TECHNICAL MANUAL

WESTERBEKE CORPORATION

26 G AND 26 GX

MARINE GASOLINE ENGINES

Publication # 037425

Edition Two

JANUARY, 1993

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MYLES STANDISH INDUSTRIAL PARK
150 JOHN HANCOCK ROAD, TAUNTON, MA 02780-7319

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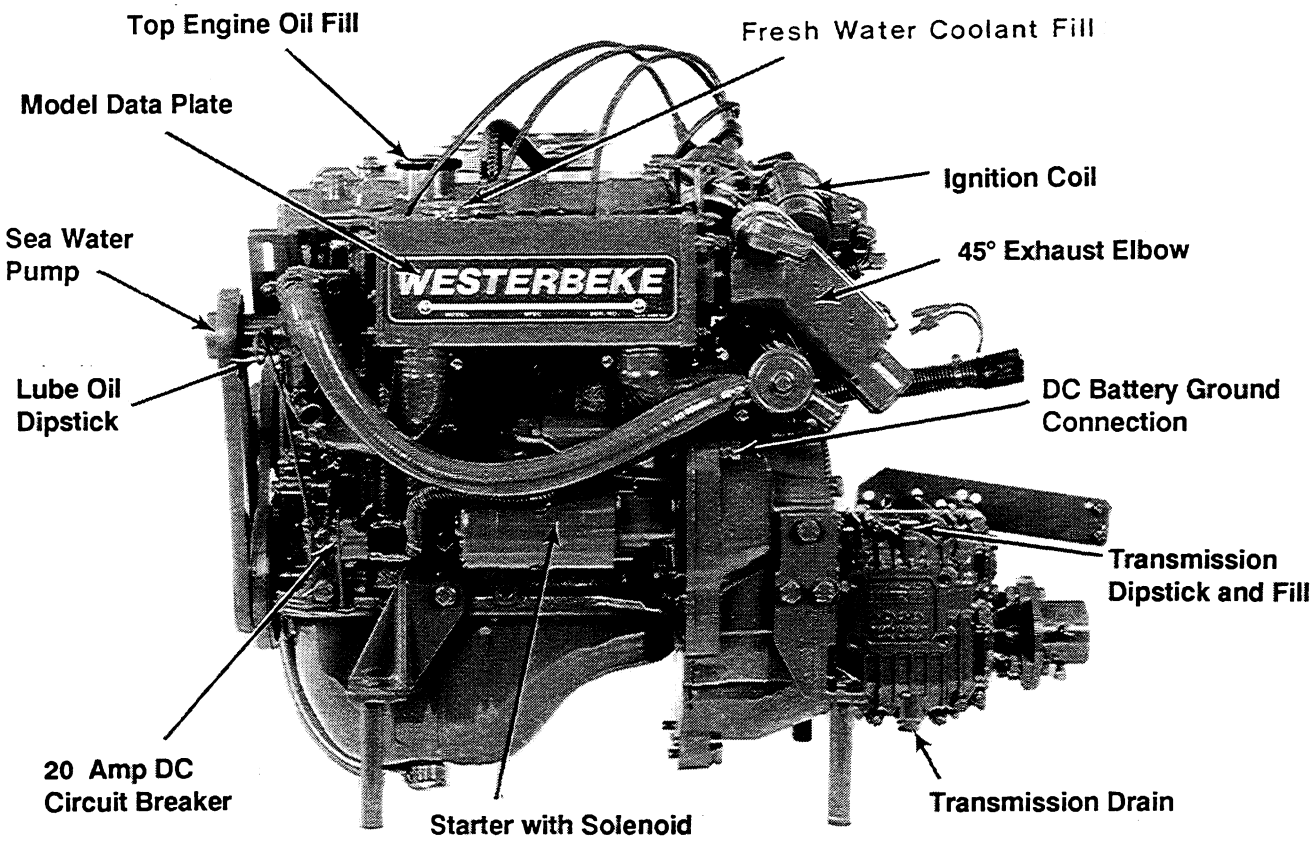
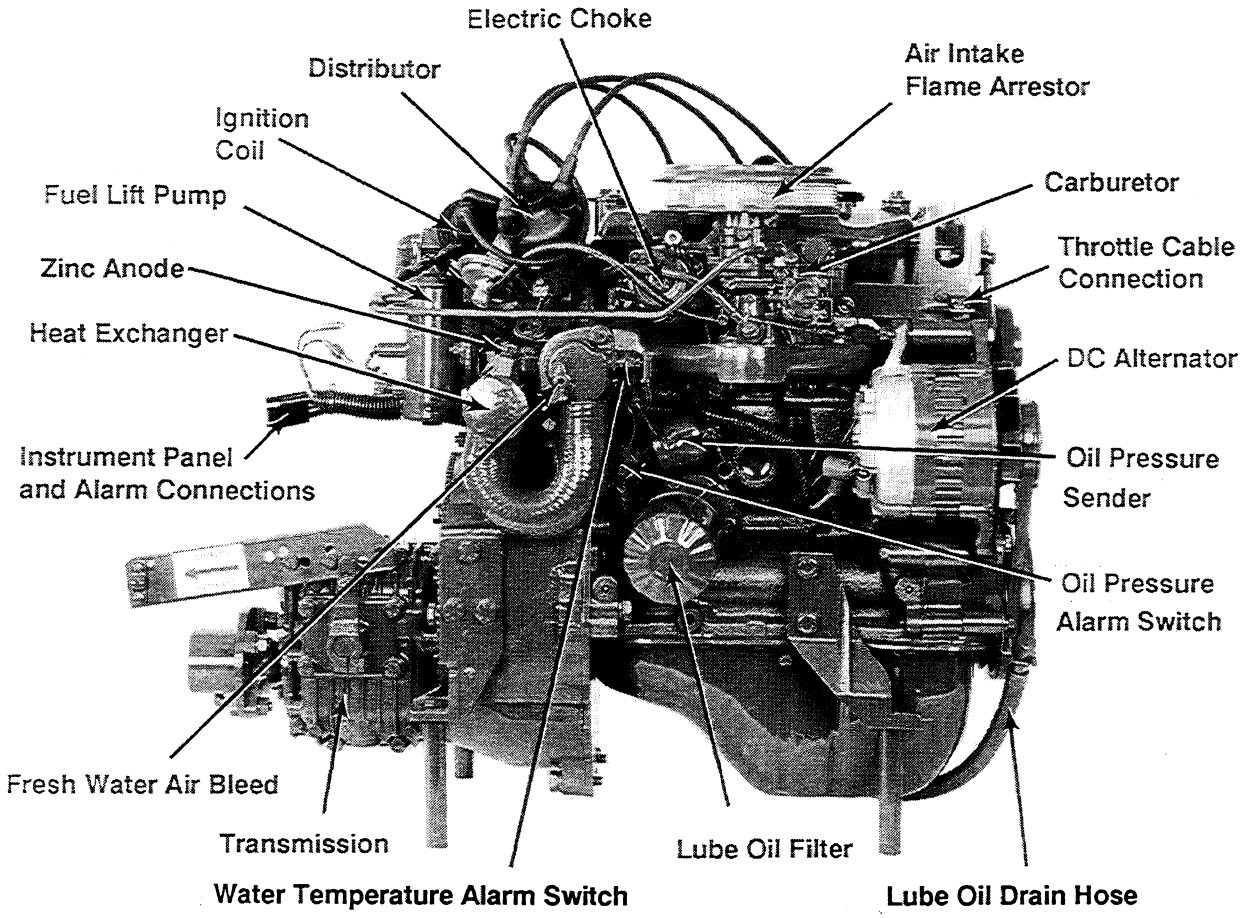


Special Note:

Please note that the W 26GX Gasoline Engine is exactly like the W 26G Gasoline Engine except for its engine mounts. The installation mounts for the W 26G engine are rubber insulated, whereas the W 26GX engine has solid mounts. The reason for this difference is that the W 26GX engine was designed to be a replacement engine for the Universal Atomic Four Gasoline Engine. Please keep in mind as you read this manual that the specifications for the W 26G engine are exactly the same for the W 26GX engine except for the engine mounts. Also note that the length of each engine will be different depending upon the type of transmission the engine comes with. Find out the exact length of your engine.

W 26G and W 26GX Marine Gasoline Engines



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GENERAL

Introduction

This manual is a general guide to the installation, start-up, operation and maintenance of your Westerbeke marine gasoline engine. The information contained in this manual is vital to your engine's dependable, long term operation.

A. Read it.
B. Keep it in a safe, dry place.
C. Keep it handy for reference at all times.

Understanding the Gasoline Propulsion Engine

The marine gasoline propulsion engine is in many ways similar to a gasoline automobile engine. The cylinders are vertical in-line, and the engine's cylinder head has an overhead camshaft which is chain-driven. The engine utilizes a solid-state distributor which is horizontally mounted and camshaft-driven. The engine incorporates a pressure type lubrication system, and a fresh water-cooled engine block which is thermostat -controlled. To a large degree, the marine gasoline engine requires the same preventive maintenance that is required of a gasoline automobile engine. The most important factors to the engine's longevity are proper ventilation, maintenance of the fuel system, ignition system, and the fresh water cooling system.

Ordering Parts

Whenever replacement parts are needed, always provide the engine's model and serial number, and transmission number as they appear on the black and silver name plate located on the engine's exhaust manifold. You must provide us with this information so we may properly identify your engine. In addition, include a complete part description and part number for each part needed (see the separately furnished Parts List). Also, be sure to insist upon Westerbeke factory packaged parts, because "will fit" or generic parts are frequently not made to the same specifications as original equipment.

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

Westerbeke engines are thoroughly checked and given a final run under various load conditions before leaving the factory. Test running the engine ensures dependable operation, long service, and a satisfied owner.

Care at the factory during assembly and thorough testing have resulted in a Westerbeke gasoline engine capable of many thousands of hours of dependable service. However, what the manufacturer cannot control is the treatment the engine receives in the field. That part is up to the owner/operator.

W 26G and W 26GX MARINE GASOLINE ENGINES
GENERAL SPECIFICATIONS

Engine Type	Gasoline, four-cycle, three-cylinder, fresh water-cooled Vertical, in-line overhead valve mechanism (30 hp at 3200 rpm maximum).
Combustion Chamber	Multi-sphere type
Bore & Stroke	2.99 x 2.87 inches (76 x 73 mm)
Piston Displacement	60.6 cubic inches (0.993 liters)
Firing Order	1-2-3
Direction of Rotation	Clockwise, when viewed from the front
Maximum Torque (at 2500 rpm)	47 lb-ft (6.5 kg-m)
Compression Ratio	9.5:1
Compression Pressure (Limit of difference between cylinders)	177 psi (12.5 kg/cm^2) at 350 rpm (28 psi [2.0 kg/cm^2])
Valve Timing	Intake Opens 19° BTDC Intake Closes 51° ABDC Exhaust Opens 51° BBDC Exhaust Closes 19° ATDC
Valve Seat Angle	Intake 45° Exhaust 45°
Valve Clearance (engine cold)	Intake 0.0098 inches (0.25 mm) Exhaust 0.0098 inches (0.25 mm)
Engine Speed	Idle Speed 700 - 900 rpm Cruising rpm 2500 - 3000 Maximum No Load (Neutral) rpm 4000
Dimensions	Height: (total) 22.88 inches (581.15 mm) Height: (from base mount) 18.75 inches (476.25 mm) Width: 18.69 inches (474.73 mm) *Length: 27.75 inches (704.85 mm) *(Length can vary depending upon transmission length)
Weight	275 lbs (124.74 kgs)
Fuel Consumption	1.5 gph (5.68 lph) running at 3200 rpm (approximate)
Inclination	Continuous 15° Temporary 20° (not to exceed 20 min.)

W 26G and W 26GX SYSTEM SPECIFICATIONS

INTAKE SYSTEM

Carburetor (STD type)	Down draft type, single barrel with U.S.C.G. approved flame arrester.

IGNITION SYSTEM

General	Battery ignition, 12-Volts, negative ground, distributor with points, ignition coil and spark plugs.
Distributor	Solid state type with signal generator and igniter
Spark Plug Thread Size	14 mm x 1.25 pitch
Spark Plug Type	Westerbeke part Number 33805 (Always identify the engine model when ordering parts.)

FUEL SYSTEM

General	Conventional carburetor type with fuel lift pump
Fuel	Regular or unleaded gasoline with an octane rating of 89 or better.
Lift Pump	12-Volt DC; lift capacity 5 ft (1.5 m)
Fuel Screens (on engine)	Reusable screen type (one in Carburetor and one in electric fuel pump).
Air cleaner	Metal screen type - cleanable
Air Flow (engine combustion)	64 cfm (0.906 cmm) at 3200 rpm

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger.
Operating Temperature	170 - 190° F (78 - 88° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Sea Water Pump	Positive displacement, rubber impeller, belt-driven.

W 26G and W 26GX SYSTEM SPECIFICATIONS

Sea Water Flow, at 3200 rpm (measured before discharging into exhaust elbow)	6.5 - 6.6 gpm (24.6 - 24.9 lpm)
System Capacity (fresh water)	5.7 qts (5.39 liters)

LUBRICATION SYSTEM

General	Pressure type by Trochoid pump, chain-driven through balance shaft.
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	3.0 U.S. qts (2.9 liters)
Operating Oil Pressure (engine hot)	50 - 75 psi (3.5 - 5.2 kg/cm^2)
Oil Grade	API specification of SC, SD, SE, or SF

ELECTRICAL SYSTEM

Starting Battery	12-Volt, 26 A-H, (-) negative ground (recommended) (35 A-H in cold areas)
Battery Capacity	90 - 125 (Ampere-Hours)
Alternator	Belt driven, 12 Volt, 50 Amps.
Starter	12-Volt, 1.2KW, reduction type, solenoid-mounted
DC No-Load Current	90 Amp (max.) at 11.5 Volts.
DC Cranking Current	175 - 200 Amps (engine cold)

W 26G and W 26GX SYSTEM SPECIFICATIONS

TRANSMISSION SPECIFICATIONS

HBW 100

Standard Gear Ratio	W 26G W 26GX	1.79:1 1.48:1
Direction of Rotation	Right handed - standard transmission	
Lubricant	Automatic Transmission Fluid (ATF) Type A or Dexron II	
Sump Capacity	0.3.7 U.S. qts (0.35 liters) approximate	

HBW 100-2 (W 26G 1.79:1 Ratio)
Propeller Recommendations
(approximate)
(using HBW 100-2 transmission)

15 D x 9 P -2 blade or 15 D x 7 P - 3 blade
Propeller should allow the engine to reach
its full rated RPM (3200 + 000 - 100) at full open
throttle while underway.

HBW 100-1.5 (W 26GX 1.48:1 Ratio)
Propeller Recommendations
(approximate)
(using HBW 100-1.5 transmission)

13 D x 10 P - 2 blade or 13 D x 8 P - 3 blade
Propeller should allow the engine to reach
its full rated RPM (3200 + 000 - 100) at full open
throttle while underway.

BW-7

Standard Gear Ratio	2.05:1
Direction of Rotation	Right handed - standard transmission
Lubricant	SAE 20W/20 or SAE 30 **DO NOT MIX SAE GRADES !** **DO NOT USE MULTI-GRADE OILS !**
Sump Capacity	1 U.S. qt (1 liter) approximate

Propeller Recommendations
(approximate)
(using BW-7 transmission)

16 D x 10 P -2 blade or 16 D x 8 P - 3 blade
Propeller should allow the engine to reach
its full rated RPM (3200 + 000 - 100) at full open
throttle while underway.

W 26G and W 26GX SYSTEM SPECIFICATIONS

TUNE-UP SPECIFICATIONS

Spark Plug Gap	0.028 - 0.036 inches (0.7 - 0.9 mm)
Timing	10° ± 2° BTDC at idle (900 rpm)

W 26G and W 26GX

ENGINE SERVICE SPECIFICATIONS

	Specified Value	Allowable Limit
Cylinder Head		
Lower gasket surface distortion - inches (mm)	-	0.0039 (0.10 mm)
Grinding tolerance - inches (mm)	0.0118 (0.3 mm)	4.949 (total height) (125.50 mm)
Manifold gasket surface distortion - inches (mm)	-	0.0039 (0.10 mm)
Valve seat width (Intake and Exhaust)	0.039 - 0.071 (1.0 - 1.8 mm)	- -
Valve seat angle	45°	
Valve seat recession allowable limit - inches (mm)	-	0.020 (0.5 mm)
Valve Guide Bushing		
Valve stem-to-bushing clearance - inches (mm)		
Intake	0.0016 - 0.0028 (0.040 - 0.070 mm)	0.0035 (0.09 mm)
Exhaust	0.0018 - 0.0030 (0.045 - 0.075 mm)	0.0039 (0.10 mm)
Valves		
Valve seat width (Intake and Exhaust) - inches (mm)	0.039 - 0.071 (1.0 - 1.8 mm)	-
Valve head stock thickness - inches (mm)		
Intake	0.035 - 0.059 (0.9 - 1.5 mm)	0.031 (0.8 mm)
Exhaust	0.047 - 0.071 (1.2 - 1.8 mm)	0.039 (1.0 mm)
Valve stem outer diameter - inches (mm)		
Intake	0.2734 - 0.2740 (6.945 - 6.960 mm)	0.2724 (6.920 mm)
Exhaust	0.2732 - 0.2738 (6.940 - 6.955 mm)	0.2720 (6.910 mm)

Valve Spring

Free length - inches (mm)	1.7047 (43.3 mm)	1.6535 (42.0 mm)
Length as installed - inches (mm)	1.3740 (34.9 mm)	
Out-of-squareness -inches (mm)	-	0.059 (1.5 mm)

Valve Rocker Shaft and Rocker Arm

Rocker shaft-to-rocker arm clearance -inches (mm)	0.0006 - 0.0024 (0.16 - 0.060 mm)	0.0035 (0.09 mm)

Cylinder Block

Top gasket surface distortion - inches (mm)	-	0.0020 (0.05 mm)
Cylinder bore wear - inches (mm)	-	0.0039 (0.10 mm)
Cylinder bore out-of-roundness, taper	-	0.0031 (0.08 mm)

Piston, Piston Pin, and Piston Ring

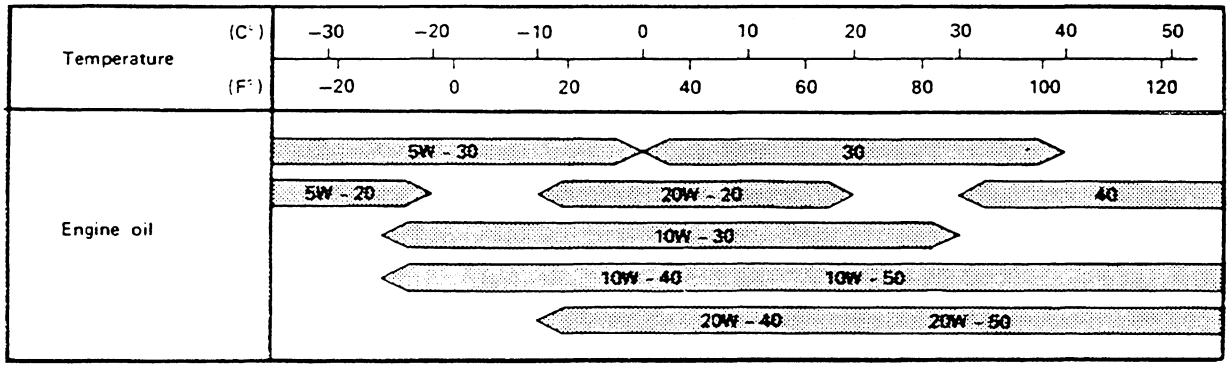
Piston-to-cylinder clearance - inches (mm)	0.0014 - 0.0022 (0.035 - 0.055 mm)	0.0039 (0.10 mm)
Piston ring end gap - inches (mm)		
Compression No.1 and No.2	0.0079 - 0.0157 (0.2 - 0.4 mm)	0.0276 (0.70 mm)
Oil	0.0079 - 0.0315 (0.2 - 0.8 mm)	0.0433 (1.10 mm)
Piston ring side clearance -inches (mm)		
Compression No.1	0.0012 - 0.0026 (0.03 - 0.07 mm)	0.0047 (0.12 mm)
Compression No.2	0.0008 - 0.0024 (0.02 - 0.06 mm)	0.0047 (0.12 mm)
Piston outer diameter - inches (mm)	2.9903 - 2.9915 (75.955 - 75.985 mm)	-
Piston-to-piston pin clearance - inches (mm)	0.0002 - 0.0004 (0.005 - 0.011 mm)	0.0008 (0.02 mm)

	Specified Value	Allowable Limit
Connecting Rod		
Bend of rod per 3.94 inches (100 mm)	-	0.0020 (0.05 mm)
Twist of rod per 3.94 inches (100 mm)	-	0.0020 (0.05 mm)
Connecting rod bearing oil clearance - inches (mm)		
	0.0008 - 0.0017 (0.020 - 0.044 mm)	0.0028 (0.07 mm)
Big end thrust clearance - inches (mm)	0.0059 - 0.0087 (0.150 - 0.220 mm)	0.0118 (0.30 mm)
Crankshaft		
Crankshaft run-out - inches (mm)	-	0.0012 (0.03 mm)
Uneven wear of journal section - inches (mm)	-	0.0008 (0.02 mm)
Crankshaft bearing oil clearance - inches (mm)	0.0008 - 0.0017 (0.020 - 0.044 mm)	0.0028 (0.07 mm)
Side clearance - inches (mm)	0.0004 - 0.0063 (0.010 - 0.160 mm)	0.0118 (0.30 mm)
Balance Shaft		
Thrust clearance - inches (mm)	0.0012 - 0.0051 (0.03 - 0.13 mm)	0.0039 (0.10 mm)
Balance shaft bearing oil clearance - inches (mm)	0.0010 - 0.0026 (0.025 - 0.066 mm)	0.0039 (0.10 mm)
Camshaft		
Thrust clearance - inches (mm)	0.0402 - 0.0496 (1.020 - 1.260 mm)	0.0551 (1.40 mm)
Cam lobe height - inches (mm)	1.5743 - 1.5822 (39.987 - 40.187 mm)	1.5630 (39.70 mm)
Camshaft journal uneven wear - inches (mm)	-	0.0016 (0.04 mm)
Camshaft bearing oil clearance - inches (mm)		
(front)	0.0016 - 0.0035 (0.04 - 0.09 mm)	0.0055 (0.14 mm)
(center)	0.0035 - 0.0055 (0.09 - 0.14 mm)	0.0075 (0.19 mm)
(rear)	0.0024 - 0.0043 (0.06 - 0.11 mm)	0.0063 (0.16 mm)

	Specified Value	Allowable Limit
Timing Belt Pulley		
Pulley outer diameter - inches (mm)		
Camshaft pulley	4.7189 - 4.7260 (119.86 - 120.40 mm)	4.7165 (119.80 mm)
Crankshaft pulley	2.3331 - 2.3370 (59.26 - 59.36 mm)	2.3307 (59.20 mm)
Manifold		
Intake manifold gasket surface distortion - inches (mm)	-	0.0039 (0.10 mm)
Exhaust manifold gasket surface distortion - inches (mm)	-	0.0039 (0.10 mm)
Flywheel		
Flywheel run-out - inches (mm)	-	0.0039 (0.10 mm)
Electrical System		
Starting battery (recommended)	12-Volt, 30 A-H	(45 A-H in cold areas)
Starter	12-Volt, 1.2KW, reduction type, solenoid-mounted.	
No-load performance	Less than 50 Amp at 11 Volts	
Alternator		
No-load performance (Engine speed at 2000 rpm)		
Regulated voltage	13.9 - 15.1 Volts	-
Current	Less than 10 Amps	-
Load performance (Engine speed at 2000 rpm)		
Regulated voltage	13.9 - 15.1KW	-
Brush length - inches (mm)	_____	_____
Stator resistance - Ω (Ohms)	Less than 1 Ω	-
Rotor resistance - Ω (Ohms)	2.9 Ω	-

	Specified Value	Allowable Limit
Ignition System		
Distributor		
Condenser capacity - uF (microfarads)	0.27	-
Contact point clearance - inch (mm)	0.016 - 0.020 (0.4 - 0.5 mm)	-
Dwell angle - degrees	58 - 66	
Ignition coil		
Primary coil resistance	Ohms 0.98 ± 0.1	
Secondary coil resistance	Ohms 17.5 ± 2.6	
Resistor resistance	Ohms 1.92 ± 0.2	
Lubricating System		
General	Pressure type with Trochoid pump, chain-driven through balance shaft.	
Oil filter	Full flow, paper element, spin-cartridge.	
Oil sump capacity (filter not included) - qts (liters)	3.0 (2.9 liters)	-
Oil pressure at 1800 rpm engine speed	50 - 70 psi	-
(engine hot)	3.5 - 4.9 kg/cm^2	-
Oil pump		
Oil pump chain deflection - inches (mm)	-	0.275 (7 mm)
Shaft-to-body clearance - inches (mm)	0.008 - 0.0033 (0.045 - 0.085 mm)	0.0039 (0.10 mm)
Tip clearance (inner to outer rotor) - inches (mm)	0.0059 (0.15 mm)	0.0098 (0.25 mm)
Side clearance (rotor end float)	0.0012 - 0.0035 (0.03 - 0.09 mm)	0.0079 (0.20 mm)
Body clearance (outer rotor-to-body) - inches (mm)	0.0039 - 0.0063 (0.10 - 0.16 mm)	0.0118 (0.30 mm)

Lubricant: API specification of SC or SD, grade in accordance with thermal environment (see table).



	Specified Value	Allowable Limit
Cooling System		
General	Fresh water-cooled block, thermostatically-controlled, with sea water heat exchanger system	
Operating Temperature ° F (° C)	130 - 150 (55 - 66)	
Fresh water pump	Centrifugal type, metal impeller, belt-driven	
Sea water pump	Positive displacement, rubber impeller, belt-driven	
Sea water flow at 1800 rpm (measured at discharge point from heat exchanger)	4.75 - 5.0 gpm	-
System capacity (fresh water) - qts (liters)	5.7 (5.39 liters)	-
Fuel System		
Fuel	Unleaded or leaded gasoline (minimum octane rating of 89)	
Carburetor	Single-barrel, down-draft	
Governor	Mechanical, belt-driven	
Lift pump	12-Volt electric; lift capacity 6 feet (1.8 meters)	
Air cleaner	Metal screen type, cleanable	
Fuel filter	Reusable metal screen	
Engine fuel consumption at 3200 rpm (approximat)e U.S gph (lph)	1.5 (5.68)	-

ENGINE TUNE-UP SPECIFICATIONS

Spark Plug Gap - inches (mm)		0.028 - 0.036 (0.7 - 0.9 mm)	
Contact Point Clearance - inches (mm)		0.016 - 0.020 (0.4 - 0.5 mm)	
Dwell Angle - degrees		58 - 66	
Condenser Capacity - microfarads		0.270	
Valve Clearance (engine cold) - inches (mm)		Intake	Exhaust
		0.0071 (0.18 mm)	0.0071 (0.18 mm)
Timing	900 rpm (at idle)	10° ± 2° BTDC	

TIGHTENING TORQUE REQUIREMENTS

	Lb-ft	Kg-m
Cylinder head to cylinder block	36.2 - 43.4	5.0 - 6.0
Crankshaft pulley to crankshaft	65.2 - 72.4	9.0 - 10.0
Manifold to cylinder head	7.2 - 11.6	1.0 - 1.6
Main bearing caps to cylinder block	39.1 - 47.7	5.4 - 6.6
Connecting rod bearing caps to connecting rod	15.2 - 21.0	2.1 - 2.9
Balance shaft thrust plate	7.2 - 10.8	1.0 - 1.5
Spark plug to cylinder head	10.8 - 15.9	1.5 - 2.2
Rocker cover to cylinder head	5.8 - 8.7	0.8 - 1.2
Flywheel to crankshaft	28.9 - 36.2	4.0 - 5.0
Timing belt cover to cylinder head	1.4 - 2.9	0.2 - 0.4
Timing belt cover to cylinder block	7.2 - 11.6	1.0 - 1.6
Valve adjusting screw locknut	9.4 - 13.0	1.3 - 1.8
Camshaft timing belt pulley to camshaft	21.7 - 32.5	3.0 - 4.5
Fuel pump drive cam to camshaft	7.2 - 10.8	1.0 - 1.5
Timing belt tensioner to cylinder block	21.7 - 32.5	3.0 - 4.5
Oil pan to cylinder block	2.9 - 5.1	0.4 - 0.7
Oil pan drain plug	18.1 - 25.3	2.5 - 3.5
Oil pump to cylinder block	10.8 - 15.9	1.5 - 2.2
Oil pump drive shaft sprocket to oil pump rotor	7.2 - 11.6	1.0 - 1.6
Balance shaft gear cover to cylinder block	7.2 - 11.6	1.0 - 1.6
Distributor housing to cylinder block	10.8 - 15.9	1.5 - 2.2
Oil seal retainer to cylinder block	7.2 - 11.6	1.0 - 1.6
Flywheel housing to cylinder block (Backplate)	7.2 - 11.6	1.0 - 1.6
Fuel line to pump	10.8 - 14.5	1.5 - 2.0

TIGHTENING TORQUE REQUIREMENTS
(continued)

Fuel line to carburetor	10.8 - 14.5	1.5 - 2.0

M10 indicates Metric thread diameter; (17), if given, indicates 17 mm across the flats of the bolt head.

TABLE OF STANDARD HARDWARE TIGHTENING TORQUES

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

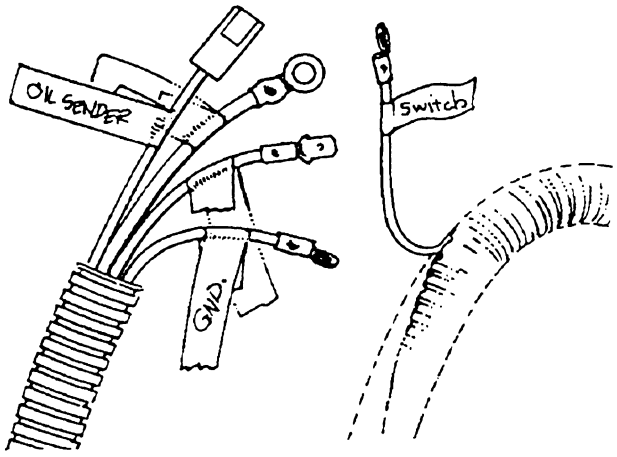
	Pitch	lb-ft	kg-m
Grade 4T			
6mm bolt head/nut	1	2.9 - 5.1	0.4 - 0.7
8mm bolt head/nut	1.25	7.2 - 11.6	1.0 - 1.6
10mm bolt head/nut	1.25	13.7 - 22.4	1.9 - 3.1
10mm bolt head/nut	1.5	13.0 - 21.7	1.8 - 3.0
12mm bolt head/nut	1.25 (ISO)	25.3 - 39.8	3.5 - 5.5
12mm bolt head/nut	1.5	25.3 - 39.8	3.5 - 5.5
12mm bolt head/nut	1.75	21.7 - 36.2	3.0 - 5.0
13mm bolt head/nut	1.5	32.5 - 50.6	4.5 - 7.0
14mm bolt head/nut	1.5	36.2 - 57.9	5.0 - 8.0
14mm bolt head/nut	2	34.0 - 55.7	4.7 - 7.7
16mm bolt head/nut	1.5	54.2 - 79.6	7.5 -11.0
16mm bolt head/nut	2	51.4 - 76.7	7.1 -10.6
Grade 6T			
6mm bolt head/nut	1	4.3 - 6.5	0.6 - 0.9
8mm bolt head/nut	1.25	10.8 - 15.9	1.5 - 2.2
l0mm bolt head/nut	1.25	21.7 - 32.5	3.0 - 4.5
10mm bolt head/nut	1.5	19.5 - 30.4	2.7 - 4.2
12mm bolt head/nut	1.25 (ISO)	36.2 - 57.9	5.0 - 8.0
12mm bolt head/nut	1.5	36.2 - 50.6	5.0 - 7.0
12mm bolt head/nut	1.75	34.7 - 49.2	4.8 - 6.8
Grade 7T, 8T and 8.8			
6mm bolt head/nut	1	5.8 - 8.7	0.8 - 1.2
8mm bolt head/nut	1.25	14.5 - 21.7	2.0 - 3.0
10mm bolt head/nut	1.25	28.9 - 39.8	4.0 - 5.5
10mm bolt head/nut	1.5	26.8 - 37.6	3.7 - 5.2
12mm bolt head/nut	1.25 (ISO)	54.2 - 75.9	7.5 -10.5
12mm bolt head/nut	1.5	50.6 - 65.1	7.0 - 9.0
12mm bolt head/nut	1.75	43.4 - 61.5	6.0 - 8.5
13mm bolt head/nut	1.5	57.9 - 86.8	8.0 -12.0
14mm bolt head/nut	1.5	72.3 -108.5	10.0 -15.0
14mm bolt head/nut	2	68.7 -101.3	9.5 - 14.0
16mm bolt head/nut	1.5	108.5 - 166.4	15.0 - 23.0
16mm bolt head/nut	2	101.3 - 159.1	14.0 - 22.0
Grade 5 capscrew			
1/4 UNC		9 - 11	1.2 - 1.5
1/4 UNF		11 - 13	1.5 - 1.8
5/16 UNC		18 - 20	2.5 - 2.8
5/16 UNF		21 - 23	2.9 - 3.2
3/8 UNC		28 - 33	3.7 - 4.6
3/8 UNF		30 - 35	4.1 - 4.8
7/16 UNC		44 - 49	6.1 - 6.8
7/16 UNF		50 - 55	6.9 - 7.6
1/2 UNC		68 - 73	9.4 -10.1
1/2 UNF		73 - 80	10.1 -11.1

ENGINE OVERHAUL

NOTE: Special Service Tools are available through Westerbeke Corporation to help in the removal or installation of engine parts. Refer to the "SPECIAL SERVICE TOOLS" section of this manual, page 62, for illustrations and part numbers for each tool.

PREPARATIONS

1. Remove all wire connections running to the engine from the control panel and battery. Make sure that the wire ends are properly marked.

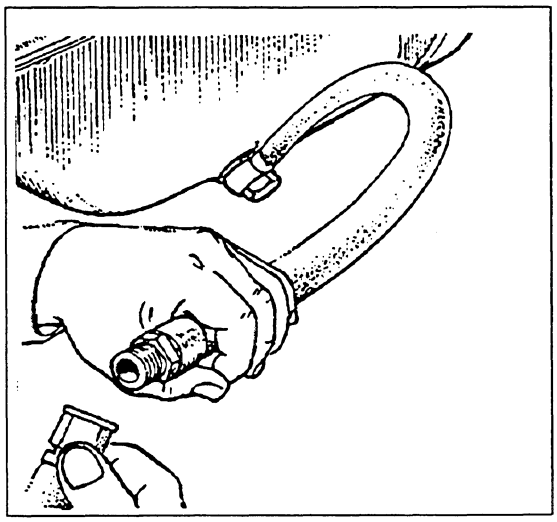


2. Shut off all fuel and sea water lines, and disconnect the exhaust system.

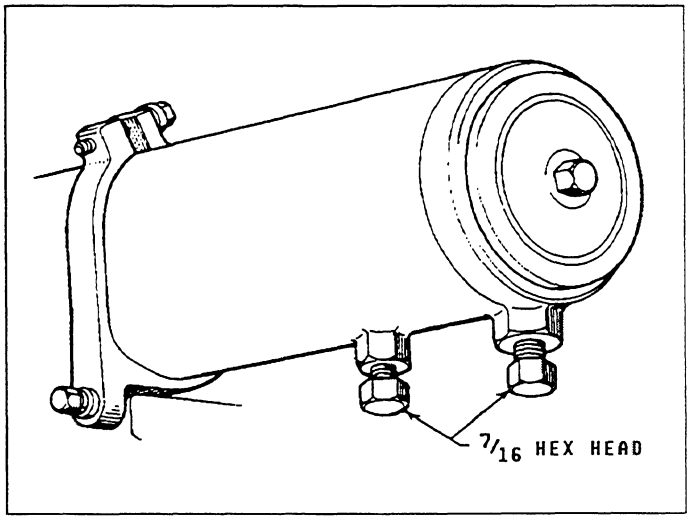
3. Unbolt the engine from its bed and carefully move it to the overhaul shop.

4. Once at the overhaul shop, drain all lubricating oil and coolant from the engine and heat exchanger.

5. Clean all oil and dirt from the engine's exterior.



Oil Sump Drain



Heat Exchanger Drains

ENGINE DISASSEMBLY

This section describes the disassembly of the engine when performing a complete overhaul of the unit. The procedures which follow include the disassembly of subassemblies, inspection of their components parts, repair or replacement of these parts (if necessary), and the reassembly of the subassemblies.

Removal of External Parts and Subassemblies

1. Remove the exhaust manifold and related hoses as a unit Disassemble and inspect these parts.

2. Remove the heat exchanger and its related hoses and mounts from the front of the engine. Have the heat exchanger cleaned and tested at a local automotive radiator repair shop, or replace it if necessary.

3. Remove the starter motor and circuit breaker assembly. Examine the starter and have it repaired or replaced if necessary.

4. Remove the sea water pump, the drive belt, and the sea water pump's mounting brackets.

5. Remove the alternator, the fresh water pump's drive belt, and the alternator's mounting bracket.

6. Remove the fresh water circulating pump's pulley.

7. Remove the fresh water circulating pump.

8. Remove the fuel line, the carburetor, the fuel pump, and the intake manifold.

9. Remove the ignition coil and its mounting bracket.

10. Remove the engine's transmission.

11. Remove the water temperature switch and the water temperature sender.

12. Remove the oil pressure switch, the oil pressure sender, the oil filter, and the oil filter bracket.

13. Remove the thermostat housing and the thermostat.

14. Remove the crankshaft pulley from the crankshaft.

15. Remove the spark plugs from the cylinder head.

16. Remove the distributor from the right rear of the engine.

The basic engine assembly is now ready for disassembly, cleaning, inspection, and repair if necessary.

Since the W 26G or W 26GX engines are not as bulky nor as heavy as an automobile engine, the engines may be laid on a sturdy bench while they are disassembled and repaired. However, special service tools are available through Westerbeke that will help to make the overhaul of the engine easier. For example, and overhaul attachment (service tool #09219 - 87701) can be attached to the cylinder block. This overhaul attachment can then be attached to the overhaul stand (special service tool #09219 - 87202, which is also available through the Westerbeke Corporation).

Timing Belt Removal

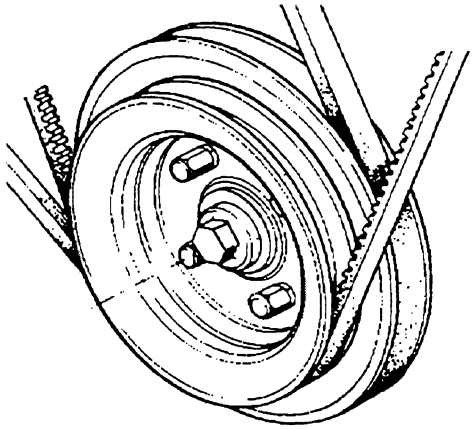
1. Remove the sea water pump, the drive belt, and the sea water pump's mounting bracket.

2. Remove the alternator, the fresh water pump drive belt, and the alternator's mounting bracket. At this time, inspect the belt for wear.

6. Remove the fresh water circulating pump pulley.

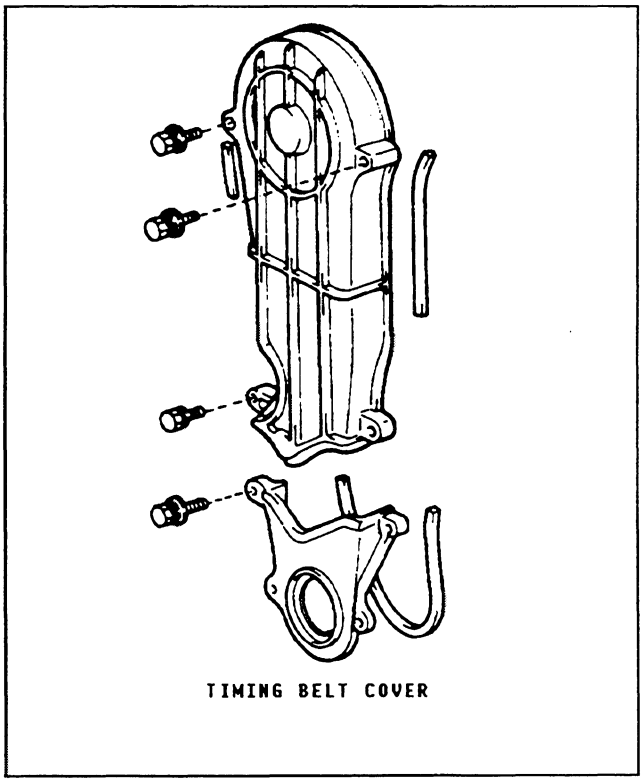
7. Remove the fresh water circulating pump.

8. Remove the crankshaft pulley from the crankshaft.

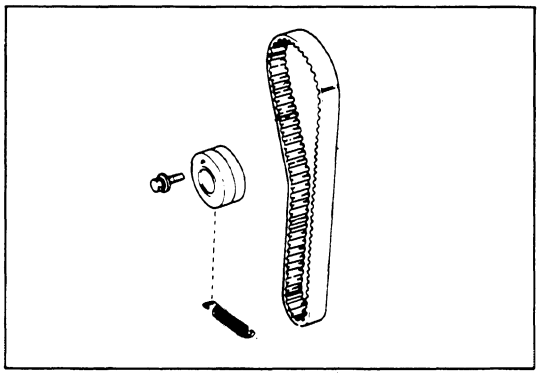


9. Remove the rocker cover and gasket from the cylinder head. Inspect the gasket for cuts and breaks. Replace the gasket if necessary, or keep it for reinstallation.

10. Remove the upper and lower timing belt covers along with their associated dust covers.



11. Remove the tension spring from the timing belt tensioner and the tension spring bracket, and remove the timing belt tensioner.



CAUTION

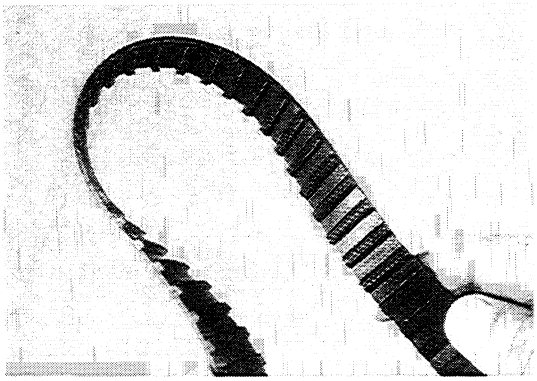
When removing the timing belt, be sure NOT to bend the belt sharply (that is, do not bend the belt into a small radius). The cablecord contained in the timing belt is extremely durable against tensile forces. However, the cablecord is susceptible to breakage when the belt is sharply bent. Bending reduces the belt's overall strength.

12. Carefully remove the timing belt from its pulleys.

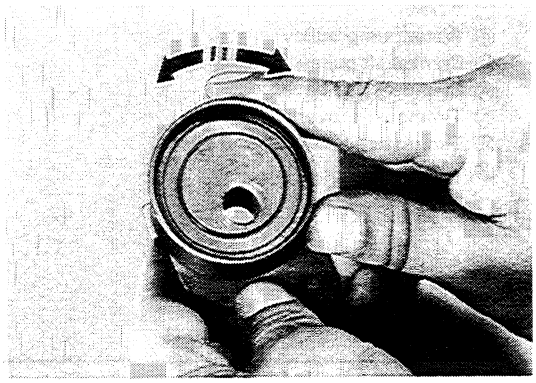
CAUTION

The timing belt must be kept free of oil, grease, water or other substances which may cause the belt to deteriorate or swell.

13. Inspect the timing belt for deterioration, swelling, cracking, and peeling or deformed teeth; replace the belt if it is found to be faulty. Refer to the picture below.



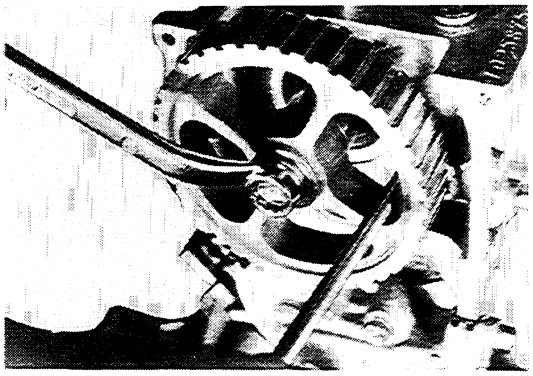
14. Inspect the timing belt tensioner for abnormal noise and/or damage at the belt contact point. If the timing belt tensioner is excessively worn, replace it.



Checking the Belt Tensioner

15. Remove the camshaft timing belt pulley.

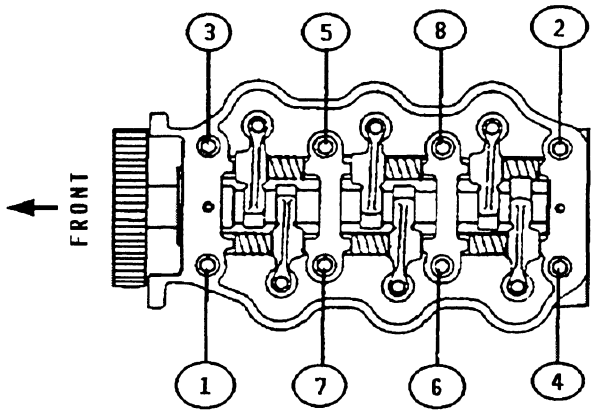
NOTE: When removing the camshaft timing belt pulley, insert a screwdriver between the spokes of the pulley to prevent the camshaft rotating while loosening the pulley's screw.



REMOVING THE CYLINDER HEAD FROM THE CYLINDER BLOCK

To avoid the possibility of distorting the cylinder head, loosen each of the cylinder head bolts, a little at a time, in the sequence shown below. Repeat this sequence several times until the bolts are unfastened. Remove the cylinder head and cylinder head's gasket.

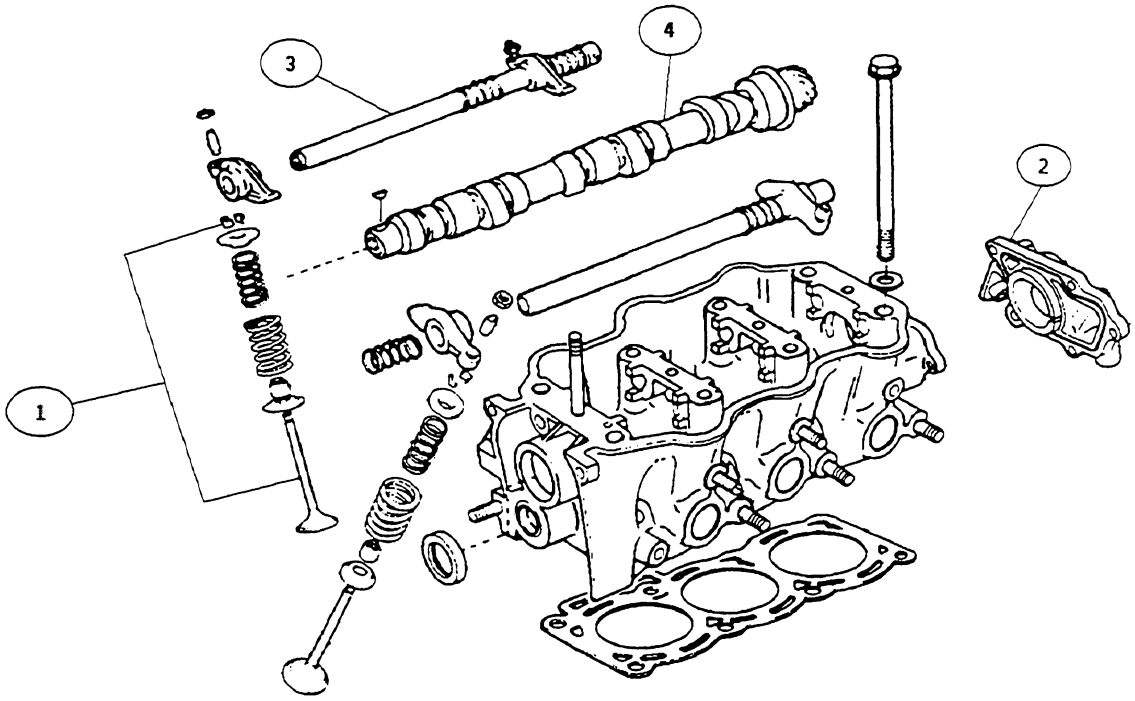
NOTE: Discard the cylinder head gasket when it is removed. When reassembling the cylinder head to the cylinder block, install a new cylinder head gasket.



W 26G HEAD BOLT
LOOSENING SEQUENCE

CYLINDER HEAD DISASSEMBLY

The figure below presents the relationship of parts (and the order in which those parts are disassembled) for the W 26G and W 26GX engines' cylinder heads.

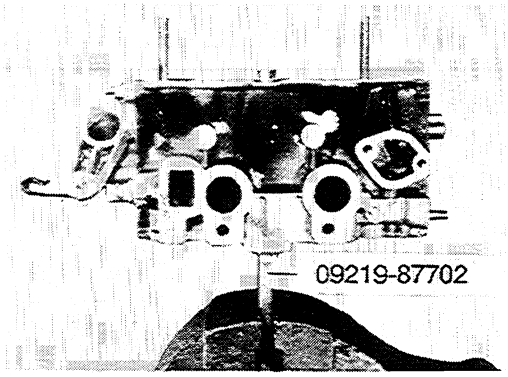


CYLINDER HEAD DISASSEMBLY ORDER

*1. Valves	(page 54, step 2)
2. Distributor Housing	
*3. Rocker Arms	(page 55, step 3)
*4. Camshaft	(page 55, step 4)

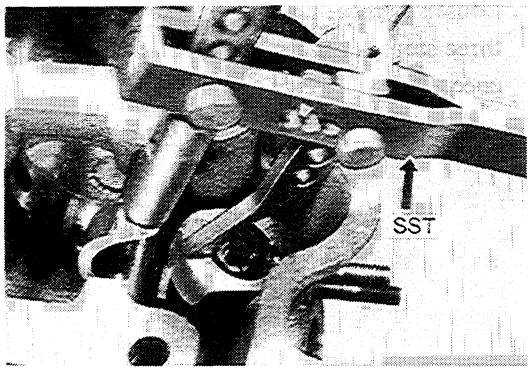
* Denotes that disassembly instructions for these parts follow on the indicated pages.

1. Mount the cylinder head on the cylinder head holder using special service tool [SST] # 09219-87702. This tool is available through the Westerbeke Corporation. Clamp the special tool in a bench vise and remove the designated parts as follows.



2. Remove the valves and their associated parts using the valve spring replacer (special service tool [SST] # 09202-87701). This tool is available from the Westerbeke Corporation.

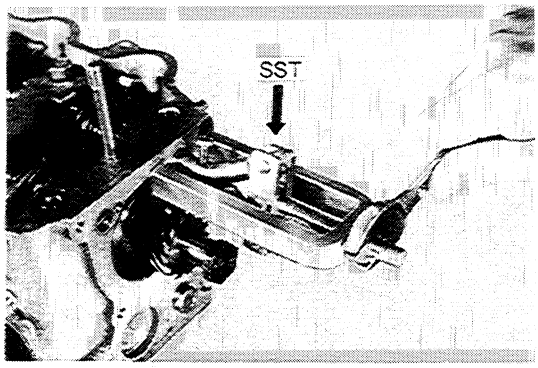
NOTE: As the valves and their associated parts are removed, keep valve sets together and in correct order with respect to their placement in the cylinder head. Unless any of the parts are replaced, they must be returned to the same locations from which they were removed.



2. Remove the distributor housing.

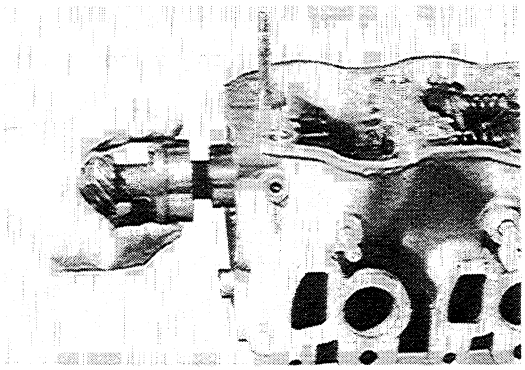
3. Loosen the lock nuts and back the adjusting screws off the valve rocker arms.

4. Remove the rocker shaft plug from the rear end of the No. 1 rocker shaft and use the valve shaft puller (special service tool [SST] # 09204-87701 which is available from the Westerbeke Corporation) to extract the rocker shaft; repeat this process for the No. 2 rocker shaft.



NOTE: At the same time the rocker shaft is extracted, remove the valve rocker arms and compression springs associated with the shaft.

5. Extract the camshaft from the rear end of the cylinder head.

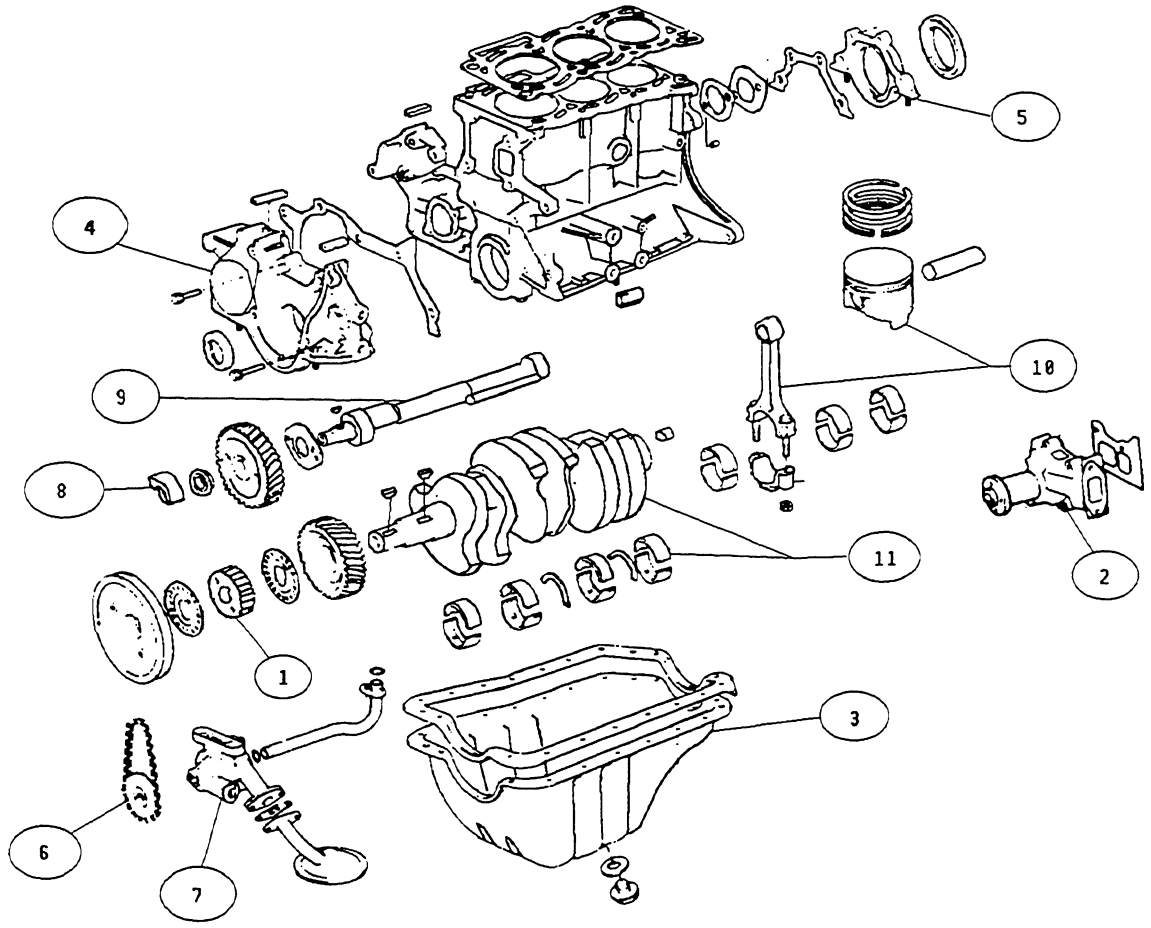


CAUTION

Exercise care when removing the camshaft to avoid damaging the bearing journals or cam lobe surfaces of the camshaft.

CYLINDER BLOCK DISASSEMBLY

The figure below presents the relationship of parts (and the order in which those parts are disassembled) for the W 26G and W 26GX engines' cylinder blocks.



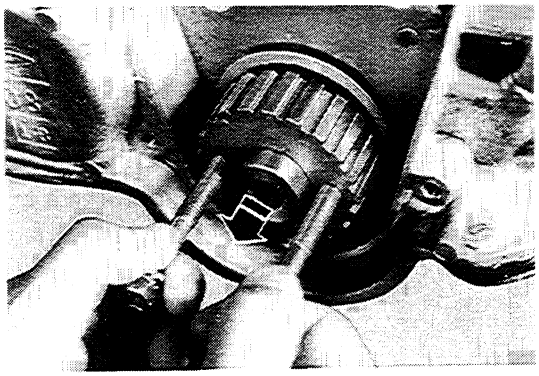
CYLINDER BLOCK DISASSEMBLY ORDER

*	1. Crankshaft Timing Belt Pulley	(page 57, step 1)
	2. Fresh Water Pump	
	3. Oil Pan and Gasket	
	4. Balance Shaft Gear Cover	
	5. Rear Oil Seal Retainer	
	6. Oil Pump Drive Sprocket and Chain	
	7. Oil Pump	
	8. Balance Shaft Weight	
*	9. Balance Shaft and Pulley	(page 57, step 8)
*	10. Pistons and Connecting Rod Assembly	(page 58, step 9-10)
*	11.Crankshaft and Bearings	(page 59, step 12-15)

* Denotes that disassembly instructions for these parts follow on the indicated pages.

1. Remove the crankshaft's timing belt pulley and the crankshaft timing belt pulley's flanges.

   NOTE: If the crankshaft's timing belt pulley is difficult to remove, screw a pair of bolts into the threaded holes in the face of the pulley as shown in the illustration below. Withdraw the pulley with the two bolts.



2. Remove the fresh water pump assembly and gasket.

3. Remove the oil pan and gasket.

4. Remove the balance shaft's gear cover, gasket, and dust seals.

5. Remove the rear oil seal retainer.

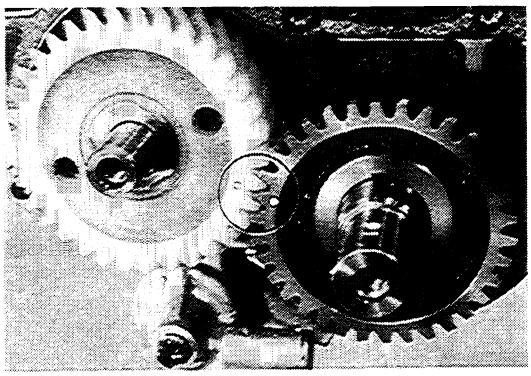
6. Remove the oil pump's drive sprocket from the right side balance gear; remove the oil pump's drive shaft sprocket and oil pump drive chain from the oil pump's drive shaft.

7. Remove the oil pump together with the oil pump outlet pipe.

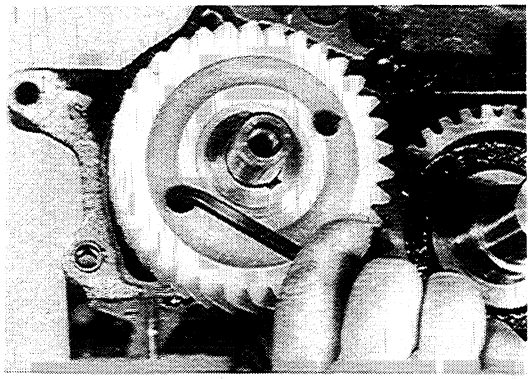
   NOTE: The oil pump is fastened to the cylinder block with hexagon socket head cap screws. Use a 6-mm hexagon wrench (which is commercially available) to remove the oil pump.

8. Remove the balance shaft as follows.

   A. Align the stamped mark on the balance shaft's drive gear. This aligns the holes in the face of the balance shaft's gear with the hexagon socket head cap screws which fasten the balance shaft's thrust plate to the cylinder block.



B. Remove the hexagon socket head cap screws from the cylinder block using a 6-mm hexagon wrench; extract the balance shaft and balance shaft gear toward the front of the cylinder block taking care to avoid damaging the bearing journals.



9. Remove the connecting rod cap screws and detach the connecting rod cap. Push the connecting rod and piston assembly upward, out of the top of the cylinder block, using the handle of a hammer (or similar nonmetallic tool).

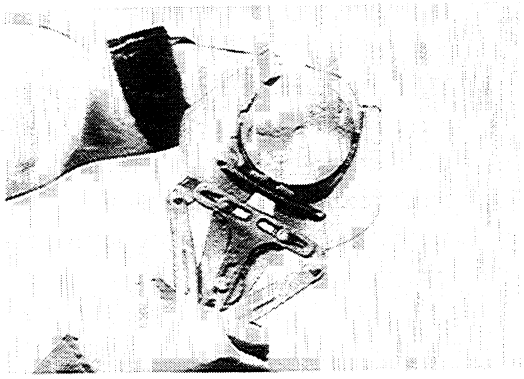
NOTE: Temporarily reassemble the connecting rod and cap to keep the parts together for later reassembly of the cylinder block components in the same locations from which they were removed.

Repeat this procedure for each cylinder.

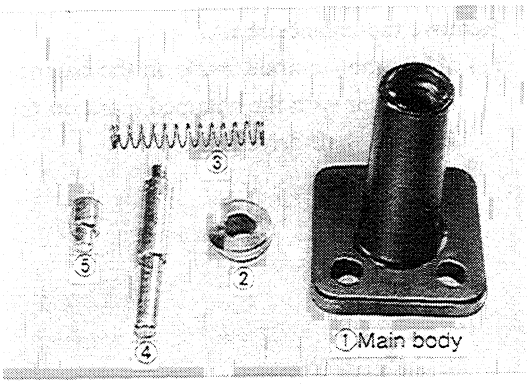
10. Remove the piston rings from each piston as follows.

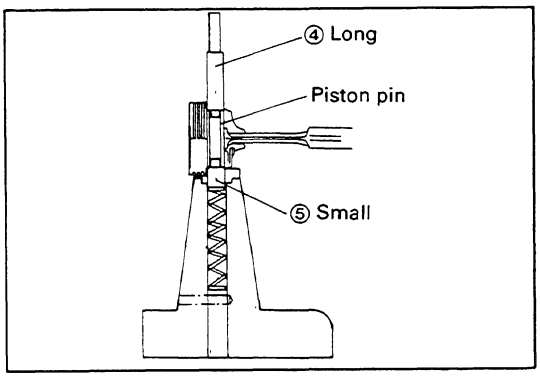
A. Remove the No. 1 and No. 2 piston rings using a commercially-available piston ring expander. Refer to the illustration shown to the right.

B. Remove the combination-type oil ring by hand.



11. Remove the piston pin from each piston and connecting rod assembly using the piston pin removal tools (special service tools # 09221-87702 and # 09221-25018).





A. Attach the fitting piece (2) into the main body (1).

B. Place the spring (3) and the small bar (5) into the main body (1).

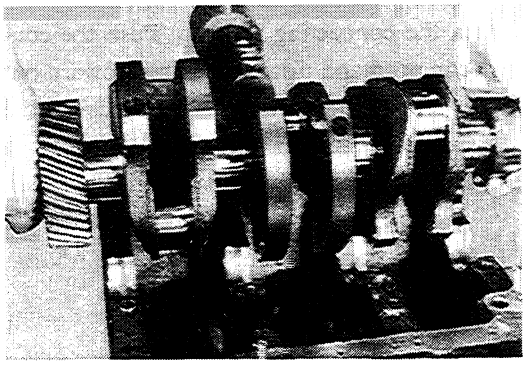
C. Position the piston/rod assembly on the main body (1).

D. Insert the large bar (4) into the piston over the piston pin.

E. Use a soft-metal pin punch or a bearing press to drive the piston pin from the piston.

NOTE: Take care to keep the related pins and pistons in their proper order so that the pins are replaced in the same pistons from which they were removed, and the pistons replaced in the same cylinders from which they were removed.

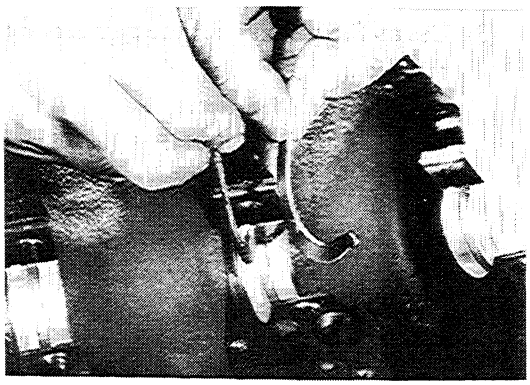
12. Remove the crankshaft's bearing caps.



13. Remove the crankshaft.

14. Remove the crankshaft's bearing sets and the No. 3 thrust bearing.

NOTE: the crankshaft's bearing sets must be kept in proper order so they can be reassembled in the same locations from which they were removed.



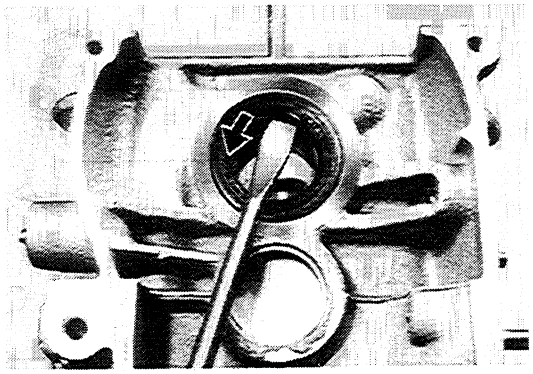
15. Remove the studs and other small parts as required.

Camshaft Oil Seal Removal

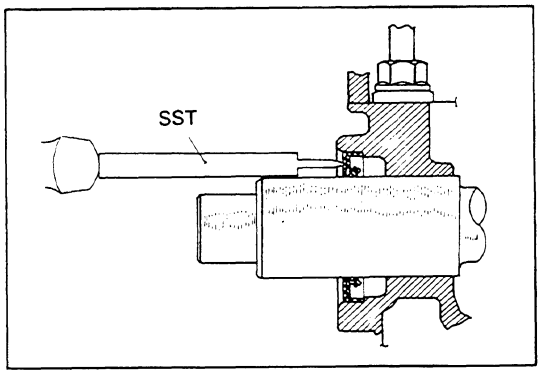
Remove the camshaft's oil seal from the cylinder head using either a large screwdriver, or the oil seal remover and replacer (special service tool # 09223-87701). This tool is available from the Westerbeke Corporation.

A. For removing the camshaft's oil seal with a screwdriver, insert the screwdriver in the inner grove of the seal and gently pry the seal out while turning the seal with the screwdriver. Refer to the illustration to the right.

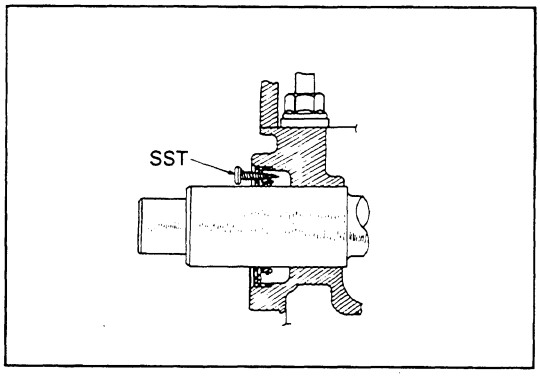
NOTE: Be extremely careful not to damage the oil sea journal's surface. Damaging this surface could cause excessive oil leaks even when a new oil seal has been installed.



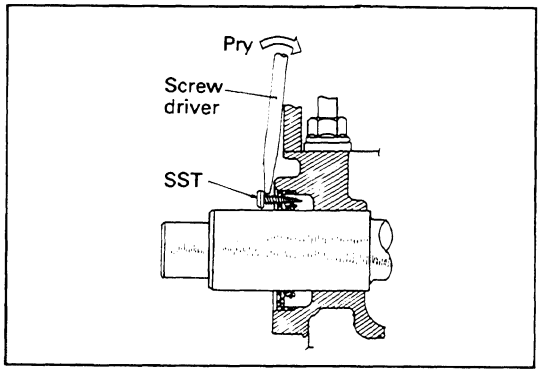
For removing the camshaft's oil seal with the special service tool, punch a hole in the camshaft's oil seal with the oil seal remover tool [SST] # 09223-87701-002 .



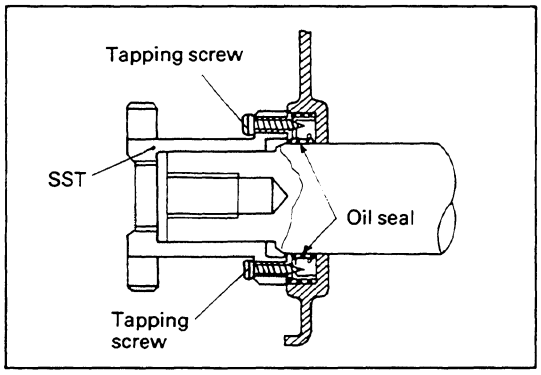
B. Screw the oil seal remover [SST] # 09233-87701-004 into the hole punched in step **A**.



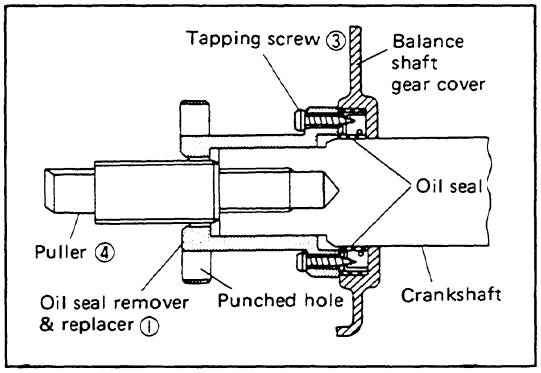
C. Remove the oil seal by prying against the oil seal remover that was installed in step **B**.



D. Align the oil remover tool in the punched hole (aligning it with the punch) and screw in the tapping screws to hold the oil seal remover tool.

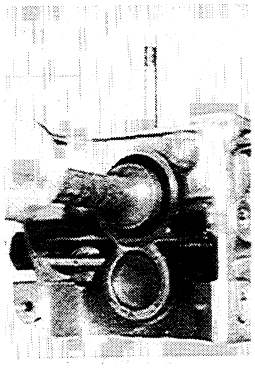


E. Remove the oil seal by extracting the oil seal remover tool with the puller (4).



Camshaft Oil Seal Installation

Install a new oil seal using special service tool # 09515-87202.



SPECIAL SERVICE TOOLS

NOTE: Special Service Tools are listed in the same order as they appear in the manual.

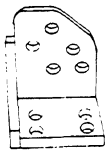
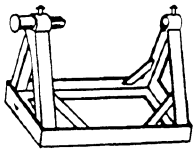
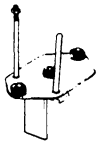
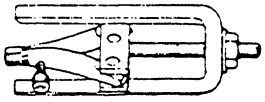
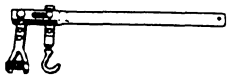
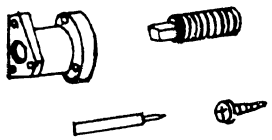
Illustration	Tool No.	Tool Name
	09219-87701	Engine overhaul attachment
	09219-87202	Engine overhaul stand
	09219-87702	Cylinder head holder
	09204-87701	Valve rocker shaft puller
	09202-87701	Valve spring replacer

Illustration	Tool No.	Tool Name
	09221-25014	Piston pin remover and replacer
	09223-87701	Oil seal remover and replacer

YOUR NOTES

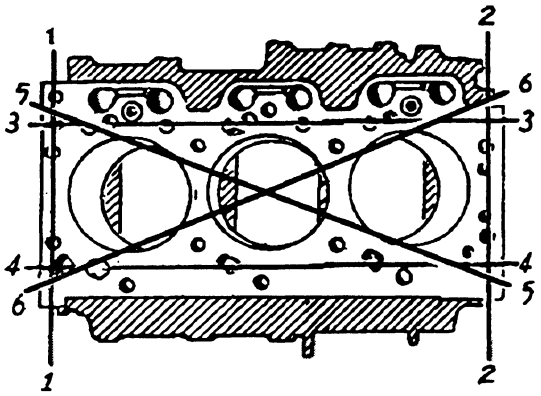
CYLINDER HEAD AND ENGINE BLOCK INSPECTION AND REPAIR

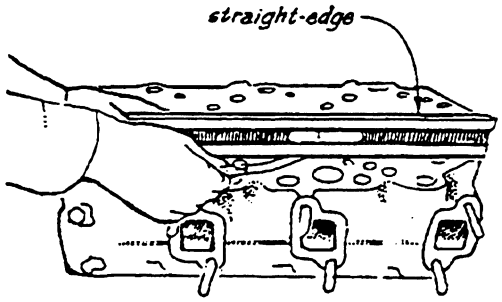
NOTE: Before washing the cylinder head and block, check them for indications of water leaks, gas leaks, damage or cracks. After checking these components, wash each part to remove any adhered matter such as pieces of gasket, dust, oil, carbon, and scale. Since the cylinder head, cylinder head cover, timing chain cover and other engine parts are made of aluminum, handle them carefully to ensure against damage. Do not use cleaning solutions that will be harmful to the aluminum.

Checking the Cylinder Head

1. Replace the cylinder head if it shows signs of water leaks, gas leaks or cracks.

2. Measure the extent of warping (flatness) on the lower surface that mates with the cylinder block. If the warping exceeds the allowable limit of distortion, grind the surface to within the specified grinding tolerance. If the warping exceeds the allowable grinding tolerance, then replace the cylinder head.





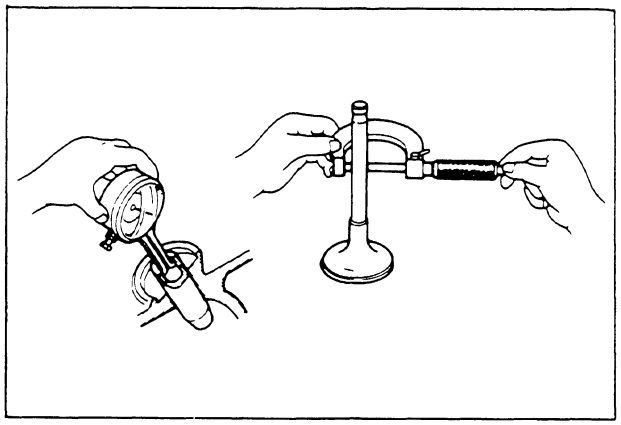
Specified Cylinder Head Height:	4.953 inches (125.8 mm)
Allowable Limit of Distortion:	0.0039 inches (0.10 mm)
Grinding Tolerance:	0.0118 inches (0.30 mm)

Checking Valve Guides

Measure the clearance between the valve and guide bushing. If the clearance exceeds the specified limit, replace those parts that have worn beyond the allowable limit.

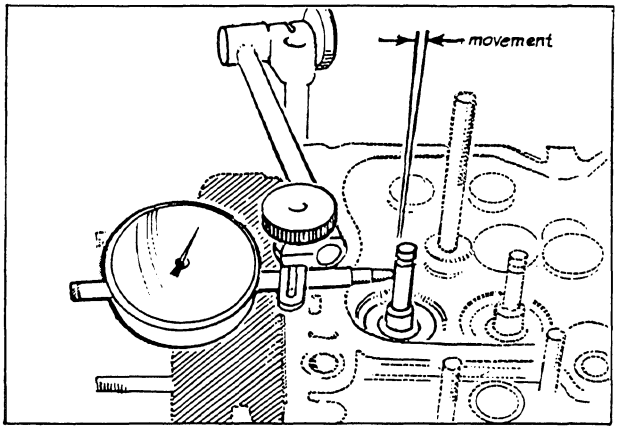
Specified Limit:	Intake 0.0016 - 0.0028 inches (0.040 - 0.070 mm) Exhaust 0.0018 - 0.0030 inches (0.045 - 0.075 mm)
Allowable Limit:	Intake 0.0031 (0.080 mm) Exhaust 0.0039 (0.100 mm)

Measuring Method #1: Check the difference between the inner diameter of the guide bushing and the diameter of the valve stem.



Measuring Method #2: Check each valve's deflection with a mounted dial indicator by moving the valve stem from side to side.

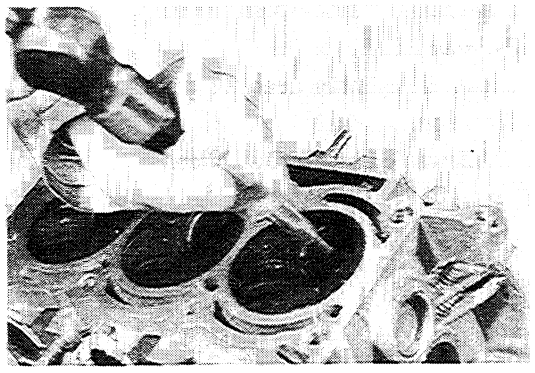
NOTE: Separate the valve from the valve seat before measuring. Measure at a position closest to the valve guide bushing.



Replacing the Valve Guides

1. Remove the valve seal from the valve guide.

2. Knock the guide out toward the opposite side of the combustion chamber with a valve guide installer. (Special Service Tool # 09201-87201-000)



3. Place a clip on the new valve guide and drive it in from the opposite side of the combustion chamber with the valve guide installer.

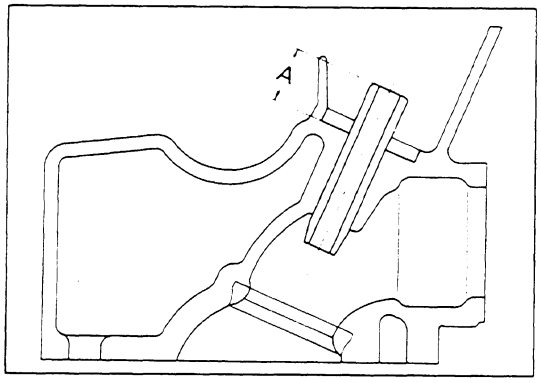
   NOTE: The shape of the intake valve guides differs from that of the guides on the exhaust side.

4. Install the valve seal on the valve guide with a valve seal pusher.

5. Check the clearance for each new valve guide bushing.

   Projection Height (Dimension **A**):

   0.598 - 0.622 inches (15.2 - 15.8 mm)



Checking Valves

1. Check the contact surface of the valve face and valve seat for damage. Minor or rough surface may be repaired with a valve grinder.

2. If the valve stem is worn, damaged, bent or the end surface of the stem is dented, replace the valve.

3. Check the valve stem's diameter with a micrometer; if the stem is worn beyond the allowable limit, replace the valve.

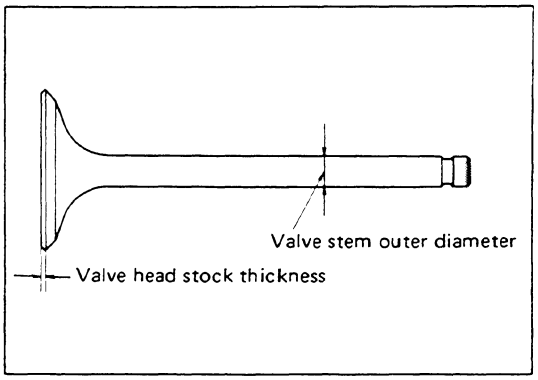
   Valve stem diameter limit:

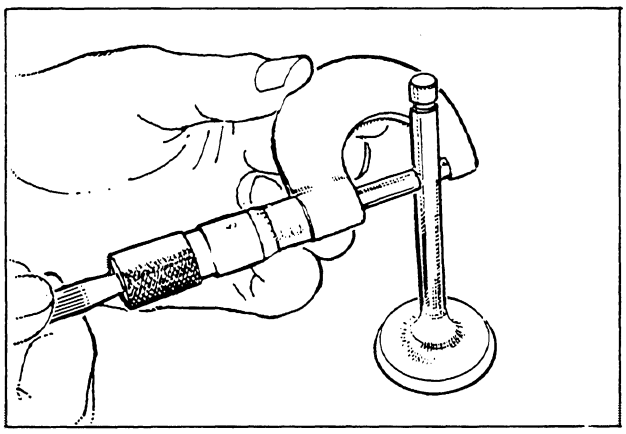
   Specified Limit
   Intake: 0.2734 - 0.2740 inches
   (6.945 - 6.960 mm)

   Exhaust: 0.2732 - 0.2738 inches
   6.940 - 6.955 mm)

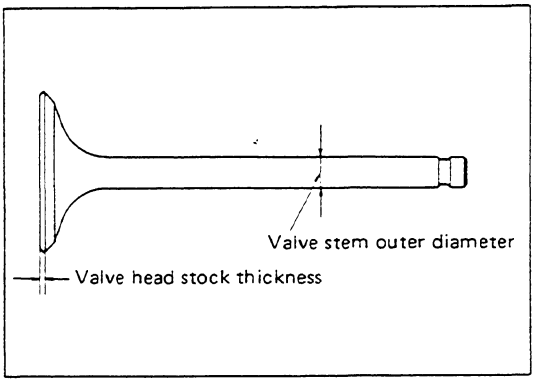
   Allowable Limit
   Intake: 0.2724 inches
   (6.920 mm)

   Exhaust: 0.2720 inches
   (6.910 mm)





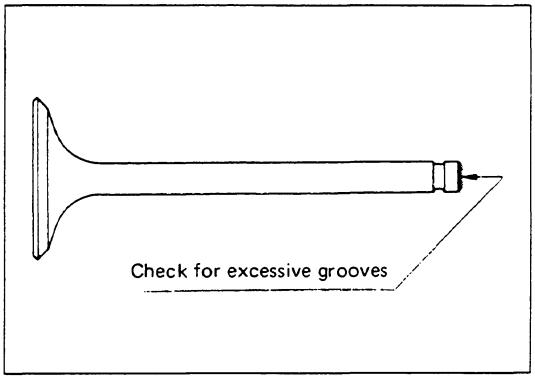
4. Check of each valve's head stock thickness. Replace the valve if it is beyond the allowable limit.



Valve Head Stock Thickness Limit
Specified Limit
Intake: 0.35 - 0.59 inches
(0.9 - 1.5 mm)

Exhaust: 0.047 - 0.071 inches
(1.2 - 1.8 mm)

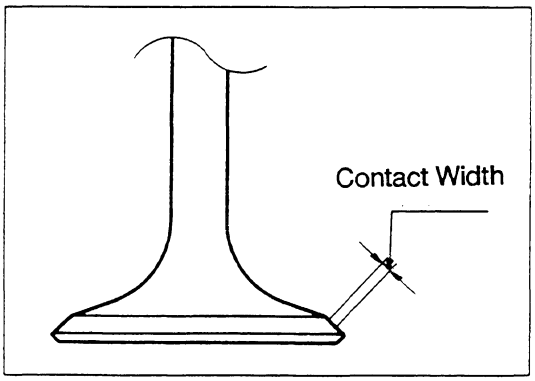
5. Check for excessive grooves at the end of the valve stem.



Valve Seats

1. Inspect the valve's contact surface for pitting and damage.

2. Measure each valve's contact width.



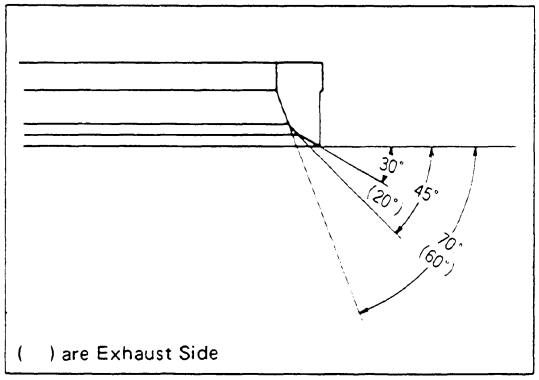
Contact Width (Both Intake and Exhaust)

0.039 - 0.071 inches
(1.0 - 1.8 mm)

NOTE: Check the valve's contact area and position by applying a this coat of Prussian Blue or red lead to the valve's seat and push the valve upward into cylinder head's seat (apply only enough pressure to assure a press fit). Under its own weight, let the valve drop away from the cylinder head. Perform this operation two or three times until the valve's contact surface can be accurately measured.

Check if the valve seat's contact face contacts the center position of the valve's contact face. **DO NOT** rotate the valve.

Refacing the Valve and Valve Seat



To reface the valve and cylinder head valve seats, follow the steps below.

1. For the intake port in the cylinder head, use a 30° cutter to bring back the valve seat's shoulder. Then use a 45° cutter to recondition the valve seat contact face.

2. For the exhaust port in the cylinder head, use a 20° cutter to bring back the valve seat's shoulder. Then use a 45° cutter to recondition the valve seat contact face.

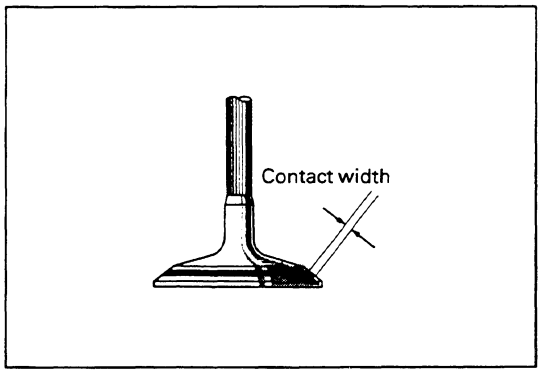
3. Grind each valve's contact face to 45°. Match each valve to its respective cylinder head port and check to ensure that both the cylinder's contact face and the valve's contact face are perfectly matched.

4. After each valve is reconditioned, hand lap each valve with a good brand of lapping compound.

5. Remeasure the contact width of both the valves and each cylinder head valve seat and ensure that they conform to the following specification.

   Contact Width (Both Intake and Exhaust)

   0.039 - 0.071 inches
   (1.0 - 1.8 mm)



Checking Rocker Arms and the Rocker Shaft

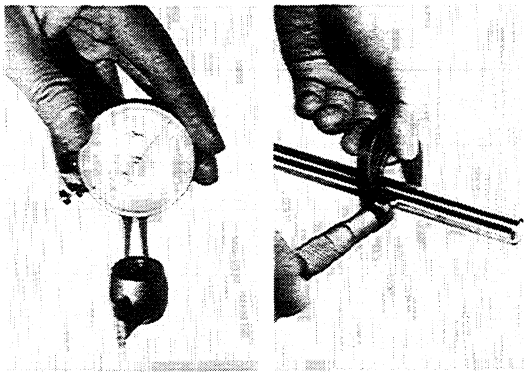
1. Check each component of the rocker arm assembly for damage or cracks. If necessary, replace it with a new one.

2. Check to see that the oil passages of the rocker arm and shaft are open. If any clogs are found, remove them or replace the unit.

3. Measure the clearance between each rocker arm's bore and the shaft. If this measurement exceeds the allowable limit, replace the worn rocker arm bushings and shaft.

   Arm Inner Diameter: 0.6300 - 0.6307 inches
   (16.000 - 16.018 mm)

   Shaft Outer Diameter: 0.6283 - 0.6293 inches
   (15.958 - 15.984 mm)



(See next page)

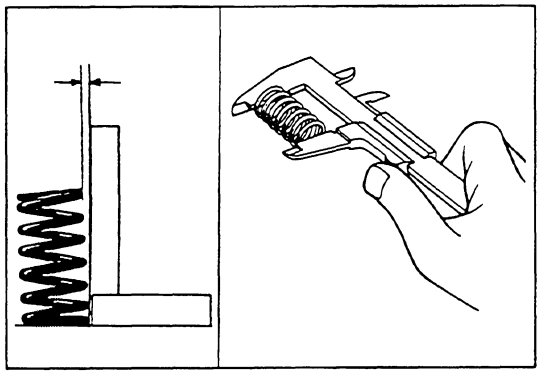
Clearance

Specified Limit: 0.0006 - 0.060 inches
(0.016 - 0.060 mm)

Allowable Limit: 0.003 inches (0.08 mm)

Checking Valve Springs

All models covered by this manual have two springs for each valve, an inner spring and an outer spring.

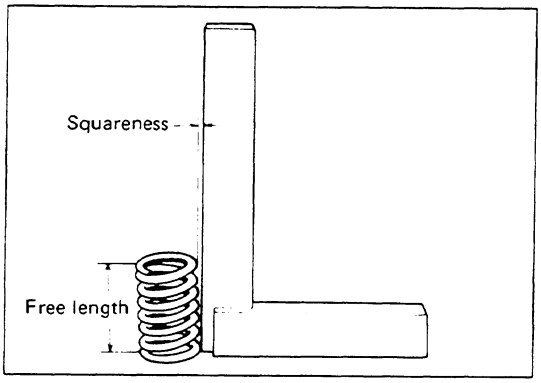


1. Check the valve spring for corrosion or damage and replace, if necessary.

2. Check each spring for free length and squareness; replace the spring if the free length is less than the free length limit specified below.

Free Length Standard
Outer: 1.646 inches (41.8 mm)
Inner: 1.614 inches (41.0 mm)

Free Length Limit
Outer: 1.594 inches (40.5 mm)
Inner: 1.567 inches (39.8 mm)



3. Check the squareness of the valve spring. If it exceeds the limit, replace with a new one.

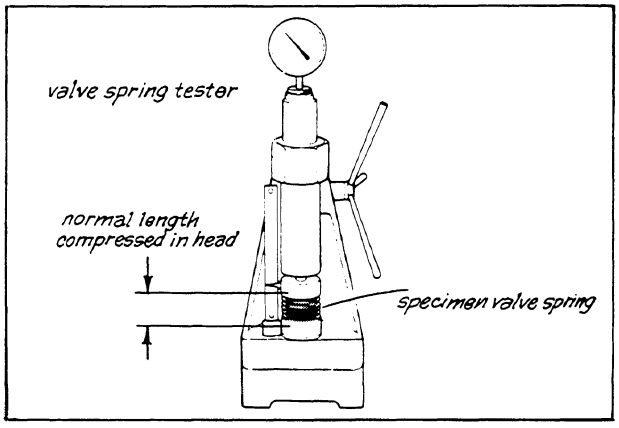
Squareness limit
Outer: 0.059 inches (1.5 mm)
Inner: 0.059 inches (1.5 mm)

4. Using a spring tester, measure each spring's tension at the specified installed length. Replace the springs if they prove to be weakened.

Installed Length: 1.374 inches (34.9 mm)

Installed Load
Standard: 62.8 - 69.0 lbs
(28.5 - 31.3 kgs)

Allowable Limit: 56.7 lbs
(25.7 kgs)

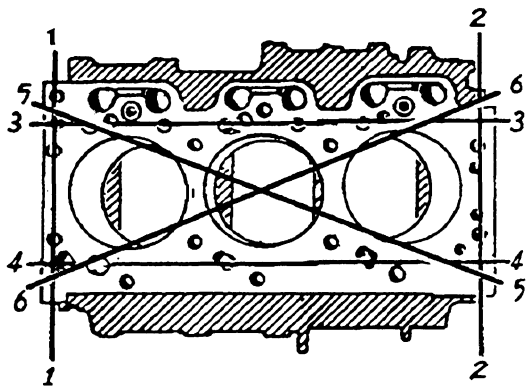


Checking the Cylinder Block

1. Check the cylinder block for damage or cracks. If necessary, repair or replace the cylinder block.

2. Check to see that the oil passages and coolant passages of the cylinder block are open. If clogged, remove with compressed air or a wire probe.

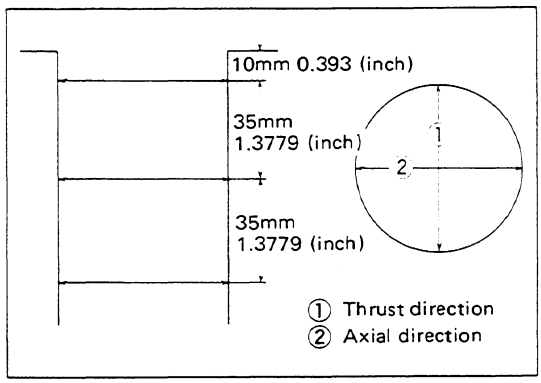
3. Check the cylinder block for distortion. If it exceeds the allowable limit of distortion, repair or replace the cylinder block.



Allowable Limit of Distortion: 0.002 inches (0.05 mm)

4. Check for scratches or burns on the cylinder walls. If necessary, repair by boring each cylinder or replace the cylinder block.

5. Measure the wear on the cylinder bores at the six positions shown in the figure to the right with an inside micrometer. (The wear is the difference between the maximum and minimum diameters.) If the cylinder bores have worn beyond the specified wear limit, the cylinder block requires boring to restore each cylinder's true wall surface.

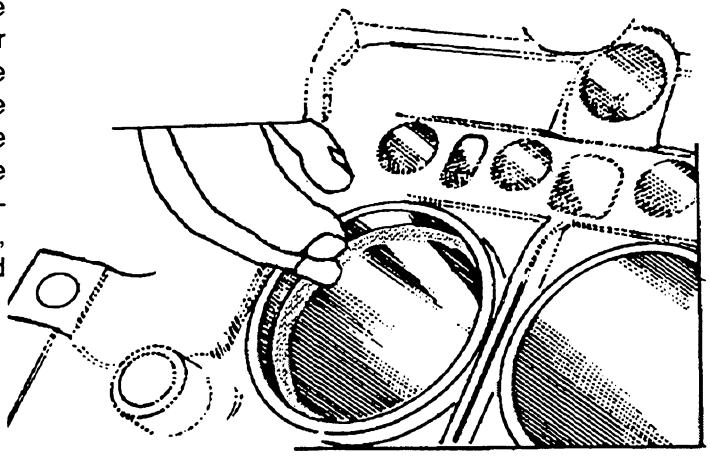


Standard Bore Diameter: 2.9921 - 2.9933 inches (76.00 - 76.03 mm)

Out-of-Roundness, Taper Limit: 0.0031 inches (0.08 mm)

Wear limit: 0.0039 inches (0.10 mm)

6. Check the ridge in the cylinder. If the engine has a number of hours on it, a large cylinder ridge most likely will be present. If a ridge exists, have the cylinders reamed to remove these ridges. Leaving these ridges in the cylinder can break piston rings when the pistons are installed in the engine. In addition, if new piston rings are to be installed, have the cylinder walls de-glazed (roughed up) so the rings may seat properly.



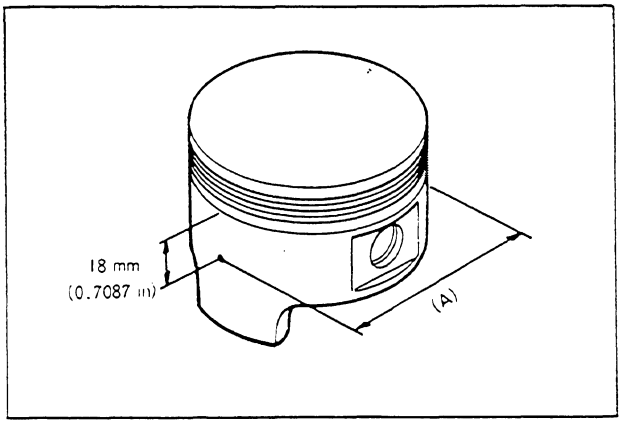
Checking the Pistons

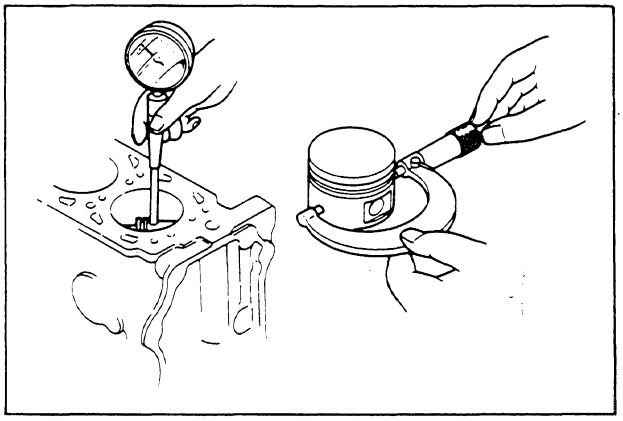
1. Check all pistons carefully, and replace those that exhibit severe burns or scratches on the external circumference of the piston are found.

2. Measure each piston's diameter 0.7087 inches (18 mm) under the oil ring groove, at right angles to the piston pin's location (that is, in the thrust direction) without the pin in place.

3. Check the clearance between the piston and the cylinder wall.

Piston Diameter (Dimension **A**):	2.9903 - 2.9915 inches (75.955 - 75.985 mm)
Standard Cylinder-to-Piston Clearance:	0.0014 - 0.0022 inches (0.035 - 0.055 mm)
Allowable Cylinder-to-Piston Limit:	0.0039 inches (0.10 mm)



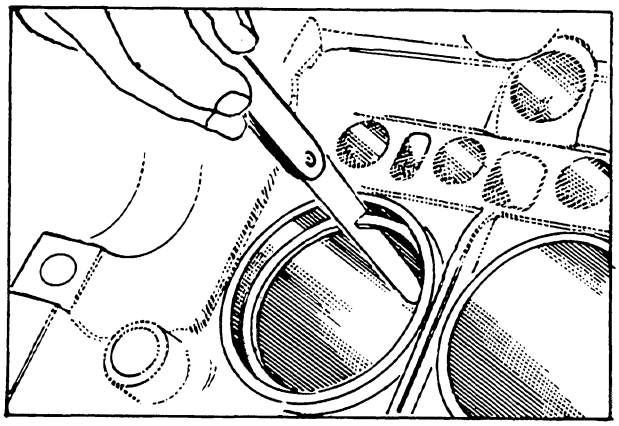


Checking Piston Rings

1. Check the piston rings for cracks, burning or wear and replace, if necessary.

2. Measure each piston ring's end gap. Replace the ring if the gap exceeds the allowable end gap limit.

   NOTE: Push a ring into the cylinder with a piston until it is about 2 inches from the block's top surface.



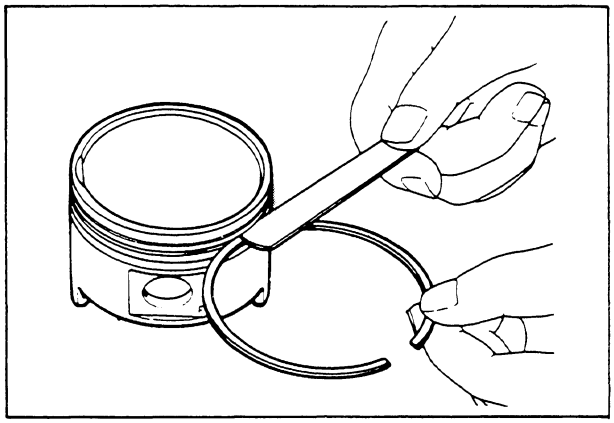
Standard End Gap Clearance

Compression ring No.1: 0.0079 - 0.0157 inches (0.20 - 0.40 mm)

Compression ring No.2: 0.0079 - 0.0157 inches (0.20 - 0.40 mm)

Oil ring: 0.0079 - 0.0315 inches (0.20 - 0.80 mm)

3. Measure the side clearance between the piston ring and ring groove.



NOTE: Measure the clearance around the total circumference of the ring groove.

Standard Side Clearance
Compression Ring No.1:
0.0012 - 0.0028 inches
(0.03 - 0.07 mm)

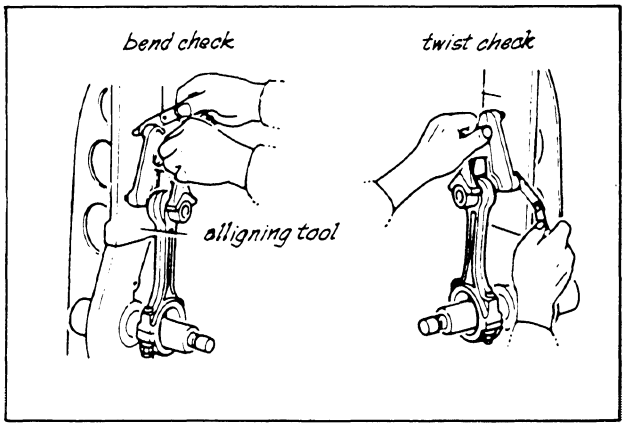
Compression Ring No.2:
0.0008 - 0.0014 inches
(0.02 - 0.06 mm)

Allowable Side Clearance Limit:
0.0047 inches (0.12 mm)

Checking the Connecting Rods

1. Check the side of each connecting rod's small end and large end for cracks or damage. If necessary, replace damaged connecting rods.

2. Check the connecting rod for bends or twists with a suitable alignment fixture. If realignment is necessary, place the connecting rod in a press and apply a gradual pressure to the rod or replace the connecting rod.



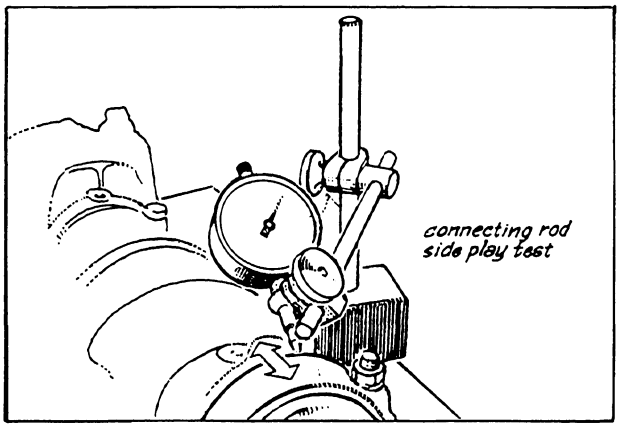
Allowable Limit per 3.937 inches (100 mm)

Bend: 0.0020 inches (0.05 mm)

Twist: 0.0020 inches (0.05 mm)

3. Check the connecting rod's side play with a dial indicator or a feeler gauge as shown in the figure. If it exceeds the limit, replace the connecting rod or crankshaft.

   End play limit: 0.012 inches (0.30 mm)



Checking the Piston Pins

1. Check each piston pin's oil clearance.

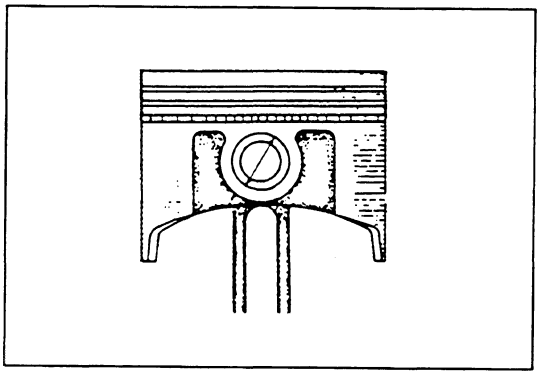
   A. Measure each piston pin's bore diameter.

      Standard Bore Diameter: 0.7086 - 0.7089 inches (17.999 - 18.008 mm)

   B. Measure each piston pin's diameter.

      Standard Pin Diameter: 0.7083 - 0.7087 inches (17.991 - 18.000 mm)

      Standard Oil Clearance: 0.0002 - 0.0004 inches (0.005 - 0.011 mm)



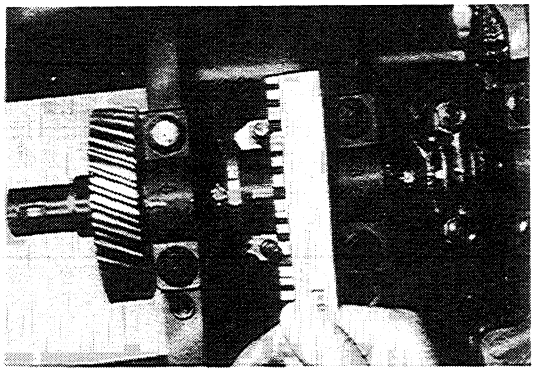
2. Replace the piston and piston pin if the pin's oil clearance exceeds the allowable limit specified below.

   Allowable Limit: 0.0004 - 0.0008 inches (0.011 - 0.020 mm)

Checking the Connecting Rod Bearings

1. Check each connecting rod bearing carefully and replace it if it is worn, scored or flaked.

2. Check each connecting rod bearing's oil clearance with a "plastigauge." If the clearance for these bearings exceed the allowable limit, replace all the connecting rod bearings. If the connecting rod journals are scored or flaked, grind the crankshaft's connecting rod journals and install an undersized bearing.



Bearing Oil Clearance:

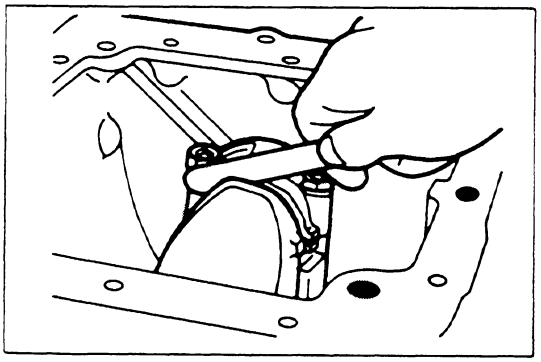
Specified Limit: 0.0008 - 0.0016 inches (0.020 -0.044 mm)

Allowable Limit: 0.0031 inches (0.08 mm)

Kinds of Connecting Rod Bearings:

Standard Repair	1.5739 - 1.5748 inches (39.976 - 40.000 mm)
Undersize 0.0098 inches (0.25 mm)	1.5642 - 1.5646 inches (39.732 - 39.742 mm)
Undersize 0.0196 inches (0.50 mm)	1.5544 - 1.5548 inches (39.482 - 39.492 mm)

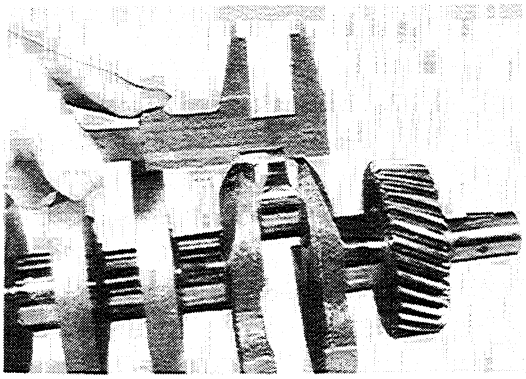
3. Check each connecting rod's thrust clearance.



Specified Limit: 0.0059 - 0.0098 inches (0.150 - 0.250 mm)

Allowable Limit; 0.0012 inches (0.03 mm)

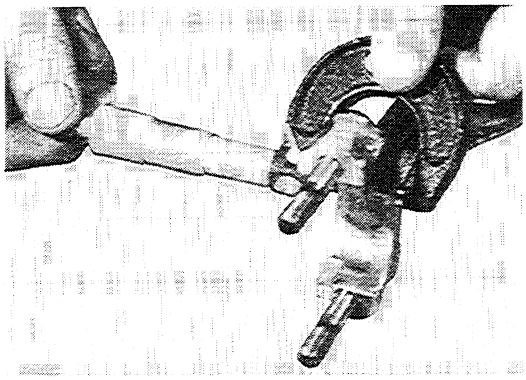
4. Check each connecting rod's journal width.



Journal Width: 0.8661 - 0.8681 inches (22.00 - 22.05 mm)

5. Measure the connecting rod width.

Standard Rod Width: 0.8583 - 0.8602 inches
(21.80 - 21.85 mm)

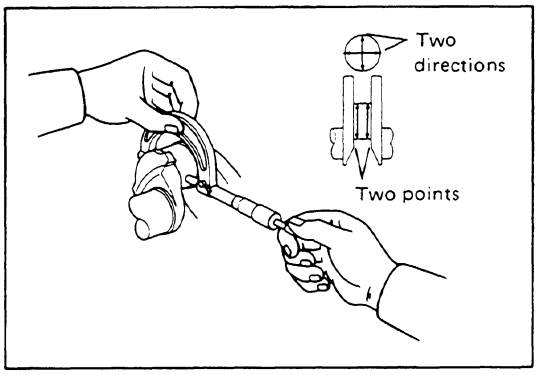


Checking the Crankshaft

1. Check the crankshaft for cracks or other damage. If necessary, replace the crankshaft.

2. Check to see that the oil passages of the crankshaft are open. If any clogs are found, remove them with compressed air or a suitable wire.

3. Check the crankshaft for eccentric wear; that is, see if the journals have become elliptical or tapered. If it exceeds the allowable limit, compensate for this wear by grinding the bearing journals and replace the bearings with undersized bearings.



NOTE: Measure the diameter of each of the crankpins and main journals at two points (the front and rear portions) at 90 degrees to the crankshaft axis, as shown in the figure.

Allowable elliptical or tapered Limit: 0.0008 inches (0.02 mm)

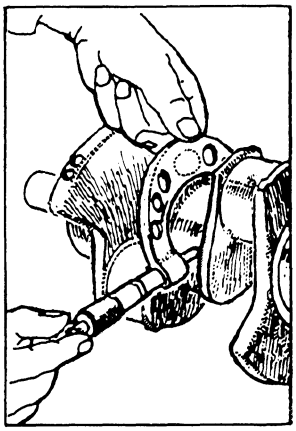
Specified Oil Clearance: 0.008 - 0.0017 inches (0.020 - 0.044 mm)
Allowable Limit: 0.0028 inches (0.07 mm)

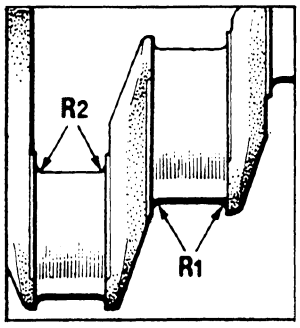
4. If the journals must be ground because of severe burning or scoring, grind the crankshaft and replace the crankshaft bearings with undersized bearings.

	Main Journal Outer Diameter	Crankpin Journal Outer Diameter
Standard Repair limit	1.6526 - 1.6535 inches (41.976 - 42.000 mm)	1.5739 - 1.5748 inches (39.976 - 40.000 mm)
Undersize 0.0098 inches (0.25 mm)	1.6430 - 1.6434 inches (41.732 - 41.742 mm)	1.5642 - 1.5646 inches (39.732 - 39.742 mm)
Undersize 0.0196 inches (0.50 mm)	1.6331 - 1.6335 inches (41.482 - 41.492 mm)	1.5544 - 1.5548 inches (39.482 - 39.492 mm)

NOTE: When grinding the crankshaft, the corner sections of the main journals and crank pin journals *must* be ground to a radius of 0.0098 inches (0.25 mm) (R1 and R2). Any crankshaft grinding should be done by a qualified machine shop.

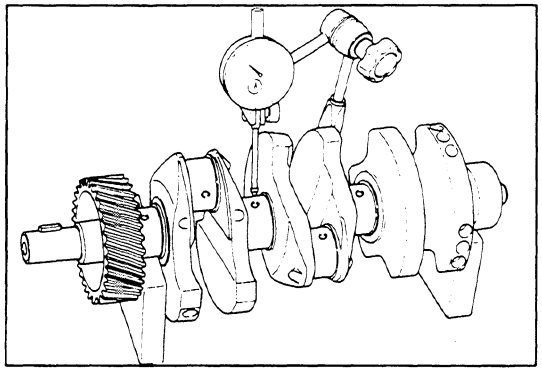
NOTE: The Main and Crankpin Journals *must* be accurately ground to a radius of 0.0098 inches (0.25 mm)





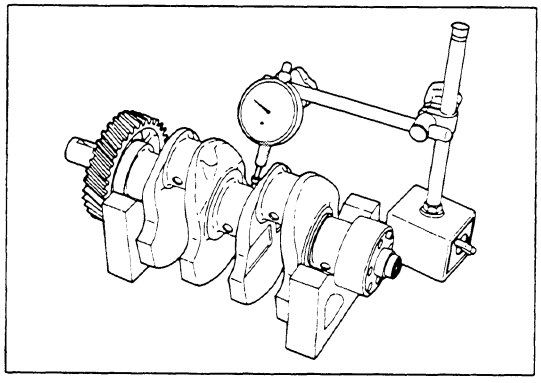
5. Measure the crankshaft's runout.

   Runout Limit: 0.0012 inches (0.03 mm)

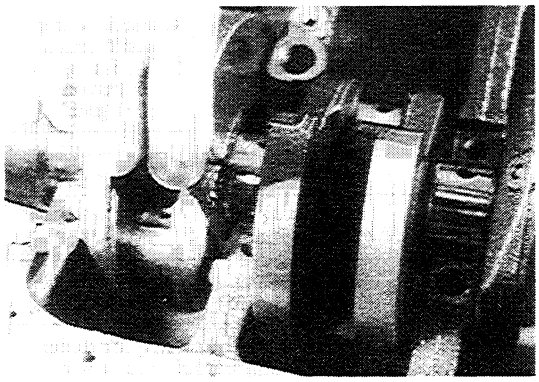


6. Measure the crankshaft for bend by placing a dial gauge at the center bearing journal and turning the crankshaft, as shown in the illustration to the right.

   Bend Limit: 0.0012 inches (0.03 mm)



7. Check the crankshaft's thrust clearance with a feeler gauge, as shown in the figure. If it exceeds the allowable limit, replace the thrust washer.



Specified Limit

0.0004 - 0.0063 inches
(0.010 - 0.160 mm)

Allowable Limit

0.0118 inches (0.30 mm)

Kinds of Thrust Washers:

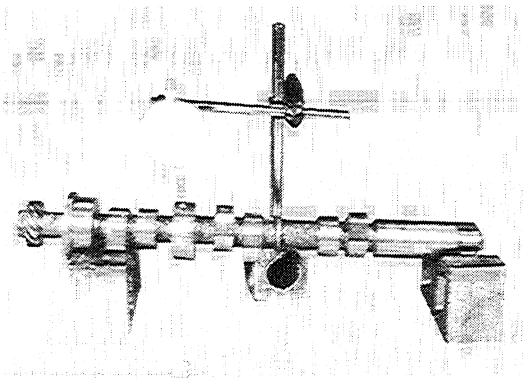
Standard Repair	0.0764 - 0.0783 inches (1.940 - 1.990 mm)
Over size 0.0049 inches (0.125 mm)	0.0813 - 0.0833 inches (2.065 - 2.115 mm)
Oversize 0.0098 inches (0.250 mm)	0.0862 - 0.0882 inches (2.190 - 2.240 mm)

Checking the Camshaft

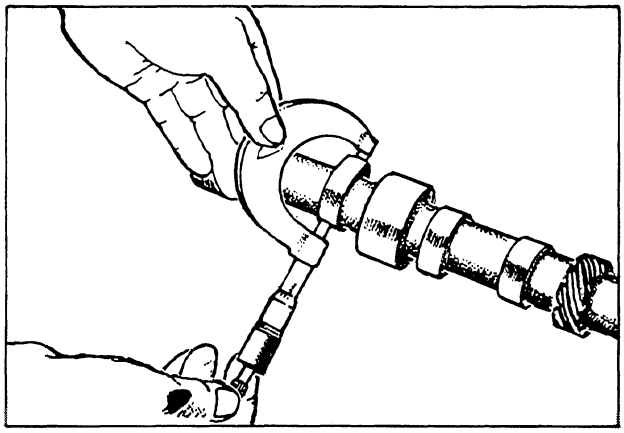
1. Check the camshaft for cracks, wear or damage and replace it if necessary.

2. Measure the runout. If it exceeds the allowable limit, replace the camshaft.

   Allowable Limit of Runout: 0.0012 (0.03 mm)



3. Measure the camshaft's lobe height. Replace the camshaft if the wear limit is exceeded.



Cam Height (Both Intake and Exhaust)

Specified Limit

1.5743 - 1.5822 inches
(39.987 - 40.187 mm)

Allowable Limit

1.563 inches
(39.7 mm)

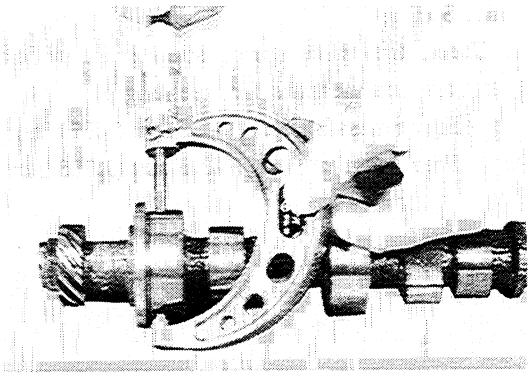
4. Measure the camshaft journal-to-cylinder head journal clearance. Replace the part that exhibits the most wear.

Camshaft Diameter (Specified Limit)

Front: 1.2583 - 1.2591 inches
(31.96 - 31.98 mm)

Center: 1.8655 - 1.8665 inches
(47.385 - 47.410 mm)

Rear: 1.9061 - 1.9071 inches
(48.415 - 48.440 mm)

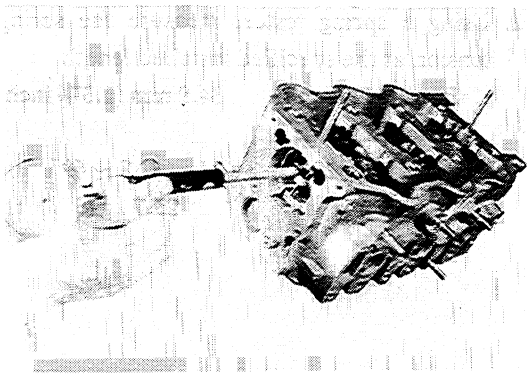


Cylinder Head Bearing Diameter (Specified Limit)

Front: 1.2606 - 1.2616 inches
(32.020 - 32045 mm)

Center: 1.8701 - 1.711 inches
(47.500 - 47.525 mm)

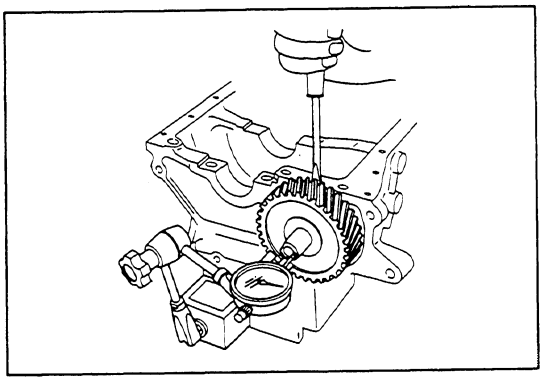
Rear: 1.9094 - 1.9104 inches
(48.500 - 48.525 mm)



Oil Clearance between Camshaft Journals and Cylinder Head Journals

Specified Limit:	Allowable Limit
Front: 0.0016 - 0.0035 inches (0.04 - 0.09 mm)	0.0055 inches (0.14 mm)
Center: 0.0035 - 0.0055 inches (0.09 - 0.14 mm)	0.0075 inches (0.19 mm)
Rear: 0.0024 - 0.0043 inches (0.06 - 0.11 mm)	0.0063 inches (0.16 mm)

Checking the Balance Shaft Thrust Bearing



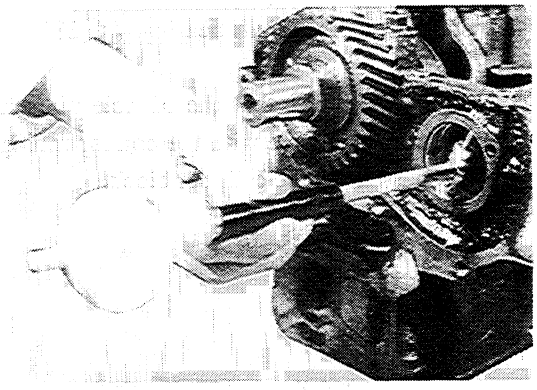
1. Tighten the thrust plate to 3.6 - 7.2 lb-ft (0.5 - 1.0 kg-m) and measure the clearance.

Thrust Bearing Clearance

Specified Limit: 0.0012 - 0.0051 inches (0.15 - 0.25 mm)

Allowable Limit: 0.0118 inches 90.30 mm)

2. Measure the balance shaft's oil clearance.

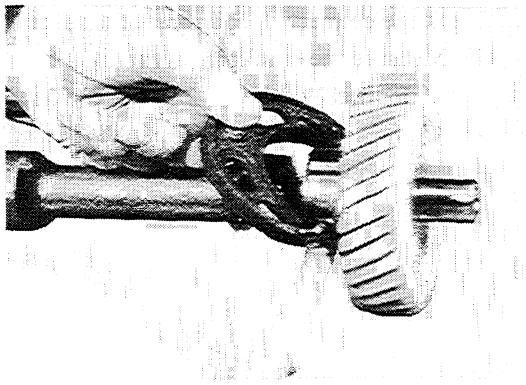


Oil Clearance

Block Inner Bearing Diameter

Front: 1.7717 - 1.7726 inches (45.000 - 45.025 mm)

Rear: 1.3386 - 1.3396 inches (34.000 - 34.025 mm)



Balance Shaft Outer Diameter

Front: 1.7700 - 1.7707 inches (44.959 - 44.975 mm)

Rear: 1.3370 - 1.3376 inches (33.959 - 33.975 mm)

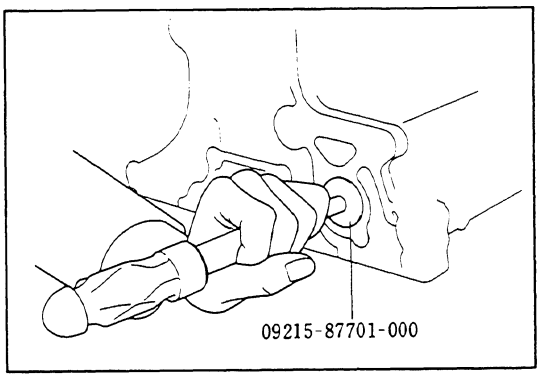
If the oil clearance is not within the allowable limit, replace the bearings or refinish the balance shaft.

Bearing Size (Undersize 0.0196 inches [0.5 mm])

	Block's inner diameter	Balance Shaft's outer diameter
Front Bearing	1.7530 - 1.7542 inches (44.526 - 44.556 mm)	1.7516 - 1.7520 inches (44.490 - 44.500 mm)
Rear Bearing	1.3199 - 1.3211 inches (33.526 - 33.556 mm)	1.3185 - 1.3189 inches (33.490 - 33.500 mm)

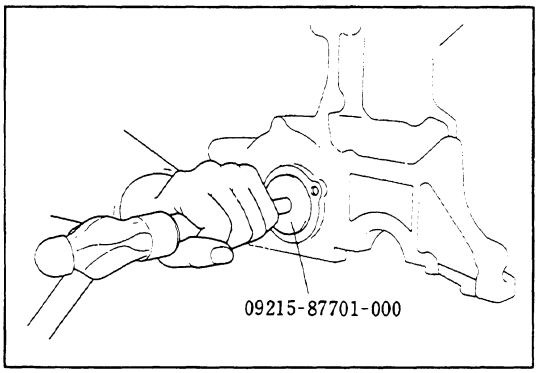
Replacing the Balance Shaft Bearing

1. Remove the balance shaft's bearing with special service tool # 09215-87701 (This tool is available through the Westerbeke Corporation).

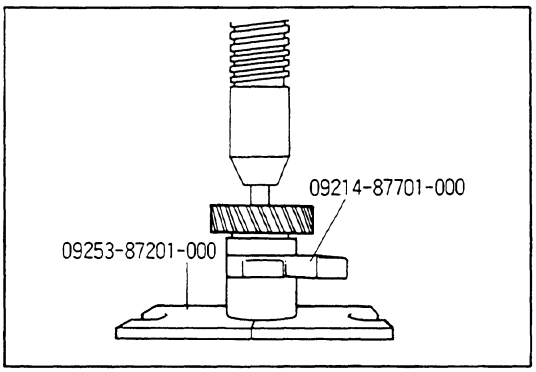


2. Install a new, or undersized bearing depending on the journal conditions, with the same special service tool used to remove the bearing.

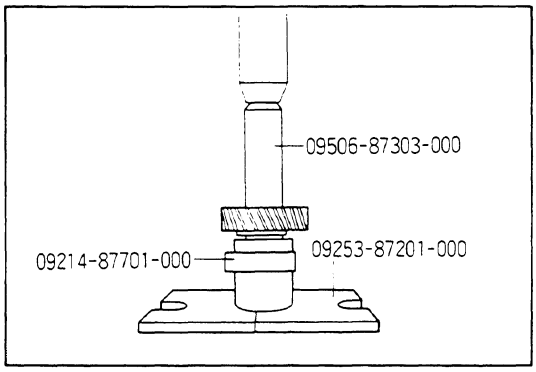
   NOTE: Make sure that the oil hole of each bearing aligns with its corresponding oil passage in the block.



3. In order to refinish the balance shaft, the balance shaft's gear must be pressed off the shaft with special service tools # 09253-87201-000 and 09214-87701-000.

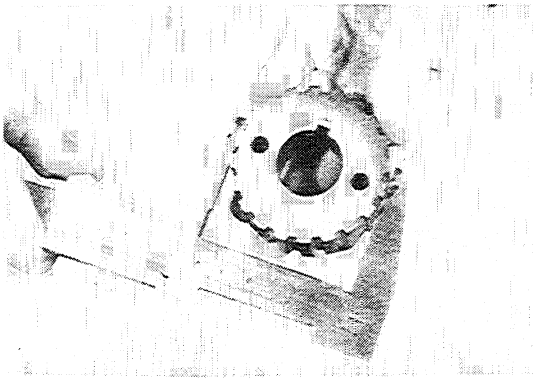


4. Replace the shaft's gear after the shaft has been refinished. Use special service tools # 09253-87201, 09506-87303, and 09214-87701.



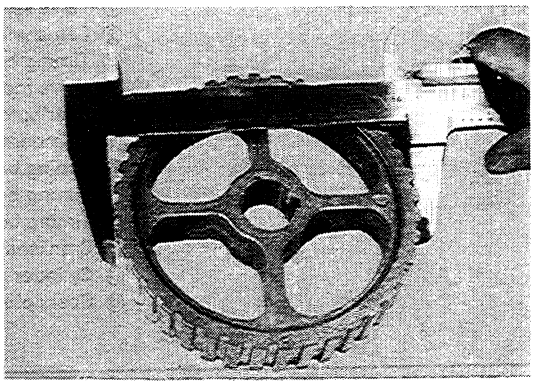
Checking the Crankshaft Timing Belt Pulleys

Measure the outside diameter of both the crankshaft and camshaft pulleys. Replace those pulleys that have worn beyond the allowable limit.



Crankshaft Pulley
Specified Limit: 2.3331 - 2.3370 inches
(59.26 - 59.36 mm)

Allowable Limit: 2.3307 inches (59.20 mm)

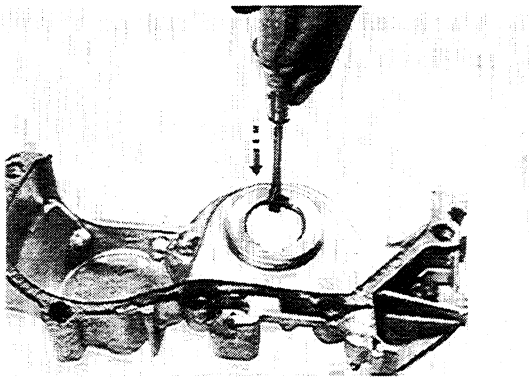


Camshaft Pulley
Specified Limit: 4.7189 - 4.7260 inches
(119.86 - 120.04 mm)

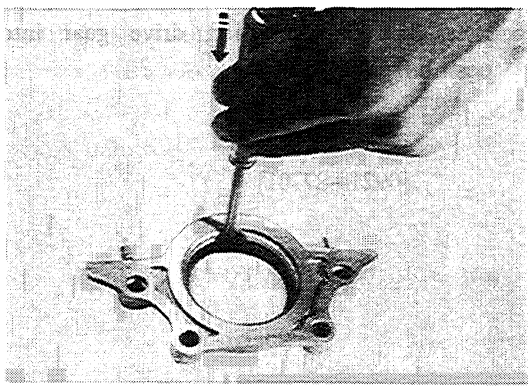
Allowable Limit: 4.7165 inches (119.80 mm)

Replacing Front and Rear Crankshaft Oil Seals

1. Remove both front and rear oil seals with a screwdriver. Be careful not to scratch the journal that holds the seal.



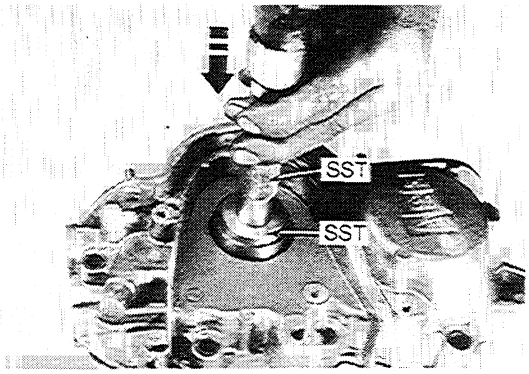
Front Oil Seal



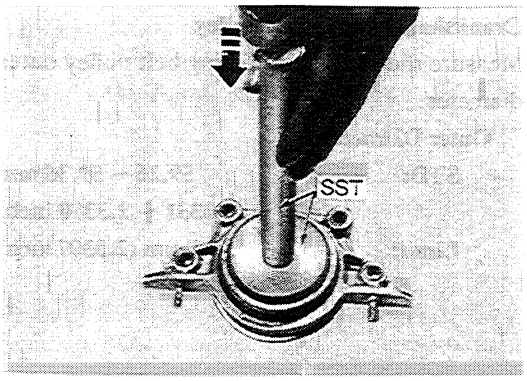
Rear Oil Seal

2. Install a new front oil seal using the special service tool # 09515-87202

Front Oil seal



Rear Oil Seal



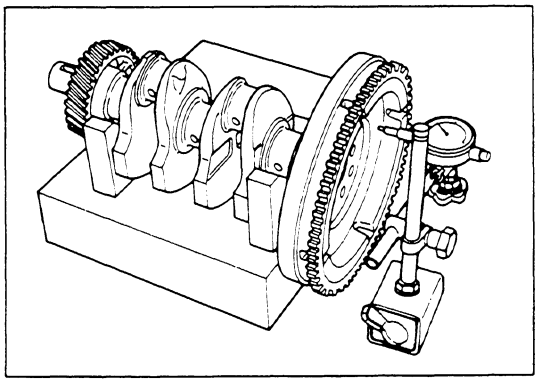
3. After installing new front and rear oil seals, coat them with MP grease.

Checking the Flywheel and Ring Gear

1. Check the flywheel for damage or wear. Check the ring gear's teeth for wear. Replace the ring gear if it is badly worn.

2. Check the runout limit on the flywheel.

   Runout Limit: 0.0079 inches (0.20 mm)



2. Replace the ring gear by the following procedure:

   A. Heat the ring with a torch.

   B. Remove the ring gear by striking its circumference.

   C. Heat the new ring gear to 250 - 300° C (480 - 570° F) on a hot plate or in an oven. Before slipping it onto the flywheel, make sure that the chamfered side of the ring gear is directed toward the engine.

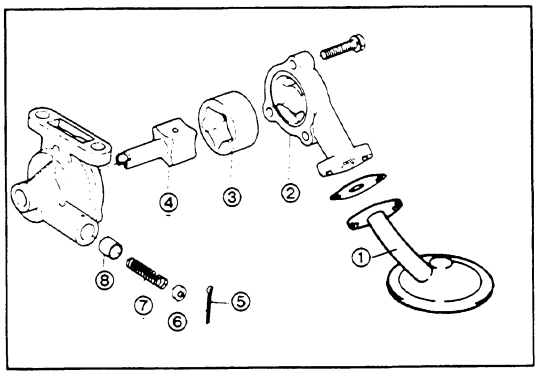
   NOTE: Excessive heat may destroy the original heat treatment and cause premature failure of the ring gear.

YOUR NOTES

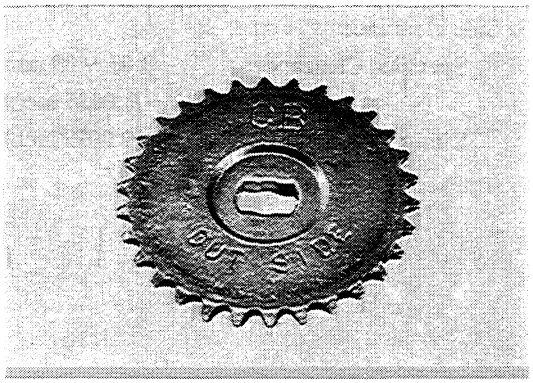
SUBASSEMBLY INSPECTION, REPAIR, AND ASSEMBLY

Disassembling and Inspecting the Oil Pump

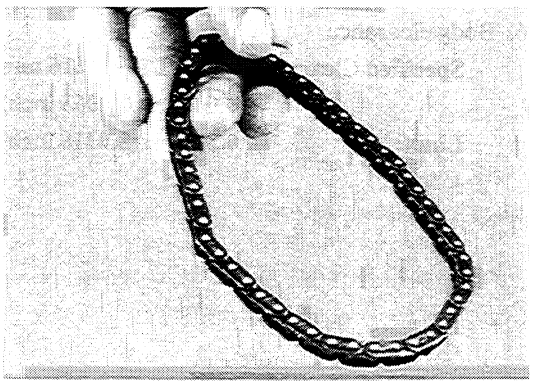
1. Disassemble the parts according to the numerical order presented in the illustration to the right.



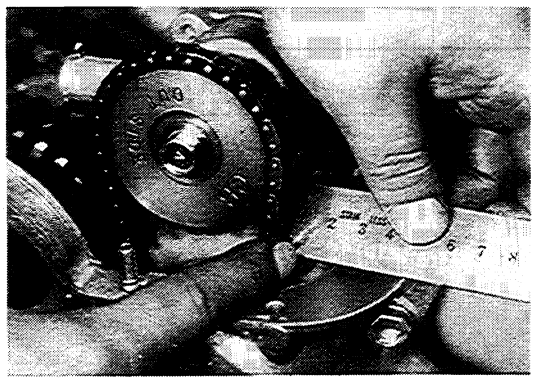
2. Inspect the oil pump's drive shaft sprocket. Check for cracks, worn teeth, or any damage.



3. Check the oil pump's drive chain for wear.



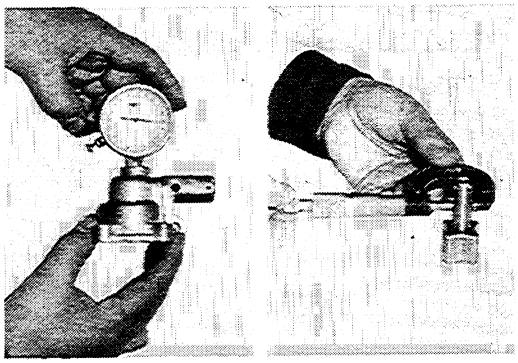
When the oil pump is installed, check the deflection of the oil pump's chain. Measure the chain's deflection at the center of the chain along the widest span between the two sprockets.



4. Measure the rotor shaft's clearance. If it has worn beyond the allowable limit, replace the rotor and the rotor housing.

   Specified Limit: 0.0018 - 0.0033 inches
   (0.045 - 0.085 mm)

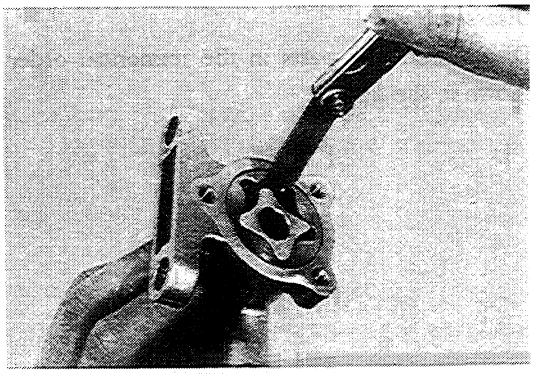
   Allowable Limit: 0.0039 inches (0.10 mm)



5. Measure the tip clearance.

   Specified Limit: 0.0059 inches (0.15 mm) or less

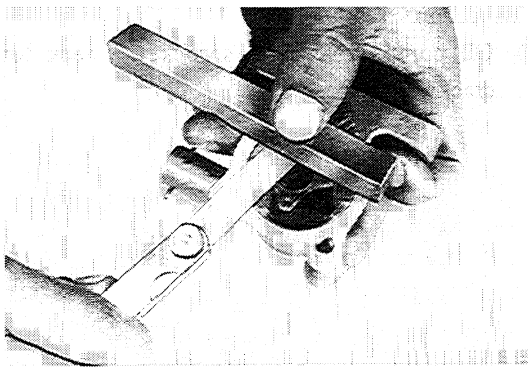
   Allowable Limit: 0.0079 inches (0.20 mm)



6. Measure side clearance.

   Specified Limit: 0.0012 - 0.0035 inches
   (0.03 - 0.09 mm)

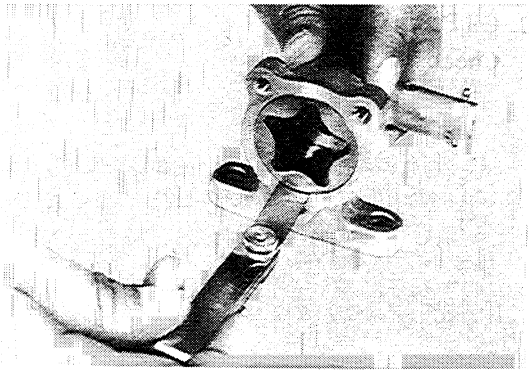
   Allowable Limit: 0.0079 inches (0.20 mm)



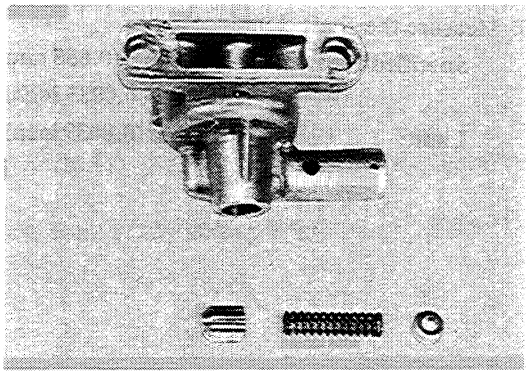
7. Measure the body clearance.

Specified limit: 0.0039 - 0.0063 inches
(0.10 - 0.16 mm)

Allowable Limit: 0.0118 inches (0.30 mm)



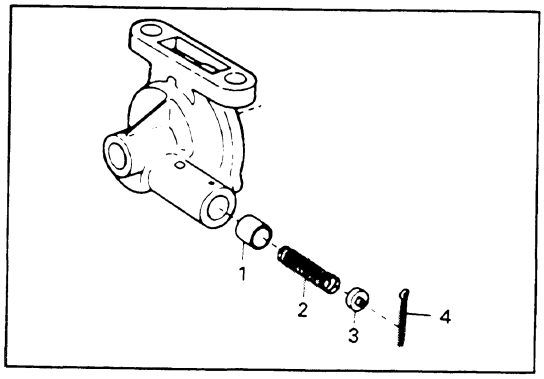
8. Check the relief valve's oil passage and sliding surface for damage.



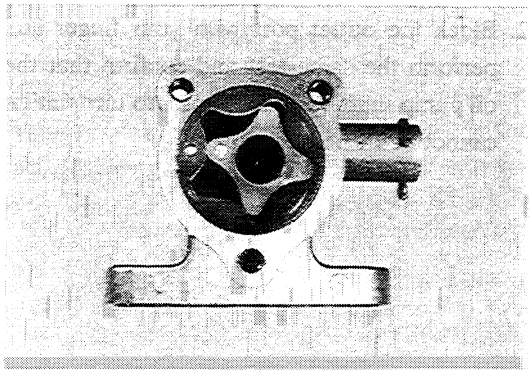
Assembling the Oil Pump

NOTE: Coat each sliding part with engine oil before it is assembled with its mating part.

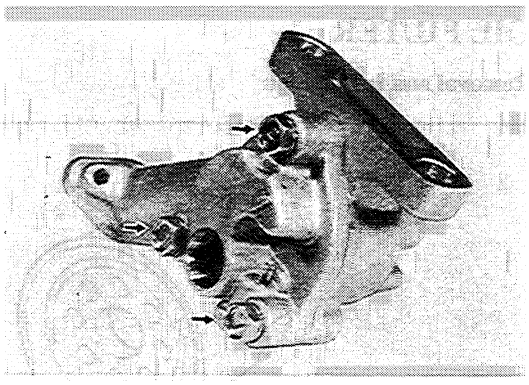
1. Assemble the relief valve in the numerical order shown in the illustration to the right.



2. Assemble the rotor and rotor housing, aligning the punched marks so that they face each other and also face toward you. Refer to the illustration to the right.

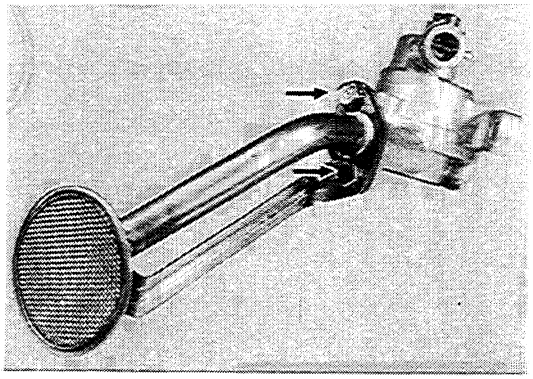


3. Assemble the pump cover and body. Tighten the bolts between 2.9 to 5.1 lb-ft (0.4 - 0.7 kg-m).



4. Attach the oil pump pickup strainer. Tighten the bolts between 2.9 to 5.1 lb-ft (0.4 - 0.7 kg-m)

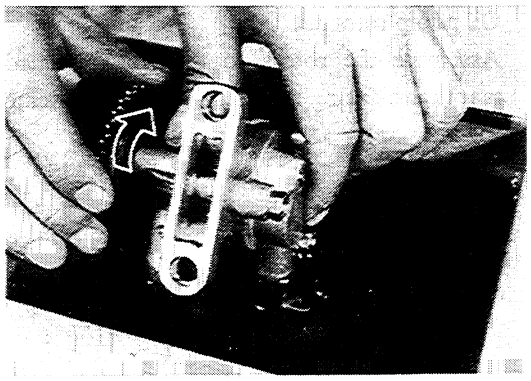
   NOTE: Replace the gasket with a new one.



5. Check the oil pump's operation.

   A. After assembling the oil pump, immerse the pump's strainer into a pail of clean engine oil, and hand turn the pump's sprocket counterclockwise.

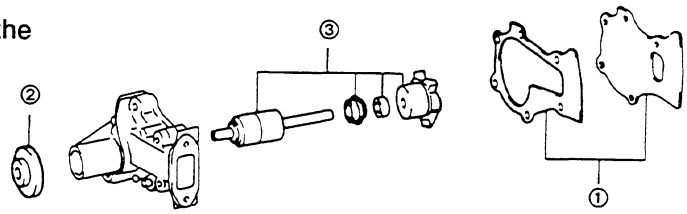
   Oil should be discharged from the oil pump's outlet port.



6. Block the outlet port with your finger and perform the same test as described in step #5. Confirm that the oil pump's shaft becomes harder to turn until it cannot be turned any more.

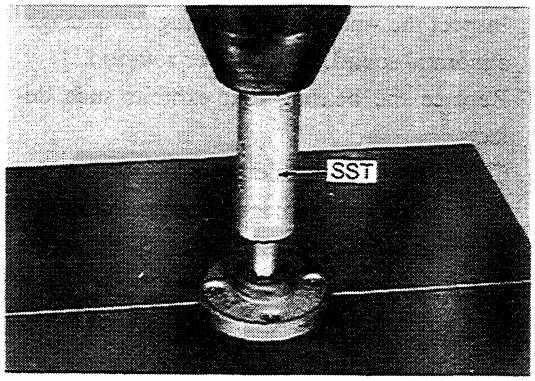
Disassembling and Inspecting the Fresh Water Pump

Disassemble the water pump according to the numerical order presented in the illustration.

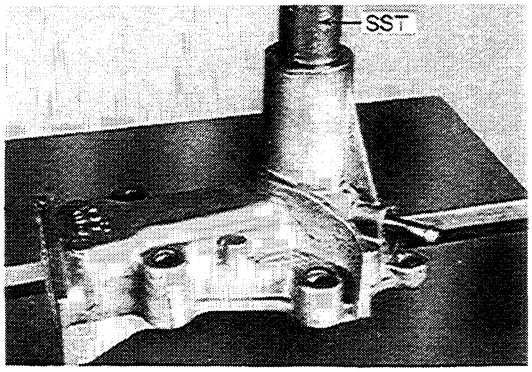


Disassemble
① Water pump cover and gasket
② Water pump pulley seat
③ Water pump bearing, seal set and rotor

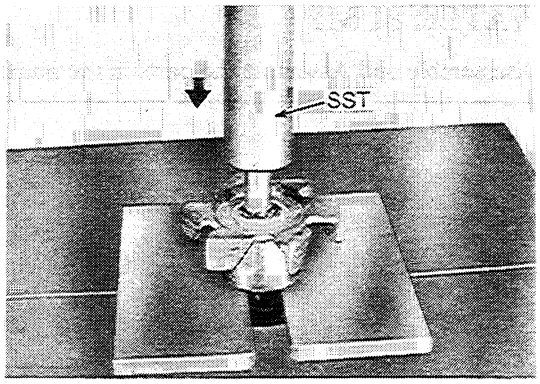
1. Using special service tool # 09253-87201 and 09238-87201, press off the water pump's pulley seat.



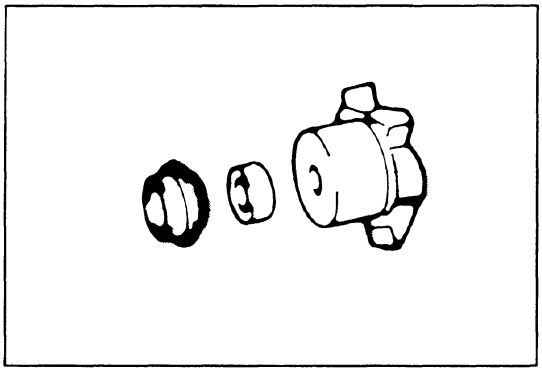
2. Using the same special service tools as in step #1, press off the water pump's bearing and seal set.



3. Using the same special service tools, press off the rotor from the water pump's bearing.

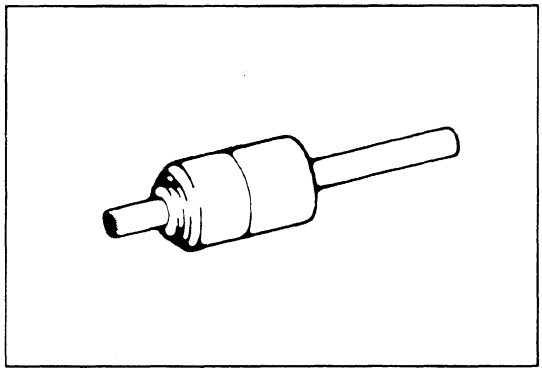


4. Inspect the water pump's rotor and seal set for wear or damage. Replace any part that shows signs of excessive wear or damage.



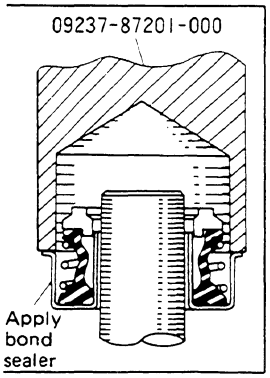
5. Inspect the water pump's bearing for damage, abnormal sound, or improper rotation. Replace the bearing if it shows any of these symptoms.

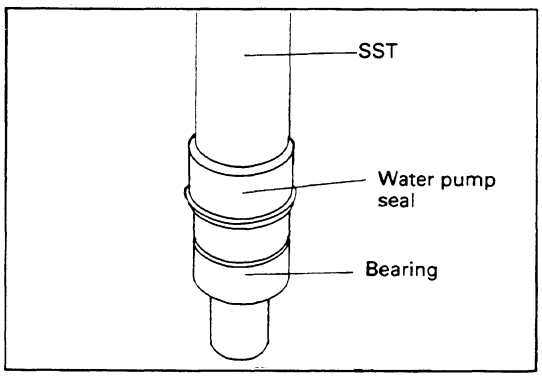
6. Inspect the water inlet's O-ring for deterioration or damage. Replace the O-ring if it shows any signs of deterioration or damage.



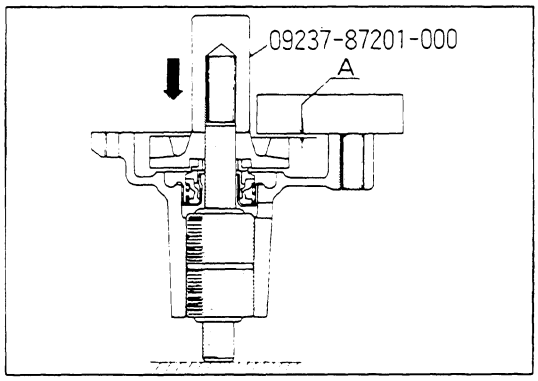
Assembling the Fresh Water Pump

1. Press the water pump's seal set into position after applying the bond sealer to the seal set's press-fitting section. Use special service tool # 09237-87201.

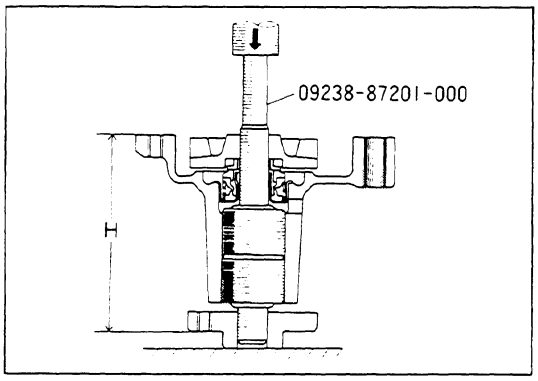




2. Press the rotor into position. Make sure that dimension **A** equals 0.008 inches (0.2 mm)

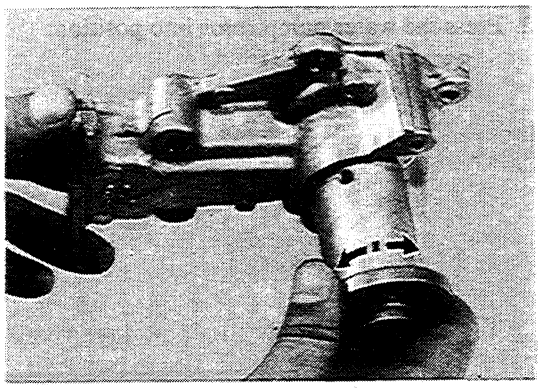


3. Press the water pump assembly into the water pump's pulley seat. Make sure that dimension **H** is maintained between 3.78 to 3.80 inches (96 - 97 mm)



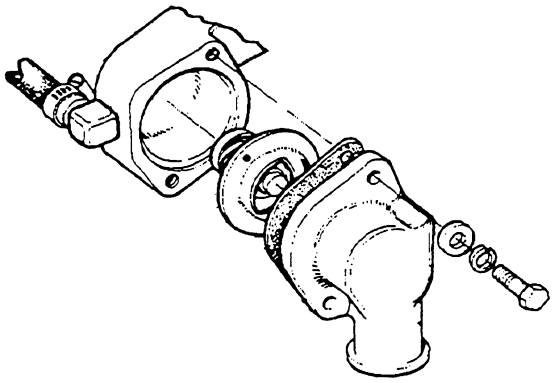
4. After the water pump has been assembled, make sure that the rotor rotates smoothly.

NOTE: When installing the water pump on the engine, use new gaskets.



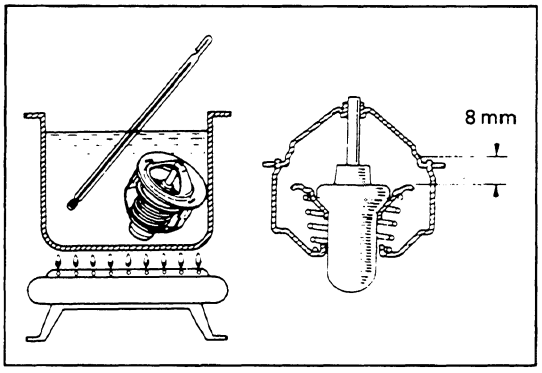
Thermostat Removal and Inspection

The thermostat is located toward the rear of the intake manifold within the thermostat housing.

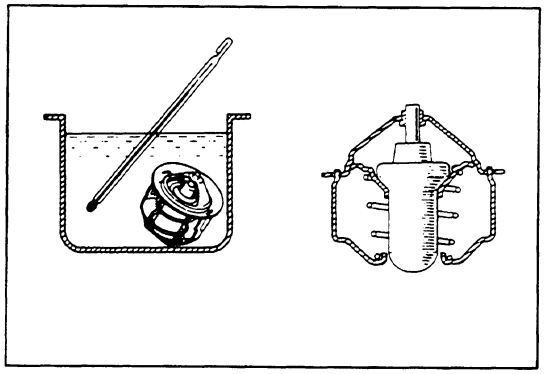


1. Remove the thermostat from its housing.

2. To test the thermostat, immerse it in water and gradually heat the water. The thermostat should start to open when the water temperature reaches 176 to 183° F (80 - 84° C). The thermostat should open by more than 0.31 inches (8 mm) when the water temperature reaches 203° F (95° C).



3. Replace the thermostat if the valve remains open at normal temperatures or if the valve is lose when the valve is fully closed.

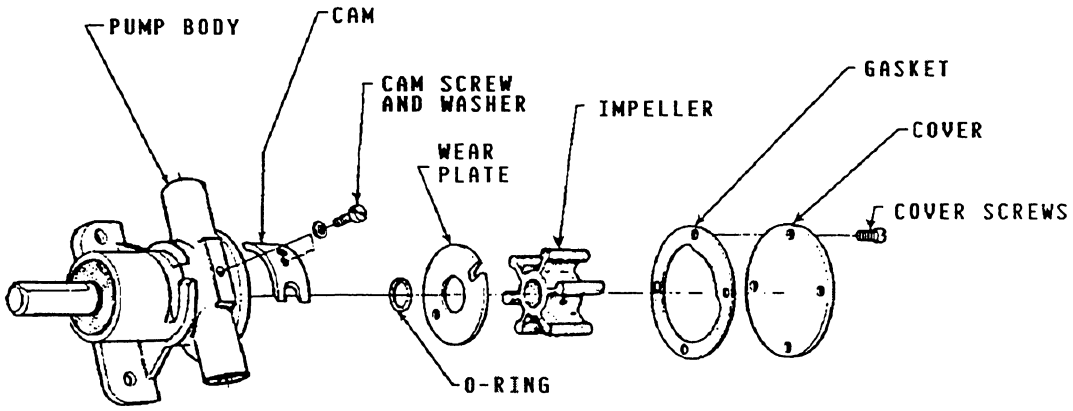


CAUTION

When replacing the thermostat, use genuine Westerbeke thermostats. These thermostats are designed specifically for the engines covered in this manual. Other, generic thermostats will not work in the engine, and may seriously damage the engine should they be installed.

Disassembling and Inspecting the Sea Water Pump

When disassembling the sea water pump for inspection, an impeller kit (part # 032620) should be purchased so the impeller can be replaced along with a new gasket at the time of inspection. Although the impeller is a small part, it plays an important role in the proper operation of the engine. Replacing the impeller at the time of the sea water pump's inspection can only improve the sea water pump's pumping ability. In addition, a new impeller is accompanied with a new gasket, an item that is needed to assemble the sea water pump. See the note below.



1. To disassemble the sea water pump, remove the four cover screws.

2. Remove the cover and the gasket.

3. Remove the rubber impeller and the wear plate.

4. Remove the rubber O-ring.

5. Remove the cam screw and washer and the cam.

Now the sea water pump is stripped far enough to be inspected.

Inspect the sea water pump by rotating the pump's drive shaft. If it excessive play exists in it, or if it sound rough or is frozen, replace the entire pump.

Since rebuilding a damaged or worn pump from individually purchased pieces would almost match the price of a new pump, we recommend that an new pump be purchased instead of rebuilding one.

> NOTE: When reassembling the sea water pump with a new impeller kit, wipe a little petroleum jelly around the impeller. This ensures that when the engine is started the pump will not run dry until sea water reaches the pump.

Testing and Disassembling the Electric Fuel Pump

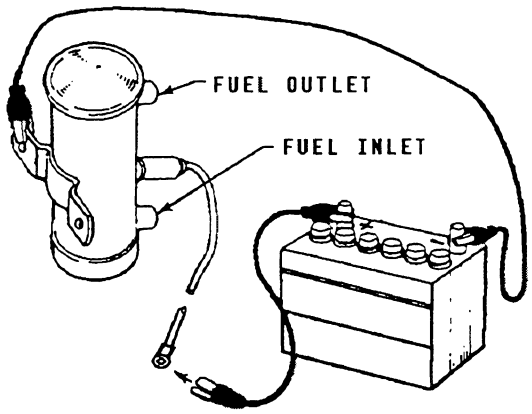
To test the electric lift pump, follow the steps below.

1. Working from a workbench, place the pump's inlet line into a clean tank of gasoline.

2. Place the outlet fuel line into a measuring container such as a beaker.

3. Using a fully-charged 12-Volt battery, connect a negative (-) wire to the fuel pump's body. Energize the fuel pump by connecting the pump's positive (+) lead to the battery's positive terminal. Refer to the illustration to the right

4. When the pump is energized, it should pump a minimum of 2 quarts per 21 minutes at 2 psi (1.89 liters per 21 minutes). A pumping rate below this is not adequate. If the pump's pumping rate is below this rating, perform the following steps.



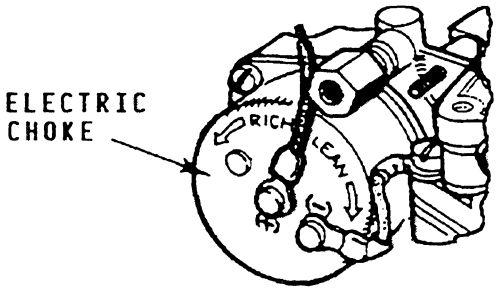
POSITIVE (+) CONNECTION

Electric Choke

The electric choke uses a 12 volt heating element which opens the choke automatically once the engine starts and is running.

NOTE: Some hunting will be present when the generator is first started, when the choke is on, and when the generator has no-load on it.

The choke is adjusted with the engine off and cooled. Adjust the choke by loosening the three cover-securing screws and rotating the cover clockwise to **LEAN** the choke and counterclockwise to **RICH** the choke. The choke is initially set at the factory for an average of 70° F (21° C) room temperature.



The choke may need readjustment at engine commissioning for the ambient temperature of the area the engine is operating in.

The choke index mark is located on the choke cover lower right inboard side.

WARNING

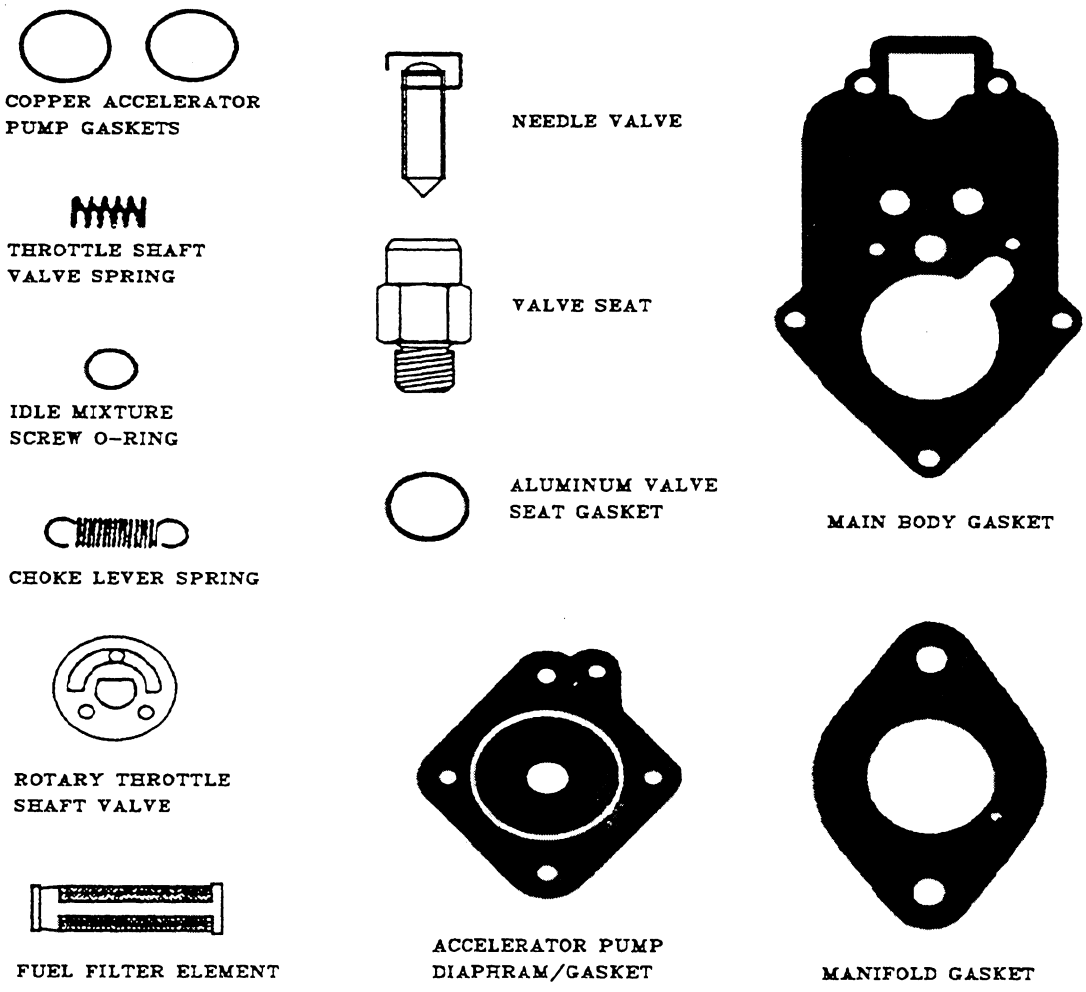
The choke housing will normally get hot during engine operation.

NOTE: When initially starting the engine (commissioning) or after servicing the fuel system, prime the engine's fuel system by using the engine mounted fuel pump. Prime the fuel system by depressing the control panel's ON switch. To prevent the unwanted activation of the carburetor's electric choke, unplug the 12 volt (+) lead at the electric choke during this priming operation and reconnect it after priming to start the engine.

Disassembling and Rebuilding the Carburetor

To rebuild the carburetor, first purchase a carburetor rebuilding kit. Make sure that the rebuild kit contains all of the following rebuild parts. Refer to the illustration below the list.

- Two (2) copper accelerator pump gaskets
- One (1) throttle shaft valve spring
- One (1) idle mixture screw O-ring
- One (1) choke lever spring
- One (1) rotary throttle shaft valve
- One (1) fuel filter element
- One (1) needle valve and seat (two pieces to the set)
- One (1) aluminum seat gasket
- One (1) accelerator pump diaphram/gasket
- One (1) main body gasket
- One (1) manifold gasket



Carburetor

The carburetor is a single barrel down draft type with a metal screened air intake filter which is cleanable. The carburetor has two metering jets, one of which is adjustable (the idle mixture). The other fast running jet is set at the factory and will accept no adjustment. Any adjustment to the idle mixture jet should be done with the engine warmed up and without any load on the generator.

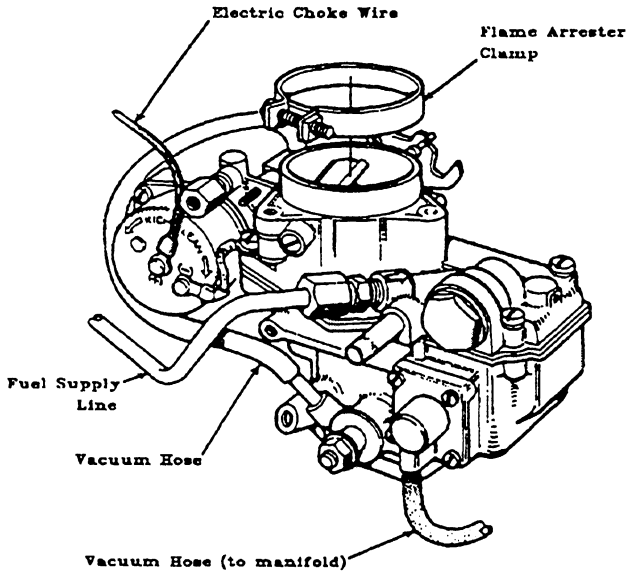
Carburetor Adjustment

1. Idle Mixture Jet

Disconnect the throttle linkage arm from the governor control arm and reduce the engine's speed with the idle stop screw. Turn the idle mixture screw clockwise (in) until the engine skips; back the screw out (counterclockwise), slowly, until the engine smooths then skips again; then turn the screw clockwise (in) one-quarter to one-half of a turn. The idle mixture should be satisfactory at this setting.

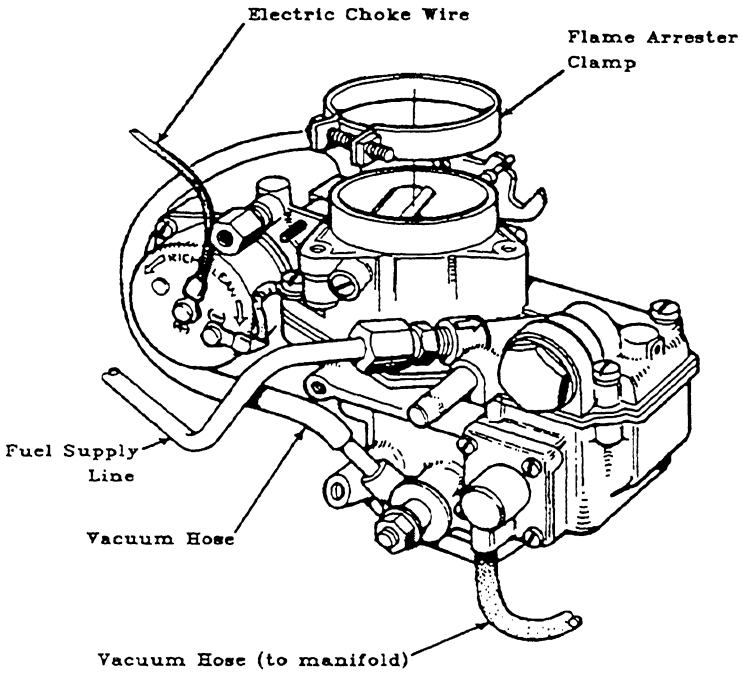
2. Run Mixture Jet

This mixture jet is presized at the factory and is not adjustable. The idle mixture jet adjustment can be made in the 1800 rpm range to improve engine performance. Refer to the "Governor Adjustments" section of this manual for instructions on how to adjust the engine's speed, page 106.



Carburetor with flame arrester removed.

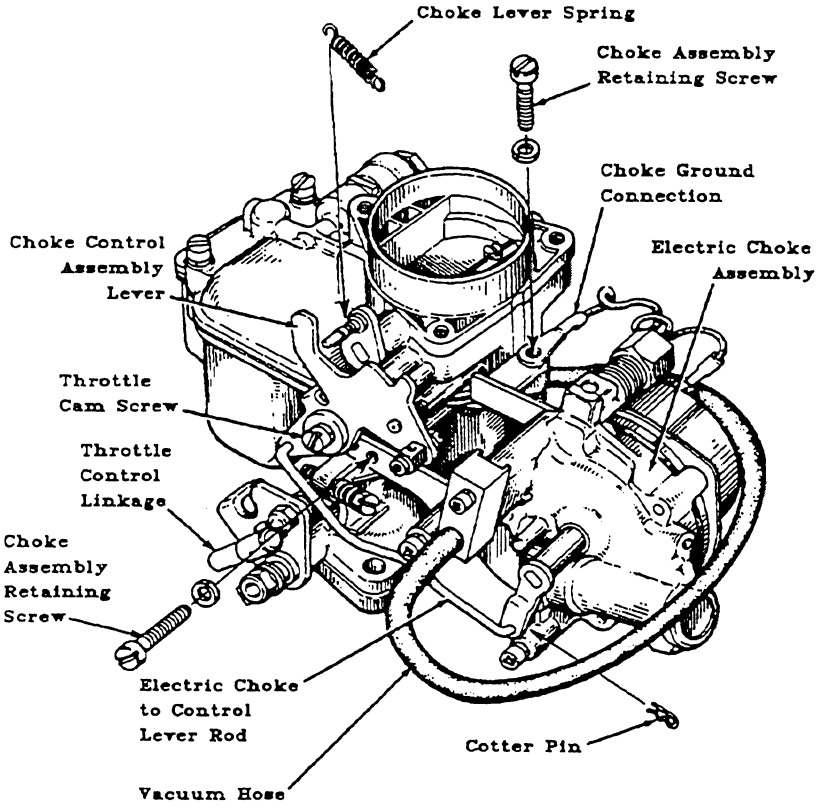
1. Loosen the flame arrester clamp and remove the flame arrester (not shown). Disconnect the electric choke wire, the vacuum hose attached to the manifold, the fuel supply line, and the throttle control linkage (see bottom drawing).



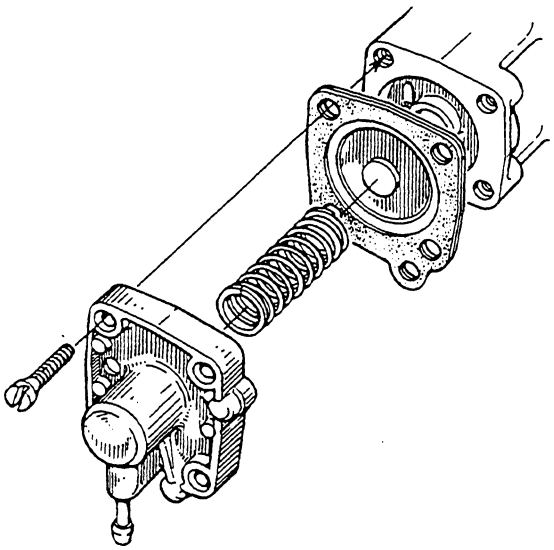
2. Remove the two nuts holding the carburetor to the manifold and lift the carburetor from the manifold.

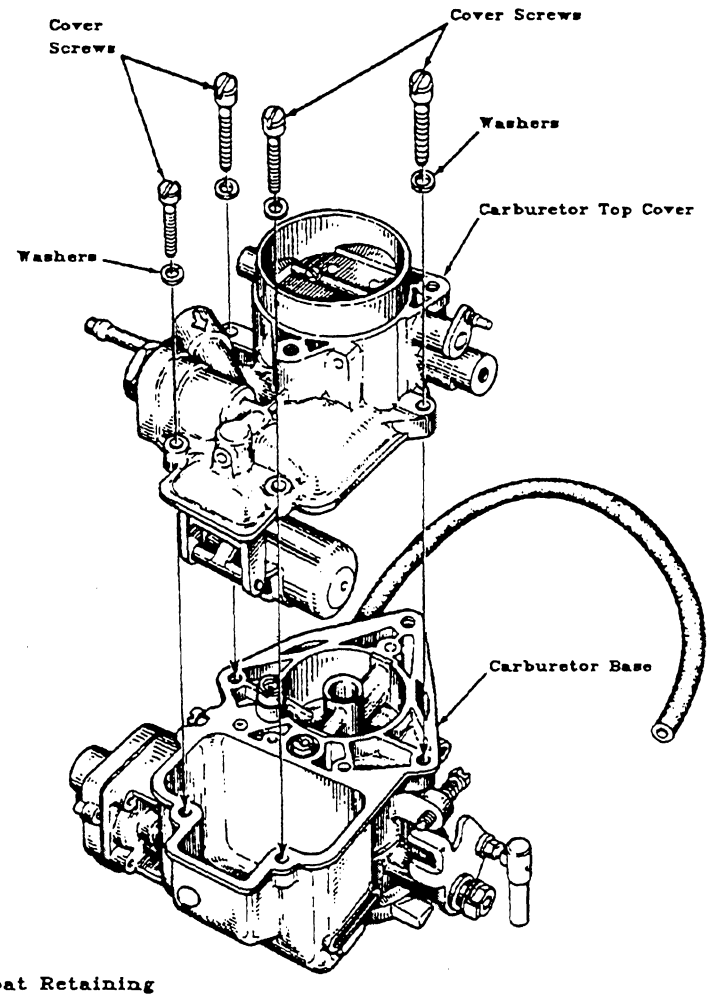
3. Disconnect the vacuum hose at one end. Remove the cotter pin from the electric choke to control lever rod and disconnect the electric choke to control lever rod from the electric choke assembly.

4. Remove the two choke assembly retaining screws and their washers. Disconnect the electric choke assembly from the carburetor.



5. Remove the four cover screws and their washers. Lift the carburetor's top cover straight up and away from the carburetor's base. Take off the four screws holding the accellerator housing cover to the side of the carburetor body. Remove the cover, accellerator diaphram and spring. Inspect the diaphram and replace it if cracked or pourous.

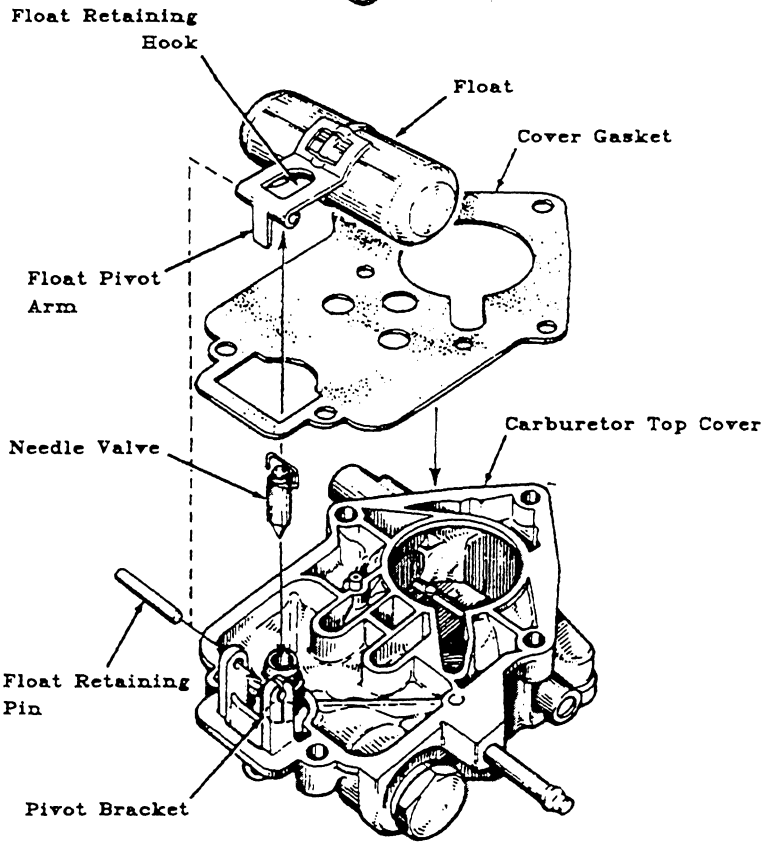




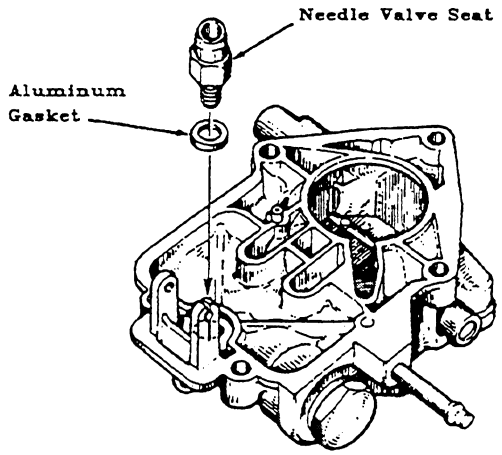
6. In the carburetor top cover, gently punch out the float retaining pin in the opposite direction of the split side of the pivot bracket and remove the float. **Make sure you catch the needle valve that hangs from the float retaining hook under the float's pivot arm and place it aside.**

7. Remove the old cover gasket.

8. Shake the float. If you can hear any sand-like particles moving inside the float, replace it.



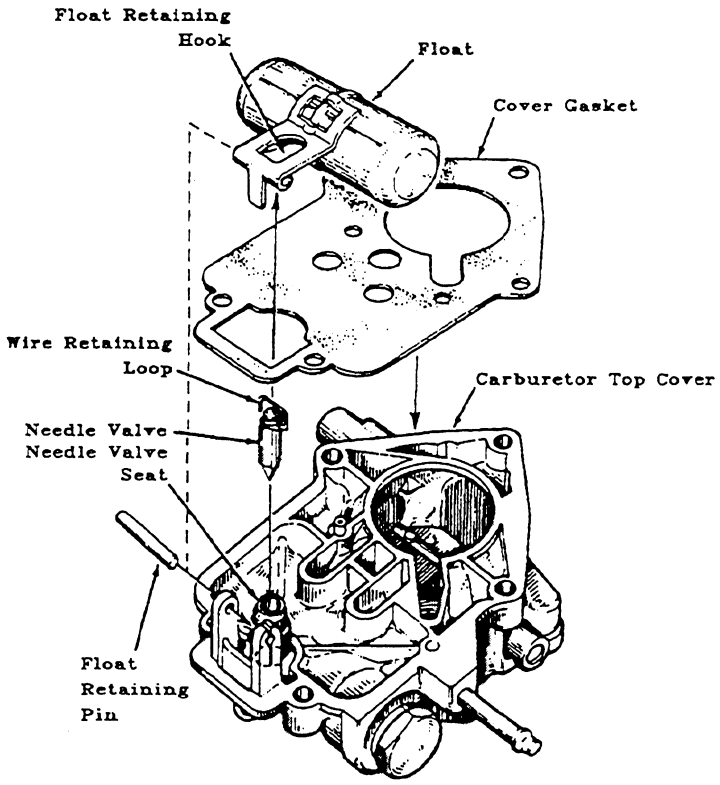
9. Remove the needle valve's seat with a 10 millimeter wrench. Make sure that the seat's aluminum gasket is removed at this time. Screw in the new seat along with a new gasket.

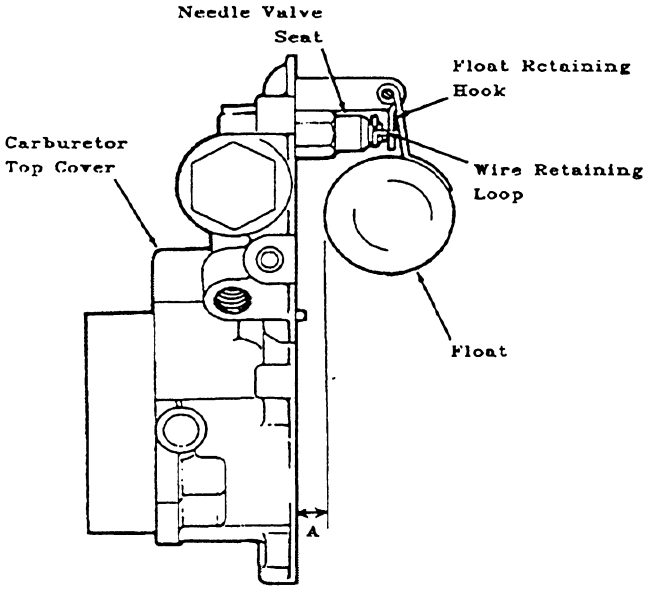


10. Place a new carburetor cover gasket on the carburetor top cover. **Do not** use any gasket sealer on this gasket.

11. Gently place the needle valve in the needle valve seat. Replace the float and float retaining pin so that the needle valve's wire retaining loop hooks onto the float's retaining hook. Now check the float level distance from the housing mating surface with the **housing held vertically.**

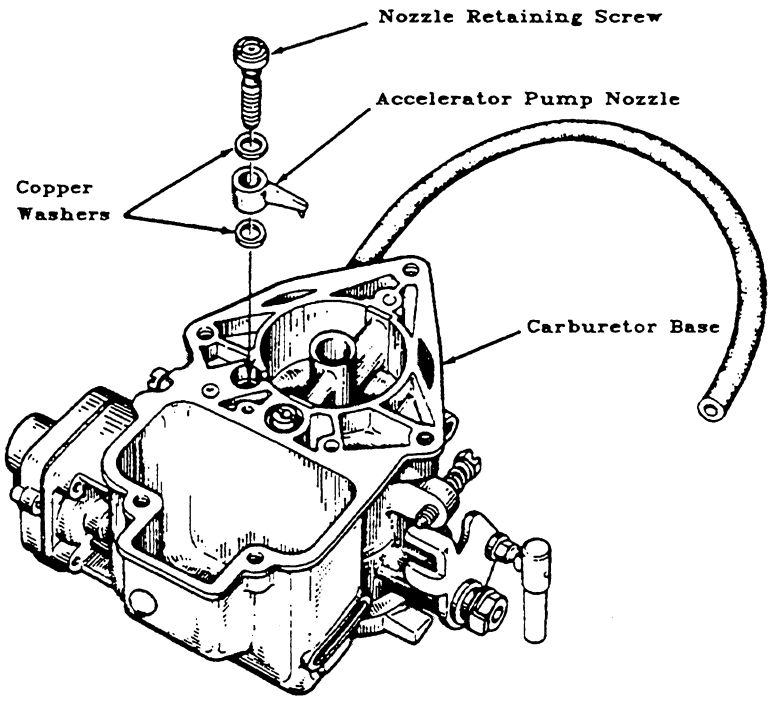
Distance "A" from mating surface: 3/16 inches (4.76 mm).



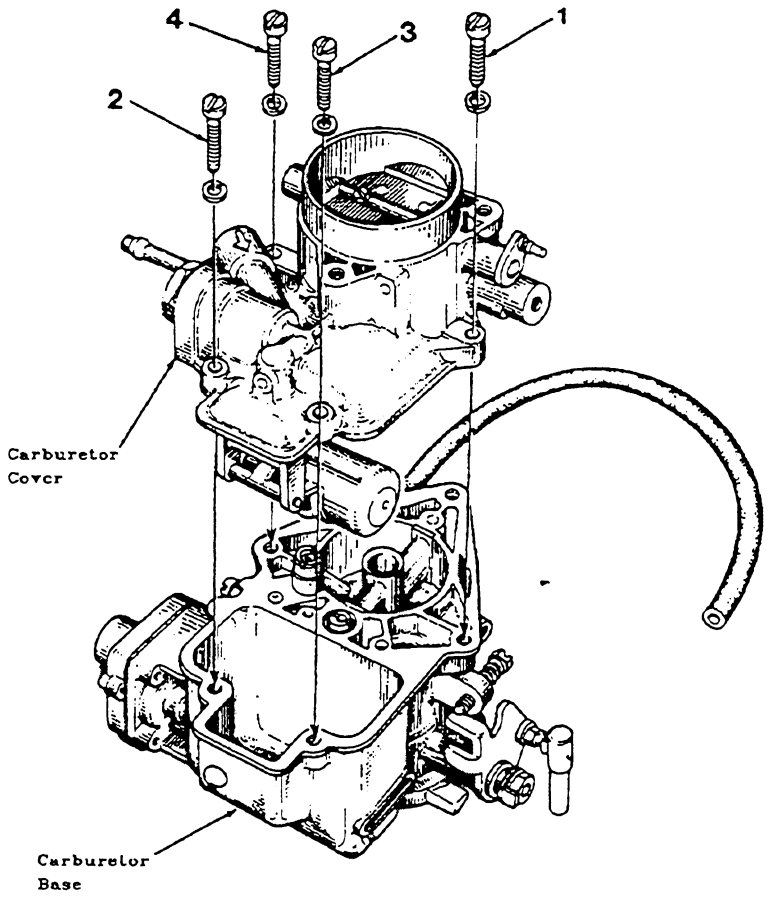


12. On the carburetor base, remove the retaining screw to the accelerator pump nozzle, the nozzle, and the two copper washers placed above and below the nozzle.

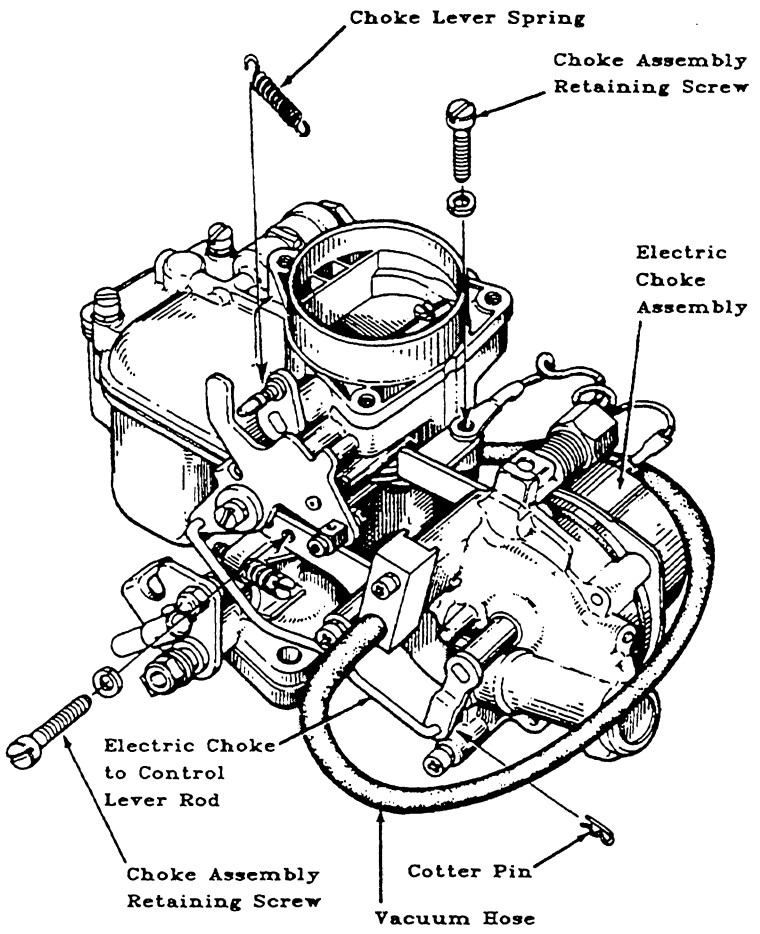
13. Replace the two copper washers and reinstall the accelerator pump nozzle. Snug down the nozzle's retaining screw. **Do not** overtighten the screw. Reinstall the accellerator pump diaphram, spring and housing. Snug down the four retaining screws.



14. Place the carburetor top cover straight down on the carburetor base. Replace the four washers and hand tighten the four cover screws in the indicated order as shown in the drawing to the right. Snug down each screw. Over tightening these screws can strip the threads in the carburetor.



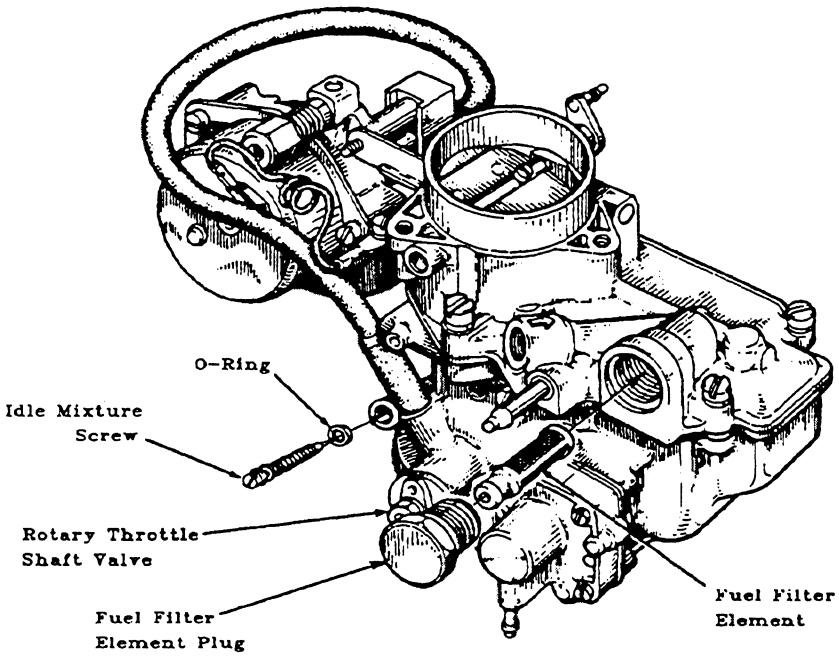
15. Reconnect the electric choke assembly to the carburetor and replace the two choke assembly retaining screws and their washers. Reattach the electric choke to control lever rod to the electric choke assembly and insert the cotter pin. Reattach the vacuum hose.



16. Replace the idle mixture screw's O-ring, the rotary throttle shaft valve and the rotary throttle shaft valve spring. Remove the fuel filter element plug and replace the fuel filter element.

Now the carburetor is rebuilt. Make sure all the screws on the carburetor are properly tightened and replace the carburetor on the intake manifold using a new manifold gasket along with a gasket sealant. Replace the two nuts and tighten the carburetor to the manifold.

Reconnect the throttle control linkage, the fuel supply line, the vacuum hose, and the electric choke wire. Replace the flame arrester on the carburetor and tighten the flame arrester clamp.

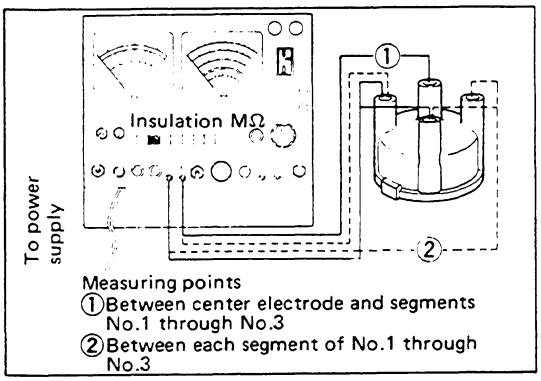


Inspecting the Distributor and its Components

1. Inspect the rotor and cap for cracks, wear, rust, dirt or salt deposits.

2. Check the cap with an electronic tester, as illustrated in the diagram to the right.

   Prior to testing the distributor cap, apply your breath inside of the cap to damped the interior of the cap. Set the range of the ohm tester to **INSULATION M Ohm.** If the cap's resistance is less that 20M ohms, clean the cap using a neutral detergent. After drying the cap, remeasure the insulation resistance. If the insulation resistance is still less than 20M ohms, replace the cap.

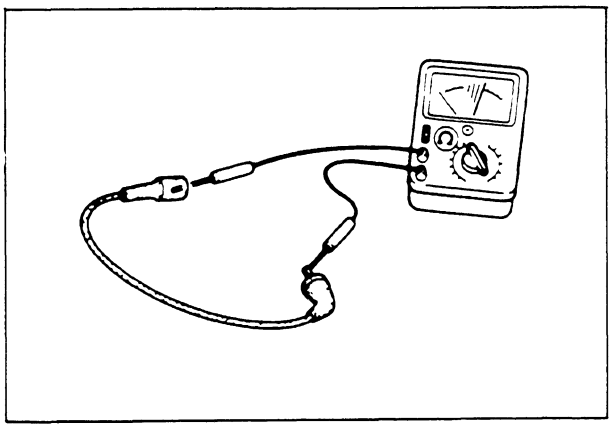


3. Check the distributor shaft for wear or damage. Replace all damaged parts.

4. Measure the condenser capacity with a circuit tester. If the reading does not fall within the specified range, replace the condenser.

Specified range: (Condenser Capacity)	0.225 - 0.275 microfarads (uF)

5. Test each spark plug wire and the coil wire. Connect the leads of a circuit tester to each end of the spark plug wire. Check the continuity of the spark plug wire while gently waving the center portion of the spark plug wire. If the pointer on the tester deflects while the wires are waved, then the wires are satisfactory.



Specified resistance:	16K Ohm/m
Allowable limit:	25K Ohm/m

Testing the Ignition Coil PN#035667

Measure the Ignition coil's primary and secondary resistance and capacitance as follows. Replace the coil if any test fails to meet the resistance value given.

Primary Coil Resistance:	0.98 ±0.1 ohm
Secondary Coil Resistance:	17.5 ±2.6 ohm
Resistor Resistance: (Replace only the resistor if it fails this test.)	1.92 ±0.2 ohm

IGNITION COIL (LATE MODELS) PN#036162

Specifications

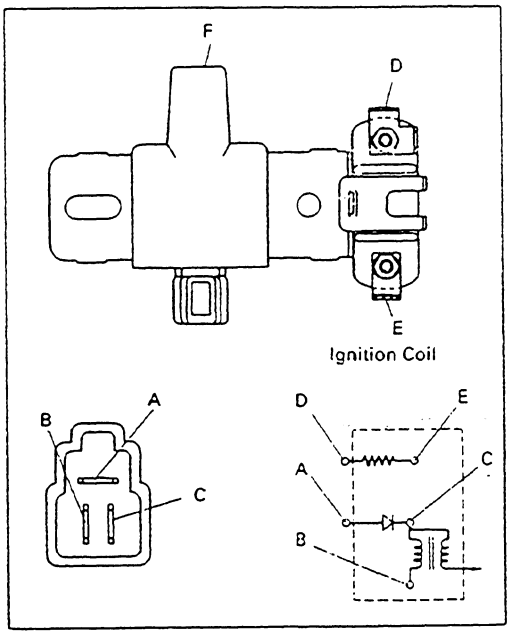
Primary resistance	(Ω)	1.2 ± 0.12
Secondary resistance	(kΩ)	26 ± 3.9
External resistance	(Ω)	1.7 ± 0.17

3. Ignition coil

Primary coil resistance Measurement. Between positive B and negative C terminal.
Resistance: 1.08 ~ 1.32 Ω

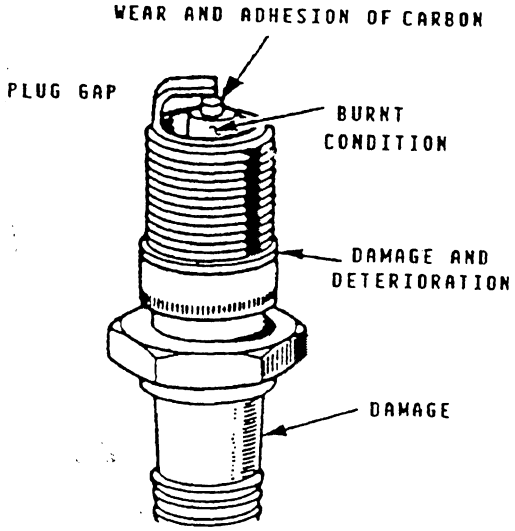
Secondary coil resistance measurement. Between positive C terminal and high tension terminal F.
Resistance: 22.1 ~ 29.9 kΩ

Resister resistance measurement. D to E
Resistance: 1.53 ~ 1.87 Ω



Inspecting the Spark Plugs

Inspect each spark plug for cracks, chips, or for fouling. Clean of replace the spark plugs if necessary. Make sure that new or used spark plugs are gapped before they are installed in the engine.



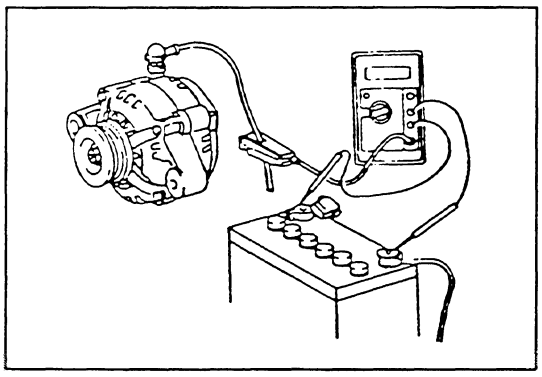
Spark Plug Gap: 0.028 - 0.036 inches (0.7 - 0.9 mm)

NOTE: Make sure that the engine is cold before in-removing and specting the spark plugs.

Testing the Alternator

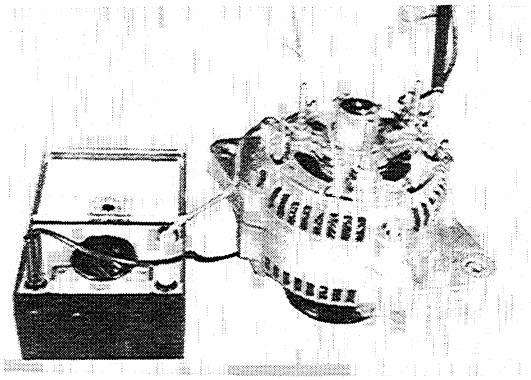
1. For the No Load performance inspection, start the engine and test the alternator's regulated voltage.

   Regulated voltage: 13.9 - 15.1 Volts
   Current: Less than 10 Amps



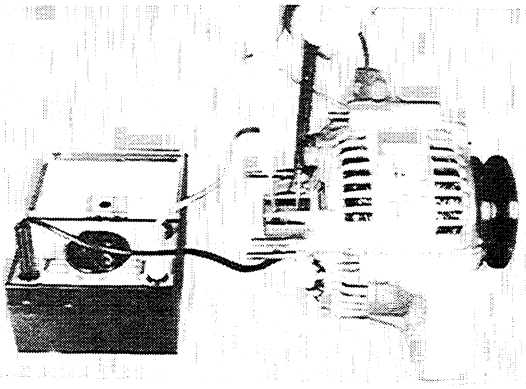
2. To test the stator, use an ohm meter to check the resistance between each terminal.

   Resistance: Less than 1 ohm



3. To test the rotor, use an ohm meter to check the resistance between the slip rings.

   Resistance: 2.9 ohms



Testing the Starter

(Left blank for starter test procedures)

(Left blank for starter test procedures)

YOUR NOTES

ENGINE ASSEMBLY

Take the following precautions when assembling the engine:

A. Make sure that all parts to be assembled are thoroughly cleaned.

B. Be careful not to mix nuts and bolts. Metric and SAE bolts are used on various engine assemblies.

C. During the assembly, recheck clearances and ensure that all parts are assembled in their proper order and face the correct direction in relation to the engine block; that is, pistons, piston rings, bearings and bearing caps.

D. Apply lubricating oil to moving parts during the assembly. Ensure that moving parts, when assembled on the engine, rotate or slide and are not subject to binding or excessive tension.

E. If there are mating marks scribed during disassembly, reference them correctly for assembly.

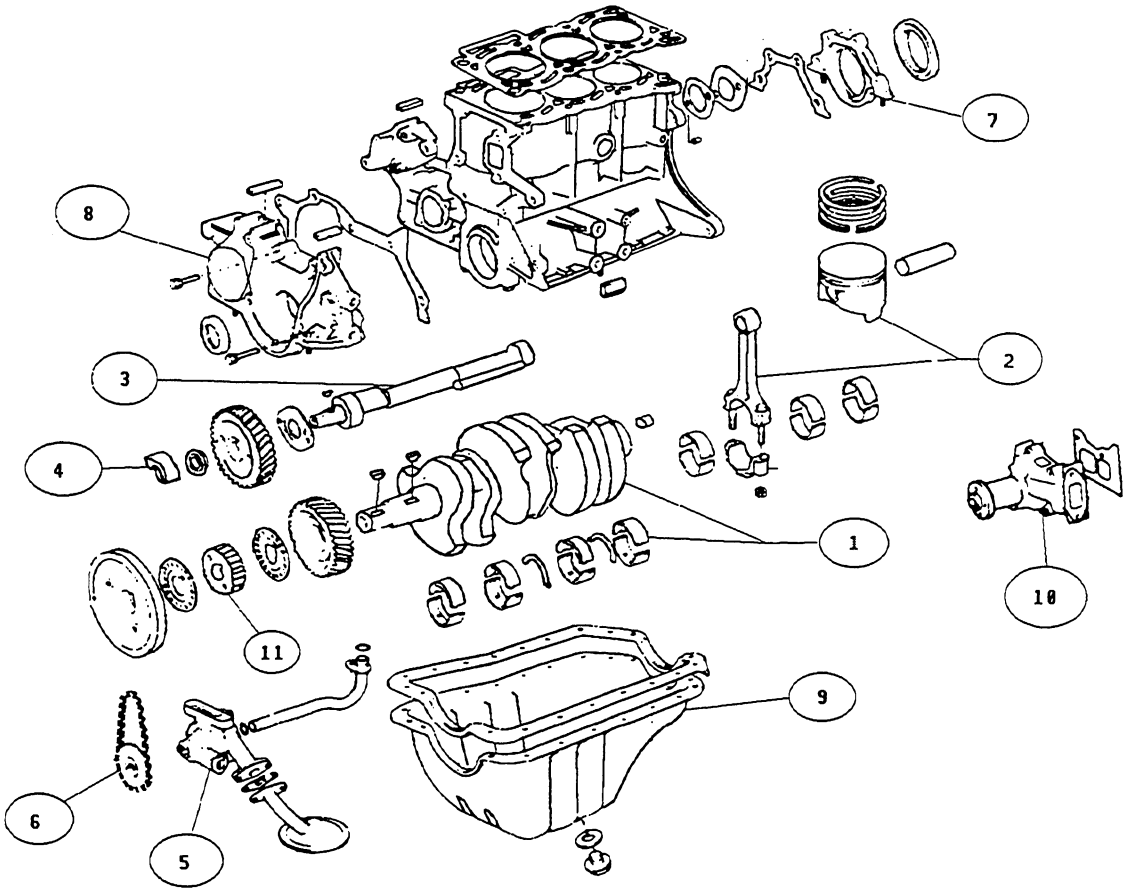
F. Use new gaskets, lockwashers, and O-rings.

G. Tighten the bolts and nuts on important parts of the engine to specified torques using a reliable torque wrench.

H. Use liquid sealants when required on nuts, bolts and gaskets. Refrain from using tape sealants.

CYLINDER BLOCK ASSEMBLY

For the W 26G and the W 26GX engines, assemble the components in the order indicated below.



CYLINDER BLOCK ASSEMBLY ORDER

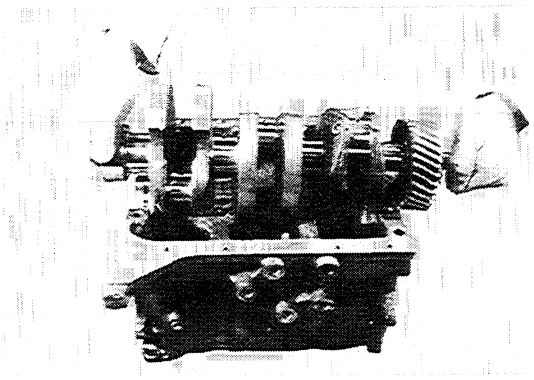
* 1. Crankshaft and Bearings	(page 114)
* 2. Piston and Connecting Rod Assembly	(page 115)
* 3. Balance Shaft	(page 117, step # 7-8)
4. Balance Weight	
5. Oil Pump	
* 6. Oil Pump Drive Sprocket and Chain	(page 117, step # 8)
7. Rear Oil Seal Retainer	
* 8. Balance Shaft Gear Cover	(page 118, step 9)
* 9. Oil Pan	(page 118, step 10-11)
10. Water Pump	
*11. Crankshaft Timing Belt Pulley	(page 119)

* Denotes that assembly instructions for these parts follow on the indicated pages.

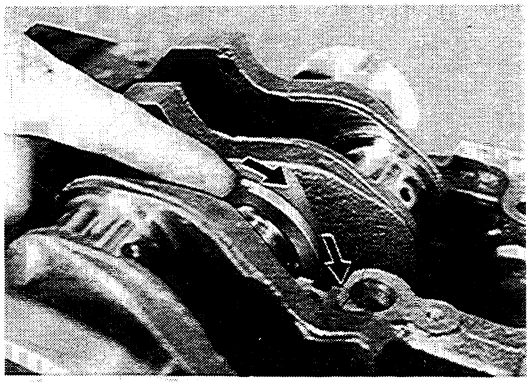
Assembling the Crankshaft

1. Before each bearing cap is installed, coat the crankshaft's bearing cap bolts (threaded portion) with engine oil.

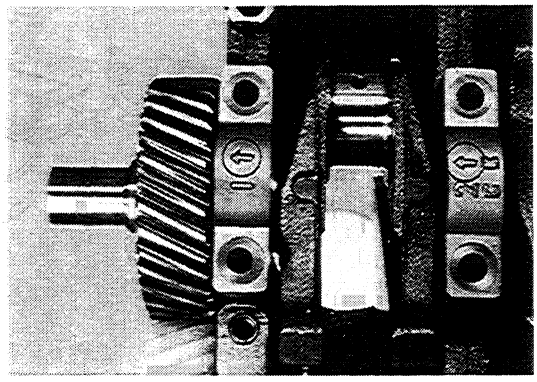
   NOTE: Do not allow any oil to get on the back-side of the bearing inserts.



2. Attach the thrust washers on the cylinder block at the front and rear sides of the No. 3 bearing

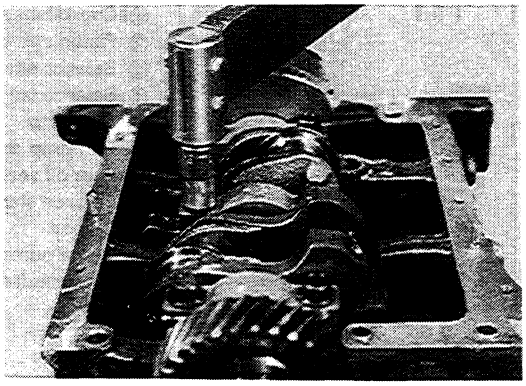


3. When installing the bearing caps, be certain that their arrowheads face toward the front of the cylinder block, respectively. After the bearing cap bolts have been torqued to the proper specification, ensure that the crankshaft can rotate lightly.



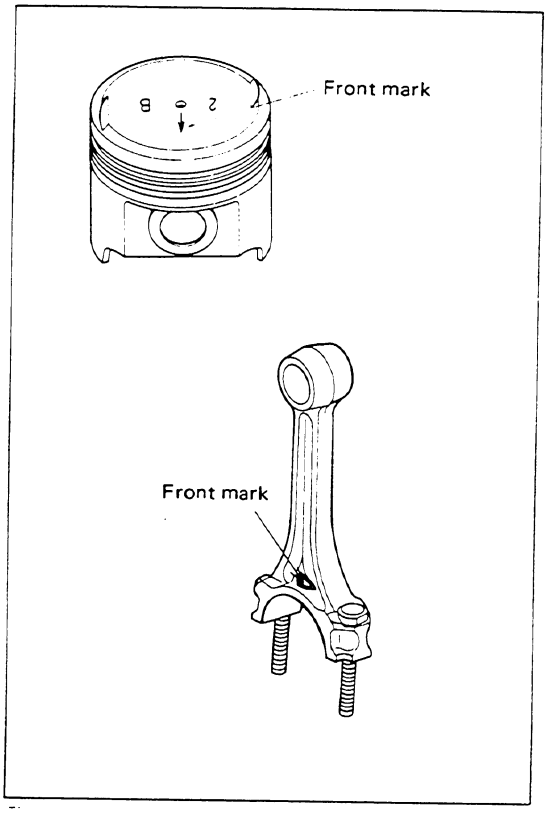
4. Tighten the bearing caps.

   40 - 47 lb-ft (5.4 - 6.6 kg-m)

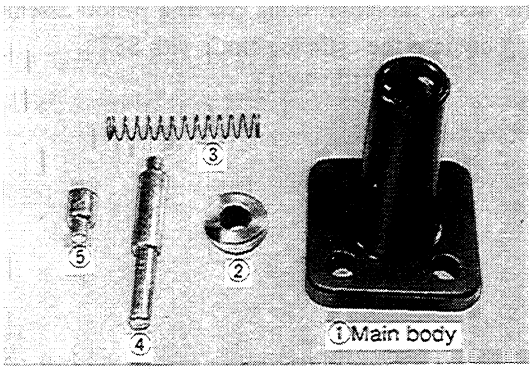


Piston and Connecting Rod Assembly

1. Assemble the pistons and connecting rods so that the front mark located at the side of the connecting rod and the front mark provided on the top of the piston come on the same side.

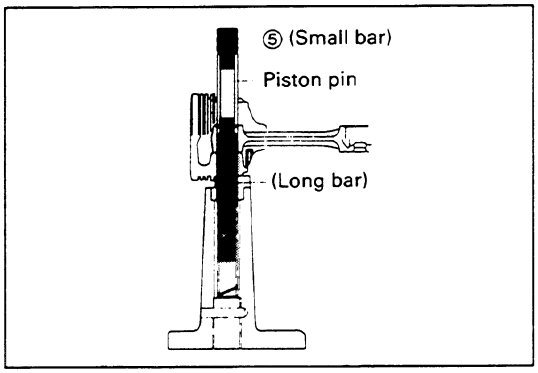


2. Using the special service tool # 09221-25014 (Main body) and 09221-87702, attach the fitting piece (2) onto the stand (1), and place the long bar (4) into position.



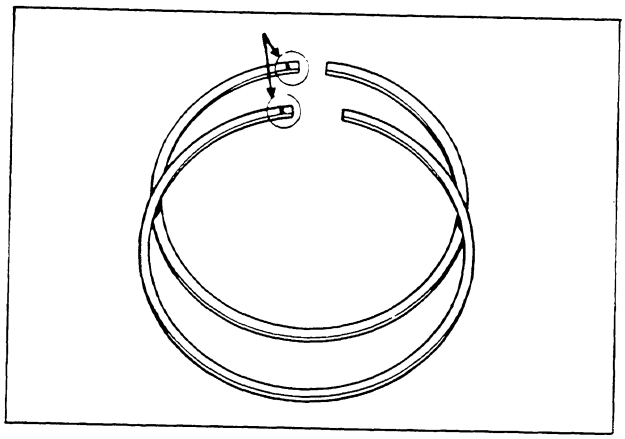
3. Place the small bar (5) into the piston pin. Then press the piston pin into position using a press.

   NOTE: After the connecting rod has been assembled in the piston, ensure that the piston can move lightly back and forth.



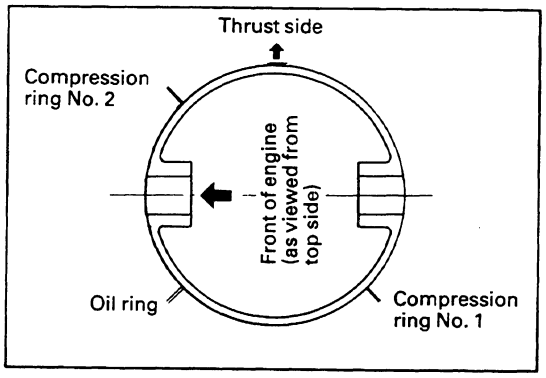
Piston Ring Installation

1. When installing the piston rings, make sure that the marks stamped on the rings by the manufacturer face upward.

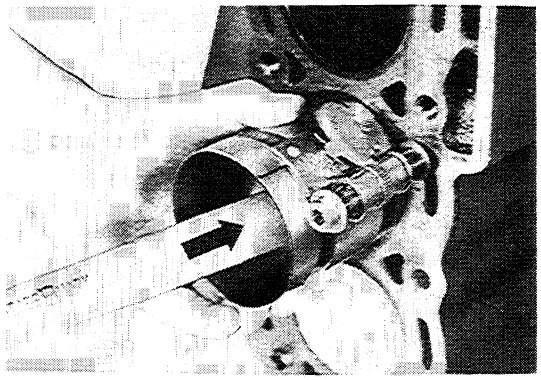


2. Make sure that the ring openings **DO NOT** align when they are on the piston. Position the ring gaps in the direction shown in the figure.

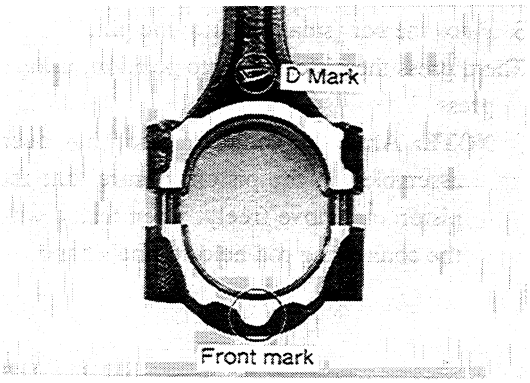
3. Apply engine oil to the external circumference of piston pin.



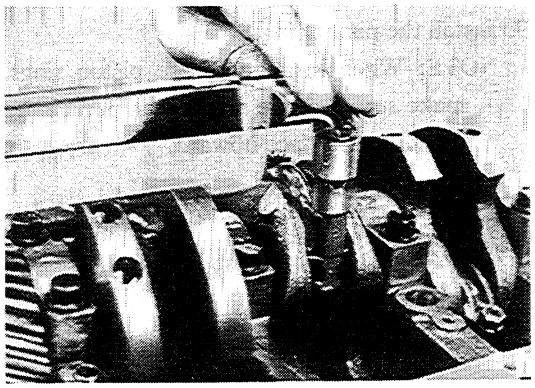
4. Insert the connecting rod and piston assembly into the cylinder block with a piston ring compressor attached.



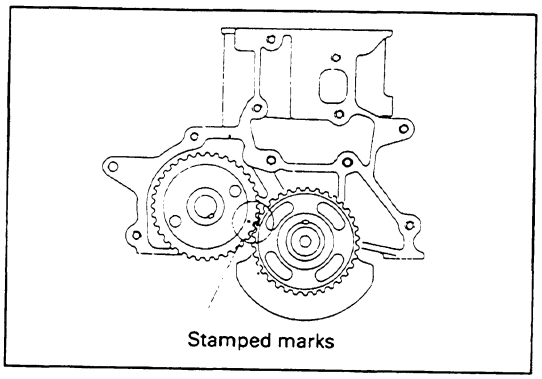
5. Install the cap on the connecting rod, making sure that the front mark (projected) on the bearing caps are aligned with the mark provided on the connecting rod.



6. Tighten the connecting rod caps between 15.2 - 21.0 lb-ft (2.1 - 2.9 kg-m).

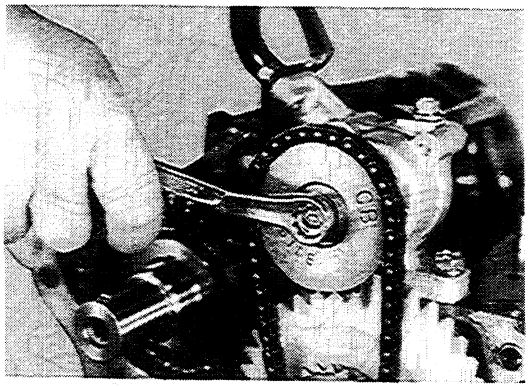


7. Install the balance shaft. Align the stamped mark on the balance shaft's drive gear with the stamped mark on the balance gear.



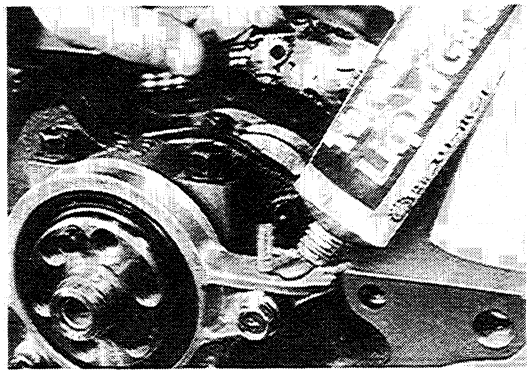
8. Install the oil pump's drive chain.

   NOTE: The sprocket that attaches to the balance shaft must be attached so that the stamped mark **CB-OUTSIDE** faces away from the engine.

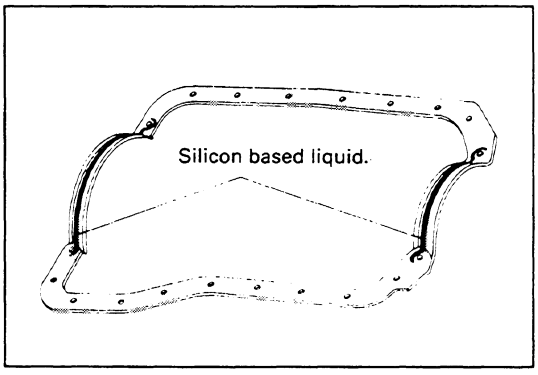


9. Install the balance shaft's gear cover.

10. Replace the old oil pan gasket with a new one. Prior to installing the oil pan, apply silicon bond sealer to the gasket.

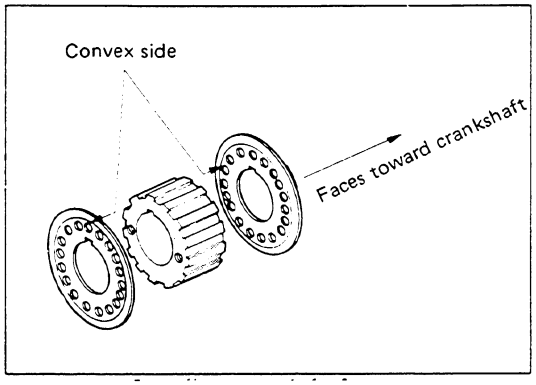


11. Place the gasket on the cylinder block and attach the oil pan. Tighten the oil pan bolts between 2.9 - 5.1 lb-ft (0.4 - 0.7 kg-m).



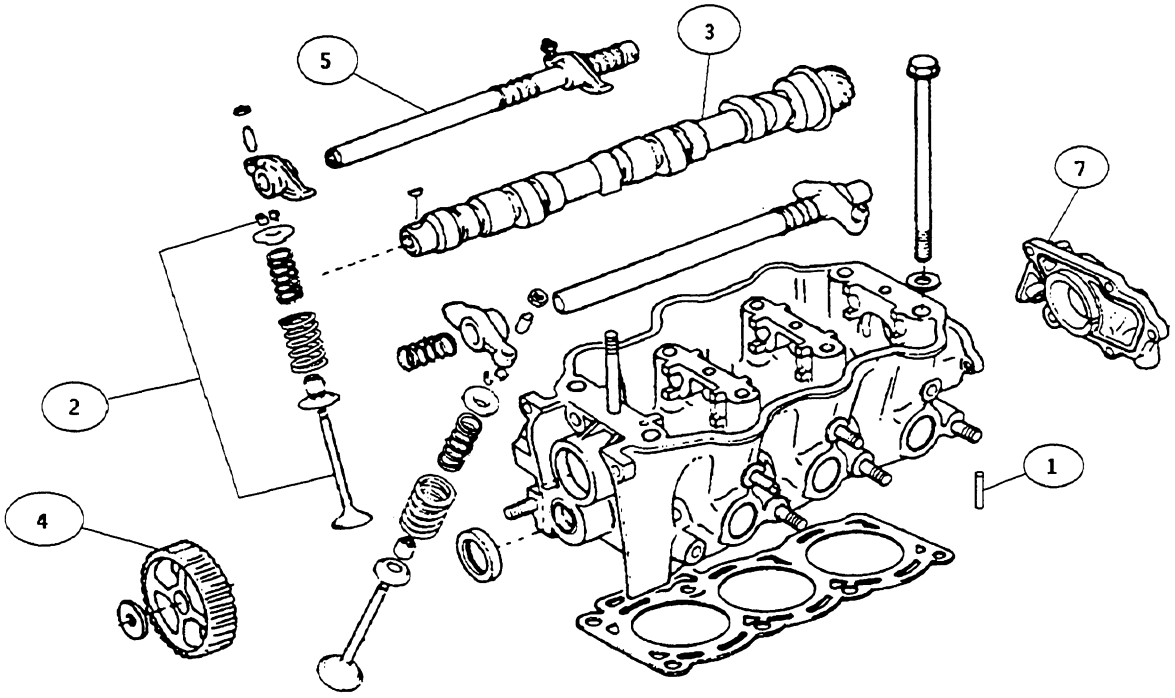
Installing the Crankshaft Timing Belt Pulley

After the balance shaft drive gear has been installed on the crankshaft, place the two crankshaft timing belt pulley flanges (convex side toward the crankshaft) on both sides of the crankshaft timing belt pulley. Refer to the illustration to the right.



CYLINDER HEAD ASSEMBLY

For the W 26G and the W 26GX cylinder heads, assemble the components in the order indicated below.

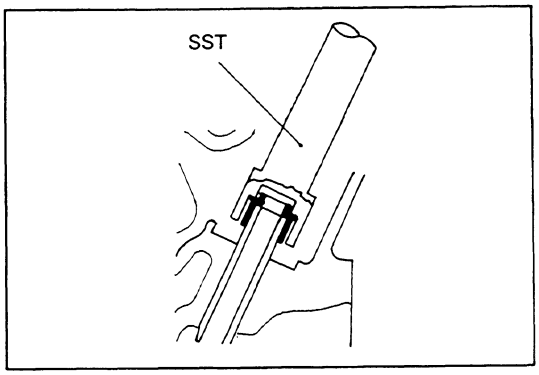


CYLINDER HEAD ASSEMBLY ORDER

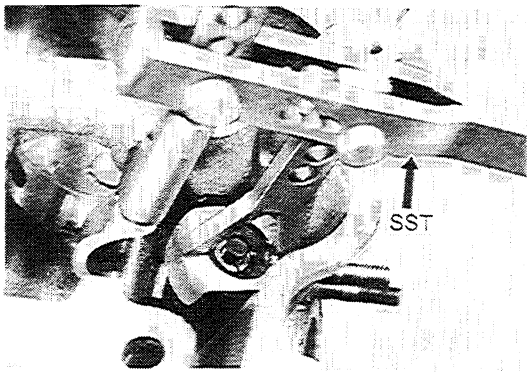
*1. Valve Guide Bushings	(page 121, step 1)
*2. Valves	(page 121, step 2)
*3. Camshaft	(page 121, step 3)
*4. Timing Belt Pulley	(page 121, step 3)
*5. Rocker Arm Shafts	(page 122, step 4)
*6. Wave Washer (not shown)	(page 122, step 5)
*7. Distributor Housing	(page 122, step 6)

*Denotes that assembly instructions for these parts follow on the indicated pages.

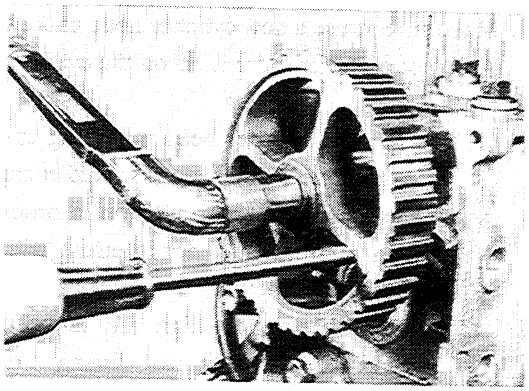
1. If the cylinder head had its valve guide bushings removed, insert new valve guide bushings using the special service tool [SST] # 09201-87702. Replace the plate washer.



2. NOTE: For this step, temporarily insert the rocker arm shafts (see step# 4). Insert a valve, compress the valve springs, using special service tools # 09202-87001 and 09219-87702, and install the spring retainer locks. Repeat this process for each valve.

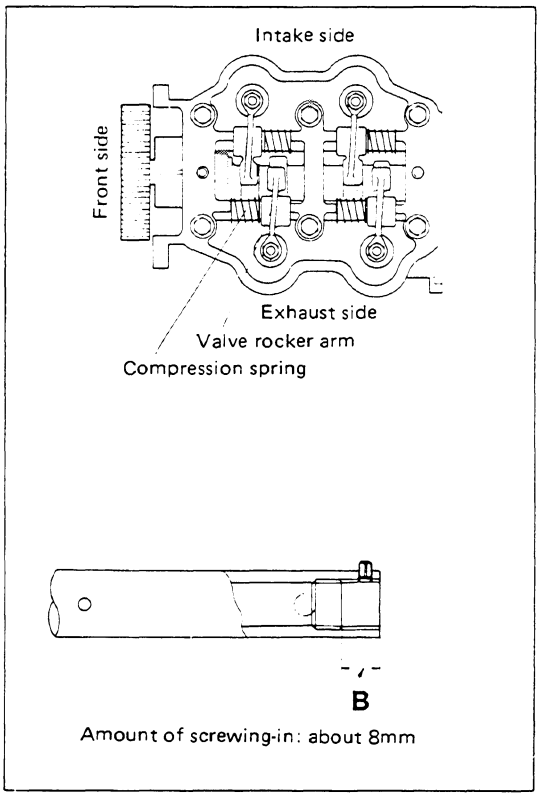


3. Install the camshaft and timing belt pulley. During the installation, the camshaft can be prevented from rotating by inserting a screw driver through the opening of the pulley. Tighten the timing belt pulley bolt between 21.7 to 32.5 lb-ft (3.0 - 4.5 kg-m).

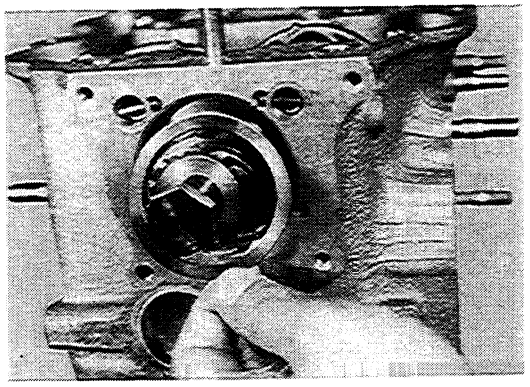


4. The rocker arm shaft for the exhaust side, which is the longest rocker shaft, must be installed in the cylinder head's right side, as viewed from the front. The shaft is inserted from the back of the cylinder head. The dowel pin at the end of the rocker arm shaft fits into a slot at the rear of the cylinder head. This pin aligns the oil ports in the rocker shaft to those in the cylinder head.

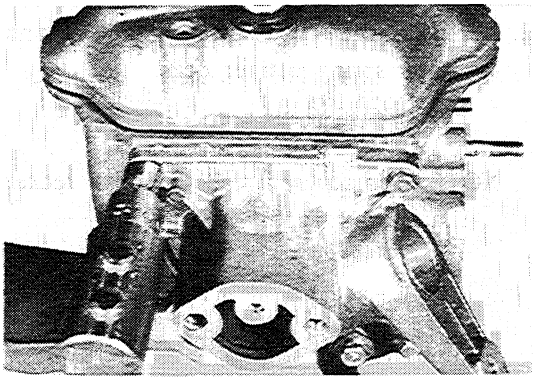
   NOTE: If the set screws at the end of the rocker arm shafts were removed so the center of the shafts could be cleaned, do not screw the set screw in so far as to block the first oil port in the rocker arm shaft (allow dimension **B** to be 0.314 inches [8 mm]).



5. Insert the wave washer (see right).



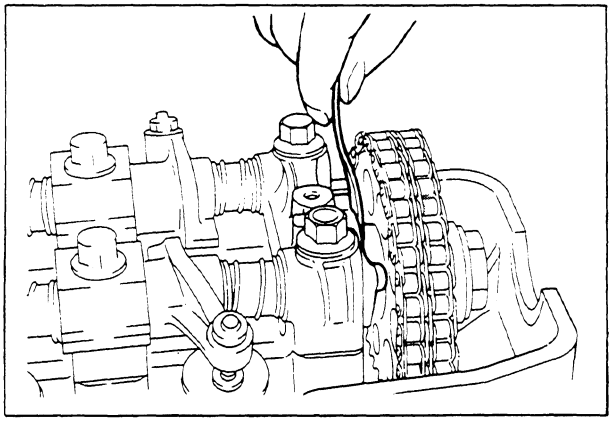
6. Install the distributor housing along with a new O-ring gasket. Tighten the bolts between 2.9 to 5.1 lb-ft (0.4 - 0.7 kg-m).



7. Measure the play in the camshaft's thrust direction. Next check the camshaft's end play in the axial direction (that is, movement from side to side).

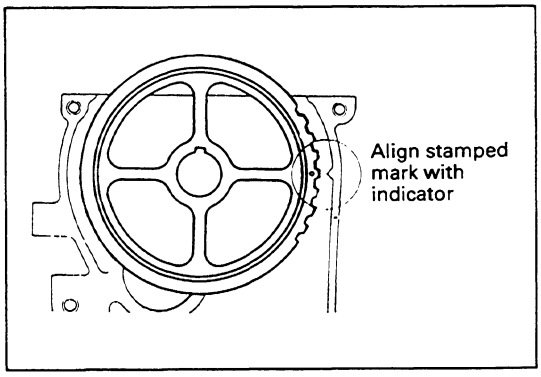
   Specified Limit: 0.002 - 0.011 inches
   (0.05 - 0.29 mm)

   Allowable Limit: 0.0157 inches (0.4 mm)



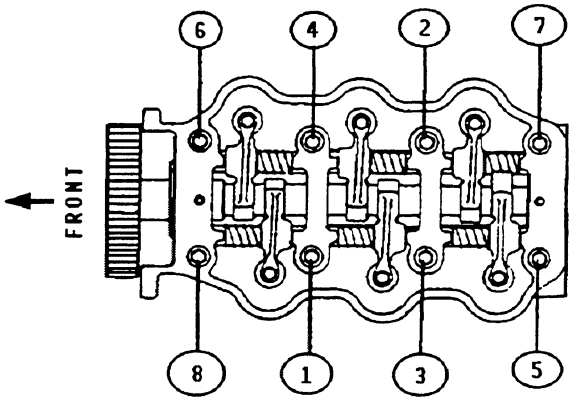
BOLTING THE CYLINDER HEAD TO THE CYLINDER BLOCK

1. Make sure none of the pistons come to their Top Dead Center (TDC) position. This allows the cylinder head to be mounted on the cylinder block without the valves interfering with the pistons. Be sure to align the stamped mark on the camshaft timing belt pulley with the indicator on the cylinder head.



2. Make sure the mating surface of the cylinder head and cylinder block are clean of old gasket material, oil or grease. Use a new cylinder gasket when installing the cylinder head on the cylinder block. Do not use any gasket sealer on this gasket.

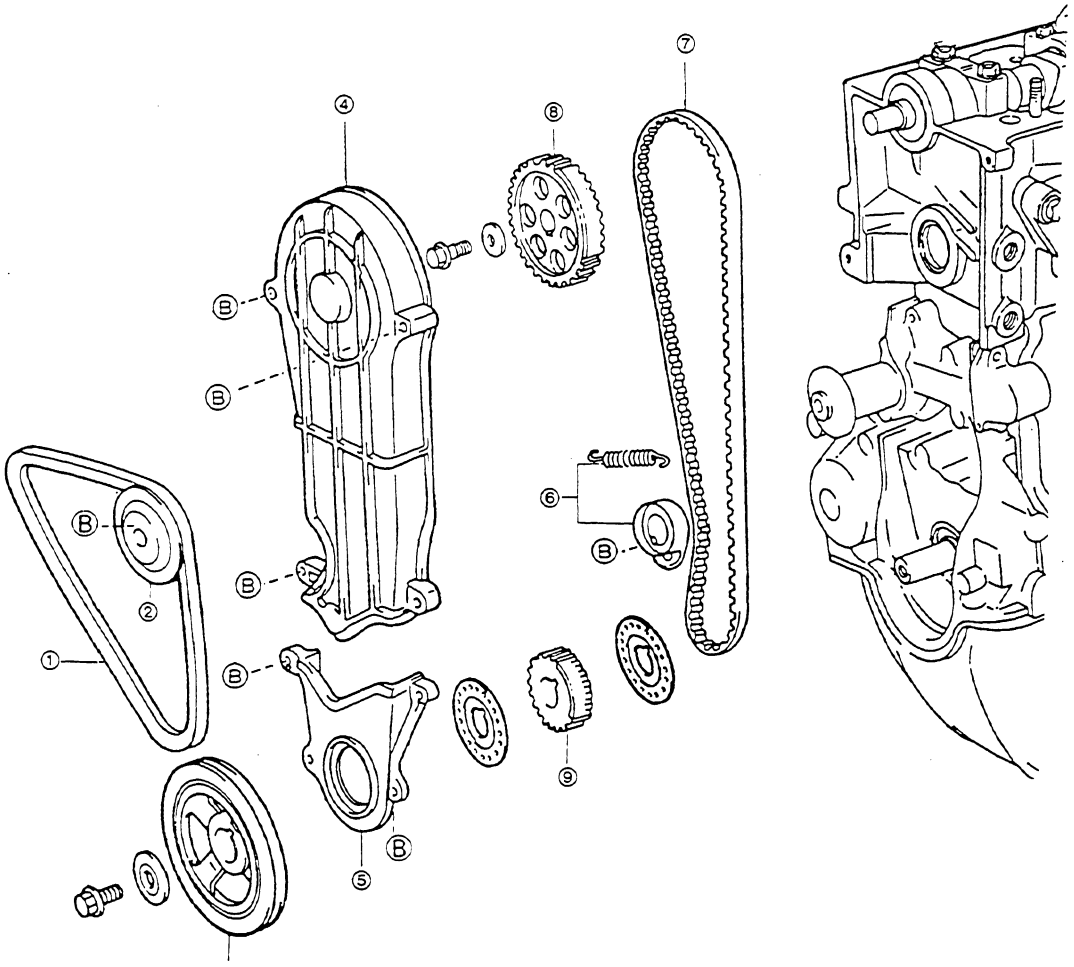
3. Mount the cylinder head on the cylinder block and tighten the cylinder head bolt between 28.9 to 36.2 lb-ft (4.0 - 5.0 kg-m).



W 26G HEAD BOLT
TIGHTENING SEQUENCE

TIMING BELT ASSEMBLY

For the W 26G and the W 26GX engines, assemble the timing belt components in the numerical order indicated below.



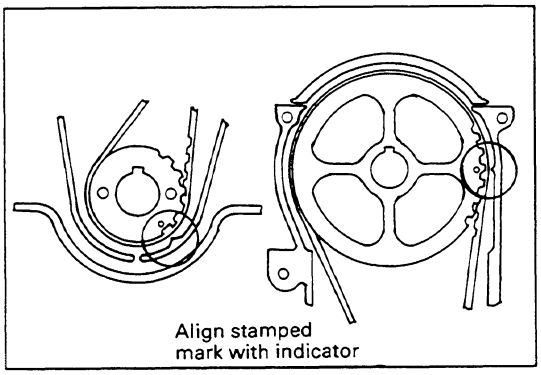
TIMING BELT ASSEMBLY

*	1. Timing Belt Pulley (Crankshaft)	(page 119)
	2. Timiung Belt Pulley (Camshaft)	(page 126, step 1)
*	3. Timing Belt	(page 127, step 5)
*	4. Timing Belt Tensioner and Spring	(page 128, step 7)
	5. Lower Timing Belt Cover	
	6. Upper Timing Belt Cover	
	7. Crankshaft Pulley	
	8. Water Pump Pulley	
	9. V-Belt	

* Denotes that disassembly instructions for these parts follow on the indicated pages.

(B) Denotes that a bolt is needed to secure this part.

1. Make sure the stamped marks on the camshaft and crankshaft timing belt pulleys are aligned with their respective indicators (pointers) on the cylinder head and bearing shaft gear cover (note that the camshaft pulley mark is at 3 o'clock; the crankshaft pulley mark is between 4 and 5 o'clock when the pulley keyways are at 12 o'clock).



2. Temporarily attach the timing belt tensioner, leaving its setting bolt backed off one half turn.

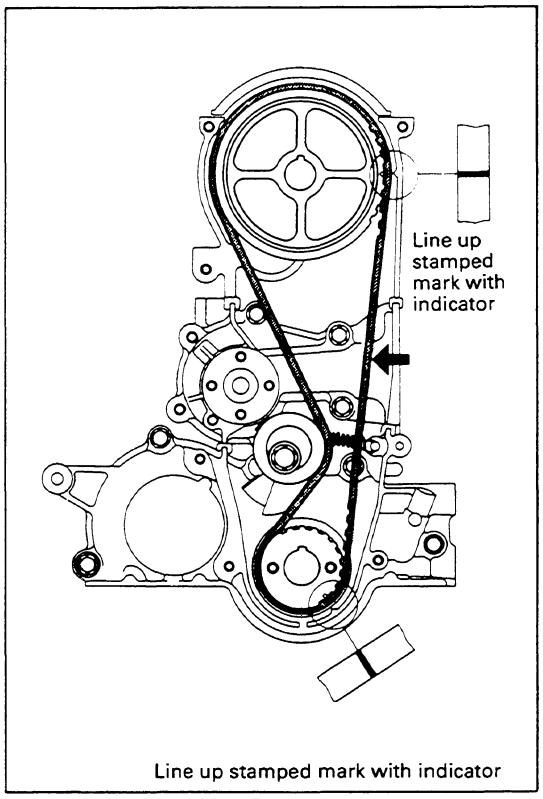
3. Install the tension spring.

4. If the crankshaft timing belt pulley was removed during disassembly and had not been reinstalled on the crankshaft as described on page 119, then place the crankshaft timing belt pulley on the crankshaft. Make sure the crankshaft timing belt pulley's flanges are properly placed on either side of the pulley (convex surface of flange toward pulley). See page 119.

CAUTION

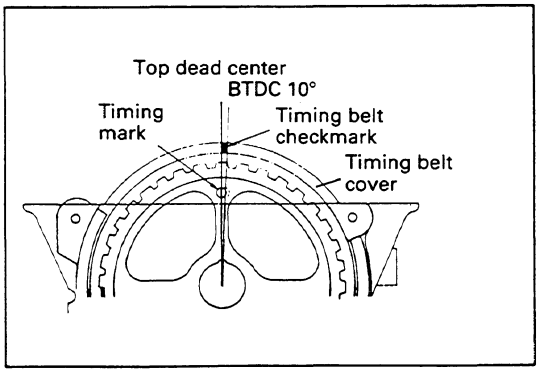
When installing the timing belt, **DO NOT** pry the belt with a screwdriver or similar tool. Damage to the belt will result.

5. Install the timing belt by hand, making sure that there is no slack between the pulleys on the side of the belt away from the tensioner and that the stamped marks on the two pulleys are still properly aligned with their respective indicators.



Line up stamped mark with indicator

6. Rotate the crankshaft two complete turns in the normal direction of rotation until the No. 1 piston returns to Top Dead Center (TDC). Check that the timing belt pulleys again are properly aligned with their respective indicators, as indicated in step 5.

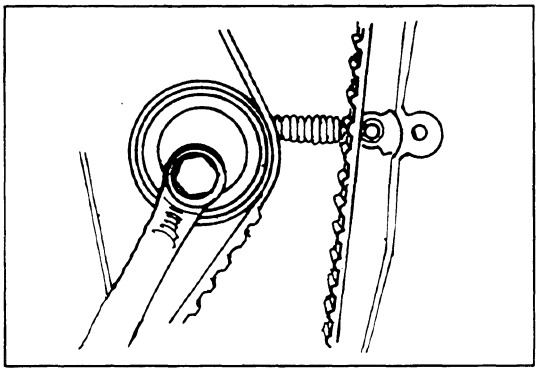


CAUTION

Ensure that no other force save that of the tensioner spring is applied to the tensioner when tightening the setting bolts.

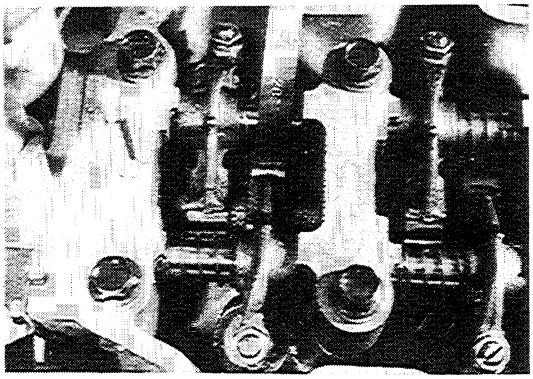
7. With the timing belt aligned and checked, tighten the single setting bolt to the specifications given below.

Tightening Torque:	13.7 - 22.4 lb-ft (1.9 - 3.1 kg-m)



ADJUSTING VALVE CLEARANCES

1. Adjust the valve clearances according to the following specifications. (Adjustments are made using the appropriate feeler gauge between the rocker arm and its associated cam lobe on the cam shaft, as shown in the figures below.)



For the W 26G and the W 26GX engines adjust valve clearances as follows:

1. Set the piston of the No. 1 cylinder at the end of its compression stroke. Adjust the No. 1 and No. 3 intake valve clearances and the No. 1 and No. 2 exhaust valve clearances as specified below.

Valve Clearances (engine cold)	Intake 0.0071 inches (0.20 mm) Exhaust 0.0071 inches (0.20 mm)

2. Set the piston of the No. 1 cylinder at the top of its intake and the end of its exhaust stroke (rotate the crankshaft 360°). Adjust the No. 2 intake and the No. 3 exhaust valve clearances as specified above.

2. Install the upper and lower timing belt covers, ensuring that the associated dust seals are properly installed and that the crankshaft timing belt pulley flange is properly positioned in front of the pulley.

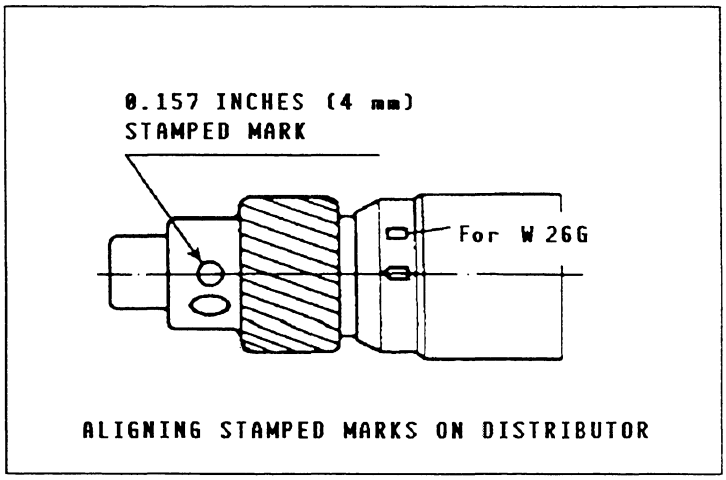
Tightening Torque:	1.4 - 2.9 lb-ft (0.2 - 0.4 kg-m)

Installing the Distributor

1. Set the No. 1 piston at Top Dead Center (TDC) at the end of the compression stroke.

2. Turn the distributor shaft until the stamped mark located at the end of the distributor shaft is aligned with the recessed mark, as indicated in the illustration to the right.

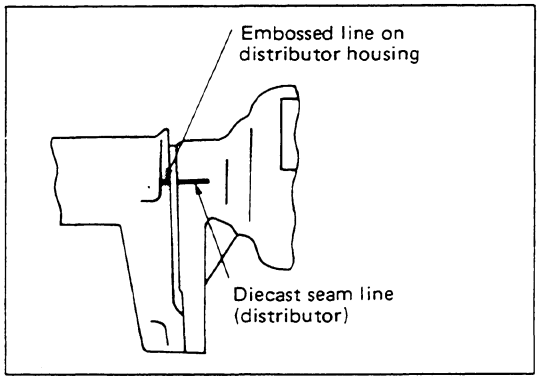
   At this point, the distributor is correctly aligned for installation.



ALIGNING STAMPED MARKS ON DISTRIBUTOR

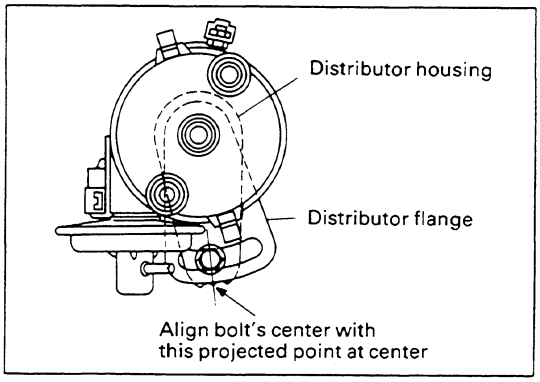
   NOTE: At this point, fill the distributor housing with approximately 30 cc of engine oil.

3. Install the distributor into the cylinder block in such a way that the mold seam line provided on the distributor body is lined up with the embossed line located on the distributor housing.



4. Temporarily tighten the distributor retaining bolt.

   NOTE: Make sure to tighten the distributor retaining bolt after the engine tune-up operation has been completed.



Installing External Parts and Subassemblies

1. Install the exhaust manifold.

2. Install the intake manifold.

3. Attach the cylinder head cover, ensuring that the cylinder head cover gasket is properly positioned in its grove in the cover before installing the cover's cap nuts and seal washers.

   Tightening Torque: 5.1 - 9.4 lb-ft (0.7 -1.3 kg-m)

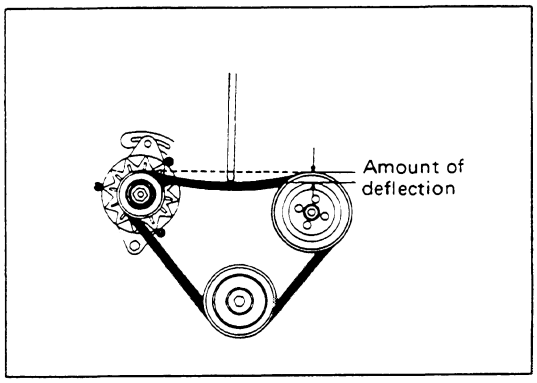
4. Install the crankshaft pulley to the crankshaft.

   Tightening Torque: 36.2 - 43.4 lb-ft (5.0 - 6.0 kg-m)

5. Install the fresh water circulating pump and the fresh water circulating pump's pulley.

6. Install the governor's mounting bracket and the governor; attach the linkage arm to the carburetor.

7. Install the alternator's mounting bracket and the alternator; install the fresh water pump's drive belt and adjust the belt so that it deflects between 0.43 to 0.51 of an inch (11 to 13 mm). Refer to the illustration below.



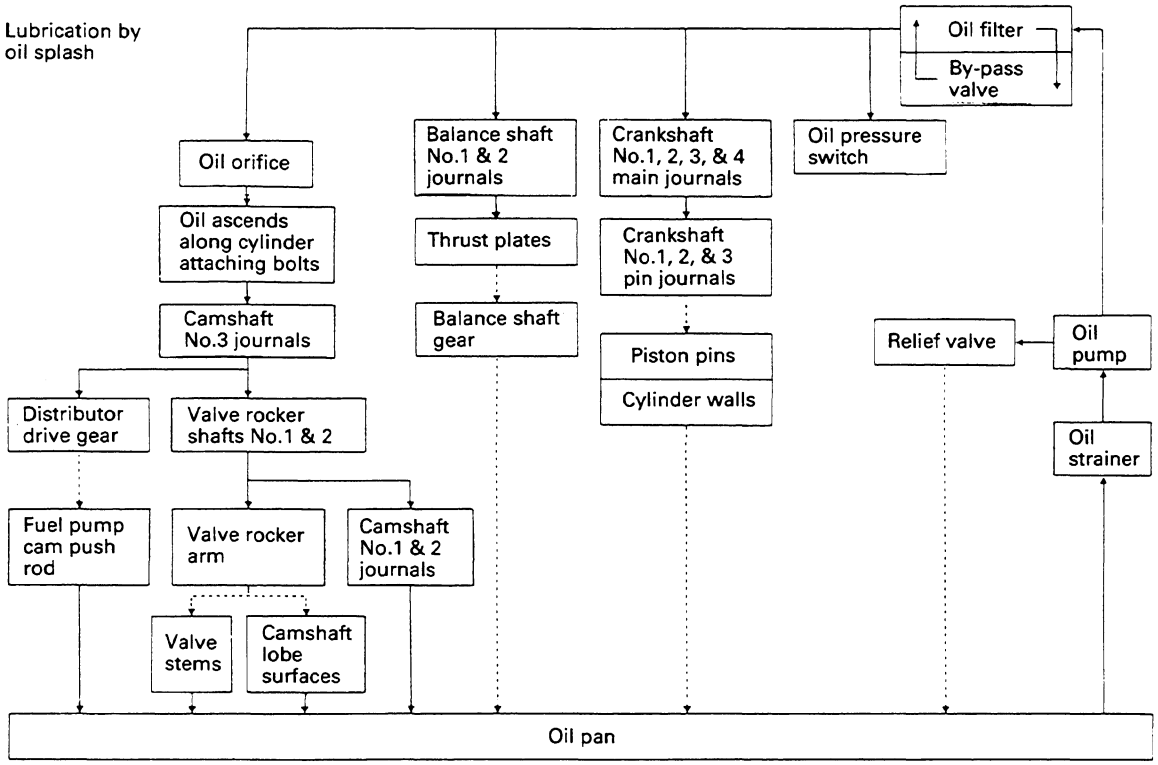
8. Install the sea water pump's mounting bracket and the sea water pump; install the drive belt and adjust the belt so that it deflects between 0.43 to 0.51 of an inch (11 to 13 mm).

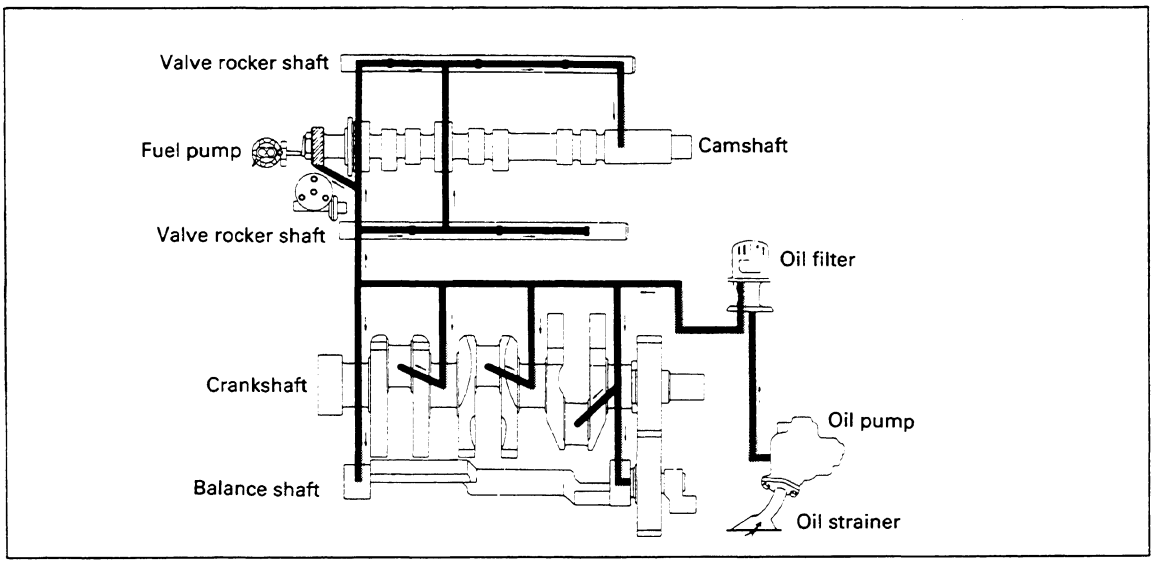
YOUR NOTES

Operation

The lubricating system is a pressure feeding system using an oil pump. The engine oil forced out of the oil pump is passed through the oil filter. The oil passes through the oil filter and then to the various lubricating points in the engine and then returns to the lubrication oil sump.

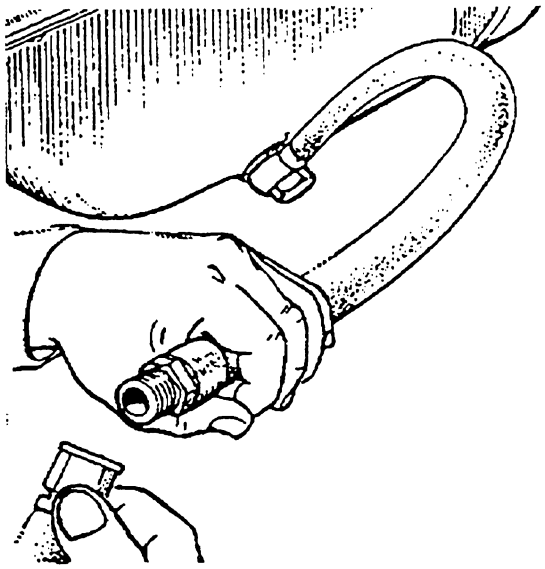
When the oil pressure exceeds the specified pressure, the oil pushes open the relief valve in the oil pump and returns to the oil pan, thereby keeping the oil pressure within its specified range.





Engine Oil Change (to include filter)

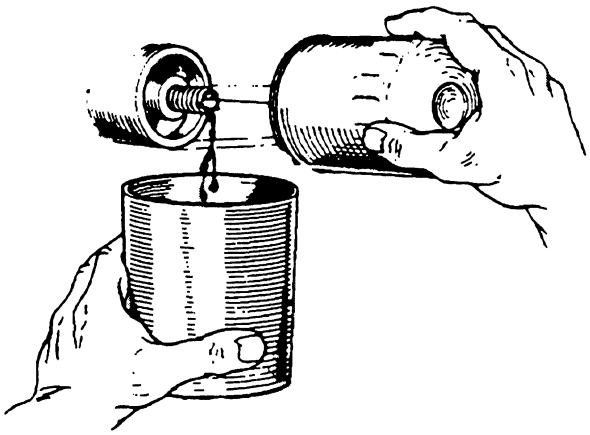
1. Draining the Oil Sump



Discharge the old oil through the sump drain hose (attached at the front of the engine) while engine is still warm. Drain the old oil completely, replace the hose in its bracket, and replace the end cap securely.

Always observe the old oil as it is removed. A yellow/gray emulsion indicates the presence of water in the oil. Although this condition is rare, it does require prompt attention to prevent serious damage. Call a competent mechanic should water be present in the oil. Sea water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning through the sea water cooling circuit into the exhaust, filling it up into the engine (refer to the installation illustrations on page 13).

2. Replacement of the Oil Filter



When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small style automotive filter wrench should be helpful in removing the old oil filter. Place some paper towels and a plastic bag around the filter when unscrewing it to catch any oil left in the filter. (Oil or any other fluid on the engine reduces the engine's cooling ability. Please keep your generator's engine clean.) Inspect the old oil filter as it is removed to make sure that the rubber sealing gasket came off with the old oil filter. If this rubber sealing gasket remains sealed against the engine block, gently remove it. The replaceable cartridge-type oil filter requires no cleaning inside, so it may be properly disposed of.

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

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

3. Filling the Oil Sump

Add fresh oil through the oil filler cap on the valve cover (refer to the photographs on pages 3 and 4 for the location of the oil filler cap and lube oil dipstick). After refilling the oil, run the engine for a few moments while checking the engine's oil pressure. Ensure there is no leakage around the new oil filter or from the oil drain system, and then stop the engine. Then check the quantity of oil with the lube oil dipstick. Fill to, but not over, the high mark on the dipstick, should the engine require additional oil.

Checking the Engine's Lubricating Oil

1. Check for any engine oil leakage. Should an oil leak be detected, inspect the engine to locate the leak and correct it. Tightening of fittings and bolts is considered normal maintenance and is the responsibility of the owner.

2. Check engine's oil level with the oil dipstick at least once daily prior to engine usage. Add oil as needed.

3. Make sure the engine's oil level is maintained near , but not over, the **F** mark on the dipstick. If the engine's oil drops close to the **L** mark, add the engine oil until the oil level reaches the **F** mark. Keep an eye on the engine's oil level. After the engine is broken in, if the engine continues to consume a noticeable quantity of engine oil, consult a competent marine mechanic.

   NOTE: Maintaining the engine's oil level with the proper lubricating oil, and making sure that the oil is changed at the proper intervals, is the responsibility of the owner/operator. Engine damage resulting from the lack of engine oil, from the wrong type of oil, or from unclean oil is not a warrantable issue.

Engine oil capacity: (not including filter) 3.0 quarts (2.9 liters)

Troubleshooting the Oil System

Trouble	Possible Cause	Remedy
Oil leak	1. Loose oil drain hose.	1. Tighten or replace.
	2. Oil pan to cylinder block leakage.	2. Tighten securing belts or replace pan gasket.
	3. Damaged or loose timing chain cover or rocker cover.	3. Replace or tighten bolts.
	4. Damaged or loose cylinder head gasket.	4. Tighten or replace.
	5. Loose or damaged oil filter.	5. Tighten or replace.
	6. Loose or damaged pressure switch or sender.	6. Tighten or replace.

Trouble	Possible Cause	Remedy
Low Oil Pressure (unit shutdown)	1. Oil leaks.	1. Refer to above.
	2. Low oil level or incorrect grade.	2. Add oil to proper level or change.
	3. Faulty oil pressure switch.	3. Test and replace.
	4. Clogged oil filter.	4. Remove and replace oil filter.
	5. Clogged oil pump strainer.	5. Remove and clean.
	6. Worn or fatigued oil pressure relief valve spring.	6. Remove and replace.
	7. Faulty electrical circuit.	7. Check circuit and repair as needed.

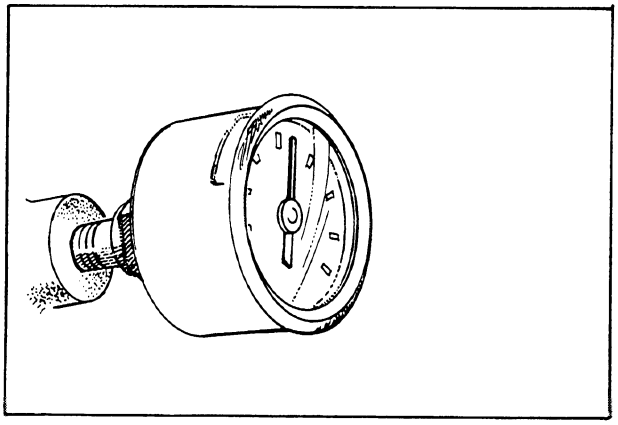
Checking Oil Pressure with a Mechanical Gauge

1. Remove the oil pressure sender and connect a mechanical oil pressure gauge in its place.

2. Electrically jump the oil pressure switch's connections.

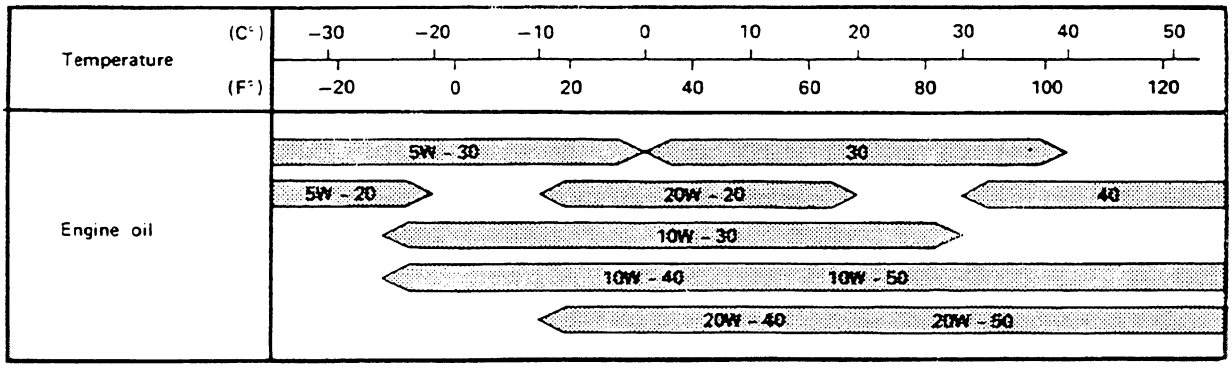
3. Start the engine and encourage a fast warm up.

4. Measure the oil pressure. If it is less than the specification listed below, check the engine's lubricating system.



Oil pressure: 50 - 70 psi
(3.5 - 4.0 kg/cm^2)

NOTE: Ensure that the engine's oil meets all temperature requirements and the API specification of SC, SD, SE, or SF.



COOLING SYSTEM

Description

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

Fresh Water Circuit

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

Sea Water Circuit

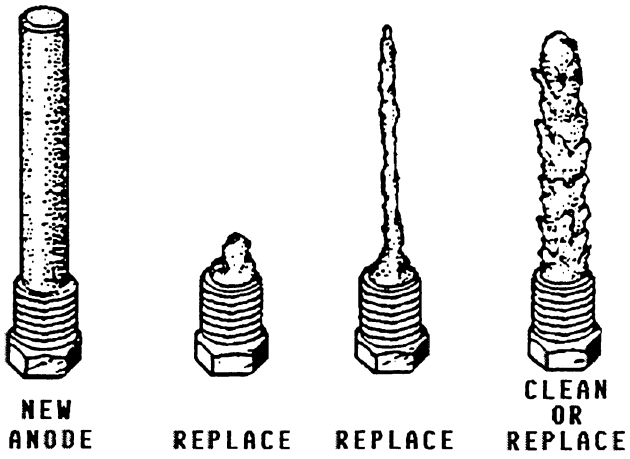
The sea water flow is created by a positive displacement neoprene impeller pump. Normally the pump draws sea water directly from the ocean through a flush-hull sea cock and sea water strainer. Sea water then flows directly from the discharge of the sea water pump to the heat exchanger sea water inlet. After passing through the tubes of the heat exchanger, the sea water enters a water injected, wet exhaust system, the most popular type of exhaust system in use. In the case of larger engines, the sea water flow is divided prior to entering the exhaust systems so that a portion is used to cool the exhaust system. Full sea water flow would create unnecessary exhaust back pressure.

Sea Water Pump

The sea water pump is self priming and positive displacement. This rotary sea water pump has a non-ferrous housing and a neoprene impeller. The impeller has flexible vanes which wipe against a curved cam plate within the impeller housing, producing a pumping action. On no account should this pump be run dry. There should always be a spare impeller and impeller cover gasket aboard (an impeller kit).

Zinc Anodes

A zinc anode, or pencil, is located in the sea water cooling circuit within the heat exchanger. The purpose of the zinc anode is to sacrifice itself to electrolysis action taking place in the sea water cooling circuit, thereby reducing the effects of electrolysis on other components of the system. The condition of the zinc anode should be checked monthly and the anode cleaned or replaced, as required. Spare anodes should be carried on board.



Troubleshooting the Cooling System

Trouble	Possible Cause	Remedy
Coolant leaks: It is recommended that when trying to locate a leak in the cooling system that the system be pressure tested using a commercially available pressure tester such as the STANT #ST255. Follow instructions with the tester. Locate and correct the leak.		
	2. Leaking pressure cap.	2. Test with above unit and/or replace.
	3. Faulty plastic coolant recovery tank.	3. Check and tighten connections or replace tank.
Overheating (Fresh Water System)	1. Insufficient coolant.	1. Replenish coolant and check for cause of loss.
	2. Loose or broken water pump drive belt.	2. Adjust or replace.
	3. Faulty thermostat	3. Remove and replace.
	4. Faulty overheat switch.	4. Remove and replace.
	5. Scale and sediment in cooling system.	5. Flush engine cooling system and heat exchanger; replenish coolant.
	6. Faulty circulating pump.	6. Remove and replace.
Overheating (Sea Water System)	1. Loose or broken sea water pump drive belt.	1. Adjust or replace.
	2. Faulty sea water pump.	2. Check sea water pump for wear, defective impeller. Repair or replace as needed.
	3. Clogged heat exchanger.	3. Remove exchanger, clean and flush.
	4. Scale in exhaust.	4. Remove elbow and clean.

Other causes of engine overheating may be caused from faults in the sea water circuit supplying coolant to the sea water pump on the engine. Examine the off circuit for possible contributing faults.

CARBURETOR AND FUEL SYSTEM

Carburetor

The carburetor is a single barrel down draft type with a metal screened air intake filter which is cleanable.

The carburetor has two metering jets, one of which is adjustable (the idle mixture). The other fast running jet is set at the factory and will accept no adjustment.

Any adjustment to the idle mixture jet should be done with the engine warmed up.

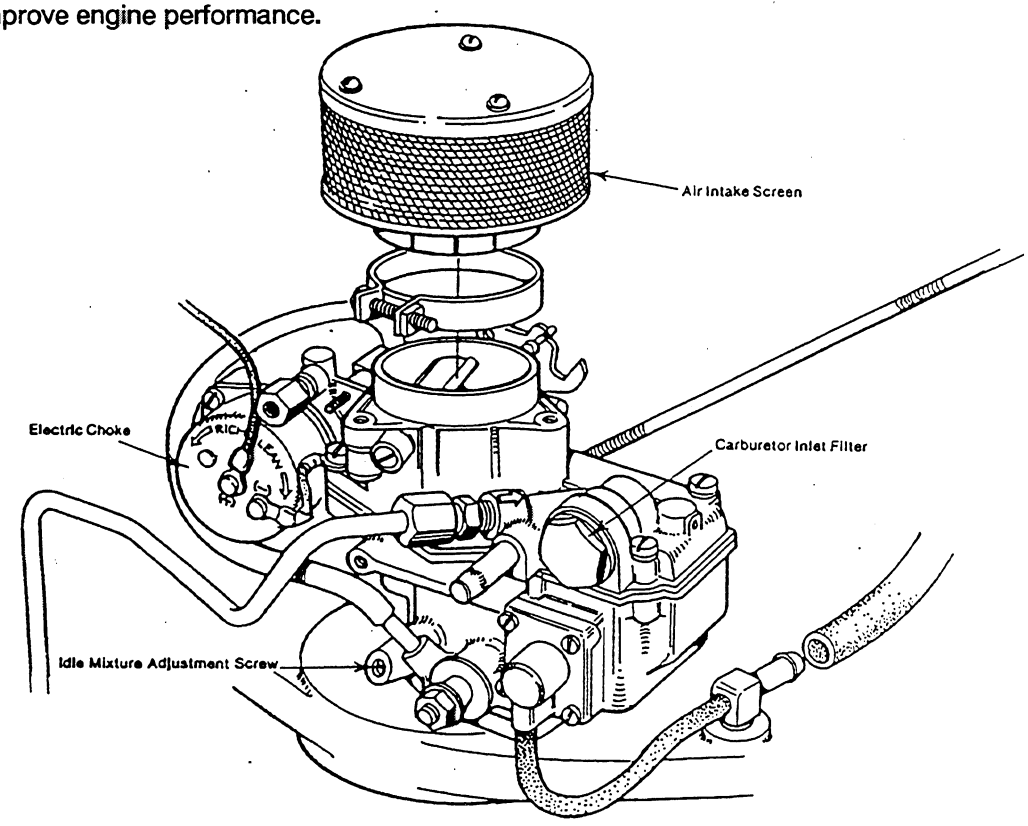
Carburetor Adjustment

1. Idle Mixture Jet

   Turn the idle mixture screw clockwise (in) until the engine skips; back the screw out (counterclockwise) slowly until the engine smooths then skips again; then turn the screw clockwise (in) one-quarter to one-half of a turn. The idle mixture should be satisfactory at this setting.

2. Run Mixture Jet

   This mixture jet is pre-sized at the factory and is not adjustable. The idle mixture jet adjustment can be made to improve engine performance.



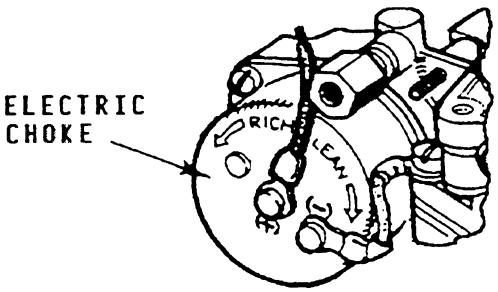
NOTE: Choke index mark is located on the choke cover lower right inboard side.

Electric Choke

The electric choke uses a 12 volt heating element which opens the choke automatically once the engine starts and is running.

The choke is adjusted with the engine OFF and cooled.

Adjust the choke by loosening the three cover-securing screws and rotating the cover clockwise to **ENRICH** the choke and counterclockwise to **LEAN** the choke. The choke is initially set at the factory for an average of 70° F (21° C) room temperature.



The choke may need readjustment at engine commissioning for the ambient temperature of the area the engine is operating in.

The choke index mark is located on the choke cover lower right inboard side.

CAUTION

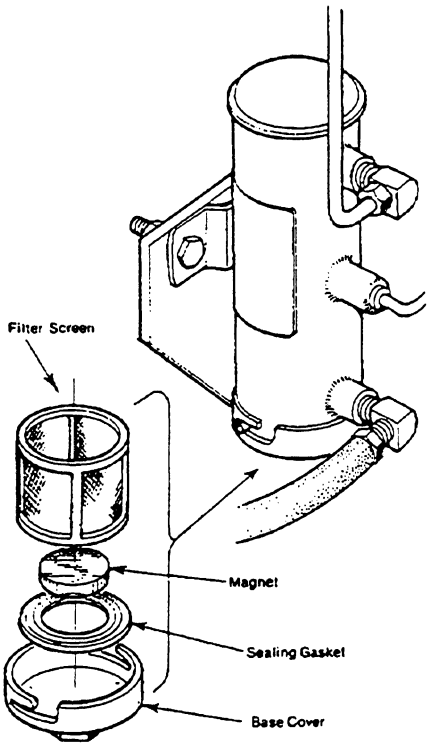
The choke housing will normally get hot during engine operation.

NOTE: When initially starting the engine (commissioning) or after servicing the fuel system, prime the engine's fuel system by using the engine mounted fuel pump. Prime the fuel system by turning the Key Switch ON and pressing the START button. To prevent the unwanted activation of the carburetor's electric choke, unplug the 12 volt (+) lead at the electric choke during this priming operation and reconnect it after priming to start the engine.

Electric Fuel Pump

The engine-mounted electric fuel pump supplies fuel to the engine's carburetor during engine operation. A cleanable filter screen is contained in the pump's base.

Remove the base by placing a wrench on the hex nut and twisting it loose from the bayonet fittings. Clean the screen as needed. A new base gasket #34706 must be installed each time the pump base is removed and reinstalled.



WARNING

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

Troubleshooting the Fuel System

Trouble	Possible Cause	Remedy
Hard starting	1. Faulty check.	1. Check choke adjustment and operation .
	2. Fuel.	2. Check fuel supply and correct type.
	3. Fuel pump.	3. Check pump operation and clean filter screen.
	4. Faulty idle jet adjustment	4. Adjust idle jet.
Flooded	1. Carburetor float needle valve open or damaged.	1. Clean or replace the needle valve.
	2. Float in carburetor leaking.	2. Repair or replace float.
	3. Float chamber gasket damaged or securing screws are loose.	3. Replace gasket and/or tighten screws.
Poor performance at generator speed	1. Main jet clogged.	1. Remove and clean.
	2. Carburetor inlet filter clogged.	2. Remove and clean.
	3. Fuel pump filter clogged.	3. Remove and clean.
	4. Air intake filter screen dirty.	4. Remove and clean.

YOUR NOTES

DC ELECTRICAL SYSTEM

Safety Information

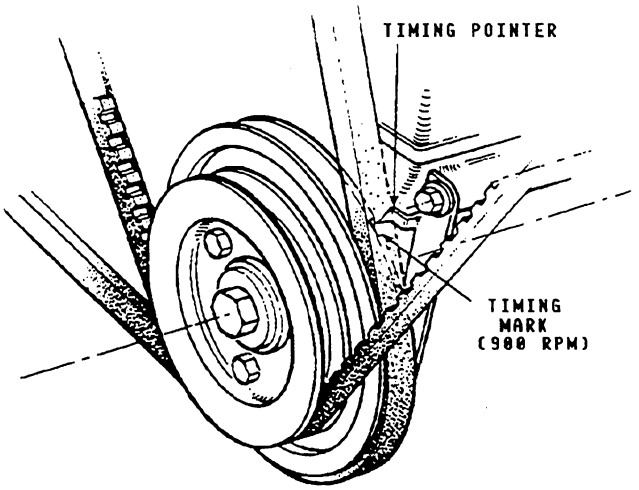
This circuit is designed and manufactured in compliance with United States Coast Guard Standards (33 CFR PART 183). No modifications may be made to it by the installer or user. It is the installer's responsibility to assure that the installation of the control panel is done so in compliance with the above Coast Guard Standards. Failure to observe these requirements could be the cause of injury.

Distributor

The distributor is a solid state type without breaker points; therefore, it requires no adjustment. It consists of a cap, rotor, signal generator, igniter and centrifugal advance system.

The signal generator consists of a signal rotor, a magnet and a pickup coil. When the signal rotor is driven, the amount of magnetic flux through the pickup coil varies and an electric signal is conducted at both ends of the pickup coil and sent to the igniter.

The centrifugal advance controls the signal generator timing so as to control the ignition timing according to the engine speed and load.



Ignition Timing

1. Attach a timing light to the #1 spark plug and mark the front crankshaft timing groove and the timing mark on the scale embossed on the engine's front cover.

2. Start the engine and warm it up to its normal operating temperature.

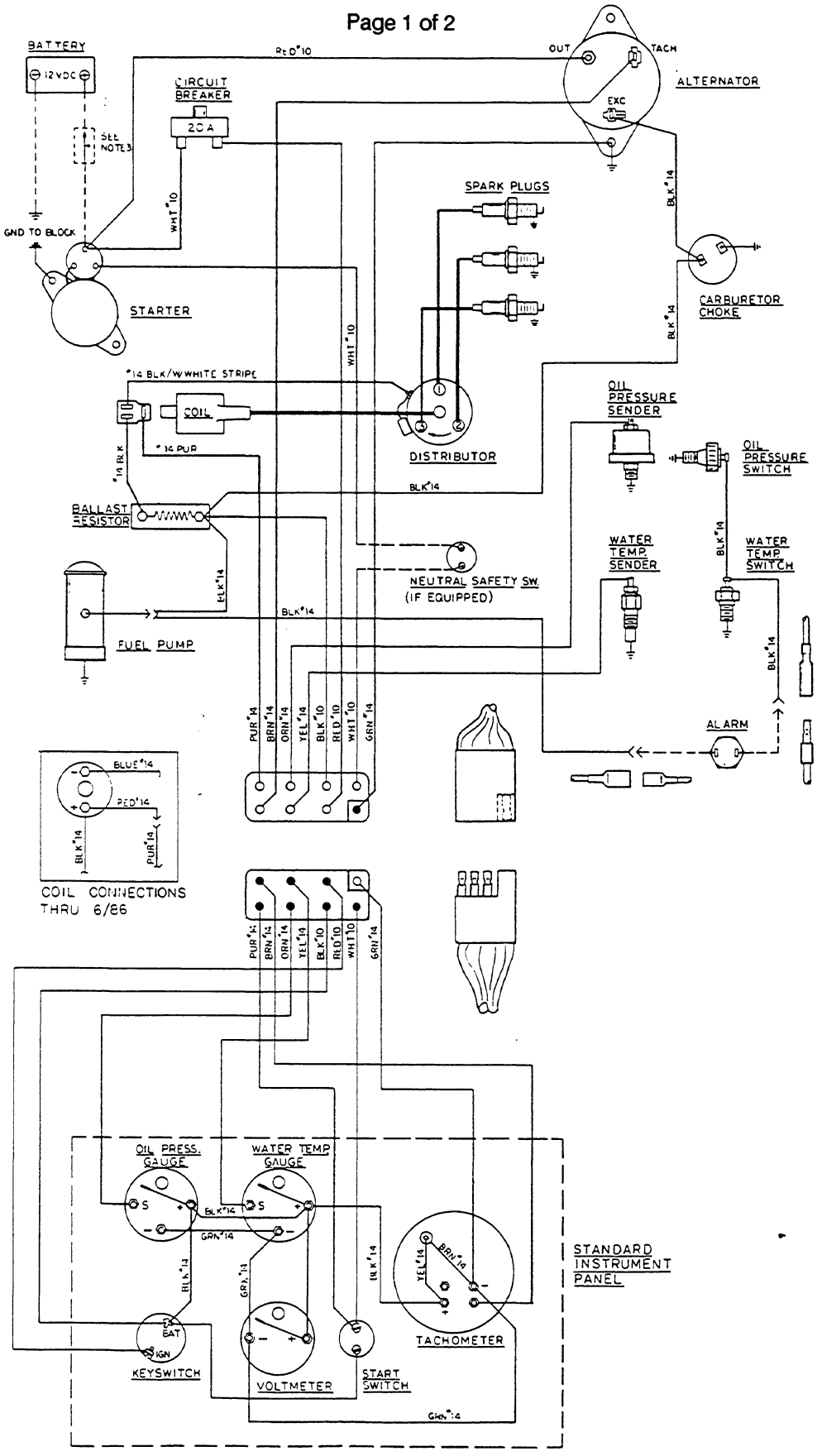
3. Using the timing light, align the timing groove in the front crankshaft pulley with the proper timing mark on the ignition timing scale embossed on the engine's front cover. Do this by loosening and slowly rotating the distributor body.

Timing Specifications: 10° ± 2° BTDC at idle (900 rpm)

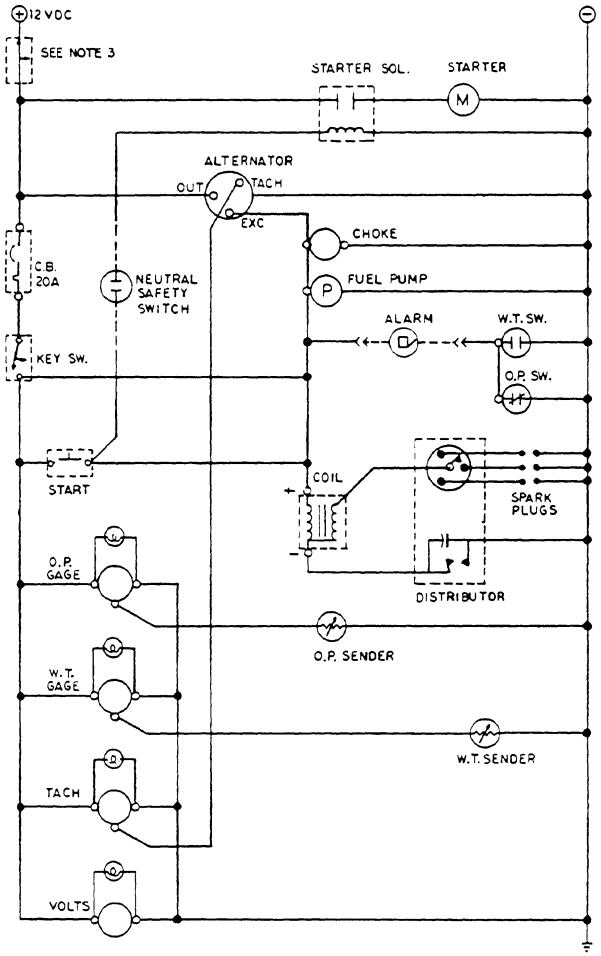
Refer to the "ENGINE TUNE-UP SPECIFICATIONS" section of this manual for additional information regarding tune-up specifications, page 42.

DC WIRING DIAGRAM #36037

Page 1 of 2



DC WIRING DIAGRAM # 36037



RESPONSIBILITY FOR SAFETY REGULATIONS

1. THE WESTERBEKE 26G GASOLINE MARINE PROPULSION ENGINE AS SHIPPED FROM THE FACTORY AND EXCLUSIVE OF ITS INSTRUMENT PANEL COMPLIES WITH U.S. COAST GUARD REGULATION 33CFR-183. THE STANDARD INSTRUMENT PANEL DOES NOT NECCESARILY SO COMPLY AND IS INTENDED TO BE INSTALLED ABOVE DECK AND ISOLATED FROM GASOLINE SOURCES IN ACCORDANCE WITH 33CFR-183.410(b).

2. IT IS THE RESPONSIBILITY OF THE BOAT MANUFACTURER TO INSURE THAT THE INSTALLATION OF OF THIS ENGINE AND ITS INSTRUMENT PANEL COMPLY WITH 33CFR-183.

3. AN ON-OFF SWITCH MUST BE INSTALLED IN THIS LINE TO DISCONNECT THE STARTER CIRCUIT FROM THE BATTERY IN AN EMERGENCY AND WHEN LEAVING THE BOAT. TWELVE VOLT STARTERS TYPICALLY DRAW 200 TO 300 AMPS WHEN CRANKING. THE DURATION OF INDIVIDUAL CRANKING CYCLES SHOULD NOT EXCEED 30 SECONDS. A SWITCH WITH A CONTINOUS RATING OF 175 AMPS AT 12 VOLTS WILL NORMALLY SERVE THESE FUNCTIONS BUT SUCH A SWITCH SHOULD NOT BE USED TO "MAKE" THE CIRCUIT.

4. THIS PRODUCT IS PROTECTED BY A MANUAL RESET CIRCUIT BREAKER LOCATED NEAR THE STARTER AND AS CLOSE AS POSSIBLE TO THE SOURCE OF CURRENT. EXCESSIVE CURRENT DRAIN ANYWHERE IN THE INSTRUMENT PANEL, WIRING OR ENGINE WILL CAUSE THE BREAKER TO TRIP. IN THIS EVENT MOST ENGINE MODELS WILL SHUT DOWN BECAUSE THE OPENED BREAKER WILL DISCONNECT THE FUEL SUPPLY. THEREFORE THE BUILDER/OWNER MUST BE SURE THAT THE INSTRUMENT PANEL, WIRING AND ENGINE ARE INSTALLED TO PREVENT CONTACT BETWEEN ELECTRICAL DEVICES AND SALT WATER.

Spark Plugs

Service spark plugs, clean gap or replace as needed.

Spark plug gap: 0.028 - 0.036 inches
(0.7 - 0.9 mm)

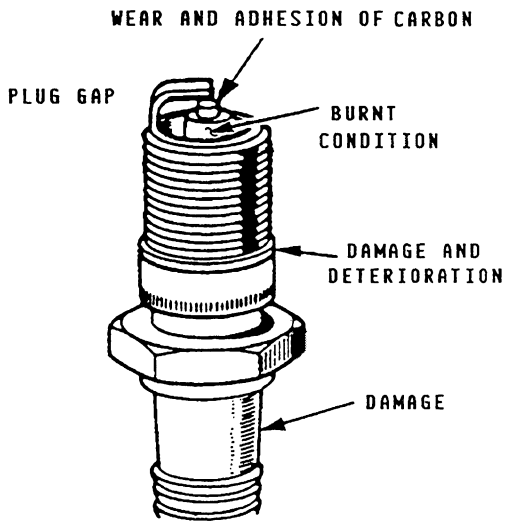
Spark plug torque: 10.8 - 15.9 lb-ft (1.5 - 2.2 kg-m)

Check plugs for damage and/or wear.

NOTE: Loc-tite "Anti-Seize" applied to the threaded portion of the spark plugs will retard corrosion, making future removal of the spark plugs easier.

CAUTION

DO NOT remove the spark plugs while the engine is hot. Removing the spark plug from a hot engine can damage the threads in the cylinder head. Let the engine cool down before removing or replacing the spark plugs.



Voltmeter

The voltmeter in the remote instrument panel can be a useful instrument in determining the status of your electrical system and in warning you when an abnormality occurs. The voltmeter will indicate differently, depending when the readings are taken.

Fully charged batteries that are in a static state should read between 12.3 and 12.6 volts on the dial. The term static means that the battery has not been charged or discharged for at least 2 hours. If the reading is between 11 and 11.5 volts, then the battery is about half discharged and should be charged to ensure its usefulness. If the engine is started and the needle does not go up, this would indicate that no charge is presently delivered to the battery.

When the battery is charging, the needle should be between 12.6 and 13 volts. The needle may move up to about the 14.6 volt range toward the end of the charge cycle, at which time the needle drops back to the 12.6 to 13 volt range, as voltage regulation controls this function. If the battery's voltage exceeds 15 volts, this indicates that the battery is being overcharged and the battery will be damaged if left unchecked. The voltage regulator is most likely at fault when this happens.

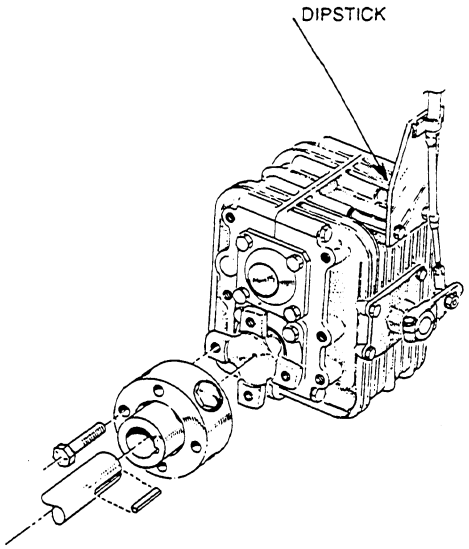
When the battery is discharging (having electrical loads placed upon it and no charging current applied), it is normal for the needle to indicate between 11.4 and 12.6 volts.

Troubleshooting the Electrical System

Trouble	Possible Cause	Remedy
Key Switch turned ON, electric fuel pump not energized.	1. Battery switch or power not on.	1. Check switch and/or battery connections.
	2. 20 Amp circuit breaker tripped.	2. Reset breaker.
Engine cranks, but does not start.	1. Fuse blown.	1. Check fuses; replace if necessary.
	2. Lack of fuel.	3. Check for fuel to engine. Check fuel lift pump.
	4. Choke faulty.	4. Check to see that it is not jammed. Should be closed if engine is cold.
	5. Coil faulty .	5. Check coil.
	6. Distributor faulty.	6. Check distributor, cap and wires.
	7. Wiring faulty.	7. Check wires and connections for shorts, breaks and corrosion.
Engine stops.	1. Low oil pressure or overheated.	2. Check oil, fresh water and sea water cooling.
	2. Low oil pressure switch fails to close.	2. Check for satisfactory operation with switch bypassed.
	3. High water or exhaust temperature switches open at too low a temperature.	3. Same as above.
	4. Switch and wiring.	5. Inspect all wiring for loose connections and short circuits.

Trouble	Possible Cause	Remedy
Not charging battery or battery runs down.	1. Alternator drive.	1. Check drivebelt and its tension. Be sure alternator turns freely. Check for loose connections.
	2. Oil pressure switch.	2. Observe if gauges and light are on when engine is not running. Test the normally open oil pressure switch by disconnecting one lead. If lights go out, replace oil pressure switch.
	3. High resistance leak to ground.	3. Check wiring. Insert sensitive (0-.25 Amp) meter in battery lines. (Do not start engine.) Remove connections and replace until short is located
	4. Low resistance leak to ground.	4. Check all wires for temperature rise to locate fault.
	5. Alternator.	5. Disconnect alternator at output, after a good battery charging. If leakage stops, replace alternator's protective diode plate. That failing, replace alternator.

YOUR NOTES



DESCRIPTION

1. BRIEF DESCRIPTION

The Type HBW Short Profile Sailing Gears are equipped with a positively-driven, mechanically-operated helical gearing system. The servo-operated multiple-disc clutch requires only minimum effort for gear changing, making the transmission suitable for single-lever remote control via a rod linkage, Morse or Bowden cable.

The torque transmission capacity of the clutch is exactly rated, preventing shock loads from exceeding a predetermined value and thus ensuring maximum protection of the engine.

The transmission units are characterized by low weight and small overall dimensions. The gearbox castings are made of a high-strength, corrosion-resistant aluminum alloy, chromized for improved sea water resistance and optimum adhesion of paint.

The transmissions are immersion-lubricated. Maintenance is restricted to fluid level checks (see Maintenance).

2. GEAR CASING

The rotating parts of the HBW transmission are accommodated in an oil-tight casing, divided into two halves in the plane of the vertical axis. Amply-dimensioned cooling ribs ensure good heat dissipation and mechanical rigidity.

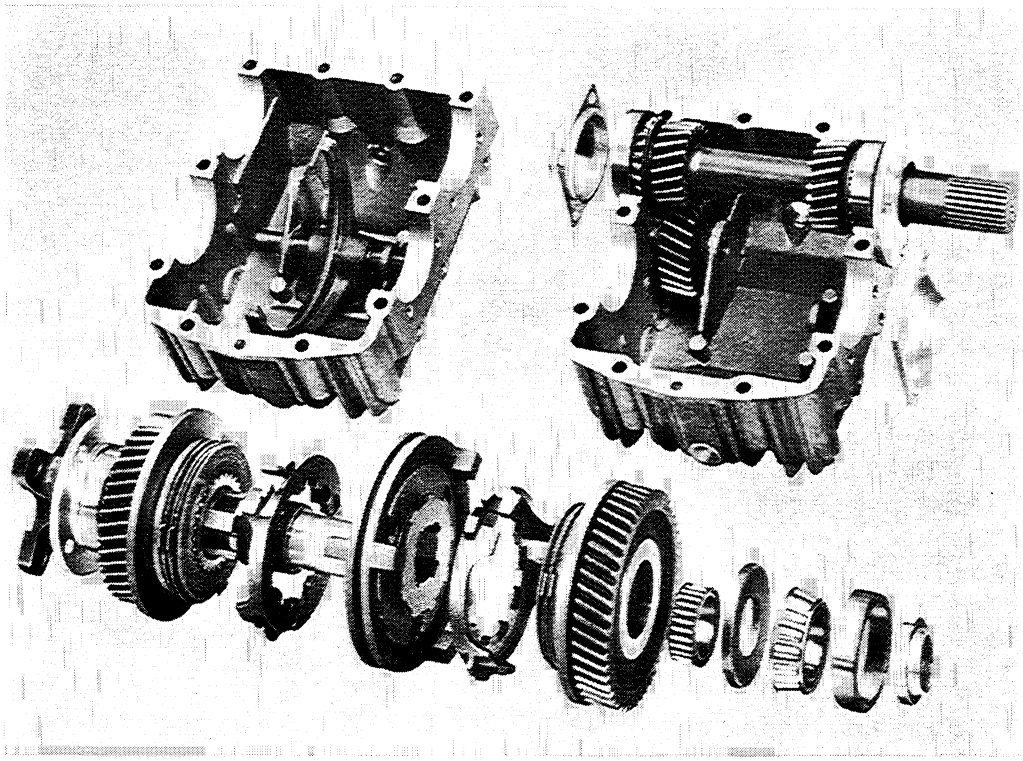
A fluid filler screw with dipstick and a fluid drain plug are screwed into the gear casing. The filler screw is provided with a breather hole.

The shaft for actuating the multiple-disc clutch extends through a cover on the side of the gear casing.

3. GEAR SETS

The transmission is equipped with shaved, case-hardened helical gears made of forged low-carbon alloy steel. The multi-spline driving shaft connecting the transmission with the engine is hardened as well.

The driven shaft (propeller side) of the transmission is fitted with a forged coupling flange, except on the V-drive model.



4. MULTIPLE-DISC CLUTCH INCLUDING OPERATION - POWER TRAIN

The engine torque is applied to the input shaft (36) in the specified direction of rotation and, in shifting position A (forward), via gear (44), the frictionally-engaged clutch discs (51 and 52) to the external disc carrier (57), and from there via the guide sleeve (59) to the output shaft (66).

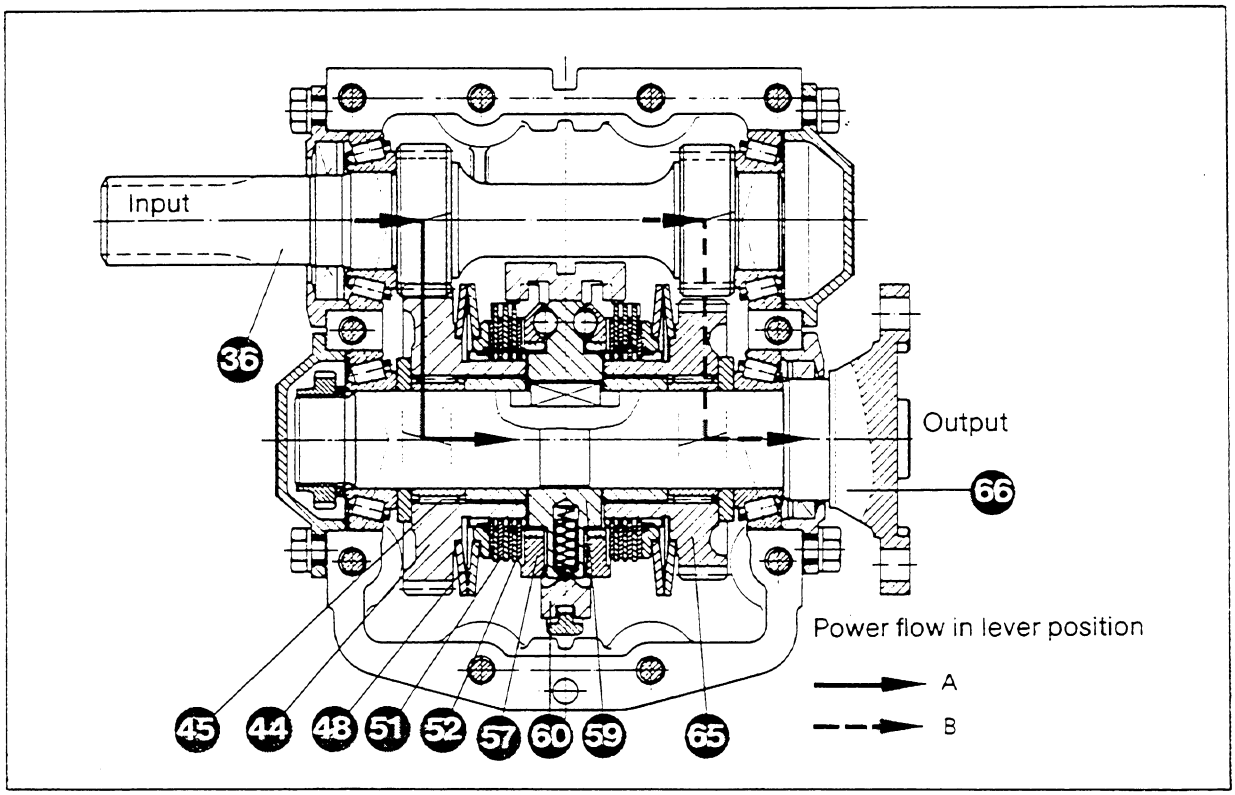
In shifting position B (reverse), the torque is transmitted from the input shaft (36) via the intermediate gear (not shown in cross-section), gear (65), clutch discs (51 and 52) to the external disc carrier (57), the guide sleeve (59) and the output shaft (66).

FUNCTION

The transmission uses a positively-driven, mechanically-operated multiple-disc clutch system mounted on the output shaft.

The thrust force required for obtaining positive frictional engagement between the clutch discs is provided by a servo system. This essentially comprises a number of balls which, by the rotary movement of the external disc carrier, are urged against inclined surfaces provided in pockets between the guide sleeve and the external disc carrier and in this manner exert axial pressure. The thrust force and, as a result, the transmittable friction torque are thus proportional to the input torque applied. Due to the cup springs (48) supporting the clutch disc stack and a limitation of the range of axial travel of the external disc carrier (57), the thrust force cannot exceed a predetermined value.

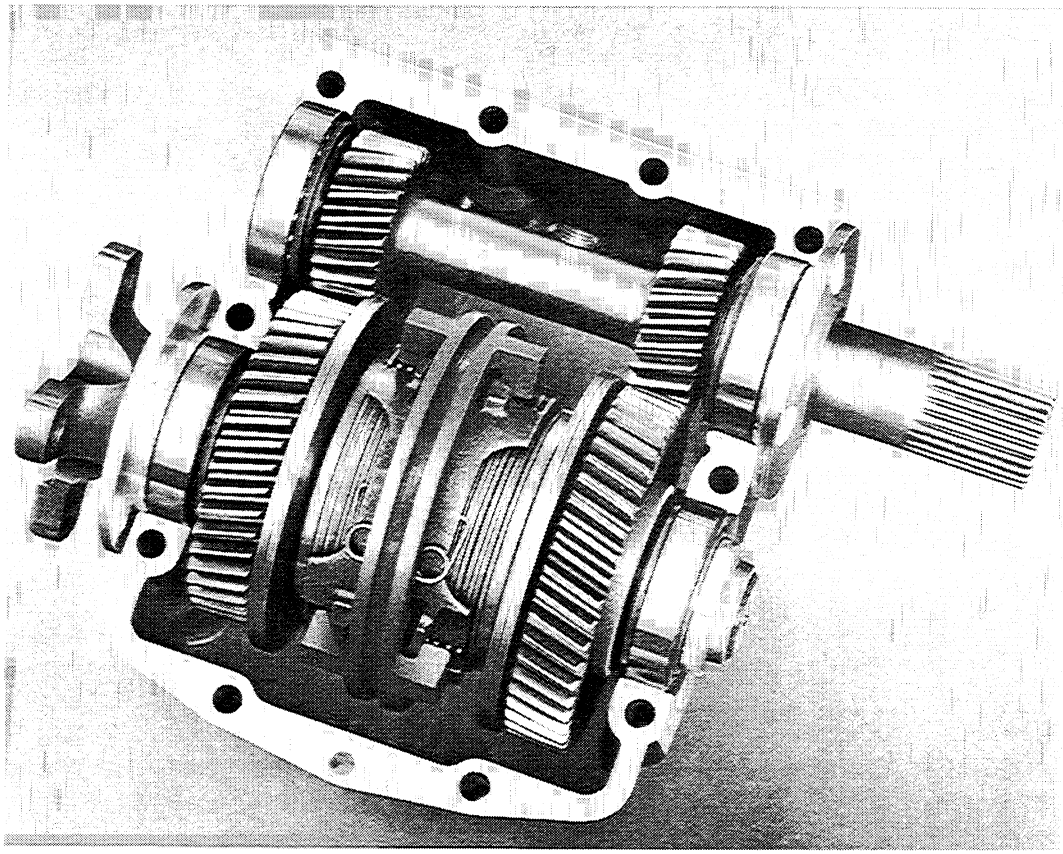
The actuating sleeve (60) is held in the middle position by spring-loaded pins. To initiate the shifting operation, the actuating sleeve (60) need merely be displaced axially by a shifting fork until the arresting force has been overcome. Then the actuating sleeve (60) is moved automatically by the spring-loaded pins, while the external disc carrier, which follows this movement, is rotated by the frictional forces exerted by the clutch discs, and the shifting operation is completed as described above.



5. SHAFT BEARINGS

Both the input and the output shafts are carried in amply-dimensioned taper roll bearings.

The intermediate gear and the movable gears are carried in sturdy needle roller bearings.



6. SHAFT SEALS

External sealing of the input and output shafts is provided by radial sealing rings. The running surface on the shafts is case-hardened.

7. LUBRICATION

The transmissions are immersion-lubricated. The bearings are generously supplied with splash fluid and fluid mist.

INSTALLATION

1. DELIVERY CONDITION

For safety reasons, the gearbox is NOT filled with fluid for shipment. The actuating lever is mounted on the actuating shaft.

Before leaving the factory, each transmission is subjected to a test run with the prescribed ATF fluid. The residual oil remaining in the transmission after draining acts as a preservative and provides

reliable protection against corrosion for at least one year if the units are properly stored.

2. PAINTING THE GEARBOX

ALWAYS COVER THE RUNNING SURFACES AND SEALING LIPS OF THE RADIAL SEALING RINGS ON BOTH SHAFTS BEFORE PAINTING. Make certain that the breather hole on the oil filler screw is not closed by the paint. Indicating plates should remain clearly legible.

3. CONNECTION OF GEARBOX WITH ENGINE

A torsio-elastic damping plate between the engine and the transmission is to compensate for minor alignment errors and to protect the input shaft from external forces and loads. Radial play should be at least 0.5mm.

4. SUSPENSION OF ENGINE-GEARBOX ASSEMBLY IN THE BOAT

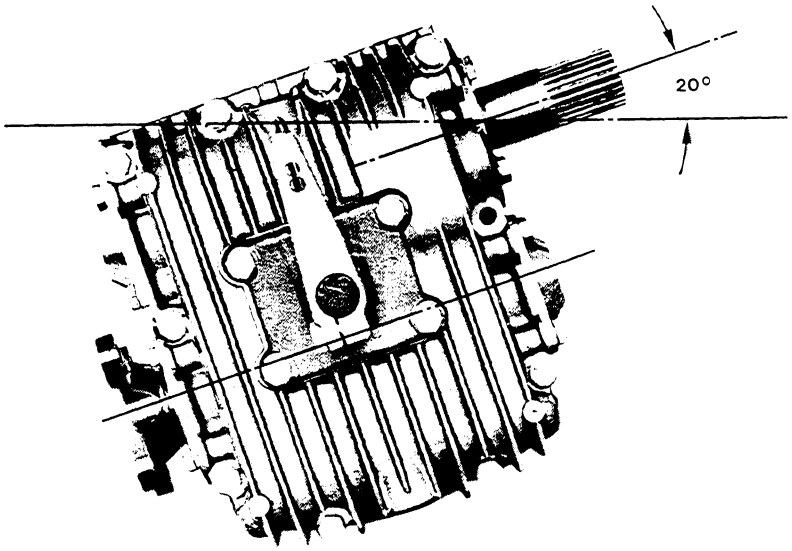
To protect the gearbox from detrimental stresses and loads, provision should be made for elastic suspension of the engine-gearbox assembly in the boat or craft.

The fluid drain plug of the gearbox should be conveniently accessible.

5. POSITION OF GEARBOX IN THE BOAT

The inclination of the gearbox unit in the direction of the shafts should not permanently exceed an angle of 20 degrees (15 degrees for the V-drive model). (See illustration.)

The gearbox also can be mounted with the output shaft in the upward position. Interchange the fluid dipstick and the fluid drain plug in this case.



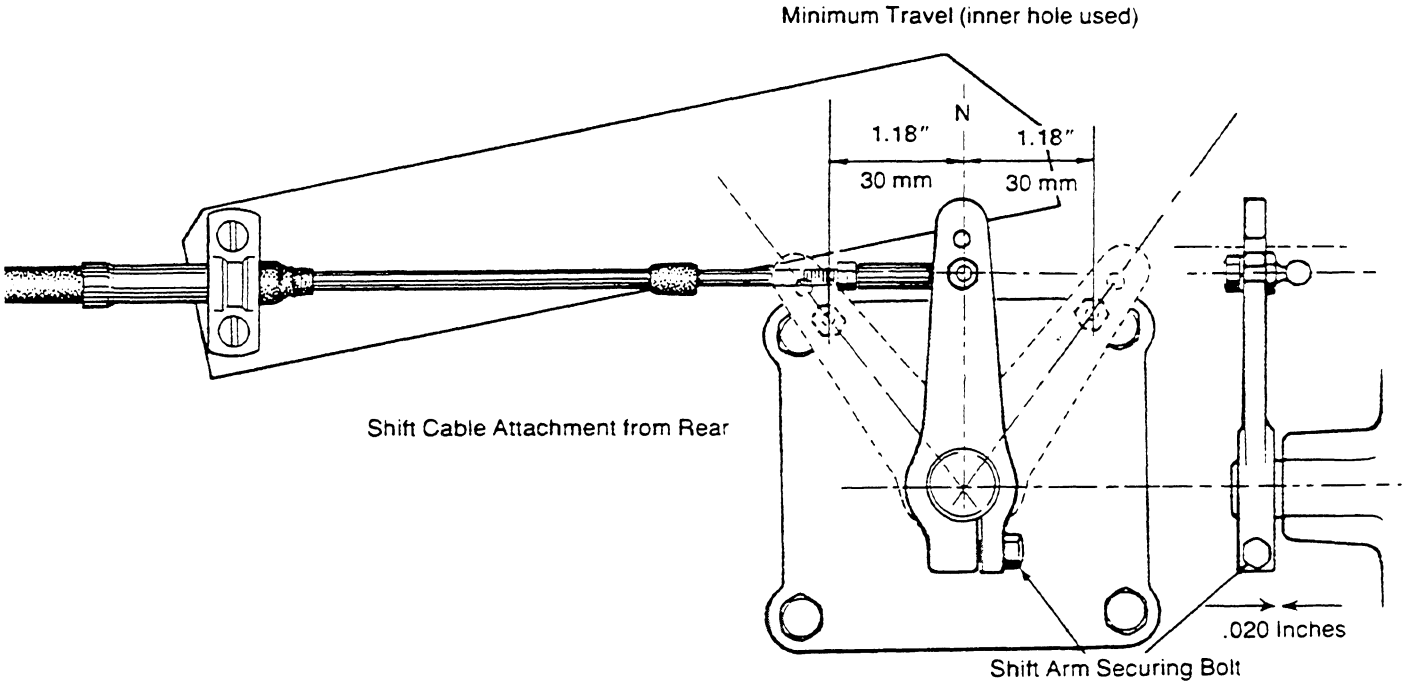
6. OPERATION OF GEARBOX.

Gear changing requires minimal effort. The gearbox is suitable for single-lever remote control. Upon loosening the retaining screw, the actuating lever (see illustration) can be moved to any position required for the control elements (cable or rod linkage). Make certain that the lever does not contact the actuating lever cover plate; the minimum distance between the lever and cover should be 0.5mm.

The control cable or rod should be arranged at right angles to the actuating lever in the neutral position of the lever.

A larger amount of lever travel is not detrimental.

However, if the lever travel is shorter, proper gear engagement might be impeded which will result in damage from premature wear and excessive heat generation.



The position of the cover plate underneath the actuating lever is factory-adjusted to ensure equal lever travel from neutral to position A or B.

CAUTION

Do not loosen the capscrews mounting this assembly. Removal or disturbing of the shift cover will void all warranty responsibilities by Westerbeke.

When installing the gearbox, make certain that shifting is not impeded (e.g., by restricted movability of the cable or rod linkage; by unsuitably positioned guide sheaves; too small bending radius, etc.)

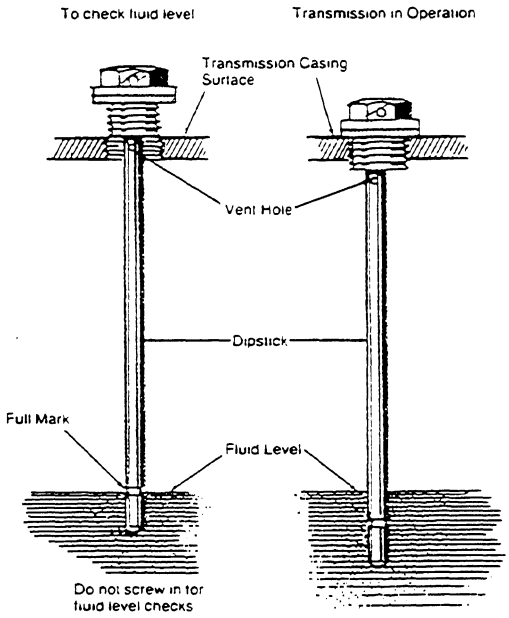
7. ENGINE-GEARBOX COMPARTMENT.

Care should be taken that the engine-gearbox compartment is properly ventilated.

OPERATION

1. INITIAL OPERATION.

Fill the gearbox with automatic transmission fluid. The fluid level is indicated by the index mark on the dipstick (see illustration).



To check the fluid level, just insert the dipstick. Do not screw in. Retighten the hex screw with the dipstick after the fluid level check. Do not omit the O-ring seal.

2. OPERATING TEMPERATURE

The maximum permissible temperature of the transmission fluid is 130°C(266°F). If this temperature is to be exceeded, an optional fluid cooler is available.

3. OPERATION OF GEARBOX

The zero position of the operating lever on the control console must coincide with the zero position of the actuating lever on the transmission. Shifting is initiated by a cable or rod linkage via the actuating lever and an actuating cam. The completion of the gear changing operation is servo-automatically controlled.

Gear changing should be smooth, not too slow, and continuous (without interruption). Direct changes from forward to reverse are permissible, since the multiple-disc clutch permits gear changing at high RPM, including sudden reversing at top speeds in the event of danger.

4. OPERATION WITHOUT LOAD.

Rotation of the propeller without load (e.g., while the boat is sailing, being towed or anchored in a river), and idling the engine with the propeller stopped, will have no detrimental effects on the gearbox.

Locking of the propeller shaft by an additional brake is not required, as locking is possible by engaging the reverse gear. Do NOT sail while engaged in forward.

5. LAY-UP PERIODS.

If the transmission is not used for periods of more than 1 year, it should be filled completely with fluid of the same grade to prevent corrosion. Protect the input shaft and the output flange by means of an anticorrosive coating,if required.

6. PREPARATION FOR RE-USE.

Drain the transmission of all fluid and refill to the proper level with the prescribed fluid.

MAINTENANCE

1. TRANSMISSION FLUID

To ensure trouble-free operation of the clutch, use only automatic transmission fluid (ATF).

Under no circumstances should the fluid contain any additives, such as molybdenum sulphite.

Commercial Automatic Transmission Fluid (ATF), Type A or Dexron II, is recommended.

2. OIL QUANTITY

HBW 100 Approximately 0.37 U.S. Quarts (0.35 Liters)

3. FLUID LEVEL CHECKS

Check the fluid level in the transmission daily. Correct fluid level is indicated by the index mark on the dipstick. (See item 1 under OPERATION.) Always use the same fluid grade when topping off.

4. FLUID CHANGE

Change the fluid for the first time after 25 hours of operation, then at intervals of at least once per year.

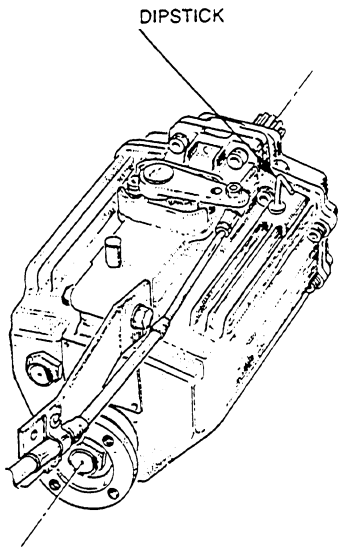
5. CHECKING THE CABLE OR ROD LINKAGE

The cable or rod linkage should be checked at frequent intervals. Also, check the zero position of the operating lever (on the control console) and of the actuating lever (on the gearbox) at this time. The minimum lever travel from the neutral position to the operating positions (0-A = 0-B) should be 35mm for the outer and 30mm for the inner pivot point. Make certain that these minimum values are safely reached. Check the cable or rod linkage for easy movability (see item 6 under INSTALLATION).

6. OVERHAUL.

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

BW-7 TRANSMISSION



General

The transmission's gear ratio is 2.05 to 1. The BW-7 transmission is made of a lightweight , high-strength, corrosion-resistant aluminum alloy suitable for the marine environment. This manual transmission rotates opposite to the engine when in forward gear. The BW-7 transmits its power with case-hardened helical gears and, in reverse, an intermediate gear. The reversing process is carried out by a servo double disc system. For safety reasons, the transmission is **NOT** filled with lubricating oil for shipment. Before leaving the factory, however, each transmission is thoroughly tested with oil in the transmission. This testing, among other things, provides all internal parts with a coating of oil. This oil acts as a preservative, providing reliable protection against corrosion for at least one year if the transmission is properly stored.

Lubrication

The BW-7 transmission is an immersion-lubricated type. Fill the transmission up to or near the top of the machined notch cut on the dipstick with SAE 20 W/20 or SAE 30 weight engine oil exclusively. Multi-grade oils are not to be used in this transmission. **DO NOT** mix grades of oil! Lubricating oils may have an API specification of CC, CD, SC, SD, or SE.

The oil capacity for the BW-7 transmission is approximately 1.0 quart (1.0 liter). Check the oil level daily after the engine has been warmed and stopped. The oil level should be maintained at the top of the machined flat on the dipstick when the dipstick is completely inserted into the transmission housing. Make sure that the two O-ring gaskets on the dipstick are in good shape. These O-rings will help keep the dipstick in place.

Change the transmission oil after the first 30 hours of engine operation and thereafter every 250 hours (or once per year, minimum). The BW-7 has a drain plug for draining the old oil. To ensure that most of the old oil is drained from the transmission, run the engine in NEUTRAL for approximately 10 to 15 minutes so the oil may warm and flow better from the transmission. This oil may also be removed by inserting a small tube through the dipstick opening (where the oil is added) and attaching a pump onto the tube so the oil may be sucked out.

The operating oil temperature must not exceed 250° F (120° C).

Alignment

Misalignment between the transmission's coupling and the propeller shaft's coupling can create serious problems. Ensure that the alignment procedures outlined in the "Propeller Coupling," the " Propeller, " and the " Alignment of the Engine" sections of this manual are followed, pages 11 and 12.

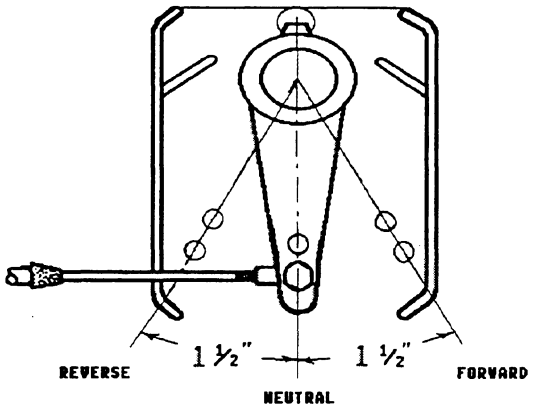
Controls

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

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

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

GEAR BOX SHIFT LEVER



Shifting

To shift the transmission from NEUTRAL into FORWARD, exert a *heavy push* to the remote control lever. A gentle throw may not carry enough force to actually shift the transmission's internal gears. A gentle throw is signalled by the transmission not engaging into the desired drive. Make sure the remote control lever is lubricated at lease once each operating season. Shift the transmission while the engine is running at 1500 rpm or below.

CAUTION

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

Sailing Operation

The BW-7 transmission should be left in its NEUTRAL position while sailing. Leaving the transmission in NEUTRAL while sailing alleviates unnecessary drag on the vessel because the propeller is able to freewheel (spin). DO NOT leave the transmission in its FORWARD gear while sailing. (Leaving the transmission in NEUTRAL is just good sailing practice.)

Service

If any seal on the transmission shows signs of leaking, have the transmission looked at by a qualified Westerbeke Dealer. This problem, especially concerning the rear seal, is often contributed to an improper alignment of the transmission's coupling and the propeller shaft's coupling. Refer to the "Alignment of the Engine" section of this manual, page 11.

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

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

Cooling

The BW-7 transmission is sea water-cooled. Sea water enters the transmission through a stainless steel inlet pipe located at the base of the bell housing. This water helps to cool the transmission's lubricating oil.

LAY-UP AND RECOMMISSIONING

General

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

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

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

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

Fresh Water Cooling System

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

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

Lubrication System

With the engine warm, drain all the 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 during its removal.)

When installing the new oil filter, be sure to apply a small amount of oil on the rubber sealing gasket at the base of the filter. Fill the sump with the correct amount of oil for your engine model. Use an oil with an API specification of SC or SD. Run the engine and check for proper oil pressure and ensure that there are no leaks.

CAUTION

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

Fuel System

Top off your fuel tanks with regular or unleaded gasoline with an octane rating of 89 or better. Fuel additives should be added at this time to control algae and condition the fuel. Care should be taken that the additives used are compatible with the primary filter/water separator used in the system. Change the element in your primary fuel filter/water separator, if the fuel system contains one, and clean the separator sediment bowl. Clean the filter screen in the fuel lift pump and in the carburetor.

Sea Water Circuit

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

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

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

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

Intake Manifold and Through-Hull Exhaust

Place a clean cloth, lightly soaked in lubricating oil, around the air arrester. Be sure to remove this cloth before recommissioning. Make a note to remove the cloth prior to start-up. The through-hull exhaust part can be blocked in the same manner.

Starter Motor

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

Cylinder Lubrication

Fogging the engine should be done as the last of the antifreeze mixture is drawn into the sea water circuit. Remove the air intake screen (the air filter) and spray Marvel Mystery Oil or another commercially available fogging oil into the carburetor while the engine is running. Spray enough oil to stall the engine. This will coat the walls of the cylinders, pistons, and valve surfaces with this protective oil. Remove the spark plugs and spray a small amount of this oil into each spark plug hole and turn the engine over two or three complete revolutions by hand. Reinstall, but do not tighten, the spark plugs, as these will need to be cleaned and gapped prior to recommissioning. Close off the carburetor's air filter with an oily rag.

Spares

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

Batteries

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

Recommissioning

The recommissioning of your Westerbeke unit after a seasonal lay-up generally follows the same procedures as those presented in the "PREPARATION FOR STARTING" section, page 21, regarding preparation for starting and normal starts. However, some of the lay-up procedures will need to be counteracted before starting the engine.

1. Remove the oil-soaked cloths from the intake manifold and from the through-hull exhaust port.

2. Remove the sea water pump cover and gasket. Discard the gasket. Install the sea water pump impeller removed during lay-up (or a replacement, if required). Install the sea water pump cover with a new cover gasket.

WARNING

Wear rubber gloves, a rubber apron, and eye protection when servicing batteries.

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

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

4. Check the condition of the zinc anode in the sea water circuit and clean or replace the anode as needed. Note that it is not necessary to flush the antifreeze/fresh water solution from the sea water coolant system. When the unit is put into operation, the system will self-flush in a short period of time with no adverse affects.

5. Start the unit in accordance with those procedures found in the "STARTING PROCEDURE" section of this manual, page 24.

YOUR NOTES

SPARE PARTS LIST

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

Listed below are those spare parts that should be carried on board at all times.

1. An Impeller Kit
2. An Electric Fuel Lift Pump Filter and a Secondary Fuel Filter.
3. An Alternator/Sea Water Pump Belt
4. Hose Clamps
5. A Spare Oil Filter with a Spare Quart of Engine Oil along with a Quart of Transmission Lubricant and a Gallon of Pre-mixed Antifreeze.

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

1. Spark Plugs
2. Coil
3. Cooling System Hoses
4. An Alternator
5. A Starter
6. A 20 Amp DC Circuit Breaker
7. An Electric Fuel Lift Pump
8. A Sea Water Pump
9. Battery Terminal Connectors

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

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