

# **OPERATORS MANUAL**

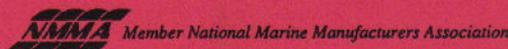
# **MARINE DIESEL ENGINES**

# **20B TWO / 30B THREE**

PUBLICATION NO.36906  
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WESTERBEKE CORPORATION • 150 JOHN HANCOCK ROAD  
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**CALIFORNIA  
PROPOSITION 65 WARNING**

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

**⚠ WARNING**

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

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

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



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

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

# SAFETY INSTRUCTIONS

## INTRODUCTION

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

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

## PREVENT ELECTRIC SHOCK

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

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

## PREVENT BURNS — HOT ENGINE

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

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

**⚠ WARNING: Steam can cause injury or death!**

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

## PREVENT BURNS — FIRE

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

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

## PREVENT BURNS — EXPLOSION

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

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

# SAFETY INSTRUCTIONS

## ACCIDENTAL STARTING

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

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

## BATTERY EXPLOSION

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

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

## TOXIC EXHAUST GASES

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

- Ensure that the exhaust system is adequate to expel gases discharged from the engine. Check the exhaust system regularly for leaks and make sure the exhaust manifolds are securely attached and no warping exists. Pay close attention to the manifold, water injection elbow, and exhaust pipe nipple.
- Be sure the unit and its surroundings are well ventilated.
- In addition to routine inspection of the exhaust system, install a carbon monoxide detector. Consult your boat builder or dealer for installation of approved detectors.
- For additional information refer to ABYC T-22 (educational information on Carbon Monoxide).

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

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

## AVOID MOVING PARTS

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

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

# SAFETY INSTRUCTIONS

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

## HAZARDOUS NOISE

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

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

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

## OPERATORS MANUAL

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

## ENGINE INSTALLATIONS

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

Sections of the ABYC standards of particular interest are:

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

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

## ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING DIESEL ENGINES

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

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

Order from:

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

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

Order from:

NFPA  
11 Tracy Drive  
Avon Industrial Park  
Avon, MA 02322

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

Order from:

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

# INSTALLATION

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

## CODES AND REGULATIONS

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

## SIPHON-BREAK

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

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

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

## EXHAUST SYSTEM

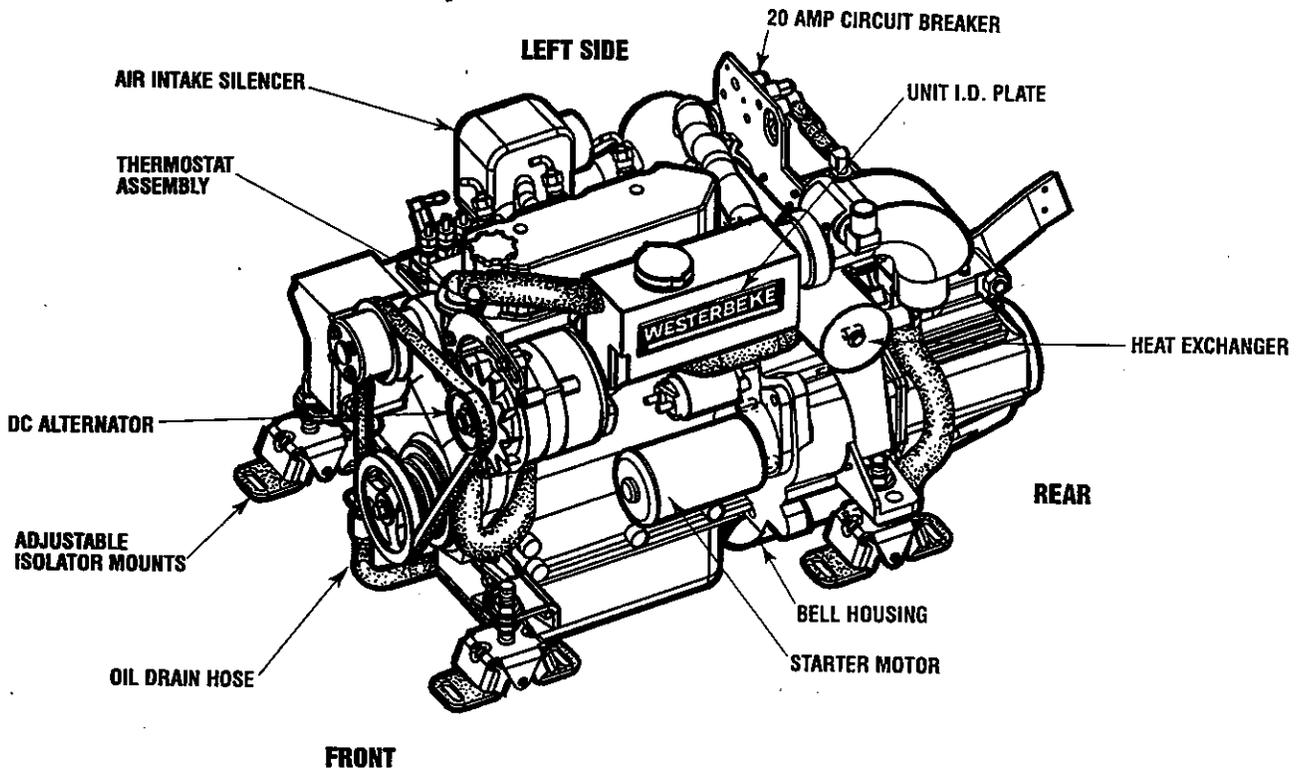
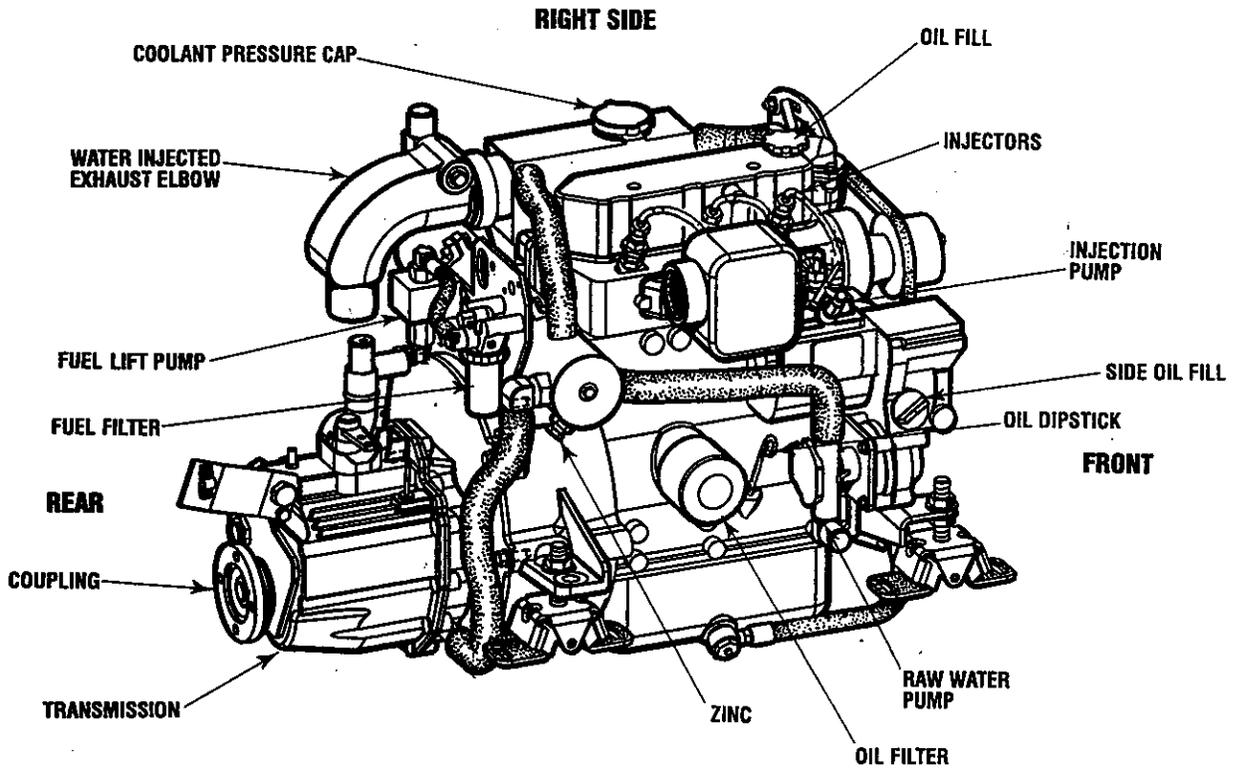
The exhaust hose must be certified for marine use. The system must be designed to prevent water from entering the exhaust under any sea conditions and at any angle of the vessels hull.

**A detailed 40 page Marine Installation Manual covering gasoline and diesel, engines and generators, is available from your WESTERBEKE dealer.**

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# PARTS IDENTIFICATION



## IMPORTANT

### PRODUCT SOFTWARE DISCLAIMER

Product software of all kinds, such as brochures, drawings, technical data, operator's and workshop manuals, parts lists and parts price lists (and other related information), instructions and specifications provided from sources other than Westerbeke, is not within Westerbeke's control and, accordingly, is provided to Westerbeke customers only as a courtesy and service. WESTERBEKE CANNOT BE RESPONSIBLE FOR THE CONTENT OF SUCH SOFTWARE, MAKES NO WARRANTIES OR REPRESENTATIONS WITH RESPECT THERETO, INCLUDING THE ACCURACY, TIMELINESS OR COMPLETENESS THEREOF, AND WILL IN NO EVENT BE LIABLE FOR ANY TYPE OF DAMAGES OR INJURY INCURRED IN CONNECTION WITH, OR ARISING OUT OF, THE FURNISHING OR USE OF SUCH SOFTWARE.

For example, components and subassemblies incorporated into Westerbeke's products and supplied by others (such as engine blocks, fuel systems and components, transmissions, electrical components, pumps and other products) are generally supported by their manufacturers with their own software, and Westerbeke must depend on such software for the design of Westerbeke's own product software. Such software, however, may be outdated and no longer accurate. Routine changes made by Westerbeke's suppliers, of which Westerbeke rarely has notice in advance, are frequently not reflected in the supplier's software until after such changes take place.

Westerbeke customers should also keep in mind the time span between printings of Westerbeke product software, and the unavoidable existence of earlier, non-current Westerbeke software editions in the field. Additionally, most Westerbeke products include customer-requested special features that frequently do not include complete documentation.

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 currency of the product software being consulted by the customer.

## GENERAL

### INTRODUCTION

This manual contains the equipment operating procedures as well as additional information needed to help the operator keep the marine equipment in proper working order. Study and follow the instructions carefully. A planned maintenance program is included in this manual; adhering to the program will result in better equipment performance and longer equipment life. Proper diagnosis of a problem is the most important step to satisfactory repair, consequently, a troubleshooting table is included.

### UNDERSTANDING THE DIESEL ENGINE

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

Therefore, to a great extent, a diesel engine requires the same preventive maintenance as a gasoline engine. The most important factors are proper ventilation and proper maintenance of the fuel, lubricating and cooling systems. Replacement of fuel and lubricating filter elements at the time periods specified is a must, and frequent checking for contamination (that is, water, sediment, or algae) in the fuel system is also essential. Another important factor is the use of the same brand of high detergent diesel lubricating oil designed specifically for diesel engines. Be careful not to put gasoline in the diesel fuel tank(s). Gasoline does not have the same lubricating qualities as diesel fuel; consequently, gasoline in the fuel lines will damage components in the lift pump assembly, fuel injection pump, and in the injectors.

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 are two components - the fuel injection pump and fuel injectors.

### ORDERING PARTS

When contacting your Westerbeke dealer, parts distributor, or the factory concerning your Westerbeke unit, always provide the engine's model and serial number, and transmission number as they appear on the black and silver "Westerbeke" plate which is mounted on the engine's exhaust manifold.

Note that component locations in the manual are referenced from the front of the engine which is the pulley/drive belt end. (The flywheel/generator end is the rear end.) Left and right sides are determined by the engine; imagine straddling the engine and facing in the same direction as the front of the engine; the left side is at your left, the right side is at your right.

Westerbeke engines are thoroughly checked and given a final run under various load conditions before leaving the factory. This is done to ensure dependable operation, long service, and a satisfied owner. Care at the factory during assembly and thorough testing have resulted in Westerbeke units being capable of many thousands of hours of dependable service. However, the manufacturer cannot control the type of treatment a unit receives in the field. This part is up to the owner/operator.

## FOREWORD

Thank you for selecting a Westerbeke marine product for your use. We at Westerbeke are pleased to have you as a customer.

Read this manual carefully and observe all safety precautions included throughout. Operating procedures, periodic preventive maintenance procedures, installation checks, system descriptions and minor adjustment procedures are included herein so you can operate your equipment safely and properly, maintain the equipment at a high level of efficiency, and expect dependable performance and long service life in return.

Should your unit require special attention, contact your Westerbeke dealer for assistance. The Westerbeke Service Organization is trained to provide the support necessary to ensure long-term dependable performance.

If, within 60 days of submitting the Warranty Registration Form for your unit, you have not received a Customer Identification Card (see below) registering your warranty, please contact the factory in writing with Model information, including the engine's serial number and commission date.

<p><b>from:</b> WESTERBEKE CORPORATION AVON INDUSTRIAL PARK AVON, MA 02322</p>	<p> <b>Customer Identification</b> WESTERBEKE OWNER MAIN STREET HOMETOWN, USA</p>
<p><b>Mail To:</b></p>	<p>Model 30B THREE. Ser. #D703XXXX Expires 9/20/02</p>

### Inspection of Equipment

The engine is shipped from the factory mounted securely and properly crated. Accessory equipment is shipped in a separate small box, usually packed within the engine's crate.

Before accepting shipment of the engine from the transportation company, the crate should be opened and the contents inspected for concealed damage. If either visible or concealed damage is noted, you should require that the delivery agent sign "Received in damaged condition" on the proper delivery receipt. Also check the contents of the shipment against the packing list and make sure that the proper notation is made if any discrepancies exist. These noted discrepancies are your protection against loss or damage. Claims concerning loss or damage *must* be made to the *carrier*, not to the Westerbeke Corporation.

UNIT I.D. PLATES



20B TWO UNIT I.D. PLATE



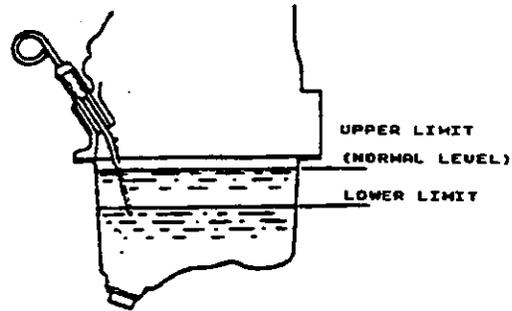
30B THREE UNIT I.D. PLATE

The unit I.D. plate is attached to the exhaust manifold of the engine. These illustrations are provided so that the owner/operator may transcribe the specifications and serial number from the I.D. plate on the engine to one of the illustrations above. This will allow for easy reference when seeking parts, service or technical needs.

## PREPARATION FOR STARTING

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

Fill your engine with oil up to or near the upper limit on the dipstick (the installation angle may have an effect on the dipstick reading). Select readily available lubricating oil with an API specification of CF or CG-4 and an SAE number suitable for the temperature in your operating area. For the quantity of oil needed in your engine, refer to the "SYSTEM SPECIFICATION" section of this manual.



Fill the transmission to the **FULL** mark on the dipstick with the correct lubricant. (Refer to the "SYSTEM SPECIFICATIONS" section of this manual, page 11 for the 20B TWO and page 14 for the 30B THREE.)

Each unit is supplied with a coolant recovery kit (#24977) as standard equipment, to which the following applies:

- A. Remove the pressure cap from the engine's exhaust manifold and slowly fill the engine's cooling system with a mixture of water and antifreeze suitable for your temperature zone. (See the "COOLING SYSTEM" section of this manual. Operate the engine and observe the coolant level in the manifold. Maintain this level to the base of the filler neck. Once the engine reaches its operating temperature (170 - 190° F), make sure there is coolant flow to the domestic water heaters when installed. Top off the cooling system and install the pressure cap.
- B. Make sure the plastic recovery tank is properly mounted near the unit (with the bracket provided), in a location where it can be monitored and filled easily. The recovery tank should be mounted at manifold level or above. In those installations that require it, the plastic recovery tank can be mounted below the exhaust manifold's level.
- C. Add coolant to the plastic tank after the engine has been started and operating temperature has been reached, to make sure all air is expelled from the manifold and the engine's cooling system. With the manifold filled and the pressure cap installed, fill the plastic recovery tank half full. Monitor daily and add coolant as needed.

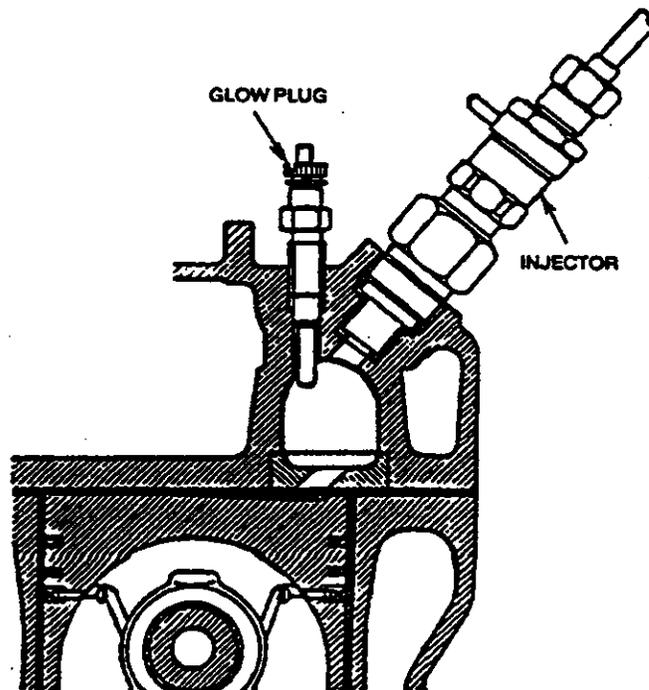
Fill the fuel tank with a good grade of No.2 diesel fuel and manually prime the fuel system up to and including the engine. When running fuel is free of air, the engine's fuel system is bled and the engine is ready to start.

Make sure the Installation Checks have been made in accordance with those specified in the "INSTALLATION CHECKS" section of this manual.

## Description of Starting System

All Westerbeke diesel engines use electric starters assisted by glow plugs for both normal and cold weather starting. The figure below shows a cross-sectional view of one cylinder. The glow plug is located in the combustion chamber so that its tip is in the injector nozzle's spray path. When the glow plug is energized by the PREHEAT button, the plug glows red at the tip and assists in igniting the fuel. The result is a rapid start with less wear on the starter.

This system is common to Westerbeke Diesels. The start circuitry is designed so that the PREHEAT button must be depressed for the time specified in the "Preheat" chart shown on page 13. Then, while keeping the PREHEAT button engaged, the START button is depressed to crank the engine.

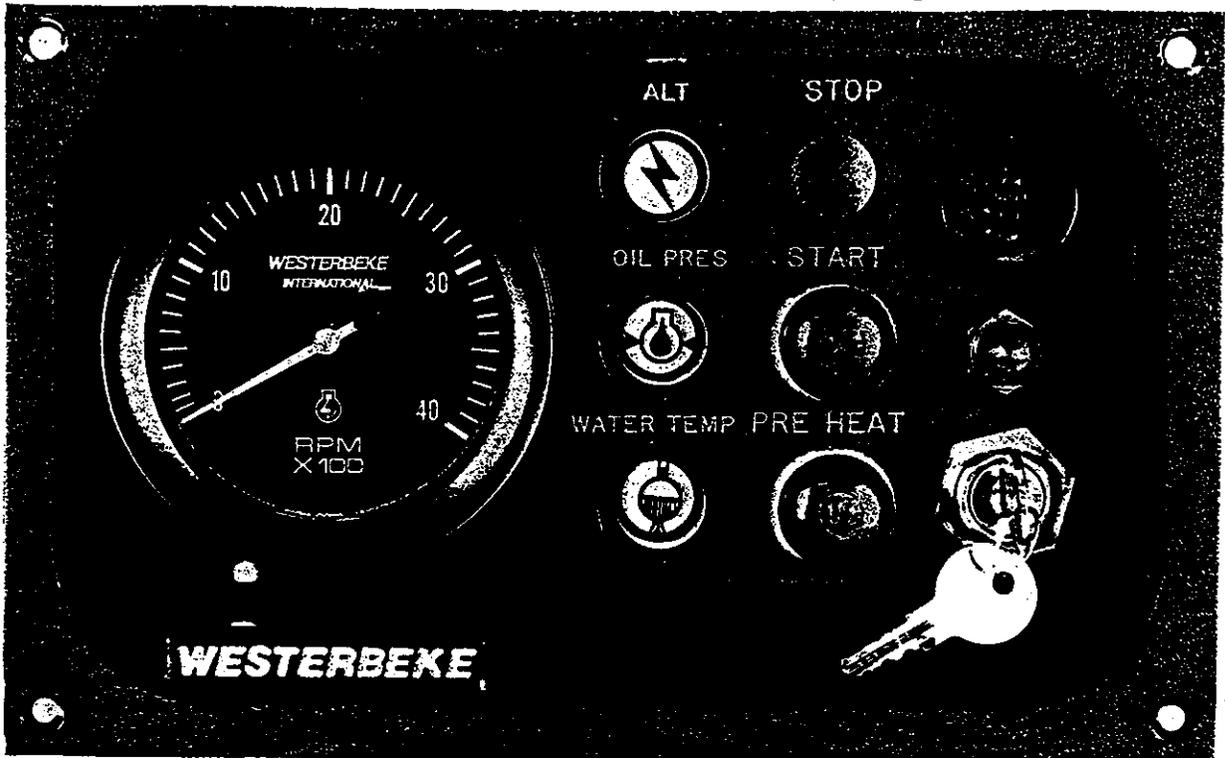


Combustion Chamber

**NOTE:** The START button will not energize unless the PREHEAT button is depressed. When depressing the preheat switch, we are activating the glow plugs in the cylinder head, so use the preheat intermittently so as not to overheat the glow plugs.

## ENGINE CONTROL PANELS

Westerbeke offers two types of control panels as optional equipment.  
Read the following instructions that apply to the panel you purchased with your engine.



CAPTAIN PANEL

### GENERAL

This manually-operated control panel is equipped with a Key Switch; an RPM gauge; PREHEAT and START buttons; an instrument test button; three indicator lamps, one for alternator discharge, one for low oil pressure, and one for high engine coolant temperature; and an alarm buzzer for low oil pressure or high water temperature. The RPM gauge is illuminated when the key switch is turned ON and remains illuminated while the engine is in operation. The key switch and the three buttons serve the following functions:

1. Key Switch: The Key Switch provides power only to the instrument panel cluster. Be aware that the key switch does not shutdown the engine when the key is turned OFF. Refer to the "STOPPING PROCEDURE" section of this manual.
2. PREHEAT: The PREHEAT button energizes the alternator's regulator, the engine's glow plugs, and bypasses the engine's oil pressure alarm switch. In addition, this button energizes the START button.
3. START: The START button, when pressed, energizes the starter's solenoid which cranks the engine. This button will not operate electrically unless the PREHEAT button is pressed and held at the same time.
4. Test Button: The Test Button, located above the key switch, tests the alternator, the oil pressure, and the water temperature control circuits. When this button is pressed, the alternator, the oil pressure, and the water temperature indicator lights illuminate in addition to sounding the buzzer.

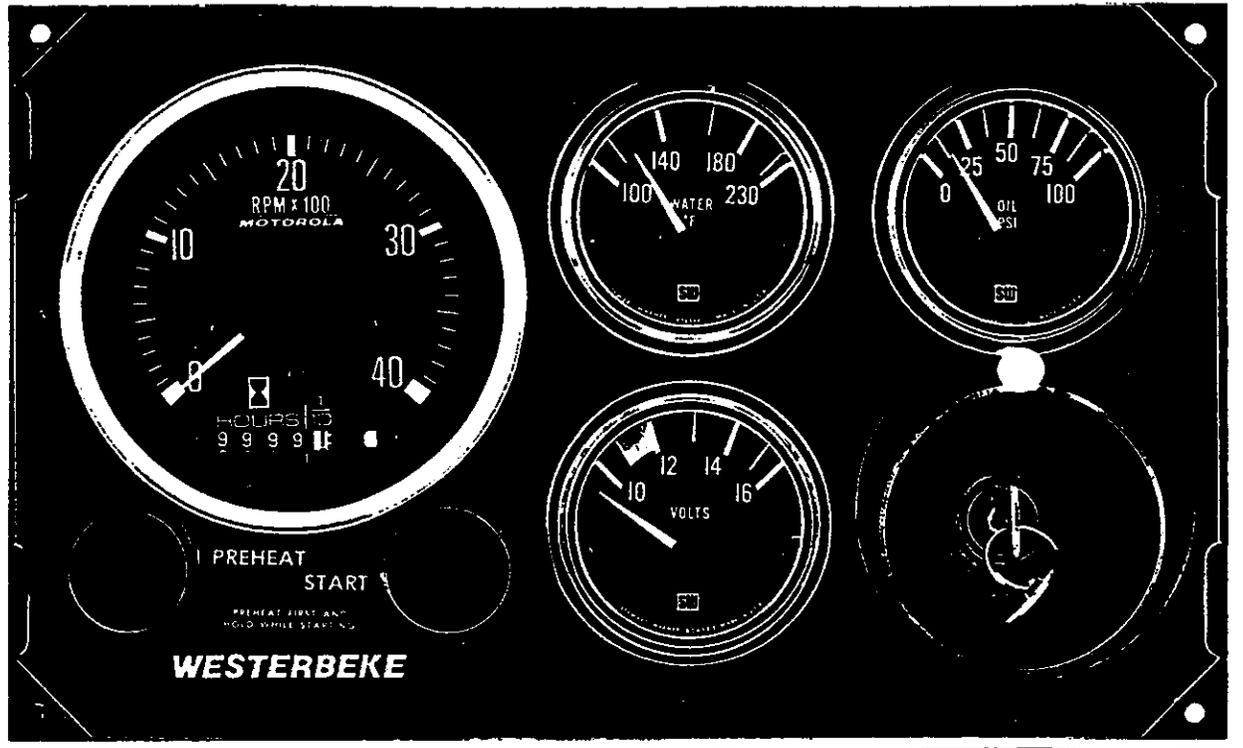
5. Alarm: The alarm is located above the test button and will sound if the engine's oil pressure falls below 15 psi. In this event, the alarm will emit a *pulsating* signal. The alarm will also sound if the water temperature in the fresh water cooling circuit rises to 205° F. In this event, the alarm will emit continuous signals.

**NOTE:** The alarm will sound when the Key Switch is turned ON. This sounding is normal for the engines covered in this manual. Once the engine starts, and the engine's oil pressure reaches 15 psi, the alarm will silence.

\*6. Water Temperature Gauge: This gauge is graduated in degrees Fahrenheit and is illuminated while the Key Switch is turned ON. The engine's normal operating temperature is 170 - 190° F (77 - 88° C).

\*7. Oil Pressure Gauge: This gauge is graduated in pounds per square inch (PSI) and is illuminated while the Key Switch is turned ON. The engine's normal operating oil pressure ranges between 30 - 60 PSI.

\*NOTE: When the engine is manually shut down, and the engine's Key Switch is turned OFF, the water temperature gauge will continue to register the last temperature reading indicated by the gauge before electrical power was turned OFF. The oil pressure gauge will fall to zero when the Key Switch is turned OFF. The temperature gauge will once again register the engine's true temperature once electrical power is restored to the gauge.



**Admirals Panel**

### **General**

This manually-controlled control panel is equipped with a key switch and an RPM gauge with an ELAPSED TIME meter which measures the engine's running time in HOURS and in 1/10 hours. The panel also includes a water temperature gauge which indicates water temperature in degrees Fahrenheit (WATER ° F), an oil pressure gauge which measures the engine's oil pressure in pounds per square inch (OIL PSI), and a DC control circuit voltage gauge which measures the system's voltage (VOLTS). All gauges are illuminated when the key switch is turned ON and remain illuminated while the engine is in operation. The panel also contains two rubber-booted push buttons, one for PREHEAT and one for START.

1. **Key Switch:** The Key Switch provides power only to the instrument cluster. Be aware that the key switch does not shutdown the engine when the key is turned OFF. Refer to the "STOPPING PROCEDURE" section of this manual.
2. **PREHEAT:** The PREHEAT button energizes the alternator's exciter, the engine's glow plugs, and bypasses the engine's protective oil pressure switch. In addition, this button energizes the START button.
3. **START:** The START button, when pressed, energizes the starter's solenoid which cranks the engine. This button will not operate electrically unless the PREHEAT button is pressed and held at the same time.

5. **Alarm:** The alarm is located above the test button and will sound if the engine's oil pressure falls below 15 psi. In this event, the alarm will emit a *pulsating* signal. The alarm will also sound if the water temperature in the fresh water cooling circuit rises to 210° F. In this event, the alarm will emit *continuous* signal.

**NOTE:** The alarm will sound when the Key Switch is turned ON. This sounding is normal for the engines covered in this manual. Once the engine starts, and the engine's oil pressure reaches 15 psi, the alarm will silence.

\*6. **Water Temperature Gauge:** This gauge is graduated in degrees Fahrenheit and is illuminated while the Key Switch is turned ON. The engine's normal operating temperature is 170 - 190° F (77 - 88°C).

\*7. **Oil Pressure Gauge:** This gauge is graduated in pounds per square inch (PSI) and is illuminated while the Key Switch is turned ON. The engine's normal operating oil pressure ranges between 30 - 60 PSI.

**\*NOTE:** When the engine is manually shut down, and the engine's Key Switch is turned OFF, the water temperature gauge will continue to register the last temperature reading indicated by the gauge before electrical power was turned OFF. The oil pressure gauge will fall to zero when the Key Switch is turned OFF. The temperature gauge will once again register the engine's true temperature once electrical power is restored to the gauge.

**NOTE:** A separate alarm buzzer with harness is supplied with every Admiral Panel. The installer is responsible for electrically connecting the buzzer to the four-pin connection on the engine's electrical harness. The installer is also responsible for installing the buzzer in a location will be dry and where it will be audible to the operator should it sound while the engine is running. The buzzer will sound when the ignition key is turned ON and should silence when the engine has started and when the engine's oil pressure rises above 15 psi.

## STARTING PROCEDURE

Place the transmission in the NEUTRAL position and advance the throttle to its full open position for a cold engine, and partially open for a warm engine.

Turn the Key Switch to the ON position (2 o'clock); prime the engine's fuel system at the mechanical fuel pump to bleed all the air from the fuel system, if needed (see page 39).

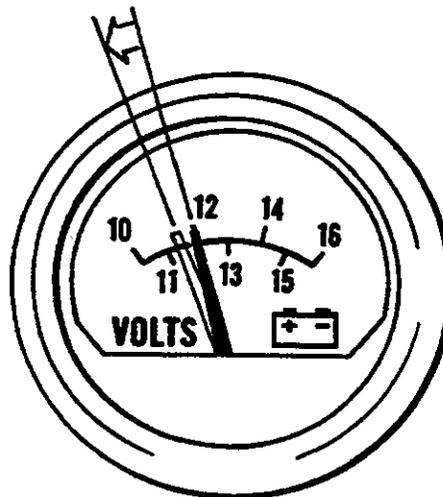
Depress and hold the PREHEAT switch. Preheat according to the following chart:

Atmospheric Temperature	Preheating Time
+41° F (+5° C) or higher	Approx. 05 sec.
+41° F (+5° C) to +23° F (-5° C)	Approx. 10 sec.
+23° F (-5° C) or lower	Approx. 15 sec.
Limit of continuous use	30 seconds before cranking

Proper glow plug function is indicated by a voltmeter drop when the PREHEAT switch is depressed. This drop will be slight but discernible. If no voltage drop is noted, it may indicate defective glow plugs or a faulty preheat circuit (check for loose connections).

While holding the PREHEAT button depressed, depress the START button. The starter motor will run, thereby cranking the engine. As soon as the engine runs, release the START button and PREHEAT button. Check your instrumentation for proper engine operation. Make sure sea water discharges along with the exhaust discharge.

Should the engine not start when the START button is depressed for 10 to 12 seconds, release both buttons and wait 30 seconds; repeat the previous procedure. Never run the starter motor for more than 30 seconds at a time.



### CAUTION

Prolonged cranking intervals without the engine starting can result in filling the engine-mounted exhaust system with sea water coolant. This may happen because the sea water pump is pumping sea water through the sea water cooling system during cranking. This sea water can enter the engine's cylinder's by way of the exhaust manifold once the exhaust system fills. Prevent this from happening by closing the sea water supply through-hull shut-off, drain the exhaust muffler, and correct the cause for the excessive engine cranking needed to obtain a start. Engine damage resulting from this type of sea water entry is not a warrantable issue; the owner/operator should keep this in mind.

Once the engine starts, run it at idle for a few minutes to warm up the engine and check instruments for proper oil pressure and battery charging voltage. Never attempt to engage the starter while the engine is running.

**NOTE:** Some unstable running may occur in a cold engine, but this condition should smooth out as the operating temperature of 170 - 190° F (77 - 88° C) is reached.

### STOPPING PROCEDURE

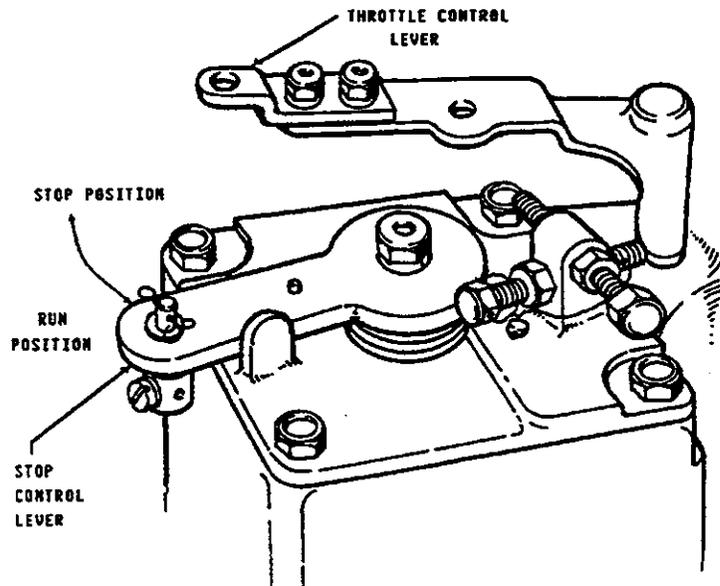
A manual pull type stop control (tee handle or knob) is provided by the installer in a location close to the engine's controls. Know the location of this control before attempting to start the engine. To stop the engine, pull out on this tee handle or knob fully and hold it out until the engine comes to a complete stop. Push back on this control to return it to the engine run position otherwise the engine will not restart.

With the engine stopped, turn the key switch turned to the OFF position (12 o'clock). If the Key Switch is left ON, the battery will discharge. An engine alarm buzzer is provided to warn the operator of this condition (Key Switch ON). The best method of preventing the battery from discharge is to remove the key from the Key Switch after stopping the engine.

### CAUTION

**DO NOT** attempt to shutdown the engine by turning the Key Switch OFF. The Key Switch only provides power to the instrument panel: the engine will continue running even if the Key Switch is turned OFF. Shut down the engine by pulling the stop control out fully.

(An optional key shut off package is available, that allows the operator to shut off the engine by turning the Key Switch OFF which turns OFF an electrically run Fuel Run Solenoid. This electrical shut off option is installed at the factory upon the specific request/order of the owner.)



## **Engine Break-In Procedures**

Although your engine has experienced a minimum of one hour of test operations to ensure accurate assembly and proper operation of all systems, break-in time is required. The service life of your engine is dependent upon how the engine is operated and serviced during its initial 50 hours of use.

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:

1. Start the engine according to the "STARTING PROCEDURE" section found in this manual. Run the engine at fast idle while checking that all systems (sea water pump, oil pressure, battery charging) are functioning.
2. Allow the engine to warm up (preferably by running at fast idle) until the water temperature gauge moves into the 130-140° F range.
3. While using the vessel, run the engine at varying engine speeds for the first 25 hours.
4. Avoid rapid acceleration, especially with a cold engine.
5. Use caution not to overload the engine. The presence of a gray or black exhaust, and the inability of the engine to reach its full rated speed, are signs of an overload.
6. During the next 25 hours, the engine may be operated at varying engine speeds, with short runs at full rated rpm. Avoid prolonged idling during this break-in period.

Breaking-in a new engine basically involves seating the piston rings to the cylinder walls. This cannot be accomplished by long periods of running at idle, nor by early running at full rpm.

Idle running may glaze the cylinder walls, resulting in excessive oil consumption and smoky operation. Excessive speed or heavy overloading, especially with a cold engine, may cause scoring of the cylinder walls, producing similar results.

As indicated above, operate the engine in moderation during the 50-hour break-in period. (Don't baby the engine, but do not abuse it.)

## **Starting Under Normal Conditions**

Follow the procedure below for normal starting of the engine:

1. Check the engine and transmission lubricant levels and fill, if necessary.
2. Make sure there is sufficient fuel on board. Keep fuel tank(s) as full as possible. Check the fuel filters and water separators for the presence of contaminants and/or water. Drain and clean them as needed.
3. Check the coolant level in the plastic recovery tank. Add coolant solution as needed.

**NOTE:** Excessive loss of coolant from the plastic recovery tank indicates a cooling system leak. Check the entire cooling system and pressurize the system to locate the leak. In cases of excessive coolant loss, the system must be refilled as outlined under the "PREPARATION FOR STARTING" section of this manual.

4. Check for oil and fuel leaks, particularly if signs of such leaks are found on the bottom of the engine or below the engine.

Start the engine in accordance with the "STARTING PROCEDURE" instructions found in this manual. Allow the engine's operating temperature to reach 140 - 150 F before operating the engine underway.

## **Starting Under Cold Conditions**

Under extremely cold temperatures, the following conditions can occur. Follow the instructions listed below when operating your engine in cold weather.

**LUBRICATING OIL TURNS VISCOUS** - Make certain that the lubricating oil used conforms with the ratings for the prevailing atmospheric temperature. Refer to the "LUBRICATION SYSTEM" section of this manual.

**VOLTAGE ACROSS THE BATTERY TERMINALS DROPS** - Make certain that the battery is fully charged to minimize voltage drop across the battery terminals.

**THE TEMPERATURE OF THE INTAKE AIR IS LOW AND THE COMPRESSION TEMPERATURE DOES NOT RISE ENOUGH** - Allow the glow plugs to operate sufficiently to aid in starting during the preheat period whenever the temperature of the intake air is low and when the compression temperature does not rise enough. Refer to the preheat chart found in the "STARTING PROCEDURE" section.

## FUEL SYSTEM

### Diesel Fuel

Use No. 2 diesel fuel with a cetane rating of 45 or higher. Never use kerosene or home heating oil.

In cold weather particularly, water vapor is produced by condensation when air is present in the fuel tank. Keep fuel tank(s) full and completely free of dirt and water.

### Fuel Filter/Water Separators

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

Most installers included with the generator installation package a type of filter/water separator for they are aware of the problems contaminants in the fuel can cause - all of which are not warrantable through Westerbeke.

A typical fuel filter/water separator is illustrated in this diagram. This is the Raycor Model 500MA. 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.

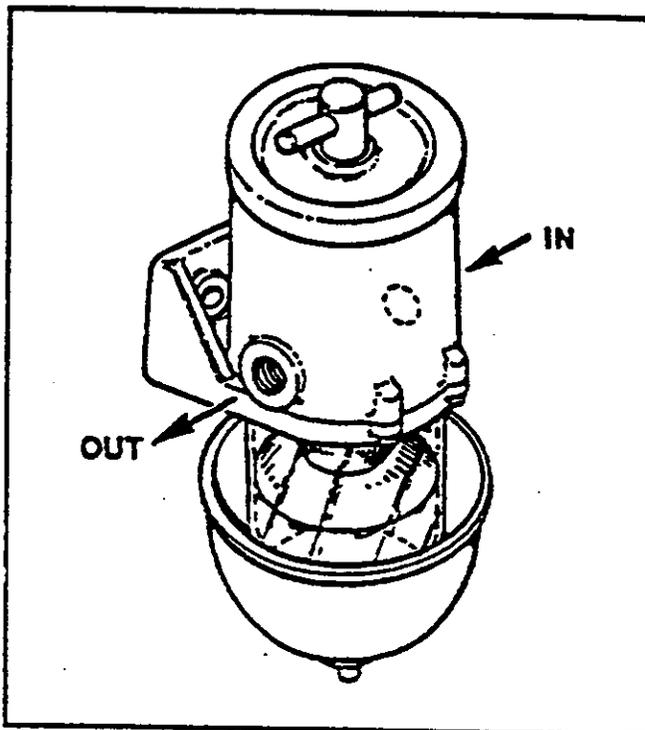
In addition, any gasoline in the fuel system will damage the engine's fuel injection pump assembly and injectors as gasoline does not have the same lubricating qualities as diesel fuel.

If a filter/water separator is not installed between the fuel tank and the engine-mounted fuel system, water in the fuel system will inhibit proper starts and particles will pass on to the lift pump's filter, eventually clogging it and pass on into the engine's injection equipment.

### Notes on Fuel System

#### WARNING

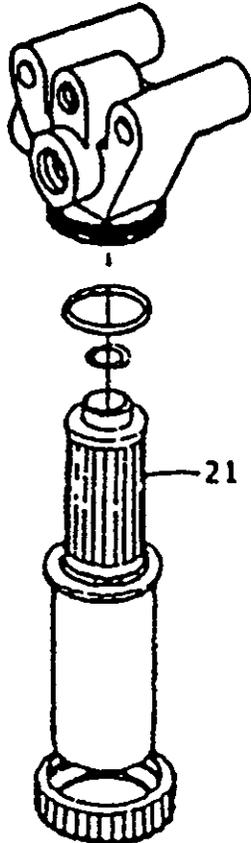
Shut off the fuel service valve at the tank when servicing the fuel system. Take care in catching any fuel that may spill from within the pump when the base is removed. **DO NOT** allow any smoking, open flames, or other sources of fire near the fuel system when servicing. Ensure proper ventilation exists when servicing the fuel system.



Fuel Filter/Water Separator

## Priming the Fuel System

The models covered by this manual have a single replaceable fuel filter in the engine-mounted fuel system. This filter is located between the engine mounted electric fuel pump and the inlet to the fuel injection pump. The exploded view below shows this filter element as item #21. Servicing this filter element is explained a few pages further in this manual. When the filter element in this cannister has been changed, the air in the system is bled out by simply turning on the panel key switch which energizes the fuel pump. The pump delivers fuel to the system which pushes the air out. Allow the fuel pump to operated for approximately on minute to accomplish this.



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



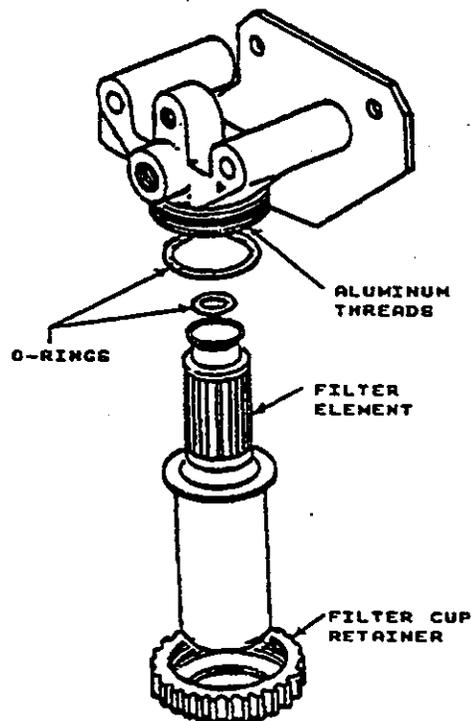
The Westerbeke fuel system bleed is manual in operation. While it is unlikely that the operator will be forced to service the system at sea, the possibility does exist. Therefore, we recommended that a replacement fuel filter be carried on board at all times. Each fuel filter comes with two O-ring gaskets. Select the part number for this fuel filter from your Parts List and purchase spares from your local Westerbeke Dealer or Distributor.

If a leak should develop at a fuel banjo or sealing washer location that cannot be remedied by a slight tightening of the filter cup retainer, replace the filter along with the O-rings supplied with the new filter.

### Replacing the Fuel Filter Element

After the first 50 hours of operation, loosen the filter cup retainer and remove the filter cup. *Be careful in catching any fuel that may spill from within the filter cup.* Discard the old filter element and the old O-rings. Clean the filter cup and install the new filter along with the new O-rings. Carefully replace the filter cup and retainer. Take care not to cross thread the retainer when threading on to the filter bracket.

**NOTE: DO NOT** over-tighten the filter cup retainer; excessive tightening can strip the soft aluminum threads on the fuel filter assembly.

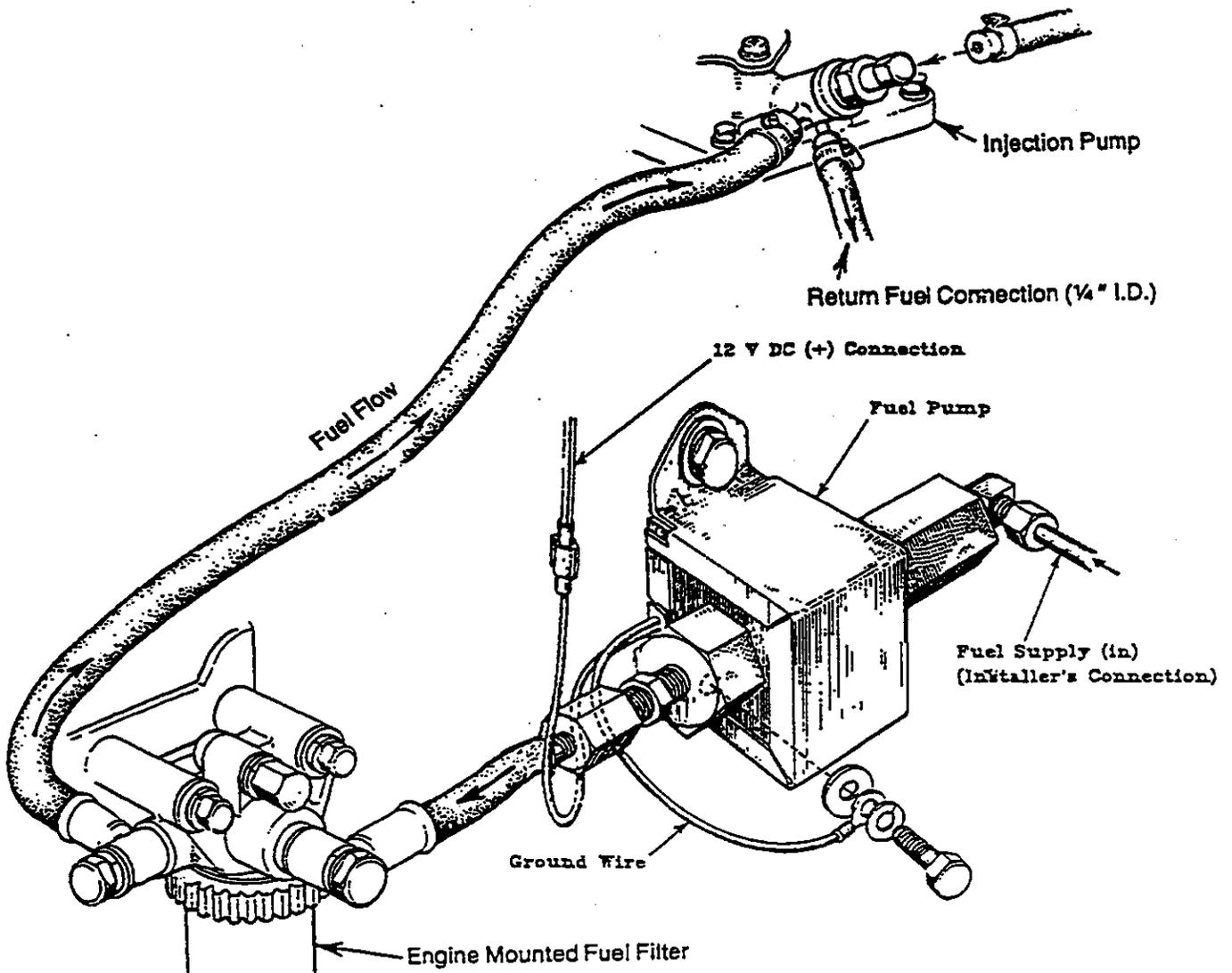


After the first 50-hour change, the change period may be increased to 200 hours or once per season.

## Fuel Injection Pump

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

Idle speed and timing adjustment are the only adjustments the servicing dealer can perform on the injection pump. Other types of adjustments or repairs must be performed by a qualified injection service shop.



## ELECTRICAL SYSTEM

### Engine 12-Volt DC Control Circuit

The Westerbeke models 20B TWO and 30B THREE propulsion engines each have a 12-Volt DC electrical control circuit, as shown on the wiring diagrams which follow. Refer to these diagrams when troubleshooting or servicing electrical components on the engine.

#### CAUTION

To avoid damage to the battery charging circuit, never shut off the engine battery switch while the engine is running.

However, shut off the engine battery switch to avoid electrical shorts when working on the engine electrical circuit.

### Battery Specification

The minimum recommended capacity of the battery used in the engine's 12-Volt DC control circuit is 90 - 125 Ampere-hours (minimum).

#### CAUTION

When quick-charging the battery with an external charger, be sure to disconnect the battery cables from the battery. Leaving the charging circuit connected while quick-charging will damage the alternator's diodes.

### Alternator

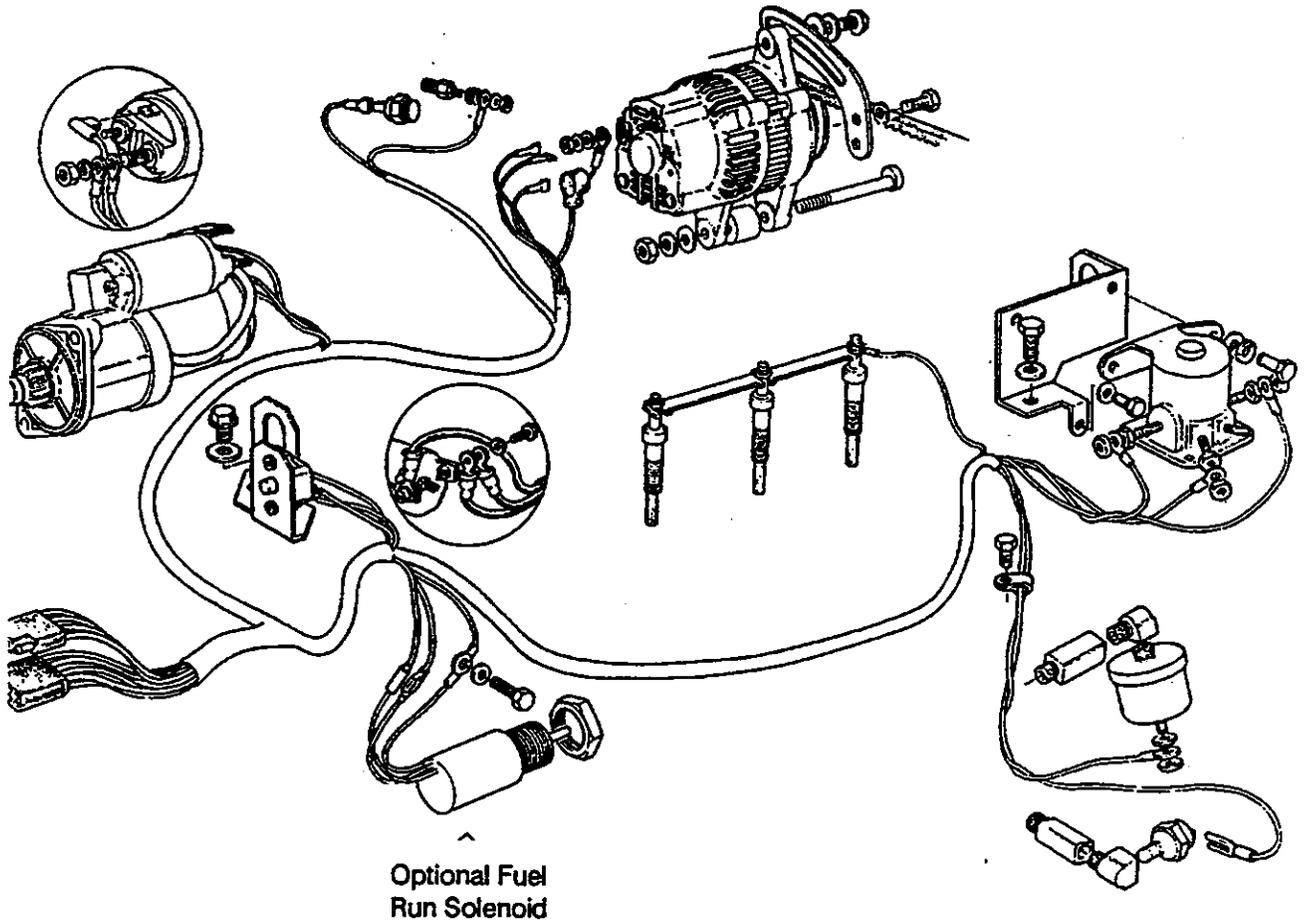
#### CAUTION

When testing the alternator circuit (charging circuit), do not use a high-voltage tester such as a megger; damaged diodes could result.

During high-speed operation of the engine, do not disconnect the positive terminal of the battery from the B terminal of the alternator, nor disconnect the negative terminal of the battery from the ground.

When cleaning the engine with a steam cleaner, be careful to keep steam away from the alternator.

Illustrated below is a wiring harness for the 30B THREE's electrical system. The wiring harness for the 20B TWO's electrical system differs only in that it has one less glow plug terminal.

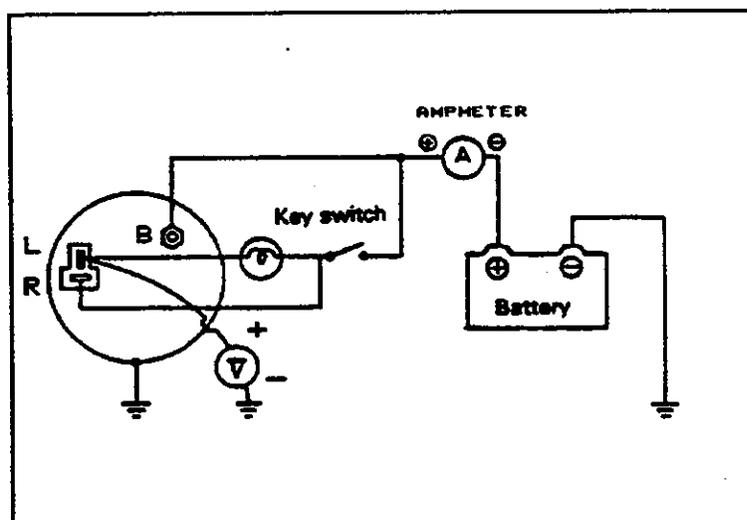


The charging system consists of an alternator with an internal voltage regulator, an engine-mounted circuit breaker, a battery and connecting wires.

Because of the use of IC's (integrated circuits), the electronic voltage regulator is very compact and is built into the rear bracket of the alternator.

### Charging Voltage Test

If you suspect that the alternator is not producing enough voltage to charge the engine's battery, perform the following voltage test.



Interconnections for Charging Voltage Test

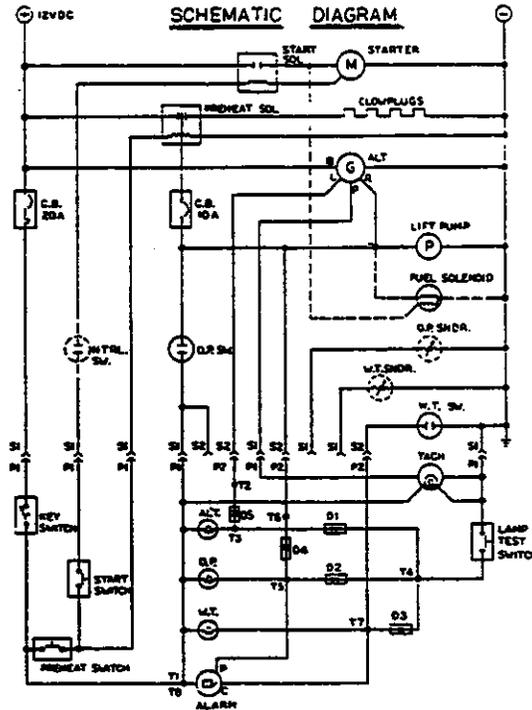
1. Using a voltmeter, connect the voltmeter's red wire clip to the B output terminal on the alternator. Refer to the schematic shown above.
2. Connect the other wire clip to a ground on the engine.
3. Start the engine and increase the engine's speed to 2000 rpm. Now record the reading given by the voltmeter.

The voltage reading for a properly operating alternator should be between 13.5 to 14.5 volts. If your alternator is over or under charging, have it replaced or rebuilt by a reliable service shop.

**NOTE:** Before removing the alternator for repair, make sure 12-Volts excitation is present at the R terminal should the above test show only battery voltage at the B output terminal.



**Captains Panel DC Control Circuit Wiring Diagram # 36467**  
 page 2 of 2



- START:** 1. TURN KEY TO ON POSITION. THE ALARM WILL SOUND, OIL PRESSURE AND BATTERY CHARGE INDICATORS WILL LIGHT.
2. PUSH PREHEAT SWITCH FOR 5 TO 30 SECONDS AS REQUIRED, ALARM WILL STOP.
3. WHILE CONTINUING TO PUSH PREHEAT SWITCH, PUSH THE START SWITCH ALSO. WHEN THE ENGINE STARTS RELEASE THE START SWITCH ONLY.
4. WHEN THE OIL PRESSURE INDICATOR LAMP GOES OUT RELEASE THE PREHEAT SWITCH.

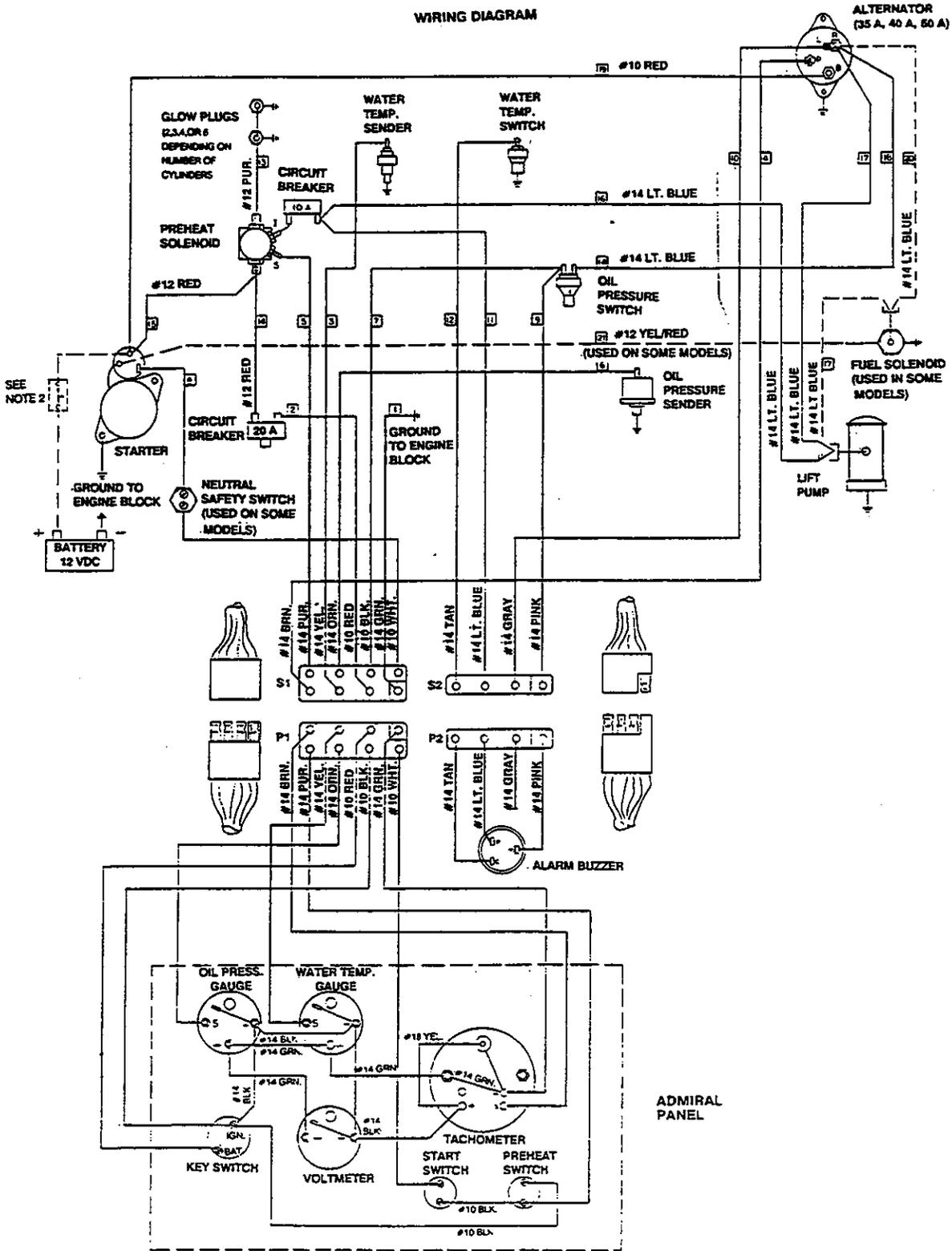
**STOP:** TURN THE KEY TO THE OFF POSITION.

**NOTES:**

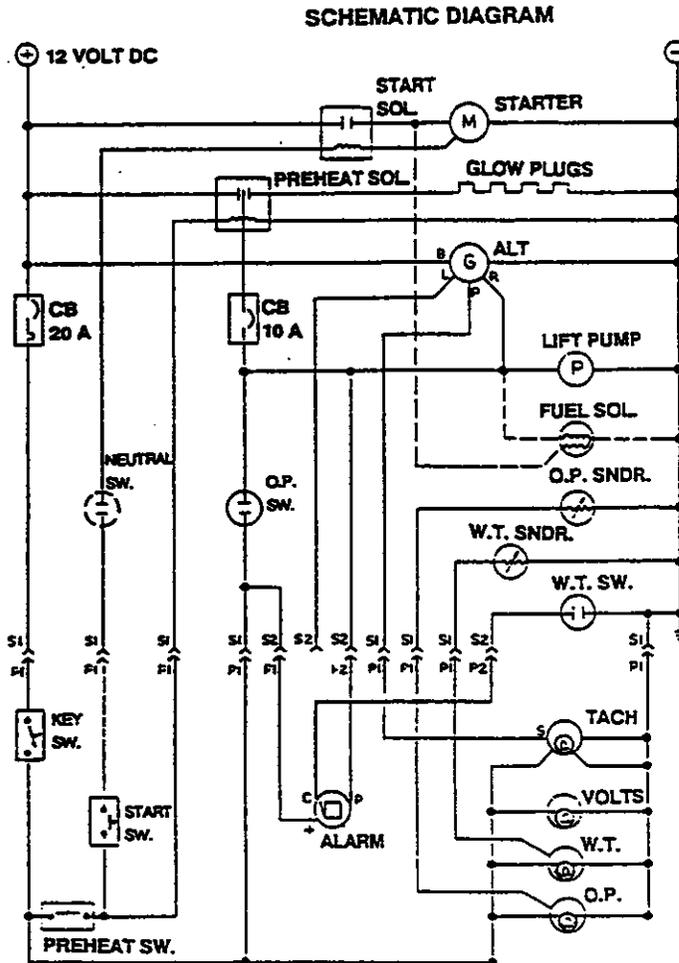
1. THIS PRODUCT IS PROTECTED BY A MANUAL RESET CIRCUIT BREAKER LOCATED NEAR THE STARTER. EXCESSIVE CURRENT DRAIN WILL CAUSE THE BREAKER TO TRIP AND THE ENGINE WILL SHUT DOWN. THE BUILDER/OWNER MUST BE SURE THAT THE INSTRUMENT PANEL, WIRING AND ENGINE ARE INSTALLED TO PREVENT CONTACT BETWEEN ELECTRICAL DEVICES AND SALT WATER.
2. AN ON-OFF SWITCH SHOULD BE INSTALLED BETWEEN THE BATTERY AND STARTER TO DISCONNECT THE BATTERY IN AN EMERGENCY AND WHEN LEAVING THE BOAT. A SWITCH WITH A CONTINUOUS RATING OF 175 AMPS AT 12VDC WILL SERVE THIS FUNCTION. THIS SWITCH SHOULD NOT BE USED TO MAKE OR BREAK THE CIRCUIT.
3. PINK WIRE AT PLUG 2 IS UNUSED AND SHOULD BE INSULATED.

Admirals Panel DC Control Circuit Wiring Diagram # 36844  
page 1 of 2

WIRING DIAGRAM



Admirals Panel DC Control Circuit Wiring Diagram # 36844  
page 2 of 2



**NOTE:**

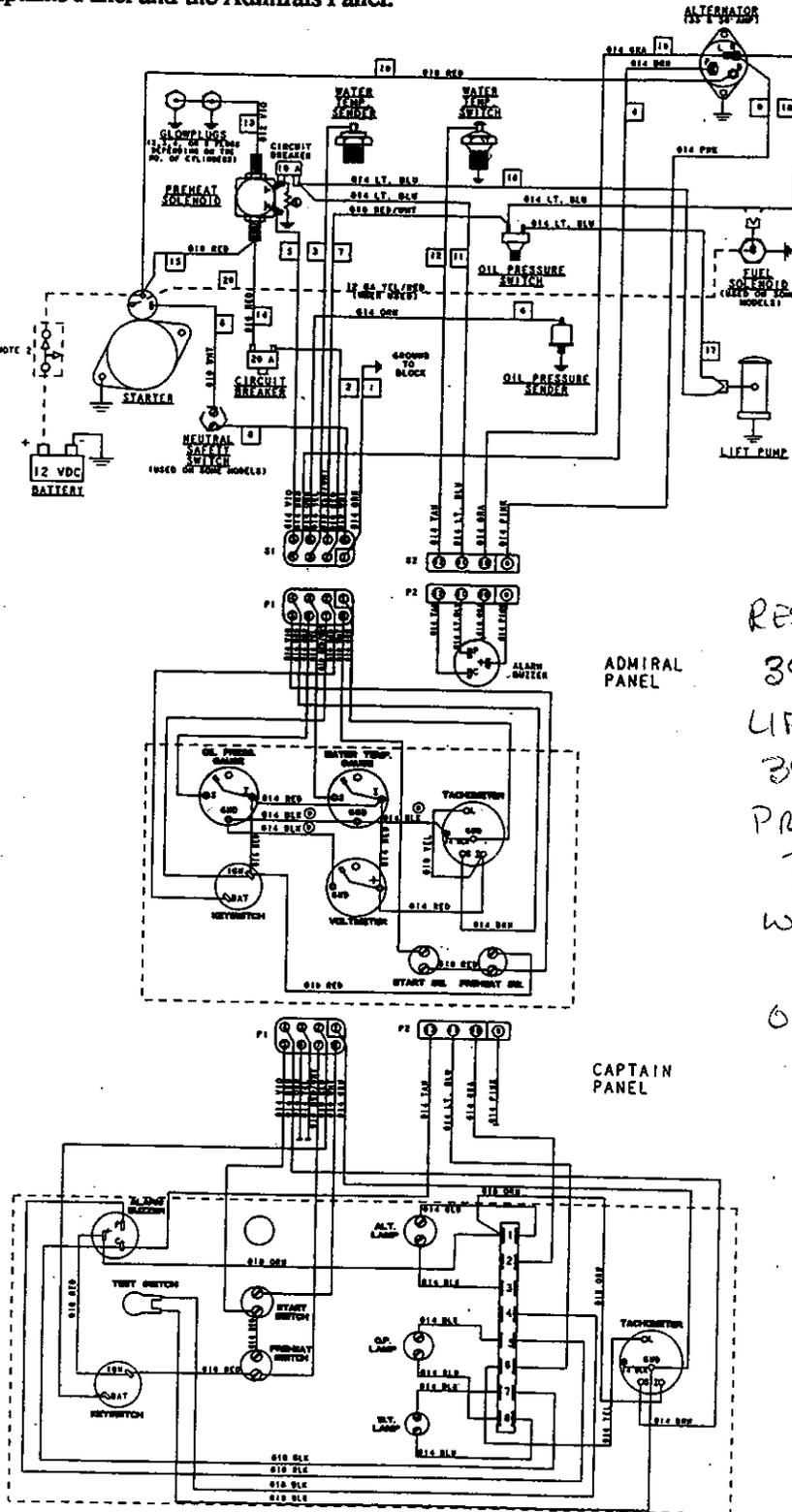
1. THIS PRODUCT IS PROTECTED BY A MANUAL RESET CIRCUIT BREAKER LOCATED NEAR THE STARTER. EXCESSIVE CURRENT DRAIN WILL CAUSE THE BREAKER TO TRIP AND THE ENGINE WILL SHUT DOWN. THE BUILDER/OWNER MUST BE SURE THAT THE INSTRUMENT PANEL, WIRING, AND ENGINE ARE INSTALLED TO PREVENT CONTACT BETWEEN ELECTRICAL DEVICES AND SALT WATER.
2. AN ON-OFF SWITCH SHOULD BE INSTALLED BETWEEN THE BATTERY AND STARTER TO DISCONNECT THE BATTERY IN AN EMERGENCY, AND WHEN LEAVING THE BOAT. A SWITCH WITH A CONTINUOUS RATING OF 175 AMPS AT 12 VOLTS DC WILL SERVE THIS FUNCTION. THIS SWITCH SHOULD NOT BE USED TO MAKE OR BREAK THE CIRCUIT.
3. THE GRAY WIRE AT PLUG #2 IS UNUSED AND SHOULD BE INSULATED.

# DC ELECTRICAL SYSTEM

## WIRING DIAGRAM #39144

This diagram illustrates the 12 VDC negative ground electrical circuit. Two optional instrument panels are also shown: the Captains Panel and the Admirals Panel.

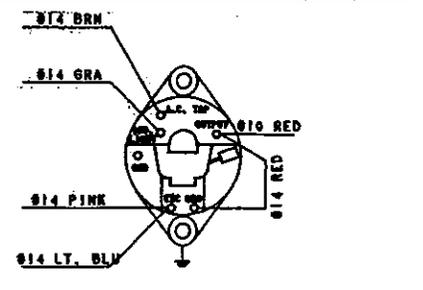
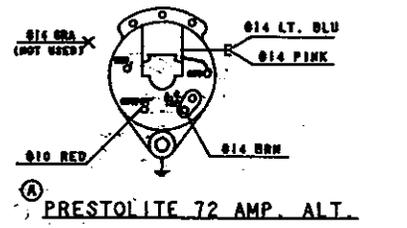
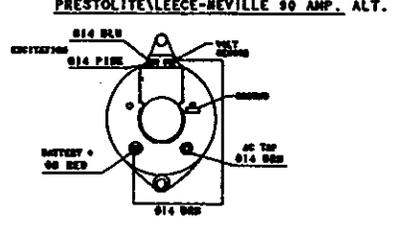
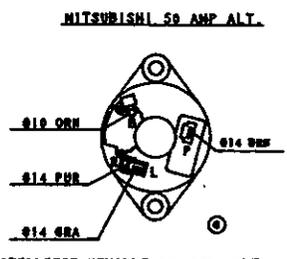
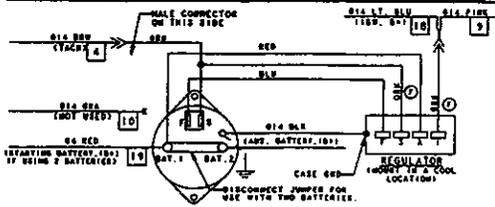
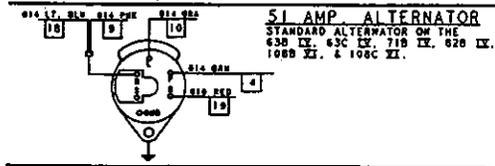
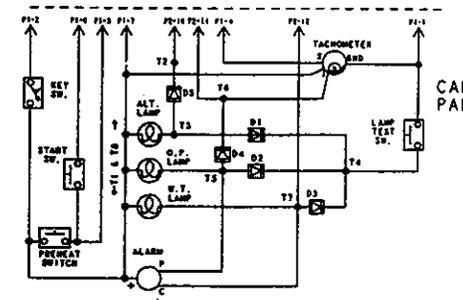
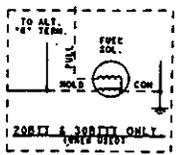
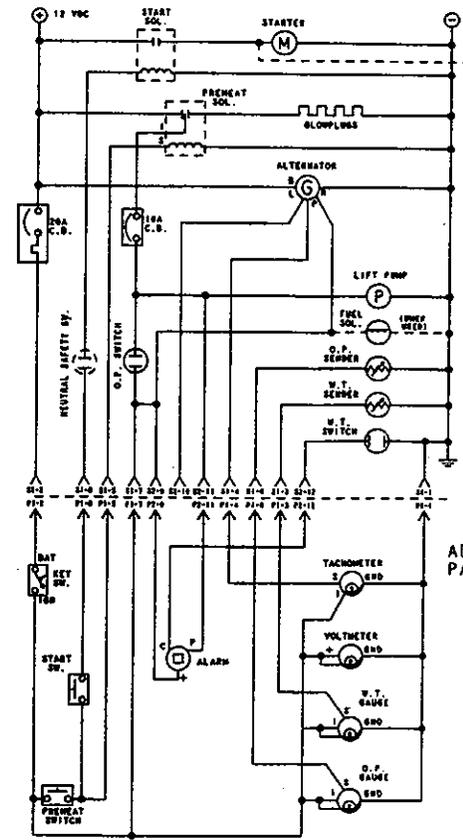
**NOTE:**  
AN ON-OFF SWITCH SHOULD BE INSTALLED BETWEEN THE BATTERY AND STARTER TO DISCONNECT THE BATTERY IN AN EMERGENCY AND WHEN LEAVING THE BOAT A SWITCH WITH A CONTINUOUS RATING OF 175 AMPS AT 12 VDC WILL SERVE THIS FUNCTION. THIS SWITCH SHOULD NOT BE USED TO MAKE OR BREAK THE CIRCUIT.



- RESISTOR P.N. 39806
- LIFT PUMP 39275
- PREHEAT SOL. 24338
- WATER TEMP SWITCH 30125
- OIL SWITCH 37323

# DC ELECTRICAL SYSTEM

## WIRING SCHEMATIC #39144



## COOLING SYSTEM

### Description

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

### Fresh Water Circuit

**NOTE:** Refer to paragraphs A and B in this section on the recommended antifreeze and water mixture to be used as the fresh water coolant, and for information on filling the fresh water system.

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

#### A. Fresh Water Coolant (Antifreeze) Mixture.

A freshwater and antifreeze mixture should be used year-round. Water, when it freezes, expands sufficiently to split the heat exchanger and crack the engine block. A water/antifreeze mixture of proper concentration will prevent freezing.

Use soft water with few impurities, such as tap water (potable water) or rainwater. Never use hard or foul water. Use of hard water or water containing impurities will lead to the collection of scale in the engine and heat exchanger which will reduce the cooling system's efficiency.

Antifreeze of poor quality or without rust inhibitors will cause corrosion within the cooling system. Always use antifreeze which is compatible with aluminum cooling system components and is made by a reliable manufacturer. Never mix different brands of antifreeze.

Make sure the engine's cooling system is well cleaned before adding antifreeze. Recommended antifreeze for year round use is ZEREX or PRESTONE with rust inhibitors.

In order to control the concentration of the mixture, mix the antifreeze and freshwater thoroughly before adding it to the cooling system.

## ANTIFREEZE CONCENTRATION DATA

Antifreeze Concentration	%	13	23	30	35	45	50	60
Freezing Temperature	° F	23	14	5	-4	-22	-40	-58
	(° C)	(-5)	(-10)	(-15)	(-20)	(-30)	(-40)	(-50)

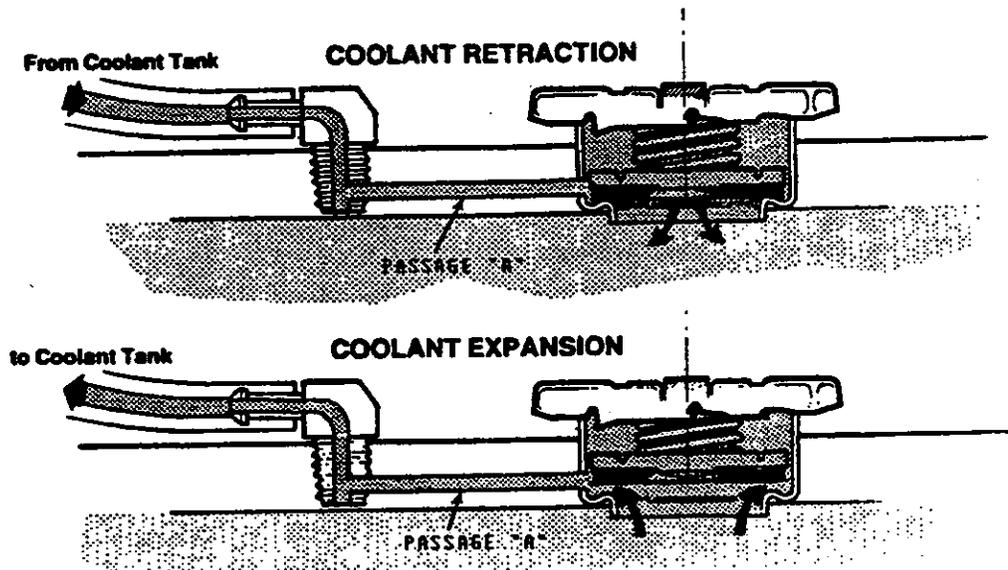
**NOTE:** An antifreeze concentration should be selected on the basis of a temperature which is about 10° F (5° C) lower than the actual atmospheric temperature expected.

### B. Filling the Fresh Water System

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

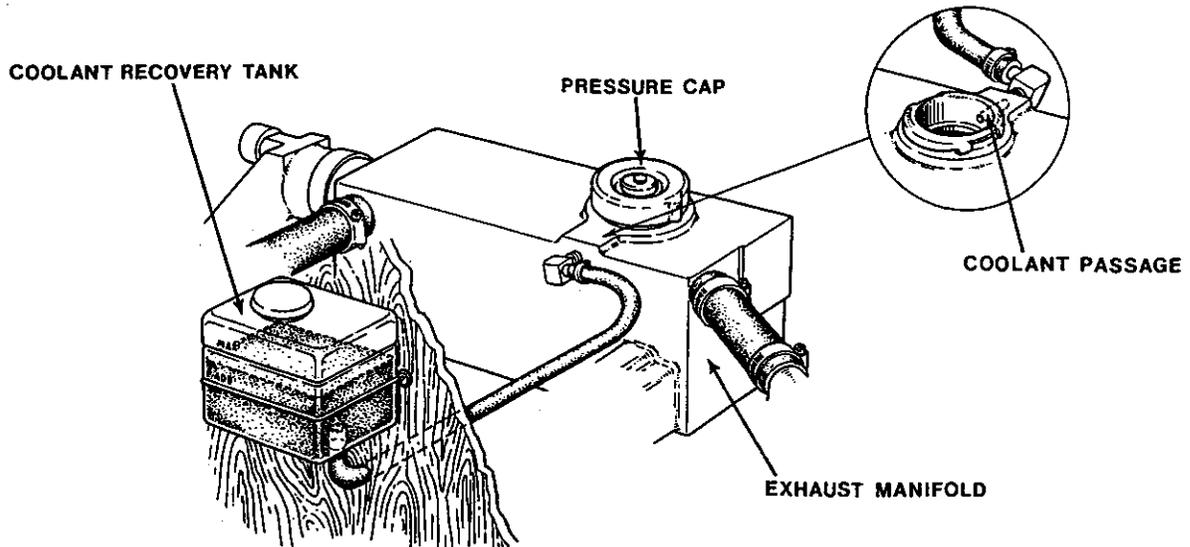
This coolant recovery tank should be installed at, or above, engine manifold level, in a location where it can be easily monitored and where coolant can be easily added if needed (see the figure below). A stainless steel mounting bracket is supplied with each kit along with a 30-inch length of clear plastic hose and clamps to connect the hose between the engine's manifold fitting to the hose spud on the base of the recovery tank.

#### FUNCTION OF MANIFOLD PRESSURE CAP



Coolant from the engine, when heated during engine operation, will expand, lifting the spring-loaded manifold pressure cap, and enter the recovery tank via the hose connecting the recovery tank to the manifold.

When the engine is shut down and cools, a small check valve in the pressure cap is opened by the contraction of the engine coolant, allowing some of the coolant in the recovery tank to be drawn back into the engine's cooling system, free of air and without loss. Periodically check that the passage (A) between the 90° fitting on the manifold and the filler neck in the manifold is clear so coolant can flow in either direction.



### Coolant Recovery Tank, Recommended Installation

Fill the fresh water system as follows:

1. Remove the pressure cap from the manifold.
2. Pour a clean, antifreeze mixture into the manifold and allow enough time for the coolant to fill the fresh water cooling system.
3. Start the engine and allow it to come up to its operating temperature. Monitor the coolant in the manifold and add antifreeze coolant as air is expelled. Once all air is expelled from the system, fill the manifold to the filler neck and install the pressure cap.
4. Remove the plastic cap from the plastic coolant recovery tank and fill the tank with coolant halfway between the **ADD** mark and the **MAX** mark. Replace the plastic cap.
5. Run the engine and observe the coolant's expansion flow into the plastic recovery tank.
6. Check for leaks between the pressure cap/filler neck and then plastic recovery tank. Stop the engine and allow it to cool. Coolant should be drawn back into the cooling system as the engine's temperature comes down.
7. Add coolant to the recovery tank, as required, to top off the fresh water coolant system.

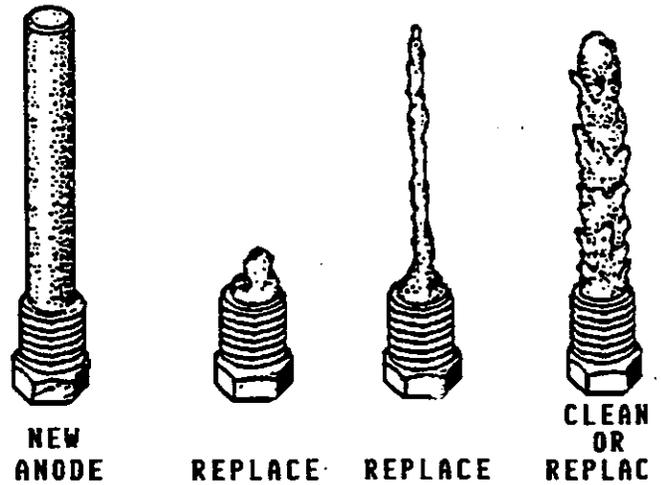
### Thermostat

Generally, thermostats are of two types. One is simply a choking device which opens and closes as the engine's temperature rises and falls. The second type has a bypass mechanism. Usually this is a disc on the bottom of the thermostat which moves downward to close off an internal bypass passage within the head. Since 1980, each type of thermostat has a hole punched through it. The hole is a bypass to prevent the exhaust manifold from overheating during the engine's warm-up. Replacement thermostats must have this design characteristic.

## Sea Water Circuit

The sea water flow is created by a gear-driven, positive displacement, neoprene impeller pump. The pump draws sea water directly from the ocean through the sea cock and sea water strainer and passes the water to the heat exchanger's sea water inlet. The sea water passes through the heat exchanger's tubes, absorbing heat from the fresh water circulating around the tubes. The sea water is then discharged from the cooling system overboard through the water-injected wet exhaust system.

A zinc anode, or pencil, is located in the sea water cooling circuit within the heat exchanger. The purpose of the zinc anode is to sacrifice itself to electrolysis action taking place in the sea water cooling circuit, thereby reducing the effects of electrolysis on other components of the system. The condition of the zinc anode should be checked monthly and the anode cleaned or replaced as required. Spare anodes should be carried on board. Zinc anode debris should be cleaned from the area inside of the heat exchanger where the zinc is located. If this zinc debris is allowed to accumulate, it will block the tube openings through which the cooling sea water should flow.



Zinc Anode Conditions

## Sea Water Pump

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

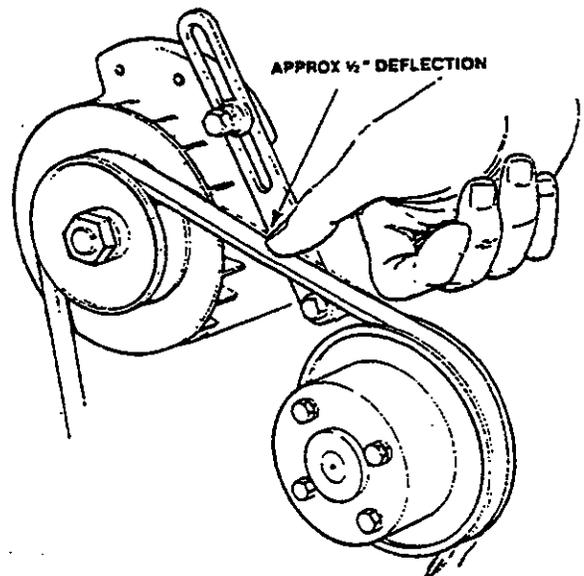
## Alternator and Water Pump Drive Belt Tension

### WARNING

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

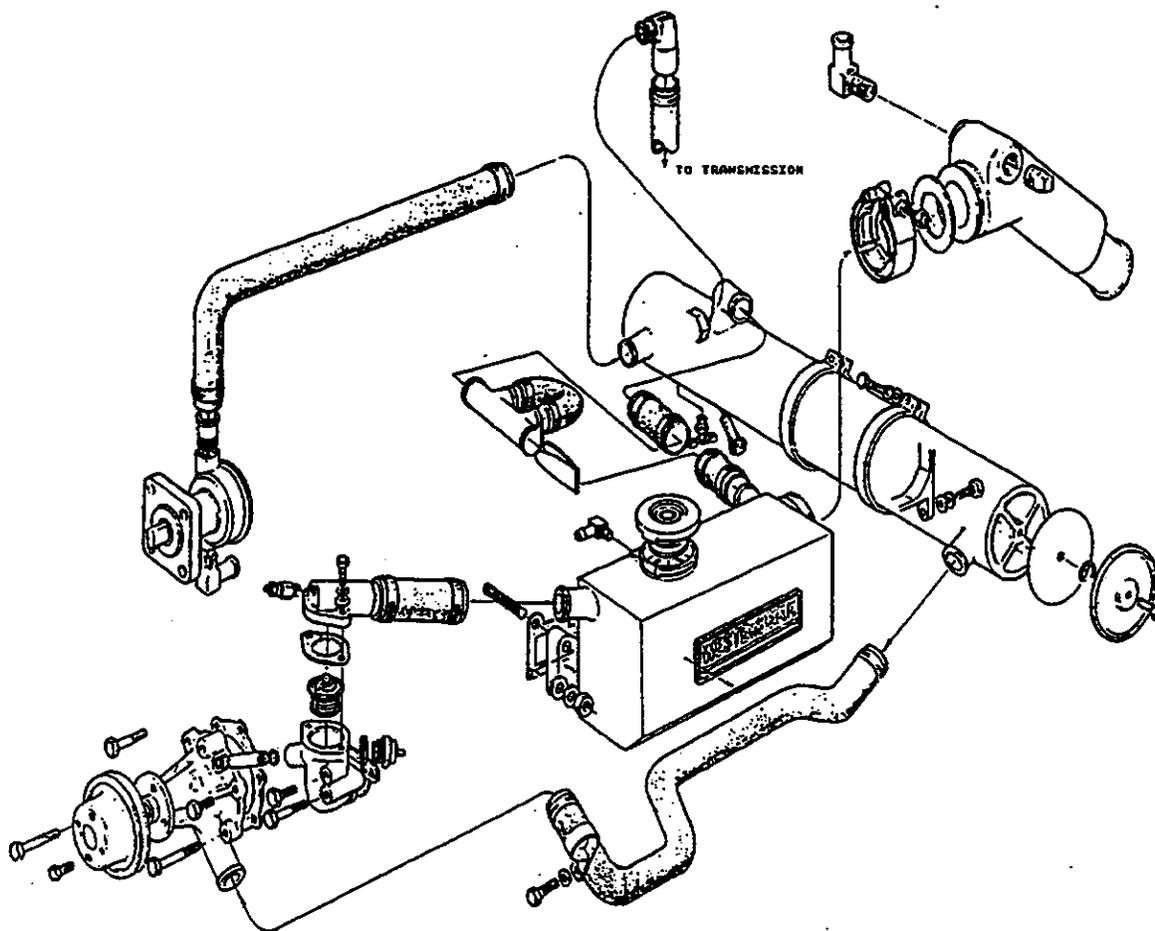
### CAUTION

Excessive alternator and water pump drive belt tension can cause rapid wear of the belt and reduce the service life of the fresh water pump and alternator shaft bearings. Excessive slack or the presence of oil on the belt can cause belt slipping, resulting in high operating temperature, as well as insufficient alternator output.



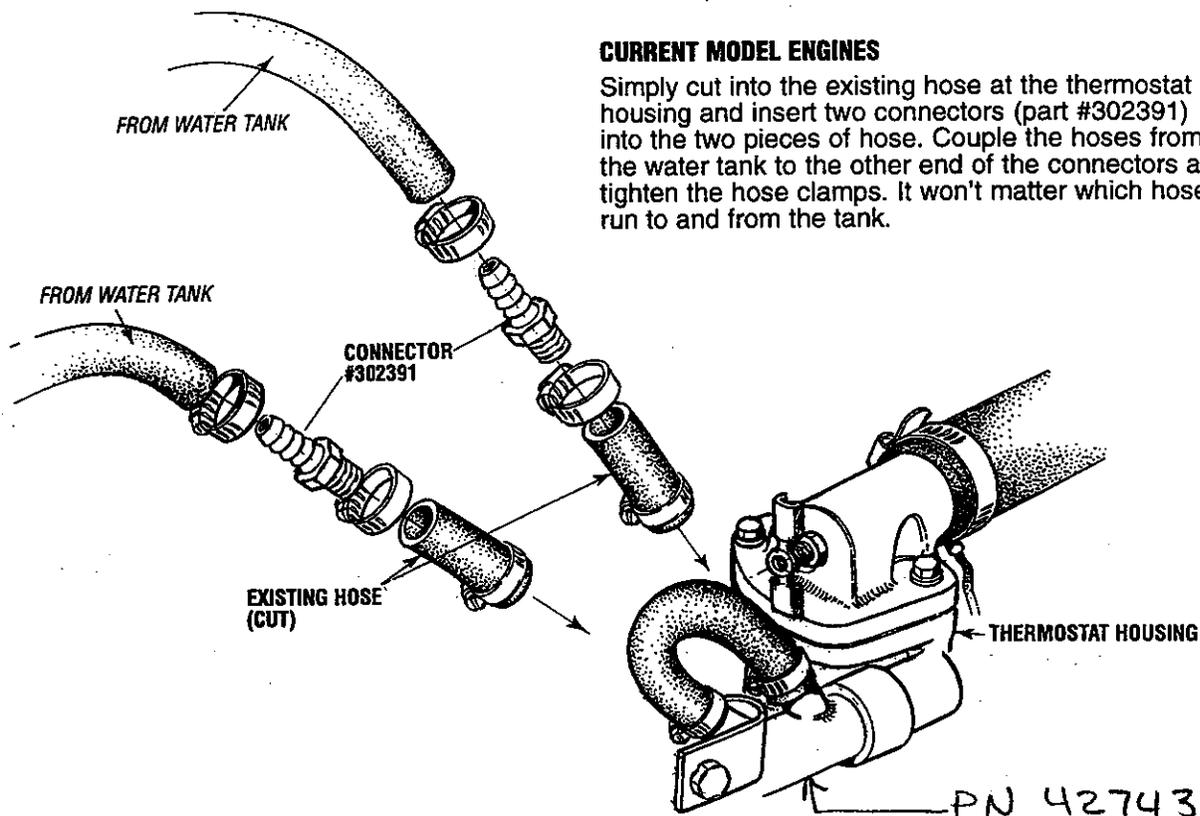
The alternator and water pump drive belt is properly adjusted if the belt can be deflected no less than 3/8 inch and no more than 1/2 inch (10 mm, 12 mm) as the belt is depressed with the thumb at the midpoint between the two pulleys on the longest span of the belt. (See the illustration on the previous page.) A spare drive belt should be carried on board. Refer to the "SPARE PARTS" section of this manual.

The illustration below shows the cooling system components for the 30B THREE engine. The 20B TWO's cooling system is much the same. Refer to the Parts List for each component's name and part number.



Cooling System Components, Exploded View

## DOMESTIC HOT WATER TANK CONNECTIONS



### CURRENT MODEL ENGINES

Simply cut into the existing hose at the thermostat housing and insert two connectors (part #302391) into the two pieces of hose. Couple the hoses from the water tank to the other end of the connectors and tighten the hose clamps. It won't matter which hoses run to and from the tank.

Hoses should rise continuously from their low point at the heater to the engine so that trapped air will rise naturally from the heater to the engine. If trapped air is able rise to the heater, then an air bleed petcock must be installed at the higher fitting on the heater for bleeding air while filling the system. Avoid loops in hose runs which will trap air.

**NOTE:** If any portion of the heating circuit rises above the engine's own pressure cap, then a pressurized (aluminum) remote expansion tank must be installed in the circuit to become the highest point. The remote expansion tank's part number is 24177. Tee the remote expansion tank into the heater circuit at the heater connection, choosing the higher of the two for the return. Tee right at the heater and plumb a single line up to the tank's location and the other back to the engine's flow control. Install the remote expansion tank in a convenient location such as in a sail locker so the fresh water coolant level can easily be checked. The remote expansion tank will now serve as a check and system fill point. The plastic coolant recovery tank is not used when the remote expansion tank kit is installed, since this tank serves the same function.

The pressure cap on the engine's manifold should be installed once the engine's cooling system is filled with coolant. Finish filling the cooling system from the remote tank once the system is filled and is free of air and exhibits good coolant circulation. During engine operation, checking the engine's coolant should be done at the remote tank and not at the engine manifold cap.

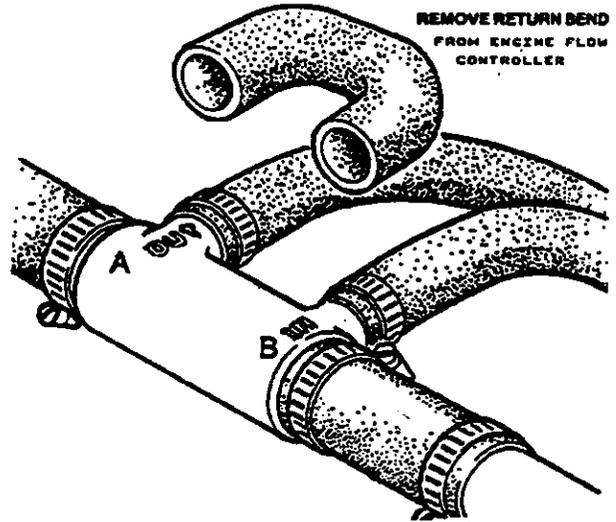
The hose connection from the heater to the remote expansion tank should be routed and supported so as to rise continuously from the heater to the tank, enabling any air in the system to rise.

## EARLY MODEL ENGINES

### Domestic Hot Water

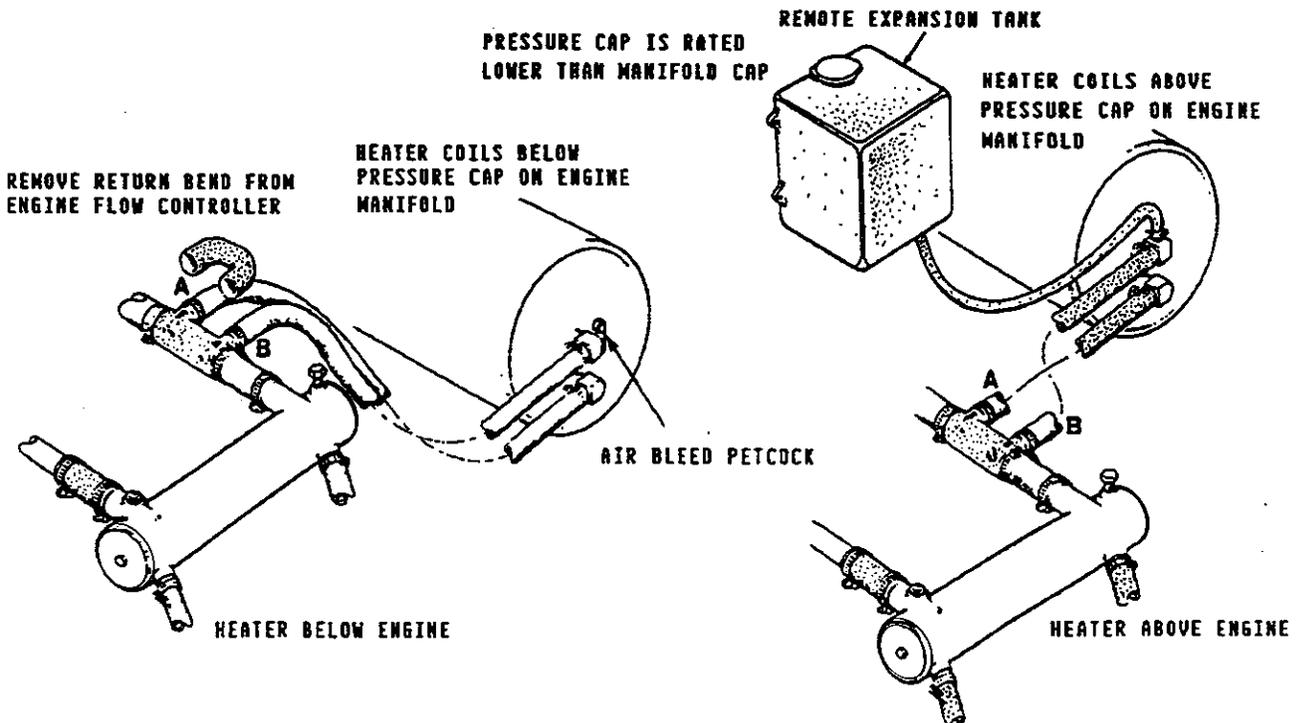
Both the 20B TWO and the 30B THREE engines are equipped with a domestic hot water connection. If the owner/operator wishes to connect a hot water heater, remove the bypass hose and connect a heater as described in the instructions presented below.

**General:** With the bypass hose (Part # 30962) removed, there remain two connecting points A and B for hoses to run to and from the water heater. These connections assure a flow of hot water through the heater at all times but do not restrict the engine's cooling water.



Flow Controller

**Installation:** The heater should be mounted conveniently either in a high or low position in relation to the engine, so that the connecting hoses from the heater to the engine can run in a reasonably direct line without any loops which might trap air. Connection point A on the Flow Control housing should connect to the lower of the two connections on the water heater while the upper connection on the heater returns to connection B, nearest to the heat exchanger.



The illustrations shown above are Flow Control designs that have been adapted to operate with the single pass manifolds installed on the 20B TWO and the 30B THREE engines.

## LUBRICATION SYSTEM

### Engine Oil

For engine lubrication, use lubricating oil designated for diesel service. These oils are classified according to the API specifications into service grades CF and CG-4. The use of CF or higher (CG-4) grades, made by well-known manufactures is recommended. The oil selected should be used thereafter.

### Engine Oil Viscosity (SAE Number)

Use an oil having a viscosity best suited to the atmospheric temperature. Use of an all-season oil SAE 10W-30 with minimum viscosity change under different temperatures is suggested.

<u>Atmospheric Temperature</u>	<u>Viscosity</u>
68° F (20° C) or higher	SAE 30 or 10W-30
41° F (5° C) - 68° F (20° C)	SAE 20 or 10W-30
41° F (5° C) - or lower	SAE 10W-30

NOTE: Do not use an engine lubricating oil with an SAE number greater than 30 in the engine.

### Oil Pressure

The oil pressure during operation of the engine is indicated by the oil pressure gauge on the Admiral Panel.

During normal operation, the oil pressure will range between 30 and 55 psi. At idle speed, the oil pressure will range between 15 and 30 psi. At the time of cranking, the oil pressure will rise proportionately with speed.

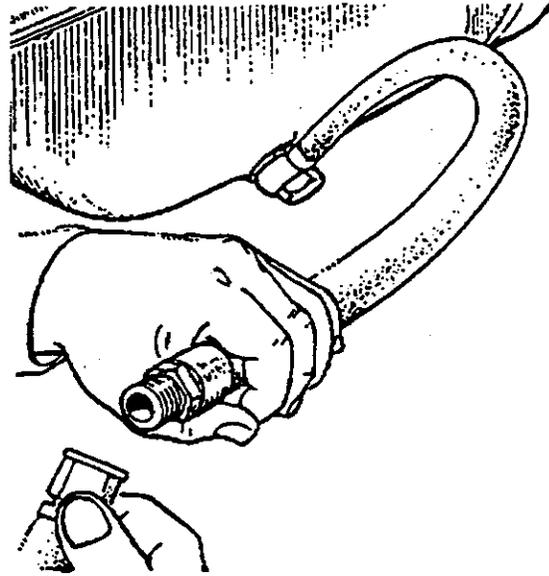
NOTE: A newly started, cold engine can have an oil pressure reading upwards of 55 psi. A warmed engine can have an oil pressure reading as low as 15 psi. These readings may also vary depending upon the speed at which the engine is running.

## Engine Oil Change (to include filter)

### 1. Draining the Oil Sump

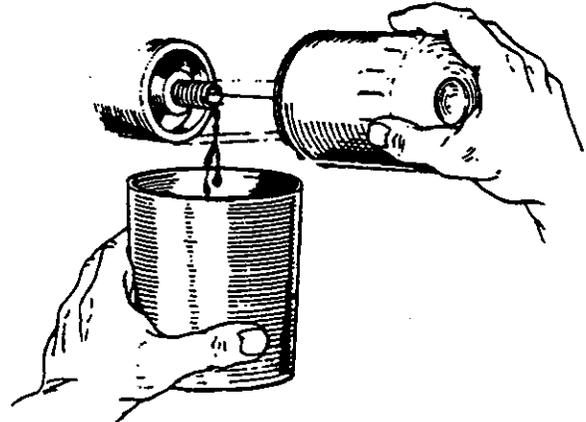
Remove the oil drain hose from its attachment bracket and lower it into a container and allow the oil to drain, or attach a pump to the end of the drain hose and pump the old oil out. Make sure the oil drain hose is properly secured in its holder after all of the old oil has been drained.

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



### 2. Replacement of 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 style automotive filter wrench should be helpful in removing the old oil filter. Place some paper towels and a plastic bag around the filter when unscrewing it to catch any oil left in the filter. (Oil or any other fluid on the engine reduces the engine's cooling ability. Please keep your engine clean.) Inspect the old oil filter as it is removed to make sure that the rubber sealing gasket came off with the old oil filter. If this rubber sealing gasket remains sealed against the engine block, gently remove it. The replaceable cartridge-type oil filter requires no cleaning inside, so it may be properly disposed of.

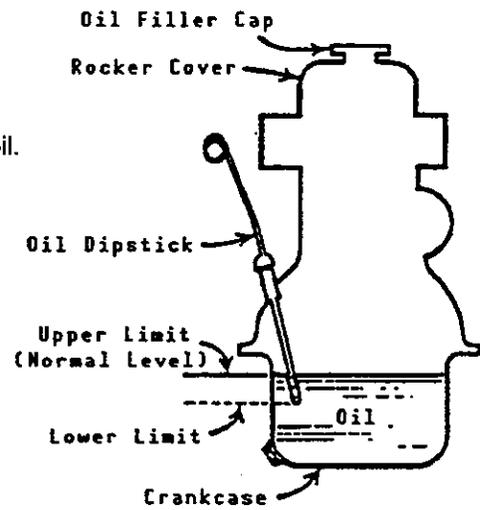


When installing the new oil filter element, wipe the filter gasket's sealing surface on the engine block free of oil and apply a thin coat of clean engine oil to the rubber gasket on the oil filter. Screw the filter onto the threaded oil filter stub, and then tighten the filter firmly by hand.

**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 for a few minutes 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

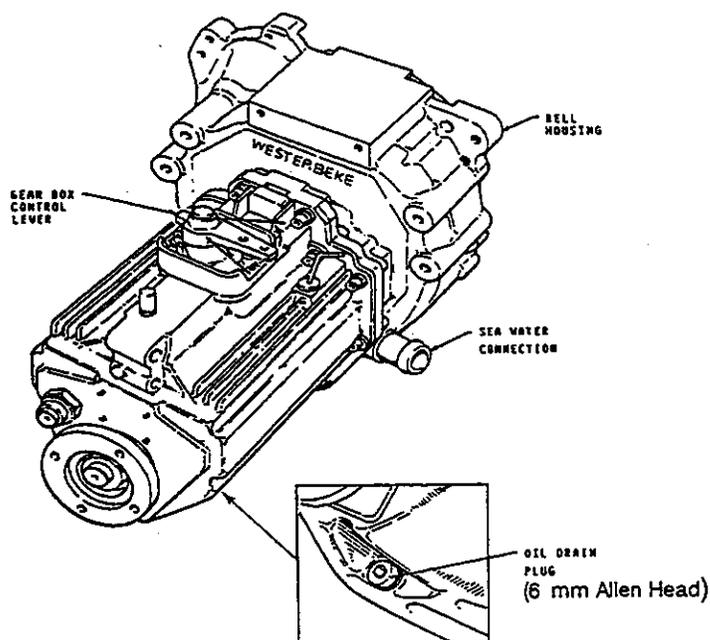
Add fresh oil through the oil filler cap on the valve cover. After refilling the oil, run the engine for a few moments while checking the engine's oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and stop the engine. Fill to, but not cover, the high mark on the dipstick, should the engine require additional oil.



## JS TRANSMISSION

### General

The transmission's gear ratio is 2.47 to 1. The JS transmission is made of a lightweight, high-strength, corrosion-resistant aluminum alloy suitable for the marine environment. This manual transmission rotates opposite to the engine when in forward gear. The JS transmits its power with case-hardened helical gears and, in reverse, an intermediate gear. The reversing process is carried out by a servo double disc system. For safety reasons, the transmission is **NOT** filled with lubricating oil for shipment. Before leaving the factory, however, each transmission is thoroughly tested with oil in the transmission. This testing, among other things, provides all internal parts with a coating of oil. This oil acts as a preservative, providing reliable protection against corrosion for at least one year if the transmission is properly stored.



### Lubrication

The JS transmission is an immersion-lubricated type. Fill the transmission up to or near the top of the machined notch cut on the dipstick with SAE 20, W/20, or SAE 30 weight engine oil exclusively. Multigrade oils are not to be used in this transmission. **DO NOT** mix grades of oil! Lubricating oils should have an API specification of CF, CG-4, SD, or SE.

The oil capacity for the JS transmission is approximately 1.0 quart (1.0 liter). Check the oil level daily after the engine has been warmed and stopped. The oil level should be maintained at the top of the machined flat on the dipstick when the dipstick is completely inserted into the transmission housing. Make sure that the two O-ring gaskets on the dipstick are in good shape. These O-rings will help keep the dipstick in place.

Change the transmission oil after the first 30 hours of engine operation and thereafter every 250 hours (or once per year, minimum). The JS has a 6 mm Allen Hex wrench drain plug for draining the old oil. To make sure most of the old oil will be drained from the transmission, run the engine in NEUTRAL for approximately 10 to 15 minutes so the oil may warm and flow better from the transmission. This oil may also be removed by inserting a small tube through the dipstick opening (where the oil is added) and attaching a pump onto the tube so the oil may be sucked out. The operating oil temperature must not exceed 250° F (120° C).

## Alignment

Misalignment between the transmission's coupling and the propeller shaft's coupling can create serious problems. Make sure the alignment procedures outlined in the "Propeller Shaft Coupling", the "propeller" and the "Alignment of the Engine" in the Westerbeke installation manual are adhered to.

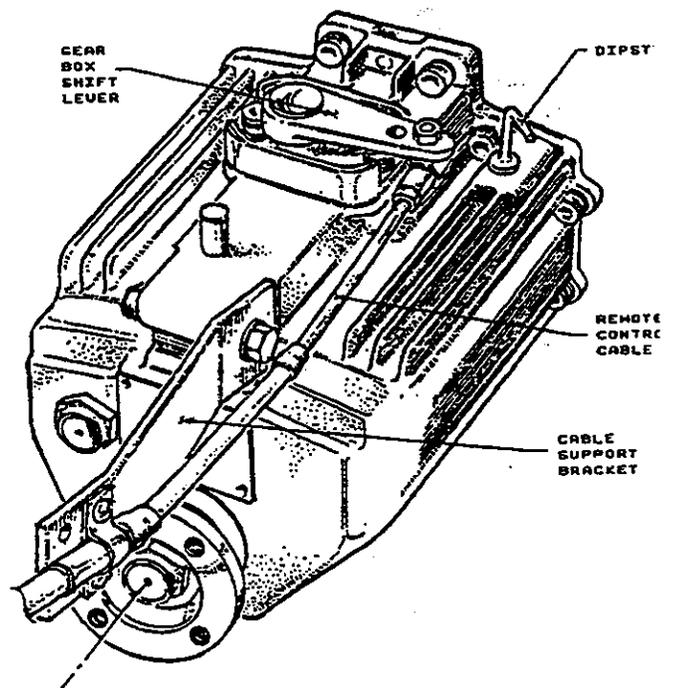
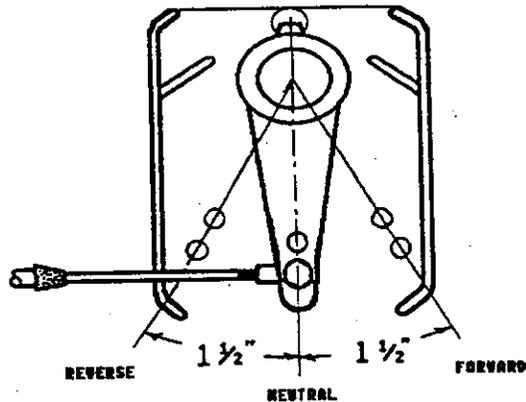
## Controls

The only controls required to operate the transmission is a single lever remote control cable. The cable should be attached to the gear box lever using the cable bracket supplied with the unit. Both the gear box lever and the remote control lever must be in the NEUTRAL position when the cable is attached to the gear box lever. This allows the remote cable an equal throw distance to shift the gear box into FORWARD or into REVERSE from the NEUTRAL position without running out of cable. Allow approximately 1 1/2 inches of cable throw from the NEUTRAL position on the transmission's gear box lever to the each of the two drive positions.

**NOTE:** If the throw distance (or travel) of the remote cable is too short, the gear box lever cannot fully engage the transmission into FORWARD or REVERSE. In this situation, the transmission's internal clutches will wear prematurely and the transmission may over heat and eventually fail.

**NOTE:** Excessive throw distance in the remote control lever is not detrimental to the transmission. Note that the position of the remote control lever should align with the NEUTRAL marking on its bracket when the transmission is really in NEUTRAL.

GEAR BOX SHIFT LEVER



## Shifting

To shift the transmission from NEUTRAL into FORWARD, exert a *heavy push* to the remote control lever. A gentle throw may not carry enough force to actually shift the transmission's internal gears. A gentle throw is signalled by the transmission not engaging into the desired drive. Make sure the remote control lever is lubricated at least once each operating season. Shift the transmission while the engine is running at 1200 rpm or below.

### CAUTION

NEVER remove or loosen the two-bolt gear box lever cover from transmission. The position of this plate and the actuating lever inside of the transmission has been finely adjusted at the factory to ensure equal throw distance of internal mechanisms. Loosening of this cover's capscrews voids the transmission's warranty.

## Sailing Operation

The JS transmission should be left in its NEUTRAL position while sailing. Leaving the transmission in NEUTRAL while sailing alleviates unnecessary drag on the vessel because the propeller is able to freewheel (spin). However, if the transmission is left in its FORWARD gear while sailing, the transmission will not be damaged. (Leaving the transmission in NEUTRAL is just good sailing practice.)

## Service

If any seal on the transmission shows signs of leaking, have the transmission looked at by a qualified Westerbeke Dealer. This problem, especially concerning the rear seal, is often contributed to an improper alignment of the transmission's coupling and the propeller shaft's coupling.

Never loosen the gear box lever cover screws, except in the course of qualified servicing; this upsets critical adjustments.

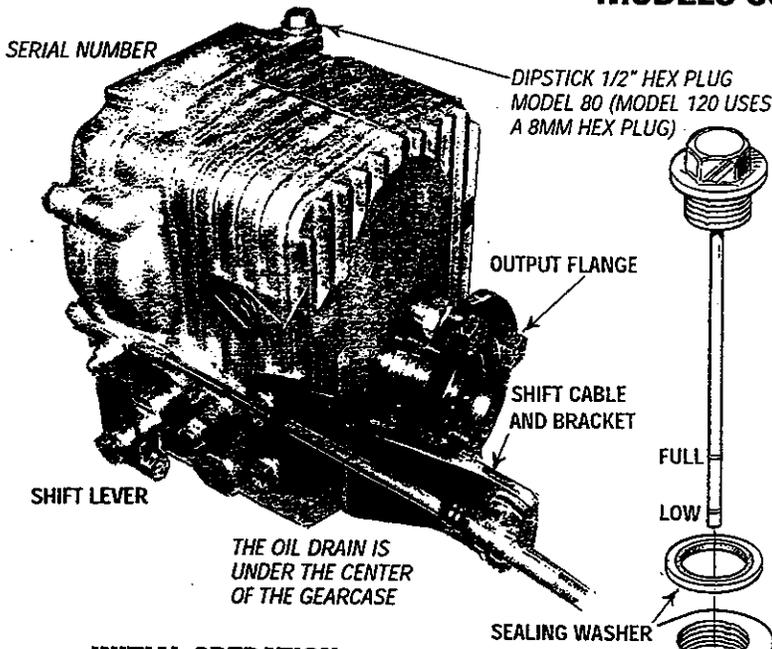
Disassembly of the transmission in the field is not recommended. If an overhaul or repair is needed, the work should be done by Westerbeke or an authorized Westerbeke service center.

## Cooling

The JS transmission is sea water-cooled. Sea water enters the transmission through a stainless steel inlet pipe located at the base of the bell housing. This water helps to cool the transmission's lubricating oil.

THE MODEL 120 HAS A BREATHER  
FITTING ON THE TOP OF THE CASE

# PRM NEWAGE TRANSMISSIONS MODELS 80 AND 120



Push a suction pump hose down through the dipstick hole to the bottom of the housing and suck out the oil. (If space allows, use the transmission drain). Remove the drain plug from the bottom of the transmission (1" with sealing washer) and allow the oil to drain into a container, then reinstall the plug with its sealing washer. Wipe down the transmission and properly dispose of the used oil. After running the engine, shut down and recheck the oil level.

**NOTE:** When changing the oil, take care not to lose the drain plug sealing washer. The drain plug will leak without this sealing washer.

**WARNING:** Never pull out the dipstick while the engine is running. Hot fluid will splash from the dipstick hole. This could cause severe burns.

## DAILY OPERATION

- Check the transmission oil.
- Visually check the gear shift linkage and transmission.
- Start the engine in neutral, allowing a few minutes at idle to warm the oil.
- Shift into gear.

**NOTE:** Too low an idle speed will produce a chattering noise from the transmission gear and damper plate. In such cases the idle speed should be increased.

## GEAR SHIFTING

The engine must be at idle. Pause in neutral before selecting ahead or astern. Transmission models PRM 80 and 120 are ideal for single lever engine controls, controlling both the throttle and the gear shift at one time.

**WARNING:** When shifting gears, bring the engine throttle to idle and pause in neutral before shifting ahead or astern.

## LOCKING THE PROPELLER

Locking of the propeller shaft by an additional brake is not required: Use the gear shift lever position opposite your direction of travel for this purpose. Never put the gear shift in the position corresponding to the direction of travel of the boat.

## WHEN UNDER SAIL OR BEING TOWED

Rotation of the propeller without load, such as when the boat is being sailed, being towed, or anchored in a river, as well as operation of the engine with the propeller stopped (for charging the battery), will have no detrimental effects on the transmission.

## INITIAL OPERATION

Before getting started, remove the dipstick and fill the gear box with engine oil. Use a heavy duty engine oil with an API classification of CF or CG-4 or better. For recommended oil viscosity, see the following chart:

Operating Temperature	Oil Viscosity
Above 68° F (20° C)	SAE 30, 10W-30 or 15W-40
41° - 68° F (5°-20° C)	SAE 20 or 10W-30
Below 41° F (5° C)	SAE 10W-30

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

Fill the transmission with the recommended capacity oil model PRM80-1.0 U.S. pint (0.6L), model PRM 120-1.4 U.S. pints (0.8L).

**NOTE:** Always clean the area around the dipstick plug before filling with oil. Replace the dipstick by screwing it down.

Run the engine to warm up the oil and after shutting down the engine, re-check the oil level.

## CHANGING THE TRANSMISSION OIL

Change the oil for the first time after about 25 hours of operation, then every 250 operating hours or at least once a year or when you change engine oil. Check for leaks and make visual inspection of the shift cables and shaft coupling.

# PRM NEWAGE TRANSMISSIONS

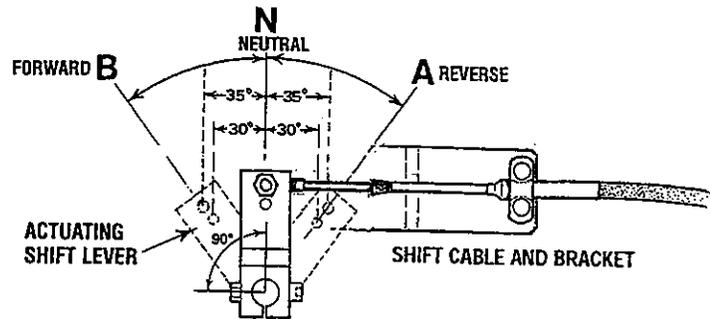
## MODELS 80 AND 120

### CONTROL CABLES

**NOTE:** When installing the transmission, make certain that shifting is not impeded by restricted movability of the Bowden cable or rod linkage, by unsuitably positioned guide sheaves, too small a bending radius, etc.

The control cable or rod should be arranged at right angle to the actuating shift lever when in the neutral position. The neutral position of the operating lever on the control console should coincide with the neutral position of this lever.

The shifting travel, as measured at the pivot point of the actuating lever, between the neutral position and end positions A and B should be at least 35mm for the outer and 30mm for the inner pivot point.



A greater amount of shift lever travel is in no way detrimental and is recommended. However, if the lever travel is shorter, proper clutch engagement might be impeded which, in turn, would mean premature wear, excessive heat generation and clutch plate failure. This would be indicated by slow clutch engagement or no engagement at all.

**NOTE** Check for proper lever travel at least each season.

### TROUBLESHOOTING

Problem	Probable Cause	Verification/Remedy
Excessive noise at low speeds.	1. Engine idle speed too low.	1. Increase idling speed.
Excessive noise at all speeds.	1. Defective coupling. 2. Shaft misalignment. 3. Prop out of balance.	1. Inspect/replace coupling if necessary. 2. Check alignment with feeler gauge. 3. Remove, check pitch, balance and weight.
Oil level needs constant topping off.	1. Power to high. 2. Oil leak.	1. Compare engine and transmission data. 2. Inspect seals, drain etc for oil leaks.
Difficulty in moving lever control.	1. Poor installation of cable. 2. Faulty cable.	1. Check installation, remove sharp bends and turns. 2. Replace.
Escape of pressure from gearbox when dipstick is removed.	1. Defective breather. (Model 120)	1. Inspect breather (Model 120), contact a Distributor or your WESTERBEKE dealer.

### MAINTENANCE/SERVICE

Make certain the transmission oil is changed annually. If the oil should become contaminated by water or the gearbox suffers major mechanical damage, the gearbox must be thoroughly flushed out and re-filled with fresh oil to the correct specifications.

NEWAGE TRANSMISSIONS LTD. has distributors around the world. Listed here are those in the United States.

Atlantis Marine Gear Supply Inc.  
418 Boston Street  
Topsfield, MA 01933  
Tel: 978-887-0001  
Fax: 978-887-5599

Hamilton Jet  
1111 NW Ballard Way  
Seattle, WA 98107  
Tel: 206-784-8400  
Fax: 206-783-7323

Transmission Marine  
223 Southwest 33 Court  
P.O. Box 21086  
Ft. Lauderdale, FL 33335-1086  
Tel: 954-467-1540  
Fax: 954-467-1525

Or contact your WESTERBEKE dealer.

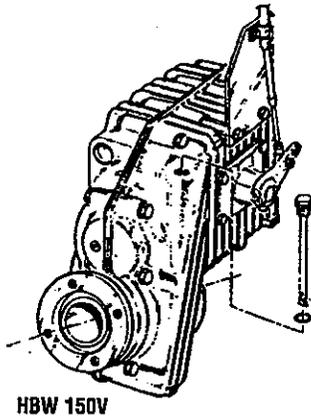
If a major problem should occur, contact your WESTERBEKE dealer or a NEWAGE distributor. To avoid prejudicing warranty rights, do not undertake repair work on the gearbox without first contacting NEWAGE TRANSMISSIONS LIMITED or a NEWAGE distributor (listed above) or your WESTERBEKE dealer.

### Warranty

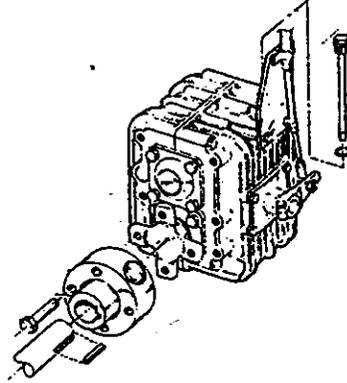
Newage transmission limited warrants that all PRM Newage Transmissions will be free from defects in material and workmanship under normal use and service for a period of twenty- four months.

All PRM Transmissions must be correctly installed, aligned and maintained.

## OPTIONAL TRANSMISSIONS



HBW 150V



HBW 50 & 100

All HBW models turn right hand propellers.

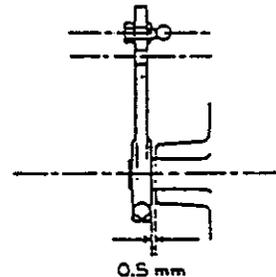
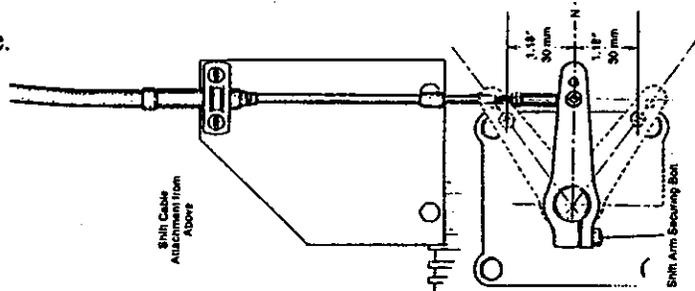
All HBW models have their own oil sumps and dipsticks.

All HBW models use ATF lubricant.

All HBW models should be shifted into gear in one swift motion - not allowed to slip in slowly.

### Control of Gearbox:

1. The gearbox is suitable for single lever remote control using 33C cable.
2. The cable should attach at right angles to the actuating lever using the cable bracket supplied.
3. Both gear box lever and remote lever must be in neutral position when cable is attached so that travel of gearbox lever will be equal forward or reverse.
4. Check that actuating lever hub does not touch cover plate hub. Maintain at least 0.5 mm (0.002") clearance.
5. Over travel of the actuating lever does no harm. However, if the travel is too short to give full engagement, premature wear, excessive heat generation and gear failure may result.



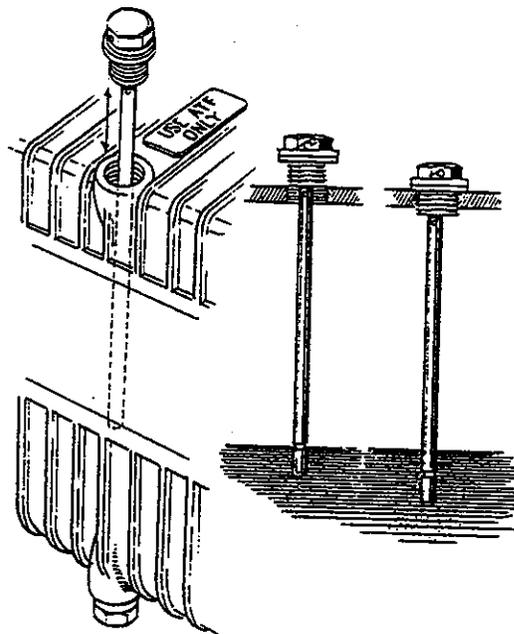
Control of Gear box

6. The position of the cover plate underneath the actuating lever is factory adjusted to ensure lever travel from neutral to A and B. **DO NOT LOOSEN THE CAP SCREWS HOLDING THIS ASSEMBLY.** Doing this voids transmission warranty.

7. Fill gearbox with automatic transmission fluid to the level indicated by the dipstick mark. (See the illustration to the right.)

8. Note that to check oil level, the dipstick drops on the housing. It does not screw in.

9. The HBW gear box can be freewheeled in Neutral. To stop propeller shaft rotation while under sail, place the gear into Reverse.



**NOTE:** The transmission is vented through a small hole in the dipstick. Keep this vent clear.

Transmission	Gear Ratios	
20B Only	HBW 50	2.05:1, 2.72:1
30B	HBW 100	1.48:1, 1.79:1, 2.72:1
30B	HBW 150V	1.77:1, 2.13:1, 2.99:1

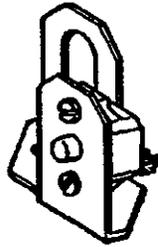
These transmissions each have their own oil sumps and dipsticks. The HBW transmission uses Automatic Transmission Fluid (ATF) type A or Dextron II or III.

## ENGINE TROUBLESHOOTING

### Introduction

The tables which follow indicate troubleshooting procedures based upon certain problem indicators, the probable causes of the problems, and the recommendations to overcome these problems.

Note that the engine's control system (electrical system) is protected by a 20-Ampere manual reset circuit breaker located on the rear lifting bracket.



<u>Problem</u>	<u>Probable Cause</u>	<u>Verification/Remedy</u>
Key switch ON but no panel or test function.	<ol style="list-style-type: none"><li>1. Battery OFF.</li><li>2. 20 Amp circuit breaker is tripped.</li><li>3. Loose battery cable connection</li></ol>	<ol style="list-style-type: none"><li>1. Turn Battery ON.</li><li>2. Reset the breaker by pushing in the button.</li><li>3. Check the + connection to the starter and the - connection to the ground stud on the bell housing.</li></ol>
PREHEAT switch is depressed: no preheat solenoid activation: no electric fuel pump or alternator excitation.	<ol style="list-style-type: none"><li>1. Faulty solenoid, connections or switch.</li><li>2. Faulty connection or tripped 10 Amp breaker on the I terminal on the preheat solenoid.</li></ol>	<ol style="list-style-type: none"><li>1. Connection for 12 volts at S terminal of the solenoid is faulty.</li><li>1. Check the preheat switch.</li><li>2. Check for 12 volts at the 10 Amp breaker. Check for 12 volts at the R terminal on the alternator when the the preheat button is pushed.</li></ol>

<u>Problem</u>	<u>Probable Cause</u>	<u>Verification/Remedy</u>
START switch is depressed: no starter engagement.	<ol style="list-style-type: none"> <li>1. Connection to solenoid faulty.</li> <li>2. Faulty START switch. ohmmeter.</li> <li>3. Faulty solenoid.</li> <li>4. Loose battery connection.</li> <li>5. Low batteries.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check connection <b>S</b> at the starter solenoid for 12 volts with the switch depressed.</li> <li>2. Check switch with an ohmmeter.</li> <li>3. Twelve volts is present at the <b>S</b> terminal of the starter solenoid.</li> <li>4. Check battery connections at both the + and - ground.</li> <li>5. Check battery charge state. Low voltage at the solenoid's <b>S</b> terminal with no activation.</li> </ol>
Engine cranks, but does not start.	<ol style="list-style-type: none"> <li>1. Shut-off valve at fuel tank.</li> <li>2. Faulty fueling system to engine.</li> <li>3. Air is in the fuel system.</li> <li>4. Fuel pump is not operating.</li> <li>5. Fuel filters are clogged.</li> <li>6. Blockage in exhaust.</li> </ol>	<ol style="list-style-type: none"> <li>1. Return shut-off valve to its ON position. Now bleed the fuel system.</li> <li>2. Check for fuel</li> <li>3. Bleed the fuel system. Locate the leak and correct it.</li> <li>4. Check pump operation.</li> <li>5. Clean/replace filters.</li> <li>6. Remove exhaust hose from the engine and crank to start.</li> </ol>
Failure to stop.	<ol style="list-style-type: none"> <li>1. Mechanical Run linkage disconnected.</li> </ol>	<ol style="list-style-type: none"> <li>1. Stop engine by manually moving the <b>RUN</b> linkage to <b>STOP</b>. That failing, shut OFF fuel and air.</li> </ol>

<u>Problem</u>	<u>Probable Cause</u>	<u>Verification/Remedy</u>
Engine Stops.	1. Fuel starvation. Fuel shut-off is turned OFF.	1. Check to see that the shut-off valve at the fuel tank is ON.
	2. Fuel pump is inoperative.	2. Inspect the fuel pump to see if it is pumping. Manually prime the system and check the return flow.
	3. Water is in the fuel.	3. Pump water out of the bottom of the fuel tank(s) and change the fuel filters and bleed the fuel system.
	4. Exhaust system is restricted.	4. Check exhaust system for some type of blockage such as carbon buildup at the exhaust elbow. Check for a fault in the muffler. Check for a collapsed exhaust hose.

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Battery runs down.	1. Alternator output is low.	1. Check drive belt tension. Make an output check with a voltmeter at the B+ terminal on the alternator.
	2. Faulty alternator.	2. Voltage leak through the alternator when not operating.
	3. Bad battery connections.	3. Connections are corroded or loose at the battery or/and at the engine.

## MAINTENANCE AND ADJUSTMENTS

### Introduction

This section contains a scheduled preventive maintenance program and several adjustment procedures the owner/operator can perform without the benefit of sophisticated and expensive tools and instruments.

### Preventive Maintenance

Perform the preventive maintenance in accordance with the schedules listed in the following paragraphs. Adherence to these schedules will ensure the equipment is maintained in the best possible condition and that it will perform to expectations. Those items marked by an asterisk (\*) are recommended to be performed by an authorized dealer or distributor.

### Daily (before each use)

1. Check the oil sump level. Maintain the oil level at or near upper level mark on dipstick.
2. Check the coolant level in the plastic recovery tank. Maintain this level at or above the level marked **ADD**.
3. Check the transmission's lubricant level, and add additional lubricant as needed.
4. Visually inspect the unit; check for loose belts, chafed or broken wires, loose brackets and fittings, damaged hoses, loose clamps, and other equipment not properly secured.
5. Check the fuel supply. Fill tank(s) with a good grade of No. 2 diesel fuel, if required.
6. Check the primary filter/water separator. Drain and service as required. (A primary filter/water separator is optional, but strongly recommended.)
7. Check the engine's gauges or lights for proper oil pressure, operating temperature, and starting battery charging voltage once the engine is operating.
8. Check the alternator's output gauge (if installed) for proper DC voltage.

### Monthly

Check the condition of the zinc anode in the heat exchanger's sea water circuit. Clean or replace the anode, as required. Keep the area inside the heat exchanger clean of zinc anode debris.

### Servicing After Initial 50 Hours of Operation

1. Change the engine's lubrication oil and oil filter.
2. Replace the fuel filter element in the on-engine filter and in the optional water/sediment separator, if a separator has been installed.

- \*3. Torque the cylinder head hold-down bolts.
- \*4. Adjust valve clearances.
- 5. Adjust the alternator and water pump drive belt tension, if required.
- 6. Lubricate the throttle, the RUN linkage cable, and the transmission's remote control cable.
- 7. Change the transmission's transmission lubricant.
- 8. Adjust the engine's idle speed (1000 - 1200 rpm).

#### **Servicing After Every 100 Hours of Operation**

- 1. Change the engine's lubrication oil and oil filter.
- 2. Adjust the alternator and water pump drive belt tension, if required.

#### **Servicing After Every 250 Hours of Operation**

Replace the fuel filter elements in the on-engine fuel filter and in the optional water/sediment separator.

#### **Servicing After Every 500 Hours of Operation**

- \*1. Torque the cylinder head hold-down bolts.
- \*2. Adjust the valve clearances.
- \*3. Drain, flush, and refill the fresh water cooling system.
- \*4. Check the condition of the starter motor drive pinion; lubricate pinion.
- 5. Check the resistance of the glow plugs.

NOTE: Items marked by an asterisk (\*) should be performed by a competent mechanic.

- 6. Check the condition of the sea water pump. Examine the pump's impeller and other pump components for wear. Replace worn components as needed.
- 7. Check the condition of the water injected exhaust elbow. Inspect for corrosion and carbon build-up, clean as needed. Replace if corrosion is excessive.

## Servicing After Every 800 Hours of Operation

- \*1. Remove and check fuel injectors.

Injector spray pressure:

1991 psi + 140 psi  
(140 kg/cm<sup>2</sup> + 10 kg/cm<sup>2</sup>)

NOTE: poor fuel quality and contaminants will shorten the injector and injector pump service life.

Eliminate undesirable injection conditions including after dripping.



- \*2. Check the compression pressure. Remove each glow plug and check each cylinder's compression pressure. The engine's cranking speed is at 280 rpm.

20B TWO & 30B THREE	
Standard	Minimum

389 psi (28 kg/cm <sup>2</sup> )	312 psi (22 kg/cm <sup>2</sup> )	(Maximum difference between cylinders: 35.5 psi (2.5 kg/cm <sup>2</sup> ))
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- \*3. Check the battery-charging alternator for proper operation.
- \*4. Check the tightness of bolts, nuts, and clamps.

## Servicing After Every 1000 Hours of Operation

1. Remove, clean, and pressure test the primary heat exchanger. (A local automotive radiator shop should be able to clean and test the heat exchanger.)

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

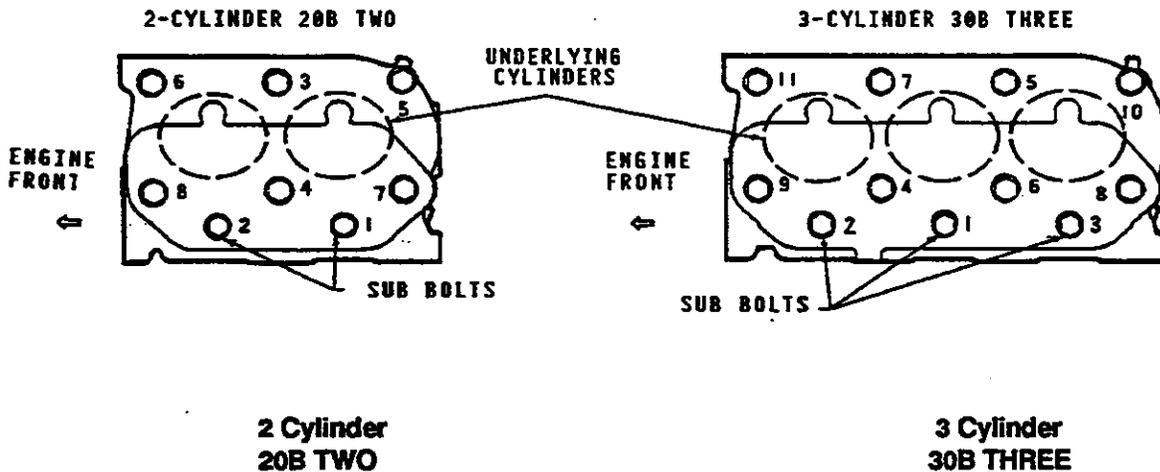
- \*2. Check the injection pump's timing.

## Cylinder Head Bolt Tightening Sequence

### CAUTION

Tighten the cylinder head bolts to the specified torque before the valves are adjusted.

**NOTE:** The rocker shaft assembly should be removed to allow access to the cylinder head bolts.



### Cylinder Head Bolt Tightening Sequence

Torque the cylinder head bolts in the numbered sequence shown in the illustration shown above. The engine should be cold. Before torquing each head bolt, loosen the bolt slightly and then tighten the bolt to the specified torque.

#### Torque Specifications

<b>20B TWO:</b> Bolts # 1 and 2	14.4 to 21.7 lb-ft (2.0 to 3.0 kg-m)
Bolts # 3, 4, 5, 6, 7 and 8	54.2 to 61.4 lb-ft (7.5 to 8.5 kg-m)
<b>30B THREE:</b> Bolts # 1, 2, and 3	14.4 to 21.7 lb-ft (2.0 to 3.0 kg-m)
Bolts # 4, 5, 6, 7, 8, 9, 10 and 11	54.2 to 61.4 lb-ft (7.5 to 8.5 kg-m)
<b>Rocker shaft hold-down bolts:</b>	10.8 to 15.9 lb-ft (1.5 to 2.2 kg-m)

All Main bolts are 14 mm across the bolt head flats.  
All Sub bolts are 12 mm across the bolt head flats.

Rocker shaft hold-down bolts are 12 mm across the bolt head flats

## Adjustment of Valve Clearances

### CAUTION

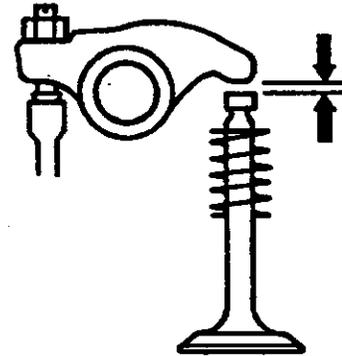
Tighten the cylinder head bolts to the specified torque before making valve adjustments.

Adjust the valve clearances when the engine is cold.

Intake 0.010 inches (0.25 mm)  
Exhaust 0.010 inches (0.25 mm)

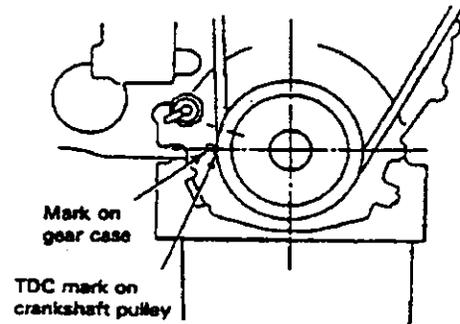
1. Pull off the air breather pipe from the rocker cover, and take off the rocker cover bolts. Adjust the valve clearances at TDC (Top Dead Center) for each cylinder when they are on their compression stroke.
2. Adjust all valve clearances at the Top Dead Center (TDC) of the compression stroke for each cylinder. Take care to align the TDC timing mark on the crankshaft pulley exactly with the indicator mark on the gear case, as shown on the illustration below. If these marks are not exactly aligned, the valves may be pushed up by the piston, depending on the position of the cam lobe.
3. Confirm that the valves do not move up or down when the crankshaft is turned slightly in either direction from the TDC mark.
4. Align the mark (as shown) for TDC for the No. 1 cylinder on its compression stroke and adjust the valve clearances for both intake and exhaust valves for the No. 1 cylinder with the engine cold.
5. When setting TDC for the No. 2 cylinder (or the No. 3 cylinder for the 30B THREE), proceed as follows:

ADJUST VALVES TO 0.010 INCHES  
(0.25 MM)



A. For the 20B TWO engine (2 cylinder) from TDC for the No. 1 cylinder, rotate the crankshaft 180° clockwise (as viewed from the front of the engine) and adjust the valve clearances for both intake and exhaust valves for the No. 2 cylinder.

B. For the 30B THREE engine (3 cylinder) from TDC for the No. 1 cylinder, rotate the crankshaft 240° clockwise (as viewed from the front of the engine) to position the No. 3 cylinder at TDC. Adjust the valve clearances for both intake and exhaust valves for the No. 3 cylinder.



Rotate the crankshaft an additional 240° clockwise to position the No. 2 cylinder at TDC. Adjust the valve clearances for both intake and exhaust valves for the No. 2 cylinder.

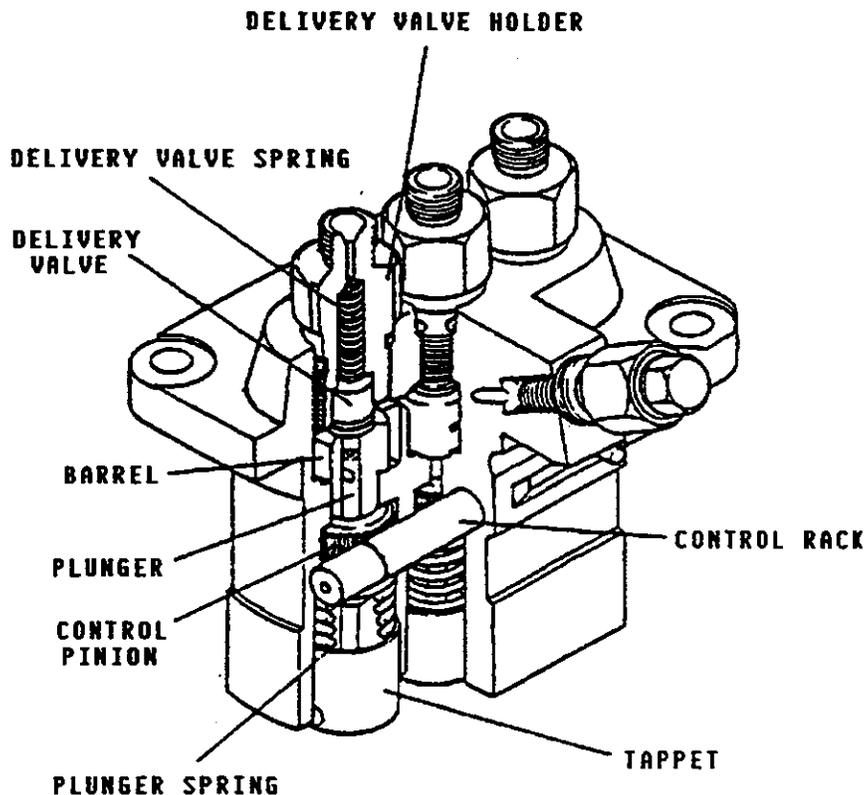
## Injection Pump Timing Adjustment (Spill Timing)

Incorrect fuel injection timing will result in hard engine starting and poor engine performance. Adjust the injection timing as follows:

**NOTE:** The shut-off lever (throttle) must be in the RUN position while making the adjustment or no fuel will flow to the fuel injection pump.

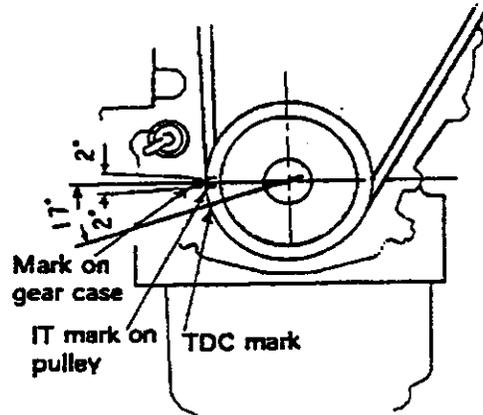
Refer to the cutaway view of the fuel injection pump. Remove the cylinder glow plugs to allow the engine's crankshaft to be easily rotated while making this adjustment. Rotate the engine so as to position the No. 1 piston at approximately the beginning of its compression stroke. Remove the high pressure injector line from between the injector pump and the No. 1 injector. Carefully remove the delivery valve holder from the pump and lift out the delivery valve spring. Carefully reinstall the delivery valve holder and tighten it in the pump. Reattach the No. 1 high pressure injector line to the delivery valve holder but do not connect it to the No. 1 injector; rather, swing the line out away from the engine so that during the timing check fuel will flow from this line and into a bucket and not on the engine.

Slowly work the priming lever on the fuel lift pump. Working this lever will prime the injector pump and fuel will flow from the No. 1 injector line. Continue priming slowly and rotate the engine's crankshaft in its normal direction of rotation (moving the No. 1 piston up on its compression stroke). Observe the fuel flow from the No. 1 injector line as the crankshaft is slowly turned. The instant the fuel flow stops marks the beginning of fuel injection. Check that the 19° BTDC timing mark on the crankshaft pulley is in alignment with the timing pointer on the front cover. The injection timing should be within  $\pm 0.5^\circ$ .



Cutaway View of the 30B THREE's Fuel Injection Pump

Adjust the injection timing by adding or removing shim thickness from under the injection pump: 1 mm of shim thickness is equivalent to approximately 1° of change in injection timing. The addition of shim thickness retards the timing, whereas the removal of shim thickness advances the timing.



Injection Timing Marks

# LAY-UP & RECOMMISSIONING

## GENERAL

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

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

These procedures should afford your engine protection during a lay-up and also help familiarize you with the maintenance needs of your engine.

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

## Propeller Shaft Coupling [Propulsion Engine]

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

## Fresh Water Cooling Circuit

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. Engine oil and combustion deposits combine to produce harmful chemicals which can reduce the life of your engine's internal parts.

## Fuel System [Gasoline]

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

## Fuel System [Diesel]

Top off your fuel tanks with No. 2 diesel fuel. Fuel additives such as *BIOBOR* and *STABIL* should be added at this time to control algae and condition the fuel. Care should be taken that the additives used are compatible with the primary fuel filter/water 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.

## Raw Water Cooling Circuit

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

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

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

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

## Cylinder Lubrication [Gasoline]

With the engine running, remove the flame arrester and spray fogging oil into the open air intake. The fogging oil will stall out the engine as it coats the valves, cylinders and spark plugs for winter protection.

# LAY-UP & RECOMMISSIONING

## Starter Motor

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

## Cylinder Lubrication [Diesel]

If you anticipate a long lay-up period (12 months or more) WESTERBEKE recommends removing the glow plugs or fuel injectors for access to the cylinders. Squirt light lubricating oil into the cylinders to prevent the piston rings from sticking to the cylinder walls. Rotate the engine by hand two revolutions then replace the glow plugs or injectors.

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

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

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

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

## Intake Manifold [Gasoline]

Clean the filter screen in the flame arrester, and place a clean cloth lightly soaked in lube oil around the flame arrester to block any opening. Also place an oil-soaked cloth in the through-hull exhaust port. Make a note to remove cloths prior to start-up!

## Transmission [Propulsion Engine]

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

## Batteries

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

## SPARE PARTS

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

## RECOMMISSIONING

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

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

## W 20B TWO MARINE DIESEL ENGINE

### GENERAL SPECIFICATIONS

Engine Type	Diesel, four-cycle, two-cylinder, fresh water-cooled, vertical, in-line (18 hp at 3600 rpm maximum)
Governor	Mechanical, centrifugal weight type
Valve Mechanism	Overhead
Combustion Chamber	Swirl chamber type
Bore & Stroke	2.99 x 2.76 inches (76 x 70 mm)
Piston Displacement	38.75 cubic inches (0.635 liters)
Firing Order	1-2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 2200 rpm)	30 lb-ft (4.15 kg-m)
Compression Ratio	23:1
Compression Pressure	398 psi (28 kg/cm <sup>2</sup> ) at 280 rpm
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance (engine cold)	Intake 0.010 inches (0.25 mm) Exhaust 0.010 inches (0.25 mm)
Dimensions	Height: 19.75 inches (501.65 mm) Width: 16.00 inches (406.40 mm) Length: 25.87 inches (657.10 mm)
Inclination	Continuous 14° Temporary 25° (not to exceed 30 min.)
Dry Weight	228 lbs (103.4 kgs)
Fuel Consumption (Propeller allowing rated RPM)	0.7 U.S. gph (2.65 lph) running at 2500 rpm (approximate)
Idle Speed	1000 - 1200 rpm
Cruise RPM	2500 - 3000 rpm

## 20B TWO MARINE DIESEL SYSTEM SPECIFICATIONS

### FUEL SYSTEM

General	Open flow - totally self-bleeding, manual priming.
Fuel	No. 2 Diesel (cetane # 45 or better).
Injector Pump	In-line plunger type (Bosch type).
Engine Timing (spill timing)	19° ±1° BTDC Static
Injector Pressure	1991 psi (140 kg/cm <sup>2</sup> )
Nozzle	Throttle type.
Lift Pump PN 037818	12-volt DC; lift capacity 5 ft (1.5 m)
Air cleaner	Plastic screen type - cleanable.
Air Flow (engine combustion)	40.6 cfm (1.1 cmm)

### COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump PN 037015	Centrifugal type, metal impeller, belt-driven.
Raw Water Pump PN 033636	Positive displacement, rubber impeller, mechanically-driven.
Raw Water Flow, at 3600 rpm (measured before discharging into exhaust elbow)	11.1 U.S. gpm (42 lpm) approximate.
System Capacity (fresh water)	2.9 qts (2.7 liters)

### LUBRICATION SYSTEM

General	Pressure type by Trochoid pump, gear-driven, with external pressure relief valve.
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## W 20B TWO SYSTEM SPECIFICATIONS

Operating Oil Pressure  
(engine hot) 15.0 - 45.0 psi (1.0 - 3.1 kg/cm<sup>2</sup>)

Oil Grade API specification of CF or CG-4

Sump Capacity (including filter) 3.0 U.S. qts. (2.8 liters)

### ELECTRICAL SYSTEM

Starting Battery 12-Volt, 35 A-H, (-) negative ground  
(recommended) (45 A-H cold areas)

Battery Capacity 90 - 125 (Ampere-Hours)

Starting Aid Glow plug, sheathed type

Starter Motor 12-Volt, 1.2KW, solenoid, actuated shift

DC No-Load Current 100 Amps at 11.5 Volts (3000 rpm, min.)

Cold Cranking Current 125 Amps at 10 Volts (805 rpm, min.)

Alternator 12-Volt DC, 50 Amps

Regulator Internal regulator, built into alternator

### TRANSMISSION

General (JS Transmission) Case-hardened helical gears, with an intermediate reverse gear. Reversing carried out by a servo double disc system.

Standard Gear Ratio 2.47:1

Propeller Shaft,  
Direction of Rotation Right handed - standard transmission

Propeller Recommendations 14 D x 11 P - 2 blade or 14 D x 9 P - 3 blade  
(using JS transmission Propeller should allow the engine to reach  
2.47:1 reduction) its full rated RPM (3600 + 000 - 100) at full open  
throttle while underway.

Lubricating Oil Grade API specification of CF or CG-4

SAE Grade SAE 20W/20 or SAE 30 exclusively  
(DO NOT mix grades of oil!)  
(DO NOT use multigrade oils!)

Transmission Sump Capacity 1 qt (1 liter)

## W 30B THREE MARINE DIESEL ENGINE

### GENERAL SPECIFICATIONS

Engine Type	Diesel, four-cycle, three-cylinder, fresh water-cooled, vertical, in-line (27 hp at 3600 rpm maximum)
Governor	Mechanical, centrifugal weight type
Valve Mechanism	Overhead
Combustion Chamber	Swirl chamber type
Bore & Stroke	2.99 x 2.76 inches (76 x 70 mm)
Piston Displacement	59.09 cubic inches (0.952 liters)
Firing Order	1-3-2
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 2200 rpm)	43 lb-ft (5.9 kg-m)
Compression Ratio	23:1
Compression Pressure	398 psi (28 kg/cm <sup>2</sup> ) at 280 rpm
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance (engine cold)	Intake 0.0098 inches (0.25 mm) Exhaust 0.0098 inches (0.25 mm)
Dimensions	Height: 19.75 inches (501.65 mm) Width: 16.00 inches (406.40 mm) Length: 28.81 inches (731.77 mm)
Inclination	Continuous 14° Temporary 25° (not to exceed 30 min.)
Dry Weight	272 lbs (123.3 kgs)
Fuel Consumption (Propeller allowing rated RPM)	1.19 U.S. gph (4.5 lph) running at 2500 rpm (approximate)
Idle Speed	1000 - 1200 rpm
Cruise RPM	2500 - 3000 rpm

## 30B THREE MARINE DIESEL SYSTEM SPECIFICATIONS

### FUEL SYSTEM

General	Open flow - totally self-bleeding, manual priming.
Fuel	No. 2 Diesel (cetane # 45 or better).
Injector Pump	In-line plunger type (Bosch type).
Engine Timing (spill timing)	19° ±1° BTDC Static
Injector Pressure	1991 psi (140 kg/cm <sup>2</sup> )
Nozzle	Throttle type.
Lift Pump PN 037818	12-volt DC; lift capacity 5 ft (1.5 m)
Air cleaner	Plastic screen type - cleanable.
Air Flow (engine combustion)	60.4 cfm (1.7 cmm)

### COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump PN 037015	Centrifugal type, metal impeller, belt-driven.
Raw Water Pump PN 033636	Positive displacement, rubber impeller, mechanically-driven.
Raw Water Flow, at 3600 rpm (measured before discharging into exhaust elbow)	11.1 U.S. gpm (42 lpm) approximate.
System Capacity (fresh water)	4 qts (3.8 liters)

### LUBRICATION SYSTEM

General	Pressure type by Trochoid pump, gear-driven, with external pressure relief valve.
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## 30B THREE MARINE DIESEL SYSTEM SPECIFICATIONS

Oil Filter PN 036920	Full flow, paper element, spin-on type.
Sump Capacity (including filter)	3.7 U.S. qts (3.5 liters)
Operating Oil Pressure (engine hot)	15 - 45 psi (1.0 - 3.1 kg/cm <sup>2</sup> )
Oil Grade	API specification of CF or CG-4

### ELECTRICAL SYSTEM

Starting Battery	12-volt, 26 A-H, (-) negative ground (recommended) (35 A-H in cold areas)
Battery Capacity	90 - 125 (ampere-hours)
Starter PN 034552	12-volt, 1.2 KW, reduction type, solenoid-mounted.
DC No-Load Current	100 amp (max.) at 11.5 volts (3000 rpm, min.).
DC Cranking Current	190 amps at 10 volts (805 rpm, min.) (engine cold).
DC Alternator PN 030594	12 volt DC, 50 amps

### TRANSMISSION

General (JS Transmission)	Case hardened helical gears with an intermediate reverse gear. Reversing out by a servo double disc system.
Standard Gear Ratio	2.47:1
Propeller Shaft Direction of Rotation	Right handed - standard transmission.
Propeller Recommendations (using JS transmission 2.47:1 reduction)	18D x 11P - 2 blade or 18D x 9P - 3 blade propeller should allow the engine to reach its full rated rpm (3600 + 000 - 100) at full open throttle while underway.
Lubricating Oil Grade	API specification of CF or CG-4
SAE Grade	SAE 20W/20 or SAE 30 exclusively. (Do not mix grades of oil or use multigrade oils!)
Transmission Sump Capacity	1 qt (1 liter)

## TORQUE SPECIFICATIONS

	<u>Lb-ft</u>	<u>Kg-m</u>
Cylinder head bolt, main *(wet), M10 (14)	54.23 - 61.46	7.5 - 8.5
Cylinder head bolt, sub *(wet), M8 (12)	14.46 - 21.69	2.0 - 3.0
<b>See the "Cylinder Head Bolt Tightening Sequence"</b>		
Connecting rod cap nut, M8 (14)	23.14 - 25.31	3.2 - 3.5
Flywheel bolt, M10 (17)	61.46 - 68.69	8.5 - 9.5
Crankshaft pulley nut, M16 (24)	72.31 - 86.77	10.0 - 12.0
Main Bearing cap bolt, M10 (17)	36.15 - 39.77	5.0 - 5.5
Rocker shaft hold-down bolt, M8 (12)	10.85 - 15.91	1.5 - 2.2
Rocker cover nut, M6 (10)	3.62 - 5.06	0.5 - 0.7
Nozzle holder (fitting to engine), M20 (21)	36.15 - 43.38	5.0 - 6.0
Nozzle union color fixing nut, M12 (17)	18.08 - 21.69	2.5 - 3.0
Nozzle retaining nut, M16 (21)	25.31 - 28.92	3.5 - 4.0
Fuel injection pipe nut, M12 (17)	18.08 - 25.31	2.5 - 3.5
Delivery valve holder, M16 (17)	25.31 - 28.20	3.5 - 3.9
Injection pump hollow screw, M10 (14)	7.23 - 10.85	1.0 - 1.5
Solenoid locknut, M30 (36)	28.92 - 36.15	4.0 - 5.0
Water temperature gauge joint, M16 (23)	14.46 - 21.69	2.0 - 3.0
Oil filter, M20 (17)	7.95 - 9.40	1.1 - 1.3
Oil relief plug, M18 (22)	28.92 - 36.15	4.0 - 5.0
Oil drain hose plug, M18 (19)	36.15 - 43.38	5.0 - 6.0
Glow plug, M10 (12)	10.85 - 14.46	1.5 - 2.0
Glow plug lead wire fitting nut, M4 (7)	0.723 - 1.08	0.1 - 0.15

NOTE: Hardware listed on the previous page is metric, with values given as in the following example: Flywheel bolt M10 (17). M10 indicates Metric, 10mm thread diameter; (17) indicates 17 mm across the flats of the bolt head.

\* Wet indicates that the bolts (if removed) are to have a thin oil film wiped on them before they are retorqued. If the bolts have not been removed and need only to be retorqued, then no oil is needed. Refer to page 69 for the location of the main and sub bolts.

## TABLE OF STANDARD HARDWARE TIGHTENING TORQUES

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

	Pitch	lb-ft	kg-m
<b>Grade 4T</b>			
6mm bolt head/nut	1	2.9 - 5.1	0.4 - 0.7
8mm bolt head/nut	1.25	7.2 - 11.6	1.0 - 1.6
10mm bolt head/nut	1.25	13.7 - 22.4	1.9 - 3.1
10mm bolt head/nut	1.5	13.0 - 21.7	1.8 - 3.0
12mm bolt head/nut	1.25 (ISO)	25.3 - 39.8	3.5 - 5.5
12mm bolt head/nut	1.5	25.3 - 39.8	3.5 - 5.5
12mm bolt head/nut	1.75	21.7 - 36.2	3.0 - 5.0
13mm bolt head/nut	1.5	32.5 - 50.6	4.5 - 7.0
14mm bolt head/nut	1.5	36.2 - 57.9	5.0 - 8.0
14mm bolt head/nut	2	34.0 - 55.7	4.7 - 7.7
16mm bolt head/nut	1.5	54.2 - 79.6	7.5 - 11.0
16mm bolt head/nut	2	51.4 - 76.7	7.1 - 10.6
<b>Grade 6T</b>			
6mm bolt head/nut	1	4.3 - 6.5	0.6 - 0.9
8mm bolt head/nut	1.25	10.8 - 15.9	1.5 - 2.2
10mm bolt head/nut	1.25	21.7 - 32.5	3.0 - 4.5
10mm bolt head/nut	1.5	19.5 - 30.4	2.7 - 4.2
12mm bolt head/nut	1.25 (ISO)	36.2 - 57.9	5.0 - 8.0
12mm bolt head/nut	1.5	36.2 - 50.6	5.0 - 7.0
12mm bolt head/nut	1.75	34.7 - 49.2	4.8 - 6.8
<b>Grade 7T, 8T and 8.8</b>			
6mm bolt head/nut	1	5.8 - 8.7	0.8 - 1.2
8mm bolt head/nut	1.25	14.5 - 21.7	2.0 - 3.0
10mm bolt head/nut	1.25	28.9 - 39.8	4.0 - 5.5
10mm bolt head/nut	1.5	26.8 - 37.6	3.7 - 5.2
12mm bolt head/nut	1.25 (ISO)	54.2 - 75.9	7.5 - 10.5
12mm bolt head/nut	1.5	50.6 - 65.1	7.0 - 9.0
12mm bolt head/nut	1.75	43.4 - 61.5	6.0 - 8.5
13mm bolt head/nut	1.5	57.9 - 86.8	8.0 - 12.0
14mm bolt head/nut	1.5	72.3 - 108.5	10.0 - 15.0
14mm bolt head/nut	2	68.7 - 101.3	9.5 - 14.0
16mm bolt head/nut	1.5	108.5 - 166.4	15.0 - 23.0
16mm bolt head/nut	2	101.3 - 159.1	14.0 - 22.0
<b>Grade 5 capscrew</b>			
1/4 UNC		9 - 11	1.2 - 1.5
1/4 UNF		11 - 13	1.5 - 1.8
5/16 UNC		18 - 20	2.5 - 2.8
5/16 UNF		21 - 23	2.9 - 3.2
3/8 UNC		28 - 33	3.7 - 4.6
3/8 UNF		30 - 35	4.1 - 4.8
7/16 UNC		44 - 49	6.1 - 6.8
7/16 UNF		50 - 55	6.9 - 7.6
1/2 UNC		68 - 73	9.4 - 10.1
1/2 UNF		73 - 80	10.1 - 11.1

## SPARE PARTS

Since a possibility exists in which the engine may need to be serviced at sea or while in a port other than your home port, certain spare parts should be kept on board to help minimize delays in your voyage. Please refer to your engine's Parts List for part numbers when ordering spare parts. Listed below are those spare parts that should be carried on board at all times.

1. An Impeller kit.
2. A Fuel System hardware kit.
3. A Secondary Fuel Filter.
4. An Alternator/Raw Water Pump Belt.
5. Hose Clamps
6. A Spare Oil Filter with a Spare Quart of Diesel Service Engine Oil along with a Quart of Transmission Oil and a Gallon of Premixed Antifreeze.
7. Zinc Anodes.
8. Heat Exchanger End Cap Gaskets.
9. Oil Pressure Switch and Sender.

Other parts, whose life expectancy cannot be accurately predetermined, should be carried on board (in addition to those listed above) especially if the vessel is to be taken on long ocean voyages. These parts are listed below.

1. Fuel Injectors or injector nozzles - these can be installed by injection shop.
2. Glow plugs
3. Cooling System Hoses
4. An Alternator
5. A Starter
6. A 20 Amp DC Circuit Breaker
7. A Fuel Lift Pump
8. A Raw Water Pump
9. Battery Terminal Connectors

The spare parts listed directly above are those we *recommend* be carried on board during long ocean voyages. You may wish to ask other boat owners who have similar crafts and who have completed long ocean voyages as to what spare parts they carried on board and what parts were needed at specific times of the voyage. From the list provided directly above and from these inquiries, you can determine what spare parts may be needed. In addition, if you are planning a long ocean voyage, consult your local Westerbeke dealer for a listing of the Westerbeke dealers located on your route.



**Declaration of Conformity**

**Application of Council Directive(s)** EMC 89/336/EEC

**Standard(s) to Which Conformity is declared** EN50081-1  
EN50082-2  
EN55020

**Manufacturers Name** Westerbeke Corporation

**Manufacturers Address** 150 John Hancock Road  
Myles Standish Industrial Park  
Taunton, MA 02780-7319, USA

**Type of Equipment** Marine Diesel Engine

**Product Name** Westerbeke Marine Diesel Engine

**Model(s)** 12C-TWO, 20B-TWO, 30B-THREE  
35C-THREE, 44A-FOUR, 63D-FOUR,  
82B-FOUR, 80-N4, 110-T4, 120-N6,  
170-T6

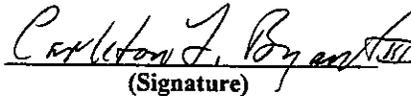
**Product Options** All

**Supplementary Information**

- 1.) The equipment listed is only for use in Marine Applications aboard boats.
- 2.) The equipment listed must be located below decks on the vessel and Permanently installed in its location.
- 3.) The equipment listed must be wired to the grounding system of the vessel.

I the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place Taunton, Massachusetts, U.S.A.

  
(Signature)

Date: September 25, 2001

Carleton F. Bryant  
(Full Name)

Chief Operating Officer  
(Title)

**INTERNATIONAL MARINE CERTIFICATION INSTITUTE**

Rond Point Schuman 8, Box 0  
8 - 1040 BRUXELLES  
BELGIQUE  
tel: (32) 2-230-7862  
fax: (32) 2-230-7700



**CERTIFICATE**

We hereby certify that the engine stated below meets the EC Directive 94/25/EC, including power declaration in accordance with ISO 8665

for model year  
2000

MANUFACTURER	Westerbeke Corporation
ADDRESS	Avon Industrial Park AVON, MA 02322 USA
MODEL NAME	20 B II

SPECIFICATIONS	
Engine Type	Inboard
Fuel Type	Diesel
Aspiration Type	Natural

Rating Level	Highest Output (1)	(2)	(3)	(4)	Lowest Output (5)
Crankshaft Power [kW]	11	*	*	*	*
Propeller Shaft Power [kW]	10	*	*	*	*
at RPM [min <sup>-1</sup> ]	3.600	*	*	*	*

Manufacturer's verification statement	
Power rating is in accordance with IMCI Procedure	
This application form has not been lodged with any other notified body	
Company:	Westerbeke Corporation
Date:	30/Mar/2000
Name:	Norman Ellis
Title:	International Sales Manager
Signature:	

Certification number	IDNWESTER007
Signed	
Name	Ulrich Heinemann
Title	Managing Director
EU Notified Body No.	0609
Date	01/Apr/2000