WSM

WORKSHOP MANUAL
KUBOTA EXCAVATOR

U17
U17-3

Kubota

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Code No.97899-61970

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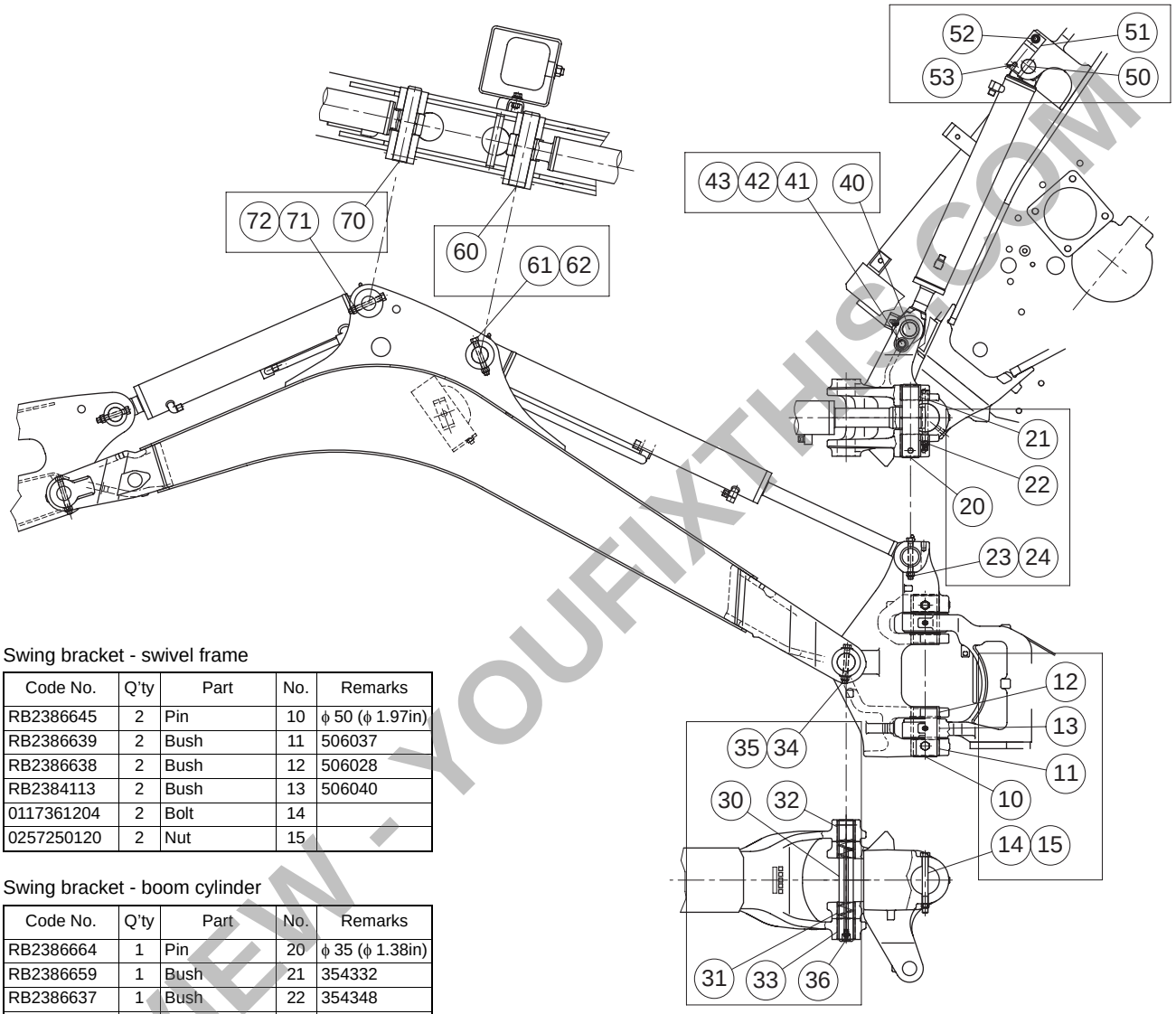
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(B) FRONT ATTACHMENT

a) Pin, Bush and Shim Installation

(1) Swing cylinder, swing bracket, boom



Swing bracket - swivel frame

Code No.	Q'ty	Part	No.	Remarks
RB2386645	2	Pin	10	ϕ 50 (ϕ 1.97in)
RB2386639	2	Bush	11	506037
RB2386638	2	Bush	12	506028
RB2384113	2	Bush	13	506040
0117361204	2	Bolt	14	
0257250120	2	Nut	15	

Swing bracket - boom cylinder

Code No.	Q'ty	Part	No.	Remarks
RB2386664	1	Pin	20	ϕ 35 (ϕ 1.38in)
RB2386659	1	Bush	21	354332
RB2386637	1	Bush	22	354348
0117361080	1	Bolt	23	
0257450100	1	Nut	24	

Swing bracket - boom

Code No.	Q'ty	Part	No.	Remarks
RB2386656	1	Pin	30	ϕ 35 (ϕ 1.38in)
RB2386646	2	Bush	31	354535
RB2376657	1	Bush	32	354344
RB2376658	1	Bush	33	354344
0117361204	1	Bolt	34	
0257450100	1	Nut	35	
0661115010	1	Grease nipple	36	

Swing bracket - Swing cylinder

Code No.	Q'ty	Part	No.	Remarks
RB2386746	1	Pin	40	ϕ 30 (ϕ 1.18in)
0113361020	1	Bolt	41	
691816644	1	Spacer	42	
535825356	1	Washer	43	

Swing bracket - Swing cylinder

Code No.	Q'ty	Part	No.	Remarks
RA22166481	1	Pin	50	ϕ 30 (ϕ 1.18in)
0113361020	1	Bolt	52	
6718166441		Spacer	54	
5358253561	1	Washer	55	

Boom - boom cylinder

Code No.	Q'ty	Part	No.	Remarks
RB2386664	1	Pin	60	ϕ 35 (ϕ 1.38in)
0117361080	2	Bolt	61	
0257450100	1	Nut	62	

Boom - arm cylinder

Code No.	Q'ty	Part	No.	Remarks
RB2386654	1	Pin	70	ϕ 30 (ϕ 1.18in)
0117361080	2	Bolt	71	
0257450100	1	Nut	72	

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(8) Tightening torque of bolts and nuts

Refer to the tightness torque table below.

Bolts, Nuts / Nomial Dia.	4T 	7T 	9T 
	SS41	S40C, S45C	SCr4
M6	7.8 ~ 9.3 N·m 0.80 ~ 0.95 kgf·m 5.8 ~ 6.9 ft·lbf	9.8 ~ 11.3 N·m 1.00 ~ 1.15 kgf·m 7.2 ~ 8.3 ft·lbf	12.3 ~ 14.2 N·m 1.25 ~ 1.45 kgf·m 9.0 ~ 10.5 ft·lbf
M8	17.7 ~ 20.6 N·m 1.80 ~ 2.10 kgf·m 13.0 ~ 15.2 ft·lbf	23.5 ~ 27.5 N·m 2.40 ~ 2.80 kgf·m 17.4 ~ 20.3 ft·lbf	29.4 ~ 34.3 N·m 3.00 ~ 3.50 kgf·m 21.7 ~ 25.3 ft·lbf
M10	39.2 ~ 45.1 N·m 4.00 ~ 4.60 kgf·m 28.9 ~ 33.3 ft·lbf	48.0 ~ 55.9 N·m 4.90 ~ 5.70 kgf·m 35.4 ~ 41.2 ft·lbf	60.8 ~ 70.6 N·m 6.20 ~ 7.20 kgf·m 44.8 ~ 52.1 ft·lbf
M12	62.8 ~ 72.6 N·m 6.40 ~ 7.40 kgf·m 46.3 ~ 53.5 ft·lbf	77.5 ~ 90.2 N·m 7.90 ~ 9.20 kgf·m 57.1 ~ 66.5 ft·lbf	103.0 ~ 117.7 N·m 10.50 ~ 12.00 kgf·m 75.9~ 86.8 ft·lbf
M14	107.9 ~ 125.5 N·m 11.00 ~ 12.80 kgf·m 79.6 ~ 92.6 ft·lbf	123.6 ~ 147.1 N·m 12.60 ~ 15.0 kgf·m 91.1 ~ 108.5 ft·lbf	166.7 ~ 196.1 N·m 17.00 ~ 20.00 kgf·m 123.0 ~ 144.7 ft·lbf
M16	166.7 ~ 191.2 N·m 17.00 ~ 19.50 kgf·m 123.0 ~ 141.0 ft·lbf	196.1 ~ 225.6 N·m 20.00 ~ 23.00 kgf·m 144.7 ~ 166.4 ft·lbf	259.9 ~ 304.0 N·m 26.50 ~ 31.00 kgf·m 191.7 ~ 224.2 ft·lbf
M18	245.2 ~ 284.4 N·m 25.00 ~ 29.0 kgf·m 180.8 ~ 209.7 ft·lbf	274.6 ~ 318.7 N·m 28.00 ~ 32.50 kgf·m 202.5 ~ 235.1 ft·lbf	343.2~ 402.1 N·m 35.00 ~ 41.00 kgf·m 253.2 ~ 296.5 ft·lbf
M20	333.4~ 392.2 N·m 34.00 ~ 40.00 kgf·m 245.9 ~ 389.3 ft·lbf	367.7 ~ 431.5 N·m 37.50 ~ 44.0 kgf·m 271.2 ~ 318.2 ft·lbf	519.8 ~ 568.8 N·m 53.00 ~ 58.00 kgf·m 383.3 ~ 419.5 ft·lbf

(9) Types and materials of bolts and nuts

[ex. bolts]

Types	Material	Tensile strength	Hardness	Bolt head marking	
4T	SS41	Over 392 MPa 4000 kgf/cm^2 56892 lbf/in^2	H_RB 62 ~ 98		No mark or marked 4
7T	S40C S45C	Over 686 MPa 7000 kgf/cm^2 99561 lbf/in^2	H_RC 20 ~ 28		Marked 7
9T	SCr4	Over 882 MPa 9000 kgf/cm^2 128007 lbf/in^2	H_RC 28 ~ 34		Marked 9

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f) Troubleshooting for Operators

If the excavator does not show the desired performance, or when trouble arises, refer to the table below and undertake appropriate measures.

Trouble		Cause	Countermeasure
Engine	Starting difficulties	Fuel is too viscous	* Check fuel tank and filter * Remove impurities and water * If necessary, replace filter
		Air or water in the fuel system	* Remove water from the fuel tank * Check fuel pipe joint bolts and nuts for looseness * Purging of the fuel system (for fuel filter and injection pump, see "PURGING OF THE FUEL SYSTEM" in "OTHER ADJUSTMENTS AND REPLACEMENTS".)
		Oil viscosity is too high that the engine runs sluggishly in winter	* Pour hot water over the radiator * Use oils of different viscosities depending on the ambient temperature. (Use SAE10W, SAE10W-30 or SAE10W-40)
		Battery is almost dead; insufficient compression	* Recharge battery
	Insufficient engine power	Low fuel level	* Check fuel and add if necessary
		Clogged air cleaner	* Clean the air filter element
	Engine suddenly stops	Low fuel level	* Check fuel and add if necessary * Purge the fuel system
	Abnormal exhaust gas color	Poor fuel	* Use high quality fuel
		Too much engine oil	* Drain engine oil to prescribed oil level
	Water temperature too high (Overheating)	Defective seal of the water pump	* Replace
		Worn or torn fan belt	* Adjust or replace
		Thermostat is defect	* Replace
		Coolant level too low	* Fill to prescribed level
		Radiator grill or fins are clogged	* Clean
		Coolant is contaminated with rust from the cylinder head or crank case	* Replace coolant fluid and add anti-rust
		Defective radiator cap (Evaporation)	* Replace
		Corroded coolant pipes	* Clean
		Continuous operation under full load	* Reduce load
		Cylinder head gasket is damaged (Coolant loss)	* Replace
		Engine oil level too low	* Fill to prescribed level
		Maladjustment of fuel injection	* Readjust ignition timing
		Use of poor fuel	* Use prescribed fuel
Hydraulic System	Boom, arm, bucket, drive, swing and dozer power is too low	Hydraulic oil level too low	* Add oil
		Leakages of hoses and/or joints	* Replace hose or joint
	Non-function of swing motor	Swing lock pin is in lock position	* Remove swing lock pin in unlock position
Drive System	Deviation of drive direction	Blocked through stones	* Remove
		Crawler too loose or too tight	* Adjust accordingly

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(A) MACHINE SPECIFICATIONS

a) Major Dimensions and Working Range (with Rubber Crawler)

1. Specifications for the U17-3α: EU-version

			KUBOTA Excavator
Model name			U17-3α
Type (rubber crawler)			Canopy
Operating weight	(without driver)	kg	1650
Bucket	Volume	m³	0,04
	Width	mm	400
Engine	Type		3 cylinder diesel engine, water-cooled
	Model name		KUBOTA D902-BH-1
	Displacement	cm³	898
	Engine performance DIN 70020	kW	11,6
	Rated speed	1/min	2300
Performance	Swivel speed (swivel frame)	1/min	9,1
	Vehicle speed	fast km/h	4,1
		slow km/h	2,1
	Ground pressure (without driver)	kPa (kgf/cm²)	26 (0,26)
	Climbing performance	% (degree)	58 (30)
	Max. lateral sway	% (degree)	27 (15)
Dozer (width x height)		mm	990 x 260; 1240 x 260
Swing angle of the boom	Left	rad (degree)	1,13 (65)
	Right	rad (degree)	1,01 (58)
Service port connector	Max. volume (theoretical)	L/min	27
	Max. pressure	MPa	18,6
		(kgf/cm²)	190
Volume of the fuel reservoir		L	19
Pulling capacity of the tow lug		N	32300
Tongue load at the tow lug		N	2700
Noise level	LpA	dB (A)	79
	LwA	(2000/14/EC) dB (A)	92
Vibration at the drive lever		m/s²	< 3,0
Vibration at the control lever		m/s²	< 4,5
Vibration at the driver's seat		m/s²	< 0,5
Vibration at the bottom plate		m/s²	< 0,9

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(E) MAINTENANCE INTERVALS

a) EU-version

[Operator servicing]

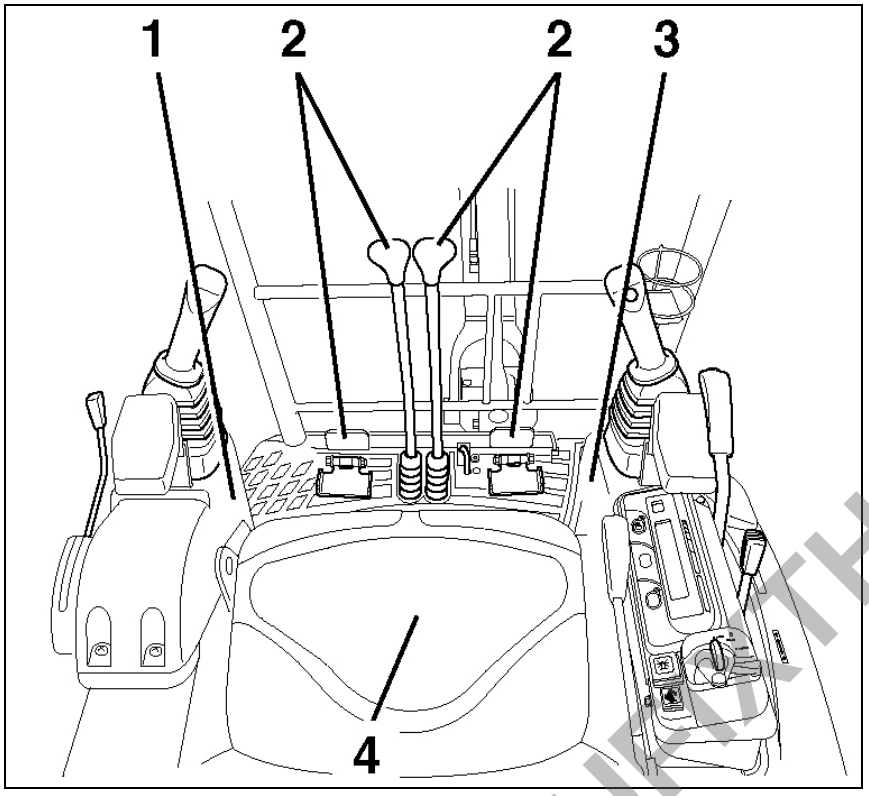
General maintenance	Elapsed hours of operation										
	50	100	150	200	250	300	350	400	450	500	Interval
Checking the engine oil level											daily
Check hydraulic oil level											daily
Check fuel level											daily
Check coolant level											daily
Lubricate front-end attachments											daily
Checking the radiator and oil cooler											daily
Check electric cables and connections											daily
Check water separator											daily
Check V-belt											daily
Drain water from the fuel reservoir										○	500 h
Lubricate the swivel gear	○	○	○	○	○	○	○	○	○	○	50 h
Battery service	○	○	○	○	○	○	○	○	○	○	50 h
Tracks and chassis: clean, visually inspect and check tension	○	○	○	○	○	○	○	○	○	○	weekly (50 h)
Check nuts and bolts		○		○		○		○		○	100 h
Check, clean air filter 1.)				○				○			200 h
Grease the swivel bearing				○				○			200 h

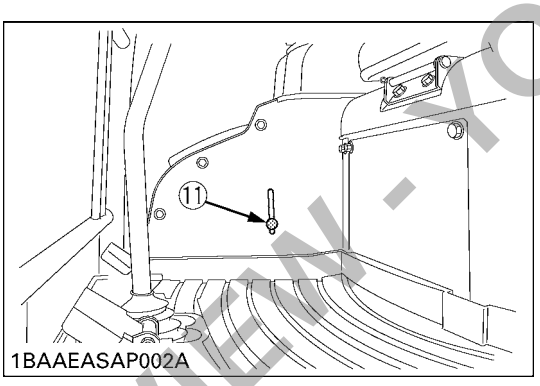
1.) Under dusty conditions the air filter must be cleaned more frequently or replaced.

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1. Arrangement of control levers





(1) Left control console
(2) Drive levers and control pedals
(3) Right control console
(4) Driver's seat

(11) Track width change/dozer select lever

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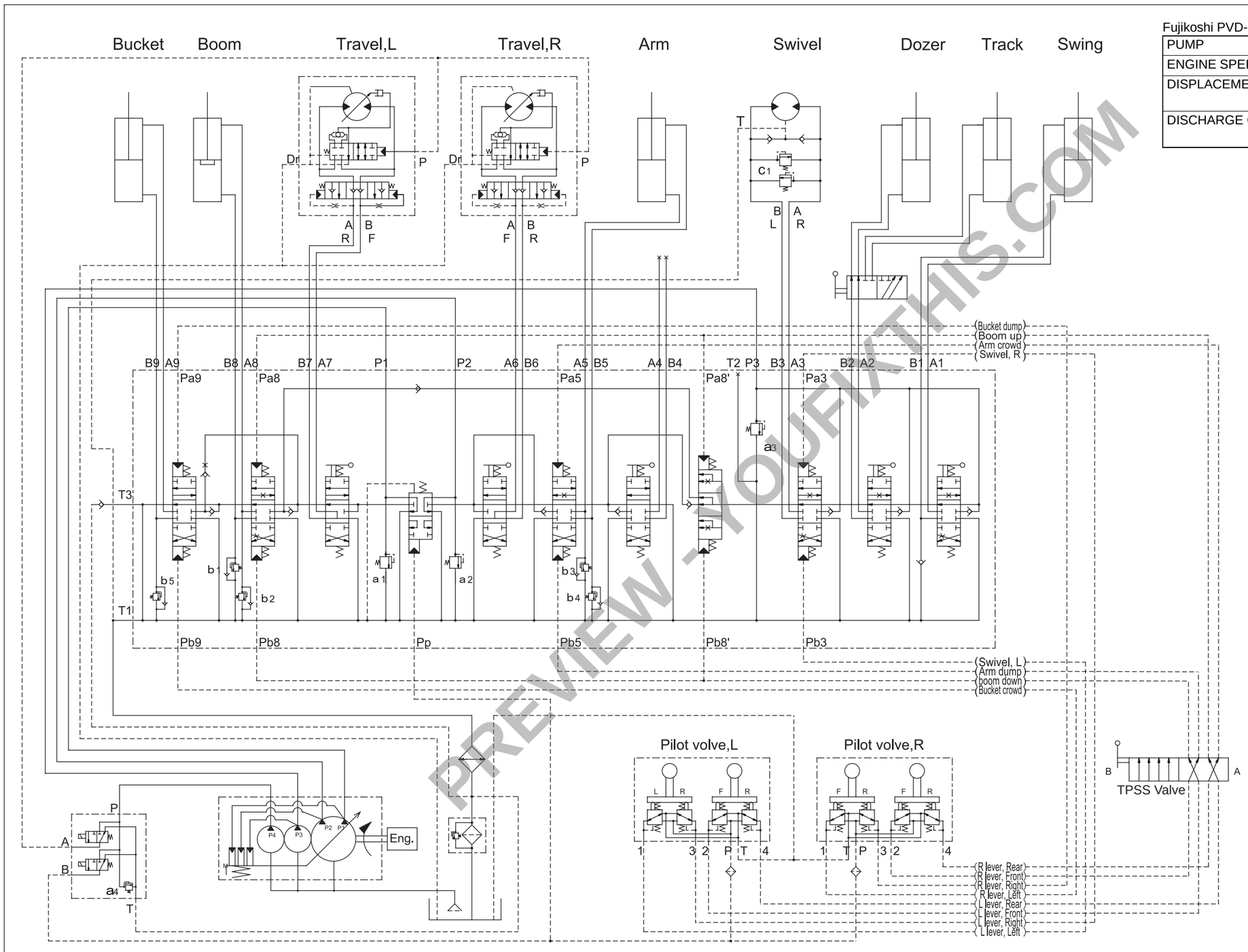
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4. U-17, U17-3, PP-version

Fujikoshi PVD-00B-15P-5G3-4982A

PUMP		P1	P2	P3	P4
ENGINE SPEED	(rpm)	2300	2300	2300	2300
DISPLACEMENT	cc/rev (in3/rev)	7.5 (0.46)	7.5 (0.46)	4.5 (0.27)	2.7 (0.16)
DISCHARGE CAPACITY	LMP (GPM)	17.3 (4.57)	17.3 (4.57)	10.4 (2.75)	6.2 (1.64)

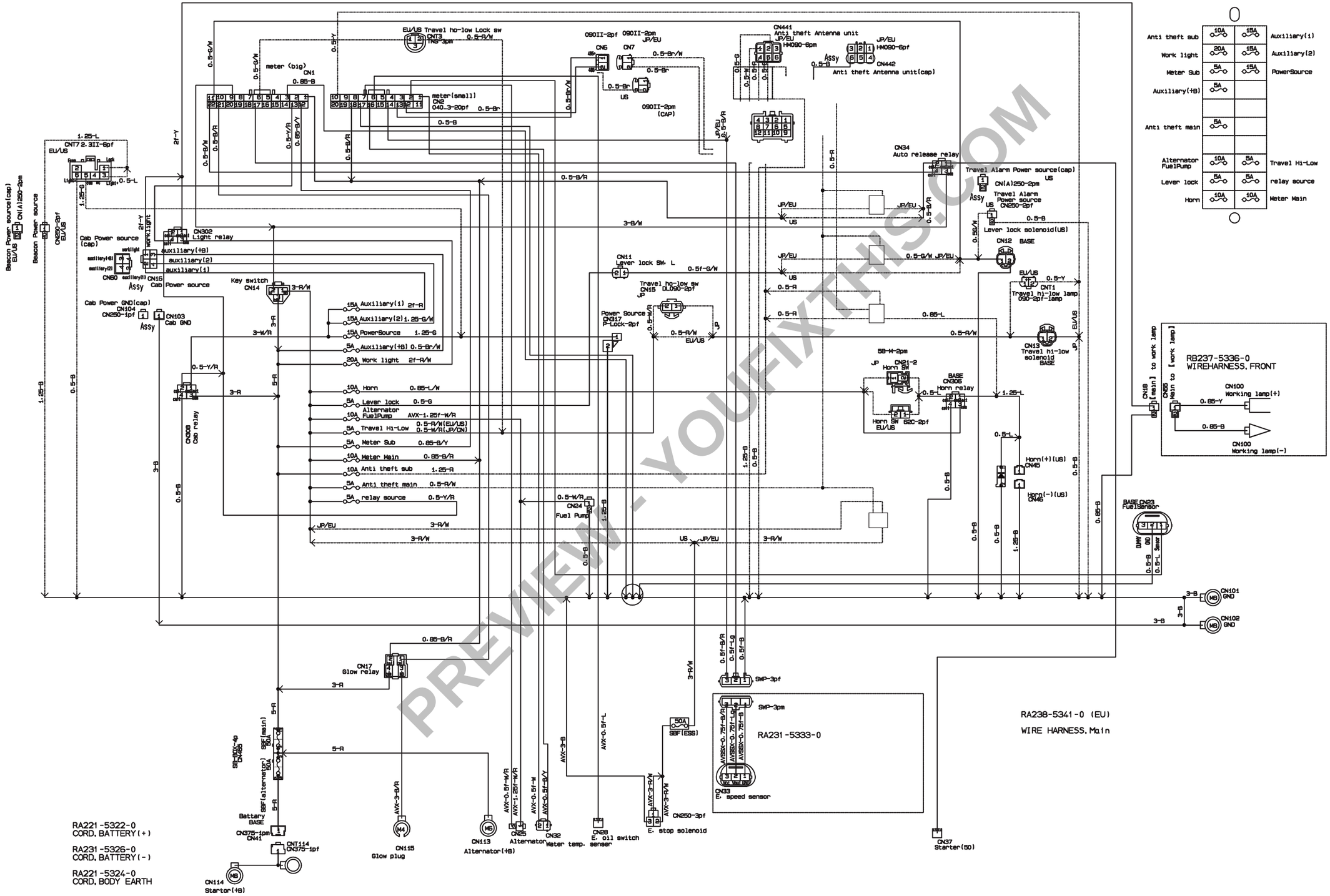
PRESSURE SETTING AT BENCH	(MPa)	(Kgf/cm²)	(psi)
a1	21.6	220	3129
a2	21.6	220	3129
a3	18.6	190	2702
a4	3.9	40	569
b1	17.7	180	2560
b2	27.5	280	3983
b3	23.5	240	3414
b4	23.5	240	3414
b5	23.5	240	3414
c1	13.2	135	1920



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k) Electrical Wiring Diagram, EU - version



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f) Failure Diagnosis

1. Failure display and diagnosis criteria

The following table 1 shows data on failure diagnosis, for operating mode and service mode.
Note:

- Display items of the system in service mode can be checked with the fail record.
- In the case of a warning for fuel scarcity, the buzzer will be turned ON for a moment at five-minute intervals.
- No.11 ~ 61 except 31, 32, 51, 52, 53, 54, 55 will be incorporatrd in future version machine, such as auto idle (AI) model, anxilliary port (AUX) model and anti - theft system model.

Table 1. Failure diagnosis

Display		Buzzer	Lamp	Reset method	Function stop point	EEPROM address	Method of diagnosis
Operating mode	service mode						
1 Fuel	-	5-minute intervals	Yellow	Replenish fuel	---	---	Fuel scarcity rate is 90% min. after 60-s sampling
2 Engine oil	2 Engine oil	Continually	Red	Returns to normal	---	66, 86	At 5 V (normal). The following conditions continue 10 s: oil = SW is L level and Engine speed is less than 800 rpm min.
3 Charge	3 Charge	Momentarily	Red	Returns to normal	---	65, 85	At 5 V (normal). The following conditions continue 10 s: charge = SW is L level and Engine speed is less than 800 rpm min.
4 High voltage	4 High voltage	Continually	Red	Turn key OFF	AI AUX	67, 87	At 5 V (normal). A power supply voltage of 18 V min. continues 3 s.
5 Overheat (EU only)	5 Overheat	Continually	Red	112°C ± α max.	AI AUX	77, 97	At 5 V (normal). The following conditions continue: Engine revolution of 800 rpm min. with overheat warning When the water temperature sensor is normal, a water temperature of (124 ±) °C min. continues 5 s. (α: Adjustable between -10 °C and +10 °C.)
31 Lift up unload lever	-	Momentarily	Yellow	Wait for 5 s, then disappear	Engine does not start	---	The key is shifted to the start position with the lever lock moved down.
32 Service hour	-	Momentarily	Yellow	Wait for 10 s	---	---	The specified hour meter is set.
33 Key is wrong	-	Momentarily	Yellow	Wait for 3 s	Engine does not start	---	Theft prevention specifications The wrong key is used to start the engine. The specifications are presently under consideration.
34 Different key	-	Momentarily	Yellow	Wait for 3 s	Engine does not start	---	Theft prevention specifications The different key is used to start the engine. The specifications are presently under consideration.
51 Coolant sensor (EU only)	-	Momentarily	Red	Turn key OFF	---	82, 102	At 5 V (normal). A water temperature of below -30 °C or over 140 °C continues for 1 s.
-	52 Fuel sensor	Momentarily	Red	Turn key OFF	---	81, 101	At 5 V (normal). The fuel sensor at 2 V min. continues for 10 s.
53 Sensor supply short 5V	53 Sensor supply short 5V	Momentarily	Red	Turn key OFF	LCD turns OFF AI AUX 5-V output turns OFF	79, 99	5-V short-circuiting detection terminal at H level continues for 0.1 s.
54 Sensor supply short 12V	54 Sensor supply short 12V	Momentarily	Red	Turn key OFF	AI AUX always 0 rpm	80, 100	At 5 V (normal). The 12-V short-circuiting detection terminal at H level continues for 0.1 s.
55 Meter controller error	-	Momentarily	Red	Turn key OFF	AI AUX	78, 98	The rightmost 16 bits of the added value of addresses 36 through 50 do not coincide with the value of address 64.
-	61 AI motor restricted	Momentarily	Red	Press accelerator	---	83, 103	At 12 V (normal). AI specifications A motor current of 6 A min. continues for 3 s.

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(B) SAFETY PRECAUTIONS FOR SERVICING, DISASSEMBLY AND REASSEMBLY

⚠ Safety precautions for servicing

Most accidents during servicing arise from carelessness. Please remember that safety involves both the welfare of the employees and improved work efficiency.

⚠ Safety precautions for disassembly and reassembly

Machines must be disassembled and assembled efficiently and safely.
It is very important to thoroughly understand the construction and function of the machine, to make all appropriate preparations, and start operations according to the specified working procedures.

a) Safety Measures Before Starting Work

(1) Work clothes

1. Wear specified work cap and clothed. (Under no circumstances may workers wear undershirts only.)
   Cuffs must be kept buttoned, and any tears must be mended.)
2. Wear safety shoes.
3. Do not wear cotton gloves when working on the internal section of engine, reduction gears or hydraulic units for repair or others, or when using a hammer. Wear leather gloves, however, when hoisting wires.

(2) Inspecting equipment and tools

1. Prepare equipment (cranes, fork lifts, tool, etc.) required for servicing and inspect for any problems before starting work.
2. Hammer heads (metal parts) must be firmly secured to their handles.
3. Check hosting tools (wire ropes, hoisting chains, etc.) before use.

(3) Set workshop in order

1. Secure appropriate space needed for disassembly.
2. Secure a clean, safe place for arranging disassembled parts.
3. Store volatile substances (gasoline, light oil, thinner, oily articles, etc.) in appropriate containers at selected locations to prevent fire hazards.

b) Safety Measures During Work

(1) Protectors

1. Wear goggles when using chisels for chipping.
2. Use appropriate protectors during welding.
3. Wear a helmet when working with a crane or at elevated locations.

(2) Team work

1. When working with two or more people, divide the work and maintain close communication.
2. Crane work must be carried out using predetermined signals.

(3) Disassembly and assembly

1. Do not wear gloves when using hammers.
2. Use rods of the specified soft material for removing pins. Do not use a hammer as a pad.
3. Do not place fingers in holes when centering.
4. Heavy parts must be adequately supported before removing bolts.

(4) Cranes

1. Basically, use a crane for objects heavier than 44lb (20kg).
2. Crane operation and hoisting must be performed only by qualified personnel.
3. Pay careful attention to the center of gravity when hoisting, and do not stand under the lifted objects.

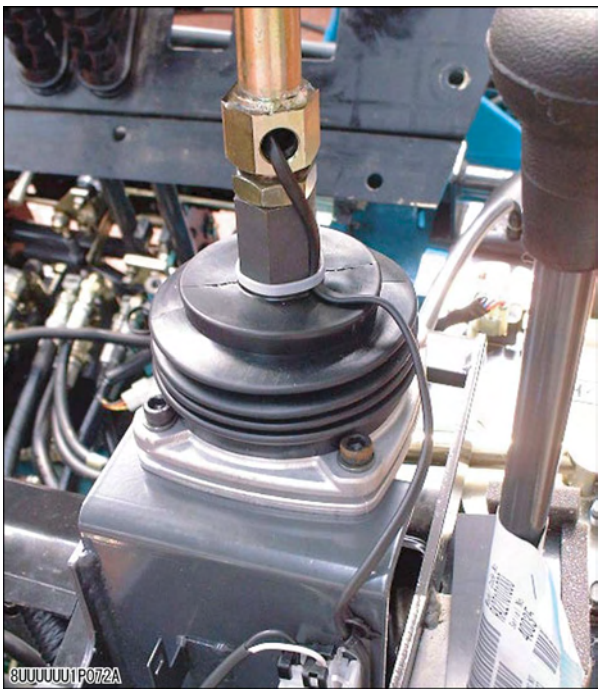
(5) Others

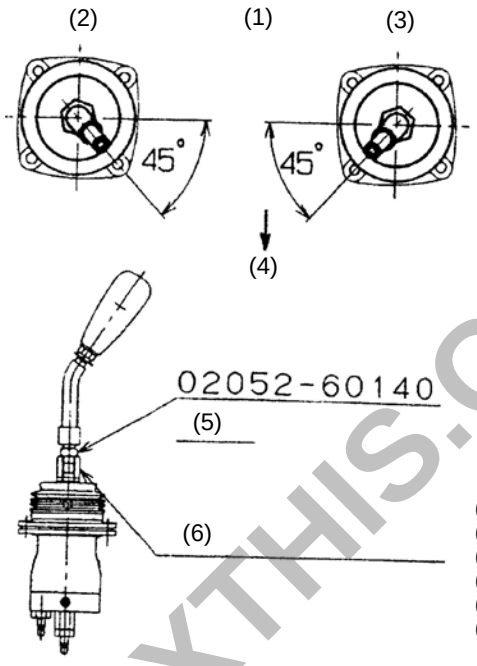
1. To work under a jacked-up carrier, be sure to place wood pieces underneath.
2. When charging batteries, make sure there are no open flames in the immediate vicinity.
3. All electric tools must be grounded.
4. Before welding the machine, remove the battery.
   - When removing the battery, be sure to disconnect negative (-) cord first.
   - When mounting the battery, be sure to connect the positive (+) cord first.

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h) Pilot Control Valve





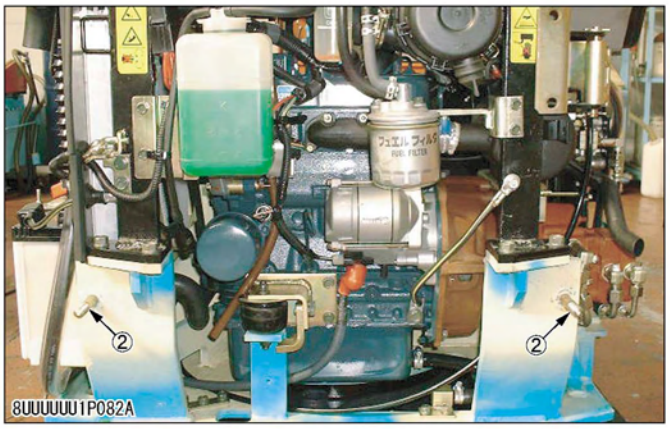
(1) Lever directions
(2) PV, right
(3) PV, left
(4) Front
(5) Nut
(6) Do not turn this part.

Item	Points to remember	
Fitting directions of grips Left (RB101-6561Δ) Right (RC411-6562Δ)	Have the grip's projection forward.	Different lever position ↓ Control failure
Setup dimensions of operation lever	See left. (Reference value)	Malpositioned ↓ Control failure
Lever move-up position	See left. Do not pull the hose by force.	Malpositioned ↓ Kinky hose ↓ Damaged hose, oil leak
Tightening torque of lever lock nut (02052-60140)	For both sides 39.0 ~ 43.0 N·m (4.0 ~ 4.4 kgf·m) (28.77 ~ 31.72 ft·lbf) Do not turn the hex PV nut.	Turning lever ↓ Control failure
Loose lever	Within 2 mm	Too loose ↓ Unspecified stroke ↓ Interference with nearby parts
Fitting directions of grips Left (RB101-6561Δ) Right (RC411-6562Δ)	Have the grip's projection forward.	Different lever position ↓ Control failure
Fitting direction of grip lock nut (RC301-6524Δ)	Have the stepped (processed) side toward the grip.	Wrong direction ↓ Tube not fixed properly
	Tightening torque 25.0 ~ 27.0 N·m (2.5 ~ 2.8 kgf·m) (18.44 ~ 19.92 ft·lbf)	Poor tightness ↓ Loose ↓ Control failure
Horn harness routing	Pass the harness through the opening of the pilot valve. Install the vinyl tube (RB101-5339Δ) down into the opening of the lever. Apply tape to the other end. With the lever movement in mind, give the harness length some allowance.	Contact ↓ Cover peel-off ↓ Short-circuit

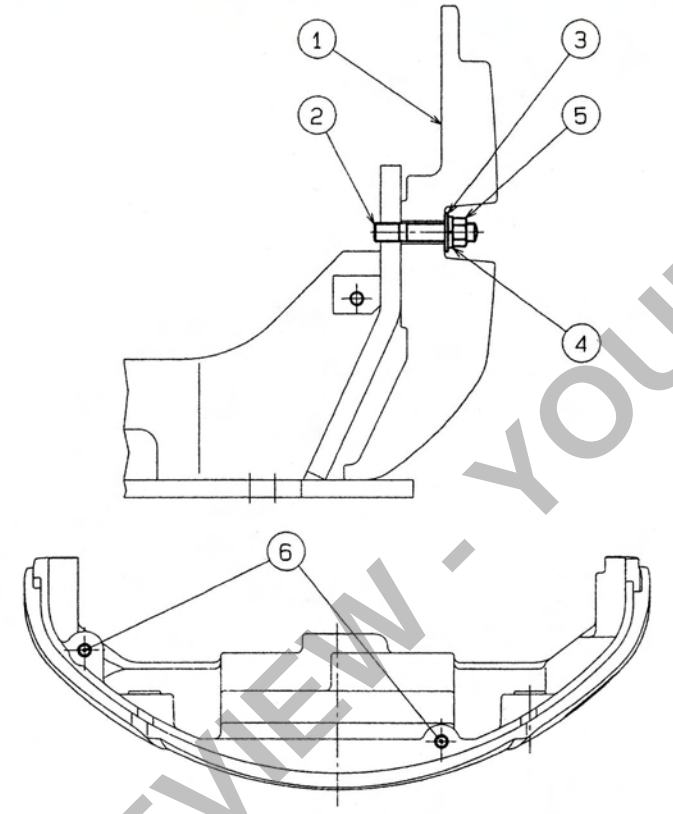
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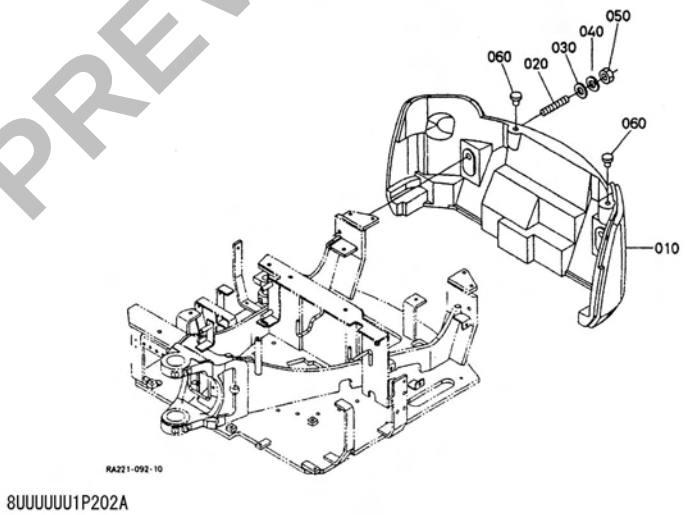
m)Weight



Item		Points to remember	
A	Installation of counterweight (RA211-4821Δ)	Stud (01517-51460) Tightening torque 107.9 ~ 125.5 N·m (11.0 ~ 12.8 kgf·m) (79.6 ~ 92.6 ft·lbf) (Apply thread adhesive.)	Loose ↓ Come-off
		Nut (02174-60140) Tightening torque 107.9 ~ 125.5 N·m (11.0 ~ 12.8 kgf·m) (79.6 ~ 92.6 ft·lbf) (Apply thread adhesive.)	Loose ↓ Come-off



No.	Part Code	Part Name	Q'ty	Remarks
1	RA221-4821Δ	Counterweight	1	205kg
2	01517-51460	Stud	2	7T M14 x 60L
3	04011-60140	Plain washer	2	
4	04512-60140	Spring washer	2	
5	02174-60140	Nut	2	4T
6	90585-1199Δ	Plug	2	M16 x 2 (medium pitch)

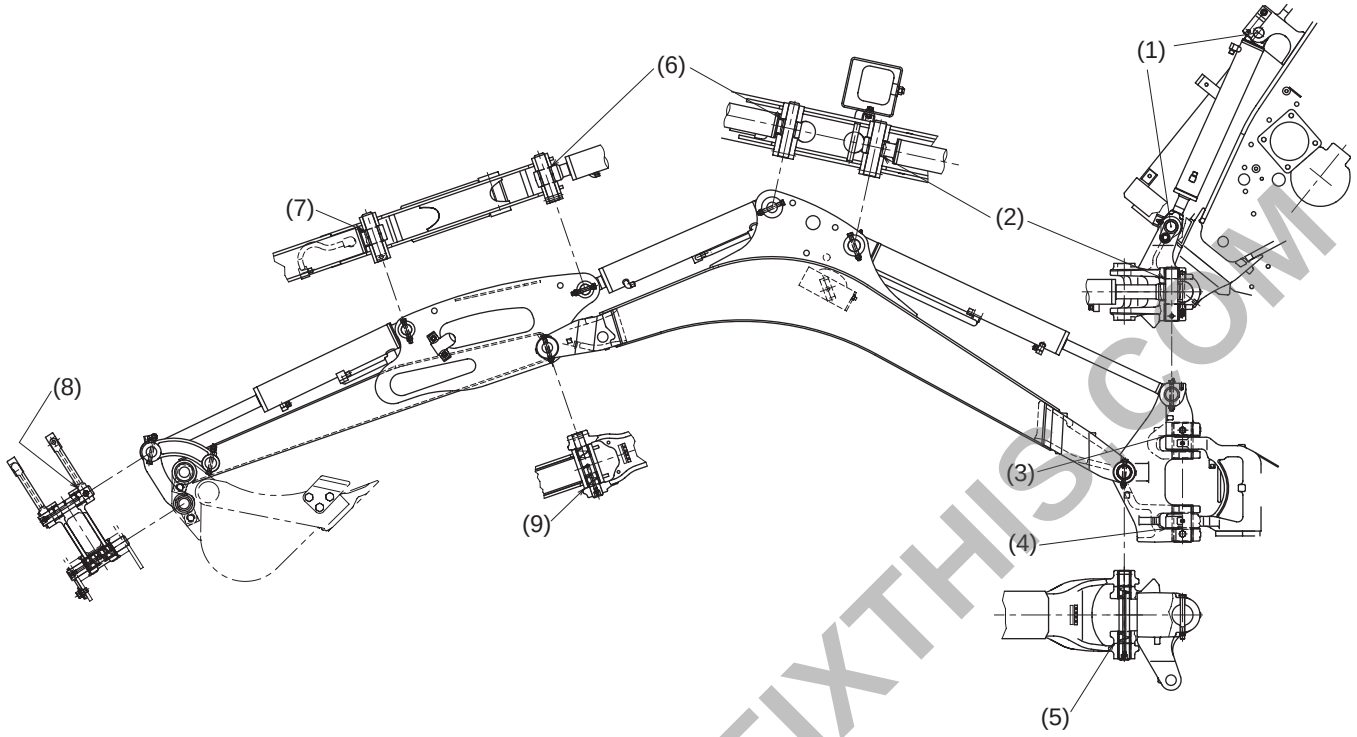


No.	Part Code	Part Name	Q'ty	Remarks
1	RA221-4821-4	Counterweight	1	
2	01517-51460	Stud bolt	2	
3	04013-60140	Plain washer	2	
4	04512-60140	Spring washer	2	
5	02174-60140	Nut	2	
6	90585-1190-0	Plug	2	

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(4) Clearance adjustment



(1) 68721-6697 Shim (0.5, 60-31) SPCC
68051-6633 Shim (1.0, 60-31) SPCC
68051-6634 Shim (1.6, 60-31) SPCC
Selective use
* Insert a number of shims according to the clearance on the swing cyl bottom side.

(2) RA211-6647 Shim (0.3, 70-36) SPCC
RB211-6762 Shim (0.5, 70-36) SPCC
68741-6688 Shim (1.0, 70-36) SPCC
68741-6689 Shim (1.6, 60-36) SPCC
RA211-6649 Shim (2.0, 70-36) SPCC
} Selective use

(3) RB238-6644 Thrust collar (2.3, 92-51) SK5M
* Refer to the mounting method of thrust collar.

(4) RB238-6644 Thrust collar (2.3, 92-51) SK5M
RB238-6648 Thrust collar (2.0, 92-51) SK5M
RB238-6649 Thrust collar (2.5, 92-51) SK5M
} Selective use
* Refer to the mounting method of thrust collar.

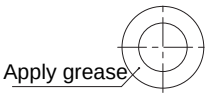
(5) RG401-6762 Shim (0.5, 70-36) SPCC

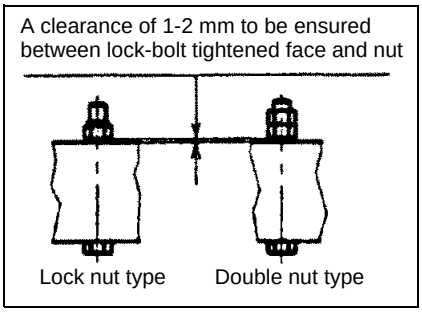
(6) 68721-6697 Shim (0.5, 60-31) SPCC
68051-6633 Shim (1.0, 60-31) SPCC
} Selective use

(7) 68721-6697 Shim (0.5, 60-31) SPCC
68051-6633 Shim (1.6, 60-31) SPCC
} Selective use

(8) 68721-6697 Shim (0.5, 60-31) SPCC
68051-6633 Shim (1.0, 60-31) SPCC
} Selective use

(9) 68721-6697 Shim (0.5, 60-31) SPCC
68051-6633 Shim (1.0, 60-31) SPCC
} Selective use

1. Front Play * Pin on fulcrum Thrust direction Clearance	0.6 mm (0.023 in) max. * If the play exceeds 0.6 mm, add some shims and make adjustments. (Use the shims shown in the illustration.)
2. Vertical clearance between swivel frame and swing bracket.	+ 0.3 ~ +1.3 mm (+ 0.012 ~ +0.051 in)
3. Use the shim and thrust collar selectively with each part.	
4. Installation of thrust collar	Apply grease on both surface. 



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(9) Water and Oil Quantity

	Unit	U17-3α, U17/U17-3	Remarks
Radiator soft water	L (US gal)	2.6 (0.713)	Kubota LLC-N-50F
Reserve tank soft water	L (US gal)	0.56 (0.159)	
Crankcase engine oil (at filter replacement)	L (US gal)	3.6 (0.295)	Class CF/CF-4 10W30
Hydraulic tank oil	L (US gal)	13 (3.434)	ISO VG 46
Total hydraulic oil	L (US gal)	21 (5.812)	ISO VG 46
Wheel motor gear oil	L (US gal)	0.25 (0.066)	SAE 90 (API, GL-4)
Swivel reduction gear oil	L (US gal)	-	
Track roller gear oil	cc (cu-in)	40 (2.44)	Engine Oil SAE 30 Class CD
Carrier roller (upper roller)	cc (cu-in)	- (-)	Grease EP2
Front idler	cc (cu-in)	30 (1.83)	Engine Oil SAE 30 Class CD
Fuel tank light oil (full)	L (US gal)	19 (4.755)	Diesel fuel No. 3

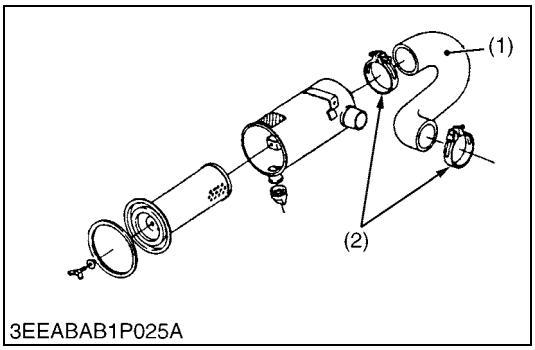
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[15] CHECK POINTS OF EVERY 2 YEARS



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Replacing Intake Air Line

1. Loosen the clamp (2).
2. Remove the intake air hose (1) and clamp (2).
3. Replace new intake air hose (1) and new clamp (2).
4. Tighten the clamp (2).

■ **NOTE**

- **To prevent serious damage to the engine, keep out any dust inside the intake air line.**

(1) Intake Air Hose (2) Clamp

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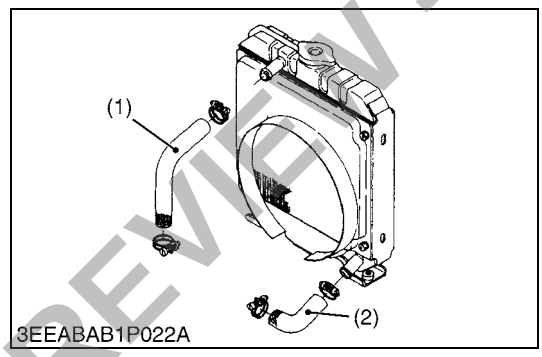
Replacing Battery

CAUTION

- **When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.**
- **When charging battery, remove battery vent plugs.**
- **When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first.**
- **Never check battery charge by placing a metal object across the posts.**

1. Disconnect the negative terminal and positive terminal.
2. Remove the battery holder.
3. Remove the used battery.
4. Replace the new battery.
5. Tighten the battery holder.
6. Connect the positive terminal.
7. Connect the negative terminal.

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Replacing Radiator Hoses and Clamp Bands

CAUTION

- **Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**

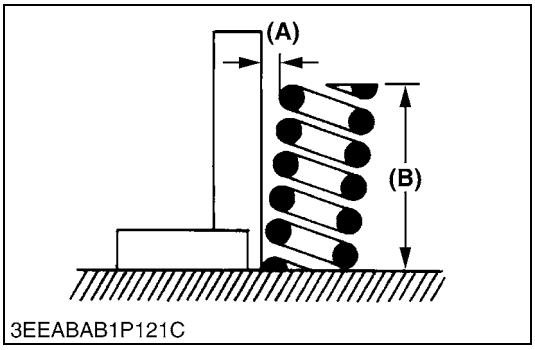
1. Drain the coolant.
2. Loosen the clamp bands.
3. Remove the upper hose (1) and lower hose (2).
4. Replace new upper / lower hose (1), (2) and clamp bands.
5. Tighten the clamp bands.
6. Fill with clean water and anti-freeze until the coolant level is just below the port. Install the radiator cap securely.

(1) Upper Hose (2) Lower Hose

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Free Length and Tilt of Valve Spring

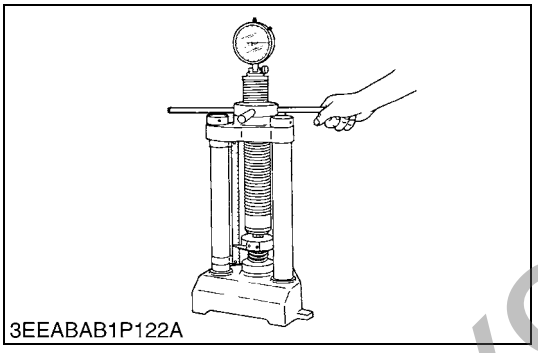
1. Measure the free length **(B)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate the valve spring and measure the maximum tilt **(A)**. If the measurement exceeds the allowable limit, replace it.
4. Check the entire surface of the valve spring for scratches. If there is any defect, replace it.

Tilt **(A)**	Allowable limit	1.2 mm 0.047 in.

Free length **(B)**	Factory spec.	31.3 to 31.8 mm 1.24 to 1.25 in.
	Allowable limit	28.4 mm 1.12 in.

(A) Tilt **(B) Free Length**

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Valve Spring Setting Load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed the engine.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Setting load / Setting length	Factory spec.	65 N / 27.0 mm 6.6 kgf / 27.0 mm 15 lbf / 1.06 in.
	Allowable limit	55 N / 27.0 mm 5.6 kgf / 27.0 mm 12 lbf / 1.06 in.

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Oil Clearance between Rocker Arm and Rocker Arm Shaft

1. Measure the rocker arm shaft O.D. with an outside micrometer.
2. Measure the rocker arm I.D. with an inside micrometer, and then calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable limit, replace also the rocker arm shaft.

Oil clearance between rocker arm and rocker arm shaft	Factory spec.	0.016 to 0.045 mm 0.00063 to 0.0017 in.
	Allowable limit	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory spec.	10.473 to 10.484 mm 0.41233 to 0.41275 in.
Rocker arm I.D.	Factory spec.	10.500 to 10.518 mm 0.41339 to 0.41409 in.

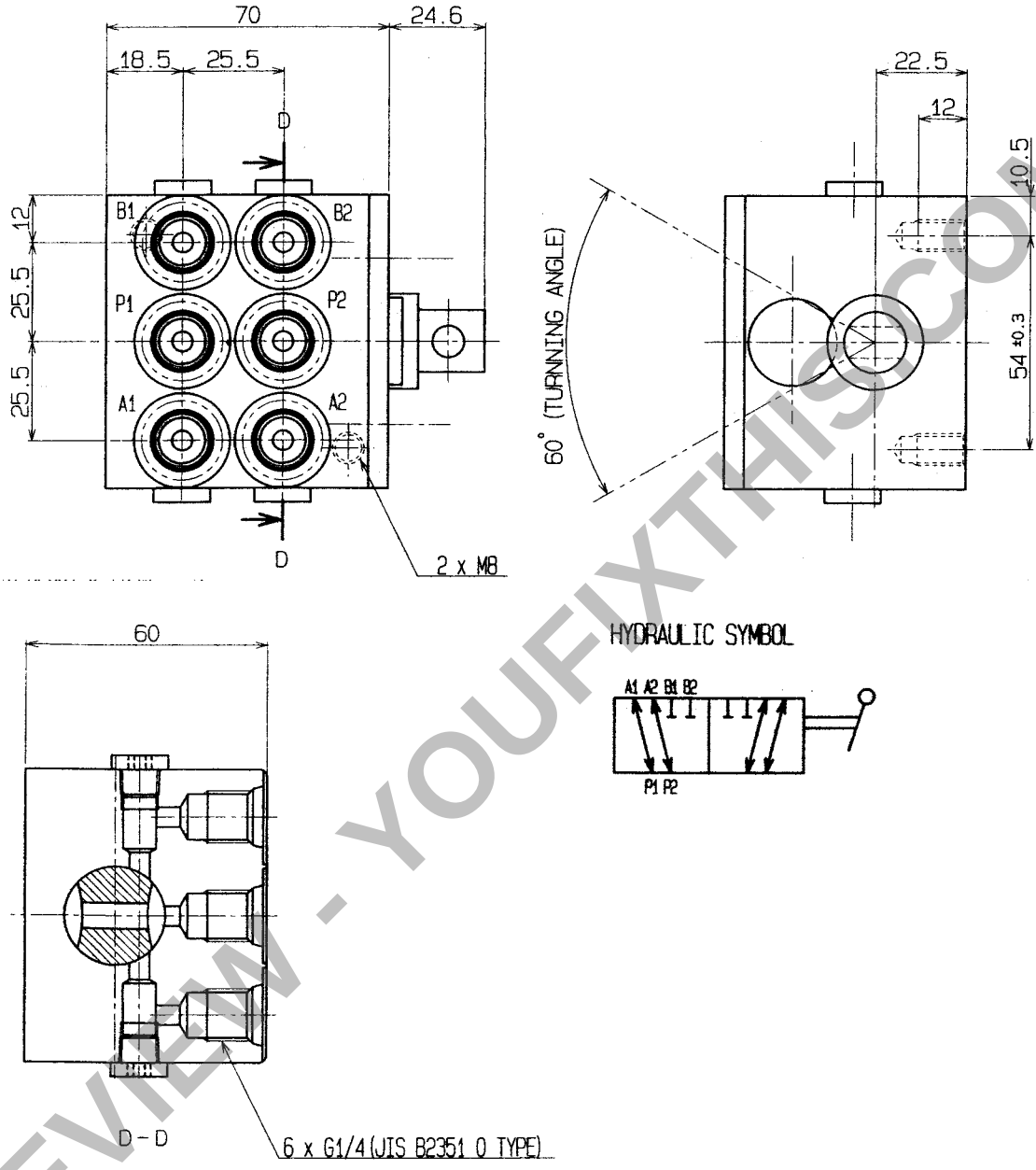
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g) Selector Valve

1. Structure



2. Function

This valve is to select the oil flow direction for blade cylinder or track cylinder.

3. Specifications

1) Operating pressure and flow: Main relief pressure (20.6 MPa) (2986.9 psi) at 10.4 l/min (2.75 USGPM).
2) Inside leakage: 8 cc/min at 20.6 Mpa, 50°C (0.49 in^3/min at 2986.9 psi 122°F)

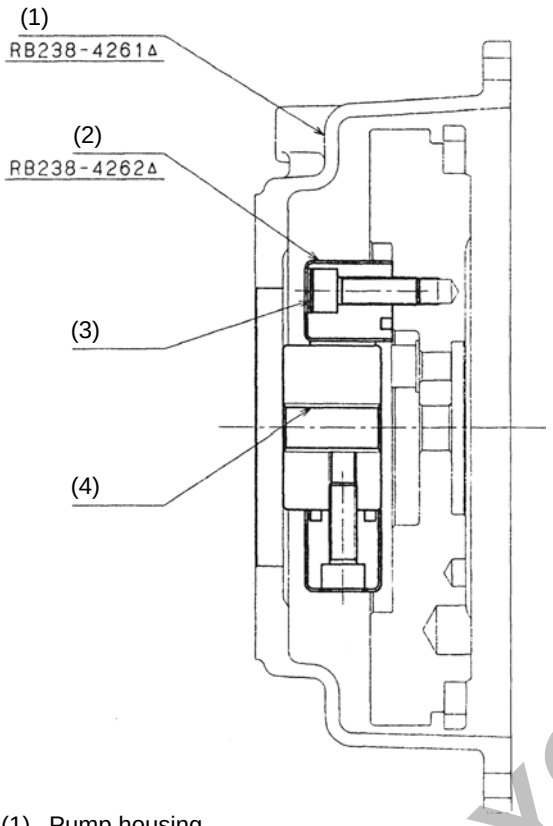
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(D) DISASSEMBLING AND REASSEMBLING

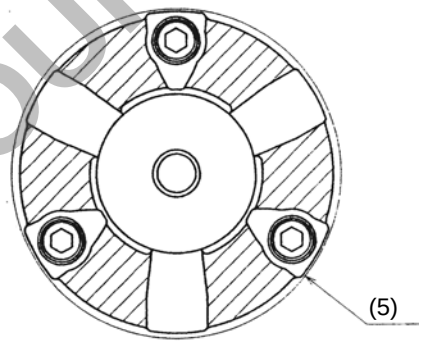
a) Pump

(1) Pump coupling



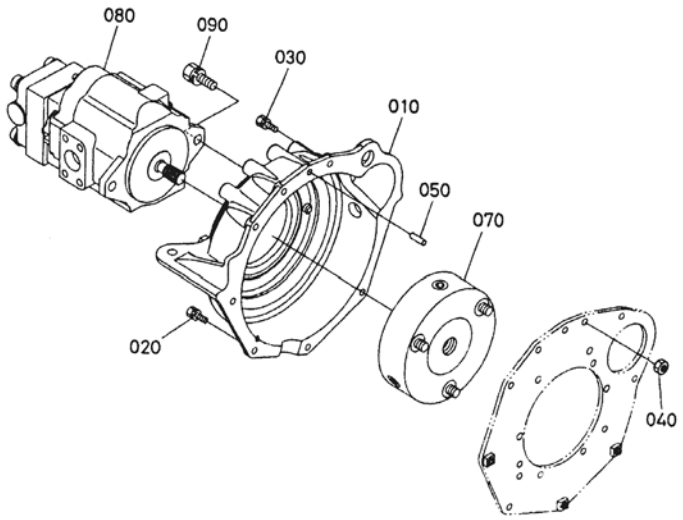
Item		Points to remember	
	Greasing of spline	Apply an appropriate amount of grease. (Do not allow oozing out.)	Burnt spline ↓ Detaching impossible
A	Tightening torque of coupling mounting bolt (RB238-4262Δ) * MEC-treated	48.1 ~ 55.9 N·m (4.9 ~ 5.7 kgf·m) (35.5 ~ 41.2 ft·lbf) * Do not apply thread adhesive.	Poor tightness ↓ Come-off Too tight ↓ Damage Thread adhesive used ↓ Adhesive deposit on rubber ↓ Chemical reaction to degrade the rubber ↓ Damaged coupling

(1) Pump housing
(2) Coupling
(3) Bolt
(4) Spline (Apply grease)
(5) Finally cut off the tape applied around.



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No.	Part Code	Part Name	Q'ty
010	RB238-4261-2	Housing	1
020	01123-60825	Bolt	5
030	01123-60825	Bolt	2
040	02114-60080	Nut	2
050	05012-00814	pin	1
060	-		-
070	RB238-4262-0	Coupling	1
080	RA221-6111-0	Piston pump	1
090	01133-61230	Bolt	2



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1) Tools and tightening torque

Tool	Size (mm)	Part No.	Part name	Screw size	Tightening torque N·m kgf·m ft·lbf
Hex wrench	6	125	Hex socket bolt	M8	20.6 ± 1.5 2.1 ± 0.15 15.2 ± 1.1
Spanner	22	312	Adjusting nut	M14	68.6 ± 4.9 7.0 ± 0.5 50.6 ± 3.6
	32	302	Disc	M14	
Special tool (Drawing on page 17)	24	301	Joint	M14	47.1 ± 2.9 4.8 ± 0.3 34.7 ± 2.1

Others
- Vapor phase inhibitor
- Kerosene
- Heat-resistant grease
- Sandpaper (#1000, #2000)
- Oilstone
- Vise

2) Maintenance standard

Checkpoints	Criteria	Remarks
Leak amount	Replace the pilot valve assembly with new one if the oil leak exceeds 1000 cc/min with the steering wheel at neutral or 2000 cc/min while in operation.	Conditions: Primary pressure: 2.95 MPa Oil viscosity: 23 mm^2/s
Spool	If the sliding face is worn over 10 μ more than the non-sliding one, replace the pilot valve assembly with new one.	This amount of wear corresponds to the above leak amount. The same conditions as above are expected.
Push rod	If the tip is worn 1 mm or more, replace the push rod with new one.	
Loose control elements	If the disc (302) or joint (301) is worn out and loose 2 mm or more, replace it with new one.	If the shakiness is caused by a loose fixture, tighten it up.
Stable operation	If unusual noise, hunting, primary pressure drop, etc., occurs and it cannot be corrected according to "Troubleshooting", replace the pilot valve assembly with new one.	

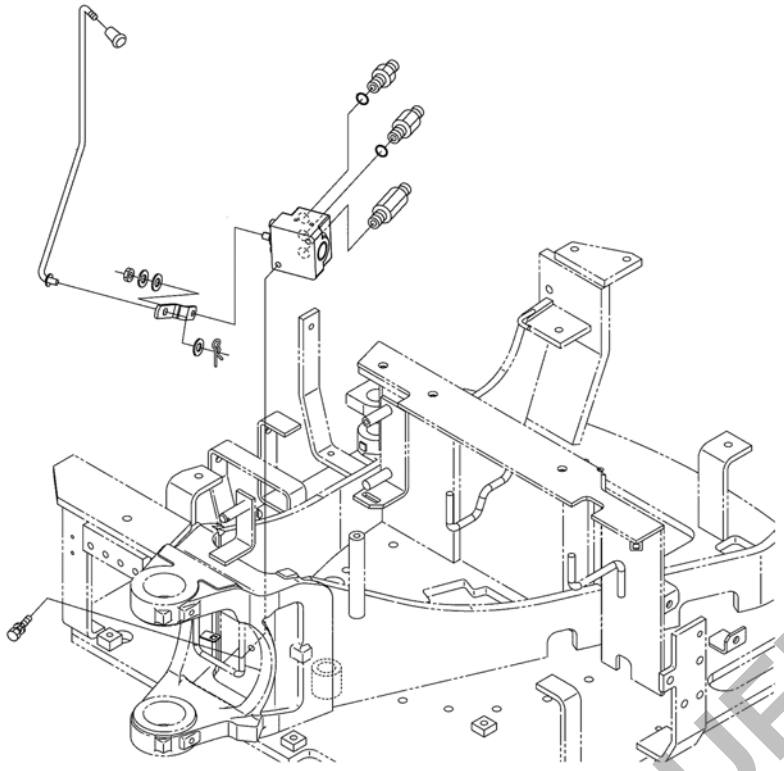
Note 1: It is advisable to replace the O-rings and other sealing elements at every disassembly. They may be reused when they are found not damaged.
Note 2: When the hex socket bolt (125) has been loosened, be sure to replace the sealing washer (121).

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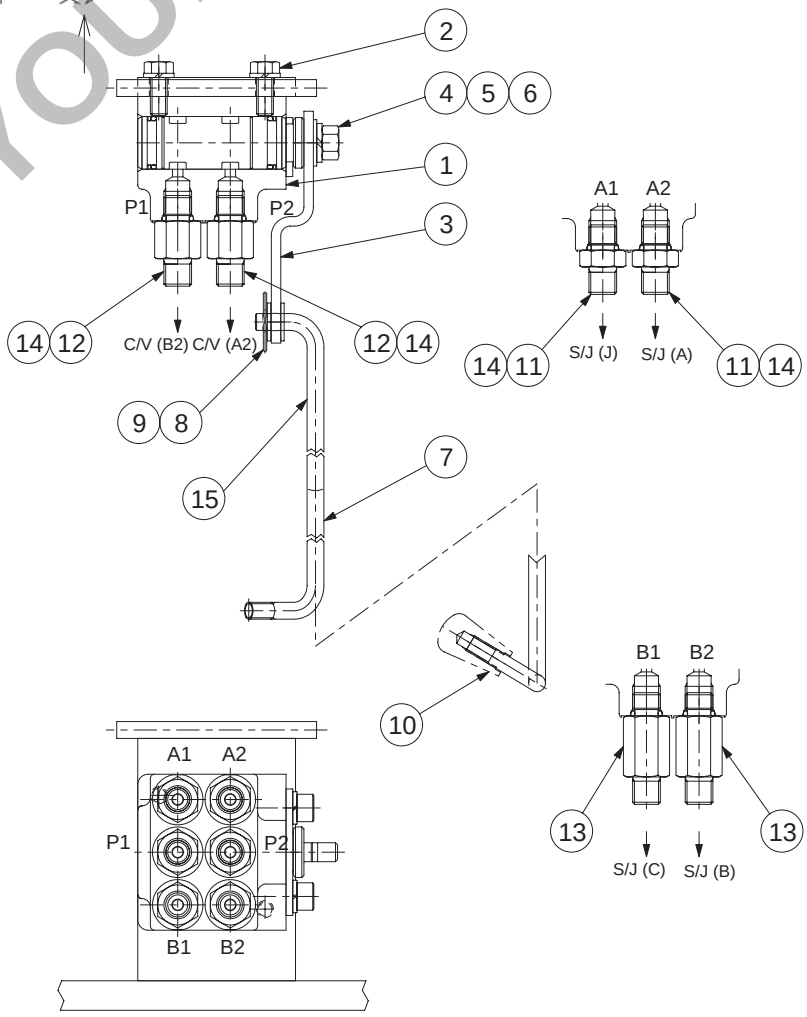
h) Change Valve (Dozer, Track)

(1) Location and adaptor



1	Fitting the adaptor	Pipe joint (S, G1/4-G1/4) (RA221-6195Δ) for B1 and B2 ports
		Adaptor for A1 and A2 ports (68728-7615Δ)
		Pipe joint (S, G1/4-G1/4) (RA111-6313Δ) for P1 and P2 ports
		Apply oil (New UDT, M80B or equivalent) to the O-ring.
		G1/4 24.5 ~ 29.4 N·m (2.5 ~ 3.0 kgf·m) (18.1 ~ 21.7 ft·lbf)
2	Fitting the lever grip (10)	Hand-tighten the grip until it does not turn any longer.
3	Fitting the selector valve	17.7 ~ 20.6 N·m (1.8 ~ 2.1 kgf·m) (13.0 ~ 15.2 ft·lbf) Apply screw adhesive (Loctite 271 or equivalent).

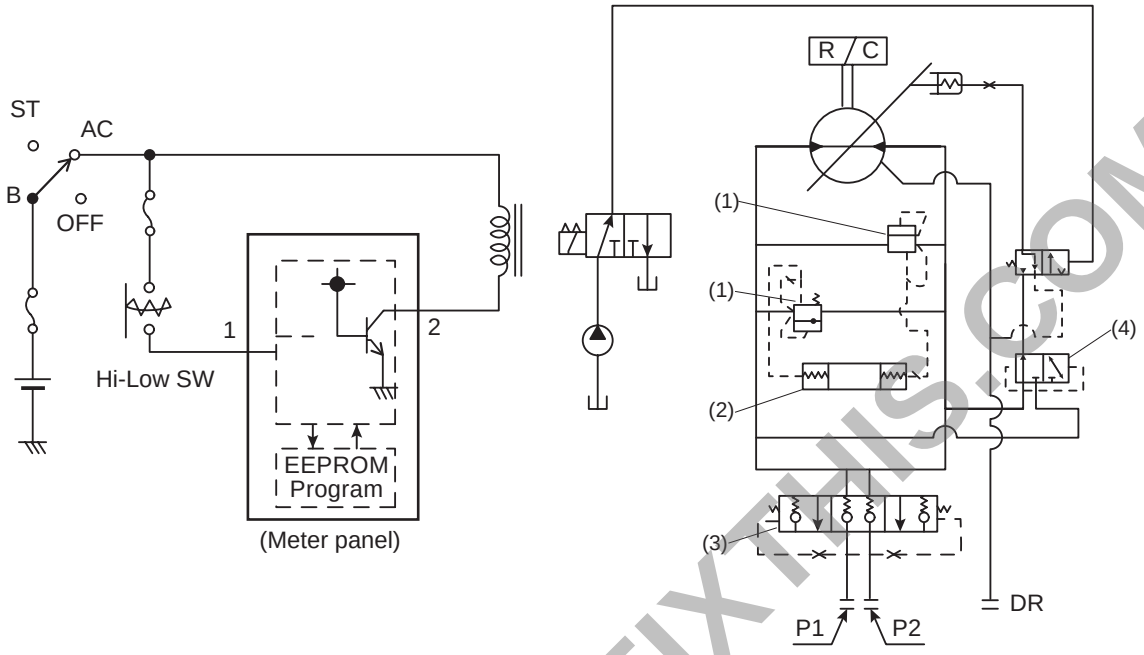
No.	Part Name	Q'ty	Remarks
1	Valve assembly (selector)	1	
2	Bolt	2	M8 7T
3	Lever (telescopic)	1	
4	Nut	1	4T
5	Spring washer	1	
6	Plain washer	1	
7	Rod (telescopic)	1	
8	Plain washer	1	
9	Snap pin	1	
10	Gearshift lever grip	1	M8 (Resin)
11	Adaptor	2	A1·A2
12	Pipe joint (S, G1/4-G1/4)	2	P1·P2
13	Pipe joint (S, G1/4-G1/4)	2	B1·B2
14	O-ring	4	1/4 B1,2 · P1, 2
15	Rod (telescopic) To be connected in this position		



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(2) Travel hi-speed control circuit



Troubleshooting: Travel hi-speed malfunction

1. Turn the key switch to the ON position to see if 12 V is applied to terminal 2 of the travel hi-speed switch.
2. Press the travel hi-speed switch to see if the 12 V signal comes to terminal 1.
3. Turn on and off the travel hi-speed switch and check the continuity and discontinuity.
4. Check the continuity of the travel hi-speed solenoid coil and measure its resistance.
5. If there is no problem with the above steps, it means the electrical system functions. Now go to the hydraulic system.
6. Possible troubles with the hydraulic system include stuck solenoid spool, poorly performing pilot pump, malfunctioning primary relief valve, stuck Hi-Lo selector spool, etc.

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