MITSUBISHI
FORKLIFT TRUCKS

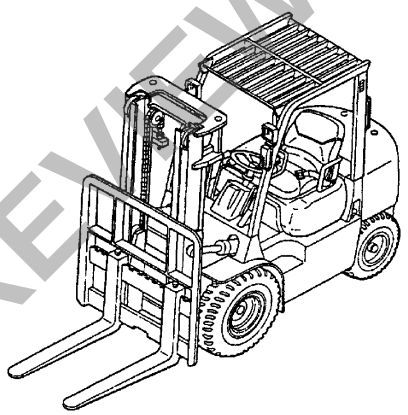
SERVICE MANUAL

4DQ7

for FD10
FD14
FD15
FD18

S4S

for FD20	AF18B00001-49999
FD25	AF18B00001-49999
	AF18B50001-50100
FD30	AF14C30001-49999
FD35A	AF14C50001-99999



Quality Makes the Difference

DIESEL ENGINE

October 1993

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Foreword

This service manual has instructions and procedures for the subject on the front cover. 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 these 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.

Safety is not only your concern but everybody's concern. Safe working habits cannot be bought or manufactured; they must be learned through the job you do. By learning what CAUTION or WARNING symbol emphasizes, know what is safe – what is not safe. Consult your foreman, if necessary, for specific instructions on a job, and the safety equipment required.

NOTES, CAUTIONS and WARNINGS

NOTES, CAUTIONS and WARNINGS are used in this manual to emphasize important and critical instructions. They are used for the following conditions:

NOTE .....An operating procedure, condition, etc., essential to highlight.

CAUTION .....Operating procedures, practices, etc., which if not strictly observed, will result in damage to or destruction of engine.

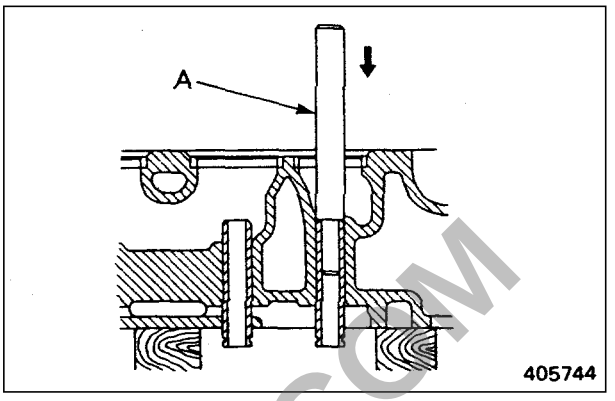
WARNING .....Operating procedures, practices, etc., which if not correctly followed, will result in personal injury or loss of life.

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(3) Replacing valve guides

(a) Using valve guide remover A (32A91-00300), remove the guide (worn) for replacement.

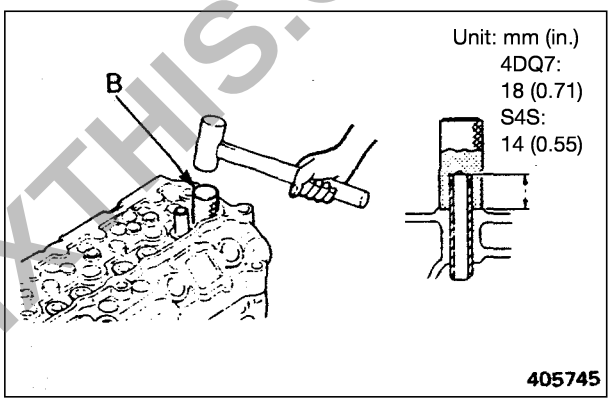


Removing valve guide

(b) To install a replacement guide, use valve guide installer B (30691-10200 for 4DQ7 or 32A91-00100 for S4S).

⚠ CAUTION

Height to top of the valve guide is specified; be sure to use the valve guide installer to insure this height.



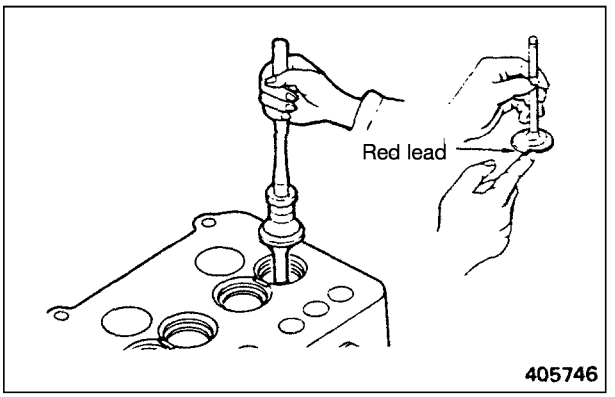
Installing valve guide

(4) Inspecting valve face

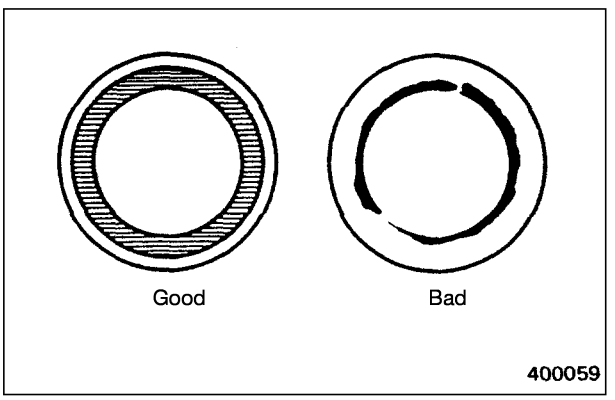
Coat the valve face lightly with red lead and, using a valve lapper, check the valve contact with its seat. If the contact is not uniform, or if the valve is defective or the repair limit is reached, repair or replace the valve and valve seat.

NOTE

1) Check the valve face after checking or replacing the valve guide.
2) Press the valve coated with red lead into the seat without rotating it.



Checking valve face

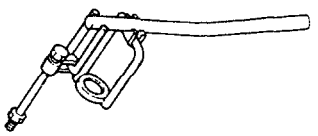
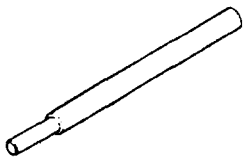
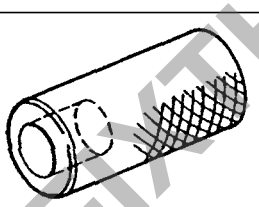
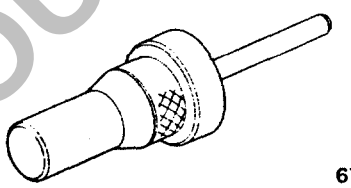
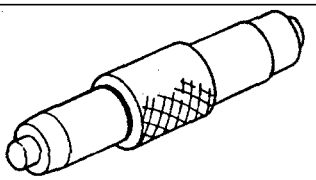
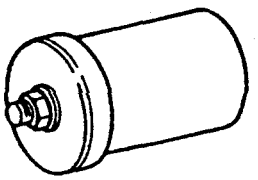
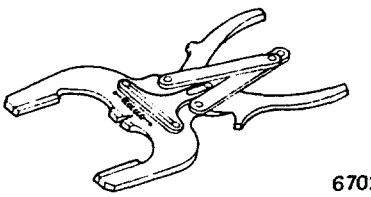


Valve contact with its seat

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SPECIAL TOOL LIST

Tool name	Part No.	Shape	Use
Valve spring pusher	30691-04500	 401793	Valve spring removal/installation
Valve guide remover	32A91-00300	 670230	Valve guide removal
Valve guide installer	4DQ7: 30691-10200 S4S: 32A91-00100	 670228	Valve guide installation
Valve seat insert caulking tool	Inlet 4DQ7: 30691-02700 S4S: 36791-00200 Exhaust 4DQ7: 30691-02800 S4S: 34491-03020	 670232	Valve seat installation
Idle gear bushing installer	4DQ7: 30691-51900 S4S: 30091-07300	 670242	Idle gear bushing removal/installation
Idle gear shaft puller	MH061077	 670237	Idle gear shaft removal
Piston ring pliers	31391-12900	 670240	Piston ring removal/installation

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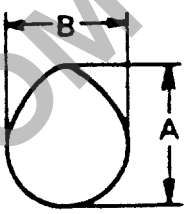
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Possible cause		Remedy
Poor compression	Defective valve seats	Repair.
	Sticking valve stems	Repair and replace valve stems if necessary.
	Failure of rocker arms to lift valves	Adjust valve clearance to 0.25 mm (0.0098 in.).
	Worn cylinders, pistons or piston rings	Repair and replace parts if necessary.
	Sticking piston rings	Replace damaged rings.
	Exhaust gases leak through cylinder head gasket	Retighten and replace gasket if necessary.
	Worn or broken valve springs	Replace springs.
	Insufficient torque of starting motor (at starting)	Replace parts.
Insufficient coolant	Insufficient coolant	Add water to prescribed level.
	Overheating	
	Water leaks from unit seal of pump	Replace seal.
	Crack in crankcase water jacket	Replace crankcase.
	Water leaks from other parts	Check and repair.
Failure of radiator to dissipate heat properly	Air in cooling system	Bleed air by loosening air bleed plug, drain plug, or hose clamp.
	Rust and scale deposited in radiator	Flush.
	Dust and dirt around radiator	Flush.
	Slippage of fan belt	Adjust belt tension.
	Inoperative thermostat (stuck closed)	Replace.
Radiator dissipates heat excessively	Extremely low atmospheric temperature	
	Uncovered radiator	Cover radiator.
	Inoperative thermostat (stuck open)	Replace.
Jammed moving parts	Sticking cylinders, pistons or piston rings	Repair and replace if necessary.
	Sticking main bearings and crankpin bearings	Repair and replace if necessary.
	Sticking cam bushing and idle gear bushing	Repair and replace if necessary.

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Unit: mm (in.)

Group	Inspection Point			Nominal value	Assembly standard (standard clearance)	Repair limit (clearance)	Service limit (clearance)	Remarks
Timing gears	Camshaft	Runout	–	–	0.02 (0.0008), maximum	0.05 (0.0020)	–	Straighten by cold working or replace.
		Cam profile – Inlet	–	A 46.916 (1.84708)	A – B = 6.684 (0.26315)	–	A – B = 6.184 (0.24346)	
		Cam profile – Exhaust	4DQ7	A 45.944 (1.80882)	A – B = 7.344 (0.28913)	–	A – B = 6.844 (0.26945)	
			S4S	A 46.880 (1.84567)	A – B = 6.720 (0.26457)	–	A – B = 6.220 (0.24488)	Replace camshaft.
		Diameters of journals – No. 1 No. 2		54 (2.13)	53.94 to 53.96 (2.1236 to 2.1244)	–	53.90 (2.1220)	–
		Diameters of journals – No. 3		53 (2.09)	52.94 to 52.96 (2.0842 to 2.0850)	–	52.90 (2.0827)	–
		End play		–	0.10 to 0.25 (0.0039 to 0.0098)	–	0.30 (0.0118)	Replace thrust plate.
	Idle gear	Inside diameter of bushing	4DQ7	36 (1.42)	36.000 to 36.025 (1.41732 to 1.41830)	–	–	–
			S4S	40 (1.57)	40.000 to 40.025 (1.57480 to 1.57578)	–	–	
		Outside diameter of shaft	4DQ7	36 (1.42)	35.975 to 35.950 (1.41633 to 1.41535)	–	–	–
			S4S	40 (1.57)	39.991 to 39.975 (1.57444 to 1.57381)	–	–	
		Shaft clearance in bushing	4DQ7	–	0.025 to 0.075) (0.00098 to 0.00295)	–	0.100 (0.00394)	Replace bushing.
			S4S	–	0.009 to 0.050 (0.00035 to 0.00197)	–		
		End play		–	0.05 to 0.20 (0.0020 to 0.0079)	–	0.35 (0.0138)	–
		Length of thrust journal of shaft and boss		26 (1.02)	0.05 to 0.20 (0.0020 to 0.0079)	0.4 (0.016)	–	Replace thrust plate.
		Fit (interference) of shaft in crankcase bore	4DQ7	30 (1.18)	0.039T to 0.076T (0.00154T to 0.00299T)	–	–	–
			S4S		0.035T to 0.076T (0.00138T to 0.00299T)	–	–	
	Backlash	4DQ7		–	0.05 to 0.15 (0.0020 to 0.0059)	–	0.25 (0.0098)	–
		S4S – Idle gear and oil pump gear		–	0.06 to 0.24 (0.0024 to 0.0094)	–	0.30 (0.012)	–
		S4S – Idle gear and injection pump gear		–	0.05 to 0.17 (0.0020 to 0.0067)	–	0.25 (0.0098)	Replace gears.

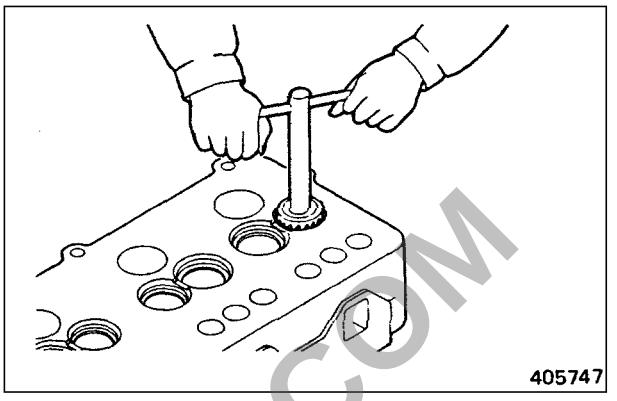
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(6) Refacing valve seat

(a) Using a valve seat cutter or valve seat grinder, cut the valve seat. After cutting, grind the seat lightly by using a sandpaper of #400 grade or so, inserted between the cutter and seat.

(b) Lap the valve in the seat.



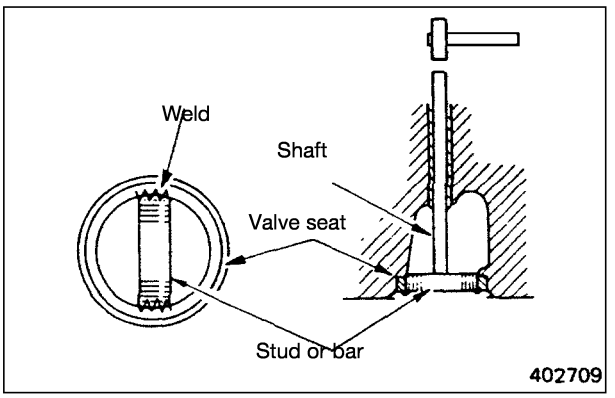
Refacing valve face

NOTE

1) Cut or grind the valve seat only as necessary for refacing.
2) If the seat width is in excess of the repair limit as a result of wear or cutting, replace the valve seat.
3) If the valve sinkage exceeds the repair limit after refacing, replace the valve seat.

(7) Replacing valve seats

(a) Weld a stud or bar to the valve seat. Insert a shaft into the valve guide hole from the upper side of cylinder head, and drive the seat off the head as shown.

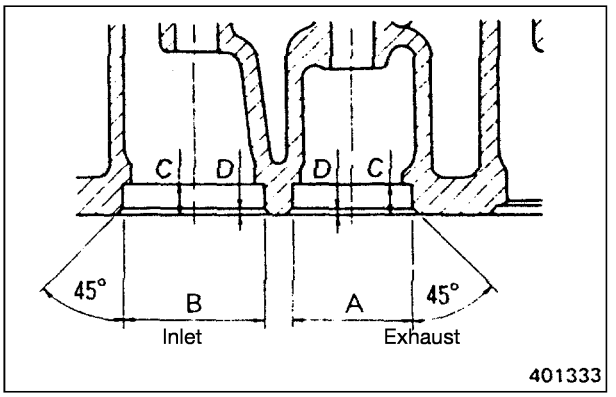


Removing valve seat

NOTE

When welding the stud or bar, be careful not to permit spatters to come in contact with the machined surfaces of cylinder head.

(b) Measure the dimensions of valve seat holes in the cylinder head before installing the valve seats and make sure that they are as specified.



Valve seat dimensions

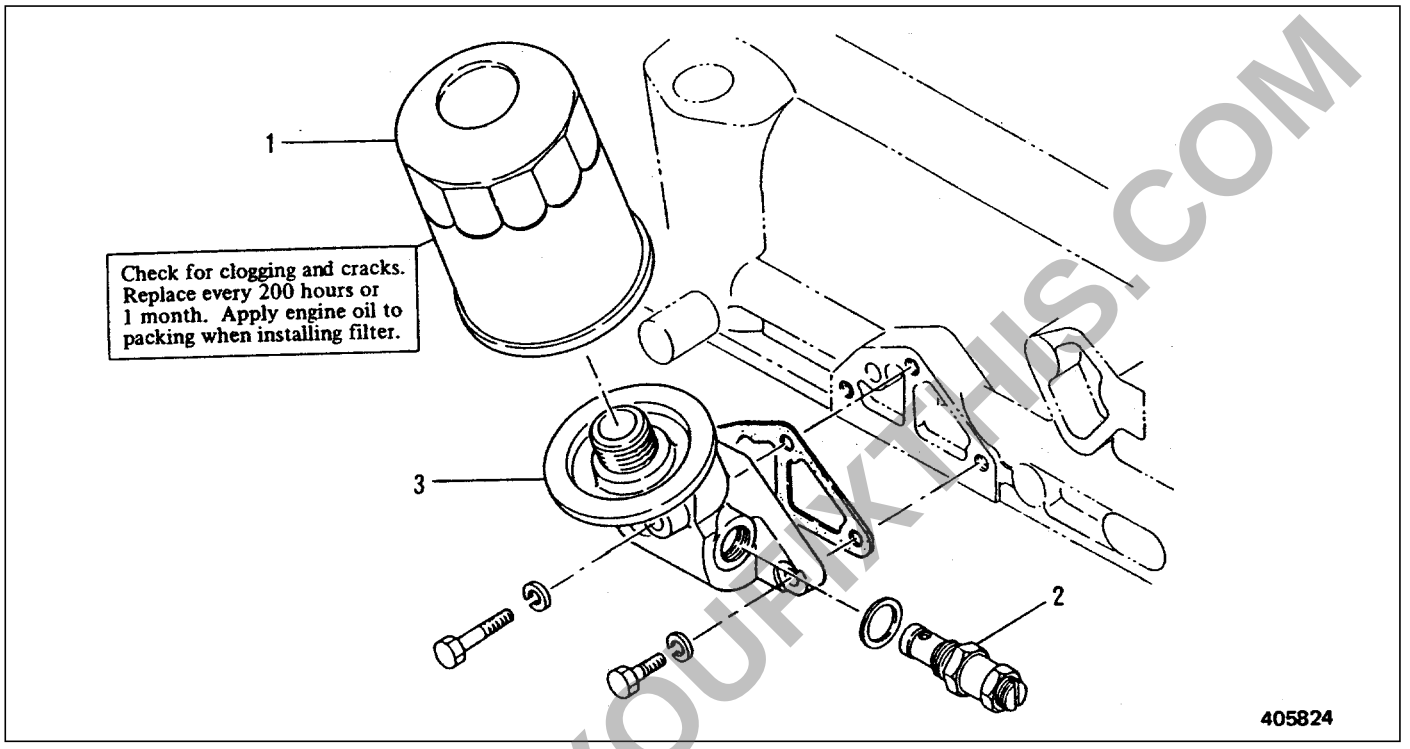
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3. OIL FILTER

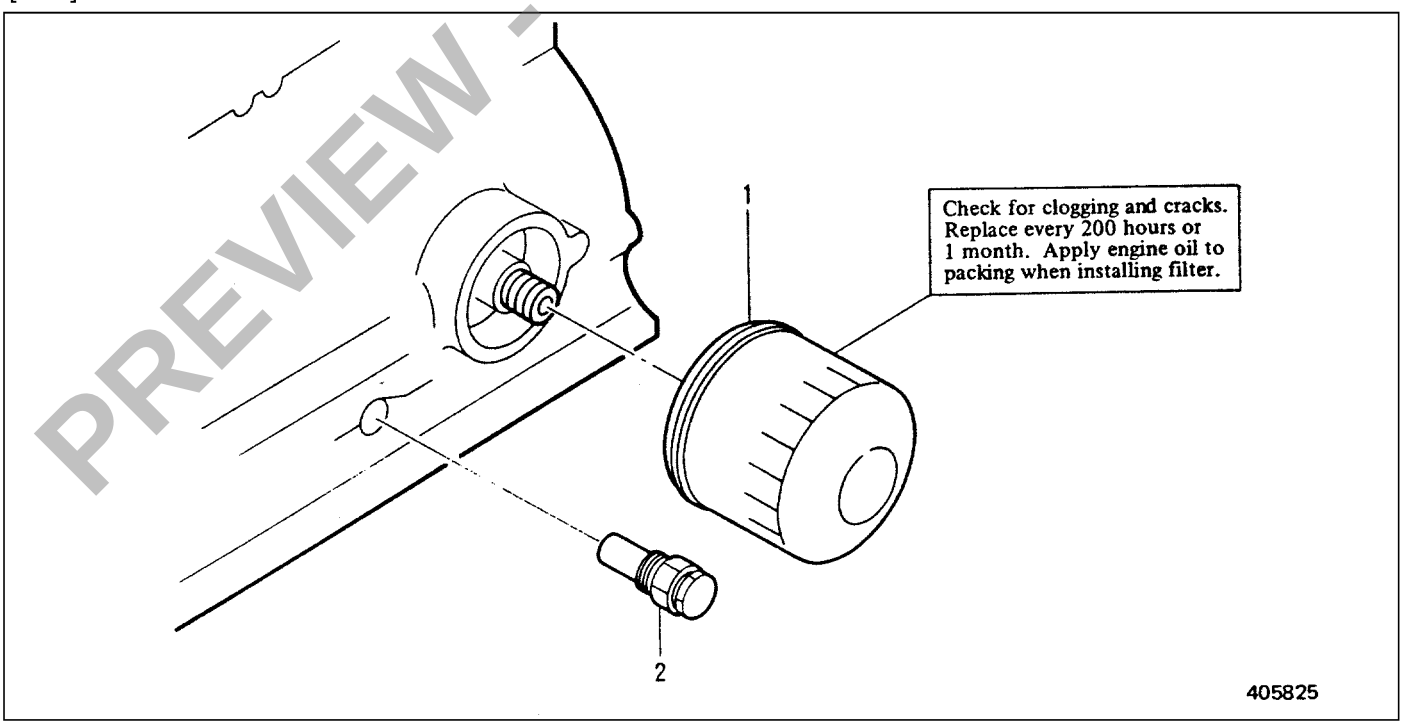
Disassembly and inspection

[4DQ7]



1 Oil filter 2 Relief valve 3 Oil filter bracket

[S4S]



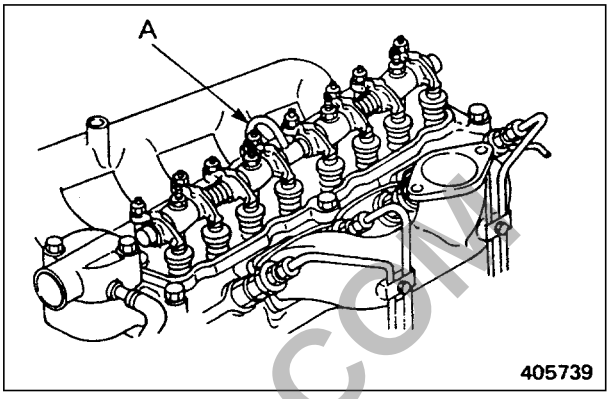
1 Oil filter 2 Relief valve

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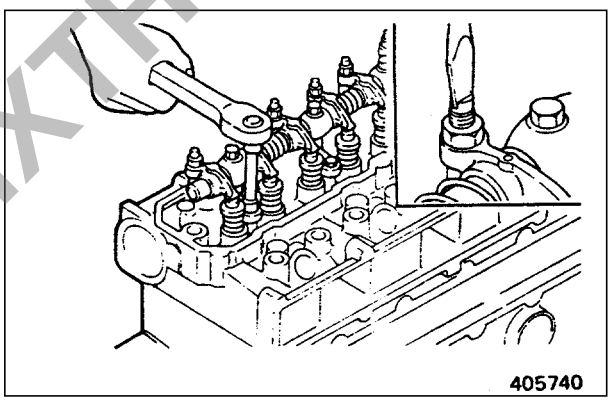
(1) Removing rocker shaft assemblies

(a) Remove the union nut for oil pipe A from the connector (4DQ7).



(b) Loosen the adjusting screw for each rocker about one turn.

(c) Loosen the short bolt and long bolt for the rocker bracket in that order, and remove the rocker shaft assembly from the cylinder head.



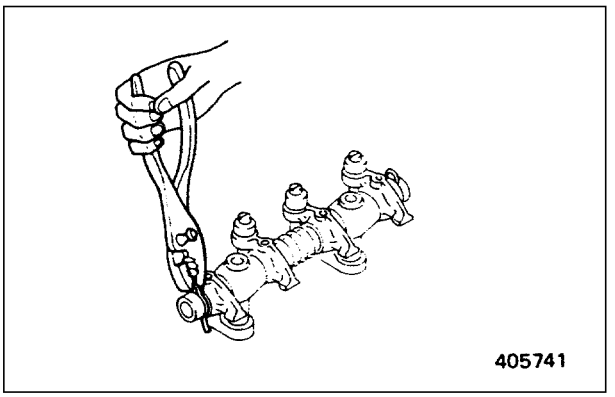
⚠ CAUTION

If the long bolt is loosened in the first place, the bracket might suffer damage.

(d) Remove the pushrod.

(2) Disassembling rocker shaft assemblies

Lay the disassembled rocker shaft(s) and rocker arms in groups, each marked or tagged for its location, so that the same clearance as before can be reproduced at the time of assembling.



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TABLE OF CONTENTS

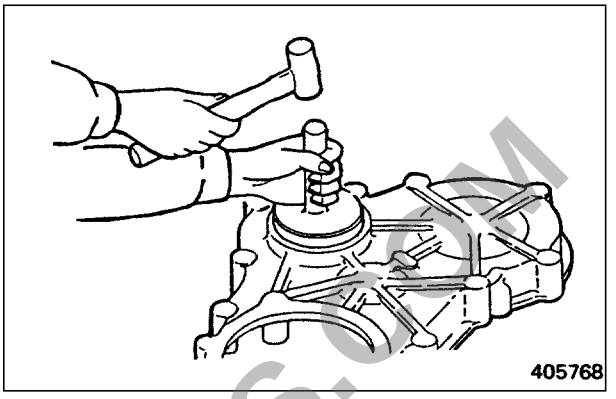
GENERAL....2
MAINTENANCE STANDARDS....12
SPECIAL TOOLS....27
ENGINE PROPER....30
INLET AND EXHAUST SYSTEMS....89
LUBRICATION SYSTEM....91
COOLING SYSTEM....100
FUEL SYSTEM....104
ELECTRICAL SYSTEM....117
WORKSHOP THEORY....132
TROUBLESHOOTING....137

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(5) Installing oil seal

Install the oil seal to the timing gear case with an installer.

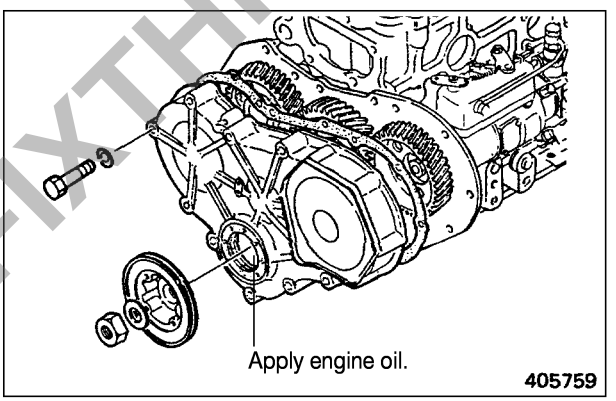


(6) Installing timing gear case

(a) Put the timing gear case on the crankcase together with gasket. Make sure the dowel pins enter their holes.

NOTE

Apply engine oil to the lip of oil seal.



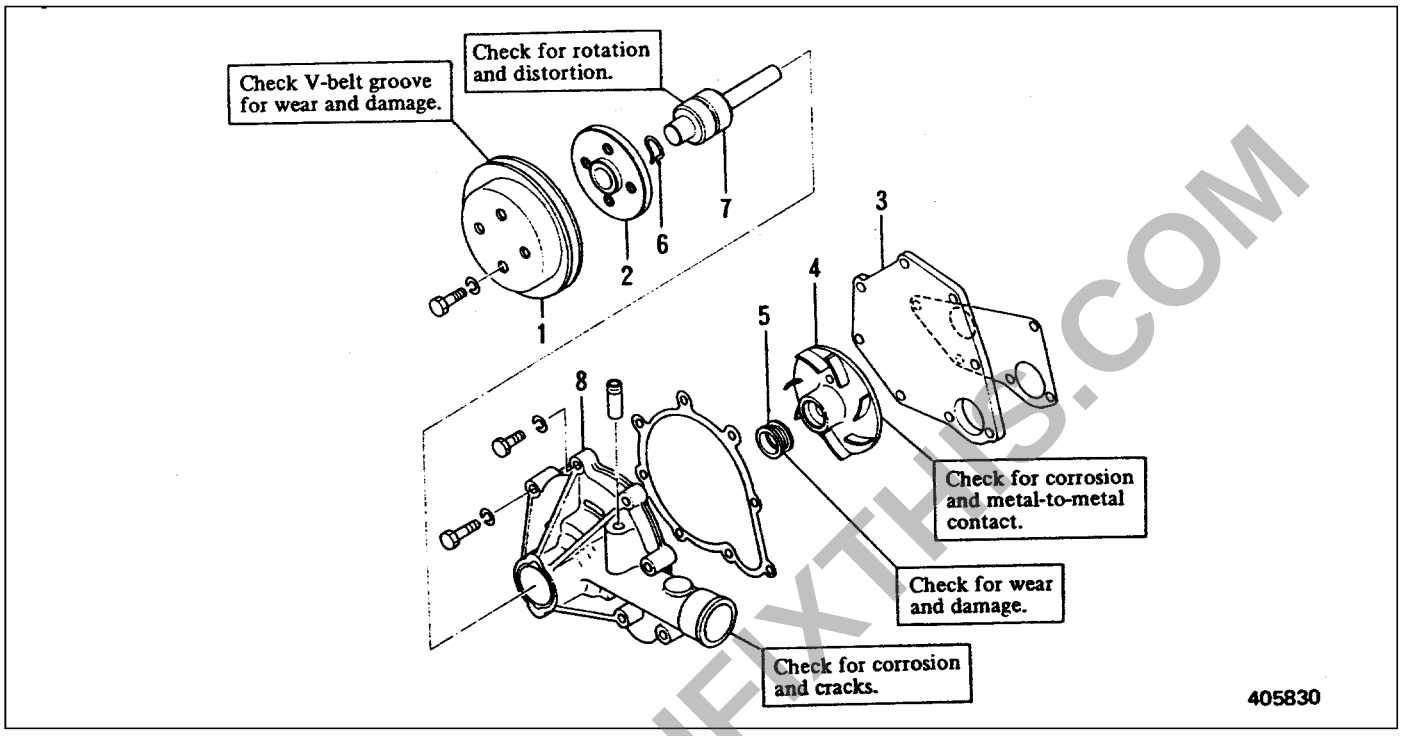
(b) Tighten the timing gear case bolts to 1.0 ± 0.5 kgf·m (7 ± 4 lbf·ft) [10 ± 5 N·m] (4DQ7) or 1.0 to 1.3 kgf·m (7 to 9 lbf ·ft) [10 to 13 N·m] (S4S).

(c) Put the crankshaft pulley in position, and tighten the nut to 40 ± 1 kgf·m (289 ± 7 lbf·ft) [392 ± 10 N·m] (4DQ7) or 50 ± 1 kgf·m (362 ± 7 lbf ·ft) [490 ± 10 N·m] (S4S).

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[S4S]



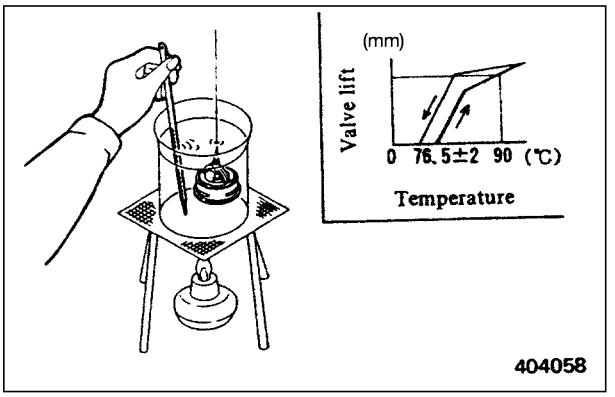
1	Water pump pulley	4	Impeller	7	Bearing unit
2	Flange	5	Unit seal	8	Case
3	Cover	6	Wire clip		

3. THERMOSTAT

Inspection

Place the thermostat in a water tub, and test it for thermostatic action by heating the tub to raise the water temperature. Measure the temperature at which the valve lifts more than 10 mm (0.4 in.). If the valve fails to operate properly, replace the thermostat.

Item		Assembly standard
Temperature at which valve starts opening	4DQ7	76.5 ± 2°C (170 ± 3.6°F)
	S4S	76.5 ± 1.5°C (170 ± 2.7°F)
Valve lift at 90°C (194°F)	4DQ7	9 mm (0.35 in.), minimum
	S4S	8 mm (0.31 in.), minimum



CAUTION

1) Stir the water in the bath with a stick to maintain its temperature uniform during test.
2) Install the thermostat with its air vent hole up.

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