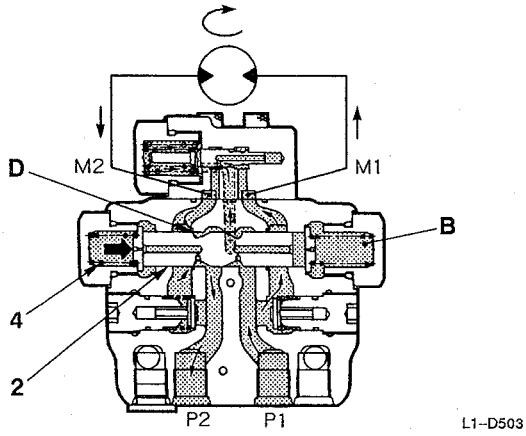
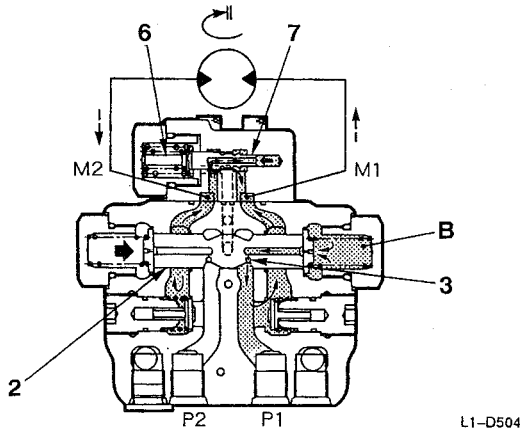
If the motor's turning becomes too fast, and the amount of oil flowing out of port M2 is greater than the amount of oil flowing into port M1, the pressure in port P1 and chamber B drops. When the pressure in chamber B drops below the set valve of the spring (4), the spool (2) attempts to return to the right side. As a result, since the returning oil is constricted at portion D, back pressure is generated at port M2 and the motor's turning is slowed.
When the motor is slowed, the pressure in port P1 and chamber B rises again and the spool (2) moves to the left side, eliminating the back pressure generated at port M2. In this way, the motor is controlled so that it rotates at a speed appropriate for the amount of oil flowing into it.



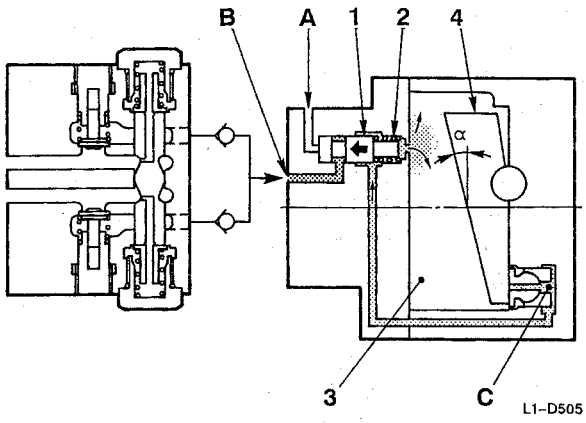
If the high pressure hydraulic oil introduced into port P1 is cut off, the pressure at ports P1 and P2 becomes the same and the spool (2) returns to the neutral position by spring force. For this reason, the oil in chamber B is pushed out at port P1. At this time, the flow of oil is restricted by the orifice (3) as it is returning to port P1, so the spool (2) returns to the neutral position slowly. In this way, the motor is stopped while the shock during stopping is absorbed.
Also, when the motor is stopped, the force of inertia acts to turn it, so the motor pumps and acts to draw in oil. However, since the flow of hydraulic oil is restricted, cavitation occurs in the motor. When this happens, the passage from the spool (2) is closed, so the pressure of the return oil from the motor increases on the M2 port side. This pressure moves the stopper (6) and spool (7) to the left side and ports M2 and M1 are connected, preventing cavitation.



Two-speed mechanism

1st speed

When the pilot pressure is not supplied from port A, the valve (1) is pushed to the left side by the force of the spring (2) and the hydraulic oil of supply port B is cut off. At this time, the oil in chamber C is released into the motor case (3) via the valve (1).
Because of this, the swash plate (4) is set to the maximum angle of inclination α, the motor's piston stroke capacity is the maximum, and the motor turns at 1st (low) speed.

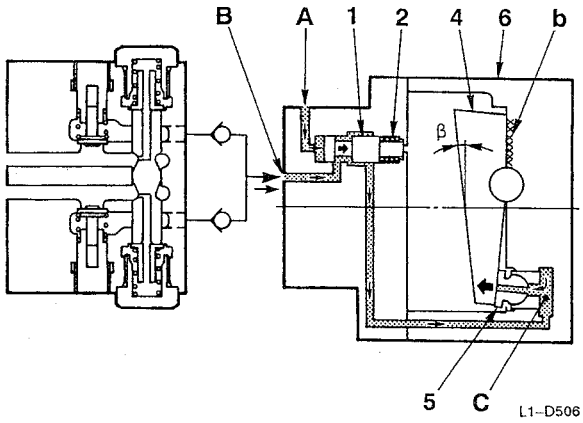


2nd speed

When the pilot pressure is supplied from port A, the pilot pressure overcomes the force of the spring (2), and the valve (1) is pushed to the right side. The hydraulic oil of supply port B flows into chamber C through the valve (1), the piston (5) pushes up the swash plate (4) until it touches surface "b" of the spindle (6) and keeps it against this surface.

At this time, the swash plate (4) is set to the minimum angle of inclination β, the motor's piston stroke capacity is the minimum, and the motor turns at 2nd (high) speed.

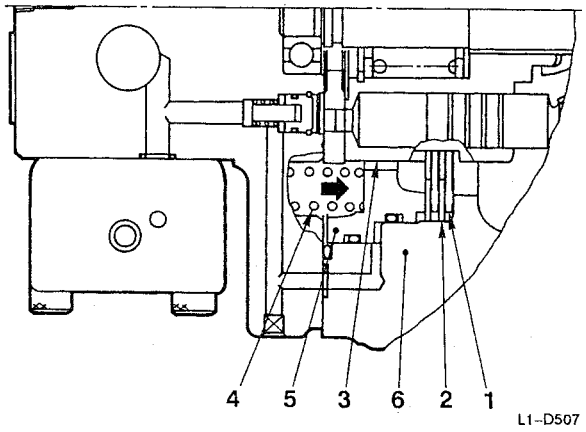
When the engine is stopped, the pilot pressure is cut off, so the speed switches to 1st.



Parking Brake

When stopped

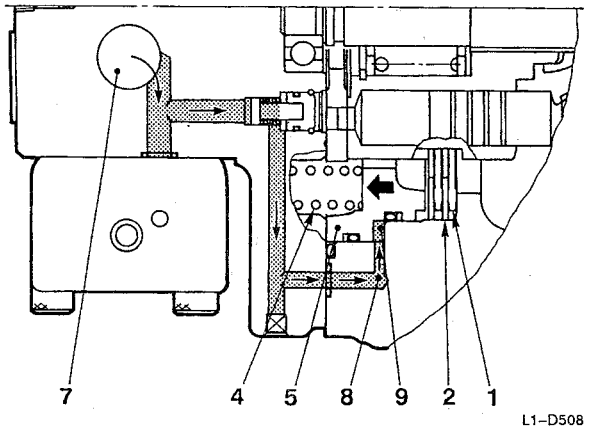
The friction discs (1) are connected via a spline to the cylinder block (3), while the center discs (2) are connected via a spline to the spindle (6). The friction discs (1) and the center discs (2) are pushed by the springs (4) via the brake piston (5) against the spindle (6), brake torque is generated by the friction between these discs, and rotation of the cylinder block (3) is prevented.



During travel

When pressure oil is led to the motor, the spool (7) of the brake valve operates, oil flows from the parking brake release port (8) to the brake piston chamber (9), the spring force is overcome, and the brake piston (5) is moved to the right. This creates gaps between the friction discs (1) and the center discs (2), so that the parking brake is released.

When the motor is stopped, the spool (7) returns to the neutral position and oil no longer flows to the parking brake release post (8). The pressure oil in the brake piston chamber (9) is led into the motor case, and the parking brake is applied by the springs (4)

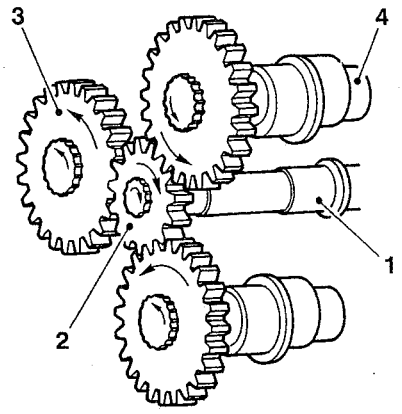


Reduction gear operation

This reduction gear consists of spur gearing (1st reduction section) and differential gearing with peri-cycloid teeth (2nd reduction section). It functions to decelerate the high speed rotational motion from the motor, convert it to a high low-speed torque and achieve rotation of the housing.

1st reduction section

The rotational motion of the motor axle is transferred to the input gear (2) which is splined to the shaft (1). The three spur gears (3) are engaged with the input gear (2) and their rotation is decelerated.



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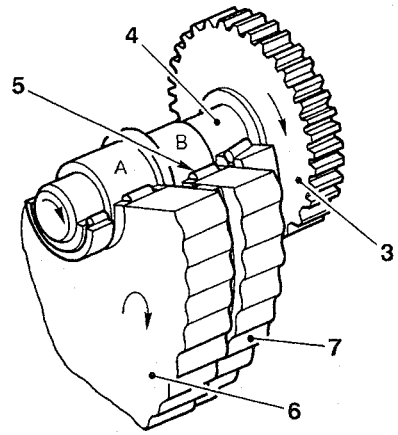
2nd reduction section

The three spur gears (3) are each splined to crank shafts (4) and this is the input from the 1st reduction section to the 2nd reduction section.

When the crank shafts (4) rotate, their eccentric bodies A and B move in an eccentric motion (revolving motion) while rotating on their axes.

Using eccentric bodies A and B and the needle bearings (5) incorporated in them, RV gear A (6) and RV gear B (7) transmit only the eccentric motion of eccentric bodies A and B.

In this way, RV gear A (6) and RV gear B (7) move in an eccentric motion in the same direction and at the same speed as the spur gears (3) and crank shafts (4).



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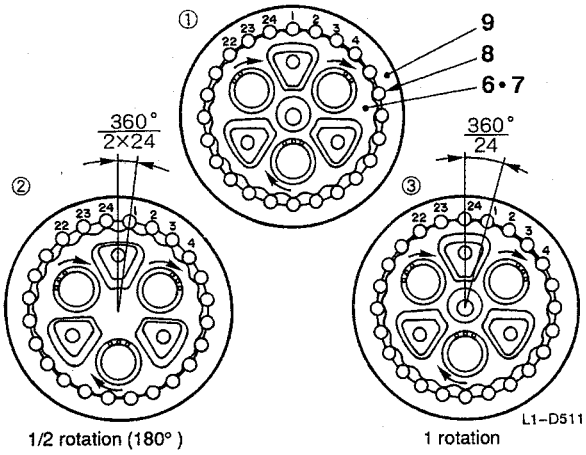
When RV gear A (6) and RV gear B (7) move in an eccentric motion, the surfaces of their teeth roll and gradually change the point of engagement with the pins (8), which are constantly engaged.

When RV gear A (6) and RV gear B (7) perform one eccentric motion, the pins (8) revolve by the difference (ZP - ZR)/ZP, where ZR is the number of teeth on RV gears A and B and ZP is the number of pins, in the same direction as the eccentric motion. The revolution of the pins (8) is transmitted to the housing (9), and this rotation is the output rotation of the reduction gear.



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DISASSEMBLY AND ASSEMBLY

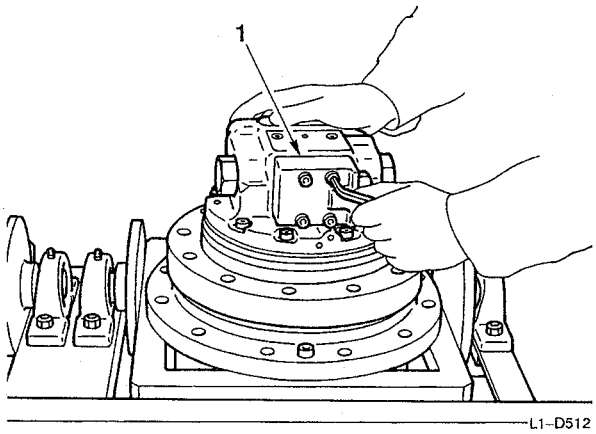
General Cautions

- Carry out disassembly and assembly operations in a clean place and provide clean containers to place the disassembled parts in.
- Before disassembly, clean around the ports and remove the paint from each joint using a wire brush.
- Wash the disassembled parts and dry them with compressed air. Do not use a rag, as this could cause clogging of dirt.
- Make match marks on each part so that they will be assembled in the same positions when reassembled.
- Replace all seals with new ones each time the pump is disassembled, coating them lightly with grease.
- Check each part to make sure there is no abnormal wear or seizing and use sandpaper, etc. to remove any burrs, sharp edges, etc.

Disassembly

Disassembling the Flange

1. Loosen the socket bolts and remove the valve (1) from the flange.



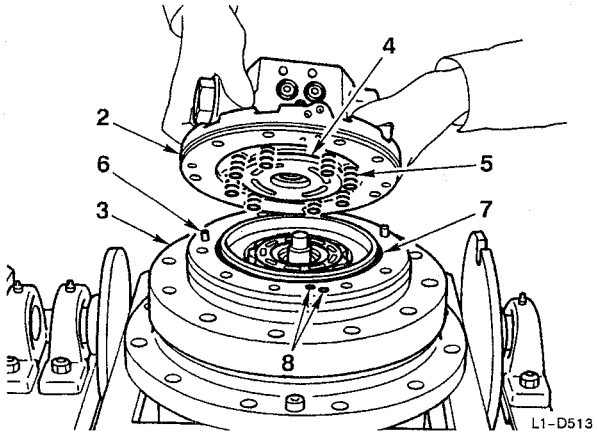
2. Remove the O-rings from the flange.

3. Loosen the socket bolts and remove the flange (2) from the spindle.
   - Lift the flange straight up.
   - Do not drop or damage the valve plate (4).

4. Remove the springs (5) from the flange (2).

5. Remove the pins (6) from the spindle (3).

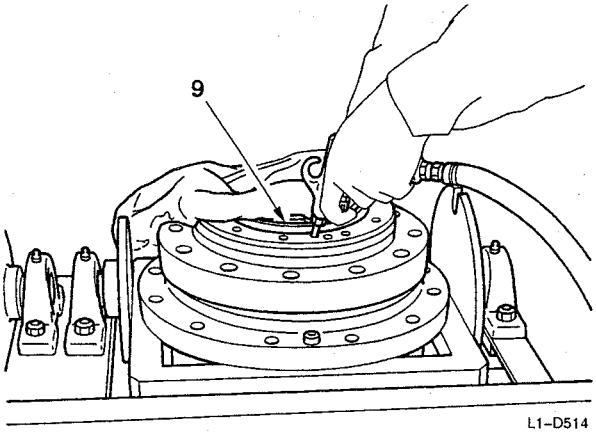
6. Remove O-rings (7) and (8) from the spindle (3).



Removing the parking brake

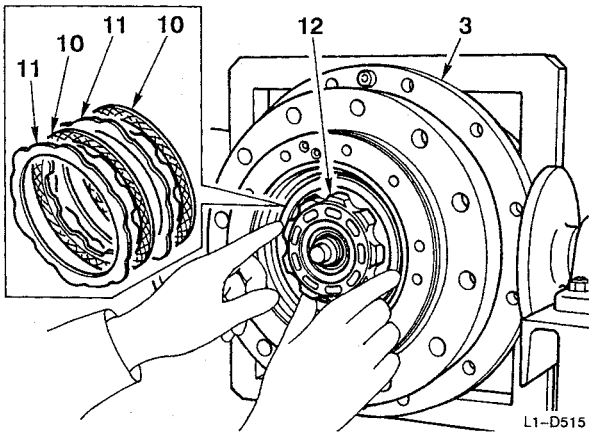
1. Fill compressed air into the spindle's parking brake release port and remove the brake piston (9).
   - Be careful that the brake piston does not fly out.

2. Remove the O-rings and backup rings from the brake piston (9).



3. Tilt the housing 90 degrees and discharge the oil in the motor.
   - Use an oil pan.

4. Remove the friction discs (10) and center discs (11) from the spindle (3).
   - Be careful that the cylinder block does not come out of the spindle.



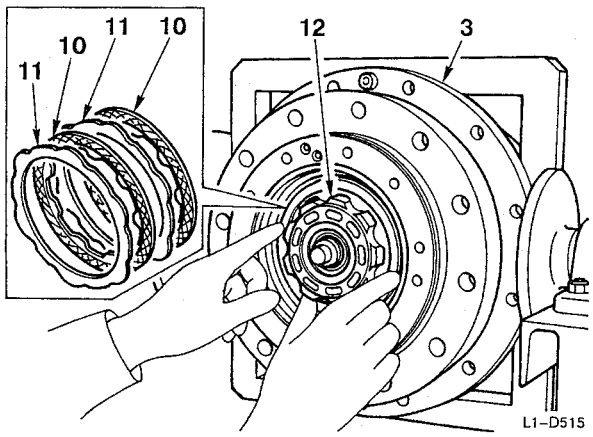
Assembly

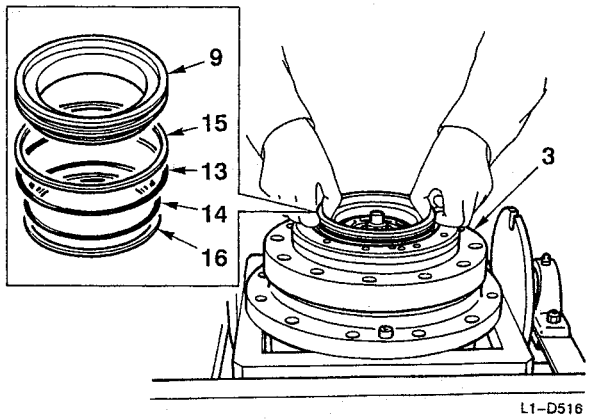
Assembling the Parking Brake

1. Set the friction discs (10) and center discs (11) alternately in the outer grooves of the cylinder block (12).
   - Soak the friction discs and center discs in hydraulic oil before installing them.

2. Install O-rings (13) and (14) and backup rings (15) and (16) on the brake piston (9).

3. Install the brake piston (9) on the spindle (3).
   - If it is hard to install, use a plastic hammer and gently hammer on the end of the brake piston.
   - Be careful not to scratch the O-rings.





Assembling the Flange

1. Insert the pins in the flange's (2) pin holes.

2. Install the valve plate (4) on the flange (2) using the pin as a guide.
   - Apply grease to the back surface of the valve brake to prevent it from dropping.

3. Install O-rings (7) and (8) on the spindle (3).
   - Do not apply grease to O-ring (7), since grease oozing out from it can be mistaken for an oil leak.

4. Install the pins (6) on the spindle (3).

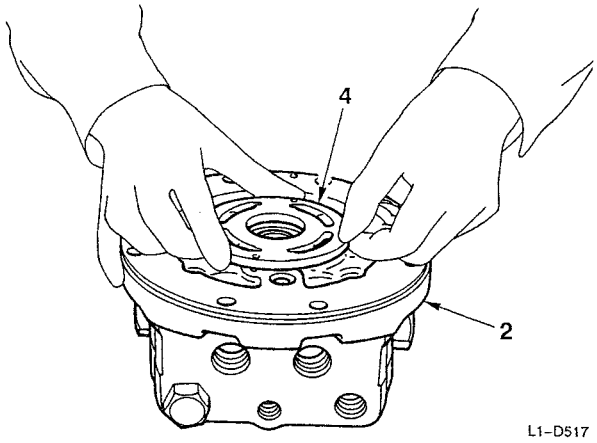
5. Pour hydraulic oil into the spindle (3).
   - Quantity of Oil: 0.55 *l*

6. Install the springs (5) on the flange (2).
   - Apply grease to the spring to prevent it from dropping.

7. Install the flange (2) on the spindle (3).
   - Align the pin in the spindle with the pin hole.
   - Socket Bolt Tightening Torque: 5.9 ±1.0 kgf·m

8. Install O-rings (17) and (18) on the flange (2).

9. Install the valve (1) on the flange.
   - Socket bolt tightening torque: 3 ±0.5 kgf·m



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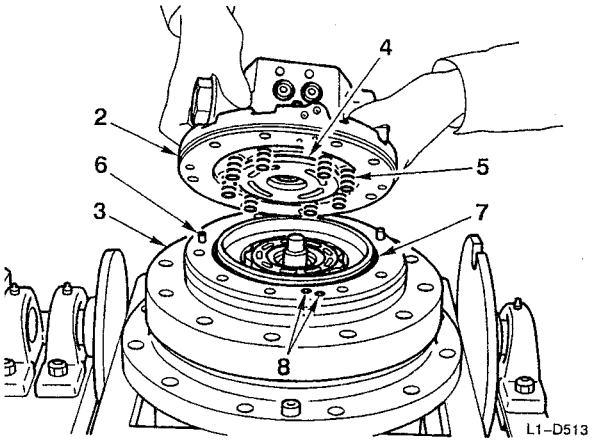

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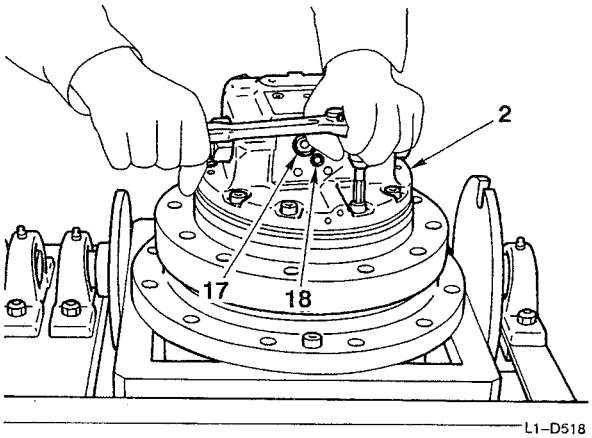

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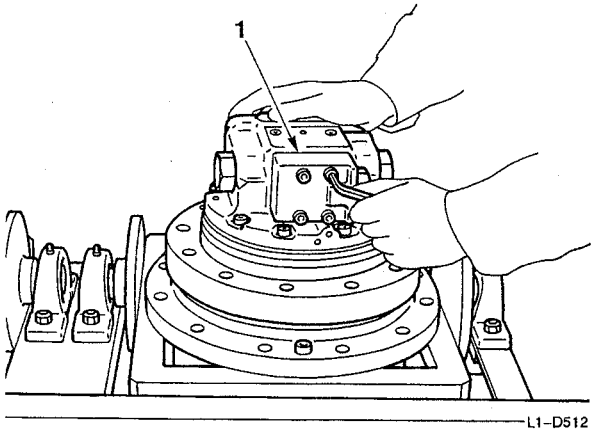

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