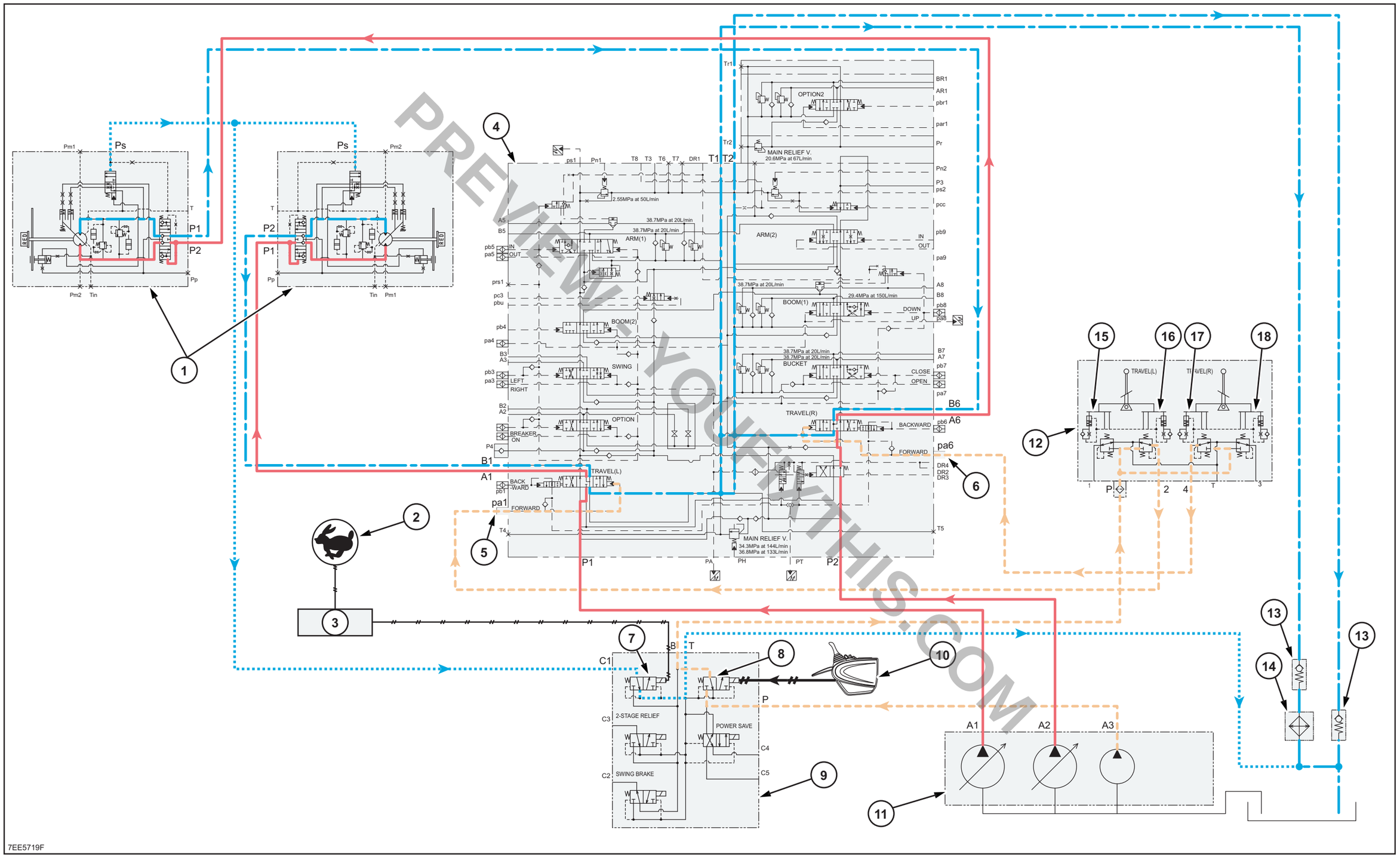
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Travel circuit

Travel low-speed circuit



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Removal and Installation of Shoe Assembly

Warning

- When loosening the grease cylinder check valve, loosen it a little bit at a time.
- The pressure inside the cylinder is very high, so there is the danger of grease being expelled and the plug flying off.
  The check valve adjustment procedure should not be done in front of the check valve.
- Do not get under the main unit when it is jacked up.
  Make sure to place the main unit on crossties to prevent falling.

Caution

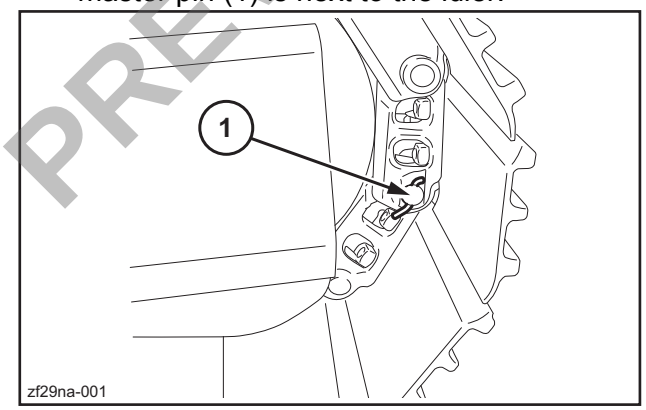
- Make sure to stop the engine for loosening shoes and when removing master pins.

Items to prepare

- Wrenches [17 mm (0.669 in), 19 mm (0.748 in)]
- Box wrench [19 mm (0.748 in)]
- Hammer
- Wood planks, etc.
- Striking jig
- Crowbar
- Rag
- Lifting equipment (with the required breaking load)
- Liftcrane (with the required lifting capacity)

Removal of Shoe Assembly

1. Rotate the shoe and align it so that the master pin (1) is next to the idler.

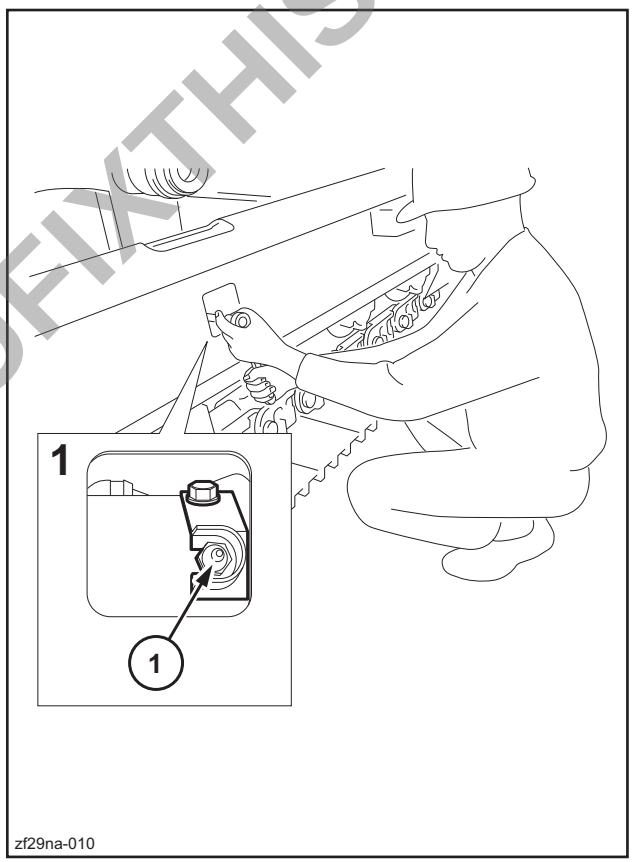


2. Use a box wrench [19 mm (0.748 in)] to loosen the check valve (1) to release grease, and then loosen the track shoe tension.

Warning

- If the check valve (1) is too loose, it may fly off.
- Do not place your body in front.

Do not loosen the check valve all at once. Loosen it slowly while monitoring the grease output and shoe loosening.
Use a rag to catch grease that trickles out of the check valve.



3. Use a wrench [17 mm (0.669 in)] to remove the bolt (1), and then remove the check valve (2) and stopper (3).
   - If the check valve (2) is removed, it is easier to loosen the track shoe tension.

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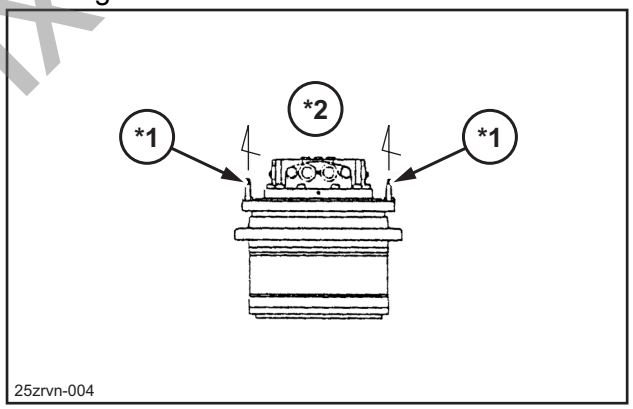
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Motor Disassembly Procedures

Precautions before Motor Disassembly

Begin motor disassembly only after thoroughly reading the precautions below.

1. When performing disassembly, always wear protective gear such as a helmet, goggles and safety shoes.
2. Use the specified tools when performing disassembly.
3. Remove all lines connected to the motor and remove the motor from the machine only after making sure that the machine is on a level surface and there are no external forces acting on rotating parts, so that the machine does not operate uncontrollably when the motor is removed.
4. To prevent foreign matter from entering the lines and motor when removing the motor from the machine, sufficiently clean off mud and dirt adhered around the motor before removing lines connected to the motor.
5. When removing lines connected to the motor, hydraulic oil from inside the lines will spray out.
   For this reason, remove these lines only after removing pressure from inside the lines and preparing an oil pan.
   To prevent injuries due to the motor falling when transporting it by lifting the motor with a liftcrane, lift the machine with the eyebolts mounted in the positions indicated in the diagram below.
6. The motor is filled with hydraulic oil.
   Before disassembling the motor, prepare an oil pan and drain the hydraulic oil from the motor.
7. To prevent injuries during disassembly, prepare a waist-high, stable work platform to perform work on.
8. The motor comprises high-precision parts. For this reason, foreign matter adhering to parts can be damaging.
   Motor disassembly should be done in an inside space without dust, and mud and dirt should be prevented from adhering to parts.
9. The motor comprises high-precision parts. For this reason, dents and scratches on part surfaces can be damaging.
   Be very careful when handling parts during disassembly and do not create any dents or scratching.
10. To prevent personal injury and damage to parts during disassembly, do not force disassembly of parts which are especially tight to disassemble.



*1	Eyebolt
*2	Lifting

Tightening Torque

Table 5 indicates tightening torque for each fastening section.

Reference number	Part name	Screw size	Bolt width	Tightening torque
1-2-2-4	Plug	M24 x 1.5	14 (0.551)	127 - 147 N・m (93.69 - 108.44 lbf・ft)
1-2-6-4	Hexagon socket head bolt	M12 x 1.75 x 40 (1.575) L	10 (0.394)	98 - 118 N・m (72.30 - 87.04 lbf・ft)
1-2-7	Relief valve assembly	1-5/16 12UNF	27 (1.063)	353 - 393 N・m (260.41 - 289.91 lbf・ft)
1-2-8	Plug	NPTF1/16	4 (0.157)	8.8 - 10.8 N・m (6.492 - 7.967 lbf・ft)

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Main Equipment Structure and Operation Explanation

Explanation of Component Device Operation

Travel Motor

Travel motor operation explanation

Double Counter Balance Valve

The purpose of the "double counter balance valve" is to control the speed of the motor according to the feed flow.
Therefore, motor rotation getting away due to external load is prevented.
As the roles of the double counter balance valve, there are

1. The overrun prevention function that controls the piston motor speed to match feed quantity in the state of rotation at or higher than the speed determined by the flow feed from the piston motor for the external load (below, pumping action).
2. The brake function used together with the crossover relief valve to make up the brake circuit that gradually stops the rotation of the piston motor by applying braking force to the piston motor rotation.
3. The high-pressure selection shuttle valve function for releasing the parking brake through its own pressure.
   Diagram 3 shows a structural diagram of the standard double counter balance valve.
   This section explains the operations of each function using this standard double counter balance valve.

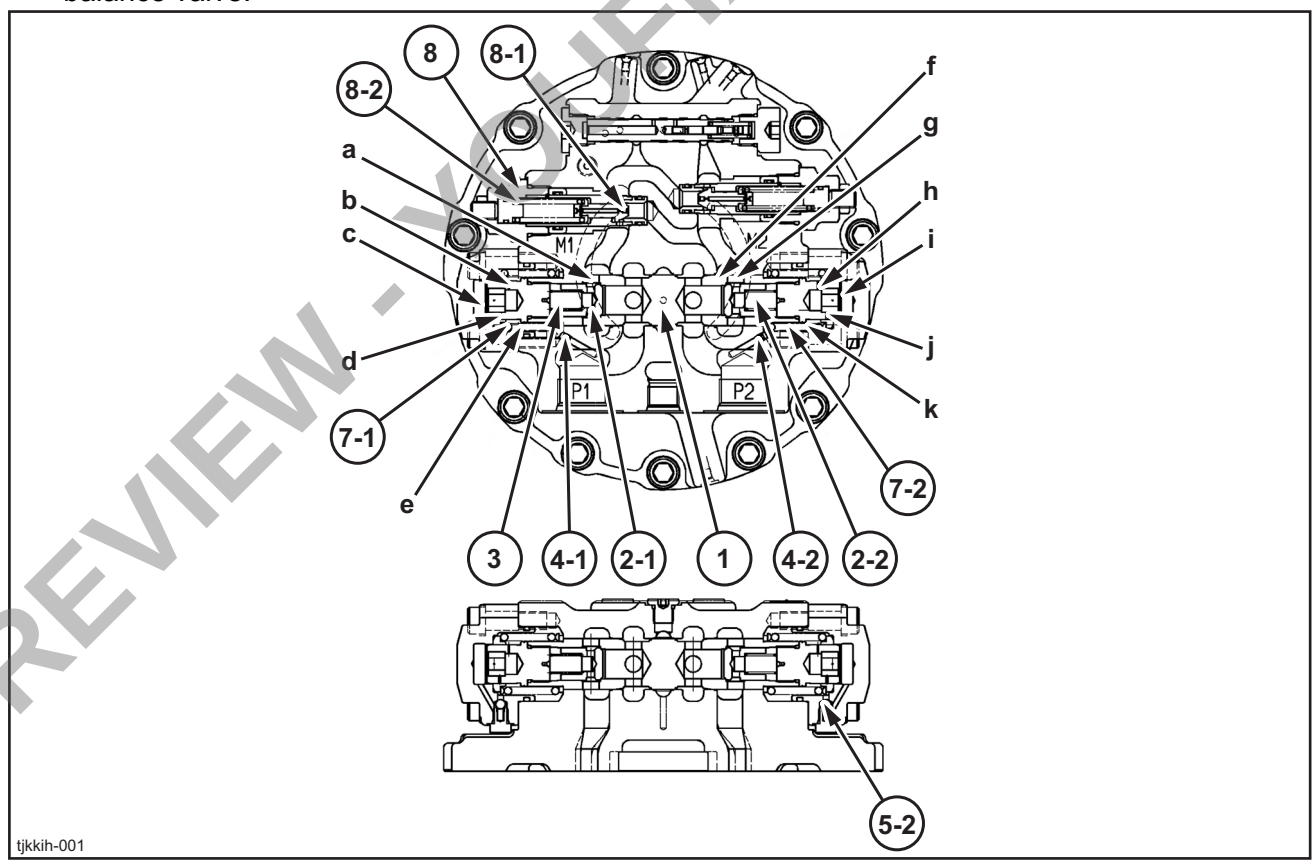


Diagram 3 Double counter balance valve structural diagram (stopped state)

a	Oil path C1	e	Spring chamber 1	i	Damper chamber A2
b	Orifice D1	f	Oil path B	j	Orifice D4
c	Damper chamber A1	g	Oil path C2	k	Spring chamber 2
d	Orifice D2	h	Orifice D3		

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Troubleshooting

See the troubleshooting section below to perform checking, countermeasures and to solve problems when any kind of problem occurs in the motor during operation.

1. Piston motor troubleshooting

Trouble phenomenon	Suggested cause	Countermeasure and solution
The motor does not rotate	There is an operation problem in a piece of equipment other than the piston motor or reduction gear.	After investigating whether pressure is reaching the motor inlet side, investigate the causes of problems and countermeasures for each piece of equipment and perform inspection and repair.
	If the cause is in the motor itself, there is dirt clogging an operation section or there is an operation problem.	Perform disassembly and clean and remove dirt from parts before reassembling the motor. If parts are damaged due to dirt, replace the parts.
	Motor inlet side pressure is low.	Operate the main relief valve of the circuit and raise the set pressure.
	There is abnormal wear on the sliding sections of the piston motor and pressure oil is escaping.	Perform disassembly and replace abnormally worn parts. After completely removing surface scratching, burrs, etc. and cleaning, perform reassembly.
	Damage is occurring with the main parts of the piston motor. In this instance, abnormal noise is coming from the piston motor.	Perform disassembly and replace damaged parts. Perform reassembly after cleaning parts.
	The load on the piston motor is too large and the relief valve is operating.	Investigate the load conditions and adjust the load to an amount appropriate to the set pressure of the relief valve.
Motor rotation speed is insufficient	The cause resides in the hydraulic pump, pressure control valve, flow control valve, etc. Required oil flow is not being supplied to the piston motor and rotation is insufficient.	After investigating whether the required flow is being supplied to the piston motor inlet side, investigate the causes of problems and countermeasures for each piece of equipment and perform inspection and repair.
	Pressure oil is moving from the high-pressure side to the low-pressure side due to wear on the sliding sections of the piston motor (volume efficiency reduction) and speed is insufficient.	Perform disassembly, investigate the status of wear on the sliding sections of the piston motor, and perform repair or replacement according to the maintenance standards.
	There is looseness in the piston motor base plate fastening bolts. Internal leaking is increased and speed is insufficient.	Retighten the base plate fastening bolts to the specified torque.
Motor rotation variation is high	There is wear on the sliding sections of the piston motor and high-pressure oil is leaking and flowing out from the drain port, which is causing speed to greatly decrease and causing rotation variation.	Perform disassembly, check the status of wear on the sliding sections, and perform repair or replacement according to the maintenance standards.
	When going down an incline, the double counter balance valve is causing hunting and rotation variation.	Perform disassembly, check the status of wear on the double counter balance valve, and perform repair or replacement according to the maintenance standards.
Noise is high	The shaft is touching driven parts due to problems with shaft core alignment, and this is producing noise.	Make the shaft core alignment accurate.

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Specifications

235X3

Travel Lower Body

Travel hydraulic motor	Variable displacement piston motor x 2
Reduction gear	Planetary gear 2-stage reduction gear
Travel brake	Hydraulic lock
Parking brake	Mechanical lock (travel lever linkage type)
Track shoe	
Model	Assembly-type triple grouser shoe
No. of shoes (per side)	49
Shoe width	600 mm (23.622 in) [options 700 mm (27.559 in)、800 mm (31.496 in)]
Grouser height	26 mm (1.027 in)
Link pitch	190 mm (7.480 in)
Roller	
No. of upper rollers (per side)	2
No. of lower rollers (per side)	7
Track belt tension adjuster	Grease cylinder type (with cushion spring)

235X3 (Blade)

Travel Lower Body

Travel hydraulic motor	Variable displacement piston motor x 2
Reduction gear	Planetary gear 2-stage reduction gear
Travel brake	Hydraulic lock
Parking brake	Mechanical lock (travel lever linkage type)
Track shoe	
Model	Assembly-type triple grouser shoe
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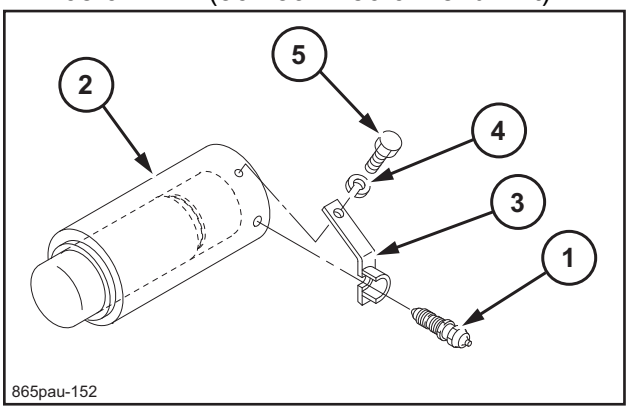
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6. Tighten the check valve (1) to the grease cylinder (2) to the specified tightening torque.
   Install the bracket (3) and secure it with the spring washer (4) and the bolt (5).
   Check valve tightening torque: 48.99 - 68.61 N•m (36.1394 - 50.6128 lbf・ft)

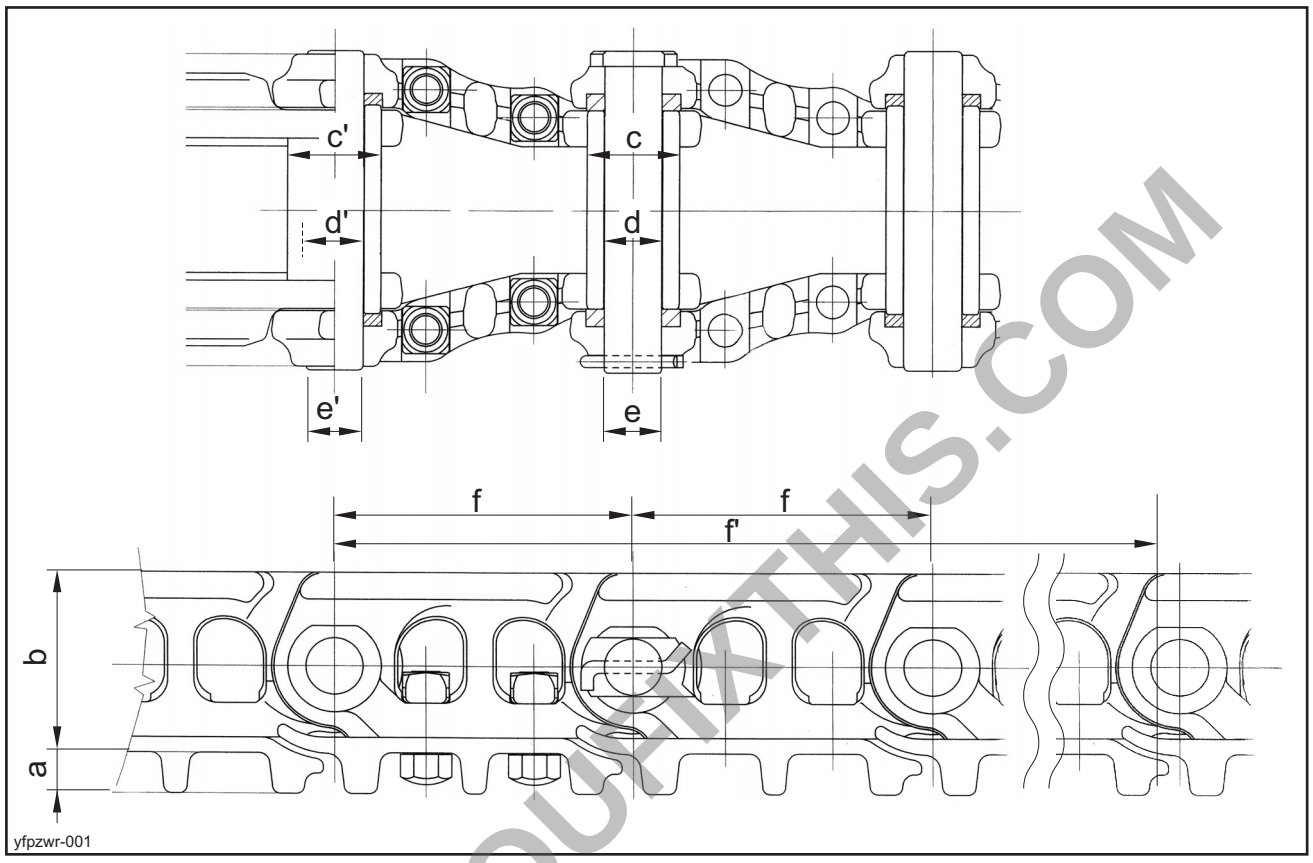


This completes the assembly.

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Track Shoe (grouser shoe)



Part name	Code	Measurement dimensions [mm (in)]	Standard value [mm (in)]	Usage limits [mm (in)]	Judgment	Solution
Shoe plate	a		36 (1.417)	30 (1.181)	Acceptable/ Unacceptable	Replacement
Link	b		106 (4.173)	101 (3.976)	Acceptable/ Unacceptable	Cladding by welding or replacement
Master bushing	c	D	D58.72 (2.31181)	D57.5 (2.2638)	Acceptable/ Unacceptable	Replacement
	d	D	D37.3 (1.4685)	D38.3 (1.5079)	Acceptable/ Unacceptable	
Master pin	e	D	D36.6 (1.4409)	D35.5 (1.3976)	Acceptable/ Unacceptable	Replacement
Link pitch (4-link portion)	f		190 (7.480)	193.7 (7.6260)	Acceptable/ Unacceptable	Replacement
	f'		760 (29.921)	774.9 (30.5079)	Acceptable/ Unacceptable	
Track bushing	c'	D	D58.72 (2.31181)	D57.5 (2.2638)	Acceptable/ Unacceptable	Replacement
	d'	D	D37.3 (1.4685)	D38.3 (1.5079)	Acceptable/ Unacceptable	
Track pin	e'	D	D36.65 (1.44291)	D35.5 (1.3976)	Acceptable/ Unacceptable	Replacement

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	Pressure line		Pilot tank line
	Tank line		Electric line
	Pilotpressure line		

1	Travel motor	10	Straight travel signal (left)	19	Boom cylinder
2	Boom (up)	11	Straight travel signal (right)	20	Travel remote control valve
3	Boom (down)	12	Travel high-speed select switch	21	Check valve
4	Cushion valve	13	Computer A	22	Oil cooler
5	Remote control valve (boom, bucket)	14	Travel high speed	23	Backward left
6	Control valve	15	Lever lock	24	Forward left
7	Travel (left)	16	5 stack solenoid valve	25	Forward right
8	Travel (right)	17	Console lever lock switch	26	Backward right
9	Straight travel valve	18	Hydraulic pump		

As an example, this section explains simultaneous forward travel and boom-up operations.
By operating the travel remote control valve to the forward side, the pilot pressure oil is fed to the control valve pa1 port and switches the left travel spool to the forward side.
In the same way, oil is also fed to the pa6 port to switch the right travel spool to the forward side.
Furthermore, the right forward travel pilot pressure oil separated internally from the control valve pa6 port switches the straight travel signal (right).
On the other hand, the travel pilot pressure oil separated internally from the pa1 port switches the straight travel signal (left) via the straight travel signal (right).
The discharge oil from hydraulic pump A1 enters the control valve P1 port and the discharge oil from hydraulic pump A2 enters the control valve P2 port.
Each flows to the respective travel motor and causes forward travel through the left and right travel spools being switched.
If a boom-up operation is carried out during travel, the pilot pressure oil is fed via the cushion valve to the control valve pa4 port and switches the boom (1) and (2) spools to the up side.
The upper (boom, arm, bucket, swing, option) pilot pressure oil separated internally from the control valve pa4 port is fed to the straight travel valve via the straight travel signal (left) and the straight travel spool is switched.
The amount of switching of the straight travel spool varies with the upper pilot pressure.
(Because the pilot pressure is low for slight upper operation, the amount of switching of the straight travel spool is slight to prevent sharp reduction in the travel speed.)
Through the straight travel valve being switched, it is possible for the control valve P1 pressurized oil to drive the left and right travel motors and for the control valve P2 pressurized oil to drive the boom.
Because the left and right motors are driven by 1 pump, the left and right motors have the same pressure and straight travel is possible.
Furthermore, the P2 excess pressurized oil is fed to the travel side via the check valve with travel merge orifice to minimize the drop in speed.
The same operations are carried out when travel and an upper actuator other than for the boom are operated simultaneously.
When the circuit has an HBCV, switching the spool lets the oil flow through the HBCV check valve and into the boom cylinder bottom side and the boom-up operation is carried out.

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