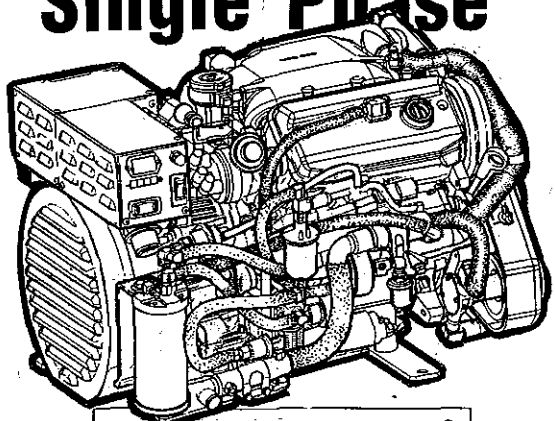
OPERATORS MANUAL

MARINE DIESEL GENERATORS

6.5KW SBCG-60HZ 5.4KW SBCG-50HZ
5.0KW SBCG-60HZ 4.2KW SBCG-50HZ
Single Phase



PUBLICATION NO. 49740
THIRD EDITION
MAY 2009

WESTERBEKE™ GENERATORS

SAFE CO™

Ultra-Low Carbon Monoxide Emissions

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.

WESTERBEKE
Engines & Generators

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. 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.
- 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 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!***

- 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.

ACCIDENTAL STARTING

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

- To prevent accidental starting when servicing the generator, remove the 8 amp fuse from the control panel.
- 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.

SAFETY INSTRUCTIONS

BATTERY EXPLOSION

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

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

BATTERY ACID

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

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

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

- Ensure that the exhaust system is adequate to expel gases discharged from the engine. Check the exhaust system regularly for leaks and make sure the exhaust manifolds are securely attached and no warping exists. Pay close attention to the manifold, water injection elbow, and exhaust pipe nipple.
- Be sure the unit and its surroundings are well ventilated.
- In addition to routine inspection of the exhaust system, install a **carbon monoxide detector**. Consult your boat builder or dealer for installation of approved detectors.

⚠ 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.
- 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	Muscular twitching
Dizziness	Intense headache
Throbbing in temples	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.
- 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.

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!***

SAFETY INSTRUCTIONS

OPERATORS MANUAL

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

GASOLINE ENGINE AND GENERATOR INSTALLATIONS

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

Sections of the ABYC standards of particular interest are:

H-2 Ventilation
H-24 Gasoline Fuel Systems
P-1 Exhaust Systems
P-4 Inboard Engines
E-9 DC Electrical Systems

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

ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING DIESEL ENGINES

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

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

Order from:

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

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

Order from:

NFPA
11 Tracy Drive
Avon Industrial Park
Avon, MA 02322

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

Order from:

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

CARBON MONOXIDE "CO"/SAFE-CO GENERATORS
IMPORTANT INFORMATION

DESCRIPTION

Carbon monoxide "CO" is a component of engine exhaust. It is a colorless, tasteless, odorless, lighter than air poisonous gas that can kill you without any warning. CO poisoning is one of the major safety risks associated with boating. It is a threat that must not be underestimated.

Westerbeke Safe-CO generators are designed to reduce normal levels of CO in the engine exhaust by approximately 99%.

Several standards for CO have been published, expressed in parts per million "ppm" and hours of exposure:

Regulator	CO ppm	Exposure Hours
EPA	9	8
ACGIH	25	8
EPA	35	1
NIOSH	35	8
OSHA	50	8
ACGIH	125	0.5
NIOSH	200	0.0
NIOSH (IDLH)	1200	0.0

1200 ppm is the so-called IDLH concentration - IMMEDIATELY DANGEROUS TO LIFE AND HEALTH.

A city in California characterizes the effect of CO concentration this way:

Parts per Million	Responses
25	Permissible exposure level, no apparent toxic symptoms.
100	No poisoning for long period. Allowable for several hours.
200	Should not be exposed above this level for any period of time. A possible mild frontal headache in two to three hours.

Even though the generator normally produces very low levels Westerbeke Safe-CO generators are designed to reduce normal levels of CO in the engine exhaust by approximately 99%., an exhaust leak of untreated exhaust would be extremely dangerous. For this reason it is extremely important to install a CO detector near the generator and to be sure it is always turned on and functioning properly. If this detector sounds, do not turn it off, assuming it is a false signal. You can not taste, smell, or otherwise detect CO. Leave the detector on, turn off all engines and generators, evacuate the boat leaving ports and hatches open, and seek professional help.

As soon as CO leaves the exhaust outlet, the level is subject to dilution in the open air. The closer a person is to the exhaust outlet, the higher the concentration of CO.

In a closed space, such as the engine compartment, the boat, or underneath a stern swim platform, concentrations will potentially rise to the undiluted level emanating from the exhaust system due to a lack of fresh air to dilute the exhaust gas. Therefore, one should never rely on dilution of the exhaust to provide a margin of safety.

Westerbeke Safe-CO generators achieve an approximate 99% reduction of typical CO by precise control control of the engine's air/fuel ration coupled with after treatment in a special catalyst. CO emissions are not the same for every model because each engine is different. Also, certain fuel system components are commonized across several engine models being adequate for some and extra-adequate for others, thus producing different CO levels for different models.

The fuel system which accomplishes the required precise air/fuel ratio control is comprised of many different components: purchased sub-assemblies, machined castings, sensors, electronics and others. Because of the extreme level of CO reduction, any variability in the functioning of any these components can and will cause variability of the CO output.

CO concentration also varies with load. Usually, but not always, the worst case CO concentration occurs at maximum load.

INSPECTION

The catalyst is critical to optimizing CO levels. Any water intrusion into the exhaust system will likely quickly compromise the proper operation of the catalyst. Westerbeke's exhaust system installation instructions dated on or after February 2004 must be adhered to.

NOTE: *Water intrusion is not a product defect and is not covered under warranty, neither Westerbeke's normal product warranty nor the emissions specific warranty mandated by various regulating authorities such as EPA and CARB.*

Maintenance of any components affecting the flow of air or the flow of fuel to the engine is critically important, such as fuel filters and air filters (if any).

Inspection of the catalyst at the prescribed intervals is critically important. The exhaust elbow is removed by loosening the metal clamp to provide a view of the output surface of the catalyst. Any visual irregularity of the normal flush, honeycomb appearance is most likely a result of water intrusion. The cause of the irregularity must be identified and addressed. If there is irregularity, the catalyst and gasket must be replaced. Upon careful reassembly of the catalyst, exhaust elbow gasket, and exhaust elbow, check for the presence of CO while the engine is running. This must be performed with a CO analyzer.

CARBON MONOXIDE "CO"/SAFE-CO GENERATORS
IMPORTANT INFORMATION

Catalyst performance will degrade over time. As the generator accumulates operating hours, CO concentrations will increase. **The catalyst must be replaced every 2,000 hours of engine operation.**

Verification of satisfactory CO levels must be done seasonally or each 1,000 hours (which ever occurs first). Verification involves actual sampling of exhaust gas with an appropriate CO analyzer.

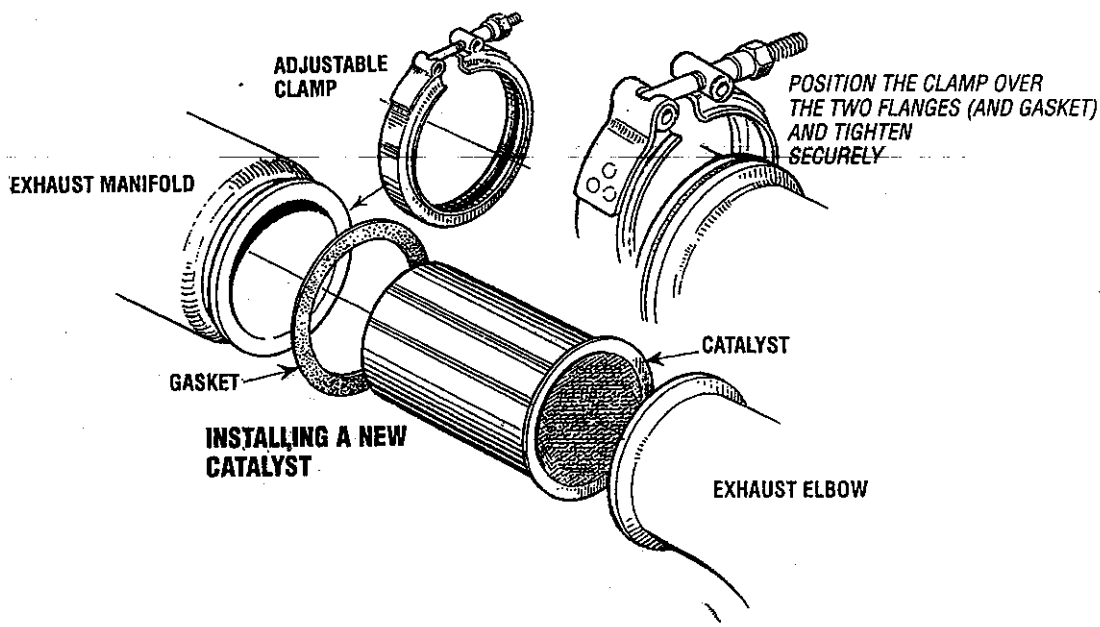
There are two locations where exhaust gas can be sampled. Dry, but hot, exhaust can be sampled at the plugged tapped hole in the exhaust elbow intended for back pressure measurements. Measurements at this location may not be practical in all instances due to the high exhaust temperature, temperature limits of the analyzer, safety concerns over temperatures involved or the possibility of high levels of CO. The other location is the boat's exhaust outlet, which contains entrained cooling water (except dry stack exhaust systems). Only analyzers with probes should be used at this location and it is critical that the probe not ingest water. Probe-type analyzers have an air pump drawing a gas sample through the probe. As a result, they tend to ingest water when it is present. Be sure to aim the probe downwards with the opening pointed in the direction of the water flow and just out of the flow. Position the analyzer as high as possible with the tubing leading to the probe running continuously downhill. Observe the usually translucent tubing between the probe and the analyzer and be sure no water is being ingested. If any water is ingested into the analyzer, it must be repaired or replaced and recalibrated.

When measuring CO at the exhaust outlet be aware of the ambient CO level by also measuring CO away from and upwind of the exhaust outlet, especially in marinas. the CO level at the exhaust will be influenced upwards by the ambient level.

Whenever taking the time to verify proper CO concentration from the exhaust with a CO analyzer, always take the opportunity to use the analyzer to "sniff" around the engine looking for CO from exhaust leaks. Pay close attention to the connection of the cylinder head to the exhaust manifold, the exhaust manifold to the water injected exhaust elbow, and all subsequent downstream exhaust components and hoses. Remember, exhaust gas that has not yet passed through the catalyst is raw, untreated exhaust and is very high in CO content.

Analyzers usually require periodic calibration. Follow the instructions that come with the analyzer very carefully regarding calibration.

The following are manufacturers that offer CO analyzers: Extech, TIF, Testo, TSI, Bacharach, Fluke, Monoxor, Fyrite, Zellwgwer Analytics, Industrial Scientific Corp, GFG, TPI, Teledyne and others. Westerbeke recommends analyzers with a probe connected to the analyzer by a length of transparent tubing. They are slightly more expensive than those with the sensor built into one end of the analyzer, but they allow you to sample the exhaust coming out of the boat's exhaust outlet.



EMISSIONS

This genset meets the requirements of California's Exhaust Emissions Standards as stated on the nameplate.

California users of this genset should be aware that unauthorized modifications or replacement of fuel, exhaust, air intake, or speed control system components that affect engine emissions are prohibited. Unauthorized modification, removal or replacement of the engine label is prohibited.

Federal Emissions Compliance Period: The Federal Emissions Compliance Period referred to on the nameplate indicates the number of operating hours for which the engine has been shown to meet Federal Emissions requirements.

Catagory C= 250 hrs, B=500 hrs,m A =1000.hrs.

You should carefully review operator (Owner) Installation and other manuals and information you receive with your genset. If you are unsure that the installation, use, maintenance or service of your genset is authorized, you should seek assistance from an approved WESTERBEKE dealer.

California genset users may use the table below as an aid in locating information related to the California Air Resources Board requirements for emissions control.

EMISSIONS CONTROL INFORMATION TABLE

Emissions Warranty Information	The California emissions control warranty statement is located in the same packet, if information as this manual when the genset is shipped from the factory.
Engine Fuel Requirements	The engine is certified to operate on unleaded gasoline. See *FUEL RECOMMENDATIONS.*
Engine Valve Adjustment	See *MAINTENANCE SCHEDULE.*
Engine Ignition Timing	See *MAINTENANCE SCHEDULE.*
Engine Lubricating Oil Requirements	See *ENGINE OIL RECOMMENDATIONS.*
Engine Adjustments	ECU.
Engine Emission Contol System	The engine emission control system consists of engine design and precision manufacture.
Catalyst	See *MAINTENANCE SCHEDULE.*
Oxygen Sensor	See *MAINTENANCE SCHEDULE.*
Back Pressure	See *MAINTENANCE SCHEDULE.*

INSTALLATION

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

CODES AND REGULATIONS

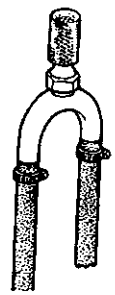
Strict federal regulations, ABYC guidelines, and safety codes must be complied with when installing engines and generators in a marine environment.

SIPHON-BREAK

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

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

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



AVAILABLE FROM YOUR WESTERBEKE DEALER

EXHAUST SYSTEM

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

A detailed 40 page Marine Installation Manual covering gasoline and diesel, engines and generators, is supplied with every WESTERBEKE unit.

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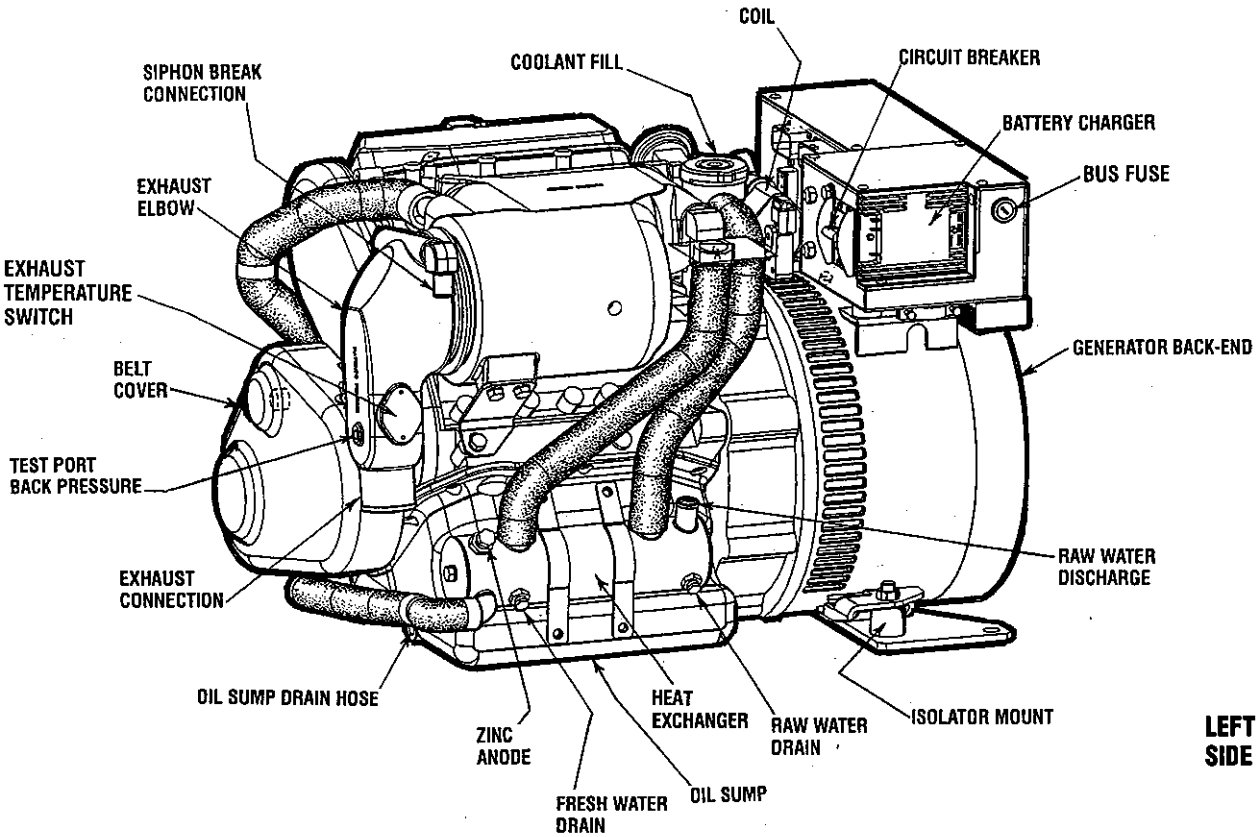
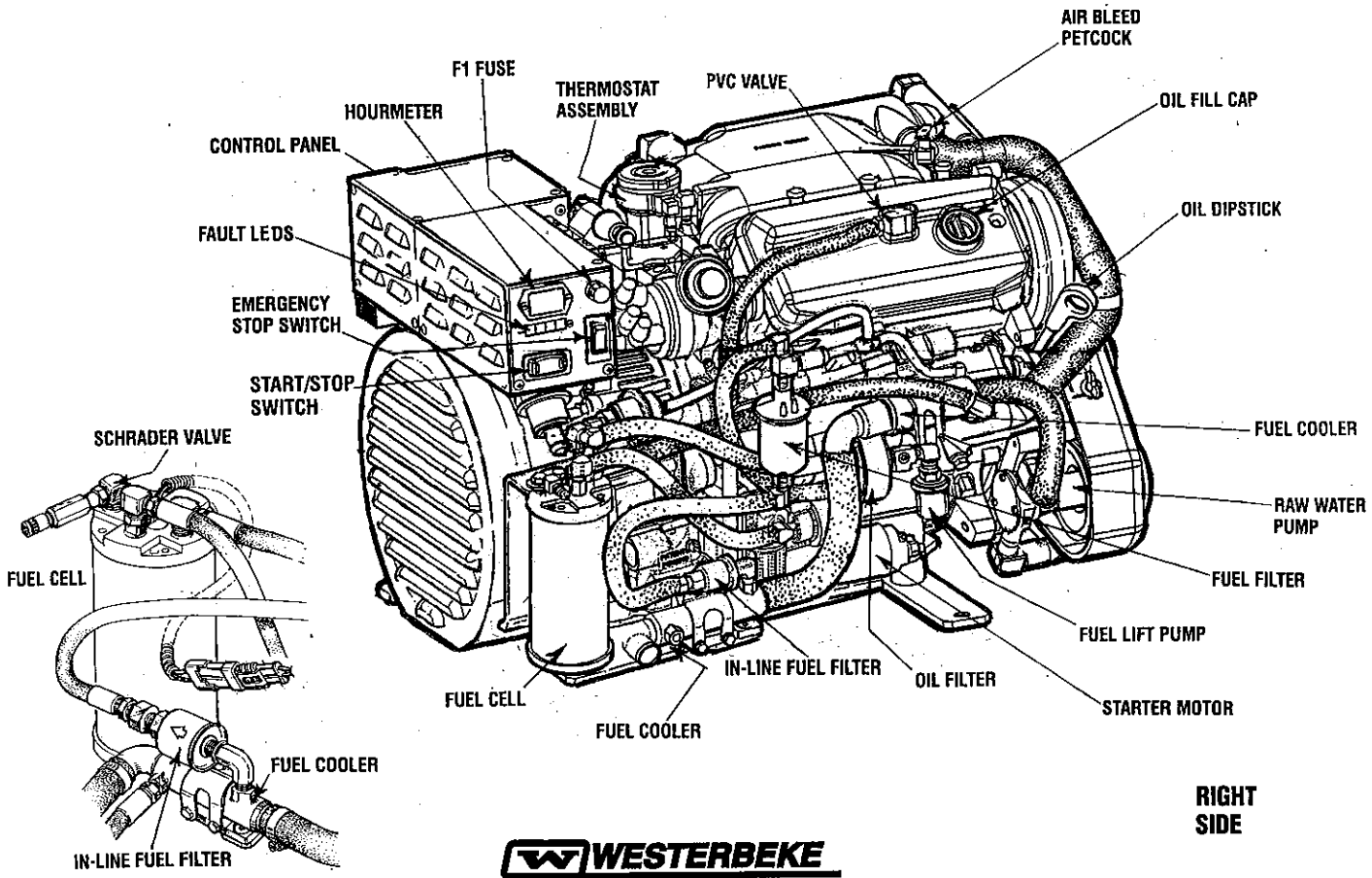
SBCG PARTS IDENTIFICATION





WESTERBEKE
Engines & Generators

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

This is your Operators Manual. A Parts Catalog is also provided and a Technical Manual is available from your WESTERBEKE dealer. Also, 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.

WESTERBEKE
Engines & Generators

Customer Identification

WESTERBEKE OWNER
MAIN STREET
HOMETOWN, USA

Model: Serial: #
Expires:

PRODUCT SOFTWARE

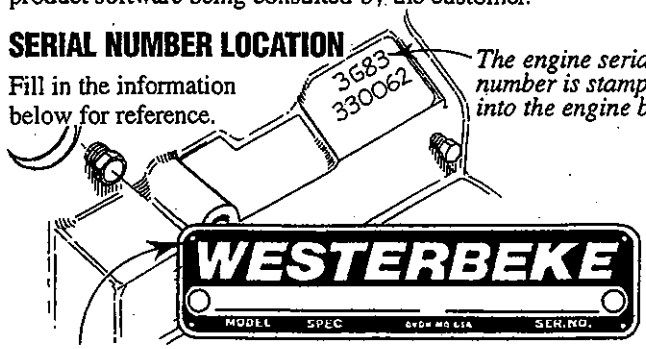
Product software (tech data, parts lists, manuals, brochures and catalogs) provided from sources other than WESTERBEKE are not within WESTERBEKE'S CONTROL.

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

Fill in the information below for reference.



The engine serial number is stamped into the engine block.

The engine model number and serial number are printed on a decal on the engine manifold.

The generator serial number is stamped on the top of the generator housing.

The generator specifications are printed on a decal on the side of the generator.

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.		

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 visable location in the engine room.*

SPARES AND ACCESSORIES

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

PROTECTING YOUR INVESTMENT

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

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

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

UNDERSTANDING THE GASOLINE GENERATOR

The gasoline engine driving an AC generator is in many ways similar to a gasoline automobile engine. The cylinders are 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.

PREPARATIONS FOR INITIAL START-UP

PRESTART INSPECTION

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

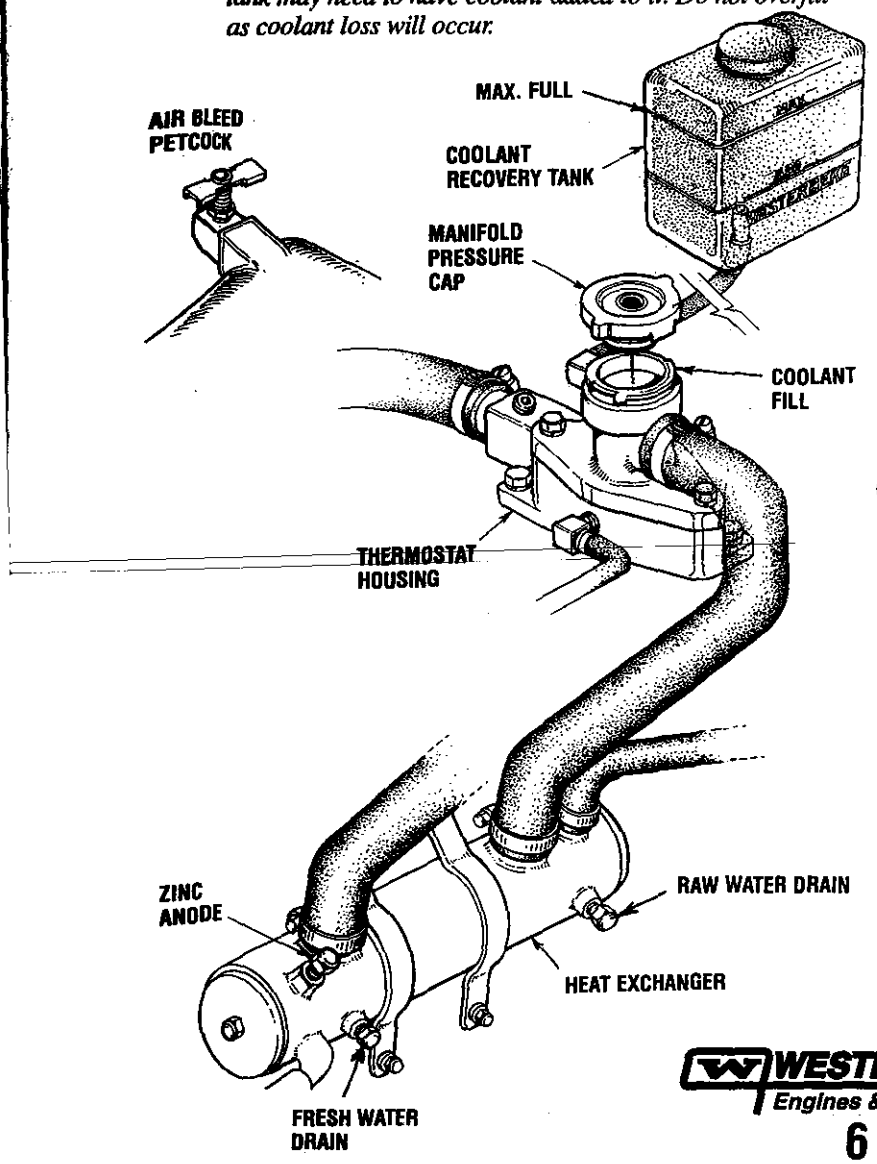
- Check the engine oil level: add oil to maintain the level at the full mark on the dipstick.
- Check the fuel supply and examine the fuel filter/separator bowls for contaminants.
- Check the DC electrical system. Inspect wire connections and battery cable connections.
- Check the coolant level in both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

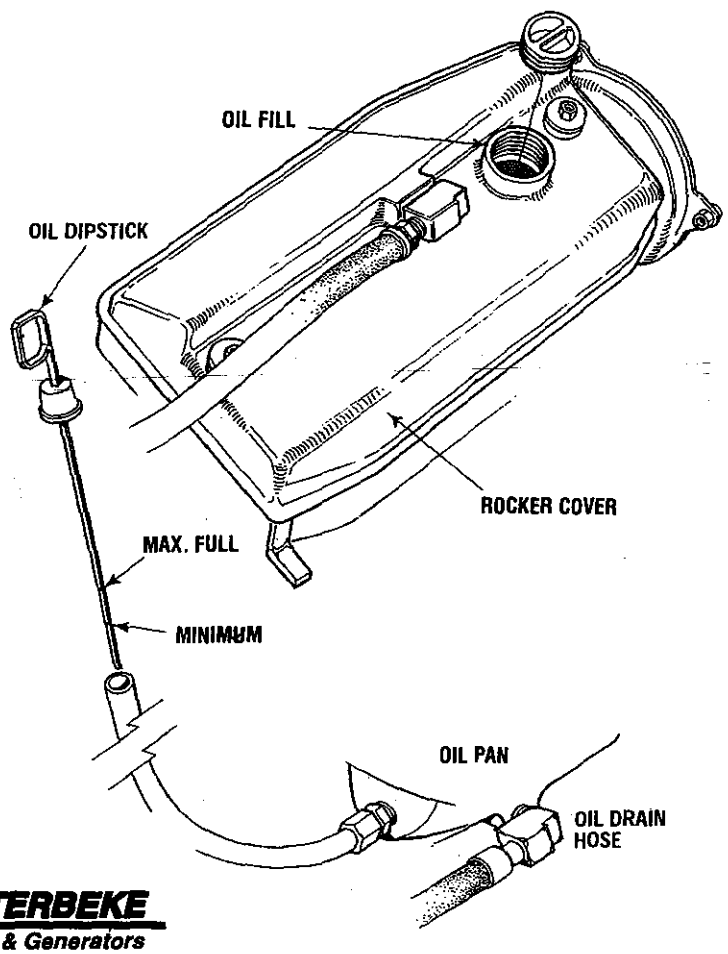
  NOTE: *During the initial filling of the cooling system, the air bleed petcock on the manifold should be opened to purge air from the engine block. Once coolant, free of air bubbles, flows from the petcock - close the petcock.*

  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.

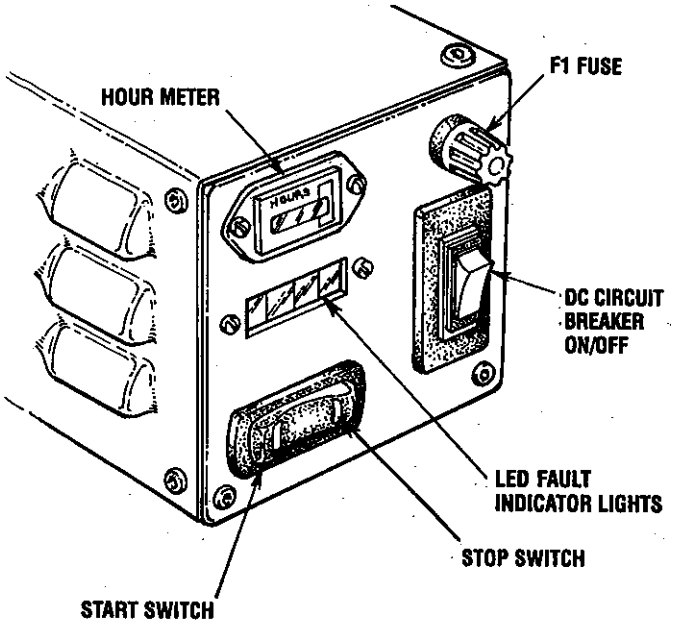
  Before subsequent operation of the generator, the engine's manifold should be topped off, and the coolant recovery tank may need to have coolant added to it. Do not overfill as coolant loss will occur.
- Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, 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

The start/stop rocker switch is the only functional component on the generator control panel used to start and stop the generator.

The start/stop rocker switch is a three position switch with momentary contacts in the **(START)** and **(STOP)** position and a stationary contact function in the center **(NORMAL)** this position allows the generator to run once started and also enables the remote start/stop panel(s) to control the start/stop functions of the generator.

The **(START)** position starts the generator and once released reverts to the center position. The **(STOP)** position stops the engine in normal operation as well as in an emergency situation. This position opens the K2 run relay which de-energizes the engine's run circuit and shuts down the engine.

Starting

Simply press the **(START)** switch momentarily. The ECU will take the command and start the generator. The green LED on the start switch will illuminate and dim as the engine cranks and glow bright once the engine starts.

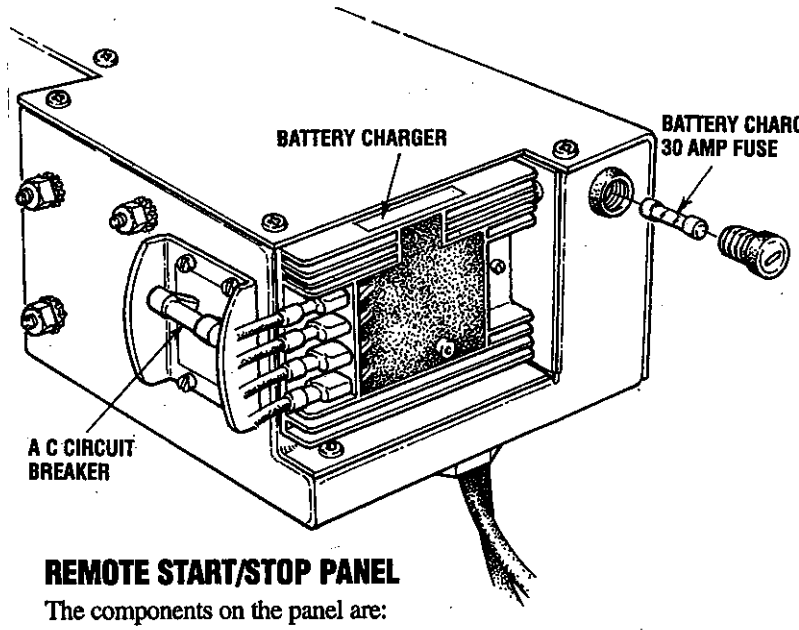
Stopping

Depress the **(STOP)** switch momentarily and release. The ECU will receive the **(STOP)** command and shut the generator down.

Failure to Start

The start cycle will automatically terminate if the unit fails to start after 12-14 seconds of cranking. wait 20 seconds. Then repeat the start.

During times when maintenance is being performed on the engine/generator, the DC breaker located adjacent to the start/stop rocker switch on the generator's control box should be placed in the stationary (off) position. This will prevent any attempts to start the generator from remote start/stop panel locations or at the generator itself.



REMOTE START/STOP PANEL

The components on the panel are:

1. A three position start/stop rocker switch.
2. A green LED run indicator light on the rocker switch.
3. A four position LED fault shut down display board.

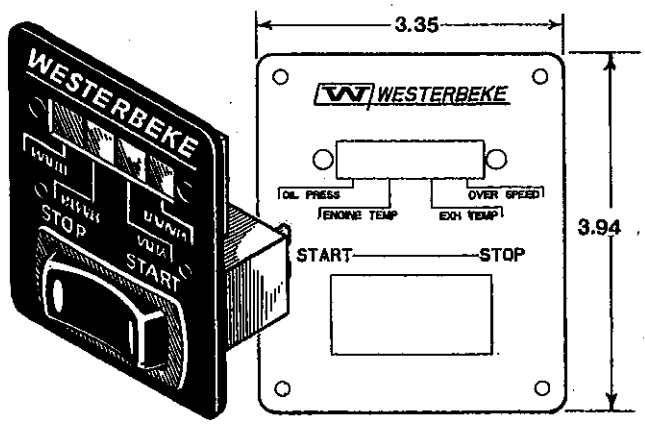
The start/stop rocker switch functions the same as the start/stop rocker switch on the generator's control panel as previously explained.

The green LED run indicator light on the rocker switch will illuminate when the start circuit is energized. It will go dim as the engine cranks and will brighten as the engine starts indicating the generator is running.

The LED fault shut down display board has four separate LED lights to display to the operator the cause of the generators automatic shut down. The four LED displays are: low oil pressure, high engine operating temperature, high exhaust temperature and engine over-speed/under-speed (flashes).

Should the generator shut down from one of these faults, the fault LED will remain illuminated. To reset the LED, the stop switch must be momentarily depressed.

The remote start/stop panel is a plug-in accessory and has extension harnesses available in varying lengths from 15 feet up to 100 feet in length.



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 generator's 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 belts for wear and proper tension (weekly).
- Check for abnormal noise such as knocking, vibration and blow-by 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.***

GENERATOR ADJUSTMENTS

Once the generator has been placed in operation, there may be governor adjustments required for engine speed (hertz) during the engine's break-in period (first 50 hours) or after this period (see *ENGINE SPEED (HERTZ) ADJUSTMENT* under *ENGINE ADJUSTMENTS*.

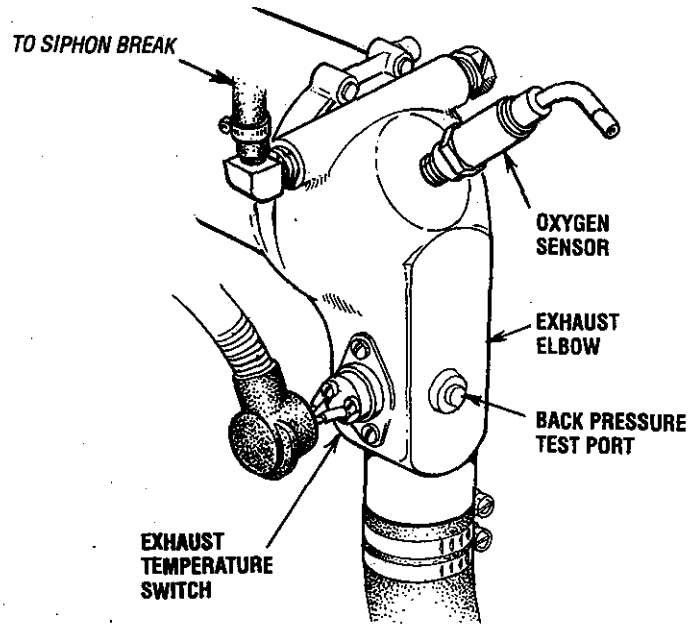
NOTE: *After the first 50 hours of generator operation check the maintenance schedule for the 50 hour service check.*

SAFETY SHUTDOWN SENSORS AND SWITCHES

The engine is protected by a variety of shutdown sensors and switches that signal the ECU (Electronic Control Unit) when a fault occurs., Should an automatic shutdown occur from a fault, one of the four fault LED lights on the control panel will illuminate to indicate the cause: Correct the cause of the shutdown. To restart the ECU and turn off the fault LED light, momentarily depress the stop switch.The following is a description of these automatic shutdown sensors and switches

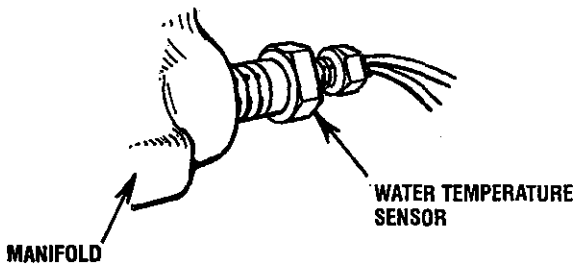
Exhaust Temperature Switch

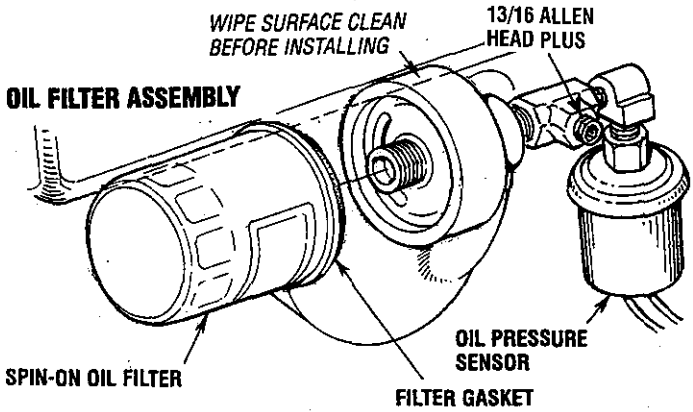
A exhaust temperature switch is located on the exhaust elbow. Normally closed, this switch will open and and interrupt the DC voltage to the K2-run relay (shutting off the engine) should the switch's sensor indicate an excessive exhaust temperature (an inadequate supply of raw water causes high exhaust temperatures). This switch opens at 260-270°F (127-132°C). This switch resets at approximately 225°F (107°C).



Water Temperature Sensor

A water temperature sensor is located on the water jacketed intake manifold to monitor engine antifreeze coolant temperature. The sensor is sending a DC voltage.to the ECU that interprets this as engine coolant temperature. Should the DC voltage reach an overheat threshold, the ECU will shut the engine down and will illuminate the over temp fault LED light on the control panel.



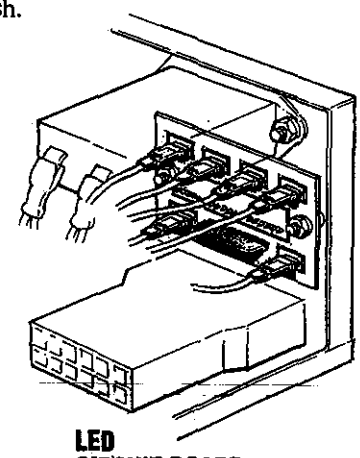


Oil Pressure Sensor

An oil pressure sensor is located adjacent to the lube oil filter. filter. It sends a DC voltage to the ECU that is interpreted as oil pressure. Should this DC voltage drop to a preset threshold. The ECU will shut the engine down and will illuminate the low oil pressure fault LED on the control panel.

Overspeed shutdown

The ECU is monitoring engine rpm from an AC signal sent to it from the MPU (Magnetic Pick-up) positioned over the flywheel ring gear teeth. Should the engine speed cause the MPU to generate an AC voltage indicating an overspeed condition. The ECU will shut the engine down and illuminate the overspeed fault LED on the control panel. Likewise with an under-speed, the ECU will shut the unit down and the LED will flash.



Engine DC Circuit Breaker

The generator's engine is protected by a panel mounted manual reset circuit breaker. Excessive DC 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 shutdown because the opened breaker interrupts the DC circuit to the the ECU. If this should occur, check and repair the source of the problem. After repairing the fault, reset the breaker and restart the generator.

MAINTENANCE SCHEDULE

⚠ 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.***

Maintenance items that are very important to the proper operation of Safe CO" generators.

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							MAINTENANCE DESCRIPTION
		50	100	250	500	750	1000	1250	
Fuel Supply	☐								Unleaded gasoline with octane rating of 89 of higher
Fuel/Water Separator	☐								Check for water and dirt in fuel (drain/replace filter if necessary).
Engine Oil Level	☐								Oil level should indicate between MAX. and LOW on dipstick.
Coolant Level	☐								Check at recovery tank; if empty, check at manifold. Add coolant if needed.
Drive Belts	☐ weekly								Inspect for proper tension (3/8" to 1/2" deflection) and adjust if needed. Check belt edges for wear.
Visual Inspection of Engine	☐	**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 SAFE CO		☐		☐	☐	☐	☐	☐	Check gap, inspect for burning and corrosion.
Starting Batteries (and House Batteries)	☐ weekly								Every 50 operating hours check electrolyte levels and make sure connections are very tight. Clean off excessive corrosion.
Engine Oil		☐	☐	☐	☐	☐	☐	☐	Initial engine oil and filter change at 50 hours, then change both every 100 hours.
Generator		☐	☐	☐	☐	☐	☐	☐	Check that AC connections are clean and secure with no chafing-see *GENERATOR INFORMATION.*
Fuel Lift Pump		☐							Periodically inspect for leaks, electrical connections are clean and tight.
Air Screen SAFE CO		☐							Clean at 50 hrs., then every 100 hours.
Exhaust System		☐		☐		☐		☐	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		☐	☐	☐	☐	☐	☐	☐	Hose should be hard & tight. Replace if hoses become spongy. Check and tighten all hose clamps.
Raw Water Pump				☐		☐		☐	Remove the pump cover and inspect for wear. Inspect impeller, cam and wear plate. Replace gasket. Lubricate impeller when reassembling.
Heat Exchanger		☐	☐	☐	☐	☐	☐	☐	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					☐		☐		Drain, flush, and refill cooling system with appropriate antifreeze mix.
Fuel Filter			☐	☐	☐	☐	☐	☐	Change every 250 operating hours.
Inlet Fuel Filter			☐	☐	☐	☐	☐	☐	Change every 250 operating hours.

(continued)

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	
*Starter Motor					☐			☐	Check solenoid and motor for corrosion. Remove and lubricate. Clean and lubricate the starter motor pinion drive.
Distributor		☐			☐				Check ignition timing. Check condition of distributor cap and rotor.
*Engine Cylinder Compression and Valve Clearances					☐			☐	Incorrect valve clearance will result in poor engine performance, check compression pressure and timing and adjust valve clearances.
*Engine Timing Belt					☐				Remove and replace every 1000 hours. **NOTE:** *Failure to replace the timing belt at the recommended interval could result in timing chain failure resulting in major damage to the engine.*
*Exhaust Elbow					☐				Test exhaust elbow for casting integrity. Replace if casting is corroded or deteriorated. **NOTE:** *A defective exhaust elbow can cause carbon monoxide leakage!*
*Exhaust System Back Pressure					☐				Perform back pressure test to ensure system is not developing restrictions that will increase pressure above 1.5 PSI or 41 inches of water column at full operating amperage load. Correct as needed.
Catalyst 							☐		Remove water injected exhaust elbow and visually inspect every 2000 hours. Replace as needed.
Oxygen Sensor 							☐		Inspect every 1000 hours. Replace every 2000 hours.
CO in Exhaust 							☐		Sample with CO analyzer.

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

COOLING SYSTEM

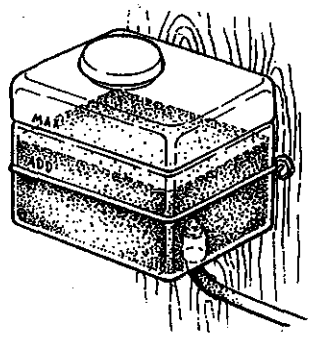
FRESH WATER COOLING CIRCUIT

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

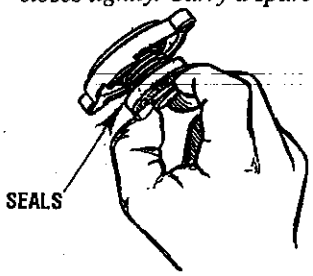
Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the manifold, to the heat exchanger where it is cooled, and returned to the engine block via the suction side of the circulating pump.When the engine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

Coolant Recovery Tank

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



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.*



CHECKING THE PRESSURE 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 and opening the manifold pressure cap. Flush the system with fresh water, then reinstall the drain and start the refill process.

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

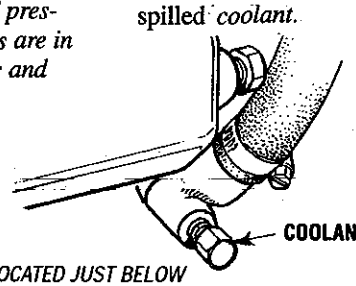
Refilling the Coolant

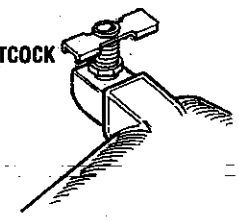
After replacing the engine drain plug, open the air bleed petcock on the exhaust manifold and slowly pour clean, premixed coolant into the manifold.

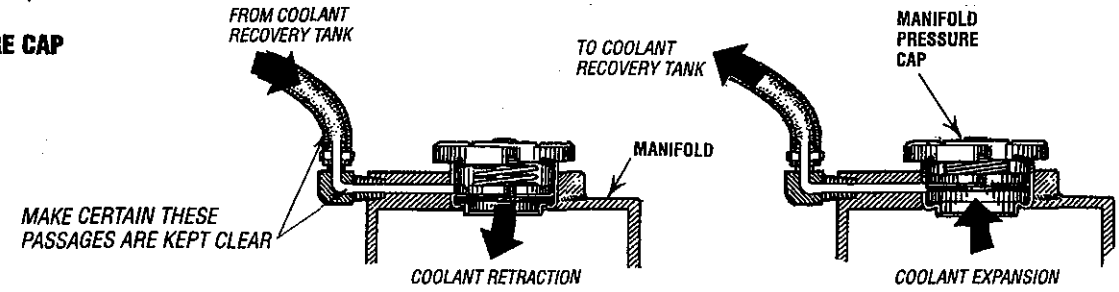
Monitor the coolant in the manifold and add as needed. Fill the manifold neck. Once coolant begins flowing from the air bleed petcock free of air bubbles, close the petcock and install the manifold pressure cap.

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.





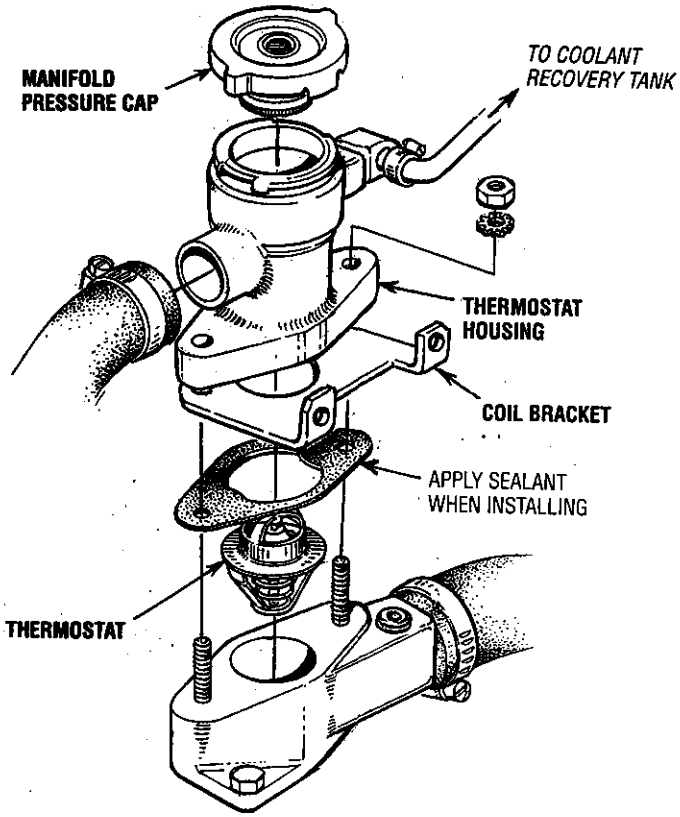


COOLING SYSTEM

THERMOSTAT

A thermostat 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 around 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.

If you suspect a faulty thermostat, place it in a pan of water and bring to a boil. A working thermostat should open about 1/2"



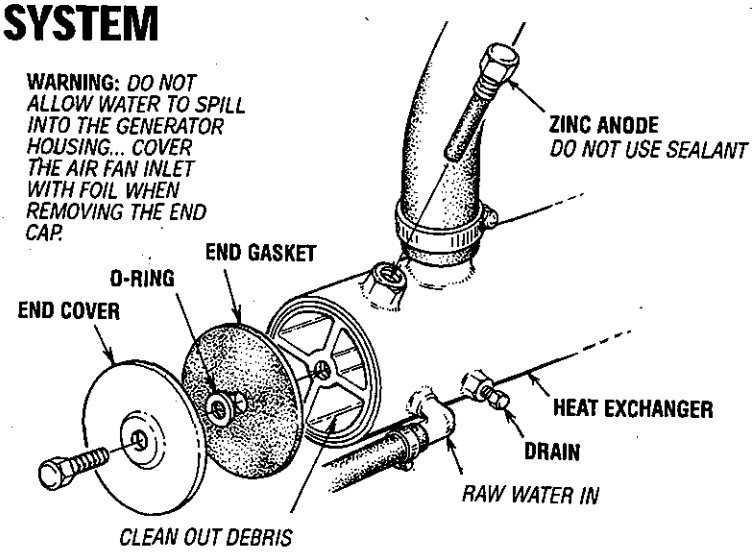
HEAT EXCHANGER

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 though 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 then every 1000 hours.*

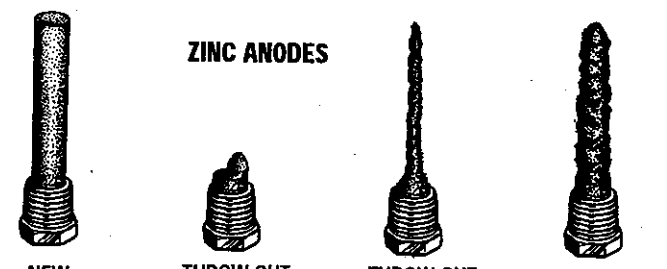
ZINC ANODE

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

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

If the zinc anodes need replacement, hold the hex boss into which the zinc anode is threaded with a wrench while loosening the anode with another wrench. This prevents the hex boss from possibly tearing off the exchanger shell. After removing the zinc, note the condition of it. If the zinc is in poor condition, there are probably alot 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.*



RAW WATER INTAKE STRAINER

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

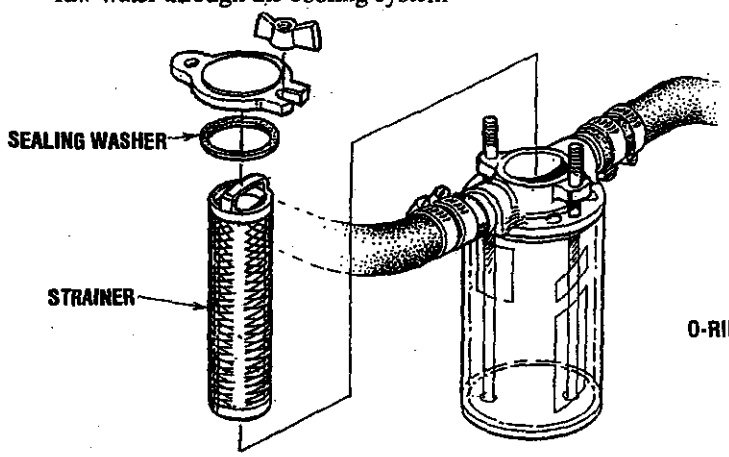
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should be clear.

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 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



RAW WATER INTAKE STRAINER
OWNER INSTALLED (TYPICAL)

RAW WATER COOLING CIRCUIT

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

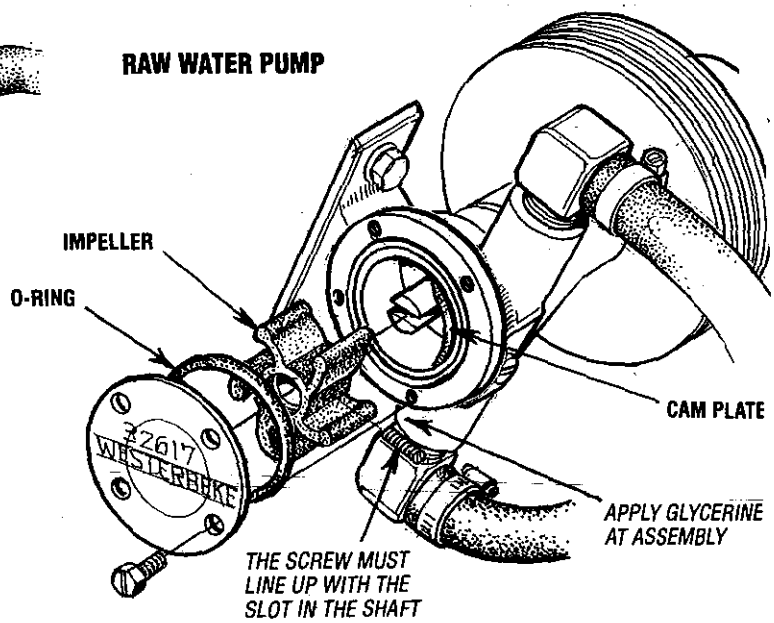
RAW WATER PUMP

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.*** There should always be a spare impeller and impeller cover gasket aboard (an impeller kit). 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 raw water pump should be inspected periodically for broken or torn impeller blades. See *MAINTENANCE SCHEDULE.*

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

Changing the Raw Water Pump Impeller

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



⚠ CAUTION: ***If any of the vanes 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.***

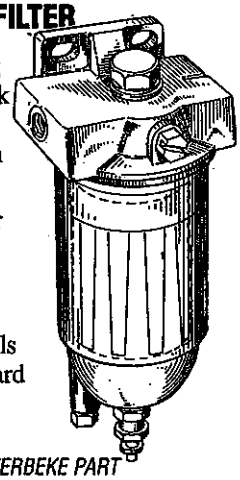
FUEL SYSTEM

GASOLINE

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

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

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 contaminant's 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 aware of the problems that contaminant's in the fuel can cause.

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

WESTERBEKE PART NUMBER (49602) OWNER INSTALLED

FUEL PUMP

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

INLET FUEL FILTER

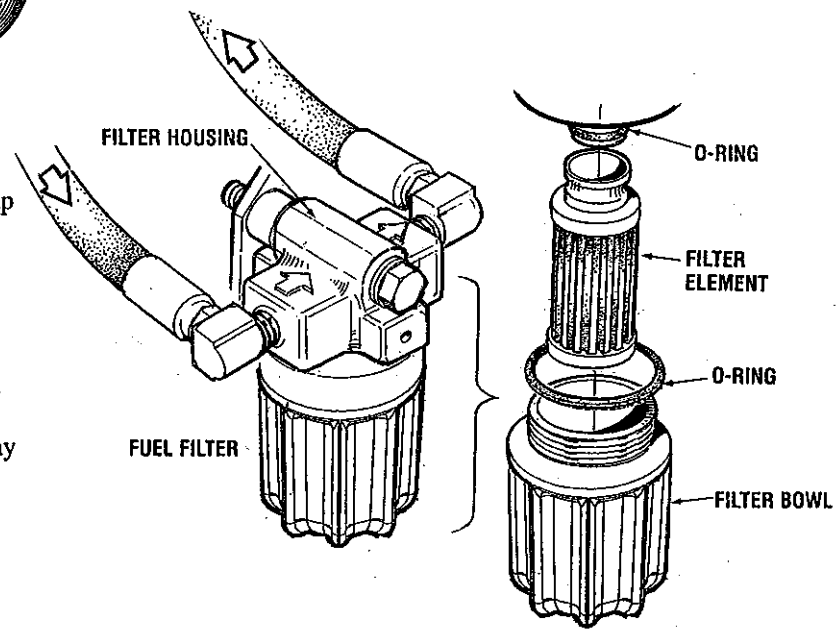
1. Shut off the fuel supply to the generator. Disconnect the fuel supply line to the inlet filter and unscrew the filter from the pump inlet. Take care to catch any fuel that may be present.
2. Thread on the replacement inlet filter and connect the fuel supply line. Use care when connecting and tightening 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.

ENGINE FUEL FILTER

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

Changing Filter Element

1. Shut the fuel supply to the generator off.
2. Ensure there is no pressure in the fuel system by bleeding off any existing pressure using a Schrader valve on the throttle body and fuel cell. Use a pressure testing kit as shown on the next page.
3. Unscrew the fuel bowl from the housing and allow the bowl to come away from the housing.
4. Remove and replace the filter element and clean the bowl.
5. Inspect both "O" rings. Replace if necessary.
6. Press on a new filter and replace the filter bowl.
7. Open the fuel supply. Inspect for leaks.



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

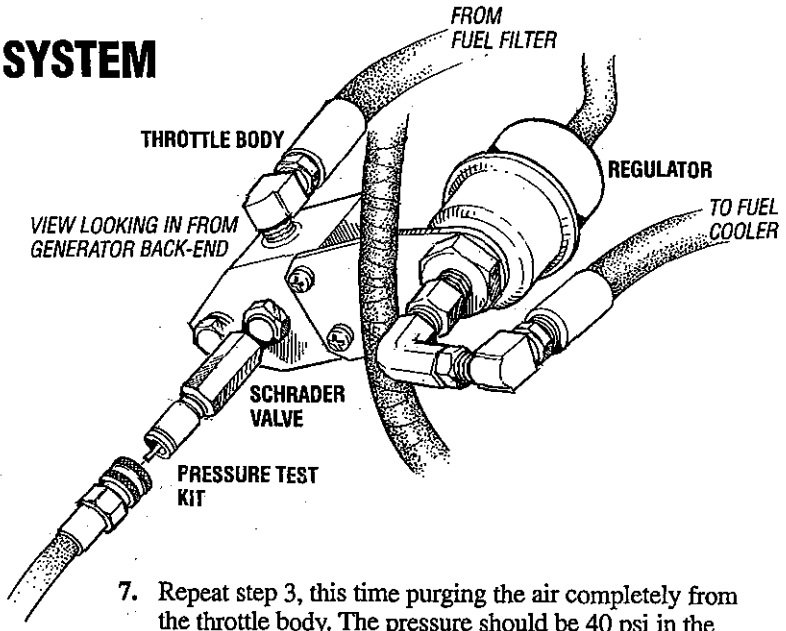
FUEL SYSTEM

BLEEDING THE FUEL SYSTEM

1. Insure that the fuel cell ***is not*** connected to the wiring harness, and that the lift pump ***is*** connected.
2. Attach Snap On MT337B, OTC 7211 or equivalent fuel pressure gauge set to the Schrader valve on fuel cell.

> ⚠ **CAUTION:** ***Follow manufacturer's instructions for safe use of the gauge sets to purge a high-pressure fuel system.***

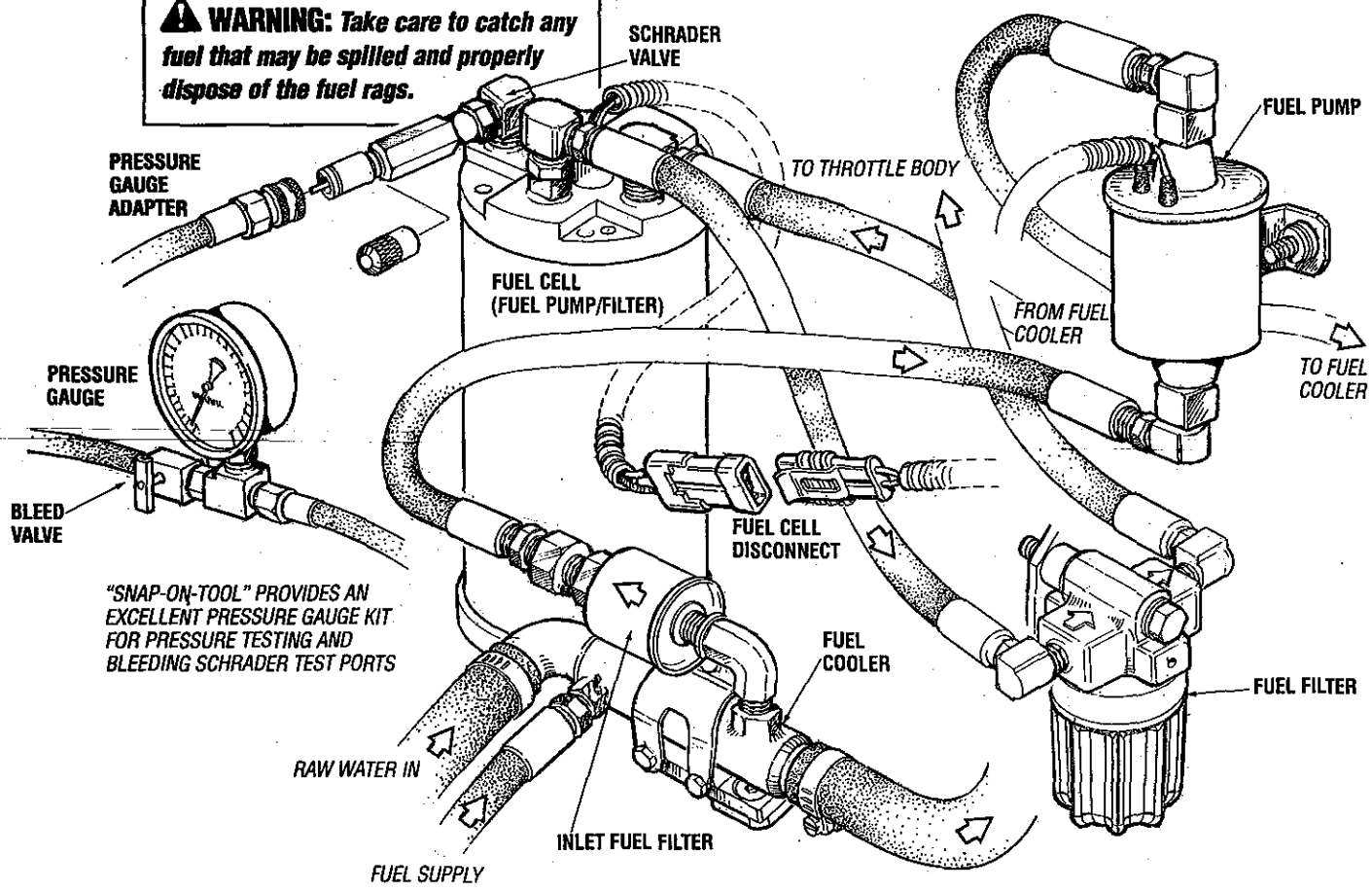
3. While holding the stop switch in the ***prime*** (depress) position, purge the air from the fuel cell. The fuel cell is purged when no air bubbles are visible escaping from the drain line attached to the Schrader valve. The pressure should typically be 3 - 4 psi.
4. Remove the pressure gauge set from the fuel cell and connect it to the Schrader valve on the throttle body.
5. Connect the fuel cell to the wiring harness.
6. Open the valve on the fuel pressure gauge purge line. Do not prime the system without the fuel gauge purge valve open or air can be forced back into the fuel cell. If this happens, repeat steps 1, 2, and 3 to remove the trapped air from the fuel cell.



7. Repeat step 3, this time purging the air completely from the throttle body. The pressure should be 40 psi in the throttle body after purging the system.

   NOTE: *The system can develop 40 psi without being fully purged. The system is fully purged when no bubbles are visible in the purge line.*
8. Remove the pressure gauge set, and cap all Schrader valves.
9. Insure that all wire connections are secure and that there are no leaks in the fuel system.

> ⚠ **WARNING:** ***Take care to catch any fuel that may be spilled and properly dispose of the fuel rags.***



ELECTRONIC FUEL INJECTION

DESCRIPTION

The illustration shows the throttle body assembly that attaches to the intake manifold.

An electronic control unit (ECU) controls the fuel injector and the throttle actuator.

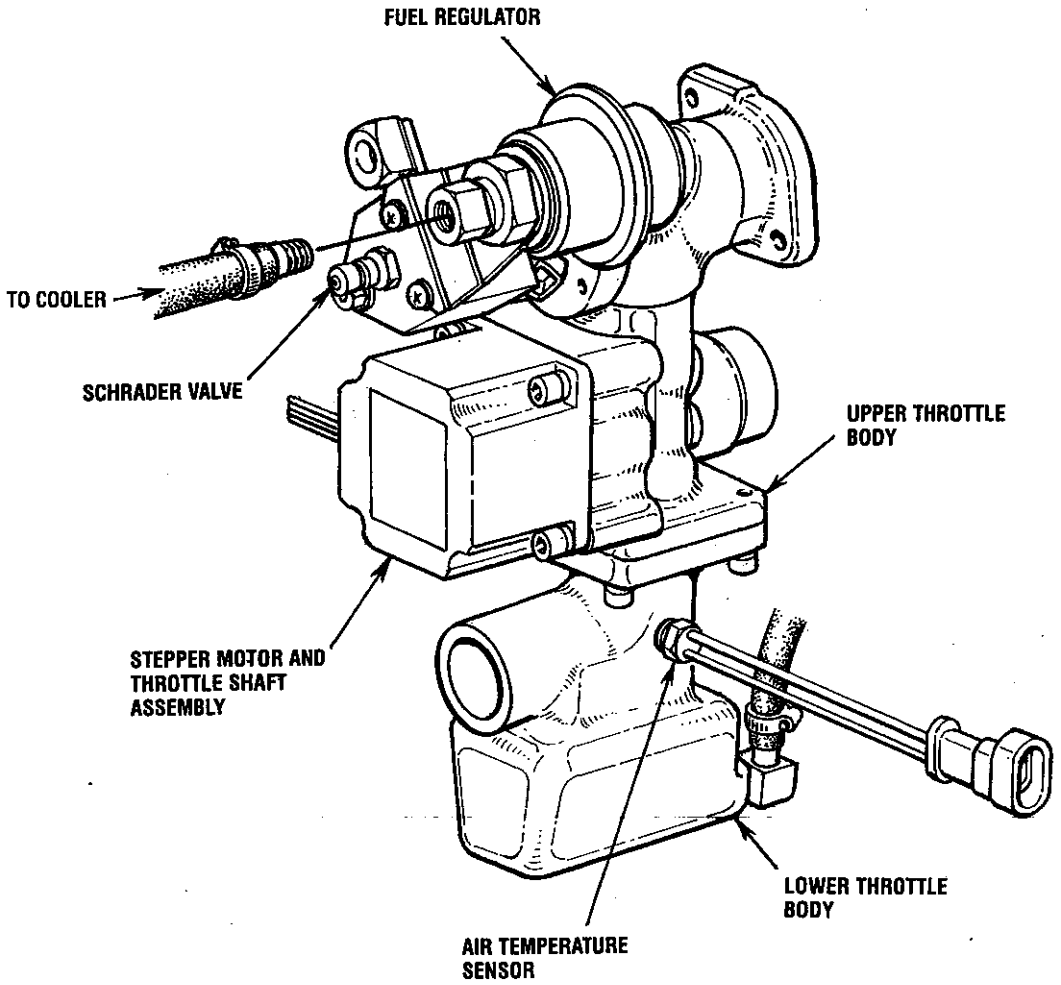
The ECU is supplied with engine operating conditions from sensors that monitor intake air temperature, engine coolant temperature, map sensor (intake manifold absolute pressure), engine rpm and battery voltage.

The ECU interprets this information to determine the appropriate injector pulse rate and throttle opening position.

A high pressure fuel pump supplies fuel to the area around the injector and the regulator maintains the fuel pressure in that area at 35 - 40 PSI maximum.

The injector is a solenoid operated pintle valve that meters fuel into the intake manifold depending on engine operating conditions and generator amperage load as determined by the ECU.

Air flow into the intake manifold is controlled by the ECU operation of the throttle plate via the actuator. Throttle plate positioning for proper air flow into the engine is accomplished through the ECU interpretation of engine operating conditions. The Schrader valve is used to monitor/check fuel pressure around the fuel injector.

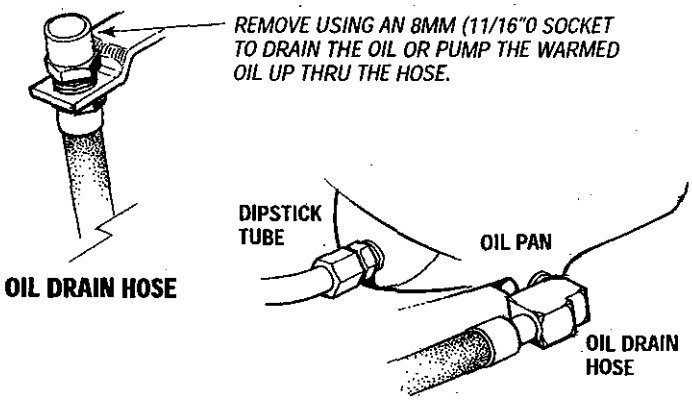


ENGINE OIL CHANGE

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

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

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

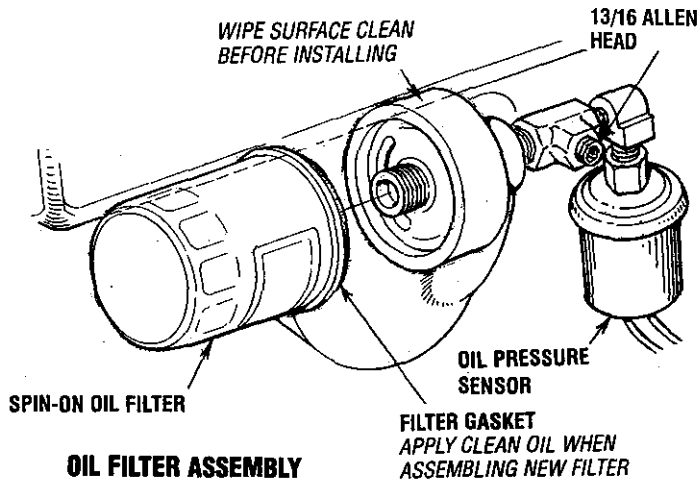


2. ***Replacing the Oil Filter.*** When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small automotive filter wrench should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

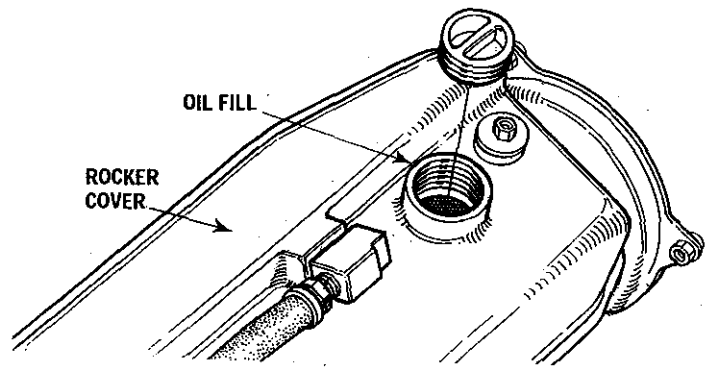
   NOTE: *Do not punch this hole without first loosening the filter to make certain it can be removed.*

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

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



OIL FILTER ASSEMBLY



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

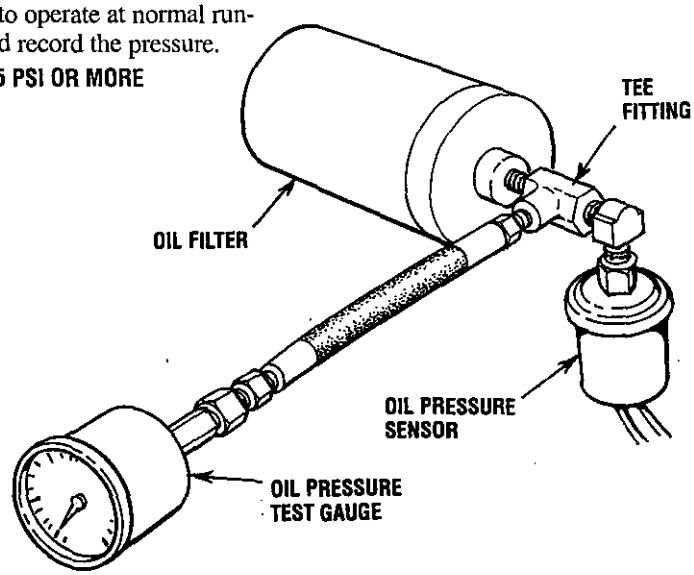
3. ***Filling the Oil Sump.*** After refilling, run the engine for a few moments while checking the oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and stop the engine. Then check the quantity of oil with the lube oil dipstick. Fill to, but not over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

> ⚠ **CAUTION:** ***Used engine oil contains harmful contaminates. 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.***

TESTING OIL PRESSURE

To test engine oil pressure, remove the hex plug (1/8npt threads) in the tee fitting located on the oil filter adapter. Install an accurate mechanical oil pressure test gauge in its place. Start the engine and allow it to operate at normal running RPM(1800/1500). Observe and record the pressure.

OIL PRESSURE AT 1800/1500: 35-45 PSI OR MORE



BATTERY CHARGING CIRCUIT

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

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

BATTERIES

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

Specifications

The minimum recommended capacity of the battery used in the engine's 12-volt DC control circuit is 600 CCA.

BATTERY CHARGING

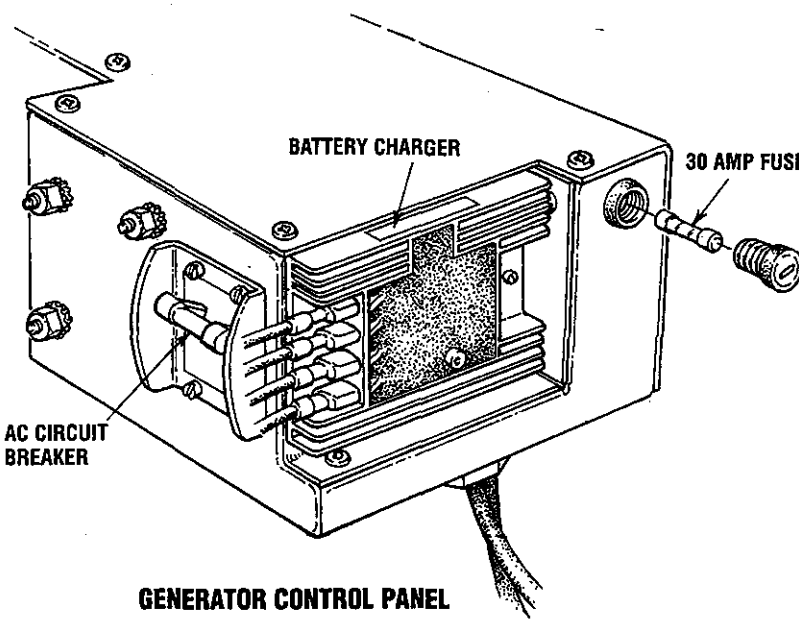
The generator supplies a continuous 12 amp (maximum) charge from its battery charger to the starting battery. To test the battery charger, put a multimeter between the positive (+) and negative (-) leads to the battery. It should indicate 13.0V to 13.4V with the engine running. If only the battery voltage is indicated, check that the battery charger terminal connections are tight. With the unit running, test between the (+) and (-) terminals for 13.0V to 13.4V. If no charge is indicated, replace the charger.

Battery Maintenance

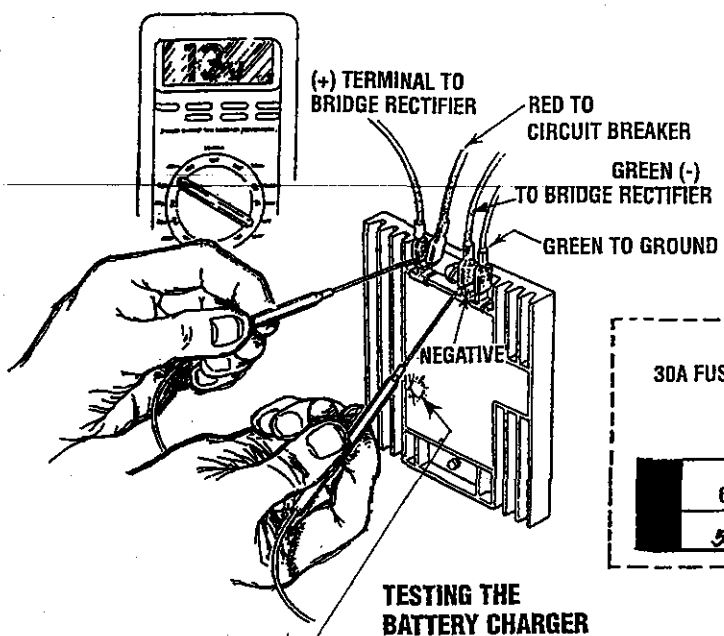
Review the manufacturer's recommendations and then establish a systematic maintenance schedule for your engine's starting batteries and house batteries.

- 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.

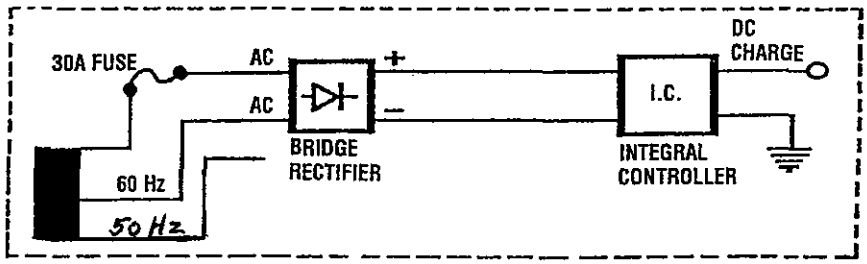
> ⚠ **WARNING:** ***Sulfuric acid in lead batteries can cause severe burns on skin and damage clothing. Wear protective gear.***

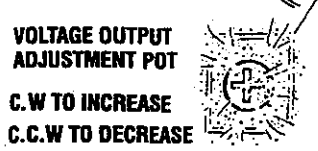


GENERATOR CONTROL PANEL



TESTING THE BATTERY CHARGER





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.*

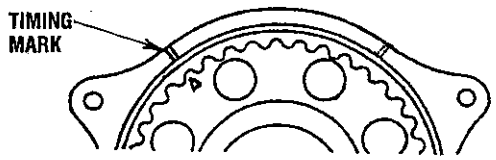
TIMING BELT INSPECTION AND REPLACEMENT

Timing Belt Removal

> **⚠ 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 camshaft oil seals for a possible oil leak.***

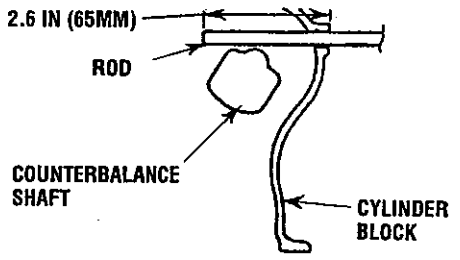
1. Turn the crankshaft clockwise to align the timing mark on the camshaft sprocket and timing belt rear cover.

   NOTE: *always turn the crankshaft clockwise.*

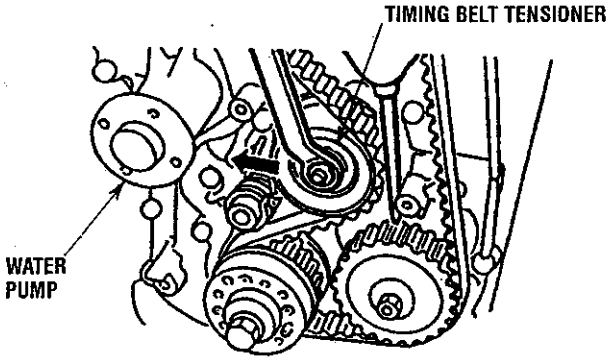


2. Remove the plug on the left surface of the cylinder block and insert a rod with a diameter of 8mm (0.31in.) to lock the counterbalance shaft.

   NOTE: *Be sure to use an inserting rod with a diameter of 8mm (0.31 in.).*

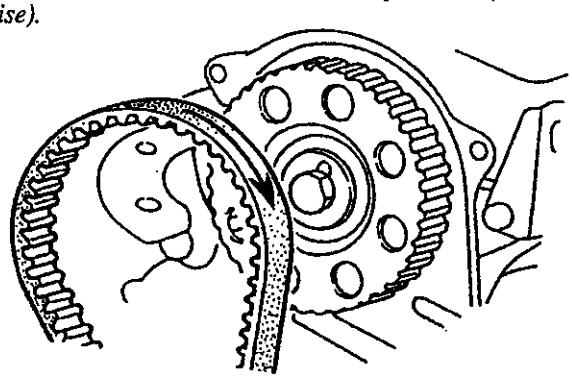


3. Loosen the timing belt tensioner nut.
4. Move the timing belt tensioner toward the water pump, and temporarily tighten the nut to hold the tensioner in that position.



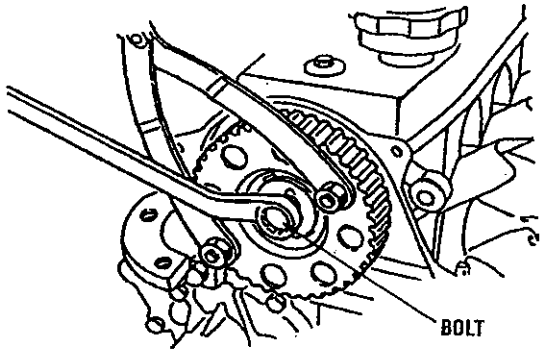
5. Remove the timing belt.

   NOTE: *If the timing belt is to be reused, draw an arrow on the belt back to indicate the direction of rotation (clockwise).*



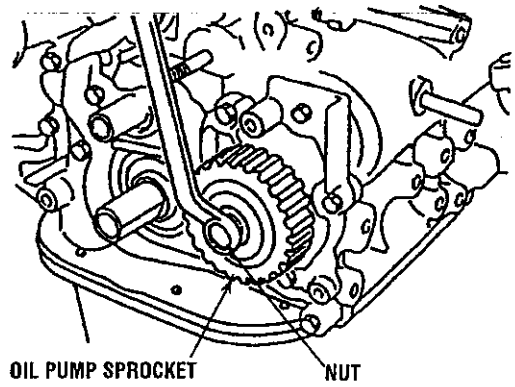
Camshaft Sprocket Removal

1. Remove the bolt without turning the camshaft.



Oil Pump Sprocket Flange Nut Removal.

1. Remove the plug from the left side of the cylinder block.
2. Insert an 8 mm (0.31 in.) diameter round bar to lock the counterbalance shaft.
3. Remove the nut.



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.*

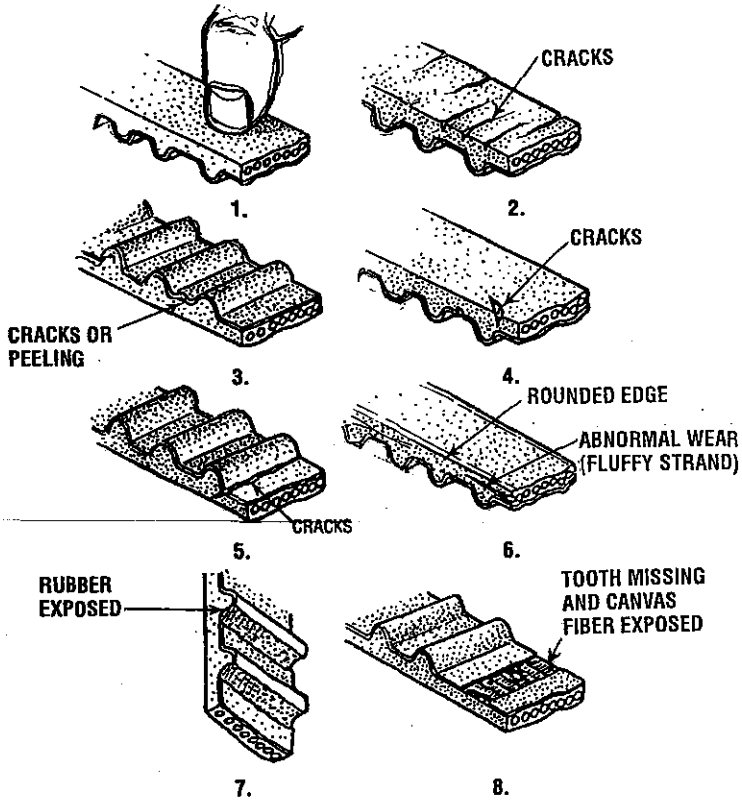
Crankshaft Bolt Removal

1. Lock the crankshaft in position.
   NOTE: *Do not turn the crankshaft.*
2. Remove the crankshaft bolt.

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.

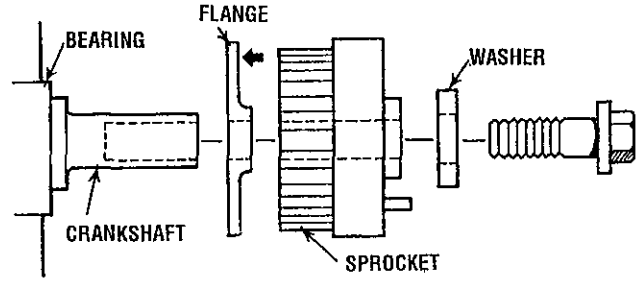


Tensioner Inspection

1. Replace the tensioner if the pulley binds, rattles or is noisy when turned.

Flange Installation

1. Mount the flange so that its side shown by the heavy arrow in the illustration faces toward the sprocket.

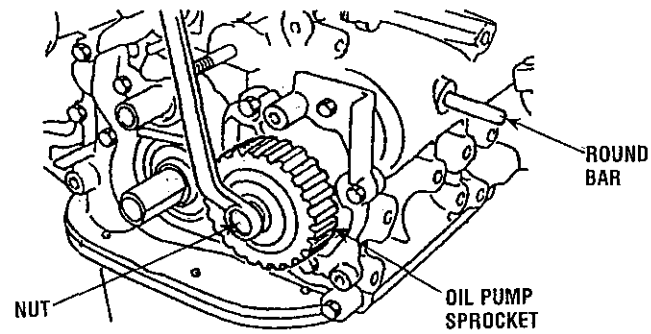


Crankshaft Bolt Installation

1. Lock the crankshaft.
   NOTE: *Do not turn the crankshaft.*
2. Tighten the crankshaft bolt to the specified torque.

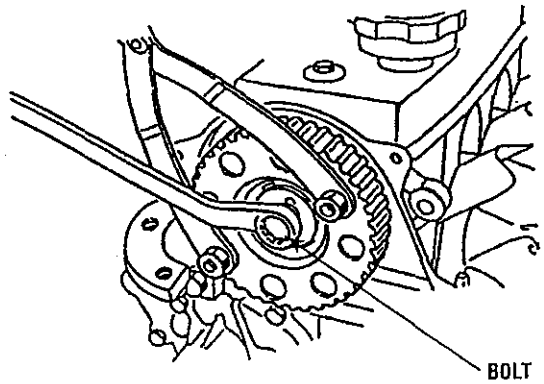
Oil Pump Sprocket Flange Nut Installation

1. Insert a round bar into the plug hole in the left side of the cylinder block to keep the counterbalance shaft from turning.
2. Install the oil pump sprocket.
3. Tighten the nut to the specified torque.



Camshaft Sprocket Bolt Installation

1. Tighten the bolt to the specified torque.
   Bearing Cap Bolt Torque 36 40 ftlbs (50 -55 Nm)

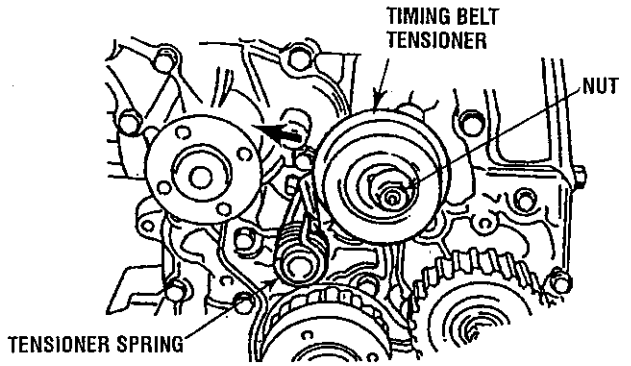


ENGINE ADJUSTMENTS

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

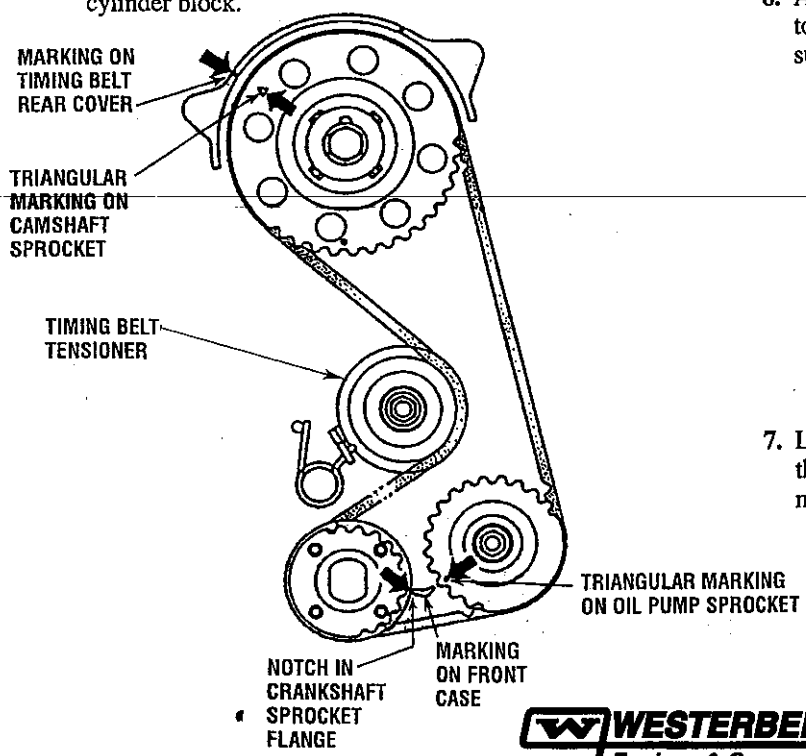
Tensioner Spring/Timing Tensioner Installation

1. Install the tensioner spring and timing belt tensioner.
2. Hook the tensioner spring onto the bend of the timing belt tensioner bracket and the stopper pin on the cylinder block.
3. Move the timing belt tensioner as close as possible to the water pump; temporarily tighten the tensioner nut.



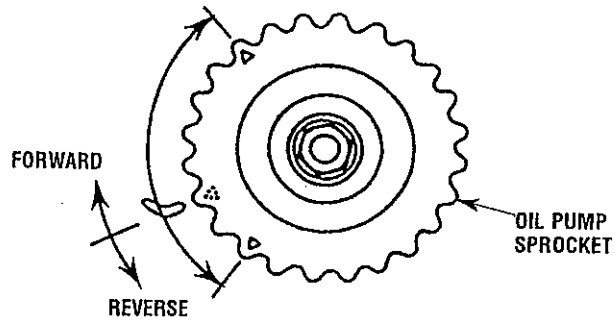
Timing Belt Installation

1. Align the triangular marking on the camshaft sprocket with a marking on the timing belt rear cover.
2. Align the notch in the crankshaft sprocket flange with the marking on the front case.
3. Align the triangular marking on the oil pump sprocket with the marking on the front case, and then insert a 65 mm (2.56 in.) or longer, 8 mm (0.31 in.) diameter round bar into the plug hole in the left side of the cylinder block.



At this time, check that the moveable range of teeth on the oil pump sprocket is according to specifications.

Standard value: 4 to 5 teeth in forward direction.
1 to 2 teeth in reverse direction.



4. If the movable range of the oil pump sprocket exceeds the specified range, correct as follows:

   a. Pull out the round bar from the plug hole in the left side of the cylinder block.

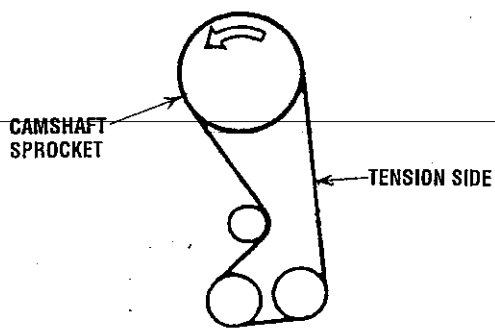
   b. Turn the oil pump sprocket one turn at a time until the round bar can again be inserted.

   c. Check that the movable range of the oil pump sprocket is in the specified value.

5. Set the timing belt over the crankshaft sprocket and then over the oil pump sprocket and camshaft sprocket, in that order.

   NOTE: *Ensure that the tension side of the timing belt is not slack. Keep the round bar inserted until the timing belt has been placed. After this step, be sure to remove the round bar.*

6. Apply counterclockwise force to the camshaft sprocket to make the belt taut on the tension side, and make sure that all timing marks are lined up.



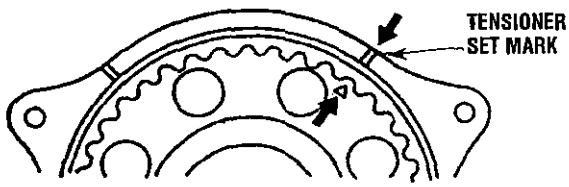
7. Loosen the temperorarily tightened tensioner nut on the water pump side 1 or 2 turns, and tension the belt making use of spring force.

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.*

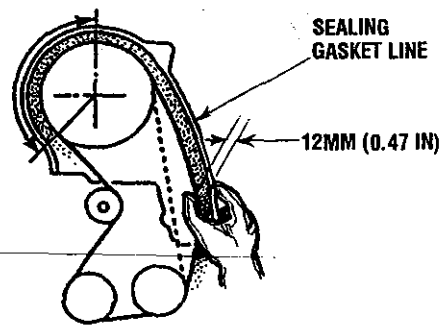
8. Turn the crankshaft ***clockwise*** by nine camshaft sprocket teeth (817) to align the timing mark on the camshaft sprocket with the tensioner set mark on the timing belt rear cover.

> ⚠ **CAUTION:** ***This operation is performed to give a proper tension to the timing belt, so do not turn the crankshaft counterclockwise and push the belt to check the tension.***



9. Make sure that the timing belt teeth are engaged with the camshaft sprocket teeth along the portion of the sprocket shown by the curved arrow in the illustration below. Then tighten the tensioner nut.
10. Pull the timing belt in the center of the tension side toward the sealing gasket line for the belt cover, as illustrated. Make sure that the clearance between the back of the belt and the sealing line is the standard value.

    Standard Value: 12mm (0.47in.)



11. Pull out a rod from the plug hole on the left surface of the cylinder block and apply the specified sealant. Then tighten the plug to the specified torque.

    Specified sealant value: 3M ATD Part No. 8660 or equivalent

    Tightening torque: 15-22 Nm (11-16 ft.lbs.)

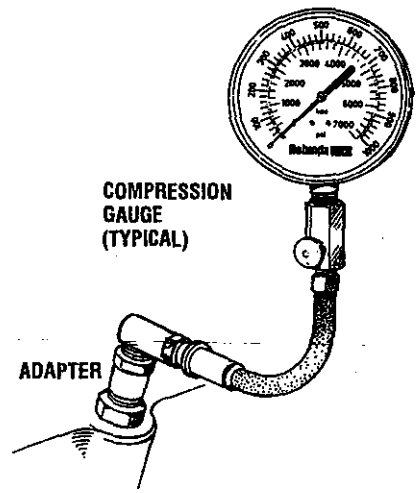
ENGINE COMPRESSION TEST

1. To check the engine's compression pressure, warm up the engine then shut it down.
2. Remove the three spark plug caps and remove the three spark plugs.
3. Install a compression adapter and gauge in the spark plug hole.
4. Close off the raw water intake seacock.
5. Crank the engine with the start motor and unplug the ignition coil and allow the compression gauge to reach a maximum reading and record.
6. 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).
7. 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 4 and 5.

   (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.
8. Reinstall three plugs and ignition wires.
9. **Open the raw water thru seacock.**



ENGINE ADJUSTMENTS

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

VALVE CLEARANCE ADJUSTMENT

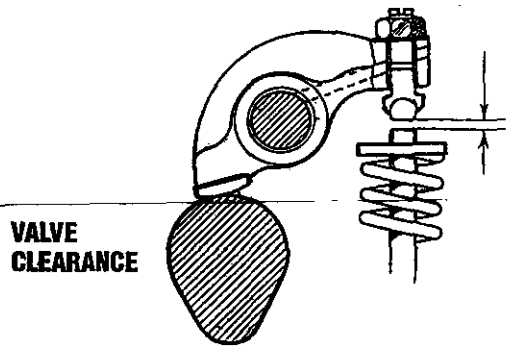
NOTE: *Retorque the cylinder head bolts before adjusting the engine's valves (see TORQUING THE CYLINDER HEAD BOLTS).*

1. Remove the rocker cover and gasket.
2. Rotate the crankshaft in the normal direction of rotation, placing the No. 1 piston at the top of its compression stroke with the exhaust and intake valves completely closed. Adjust the intake and exhaust valves for No. 1 cylinder, the exhaust valve for No. 2 cylinder, and the intake valve for No. 3 cylinder (see chart).
3. Rotate the crankshaft 180° in its normal direction of rotation. Locate the piston in No. 1 cylinder at the top of its exhaust stroke. Adjust the intake valve for No. 2 cylinder and the exhaust valve for No. 3 cylinder (see chart).

CRANK ANGLE		CYLINDER #		
		1	2	3
When No. 1 piston is set at top of compression stroke	IN	●		●
	EX	●	●	
When No. 1 piston is positioned at top of exhaust stroke	IN		●	
	EX			●

4.. Replace the rocker cover along with a new rocker cover gasket..

Rocker Cover Torque: 2.9 – 5.1 lb-ft (0.4 - 0.7 Kg-m)

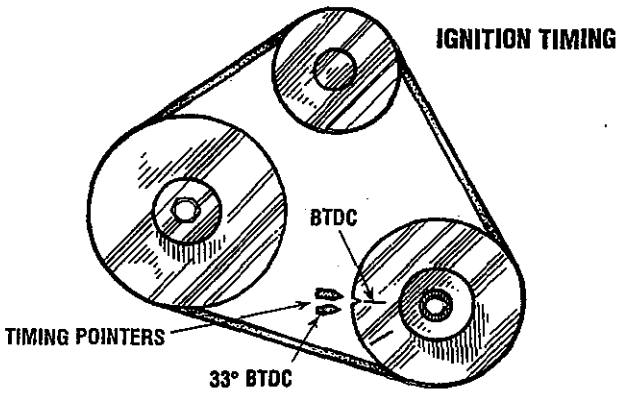


Valve Clearance: Intake 0.20mm (.008 inches)
Exhaust 0.30mm (.012 inches)

IGNITION TIMING

1. Attach a timing light to the #1 spark plug and mark the front timing pointer to indicate 15°. Locate the timing mark on the crankshaft pulley and mark it with white chalk or a crayon.
2. Start the engine and warm it up to its normal operating temperature. Make sure the generator is operating ***without a load on it.***
3. Using the timing light, align the timing mark in the front crankshaft pulley so it is just slightly before the first timing pointer. Do this by loosening and slowly rotating the distributor body. Use the following timing specifications:

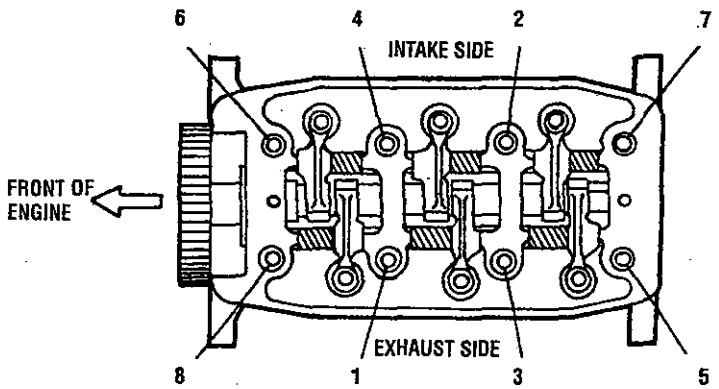
Timing Specifications: **33° ±1.0° BTDC at 1800 rpm**
(no load on generator, with vacuum advance connected)



TORQUING THE CYLINDER HEAD BOLTS

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

Tighten the cylinder head bolts according to the sequence shown. Make sure the engine is cold when this is done, and loosen one head bolt one-half turn and then tighten it between 43 - 51 lb-ft (60 - 70 Nm). Then proceed to the next head bolt in the sequence. Tighten the RS (rocker cover stud) securely.



ENGINE ADJUSTMENTS

SPARK PLUGS

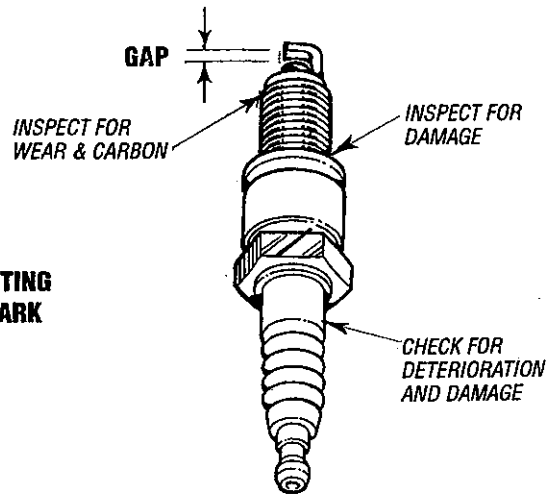
The spark plugs should be cleaned and regapped after the first 50 hour break-in period, then inspected every 250 hours thereafter and replaced as needed.

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

Spark plug gap: 0.031 ± .002 in. (0.8 – 0.05 mm).

Spark plug torque: 10 – 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.*



INSPECTING THE SPARK PLUGS

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 seperated 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.

TESTING FUEL PRESSURE

Poor engine performance and/or hard starting may be an indicator of improper fuel pressure. To test the fuel pressure, connect a fuel pressure gauge at the throttle body. With the generator running, the fuel pressure should indicate 35 to 40 PSI.

DRIVE BELT ADJUSTMENT

The drive belt 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 generator 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:

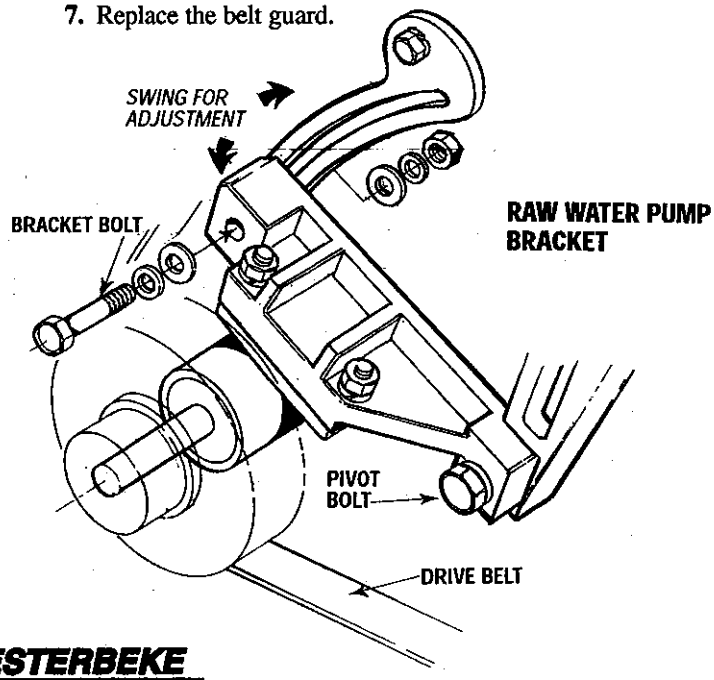
1. Remove the belt guard.
2. To adjust the governor drive belt, loosen the two governor mounting bolts.

   To adjust the raw water pump/fresh water pump drive belt, loosen the two raw water pump 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 loosen or tighten 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.

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

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



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 indicted on the generator's data plate. The output voltage should be checked periodically to ensure proper operation of the generating plant and the appliances it supplies. If an AC voltmeter or amp meter is not installed to monitor voltage and load, check it with a portable meter and amp probe.

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.

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 reduced life of windings.
- For unusually severe conditions, thin rust-inhibiting petroleum-base 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 generators 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 bearing at periodic intervals. No side movement of 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 generator.

Carbon Monoxide Detector

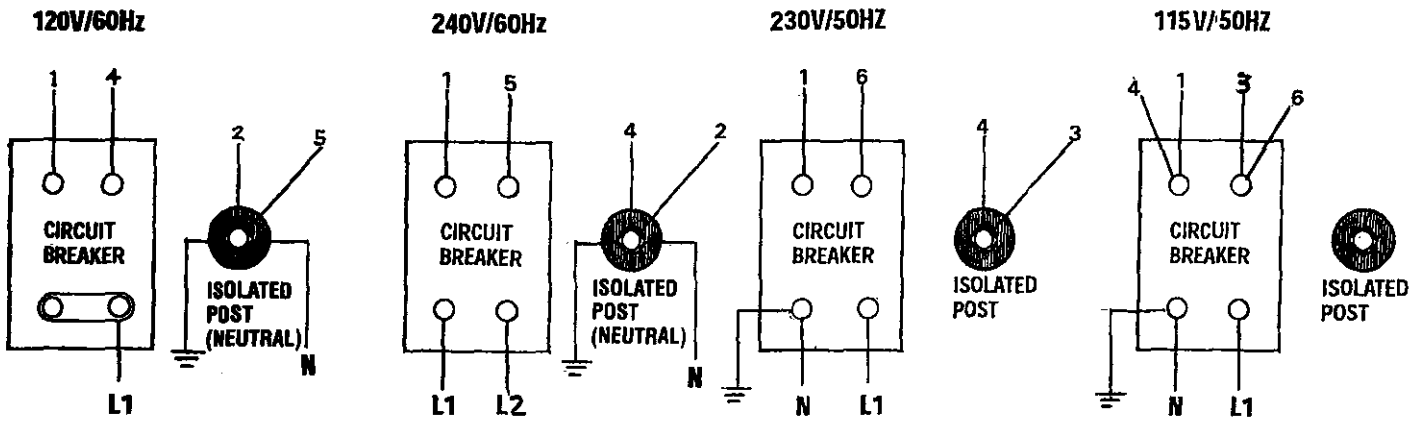
WESTERBEKE recommends mounting a carbon monoxide detector in the vessels living quarters. **Carbon monoxide, even in small amounts, is deadly.**

The presence of carbon monoxide 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.

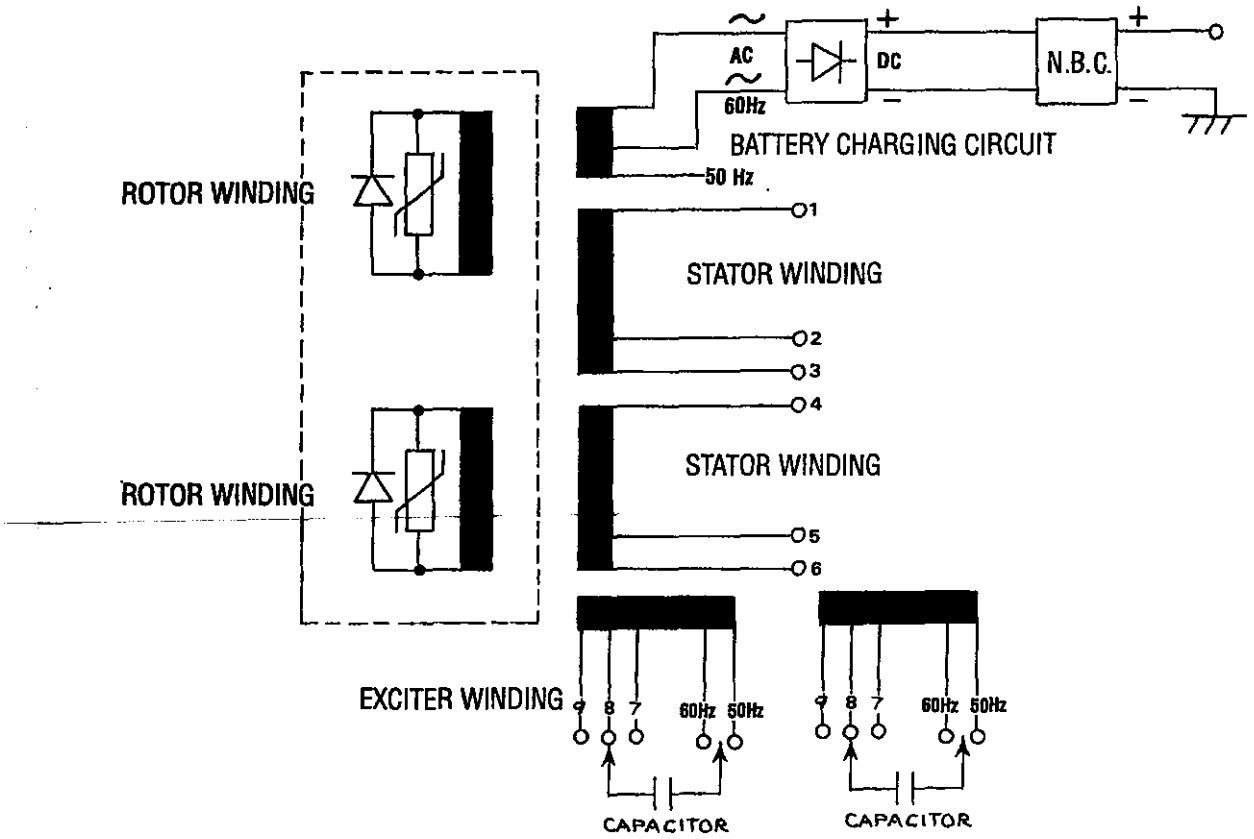
If carbon monoxide is present, ventilate the area with clean air and correct the problem immediately!

AC TERMINAL CONNECTIONS

NOTE: *Correctly position the case ground wire (white/green) onto the neutral/ground terminal.*



SBCG GENERATOR WINDINGS SCHEMATIC



GENERATOR HERTZ CONVERSION

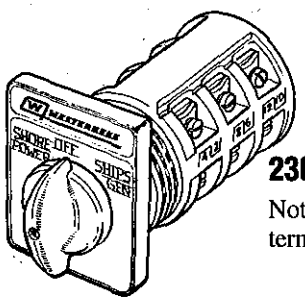
DESCRIPTION

1. Reconfigure the AC stator output leads to the voltage configuration/hertz desired. Reference previous page illustrating these connections and others.

   Note: *Ensure the case ground wire (white/green) is correctly positioned.*
2. The DC battery charge circuit. Place the correct hertz connection on the AC terminal of the charge circuit bridge rectifier.
3. The Exciter circuit capacitors. Place the corresponding hertz connection on one terminal of each capacitor.
4. Shut off the 20 amp DC breaker on the panel box and move the hertz dipswitch #1 on the ECU (Electronic Control Unit) in the panel box to the corresponding position for the hertz desired. **ON for 50 hertz, OFF for 60 hertz.** Dipswitches 2, 3, and 4 have no functions.
5. Install the correct amperage rated AC circuit breaker.
6. Shut off the AC circuit breaker and start the unit. Monitor the AC voltage output and hertz with your meter. Turn **ON** the AC circuit breaker and load the generator and monitor operation.

SHORE POWER TRANSFER SWITCH

SINGLE LINE 120 VOLT SYSTEM



NOTE: *Diagram shows connections for a two wire, 120-volt system from the generator with three wire, 120-volt boat system.*

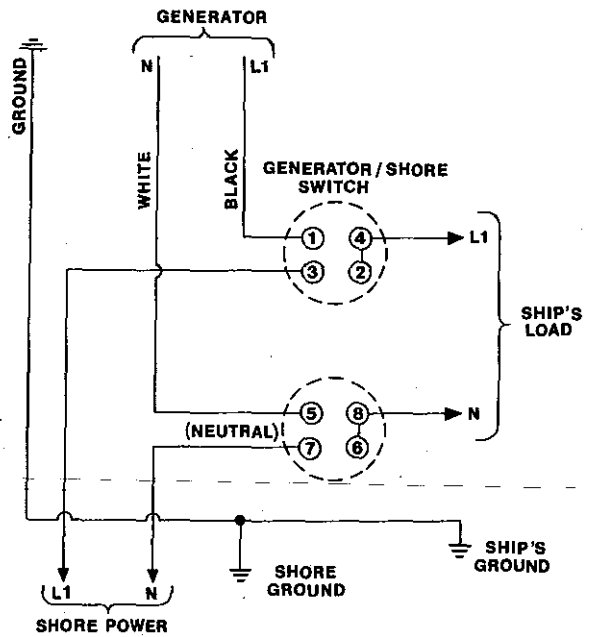
If the installer connects shore power to the vessel's AC circuit, this must be done by means of the Shore Power Transfer Switch. Set the transfer switch shown in the diagrams to the OFF position. This switch prevents simultaneous connection of shore power to generator output.

⚠ 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.***

NOTE: *Ship to shore switches are available at your WESTERBEKE dealer.*

230 VOLT/50 HERTZ TWO 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 leads should be shut off before switching shore power to generator power or vice-versa because voltage surges induced by switching with heavy AC loads on the vessel being operated may cause damage to the exciter circuit components in the generator.***

BC GENERATOR SINGLE PHASE

NOTE: *WESTERBEKE recommends that the following generator tests and adjustments be performed by a qualified technician.*

INTEGRAL CONTROLLER (I.C.)

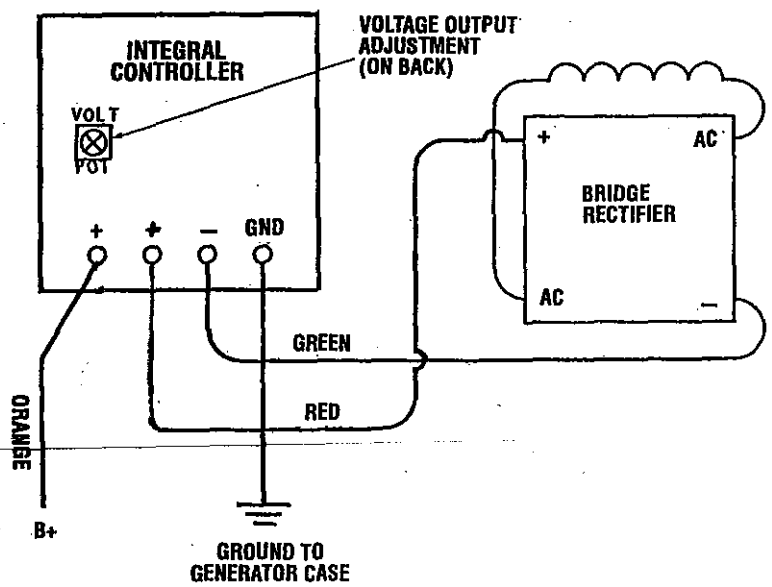
The Integral Controller (I.C.) is an encapsulated, solid-state unit that supplies a DC charging voltage to the generator's starting battery while the generator is opening.

Charging Voltage: 13.1 - 13.4 volts DC
Charging Amperage: .5 - 12.0- amps DC

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

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

The Integral Controller is mounted inside the generator housing in the 12:00 position. There is a voltage output adjustment on the controller that will allow a DC voltage output adjustment of ± 2 volts.



Testing the Battery Charging Circuit

1. **Bridge Rectifier**

   Normal AC voltage running to the rectifier (while the engine is operating at 1800 rpm) is measured across the two AC connections on the bridge rectifier. (As illustrated).

   AC voltage running to the bridge rectifier (approximate):
   No-load off the generator 16.0 volts AC
   Full-load off the generator 17.5 volts AC

   Normal DC voltage running out of the rectifier (in volts DC) is measured across the two DC connections of the bridge rectifier; that is + and –.

   DC voltage running from the bridge rectifier (approximate):
   No-load off the generator 17.0 volts DC
   Full-load off the generator 18.5 volts DC

2. **AC winding: 0.14 ohm**

   Lift the two AC wire leads off the bridge rectifier and measure, the resistance between these two leads with an ohmmeter. It should measure 0.14 ohm. No continuity should exist between these two leads and the ground or the main AC stator windings.

3. **Testing the Bridge Rectifier** (meter used - Simpson 260)

   A. Set your ohmmeter's scale on RX1 (+ DC) and set the needle to zero.

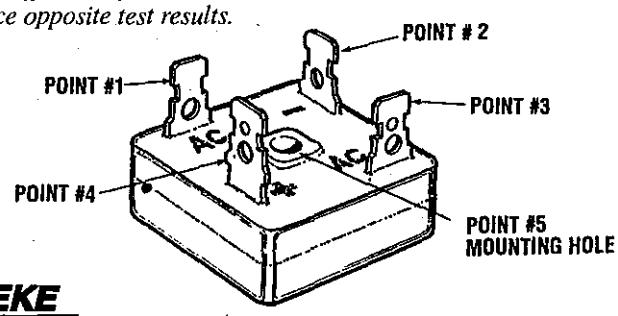
   B. Connect the (+) positive lead from the ohmmeter to point #4. Taking the ohmmeter's negative (–) lead, momentarily touch points #1, #2, #3, and #5. The ohmmeter should register no deflection for any of the points touched.

   C. Remove the positive (+) lead from point #4 and connect the negative (–) lead; momentarily touch points #1, #2, and #3. The ohmmeter's needle should deflect when each point is touched.

   D. Leaving the negative ohmmeter (–) lead on point #4, touch point #5 with the positive lead. No deflection should take place.

   E. Place the positive (+) lead on point #1 and the negative (–) lead on point #3. The ohmmeter again should not register any deflection (no deflection indicated infinite resistance). Reverse these connections and the ohmmeter should again register no deflection. If the rectifier fails any of the previous tests (A-E), replace the rectifier because it is defective.

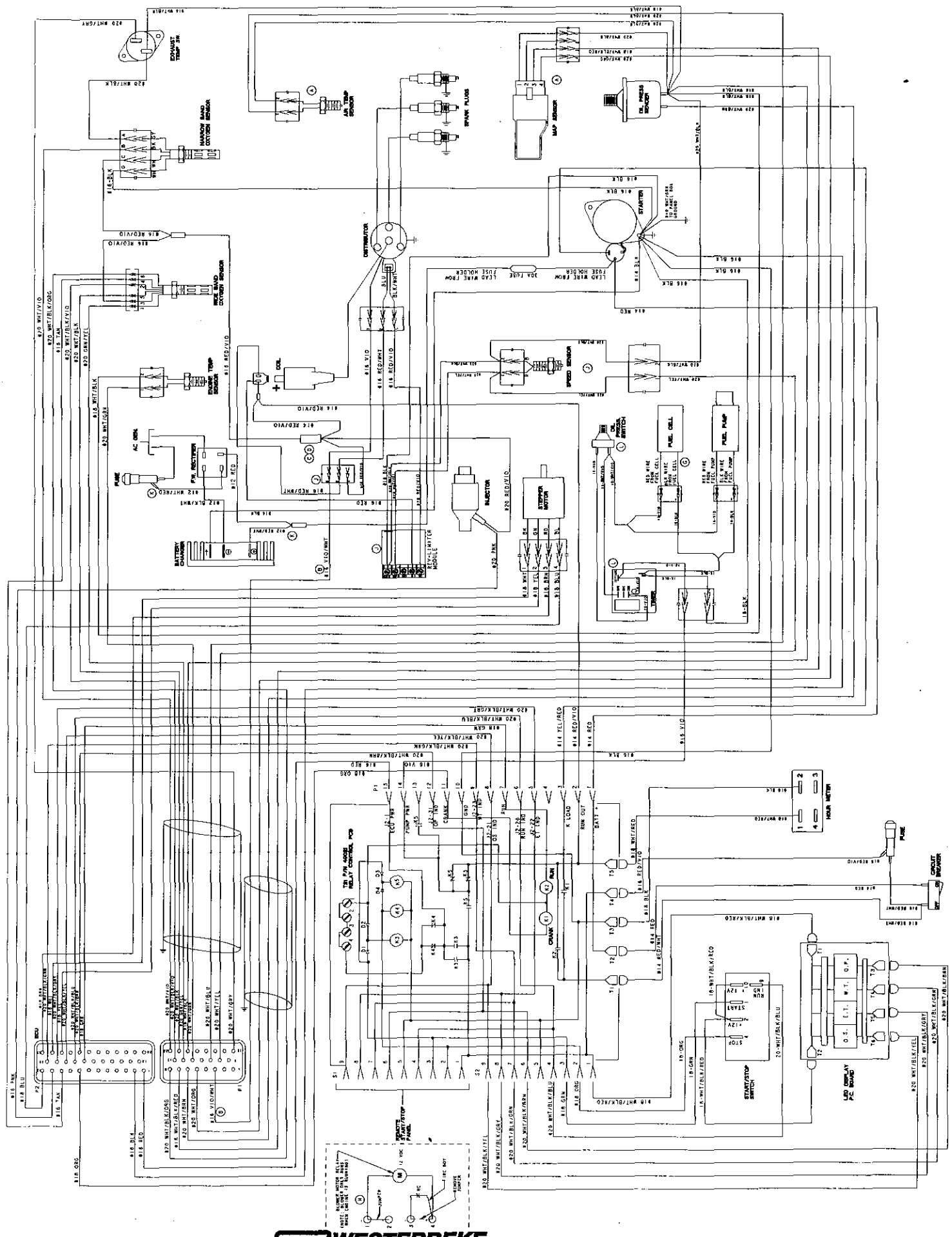
NOTE: *Different types and/or brands of test meters may produce opposite test results.*



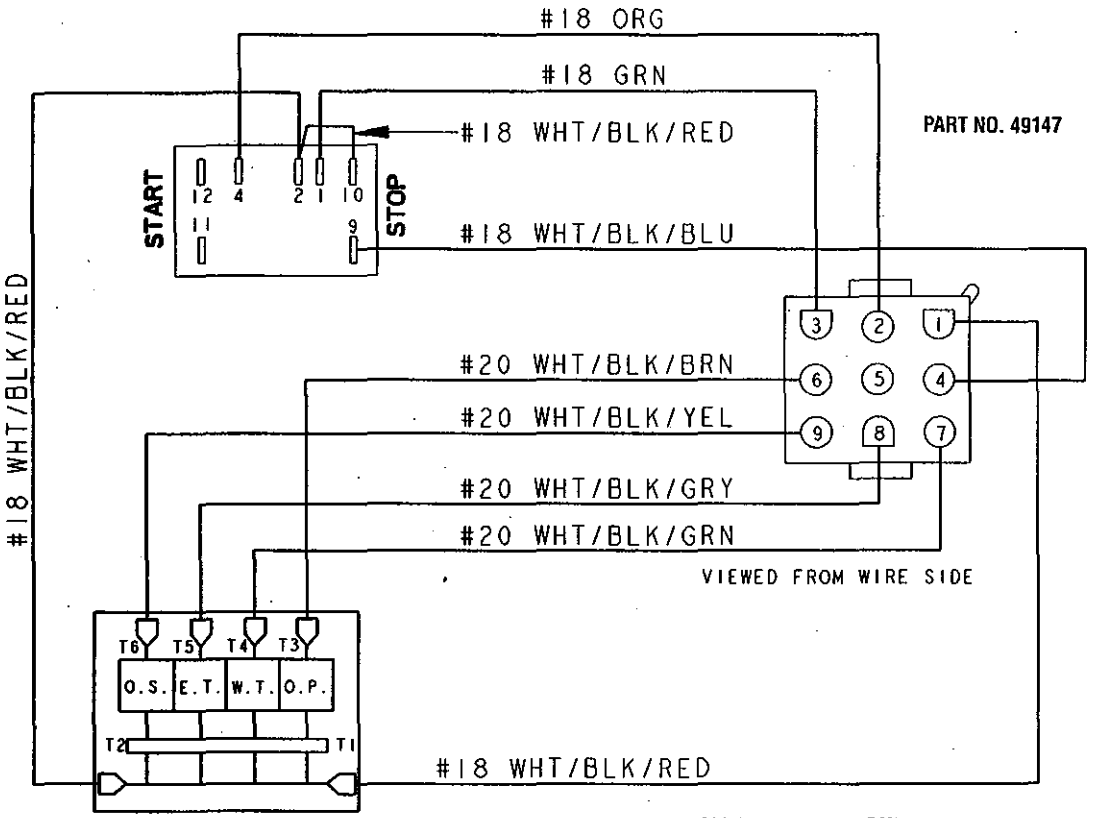
BRIDGE RECTIFIER

WIRING SCHEMATIC #49166

WIRING SCHEMATIC #49166



REMOTE START/STOP PANEL WIRING DIAGRAM
SCHEMATIC #49209



AVAILABLE FROM YOUR WESTERBEKE DEALER.
WIRING HARNESS EXTENSIONS:

15 FT. PART NO. 49201
30 FT. PART NO. 49211
50 FT. PART NO. 49667
75 FT. PART NO. 49668
100 FT. PART NO. 49669

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 DIAGRAM*, as these may reveal other possible causes of the problem which are not listed below.

NOTE: *The engines control system (electrical system) is protected by a 8 Ampere manual fuse located on the control panel. The generator has an AC circuit breaker at the control panel which should be in the off position when performing troubleshooting.*

PROBLEM	PROBABLE CAUSE
Engine does not crank.	1. Voltage drop at starter solenoid terminal. 2. Engine circuit breaker has tripped. 3. 8 amp fuse/holder is faulty. 4. Battery is low or dead. 5. Loose battery connections. 6. Faulty wire connection. 7. Faulty start switch. 8. Faulty starter relay. 9. Faulty starter solenoid. 10. Raw water filled cylinders.
Engine starts, runs but then shuts down.	1. Faulty shutdown switch. (oil pressure, coolant or exhaust temperature). 2. Faulty overspeed switch. 3. Dirty fuel/water separator filter. 4. Faulty speed sensor. 5. Low oil level in sump. 6. Faulty fuel pump. 7. High engine water or exhaust temperature.
Engine starts, runs but does not come up to speed.	1. Faulty mag. pick-up sensor. 2. Electronic governor controller faulty, 3. Fuel pump. 4. Fuel supply to engine restricted. 5. Throttle shaft binding. 6. Actuator or electrical connections faulty. 7. AC generator overload./short. 8. Air intake restricted. 9. Exhaust restricted. 10. Air in fuel system.

PROBLEM	PROBABLE CAUSE
Engine cranks but fails to start.	1. Out of fuel. 2. Engine is flooded. 3. Bad ignition coil. 4. Faulty spark plug. 5. Unplugged distributor wire. 6. Faulty electrical connection.
Engine hunts.	1. Controller gain adjustment needed. 2. Faulty fuel pump. 3. Mag. pick-up sensor needs adjustment. 4. Low DC battery voltage. 5. Generator overload. 6. Valves need adjustment.
Engine misfires.	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.	1. Spark plug wires are connected wrong. 2. Incorrect timing. 3. Engine is flooded. 4. Dirty flame arrester. 5. Cracked distributor cap. 6. High exhaust back-pressure.
Engine overheats.	1. Coolant loss. Pressure test cooling system. Refill. 2. Faulty raw water pump impeller. 3. Belts are loose or broken. 4. Raw water pump worn. 5. Faulty thermostat.

ELECTRICAL TROUBLESHOOTING GUIDE

The following test procedures will require the use of a multimeter and the engine's wiring diagram (in this manual). WESTERBEKE recommends that these tests be performed by a qualified technicion.

PROBLEM	TESTING *(12 VDC is battery + voltage measured to ground)*	INSPECTION/SOLUTION
Engine does not crank.....	Test for B+ (12v) at the circuit breaker to the PC board terminal T4. **If OK ↓**	Check for bad connections at the engine harness connector P1, the red wire, or at the battery + on the starter. Check the connections at the PC board terminal 4 and at the circuit breaker.
	Test for B+ (12v) at the circuit breaker to the panel fuse end and to the PC board terminal T2. **If OK ↓**	Look for a bad connection from the circuit breaker to the fuse or at the PC board terminal T2. Replace the fuse.
	Test for B+(12v) from the fuse end to the PC board terminal T1. **If OK ↓**	Inspect the connections at the fuse or PC board terminal T1. Replace the fuse.
	Test for B+(12v) at the relay K1 terminal 30. **If OK ↓**	Check for a bad connection at the engine harness connector P1, pin 3. The red/white wire or at K1, K2, terminal 30.
	Test for B+ (12v) at the start/stop switch terminals 2 and 10. **If OK ↓**	Look for bad connections at the panel connector 52, pin 1, white/black/red wire to the terminal PC board or at the start/stop switch terminals 2 and 10.
	Test for B+ (12v) at the start switch terminal 1 when the switch is activated. **If OK ↓**	Replace the start switch.
	Test for B+ (12v) at relay K1, terminal 86. **If OK ↓**	Check for bad connections at the panel connector S2, pin 3, green wire to the PC board. Then check the engine harness connection at the connector P1, pin 7.
	Test for B+(12v) at relay R1 terminal 85. Activate the start switch and after a few seconds the voltage should drop below .5 volts. **If OK ↓**	Inspect connections on jumpers on the terminal strip TS1 or between any external contacts connected to TS1. Replace the PC board.
	Activate the start switch, after 2 seconds B+(12v) should be present at terminal 87 on relay 1. **If OK ↓**	Look for a bad connection at relay K1.
	Activate the start switch, after 2 seconds check for B+(12v) at the start solenoid. **If OK ↓**	Look for a bad connection at relay K1, terminal 85 orange wire or at the ECU connector P2 pin. Replace the ECU.
	Inspect the starter.	Check the connections at relay K1 terminal 87. yellow/red wire or at the start solenoid. Replace the starter.

ELECTRICAL TROUBLESHOOTING GUIDE

The following test procedures will require the use of a multimeter and the engine's wiring diagram (in this manual). Also refer to the relay testing page.WESTERBEKE recommends that these tests be performed by a qualified technician.

PROBLEM	TESTING *(12 VDC is battery + voltage measured to ground)*	INSPECTION/SOLUTION
Engine cranks but fails to start...	Test for B+ (12v) at terminals 30 and 86 on the K2 Relay **If OK ↓**	Check for bad connections at both terminals. Replace the K2 relay.
	Test for B+ (12v) at relay K2, terminal 86 and activate the start switch. Voltage should be less than 5 volts. **If OK ↓**	Inspect the connections at relay K2, terminal 86, the green wire, or at the ECU connector P2, pin 19. Replace the ECU.
	Activate the start switch, test for B+(12v) at relay K2, terminal 87.	Replace the K2 relay.
	NOTE: *For other possible causes (failure to start) such as fuel pump, speed sensor (MPU), ignition, etc, refer to these sections in this manual.*	
Engine starts, runs but shuts down.....	Test for voltage across the oil pressure sensor terminals, with the engine running voltage should be less than 1.0 volts. **If OK ↓**	Faulty oil pressure sensor. Replace sensor/switch.
	Test for voltage across the exhaust temperature switch, when the engine shuts down, it should read zero (0) volts. **If OK ↓**	Faulty exhaust temperature switch. Replace switch. Loss of coolant thru exhaust elbow. High exhaust temperature.
	The engine temperature sensor maybe faulty.	Test sensor, refer to component testing in this manual.

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 removing the glow plugs or fuel injectors for access to the cylinders. Squirt light lubricating oil into the cylinders to prevent the piston rings from sticking to the cylinder walls. Rotate the engine by hand two revolutions then replace the glow plugs or injectors.

Make sure you have a replacement if removing the injector sealing washer for the injector and fuel line return.

NOTE: *If engine storage is going to be a lengthy one, 12 months or beyond, it is wise to rotate the engine by hand two complete turns every additional 4 months to allow the injection pump components to move. This will help prevent their sticking during extended storage periods.*

Intake Manifold and Thru-Hull Exhaust *[Diesel]*

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

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!

Transmission *[Propulsion Engine]*

Check or change fluid in the transmission as required. If the engine is to be layed up 12 months or more, fill the transmission to the very top to prevent corrosion. **Lower the fluid to its normal at recommissioning.** Wipe off grime and grease and touch up unpainted areas. Protect coupling and output flange with an anticorrosion coating, Refer to the *TRANSMISSION SECTION* in this manual for additional information.

Batteries

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

SPARE PARTS

Lay-up time provides a good opportunity to inspe WESTERBEKE engine to see if external items su belts or coolant hoses need replacement. Check y spares kit and order items not on hand, or replace used during the lay-up, such as filters and zinc anc to the *SPARE PARTS* section of this manual.

RECOMMISSIONING

The recommissioning of your WESTERBEKE eng seasonal lay-up generally follows the same proced those described in the *PREPARATIONS FOR STAR* tion regarding preparation for starting and normal s However, some of the lay-up procedures will need counteracted before starting the engine.

1. Remove any rags that were placed in the exhau manifold, or flame arrester.
2. Remove the raw water pump cover and gasket a the old gasket. Install the raw water pump impell removed during lay-up (or a replacement, if requ Install the raw water pump cover with a new cov
3. Reinstall the batteries that were removed during up, and reconnect the battery cables, making sure terminals are clean and that the connections are ti Check to make sure that the batteries are fully ch
4. Remove the spark plugs, wipe clean, re-gap, and to proper tightness. *[Gasoline]*
5. Check the condition of the zinc anode in the raw circuit and clean or replace the anode as needed. N that it is not necessary to flush the antifreeze/fresh solution from the raw water coolant system. Wher engine is put into operation, the system will self-fl short period of time with no adverse affects. Also the heat exchanger ends and clear out any accumu debris.
6. Check the transmission fluid, if it had been topped during the lay-up, lower the level of the fluid to n *[Propulsion Engine]*
7. Make certain all electrical connections and switch in the correct position and there are no-loads on th generator at start up. *[Generator]*
8. Start the engine in accordance with the procedures described in the *PREPARATIONS FOR STARTIN* section of this manual.

4.2KW and 5.0KW SBCG GENERATOR SPECIFICATIONS

ENGINE SPECIFICATIONS

Engine Type	3-cylinder, 4-cycle, , overhead camshaft w/counterbalance shaft, water cooled gasoline engine
Bore & Stroke	2.56 x 2.61 inches (65.0 x 66.3 mm)
Total Displacement	40.3 cubic inches (0.66 liters)
Bearings	Four main bearings
Compression Chamber	Semi-spherical
Compression Ratio	9.8:1
Hp@1800/1500 rpm	10.0
Firing Order	1 - 3 - 2
Aspiration	Naturally aspirated
Direction of Rotation	Counterclockwise viewed from the back end
Inclination	25° continuous, all directions
Dry weight	351 lbs (159.2 Kgs)
Governor	Electronic

FUEL SYSTEM

General	Thottle body fuel injection
Fuel	Unleaded gasoline with an octane rating of 89 or higher
Fuel Consumption (full load)	.6 GPH @ 1800 rpm .5 GPH @ 1500 rpm
Fuel Hose Size (supply and return)	1/4" I.D. minimum - 3/8" I.D. maximum
Fuel Pump	12 volt electric (high pressure)
Fuel Filter (on engine)	Replaceable cartridge-canister type
Air Cleaner (flame arrester)	Metal screen type - cleanable

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground Battery must be totally dedicated to the generator and maintained only by the DC charge controller system in the AC generator
Battery Capacity	800-1000 Cold Cranking Amps (CCA) (minimum)
Starter	120 Volt, reduction-solenoid mounted
DC Charging	Solid state controller, 12 amp rated
DC Cold Cranking Amps	150-176 amps

AIR REQUIREMENTS

Generator Cooling	225 -250 CFM (6.3 - 7.0 cmm)
Engine Combustion (all models)	21 CFM (0.6 cmm)
Engine Cooling	100 CFM (2.8 cmm)

Note: *Forced ventilation should be provided to maintain the generators compartment temperature below 104°F (40°C).*

COOLING SYSTEM

General	Fresh water-cooled block through raw water-cooled heat exchanger circuit
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven.
Raw Water Pump	Positive displacement, rubber impeller, belt-driven.
Raw Water Flow,	4.9 US gpm (18.5 liters) @ 1800 rpm (approx. measure before discharging into exhaust elbow).
Cooling Water Capacity	3.5 qts (3.3 liters).
Operating Temperature	150° - 170° F (65 - 77° C)

LUBRICATION SYSTEM

General	Forced lubrication by gear pump.
Oil Filter	Full flow, paper element. spin-on disposals.
Oil Capacity	3.0 qts. (2.8 liters).
Operating Oil Pressure	40 - 60 psi (2.8 - 4.2 kg/cm^2).
Oil Grade	API Specification SJ class

AC GENERATOR (Single Phase)

Single Phase	Brushless, four-pole capacitor, regulated. 1800 rpm/60Hz, 1500 rpm/50Hz
Ratings:	
4.2KW	230 volts, 18.2 amps, 50Hz single phase, 4 wire, 1.0 power factor
5.0KW	120 volts, 41.6 amps, 60Hz single phase, 4 wire, 1.0 power factor

TUNE-UP SPECIFICATIONS

Spark Plugs	14mm
Ignition Coil	12 volt
Distributor	Breakerless with ignitor and pick-up assembly
Spark plug Gap	0.031 ± .002 inches (0.8 ± 0.05mm)
Spark Plug Torque	10.8 - 15.2 lb-ft
Cylinder Head Torque	60-70 Nm (43-51 ft-lbs)
Bolt Torque	See *TORQUING THE CYLINDER HEAD*

IGNITION SYSTEM

General	Battery ignition 12 volts negative ground. Distributor with ignition module and ignitor. Ignition coil and spark plugs.
Distributor	Solid state type with signal generator and ignitor.
Spark Plug Thread Gap	11mm x 1.25 pitch
Spark Plug Gap	0.028 - 0.031 inches (0.7 0 0.8mm)
Ignition Timing	11° BTDC at 1800 RPM ± 1° (Vacuum advance hose disconnected) 33° BTDC at 1800 RPM ± 1° (Vacuum advance hose connected)

5.4KW and 6.5KW SBCG GENERATOR SPECIFICATIONS

ENGINE SPECIFICATIONS

Engine Type	3-cylinder, 4-cycle, , overhead camshaft w/counterbalance shaft, water cooled gasoline engine
Bore & Stroke	2.56 x 2.61 inches (65.0 x 66.3 mm)
Total Displacement	40.3 cubic inches (0.66 liters)
Bearings	Four main bearings
Compression Chamber	Semi-spherical
Compression Ratio	9.8:1
Hp@1800/1500 rpm	10.0
Firing Order	1 - 3 - 2
Aspiration	Naturally aspirated
Direction of Rotation	Counterclockwise viewed from the back end
Inclination	25° continuous, all directions
Dry weight	381 lbs (172.8 Kgs)
Governor	Electronic

FUEL SYSTEM

General	Thottle body fuel injection
Fuel	Unleaded gasoline with an octane rating of 89 or higher
Fuel Consumption (full load)	.7 GPH @ 1800 rpm .6 GPH @ 1500 rpm
Fuel Hose Size (supply and return)	1/4" I.D. minimum - 3/8" I.D. maximum
Fuel Pump	12 volt electric (high pressure)
Fuel Filter (on engine)	Replaceable cartridge-canister type
Air Cleaner (flame arrester)	Metal screen type - cleanable

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground Battery must be totally dedicated to the generator and maintained only by the DC charge controller system in the AC generator
Battery Capacity	800-1000 Cold Cranking Amps (CCA) (minimum)
Starter	120 Volt, reduction-solenoid mounted
DC Charging	Solid state controller, 12 amp rated
DC Cold Cranking Amps	150-176 amps

AIR REQUIREMENTS

Generator Cooling	225 -250 CFM (6.3 - 7.0 cmm)
Engine Combustion (all models)	21 CFM (0.6 cmm)
Engine Cooling	100 CFM (2.8 cmm)

Note: *Forced ventilation should be provided to maintain the generators compartment temperature below 104°F (40°C)*

COOLING SYSTEM

General	Fresh water-cooled block through raw water-cooled heat exchanger circuit
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven.
Raw Water Pump	Positive displacement, rubber impeller, belt-driven.
Raw Water Flow,	4.9 US gpm (18.5 liters) @ 1800 rpm (approx. measure before discharging into exhaust elbow).
Cooling Water Capacity	3.5 qts (3.3 liters).
Operating Temperature	150° - 170° F (65 - 77° C)

LUBRICATION SYSTEM

General	Forced lubrication by gear pump.
Oil Filter	Full flow, paper element. spin-on disposals.
Oil Capacity	3.0 qts. (2.8 liters).
Operating Oil Pressure	40 - 60 psi (2.8 - 4.2 kg/cm^2).
Oil Grade	API Specification SJ class

AC GENERATOR (Single Phase)

Single Phase	Brushless, four-pole capacitor, regulated. 1800 rpm/60Hz, 1500 rpm/50Hz
Ratings:	
5.4KW	230 volts, 23.4 amps, 50Hz single phase, 4 wire, 1.0 power factor
6.5KW	120 volts, 54.1 amps, 60Hz single phase, 4 wire, 1.0 power factor

TUNE-UP SPECIFICATIONS

Spark Plugs	14mm
Ignition Coil	12 volt
Distributor	Breakerless with ignitor and pick-up assembly
Spark plug Gap	0.031 ± .002 inches (0.8 ± 0.05mm)
Spark Plug Torque	10.8 - 15.2 lb-ft
Cylinder Head Torque	60-70 Nm (43-51 ft-lbs)
Bolt Torque	See *TORQUING THE CYLINDER HEAD*

IGNITION SYSTEM

General	Battery ignition 12 volts negative ground. Distributor with ignition module and ignitor. Ignition coil and spark plugs.
Distributor	Solid state type with signal generator and ignitor.
Spark Plug Thread Gap	11mm x 1.25 pitch
Spark Plug Gap	0.028 - 0.031 inches (0.7 0 0.8mm)
Ignition Timing	11° BTDC at 1800 RPM ± 1° (Vacuum advance hose disconnected) 33° BTDC at 1800 RPM ± 1° (Vacuum advance hose connected)

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.

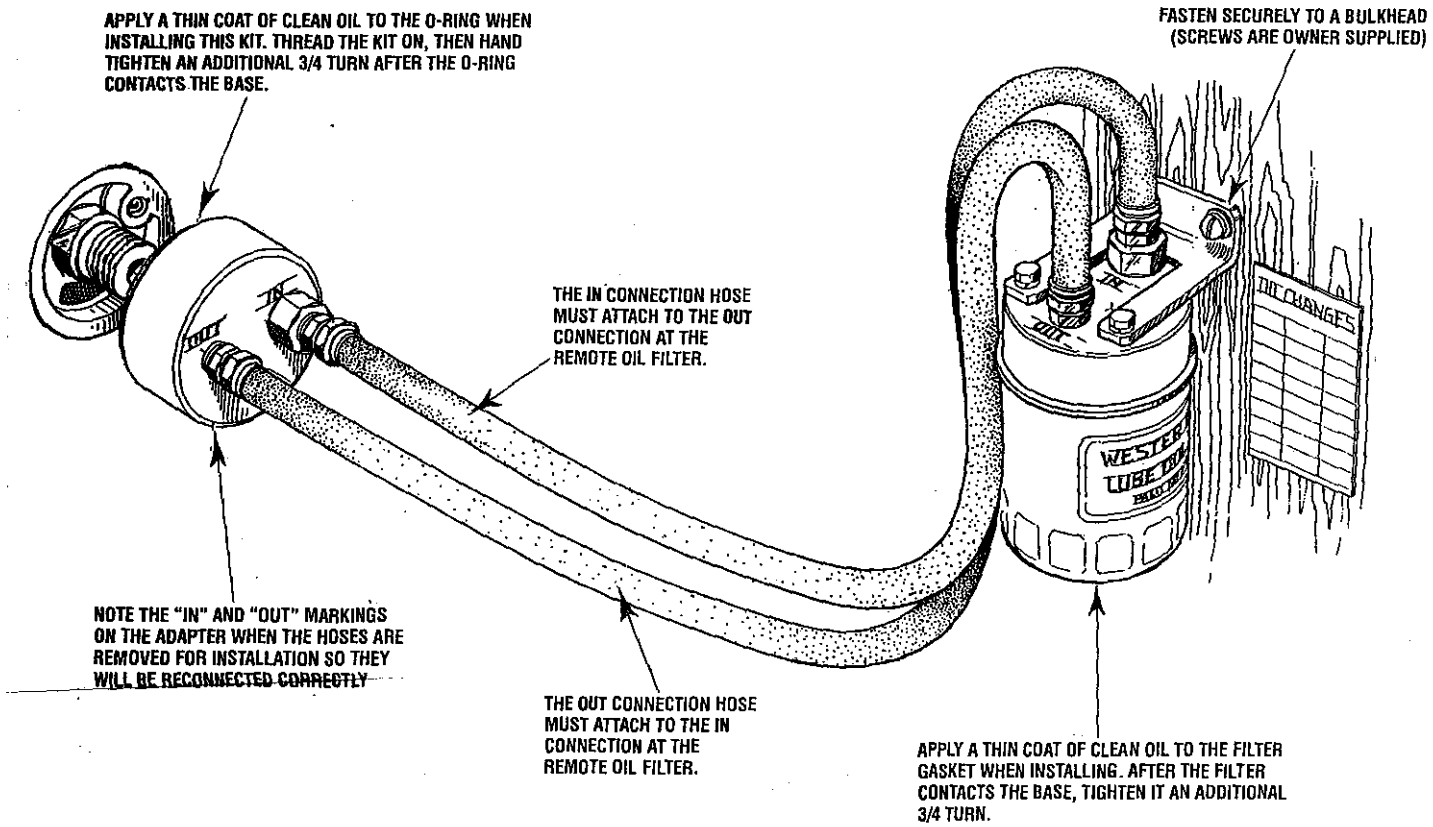
NOTE: *Refer to ENGINE OIL CHANGE in this manual for instructions on removing the oil filter.*

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 by-pass 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.***



GENERATOR HARDWARE TORQUES

Timing Belt	Nm	ft. lbs.
Crankshaft bolt	135-145	98-105
Timing belt cover bolts	10-12	7-9
Camshaft sprocket bolts	80-100	58-72
Oil pump sprocket nuts	50-57	36-41
Timing tensioner nuts	22-30	16-22
Timing belt rear cover bolts	10-12	7-9
Rocker Arms and Rocker Shaft		
Rocker cover shaft	29-35	21-25
Camshaft thrust plate bolt	10-12	7-9
Rocker arm adjust nut	8-10	6-7
Cylinder Head, Valve		
Cylinder head bolt (cold engine)	60-70	43-51
Spark plug	15.2	10.8
Rocket cover	12-13	9-10
Miscellaneous		
Coolant temperature sender	12-18	9-13
Coolant temperature switch	12-18	9-13
Generator mounts	34-47	23-34
Exhaust manifold	16-23	12-17
Thermostat housing	8-11	6-8

Front Case, Counterbalance Shaft	Nm	ft. lbs.
Front case bolts	8-10	6-7
Oil pump cover bolts	8-10	6-7
Oil pan bolts	10-12	7-9
Oil drain plug	35-45	25-33
Oil screen bolts	15-22	11-16
Oil pump driven gear bolt	34-40	25-29
Rear cover bolts	10-12	7-9
Piston and Connecting Rod		
Connecting rod cap nut	15 + 90° turn	11 + 90° turn
Crankshaft, Bearing		
Oil seal case bolts	10-12	7-9
Bearing cap bolts	50-55	36-40
Cylinder Block		
Taper plug 1/16	8-12	6-9
Taper plug 1/8	15-22	11-16
Water drain plug	35-45	25-33
Taper plug 1/4 NPT	35-45	25-33
Oil pressure switch	12-18	9-13
Oil pressure sender	12-18	9-13
Water Pump		
Water pump	8-10	6-7

STANDARD AND METRIC CONVERSION DATA

LENGTH-DISTANCE

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

DISTANCE EQUIVALENTS

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

VOLUME

Cubic Inches (in^3) x 16.387 = Cubic Centimeters x .061 = in^3
Imperial Pints (IMP pt) x .568 = Liters (L) x 1.76 = IMP pt
Imperial Quarts (IMP qt) x 1.137 = Liters (L) x.88 = IMP qt
Imperial Gallons (IMP gal) x 4.546 = Liters (L) x .22 = IMP gal
Imperial Quarts (IMP qt) x 1.201 = US Quarts (US qt) x .833 = IMP qt
Imperial Gallons (IMP gal) x 1.201 = US Gallons (US gal) x .833 = IMP gal
Fluid Ounces x 29.573 = Milliliters x .034 = Ounces
US Pints (US pt) x .473 = Liters(L) x 2.113 = Pints
US Quarts (US qt) x .946 = Liters (L) x 1.057 = Quarts
US Gallons (US gal) x 3.785 = Liters (L) x .264 = Gallons

MASS-WEIGHT

Ounces (oz) x 28.35 = Grams (g) x .035 = Ounces
Pounds (lb) x .454 = Kilograms (kg) x 2.205 = Pounds

PRESSURE

Pounds Per Sq In (psi) x 6.895 = Kilopascals (kPa) x .145 = psi
Inches of Mercury (Hg) x .4912 = psi x 2.036 = Hg
Inches of Mercury (Hg) x 3.377 = Kilopascals (kPa) x .2961 = Hg
Inches of Water (H_2O) x .07355 = Inches of Mercury x 13.783 = H_2O
Inches of Water (H_2O) x .03613 = psi x 27.684 = H_2O
Inches of Water (H_2O) x .248 = Kilopascals (kPa) x 4.026 = H_2O

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

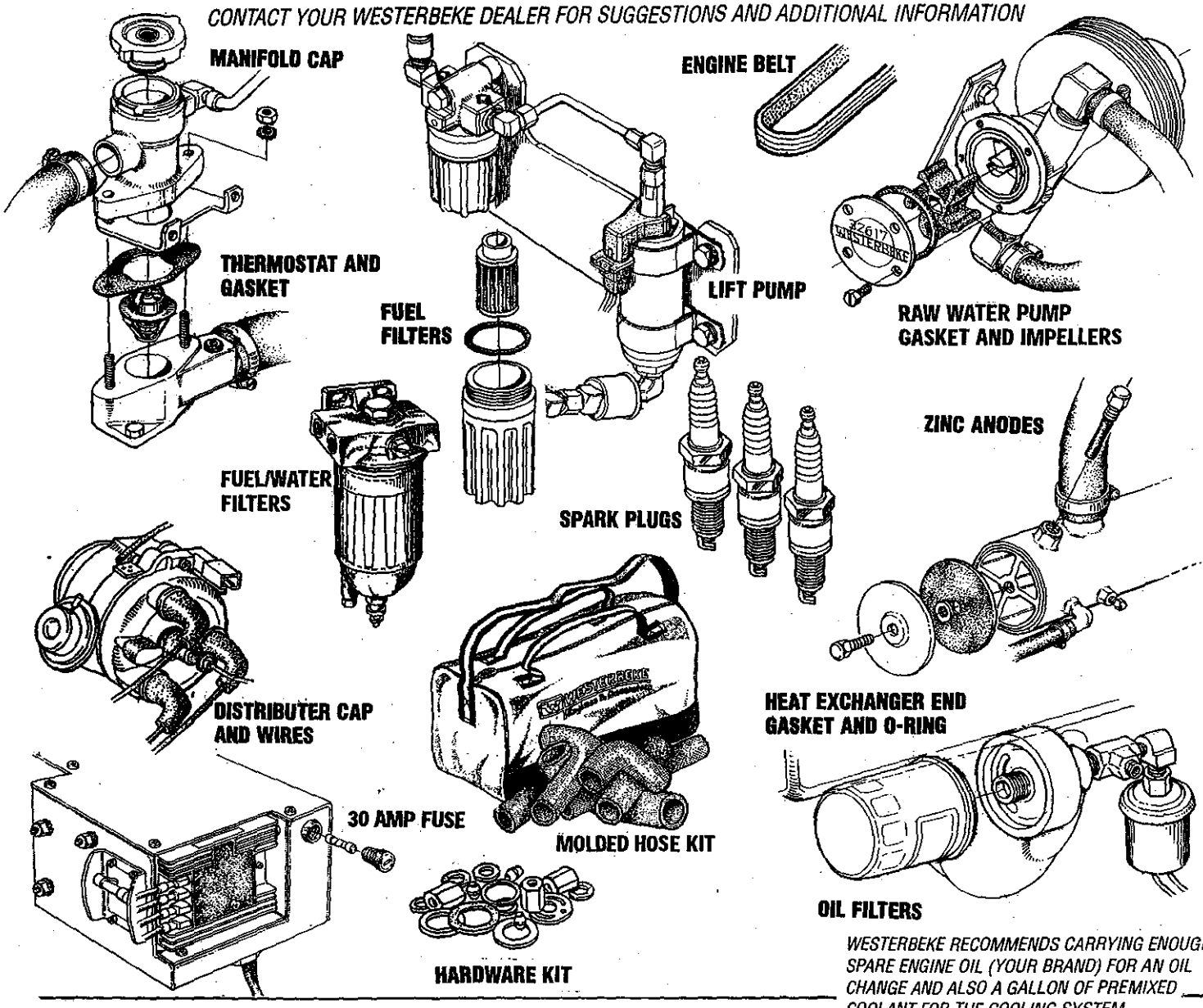
DECIMAL TO METRIC EQUIVALENT CHART

Fractions of an inch	Decimal (in.)	Metric (mm)	Fractions of an inch	Decimal (in.)	Metric (mm)
1/64	0.015625	0.39688	33/64	0.515625	13.09687
1/32	0.03125	0.79375	17/32	0.53125	13.49375
3/64	0.046875	1.19062	35/64	0.546875	13.89062
1/16	0.0625	1.58750	9/16	0.5625	14.28750
5/64	0.078125	1.98437	37/64	0.578125	14.68437
3/32	0.09375	2.38125	19/32	0.59375	15.08125
7/64	0.109375	2.77812	39/64	0.609375	15.47812
1/8	0.125	3.175	5/8	0.625	15.87500
9/64	0.140625	3.57187	41/64	0.640625	16.27187
5/32	0.15625	3.96875	21/32	0.65625	16.66875
11/64	0.171875	4.36562	43/64	0.671875	17.06562
3/16	0.1875	4.76250	11/16	0.6875	17.46250
13/64	0.203125	5.15937	45/64	0.703125	17.85937
7/32	0.21875	5.55625	23/32	0.71875	18.25625
15/64	0.234375	5.95312	47/64	0.734375	18.65312
1/4	0.250	6.35000	3/4	0.750	19.05000
17/64	0.265625	6.74687	49/64	0.765625	19.44687
9/32	0.28125	7.14375	25/32	0.78125	19.84375
19/64	0.296875	7.54062	51/64	0.796875	20.24062
5/16	0.3125	7.93750	13/16	0.8125	20.63750
21/64	0.328125	8.33437	53/64	0.828125	21.03437
11/32	0.34375	8.73125	27/32	0.84375	21.43125
23/64	0.359375	9.12812	55/64	0.859375	21.82812
3/8	0.375	9.52500	7/8	0.875	22.22500
25/64	0.390625	9.92187	57/64	0.890625	22.62187
13/32	0.40625	10.31875	29/32	0.90625	23.01875
27/64	0.421875	10.71562	59/64	0.921875	23.41562
7/16	0.4375	11.11250	15/16	0.9375	23.81250
29/64	0.453125	11.50937	61/64	0.953125	24.20937
15/32	0.46875	11.90625	31/32	0.96875	24.60625
31/64	0.484375	12.30312	63/64	0.984375	25.00312
1/2	0.500	12.70000	1	1.00	25.40000

SUGGESTED SPARE PARTS

WESTERBEKE MARINE GASOLINE GENERATORS

CONTACT YOUR WESTERBEKE DEALER FOR SUGGESTIONS AND ADDITIONAL INFORMATION



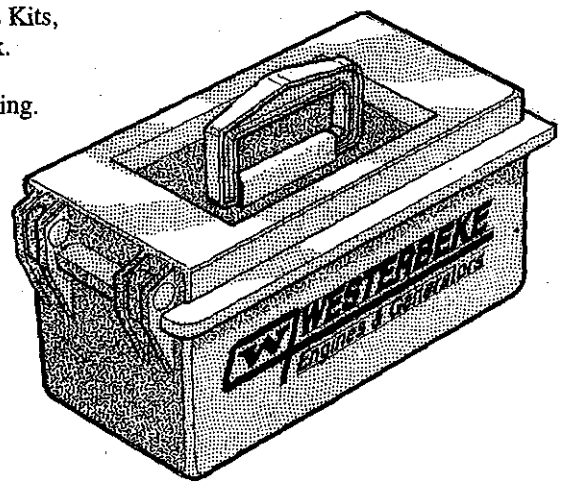
WESTERBEKE RECOMMENDS CARRYING ENOUGH SPARE ENGINE OIL (YOUR BRAND) FOR AN OIL CHANGE AND ALSO A GALLON OF PREMIXED COOLANT FOR THE COOLING SYSTEM.

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
Fuel Filters



Kit B

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

WESTERBEKE
Engines & Generators

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