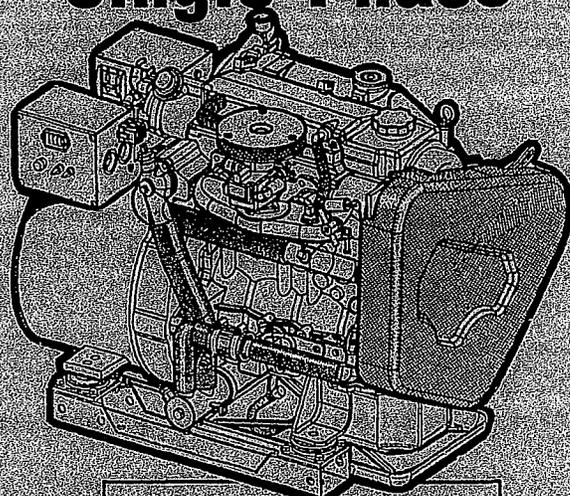


OPERATORS MANUAL

8.0 KW - 60Hz — 6.4 KW - 50Hz BEG
10.0 KW - 60Hz — 8.0 KW - 50Hz BEG
12.5 KW - 60Hz — 10.0 KW - 50Hz BEG
15.0 KW - 60Hz — 12.0 KW - 50Hz BEG

MARINE GASOLINE GENERATORS Single Phase



PUBLICATION NO. 046221
REVISION 2
DECEMBER 2011



member
NMA

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FAX (508) 884-9688 • WEBSITE: WWW.WESTERBEKE.COM

Gasoline with an ETHANOL content higher than 10% (E10) is **not allowed and may void warranty.**



WESTERBEKE™
Engines & Generators

**CALIFORNIA PROPOSITION 65
WARNING**

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

⚠ WARNING:

Exhaust gasses contain Carbon Monoxide, an odorless and colorless gas. Carbon Monoxide is poisonous and can cause unconsciousness and death. Symptoms of Carbon Monoxide exposure can include:

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

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

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

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



SAFETY INSTRUCTIONS

INTRODUCTION

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

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

PREVENT ELECTRIC SHOCK

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

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

PREVENT BURNS — HOT ENGINE

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

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

WARNING: Steam can cause injury or death!

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

PREVENT BURNS — FIRE

WARNING: Fire can cause injury or death!

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

PREVENT BURNS — EXPLOSION

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

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

SAFETY INSTRUCTIONS

ACCIDENTAL STARTING

WARNING: Accidental starting can cause injury or death!

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

BATTERY EXPLOSION

WARNING: Battery explosion can cause injury or death!

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

BATTERY ACID

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

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

TOXIC EXHAUST GASES

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

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

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

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

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

AVOID MOVING PARTS

WARNING: Rotating parts can cause injury or death!

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

SAFETY INSTRUCTIONS

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

HAZARDOUS NOISE

▲ WARNING: High noise levels can cause hearing loss!

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

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

OPERATORS MANUAL

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

ENGINE INSTALLATIONS

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

Sections of the ABYC standards of particular interest are:

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

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

ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING DIESEL ENGINES

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

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

Order from:

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

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

Order from:

NFPA
11 Tracy Drive
Avon Industrial Park
Avon, MA 02322

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

Order from:

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

INSTALLATION

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

CODES AND REGULATIONS

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

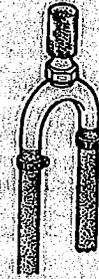
SIPHON-BREAK

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

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

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 vessel's hull.



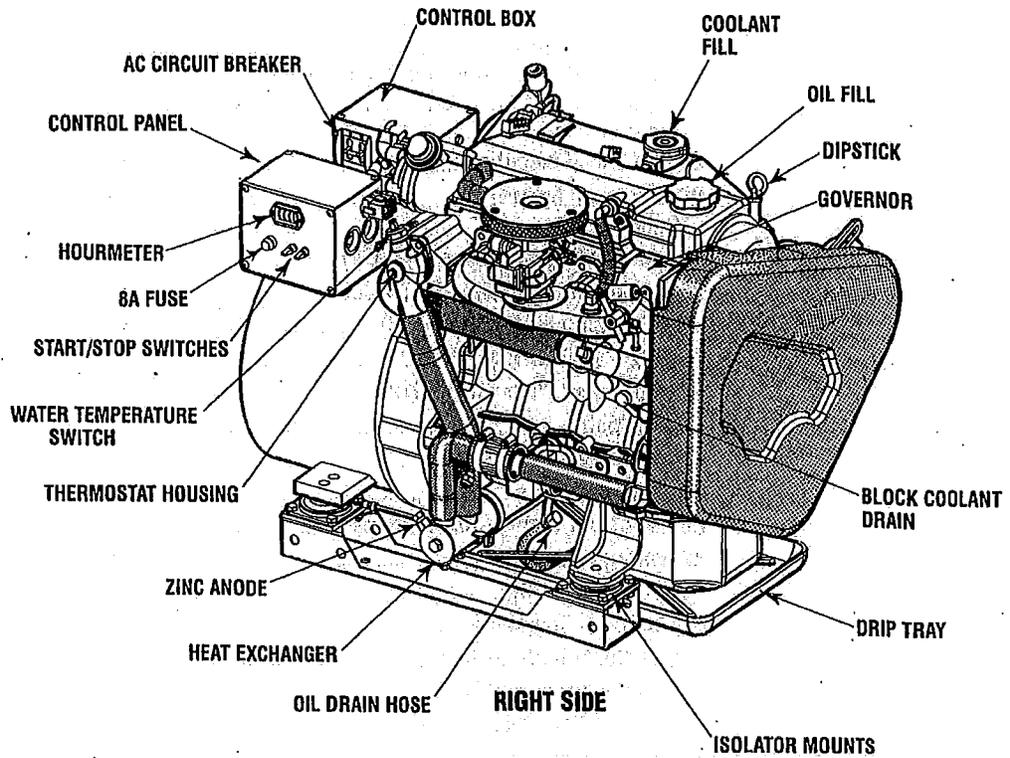
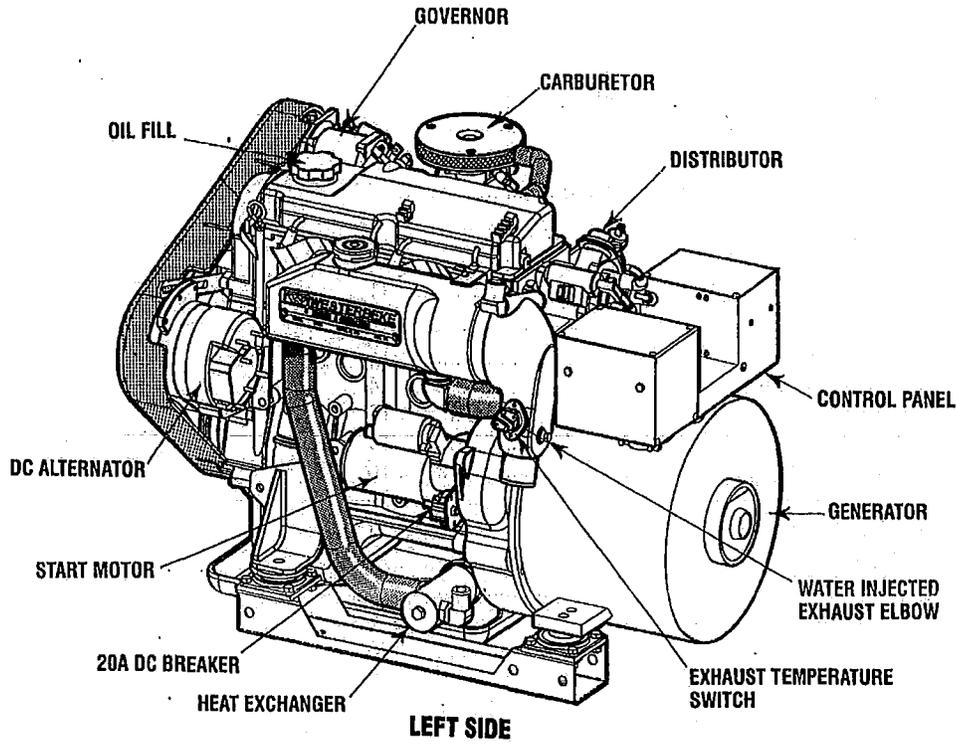
AVAILABLE FROM
YOUR WESTERBEKE
DEALER

A detailed Marine Installation Manual covering gasoline and diesel, engine and generators is supplied with each unit. A pdf copy is available to download from our website at www.westerbeke.com.

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PARTS IDENTIFICATION



INTRODUCTION

This WESTERBEKE Generator is a product 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 generator 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 yourself, contact your WESTERBEKE dealer for WESTERBEKE'S Installation Manual.

WARRANTY PROCEDURES

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



Customer Identification

WESTERBEKE OWNER
MAIN STREET
HOMETOWN, USA

Model BEG Ser. #
 Expires

PRODUCT SOFTWARE

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

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

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

SERIAL NUMBER LOCATION

The engine's model and serial number can be found on I.D. stickers affixed to either side of the generator housing. The engine's serial number can also be found stamped into the engine block on a flat surface just above and inboard of the lube oil filter. Take the time to enter this information on the illustration of the I.D. sticker below, as this will provide a quick reference when seeking technical information and/or ordering service/repair 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 reference.



Engine I.D. Plate

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 spares will be needed to support and maintain your WESTERBEKE generator. Your local WESTERBEKE dealer will assist you in preparing an inventory of spare parts. See the *SPARE PARTS* page in this manual. For Engine and Generator Accessories, see the *ACCESSORIES* brochure.

INSTALLATION MANUAL

Publication #43400 provides detailed information for installing generators.

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 verticle in-line, and the engine's cylinder head has an overhead camshaft which is chain-driven. The engine utilizes a solid-state distributor which is horizontally mounted and camshaft-driven. The engine incorporates a pressure type lubrication system, and a fresh water-cooled engine block which is thermostatically-controlled. 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, cooling system and the generator backend.

FUEL, ENGINE OIL AND ENGINE COOLANT

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 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. The filter must be rated at 10 microns or less.

ENGINE OIL

Use a heavy duty engine oil with an API classification of SJ, SL, or SM. Change the engine oil and filter after an initial 50 hours of break-in operation. Then follow the oil change interval as specified in the **MAINTENANCE SCHEDULE** in this manual.

An oil viscosity of SAE 15W-40 is recommended for this engine in all conditions and all seasons.

Westerbeke Corporation does not approve or disapprove the use of synthetic oils. If synthetic oils are used, engine break-in must be performed using conventional oil. Oil change intervals must be as listed in the **MAINTENANCE SCHEDULE** section of this manual and not be extended if synthetic oils are used.

NOTE: The information above supersedes all previous statements regarding synthetic oil.

NOTE: Be very careful not to overfill the oil sump. Overfilling of the oil sump will result in erratic operation of the engine, white-smokey/oil laden exhaust discharge, possible hard starting or no start and fouled spark plugs.

ENGINE COOLANT

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

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

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

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

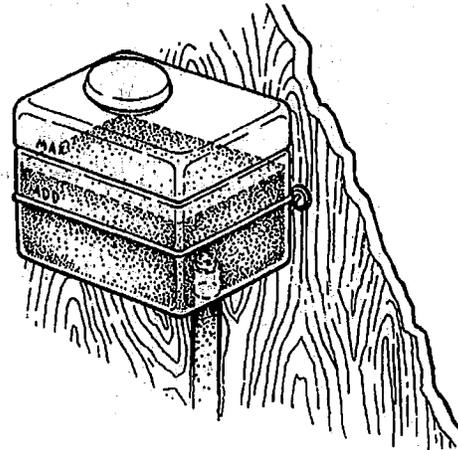
A proper 50/50 mixture as recommended will protect the engine coolant to temperatures of -40°F.

ANTIFREEZE PROTECTION

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

COOLANT RECOVERY TANK

A coolant recovery tank kit is supplied with each generator. The purpose of this recovery tank is to allow for engine coolant expansion and contraction during engine operation. Some loss of coolant may occur as a result of evaporation and the effects of exhaust manifold working temperature.



PREPARATIONS FOR INITIAL START-UP

PRESTART INSPECTION

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

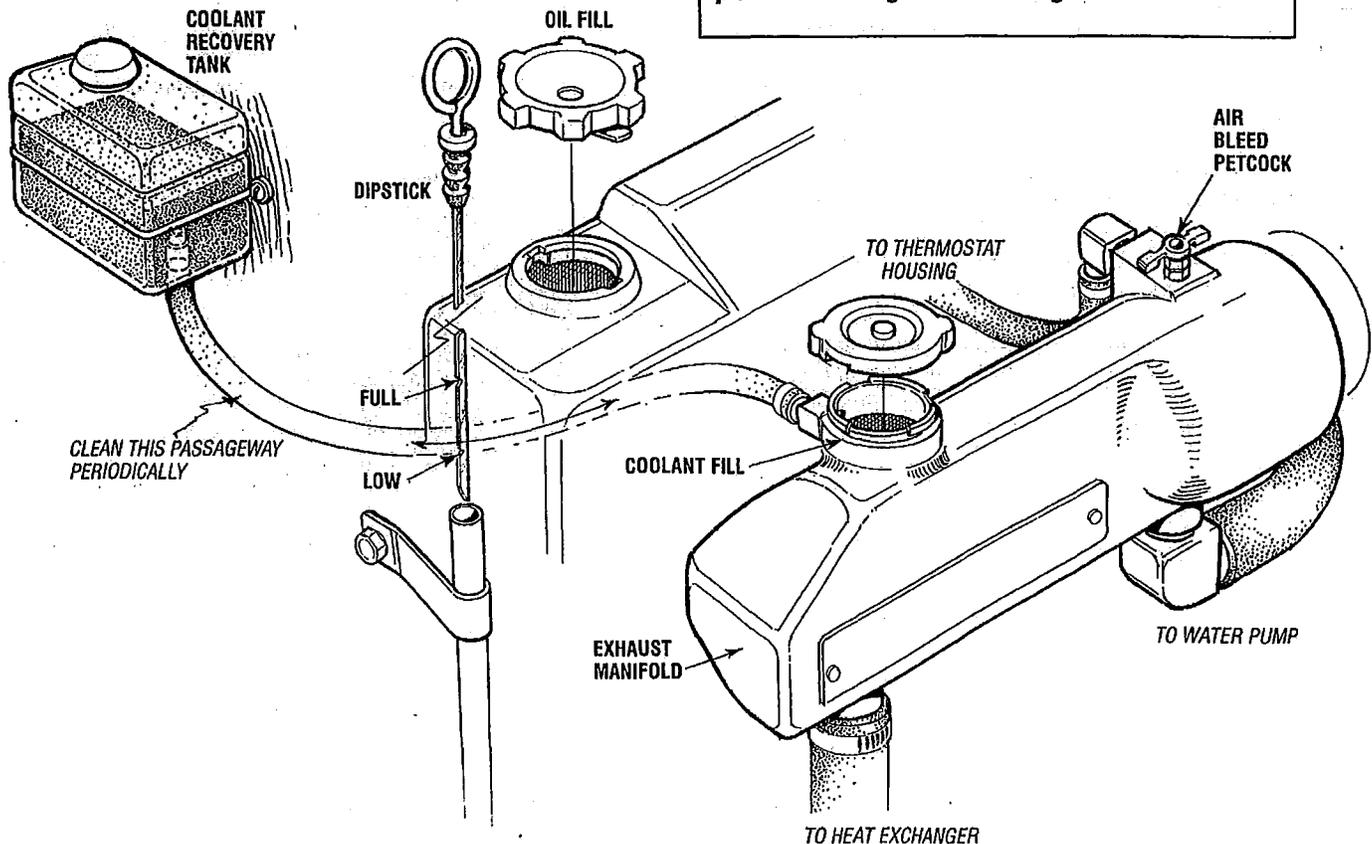
- Check the engine oil level: add oil to maintain the level at the full mark on the dipstick.
- Check the fuel supply and examine the fuel filter/separator bowls for contaminants.
- Check the DC electrical system. Inspect wire connections and battery cable connections.
- Check the coolant level in both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

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

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

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

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.



OPERATING INSTRUCTIONS

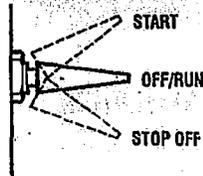
GENERATOR CONTROL PANEL

Starting the Generator

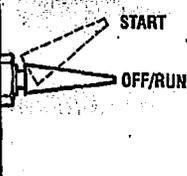
Move the **ON** toggle switch up and hold it. Allow a few second for the electric fuel pump to prime the engines fuel system. Then move the **START** toggle switch up engaging the starter cranking and the engine. Once the engine fires and runs release the **START** toggle switch only. Hold the **ON** toggle switch up for a few seconds to allow the oil pressure switch to close and maintain the run circuit then release it.

NOTE: Should the engine fail to start, release both switches, wait 20 seconds, and try again. Never run the starter more than 20 seconds at a time.

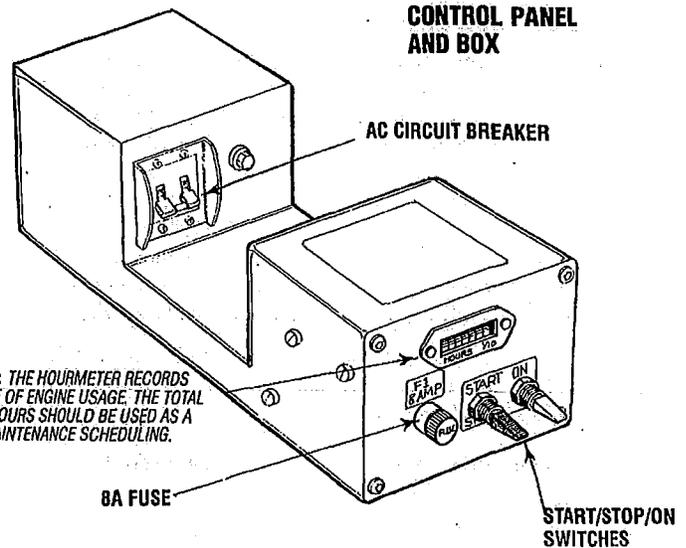
START/STOP SWITCH



ON SWITCH



HOURLMETER: THE HOURLMETER RECORDS ELAPSED TIME OF ENGINE USAGE. THE TOTAL NUMBER OF HOURS SHOULD BE USED AS A GUIDE FOR MAINTENANCE SCHEDULING.



Starting under Cold Conditions

Make certain the lubricating oil conforms with the ratings for the prevailing temperature. Check the table under **ENGINE LUBRICATING OIL**. The battery should be fully charged to minimize voltage drop.

Stopping the Generator

To stop the generator, press the **STOP** switch down then release it to the center (normal) position.

EMERGENCY STOPPING

If the generator does not stop using the **STOP** switch, remove the 8 amp fuse or disconnect the battery.

CAUTION: Prolonged cranking intervals without the engine starting can result in the engine exhaust system filling with raw water. This may happen because the pump is pumping raw water through the raw water cooling system during cranking. This raw water can enter the engine's cylinders by way of the exhaust manifold once the exhaust system fills. Prevent this from happening by closing the raw water supply through-hull shut-off, draining the exhaust muffler, and correcting the cause of the excessive engine cranking. Engine damage resulting from raw water entry is not a warrantable issue; the owner/operator should keep this in mind.

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. The fault stop conditions are:

1. Overspeed condition.
2. High engine temperature.
3. Low oil pressure.
4. High exhaust temperature.
5. Electrical overload.
 - a. Fuse at the control panel.
 - b. 20A breaker on the engine.
 - c. Main circuit breaker.

Should a fault condition occur, the engine will shutdown. On the remote panel the green LED light will turn off indicating an engine shutdown. Once detected, the fault should be located and corrected (see **ENGINE TROUBLESHOOTING**).

OPERATING INSTRUCTIONS (OPTIONAL PANELS)

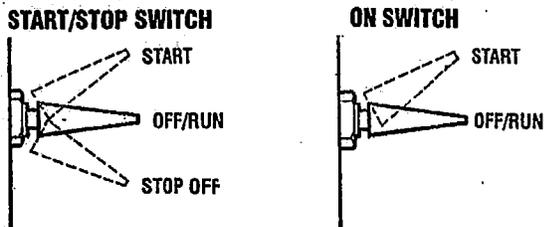
NOTE: Remote panels cannot be inter-connected. Only one panel can be used.

REMOTE PANEL

Starting the Generator

To start the generator, hold the **ON** toggle switch in the up position (the panel green LED light will come on). Hold the switch in this position for a few seconds to allow the electric fuel pump to prime the engines fuel system. Then move the **START** toggle switch to the up position, this will engage the starter cranking the engine (the green LED light will dim). Once the engine fires and runs, the green LED will brighten. Release the **START** toggle switch, but continue to hold the **ON** up for a few seconds to allow the oil pressure to close to maintain the DC run circuit then release the **ON** switch.

NOTE: Should the engine fail to start, release both switches, wait 20 seconds, and try again. Never run the starter more than 20 seconds at a time.



Stopping the Generator

To stop the generator, move the **START/STOP** switch to the down (*stop*) position then release it to the center (*off/run* mode) position.

REMOTE START/STOP PANEL (HARDWIRED)

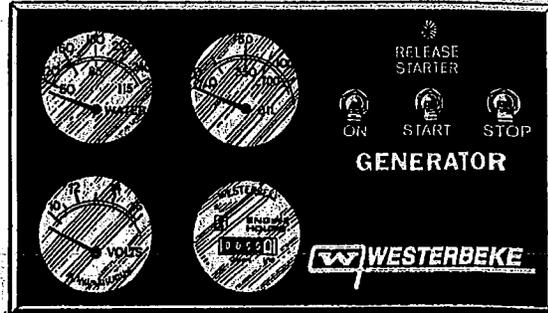
An optional remote start/stop panel is available for controlling the generator from a remote location.

This panel has the same **ON**, **START** and **STOP** functions previously described. Also included is a green LED light which glows once the engine/generator has reached 600 rpm's. The purpose of the LED is to alert the operator to release the **START** switch. It is also an indication that the engine/generator is running.



REMOTE INSTRUMENT PANEL (HARDWIRED)

An optional remote instrument panel is available which includes a water temperature gauge, oil pressure gauge, DC charging voltmeter, operating hourmeter, and start/stop switches.



REMOTE INSTRUMENT PANEL INSTALLATION

The remote instrument panel has two sending units to be installed on the engine block, a *water temperature sender* and an *oil pressure gauge sender*. Plugged ports for each are located on the engine. The water temperature sender is installed in the thermostat housing and the oil pressure sender is adjacent to the oil pressure switch. Use sealing compound on the threads of both senders. Electrical connections for each sender are tied off next to the senders location (in the wiring harness).

The blue wire is for the oil pressure sender and the tan wire is for the water temperature sender. If there is a jumper between terminal board connections TBI-1 and TBI-2, it should be removed. Refer to the *REMOTE INSTRUMENT WIRING DIAGRAM* in this manual.

NOTE: When installing the optional remote panels, it is the installers responsibility to comply with the U.S. Coast Guard standards 33 CFR part 183.

REMOTE STOP/START PANEL (PLUG CONNECTER)



This stop/start remote panel is available with either a 15' or 30' harness that plugs directly into the generators control panel. Operating instructions are the same as the remote panel to the left.

BREAK-IN PROCEDURE/DAILY OPERATION

BREAK-IN PROCEDURE

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

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

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

Avoid overload at all times. An overload is signaled by a smoky exhaust with reduced output voltage and frequency. Monitor the current being drawn from the generator and keep it within the generators' rating. Since the generator operates at 1800 rpm to produce 60 hertz, or at 1500 rpm to produce 50 hertz, control of the generator's engine break-in is governed by the current drawn from the generator.

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

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

CHECK LIST

Follow this checklist each day before starting your generator.

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

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

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

STOPPING THE GENERATOR

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

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

GENERATOR ADJUSTMENTS

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

SAFETY SHUTDOWN SWITCHES

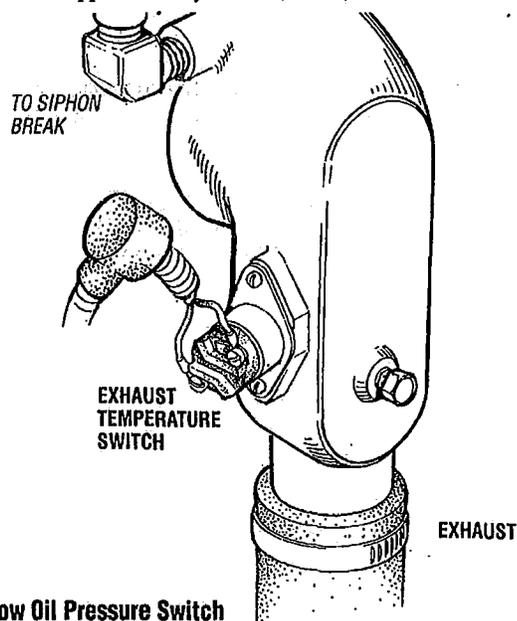
SAFETY SHUTDOWN SWITCHES

The engine is protected by five automatic shutdown switches. 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.

The following is a description of these automatic shutdown switches:

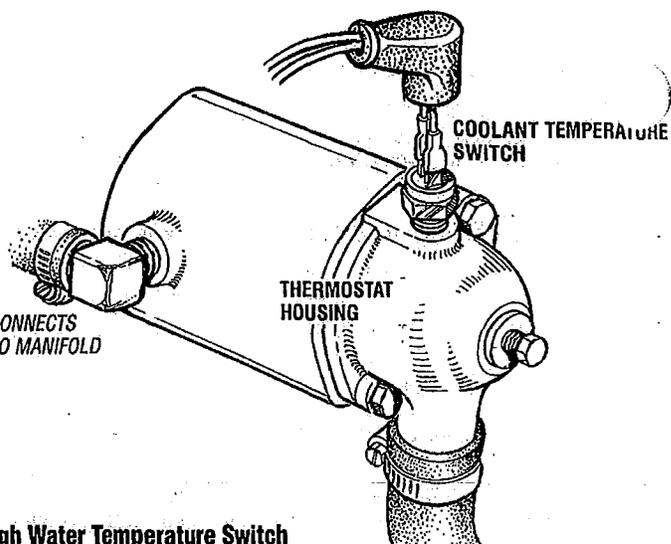
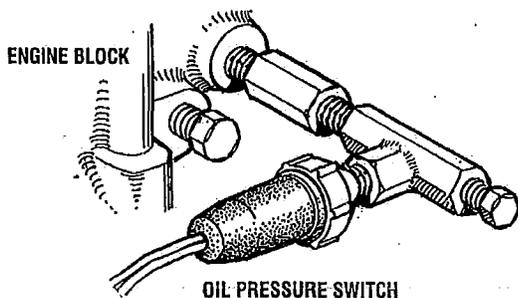
High Exhaust Temperature Switch

An exhaust temperature switch is located on the exhaust elbow. Normally closed, this switch will open and interrupt the DC voltage (shutting off the engine) should the switch's sensor indicate an excessive exhaust temperature (an inadequate supply of raw water causes high exhaust temperatures). This switch opens at 260-270°F (127-132°C). This switch resets at approximately 225°F (107°C).



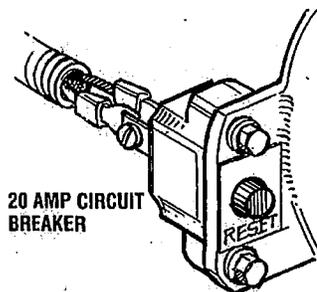
Low Oil Pressure Switch

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



High Water Temperature Switch

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 interrupt the DC voltage thereby shutting off the engine. This switch resets at 195°F (107°C).



Engine Circuit Breaker

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

HIGH RPM SHUTDOWN SWITCH

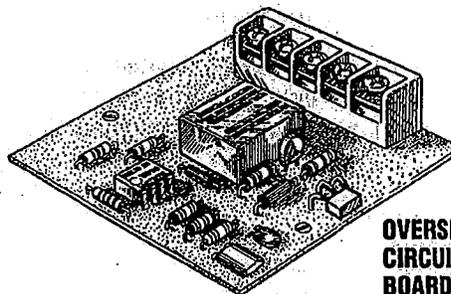
DESCRIPTION

An overspeed switch in the DC circuit shuts off the generators engine by grounding out the ignition system if the engine's speed reaches 2175 rpm (approximately). After correcting the problem, this switch can be reset by momentarily depressing the stop switch. Refer to the *WIRING DIAGRAMS* in this manual.

If the overspeed switch is faulty, (resetting with the stop switch fails to reset the circuit), lift the white/yellow wire off the T5 terminal and connect it with the red/purple wire on the T4 terminal. Now restart the generator.

If this bypass is successful, replace the faulty overspeed switch.

NOTE: *Overspeed switches draw a small amount of amperage (25 milliamps) at all times once the generator is connected to its starting battery. This amounts to approximately 18 amp-hours in a month. It is not necessary to be concerned with this slight amperage draw during normal seasonal operation. However, if the generator set is to be unused for many months, it is best to either remove the 8 amp ignition fuse from the control panel on the generator or turn off the generator's starting battery switch.*



**OVERSPEED
CIRCUIT
BOARD**

CAUTION: *It is very important that the overspeed shutdown always be installed and functioning. Any tampering with the overspeed shutdown module, which would cause it to malfunction, could be a cause of injury should the generator's belt-driven governor fail and cause the generator to run away.*

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 procedures 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							MAINTENANCE DESCRIPTION
		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"/>								Oil level should indicate between MAX and LOW on dipstick.
Coolant Level	<input type="checkbox"/>								Check at recovery tank; if empty, check at manifold. Add coolant if needed.
Drive Belts	<input type="checkbox"/> weekly								Inspect for proper tension (3/8" to 1/2" deflection) and adjust if needed. Check belt edges for wear.
Visual Inspection of Engine	<input type="checkbox"/>	NOTE: Keep engine surface clean. Dirt and oil will inhibit the engine's ability to remain cool.							Check for fuel, oil and water leaks. Inspect wiring and electrical connections. Keep bolts & nuts tight. Check for loose belt tension.
Sparks Plugs		<input type="checkbox"/>		<input type="checkbox"/>	Check gap, inspect for burning and corrosion.				
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		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial engine oil and filter change at 50 hours, then change both every 100 hours.
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 Lift Pump and Gasdenser		<input type="checkbox"/>							Periodically inspect for leaks.
Air Screen (Flame Arrarster)		<input type="checkbox"/>							Clean at 50 hrs., then every 100 hours.
Exhaust System		<input type="checkbox"/>		<input type="checkbox"/>	Initial check at 50 hours, then every 250 hours. Inspect for leaks. Check anti-siphon valve 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"/>	<input type="checkbox"/>	Hose should be hard & tight. Replace if hoses become spongy. Check and tighten all hose clamps.
Raw Water Pump			<input type="checkbox"/>	Visually inspect for leaks. Remove the pump cover and inspect cover surface and cam for wear. Inspect impeller. Ensure impeller shaft is secure and does not wobble. Replace items as needed. Rebuild/replace pump as needed.					
Belt Driven Governor				<input type="checkbox"/>	Change governor oil every 250 hours. Adjust governor operation as needed.				
Inlet Fuel Filter				<input type="checkbox"/>	Replace.				

MAINTENANCE SCHEDULE

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

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							MAINTENANCE DESCRIPTION
		50	100	250	500	750	1000	1250	
Heat Exchanger		<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.						
Coolant System					<input type="checkbox"/>				Drain, flush, and refill cooling system with appropriate antifreeze mix every 500 hours of operation.
*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.
Distributor		<input type="checkbox"/>			<input type="checkbox"/>				Check ignition timing. Check condition of distributor cap and rotor.
*Engine Cylinder Compression and Valve Clearances					<input type="checkbox"/>			<input type="checkbox"/>	Incorrect valve clearance will result in poor engine performance, check compression pressure and timing and adjust valve clearances.
*Engine Timing Belt									Remove and replace at <u>3000</u> operating hours.
*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!
Carburetor Fuel Filter Screen		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<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 Timing Belt					<input type="checkbox"/>		<input type="checkbox"/>		Visually inspect every 500 operating hours.

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

⚠ WARNING: When servicing generator/engine components, the DC power must be turned off using either the DC breaker or the battery switch.

COOLING SYSTEM

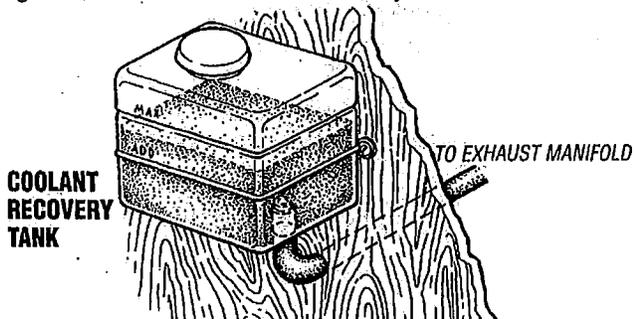
FRESH WATER COOLING CIRCUIT

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

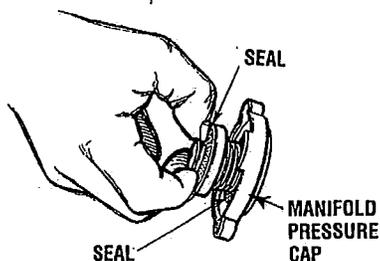
Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the heat exchanger where it is cooled, and returned to the engine block via the suction side of the circulating pump. When the engine is started cold, external coolant flow is prevented by the closed thermostat (although some coolant flow is bypassed around the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens, allowing full flow of the engine's coolant to flow unrestricted to the external portion of the cooling system.

Coolant Recovery Tank

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



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



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 removing the drain plug on the engine block and opening the manifold pressure cap. Flush the system with fresh water, then reinstall the drain and start the refill process.

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

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

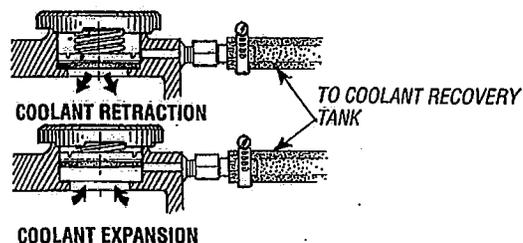
Refilling the Coolant

After replacing the engine block drain plug, close the heat exchanger's coolant petcock. Then run the engine at idle and slowly pour clean, premixed coolant into the manifold.

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

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

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



KEEP THESE PASSAGES CLEAR TO ENSURE A FULL FLOW OF COOLANT TO AND FROM THE COOLANT RECOVERY TANK (A PIPE CLEANER WORKS WELL)

COOLING SYSTEM

HEAT EXCHANGER

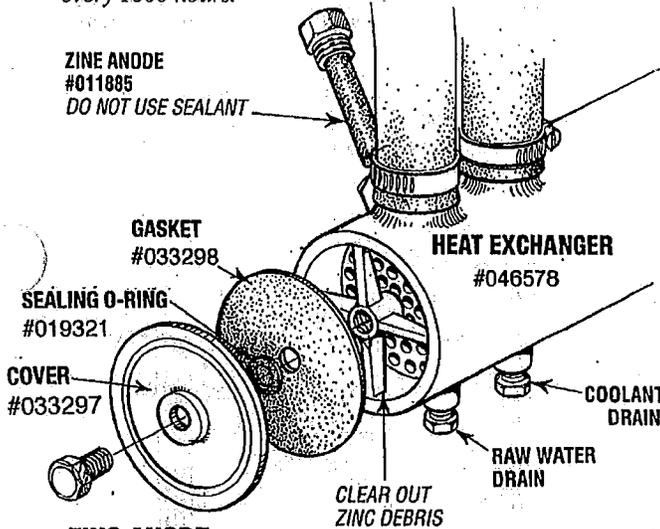
Cool raw water flows through the inner tubes of the heat exchanger. As the engine coolant passes around these tubes the heat of the internal engine is conducted to the raw water which is then pumped into the exhaust system and discharged. The engine coolant (now cooled) flows back through the engine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

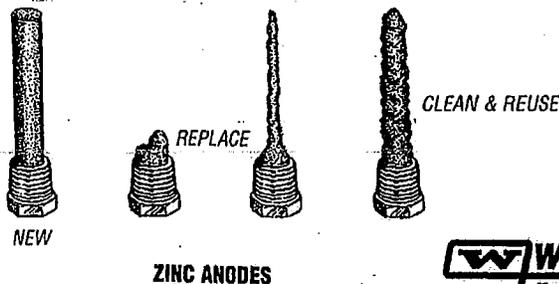
NOTE: Operating in silty and/or tropical waters may require that a heat exchanger cleaning be performed more often than every 1000 hours.



ZINC ANODE

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

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



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

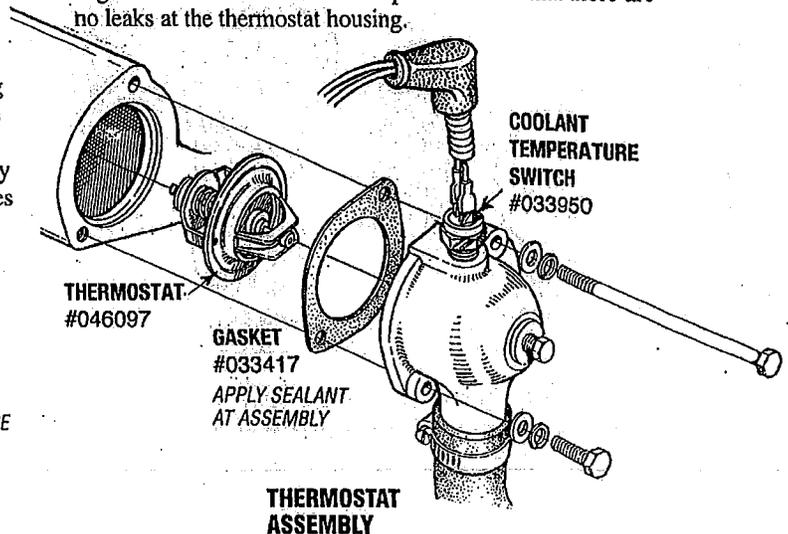
NOTE: The threads of the zinc anodes are pipe threads and do not require sealant. Sealant should not be used as it may insulate the zinc from the metal of the heat exchanger housing preventing electrolysis action on the zinc.

THERMOSTAT

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

Replacing the Thermostat

To avoid spilling coolant, drain the coolant down below the manifold level (*REFER TO CHANGING COOLANT*). Remove the cap screws and disassemble the thermostat housing as shown. When installing the new thermostat and gasket, apply a thin coat of sealant on both sides of the gasket before pressing it into place. Do not over-tighten the cap screws. Replace the coolant in the manifold. Run the engine and check for normal temperatures and that there are no leaks at the thermostat housing.



COOLING SYSTEM

RAW WATER PUMP

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

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

Inspecting/Changing the Raw Water Pump Impeller

Close the raw water intake valve. Remove the pump cover and, with the proper size impeller tool, carefully pry the impeller out of the pump (the impeller can be pried out using a pair of screwdrivers if an impeller puller is unavailable. Take care not to tear the impeller). Install the new impeller and gasket. Move the blades to conform to the curved cam plate and push the impeller into the pump's housing. When assembling, apply a thin coating of lubricant to the impeller and gasket. **Open the raw water intake valve.**

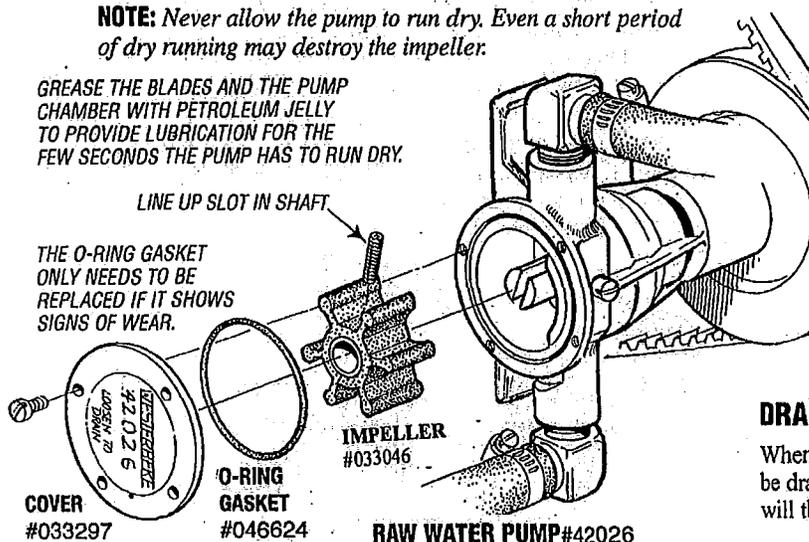
Run the engine and check for leaks around the pump. Also check for water discharge at the stern tube. Absence of water flow indicates the pump has not primed itself properly.

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

GREASE THE BLADES AND THE PUMP CHAMBER WITH PETROLEUM JELLY TO PROVIDE LUBRICATION FOR THE FEW SECONDS THE PUMP HAS TO RUN DRY.

LINE UP SLOT IN SHAFT

THE O-RING GASKET ONLY NEEDS TO BE REPLACED IF IT SHOWS SIGNS OF WEAR.



RAW WATER INTAKE STRAINER

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

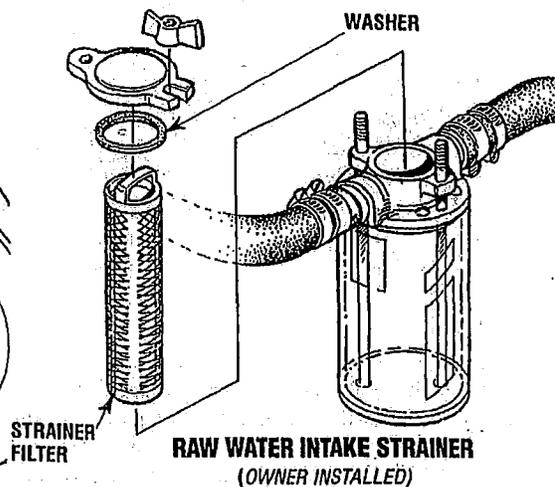
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should be clear.

Perform the following maintenance after every 100 hours of operation:

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

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

If the engine temperature gauge ever shows a higher than normal reading, the cause may be that silt, leaves or grass may have been caught up in the strainer, slowing the flow of raw water through the cooling system.



DRAINING THE COOLING SYSTEM

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

CAUTION: *If any of the blades have broken off the impeller, they must be located to prevent blockage in the cooling circuit. They often can be found in the heat exchanger*

ENGINE LUBRICATING OIL

OIL GRADE

Use a heavy duty engine oil with an API classification of SJ, SL, or SM. Change the engine oil and filter after an initial 50 hours of break-in operation. Then follow the oil change interval as specified in the **MAINTENANCE SCHEDULE** in this manual.

An oil viscosity of SAE-15W-40 is recommended for this engine in all conditions and all seasons.

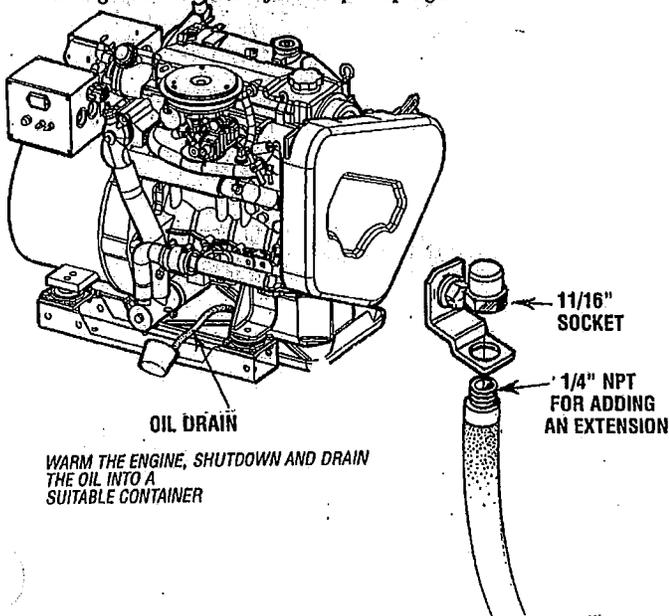
Westerbeke Corporation does not approve or disapprove the use of synthetic oils. If synthetic oils are used, engine break-in must be performed using conventional oil. Oil change intervals must be as listed in the **MAINTENANCE SCHEDULE** section of this manual and not be extended if synthetic oils are used.

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.

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. Raw water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning through the raw water cooling circuit into the exhaust, filling into the engine.

NOTE: Be very careful not to overfill the oil sump. Overfilling of the oil sump will result in erratic operation of the engine, white-smokey/oil laden exhaust discharge, possible hard starting or no start and fouled spark plugs.



WARM THE ENGINE, SHUTDOWN AND DRAIN THE OIL INTO A SUITABLE CONTAINER

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.

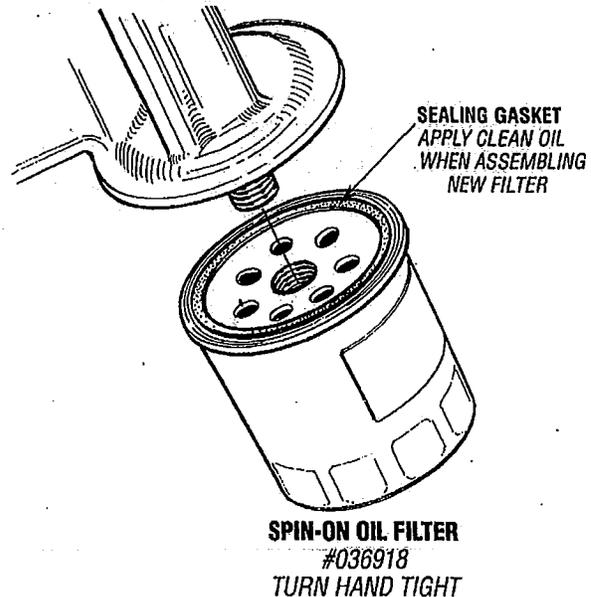
Replacing the Oil Filter

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, but not over, the FULL mark on the dipstick.



REMOTE OIL FILTER (OPTIONAL) PN #052537

INSTALLATION

This popular accessory is used to relocate the engine's oil filter from the engine to a more convenient location such as an engine room bulkhead.

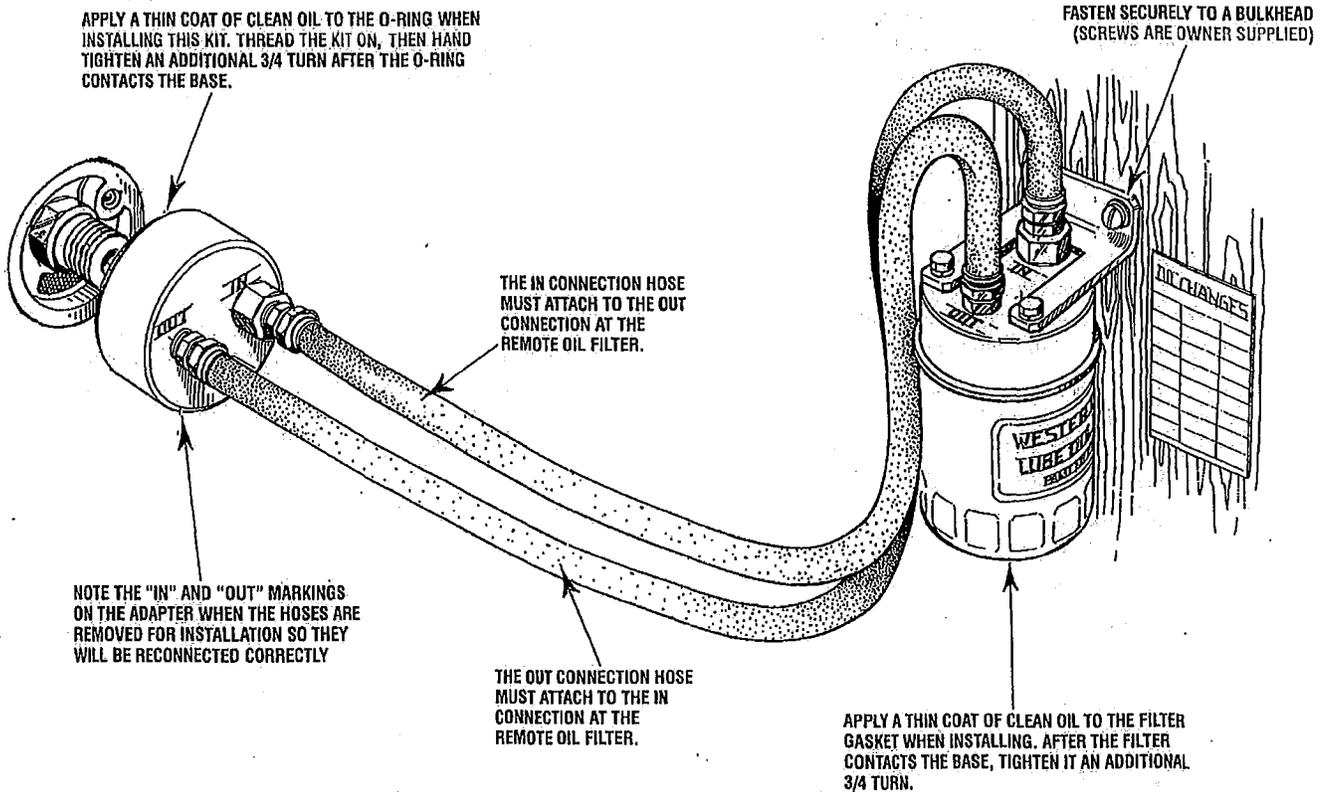
NOTE: Refer to *ENGINE OIL CHANGE* in this manual for instructions on removing the oil filter.

To install, simply remove the engine oil filter and thread on WESTERBEKE's remote oil filter kit as shown. Always install this kit with the oil filter facing down as illustrated.

Contact your WESTERBEKE dealer for more information

NOTE: Westerbeke is not responsible for engine failure due to incorrect installation of the Remote Oil Filter.

CAUTION: It is vital to install the oil lines correctly. If the oil flows in the reverse direction, the bypass valve in the filter assembly will prevent the oil from reaching the engine causing an internal engine failure. If there is no oil pressure reading, shutdown immediately and check the hose connections.



OIL PRESSURE

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

DESCRIPTION

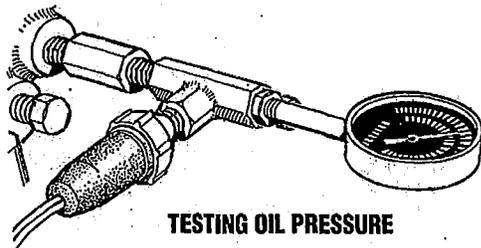
The lubricating system is a pressure feeding system using an oil pump. The engine oil is drawn from the oil sump by the oil pump, which drives the oil, under pressure, through the oil filter, oil cooler and various lubricating points in the engine. The oil then returns to the oil sump to repeat the continuous 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 hex head plug from the oil manifold and install a mechanical oil pressure gauge in its place. After warming up the engine, set the engine speed at 1800 rpm and read the oil pressure gauge.

Oil Pressure Between 50 and 60 psi at 1800 rpm.

Note: A newly started (cold) engine may have an oil pressure up to 70 or 80 psi. A warmed engine can have an oil pressure as low as 30 psi. Oil pressure will vary depending on the load placed on the generator.



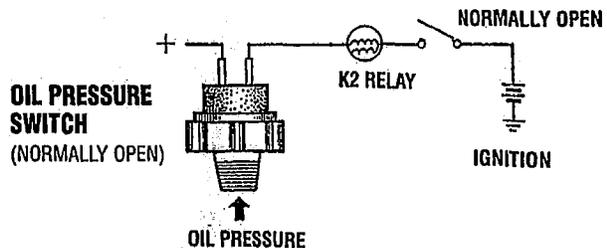
LOW OIL PRESSURE

The specified safe minimum oil pressure is 4.3 + 1.4 psi (0.3 + 0.1 kg/cm²). A gradual loss of oil pressure usually indicates worn bearings. For additional information on low oil pressure readings, see the *ENGINE TROUBLESHOOTING* chart.

OIL PRESSURE SWITCH

The generator is fitted with an oil pressure switch. Should oil pressure for some reason drop below the minimum, the switch contacts will open, breaking the DC circuit to the K2 run relay, shutting the unit down.

CAUTION: OIL PRESSURE SWITCH-Do not use lock pliers, vise grips or pipe wrenches on the oil pressure switch. Use the correct socket which is available from Snap-on, Proto, New Britain and others. Damage to the switch will cause oil leaks and/or switch failure.



FUEL SYSTEM

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 engine compartment should have a gasoline fume detector/alarm properly installed and working.*

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 type of filter/water separator with the installation package as they are well aware of the problems that contaminates 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. The Filter rating must 10 microns or less.



GASOLINE/WATER SEPARATOR & FILTER
(OWNER INSTALLED)

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.*

CARBURETOR

The carburetor is a single barrel downdraft type with an electric solenoid operated choke. (Refer to the following pages)

INLET FUEL FILTER

1. Shut off the fuel supply to the generator. Disconnect the fuel supply line to the inlet filter and unscrew the filter from the pump inlet. Take care to catch any fuel that may be present.
2. Thread on the replacement inlet filter and connect the fuel supply line. Use care when connecting and tightening the fuel supply line so as not to distort the inlet filter.
3. Turn on the fuel supply to the generator and start the generator. Ensure that there are no leaks.

FUEL LIFT PUMP

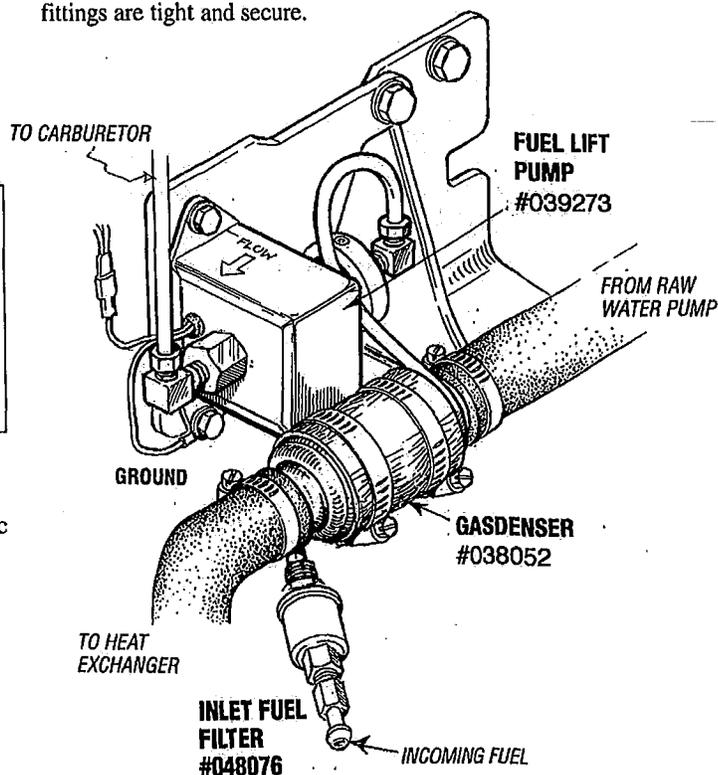
Periodically check the fuel connections to and out of the pump and make sure that no leakage is present and that the fittings are tight and secure. The DC ground connection at one of the pump's mounting bolts should be clean and well secured by the mounting bolt to ensure proper pump operation.

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.*

The start sequence energizes the fuel lift pump as the piston in the pump operates, it creates an audible ticking sound. If no ticking is heard, check for 12 volts at the pump connections. Also check that the ground wire is properly connected to the ground.

GASDENSER

The gasdenser cools the fuel to prevent vapor lock. There is no maintenance required except making certain the fuel fittings are tight and secure.



CARBURETOR

CURRENT MODELS PN.052315

CARBURETOR

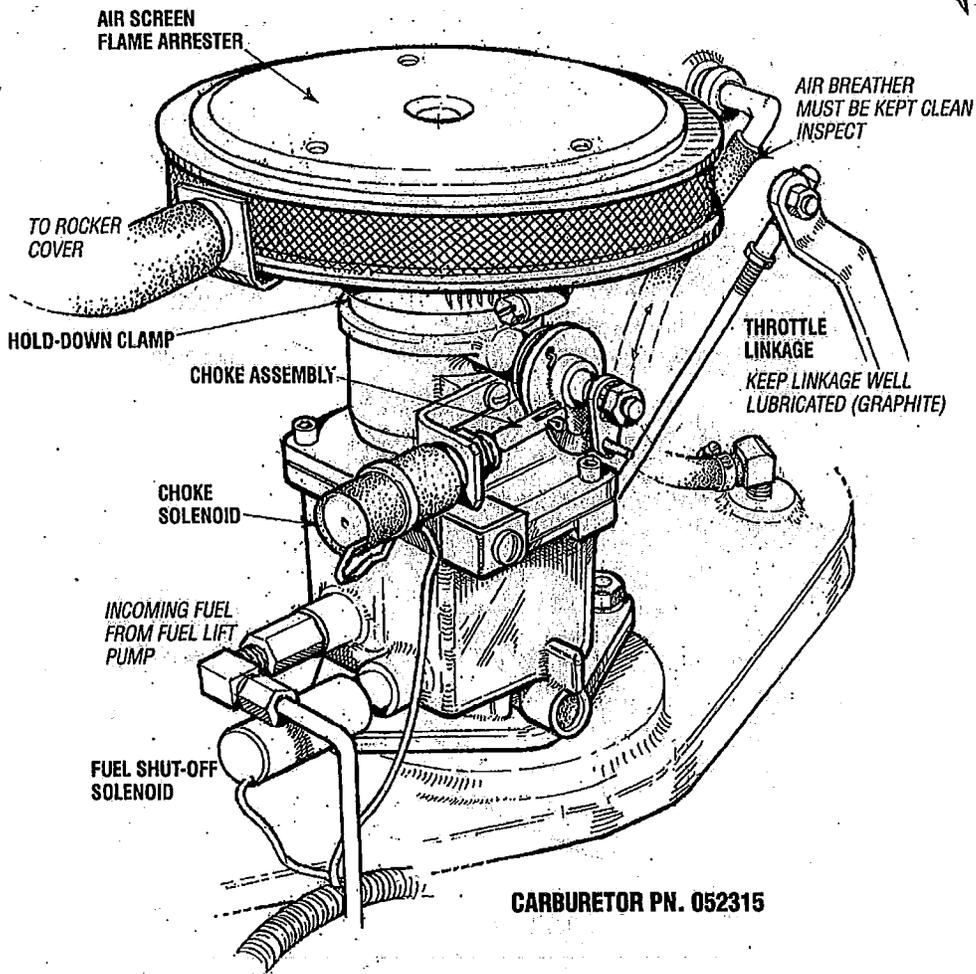
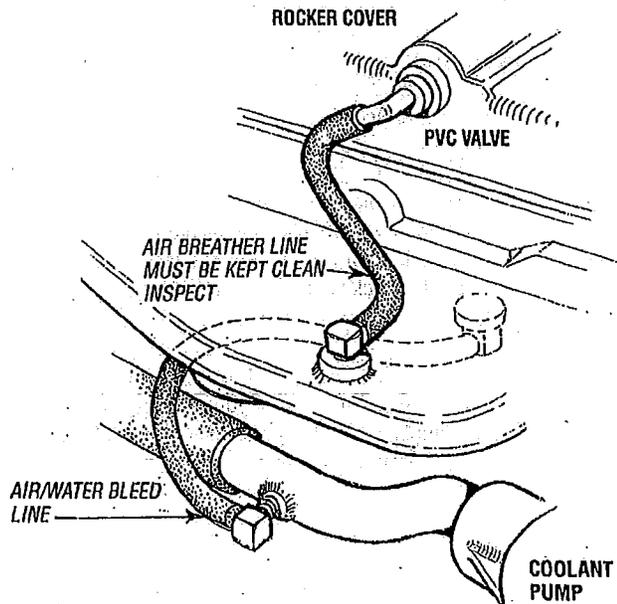
The carburetor is a single barrel, down-draft type with a cleanable metal screen air intake filter/spark arrester. The choke is operated by a 12-volt choke solenoid activated when the ON switch is depressed.

Air Screen/Flame Arrester

The air screen/flame arrester can easily be removed by releasing the hold-down clamp. Clean after the first 50 hours of operation, every 100 hours from then on. Clean the air screen in a water soluble cleaner such as GUNK.

Fuel Filter

To ensure proper operation, there must be a Coast Guard approved filter/water separator (10 microns or less) installed between the fuel supply and the engine. This filter must be of good quality and properly maintained.



CARBURETOR

EARLIER MODEL #046444 (NLA)

CARBURETOR

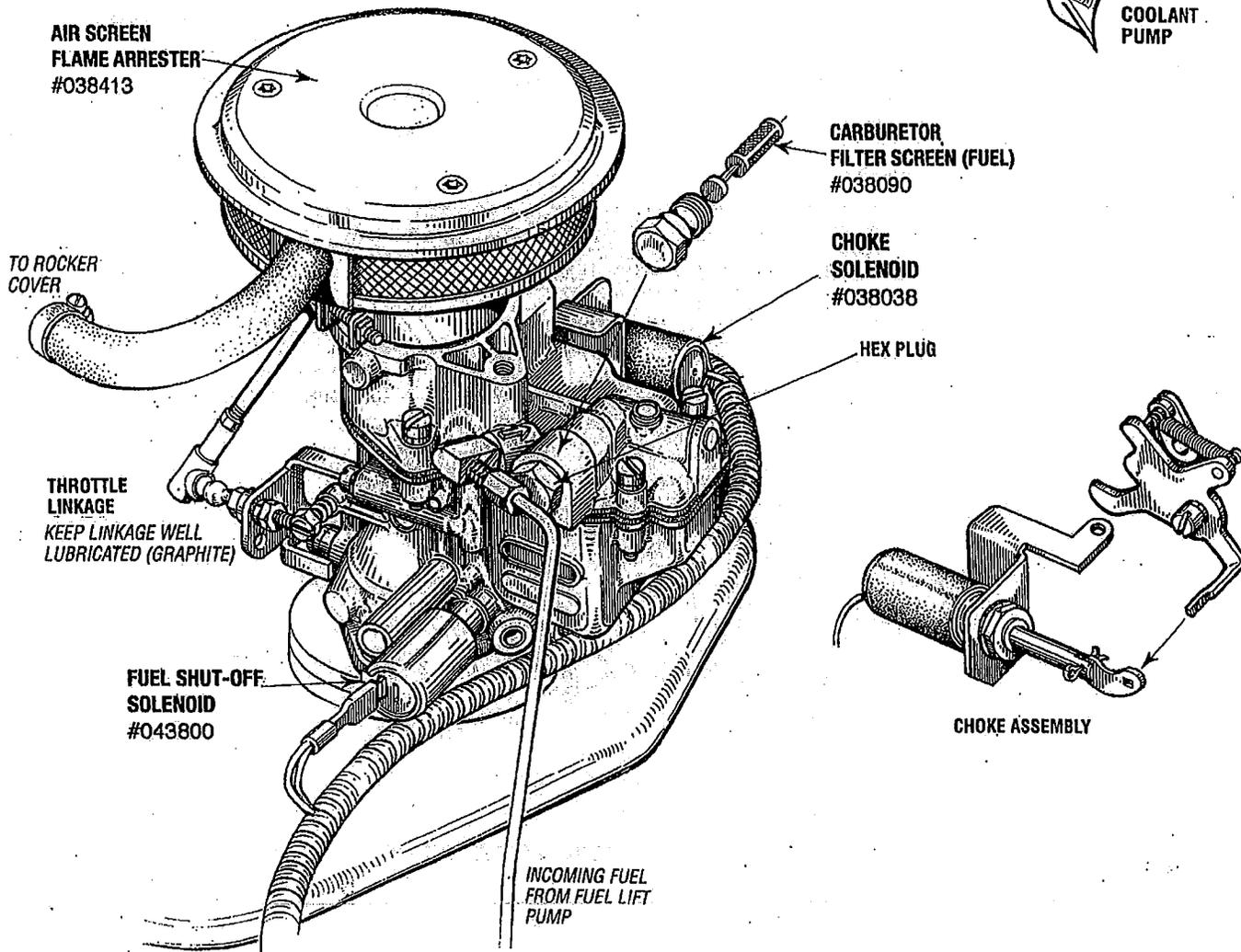
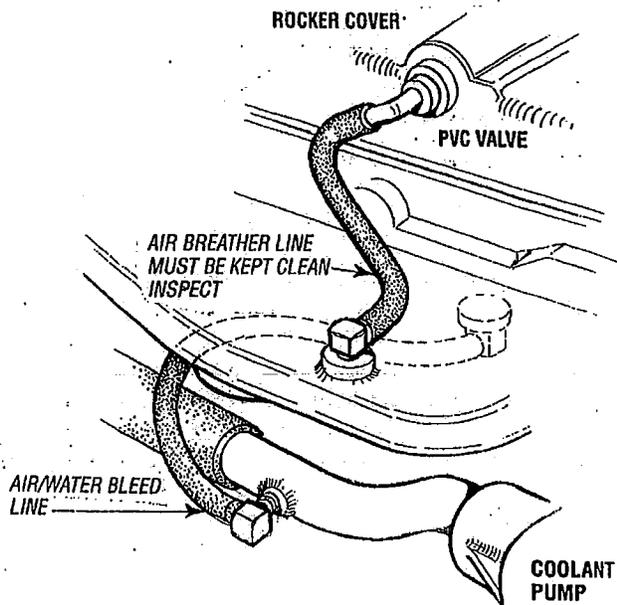
The carburetor is a single barrel, down-draft type with a cleanable metal screen air intake filter/spark arrester. The choke is operated by a 12-volt choke solenoid activated when the ON switch is depressed.

Air Screen/Flame Arrester

The air screen/flame arrester can easily be removed by releasing the hold-down clamp. Clean after the first 50 hours of operation, every 100 hours from then on. Clean the air screen in a water soluble cleaner such as GUNK.

Fuel Filter

To ensure proper operation, there must be a Coast Guard approved filter/water separator (10 microns or less) installed between the fuel supply and the engine. This filter must be of good quality and properly maintained.



ENGINE ADJUSTMENTS

SPARK PLUGS

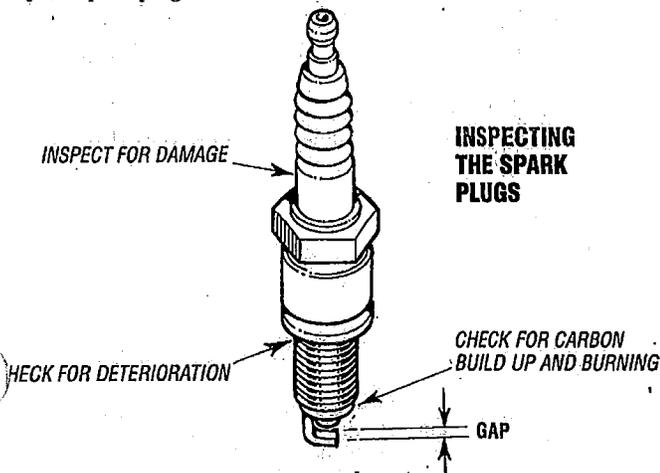
The spark plugs should be cleaned and re-gapped after the first 50 hour break-in period, then inspected every 250 hours thereafter and replaced as needed.

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

SPARK PLUG GAP: 0.027 - 0.031 in. (0.7 - 0.87 mm).

SPARK PLUG TORQUE: 101 - 15 lb-ft (1.5 - 2.31 kg-m).

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

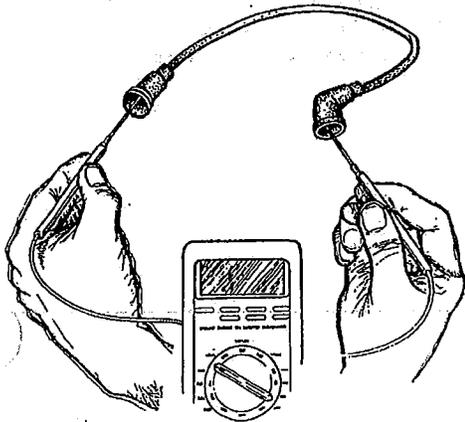


HIGH TENSION CORDS (IGNITION WIRES)

Check the ignition wires every 500 operating hours as engine compartment heat can deteriorate the wires.

Check the resistance of each wire. Do not pull on the wire because the wire connection inside the cap may become separated or the insulator may be damaged. When removing the wires from the spark plugs, grasp and twist the moulded cap, then pull the cap off the spark plug.

The resistance value is 410 ohm per inch of wire.



DRIVE BELT ADJUSTMENT

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

The BEG generators have two drive belts, one drives the governor and alternator and the other drives the raw water pump. The tension adjustment procedure for both belts is as follows:

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

1. Remove the belt guard.
2. To adjust the governor drive belt, loosen the two governor mounting bolts.
3. With the belt(s) loose, inspect for wear, cracks, and frayed edges, and replace if necessary.
4. To loosen or tighten the governor drive belt, slide the governor in or out as required, then retighten its mounting bolts.

To adjust the raw water pump/fresh water pump drive belt, slide the raw water pump in or out as required, then retighten its mounting bolts.

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

NOTE: Maintain a 22lb pressure to the belt's outer face for proper belt operation. Spare belts should always be carried on board.

6. Operate the generator for about 5 minutes then shut down and recheck the belt(s) tension.
7. Replace the belt guard.

ENGINE ADJUSTMENTS

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

ENGINE SPEED (HERTZ) ADJUSTMENT

Governor

The belt-driven, mechanically operated governor maintains the engine's rpm under various load conditions. Engine speed determines the hertz and voltage output of the generator.

Governor Adjustments

Operate the generator to bring the unit up to operating temperature before adjusting the governor.

NOTE: If the governor is severely out of adjustment, manually adjust the linkage at no-load to obtain a safe output voltage before proceeding with the adjustment.

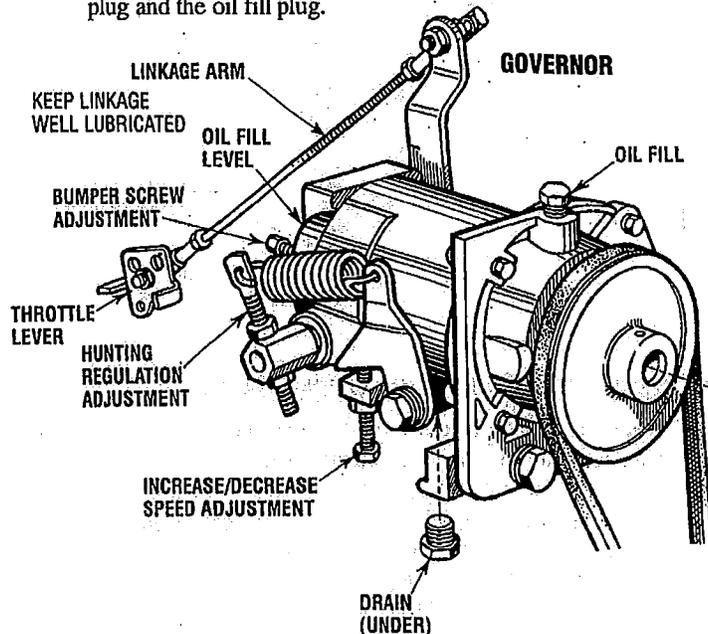
There are three adjusting points on the governor (see illustration).

- 1. Increase/Decrease Speed Adjustment.** This adjusting bolt sets the no-load speed of the engine. (The linkage arm between the governor arm and throttle lever should be adjusted to hold the throttle full open when the engine is not running.) Make sure this linkage moves freely and that the ball joint connectors are properly lubricated. Use graphite lube for this purpose. Disconnect the ball joint and apply graphite lube to the inside of the joint.
- 2. Hunting/Regulation Adjustment.** If the variation in engine speed between no-load and full-load is too great, adjust this eye bolt to draw the spring closer to the lever hub. The increase/decrease speed bolt may need to be adjusted as well.
If the governor surges under load, adjust this eye bolt to move the spring away from the lever hub (check speed adjustment).
- 3. Bumper Screw Adjustment.** This screw is used to remove a no-load surge ONLY. NEVER turn the bumper screw into the governor so far that it increases the no-load speed.

Governor Maintenance

- Periodically lubricate the linkage arm attaching points at the governor arm and throttle lever. Use a graphite lubricant or equivalent.
NOTE: Free movement of this linkage arm is important for proper governor/throttle operation.
- Governor Oil Capacity: 3 ounces SAE 10W/30 oil. (Synthetic oil is recommended).
NOTE: Do not overfill the governor.
- To change the oil, remove the oil fill plug. Place a small container under the governor and remove the governor drain plug.

Allow the oil to completely drain. Replace the governor drain plug. Then remove the allen head oil fill level plug located on the back of the governor. Fill the governor with three ounces of oil or more until oil starts to flow out of the oil fill level opening. Replace the allen head plug and the oil fill plug.



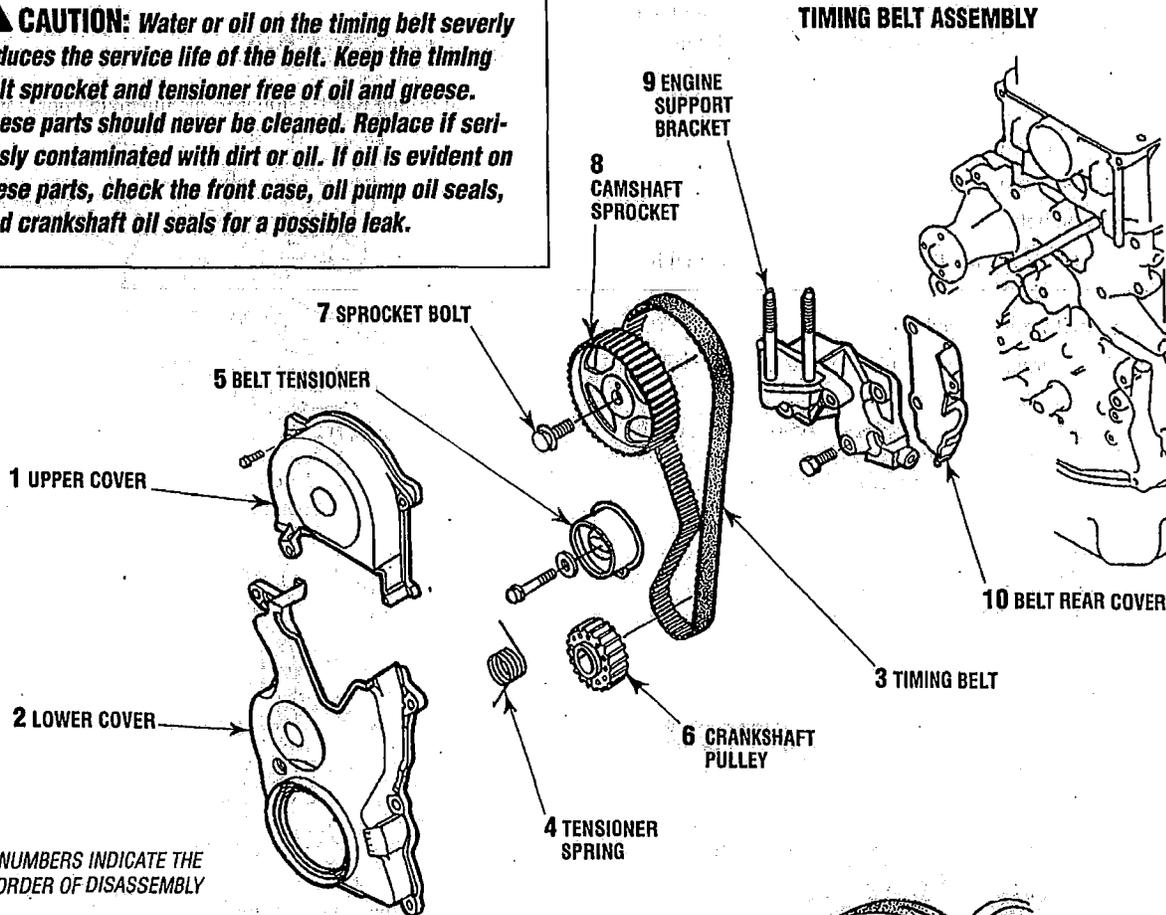
- Periodically adjust the governor belt tension (see *DRIVE BELT ADJUSTMENTS*). Since belts stretch slightly, this stretching will, to some degree, affect the governor's action.

ENGINE ADJUSTMENTS

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

TIMING BELT INSPECTION AND REPLACEMENT

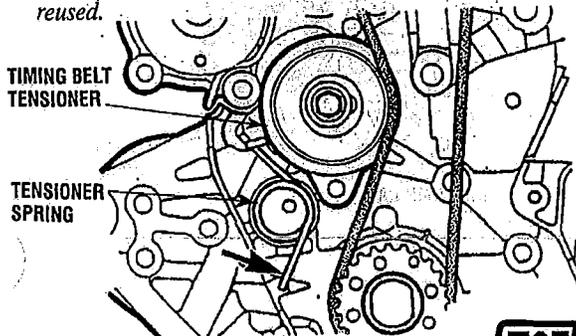
CAUTION: Water or oil on the timing belt severely reduces the service life of the belt. Keep the timing belt sprocket and tensioner free of oil and grease. These parts should never be cleaned. Replace if seriously contaminated with dirt or oil. If oil is evident on these parts, check the front case, oil pump oil seals, and crankshaft oil seals for a possible leak.



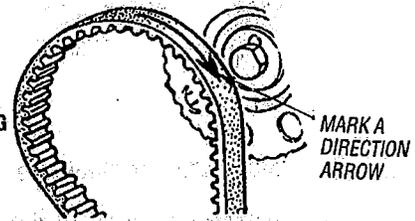
TIMING BELT REMOVAL

Using pliers, grip the tensioner spring projection and remove it from the oil pump case stopper. Then, remove the tensioner spring and the timing belt tensioner.

NOTE: If the timing belt is to be reused, chalk an arrow on the belt to indicate the direction of rotation before removing it. This will ensure the timing belt is fitted correctly when reused.

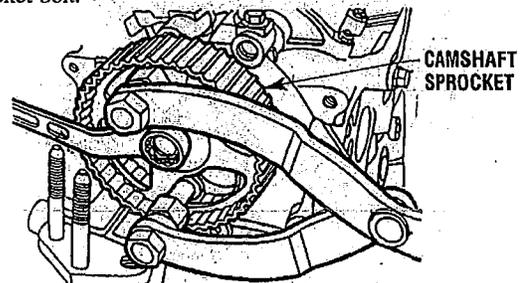


REMOVING THE TIMING BELT



SPROCKET BOLT REMOVAL (CAMSHAFT)

Using the special tools shown in the illustration, lock the camshaft sprocket in position and then loosen the camshaft sprocket bolt.



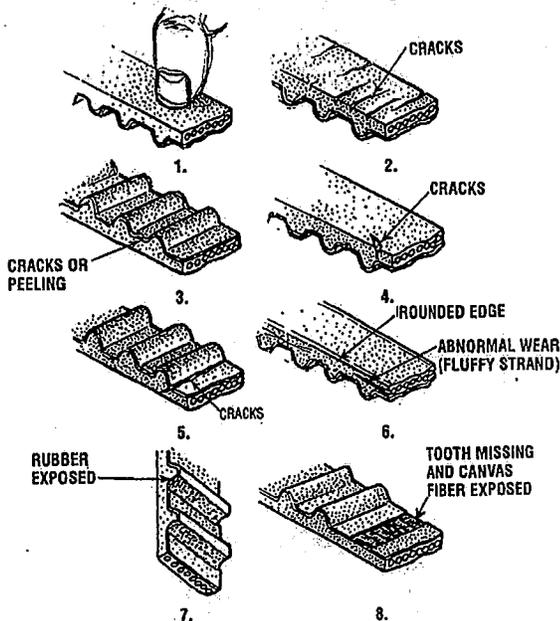
ENGINE ADJUSTMENTS

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Timing Belt Inspection

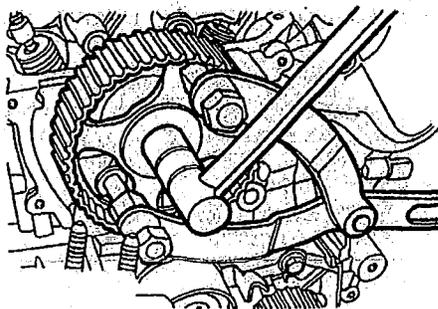
Replace the belt if any of the following conditions exist:

1. Hardening of back rubber-back side is glossy, without resilience, and leaves no indent when pressed with fingernail.
2. Cracks on rubber back.
3. Cracks or peeling of canvas.
4. Cracks on tooth bottom.
5. Cracks on belt.
6. Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.
7. Abnormal wear on teeth.
8. Tooth missing and canvas fiber exposed.



Sprocket Bolt Installation (Camshaft)

Using the special tools shown in the illustration, lock the camshaft sprocket in position and tighten the camshaft sprocket bolt to the specified torque.



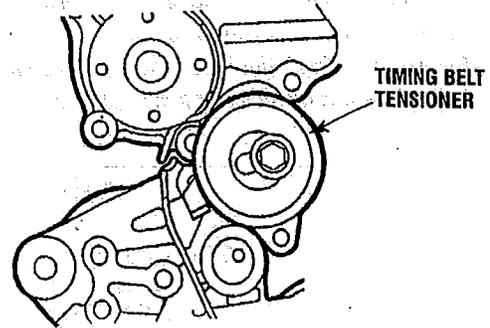
LOCKING THE CAMSHAFT SPROCKET

Belt Tensioner Inspection

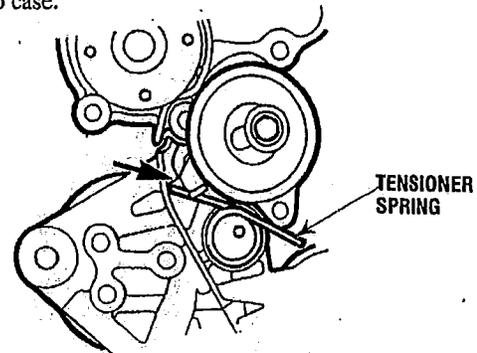
Replace the belt tensioner if it binds, rattles, or is noisy when turned.

Tensioner Spring Installation

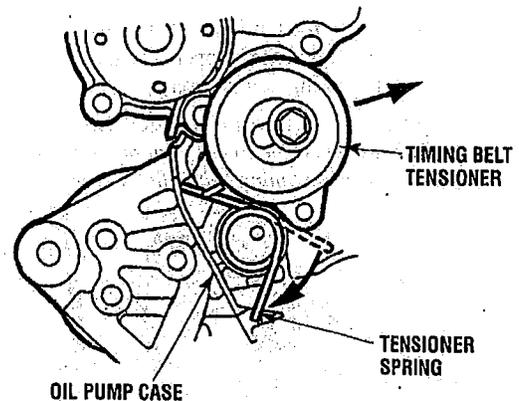
1. Lock the timing belt tensioner in the illustrated position.



2. Fit one of the tensioner spring projections over the hooked portion of the belt tensioner and fit the tensioner onto the oil pump case.



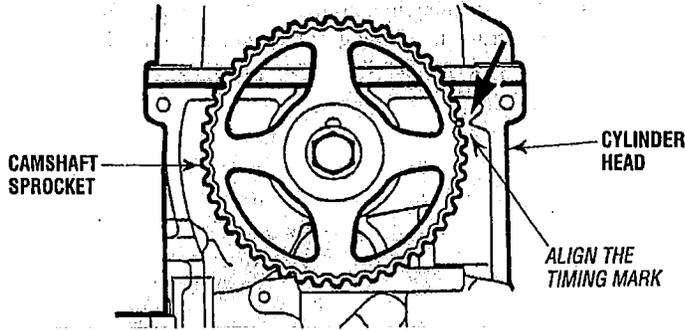
3. Grip the other tensioner spring projection and fit it onto the oil pump case lug as shown in the illustration. Move the timing belt tensioner in the direction shown and temporarily tighten the bolt.



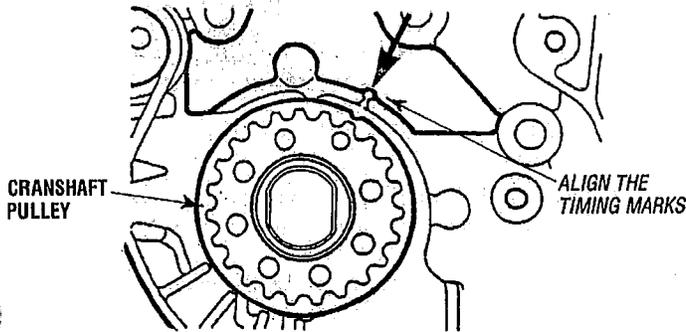
ENGINE ADJUSTMENTS

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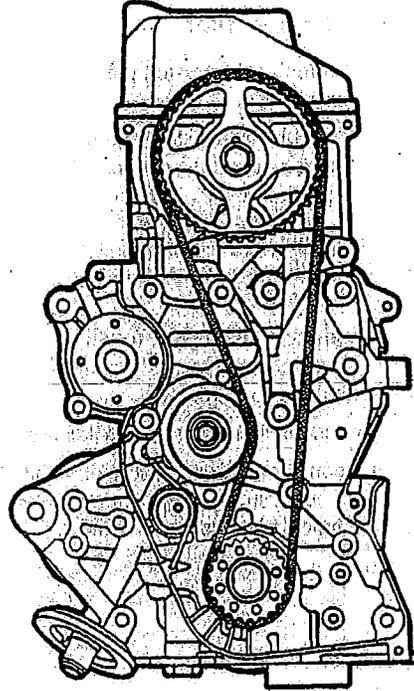
Timing Belt Installation



1. Align the camshaft timing mark with the timing mark on the cylinder head.



2. Align the crankshaft timing mark with the timing mark on the front case.
3. Keeping the tension side of the timing belt tight, fit the timing belt onto the crankshaft sprocket, camshaft sprocket, and tensioner pulley in that order.
4. Loosen the tensioner pulley mounting bolts by 1/4 to 1/2 of a turn and allow the tensioner spring to apply tension to the timing belt.



5. Turn the crankshaft twice in the normal rotating direction (clockwise) and check that the timing marks are correctly aligned.

CAUTION: This procedure utilizes the camshaft's driving torque to apply tension evenly to the timing belt. Be sure to turn the crankshaft as described above. Do not turn the crankshaft in reverse.

6. Tighten the tensioner pulley mounting bolts.
IDLER PULLEY BOLTS TORQUE 23 Nm (17 ft-lb)
7. Replace the timing belt covers.
TIMING BELT COVER BOLTS TORQUE 11 Nm (8 ft-lb)

ENGINE ADJUSTMENTS

NOTE: WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic.

ENGINE COMPRESSION TEST

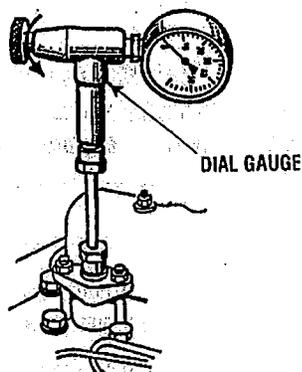
1. To check the engine's compression pressure, warm up the engine then shut it down.
 2. Remove the spark plug and install a compression adapter (screws into a plug hole) with a gauge.
 3. Close off the raw water intake seacock.
 4. Crank the engine with the start motor and unplug the ignition coil and allow the compression gauge to reach a maximum reading and record.
 5. Measure the compression pressure for all the cylinders. Ensure that compression pressure differential for each cylinder is within the specified unit.
- Compression pressure should not differ by more than 14 psi (100 Kpa).
6. If a cylinder's compression or pressure differential is below the limit, add a small amount of engine oil through the spark plug hole and repeat steps 3 and 4.

(a) If additional of oil causes an increase of pressure, the piston ring and/or cylinder wall may be worn or damaged.

(b) If additional oil does not increase compression pressure suspect poor valve contact, valve seizure, or valve wear.

7. Reinstall plugs and ignition wires.
8. Open the raw water thru seacock.

MEASURING COMPRESSION

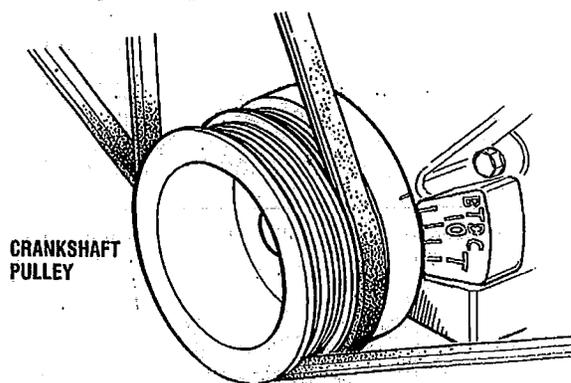


Standard Compression 165 p.s.i. at 300 rpm
(limit of difference between cylinders) 14 p.s.i.

IGNITION TIMING

1. Attach a timing light to the #1 spark plug and mark the front crankshaft timing groove and the timing mark on the scale embossed on the engine's front cover.

Each timing mark represents 5°.



2. Start the engine and warm the engine to its normal operating temperature.
3. Using the timing light, position the timing groove in the front crankshaft pulley approximately 1/4 inch above the top timing mark on the timing scale embossed on the engine's front gear case cover. Do this by loosening the Hex B securing screw for the distributor and slowly rotating the distributor body to position the crankshaft pulley mark.

IGNITION TIMING AT 1800RPM: 20° BTDC ±1°

ENGINE TROUBLESHOOTING

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

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

NOTE: *The engine's control system (electrical system) is protected by a 20-Ampere manual reset circuit breaker located just outboard of the starter motor.*

PROBLEM	PROBABLE CAUSE
Engine does not crank.	<ol style="list-style-type: none"> 1. Voltage drop at starter solenoid terminal. 2. Engine 20A circuit breaker has tripped. 3. Battery is low or dead. 4. Loose battery connections. 5. Faulty wire connection. 6. Faulty start switch. 7. Faulty start relay (K1). 8. Faulty starter solenoid. 9. Raw water filled cylinders.
Engine cranks but fails to start.	<ol style="list-style-type: none"> 1. Out of fuel. 2. Engine is flooded. <ol style="list-style-type: none"> a. Carburetor float needle valve open or damaged. Clean or replace the needle valve b. Float in carburetor is leaking. Repair or replace float. c. Float chamber gasket damaged or securing screws are loose. Replace gasket and/or tighten screws. 3. Fuel pump inoperative. 4. Worn or faulty spark plugs. 5. High tension wires grounding (wet system). 6. Faulty ignition coil. 7. Faulty distributor. 8. Faulty run relay (K2). 9. Faulty wire connection. 10. No engine compression. 11. Filters are clogged by contaminated fuel. 12. Voltage drop at (+) at overspeed switch. 13. Faulty overspeed switch. (by-pass and test run)

PROBLEM	PROBABLE CAUSE
Engine starts, runs and then shuts down.	<ol style="list-style-type: none"> 1. Faulty shutdown switch, (oil pressure, water, exhaust temperature or overspeed). 2. High engine water or exhaust temperature. 3. Dirty fuel/water separator filters. 4. Mechanical check valve at the fuel supply faulty (if installed). 5. Low oil level in sump. 6. Faulty fuel pump.
Engine starts, runs but does not come up to speed.	<ol style="list-style-type: none"> 1. Fuel line restriction. 2. Mechanical check valve at the fuel supply is restricting fuel flow. 3. Throttle plate binding. 4. Faulty fuel pump. 5. Faulty wire connection. 6. Choke stuck closed. 7. AC generator overload. 8. High exhaust pressure.
Engine hunts.	<ol style="list-style-type: none"> 1. Low battery voltage. 2. Generator is overloaded. 3. Cracked distributor cap 4. Faulty high tension wires. 5. Faulty fuel pump. 6. High exhaust back-pressure. 7. Valves are out of adjustment. 8. Governor is out of adjustment. 9. Dirty fuel filters. 10. Throttle linkage is binding.

ENGINE TROUBLESHOOTING

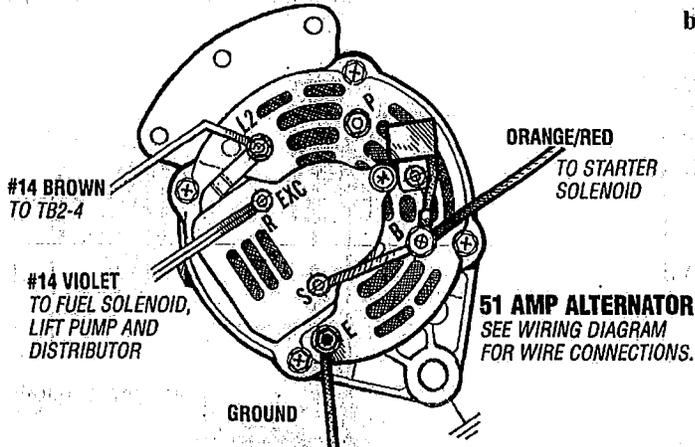
PROBLEM	PROBABLE CAUSE
Engine misfires.	<ol style="list-style-type: none"> 1. Poor quality fuel. 2. Incorrect timing. 3. Dirty flame arrester. 4. Cracked distributor cap. 5. Faulty ignition wires. 6. Spark plugs are worn. 7. High exhaust back-pressure. 8. Valve clearances are incorrect.
Engine backfires.	<ol style="list-style-type: none"> 1. Spark plug wires are connected wrong. 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. Cracked distributor cap. 6. High exhaust back-pressure.
Engine overheats.	<ol style="list-style-type: none"> 1. Coolant loss. Pressure test cooling system. 2. Faulty raw water pump impeller. 3. Belts are loose or broken. 4. Raw water pump worn. 5. Faulty thermostat.
Low oil pressure.	<ol style="list-style-type: none"> 1. Low oil level. 2. Wrong SAE type oil in the engine. 3. Wrong type oil filter. 4. Relief valve is stuck. 5. Faulty oil pump. 6. Faulty engine bearings. 7. Faulty oil filter.
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.

PROBLEM	PROBABLE CAUSE
No DC charge to the starting battery.	<ol style="list-style-type: none"> 1. Alternator drive belt slipping. 2. Loose/corroded connections on DC alternator 3. No excitation to alternator regulator. 4. Faulty regulator. 5. Faulty alternator.
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. Accelerator diaphragm leaking. 5. Valves are worn or incorrectly adjusted. 6. Lube oil is diluted. 7. Piston rings are worn or unseated. 8. Crankcase breather hose is clogged.
Poor performance at generator speed.	<ol style="list-style-type: none"> 1. Main jet clogged. remove and clean. 2. Carburetor inlet filter clogged. Remove and clean. 3. Fuel pump clogged. Remove and clean. 4. Air intake filter screen dirty. Remove and clean. 5. Governor needs adjustment.

DC ELECTRICAL SYSTEM

ALTERNATOR

The charging system consists of a DC belt driven alternator with a voltage regulator, an engine DC wiring harness, a mounted DC circuit breaker and a battery with connecting cables. Because of the use of integrated circuits (IC's), the electronic voltage regulator is very compact and is mounted internally or on the back of the alternator.



ALTERNATOR TROUBLESHOOTING

WARNING: A failed alternator can become very hot. Do not touch until the alternator has cooled down.

Use this troubleshooting section to determine if a problem exists with the charging circuit or with the alternator. If it is determined that the alternator or voltage regulator is faulty, have a qualified technician check it.

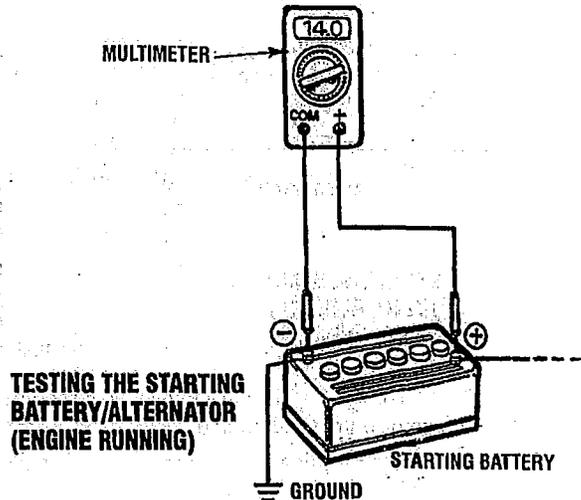
The alternator charging circuit charges the starting battery and the service battery. An isolator with a diode, a solenoid or a battery selector switch is usually mounted in the circuit to isolate the batteries so the starting battery is not discharged along with the service battery. If the alternator is charging the starting battery but not the service battery, the problem is in the service battery's charging circuit and not with the alternator.

Testing the Alternator

CAUTION: Before starting the engine make certain that everyone is clear of moving parts! Keep away from sheaves and belts during test procedures.

WARNING: When testing with a multimeter: DC and AC circuits are often mixed together in marine applications. Always disconnect a shore power cord, isolate DC and AC converters, and shut down the engine before performing DC testing. No AC tests should be made without a proper knowledge of AC circuits.

1. Start the engine.
2. After the engine has run for a few minutes, measure the starting battery voltage at the battery terminals using a multimeter set on DC volts.
 - a. If the voltage is increasing toward 14 volts, the alternator is working; omit Steps 3 through 8 and go directly to "Checking the Service Battery" on the next page.
 - b. If the voltage remains around 12 volts, a problem exists with either the alternator or the charging circuit; continue with Steps 3 through 8.

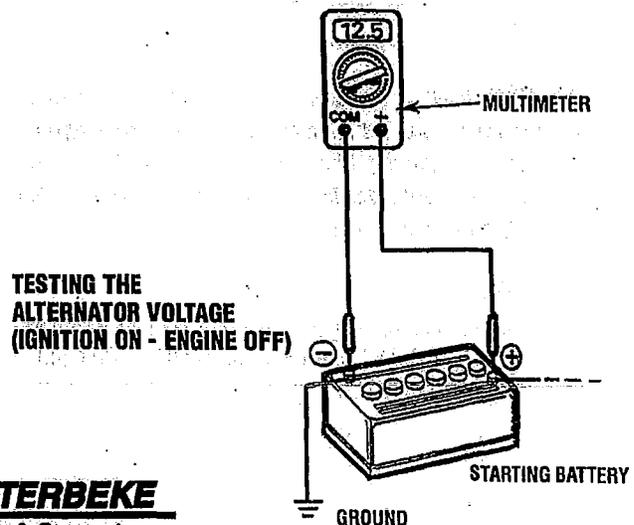


TESTING THE STARTING BATTERY/ALTERNATOR (ENGINE RUNNING)

3. Turn off the engine. Inspect all wiring and connections. Ensure that the battery terminals and the engine ground connections are tight and clean.

CAUTION: To avoid damage to the battery charging circuit, never shut off the engine battery switch when the engine is running!

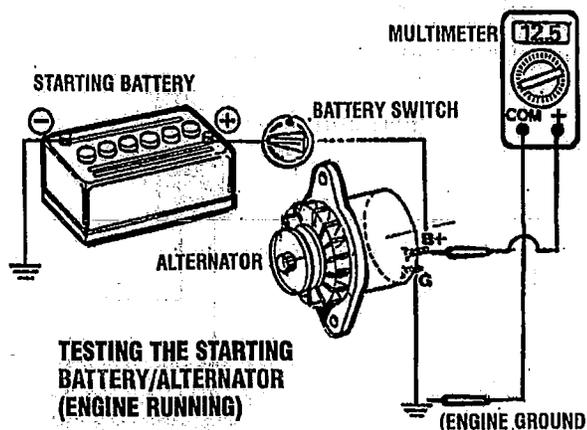
4. If a battery selector switch is in the charging circuit, ensure that it is on the correct setting.
5. Turn on the ignition switch, but do not start the engine.
6. Check the battery voltage. If the battery is in good condition, the reading should be 12 to 13 volts.



TESTING THE ALTERNATOR VOLTAGE (IGNITION ON - ENGINE OFF)

DC ELECTRICAL SYSTEM

7. Now check the voltage between the alternator output terminal (B+) and ground. If the circuit is good, the voltage at the alternator will be the same as the battery, or if an isolator is in the circuit the alternator voltage will be zero. If neither of the above is true, a problem exists in the circuit between the alternator and the battery. Check all the connections — look for an opening in the charging circuit.



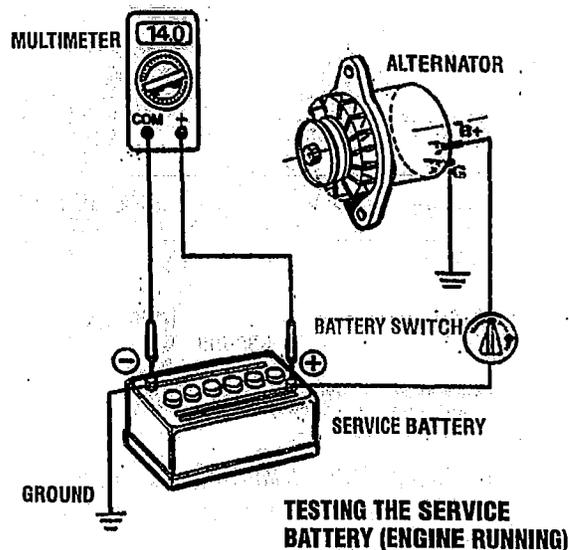
8. Start the engine again. Check the voltage between the alternator output and ground. The voltage reading for a properly operating alternator should be between 13.5 and 14.5 volts. If your alternator is over- or under-charging, have it repaired at a reliable service facility.

NOTE: Before removing the alternator for repair, use a voltmeter to ensure that 12 volts DC excitation is present at the EXC terminal if the previous test showed only battery voltage at the B output terminal.

If 12 volts is not present at the EXC terminal, trace the wiring and look for breaks and poor connections.

Checking the Service Battery

Check the voltage of the service battery. This battery should have a voltage between 13 and 14 volts when the engine is running. If not, there is a problem in the service battery charging circuit. Troubleshoot the service battery charging circuit by checking the wiring and connections, the solenoid, isolator, battery switch, and the battery itself.



CAUTION: To avoid damaging the alternator diodes, do not use a high voltage tester (i.e. a megger) when performing tests on the alternator charging circuit.

12 VOLT DC CONTROL CIRCUIT

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

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.

BATTERY

The minimum recommended capacity of the battery used in the engine's 12-volt DC control circuit is 600 – 900 Cold Cranking Amps (CCA).

Battery Care

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

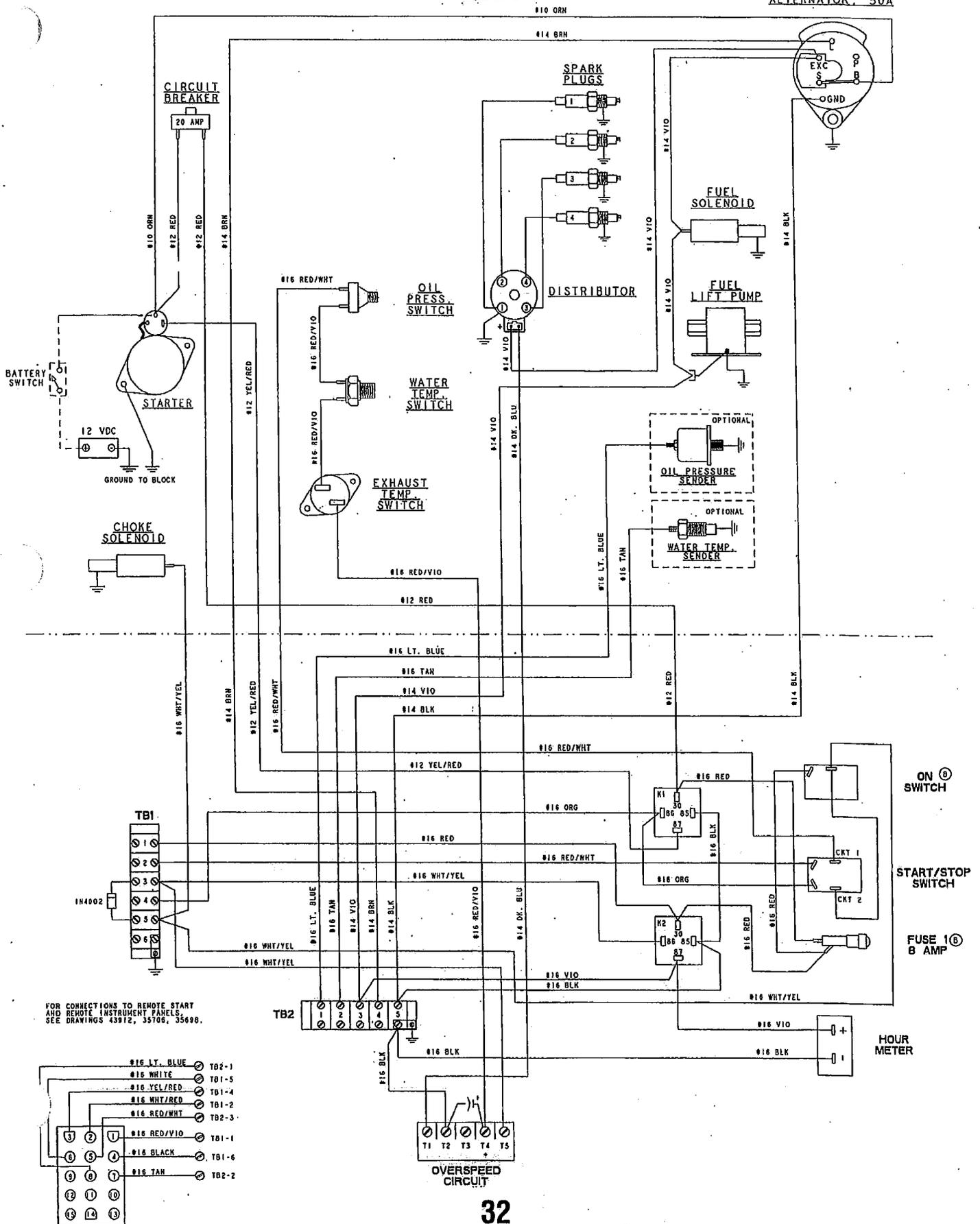
- Monitor your voltmeter for proper charging during engine operation.
- Check the electrolyte level and specific gravity with a hydrometer.
- Use only distilled water to bring electrolytes to a proper level.
- Make certain that battery cable connections are clean and tight to the battery posts (and to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

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

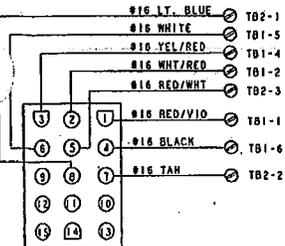
WIRING DIAGRAM GASOLINE GENERATORS

#46094

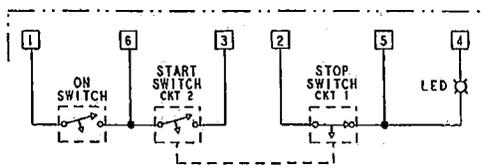
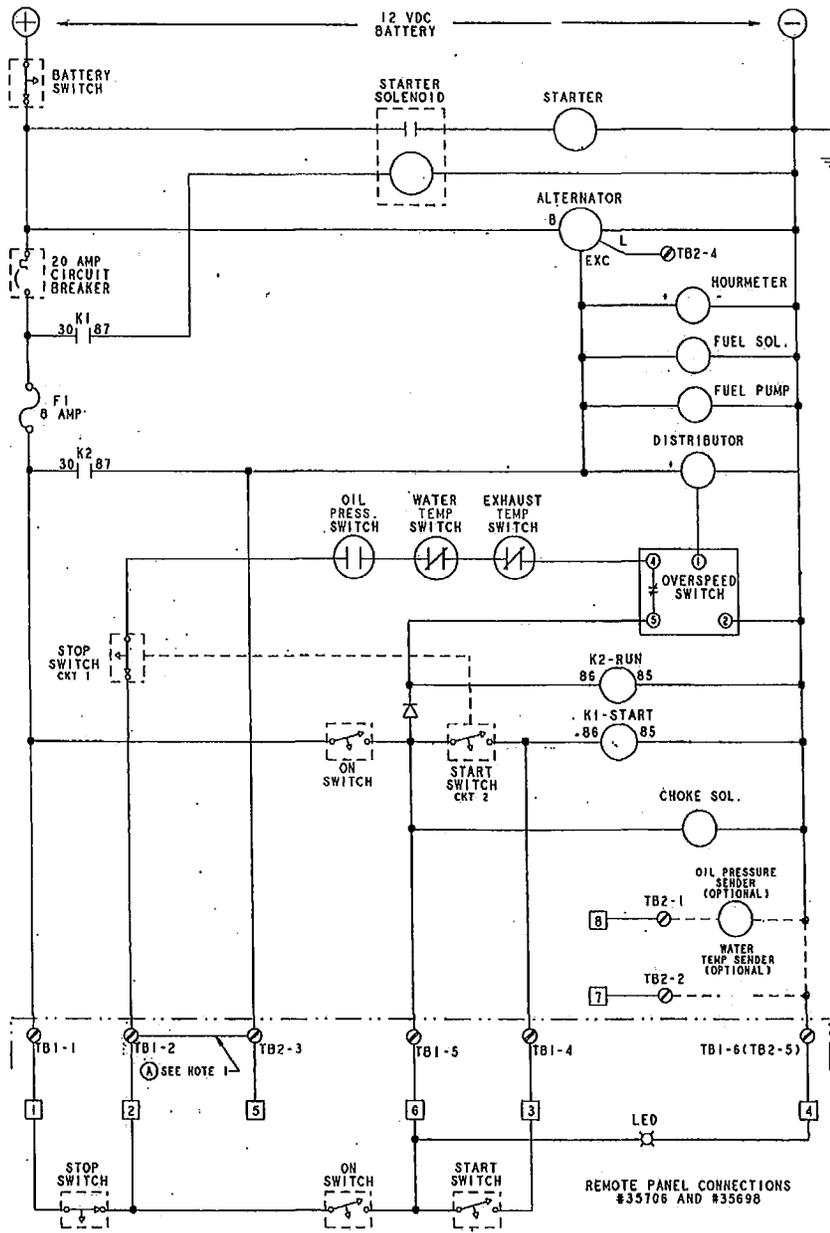
ALTERNATOR, 50A



FOR CONNECTIONS TO REMOTE START AND REMOTE INSTRUMENT PANELS SEE DRAWINGS 43912, 35706, 35698.



WIRING SCHEMATIC GASOLINE GENERATORS #46094



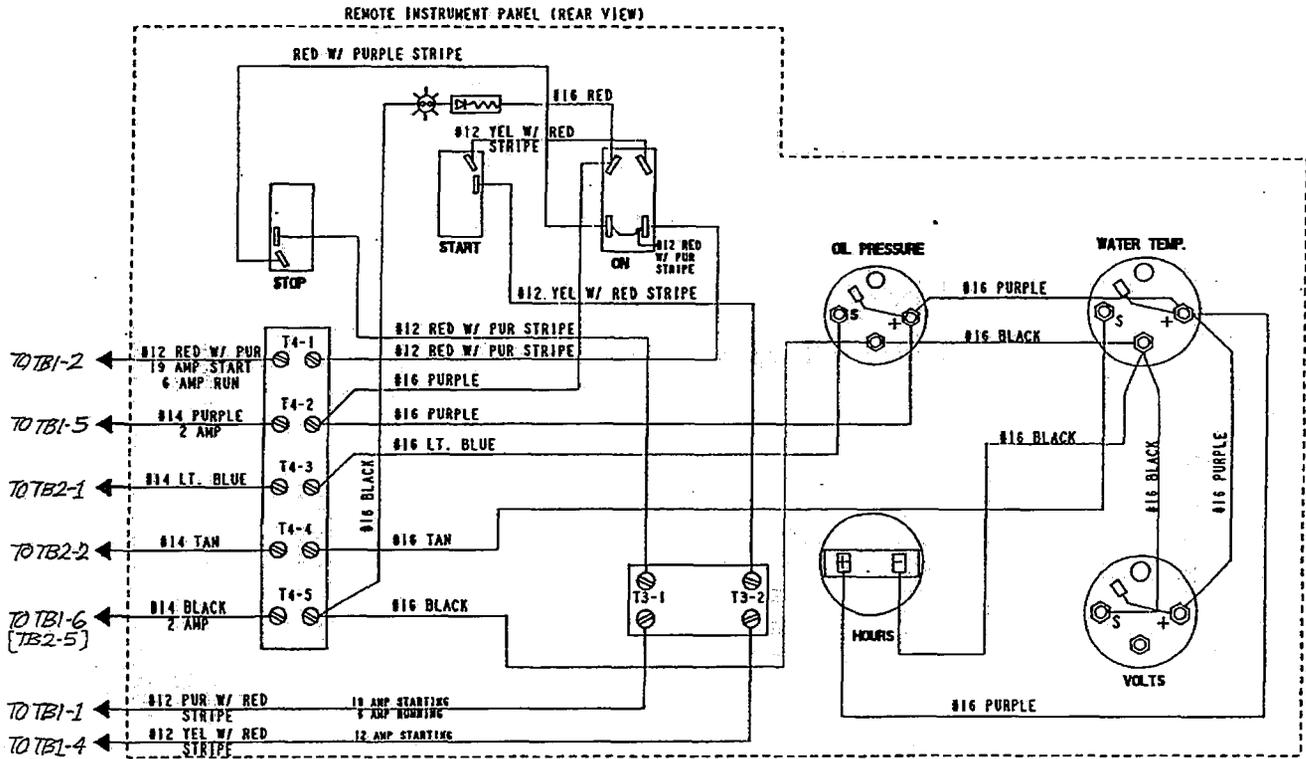
REMOTE PANEL CONNECTIONS
#43912

① NOTES:
1. REMOVE JUMPER (ON 15 PIN PLUG)
BETWEEN TB1-2 AND TB2-3 WHEN
USING A REMOTE PANEL.

□ DENOTES REMOTE CONNECTOR PIN NUMBERS

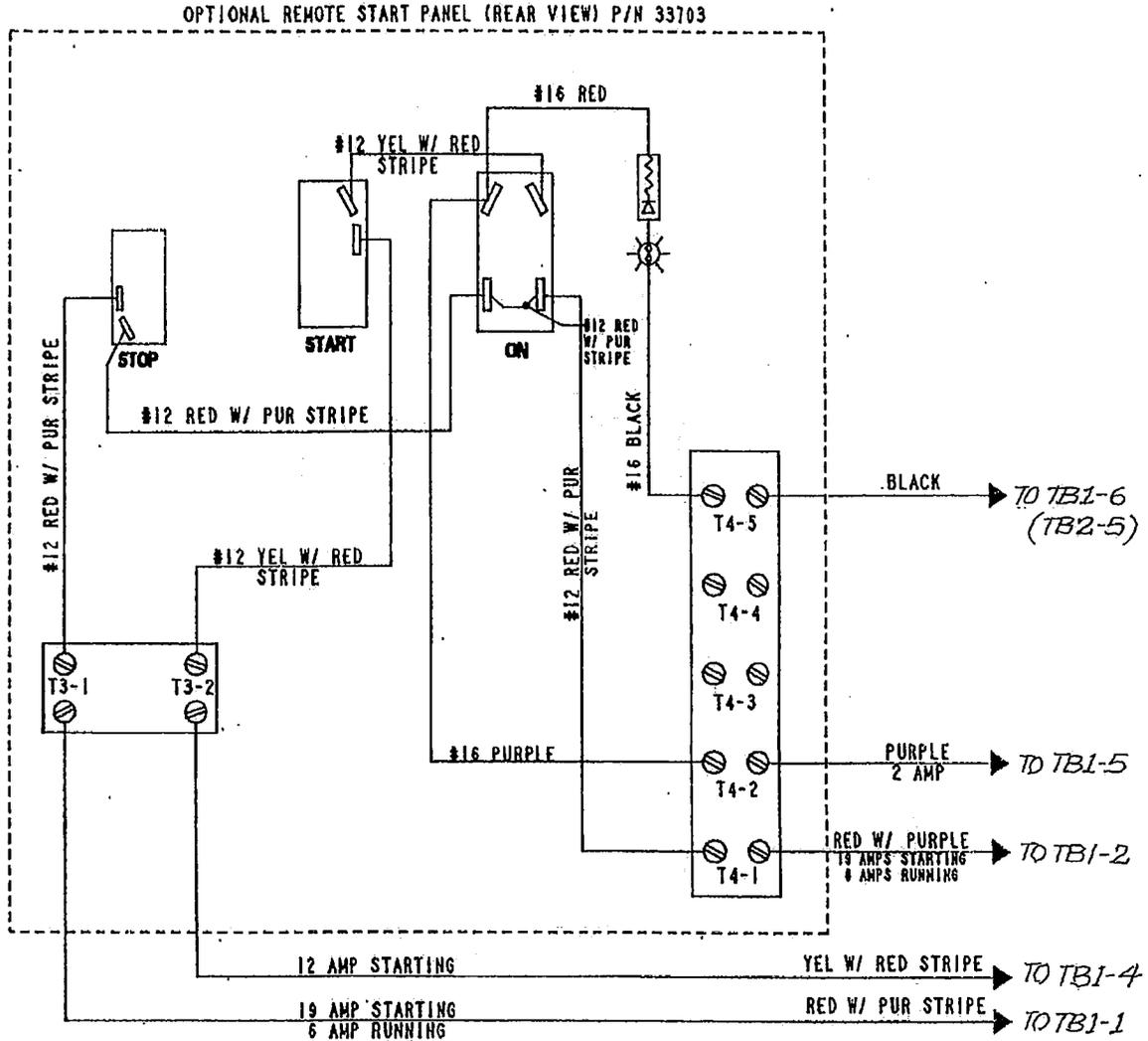
OPTIONAL REMOTE INSTRUMENT PANEL

WIRING DIAGRAM #035698



OPTIONAL REMOTE START PANEL

WIRING DIAGRAM #035706

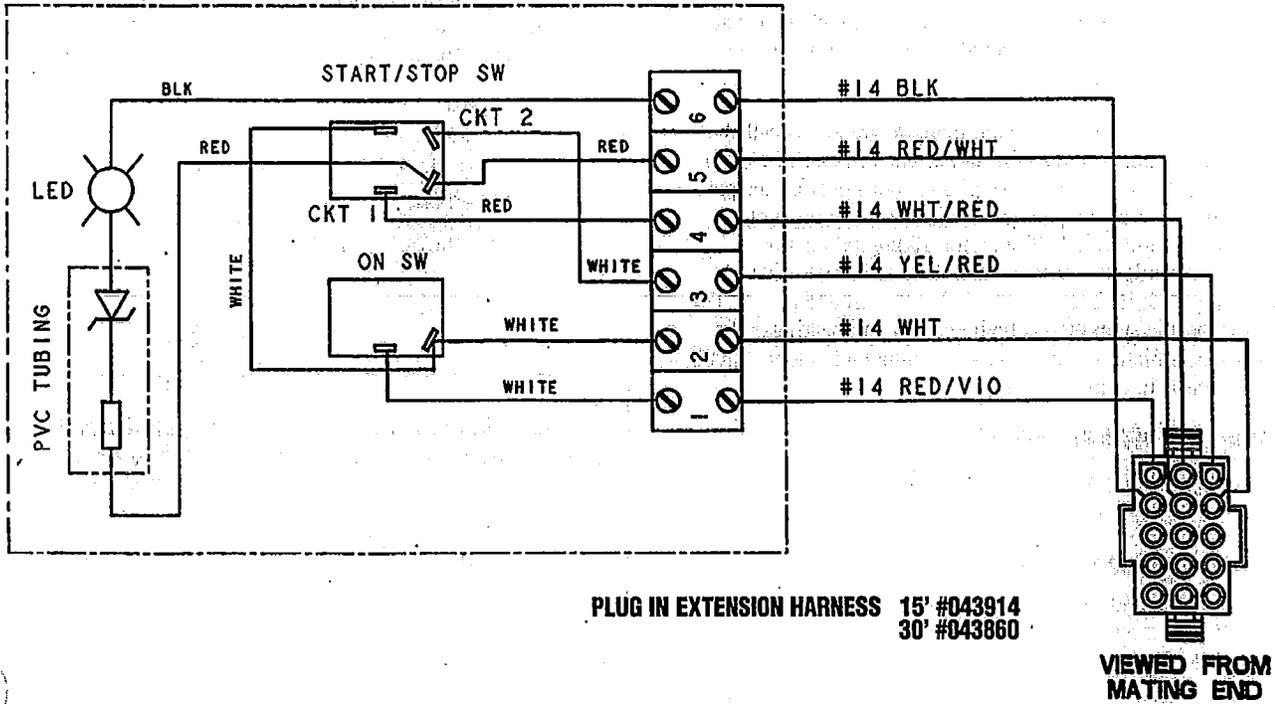


NOTE: Use #14 wire for all connections up to 100', increase to #12 wire for connections over 100'.

NOTE: When installing this panel, remove the external plug connector.

REMOTE PANEL WIRING SCHEMATIC #043912

REMOTE PANEL #043912



STARTER MOTOR

DESCRIPTION

The starter can be roughly divided into the following sections:

- A motor section which generates a drive power.
- An overrunning clutch section which transmits an armature torque, preventing motor overrun after starting.
- A switch section (solenoid) which is operated when actuating the overrunning clutch through a lever and which supplies load current to the motor.

The starter is a new type, small, light-weight and is called a high-speed internal-reduction starter. The pinion shaft is separate from the motor shaft; the pinion slides only on the pinion shaft. A reduction gear is installed between the motor shaft and a pinion shaft. The pinion sliding part is not exposed outside the starter so that the pinion may slide smoothly without becoming fouled with dust and grease. The motor shaft is supported at both ends on ball bearings. The lever mechanism, switch and overrunning clutch inner circuit are identical to conventional ones.

ADJUSTMENT AND REPAIR

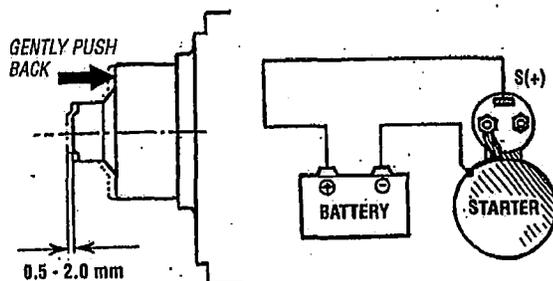
If any abnormality is found by the following tests, the starter should be disassembled and repaired.

Pinion Gap Inspection

1. Connect a battery (12V) between the starter terminal S and the starter body, and the pinion drive should rotate out and stop.

CAUTION: Never apply battery voltage for over 10 seconds continuously.

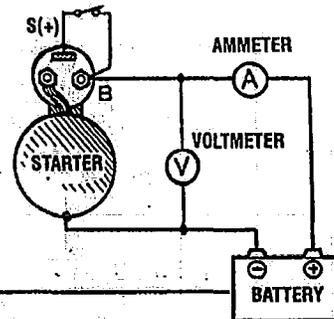
2. Lightly push the pinion back and measure the return stroke (called pinion gap).
3. If the pinion gap is not within the standard range, (0.5 to 2.0 mm), adjust it by increasing or decreasing the number of shims on the solenoid. The gap is decreased as the number of shims increases.



PINION GAP

No-Load Test

1. Connect the ammeter, voltmeter, and battery to the starter as illustrated.
2. When the switch is closed, the pinion must protrude and the starter must run smoothly (at 3000 rpm or more). If the current or starter speed is out of specification, disassemble the starter and repair it.

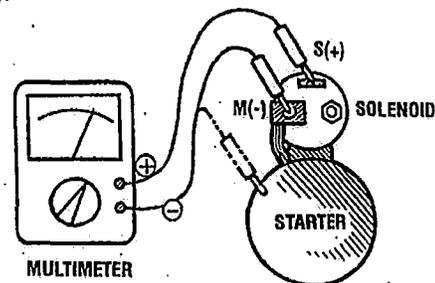


CAUTION: Use thick wires as much as possible and tighten every terminal securely. This is a solenoid shift-type starter which makes a rotating sound louder than that of a direct-drive type starter. When detecting starter rotation at the pinion tip, be careful not to come in contact with the pinion gear when it protrudes.

SOLENOID

Perform the following tests. If any test result is not satisfactory, replace the solenoid assembly.

1. Inspect the solenoid for continuity between terminals (+) and (-) and between terminals S and the body and M and the body. There should be no continuity found between terminals S and M. Continuity will be found between terminals S and the body and terminal M and the body.

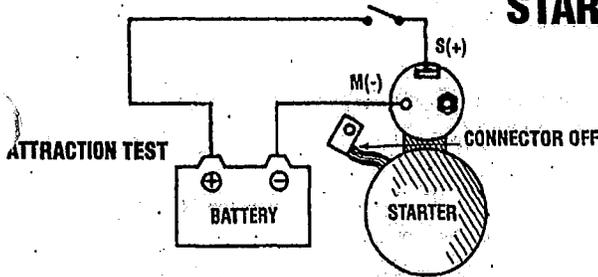


NOTE: Disconnect the wire from terminal M.

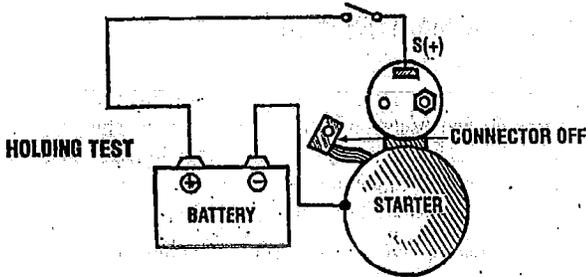
2. Connect a battery to the solenoid's terminal S for (+) and M for (-). Have a switch in the + lead and close it. The pinion drive should extend fully out.

CAUTION: Do not apply battery current for more than 10 seconds when testing the solenoid.

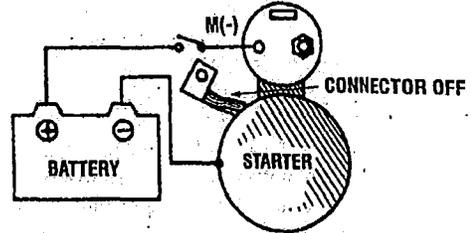
STARTER MOTOR



3. **Holding test.** With a battery connected to the solenoid terminal S (+) and to the starter body, manually pull out the pinion fully. The pinion must remain at that position even when released from holding with your hand.



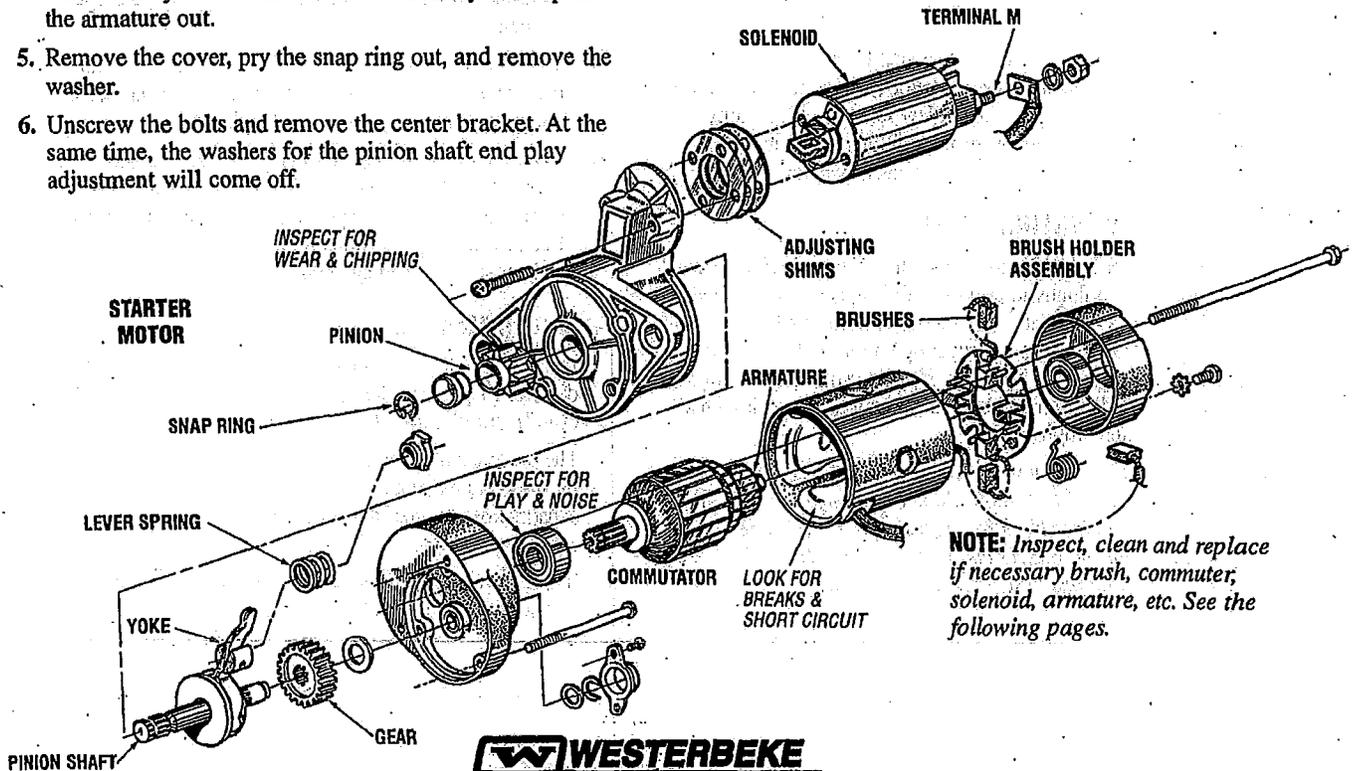
4. **Return test:** With a battery connected to the solenoid terminal M (-) and to the starter body, manually pull out the pinion fully. The pinion must return to its original position when released from holding by hand.



STARTER DISASSEMBLY

1. Disconnect the wire from the solenoid terminal M (-).
2. Loosen the two screws fastening the solenoid. Remove the solenoid assembly.
3. Remove the two long through bolts and two screws fastening the brush holder. Remove the rear bracket.
4. With the brushes pulled away from the armature, remove the yoke and brush holder assembly. Then pull the armature out.
5. Remove the cover, pry the snap ring out, and remove the washer.
6. Unscrew the bolts and remove the center bracket. At the same time, the washers for the pinion shaft end play adjustment will come off.

7. Pull out the reduction gear lever and lever spring from the front bracket.
8. On the pinion side, pry the snap ring out, and pull out the pinion and pinion shaft.
9. At each end of the armature, remove the ball bearing with a bearing puller. It is impossible to replace the ball bearing press-fitted in the front bracket. If that bearing has worn off, replace the front bracket assembly.



NOTE: Inspect, clean and replace if necessary brush, commutator, solenoid, armature, etc. See the following pages.

GENERATOR INFORMATION

USE OF ELECTRIC MOTORS

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

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

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

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

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

REQUIRED OPERATING SPEED

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

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

GENERATOR FREQUENCY ADJUSTMENT

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

- When the generator is run at 1800 rpm, the AC voltage output frequency is 60 Hertz.
- When the generator is run at 1500 rpm, the AC voltage output frequency is 50 Hertz.

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

GENERATOR MAINTENANCE

- Maintaining reasonable cleanliness is important. Connections of terminal boards 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 reduce life of windings.
- For unusually severe conditions, thin rust-inhibiting petroleum based coatings should be sprayed or brushed over all surfaces to reduce rusting and corrosion.
- In addition to periodic cleaning, the generator should be inspected for tightness of all connections, evidence of overheated terminals and loose or damaged wires.
- The drive discs on single bearing generator's should be checked periodically if possible for tightness of screws and for any evidence of incipient cracking failure. Discs should not be allowed to become rusty because rust may accelerate cracking. The bolts which fasten the drive disc to the generator shaft must be hardened steel SAE grade 8, identified by 6 radial marks, one at each of the 6 corners of the head.
- The rear armature bearing is lubricated and sealed; no maintenance is required. However, if the bearing becomes noisy or rough-sounding, have it replaced.
- Examine the bearing at periodic intervals. No side movement of the shaft should be detected when force is applied. If side motion is detectable, inspect the bearing and shaft for wear. Repair must be made quickly or major components will rub and cause major damage to the generator.

Carbon Monoxide Detector

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

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

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

BE GENERATOR

WITH VOLTAGE REGULATOR #046446

DESCRIPTION

This is a four pole brushless generator. The exciter provides residual magnetism which guarantees the self excitation of the generator on start-up. (The residual voltage is about 10% of nominal AC voltage). The Automatic Voltage Regulator (AVR) converts this AC voltage to DC voltage and supplies this DC voltage to the exciter windings. This DC voltage indirectly controls the main rotating field by means of the sequence exciter rotor-diode bridges-main rotating field. The AVR has a plus or minus voltage precision of 1% in the generators working range with distortion free loads. The AVR controls and keeps the voltage constant on one phase. The AVR monitors generator frequency, if the frequency should drop below a factory set point, excitation from the AVR can be modulated to remove any voltage output instability that may arise.

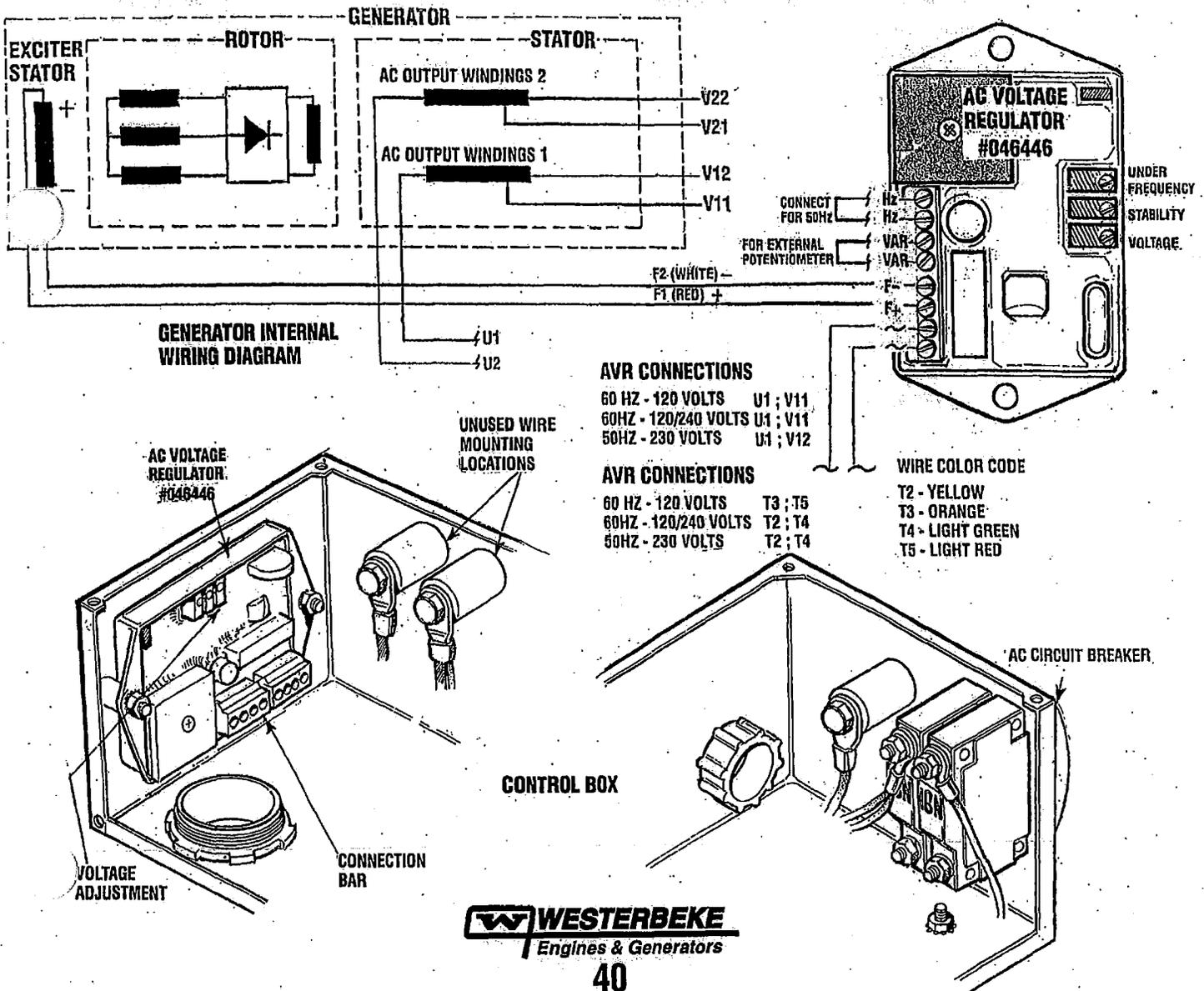
Voltage Adjustments

This potentiometer is used to adjust output voltage. At proper engine operating speed the output voltage should be held at $\pm 2\%$ from a no-load condition to a full rated generator output and from power factor 1.0 with engine drive speed variations up to .5Hz (1%).

With the alternator running at no-load, at normal speed, and with VOLT adjust at minimum, it is possible that output voltage will oscillate. Slowly rotate the VOLT adjustment clockwise. The voltage output of the alternator will increase and stabilize. Increase the voltage to the desired value.

CIRCUIT BREAKER

A circuit breaker is installed on all WESTERBEKE generators. This circuit breaker will automatically disconnect generator power in case of an electrical overload. The circuit breaker can be manually shut off when servicing the generator to ensure that no power is coming into the boat.



BE GENERATOR VOLTAGE CONNECTIONS

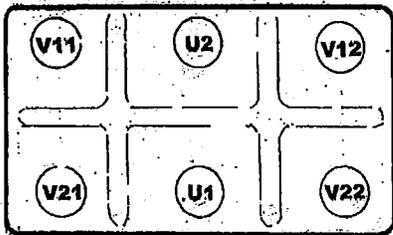
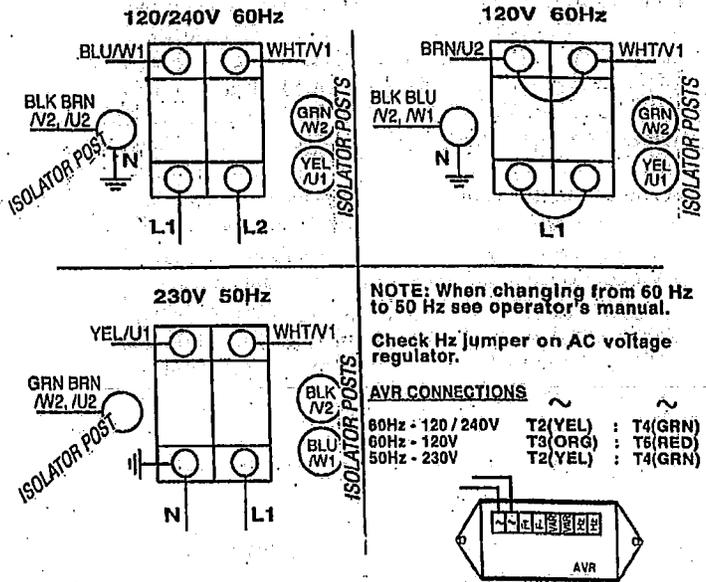
AC VOLTAGE CONNECTIONS

The frame ground wire (green) must be properly positioned when changing the AC output configuration of the AC terminal block. For making connections to the AC terminal block, use terminal ends for 1/4 inch studs that will accept multi strand copper wire sized for the amperage rating from the hot lead connection. The frame ground green wire connects between the neutral stud and the generator frame.

Generator Frequency

1. Frequency is a direct result of engine/generator speed: 1800 rpm = 60 hertz; 1500 rmp = 50 hertz.
2. To change generator frequency, follow the steps below:
Configure the AC terminal block for the desired voltage frequency as shown. Ensure that the case ground wire is connected to the correct terminal block neutral ground stud.
3. Remove or install the jumper on the automatic regulator (depending on frequency). Refer to *BE GENERATOR*.

NOTE: The green ground wire may be removed in those installations where the AC circuit has a separate neutral and ground circuit. This will prevent the unit from being a ground source in the vessel.

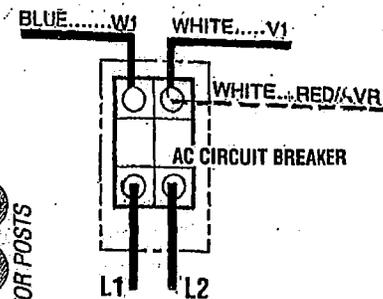
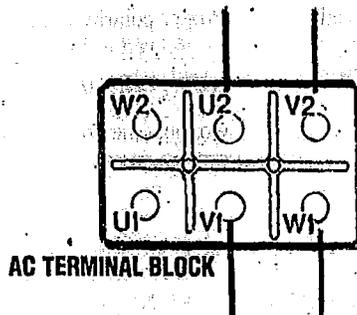
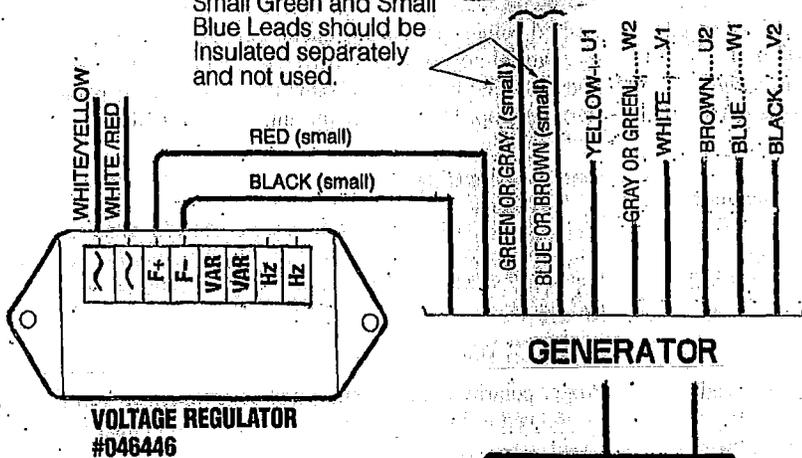


AC TERMINAL BLOCK

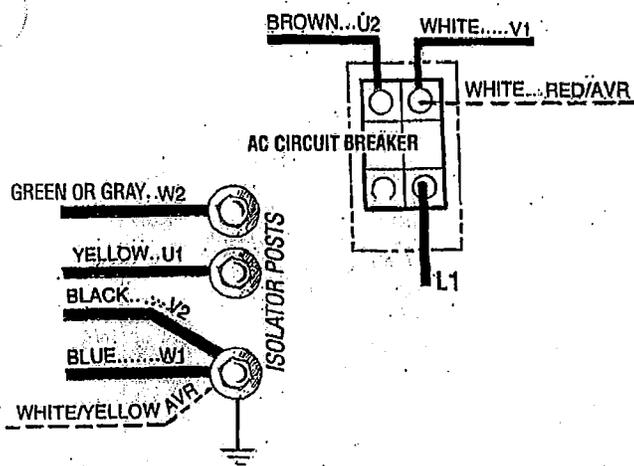
AC VOLTAGE CONNECTIONS WITH VOLTAGE REGULATOR #046446

Small Green and Small Blue Leads should be insulated separately and not used.

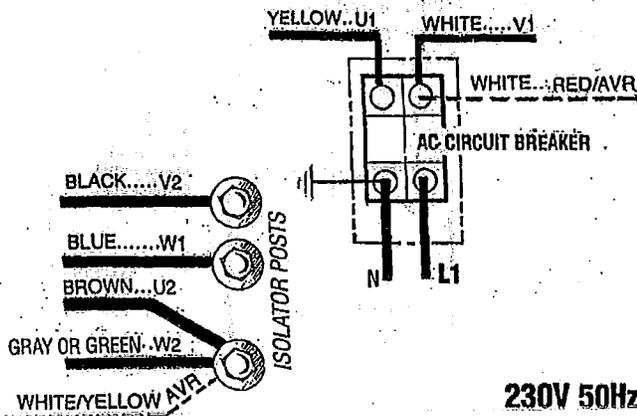
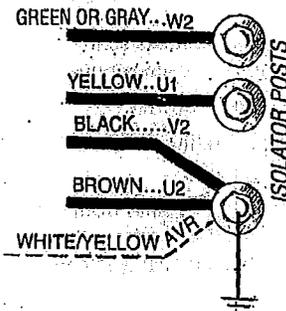
WARNING:



120/240V 60Hz



120V 60Hz



230V 50Hz

AC VOLTAGE REGULATOR

#046446

VOLTAGE POTENTIOMETER

The output voltage of the generator can be adjusted using the potentiometer with the generator running at its selected speed (frequency) by turning the adjustment until the desired voltage is obtained. **NOTE:** *If the voltage is set higher than selected rated voltage, the generator may be damaged.*

FREQUENCY

A jumper on the regulator is connected to two of the three pins for either 60 hertz or 50 hertz operation. **NOTE:** *This does not automatically change the engine speed. Engine speed change is performed using the adjustment on the belt driven mechanical governor.*

STABILITY

If at no-load or while under load with steady engine speed, AC output voltage fluctuation is experienced. Adjust the stability potentiometer. This modulates the reaction time of the regulator to external inputs, thereby eliminating any instability in the AC generator load system.

UNDER FREQUENCY

With the generator running at rated speed and producing desired voltage, reduce the engine speed using the mechanical governor by 4 hertz. Adjust the under frequency potentiometer until the AC output voltage of the generator starts to drop. Then restore the engine speed to the original rated speed.

VOLTAGE SENSING

The voltage sensing connections are 0 and 115 when selected output voltage is between 100V and 140V. Connect between 0 and 230 when selected output voltage is between 200V and 280V.

EXCITER WINDING

Proper polarity in this circuit **must** be maintained. White to F- and red to F+. Failure to do so may damage the regulator.

AUXILIARY WINDING

Connect the correct color wires to the terminals. Green or gray to Aux L and blue and brown to Aux N.

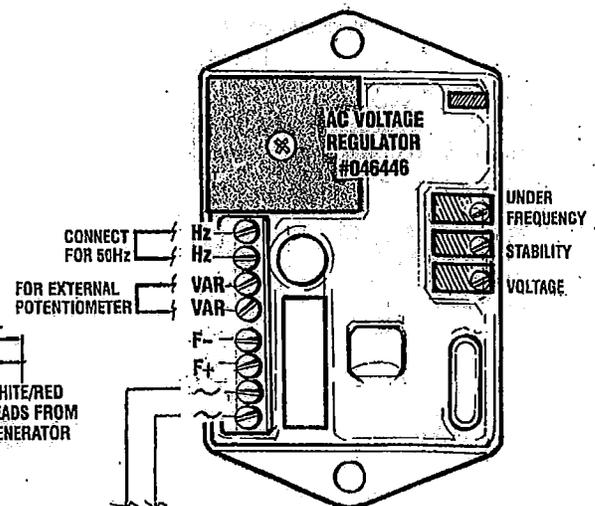
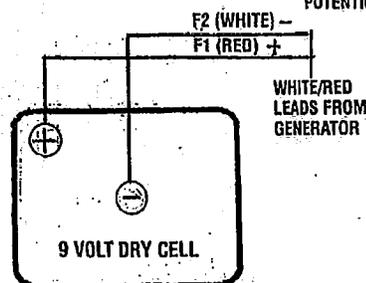
EXCITING THE GENERATOR

Exciting the generator using an external DC source can be performed when troubleshooting a generator/AC voltage output issue.

The following procedure should be followed:

1. The generator should not be operating. Remove the F- and F+ electrical connections off the regulator.
2. Maintaining polarity. Connect the + (plus) from a 9 volt dry cell battery to the red electrical lead coming from the generator and the - (negative) to the F- white electrical lead coming from the generator.
3. Start the generator and observe the reaction and voltage output from the generator and react accordingly.

The troubleshooting booklet for the BE style generator will help you determine the cause of a generator AC voltage output issue by the AC voltage found being produced by the generator and the reaction of the generation to excitation.



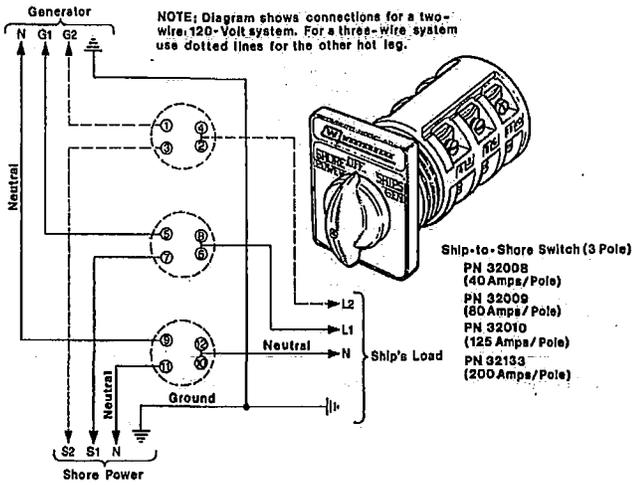
BE TROUBLESHOOTING

NOTE: AC GENERATOR TROUBLESHOOTING MUST BE PERFORMED WITH ENGINE OPERATING AT 60 HERTZ.

PROBLEM	PROBABLE CAUSE	
No AC voltage output at no load.	<ol style="list-style-type: none"> 1. Short or open in the main stator winding. 2. Shorted pozl-resistor on exciter rotor. 3. Four or more shorted or open diodes on exciter rotor. 	<ol style="list-style-type: none"> 4. Open in exciter stator winding. 5. Open in rotating field winding.
Residual voltage produced at no load 15 - 20 volts AC.	<ol style="list-style-type: none"> 1. Faulty voltage regulator. 2. Short or open to wiring to voltage regulator. 	<ol style="list-style-type: none"> 3. Shorted or open main stator auxillary winding.
Low AC voltage output at no load 60 - 100 VAC.	<ol style="list-style-type: none"> 1. Reset voltage potentiometer. 2. Open or shorted diodes in exciter rotor 1 to 3 diodes. 3. Open or shorted exciter rotor winding. 	<ol style="list-style-type: none"> 4. Faulty voltage regulator. 5. Short in exciter stator winding. 6. Short in rotating field winding.
High AC output voltage 150 VAC or higher.	<ol style="list-style-type: none"> 1. Reset voltage potentiometer. 2. Faulty voltage regulator. 	
Unstable voltage output. Engine Speed Steady	<ol style="list-style-type: none"> 1. Adjust voltage regulator. 	<ol style="list-style-type: none"> 2. Faulty voltage regulator.
AC voltage drop under load 60 - 100 volts AC.	<ol style="list-style-type: none"> 1. Diode(s) on exciter rotor. breaking down when load is applied (inductive) 1-3 diodes. 	

SHORE POWER TRANSFER SWITCH

SHORE POWER CONNECTIONS (60 HERTZ)

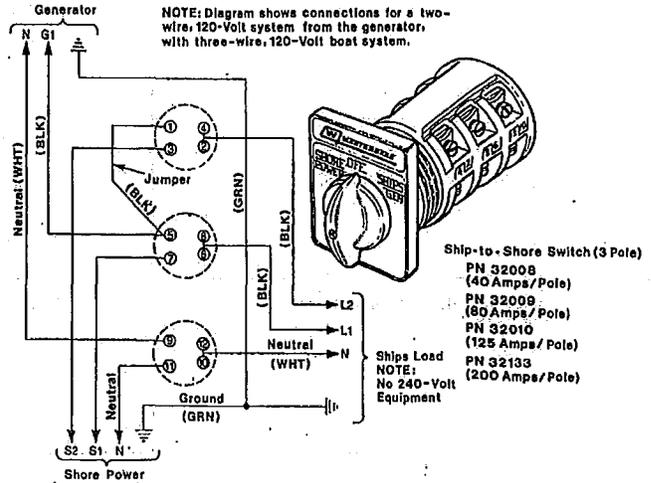


If the installer connects shore power to the vessel's AC circuit, this must be done by means of the Shore Power Transfer Switch. Set the transfer switch shown in the diagrams to the OFF position. This switch prevents simultaneous connection of shore power to generator output.

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.

120 VOLT/60 HZ THREE WIRE CONFIGURATION

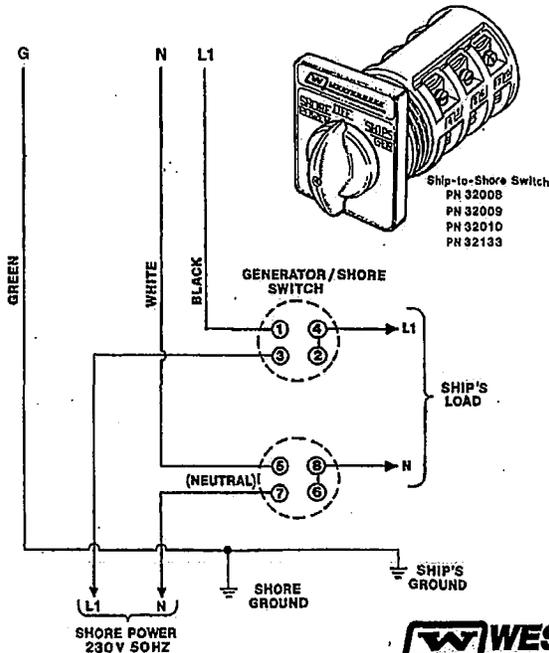
Notice the repositioning of the white wire ground load on the terminal block to the generator case.



Switching Shore Power to Generator Power

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

230 VOLT/50 HERTZ TWO WIRE CONFIGURATION



WESTERBEKE
Engines & Generators

WESTERBEKE 8.0KW to 15KW BEG ENGINE SPECIFICATIONS (60HZ MODELS)

ENGINE SPECIFICATIONS

Engine Type	Gasoline, four-cycle, four-cylinder, fresh water-cooled, Vertical, in-line overhead mechanism	
Governor	Hoof, flyball type. 5% speed regulation	
Combustion Chamber	Semi-spherical type	
Bore & Stroke	2.97 x 3.23 inches (75.5 x 82.0 mm).	
Piston Displacement	89.6 cubic inches (1468 cubic centimeters)	
Firing Order	1 - 3 - 4 - 2	
Direction of Rotation	Clockwise, when viewed from the front	
Compression Ratio	9.0:1	
Weight	8.0Kw	440 lbs (199 kgs)
	10.0Kw	466 lbs (211 kgs)
	12.5Kw	497 lbs (225 kgs)
	15.0Kw	525 lbs (238 kgs)

TUNE-UP SPECIFICATIONS

Compression Pressure (Limit of difference between cylinders)	Limit 14 psi (100Kpa)
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance (engine hot)	Intake 0.08 inches (0.20 mm) Exhaust 0.09 inches (0.25 mm)
Engine Timing	20° BTDC at 1800 rpm ± .5°

EXHAUST EMISSIONS SYSTEMS

Emission Control Systems	Meets U.S.C.G. Regulation 33 CFR 183
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LUBRICATION SYSTEM

General	Forced lubrication by geared pump
Oil Filter	Full flow, spin-on replaceable type
Sump Capacity (not including filter)	3.5 U.S. qts (15.2 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	55-60 psi
Oil Grade	API Specification of SJ, SL, or SM.

ELECTRICAL SYSTEM

Starter Motor	12-Volt, reduction gear/solenoid
Starter Battery	12-Volt, (-) negative ground
CCA	600-800 Amps
Starter Draw	150 Cold Cranking Amps (CCA)

IGNITION SYSTEM

General	Battery ignition 12V negative ground. Distributor with Ignition module and igniter. Ignition coil and spark plug.
Distributor	Equipped with auto timing controller, ignition coil built-in breakerless type
Spark Plug Thread Size	14mm X 1.25 pitch

IGNITION SYSTEM (CONT.)

Throttle Body	Electronic fuel injection with Electronic Governor
Spark Plug Gap	.030 inches (0.8 mm)

FUEL SYSTEM

General	Conventional carburetor type with electric fuel pump. Electric-lift capability of 6 ft. (18mm).
Fuel	Regular or unleaded gasoline with an octane rating of 89 or better.
Fuel Consumption 8.0Kw to 15.0Kw	1.0 to 1.7 U.S. GPH at 1800 rpm at full load
Fuel Filter (on engine)	Replaceable cartridge-screw on
Air Cleaner (flame arrester)	Metal screen type - cleanable
Air Flow (engine combustion)	46.6 cfm (1.3 cmm)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	140 - 160° F (60 - 71° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Raw Water Pump	Positive displacement, rubber impeller, belt driven
Raw Water Flow, at 1800 rpm	5.5 gpm (5.20 lpm)
System Capacity (coolant)	5.5 qts (5.20 liters)

AC GENERATOR (SINGLE PHASE)

General-Single Phase	Brushless six pole, revolving field. Sealed lubricated single bearing design. Reconnectable single phase transformer with solid state voltage regulator
Voltage	120 Or 120/240 volts - 60 hertz 230 volts - 50 hertz
Voltage Regulation	±5% no load to full load.
Frequency Regulation	±3% no load to full load.
Rating (Volts AC)	
8.0 Kw - 60 Hz	120/240 volts - 66/33
10.0 Kw - 60 Hz	120/240 volts - 83/41
12.5 Kw - 60 Hz	120/240 volts - 104/52
15.0 Kw - 60 Hz	120/240 volts - 125/62
Generator Cooling Air Requirements (60 Hertz at 1800 RPM)	200 - 300 cfm (5.6 - 8.4 cmm)
Engine combustion Air Requirements (60 Hertz at 1800 RPM)	46.6 cfm (1.3 cmm)
Engine Compartment Ambient temperature Recommendations	122 F (50 C) maximum. Forced ventilation must be provided to keep compartment temperature below the maximum.

WESTERBEKE 6.4KW to 12KW BEG ENGINE SPECIFICATIONS (50HZ MODELS)

ENGINE SPECIFICATIONS

Engine Type	Gasoline, four-cycle, four-cylinder, fresh water-cooled, Vertical, in-line overhead mechanism	
Governor	Hoof, flyball type. 5% speed regulation	
Combustion Chamber	Semi-spherical type	
Bore & Stroke	2.97 x 3.23 inches (75.5 x 82.0 mm).	
Piston Displacement	89.6 cubic inches (1468 cubic centimeters)	
Firing Order	1 - 3 - 4 - 2	
Direction of Rotation	Clockwise, when viewed from the front	
Compression Ratio	9.0:1	
Weight	6.4Kw	440 lbs (199 kgs)
	8.0Kw	466 lbs (211 kgs)
	10.0Kw	497 lbs (225 kgs)
	12.0Kw	525 lbs (238 kgs)

TUNE-UP SPECIFICATIONS

Compression Pressure (Limit of difference between cylinders)	Limit 14 psi (100Kpa)
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance (engine hot)	Intake 0.08 inches (0.20 mm) Exhaust 0.09 inches (0.25 mm)
Engine Timing	20° BTDC at 1800 rpm ± .5°

EXHAUST EMISSIONS SYSTEMS

Emission Control Systems	Meets U.S.C.G. Regulation 33 CFR 183
--------------------------	--------------------------------------

LUBRICATION SYSTEM

General	Forced lubrication by geared pump
Oil Filter	Full flow, spin-on replaceable type
Sump Capacity (not including filter)	3.5 U.S. qts (3.3 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	55-60 psi
Oil Grade	API Specification of SJ, SL, or SM.

ELECTRICAL SYSTEM

Starter Motor	12-Volt, reduction gear/solenoid
Starter Battery	12-Volt, (-) negative ground
CCA	600-800 Amps
Starter Draw	150 Cold Cranking Amps (CCA)

IGNITION SYSTEM

General	Battery ignition 12V negative ground. Distributor with ignition module and igniter. Ignition coil and spark plug.
Distributor	Equipped with auto timing controller, ignition coil built-in breakerless type
Spark Plug Thread Size	14mm X 1.25 pitch
Spark Plug Gap	.030 inches (0.8 mm)

FUEL SYSTEM

General	Conventional carburetor type with electric fuel pump.
Fuel	Regular or unleaded gasoline with an octane rating of 89 or better.
Fuel Consumption 6.4Kw to 12.0Kw	3.4 to 5.1 LPH at 1500 rpm at full load
Fuel Filter (on engine)	Replaceable cartridge-screw on
Air Cleaner (flame arrester)	Metal screen type - cleanable
Air Flow (engine combustion)	39 cfm (1.1 cmm)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	140 - 160° F (60 - 71° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Raw Water Pump	Positive displacement, rubber impeller, belt driven
Raw Water Flow, at 1500 rpm	4.5 gpm (17.0 lpm)
System Capacity (coolant)	5.5 qts (5.20 liters)

AC GENERATOR (SINGLE PHASE)

General-Single Phase	Brushless six pole, revolving field. Sealed lubricated single bearing design. Reconnectable single phase transformer with solid state voltage regulator
Voltage	120 Or 120/240 volts - 60 hertz 230 volts - 50 hertz
Voltage Regulation	±5% no load to full load.
Frequency Regulation	±3% no load to full load.
Rating (Volts AC)	
6.4Kw - 50 Hz	27 Amps/230 Volts
8.0Kw - 50 Hz	34 Amps/ 230 Volts
10.0Kw - 50 Hz	43 Amps/ 230 Volts
12.0Kw - 50 Hz	52 Amps/ 230 Volts
Generator Cooling Air Requirements (50 Hertz at 1500 RPM)	230 - 345 cfm (6.4 - 9.6 cmm)
Engine combustion Air Requirements (50 Hertz at 1500 RPM)	39 cfm (1.1 cmm)
Engine Compartment Ambient temperature Recommendations	122 F (50 C) maximum. Forced ventilation must be provided to keep compartment temperature below the maximum.

LAY-UP & RECOMMISSIONING

GENERAL

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

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

These procedures should afford your engine protection during 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.

Propeller Shaft Coupling [Propulsion Engine]

The transmission and propeller half couplings should always be opened up and the bolts removed when the boat is hauled out of the water or moved from land to water, and during storage in the cradle. The flexibility of the boat often puts a severe strain on the propeller shaft or coupling or both, while the boat is taken out or put in the water. In some cases, the shaft has actually been bent by these strains. This does not apply to small boats that are hauled out of the water when not in use, unless they have been dry for a considerable period of time.

Fresh Water Cooling Circuit [Propulsion Engine]

A 50-50 solution of antifreeze and distilled water is recommended for use in the coolant system at all times. This solution may require a higher concentration of antifreeze, depending on the area's winter climate. Check the solution to make sure the antifreeze protection is adequate.

Should more antifreeze be needed, drain an appropriate amount from the engine block and add a more concentrated mixture. Operate the engine to ensure a complete circulation and mixture of the antifreeze concentration throughout the cooling system. Now recheck the antifreeze solution's strength.

Lubrication System

With the engine warm, drain all the engine 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 check for proper oil pressure and make sure there are no leaks.

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

Fuel System [Gasoline]

Top off your fuel tanks with *unleaded* gasoline of 89 octane or higher. A fuel conditioner such as *Sta-Bil* 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.

Fuel System [Diesel]

Top off your fuel tanks with No. 2D diesel fuel. Fuel additives should be added prior to topping off to ensure they mix with the fuel being added and fuel still in the tank. Additives such as Bio-bor and Diesel Kleen + Cetane Boost should be added at this time to control bacteria growth and condition the fuel. Care should be taken that the additives used are compatible with the primary fuel filter/water separator used in the system. Change the element in your primary fuel filter/water separator clean the separator sediment bowl.

Change the fuel filter elements on the engine and bleed the fuel system, as needed. Start the engine and allow it to run for 5 - 10 minutes to make sure no air is left in the fuel system. Check for any leaks that may have been created in the fuel system during this servicing, correcting them as needed. Operating the engine for 5 - 10 minutes will help allow movement of the treated fuel through the injection equipment on the engine.

Raw Water Cooling Circuit

Close the through-hull seacock. Remove the raw water intake hose from the seacock. Place the end of this hose into a five gallon bucket of clean fresh water. Before starting the engine, check the zinc anode found in the primary heat exchanger on the engine and clean or replace it as required, and also clean any zinc debris from inside the heat exchanger where the zinc anode is located. Clean the raw water strainer.

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

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

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

LAY-UP & RECOMMISSIONING

Starter Motor

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

Cylinder Lubrication [Diesel]

If you anticipate a long lay-up period (12 months or more) WESTERBEKE recommends removal of the glow plugs for access to the cylinders. Squirt some Marvel Mystery Oil into the cylinder walls. Rotate the engine crankshaft by hand two revolutions and re-install the glow plugs.

If your engine does not have glow plugs, the injectors will have to be removed. Be sure to have replacement sealing washers for the injectors and return fuel line as needed.

Intake Manifold [Gasoline]

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 through-hull exhaust port. Make a note to remove cloths prior to start-up!

Cylinder Lubrication [Gasoline]

With the engine running, remove the flame arrester and spray fogging oil into the open air intake. The fogging oil will stall the engine and coat the intake components (valves, cylinders, and spark plugs) for winter protection.

NOTE: At re-commissioning, remove the spark plugs and clean and gap them. Rotate the engine by hand two complete revolutions. Re-install the spark plugs and tighten securely and firmly attach the high tension leads.

Batteries

If batteries are to be left on board during the lay-up period, make sure that they are fully charged, and will remain that way, to prevent them from freezing. If there is 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.

⚠ WARNING: Lead acid batteries emit hydrogen, a highly-explosive gas, which can be ignited by electrical arcing or a lighted cigarette, cigar, or pipe. Do not smoke or allow an open flame near the battery being serviced. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.

Transmission [Propulsion Engine]

Check or change the fluid in the transmission as required. Wipe off grime and grease and touch up any unpainted areas. Protect the coupling and the output flange with an anti-corrosion coating. Check that the transmission vent is open. For additional information, refer to the TRANSMISSION SECTION.

Spare Parts

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.

Recommissioning

The recommissioning of your Westerbeke engine after a seasonal lay-up generally follows the same procedures as those described 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 oil-soaked cloths from the intake manifold.
2. Remove the raw water pump cover and gasket and discard the old gasket. Install the raw water pump impeller removed during lay-up (or a replacement, if required). Install the raw water pump cover with a new cover gasket.
3. Reinstall the batteries that were removed during the lay-up, and reconnect the battery cables, making sure the terminals are clean and that the connections are tight. Check to make sure that the batteries are fully charged.

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

4. Remove the spark plugs, wipe clean, re-gap, and install to proper tightness [gasoline].
5. Check the condition of the zinc anode in the raw water circuit and clean or replace the anode as needed. Note that it is not necessary to flush the antifreeze/fresh water solution from the raw water coolant system. When the engine is put into operation, the system will self-flush in a short period of time with no adverse affects. It is advisable, as either an end of season or recommissioning service, to inspect the area where the zinc is located in the heat exchanger and clear any and all zinc debris from that area.
6. Start the engine in accordance with procedures described in the PREPARATIONS FOR STARTING section of this manual.

STANDARD AND METRIC CONVERSION DATA

LENGTH-DISTANCE

Inches (in) x 25.4 = Millimeters (mm) x .0394 = Inches
Feet (ft) x .305 = Meters (m) x 3.281 = Feet
Miles x 1.609 = Kilometers (km) x .0621 = Miles

DISTANCE EQUIVALENTS

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

VOLUME

Cubic Inches (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

STANDARD HARDWARE

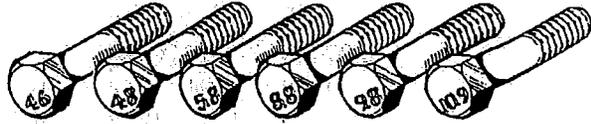
BOLT HEAD MARKINGS

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

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



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



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

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

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

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

SEALANTS & LUBRICANTS

GASKETS/SEALANTS

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

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

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

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

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

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

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

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

BOLTS & FASTENERS/ASSEMBLIES

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

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

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

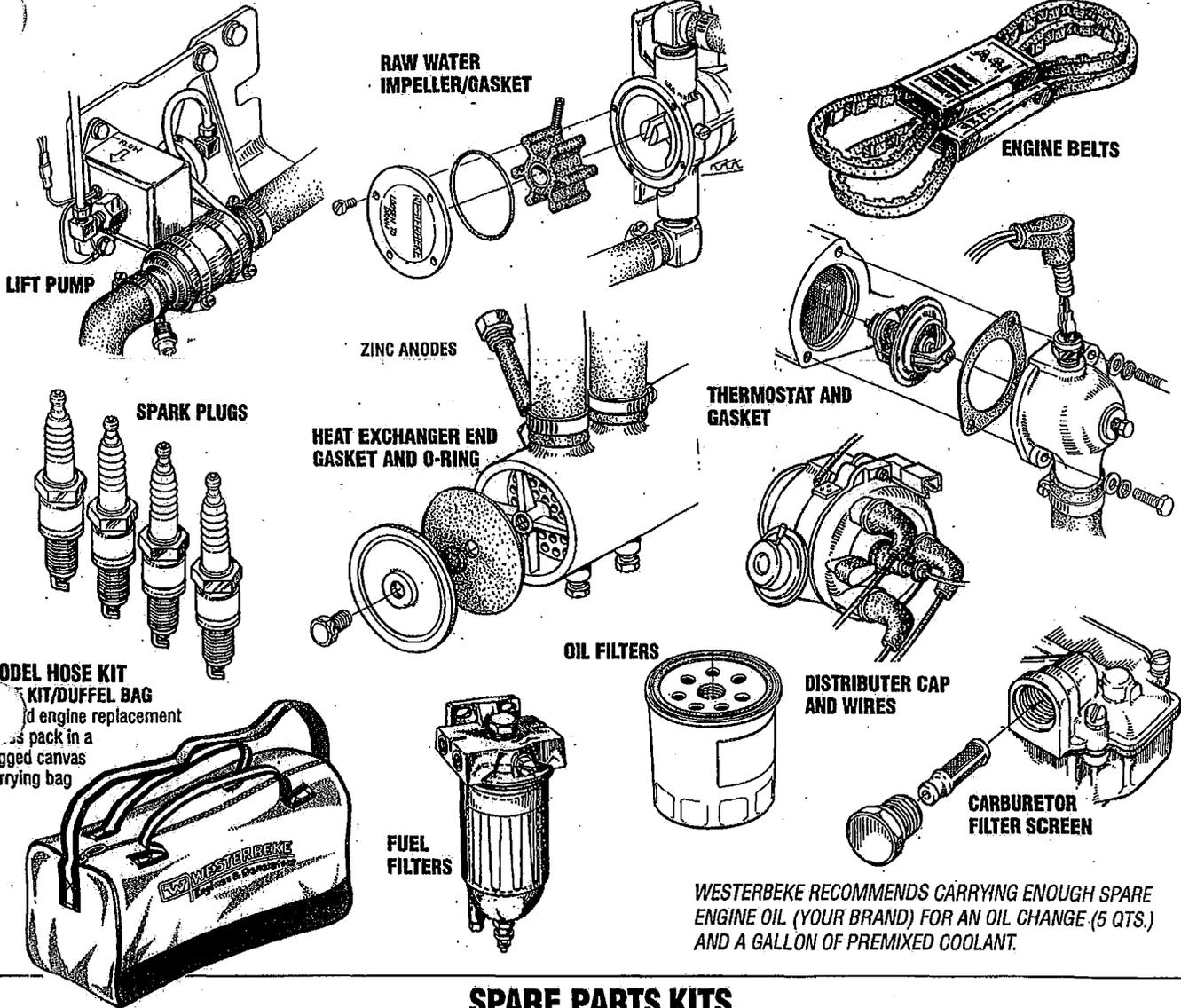
LITHIUM based grease is waterproof, ideal for water pump bearings and stuffing boxes.

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

SUGGESTED SPARE PARTS

WESTERBEKE MARINE GASOLINE GENERATORS

CONTACT YOUR WESTERBEKE DEALER FOR SUGGESTIONS AND ADDITIONAL INFORMATION



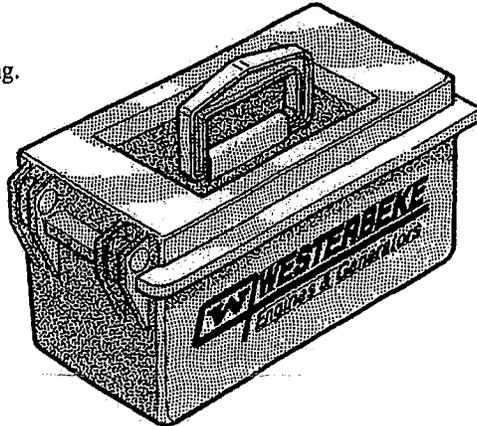
WESTERBEKE RECOMMENDS CARRYING ENOUGH SPARE ENGINE OIL (YOUR BRAND) FOR AN OIL CHANGE (5 QTS.) AND A GALLON OF PREMIXED COOLANT.

SPARE PARTS KITS

WESTERBEKE also offers two Spare Parts Kits, each packaged in a rugged, rust free toolbox. **KIT A** includes the basic spares. **KIT B** is for more extensive off-shore cruising.

KIT A

- Impeller Kit
- Heat Exchanger Gasket
- Oil Filter
- Drive Belt
- Zinc Anodes
- Spark Plugs



KIT B

- Impeller Kit
- Water Pump Repair Kit
- Thermostat Kit
- Zinc Anodes
- Complete Gasket Kit
- Heat Exchanger Gasket
- Oil Filter
- Drive Belt
- Spark Plugs

