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CHAPTER 4
ENGINE
B7-5 (4TNE98-EBVA)

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

2-1-1 Machine Body

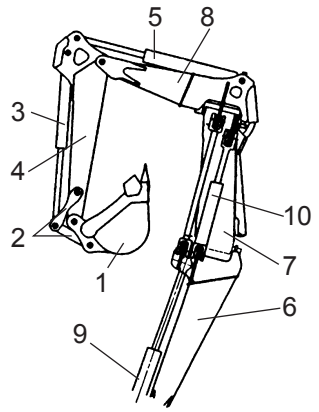
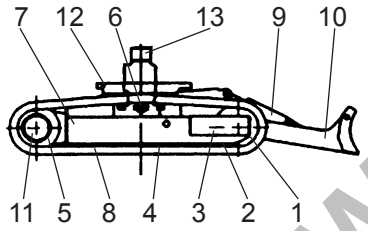
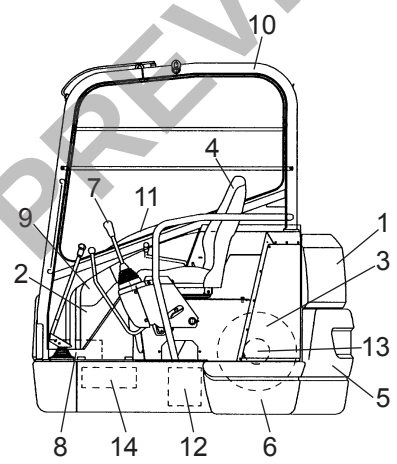
Item					Unit	B7-5, B7-5A
Main Specifications of Machine						
Dimensions						
	Overall length (Transportation position)				in. (mm)	227.56 (5780)
	Cabin	Overall height	Transportation position		in. (mm)	*1: 103.54 (2630) *2: 106.89 (2715)
			Traveling position		in. (mm)	111.57 (2834)
		Overall width	Full machine width		in. (mm)	89.37 (2270)
	Canopy	Overall height	Transportation position		in. (mm)	-
			Traveling position		in. (mm)	-
		Overall width	Full machine width		in. (mm)	-
	Tumbler center distance		Rubber		in. (mm)	90.08 (2288)
			Steel		in. (mm)	89.65 (2277)
	Track gauge				in. (mm)	73.62 (1870)
	Minimum ground clearance				in. (mm)	14.96 (380)
Traveling performance						
	Travel speed	Steel crawler	Low speed (Forward / Reverse)		MPH (km / h)	1.55 (2.5)
			High speed (Forward / Reverse)		MPH (km / h)	2.80 (4.5)
		Rubber crawler	Low speed (Forward / Reverse)		MPH (km / h)	1.68 (2.7)
			High speed (Forward / Reverse)		MPH (km / h)	2.92 (4.7)
	Climbing ability				degrees	–
	Permissible water depth limit				in. (mm)	19.69 (500)
Work performance						
	Bucket		Width (Standard) (Including side cutter)		in. (mm)	29.53 (750)
			(Standard. JIS heaped capacity) / [Old JIS]		cu.ft. (cu.m)	9.89 (0.28) / [8.83 (0.25)]
			Number of teeth / Installation method		pcs.	4 / Rubber pin lock
	Maximum digging depth		With blade raised		in. (mm)	171.26 (4350)
			With blade on the ground		in. (mm)	177.17 (4500)
	Maximum depth of vertically digging				in. (mm)	148.42 (3770)
	Maximum dumping height				in. (mm)	216.14 (5490)
	Minimum front swing radius (with boom in front)				in. (mm)	47.24 (1200)
	Minimum front swing radius (Boom offset)			Left	in. (mm)	68.27 (1734)
				Right	in. (mm)	74.53 (1893)
	Rear end swing radius				in. (mm)	44.49 (1130)

*1: <AYR spec> B7-5 S/N 50501 to 50642, <US spec> B7-5 S/N 50501 and after
*2: <AYR spec> B7-5 S/N 50643 and after, B7-5A S/N 57501 and after, <US spec> B7-5A S/N 57501 and after

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2-3 Weight List of Main Parts

[Unit : lbs. (kg)]

Equipment	No.	Part		B7-5, B7-5A Cabin	
				Steel crawler	Rubber crawler
Front implement					
	1	Bucket	Ass'y	434.4 (197)	
	2	Bucket arm & link	Ass'y	77.2 (35)	
	3	Bucket cylinder	Ass'y	105.8 (48)	
	4	Arm	Ass'y	313.1 (142)	
	5	Arm cylinder	Ass'y	196.2 (89)	
	6	Boom A	Ass'y	606.4 (275)	
	7	Boom B	Ass'y	507.2 (230)	
	8	Boom C	Ass'y	496.1 (225)	
	9	Boom cylinder	Ass'y	319.7 (145)	
	10	Offset cylinder	Ass'y	154.4 (70)	
Undercarriage					
	1	Idler	Ass'y	116.8 (53) ×2	
	2	Crawler guard	Ass'y	24.3 (11) × 2	–
	3	Crawler adjuster	Ass'y	83.8 (38) × 2	
	4	Track roller	Ass'y	39.7 (18) × 10	
	5	Sprocket	Ass'y	39.7 (18) × 2	
	6	Carrier roller	Ass'y	7.72 (3.5) × 2	
	7	Track frame	Ass'y	2081.5 (944)	
	8	Steel crawler & Rubber crawler	Ass'y	897 (407) × 2	948 (430) × 2
	9	Blade cylinder	Ass'y	132.3 (60)	
	10	Blade	Ass'y	981.2 (445)	
	11	Travel motor	Ass'y	191.8 (87) × 2	
	12	Swing bearing	Ass'y	216.1 (98)	
	13	Swivel & hose or fitting	Ass'y	99.2 (45)	
Upperstructure					
	1	Engine hood	Ass'y	44.1 (20)	
	2	Hydraulic oil tank & filters	Ass'y	154.4 (70)	
	3	Engine		650.5 (295)	
	4	Operator's seat & mount	Ass'y	138.9 (63)	
	5	Counterweight	Ass'y	1415.6 (642)	
	6	Turning frame	Ass'y	2381.4 (1080)	
	7	Controls (4 cables)	Ass'y	88.2 (40)	
	8	Battery	Ass'y	63.9 (29)	
	9	Fuel tank & piping	Ass'y	99.2 (45)	
	10	Canopy or cabin	Ass'y	529.2 (240)	
	11	Covers, steps and panels		66.2 (30)	
	12	Swing motor	Ass'y	165.4 (75)	
	13	Pump & mount and hoses	Ass'y	165.4 (75)	
	14	Control valve & fitting and hoses	Ass'y	220 (100)	

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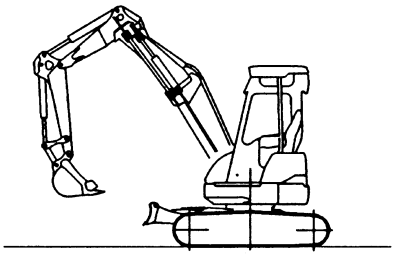
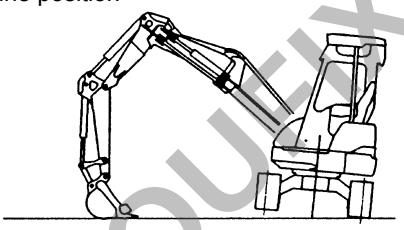
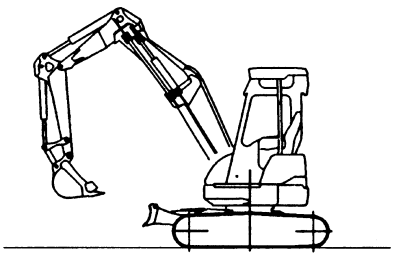
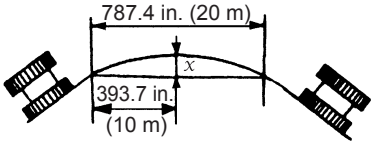
3-7 List of Tightening Torque

3-7-1 Machine

Applicable model			B7-5, B7-5A		
Equipment			Thread size	Tightening torque ft•lbf (N•m)	Adhesive
	No.	Tightening part			
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	M16 (10.9T)	151.9 to 173.6 (205.9 to 235.4)	Three Bond 1324
	2	Engine × Engine mount (Flywheel side)	M10 (11T)	61.5 (83.4)	Three Bond 1324
	3	Engine × Engine mount (Radiator side)	M12 (10.9T)	79.6 to 94.0 (107.9 to 127.5)	Three Bond 1324
	4	Clamp	M10 Nut 10	18.1 to 23.9 (24.5 to 32.4)	
	5	Air cleaner	M8	14.5 to 16.7 (19.6 to 22.6)	
	6	Air cleaner intake hose	Hose clip 70	1.5 to 2.1 (2.0 to 2.9)	
	7	Air cleaner intake hose	Hose clip 80	1.5 to 2.1 (2.0 to 2.9)	
	8	Air cleaner intake hose (suction side)	Hose clip 80	0.7 to 1.5 (1.0 to 2.0)	
	9	Cooling water hose	Hose band 50	2.1 (2.9)	
	10	Fuel gauge unit	Pan-head machine screw M5	0.7 to 1.5 (1.0 to 2.0)	
	11	Fuel gauge hose	Hose band 14	0.7 to 1.5 (1.0 to 2.0)	
	12	Fuel tank	M16	123.0 to 151.9 (166.7 to 205.9)	Three Bond 1324
	13	Buttery holding rod	Nut M8	2.1 (2.9)	
	14	Radiator bracket R	M16	195.3 to 224.2 (264.8 to 304.0)	Three Bond 1324
	15	Radiator mount vibroisolating rubber	Nut M8	9.4 to 12.3 (12.7 to 16.7)	
	16	Radiator mount vibroisolating rubber	Nut M10	18.1 to 23.9 (24.5 to 32.4)	
	17	Exhaust duct vibroisolating rubber	Nut M10	18.1 to 23.9 (24.5 to 32.4)	
	18	Heater hose	Hose clip 22	1.5 to 2.1 (2.0 to 2.9)	
	19	Starter switch	Fine lock nut M18	21.7 to 25.3 (29.4 to 34.3)	
	20	Safety switch	Fine lock nut M16	21.7 to 25.3 (29.4 to 34.3)	

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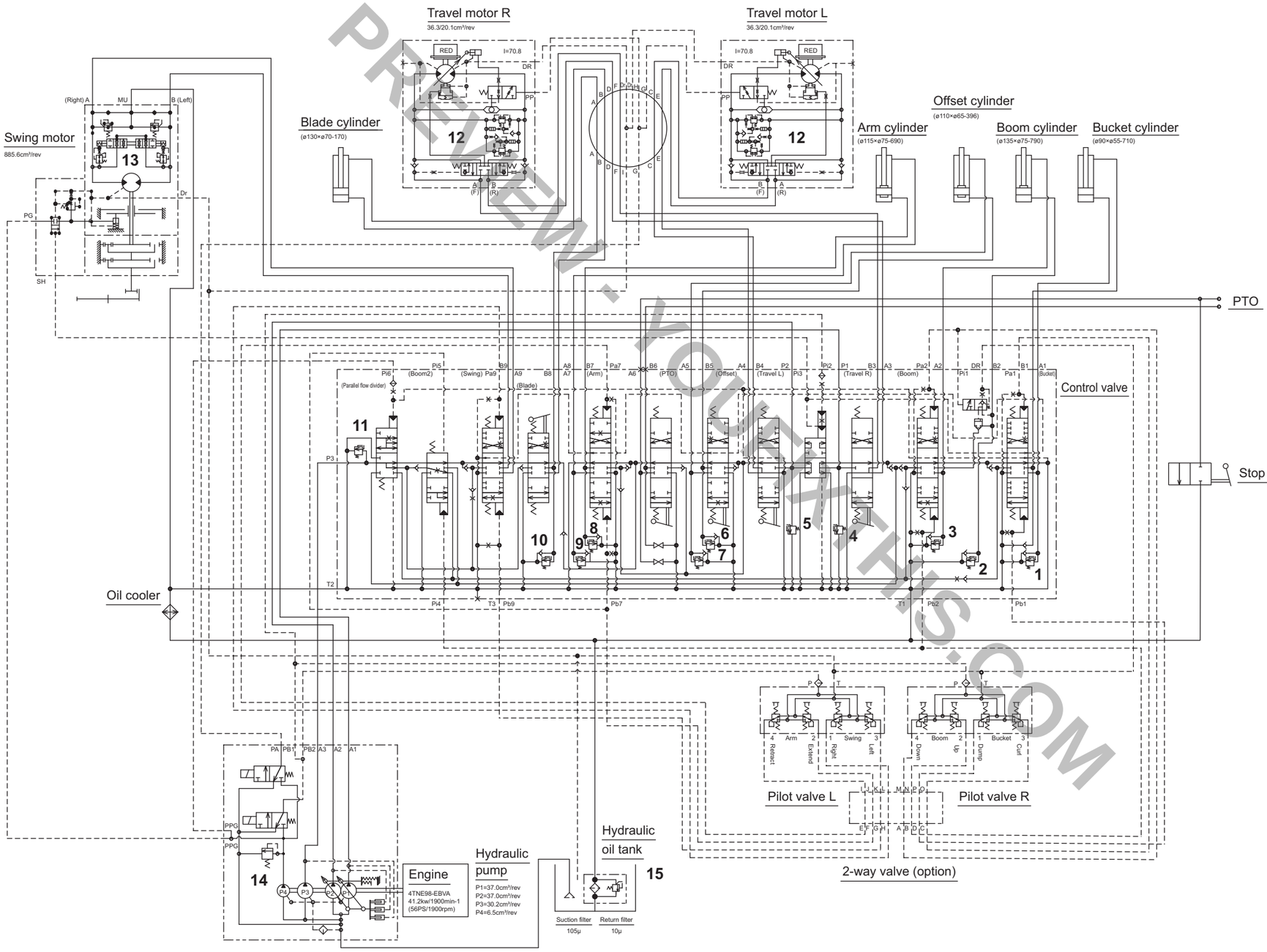
3. SERVICING STANDARDS

Applicable model				B7-5, B7-5A	
Item	Measuring condition	Unit		Standard	Allowance
Machine performance					
Travel speed	Machine position  • Engine : rated speed • Hydraulic oil temp. : 122 to 140 °F (50 to 60 °C) • Site : Firm, flat ground • Traveling time for 787.4 in. (20 m) after an approach run of 196.9 in. (5 m) or more.	sec. < > Value is rubber track spec.	High	17.0 <16.0>	20.0 <19.0>
			Low	28.5 <27>	31.5 <30>
Track speed	Machine position  • Engine : rated speed • Hydraulic oil temp. : 122 to 140 °F (50 to 60 °C) • Site : Firm, flat ground • Travel lever : Full throttle (Floating crawler side) • Float one side of the crawler. Make a mark on the crawler. After turning the floating crawler side more than once at full throttle, measure the time needed for 3 turns of the crawler.	sec.	High	14.5	16.5
			Low	25	28
Track deviation	Machine position  • Engine : rated speed • Hydraulic oil temp. : 122 to 140 °F (50 to 60 °C) • Site : Firm, flat ground • Measure the deviation (χ) in a travel distance of 787.4 in. (20 m) after an approach run of 196.9 in. (5 m) or more. 	in. (mm) /787.4 in. (20 m)	11.8 (300) or less		14.2 (360)

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5-2 Hydraulic Circuit Schematic

5-2-1 B7-5



Relief valve set pressure

No.	PSI	MPa
1	3981.6	27.5
2	4266	29.4
3	3981.6	27.5
4	3555	24.5
5	3555	24.5
6	3981.6	27.5
7	3981.6	27.5
8	3981.6	27.5
9	3981.6	27.5
10	2133	14.7
11	2986.2	20.6
12	3555	24.5
13	2986.2	20.6
14	426.6	2.94
15	21.3	0.147

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4-2 Troubleshooting

4-2-1 Quick Reference Table for Troubleshooting

The following table summarizes the general trouble symptoms and their causes. If ant trouble symptom occurs, take corrective action before it develops into a serious problem so as not to shorten the engine service life.

Cause \ Trouble symptom		Starting failure				Insufficient engine output			Poor exhaust color		High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting		Large engine vibration	Difficulty in returning to low speed	Excessive fuel consumption	Lubricating oil				Much blow-by gas	Cooling water		Air intake		Exhaust temperature rise		Corrective action
			Engine starts but stops soon			Exhaust color			During work					During idling	During work				Excessive consumption	Dilution by fuel oil	Mixture with water	Low L.O. pressure		Overheat	Low water temperature	Pressure drop	Pressure rise			
		Engine does not start	Exhaust smoke: None	Exhaust smoke: Little	Exhaust smoke: Much	Ordinary	White	Black	White	Black																					
Engine system	Improper clearance of intake/exhaust valve	○	○			○						○															○		○		Adjust the valve clearance.
	Compression leakage from valve seat					○		○		○		○						○					○				○		○		Lap the valve seat.
	Seizure of intake/exhaust valve	○			○	○		○		○		○			○	○				○			○				○				Correct or replace.
	Blowout from cylinder head gasket					○															○			○							Replace the gasket.
	Seized or broken piston ring	○			○		○		○			○		○		○			○	○			○	○					○		Replace the piston ring.
	Worn piston ring, piston or cylinder	○			○		○		○										○	○			○								Perform honing and use oversize parts.
	Seized crankpin metal or bearing	○	○									○		○	○	○							○								Repair the replace.
	Improper arrangement of piston ring joints		○				○												○				○								Correct the ring joint positions.
	Reverse assembly of piston rings						○		○										○				○								Reassemble correctly.
	Worn crankpin and journal bearing					○						○		○	○	○						○									Measure and replace.
	Loosened connecting rod bolt											○				○						○									Tighten to the specified torque.
	Foreign matter trapped in combustion chamber	○										○							○				○								Disassemble and repair.
	Excessive gear backlash											○																			Adjust gear meshing.
	Worn intake/exhaust valve guide						○												○				○								Measure and replace.
	Defective governor		○											○	○	○	○														Make adjustment.
	Improper open/close timing of intake/exhaust valves	○					○	○	○	○		○																			Adjust the valve clearance.
Turbocharger																															

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2) Spray Pattern Inspection

After adjustment to the specified valve opening pressure, use a nozzle tester and check the spray pattern and seat oil-tightness.

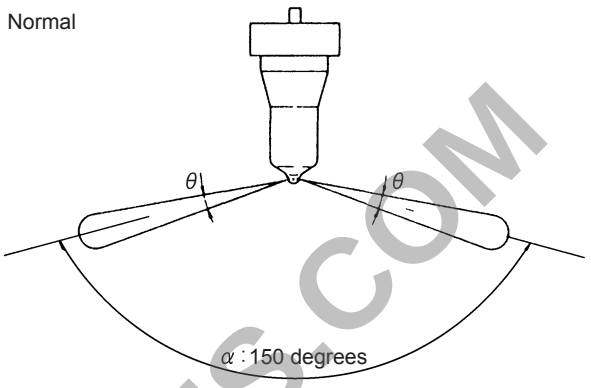
(1) Seat oil-tightness check

- After injecting a few times, increase the pressure gradually. Hold the pressure for about 5 seconds at a little before the valve opening pressure of 284 PSI (1961 kPa), and check to see that oil does not drip from the tip end of the nozzle.
- If extreme oil leak from the overflow joint exists during injection by the nozzle tester, check after retightening. If much oil is leaking, replace the nozzle assembly.

(2) Spray and injection states

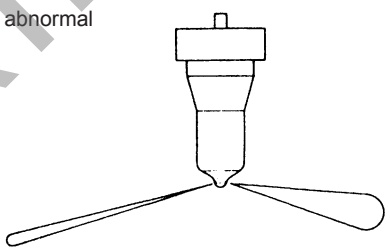
- Operate the nozzle tester lever at a rate of once or twice a second and check no abnormal injection.
- If normal injection as shown below cannot be obtained, replace the fuel injection valve.
  - •No extreme difference in angle (θ)
  - •No extreme injection angle difference (α)
  - •Finely atomized spray
  - •Excellent spray departure

Normal



Uniform spray pattern from each nozzle

abnormal



Extreme difference in angle (θ)
Extremely different injection angle (α)
Non-atomized spray
Stagnant spray

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4-3-12 Periodic Maintenance Schedule

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lubricating oils used and handling status. General rules are described here.

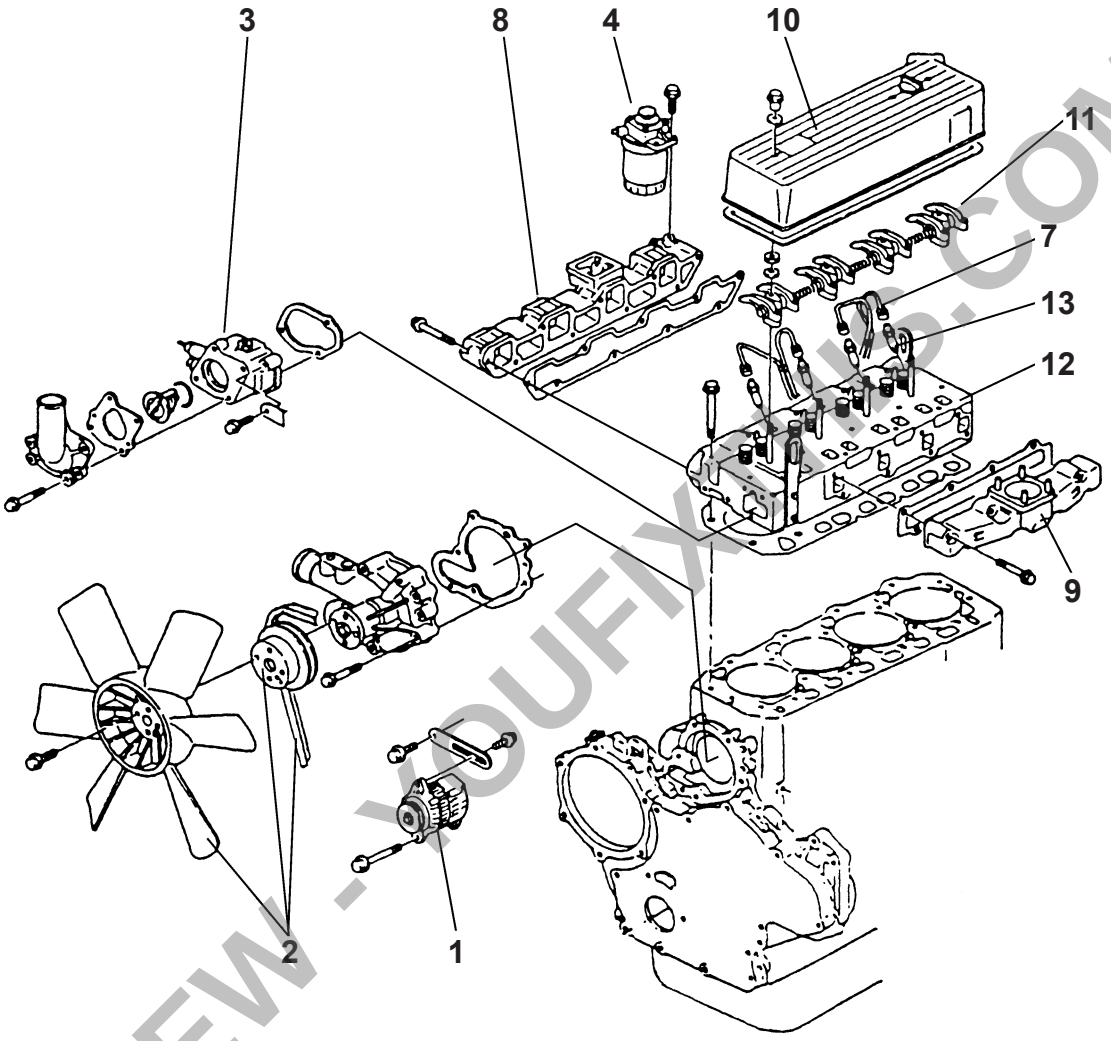
○: Inspection ◇: Parts replacement

Classification	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Fuel oil system	Fuel tank level check and fuel supply	○					
	Fuel tank draining		○				
	Water separator draining (Option)		○ Every 100 hours				
	Water separator cleaning (Option)				○		
	Fuel filter element replacement				◇		
Lube oil system	Lube oil level check	○					
	Lube oil replacement		◇ 1st time	◇ 2nd time and there after			
	Lube oil filter replacement						
Cooling water system	Cooling water level check and replenish	○					
	Radiator fin cleaning			○			
	Cooling fan V-belt tension check	○					
	Cooling water replacement					◇	
	Cooling water path flushing and maintenance					○ within one years	
Fuel oil, lube oil and cooling water leakage check		○					
Rubber hose	Fuel pipe and cooling water pipe inspection and maintenance						○
Air intake system	Air cleaner cleaning and element replacement			○	◇		
	Turbocharger blower cleaning					○	
Electrical system	Warning lamp & instruments function check	○					
	Battery electrolyte level check and battery recharging	○					
Cylinder head	Intake/exhaust valve head clearance adjustment					○	
Fuel injection pump and valve	Fuel injection valve pressure inspection					○	
	Fuel injection timing inspection						○

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4-4-2 Cylinder Head

1) Components



2) Disassembly Procedure :

Disassemble in the order of the numbers shown in the illustration.

1 Remove the alternator ass'y. ***(Point 1)***
2 Remove the fan, pulley and V belt.
3 Remove the thermostat case. ***(Point 2)***
4 Remove the fuel filter and fuel oil piping. ***(Point 3)***
5 Remove the oil level gage ass'y.
6 Remove the oil filter. ***(Point 4)***
7 Remove the fuel injection pipes. ***(Point 5)***
8 Remove the intake manifold ass'y.
9 Remove the exhaust manifold ass'y.
10 Remove the bonnet ass'y.
11 Remove the rocker shaft ass'y, push rods and valve caps. ***(Point 6)***
12 Remove the cylinder head ass'y and head gasket. ***(Point 7)***
13 Remove the fuel injection valves and fuel return pipe. ***(Point 8)***
14 Remove the intake/exhaust valves, stem seals and valve springs. ***(Point 9)***
15 Remove the rocker arms from the rocker shaft.

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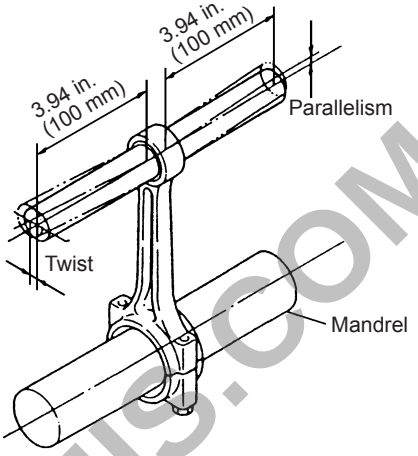
(5) Connecting rod

[1] Appearance inspection

Inspect the portion near the boundary of the chamfered portion and I-beam section of the big and small ends of the connecting rod as well as the portion near the oil hole of the bushing at the small end for cracks, deformation, and discoloration.

[2] Twist and parallelism measurement

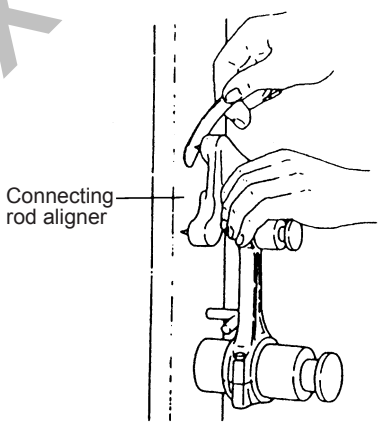
Use a connecting rod aligner and measure the twist and bend.



Twist and parallelism measurement

in. (mm)

	Standard dimension	Limit dimension
Twist and parallelism	Refer to Section 3-2 Engine of Chapter 3.	



Twist measurement using a connecting rod aligner

[3] Rod small end measurement

Measure the pin outside diameter according to (4) [1] described above.

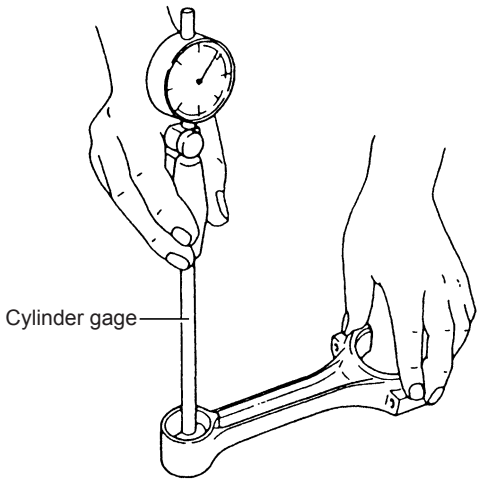
in. (mm)

	Standard	Limit
Piston pin I.D. bushing	Refer to Section 3-2 Engine of Chapter 3.	
Piston pin O.D.		
Oil clearance		

If the bushing is to be replaced because the oil clearance exceeds the limit, use spare part code No.129900-23910.

[4] Rod big end measurement

Measure the crankpin and bushing according to (2) [3] described above.



Connecting rod small end

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Applicable model				4TNE98-EBVA	
Item			Unit	Standard	Wear limit
Valve					
	Intake / exhaust valve rocker arm	Shaft outside dia.	in. (mm)	0.7272 to 0.7280 (18.47 to 18.49)	0.7260 (18.44)
		Bush inside dia.		0.7283 to 0.7291 (18.50 to 18.52)	0.7382 (18.75)
		Oil clearance		0.0004 to 0.0020 (0.01 to 0.05)	0.0051 (0.13)
	Push rod bend			0.0012 (0.03) or less	–
	Tappet	Stem outside dia.		0.4715 to 0.4720 (11.975 to 11.990)	0.4707 (11.955)
		Guide hole inside dia.		0.4724 to 0.4731 (12.000 to 12.018)	0.4739 (12.038)
		Oil clearance		0.0004 to 0.0017 (0.010 to 0.043)	0.0033 (0.083)
Piston					
	Piston outside dia.		in. (mm)	3.8557 to 3.8569 (97.935 to 97.965)	3.8543 (97.90)
	Piston outside dia.	L mark		3.8565 to 3.8569 (97.955 to 97.965)	
		ML mark		3.8563 to 3.8565 (97.950 to 97.955)	
		MS mark		3.8561 to 3.8563 (97.945 to 97.950)	
		S mark		3.8557 to 3.8561 (97.935 to 97.945)	
	Minimum clearance between piston and cylinder			0.0020 to 0.0031 (0.050 to 0.080)	–
	Top clearance			0.0290 to 0.0342 (0.737 to 0.869)	–
	Piston pin	Outside dia.		1.1807 to 1.1811 (29.989 to 30.000)	1.1795 (29.959)
		Bush inside dia.		1.1811 to 1.1815 (30.000 to 30.009)	1.1826 (30.039)
		Oil clearance		0 to 0.0008 (0.000 to 0.020)	0.0031 (0.080)
Piston ring					
	Top ring	Ring groove width	in. (mm)	0.0803 to 0.0811 (2.040 to 2.060)	–
		Ring width		0.0764 to 0.0772 (1.940 to 1.960)	0.0756 (1.920)
		Clearance between groove and ring		0.0024 to 0.0039 (0.060 to 0.100)	–
		End gap		0.0098 to 0.0177 (0.250 to 0.450)	0.0213 (0.540)
	Second ring	Ring groove width		0.0189 to 0.0825 (2.08 to 2.095)	0.0864 (2.195)
		Ring width		0.0776 to 0.0783 (1.970 to 1.990)	0.0768 (1.950)
		Clearance between groove and ring		0.0035 to 0.0049 (0.090 to 0.125)	0.0096 (0.245)
		End gap		0.0177 to 0.0256 (0.450 to 0.650)	0.0287 (0.730)

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3) Reassembly Procedure :

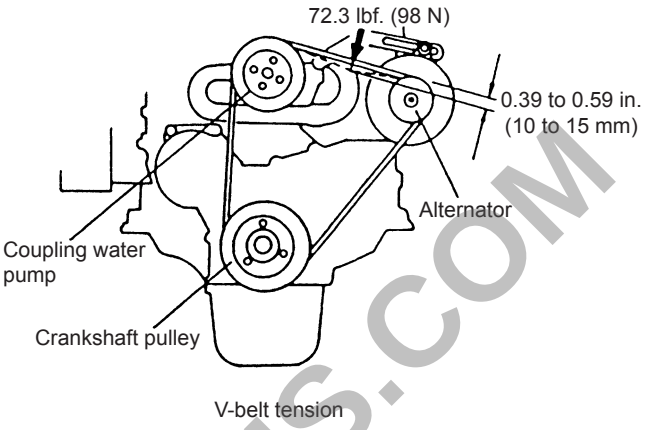
Reverse order of the disassembly procedure.

4) Servicing Points

Point 1

Disassemble :

• Loosen the mounting bolt while supporting the alternator.



⚠ CAUTION

Do not tilt the alternator toward the cylinder block in a haste since it may damage the alternator or pinch a finger.

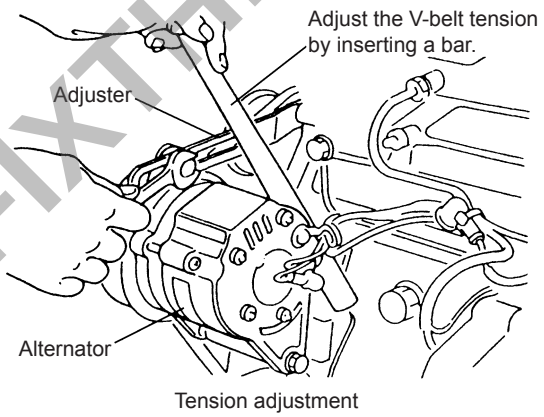
Reassemble :

• The belt deflection shall be 0.39 to 0.59 in. (10 to 15 mm) (0.28 to 0.35 in. (7 to 9 mm)) for a new belt).

Reassemble :

• Replace the belt with a new one if cracked, worn or damaged.

• Carefully prevent the belt from being smeared with oil or grease.



Point 2

Reassemble :

• Check the thermostat function.

Point 3

Reassemble :

• Replace the fuel filter element with a new one.

Disassemble :

• Cover the fuel pipe opening with tape to prevent intrusion of foreign matters.

Point 4

Reassemble :

• Replace the oil filter with a new one.

• After fully tightening the filter manually, retighten it with a filter wrench by 3/4 turn.

Point 5

Disassemble :

• Cover the fuel injection pipe and pump inlets and outlets with tape or the like to prevent intrusion of foreign matters.

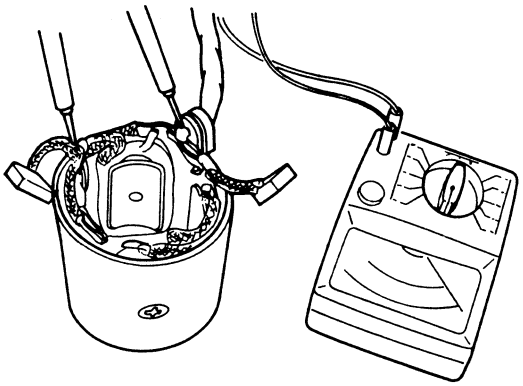
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2) Field Coil

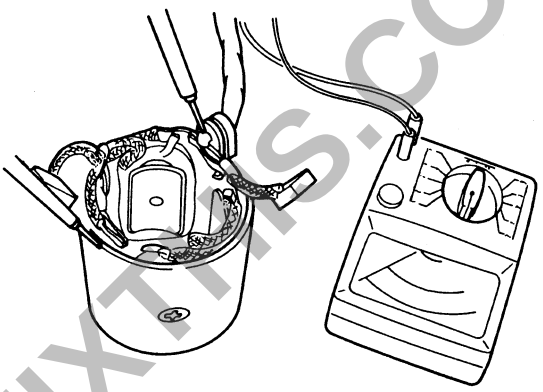
(1) Field coil continuity and earth tests

Test type	Measurement point	Normal	Abnormal (cause)
Continuity test	Across field coils	Yes	None (open circuit)
Earth test	Between commutator and yoke	None	Yes (short-circuiting)

Replace if needed



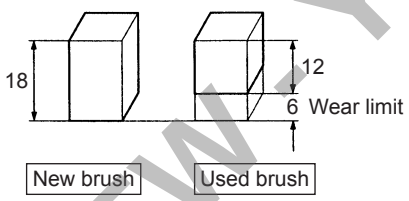
Field coil continuity test



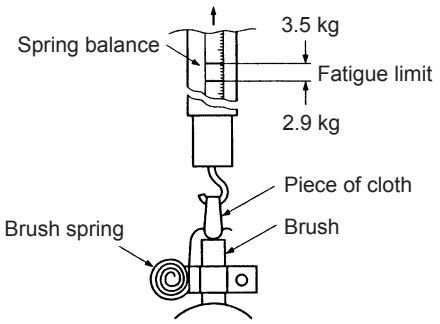
Field coil insulation test

3) Brush

(1) Check wear of the brush and the brush spring force.



Wear limit for brush



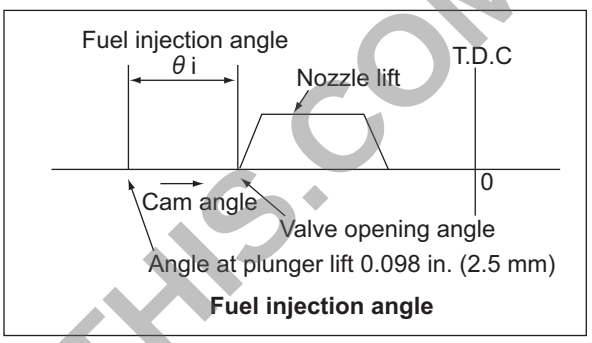
Measuring brush spring force

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4-13-7 Fuel Injection Timing Adjustment / Fuel Injection Pump Inspection and Adjustment

The fuel injection timing and the fuel injection pump are adjusted so that engine performance may become the best condition. As for the inspection and adjustment of the fuel pump, it is based on the service manual of the MP pump of the separate volume. The fuel injection timing is adjusted by the following procedure.

As for the engine, which adopts a MP type fuel injection pump, the fuel injection angle θ_i (note) is adjusted for the fuel injection timing adjustment, because the adjusting method of fuel injection timing like an inline fuel pump can't be applied.



Fuel injection angle

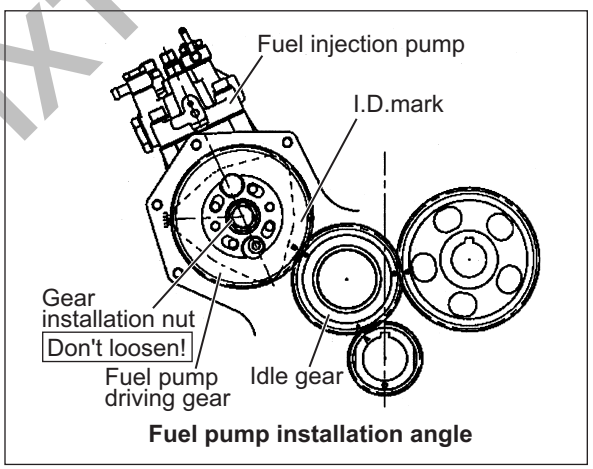
Note :

The fuel injection angle θ_i (cam angle) is the difference from the injection valve opening angle while the fuel injection pump being driven by a motor and the angle at the plunger lift 0.098 in. (2.5 mm) of the fuel pump.

And, as for the actual fuel injection angle θ_i , the measured value is recorded on the pump body by each every fuel pump.

The adjustment of fuel injection angle θ_i

In case that a fuel pump cover, installed with a gear case cover and the fuel pump are removed, and reassembled, the procedure of fuel injection angle adjustment is as follows.

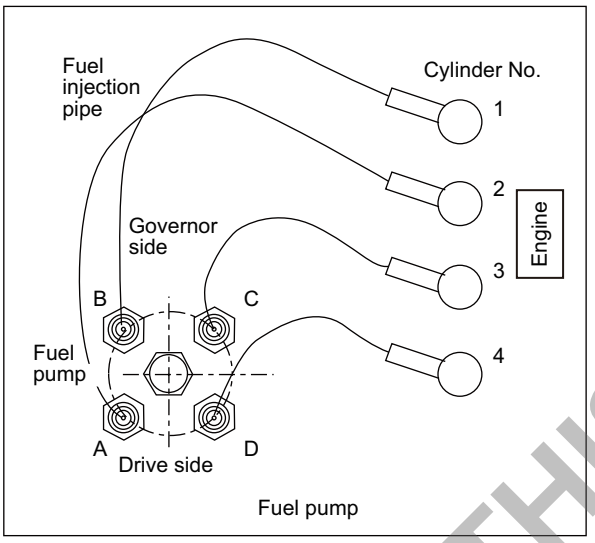


Fuel pump installation angle

Notice :

Never loosen four flange bolts, which fasten a pump flange and a fuel pump drive gear at the time of the removal of the fuel pump. When it is loosened, the adjustment of the fuel injection timing becomes very difficult.

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4) Assembly Procedure

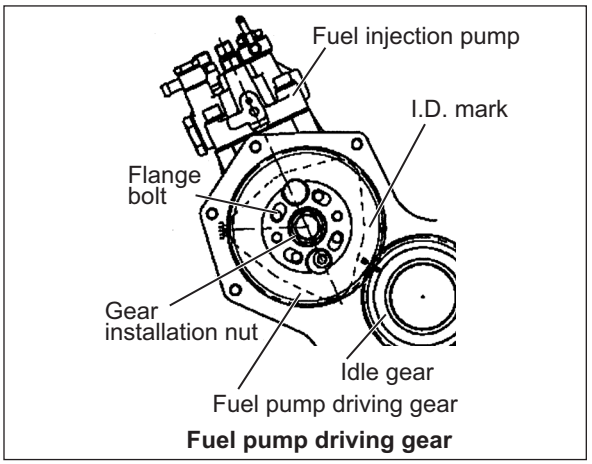
Reverse the disassembly procedure and adjust the fuel injection timing finally.

5) Servicing Points

Point 1

Disassemble :

- Block an entrance with the tape so that trash may not enter the fuel injection pipe and the fuel injection pump.



Fuel pump driving gear

Point 2

Disassemble :

- After putting the I.D. marks on the gearing part of the pump drive gear and the idle gear with paint and so on, remove the gear installation nut.

Notice :

Don't remove four flange bolts.

Reassemble :

- Reassemble the pump driving gear while checking the I.D. marks on the driving gear and idle gear.

Tightening torque of the gear installation nut

ft•lbf (N•m)	Lubricating oil application (thread portion, and seat surface)
83.3 to 90.7 (113 to 123)	Not applied

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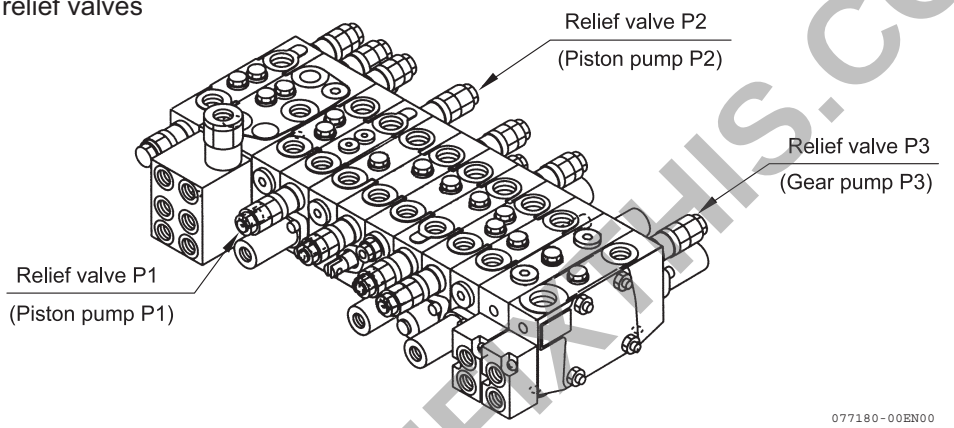
4) Adjustment procedure

(1) To check the pressure of the system relief valve (for the piston pump P1) of the control valve, retract the bucket cylinder to its stroke end, hold the lever and read the gauge. Adjust the pressure if necessary.

(2) To check the pressure of the system relief valve (for the pilot pump P2), retract or extend the offset cylinder to its stroke end, hold the lever and read the gauge.

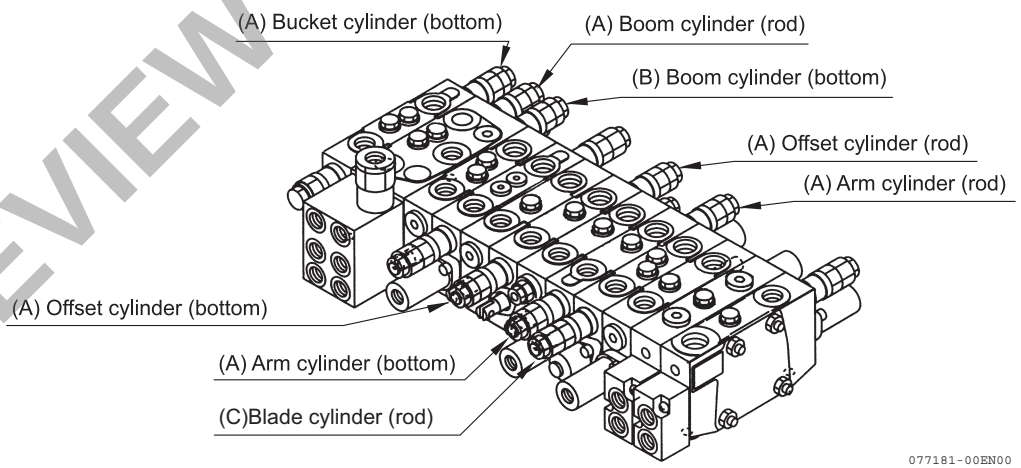
(3) To check the pressure of the system relief valve (for the gear pump), extend the blade cylinder to its stroke end, hold the lever and read the gauge.

System relief valves



(4) To adjust the pressure of the circuit relief valve, extend each cylinder to its stroke end, hold the lever and read the gauge. When the pressure of the circuit relief valve is lower than the pressure of the system relief valve, it can be read on the gauge. Increase the pressure of the system relief valve and the circuit relief valve by turns, and lock the adjust screw when the specified pressure of the circuit relief valve is obtained. Then lower the pressure of the system relief valve to the specified pressure and lock the adjust screw.

Circuit relief valves

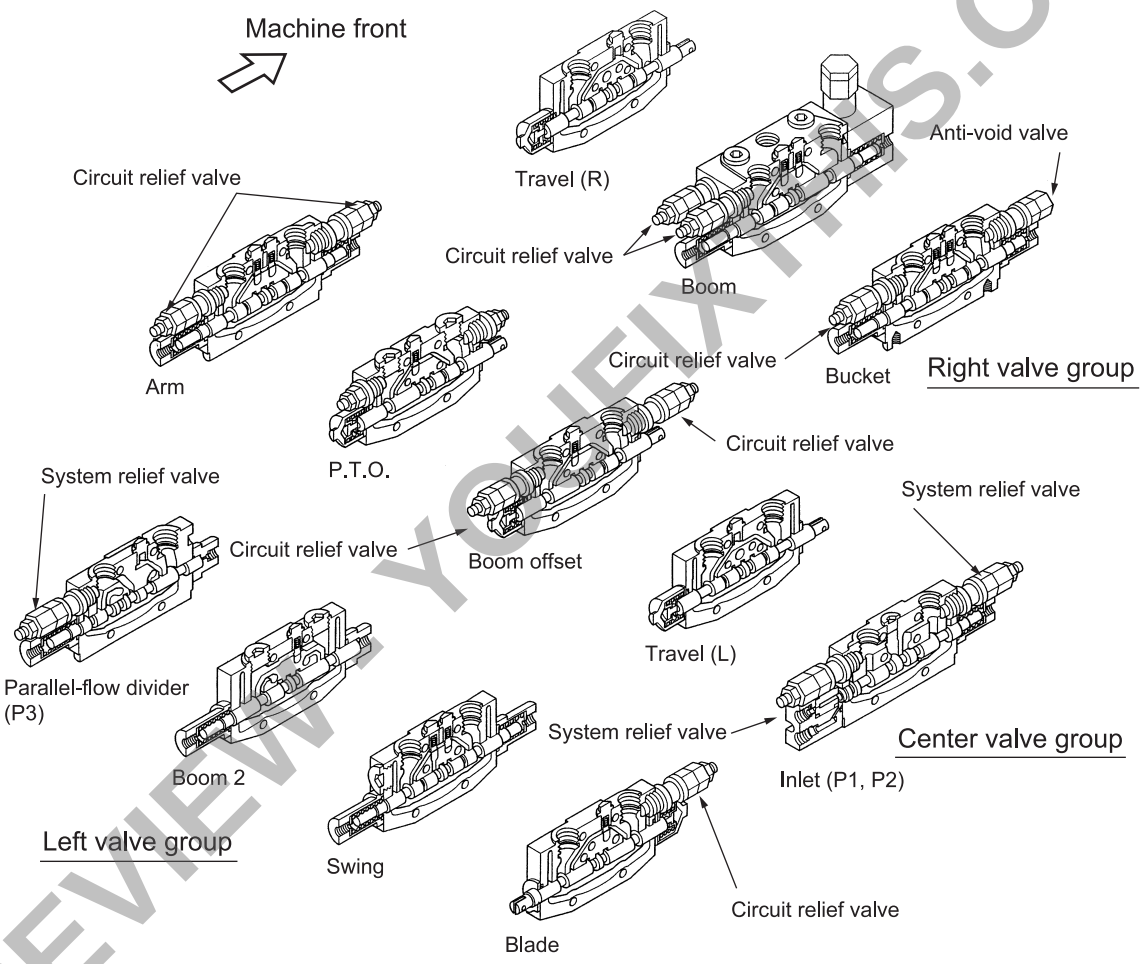


5) Pressure change / one turn of adjust screw

		Pressure change	Number of adjust screw turns
System relief valve		2566.5 PSI (17.7 MPa)	1/1
Circuit relief valve	(A), (B)	4118 PSI (28.4 MPa)	1/1
	(C)	2581 PSI (17.8 MPa)	

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The circuit relief valves of the right valve group also have the anti-cavitation function, and are located in the circuit at both ends of the boom cylinder and at the bottom end of the bucket cylinder.
The anti-void valve of the right valve group has the anti-cavitation function, and is located in the circuit at the rod end of the bucket cylinder.
The circuit relief valves of the center valve group also have the anti-cavitation function, and are located in the circuit at both ends of the boom offset cylinder and at both ends of the arm cylinder.
The circuit relief valve of the left valve group also has the anti-cavitation function, and is located in the circuit at the rod end of the blade cylinder.



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2) Disassembly and reassembly of system relief valves

(1) Disassembly

[1] Hold body **1** with a vice to remove plug **2**. (remove the whole plug unit including the inner parts.)

[2] Remove body **1** from the vice. Then, remove sleeve **3**, spring **9** and main poppet **4**.

[3] Remove O-ring **13** from body **1**.

[4] Hold plug **2** with a vice to loosen the lock nut of adjuster kit **7**.

[5] Remove the adjuster kit. Then, remove spring **8**, pilot poppet **6** and O-ring **15**.

[6] Remove O-rings **10** and **12**, and backup ring **11** from plug **2**.

Note :

Place the removed parts in order on a clean work table.

(2) Reassembly

[1] Install pilot poppet **6** and spring **8** to plug **2**.

[2] Install O-ring **15** to the adjuster kit and temporarily tighten the adjuster kit on plug **2**.

[3] Install O-rings **10** and **12**, and backup ring **11** to plug **2**.

Note :

Check the locations of the O-rings and the backup ring.

[4] Install O-ring **13** to body **1**.

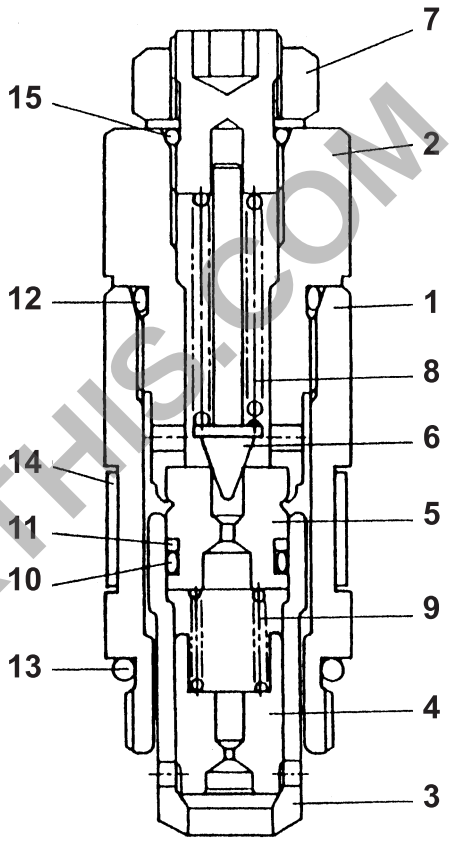
[5] Install main poppet **4** and spring **9** to sleeve **3**, and insert them into body **1**.

[6] Install plug **2** with pilot poppet and other parts installed into body **1**.

[7] Hold body **1** with a vice to tighten plug **2**.
Tightening torque : 57.9 to 65.1 ft•lbf (78.5 to 88.3 N•m)

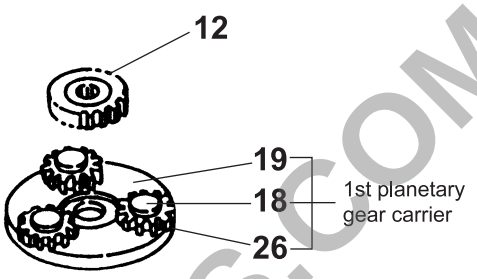
[8] Install the body to the control valve housing.
Tightening torque : 50.7 to 57.9 ft•lbf (68.7 to 78.5 N•m)

[9] For pressure adjustment, see the section 4) Adjustment (P.5-2-50).



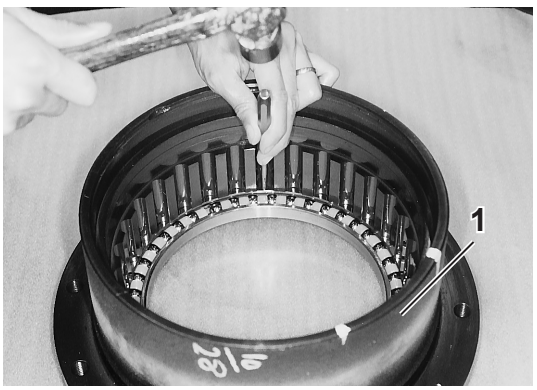
No.	Part
1	Body
2	Plug
3	Sleeve
4	Main poppet
5	Pilot seat
6	Pilot poppet
7	Adjuster kit (lock nut)
8	Spring (for pilot poppet)
9	Spring
10	O-ring
11	Backup ring
12	O-ring
13	O-ring
14	Name plate
15	O-ring

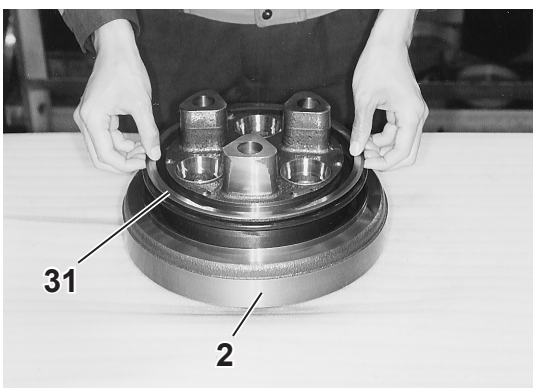
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Procedure	
(15) While engaging sun gear **12** and spur gears 2 **26**, install the sun gear to 1st planetary gear carrier. ***Note :*** *Check that pinion shaft **1** rotates smoothly when 1st planetary gear carrier is rotated.*	

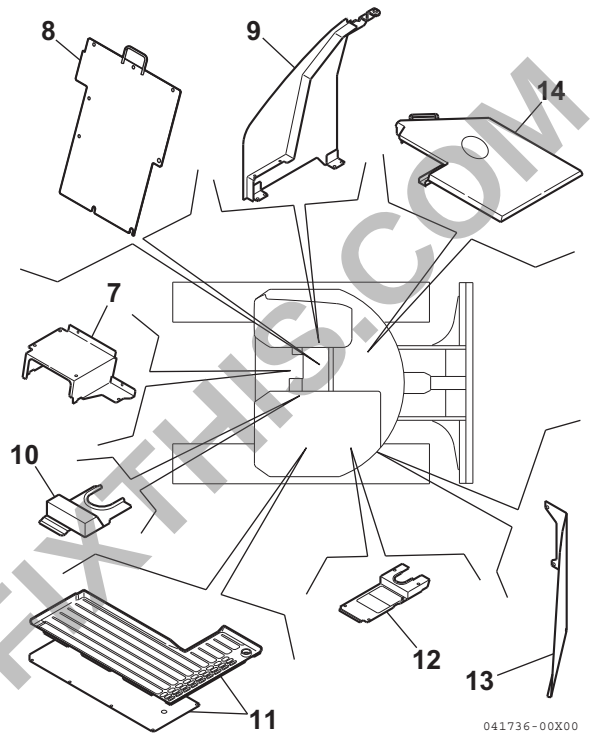
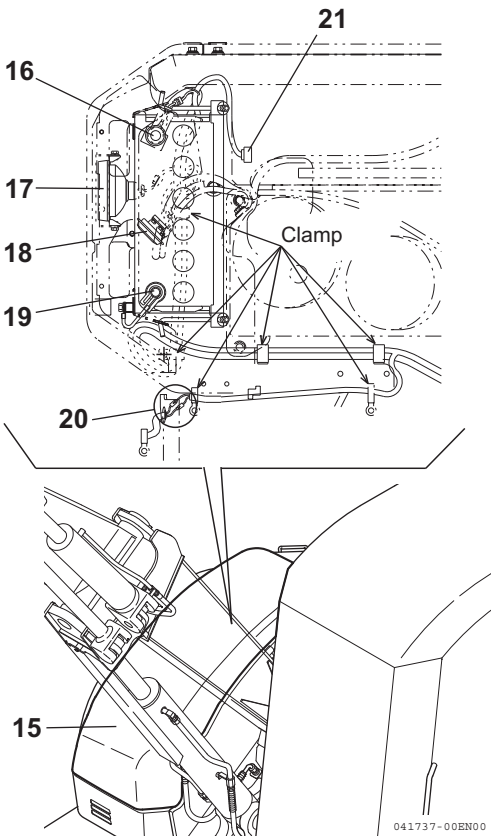
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Procedure	
(2) Strike the end face of the pin **17** with a pin punch and a hammer, and remove the ball bearing **21** from the hub **1**. At this time, the RV gear assembly (RV gear A **4**, RV gear B **5**, crankshaft **9**, tapered roller bearing **22**, needle roller bearing with retainer **23**, spacer **12**) and pin **17** can be taken out together. ***Note :*** *When removing the ball bearing **21**, tap the end face of the pins equally in 3 to 4 places around the circumference a little at a time so as not to wrench the ball bearing **21**.* *When the mating part of the outer ring of the ball bearing **21** is removed from the hub **1**, the ball bearing **21**, RV gear assembly and pin **17** will fall from the hub **1**.* *In order to keep the parts from being damaged, place a container underneath the workbench, and place a rubber mat over it.* (3) Remove the ball bearing **21**, RV gear assembly and pin **17** which have fallen. ***Note :*** *The tapered roller bearing **22**, needle roller bearing **23**, spacer **12** are not removed from the crank shaft **9** except when replacing.*	

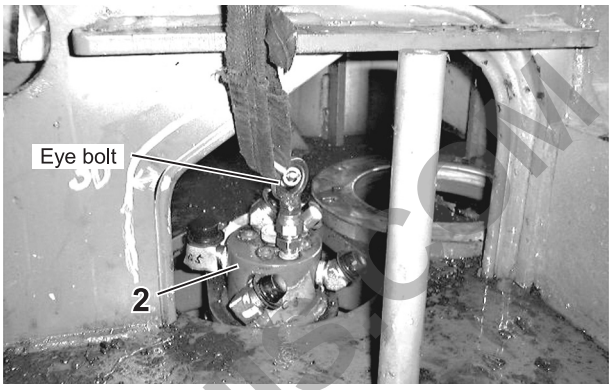
21. Ball bearing removal (1) From the cover **8** side of the hub **1**, strike the end face of the pin **17** with a pin punch and hammer, and remove the ball bearing **21** from the hub **1**. ***Note :*** *When removing, the ball bearing **21** falls from the hub **1**.* *Place a rubber mat underneath the workbench to keep the part from being damaged.*	

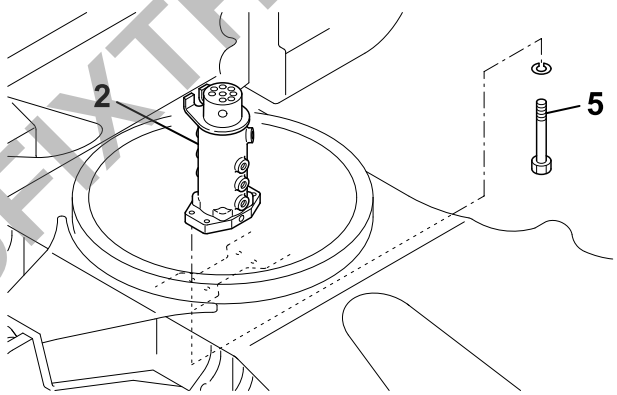
22. Removal of spindle mounted parts (1) Take the floating seal **31** out of the spindle **2**.	

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Procedure	
(6) Remove the covers. • Step cover **7** • Center cover **8** • Side cover **9** • Seat cover R **10** • Floor mat and floor step **11** • Multipurpose cover **12** • Operator's seat mount cover **13** • Bonnet UP **14**	
(7) Open bonnet B **15** and disconnect battery cables (positive **16** and negative **19**). (8) Disconnect the couplers for horn **18**, headlight **17**, and work lamp **20**. Then remove slow blow fuse **21** from the hook. ***Note :*** *Remove the clamps for the wire harnesses.*	

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Procedure	
(5) Put the eye bolt on the port A of the upper side of swivel joint **2** and temporarily lift swivel joint **2**.	

(6) Remove bolts **5** (4 pcs.) and then, lift swivel joint **2** down. ***Note :*** *Put match marks on the swivel joint to indicate the direction of the reinstallation.*	

2) Reinstallation

Reinstall the swivel joint in the reverse order of the removal procedure.

Notes :

Installation bolts for the swivel joint.

- Apply Three Bond 1324 or its equivalent.
- Tightening torque : 57.9 to 72.3 ft•lbf (78.5 to 98.1 N•m)

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8. PERIODIC INSPECTION AND SERVICING

8. Periodic Inspection and Servicing

8-1 List of Periodic Inspection and Servicing

◇ : Check ○ : Supply ● : Replace □ : Adjust (clean) ■ : Oil & grease

Check & service items			Daily	Every 50	Every 100	Every 250	Every 500	Every 1000 hrs
General	Check falling off, breakage of parts		◇					
	Check loosened bolts & nuts, retighten		◇					
	Check engine condition		◇					
	Clean		□					
Lube oil	*Swing gear case oil	Check, resupply				○		
		Replace			● 1st time			●
	Travel reduction gear oil	Check, resupply				○		
		Replace			● 1st time			●
	*Transmission oil	Check, resupply	◇					
		Replace			● 1st time			●
	*Differential gear oil	Check, resupply			◇			
		Replace			● 1st time			●
Hydraulic system	Hydraulic oil	Check, resupply	◇					
		Replace						●
	Clean suction filter					□ 1st time		□
	Replace return filter					● 1st time	●	
	Check for abnormality of hydraulic pump		◇					
Grease	Check grease-up positions, grease		■					
	Greasing the swing gears and the swing bearings			■				
Undercar-riage	Check, adjust track tension		◇					
	*Check air pressure, wear, flaw in tyres		◇					
Steering equipment	Check performance, play of steering lever		◇					
	Check performance, play of travel lever		◇					
	*Check performance of speed change lever		◇					
	*Check performance of forward/reverse pedal		◇					
	*Check performance, play of steering wheel		◇					
	*Brake pedal	Stroke	◇					
		Performance	◇					
	*Parking brake	Stroke	◇					
		Performance	◇					
	Check performance of accel. level		◇					
Electric equipment	Check front & work lights, horn		◇					
	Check hourmeter function		◇					
	Check function of change, oil and pilot lamps		◇					
	Check wire breakage, short-circuits, loosened terminals, retighten		◇					
	Check, resupply battery fluid		◇					
	Check specific gravity of electrolyte		◇				□ As required	
	Check function of OK monitor		◇					

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