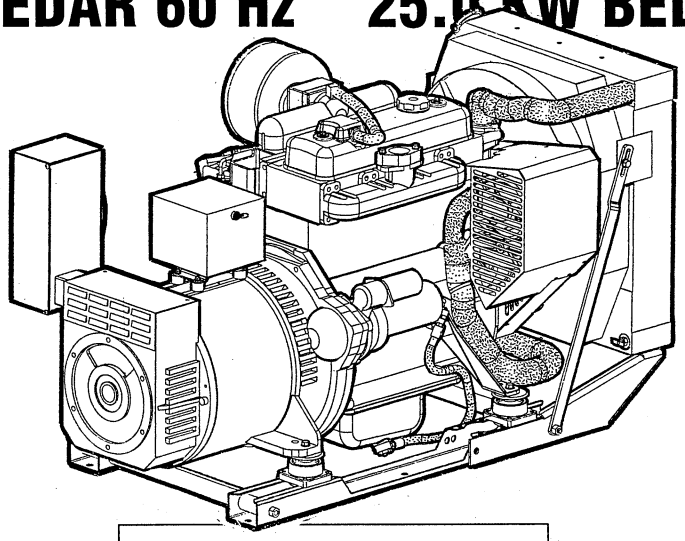
OPERATORS MANUAL
DIESEL GENERATORS
MOBILE AND INDUSTRIAL

20.0 KW BEDAR 60 Hz **16.0 KW BEDAR 50 Hz**

25.0 KW BEDR 60 Hz **20.0 KW BEDR 50 Hz**

32.0 KW BEDAR 60 Hz **25.0 KW BEDAR 50 Hz**



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WESTERBEKE

member NMMA

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MYLES STANDISH INDUSTRIAL PARK • TAUNTON MA 02780
WEBSITE: WWW.WESTERBEKE.COM

CALIFORNIA
PROPOSITION 65 WARNING

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

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

- ***Dizziness***
- ***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 near the engine room. They are inexpensive and easily obtainable at your local hardware store.

WESTERBEKE
Engines & Generators

SAFETY INSTRUCTIONS

INTRODUCTION

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

PREVENT ELECTRIC SHOCK

> ⚠ **WARNING:** ***Do not touch AC electrical connections while engine is running. Lethal voltage is present at these connections!***

- Do not operate this machinery without electrical enclosures and covers in place.
- Shut off electrical power before accessing electrical equipment.
- Use insulated mats whenever working on electrical equipment.
- Make sure your clothing and skin are dry, not damp (particularly shoes) when handling electrical equipment.
- Remove wristwatch and all jewelry when working on electrical equipment.
- Electrical shock results from handling a charged capacitor. Discharge capacitor by shorting terminals together.

PREVENT BURNS — HOT ENGINE

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

- Always check the engine coolant level at the coolant recovery tank.
- Do not open the radiator pressure cap when the engine is hot!

> ⚠ **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.
- Do not open the radiator pressure cap when the engine is hot!

PREVENT BURNS — FIRE

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

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

PREVENT BURNS — EXPLOSION

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

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

ACCIDENTAL STARTING

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

- To prevent accidental starting when servicing the generator, remove the fuse from the control panel.
- Disconnect the battery cables before servicing the engine/generator. Remove the negative lead first and reconnect it last.
- Make certain all personnel are clear of the engine before starting.
- Make certain all covers, guards, and hatches are re-installed before starting the engine.

SAFETY INSTRUCTIONS

BATTERY EXPLOSION

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

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

BATTERY ACID

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

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

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

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

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

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

Vomiting	Muscular twitching
Dizziness	Intense headache
Throbbing in temples	Weakness and sleepiness

AVOID MOVING PARTS

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

- Do not operate the generator without drive belt covers in place!
- 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 belts tension while the engine is operating.

HAZARDOUS NOISE

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

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

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

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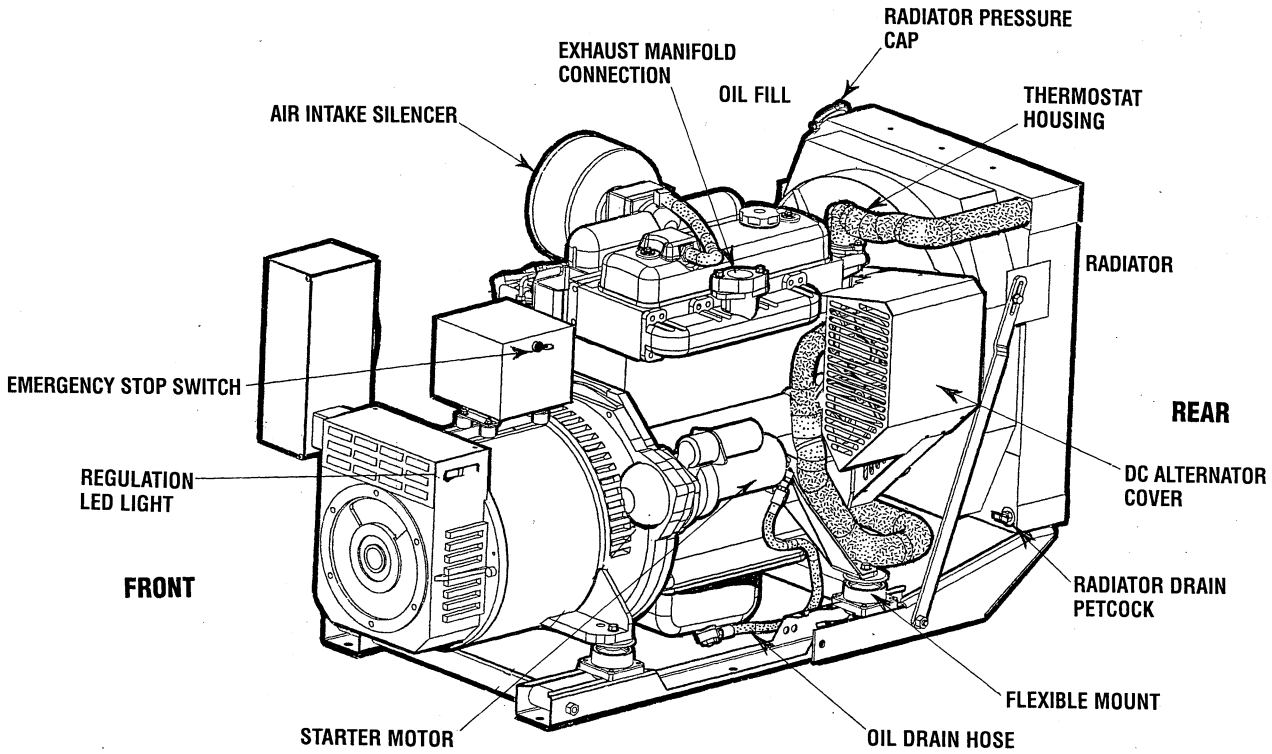
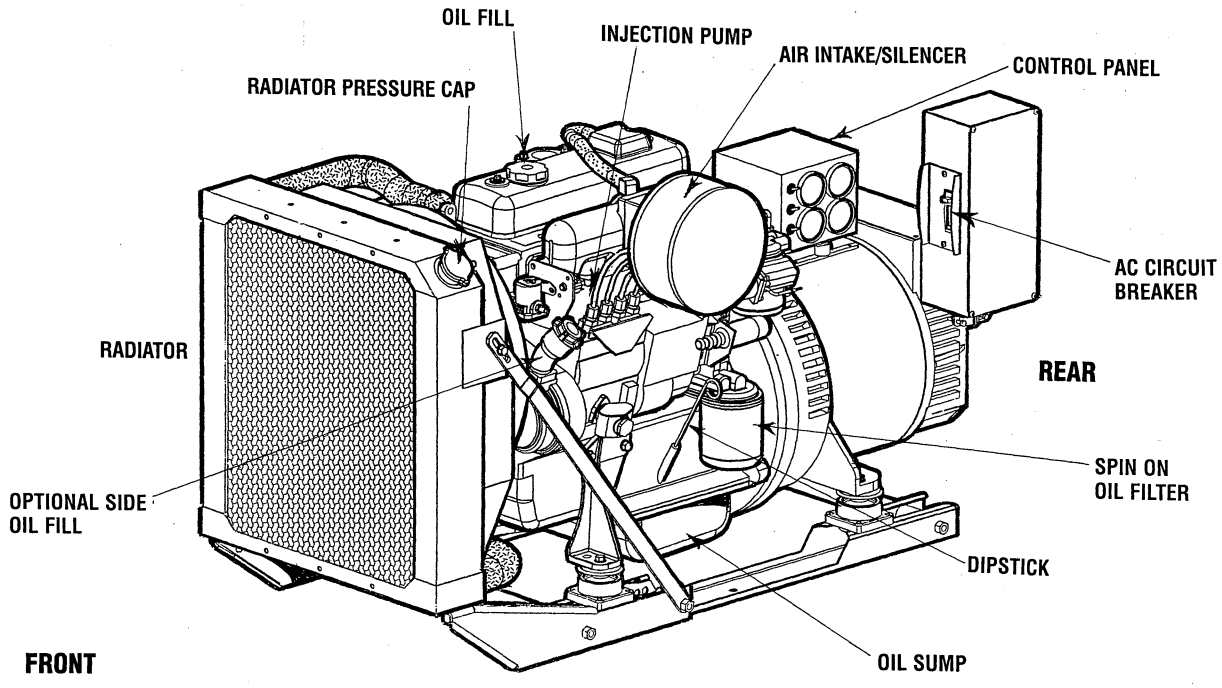
PARTS IDENTIFICATION
32 KW ILLUSTRATED



RIGHT SIDE



LEFT SIDE

INTRODUCTION

This WESTERBEKE Diesel Generator is a product of WESTERBEKE's long years of experience and advanced technology. We take great pride in the superior durability and dependable performance of our engines and generators. Thank you for selecting WESTERBEKE.

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

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

WARRANTY PROCEDURES

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

Customer Identification Card

WESTERBEKE
Engines & Generators

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

PRODUCT SOFTWARE

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

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NOTES, CAUTIONS AND WARNINGS

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

NOTE: *An operating procedure essential to note.*

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

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

INTRODUCTION

SERIAL NUMBER LOCATION

The engine and generator serial numbers and model numbers are located on a decal on the generator housing. Take the time to enter this information on the illustration of the name-plate shown below, as this will provide a quick reference when seeking technical information and/or ordering repair parts.

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

The engine serial number can also be found stamped into the engine block just above the injection pump. The generator serial number is stamped into the generator housing on the flat surface on the left side of the generator.

An identification plate on the engine manifold also displays the engine model and serial number.

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

UNDERSTANDING THE DIESEL ENGINE

The diesel engine closely resembles the gasoline engine, since the mechanism is essentially the same. The cylinders are arranged above a closed crankcase;the crankshaft is of the same general type as that of a gasoline engine, and the diesel engine has the same type of valves, camshaft, pistons, connecting rods and lubricating system.

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

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

ORDERING PARTS

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

SPARES AND ACCESSORIES

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

INSTALLATION MANUAL

Publication #43400 provides detailed information for installing generators and is available at your WESTERBEKE dealer.

FUEL, ENGINE OIL AND ENGINE COOLANT

FUEL

> ⚠ **CAUTION:** ***Use number 2 diesel fuel with a cetane rating of 45 or higher.***

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 filter/water separator between the fuel tank and the engine.

ENGINE OIL

Use a heavy duty engine oil (petroleum or synthetic) with an API classification of CF or CG-4. Change the engine oil and filter after an initial 50 hours of break-in operation, and every 100 hours of operation thereafter.An oil viscosity of SAE 15W-40 is recommended for this engine in all conditions.

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

ENGINE 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.

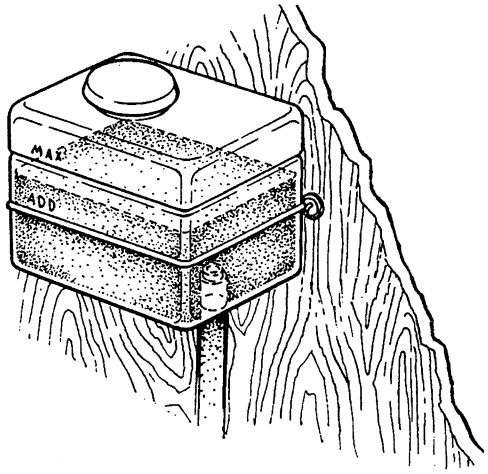
The water and antifreeze should be premixed before being poured into the cooling circuit.

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.

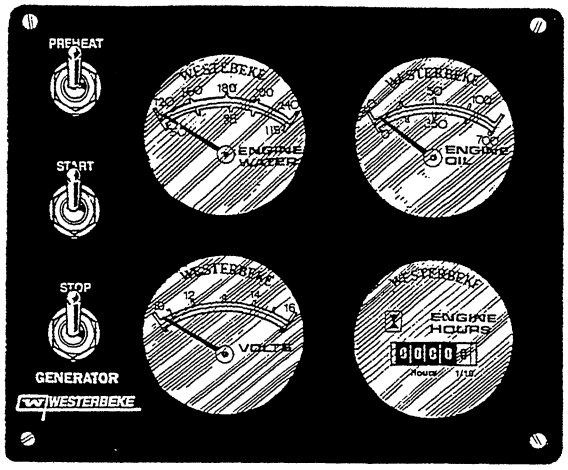


GENERATOR CONTROL PANELS

DESCRIPTION OF SWITCHES

This manually controlled series of WESTERBEKE diesel generators is equipped with toggle switches on the engine control panel and, optionally, at remote panels.

All three switches are momentary contact type and serve the following functions:



PREHEAT: The PREHEAT toggle serves two purposes: preheating the engine for easy starting and bypassing the engine oil pressure switch. The PREHEAT function closes the K2 relay. as well as supplies current to the fuel solenoid pull coil.

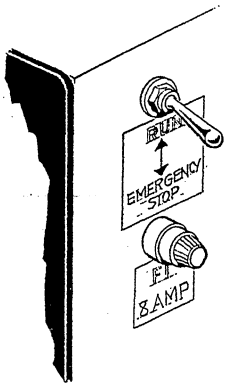
When the PREHEAT switch is depressed, the voltmeter, panel lights, gauges and meters and the hold coil of the fuel solenoid.

START: The START toggle switch closes the K1 relay that energizes the starter solenoid and activates the starter. While the PREHEAT switch is still depressed, depressing the START switch engages the start solenoid. When the engine begins to fire, the START switch should be released. The PREHEAT switch should not be released until the oil pressure reaches 5 - 10 psi.

STOP: The STOP toggle switch is a normally closed switch providing power to the K2 relay. Opening of this switch opens the power circuit to the fuel solenoid, stopping the flow of fuel to the engine and shuts down the engine. To stop the engine, depress the STOP switch. When the STOP switch is depressed, the power feed to the fuel solenoid is opened, and the fuel flow to the engine is stopped. The STOP switch should be depressed until the generator stops rotating

NOTE: *When the engine is shut down, the water temperature gauge and the oil pressure gauge will continue to register the last temperature and oil pressure readings displayed. They will return to zero once electrical power is restored.*

EMERGENCY STOP: The EMERGENCY stop switch on the side of the control box, is normally closed. When depressed, it will open the DC circuit to the control panel and shut the engine down. As the switch is not toggled it can be used when performing maintenance.



DESCRIPTION OF GAUGES

Coolant Temperature

Engine coolant (water) temperature should normally indicate 175° to 195° F (80° to 90° C).

Engine Oil Pressure

Oil pressure (psi) may fluctuate depending on the generator load but should range between between 30 to 60 psi.

DC Voltmeter

Indicates the amount the battery is being charged should show 13V to 14V.

Hourmeter

Registers elapsed time and is used as a guide for when to perform scheduled maintenance.

REMOTE PANEL

For remote operation of the generator system, the same three switches are used. The PREHEAT and START switches are connected in parallel with the gauge panel's switches and serve the same functions as in the gauge panel. The STOP switch is in series with the gauge panel's STOP switch and serves the same function. There is a REMOTE START/STOP WIRING DIAGRAM in this manual.

NOTE: *For additional information on Control Panels. Refer to: STARTING/STOPPING PROCEDURE, DC WIRING DIAGRAMS and TROUBLESHOOTING GAUGES.*

PREPARATIONS FOR INITIAL START-UP

PRESTART INSPECTION

This section of the manual provides the operator with preparation, initial starting, break-in, starting (warm or cold) and stopping procedures. Follow the procedures as presented for the conditions indicated and your WESTERBEKE generator set will give reliable performance and long service life.

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

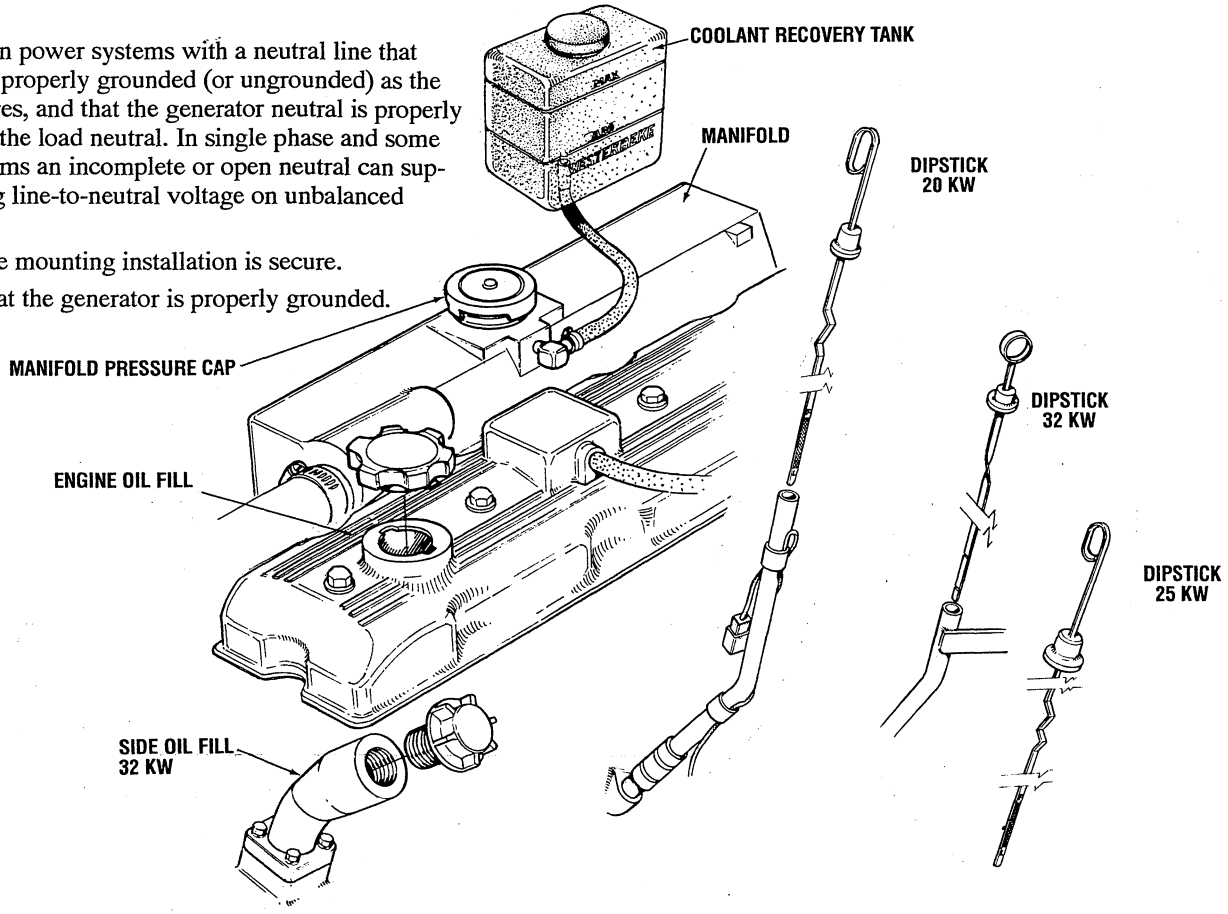
- ☐ Check the engine oil level. Add oil to maintain the level at the high mark on the dipstick.
- ☐ Check the fuel supply and examine the fuel filter/separator bowls for contaminants.
- ☐ Check the DC electrical system. Inspect wire connections and battery cable connections. Make certain the (+) battery cable is connected to the starter solenoid and the negative (–) cable is connected to the engine ground stud (this location is tagged).
- ☐ Check the coolant level in both the plastic recovery tank and at the manifold.
- ☐ Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, and check threaded connections.
- ☐ Check load leads for correct connection as specified in the wiring diagrams.
- ☐ Examine air inlet and outlet for air flow obstructions.
- ☐ Be sure no other generator or utility power is connected to load lines.
- ☐ Be sure that in power systems with a neutral line that the neutral is properly grounded (or ungrounded) as the system requires, and that the generator neutral is properly connected to the load neutral. In single phase and some 3-phase systems an incomplete or open neutral can supply the wrong line-to-neutral voltage on unbalanced loads.
- ☐ Make sure the mounting installation is secure.
- ☐ Make sure that the generator is properly grounded.

⚠ 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.***

GENERATOR VOLTAGE

The speed of the generator engine is adjusted at the factory, however, it is advisable to verify.

To supply 60 hertz, the speed should be 1800 rpm at no-load, and should not fall below 1800 rpm by more than .005 percent .3 Hz at full-load.
To supply 50 hertz, the speed should be 1500 rpm at full-load. Generator voltage should build to its rated value within 5 seconds after rated speed is attained. Record or observe the voltage of the generator at no-load and at full-load (hot). The voltages are easily adjusted to optimum values no-load and full-load (refer to *VOLTAGE ADJUSTMENT* in this manual). If possible, apply actual service load or test load of the same power factor as the load to be used in service. If the voltage cannot be adjusted to suitable values and a fault seems evident, contact your authorized WESTERBEKE service dealer.

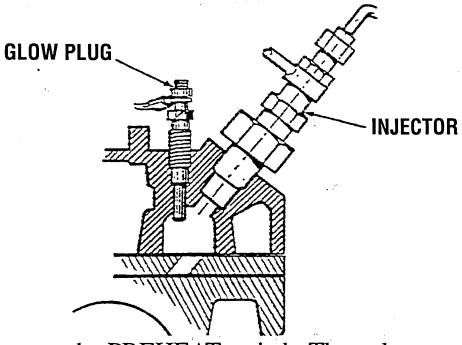


STARTING / STOPPING PROCEDURE

THE STARTING SYSTEM

Westerbeke diesel generators use electric starters assisted by glow plugs for both normal and cold weather starting. The glow plug is located in the combustion chamber so that its tip is in the injector nozzle's spray path. When the glow plug is energized by the PREHEAT button, the plug glows red at the tip and assists in igniting the fuel. The result is a rapid start with less wear on the starter. The start circuitry is designed so that the PREHEAT button must be depressed for the time specified in the preheat chart. Then, while keeping the PREHEAT button engaged, the START button is depressed to crank the engine.

NOTE: *The START switch will not energize unless the PREHEAT switch is depressed. Depressing the PREHEAT switch activates the glow plugs in the cylinder head so use the PREHEAT intermittently to avoid overheating the glow plugs.*

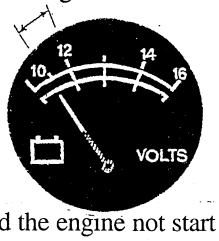


PREHEAT: Depress the PREHEAT switch. The voltmeter and panel lights, gauges and meters will be activated. The PREHEAT switch should be depressed in accordance with the following chart:

Temperature/Preheat

Atmospheric Temperature	Preheating Time
+41°F(+5°C) or higher	Approx. 10 seconds
+41°F(+5°C) to 23°F (-5°C)	Approx. 15 seconds
+23°F(-5°C) or lower	Approx. 20 seconds
Limit of continuous use	30 seconds before cranking

START: While still depressing the PREHEAT switch, depress the START switch. This will engage the starter solenoid. Upon engine starting, release the START switch. Do not release the PREHEAT switch until the oil pressure reaches 15 psi. Then as long as the high water temperature and low oil pressure protective circuits do not activate, the engine will remain energized and continue to run.



NOTE: *When starting: A voltage drop will occur when the preheat switch is depressed.*

Should the engine not start when the START switch is depressed for 10 to 20 seconds, release both switches and wait 30 seconds; repeat the procedure above and preheat longer. *Never run the starter for more than 30 seconds.*

Remote Starting Procedure

The remote start panel is the same as the engine-mounted start panel except that it has a green LED light and no gauges. When starting at a remote location, the green LED lights when the generator is running at approximately 600 rpm. This indicates when the START switch can be released since the starting of the generator may not be audible.

A. When the PREHEAT switch is depressed at the remote start/stop panel the LED light will illuminate. When the START switch is depressed and the starter cranks the engine this LED light will dim. When the engine starts the LED light will brighten signaling to release the START switch. Continue to hold the PREHEAT depressed for a few seconds to allow oil pressure to build up which closes the oil pressure safety switch that is in the series path for 12V B+ to the fuel run solenoid.

B. After the generator is started and the START switch is released, the generators starter will not crank until the PREHEAT switch is operated first because this switch supplies voltage to the START switch.

Once the engine starts, check the engine's instruments for proper oil pressure and battery charging voltage. Apply a light load to the generator and allow the engine's operating temperature to come up to 140-150°F (60-66°C) before applying heavy loads.

NOTE: *Some unstable running may occur in a cold engine. Depressing the PREHEAT switch for 10-15 second intervals will help stabilize the engine RPM until the operating temperature reaches the 140-150°F and a load is applied to the engine.*

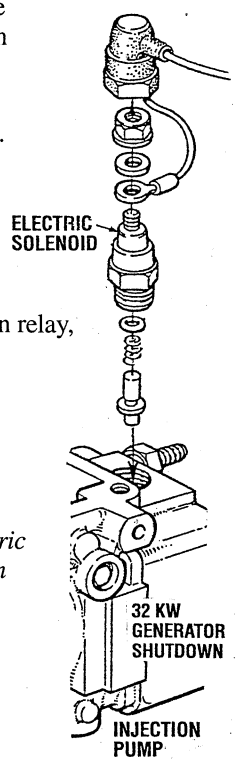
STOPPING PROCEDURE

1. Remove the AC electrical load from the generator and allow the generator to run for three to five minutes to stabilize its operating temperatures.
2. Depress the STOP switch and release it. This opens the K2 relay, shutting the generator down.

Remote Stopping Procedure

To stop the generator, depress the STOP switch and release it, this opens the K2 run relay, shutting the generator down.

NOTE: *The generator is stopped when the electric solenoid mounted on the injection pump is de-energized shutting off the flow of fuel (Models 20 KW and 25 KW). The 32 KW Generator is shutdown by an electric fuel solenoid that is attached to a lever on the fuel injection pump.*



THE DAILY OPERATION

CHECK LIST

Follow this check list each day before starting your generator.

- ☐ Record the hourmeter reading in your log (engine hours relate to the maintenance schedule.)
- ☐ Visually inspect the generator for fuel, oil, or water leaks.
- ☐ Check the oil level (dipstick).
- ☐ Check the coolant level in the coolant recovery tank/radiator.
- ☐ Check your diesel fuel supply.
- ☐ Look for clean fuel in the fuel/separator transparent bowl.
- ☐ Check for loose wires at the alternator.
- ☐ Check the starting batteries (weekly).
- ☐ Check drive belts for wear and proper tension (weekly).

START THE GENERATOR

(See *STARTING PROCEDURES* on previous pages). Allow the engine to warm up for 5 to 10 minutes to reach operating temperatures of 140° to 150°F (60°-66°C) before applying AC loads. Apply loads systematically allowing the generator to adjust to each load before applying the next. Check the gauges for proper oil pressure, operating temperature, and DC voltage.

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

STOPPING THE GENERATOR

Remove the major AC loads from the generator one at a time. Allow the generator to run for a few minutes to stabilize the operating temperature and depress the stop switch. (See *STOPPING PROCEDURES* on the previous page.)

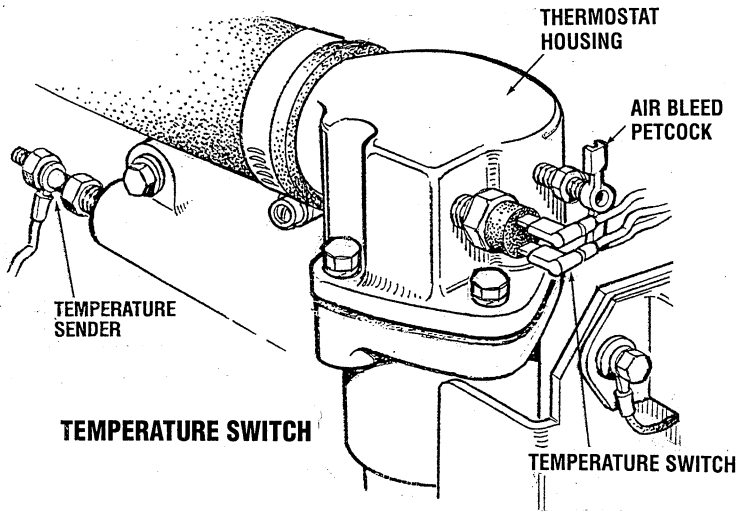
AUTOMATIC SHUTDOWN

SAFETY SHUTDOWN SWITCHES

The engine is protected by two automatic shutdown switches. Should shutdown occur, ***do not attempt to restart without finding and correcting the cause. Refer to the heading "Engine Stops" in the*** **TROUBLESHOOTING** ***section of this manual.*** The following is a description of these automatic shutdown switches:

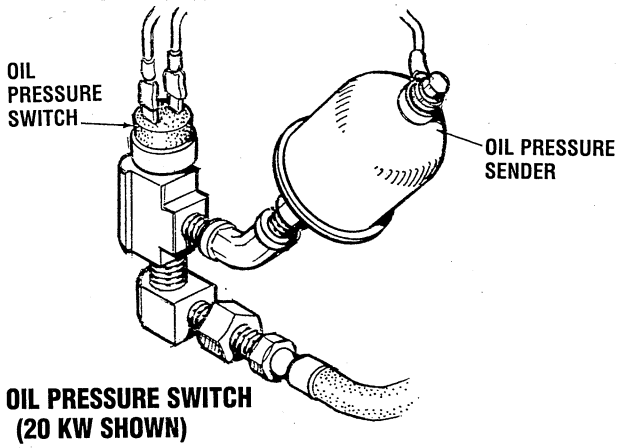
Coolant Temperature Switch

An high water temperature switch is located on the thermostat housing. Normally closed, this switch, should the fresh water coolant's operating temperature reach approximately 210°F (99°C), will open and interrupt the DC voltage to the K2 run relay. thereby shutting off the engine. This switch resets at 195°F (107°C).



Low Oil Pressure Switch

A low oil pressure shutdown switch is located off the engine's oil gallery. Normally open in a static state, this switch's sensor monitors the engine's oil pressure. Should the engine's oil pressure fall to 5-10 psi, this switch will open, interrupting the DC voltage to the K2 run relay, thereby shutting off the engine.



LOW OIL PRESSURE SWITCH (20 KW SHOWN)

Engine Circuit Breaker

The generators 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. If this should occur, check and repair the source of the problem. After repairing the fault, reset the breaker and restart the generator.

MAINTENANCE SCHEDULE

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

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	☐								Diesel No. 2 rating of 45 cetane 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 MAX. and LOW on dipstick.
Coolant Level	☐								Check at recovery tank; if empty, check at radiator. 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.
Fuel Filter		☐		☐	☐	☐	☐	☐	Initial change at 50 hrs, then change every 250 hrs.
Starting Batteries	☐ weekly								Every 50 operating hours check electrolyte levels and make sure connections are very tight. Clean off excessive corrosion.
Engine Oil (and filter)		☐	☐	☐	☐	☐	☐	☐	Initial engine oil & filter change at 50 hrs., then change both every **100** hours.
Generator		☐	☐	☐	☐	☐	☐	☐	Check that AC connections are clean and secure with no chafing. See *GENERATOR SECTION* for additional information.
Fuel/Water Separator			☐	☐	☐	☐	☐	☐	Change every 200 hours.
Electronic Governor Control (if applicable)		☐				☐			Check and or adjust the no-load speed in the panel, required (hertz) and the regulator board adjustment as needed. **NOTE:** *These adjustment are not a warrantable adjustment during or after the unit's break-in.*
Exhaust System		☐		☐		☐		☐	Initially check the exhaust system after the 50 hour unit break-in. Then every 250 operating hour intervals. Check that all connections are tight. No leaks. Ensure no areas are subjected to stress or chaffing.
Engine Hoses			☐	☐	☐	☐	☐	☐	Hose should be hard & tight. Replace if soft or spongy. Check and tighten all hose clamps.
Fuel Feed Pump (32 KW)		☐		☐	☐	☐	☐	☐	Clean strainer every 250 hours, compressed air or kerosene

MAINTENANCE SCHEDULE

NOTE: *Use the engine hour meter 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	
Coolant System					☐			☐	Drain, flush, and refill cooling system with appropriate antifreeze mix.
Air Intake Filter			☐	☐	☐	☐	☐	☐	Clean every 100 hours. Replace as needed.
Electric Fuel Lift Pump		☐		☐	☐	☐	☐	☐	Periodically check the wiring connections..
DC Alternator				☐		☐		☐	Check DC charge from alternator. Check mounting bracket; tighten electrical connections.
***Fuel Injectors**						☐			Check and adjust injection opening pressure and spray condition (see *ENGINE ADJUSTMENTS*).
***Starter Motor**					☐			☐	Check solenoid and motor for corrosion. Remove and lubricate. Clean and lubricate the starter motor pinion drive.
***Preheat Circuit**					☐			☐	Check operation of preheat solenoid. Remove and clean glow plugs; check resistance (4-6 ohms). Reinstall with anti-seize compound on threads.
***Engine Cylinder Compression**					☐			☐	Check compression pressure and timing (see *ENGINE ADJUSTMENTS*).
***Torque Cylinder Head Hold-down bolts**		☐			☐		☐		At first 50 hours, then every 500 hours (see *ENGINE ADJUSTMENTS*).
***Adjust the Valve Clearances**		☐			☐		☐		Adjust Valve Clearances (see *ENGINE ADJUSTMENTS*).
***Radiator**							☐		Remove, have professionally cleaned and pressure tested.

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

ENGINE COOLING CIRCUIT

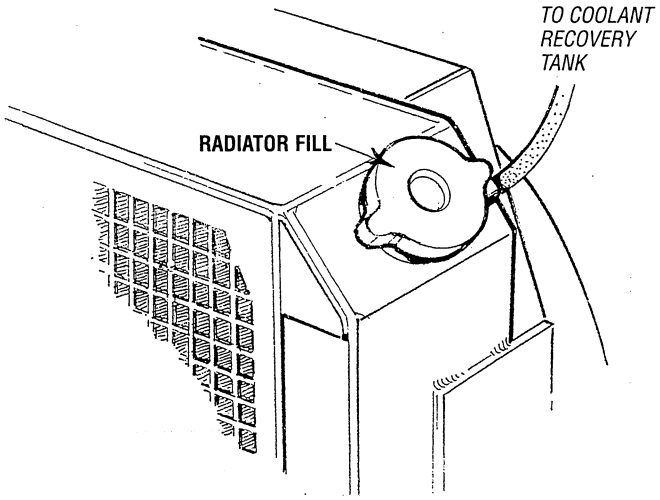
DESCRIPTION

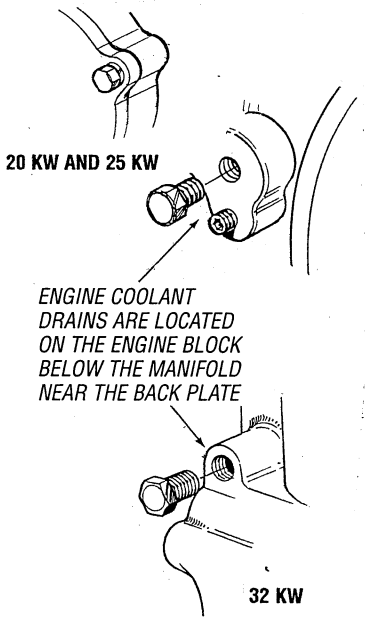
Westerbeke diesel engines are designed and equipped for fresh water cooling. Heat produced in the engine by combustion and friction is transferred to fresh water coolant which circulates throughout the engine. This circulating fresh water coolant cools the engine block and its internal moving parts and the engine oil.

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 radiator where it is cooled and returned to the engine block via the suction side of the circulating pump.

Fresh Water Circuit

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





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 engine 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 radiator level and should be easily accessible.

CHANGING COOLANT

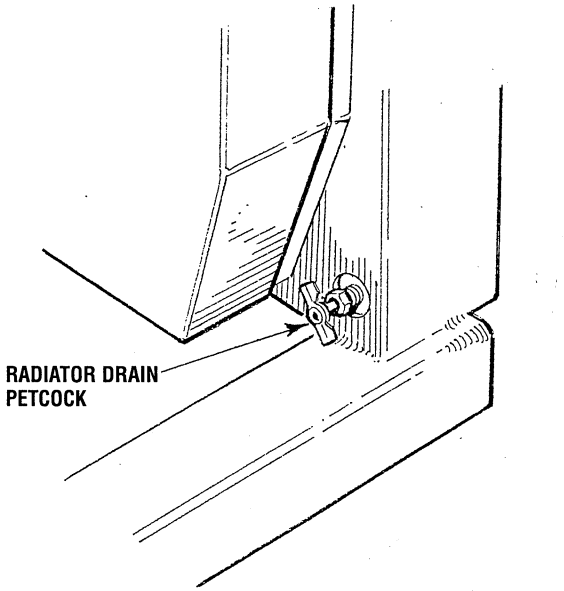
The engine's coolant must be changed according to the *MAINTENANCE SCHEDULE*. If the coolant is allowed to become contaminated, it can lead to overheating problems.

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

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

NOTE: *The petcock on the radiator can also be used to drain engine coolant.*

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



ENGINE COOLING CIRCUIT

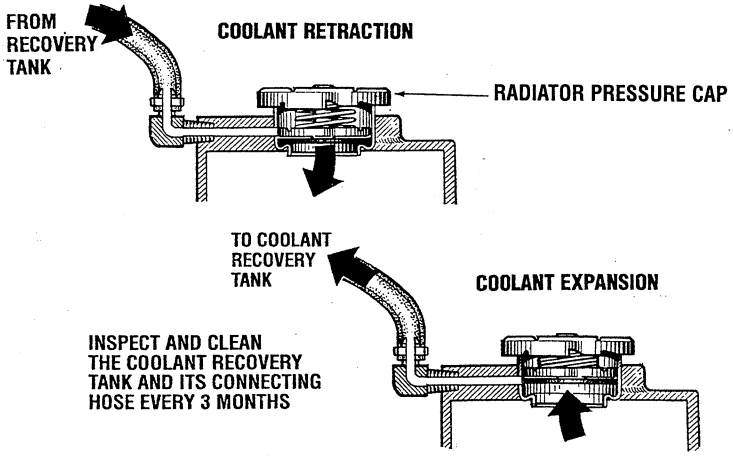
Refilling the Antifreeze Coolant System

Re-install the engine block drain plug. Close the drain plug/petcock on the radiator. Pre-mix your antifreeze and add it to the radiator until the system is visibly near full.

Start the generator and continue to add the antifreeze mix as air is expelled. Observe the engine operating temperature. As the temperature nears 180°F. The thermostat should be opening and flow through the radiator observed.

When all the air is expelled, top off the radiator and install the pressure cap, now add more antifreeze mixture to the remote recovery tank until half full.

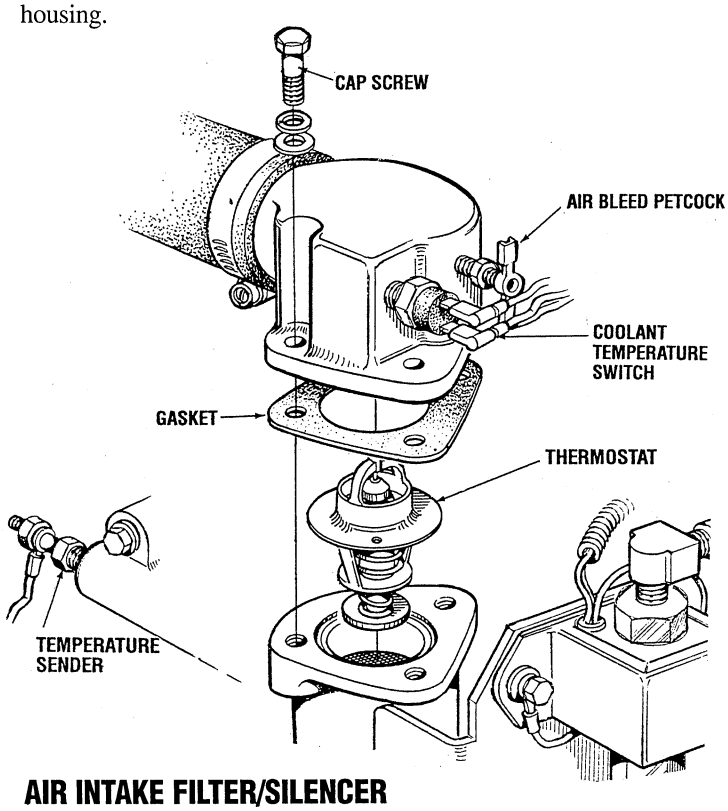
Inspect the system for any leaks. Stop the engine and allow the system to cool down. Coolant in the plastic coolant recovery tank should be drawn into the engines cooling system,. Add enough coolant to the recovery tank to place the level between the low and high marks.



NOTE: *Periodically check the condition of the radiator 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.*

Replacing the Thermostat

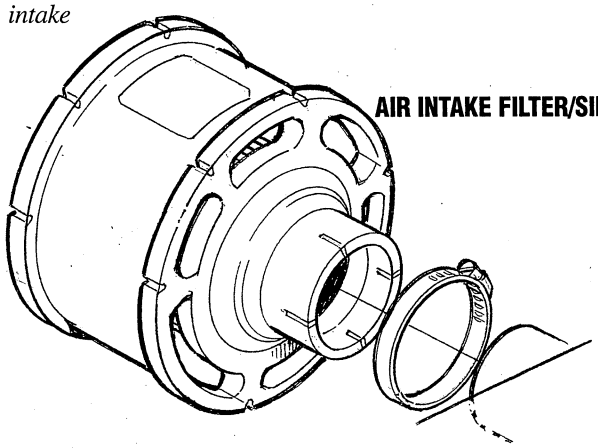
Remove the cap screws and disassemble the thermostat housing as shown. When installing the new thermostat and gasket, apply a thin coat of sealant on both sides of the gasket before pressing it into place. Do *not* over-tighten the cap screws. Run the engine and check for normal temperatures and that there are no leaks at the thermostat housing.



AIR INTAKE FILTER/SILENCER

The replaceable canister contains a paper element that should be inspected every 100 operating hours. Dirt in the element can be shaken off or cleaned with compressed air, however, if the element is greasy or black with dirt, the canister must be replaced, carry a spare.

NOTE: *To operate efficiently a diesel engine must intake a continuous volume of clear air. Hard starting, an erratic idle, and black exhaust smoke are all symptoms of a restricted air intake*



CANISTER SLIDES ONTO THE MANIFOLD AND IS HELD IN PLACE WITH A HOSE CLAMP

FUEL SYSTEM

DIESEL FUEL

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

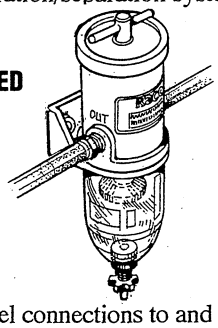
FUEL/WATER SEPARATOR

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

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

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

OWNER INSTALLED FUEL WATER SEPERATOR

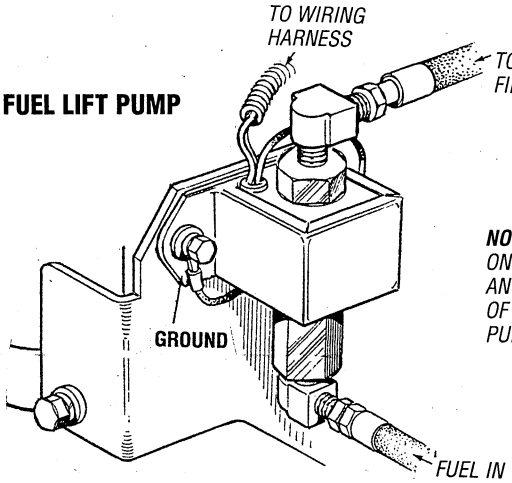


FUEL LIFT PUMP

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

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

FUEL LIFT PUMP



NOTE: *THE FUEL LIFT PUMP ON THE 32 KW IS AN INTEGRAL PART OF THE FUEL INJECTION PUMP*

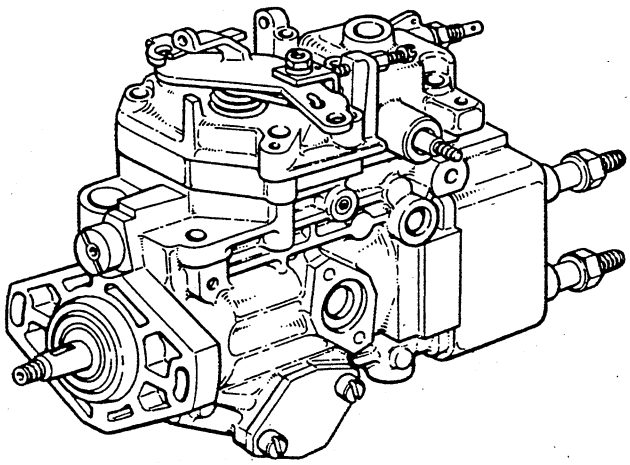
FUEL INJECTION PUMP

The fuel injection pump is the most important component of the diesel engine and, therefore, calls for the utmost caution in handling. The fuel injection pump has been thoroughly bench-tested and should not be tampered with.

Speed (hertz) and timing are the only adjustments the servicing dealer can perform on the injection pump. See the *ENGINE ADJUSTMENT* section in this manual. Other types of adjustments or repairs must be performed by a qualified injection service shop.

NOTE: *When servicing the injection pump, the service shop must be advised that the pump is being used in a generator application.*

NOTE: *The injection pumps should only be serviced by an authorized fuel injection service facility.*



TYPICAL FUEL INJECTION PUMP (25 KW SHOWN)

FUEL SYSTEM

FUEL FILTERS

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

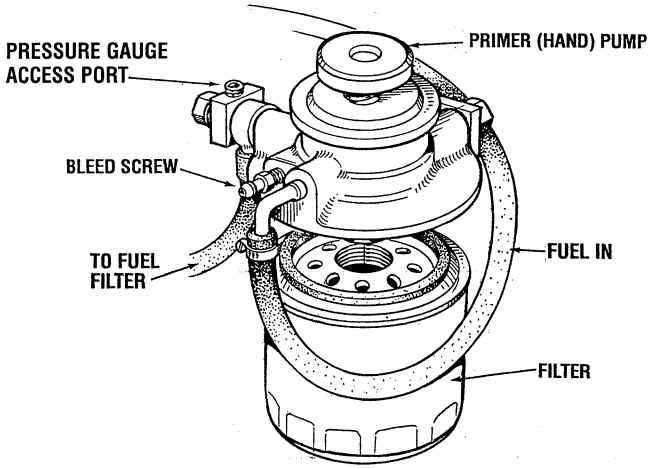
> ⚠ **WARNING:** ***Shut off the fuel valve at the tank when servicing the fuel system. Take care in catching any fuel that may spill. DO NOT allow any smoking, open flames or other sources of fire near the fuel system when servicing. Ensure proper ventilation exists when servicing the fuel system.***

Changing the Fuel Filter/20.0 KW and 25 KW

1. Shut the fuel supply off.
2. Loosen the fuel filter turning counterclockwise with a filter wrench.

NOTE: *The cartridge contains fuel. Take care not to spill it during disassembly. Perform the PRIMING THE FUEL SYSTEM after replacing the spin-on filter.*

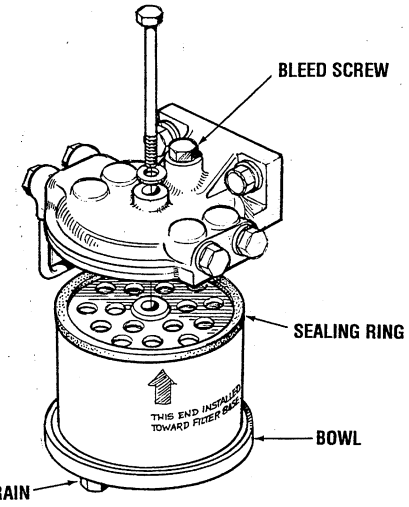
3. Wipe clean the sealing face on the housing bracket with a rag, so the new filter will seat properly.
4. Lightly oil the sealing o-ring on the new filter. To reinstall, turn the filter assembly clockwise carefully until the o-ring contacts the sealing surface of the housing bracket. Turn 2/3 further with the filter wrench.
5. Turn on the fuel and start the engine. The normal preheat function should quickly prime the system and the engine should start. If the engine should fail to start immediately, follow the *Priming* instructions in this section.



FUEL FILTER [20 AND 25 KW]

Changing the Fuel Filter/32.0 KW

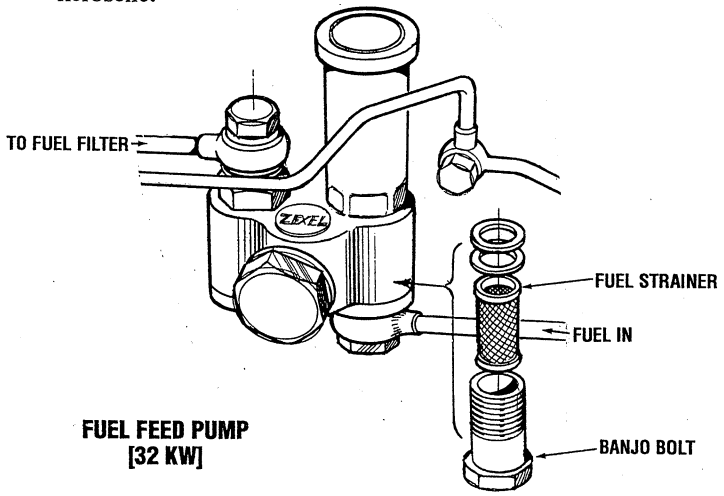
1. Shut off the fuel supply.
2. Open the bleed screw on top of the filter. Place a container under the fuel filter and open the drain on the bottom of the bowl and drain the fuel.
3. Close the drain and unscrew the bolt that secures the bowl. The bowl and filter will drop down.
4. Clean the base. Install a new sealing ring in the base making certain that it lies squarely on the base recess.
5. Replace the upper sealing ring and the "o" ring in the filter head. Install the new filter element and re-install the retaining bolt.
6. Bleed the air from the filter assembly.



FUEL FILTER [32 KW]

FUEL FEED PUMP STRAINER/32 KW

An additional fuel filter is located in the feed pump. This filter (strainer) is removed for cleaning by releasing the banjo bolt at the bottom. This strainer should be cleaned every 250 operating hours. Use compressed air and/or clean with kerosene.



FUEL FEED PUMP [32 KW]

FUEL SYSTEM

BLEEDING (PRIMING) THE FUEL SYSTEM/20.0 KW AND 25.0 KW

There is one bleed point in the on-engine fuel system to open for the removal of air. On the 20.0 KW and 25 KW this bleed screw is located on the housing for the spin-on fuel filter mounted on the engine. This screw should be opened one or two turns to remove air from the upper housing area of the fuel filter. Energizing the preheat switch for 10-20 seconds or by using the palm of your hand to slowly depress and release the primer pump on the top of the filter housing either method will force air out through the bleed point. Once all air is expelled, tighten the bleed screw. Depress the preheat switch 10-20 seconds or slowly pumping the primer on the fuel filter housing to force any air in the system between the filter housing and the injection pump out of the system and back to the fuel tank through the return.

NOTE: *When using the preheat function to bleed air from the filter assembly keep in mind that the preheat elements (glow plugs) are being energized. Take care not to overheat them.*

BLEEDING (PRIMING) THE FUEL SYSTEM/32.0 KW

To bleed the fuel system on the 32.0 KW Generators open the bleed screw on top of the fuel filter and then locate the fuel feed pump (see illustration).

Unscrew the knob on the fuel feed pump and the cylinder will pop up. Slowly work this priming pump by pulling the knob fully upward and pushing it down to achieve a full pumping stroke. Pump until free of air bubbles from the open bleed screw, then close the bleed screw.

Disconnect the fuel line return hose. Place towels under the hose and slowly pump the fuel feed pump again. When clear fuel, free of air, is discharging from the line-stop pumping.

Reconnect the return line and work the pump a few more strokes. Then push the cylinder in and secure it.

Start the engine and check/correct any leaks.

Should unstable running occur open the nut that secures the high pressure line to the injector to expel air in the line. Loosen 1/2 to a full turn place a cloth over the line and wrench to catch the spurting fuel. When free of air retighten the nut and proceed to the next injector line until the engine runs smoothly.

FUEL PRESSURE GAUGE

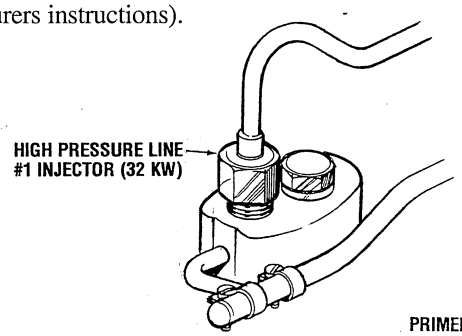
The 20.0 KW and 25.0 KW generators have a 1/8" NPT plugged access port on the engine mounted secondary spin on fuel filter housing to check and monitor fuel delivery pressure to the engines fuel injection pump. 1.5 PSI is minimum inlet pressure for proper injection pump operation. 2.5 - 3.5 PSI or higher is the desired pressure the fuel system should provide.

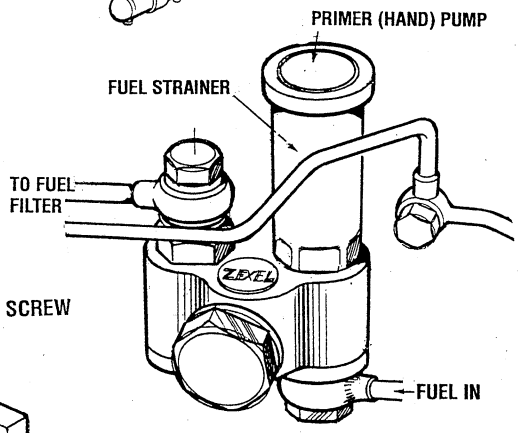
The absence of a positive inlet pressure to the injection pump usually indicates excessive fuel flow restriction in the fuel piping from the fuel tank to the engine.

When the combination of distance, lifting height and primary filter is too great for the fuel lift pump on the engine to overcome and maintain a positive pressure, then an auxiliary boost fuel pump at the fuel tank and/or a fuel day tank is required.

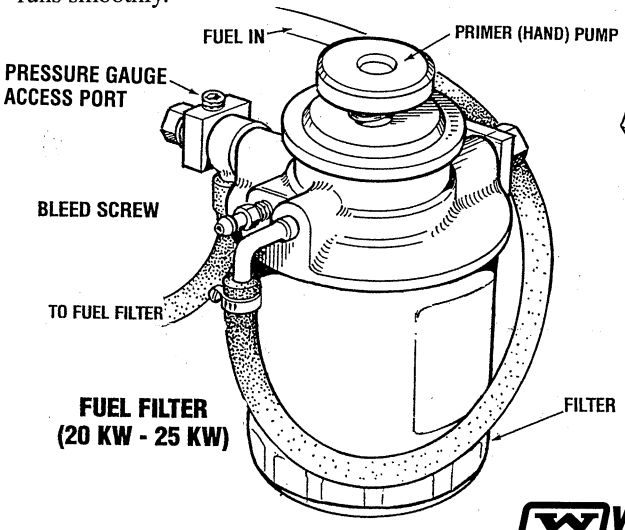
FUEL ADDITIVES

If fungus or bacteria is causing fuel problems you should have an authorized dealer correct these problems. Then use a diesel fuel biocide to sterilize the fuel (follow the manufacturers instructions).

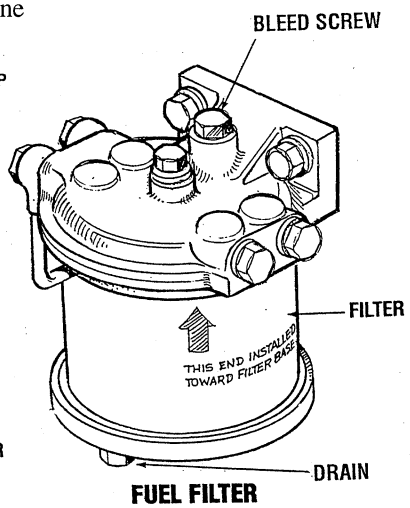




FUEL FEED PUMP [32 KW]



FUEL FILTER (20 KW - 25 KW)



FUEL FILTER (32 KW)

ENGINE OIL CHANGE

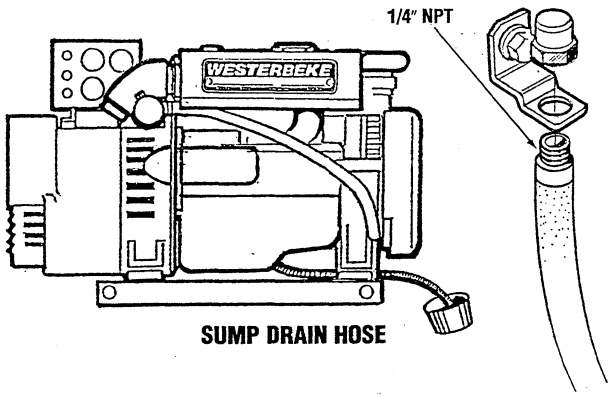
Engine Oil Change

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

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

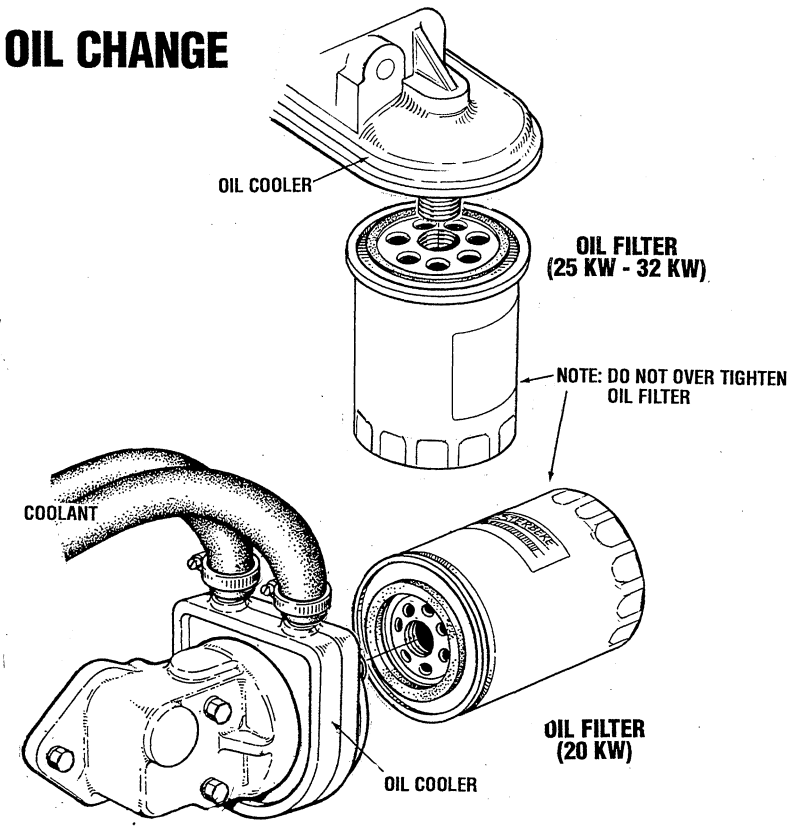
2. ***Replacing the Oil Filter.*** When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small automotive filter wrench should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

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



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

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



3. **Filling the Oil Sump.** Add new oil through the oil filler cap on the top of the engine or through the side oil fill. After refilling, run the generator for a few moments while checking the engine's oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and stop the generator. Then check the quantity of oil with the lube oil dipstick. Fill to, but not over the high mark on the dipstick, should the engine require additional oil. Immediately after an oil filter change and oil fill, run the engine to make sure the oil pressure is normal and that there are no oil leaks around the new oil filter.

   NOTE: *Generic filters are not recommended, as the material standards or diameters of important items on generic parts might be entirely different from genuine parts.*

> ⚠ **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.***

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 50 and 60 psi.

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

REMOTE OIL FILTER (OPTIONAL)

INSTALLATION

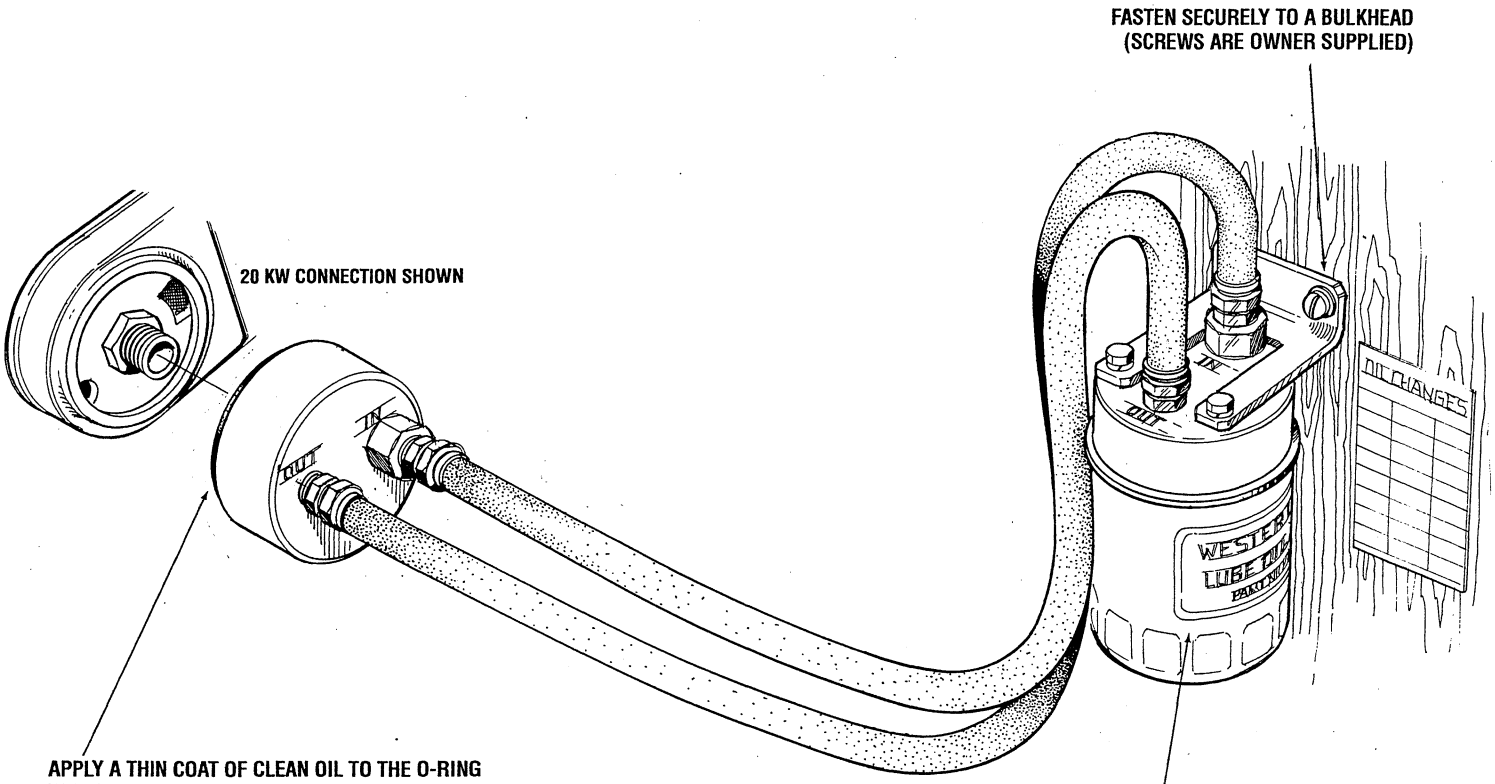
This popular accessory is used to relocate the engine's oil filter from the engine to a more convenient location such as an engine room bulkhead.

NOTE: *Refer to the ENGINE OIL CHANGE page 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.*



DC ELECTRICAL SYSTEM

ENGINE 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 on the engine.

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

Battery Specification

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

GLOW PLUGS

The glow plug is a small heater installed in each pre-combustion chamber. They run off the engine starting battery and become red hot when activated.

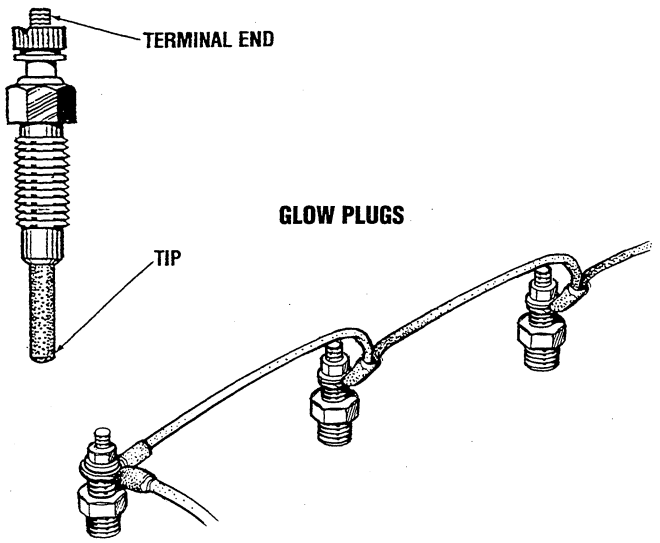
The glow plugs are wired through the preheat solenoid. When PREHEAT is pressed at the control panel this solenoid should "click" on and the glow plug should begin to get hot.

Glow plugs can be checked by unscrewing and holding them against a good ground (engine block) and turning them on. The tip should glow red hot. You can also use an ammeter to test the power drain (8 to 9 amps per plug), or an ohmmeter to test resistance (1.1 to 1.2 ohms).

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

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

> ⚠ **CAUTION:** ***Do not keep glow plug on for more than 30 seconds.***



AIR INTAKE HEATER

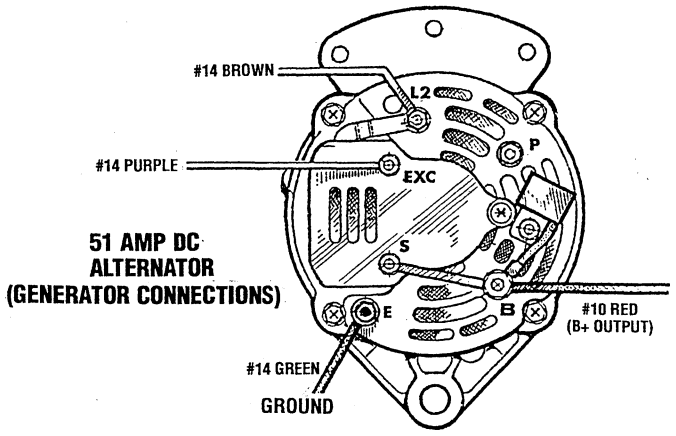
Glow plugs are not used on the 32 KW generator. The preheat solenoid activates a heater element in the engine's air intake that quickly heats the air as it is drawn into the combustion chamber. There is no maintenance required except an occasional cleaning of the element and its electrical connectors.

If the element fails to heat up when the preheat sequence is activated and the solenoid "clicks" on, replace the heater.

DC ELECTRICAL SYSTEM/ALTERNATOR

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.



51 AMP DC ALTERNATOR (GENERATOR CONNECTIONS)

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 problems 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.

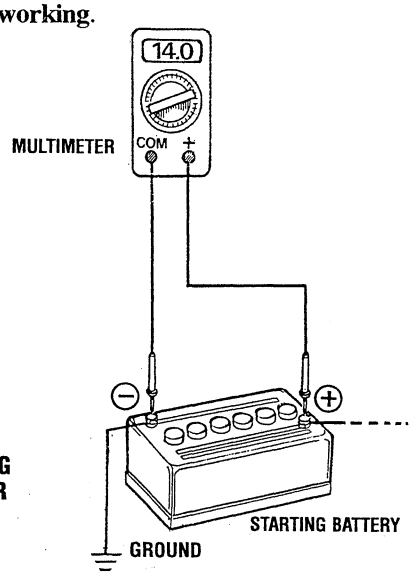
The alternator charging circuit charges the starting battery and the service battery. An isolator with a diode, a solenoid, or a battery selector switch is usually mounted in the circuit to isolate the batteries, so the starting battery is not discharged along with the service battery. If the alternator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

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, **your alternator is working.**



TESTING THE STARTING BATTERY-ALTERNATOR (ENGINE RUNNING)

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.

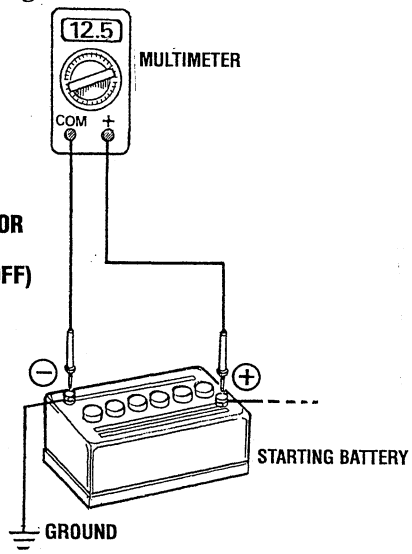
   A. Turn off the engine. Inspect all wiring and connections. Insure that the battery terminals and the engine ground connections are tight and clean.

> ⚠ **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, insure that it is on the correct setting.

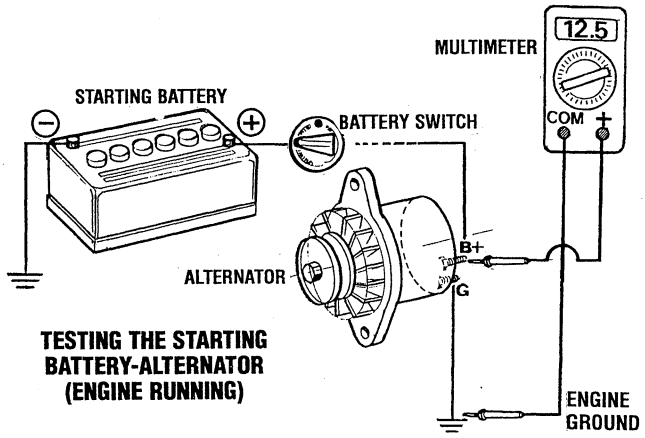
   C. Turn on the ignition switch, but do not start the engine.

   D. Check the battery voltage. If your battery is in good condition the reading should be 12 to 13 volts.



TESTING THE ALTERNATOR VOLTAGE (IGNITION ON – ENGINE OFF)

E. Now check the voltage between the alternator output terminal (B+) and ground. If the circuit is good, the voltage at the alternator should be the same as the battery, or if an isolator is in the circuit the alternator voltage will be zero. If not, a problem exists in the circuit between the alternator and the battery. Check all connections - look for an opening in the charging circuit.



TESTING THE STARTING BATTERY-ALTERNATOR (ENGINE RUNNING)

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

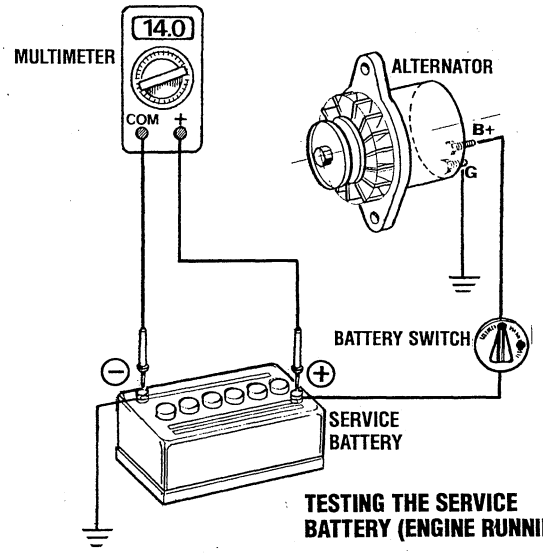
The voltage reading for a properly operating alternator should be between 13.5 and 14.5 volts. If your alternator is over- or undercharging, have it repaired at a reliable service shop.

NOTE: *Before removing the alternator for repair, use your 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, look for breaks and poor connections.

Alternator is Working

4. 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. Trouble-shoot 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: ***When performing tests on the alternator charging circuit do not use a high voltage tester (ie Megger). You can damage the alternator diodes.***

STARTER MOTOR

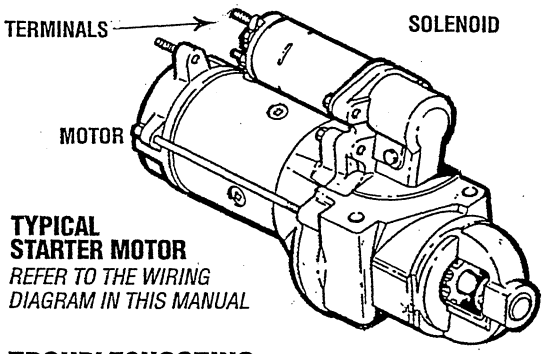
DESCRIPTION

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

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

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

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



TYPICAL STARTER MOTOR
REFER TO THE WIRING DIAGRAM IN THIS MANUAL

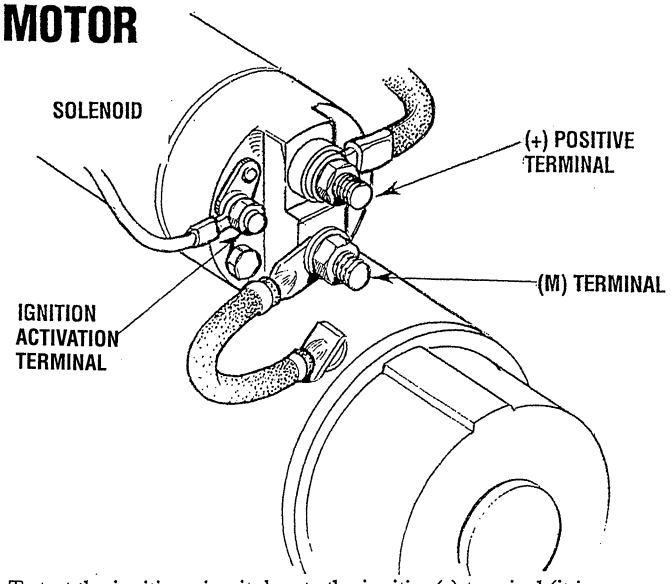
TROUBLESHOOTING

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

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

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

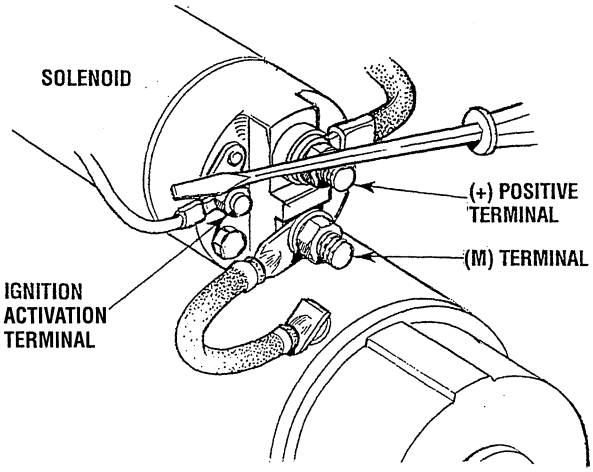
If you read 12 volts, the starter is faulty.



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

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

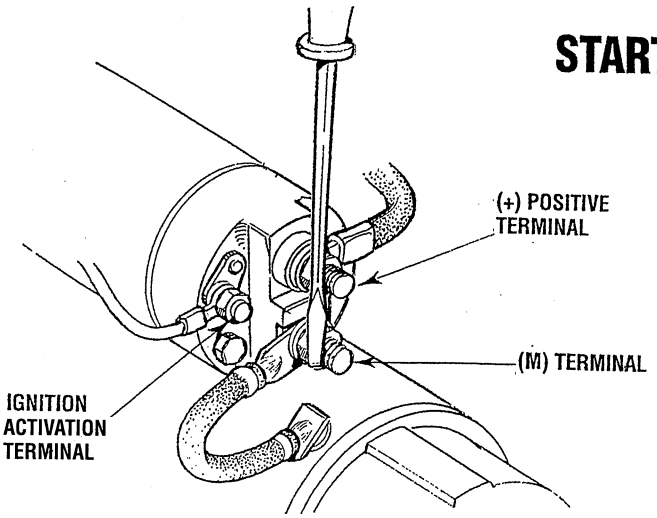
If the solenoid clicks but nothing else happens, the starter motor is probably faulty.



If nothing at all happens the solenoid isn't getting current. Check the battery isolation switch and inspect the wiring connections. It is also possible that the solenoid is defective.

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

STARTER MOTOR



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

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

If the starter spins, the solenoid is faulty.

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

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

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

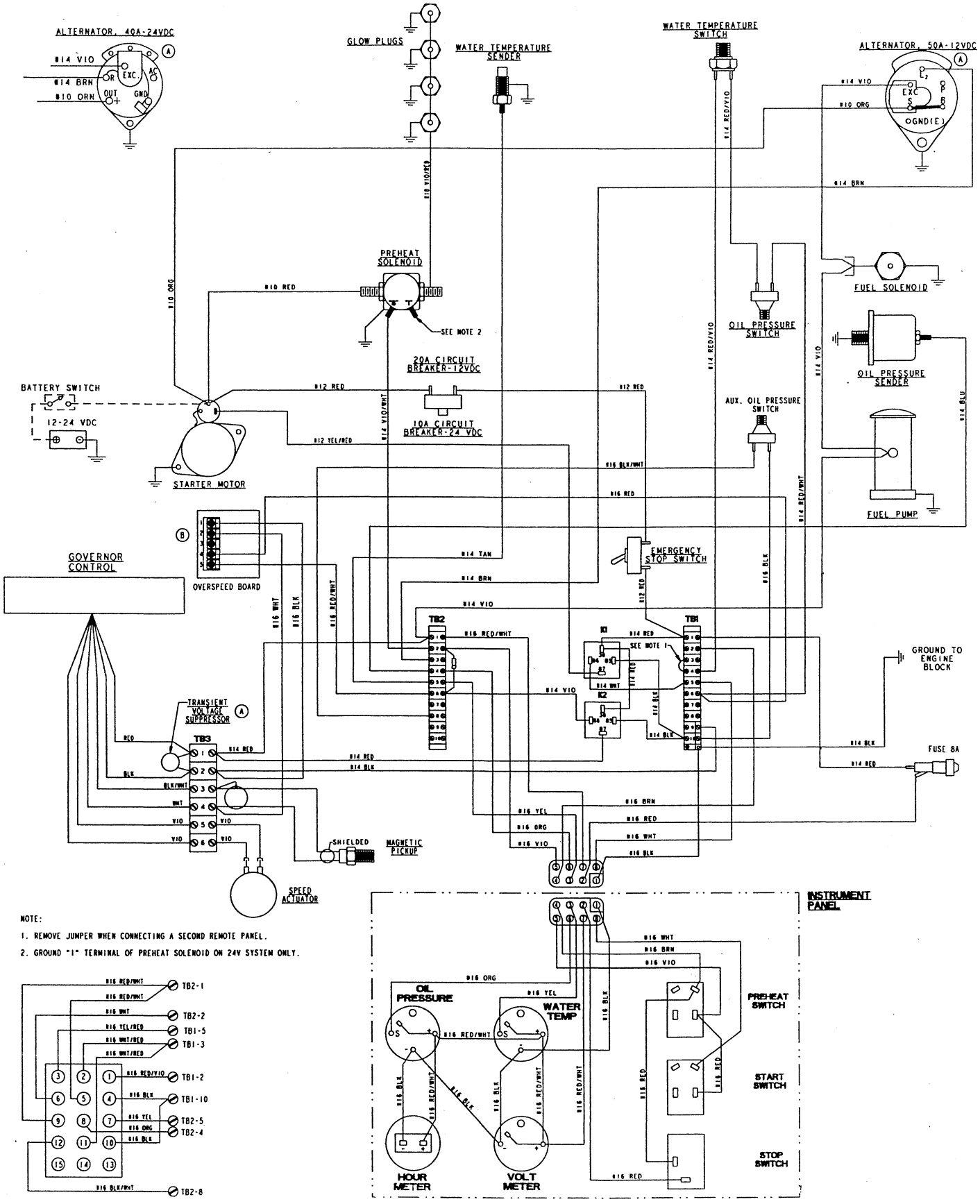
SERVICE

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

TO REMOVE FOR SERVICE

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

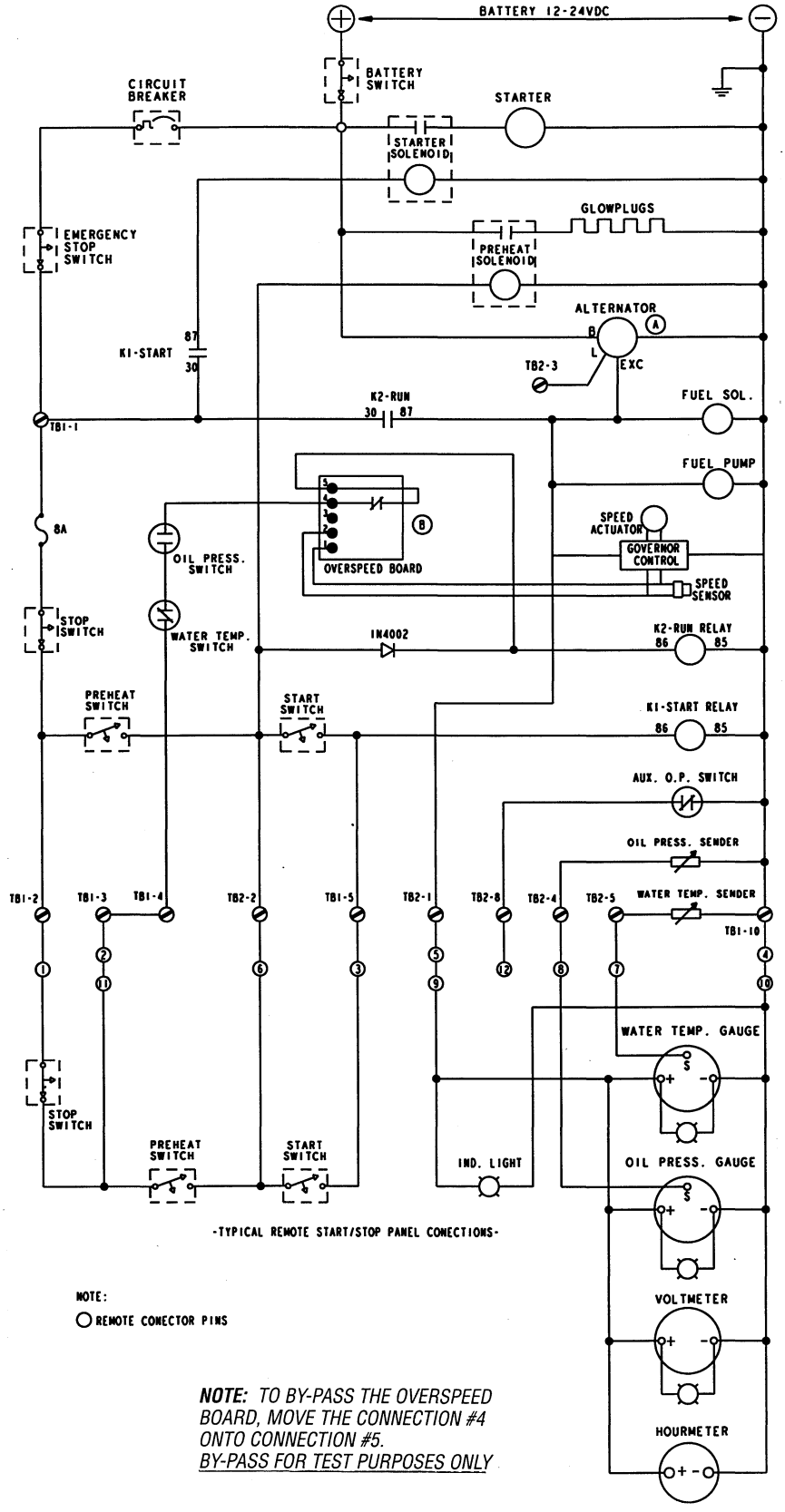
20 BEDAR / 25 BEDR #44752
WIRING DIAGRAM



NOTE:

1. REMOVE JUMPER WHEN CONNECTING A SECOND REMOTE PANEL.
2. GROUND "I" TERMINAL OF PREHEAT SOLENOID ON 24V SYSTEM ONLY.

20 BEDAR / 25 BEDR #44752
WIRING DIAGRAM

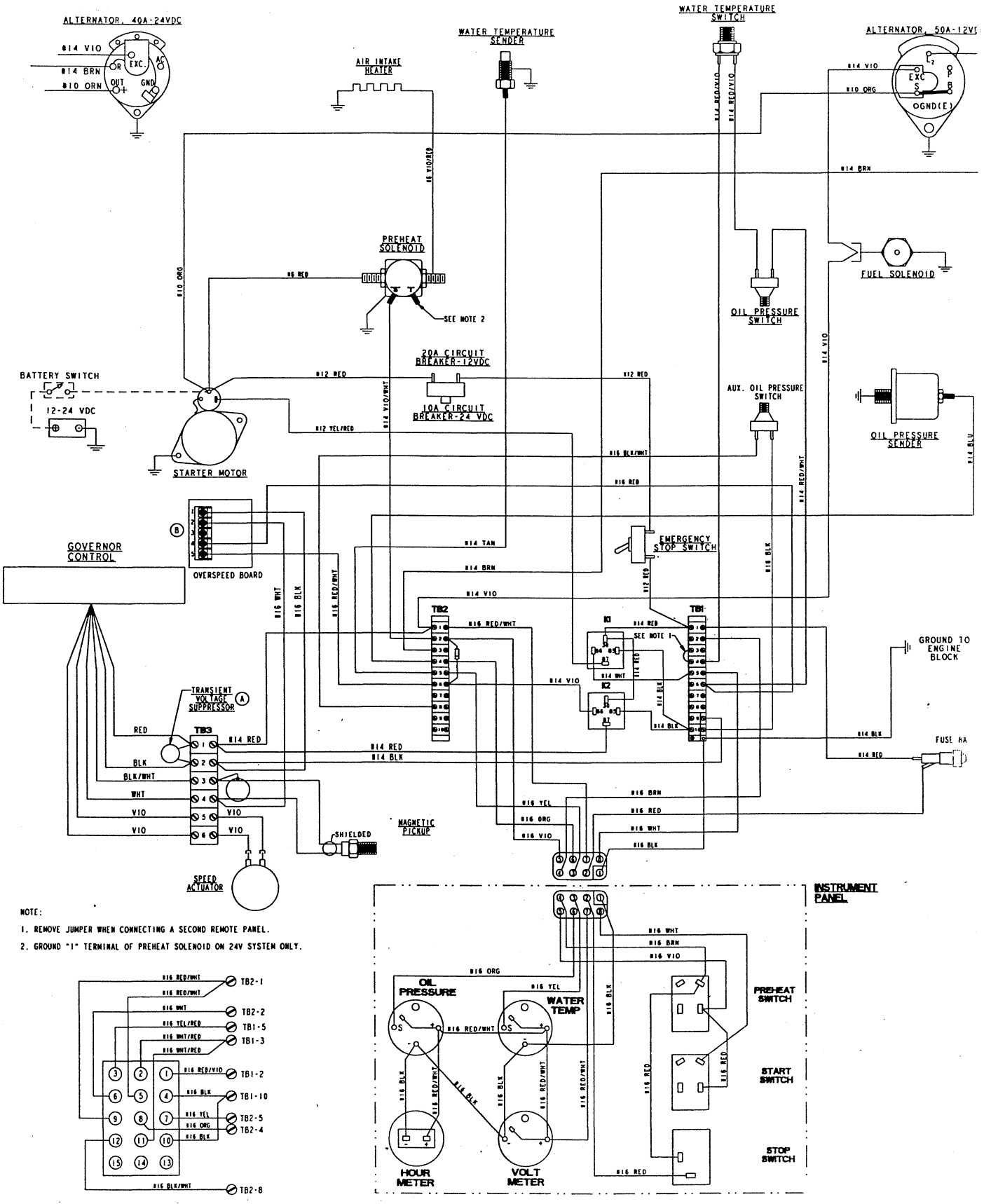


-TYPICAL REMOTE START/STOP PANEL CONECTIONS-

NOTE:
○ REMOTE CONECTOR PINS

NOTE: *TO BY-PASS THE OVERSPEED BOARD, MOVE THE CONNECTION #4 ONTO CONNECTION #5.*
BY-PASS FOR TEST PURPOSES ONLY

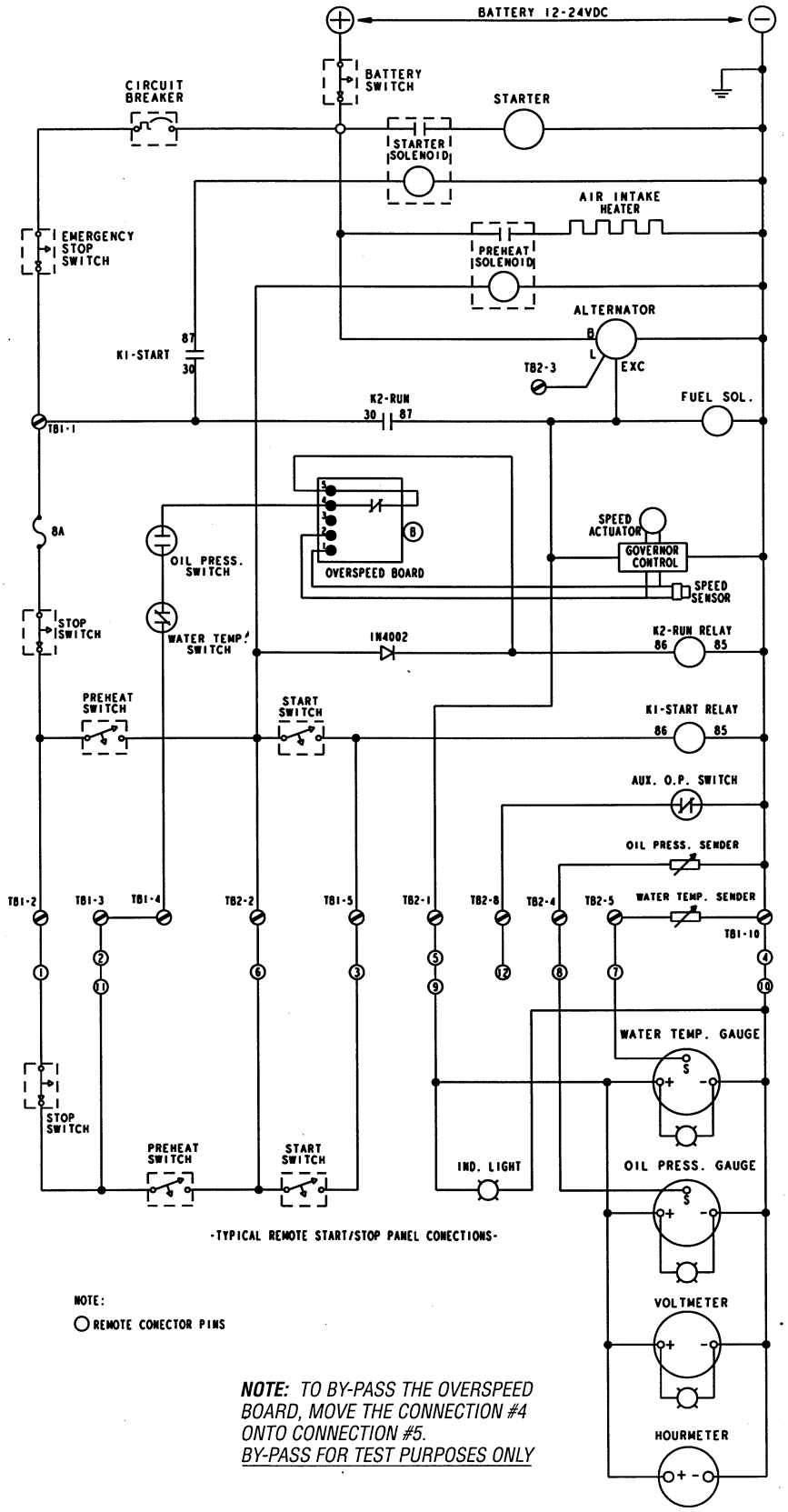
32 BEDAR #44753
WIRING DIAGRAM



NOTE:

1. REMOVE JUMPER WHEN CONNECTING A SECOND REMOTE PANEL.
2. GROUND "I" TERMINAL OF PREHEAT SOLENOID ON 24V SYSTEM ONLY.

32 BEDAR #44753
WIRING DIAGRAM

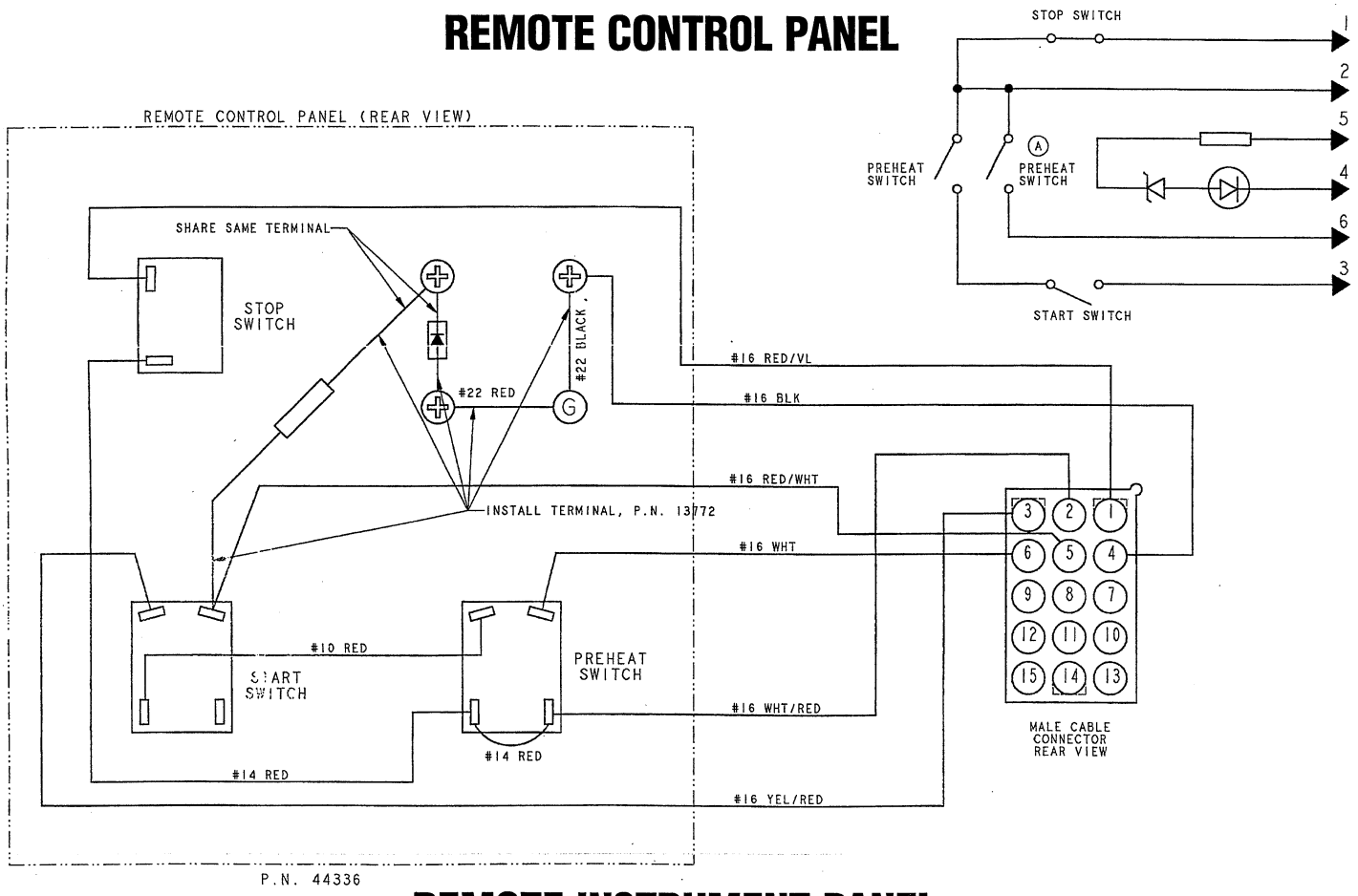


-TYPICAL REMOTE START/STOP PANEL CONECTIONS-

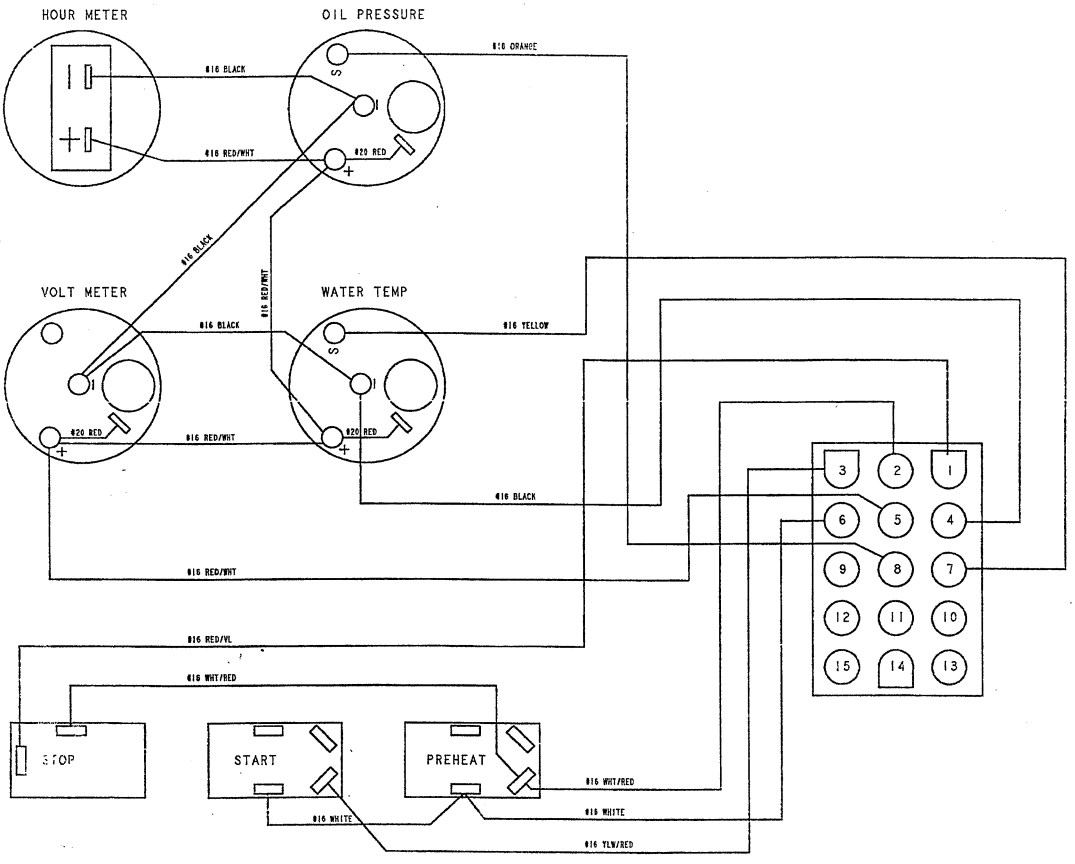
NOTE:
○ REMOTE CONECTOR PINS

NOTE: *TO BY-PASS THE OVERSPEED BOARD, MOVE THE CONNECTION #4 ONTO CONNECTION #5.*
BY-PASS FOR TEST PURPOSES ONLY

REMOTE CONTROL PANEL



REMOTE INSTRUMENT PANEL

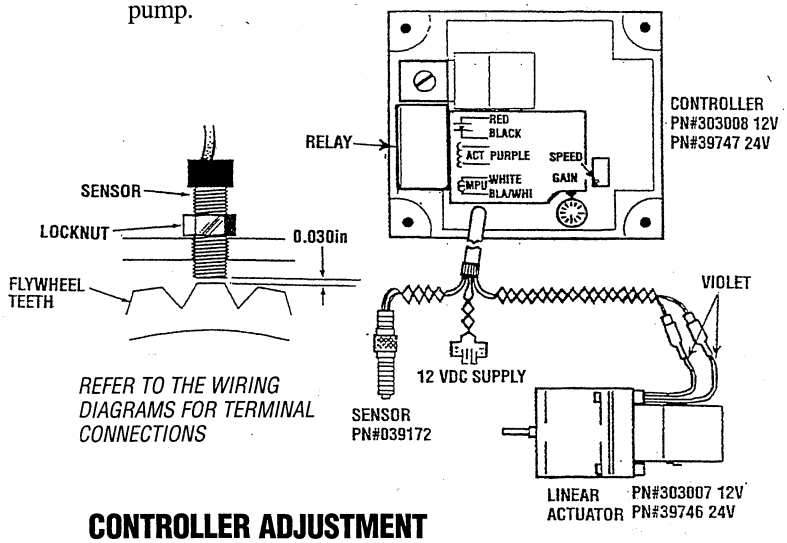


ELECTRIC GOVERNOR ADJUSTMENTS

DESCRIPTION

The system is composed of three basic components:

1. **Controller.** Mounted in the instrument panel.
2. **MPU.** Installed on the bellhousing over the flywheel ring gear.
3. **Actuator.** Mounted at the front of the engine and attached with linkage to the throttle arm of the injection pump.



CONTROLLER ADJUSTMENT

1. **Speed.** This adjustment is used to raise or lower the engine's speed to the desired hertz.
2. **Gain.** This adjustment affects the reaction time of the actuator to the generator/engine load changes.

   NOTE: *A high gain adjustment can induce an oscillating of the actuator producing a hunting mode. In such cases,lessen the gain adjustment.*

Calibration

1. With no power to the governor, adjust the GAIN to 9:00 o'clock.
2. Start the engine and adjust the speed by turning the speed pot clockwise to desired speed.

   NOTE: *Controllers are factory adjusted to minimum rpm. However. for safety, one should be capable of disabling the engine if an overspeed should exist.*

3. At no-load, turn the GAIN potentiometer clockwise until the engine begins to hunt. if the engine does not hunt, physically upset the governor linkage.
4. Turn the GAIN potentiometer counterclockwise until stable.

   NOTE: *The controller operates on 12VDC. The voltage range is ± 20% (9.6VDC 12VDC 14.4VDC). If voltage varies above or below these ranges, the controller will not operate and the engine will run in an idle mode until proper voltage is supplied to the controller.*

INSPECTION AND ADJUSTMENT

The controller has two adjustment pods. You need a mini screw driver to adjust these. One is speed and the gain. These are noted on the drawing of the controller.

When you press the preheat switch the actuator linkage attached to the throttle arm of the injection pump should move outward towards the injection pump and return back into the actuator in a quick motion.

Start the engine. The speed should be in the low idle range 600-700 rpm. If the engine speed is higher than this idle range, shut the engine down. Check the linkage between the actuator and throttle arm. The throttle arm stop should be about touching the open idle stop screw boss. Adjust the linkage to position the throttle lever. The controller has an adjustment screw for speed adjustment. Turn this screw outward (counter clockwise) a few turns. Restart the engine.

NOTE: *If there is any oscillating of the actuator linkage producing hunting, adjust the gain towards zero "0" until this hunting is removed.*

Increase the engine speed slowly with the speed adjusting screw turning it inward (clockwise). In some instances this screw may need to be turned 6-10 turns before an increase in engine speed is noted. Bring the engine speed to 1800 rpm (60 Hz), 1500 rpm (50 Hz). Momentarily push the actuator linkage towards the actuator and release. The actuator should quickly regain proper speed. If there is any hunting adjust the gain towards zero "0" until this hunting is removed.

When the gain is adjusted you may need to readjust the speed at no load, shut the generator down.

Push the DC exciter circuit breaker in. Start the generator.

Check speed (Hertz) set at 60 Hz.

Load the generator.

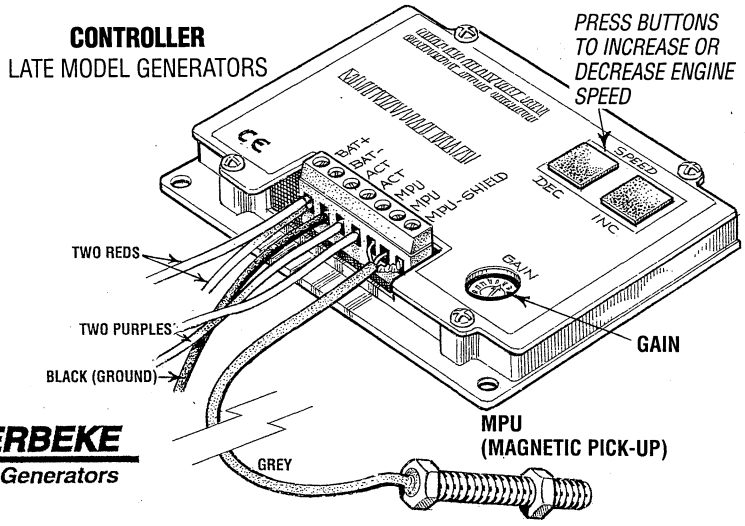
If the governor is slow to react and maintain 60 Hertz adjust the gain clockwise. Again you may need to adjust the speed at no load.

You will find the governor will maintain 60 ± 0.5 Hertz right up to the full rated amperage output for the generator.

CONTROLLER (LATEST MODELS)

The instructions above: calibration, inspection and adjustment, are the same for the new controller illustrated below with the exception of the speed adjustment.

CONTROLLER
LATE MODEL GENERATORS



LINEAR ACTUATOR TROUBLESHOOTING

Problem	Test/Check	Correct
System appears dead. (No actuator movement) Engine runs, but at idle speed	**1.** Check the battery voltage at the controller terminal block with the Preheat/On switch depressed.	**1.** Inspect the DC circuit back to the starting battery.
	2. Inspect the linkage for binding or sticking.	**2.** Free up the linkage and clean and lubricate the linkage.
	3. If there is no signal or a weak signal from the MPU, measure the AC voltage between the white and black/white wire leads from the MPU on the controller terminal block. While cranking the engine or with the engine running at idle, voltage should be 1.5-2.5 VAC. **NOTE:** *The AC input impedance of meter must be 5000 ohms/volts or greater.* **NOTE:** *When making this test on diesel units, disable the preheat solenoid by disconnecting the "S" terminal connection so as not to damage the glow plugs.*	**3.** Check for damage to or improper adjustment of magnetic pick-up. Replace or re-adjust.
	4. Check the actuator with the preheat/on switch depressed. This provides DC voltage to the controller. Measure the DC voltage between the actuator connections on the controller block and the black DC (-) power connection on the controller terminal block. Both connections should have battery voltage +0.00 or -0.75 VDC.	**4.** Low voltage (1.0-2.0 VDC) at either actuator connections.
	a. Purple lead to Black DC (-).	
	b. Purple lead/purple/white lead to Black DC (-). **NOTE:** *Continue this test (ONLY) if the battery voltage is not present.*	**b.** Replace the controller if battery voltage is not present at both the Purple leads.
	c. The following checks are performed between the connections at the actuator and the Black DC (-) connection on the controller terminal block. This is to determine if there is a break in the line between the controllers terminal block connection and the actuator connections or the actuator leads themselves. **NOTE:** *The actuator should fully extend and retract when the preheat switch is depressed and held. for diesels. Retract and hold in for gasoline units.*	
	1) Low voltage (1.0-2.0 VDC) at either actuator connections.	**1)** Broken actuator lead, repair.
	2) Battery voltage at both actuator connections.	**2)** Broken actuator lead, repair or replace actuator.
	3) Battery voltage at one actuator connection but not at the second.	**3)** Check actuator winding for open. Replace actuator.
Actuator lever goes to full extension when the preheat switch is depressed and stays extended.	**1.** Check the controller by removing the two. purple leads one at a time that come from the actuator off the controller terminal block. Lift one actuator lead and depress the preheat/on switch. Reconnect and do the same with the second. **NOTE:** *Early controllers had two solid purple leads for the actuator connections. Later model controllers have one solid purple and a purple/white stripe for the actuator connection. The purple/white lead is designated (+) and is specific only in gasoline DC circuits.*	**1.** Check for a shorted actuator lead. Replace the controller because it should not cause the actuator lever to go to full fuel when the engine is not running.
	a. Actuator goes to full extension (Diesel),. Does not retract (Gasoline).	**a.** Check for shorted actuator load.
	b. Actuator does not extend (Diesel).	**b.** Replace controller.
Actuator hunts during operation.	**1.** Linkage or rod end bearings are sticking or binding.	**1.** Lubricate or replace.
	2. Improper governor adjustment.	**2.** Re-adjust the calibration.
	3. Inadequate power supply voltage. **a.** Connect a DC voltmeter to Red (+) and Black (-) leads at the controller terminal block. **b.** Disconnect both leads coming from actuator from controller terminal block. **c.** Connect one lead from the actuator to the Red (+) on the terminal block and the other actuator lead to the Black (-)on the terminal block. **d.** Momentarily depress the preheat/on switch. The actuator should extend fully and stay extended (diesel) and retract (gasoline) as long as the switch is depressed. Measure the DC voltage across the Red (+) and Black (-) leads while performing this test. DC voltage must be greater than 80% of the DC voltage measured across the battery supply. 24 VDC @ 80% = 19.2 VDC 12 VDC @ 80% = 9.6 VDC **NOTE:** *Reconnect the actuator leads properly after completing this test.*	**3.** If actuator doesn't fully extend (diesels) or retract (gasoline)then check the actuator leads. If the voltage is less than specified, check for loose or poor connections in the DC circuit back to the battery, check the K2 relay and its connections.
	e. MPU positioned marginally too far away from flywheel teeth giving erratic AC input to controller.	**e.** Check the position of the MPU.

If problems continue to persist, contact your WESTERBEKE dealer for additional assistance.

ENGINE TROUBLESHOOTING

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

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

Problem	Probable Cause	Verification/Remedy
Key switch on, PREHEAT switch depressed: no panel indications; fuel solenoid or electrical fuel pump	**1.** Battery Switch not on.	**1.** Check switch and/or battery connections.
	2. Emergency stop switch off.	**2.** Check emergency stop switch position.
	3. 20-Amp circuit breaker tripped.	**3.** Reset breaker; if breaker trips again, check preheat solenoid circuit and check circuit for shorts to ground.
	4. K2 relay	**4.** Check K2 relay.
	5. Loose battery connections.	**5.** Check (+) connection to starter solenoid and (-) connection to engine ground stud. Check battery cable connections.
START SWITCH DEPRESSED, no starter engagement.	**1.** Connection to solenoid faulty.	**1.** Check connection.
	2. Faulty switch.	**2.** Check switch with ohmmeter.
	3. Faulty solenoid.	**3.** Check that 12 volts are present at the solenoid connection.
	4. Loose battery connections.	**4.** Check battery connections.
	5. Low battery.	**5.** Check battery charge state.
	6. K1 relay.	**6.** Check K1 relay.
START switch is depressed; panel indications OK; starter solenoid OK fuel solenoid not functioning.	**1.** Poor connections to fuel solenoid.	**1.** Check connections.
	2. Defective fuel solenoid.	**2.** Check that 12 volts are present at the (+) connection on the fuel run solenoid.
Generator engine cranks, but does not start, fuel solenoid energized.	**1.** Faulty fueling system.	**1.** Check that fuel valves are open. **1a.** Switch to combine vehicle and start batteries. **1b.** Replace batteries. **1c.** Check fuel lift pump.
	2. Preheat solenoid faulty.	**2.** Check solenoid.
Engine can't be stopped.	**1.** Faulty DC alternator.	**1.** Remove Exc. connection at alternator, repair alternator.
Battery runs down.	**1.** Oil Pressure switch.	**1.** Observe if gauges and panel lights are activated when engine is not running. Test the oil pressure switch.
	2. High resistance leak to ground.	**2.** Check wiring. Insert sensitive (0 - .25 amp) meter in battery lines. (Do not start engine.) Remove connections and replace after short is located.
	3. Low resistance leak.	**3.** Check all wires for temperature rise to locate the fault.
	4. Poor battery connections.	**4.** Check cable connections at battery for loose connections, corrosion.
	5. DC alternator not charging..	**5.** Check connections, check belt tension, test alternator. See *DC ELECTRICAL SYSTEM/ALTERNATOR.*
Battery not charging	**1.** DC charge circuit faulty.	**1.** Perform D.C. voltage check of generator charging circuit. See *DC ELECTRICAL SYSTEM/ALTERNATOR* in this manual.
	2. Alternator drive.	**2.** Check drive belt tension. Alternator should turn freely. Check for loose connections. Check output with voltmeter. Ensure 12 volts are present at the Exc. terminal.
Generator engine stops.	**1.** Fuel feed pump strainer is dirty.	**1.** Clean strainer. (32 KW only)
	2. Switches and/or wiring loose or disconnected.	**2.** Inspect wiring for short circuits and loose connections. Inspect switches for proper operation.
	3. Fuel starvation.	**3.** Check fuel supply, fuel valves, fuel feed strainer..
	4. 20 Amp circuit breaker tripping.	**4.** Check for high DC amperage draw during operation. Ensure breaker is not overly sensitive to heat which would cause tripping.
	5. Exhaust system is restricted.	**5.** Check for blockage, collapsed hose, carbon buildup at exhaust elbow.
	6. Water in fuel.	**6.** Pump water from fuel tank(s); change filters and bleed fuel system.
	7. Air intake obstruction.	**7.** Check air intake filter cartridge.

ENGINE TROUBLESHOOTING

Problem	Probable Cause	Verification/Remedy
Generator engine overheats/shuts down.	**1.** Coolant not circulating.	**1.** Thermostat - remove and test in hot water. Replace thermostat. **1a.** Loss of coolant - check hoses, hose clamps, drain plug, etc. for leaks. **1b.** Broken or loose belts - tighten/replace. **1c.** Air leak in system; run engine and open the pressure cap to bleed air. Add coolant as needed.
Generator engine shuts down, low oil pressure.	**1.** Loss of oil. **2.** Oil pressure switch.	**1.** Check dipstick, look for oil leaks at oil filter and at oil drain hose connection. **2.** Replace oil pressure switch.
Generator engine shuts down, High exhaust temperature.	**1.** Exhaust too hot. **2.** High temperature switch opens at . too low a temperature.	**1.** Check raw water injection flow, look for exhaust obstruction. **2.** Check for satisfactory operation with switch bypassed, check with ohmmeter, replace if faulty.
Exhaust smoking problems.	**1.** Blue smoke. **2.** White smoke. **3.** Black smoke.	**1.** Incorrect grade of engine oil. **1a.** Crankcase is overfilled with engine oil (oil is blowing out through the exhaust). **2.** Engine is running cold. **2a.** Faulty injector or incorrect injector timing. **3.** Improper grade of fuel. **3a.** Fuel burn incomplete due to high back pressure in exhaust or insufficient air for proper combustion (Check for restrictions in exhaust system; check air intake.). **3b.** Improperly timed injectors or valves or poor compression. **3c.** Lack of air - check air intake and air filter. Check for proper ventilation. **3d.** Overload.
Engine starts, runs and shuts down.	**1.** Oil Pressure switch. **2.** Faulty overspeed boartd. **3.** Water Temperature switch.	**1.** Check oil pressure switch. **2.** By-pass the overspeed board to test. **3.** Check water temperature switch.
Engine starts, runs at idle..	**1.** Electronic goverbor system faulty.	**1.** Check governor syustem components.

ENGINE ADJUSTMENTS

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

VALVE CLEARANCE ADJUSTMENT

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

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

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

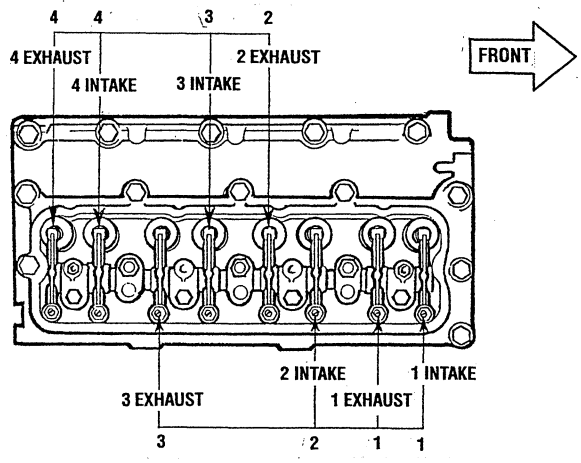
Position the No. 1 piston at Top Dead Center (TDC) on its compression stroke and adjust the # 1, 2, 3 and 6 valves as illustrated.

Position the No. 4 piston at TDC of its compression stroke and adjust the # 4, 5, 7 and 8 valves. The valves are numbered 1 to 8 from the front of the engine to the back.

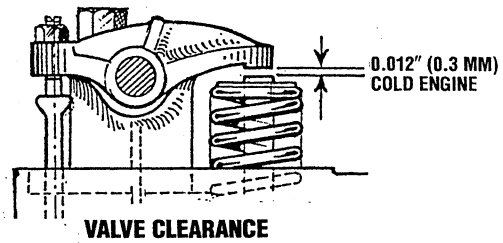
Adjust each valve's clearance by inserting a 0.012 inch (0.3 mm) feeler gauge between the rocker arm and the valve stem. Make sure to adjust all valves to 0.012 inches (0.3 mm) while the engine is cold.

VALVE ADJUSTMENT SEQUENCE

WHEN NO. 4 CYLINDER IS AT TOP DEAD CENTER



WHEN NO. 1 CYLINDER IS AT TOP DEAD CENTER



VALVE CLEARANCE

DRIVE BELT ADJUSTMENT

For your safety, Westerbeke generator models come equipped with belt guards that cover over the belt(s) on the front of the engine. ("Out of sight - out of mind." The belt guard is NOT installed for that purpose.) Operators are advised that proper inspection, service, and maintenance is required.

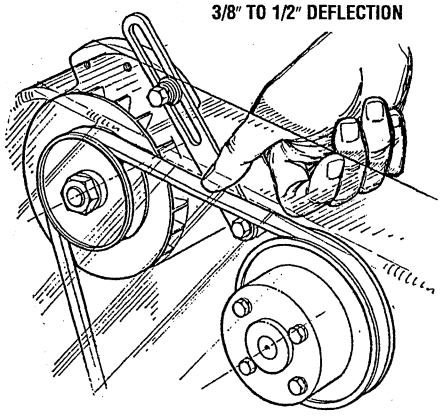
Drive belts must be properly tensioned. Loose drive belts will not provide proper alternator charging and will eventually damage the alternator. Drive belts that are too tight will pull the alternator out of alignment and/or cause the alternator to wear out prematurely. Excessive drive belt tension can also cause rapid wear of the belt and reduce the service life of the fresh water pump's bearing. A slack belt or the presence of oil on the belt can cause belt slipping, resulting in high operating temperatures.

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

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

Adjusting Belt Tension

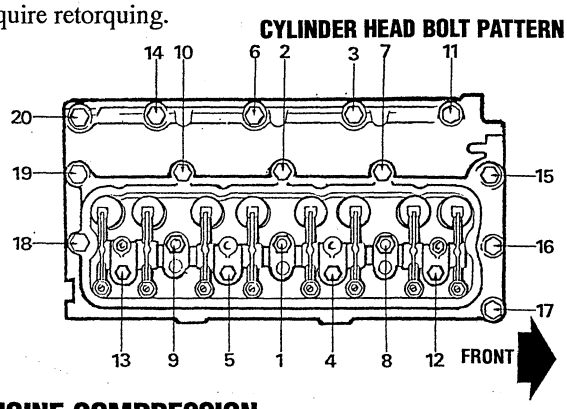
1. Remove the belt guard.
2. Loosen the alternator adjusting strap bolt and the base mounting bolt.
3. With the belt loose, inspect for wear, cracks, and frayed edges.
4. Pivot the alternator on the base mounting bolt to the left or right as required, to loosen or tighten.
5. Tighten the base mounting bolt and the adjusting strap bolt.
6. Operate the generator for about 5 minutes then shut down and recheck the belt tension.
7. Replace the guard.



ENGINE ADJUSTMENTS

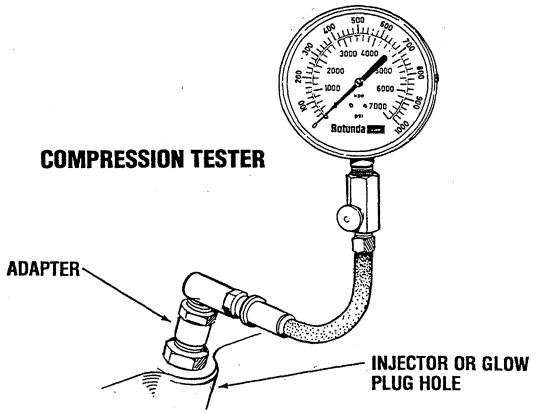
TORQUING CYLINDER HEAD BOLTS

Tighten the cylinder head bolts according to the sequence shown in the illustration below. Make sure the engine is cold when this is done, and loosen one head bolt one-half turn and then tighten it between 85 to 90 lb-ft. (11.8 to 12.5 kg/m) for the BED 20KW and 25KW. The 32 KW head bolts do NOT require retorquing.



ENGINE COMPRESSION

Check the compression pressure. To do this, warm the engine, remove all fuel injectors, or glow plugs, disconnect the fuel shut-off solenoid wire, and install a compression adapter in the injector hole or glow plug hole. Connect a compression tester on the adapter and crank the engine with the starter motor until the pressure reaches a maximum value. Repeat this process for each cylinder. Look for cylinders with dramatically (at least 20%) lower compression than the average of the others. Compression pressure should not differ by more than 42.7 psi (3.0 kg/cm2) at 200 rpm.



If a weak cylinder is flanked by healthy cylinders, the problem is either valve-or piston related. Check the valve clearances for the weak cylinder, adjust as needed and test again. If the cylinder is still low apply a small amount of oil into the cylinder to seal the rings and repeat the test. If compression comes up – the rings are faulty.

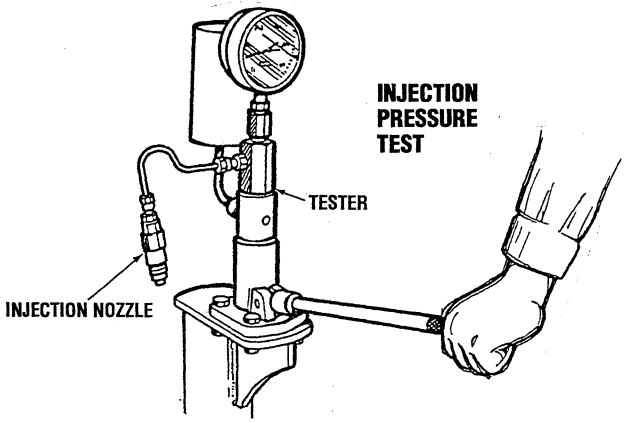
Abnormally high readings on all cylinders indicate heavy carbon accumulations, a condition that might be accompanied by high pressures and noise.

NOTE: *In case of severe vibrations and detonation noise, have the injectors checked and overhauled by an authorized fuel injection service center. Poor fuel quality, contaminates and loss of positive fuel pressure to the injection pump will result in injector faults.*

When re-installing the glow plugs use anti-seize compound.

TESTING FUEL INJECTORS

Remove and check fuel injectors. The injector spray pressure should be 1920 ±71 psi (135 kg/cm² ± 10 kg/cm²).

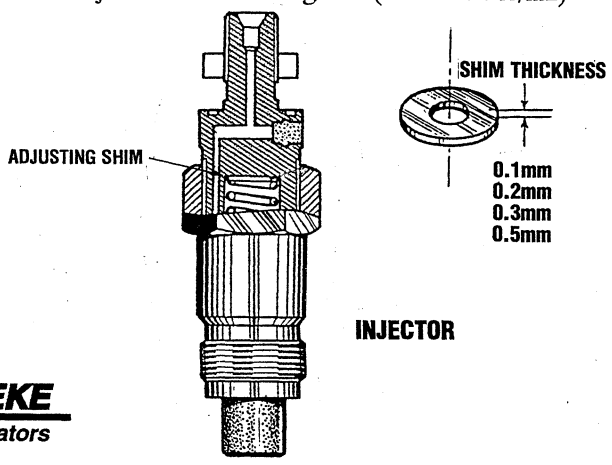


1. Using the nozzle tester, check the spray pattern and injection starting pressure of nozzle and, if it exceeds the limit, adjust or replace the nozzle. When using nozzle tester, take the following precautions:

> ⚠ **CAUTION:** ***The spray injected from the nozzle is of such velocity that it may penetrate deeply into the skin of fingers and hands, destroying tissue. If it enters the bloodstream, it may cause blood poisoning.***

   a. If the diesel fuel of the nozzle tester is stained, replace it. At the same time, clean or replace the fuel filter.
   b. Set the nozzle tester in a clean place where there is no dust or dirt.
   c. Mount the nozzle and nozzle holder on the nozzle tester.
   d. Operate the hand lever of nozzle tester several times to bleed the air in the nozzle line, then move the hand lever at intervals of one stroke per second while reading the injection starting pressure.

   Start to injection: 135 – 140 kg/cm2 (1920-1990 lb/in2)



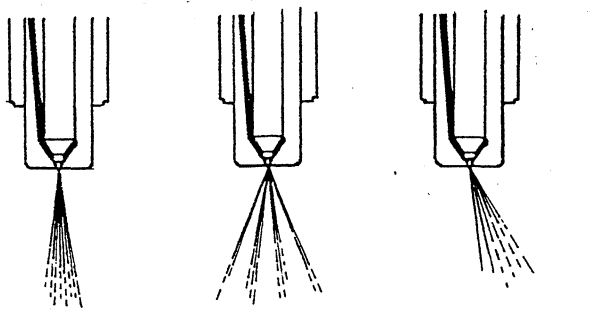
If the pressure is different from the standard value, adjust to the specified pressure by increasing or decreasing the thickness of the adjusting shim.

The shim has 10 different thicknesses for every 0.05 mm (0.0020 in) from 1.0 mm (0.0393 in) to 1.95 mm (0.0768 in). As 0.05 mm (0.0020 in) is increased, approx. 5.0 kg/cm² (71.1 lb/in²) of injection pressure increases.

When replacing the shim, grip the retaining nut in a vise and remove the body with a wrench. Tighten the retaining nut to the specified torque.

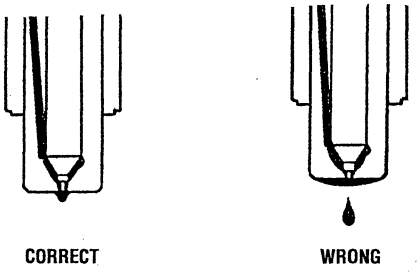
INSPECTING THE SPRAY PATTERN

1. Operate the hand lever of the nozzle tester at intervals of one stroke per second to check if the fuel is injected correctly in its axial direction. A nozzle is defective if it injects fuel in an oblique direction or in several separate strips. Also, a spray in the form of particles indicates a defect. These defects may sometimes be caused by clogging with dust and, therefore, all parts should be carefully cleaned before reassembly. (Care should be taken not to expose one's skin to this spray as it may penetrate the skin and cause infection.)



CHATTERING TEST

2. Apply the pressure of 115 kg/cm² (1635 lb/in²) to nozzle by operating the hand lever, and check the drips from the nozzle tip. If it drips or has a large accumulation of fuel on the bottom, it is considered defective and should be replaced. A very small amount of fuel may sometimes remain on the tip of the nozzle; however, this does not indicate a defect.



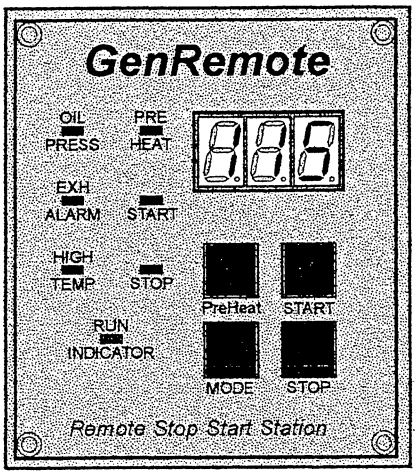
AFTER DRIP TEST

The unit consists of a **Power Logic Module**, **Display Panel** and six conductor shielded **Display Cable**. The shielded cable links the display to the module and can be up to 300 feet long. Two display panels can be daisy chained to one (l) module output. The module supports two display cable outputs allowing for a total of four (4) displays per module. Total allowed cable length per module, including both display cable outputs, is six-hundred (600') feet.

The logic module is powered directly from the generator's cranking battery and consumes less than 70 milli amps (70/1000 of an amp) when the generator is idle. DC operating voltage can be 12 or 24 volts. The AC generator output can be 115V, 240V, 50/60 Hz, single phase (1Ø) or three (3 Ø) phase.

Generator and Engine Monitoring

1. DC Voltage
2. Oil Pressure
3. Water Temperature
4. AC Voltage
5. AC Current L-1
6. AC Current L-2
7. Line Frequency Hz
8. Engine Hours Up to 10,000 Hours
9. Exhaust Over Temperature Alarm



GenRemote is designed to safely interface with the existing engine sensors. The digital display is easily calibrated to match the readings of the manufacturer supplied mechanical gauge package.

The GenRemote circuitry is isolated from the generators OEM electrical system. This assures that GenRemote will not interfere with the manufacturers supplied gauge package. Electrical isolation also allows normal generator operation should the GenRemote be accidentally disconnected from the generator.

Electrical Hook-Up

Electrical hookup includes interconnecting with both the generators AC and DC systems.

The AC wires Required: The 115 volt Line One [L-1] is Black. Line Two [L-2] is White. The 220 volt Line - 2 [L-2] is Black with a Red Stripe. The 220 VAC Neutral connection is White and is **Not** connected to the GenRemote.

The 220 VAC Generator Neutral is the same as Green Ground wire. The 115/220 VAC Neutral [White Color] is connected to the generator frame.

The DC Wire Harness Supplied Color Code as follows: Green is Ground, White is ESS [Emergency Stop Switch], White/Black is the Stop Switch, Black is Preheat, Orange is Oil Pressure, Red is Water Temperature, Yellow is the Exhaust High Temperature Alarm [marine applications only] and Black/Red is the Start Button.

IMPORTANT ! The Exhaust High Temp terminal is connected to the ESS terminal when it is not used.

GenRemote CONTROL STATION

IMPORTANT! The generator must be running and the system fully operational before the calibration mode can be accessed.

Enter the Calibration Mode: Press and holding the Mode Button for 10 seconds. Entry is indicated when the hundreds place decimal of the 3-digit, 7-segment display **turns on**.

Calibration Button Functions

Mode Button: Press and hold the mode button to enter the calibration mode.

Preheat Button: Use the Preheat Button to manually advance through the AutoGauge Scroll functions until the desired gauge is reached.

Stop Button: Use the Stop Button to decrement or reduce the gauge value.

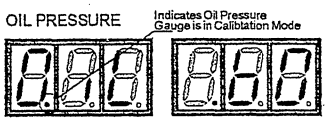
Start Button: Use the Start Button to increment or increase the gauge value.

Mode Button: Press the mode button to exit the calibration mode. Not pressing any button for 30 seconds will also exit the calibration mode.

Firmware I.D. The firmware identification number will appear in the display when the calibration mode is exited. A typical firmware identification number is **"A15"**.

Calibration Method

Calibrate the AutoGaugeScroll by using the values derived from the mechanical gauge package supplied with the generator.



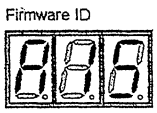
Calibrate the AC Volt and Current Meter with a standard Amp and Voltmeter normally carried by most service technicians.

No calibration of the Frequency Meter is required or allowed. The Frequency Meter is factory calibrated to ± one (1) Hz.

NOTE: The unit will automatically exit the Calibration Mode if no buttons are pressed for thirty (30) seconds.

Firmware Identification

When calling for service or warranty repair it is useful to have the firmware identification number. The unit's age, software revision level and the systems hardware can be identified from this number. The firmware identification number is also placed on the 28 pin microprocessor located in the control module assembly. The firmware number appears in the display when the calibration mode is exited.



FAIL SAFE PROCEDURES

The fail-safe system is setup to display potential failures approximately 10% lower than the OEM settings. This allows time for the operator to manually shut down the generator before serious damage occurs.

Failures are displayed by turning on the appropriate warning LED. For Example, the high coolant temperature alarm will appear at 195 ° F and the OEM safety switch will stop the generator at 210 ° F.

The alarm LED will remain lit after the generator shuts down to provide indication as to why the unit stopped.

The alarm LED can be cleared by pressing the stop button or by restarting the unit.

The Fail-Safe Protocols include:

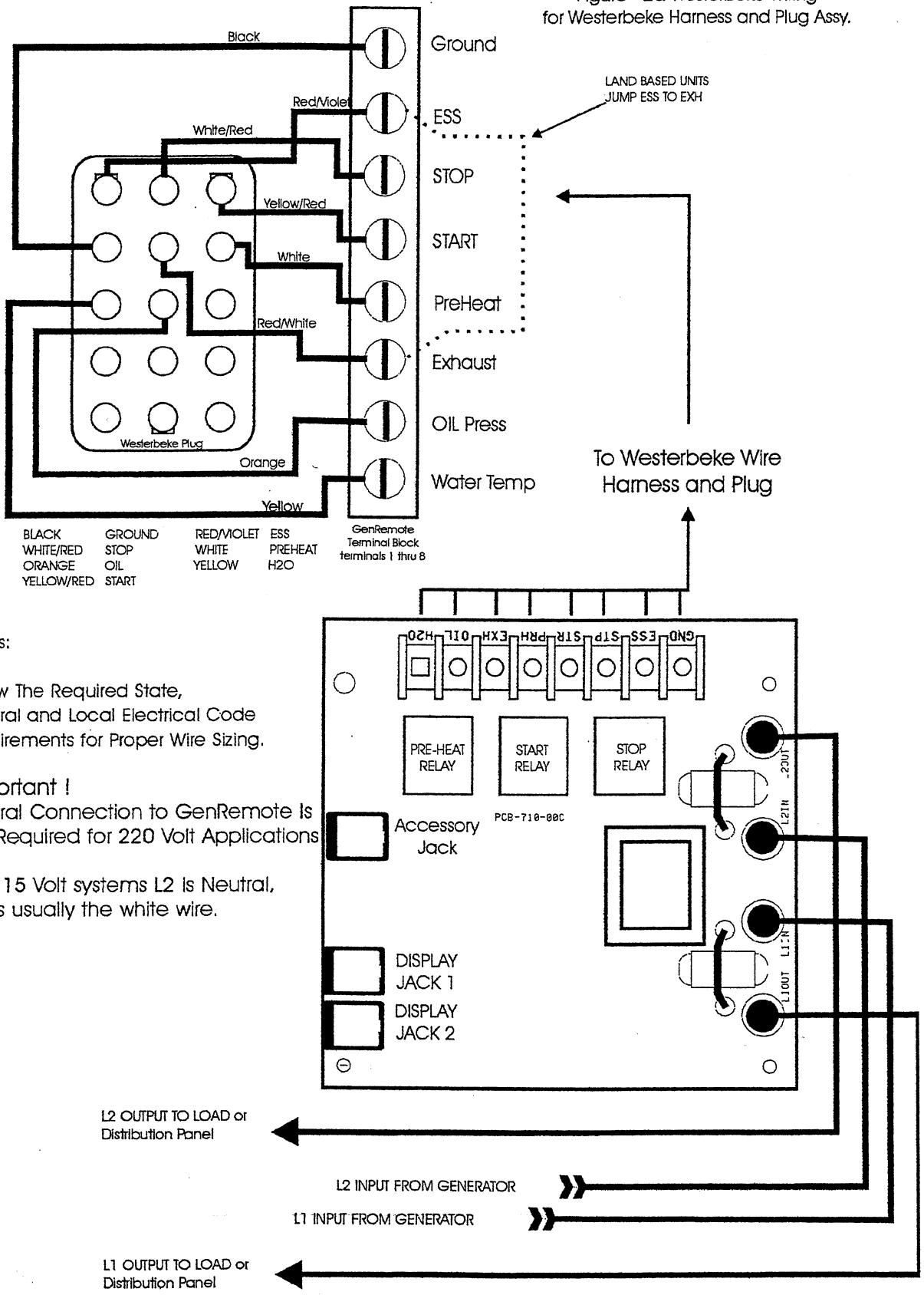
1 - Oil Pressure

2 - Coolant Temperature

3 - Exhaust Over temperature KLIXON

GenRemote WIRING DIAGRAM

Figure - 2a Westerbeke Wiring
for Westerbeke Harness and Plug Assy.



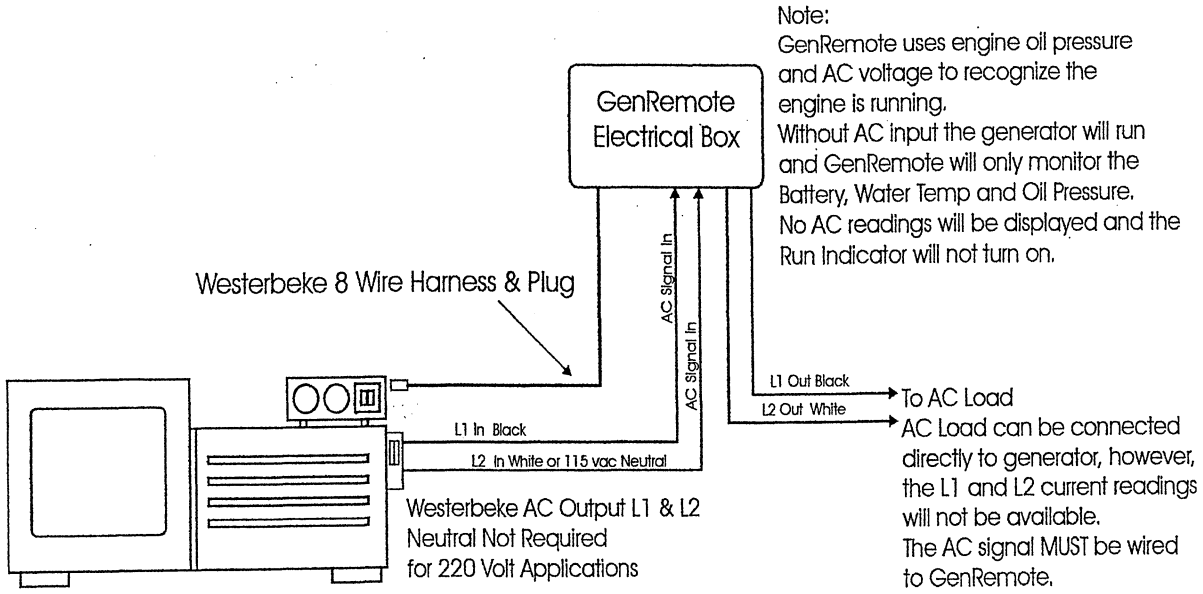
Notes:

Follow The Required State,
Federal and Local Electrical Code
Requirements for Proper Wire Sizing.

Important !
Neutral Connection to GenRemote Is
Not Required for 220 Volt Applications

For 115 Volt systems L2 is Neutral,
this is usually the white wire.

GenRemote INSTALLATION DIAGRAM



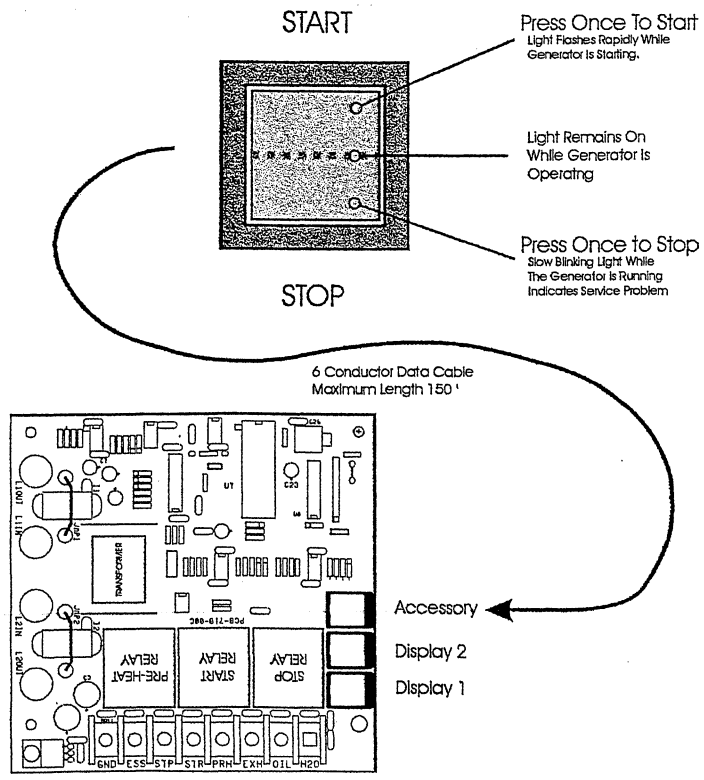
STOP/START ROCKER SWITCH

The One Illuminated Button Start / Stop Rocker Switch is provided for areas where remote start stop functions are required and no space is available for the standard display panel.

Start the generator by pressing and releasing the upper rocker once. The lamp will flicker rapidly while the generator is starting. The indicator lamp will remain on and steady while the generator is running.

Stop the generator by pressing and releasing the lower rocker once.

Trouble Indicator: The indicator lamp will flicker slowly while the generator is operating if a service problem is developing. Possible problems include, High Coolant Water Temperature, Low Oil Pressure and High Exhaust Temperature Safety Switch.



GenRemote SPECIFICATIONS

DC Operating Voltages	12 or 24 VDC
DC Current Requirement--Module	50 mA
DC Current Requirement--Display	20 mA
DC Current each additional Display	15 mA
AC Voltages	120 / 240 VAC
Phase	1 Ø or 3 Ø
Standard Current Meter	60 amps
Remote Current Meter	200 amps
Start Relay	7 amps
Stop Relay	7 amps
Preheat Relay	7 amps
Maximum # of Displays per Module	4
Maximum # of Displays Daisy Chained	2
Maximum Display Cable Length (one direction)	300 ft.
Total Allowed Display Cable Length	600 ft.
Temperature Range	0 ° F through 180 ° F

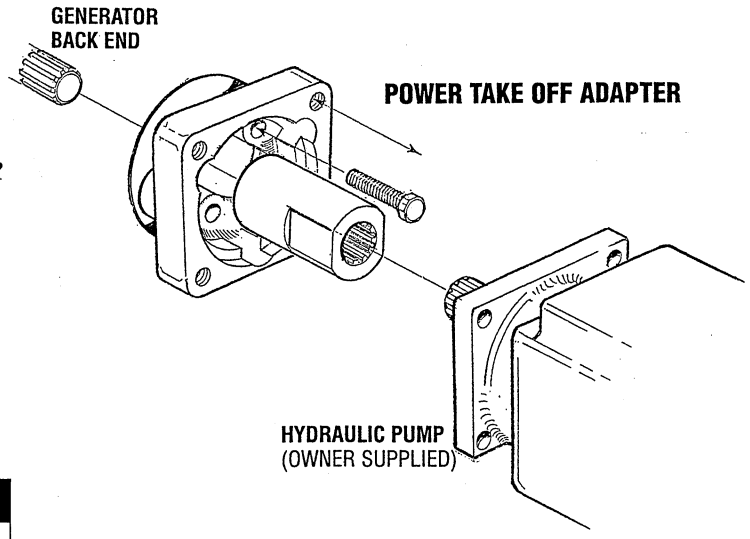
NOTE: Each module will support a maximum of four displays. No more than two (2) displays should be daisy chained to one module output. The module supports two (2) separate display output lines.

POWER TAKE OFF SYSTEMS

POWER TAKE OFF ADAPTER

A power take off adapter can be attached to the generator backend. This adapter allows access to the full power of the engine for a variety of hydraulic and electrical accessories.

Contact your *WESTERBEKE COMMERCIAL GENERATOR SUPPLIER* for additional information.



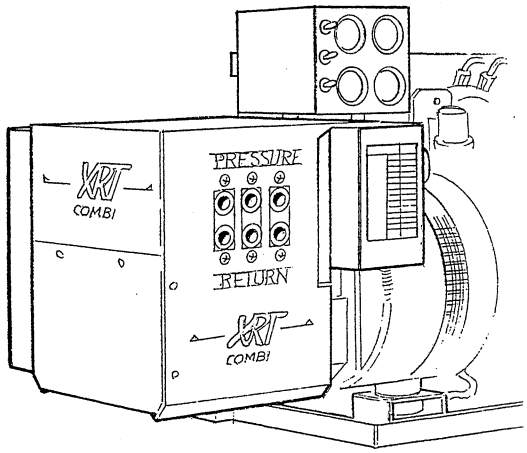
XRT POWER SYSTEM

The XRT power system combined with a Westerbeke generator provides electrical and hydraulic power for fire/emergency apparatus The system generates electrical power for auxillary lighting and provides continuous operation of up to three extrication tools at the same time.

SPECIFICATIONS	
Components	Dual stage continuous duty pump, stainless high pressure fittings, three gallon reservoir with filter, pump enclosure with integral control block assemblies.
System Availability	5,000 psi phosphate ester fluid and mineral fluid systems up to 10,500psi.
Dimensions	COMBI pump in shroud. L:10" x W:15" x H:14" x 42 lbs Reservoir: H: 12" x W: 12" x D: 6.5" Open Center Valves: L: 3.75" x W: 2.75" x H" 4.0."

For additional information, contact XRT POWER SYSTEMS at www.xrtcombi.com or call (800) 343-0480.

XRT POWER SYSTEMS
32 Tioga Way
Marblehead, MA 01945



XRT COMBI POWER SYSTEM

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 generators capacity, and finally loaded to its full capacity as indicted on the generators data plate. The output voltage should be checked periodically to ensure proper operation of the generating plant and the appliances it supplies. If an AC voltmeter or ampmeter is not installed to monitor voltage and load, check it with a portable meter and amp probe.

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

Generator Maintenance

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

CARBON MONOXIDE DETECTOR

WESTERBEKE recommends mounting a carbon monoxide detector in the 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 generator are leaking in your area.

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

THE BE GENERATOR
SINGLE AND THREE PHASE

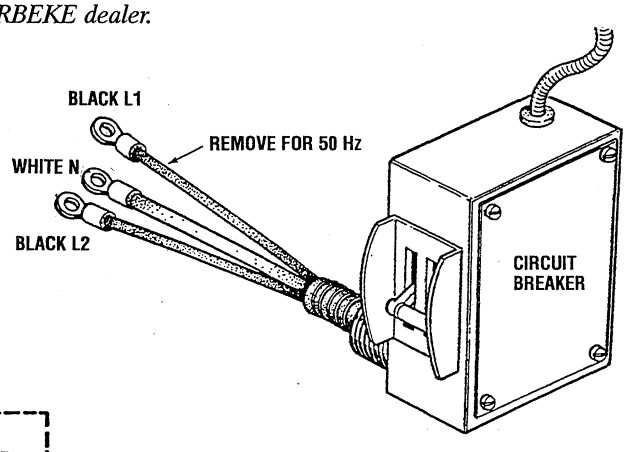
DESCRIPTION

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 excitor 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. An AC voltage is produced in the auxiliary windings of the main stator and is, in turn, supplied to a voltage regulator. The regulator produces a DC voltage to further excite the exciter stator windings, enabling the generator to produce a rated AC output. The voltage regulator senses AC voltage output and adjusts DC excitation to the exciter stator winding according to amperage load the generator is furnishing. To maintain a constant voltage output.

CIRCUIT BREAKER

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

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



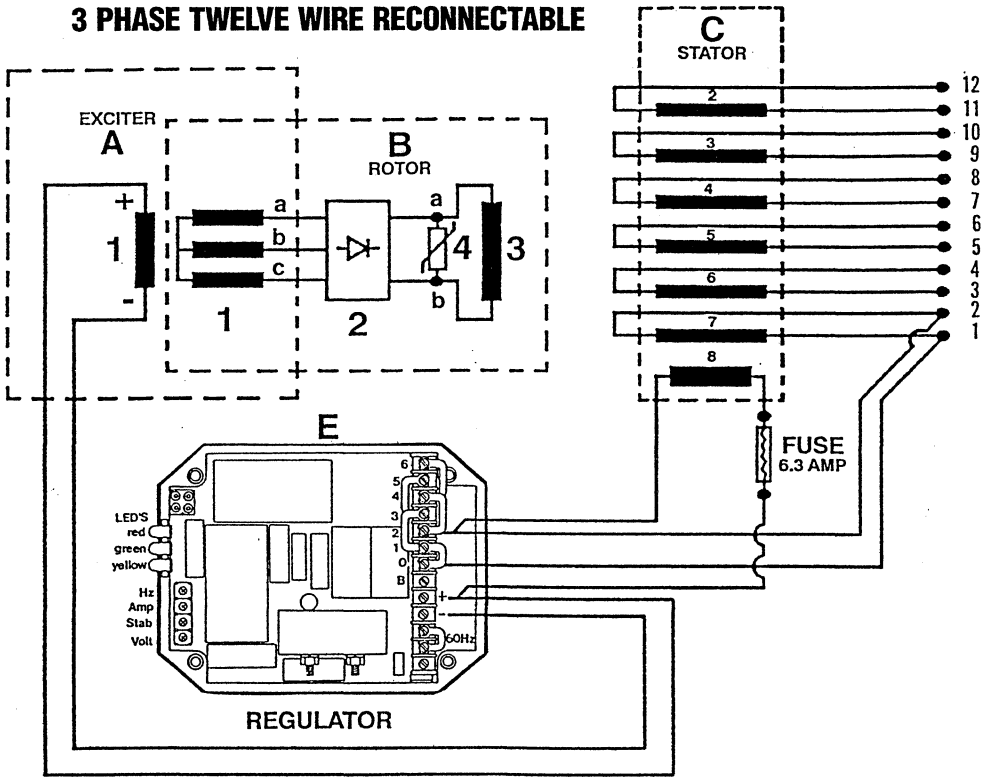
CIRCUIT BREAKER PART NUMBERS

20 KW – 60 Hz NO. 42701
[16 KW – 50 Hz NO. 42718]

25 KW – 60 Hz NO. 42702
[20 KW – 50 Hz NO. 42711]

32 KW – 60 Hz NO. 42703
[25 KW – 50 Hz NO. T D B]

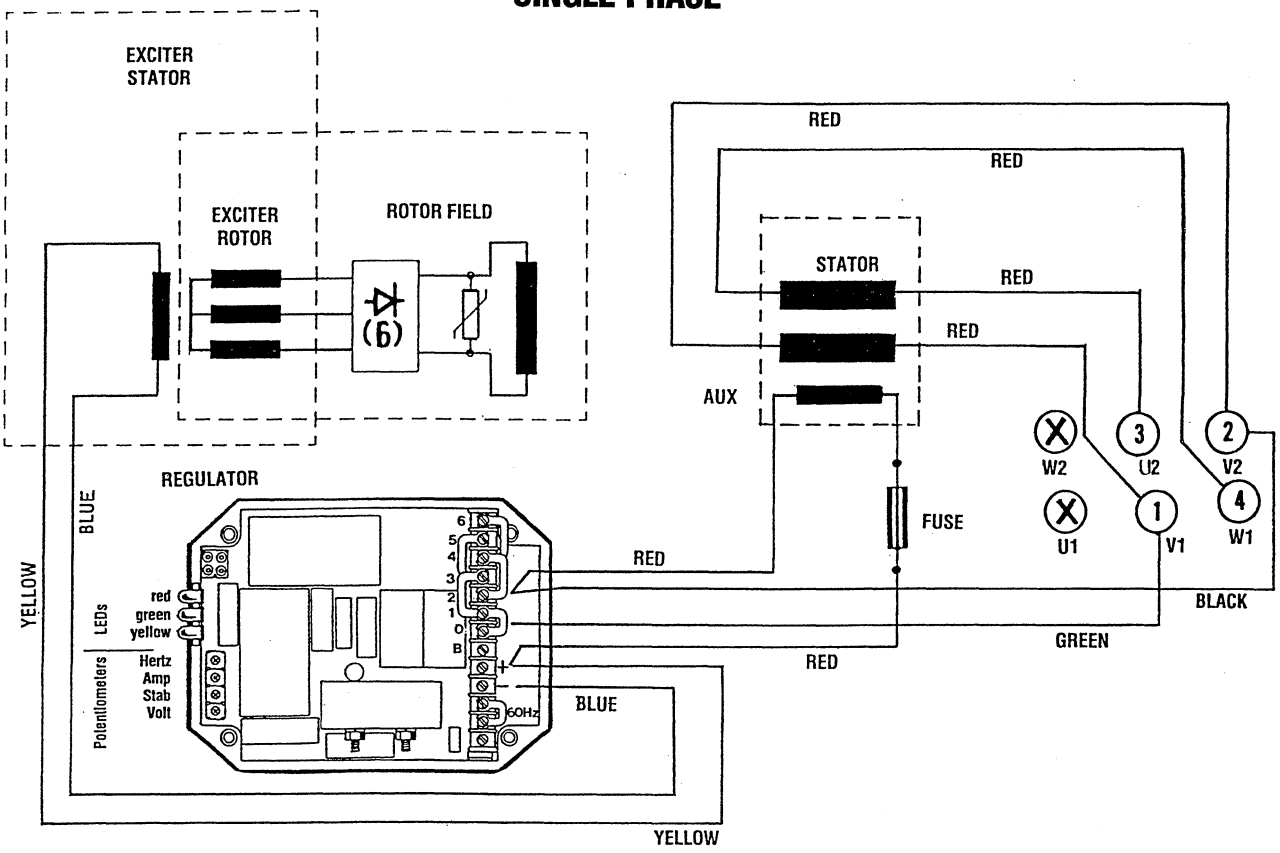
INTERNAL WIRING SCHEMATIC
3 PHASE TWELVE WIRE RECONNECTABLE



A. EXCITOR
   1. Exciter Stator Windings
B. ROTOR
   1. Auxiliary Windings a.b.c.
   2. Diodes
   3. Main Rotor Windings
   4. Pozi Resistor
C. MAIN STATOR
   1. Auxiliary Windings
   2. – 7 Main Stator Windings
   3. Auxiliary Windings (AC to Regulator)
D. AC TERMINAL BOARD
E. REGULATOR

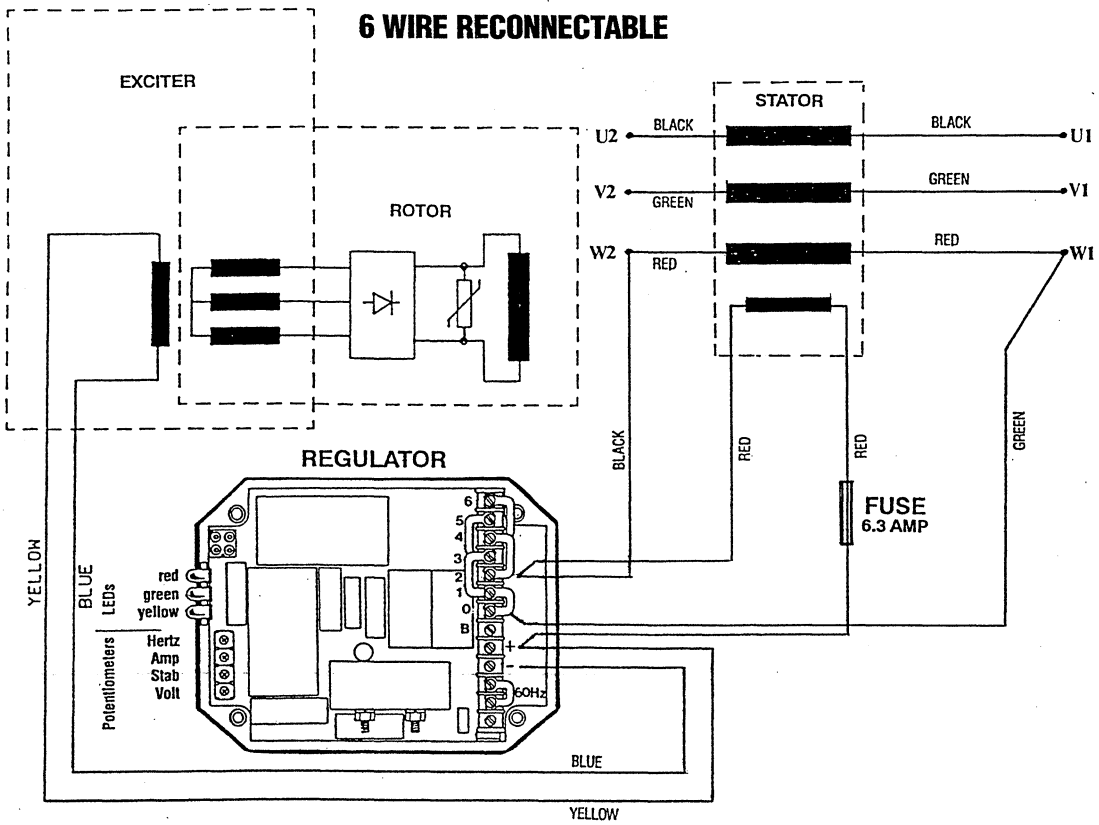
INTERNAL WIRING SCHEMATICS

SINGLE PHASE



THREE PHASE

6 WIRE RECONNECTABLE



GENERATOR AC VOLTAGE CONNECTIONS

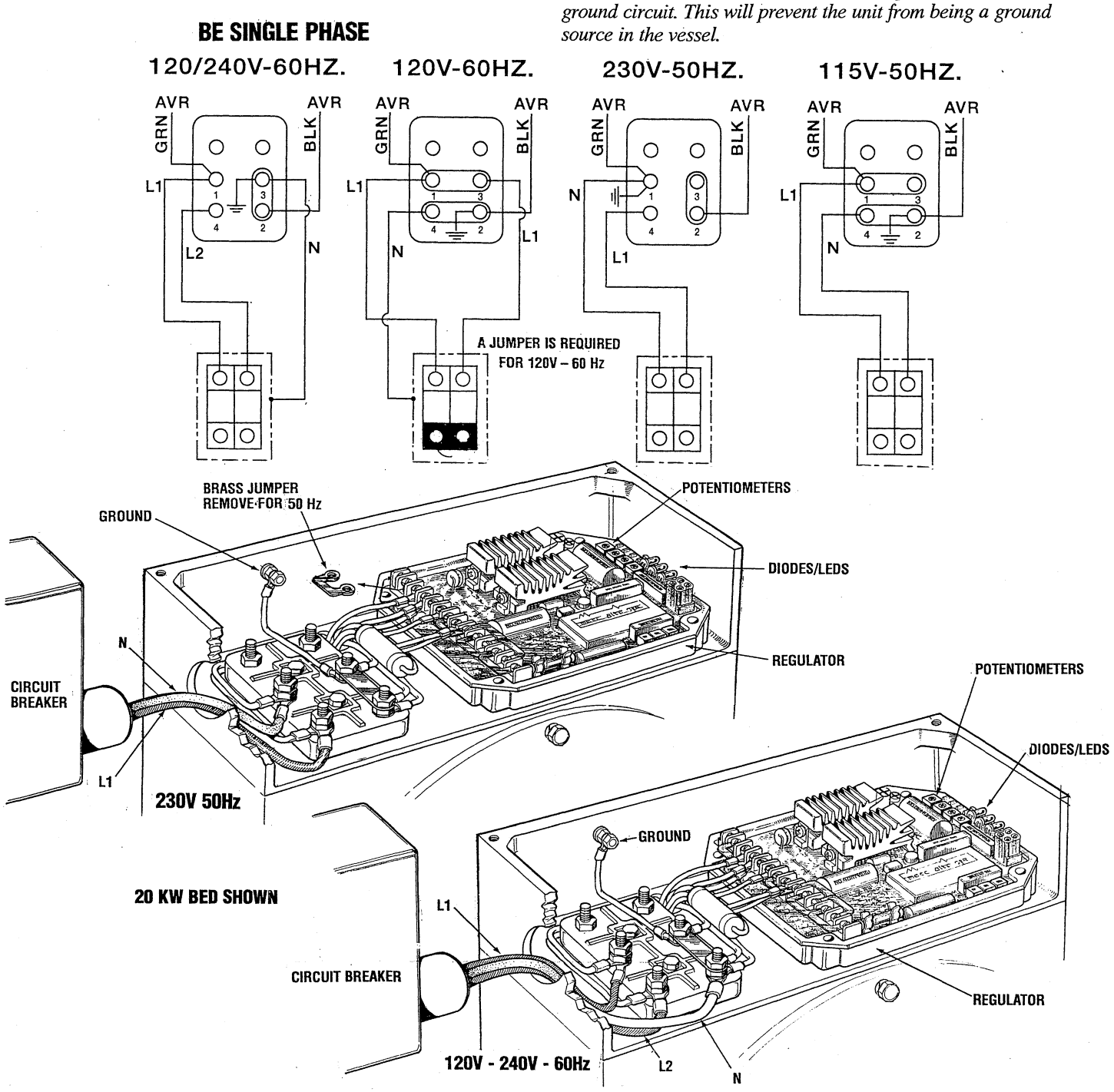
AC VOLTAGE CONNECTIONS

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

Generator Frequency

1. Frequency is a direct result of engine/generator speed: 1800 rpm = 60 hertz; 1500 rmp = 50 hertz.
2. To change generator frequency, follow the steps below:
   Configure the AC terminal block for the desired voltage frequency as shown. Ensure that the case ground wire is connected to the correct terminal block neutral ground stud.

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

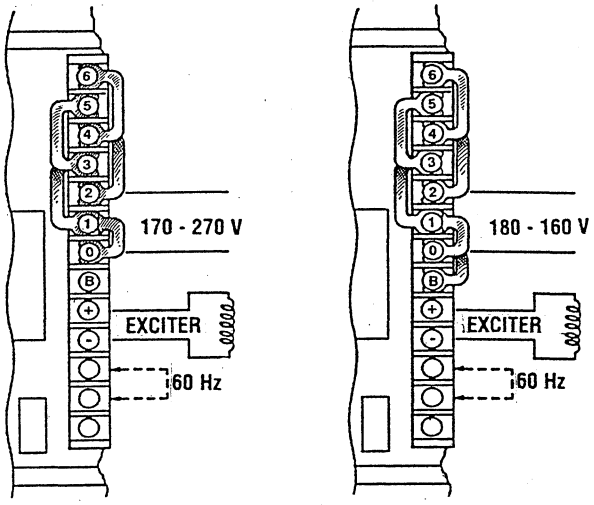


GENERATOR AC VOLTAGE CONNECTIONS

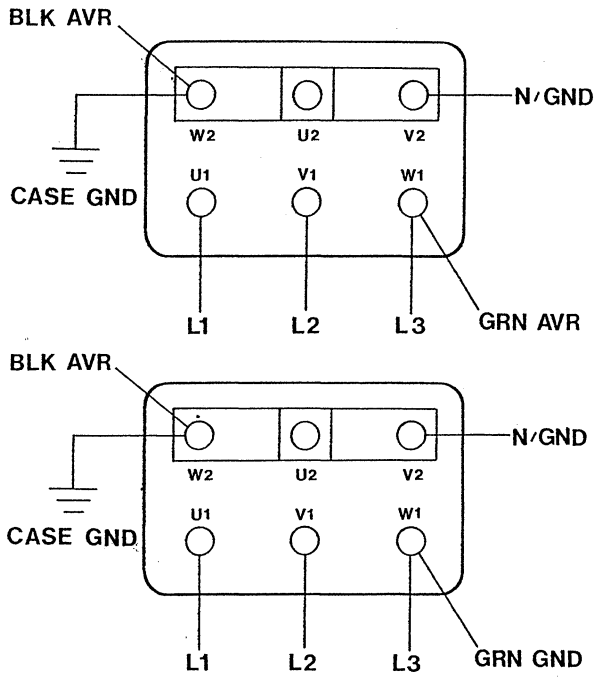
DESCRIPTION

The regulator is equipped with seven numbered terminals (0 to 6) and their related brass jumpers. The illustrations show connection points and jumpers for the 3 phase configuration of the generator. The sensing leads connect between pin #1 and pin #2 on the AC terminal block and connection #2 and #0 on the voltage regulator board.

NOTE: *Series Delta requires the installation of a jumper on the regulator board between terminal B and 10.*

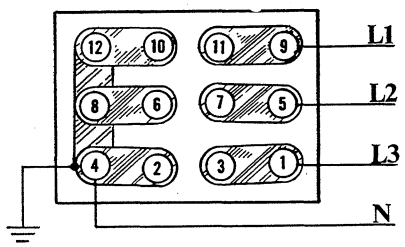


3 PHASE VOLTAGE REGULATOR



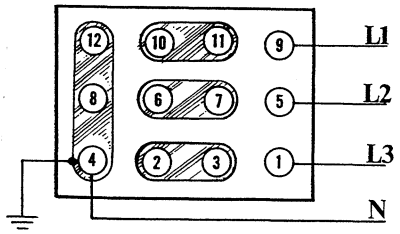
BE THREE PHASE (SIX WIRE)

PARALLEL WYE (STAR)



L-L – 208 VAC 3Ø 50 Hz
L-N – 120 VAC 1Ø 60 Hz
L-L – 190 VAC 3Ø 50 Hz
L-N – 110 VAC 1Ø 60 Hz

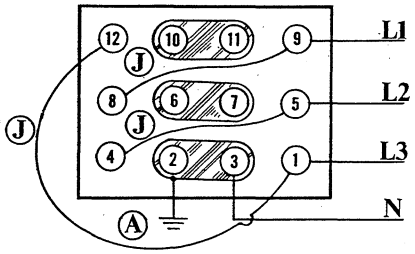
SERIES WYE (STAR)



L-L – 450 VAC 3Ø 60 Hz
L-N – 265 VAC 1Ø 60 Hz
L-L – 380 VAC 3Ø 50 Hz
L-N –230 VAC 1Ø 50 Hz

BE THREE PHASE (TWELVE WIRE)

SERIES DELTA



L-L – 240 VAC 3Ø 60 Hz
L2, L3-N – 120 VAC 1Ø 60 Hz
L-L – 230 VAC 3Ø 50 Hz
L2, L3-N – 115 VAC 1Ø 50 Hz

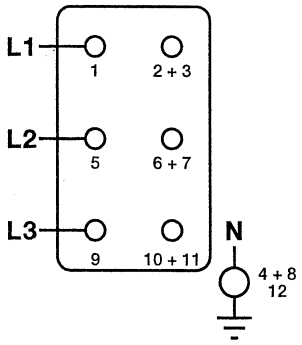
A. SERIES DELTA – Note the repositioning of the ground lead from neutral to generator housing.

J. Jumper using #10 AWG Wire.

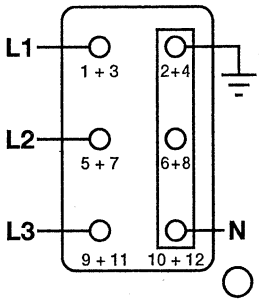
GENERATOR AC VOLTAGE CONNECTIONS

BE THREE PHASE 6 STUD / 12 WIRE TERMINAL BLOCKS

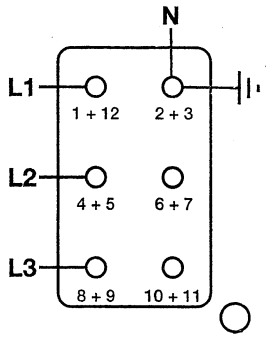
NOTE: *For ouput leads from the AC terminal block use terminal ends for 1/4" studs that accept multi-strand copper wire sized for the average rating from the hot lead connection*



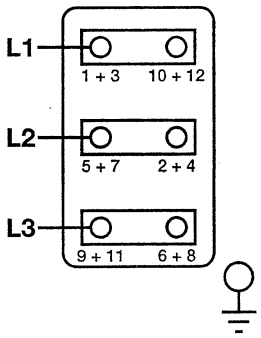
"SERIES Y"
480V/60 Hz.
380V/50 Hz.



"PARALLEL Y"
208V/60 Hz.
190V/50 Hz.

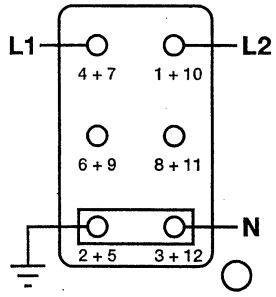


"SERIES DELTA"
240V/60 Hz.
220V/50 Hz.



"PARALLEL DELTA"
120V/60 Hz.
110V/50 Hz.

"SINGLE PHASE"



"DOUBLE DELTA"
120-240V/60 Hz.
110-220V/50 Hz.

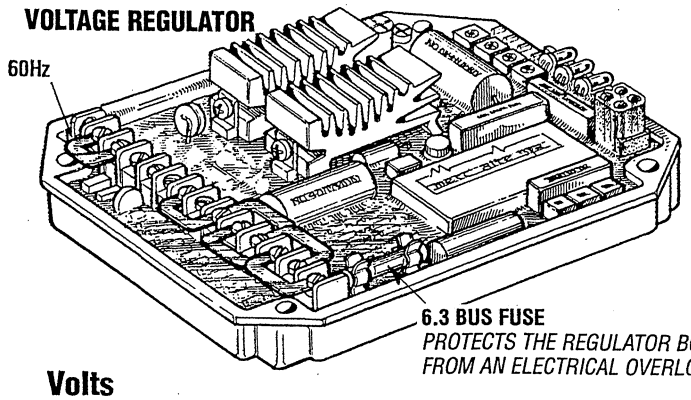
NOTE:

IF WIRING FOR 50 HZ. THE 60 HZ. JUMPER MUST BE REMOVED FROM THE REGULATOR.

GENERATOR VOLTAGE REGULATOR ADJUSTMENTS [THREE PHASE]

Description

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



Volts

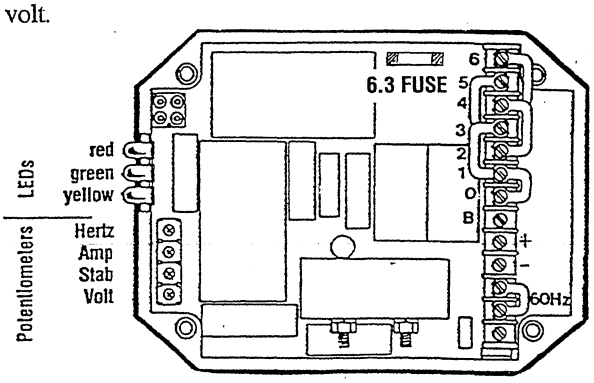
This potentiometer is used to adjust output voltage. At proper engine operating speed the output voltage should be held at ±1% from a no-load condition to a full rated generator output and from power factor 1.0 - 0.8 with engine drive speed variations up to -6%. Prior to starting the engine, turn the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

1. Load the generator 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 generator 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.
4. Return to nominal speed, the yellow LED will turn off and the generator 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 generator should be running at no-load.*

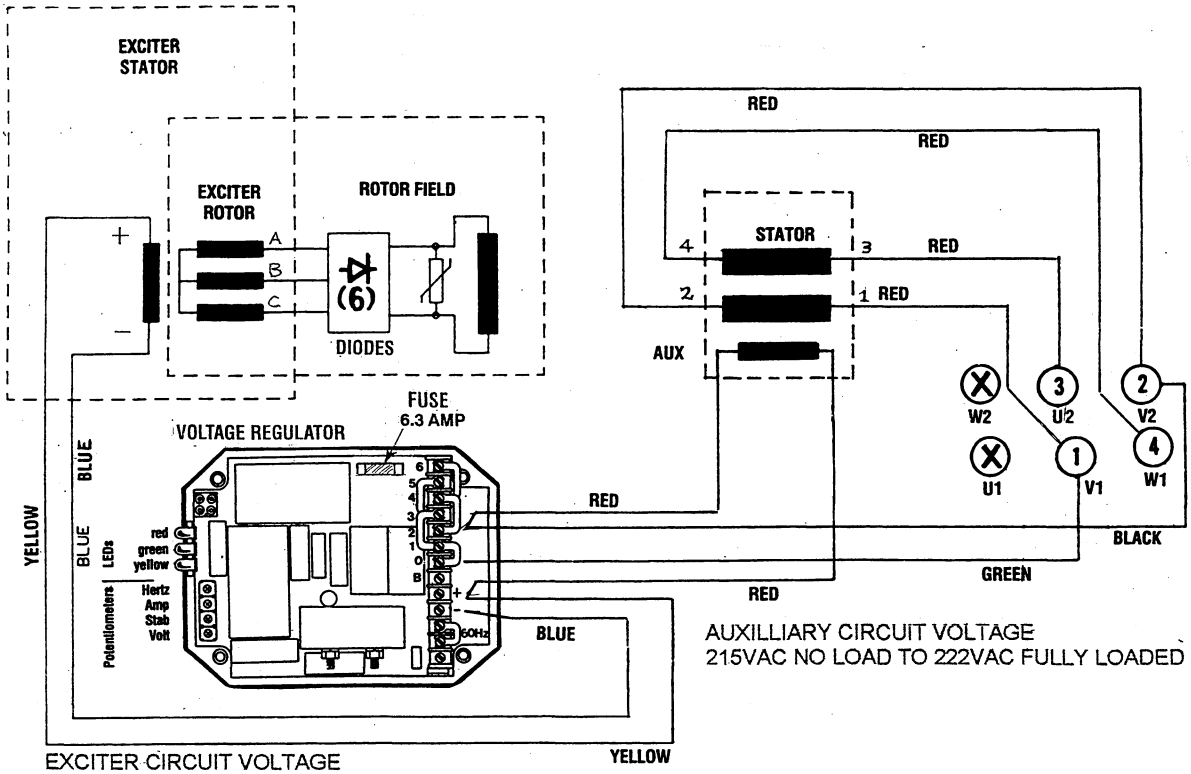
1. To adjust the underspeed (low frequency) protection circuit, lower the engine speed at 90% of its normal running speed (54 hertz on 60 hertz units, 45 hertz on 50 hertz units.
2. Rotate the Hertz adjustment counterclockwise slowly until the generator's AC output voltage starts to decrease and at the 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.

BE TROUBLESHOOTING

NOTE: *AC GENERATOR TROUBLESHOOTING MUST BE PERFORMED WITH THE ENGINE OPERATING 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 feed to AVR. **2.** Faulty voltage regulator **3.** Shorted or open main stator auxiliary winding.
LOW AC VOLTAGE OUTPUT AT NO LOAD 60 - 100 VAC.	**1.** Reset voltage potentiometer. **2.** Open or shorted diodes in. exciter rotor 1 to 3 diodes. **3.** Faulty voltage regulator **4.** Short in rotating field winding. rotor winding. **5.** Short in exciter stator.
HIGH AC OUTPUT VOLTAGE 150 VAC OR HIGHER.	**1.** Reset voltage potentiometer.
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.



SPECIFICATIONS
WESTERBEKE 20 KW GENERATOR

SPECIFICATIONS

Engine Type	Diesel, four-cycle, four-cylinder, fresh water-cooled Vertical, in-line overhead valve mechanism (33 hp at 1800 rpm maximum).
Aspiration	Naturally aspirated.
Governor	Electronic Governing
Combustion Chamber	Swirl type
Bore & Stroke	3.50 x 4.0 inches (88.9 x 101.6 mm)
Piston Displacement	154 cubic inches (2.5 liters)
Firing Order	1 - 3 - 4 - 2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 1800 rpm)	117 lb-ft (16.18 kg-m)
Compression Ratio	21:1
Dimensions	Height: 28.50 inches (723.9 mm) Width: 22.00 inches (546.1 mm) Length: 45.79 inches (1163.3 mm)
Weight	943 lbs (431.7 kgs)
Fuel Consumption (approximate)	2.0 gph (7.57 lph) at full rated output
Inclination	Continuous 15° Temporary 20° (not to exceed 20 min.)
Generator Power Take off	30 Horsepower (maximum)

TUNE-UP SPECIFICATIONS

Compression Pressure (Limit of difference between cylinders)	427 psi (30 kg/cm²) at 200 rpm (47.2 psi (3.0 kg/cm²))
Valve Timing	Intake Opens 17° BTDC Intake Closes 47° ABDC Exhaust Opens 51° BBDC Exhaust Closes 13° ATDC
Valve Seat Angle	Intake 45° Exhaust 30°
Valve Clearance (engine cold)	Intake 0.012 inches (0.3 mm) Exhaust 0.012 inches (0.3 mm)
Engine Speed	1800 RPM 60 Hertz 1500 RPM 50 Hertz
Injector Pressure	1920 + 71 - 0 psi (135 + 5 - 0 kg/cm²)
Engine Timing	Static timed - drop valve method 0.205 ± .005 inches BTDC

FUEL SYSTEM

General	Open flow, self priming - 1 bleed point
Fuel	No. 2 diesel oil (cetane rating of 45 or higher)
Fuel Injection Pump	ZEXEL Model VE Distributor
Fuel Injection Timing	0° TDC (Top Dead Center)
Nozzle	Throttle type
Fuel Filter (on engine)	Spin-on type, full flow
Air cleaner	Slide on cannister/replaceable
Air Flow (engine combustion)	81.0 cfm (2.29 cmm)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
System Capacity (fresh water)	11.5 qts (10.88 liters)

LUBRICATION SYSTEM

General	Pressure fed system
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	6.5 U.S. qts (6.15 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	50-60 psi (3.5 - 4.2 kg/cm²)
Oil Grade	API Specification of CF or CG-4, SAE 30, 10W-30, 15W-40 *PETROLEUM* *OR SYNTHETIC*

SPECIFICATIONS
WESTERBEKE 20 KW GENERATOR

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground
Battery Capacity	400 - 600 Cold Cranking Amps (CCA)
DC Charging Alternator	51 Amp rated, belt-driven
Starter	12-Volt, Reduction Gear, 3 KW
Starting Aid	Glow plugs, sheathed type
DC No-Load Current	5 2% of rated Amps
DC Cranking Current	250 - 300 Amps (engine cold)

AC GENERATOR (SINGLE PHASE)

General - Single Phase	Brushless, four-pole, revolving field Sealed lubricated single bearing design. Reconnectable single phase for 120/240 volts with solid state voltage regulator.
Voltage - Single Phase	120 or 120/240 Volts - 60 Hertz 230 Volts - 50 Hertz
Voltage regulation:	5 2% no load to full load.
Frequency regulation:	0.30 Hertz no load to full load.
Rating (Volts AC)	20 KW - 60 Hertz (1800 rpm) 120 Volts 166 Amps 120/240 Volts 166/83 Amps 16 KW - 50 Hertz (1500 rpm) 230 Volts 69.6 Amps

AC GENERATOR (3 Phase)

General - 3 Phase 20.0 KW - 60 Hertz 16.0 KW - 50 Hertz	Brushless six pole, revolving field. Sealed lubricated single bearing design. 12 Lead reconnectable for low voltage WYE, high voltage Delta. Solid State voltage regulator with protection circuitry.	
Voltage - 3 Phase (60 Hertz)	Low voltage WYE High voltage WYE DELTA	208 volts 480 volts 240 volts
Voltage - 3 Phase (50 Hertz)	High voltage WYE DELTA	380 volts 240 volts
Amperage - 3 Phase (60 Hertz)	Low voltage WYE High voltage WYE DELTA	70 Amps 35 Amps 60 Amps
Amperage - 3 Phase (50 Hertz)	High voltage WYE DELTA	30.4 Amps 52.5 Amps

GENERATOR COOLING

Air Requirements (60 Hertz at 1800 RPM)	425 cfm (12.74 cmm)
Note: Increase air supply 15% for 50 Hertz operation 1500 rpm	
Engine Combustion Air Requirements (60 Hertz at 1800 RPM)	81.0 cfm (2.29 cmm)

SPECIFICATIONS
WESTERBEKE 25 KW GENERATOR

SPECIFICATIONS

Engine Type	Diesel, four-cycle, four-cylinder, fresh water-cooled, Vertical, in-line overhead valve mechanism (50 hp at 1800 rpm maximum).
Aspiration	Naturally aspirated.
Governor	Electronic Governing
Combustion Chamber	Swirl type
Bore & Stroke	3.74 x 4.13 inches (95 x 105 mm)
Piston Displacement	182 cubic inches (2.98 liters)
Firing Order	1 - 3 - 4 - 2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 1800 rpm)	148 lb-ft (20.46 kg-m)
Compression Ratio	21:1
Dimensions	Height: 28.56 inches (726.4 mm) Width: 23.3 inches (591.8 mm) Length: 49.9 inches (1140.5 mm)
Weight	971 lbs (440 kgs)
Fuel Consumption (approximate)	2.9 gph (10.9 lph) at full output
Inclination	Continuous 15° Temporary 20° (not to exceed 20 min.)
Generator Power Take-off	40 Horsepower (maximum)

TUNE-UP SPECIFICATIONS

Compression Pressure	427 psi (30 kg/cm²) at 200 rpm
(Limit of difference between cylinders)	(47.2 psi (3.0 kg/cm²))
Valve Timing	Intake Opens 17° BTDC Intake Closes 47° ABDC Exhaust Opens 51° BBDC Exhaust Closes 13° ATDC
Valve Seat Angle	Intake 45° Exhaust 30°
Valve Clearance (engine cold)	Intake 0.012 inches (0.3 mm) Exhaust 0.012 inches (0.3 mm)
Injector Pressure	1920 + 71-0 psi (135 + 5-0 kg/cm²)
Engine Timing	Static timed - drop valve method 0.205 ± .005 inches BTDC
Engine Speed	1800 RPM 60 Hertz 1500 RPM 50 Hertz

FUEL SYSTEM

General	Open flow, self priming - 1 bleed point
Fuel	No. 2 diesel oil (cetane rating of 45 or higher)
Fuel Injection Pump	ZEXEL Model VE Distributor
Fuel Injection Timing	0° TDC (Top Dead Center)
Nozzle	Throttle type
Fuel Filter (on engine)	Spin-on type, full flow
Air cleaner	Slide on canister-cleanable/replaceable
Air Flow (engine combustion)	94.6 cfm (2.7 cmm)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
System Capacity (fresh water)	11.5 qts (10.88 liters)

LUBRICATION SYSTEM

General	Pressure fed system
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	6.5 U.S. qts (6.15 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	50-60 psi (3.5 - 4.2 kg/cm²)
Oil Grade	API Specification of CF or CG-4, SAE 30, 10W-30, 15W-40 *PETROLEUM* *OR SYNTHETIC*

SPECIFICATIONS
WESTERBEKE 25 KW GENERATOR

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground
Battery Capacity	400 - 600 Cold Cranking Amps (CCA)
DC Charging Alternator	51 Amp rated, belt-driven
Starter	12-Volt, Reduction Gear
Starting Aid	Glow plugs, sheathed type
DC No-Load Current	± 2% of rated Amps
DC Cranking Current	250 - 300 Amps (engine cold)

AC GENERATOR (SINGLE PHASE)

General - Single Phase	Brushless, four-pole, revolving field Sealed lubricated single bearing design. Reconnectable single phase for 120/240 volts with solid state voltage regulator.
Voltage - Single Phase	120 or 120/240 Volts - 60 Hertz 220 Volts - 50 Hertz
Voltage regulation:	± 2% no load to full load.
Frequency regulation:	.3 Hertz no load to full load.
Rating (Volts AC)	20 KW - 60 Hertz (1800 rpm) 120 Volts 208 Amps 120/240 Volts 208.109 Amps 20 KW - 50 Hertz (1500 rpm) 230 Volts 87 Amps

AC GENERATOR (3 Phase)

General - 3 Phase	Brushless six pole, revolving field. Sealed lubricated single bearing design. 12 Lead reconnectable for low voltage WYE and for Delta. Solid State voltage regulator with protection circuitry.	
Voltage - 3 Phase (60 Hertz)	Low voltage WYE High voltage WYE DELTA	208 volts 480 volts 240 volts
Voltage - 3 Phase (50 Hertz)	High voltage WYE DELTA	380 volts 240 volts
Amperage - 3 Phase (60 Hertz)	Low voltage WYE High voltage WYE DELTA	86.7 Amps 37.6 Amps 75.2 Amps
Amperage - 3 Phase (50 Hertz)	High voltage WYE DELTA	38.0 Amps 65.6 Amps

GENERATOR COOLING

Air Requirements (60 Hertz at 1800 RPM)	1.0 Power Factor 425 cfm (12.74 cmm)
Note: Increase air supply 15% for 50 Hertz operation 1500 rpm	
Engine Combustion Air Requirements (60 Hertz at 1800 RPM)	94.6 cfm (2.7 cmm)

SPECIFICATIONS
WESTERBEKE 32 KW GENERATOR

SPECIFICATIONS

Engine Type	Diesel, four-cycle, four-cylinder, fresh water-cooled, Vertical, in-line overhead valve mechanism (46 hp at 1800 rpm maximum).
Aspiration	Naturally aspirated.
Governor	Electronic Governing
Combustion Chamber	Swirl type
Bore & Stroke	3.94 x 4.33 inches (100.1 x 110.0 mm)
Piston Displacement	210.8 cubic inches (3.5 liters)
Firing Order	1 - 3 - 4 - 2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 1800 rpm)	166 lb-ft (23 kg-m)
Compression Ratio	18:1
Dimensions	Height: 30.0 inches (762.0 mm) Width: 22.0 inches (558.8 mm) Length: 44.6 inches (113.3 mm)
Weight	1038 lbs (471.8 kgs)

TUNE-UP SPECIFICATIONS

Compression Pressure (Limit of difference between cylinders)	427 psi (30 kg/cm²) at 200 rpm 47.2 psi (3.0 kg/cm²))
Valve Timing	Intake Opens 19° BTDC Intake Closes 47° ABDC Exhaust Opens 52° BBDC Exhaust Closes 14° ATDC
Engine Timing	Static timed - drop valve method 0.180 ± .005 inches BTDC
Injector Pressure	2450 ± 35 psi (1 + 5-0 kg/cm²)
Valve Seat Angle	Intake 45° Exhaust 30°
Valve Clearance (engine cold)	Intake 0.012 inches (0.3 mm) Exhaust 0.014 inches (0.35 mm)
Engine Speed	1800 RPM 60 Hertz 1500 RPM 50 Hertz

FUEL SYSTEM

General	Open flow, self priming - 1 bleed point
Fuel	No. 2 diesel oil (cetane rating of 45 or higher)
Fuel Injection Pump	ZEXEL Model PE (In-Line)
Fuel Injection Timing	12° BTDC
Nozzle	Orifice type
Fuel Filter (on engine)	Full Flow Replaceable
Air cleaner	Slide on cannister - cleanable/replaceable
Air Flow (engine combustion)	110 cfm (3.1 cmm)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
System Capacity (fresh water)	8.5 qts (8.04 liters)

LUBRICATION SYSTEM

General	Pressure fed system
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	6.3 U.S. qts (6.0 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	50-60 psi (3.5 - 4.2 kg/cm²)
Oil Grade	API Specification of CF or CG-4, SAE 30, 10W-30, 15W-40 *PETROLEUM* *OR SYNTHETIC*

SPECIFICATIONS
WESTERBEKE 32 KW GENERATOR

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground
Battery Capacity	600 - 900 Cold Cranking Amps (CCA)
DC Charging Alternator	51 Amp rated, belt-driven
Starter	12-Volt, 3 KW
Starting Aid	Glow plugs, sheathed type .1 – .2 ohm
DC No-Load Current	± 2% of rated Amps
DC Cranking Current	250 - 300 Amps (engine cold)

AC GENERATOR (SINGLE PHASE)

General - Single Phase	Brushless, four-pole, revolving field Sealed lubricated single bearing design. Reconnectable single phase for 120/240 volts with solid state voltage regulator.
Voltage - Single Phase	120 or 120/240 Volts - 60 Hertz 220 Volts - 50 Hertz
Voltage regulation:	± 2% no load to full load.
Frequency regulation:	.3 Hertz no load to full load.
Rating (Volts AC)	32 KW - 60 Hertz (1800 rpm) 120 Volts 266 Amps 120/240 Volts 266/133 Amps 25 KW - 50 Hertz (1500 rpm) 230 Volts 108.7 Amps

AC GENERATOR (3 Phase)

General - 3 Phase 20.0 KW - 60 Hertz 16.0 KW - 50 Hertz	Brushless six pole, revolving field. Sealed lubricated single bearing design. 12 Lead reconnectable for low voltage WYE and for Delta. Solid State voltage regulator with protection circuitry.	
Voltage - 3 Phase (60 Hertz)	Low voltage WYE High voltage WYE DELTA	208 volts 480 volts 240 volts
Voltage - 3 Phase (50 Hertz)	High voltage WYE DELTA	380 volts 220 volts
Amperage - 3 Phase (60 Hertz) .8 power factor	Low voltage WYE High voltage WYE DELTA	111.0 Amps 48.1 Amps 96.2 Amps
Amperage - 3 Phase (50 Hertz) .8 power factor	High voltage WYE DELTA	47.5 Amps 82.0 Amps

GENERATOR COOLING

Air Requirements (60 Hertz at 1800 RPM)	1.0 power factor 500 cfm (15.0 cmm)
Note: Increase air supply 15% for 50 Hertz operation 1500 rpm	
Engine Combustion Air Requirements (60 Hertz at 1800 RPM)	110 cfm (3.1 cmm)

TORQUE SPECIFICATIONS

lb–ft (m–Kg)

COMPONENT	BEDA 20.0 KW		BED 25.0 KW		BEDA 32.0 KW	
Cylinder head bolts	85 – 89	(11.8 – 12.5)	85 – 89	(11.8 – 12.5)	(Do Not Torque)	
Cylinder head cover	2 – 3	(0.3 – 0.45)	2 – 3	(0.3 – 0.45)	1.4 – 2.5	(0.2 – 0.35)
Connecting rod cap	59 – 65	(8.2 – 9.0)	59 – 65	(8.2 – 9.0)	59 – 65	(8.2 – 9.0)
Main bearing cap	80 – 85	(11.0 – 11.7)	80 – 85	(11.0 – 11.7)	72 – 77	(10.0 – 10.7)
Camshaft thrust plate	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)	14 – 19	(1.9 – 2.6)
Idler Gear	16 – 23	(2.2 – 3.2)	16 – 23	(2.2 – 3.2)	14 – 19	(1.9 – 2.6)
Rocker arm assembly	80 – 85	(11.0 – 11.7)	80 – 85	(11.0 – 11.7)	14 – 19	(1.9 – 2.6)
Timing gear cover	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)	14 – 19	(1.9 – 2.6)
Rear oil seal cap	11 – 15	(1.5 – 2.0)	11 – 15	(1.5 – 2.0)	14 – 19	(1.9 – 2.6)
Oil pan bolts	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)	14 – 19	(1.9 – 2.6)
Oil pump pipe	6 – 9	(0.8 – 1.2)	6 – 9	(0.8 – 1.2)	5.8 – 8	(0.8 – 1.1)
Fresh water pump bolts	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)
Crankshaft pulley nut	253 – 289	(35 – 40)	253 – 289	(35 – 40)	253 – 289	(35 – 40)
* Injector to head	43 – 51	(6.0 – 7.0)	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)
Injection pipe flare nut	18 – 22	(2.5 – 3.0)	18 – 22	(2.5 – 3.0)	18 – 22	(2.5 – 3.0)
Intake manifold	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)	14 – 19	(1.9 – 2.6)
Exhaust manifold	20 – 24	(2.7 – 3.3)	20 – 24	(2.7 – 3.3)	17 – 20	(2.3 – 2.7)
Back plate	24 – 35	(3.3 – 4.8)	24 – 35	(3.3 – 4.8)	28 – 38	(3.8 – 5.3)
Flywheel	112 – 118	(15.5 – 16.3)	112 – 118	(15.5 – 16.3)	130 – 145	(18 – 20)
Damper	14 – 20	(1.9 – 2.7)	14 – 20	(1.9 – 2.7)	16 – 24	(2.2 – 3.4)
Timing gear cover	12 – 17	(1.6 – 2.4)	12 – 17	(1.6 – 2.4)	14 – 19	(1.9 – 2.6)
Alternator bracket	27 – 38	(3.8 – 5.3)	27 – 38	(3.8 – 5.3)	27 – 38	(3.8 – 5.3)
Thermostat housing	6 – 8	(0.8 – 1.1)	6 – 8	(0.8 – 1.1)	5.8 – 8.0	(0.8 – 1.1)
Thrust plate	14 – 19	(1.9 – 2.6)	14 – 19	(1.9 – 2.6)	14 – 19	(1.9 – 2.6)
Oil pressure sender	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)
Oil pressure switch	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)	9 – 13	(1.2 – 1.8)
Engine mounts	23 – 34	(3.2 – 4.7)	23 – 34	(3.2 – 4.7)	23 – 34	(3.2 – 4.7)
Alternator bracket	27 – 38	(3.8 – 5.3)	27 – 38	(3.8 – 5.3)	27 – 38	(3.8 – 5.3)
Coolant temperature switch	18 – 29	(2.5 – 4.0)	18 – 29	(2.5 – 4.0)	18 – 29	(2.5 – 4.0)
Coolant temperature sender	18 – 29	(2.5 – 4.0)	18 – 29	(2.5 – 4.0)	18 – 29	(2.5 – 4.0)
Glow plug	7 – 11	(1.0 – 1.5)	7 – 11	(1.0 – 1.5)	NA	
Camshaft gear	46 – 69	(6.4 – 9.5)	46 – 69	(6.4 – 9.5)	NA	
Injection pump gear	29 – 52	(4.0 – 9.0)	29 – 52	(4.0 – 9.0)	29 – 52	(4.0 – 9.0)

* BEDA 20 KW Generator uses an injector that is screwed into the head torque 43 – 51 lb-ft (6.0 – 7.0).

BED 25 KW and 32 KW Generators use injectors that are bolted to the head – torque value is 12 to 17 lb-ft (1.6 – 2.4) per bolt tightened evenly.

STANDARD HARDWARE TORQUES

NOTE: *Unless stated otherwise for a specific assembly, use the following torque values when tightening standard hardware.*

Grade 4	Pitch	lb-ft	kg-m
6mm bolt head/nut	1	2.9-5.1	0.4-0.7
8mm bolt head/nut	1.25	7.2-11.6	1.0-1.6
10mm bolt head/nut	1.25	13.7-22.4	1.9-3.1
10mm bolt head/nut	1.5	13.0-21.7	1.8-3.0
12mm bolt head/nut	1.25 (ISO)	25.3-39.8	3.5-5.5
12mm bolt head/nut	1.5	25.3-39.8	3.5-5.5
12mm bolt head/nut	1.75	21.7-36.2	3.0-5.0
13mm bolt head/nut	1.5	32.5-50.6	4.5-7.0
14mm bolt head/nut	1.5	36.2-57.9	5.0-8.0
14mm bolt head/nut	2	34.0-55.7	4.7-7.7
16mm bolt head/nut	1.5	54.2-79.6	7.5-11.0
16mm bolt head/nut	2	51.4-76.7	7.1-10.6
Grade 6T			
6mm bolt head/nut	1	4.3-6.5	0.6-0.9
8mm bolt head/nut	1.25	10.8-15.9	1.5-2.2
10mm bolt head/nut	1.25	21.7-32.5	3.0-4.5
10mm bolt head/nut	1.5	19.5-30.4	2.7-4.2
12mm bolt head/nut	1.25 (ISO)	36.2-57.9	5.0-8.0
12mm bolt head/nut	1.5	36.2-50.6	5.0-7.0
12mm bolt head/nut	1.75	34.7-49.2	4.8-6.8

Grade 7T, 8T and 8.8	Pitch	lb-ft	kg-m
6mm bolt head/nut	1	5.8-8.7	0.8-1.2
8mm bolt head/nut	1.25	14.5-21.7	2.0-3.0
10mm bolt head/nut	1.25	28.9-39.8	4.0-5.5
10mm bolt head/nut	1.5	26.8-37.6	3.7-5.2
12mm bolt head/nut	1.25 (ISO)	54.2-75.9	7.5-10.5
12mm bolt head/nut	1.5	50.6-65.1	7.0-9.0
12mm bolt head/nut	1.75	43.4-61.5	6.0-8.5
13mm bolt head/nut	1.5	57.9-86.8	8.0-12.0
14mm bolt head/nut	1.5	72.3-108.5	10.0-15.0
14mm bolt head/nut	2	68.7-101.3	9.5-14.0
16mm bolt head/nut	1.5	108.5-166.4	15.0-23.0
16mm bolt head/nut	2	101.3-159.1	14.0-22.0
Grade 5 Cap Screw			
1/4 UNC		9-11	1.2-1.5
1/4 UNF		11-13	1.5-1.8
5/16 UNC		18-20	2.5-2.8
5/16 UNF		21-23	2.9-3.2
3/8 UNC		28-33	3.7-4.6
3/8 UNF		30-35	4.1-4.8
7/16 UNC		44-49	6.1-6.8
7/16 UNF		50-55	6.9-7.6
1/2 UNC		68-73	9.4-10.1
1/2 UNF		73-80	10.1-11.1

GENERAL SCREWS

BOLT DIA.	BOLT HEAD MARK		
	4	7	10
M6	0.3 – 0.5	0.8 – 1.0	1.0 – 1.3
M8	1.0 – 1.3	1.5 – 2.2	2.5 – 3.5
M10	1.8 – 2.5	3.0 – 4.2	5.0 – 7.0
M12	3.0 – 4.2	5.5 – 7.5	9.5 – 12.0
M14	5.0 – 7.0	8.0 – 11.0	16.0 – 19.0

SEALANTS

PARTS REQUIRING SEALANT	SURFACES REQUIRING SEALANT (where to mount sealant coated parts)	SEALANT
Taper screw 1/2 "	Thread portion (Gear case)	Liquid Teflon
Taper screw 1/4 "	Thread portion (Cylinder block right side, pump cover)	Liquid Teflon
Taper screw 1/8 "	Thread portion (Cylinder head rear surface)	Liquid Teflon
Water drain plug	Thread portion (Cylinder block right side, rear middle portion)	Liquid Teflon
Oil pressure switch	Thread portion (Cylinder block right side surface)	Liquid Teflon
Side seal	Periphery (Main bearing caps No. 1 and No. 5)	Permatex #6B
Bearing cap No. 1	Contact surface with cylinder block	Permatex #6B

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

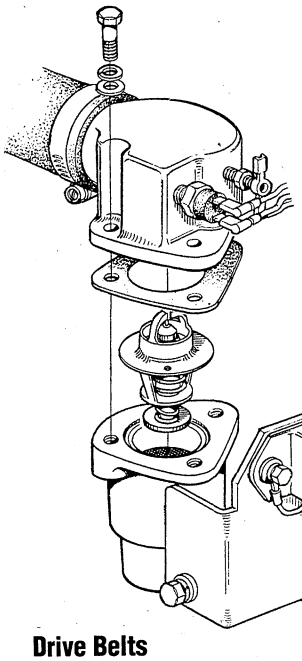
Degree Fahrenheit (°F) = (°C X 1.8) + 32
Degree Celsius (°C) = (°F - 32) x .56

LIQUID WEIGHTS

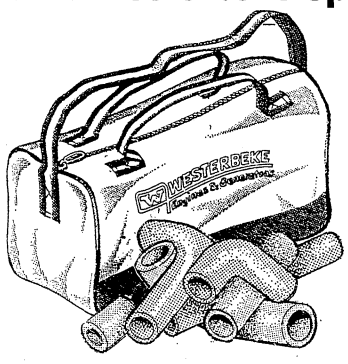
Diesel Oil = 1 US gallon = 7.13 lbs
Fresh Water = 1 US gallon = 8.33 lbs
Gasoline = 1 US gallon = 6.1 lbs
Salt Water = 1 US gallon = 8.56 lbs

SUGGESTED SPARE PARTS

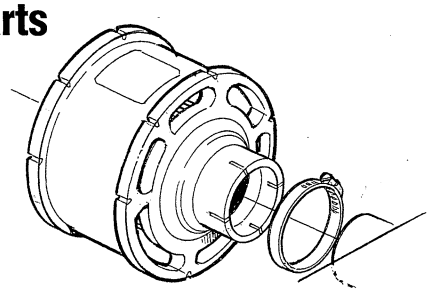
Carry Only Genuine Westerbeke Spare Parts



Thermostat and Gasket
Always carry a spare set.

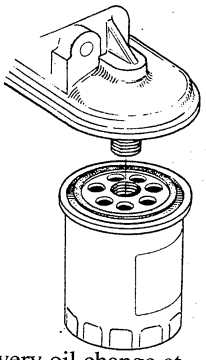


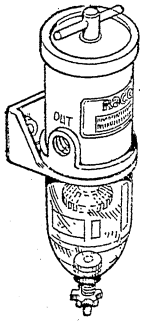
Molded Hose Kit
In a canvas carrying bag.



Air Intake Cleaner/Filter
Service every 100 operating hours.

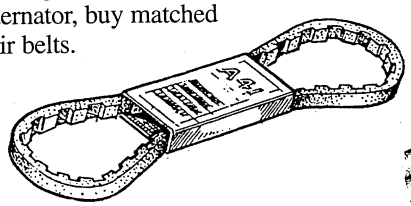
Fuel Lift Pump
Easy to replace in case of a failure.



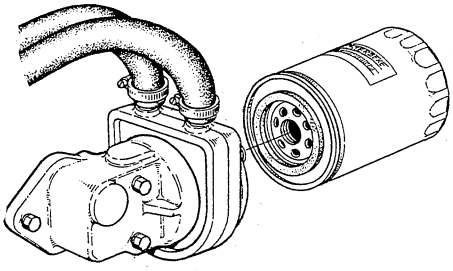


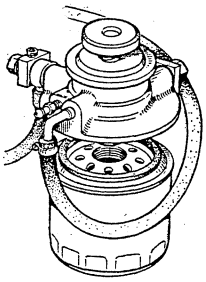
Fuel Line Filters
Owner Installed.

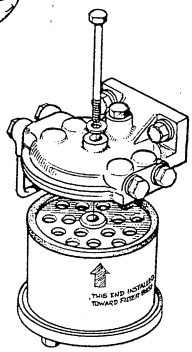
Drive Belts
Insect often, look for cracking and fraying.
If using a dual sheave alternator, buy matched pair belts.



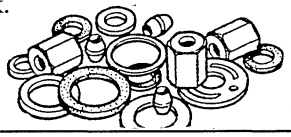
Oil Filters
Replace with every oil change at every 100 operating hours. Keep extras on-board.







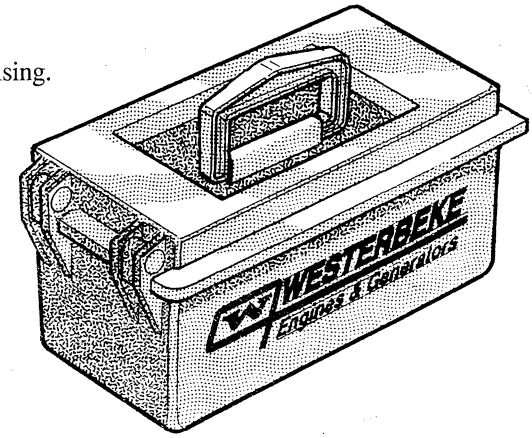
Fuel Hardware Kit
Fuel line banjo fittings, washers etc. to fix a leak.



Fuel Filters
Carry several on-board, use only genuine Westerbeke filters. Change every 250 operating hours.

SPARE PARTS KITS

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



Kit A

Impeller Kit
Fuel Filter with Gasket
Oil Filter
Drive Belt
Air Intake Cleaner/Filter

Kit B

Impeller Kit
Water Pump Repair Kit
Thermostat Kit
Complete Gasket Kit
Injector
Fuel Filter with Gasket
Oil Filter
Drive Belt
Air Intake Cleaner/Filter


WESTERBEKE
Engines & Generators