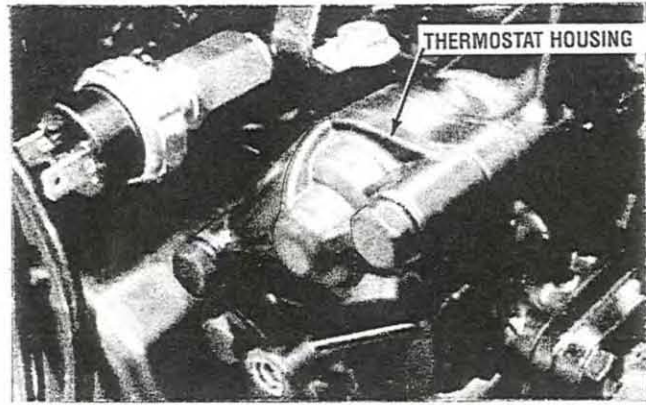
NOTE: Loctite Anti-Seize applied to the threaded portion of the spark plugs will retard corrosion, making future removal of the spark plugs easier.



INSPECTING THE SPARK PLUGS

CHOKE SOLENOID

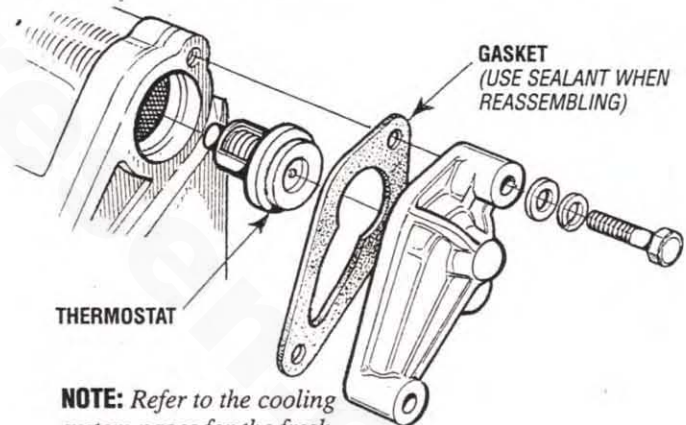
The choke solenoid is a 12 volt DC operated unit that is an integral part of the carburetor. When the engine is cold, extra fuel is supplied to the engine. The choke is controlled by the ignition control module and requires no adjustments.



THERMOSTAT [Raw Water Cooled Models]

A thermostat controls the coolant temperature as the raw water continuously flows through the closed cooling circuit. When the engine is first started, the closed thermostat prevents the water from flowing (some water is by-passed around the thermostat to provide coolant circulation in the engine block). 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.

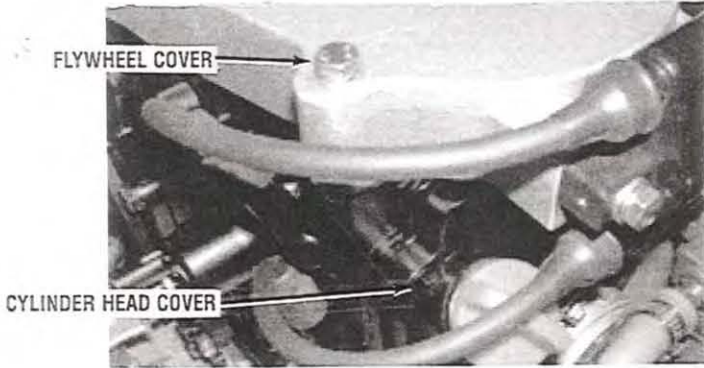
If you suspect a faulty thermostat, place it in a pan of water and bring to a boil. A working thermostat should open when heated and close when cold.



VALVE CLEARANCE

It is routine maintenance to adjust the valve clearance after the first fifty hours of operation. Valve clearance adjustment must be performed when the engine is cool and the piston must be the top dead center of the compression stroke. Perform the following adjustment steps:

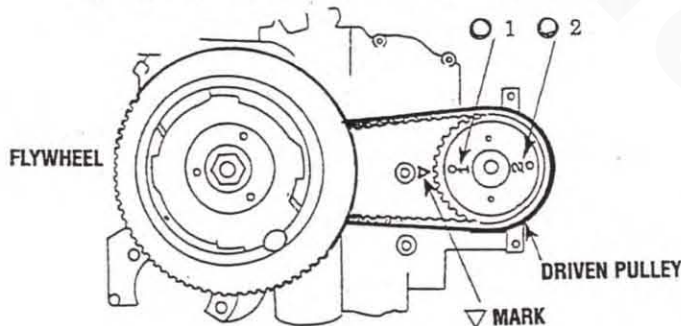
1. Remove the fuel pump and fuel filter from the cylinder head cover. This assembly can be set aside without disconnecting the hoses.
2. Remove the cylinder head cover.



3. Remove the flywheel cover to access the flywheel and driven pulley.

NOTE: The governor sensor (mag pick-up) wires can be disconnected at the side of the control panel.

4. Turn the driven gear and align the "1 and O" mark on the driven pulley with the "∇" mark on the cylinder head.



5. Adjust the intake and exhaust valve clearance for cylinder #1.
 - a. Loosen the lock nut.
 - b. Insert a feeler gauge between the valve end and the adjusting screw.
 - c. Set the valve clearance by the adjusting screw.

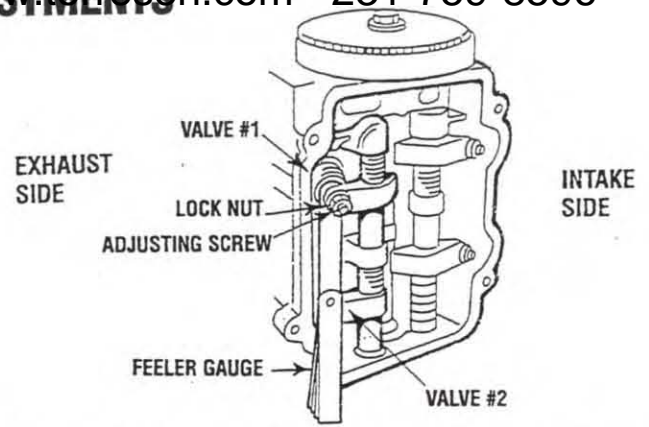
VALVE CLEARANCE:

INTAKE: 0.13 - 0.17mm (0.005 - 0.007in)

E EXHAUST: 0.18 - 0.22mm (0.007 - 0.009in)

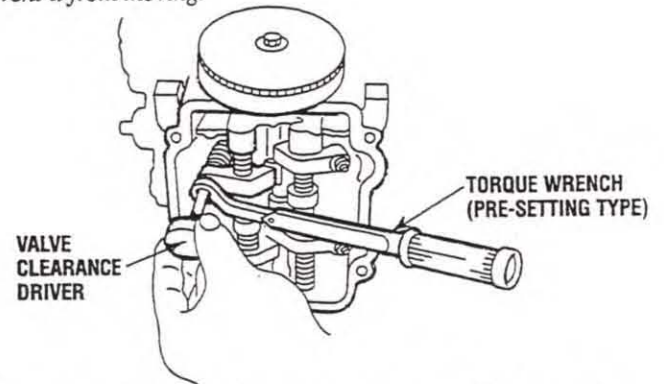
- d. Tighten the lock nut.
- e. Again, check the valve clearance.

6. Turn the driven gear and align the "2 and O" mark on the driven pulley with the "∇" mark on the cylinder head.



7. Adjust the intake and exhaust valve clearance for cylinder #2 using the same sequence.

NOTE: When loosening and tightening the lock nut, hold the adjusting screw with a valve clearance driver to prevent it from moving.

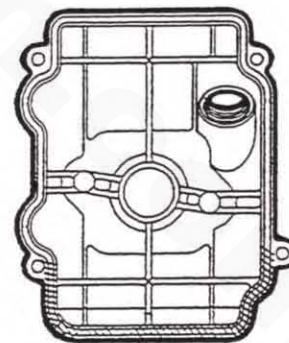


8. Install the cylinder head cover. Apply sealant to the inside rim of the cover as indicated by the shaded area of the drawing.

BOLT TORQUE:

8 - 10 Nm (0.8 - 1.0 kg-m) 5.8 - 7.2 lb-ft

9. Install the flywheel cover and re-attach the sensor wires.



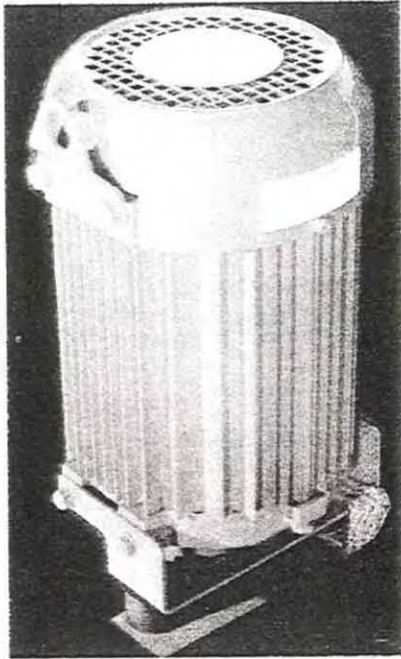
When troubleshooting indicates an electrical problem, see the ELECTRICAL SYSTEM WIRING DIAGRAM, as this may reveal other possible causes of the problem which are not listed below.

The following troubleshooting tables are based upon certain engine problem indicators and the most likely causes of the problems

PROBLEM	PROBABLE CAUSE	PROBLEM	PROBABLE CAUSE
Engine does not crank.	<ol style="list-style-type: none"> 1. Voltage drop at starter solenoid terminal. 2. Main 10 amp fuse blown. 4. Battery is low or dead. 5. Loose battery connections. 6. Faulty wire connection. 7. Faulty start switch. 8. Faulty pc board 9. Faulty starter solenoid 10. Water filled cylinders. 	Engine misfires.	<ol style="list-style-type: none"> 1. Poor quality fuel. 2. Faulty ignition control module. 3. Dirty flame arrester. 4. Faulty ignition wires. 5. Spark plugs are worn. 6. Binding actuator linkage. 7. High exhaust back-pressure. 8. Valve clearances are incorrect. 9. Valve clearances are incorrect.
Engine starts, runs and then shuts down.	<ol style="list-style-type: none"> 1. Faulty shutdown switch,(oil pressure, or exhaust temperature). 2. Faulty overspeed switch. 3. Dirty fuel/water separator filter. 4. Clogged fuel line. 5. Low oil level in sump. 6. Faulty fuel pump. 7. No fuel 8. Clogged fuel filter 	Engine backfires.	<ol style="list-style-type: none"> 1. Faulty ignition control module. 2. Incorrect timing. 3. Engine is flooded. See <i>Engine is flooded under Engine cranks but fails to start.</i> 4. Dirty flame arrester. 5. Faulty ignition coil. 6. High exhaust back-pressure.
Engine starts, runs but does not come up to speed.	<ol style="list-style-type: none"> 1. Faulty mag-pickup sensor. 2. Electronic governor controller faulty, 3. Fuel pump. 4. Fuel supply to engine restricted. 5. Actuator linkage binding. 6. Actuator or electrical connections faulty. 7. Air intake restricted. 8. Exhaust restricted. 	Engine overheats.	<ol style="list-style-type: none"> 1. Blockage in cooling water flow: inspect the raw water intake, intake strainer, pump impellers, and look for broken or seperated hoses. 2. Belts may be loose or broken. 3. Obstructed by-pass hose.
Engine cranks but fails to start.	<ol style="list-style-type: none"> 1. Out of fuel. 2. Engine is flooded. 3. Faulty carburetor. (See <i>Carburetor page</i>) 4. Faulty choke solenoid 5. Faulty ignition coil. 6. Bad spark plugs 	Low oil pressure.	<ol style="list-style-type: none"> 1. Low oil level. 2. Wrong SAE type oil in the engine. 3. Oil diluted with fuel. 4. Relief valve is stuck. 5. Faulty oil pump. 6. Faulty engine bearings. 7. Boat heeled over too much. 8. Faulty oil filter.
Engine hunts.	<ol style="list-style-type: none"> 1. Controller gain adjustment needed. 2. Faulty fuel pump. 3. Faulty PC board. 4. Improper drive belt tension. 5. Low DC battery voltage. 6. High exhaust back pressure. 7. Dirty fuel filter 8. Generator overload. 9. Valves need adjustment. 	High oil pressure.	<ol style="list-style-type: none"> 1. Dirty oil or wrong SAE type oil in the engine. 2. Relief valve is stuck.
		No DC charge to the starting battery.	<ol style="list-style-type: none"> 1. Faulty connections to battery charging control. 2. 20 amp fuse blown/faulty. 3. Faulty voltage regulator. 4. Faulty magneto.

TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE CAUSE
Blue Exhaust Smoke Discharge from the Engine	<ol style="list-style-type: none"> 1. Lube oil is diluted. 2. High lube oil level. 3. Crankcase breather hose is clogged. 4. Valves are worn or adjusted incorrectly. 5. Piston rings are worn or unseated.
Black exhaust smoke Discharge from the Engine	<ol style="list-style-type: none"> 1. Dirty flame arrester. 2. Faulty carburetor. 3. Idle mixture jet too rich. 4. Valves are worn or incorrectly adjusted. 5. Piston rings are worn or unseated.
Poor performance at generator speed	<ol style="list-style-type: none"> 1. Contaminates in carburetor. 2. Faulty fuel pump/contaminated. 3. Electronic governor controller needs adjustment.



PERMANENT MAGNET GENERATOR

Engine rpm at 2200 rpm
 Generator turns at 3600 rpm
 60Hz/120 AC volts - 25 amps

⚠ WARNING: Do not attempt to make adjustments or repairs to the generator. the generator is maintenance free. If the generator fails (no ac output), contact your WESTERBEKE dealer or distributor.

Required Operating Speed

Run the generator first with no load applied, then at half the generators capacity, and finally loaded to its full capacity as indicted on the generators data plate. The output voltage should be checked periodically to ensure proper operation of the generating plant and the appliances it supplies. To monitor voltage and load, check it with a portable meter and amprobe.

Generator Maintenance

Maintaining reasonable cleanliness is important. Connections of terminal boards and rectifiers 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 reduced life of windings.

In addition to periodic cleaning, the generator should be inspected for tightness of all connections, evidence of overheated terminals and loose or damaged wires.

MOTOR DATA

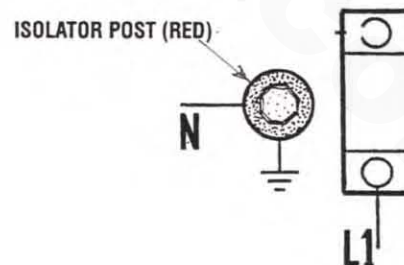
The power required to start an electric motor is considerably more than is required to keep it running after it is started. Some motors require much more current to start them than others. Split-phase (AC) motors require more current to start, under similar circumstances, than other types. They are commonly 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:

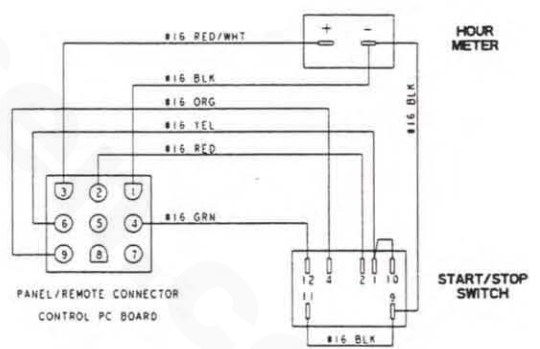
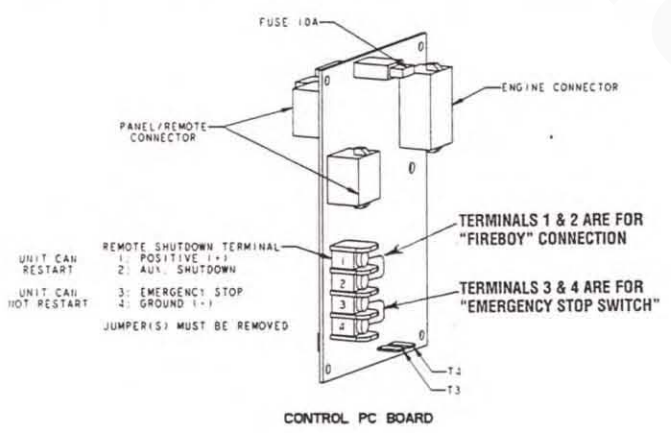
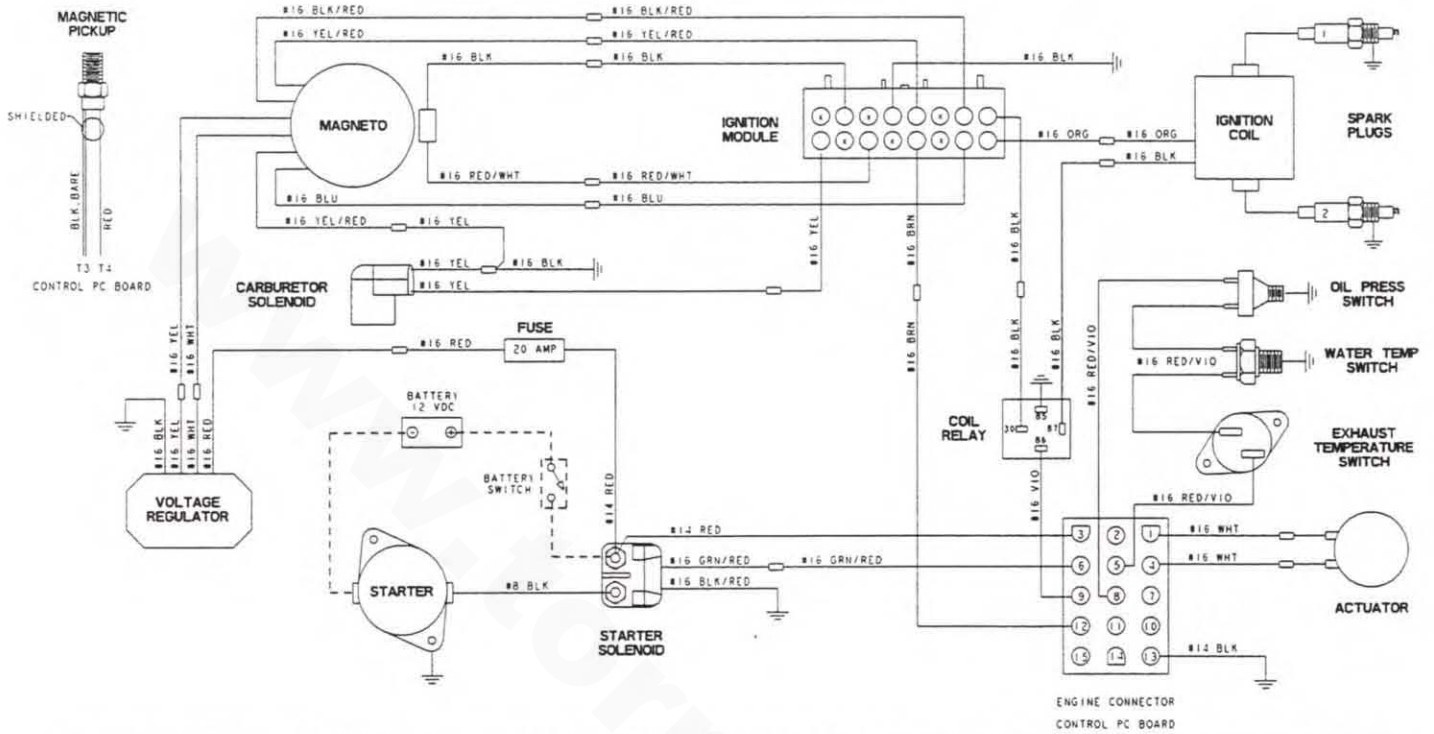
MOTOR SIZE (HP)	AMPS FOR RUNNING (AMPERES)	AMPS FOR STARTING (AMPERES)
1/6	3.2	6.4 to 22.4*
1/4	4.6	9.2 to 32.2*
1/3	5.2	10.4 to 72.8*
1/2	7.2	14.4 to 29.2*
3/4	10.2	20.4 to 40.8*
1	13	26 to 52

***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.



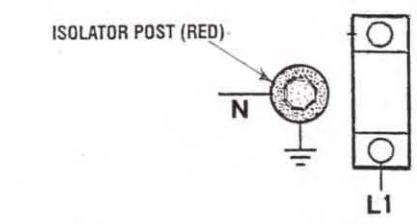
AC OUTPUT CONNECTIONS 120V 60Hz



REMOTE START/STOP PANEL
PART NO.048056

REMOTE PANEL EXTENSION HARNESS 15FT.
PART NO. 048200

REMOTE PANEL EXTENSION HARNESS 30FT.
PART NO. 048201



AC OUTPUT CONNECTIONS 120V 60Hz



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 to use as a check list if others do the procedures.

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

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

ENGINE COOLING SYSTEM

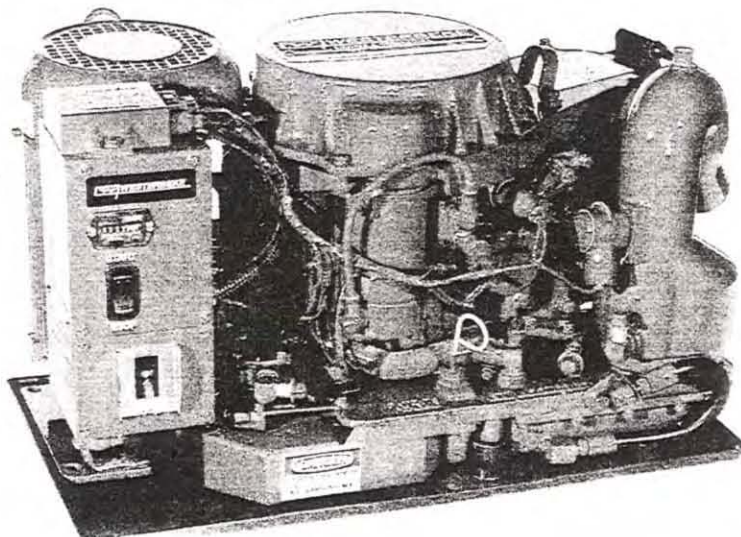
If the engine will be out of commission for 3 months or more, the engine's cooling passages should be flushed with fresh water. Also the water pump(s) should be disassembled and the impellers stowed in a cool, dark area.

This is best accomplished by disconnecting the water intake hose from the vessels thru hull fitting. **Close the intake valve before disconnecting the hose.** Insert the hose end into a large container of fresh water.

Before starting the engine, remove the engine thermostat (replace the gasket and cover). This will ensure a full flow of water thru the engine.

The fresh water will flush out the engines water passages and exhaust lines. If the engine is being stored where there is the probability of freezing, run an antifreeze mixture thru the engine in place of freshwater. This will protect the engine and exhaust components from freezing.

When recommissioning, make certain the valves and seacocks are open so the engine will quickly receive fresh water. If the engine is stowed where it is warm, the fresh water can stay in the engine.



LUBRICATION SYSTEM

With the engine warm, drain all the lubricating oil from the oil sump. Remove and replace the oil filter and fill the sump with new oil. Use the correct grade of oil. refer to the *ENGINE LUBRICATING OIL* pages in this manual for the oil changing procedure. Run the engine and make sure there are no leaks.

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

INTAKE MANIFOLD

Clean the filter screen in the flame arrester, and place a clean cloth lightly soaked in lube oil around the flame arrester to block any opening. Also place an oil-soaked cloth in the thru-hull exhaust port. Make note to remove cloths prior to start-up!

FUEL SYSTEM

Top off your fuel tanks with *unleaded* gasoline of 89 octane or higher. A fuel conditioner such as stabil gasoline stabilizer should be added. Change the element in your gasoline/water separator and clean the metal bowl. Re-install and make certain there are no leaks. Clean up any spilled fuel.

STARTER MOTOR

Lubrication and cleaning of the starter drive pinion is advisable, the pinion is accessible when the flywheel cover is removed. 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.

SPARES

Lay-up time provides a good opportunity to inspect your WESTERBEKE engine to see if external items such as drive belts 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 and zinc anodes. Refer to the *SPARE PARTS* section of this manual.

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 exists any doubt that the batteries will not remain fully charged, or that they will be subjected to severe environmental conditions, remove the batteries and store them in a warmer, more compatible environment.

LAY-UP AND RECOMMISSIONING

RECOMMISSIONING

The recommissioning of your WESTERBEKE engine after a seasonal lay-up generally follows the same procedures as those presented in the *PREPARATIONS FOR STARTING* 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 any rags that were placed in the exhaust, intake manifold, or flame arrester.
2. 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 the batteries are fully charged. remove the spark plugs, wipe clean, re-gap, and install to proper tightness.
3. Make certain the cooling system intake hose is attached and the thru-hull valve is open.
4. Check the condition of the zinc anode in the circuit and clean or replace the anode as needed.
5. Check the condition of the heat exchanger zinc, clean or replace as needed. (Fresh Water Cooled Models)
6. Make certain all electrical connections and switches are in the correct position and there are no-loads on the generator at start up. (see *GENERATOR*)
7. Inspect the fresh water pump impeller, replace if necessary. (Fresh Water Cooled Models)
8. Start the engine in accordance with the procedures described in the *PREPARATIONS FOR STARTING* section of this manual.

ENGINE SPECIFICATIONS	
Engine Type	Two cylinder, four stroke gasoline engine.
Bore & Stroke	2.32 x 2.36 inches (59 x 60 mm)
Total Displacement	20.01 Cubic Inches (.33 liter)
Bearings	Two main bearings.
Valve System	Overhead cam-cross flow.
Compression Ratio	9:1
Firing Order	1 - 2
Aspiration	Naturally aspirated.
Direction of Rotation	Counterclockwise viewed from the back end.
Inclination	25° maximum angle of operation
Dry Weight	165 lbs (75 Kg)
Governor	Electronic

FUEL SYSTEM	
Fuel Pump	Mechanical fuel pump.
Fuel	Unleaded 89 octane or higher gasoline.
Ignition Timing	BTDC 25° (not adjustable).
Ignition Coil	12 volt.
Flame Arrester	Metal screen type.
Carburetor	Single barrel side draft.
Fuel Consumption (Full Load)	0.4 GPH @ 2200 RPM/25 Amps
Ignition Timing	12-Volt flywheel magneto.

ELECTRICAL SYSTEM	
Start Motor	12-Volt reduction gear with solenoid.
Starting Battery	12-Volt, (-) negative ground
Battery Capacity	300-900 Cold Cranking Amps (CCA)
Battery Charging	11 Amp
DC Amperage Draw	70 Amps DC

LUBRICATION SYSTEM	
Type	Wet sump system trochoid type pump.
Oil Filter	Fuel flow, paper element, spin-on disposals.
Oil Capacity	1.5 qts. (91.4 L)
Oil Grade	API SJ 10W-30, 15W-40

COOLING SYSTEM	
General	Water cooled via raw water pump.
Raw Water Pump	Positive displacement type, rubber impeller, belt driven.
Raw Water Flow (into water injected exhaust elbow)	1.75 GPM (before thermostat opens) 2.0 GPM (thermostat open)
Operating Temperature	140°F (60°C)

AC GENERATOR (SINGLE PHASE)	
Type	Permanent magnet generator
Speed	3600 RPM / 60Hz.
3.0 Kw	3.0 KW - 60 Hz single phase, 120 volts 2 wire, 25 amp.

TUNE-UP SPECIFICATIONS	
Spark Plug Gap	0.032 - 0.035in (0.8 - 0.9mm)
Spark Plug Torque	11 - 15 lb-ft (15 - 20 Nm)
Bolt Torque	See <i>TORQUING THE CYLINDER HEAD.</i>

AIR REQUIREMENTS	
Engine Combustion	13 CFM (0.287 cmm)
Generator Cooling	200 CFM (5.66 cmm)

FRESH WATER COOLED MODELS	
Cooling System	Fresh water cooled block, thermostatically controlled thru a heat exchanger.
Fresh Water (coolant) Pump	Positive displacement, rubber impeller belt driven
Raw Water Pump	Positive displacement, rubber impeller belt driven
Raw Water Flow (into water injected exhaust elbow)	1.75 GPM (before thermostat opens) 2.0 GPM (thermostat open)
Operating Temperature	140° F (60°C)



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

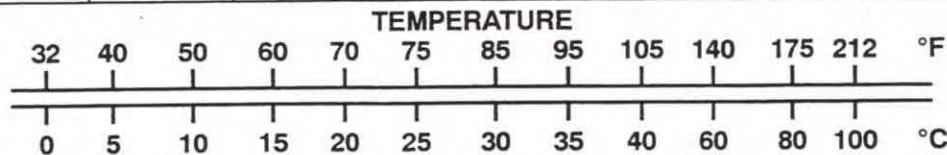
YARDS TO METERS				METERS TO YARDS			
Yards	Meters	Yards	Meters	Meters	Yards	Meters	Yards
1	0.91440	6	5.48640	1	1.09361	6	6.56168
2	1.82880	7	6.40080	2	2.18723	7	7.65529
3	2.74320	8	7.31520	3	3.28084	8	8.74891
4	3.65760	9	8.22960	4	4.37445	9	9.84252
5	4.57200	10	9.14400	5	5.46807	10	10.93614

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



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 .621 = Miles

DISTANCE EQUIVALENTS

1 Degree of Latitude = 60 Nm = 111.120 km
 1 Minute of Latitude = 1 Nm = 1.852 km

VOLUME

Cubic Inches (in³) x 16.387 = Cubic Centimeters x .061 = in³
 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 (H₂O) x .07355 = Inches of Mercury x 13.783 = H₂O
 Inches of Water (H₂O) x .03613 = psi x 27.684 = H₂O
 Inches of Water (H₂O) x .248 = Kilopascals (kPa) x 4.026 = H₂O

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

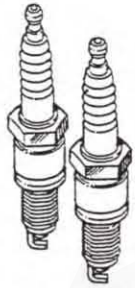
LIQUID WEIGHTS

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

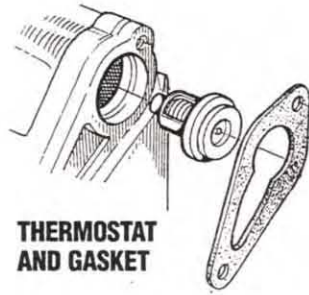
SUGGESTED SPARE PARTS

WESTERBEKE MARINE GASOLINE GENERATORS

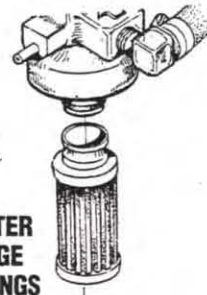
CONTACT YOUR WESTERBEKE DEALER FOR SUGGESTIONS AND ADDITIONAL INFORMATION



SPARK PLUGS



THERMOSTAT AND GASKET



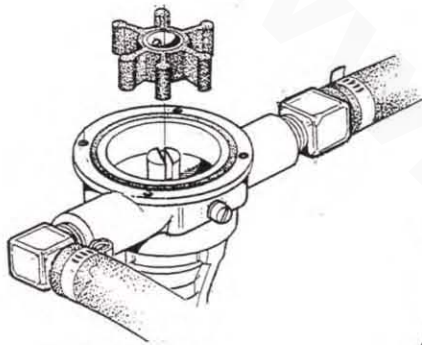
FUEL FILTER CARTRIDGE AND O-RINGS



GASOLINE FUEL/WATER FILTERS



ZINC ANODE AND GASKET



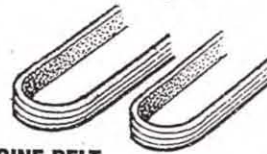
WATER PUMP IMPELLERS, O-RINGS AND GLYCERIN TUBE



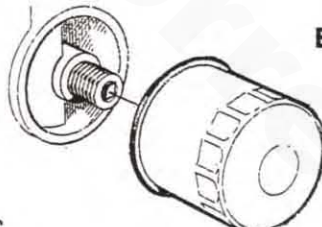
10A FUSE (ON SIDE OF CONTROL PANEL)



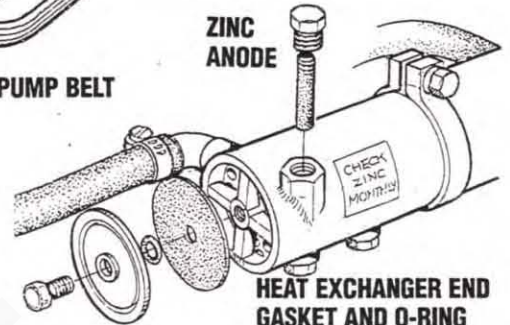
20A IN-LINE FUSE



ENGINE BELT WATER PUMP BELT



OIL FILTER



ZINC ANODE

HEAT EXCHANGER END GASKET AND O-RING

WESTERBEKE ALSO RECOMMENDS HAVING ENOUGH OIL ON-BOARD FOR AT LEAST ONE OIL CHANGE

SPARE PARTS KITS

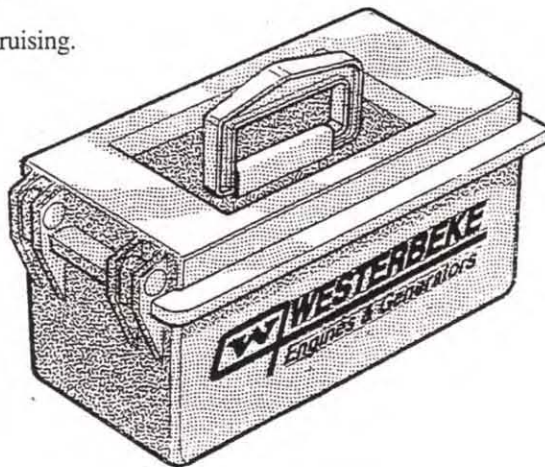
WESTERBEKE also offers two Spare Parts Kits, each packaged in a rugged hinged toolbox.

Kit A includes the basic spares.

Kit B is for more extensive off-shore cruising.

KIT A

- IMPELLER KIT
- OIL FILTER
- GENERATOR DRIVE BELT
- ZINC ANODES WITH GASKET
- SPARK PLUGS
- 20A FUSE
- WATER PUMP BELT
- FUEL FILTER KIT
- 10A FUSE
- HEAT EXCHANGER ZINC



KIT B

- IMPELLER KIT
- OIL FILTER
- GENERATOR DRIVE BELT
- ZINC ANODES WITH GASKET
- SPARK PLUGS
- 20A FUSE
- WATER PUMP BELT
- FUEL FILTER KIT
- 10A FUSE
- COMPLETE GASKET SET
- THERMOSTAT KIT
- WATER PUMP REPAIR KIT
- OIL PRESSURE SWITCH
- HEAT EXCHANGER ZINC

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