

OPERATOR'S MANUAL

for

WESTERBEKE 10 TWO

MARINE ENGINE

AND

WESTERBEKE 3KW

GENERATOR SET

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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.

FOREWORD

Thank you for having selected a Westerbeke Diesel Engine for your use.

This manual describes the procedures for proper handling and maintenance of both:

- (a) 10 Horsepower Marine Propulsion Engine
- (b) 3 KW Marine Generator Set

To obtain best operating condition and longest life, it is important to use it sensibly and carry out operation and maintenance according to this manual.

If you have questions about your equipment or in the event of a failure, please contact your nearest distributor or dealer.

We look forward to your continued patronage.

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GENERAL SPECIFICATIONS

ENGINE

Type	Vertical 4 cycle, water cooled
No. of cylinders	Two
Bore & stroke (inches)	2.56 X 2.68
Cubic inch displacement	27.52
Compression ratio	25:1
Firing order	1-2
Dry weight, engine only	128 pounds
Injection pump	Bosch type
Injectors	Throttle type
Combustion chamber	Swirl type
Fuel	#2 diesel
Governor	Centrifugal weight type
Lubrication system	Pressure by trochoid pump
Oil filter	Paper type, engine mounted
Engine oil capacity	2 quarts
Cooling system	Forced circulation through heat exchanger
Electric starter	12 volt, 1 horsepower
Alternator	35 ampere, 12 volt
Glow plugs	Sheathed quick heat type
Battery capacity	Recommend 60 amp hour

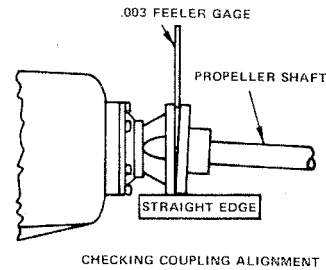
GENERATOR

Generator type	4 pole, revolving armature, inherently regulated, self limiting, rectifier excited, AC slip rings, single bearing design
Insulation	Class F

INSTALLATION AND SUPPLY CAUTIONS

- * Check important aspects of installation before operating engine.

- (1) Alignment (Error to be no more than one thousandth of an inch per inch of coupling diameter)
- (2) Provide sufficient ventilation
- (3) Provide adequate service room around engine (See warranty clauses)



- * Fill fuel tank with CLEAN #2 diesel from a reputable manufacturer.
- * Fill lubricating oil to full mark on dipstick (Select readily available lubricating oil of grade CC or CD).
- * Fill water with suitable mixture of water and antifreeze to suit your temperature zone. See page 16.
- * Plug-in Panel Harness Connection. After assembly, joint should be taped to prevent corrosion or, preferably, assembled using a silicon grease which can be obtained at an electronic store such as Radio Shack.

SAFETY PRECAUTIONS

- * Never operate engine with inadequate ventilation.
- * Do not touch moving parts during operation.
- * Do not touch hot parts such as exhaust pipe, and do not place combustible materials near.
- * Inspect and adjust parts of the engine only after it is stopped.
- * Check and refill engine oil, cooling water and fuel after the engine is brought to a stop.
- * In checking the water level for refilling, remove the pressure cap only after the water temperature has fallen enough to prevent a steam burn.
- * Always use tools that fit correctly and use caution during servicing.
- * Be sure that current carrying wires are protected from abrasion and that all connections are tight.

BREAKING IN YOUR NEW ENGINE

While your engine has had individual test operations sufficient to demonstrate accurate assembly and correct operation of all systems, it still requires break in time.

Service life of your engine is dependent on how your engine is operated and serviced during the initial twenty hours of operation.

Your new engine needs twenty hours of conditioning operation for breaking in each moving part, thus maximizing performance and life of engine. Perform this conditioning carefully, keeping the following points in mind.

1. Start engine, run idle while checking that all systems are functioning - sea water pump, oil pressure, battery charge.
2. Warm engine, preferably by running propeller at fast idle while tied down, until water temperature gauge moves into the 130 - 140 degree range.
3. Then use engine at moderate load (60% \pm) for first five hours.
4. Avoid rapid acceleration.
5. Use caution not to overload engine. Grey or black smoke is a sign of overload.
6. Next fifteen hours may be run at 70 - 75% load.

Explanation:

"Breaking in" a new engine is basically a seating of the piston rings to the cylinder walls. This is not accomplished by long periods of running idle, nor by early running under full load, nor by varying loads with intervals of fast acceleration and/or excessive speed.

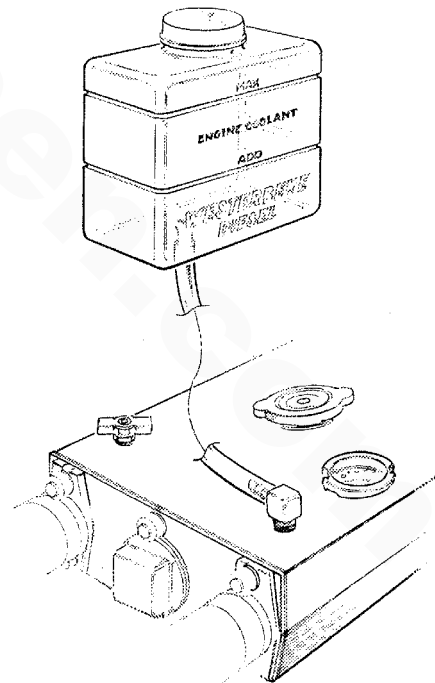
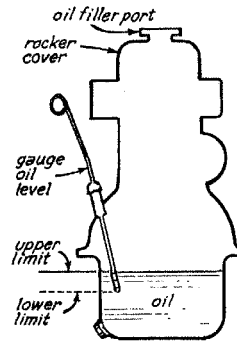
Idle running may glaze the cylinder walls causing oil consumption and smoky operation. Excessive speeds and loads may score cylinder walls with similar results.

As indicated above, use a short warm up at idle and put engine under moderate load and speed for the first five hours of operation. For the next fifteen hours, use approximately 70% load. This kind of careful operation will result in best results from your engine.

PREPARATIONS

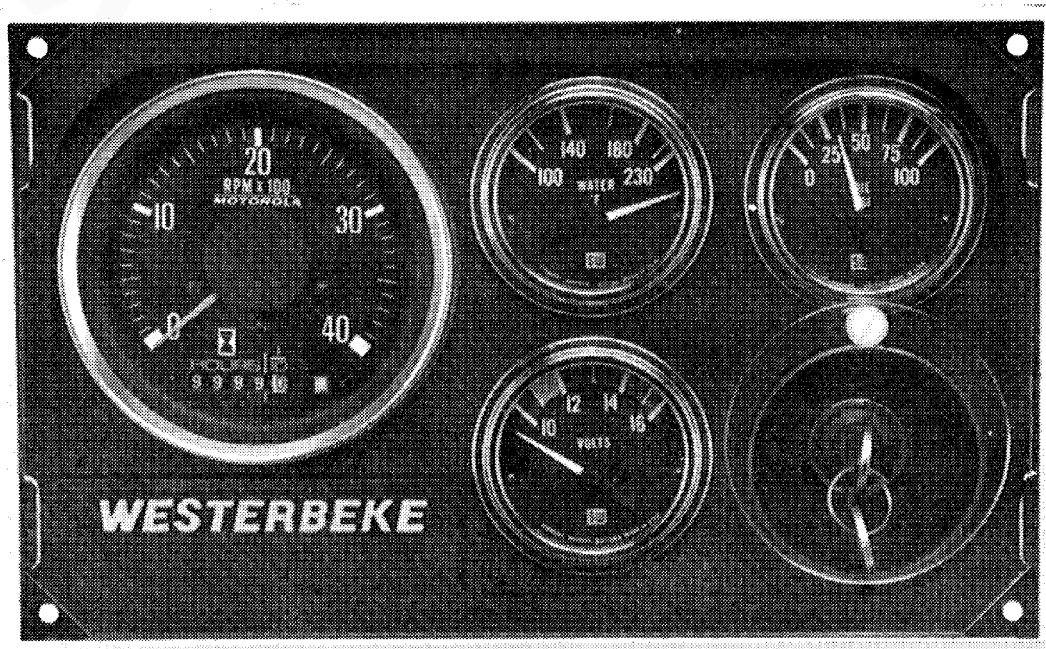
Take steps as shown below in starting your engine for the first time or after a prolonged shut-down.

1. Fill your engine with oil up to or near the upper limit on the dipstick. Use a good grade of oil with API specification of CC or better. For quantity of oil, you may refer to the General Specifications page. However, it is best always to be guided by dipstick measurement as angle of installation has some effect.
2. Your engine is supplied with a coolant recovery system to which the following instructions apply:
 - a) Fill engine completely to the neck of the manifold cap.
 - b) Then fill the recovery tank to the bottom level line. Need for adding coolant is indicated when a cold engine has coolant level below the bottom level line.
 - c) In winter add antifreeze as described on page 16. Antifreeze may be used year round if changed annually.
3. Fill the fuel tank with Diesel fuel. The interior of the fuel tank must be maintained clean. Be careful not to allow introduction of dirt when filling fuel.
4. Engine oil, coolant and transmission levels should be checked at least once a day prior to engine use.



STARTING PROCEDURES

Instrument panel, description and use of:



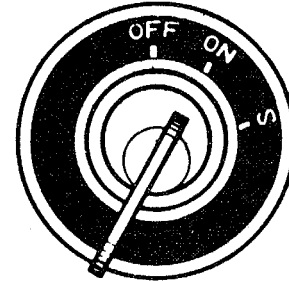
Note 1: When engine is stopped after use, the water temperature and oil pressure gauges may stay at their running readings.

Note 2: When engine is next to be used, turn start switch to "ON". The temperature and pressure gauges will "ZERO" and the voltmeter will register battery voltage. The electric fuel pump, mounted on the engine, will also begin to operate, purging any air accumulated in the system.

Note 3: The engine is now prepared for starting.

STARTING PROCEDURES

1. Turn the starter switch to the "ON" position. If making an initial start after lay-up, fuel filter servicing or repairs, allow fuel pump to work 15-25 seconds to purge the system of any air. Check that clutch is in neutral and that throttle is in full forward.



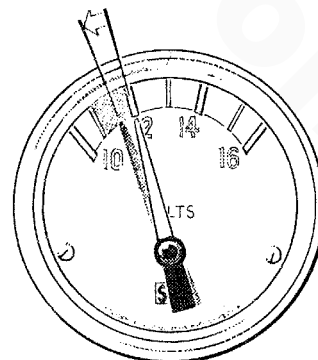
2. Glow plug preheating

With key in "ON" position, push in about 1/4 inch or enough so that voltmeter indicates discharge. Hold key in depressed position until glow plugs are sufficiently hot. Follow Table below for preheating time.

Quick-heat type (Y114T)

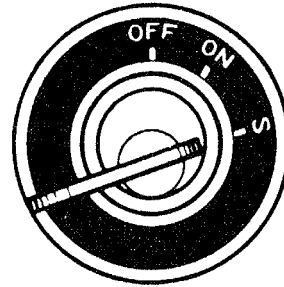
Atmospheric temperature	Preheating time
+5°C (+41°F) or higher	Approx. 10 sec.
+5°C (+41°F) to -5°C (+23°F)	Approx. 20 sec.
-5°C (+23°F) or lower	Approx. 30 sec.
Limit of continuous use	1 minute

3. Proper glow plug function is indicated by voltmeter drop when key 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 connection).



4. Starting

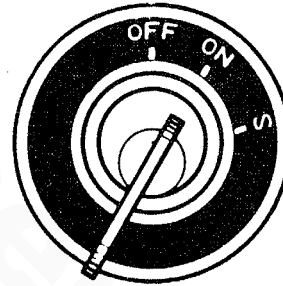
Continuing to hold the key depressed, turn to the "START" position. The starter motor will run thereby cranking the engine. Hold throttle open until engine runs and then reduce throttle.



Should the engine not start even when the starter switch is left at "S" position for 10 seconds, take your hand off the starter switch for 30 seconds, and then attempt to start the engine again by sufficiently preheating the glow plug. The starter motor should never be allowed to run for more than 30 seconds at a time.

5. Operation

As soon as the engine has started, release the key. The key will automatically return to the "ON" position. Leave the key at "ON" during operation. Check that with engine running, oil pressure and battery charge voltage are registering and that raw water is discharging with the exhaust.



During engine operation, do not turn the key to "S" position. This may damage the starter motor.

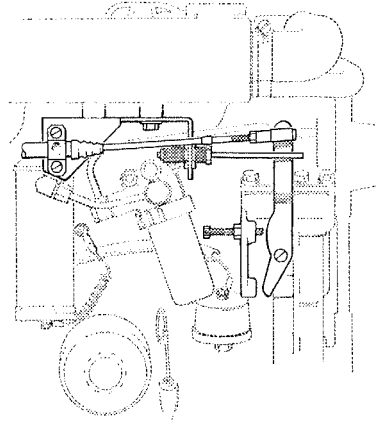
6. Warm-up operation

Run a few minutes at "IDLE" position to assure that all functions are operating. Then operate under reduced load until water temperature rises into the 140-150° range.

STOPPING PROCEDURE

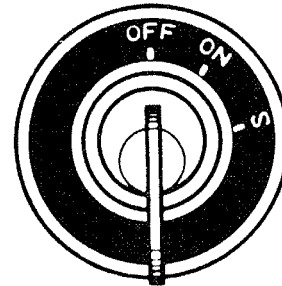
1. Stop

To stop the engine move the throttle control through the idle position to stop. As the throttle is moved past idle there will be increased resistance to movement because a spring loading must be overcome. Hold the throttle firmly against the pressure until the engine comes to a complete stop.



2. Starter switch off

With the engine stopped, turn the starter key back to "OFF" position. The battery will be discharged if the key is left at "ON" position. An engine alarm buzzer is provided to warn the operator of this possibility. Best precaution is always to remove the key.



CAUTIONS ON STARTING AND OPERATION

1. Normal starting

Follow the procedures below for routine starting of your engine.

- 1) Check the engine and transmission oil levels and refill if necessary.
- 2) Insure that you have sufficient fuel. Keep tank as full as possible.
- 3) Check cooling water level, and refill if necessary.
Note: Check for leaks of water or oil, particularly when signs of such leak are found on the bottom of the engine or in the drip tray.
- 4) Start the engine in accordance with the procedures given on the preceding pages.
- 5) Allow the engine to warm up to 140°-150° F before placing the engine under heavy load.

2. Starting under cold conditions

The following three adverse conditions concur as the atmospheric temperature drops exceedingly, and the engine must, under such conditions, be started by taking steps described below:

LUBRICATING OIL TURNS VISCOUS - Make certain that viscosity is proper for the prevailing atmospheric temperature. Check the oil also for deterioration. (Study page 12.)

VOLTAGE ACROSS BATTERY TERMINALS DROPS - Check that the battery is fully charged.

THE TEMPERATURE OF INTAKE AIR IS LOW AND COMPRESSION TEMPERATURE DOES NOT RISE ENOUGH - Allow the glow plug to operate sufficiently to aid starting. See table on page 8.

3. Cautions during operation

Confirm that the oil pressure is normal during normal operation.

Confirm that exhaust gas is as follows:

- * While engine is cold.....White smoke
- * When the engine grows warm.....Almost smokeless
- * When the engine is overloaded.....Some black smoke

Check for abnormal noise such as knocking, friction or leaking sounds, and vibration and blow-back sounds.

Check for leaks of fuel and engine oil.

A knocking sound is heard while the engine is cold, during quick acceleration and at idle. Confirm that no knocking sound is heard in other cases.

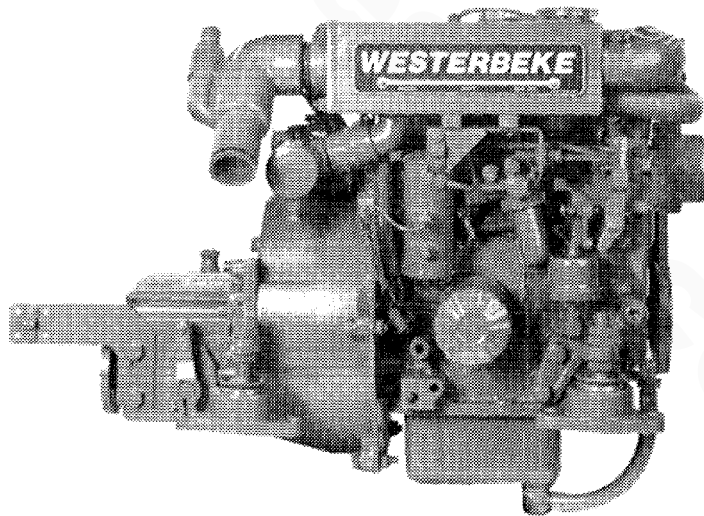


Photo above is right hand side of W10two with 2:1 reverse and reduction gear. Note convenient cable attachment brackets for clutch and throttle, accessible filter location and lube oil drain hose.

REQUIREMENTS FOR PROPER OPERATION

LUBRICATION SYSTEM

1. Engine oil

For engine lubrication, use diesel engine oil. Diesel engine oils are classified according to the API Specifications into grades CA, CB, CC and CD. Any one of them is usable, but use of CC or higher grades prepared by well-known makers is recommended.

2. Engine oil viscosity

Use oil having viscosity best suited to the atmospheric temperature. Use of an all-season oil SAE10W-30 with minimum viscosity change under different temperatures is suggested.

Atmospheric temperature	Viscosity
20°C (68°F) or higher	SAE 30 or 1 ^W -30
5°C (41°F) - 20°C (68°F)	SAE 20 or 10W-30
5°C (41°F) or lower	SAE 10W-30

3. Oil pressure

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

During normal operation.....Oil pressure will range between 50 and 70 PSI.

At the time of cranking.....Pressure will rise proportionately with speed.

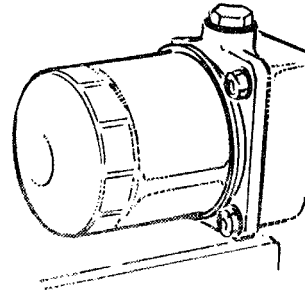
4. Engine oil change

To renew engine oil, discharge old oil through the sump drain hose attached at front of engine while engine is still warm. Drain old oil completely, replace the hose, plug the end securely and add fresh oil through the oil inlet port on the valve cover. After refilling oil, idle the engine for several minutes and stop. Then check the quantity of oil by the oil level gauge. Fill to but not over the high mark on the dipstick. Always observe old oil as it is removed. A yellow/grey emulsion indicates presence of water in the oil. While this condition is rare, it does require prompt attention to prevent serious damage.

5. Replacement of oil filter

Being a replaceable cartridge type, the oil filter requires no cleaning inside.

In installing the oil filter, apply engine oil thinly on to the O-ring, and then tighten it by hand firmly.



When removing the used filter, cover over with a plastic bag. This will allow both filter element and spilled oil to be collected cleanly without spilling oil in the bilge.

Note A: After market filters are not recommended since the material standard or diameters of important items might be entirely different from genuine parts.

Note B: Immediately after filter change and oil fill, run engine to ensure that oil pressure is normal and that there are no oil leaks.

FUEL SYSTEM

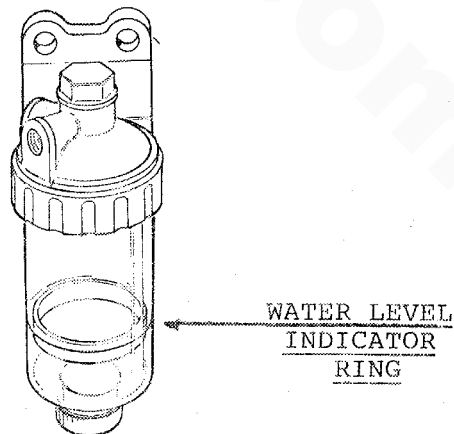
1. Diesel fuel

USE #2 DIESEL FUEL. NEVER USE KEROSENE OR HEAVY OIL.

In cold weather particularly, water vapor is produced by condensation when air is present in the fuel tank. The tank, therefore, should be kept full as much as possible.

The fuel tank, furthermore, needs to be kept completely free of dirt and water.

2. It is required that a primary fuel filter of the water entrapment type be installed between the fuel tank and the engine. Such a filter, shown here, is available under Part #32974 from your local Westerbeke representative or your boat builder. This filter, adapted for boat builder use, comes complete with fittings for either hose or metal tubing. Mount in an accessible place, inspect often and drain off water accumulation frequently.



3. Notes on fuel system

See on facing page a typical exploded view of a fuel system for a two cylinder engine. It is also illustrative of the self-bleeding system used on the Westerbeke 3 KW marine generator set.

The Westerbeke self-bleeding fuel system is automatic in operation. While it is unlikely that the operator will be forced to service the system at sea, the possibility does exist. Therefore, it is recommended that the following parts be carried onboard.

Banjo washers #'s 11, 30, 31, 33, 34, 45
Injector seat washers #42
Lift pump filter and gaskets #'s 6, 7, 8
Fuel filter element and gaskets #'s 13, 14 ,15

If a leak should develop at a banjo or washer that cannot be remedied by a simple tightening of the screw, renew the washers.

The engine can be started by taking the steps described on pages 8 and 9. In cases where the engine cannot be started easily, loosen two injection nuts on the nozzle side, turn the speed control lever to "full open" position, turn the starter motor and then tighten the nuts firmly.

4. Cleaning fuel filter and replacing filter element

After the first 50 hours of operation, loosen the retainer ring #16 and discard filter element #15. Clean bowl #17 and re-install new filter, using new gasket #13 and #14.

This same treatment is required of the filter element #6 in the fuel lift pump. Similarly, replace new filter element #6 using new gasket #7 and #8.

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

5. Fuel injection pump

The fuel injection pump is one of the most important components of the diesel engine and thus it calls for the utmost caution in handling. Furthermore, the fuel injection pump has been thoroughly shop-adjusted and should never be readjusted carelessly.

Such adjustment, whenever necessary, should be performed at an authorized service station, as a precision pump tester and skills are required.

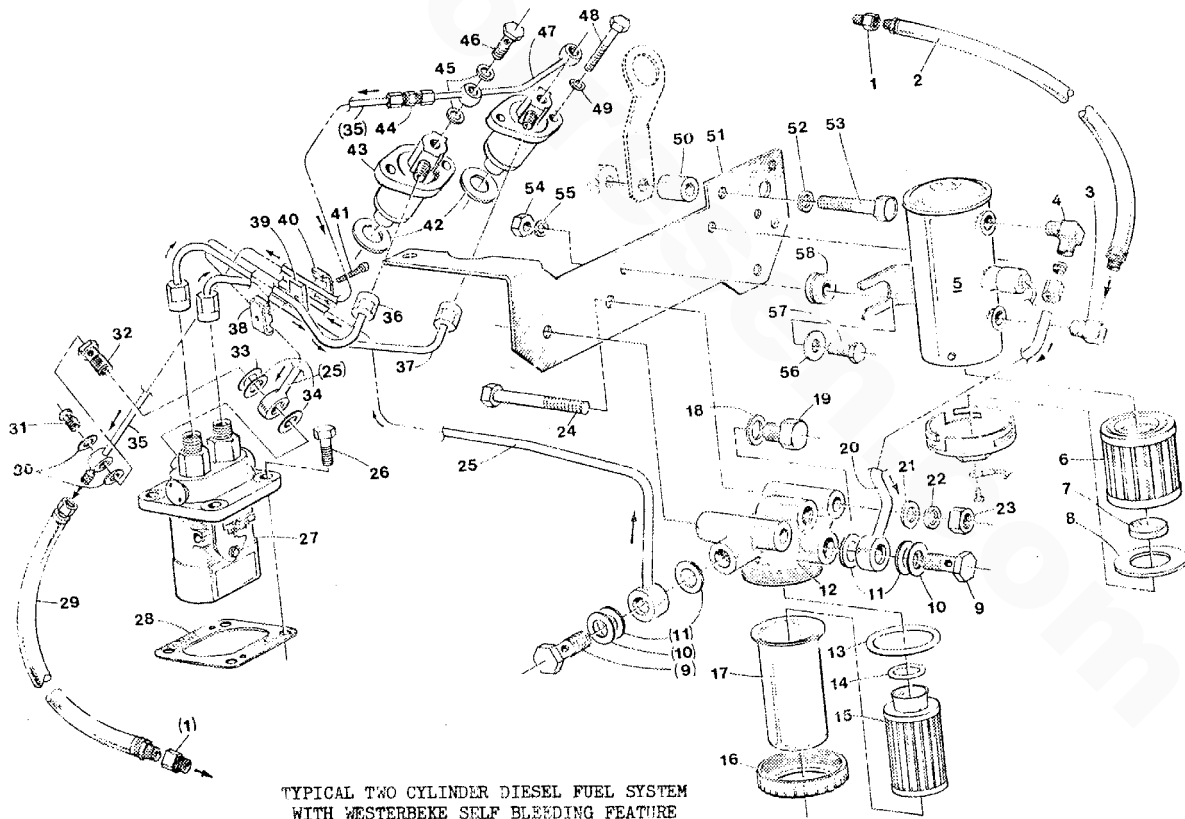
To obtain long and satisfactory use of your injection pump:

Always use fuel which is free from impurities.
Clean and renew the fuel filter periodically.
Inspect water entrapment filter regularly.

If a water trap type filter (see page 13) is not interposed between the fuel tank and engine lift pump, any entrained water will tend to lay in bottom of lift pump. Internal metal parts of the lift pump will rust. Particles will pass on to filters and eventually to injection pump and injectors with damaging and expensive results.

While many boat builders do supply a water trap filter, there are some who do not. It is to prevent such omission that Westerbeke offers a sedimenter/water trap filter as a desirable optional extra at moderate cost. It is supplied with fittings for either hose piping or metal tube piping.

Order it with the engine, install it in an accessible place, inspect it daily and drain as needed.



COOLING SYSTEM

1. Cooling water

As cooling water, use soft water with least impurity content such as tap water (potable water) or rainwater, and never use hard water or foul water. Use of hard water or water containing much impurity will lead to collection of scale in the engine and heat exchanger with resultant decline in cooling effects.

2. Antifreeze

In cold districts, care should be taken to prevent cooling water from freezing. Cooling water, when frozen, expands to break the heat exchanger and the cylinder block, and it is essential that antifreeze be added to cooling water in a quantity proportional to the lowest temperature of the district. It is recommended that the antifreeze mixture be used throughout the year.

*Antifreeze of poor quality or without rust inhibitor will cause corrosion of the cooling system. Always use antifreeze prepared by a reliable maker, and never use it mixed with antifreeze of a different brand.

*Make sure that the cooling system of the engine is cleaned well before adding antifreeze.

*Recommended antifreeze for year round use is ZEREX or PRESTONE with rust inhibitor.

ANTIFREEZE ADDITION DATA

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

Note: It is advisable that antifreeze concentration be selected on the basis of a temperature which is about 5°C (10°F) lower than the actual atmospheric temperature expected.

3. Fresh water cooling system

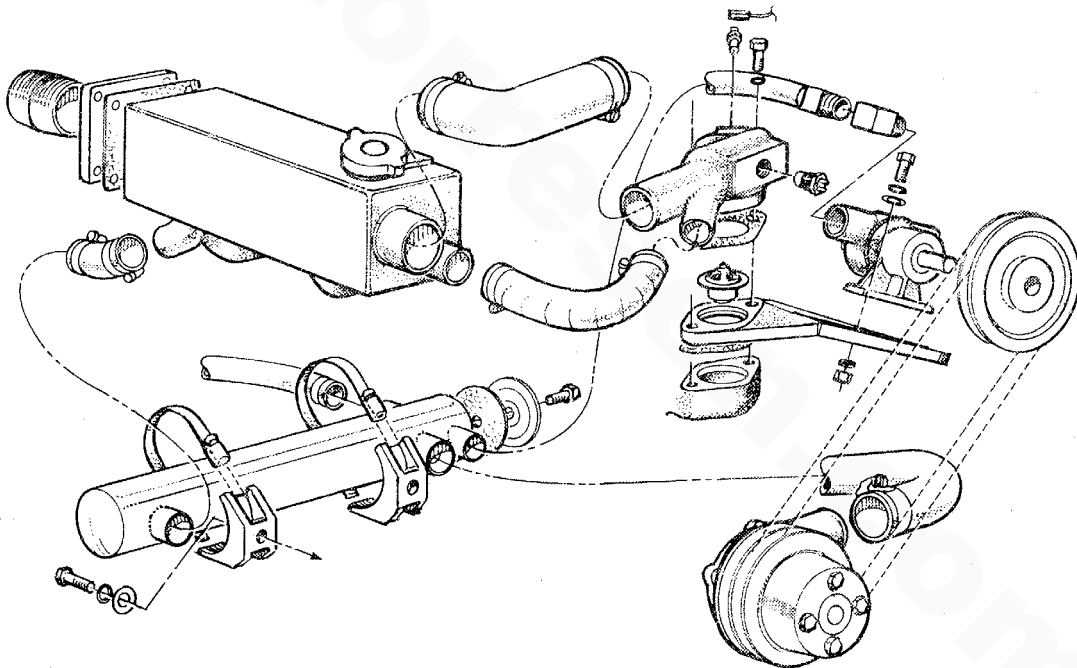
The system consists of a sea water pump which pumps raw sea water through a heat exchanger to remove heat from the coolant. The raw water is discharged overboard through the exhaust line.

The engine coolant (fresh water with or without antifreeze) is circulated by the fresh water pump in continuous circuit, pumped through the cylinder block, cylinder head, heat exchanger and back to the fresh water pump.

The total system is very reliable and requires only a daily check of the water level in the system plus routine check of hose clamps and fittings.

It is likely that zinc electrodes will waste away from contact with sea water. It is also possible for the raw water pump impeller to fail due to lack of sea water or deterioration. An early sign of impeller failure is less water and more steam at the exhaust through hull fitting.

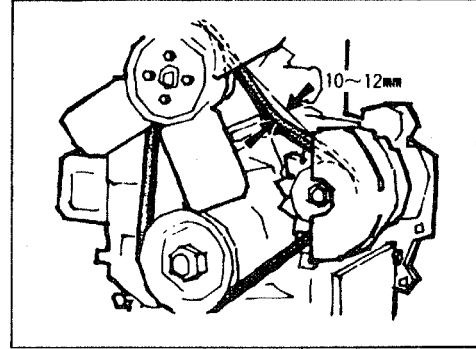
It is recommended, therefore, that zinc electrodes #11885, water pump belt #32942, alternator belt #13585, sea water pump assembly #32617 and sea water impeller kit #32620 be carried onboard at all times. These parts should be ordered from your nearest stocking dealer and used as inspection dictates.



EXPLODED VIEW OF FRESH WATER COOLING SYSTEM

Alternator belt and water pump tension

The belts are properly tense if they deflect 10 to 12 mm (0.39 to 0.47 in) as they are depressed with a finger between the pulley and pulley of the long distance side. Excessive tension can cause quick wear of the belt and bearings of the water pump and the alternator. Excessive slackness or presence of oil on the belt, on the other hand, can lead to engine overheating and insufficient charging due to a slipping belt.



CAUTION:

Never attempt to adjust tension of the fan belt while the engine is in operation.

WIRING DIAGRAM

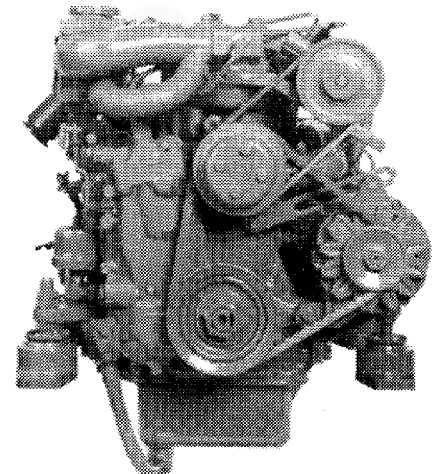
Your engine is of 12V system and its electric circuit is as shown in diagram #24666 shipped loose with this manual.

For installing electrical parts, connect them correctly by referring to the diagram and at the same time check for damaged wire sheathing and confirm that grounding is provided properly. Care must always be taken while working on the electrical system.

Never shut the engine battery switch off while the engine is running. Damage to the battery charging alternator will result should this be done.

DOMESTIC HOT WATER

The smaller of two hoses at top left in the photo is the FLOWCONTROLLER bypass. When you connect your engine to supply domestic hot water, remove the bypass hose, connect the spud on the thermostat housing to the lower connection on the water heater coil. Connect the higher connection on the water heater coil to the spud on the manifold. Study instructions and illustrations on next page.



Model W10two comes complete with FLOWCONTROLLER which, when properly connected to a heater tank, produces domestic hot water from waste engine heat.

Principle: There are two 7/8" hose connections at front of the engine which provide a parallel flow of engine cooling water to and from the heater. These connections are part of the FLOWCONTROLLER which assures a flow of hot water through the heater at all times and yet precludes excessive restriction of engine cooling water flow caused by the heater - all simply and automatically.

Installation: Remove the hose connecting the 7/8" spuds on front of engine as shipped from the factory (see illustration preceding page). Connect these spuds to the heater with 7/8" ID wire inserted hose. The spud on thermostat housing is the flow FROM the engine and should connect to lower fitting on heater. The spud on manifold is the flow RETURNING to the engine and should connect to the upper connection on heater.

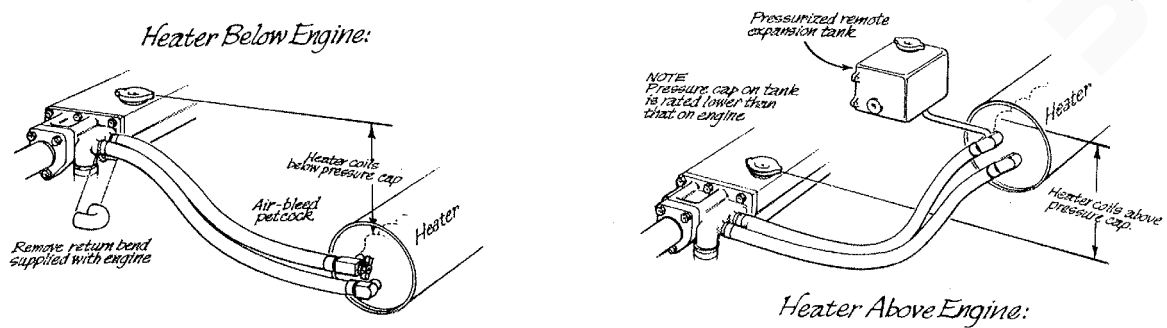
Hoses should rise continuously from their low point at the heater to the engine so that trapped air will rise naturally from the heater to the engine. If trapped air can rise to the heater, then an air bleed petcock must be installed at the higher fitting on the heater for bleeding air while filling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

If any portion of the engine cooling water circuit to or from the heater rises above the engine's own pressure cap, then the pressurized remote expansion tank must be installed in the circuit to become the highest point. The tank kit Part Number is 24177. Install the remote expansion tank in a convenient location such as a sail locker for ease of checking fresh water coolant level.

The cap on the engine mounted expansion tank/manifold should not be opened once the remote system is installed and filled.

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.

Illustrations below are of FLOWCONTROLLER adapted to our two pass manifolds. While on Model W10two the appearance is different, the principle is the same.



RECOMMENDED MAINTENANCE SERVICE

Check and service your engine at specified intervals to maintain it in its best conditions and permit it to perform as it should. As for those asterisked items, it is suggested that you have them performed by an authorized distributor or dealer.

1. Daily inspection before use

- A. Checkup of engine oil level and refilling

No refill is required if the level is near the upper limit line of the gauge.

- B. Checkup of cooling water and refilling

Refill up to the filler cap neck.

- C. Check your fuel supply

- D. Checkup of gauges and meters

After starting your engine, check oil pressure, water temperature and voltage reading.

- E. Checkup for loose parts (fan belt or bolt, etc.), damage and leaks

- F. Checkup for abnormality with exhaust gas, noise and vibration

2. Servicing following initial 50 hours of operation

- A. Renewal of engine oil

- B. Replacement of oil filter

- C. Renewal of cooling water

- D. Adjustment of valve clearance (See SERVICE DATA)

- *E. Tightening of bolts and nuts

- *F. Adjustment of engine idle

3. Servicing at every 100 hours of operation

- A. Renewal of engine oil

- B. Replacement of oil filter

- C. Cleaning of fuel filter

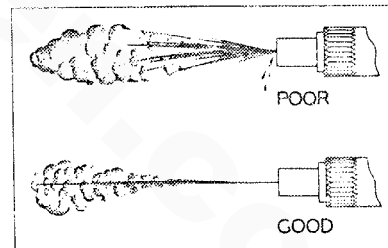
- D. Adjustment of engine idle
- 4. Servicing at every 200 hours of operation
 - A. Replacement of engine mounted fuel filter elements
 - B. Replacement of fuel filter (cartridge type)
- 5. Servicing at every 400 hours of operation
 - A. Cleaning of fuel tank
 - *B. Adjustment of valve clearance
 - *C. Checkup of starter motor, alternator and regulator

Check the brush and surface of commutator for the degree of wear. Replace the brush if it is worn beyond the limits of wear.
 - *D. Checkup of glow plugs

Check the glow plugs for blow-out.
 - E. Removal of cooling water and flushing is suggested.
- 6. Servicing at every 800 hours of operation

- *A. Checkup of nozzles

Set the injection starting
+142
pressure to 1707 -0 psi
and eliminate undesirable
injection conditions in-
cluding "after dripping".



- *B. Checkup of compression pressure

Remove each glow plug and check cylinders, one by one, using a compression pressure gauge. If the pressure differs by more than 2.5 kg/cm² (35.6 psi) between cylinders or if the cylinder pressure is less than 32 kg/cm² (455.0 psi) at 320 RPM, correct it.
- *C. Fuel injection adjustment

In case of severe vibration during idling, have it repaired at an authorized distributor or dealer which is equipped with a pump tester.

*D. Checkup of alternator and regulator

Regulate the voltage and current by use of a circuit tester.

*E. Checkup of starter motor pinion and flywheel ring gear

Rectify the chamfered area that has been severely damaged by use of an oil stone or some pencil grinder, and replace the part if it is damaged all over.

*F. Tightening of bolts and nuts

TRANSMISSIONS

Westerbeke Model 10two may be supplied with standard transmission BW-3 and 2:1 RG or optional HBW-50 either 2:1 or 2.7:1 RG, also optional HBW-150 V-drive 1.8, 2.1, or 3:1 RG.

All models turn right hand propellers.

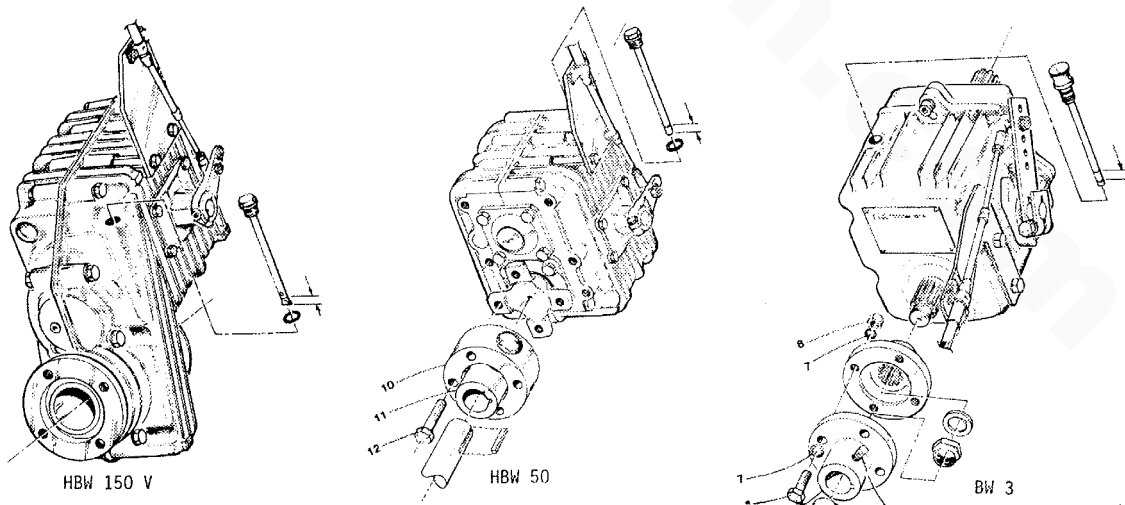
All models have their own oil sumps and dipsticks.

All HBW models use ATF lubricant.

BW units may use either ATF or 30 weight engine oil.

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

The transmissions, their dipsticks and markings are illustrated in the sketches below. For dipsticks that are threaded in the case, measure oil by dropping dipstick on the case. Do not screw in.



TROUBLESHOOTING

PROBLEM	REMEDY
1. ENGINE DOES NOT START	
a. Starting switch is defective	Correct connections and contacts
b. Deficient drive torque of the starter motor	The battery is exhausted, trouble with the starter motor, or dirty or loose wiring
c. Improper viscosity of engine oil	Check the viscosity and renew oil if necessary
d. Engine too cold	Use glowplug starting aid
e. Seizure of moving parts	Rectify
f. Air present in fuel system	Purge thoroughly with electric fuel pump
g. No fuel in fuel tank	Refill
h. Fuel filter clogged	Clean or renew
2. ENGINE STALLS WHILE IN OPERATION	
a. Fuel tank is empty	Refill
b. Fuel filter clogged	Clean or renew
c. Air present in fuel system	Retighten fuel line connections to allow electric fuel pump to run long enough to purge air thoroughly
3. IMPROPER OIL PRESSURE	
a. Oil shortage	Refill
b. Oil leak through connections	Repair
c. Oil pressure switch defective	Replace
4. ENGINE OVERHEATING	
a. Cooling water shortage	Refill
b. Water leaks	Repair
c. Belt loose or smeared with oil	Clean or renew
d. Raw water pump defective	Repair or renew
5. BATTERY IS UNDERCHARGED	
a. Belt tension improper	Rectify
b. Faulty wiring circuit	Rectify
c. Alternator not functioning (observe voltmeter)	Replace
d. Battery faulty	Replace
e. Faulty voltage regulator	Repair or renew

SERVICE DATA

1. Valve clearance (engine cold) 0.25 mm (0.010 in.)
(both intake and exhaust)
2. Compression pressure
W10two and 3 KW 32 kg/cm² at 320 RPM (455 lbs/sq in)
3. Engine oil capacity 2-1/2 quarts approximately
(including oil filter) (Go by dipstick.)
4. Firing order 1 - 2
5. Injection timing - BTDC of compression stroke when started at
smoke set position.
Marine Engine 25° before top dead center
Generator 25° before top dead center
6. Injection starting pressure +142
1707 0 psi
7. Cooling water capacity (in engine body alone) 3 quarts approximately

TIGHTENING TORQUES

1. Cylinder head bolt (M8) 3.5 - 4.0 kg-m (25.3 - 28.9 lb-ft)
2. Rocker cover nut (M8) 0.5 - 0/7 kg-m (3.6 - 5.1 lb-ft)
3. Connecting rod cap nut 3.2 - 3.5 kg-m (23.1 - 25.3 lb-ft)
4. Flywheel bolt (M10) 6.5 - 7.0 kg-m (47.0 - 50/6 lb-ft)
5. Crankshaft pulley nut (M24) 15 - 20 kg-m (108.5 - 144.7 lb-ft)
6. Oil drain plug 5.0 - 6.0 kg-m (36.2 - 43.4 lb-ft)
7. Oil filter 1.1 - 1.3 kg-m (7.96 - 9.40 lb-ft)
8. Nozzle holder 5.0 - 6.0 kg-m (36.2 - 43.4 lb-ft)
9. Nozzle holder & retaining nut 6.0 - 8.0 kg-m (43.4 - 57.9 lb-ft)

INSTRUCTIONS FOR 3 KW GENERATOR SET

Instructions for the engine portion are generally the same as for the propulsion unit W10two. The differences will be described in the following pages.

BREAKING IN

Service life of your generator is dependent upon how the engine is operated and serviced during the initial 10 hours of operation!

Your new engine needs at least 10 hours of conditioning operation for breaking each moving part in and maximizing performance and life of engine. Perform this conditioning carefully, bearing the following points in mind:

1. Since generator sets operate at 1800 RPM to obtain 60 cycle current, your control of the breaking in process is limited to control of load.
2. Do not ever attempt to BREAK IN your generator set by running at NO LOAD.
3. Immediately on starting the set, add approximately 25% load to cause a fast warm up.
4. For the first 10 hours of operation, run between 20 and 60 percent load.
5. After 10 hours, you may load as needed, except that:
6. You must avoid overload at all times. Overload is signalled by smoky exhaust and/or a reduction in speed and voltage.

Explanation:

"Breaking in" a new engine is basically a seating of the piston rings to the cylinder walls. This is not accomplished by long periods of running idle, nor by early running under full load.

Idle running may glaze the cylinder walls causing oil consumption and smoky operation. Excessive loads may score cylinder walls with similar results.

As indicated above, use a short warm up period under moderate load for the first ten hours of operation. For the next forty hours, use approximately 70% load. This kind of careful operation will result in best results from your engine.

STARTING PROCEDURES

Instrument panel, description and use of:



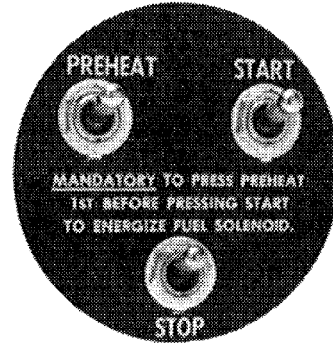
Note 1: When generator is stopped after use, the water temperature and oil pressure gauges may stay at their running readings.

Note 2: When generator is next to be used, depress preheat switch. The temperature and pressure gauges will "ZERO" and the voltmeter will register battery voltage. The electric fuel pump, mounted on the engine, will also begin to operate, purging any air accumulated in the system.

Note 3: The generator is now prepared for starting. See next page for specific instructions.

STARTING PROCEDURES

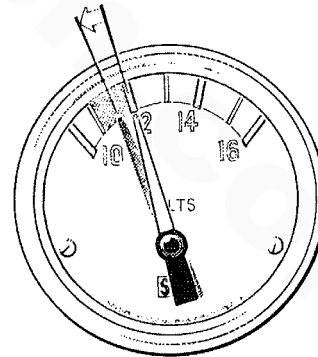
1. If making an initial start after lay-up, fuel filter servicing or repairs, depress the preheat switch for 15 to 25 seconds. This will energize the fuel pump allowing it to purge the system of any accumulated air. This will preheat the glow plugs at the same time. (See table below for preheating time.)



Quick-heat type (Y114T)

Atmospheric temperature	Preheating time
+5°C (+41°F) or higher	Approx. 10 sec.
+5°C (+41°F) to -5°C (+23°F)	Approx. 20 sec.
-5°C (+23°F) or lower	Approx. 30 sec.
Limit of continuous use	1 minute

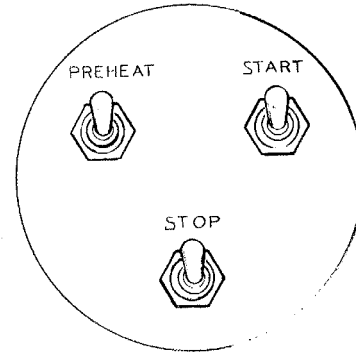
2. Proper glow plug function is indicated by voltmeter drop when key is depressed. This drop will be slight but discernible. If no voltage drop is noted, it may indicate defective glow plugs or a faulty preheat circuit (check for loose connection).



3. The start wiring is designed so that the preheat switch must be depressed before the start switch will function.

4. Starting

While still holding preheat switch depressed, depress the start switch. The starter motor will run thereby cranking the engine. As soon as the engine runs, release the start switch which will return to its normally open position. Continue holding the preheat switch depressed for 2 or 3 seconds. This defeats the low oil pressure shutdown until the engine oil pressure rises to normal running pressure. Now release the preheat switch.



Should the engine not start when start switch is depressed for 10 to 12 seconds, wait 30 seconds and repeat "3" with adequate preheat time. Never run the starter motor for more than 30 seconds at a time.

5. Operation

With the engine running, check that oil pressure and battery charge voltage are registering and that raw water is discharging with the exhaust. During engine operation, do not depress start switch as this will damage starter motor.

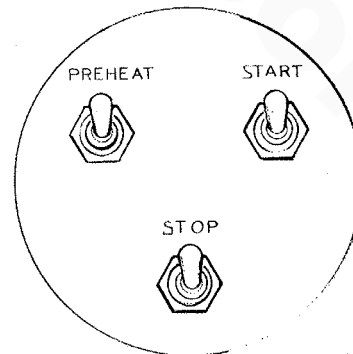
6. Warm-up operation

Operate at reduced load until water temperature rises to the 140 to 150 degree range.

STOPPING PROCEDURE

1. Stop

To stop the generator, depress the stop switch until engine stops completely and then release.



WIRING DIAGRAM FOR 3 KW GENERATOR SET

Your engine is of 12V system and its electric circuit is as shown on wiring diagram #24700 as shipped loose with this manual.

For installing electrical parts, connect them correctly by referring to the diagram and at the same time check for damaged wire sheathing and confirm that grounding is provided properly. Care must always be taken while working on the electrical system.

Never shut the engine battery switch off while the engine is running. Damage to the battery charging alternator will result should this be done.

GENERATOR COMPONENT OF GENERATOR SET

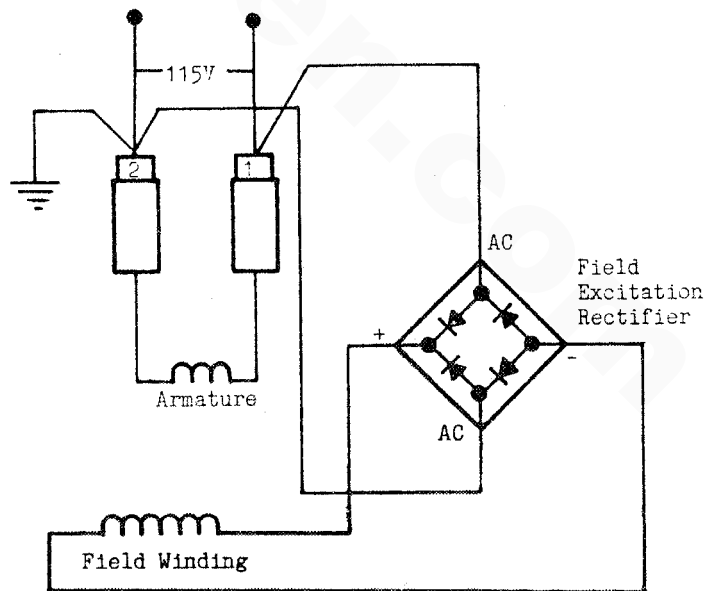
All generators for the inherently regulated series are identical in design and alike except for length of the various sizes.

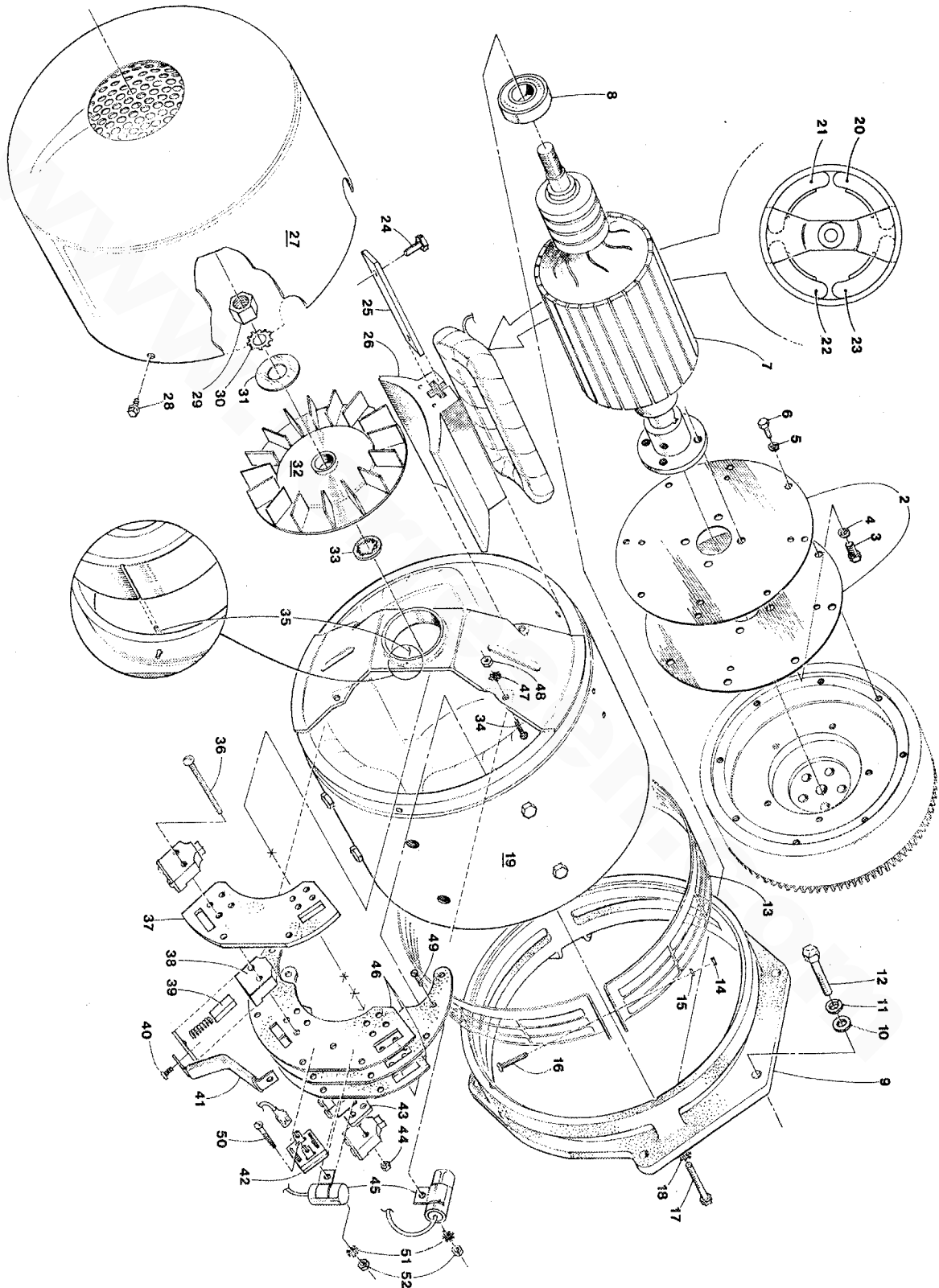
Wearing and replaceable parts are similar throughout. Brushes (39), bearings (8), rectifier (42), capacitor (45) all bear a high degree of commonality. (See next page.)

It is necessary only to give correct model and serial number to obtain correct parts from your local Dealer or Distributor.

Occasionally when a generator set is started, there will be no voltage build-up. When this occurs, the fields must be flashed to restore residual magnetism. The fields may be flashed with a 6 or 12 volt battery as follows:

Stop the engine; remove the generator end cover. You will notice the positive (+) lead from the field coil is connected to the + terminal of the rectifier (Part 42, opposite page), the negative lead from the field coil is connected to the opposite negative unmarked terminal of the rectifier. Using alligator clips, connect field coil positive to battery positive and field coil negative to battery negative for approximately ten seconds. The set will then build voltage and output. (Be careful not to connect on the AC terminals as this will destroy the rectifier.)





GENERAL INFORMATION AND CARE OF GENERATORS

1. Use of Electric Motors

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

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

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

*Note that in the above table the maximum "amps for starting" is more for some small motors than for larger ones. This is because the hardest starting types (split-phase), are not made in larger sizes.

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

2. Required Operating Speed

Although individual units and models may vary slightly, the normal voltage and frequency of typical 60 cycle engine-driven generators described in this book are approximately as follows when run first with no load applied, then at half the generator capacity and finally when loaded to its full capacity as rated on the nameplate.

Load Applied	Speed 4 pole	Frequency	Generator 115v. Plants	Voltage 230v. Plants
None	1830	61	129	258
Half	1800	60	120	240
Full	1755	58½	115	230

The output voltage should be checked periodically to insure proper operation of the generating plant and appliances. If the generator is not equipped with a voltmeter, it can be checked with a portable meter.

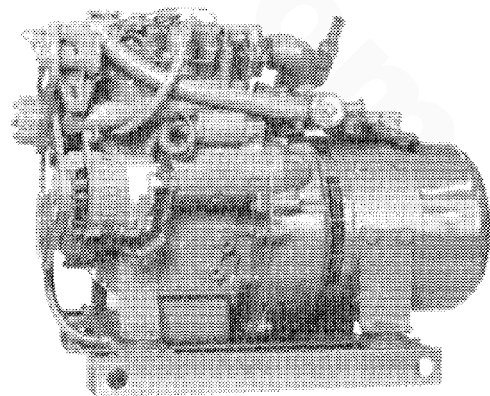
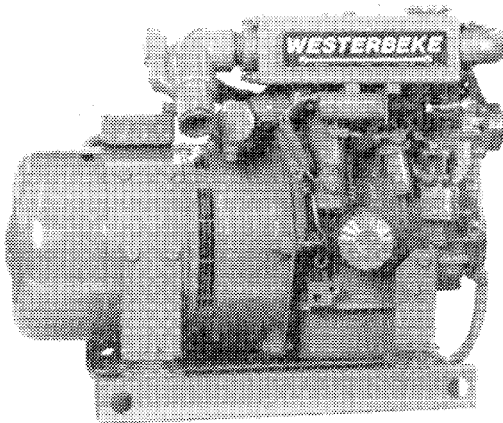
3. Maintenance

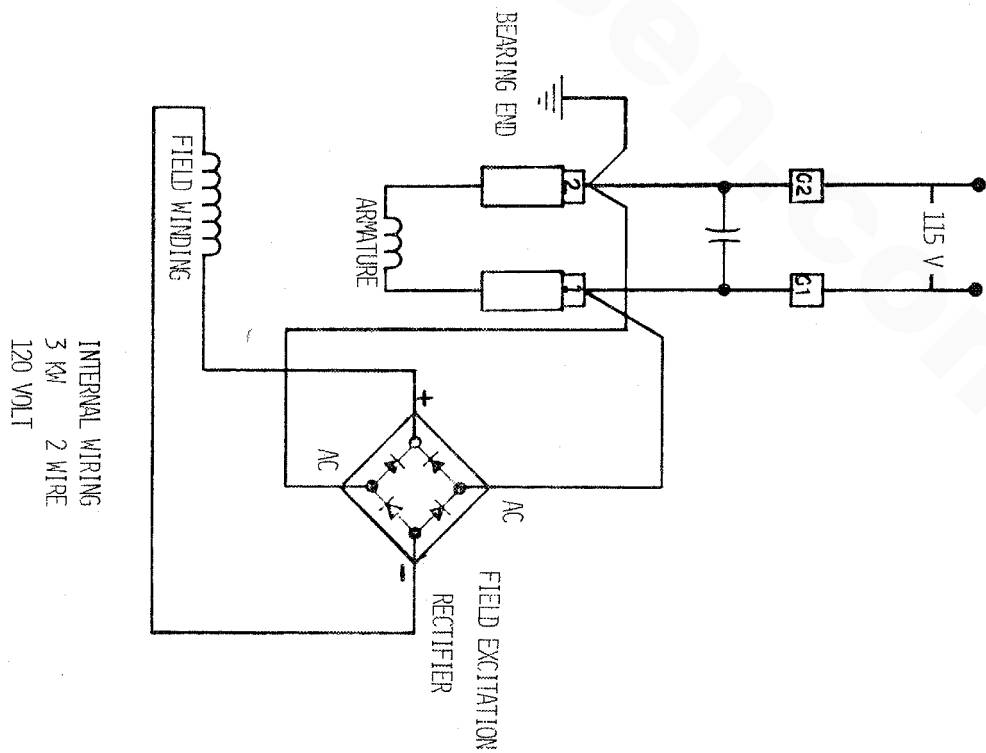
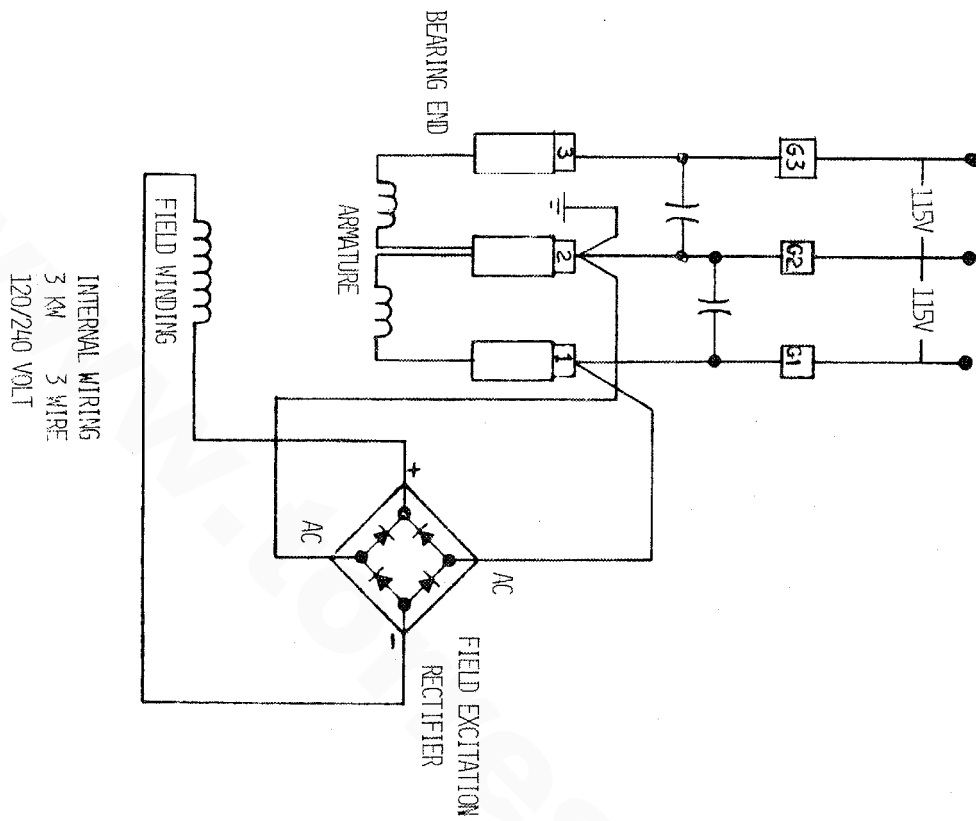
See the engine instruction book for engine maintenance.

BRUSHES - Check the brushes for wear after about 1000 hours of operation and every few hundred hours of operation thereafter. They should be replaced when worn down to one half inch. Whenever replacing brushes or removing them to do other service work, remove one brush at a time and put the screws back into the brush holder to hold the wire terminals on place so there will be no difficulty replacing the wires correctly.

COMMUTATOR - A commutator in good condition has a glossy finish and is brownish in color. If it gets greasy, rough or dirty, it may be cleaned with very fine sandpaper. (Do not use emery cloth.)

BEARINGS - All ball bearings used in these generators are packed with grease before assembly - no further greasing is required. If they become rough or worn, they should be replaced.





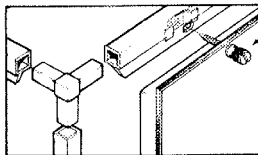
SOUND GUARD INSTRUCTIONS

INSTRUCTIONS

1. Plywood base, generator set bolts and skirt are in place as received.
2. Hoist the generator set enough so that two men can lift the plywood base and enter the bolts into corresponding holes in generator set rails. Spin nuts finger tight. Assembly may then be lowered into position and bolting completed.
3. The generator set and base may then be bolted to the sub-basethrough holes in corner of the plywood.
4. To assemble frame, follow the drawing. Be sure that open holes are opposite guide pins and that riveted screw receptacles are opposite screws.
5. On units which require a fan follow this procedure.
 - A. Remove 4 short screws which hold fresh water pump pulley hub.
 - B. Reassemble hub with fan, fan spacer, and 4 cap screws furnished. Tighten securely.
6. Holes for fuel lines, battery cables, remote panel cable, and power lines are to be cut in the lower skirt by the installer. These holes should be cut to minimum usable size in order to minimize the escape of sound.
7. Make a final check to be sure fan has clearance in its opening, that the fresh air duct from intake plenum to engine air intake is clamped in place, and that there is a tight fit of air plenum against the end of the generator to prevent re-circulation of air.
8. If you plan to order SOUND GUARD, order the generator set with remote panel and cable extension.

CAUTION: With the air discharge end panel removed, the fan is exposed and unprotected.
DO NOT remove air discharge end panel without first stopping engine.

SIMPLE QUICK ACTION LOCK AND RELEASE FASTENINGS

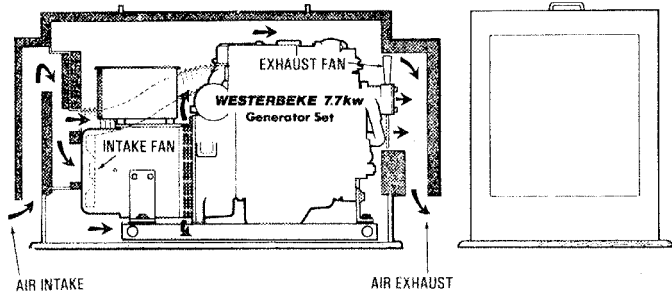


EASY TO ASSEMBLE CORNER DETAIL

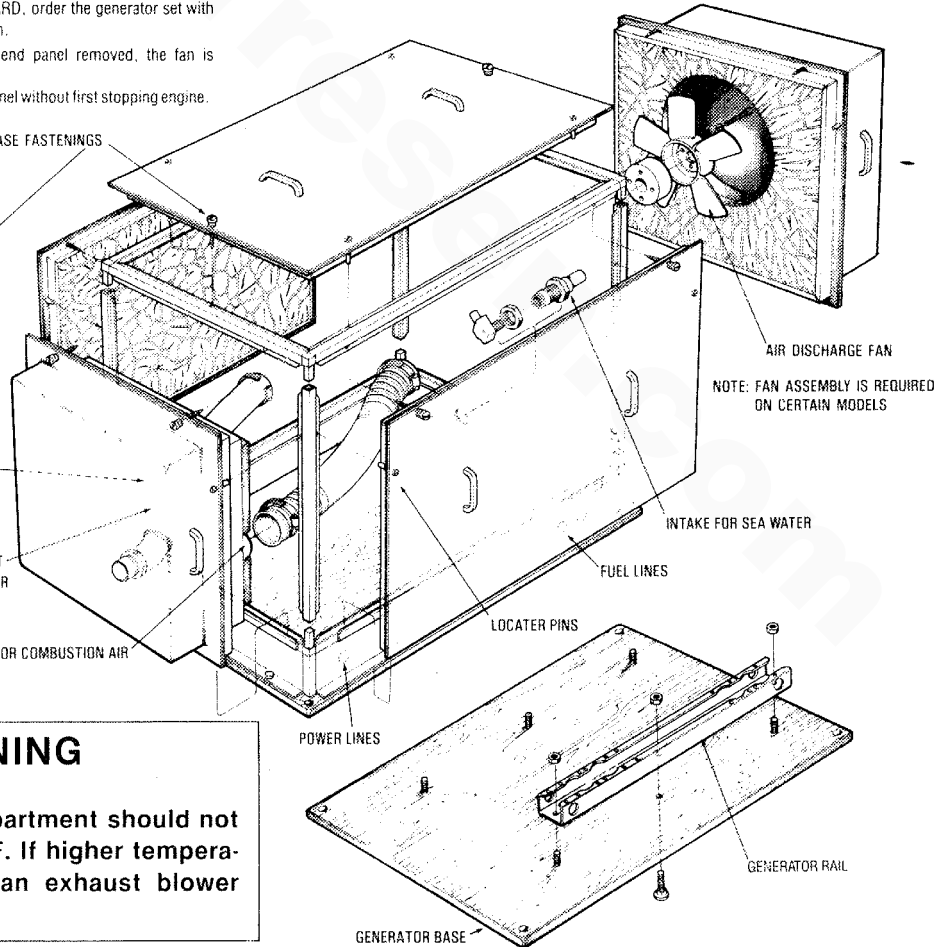
BATTERY CONNECTIONS
 WATER INJECTED RUBBER EXHAUST HOSE TO WATER LIFT TYPE MUFFLER

FLEX DUCT FOR COMBUSTION AIR

SOUND GUARD AIR FLOW DIAGRAM



9. The engine must receive combustion air from outside the SOUND GUARD. Be sure that flex duct for combustion air is securely clamped in place during operation.
10. When replacing panels on SOUND GUARD, set up the quick acting screws finger tight only. Do not use excessive force.



WARNING

Air in generator compartment should not exceed 100 degrees F. If higher temperatures are expected, an exhaust blower should be installed.

WESTERBEKE LIMITED WARRANTY

1. Warranty Obligation and Duration

Westerbeke warrants to the original consumer purchaser that all standard Westerbeke marine engines and generator sets manufactured or supplied by us will be free from defects in material and workmanship for a period of one year: from date of commission, or date of purchase on repower, OR fifteen hundred (1500) hours on Commercial Generators, only (whichever occurs first).

2. Remedy

Westerbeke will elect to repair or replace free of charge to you any product or part returned to our factory transportation costs prepaid which we adjudge defective in materials or workmanship. Alternatively, we may reimburse at our discretion a portion of labor costs incurred to repair defective parts or products on site. If you request shipment of replacement parts to you prior to our determination of cause of failure, such shipment will be sent C.O.D.

3. Notification

If you encounter a problem with your Westerbeke engine or generator set within the warranty period as stated above, contact your nearest authorized Westerbeke Master Distributor directly, by telephone or letter.

Be prepared to furnish the following information:

- a. number of hours on unit
- b. date of commission, date of purchase
- c. owner's office and home telephone
- d. model number, serial number
- e. name of vessel
- f. present location of vessel or product
- g. name and address of builder
- h. boat model name
- i. who performed prior servicing, installation
- j. description of current problem
- k. any service outlet consulted and their diagnosis

4. Exclusions

This warranty shall not apply to:

- a) failures due to wear and tear, misuse, accident or negligence, including but not limited to improper storage or installation, inadequate maintenance, overloading and insufficient lubrication;
- b) consequential harm caused by overheating of engine cooling water or loss of engine lubricating pressure (these conditions should be constantly monitored by engine instruments and/or alarms);
- c) consequential harm caused by improper installation or failure of accessories attached to our product, such as water heaters and refrigeration compressors;
- d) products altered or modified in a manner not authorized in writing by Westerbeke;
- e) products damaged in transit;
- f) replacement of engine fluids, filter elements or vee belts, engine tune-up, valve adjustment, oil and water leaks, or any other normal service items;
- g) specially manufactured products provided to customer specifications;
- h) fuel systems, cooling systems, exhaust systems, electrical systems and cable control systems beyond the connection points on the product.

5. Application of Warranty

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ANY WARRANTY IMPLIED BY LAW, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS, IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESS WARRANTY SET FORTH IN THE FIRST PARAGRAPH ABOVE. NO REPRESENTATIVE OR PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR TO ASSUME FOR WESTERBEKE ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF ITS PRODUCTS. WESTERBEKE WILL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR INSTALLATION OF ITS PRODUCTS.

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