

ISUZU WORKSHOP MANUAL INDUSTRIAL DIESEL ENGINE 4B-6B SERIES

**4BB1-4BD1-6BB1-6BD1-6BG1
4BD1T-6BD1T-6BG1T
MODELS**

FOREWORD

This Workshop Manual is designed to help you perform necessary maintenance, service, and repair procedures on applicable Isuzu industrial engines.

Information contained in this Workshop Manual is the latest available at the time of publication.

Isuzu reserves the right to make changes at any time without prior notice.

The Table of Contents at the right hand side of this page shows you the general arrangement of the material in this Workshop Manual. A more detailed Table of Contents precedes each individual section.

The black spot at the right hand side of some pages indicates the first page of a given section.

This Workshop Manual is applicable to 1986 and later models.

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MAIN DATA AND SPECIFICATIONS

Engine Model		4BB1	4BD1	4BD1T
Item				
Engine type		Water cooled, four cycle, vertical in-line, overhead valve		
Combustion chamber type		Direct injection		
Cylinder liner type		Dry		
No. of cylinders — bore × stroke	mm(in)	4—102.0×110.0 (4.02×4.33)	4 — 102.0 × 118.0 (4.02 × 4.65)	
Total piston displacement	cm ³ (in ³)	3,595 (219)	3,856 (235)	
Compression ratio (To 1)		17.5		
*Engine dimensions	mm(in)	842×645×775 (33.1×25.4×30.5)	842×645×775 (33.1×25.4×30.5)	810×690×856 (31.9×27.2×33.7)
Length × width × height				
*Engine weight (Dry)	kg(lb)	325 (716)	325 (716)	340 (750)
Fuel injection order		1 — 3 — 4 — 2		
Specified fuel		Diesel fuel (ASTM D975 No. 2D)		
Injection pump		In-line plunger, Bosch A type		
Governor		Mechanical, RSV type		
Injection nozzle		Multi hole		
*Injection starting pressure	kg/cm ² (psi)	150 (2,133), or 185 (2,630)		185 (2,630)
Fuel filter type		Center bolt or cartridge (spin-on)		
Water sedimentor (if so equipped)		Sediment/water level indicating type		
Compression pressure (At warm)	kg/cm ² (psi)	31 (441) at 200 rpm at sea level		
Valve clearances (At cold)	Intake mm(in)	0.40 (0.016)		
	Exhaust mm(in)	0.40 (0.016)		
Lubrication method		Pressurized circulation		
Oil pump		Gear type		
Main oil filter type		Center bolt, full flow or cartridge (spin-on)		
*Lubricating oil capacity	lit(US/UK gal)	13 (3.44/2.86)		
Oil cooler		Water cooled integral type		
Cooling method		Pressurized forced circulation		
Coolant capacity (engine only)	lit(US/UK gal)	8.5 (2.25/1.87)		
Water pump		Belt driven impeller type		
Thermostat type		Wax pellet type		
*Alternator	V-A	24 — 15		
*Starter	V-KW	24 — 3.5		
*Turbocharger manufacturer		—	—	IHI
*Turbocharger model		—	—	RHB6A

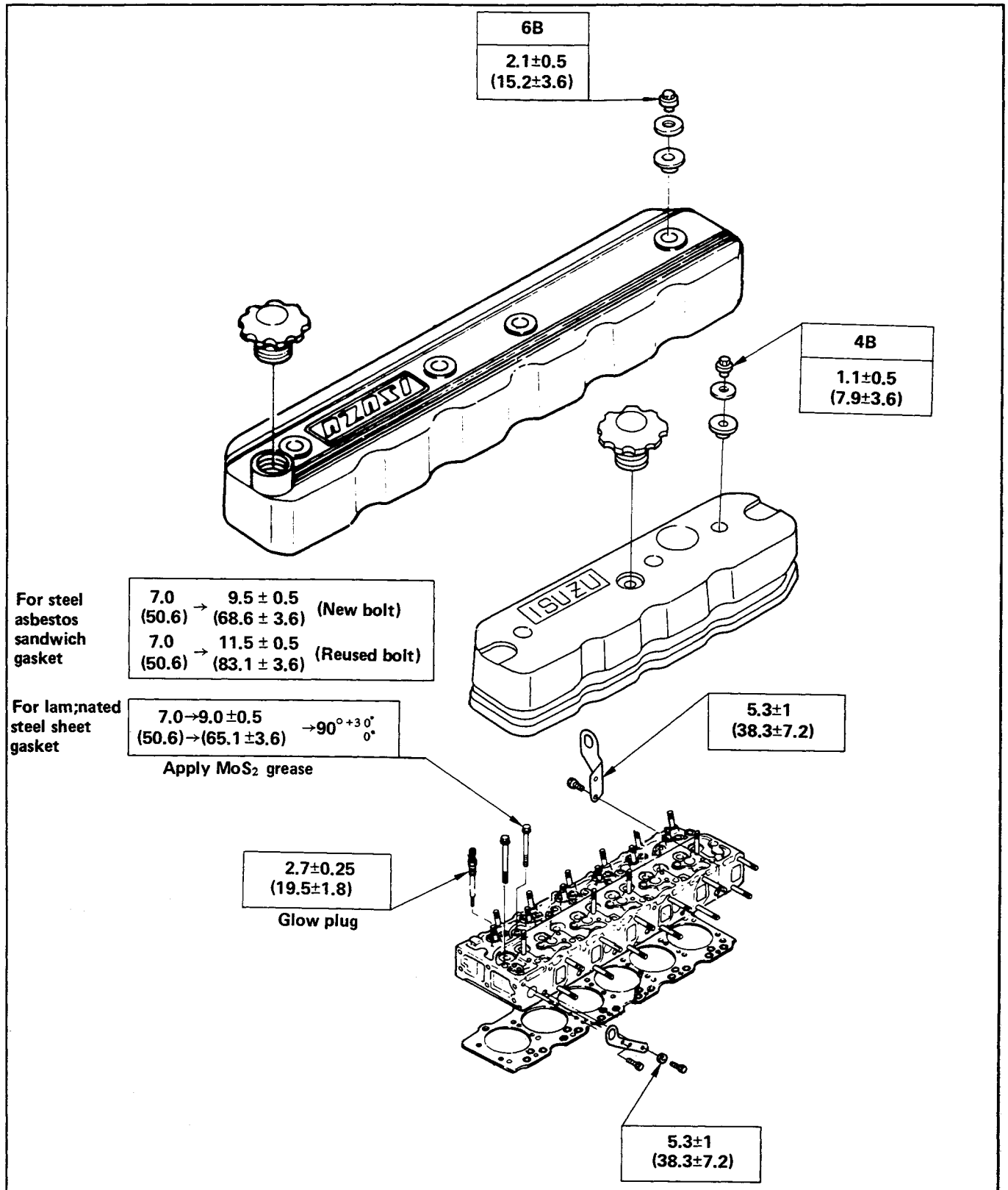
Note: 1. These specifications are based on the standard engine.
 2. Specifications for items marked with an asterisk (*) will vary according to the type of equipment on which the engine is installed.
 If you are unable to locate the data applicable to these specifications, please contact Isuzu Motors LTD through your machine supplier.



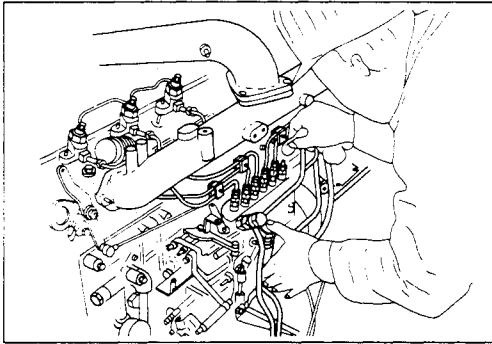
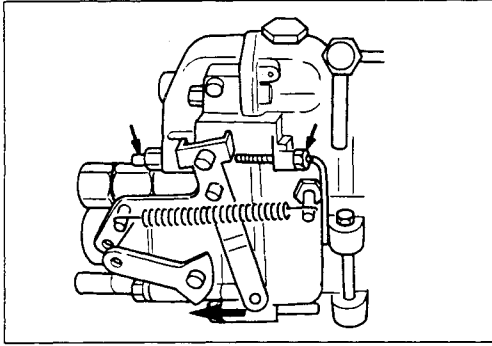
MAJOR PART FIXING NUTS AND BOLTS

Cylinder Head and Cover

kg-m(lb.ft)



Mos₂ Molybdenum disulfide paste.



6. Hold the fuel control lever at the fully open position.

7. Slowly turn the crankshaft pulley clockwise, at the same time, continue to feed the fuel with pumping the priming pump.

When the fuel stop to flow out from the No. 1 delivery valve holder, stop the pump instantaneously.

This crankangle position is the injection starting of the engine.



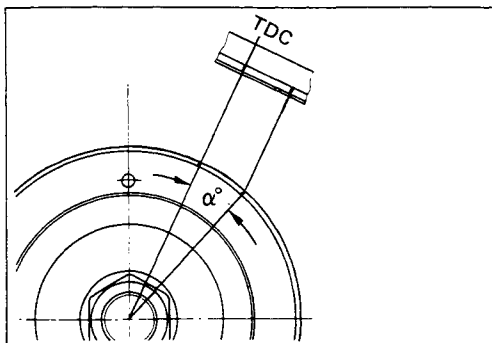
8. Observe and make sure that mark (injection starting angle line α°) on the crankshaft pulley is aligning with the pointer.



The timing line shows the injection starting angle of the engine.

Blow out the remaining fuel from the delivery valve holder.

Make sure that there is no fuel being delivered from the priming pump.



Note

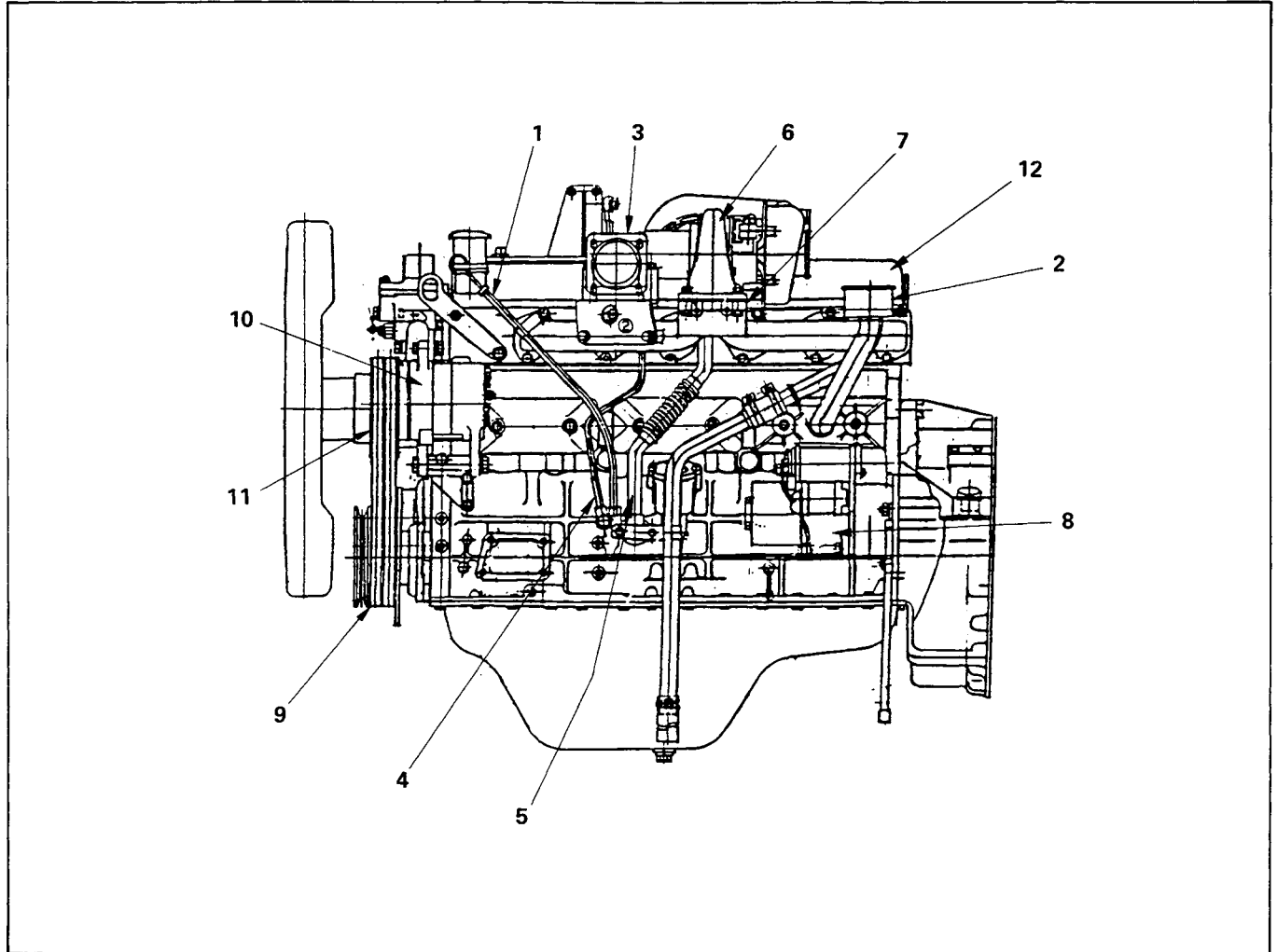
As the fuel injection timing crank angle differs depending on the engine application, respective engine's timing crank angle, when necessary, should be asked ISUZU MOTORS LIMITED via the machine supply source or the engine supply source. In such case, be sure to give the supply source full information on your engine's identification such as the engine serial number etc. which is stamped or affixed on the engine.



EXTERNAL PARTS DISASSEMBLY STEPS

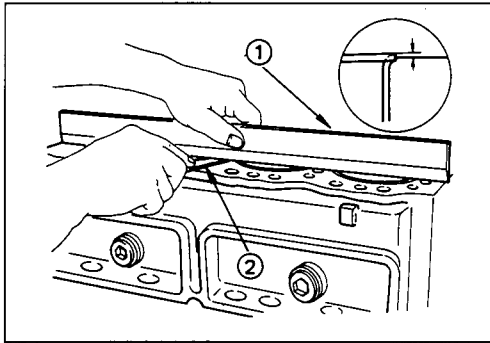
(Left-hand side)

MODEL 6BD1T



Disassembly Steps

- | | |
|----------------------------|-------------------------|
| 1. Dipstick and guide tube | 7. Gasket |
| 2. Air breather | 8. Starter motor |
| 3. Turbo adaptor | 9. Fan belt |
| 4. Oil feed pipe | 10. Alternator |
| 5. Oil drain pipe | 11. Fan pulley |
| ▲ 6. Turbocharger | 12. Cylinder head cover |



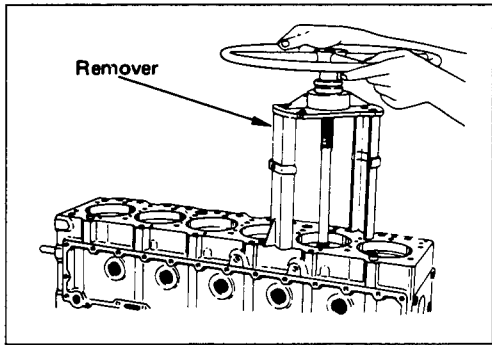
Cylinder Liner Projection Inspection



1. Hold a straight edge ① along the top edge of the cylinder liner to be measured.
2. Use a feeler gauge ② to measure each cylinder liner projection.

	mm(in)
	Limit
Cylinder Liner Projection	0.03 — 0.10 (0.001 — 0.004)

The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 mm (0.001 in).



Cylinder Liner Replacement

Cylinder Liner Removal



1. Set the cylinder liner remover to the cylinder liner.
2. Check that the remover shaft ankle is firmly gripping the cylinder liner bottom edge.
3. Slowly turn the remover shaft handle counterclockwise to pull the cylinder liner free.

Cylinder Liner Remover: 9-8523-1169-0

Cylinder Liner Remover Ankle:

For all models except 6BG1; 9-8523-2557-0

For 6BG1 ; 5-8523-1004-0

Note:

Take care not to damage the cylinder body upper face during the cylinder liner removal procedure.

Crankshaft Pin Bearing Clearance

1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
2. Install the bearing to the connecting rod.
Do not allow the crankshaft to move when installing the bearing cap.
3. Hold the connecting rod (with the bearing installed) against the crankshaft pin.
4. Attach the plastigage to the crankshaft pin.
Apply engine oil to the plastigage to keep it from falling.



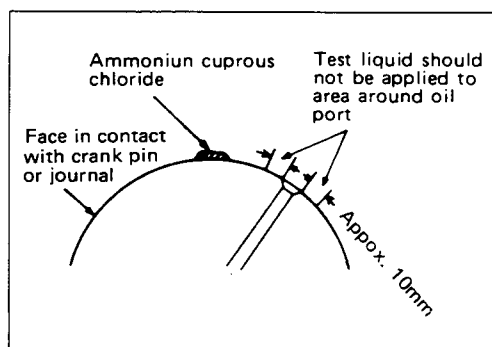
5. Install the connecting rod bearing cap and tighten it to the specified torque.
Do not allow the connecting rod to move when installing and tightening the bearing cap.



6. Remove the bearing cap.
7. Compare the width of the plastigage attached to either the crankshaft or the bearing against the scale printed on the plastigage container.

If the measured value exceeds the limit, perform the following additional steps.

- 1) Use a micrometer to measure the crankshaft outside diameter.
- 2) Use an inside dial indicator to measure the bearing inside diameter.
- 3) Replace the crankshaft and/or the bearing if the measured value(s) exceed the limit.



Crankshaft Tufftriding Inspection

Inspection

Model 6BG1, 6BG1T, 6BD1T and 4BD1T

1. Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of oil on the surfaces to be inspected.
2. Prepare a 10% solution of ammonium cuprous chloride (dissolved in distilled water).
3. Use a spot glass rod to apply the solution to the surface to be inspected.

Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

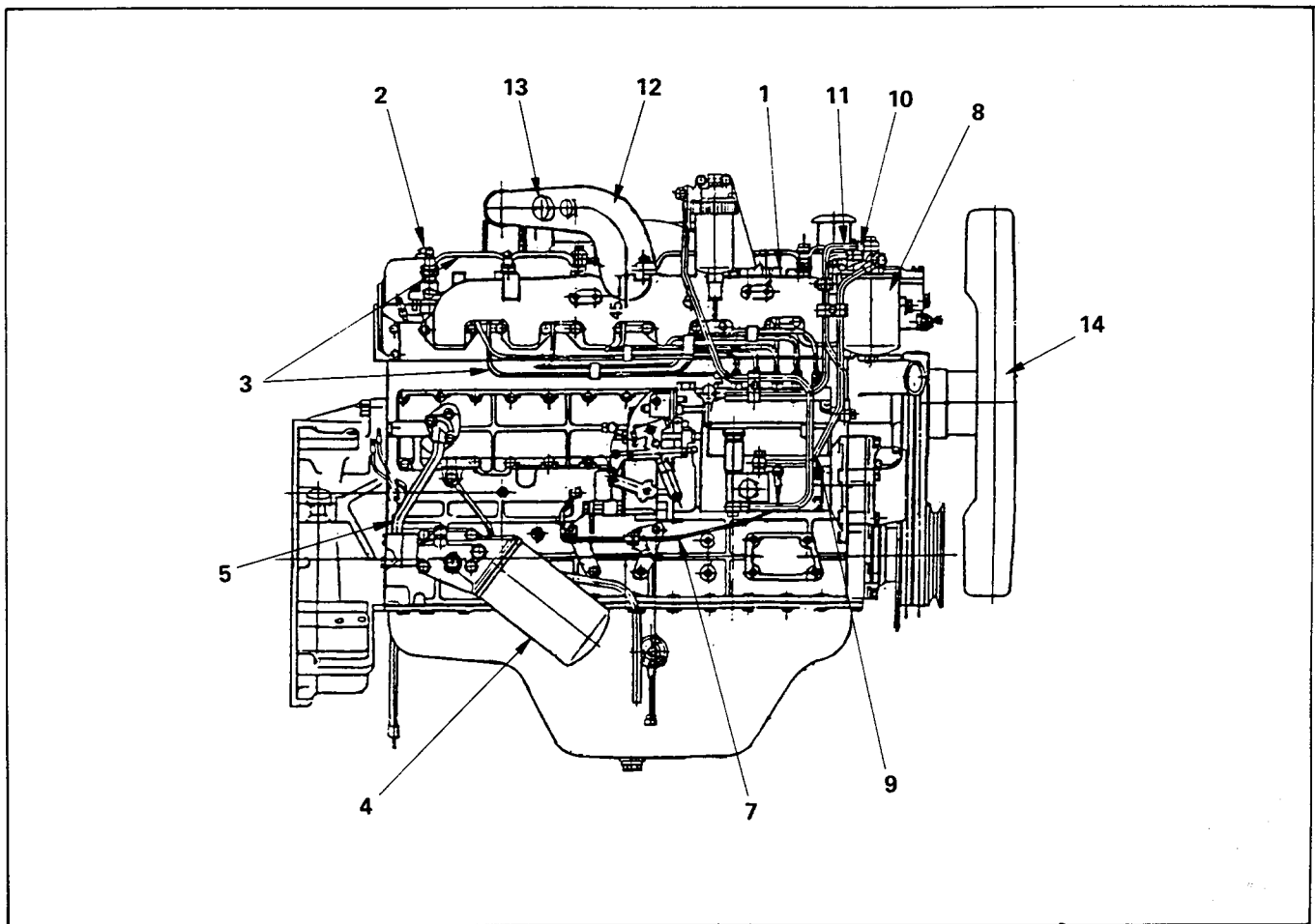
Note:

Do not allow the solution to come in contact with the oil ports and their surrounding area.



EXTERNAL PARTS REASSEMBLY STEPS (Right-hand Side)

MODEL 6BD1T

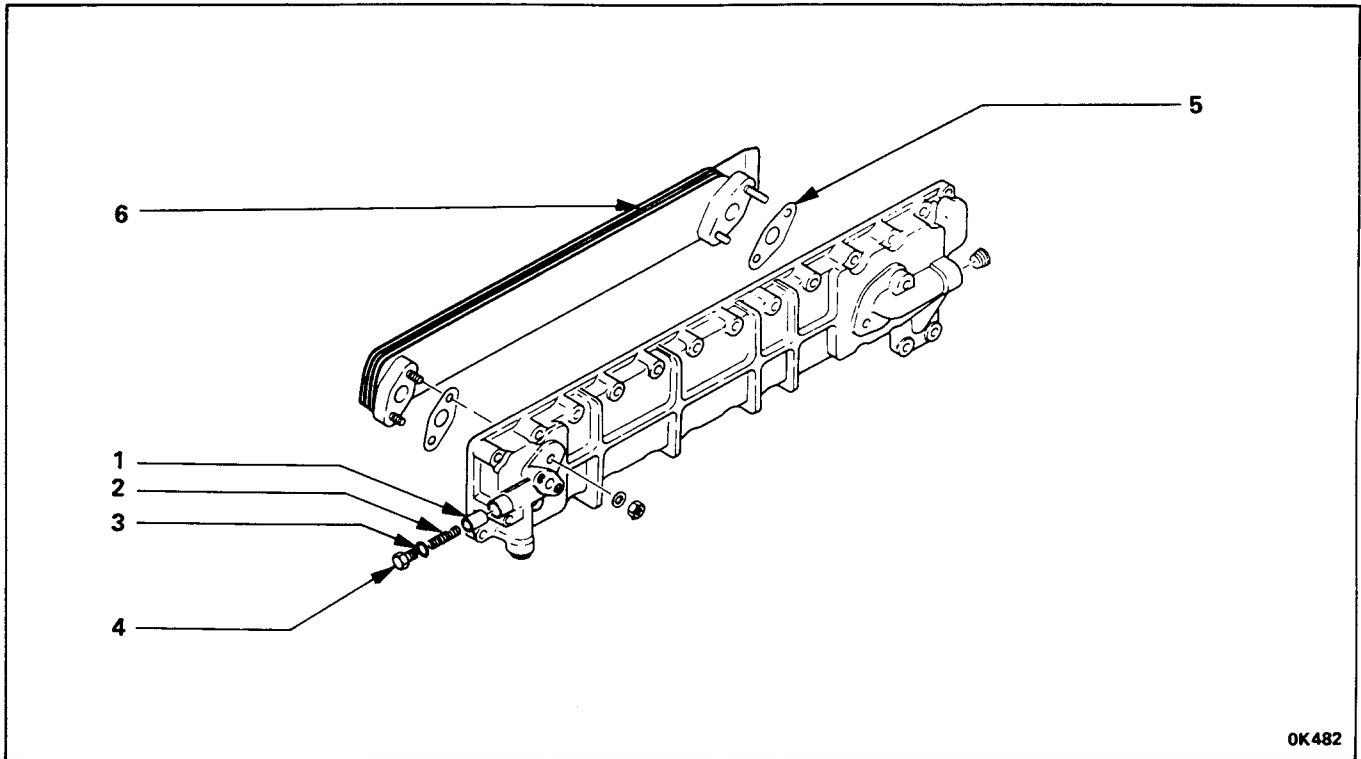


Reassembly Steps

- | | |
|---|---|
| 1. Glow plug | 8. Fuel filter |
| ▲ 2. Injection nozzle | ▲ 9. Fuel pipe ; feed pump to fuel filter |
| ▲ 3. Injection pipe and fuel leak off pipe | ▲ 10. Fuel pipe ; fuel filter to injection pump |
| ▲ 4. Oil filter | ▲ 11. Fuel return pipe |
| 5. Oil pipe ; filter to cooler | ▲ 12. Intake pipe |
| 6. Not installed | 13. Not installed |
| 7. Oil pipe ; injection pump to engine body | 14. Cooling fan |



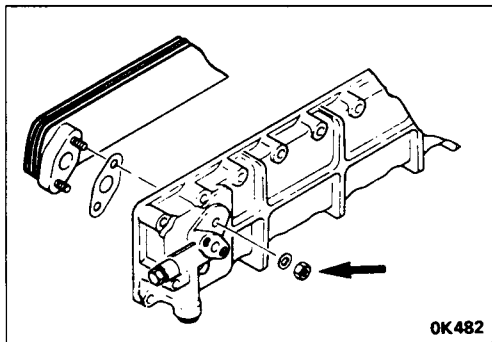
REASSEMBLY



OK482

Reassembly Steps

- 1. By-pass valve
- 2. By-pass valve spring
- 3. O-ring ; plug
- 4. By-pass valve plug
- 5. Element gasket
- ▲ 6. Oil cooler element



Important Operation



6. Oil Cooler Element

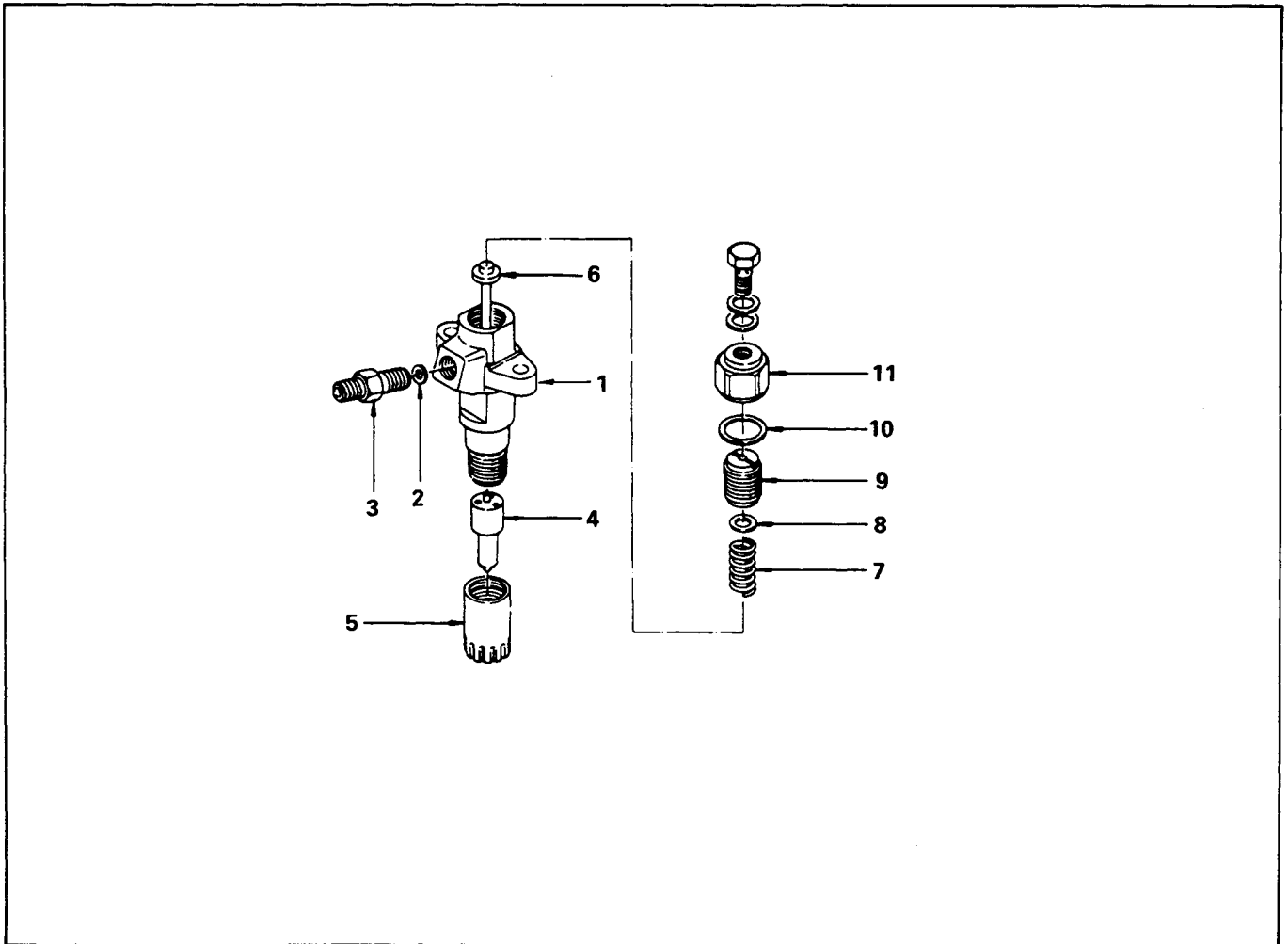
Install the oil cooler element to the oil cooler, and tighten the cooler element fixing nuts to the specified torque.

kg·m(lb.ft)

Oil Cooler Element Fixing Nut Torque	2.6 ± 0.5 (18.8 ± 3.6)
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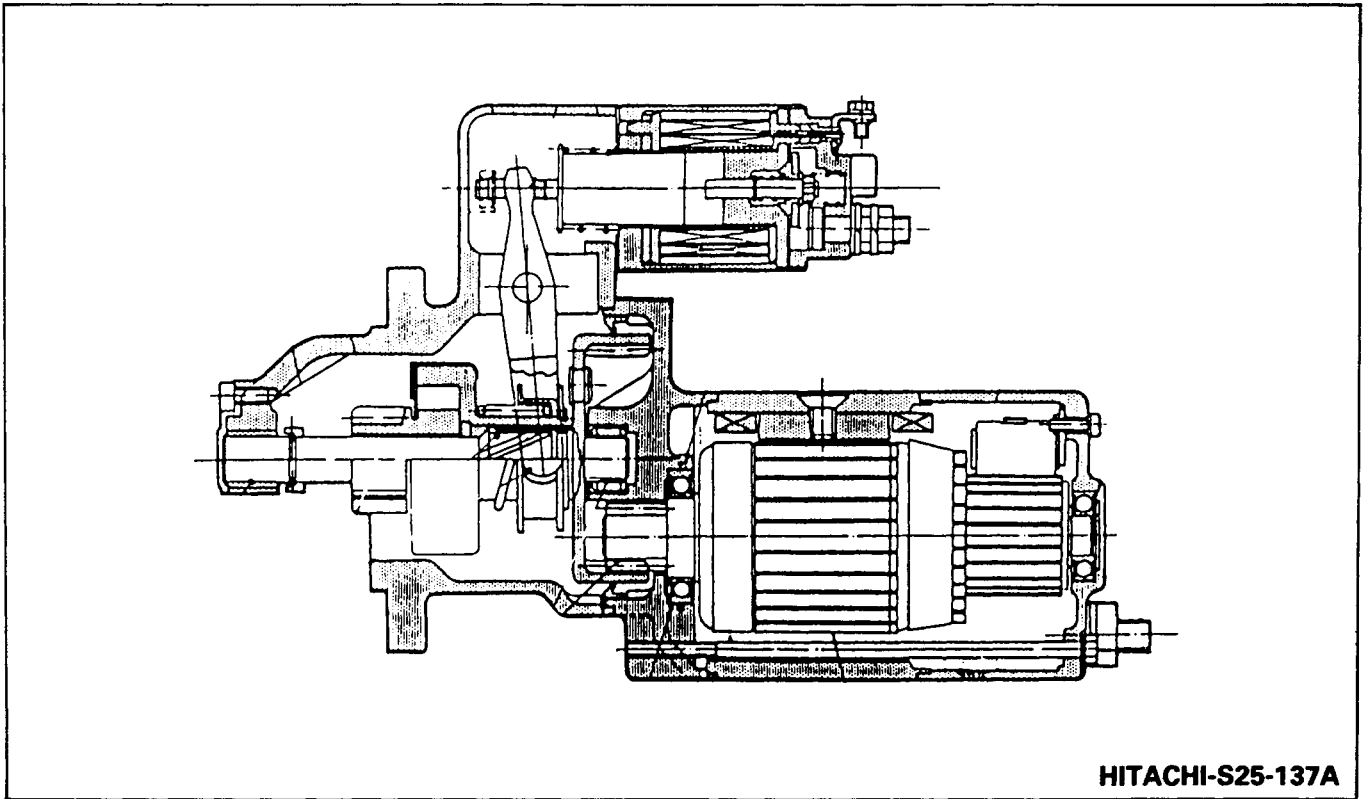
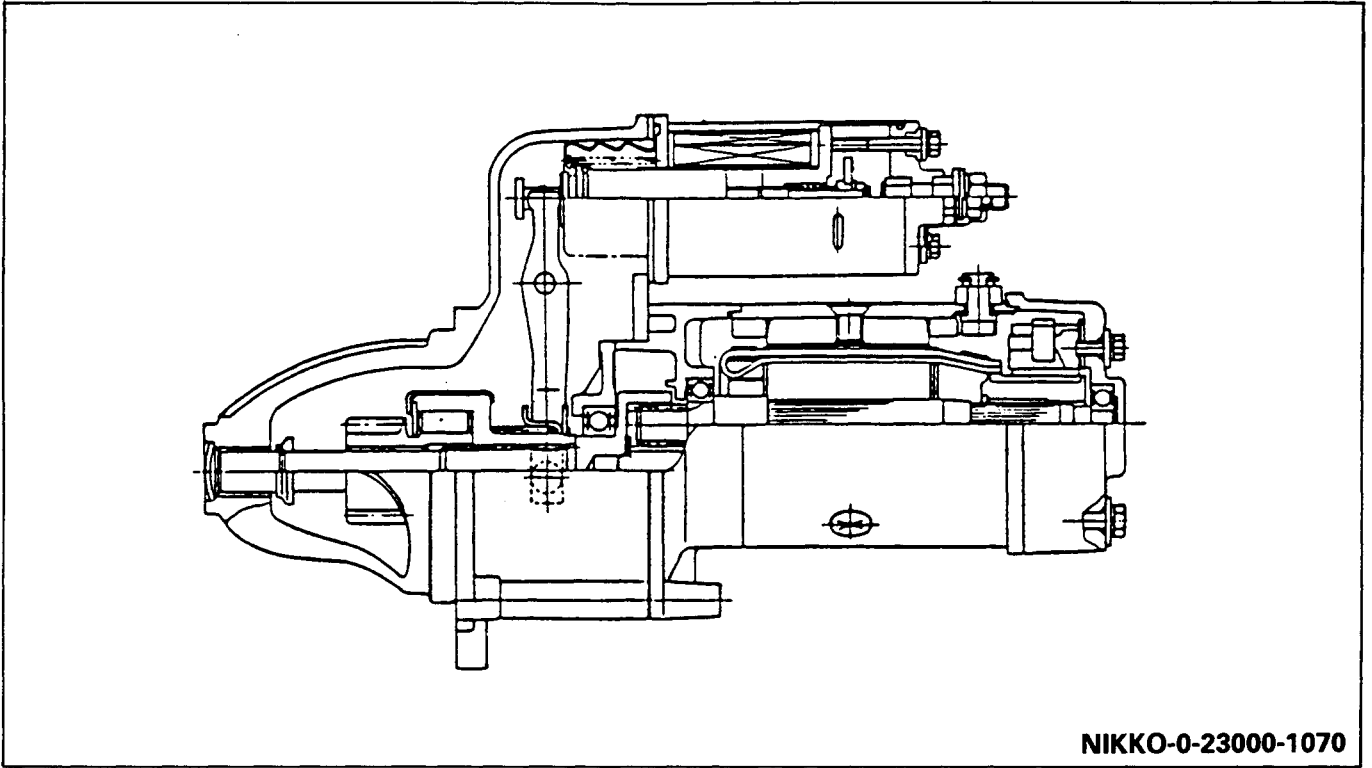
REASSEMBLY

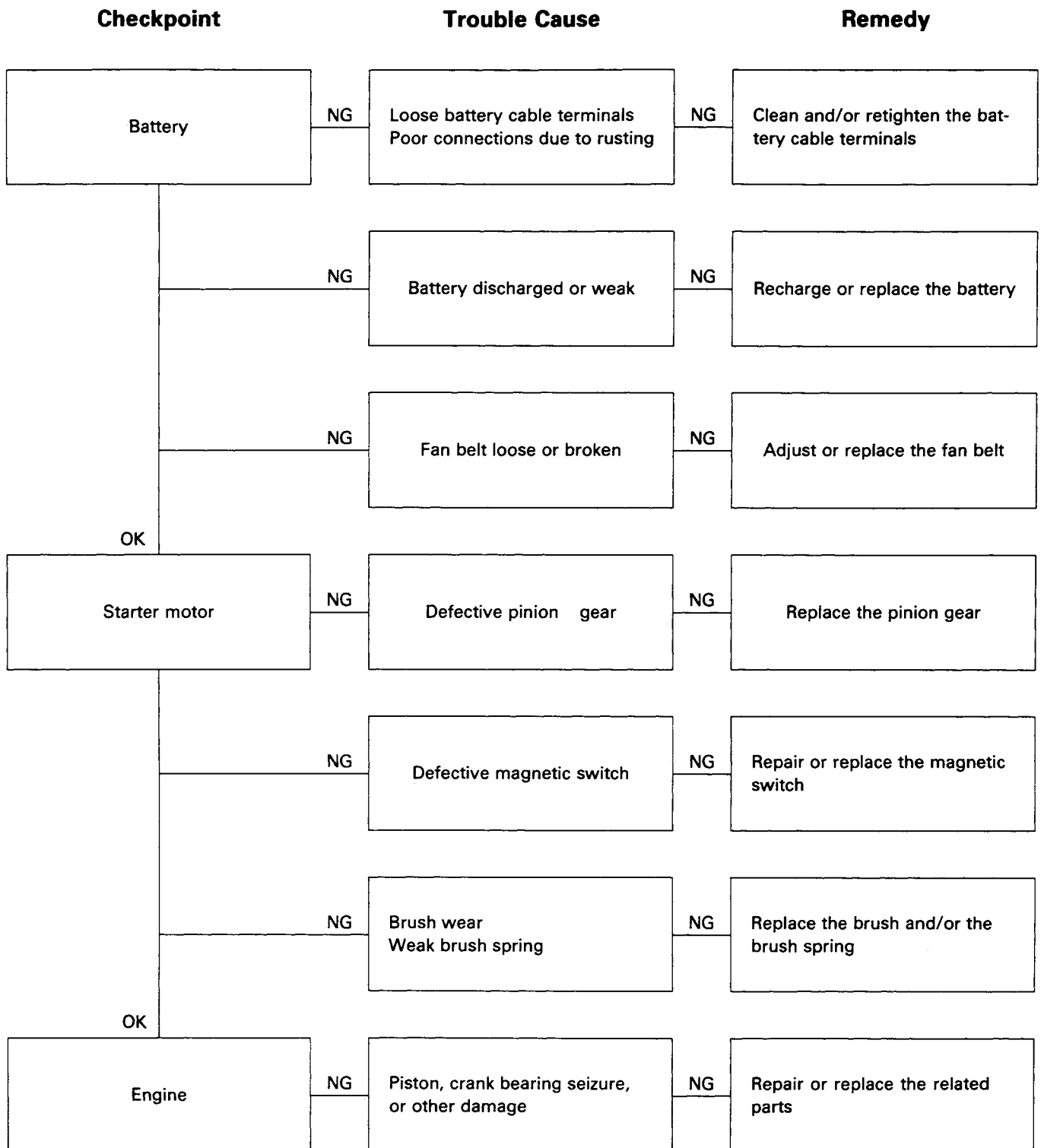


Reassembly Steps

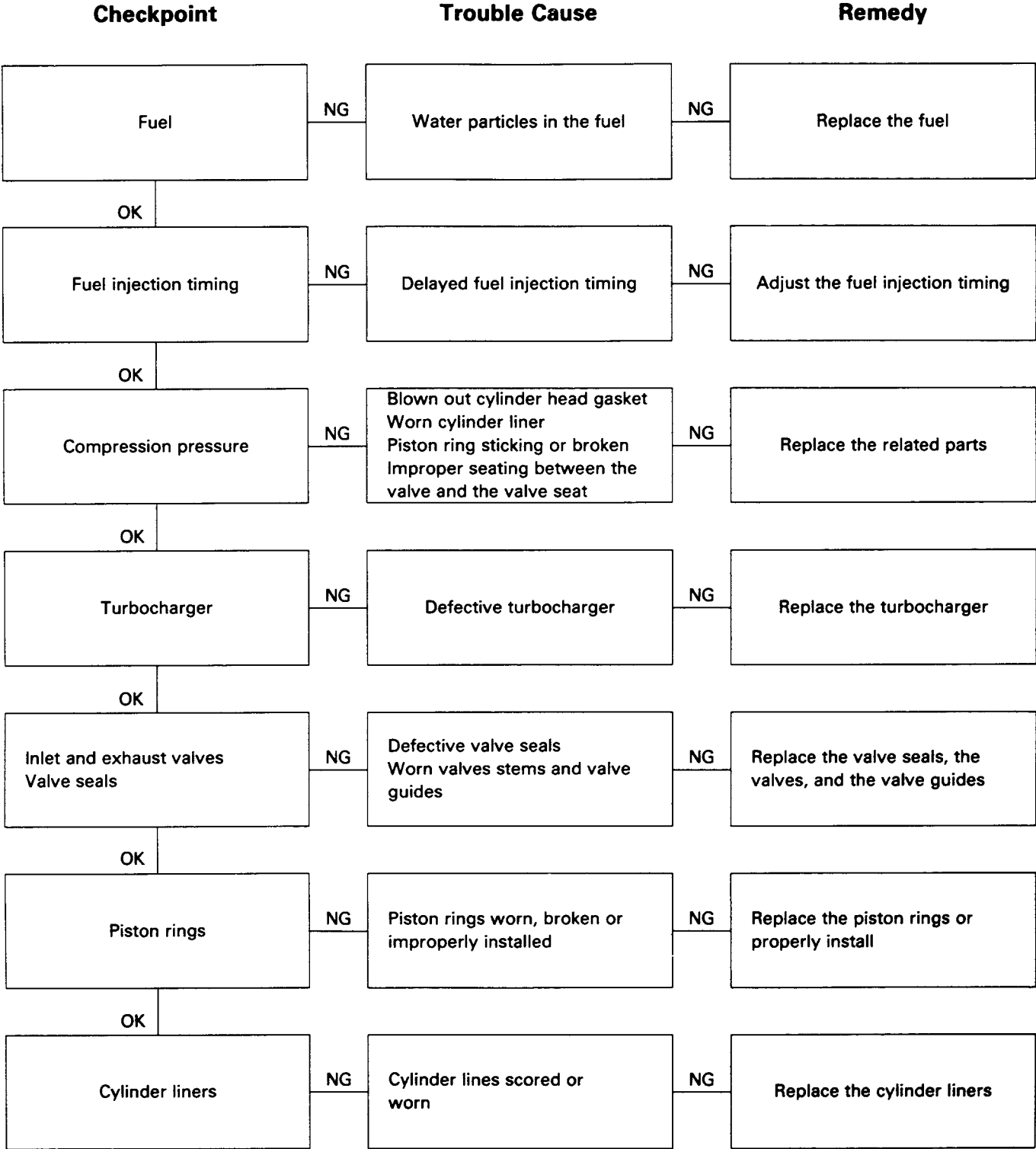
- | | |
|-------------------------------|-----------------------------|
| 1. Nozzle holder body | 7. Push rod spring |
| 2. Connector gasket | 8. Spring seat |
| ▲ 3. Injection pipe connector | 9. Nozzle adjusting screw |
| ▲ 4. Injection nozzle | 10. Cap nut gasket |
| ▲ 5. Retaining nut | ▲ 11. Nozzle holder cap nut |
| 6. Nozzle holder push rod | |

STARTER MOTOR SECTIONAL VIEW



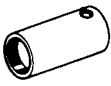
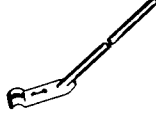


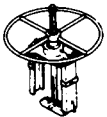





HARD STARTING**2) STARTER MOTOR OPERATES BUT ENGINE DOES NOT TURN OVER**

WHITE EXHAUST SMOKE



SPECIAL TOOL LIST

ITEM NO.	ILLUSTRATION	PART NO.	PARTS NAME	PAGE
1.		1-85111-003-0	Cylinder head bolt wrench	3— 8
2.		5-85317-001-0	Compression gauge adaptor	2—15
3.		9-8521-0122-0	Crankshaft taper bushing remover	3— 9
4.		9-8523-1426-0	Valve spring compressor	3—13 5— 5
5.		1-85220-001-0	Valve guide remover and installer	4— 3
6.		9-8523-1818-0	Camshaft bearing remover and installer	4—10
7.		9-8523-1169-0	Cylinder liner remover	4—12
8.		For except 6BG1 9-8523-2557-0 For 6BG1 5-8523-1004-0	Cylinder liner remover ankle	4—12
9.		For except 6BG1 9-8523-2554-0 For 6BG1 5-8522-1018-0	Cylinder liner installer	4—15
10.		9-8521-0141-0	Crankshaft gear remover	4—30

14—8 CONVERSION TABLE

TEMPERATURE

FAHRENHEIT TO CENTIGRADE

°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C
-60	-51.1	-2	-18.9	56	13.3	114	45.6	172	77.8	230	110.0	288	142.2	346	174.4
-58	-50	0	-17.8	58	14.4	116	46.7	174	78.9	232	111.1	290	143.3	348	175.6
-56	-48.9	2	-16.7	60	15.6	118	47.8	176	80.0	234	112.2	292	144.4	350	176.7
-54	-47.8	4	-15.6	62	16.7	120	48.9	178	81.1	236	113.3	294	145.6	352	177.8
-52	-46.7	6	-14.4	64	17.8	122	50.0	180	82.2	238	114.4	296	146.7	354	178.9
-50	-45.6	8	-13.3	66	18.9	124	51.1	182	83.3	240	115.6	298	147.8	356	180.0
-48	-44.4	10	-12.2	68	20.0	126	52.2	184	84.4	242	116.7	300	148.9	358	181.1
-46	-43.3	12	-11.1	70	21.1	128	53.3	186	85.6	244	117.8	302	150.0	360	182.2
-44	-42.2	14	-10.0	72	22.2	130	54.4	188	86.7	246	118.9	304	151.1	362	183.3
-42	-41.1	16	-8.9	74	23.3	132	55.6	190	87.8	248	120.0	306	152.2	364	184.4
-40	-40.0	18	-7.8	76	24.9	134	56.7	192	88.9	250	121.1	308	153.3	366	185.6
-38	-38.9	20	-6.7	78	25.6	136	57.8	194	90.0	252	122.2	310	154.4	368	186.7
-36	-37.8	22	-5.6	80	26.7	138	58.9	196	91.1	254	123.3	312	155.6	370	187.8
-34	-36.7	24	-4.4	82	27.8	140	60.0	198	92.2	256	124.4	314	156.7	372	188.9
-32	-35.6	26	-3.3	84	28.9	142	61.1	200	93.3	258	125.6	316	157.8	374	190.0
-30	-34.4	28	-2.2	86	30.0	144	62.2	202	94.4	260	126.7	318	158.9	376	191.1
-28	-33.3	30	-1.1	88	31.1	146	63.3	204	95.6	262	127.8	320	160.0	378	192.2
-26	-32.2	32	0	90	32.2	148	64.4	206	96.7	264	128.9	322	161.1	380	193.3
-24	-31.1	34	1.1	92	33.3	150	65.6	208	97.8	266	130.0	324	162.2	382	194.4
-22	-30.0	36	2.2	94	34.4	152	66.7	210	98.9	268	131.1	326	163.3	384	195.6
-20	-28.9	38	3.3	96	35.6	154	67.8	212	100.0	270	132.2	328	164.4	386	196.7
-18	-27.8	40	4.4	98	36.7	156	68.9	214	101.1	272	133.3	330	165.6	388	197.8
-16	-26.7	42	5.6	100	37.8	158	70.0	216	102.2	274	134.4	332	166.7	390	198.9
-14	-25.6	44	6.7	102	38.9	160	71.1	218	103.3	276	135.6	334	167.8	392	200.0
-12	-24.4	46	7.8	104	40.0	162	72.2	220	104.4	278	136.7	336	168.9	400	204.4
-10	-23.3	48	8.9	106	41.1	164	73.3	222	105.6	280	137.8	338	170.0	410	210.0
-8	-22.2	50	10.0	108	42.2	166	74.4	224	106.7	282	138.9	340	171.1	420	215.6
-6	-21.1	52	11.1	110	43.3	168	75.6	226	107.8	284	140.0	342	172.2	430	221.1
-4	-20.0	54	12.2	112	44.4	170	76.7	228	108.9	286	141.1	344	173.3	440	226.7

CENTIGRADE TO FAHRENHEIT

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
-50	-58.0	-18	-0.4	14	57.2	46	114.8	78	172.4	110	230.0	142	287.6	174	345.2
-49	-56.2	-17	1.4	15	59.0	47	116.6	79	174.2	111	231.8	143	289.4	175	347.0
-48	-54.4	-16	3.2	16	60.8	48	118.4	80	176.0	112	233.6	144	291.2	176	348.8
-47	-52.6	-15	5.0	17	62.6	49	120.2	81	177.8	113	235.4	145	293.0	177	350.6
-46	-50.8	-14	6.8	18	64.4	50	122.0	82	179.6	114	237.2	146	294.8	178	352.4
-45	-49.0	-13	8.6	19	66.2	51	123.8	83	181.4	115	239.0	147	296.6	179	354.2
-44	-47.2	-12	10.4	20	68.0	52	125.6	84	183.2	116	240.8	148	298.4	180	356.0
-43	-45.4	-11	12.2	21	69.8	53	127.4	85	185.0	117	242.6	149	300.2	181	357.8
-42	-43.6	-10	14.0	22	71.6	54	129.2	86	186.8	118	244.4	150	302.0	182	359.6
-41	-41.8	-9	15.8	23	73.4	55	131.0	87	188.6	119	246.2	151	303.8	183	361.4
-40	-40.0	-8	17.6	24	75.2	56	132.8	88	190.4	120	248.0	152	305.6	184	363.2
-39	-38.2	-7	19.4	25	77.0	57	134.6	89	192.2	121	249.8	153	307.4	185	365.0
-38	-36.4	-6	21.2	26	78.8	58	136.4	90	194.0	122	251.6	154	309.2	186	366.8
-37	-34.6	-5	23.0	27	80.6	59	138.2	91	195.8	123	253.4	155	311.0	187	368.6
-36	-32.8	-4	24.8	28	82.4	60	140.0	92	197.6	124	255.2	156	312.8	188	370.4
-35	-31.0	-3	26.6	29	84.2	61	141.8	93	199.4	125	257.0	157	314.6	189	372.2
-34	-29.2	-2	28.4	30	86.0	62	143.6	94	201.2	126	258.8	158	316.4	190	374.0
-33	-27.4	-1	30.2	31	87.8	63	145.4	95	203.0	127	260.6	159	318.2	191	375.8
-32	-25.6	0	32.0	32	89.6	64	147.2	96	204.8	128	262.4	160	320.0	192	377.6
-31	-23.8	1	33.8	33	91.4	65	149.0	97	206.6	129	264.2	161	321.8	193	379.4
-30	-22.0	2	35.6	34	93.2	66	150.8	98	208.4	130	266.0	162	323.6	194	381.2
-29	-20.2	3	37.4	35	95.0	67	152.6	99	210.2	131	267.8	163	325.4	195	383.0
-28	-18.4	4	39.2	36	96.8	68	154.4	100	212.0	132	269.6	164	327.2	196	384.8
-27	-16.6	5	41.0	37	98.6	69	156.2	101	213.8	133	271.4	165	329.0	197	386.6
-26	-14.8	6	42.8	38	100.4	70	158.0	102	215.6	134	273.2	166	330.8	198	388.4
-25	-13.0	7	44.6	39	102.2	71	159.8	103	217.4	135	275.0	167	332.6	199	390.2
-24	-11.2	8	46.4	40	104.0	72	161.6	104	219.2	136	276.8	168	334.4	200	392.0
-23	-9.4	9	48.2	41	105.8	73	163.4	105	221.0	137	278.6	169	336.2	210	410.0
-22	-7.6	10	50.0	42	107.6	74	165.2	106	222.8	138	280.4	170	338.0	220	428.0
-21	-5.8	11	51.8	43	109.4	75	167.0	107	224.6	139	282.2	171	339.8	230	446.0
-20	-4.4	12	53.6	44	111.2	76	168.8	108	226.4	140	284.0	172	341.6	240	464.0
-19	-2.2	13	55.4	45	113.0	77	170.6	109	228.2	141	285.8	173	343.4	250	482.0