OPERATORS MANUAL

8.5Kw BTG 50Hz
6.8Kw BTG 50Hz
8.5Kw BTGA 60Hz
6.8Kw BTGA 50Hz
12.5Kw BTG 60Hz
10.0Kw BTG 50Hz
15.0Kw BTG 60Hz
12.0Kw BTG 50Hz

MARINE GASOLINE GENERATORS

PUBLICATION #035909
REVISION 5
MARCH 2018

WESTERBEKE

WESTERBEKE CORPORATION • 150 JOHN HANCOCK ROAD
MYLES STANDISH INDUSTRIAL PARK • TAUNTON MA 02780
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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

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

WESTERBEKE™

Engines & Generators

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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.

As the owner or operator, always observe the following safety rules and advisories provided for your convenience. This safety information is in alignment with the American Boat and Yacht Council (ABYC) standards; however, safety risks are not limited to the information in the following pages. The responsibility for the identification of potential and actual risks for compliance with all safety advisories, maintenance activities, and other conditions belong exclusively to the owner/operator.

PREVENT ELECTRIC SHOCK

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

- Do not operate this machinery without electrical enclosures and covers in place.
- Shut off electrical power before accessing electrical equipment.
- Use insulated mats whenever working on electrical equipment.
- Make sure your clothing and skin are dry, not damp (particularly shoes) when handling electrical equipment.
- Remove wristwatch and all jewelry when working on electrical equipment.

PREVENT BURNS — HOT ENGINE

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

- Monitor engine antifreeze coolant level at the plastic coolant recovery tank and periodically at the filler cap location on the water jacketed exhaust manifold, but only when the engine is COLD.

⚠ 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!***

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

SAFETY INSTRUCTIONS

ACCIDENTAL STARTING

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

- Turn OFF the DC breaker on the control panel or turn the unit's battery selector switch to OFF before servicing the engine.
- Make certain all personnel are clear of the engine before starting.
- Make certain all covers, guards, and hatches are re-installed before starting the engine.

BATTERY EXPLOSION

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

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

BATTERY ACID

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

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

TOXIC EXHAUST GASES

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

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

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

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

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

AVOID MOVING PARTS

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

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

- 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.
- Do not allow any swimming or activity around or near the exhaust discharge opening for the generator while the generator is operating. Carbon Monoxide poisoning or death can occur.

HAZARDOUS NOISE

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

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

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

OPERATORS MANUAL

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

GASOLINE ENGINE AND GENERATOR INSTALLATIONS

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

Sections of the ABYC standards of particular interest are:

H-2 Ventilation for Boats using Gasoline
H-24 Gasoline Fuel Systems
P-1 Installation of Exhaust Systems
for Propulsion and Auxiliary Engines
P-4 Marine Inboard Engines and Transmissions
E-11 AC and DC Electrical Systems on Boats

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

www.abycinc.org

ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING ENGINES AND GENERATORS

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)
"Standards and Technical Information Reports for Small Craft"

Order from:

ABYC
613 Third Street, Suite 10
Annapolis, MD 21403

www.abycinc.org

NFPA - No.302 (National Fire Protection Association)
"Pleasure and Commercial Motor Craft"

Order from:

National Fire Protection Association
Battery March Park
Quincy, MA 02269

USCG (United States Coast Guard)
"regulatedions are under titles CFR33 and CFR46 of the Code of Regulations"

Order from:

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

INSTALLATION

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

CODES AND REGULATIONS

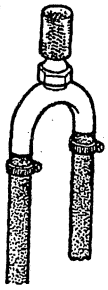
Strict federal regulations, ABYC guidelines, and safety codes must be complied with when installing engines and generators in a marine environment.

SIPHON-BREAK

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

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

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



AVAILABLE FROM YOUR WESTERBEKE DEALER

SIPHON-BREAK WITH STAINLESS LOOP

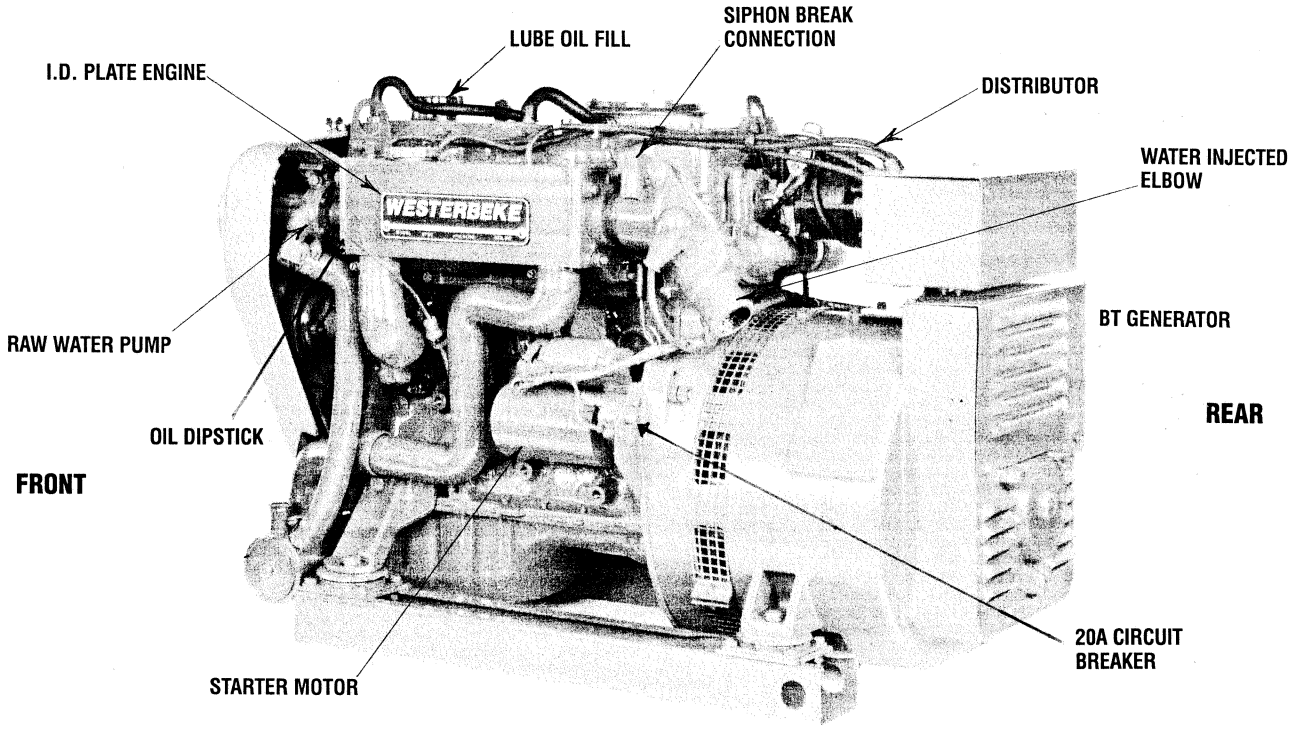
EXHAUST SYSTEM

The exhaust system's hose MUST be certified for marine use. Corrugated Marine Exhaust Hose is recommended. The use of this type of hose allows for extreme bends and turns without the need of additional fitting and clamps to accomplish these bends and turns. In this regard, a single length of corrugated exhaust hose can be used. The system MUST be designed to prevent the entry of water into the exhaust system under any sea conditions and at any angle of vessels heel.

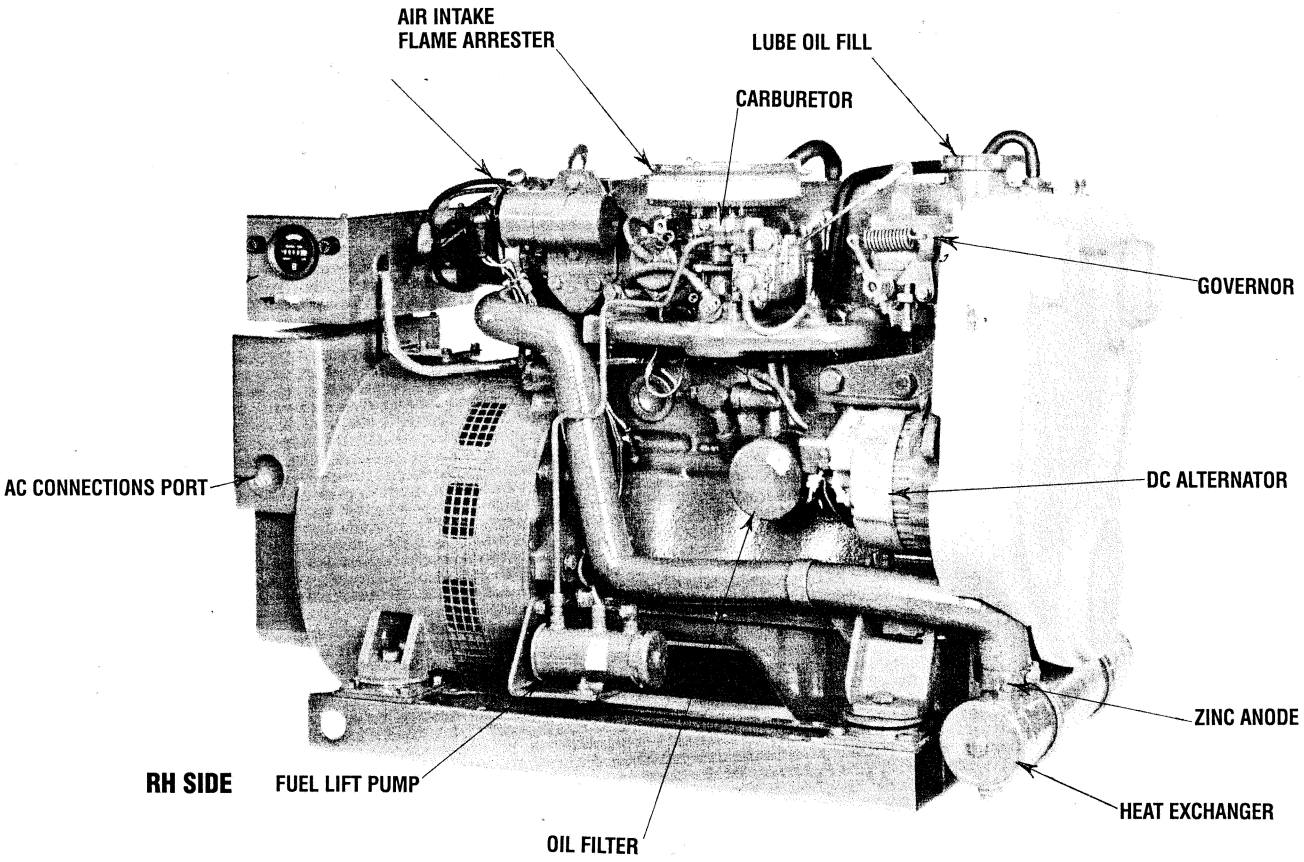
A detailed Marine Installation Manual covering gasoline and diesel, engines and generators, is supplied with each unit. A pdf is available to download from our website at www.westerbeke.com.

TABLE OF CONTENTS

PARTS IDENTIFICATION



12.5KW BTG 15.0KW BTG
GASOLINE GENERATOR



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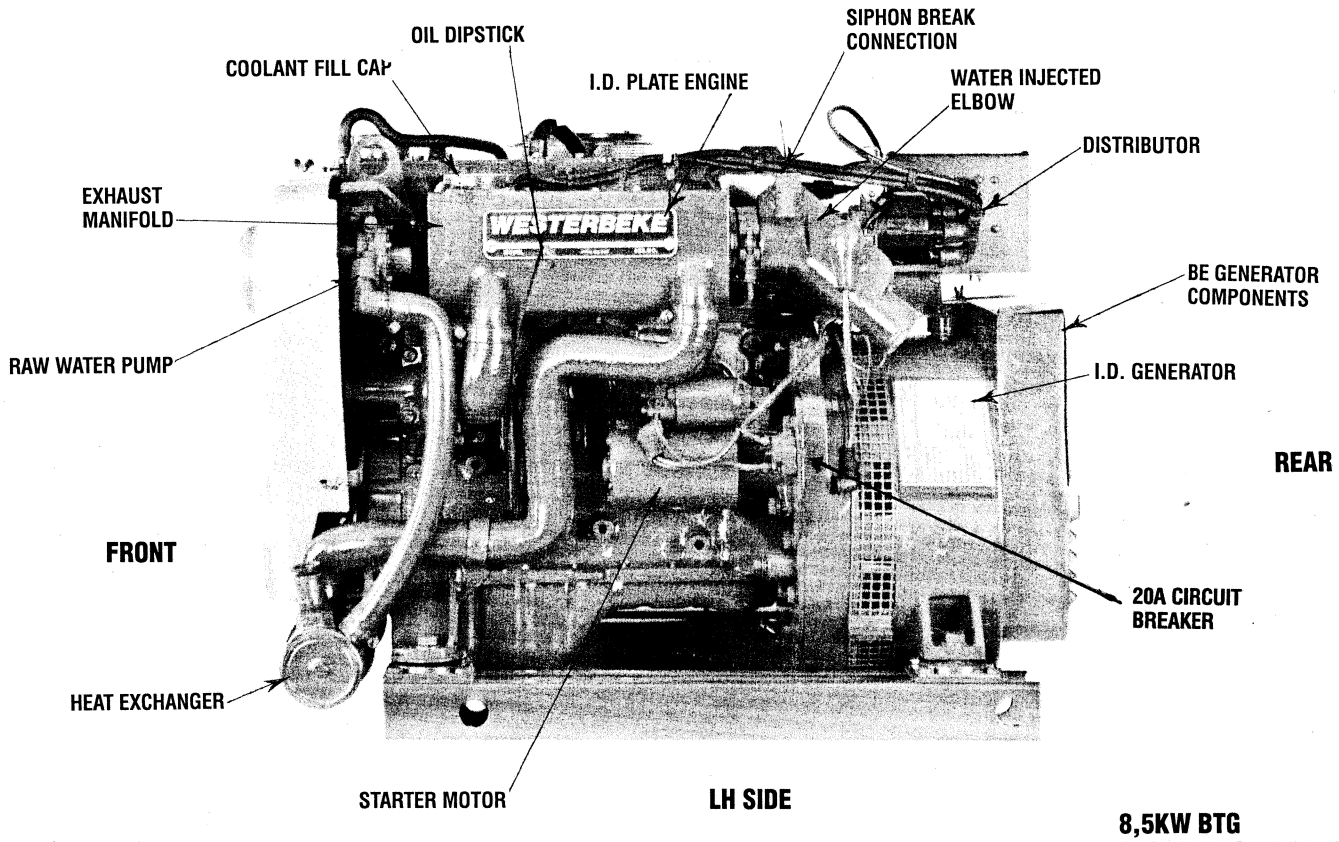
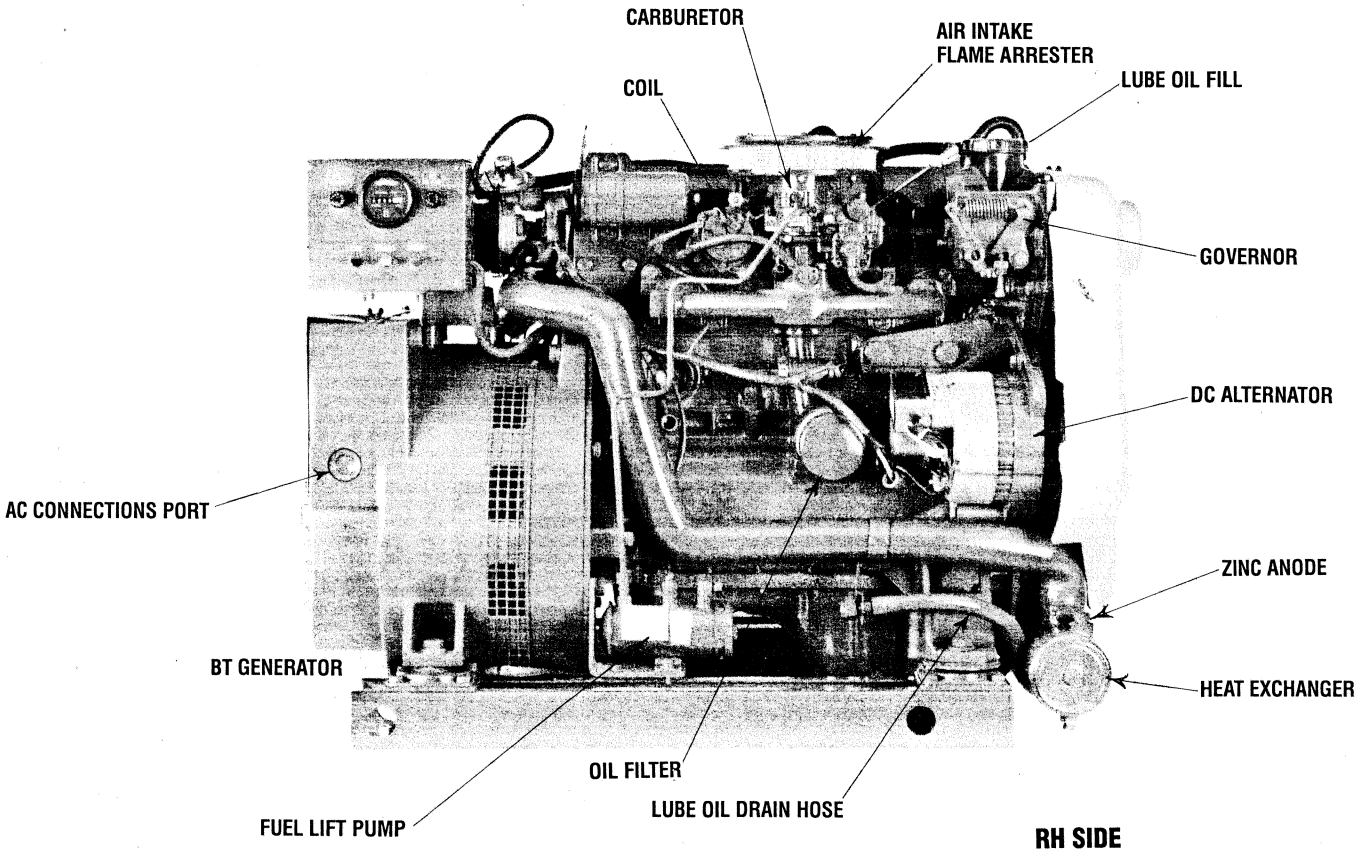


8,5KW BTG GASOLINE GENERATOR



INTRODUCTION

ORDERING PARTS

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

NOTES, CAUTIONS AND WARNINGS

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

NOTE: *An operating procedure essential to note.*

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

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

NOTE: *A carbon monoxide warning decal has been provided by WESTERBEKE. Affix this decal in a 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.

CARBON MONOXIDE DETECTOR

WESTERBEKE highly recommends mounting a carbon monoxide detector in the vessels **living and sleeping** quarters. **Carbon monoxide even in small amounts, can be deadly.**

The presence of carbon monoxide indicates a possible exhaust leak from the main engine or generator, it's exhaust system, from the exhaust discharge location on the vessel or from a neighboring vessel.

If the dectector signals the presence of carbon monoxide. Ventilate the area, move into a fresh air location and locate the source of the carbon monoxide and arrest it.

FUEL, ENGINE OIL AND ENGINE COOLANT

GASOLINE

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

Care Of The Fuel Supply

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

Purchase a well-known brand of fuel.

Install and regularly service a good, Coast Guard approved metal bowl type filter/water separator between the fuel tank and the engine.

ENGINE OIL

Use a heavy duty engine oil as called for in the Specifications Section of this manual. Change the engine oil and filter after the initial 50 hours of break-in operation. Then follow the oil and filter change intervals as specified in MAINTENANCE SCHEDULE in this manual.

Westerbeke Corporation does not approve or disapprove the use of synthetic oils. If synthetic oils are used, engine break-in must be performed using conventional oil. Oil change intervals must be as listed in the MAINTENANCE SCHEDULE section of this manual and not extended if synthetic oils are used.
NOTE: The information above supersedes all previous statements regarding synthetic oil.

ENGINE COOLANT

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

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

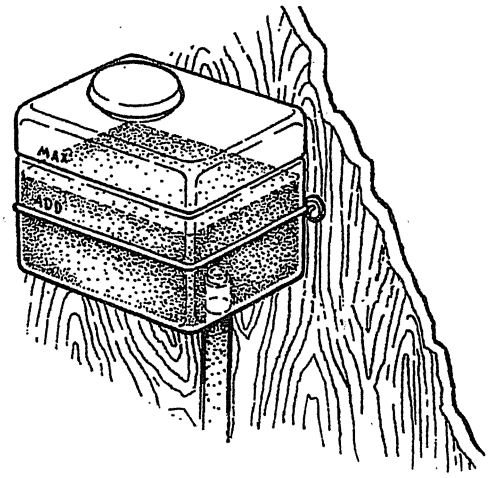
The water and antifreeze should be premixed before being poured into the cooling circuit.

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

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

COOLANT RECOVERY TANK

A coolant recovery tank kit is supplied with each generator. The purpose of this recovery tank is to allow for engine coolant expansion and contraction during engine operation, without the loss of coolant and without introducing air into the cooling system.



CONTROL PANELS

DESCRIPTION

The generator mounted control panel is equipped with an **ON** switch (black), a **START** switch(white) and a **STOP** switch (red).

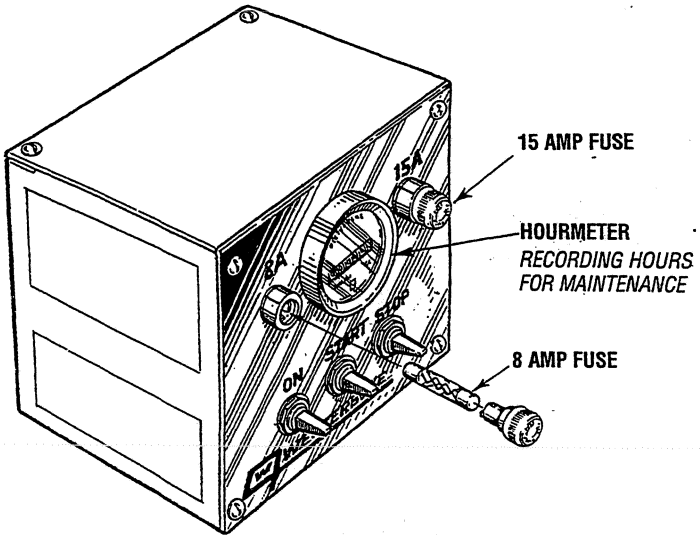
The *ON* switch provides power to the start circuit. This switch by-passes the protective oil pressure shutdown switch until the oil pressure reaches 5 - 10 psi.

The *START* switch energizes the start solenoid/starter which cranks the engine. This switch will **not** operate unless the **on** switch is depressed and held at the same time.

The *STOP* switch will turn off the engine/generator. This switch must be depressed until the stop sequence is complete.

The panel also has two fuses to protect the DC circuit:

- *A 15 amp slow bluw fuse protects the start circuit.*
- *An 8 amp fuse protects the engine operating circuit and any optional remote start/stop or instrument panel.*



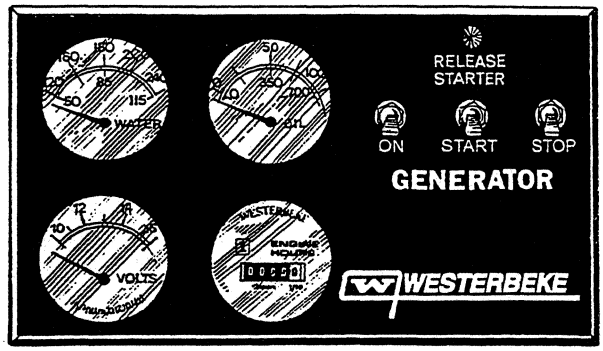
REMOTE START/STOP PANEL (OPTIONAL)

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

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

REMOTE INSTRUMENT PANEL (OPTIONAL)

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



REMOTE INSTRUMENT PANEL INSTALLATION

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

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

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

OPERATING INSTRUCTIONS

PRESTART INSPECTION

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

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

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

  Before subsequent operation of the generator, the engine's manifold should be topped off, and the coolant recovery tank may need to be filled to the MAX level.
- Check load leads for correct connections as specified in the wiring diagrams.
- Examine the air inlet and outlet for air flow obstructions.
- Be sure no other generator or utility power is connected to the load lines.
- Be sure that in power systems with a neutral line that the neutral is properly grounded (or ungrounded) as the system requires, and that generator neutral is properly connected to the load neutral. In single phase systems an incomplete or open neutral can supply the wrong line-to-neutral voltage on unbalanced loads.

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

STARTING THE GENERATOR

> ⚠ **WARNING:** ***Ventilate the generator compartment for a minimum of five minutes prior to starting. The ventilating blowers remove any explosive gasoline fumes from the generator compartment and bilges.***

1. Depress the **ON** switch and hold it down (5-15 seconds), this primes carburetor. Continue to depress **ON**.
2. Depress the **START** (white), when the generator starts, release the **START** switch. Continue to engage the **ON** switch a few seconds longer.

NOTE: *Keeping the ON switch depressed by-passes the oil pressure shutdown circuit allowing the oil pressure to rise enough to close the switch and maintain the ignition circuit*

3. Release the **ON** switch.

Once The engine is running apply a light load to the generator and allow the engine to warm up to operating temperature (130°-150° F/ 55°-56°C) before applying heavy loads.

If an optional instrument panel is installed, monitor the gauges for normal readings.

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

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

STOPPING THE GENERATOR

1. Remove the AC loads from the generator and allow the generator to run for an added 3 to 5 minutes (this stabilizes its operating temperature).
2. Depress the **STOP** (red) switch.
3. When the generator stops, release the **STOP** switch.

NOTE: *In an emergency, if the generator will not stop using the stop switch, remove the 8 amp fuse in the control panel.*

GENERATOR BREAK-IN PROCEDURE

DESCRIPTION

Although your engine has experienced a minimum of one hour of test operations at the factory to make sure accurate assembly procedures were followed and that the engine operated properly, a break-in time is required. The service life of your engine is dependent upon how the engine is operated and serviced during its initial hours of use.

Breaking-in a new engine basically involves seating the piston rings to the cylinder walls. Excessive oil consumption and smoky operation indicate that the cylinder walls are scored, which is caused by overloading the engine during the break-in period.

Your new engine requires approximately 50 hours of initial conditioning operation to break in each moving part in order to maximize the performance and service life of the engine. Perform this conditioning carefully, keeping in mind the following:

Start the engine according to the *STARTING PROCEDURE* section. Run the engine while checking that all systems (raw water pump, oil pressure, battery charging) are functioning.

reach its full rated speed are signs of an overload.

AFTER START-UP

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

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

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

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

GENERATOR ADJUSTMENTS

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

THE DAILY ROUTINE

CHECK LIST

Follow this checklist each day before starting your generator.

- Check that all generator circuit breakers (power panel) are in the off position before starting.
- Record the hourmeter reading in your log (engine hours relate to the maintenance schedule).
- Visually inspect the engine for fuel, oil, or water leaks.
- Check the oil level (dipstick).
- Check the coolant level in the coolant recovery tank.
- Check your fuel supply.
- Check the starting batteries (weekly).
- Check the drive belt for wear and proper tension (weekly).

CHECK WITH THE ENGINE RUNNING.

- Check for abnormal noise such as knocking, vibration and blow-back sounds.
- Confirm exhaust smoke:
  When the engine is cold – White Smoke.
  When the engine is warm – almost Smokeless.
  When the engine is overloaded – some Black Smoke.

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

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

ALARMS AND CIRCUIT BREAKER

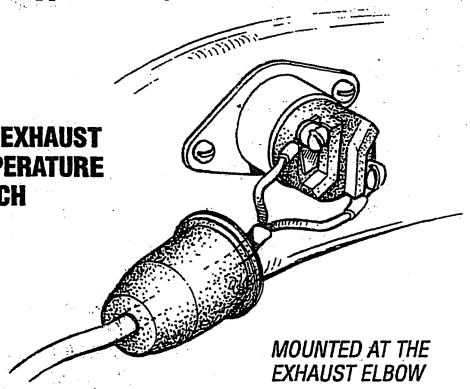
SAFETY SHUTDOWN SWITCHES

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

The following is a description of these automatic shutdown switches:

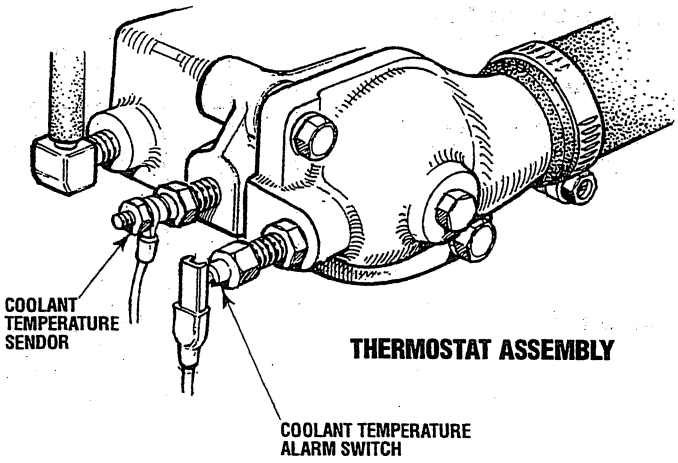
High Exhaust Temperature Switch

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



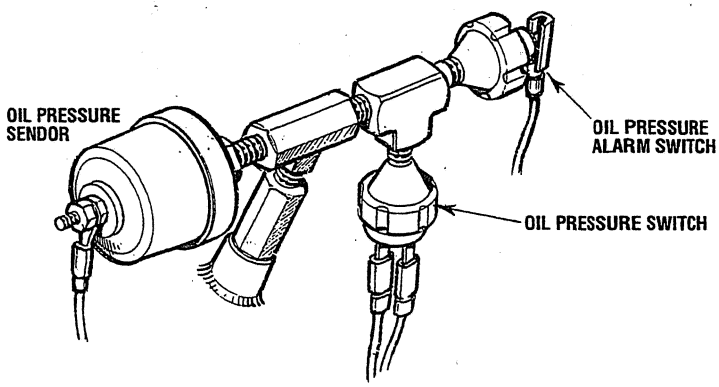
COOLANT TEMPERATURE SWITCH

A coolant temperature switch is located on the thermostat housing. This switch will activate a continuous alarm if the coolant's operating temperature reaches approximately 210°F (99°C).



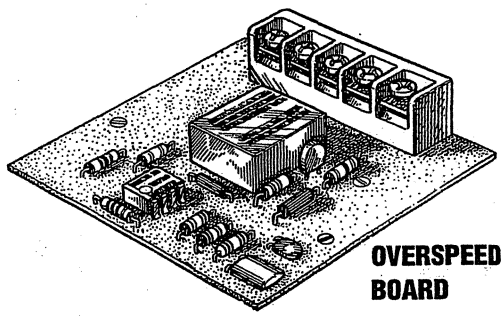
LOW OIL PRESSURE ALARM SWITCH

Allow oil pressure alarm switch is located off the engine's oil gallery. This switch's sensor monitors the engine's oil pressure. Should the engine's oil pressure fall to 5 -10 psi (0.4 - 0.7 kg/cm²), this switch will activate a pulsating alarm.



Engine Circuit Breaker

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



High RPM Shutdown Switch

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

NOTE: When troubleshooting a possible faulty switch. For test purposes to by-pass the switch. Move connection T4 onto T5.
DO NOT purposely by-pass a faulty switch so as to be able to operate the generator. This could create a potential safety hazard.

MAINTENANCE SCHEDULE

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

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

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
Fuel Supply	☐								Unleaded gasoline with octane rating of 89 or higher.
Fuel/Water Separator	☐								Check for water and dirt in fuel (drain/replace filter if necessary).
Engine Oil Level	☐								Oil level should indicate between FULL 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:** *Please 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.
Spark Plugs		☐		☐	☐	☐	☐	☐	Check gap; inspect for burning and corrosion.
Generator (if applicable)		☐	☐	☐	☐	☐	☐	☐	Check that AC connections are clean and secure with no chafing - see *GENERATOR INFORMATION* (if applicable) for addition information.
Fuel Filter (Lift Pump)		☐		☐	☐	☐	☐	☐	Inspect for fuel leaks. Check wire connections.
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 & filter change at 50 hrs., then change both every **100** hours.
Re-torque Cylinder Head		☐			☐		☐		retorque at 50 hrs., them every 500 hours.
***Adjust the Valve Clearances**		☐			☐		☐		Initial adjustment at 50 hrs., then every 500 hrs.
Air Screen (Flame Arrester)		☐							Clean at 50 hours, then every 100 hours.
Exhaust System		☐		☐		☐		☐	Initial check at 50 hrs., then every 250 hrs. Inspect for leaks. Check siphon brake operation. Check the exhaust elbow for carbon and/or corrosion buildup on inside passages; clean and replace as necessary. Check that all connections are tight.
Engine Hoses			☐	☐	☐	☐	☐	☐	Hose should be hard & tight. Replace if soft or spongy. Check and tighten all hose clamps.
Inlet Fuel Filter		☐		☐	☐	☐	☐	☐	Replace 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							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
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.
Raw Water Pump				☐		☐		☐	Remove the pump cover and inspect the impeller for wear, replace if needed. Also replace the gasket. Lubricate both when re-assembling.
Coolant System					☐		☐		Drain, flush, and refill cooling system with appropriate antifreeze mix.
***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 Clearance**					☐			☐	Incorrect valve clearance will result in poor engine performance. Check compression pressure and timing and adjust valve clearances.
***Exhaust Elbow**					☐				Test exhaust elbow for casting integrity. Replace if casting is corroded or deteriorated. **WARNING:** *A defective exhaust elbow can cause carbon monoxide leakage.*
Carburetor Filter Screen		☐			☐	☐	☐	☐	Clean at first 50 hours and every 250 hours.

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

FUEL SYSTEM

GASOLINE

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

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

GASOLINE/WATER SEPARATOR AND FILTER

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

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

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

GASOLINE/WATER SEPERATOR & FILTER
[TYPICAL]

REPLACEABLE FILTERS

CARBURETOR

The carburetor is a single barrel downdraft type with an electric by metalic choke. Refer to *CARBURETOR ADJUSTMENTS* for more information.

FUEL LIFT PUMP

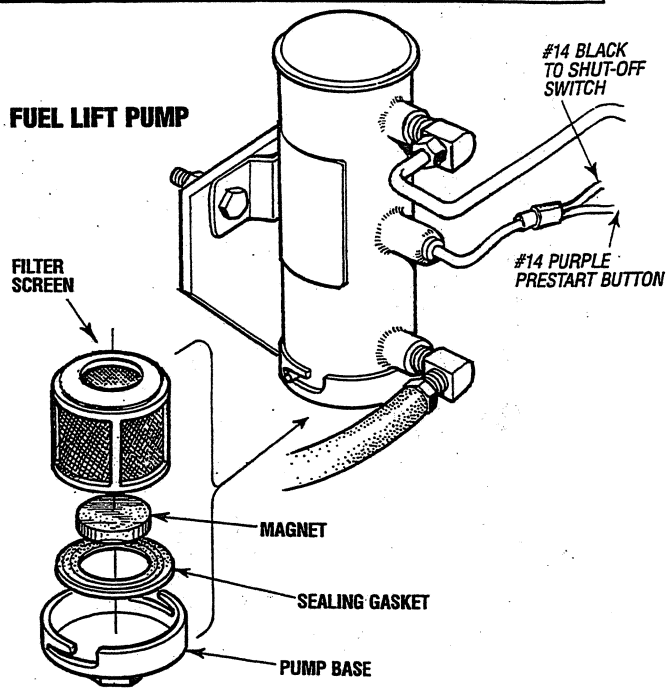
Periodically check the fuel connections to and out of the pump and make sure that no leakage is present and that the fittings are tight and secure. The DC ground connection at one of the pump's mounting bolts should be clean and well secured by the mounting bolt to ensure proper pump operation.

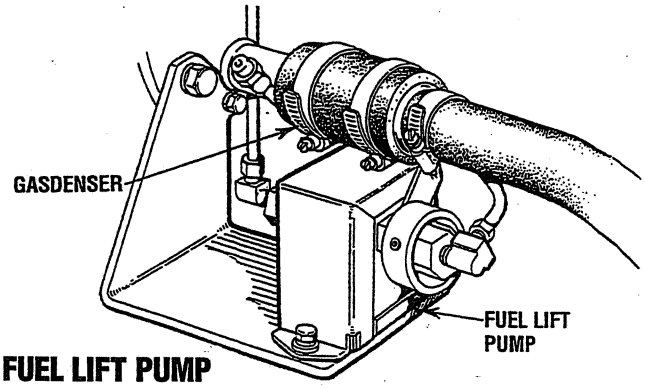
The start sequence energizes the fuel lift pump as the piston in the pump operates, it creates an audible ticking sound. If no ticking is heard, check for 12 volts at the pump connections. Also check that the ground wire is properly connected to ground.

NOTE: At initial start-up or when re-commissioning the engine, it maybe necessary to prime the engine's fuel system. To do this depress and hold the ON switch. This will activate the engine's electric fuel pump which will pump fuel through the engine's fuel system and fill the carburetor's fuel bowl. Do this for 4-6 seconds then proceed to start the engine.

The pump filter should be cleaned every 250 operating hours, also clean off the magnet [the magnet removes metal particles from the fuel]. The pump base can be removed by twisting the base hex nut with a wrench. When reassembling, replace the sealing gasket.

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





FUEL LIFT PUMP

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

COOLING SYSTEM

DESCRIPTION

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

FRESH WATER COOLING CIRCUIT

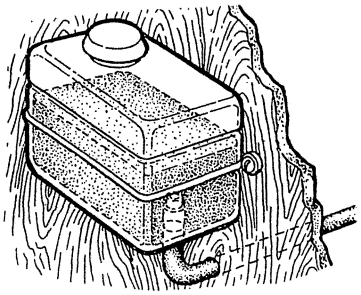
NOTE: *Refer to the ENGINE COOLANT section for the recommended antifreeze and water mixture to be used as the fresh water coolant.*

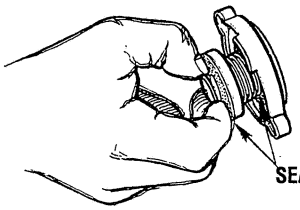
Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the manifold, to the heat exchanger where it is cooled, and returned to the engine block via the suction side of the circulating pump.When the engine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

Coolant Recovery Tank

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

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





CHANGING COOLANT

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

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

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

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

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

Refilling the Coolant

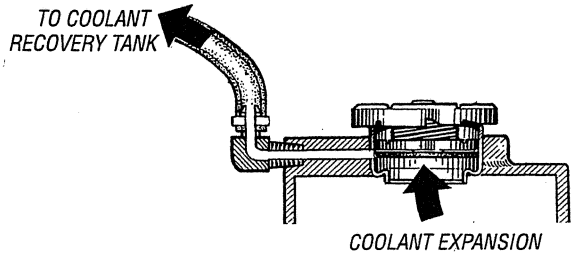
After replacing the engine block drain plug, close the heat exchanger's coolant petcock. Then run the engine at idle and slowly pour clean, premixed coolant into the manifold.

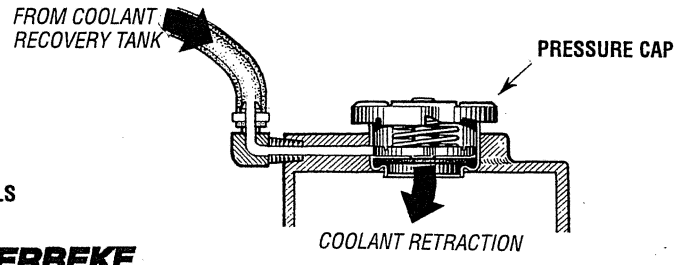
NOTE: *Open the air-bleed petcock on the heat exchanger. When a steady flow of coolant appears at the petcock, close the petcock and fill the system until the manifold remains full.*

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

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

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





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).

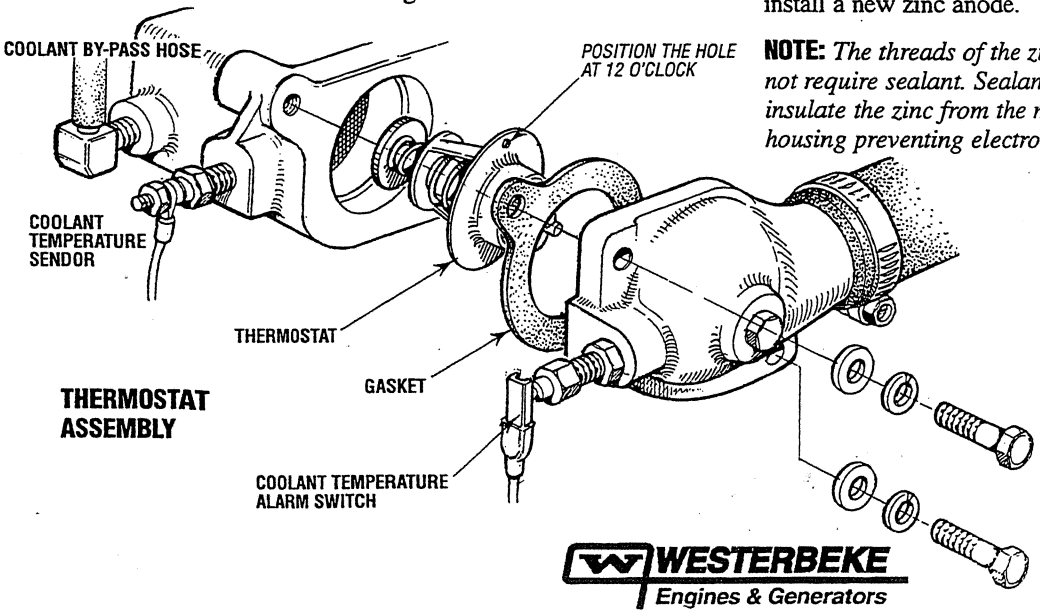
NOTE: *Operating in silty and/or tropical waters may require that a heat exchanger cleaning be performed more often then every 1000 hours.*

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 over-heating). As the engine warms up, the thermostat gradually opens. The thermostat is accessible and can be checked, cleaned, or replaced easily. Carry a spare thermostat and gasket.

Replacing the Thermostat

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

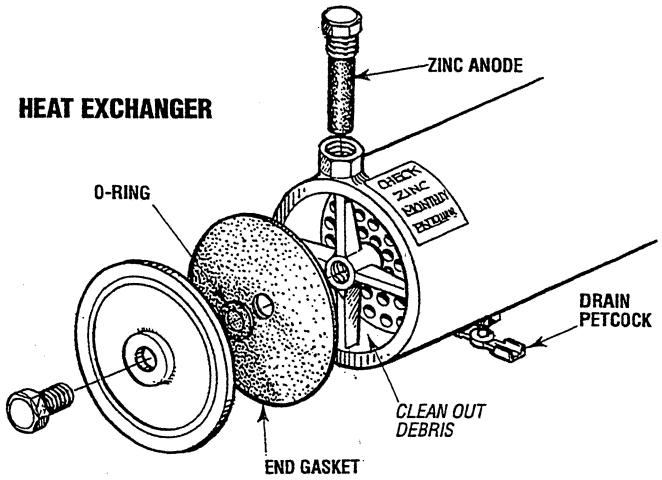


THERMOSTAT ASSEMBLY

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.

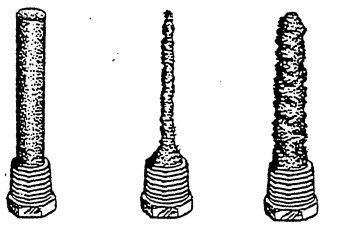
NOTE: *Electrolysis is the result of each particular installation and vessel location, not that of the engine.*



HEAT EXCHANGER

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

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



ZINC ANODES

RAW WATER INTAKE STRAINER

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

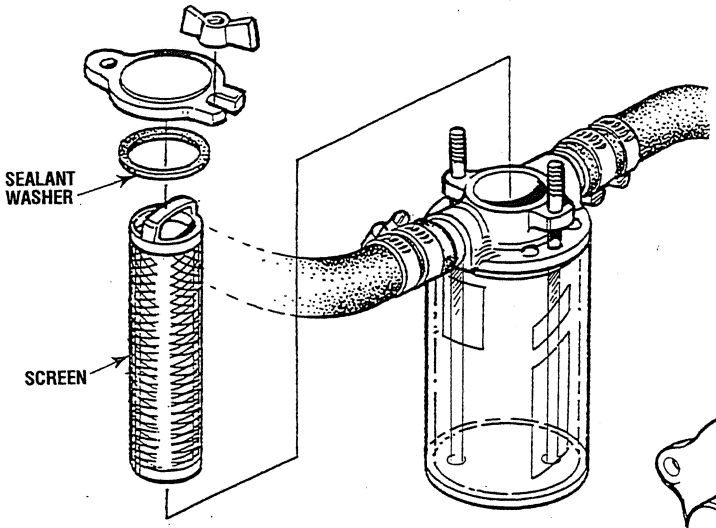
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should be clear.

Perform the following maintenance after every 100 hours of operation:

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

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

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



RAW WATER INTAKE STRAINER TYPICAL [OWNER INSTALLED]

RAW WATER PUMP

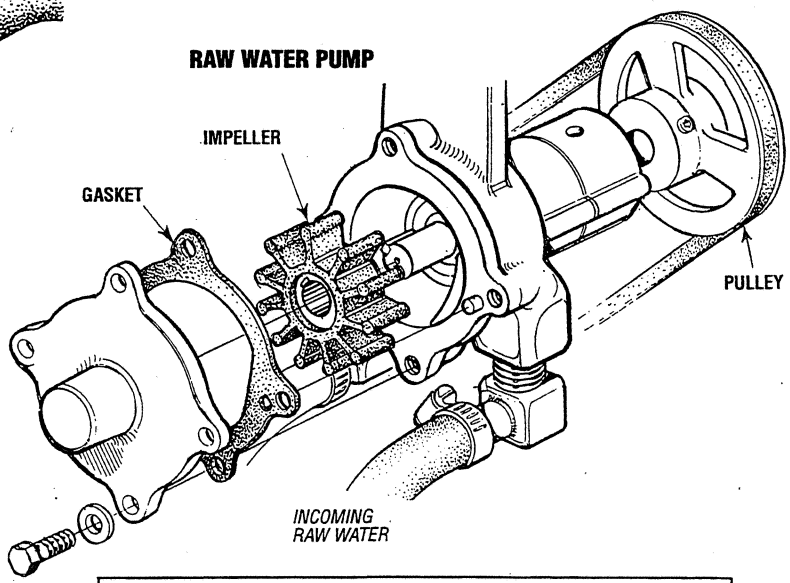
The raw water pump is a self-priming, rotary pump with a non-ferrous housing and a Neoprene impeller. The impeller has flexible blades which wipe against a curved cam plate within the impeller housing, producing the pumping action. ***On no account should this pump be run dry.*** There should always 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 gasket. Move the blades to conform to the curved cam plate and push the impeller into the pump's housing. When assembling, apply a thin coating of lubricant to the impeller and gasket. **Open the raw water intake valve.**

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

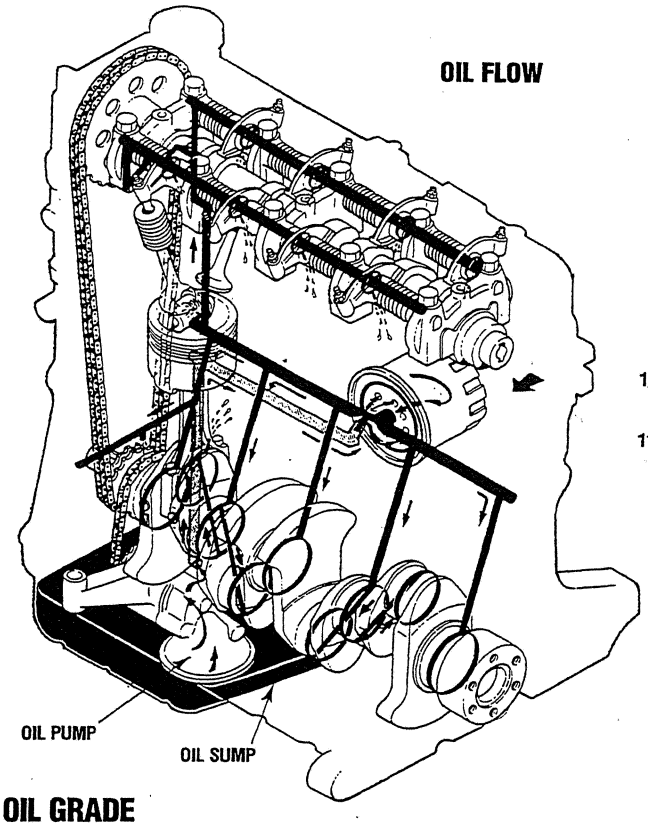


⚠ CAUTION: ***If any of the vanes have broken off the impeller, they must be located to prevent blockage in the cooling circuit. They often can be found in the heat exchanger***

ENGINE LUBRICATING OIL

DESCRIPTION

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



OIL GRADE

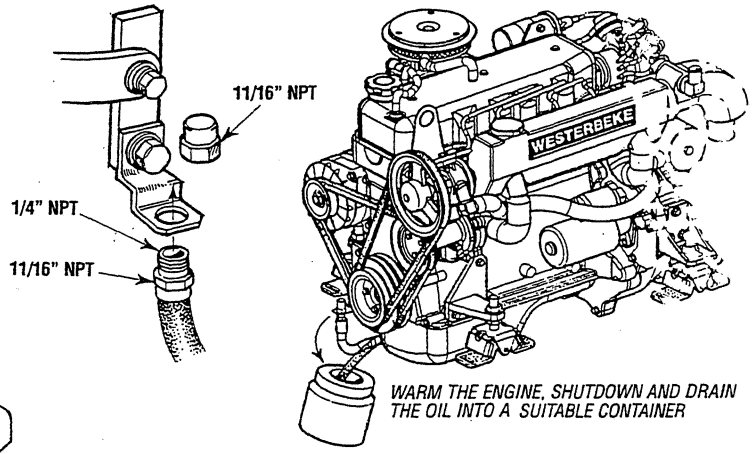
Use a heavy duty engine oil as called for in the Specifications Section of this manual. Change the engine oil and filter after the initial 50 hours of break-in operation. Then follow the oil and filter change intervals as specified in MAINTENANCE SCHEDULE in this manual.

Westerbeke Corporation does not approve or disapprove the use of synthetic oils. If synthetic oils are used, engine break-in must be performed using conventional oil. Oil change intervals must be as listed in the MAINTENANCE SCHEDULE section of this manual and not extended if synthetic oils are used.
NOTE: The information above supersedes all previous statements regarding synthetic oil.

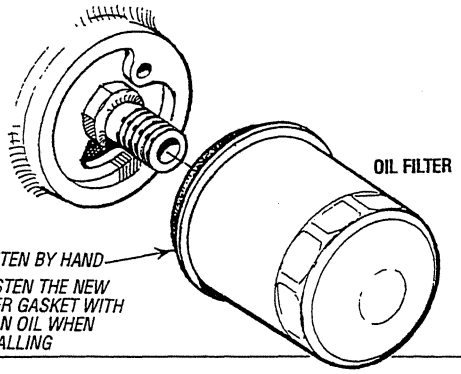
CHANGING THE ENGINE OIL

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

Always observe the old oil as it is removed. A yellow/gray emulsion indicates the presence of water in the oil. Although this condition is rare, it does require prompt attention to prevent serious damage. Call a competent mechanic if water is present in the oil. Raw water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning through the raw water cooling circuit into the exhaust, filling into the engine.



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



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

REMOTE OIL FILTER (OPTIONAL)

PN# 032149

INSTALLATION

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

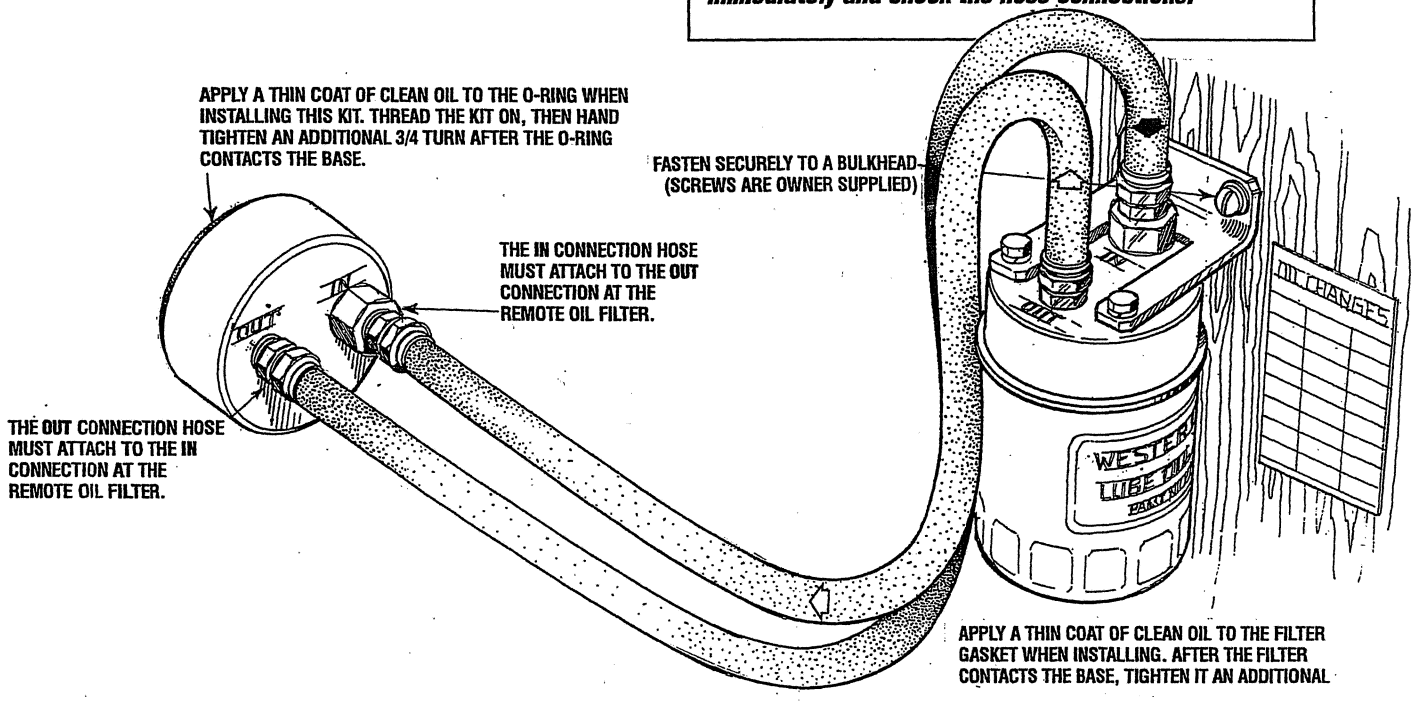
NOTE: *Refer to ENGINE OIL CHANGE in this manual for instructions on removing the oil filter.*

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

Contact your WESTERBEKE dealer for more information.

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

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



CARBURETOR ADJUSTMENTS

CARBURETOR

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

The electric choke uses a 12-volt heating element which opens the choke automatically once the engine starts and remains running. Some hunting will occur when the generator is started, is on choke, and is running without a load on the generator. (The choke is factory set).

Air Screen/Flame Arrester

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

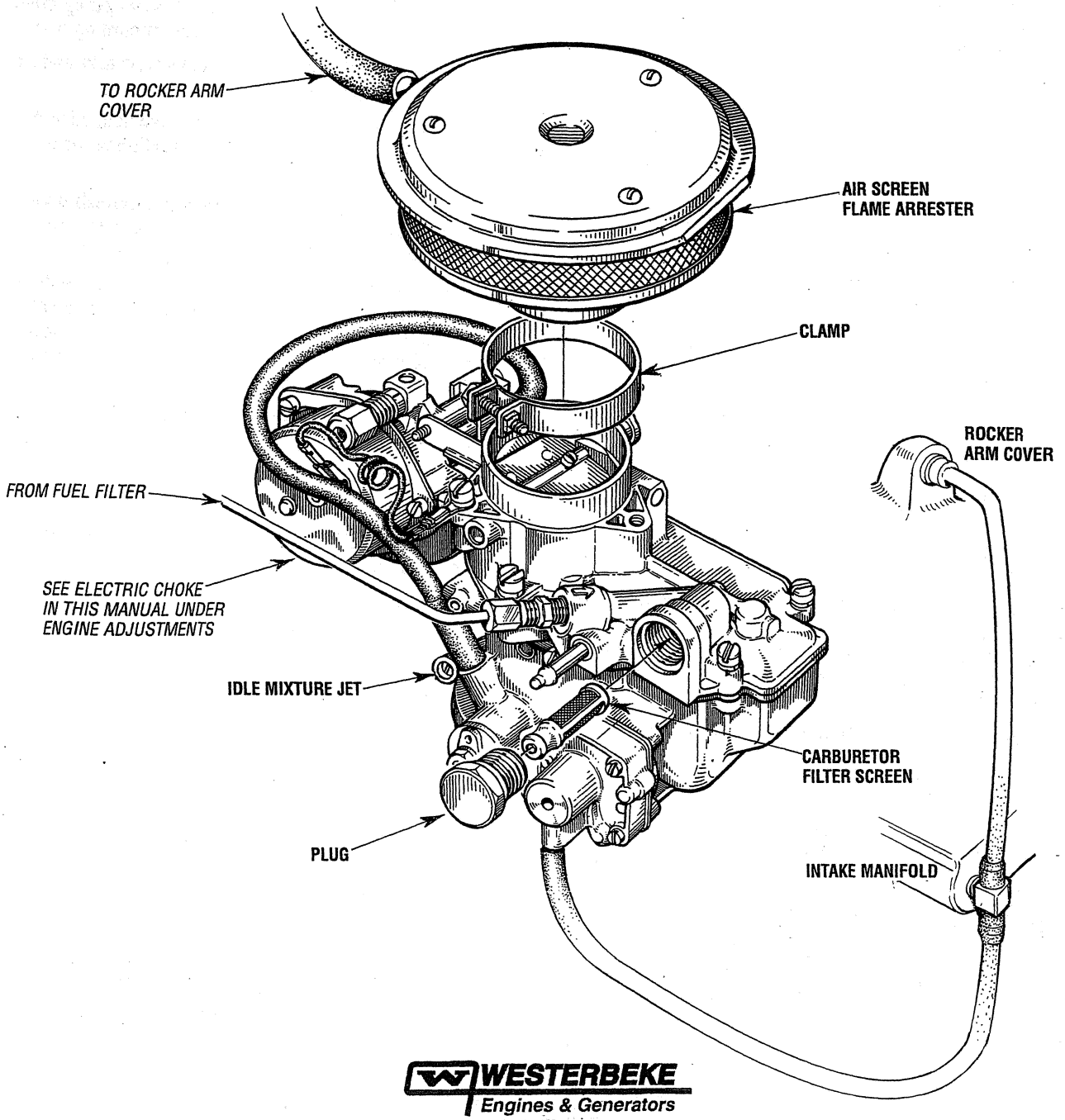
Carburetor Filter Screen

Clean this filter element after the first 50 hours of operation, then clean and inspect every 250 operating hours. Replace the screen if necessary. Tighten the plug and make certain there are no leaks.

Idle Mixture Jet

Ajustment is performed with the generator not operating. Screw the jet in slowly until you feel it seat. Then back it out ½ to 1 turn.

Note: *An idle mixture jet adjusted too far off its seat can induce a sooty exhaust discharge at engine start-up and shut-down.*



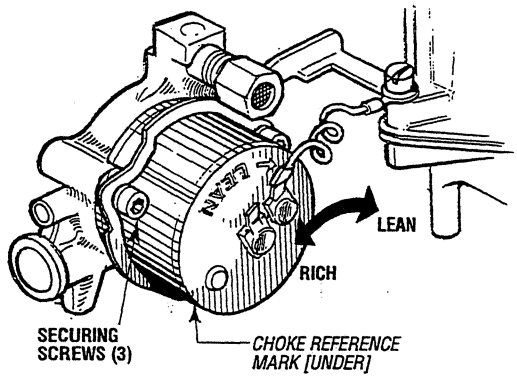
ENGINE ADJUSTMENTS

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

ELECTRIC CHOKE

The electric choke uses a 12 volt heating element which opens the choke automatically when the engine starts.

The choke is adjusted with the engine off and cooled. Adjust the choke by loosening the three cover-securing screws and rotating the cover clockwise to **LEAN** the choke and counterclockwise to **RICH** the choke. The choke is initially set at the factory for an average of 70°F (21°C) room temperature. The choke may need readjustment at engine commissioning for the ambient temperature of the area the engine is operating in. The choke reference mark is located on the underside of the choke cover.

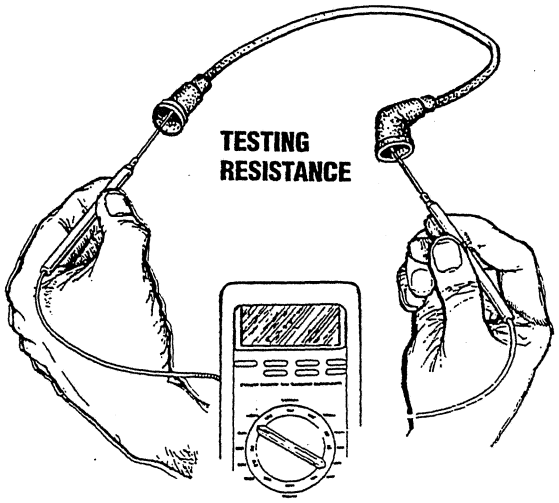


HIGH TENSION CORDS (IGNITION WIRES)

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

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

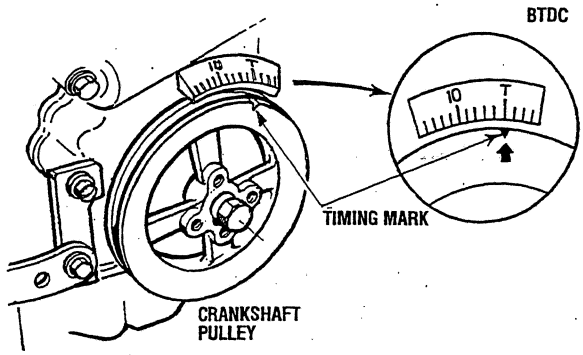
THE RESISTANCE VALUE IS 410 OHM PER INCH.



IGNITION TIMING

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

   Each timing mark represents 2°.



2. Start the engine and warm the engine to its normal operating temperature.
3. Using the timing light, align the timing groove in the front crankshaft pulley with the proper timing mark on the ignition timing scale embossed on the engine's front cover. Do this by loosening and slowly rotating the distributor body. Refer to the timing specifications:

TIMING SPECIFICATIONS

8.5Kw	**13° BTDC ± 1° at 1800 rpm**
12.5Kw	**13° BTDC ± 1° at 1800 rpm**
15.0Kw	**18° BTDC ± 1° at 1800 rpm**

ENGINE COMPRESSION TEST

If it becomes necessary to check the engines cylinder compression, warm the engine and shut it down.

Remove the spark plugs and install a compression adapter (screws into a plug hole) with a gauge.

Crank the engine (close off the raw water) and unplug the ignition coil. Allow the compression gauge to reach a maximum reading and record.

Measure the compression pressure for each cylinder. Ensure that the pressure differential for each cylinder is within the specifications.

COMPRESSION PRESSURE AT 300 RPM	**170 LB/IN² [12.0 Kg-cm²]**
LIMIT AT 300 RPM	**128 LB/IN² [9.0 Kg-cm²]**
LIMIT OF DIFFERENCE BETWEEN CYLINDERS	**2.8 LB/IN² [2.0 Kg-cm²]**

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 the test. If the oil causes an increase of pressure, the piston ring and/or cylinder wall may be worn or damaged. If the added oil does not increase compression pressure suspect poor valve contact, valve seizure, or valve wear. Reinstall the plugs, ignition wires, and coil. **Open the raw water thru seacock.**

ENGINE ADJUSTMENTS

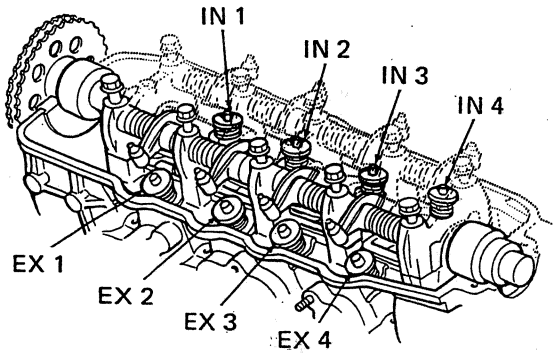
NOTE: *WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.*

VALVE CLEARANCE ADJUSTMENT

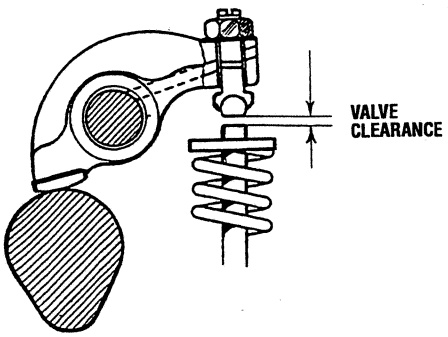
After the initial break-in period (approximately 50 hours), the valve clearances should be adjusted.

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. Position the No.1 piston at Top Dead Center (TDC) of its compression stroke and adjust the #1 and #3 exhaust valves. While facing the front of the engine, rotate the crankshaft 360° clockwise and adjust the remaining valves.

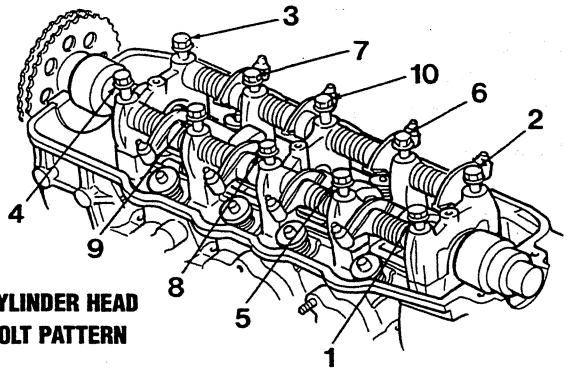


CLEARANCES:	**VALVE SIDE**	**INTAKE**	**0.010 in (0.25mm)**
		EXHAUST	**.0012 in (0.30mm)**
	CAM SIDE	**INTAKE**	**0.007 in (0.18mm)**
		EXHAUST	**0.009 in (0.23mm)**



VALVE CLEARANCE

3. Replace the rocker cover and rocker cover gasket.
   ROCKER COVER TIGHTENING TORQUE: 2.6–4.0 Ft-lb (4.0–6.0 Kg-m)

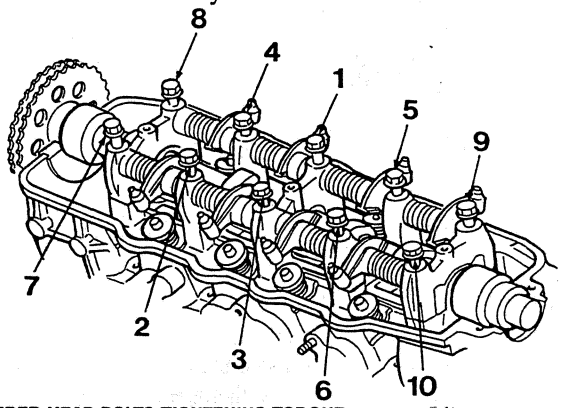


CYLINDER HEAD BOLT PATTERN

TORQUING THE CYLINDER HEAD BOLTS

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

Loosen the cylinder head bolts one half turn in the order shown. (The engine should be cold). Then tighten the bolts in the sequence shown below. One bolt at a time. Tighten the rocker cover stud securely.



CYLINDER HEAD BOLTS TIGHTENING TORQUE:
56–59 Ft-lb (7.8–8.2 Kg-m)

OIL PRESSURE

The engine's oil pressure, during operation, is indicated by the oil pressure gauge on the instrument panel. During normal operation, the oil pressure will range between 40 and 60 psi (2.8 and 4.2 kg/cm²).

NOTE: *A newly started, cold engine can have an oil pressure reading up to 60 psi (4.2 kg/cm²). A warmed engine can have an oil pressure reading as low as 35 psi (2.5 kg/cm²). These readings will vary depending upon the temperature of the engine and the rpms.*

TESTING OIL PRESSURE

To test the oil pressure, remove the oil pressure sender, then install a mechanical oil pressure gauge in it's place. After warming up the engine, set the engine speed at 1800 rpm and read the oil pressure gauge.

Oil Pressure **35.0 lb/in² (3.8 kg/cm²) or more at 1800 rpm.**
Sender and Switch Torgue **9 - 13 ft-lb (1.2 - 1.8 m - kg).**

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.

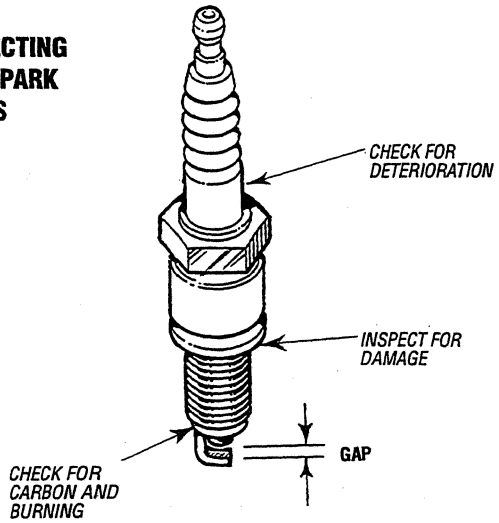
> ⚠ **WARNING:** ***Do not remove the spark plugs while the engine is hot. Allow the engine to cool before removing them.***

SPARK PLUG GAP: 0.031 – ± 0.0002 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



DRIVE BELT ADJUSTMENT

The drive belts must be properly tensioned. Excessive drive belt tension can cause rapid wear of the belts and reduce the service life of the bearing and the alternator, raw water pump, and engine coolant pump. A slack belt or the presence of oil on the belt can cause belt slipping, resulting in high operating temperatures and the failure of the same components.

1. To adjust the alternator and the engine coolant belts, loosen the alternator mounting bolts and pivot the alternator as needed. Retighten the bolts.
2. To adjust the raw water pump belt, loosen the mounting bolts and slide the pump up and down as needed. Retighten the bolts.

NOTE: *When the belts are loose, inspect for wear, cracks and frayed edges, and replace if necessary.*

3. 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.
4. Operate the engine for about 5 minutes, then shut down the engine and recheck the belts tension.

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

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

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*

ENGINE SPEED (HERTZ) ADJUSTMENT

Governor

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

Governor Adjustments

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

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

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

1. ***Increase/Decrease Speed Adjustment.*** This adjusting bolt sets the no-load speed of the engine. The linkage between the governor and the throttle lever should be adjusted to hold the throttle just slightly closed; about the width of the ball joint at the linkage arms end towards the closed position (when the engine is not running). Make sure this linkage moves freely and that the ball joint connectors are properly lubricated. Use graphite lube for this purpose. Disconnect the ball joint and apply graphite lube to the inside of the joint.
2. ***Hunting/Regulation Adjustment.*** If the variation in engine speed between no-load and full-load is too great, adjust this eye bolt to draw the spring closer to the lever hub. The increase/decrease speed bolt may need to be adjusted as well.

   If the governor surges under load, adjust this eye bolt to move the spring away from the lever hub (check speed adjustment).
3. ***Bumper Screw Adjustment.*** This screw is used to remove a no-load surge ONLY. ***NEVER*** turn the bumper screw into the governor so far that it increases the no-load speed.

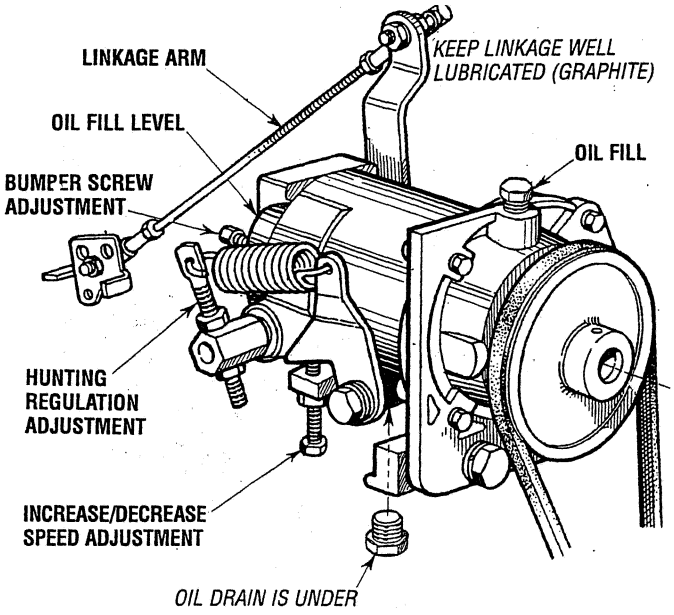
Governor Maintenance

1. Periodically lubricate the linkage arm attaching points at the governor arm and throttle lever. Use a graphite lubricant or equivalent.

   NOTE: *Free movement of this linkage arm is important for proper governor/throttle operation.*
2. Governor oil capacity – 3 ounces 10/30 engine oil.

   NOTE: *Do not overfill the governor.*
3. Change the governor oil every 250 hours of operation.

   To change the oil, remove the governor from the engine, remove the oil fill and the fill level plug, and drain all the oil. Reinstall on the engine and fill with 3 ounces of 10/30 engine oil. Replace the plugs.
4. Periodically adjust the governor belt tension (see *DRIVE BELTS ADJUSTMENT*). Since belts stretch slightly, this stretching will, to some degree, affect the govenor's action.



NOTE: Synthetic oil is recommended for use in the governor.

ALTERNATOR TESTING

DESCRIPTION

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

TROUBLESHOOTING

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

This troubleshooting section is to determine if a problem exists with the charging circuit or with the alternator. If it is determined that the alternator or voltage regulator is bad, it is best to have a qualified technician check it out.

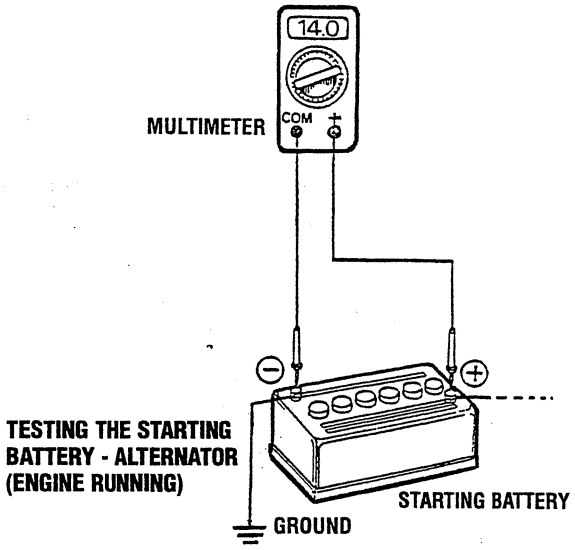
The alternator charging circuit charges the starting battery and the service battery. An isolator with a diode, a solenoid, or a battery selector switch is usually mounted in the circuit to isolate the batteries so the service battery is not discharged along with the service battery. If the alternator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

Testing the Alternator

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

> ⚠ **WARNING:** ***MULTIMETERS AND DC CIRCUITS: DC and AC circuits are often mixed together in marine applications. Always disconnect shore power cords, isolate DC and AC converters and shut down generators before performing DC testing. No AC tests should be made without proper knowledge of AC circuits.***

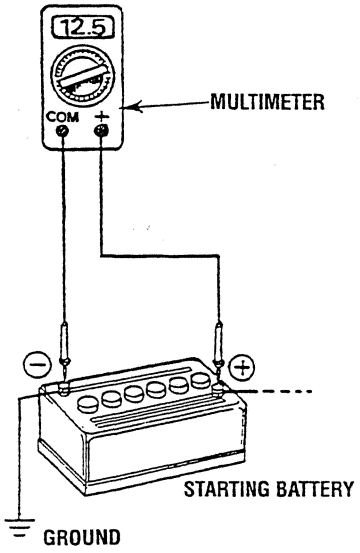
1. **Start the Engine.**
2. After a few minutes of running measure the starting battery voltage at the battery terminals using a multi-meter set on DC volts.
   The voltage should be increasing toward 14 volts. If it is, **the alternator is working**. Turn to Step 4 .



3. If the starting battery voltage remains around 12 volts after the engine is started and run for a few minutes, a problem exists with the alternator or the charging circuit.
   a. Turn off the engine. Inspect all wiring and connections. Ensure that the battery terminals and the engine ground connections are tight and clean.

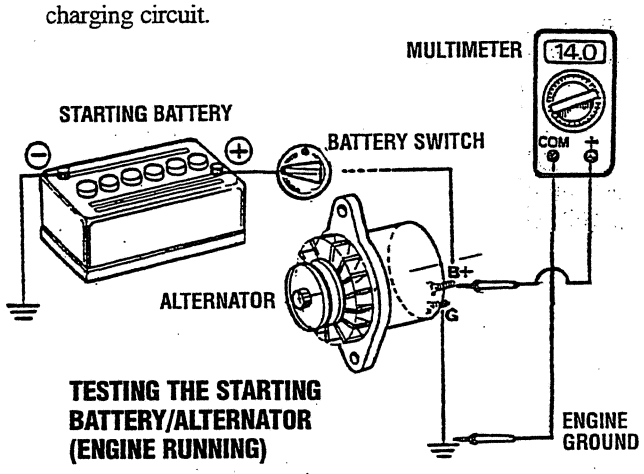
> ⚠ **CAUTION:** ***To avoid damage to the battery charging circuit, never shut off the engine battery switch when the engine is running!***

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



TESTING THE BATTERY VOLTAGE ENGINE NOT RUNNING

7. Now check the voltage between the alternator output terminal (B+) and ground. If the circuit is good, the voltage at the alternator will be the same as the battery, or if an isolator is in the circuit the alternator voltage will be .5 - 1.0 volts lower. If neither of the above is true, a problem exists in the circuit between the alternator and the battery. Check all the connections — look for an opening in the charging circuit.



TESTING THE STARTING BATTERY/ALTERNATOR (ENGINE RUNNING)

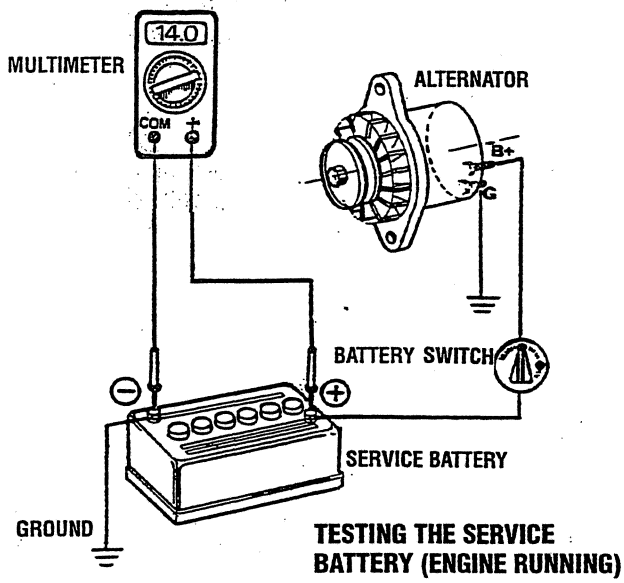
8. Start the engine again. Check the voltage between the alternator output and ground.

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

   NOTE: *Before removing the alternator for repair, use a voltmeter to ensure that 12 volts DC excitation is present at the EXC terminal if the previous test showed only battery voltage at the B output terminal. If 12 volts is not present at the EXC terminal, trace the wiring and look for breaks and poor connections.*

Checking the Service Battery

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



TESTING THE SERVICE BATTERY (ENGINE RUNNING)

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

12 VOLT DC CONTROL CIRCUIT

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

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

BATTERY

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

Battery Care

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

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

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

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. Low oil level in sump. 5. Faulty fuel pump.
Engine starts, runs but does not come up to speed.	1. Governor out of adjustment. 2. Governor linkage binding. 3. Faulty fuel pump. 4. Restricted fuel supply. 5. Throttle plate binding. 6. AC generator issues. 7. Air intake restricted. 8. Exhaust restricted. 9. 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. Governor needs adjustment. 2. Faulty governor. 3. Faulty fuel pump. 4. Generator overloaded. 5. 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.

ENGINE TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE
Low oil pressure.	1. Low oil level. 2. Wrong SAE type oil in the engine. 3. Faulty or wrong type oil filter. 4. Relief valve is stuck. 5. Faulty oil pump. 6. Faulty engine bearings. 7. Faulty oil filter.
High oil pressure.	1. Dirty oil or wrong SAE type oil in the engine. 2. Relief valve is stuck.
No DC charge to the starting battery.	1. DC alternator connections. 2. Faulty DC alternator.
Blue exhaust smoke discharged from the engine.	1. Lube oil is diluted. 2. High lube oil level. 3. Crankcase breather hose is clogged. 4. Valves are worn or adjusted incorrectly. 5. Piston rings are worn or unseated.Black exhaust smoke

PROBLEM	PROBABLE CAUSE
Black exhaust smoke discharged from the engine.	1. Dirty flame arrester. 2. Idle mixture jet too rich. 3. Valves are worn or incorrectly adjusted. 4. Piston rings are worn or unseated.
Poor performance at generator speed.	1. Contaminates in fuel system. 2. Faulty fuel pump/contaminated.

LAY-UP & RECOMMISSIONING

General

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

The procedures which follow will allow you to perform your own lay-up and recommissioning, or will serve as a checklist if others do the procedures.

These procedures should provide protection for your engine/generator during a lay-up and also help familiarize you with its maintenance needs.

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

Propeller Shaft Coupling [*Propulsion Engine*]

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

Fresh Water Cooling Circuit

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

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

Lubrication System

With the engine warm, drain all the engine oil from the oil sump. Remove and replace the oil filter and fill the sump with new oil. Use the correct grade of oil. Refer to the *ENGINE LUBRICATING OIL* pages in this manual for "engine oil change".

Run the engine and check for proper oil pressure and make sure there are no leaks.

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

Fuel System [*Gasoline*]

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

Fuel System [*Diesel*]

Top off your fuel tanks with No.2 diesel fuel. Fuel additives such as *BIOBOR* and *STABIL* should be added at this time to control algae and condition the fuel. Care should be taken that the additives used are compatible with the primary fuel filter/water seperator used in the system. Change the element in your primary fuel filter/water seperator, if the fuel system has one, and clean the seperator sediment bowl.

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

Raw Water Cooling Circuit

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

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

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

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

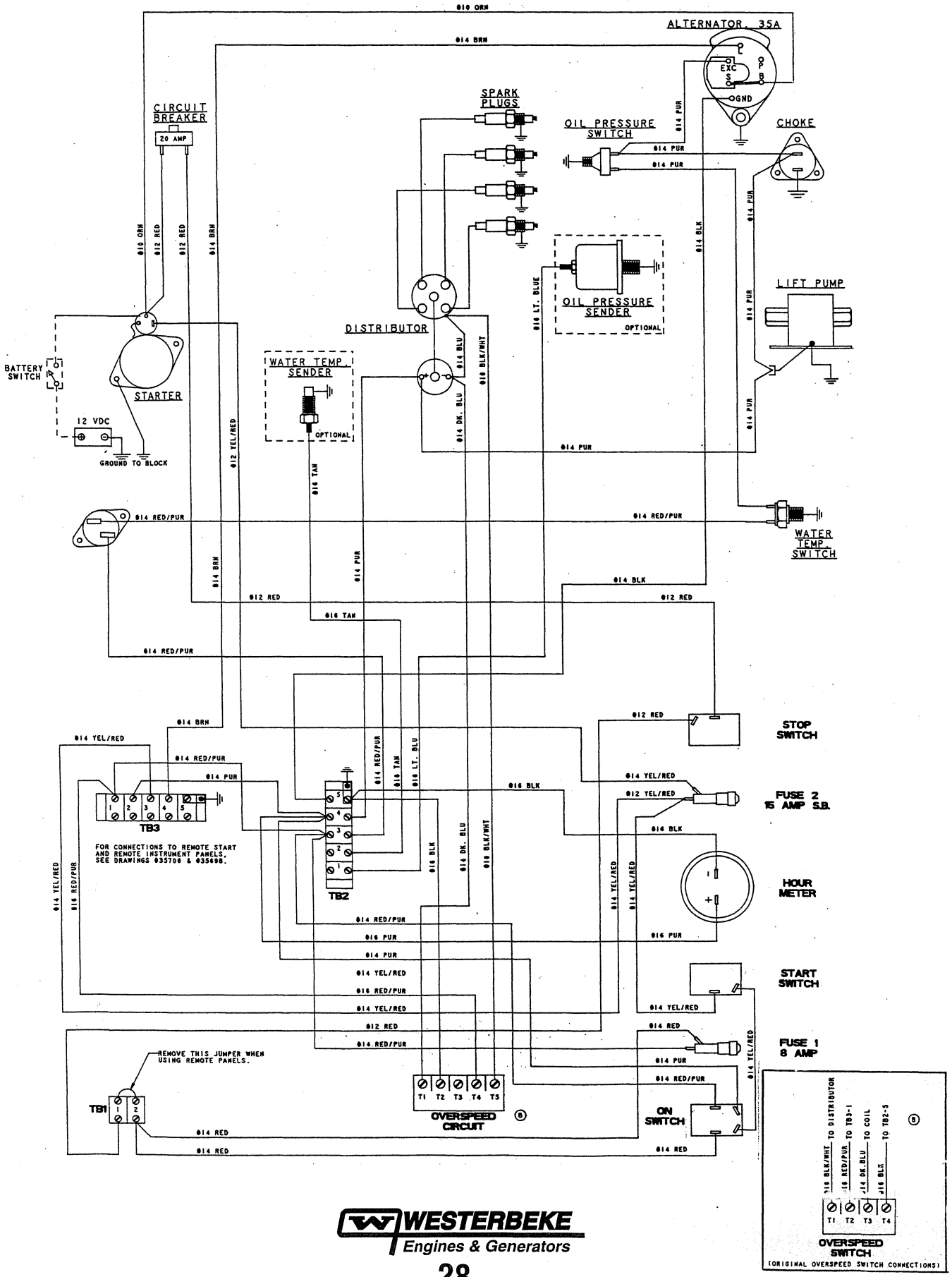
Intake Manifold and Thru-Hull Exhaust

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 visable at recommissioning, and an attempt is made to start the engine, you may need assistance of the servicing dealer). Make a note to remove the cloth prior to start-up. The thru-hull exhaust port can be blocked in the same manner.

WIRING DIAGRAM

DC WIRING DIAGRAM #37190

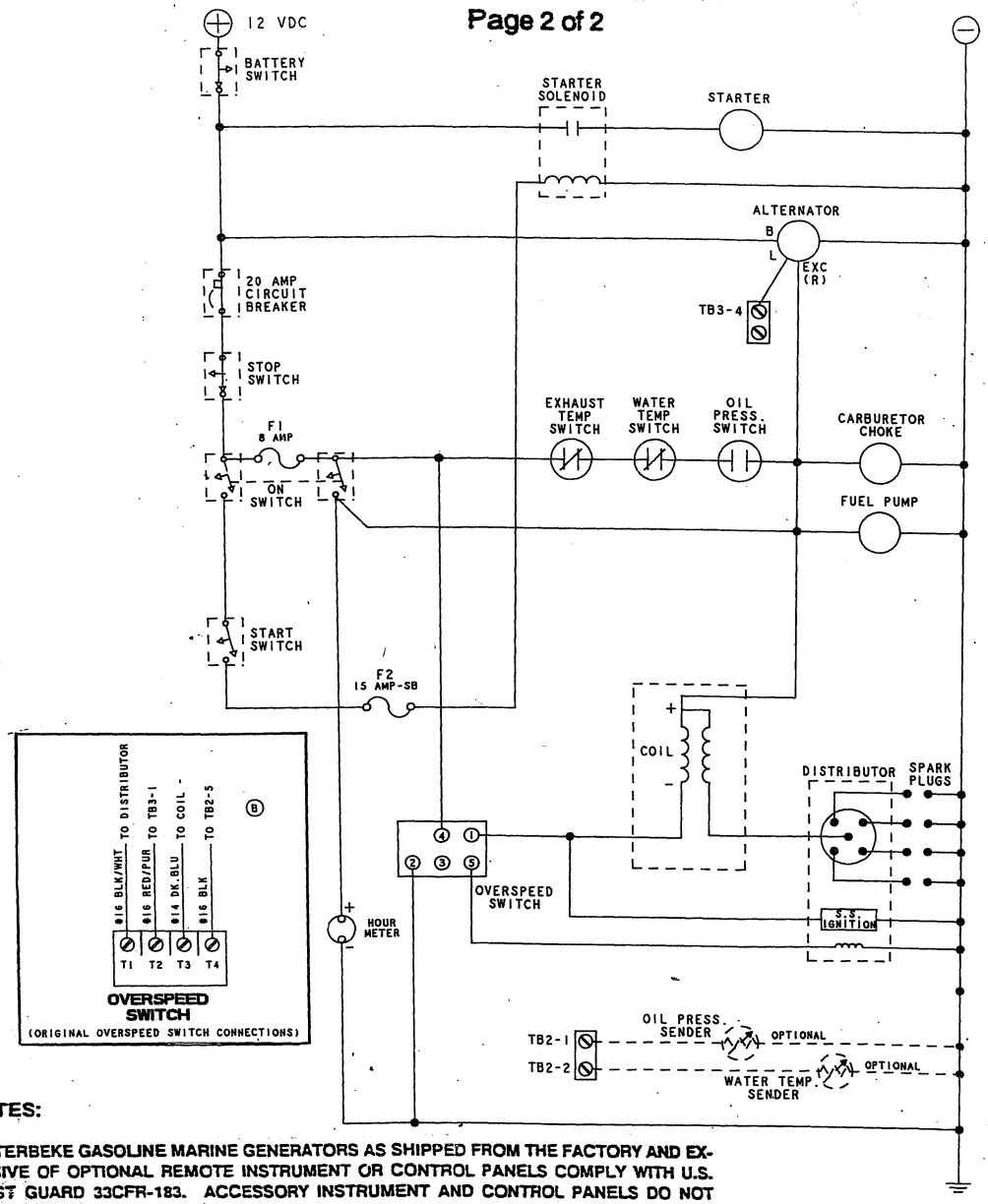
Page 1 of 2



WIRING SCHEMATIC #49167

DC WIRING DIAGRAM #37190

Page 2 of 2



NOTES:

1. WESTERBEKE GASOLINE MARINE GENERATORS AS SHIPPED FROM THE FACTORY AND EXCLUSIVE OF OPTIONAL REMOTE INSTRUMENT OR CONTROL PANELS COMPLY WITH U.S. COAST GUARD 33CFR-183. ACCESSORY INSTRUMENT AND CONTROL PANELS DO NOT NECESSARILY SO COMPLY AND ARE INTENDED TO BE INSTALLED ABOVE THE DECK AND ISOLATED FROM GASOLINE SOURCES IN ACCORDANCE WITH 33CFR-183.410(B).

   IT IS THE RESPONSIBILITY OF THE BOAT MANUFACTURER TO ENSURE THAT THE INSTALLATION OF THESE GENERATORS, AND OPTIONALLY THEIR REMOTE INSTRUMENT PANELS, COMPLY WITH 33CFR-183.

2. THIS PRODUCT IS PROTECTED BY A MANUAL RESET CIRCUIT BREAKER LOCATED NEAR THE STARTER AND AS CLOSE AS POSSIBLE TO THE SOURCE OF CURRENT. EXCESSIVE DRAIN ANYWHERE IN THE INSTRUMENT PANEL, WIRING OR ENGINE WILL CAUSE THE BREAKER TO TRIP. IN THIS EVENT, THE ENGINE WILL SHUT DOWN BECAUSE THE OPEN BREAKER WILL DISCONNECT THE FUEL SUPPLY. THEREFORE, THE BUILDER/OWNER MUST BE SURE THAT THE INSTRUMENT PANEL, WIRING AND ENGINE ARE INSTALLED TO PREVENT CONTACT BETWEEN ELECTRICAL DEVICES AND SEA WATER.

3. AN ON-OFF SWITCH MUST BE INSTALLED TO DISCONNECT THE STARTER FROM THE BATTERY IN AN EMERGENCY AND WHEN LEAVING THE BOAT. TWELVE VOLT STARTERS TYPICALLY DRAW 200 TO 300 AMPS WHEN CRANKING. THE DURATION OF INDIVIDUAL CRANKING CYCLES SHOULD NOT EXCEED 30 SECONDS. A SWITCH WITH A CONTINUOUS RATING OF 175 AMPS AT 12 VOLTS WILL NORMALLY SERVE THIS FUNCTION, BUT A SWITCH MUST NOT BE USED TO MAKE THE CIRCUIT.

4. SENDERS ARE SUPPLIED WITH AN OPTIONAL INSTRUMENT PANEL.

TESTING FOR A FAULTY OVERSPEED SWITCH:

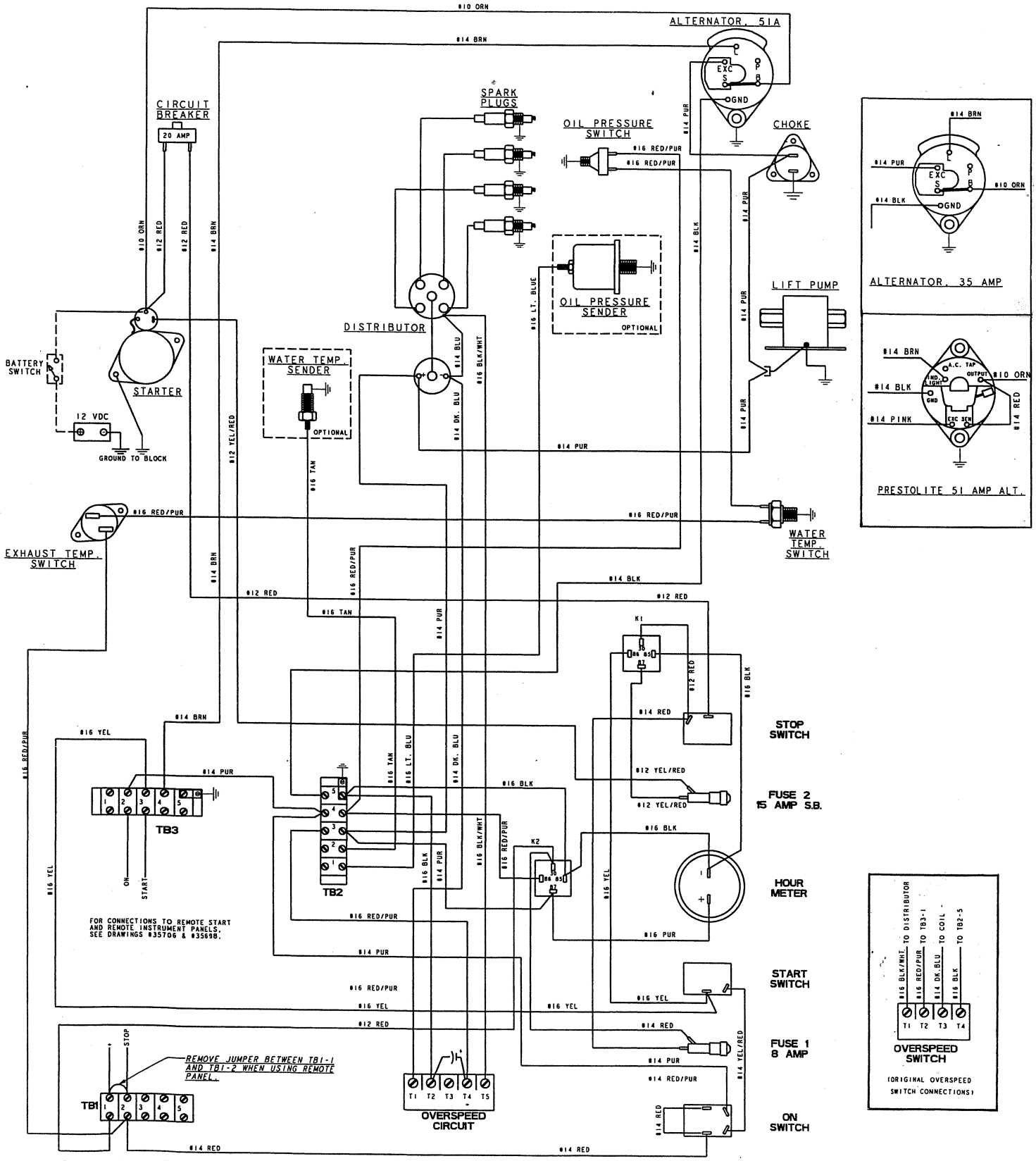
Original: Move T1 onto T2.

Current: Move T5 onto T4.

WIRING DIAGRAM

DC WIRING DIAGRAM #044628 (TWO RELAYS)

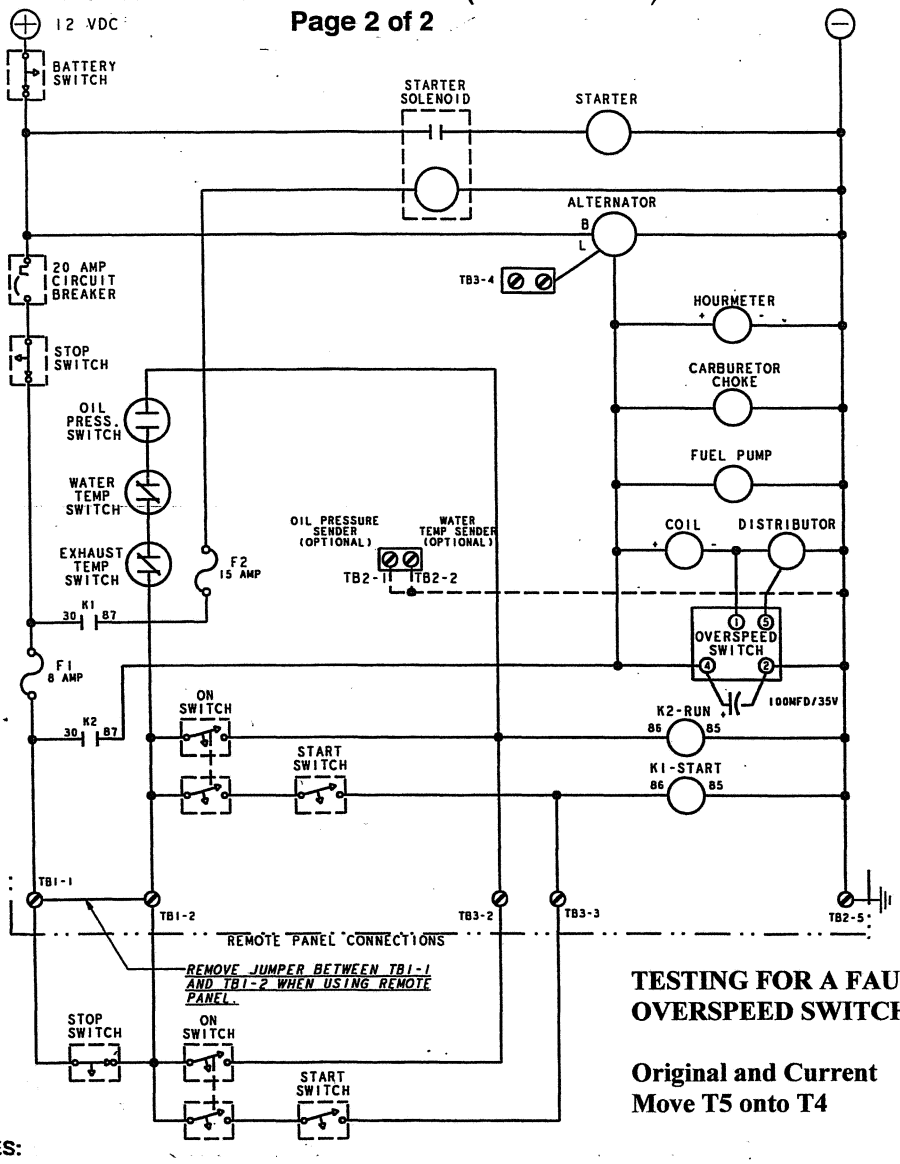
Page 1 of 2



WIRING DIAGRAM

DC WIRING DIAGRAM #044628 (TWO RELAYS)

NOTE: *An on-off switch should be installed in this circuit to disconnect the starter from the battery in an emergency and when leaving the boat. Twelve volt engine starters typically draw 200 to 300 amps when cranking. A switch with a continuous rating of 175 amps at 12 VDC will normally serve this function, but a switch must never be used to "make" the starter circuit.*



TESTING FOR A FAULTY OVERSPEED SWITCH:

Original and Current
Move T5 onto T4

NOTES:

1. WESTERBEKE GASOLINE MARINE GENERATORS AS SHIPPED FROM THE FACTORY AND EXCLUSIVE OF OPTIONAL REMOTE INSTRUMENT OR CONTROL PANELS COMPLY WITH U.S. COAST GUARD 33CFR-183. ACCESSORY INSTRUMENT AND CONTROL PANELS DO NOT NECESSARILY SO COMPLY AND ARE INTENDED TO BE INSTALLED ABOVE THE DECK AND ISOLATED FROM GASOLINE SOURCES IN ACCORDANCE WITH 33CFR-183.410(B).

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2. THIS PRODUCT IS PROTECTED BY A MANUAL RESET CIRCUIT BREAKER LOCATED NEAR THE STARTER AND AS CLOSE AS POSSIBLE TO THE SOURCE OF CURRENT. EXCESSIVE DRAIN ANYWHERE IN THE INSTRUMENT PANEL, WIRING OR ENGINE WILL CAUSE THE BREAKER TO TRIP. IN THIS EVENT, THE ENGINE WILL SHUT DOWN BECAUSE THE OPEN BREAKER WILL DISCONNECT THE FUEL SUPPLY. THEREFORE, THE BUILDER/OWNER MUST BE SURE THAT THE INSTRUMENT PANEL, WIRING AND ENGINE ARE INSTALLED TO PREVENT CONTACT BETWEEN ELECTRICAL DEVICES AND SEA WATER.

3. AN ON-OFF SWITCH MUST BE INSTALLED TO DISCONNECT THE STARTER FROM THE BATTERY IN AN EMERGENCY AND WHEN LEAVING THE BOAT. TWELVE VOLT STARTERS TYPICALLY DRAW 200 TO 300 AMPS WHEN CRANKING. THE DURATION OF INDIVIDUAL CRANKING CYCLES SHOULD NOT EXCEED 30 SECONDS. A SWITCH WITH A CONTINUOUS RATING OF 175 AMPS AT 12 VOLTS WILL NORMALLY SERVE THIS FUNCTION, BUT A SWITCH MUST NOT BE USED TO MAKE THE CIRCUIT.

4. SENDERS ARE SUPPLIED WITH AN OPTIONAL INSTRUMENT PANEL

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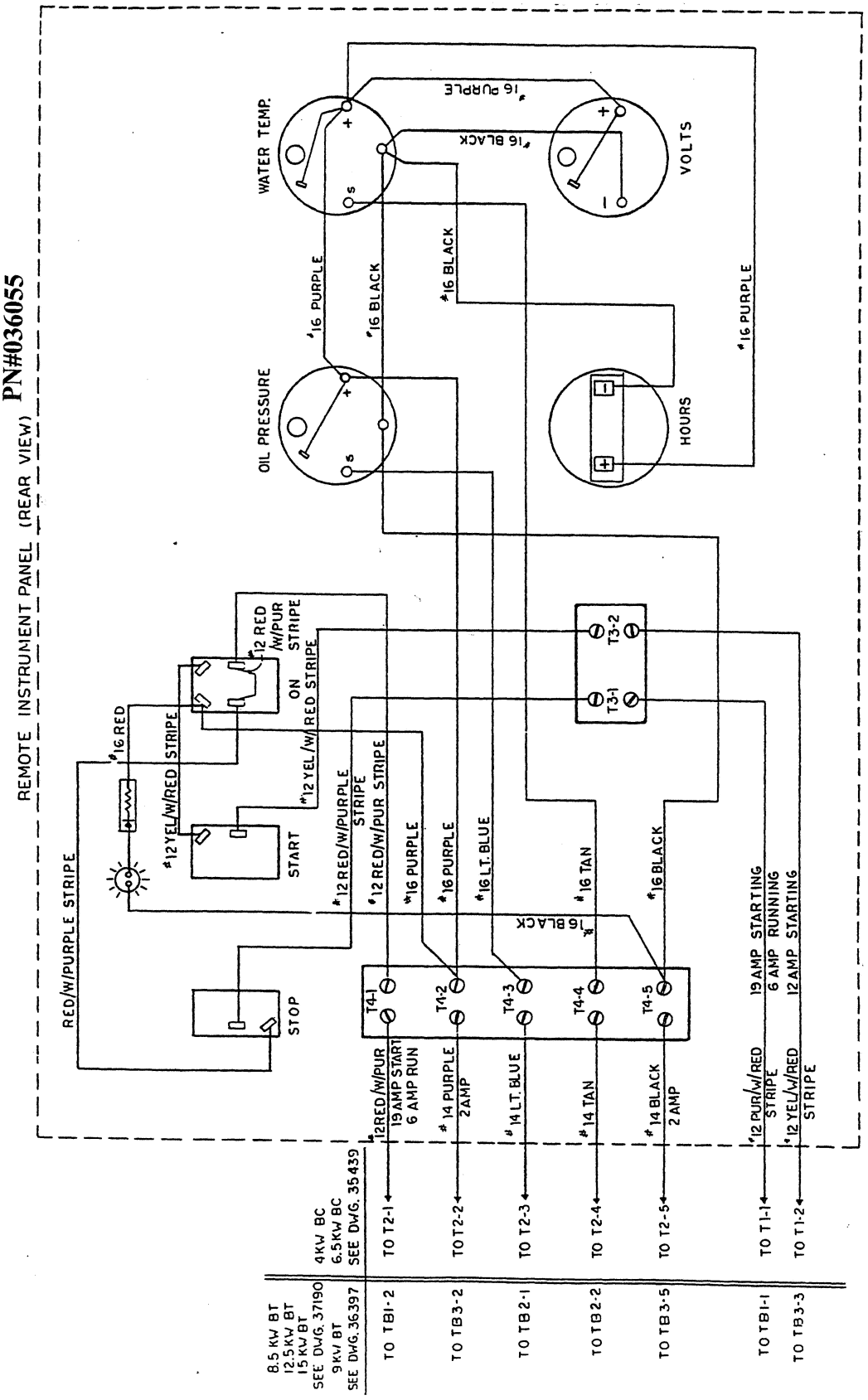
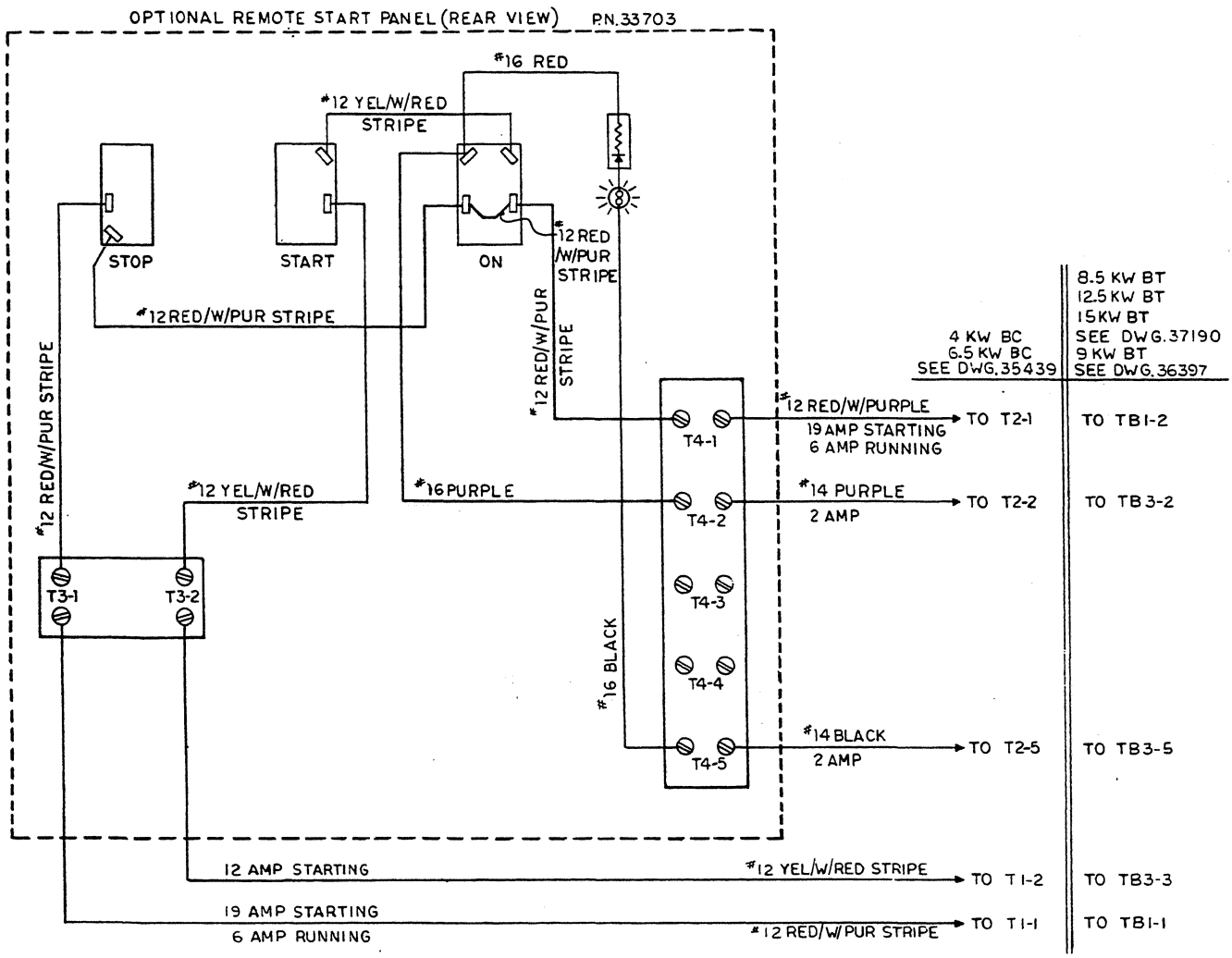
REMOTE STOP/START PANEL WIRING DIAGRAM

WIRING DIAGRAM # 35698



REMOTE STOP/START PANEL WIRING DIAGRAM

DIAGRAM # 35706



MINIMUM WIRE GAUGES (AWG)

WIRE LENGTH FROM GENERATOR TO REMOTE PANEL

Terminals	0-16'	16-20'	20-25'	25-32'	32-40'	40-50'	50-65'
TB1-1 to TB3-1	#12	#10	#10	#8	#8	#6	#6
TB1-2 to TB3-2	14	12	12	10	10	8	8
TB2-1 to TB4-1	14	14	12	10	10	8	8
TB2-2 to TB4-2	14	14	14	14	14	14	14
TB2-3 to TB4-3	14	14	14	14	14	14	14
TB2-4 to TB4-4	14	14	14	14	14	14	14
TB2-5 to TB4-3	14	14	14	14	14	14	14

GENERATOR INFORMATION

USE OF ELECTRIC MOTORS

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

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

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

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

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

REQUIRED OPERATING SPEED

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

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

GENERATOR FREQUENCY ADJUSTMENT

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

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

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

GENERATOR MAINTENANCE

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

Carbon Monoxide Detector

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

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

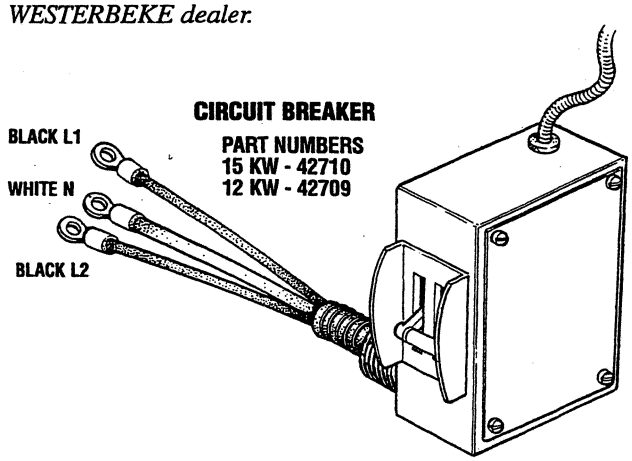
If carbon monoxide is present, ventilate the area with clean air and correct the problem immediately!

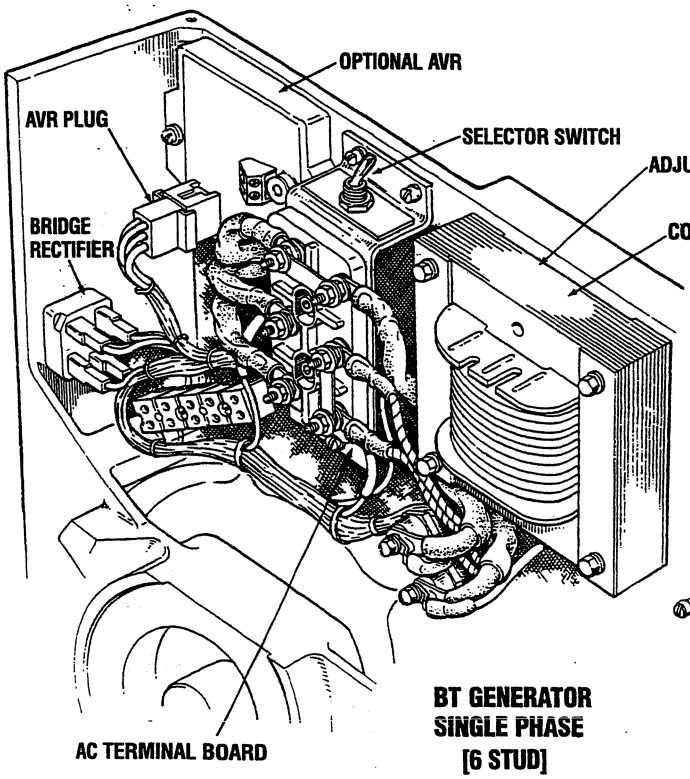
BT GENERATOR SINGLE/THREE PHASE

This generator is a four-pole, brushless, self-excited generator which requires only the driving force of the engine to produce AC output. The copper and laminated iron in the exciter stator are responsible for the self-exciting feature of this generator. The magnetic field produced causes an AC voltage to be induced into the related exciter rotor windings during rotation. Diodes located in the exciter rotor rectify this voltage to DC and supply it to the windings of the rotating field. This creates an electromagnetic field which rotates through the windings of the main stator, inducing an AC voltage which is supplied to a load. A step down transformer is connected in parallel to the AC output of the main stator. An AC voltage is produced in the auxiliary windings of the transformer and the main stator and is, in turn, supplied to a full-wave bridge rectifier. The rectifier produces a DC voltage to further excite the exciter stator windings, enabling the generator to produce a rated AC output. An optional solid-state voltage regulator is available to work in tandem with the transformer regulator to produce a more stable AC output.

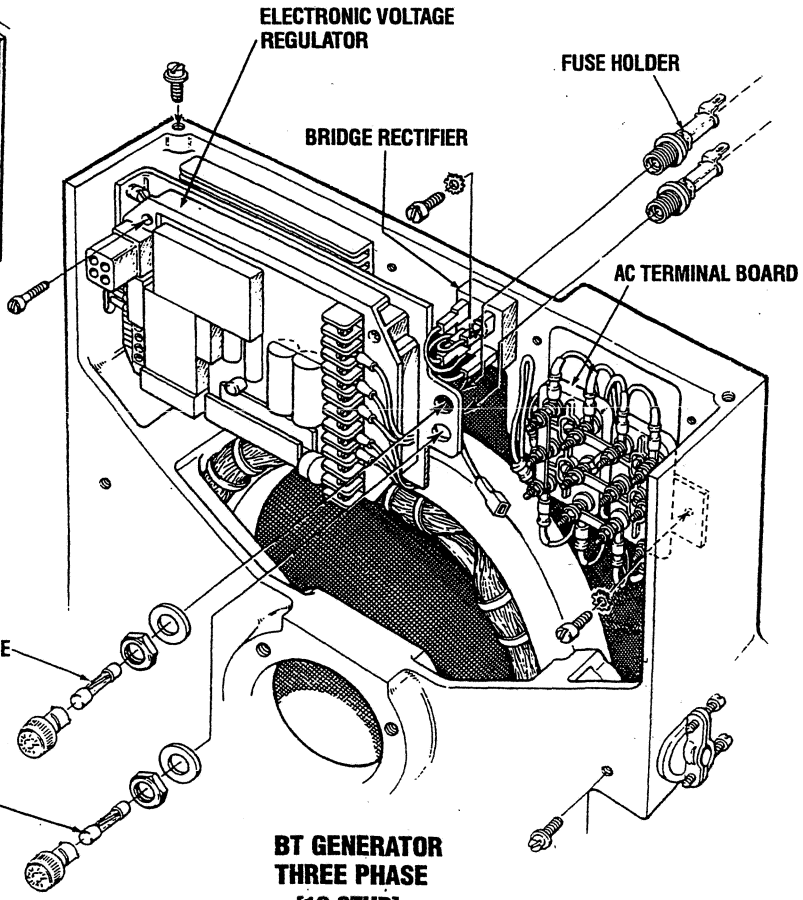
A circuit breaker is installed on all WESTERBEKE generators. This circuit breaker will automatically disconnect generator power in case of an electrical overload. The circuit breaker can be manually shut off when servicing the generator to ensure no power is coming into the boat.

NOTE: *This circuit breaker is available as a WESTERBEKE add-on kit for earlier model generations; contact your WESTERBEKE dealer.*





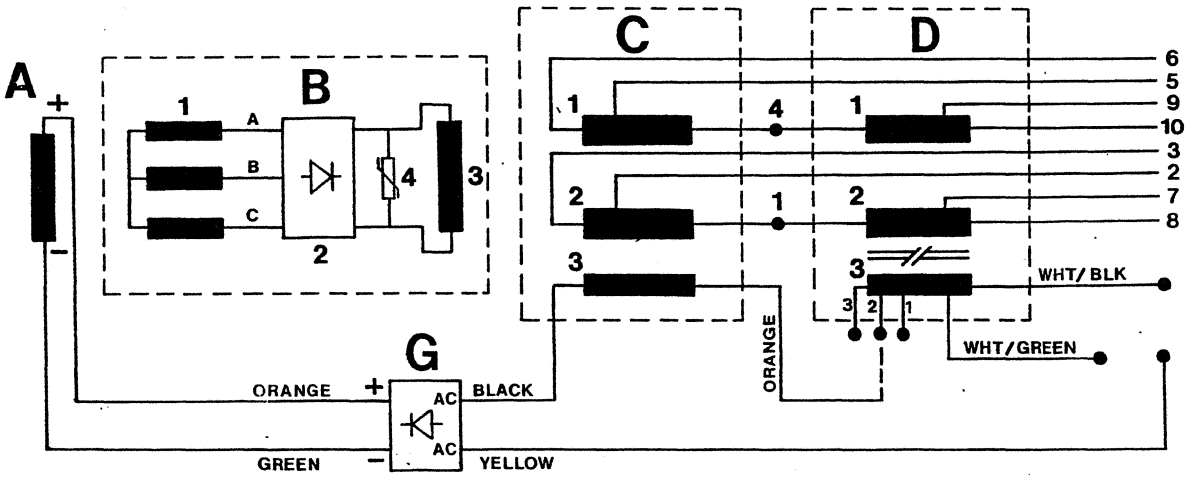
BT GENERATOR SINGLE PHASE [6 STUD]



BT GENERATOR THREE PHASE [12 STUD]

BT GENERATOR 12 STUD INTERNAL WIRING SCHEMATIC

NOTE: *Refer to the text and diagrams for the proper method of testing for resistance and continuity.*



COMPONENT RESISTANCE VALUES [OHMS]

A EXCITER STATOR WINDINGS _____ 10.0Ω

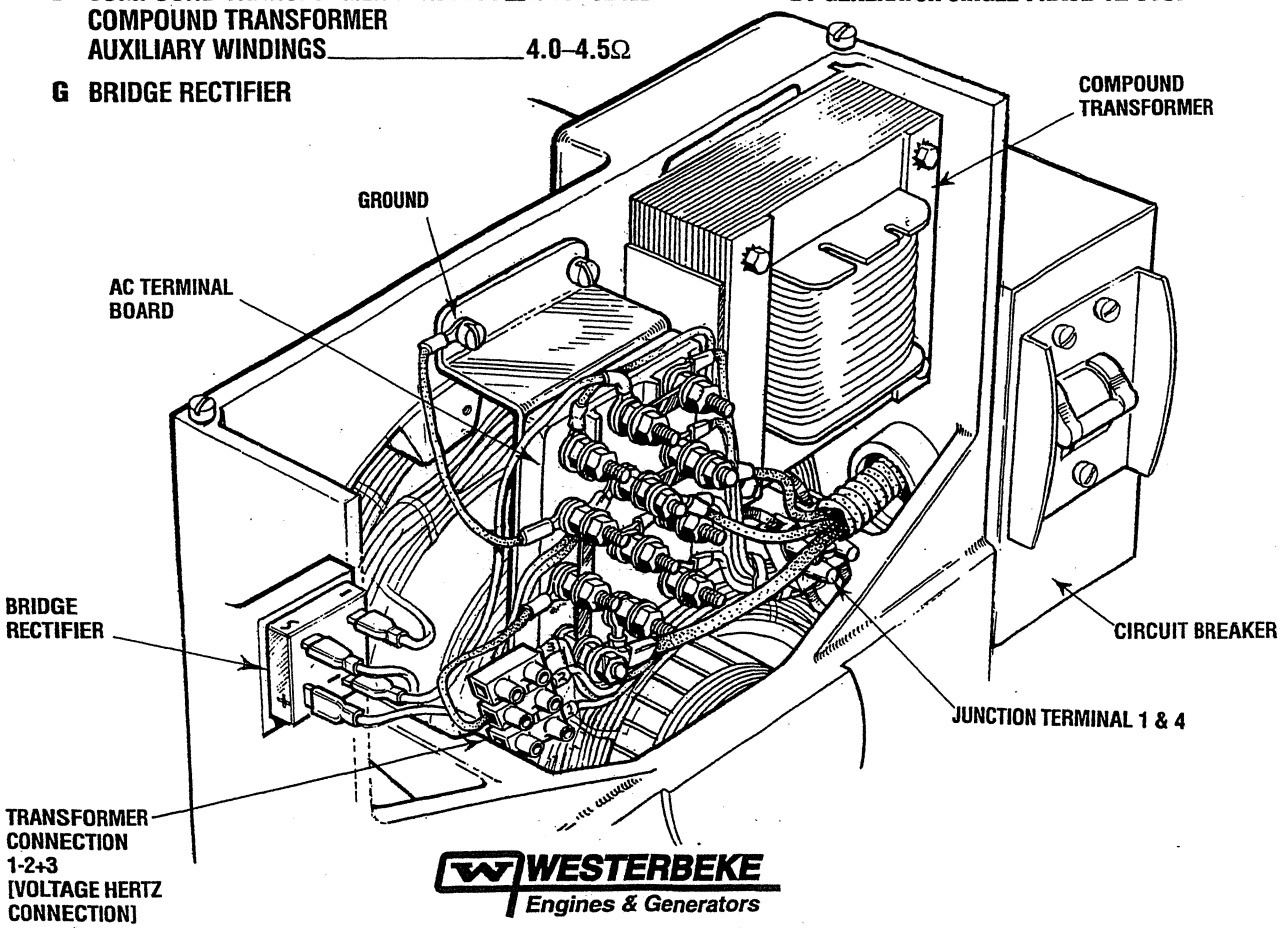
B AUXILIARY ROTOR WINDINGS (A,B,C) ___ 1.0–1.2Ω
DIODES (6) _____ 11Ω/infinite
ROTATING FIELD WINDINGS _____ 7.0–8.0Ω
POSI RESISTOR) _____ infinite

C MAIN STATOR WINDINGS _____ 20-22Ω
MAIN STATOR AUXILIARY WINDINGS ___ 1.5–1.8Ω

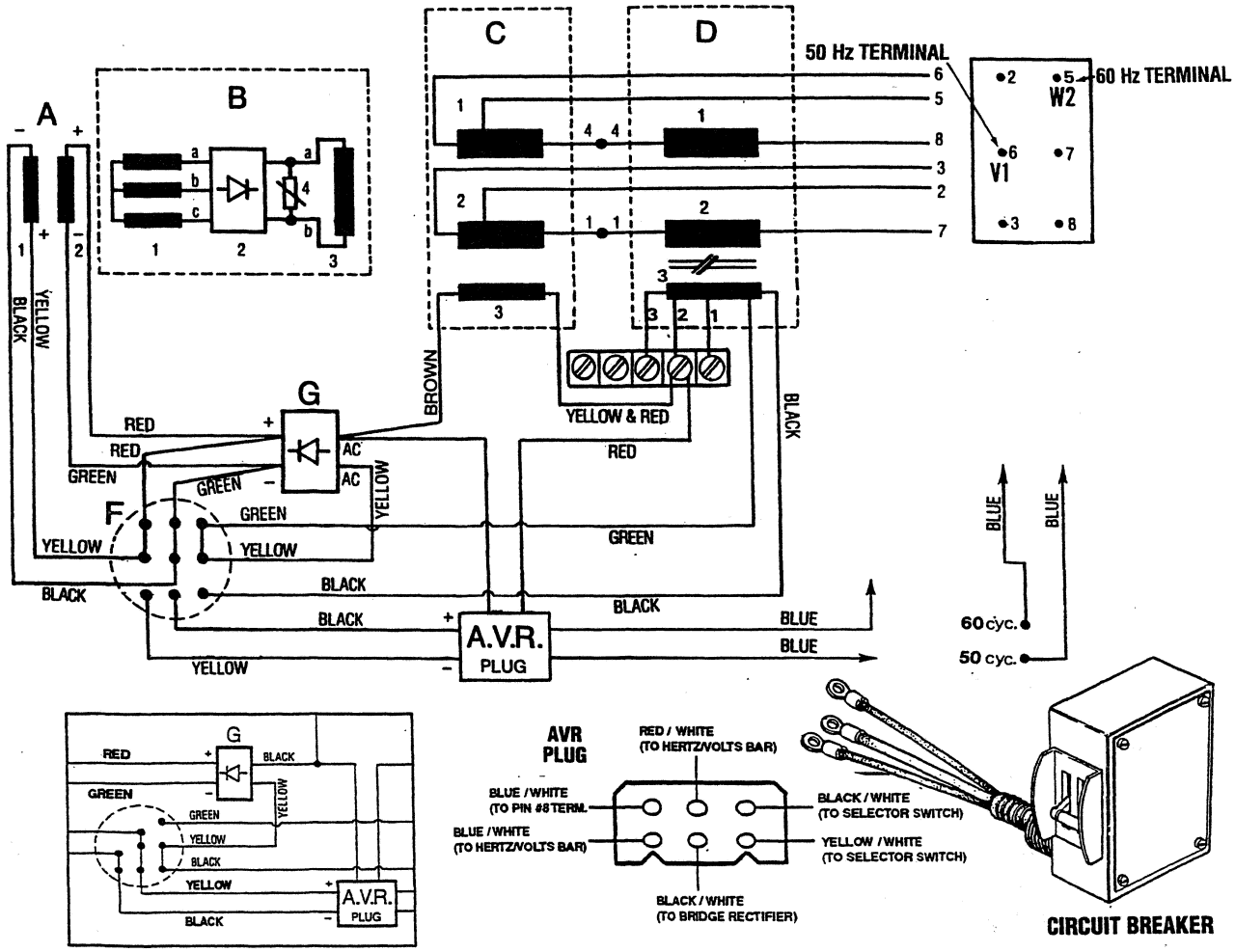
D COMPOUND TRANSFORMER WINDINGS __ .019-.021Ω
COMPOUND TRANSFORMER
AUXILIARY WINDINGS _____ 4.0–4.5Ω

G BRIDGE RECTIFIER

BT GENERATOR SINGLE PHASE 12 STUD



BT GENERATOR/SINGLE PHASE



BT GENERATOR/SINGLE PHASE
10KW-15KW GENERATORS

A. EXCITER STATOR WINDINGS 1& 2
A-1 and **A-2** Exciter Stator Windings (Selector in **COMP** position)

B. EXCITER ROTOR and FIELD
1. Auxiliary Windings **(a-b-c)**
2. Diodes (6)
3. Rotating Field Windings
4. Posi Resistor

C. MAIN STATOR
1. Main Stator Windings
2. Main Stator Windings
3. Main Stator Auxiliary Windings

D. COMPOUND TRANSFORMER
1. Compound Transformer Windings
2. Compound Transformer Windings
3. Compound Transformer Auxiliary Windings

Resistance readings and voltage checks can be accessed easily for the components in the exciter circuit **A**, **G**, **C-3** and **D-3** by locating the color coded wires at the connection points shown on the above schematic. When checking winding resistance values be sure to lift both of the component's electrical connections.

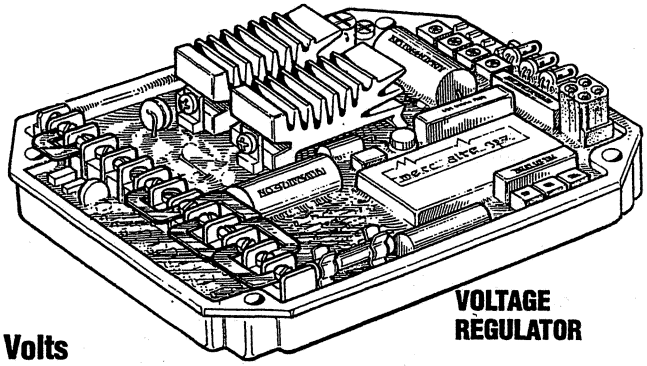
G. BRIDGE RECTIFIER

A.V.R. Optional Automatic Voltage Regulator Plug (6 Prong).

VOLTAGE REGULATOR ADJUSTMENTS

Description

The voltage regulator is an advanced design which ensures optimum AC alternator performance. It is equipped with complete protection circuitry to guard against operating conditions that could be detrimental to the AC alternator.



VOLTAGE REGULATOR

Volts

This potentiometer is used to adjust output voltage. At proper engine operating speed the output voltage should be held at ±1% from a no-load condition to a full rated generator output and from power factor 1.0 - 0.8 with engine drive speed variations up to -6%.

Prior to starting the engine, turn the VOLT and STAB trimmers (using a mini phillips screwdriver) fully in a counter clockwise (Minimum) direction until you feel them hit their stops.

Turn the AMP and HERTZ trimmers completely clockwise (Maximum) in the same manner.

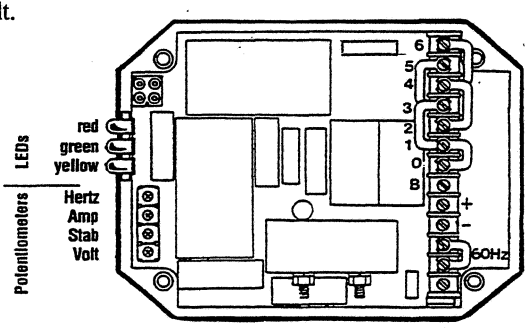
With the alternator running at no-load, at normal speed, and with VOLT adjust at minimum, it is possible that output voltage will oscillate. Slowly rotate the VOLT adjust clockwise. The voltage output of the alternator will increase and stabilize. Increase the voltage to the desired value. In this situation,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

Stability

This potentiometer permits variation of the regulator's response to generator load changes so as to limit overcompensation and obtain a minimum recovery time to the normal voltage output.

In order to adjust the regulator stability the alternator must be running at no-load and the output must be monitored.

Turn the STAB adjust slowly clockwise until the voltage starts to fluctuate. At this point rotate the STAB adjust counterclockwise until the voltage is stable within 1 or 2 tenths of a volt.



VOLTAGE REGULATOR DIAGRAM

Amp-Hertz

These two adjustments are used in conjunction with the two protection circuits in the voltage regulator that are indicated by the illumination of a colored LED lights.

1. Delayed overload protection (yellow LED).
2. Low speed protection (red LED).

Both systems have an intervention threshold which can be adjusted using the respective potentiometer. Each of the two circuits are able to cause an adequate reduction in excitor voltage to safeguard the excitor windings and prevent their overheating.

The overload protection system has a delay which permits temporary overloading of the generator during times such as motor start-up or other similar load surge demands. The regulator also has a third LED (green), that glows during generator operation to indicate correct operation of the regulator with the generator.

Setting the Overload Protection

In order to set the AMP overload protection, the alternator must be loaded to its full output rating.

1. Load the alternator to its rating, then decrease the speed of the engine by 10.10% (54 Hertz on 60 hertz units, 45 hertz on 50 hertz units).
2. Rotate the AMP adjustment counterclockwise until it hits its stop. Wait about 15-20 seconds after which the AC output of the alternator should drop and the yellow LED light should come on.
3. Slowly rotate the AMP adjustment clockwise until the output voltage increases to approximately 97% of the voltage output at the start of the adjustment. At this point the yellow LED light should come on.
4. Return to nominal speed, the yellow LED will turn off and the alternator voltage will rise to its normal value. Should this not happen, repeat the adjustment.

NOTE: *When changing from 60 hertz to 50 hertz operation, remove the 60 hertz jumper bar from the regulator board.*

Setting the Underspeed Protection

NOTE: *If the unit is operating at 60 Hertz ensure that the jumper strap is in place on the regulator board between the two 60 Hertz terminals. In order to adjust the underspeed setting, the alternator should be running at no-load.*

1. To adjust the underspeed (low frequency) protection circuit, lower the engine speed at 90% of its normal running speed (54 hertz on 60 hertz units, 45 hertz on 50 hertz units.
2. Rotate the Hertz adjustment counterclockwise slowly until the alternator's AC output voltage starts to decrease and at the same time the red "LED" light comes on.
3. Increase the engine speed to its normal speed (frequency). The red "LED" light will go out and the AC voltage output will return to normal.

With the above adjustments made, the regulator should function normally.

BT GENERATOR TROUBLESHOOTING CHART

The following troubleshooting chart is designed to give insight into problems which may be encountered with the BT brushless generators operating on compound transformer regulation. Owing to the simplicity of the equipment and controls, troubleshooting is relatively easy, once the relationship between cause and effect is understood. Most potential problems are covered in the text of this manual

Keep in mind that a basic fundamental knowledge of electricity is required for this troubleshooting, and always remember that lethal voltages are present in the circuitry; therefore, extreme caution is essential when troubleshooting a generator.

Only a few basic tools are necessary for diagnosis and repair. These are hand tools: an ampprobe and a quality volt-ohmmeter capable of reading less than one ohm due to the precision required in reading component winding resistances.

Before attempting any repairs, get a clear an explanation of the problem as possible, preferably from an individual witnessing the problem. In some cases, this may bring to light a problem which is related to the method of operation rather than equipment fault. Bring basic repair tools with you on the initial trip to the problem equipment, such as: diodes and bridge rectifier, so that if the problem should be found in one of these easily replaceable parts, the problem can be remedied early and efficiently.

NOTE: *When fault finding, troubleshoot components in the order indicated below.*

COMPONENT CHECKS

REFER TO THE INTERNAL WIRING DIAGRAMS

1. LOW VOLTAGE 60-100 VOLTS AC

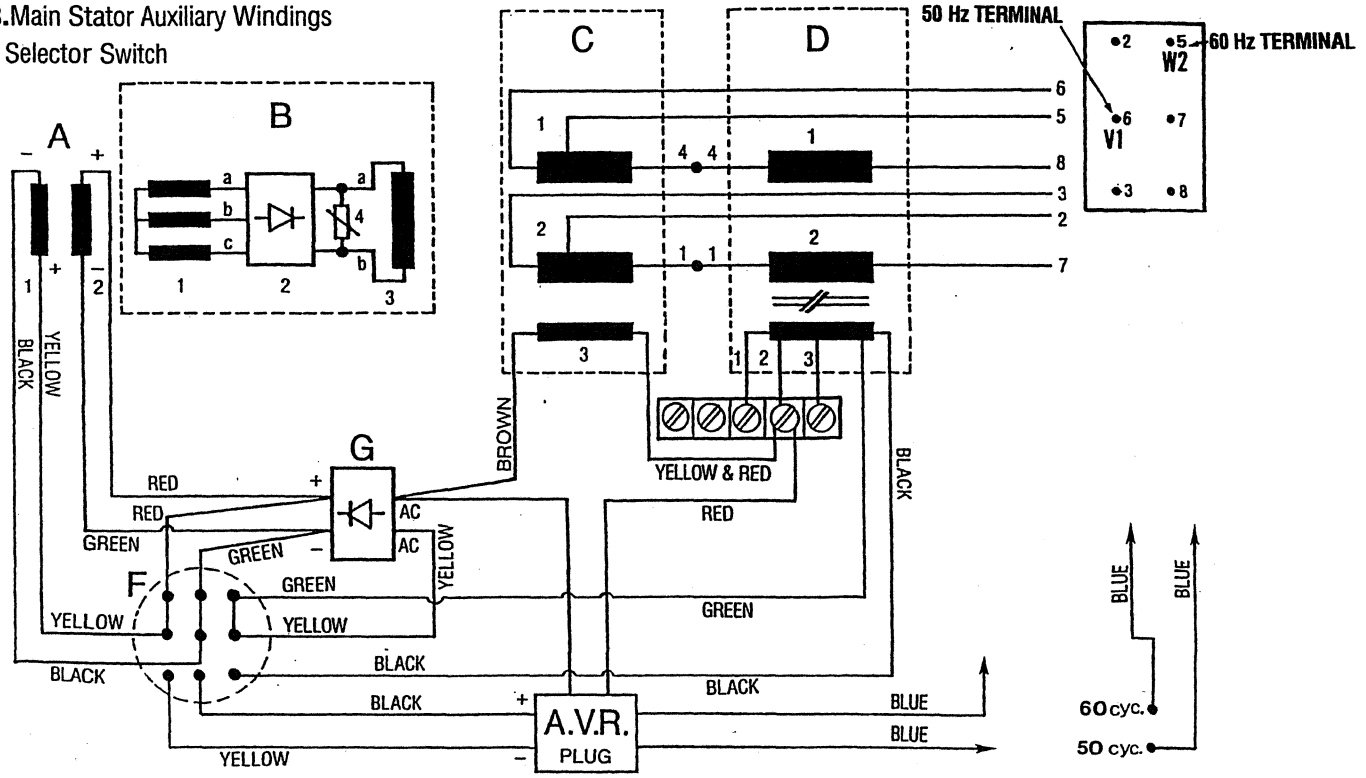
- **F.** Selector Switch
- **B.** Rotor Components
  - **B-2** Exciter Rotor Diodes
  - **B-3** Rotor Field Windings
  - **B-1** Exciteor Rotor Windings **a,b, c**
- **A.** (1-1+2) Exciter Stator Windings

2. RESIDUAL VOLTAGE - EXCITER CIRCUIT FAULTY

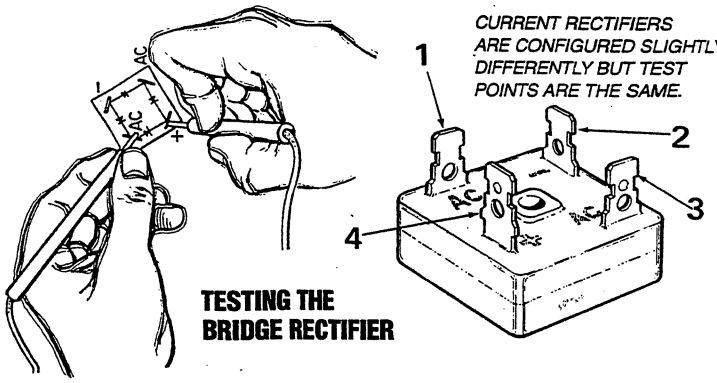
- **A.** (1-1+2) Exciter Stator Windings
- **G.** Bridge Rectifier
- **D-3.**Transformer Auxiliary Windings
- **C-3.**Main Stator Auxiliary Windings
- **F.** Selector Switch

3. NO AC VOLTAGE OUTPUT - MAIN STATOR/ROTOR COMPONENTS/TRANSFORMER

- **C.** (1+2) Exciter Stator Windings
- **B-4.**Posi Resistor
- **B-2.**Diodes (4-6 open/shortened)
- **D.** (1+2) Compound Transformer Windings
- **B-3.**Rotor Field Windings



BT GENERATOR TROUBLESHOOTING/SINGLE PHASE



4. Leaving the negative (-) ohmmeter lead on point #4, touch point #5 with the positive (+) lead. No deflection of the needle should occur.
5. Place the positive (+) lead of the ohmmeter on point #1 and the negative (-) lead on point #3. The ohmmeter should not register any deflection of the needle (no deflection indicates infinite resistance). Reverse these connections and the ohmmeter should again register no deflection.
   If the rectifier fails any of the previous tests (1 - 4) it is defective and should be replaced.

NOTE: *Different style/model meters may produce opposite results from the above tests.*

Component Resistance Values

A. Exciter Stator
A-1 & A-2 11.5 ohm
A-1 49.4 ohm
A-2 12.9 ohm

B. Excitor Rotor/Field
B-1 1.05 ohm,
B-2 8.9 ohm

C. Main Stator
C-1 0.089 ohm
C-2 0.089 ohm
Auxiliary Windings
C-3 0.85 ohm

D. Compound Transformer
D-1 0.007 ohm
D-2 0.007 ohm
Auxiliary Windings
D-3 5.02 ohm

E. A.C. Terminal Board

F. Selector Switch

G. Bridge Rectifier

H. Optional AVR (early models)

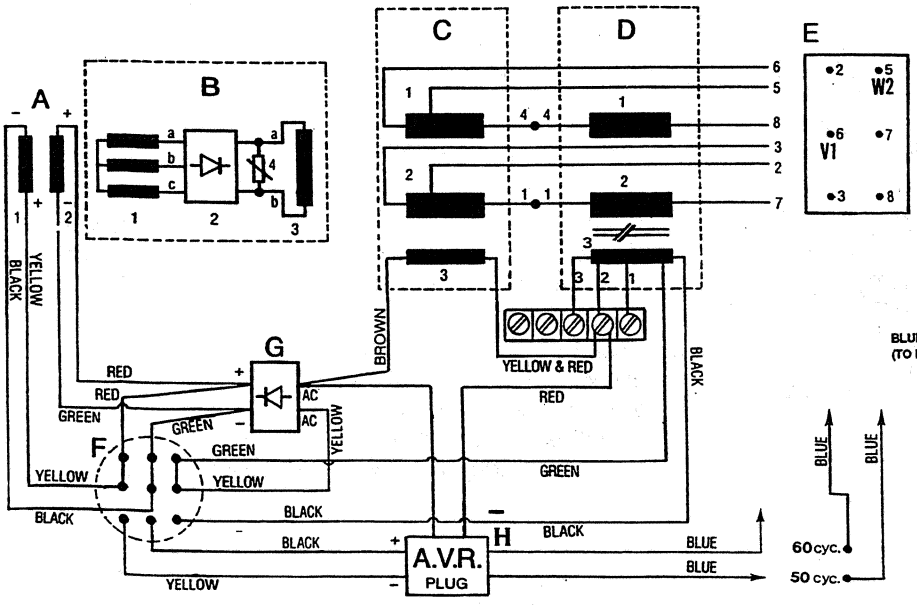
The model code number is found stamped in the generator housing on a flat surface above the rear generator carrier bearing.

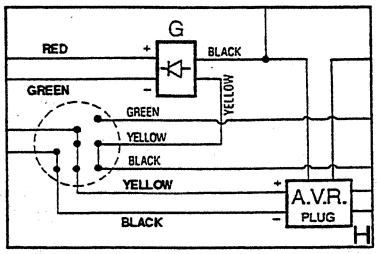
NOTE: *These two model BT generators are used on models rated lower than the capabilities of the generator. However, the generator is rated according to the capabilities of the drive engine since horsepower produces kilowatts.*

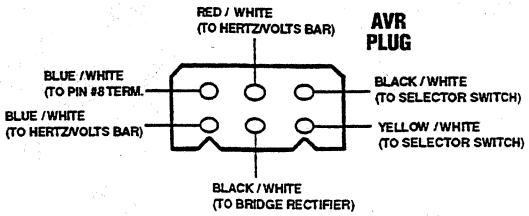
COMPONENT RESISTANCE CHECKS
Exciter Stator Windings

1. **Windings A-1 and A-2**
   Resistance readings for exciter windings A-1 and A-2 with the selector switch in the COMP position are taken between the positive (+) and negative (-) leads lifted off the bridge rectifier (G). Neither of these two leads should have the continuity to the generator case/ground.
2. **Winding A-1**
   Resistance readings for exciter windings A-1 with the selector switch in the ELEC position is taken between the yellow wire and the black at the A.V.R. plug (G).
3. **Winding A-2**
   Resistance readings for exciter winding A-2 with the selector switch in the ELEC position is taken between the green wire lifted off the negative (-) terminal of the bridge rectifier (G) and the red wires lifted off the positive (+) terminal of the bridge rectifier (G).

NOTE: *The white striped wiring on earlier model generators has been changed to solid colors on current generators, the colors, however, remain the same.*







BT GENERATOR INTERNAL WIRING SCHEMATIC (W/OPTIONAL AVR)

NOTE: *Striped wires were used on early model generators. The colors will, however, matchup to the current solid color wires.*

BT GENERATOR TROUBLESHOOTING

Testing Residual Voltage

1. The amount of no-load voltage produced by the generator can be an indicator of where in the generator the problem/fault may lie.

Residual Voltage 10-14 volts AC

This voltage is the AC voltage produced by the generator from magnetism in the exciter stator field. This voltage is measured between the AC Neutral and Hot leg(s) with no-load on the generator running at 60 hertz.
The presence of residual voltage is an indication that the following generator components are OK. Refer to *INTERNAL WIRING SCHEMATICS.*

a. Exciter Rotor (B-1 a, b, & c) & (B-2);

b. Rotating Field (B-3);

c. Main Stator (C-1 & C-2); and

d. Compound Transformer (D-1 & D-2).

The fault lies in one or more of the following components in the exciter circuit:

a. Exciter Stator (A-1 & A-2)

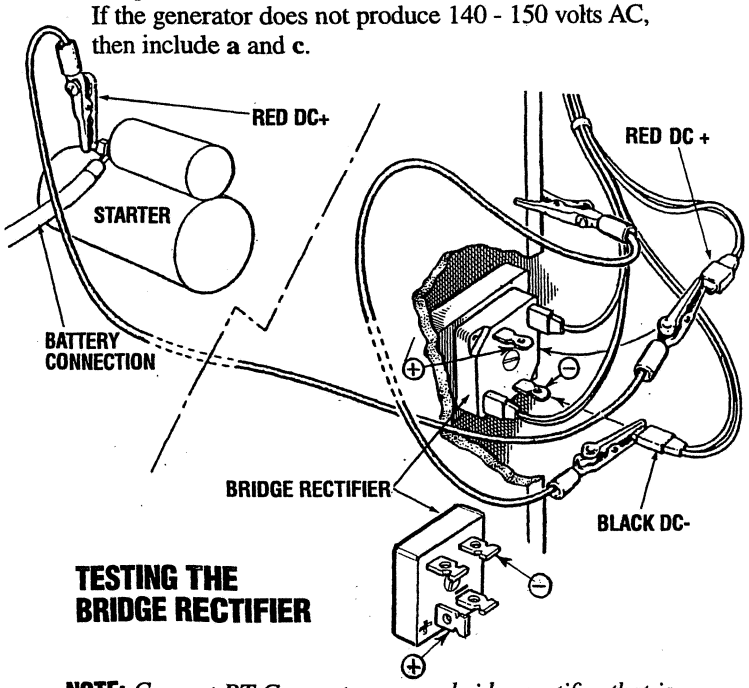
b. Bridge Rectifier (G)

c. Selector Switch (F)

d. Main Stator Auxiliary Windings (C-3)

e. Compound Transformer Auxiliary Winding (D-3)

2. Twelve (12) volt DC excitation of the exciter stator windings should cause the generator to produce between 140 - 150 volts AC between each hot lead and the neutral (12 volts DC is applied between the lifted (+) and (-) leads of the bridge rectifier, + to + and - to -).
Correct voltage produced with twelve volts DC excitation indicates the fault is in one or more of the above listed components **b, d** or **e.**
If the generator does not produce 140 - 150 volts AC, then include **a** and **c.**



TESTING THE BRIDGE RECTIFIER

NOTE: *Current BT Generators use a bridge rectifier that is configured differently, connections are the same.*

3. The absence of any voltage from the generator indicates a fault with the main stator windings C-1 and C-2 and/or the compound transformer windings D-1 and D-2.
Apply 12 volt DC excitation to the exciter stator windings as explained in paragraph 2. A fault in the main stator and/or compound transformer windings such as a short will cause the generator engine to load down and the shorted windings to eventually produce smoke as the excitation is continued.

4. Voltage output greater than residual and less than rated output (25 - 100 volts) indicates a fault in the exciter rotor/field B-1, B-2 or B-3. Excitation of the generator as explained in paragraph **2** should produce a partial rise in voltage output and, when removed, the voltage will return to the original low output.

BRIDGE RECTIFIER

The bridge rectifier is supplied AC voltage from the auxiliary windings in the generator stator (C-3) and the compound transformer (D-3). The AC voltage measured across the AC terminals of the rectifier during engine operation is as follows:

120 Volts	**120/240**
N/L F/L	N/L F/L
11 – 20 volts AC	11 – 20 volts AC

Diodes in the rectifier convert this AC voltage to DC and supply it to the windings of the exciter stator to induce a field through which the exciter rotor revolves. The DC voltage measured across the (+) and (–) terminals of the bridge rectifier during engine operation is as follows:

120 Volts	**120/240**
N/L F/L	N/L F/L
8 – 15 volts AC	8 – 15 volts AC

Failure of the bridge rectifier will result in a weak field being produced by the exciter stator windings. A weak field is present, due to the magnetism in the exciter stator, which will cause the generator to produce residual voltage.

Testing the Bridge Rectifier for Faults with an Ohmmeter

(Meter used: *Simpson 260* at 70°F (21°C)

1. Set the ohmmeter scale on RX1 (+ DC) and set the needle to zero.
2. Connect the positive (+) lead from the ohmmeter to point #4. Taking the ohmmeter's negative (-) lead, momentarily contact points #1, #2, #3, and #5. The ohmmeter should register no deflection for any of the points touched.
3. Remove the positive (+) lead from point #4 and connect the negative (-) lead to point #4 and, with the positive (+) lead, momentarily touch points #1, #2, and #3. The ohmmeter's needle should deflect when each point is touched, showing a passage of meter voltage through the diodes in the rectifier.

BT GENERATOR TROUBLESHOOTING/SINGLE PHASE

Main Stator Windings

1. **Group #1.** The resistance value is measured between the lifted lead #4 from the insulated terminal below the transformer and lead #6 lifted from the AC terminal block. Lead #5 should be lifted from the terminal block in order to totally isolate the stator windings of group #1, .
2. **Group #2.** The resistance value is measured between the lifted lead #1 from the insulated terminal below the transformer and lead #3 lifted from the AC terminal block. In order to totally isolate the stator windings of group #2, lead #2 should be lifted from the terminal block.

   NOTE: *No continuity should be found between any of the lifted stator leads and the case ground or between the connections of the two groups.*

Main Stator Windings 20 - 22 Ohms

3. **Main Stator Auxiliary Windings.** The resistance values for these windings are measured between the black double lead connection lifted off the AC terminal of the bridge rectifier (G) and the red #3 lead lifted off the Voltage/Hertz connection bar.

   NOTE: *No continuity should be found between either of these winding groups or to the generator case.*

Main Stator Auxiliary Windings 1.5 - 1.8 Ohms

Compound Transformer

1. **Group 1.** Resistance value is measured between lifted lead #4 from the red insulated terminal stud below the transformer and lead #8 lifted off the AC terminal block.
2. **Group 2.** Resistance value is measured between lifted lead #1 from the red insulated terminal stud below the transformer and lead #7 lifted off the AC terminal block.

   NOTE: *No continuity should be found between either of these lifted leads or to the generator case/ground.*

Compound Transformer Windings 0.019 - 0.021 Ohms

3. **Transformer Auxiliary Windings.** Resistance is measured between the yellow wire lifted off the AC terminal block of the bridge rectifier (G) with the selector switch in the ELEC position and the #1 red lead lifted off the Voltage/Hertz connection bar. Off this same bar, lift the #2 and #3 red leads that come from the auxiliary windings to totally isolate these windings. There should be no continuity found from either of these connections to the case/ground or to either of the transformer groups.

Selector Switch

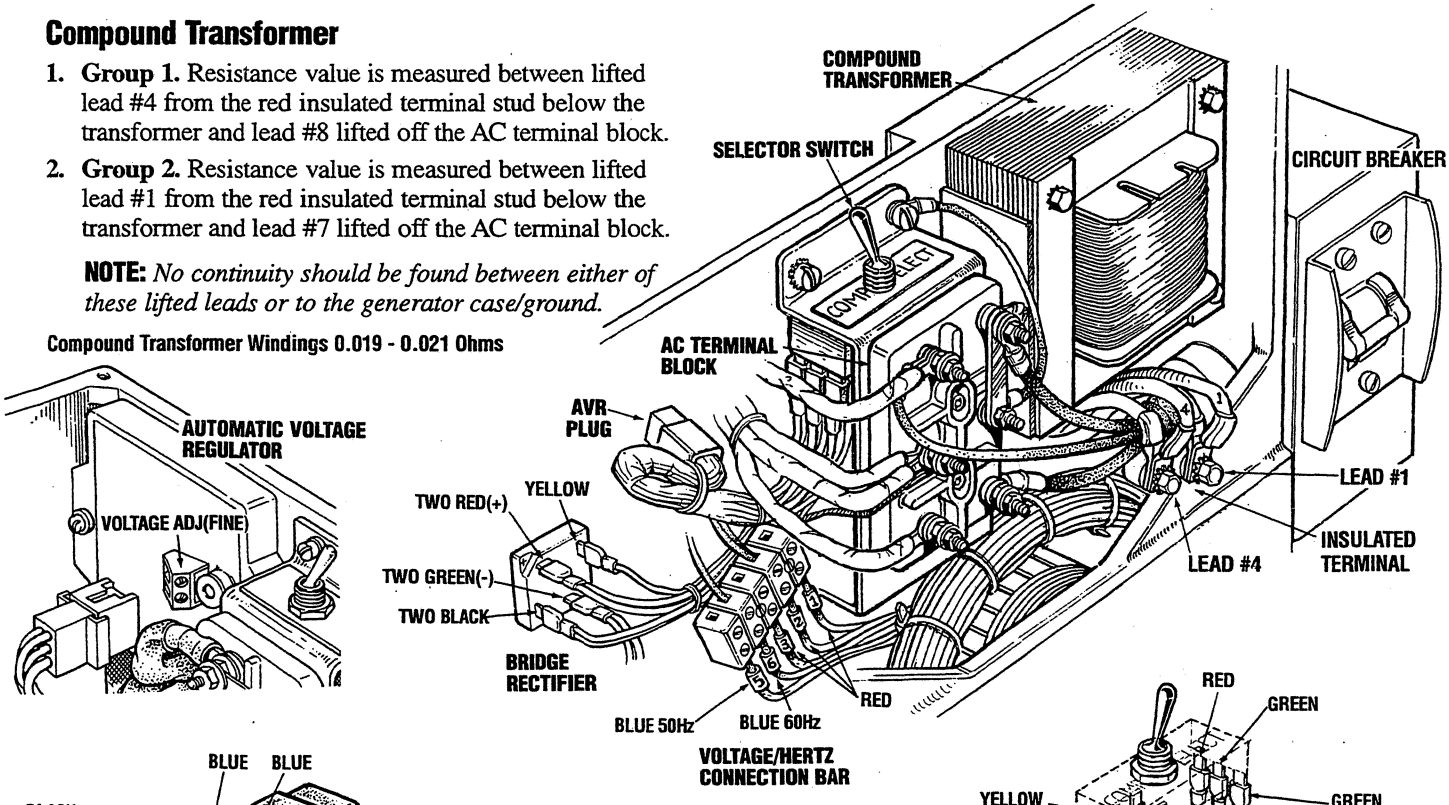
This switch is is normally set in the COMP position. If an optional AVR is installed, the switch is toggled to the ELEC position.

NOTE: *With the selector switch in ELEC position the exciter stator windings are divided, one group is excited through the bridge rectifier and the other group through the A.V.R.*

Bridge Rectifier Wiring

The illustration below shows the color coded wires at the two AC terminals and the color coded wires at the (+) and (-) DC terminals.

NOTE: *When removing or reinstalling connections, maintain correct polarity connection on the (+) and (-) DC terminals.*



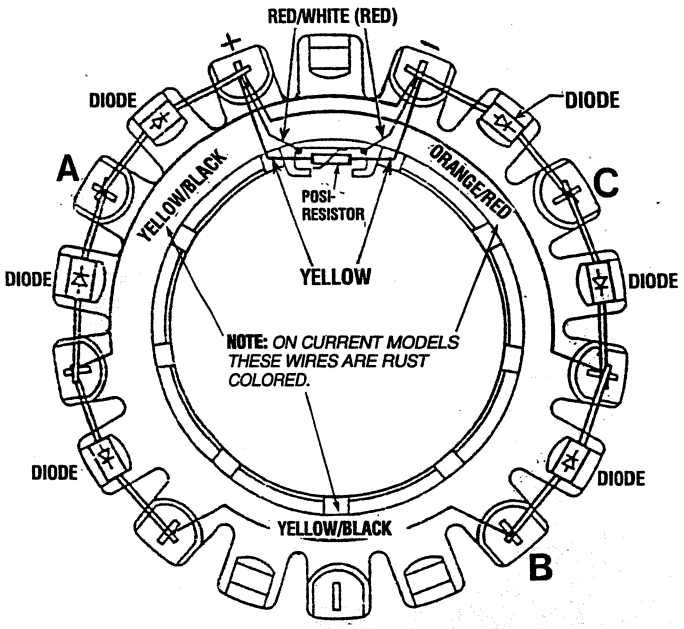
NOTE: *Striped wires were used on early model generators. The colors will ,however, matchup to the current solid color wires.*

BT GENERATOR TROUBLESHOOTING

Exciter Rotor/Field

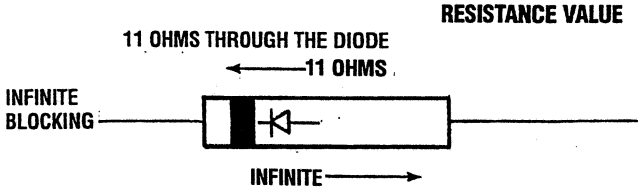
1. **Auxiliary windings group a, b and c.** Locate the three terminal points on the exciter rotor for these auxiliary winding groups. Position the exciter rotor as shown in the illustration and count off the porcelain knobs from the 12 o'clock point either left or right to locate terminal points a, b and c. Measure the resistance value between the pairs of terminal points A & B, B & C, and C & A. There is no need to unsolder these connections unless a faulty reading appears. If this occurs, unsolder and verify the winding fault. There should be no continuity found between any of the three terminal points and the rotor shaft/case ground.

Auxiliary Windings 1.0 - 1.2 Ohms



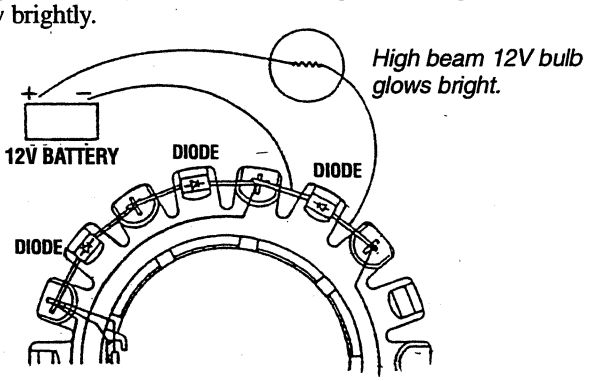
2. **Rotating Field Windings.** Refer to the illustration above of the exciter rotor. The field winding connections are noted as the (+) and (–) connections of the red & white striped wires. Measure the resistance value with your ohmmeter between these two connection points. These connections need not be unsoldered unless a faulty reading appears. If this occurs unsolder the connection and verify the resistance reading. With these connections lifted, there should be no continuity to the rotor shaft. This would indicate a short to ground with these field windings.

3. **Diodes.** Six diodes are mounted on the exciter rotor; they rectify the AC voltage produced by the three groups of auxiliary windings to DC voltages and supply this DC voltage to the rotating field windings.
The diodes can be easily checked in place with the use of a common automotive 12-volt high beam headlight bulb, some jumper leads and the generator's 12 volt starting battery.
A short or an open in a diode can easily be found with the above without having to unsolder and isolate each diode to check it with an ohmmeter.



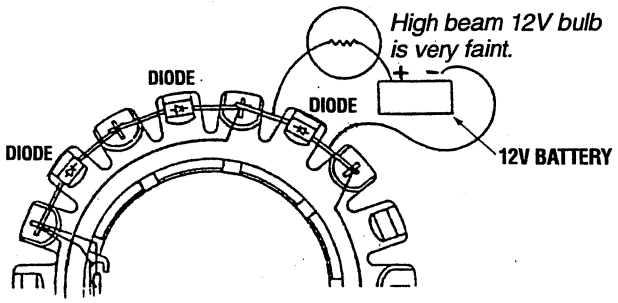
NOTE: *Attempting to check diodes in place with an ohmmeter will give erroneous readings on the diodes due to the auxiliary winding's connections.*

4. When leads are put across the diode, as illustrated, voltage passes through the diode allowing the headlight to glow brightly.



5. **Reverse the leads across the diode.** The diode should block voltage passing through it, and the headlight should not glow, or it may glow faintly.
   a. Should the bulb not glow with leads connected in both directions, the diode is open internally.
   b. Should the bulb glow with leads connected in both directions, the diode is shorted internally.

   In both **a** and **b** above, the diode should be replaced. Check the resistance values of the rotating field windings and the integrity of the resistors connected between the field windings.



6. **Rotating Field Windings 7.0–8.0 ohm.** Readings taken between the two red & white wires connected to the (+) and (–) terminals of the exciter rotor as shown.
7. **Posi-resistor.** Infinite readings between both yellow leads lifted from the (+) and (–) terminals on the exciter rotor. A short in the posi-resistor will cause a loss of the rotating field. AC output voltage will drop to zero.

BT GENERATOR TROUBLESHOOTING/SINGLE PHASE

No-Load Voltage Adjustment

Voltage adjustment is made with the generator regulation being governed by the compound transformer.

1. The selector switch *must* be in the COMP position.
2. To confirm no-load voltage, start the generator and apply a momentary (moderate) load to excite the transformer. The voltage produced by the generator after the momentary load is removed is no-load voltage. Note the voltage output from the generators 120 volt leg(s) (230 volt 50 hertz). The no-load voltage should be between 121-124 volts at 61.5-62 hertz (232- 236 volts at 51.5-52 hertz).
3. To raise or lower the voltage, shims of varying thickness (non-conductive material) are placed or removed from under the steel laminated bar on top of the compound transformer. The material used for shimming should not soften at temperatures in the 176° F (80° C) range. A small reduction in no-load voltage (1 to 3 volts) can some times be accomplished by gently tapping the top of the laminated steel bar to reduce the gap between the exist ing shims and the transformer core.

VOLTAGE/HERTZ CONNECTION BAR

If there is no automatic voltage regulator (AVR) installed, do not change the wiring on the Voltage/Hertz Connection Bar. Simply reconfigure the AC voltage connections at the AC terminal for the hertz change.

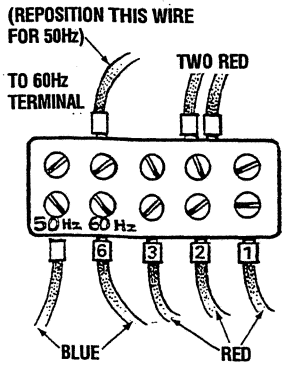
The blue or blue/white lead should be connected to the Hertz terminal that the generator will be set to produce.

The order of the numbered connections on some Voltage/Hertz Connection Bars may be reversed (as in the diagrams below). To ensure a proper connection follow the blue/white or blue lead to the AC terminal block, it should connect to the correct terminal: stud 6(V1) for 50 Hz, 5(W2) for 60 Hz. See the *BT WIRING SCHEMATIC.*

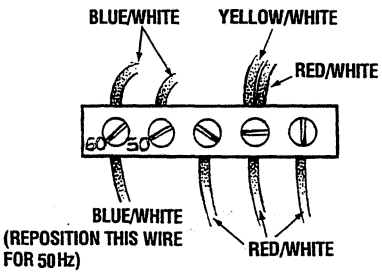
NOTE: *When the optional voltage regulator is installed and if the Blue/White (Blue) lead is not correctly positioned to correspond to the Hertz the unit is operating at, the regulator will sense incorrect voltage and cause the generator to produce abnormally high output voltage.*

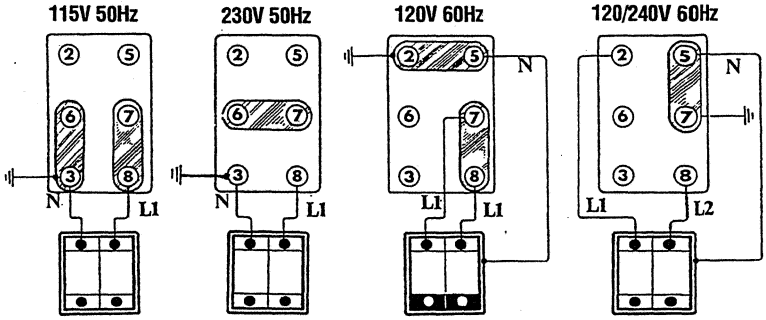
CURRENT MODELS

VOLTAGE/HERTZ CONNECTION BAR



EARLY MODELS





BT Generator Six Stud AC Voltage Connections

NOTE: *The frame ground wire must be moved when changing from 110 volts and 110/220 volts 50 hertz to 230 volts 50 hertz. For output leads from the AC terminal block, use terminal ends for 1/4 inch studs that will accept multi-strand copper wire sized for the amperage rating from the hot lead connection. The frame ground wire connects between the neutral stud and the generator frame.*

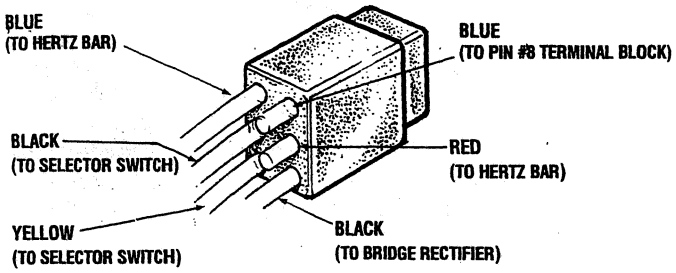
Generator Frequency

1. Frequency is a direct result of engine/generator speed:
   1800 rpm = 60 hertz;
   1500 rpm = 50 hertz.
2. To change generator frequency follow the steps below.
   a. Connect the AC output leads to the AC terminal block, following the correct diagram above..
   b. If an AVR is installed, reposition the blue or blue/white lead to correspond to the hertz selected on the Voltage/Hertz Connection Bar.
   c. Start the engine, monitor voltage and adjust engine no-load speed. Adjust diesel units by the linkage between the throttle arm and fuel solenoid or the throttle lever on the injection pump.
   60 hertz: no-load speed, 61.5-62.0 hertz.
   50 hertz: no-load speed, 51.5-52.0 hertz.
   d. After the no-load hertz adjustment is made, the no-load voltage may need to be readjusted. In most cases, if the generator was producing the correct no-load voltage at the previous hertz setting, it would be correct at the changed hertz setting.
   In the event it needs adjustment, adjust the shim thickness under the laminated steel bar of the transformer.
   60 hertz: no-load voltage, 121-124 volts
   50 hertz: no-load voltage, 232-236 volts,
   e. Load the generator to the rated amperage output corresponding to the hertz speed of the generator.
   Rated Loaded Speed
   60 hertz: loaded speed, 58.5-59.0 hertz
   50 hertz: loaded speed, 48.5-49.0 hertz
   The lowest acceptable voltage at full rated output (amps)
   60 hertz: 108-110 volts
   50 hertz: 205-210 volts

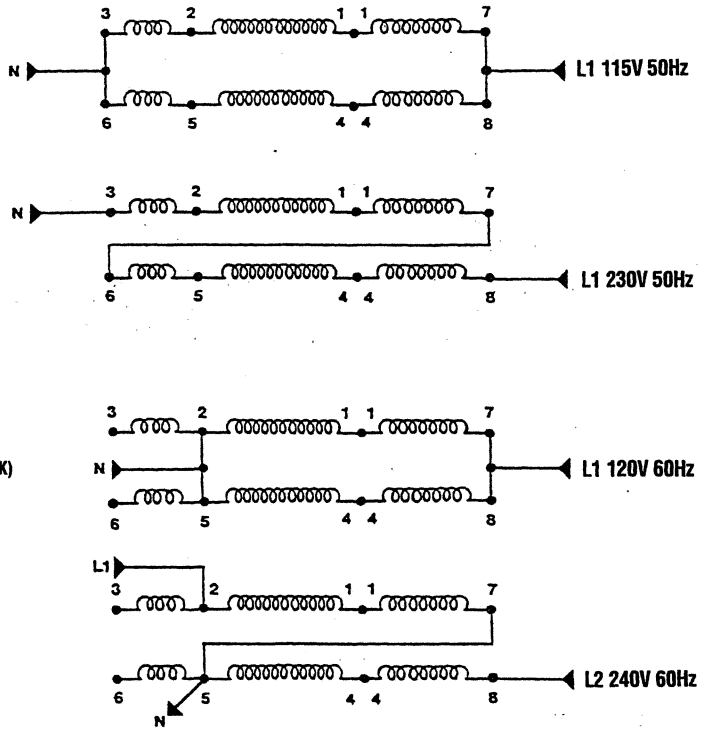
BT GENERATOR TROUBLESHOOTING

f. Should the voltage drop below the proper rate, loaded excitation can be increased to raise this voltage by repositioning connections on the Voltage/Hertz Connection Bar. Repositioning the two leads (red/white and yellow/white) from (1) to (2) or (3) terminals will increase the loaded voltage out progressively in that order.

NOTE: *No-load voltage may be effected needing readjustment with the compound transformer.* ***Do not*** *use these adjustments to compensate for overload conditions being placed on the generator/engine (inductive-motor type loads). Loss of generator hertz/speed, the result of overload, will cause a drop in voltage output.*



A.V.R. Plug and Connections



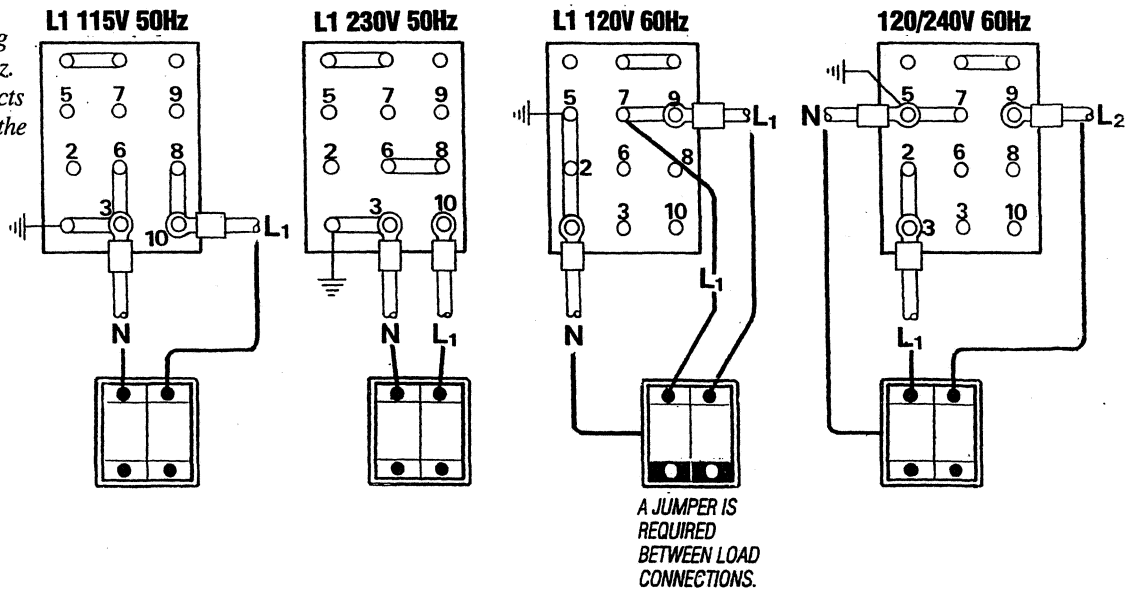
Terminal Block Wiring Connections

Wiring connections needed to obtain proper voltage and frequency are illustrated in the diagrams above.

NOTE: *Connections 1 and 4 are located on two red terminals below the compound transformer.*

AC TERMINAL BOARD CONNECTIONS [12 STUD]

NOTE: *The frame ground wire must be moved when changing from 115V/50Hz to 230V/50Hz. The frame ground wire connects between the neutral stud and the generator frame.*

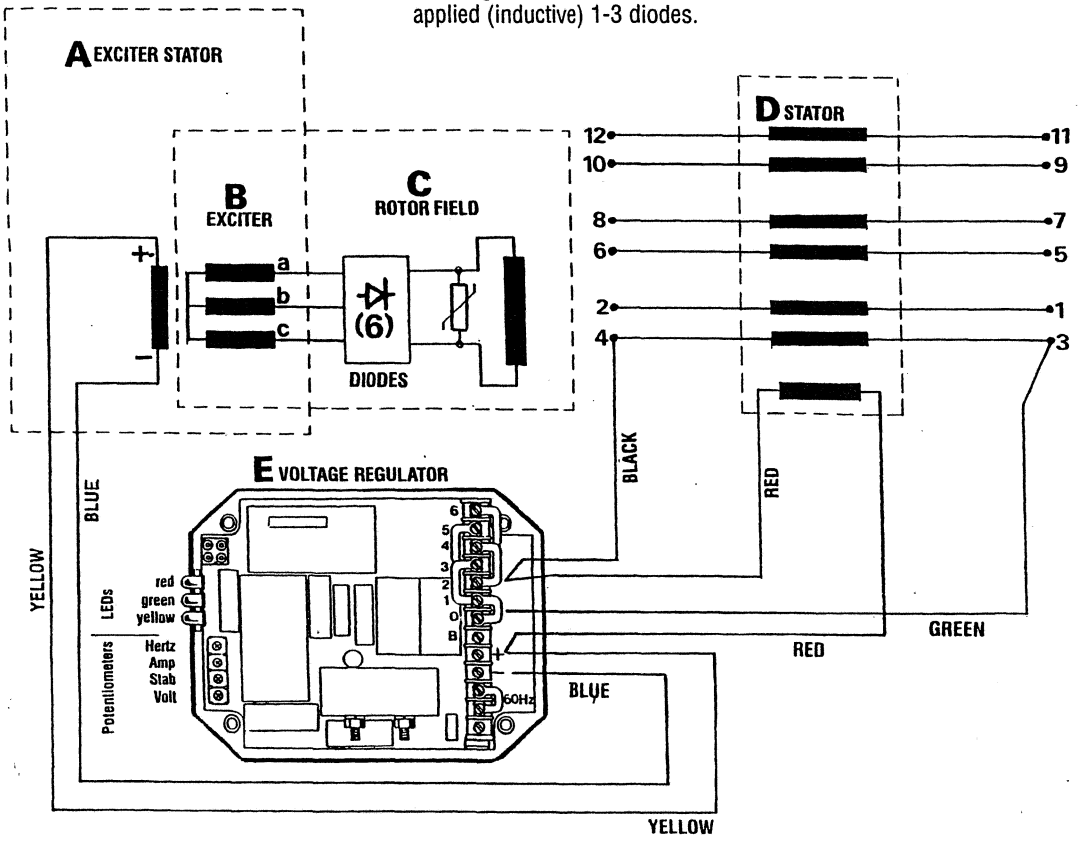


NOTE: *For ouput leads from the AC terminal block use terminal ends for 1/4"studs that accept multi-strand copper wire sized for the average rating from the hot lead connection*

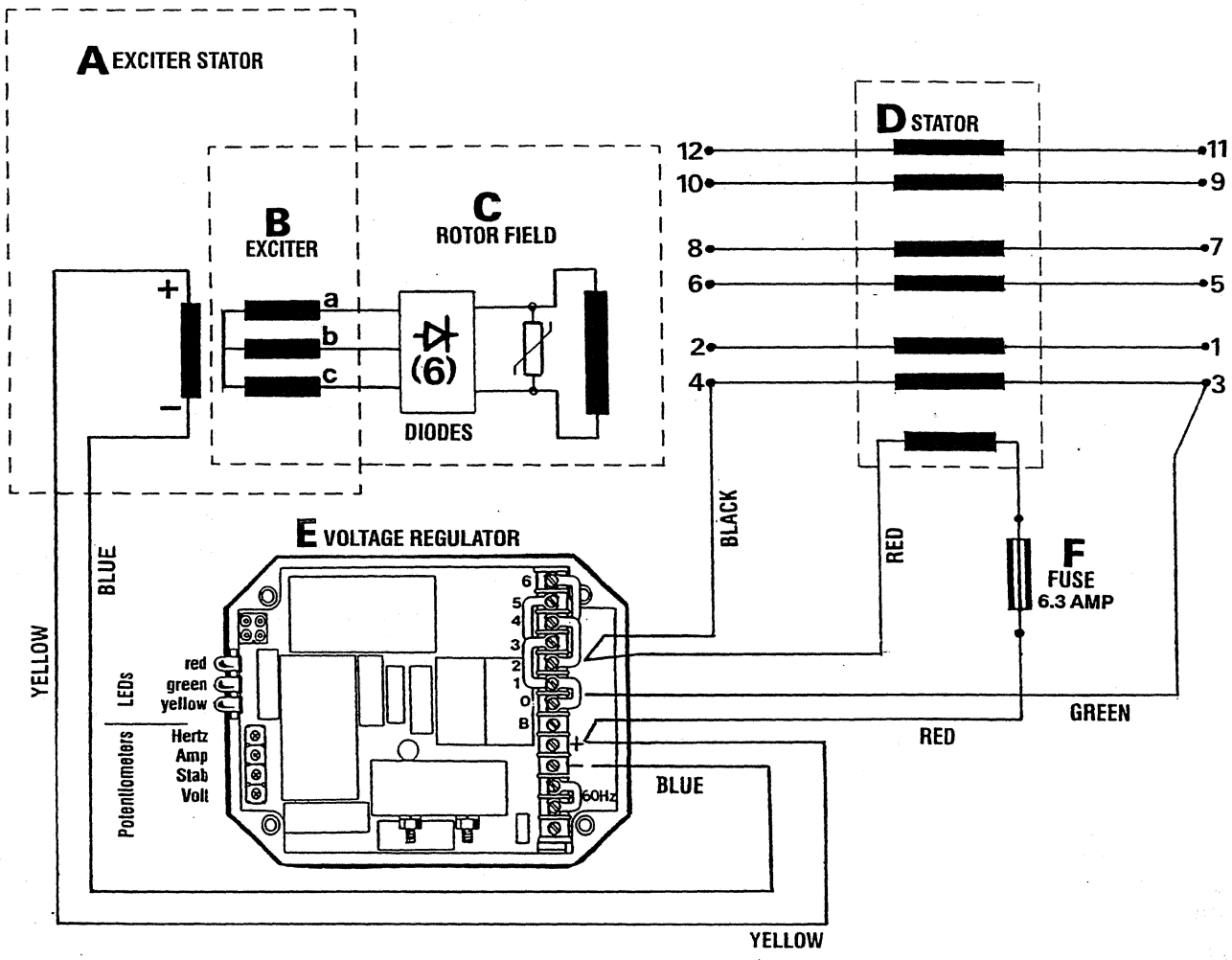
BT GENERATOR TROUBLESHOOTING/3 PHASE

NOTE: *AC generator troubleshooting must be performed with the engine operatin at 60 Hz.*

FAULT	PROBABLE CAUSE
NO AC VOLTAGE OUTPUT AT NO LOAD.	**1.** Short or open in the main stator winding. **2.** Shorted pozi-resistor on exciter rotor. **3.** Four or more shorted or open diodes on exciter rotor. **4.** Open in exciter stator winding. **5.** Open in rotating field winding.
RESIDUAL VOLTAGE PRODUCED AT NO LOAD 15 - 20 VOLTS AC.	**1.** Blown 6 AMP fuse auxiliary circuit AVR. **2.** Faulty voltage regulator **3.** Shorted or open main stator auxiliary winding.
LOW AC VOLTAGE OUTPUT AT NO LOAD 60 - 100 VAC.	**1.** Open or shorted diodes in. exciter rotor 1 to 3 diodes. **2.** Shorted exciter rotor winding. **3.** Faulty voltage regulator.
HIGH AC OUTPUT VOLTAGE 150 VAC OR HIGHER.	**1.** Faulty voltage regulator.
UNSTABLE VOLTAGE OUTPUT.	**1.** STB pod on regulator needs adjustment. **2.** Faulty voltage regulator.
AC VOLTAGE DROP UNDER LOAD 60 - 100 VOLTS AC.	**1.** Diode(s) on exciter rotor breaking down when load is applied (inductive) 1-3 diodes.



BT GENERATOR INTERNAL WIRING
3 PHASE TWELVE WIRE RECONNECTABLE



Resistance Values

A. EXCITER STATOR (17.9 ohm)

B. EXCITER ROTOR WINDINGS a b c (0.6 ohm)

C. ROTATING FIELD (2.49 OHM)

D. MAIN STATOR-WINDINGS (0.05 OHM)
AUXILIARY WINDING (1.2 OHM)

E. VOLTAGE REGULATOR

F. AUXILIARY CIRCUIT FUSE

BT GENERATOR TROUBLESHOOTING CHART

Problem	Probable Cause	Verification/Remedy
Low voltage at N/L and F/L. No adjustment from regulator potentiometer.	1. Regulator board defective.	1. Replace the regulator board. Adjust N/L voltage with transformer; then switch to ELEC and adjust with A.V.R. potentiometer.
	2. Exciter stator winding A-1 open.	2. Check resistance values of C-3 and D-3 windings and their connections.
Low voltage at N/L and voltage drops further as a load is applied.	1. Diode(s) in exciter rotor shorted (B-2).	1. Check the diodes in the exciter rotor.
	2. Auxiliary windings in exciter rotor shorted (B-2).	2. Check the resistance values and continuity to ground.
Voltage OK at N/L and low at F/L.	1. Auxiliary windings in the exciter rotor.	1. Check the resistance values and continuity to ground.
	2. Exciter stator compound winding A-2 is open	2. Check the continuity and the connection of the winding.
	3. Auxiliary windings D-3 or C-3 open.	3. Check the continuity and the connection of the winding.
Voltage unstable.	1. Defective regulator board.	1. Check the stability of DC voltage from the regulator to the exciter stator windings. Operate the unit on COMP. Replace the regulator board.
	2. Engine is hunting. Engine's rpm fluctuating.	2. Check the engine operation and the fuel system.
	3. Electrical connections.	3. Check for clean and secure connections.
		See *ENGINE ADJUSTMENTS.*
Low voltage (70 volts) at N/L with and loss of voltage as load is applied. No loss of engine speed and hertz.	1. Selector switch in wrong position.	1. Place selector switch in COMP position.
High voltage (125 - 135 volts) at N/L with correct voltage when loaded (115 - 120 volts).	1. Generator's engine speed (rpm) high at N/L.	1. Check N/L speed and adjust N/L voltage.
High voltage at N/L and F/L.	1. Generator's engine speed (rpm) high.	1. Check N/L rpm and adjust N/L voltage.
	2. Short in compound transformer auxiliary windings D-3.	2. Check continuity and connections of D-3 windings.
Low voltage (0 - 5 volts) at N/L with growling noise from generator and loss of engine speed when load is applied.	1. Main stator windings shorted C-1, C-2.	1. Check continuity and resistance values of C-1, C-2 windings and connections.
	2. Compound transformer windings shorted D-1, D-2.	2. Check continuity and resistance values of D-1, D-2 windings.
Generator does not excite; voltage is is 0 volts at N/L.	1. Generator's engine speed is slow.	1. Adjust the engine's speed and adjust N/L voltage.
	2. Short in the main stator windings or transformer.	2. Check the diodes as shown in this manual.
Low voltage (10 - 20 volts) at N/L, when load is applied, voltage drops.	1. Diodes(s) in rotating exciter (B-2) shorted.	1. Check B-1 and B-2 in the rotating exciter as explained in this section.
	2. Bridge rectifier defective.	2. Follow test procedure for the bridge rectifier.
	3. Auxiliary windings B-1 shorted.	3. Check the continuity and resistance values.
	4. Auxiliary windings D-3 and/or C-3 open.	4. Check the continuity and resistance values of windings and connections.
Low voltage at N/L and F/L (50 - 70 volts).	1. Exciter stator windings (A) are open.	1. Check the continuity and resistance values of the windings.
	2. Generator's engine speed (rpm) is too low.	2. Check the N/L rpm and adjust the N/L voltage. Check and adjust the engine's rpm.
Voltage correct at N/L, but not at F/L with loss of engine rpm (hertz).	1. Generator overload.	1. Monitor the load.
	2. Rotating diode failing.	2. Check the diode.
	3. Generator's engine speed is low.	3. Check the electronic governor operation.
	4. Low power load factor.	4. Check the type of load applied. Consider use of optional regulator board.
Voltage correct at N/L and loss of voltage at F/L.	1. Diode in exciter rotor B-2 shorted.	1. Check the diodes in the exciter rotor.
High voltage at N/L with no adjustment from regulator potentiometer.	1. Regulator board defective.	1. Replace the regulator board. Adjust N/L voltage with transformer; then switch to ELEC and adjust with A.V.R. potentiometer.

BTG/BTGA 8.5KW SPECIFICATIONS

SPECIFICATIONS

Engine Type	Gasoline, four-cycle, two-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism. (18.5 hp at 1800 rpm max.)
Engine Speed	1800 rpm @ 60 Hertz 1500 rpm @ 50 Hertz
Governor	Hoof, flyball type, 5% speed regulation
Combustion Chamber	Multi-sphere type
Bore & Stroke	2.76 x 2.74 inches (70 x 69.6 mm) BTG 3.03 x 2.74 inches (77 x 69.6 mm) BTGA
Piston Displacement	965.4 cubic inches (1.07 liters)
Firing Order	1 - 3 - 4 -2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque	51.3 lb-ft (7.1 kg-m) at 1800 rpm
Compression Ratio	9.2:1
Compression Pressure (Limit of difference between cylinders)	170 psi (12 kg/cm²) at 300 rpm (2.8 psi [2.0 kg/cm²])
Dimensions	Height: 23.63 inches (600.20 mm) Width: 18.75 inches (476.25 mm) Length: 31.50 inches (800.10 mm)
Weight	513 lbs (232.7 kgs)
Fuel Consumption	1.4 U.S.gph (6.0 LPH) at full rated output (approximate)
Inclination	Continuous 15° Temporary 20° (not to exceed 20 min.)
Valve Timing	Intake Opens 15° BTDC Intake Closes 44° ABDC Exhaust Opens 53° BBDC Exhaust Closes 6° ATDC
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance	Intake 0.0098 inches (0.25mm) Exhaust 0.0098 inches (0.25mm)

IGNITION

General	Battery ignition, 12 volts, negative ground, distributor with igniter, mobile pick-up, ignition coil and spark plugs
Distributor	Solid state type with signal generator and igniter
Spark Plug Thread Size	14mm x 1.25 pitch
Spark Plug Type	Westerbeke part number 033805
Carburetor (STD type)	Down draft type, single barrel with USCG approved flame arrester

LUBRICATION

General	Pressure type by Trochoid pump, chain-driven by crankshaft
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	3.9 U.S. qts (3.7 liters)
Operating Oil Pressure (engine hot)	25-35 psi (1.7 - 2.50 kg/cm²)
Oil Grade	API Category SJ, SL, SM or better. SAE 30W, 10W-30 or 10W-40

FUEL

General	Conventional carburetor type with fuel lift pump
Fuel	Unleaded 89 Octane or better. Ethanol blend E10 **maximum.**
Lift Pump	12 volt DC, lift capacity 6 ft (1.8m)
Fuel Screen (engine)	Reusable screen type (one at inlet to carburetor and one in base of early style fuel pump)
Air Cleaner	Metal screen type - cleanable
Air Flow (engine combustion	35 cfm (1.0 cmm)

COOLING

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	130 – 150° F (55 – 66° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven.
Sea Water Pump	Positive displacement, rubber impeller, belt-driven.
Sea Water Flow	6.7 gpm (25.3 lpm) at 1800 rpm (measured before discharging into the exhaust elbow)
System Capacity (fresh water)	5 qts (4.7 liters)

ELECTRICAL

Starting Battery	12-volt negative ground 400-600 C.C.A. rated minimum
Battery Capacity	90 - 125 (ampere-hours)
DC Battery Charger	12VDC 50 amp rated alternator
Starter	12-Volt, 1.2 Kw, reduction type, solenoid mounted
DC No-Load Current	90 Amp (max) at 11.5 volts
DC Cranking Current	175 - 200 amps (cold engine)

BTG/BTGA 8.5KW SPECIFICATIONS

AC GENERATOR

General	Brushless, four pole, revolving field. Pre-lubricated, single bearing design. Reconnectable, single phase transformer regulation (optional solid state voltage regulator)	
Voltage	120 or 120/240 volts - 60 hertz 220 Volts - 50 Hertz	
Voltage Regulation	±5% no load to full load.	
Frequency Regulation	±3 Hertz (5%) no load to full load.	
Rating (Volts AC)		
60 Hz (1800 rpm)	120 volts 120/240 volts	70 amps 70/35 amps
50 Hz (1500 rpm)	220 volts	31 amps
AC Circuit Breaker	To be rated at 120% of the generators rated amperage output and voltage	
Generator Cooling	200 - 225 cfm (5.7 - 6.4 cmm) Air requirements (60 Hz) at 1800 rpm	

NOTE: *Increase air supply 15% for 50 Hertz operation (1500 rpm)*

Engine Combustion Air Requirements, (60 Hertz) at 1800 rpm	35 cfm (1.0 cmm)

TUNE-UP SPECIFICATIONS

Spark Plug Gap	0.031 ± 0.002 inches (0.80 ± 0.05mm)
Timing	18° ± 1° BTDC at 1800 rpm

EMISSION CONTROL

Engine Modifications

BTG 12.5KW SPECIFICATIONS

SPECIFICATIONS

Engine Type	Gasoline, four-cycle, four-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism. (22.5 hp at 1800 rpm max.)
Engine Speed	1800 rpm @ 60 Hertz 1500 rpm @ 50 Hertz
Governor	Hoof, flyball type, 5% speed regulation
Combustion Chamber	Multi-sphere type
Bore & Stroke	3.03 x 2.74 inches (77 x 69.6 mm)
Piston Displacement	79.1 cubic inches (1.296 liters)
Firing Order	1 - 3 - 4 -2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque	63.6 lb-ft (8.8 kg-m) at 1800 rpm
Compression Ratio	9.2:1
Compression Pressure (Limit of difference between cylinders)	170 psi (12 kg/cm²) at 300 rpm (2.8 psi [2.0 kg/cm²])
Dimensions	Height: 23.63 inches (600.10 mm) Width: 18.75 inches (476.25 mm) Length: 33.63 inches (854.20 mm)
Weight	533 lbs (241.7 kgs)
Fuel Consumption	1.6 U.S.gph (6.0 LPH) at full rated output (approximate)
Inclination	Continuous 15° Temporary 25° (not to exceed 20 min.)
Valve Timing	Intake Opens 15° BTDC Intake Closes 44° ABDC Exhaust Opens 53° BBDC Exhaust Closes 46° ATDC
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance	Intake 0.0098 inches (0.25mm) Exhaust 0.0098 inches (0.25mm)

IGNITION

General	Battery ignition, 12 volts, negative ground, distributor with igniter, mobile pick-up, ignition coil and spark plugs
Distributor	Solid state type with signal generator and igniter
Spark Plug Thread Size	14mm x 1.25 pitch
Spark Plug Type	Westerbeke part number 033805
Carburetor (STD type)	Down draft type, single barrel with USCG approved flame arrester

LUBRICATION

General	Pressure type by Trochoid pump, chain-driven by crankshaft
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	3.9 U.S. qts (3.7 liters)
Operating Oil Pressure (engine hot)	25-35 psi (1.7 - 2.50 kg/cm²)
Oil Grade	API Category SJ, SL, SM or better. SAE 30W, 10W-30 or 10W-40

FUEL

General	Conventional carburetor type with fuel lift pump
Fuel	Unleaded 89 Octane or better. Ethanol blend E10 **maximum.**
Lift Pump	12 volt DC, lift capacity 6 ft (1.8m)
Fuel Screen (engine)	Reusable screen type (one at inlet to carburetor and one in base of early style fuel pump)
Air Cleaner	Metal screen type - cleanable
Air Flow (engine combustion	41.1 cfm (1.16 cmm)

COOLING

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	130 – 150° F (55 – 66° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven.
Sea Water Pump	Positive displacement, rubber impeller, belt-driven.
Sea Water Flow	6.7 gpm (25.3 lpm) at 1800 rpm (measured before discharging into the exhaust elbow)
System Capacity (fresh water)	5 qts (4.7 liters)

ELECTRICAL

Starting Battery	12-volt negative ground 400-600 C.C.A. rated minimum
Battery Capacity	90 - 125 (ampere-hours)
DC Battery Charger	12VDC 50 amp rated alternator
Starter	12-Volt, 1.3 Kw, reduction type, solenoid mounted
DC No-Load Current	90 Amp (max) at 11.5 volts
DC Cranking Current	175 - 200 amps (cold engine).

BTG 12.5KW SYSTEM SPECIFICATIONS

AC GENERATOR

General	Brushless, four pole, revolving field. Pre-lubricated, single bearing design. Reconnectable, single phase transformer regulation (optional solid state voltage regulator)	
Voltage	120 or 120/240 volts - 60 hertz 220 Volts - 50 Hertz	
Voltage Regulation	±5% no load to full load.	
Frequency Regulation	±3 Hertz (5%) no load to full load.	
Rating (Volts AC)		
60 Hz (1800 rpm)	120 volts 120/240 volts	104 amps 104/52 amps
50 Hz (1500 rpm)	220 volts	47 amps
AC Circuit Breaker	To be rated at 120% of the generator's rated amperage output and voltage	
Generator Cooling	220 cfm (6.23 cmm) Air requirements (60 Hz) at 1800 rpm	

NOTE: *Increase air supply 15% for 50 Hertz operation (1500 rpm)*

Engine Combustion Air Requirements, (60 Hertz) at 1800 rpm	41.1 cfm (1.16 cmm)

TUNE-UP SPECIFICATIONS

Spark Plug Gap	0.031 ± 0.002 inches (0.80 ± 0.05mm)
Timing	13° BTDC ± 1° at 1800 rpm

EMISSION CONTROL

Engine Modifications

BTG 15.0KW SPECIFICATIONS

SPECIFICATIONS

Engine Type	Gasoline, four-cycle, two-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism. (27 hp at 1800 rpm max.)
Engine Speed	1800 rpm @ 60 Hertz 1500 rpm @ 50 Hertz
Governor	Hoof, flyball type, 5% speed regulation
Combustion Chamber	Multi-sphere type
Bore & Stroke	3.03 x 3.15 inches (77 x 80 mm)
Piston Displacement	90.0 cubic inches (1.48 liters)
Firing Order	1 - 3 - 4 -2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque	76.6 lb-ft (10.6 kg-m) at 1800 rpm
Compression Ratio	9.0:1
Compression Pressure (Limit of difference between cylinders)	170 psi (12 kg/cm²) at 300 rpm (2.8 psi [2.0 kg/cm²])
Dimensions	Height: 23.63 inches (600.10 mm) Width: 18.75 inches (476.25 mm) Length: 33.63 inches (854.20 mm)
Weight	560 lbs (254 kgs)
Fuel Consumption	1.9 U.S.gph (7.2 LPH) at full rated output (approximate)
Inclination	Continuous 15° Temporary 25° (not to exceed 20 min.)
Valve Timing	Intake Opens 15° BTDC Intake Closes 58° ABDC Exhaust Opens 58° BBDC Exhaust Closes 15° ATDC
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance	Intake 0.0098 inches (0.25mm) Exhaust 0.0098 inches (0.25mm)

IGNITION

General	Battery ignition, 12 volts, negative ground, distributor with igniter, mobile pick-up, ignition coil and spark plugs
Distributor	Solid state type with signal generator and igniter
Spark Plug Thread Size	14mm x 1.25 pitch
Spark Plug Type	Westerbeke part number 033805
Carburetor (STD type)	Down draft type, single barrel with USCG approved flame arrester

LUBRICATION

General	Pressure type by Trochoid pump, chain-driven by crankshaft
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	3.9 U.S. qts (3.7 liters)
Operating Oil Pressure (engine hot)	25-35 psi (1.7 - 2.50 kg/cm²)
Oil Grade	API Category SJ, SL, SM or better. SAE 30W, 10W-30 or 10W-40

FUEL

General	Conventional carburetor type with fuel lift pump
Fuel	Unleaded 89 Octane or better. Ethanol blend E10 **maximum.**
Lift Pump	12 volt DC, lift capacity 6 ft (1.8m)
Fuel Screen (engine)	Reusable screen type (one at inlet to carburetor and one in base of early style fuel pump)
Air Cleaner	Metal screen type - cleanable
Air Flow (engine combustion	47 cfm (1.3 cmm)

COOLING

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	130 – 150° F (55 – 66° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven.
Sea Water Pump	Positive displacement, rubber impeller, belt-driven.
Sea Water Flow	7 gpm (26.5 lpm) at 1800 rpm (measured before discharging into the exhaust elbow)
System Capacity (fresh water)	7 qts (6.6 liters)

ELECTRICAL

Starting Battery	12-volt negative ground 400-600 C.C.A. rated minimum
Battery Capacity	90 - 125 (ampere-hours)
DC Battery Charger	12VDC 50 amp rated alternator
Starter	12-Volt, 1.2 Kw, reduction type, solenoid mounted
DC No-Load Current	90 Amp (max) at 11.5 volts
DC Cranking Current	175 - 200 amps (cold engine).

BTG 15.0KW SPECIFICATIONS

AC GENERATOR

General	Brushless, four pole, revolving field. Pre-lubricated, single bearing design. Reconnectable, single phase transformer regulation (optional solid state voltage regulator)	
Voltage	120 or 120/240 volts - 60 hertz 220 Volts - 50 Hertz	
Voltage Regulation	±5% no load to full load.	
Frequency Regulation	±3 Hertz (5%) no load to full load.	
Rating (Volts AC)		
60 Hz (1800 rpm)	120 volts 120/240 volts	124 amps 124/62 amps
50 Hz (1500 rpm)	220 volts	60 amps
AC Circuit Breaker	To be rated at 120% of the generator's rated amperage output and voltage	
Generator Cooling	250 - 275 cfm (7.0 - 7.8 cmm) Air requirements (60 Hz) at 1800 rpm	

NOTE: *Increase air supply 15% for 50 Hertz operation (1500 rpm)*

Engine Combustion Air Requirements, (60 Hertz) at 1800 rpm	47 cfm (1.3 cmm)

TUNE-UP SPECIFICATIONS

Spark Plug Gap	0.031 ± 0.002 inches (0.80 ± 0.05mm)
Timing	18° ± 1° BTDC at 1800 rpm

EMISSION CONTROL

Engine Modifications

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

ENGLISH TO METRIC CONVERSION CHART

Multiply Temperature	By	To get equivalent number of:
Degree Fahrenheit (°F)	(°F-32) ÷ 1.8	Degree Celsius °C)
Multiply Acceleration	**By**	**To get equivalent number of:**
Foot/second^2(ft/sec^2)	0.3048	Meter/second^2(m/s^2)
Inch/second^2(in./sec^2)	0.0254	Meter/second^2 (m/s^2)
Multiply Torque	**By**	**To get equivalent number of:**
Pound-inch (lb·in.)	0.11298	Newton-meters (N·m)
Pound-foot (lb·ft)	1.3558	Newton-meters (N·m)
Multiply Power	**By**	**To get equivalent number of:**
Horsepower (hp)	0.746	Kilowatts (kW)
Multiply Pressure or Stress	**By**	**To get equivalent number of:**
Inches of water (in. H_2O)	0.2491	Kilopascals (kPa)
Pounds/square in. (lb/in.^{2})	6.895	Kilopascals (kPa)
Multiply Energy or Work	**By**	**To get equivalent number of:**
British Thermal Unit (Btu)	1055	Joules (J)
Foot-pound (ft·lb)	1.3558	Joules (J)
kilowatt-hour (kW·hr)	3,600,000. or 3.6×10^6	Joules (J = one W/s)
Multiply Light	**By**	**To get equivalent number of:**
Foot candle (fc)	1.0764	Lumens/meter^2(lm/m^2)
Multiply Fuel Performance	**By**	**To get equivalent number of:**
Miles/gal (mile/gal)	0.4251	Kilometers/liter (km/L)
Gallons/mile (gal/mile)	2.3527	Liter/kilometer (L/km)
Multiply Velocity	**By**	**To get equivalent number of:**
Miles/hour (mile/hr)	1.6093	Kilometers/hour (km/hr)

Multiply Length	By	To get equivalent number of:
Inch (in.)	25.4	Millimeters (mm)
Foot (ft)	0.3048	Meters (m)
Yard (yd)	0.9144	Meters (m)
Mile (mile)	1.609	Kilometers (km)
Multiply Area	**By**	**To get equivalent number of:**
Inch^2(in.^{2})	6452	Millimeters^2(mm^2)
Inch^2(in.^{2})	6.45	Centimeters^2(cm^2)
Foot^2(ft^2)	0.0929	Meters^2(m^2)
Yard^2(yd^2)	0.8361	Meters^2(m^2)
Multiply Volume	**By**	**To get equivalent number of:**
Inch^3(in.^{3})	16387	Millimeters^3(mm^3)
Inch^3(in.^{3})	16.387	Centimeters^3(cm^3)
Inch^3(in.^{3})	0.0164	Liters (L)
Quart (qt)	0.9464	Liters (L)
Gallon (gal)	3.785	Liters (L)
Yard^3(yd^3)	0.7646	Meters^3(m^3)
Multiply Mass	**By**	**To get equivalent number of:**
Pound (lb)	0.4536	Kilograms (kg)
Ton (ton)	907.18	Kilograms (kg)
Ton (ton)	0.907	Tonne (t)
Multiply Force	**By**	**To get equivalent number of:**
Kilogram (kg)	9.807	Newtons (N)
Ounce (oz)	0.2780	Newtons (N)
Pound (lb)	4.448	Newtons (N)

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