

Service Manual

4G63, 4G64 Gasoline Engine

4G63 AA0001-ZZ9999

4G64 AA0001-ZZ9999

For use with GC15, GC18, GC20, GC25, GC30,
GC15K, GC18K, GC20K, GC25K, GC30K,
GP15, GP18, GP20, GP25, GP30, GP35,
GP15K, GP18K, GP20K, GP25K, GP30K, GP35K
Lift Trucks

Product: Caterpillar 4G63, 4G64 Gasoline Engine Service Repair Workshop Manual
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FOREWORD

This service manual has instructions and procedures for the 4G63 and 4G64 gasoline engines. The information, specifications, and illustrations used in this manual are based on information that was current at the time this issue was written.

Correct servicing will give the engines a long productive life. Before attempting to start a test, repair or rebuild job, be sure that you have studied the respective sections of this manual, and know all the components you will work on.

Continuing advancement and improvement of product design may have caused changes to your engines which are not included in this manual.

Whenever a question arises regarding your engines, or this manual, please consult your dealer for the latest available information.

WARNING INDICATION

NOTE

Indicates supplementary explanation.

CAUTION

Indicates items that users must always observe in order to prevent injuries and damage to the vehicle and surrounding area.

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HOW TO READ THIS MANUAL

Scope of Explanation

This book describes the service procedures for the engine removed from the vehicle.

For the procedure concerning removal of the engine from the vehicle and on-vehicle inspection and servicing, refer to the appropriate service manuals separately prepared for the individual models.

Maintenance and Servicing Procedures

- (1) A diagram of the component parts is provided near the front of each section in order to give the reader a better understanding of the installed condition of component parts.
- (2) The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures; the symbol **N** indicates a non-reusable part; the tightening torque is provided where applicable.

Removal steps:

The part designation number corresponds to the number in the illustration to indicate removal steps.

Installation steps:

Specified in case installation is impossible in reverse order of removal steps. Omitted if installation is possible in reverse order of removal steps.

Disassembly steps:

The part designation number corresponds to the number in the illustration to indicate disassembly steps.

Reassembly steps:

Specified in case reassembly is impossible in reverse order of disassembly steps. Omitted if reassembly is possible in reverse order of disassembly steps.

Classification of Major Maintenance/Service Points

When there are major points relative to maintenance and servicing procedures (such as essential maintenance and service points, maintenance and service standard values, information regarding the use of special tools, etc.), these are arranged together as major maintenance and service points and explained in detail.

◊**A**◊: Indicates that there are essential points for removal or disassembly.

◆**B**◆: Indicates that there are essential points for installation or reassembly.

Symbols for Lubrication, Sealants and Adhesives

Information concerning the location for lubrication and for application of sealants and adhesives is provided by using symbols, the diagram of component parts, or on the page following the component parts page.



Grease
(multipurpose grease unless there is a brand or type specified)



Sealant or adhesive



Brake fluid, automatic transmission fluid or air conditioner compressor oil



Engine oil or gear oil

Inspection

Only the inspections to be performed by using special tools or measuring instruments are covered. General service procedures not covered in this manual, such as visual inspections and cleaning of parts, however, should always be performed during actual service operations.

FRONT CASE AND OIL PAN 47

REMOVAL AND INSTALLATION

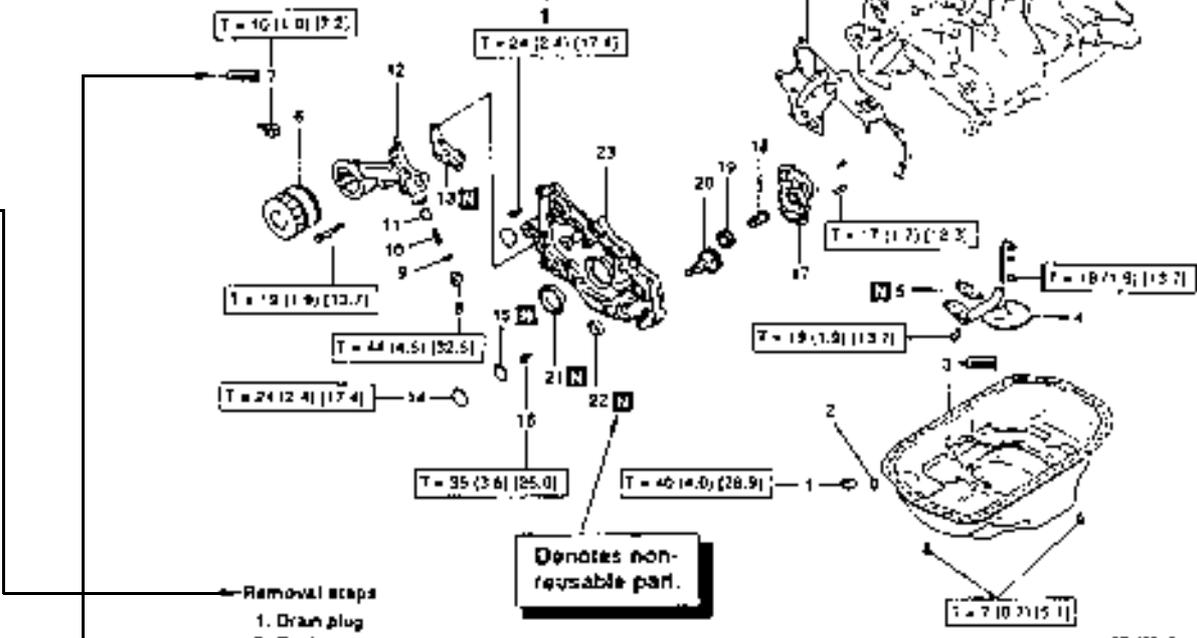
Indicates the section title.

Unit: N·m (kgf·m) (lbf·ft)

Indicates the page number

Denotes tightening torque.

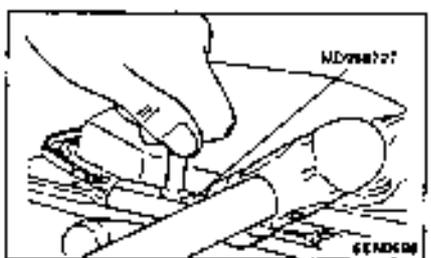
Denotes non-reusable part.



- Removal steps
1. Drain plug
 2. Gasket
 3. Oil pan
 4. Oil screen
 5. Gasket
 6. Oil hose
 7. Oil pressure switch
 8. Relief plug
 9. Gasket
 10. Relief spring
 11. Plunger
 12. Oil filter bracket
 13. Gasket
 14. Plug
 15. O-ring
 16. Bolt
 17. Oil pump cover
 18. Oil pump shaft

- ⊕C 19 Oil pump driver gear
- ⊕C 20 Oil pump driver gear
- ⊕B 21. Oil seal
- ⊕A 22 Oil seal
- 23. Front case
- 24. Gasket

Lubricate all internal parts with engine oil during assembly.

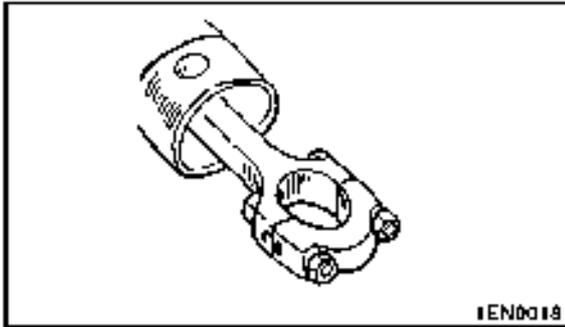


REMOVAL SERVICE POINTS

- Oil pan removal
- (1) Remove all oil pan bolts.
 - (2) Drive in the special tool between the cylinder block and oil pan.
 - (3) Slide the tool by striking the edge of the special tool to separate the oil pan from the cylinder block.

This letter corresponds to the one assigned to a part in the removal, installation, disassembly or reassembly steps that are indicated in the drawing on the first page of each section.

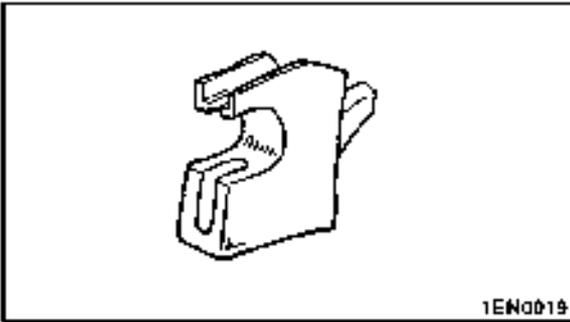
Operating procedures, cautions, etc. on removal installation, disassembly and reassembly are described.



PRECAUTIONS BEFORE SERVICE

Removal and Disassembly

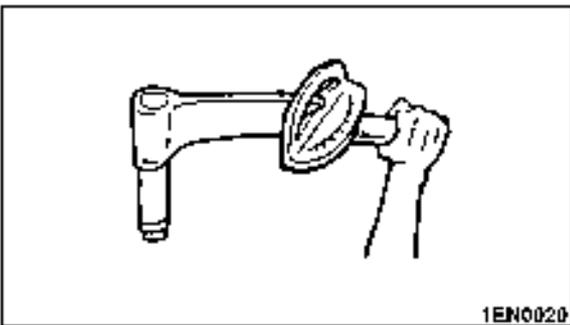
To prevent incorrect installation or reassembly and for ease of operation, put mating marks on the parts where no function is adversely affected.



Special Tool

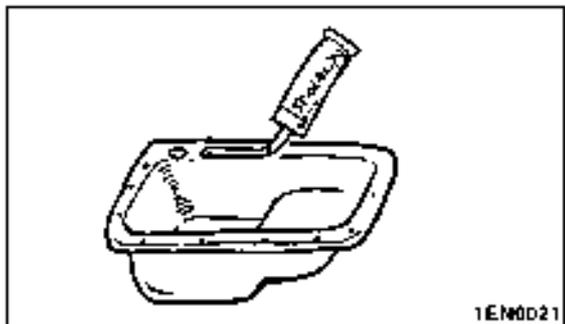
Be sure to use special tools when their use is specified for the operation.

Using substitute tools will result in malfunction of the part or damage it.



Tightening Torque

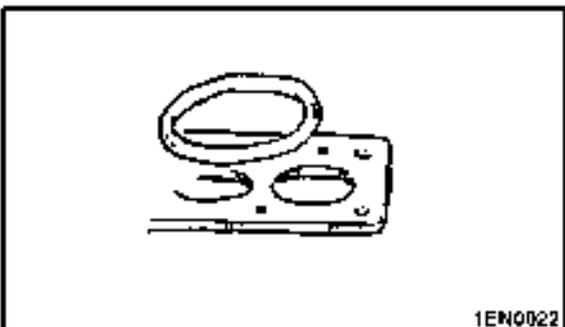
Tighten the part properly to specified torque.



Sealant

Use specified brand of sealant.

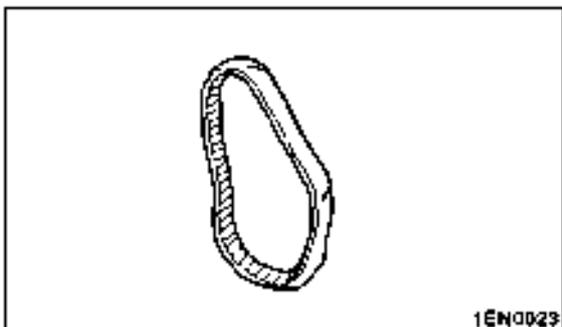
Use of sealant other than specified sealant may cause water or oil leaks.



Replacement Part

When oil seal, O-ring, packing and gasket have been removed, be sure to replace them with new parts.

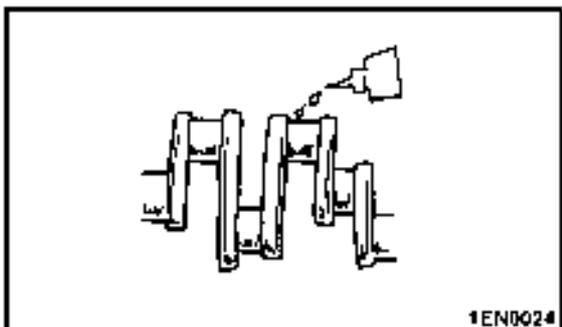
However, rocker cover gasket may be reused if it is not damaged.



Rubber Parts

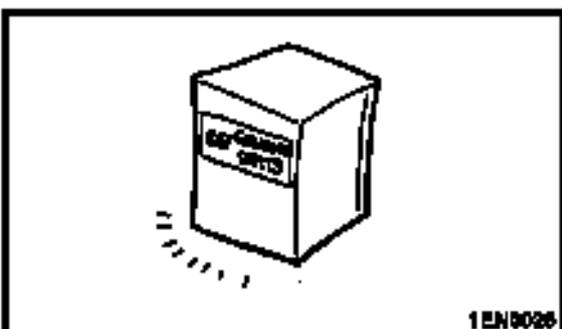
Do not stain timing belt or V-belt with oil or water.

Therefore, do not clean the pulley and sprocket with detergent.



Oil and Grease

Before reassembly, apply specified oil to the rotating and sliding parts.



Genuine Part

When a part is to be replaced, be sure to use a genuine part.

For selection of appropriate part, refer to the Parts Catalog.

GENERAL

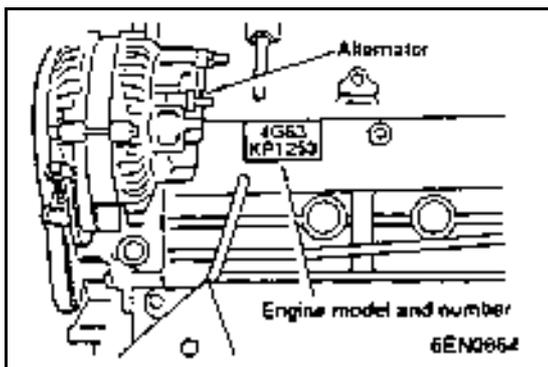
Engine Models and Numbers

Engine model	Fuel type
4G63-32-FDA	Gasoline
4G63-32-FDS	Gasoline
4G63-32-FLA	L.P.G.
4G63-32-FL	L.P.G.
4G63-32-FDB	Gasoline
4G63-32-FLB	L.P.G.
4G64-32-FDS	Gasoline
4G64-32-FL	L.P.G.
4G64-32-FDB	Gasoline
4G64-32-FLB	L.P.G.

Indication of engine model and number

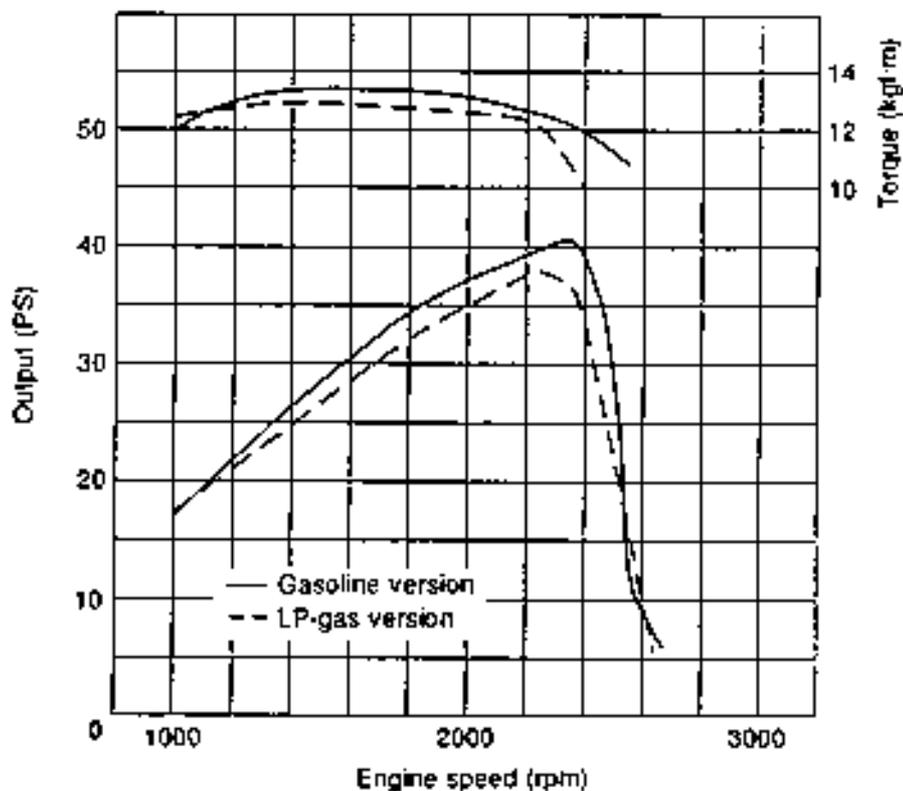
The engine model and serial number are stamped on the right side of cylinder block surface.

Engine model	Engine number
4G63, 4G64	AA0001 to YY9999



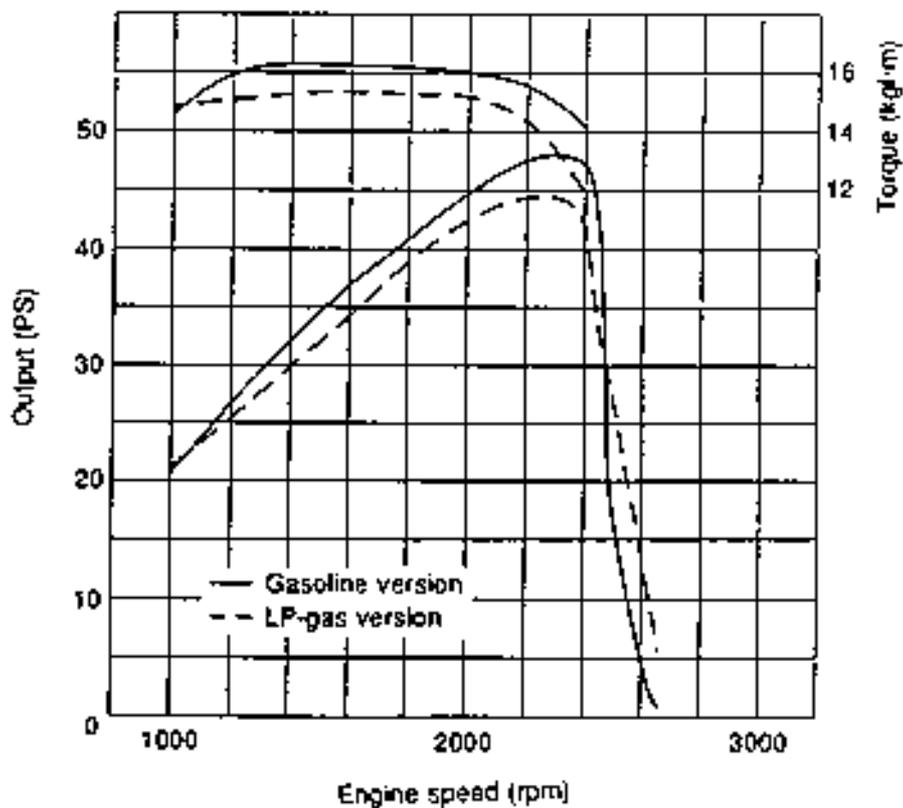
PERFORMANCE CURVES

4G63



6EN0913

4G64

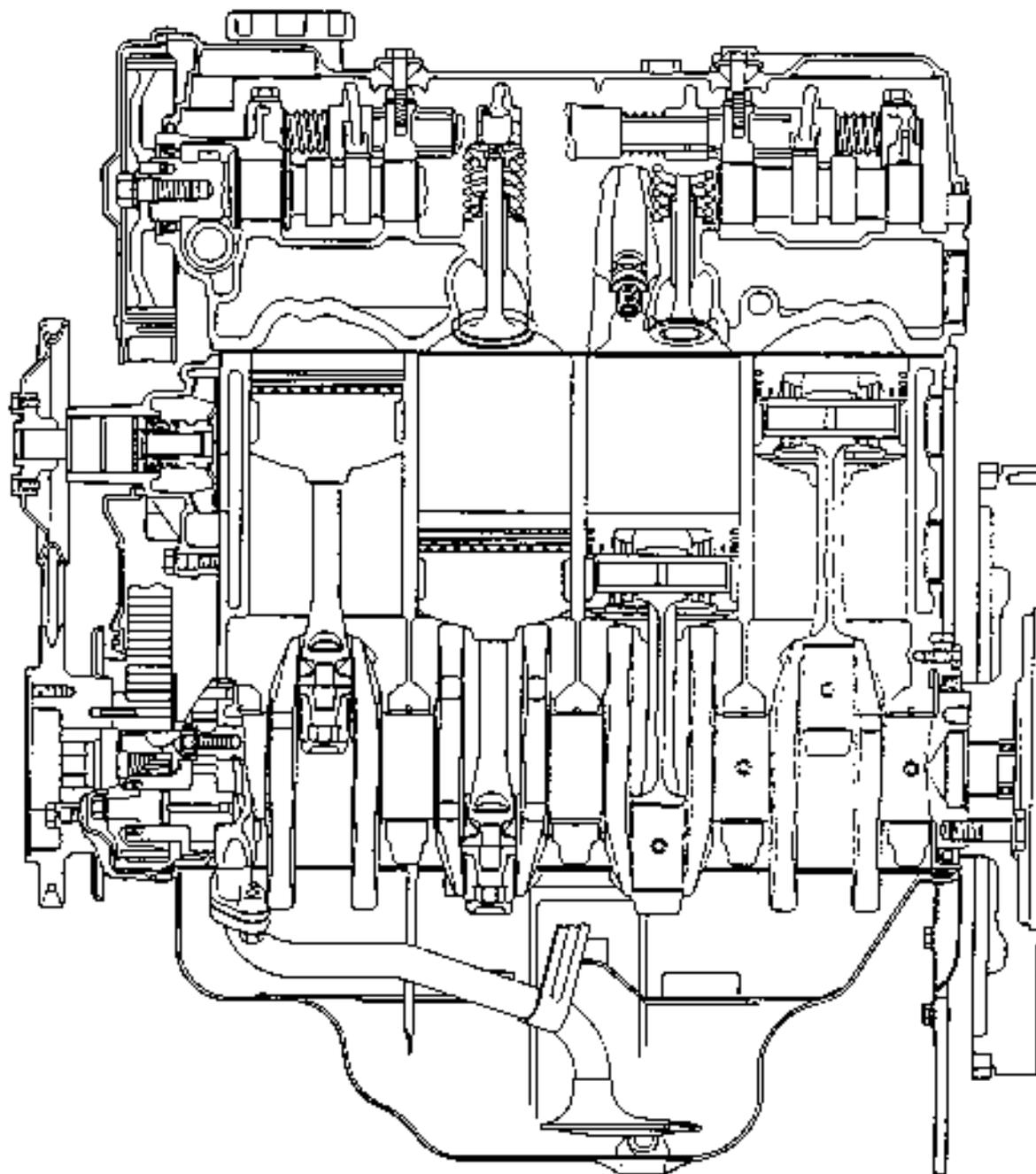


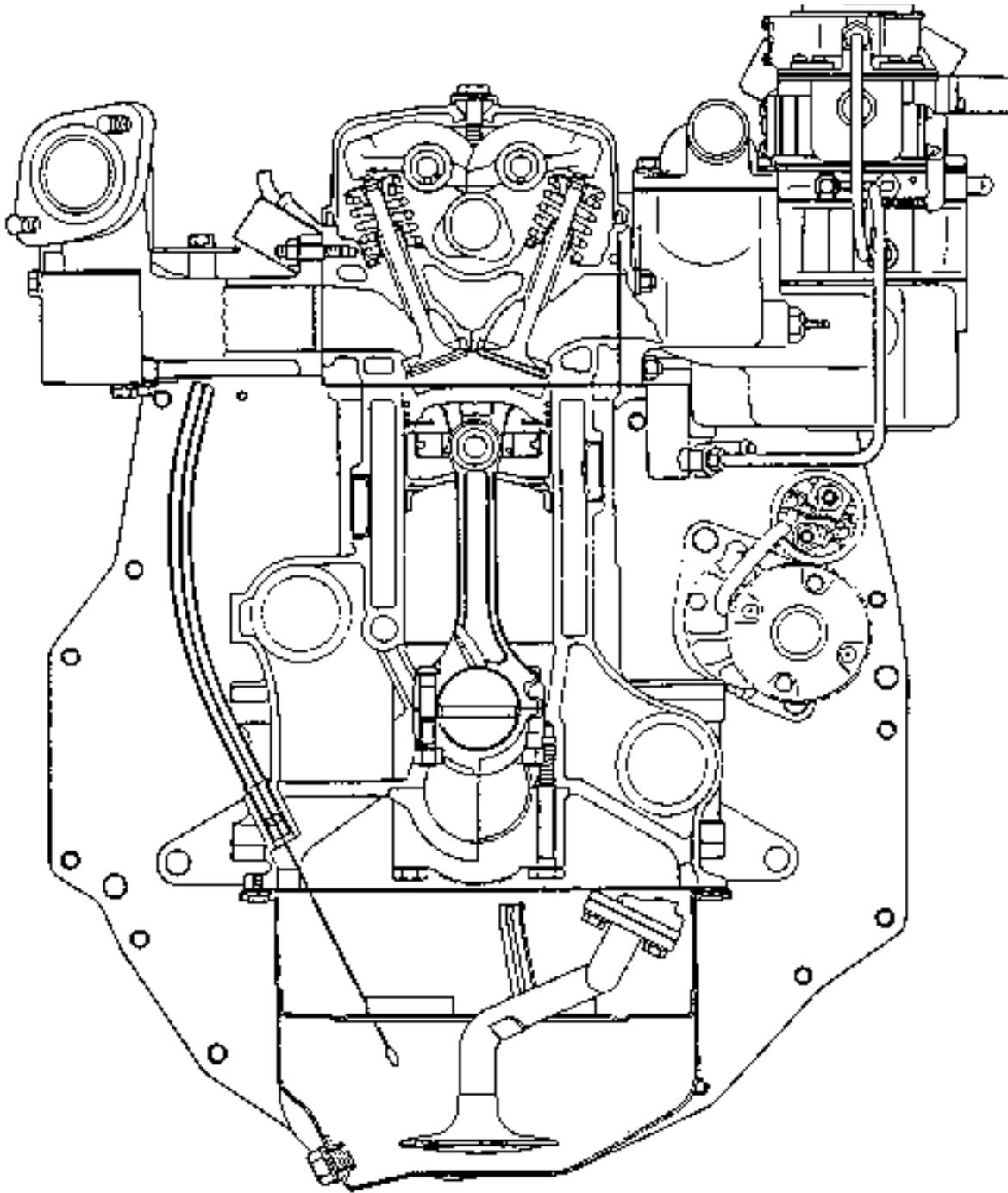
6EN0914

GENERAL SPECIFICATIONS

Item		Engine model	4G63	4G64
Type		Water-cooled, 4-cycle, gasoline-powered and L.P.G.-powered		
No. of cylinders and arrangement		4, in-line		
Combustion chamber type		Semi-spherical		
Valve mechanism		OHC		
Total displacement, cm ³ (cc) [cu in.]		1997 (1997) [122]	2350 (2350) [143]	
Bore x stroke, mm (in.)		85 x 88 (3.35 x 3.46)	86.5 x 100 (3.41 x 3.94)	
Dry weight, kg (lb)		31FD	142 (313)	145 (320)
		31FW	139 (306)	142 (313)
Compression ratio		8.5	8.6	
Compression pressure, kPa (kgf/cm ²) [psi]		1128 (11.5) [163.5]		
Valve timing		Intake valve	Open	12° BTDC
			Close	40° ABDC
		Exhaust valve	Open	54° BBDC
			Close	6° ATDC
Firing order		1 - 3 - 4 - 2		
Ignition timing, BTDC/rpm		4° /740 (gasoline), 9° /740 (L.P.G.)		
Fuel pump		Mechanical (diaphragm type)		
Carburetor		Down-draft type		
Governor		Pneumatic type		
Lubrication system		Pressure feed, full-flow filtration type		
Oil pump		Gear, driven by timing belt		
Oil filter		Filter paper, cartridge type		
Cooling system		Water-cooled, forced circulation		
Water pump		Centrifugal, driven by V-belt		
Thermostat		Wax type		
Electrical system		12V DC, negative ground		
Alternator, (12V - 65A)		Alternator current, built-in fan and regulator		
Starter motor, (12V - 1.2 kW)		Reduction drive		
Distributor		Contact point less (transistor type)		
Spark plug (NGK or ND)		Gasoline	BP4ES or W14EX-U	
		L.P.G.	BP5ES or W16EX-U	
Quantity of lubricating oil, cm ³ (liter) [U.S. gal]		4800 (4.8) [1.27] (including 300 cm ³ (0.3 liter) [0.08 U.S. gal] in oil filter)		
Quantity of coolant, cm ³ (liter) [U.S. gal]		3100 (3.1) [0.82] (in engine proper)		

4G63 SIDE CUTAWAY VIEW



4G63 END CUTAWAY VIEW

6EN0833

Unit: mm (in.)

Item		Standard value	Limit	Remarks		
Cylinder Head	Flatness of gasket surface		0.03 (0.0012)			
	Grinding limit			0.2 (0.008)	Total resurfacing depth of both cylinder head and cylinder block	
	Overall height		89.9 to 90.1 (3.539 to 3.547)			
	Oversize rework dimensions of valve guide hole		0.05 (0.0020)	13.05 to 13.07 (0.5138 to 0.5146)		
			0.25 (0.0098)	13.25 to 13.27 (0.5217 to 0.5224)		
			0.50 (0.0197)	13.55 to 13.57 (0.5315 to 0.5343)		
	Oversize rework dimensions of valve seat ring hole	4G63	Intake	0.30 (0.0118)	44.30 to 44.33 (1.7441 to 1.7453)	
				0.60 (0.0236)	44.60 to 44.63 (1.7559 to 1.7571)	
			Exhaust	0.30 (0.0118)	38.30 to 38.33 (1.5079 to 1.5091)	
				0.60 (0.0236)	38.60 to 38.63 (1.5197 to 1.5209)	
		4G64	Intake	0.30 (0.0118)	47.30 to 47.33 (1.8622 to 1.8634)	
				0.60 (0.0236)	47.60 to 47.63 (1.8740 to 1.8752)	
			Exhaust	0.30 (0.0118)	40.30 to 40.33 (1.5866 to 1.5878)	
				0.60 (0.0236)	40.60 to 40.63 (1.5984 to 1.5996)	
Camshaft	Cam height		Intake	41.62 (1.6386)	41.12 (1.6189)	
			Exhaust	41.62 (1.6386)	41.12 (1.6189)	
	Journal diameter		33.935 to 33.950 (1.33602 to 1.33661)			
	Oil clearance		0.05 to 0.09 (0.0020 to 0.0035)			
Valve	Overall length	4G63	Intake	109.8 (4.328)	109.3 (4.3031)	
			Exhaust	106.6 (4.197)	106.1 (4.126)	
		4G64	Intake	108.7 (4.280)	108.2 (4.260)	
			Exhaust	105.2 (4.142)	104.7 (4.122)	
	Valve stem projection		42.05 (1.6555)		42.55 (1.6752)	
	Stem diameter		Intake	7.960 to 7.975 (0.31339 to 0.31398)		
			Exhaust	7.930 to 7.950 (0.31220 to 0.31299)		
	Face angle		45° to 45.5°			
	Thickness of valve head (margin)		Intake	1.2 (0.047)		
			Exhaust	2.0 (0.079)		
	Stem-to-guide clearance		Intake	0.03 to 0.06 (0.0012 to 0.0024)		
Exhaust			0.05 to 0.09 (0.0020 to 0.0035)			
Valve spring	Free height		48.0 (1.89)	47.0 (1.85)		
	Load/installed height		176.5 N (18 kgf) [39.7 lbf]/40.4 (1.591)			
	Out-of-squareness		2° or less		4°	

Unit: mm (in.)

Item		Standard value	Limit	Remarks	
Valve guide	Overall length	Intake	47 (1.85)		
		Exhaust	52 (2.05)		
	Inner diameter		8.000 to 8.018 (0.31496 to 0.31567)		
Valve seat	Valve contact width		0.9 to 1.3 (0.035 to 0.051)		
	Sinkage			0.2 (0.008)	
Piston	Outside diameter	4G63	84.97 to 85.00 (3.3453 to 3.3465)		
		4G64	86.47 to 86.50 (3.4043 to 3.4055)		
	Piston clearance		0.02 to 0.40 (0.0008 to 0.0016)		
Piston ring	End gap	No. 1 ring	0.25 to 0.40 (0.0098 to 0.0157)	0.8 (0.031)	
		No. 2 ring	0.45 to 0.60 (0.0177 to 0.0236)	0.8 (0.031)	
		Oil ring	0.20 to 0.60 (0.0079 to 0.0236)	1.0 (0.039)	
	Ring-to-ring groove clearance	No. 1	4G63	0.02 to 0.06 (0.0008 to 0.0024)	
			4G64	0.03 to 0.07 (0.0012 to 0.0028)	
		No. 2	4G63	0.02 to 0.06 (0.0008 to 0.0024)	
			4G64	0.03 to 0.07 (0.0012 to 0.0028)	
Piston pin	Outside diameter		22.002 to 22.005 (0.86622 to 0.86634)		
	Press-in load (at room temperature), N (kgf) [lbf]		7350 to 17160 (750 to 1750) [1650 to 3860]		
Connecting rod	Big end center-to-small end center length		149.0 to 150.0 (5.902 to 5.906)		
	Bend		0.05 (0.0020)		
	Twist		0.10 (0.0039)		
	Big end thrust clearance		0.10 to 0.25 (0.0039 to 0.0098)		
Crankshaft	End play		0.05 to 0.18 (0.0020 to 0.0071)		
	Journal outside diameter		56.982 to 57.000 (2.24338 to 2.24409)		
	Pin outside diameter		44.985 to 45.000 (1.77106 to 1.77165)		
	Out-of-roundness and taper of journal and pin		0.005 (0.00020)		
	Concentricity of journal and pin		0.03 (0.0012)		
	Oil clearance of journal		0.02 to 0.04 (0.0008 to 0.0016)		
	Oil clearance of pin		0.02 to 0.05 (0.0008 to 0.0020)		

Item		Standard value	Limit	Remarks	
Cylinder block	Cylinder inner diameter	4G63	85.00 to 85.03 (3.3465 to 3.3476)		
		4G64	86.50 to 86.53 (3.4055 to 3.4067)		
	Flatness of gasket surface		0.05 (0.0020)		
	Grinding limit			0.2 (0.008)	Total resurfacing depth of both cylinder head and cylinder block
	Overall height	4G63	283.9 to 284.1 (11.177 to 11.185)		
		4G64	289.9 to 290.1 (11.413 to 11.421)		
Side clearance	Drive gear	0.08 to 0.14 (0.0031 to 0.0055)			
	Driven gear	0.06 to 0.12 (0.0024 to 0.0047)			
Oil pump	Oil relief valve pressure	Valve opening	5.0 to 6.0 kg/cm ² (36.2 to 43.4 lb.ft)		
	Oil filter pressure	Bypass valve opening	0.8 to 1.2 kg/cm ² (5.8 to 8.7 lb.ft)		
	Oil pressure	Normal operating - hot	80 to 120 40 to 65		
Drive belt	Deflection	New belt	14 mm (0.55 in.)	Apply 10 kg (22 lbs) of force to the center of the belt span	
		Used belt	10 (0.39)	Apply 10 kg (22 lbs) of force to the center of the belt span	
	Tension N (kgf) [lbf]	New belt	588.0 (60.0) [132.0]		Measured with a belt tension gauge
		Used belt	392.0 (40.0) [88.0]		Measured with a belt tension gauge
Carburetor	Throttle bore diameter		32 (1.26)		
	Outer venturi diameter		24 (0.94)		
	Inner venturi diameter		9 to 12 (0.35 to 0.47)		
	Main jet	4G63	13 (0.512)		
		4G64	13.5 (0.531)		
	Main air jet diameter		0.9 (0.035)		
	Pilot jet diameter		0.55 (0.0217)		
	Pilot jet air diameter		1.6 (0.063)		
Fast idle opening angle		18.5 (0.728)			
Alternator	Nominal output, A		65		
	Brush length			Wear limit line	
	Slip ring outer diameter		23 (0.91)		
	Rotor coil resistance, ž		3 to 5		

Item		Standard value	Limit	Remarks	
Starter motor	Nominal output, kž		1.2		
	No-load characteristics	Voltage, V	11.5		
		Current, A	100 or less		
		Speed, rpm	3000		
	Commutator	Outer diameter	32 (1.26)	31 (1.22)	
		Runout	0.05 (0.0020)	0.1 (0.0039)	
		Undercut	0.5 (0.020)	0.2 (0.008)	
	Pinion gap		0.5 to 2.0 (0.020 to 0.079)		
Brush length			Wear limit line		
Distributor	Centrifugal advance crank angle/engine speed, °/rpm	Start	0°/800		
		End	20°/5000		
	Vacuum advance crank angle/vacuum, °/mmHg	End	0°/80		
		Start	23°/280		
Ignition coil	Primary coil resistance, ž		1.2ž± 10%		
	Secondary coil resistance, kž		26.0ž± 15%		
	External resistor, ž		1.22 to 1.49	If equipped	
Ignition cables	Spark plug cable resistance, kW and high tension cable		16 kž/m (4.88 kž/ft)		
Spark plug	Plug gap		0.7 to 0.8 (0.028 to 0.031)	Gas and L.P.G.	
Thermostat	Valve opening temperature, °C (°F)		82 (180)		
	Fully opening temperature, °C (°F)		95 (203)		
	Valve lift		8 (0.31) or more		

MAJOR BOLTS AND NUTS

Item		Torque			Remarks	
		N.m	kgf.m	lbf.ft		
Alternator, ignition coil	Water pump pulley bolt		9	0.9	6.5	
	Alternator pivot nut		42	4.2	30.4	
	Adjuster lock bolt		24	2.4	17.4	
	Alternator brace bolt		14	1.4	10.1	
	Crankshaft pulley bolt		25	2.5	18.1	
	Spark plug		25	2.5	18.1	
	Distributor nut		12	1.2	8.7	
Timing belt	Timing belt cover bolt		11	1.1	8.0	Bolt without spring washer
			9	0.9	6.5	Bolt with spring washer
	Tensioner spring spacer		48	4.9	35.4	
	Tensioner bolt		48	4.9	35.4	
	Oil pump sprocket nut		54	5.5	39.8	
	Crankshaft bolt		118	12.0	86.8	
	Camshaft sprocket bolt		88	9.0	65.1	
	Engine support bracket bolt		35	3.6	26.0	
	Timing belt rear bolt		14	1.4	10.1	
Fuel system	Fuel pump		11	1.1	8.0	
	Carburetor nut		12	1.2	8.7	
Intake manifold	Water outlet bolt		14	1.4	10.1	
	Water temperature gauge unit		15	1.5	10.8	
	Intake manifold bolt/nut		18	1.8	13.0	
Exhaust manifold	Oil level gauge guide bolt		14	1.4	10.1	
	Heat protector bolt		9	0.9	6.5	
	Exhaust manifold nut		34	3.5	25.3	
	Water pump bolt		14	1.4	10.1	
Rocker arm and camshaft	Rocker cover bolt		6	0.6	4.3	
	Bearing cap bolt	M8x25	24	2.4	17.4	
		M8x65	24	2.4	17.4	

Note

Unless otherwise specified all torques shown are dry torque.

Item		Torque			Remarks
		N.m	kgf.m	lbf.ft	
Cylinder head, valve	Cylinder head bolt	20 N.m (2.0 kgf.m) [14.5 lbf.ft] + 1/4 turn + 1/4 turn [Wet]			Inspect bolts for damage or stretch before reusing
Front case, oil pan	Drain plug	40	4.0	28.9	
	Oil pan bolt	7	0.7	5.1	
	Oil screen bolt/nut	19	1.9	13.7	
	Oil pressure switch	10	1.0	7.2	
	Relief plug	44	4.5	32.5	
	Oil filter basket	19	1.9	13.7	
	Plug	24	2.4	17.4	
	Bolt	35	3.6	26.0	
	Oil pump cover bolt	17	1.7	12.3	
	Oil pump cover screw	10	1.0	7.2	
	Front case bolt	24	2.4	17.4	
Piston, connecting rod	Connecting rod bearing	10 N.m (2.0 kgf.m) [14.5 lbf.ft] + 1/4 turn[Wet]			Inspect bolts and nuts for damage or stretch before reusing
Crankshaft, cylinder block	Flywheel bolt	132	13.5	97.6	
	Oil seal case bolt	5	0.5	3.6	
	Rear plate bolt	9	0.9	6.5	
		59	6.0	43.4	
	Rear plate cover	11	1.1	8.0	
	Rear oil seal case bolt	11	1.1	8.0	
	Bearing cap bolt	25 N.m (2.5 kgf.m) [18.0 lbf.ft] + 1/4 turn			Inspect bolts for damage or stretch before reusing
Starter motor	Starter motor bolt	26	2.7	19.5	

Note

Unless otherwise specified all torques shown are dry torque.

Note

Items marked [Wet] apply a light coating of engine oil to bolt threads and washers before torquing.

GENERAL BOLTS AND NUTS TIGHTENING TORQUE

Standard Bolts and Nuts

Nominal diameter	Pitch	Torque, N.m (kgf.m) [lbf.ft]				
		Bolt, stud, nut (with spring washer)			Flange bolt, flange	
		Head mark 4	Head mark 7	Head mark 10	Head mark 4	Head mark 7
M5	0.8	—	4.9 (0.5) [3.6]	—	—	5.9 (0.6) [4.3]
M6	1.0	—	8.8 (0.9) [6.5]	12 (1.2) [8.7]	—	9.8 (1.0) [7.2]
M7	1.25	12 (1.2) [8.7]	22 (2.2) [15.9]	29 (3.0) [21.7]	13 (1.3) [9.4]	24 (2.4) [17.4]
M8	1.25	25 (2.5) [18.1]	44 (4.5) [32.5]	59 (6.0) [43.4]	25 (2.6) [18.8]	49 (5.0) [36.2]
M9	1.25	41 (4.2) [30.4]	81 (8.3) [60.0]	105 (10.7) [77.4]	46 (4.7) [34.0]	93 (9.5) [68.7]
M10	1.5	72 (7.3) [52.8]	137 (14.0) [101.3]	142 (14.5) [104.9]	—	—

Tapered Threads

Size	Torque, N.m (kgf.m) [lbf.ft]	
	Material or internal threads: Aluminum alloy	Material or internal threads: Cast iron or steel
NPTF 1/16	5 to 8 (0.5 to 0.8) [3.6 to 5.8]	8 to 11 (0.8 to 1.2) [5.8 to 8.7]
PT 1/8	8 to 11 (0.8 to 1.2) [5.8 to 8.7]	15 to 21 (1.5 to 2.2) [10.8 to 15.9]
PT 1/4	20 to 29 (2.0 to 3.0) [14.5 to 21.7]	34 to 44 (3.5 to 4.5) [25.3 to 32.5]
NPTF 1/4	20 to 29 (2.0 to 3.0) [14.5 to 21.7]	34 to 44 (3.5 to 4.5) [25.3 to 32.5]
PT 3/8	39 to 59 (4.0 to 5.5) [28.9 to 39.8]	54 to 73 (5.5 to 7.5) [39.8 to 54.2]
PT 1/2	69 to 98 (7.0 to 10.0) [50.6 to 72.3]	118 to 156 (12.0 to 16.0) [86.8 to 115.7]

NEW TIGHTENING METHOD - BY USE OF BOLTS TO BE TIGHTENED IN PLASTIC AREA

A new type of bolt, to be tightened in plastic area, is currently used in some parts of the engine. The tightening method for these bolts is different from the conventional one. Be sure to observe the method described in the text when tightening the bolts.

Service limits are provided for the bolts. Make sure that the service limits described in the text are strictly observed.

- Area where the bolts are in use:
 - (1) Cylinder head bolts
 - (2) Main bearing cap bolts
 - (3) Connecting rod cap bolts
- Tightening method

After tightening the bolts to the specified torque, tighten them another 90° or 180° (twice 90°). The tightening method varies on different areas. Observe the tightening method described in the text.

Part to be applied	Brand
Water temperature gauge unit	Three Bond 1104F, 3M ATD Part No. 8660 or equivalent
Semi circular packing	Three Bond 1212D, 3M ATD Part No. 8660 or equivalent
Rocker cover	Three Bond 1212D, 3M ATD Part No. 8660 or equivalent
Oil pressure switch	Three Bond 1211, 3M ATD Part No. 8660 or equivalent
Oil pan	Three Bond 1207F, Genuine Part No. MD990389 or equivalent
Rear oil seal case	Three Bond 1207F, Genuine Part No. MD990389 or equivalent
Rear plate bolt	Three Bond 1104, 3M ATD Part No. 8660 or equivalent
Oil seal case bolt	Three Bond 1104, 3M ATD Part No. 8660 or equivalent

FROM-IN-PLACE GASKET (FIPG)

The engine has several areas where the from-in-place gasket (FIPG) is in use. To ensure that the gasket fully serves its purpose, it is necessary to observe some precautions when applying the gasket. Bead size, continuity and location are of paramount importance. Too thin a bead could cause leaks. Too thick a bead, on the other hand, could be squeezed out of location, causing blocking or narrowing of the fluid feed line. To eliminate the possibility of leaks from a joint, therefore, it is absolutely necessary to apply the gasket evenly without a break, while observing the correct bead size.

Since the FIPG used in the engine hardens as it reacts with the moisture in the atmospheric air, it is normally used in the metallic flange areas.

Disassembly

The parts assembled with the FIPG can be easily disassembled without the use of a special method. In some cases, however, the sealant between the joined surfaces may have to be broken by lightly striking it with a mallet or similar tool. A flat and thin gasket scraper may be lightly hammered in between the joined surfaces. In this case, however, care must be taken to prevent damage to the joined surfaces. For removal of the oil pan, the special tool Oil Pan Remover (MD998727) is available. Be sure to use the special tool to remove the oil pan.

Surface preparation

Thoroughly remove all substances deposited on the gasket application surfaces, using a gasket scraper or wire brush. Check to ensure that the surfaces to which the FIPG is to be applied is flat. Make sure that there are no oils, greases, and foreign substances deposited on the application surfaces. Do not forget to remove the old FIPG remaining in the bolt holes.

From-in-place gasket application

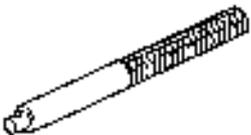
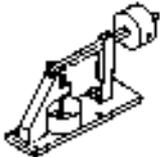
The applied FIPG bead should be of the specified size and without breaks. Also be sure to encircle the bolt hole circumference with a completely continuous bead. The FIPG can be wiped away unless it is hardened. While the FIPG is still moist (in less than 15 minutes), mount the parts in position. When the parts are mounted, make sure that the gasket is applied to the required area only.

The FIPG application procedure may vary on different areas. Observe the procedure described in the text when applying the FIPG.

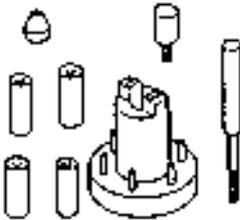
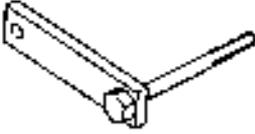
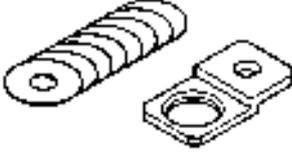
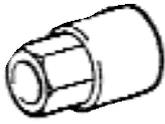
Note

All special tool part numbers beginning with MCF- can be found in your new dealer service tool and equipment catalog/manual. This catalog contains a wide assortment of tool and equipment used to service your lift truck. Information on ordering, warranty and repair will be covered in this service tool and equipment manual. MCF-5000. For tool information on part numbers beginning with MCF, contact SPX/OTC service tools department at 1-800-533-0492.

SPECIAL TOOLS

Tool No.	Tool name	Style	Use
MCF-1021 or MB990767	End yoke holder		Holding camshaft sprocket (Use with MD998719)
MCF-1045 or MB990938	Handle		Installation crankshaft rear oil seal (Use with MD998776) (Use with MCF-1023 Seal installer)
MD998162	Plug wrench		Removal and installation of front case cap plug
MCF-1027 or MD998285	Crankshaft front oil seal guide		Guide for installation of crankshaft front oil seal
MCF-1025 or MD998375	Crankshaft front oil seal installer		Installation of crankshaft front oil seal
MD998440	Leak-down tester		Leak-down test of lash adjuster
MCF-1028 or MD998441	Lash adjuster retainer		Air bleeding of lash adjuster

Tool No.	Tool name	Style	Use
MCF-1031 or MD998442	Air bleed wire		Air bleeding of lash adjuster
MCF-1026 or MD998443	Lash adjuster holder		Retainer for holding lash adjuster in rocker arm at timer of removal and installation of rocker arm and rocker shaft assembly
MD998713	Camshaft oil seal installer		Installation of oil seal
MD998719	Pulley holding pins		Holding camshaft sprocket when loosening or torquing bolt (Use with MB990767 - Single camshaft engine) (Part of MCF-1021 - End yoke holder)
MD998727	Oil pan remover		Removal of the oil pan
MCF-1032 or MD998728	Valve stem seal installer		Installation of valve stem seal (8-valve single camshaft engine)
MD998772	Valve spring compressor		Compression of valve spring

Tool No.	Tool name	Style	Use
MCF-1023 or MD998776	Crankshaft rear oil seal installer		Installation of crankshaft rear oil seal (Use with MCF-1045 driver handle)
MD998778	Crankshaft sprocket puller		Removal of crankshaft sprocket
MD998780	Piston pin setting tool		Removal and installation of piston pin
MD998781	Flywheel stopper		Holding flywheel and drive plate
MD998783	Plug wrench retainer		Removal and installation of frontcase cap plug (Use with MD998162)
MD998054	Oil pressure switch wrench		Removal and installation of oil pressure switch

1. Valve Clearance Adjustment

Being adjusted automatically with a lash adjuster, the valve clearance needs no adjustment.

2. Ignition Timing Adjustment

- (1) Let the engine warm up until the engine coolant temperature rises to 80 to 90°C (176 to 194°F).
- (2) Check that the ignition timing is as indicated when the engine is running at idling speed.

Standard value: 4° BTDC/740 rpm(gasoline)

9° BTDC/740 rpm(L.P.G.)

- (3) If the ignition timing does not conform to the standard value, adjust by moving the distributor.

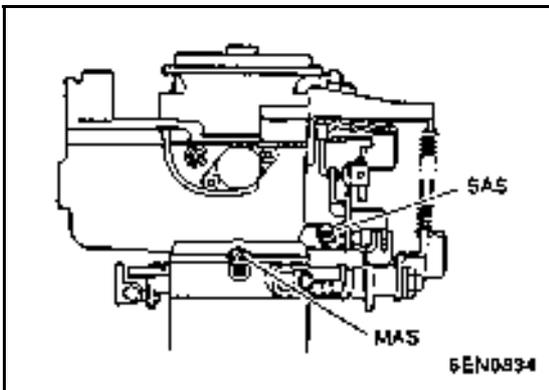
3. Idling Speed Adjustment

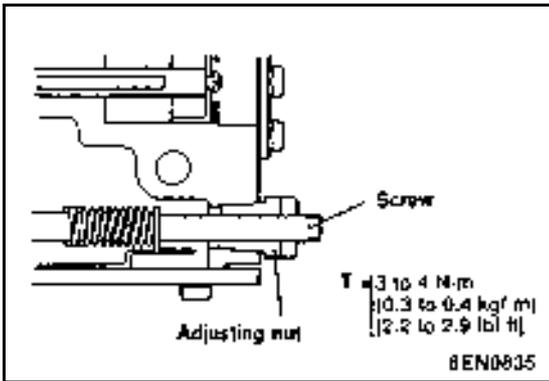
- (1) Let the engine warm up until the engine coolant temperature rises to 80 to 90°C (176 to 194°F).
- (2) Back off the mixture adjusting screw (MAS) 3.5±0.5 turns from the fully closed position.
- (3) Adjust the engine speed to the specified low idling speed with the speed adjusting screw (SAS).

- (4) Slowly turn down the mixture adjusting screw (MAS) to a point where the engine speed begins to decrease.

Standard value: OPS\650 rpm

- (5) After racing the engine two or three times (at approx. 2500 rpm), readjust the speed adjusting screw to the point at which the engine rests at the specified idling speed.





4. Air Governor Adjustment

High Speed Adjustment

- (1) Place all the hydraulic levers in the neutral position.
- (2) Depress the accelerator pedal all the way. (The carburetor throttle valve will open fully.)
- (3) While holding the adjust screw to prevent it from turning, rotate the adjusting nut either clockwise or counterclockwise to make the engine run at 2600 ± 50 rpm.

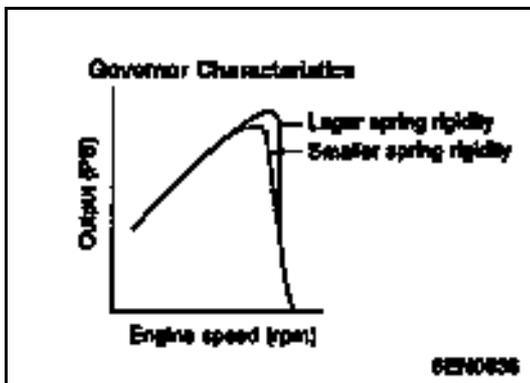
Adjusting nut:

Clockwise rotation

Increases the engine speed (increases the installed load of spring).

Counterclockwise rotation

Decreases the engine speed (decreases the engine installed load of spring).



5. Anti-Hunting Adjustment

- (1) Place all the hydraulic levers or power train in the neutral position.
- (2) Depress the accelerator pedal all the way. (The carburetor throttle valve will open fully.)
- (3) Slowly rotate the adjusting screw clockwise until hunting disappears.

Adjusting screw:

Clockwise rotation

Increases spring tension (reduces the number of active turns of spring).

Counterclockwise rotation

Reduces spring tension (increases the number of active turns of spring).

Increasing the spring tension will eliminate hunting, but excessively high tension will change the governor characteristics and will produce some effects on the output characteristics of the engine. It is, therefore, imperative to limit the movement of the adjusting screw to less than two turns from the standard position.

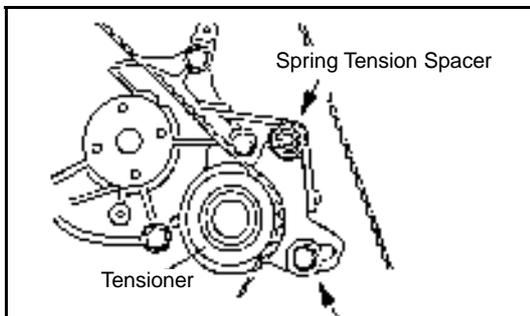
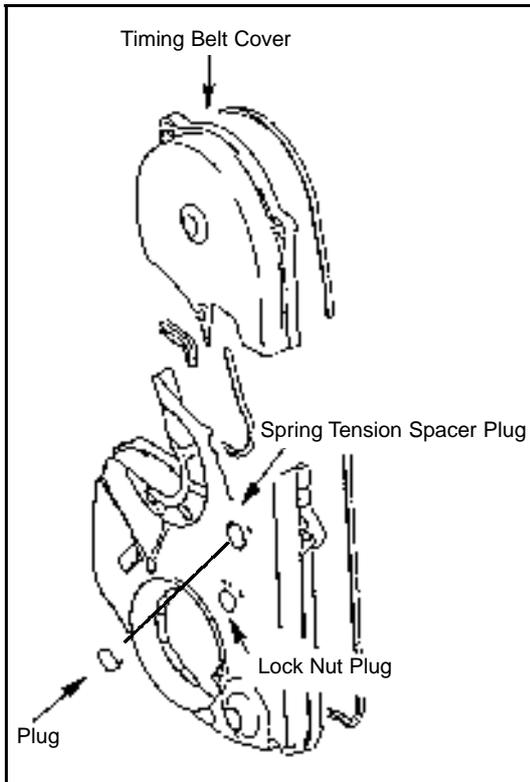
- (4) Clockwise rotation of the adjusting screw raises the engine maximum speed. Rotate the push nut counterclockwise to reduce the speed.
- (5) Repeat the anti-hunting adjustment two or three times by alternately adjusting the push nut and the adjusting screw until the best result is obtained.
- (6) The number of active turns of the spring should not be less than 11 when the adjustment is finished.

NOTE

After all adjustments to the governor are made and rechecked, reseal the governor.

6. Timing Belt Adjustment

Adjust and inspect the timing belt at first PM or 200 hours, whichever comes first.



- (1) Remove the two plugs in the timing belt cover.
- (2) Use a 10 mm Allen wrench socket to loosen the spring tension spacer two or three turns.
- (3) Use a 14 mm socket to loosen the locking bolt two or three turns. The tensioning spring will then self adjust and apply the correct force to the timing belt.
- (4) After allowing the belt to self adjust in step 3, torque the locking bolt to 4.9 kgf.m (35.4 lbf.ft) [48 N.m].
- (5) Next, torque the spring tensioning spacer to 4.9 kgf.m (35.4 lbf.ft) [48 N.m].
- (6) Replace the two plugs in the timing belt cover.

NOTE

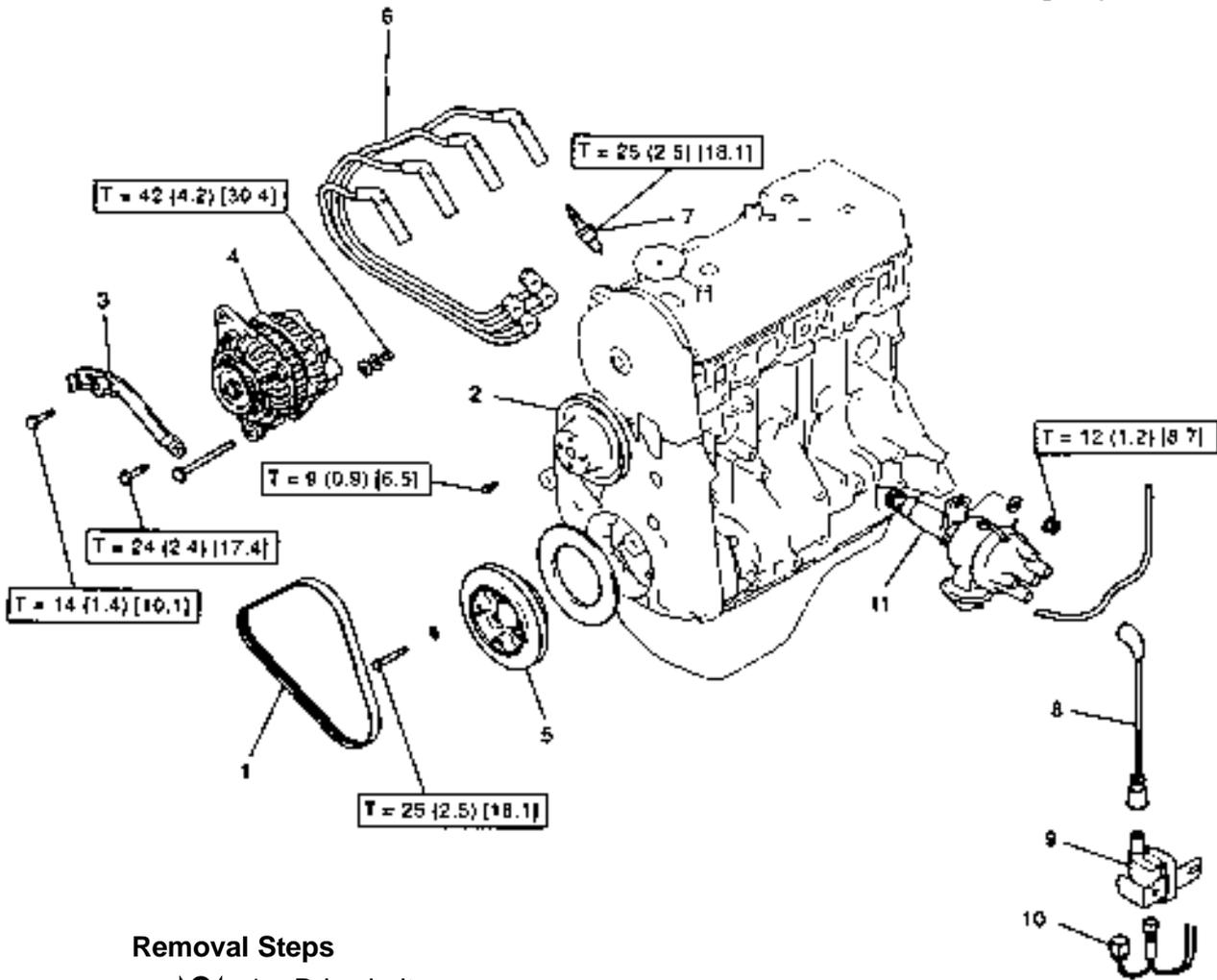
If the tensioning spacer is tightened first, the spacer may turn together with the spring loosening the tension on the belt.

- (7) a. Adjust and inspect the timing belt for wear and cracks and replace, if required, every 2000 hours or every year, whichever comes first.
- b. Replace the timing belt every 3000 hours or every 18 months, whichever comes first.

ALTERNATOR AND IGNITION SYSTEM

REMOVAL AND INSTALLATION

Unit: N m (kgf m) (lbf-ft)



Removal Steps

- ◆C◆ 1. Drive belt
- 2. Water pump pulley
- 3. Alternator brace
- 4. Alternator
- ◆B◆ 5. Crankshaft pulley
- ◆A◆ ◆D◆ 6. Spark plug cable
- 7. Spark plug
- ◆A◆ ◆D◆ 8. High tension cable
- 9. Ignition coil
- 10. Harness
- ◆A◆ 11. Distributor

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