

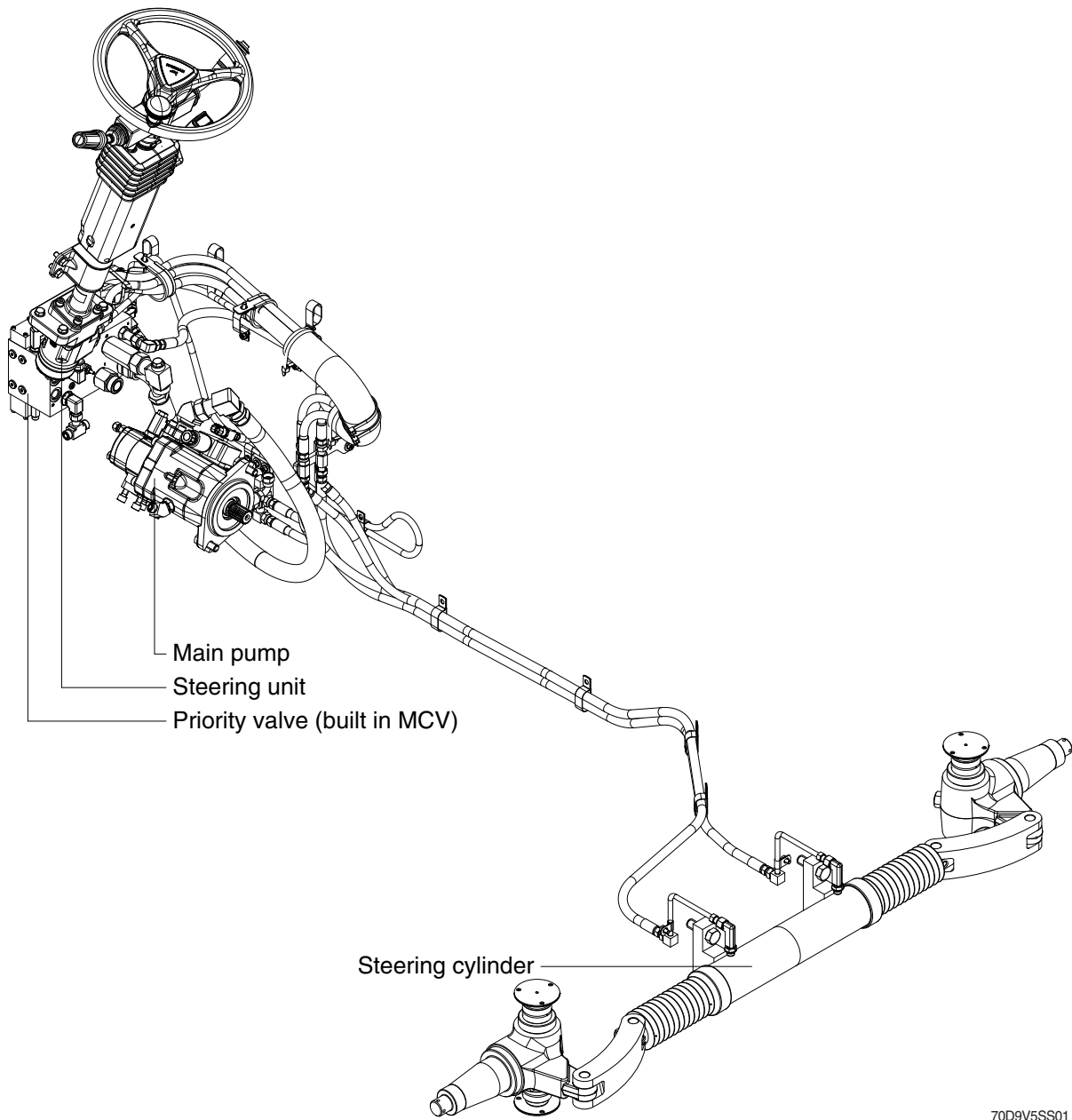
SECTION 5 STEERING SYSTEM

| | | |
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SECTION 5 STEERING SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

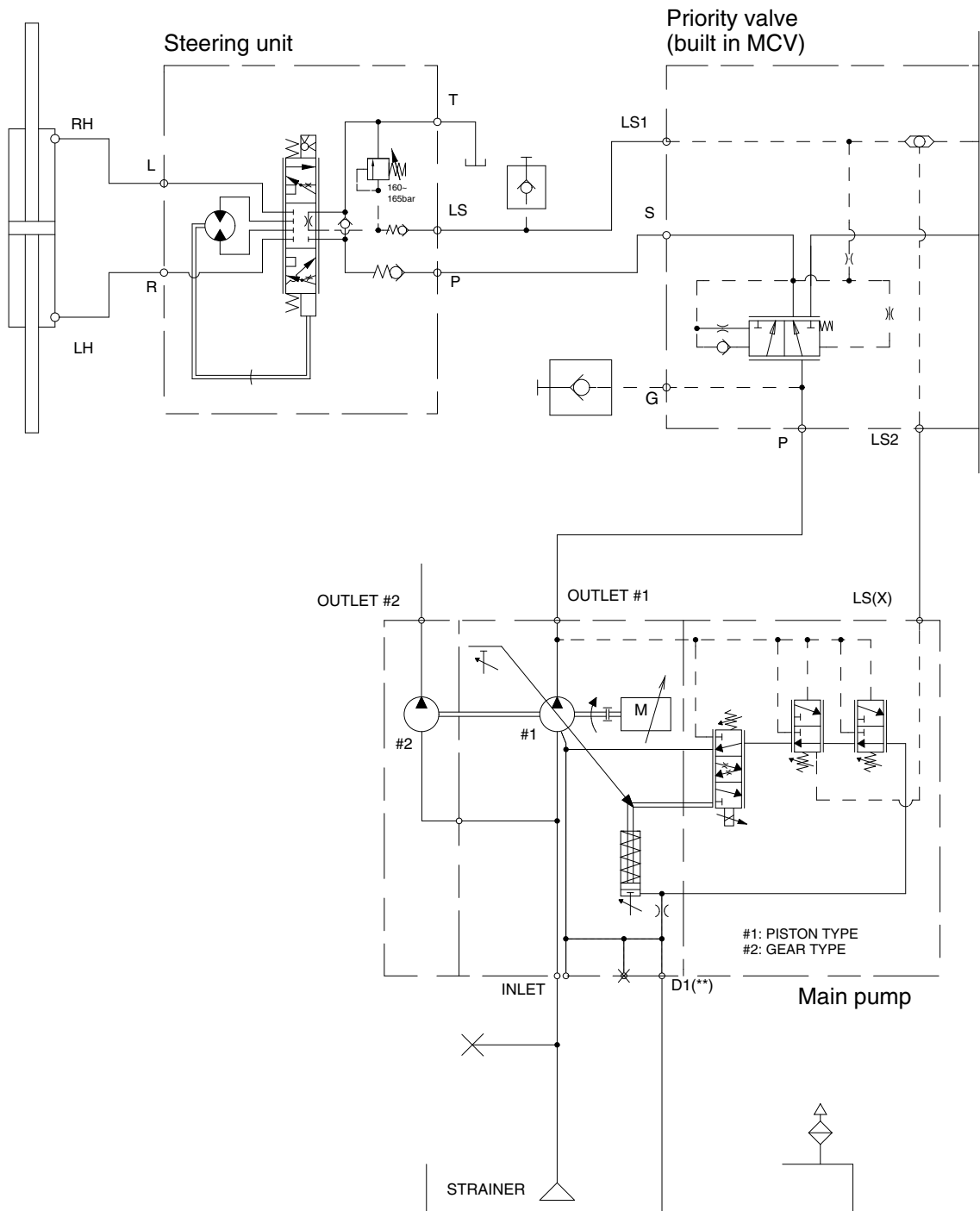
1. OUTLINE



70D9V5SS01

The steering system for this truck is composed of main pump, steering wheel assembly, steering unit, priority valve (built in MCV), steering cylinders, steering axle and piping. The steering axle supports the forklift weight with the rear axle, contains a cylinder and controls the position of the rear tires. The steering axle body is unit structure having steering knuckles installed to its both ends by means of king pins. Hub and wheel are mounted through bearing to spindle of knuckle. When the steering wheel is turned, the rotation torque is transmitted to the steering unit, and the hydraulic oil in the steering unit is transmitted to the steering axle hydraulic cylinder through the hose, so that the forklift moves left and right. The force produced by the steering cylinders moves the knuckle of rear tires through the intermediate link. Refer to the illustration for the location of the steering system components.

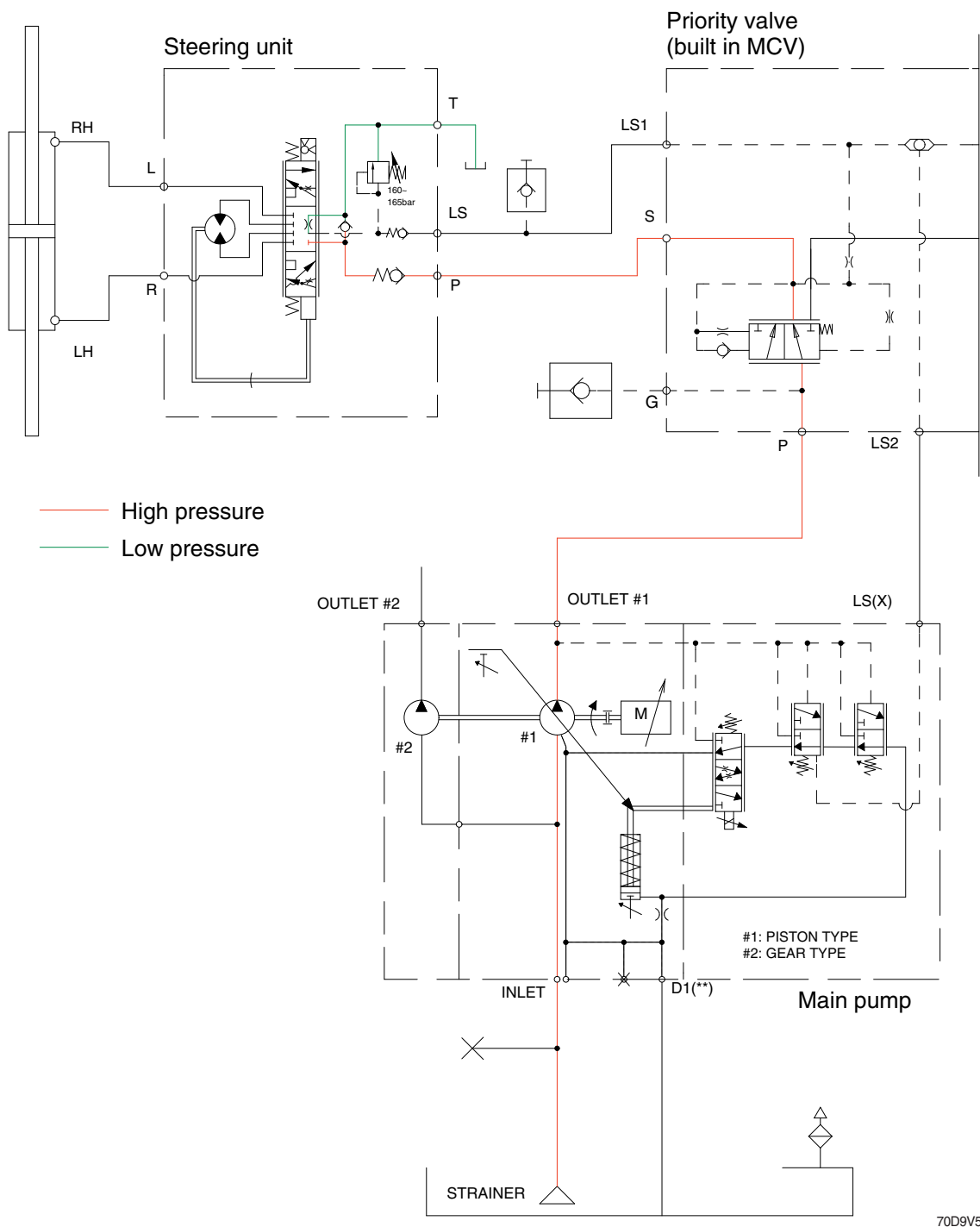
2. HYDRAULIC CIRCUIT



70D9V5SS02

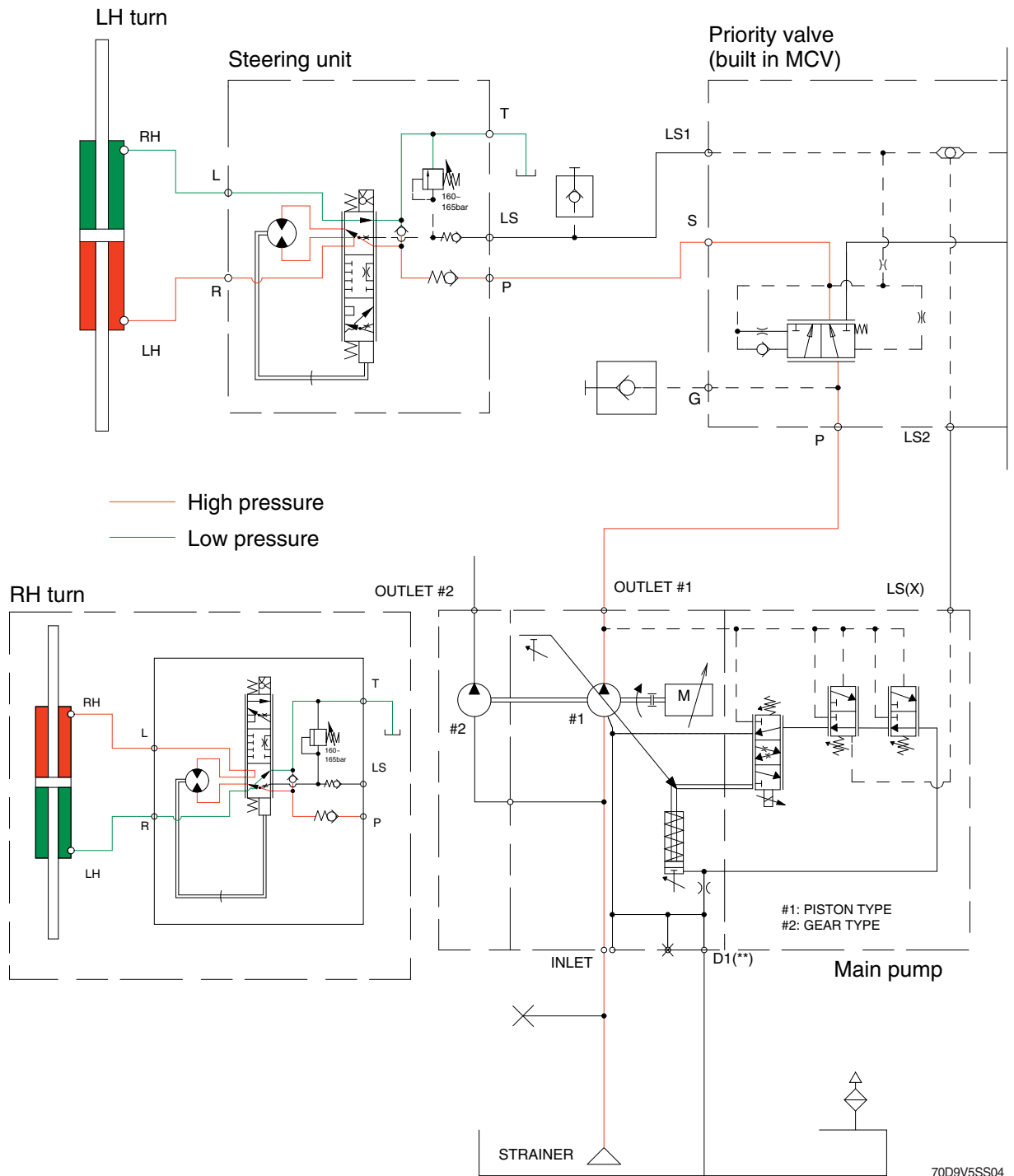
The hydraulic oil discharged from the pump flows to the priority valve. When the driver operates the steering wheel, the steering unit is supplied with pressure oil preferentially by the priority valve operation circuit. The oil passages in the steering unit are changed over to direct the hydraulic pressure from the priority valve to the steering cylinder, which extends or contracts depending on the hydraulic pressure, thereby steering the truck. The excess flow of the pump generated at this time flows to the priority valve and the tank through the priority valve EF flow path.

1) NEUTRAL



When the engine is running and the steering wheel is not being turned, the steering unit spool and sleeve set are aligned (neutral position). Oil flow through the valve is blocked from entering the left or right steering ports. The pressure on the pilot side of the priority valve spool controls the spool to move in the opposite direction (spring direction). This movement causes the pump discharge flow to flow to the priority valve. In this neutral position, a small amount of oil is constantly bled through the dynamic orifice. The oil then flows into the LS hose piping and returns to the tank through the steering unit spool and sleeve set. This dynamic flow prevents initial hard spot when steering is turned rapidly or abruptly.

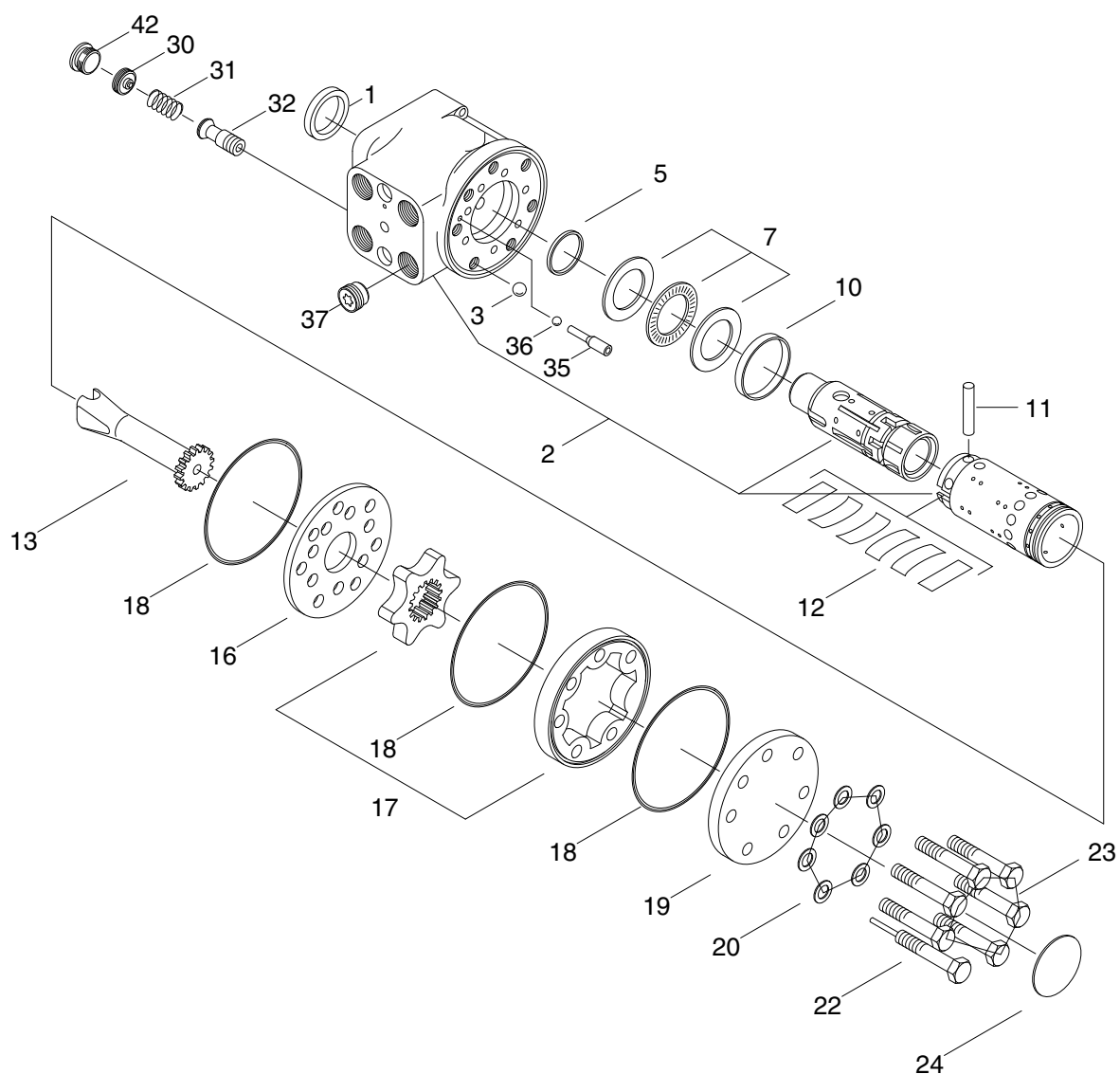
2) LEFT OR RIGHT TURN



When the engine is running and the steering wheel is being turned, the steering unit spool and sleeve set rotates. The passage opens to allow oil to flow into the internal gerotor gear of the steering unit. The oil flow causes the gerotor pump to rotate. Oil flows back into the steering valve spool and sleeve set and out to the left or right steering ports depending on the direction of steering wheel rotation. At the same time, the LS circuit blocks the return to the hydraulic tank and is connected to the S port to sense the pressure required to turn the steering wheel. As the required pressure increases or decreases in the LS circuit, the priority valve spool moves to meet the flow and pressure required to rotate the tire. When the steering cylinder reaches the end of the stroke, a relief valve in the steering circuit releases LS pressure into the hydraulic tank.

3. STEERING UNIT

1) STRUCTURE

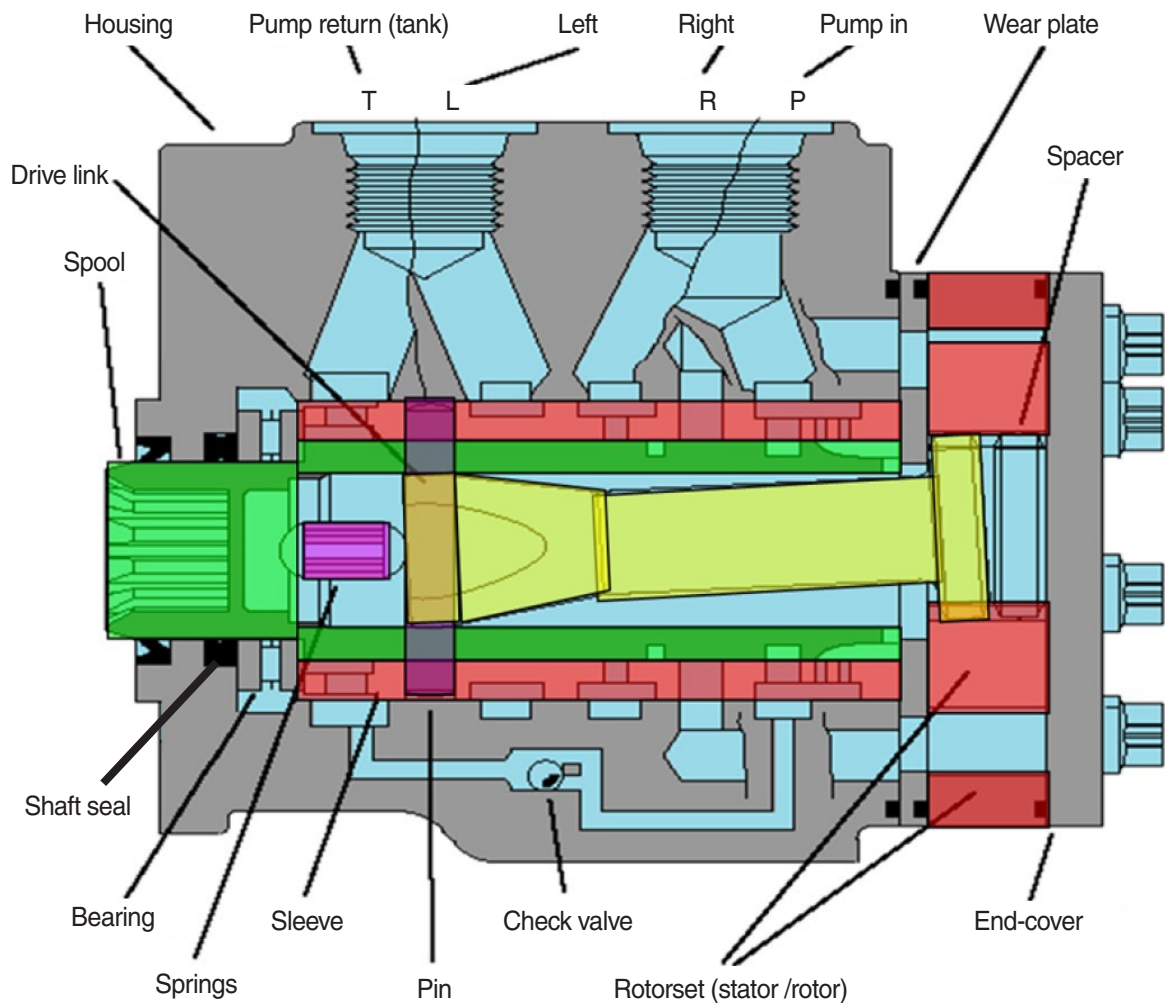


70D9V5SS06

| | | | | | |
|----|--------------------------|----|-------------------|----|--------------------|
| 1 | Dust seal ring | 13 | Cardan shaft | 24 | Model / Code label |
| 2 | Housing and spool/sleeve | 16 | Distributor plate | 30 | Adjusting screw |
| 3 | Ball | 17 | Gearwheel set | 31 | Spring |
| 5 | Shaft seal | 18 | O-ring | 32 | Piston |
| 7 | Bearing assembly | 19 | End over | 35 | Ball |
| 10 | Ring | 20 | Washer | 36 | Ball |
| 11 | Cross pin | 22 | Pin bolt screw | 37 | Check valve |
| 12 | Set of springs | 23 | Screw | 42 | Plug |

※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7)

2) OPERATION

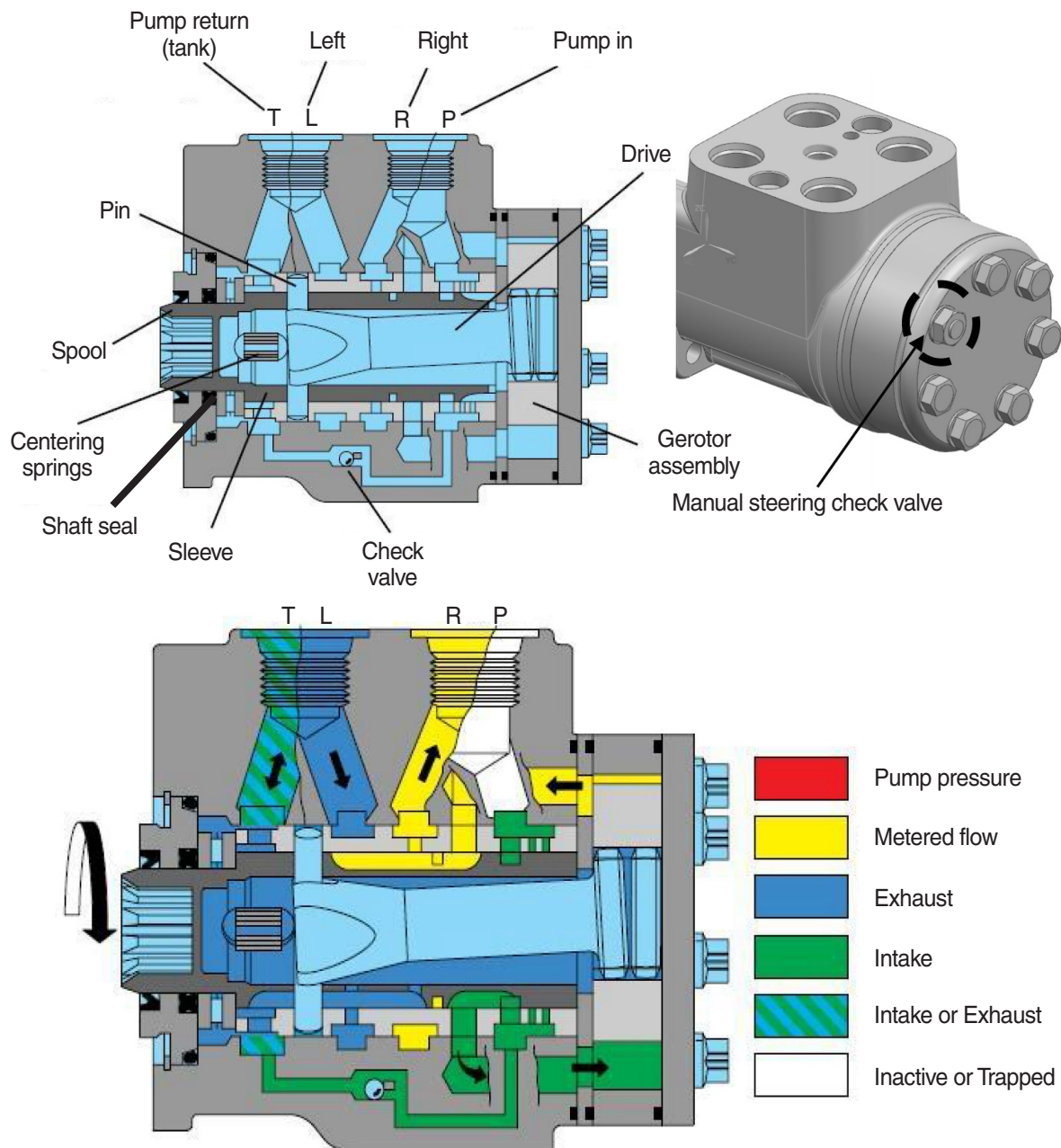


35D9VB5SS76

The steering unit is a closed center circuit and consists of a rotary valve (spool + sleeve set) and a metering gear set. With a LS (load sensing) dynamic circuit, even when the viscosity of the oil is low in winter, it operates smoothly without jamming the steering wheel and reduces the impact of the steering wheel due to rapid rotation or kickback of the tire. The LS circuit in the valve is used to control the operation of the priority valve spool. Steering relief valve oil flows through an internal flow path to the tank return line. The relief valve is set lower than the AUX relief valve set pressure in the MCV.

- Manual steering check valve : converts unit to hand operated pump for limited manual steering.
- Inlet check valve (P port) : Prevents oil from returning through the steering unit when pressure on the cylinder side is greater than pressure on the inlet side to prevent steering wheel kick.
- LS relief valve : Limits maximum pressure in the steering circuit.

3) MANUAL STEERING (EMERGENCY)



35D9VBSS77

When the engine is not running and the steering wheel is being turned, the priority divider valve spool is pushed against the end stop by spring force. In this position, oil flow opens to the spool and sleeve set. As the steering wheel turns, a vacuum is created in the supply line between the priority valve and the steering unit spool and sleeve set. As the spool and sleeve set rotates, a passage opens to allow oil to flow to the inner gerotor gear set of the steering unit. Oil trapped in the steering port passes through the manual steering check valve and feeds through the gerotor gear to the opposite side of the steering cylinder, enabling manual steering.

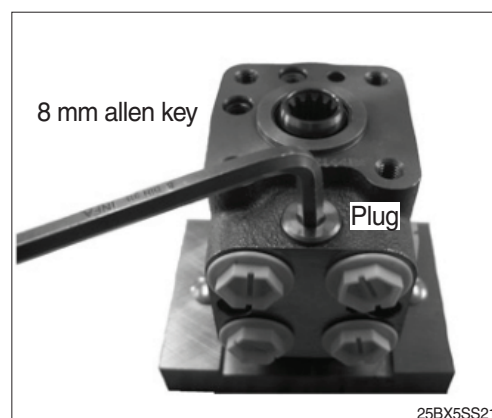
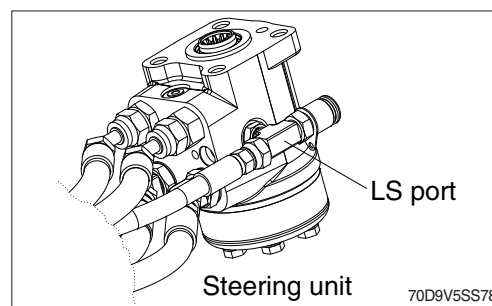
4) RELIEF VALVE PRESSURE TEST AND ADJUSTMENT

(1) Test specification

- Engine speed : low idle rpm
- Oil temperature : 50 ± 5 °C (122 ± 9 °F)
- Steering relief set pressure : 135 ~ 140 bar (1958 ~ 2031 psi)

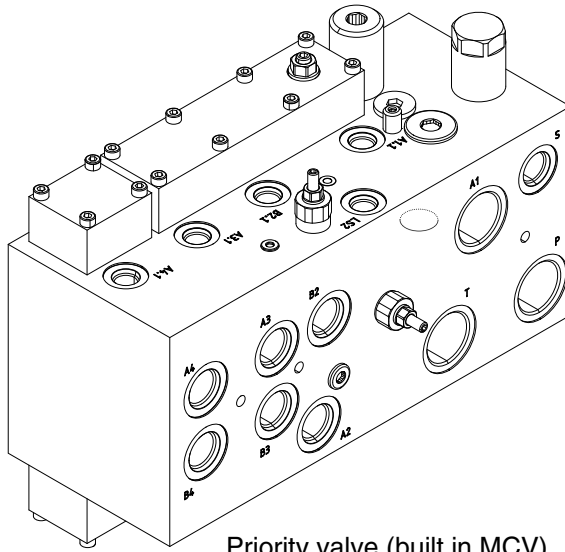
(2) Pressure test and adjustment

- ① Operate hydraulic system until the oil temperature is within test specification. See hydraulic warmup procedure.
 - ② Lower the fork to the ground, stop the engine, and apply the parking brake switch.
 - ③ Connect pressure gauge to "LS" pressure check port of the steering unit as shown the illustration.
 - ④ Operate engine at test specifications.
 - ⑤ Turn the steering wheel all the way to a stop and hold it there.
 - ⑥ Check pressure gauge reading. Compare the readings and specifications.
 - ⑦ Loosen the relief valve plug. Turn the adjusting screw to adjust the pressure.
 - Tightening torque : 6.6 ± 0.5 kgf·m (47.9 ± 3.7 lbf·ft)
 - If pressure is lower than specification, turn relief valve adjusting screw clockwise.
 - If the pressure is higher than the specification, turn the adjusting screw counterclockwise.
 - ⑧ Repeat Step ⑥, ⑦. If pressure is to specifications, remove test equipment.
- △ Do not permit dirt or other contaminants to enter the hydraulic system. Disconnected hoses, tubes, open valves, cylinder fittings, and ports should be protected with clean caps or plugs.

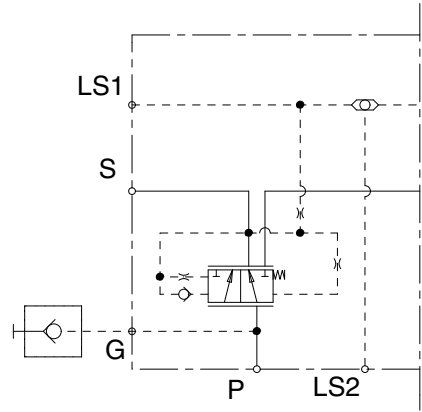


4. PRIORITY VALVE

1) STRUCTURE



Priority valve (built in MCV)



Hydraulic circuit

70D9V5SS07

2) STRUCTURE

The oil from the hydraulic pump flows to the priority valve.

The priority valve supplies a flow of oil to the steering system and lift, tilt system.

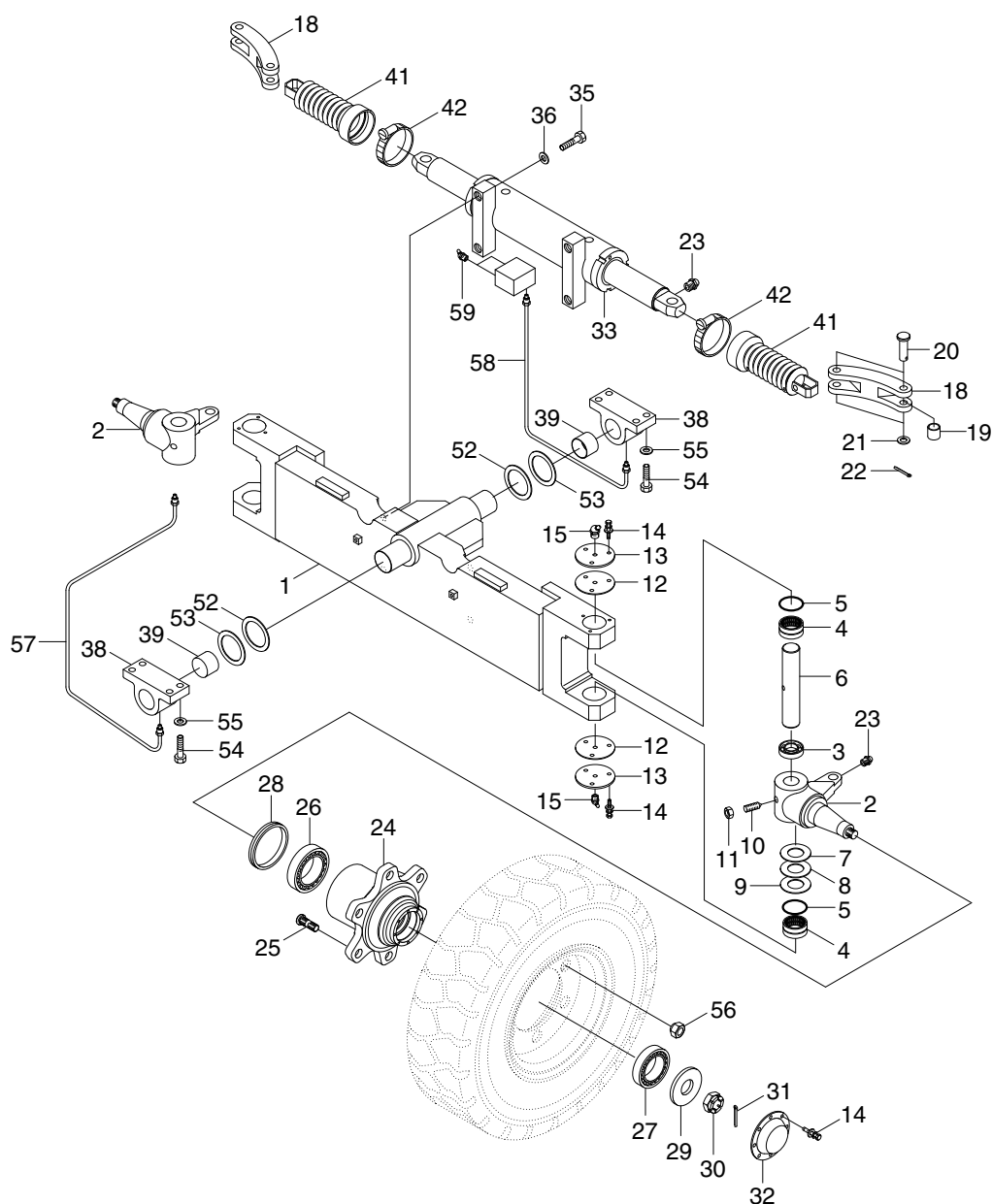
The steering flow is controlled by the steering unit to operate the steering cylinder.

The remainder of the oil flow from the pump flows to the main control valve.

5. STEERING AXLE

1) STRUCTURE

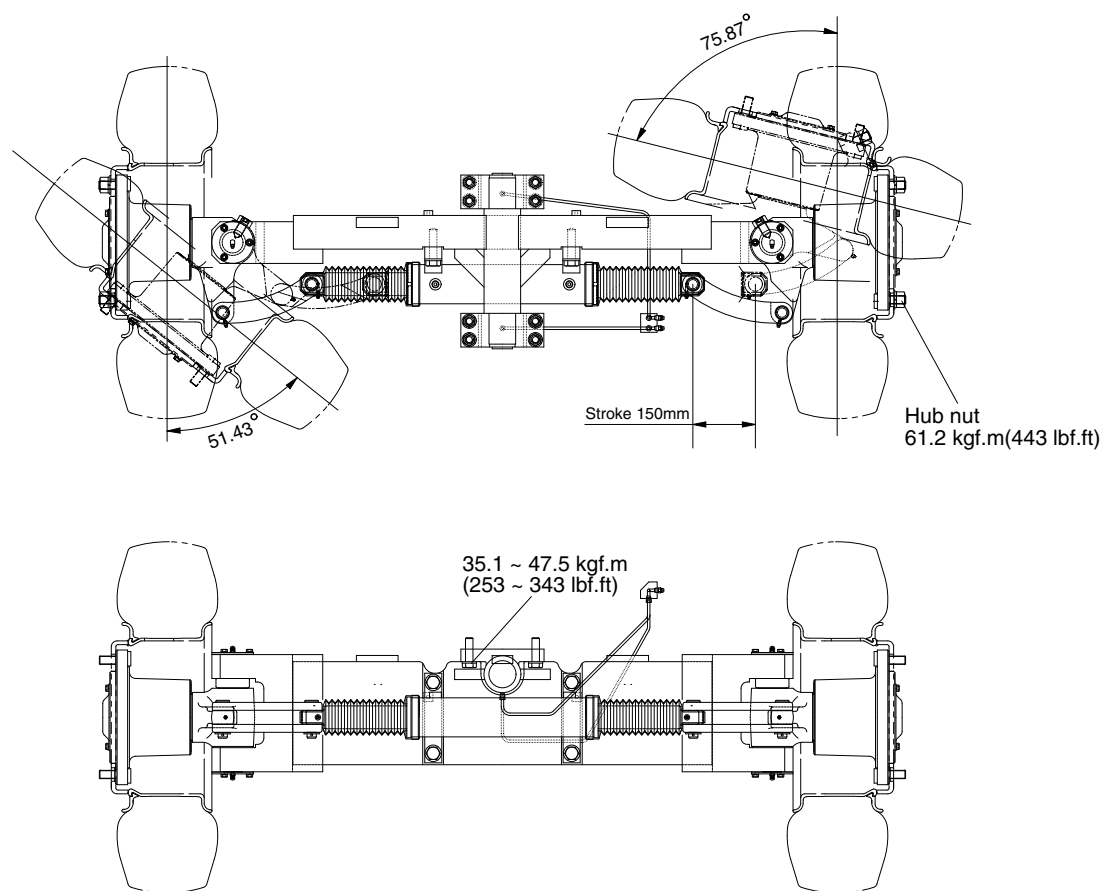
※ Do not remove the stopper bolt unless necessary.



50D9SE24

| | | | | | | | |
|----|---------------------|----|----------------|----|----------------------|----|------------------------|
| 1 | Steering axle | 13 | Cover | 25 | Hub bolt | 39 | Bushing |
| 2 | Knuckle | 14 | Bolt w/washer | 26 | Taper roller bearing | 41 | Steering cylinder boot |
| 3 | Thrust bearing | 15 | Grease nipple | 27 | Taper roller bearing | 42 | Clamp |
| 4 | Needle bearing | 16 | Hexagon bolt | 28 | Oil seal | 52 | Shim (1.0 t) |
| 5 | Oil seal | 17 | Hexagon nut | 29 | Special washer | 53 | Shim (0.5 t) |
| 6 | King pin | 18 | Link | 30 | Slotted nut | 54 | Hexagon bolt |
| 7 | Thrust washer | 19 | Bushing | 31 | Split pin | 55 | Hardened washer |
| 8 | Shim washer (0.1 t) | 20 | Link pin | 32 | Hub cap | 56 | Hub nut |
| 9 | Shim washer (0.2 t) | 21 | Special washer | 33 | Steering cylinder | 57 | Front pipe assy |
| 10 | Set screw | 22 | Split pin | 35 | Hexagon bolt | 58 | Rear pipe assy |
| 11 | Hexagon nut | 23 | Grease nipple | 36 | Hardened washer | 59 | Grease nipple |
| 12 | Gasket | 24 | Hub | 38 | Support | | |

2) TIGHTENING TORQUE AND SPECIFICATION

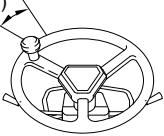


50D9SE07

| Type | Unit | Center pin support single shaft |
|----------------------------------------------|---------|---------------------------------|
| Structure of knuckle | - | Elliott type |
| Toe-in | degree | 0 |
| Camber | degree | 0 |
| Caster | degree | 0 |
| King pin angle | degree | 0 |
| Max steering angle of wheels(Inside/Outside) | degree | 75.87/ 51.43 |
| Tread | mm (in) | 1604 (63.1) |

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

| Check item | Checking procedure | | |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------|
| Steering wheel 30-60mm (1.2-2.4 in)  | <ul style="list-style-type: none"> Set rear wheels facing straight forward, then turn steering wheel to left and right. Measure range of steering wheel movement before rear wheel starts to move. Range should be 30~60 mm at rim of steering wheel. If play is too large, adjust at gear box. Test steering wheel play with engine at idling. | | |
| Knuckle | <ul style="list-style-type: none"> Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear. | | |
| Steering axle | <ul style="list-style-type: none"> Put camber gauge in contact with hub and measure camber. If camber is not within $0 \pm 0.5^\circ$; rear axle is bent. Ask assistant to drive machine at minimum turning radius. Fit bar and a piece of chalk at outside edge of counterweight to mark line of turning radius. If minimum turning radius is not within ± 100 mm (± 4 in) of specified value, adjust turning angle stopper bolt. <p>Min turning radius (Outside)</p> <table border="1"> <tr> <td>70D-9VB</td><td>3436 mm (11' 3")</td></tr> </table> | 70D-9VB | 3436 mm (11' 3") |
| 70D-9VB | 3436 mm (11' 3") | | |
| Hydraulic pressure of power steering | <p>Remove plug from the LS port of the steering unit and install oil pressure gauge. Turn steering wheel fully and check oil pressure.</p> <p>※ Oil pressure : 160 ~ 165 bar (2320 ~ 2390 psi)</p> | | |

2. TROUBLESHOOTING

1) STEERING UNIT

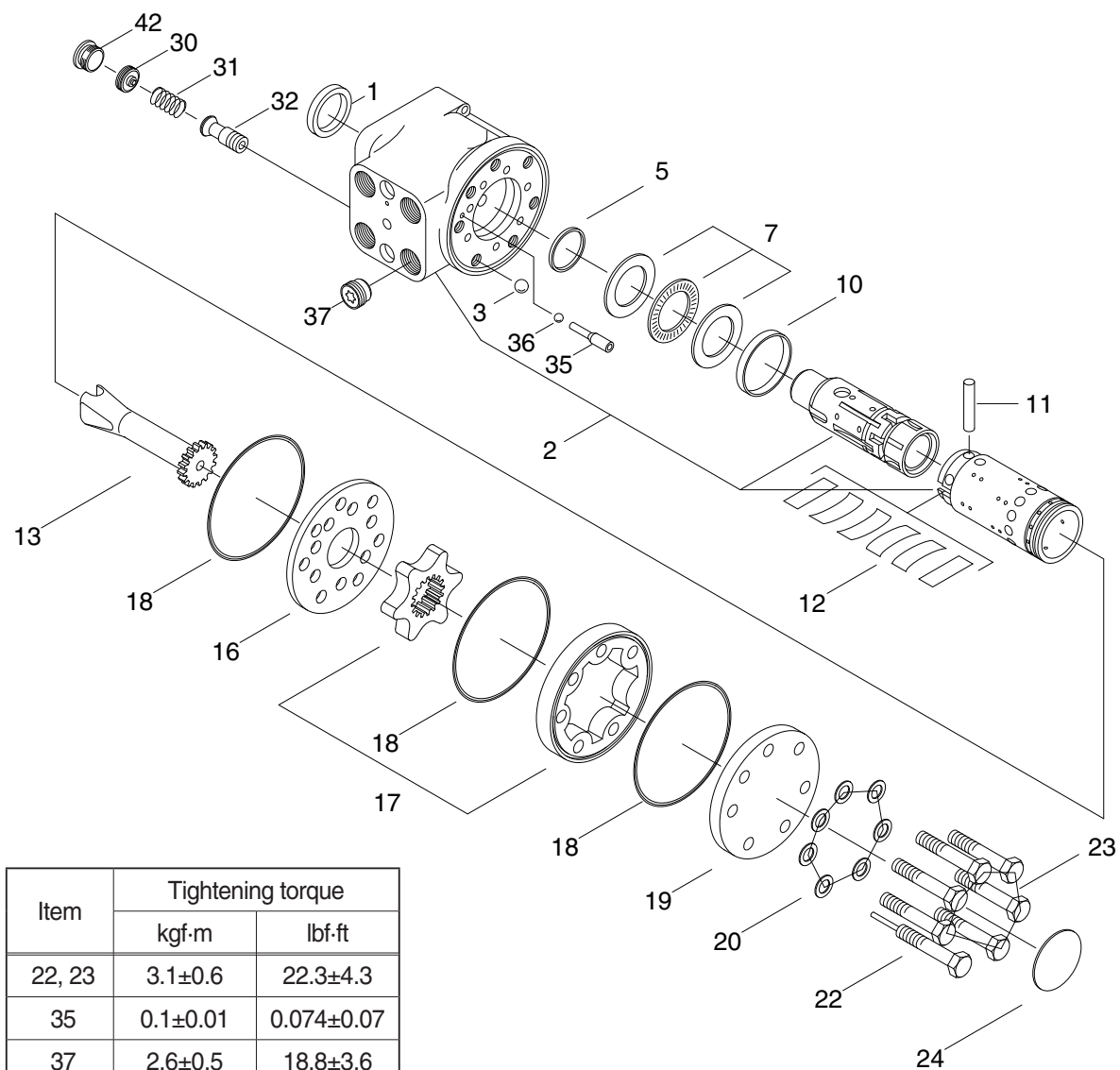
| Problem | Cause | Remedy |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The steering wheel cannot be rotated. | <ul style="list-style-type: none"> The steering unit column shaft is installed incorrectly or damaged. The oil pressure does not rise. The relief valve is faulty or not closed. LS line (Hose) incorrectly connected. The piping is damaged. | <ul style="list-style-type: none"> Inspect and correct or replace. Inspect and adjust the relief set pressure. Inspect and correct. Inspect and correct. Replace. |
| The steering wheel is heavy. | <ul style="list-style-type: none"> The tire inflating pressure is low. The oil pressure does not rise. The high and low pressure hoses are connected reversely. The power steering cylinder rod is bent or the piston is sticking. | <ul style="list-style-type: none"> Adjust the inflating pressure. Inspect and adjust the relief set pressure. Inspect and correct. Inspect and correct or replace. |

| Problem | Cause | Remedy |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The oil pressure does not rise. | <ul style="list-style-type: none"> · The high and low pressure hoses are connected reversely. · The relief valve is faulty or not closed. · The oil pump function is degraded or the oil volume is insufficient. · The power steering cylinder piston packing is damaged. | <ul style="list-style-type: none"> · Inspect and correct. · Inspect and correct. · Inspect and correct or replace. · Replace. |
| The steering wheel does not return properly. | <ul style="list-style-type: none"> · The tire inflating pressure is low. · The steering unit spool does not move smoothly. · The steering knuckle sliding motion is improper. | <ul style="list-style-type: none"> · Adjust the inflating pressure. · Correct or replace the steering unit · Add the lubricant or correct. |
| The steering wheel does not return (lateness) to the neutral position when released. | <ul style="list-style-type: none"> · The steering unit spool does not move smoothly. · The steering unit column shaft is damaged. · The centering spring is damaged. · The piping is blocked (crushed or clogged). | <ul style="list-style-type: none"> · Correct or replace the steering unit. · Replace the steering unit · Replace. · Inspect and correct or replace. |
| The play is excessive and the vehicle wobbles. | <ul style="list-style-type: none"> · Oil moves in the steering unit. · The steering unit spool is not moving correctly. · Air is sucked from the piping. · The steering unit column shaft is defective. | <ul style="list-style-type: none"> · Replace the steering unit. · Correct or replace the steering unit. · Inspect and correct or replace. · Inspect and correct or replace. |
| The tires are steered opposite to the steering wheel operated direction. | <ul style="list-style-type: none"> · The cylinder piping is connected reversely. | <ul style="list-style-type: none"> · Inspect and correct. |
| The steering wheel in the idling state is heavy. | <ul style="list-style-type: none"> · Oil moves in the steering unit. · The relief valve is not functioning correctly. · Air is sucked from the piping. · The piping is blocked (crushed or clogged). · The end cap set screw is tightened to an excessive torque. | <ul style="list-style-type: none"> · Replace the steering unit. · Inspect and correct. · Inspect and correct or replace. · Inspect and correct or replace. · Tighten uniformly to the specified torque. |
| Abnormal noise is generated. | <ul style="list-style-type: none"> · The relief valve is defective. · Air is sucked from the piping. · The piping is blocked (crushed or clogged). | <ul style="list-style-type: none"> · Correct, inspect the pressure, and adjust. · Inspect and correct or replace. · Inspect and correct or replace. |

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. STEERING UNIT

1) STRUCTURE



| Item | Tightening torque | |
|--------|-------------------|------------|
| | kgf-m | lbf-ft |
| 22, 23 | 3.1±0.6 | 22.3±4.3 |
| 35 | 0.1±0.01 | 0.074±0.07 |
| 37 | 2.6±0.5 | 18.8±3.6 |

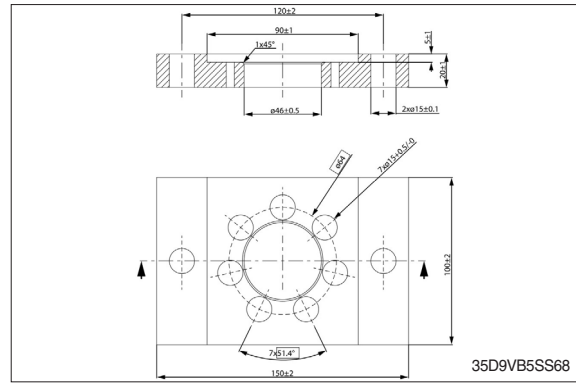
70D9V5SS06

- | | | |
|----------------------------|----------------------|-----------------------|
| 1 Dust seal ring | 13 Cardan shaft | 24 Model / Code label |
| 2 Housing and spool/sleeve | 16 Distributor plate | 30 Adjusting screw |
| 3 Ball | 17 Gearwheel set | 31 Spring |
| 5 Shaft seal | 18 O-ring | 32 Piston |
| 7 Bearing assembly | 19 End over | 35 Ball stop |
| 10 Ring | 20 Washer | 36 Ball |
| 11 Cross pin | 22 Pin bolt screw | 37 Check valve |
| 12 Set of springs | 23 Screw | 42 Plug |

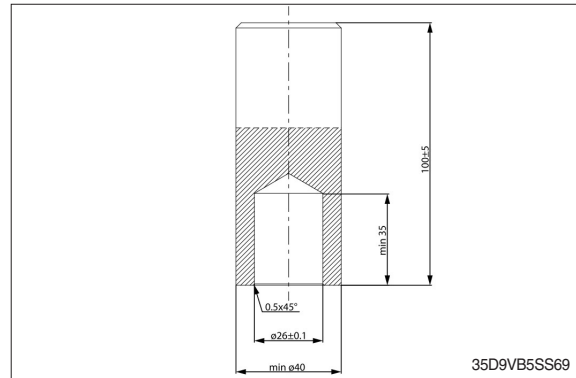
※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7)

2) TOOLS

- (1) Holding tool for the entire steering unit.
Material: Appropriate metal or hard plastic.



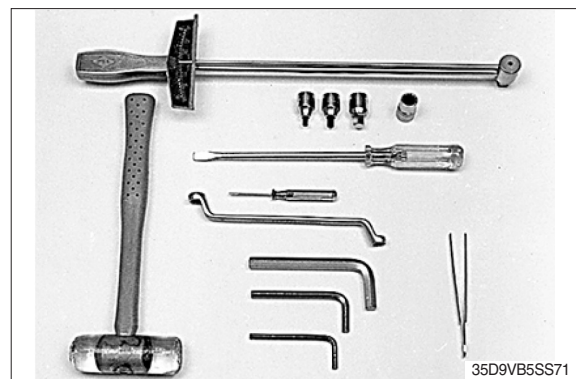
- (2) Assembly tool for dust seal.
Material: Free cutting steel.



- (3) Assembly tool for shaft seal, O-ring/Roto
Glyd type:
Code number: 11092408.



- (4) Torque wrench
- 13 mm socket spanner
 - 2 mm, 7/64 inch (2.75 mm) allen key
 - Torx Bit size T50
 - 12 mm screwdriver
 - 2 mm screwdriver
 - 13 mm ring spanner
 - Plastic hammer
 - Tweezers



3) TIGHTENING TORQUE

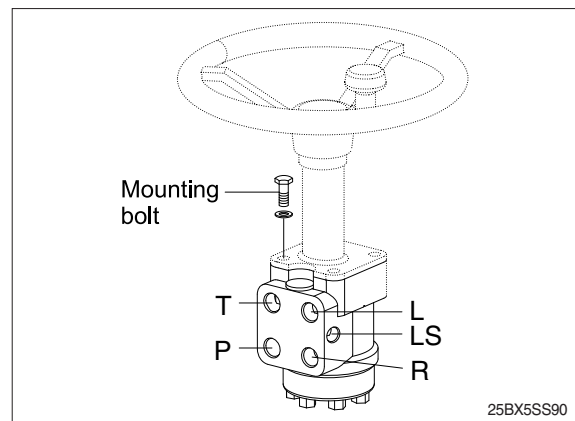
L : Left port

R : Right port

T : Tank port

P : Pump port

LS : Load sensing port



| Port | Port size | Tightening torque | |
|---------------|-------------------|-------------------|--------|
| | | kgf·m | lbf·ft |
| L, P, R, T | 3/4-16 UNF | 6 | 43.4 |
| LS | 7/16-20 UNF | 2 | 14.5 |
| Mounting bolt | M10 × 1.5 × 85 mm | 4 | 28.9 |

4) DISASSEMBLY

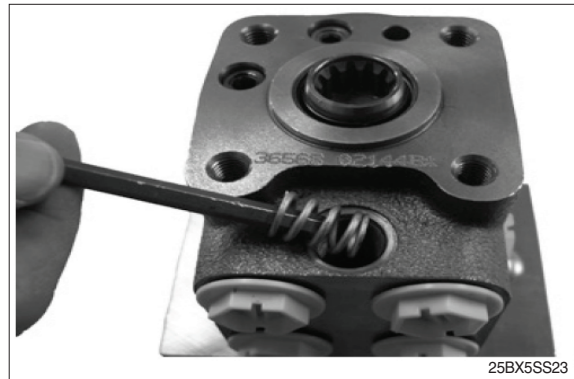
- (1) Screw out the plug (42) for relief valve using an 8 mm allen key. Sealing washer is crimped on the plug.



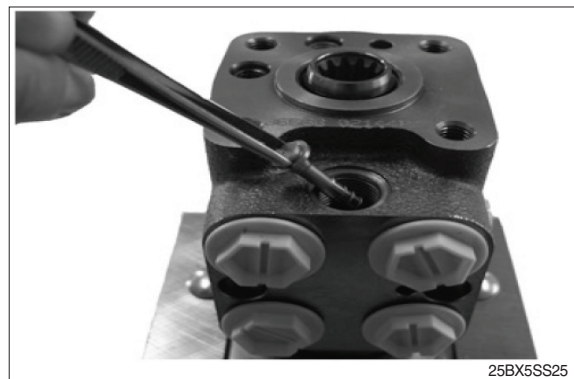
- (2) Screw out the adjusting screw (30) using a 6 mm allen key.



- (3) Remove the spring for relief valve (31).



- (4) Remove the piston for relief valve (32).



- (5) Replace the unit in the holding tool on steering column end.
Remove the screws (22 and 23) with washers (20) using a 13 mm ring spanner or top wrench.



- (6) Remove the end cover (19), sideways.



- (7) Lift the gearwheel set (17) off the unit.
Remove the two o-rings (18).



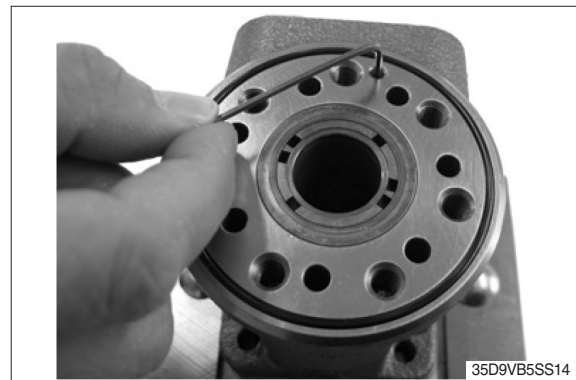
- (8) Remove the cardan shaft (13).



(9) Remove the distributor plate (16).



(10) Screw out the ball stop (35) using a 2 mm allen key.



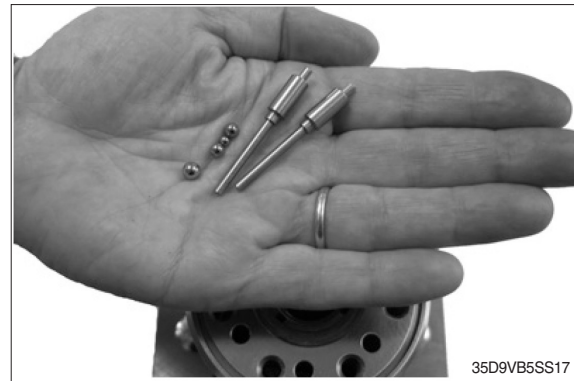
(11) Remove the o-ring (18) from housing.



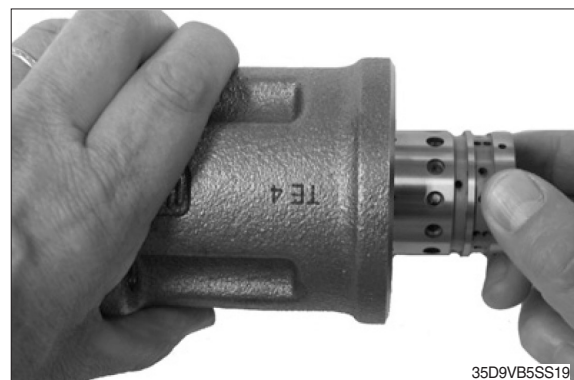
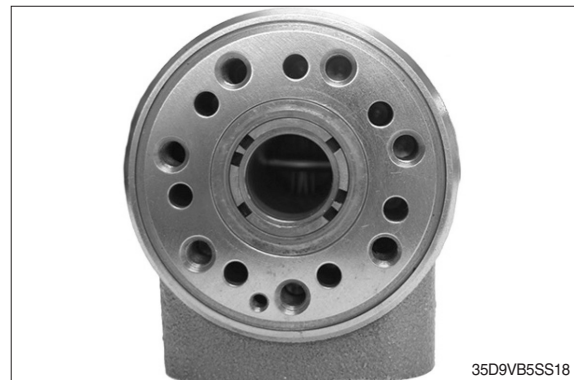
(12) Remove the check valve (37) using a torx bit size T50.



(13) Shake out the check valve ball (3), suction valve pins (34), balls (33 and 36).



(14) Place the housing with the ports facing down on the work bench. Ensure that the cross pin (11) in the spool and sleeve set (2) is in the horizontal position. The pin (11) can be observed through the open end of the spool. Press the spool (2) inwards (from the housing mounting face end) and the sleeve (2), ring (7) and bearing assembly (6) will be pushed out of the housing together.



(15) Take the bearing races and needle bearing (7) from the spool and sleeve set (2). The outer bearing (7) race can sometimes "stick" in the housing, therefore check that it has come out.



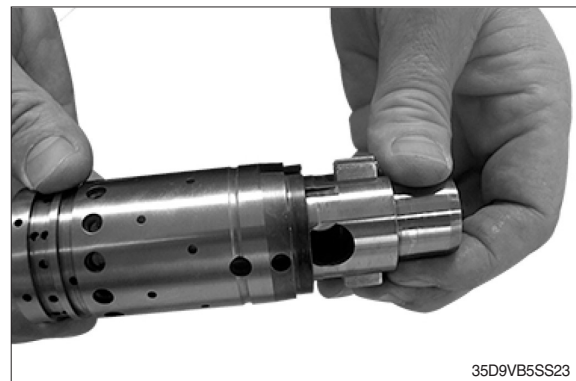
(16) Press out the cross pin (11).



(17) Remove the ring (10).



(18) Carefully press the spool out of the sleeve.



(19) Press the neutral position springs (12) out of the slot of the spool.



- (20) Remove dust seal (1) and shaft seal (Roto Glyd) (5) carefully with a screw driver or similar tool.



- (21) The steering unit is now completely dismantled.

- ※ Clean all parts carefully in shellsol K or similar cleaner fluid.
- ※ Inspection and replacement Replace all seals and washers. Check all parts carefully and make any replacements as is necessary.

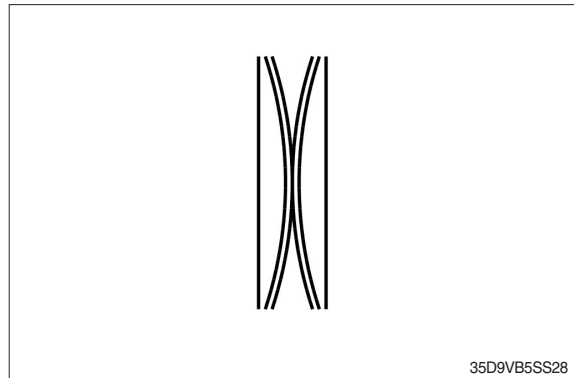


5) ASSEMBLY

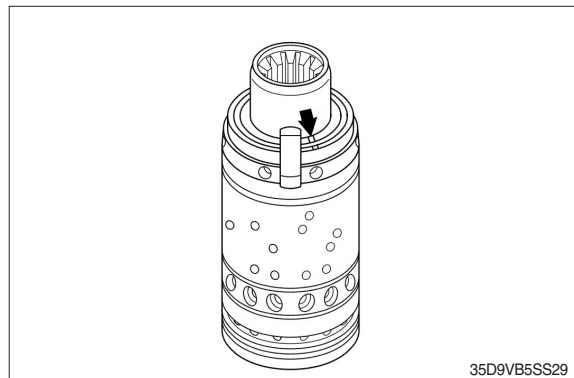
- (1) Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.



- (2) Configuration of spring set (12). There can be different numbers of curved springs depending on configuration of spring set. There can be 2, 4 or 6 curved springs.



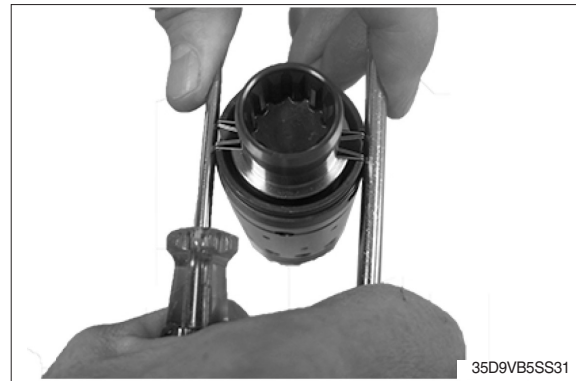
- (3) Some spool and sleeve sets for steering unit must be positioned correctly relatively to each other. Small marks are present on both spool and sleeve close to one of the slots for the spring set. Most spool and sleeve sets for steering unit have no marks, so those can be positioned relatively to each other in any of the 2 positions possible.



- (4) Guide the spool into the sleeve (2). Make sure the centering springs (12) are placed into the slot.



(5) Line up the spring set (12).



(6) Guide the ring (10) down over the sleeve.
The ring should be able to move free of the springs.



(7) Fit the cross pin (11) into the spool/sleeve.

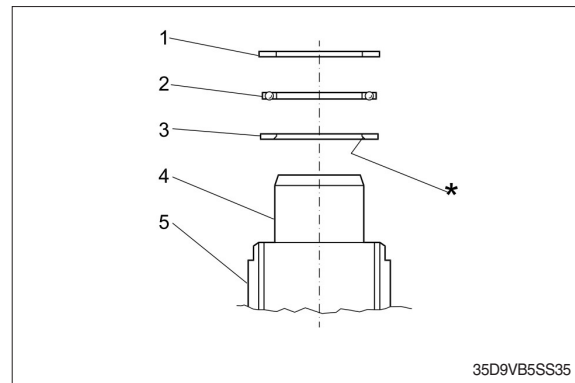


(8) Fit bearing races and needle bearing (7)
as shown on the drawing below.

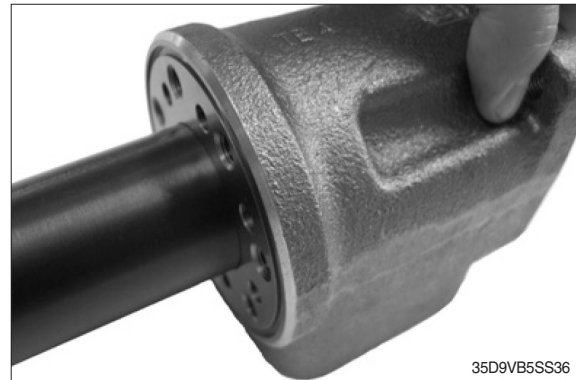


- (9) Assembly pattern for standard bearing 1
Outer bearing race → 2 Needlebearing →
3 Inner bearing race → 4 Spool → 5
Sleeve.

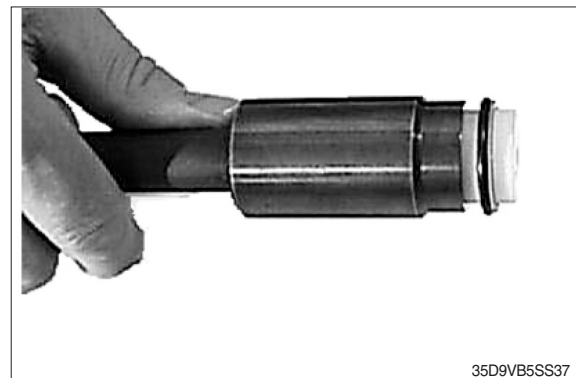
The inside chamfer on the inner bearing race must face the chest of the inner spool.



- (11) Place the steering unit housing with the port face down on the work bench. Guide the outer part of the assembly tool for shaft seal into the bore for the spool/sleeve set (2).



- (10) Grease the shaft seal (Roto Glyd, 5) with hydraulic oil and place them on the tool. Ensure that the Roto Glyd seal is placed on the insertion tool as per the photograph.



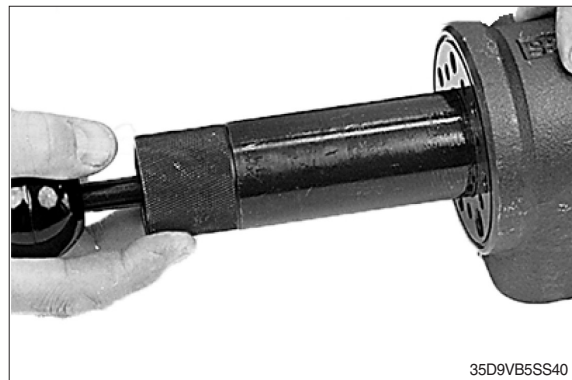
- (13) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



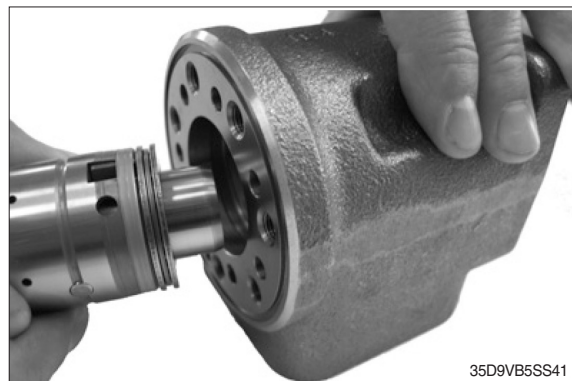
- (14) Press and turn the shaft seal (5) into position in the housing.



- (15) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



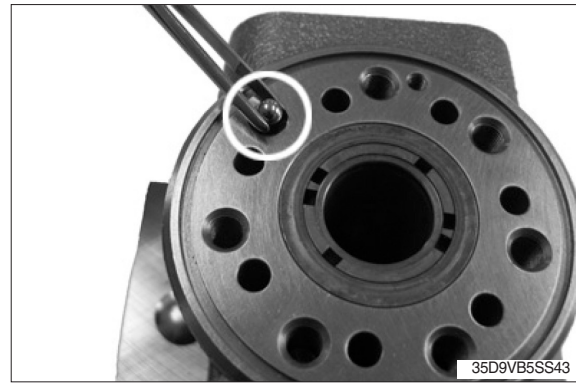
- (16) With a light turning movement, guide the spool and sleeve into the bore.
Fit the spool set holding the cross pin (11) horizontal.



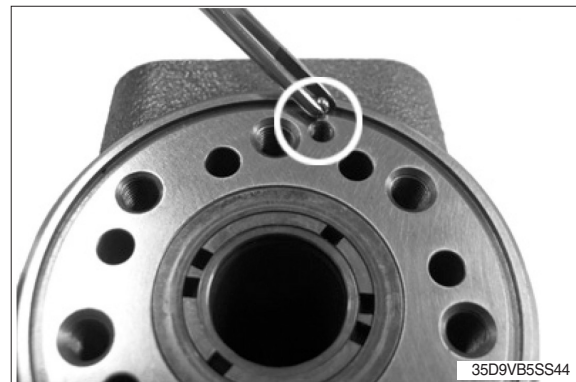
- (17) The spool set will push out the assembly tool guide. The shaft seal (5) are now installed.



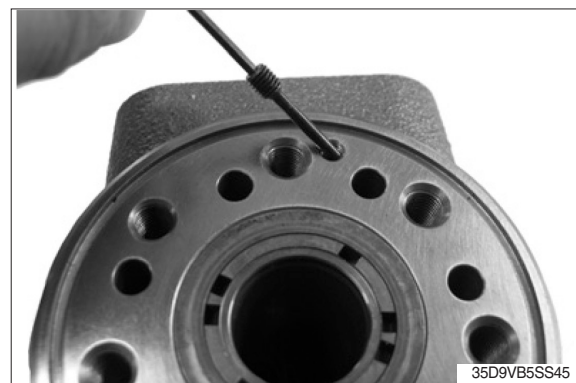
- (18) Place the steering unit housing on the holding tool on the steering column end. Put the check valve ball (3) into the hole indicated by the circle.



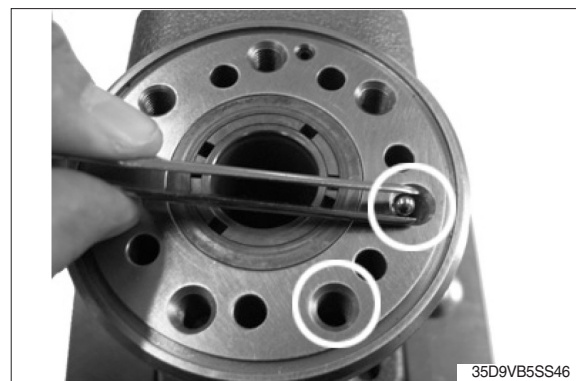
- (19) Place the ball for LS check valve (36) into the hole indicated by the circle.



- (20) Screw the ball stop (35) into the LS check valve bore using a 2 mm allen key.
- Tightening torque : 0.1 ± 0.01 kgf·m
(0.72 ± 0.072 lbf·ft)



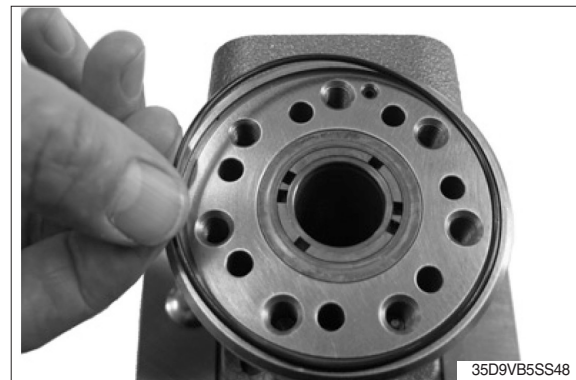
- (21) Place a ball (33) in the two bolt holes indicated by the circles.



(22) Place the pins (34) in the same two bolt holes.



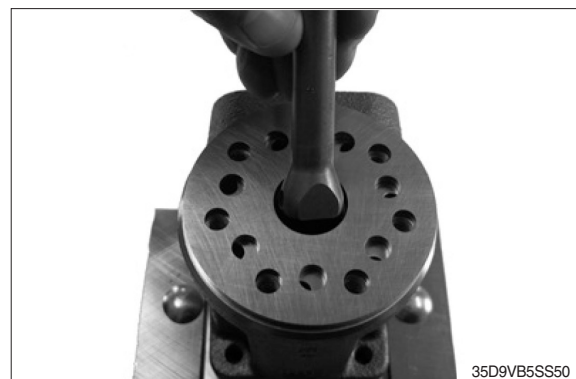
(23) Insert the O-ring (18) in the groove on the housing.



(24) Place the distributor plate (16) so that the channel holes match the thread holes in the housing.



(25) Guide the cardan shaft (13) down into the bore so that the slot is parallel with the connection flange ports and lines up with the cross pin (11).



- (26) Place the 2 o-rings (18) in the two grooves in the gear rim. Fit the gearwheel and rim (17) on the cardan shaft (13).

Place the gear wheel side with all the deeper splines facing downwards. Only this side will fit on the cardan shaft due to all gear sets used in steering unit have timing securing: splines of gear wheel and cardan shaft can only be assembled with correct timing. Line up the gear rim holes to match the thread holes of the housing.



- (27) Place the end cover (19) in position. Ensure that the bar codes and writing are parallel with port face.



- (28) Fit the pin bolt screw (22) with washer (20) and place it in the hole shown.



- (29) Fit the six screws (23) with new washers (20) and insert them. Use a 13 mm top wrench. Cross-tighten all the screws (22 and 23) with a torque

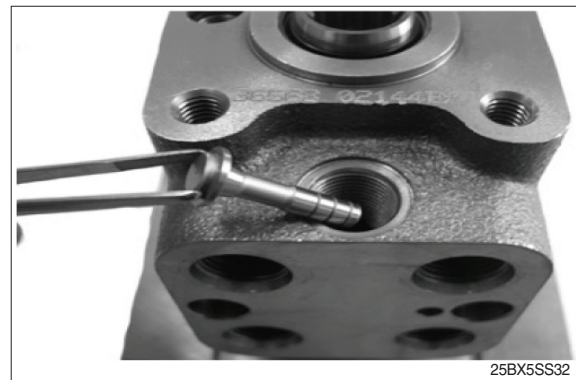
- Tightening torque : 3.1 ± 0.6 kgf·m
(22.4 ± 4.3 lbf·ft)



- (30) Screw in the check valve (37) into the P-port using a Torx Bit size T50.
- Tightening torque : 2.6 ± 0.5 kgf·m
(18.8 ± 3.6 lbf·ft)



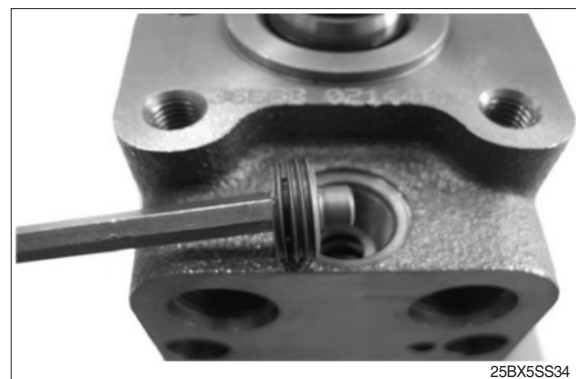
- (31) Replace the unit in the holding tool on gear set end. Install the piston (32) to housing.



- (32) Install the spring (31) on top of the piston (32).

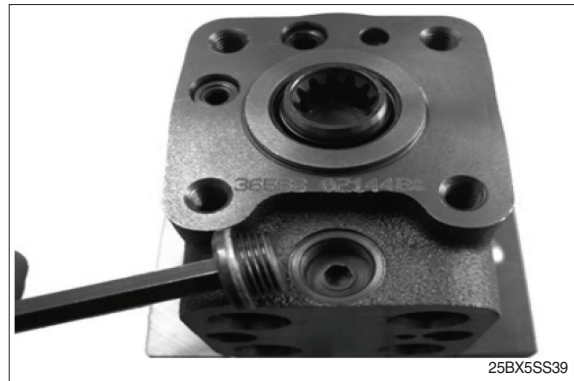


- (33) Screw in the adjustment screw (30) using a 6 mm allen key. Make the pressure setting on a test panel according to valve setting specification.



(34) Screw in the plug (42) using a 8 mm allen key.

- Tightening torque : 6.6 ± 0.5 kgf·m
(47.7 ± 3.6 lbf·ft)



(35) Place the dust seal ring (1) in the housing.



(36) Fit the dust seal ring in the housing using special tool for dust seal assembly and a plastic hammer.

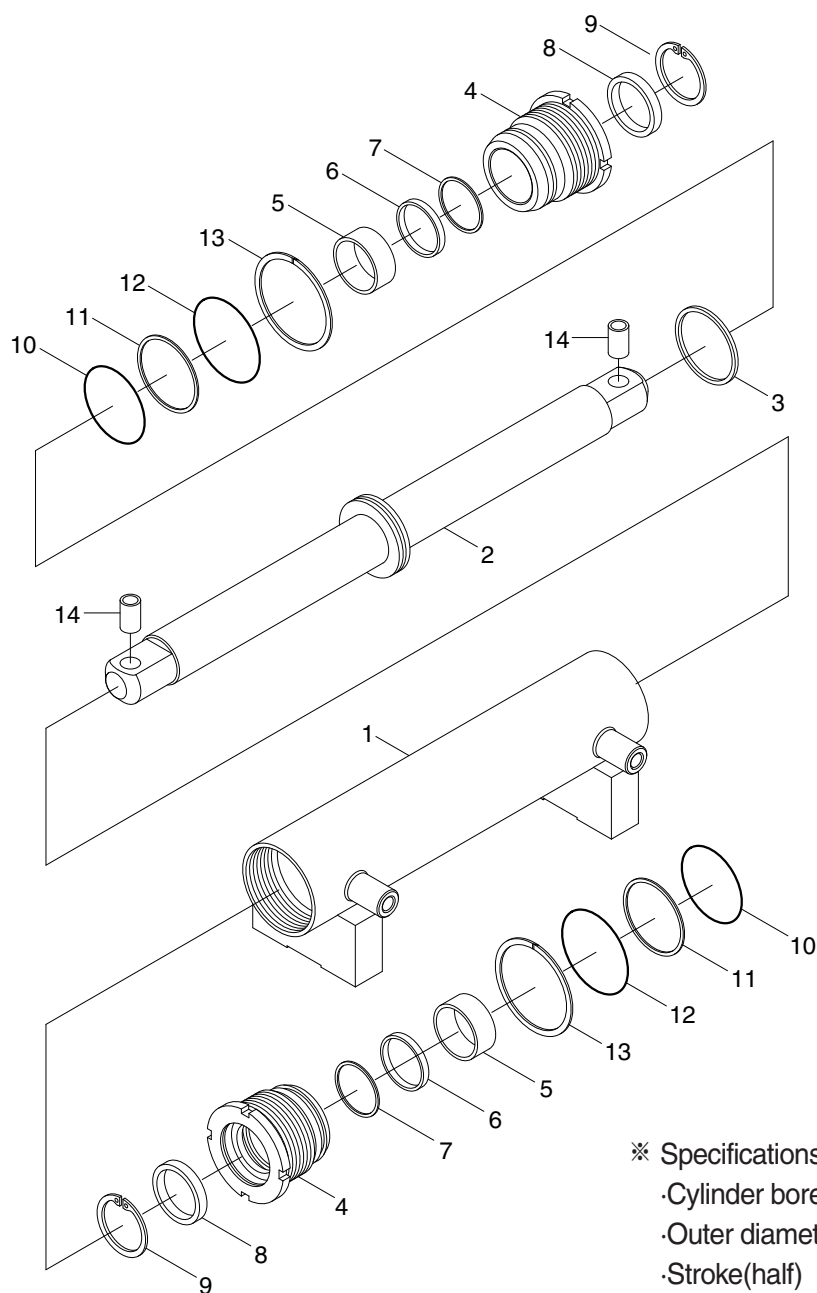


(37) Screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.



2. STEERING CYLINDER

1) STRUCTURE



※ Specifications

- Cylinder bore : 80 mm (3.1 in)
- Outer diameter : 94 mm (3.7 in)
- Stroke(half) : 150 mm (2.9 in)
- Rod diameter : 55 mm (2.2 in)

50D9SE21

- 1 Tube assy
- 2 Rod assy
- 3 Piston seal
- 4 Gland
- 5 DU bushing

- 6 Rod seal
- 7 Back up ring
- 8 Dust wiper
- 9 Snap ring
- 10 O-ring

- 11 Back up ring
- 12 O-ring
- 13 Lock washer
- 14 Pin bushing

※ Seal kit : 3, 6, 7, 8, 10, 11, 12

2) DISASSEMBLY

※ Before disassembling steering cylinder, release oil in the cylinder first.

- (1) Put wooden blocks against the cylinder tube, then hold in & vice.
- (2) Remove the cover by hook a wrench in the notch of cylinder head and turn counter-clockwise.
- (3) Remove the cylinder rod and piston from the tube.
- (4) Check wear condition of the sealing parts (O-ring, oil seal, dust seal, U-packing, bush). If there are some damage, replace with new parts.

3) CHECK AND INSPECTION

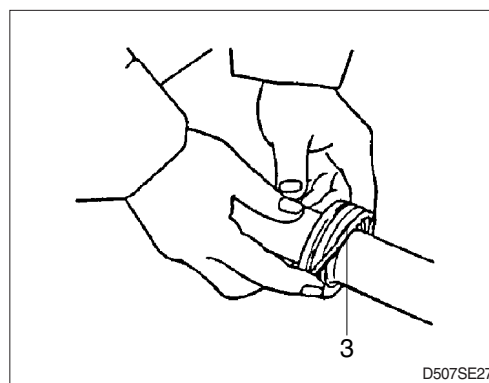
mm (in)

| Check item | Criteria | | Remedy |
|------------------------------------------|----------------------------|---------------|---------------------|
| | Standard size | Repair limit | |
| Clearance between piston & cylinder tube | 0.05~0.25 (0.002~0.01) | 0.4 (0.02) | Replace piston seal |
| Clearance between cylinder rod & bushing | 0.05~0.18 (0.002~0.007) | 0.3 (0.01) | Replace bushing |
| Seals, O-ring | Damage | | Replace |
| Cylinder rod | Dents | | Replace |
| Cylinder tube | Biting | | Replace |

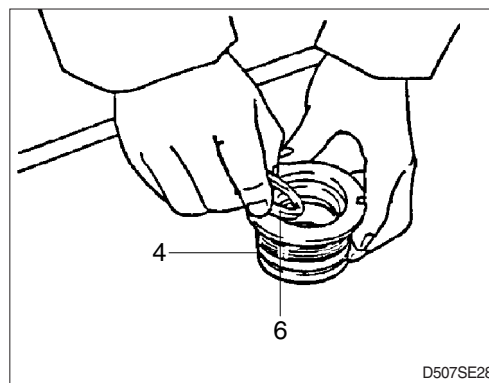
4) ASSEMBLY

- (1) Install a new piston seal (3) around the groove on the piston.

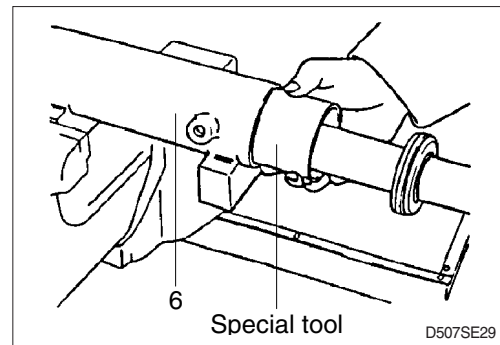
※ Be careful not to scratch the seal too much during installation or it could not be seated properly.



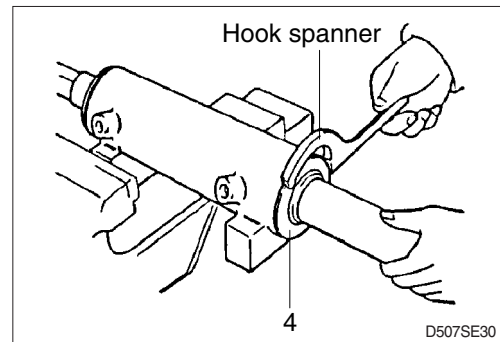
- (2) Install the rod seal (6) to the position in the gland(4) applying a slight coat with grease prior to install.



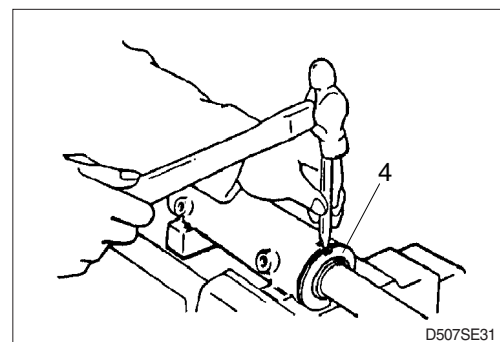
- (3) Install the dust wiper (8) to the gland (4) using a special installing tool. Coat the dust wiper with grease slightly before installing.
- (4) Using a special tool, install gland assembly into the cylinder tube (1).



- (5) Using a hook spanner, install the gland (4) assembly, and tighten it with torque 60 ± 6 kgf·m (434 ± 43 lbf·ft).



- (6) After the gland (4) assembly was installed to the cylinder tube (1), calk at the tube end into the groove on the gland to prevent screw loosening.
- ※ If it is needed to calk again, never calk on the same place.

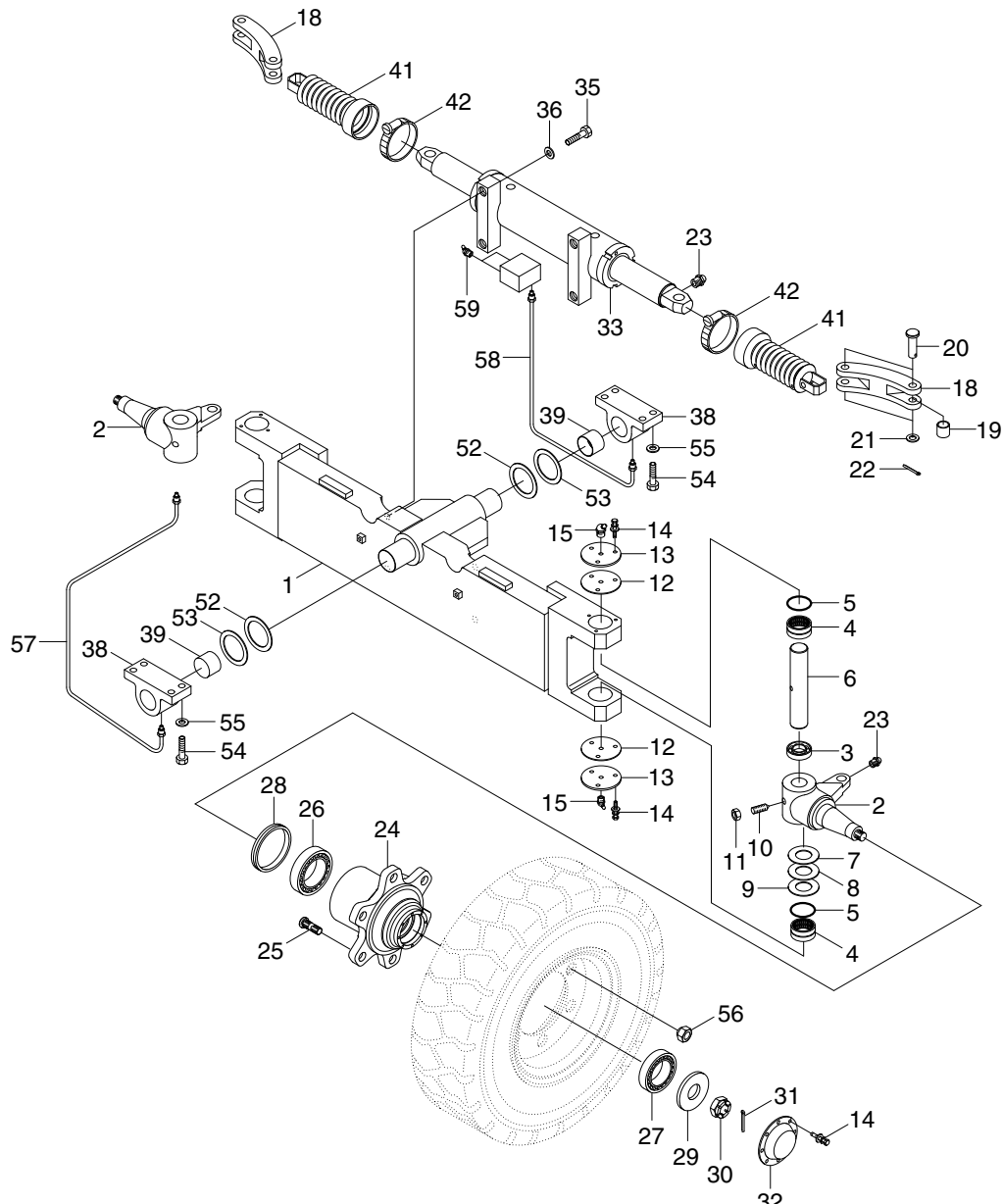


- (7) Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
- (8) Install cylinder into trail axle.
- (9) While idling the engine with the rear wheels off the ground, operate the steering wheel left and right alternately.
- ※ Then, repeat the above operation at gradually increasing engine rpm. This releases air from the system and completes preparation for operation.
- (10) Stop the engine, lower the floating rear wheels, and check pump joints for oil leaks and looseness and retighten, them as required.

4. STEERING AXLE

1) STRUCTURE

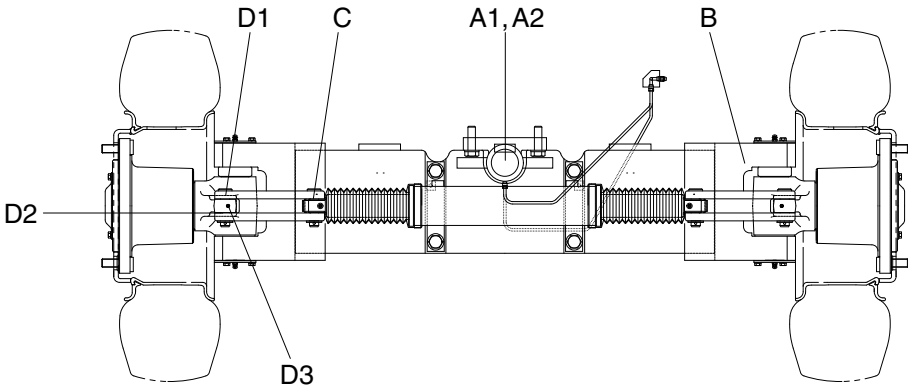
※ Do not remove the stopper bolt unless necessary.



50D9SE24

| | | | | | | | |
|----|---------------------|----|----------------|----|----------------------|----|------------------------|
| 1 | Steering axle | 13 | Cover | 25 | Hub bolt | 39 | Bushing |
| 2 | Knuckle | 14 | Bolt w/washer | 26 | Taper roller bearing | 41 | Steering cylinder boot |
| 3 | Thrust bearing | 15 | Grease nipple | 27 | Taper roller bearing | 42 | Clamp |
| 4 | Needle bearing | 16 | Hexagon bolt | 28 | Oil seal | 52 | Shim (1.0 t) |
| 5 | Oil seal | 17 | Hexagon nut | 29 | Special washer | 53 | Shim (0.5 t) |
| 6 | King pin | 18 | Link | 30 | Slotted nut | 54 | Hexagon bolt |
| 7 | Thrust washer | 19 | Bushing | 31 | Split pin | 55 | Hardened washer |
| 8 | Shim washer (0.1 t) | 20 | Link pin | 32 | Hub cap | 56 | Hub nut |
| 9 | Shim washer (0.2 t) | 21 | Special washer | 33 | Steering cylinder | 57 | Front pipe assy |
| 10 | Set screw | 22 | Split pin | 35 | Hexagon bolt | 58 | Rear pipe assy |
| 11 | Hexagon nut | 23 | Grease nipple | 36 | Hardened washer | 59 | Grease nipple |
| 12 | Gasket | 24 | Hub | 38 | Support | | |

2) CHECK AND INSPECTION



50D9SE25

unit : mm (in)

| No. | Check item | | | Criteria | | Remedy |
|-----|-----------------------------|----|---------------|---------------|--------------|-------------|
| | | | | Standard size | Repair limit | |
| A | Shaft | A1 | OD of shaft | 60(2.4) | 59.5(2.3) | Replace |
| | | A2 | ID of bushing | 60(2.4) | 59.5(2.3) | |
| B | OD of king pin | | | 50(2.0) | 49.8(2.0) | |
| C | OD of steering cylinder pin | | | 22(0.9) | 21.9(0.9) | |
| D | Knuckle | D1 | OD of pin | 22(0.9) | 21.9(0.9) | Adjust shim |
| | | D2 | Vertical play | - | 0.2(0.008) | |
| | | D3 | ID of bushing | 22(0.9) | 22.5(0.9) | Replace |

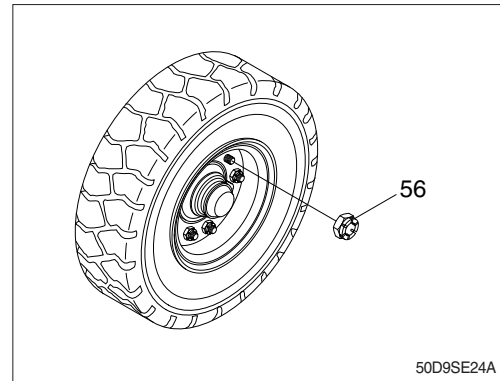
·OD : Outer diameter

·ID : Inner diameter

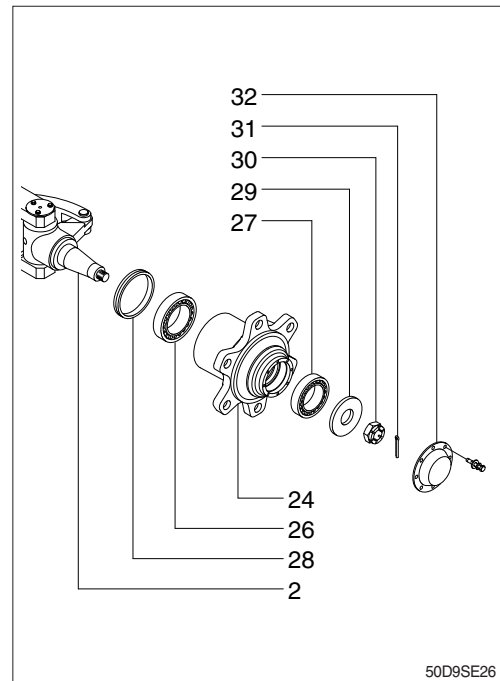
3) DISASSEMBLY

※ Servicing work on the knuckle part can be carried out without removing the axle assy from chassis.
The work can be done by jacking up the balance weight part of the truck.

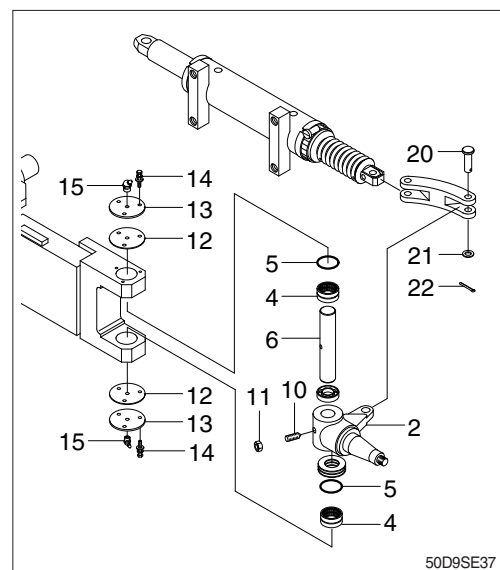
- (1) Loosen the hub nut (56) and take off the steering wheel tire.



- (2) Remove Hub cap (32).
- (3) Pull out split pin (31) and remove slotted nut (30), washer (29).
- (4) Using the puller, take off the hub (24) together with the taper roller bearing (26, 27).
※ Be very careful because just before the hub comes off, tapered roller bearing will fall out.
- (5) After hub (24) is removed take off the inner race of taper roller bearing (26, 27).
- (6) Pull out oil seal (28).
※ Don't use same oil seal twice.
- (7) Repeat the same procedure for the other side.
Moreover, when disassembling is completed, part the slotted nut in the knuckle to protect the threaded portion.



- (8) Loosen set screw (10) and nut (11).
- (9) Loosen with washer bolt (14) and remove cover (13), gasket (12). Remove grease nipple (15).
- (10) Push out the king pin (6) without damaging the knuckle arm (2).
- (11) At the same time the king pin is removed, pull out the oil seal (5).
- (12) If defect is observed in needle bearing (4), pull it out by using extractor.
- (13) Remove split pin (22), special washer (21) and link pin (20).



4) ASSEMBLY

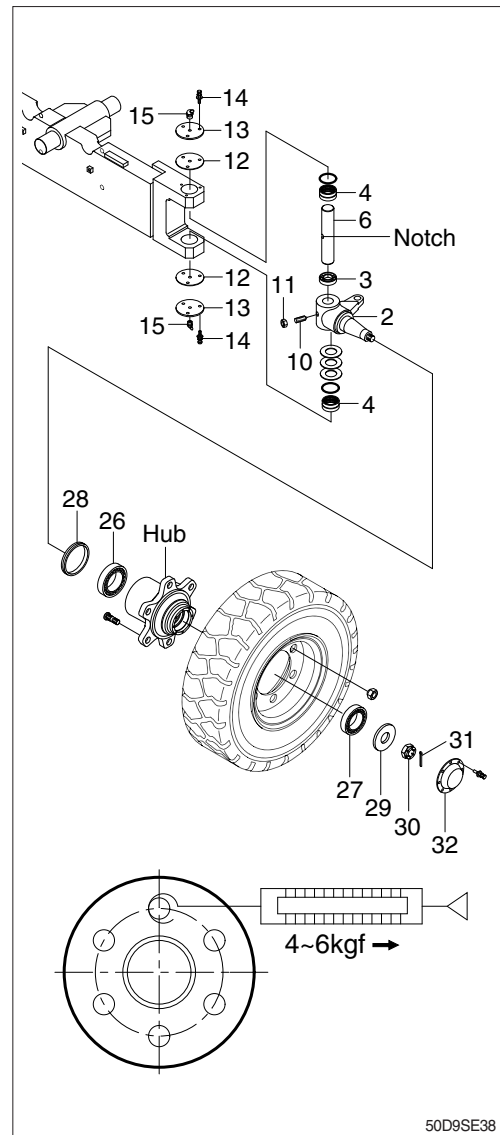
※ In reassembling, have all parts washed, grease applied to lubricating parts, and all expendable items such as oil seal and spring washers replaced by new ones.

Perform the disassembly in reverse order.

- (1) Tighten the set screw (10) of king pin (6).
- (2) There is a notch in the middle of the king pin (6), make sure that this notch is on the set screw side.
- (3) Do not hammer to drive in needle bearing(4) because it will break.
Always use drive-in tool. In assembling the thrust bearing (3), be sure that the fixed ring of the bearing is placed in position facing the knuckle (2).

(4) Hub

- ※ Mount oil seal (28) and inner race of taper roller bearing (26) on the knuckle. The bearing should be well greased before assembling.
- ※ Install the outer race of the bearing (27) in the wheel center and assemble to the knuckle.
- ※ Put washer (29) in place, tighten with nut (30) and locked with split pin (31). In locking with split pin, locate the hole for the split pin by turning the nut back 1/6 of a turn. Adjust the preload of bearing.
- ※ Mount the hub cap (32).
Bearing should be well greased before assembling.



50D9SE38