2.3 SPECIFICATIONS AND PERFORMANCE

2.3.1 SPEED AND GRADEABILITY

Applicable Machines		PJ04-03001~			
Shoe Type		Rubber shoe		Iron shoe (OPT)	
Slewing Speed	min.$^{-1}$ {rpm}	8.8 {8.8}			
Travel Speed	km/h (mph)	Low (1st)	High (2nd)	Low (1st)	High (2nd)
		2.8	4.6	2.8	4.6
Grade ability	% (degree)	58(30)			

2.3.2 ENGINE

Model (YANMAR)		**4TNV88-XYB**
Type		Water-cooled, 4-cycle type Swirl chamber type diesel engine
Number of cylinders-Bore x Stroke		4 - ø88 mm x 90 mm (3.46 in x 3.54 in)
Total Displacement	L	2.189 (134 cu. in)
Output Rating	kW/min^{-1} {PS/rpm}	30.4/2,400 {41.3/2,400}
Maximum Torque	Nm/min^{-1} (lb. ft./rpm)	139/1,440 (103/1,440)
Starting Motor	V x kW	12 x 2.3
Generator	V x A	12 x 55

2.3.3 HYDRAULIC COMPONENTS

Hydraulic Pump	**Variable displacement axial piston + gear pump**
Hydraulic Motor	Axial piston
Hydraulic Motor w/Reducer (Travel)	2-Axial piston, 2-Speed motor
Control Valve	11-spool multiple control valve
Cylinder (Boom, Arm, Swing, Bucket, Dozer)	Double action cylinder
Return Filter	Safety valve containing/Filter Type (30)

2.3.4 SIDE DIGGING & DOZER

Type		**Boom swing by hydraulic cylinder**
Boom Swing Angle	Right	60°
	Left	70°
Stroke of Dozer (above/below)	mm (in)	495 / 375 (19.5/14.8)

2.3.5 WEIGHT

Machine Weight	kg (lb.)	**Rubber shoe**	**Iron shoe**
		4,660 (10,300)	4,760 (10,500)
Upper slewing body	kg (lb.)	2,310 (5,100)	¨
Travel system	kg (lb.)	1,720 (3,790)	1,820 (4,010)
Attachment (Boom + STD Arm + STD Bucket)	kg (lb.)	535 (1,180)	
Oil & Water	kg (lb.)	95 (209)	

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22.3 HYDRAULIC CIRCUIT OPERATION

22.3.1 COLOR CODING STANDARD FOR HYDRAULIC

HYDRAULIC SCHEMATIC COLOR CODING		
Blue:	Feed, drain circuit	less than 0.34 MPa (50 psi)
Green:	Return, make-up circuit	0.34~ 0.59 MPa (50~86 psi)
Purple:	Secondary pilot pressure	0.59~3.5 MPa (85~508 psi)
Red:	Primary pilot pressure	3.5~3.9 MPa (508~ 566 psi)
Orange:	Main pump drive pressure	4.9~23 MPa 711~3340 psi)
Blue tone:	At valve selection	
Red valve:	When proportional valve (reducing) is operating	
Red solenoid:	Activated	
Displaying the flow circuit and standby circuit when operating. Regarding the electrical symbols in this manual, refer to the electric circuit diagram.		

NOTE: *For the hydraulic circuit operation, refer to* Fold Out Schematics.

22.3.2 NEUTRAL CIRCUIT

(Refer to Fold Out Schematics)

1. PILOT CIRCUIT
   1. Pilot primary pressure circuit

      Oil from port A4 on the pump (1) enters the solenoid valve (13) through the line filter (19)

      Pressurized oil from port A2 of the solenoid valve (13) with the safety lock lever released (in the operating position) is supplied to the P ports of the pilot valves for attachment (11), travel (12) and dozer (14).

      Since the operating circuit is fully closed in the neutral position, the oil from the pump, except the oil supplied to the Pp1 port of the control valve, is returned to the hydraulic tank (24) through the relief valve (set pressure: 3.5MPa [508 psi]) built in the solenoid valve (13).

      Hydraulic oil to Pp1 port provides pressure to the service spool and pilot controls for the travel circuit.

   2. Pilot secondary pressure circuit

      While the pilot valves (11),(12) and (14) are in neutral, pilot secondary pressure is not generated.

      By operating the control lever, secondary pressure is generated and sent to the control valve (2) from the pilot valve to shift each spool of shifting valve.

2. MAIN CIRCUIT
   1. Variable pump circuit

      The oil from A1 and A2 ports on the variable pump goes to the P1 and P2 ports on control valve (2).

      The oil from these two ports return to the hydraulic oil tank (24), through each valve of travel left, boom and bucket for the P1 oil, and through each valve of travel right, swing, service and arm for the P2 oil.

   2. Third pump circuit

      The oil from A3 port on 3rd pump goes to the P3 port on control valve (2).

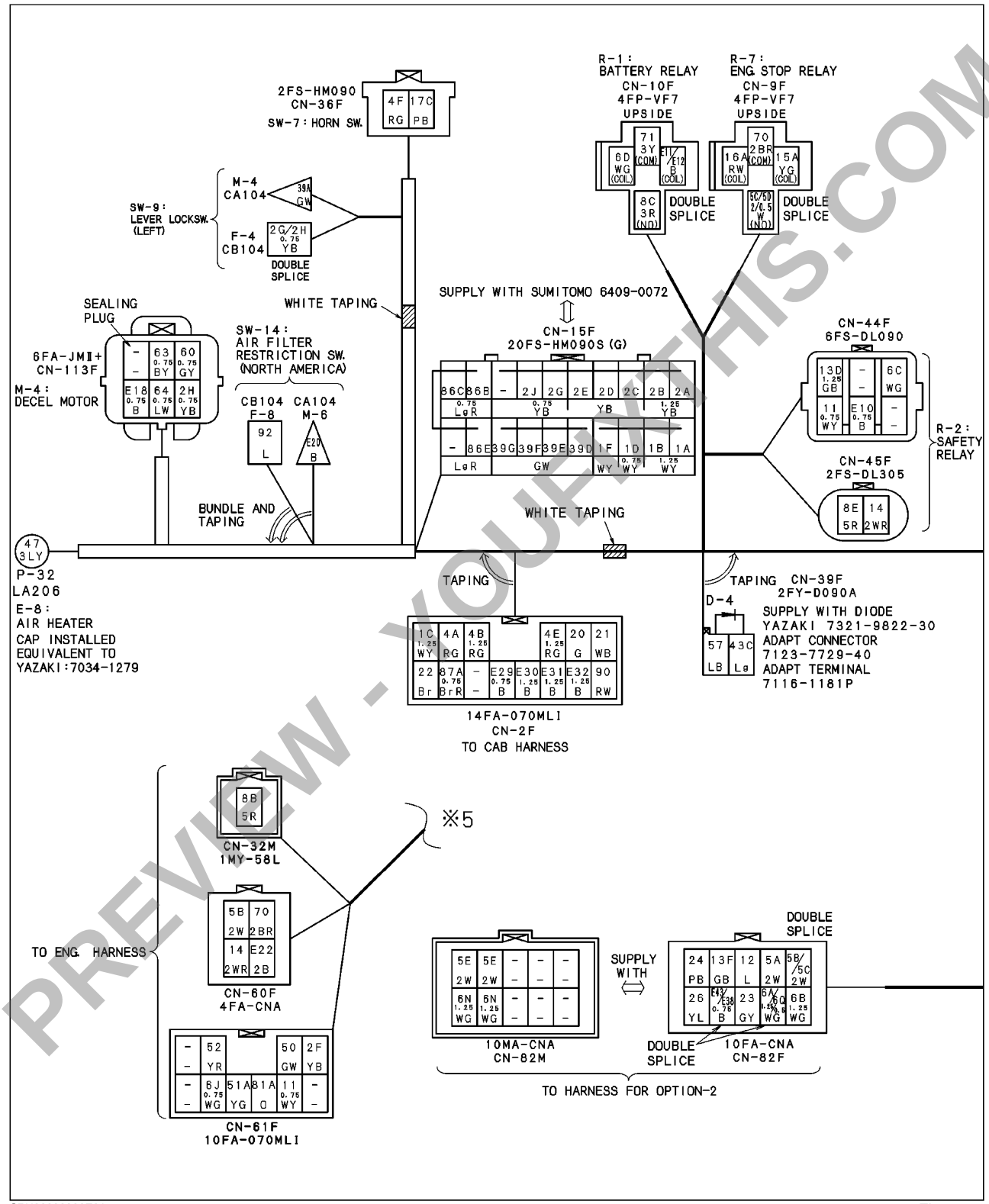
      The oil from P3 returns to the hydraulic oil tank (24) through the selector valves for the dozer, slewing, and the independent travel and flow conflux valves.

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23.2.4 DETAIL OF HARNESS & CABLE

23.2.4.1 INST • MAIN HARNESS (NO. H-1)



SPH23000036E01

Figure 26

FIG. 23-18 INST • MAIN HARNESS (NO. H-1) — (1/8)

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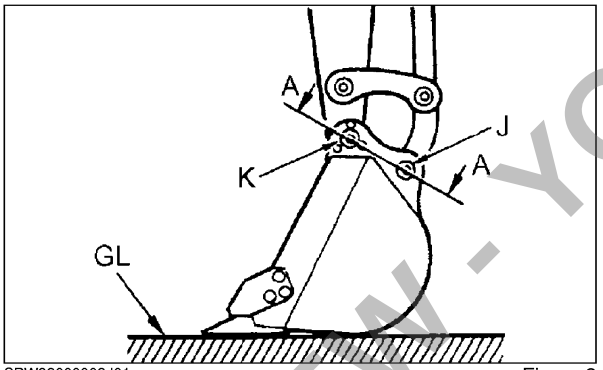
32.1.2 BUCKET

32.1.2.1 REMOVAL OF BUCKET

1. Place the bucket on the ground so that the bucket and arm connecting pins do not have pressure on them.
2. Move the O-rings (3) toward the bucket bosses.
3. In order to remove pin (K) which links the arm and bucket, remove the ring (2) and the pin (1) with a punch and drive out pin (K).
   - If the pin does not come off easily, the pin has pressure on it.
   - Do not damage the dust seal between the arm and the bucket bosses.
4. Adjust the bucket so that pin (J) between the bucket link and the bucket does not have pressure on it.
5. Remove the ring (2) and pin (1) then drive out pin (J).
6. Remove bucket assembly

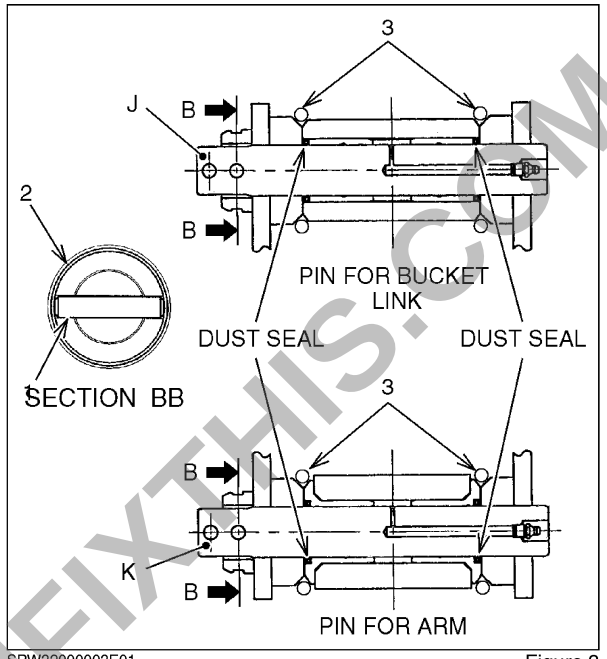
   Weight:

   112 kg (247 lbs)



SPW32000002J01 Figure 2

FIG. 32-2 TO PLACE BUCKET ON GROUND



SPW32000003E01 Figure 3

FIG. 32-3 ASSEMBLY OF PIN (SECTION A-A)

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42.2 TROUBLE DIAGNOSIS: HYDRAULIC

Classification	Reference No.		Causes / Phenomenon	Pump			Valve								Actuator		
				Main pump	Trochoid pump	Gear pump	Travel & ATT main R/V	Main gear pump R/V	Each overload R/V	Travel straight valve	Travel spool	Attachment spool	Check valve	Shuttle valve	Slewing motor unit	Travel motor unit	Hydraulic cylinder
Attachment	1	(1)	Attachment operational failure	X							X	X					
		(2)	Travel speed is slow.	X								X					X
		(3)	Attachment operating power is low.				X		X								X
		(4)	Malfunction of attachment							X		X					X
Travel operation	2	(1)	Travel operational failure	X							X					X	
		(2)	Travel speed is slow.	X							X					X	
		(3)	Travel operating power is low.				X									X	
		(4)	It deviates in travel independent operation.	X						X	X					X	
Slewing operation	3	(1)	Slewing operational failure									X			X		
		(2)	Slewing speed is slow.			X											
		(3)	Slewing operating power is low.					X	X						X		
		(4)	Malfunction of slewing operation									X		X	X		
Pump	4	(1)	Engine speed is reduced due to pump load.	X													
		(2)	Malfunction of pump	X	X	X											

Abbreviation

E/G : Engine
SOL : Solenoid
SW : Switch
ATT : Attachment
C/V : Control valve
R/V : Relief valve
V : Valve

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2. Inspection and Adjustment

2.1 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.

○: User-maintenance ◎: Parts replacement ●: Shop-inspection

Classification	Item	Daily	Maintenance period				
			Every 50 hours	Every 250 hours or 3 months	Every 500 hours or 6 months	Every 1000 hours or one year	Every 2000 hours or two years
Whole	Visual check around engine	○					
Fuel oil system	Fuel tank level check and fuel supply	○					
	Fuel tank draining		○				
	Water separator (Option) draining		○				
	Bleeding the fuel system		○				
	Water separator cleaning				○		
	Fuel filter element replacement				◎		
Lubricating oil system	Lube oil level check and replenishment	○					
	Lube oil replacement		◎ 1st time	◎ 2nd time and thereafter			
	Lube oil filter replacement						
Cooling water system	Coolant water level check and replenishment	○					
	Radiator fin cleaning			○			
	V-belt tension check		○ 1st time	○ 2nd time and thereafter			
	Coolant water replacement					◎	
	Coolant/water path flushing and maintenance						●
Rubber house	Fuel pipe and coolant water pipe inspection and maintenance	○					●
Governor	Inspection and adjustment of governor lever and accelerator	○		○			
Air intake system	Air cleaner cleaning and element replacement			○	◎		
	Diaphragm assy inspection					● (2 years)	
	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					●	
	Intake/exhaust valve seat lapping						●
Fuel injection pump and nozzle	Fuel injection nozzle pressure inspection					●*	
	Fuel injection timing adjustment Fuel injection pump inspection and adjustment						●*

*) EPA allows to maintain the emission related parts every 1,500 or 3,000 hours as shown in 1.6.3 of chapter1.

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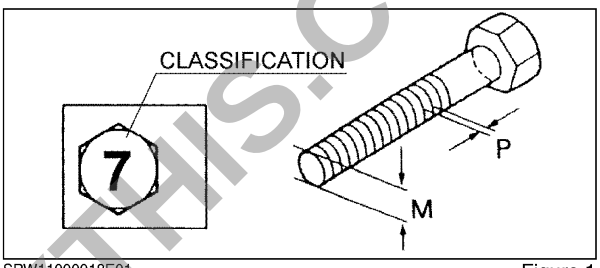
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11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS AND NUTS

The following Torque Specifications are provided for use when actual torque value of a fastener is not known. Check the capscrews and nuts for their tightness and the loss of before starting work and at periodic maintenance. Retighten and replace as needed. For a new machine, check and retorque after the first 50 hours operation. Replace with genuine parts.

Refer to the table below for the tightening and retightening of capscrews.

1. The table below is not applicable for the capscrews that secure plastic covers. For the tightening torque for such capscrews, contact your dealer. Over-tightening may cause damage to the plastic parts.
2. In case that the tightening torque is specified in the manual, use those torque values regardless to the table below.
3. Numerical indication on the capscrew head shows the classification for strength (e.g., 7=7 T). No indication is provided for smaller size of capscrews, M5 or less.



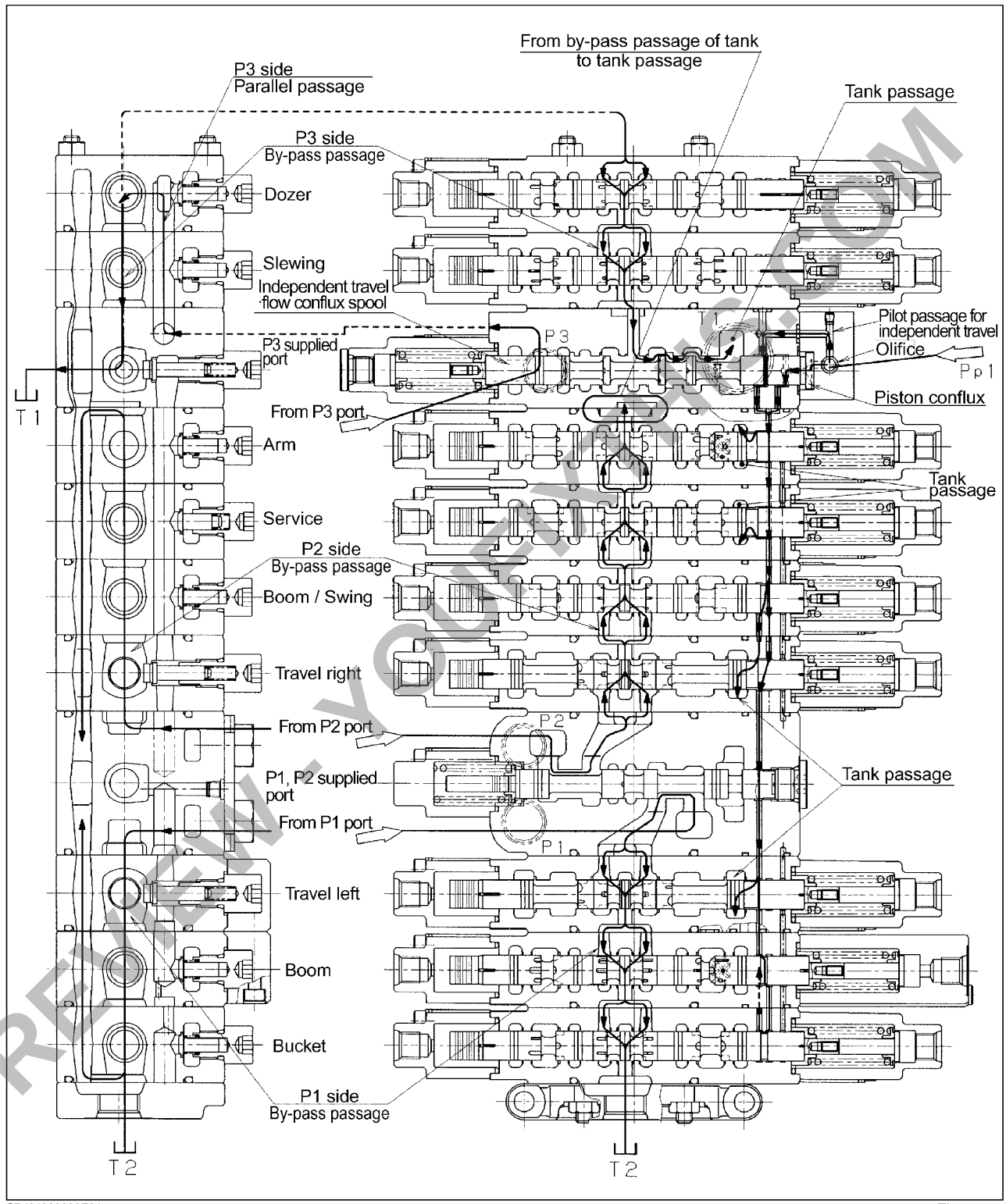
SPW11000018E01 Figure 1

11.1.1 METRIC COARSE THREAD STANDARD TIGHTENING TORQUE VALUES

Make sure to tighten all Capscrews and Nuts to proper torque values.

METRIC COARSE THREAD STANDARD TIGHTENING TORQUE VALUES							
Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6	P=1	4.4±0.5 (3.2±0.4)	3.7±0.4 (2.7±0.3)	9.6±1.0 (7.1±0.7)	8.1±0.8 (6.0±0.6)	17.4±1.8 (12.8±1.3)	14.7±1.5 (10.8±1.1)
M8	P=1.25	10.7±1.1 (7.9±0.8)	9.0±0.9 (6.6±0.7)	23.5±2.0 (17.3±1.5)	19.6±2.0 (14.5±1.5)	42.2±3.9 (31.1±2.9)	35.3±3.9 (26.0±2.9)
M10	P=1.5	21.6±2.0 (15.9±1.4)	17.9±1.8 (13.2±1.3)	46.1±4.9 (34.0±3.6)	39.2±3.9 (28.9±2.9)	83.4±8.8 (61.5±6.5)	70.6±6.9 (52.1±5.1)
M12	P=1.75	36.3±3.9 (26.8±2.9)	31.4±2.9 (23.2±2.1)	79.4±7.8 (58.6±5.8)	66.7±6.9 (49.2±5.1)	143±15 (105±11)	121±12 (89.2±8.9)
M14	P=2	57.9±5.9 (42.7±4.4)	49.0±4.9 (36.1±3.6)	126±13 (92.9±9.6)	106±10 (78.2±7.4)	226±20 (167±15)	191±19 (141±14)
M16	P=2	88.3±8.8 (65.1±6.5)	74.5±6.9 (55.0±5.1)	191±20 (141±15)	161±16 (119±12)	343±39 (253±29)	284±29 (209±21)
M18	P=2.5	122±12 (90.0±8.9)	103±10 (75.8±7.2)	265±29 (195±21)	226±20 (167±15)	481±49 (355±36)	402±39 (297±29)
M20	P=2.5	172±17 (127±13)	144±14 (106±10)	373±39 (275±29)	314±29 (232±21)	667±69 (492±51)	559±59 (412±44)
M22	P=2.5	226±20 (167±15)	192±20 (142±15)	500±49 (369±36)	422±39 (311±29)	902±88 (665±65)	755±78 (557±58)
M24	P=3	294±29 (217±21)	235±29 (173±21)	637±69 (470±51)	520±49 (383±36)	1160±118 (856±87)	941±98 (694±72)
M27	P=3	431±39 (318±29)	353±39 (260±29)	941±98 (694±72)	765±78 (564±58)	1700±167 (1250±123)	1370±137 (1010±101)
M30	P=3.5	588±59 (434±44)	490±49 (361±36)	1285±127 (948±94)	1079±108 (796±80)	2300±235 (1700±173)	1940±196 (1430±145)
M33	P=3.5	794±78 (586±58)	667±69 (492±51)	1726±177 (1270±131)	1451±147 (1070±108)	3110±314 (2290±232)	2610±265 (1930±195)
M36	P=4	1030±98 (760±72)	863±88 (637±65)	2226±226 (1640±167)	1863±186 (1370±137)	4010±402 (2960±297)	3360±333 (2480±246)

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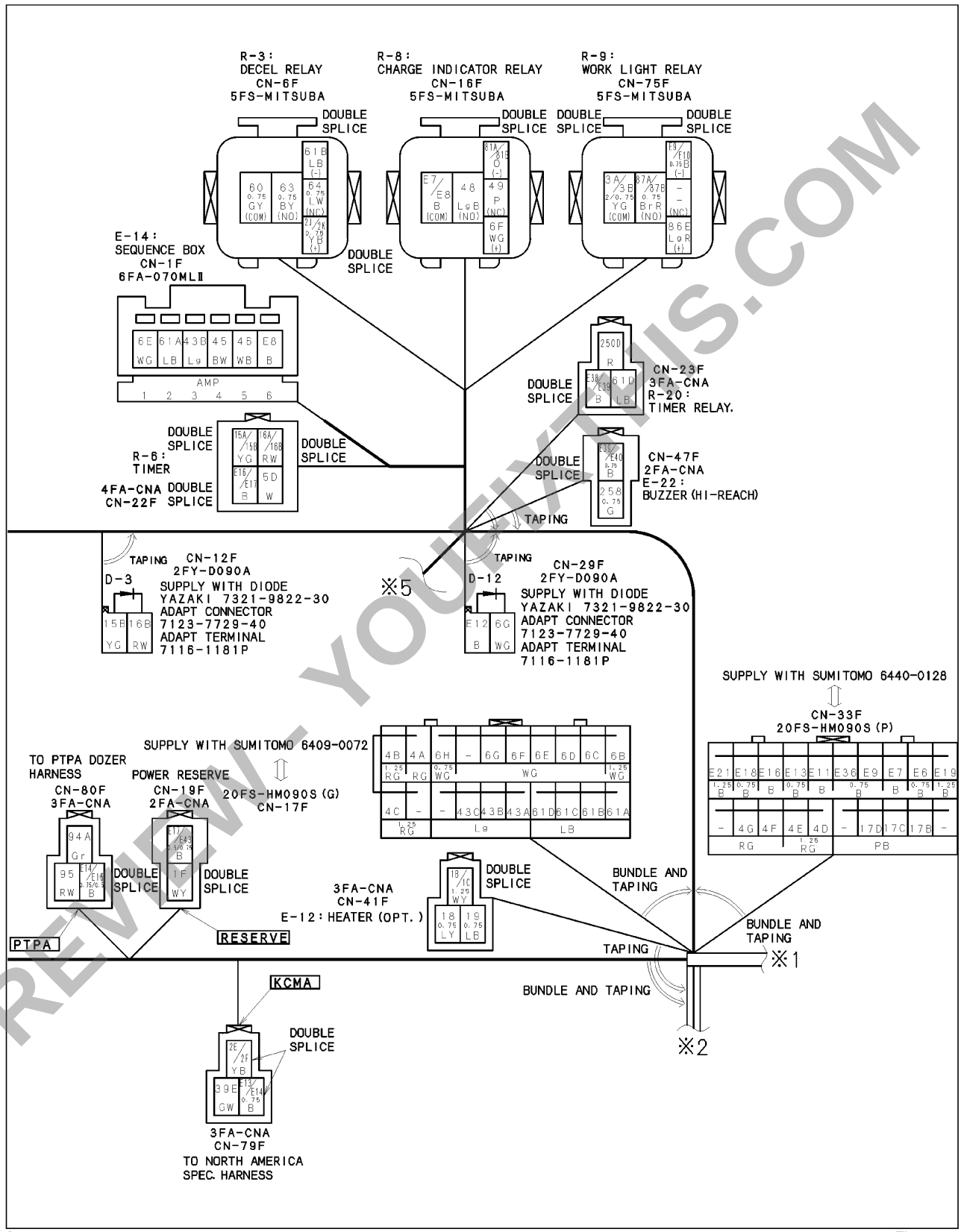
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Figure 33

FIG. 24-12 OPERATION AT NEUTRAL POSITION

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SPH23000037E01

Figure 27

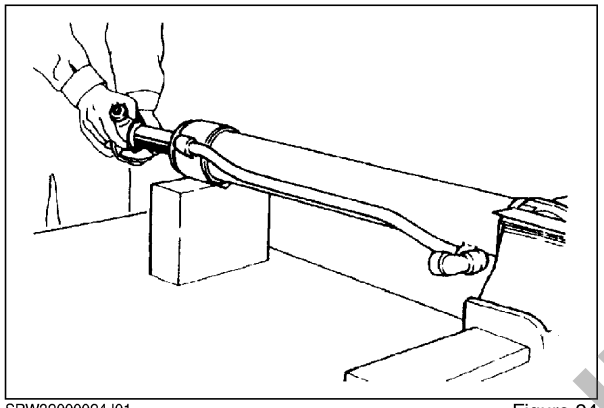
FIG. 23-19 INST • MAIN HARNESS (NO. H-1) — (2/8)

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32.2.1.4 DISASSEMBLY

NOTE: *The numbers in () following each part name are the Items corresponding to those in Fig. 32-21 unless otherwise noted.*

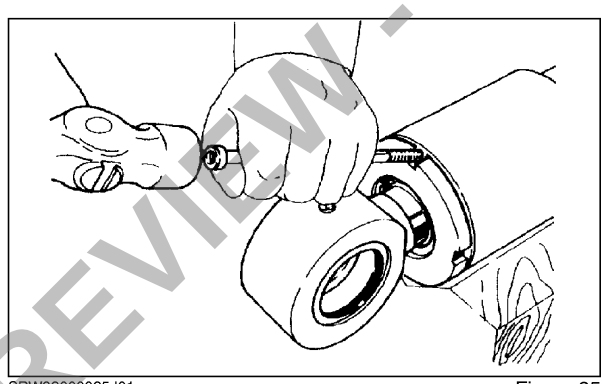
1. Disassembly of cylinder
   1. Secure the clevis portion of tube in a vice, support the other end with a wooden stand to hold the cylinder level.
   2. Drain the hydraulic oil from the cylinder.
      - Slowly move the piston rod in and out.



SPW32000024J01 Figure 24

FIG. 32-22 DISASSEMBLING CYLINDER ASSEMBLY

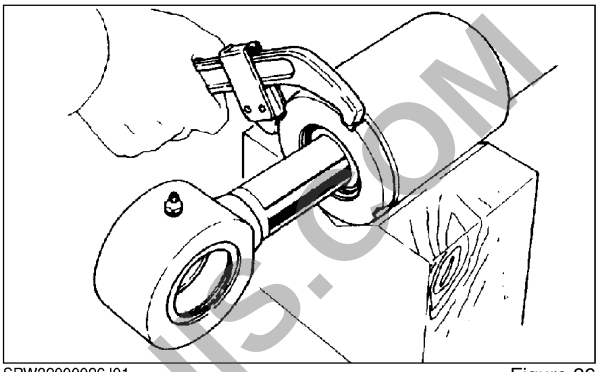
   3. Straighten the locking fin for the cylinder head (4).
      - Use caution bending or straightening the locking fin, the locking fin and cylinder tube are one-piece.



SPW32000025J01 Figure 25

FIG. 32-23 DISASSEMBLING CYLINDER ASSEMBLY

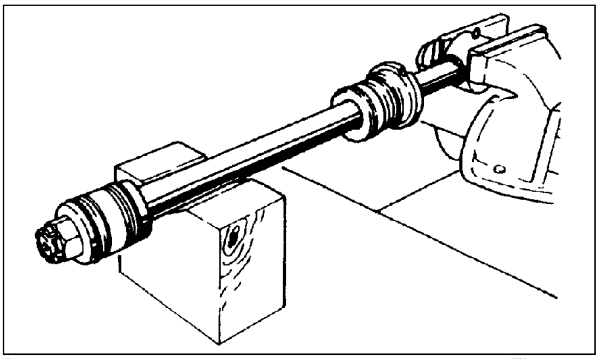
   4. Loosen the cylinder head (4).
      - Prior to loosening the cylinder head, pull out the piston rod (2) by 100 ~ 200 mm (4 ~ 8 in).



SPW32000026J01 Figure 26

FIG. 32-24 DISASSEMBLING CYLINDER HEAD

   5. Pull the piston rod assembly from the tube.
      - Pull the piston rod straight out to prevent damage to the sliding surface.
2. Disassembly of piston rod assembly
   1. Clamp the piston rod end in a vise, support the piston end with a wooden block to hold the rod level.



SPW32000027J01 Figure 27

FIG. 32-25 DISASSEMBLING PISTON ROD

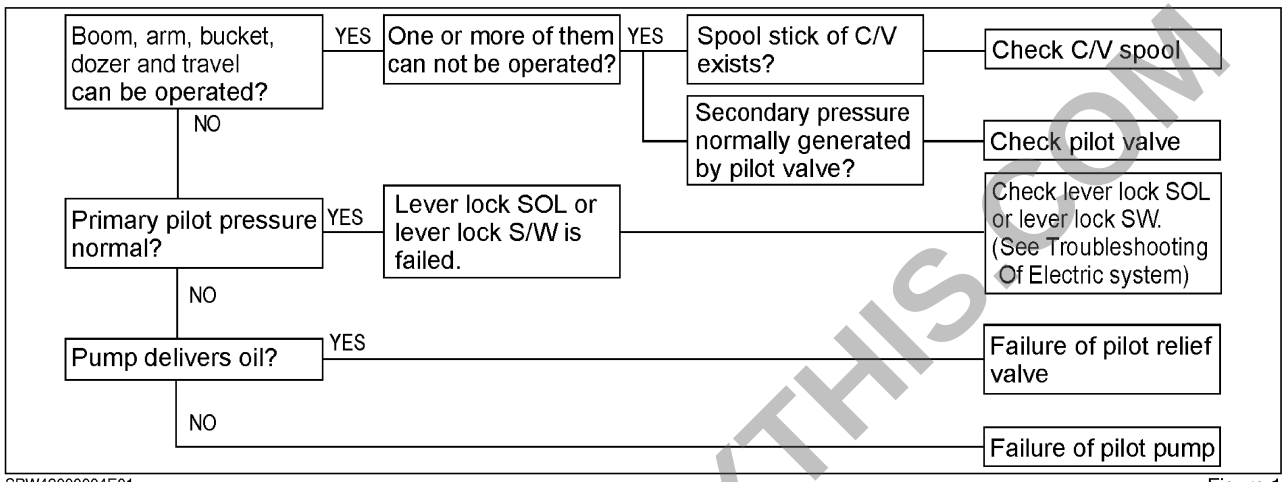
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42.3 TROUBLESHOOTING

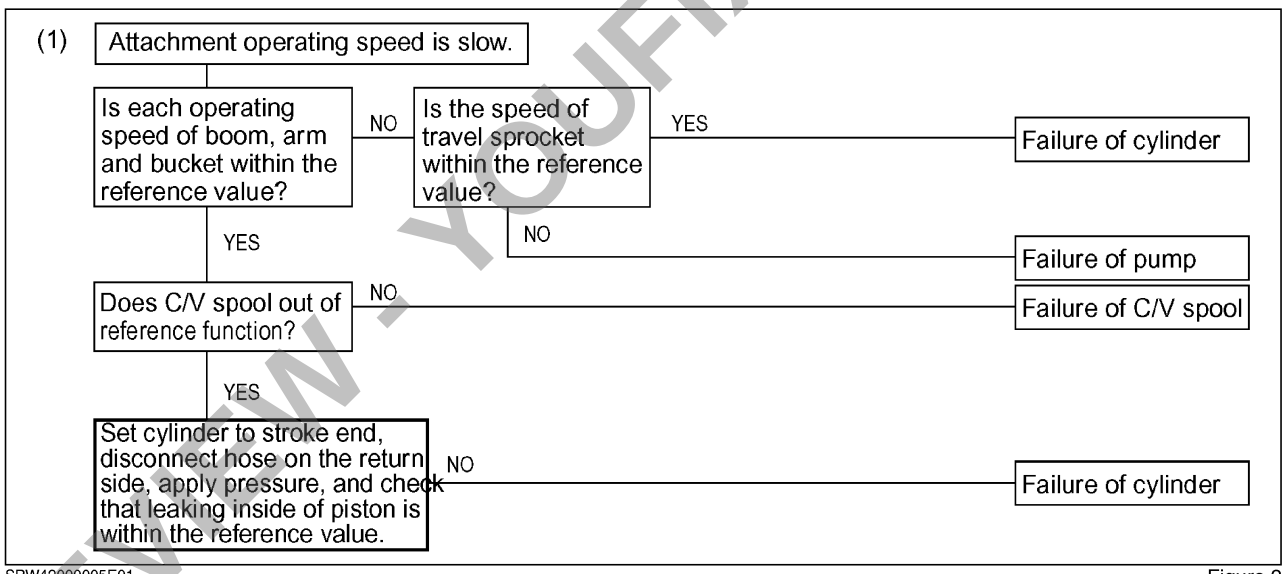
42.3.1 ATTACHMENT

42.3.1.1 ATTACHMENT OPERATIONAL FAILURE (EXCLUDING SWING OPERATIONS)



SPW42000004E01 Figure 1

42.3.1.2 ATTACHMENT SPEED IS SLOW



SPW42000005E01 Figure 2

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2.2 Periodic Inspection and Maintenance Procedure

2.2.1 Check before Daily Operation

Be sure to check the following points before starting an engine every day.

No.	Inspection Item
(1)	Visual check around engine
(2)	Fuel tank level check and fuel supply
(3)	Lube oil level check and replenishment
(4)	Coolant water level check and replenishment
(5)	Fuel pipe and coolant water pipe inspection and maintenance
(6)	Inspection and adjustment of governor lever and accelerator
(7)	Warning lamp & instruments function check

(1) Visual check around engine

If any problem is found, do not use before the engine repairs have been completed.

- Oil leak from the lubrication system
- Fuel leak from the fuel system
- Coolant water leak from the cooling water system
- Damaged parts
- Loosened or lost bolts
- Fuel, radiator rubber hoses, V belt cracked, loosened clamp

(2) Fuel tank level check and fuel supply

Check the remaining fuel oil level in the fuel tank and refuel the recommended fuel if necessary. (Refer to 1.3.(1))

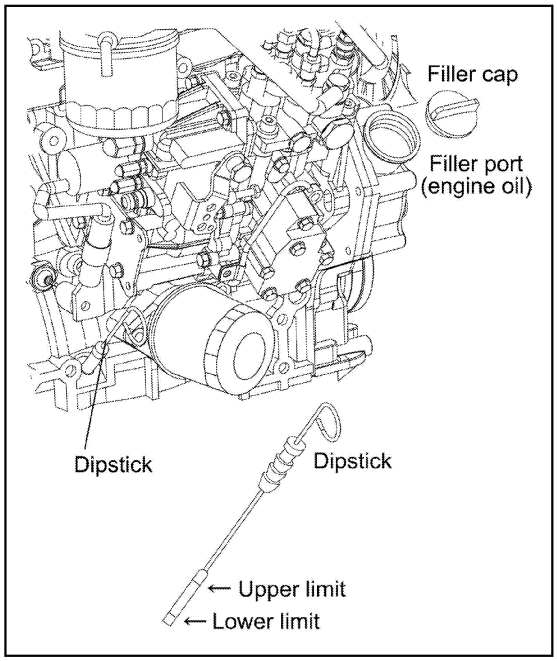
(3) Lube oil level check and replenishment

(a) Checking oil level

Check the lube oil level with the dipstick, after adjusting the posture of the machine unit so that an engine may become a horizontality. Insert the dipstick fully and check the oil level. The oil shall not be contaminated heavily and have appropriate viscosity. No coolant water or diesel fuel shall be mixed.
When lube oil is supplied after the engine running, check the lube oil level after about 10 minutes pass after the engine shutdown so that the lube oil inside may be retuned the oil pan.

Standard

The level shall be between the upper and lower limit lines on the dipstick.



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Torque value Unit: N•m (lb•ft)

11.1.2 METRIC FINE THREAD STANDARD TIGHTENING TORQUE VALUES

Make sure to tighten all Capscrews and Nuts to proper torque values.

METRIC FINE THREAD STANDARD TIGHTENING TORQUE VALUES							
Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M8	P=1.0	11.3±1.1 (8.3±0.8)	9.5±1.0 (7.0±0.7)	24.5±2.0 (18.1±1.5)	20.6±2.0 (15.2±1.5)	44.1±3.9 (32.5±2.9)	37.3±3.9 (27.5±2.9)
M10	P=1.25	22.6±2.0 (16.7±1.5)	18.7±1.9 (13.8±1.4)	48.1±4.9 (35.5±3.6)	41.2±3.9 (30.3±2.9)	87.3±8.8 (64.4±6.5)	73.5±6.9 (54.2±5.1)
M12	P=1.25	39.2±3.9 (28.9±2.9)	33.3±2.9 (24.6±2.1)	85.3±8.8 (62.9±6.5)	71.6±6.9 (52.8±5.1)	154±16 (114±12)	129±13 (95.2±9.6)
M16	P=1.5	92.2±8.8 (68.0±6.5)	77.5±7.8 (57.2±5.8)	196±20 (145±15)	169±17 (125±13)	363±39 (268±29)	304±29 (224±21)
M20	P=1.5	186±19 (137±14)	155±16 (114±12)	402±39 (297±29)	333±29 (246±21)	726±69 (535±51)	608±59 (448±44)
M24	P=2	314±29 (232±21)	265±29 (195±21)	686±69 (506±51)	569±59 (420±44)	1240±118 (915±87)	1030±98 (760±72)
M30	P=2	637±59 (470±44)	530±49 (391±36)	1390±137 (1030±101)	1157±118 (853±87)	2500±255 (1840±188)	2080±206 (1530±152)
M33	P=2	853±88 (629±65)	706±70 (521±52)	1860±186 (1370±137)	1550±155 (1140±114)	3350±334 (2470±246)	2790±275 (2060±203)
M36	P=3	1070±108 (789±80)	892±88 (658±65)	2330±226 (1720±167)	1940±196 (1430±145)	4200±422 (3100±311)	3500±353 (2580±260)
Torque value Unit: N•m (lb•ft)							

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1.1 GENERAL SAFETY INFORMATION

WARNING: *Do not operate or perform any maintenance on this machine until all instructions in the OPERATOR'S MANUAL and this MANUAL have been thoroughly read and understood.*

WARNING: *Improper operation or maintenance of this machine may cause accidents and could result in serious injury or death.*

WARNING: *Always keep the manual in storage.*
If it is missing or damaged, place an order with an authorized Distributor for a replacement.
If you have any questions, please consult your dealer.

1. Most accidents, which occur during operation, are due to neglect of precautionary measures and safety rules. Sufficient care should be taken to avoid these accidents. Erroneous operation, lubrication or maintenance services are very dangerous and may cause injury or death of personnel. Therefore all precautionary measures, NOTES, DANGERS, WARNINGS and CAUTIONS contained in the manual and on the machine should be read and understood by all personnel before starting any work with or on the machine.
2. Operation, inspection, and maintenance should be carefully carried out, safety must be given the first priority. The safety information contained in the manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
3. Messages of safety appear in the manual and on the machine:

   All messages of safety are identified by either word of DANGER, WARNING, and CAUTION.

DANGER: *Shows an imminently hazardous situation which, if not avoided, will result in death or serious injury.*

WARNING: *Shows a potentially hazardous situation which, if not avoided, could result in death or serious injury.*

CAUTION: *Shows a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components.*

4. It is very difficult to foresee every danger that may occur during operation. However, safety can be ensured by fully understanding proper operating procedures for this machine according to methods recommended.
5. While operating the machine, be sure to perform work with great care, so no damage to the machine or accidents will occur.
6. Continue studying the manual until all Safety, Operation and Maintenance procedures are completely understood by all persons working with the machine.

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HYDRAULIC EXCAVATORS

STANDARD SPECIFICATIONS AND MAINTENANCE

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12.2.3 UPPER STRUCTURE - GROUP 03

Group 03 - Upper Structure					
GROUP No.	EQUIPMENT PORTION	WORK TO BE DONE	UNIT	REMARKS	UNIT: HOUR
00	**Control portion**				
01	E / G control cable	Rem. / Inst.	1 pc.		0.2
04	Other necessary works	- ditto -	1 set	Cover and Hose	0.4
10	**Intake portion**			Refer to 33.1.12	
11	Air cleaner ASSY	Rem. / Inst.	1 pc.		0.4
12	• Hose (1)	- ditto -	1 pc.		0.1
13	• Hose (2)	- ditto -	1 pc.		0.1
14	• Element	Replace	1 pc.		0.1
20	**Exhaust portion**			Refer to 33.1.14	
21	Muffler ASSY	Rem. / Inst.	1 pc.		0.4
22	Clamp	- ditto -	1 pc.		0.1
23	Exhaust manifold attaching nuts	- ditto -	4 pcs.		0.1
24	Muffler fixing bolt	- ditto -	4 pcs.		0.1
	Other necessary works	- ditto -	1 set	Heat insulation cover	0.1
30	**E / G Accessory portion**			Refer to 33.1.13 & 33.1.16	
31	Generator	Rem. / Inst.	1 pc.		0.6
32	• Connector	- ditto -	1 pc.		0.1
33	• Generator fixing bolt	- ditto -	2 pcs.		0.1
34	• V-belt	- ditto -	1 pc.	Include tension adjusting	0.3
	Other necessary works	- ditto -	1 set	Covers	0.1
		- ditto -	1 pc.	Negative terminal of battery	0.1
36	Starter	Rem. / Inst.	1 pc.		0.5
37	• B-terminal	- ditto -	1 pc.		0.1
38	• S-terminal connector	- ditto -	1 pc.		0.1
39	• Starter fixing bolt	- ditto -	2 pcs.		0.2
	Other necessary works	- ditto -	1 set	Cover and Floor plate	0.1
		- ditto -	1 set	Seat and Stand cover	0.3
		- ditto -	1 pc.	Negative terminal of battery	0.1
40	**Fuel portion**			Refer to 33.1.10	
41	Fuel tank ASSY	Rem. / Inst.	1 pc.		0.6
42	• Fuel	Replace	1 pc.		0.2
43	• Hose (Supply; water separator side)	Rem. / Inst.	1 pc.		0.1
44	• Hose (Return; filter side)	- ditto -	1 pc.		0.1
45	• Level sensor connector	- ditto -	1 pc.		0.1
46	• Fuel tank fixing bolt	- ditto -	2 pcs.		0.1
	Other necessary works	- ditto -	1 pc.	Covers	0.4
50	**Hydraulic oil tank portion**			Refer to 33.1.11	
51	Hydraulic oil tank ASSY	Rem. / Inst.	1 pc.	After removing fuel tank;	1.6
52	• Return filter	Replace	1 pc.	Include pressure releasing & replacing O-ring	0.2
53	• Hydraulic oil	- ditto -	1 pc.		0.2
54	• Suction hose	Rem. / Inst.	1 pc.		0.2
55	• Strainer	Replace	1 pc.	Include replacing O-ring	0.1
56	• Pilot return hose	Rem. / Inst.	1 pc.		0.1
57	• Swivel drain hose	- ditto -	1 pc.		0.1

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WIRE NO	WIRE COLOR	WIRE SIZE	FROM	CONNECTION	TO
72A	L	AVS0.5sq	CN-26F	DOUBLE SPLICE	CN-20F
72B	L	AVS0.5sq	CN-26F		CN-78F
81A	O	AVS0.5sq	CN-16F	DOUBLE SPLICE	CN-61F
81B	O	AVS0.5sq	CN-16F		CN-81F
86A	LgR	AVS0.5sq	CN-37F	DOUBLE SPLICE	CN-27F
86B	LgR	AVSS0.75sq	CN-37F		CN-15F
86C	LgR	AVSS0.75sq	CN-73F	DOUBLE SPLICE	CN-15F
86D	LgR	AVSS0.75sq	CN-73F		F-2
86E	LgR	AVS0.5sq	CN-75F		CN-15F
87A	BrR	AVSS0.75sq	CN-75F	DOUBLE SPLICE	CN-2F
87B	BrR	AVSS0.75sq	CN-75F		F-7
90	RW	AVSS0.75sq	CN-2F		CN-112F
92	L	AVS0.5sq	F-8		CN-27F
94A	Gr	AVS0.5sq	CN-71F	DOUBLE SPLICE	CN-80F
94B	Gr	AVS0.5sq	CN-71F	DOUBLE SPLICE	CN-70F
94C	Gr	AVS0.5sq	CN-85F		CN-70F
95	RW	AVS0.5sq	CN-85F		CN-80F
122	LgY	AVS0.5sq	CN-81F		CN-72F
250D	R	AVS0.5sq	CN-23F	DOUBLE SPLICE	CN-73F
250A	R	AVS0.5sq	CN-77F	DOUBLE SPLICE	CN-73F
250B	R	AVS0.5sq	CN-77F		CN-313F
258	G	AVSS0.75sq	CN-47F		CN-73F
260	PB	AVSS0.75sq	CN-4M		CN-73F
303	Y	AVS0.5sq	CN-84M		CN-78F
304	G	TWIST PAIR	CN-84M		CN-78F
E1	B	AVS0.5sq	CN-27F	DOUBLE SPLICE	CN-38F
E2	B	AVS0.5sq	CN-40F	DOUBLE SPLICE	CN-38F
E3	B	AVSS0.75sq	CN-40F	DOUBLE SPLICE	CN-70F
E4	B	AVSS0.75sq	CN-14F		CN-70F
E5	B	AVS0.5sq	CN-14F		CN-78F
E20	B	AVS0.5sq	CN-14F		M-6
E6	B	AVSS0.75sq	CN-14F		CN-33F
E7	B	AVS0.5sq	CN-16F	DOUBLE SPLICE	CN-33F
E8	B	AVS0.5sq	CN-16F		CN-1F
E9	B	AVSS0.75sq	CN-75F	DOUBLE SPLICE	CN-33F
E10	B	AVSS0.75sq	CN-75F		CN-44F
E11	B	AVS0.5sq	CN-10F	DOUBLE SPLICE	CN-33F
E12	B	AVS0.5sq	CN-10F		CN-29F
E13	B	AVSS0.75sq	CN-79F	DOUBLE SPLICE	CN-33F
E14	B	AVSS0.75sq	CN-79F	DOUBLE SPLICE	CN-80F
E15	B	AVS0.5sq	CN-81F		CN-80F
E16	B	AVS0.5sq	CN-22F	DOUBLE SPLICE	CN-33F
E17	B	AVS0.5sq	CN-22F	DOUBLE SPLICE	CN-19F
E43	B	AVSS0.75sq	CN-82F	DOUBLE SPLICE	CN-19F
E38	B	AVSS0.75sq	CN-82F	DOUBLE SPLICE	CN-23F
E39	B	AVSS0.75sq	CN-47F	DOUBLE SPLICE	CN-23F
E40	B	AVSS0.75sq	CN-47F		CN-112F
E18	B	AVSS0.75sq	CN-113F		CN-33F
E19	B	AVSS1.25sq	CN-107F		CN-33F
E21	B	AVSS1.25sq	P-3	DOUBLE SPLICE	CN-33F
E22	B	AVS2sq	P-3		CN-60F
E23	B	AVS0.5sq	CN-101F	DOUBLE SPLICE	CN-73F
E24	B	AVS0.5sq	CN-107F		CN-73F
E25	B	AVS0.5sq	CN-107F		CN-76F
E26	B	AVS0.5sq	CN-107F	DOUBLE SPLICE	F-6
E27	B	AVS0.5sq	T-6	DOUBLE SPLICE	F-6
E28	B	AVS0.5sq	T-6		CN-115F
E29	B	AVSS0.75sq	CN-107F		CN-2F
E30	B	AVSS1.25sq	CN-107F		CN-2F

WIRE NO	WIRE COLOR	WIRE SIZE	FROM	CONNECTION	TO
E31	B	AVSS1.25sq	CN-107F		CN-2F
E32	B	AVSS1.25sq	CN-107F		CN-2F
E33	B	AVS0.5sq	CN-107F		CN-108F
E35	B	AVSS0.75sq	CN-107F		M-2
E42	B	AVSS0.75sq	CN-107F		CN-315F
E36	B	AVSS0.75sq	M-5	DOUBLE SPLICE	CN-33F
E37	B	AVSS0.75sq	M-5	DOUBLE SPLICE	CN-5F
E34	B	AVSS0.75sq	CN-313F		CN-5F

CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM.)	MANUFUC.	PART. NUMBER	
		HOUSING	TERMINAL
1FA-CNA	AMP	172128-1	170032-2
2FA-CNA	AMP	172130-1	170258-1
2FA-CNA(L)	AMP	172130-5	
3FA-CNA	AMP	172132-1	
4FA-CNA	AMP	172134-1	
4FA-CNA(B)	AMP	172134-2	
4FA-CNA(Br)	AMP	172134-3	
6FA-CNA	AMP	171898-1	
10FA-CNA	AMP	172138-1	
2MA-CNA(L)	AMP	172129-5	170340-1
2MA-CNA	AMP	172129-1	170340-1
4MA-CNA	AMP	172133-1	170340-1
10MA-CNA	AMP	172137-1	170340-1
4FP-VF7	P&B	VCF7-1000	
	AMP		42281-1
5FS-MITSUBA	SUMITOMO	6098-1493	1500-0207
			8240-4242
20FS-HN090S(G)	SUMITOMO	6400-0013	8240-4422
		6409-0072	
20FS-HN090S(P)	SUMITOMO	6440-0129	8240-4422
		6440-0128	
2FS-HN090	SUMITOMO	6090-1001	8240-4422
3FA-JMI+	AMP	174357-2	171662-1
14FA-040ML	AMP	917531-1	173681-1
6FS-MT090	SUMITOMO	6242-5061	8240-4422
CB104	AMP	170889-1	170003-5
CA104	AMP	170887-1	170002-5
CB103	AMP	170889-1	170012-2
11FY-090I	YAZAKI	7283-1110	7116-4021
		7322-7616	
6FA-JMI+	AMP	174262-2	171662-1 (TIN PLATING)
1MY-58L	YAZAKI	7122-4110	7114-3250
2FA-JMI+	AMP	174352-2	171662-1 (TIN PLATING)
2FS-DL305	SUMITOMO	6195-0060	8100-0498
6FS-DL090	SUMITOMO	6195-0021	8240-4952
2FY-D090A	YAZAKI	7123-7729-40	7116-1181P
6FA-070MLII	AMP	174923-1	173631-1
10FA-070MLI	AMP	174465-1	173631-1
14FA-070MLI	AMP	173852-1	173631-1
2MA-JMI+	AMP	174354-2	
2FY-312	YAZAKI	7283-3020	7116-6041
			7116-6042
12FS-DL090	SUMITOMO	6195-0149	8100-1458
			8100-1429
2FW-MR	MOLEX	52213-0211	501480-8100
12MS-DL090	SUMITOMO	6195-0152	

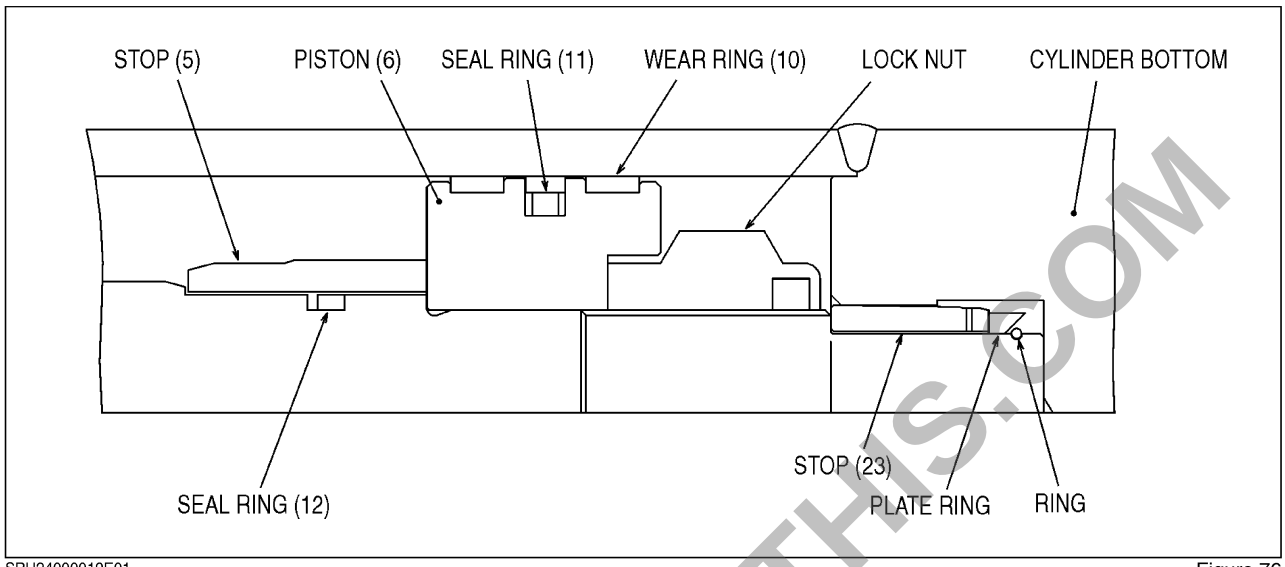
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SPJ23000013E01

Figure 33

FIG. 23-25 INST • MAIN HARNESS (NO. H-1) — (8/8)

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SPH24000019E01

Figure 76

FIG. 24-37 PISTON ASSY

2. Piston Assy

The piston assy has the seal ring (11) which is inserted at the center portion of the piston (6), to prevent leakage of pressurized oil from either chamber of left or right to the other chamber. The wear rings (10) are inserted in both sides of the seal ring (11) to bear radial load imposed on the cylinder, and also to catch contaminations.

A. Seal Ring (11)

The location of seal ring (11) is the center of piston. The seal ring (11) is to seal the circular gap between the piston and the cylinder tube utilizing a tension of the O-ring, to form both chambers of high pressure side and low pressure side isolating from each other making the piston as the border.

B. Wear Ring (19)

Two wear rings are provided at both sides of the seal ring (11) directly getting in touch with the cylinder tube. Along with the rod bushing (14), the wear rings (10) bear radial load imposed on the cylinder, perform linear movement against inside face of cylinder at high facial pressure, and minimize the eccentricity of piston rod that badly affects to the sealing effect by supporting it at one end. And the slide ring has another function of burying and catching contaminations between the cylinder tube and the slide rings.

C. Cushion Bearing (5)

The cushion bearing (5) is located between the piston and the stepped portion of piston rod. This cushion ring has the inner seal ring (12), this causes the seal ring to float. This has the function to form a circular gap adjacent to the fully extended position, and to throttle the oil to and soften the shock prior to the fully extended position.

D. Cushion Bearing (23)

The cushion bearing (23) is located at the end of piston rod. At the full retracting of cylinder rod, cushion bearing (23) plunges into hole of cylinder bottom, and forms a circular gap and throttles the oil flow. Consequently the collision speed of rod slows down and the shock of collision is absorbed.

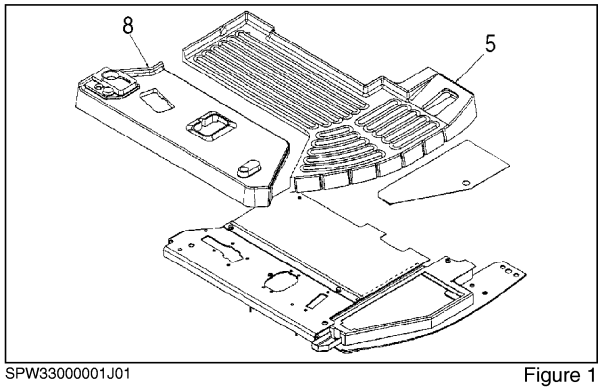
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33.1 REMOVING AND INSTALLING

33.1.1 CANOPY / CAB

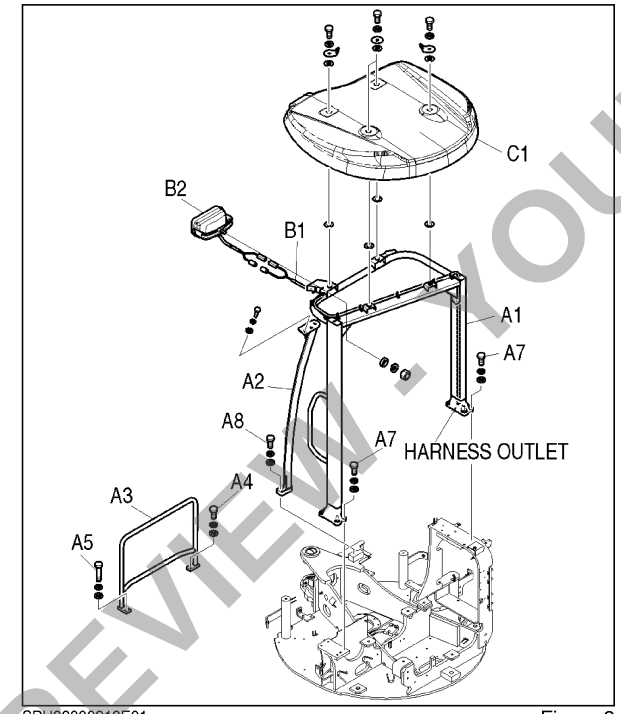
33.1.1.1 CANOPY REMOVAL



SPW33000001J01 Figure 1

FIG. 33-1 FLOOR MAT REMOVAL

1. Remove the floor mats (5) and (8).



SPH33000213E01 Figure 2

FIG. 33-2 REMOVAL OF CANOPY ASSEMBLY AND HANDRAIL

2. Removing handrail (A3)
3. Loosen the sems-bolt M16x65 (A4) and M16×100 (A5) to remove the handrail (A3).

: 24 mm

4. Removing canopy assembly
   1. Disconnect the light harness (B1) that runs inside the support (A1).
   2. Loosen one capscrew M10x40 (A8) and four capscrews M14x55 (A7) to remove the canopy.

: 17 mm and 22 mm

   3. Canopy weight: 120 kg (265 lbs)
5. Install the canopy in reverse order of the removal. Tighten the capscrews at the torque specified below:

   M10: T=46Nm (34 lb ft)

   M14: T=125 Nm (92 lb ft)

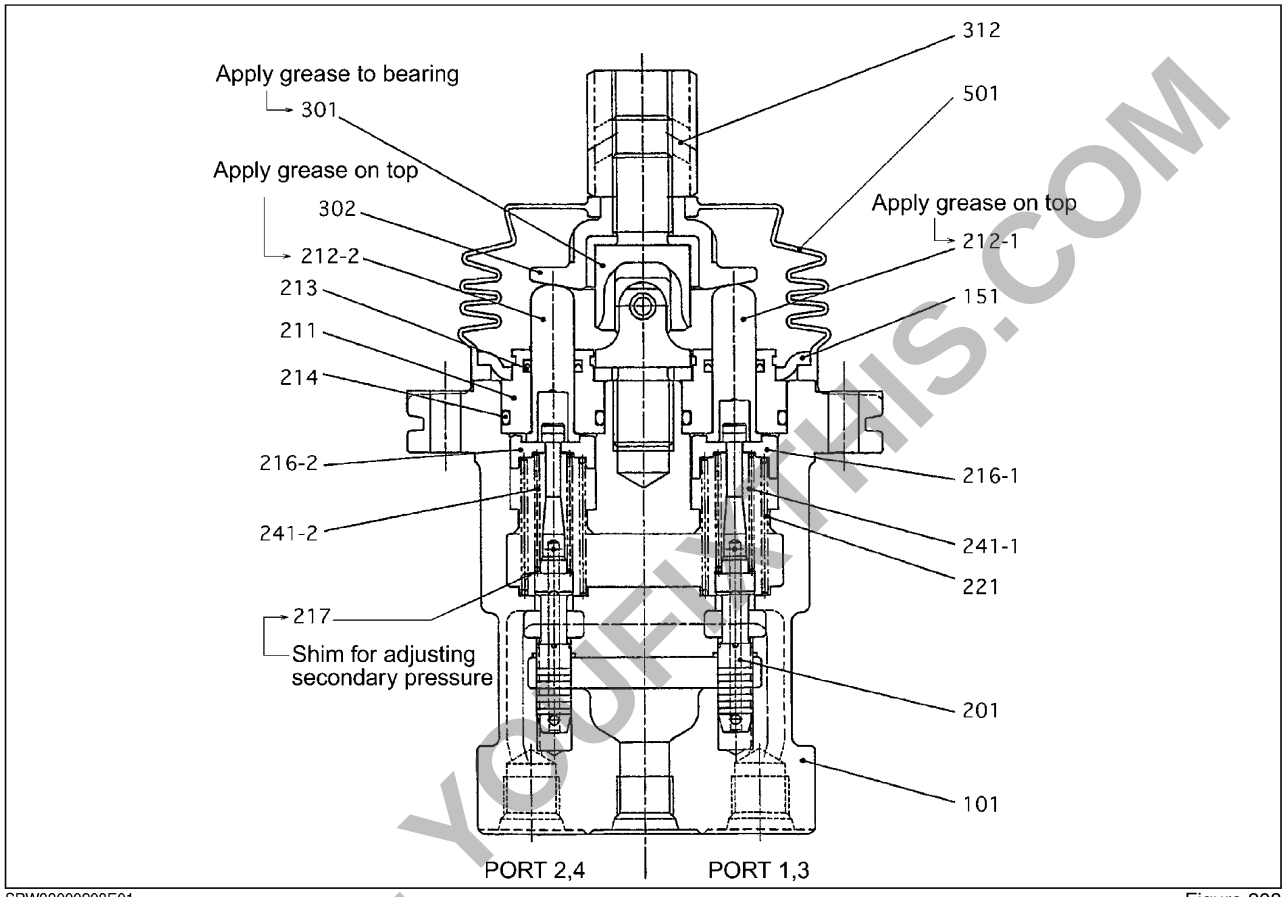
   M16: T=191 Nm (141 lb ft)

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33.2.3 PILOT VALVE (ATTACHMENT)

33.2.3.1 CONSTRUCTION



SPW33000208E01

Figure 208

FIG. 33-91 PILOT VALVE (ATTACHMENT)

Table 33-3

Item	Thread size	Tightening Torque Table Nm (lb-ft)
301	M14	47.1 (34.7)
302, 312	M14	68.6 (50.6)

Table 33-4

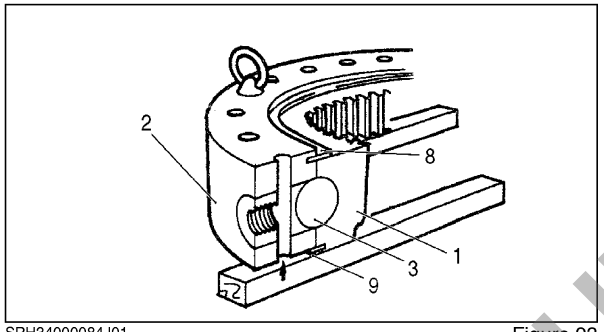
Item	NAME	Q'TY	Item	NAME	Q'TY	Item	NAME	Q'TY
101	CASING	1	213	SEAL	4	241–1	SPRING	2
151	PLATE	1	214	O-RING; 1B P20	4	241–2	SPRING	2
201	SPOOL	4	216–1	SPRING SEAT	2	301	JOINT; M14	1
211	PLUG	4	216–2	SPRING SEAT	2	302	DISK	1
212–1	PUSH ROD	2	217	WASHER 2	4	312	ADJUSTING NUT; M14	1
212–2	PUSH ROD	2	221	SPRING	4	501	BELLOWS	1

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34.1.11.3.2 ASSEMBLING

1. Degrease thoroughly the groove for seal A (8) located in the inner circumference of outer race (2) and the groove for seal B (9) located in the outer circumference of inner race (1). Coat the grooves with adhesive (Cyanoacrylate instant glue), install seal B (9), and place inner race (1) on a surface plate.
2. Lift and lower outer race (2) slowly till the top surface of inner race (1) matches the bottom of the sealing groove of outer race (2). Place an adjusting washer under outer race (2) in order to support the outer race so the track surface of ball (3) is aligned.



SPH34000084J01 Figure 93

FIG. 34-90 INSTALLING BALLS

3. Insert balls (3) and spacers (4 and 5) coating with grease (NLGI No.2 Lithium base with MoS2) alternately through the hole for plug (6) on outer race (2).

NOTE: *Do not use your finger to install the balls and spacers; always use a push rod.*

4. Install plug (6) to outer race (2).
5. Push taper pin (7) into bore, and caulk the head of the taper pin with a punch.
6. Grease the slewing bearing and confirm that the outer race rotates smoothly and that the lip of the seal is not scored.
   Grease (NLGI-2 EP type):
   Approx. 180 g(6.3 oz.)

34.1.11.4 MAINTENANCE STANDARDS

Regarding the maintenance standards for the wear of the slewing bearing, refer to the Article Measuring Slewing Performances in Chapter 13, Maintenance Standards and Test Procedures.

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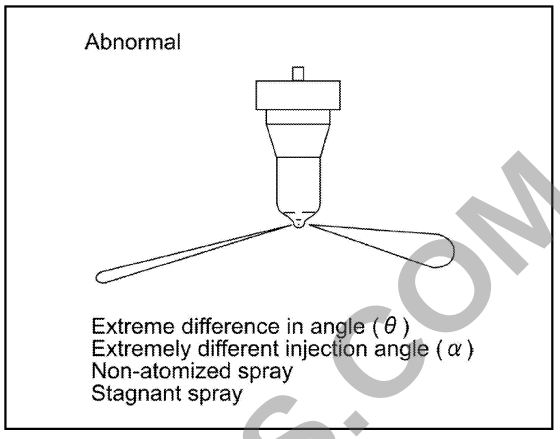
Classification	Group No.		Trouble / Cause	Engine dealer															
				Lubrication system			Cooling		Mechanical										
				Oil gets into comb. chamber through piston / valve guide	Check relief valve	Fuel mixed with oil	Check thermostat	Oil cooler element damaged	Compression low	Control rack movement not smooth	Governor spring fatigue	Crank shaft oil seal defective	Piston liner worn	Piston ring worn	Valve spring fatigue	Internal part seizure	Check fuel feed	Defective head gasket	Flywheel gear damaged
Starting trouble	1	(1)	Starter does not rotate																
		(2)	Starter rotates but hard to start				X		X				X	X	X		X	X	X
Rotation trouble	2	(1)	Idling not smooth				X		X	X	X			X	X		X	X	
		(2)	Medium speed hunting																
		(3)	High speed not smooth							X	X								
			Not reaching max. speed								X								
Output drops down	3	(1)	Engine low power				X		X					X					
			Overheat		X	X	X	X										X	
		(2)	Knocking at high temperature	X					X										
Other trouble	4	(1)	Black exhaust smoke				X							X	X	X		X	
			White exhaust smoke	X					X										
		(2)	Excessive oil consumption	X								X	X	X					
		(3)	Excessive fuel consumption						X										
		(4)	Engine does not stop when key turned OFF																
		(5)	When key is turned OFF, power supply disconnects but the engine does not stop																

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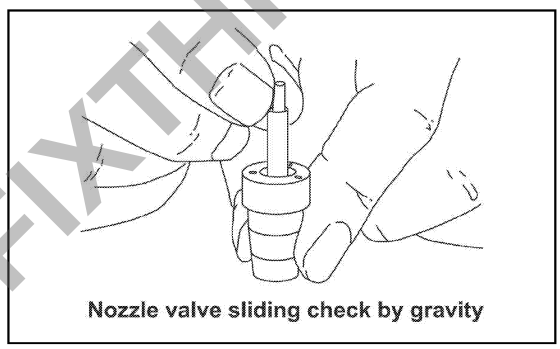
Spray and injection states

- 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

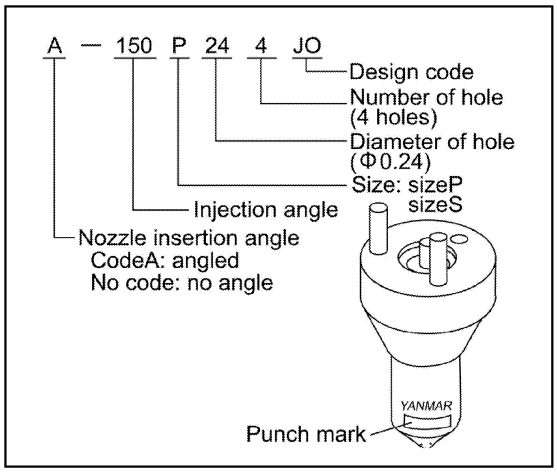


(c) Nozzle valve sliding test

Wash the nozzle valve in clean fuel oil. Place the nozzle body vertically and insert the nozzle into the body to about 1/3 of its length. The valve is normal if it smoothly falls by its own weight into the body. In case of a new nozzle, remove the seal peel, and immerse it in clean diesel oil or the like to clean the inner and outer surfaces and to thoroughly remove rust-preventive oil before using the nozzle. Note that a new nozzle is coated with rust-preventive oil and is pasted with the seal peel to shut off outer air.



(d) Nozzle punch mark



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8.3 Periodic Inspection Procedure

8.3.1 Periodic inspection intervals

Periodically inspect the turbocharger for the overall conditions and fouling.
The inspection interval varies with the operating conditions, but refer to the table below for the guideline for each application.

Application	Inspection interval		
For vehicles (automobiles)	Every 6 months or 60,000km	Every 12 months or 150,000km	Every 24 months or 300,000km
For construction machinery	Every 6 months or 500hrs	Every 12 months or 1,000hrs	Every 24 months or 2,000hrs
For faming machinery	Every 6 months or 200hrs	Every 12 months or 400hrs	Every 24 months or 800hrs
For marine use	Every 6 months or 1,500hrs	Every 12 months or 3,000hrs	Every 24 months or 6,000hrs
Rotor rotation	○		
Rotor play		○	
Overhaul and overall inspection			○
Oil filter cleaning and inspection	Based on engine operation manual		
Engine oil replacement			

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