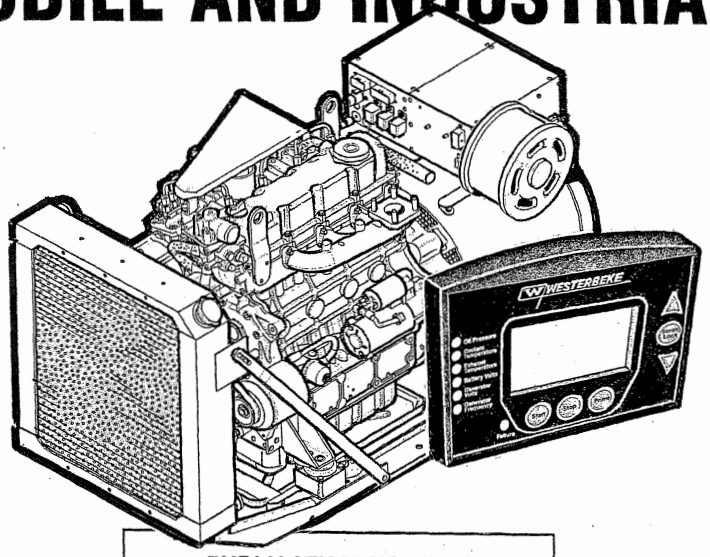
OPERATORS MANUAL
D-NET DIESEL GENERATORS

26.0 EDE(A)R - 60Hz 21.0 EDE(A)R - 50Hz
20.0 EDER - 60Hz 17.0 EDER - 50Hz
MOBILE AND INDUSTRIAL



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WESTERBEKE

WESTERBEKE CORPORATION • 150 JOHN HANCOCK ROAD
MYLES STANDISH INDUSTRIAL PARK • TAUNTON MA 02780
WEBSITE: WWW.WESTERBEKE.COM

⚠ 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.

CALIFORNIA PROPOSITION 65 WARNING

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

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, shut off the 20 amp DC circuit breaker on 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 and guards, 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 , piping an muffler.
- 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 install the exhaust outlet where exhaust can be drawn through cabin windows, 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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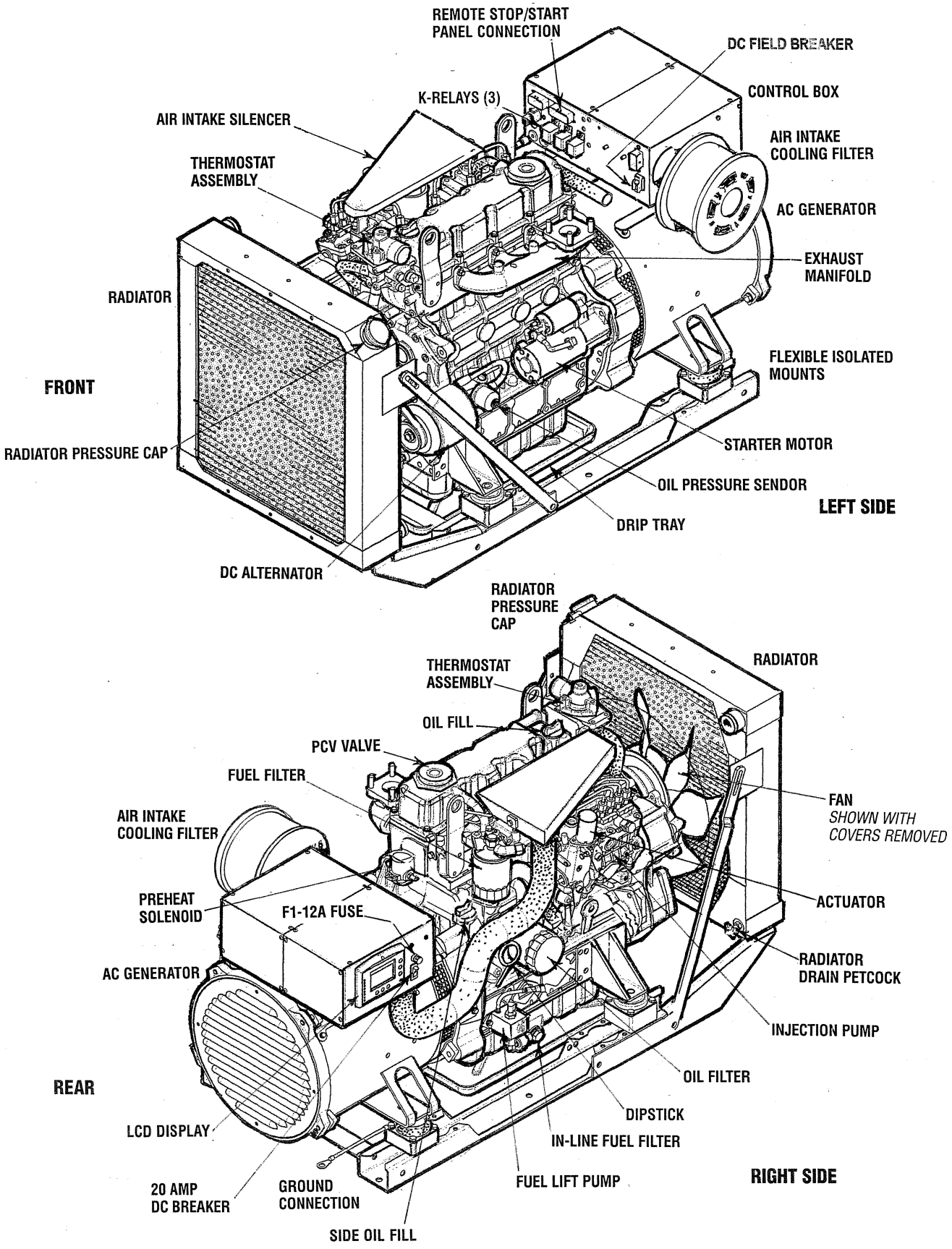
'IFICATION


REMOTE STOP/START PANEL CONNECTION
DC FIELD BREAKER
CONTROL BOX
K-RELAYS (3)
AIR INTAKE SILENCER
AIR INTAKE COOLING FILTER
THERMOSTAT ASSEMBLY
AC GENERATOR
EXHAUST MANIFOLD
RADIATOR
FLEXIBLE ISOLATED MOUNTS
FRONT
RADIATOR PRESSURE CAP
STARTER MOTOR
OIL PRESSURE SENDOR
LEFT SIDE
DRIP TRAY
DC ALTERNATOR
RADIATOR PRESSURE CAP
RADIATOR
THERMOSTAT ASSEMBLY
OIL FILL
PCV VALVE
FUEL FILTER
FAN
SHOWN WITH COVERS REMOVED
AIR INTAKE COOLING FILTER
PREHEAT SOLENOID
F1-12A FUSE
ACTUATOR
AC GENERATOR
RADIATOR DRAIN PETCOCK
INJECTION PUMP
REAR
OIL FILTER
DIPSTICK
LCD DISPLAY
IN-LINE FUEL FILTER
20 AMP DC BREAKER
GROUND CONNECTION
FUEL LIFT PUMP
RIGHT SIDE
SIDE OIL FILL

INTRODUCTION

This WESTERBEKE Engine 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 engine, it is important that you operate and maintain it correctly. This manual is designed to help you do this. Please read this manual carefully and observe all the safety precautions throughout. Should your engine require servicing, contact your nearest WESTERBEKE dealer for assistance.

This is your Operators Manual. A Service manual will also be available in pdf form on our website. Included with the unit is an Installation Manual to reference when installing the unit.

WESTERBEKE Engines & Generators

Customer Identification

WESTERBEKE OWNER

MAIN STREET

HOMETOWN, USA

Model _____ Ser. #_____

Expires _____

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.

PRODUCT SOFTWARE

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

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

NOTES, CAUTIONS AND WARNINGS

As this manual takes you through the operating procedures, maintenance schedules, and troubleshooting the generator/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.***

PROTECTING YOUR INVESTMENT

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

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

- Proper engine installation.
- An efficient well-designed exhaust system. To provide a quiet exhaust discharge and prevent the entry of rain water.
- Changing the engine oil and oil filter every 250 operating hours or at least once a year.
- Proper maintenance of all engine components according to the maintenance schedule in this manual.
- Use clean, properly filtered #2 Diesel fuel.
- Winterize your engine according to the lay-up and recommissioning section in this manual.

INTRODUCTION

SERIAL NUMBER LOCATION

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

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

An identification plate on the top of the engine air intake 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 types 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 done away with and in their place is a single component – the fuel injection pump – which performs the function of both.

ORDERING PARTS

Whenever replacement/service 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). Also 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 generator. Your local WESTERBEKE dealer will assist you in preparing an inventory of spare parts. See the *SPARE PARTS* page in this manual. For Engine and Generator Accessories, see the *ACCESSORIES* brochure.

INSTALLATION MANUAL

Publication #43400 provides detailed information for installing generators.

DIESEL FUEL, ENGINE OIL AND ENGINE COOLANT

DIESEL FUEL

Use a diesel fuel that meets the requirements of No. 2-D SAE J 313 and has a Cetane rating of #45 or higher grade of diesel fuel according to ASTM D975

Care Of The Fuel Supply

Use only clean diesel fuel! The clearance of the components in your engines fuel injection pump is very critical; invisible dirt particles which might pass through the primary and secondary filters can damage these finely machined 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 ensure 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. The use of additives to combat BACTERIAL growth in the fuel tank is recommended such as Bio-Bor and an additive such as *Diesel Kleen + Cetane Boost* to help restore lubricity back into the diesel fuel when an Ultra Low Sulfur diesel is being used.

Install and regularly service a good, visual-type fuel filter/water separator between the fuel tank and the engine. The Raycor 500 MA or 230 RMAM are good examples of such filters. A 10 micron filter element is recommended.

ENGINE OIL

Use a heavy duty diesel oil with an API classification of CF, CG-4, CH-4 or CI-4. Change the engine oil and filter after an initial 50 hours of break-in operation.Then follow the oil and filter change intervals as specified in the **MAINTENANCE SCHEDULE** in this manual. Westerbeke Corporation does not approve or disapprove the use of synthetic oils. If synthetic oils are used, engine break-in must be performed using conventional oil. Oil change intervals must be as listed in the **MAINTENANCE SCHEDULE** section of this manual and not be extended if synthetic oils are used.

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

SAE OIL VISCOSITY

For all temperature ranges: SAE 15W-40 or SAE 10W-40.

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, and lubricates and protects the cooling circuit from rust and corrosion. Look for a good quality antifreeze that contains Supplemental Cooling Additives (SCAs) that keep the antifreeze chemically balanced, crucial to long term protection.

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

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

PURCHASING ANTIFREEZE

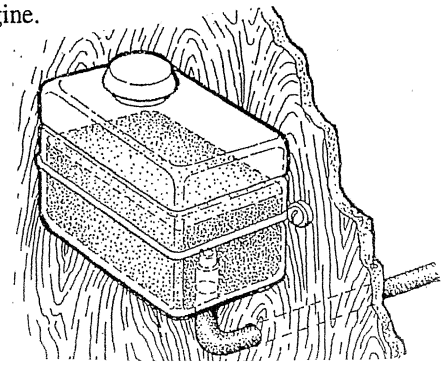
Select a brand of antifreeze specified for diesel engines. Antifreeze specified for diesel engines contains a special additive to protect against cavitation erosion of the engine's cylinder walls. Prestone and Zerex are two nationally known brands that offer antifreeze specifically for use in diesel engines. Select the pre-mixed variety so that the correct mixture will always be added to the cooling system when needed. Change the antifreeze mixture according to the MAINTENANCE SCHEDULE in this manual.

MAINTENANCE

Change the engine coolant every five years regardless of the number of operating hours as the chemical additives that protect and lubricate the engine have a limited life.

COOLANT RECOVERY TANK

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



NOTE: *This tank, with its short run of plastic hose, is best located at or above the level of the engine's manifold, but it can be located below the level of the engine's manifold if the particular installation makes this necessary.*

PREPARATIONS FOR INITIAL STARTUP

PRESTART INSPECTION

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 contaminant's.

☐ Check the DC electrical system. Inspect wire connections and battery cable connections.

☐ Check the coolant level in both the plastic recovery tank and the radiator.

NOTE: *After the initial running of the generator, the air in the engine's cooling system should be purged through the plastic coolant recovery tank. Allow the engine to cool and then carefully remove the pressure cap on the radiator. Ensure that the radiator is completely full of antifreze. If not, add mixture as needed to fill the radiator. Replace the pressure cap and then add antifreze mixture to the plastic coolant recovery tank to fill it to half way between "add" and "max".*

☐ Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, and check threaded connections. Search for any leaks.

☐ 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 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.

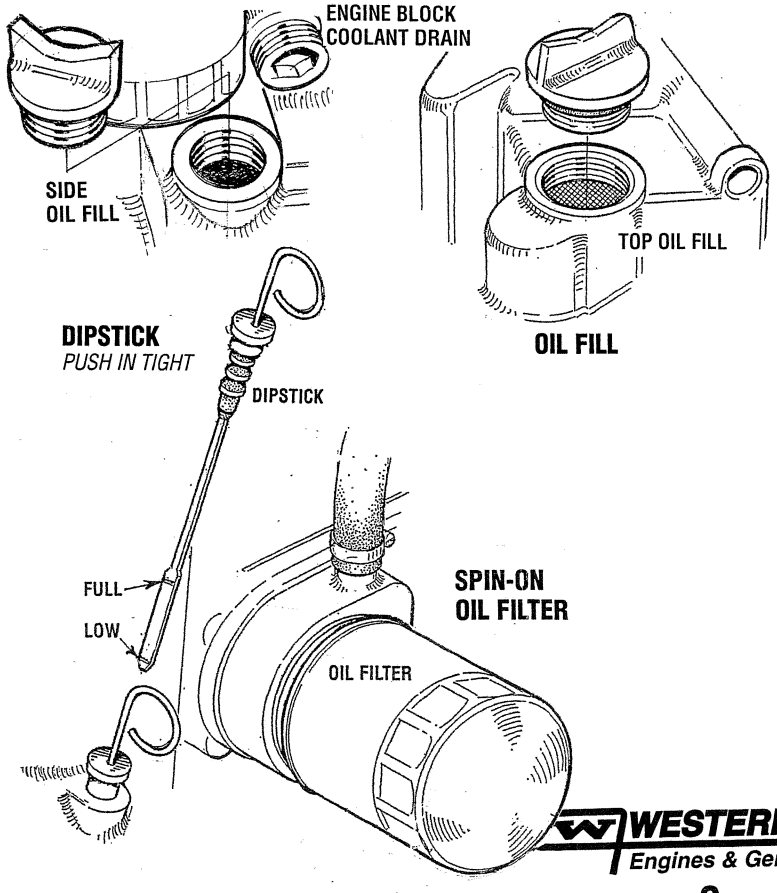
> ⚠ **CAUTION:** ***When starting the generator, it is recommended that all AC loads, especially large motors, be switched OFF until the engine has come up to speed and, in cold climates, starts to warm up. This precaution will prevent damage caused by unanticipated operation of the AC machinery and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

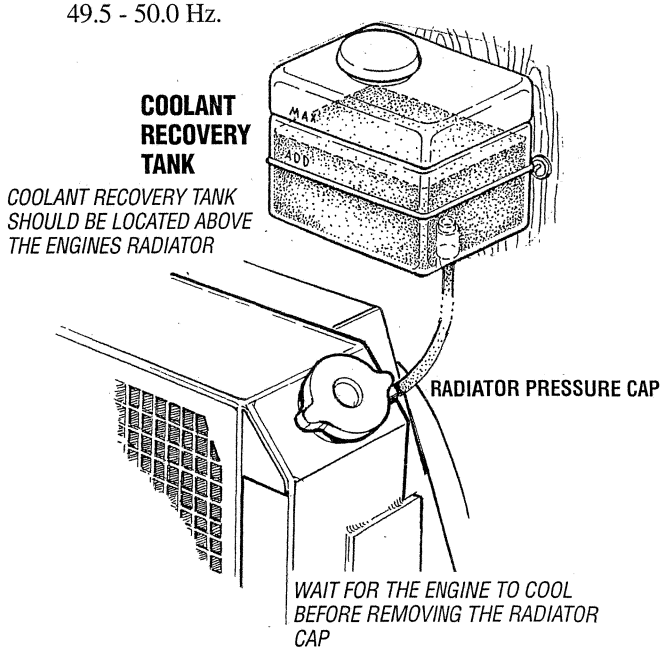
GENERATOR VOLTAGE

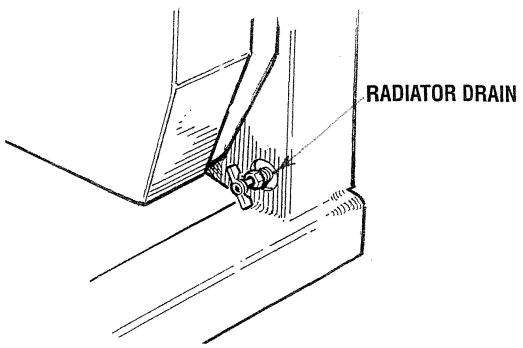
The speed of the generator engine is adjusted at the factory, however, it is advisable to verify.

60 Hz — The engine no-load speed is set at 61.0 - 60.5 Hz. At rated amperage, hertz output may decrease to 59.5 - 60.0 Hz.

50 Hz — The engine no-load speed is set at 50.0 - 50.3 Hz. At rated amperage, hertz output may decrease to 49.5 - 50.0 Hz.







DIGITAL CONTROL PANEL

DESCRIPTION

WESTERBEKE'E Digital Control Panel provides the operator with an LCD display that contunuously monitors all the operations of the generator in easy to understand text messages.

CONTROL BOX

Note that the design and size of the control box will vary depending on the model generator.

LCD DISPLAY

Operating temperatures may cause the LCD display to vary in color. This is normal and a change in color will not affect the operation on the control panel.

Periodically clean the control panel LCD screen using a soft cloth.

UP AND DOWN ARROWS
WHEN THE LCD DISPLAY IS IN ITS SCROLL MODE, THE UP AND DOWN ARROWS CAN BE USED TO ADJUST THE DARK AND LIGHT CONTRAST

UP-ARROW
*WHEN IN **SCROLL LOCK** MODE INDIVIDUAL FUNCTIONS CAN BE MONITORED BY PRESSING THE **UP-ARROW**.*

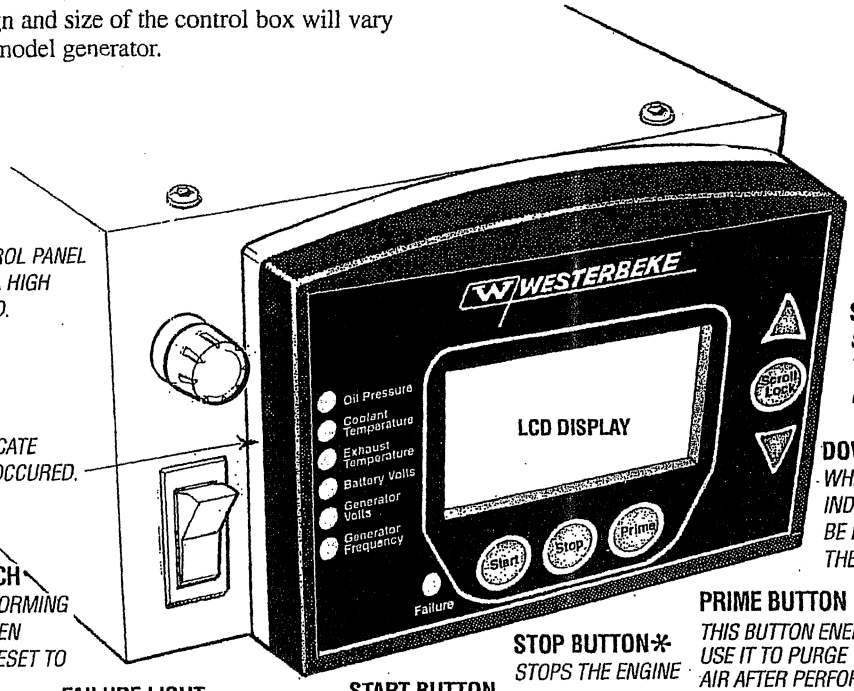
SCROLL LOCK
STOPS RUN SEQUENCE SO THAT A SINGLE FUNCTION CAN BE MONITORED

DOWN-ARROW
*WHEN IN **SCROLL LOCK** MODE INDIVIDUAL FUNCTIONS CAN BE MONITORED BY PRESSING THE **DOWN-ARROW**.*

12A FUSE
PROTECTS THE CONTROL PANEL ELECTRONICS FROM A HIGH AMPERAGE OVERLOAD.

INDICATOR LIGHTS
SIX LIGHTS THAT INDICATE WHERE A FAULT HAS OCCURED.

20A BREAKER SWITCH
SHUT-OFF WHEN PERFORMING MAINTENANCE OR WHEN REPAIRING A FAULT. RESET TO RESTART THE ENGINE.



FAILURE LIGHT
A RED LIGHT WILL APPEAR IF THE RUN SEQUENCE IS INTERUPTED BY A FAILURE.

START BUTTON
STARTS THE ENGINE

STOP BUTTON*
STOPS THE ENGINE

PRIME BUTTON
THIS BUTTON ENERGIZES THE FUEL PUMP. USE IT TO PURGE THE FUEL SYSTEM OF AIR AFTER PERFORMING REPAIRS TO THE ENGINE'S FUEL SYSTEM OR SERVICING THE ON ENGINE FULE FILTERS.

LCD DISPLAY SEQUENCE
IS SHOWN ON THE FOLLOWING PAGE

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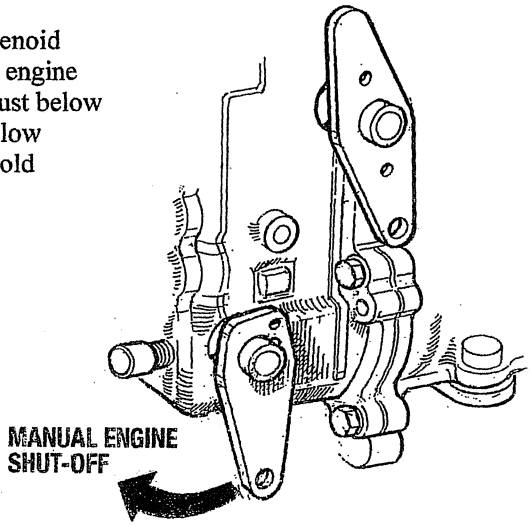
*MANUAL ENGINE SHUT-OFF

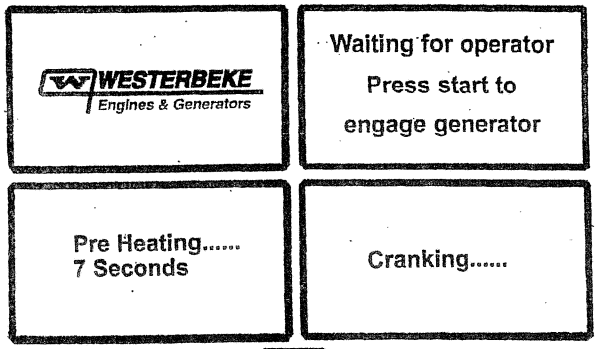
Should the engine faile to stop when the fuel shut off solenoid is de-energised when the STOP button is depressed. The engine is equiped with a manual shut-off lever. This is located just below the fixed throttle lever on the side of the engine block below the fuel injection pump. Move this lever to the left and hold it there until the engine comes to a stop. Then release.



DIGITAL CONTROL PANEL/LCD SEQUENCE

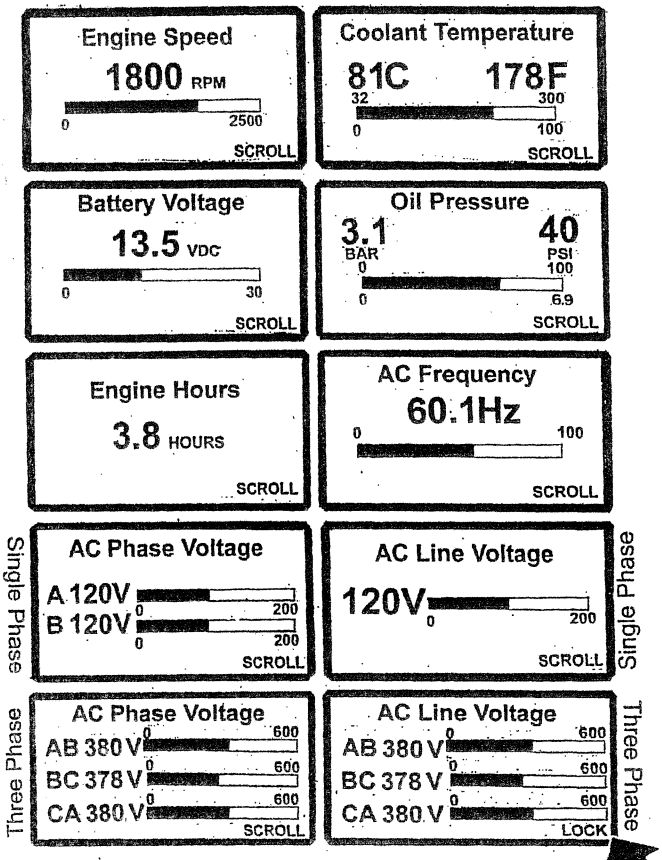
START SEQUENCE

With the pre-start inspection completed, press the START button and the automatic sequence will begin. The six indicator lights will illuminate green and the panel will display the following text:



RUN SEQUENCE

As the display cycles thru the engine functions, the speed will come up to 1800 rpms-60Hz (1500 rpms-50Hz) and the oil pressure and engine coolant will rise to their normal readings. The functions will cycle in the following sequemce:

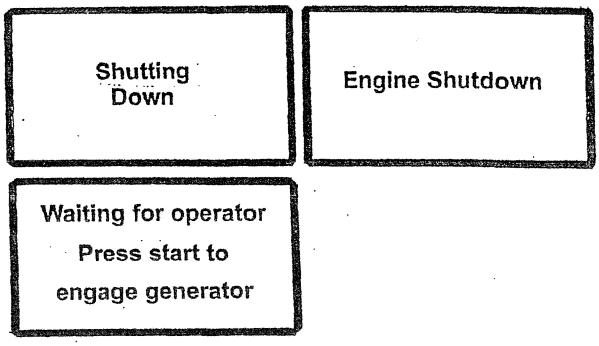


SCROLL LOCK

To stop the continuing sequence, press the SCROLL LOCK button. This enables the operator to monitor a single function for any length of time. The word LOCK will appear in the corner. Use the *up* and *down* arrows to find and observe other functions. To resume scrolling, press the SCROLL LOCK button again.

STOP SEQUENCE

To stop the generator, press the STOP button. The display will cycle thru the following text messages and shutdown.



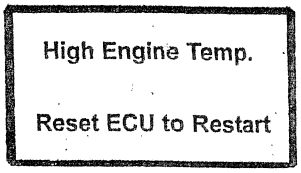
FAILURE LIGHT/SHUTDOWN

If a problem occurs, the generator will shutdown and the FAILURE light will illuminate red. In addition, one of the indicator lights will change from green to orange to reveal where the trouble has occured and the display will text message what has happened.

Examples:

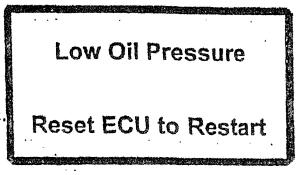
Failure Light is red.

Coolant Temperature Light is orange.



Failure Light is red.

Oil Pressure Light is orange.



When a failure occurs, refer to the troubleshooting chart, wiring diagram, and general operating text in this manual to assist in solving the trouble.

There are many combinations of messages that can be displayed but they are all self explanatory and the operator can easily isolate and correct the problem should one occur.

Before re-starting the generator, the 20 amp DC circuit breaker must be reset. With the problem corrected and the generator started, the sequences will begin cycling again.

NOTE: *Three phase voltages will vary depending on the AC output configuration of the generator.*

Control Box Components and Frequency Adjustments are on the following page.

DIGITAL CONTROL BOX

FREQUENCY FAULT

Frequency is displayed on the LCD display screen while the engine is running in RPM and frequency (hertz).

The ECU is receiving a low AC voltage signal and hertz signal from the MPU which is positioned on the bellhousing over the flywheel ring gear teeth. The ECU interprets this signal as both RPM and hertz.

Should this signal vary approximately 2% either up or down, a frequency fault shut down will occur, initiated by the ECU. The red failure LED on the display panel will illuminate, the frequency LED will turn from green to amber and the LCD display screen will show the fault text "overspeed".

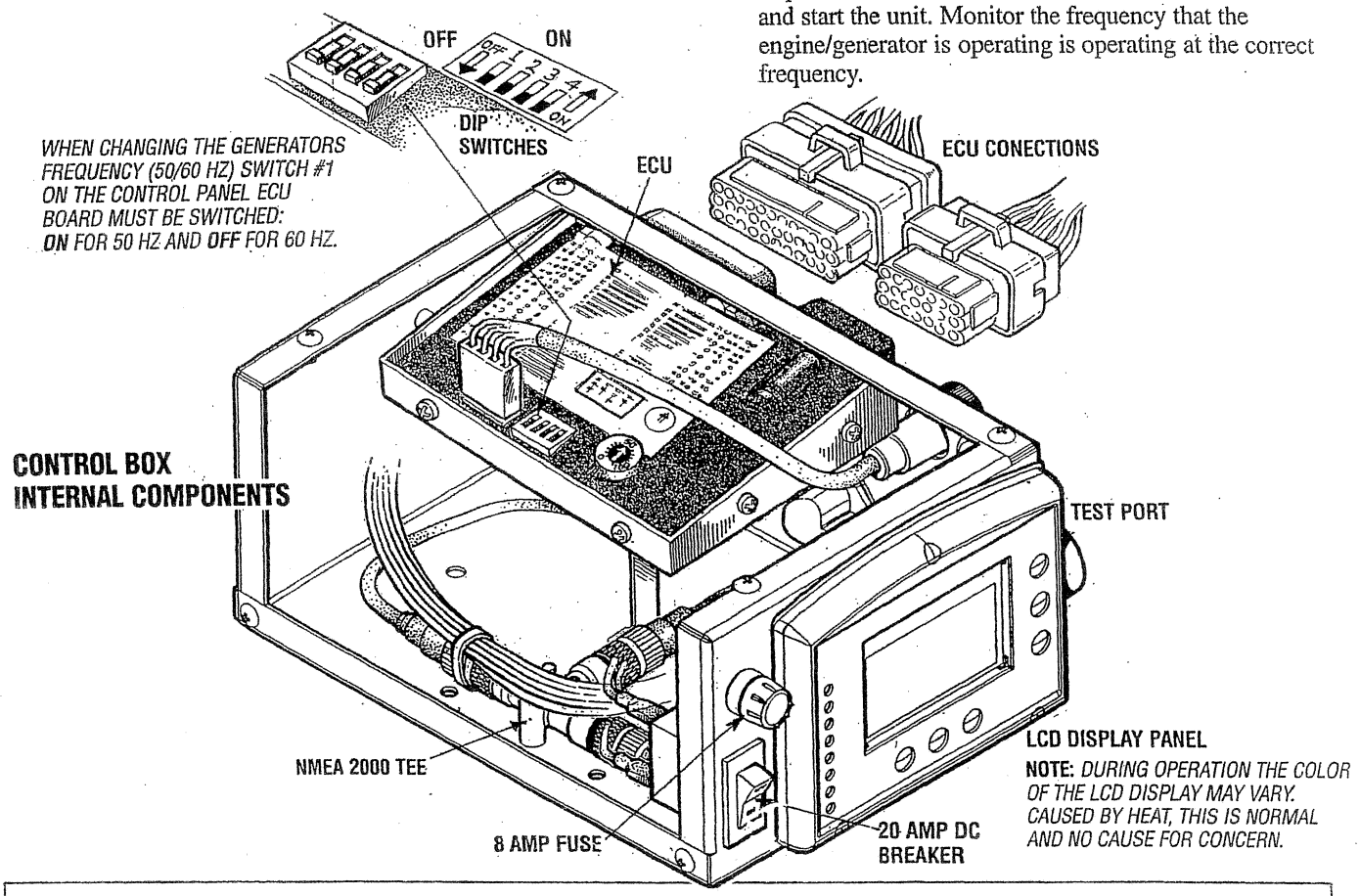
NOTE: *If the unit shuts down for an underspeed condition, the same fault "overspeed" will show on the screen but the frequency LED will BLINK.*

GENERATOR FREQUENCY ADJUSTMENT (HERTZ)

CAUTION: *When changing the generator frequency setting on the ECU, turn off the 20 amp DC circuit breaker on the control box. Turn it back on after the setting has been changed*

NOTE: *If the unit shuts down for an underspeed condition, the same fault "overspeed" will show on the screen but the frequency LED will BLINK.*

1. Turn the DC breaker on the control panel to the OFF position.
2. Open the cover of the control box and view the ECU (Electronic Control Unit).
3. Locate the #1 dipswitch on the ECU and move it to the position that corresponds to the Hertz operation desired). See the illustration below showing the ECU in the control box.
4. Replace the control box cover, turn the DC breaker ON and start the unit. Monitor the frequency that the engine/generator is operating is operating at the correct frequency.



CAUTION (WESTERLINK or NMEA-2000): *The electronic components in the Digital Diesels draw a very small amount of amperage (milli-amps) from the generator's starting battery when the unit is in a static state. This maybe as much as 50 milli-amps for the system ECU and 50 milli-amps for each display. This can be as much as 72 amp-hours in a months time with no generator use. It is not necessary to be concerned with this slight amperage draw during normal seasonal use. However, if the generator set is not to be used for a number of months, such as winter storage, it is best to disconnect the DC power to the generator with a NMEA-2000 system or shut off the DC breaker on the generator's control box for a WESTERLINK system.*

NOTE: *Keep in mind that the Westerbeke generator maybe the DC power supply for the vessel's NMEA-2000 network.*

GENERATOR BREAK-IN PROCEDURE

DESCRIPTION

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

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

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

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

AFTER START-UP

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

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

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

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

GENERATOR ADJUSTMENTS

Once the generator has been placed in operation, there maybe an adjustment needed for AC voltage output during or after the unit's break-in period (first 50 hours).
Refer to GENERATOR INFORMATION section and the voltage regulator adjustments.

THE DAILY ROUTINE

CHECK LIST

Follow this check list each day before starting your generator.

- Check that all generator circuit breakers (power panel) are in the off position before starting.
- Record the hourmeter reading in your log (engine hours relate to the maintenance schedule.)

  Any deficiency or problems in the following items must be corrected before start up.
- Visually inspect the engine for fuel, oil, or water leaks.
- Check the oil level (dipstick).
- Check the coolant level in the coolant recovery tank.
- Check your fuel supply.
- Check the starting batteries (weekly).
- Check drive belts for wear and proper tension (weekly).

CHECK WITH THE ENGINE RUNNING.

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

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

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

STOPPING THE GENERATOR

Remove the AC loads from the generator one at a time.Allow the generator to run for 3-5 minutes to stabilize the operating temperature, then momentarily depress the stop button and release. The generator will automatically shut down. Turn off the DC circuit breaker to prevent unintentional starts as a safety precaution.

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.***

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.
Engine Oil Level	☐								Oil level should indicate between MAX. and LOW on dipstick.
Coolant Level	☐								Check at recovery tank; if empty, check at manifold. Add coolant if needed.
Drive Belts	☐ weekly								Inspect for proper tension (3/8" to 1/2" deflection) and adjust if needed. Check belt edges for wear.
Visual Inspection of Engine	☐	**NOTE:** *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 (and House Batteries)	☐ weekly								Check electrolyte levels every 50 operating hours 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 **250** hours.
Generator		☐	☐	☐	☐	☐	☐	☐	Check that AC connections are clean and secure with no chafing. See *GENERATOR SECTION* for additional information.
Exhaust System		☐		☐		☐		☐	Initial check at 50 hrs., then every 250 hrs. Inspect for leaks and that all connections are tight and the system supports are in good condition as well as the muffler.
Engine Hoses			☐	☐	☐	☐	☐	☐	Hose should be hard & tight. Replace if soft or spongy. Check and tighten all hose clamps.
Inlet Fuel Filter			☐	☐	☐	☐	☐	☐	Replace.
Fuel/Water Separator	☐		☐	☐	☐	☐	☐	☐	Check daily for contaminates. Change every 200 hours or as needed.

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

MAINTENANCE SCHEDULE

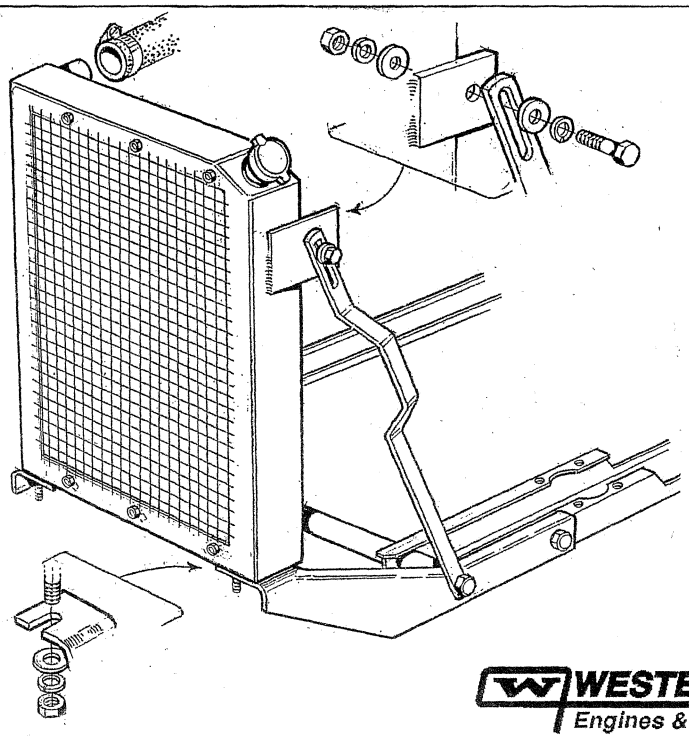
NOTE: *Use the generator hourmeter to log your engine hours or record your engine hours by running time.*

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							MAINTENANCE DESCRIPTION
		50	100	250	500	750	1000	1250	
Coolant System					☐		☐		Drain, flush, and refill cooling system with appropriate antifreeze mix.
Electric Fuel Lift Pump		☐		☐	☐	☐	☐	☐	Periodically check the wiring connections and inspect the fuel line 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 (0.4 - 0.6 ohms) Reinstall with anti-seize compound on threads.
Radiator							☐		Remove, have professionally cleaned and pressure tested.
Belts					☐				Replace DC alternator/fan belt. Tension properly.
Adjust Valves		☐			☐		☐		Adjust valve clearances.
Air Filter			☐	☐	☐	☐	☐		Remove, clean and inspect every 100 hours. Replace as needed.

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

CAUTION (WESTERLINK or NMEA-2000): *The electronic components in the Digital Diesels draw a very small amount of amperage (milli-amps) from the generator's starting battery when the unit is in a static state. This maybe as much as 50 milli-amps for the system ECU and 50 milli-amps for each display. This can be as much as 72 amp-hours in a months time with no generator use. It is not necessary to be concerned with this slight amperage draw during normal seasonal use. However, if the generator set is not to be used for a number of months, such as winter storage, it is best to di . nnect the DC power to the generator with a NMEA-2000 system or shut off the DC breaker on the generator's control box for a WESTERLINK system.*

NOTE: *Keep in mind that the Westerbeke generator maybe the DC power supply for the vessel's NMEA-2000 network.*



RADIATOR
DISASSEMBLY/ASSEMBLY

1. Remove the pressure cap from the radiator and drain the antifreeze coolant into a container using the drain petcock found on the base of the radiator.
2. Disconnect the upper and lower radiator hoses from the radiator and the engine.
3. Unbolt the right and left support straps from the side of the radiator.
4. Unbolt the radiator from the mount supports and slide the radiator off the mount supports.
5. Have the radiator professionally cleaned and serviced as needed.

Assemble the radiator back onto the mount supports in reverse order. Fill the cooling system with a 50/50 mix of antifreeze and distilled water. Operate the unit and check for leaks, top off the radiator with an antifreeze mix.

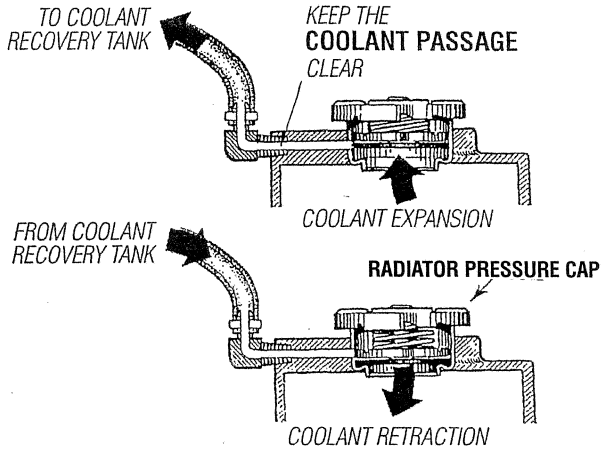
COOLING SYSTEM

FRESH WATER COOLING CIRCUIT

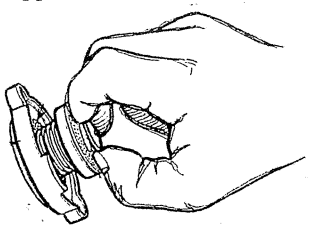
NOTE: *Refer to the ENGINE COOLANT section for the recommended antifreeze and water mixture to be used as the fresh water coolant.*

Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the radiator, where it is cooled and returned to the engine block via the suction side of the circulating pump.

When the engine is started cold, external coolant flow is prevented by the closed thermostat (although some coolant flow is bypassed around the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens, allowing full flow of the engine's coolant to flow unrestricted to the external portion of the cooling system.



NOTE: *Periodically check the condition of the radiator coolant pressure cap. Ensure the upper and lower rubber seals are in good condition. Check to ensure the vacuum valve opens and closes tightly. Carry a spare cap. Check also to ensure the coolant passage is clear so coolant within the system is able to expand and contract to and from the coolant recovery tank.*



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

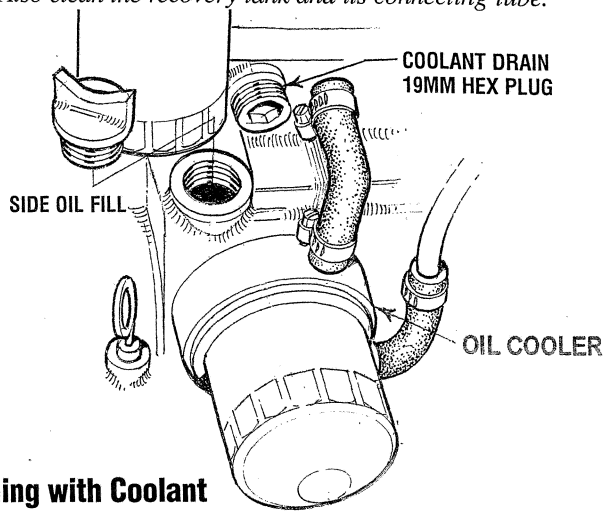
Coolant Recovery Tank

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

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. Drain the engine coolant thru the engine drain and the radiator petcock. Flush the system with fresh water, the start the refill process.

NOTE: *Also clean the recovery tank and its connecting tube.*



Refilling with Coolant

After closing the engine block drain and radiator petcock, pour clean, premixed coolant (see page 4) into the radiator. Start the engine and run. Open the air bleed petcock on the thermostat housing. Monitor the coolant in the radiator and fill the radiator to the filler neck.

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

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

⚠ CAUTION: ***Do not remove the radiator cap while the engine is running or immediately after stopping as hot water will spout from the radiator. Wear gloves!***

NOTES:

- Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, wash it off immediately.
- DO NOT mix different types of anti-freeze. The mixture can produce a chemical reaction causing harmful substances.
- Be careful of the environment and ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.

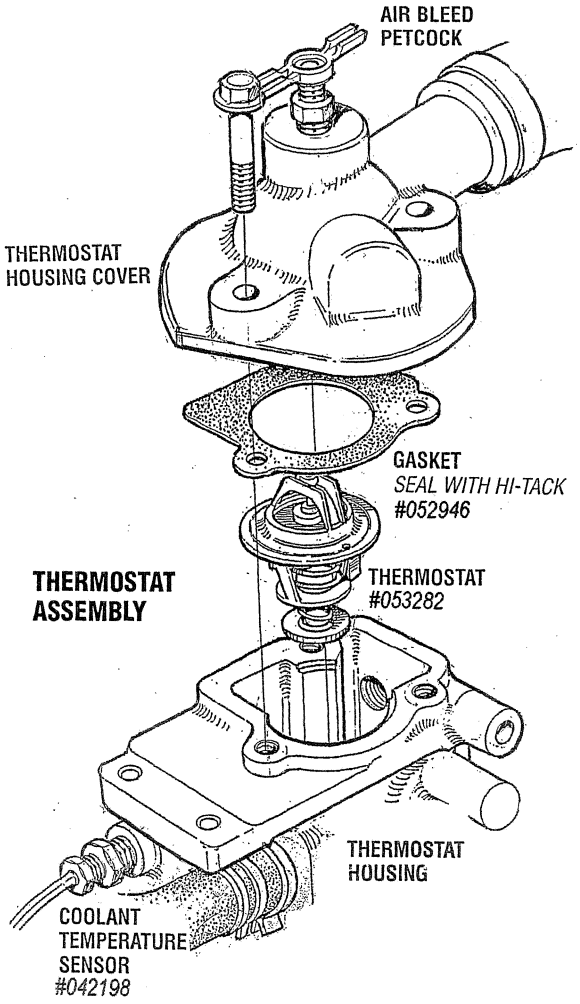
THERMOSTAT

A thermostat, located at the top front of the engine, controls the coolant operating temperature of the engine. When the engine is first started, the closed thermostat prevents coolant flow to the radiator and back into the engine. A by-pass hose is located below the thermostat. This by-pass hose allows coolant to circulate through the engine for proper cooling during warm up until the thermostat opens and closes off this by-pass and allows the coolant to flow through the radiator.The thermostat is accessible and can be checked, cleaned, or replaced easily.

REPLACING THE THERMOSTAT

1. **Drain off some coolant.** Release the coolant pressure cap and drain the coolant to the approximate level of the thermostat housing. This can be done using the radiator drain petcock.

> ⚠ **CAUTION:** ***The engine must be allowed to cool down before attempting these procedures. Not only is the surface of the engine hot but coolant temperatures can be at 190° F.***

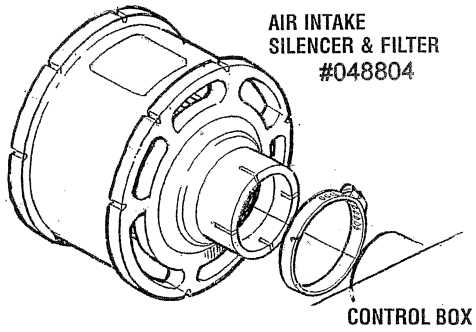


2. **Remove the thermostat housing cover.** Remove the hose clamp and twist the hose off the connection of the housing. Remove the three bolts holding the housing to the thermostat base. Lift the housing off the base. This will give you access to the housing gasket and thermostat.

3. **Replacing the thermostat.** Inspect the thermostat. If you suspect a faulty thermostat, suspend it in a container of water with a thermostat adjacent to the thermostat. Heat the water observing the thermometer. As the temperature of the water approaches 180°F, the thermostat should start to open and be fully open at 180°F. If faulty, replace with a new one and ensure the air bleed hole is open and unobstructed..

4. **Re-assemble and test.** Place the thermostat housing on a base and secure it with the three bolts. Attach the coolant hose and secure it with the clamp. Refill the radiator with the coolant drained. Operate the unit and check for leaks. Top off the radiator and re-install the pressure cap. Fill the coolant recovery tank 1/4 - 1/2 full.

   Install the cover and tighten the three bolts (do not over tighten). Top off the coolant and run the engine. Check for normal temperature and for leaks around the thermostat assembly.



AIR FILTER

The air filter assures that the cooling air is free from dust and dirt. The filter should be cleaned every 100 operating hours. Remove the filter and tap the cartridge on a flat surface or clean with compressed air. If contaminated or oily, replace it.

RADIATOR MAINTENANCE

The outside core of the radiator must be kept clean. Use running water or compressed air to clean off the fins and tube.

The radiator is solidly constructed so there is little possibility of a leak occurring. Should a leak develop, use a radiator sealant to make the repair.

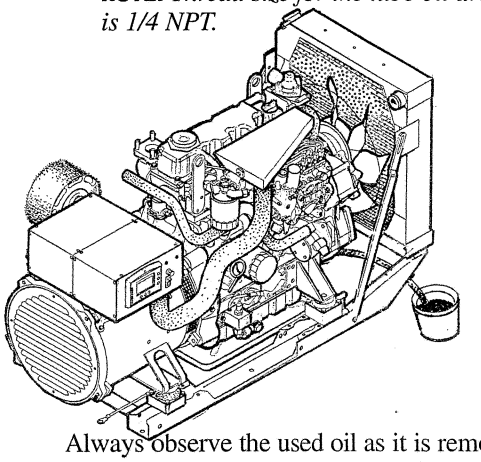
Radiator hoses tend to scale up forming blockage. They should be inspected every six months. Look for hardened, swollen, or spongy hoses as these must be replaced. Replace hoses every two years in any case.

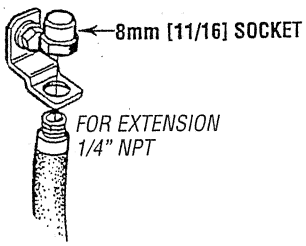
ENGINE LUBRICATING OIL

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.*





REMOVE USING AN 8MM (11/16") SOCKET TO DRAIN THE OIL OR PUMP THE WARMED OIL UP THRU THE HOSE.

Always observe the used oil as it is removed. A yellow/gray emulsion indicates the presence of water in the oil. Although this condition is rare, it does require prompt attention to prevent serious damage. Call a qualified mechanic should water be present in the oil.

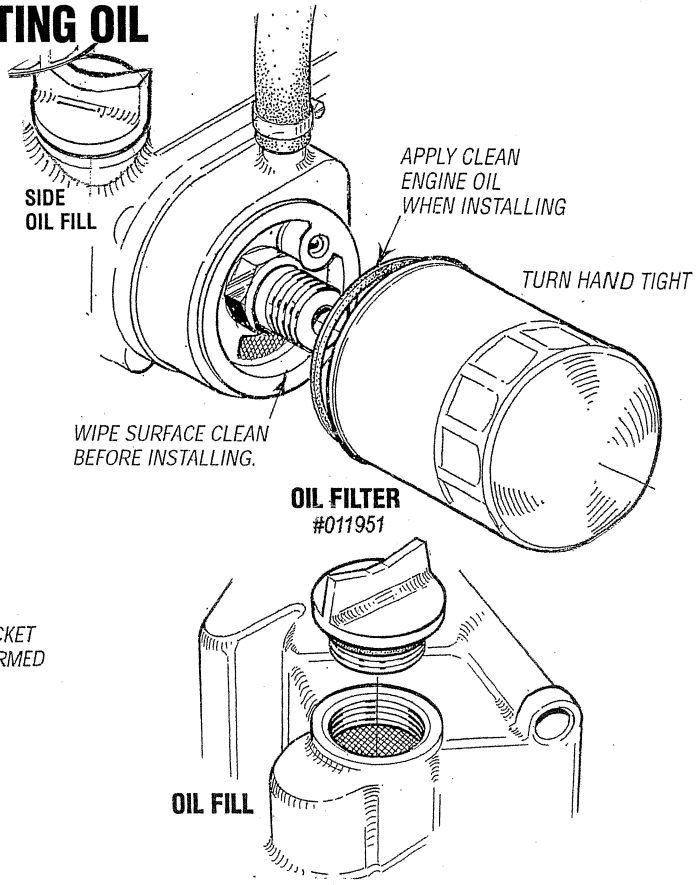
2. ***Replacing the Oil Filter.*** When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small automotive filter wrench should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

   NOTE: *The engine oil is cooled by engine coolant flowing through passages in the oil filter housing assembly.*



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

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

> ⚠ **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.***

- DO NOT pour waste onto the ground, down a drain, or into any water resource. Dispose of waste fluids according to environmental regulations.

REMOTE OIL FILTER (OPTIONAL)

#054372

INSTALLATION

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

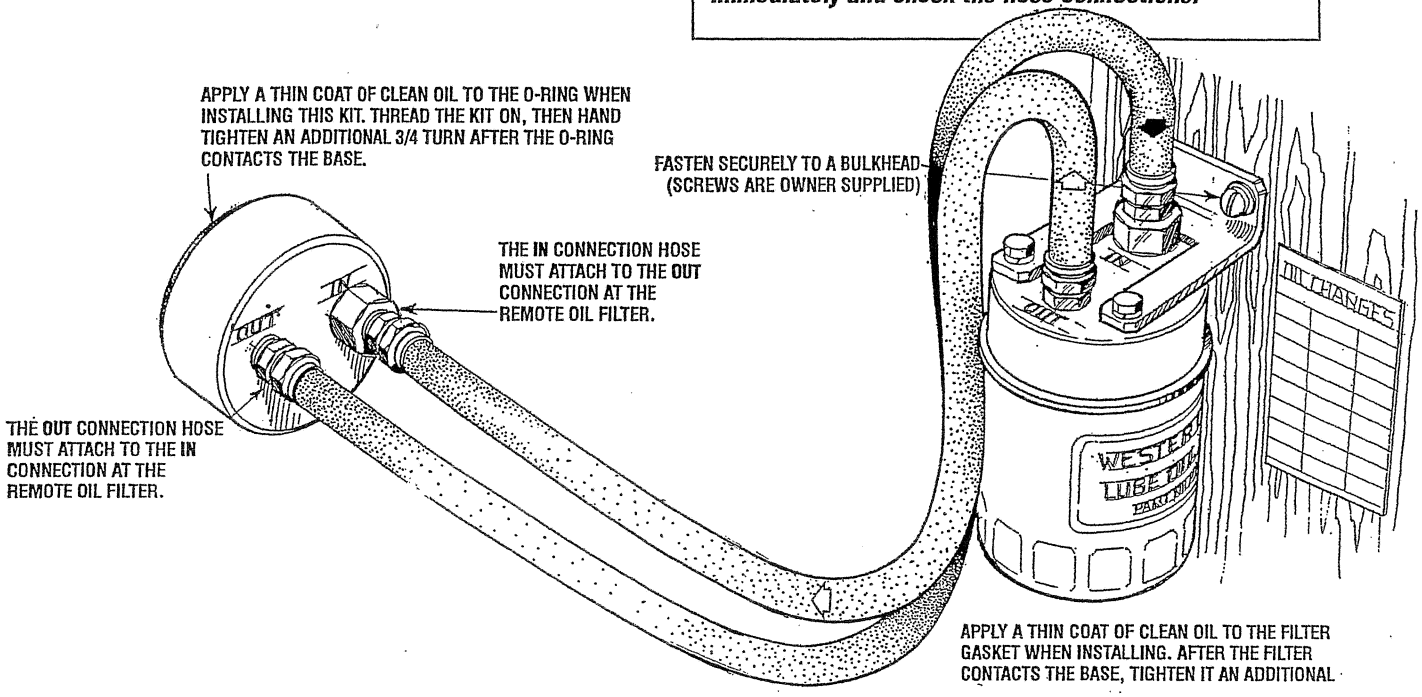
NOTE: *Refer to ENGINE OIL CHANGE in this manual for instructions on removing the oil filter.*

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

Contact your WESTERBEKE dealer for more information.

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

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



FUEL SYSTEM

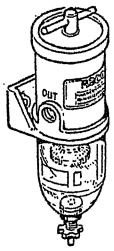
DIESEL FUEL

Use a No.2 Diesel fuel with a Cetane rating of 45 or higher. In conjunction with Ultra Low Sulfur Diesel. Use an additive such as "Diesel Kleen + Cetane Boost" to help restore lubricity back into the diesel.

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 contaminant's from the fuel before they can be carried to the fuel system on the engine.

A typical fuel filter/water separator is illustrated in this diagram. This is the Racor 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.



TYPICAL FUEL FILTER/WATER SEPARATOR

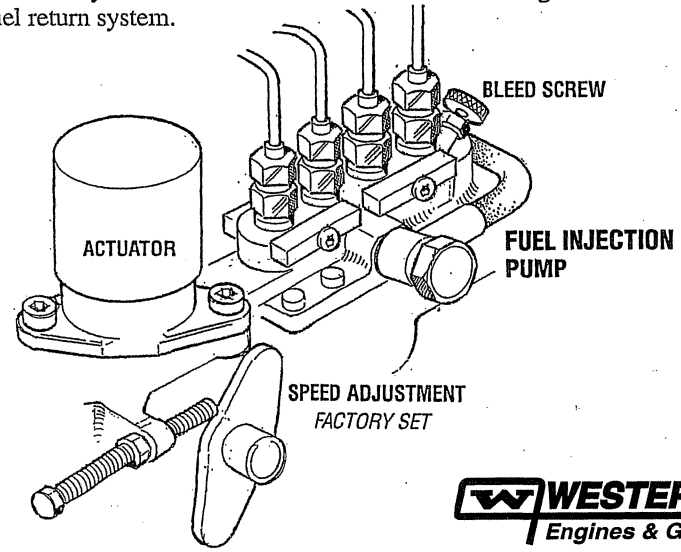
10 micron filter element recommended.

FUEL INJECTION PUMP

The fuel injection pump is the most important component of the diesel engine, requiring the utmost caution in handling. The fuel injection pump has been thoroughly bench-tested and the owner-operator is cautioned not to attempt to service it. If it requires servicing, remove it and take it to an authorized fuel injection pump service facility. Do not attempt to disassemble and repair it. Do not send the timing shims with the injection pump, leave on engine.

BLEED SCREW

The bleed screw on the injection pump should be left in the open position. This will then allow for ease in priming the engine's fuel system and during engine operation allow for air in the system to be delivered to the fuel tank through the fuel return system.



ENGINE FUEL FILTER

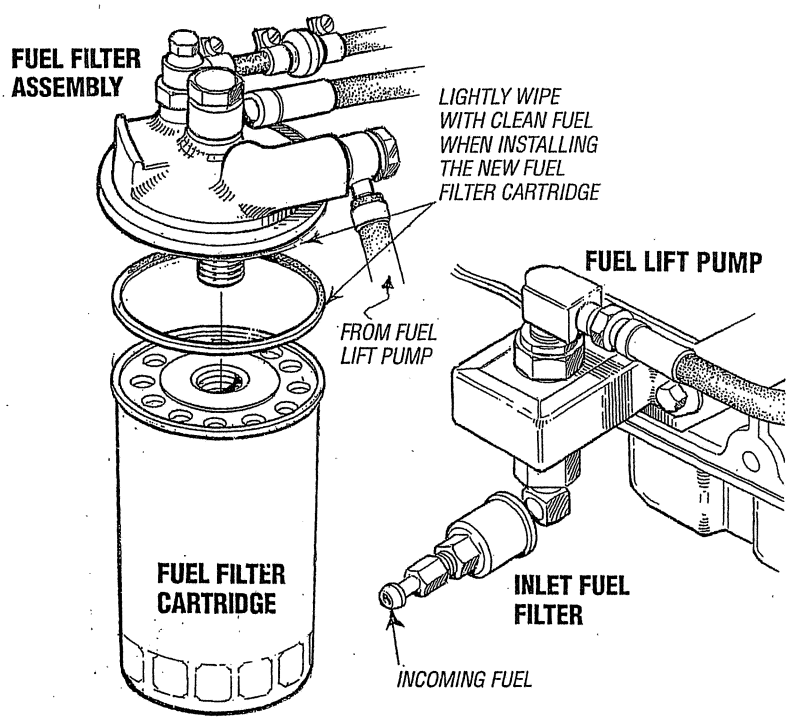
Periodically check the fuel connections and the filter bowl for leakage. Change the filter element after the first 50 hours. See the *MAINTENANCE SCHEDULE.*

Changing the Filter Cartridge

1. Shut off the fuel supply.

   NOTE: *Slide a plastic bag up over the fuel filter cartridge as it will be full of fuel.*

2. Unscrew the cartridge from its housing and remove the cartridge and its gasket.
3. Wipe both the housing and the top of the new cartridge with clean fuel.
4. To help reduce fuel system priming, fill the fuel filter with diesel before installing. This will dramatically reduce the priming time needed to purge air from the engines fuel system before starting.
5. Install the new cartridge and spin on real tight by hand.
6. Open the fuel supply. Run the engine to inspect for leaks.



FUEL LIFT PUMP

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

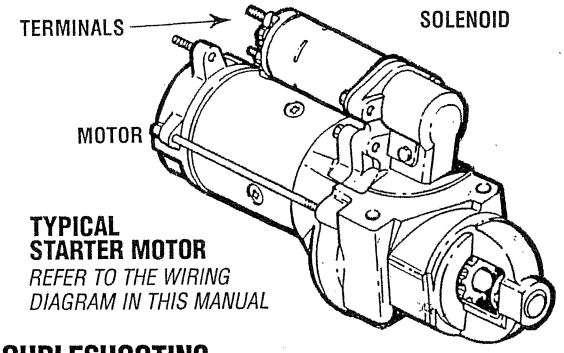
INLET FUEL FILTER

To ensure clean fuel into the fuel lift pump, there is a small in-line fuel filter connected to the fuel lift pump elbow. This filter should be replaced every 250 hours of operation.

STARTER MOTOR

DESCRIPTION

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



TYPICAL STARTER MOTOR
REFER TO THE WIRING DIAGRAM IN THIS MANUAL

TROUBLESHOOTING

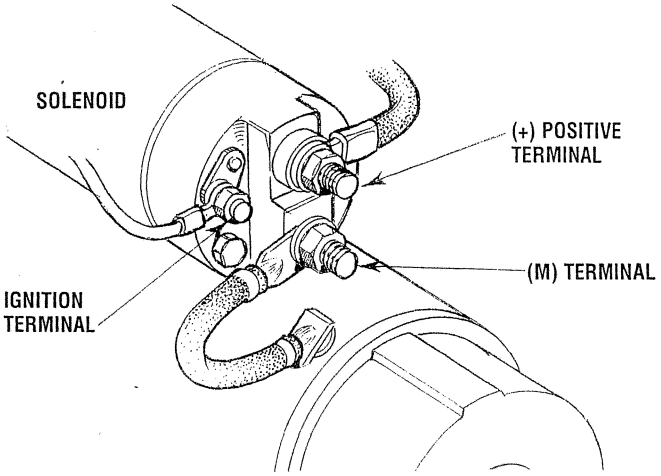
> ⚠ **WARNING:** ***The following emergency starting procedures must not be used with gasoline engines. Sparks could cause an explosion and fire.***

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).

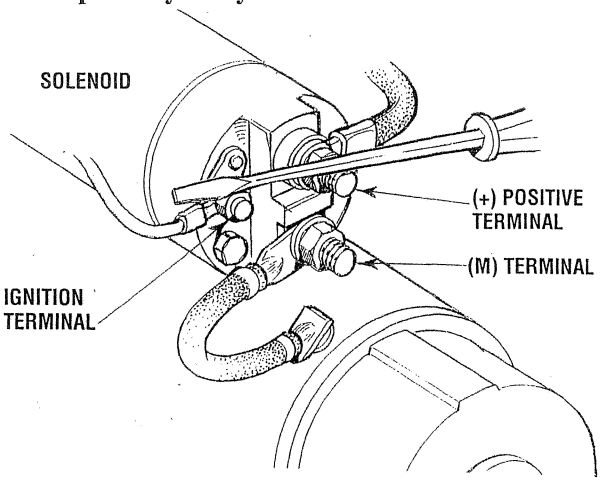
If you read 12 volts, the starter is faulty.



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 happens, the starter motor is probably faulty.

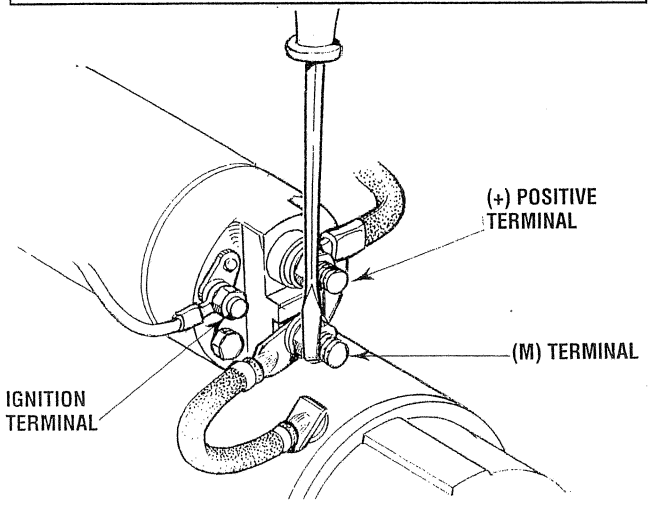


If nothing happens at all, the solenoid is not getting current.. Check the battery isolation switch and inspect the wiring connections. it is also possible that the solenoid is defective.

> ⚠ **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, and that there are NO flammable solvents or materials stored nearby.***

STARTER MOTOR

> ⚠ **WARNING:** ***When performing these procedures, position yourself safely away from the moving parts of the engine in case the engine starts-up. Also warn other crew members of the danger.***



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.

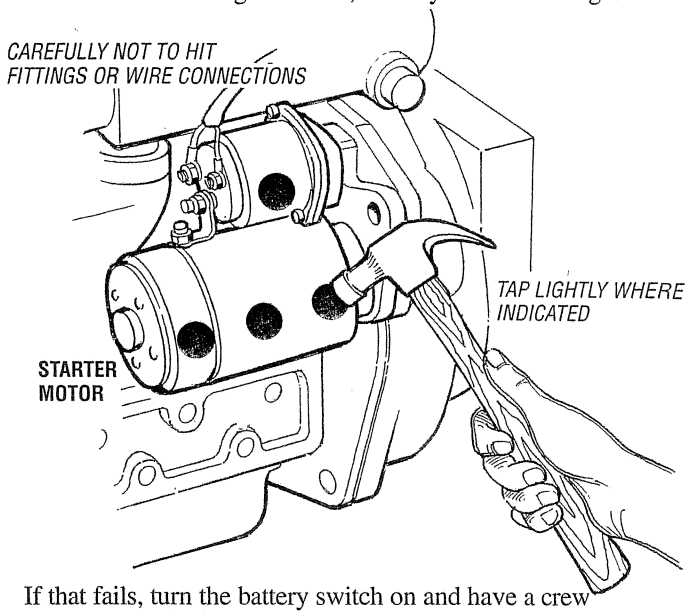
NOTE: *Starter motors are either inertia type or pre-engaged. In the pre-engaged model, the solenoid also moves an arm that engages the starter motor to the flywheel of the engine. using a screwdriver to bypass the solenoid on such a starter will run the motor without engaging the flywheel. Turn the starter switch on to provide 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.*

EMERGENCY START

Corrosion to the starter brushes and/or the solenoid contacts can cause the sporadic problem of the engine starting one time but not another. If corrosion is the problem, the starter will need to be rebuilt.

It is however, sometimes possible to get started by taping the starter lightly with a small hammer.

With the battery switch off and no ignition,. tap lightly on the starter/solenoid casing as shown, then try to start the engine.



If that fails, turn the battery switch on and have a crew member turn the ignition on and off rapidly as you tap again with the hammer., This may loosen the brushes and allow contact to start the engine. When you reach a repair facility, the starter will need to be repaired.

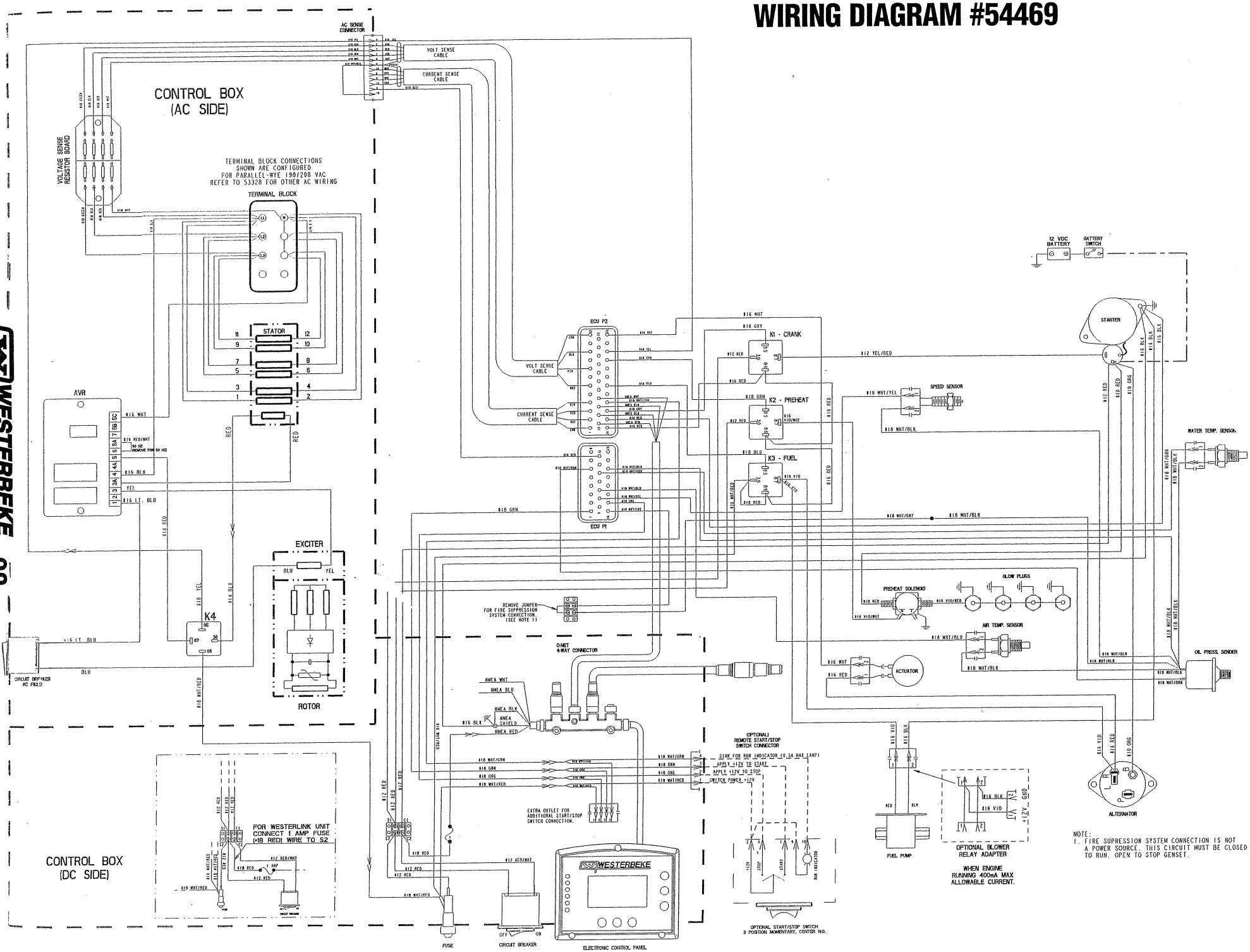
SERVICE

WESTERBEKE uses a standard 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.

WIRING DIAGRAM #54469



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.*

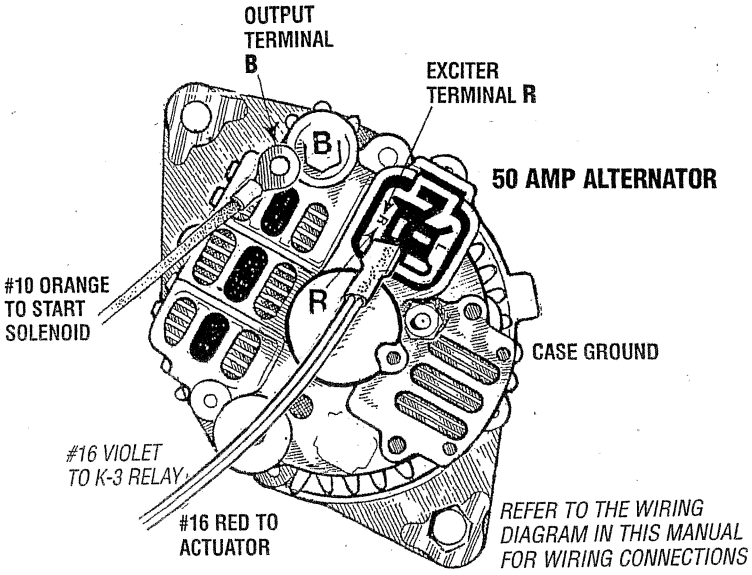
Problem	Probable Cause	Verification/Remedy
START SWITCH DEPRESSED no panel indications.	**1.** Battery Switch not on.	**1.** Check switch and/or battery connections.
	2. Circuit breaker tripped/off.	**2.** Reset breaker; if breaker trips again, check preheat solenoid circuit and check circuit for shorts to ground.
	3. Loose battery connections.	**3.** 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 solenoid.	**2.** Check that 12 volts are present at the solenoid connection.
	3. Loose battery connections.	**3.** Check battery connections.
	4. Low battery.	**4.** Check battery charge state.
	5. K1 relay.	**5.** Check K1 relay.
START BUTTON 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.** Check fuel lift pump. **1b.** Change inlet fuel filter.
	2. Preheat solenoid faulty.	**2.** Check solenoid.
Battery runs down.	**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.
Exhaust smoking problems	**1.** Blue smoke.	**1.** Incorrect grade of engine oil. **1a.** Crankcase is overfilled with engine oil (oil is blowing out through the exhaust).
	2. White smoke.	**2.** Engine is running cold. **2a.** Faulty injector or incorrect injector timing.
	3. Black smoke.	**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. Check for proper ventilation. **3d.** Overload.

(CONT.)

ENGINE TROUBLESHOOTING
LCD DISPLAY FAULTS

PROBLEM	PROBABLE CAUSE	VERIFICATION/REMEDY
LCD DISPLAY DOES NOT ILLUMINATE	1. Check battery. 2. 20 amp breaker off. 3. Loose display connection. 4. 1 amp fuse blown (faulty).	1. Battery on. 2. Turn breaker on. 3. Check all cable connections. 4. Check/replace. Determine cause
LOW OIL PRESSURE	1. Oil level low/oil leak. 2. Lack of oil pressure 3. Ground connection. 4. Faulty control module (ECU). 5. Faulty oil pressure sensor.	1. Check oil level, add oil and repair leaks. 2. Test oil pressure. If OK, test oil pressure sendor, inspect oil filter, inspect oil pump. 3. Check ground connection. 4. Inspect all the plug connections/replace. 5. Check sensor/replace.
HIGH COOLANT TEMPERATURE	1. Check system coolant level. 2. Check water pump drive belt. 3. Faulty temperature sensor. 4. Ground connection. 5. Faulty control module (ECU).	1. Add coolant. Check for leaks. 2. Adjust belt tension, replace belt. 3. Check sensor/replace. 4. Check ground circuit. 5. Check plug connections/replace.
HIGH EXHAUST TEMPERATURE	1. Faulty exhaust temperature switch. 2. Ground Connection. 3. Faulty control module (ECU). 4. Faulty fire suppression system.	1. Test/replace. 2. Check ground circuit. 3. Check plug connections. 4. By-pass system/check.
BATTERY VOLTAGE	1. Check alternator drive belt. 2. Check charge voltage. 3. Check battery connections. 4. Faulty control module (ECU).	1. Adjust tension/replace if worn. 2. Check excitation. Replace/repair alternator 3. Check + and - cables from battery to engine. 4. Check plug connections/replace.
GENERATOR FREQUENCY Overspeed (steady LED) Underspeed (flashing LED)	1. Check engine speed. 2. Check fuel supply. 3. Amperage load. 4. Crank cycle with no start. (underspeed fault)	1. Check speed setting. 2. Inspect filters/replace filters. Test fuel pump operation. 3. Check + and - cables from battery to engine. 4. Check cause for no start.
LED DISPLAY EDGES TURN PINK	1. Compartment ambient temperature too high.	1. Ventilate compartment. **Note:** *Heat will often change the color of an LCD display. This will not effect the operation of the engine.*
WAITING FOR ECU	1. ECU and LCD display not compatible. 2. Loose cable connection. 3. Panel DC breaker OFF. 4. Blown 8 amp fuse. 5. Terminating Resistors. 6. Battery Voltage to ECU.	1. Check compatibility with Westerlink or NMEA. 2. Check all cable connections. 3. Turn ON, check DC voltage across breaker. 4. Check/replace fuse. Check DC voltage across fuseholder 5. Check all terminating resistors are in place. 120 ohm per resister measured across pin #4 and #5. 6. Check between pins P2-24 and P2-25. P2 ECU plug unplugged from ECU. Power turned ON. If voltage is present, ECU is faulty.

ALTERNATORS TESTING/TROUBLESHOOTING



DESCRIPTION

The following information applies to the standard alternators that are supplied with WESTERBEKE'S Engines and Generators.

ELECTRICAL CHARGING CIRCUIT

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.

It is desirable to test the charging system (alternator and voltage regulator) using the wiring harness and electrical loads that are a permanent part of the system and will then provide the technician with an operational test of the charging system as well as the major components of the electrical system.

ALTERNATOR DESCRIPTION

The stator is connected to a three phase, full wave bridge rectifier package which contains six diodes. The bridge converts the AC generated in the stator to a DC output for battery charging and accessories.

Power to the regulator and the field output of 50 amps. Rated output is achieved at approximately 6000 alternator rpm at an ambient temperature of 75°F (23.8°C). The alternators are designed to operate in an ambient temperature range of -40°F to 212°F (-40°C to 100°C).

VOLTAGE REGULATOR

The integral voltage regulator is an electronic switching device which senses the system voltage level and switches the voltage applied to the field in order to maintain a proper system voltage.

The regulator design utilizes all-silicon semi conductors and thick-film assembly techniques. After the voltage has been adjusted to the proper regulating valve, the entire circuit is encapsulated to protect the circuit and the components from possible damage due to handling or vibration.

ALTERNATOR TROUBLESHOOTING

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

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

LOW BATTERY/FAULTY CIRCUIT

If the starter only moans or makes a clicking sound instead of spinning the engine to life it is likely a low battery or a faulty connection in the starting circuit and not an alternator problem.

PRELIMINARY INSPECTION

Before starting the actual alternator and voltage regulator, testing the following checks are recommended.

1. Make certain your alternator is securely mounted.
2. Check the drive belts for proper tension. Replace the belt if it is worn or glazed.
3. Check that all terminals, connectors and plugs are clean and tight. Loose or corroded connections cause high resistance and this could cause overcharging, undercharging or damage to the charging system. Badly corroded battery cables could prevent the battery from reaching a fully charged condition.
4. Check the condition of the battery and charge if necessary. A low or discharged battery may cause false or misleading readings in the tests.

(IF APPLICABLE)

NOTE: *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 house batteries. If the isolator is charging the starting battery but not the house battery, the alternator is OK and the problem is in the battery charging circuit.*

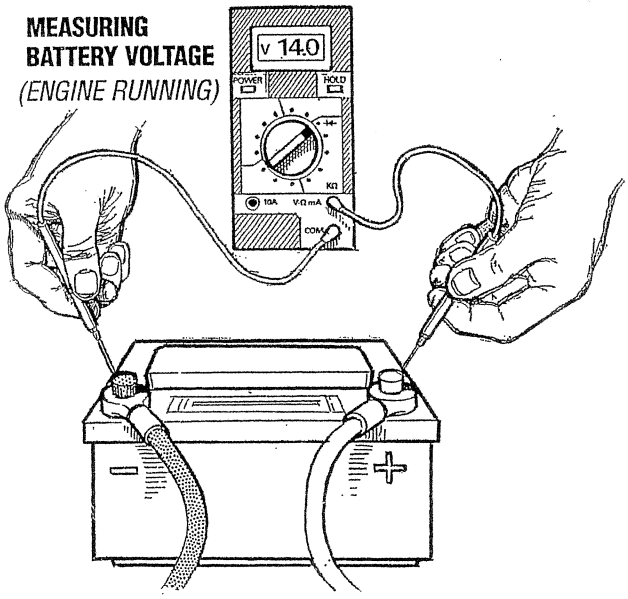
ALTERNATORS TESTING/TROUBLESHOOTING

TESTING THE ALTERNATOR

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

1. **Start the Engine.**
2. After the engine has run for a few minutes, measure the starting battery voltage at the battery terminals using a multimeter set on DC volts.
   a. If the voltage is increasing toward 14 volts, the alternator is working.
   b. If the voltage remains around 12 volts, a problem exists with either the alternator or the charging circuit; continue with Steps 3 through 6.

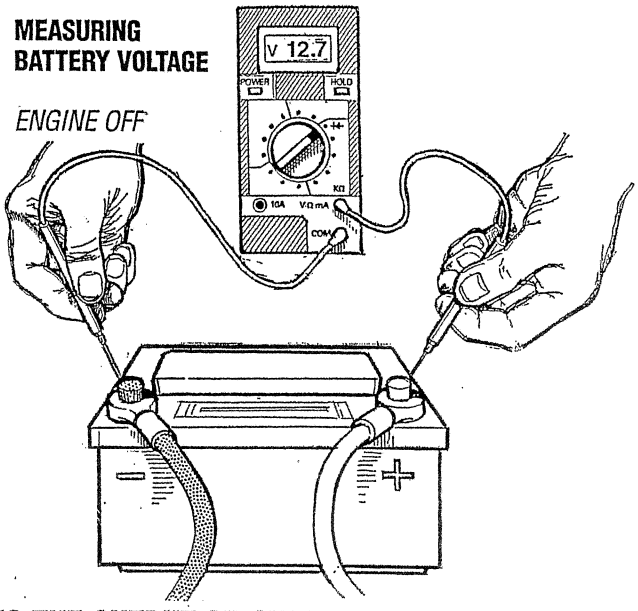
MEASURING BATTERY VOLTAGE *(ENGINE RUNNING)*



3. **Turn off the engine.** Inspect all wiring and connections. Ensure that the battery terminals and the engine ground connections are tight and clean.
4. If a battery selector switch is in the charging circuit, ensure that it is on the correct battery.
5. Check the battery voltage. If your battery is in good condition the reading should be 12 to 13 volts.
6. Load test the battery, if there is a possible issue of it having a weak/faulty cell.

MEASURING BATTERY VOLTAGE

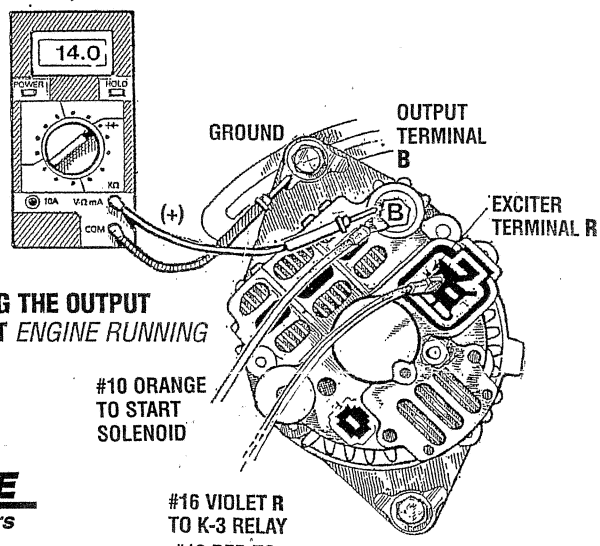
ENGINE OFF



TESTING THE OUTPUT CIRCUIT

1. Connect the positive probe to the output terminal **B** and connect the negative probe to ground.
2. Wiggle the engine wiring harness while observing the voltmeter. The meter should indicate the approximate battery voltage, and should not vary. If no reading is obtained, or if the reading varies, check the alternator output circuit for loose or dirty connections or damaged wiring.
3. **Start the engine.**
4. Repeat the same measurement, the negative probe to ground, the positive probe to **B** with the engine running. The voltage reading should be between 13.5 and 14.5 volts. If your alternator is over or under-charging, have it repaired at a reliable service shop.
5. If the previous test reads only battery voltage at terminal **B**, use the meter to measure the DC excitation terminal. If 12 volts is not present at exciter terminal **R**, inspect the wiring for breaks and poor connections. Jump 12 volts from a 12 volt source (such as the battery) and operate the alternator. If the voltage output is 13-14 volts, . . then the alternator is OK.

TESTING THE OUTPUT CIRCUIT *ENGINE RUNNING*

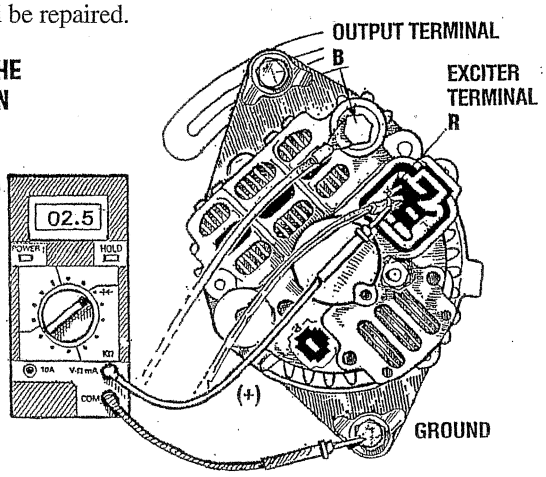


ALTERNATORS TESTING/TROUBLESHOOTING

TESTING THE EXCITATION CIRCUIT

1. Connect the positive (+) multimeter probe to the excitation terminal **R** on the alternator and the negative (-) lead to ground.
2. Start the engine and note the multimeter reading. The reading should be approximately battery charging voltage. If the reading is battery voltage, then the DC alternator's regulator is faulty or the alternator itself and should be repaired.

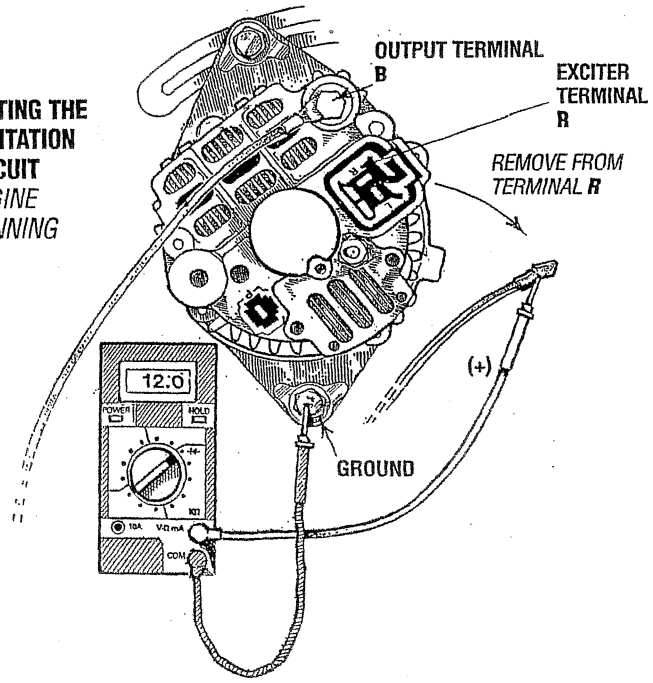
TESTING THE EXCITATION CIRCUIT *(ENGINE RUNNING)*



3. If no reading is obtained, an open exists in the alternator/excitation lead. Disconnect the lead from the excitation terminal **R.** Trace the lead to determine the fault and correct.

   Jump a 12 VDC source to the **R** terminal. Alternator output voltage should be in the 14 VDC range indicating the alternator is OK.

TESTING THE EXCITATION CIRCUIT *ENGINE RUNNING*



CHECKING THE SERVICE BATTERY (IF APPLICABLE)

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

When the problem has been solved and before the alternator is back in operation, take the time to tighten and clean the terminal studs. Also clean the connecting terminals from the wiring harness.

ALTERNATOR REPAIR

If tests indicate a failed alternator, it will need to be disassembled and repaired. Any good alternator service shop can do the job.

NOTE: *WESTERBEKE'S Service Manual has detailed instructions for the disassembly and repair of their standard alternators.*

BATTERY CARE

The minimum recommended capacity of the battery used in the engine's 12 volt DC control circuit is 800-1000 Cold Cranking Amps (CCA).

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).

GLOW PLUGS

DESCRIPTION

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.

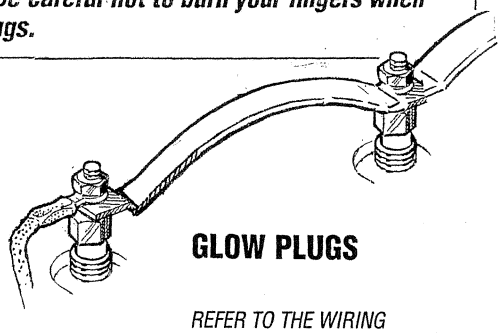
INSPECTION

To inspect the plug, remove the electrical terminal connections, then unscrew or unclamp each plug from the cylinder head. Thoroughly clean each plug's tip and threads with a soft brush and cleaning solution to remove all the carbon and oil deposits. While cleaning, examine the tip for wear and burn erosion; if it has eroded too much, replace the plug.

TESTING

An accurate way to test glow plugs is with an ohmmeter. Touch one prod to the glow plug's wire connection, and the other to the body of the glow plug, as shown. A good glow plug will have a 1.0 - 1.5 ohm resistance. This method can be used with the plug in or out of the engine. You can also use an multimeter to test the power drain (8 - 9 amps per plug).

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



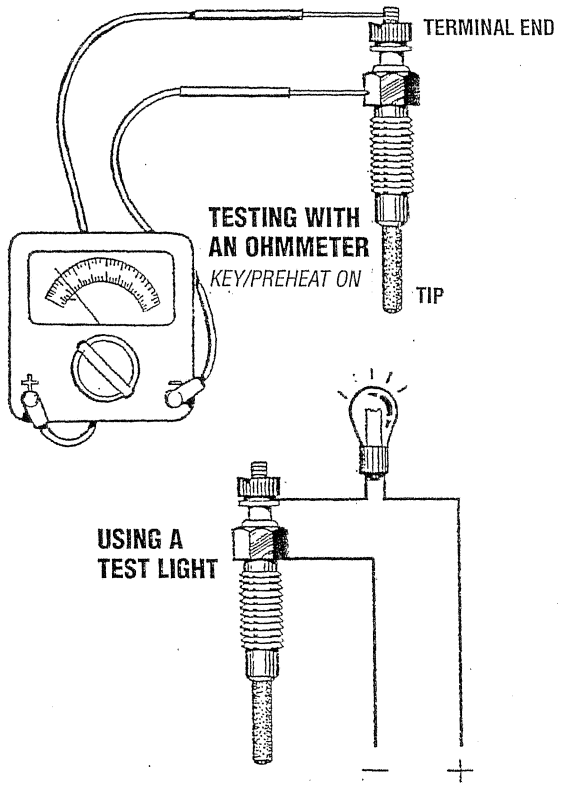
GLOW PLUGS

REFER TO THE WIRING DIAGRAM IN THIS MANUAL FOR ALL WIRING CONNECTIONS

Re-install the plugs in the engine and test them again. The plugs should get very hot (at the terminal end) within 7 to 15 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.

⚠ WARNING: ***Do not keep a glow plug on for more than 30 seconds.***

GLOW PLUG TIGHTENING TORQUE
1.0 - 1.5 M-KG (7 -11 FT-LB)

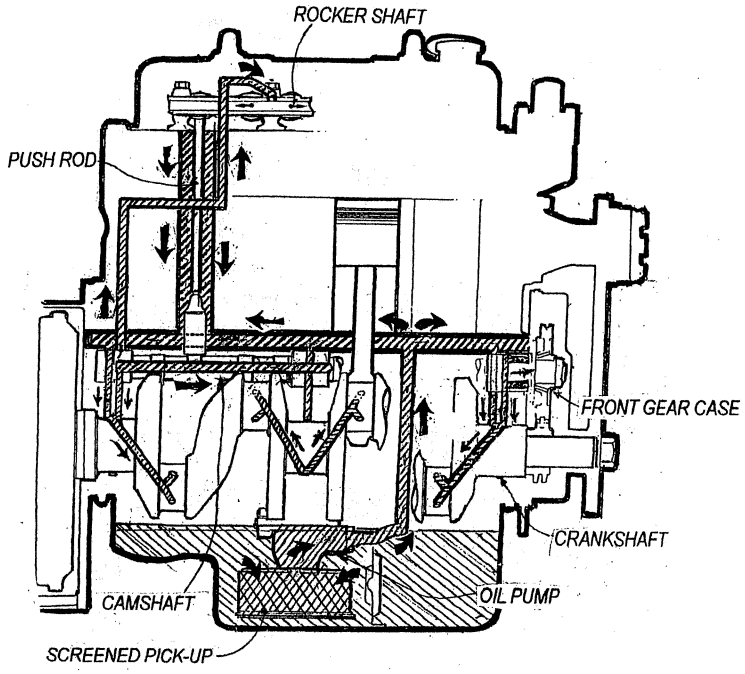


ENGINE ADJUSTMENTS

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

OIL PRESSURE

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



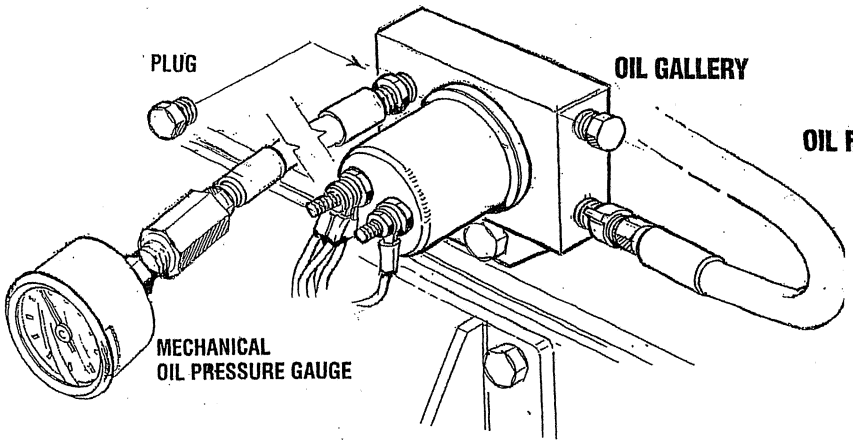
OIL PRESSURE [GENERATOR]

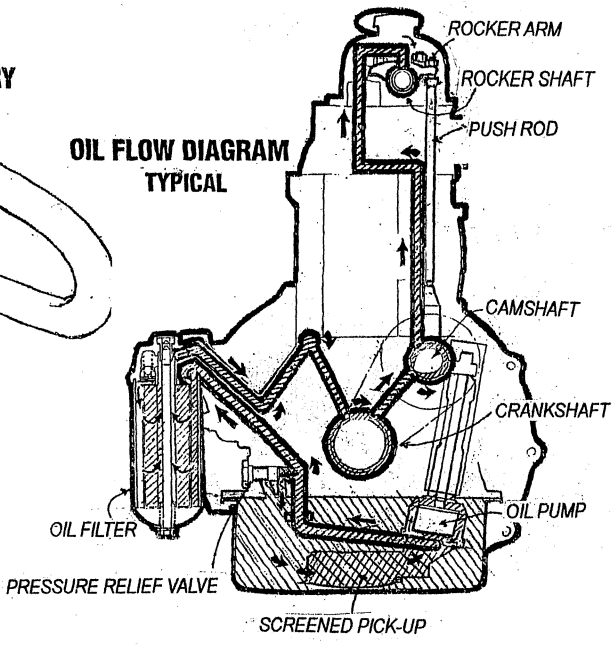
Oil pressure at 1800 (or 1500) rpm should maintain a reading of 50 psi.

TESTING OIL PRESSURE

To test the oil pressure, remove the plug in the oil gallery and install a mechanical oil pressure gauge in its place. After warming up the engine, set the engine speed at 1800 rpm and read the oil pressure.

OIL PRESSURE **50 psi at 1800 rpm.**
SENDER AND SWITCH TORQUE **9 - 13 ft-lb (1.2 - 1.8 m - kg).**





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.

The drive belt must be properly tensioned. 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 generator has one drive belt. It drives the DC alternator and the antifreeze coolant pump and fan. The tension adjustment procedure for this belt is as follows:

1. Remove the DC alternators guard.
2. Loosen the alternator adjusting strap bolt and pivot bolt. Loosen the alternator so that all tension is removed from the belt.
3. With the belt loose, the belt can be inspected for wear, cracks, and frayed edges. Replace the belt as needed.
4. Pivot the alternator on the base mounting bolt to the left or right as required, to loosen or tighten.
5. The drive belt is properly tensioned when it can be deflected no less than 3/8 inch (10mm) and no more than 1/2 inch (12mm) as the belt is depressed with the thumb at the mid-point between the two pulleys on the longest span of the belt or when the DC alternators drive pulley will not slip on the belt when attempting to turn with a wrench.

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

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

FUEL INJECTORS

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

REMOVING FUEL INJECTORS

NOTE: *Injector must be serviced in a "clean room" environment.*

1. Disconnect the high pressure fuel lines from the injectors and loosen the lines at their attachment to the injection pump and move them out of the way of the injectors. Avoid bending the lines.
2. Using a 17mm long socket, remove the fuel return line in its entirety from the top of the injectors. Take care not to loose the two sealing washers and banjo bolt that attaches the fuel return line to each injector.

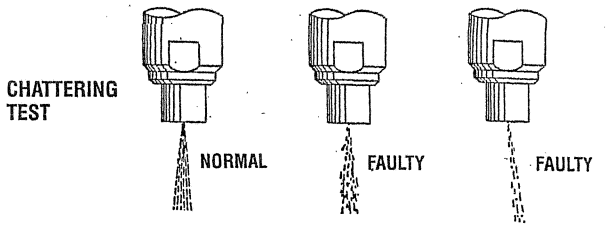
NOTE: *Clean the area around the base of the injector prior to lifting it out of the cylinder head to help prevent any rust or debris from falling down into the injector hole. If the injector will not lift out easily and is held in by carbon build-up or the like, work the injector side-to-side with the aid of the socket wrench to free it, and then lift it out.*

3. The injector seats in the cylinder head on a copper sealing washer. This washer should be removed with the injector and replaced with a new washer when the injector is reinstalled.

INJECTION TESTING

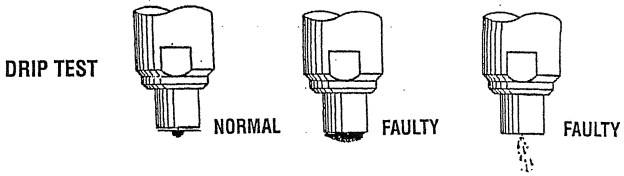
1. Using the nozzle tester, check the spray pattern and injection starting pressure of the nozzle. If it exceeds the limit, adjust or replace the nozzle. When using a nozzle testee, take the following precautions:

> ⚠ **WARNING:** ***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,***



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.



2. Apply the pressure of 1635 kg/cm² (115 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.

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.*

CHECKING VALVE CLEARANCE

Valve clearance must be checked and adjusted when engine is cold.

1. Remove the head cover.
2. Align the **ITC** mark line on the flywheel and projection on the housing so that the No.1 piston comes to the compression or overlap top dead center.
3. Check the following valve clearance (1) marked with ◐ using a feeler gauge.
4. If the clearance is not within the factory specification, adjust with the adjusting screw.

The **TC** marking line on the flywheel is just for the No. 1 There is no **TC** marking for the other cylinders. The No.1 piston comes to the top dead center position when the **TC** marking is aligned with the projection in the window on the flywheel-housing. Turn the flywheel 0.26 radius (15°) clockwise and counterclockwise to see if the piston is at the compression top dead center or the overlap position. Now, referring to the table below, readjust the valve clearance. The piston is at the top dead center when both the IN. and EX. valves do not move. It is at the overlap position when both the valves move.

Finally, turn the flywheel 6.28 radius (360°) and align the **TC** marking and the projection perfectly. Adjust all the other valve clearances as required.

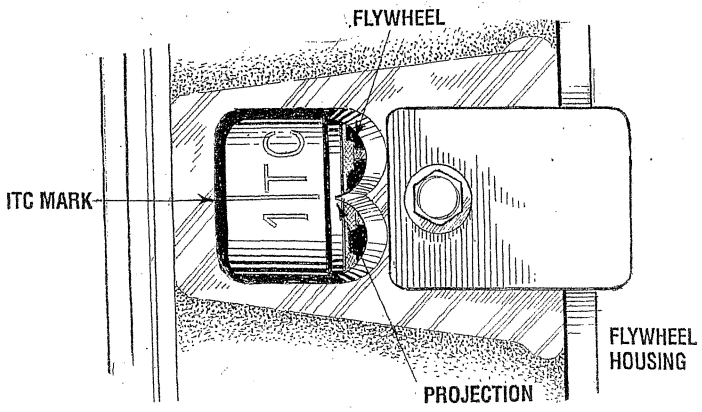
After turning the flywheel counterclockwise twice or three times, recheck the valve clearance.

After adjusting the valve clearance, firmly tighten the locknut of the adjusting screw.

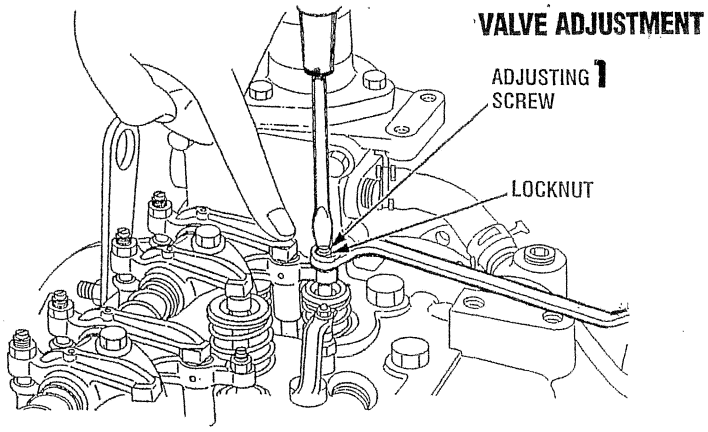
Valve clearance	Factory spec.	0.23 to 0.27 mm 0.0091 to 0.0106 in.

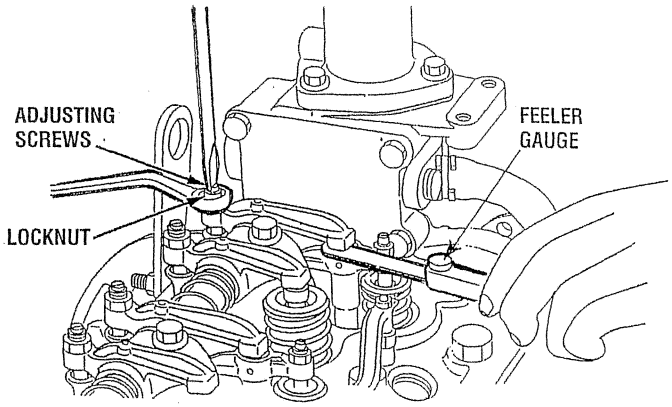
Valve arrangement Adjustment cylinder Location of piston		IN.	EX.
When No.1 piston is compression top dead center	1st	●	●
	2nd	●	
	3rd		●
	4th		
When No.1 piston is overlap position	1st		
	2nd		●
	3rd	●	
	4th	●	●

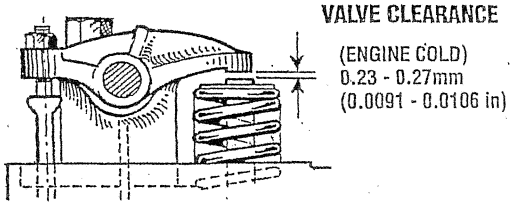
Tightening torque	Cylinder head cover screw	6.9 to 11.3 N·m 0.7 to 1.15 kgf·m 5.1 to 8.32 ft-lbs



TIMING WINDOW
(located on the engine bell housing)







TESTING THE MAGNETIC PICK UP COIL

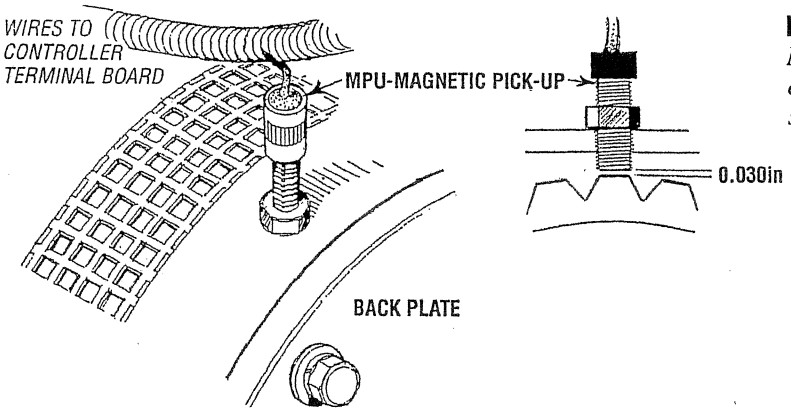
Test the speed sensor connector for voltage and resistance values.

If the values are correct, remove and inspect the magnetic pick up. With the wires disconnected, unscrew the magnetic pick up from the generator housing and visually inspect the contact end. If any damage is detected, replace the unit.

NOTE: *Carefully follow the installation instructions provided with the new magnetic pick up coil.*

SPEED SENSOR TEST VALUES
VOLTAGE (while cranking)
1.5 - 2.5 VAC

RESISTANCE (at rest) **950 - 1000 ohm**



MAGNETIC PICK-UP [MPU] INSTALLATION

The MPU is installed in the threaded opening on the side of the flywheel bellhousing. This positions the MPU over the teeth of the flywheel ring gear.
Viewing through this opening, manually rotate the engine crankshaft so as to position the flat of one of the ring gear's teeth directly under the opening. Thread the MPU into the opening until it gently contacts the flat of this tooth (Thread is 3/8" x 24). Back the MPU out of the opening one turn and then lock it in this position with the jam nut. This will position the end of the MPU approximately 0.030 inches away from the flats of the ring gear teeth.

To ensure the MPU is positioned correctly, slowly rotate the crankshaft by 360° by hand to assure there is no physical contact between the MPU and the ring gear teeth.

If contact is felt between the MPU and the flywheel teeth, the MPU may be damaged. Remove the MPU and inspect it. Replace if necessary and repeat the above installation procedure.

NOTE: *When replacing the Magnetic Pick-Up (MPU) it **MUST** be replaced without cutting and splicing into the existing wiring cable. Doing so will cause a erratic AC signal to the controller.*

SPECIFICATIONS 26.0/21.0 EDE(A)R

ENGINE SPECIFICATIONS

Engine Type	Diesel, four-cycle, four-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism (52 hp at 1800 rpm maximum)
Aspiration	Naturally aspirated
Compression Ratio	22.6:1
Governor	Electronic
Combustion Chamber	Swirl type
Bore & Stroke	98 x 110 mm (3.86 x 4.33 inches)
Piston Displacement	3.31 liters (202.53 cubic inches)
Hp @ 1800 rpm	55
Hp @ 1500 rpm	48
Firing Order	1 - 3 - 4 - 2
Inclination	Continuous 20° Temporary 30° (not to exceed 10 min.)
Weight (dry)	1135 lbs (514.8 kgs)

TUNE-UP SPECIFICATIONS

Compression Pressure (allowable limit)	626 psi (44 kg/cm²) at 250 rpm 472 psi (30.5 kg/cm²) at 250 rpm
Variation between cylinders	10% or less
Injection Timing	13° BTDC
Engine Speed	1800 rpm 60 Hertz 1500 rpm 50 Hertz
Valve Clearance (engine cold)	0.23 to 0.27 mm (0.0091 to 0.0106 inches)
Injector Pressure	1991 - 2134 psi (140 to 150 kgf/cm²)
Valve Timing	Intake Opens 14° BTDC Intake Closes 36° ABDC Exhaust Opens 45° BBDC Exhaust Closes 17° ATDC

ELECTRICAL SYSTEM

Starting Battery	12-Volt DC (-) negative ground
Battery Capacity	800-1000 CCA (Cold Cranking Amps)
DC Charging Alternator	50 Amp rated, belt-driven
Starter	2.5Kw, 12VDC direct drive
Starting Aid	Glow plugs, sheathed type
DC Cranking Current	280 - 320 Amps (includes glow plugs)

COOLING SYSTEM

General	Fresh water-cooled engine block, thermostatically-controlled
Operating Temperature	160° - 180° F (71° - 82° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Raw Water Pump	Positive displacement, rubber impeller, gear-driven
System Capacity (Fresh Water)	16.0 qts (15.1 liters)

FUEL SYSTEM

General	Open flow, self bleeding, self priming (electromagnetic fuel pump)
Fuel	No. 2-D SAE J313 Cetane # 45 or higher Diesel fuel according to ASTM D975
Fuel Injection Pump	Bosch type mini-pump
Fuel Injection Timing	13° BTDC
Injector Nozzle	Bosch throttle type
Fuel Filter	Spin-on type
Air Intake	Metal screen/intake silencer box
Air Flow Combustion	105 cfm (3.0 cmm)

LUBRICATION SYSTEM

General	Pressure fed system with external relief valve
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	14.0 U.S. qts (13.2 liters)
Operating Oil Pressure (engine hot)	28 - 57 psi (2.0 - 4.0 kg/cm²)
Oil Grade	API Category CF, CF-4, CG-4, CH-4, CI-4 or better. SAE 10W-40 or 15W-40

GENERATOR COOLING

Air Requirements (generator cooling)	0.8 Power factor unit. 400 CFM (11.3 CMM)

NOTE: *Increase cooling air flow 15% for slower turning 50 hz units.*

Generator Compartment Ambient Temperature	122° F (50° C) maximum

NOTE: *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*

SPECIFICATIONS 20.0/17.0 EDER

ENGINE SPECIFICATIONS

Engine Type	Diesel, four-cycle, four-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism (52 hp at 1800 rpm maximum)
Aspiration	Naturally aspirated
Compression Ratio	22.6:1
Governor	Electronic
Combustion Chamber	Swirl type
Bore & Stroke	87 x 92 mm (3.34 x 3.64 inches)
Piston Displacement	2.19 liters (134.10 cubic inches)
Hp @ 1800 rpm	55
Hp @ 1500 rpm	48
Firing Order	1 - 3 - 4 - 2
Inclination	Continuous 20° Temporary 30° (not to exceed 10 min.)
Weight (dry)	933 lbs (423.2 kgs)

TUNE-UP SPECIFICATIONS

Compression Pressure (allowable limit)	626 psi (44 kg/cm²) at 250 rpm 472 psi (30.5 kg/cm²) at 250 rpm
Variation between cylinders	10% or less
Injection Timing	13° BTDC
Engine Speed	1800 rpm 60 Hertz 1500 rpm 50 Hertz
Valve Clearance (engine cold)	0.23 to 0.27 mm (0.0091 to 0.0106 inches)
Injector Pressure	1991 - 2134 psi (140 to 150 kgf/cm²)
Valve Timing	Intake Opens 14° BTDC Intake Closes 36° ABDC Exhaust Opens 45° BBDC Exhaust Closes 17° ATDC

ELECTRICAL SYSTEM

Starting Battery	12-Volt DC (-) negative ground
Battery Capacity	800-1000 CCA (Cold Cranking Amps)
DC Charging Alternator	40 Amp rated, belt-driven
Starter	2.5Kw, 12VDC direct drive
Starting Aid	Glow plugs, sheathed type
DC Cranking Current	280 - 320 Amps (includes glow plugs)

COOLING SYSTEM

General	Fresh water-cooled engine block, thermostatically-controlled.
Operating Temperature	160° - 180° F (71° - 82° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Raw Water Pump	Positive displacement, rubber impeller, gear-driven.
System Capacity (Fresh Water)	14.5 qts (13.7 liters)

FUEL SYSTEM

General	Open flow, self bleeding, self priming (electromagnetic fuel pump)
Fuel	No. 2-D SAE J313 Cetane # 45 or higher Diesel fuel according to ASTM D975
Fuel Injection Pump	Bosch type mini-pump
Fuel Injection Timing	13° BTDC
Injector Nozzle	Bosch throttle type
Fuel Filter	Spin-on type
Air Intake	Metal screen/intake silencer box
Air Flow Combustion	70.0 cfm (1.9 cmm)

LUBRICATION SYSTEM

General	Pressure fed system with external relief valve
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	14.0 U.S. qts (13.2 liters)
Operating Oil Pressure (engine hot)	28 - 57 psi (2.0 - 4.0 kg/cm²)
Oil Grade	API Category CF, CF-4, CG-4, CH-4, CI-4 or better. SAE 10W-40 or 15W-40

GENERATOR COOLING

Air Requirements (generator cooling)	0.8 Power factor unit. 400 CFM (11.3 CMM)

NOTE: *Increase cooling air flow 15% for slower turning 50 hz units.*

Generator Compartment Ambient Temperature	122° F (50° C) maximum

NOTE: *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*

SPECIFICATIONS 20.0KW EDER

AC GENERATOR (Single Phase)

Single Phase	Brushless, six-pole, revolving field. Seal lubricated, single bearing design. 12 lead reconnectable, (Double Delta for 120/240 volts, 60hz.) (Series Star for 230 volts, 50hz) with solid state regulator.	
Voltage	120 or 120/240 volts - 60 hertz 230 Volts - 50 Hertz	
Voltage Regulation	± 2% no load to full load.	
Frequency Regulation	.3 Hertz (.5%) no load to full load.	
Rating (Volts AC) **60 Hz (1800 rpm)** **20.0 KW**	120 volts 120/240 volts	166.6 amps 166.6/83.3 amps
50 Hz (1500 rpm) **17.0 KW**	230 volts	69.5 amps
Generator Cooling Air requirements (Single & 3 phase)	400 cfm (11.3 cmm) **NOTE:** *Increase air supply 15% for 50 Hertz operation (1500 rpm).*	
Generator Compartment Ambient Temperature Recommendations	122°F (50°C) maximum **NOTE:** *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*	

AC GENERATOR (3 Phase)

Three Phase **20.0 KW - 60 Hertz** **17.0 KW - 50 Hertz**	Brushless, six-pole, revolving field. Sealed lubricated, single-bearing design. 12 Lead reconnectable. Solid state voltage regulator.	
Voltage - 3 phase (60 Hertz)	Low Voltage WYE High Voltage WYE DELTA	240 Volts 480 Volts 277 Volts
Voltage - 3 Phase (50 Hertz)	High Voltage WYE DELTA	400 Volts 230 Volts
Amperage - 3 phase (60 Hertz)	Low Voltage WYE High Voltage WYE DELTA	60 Amps 30 Amps 59 Amps
Amperage - 3 phase (50 Hertz)	High Voltage WYE DELTA	28.9 Amps 50.2 Amps
Generator Compartment Ambient Temperature Recommendations	122°F (50°C) maximum **NOTE:** *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*	

SPECIFICATIONS 26.0KW EDEAR

AC GENERATOR (Single Phase)

Single Phase	Brushless, six-pole, revolving field. Seal lubricated, single bearing design. 12 lead reconnectable, (Double Delta for 120/240 volts, 60hz.) (Series Star for 230 volts, 50hz) with solid state regulator.	
Voltage	120 or 120/240 volts - 60 hertz 230 Volts - 50 Hertz	
Voltage Regulation	± 2% no load to full load.	
Frequency Regulation	.3 Hertz (.5%) no load to full load.	
Rating (Volts AC) **60 Hz (1800 rpm)** **26.0 KW**	120 volts 120/240 volts	216.6 amps 216.6/108.3 amps
50 Hz (1500 rpm) **21.0 KW**	230 volts	91.3 amps
Generator Cooling Air requirements (Single & 3 phase)	400 cfm (11.3 cmm) **NOTE:** *Increase air supply 15% for 50 Hertz operation (1500 rpm).*	
Generator Compartment Ambient Temperature Recommendations	122°F (50°C) maximum **NOTE:** *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*	

AC GENERATOR (3 Phase)

Three Phase **26.0 KW - 60 Hertz** **21.0 KW - 50 Hertz**	Brushless, six-pole, revolving field. Sealed lubricated, single-bearing design. 12 Lead reconnectable. Solid state voltage regulator.	
Voltage - 3 phase (60 Hertz)	Low Voltage WYE High Voltage WYE DELTA	240 Volts 480 Volts 277 Volts
Voltage - 3 Phase (50 Hertz)	High Voltage WYE DELTA	400 Volts 230 Volts
Amperage - 3 phase (60 Hertz)	Low Voltage WYE High Voltage WYE DELTA	78.2 Amps 39.1 Amps 67.8 Amps
Amperage - 3 phase (50 Hertz)	High Voltage WYE DELTA	37.5 Amps 65.3 Amps
Generator Compartment Ambient Temperature Recommendations	122°F (50°C) maximum **NOTE:** *Forced ventilation should be provided to maintain generator compartment temperatures below 122°F (50°C).*	

GENERATOR INFORMATION

USE OF ELECTRIC MOTORS

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

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

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

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

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

Required Operating Speed

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

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

Generator Frequency Adjustment

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

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

Therefore, to change the generator's frequency/voltage, the generator's drive engine's speed must be changed using the dipswitch on the ECU. The AC output configuration of the generator changed and the connections on the voltage sensing PC board changed.

Generator Maintenance

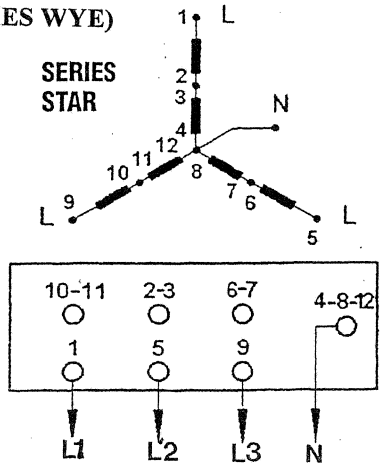
- Maintaining reasonable cleanliness is important. Connections of terminal boards and rectifiers may become corroded, and insulation surfaces may start conducting if salts, dust, engine exhaust, carbon, etc. are allowed to build up. Clogged ventilation openings may cause excessive heating and reduced 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, bearings are wearing or wear on shaft of bearing socket outside bearing has occurred. Repair must be made quickly or major components will rub and cause major damage to generator.

TWELVE LEAD WINDING/TERMINAL BOARD CONNECTIONS

AND (NOMINAL) VOLTAGES

(SERIES WYE)

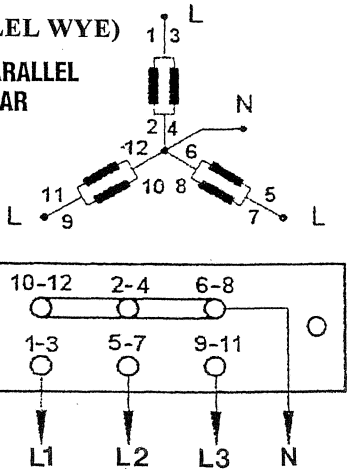
SERIES STAR



50 Hz L-L 400 volts
50 Hz L-N 230 volts
60 Hz L-L 480 volts
60 Hz L-N 277 volts

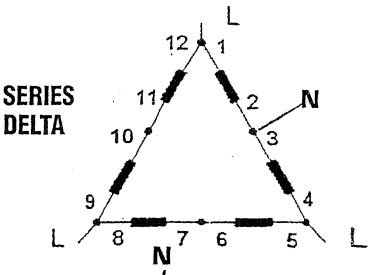
(PARALLEL WYE)

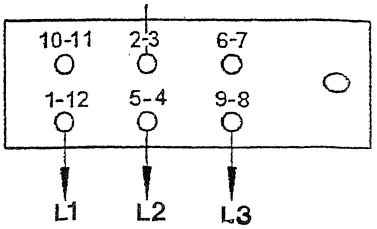
PARALLEL STAR



50 Hz L-L 200 volts
50 Hz L-N 115 volts
60 Hz L-L 240 volts
60 Hz L-N 138 volts

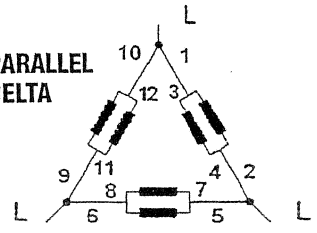
SERIES DELTA

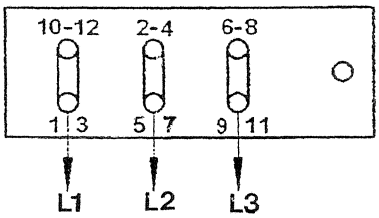




50 Hz L-L 230 volts
50 Hz L-N 115 volts
60 Hz L-L 277 volts
60 Hz L-N 138 volts
(Refer to Note #1)

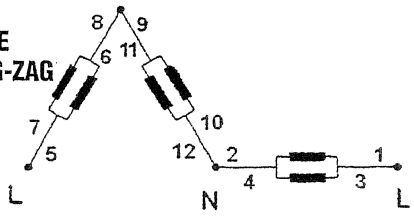
PARALLEL DELTA

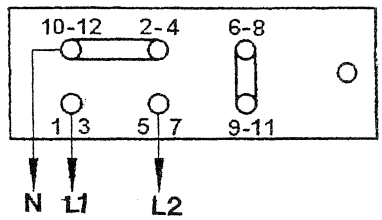




50 Hz L-L 115 volts
60 Hz L-L 138 volts

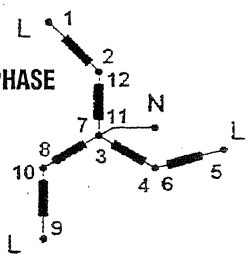
SINGLE PHASE PARALLEL ZIG-ZAG

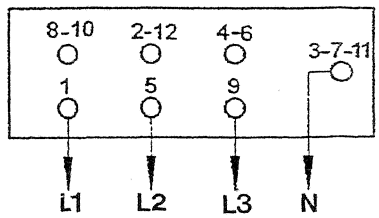




50 Hz L-L 230 volts
50 Hz L-N 115 volts
60 Hz L-L 277 volts
60 Hz L-N 138 volts
(Refer to Note #1)

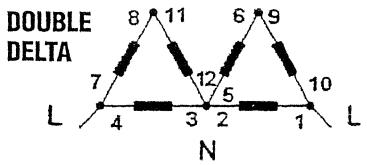
THREE PHASE ZIG-ZAG

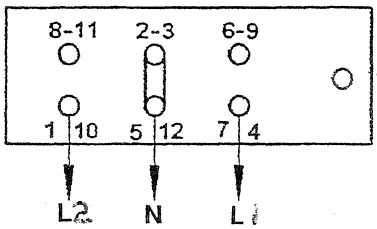




50 Hz L-L 346 volts
50 Hz L-N 200 volts
60 Hz L-L 415 volts
60 Hz L-N 240 volts
(Refer to Note #2)

DOUBLE DELTA



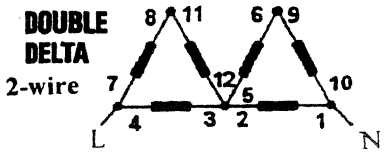


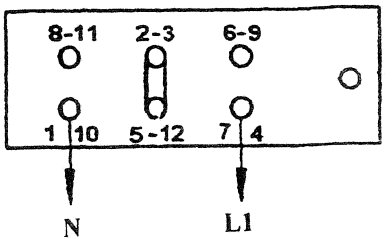
50 Hz L-L 230 volts
50 Hz L-N 115 volts
60 Hz L-L 240 volts
60 Hz L-N 120 volts

Note #1 *Single phase amperage load. The phase current must not exceed the nominal value.*

Note #2 *Three phase zig-zag connection. The rated power must be multiplied by 0.866.*

DOUBLE DELTA 2-wire





50 Hz L-N 230 volts
60 Hz L-N 240 volts

CHANGING HERTZ AND VOLTAGE

⚠ CAUTION: ***As a precaution against an unintentional start, shut OFF the 20 Amp DC breaker on the control panel.***

1. Refer to the diagrams below that illustrate the various AC voltage output configurations for both the 60 Hertz and 50 Hertz applications. Select the configuration for the Hertz/Voltage required.
2. Reconfigure the 12 AC connections on the terminal board carefully following the illustration. References below the voltage sensing diagram and its connections to the AC terminal block. There are three line connections when needed and a neutral. These connections **MUST** correspond to and be connected to the line (L) connections on the AC terminal board and the neutral connection as well to its corresponding connection.

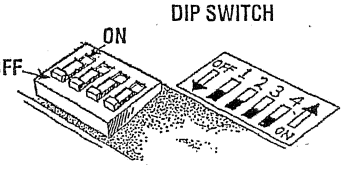
NOTE: *Software obtained from the Westerbeke Distributor will be needed to re-program the ECU to display the AC voltage the generator has been converted to.*

NOTE: When reconfiguring the AC out put. Ensure that the AVR Neutral and Line connections are properly connected at the AC terminal block.

3. There are three line connections. When an L2 or L3 is not present on the AC terminal block, insulate and tie off the unused L connection from the Voltage Sensing Board..
4. Inside the control box, locate the ECU and position the Hertz/Frequency dip switch in the correct position for the Hertz/Frequency desired.
5. Verify all connections are correct and turn off any AC panel breakers.
6. Start the generator and monitor the AC output voltage at the generator's terminal board. Line to line. line to neutral. Adjust the voltage regulator board as needed to obtain the correct voltage. Check the generator hertz/frequency with your hertz meter.
7. Turn on the AC panel breakers and load unit and monitor the operation.

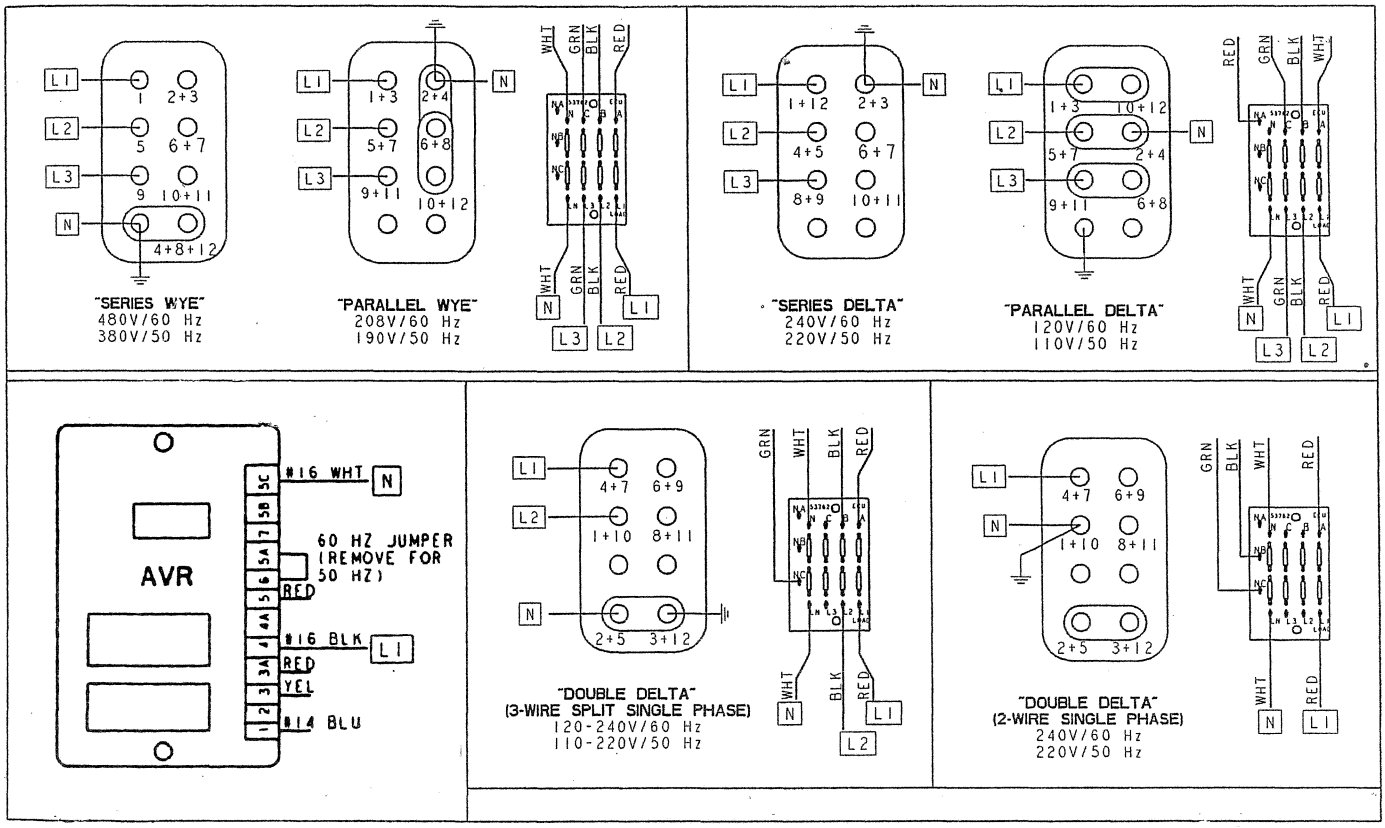
CHANGING FREQUENCY
(DC breaker must be off)

When changing the generators frequency (50/60Hz) switch ***#1*** *on the ECU board must be positioned:* **ON** for **50Hz**
OFF for **60Hz**



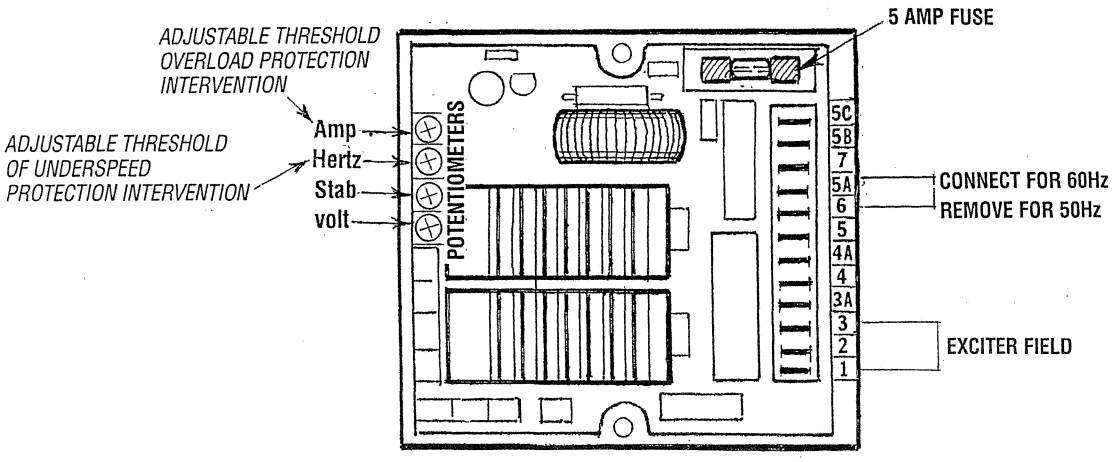
AC OUTPUT CONFIGURATIONS

VOLTAGE SENSING BOARD CONNECTIONS



NOTE: *Tie off the L3 sensing connection when not used.*

ELECTRONIC REGULATION SR7-2G AVR



DESCRIPTION

The voltage regulator (AVR) ensures optimum AC generator performance. This advanced design AVR is equipped with circuitry protection to guard against operating conditions that could be detrimental to the AC generator. The following information details the voltage regulators adjustments and connections. These procedures should be performed by a qualified technician.

TERMINAL CONNECTIONS

#1. Excitation field DC negative.

#2. Exciter field jumper to **3** if the regulator AC supply between **5** and **3A** is less than 160 VAC.

#3. Exciter field DC positive.

#3A. Supply voltage to regulator (AC).

#4. Sensing voltage.

#5. Supply voltage to regulator (AC).

#6. Jumper to **5A** for 60 Hz operation.

#7. Not used.

#5B. Not used.

#5C. Sensing voltage.

POSSIBLE CONNECTIONS

Exciter Field: The exciter field negative should be connected to terminal **1** of the electronic regulator (normally dark blue or black), while the positive (normally red or yellow) should be connected to terminal **3.**

Supply: There are two possibilities.

1. The supply coincides with the sensing. In this case the SR7/2 supply should be connected to terminals **3** and **5** (in case of three-phase generators, terminal **5** is normally connected with the star point). Terminals **3** and **4** should be connected to each other in such a way that the supply is also sensing. This connection in necessary when the generator does not have auxiliary winding for supplying the regulator.
2. The supply and sensing separate. This is the case of a generator equipped with auxiliary winding for regulator supply. Supply is always connected to terminals **3** and **5** of the regulator.

In both of these cases, the SR7/2 supply can vary from 80 to 270 VAC. But it should be noted that terminals 2 and 3 should be bridged for supply with voltage between 80 and 160 VAC, while the same terminals should be left open if the voltage is between 160 and 270 VAC.

Sensing: Sensing should be connected to terminals **4** and **5** and can vary from 80 to 350 VAC. The sensing is single phase only and therefore is normally connected to one alternator phase.

Operation at 60 Hz: When operating at 60 Hz, terminals **5A** and **6** should be connected to each other in order to keep the low frequency protection correctly regulated.

> ⚠ **WARNING:** ***Be aware that high voltages may be present. Take all necessary precautionms to safe guard against electrical hazards.***

FUNCTIONS OF THE REGULATOR POTENTIOMETERS

Volt: With this potentiometer, it is possible to adjust the voltage generated by the alternator in a very simple way. If the screw is turned clockwise, the voltage increases, if the screw is turned counterclockwise it decreases.

Stab: This potentiometer optimizes alternator performance. If turned clockwise, the stability decreases and the response time decreases but the voltage tends to be less stable. If turned counterclockwise, the response time increases and the voltage tends to be more stable.

In order to adjust this potentiometer correctly, we advise using the following method.

1. The generator must be working, starting from zero load and the potentiometer must be at maximum stability (turned fully counterclockwise).
2. Slightly turn clockwise until the light generated by the filament lamp oscillates, at this point, turn the potentiometer slowly counterclockwise until the light stabilizes.

ELECTRONIC REGULATION SR7-2G AVR

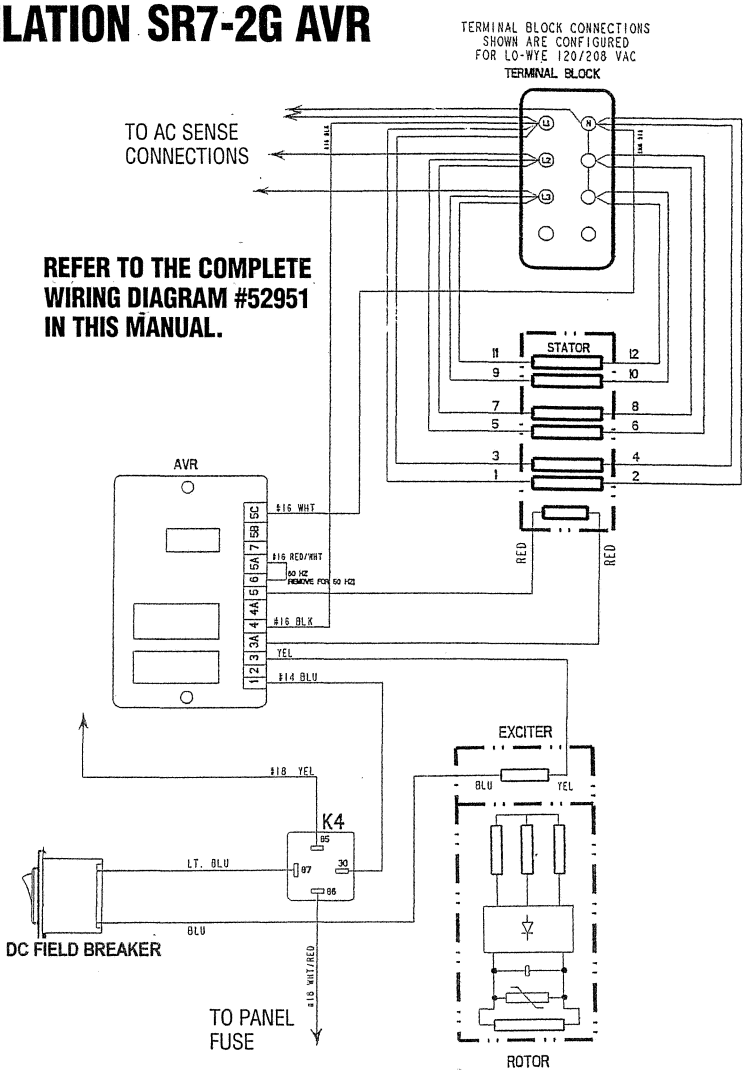
Hertz: With this potentiometer, which is normally pre-calibrated then sealed by the manufacturer, it is possible to adjust the low frequency protection intervention. To recalibrate this protection, you must take the generator to a normal zero load condition, turn the potentiometer clockwise until the limit position is reached, then decrease the nominal speed by 10 %. Then turn the potentiometer counterclockwise and measure the voltage value until it has decreased by 5 volts.

When the speed decreases by more than 10% of the nominal value, the voltage also decreases proportionally, blocking generator overheating. Even if we advise calibrating this protection at 10% of the nominal value, it is obviously possible to calibrate the threshold at other values.

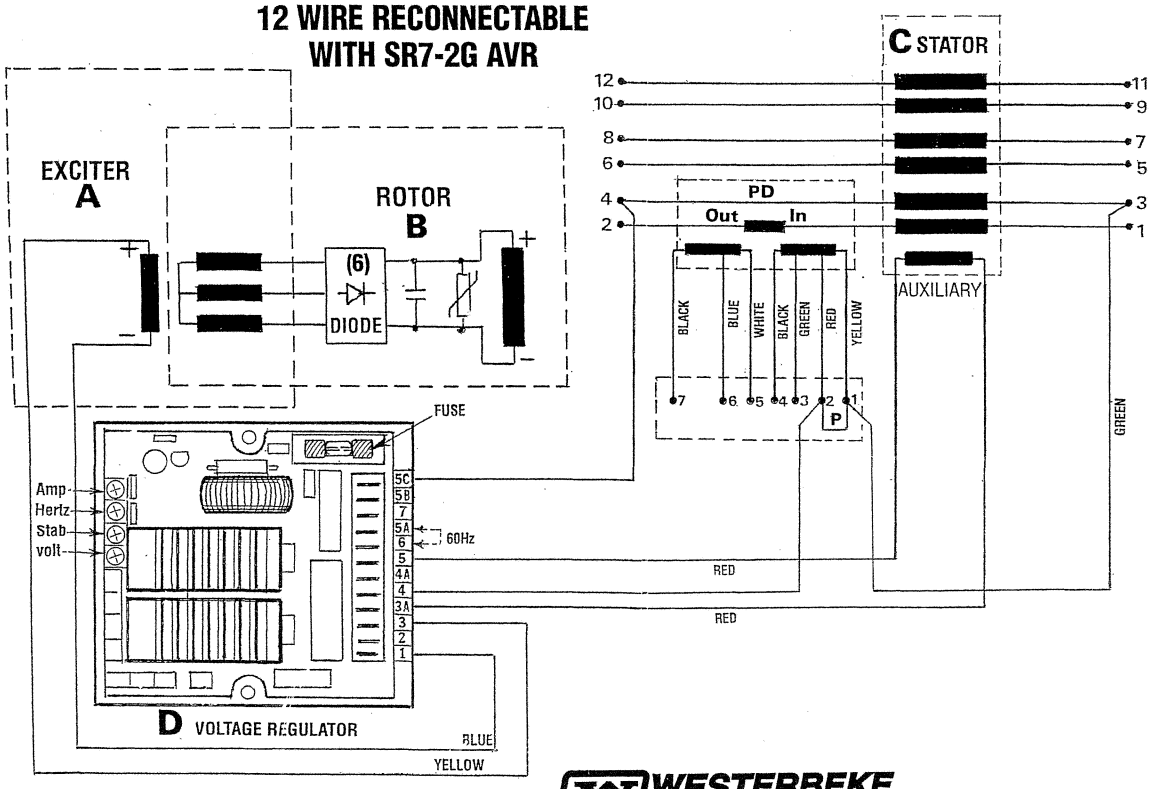
Amp: With this potentiometer, it is possible to adjust the intervention level of the overload protection. This protection system has an intervention delay, which permits a temporary overload, necessary when starting motors or similar applications.

To modify this protection, you must overload the generator by 15% of the normal load, turn the potentiometer to minimum (counterclockwise) and wait about twenty seconds. During this period of time the voltage value decreases. In this condition and while turning the potentiometer clockwise, fix the generator voltage value at 10% less than the nominal one. At this point, while the initial overload is being removed, the voltage increases to the nominal value.

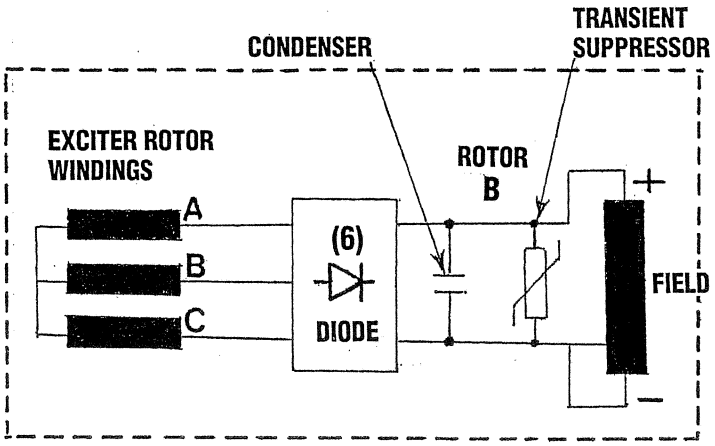
Fuse: The electronic regulator is equipped with a fuse, which protects the alternator from overheating in cases of regulator malfunction. The fuse (250V-5A, quick acting, F type) can be replaced easily.

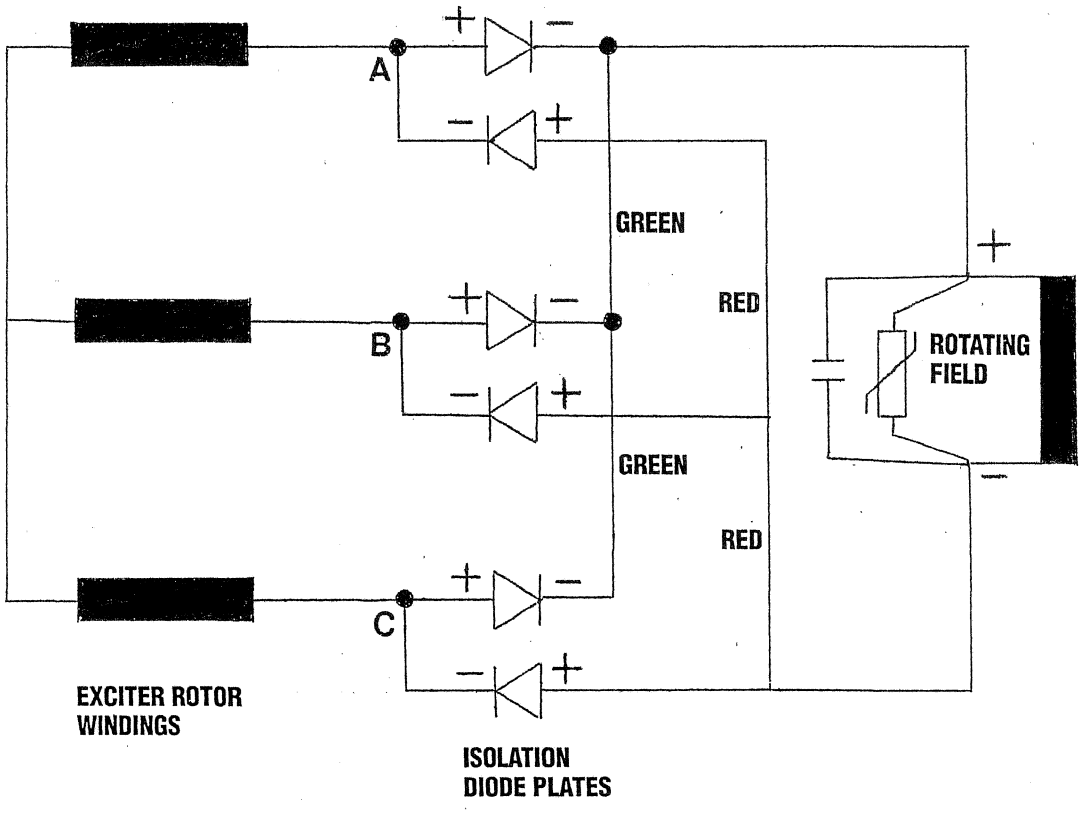


INTERNAL WIRING DIAGRAM 12 WIRE RECONNECTABLE WITH SR7-2G AVR



INTERNAL WIRING SCHEMATIC
EXCITER ROTOR/ROTATING FIELD





LAY-UP AND STORAGE

GENERAL

If your generator is to be out of operation for a long period of time, *WESTERBEKE* recommends the following procedures.

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

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

FRESH WATER COOLING CIRCUIT

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

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

LUBRICATION SYSTEM

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

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

Fuel System

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

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

CYLINDER LUBRICATION

If you anticipate a long lay-up period (12 months or more) WESTERBEKE recommends removing the glow plugs for access to the cylinders. Squirt light lubricating oil or Mystery Oil into the cylinders to aide in keeping the piston rings free.

Rotate the engine's crankshaft by hand two full revolutions and reinstall the glow plugs.

STARTER MOTOR

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

INTAKE MANIFOLD AND EXHAUST

Cover the air intake filter with a plastic bag to help prevent moist air from entering the cylinders. Close off the exhaust opening as well. Be sure to remove these covers when putting the unit back into service.

BATTERIES

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

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

GENERATOR

Refer to *GENERATOR MAINTENANCE* in this manual.

(CONT.)

LAY-UP AND STORAGE

RECOMMISSIONING

The recommissioning of your Westerbeke engine after a lengthy lay-up generally follows the same procedures as those described in the preparations for starting section regarding preparation for starting and normal starts. However, some of the lay-up procedures will need to be counteracted before starting the engine.

Remove the cover from the intake manifold, air filter and exhaust opening and make certain all engine and generator parts have been properly re-assembled and all wiring re-connected.

Re-install the batteries that were removed during the lay-up. and reconnect the battery cables, making sure the terminals are clean and that the connections are tight. Check to make sure that the batteries are fully charged.

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

Start the engine in accordance with procedures described in the *PREPARATIONS FOR STARTING* section of this manual, coolant levels, engine oil, etc.

SPARE PARTS

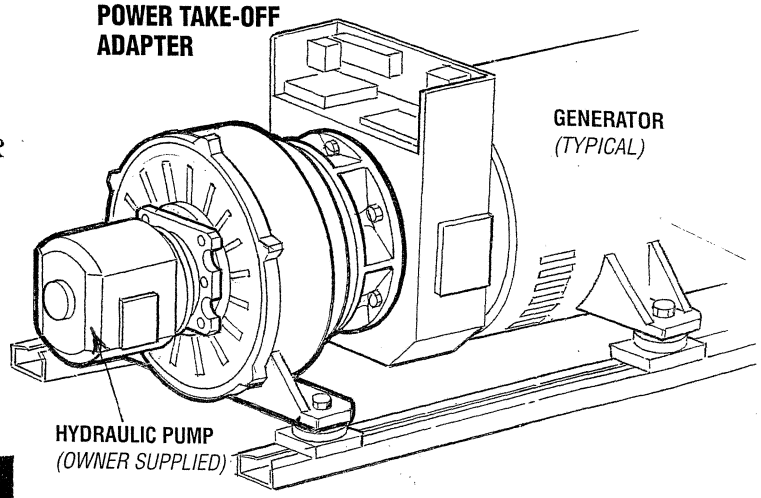
Lay-up time provides a good opportunity to inspect your Westerbeke engine to see if external items such as drive belts or coolant hoses need replacement. Check your basic spares kit and order items not on hand, or replace those items used during the lay-up, such as filters and zinc anodes. Refer to the *SPARE PARTS* section of this manual.

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.



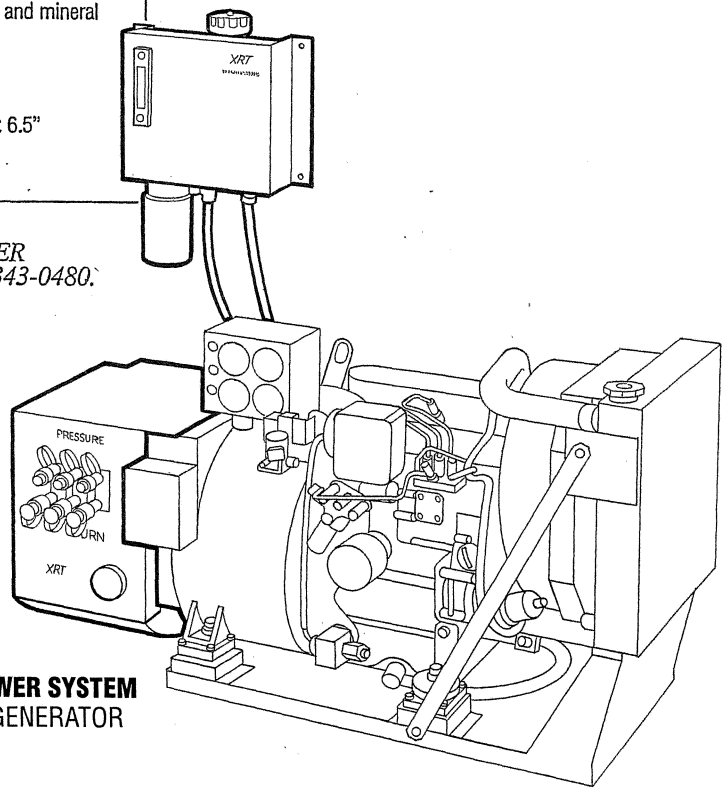
XRT POWER SYSTEM

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
WESTERBEKE GENERATOR

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

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

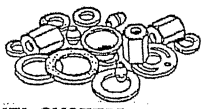
Miles Per Hour IMP (MPG) x .354 = Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L) x 2.352 = IMP MPG
Miles Per Gallons US (MPG) x .425 = Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L) x 2.352 = US MPG

TEMPERATURE

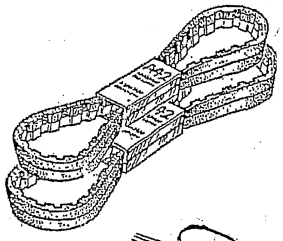
Degree Fahrenheit (°F) = (°C X 1.8) + 32
Degree Celsius (°C) = (°F - 32) x .56

SUGGESTED SPARE PARTS

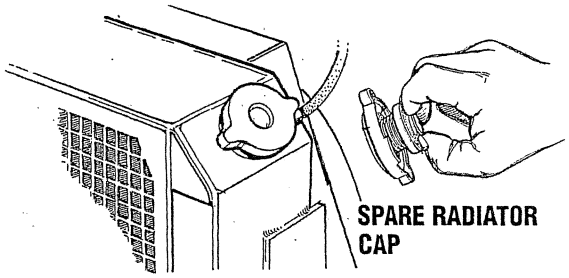
CONTACT YOUR WESTERBEKE DEALER FOR SUGGESTIONS AND ADDITIONAL INFORMATION



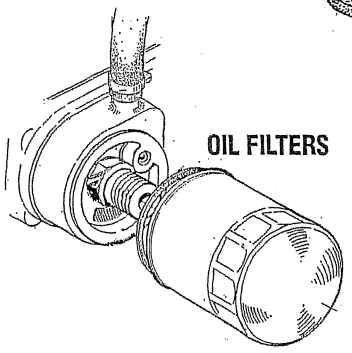
FUEL SYSTEM HARDWARE KIT



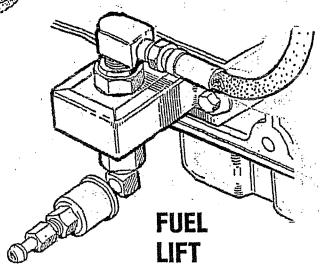
MATCHING DRIVE BELTS



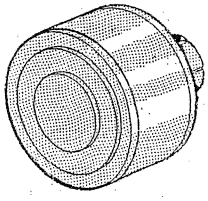
SPARE RADIATOR CAP



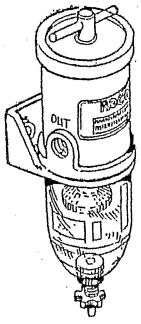
OIL FILTERS



FUEL LIFT PUMP

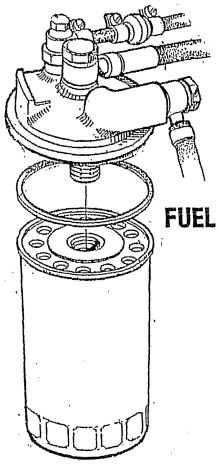


AIR CLEANER ELEMENT



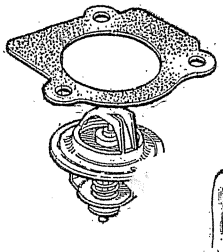
FUEL/WATER FILTER CARTRIDGE

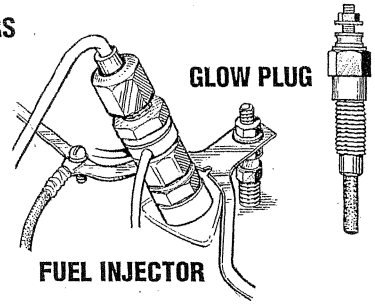
INLET FUEL FILTER



FUEL FILTERS

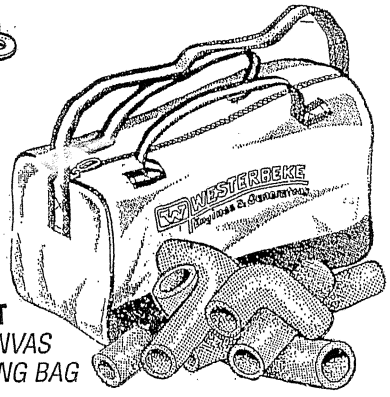
THERMOSTAT GASKET





GLOW PLUG

FUEL INJECTOR



MOLDED HOSE KIT
IN A CANVAS CARRYING BAG

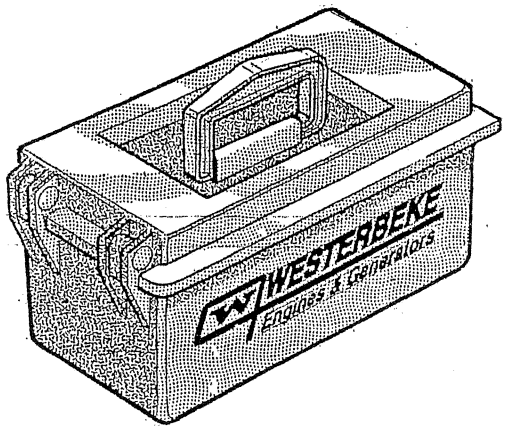
WESTERBEKE RECOMMENDS CARRYING ENOUGH SPARE ENGINE OIL (YOUR BRAND) FOR AN OIL CHANGE AND A GALLON OF PREMIXED COOLANT.

SPARE PARTS KITS

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

Kit A

Drive Belts
Oil Filter
Fuel Filter
Fuel System Hardware Kit
Fuel Pump Inlet Filter



Kit B

Drive Belts
Oil Filter
Fuel Filter
Fuel System Hardware Kit
Fuel Pump Inlet Filter
Injector
Overhaul Gasket Kit
Glow Plug

1240/3-2017