

# SECTION 5 STEERING SYSTEM

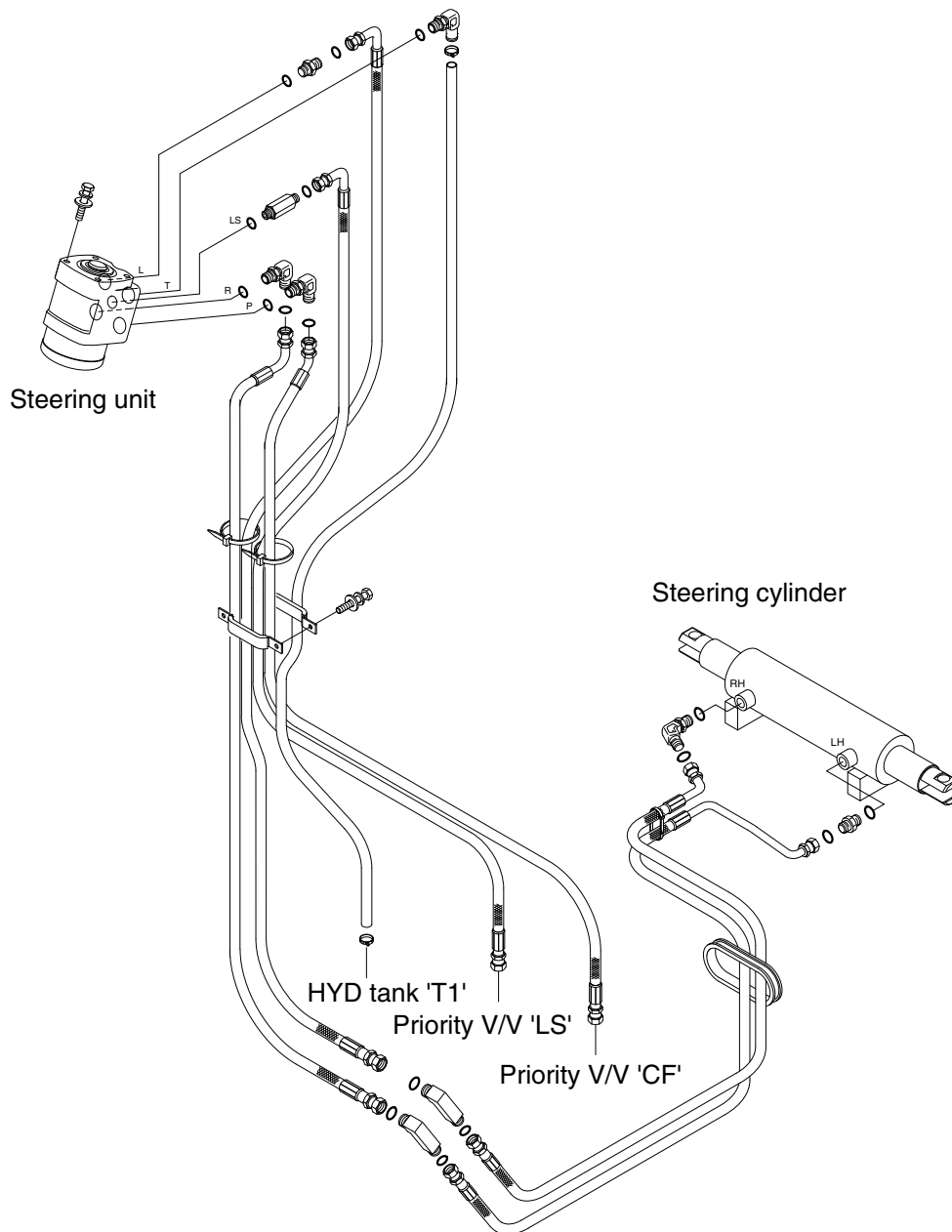


Group 1	Structure and function .....	5-1
Group 2	Operational checks and troubleshooting .....	5-13
Group 3	Disassembly and assembly .....	5-16

## SECTION 5 STEERING SYSTEM

### GROUP 1 STRUCTURE AND FUNCTION

#### 1. OUTLINE



25D9V5SS01

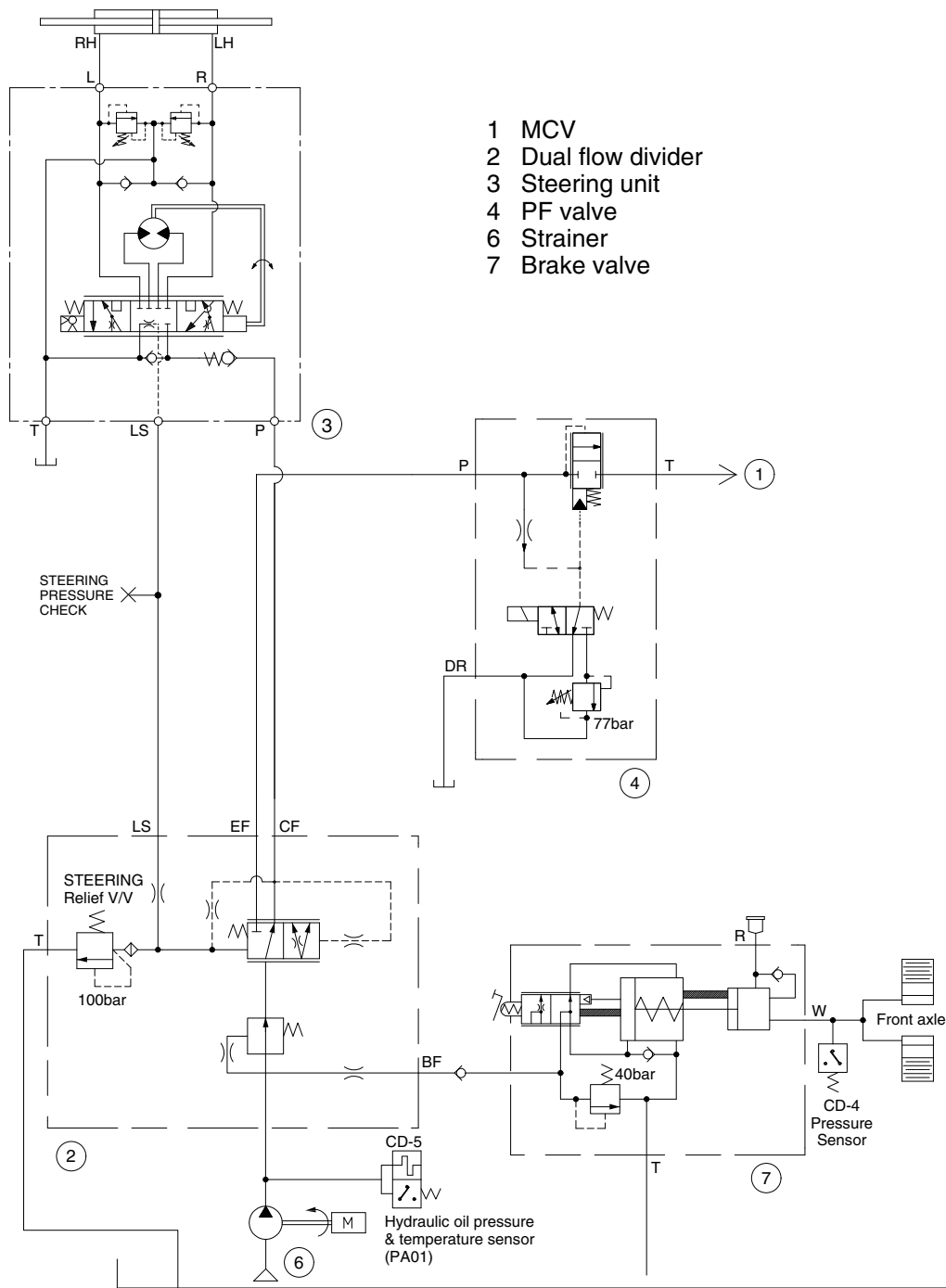
The steering system for this truck is composed of pump, steering wheel assembly, steering unit, priority valve (or dual flow divider), steering cylinders, steering axle and piping. The steering axle supports the forklift weight with the rear axle, contains a cylinder and controls the position of the 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.

### · NON-BOOSTER TYPE BRAKE



5-2

## · BOOSTER TYPE BRAKE (OPTION)

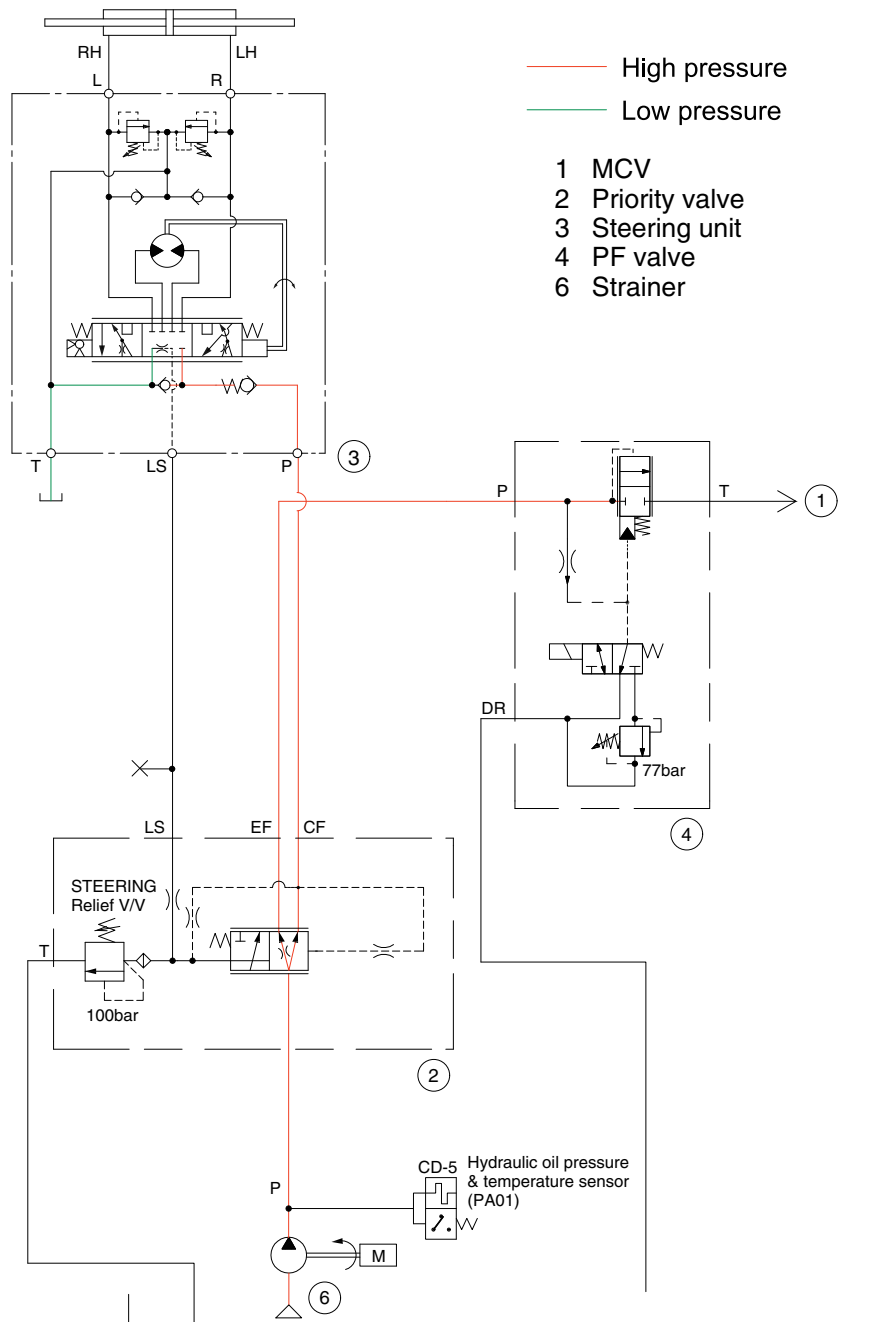


25D9V5SS03

The hydraulic oil discharged from the pump flows to the dual flow divider (2). When the driver operates the steering wheel, the steering unit (3) is supplied with pressure oil preferentially by the dual flow divider operation circuit. The oil passages in the steering unit are changed over to direct the hydraulic pressure from the dual flow divider 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 MCV and the tank through the dual flow divider EF flow path.



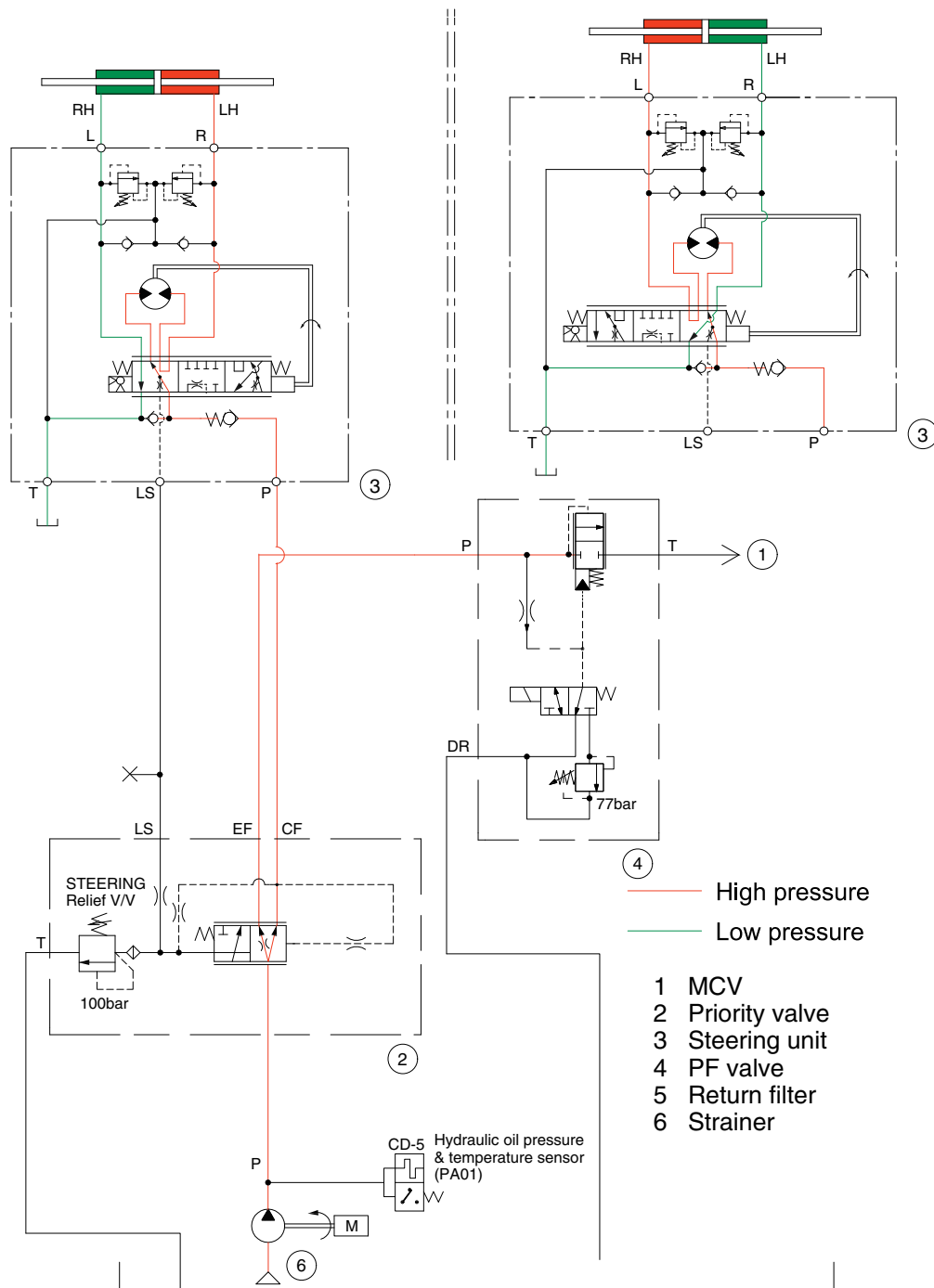
## 1) NEUTRAL



25D9V5SS04

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 MCV through the EF passage. 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

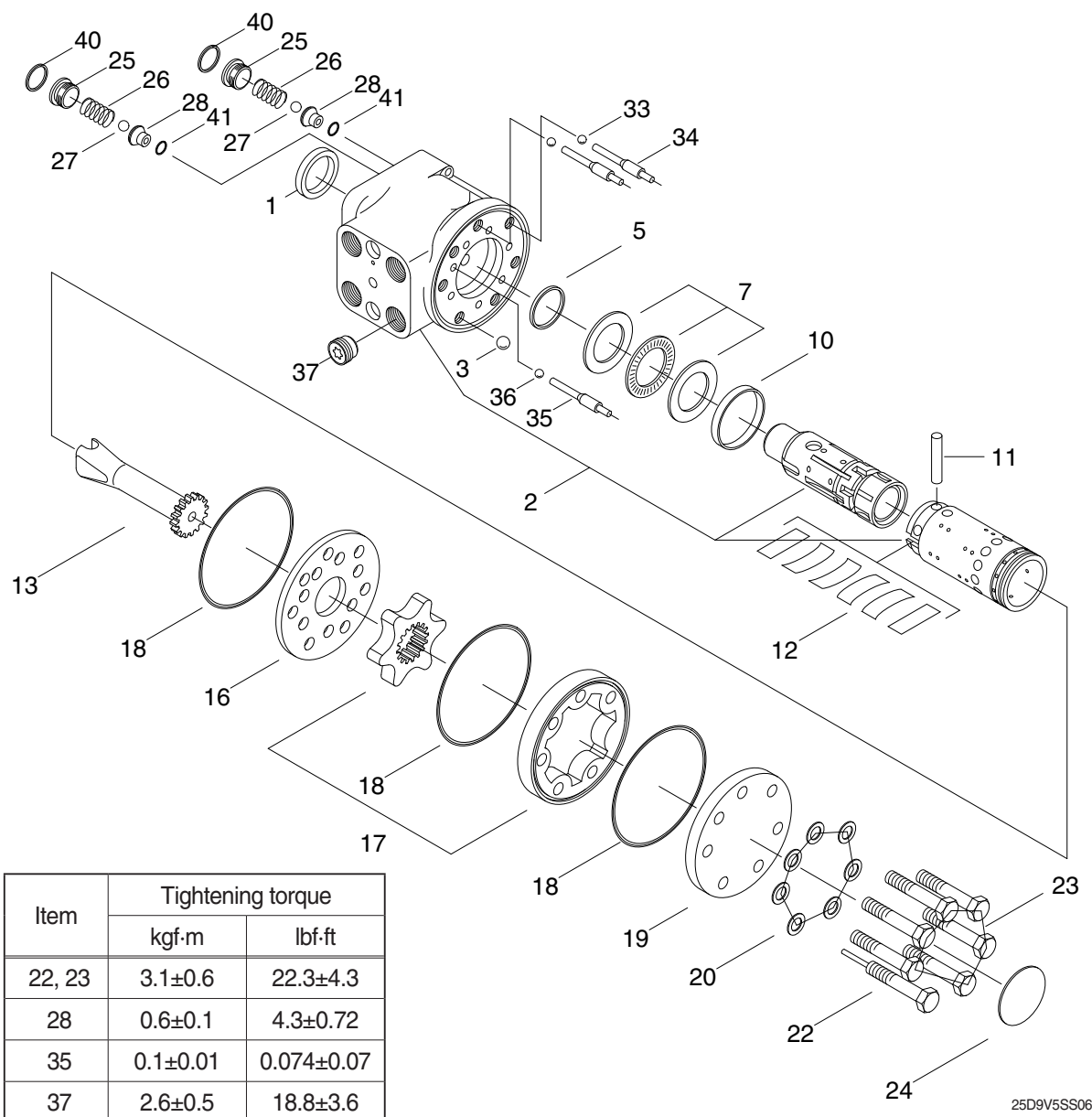


25D9V5SS05

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 CF 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. The priority valve spool moves and directs the pump flow through the EF passage to the MCV.

### 3. STEERING UNIT

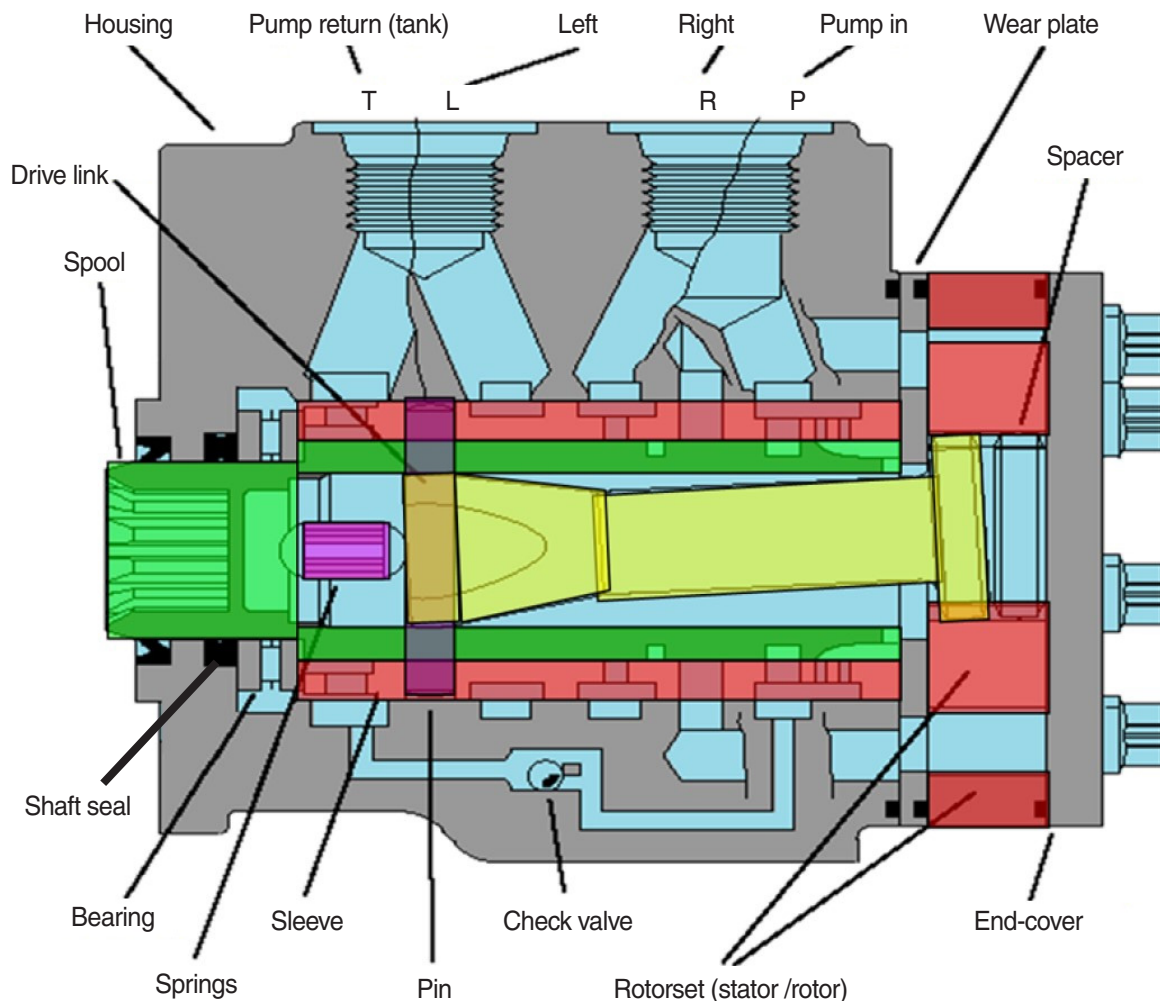
#### 1) STRUCTURE



- |                            |                       |                |
|----------------------------|-----------------------|----------------|
| 1 Dust seal ring           | 18 O-ring             | 31 Spring      |
| 2 Housing and spool/sleeve | 19 End over           | 32 Piston      |
| 3 Ball                     | 20 Washer             | 33 Ball        |
| 5 Shaft seal               | 22 Pin bolt screw     | 34 Bushing     |
| 7 Bearing assembly         | 23 Screw              | 35 Ball        |
| 10 Ring                    | 24 Model / Code label | 36 Ball        |
| 11 Cross pin               | 25 Adjusting screw    | 37 Check valve |
| 12 Set of springs          | 26 Spring             | 40 O-ring      |
| 13 Cardan shaft            | 27 Ball               | 41 O-ring      |
| 16 Distributor plate       | 28 Seat               | 42 Plug        |
| 17 Gearwheel set           | 30 Adjusting screw    |                |

※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7), 40 (2), 41 (2)

## 2) OPERATION

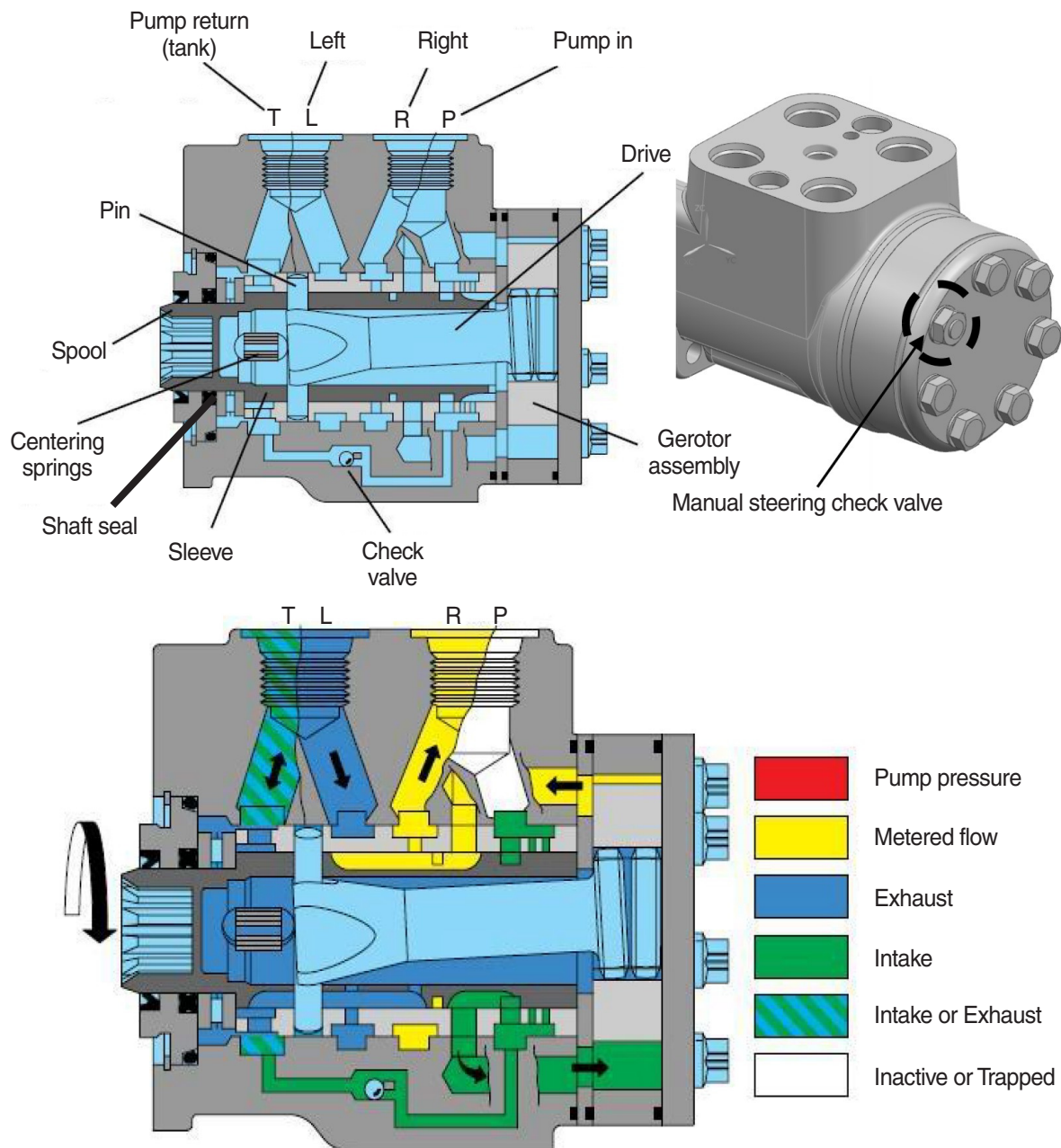


35D9VB5SS76

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.
- Anti-cavitation valve for cylinder ports : (R & L) protects steering circuit against vacuum (cavitation) conditions.
- Shock valve for cylinder ports : (R & L) protects hoses against pressure surge created by ground forces on the steering axle.

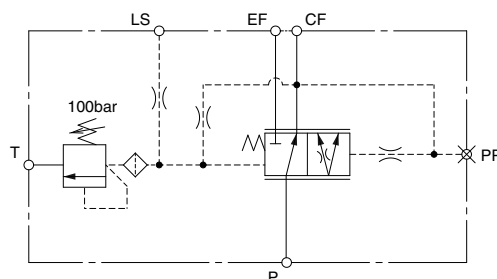
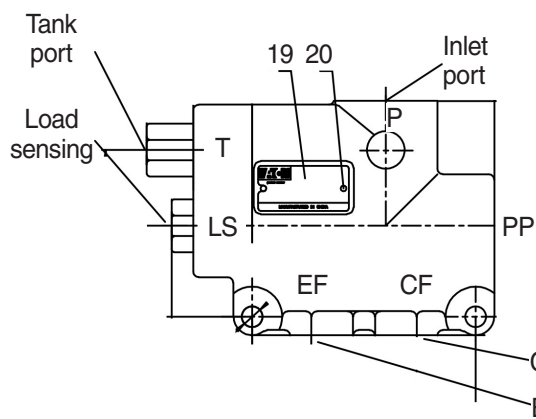
### 3) MANUAL STEERING (EMERGENCY)



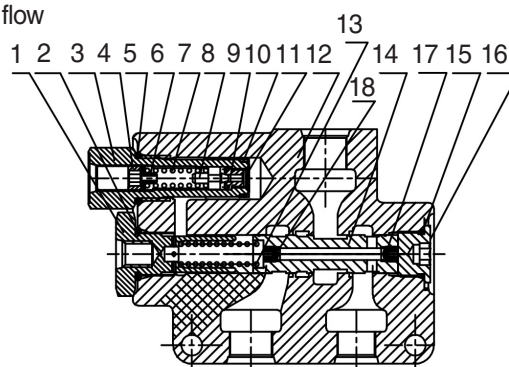
35D9VBSS77

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 and the EF port closes. 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. PRIORITY VALVE



Item/Port	Port size	Tightening torque	
		kgf·m (±0.5)	lbf·ft (±3.7)
1 (LS) 3 (T) 16 (PP)	-	5.1	36.9
LS, T	7/16-20UNF	2.5	18
CF	3/4-16 UNF	6	43.4
EF, P	1-1/16-12 UN	9.5	68.7



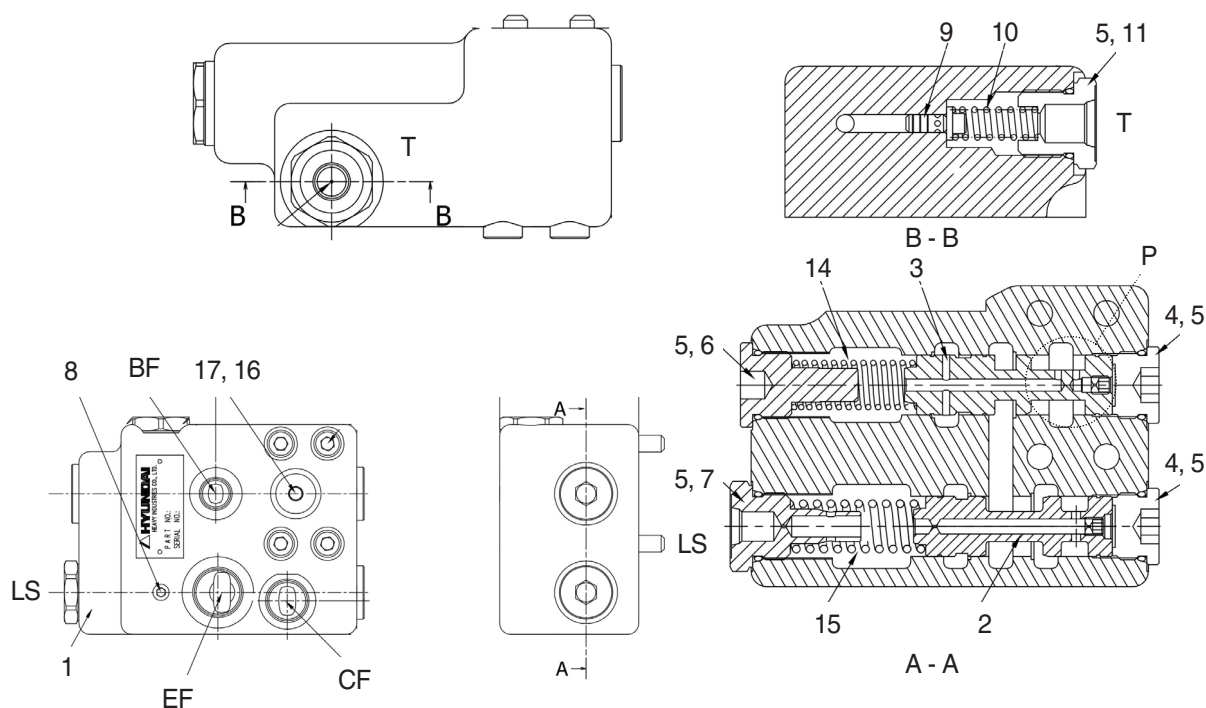
25D9VSS13

- |               |              |               |
|---------------|--------------|---------------|
| 1 Plug        | 8 Seat-valve | 15 O-ring     |
| 2 O-ring      | 9 Poppet     | 16 Plug       |
| 3 Plug        | 10 Sleeve    | 17 Orifice    |
| 4 Screw-seat  | 11 Filter    | 18 Orifice    |
| 5 O-ring      | 12 Housing   | 19 Name plate |
| 6 Seat-spring | 13 Spring    | 20 Rivet      |
| 7 Spring      | 14 Spool     |               |

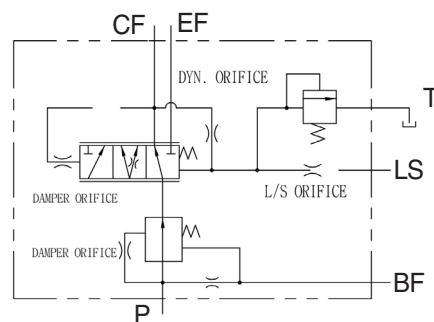
※ Relief valve kit : 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

The priority valve is located on the top of the pump and is influenced by the LS signal from the steering unit to ensure that the steering circuit receives sufficient feed. This valve always keeps the steering force and speed constant against changes in the pump discharge flow rate, and gives priority to hydraulic oil to the steering circuit.

## 5. DAUL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)



Item/Port	Port size	Tightening torque	
		kgf·m (±0.5)	lbf·ft (±3.7)
4, 6, 7, 11	-	7	516
8	-	0.45±0.05	3.3±0.37
LS, T, BF	9/16-18 UNF	3	21.7
CF	3/4-16 UNF	6	43.4
EF	7/8-14 UNF	9.5	68.7



25D9V5SS07

- |            |                  |                |
|------------|------------------|----------------|
| 1 Block    | 6 Plug-BF        | 11 Plug-relief |
| 2 Spool-CF | 7 Plug-LS        | 14 Spring-BF   |
| 3 Spool-BF | 8 Plug           | 15 Spring-CF   |
| 4 Plug     | 9 Poppet-relief  | 16 Plug        |
| 5 O-ring   | 10 Spring-relief | 17 O-ring      |

This dual flow divider is one of the spool-type flow dividers that split flow through pressure-compensated fixed orifices. The pressure-compensation feature ensures near-equal flow through the orifices - even when inlet and/or outlet pressures fluctuate. The flow of port CF (controlled flow) is delivered into the steering unit, and port CF always has the same flow when the pump is producing that flow or more. Excess pump flow goes through port EF (excess flow) to actuators via the directional control valves. Therefore this dual flow divider maintains constant flow from the CF port. Any additional flow passes out the EF port.



## 1) STRUCTURE

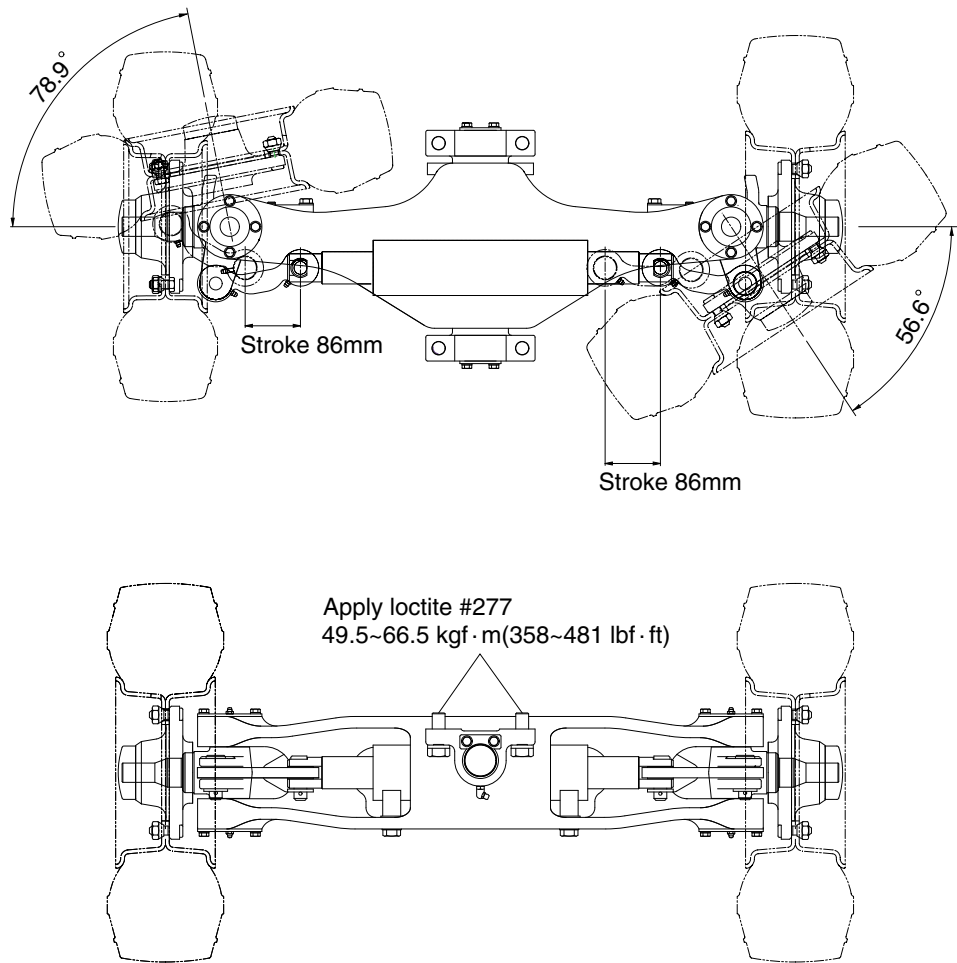
This exploded view diagram illustrates the assembly of a wheel. The components are numbered as follows:

- 1**: Main hub or axle component.
- 2**: Nut or washer.
- 3**: Hub flange or flange nut.
- 4**: Small pin or screw.
- 5**: Long central shaft or axle.
- 6**: Washer or spacer.
- 7**: Washer or spacer.
- 8**: Washer or spacer.
- 9**: Washer or spacer.
- 10**: Pin or screw.
- 11**: Washer or spacer.
- 12**: Washer or spacer.
- 13**: Pin or screw.
- 14**: Pin or screw.
- 15**: Washer or spacer.
- 16**: Washer or spacer.
- 17**: Hub flange or flange nut.
- 18**: Pin or screw.
- 19**: Tire.
- 20**: Tire cap or seal.
- 21**: Washer or spacer.
- 22**: Long central shaft or axle.
- 23**: Washer or spacer.
- 24**: Pin or screw.
- 25**: Washer or spacer.
- 26**: Pin or screw.
- 27**: Pin or screw.
- 28**: Pin or screw.
- 29**: Pin or screw.
- 30**: Pin or screw.
- 31**: Hub flange or flange nut.
- 32**: Washer or spacer.
- 33**: Washer or spacer.
- 34**: Pin or screw.
- 35**: Pin or screw.
- 36**: Pin or screw.
- 37**: Washer or spacer.
- 38**: Washer or spacer.
- 39**: Pin or screw.
- 40**: Pin or screw.
- 41**: Washer or spacer.
- 42**: Washer or spacer.
- 43**: Washer or spacer.
- 44**: Washer or spacer.
- 45**: Pin or screw.
- 46**: Washer or spacer.
- 47**: Pin or screw.
- 48**: Pin or screw.
- 49**: Washer or spacer.

1	Steering axle	18	Hub bolt	34	Pin
2	Knuckle-RH	19	Hub nut	35	Spring washer
3	Knuckle-LH	20	Hub cap	36	Hardened washer
4	Special bolt	21	Steering link	37	Upper cover
5	King pin	22	Steering cylinder	38	Lower cover
6	Taper roller bearing	23	SPH plain bearing	39	Hex bolt
7	Oil seal	24	Steer link pin	40	Spring wahser
8	Retaining ring	25	Plain washer	41	Shim (0.1)
9	Collar	26	Grease nipple	42	Shim (0.15)
10	Grease nipple	27	Lock plate	43	Shim (0.3)
11	Oil seal	28	Bolt	44	Spacer(0.5)
12	Taper roller bearing	29	Hex nut	45	Hex bolt
13	Split pin	30	Hex bolt	46	Taper roller bearing
14	Nut	31	Trunnion block	47	Plate
15	Washer	32	Bushing	48	Split pin
17	Hub	33	Thrust washer	49	Retaining ring



## 2) TIGHTENING TORQUE AND SPECIFICATION




20D7SS08

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	78.9/56.6
Tread	mm (in)	980 (38.6)

## GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

### 1. OPERATIONAL CHECKS

Check item	Checking procedure
<b>Steering wheel</b> 30-60mm (1.2-2.4 in) 	<ul style="list-style-type: none"> <li>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.</li> <li>Test steering wheel play with engine at idling.</li> </ul>
<b>Knuckle</b>	<ul style="list-style-type: none"> <li>Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear.</li> </ul>
<b>Steering axle</b>	<ul style="list-style-type: none"> <li>Put camber gauge in contact with hub and measure camber. If camber is not within <math>0 \pm 0.5^\circ</math>; rear axle is bent.</li> <li>Ask assistant to drive truck at minimum turning radius.</li> <li>Fit bar and a piece of chalk at outside edge of counterweight to mark line of turning radius.</li> <li>If minimum turning radius is not within <math>\pm 100</math> mm (<math>\pm 4</math> in) of specified value, adjust turning angle stopper bolt.</li> </ul> <p>Min turning radius (Outside)</p> <ul style="list-style-type: none"> <li>- 25D-9V/VS : 2352 mm (93 in)</li> <li>- 30D-9V/VS : 2427 mm (96 in)</li> <li>- 35DN-9V/VS : 2480 mm (98 in)</li> </ul>
<b>Hydraulic pressure of power steering</b>	<p>Remove screw coupling from CF port of priority valve and install oil pressure gauge. Turn steering wheel fully and check oil pressure.</p> <p>※ Oil pressure : 100 bar (1450 psi)</p>

## 2. TROUBLESHOOTING

### 1) STEERING UNIT

Problem	Cause	Remedy
The steering wheel cannot be rotated.	<ul style="list-style-type: none"> <li>· The steering unit column shaft is installed incorrectly or damaged.</li> <li>· The oil pressure does not rise.</li> <li>· The relief valve is faulty or not closed.</li> <li>· LS line (Hose) incorrectly connected.</li> <li>· The piping is damaged.</li> </ul>	<ul style="list-style-type: none"> <li>· Inspect and correct or replace.</li> <li>· Inspect and adjust the relief set pressure.</li> <li>· Inspect and correct.</li> <li>· Inspect and correct.</li> <li>· Replace.</li> </ul>
The steering wheel is heavy.	<ul style="list-style-type: none"> <li>· The tire inflating pressure is low.</li> <li>· The oil pressure does not rise.</li> <li>· The high and low pressure hoses are connected reversely.</li> <li>· The power steering cylinder rod is bent or the piston is sticking.</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust the inflating pressure.</li> <li>· Inspect and adjust the relief set pressure.</li> <li>· Inspect and correct.</li> <li>· Inspect and correct or replace.</li> </ul>
The oil pressure does not rise.	<ul style="list-style-type: none"> <li>· The high and low pressure hoses are connected reversely.</li> <li>· The relief valve is faulty or not closed.</li> <li>· The oil pump function is degraded or the oil volume is insufficient.</li> <li>· The power steering cylinder piston packing is damaged.</li> </ul>	<ul style="list-style-type: none"> <li>· Inspect and correct.</li> <li>· Inspect and correct.</li> <li>· Inspect and correct or replace.</li> <li>· Replace.</li> </ul>
The steering wheel does not return properly.	<ul style="list-style-type: none"> <li>· The tire inflating pressure is low.</li> <li>· The steering unit spool does not move smoothly.</li> <li>· The steering knuckle sliding motion is improper.</li> </ul>	<ul style="list-style-type: none"> <li>· Adjust the inflating pressure.</li> <li>· Correct or replace the steering unit</li> <li>· Add the lubricant or correct.</li> </ul>
The steering wheel does not return (lateness) to the neutral position when released.	<ul style="list-style-type: none"> <li>· The steering unit spool does not move smoothly.</li> <li>· The steering unit column shaft is damaged.</li> <li>· The centering spring is damaged.</li> <li>· The piping is blocked (crushed or clogged).</li> </ul>	<ul style="list-style-type: none"> <li>· Correct or replace the steering unit.</li> <li>· Replace the steering unit</li> <li>· Replace.</li> <li>· Inspect and correct or replace.</li> </ul>
The play is excessive and the vehicle wobbles.	<ul style="list-style-type: none"> <li>· Oil moves in the steering unit.</li> <li>· The steering unit spool is not moving correctly.</li> <li>· Air is sucked from the piping.</li> <li>· The steering unit column shaft is defective.</li> </ul>	<ul style="list-style-type: none"> <li>· Replace the steering unit.</li> <li>· Correct or replace the steering unit.</li> <li>· Inspect and correct or replace.</li> <li>· Inspect and correct or replace.</li> </ul>
The tires are steered opposite to the steering wheel operated direction.	<ul style="list-style-type: none"> <li>· The cylinder piping is connected reversely.</li> </ul>	<ul style="list-style-type: none"> <li>· Inspect and correct.</li> </ul>

Problem	Cause	Remedy
The steering wheel in the idling state is heavy.	<ul style="list-style-type: none"> <li>· Oil moves in the steering unit.</li> <li>· The relief valve is not functioning correctly.</li> <li>· Air is sucked from the piping.</li> <li>· The piping is blocked (crushed or clogged).</li> <li>· The end cap set screw is tightened to an excessive torque.</li> </ul>	<ul style="list-style-type: none"> <li>· Replace the steering unit.</li> <li>· Inspect and correct.</li> <li>· Inspect and correct or replace.</li> <li>· Inspect and correct or replace.</li> <li>· Tighten uniformly to the specified torque.</li> </ul>
Abnormal noise is generated.	<ul style="list-style-type: none"> <li>· The relief valve is defective.</li> <li>· Air is sucked from the piping.</li> <li>· The piping is blocked (crushed or clogged).</li> </ul>	<ul style="list-style-type: none"> <li>· Correct, inspect the pressure, and adjust.</li> <li>· Inspect and correct or replace.</li> <li>· Inspect and correct or replace.</li> </ul>

## 2) PRIORITY VALVE

Problem	Check point	Remedy
Springs scratche, wear or fall.	<ul style="list-style-type: none"> <li>· Those of having critical scratches or wear and those of below the repair limit must be replaced with a new one.</li> </ul>	<ul style="list-style-type: none"> <li>· Replace.</li> </ul>
Spools scratche or wear on sliding surface.	<ul style="list-style-type: none"> <li>· Extremely small scratches must be removed with sandpaper.</li> <li>· Those of having critical scratches or wear must be replaced with a new one.</li> </ul>	<ul style="list-style-type: none"> <li>· Replace.</li> </ul>
O-ring	<ul style="list-style-type: none"> <li>· Those of having scratches on the seal or having critical wear must be replaced with a new one.</li> </ul>	<ul style="list-style-type: none"> <li>· Replace.</li> </ul>

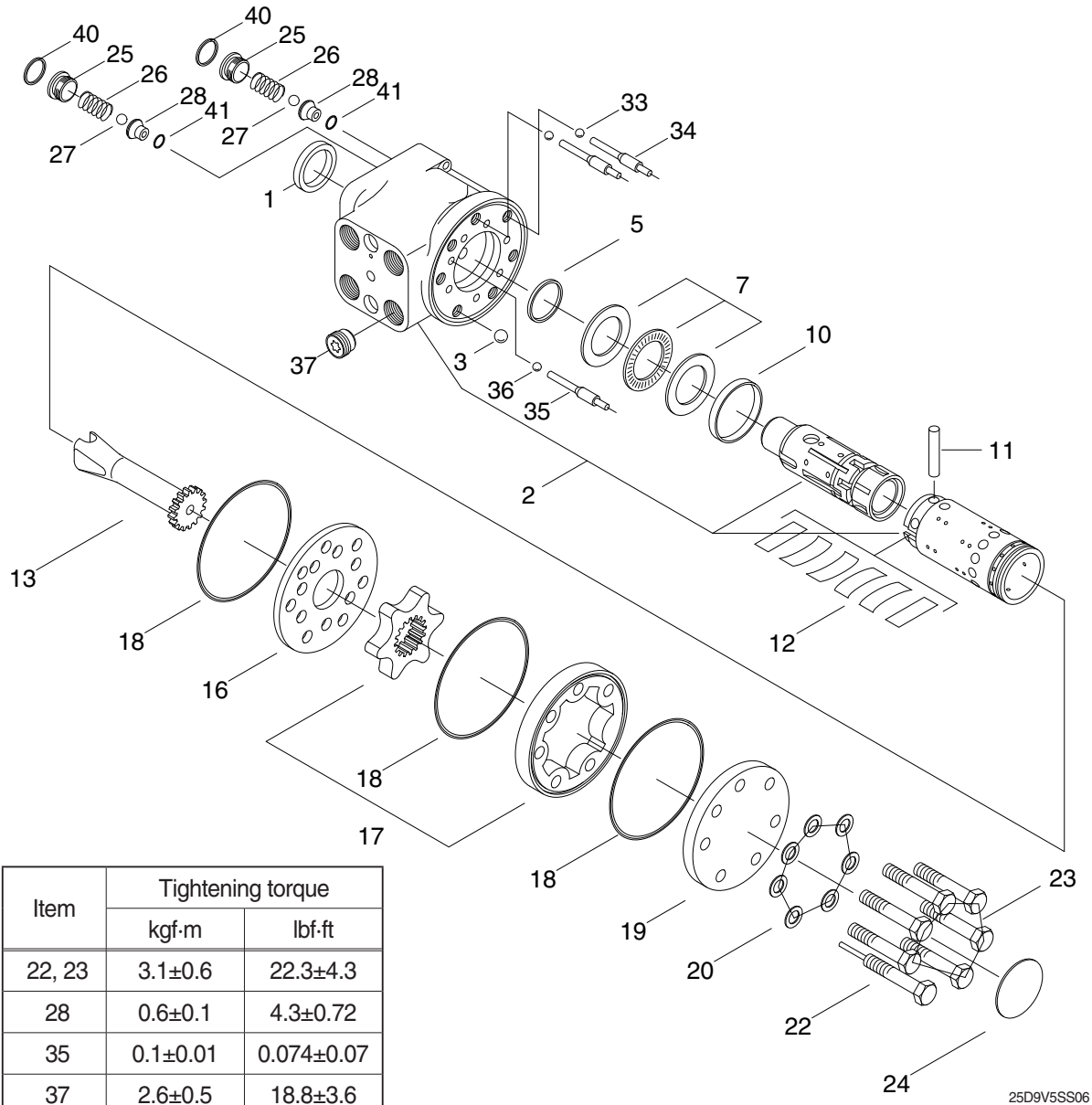
## 3) DAUL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)

Problem	Check point
BF flow is out of specification	<ul style="list-style-type: none"> <li>· Check the other material (chip, particles, ...) is in the bore and on the spool and in orifices.</li> <li>· Check the orifices' sizes in the spool (3).</li> </ul>
CF flow is out of specification	<ul style="list-style-type: none"> <li>· If it flow too much and EF too less or not, check the other material (chip, particles, ...) is stuck in the block land into CF</li> <li>· Check the orifices' sizes in the spool (2).</li> </ul>
EF flow is out of specification	<ul style="list-style-type: none"> <li>· If there is hydraulic shock in actuators while on/off(or push/pull) operation switching, check the orifices' sizes in the spool (2).</li> </ul>
LS flow is out of specification	<ul style="list-style-type: none"> <li>· Check the clearance of the Bore and Spool (2).</li> <li>· Check the orifices' sizes in the spool (2), plug orifice (7) and spring (15).</li> </ul>
Pressure Engagement is out of specification	<ul style="list-style-type: none"> <li>· Check the parts of LS relief valve and its inserted direction is in normal.</li> <li>· Check the other material (chip, particles, ...) is in the long drill holes and on the poppet (9).</li> </ul>

## GROUP 3 DISASSEMBLY AND ASSEMBLY

### 1. STEERING UNIT

#### 1) STRUCTURE

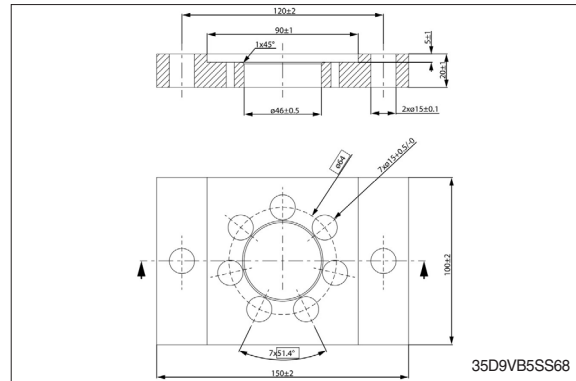


- |                            |                       |                |
|----------------------------|-----------------------|----------------|
| 1 Dust seal ring           | 18 O-ring             | 31 Spring      |
| 2 Housing and spool/sleeve | 19 End over           | 32 Piston      |
| 3 Ball                     | 20 Washer             | 33 Ball        |
| 5 Shaft seal               | 22 Pin bolt screw     | 34 Bushing     |
| 7 Bearing assembly         | 23 Screw              | 35 Ball        |
| 10 Ring                    | 24 Model / Code label | 36 Ball        |
| 11 Cross pin               | 25 Adjusting screw    | 37 Check valve |
| 12 Set of springs          | 26 Spring             | 40 O-ring      |
| 13 Cardan shaft            | 27 Ball               | 41 O-ring      |
| 16 Distributor plate       | 28 Seat               | 42 Plug        |
| 17 Gearwheel set           | 30 Adjusting screw    |                |

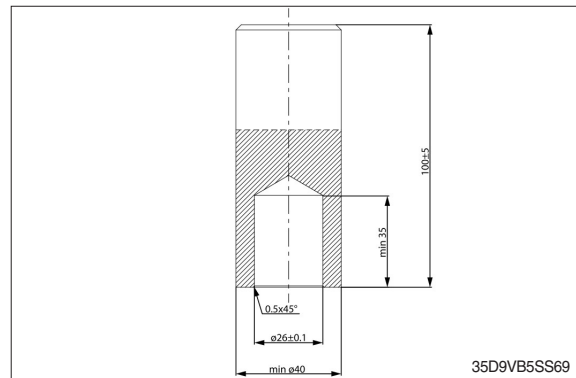
※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7), 40 (2), 41 (2)

## 2) TOOLS

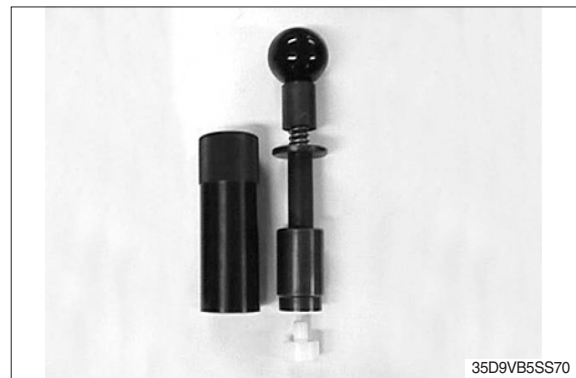
- (1) Holding tool for the entire steering unit.  
Material: Appropriate metal or hard plastic.



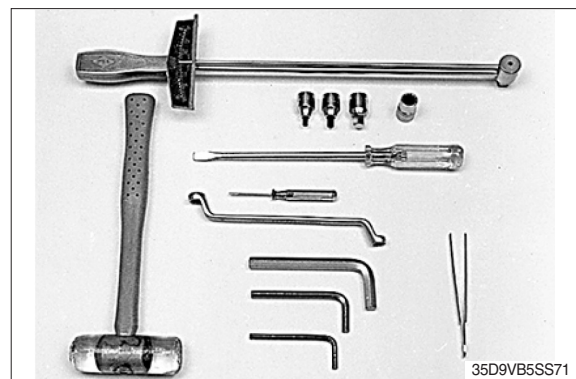
- (2) Assembly tool for dust seal.  
Material: Free cutting steel.



- (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

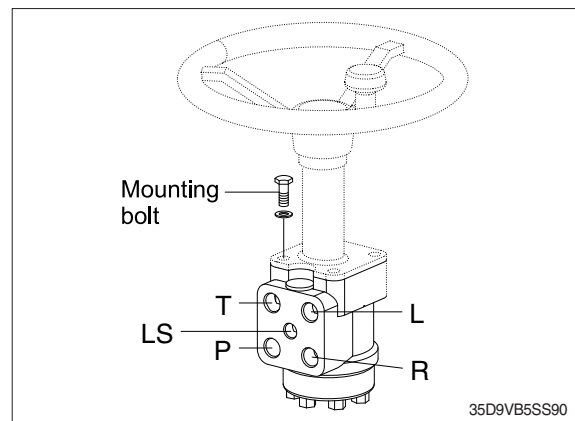
L : Left port

R : Right port

T : Tank port

P : Pump port

LS : Load sensing port



Port	Port size	Tightening torque	
		kgf·m	lbf·ft
L, R, T, P	3/4-16 UNF	6	43.4
LS	7/16-20UNF	2.5	18.4
Mounting bolt	M10×30 mm	4	28.9

#### 4) DISASSEMBLY

- (1) Arise off the plastic protection plugs from the two shock valves. Screw out the adjusting screw for shock valves (25) using a 5 mm allen key. O-ring (40) is fitted on adjusting screw (25).



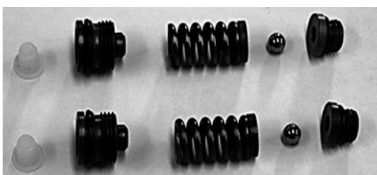
- (2) Remove the springs (26) with trust pads for shock valves.



- (3) Remove the balls (27) for shock valves.

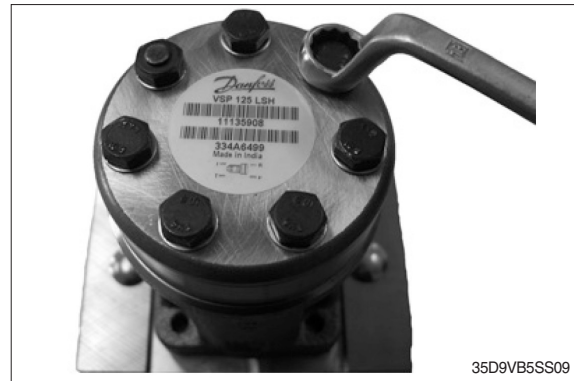


- (4) Screw out the seats (28) for shock valves using a 7/64 inch (2.75 mm) allen key. O-ring (41) is fitted on seat (28). The shock valves are now dismantled.





- (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).



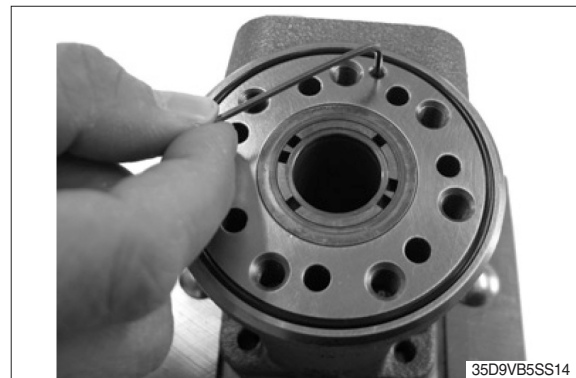
- (8) Remove the cardan shaft (13).



(9) Remove the distributor plate (16).



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



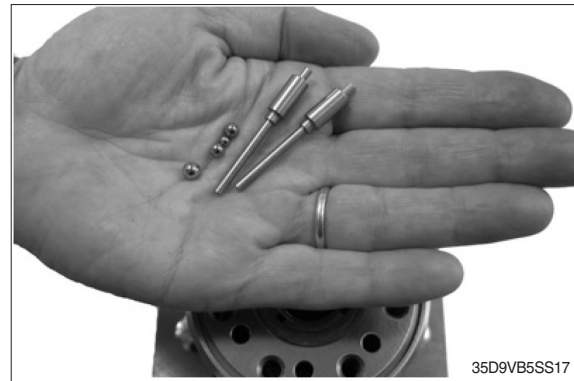
(11) Remove the o-ring (18) from housing.



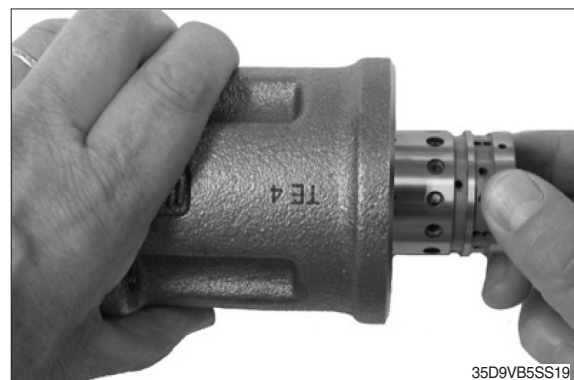
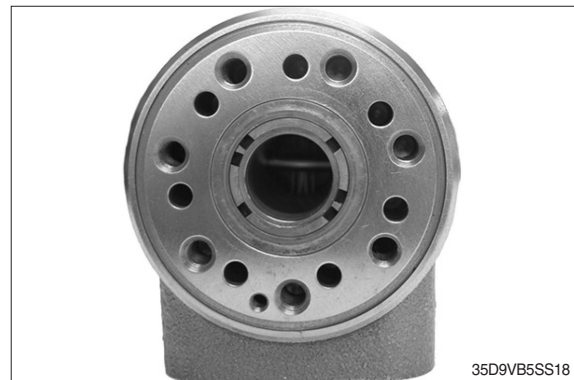
(12) Remove the check valve (37) using a torx bit size T50.



(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.



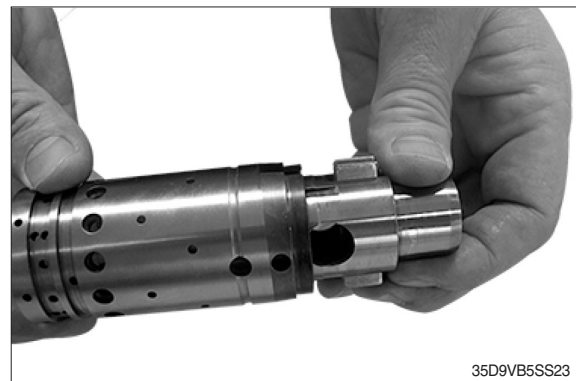
(16) Press out the cross pin (11).



(17) Remove the ring (10).



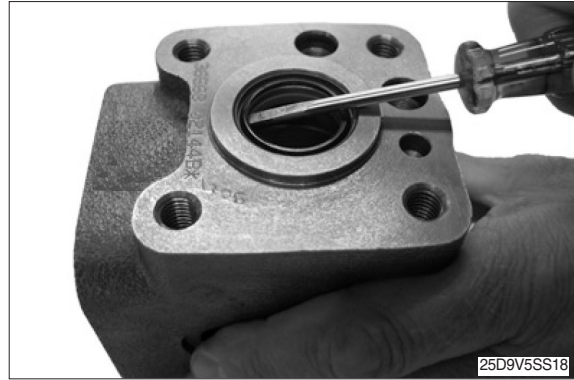
(18) Carefully press the spool out of the sleeve.



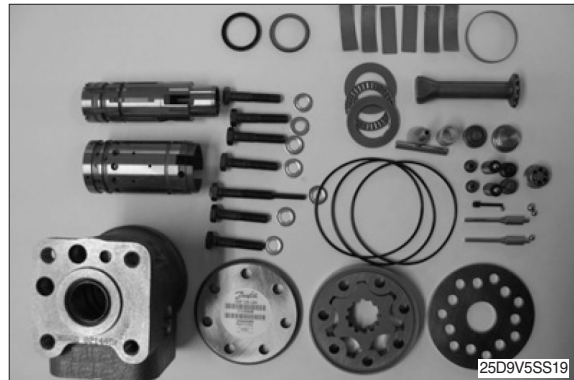
(19) Press the neutral position springs (12) out of the slot of the spool.



- (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.**

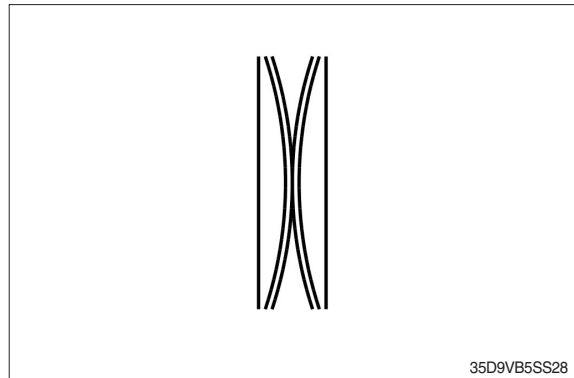


## 5) ASSEMBLY

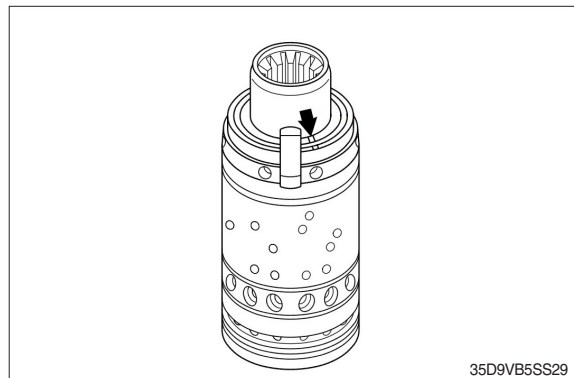
- (1) Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.



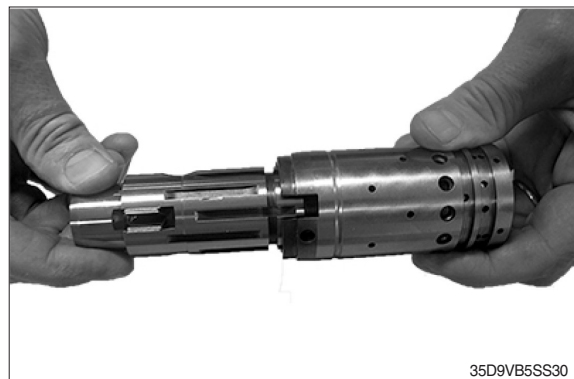
- (2) Configuration of spring set (12). There can be different numbers of curved springs depending on configuration of spring set. There can be 2, 4 or 6 curved springs.



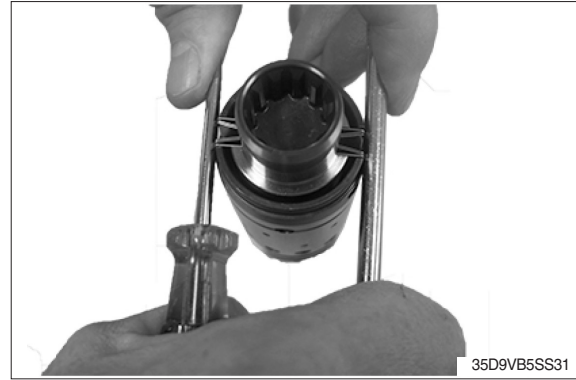
- (3) Some spool and sleeve sets for steering unit must be positioned correctly relatively to each other. Small marks are present on both spool and sleeve close to one of the slots for the spring set. Most spool and sleeve sets for steering unit have no marks, so those can be positioned relatively to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



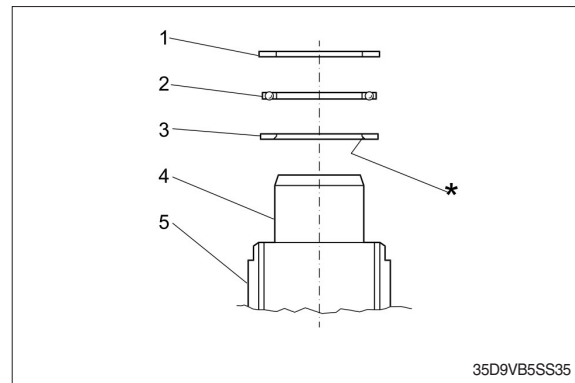
(8) Fit bearing races and needle bearing (7)  
as shown on the drawing below.



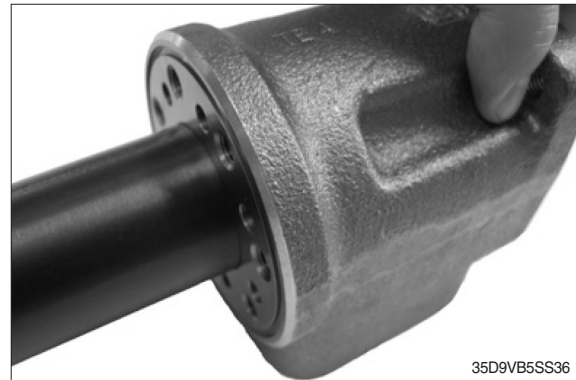


- (9) Assembly pattern for standard bearing 1  
Outer bearing race → 2 Needlebearing →  
3 Inner bearing race → 4 Spool → 5  
Sleeve.

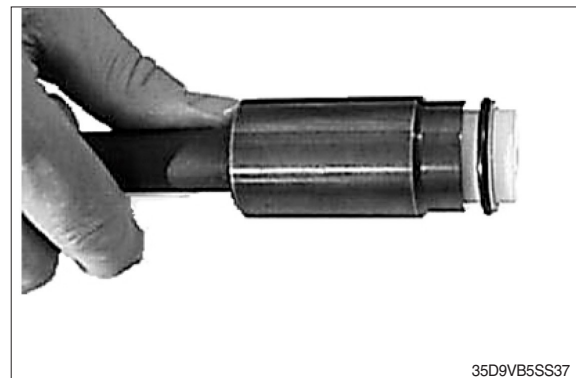
The inside chamfer on the inner bearing race must face the chest of the inner spool.



- (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.

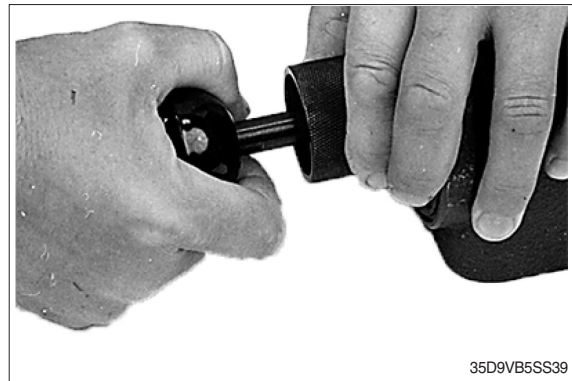


- (13) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.

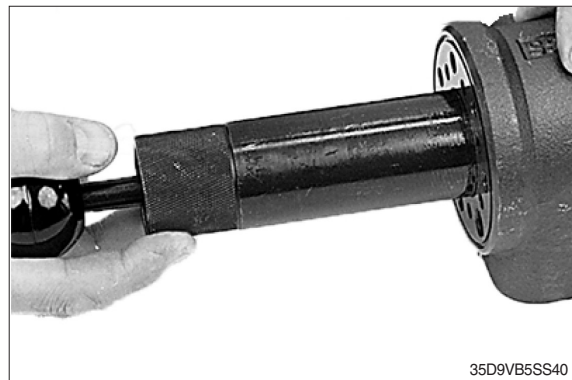




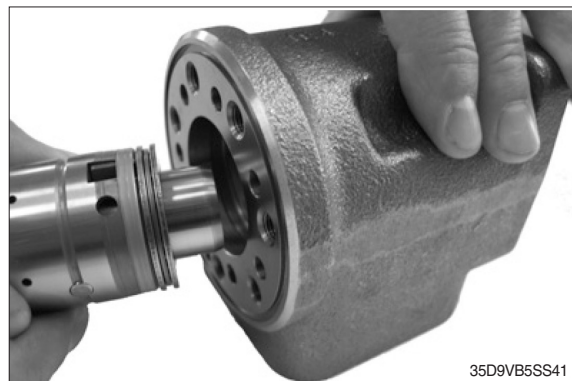
- (14) Press and turn the shaft seal (5) into position in the housing.



- (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.



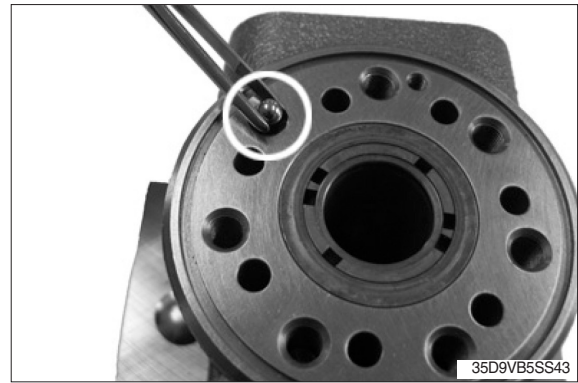
- (16) With a light turning movement, guide the spool and sleeve into the bore.  
Fit the spool set holding the cross pin (11) horizontal.



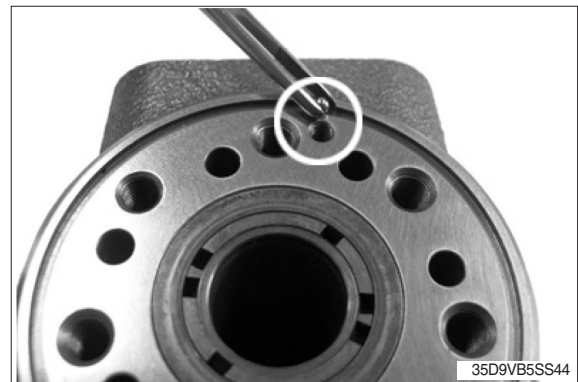
- (17) The spool set will push out the assembly tool guide. The shaft seal (5) are now installed.



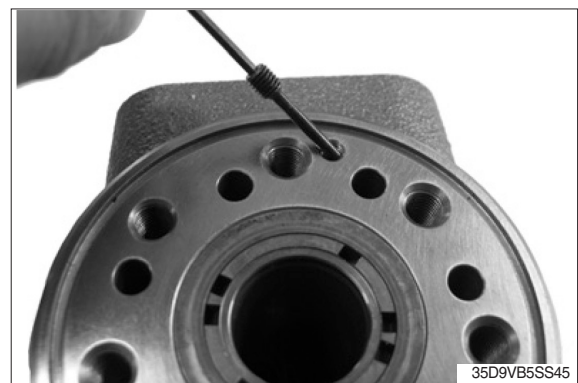
- (18) Place the steering unit housing on the holding tool on the steering column end. Put the check valve ball (3) into the hole indicated by the circle.



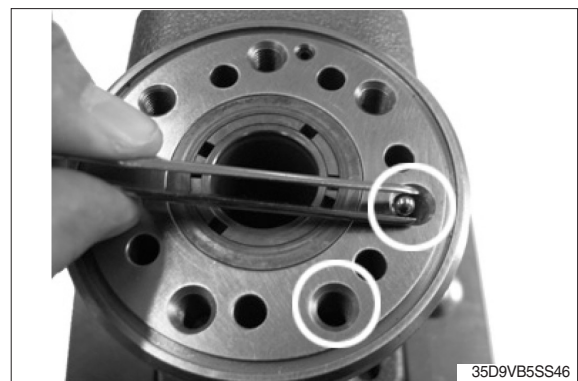
- (19) Place the ball for LS check valve (36) into the hole indicated by the circle.



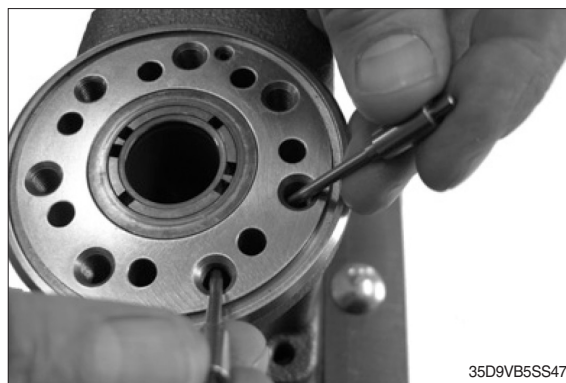
- (20) Screw the ball stop (35) into the LS check valve bore using a 2 mm allen key.
- Tightening torque :  $0.1 \pm 0.01$  kgf·m  
( $0.72 \pm 0.072$  lbf·ft)



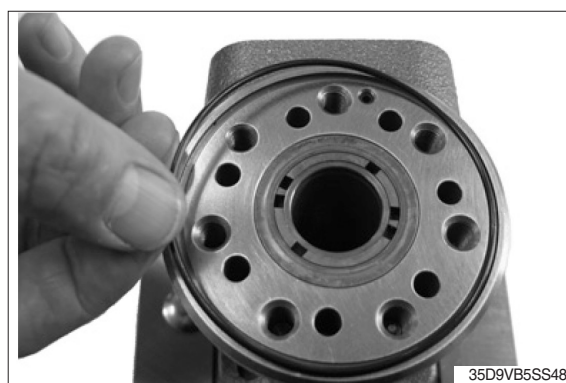
- (21) Place a ball (33) in the two bolt holes indicated by the circles.



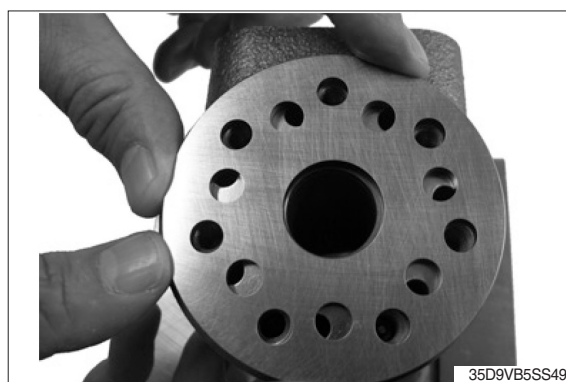
(22) Place the pins (34) in the same two bolt holes.



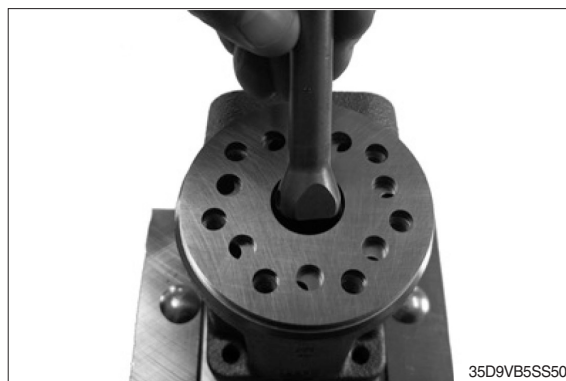
(23) Insert the O-ring (18) in the groove on the housing.



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

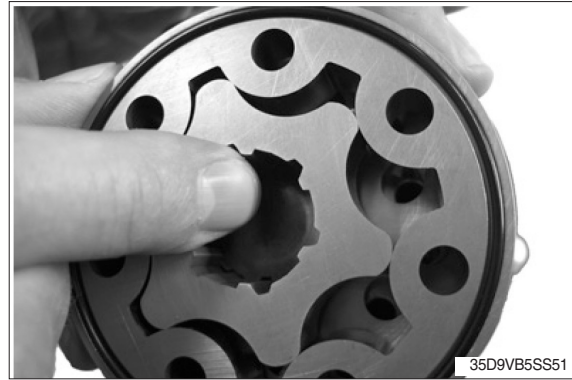


(25) Guide the cardan shaft (13) down into the bore so that the slot is parallel with the connection flange ports and lines up with the cross pin (11).



- (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 :  $3.1 \pm 0.6$  kgf·m  
( $22.4 \pm 4.3$  lbf·ft)



(30) Screw in the check valve (37) into the P-port using a Torx Bit size T50.

- Tightening torque :  $2.6 \pm 0.5$  kgf·m  
( $18.8 \pm 3.6$  lbf·ft)



(31) Replace the unit in the holding tool on gear set end.

Place o-ring (41) on the shock valve seats (28). Screw in the seats (28) using a 7/64 inch (2.75 mm) mm Allen key into the cavities indicated by the circles.

- Tightening torque :  $0.6 \pm 0.1$  kgf·m  
( $4.3 \pm 0.72$  lbf·ft)



(32) Place one ball (27) in each of the shock valve cavities.



(33) Place springs with trust pads (26) over the two balls.





- (34) Place o-rings (40) on adjusting screws (25). Screw in the two adjusting screws (25) using a 5 mm allen key. Make the pressure setting on a test panel according to valve setting specification.



- (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.



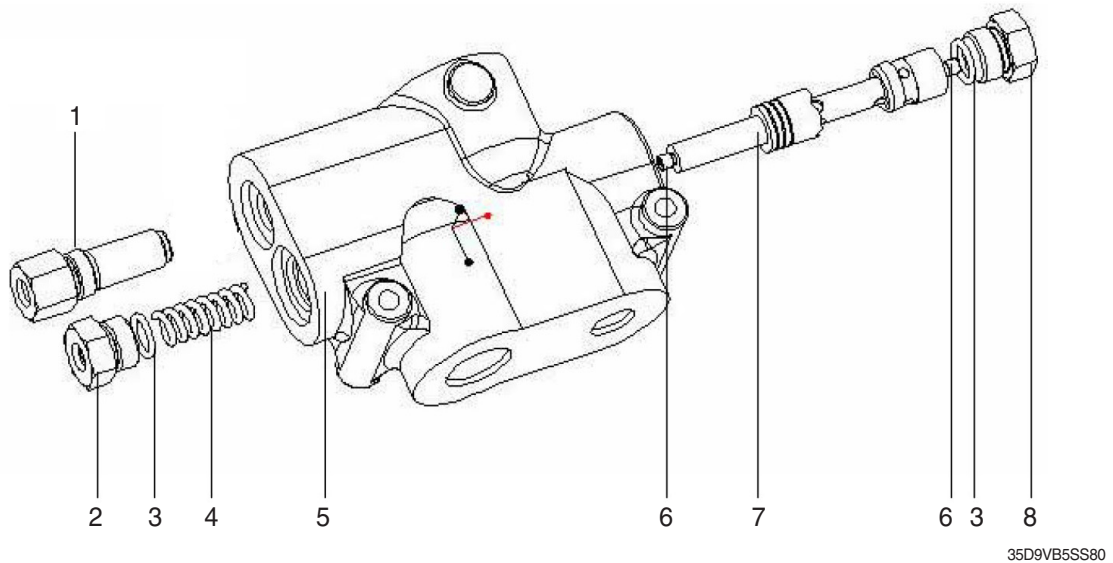
- (37) After finalizing the entire assembly, screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.

※ **Refer to the relief valve and LS port pressure test and adjustment.**



## 2. PRIORITY VALVE

### 1) STRUCTURE



- |   |                  |   |                    |   |       |
|---|------------------|---|--------------------|---|-------|
| 1 | Relief valve kit | 4 | Spring compression | 7 | Spool |
| 2 | Plug             | 5 | Housing            | 8 | Plug  |
| 3 | O-ring           | 6 | Throttle           |   |       |

### 2) DISASSEMBLY

- ※ Check that the priority valve has not been damaged during transportation.
- ※ Clean the working area before operation.
- ※ If needed, components must be replaced exclusively by serviceman.

- (1) Clamp the unit in vice. Loosen the plug (using 27 mm wrench) and screw out. Be careful of the spring.



(2) Take out the spring vertically.



(3) Unscrew the plug in the opposite side using the 27mm wrench.



(4) Press out the spool by hand.

※ It is strongly recommended that relief valve cartridge not be adjusted by customer. If necessary, it must be done by Eaton representative. Approximately 800psi per revolution of the adjusting screw.



(5) Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage.



### 3) ASSEMBLY

※ Before assembly, lubricate all parts with normal hydraulic oil.

- (1) Position the valve horizontally and insert the spool into its bore. Pay attention to spool direction and ensure spool moves smoothly.



- (2) Insert the spring into the bore.



- (3) Screw in the two plugs and tighten.
  - Tightening torque :  $5.1 \pm 0.5$  kgf·m  
( $36.9 \pm 3.7$  lbf·ft)



### 3. DUAL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)

#### 1) CAUTION FOR ASSEMBLY AND DISASSEMBLY

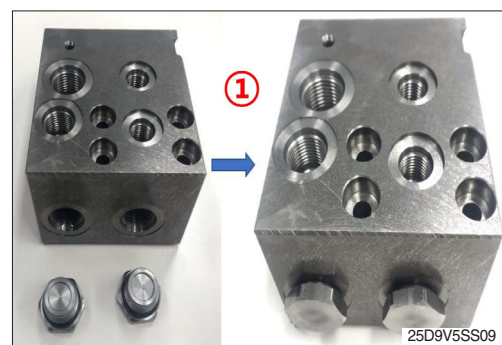
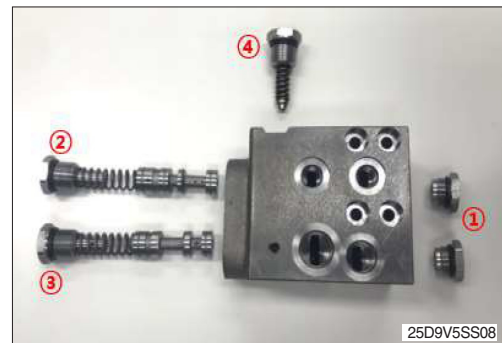
- (1) Disassembly and assembly should be performed very carefully at a clean place so that any foreign material such as dust or sand can not intrude into the dual flow divider.
- (2) For disassembly of the dual flow divider, you should start disassembly after fully understanding the structure of the valve with structural drawings and reference drawings.
- (3) In case the dual flow divider needs to be placed unassembled for a while, it must be treated with rust prevent oil and sealed to prevent rusting.
- (4) Even in case disassembly and assembly of the dual flow divider is not performed smoothly, do not hit or treat any part of the product roughly.
- (5) After disassembly, attach ID tags to each part for accurate assembly.
- (6) For o-rings and back up-rings, install new ones. And be sure not to damage one during assembly (Apply grease on the parts for smooth assembly).
- (7) Fasten bolts, nipples and plugs with the specified standard torque.
- (8) Be careful not to damage the o-ring contacting parts for preventing oil leakage.

#### 2) ASSEMBLY

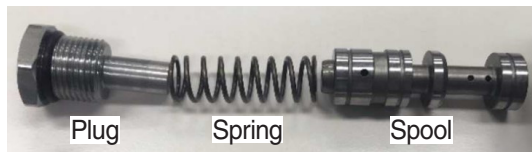
△ When disassembling, avoid mis-assembly through marking work. Pay attention to the location of the BF and CF spools and the spool assembly direction. Pay attention to the shape and assembly position of the plug and spring.

- (1) Assemble the plugs into the port on the side of the block.

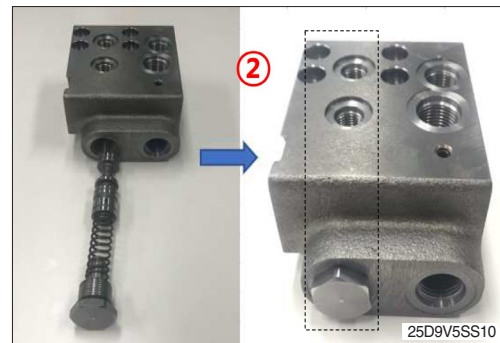
· Tightening torque : 7 kgf·m  
(50.6 lbf·ft)



- (2) Check the location of hole on the side. Assemble the spool, spring and plug into the left hole.  
 · Tightening torque : 7 kgf·m (50.6 lbf·ft)



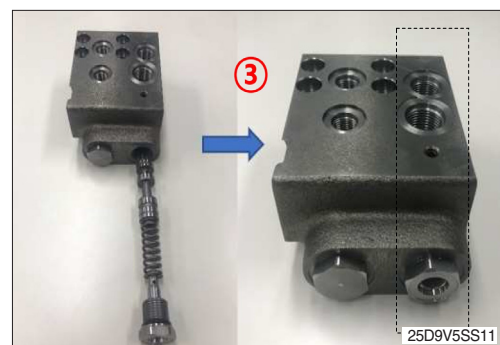
<BF spool assembly>



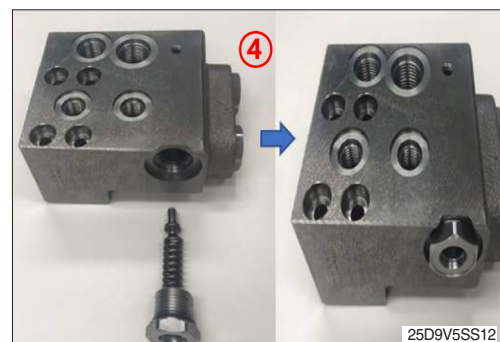
- (3) Insert and assemble into the hole which is left in other side of the block with the spool, spring, plug. Notice that the parts are mixed with other locations.  
 · Tightening torque : 7 kgf·m (50.6 lbf·ft)



<CF spool assembly>

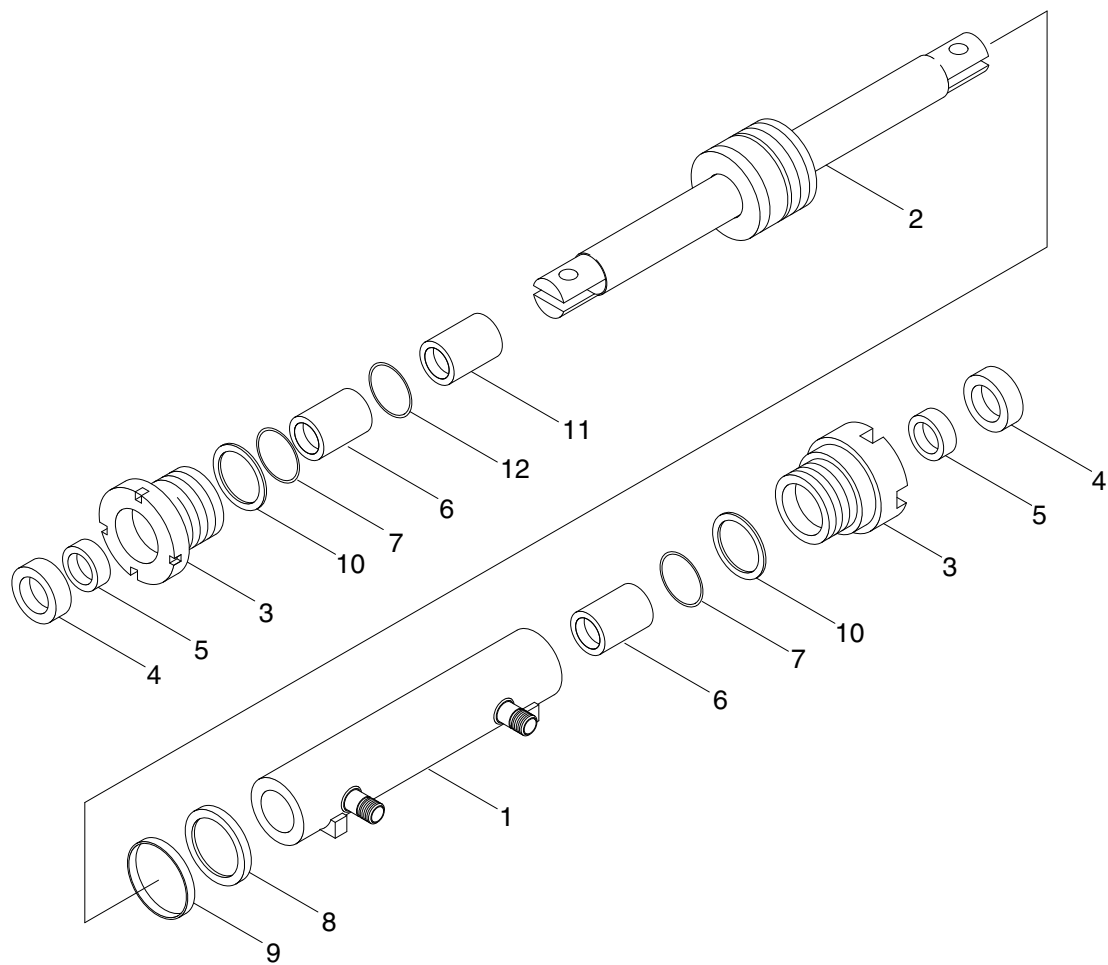


- (4) Assemble the remaining relief valve in the hole located on the upper side.  
 · Tightening torque : 7 kgf·m (50.6 lbf·ft)



## 4. STEERING CYLINDER

### 1) STRUCTURE



22D9SS11

- |   |               |   |             |    |             |
|---|---------------|---|-------------|----|-------------|
| 1 | Tube assembly | 5 | Rod seal    | 9  | Wear ring   |
| 2 | Rod assembly  | 6 | DU bushing  | 10 | Lock washer |
| 3 | Rod cover     | 7 | O-ring      | 11 | Spacer      |
| 4 | Dust wiper    | 8 | Piston seal | 12 | O-ring      |

## 2) DISASSEMBLY

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

- (1) Put wooden blocks against the cylinder tube, then hold in a vice.
- (2) Remove the gland 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. If there are some damage, replace with new parts.

## 3) CHECK AND INSPECTION

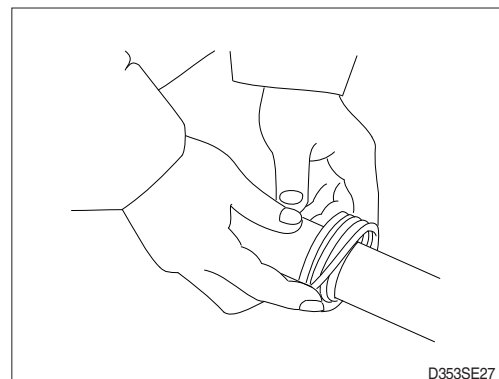
mm (in)

Check item	Criteria		Remedy
	Standard size	Repair limit	
Clearance between piston & cylinder tube	0.064~0.137 (0.0025~0.0054)	0.180 (0.0070)	Replace piston seal
Clearance between cylinder rod & bushing	0.024~0.112 (0.0009~0.0044)	0.120 (0.0049)	Replace bushing
Seals, O-ring	Damage		Replace
Cylinder rod	Dents		Replace
Cylinder tube	Biting		Replace

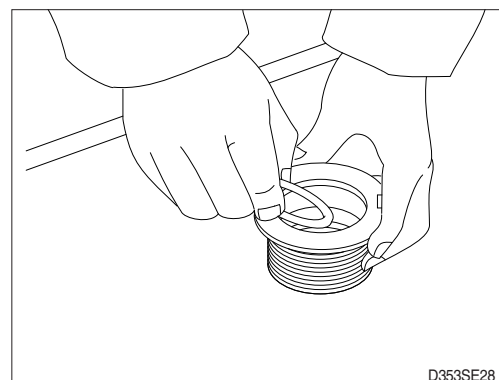
## 4) ASSEMBLY

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

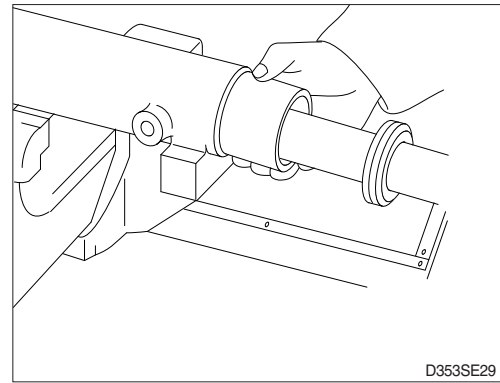
※ Be careful not to scratch the seal too much during installation or it will not seat properly.



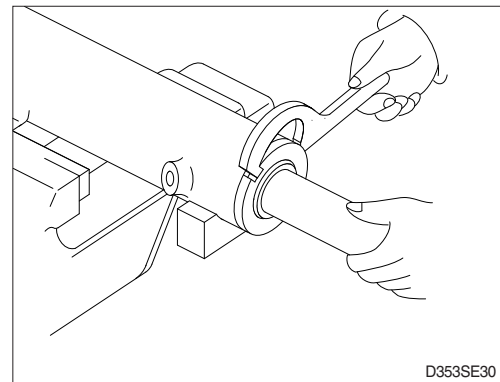
- (2) Install the rod seal to the position in the gland applying a slight coat with grease prior to install.



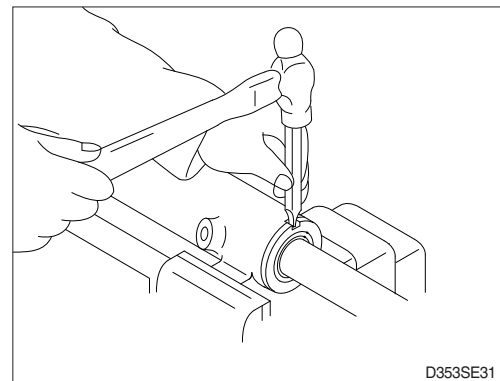
- (3) Install the dust wiper to the gland using a special installing tool. Coat the dust wiper with grease slightly before installing.
- (4) Set a special tool the cylinder, gland assembly into the cylinder tube.



- (5) Using a hook spanner, install the gland assembly, and tighten it with torque  $60 \pm 6 \text{ kgf} \cdot \text{m}$  ( $434 \pm 43 \text{ lbf} \cdot \text{ft}$ ).



- (6) After the gland assembly was installed to the cylinder tube, calk at the tube end into the groove on the gland to prevent screw loosening.
- ※ If it need calking again, never using previous calking position.

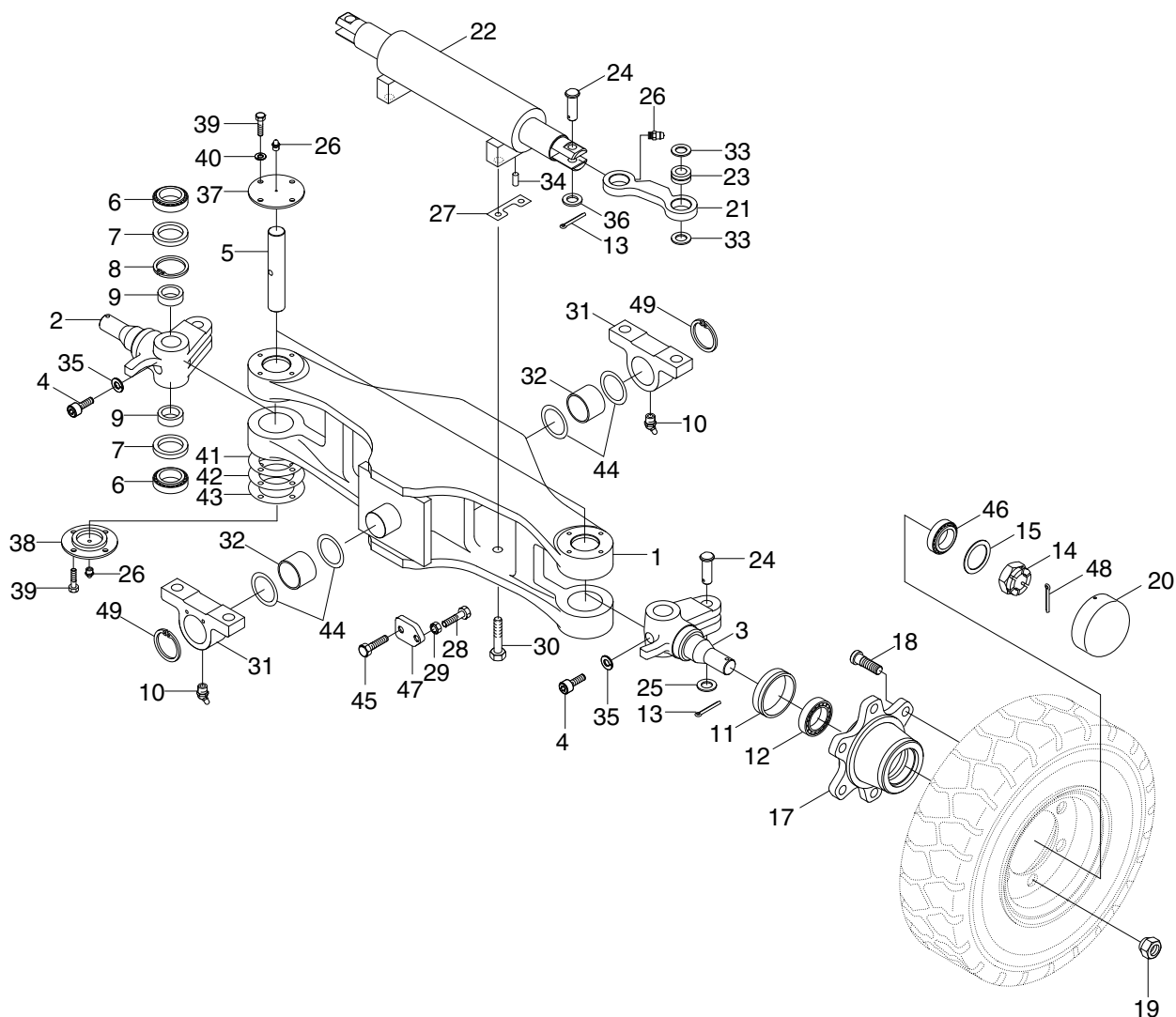


- (7) Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
- (8) Install cylinder into trail axle.
- (9) While idling the engine with the rear wheels off the ground, operate 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.

## 5. STEERING AXLE

### 1) STRUCTURE

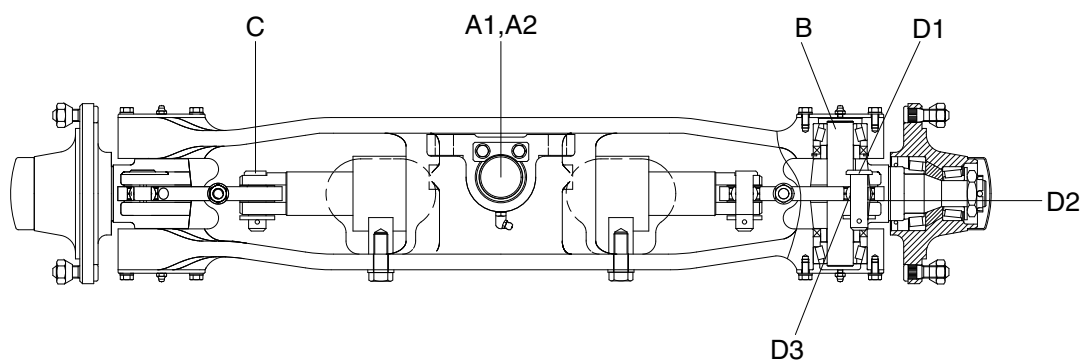
※ Do not remove the stopper bolt unless necessary.



22D9SS07

1	Steering axle	18	Hub bolt	34	Pin
2	Knuckle-RH	19	Hub nut	35	Spring washer
3	Knuckle-LH	20	Hub cap	36	Hardened washer
4	Special bolt	21	Steering link	37	Upper cover
5	King pin	22	Steering cylinder	38	Lower cover
6	Taper roller bearing	23	SPH plain bearing	39	Hex bolt
7	Oil seal	24	Steer link pin	40	Spring wahser
8	Retaining ring	25	Plain washer	41	Shim (0.1)
9	Collar	26	Grease nipple	42	Shim (0.15)
10	Grease nipple	27	Lock plate	43	Shim (0.3)
11	Oil seal	28	Bolt	44	Spacer(0.5)
12	Taper roller bearing	29	Hex nut	45	Hex bolt
13	Split pin	30	Hex bolt	46	Taper roller bearing
14	Nut	31	Trunnion block	47	Plate
15	Washer	32	Bushing	48	Split pin
17	Hub	33	Thrust washer	49	Retaining ring

## 2) CHECK AND INSPECTION



20D7SS10

unit : mm (in)

No.	Check item			Criteria		Remarks
				Standard size	Repair limit	
A	Shaft	A1	OD of shaft	55 (2.2)	54.5 (2.1)	Replace
		A2	ID of bushing	55 (2.2)	55.5 (2.2)	
B	OD of king pin			35 (1.4)	34.5 (1.4)	
C	OD of steering cylinder pin			20 (0.8)	19.5 (0.8)	
D	Knuckle	D1	OD of pin	20 (0.8)	19.5 (0.8)	Adjust with shims
		D2	Vertical play	-	-	
		D3	ID of bushing	20 (0.8)	20.5 (0.8)	Replace

· OD : Outer diameter

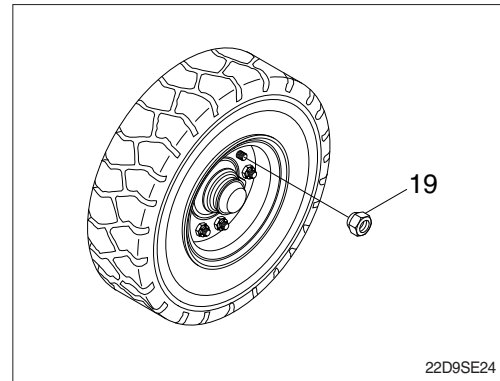
· ID : Inner diameter



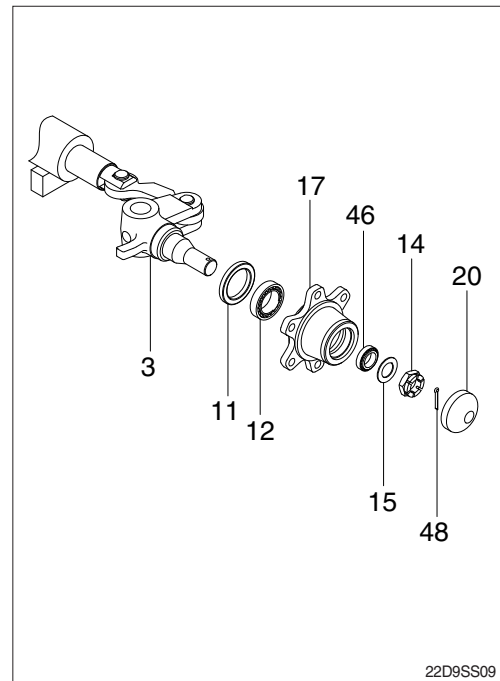
### 3) DISASSEMBLY

※ 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 counter weight part of the truck.

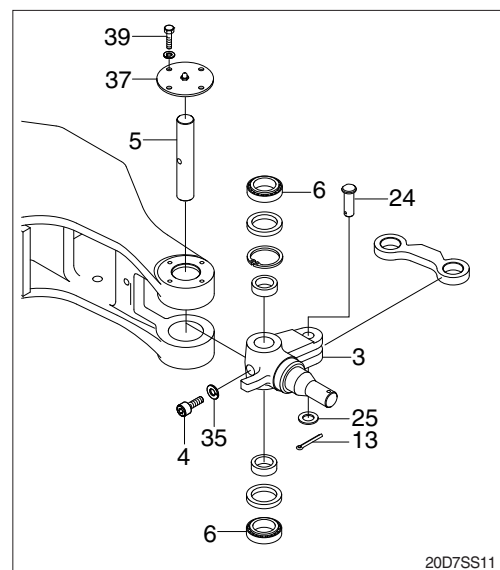
- (1) Loosen the hub nut (19) and take off the steering wheel tire.



- (2) Remove hub cap (20).
- (3) Pull out split pin (48) and remove slotted nut (14).
- (4) Using the puller, take off the hub (17) together with the roller bearing (12, 46).  
※ Be very careful because just before the hub comes off, tapered roller bearing (12, 46) will fall out.
- (5) After hub is removed take off the inner race of roller bearing (12).
- (6) Pull out oil seal (11).  
※ 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 (14) in the knuckle (3) to protect the threaded portion.



- (8) Loosen special bolt (4) and spring washer (35).
- (9) Remove hexagon bolt (39) and upper cover (37).
- (10) Push out the king pin (5) without damaging the knuckle arm (3).
- (11) If defect is observed in bearing (6), pull it out by using extractor.
- (12) Remove split pin (13), plain washer (25) and link pin (24).



#### 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 special bolt (4) and washer (35) of king pin (5).
- (2) There is a notch in the middle of the king pin (5), make sure that this notch is on the special bolt side.
- (3) Do not hammer to drive in bearing (6) because it will break.  
Always use drive-in tool.  
Be sure that the fixed ring of the bearing is placed in position facing the knuckle (3).

#### (4) Hub

- ① Mount oil seal (11) and inner race of tapered roller bearing (12) on the knuckle. The bearing should be well greased before assembling.
- ② Install the outer race of the bearing (46) in the wheel center and assemble to the knuckle.
- ③ Tighten nut (14) and lock with split pin (48). 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.
- ④ Mount the hub cap (20).  
Bearing should be well greased before assembling.

