5. REMOVAL AND INSTALLATION OF SLEWING REDUCTION UNIT

5. 1 Removing slewing speed reduction unit

1) Remove slewing motor. (See Article 4.1.)

2) Remove socket bolt (C) (M20) for speed reduction unit with box wrench and extension bar (about 600mm).

3) Attach eyebolt (M16) to the bolt hole for slewing motor, and hang it with wire rope and remove it.

- 1. Put a match mark on the speed reduction unit and the upper frame to make the installation easier.
- 2. If it is difficult to remove the speed reduction unit from the upper frame, remove the plug on the flange of the speed reduction unit and tighten socket bolt (C) to raise the reduction unit from the frame.
- 3. After removal of the reduction unit, don't fail to cover the speed reduction unit installing section to protect the slewing grease bath from entry of water and dust.

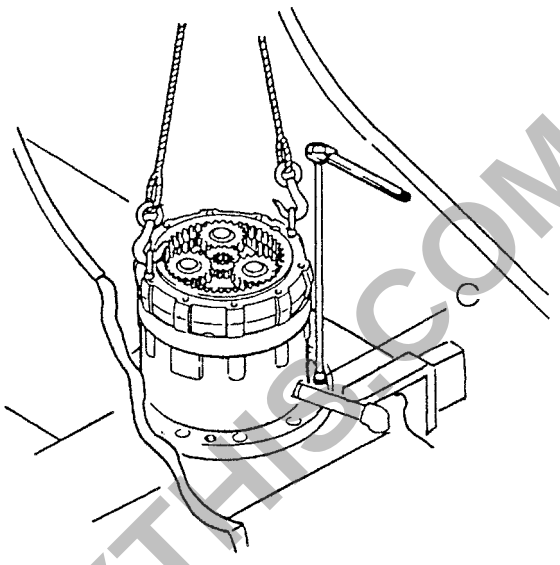


Fig. 9 Removing slewing speed reduction unit

5. 2 Installing slewing speed reduction unit

1) Remove burr and dirt from the contact surfaces of speed reduction unit to the upper frame.

2) Confirm the attaching positions where the match marks are put, and install the speed reduction unit on the upper frame.

- Apply Locktite #515 on the contact surface before installing. Apply Locktite #242 on socket bolt (C) for installing the speed reduction unit and tighten it to the specified torque.

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1. OUTLINE

The advantage of this machine are described below.

(1) Pumping control with I.T.C.S. (Intelligent Total Control System)
(2) Hydraulic travelling system with variable travel motor
(3) Slewing motor mechanical braking
(4) Arm digging auto conflux circuit
(5) Swing shockless mechanism
(6) Vibration relaxation circuit with D.D. switch when travelling
(7) Engine auto accel control

[Construction of machine]

This machine is made up of 2 units of variable displacement pump (For travel and operation), 3 units of gear pump, main control valve, slewing control valve, slewing motor, swivel joint, oil cooler, hydraulic tank, variable travel motor, pilot valve, various types of cylinder and filter, etc.

[Fuel consumption economy system]

The total pressure of two pumps is controlled so as not to exceed a constant value by two regulators, and consequently the engine output is always used effectively.
And the fuel consumption during operation is reduced by combining it with negative control, negative control relief cut valve control and KPSS (KOBELCO Power Sensing System), and also by taking advantage of the engine with direct injection type exhaust turbocharger.

[Travel circuit]

Travel drive is performed with the hydraulic travel system.
The travelling to forward or rearward is switched by switching the solenoid valve, control valve and direction of rotation of motor through the change lever.
When running at high speed (40km/h), the 1st and 2nd speeds are switched through transmission.
The transmission is switched through clutch by the power shift pump.
Combined operation is possible under the travel and attachment simultaneous operation.

[Slewing circuit]

The slewing circuit is an independent circuit, and allows reduction of abrupt change of slewing speed. In addition, the slewing motor with mechanical brake is effective for avoiding the slewing drift on slopes.
When concurrently operating the slewing and arm-in motions, it actuates as a slewing priority circuit to make the slewing push-on digging and arm slanted leveling motions smooth.
And further the swing shockless valve is placed in the slewing control valve to stop the motion due to inertia load and consequently prevents the inversion of hydraulic motor.

[Attachment circuit]

The bucket works from one pump, therefore when operating it with other attachment concurrently, smooth operation is available conforming to the lever stroke because of the parallel circuit.
For boom riase operation, parallel conflux circuit from two pumps is provided, and for boom lower operation, steady recirculation circuit is provided.
When operating the arm-in motion at light load, it is actuated through the variable recirculation circuit to reduce the speed change. When operating the arm-in motion at heavy load, it is actuated through the auto conflux circuit of sequence valve which makes the flow from two pumps confluxed speed up.
The arm out operation is performed by confluxing the flow from two pumps.
And when operating arm-in and slewing motions concurrently, the slewing priority circuit is used.

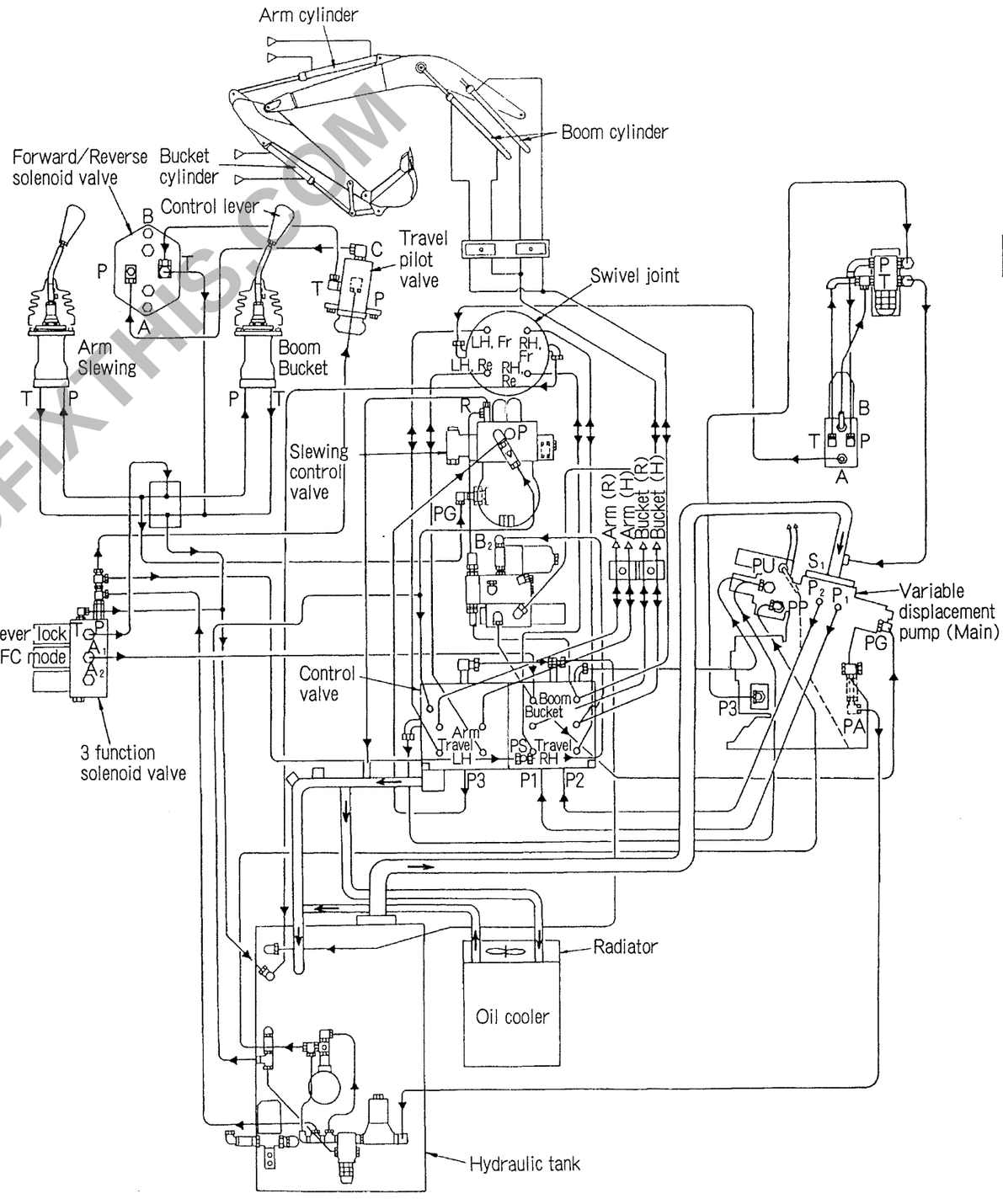
[Hydraulic oil control]

The tank is a closed type to prevent the entry of dust into hydraulic oil so as to keep it from being contaminated.
Further, the pressure type tank is applied to improve the self-priming capacity of pump. The suction oil to the variable pump passes through the suction strainer to remove foreign matter.
And the contamination of return oil in main circuit is removed by filter in the hydraulic tank.
The contamination of delivery oil in pilot circuit is removed by line filter at the outlet of gear pump.
The contamination in drain circuit from each equipment is removed by the drain filter.
The hydraulic oil temperature is cooled down by the oil cooler in front of the radiator.

[Pilot circuit]

The machine is of pilot control system. The pilot control circuit is equipped with two gear pumps (for control pilot and travel pilot, and for power shift) connected with two units of variable displacement pump and one gear pump installed outside of the engine (for power steering).

2. HYDRAULIC DIAGRAM



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1. TIGHTENING TORQUES FOR CAPSCREWS AND NUTS

Table 1 and 2 provide the reference values of applicable tightening torque unless otherwise specified. Overtightening of bolts may cause a torsional rupture and failure under loading, and insufficient tightening and loosening of bolts and falling. Bolts should be tightened to the proper torque.

Table 1 Tightening torque reference values of metric coarse screw threads

kgf·m (ft-lbs)

Classification	4.8T		7T		10.9T	
Nominal size	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6 P=1	0.45±0.05 (3.2±0.4)	0.38±0.04 (2.7±0.3)	0.98±0.1 (7.1±0.7)	0.83±0.08 (6.0±0.6)	1.77±0.18 (12.8±1.3)	1.5±0.15 (10.8±1.1)
M8 P=1.25	1.09±0.11 (7.9±0.8)	0.92±0.09 (6.6±0.7)	2.4±0.2 (17.3±1.4)	2.0±0.2 (14.4±1.4)	4.3±0.4 (31.0±2.9)	3.6±0.4 (26.0±2.9)
M10 P=1.5	2.2±0.2 (15.9±1.4)	1.83±0.18 (13.2±1.3)	4.7±0.5 (33.9±3.6)	4.0±0.4 (28.9±2.9)	8.5±0.9 (61.3±6.5)	7.2±0.7 (52.0±5.1)
M12 P=1.75	3.7±0.4 (26.7±2.9)	3.2 ±0.3 (23.1±2.2)	8.1±0.8 (58.5±5.8)	6.8±0.7 (49.1±5.1)	14.6±1.5 (105±10.8)	12.3±1.2 (88.8±8.7)
M14 P=2	5.9±0.6 (42.6±4.3)	5.0±0.5 (36.1±3.6)	12.8±1.3 (92.5±9.4)	10.8±1.1 (78.0±7.9)	23±2 (166±14)	19.5±1.9 (140±14)
M16 P=2	9.0±0.9 (64.9±6.5)	7.6±0.7 (54.8±5.1)	19.5±2.0 (140±14.4)	16.4±1.6 (118±11.5)	35±4 (252±28.9)	29±3 (209±21.6)
M18 P=2.5	12.4±1.2 (89.6±8.7)	10.5±1.0 (75.8±7.2)	27±3 (195±22)	23±2 (166±14)	49±5 (354±36)	41±4 (296±29)
M20 P=2.5	17.5±1.7 (126±12.3)	14.7±1.4 (106±10.1)	38±4 (274±29)	32±3 (231±22)	68±7 (491±51)	57±6 (412±43)
M22 P=2.5	23±2 (166±14)	19.6±2.0 (142±14)	51±5 (368±36)	43±4 (310±29)	92±9 (663±65)	77±8 (555±58)
M24 P=3	30±3 (217±22)	24±3 (173±22)	65±7 (469±51)	53±5 (383±36)	118±12 (852±87)	96±10 (693±72)
M27 P=3	44±4 (318±29)	36±3 (260±22)	96±10 (693±72)	78±8 (563±58)	173±17 (1250±120)	140±14 (1010±100)
M30 P=3.5	60±6 (433±43)	50±5 (361±36)	131±13 (946±94)	110±11 (794±79)	235±24 (1700±170)	198±20 (1430±140)
M33 P=3.5	81±8 (585±58)	68±7 (491±51)	176±18 (1270±130)	148±15 (1070±110)	317±32 (2290±230)	266±27 (1920±200)
M36 P=4	105±10 (758±72)	88±9 (636±65)	227±23 (1640±170)	190±19 (1370±140)	409±41 (2950±300)	343±34 (2480±250)

Table 2 Tightening torque reference values of metric fine screw threads

kgf·m (ft-lbs)

Classification	4.8T		7T		10.9T	
Nominal size	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M8 P=1	1.15±0.11 (8.3±0.8)	0.97±0.1 (7.0±0.7)	2.5±0.2 (18.0±1.4)	2.1±0.2 (15.2±1.4)	4.5±0.4 (32.5±2.9)	3.8±0.4 (27.4±2.9)
M10 P=1.25	2.3±0.2 (16.6±1.4)	1.91±0.19 (13.8±1.4)	4.9±0.5 (35.4±3.6)	4.2±0.4 (30.3±2.9)	8.9±0.9 (64.2±6.5)	7.5±0.7 (54.2±5.1)
M12 P=1.25	4.0±0.4 (28.9±2.9)	3.4±0.3 (24.5±2.2)	8.7±0.9 (62.8±6.5)	7.3±0.7 (52.7±5.1)	15.7±1.6 (113±12)	13.2±1.3 (95.3±9.4)
M16 P=1.5	9.4±0.9 (67.9±6.5)	7.9±0.8 (57.0±5.8)	20±2 (144±14)	17.2±1.7 (124±12)	37±4 (267±29)	31±3 (224±22)
M20 P=1.5	19±1.9 (137±14)	15.8±1.6 (114±12)	41±4 (296±29)	34±3 (246±22)	74±7 (535±51)	62±6 (448±43)
M24 P=2	32±3 (231±22)	27±3 (195±22)	70±7 (506±51)	58±6 (419±43)	126±12 (910±87)	105±10 (758±72)
M30 P=2	65±6 (469±43)	54±5 (390±36)	142±14 (1030±100)	118±12 (852±87)	255±26 (1840±190)	212±21 (1530±150)
M36 P=3	109±11 (787±79)	91±9 (657±65)	238±23 (1720±170)	198±20 (1430±140)	428±43 (3090±310)	357±36 (2580±260)

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2. REMOVAL AND INSTALLATION OF HYDRAULIC PUMP

2. 1 Removing hydraulic pump

1) After engine stop, remove panel and bracket of the guard installed on the upper section of hydraulic pump. (See Fig. 3)

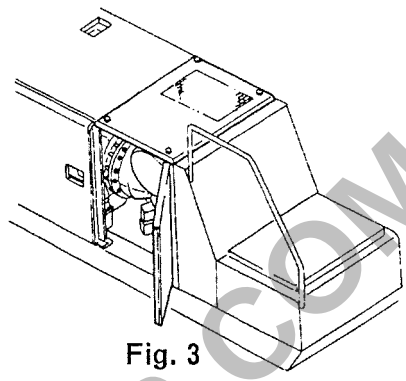


Fig. 3

2) Set a suction stopper to the suction port of the hydraulic tank. For details of the suction stopper, see Chapter 7. "Details of Suction Stopper". (See Fig. 4)

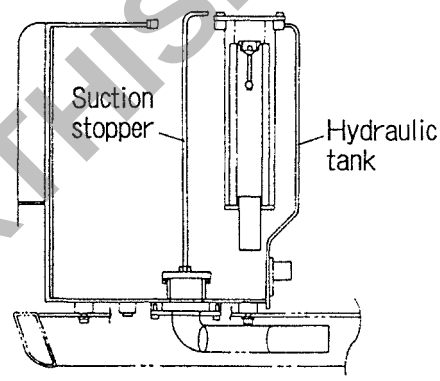


Fig. 4 Suction stopper

3) Remove all pipes and hoses, suction tube delivery hose, drain hose, pilot hose, etc., connecting to the hydraulic pump. Plug every hose, tube and port on hydraulic pump to protect them from the entry of foreign matter. (See Fig. 5)

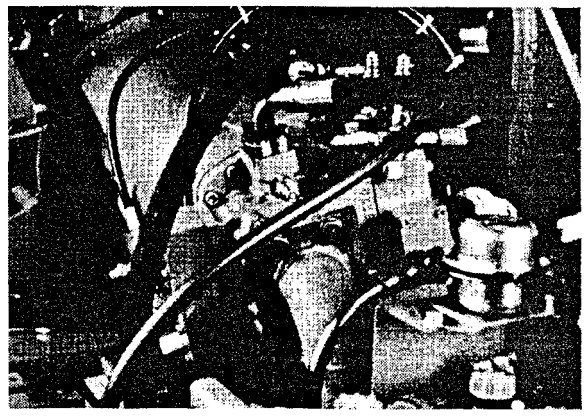


Fig. 5 Hydraulic pump

4) Hook a wire rope a little bit to the engine side from the center of hydraulic pump to support kit, and remove capscrew while keeping the rope in the proper tension condition, not tight but not slack. (See Fig. 6)

5) After removal of capscrew, pull the hydraulic pump to your side gradually keeping the rope a bit slackened, make sure that the coupling is disconnected, and hang and remove the pump. (See Fig. 6)

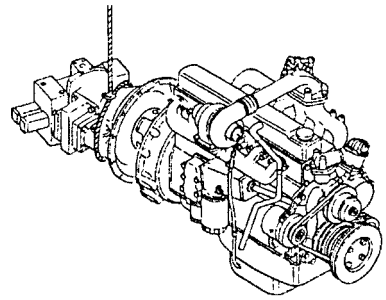


Fig. 6 Removing hydraulic pump

- **Hang the hydraulic pump taking care not to hit the guard of the frame.**

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5. MEASUREMENT OF TRAVEL PERFORMANCE

5. 1 Travel speed

1) Purpose

Measure the travel speed and make sure of the performance between hydraulic pump and travel motor on the travel drive mechanism.

2) Conditions

Hydraulic oil temperature ··· 50 ± 5℃

2WD/4WD selector switch··· Changed into 2WD side

Rear wheels lifted with ATT bucket

3) Measurement

Engine speed ····· Max. speed

KPSS work mode ····· D
selector switch

Shift lever ····· F1, F2, R1, R2

Average value of RH and LH wheel rotation speed when the tire is lifted

4) Adjusting method

After detection of the travel speed down, if it is only the speed down of running, measure the quantity of travel motor drain described in
Article 5. 3.

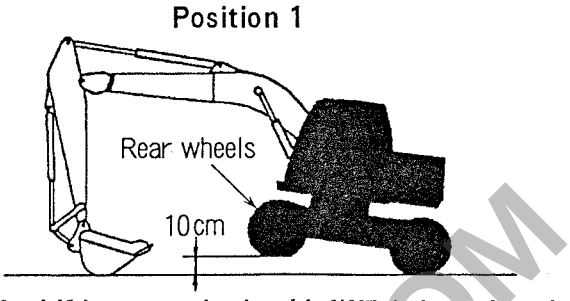


Fig. 19 Lifting rear wheels with 2WD being selected

Table 7 Unit : rpm

Measuring items			Standard value	Repairable level	Service limit
Forward & Reverse	1st speed	RH	49～45	38～35	31～
		LH	49～45	38～35	31～
	2nd speed	RH	198～192	154～150	131～
		LH	198～192	154～150	131～

● **Difference of revolutions between right and left wheels is to be 5rpm or less.**

5. 2 Parking brake performance

1) Purpose

Stop the machine at no-load running position on the slope of 1/5 grade (12 degree), and make sure of the parking brake performance.

2) Conditions

1/5 grade(12 deg.) of slope

No-load running position

Brake mode ····· P (Parking mode)
selector switch

3) Measurement

In 5 minutes after the engine stops, measure the travel length of the rear wheels on the slope.

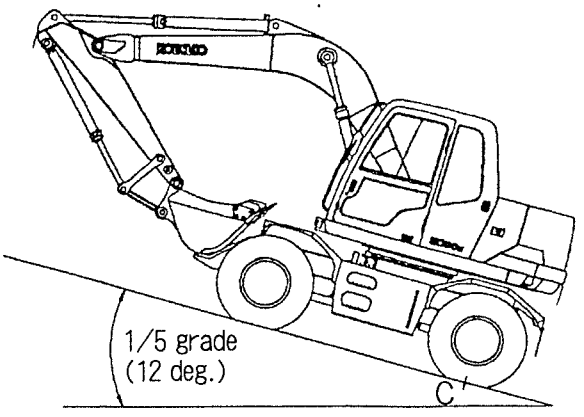


Fig. 20 Machine position when parking brake is on

Table 8 Unit : mm/5min

Measuring position	Reference value	Repairable level	Service limit value
C	0	1	2

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6. REMOVAL AND INSTALLATION OF SLEWING BEARING

6. 1 Removing slewing bearing (See Figure 10.)

1) Remove the upper frame from the machine body.
(See Section "Upper Frame" in the separate volume.)

2) Remove capscrews securing the inner race of the slewing bearing.

3) Attach two (2) eyebolts to the slewing bearing and raise it with a crane and remove it.
Slewing bearing weight : 145kg

6. 2 Installing slewing bearing (See Figure 10.)

1) Before installation of the slewing bearing, remove dust and stain on the bearing and the mating surface of slewing bearing.

2) Set the slewing bearing on the lower frame so that the S mark on the slewing bearing inner race directs the left side of the machine. (See Figure 11.)

3) Apply Locktite #262 on the threaded section of capscrew and tighten all capscrews by hand temporarily.

4) Tighten all capscrews to the specified torque, 15kgf.m, in order of the capscrews on the opposite side of 180 degree by turns temporarily.

5) Tighten all capscrews to the specified torque, 28.5gkgf.m.

- **Apply Locktite #515 on all around the inner surface of the holes for capscrew on the upper frame and slewing bearing mating surfaces.**

6) After installing the slewing bearing on the lower frame, attach capscrews on the upper frame.

7) Apply Locktite #242 on the threaded section of three (3) reamer bolts, and tighten them to the torque, 15kgf.m, temporarily.

8) Apply Locktite #242 on the capscrew same as the reamer bolts, tighten it by hand, and tighten capscrews located on the opposite side by turns to the torque, 15kgf.m, temporarily.

9) Tighten them to the specified torque, 28.5kgf.m. (For the installation of the upper frame, refer to Section "Upper Frame" in the separate volume.

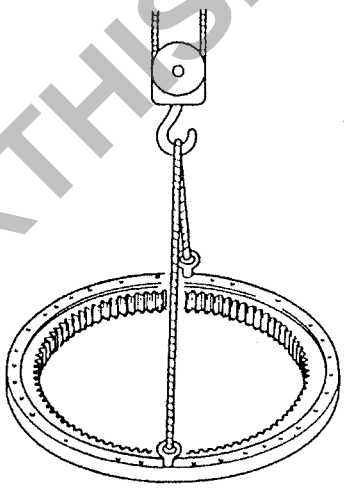


Fig. 10

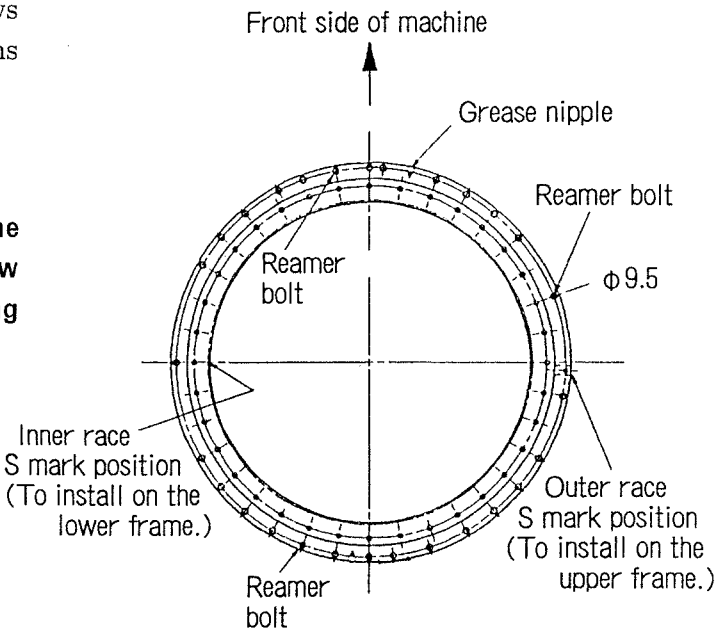


Fig. 11

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3. HYDRAULIC CIRCUIT DIAGRAM AND COMPONENTS

3. 1 Standard specification

Applicable machine YE02001～

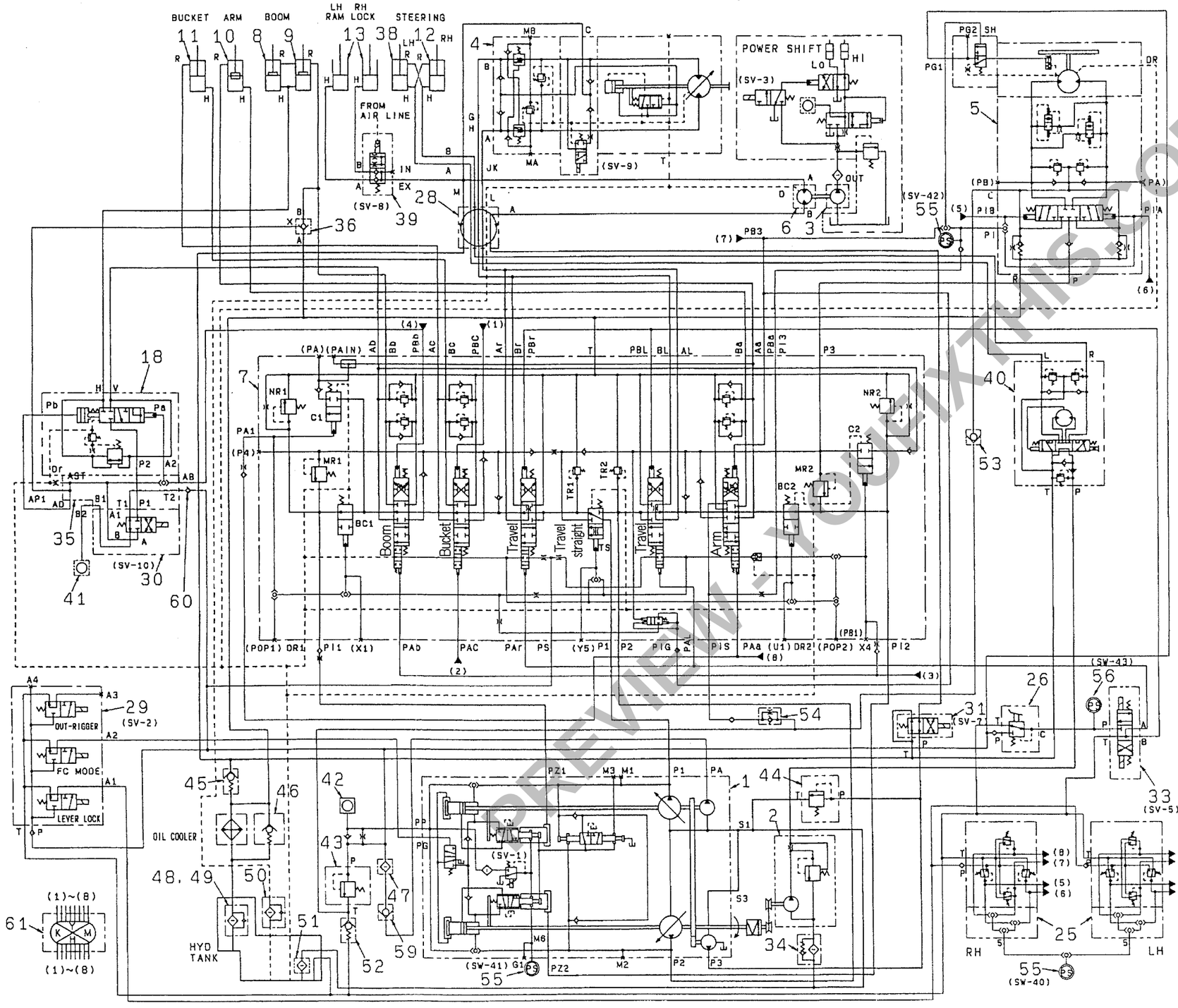


Fig. 2

(STD)

Code	Part	Part No.	Remarks
1	Pump (Main)	2437U387F2	A8V55ESBR6.2
2	Pump (Steering)	2437U537F1	
3	Pump (Shift)	2441U803F1	YP15A12D2H9
4	Motor (Travel)	2441U817F1	A6V107HA2XS1
5	Motor (Slewing)	2441U818F3	M2X63A0B-KSC15R
6	Motor (Shift)	2437U221F1	SHM15-13
7	Control valve	2436U1439F2	KMX13D/23021
8	Boom cylinder (RH)	2438U1100F2	CA100X1068B30F
9	Boom cylinder (LH)	2438U1099F2	CA100X1068B30F
10	Arm cylinder	2438U1098F2	CA115X1085B30F
11	Bucket cylinder	2438U1097F2	CA95X985B30G
12	Steering cylinder	2438U1058F1	PSC-055-025
13	Ram cylinder	2438U1093F1	90-90-115
18	Boom lock valve	2436U1427F2	
25	Pilot valve (ATT)	2436U2581F2	TH40KC1108
26	Pilot valve (Travel)	2436U1403F1	01402-0000D
28	Swivel joint	24100J12023F1	
29	Solenoid valve (3-function)	2436U1453F4	3K3LNF5G/G24N
30	Solenoid valve (DD)	2436U2736F1	4WE10UA-10LO/LG24ND-L52
31	Solenoid valve (Shift)	2436U1322F3	4WE6C-L10/AG24NS1
33	Solenoid valve (Travel)	2436U1322F1	4WE6J-L10/AG24NS1
34	Suction filter	2446U436F1	
35	Port block (DD)	2444J165	
36	Pilot check valve	2436U1428F1	for DD SV10G
38	Steering cylinder	2438U1057F1	PSC-055-025
39	Shut off vlave	2436U1438F1	LHV-40P
40	Steering unit	2436U1442F2	UE-D
41	Accumulator (DD)	2445U154F1	MK210-1300
42	Accumulator	2445R373F1	MU70-300-30
43	Relief valve (Pilot)	2436R680F4	VRD-03
44	Relief valve (Shift)	2436R680F4	VRD-03
45	Check valve	2436U1295D4025	2.5K
46	By-pass vlave (Oil cooler)	2436R393S4	Y-2395
47	Line filter	2446R151F1	
48	Return filter	2446R147	
49	By-pass valve	2446U119S3	Return filter
50	Drain filter	2446U215F2	Y-3563
51	Suction strainer	2446R307F4	
52	Check valve	2436U1171D36	for boost (7kgf/cm²)
53	Check valve	2436U1171D31	for boost (pilot pump)
54	Restrictor valve	2436U1282D2108	Arm recirculation
55	Pressure switch	2479U2010	Normal open
56	Pressure switch	2479U1311F1	Normal close
57	Ball for check	2425Z533	
59	Ball for check	2425Z533	
60	Check valve	2436U1171D21	
61	Multi control valve	2436U1244F1	K16ARB-11

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2. TIGHTENING TORQUES FOR NUTS AND SLEEVES

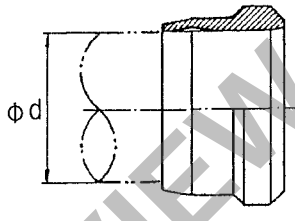
Table 3 provides the reference values of applicable tightening torque unless otherwise specified. Overtightening and insufficient tightening of nuts and sleeves used on flareless joint cause the oil leak from the connection. Nuts and sleeves should be tightened to the proper torque.

Table 3-1

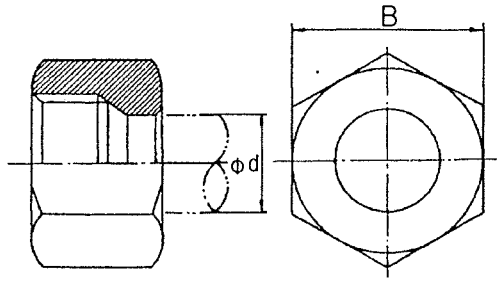
Maker	Working pressure kgf/cm² (psi)	Tube size OD × thickness mm (in)	Opposing flat (HEX) mm	Torque kgf·m (ft-lbs)
Nippon A.M.C.	300 (4270)	10×1.5 (0.394×0.059)	19	5±1 (36±7)
		15×2.0 (0.591×0.079)	27	12±1.2 (88±9)
		18×2.5 (0.709×0.098)	32	15±1.5 (109±11)
		22×3.0 (0.866×0.118)	36	22±2.2 (159±16)
		28×4.0 (1.10×0.157)	41	28±2.8 (203±20)
Ihara Koatu	300 (4270)	35×5.0 (1.38×0.20)	55	45±4.5 (325±33)

Table 3-2

SLEEVE



NUT



Tube dia. ϕd	Parts No.		Tube dia ϕd	Opposing flat B	Parts No.	
	Ihara Koatu	Nippon A.M.C.			Ihara Koatu	Nippon A.M.C.
6	ZF93S06000	—	6	14	ZF93N06000	—
8	ZF93S08000	—	8	17	ZF93N08000	—
10	ZF93S10000	ZA93S10000	10	19	ZF93N10000	ZA93N10000
12	ZF93S12000	—	12	22	ZF93N12000	—
15	ZF93S15000	ZA93S15000	15	27	ZF93N15000	ZA93N15000
18	ZF93S18000	ZA93S18000	18	32	ZF93N18000	ZA93N18000
22	ZF93S22000	ZA93S22000	22	36	ZF93N22000	ZA93N22000
28	ZF93S28000	ZA93S28000	28	41	ZF93N28000	ZA93N28000
32	ZF93S32000	—	32	50	ZF93N32000	—
35	ZF93S35000	ZA93S35000	35	55	ZF93N35000	ZA93N35000
38	ZF93S38000	—	38	60	ZF93N38000	—

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2. 2 Installing hydraulic pump (See Fig. 7, 8)

1) Remove burr and dirt on the cover mating surfaces of hydraulic pump (1) and flywheel.

2) Install the coupling (5) on the pump drive shaft with set screw (9), and the insert (4-5) on the flywheel with capscrew (7).

3) Fit element (4-3) to the insert (4-5) installed on the flywheel.

4) Install the insert (4-6) on the coupling (5) with capscrew (7).

5) Lift up the hydraulic pump (1) horizontally with wire rope, and push the hydraulic pump (1) in the engine side while fitting the element (4-3) on the flywheel side and insert (4-6) on the hydraulic pump side.

6) After making sure that the coupling is engaged securely, tighten capscrew (6).

7) Install cover (2) on the flywheel cover with capscrew (8).

- **Tighten capscrews (6)(7)(8) and set screw (9) to the specified torque referring to the Maintenance Standard.**
- **Don't use capscrew, M10×30 (6), instead of capscrew (8) because it will come into contact with starter motor.**

8) Connect the removed hose and tube, and tighten the capscrew, hose band, etc. as it originally was.

9) Remove the suction stopper of hydraulic tank, and set the suction strainer instead.

10) Start the engine, start hydraulic pump operating in low speed, loosen the air bleed plug (R), and bleed air in the pump and the circuit.

11) Check every connection for oil leakage.

12) Install the panel and bracket of the upper guard of hydraulic pump as it originally was. (See Fig. 3)

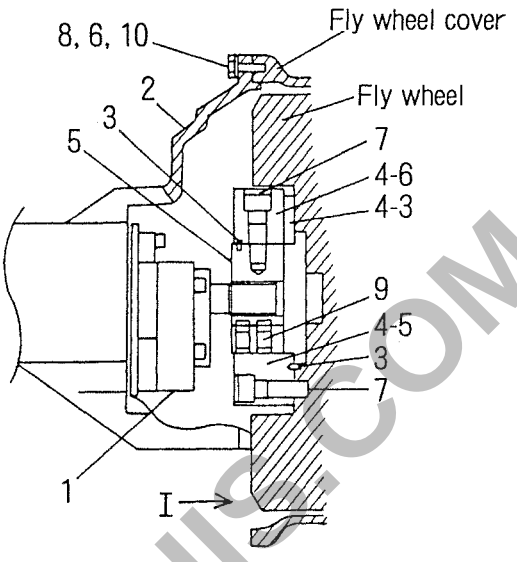
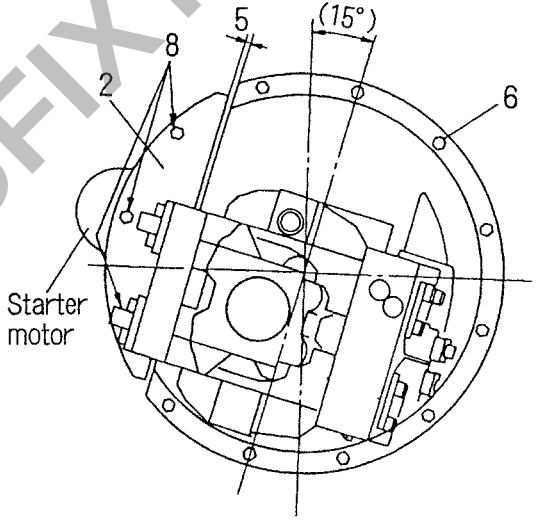


Fig. 7 Pump connection



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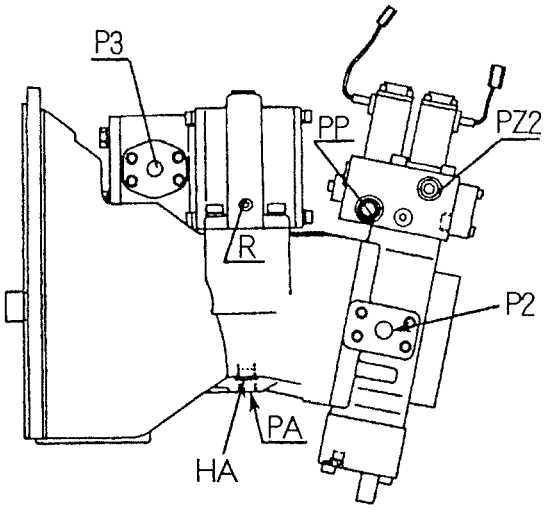


Fig. 8

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5. 3 Quantity of travel motor drain

1) Purpose

When the travel speed is down, measure the quantity of travel motor drain to decide the cause of the speed down, for example caused by the failure or the working life, on the basis of the safe and economical judgment.

2) Conditions

Hydraulic oil temperature ··· 50 ± 5℃

Engine speed ····· High idling

Quantity of hydraulic motor drain when the travel motor is locked

3) Measurement

Brake mode ····· W (Working mode) selector switch

Shift lever ····· F2 (Forward 2nd speed)

Remove the plug of drain port T (PF 1/2), and measure the quantity of drain at this position.

4) Adjusting procedure

When the damage is in the range of the repairable level, repair the travel motor or replace it with new one.

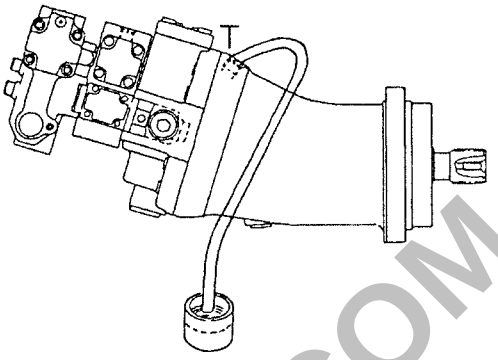


Fig. 21

Table 9 Unit : L/30s

Measuring position	Reference value	Repairable level	Service limit value
T	3	8	10

6. MEASUREMENT OF SLEWING PERFORMANCE

6. 1 Slewing speed

1) Purpose

Measure the slewing speed, and make sure of the performance of the hydraulic pump slewing motor on the slewing drive mechanism.

2) Conditions

Hydraulic oil temperature: 50 ± 5℃

Level and solid ground

Engine: Max. revolution

Work mode: H mode

3) Measurement

Slew the machine at full stroke of the lever in the empty bucket condition and at the machine position like that shown in Fig. 22. And measure the time taken for three turns after running of one turn.

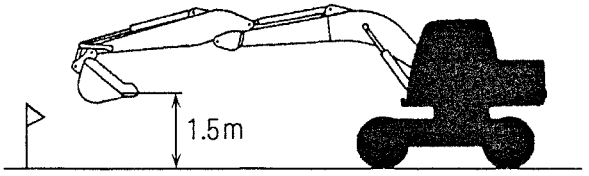


Fig. 22 Swing speed and braking performance measuring position

Table 10 Unit : L/30s

Measuring condition	Reference value	Repairable level	Service limit
H mode swing	14.7～16.3	18.8～20.9	23.3～

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7. MAINTENANCE STANDARD

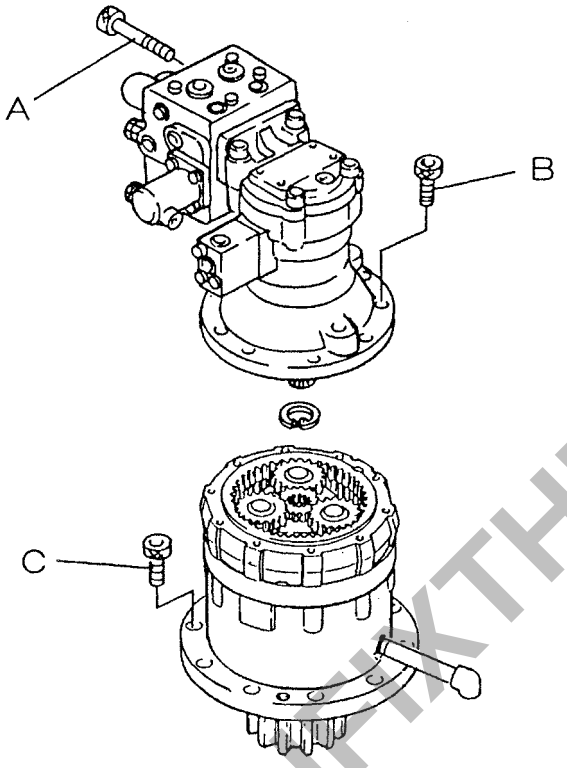


Fig. 12

Table 3

Unit : kgf·m

Code	Item		Standard value	Corrective action
A	Socket bolts for slewing control valve	6-M12	7±0.7	Tighten them again.
B	Socket bolts for slewing motor and speed reduction unit	10-M12	11.7±1.2	Apply Locktite #242 on the socket bolts.
C	Socket bolts for slewing speed reduction unit and upper frame	10-M20	55±6	Apply Locktite #242 on the socket bolts. Apply Locktite #515 on the mating surface. Tighten them again.

● **For the tightening torque of the slewing bearing, etc., refer to Section "Upper Frame" in the separate volume.**

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3. 2 Optional specification (Dozer)

Code	Part	Part No.	Remarks
17	Dozer cylinder	2438U1127F1	CA70X300B28G
33	Solenoid valve	2436U1322F1	4WE6J-L10/AG24NS1
37	Pilot check valve	2436U1416F1	
63	Solenoid valve	2436U1322F2	3WE6A-L10/AG24NS1

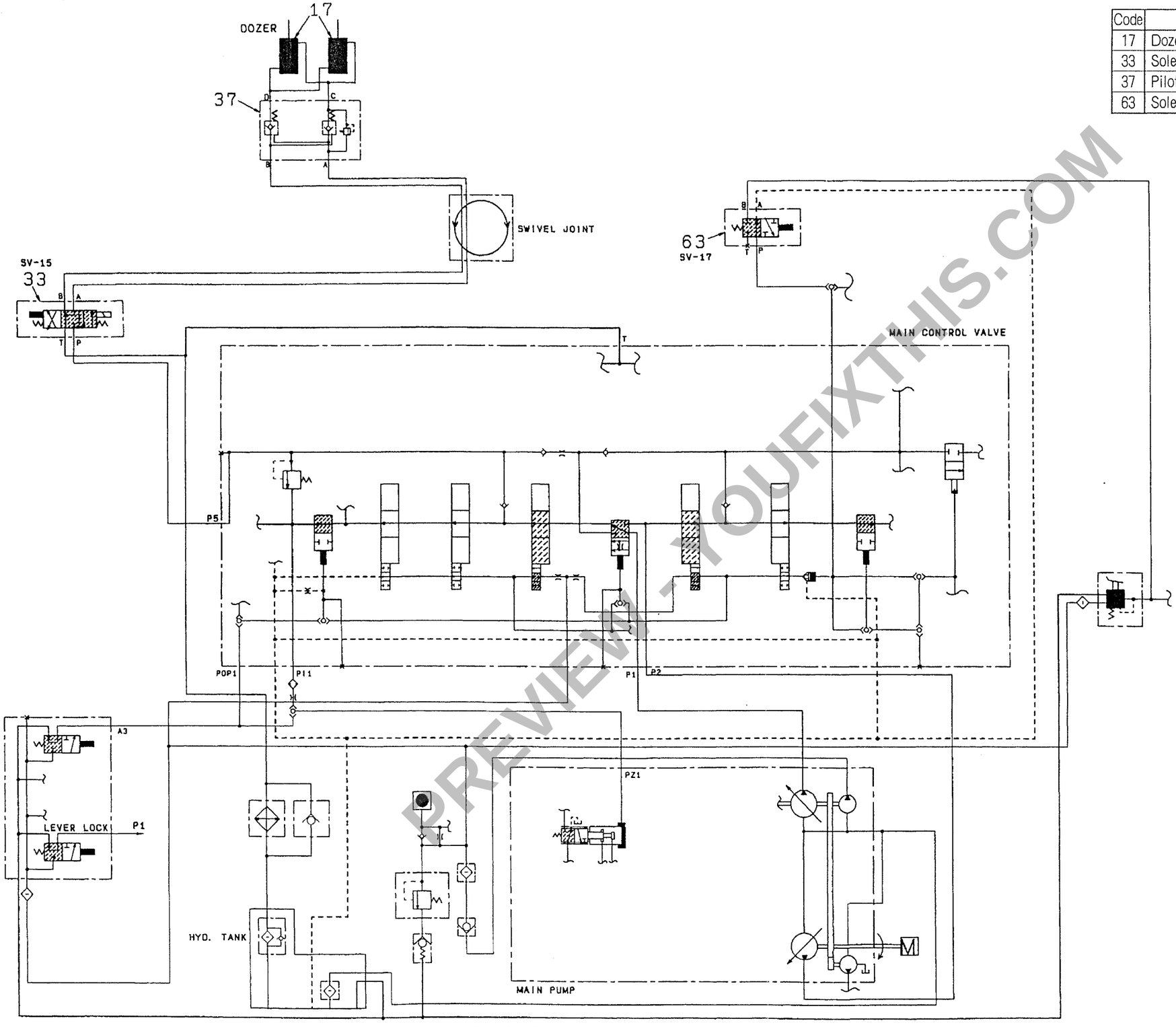


Fig. 3 Dozer operation

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Table 5

Unit : kgf·m

Code	Name	Tightening torque	Remarks
1	Capscrew to install tool box	11.7	Apply Locktite #262.
2	Capscrew to install tool box	11.7	//
3	Nut to secure front axle	65	//
4	Nut to secure front axle	95	//
5	Capscrew to install transmission	55	//
6	Nut to secure rear axle	65	//
7	Nut to secure rear axle	95	//
8	Capscrew for slewing bearing	28.5	//
9	Capscrew to install 1st propeller shaft (Rear axle side)	11.7	Apply Locktite #242.
10	Capscrew to install 2nd propeller shaft (Front axle side)	11.7	//
11	Capscrew to protect equalizer pin from slipping off	11.7	Apply Locktite #262.
12	Capscrew to secure 1st propeller shaft (Transmission side)	11.7	Apply Locktite #242.
13	Seal	——	Adhere with sealant (Cyano Bond PO-1 or equivalent)
14	Capscrew to install ram cylinder	74.5	Apply Locktite #262.
15	Capscrew to install air chamber	18.5	Apply Locktite #242.
16	Capscrew to secure 1st propeller shaft (Transmission side)	11.7	//
17	Capscrew to install fuel tank	11.7	Apply Locktite #262.

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3. REMOVAL AND INSTALLATION OF COUPLING

3. 1 Removing coupling (See Fig. 9, 10)

1) Remove the hydraulic pump (1) referring to Article 2. 1.

2) Loosen the set screw of coupling hub (5), pull out coupling hub (5) from the drive shaft of hydraulic pump (1).

3) Remove capscrew (9) while fitting coupling hub (5) onto the drive shaft or holding it with vice.

4) Remove inserts (4-6), and pull out spring pin (3) with a plier.

- **Don't remove spring pin (3) if it is not damaged. Just use it as it is.**

5) Remove capscrew (7) on the engine flywheel side, and remove the inserts (4-5). (See Fig. 10)

6) Pull out spring pin (3) driven into the engine flywheel with a plier.

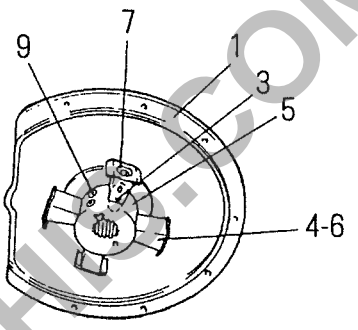


Fig. 9 Hydraulic pump side

3. 2 Installing coupling (See Fig. 9, 10)

1) Remove burr and dust on the mating surfaces of the hydraulic pump (1) and flywheel.

2) Drive spring pins (3) into the coupling and engine flywheel.

- **Make sure to drive them to the hole bottom.**

3) Fit the coupling hub (5) in the shaft of the hydraulic pump (1), and tighten set screw (9) to the specified torque.

4) Install inserts (4-6) on coupling hub (5), and tighten capscrew (7) to the specified torque.

5) Install inserts (4-5) on the engine flywheel, and tighten capscrew (7) to the specified torque. (See Fig. 10)
Then, fit elements (4-3).

6) Install hydraulic pump (1) on the engine. (See Article 2. 2)

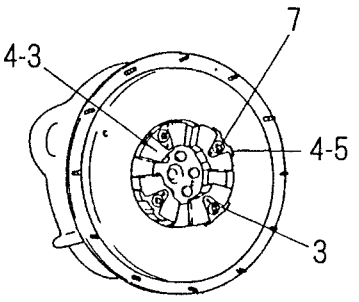


Fig. 10 Engine flywheel side

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4) Adjusting method
After detection of the slewing speed down, if it is only the speed down of slewing, measure the quantity of slewing motor drain described in Article 6. 4.

6. 2 Slewing brake performance

1) Purpose
Make sure of the braking torque performance with the slewing relief valve.

2) Conditions
Hydraulic oil temperature ··· 50 ± 5℃
Level and solid ground
Engine ····· Max. revolution
Work mode····· H mode

3) Measurement

① Put matchmarks on the upper frame side of the outer surface of slewing bearing and the travel frame side in the empty bucket condition and at the machine position like that shown in Fig. 22.

② After slewing 360 degrees at full speed, return the control lever to the neutral position at the pole position.

③ Measure the drift of matchmark on the outer surface of the slewing bearing.

$$\text{Overslewing angle (Deg.)} = \frac{\text{Drift of matchmark(m)}}{\text{Slewing race perimeter length (m)}} \times 360 \text{ Deg.}$$

4) Adjusting method
Check and adjust the slewing port pressure.

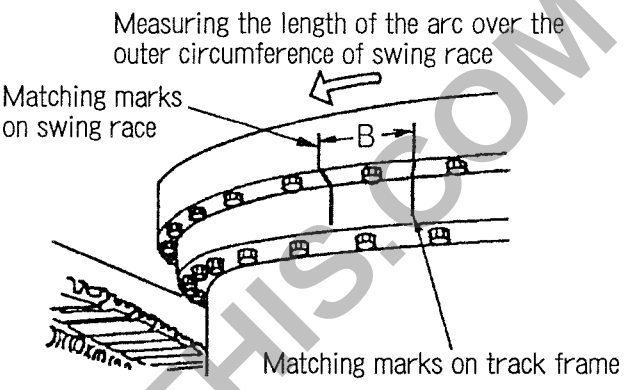


Fig. 23 Measuring position of swing brake performances

Table 9 Unit : L/30s

Measuring condition	Reference value	Repairable level	Service limit value
T	360°	90°	100°

6. 3 Slewing parking brake performance

1) Purpose
Make sure of the performance of the mechanical brake for slewing parking installed inside of the slewing motor.

2) Conditions
Stop the machine at right angles to the slope in the machine position for slewing brake performance measurement on the slope of 1/5 grade (12 degree).

3) Measurement
Measure the drift of matchmark on the outer surface of the slewing bearing after an elapse of 5 minutes after the engine stops.

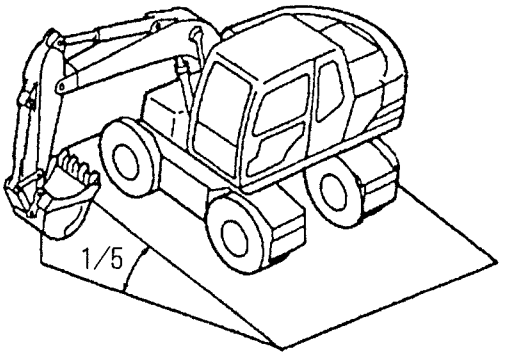


Fig. 24 Slewing parking brake performance measuring position

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SHOP MANUAL

model SK100W-2

CONTENTS

1. SPECIFICATIONS YE01
2. OPERATION (Refer to Operators Manual) .....
3. LOCATION AND WEIGHT OF COMPONENTS YE03
4. MAINTENANCE STANDARD AND TEST PROCEDURE ... YE04
5. .....
6. MAINTENANCE (Refer to Operators Manual)
7. WORK STANDARD YE07

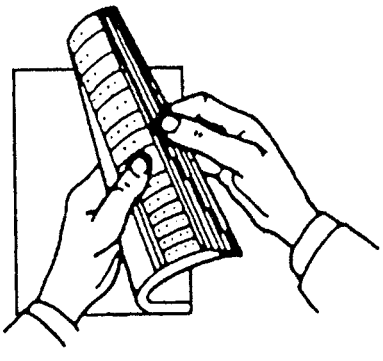
* How to index sections in this manual
The general section in this manual is composed of 7 chapters as shown above, and every chapter can be indexed easily using the marks on the edge. This is useful for rapid reference.

⚠ WARNING

The proper and safe lubrication and maintenance for this machine, recommended by KOBELCO are outlined in the OPERATORS MANUAL for this machine. Improper performance of lubrication or maintenance procedure is dangerous and could result in injury or death. Read and understand the OPERATORS MANUAL before performing any lubrication or maintenance.

⚠ WARNING

Do not operate this machine unless you have read and understand the instructions in the OPERATORS MANUAL.
Improper machine operation is dangerous and could result in injury or death.



KOBELCO

GENERAL

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GENERAL PRECAUTIONS FOR REPAIR WORK

During repair work, the highest priority must be given to safety in work operations.
Observe the following general precautions.

- The machine shall be operated by operator licensed by the government in the country the machine will be used.
  Further, before use, read Operator's Manual and the control system described in this manual, and understand the operating procedure thoroughly.
- With clothing appropriate to the work, and be sure to wear safety work shoes, safety helmet, goggles, etc.
- Read Operator's Manual carefully, and understand the contents thoroughly, and carry out safe and correct maintenance.
- Park the machine on the flat ground and be sure to put the attachment on the ground to repair the machine.
- Before inspection and maintenance of machine, hang a warning plate "Don't operate" on a door or operating lever, and make safety arrangements before starting work and don't fail to make sure of the signal.
- Provide fire extinguisher and first-aid kit for accidents and fire, and confirm the where to make contact in case of emergency.
- Be sure to stop the engine before carrying out inspection and maintenance which may cause being involved in accident.
- Every part of machine is heated immediately after the engine stops. Take care not to get burnt.
- Before removing piping parts for hydraulic oil, air, cooling water, etc. release the pressure.
- Use the specified tools, and change or repair the damaged tools.
- When it is required to lift machine and working units to carry out the work, there is a danger of being caught in it.
  Be sure to support the machine with supports and blocks.
- Be sure to start the engine of which the parts are being cleaned in the thoroughly ventilated area.
- In case of repair by welding, it may cause fire and failure of electrical equipment. Remove battery cable and authorized personal must weld it by the optimum procedure.
- To remove material of heavy weight (20kg or more), lift it with crane and slinging accessories.
- Before inspection and maintenance of electric system, turn the power off by disconnecting the battery cable.
- When the hardened parts like bearing, pin, tooth, etc. are required to be struck, be sure to wear clothes with long sleeves and goggles to guard workers from the fragments.
- When the tire used is wrong, it may cause bursting and fragmentation of rim.
  When checking the air pressure of tire, and it is required to fill with air, perform it behind the tread, keeping away from the front side of the rim.
- The battery liquid contains dilute sulfuric acid. It may cause loss of eyesight and burn. When it is splashed on, clean with water for 10 minutes or more and take medical treatment.
- Dispose of industrial waste like waste oil, waste liquid, battery liquid, etc. following the prescribed provision.
- Particles of asbestos may cause lung cancer. Be careful not to use compressed air and not to draw particles of asbestos in.
  Parts requiring care : Brake band, clutch band, gasket
- For spare parts, and oil and grease, use KOBELCO genuine parts.

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4. REMOVAL AND INSTALLATION OF SLEWING MOTOR

4. 1 Removing slewing motor

● The procedure to remove the assembly of the slewing motor and control valve is described below.
The weight of the slewing motor and the slewing control valve is about 47kg.

1) After placing the attachment on the ground, stop the engine.

2) Remove the guard panel on the slewing upper section.

3) Remove the hydraulic oil line connected to the slewing control valve, and plug every port.

4) Remove the drain hose connected to the slewing motor, and plug the hose.

5) Attach the eye bolt to lifting bolt hole (M10) on the slewing motor upper surface and sling the assy with wire rope keeping the rope in the proper slack while slinging.

6) Loosen socket bolt (B) (M12) securing the slewing motor, and remove the slewing motor from the speed reduction unit.

7) If it is hard to remove the slewing motor, insert the minus (−) driver into the groove on flange (See figure 8.) to separate it a little bit.

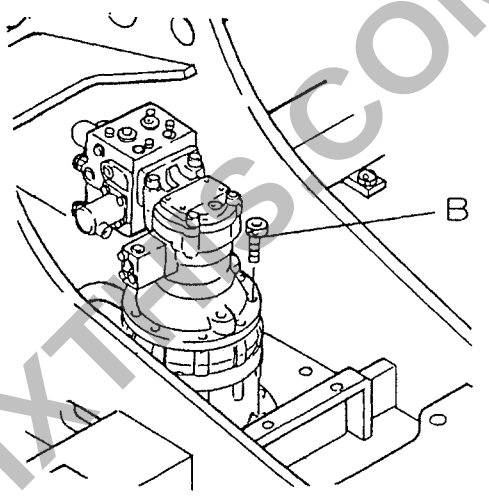


Fig. 7

4. 2 Installing slewing motor

Install the slewing motor in the reverse procedure of the removal. But pay attention to the following points.

1) Apply Locktite #515 on the contact surface of the slewing motor to the speed reduction unit.

2) Apply Locktite #242 on socket bolt (B) for the slewing motor, and tighten it to the specified torque.

3) Before starting the engine for slewing operation, check that the specified gear oil and hydraulic oil is filled in the casing of the speed reduction unit and slewing motor.

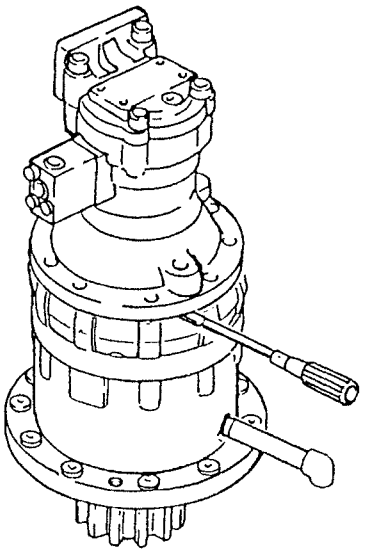
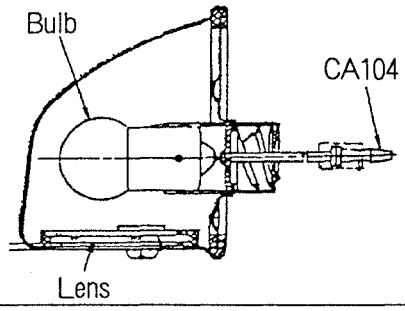
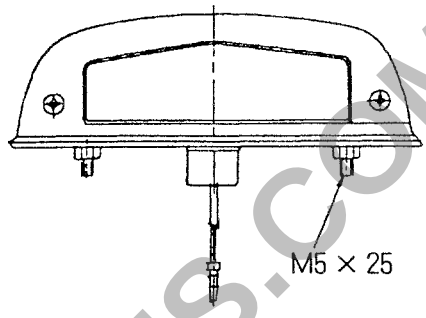


Fig. 8

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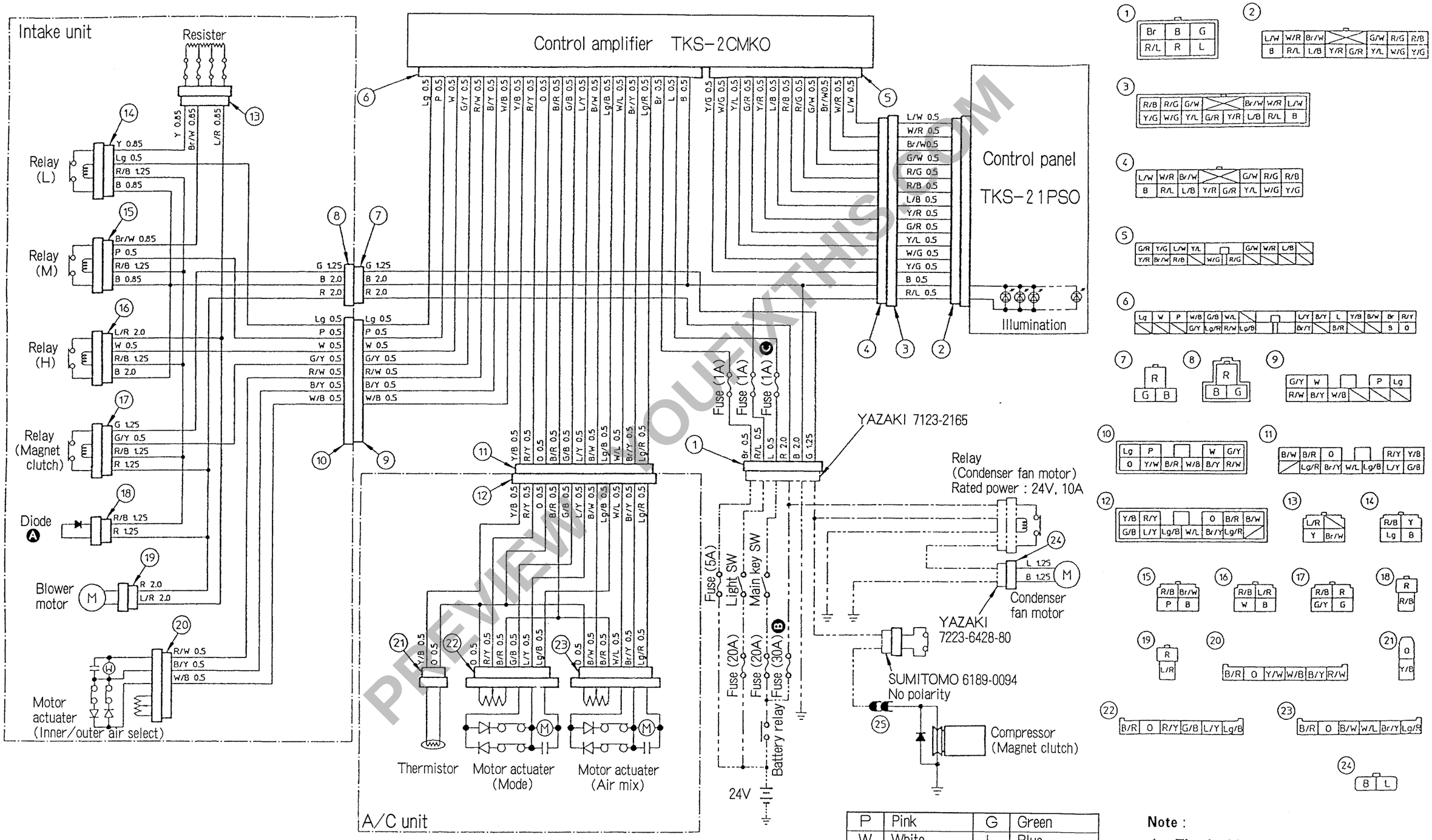
File No. Name of part Part No. Use Applicable Machine	Specifications	Description
L−11 Light 2456R335 License lamp YE01003~	Model: DS 0491 Bulb: 24V, 12W 	

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6. ELECTRIC CIRCUIT

6.1 Wiring diagram and connectors



P	Pink	G	Green
W	White	L	Blue
B	Black	Br	Brown
R	Red	Lg	Light Green
Y	Yellow	O	Orange

Note :

1. **The double chain lines indicate the wiring on the shovel side.**
2. **The connector colors indicate the cord colors seen from the connecting part.**

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11) Disassembling relief valve

① Hold plug (201) and body (101) a little and fold them, pressing them against each other.
Then lock ring (291) comes off.

- **If they are pressed too much, they can not be folded. Lock ring (291) will be easy to come off if its opening is directed outward.**

② Remove piston (302), plunger (301) and seat (341) from body (101).

- **Seat (341) will be easy to remove if it is rotated when being drawn.**

③ Draw out springs (321, 322) from plug (201).

④ Tightening setscrew (471) will make the assy of bushing (342) and piston (303) come out of plug (201).

- **Do not tighten setscrew (471) when pressure adjustment is impossible at reassembly. Lightly tapping the assy directing it downward will make it come out except the bushing.**

⑤ Bushing (342) may be disassembled into spring (323), piston (303) and spring seat (343).

12) Disassembling the swing-shockless valve

① Remove swing-shockless valve (602) from casing (101).

② Seat (313) comes off together if spring (322) is drawn out.

- **If the valve is directed down, ball (315) falls down. Take care not to lost the ball.**

③ If plug (251) is removed, the assy of plunger (311) can be drawn out.

- **Take care not to drop piston (312).**

3. 4 After disassembly

1) Clean all parts.

① Put parts in a container filled with wash oil and wash them. (rough cleaning)

- **If dirty parts are washed in wash oil they may be scratched. Keep parts immersed in wash oil till dirt and oily stain get loose.**
- **Used of dirty wash oil will damage parts and mar the performances of the parts. Control wash oil well to keep it clean.**

② Put parts in a container filled with clean wash oil and rotate it slowly till they may be washed to the inside sufficiently. (Finish cleaning)

③ Wipe off wash oil with clean lint-free rag.

- **Do not use jet air to dry parts as it may damage parts by dust and moisture contained in the jet air.**

2) Rust prevention parts
Spray rust preventive medium to parts.

- **Note that if parts are left in an as washed condition, they may be rusted.**

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2. 2 Operation

2. 2. 1 Motor section (See Fig. 4 and Table 2)

As shown in Figure 4, the pressure oil passes through IN port (a) of valve plate (131) which has ports (shaped somewhat like a crescent) which distribute the oil to inlet or outlet and flows into cylinder block (111), and the pressure acts on piston (121) and the force F is generated in the direction of shaft. The force F is broken down with vector into force F1 vertical to shoe plate (124) and force F2 at right angles to the shaft.

The force F2 is transmitted to cylinder block (111) through piston (121), and drive shaft (101) starts rotating, and rotating moment is produced.

Nine pistons (121) are put in order on cylinder block (111), and the rotating torque is transmitted to drive shaft (101) in order by piston (121) connected to high pressure inlet port (a).

If the oil inlet and outlet directions are reversed, drive shaft (101) also rotates reversely.

The theoretical output torque T can be found by using the following formula.

$$T = \frac{Q \times P}{2\pi 100}$$

T = Output torque ····· kgf•m
P = Effective differential pressure ··· kgf/cm²
Q = Capacity per rotation ····· cc/rev

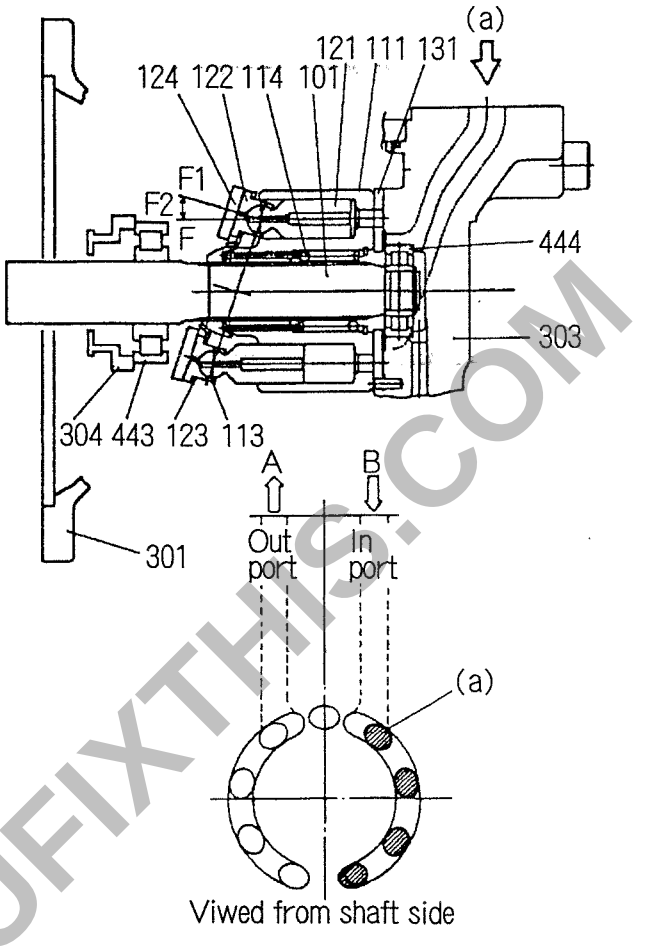


Fig. 4

Table 2

Rotating direction (viwed from shaft side)	Counter-clockwise	Clockwise
Oil inlet	B	A
Oil outlet	A	B

2. 2. 2 Brake section (See Fig. 5)

Cylinder (111) is linked with drive shaft (101) by spline. And the rotation in perimeter direction of separator plate (743) is restricted by circular arc-shaped groove on casing (301).

When friction plate (742) linked with the outer side of cylinder with spline is pushed against casing (301) by brake spring (712) through separator plate (743) and brake piston (702), and the frictional force between friction plate (742) and casing (301), separator plate (743) and brake piston (702) is produced. This frictional force restricts and brakes the drive shaft.

On the other hand, the pressure is applied on the oil chamber formed between brake piston (702) and casing (301) to release braking, and when the oil pressure is raised higher than the spring force, brake piston (702) moves and consequently friction plate (742) separates from casing (301) releasing the braking.

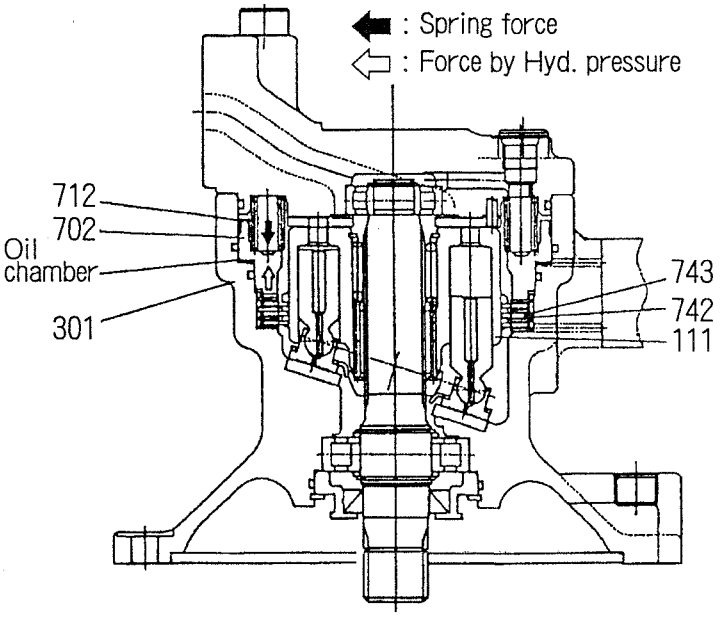


Fig. 5

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1. SPECIFICATIONS

1. 1 Outside view

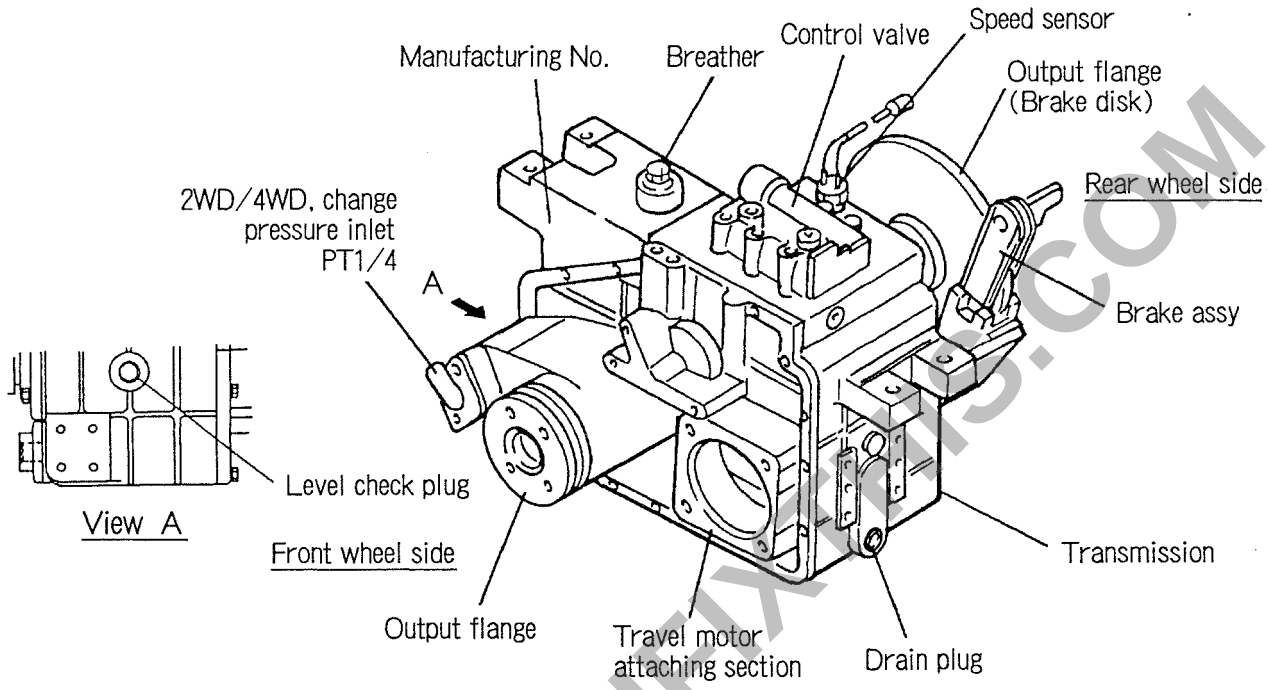


Fig. 1 Outside view of Transmission

1. 2 Specifications

Table 1

Item		Specification
Parts No.		2453U358F2
Reduction ratio	Low speed	4.139
	High speed	0.999
Total oil volume ℓ		12
Weight kg		205 (Oil included)

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4. 3 Procedures for replacement of brake pad and air bleeding

4. 3. 1 Checking pad for wear

Replace pad of which the thickness is close to 2mm.
(Refer to the criterion of brake pad thickness in Article 4.1.3.)

4. 3. 2 Pad replacement procedure (See Figure 4.)

1) Remove lock nut (12) and pull out two pad pins (11).
2) Remove remaining powder due to wear and dust, and remove pad (10) on one side.
3) Loosen breather screw (13) so that brake oil can come out of the cylinder, and push piston on the one side, and place new pad in it.

⚠ **● Replace pads on both inner and outer sides concurrently.**
● After pushing piston on one side, when the piston on other side is pushed, if the previously pushed piston comes out first, put pad between the previously pushed piston and disk vertically.
● When pad is replaced with new one, the braking force is lowered for a while until it becomes completely accustomed. Make sure of the braking after replacement.

4) After place pad on the other side in the same procedure, and pass pad pin (11) through it, and tighten lock nut (12).

: 5mm,
Tightening torque : 0.8±0.2kgf•m(6ft•lb)

● Before tightening, apply Locktite #262 on it.

5) Bleed air.

4. 3. 3 Air bleeding procedure (See Figure 4.)

When air is contaminated in brake oil of the brake system, the braking force is lowered possibly causing severe accident.

Don't fail to bleed air when it is in the following condition.

1. When replacing the brake with new one,
2. When changing the brake oil,
3. When air is contaminated in brake oil due to other than the above.

To bleed air, loosen breather screw (13) in the compressed condition, drain brake oil, and after tightening of breather screw release the pressure. Repeat this procedure until the air bubbles are completely disappeared from the brake oil flown out through breather screw (13).

● In this case, connect transparent vinyl hose to breather screw and receive brake oil in oil pan to let the bubble conditions be easily perceived, and also to prevent the brake oil from scattering which may make the brake disk etc. dirty.

After bleeding air, tighten breather screw (13) in order not to allow loosening due to vibration.

: 10mm,
Tightening torque : 0.85±0.15kgf•m(6ft•lb)

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ON-VEHICLE INSPECTION AND ADJUSTMENT

Oil Pressure Measurement

Service standards

Unit: MPa {kgf/cm^2}

Location	Maintenance item		Standard value	Limit	Remedy
—	Oil pressure (at oil temperature 70 to 90°C)	At no-load minimum speed	147 {1.5}	49 {0.5}	Adjust
		At no-load maximum speed	294 to 490 {3 to 5}	196 {2}	

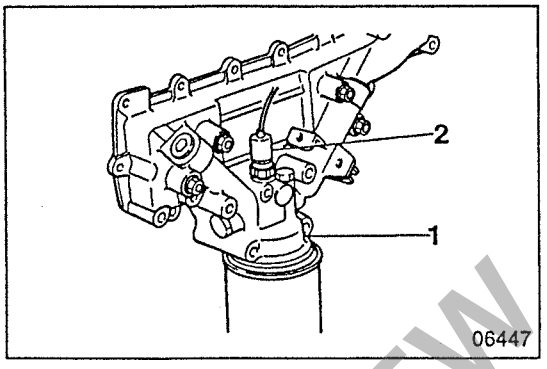
Tightening torque

Unit: N·m {kgf·m}

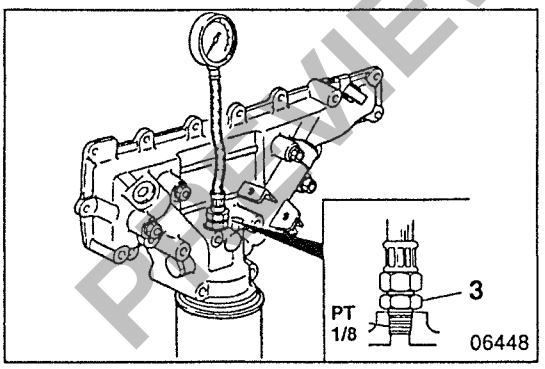
Location	Parts to be tightened	Tightening torque	Remarks
2	Engine oil pressure switch	12 {1.2}	—

Sealant

Location	Points of application	Type	Quantity
2	Wrap around thread of engine oil pressure switch	Threebond 1211	As required



- Remove the engine oil pressure switch **2** from the oil cooler **1.**
- Mount the oil pressure gauge after installing adaptor **3** onto oil cooler **1.**
- Warm up the engine until the oil temperature reaches 70 to 90°C.
- Measure the oil pressure at the engine's no-load minimum speed and no-load maximum speed. If the measurements are below specification, overhaul the lubrication system.



- After taking measurements, refit the engine oil pressure switch **2** and tighten it to the specified torque.

Inspection of engine oil pressure switch 🕮 P.12-21

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