GEMINI/WESTERBEKE OWNERS SEMINAR

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ENGINES1

History

Engines1 began its now 42-year venture as a sales/service support division of a local shipyard. The shipyard had a small yacht repair facility in Norfolk, VA that was in need of engines and parts to be competitive with engine repair.

Over the years as the business grew and the products were taken to market at a distribution level it became clear that the 4 man department was more than just a support for the yard.

As time went on the “Norshipco Engine Division” became a self sufficient and self supporting part of the company. In 1988 the distributorship was given a name of its own, Norshipco Marine Sales or NMS. In 1998 the shipyard underwent an ownership change and the engine department was sold to Western Branch Diesel, Inc. Engines1 opened for business in March of 1999.

Keeping the people through the change Engines1 “hit the ground running” and we have not looked back.

Our products are engine room related. Gasoline inboard engines. Gasoline and diesel generator sets for both marine and industrial. Marine transmissions. Engine and transmission controls. High end top of the line AGM batteries, Inverters, Battery Chargers, Power supplies, Fire suppression equipment, and a host of support products and parts for each product line.

Our staff has a combined experience of over 125 years, and most have a mechanical (motor head) background.

As always, Engines1 is big enough to serve you, yet small enough to know you. Even though we are not perfect we still believe that we are set apart by our level of customer service.

DIESEL ENGINE THEORY

Diesel engines differ from other internal combustion engines in a number of ways. Compression ratios are higher than in spark-ignited engines. The charge taken into the combustion chamber through the intake consists of air only, with no fuel mixture. Injectors receive fuel under pressure from the fuel pump and deliver it into the combustion chambers at the right time in equal quantities and at the proper condition to burn. The heat of compressed air in the combustion chamber causes the fuel mixture to ignite. The most modern diesel engine has a four-stroke cycle. The four strokes and the order in which they occur are: intake stroke, compression stroke, power stroke, and exhaust stroke.

INTAKE STROKE

During the intake stroke, the piston travels downward. The intake valve is open, and the exhaust valve is closed. The downstroke of the piston draws air in from outside to enter the cylinder through the open intake valve ports.

Some engines use turbochargers to increase air pressure in the engine intake manifold, which forces the air into the cylinder. The intake charge consists of air only with no fuel mixture.

COMPRESSION STROKE

At the end of the intake stroke, the intake valve closes and the piston starts upward on the compression stroke. The exhaust valve remains closed. The air that was drawn into the cylinder is squeezed into the combustion chamber at the top of the cylinder.

At the end of the compression stroke, the air in the combustion chamber has been forced by the piston to occupy a much smaller space than the space at the beginning of the stroke. The compression ratio is a comparison, or ratio, of the volume of air in a cylinder before compression with its volume after compression. For example, a 16:1 compression ratio means air is squeezed into one sixteenth of the space at the top of the stroke that it occupied at the bottom of the stroke.

Compressing the air into a small space causes the temperature of that air to rise. Near the end of the compression stroke, the pressure of the air above the piston is approximately 400 to 500psi, and the temperature of that air is approximately 540°C.

During the last part of the compression stroke, and the early part of the power stroke, a small, metered charge of fuel is injected into the combustion chamber. Almost immediately after the fuel charge is injected into the combustion chamber, the fuel is ignited by the hot air and starts to burn.

POWER STROKE

During the power stroke, the piston is pushed downward with both the intake and exhaust valves closed. By the time the piston reaches the end of the compression stroke, the burning fuel causes a further increase in the pressure above the piston. As more fuel is added and burns, the gases get hotter and expand more to push the piston downward and to add momentum to the crankshaft rotation.

EXHAUST STROKE

During the exhaust stroke, the intake valves are closed, the exhaust valves are opened, and the piston is on its upstroke. Burned gases are forced out of the combustion chamber through the open exhaust valve ports by the upward travel of the piston and by the pressure differential at the exhaust outlet.

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Proper engine operation depends upon two things; first, compression for ignition and second, that fuel be measured and injected into the cylinder in the proper quantity and at the proper time.

It takes two revolutions of the crankshaft to complete a cycle. Therefore, as piston one starts its power stroke, it turns the crankshaft through 90° or one quarter of a revolution (for an eight cylinder engine) before the second piston in the firing order starts its power stroke. The third piston follows the second piston, and so on until after two full crankshaft revolutions all pistons have started or completed a power stroke.

MARINE TRANSMISSIONS

Marine transmissions fall generally into two groups, mechanical shift or hydraulic shift. Mechanical transmissions connect the input from the engine to the output of the shaft by means of a mechanically operated assembly such as a dog clutch or shift fork that mechanically moves the gears into the selected position. Hydraulic transmissions connect the input from the engine to the output at the shaft by means of a hydraulically operated piston, which clamps the clutches or friction plates together locking the input shaft to the output gear.

Since we are focused on the Westerbeke product in the Gemini, we will stick with the mechanically operated transmissions. Westerbeke model 30B-Three engines have been assembled with three model transmissions. The earlier models used a Hurth model HBW100. The current engines use a Westerbeke JS gear or a Newage PRM gear. While all are mechanical transmissions they differ in their operations.

The Hurth Gear uses a servo-automatically controlled helical gear. The servo-operated multiple disc clutch system requires only minimum effort to shift. The Hurth gear is immersion lubricated. And maintenance is restricted to oil level checks, fluid changes and visual inspections.

The JS transmission is similar to the Hurth. It, however, uses a cone clutch to engage the gears. The JS gear also uses the immersion lubrication method. This transmission cannot be shifted from full ahead to full astern. All shifting must be done below 1200 rpm's.

When shifting any modern mechanical transmission used by Westerbeke, the lever must be moved in a snappy motion, slowly moving the lever may not engage the clutches.

Fluid checks are simple. Remove the dipstick, wipe it clean, reinsert into transmission, remove and check. The fluid level should be at the top mark on the dipstick.

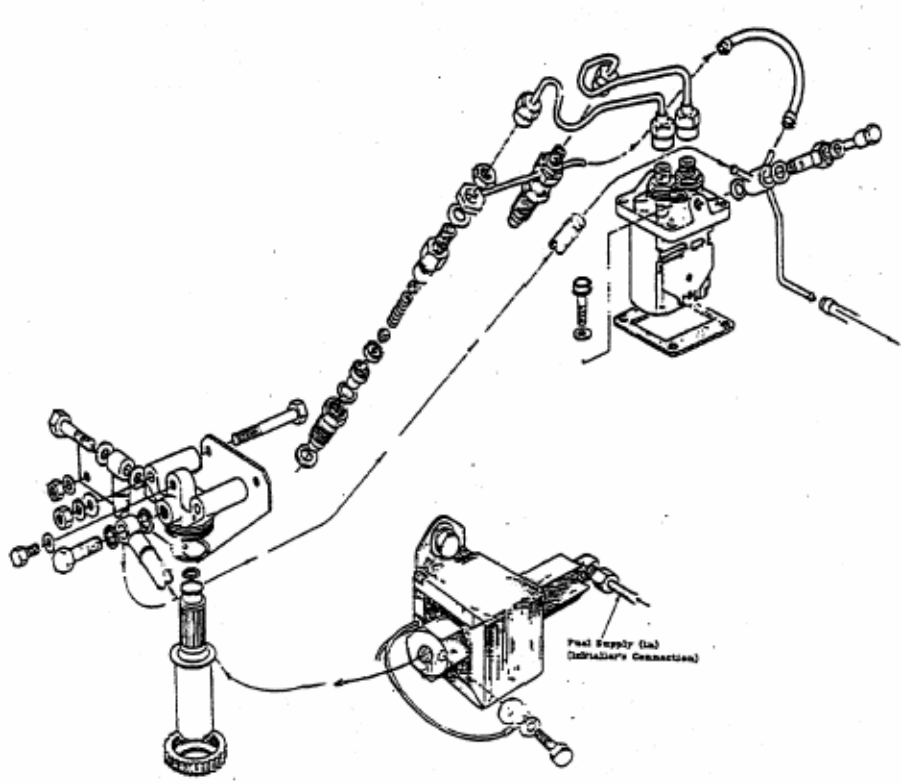
Any indication of a malfunction can be either seen or smelled from the oil on the dipstick.

System Description/Checks

Engine Systems

Fuel

On a diesel engine one of the most misunderstood systems is the fuel system. Consisting of two major and several minor parts the fuel system is generally the most neglected.



When fuel leaves the tank it is pulled toward the engine by a primary fuel pump and then forced under pressure through the secondary filter to the injection pump. The injection pump pressurizes the fuel and sends it to the injector. This event is timed to perfection with the rising of the piston on the power stroke so the fuel sprays at an exact moment during the pistons travel to the top. The atomized fuel mixes with the superheated air charge and the combustion event takes place.

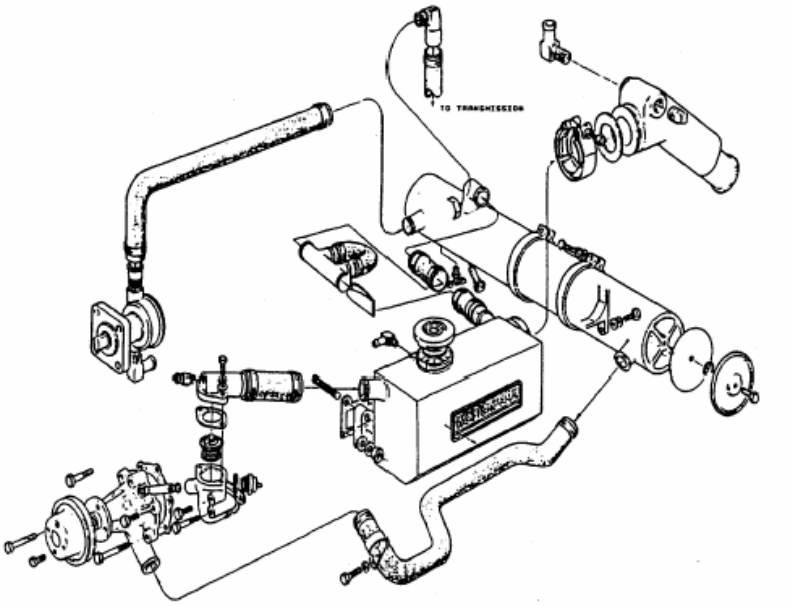
On a regular basis, every engine owner needs to perform a visual check of the fuel system. Looking for minor fuel leaks, bent tubing, or corrosion one can correct a small problem before it becomes a serious problem. However, do not limit your visual check to the engine. Check the system all the way to the tank, even the fuel fill tube, tank vent system, all clamps and hoses.

All Westerbeke engines are equipped with at least one secondary fuel filter. This is located in a small bowl mounted to the engine. Engines that are several years old, and use the round electrical fuel pump, also have a filter mounted in the bottom of the pump housing. These need to be changed as often as your large primary fuel filter is changed.

Remember the two biggest enemies of your fuel system are dirt and water. If you take the inexpensive step to prevent these it will save a lot more down the road.

Fresh Water

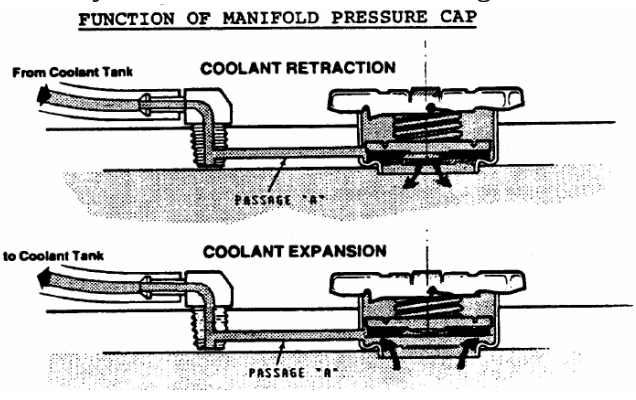
The engine's fresh water system, also know as the closed cooling system consists of a circulating pump, heat exchanger, expansion tank, thermostat, and several hoses. This is the system that cools your engine. Water is pulled from the heat exchanger and pushed into the engine's water jacket by the circulating pump. When the block and heads are full a tiny amount of water continues to circulate to help maintain a consistent temperature in the exhaust manifold and bleed air trapped in the system. As the internal engine temperature begins to rise the thermostat opens and allows the water to be pushed out of the system by a cooler charge of water pulled from the heat exchanger. This will happen until the thermostat has cooled down and closes. The process will then begin again. The expansion or holding tank is integral with the exhaust manifold. It holds water that functions as a safety net so as not to stress the system.



Cooling System Components, Exploded View

Coolant in the system is a mixture of anti-freeze and water. Depending on your local cruising climate this mixture may vary. Generally it is 50/50 or 1 part water to 1 part anti-freeze. If you use the environmentally friendly anti-freeze the mixture may vary and the specs should be on the bottle.

Closed cooling system checks are simple. The hoses should be soft yet firm with no mushy spots or brittle spots. There should be no cracks in the hoses or fittings. Clamps should be tight. The coolant should be topped off in the overflow bottle to the "Full Hot" mark. The mixture should be maintained if you have to add fluid. The engine temperature should range from 185° to 200° F. Any temperature outside this range will generally point to a thermostat problem. The coolant should be changed every 2 to 3 years. Hours are not as critical as time and deterioration will occur. Check the v-belt that turns your circulating pump. It should be flexible and show no signs of cracking. The tension should be so that the belt will flex between ½" and ¾" from side to side. Tighten the v-belt as necessary.



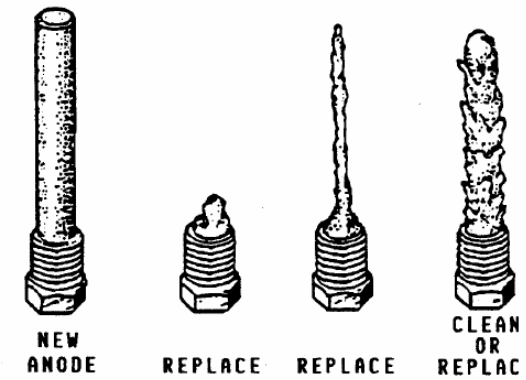
The last item is the expansion tank cap. It serves two functions, 1 to allow coolant to escape as the liquid expands from heat, and 2 to allow coolant to enter the engine as the system cools. It should be easy to see what will happen if either of these functions did not occur. At the least, check the system monthly.

Raw Water

The raw water system's primary function is to cool the water used in the closed cooling system. The raw water system consists of a pump and a couple of hoses. Combined with a through hull fitting and strainer mounted off the engine. These are all that is involved.

The raw water pump has a rubber impeller that is rotated in a housing. In this housing there is a cam that squeezes the rubber blades down and forces the water out of the pumps outlet through the hose, and into the heat exchanger. As the raw water passes through the heat exchanger it travels through the inside of a set of tubes. On the outside of these tubes is where the anti-freeze solution passes. Heat is picked up through the tubes and carried away with the raw water. When it leaves the heat exchanger the raw water passes into the exhaust elbow and is mixed with exhaust gas and dumped overboard.

On an annual basis you need to check the impeller inside the raw water pump. The blades should flexible and straight. If the blades are bent or "set", the impeller needs to be replaced. While the impeller is out, check the pump's inner housing. It should be a shade of brass in color. The body should not have any copper color inside. This indicates electrolysis and needs to be corrected. The cam in the pump should be smooth and the ends should not be broken. When checking the pump inspect the housing's exterior. The pump has weep holes to let water drain if a seal should fail. There should be no signs of water coming from these holes. The hoses in this system should also be free from cracks and kinks. Since some of the hose is wire inserted it will not be as soft as the closed system hoses. However, hoses that are not wire inserted should be checked as before.



Zinc Anode Conditions

Check your zinc! This is your only on engine protection from electrolysis. Change it frequently. The zinc should not deteriorate beyond recognition. After several zinc changes, or once a season, remove the end cover off of the heat exchanger and clean out any old zinc and other debris.

Exhaust

The exhaust elbow, water lift muffler, through hull outlet, and a few feet of hose are the parts that make up the exhaust system. Since we discussed the manifold it will not be repeated here. The purpose of the exhaust system is to take the spent exhaust gas and discharge it from the boat. As the exhaust leaves the cylinder it travels through the exhaust manifold and then through the exhaust elbow. At the end of the elbow it is mixed with the raw water from the engine. This mix goes into the water lift, or as sometimes called, aqualift muffler. As the muffler fills with water the outlet becomes blocked. When this happens the pressure from the exhaust gas forces or blows the water out of the muffler and out of the boat.

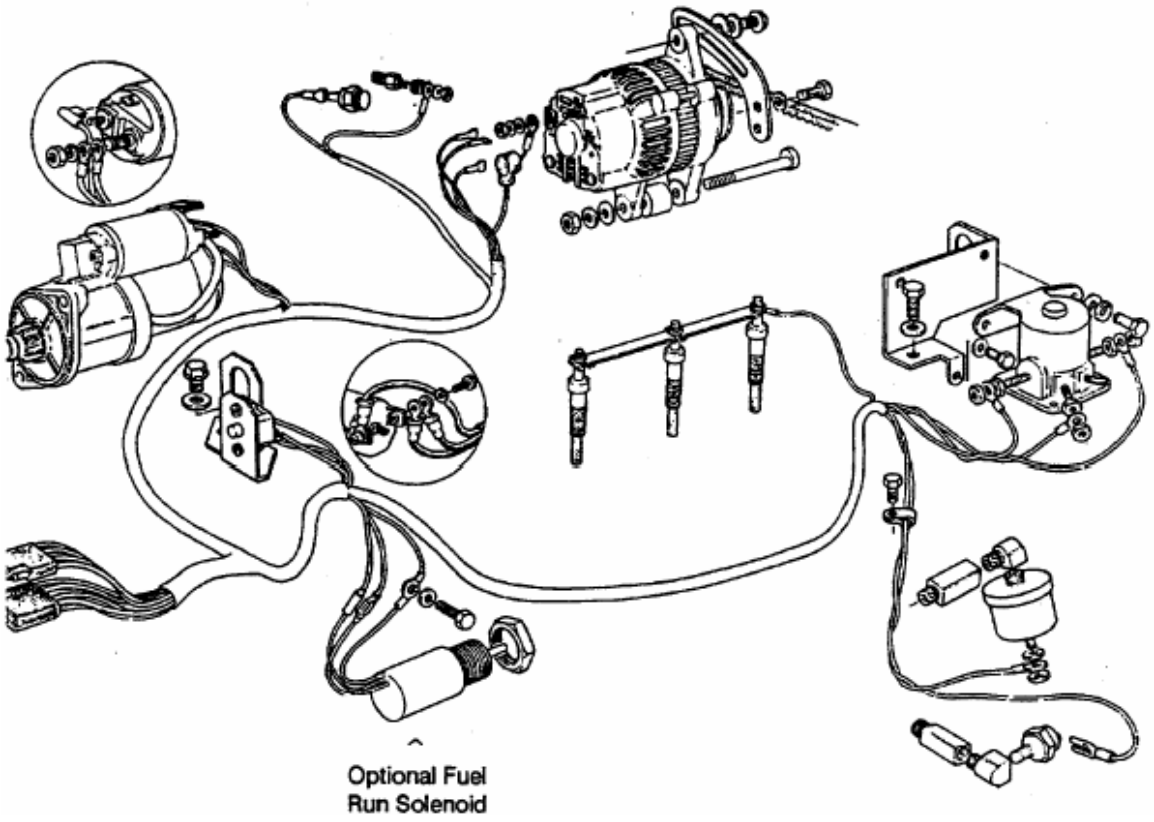
This system check should include the hoses and clamps as before. Also check the muffler for cracks. If you have a rubber muffler check it for cracks and hardness of the

rubber parts. Also check the exhaust elbow and the attaching clamp. Check the fitting at the hull and the clamps.

One caution to always follow is **not to over crank the engine**. If the engine does not start in the normal cranking period turn the seawater valve to the off position. Failure to do so will fill the muffler and ingest water into the engine.

DC Electrical System

The engine's electrical system operates on 12 volts dc. The major components are the battery, starter, alternator, fuel pump, glow plugs and solenoid, switches and instrument panel.



System checks should include battery fluid level and belt tension. Periodically check electrical connections for tightness and clean any corrosion. Since troubleshooting and repairing the electrical system can be complicated, repairs should be limited to those contained in the owner's manual. A qualified marine mechanic should do all other repairs.

Getting Help

When preparing to make a call for service, following these simple guidelines will help the technician to better prepare with parts and any manuals, bulletins, or drawings needed to finish the job. This will save the tech time and you money.

Check the Engines1 web site at www.engines1.com. The "Shoptalk" area has a lot of information about parts and service for your engine.

Have your model and serial numbers handy and record your engine hours.

When describing the problem be thorough. Describe anything unusual that took place prior to or during the failure. Did the problem occur all at once or was it gradual.

Also note anything that you have tried to repair yourself along with any parts or items that you have checked.

If it is a power related problem note the engine speed and temperature.

Were there any alarms? Did you hear any unusual noises? Did you see any smoke? Did you loose any water? Is there any oil in the engine or bilge? Do you see, smell, hear, or feel anything out of the ordinary?

Note whether or not the problem is consistent.

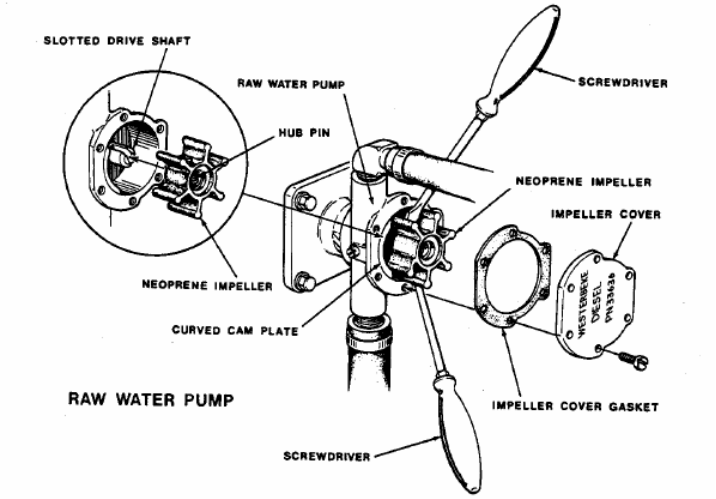
Remember if there was anything added to or removed from your vessel or any other changes that were made since the last time the engine operated properly.

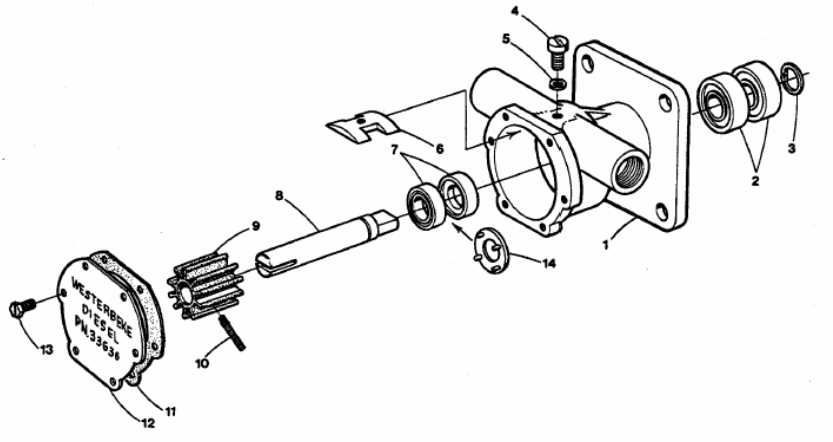
Minor Repairs

Water Pumps

There are two water pumps on the engine. The pump that is mounted into the front of the block is the circulating pump. This pump is not rebuildable and must be replaced if a failure occurs. The second is the raw water pump mounted to the right hand side behind the timing gear case cover. This pump is driven by the timing gears and is a rubber impeller type.

Servicing the pump is best done while the pump is removed from the engine although it is not necessary if you are just replacing the impeller. To remove the pump remove the 4 nuts in the corners used to attach it to the engine. Nothing will fall out of the case so don't worry. Once the pump is off the engine, start by removing the screws holding the cover to the body. This gives access to the impeller. Remove the impeller by taking two flat blade screwdrivers and gently prying up on the hub (center section) of the impeller. It should slide off of the shaft. Generally an impeller replacement is the most you will do with the pump. If you need to go deeper to replace seals or bearings refer to page 68 of the service manual part number 37600 Edition One.





Installation Hints:
Do not use any gasket sealer on the impeller cover gasket. Smear the gasket surface with some light grease or petroleum jelly.
When installing a new impeller rub a coat of light grease on the blades.
Remove the impeller when you winterize your engine. Place a tag on the battery switch to remind you to reinstall the impeller when you recommission in the spring.
Make sure the cover is flat and not grooved or pitted. If there is any surface imperfection you can sand on a flat surface until smooth.
Always refer to the manual for repair specs and procedures.

Filter Changes

Oil Filters:

If there is one thing you should remember it is this: **Your oil is the lifeblood of your engine**. Cheap oil or old and dirty oil **will** lead to premature engine failure. Westerbeke has made changing the oil very simple.

To change the oil start and run the engine for a few minutes to get it warm. This will help the oil to flow better. Locate the oil drain hose attached to the front area of the engine. Remove the cap from the end of the hose and place the hose in a container that will hold a gallon of fluid. Once the oil has drained replace the cap on the hose and reattach to the engine.

Installation Hints:

Use genuine parts. Aftermarket parts may fit, but we have had failures due to incompatibility of parts. Especially oil filters. There is more to consider besides thread and gasket surface matches

Use high-grade oil and advise your service tech to do the same. The few dollars saved on low-grade oil will cost 100 times more in the long run.

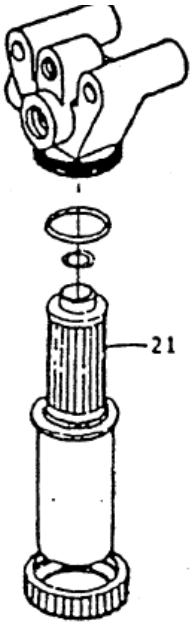
When replacing the oil filter smear some oil on the o-ring seal and fill the filter half way with new oil.

Change the oil at least once a season or every 100 hours. However it is best to change it twice. One of these changes should be done at winter lay-up. Old oil has gathered chemicals and combustion byproducts that can cause premature bearing and ring failure.

Refer to the manual for more detailed instructions.

Fuel Filters:

The Westerbeke engine uses either one or two fuel filters mounted to the engine. The secondary, on engine filter is located in a cup mounted on the oil filter side of the engine. Unscrewing the metal ring and gently pulling the cup down will give access to the filter. The filter should stay on the filter body. Pull the filter off of the body. There are two o-rings on this housing, one to seal the inside of the filter to the housing, and the other to seal the cup to the housing. There is an illustrated drawing on pages 39, 40, and 41 of the Owner's Manual, edition three. If so equipped the other filter is located in the base of the fuel pump. The pump will be round (not square). To remove the filter use a 17mm wrench on the base cap nut turning about 90°. The base will come straight down and the filter is inside the pump. There will be fuel spilled out when changing this type of filter. New Westerbeke filters come with a complete set of both o-rings and/or gaskets. If these parts are not in the new filter packages, shop at some other store, you are not being sold genuine parts.



Installation Hints:

When replacing fuel filters turn your battery switch to OFF.

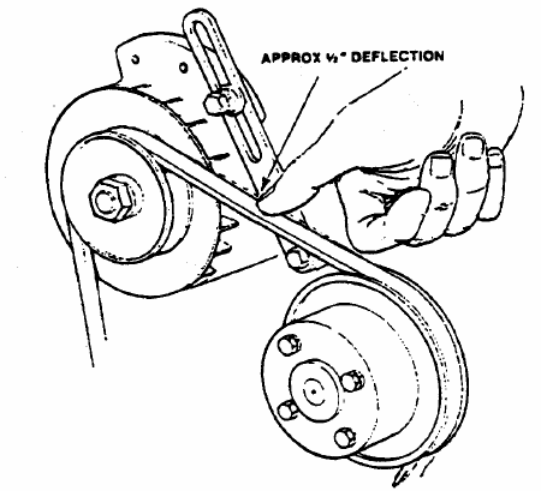
Use a gentle touch. If you strong-arm small parts you will have to replace more damaged pieces.

Westerbeke Engines are self-bleeding. After a fuel filter change hold your preheat button in for a minute or so and the fuel system will fill itself. However when replacing your large off engine mounted fuel filter/water separator it is always a good idea to fill this with fuel.

After the old filters are removed, inspect the old filters for signs of problems.

V-Belt Changes

The V-belt on your engine turns the alternator and circulating water pump. Belts should be replaced when they show signs of cracking, shredding, stretching, or hardening. When replacing the belt all that is required is tension. There should be about ½" to ¾" deflection on the belt's longest run from side to side.



Installation Hints:

Adjust tension as described above.

Check all pulleys for cleanliness. Remove any rust or debris that will lead to premature failure.

After the belt has 5 to 8 hours of run time, readjust to proper clearance.

Oil Types

The Westerbeke engine uses petroleum-based oil. The API spec should be at least CC or better. This rating can be found on the back of the oil bottle in a circle. It will not hurt to use better oil such as spec CD or CG. The 30B Three engine holds 3.7 quarts or 3.5 liters. This includes a filter change. Remember your oil is the lifeblood of your engine. Oil is not an area you want to cut corners to save money.

You can also find more information about oil type recommendation and capacities in your owner's manual.

Your transmission oil will vary by transmission type. If you have the Hurth transmission it will use ATF or Dextron oil. If your transmission is the JS type it will use petroleum based SEA 20W/20 or SAE 30. If you have the Newage gear uses ATF as with the Hurth/ZF gear. Do not mix grades. Do not use multigrade oil.

Keep a couple of extra quarts of your oil brand on your vessel for emergency servicing of the engine or transmission.

Synthetic oil is acceptable -be sure to follow the manufacturer's recommendations. **Do not** use synthetic oil during the break-in period.

Tool List:

It is a good idea to carry enough tools on your vessel to handle most minor repairs while underway or general maintenance items at the dock. A simple list of tools that do not cost a great deal of money can save a lot of aggravation. Listed are the most common tools that you may need. Your list may vary depending on your comfort level with your repairs. Don't be afraid to use your tools. Keep them stored in a dry place if possible or coat them with some spray lubricant for storage.

Metric socket set from 8mm to 17mm. If possible get both shallow and deep well 3/8" drive sockets.
Combination wrench set from 8mm to 17mm.
1 set of nut drivers (spin tights) in standard sizes from ¼" to ½".
1 set of screwdrivers. Including a small and medium flat blade and a no.1 and no.2 phillips blade.
1 pry bar or large flat blade screwdriver.
An inexpensive multimeter or a simple self powered circuit tester.
Slip joint pliers (water pump pliers).
Standard pliers.
1 set of feeler gauges. Either standard or metric.
1 small oil filter wrench.
A 1-gallon fuel container, stored empty.
1 small and 1 medium size funnel.
1 bag of shop rags.
1 bottle of spray cleaner. Use the pump type. Long-term storage of the pressure type may result in loss of pressure.
Owners Manual # 36906
Parts Manual # 37115
Technical Manual # 37600
Self prepared Maintenance Log.

Scheduled Maintenance

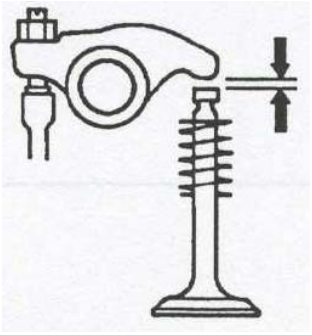
Fluid Levels:

When checking the engine oil make sure the engine has been shut down long enough for the oil to drain into the pan. The dipstick is marked with a line to show full. Always make sure your oil is at this level.

When checking the transmission oil is it a good idea to run the engine for a few seconds. Shut the engine down and check the oil. The transmission dipstick is also marked with a full line or ring on the dipstick. Always make sure the oil is at this level. Top the oil off slowly so as not to overfill.

Antifreeze is checked at the overflow bottle. This should be done when the engine is at full operating temperature. Maintain the level to the "Full Hot" mark on the bottle. Add the antifreeze in the premixed form only. Do not add straight antifreeze to the engine. It is also a good idea to check the fill level at the expansion tank periodically. On rare occasion the fitting that attaches the clear hose from the overflow bottle to the expansion tank has become clogged. This prevents fluid from flowing into or out of the engine to the overflow bottle.

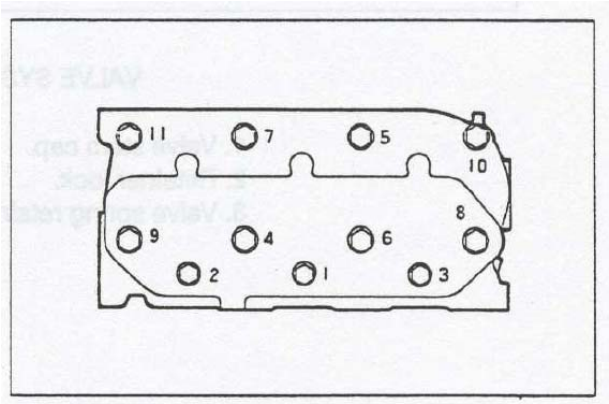
Valve Adjustment:



A detailed procedure for adjusting the valves is found on page 33 of the Technical Manual. When adjusting the valves it is a good idea to loosen the jam nut and back the lash screw out slightly. This will insure that you get the adjustment correct. While making an adjustment the feeler gauge should not be bound tight between the rocker and valve. It should have a slight resistance. When selecting feeler gauges you might want to get the go/no-go type. Adjust both valves in a cylinder at the same time.

Cylinder Head Torque:

The factory method for retightening the cylinder head bolts is listed on page 33 of the technical manual. To properly re-torque these bolts is it best to slightly loosen the bolts first. Only loosen the bolts about ¼ turn. Do not remove them from the engine. You can retighten the bolts one at a time. It is important to note there are two sizes of head bolts. Each size requires a different torque. Also note that there is a specified sequence to tightening the bolts. Follow the sequence so the head will not warp. Perform this service at the recommended intervals.



Sequence for Tightening Cylinder Head Bolts

Winterizing/Spring Commissioning:

Many owners rely on their boat yards to winterize their engines or generators for them, while some owners prefer to accomplish this task themselves. Below is a checklist of items to be performed on your engine or your generator for winter lay-up.

Fresh Water Cooling System

The use of a 50-50 solution of antifreeze and fresh water is recommended for use in the fresh water cooling system year round. This solution may require a higher concentration of antifreeze, depending on the area's winter climate. This solution should be checked to insure proper freeze protection.

If you need to add more antifreeze, drain an appropriate amount from the engine block and add more mixture. Operate the engine to insure complete circulation throughout the system. Recheck.

Lubrication System

With the engine warm, drain ALL the lubricating oil from the oil sump. Remove and replace the oil filter; place some paper towels and a plastic bag around the filter to catch the oil while removing it.

When installing the new oil filter, be sure to apply a small amount of oil on the sealing "O" ring at the base of the filter. Fill the sump with the correct amount of oil for your engine model (Ref: Operator's Manual or Technical Manual). Use oil with an A.P.I. Spec. CC. Run the engine and check for proper oil pressure and insure that there are no leaks. Do not leave old engine lubricating oil in the sump over the winter lay-up period. Lubricating oil and combustion deposits combine to produce harmful chemicals, which can reduce the life of internal engine parts.

Transmission

Drain the lubricant from your transmission and/or V-Drive. Refill with the proper lubricant to the full mark on the transmission dipstick. Run the engine and shift the transmission into forward and reverse one/two times. Stop the engine and check the transmission oil level; add lubricant as needed. Check for leaks.

Fuel System

Top off your fuel tanks with #2 diesel fuel. Fuel additives should be added at this time to control algae and condition the fuel. Care should be taken that additives used are compatible with primary filter/separator used in the system. Change the element in your primary fuel filter/separator if it contains one, and/or 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 insure that no air is left in the fuel system and check for any leaks that may have been created in the fuel system during this servicing, and correct as needed.

Sea Water Circuit

Close the thru hull seacock. Remove the raw water intake hose from the seacock. Place the end of this hose into a 5-gallon bucket of clean fresh water. Before starting the engine, check the zinc pencil found in the primary heat exchanger on the engine and clean or replace it, if required. Clean your sea strainer, if one is installed in the inside of the hull.

Start the engine and allow the raw water pump to draw the fresh water through the system. When the bucket empties, 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 empties, stop the engine. This anti-freeze mixture should

protect your raw water circuit from freezing during 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 reinstall the impeller back into the pump until the Spring commissioning.

Intake Manifold
With a clean cloth lightly soaked in oil, place it in the opening of the intake manifold so as to block it closed. DO NOT shove the cloth out of sight into the intake manifold. If you cannot see it next Spring, and you attempt to start your engine, you may need the assistance of a servicing dealer. Take a note to remove this cloth prior to start-up. The exhaust through hull can be closed in this same manner.
Propeller Shaft Coupling
Disconnect the propeller shaft coupling from the transmission. (If the boat remains in the water during winter storage, this need not be done).
This is a good time to check the security of the coupling to the propeller shaft. Insure also that the coupling set screws are tight and wired so as not to loosen. The engine alignment to the propeller shaft should be checked in the Spring when the boat is placed back in the water, and the mast stepped, and the rigging tuned.
Controls and Linkage
Check the security of control connections to the engine and transmission. Lubricate these controls and insure that they move freely. Engines with pull-type shut-off levers should be left in the "RUN" position during winter storage.
Starter Motor
Lubrication and cleaning of the starter drive pinion is advisable if access to the starter permits its easy removal. Insure that the battery connections are shut off before attempting to remove the starter. Take care to properly replace any electrical connections removed from the starter.
Injectors
You may have noticed in your Westerbeke Technical manuals, that they call for removing the injectors from the cylinder head and squirting some light lube oil down the injector hole into the cylinders.
This is not necessary for the few months the engine is laid up for the winter.
However, if you anticipate a longer lay- up period (12 months +), please follow through with this procedure. It will prevent the adhering of the piston rings to the cylinder walls. Insure that you have the proper hardware to replace the sealing washers for the injectors and return line connections.
Spares
This is a good time to look over your engine and see if external items such as belts or hoses may need replacing, come Spring commissioning. Check over your basic spares kit and order items not on hand, or replace those items used during the winter lay-up, such as filters and zincs.
Batteries
If batteries are to be left on board during the winter storage period, insure that they are in a state of full charge and will remain that way, to prevent them from freezing. If not possible, it would be wise to remove them.

By following these few steps, you should afford your engine protection over the winter lay-up. This will also help familiarize you with the maintenance needs of your engine. If you have any questions regarding winter lay-up, call your local servicing distributor or Engines1, we will be more than willing to try and answer any of your questions.

Spare Parts:

The best way to deal with disaster is to be ready for it. Westerbeke offers several methods to help you keep spares on your vessel. Prepackaged kits, individual parts and call as a need arises.

Westerbeke offers cruising kits for emergency or general maintenance purposes. Following is a list of what the kits contain. As a general rule you will only purchase Kit B if you are leaving the country for an extended cruise.

Kit A

- Kit A Zinc (2)
- Heat Exchanger Gasket
- Fuel Elements (2)
- Oil Filter
- Belt
- Fuel Hardware Kit
- Impeller and Gasket Kit

Kit B

- Zinc (2)
- Heat Exchanger Gasket
- Fuel Elements (2)
- Oil Filter
- Belt
- Fuel Hardware Kit
- Impeller and Gasket Kit
- Glow Plug
- Thermostat
- Injector
- Sea Water Pump Kit
- Complete Gasket Set

The other prepackaged kit offered is a hose kit. This kit provides all of the preformed hoses on your engine in a duffle bag.

Cooling Hose Kit

- Thermostat to Manifold
- Sea Water Pump to Exchanger
- Exchanger to Fresh Water Pump
- Manifold to Exchanger
- Hose Clamps

General Spares:

Attached is a list of common parts for the Westerbeke engine. This list was printed from the Engines1 web site. You will find several items of interest for your engine under the "Shoptalk" tab on the menu bar. It would pay you to visit there every so often to see what is new or changed.
However, along with the factory recommended spare parts it is always a good idea to carry spare screws and bolts. Electrical tape and terminal ends will also help you out of a jam. Oil, water, and antifreeze are a must for long range cruising. A few assorted hose clamps fro ¼" hose to 3" hose sizes are a good idea.

The purpose of spare parts or emergency parts is to minimize any downtime. The best news is that Westerbeke products are sold and serviced around the world. That means that if you need a Westerbeke part you can get it close to your location.

Also attached is a contact list for Engines1. Feel free to contact us if you have any questions or concerns or just to tell us a good story about your Westerbeke product or experience.

ENGINES1 CONTACT LIST

To assist you in obtaining information from Engines1, we have listed below the name of key personnel, their direct telephone number, e-mail address and the subjects they should be contacted about.

Division Manager
Tim Walters 757-673-7209 tim@engines1.com

Parts Manager
Cal Cooper 757-673-7201 cal@engines1.com
Parts, engine, generator sales, return goods authorization

Parts Sales
Jack Bowe 757-673-7204 jack@engines1.com

Technical and Warranty 757-673-7200
Part Sales, Service Questions, Technical Support and Warranty Administration

Secretary/Parts
Gerry Styles 757-673-7203 gerry@engines1.com
Part sales, Co-op advertising, general office

Government Sales/General Sales
Gary Gomer 757-673-7207 gary@engines1.com
Government sales, Quotes

Outside Sales
Gary Ouellette 757-673-7208 garyo@engines1.com
Cell 804-221-4721

Outside Sales – Maryland, Delaware
Bill Pore 757-673-7132 bpore@wbdiesel.com
Cell 757-373-3878

Power Supply Equipment (Batteries, Inverters, Chargers, Fire Suppression)
Harris Allen – North America, Caribbean
757-673-7202 Cell: 757-879-2066 harris@engines1.com

All Orders:
Toll Free: 800-548-6252
FAX: 757-673-7211

Email: info@engines1.com
Web: www.engines1.com

1. Westerbeke Model 30BTHREE Diesel Engine Parts List

Westerbeke Model 30BTHREE

Alternator	30594		Panel,Instrument-Captain	36473
Belt,Sea Water Pump			Panel,Instrument-Admiral	36843
Belt,STD Alternator	38527		Preheat & Start Switch	33764
Circuit Breaker	24683		Pump,Fresh Water	37015
Dipstick	37072		Pump,Mounting Gasket	36957
Filter,Lube Oil	36918		Pump,Rebuild Kit	N/A
Filter,Fuel Oil	30200		Pump,Sea Water	33636
Filter,Electric Lift	NA		Pump,Mounting Gasket	30326
Gasket,Head	36969		Pump,Impeller Kit	34440
Gasket,Oil Pan	36988		Pump,Repair Kit	34466
Gasket Set,Upper	37116		Pump,Seal	33043
Gasket Set,Complete	37117		Pump,Fuel Lift	37828
Glowplug	36961		Remote Lube Oil Filter	40078
Harness 15 FT. EXT 8 Pin	30760		Silencer,Air Intake	36342
Harness 15 FT. EXT 4 Pin	36557		Solenoid,Fuel Shut Off	
Heat Exchanger	37564		Solenoid,Preheat	24639
Heat Exchanger End Cap	22850		Spare Parts Kit A	37118
Heat Exchanger Gasket	22851		Spare Parts Kit B	37119
Injector	37091		Starter Motor	34552
Injection Pump	37103		Starter Solenoid	36218
Injection Hardware Kit	37121		Tank,Coolant Recovery	24977
Injector Nozzle	36935		Thermostat	37043
Injector Return Line	37099		Thermostat Mounting Gasket	36956
Isolators, Front	40621		Valve Cover Gasket	37007
Isolators, Rear	303062		Voltmeter	37605
Manual,Operator	36906		Water Temperature Meter	37601
Manual,Partslist	37115		Water Temperature Sender	35109
Manual,Technical	37600		Water Temperature Switch	37493
Oil Pressure Switch	Below		Water Inj. Exhaust Elbow 45	37402
Oil Pressure Meter	37603		Water Inj. Exhaust Elbow 90	37401
Oil Pressure Sender	24132		Zinc	11885

A.) Oil Pressure Switch - 34761 to Dec. 1988 - 37323 From Dec. 1988

3504 Shipwright Street - Portsmouth, VA - 23703
Office: 757-673-7200 - Fax: 757-673-7211
Email: info@engines1.com

1. Westerbeke Model 30B Three-Tune up, General, and Engine Specs.

Model No. **30B Three**

Tune-Up Specs

Valve Clearance	
Intake	.25mm
Exhaust	.25mm
Compression Service Limit	369psi
Glow Plug	
Resistance	1.1-1.2 ohms
Amp Draw	8-9 amps
Injector Start Pressure	1991
Injection Timing	19°

Torque Specs

Head Bolts	
M8	14.4-21.7 lb-ft
M10	54.2-61.4 lb-ft
M12	
Rocker Bolts	10.8-15.9 lb-ft
Crankshaft Pulley Bolt/Nut	73.3-86.7 lb-ft
Main Bearings	36.2-39.8 lb-ft
Rod Bearings	23.1-25.3 lb-ft
Flywheel Bolts	
With Flange	61.5-68.7 lb-ft
With Washer	
Timing Case Cover	
Injector	36.1-43.4 lb-ft
Glowplug	10.8-14.5 lb-ft
Manifold To Head	
Fresh Water Pump	

Engine Specs

# Cylinders	3
Bore	76mm
Stroke	70mm
Displacement	58.09 cid
Max HP @ Rpm's	27 @3600
Firing Order	1-3-2
Lube Oil Capacity, Engnine	3.6L
Compression Ratio	23:1
Dry Weight	272 lbs
Dimensions LxWxH	28.81x17.22x19.75

For additional and up to dateinformation please refer to the factory technical manual.
These specs are for quick reference only.

3504 Shipwright Street - Portsmouth, VA - 23703
Office: 757-673-7200 - Fax: 757-673-7211
Email: info@engines1.com

SERVICE BULLETIN

DATE: May 1, 1980 *BULLETIN NUMBER:* 107

MODEL: All Models

SUBJECT: Thermostats

Beginning approximately May, 1980, thermostats supplied by the factory have a by-pass hole sufficient to allow adequate water flow through the exhaust manifold, head, and block, during engine warm-up.

This flow is mandatory, especially in the case of marine engines and generator sets which have significant load applied soon after start-up.

We strongly recommend that only genuine WESTERBEKE thermostats be used in WESTERBEKE products to assure proper design in this regard.

J. H. WESTERBEKE CORP.
AVON INDUSTRIAL PARK, AVON, MASS. 02322 · (617) 588-7700
CABLE: WESTCORP, AVON · TELEX: 92-4444

SERVICE BULLETIN

DATE: 18 March 1983

BULLETIN NUMBER: 121

MODEL: All Marine Propulsion Engines

SUBJECT: Shift Cover Sealing

Shift covers on all HBW-Transmissions are now being mounted on the transmission by the manufacturer with loctite (orange) thus eliminating the use of the shift cover gasket (PN #22207).

This sealant will prevent the shift cover from moving out of its factory adjusted position even after removal of the 4 mounting bolts (PN#22208) and thus allow for the original factory adjusted shift pattern to be maintained.

IMPORTANT!

Removal or disturbing of the shift cover will void all warranty responsibility by Westerbeke.

Any HBW-Transmission suspect to defect during the warranty period specified by Westerbeke must be returned with the shift cover undisturbed and in its original position. Prior approval must be obtained for all HBW-Transmissions to be removed, repaired, or returned (R.G.A.) under warranty.

To: Master Distributors

WESTERBEKE
WESTERBEKE CORPORATION
AVON INDUSTRIAL PARK, AVON, MA 02322 • TEL: (508) 588-7700

SERVICE BULLETIN

DATE: February 9, 1984 *BULLETIN NUMBER:* 136

MODEL: All HBW Transmissions and V-Drives

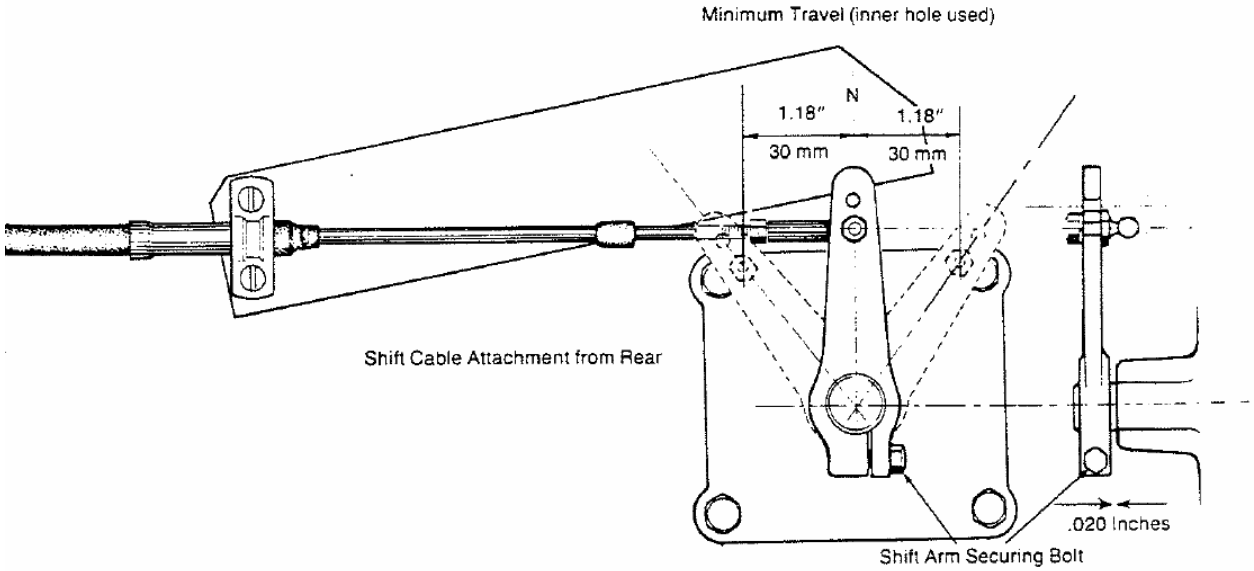
SUBJECT: HBW (Short Profile Sailing Gears) Transmission Shift Lever Adjustment

The adjustment of the shift lever on the transmission when attaching the shift control cable to it, is of prime importance to insure proper clutch engagement and long service life for the transmission.

The control cable, when attached to the transmission shift arm ball joint connector, should be attached so as to be at a 90° angle with the lever and transmission in the neutral position (Ref. Illustration).

The transmission shift arm can be rotated on the transmission side cover shifting shaft by loosening the securing bolt (13mm) and rotating the shift arm to produce the 90° angle between the arm and the shift cable when the transmission is in neutral. Insure that there is at least .020 inch clearance between the shift arm and the shift cover before retightening the securing bolt.

The shift cable and pedestal control must allow the transmission shift arm to move from the neutral position into the forward or reverse engagement a MINIMUM of 1.37 inches (35mm) when the outermost ball joint attachment hole is used on the shift arm, or 1.18 inches (30mm) when the inner is used. Use of the inner attachment hole is preferred (Ref. Illustration).



over.....

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CABLE: WESTCORP, AVON · TELEX: 92-4444

Failure to properly adjust the shift arm and cable to produce the MINIMUM shift arm travel required for clutch engagement will result in clutch slippage and eventual failure.

Adjusting the shift arm and shift cable to produce shift lever movement greater than the minimum is recommended.

Movement at the shift arm preferably should be 1.5 to 2 inches of arm movement into the forward and reverse position. Cockpit controls must be of a design that will allow for this desired cable travel.

This shift lever travel should be verified at initial commissioning, and periodically thereafter (at least once a year).

When shifting the transmission from the controls in the vessel's cockpit, it should be done smoothly and without hesitation (dump it into gear).

SERVICE BULLETIN

DATE: 1/23/85 *BULLETIN NUMBER:* 148

MODEL: ALL PROPULSION ENGINES

SUBJECT: FIELD TROUBLESHOOTING TACHOMETER/HOURMETER PN 11917

The tachometer/hourmeter used in propulsion engine instrument panels contains two separate electrical circuits with a common ground. One circuit operates the hourmeter, and the other the tachometer. The hourmeter circuit operates on 12 volts/alternator charging voltage supplied to the (+) terminal on the back of the instrument.

The tachometer circuit operates on AC voltage 6-8 volts, fed from one of the diodes in the alternator and supplied to the "tach inp." terminal while the engine is running, and the alternator producing battery charging voltage 13.0-14.8 volts D.C.

The following are procedures to follow when troubleshooting a fault in either of the two circuits in the tachometer/hourmeter.

HOURMETER FAULT	CHECK
1. Inoperative	1. Check for proper DC voltage between (+) and (-) terminals. A. Voltage present - meter defective - repair or replace. B. Voltage not present - trace (+) and (-) electrical connections for fault. (Jump 12 Volts DC to meter (+) terminal to verify operation.)

TACHOMETER FAULT	CHECK
1. Inoperative	1. Check for proper AC voltage between "Tach Inp." terminal and (-) terminal with engine running. A. Voltage present - attempt adjusting meter through calibration access hole. No results, repair or replace meter. B. AC voltage not present - check for proper alternator D.C. output voltage. C. Check for A.C. voltage at tach terminal on alternator to ground. D. Check electrical connections from "tach Inp." terminal to alternator connection.

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2. Sticking

1. Check for proper A.C. voltage between "tach inp." terminal and (-) terminal.

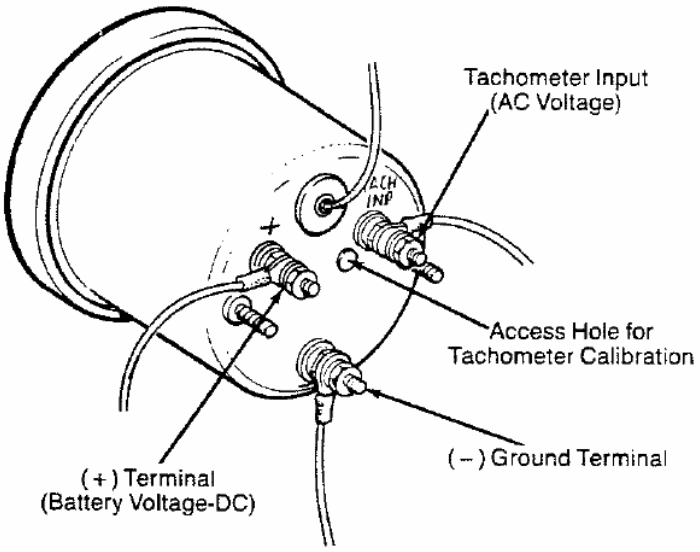
2. Check for good ground connection between meter (-) Terminal and alternator.

3. Check alternator is well grounded to engine block at alternator pivot bolt.

3. Inaccurate

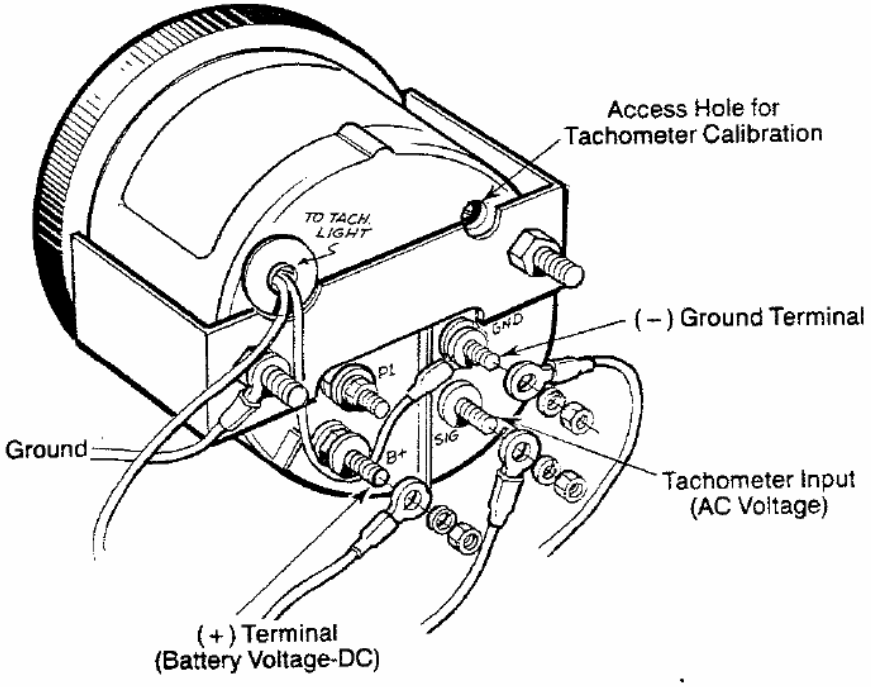
1. With hand-held tach on front crankshaft pulley retaining nut or strobe type tach read front crank shaft pulley R.P.M. Set engine R.P.M. with hand or strobe tach at 1500-1800 R.P.M.

2. Adjust tachometer with small Phillips type screwdriver through calibration access hole in rear of tachometer covered with translucent plug. Zero tach and bring to R.P.M. set by strobe or hand tach. (Verify R.P.M. at idle and at high speed 2500-3000 R.P.M.) (Adjust tach as needed.)



LATE MODEL TACHOMETER

Replaces Earlier Model as Shown on Page 2 of this Bulletin



SERVICE BULLETIN

DATE: 12JUNE 2003 **SERVICE BULLETIN #239**

MODELS: ALL PRM80 AND PRM120 TRANSMISSIONS

SUBJECT: TRANSMISSION LUBRICANT CHANGE

THE LUBRICANT SPECIFIED FOR USE IN THE PRM80 AND PRM120 TRANSMISSIONS IS BEING CHANGED FROM HEAVY DUTY ENGINE OIL TO **ATF (AUTOMATIC TRANSMISSION FLUID) DEXRON III**.

THE REASON FOR THE CHANGE IS TO IMPROVE LUBRICATION AND HEAT TRANSFER.

TRANSMISSIONS CURRENTLY OPERATING WITH HEAVY DUTY ENGINE OIL AS A LUBRICANT **MUST** BE CHANGED TO THE NEW LUBRICANT SPECIFICATION ATF (AUTOMATIC TRANSMISSION FLUID) DEXRON III.

INITIAL TRANSMISSION LUBRICANT CHANGE AFTER ENGINE COMMISSIONING IS AT 25 HOURS OF ENGINE OPERATION AS RECOMMENDED IN THE OPERATOR'S MANUAL. THE CHANGE FROM HEAVY DUTY ENGINE OIL TO ATF (DEXRON III) SHOULD BE PERFORMED AT THIS TIME.

UNITS THAT HAVE ALREADY HAD THE 25 HOUR SERVICE PERFORMED ON THE TRANSMISSION SHOULD LOOK TO CHANGE THE TRANSMISSION LUBRICANT TO DEXRON III AS SOON AS POSSIBLE.

OBSERVE THE FOLLOWING PROCEDURE WHEN CHANGING LUBRICANT

1 DRAIN/PUMP THE OIL OUT OF THE TRANSMISSION.

2. REFILL THE TRANSMISSION TO THE RECOMMENDED CAPACITY WITH ATF (DEXRON III). MODEL PRM80 – 1.0 U.S. PINT (0.6L). MODEL PRM120 – 1.4 U.S. PINTS (0.8L).

3. START THE ENGINE AND RUN THE ENGINE AT 1000 – 1200 RPM FOR 5 MINUTES. WHILE RUNNING THE ENGINE SHIFT INTO FORWARD AND REVERSE A FEW TIMES. STOP THE ENGINE.

4. DRAIN/PUMP THE ATF OUT OF THE TRANSMISSION.

5. REFILL TO THE RECOMMENDED CAPACITY WITH NEW ATF (DEXRON III).

FUTURE TRANSMISSION SERVICING USING ATF DEXRON III SHOULD BE PERFORMED AT INTERVALS AS SPECIFIED IN THE UNIT'S OPERATORS MANUAL.

OWNERS SHOULD MAKE NOTE OF THIS LUBRICANT CHANGE IN THE PRM TRANSMISSION SECTION OF THEIR OPERATOR'S MANUAL.

WESTERBEKE

PARTS DEPARTMENT BULLETIN

DATE: 29 MARCH 2004 BULLETIN NUMBER: 2004-5

TO: ALL MASTER DISTRIBUTORS AND WESTERBEKE/UNIVERSAL DEALERS

SUBJECT: CONTENT CHANGE – SPARE PARTS KITS "A" AND "B"

ALL SPARE PARTS KITS "A" AND "B" THAT PREVIOUSLY CONTAINED IMPELLER KITS #033100 OR #034440 AND SEA WATER PUMP REPAIR KITS #030718 OR #034466 FOR SEA WATER PUMP #033636 WILL BE REPLACED EFFECTIVE 1 MAY 2004 WITH KITS FOR THE NEW SEA WATER PUMP #048080.
REFERENCE PARTS BULLETIN #2004-1 DATED 9 MARCH 2004.

IMPELLER KIT #033100 FOUND IN "A" & "B" KITS WILL BE REPLACED WITH IMPELLER KIT #048500 AND SEA WATER PUMP REPAIR KIT #030718 FOUND IN "B" KITS WILL BE REPLACED WITH SEA WATER PUMP REPAIR KIT #049000.

IMPELLER KIT #034440 FOUND IN "A" & "B" KITS WILL BE REPLACED WITH IMPELLER KIT #048500 AND SEA WATER PUMP REPAIR KIT #034466 FOUND IN "B" KITS WILL BE REPLACED WITH SEA WATER PUMP REPAIR KIT #049000.

CUSTOMERS PURCHASING "A" OR "B" KITS FOR THEIR ENGINES THAT HAVE THE #033636 PUMP WILL HAVE TO PURCHASE THE IMPELLER KIT OR REPAIR KIT SEPARATELY.

WESTERBEKE DISTRIBUTORS – PLEASE ENSURE THAT A COPY OF THIS BULLETIN IS SUPPLIED TO YOUR PARTS DEPARTMENT AND ALSO PLEASE PASS A COPY ON TO ALL OF YOUR SERVICING DEALERS.

WESTERBEKE
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TAUNTON, MA 02780-7319 • TEL. 1-508-823-7677