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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Note : *< > : W/O Quick coupler type*

Item				Unit	ViO27-2
Main specifications of machine					
Dimensions					
Overall length (Transportation position)				in. (mm)	162.6 (4130) <161.4 (4100)>
Cabin	Overall height	Transportation position		in. (mm)	99.6 (2530)
		Traveling position		in. (mm)	99.6 (2530)
	Overall width	Full machine width		in. (mm)	61.0 (1550)
Canopy	Overall height	Transportation position		in. (mm)	98.4 (2500)
		Traveling position		in. (mm)	98.4 (2500)
	Overall width	Full machine width		in. (mm)	61.0 (1550)
Tumbler center distance (rubber/steel)				in. (mm)	61.6 (1564)/61.3 (1558)
Track gauge				in. (mm)	51.6 (1310)
Minimum ground clearance				in. (mm)	12.6 (320)
Traveling performance					
Travel speed	Steel crawler	Low speed (Forward/Reverse)		MPH (km/hr)	1.62 (2.6)
		High speed (Forward/Reverse)		MPH (km/hr)	2.80 (4.5)
	Rubber crawler	Low speed (Forward/Reverse)		MPH (km/hr)	1.74 (2.8)
		High speed (Forward/Reverse)		MPH (km/hr)	2.92 (4.7)
Permissible water depth limit				in. (mm)	19.7 (500)
Work performance					
Bucket	Width (Standard)			in. (mm)	19.3 (490)
	(Standard. JIS heaped capacity)			cu.ft. (cu.m)	2.82 (0.08)
	Number of teeth / Installation method			pcs.	3 / rubber pin lock type
Maximum digging depth	With blade raised			in. (mm)	106.3 (2700) <102.4 (2600)>
	With blade on the ground			in. (mm)	112.2 (2850) <108.3 (2750)>
Maximum depth of vertically digging				in. (mm)	86.6 (2200) <86.6 (2200)>
Maximum dumping height (canopy/cabin)				in. (mm)	109 (2770)/109 (2770) <111.4 (2830)/111.4 (2830)>
Minimum front swing radius (with boom in front) (canopy/cabin)				in. (mm)	79.9 (2030)/79.9 (2030) <74.8 (1900)/74.8 (1900)>
Minimum front swing radius (at 75 degrees right boom swing)			Cabin	in. (mm)	65.7 (1670) <61.0 (1550)>
			Canopy	in. (mm)	65.7 (1670) <61.0 (1550)>
Rear end swing radius				in. (mm)	30.1 (765)
Boom swing angle		Cabin	Left	degrees	50
			Right	degrees	75
		Canopy	Left	degrees	50
			Right	degrees	75
Maximum digging force		Bucket		lbs. (kN)	4961 (22.1) <5292 (23.5)>
		Arm		lbs. (kN)	3308 (14.7) <3418 (15.2)>
Maximum tractive force (Oil pressure force) (steel/rubber)				lbs. (kN)	5998 (26.7)/5513 (24.5)
Maximum swing inclination angle (with standard bucket)				degrees	20

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3-7 List of Tightening Torque

3-7-1 Machine

Unit : ft•lbf (N•m)

Applicable model:			ViO27-2, ViO35-2		
Equipment			Thread size	Tightening torque	Adhesive
	No.	Tightening part			
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	M12	32.6 to 43.4 (44.1 to 58.8)	4T torque
	2	Engine × Engine mount (Radiator side)	M12 (10.9T)	79.6 to 94.0 (107.9 to 127.5)	Three Bond 1324
	3	Engine × Engine mount (Flywheel side)	M10 (10.9T)	47.0 to 54.3 (63.7 to 73.6)	Three Bond 1324
	4	Engine stopper × Engine mount	M10	32.6 to 43.4 (44.1 to 58.8)	Three Bond 1324
	5	Engine bracket × Turning frame (fan side)	M12 (10.9T)	79.6 to 94.0 (107.9 to 127.5)	Three Bond 1324
	6	Engine bracket × Turning frame (Flywheel side)	M12 (10.9T)	57.9 to 72.3 (78.5 to 98.0)	Three Bond 1324
	7	Hose clip 48,70 (Intake hose installation)	–	1.63 to 1.85 (2.2 to 2.5)	
	8	Battery holding rod	Nut M6	1.45 to 2.17 (1.96 to2.94)	Lock nut 3.62 to 4.34 ft•lbf (4.9 to 5.88 N•m)
	9	Fuel gauge unit	Pan head screw M5	0.89 to 1.11 (1.2 to 1.5)	
	10	Fuel gauge hose	Hose clip 13	0.74 to 1.11 (1.0 to 1.5)	
	11	CW-T (A-B-C)	Hose clip 41	1.63 to 1.85 (2.2 to 2.5)	
	12	Battery cable terminals	Nut M6	2.17 to 2.89 (2.94 to 3.92)	
	13	Air cleaner	M8	14.5 to 16.6 (19.6 to 22.6)	
	14	Fuel tank band	Nut M10	1.85 to 2.15 (2.5 to 2.9) <Tank tighten side>	18.1 to 23.9 ft•lbf (24.5 to 32.4 N•m) <Lock nut side>
	15	Radiator cap	M6	2.17 to 5.06 (2.94 to 6.86)	
	16	Sub tank	M6	1.11 to 1.48 (1.5 to 2.0)	
	17	Safety starter switch (high-speed travel)	Lock nut M18 (Fine screw thread)	21.7 to 25.3 (29.4 to 34.3)	
Driving system					
	1	Sprocket (ViO27-2)	M10	32.6 to 43.4 (44.1 to 58.8)	Three Bond 1324
	2	Sprocket (ViO35-2)	M12	57.9 to 72.3 (78.5 to 98.1)	Three Bond 1324
Travel device					
	1	Plugs (idler, adjust cylinder & carrier roller)	PT 1/8	6.51 to 7.23 (8.83 to 9.81)	Loctite 572
	2	Idler seal cover × Crawler spring	M10	32.6 to 43.4 (44.1 to 58.8)	Three Bond 1324
	3	Track roller tightening nut	M16	151.9 to 180.8 (205.9 to 245.2)	Three Bond 1324
	4	Nipple valve	M16	36.2 (49.0)	

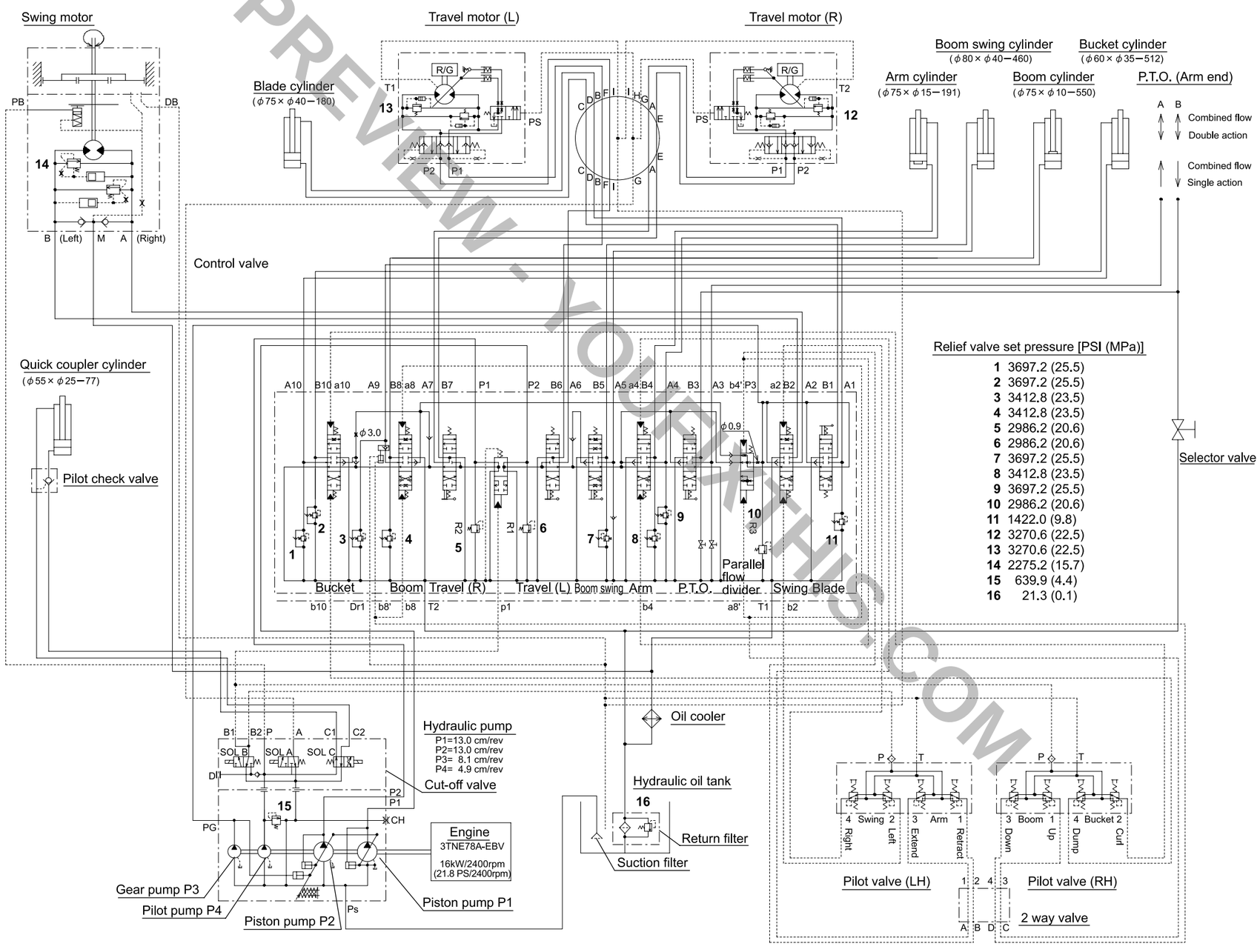
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5. HYDRAULIC SYSTEM

5-2 Hydraulic Circuit Schematic

5-2-1 Quick Coupler

Applicable model : ViO27-2

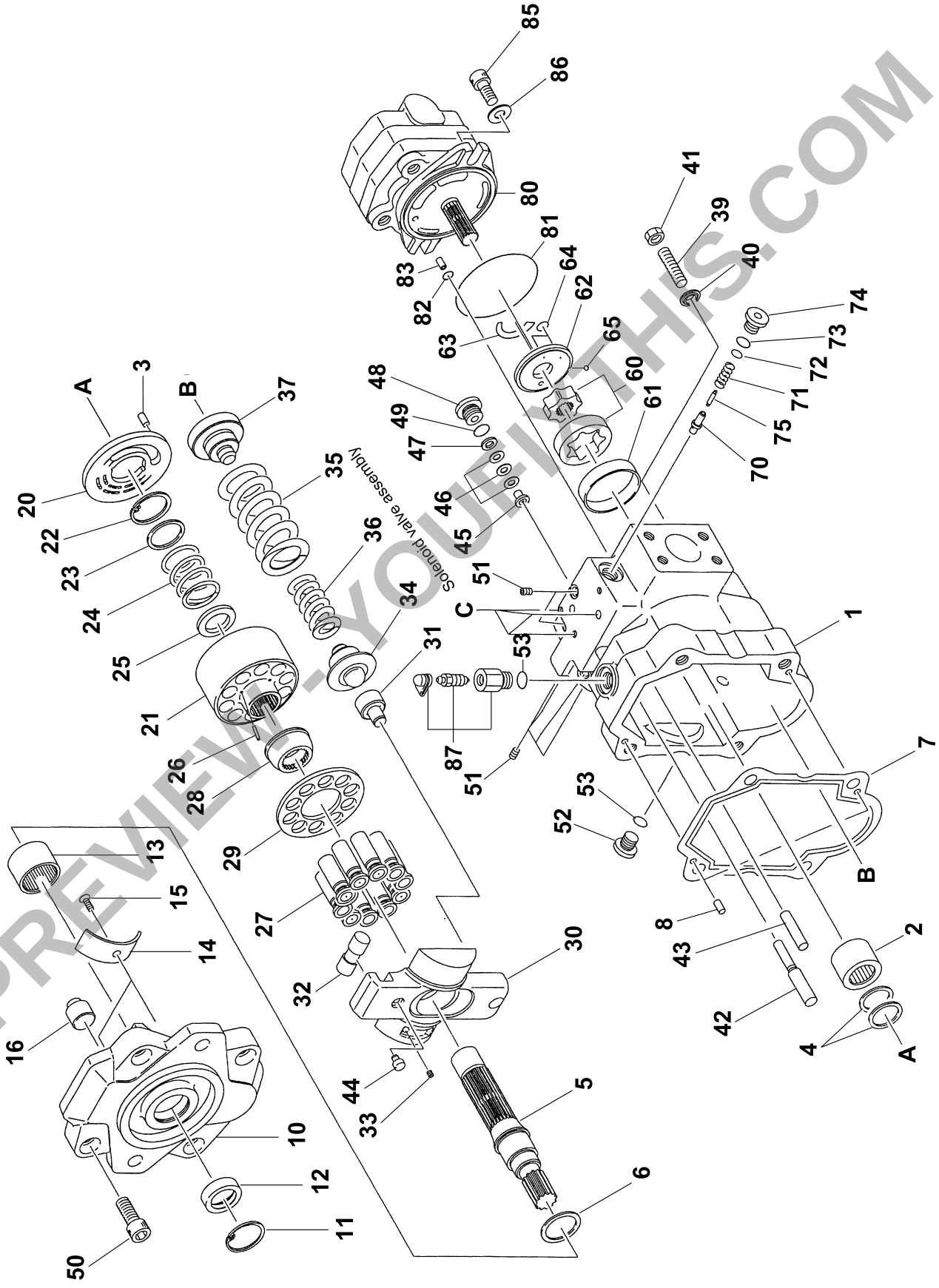


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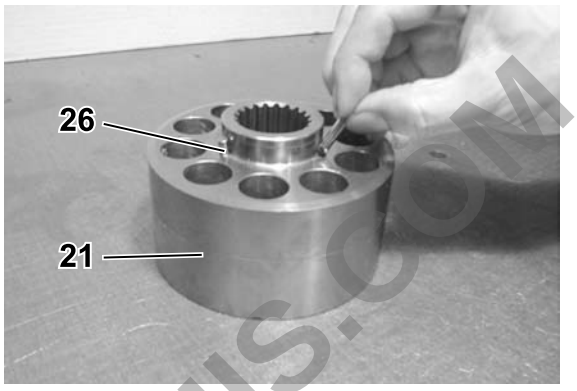
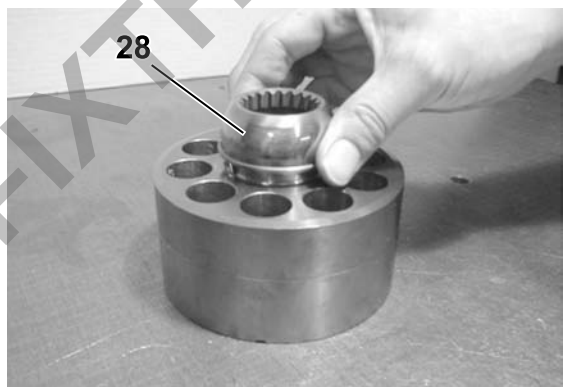
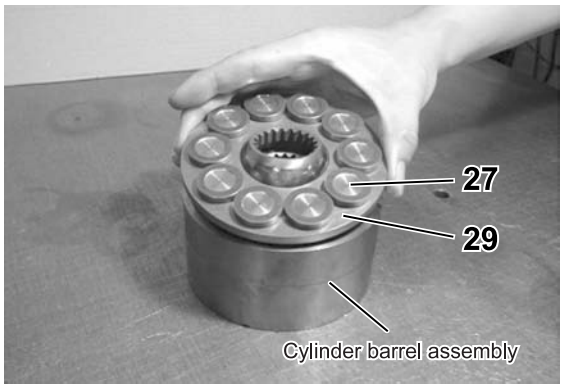
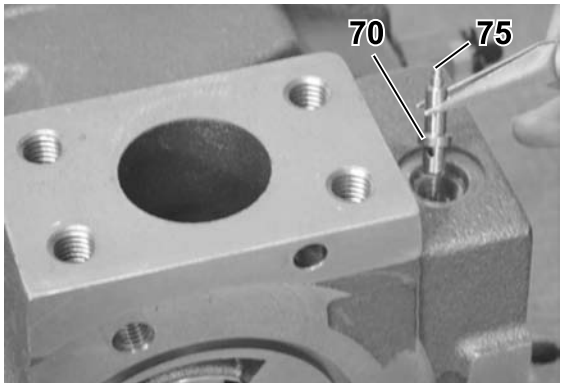
3. Exploded View and Parts Comprised

1) Hydraulic Pump



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4) Reassembly

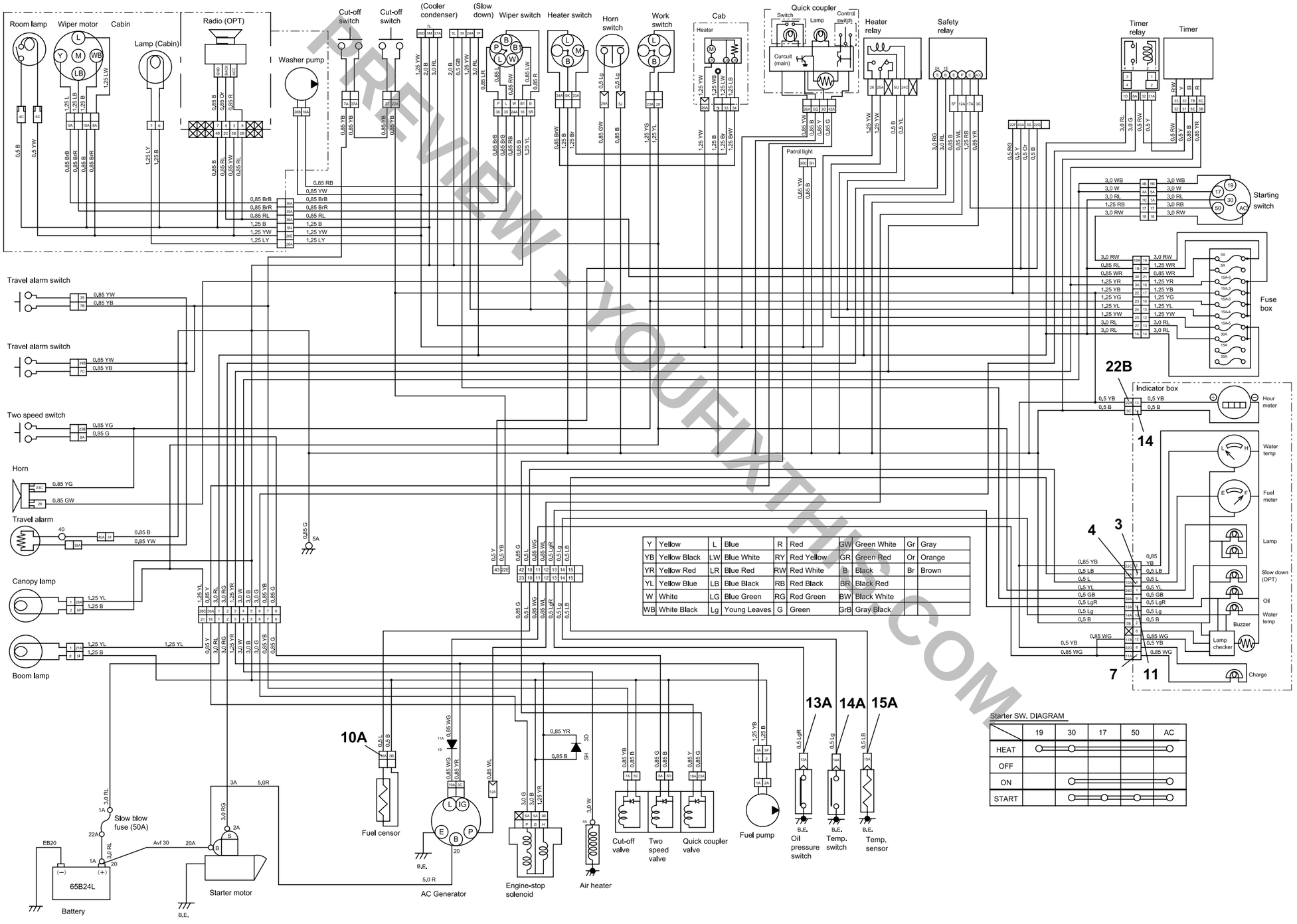
Procedure	
(1) Apply grease to the pins **26** and install them into the cylinder barrel **21**.	
(2) Insert the retainer holder **28** into the cylinder barrel **21**.	
(3) Install the piston assembly **27** into the tapered bore in the center of the retainer plate **29** from its small-diameter side and insert them into the cylinder barrel. ***Notes :*** • *Confirm that the tapered bore surface in the center of the retainer plate **29** contacts with the side surface of the retainer holder **28**.* • *When only the small-diameter side end surface of the tapered bore in the center of the retainer plate **29** contacts with the retainer holder **28**, the retainer plate **29** has been installed upside down. Remove and reinstall it in the correct direction.*	
(4) Install the poppet **70** and the pin **75** into the housing **1**. ***Note :*** *Take care about the direction of the poppet.*	

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7. ADJUSTMENT AND REPAIR

7-1-3 Wiring Diagram

1) Standard Specifications



Y	Yellow	L	Blue	R	Red	GW	Green White	Gr	Gray
YB	Yellow Black	LW	Blue White	RY	Red Yellow	GR	Green Red	Or	Orange
YR	Yellow Red	LR	Blue Red	RW	Red White	B	Black	Br	Brown
YL	Yellow Blue	LB	Blue Black	RB	Red Black	BR	Black Red		
W	White	LG	Blue Green	RG	Red Green	BW	Black White		
WB	White Black	Lg	Young Leaves	G	Green	GrB	Gray Black		

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8. PERIODIC INSPECTION AND SERVICING

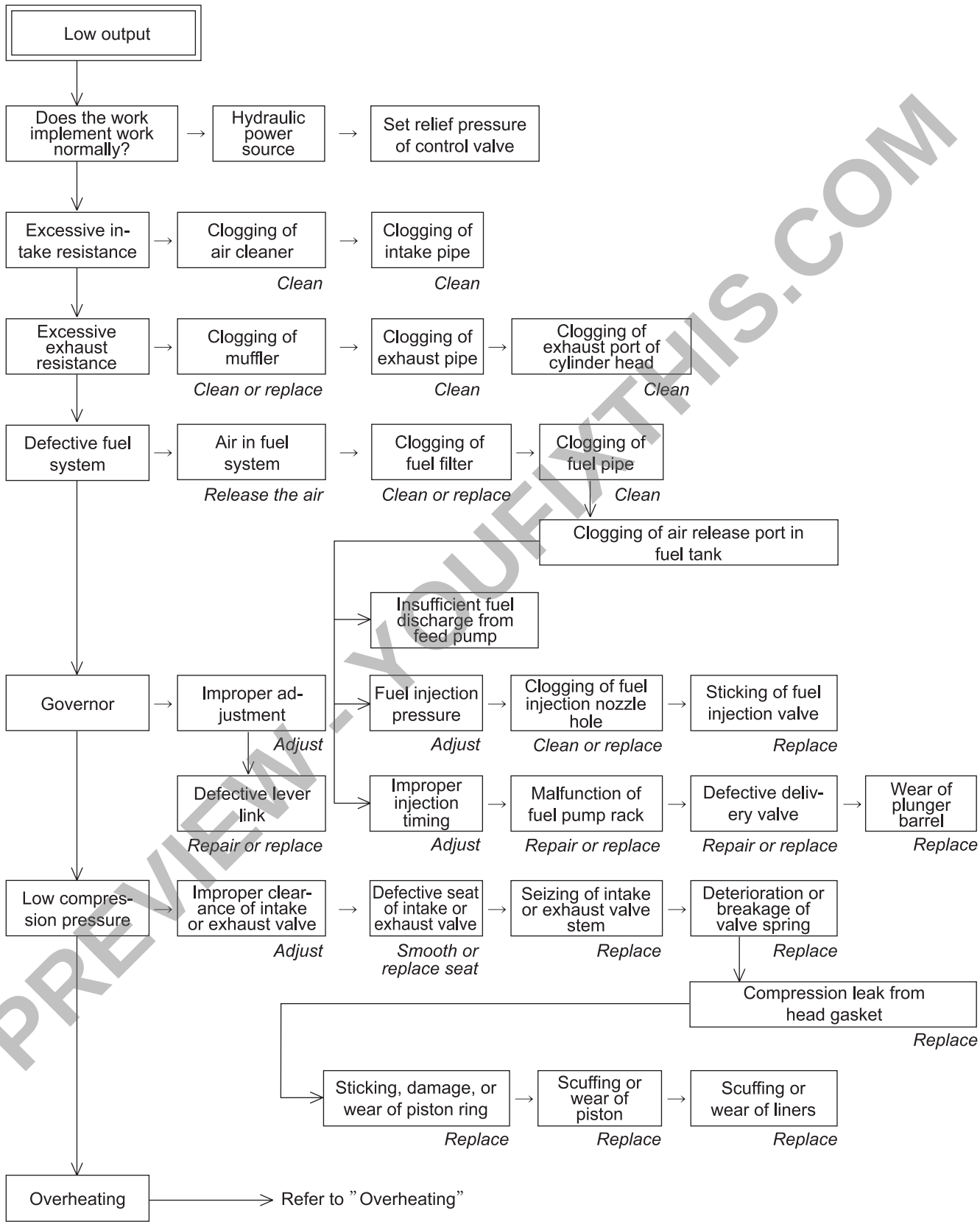
8. Periodic Inspection and Servicing

8-1 List of Periodic Inspection and Servicing

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

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

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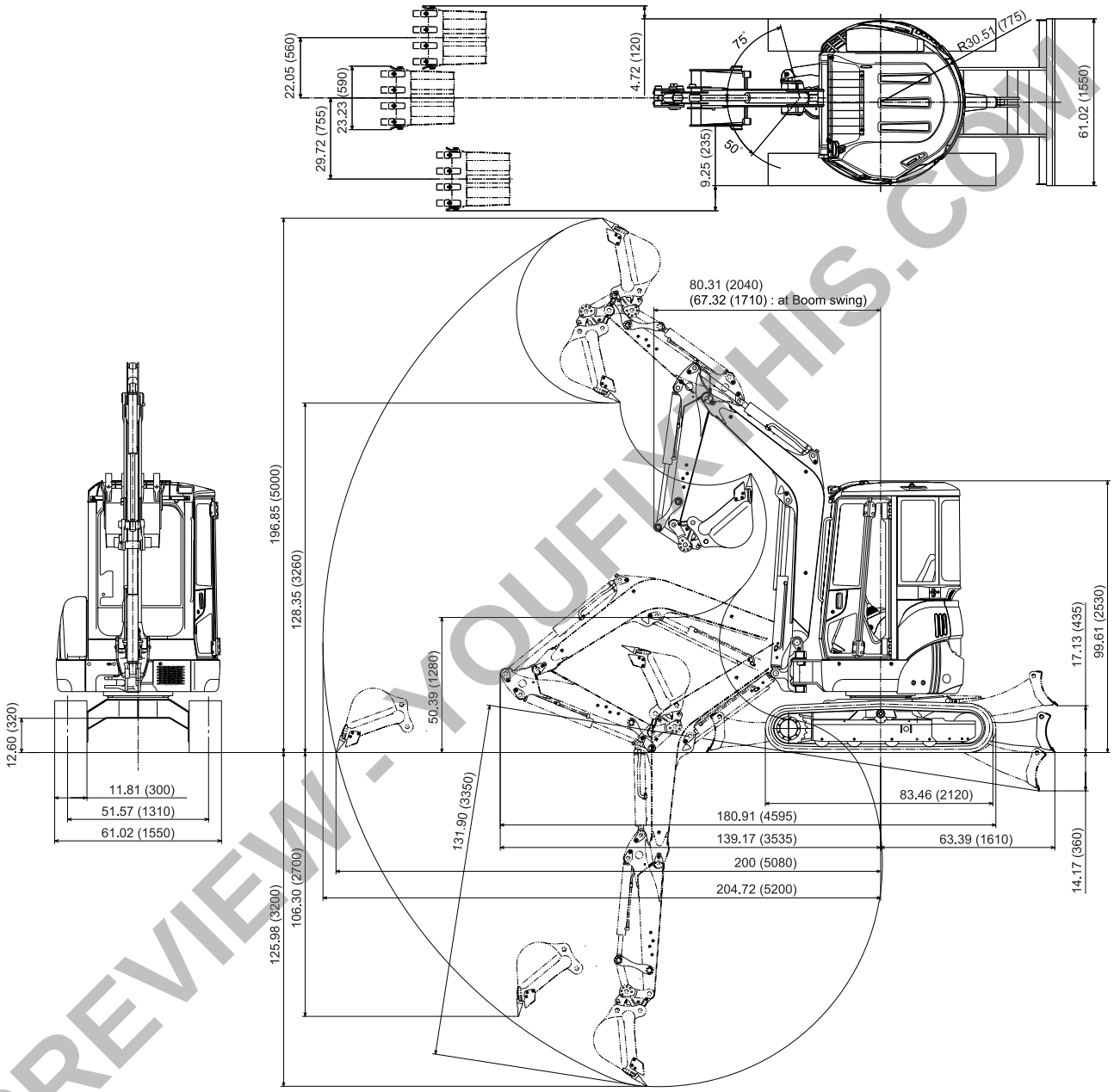
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in. (mm)

Outline drawing of excavator with cabin : ViO35-2 (Quick coupler)



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3. SERVICING STANDARDS

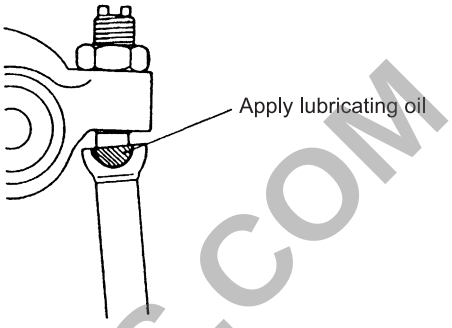
Unit : ft•lbf (N•m)

Applicable model:			ViO27-2, ViO35-2		
Equipment No.		Tightening part	Thread size	Tightening torque	Adhesive
Controls					
	1	Levers (L, R) × Pilot valve	Nut M14	54.3 to 61.5 (73.6 to 83.4)	Three Bond 1324
	2	Knobs (L, R) × Levers (L, R)	Binding head screw M4	1.48 to 1.92 (2.0 to 2.6)	Three Bond 1324
	3	L-ball 8 × Link ball 8	Nut M8	9.4 to 12.3 (12.7 to 16.7)	
	4	L-ball 8 × Rod,Link ball 8	Nut M8	5.79 to 7.23 (7.84 to 9.8)	
	5	Valve mount × Turning frame	Flange bolt M10	14.5 to 18.8 (19.6 to 25.5)	Three Bond 1324
	6	Accelerator cable	Nut M6	2.89 to 3.62 (3.92 to 4.9)	
	7	Blade cable	Nut M12	14.5 to 18.1 (19.6 to 24.5)	
Frame					
	1	Swing bearing × Lower frame	M14	180.8 (245)	Loctite 262
	2	Swing bearing × Turning frame	M14	180.8 (245)	Loctite 262
	3	Counter weight × Turning frame	M24	354.4 to 441.3 (480.5 to 598.2)	Three Bond 1324
	4	Crawler guard (steel crawler only)	M12	57.9 to 72.3 (78.5 to 98.1)	Three Bond 1324
	5	Bracket × Turning frame	M16	123.0 to 151.9 (166.7 to 205.9)	Three Bond 1324
Hydraulic equipment					
	1	CF Coupling	Hexagon socket head bolt M12	61.5 to 68.0 (83.4 to 92.2)	Three Bond 1324
	2	Swivel joint × Track frame	M10	32.6 to 43.4 (44.1 to 58.8)	Three Bond 1324
	3	Swing motor × Turning frame	M14	86.8 to 108.5 (117.7 to 147.1)	Three Bond 1324
	4	Travel motor × Track frame (ViO27-2)	M10	32.6 to 43.4 (44.1 to 58.8)	Three Bond 1324
	5	Travel motor × Track frame (ViO35-2)	M12	57.9 to 72.3 (78.5 to 98.1)	Three Bond 1324
	6	Hydraulic oil tank × Turning frame	M14	86.8 to 108.5 (117.7 to 147.1)	Three Bond 1324
	7	Drain plug 24 × Hydraulic oil tank	M24	115.7 to 137.4 (156.9 to 186.3)	
	8	Oil level gauge × Hydraulic oil tank	M10	10.9 to 11.6 (14.7 to 15.7)	
	9	Hose band 14	–	0.72 (0.98)	
	10	Hose clip 16	–	1.81 to 2.52 (2.45 to 3.4)	
	11	Hose clip 25 & 35	–	2.89 to 3.62 (3.92 to 4.9)	
	12	Hose clip 60 & 70	–	3.62 to 4.34 (4.9 to 5.88)	
	13	Breather cover (for hydraulic oil tank)	Pan head screw M5	2.0 to 3.0 (2.7 to 4.1)	
	14	Flange (pump)	M10	18.1 to 23.9 (24.5 to 32.4)	

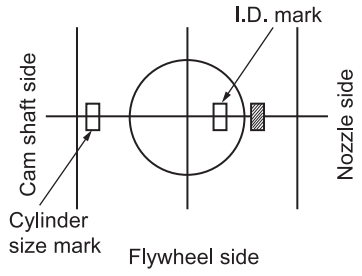
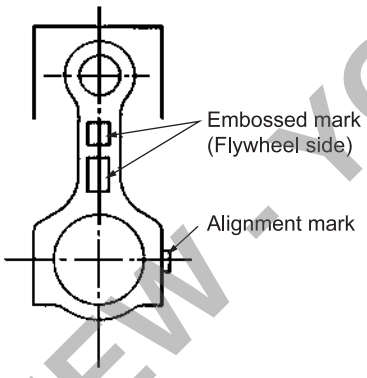
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8) Applying Lubricating Oil to the Push Rod Adjust Screw Contact Portion

Apply lubricating oil to the hatched portion of the push rod as shown in the figure, before reassembly.

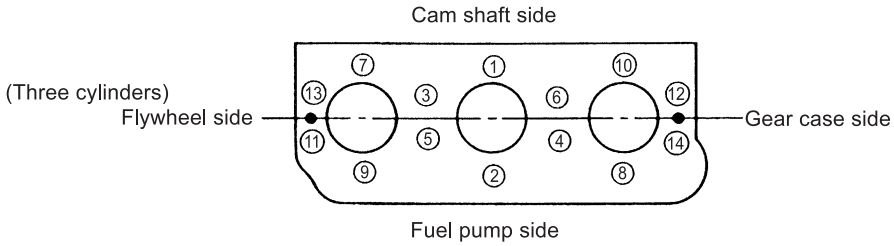


9) Installation Direction of the Piston and the Connecting Rod

Piston	
Connecting rod	

10) Tightening Order and Tightening Torque of the Cylinder Head Bolts

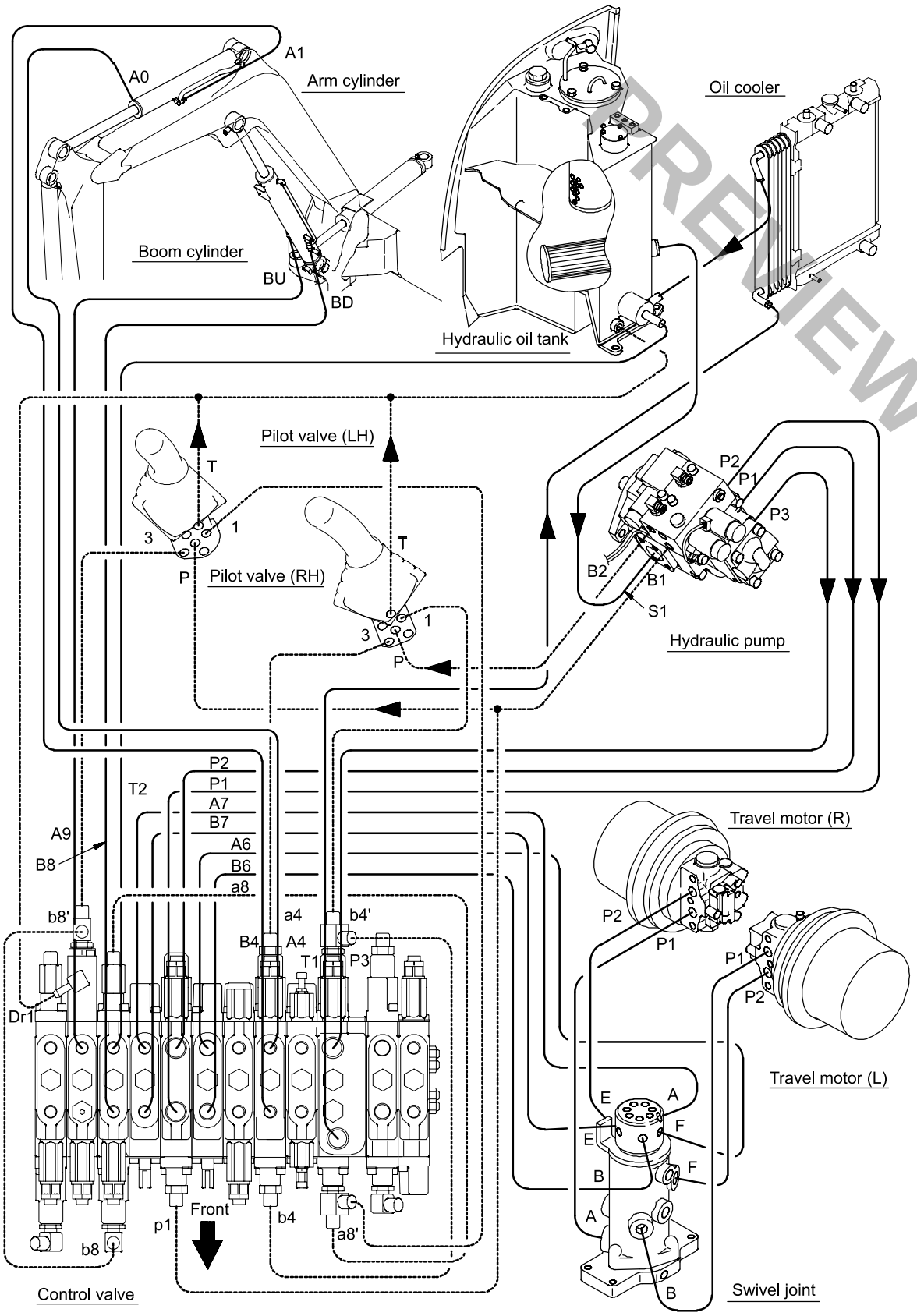
Tighten the cylinder head bolts at a specified tightening torque in the numerical order as shown below.



Tightening torque	Refer to Section "3-7-2 Engine Tightening torque for major bolts and nuts".

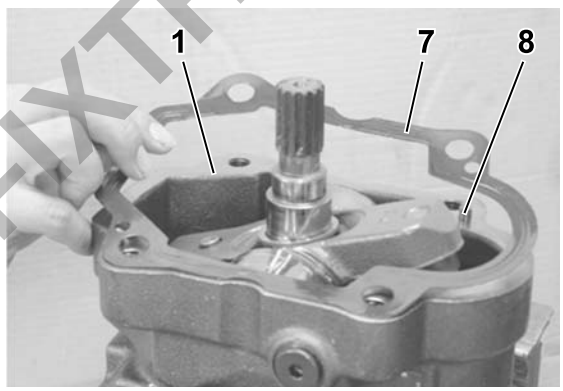
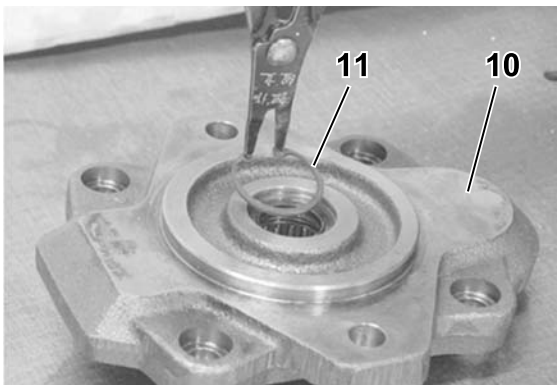
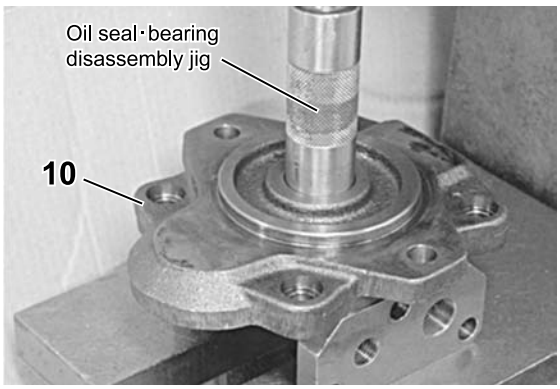
11) After Completing the Reassembly, Carry Out a Verification Run of the Engine to Check That There is No Water or Oil Leakage.

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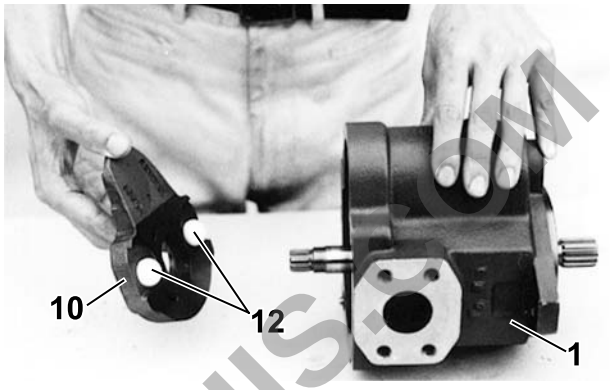
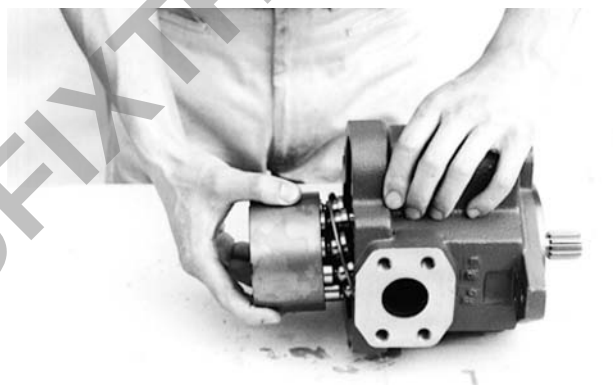
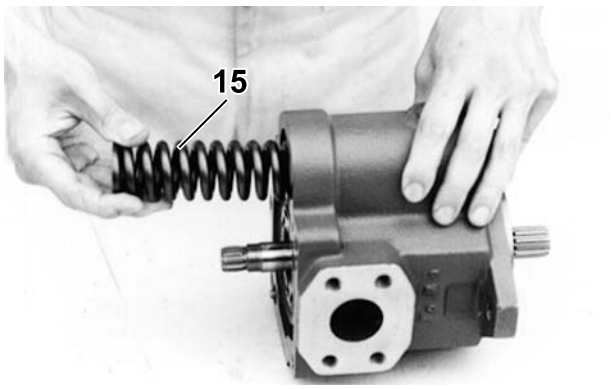


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Procedure	
(9) Remove the flange **10**.	
(10) Remove the gasket **7** and the pins **8** from the flange **10** or the housing **1**.	
(11) Remove the internal snap ring **11** from the flange **10**.	
(12) Press the oil seal **12** and the needle bearing **13** with a hand press to remove them from the flange **10**.	

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Procedure	
(4) Put the rocking pins **12** into the holes in the swash plate **10**, and install it with the rocking pins fitted into the holes in the body S **1**.	
(5) Install the cylinder barrel kit into the body S **1**.	
(6) Install the spring holder **16** on the spring T 1 **15**, and fit the globular part of spring holder **16** into the hole in the swash plate **10**.	
4. Installation of body H kit (1) Install the spring guide **17** into the body H **2**.	

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3) Disassembly

3)-1. Removal of spools

(1) Pilot operated type (swing, parallel-flow divider, and arm sections)

Remove each spool as in example of the removal procedure of the swing spool given below.

[1] Remove the two hexagon socket head bolt and SWP washer assemblies **10** with a hexagon bar wrench (4 mm).

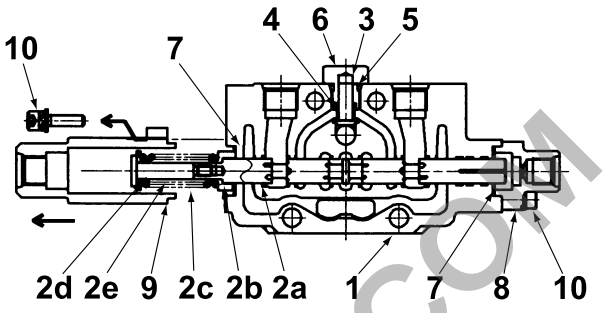
[2] Remove the pilot case A1 **9.**

[3] Slowly pull the spool assembly (**2a-2e**) out of the valve holding the spool assembly by the spring part in the level direction with the spool bore.

[4] The other pilot spools (for parallel-flow divider and arm sections) are able to be removed in the same procedure and the same direction.

Note :

*At this time, check the O-ring **7** is installed at the bottom of the flange for pilot case on the body side.*



Pilot operated type
(Swing, Parallel-flow divider, and Arm Sections)

No.		Part
1		Body (symbol GE)
2		Swing spool assembly
	a	Valve rod (for swing)
	b	Return spring holder
	c	Return spring (26 K)
	d	Return spring holder
	e	Valve rod edge
3		Check valve
4		Check valve spring
5		O-ring 1B P11
6		Check valve retainer
7		O-ring 1B S22
8		Pilot case B1
9		Pilot case A1
10		Hexagon socket head bolt M5×20 flows washer assembly

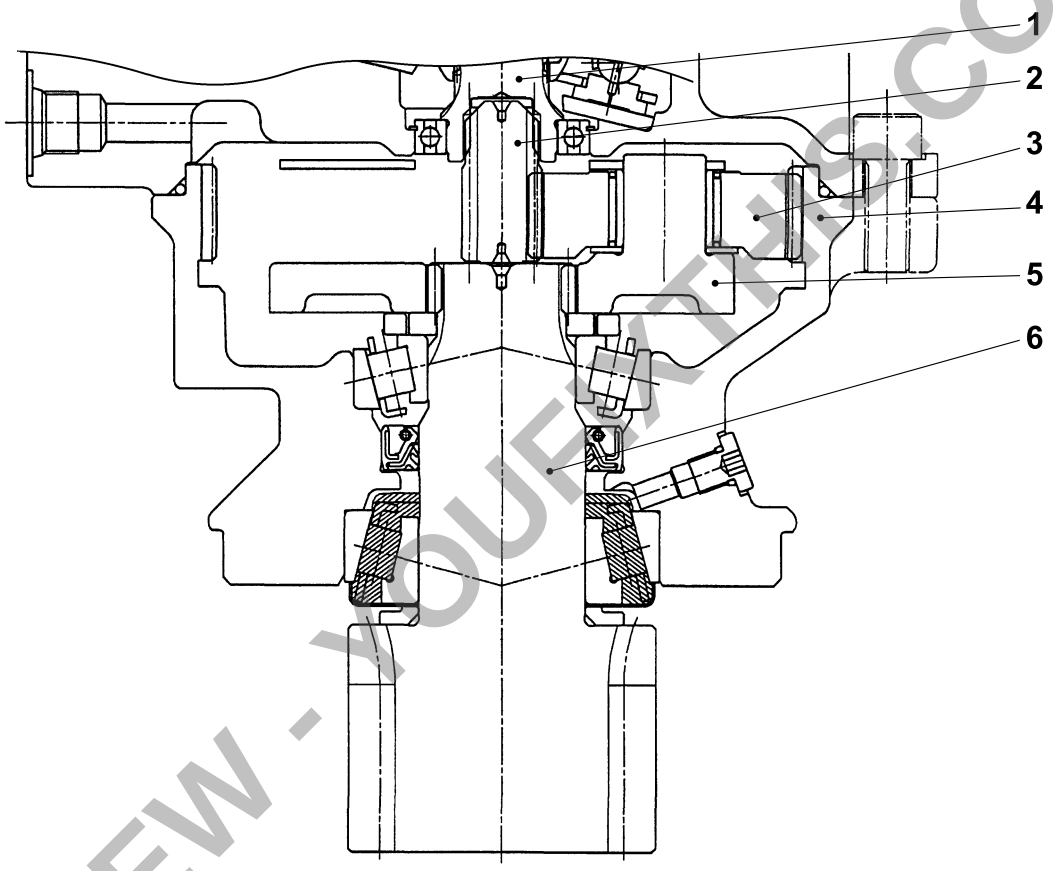
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5) Reduction Gear

(1) Planetary single reduction gear (for ViO27-2 type)

The motor shaft **1** is splined to the drive gear **2**. The drive gear **2** engages with the planetary gears **3**. The planetary gears **3** engage with the ring gear of reduction gear housing **4**. The planetary gears **3** are held by the holder **5**. The holder **5** and pinion shaft **6** are splined with each other.

The driving force of the hydraulic motor is outputted from the motor shaft **1**, and then transmitted to the pinion shaft **6** through the drive gear **2**, the planetary gears **3** and the holder **5**.



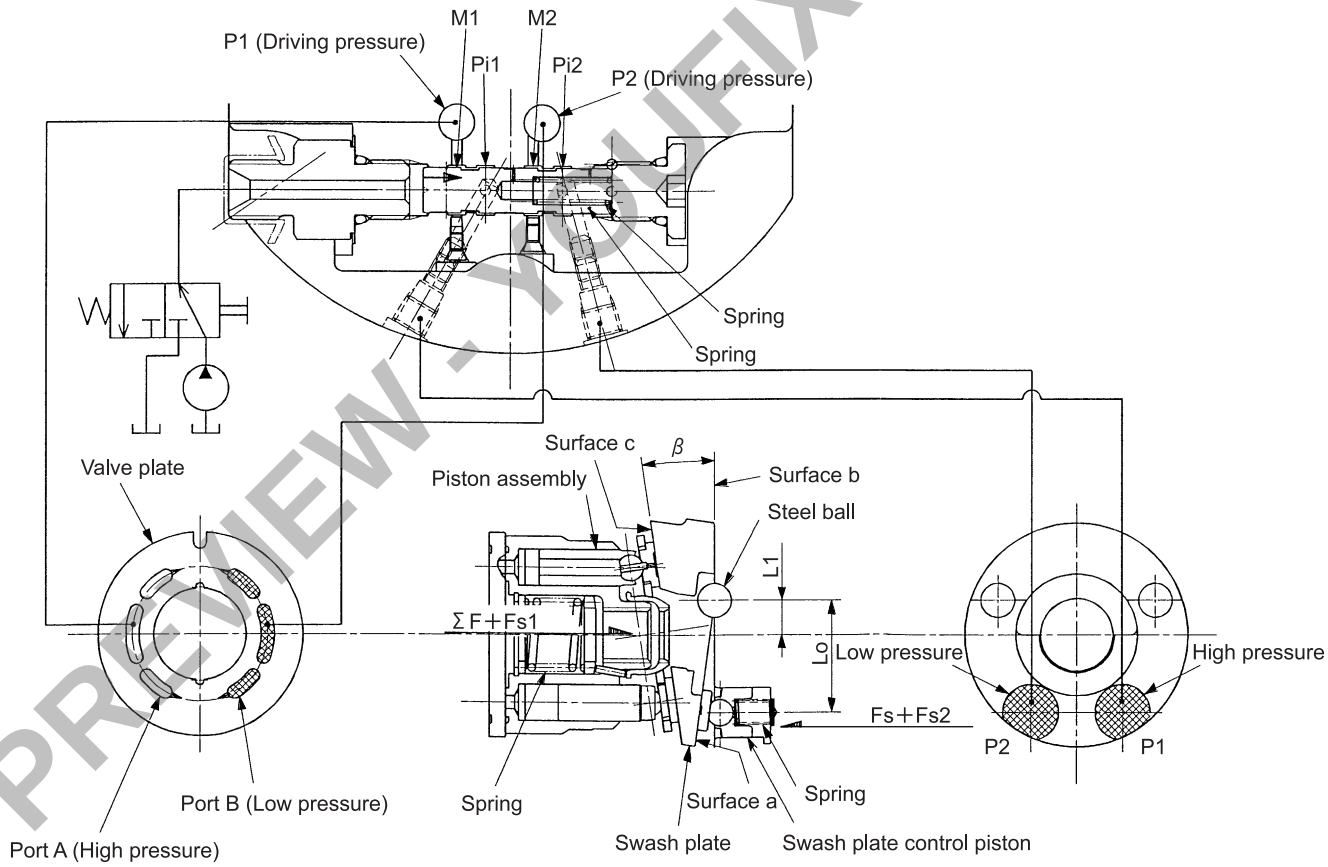
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2) 2nd Speed (High Speed)

When the control valve is switched to the high speed position, the pressure oil from the pump is led to the end face of the spool and the spool is shifted to the position as shown in the left figure. This causes the ports M1 and M2 to open and the hydraulic oil from the port A (high pressure) in the valve plate of the motor is supplied to the swash plate control piston though the valve port M1. This pressure oil pushes up the swash plate control piston, which overcomes the motor thrust force and the spring force, and the surface a of the swash plate is detached from the vertical surface to cause the surface b to be contacted with the vertical surface tightly. When the surface b contacts with the vertical surface, the inclination angle of the surface c, which is the sliding surface of the swash plate, is reduced to "β". Accordingly, the stroke of the piston is reduced to lower the motor displacement. The motor with smaller displacement rotates faster (high speed).

When the motor revolves in reverse, the same action as the above occurs, except that the high and low pressure ports are reversed.

When the engine is stopped, since no pumps work, no pressure oil is supplied to the end face of the spool and the spool returns to the 1st speed position by the spring force. Accordingly, no force is applied to the swash plate control piston to press the swash plate, and the swash plate maintains its low inclination angle "α" through the spring force. Thus, the low speed condition is always maintained at starting.

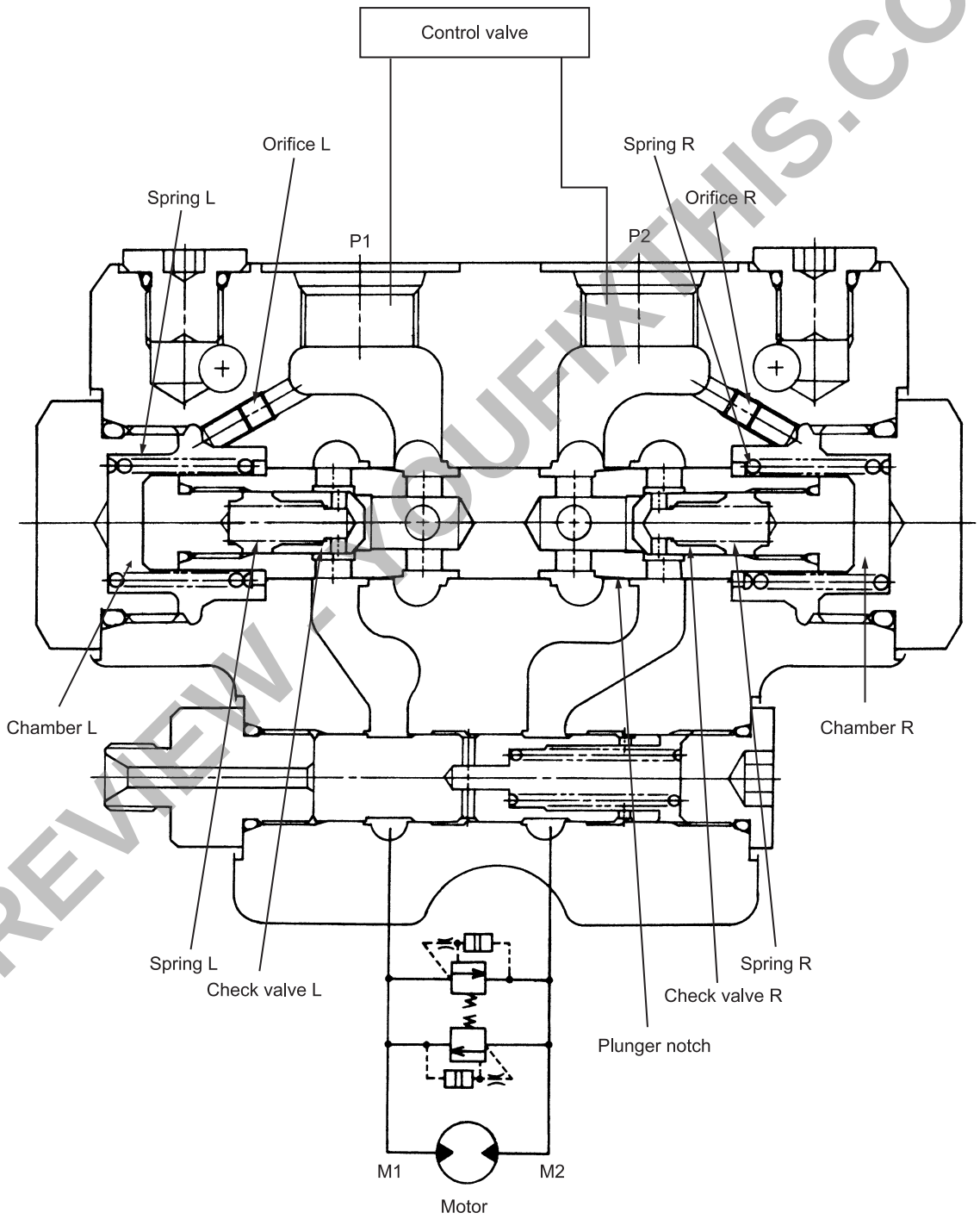


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2) Counter Balance Valve

The counter balance valve works to reduce the shock caused when the piston motor stops and to prevent it from overrunning a specified speed due to external loading.

When the control valve is moved to the neutral position, the hydraulic oil flow to the ports P1 and P2 is blocked. This causes the pressures in the chambers R and L to fall to nearly zero, and the spool is returned to the neutral position by the force of the springs on both sides. When the spool is returned to the neutral position, the ports M1 and M2 of the piston motor are blocked by the plunger and the check valve, and the motor is stopped rotating.



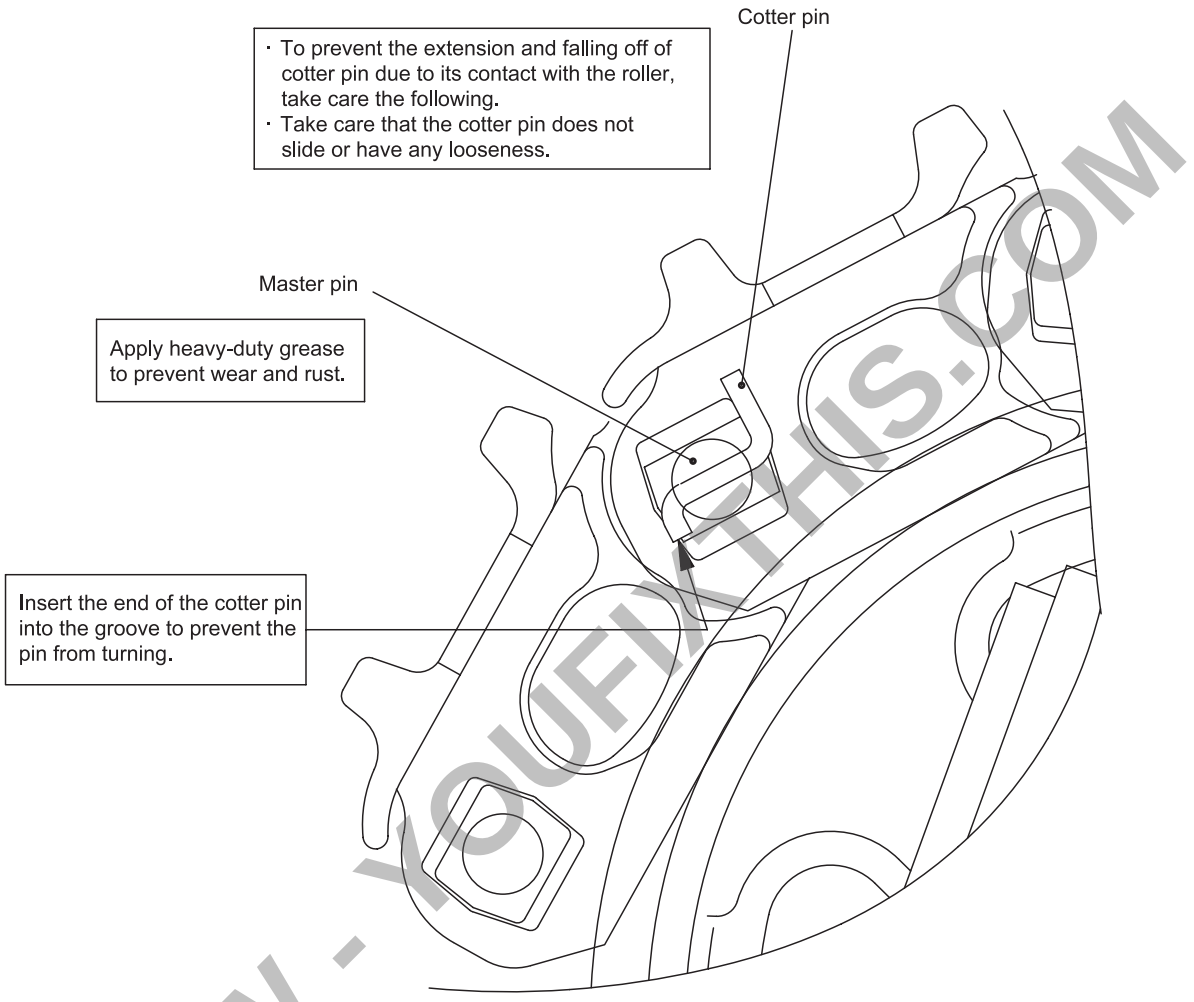
Structure of counter balance valve

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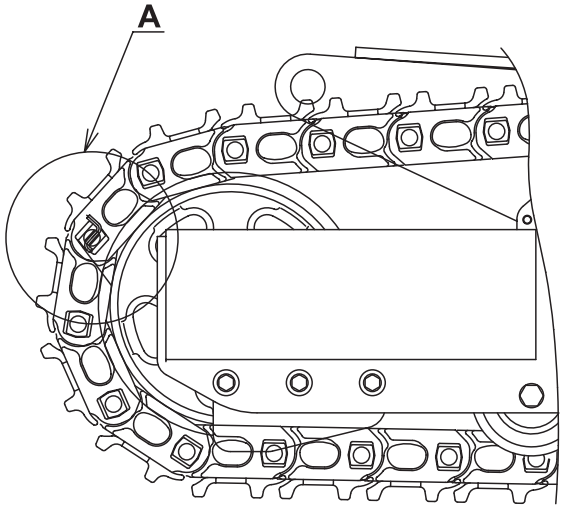
No.	Parts	Inspection item	Standard value (recommended value for replacement	Measure
17	CYlinder barrel **40**	Clearance between it and piston assembly. Sliding surface against valve plate. Surface roughness.	0.00079 in. (0.02 mm) (0.00157 in. (0.04 mm)). No excessive flaws (over 0.02 mm), wear or seizure. 0.4 Ra (0.8 Ra).	Replace cylinder barrel and piston assembly together. When sliding surface has roughened, repair it by lapping (#1000). If the damage is beyond repair, replace the cylinder barrel and piston assembly together.
18	Springs **35, 43, 59, 63, 67** and **78**	Breakage or distortion.		Replace.
19	Piston assembly **37**	Clearance between it and cylinder barrel. Sliding surface against swash plate and surface roughness. Play between pistons and shoes.	Same as No. 17. Same as No. 16. 0.00591 in. (0.15 mm) (0.0158 in. (0.4 mm).	Same as No. 17. Same as No. 16. Replace.
20	Piston assembly **34**	Clearance between it and flange holder. Sliding surface against swash plate and surface roughness.	Same as No. 17. Same as No. 16.	Same as No. 17. Same as No. 16.
21	Valve plate **46**	Sliding surface against cylinder barrel and surface roughness. Thickness : 0.197 in. (5 mm).	Same as No. 17. 0.189 in. (4.8 mm).	Same as No. 17. Replace.
22	Base plate **53**	Sliding surface against plunger. Sliding surface against spool.	No. excessive flaws, wear or seizure. No excessive flaws, wear or seizure.	Replace base plate and plunger together. Replace base plate and spool together.
23	Plunger **57**	Sliding surface against base plate. Sliding surface against check valve.	No excessive flaws, wear or seizure. No excessive flaws, wear or seizure.	Replace base plate and plunger together. Replace plunger and check valve together.
24	Check valve **58**	Sliding surface against plunger. Seat surface against plunger.	No excessive flaws, wear or seizure. The plunger is seated completely.	Replace plunger and check valve together. Replace plunger and check valve together.
25	Spool **66**	Sliding surface against base plate.	No excessive flaws, wear or seizure.	Replace base plate and spool together.

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• How to bend cotter pins (For steel crawler)



Details of A

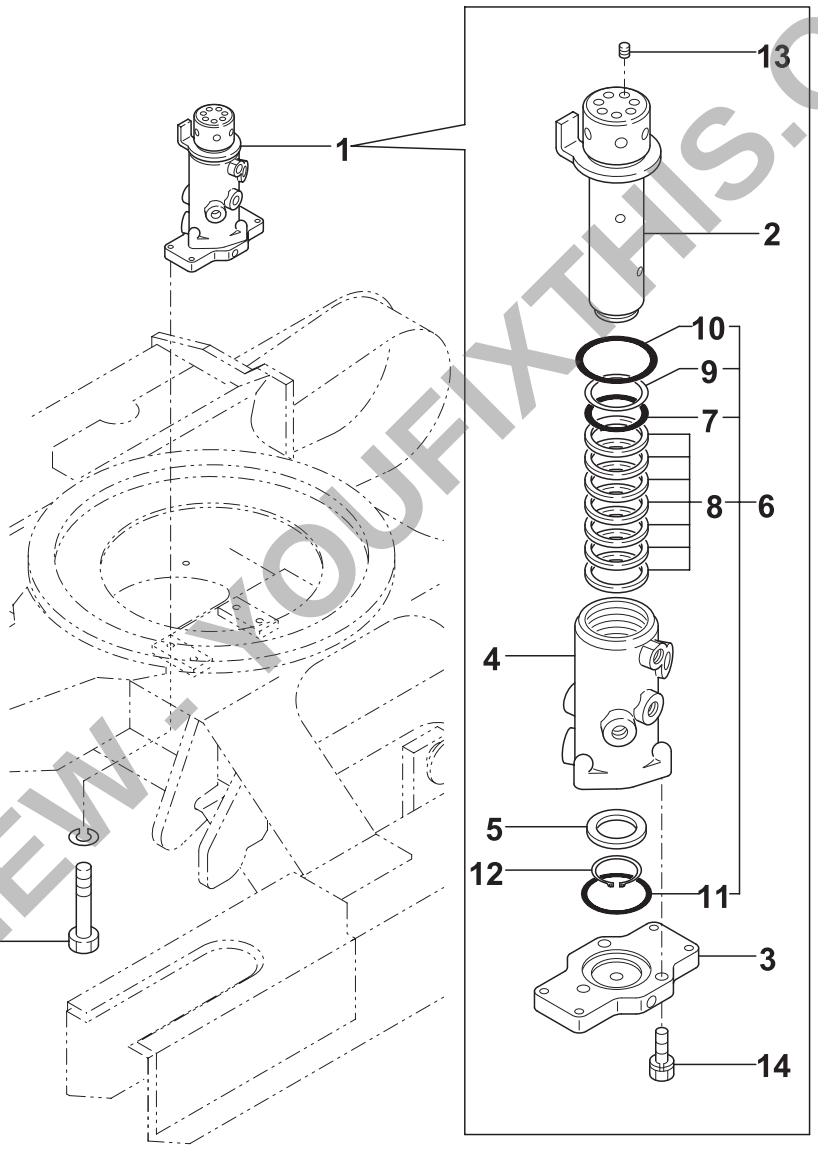


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7-5-5 Disassembly and Reassembly of Swivel Joint

1) Swivel Joint

The swivel joint is used to prevent the hydraulic piping from twisting when the upperstructure swings. The swivel joint consists of the shaft, hub and seal kit. The shaft and hub have holes and grooves, and the oil supplied from the port of the shaft, passing through the hub groove, is fed to the actuators of the undercarriage.



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No.	Part	Q'ty	No.	Part	Q'ty
1	Swivel joint assembly	1	8	Seal (O-ring 55.76×5.7)	7
2	Swivel shaft	1	9	Back-up ring	1
3	Swivel flange (with spring washer 10×40)	4	10	O-ring 1A P 75.0	1
			11	O-ring 1A G 70.0	1
4	Swivel hub	1	12	External snap ring	1
5	Swivel spacer	1	13	Screw plug PT 1/4	7
6	Seal kit	1	14	Bolt M 10	3
7	O-ring 55.76×5.7	1	15	Bolt M 10	4

2) Reinstallation

(1) Reinstall the cabin door in the reverse order of the removal procedure.

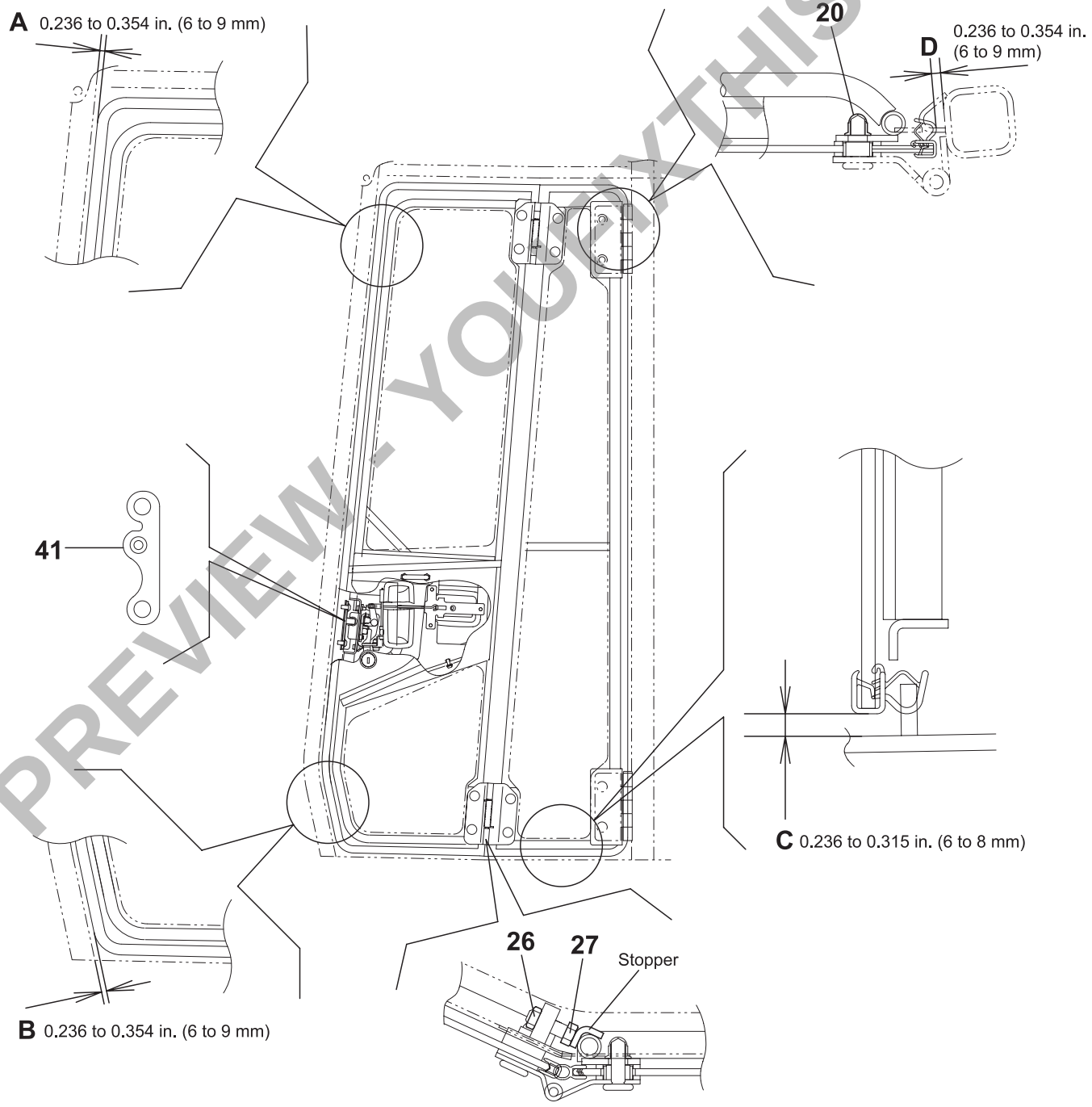
(2) Adjustment of cabin door

[1] Adjustment of clearance between the cabin door and the cabin body.

After adjusting the clearances A, B, C, and D to the respective specified values tighten the cap nuts **20**.

[2] Adjustment of striker

- Fully tighten the bolt **27** (for the stopper) in the lower part of the front door.
- Adjust the striker **41** in the front or back direction, and then set the operating force for closing the cabin door at 110.25 lbs. (50 kg) or less.
- Loosen the bolt **27** until it touches the stopper with the cabin door closed, and then lock it with the nut **26**.

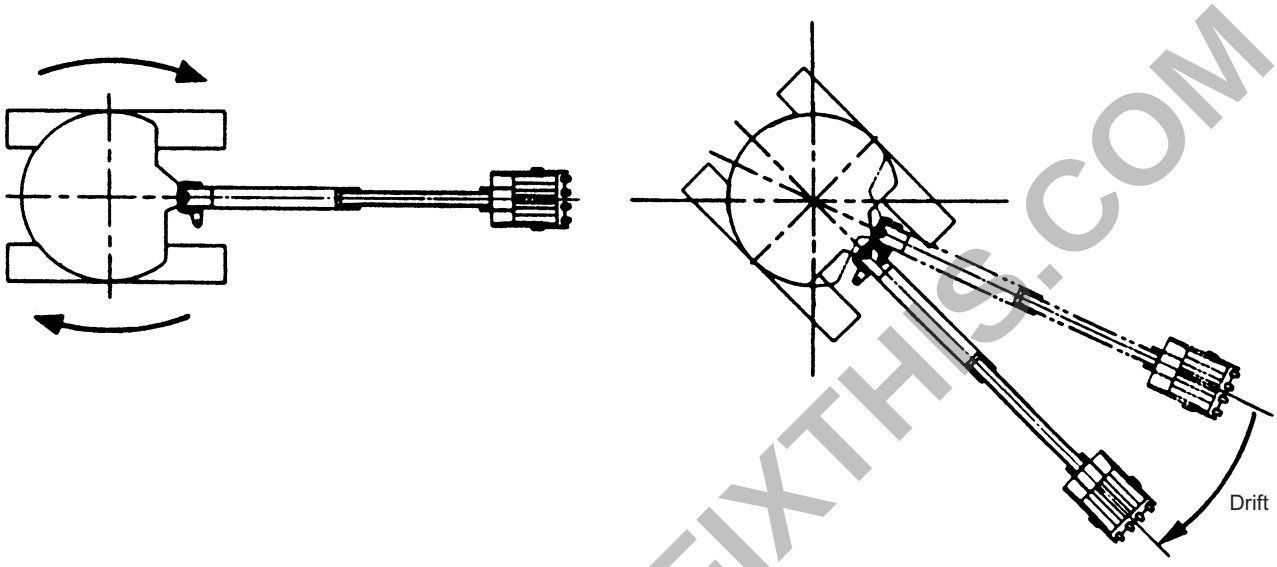


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10-1-3 Drifting of Upperstructure on Quick Travel Operation

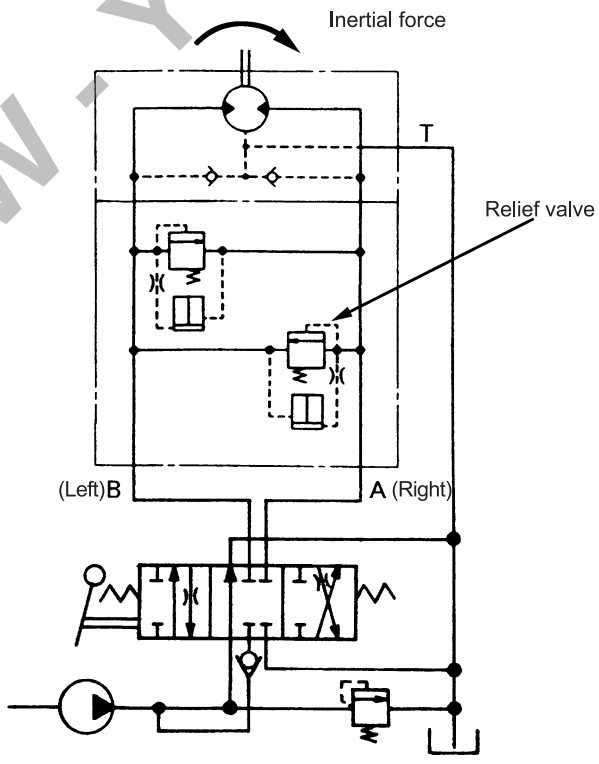
Phenomenon

The upperstructure drifts on quick travel operation (especially, on spin-or pivot-turning).



Reason

Inertial force is given to the upperstructure through the quick operation of the undercarriage, and high pressure is applied to the swing motor. The relief valve is activated to turn the swing motor.
(The mechanical brake is released when the engine is running.)



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