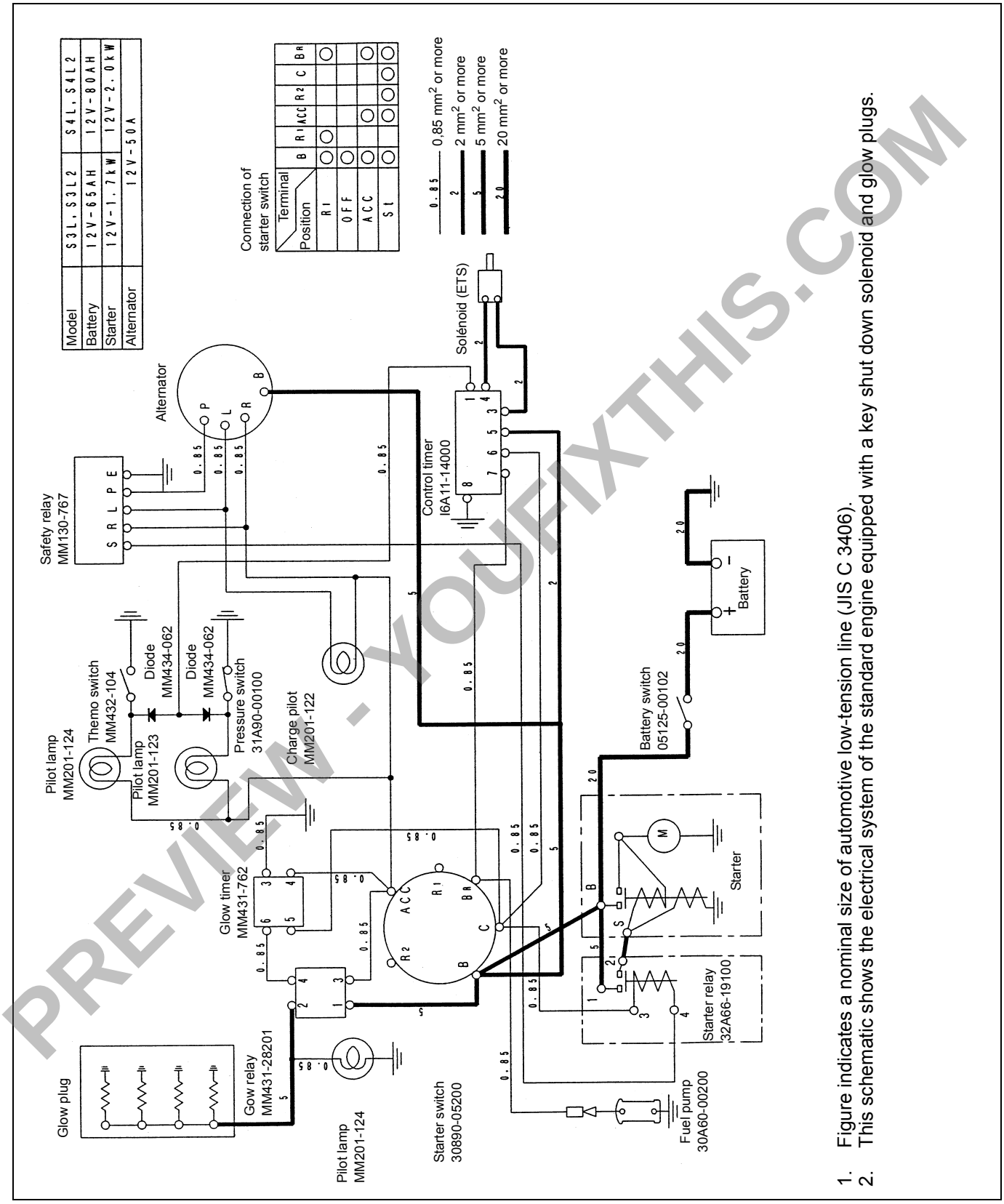
< ETS type stop solenoid >

28.2 Wiring diagrams

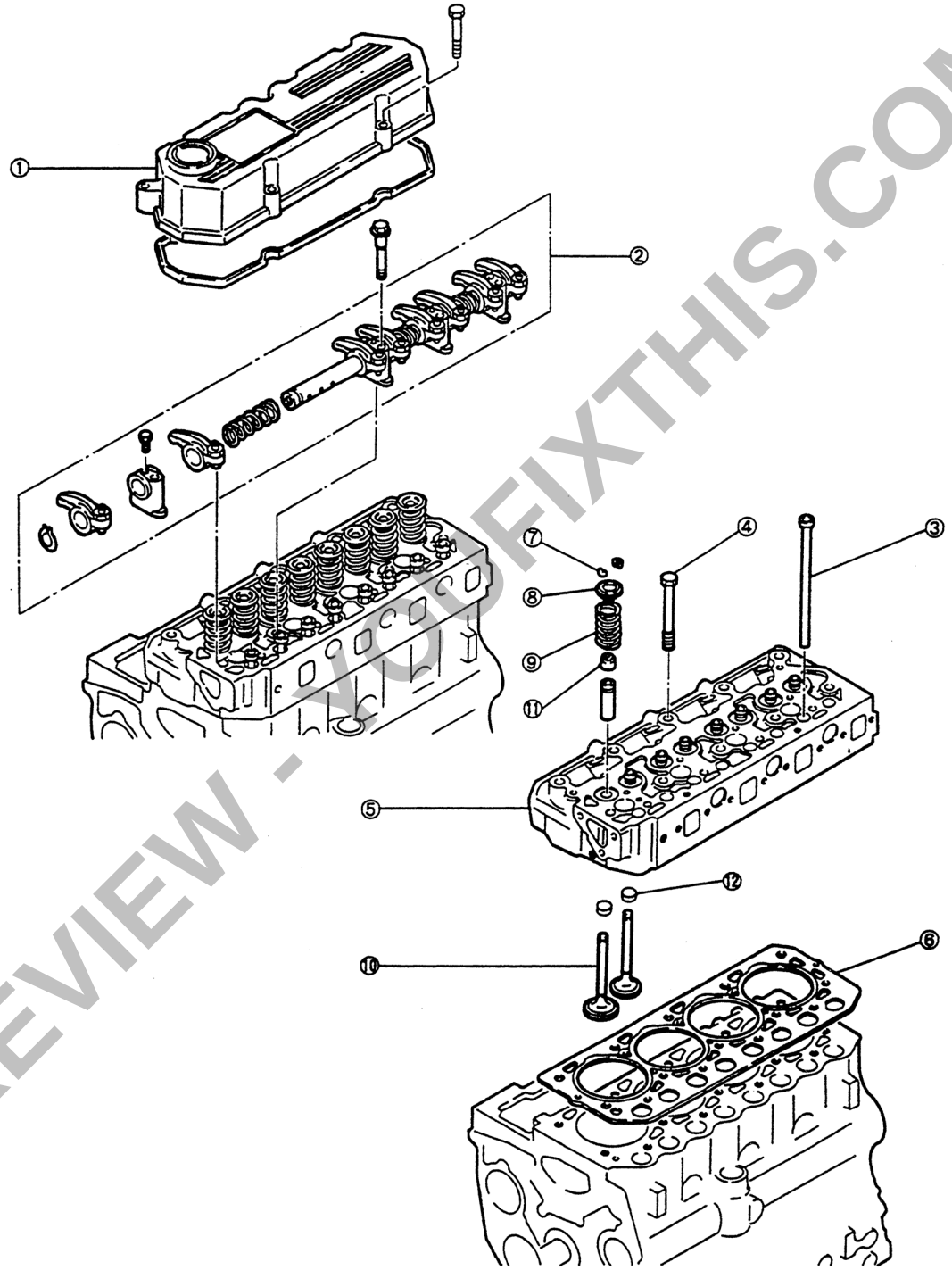


1. Figure indicates a nominal size of automotive low-tension line (JIS C 3406).
2. This schematic shows the electrical system of the standard engine equipped with a key shut down solenoid and glow plugs.

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14 CYLINDER HEAD AND VALVE MECHANISM



1. Rocker cover
2. Rocker shaft assembly
3. Valve push rod
4. Cylinder head bolt
5. Cylinder head
6. Cylinder head gasket
7. Valve lock
8. Valve retainer
9. Valve spring
10. Valve
11. Valve stem seal
12. Valve cap

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56 TIGHTENING TORQUES

56.1 Major bolts and nuts

Unit: mm (in.)

Bolt or nut	Thread, mm				Torque, kgf·m (lbf·ft) [N·m]
	Dia-meter	Pitch	Width	Clamp length	
Cylinder head bolt	M10	1.25	14	87	9 ± 0.5 (65 ± 4) [88 ± 5]
Rocker cover bolt	M8	1.25	12	40	1.15 ± 0.15 (8.3 ± 1.1) [11.3 ± 1.5]
Rocker shaft bracket bolt	M8	1.25	12	58	1.5 ± 0.5 (11 ± 4) [14.7 ± 5]
Thermoswitch	M16	1.5	17	31.5	2.3 ± 0.4 (16.6 ± 3) [22.6 ± 4]
Crankshaft pulley nut	M18	1.5	27	—	17.5 ± 2.5 (127 ± 18) [172 ± 25]
Main bearing cap bolt	M10	1.25	17	81	5.25 ± 0.25 (38 ± 2) [51.5 ± 2.5]
Connecting rod cap nut	M9	1.0	14	—	3.55 ± 0.25 (25.7 ± 2) [34.8 ± 2.5]
Rear plate bolt (for tractor engine)	M12	1.25	17	28	9.5 ± 1 (69 ± 7) [93 ± 10]
Rear plate bolt (standard)	M12	1.25	17	28	6.5 ± 1 (47 ± 7) [64 ± 10]
Rear plate bolt (stamping)	M8	1.25	12	16	1.15 ± 0.15 (8.3 ± 1.1) [11.3 ± 1.5]
Flywheel bolt	M12	1.25	19	29	13.5 ± 0.5 (98 ± 4) [132 ± 5]
Oil pan bolt (for tractor engine)	M8	1.25	12	25	2.8 ± 0.3 (20.3 ± 2.2) [27.5 ± 3]
Oil pan drain plug	M14	1.5	22	10	4 ± 0.5 (29 ± 4) [39 ± 5]
Pressure relief valve	M22	1.5	22	33	5 ± 0.5 (36 ± 4) [49 ± 5]
Oil filter	M20	1.5	—	—	1.2 ± 0.1 (8.7 ± 0.7) [12 ± 1]
Oil pressure switch	PT1/8	—	26	11	1 ± 0.2 (7.2 ± 1.4) [10 ± 2]
Fuel injection pipe nut	M12	1.5	—	—	3 ± 0.5 (22 ± 4) [29 ± 5]
Fuel leak-off pipe nut	M12	1.5	18	—	2.75 ± 0.25 (20 ± 2) [27 ± 2.5]
Delivery valve holder	—	—	19	—	4.5 ± 0.5 (32.5 ± 4) [44 ± 5]
Fuel injection nozzle holder	M20	1.5	21	—	5.5 ± 0.5 (40 ± 4) [54 ± 5]
Retaining nut for delivery valve holder body	M16	0.75	19	—	3.75 ± 0.25 (27 ± 2) [37 ± 2.5]
Sliding sleeve shaft	M10	1.25	14	29.5	3.6 ± 0.6 (26 ± 4) [35 ± 6]
Special nut for torque spring set	M12	1.0	17	—	2 ± 0.5 (14 ± 4) [20 ± 5]
Glow plug	M10	1.25	12	60	1.75 ± 0.25 (12.7 ± 2) [17.2 ± 2.5]
Glow plug connection plate	M4	0.7	8	—	0.125 ± 0.025 (0.9 ± 0.2) [1.2 ± 0.2]
Stop solenoid nut	M30	1.5	36	—	4.5 ± 0.5 (32.5 ± 4) [44 ± 5]
Starter B terminal	M8	1.25	12	—	1.1 ± 0.1 (8 ± 0.7) [10.8 ± 1]

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6.2 Engine troubleshooting

6.2.1 Problem 1: Hard starting

1. Items to be checked ahead of time
- Clogged air cleaner
- Wrong oil grade for weather conditions
- Poor quality fuel
- Low cranking speed

2. Inspection procedure

Is heating system normal? No ▷ Glow plugs are energized shortly after starter switch is turned to ON. No ▷ Check control timer unit.

▽Yes

Are fuel lines free of restriction? (Is fuel pump operating properly when starter switch in ON position?) No ▷ Check fuel filter, fuel lines and fuel tank.

▽ Yes

Are fuel injection timing and valve clearance correct? No ▷ Make adjustment to the timing and clearance.

▽ Yes

Is fuel injection nozzle discharge pattern normal? Is injection pressure correct? No ▷ Make adjustment to the nozzles.

▽ Yes

Is compression pressure correct? No ▷ Check valves, piston rings and cylinder head gasket.

▽ Yes

Fuel injection pump is faulty.

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3 SPECIFICATIONS[1]

System	Item	Model							
		S3L	S3L-T	S3L2	S3L2-T	S4L	S4L-T	S4L2	S4L2-T
ENGINE PROPER	Type	4-cycle, water-cooled, vertical, overhead valve, diesel engine							
	Combustion chamber	Swirl chamber type							
	No. of cylinders	3				4			
	Bore x Stroke (mm)	78x78.5		78x92		78x78.5		78x92	
	Total displacement (*l*)	1.125		1.318		1.500		1.758	
	Compression ratio	22							
	Firing order	1-3-2				1-3-4-2			
	Dry weight (kg)	135	139	135	139	155	159	155	159
LUBRICATING SYSTEM	Lubricating method	Forced lubrication							
	Oil pump	Trochoid pump							
	Oil filter	Paper element type							
	Oil capacity: FULL level/EMPTY level (*l*) (Exclusive of oil filter capacity 0.5 *l*)	Shallow type oil pan: 3.7/2.3 Deep type oil pan: 5.7/3.1				Shallow type oil pan: 5.5/3.7 Deep type oil pan: 7.6/4.2			
FUEL SYSTEM	Fuel injection pump	Bosch M							
	Nozzle	Throttle type							
	Fuel injection pressure	140 kgf/cm^2							
	Fuel to be used	Diesel fuel; see chapter 7							
	Governor	Centrifugal weight type							
INTAKE SYSTEM	Air cleaner	Paper-element type							
	Turbocharger model	Without	TD025	Without	TD025	Without	TD025	Without	TD03
COOLING SYSTEM	Cooling method	Forced circulation of water							
	Water pump	Centrifugal type							
	Coolant capacity (*l*) (Engine proper only)	1.8				2.5			
ELECTRICAL SYSTEM	Starter (V - kW)	12 - 1.6 or 12 - 1.7 or 12 - 2.0							
	Alternator (V - A)	AC generator (12 - 50)							
	Glow plug	Sheathed type							
	Battery (capacity depends on application)	12V, 65 Ah or more				12V, 80 Ah or more			

Table 1 Specifications

1. All specifications are subject to change without any prior notice.

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46 LUBRICATION AND MAINTENANCE CHART

Recommended service should be performed at the specified intervals. Under extremely severe, dusty or wet operating conditions, more frequent lubrication than is specified in this chart may be necessary.

Perform service on items at multiples of the original requirement. For example, at Every 500 Service Hours, also service those items listed under Every 100 (250) Service Hours, Every 50 Service Hours and Every 10 Service Hours.

Interval	Item	Remarks (specifications)	Page
Every 10 Service Hours [Pre-Start Inspection]	Walk-around inspection	See operation manual	
	Check engine oil level		172
	Check fuel level	See operation manual	
	Check coolant level	See operation manual	
Every 50 Service Hours	Drain water and sediment from the fuel tank and water separator	See operation manual	
	Check the battery electrolyte level and specific gravity	See operation manual	
First 50 Service Hours of New or Reconditioned Engine	Change engine oil	See SPECIFICATIONS (page 16)	173
	Change oil filter		173
	Retighten nuts and bolts		191
Every 100 Service Hours	Clean fuel filter element	After cleaning, prime	181
	Clean radiator fins	See operation manual	
Every 250 Service Hours or once a year (whatever comes first)	Change engine oil	See SPECIFICATIONS (page 16)	173
	Change oil filter		173
Every 500 Service Hours	Check and adjust valve clearance	0.25 mm (0.0098 in.) for both inlet and exhaust valves	175
	Change fuel filter element	After changing, prime	180
	Check and adjust injection pressure	140 kgf/cm^2 (1 991 psi) [13 729 kPa]	183
	Check and adjust fan belt	Deflection: 13 mm (0.5 in.)	184
	Check glow plugs		133
Every 1000 Service Hours	Retighten nuts and bolts		191
	Check starter		115
	Check alternator		122
	Check turbocharger	See turbocharger manual	

Table 6 Lubrication and maintenance charts

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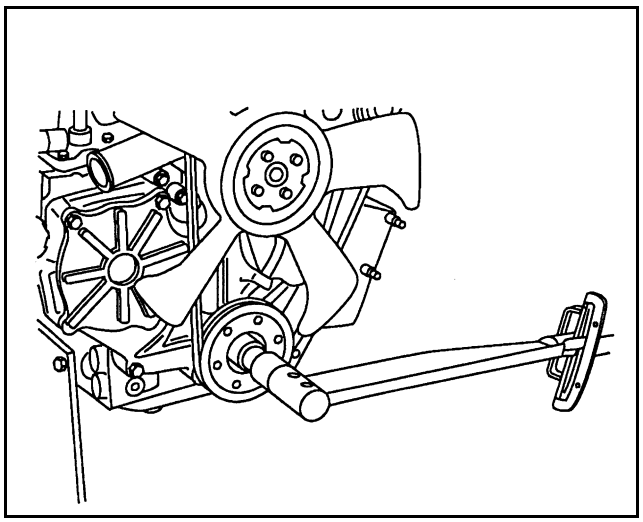


Figure 37 Holding flywheel

15.1 Flywheel removal

1. Have someone hold the crankshaft pulley with a wrench to prevent the flywheel from rotating.
2. Remove one of the bolts that hold the flywheel in position.

⚠ WARNING

Always signal each other to prevent possible personal injury.

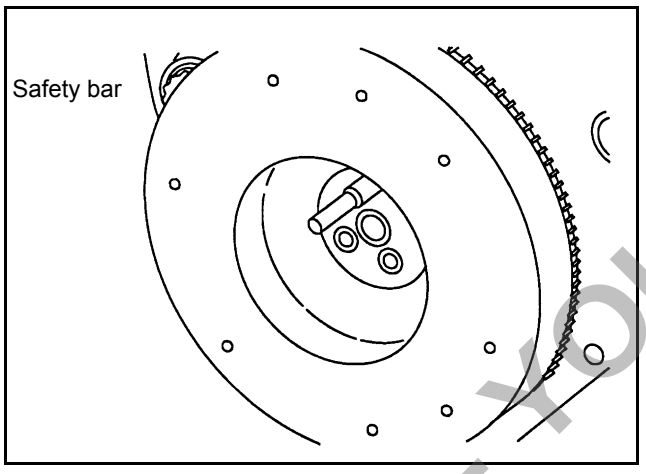


Figure 38 Removing flywheel

3. Install a safety bar (M12 x 1.25) into the threaded hole in the flywheel from which the bolt was removed in Step (2). Remove the remaining bolts.
4. Hold the flywheel by hands and withdraw it from the crankshaft. Joggling the flywheel back and forth will facilitate removal.

⚠ WARNING

When removing the flywheel, wear heavy gloves to avoid hand injury.

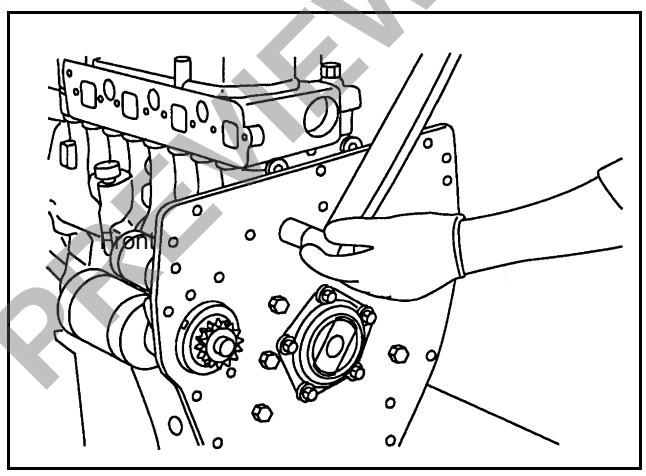


Figure 39 Removing rear plate

15.2 Rear plate removal

The rear plate is doweled in position. Pull the plate as straight as possible when removing it.

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38 GENERAL

38.1 Schematic

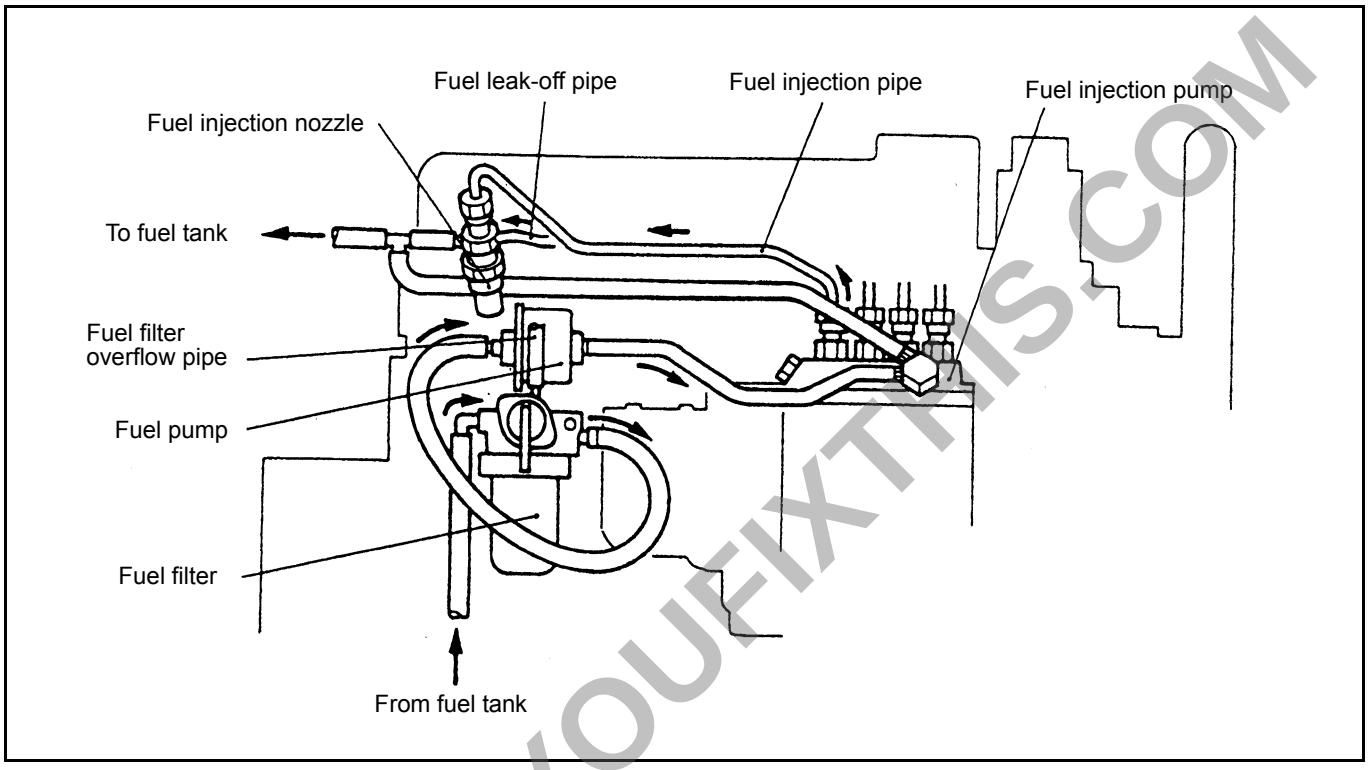


Figure 214 Schematic overview

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18 TIMING GEARS AND FLYWHEEL

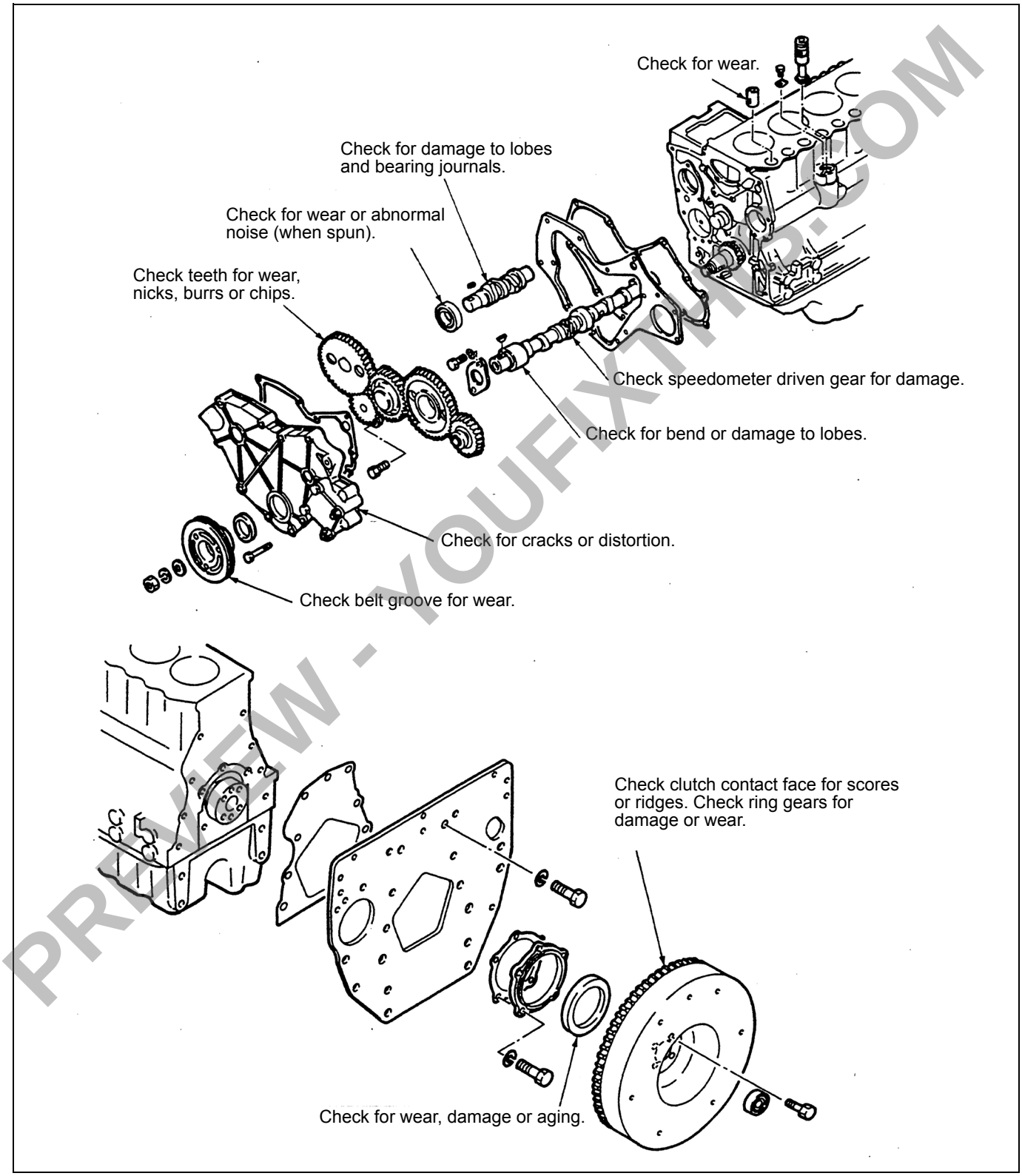


Figure 80 Inspection points

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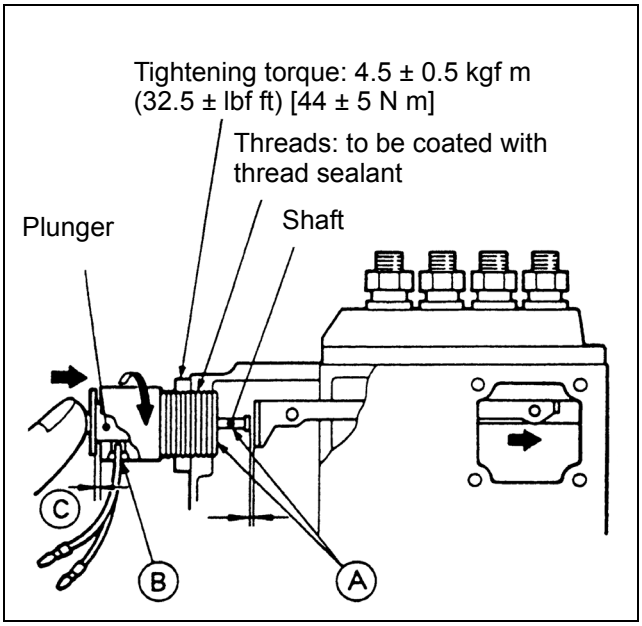


Figure 199 Installing shutoff solenoid

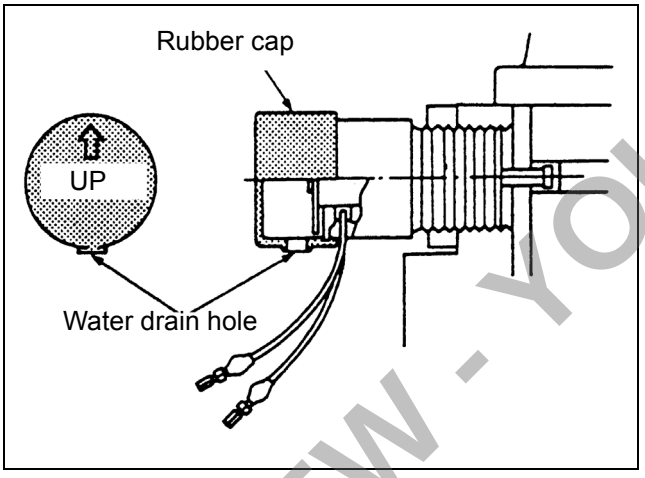


Figure 200 Installing rubber cap

5. Turn the shutoff solenoid in the governor case while pushing the plunger toward the control rack until the shaft is in touch with the tie rod. At this time, clearance C must be 0 mm. (Under this condition, the plunger will be rotated by the shutoff solenoid being turned in.)
6. Back off the shutoff solenoid 30° to 45° turn (the clearance between the control rack and plunger will be 0.15 to 0.20 mm (0.0059 to 0.0079 in.)) and tighten the nut to the specified torque.
7. Start the engine and make sure the engine stops when the plunger is pushed all the way.

NOTE

- Do not allow thread sealant to contact (A)
- Do not allow cleaning solvent to enter the solenoid through (B)

8. Install the rubber cap in position with teh arrow head toward up (with the side that has a water drain hole down) as shown in the illustration.

⚠ CAUTION

Do not allow cleaning solvent to contact any solenoid parts.

31.4 Inspection after assembly

1. For the schematic of the key shutoff system, see page 113 or 114.
2. Start the engine and make sure the engine stops when the starter switch key is turned to OFF position.
3. Start the engine and make sure the engine stops when the oil pressure switch terminal is shorted to the switch body.

NOTE

It will take about 10 seconds to restart an engine which was shut down by the key shutoff device.

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