

DK35SE/DK40SE/DK45SE/DK50SE

STEERING SYSTEM

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1. SPECIFICATIONS

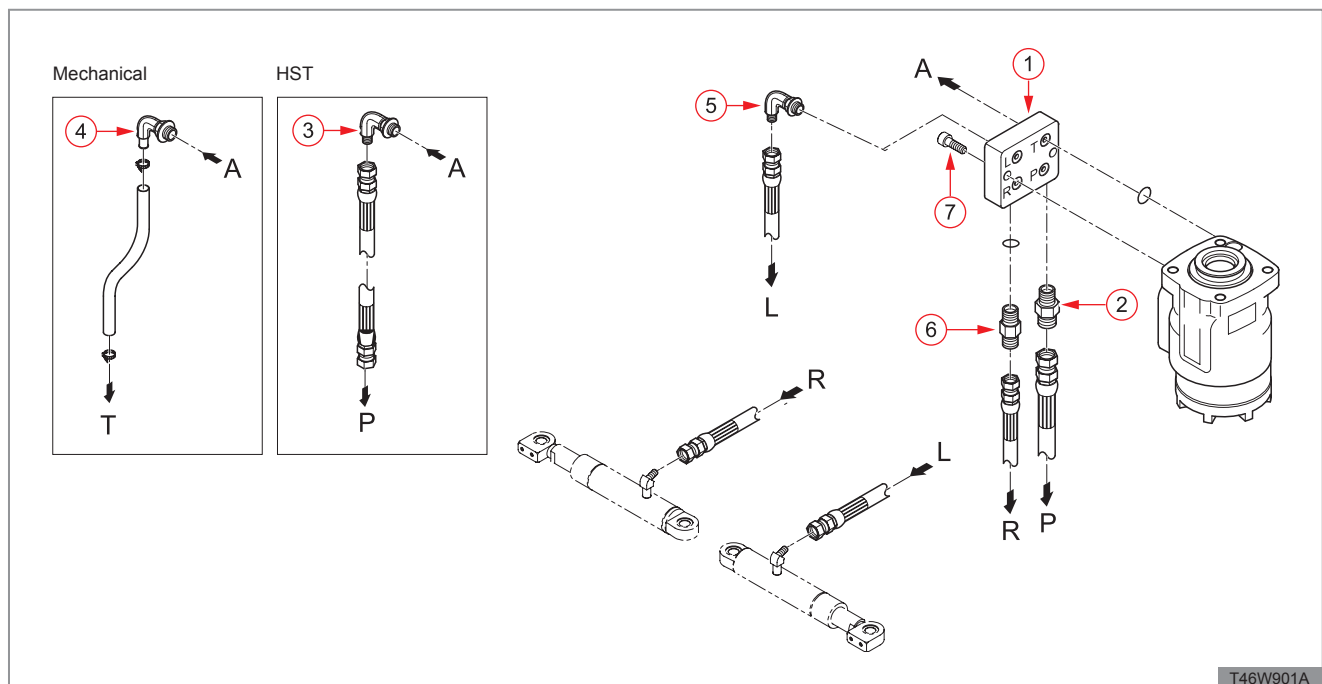
1.1 STEERING CYLINDER

1. Type.....Two cylinders with one rod single action (ram cylinder)
2. Cylinder O.D.....35 HP = 60 mm (2.3 in.), 40 ~ 50 HP = 65 mm (2.5 in.)
3. Cylinder I.D.....35 HP = 55 mm (2.1 in.), 40 ~ 50 HP = 60 mm (2.3 in.)
4. Rod O.D.....35 HP = 40 mm (1.5 in.), 40 ~ 50 HP = 45 mm (1.7 in.)
5. Cylinder stroke.....198.5 mm (7.8 in.)
6. Max. steering angle $55 \pm 1.0^\circ$

1.2 STEERING UNIT

1. Type.....Non-load reaction type
2. Steering output flow rate.....35 HP = 69 cc/rev, 40 ~ 50 HP = 96 cc/rev
3. Relief valve pressure 140 kgf/cm² (1,988 PSI)
4. Rated input flow rate.....23ℓ/min (9 gpm)
5. Pump capacity (2nd pump)....10 cc/rev.

1.3 TIGHTENING TORQUE FOR MAIN COMPONENTS

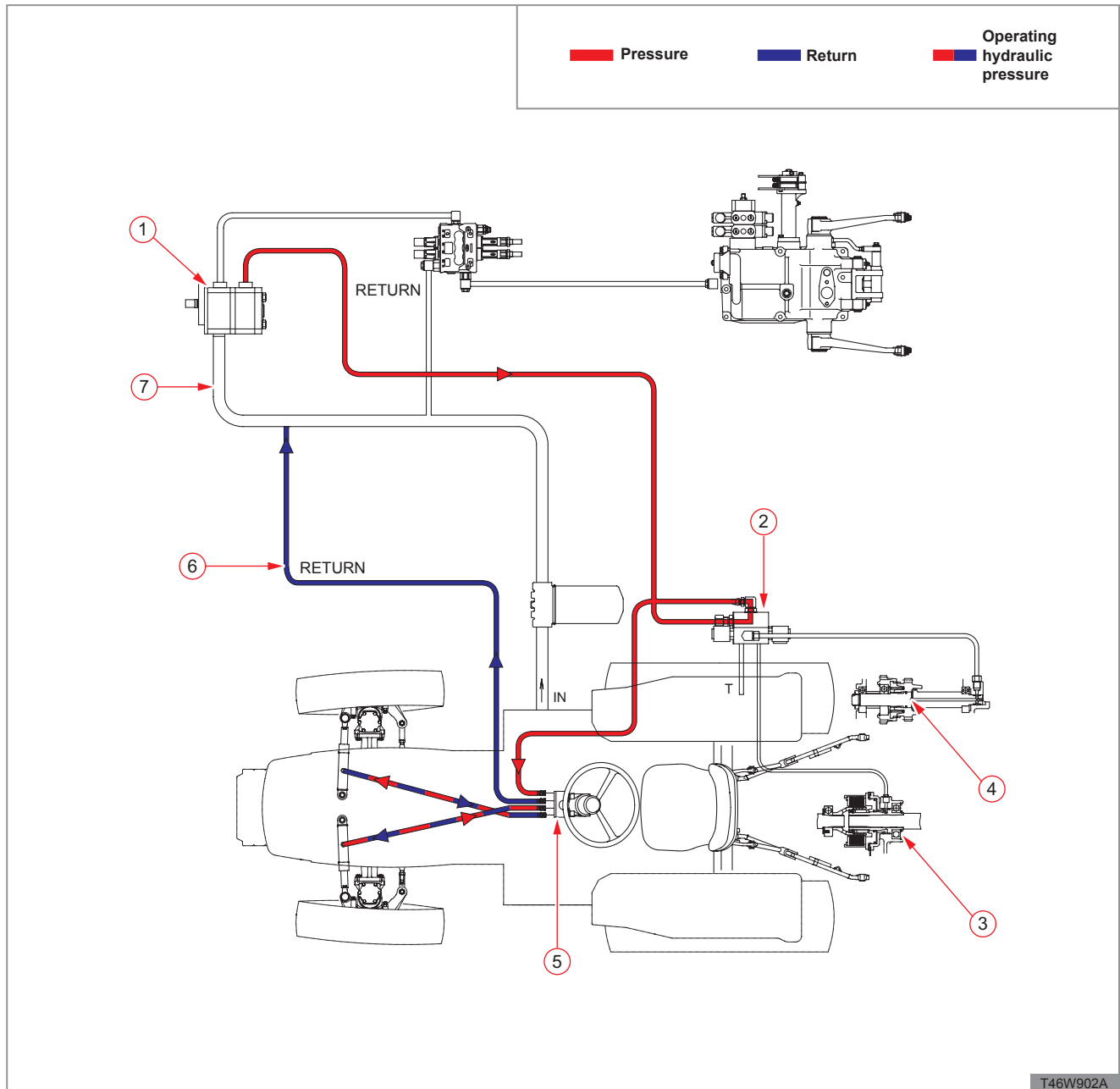


1. Connectors (2, 3, 4, 5, 6) that are connected to each port (P, T, L, R) of hydraulic block (1).....49 Nm, 5 kgf-m, 36.1 lb-ft
2. Hydraulic hoses (RH, LH).....24.5 Nm, 2.5 kgf-m, 18 lb-ft
3. Socket head bolt (7).....44.1 Nm, 4.5 kgf-m, 32.5 lb-ft
4. Hydraulic hoses (P) 49 Nm, 5 kgf-m, 36.1 lb-ft
5. Steering wheel nut.....48 ~ 55.9 Nm, 4.9 ~ 5.7 kgf-m, 35.4 ~ 41.2 lb-ft

2. OPERATING PRINCIPLE

2.1 DIAGRAM FOR STEERING OPERATION

► MECHANICAL



COMPONENTS

- (1) Gear pump
(2) Modulator valve

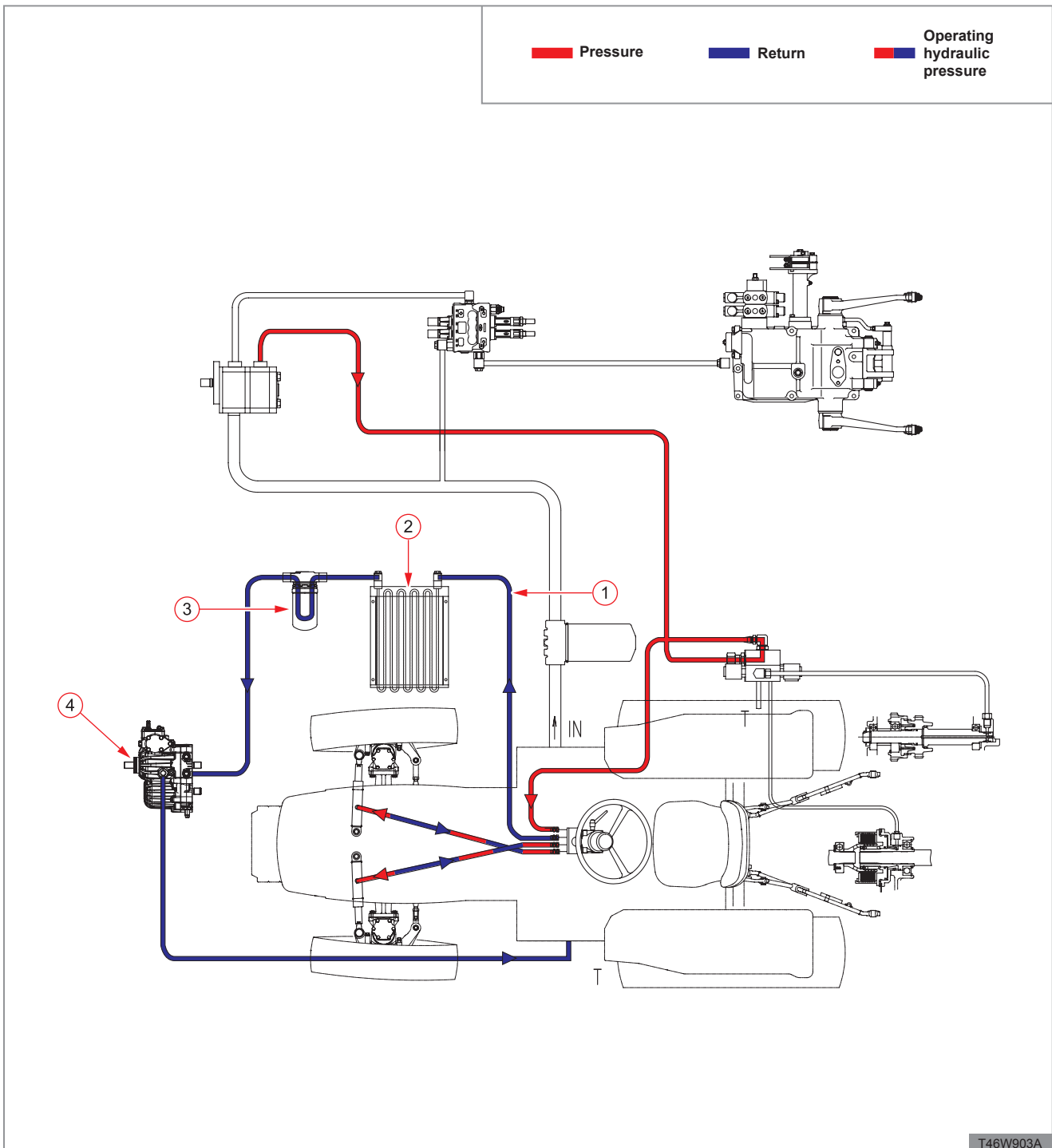
- (3) PTO clutch pack
(4) 4WD clutch

- (5) Steering unit
(6) Steering return pip

- (7) Suction pipe

The oil supplied from the gear pump (1) is sent to the modulator (2) to provide the pressure for the operation of PTO (3) or 4WD (4). Then, it is supplied to the steering unit (5).

The oil flows to the left or right steering cylinder depending on the rotated position of the steering wheel. Then, the other cylinder that is not supplied with oil is compressed by the tie rod. The oil is return to the gear pump suction line (7) through the return line (6) and recirculated.

► HST

COMPONENTS

(1) Oil cooler pipe

(2) Oil cooler

(3) HST filter

(4) HST

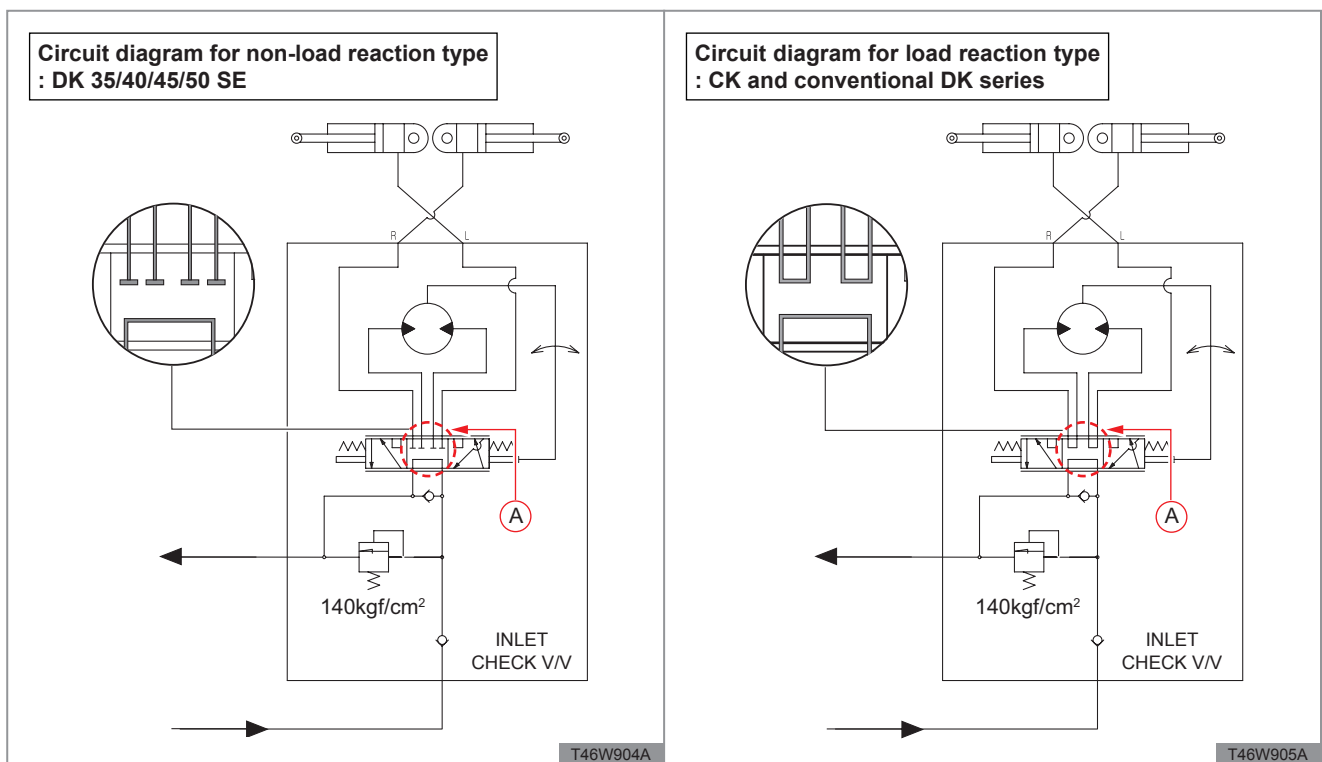
For the HST type, the route that the oil is supplied to the steering unit is the same. However, the return line (1) supplies oil to the HST (4) through the HST oil cooler and the HST filter (3) for charging of the HST.

2.2 OPERATING PRINCIPLE

Overviews

This tractor has the full hydraulic, non-load reaction type steering system.

The full hydraulic type completely relies on the hydraulic oil for transferring the power between the steering unit and the steering cylinder. It is not equipped with any mechanical transferring system, such as a drag link, pitman arm, rack or pinion. Therefore, the angles of the steering wheel and the front wheels are not fixed each other.



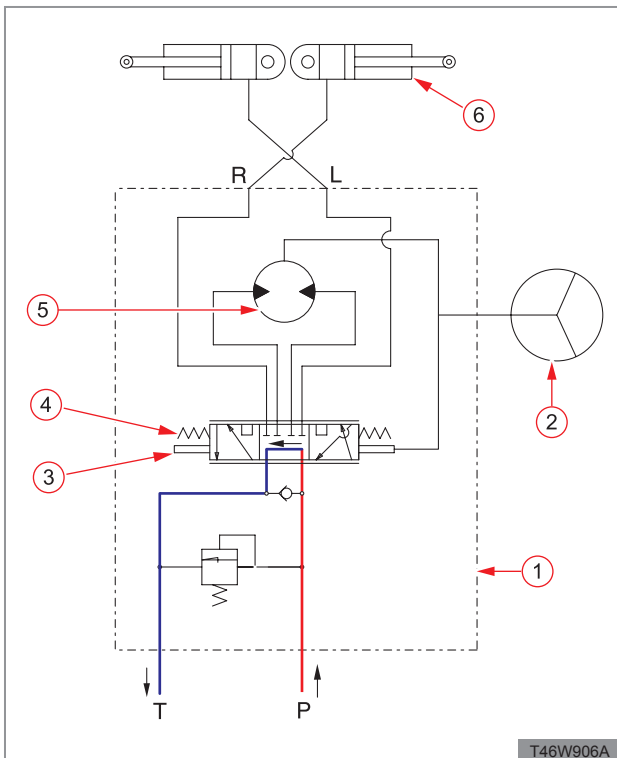
The connection of the section (A) distinguishes the load reaction and the non-load reaction.

For the load reaction type, when one steering cylinder is compressed by the outer force applied to the front wheel while driving, the returned oil turns the gerotor of the steering unit which then turns the steering wheel. Then, the oil flows to the other cylinder.

Therefore, when releasing the steering wheel after cornering, the steering wheel is automatically returned to the center position and the tractor moves straight forward or backward. This is convenient for the high-speed driving, but the steering wheel should be held to keep the steering angle and the noise and vibration is severe than the non-load reaction type. Therefore, this tractor is equipped with the non-load reaction type to enhance the operational convenience and minimize the noise and vibration.

Operation

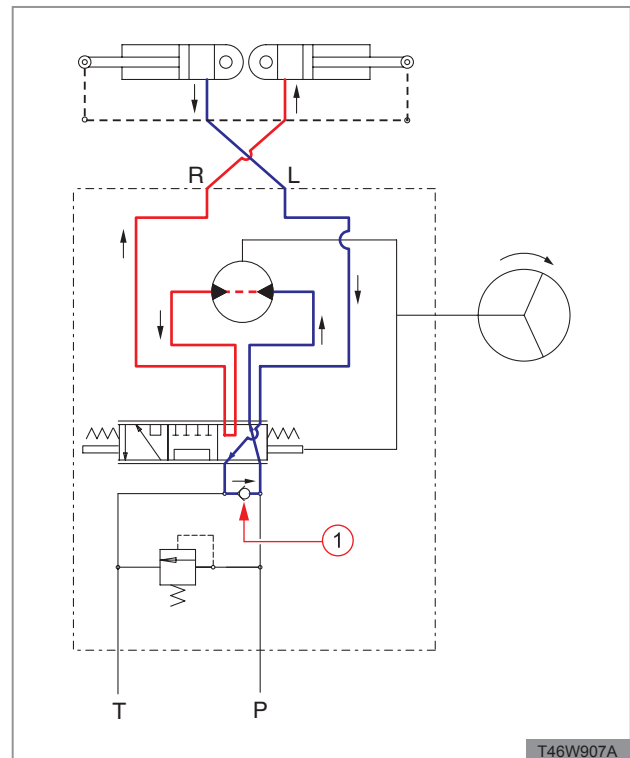
► NEUTRAL



When the steering wheel is not moved, the valve plate (3) keeps its neutral position by the centering spring (4). In this case, the oil flows to the P port through the modulator. Then, it is directly sent to the T port and then returned to the middle of the suction pipe (oil cooler for HST).

The steering angle is maintained unless the steering wheel is turned since the RH and LH lines to the steering cylinder are blocked. Therefore, the steering wheel is not returned to the center position when releasing it after cornering.

► MANUAL STEERING (RIGHT TURN)

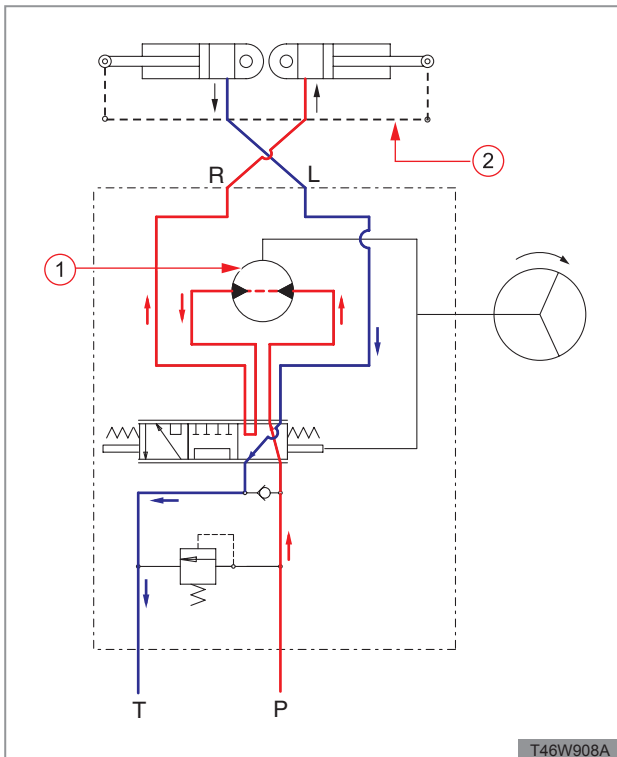


The steering should be forced to be turned in some occasions, for example, when the engine does not start or the hydraulic pump is damaged.

When turning the steering wheel to the right direction, the RH oil passage of the valve plate is open and the oil is supplied to the R port and the RH cylinder by the gerotor. Then, the drained oil by the compressed LH cylinder is returned to the valve plate and supplied to the gerotor inlet again through the check valve (1).

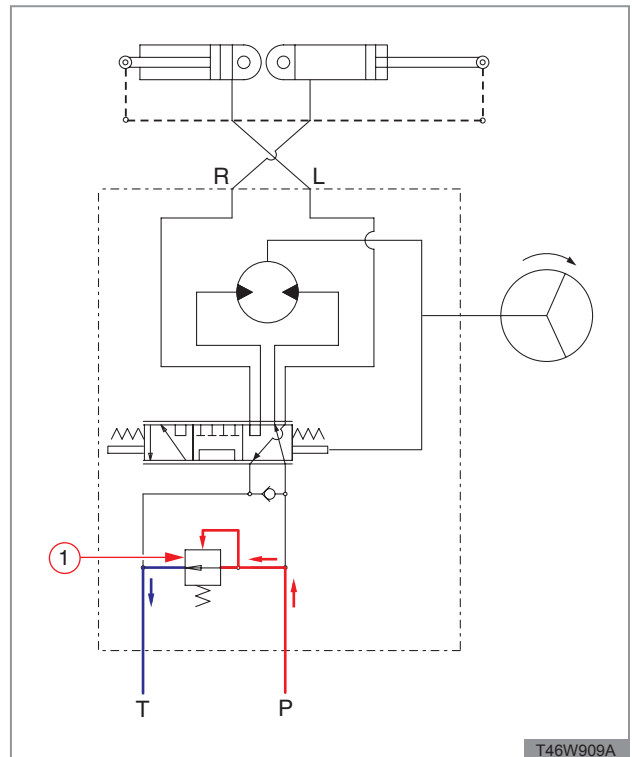
Therefore, the steering is possible by the recirculation of the oil in the steering unit and the steering cylinder even when the oil is not supplied from the gear pump.

► RIGHT TURN

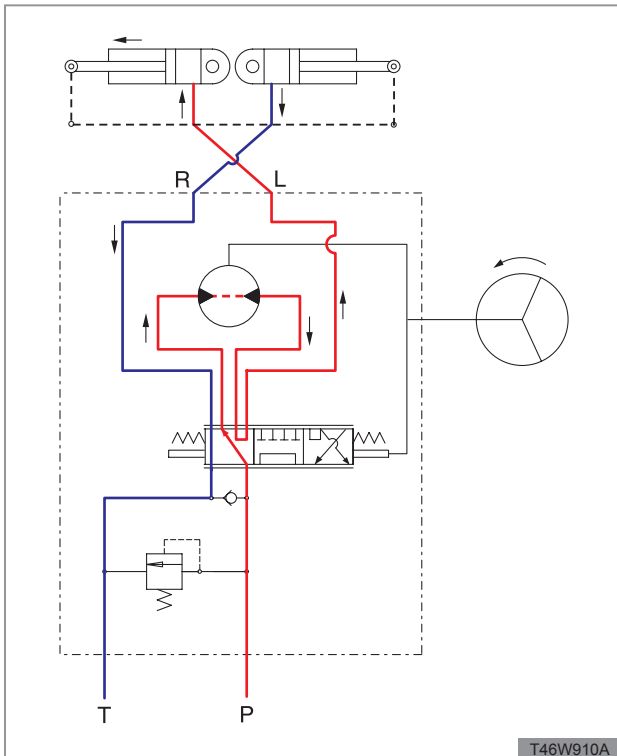


When turning the steering wheel in the right direction, the gerotor rotates and the valve plate is moved to the right side so that the gerotor (1) rotates further by the oil from the P port. Then the oil is supplied to the right cylinder through the R line so that the steering wheel can be turned with only small amount of force. When the right cylinder is expanded, the power is transferred to the tie rod (2) and the left cylinder is compressed. Therefore, the oil returned to the left cylinder is returned to the T port through the L port and the valve plate.

► OPERATION OF RELIEF VALVE (FOR RIGHT TURN)



If the steering cylinder rod is completely drawn out and does not move, the rod does not move due to the stopper even when its stroke is not complete or the wheels do not move due to the excessive load on the steering, the relief valve (140 kg-f/cm²) is open to drain the oil from the P port to the T port immediately.

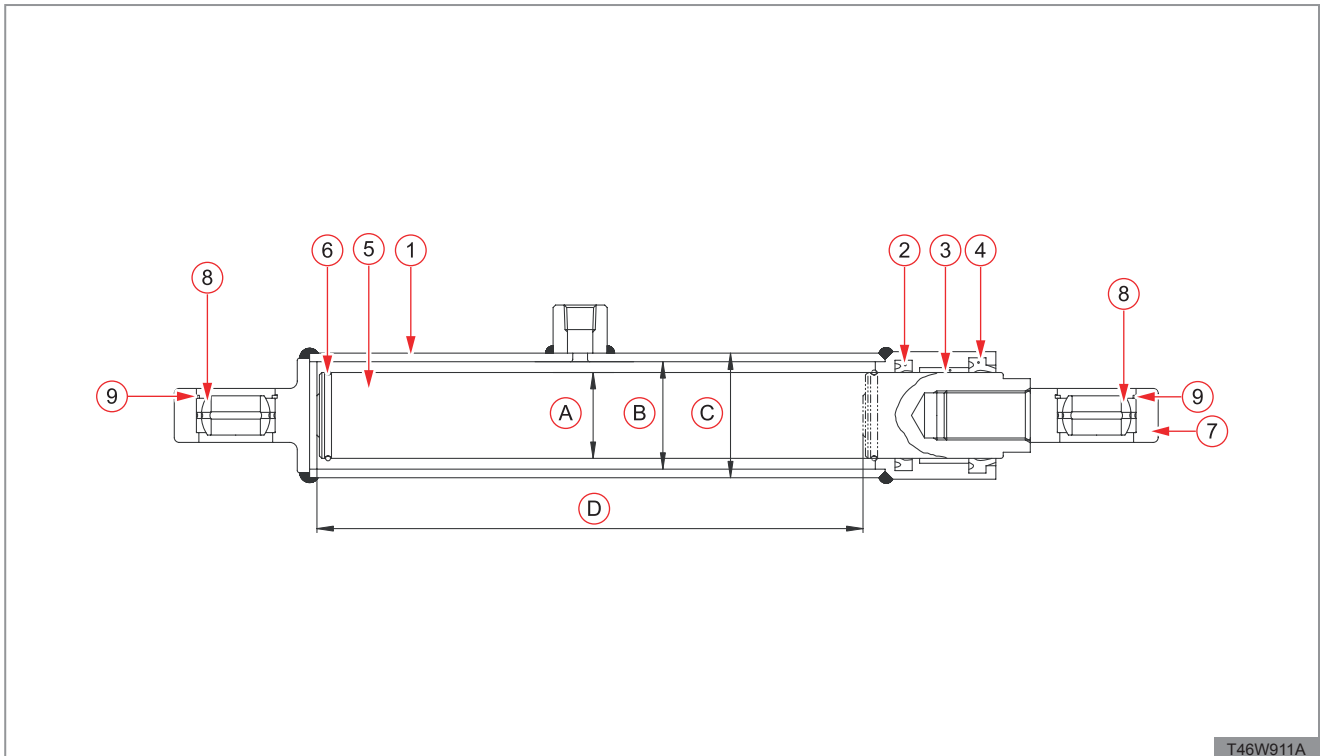
► LEFT TURN


The operation for the left turn is same as that of right turn except for the oil flow direction.

2.3 STRUCTURE

Structure and major specifications for steering cylinder

► STRUCTURE



COMPONENTS

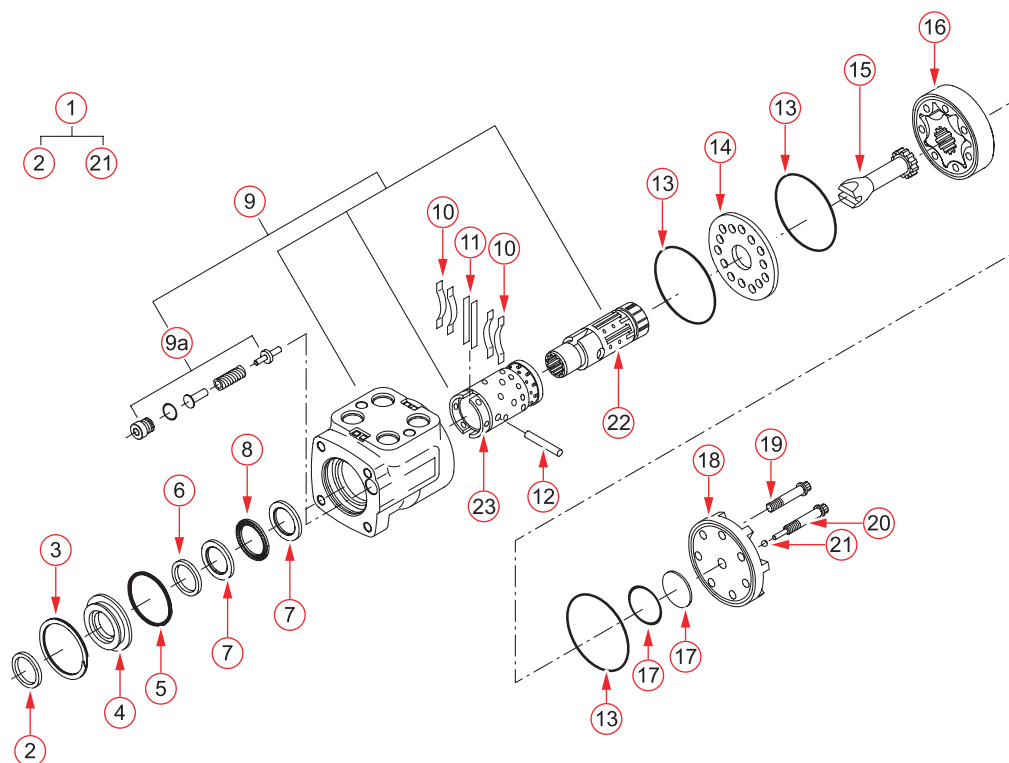
- | | | | |
|-------------|---------------|---------------|--------------|
| (1) Tube | (4) Dust seal | (7) Housing | (A) Rod O.D |
| (2) Packing | (5) Rod | (8) Bearing | (B) Tube I.D |
| (3) Bush | (6) Ring | (9) Snap ring | (C) Tube O.D |
| | | | (D) Stroke |

The steering system for this tractor has two single acting cylinders. It provides the same steering rpm (for left and right turn) and the operational feeling of the steering wheel. The outer force for cylinder rod compression is supplied by the tie rod since this is the single action type.

► MAJOR SPECIFICATIONS

Type	Tube O.D. (C)	Tube I.D. (B)	Rod O.D (A)	Stroke (D)
35HP	φ 60 (2.36 in.)	φ 55 (2.16 in.)	φ 40 (1.57 in.)	198.5 mm (7.81 in.)
40 ~ 50HP	φ 65 (2.56 in.)	φ 60 (2.36 in.)	φ 45 (1.77 in.)	198.5 mm (7.81 in.)

Steering unit



T46W912A

COMPONENTS

- | | | | |
|----------------------------|----------------------------|-------------------------|-----------------------------|
| (1) Steering case assembly | (7) Lace bearing | (12) Pin | (18) Endcap |
| (2) Dust seal | (8) Thrust needle bearing | (13) O-ring | (19) Bolt |
| (3) Retainer ring | (9) Control valve assembly | (14) Spacer | (20) Retainer bolt assembly |
| (4) Seal gland bushing | (9a) Relief valve | (15) Drive (shaft) | (21) Ball |
| (5) O-ring | (10) Centering spring | (16) Gerotor | (22) Spool |
| (6) Oil seal | (11) Plain spring | (17) Star seal assembly | (23) Sleeve |

► POWER STEERING CONTROL MOTOR

A. SPOOL AND SLEEVE

1. The spool (22) and sleeve (23) consists of the rotary valve to selectively switch the fluid passage as well as the direction of the fluid flow.

There are three types of fluid passage; Neutral, Right turn, and Left turn.

2. The spool is fitted to be rotatable in the sleeve, which is fitted into the bore of the valve body.

The spool and the sleeve are mechanically interconnected.

3. The springs (10), (11) are installed through the spool (22) and sleeve (23) to maintain the connected state of the spool and the sleeve.

This position corresponds to the neutral state, and is kept as long as the steering wheel is not turned.

4. The pin is fitted to the drive shaft (15) and the sleeve (23), there being some clearance between the pin and the holes on the spool.

Therefore, when the shaft and sleeve rotate, the spool rotates with approx. 10° of clearance. At this moment, a fluid passage is formed between the spool and the sleeve to operate the steering system. When the shaft and sleeve stop rotating, the spool and sleeve return to their original positions by the spring. Then, the fluid passage is closed and the return passage is open.

B. DRIVE SHAFT

1. The pump drive shaft (15) is slightly tilted off the spool axis, and is splined to the pump gear of the GEROTOR pump assembly by its bottom end.
2. In the event of loss of fluid pressure, turning the steering wheel drives the GEROTOR through this shaft to operate the steering manually.

C. GEROTOR PUMP

The gerotor pump provides the steering system with a back-up device for steering, and operates as previously described.

D. CHECK VALVE

The check valve normally remains closed, which prevents the fluid from flowing from its inlet side to its outlet side directly. When the steering system is manually operated, this valve forms the fluid passage so that the fluid returned from the steering cylinder flows to the GEROTOR pump for recirculation.

E. RELIEF VALVE

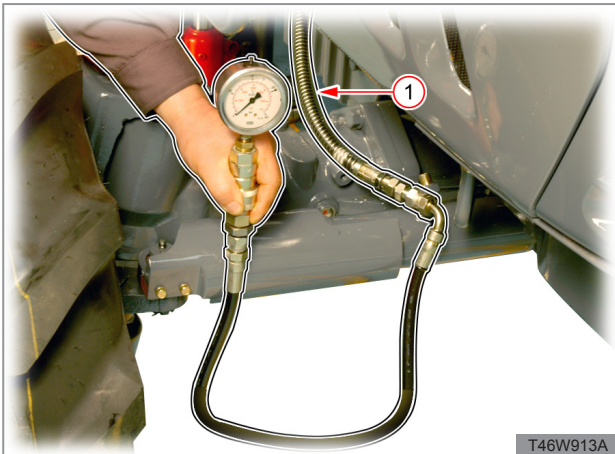
The relief valve (9a) prevents excessive hydraulic pressure from building up in steering pump and circuit. In other words, it protects the circuit when the steering cylinder stroke is completed or the steering is not possible due to the outer force.

3. TROUBLESHOOTING

Problem	Cause	Remedy
Tractor pulls to right or left	- Improper tire size, inflation pressure or shape - Worn or damaged tie rod end - Improper toe in, damaged steering cylinder rod and rod hinge - Damaged inner area of front axle	- Adjust inflation pressure or replace the tire - Replace - Replace - Replace
Excessive steering wheel reaction	- Worn or damaged tie rod end - Improper toe in - Damaged front axle - Low relief pressure of steering unit - Excessive leakage in steering unit	- Replace - Adjust - Replace - Adjust - Replace
Locked steering wheel	- Stuck steering unit - Stuck steering wheel or deflected rod - Stuck front axle pivot or thrust bearing	- Replace - Replace - Replace
Fluid leakage	- Leakage in steering hose - Leakage in steering unit - Leakage in hose connection - Damaged steering cylinder oil seal	- Replace hose - Repair or replace - Retighten and replace O-ring - Replace steering cylinder
Vibration of steering wheel	- Abnormally worn tire lug, abnormal size or deflection insufficient inflation pressure - Damaged axle bearing and gear	- Repair and replace - Replace
Steering wheel free play	- Loose steering wheel mounting nut - Leakage in steering unit or damaged steering unit - Leakage in steering cylinder - Air in steering system or no hydraulic fluid - Air in hydraulic system or no hydraulic fluid	- Retighten - Replace - Replace - Replenish and repair - Replenish and repair
Steering wheel is not tilted	- Worn components related to tilting function	- Replace
Abnormal noise	- Leakage in steering unit - Prematurely opened steering relief valve	- Replace the unit - Increase the relief pressure

4. MEASUREMENT AND ADJUSTMENT

4.1 STEERING RELIEF OPENING PRESSURE



1. Disconnect the steering hose (1) to be tested and connect the manometer (over 150 bar).



2. Start the engine and turn the steering wheel to the direction which the manometer is connected.

! WARNING

- Be careful of the turning direction of the steering since the oil spurts from the steering cylinder if the steering wheel is turned to the opposite direction.
- The spurting fluid with high pressure can penetrate your skin. In this case, see your doctor immediately. Otherwise, your skin or muscle can be seriously damaged.

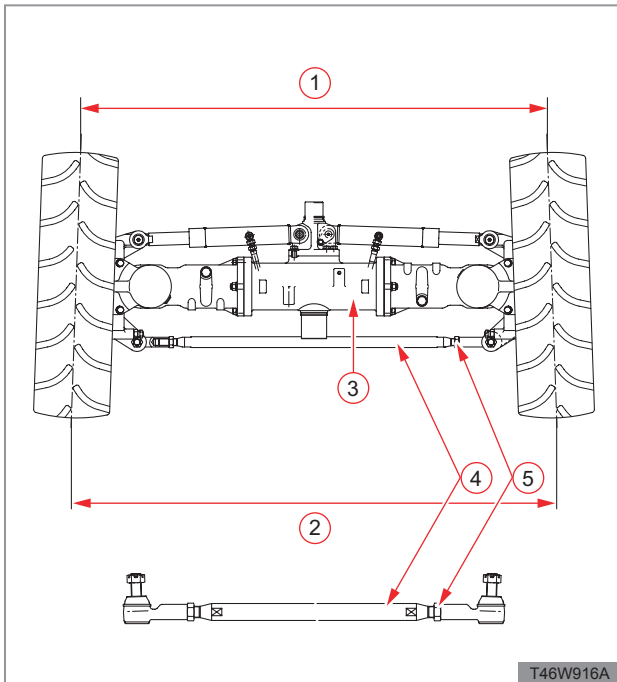
3. Adjust the pressure as necessary.

4.2 RELIEF PRESSURE ADJUSTMENT



1. Turn the plug (A) for setting relief valve 90° at one time and measure the steering relief pressure.
2. Turn the plug clockwise to increase the pressure.
3. When the right pressure is achieved, lock the plug.

4.3 TOE IN



Measurement of toe in

1. Park the tractor on level ground and apply the parking brake.
2. Lift the front tires slightly from the ground using a hydraulic jack.
3. Place the steering wheel in the straight ahead position. Keep the axle balanced.
4. Measure the front width (1) and the rear width (2) between the front wheels.
5. Measure this distance 2~3 times while turning the tires.
6. Get the average value of this distance.
7. Adjust the toe in so that the distance between the front is 2 ~ 8 mm (0.079 ~ 0.315 in.) shorter than the distance between the rear.
8. To adjust the toe in, loosen the lock nuts (5) from both tie rod ends.
9. Turn the tie rod (3) to adjust the toe in and tighten the lock nuts (5) firmly.

Lock nut.....78.5 ~ 117.7 Nm
8 ~ 12 kgf-m
57.9 ~ 86.8 lb-ft

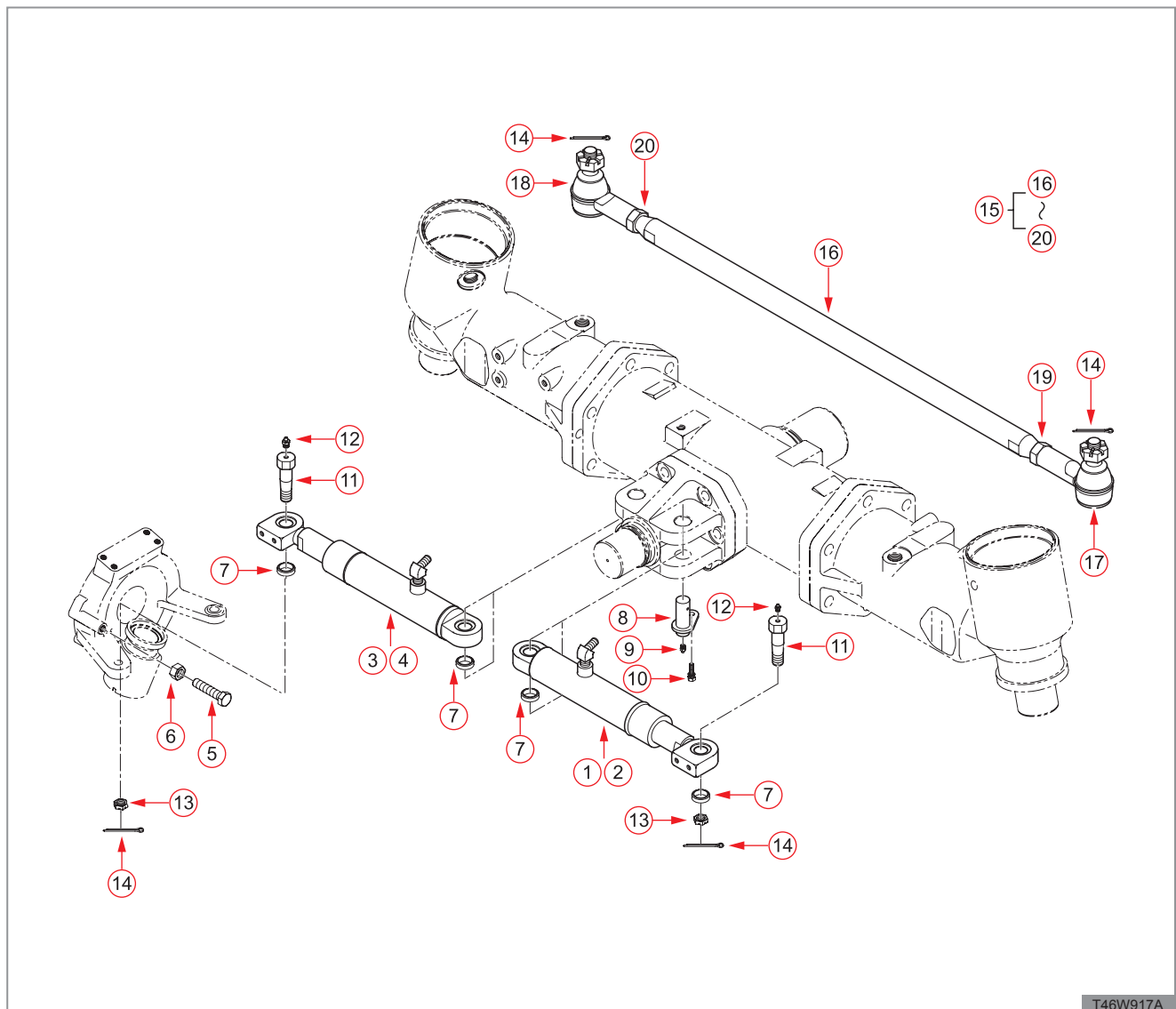
5. EXPLODED VIEW



NOTES

- The manufacturing parts are subject to change without notice. Therefore, check the parts catalog or electronic manual for latest information.

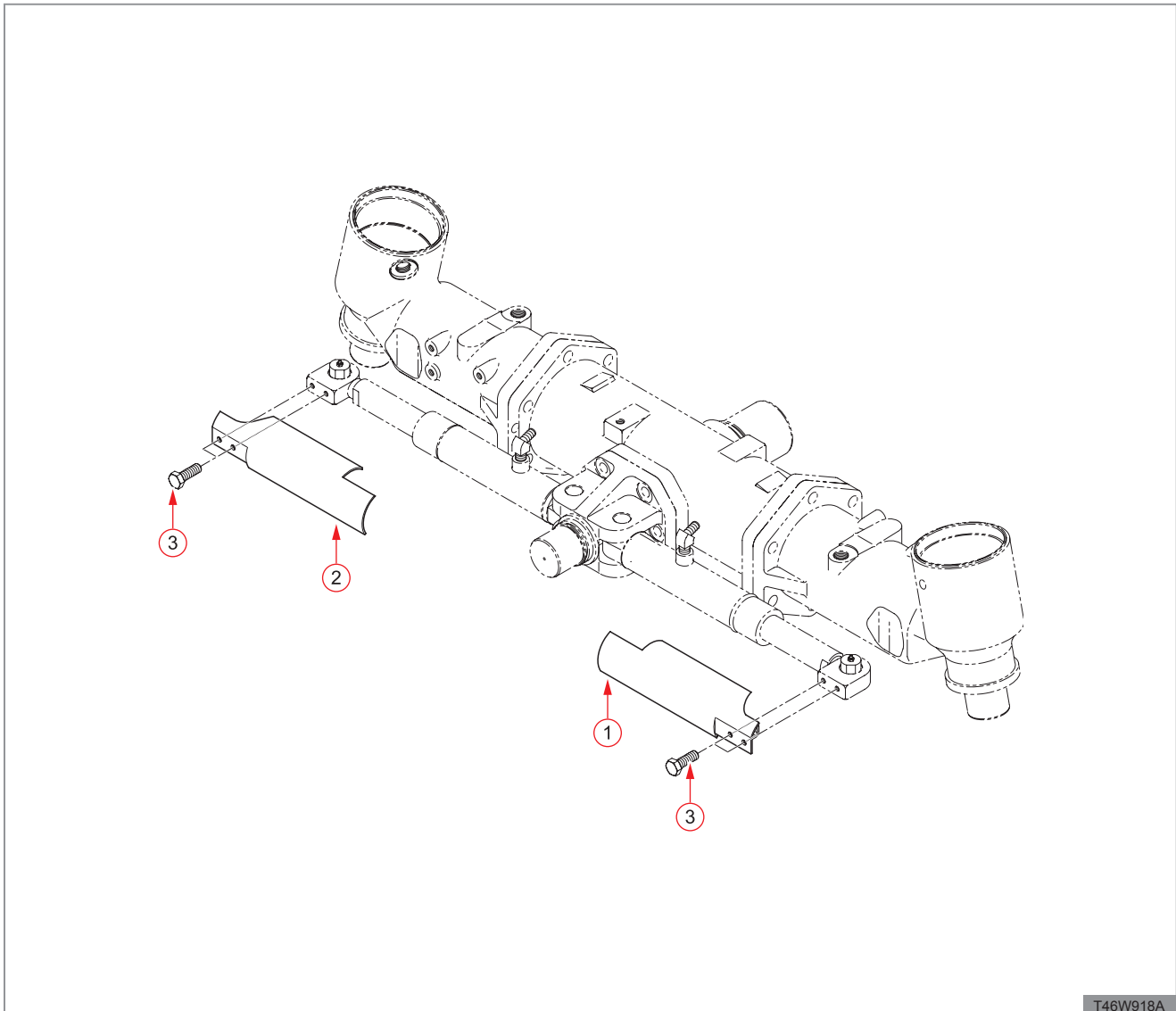
5.1 T595A STEERING CYLINDER



COMPONENTS

- | | | |
|---|-------------------------------|--------------------------------|
| (1) Steering cylinder assembly (LH, 35 HP) | (6) Nut | (14) Cotter pin |
| (2) Steering cylinder assembly (LH, 40~50 HP) | (7) Spacer | (15) Tie rod assembly |
| (3) Steering cylinder assembly (RH, 35 HP) | (8) Cylinder support pin | (16) Tie rod |
| (4) Steering cylinder assembly (RH, 40~50 HP) | (9) Grease nipple | (17) Tie rod end assembly (LH) |
| (5) Bolt | (10) Bolt with captive washer | (18) Tie rod end assembly 2 |
| | (11) Support pin | (19) Nut (LH) |
| | (12) Grease nipple | (20) Nut (RH) |
| | (13) Threaded nut | |

5.2 T596A STEERING COVER



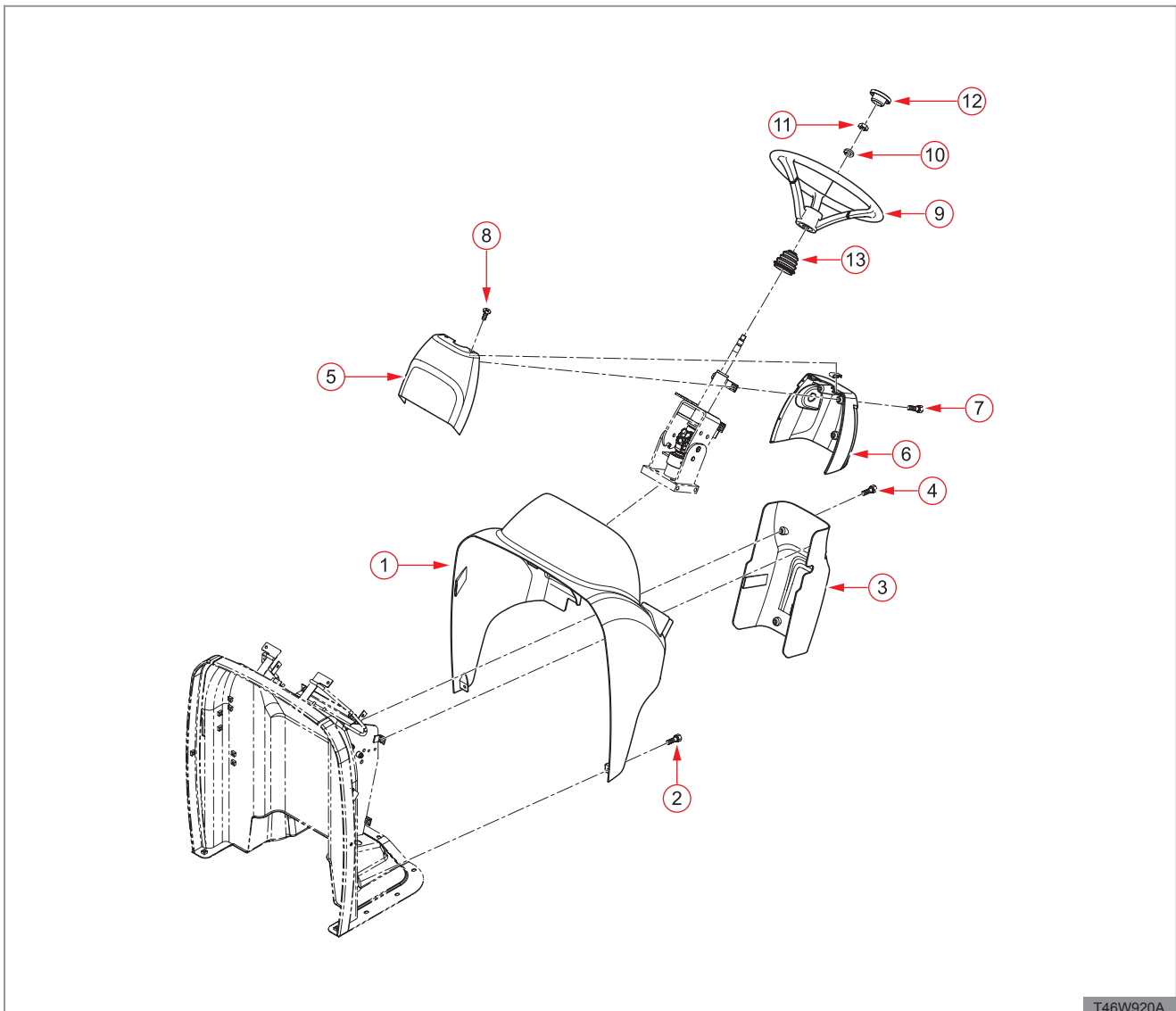
COMPONENTS

(1) Cylinder cover (LH)

(2) Cylinder cover (RH)

(3) Bolt with captive washer

5.4 T875A INSTRUMENT PANEL COVER

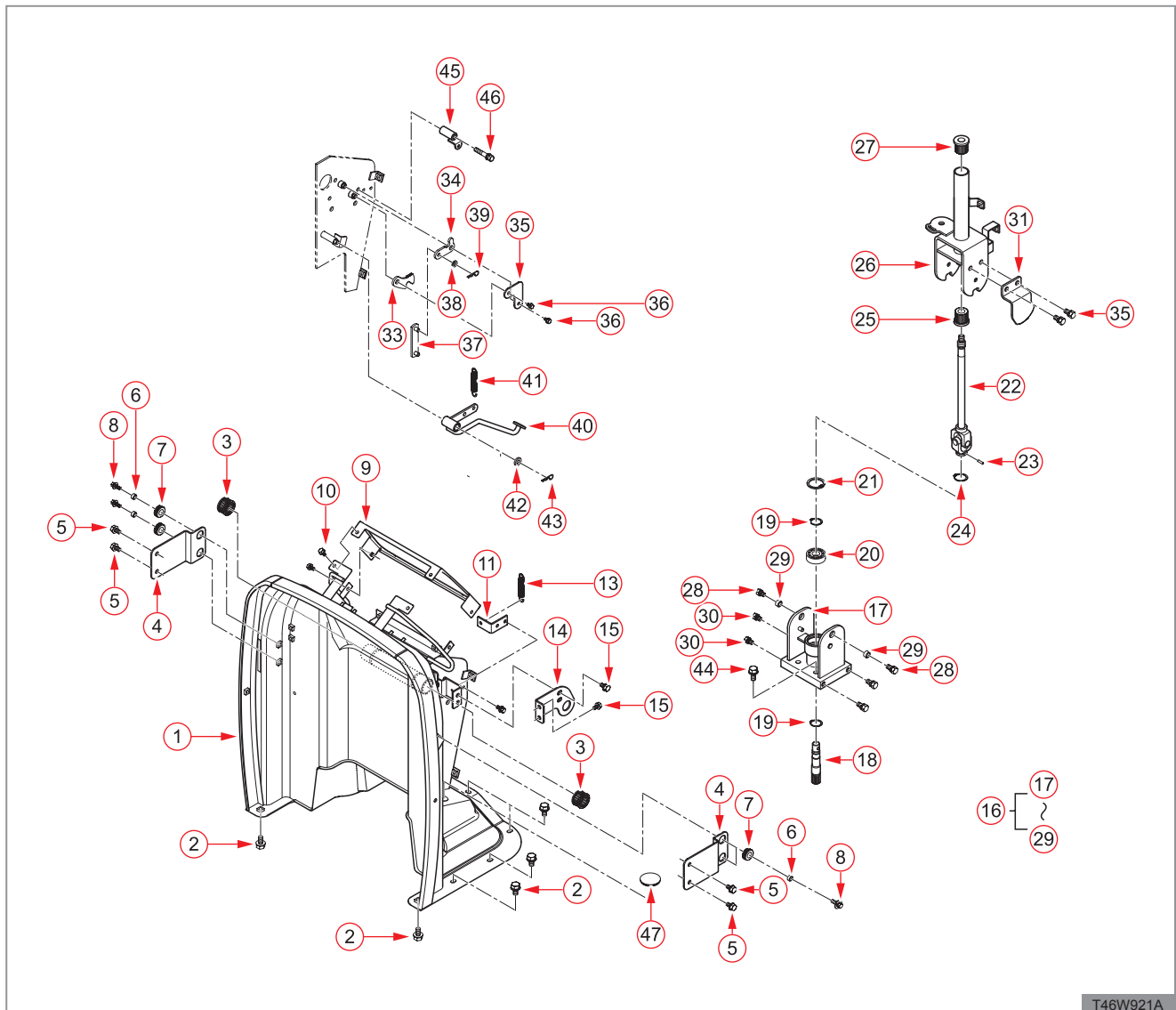


T46W920A

COMPONENTS

- | | | |
|--------------------------------|-------------------------------|-------------------------|
| (1) Instrument cover (T) | (6) Steering wheel cover (RR) | (11) Nut |
| (2) Bolt with captive washer | (7) Spring nut | (12) Steering wheel cap |
| (3) Cover (P) | (8) Screw | (13) Bellows |
| (4) Bolt with captive washer | (9) Steering wheel assembly | |
| (5) Steering wheel cover (FRT) | (10) Spring washer | |

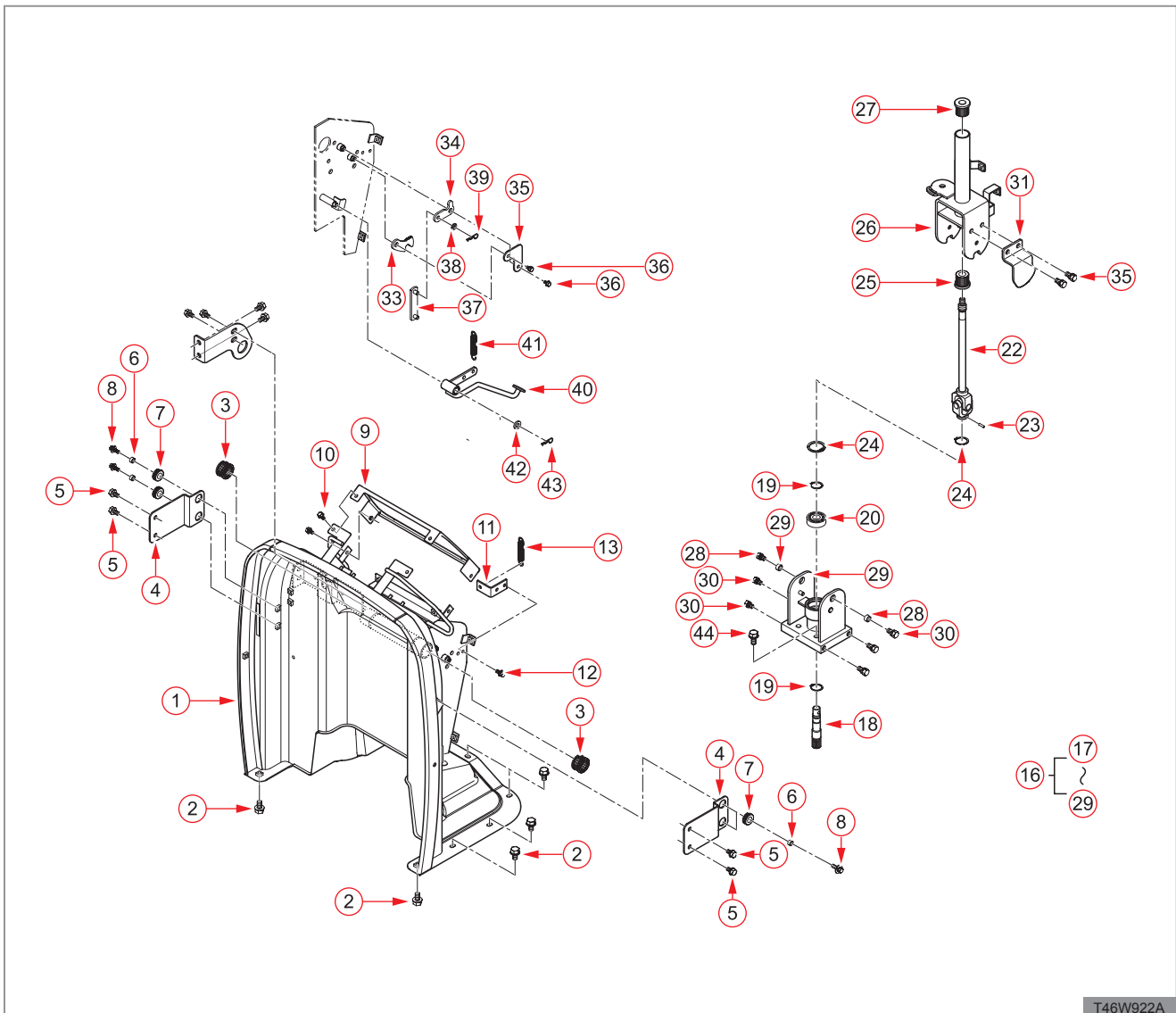
5.5 T845A-1 FRAME (HST)



COMPONENTS

- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| (1) Frame assembly | (17) Steering support | (33) Lock gear |
| (2) Flange bolt | (18) Shaft | (34) Lever (tilt) |
| (3) Needle bearing | (19) Snap ring | (35) Fixing plate (tilt) |
| (4) Tank support | (20) Ball bearing | (36) Bolt with captive washer |
| (5) Flange bolt | (21) Snap ring | (37) Rod (tilt) |
| (6) Spacer | (22) Steering shaft assembly | (38) Plain washer |
| (7) Grommet | (23) Spring pin | (39) Snap pin |
| (8) Bolt with captive washer | (24) Snap ring | (40) Tilt pedal |
| (9) Instrument panel holder | (25) Cushion rubber 2 | (41) Brake spring |
| (10) Flange bolt | (26) Column | (42) Plain washer |
| (11) Spring holder | (27) Cushion rubber | (43) Snap pin |
| (12) Flange bolt | (28) Bolt with captive washer | (44) Bolt with captive washer |
| (13) Brake spring | (29) Collar (tilt) | (45) Bracket (spring holder) |
| (14) Support | (30) Bolt with captive washer | (46) Bolt with captive washer |
| (15) Bolt with captive washer | (31) Sector gear | (47) Rubber plug (frame) |
| (16) Steering assembly | (32) Bolt with captive washer | |

5.6 T845A-2 FRAME (MECHANICAL)



T46W922A

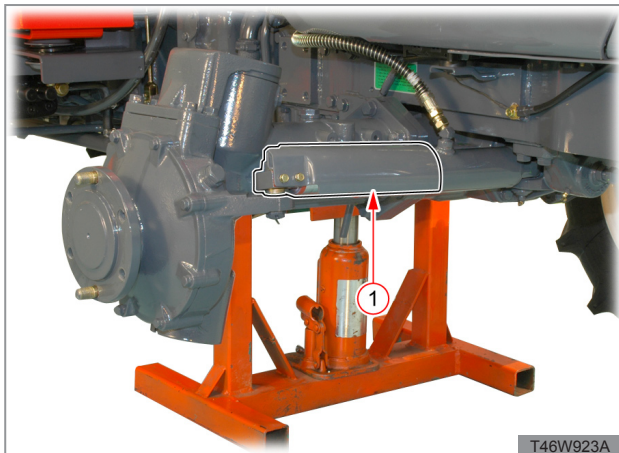
COMPONENTS

- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| (1) Frame assembly | (17) Steering support | (33) Lock gear |
| (2) Flange bolt | (18) Shaft | (34) Lever (tilt) |
| (3) Needle bearing | (19) Snap ring | (35) Fixing plate (tilt) |
| (4) Tank support | (20) Ball bearing | (36) Bolt with captive washer |
| (5) Flange bolt | (21) Snap ring | (37) Rod (tilt) |
| (6) Spacer | (22) Steering shaft assembly | (38) Plain washer |
| (7) Grommet | (23) Spring pin | (39) Snap pin |
| (8) Bolt with captive washer | (24) Snap ring | (40) Tilt pedal |
| (9) Instrument panel holder | (25) Cushion rubber 2 | (41) Brake spring |
| (10) Flange bolt | (26) Column | (42) Plain washer |
| (11) Spring holder | (27) Cushion rubber | (43) Snap pin |
| (12) Flange bolt | (28) Bolt with captive washer | (44) Bolt with captive washer |
| (13) Brake spring | (29) Collar (tilt) | (45) Bracket (spring holder) |
| (14) Support | (30) Bolt with captive washer | (46) Bolt with captive washer |
| (15) Bolt with captive washer | (31) Sector gear | (47) Rubber plug (frame) |
| (16) Steering assembly | (32) Bolt with captive washer | |

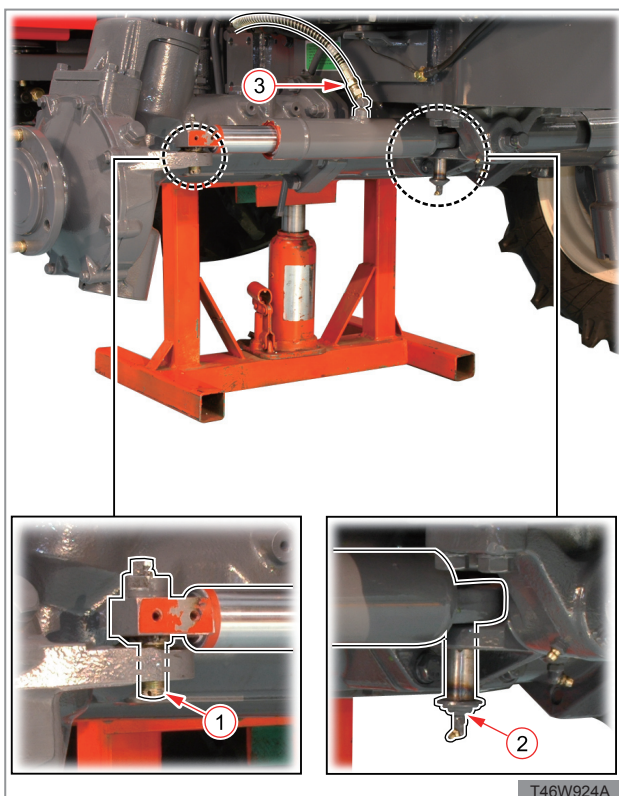
6. SERVICING

6.1 STEERING CYLINDER

Removal

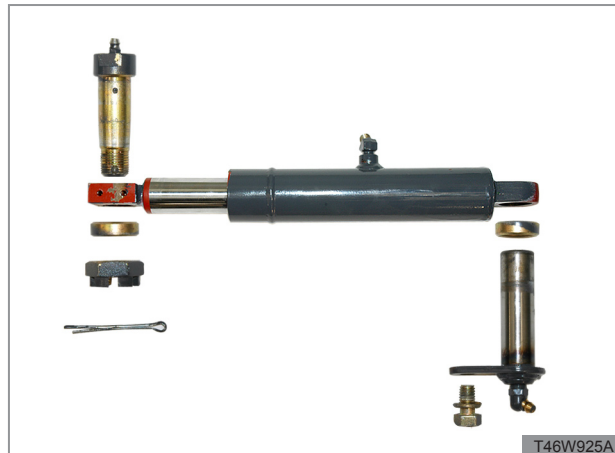


1. Lift the front axle using a hydraulic jack.
2. Remove the steering cylinder cover (1).



3. Remove both pins (1, 2) from both steering cylinders.
4. Disconnect the steering hose (4) and remove the steering cylinder.
 - The steering cylinder should be replaced as an assembly. Therefore, replace the steering cylinder as a unit in case of leakage.

Reinstallation



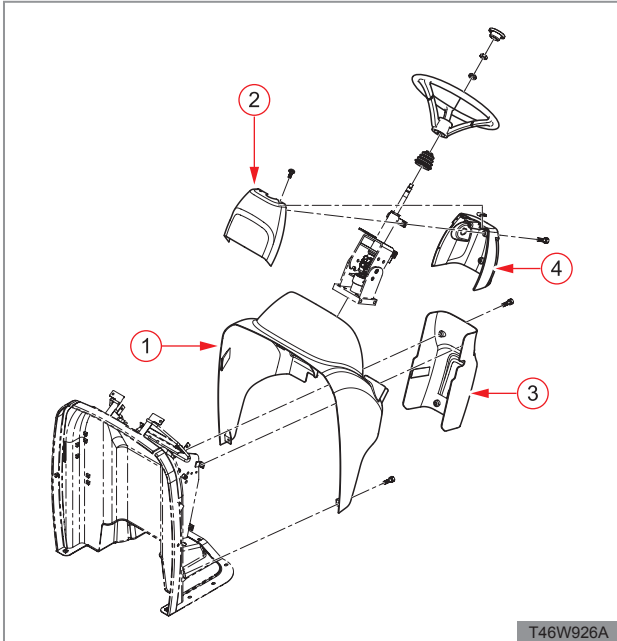
1. Tightening torque for pin mounting bolt in the steering cylinder

Tightening torque for pin mounting bolt in steering cylinder (M8) 23.5 ~ 27.5 Nm
2.4 ~ 2.8 kgf-m
17.4 ~ 20.3 lb-ft

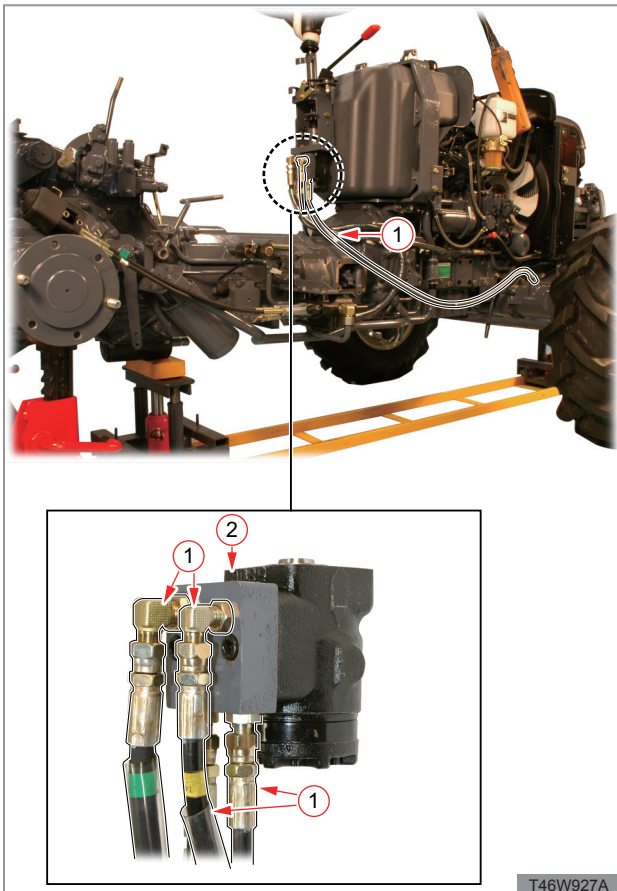
2. Installation of pin mounting nut on the steering cylinder
 - Tighten the nut slightly using a proper tool.
 - Tighten the nut until the tightening torque is sharply increased, and tighten it further until the next pin hole is shown. Insert the split pin at this point.
 - Bend the split pin so that it does not come off.
3. Tightening torque of steering hydraulic hose

Tightening torque of steering hydraulic hose (3).....24.5 Nm
2.5 kgf-m
18.1 lb-ft

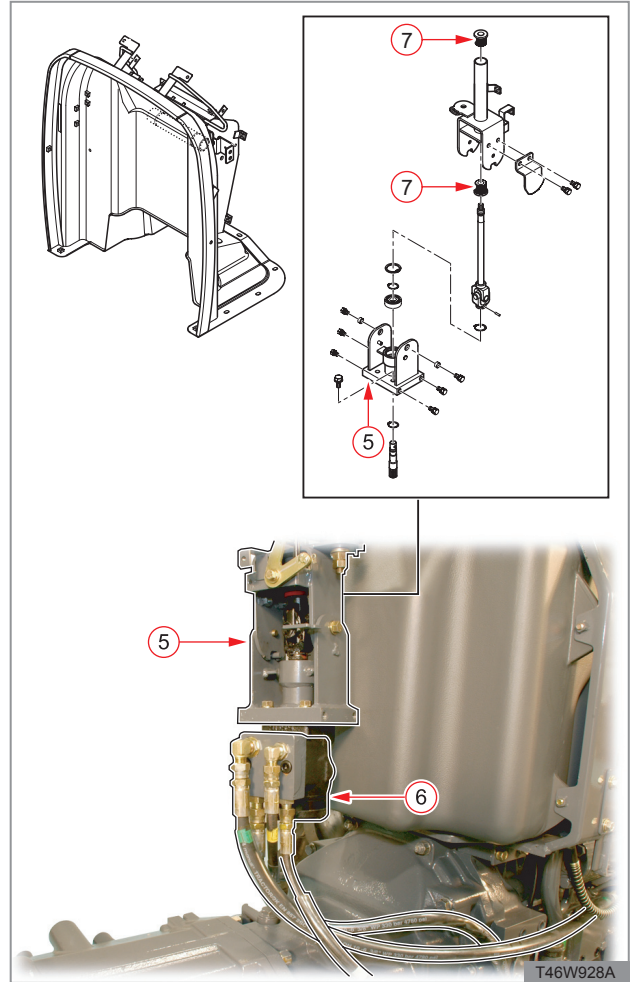
6.2 REMOVAL OF STEERING UNIT



1. Remove the upper cover (1), lower cover (3), front handle cover (2) and rear handle cover (4).

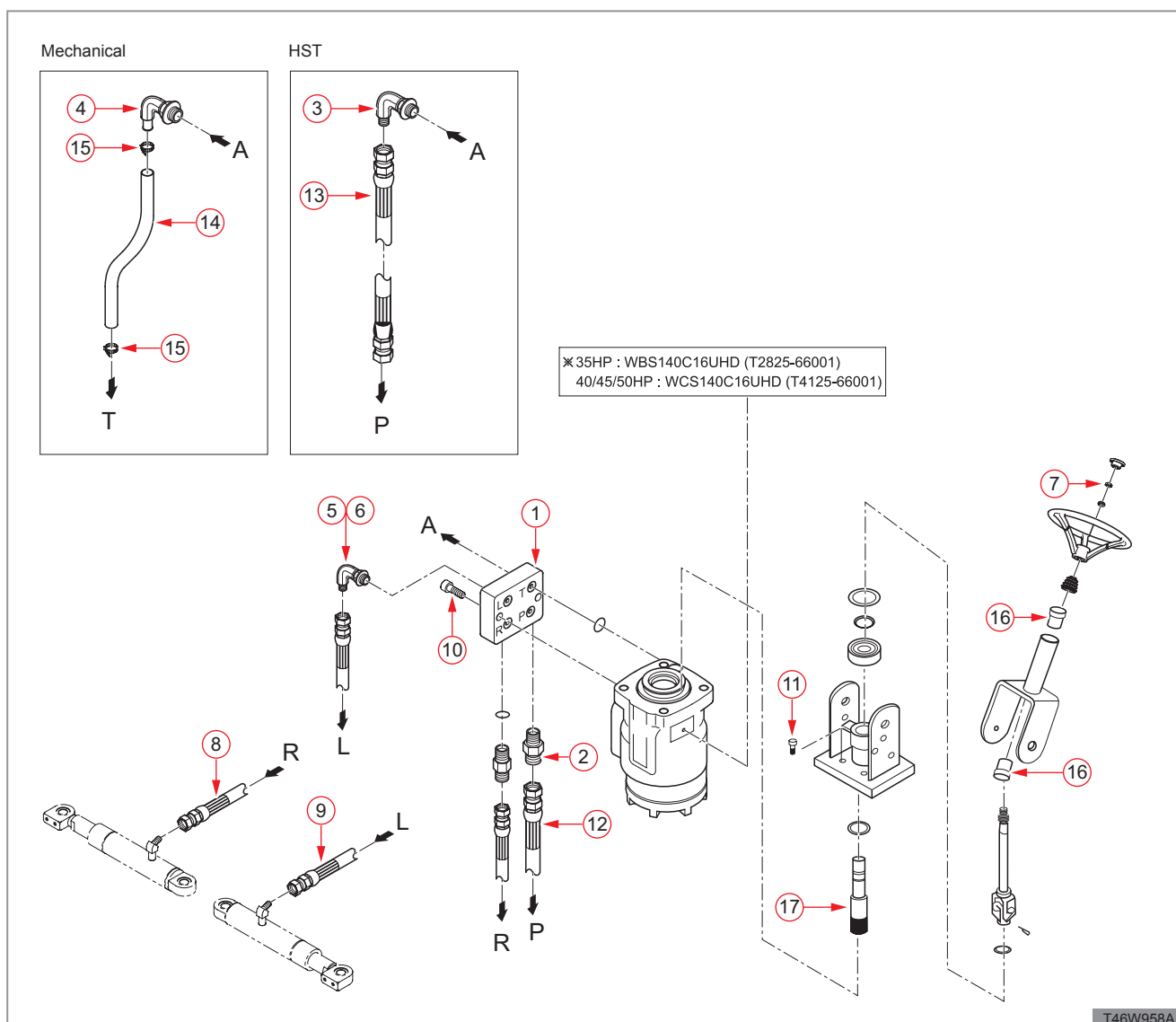


2. Disconnect the steering hoses (1) from the steering unit (2).



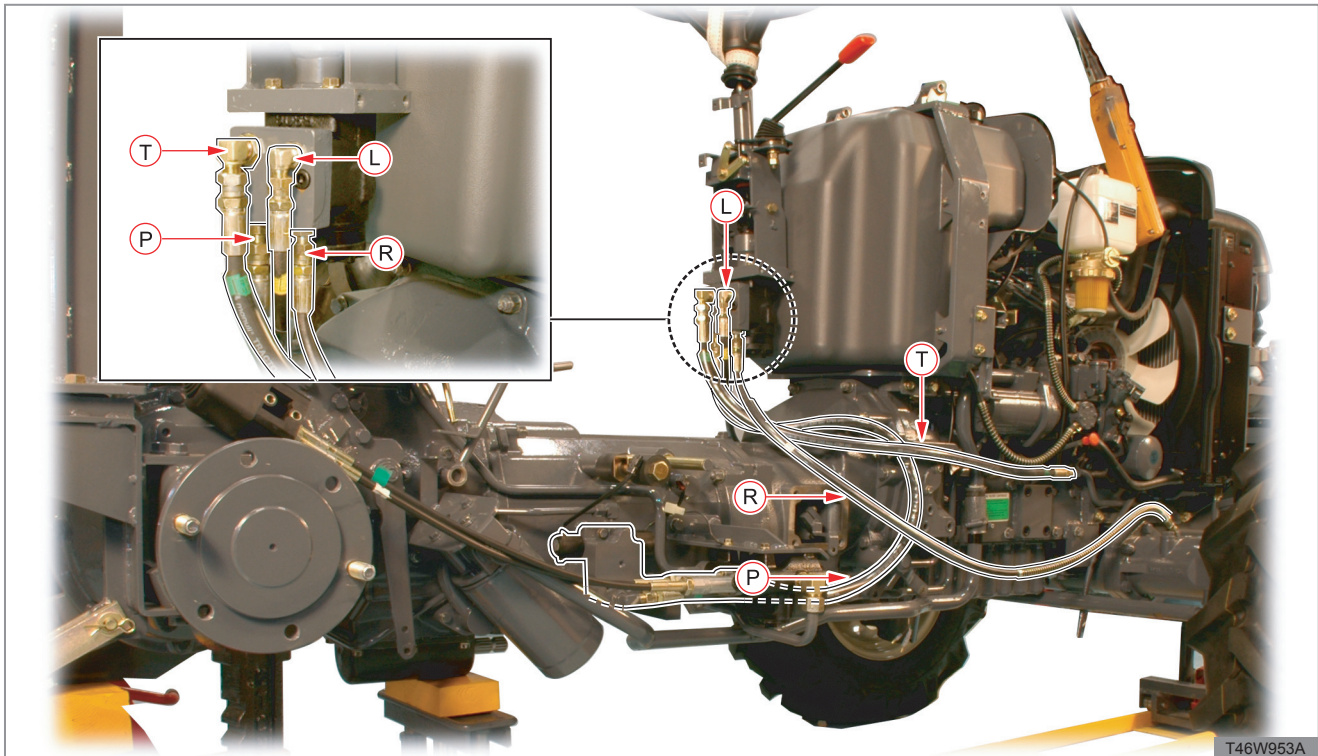
3. Remove the steering support (5) from the frame.
4. Separate the steering unit (6) from the steering support (5).

6.3 TIGHTENING TORQUE OF STEERING HOSE AND INSTALLATION OF STEERING UNIT

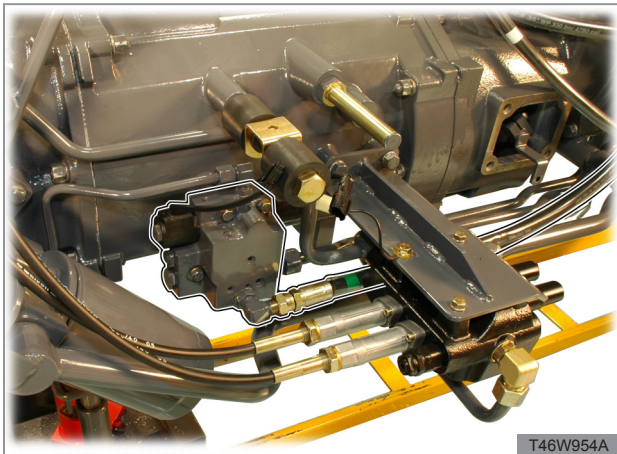


- | | |
|--|---|
| <p>1. Connectors (2, 3, 4, 5, 6) at each port (P, T, L, R) of hydraulic block (1) 49 Nm
5 kgf-m
36.1 lb-ft</p> <p>2. Both end nuts (8, 9) for hydraulic hoses (RH, LH)..... 24.5 Nm
2.5 kgf-m
18 lb-ft</p> <p>3. Socket head bolt (10) and bolt (11)..... 44.1 Nm
4.5 kgf-m
32.5 lb-ft</p> <p>4. Hydraulic hoses (P) (12, 13) 49 Nm
5 kgf-m
36.1 lb-ft</p> | <p>5. Clamp (15) tightening torque of return hose (14, for mechanical type)..... 4.9 Nm
0.5 kgf-m
3.6 lb-ft</p> <p>6. Apply grease in the cushion rubber (16) when installing it.</p> <p>7. When installing the steering shaft (17) to the steering unit, apply sufficient amount of grease on the steering shaft spline.</p> <p>8. Steering wheel nut (7) 48 ~ 55.9 Nm
4.9 ~ 5.7 kgf-m
35.4 ~ 41.2 lb-ft</p> |
|--|---|

6.4 STEERING HOSE LOCATION

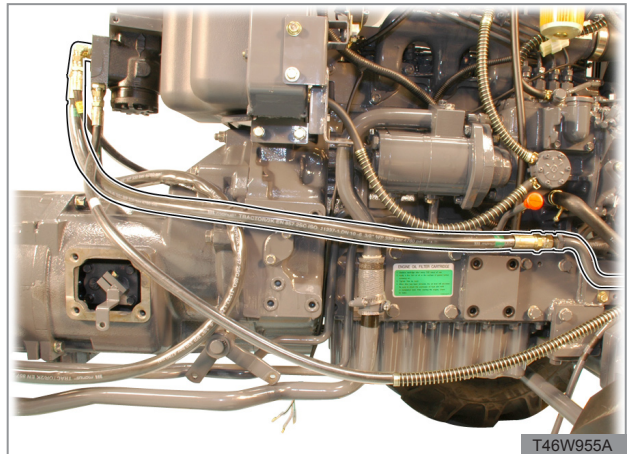


► P (PUMP)



This is the hydraulic pressure supply hose installed between modulator valve and steering unit. It is indicated by green tape on both ends.

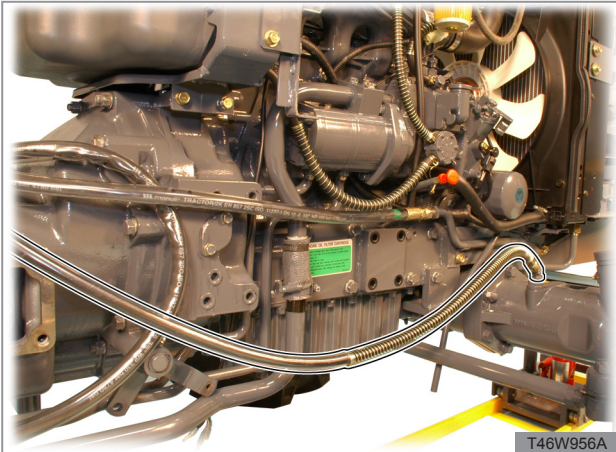
► T (RETURN)



This is the return hose installed between steering unit and hydraulic block on the gear pump.

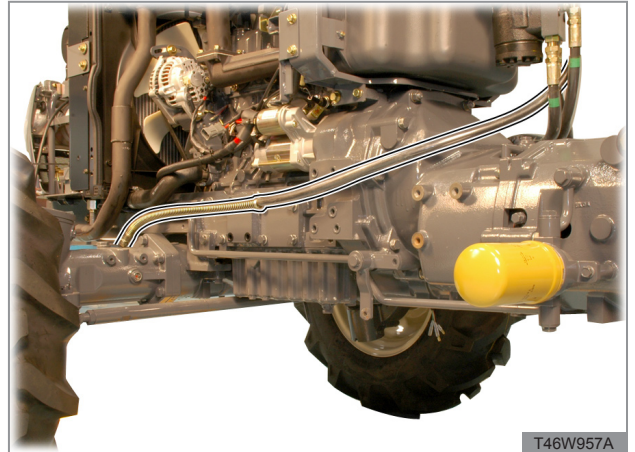
For HST tractor, this hose is connected from steering unit to HST passed through oil cooler.

► **R (RIGHT TURN)**



This hose is installed between steering unit and RH steering cylinder. It is indicated by white tape on both ends.

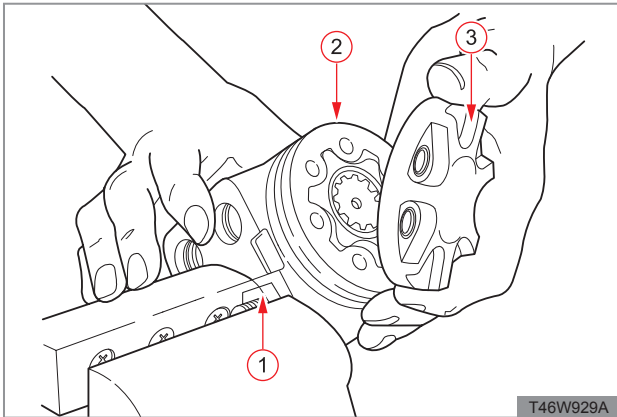
► **L (LEFT TURN)**



This hose is installed between steering unit and LH steering cylinder. It is indicated by yellow tape on both ends.

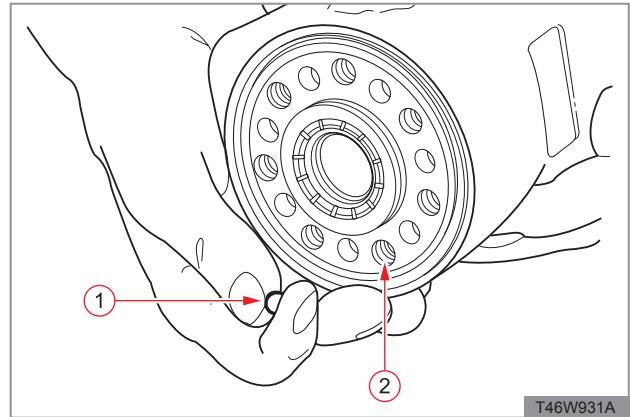
6.5 DISASSEMBLY OF STEERING UNIT COMPONENTS

► DISASSEMBLY OF POWER STEERING SYSTEM



(1) Connector (3) End cap
(2) Control motor

1. Turn over the control motor (2) and set it in a vise. Tighten the vise just enough to hold the motor using soft-faced jaws. Otherwise, the pressure could jam the components against one another.
2. Remove the seven bolts from the end cap (3) and remove the O-ring.

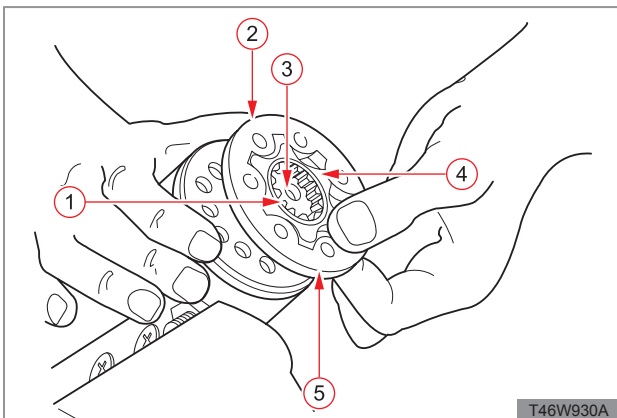


(1) Check valve ball (2) The deepest bolt hole

5. Remove the steering motor from the vise and remove the check valve ball (1) from the housing.

! CAUTION

- The check valve is located in the deepest bolt hole (2).



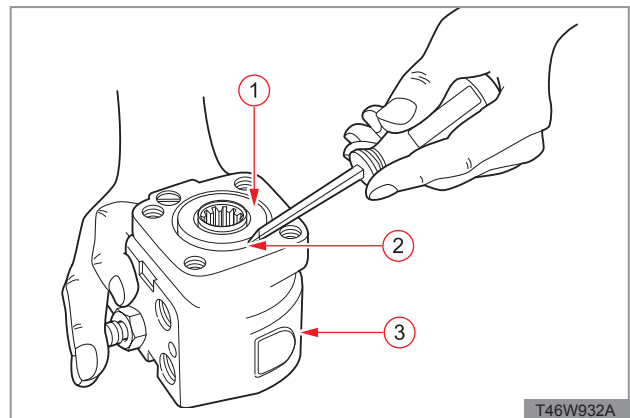
(1) Sealing (3) Drive shaft (5) Spacer
(2) Stator (4) Rotor

3. Slide the gerotor motor (rotor (4), and stator (2)) from the spacer (5). Remove the large O-ring from the stator (2), stator plate, small O-ring, seal ring (1) in rotor (4), and cap.

! CAUTION

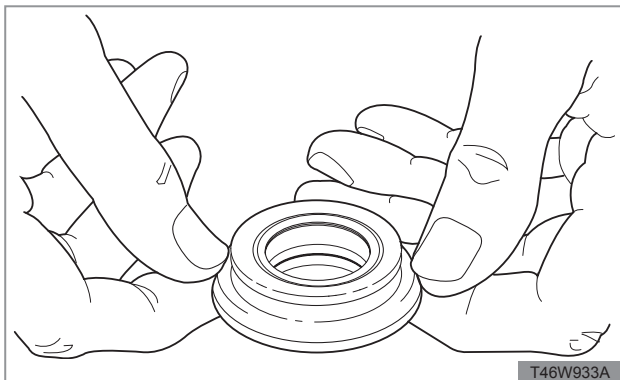
- The inner rotor is easily removed from the outer pump body rotor. Therefore, be careful not to drop any component. Otherwise, such component could be damaged.

4. Lift the drive shaft (3) and spacer (5) from the housing. Remove the O-ring under the spacer.

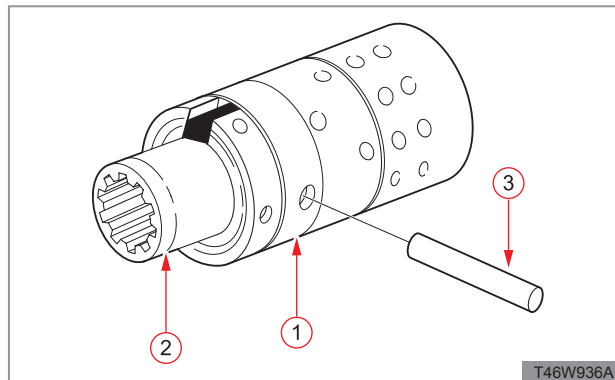


(1) Gland bushing (3) Steering housing
(2) Retainer ring

6. Using a screwdriver, remove the retaining ring (2) from the top of the steering housing (3). Then, remove the gland bushing (1).

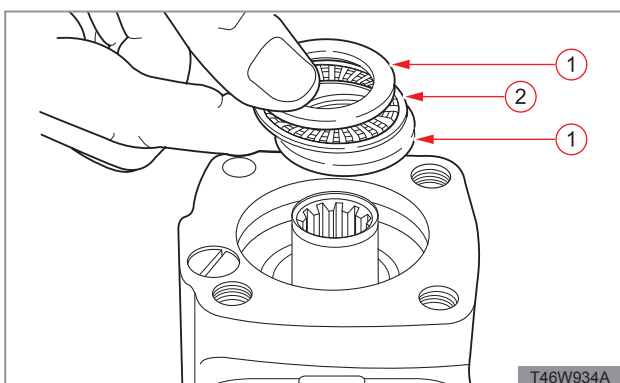


7. Remove the oil seal (1), dust seal (2) and O-ring seal (3) from the gland bushing.



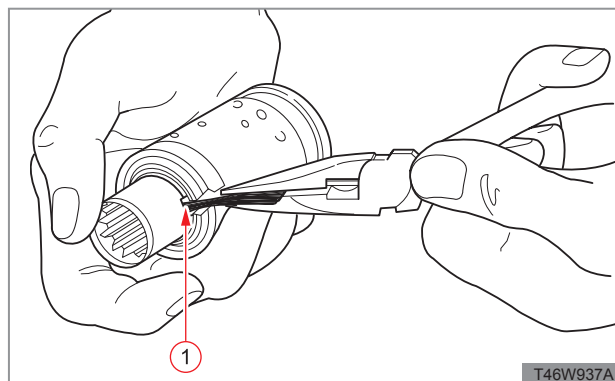
- (1) Sleeve
(2) Spool
(3) Pin

10. Remove the pin (3) from the sleeve (1) and spool (2) assembly.



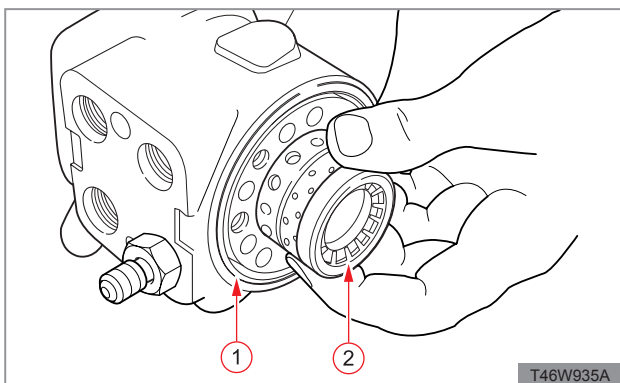
- (1) Bearing race (2) Thrust bearing

8. Remove the thrust bearing (2) and two bearing races (1) from the body.



- (1) Centering spring

11. Push the spool upward out of the sleeve slightly and pull the centering springs (1) outward. Then remove the spool from the bottom side of the sleeve.



- (1) Motor housing (2) Sleeve

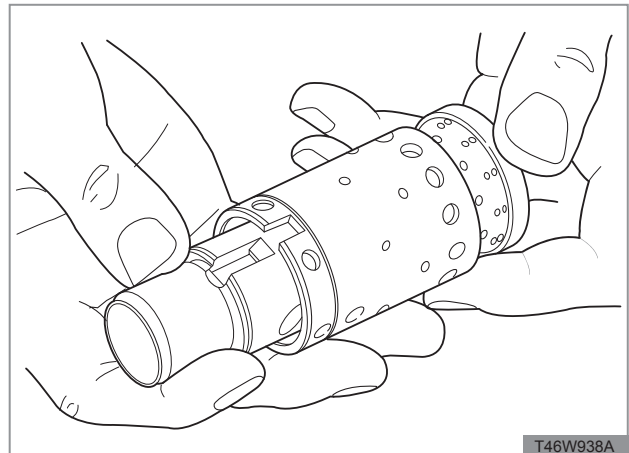
9. Pull the sleeve and spool (2) from the bottom of the motor housing (1). The sleeve is a sealed unit in steering motor housing and should be rotated slightly during removal.

Install the sleeve and spool while turning them in the housing supported by pin. At this time, keep them horizontal as much as possible. This helps prevent the pin from sliding out of its hole and catching in the housing. Pull the sleeve out as straight as possible to prevent it from becoming jammed.

► INSPECTION

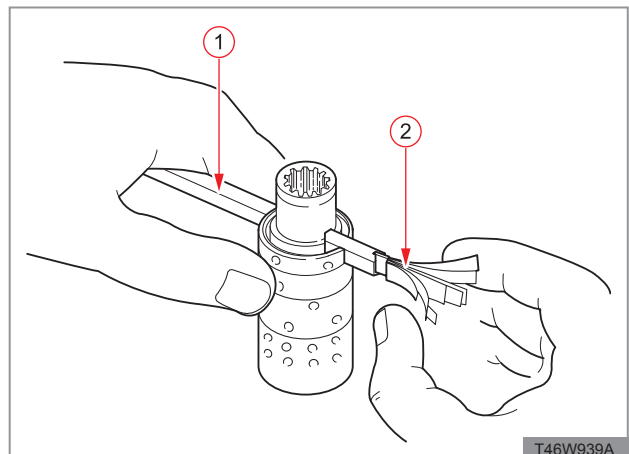
1. Check the spool and sleeve for evidence of sticking, scuff marks and any other damage. If defective, replace the spool and sleeve as a set.
2. Check the pin for damage and check the internal teeth on the spool for damage.
3. Check the inside surfaces of the motor housing for wear or damage.
4. Inspect the gerotor pump stator and rotor for wear. Make sure that the rotor turns freely in stator.
5. Check the drive shaft for wear or damage.
6. Check the thrust bearing for wear or damage.
7. Check the centering springs for distortion. Centering springs without tension should be replaced.

► INSTALLATION



T46W938A

1. Slide the spool into the sleeve. Position the spool so that the centering spring slots on the spool and sleeve are aligned in order for the centering springs to be installed.

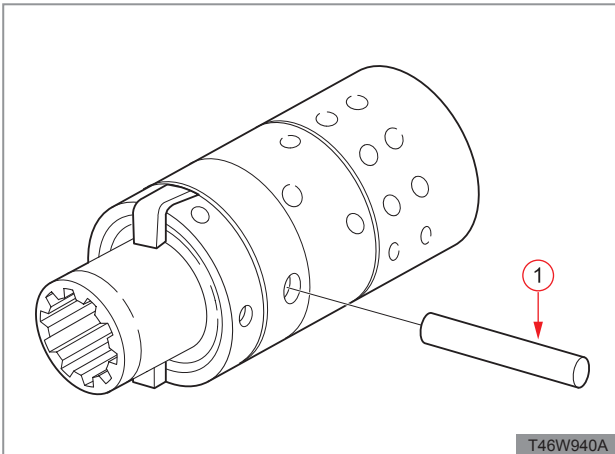


T46W939A

(1) Special tool

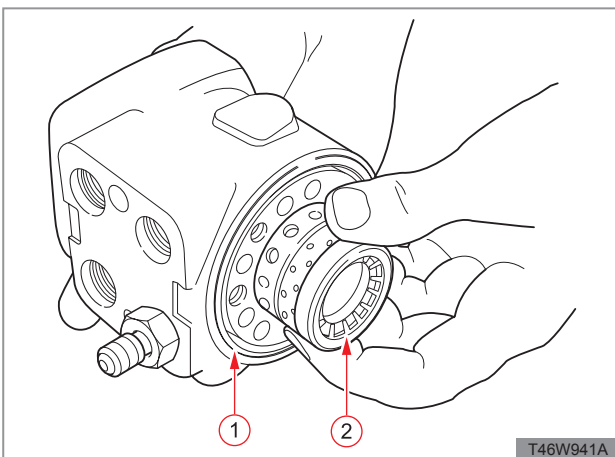
(2) Centering spring

2. With the centering spring slots aligned, insert the special tool (1) in the slots.
3. Assemble the centering springs (2), two flat springs, and two convex springs. Make sure the notched edge of the spring faces downward. And, position the assembly into the notched groove of the installation tool.
4. While holding the outer edge of the centering spring assembly and maintaining pressure against the tool, slide in the tool from the assembly. At this moment, do not remove the spring from the slot.



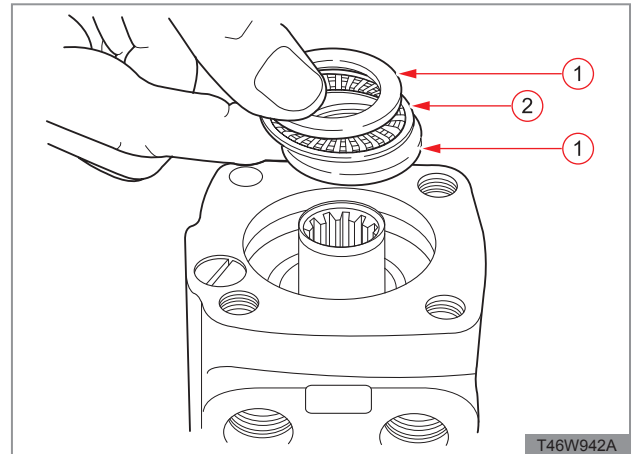
(1) Pin

5. Position the spool and sleeve so that their ends are at the same height and insert the pin (1) through the assembly until its ends are below the surfaces of the sleeve.



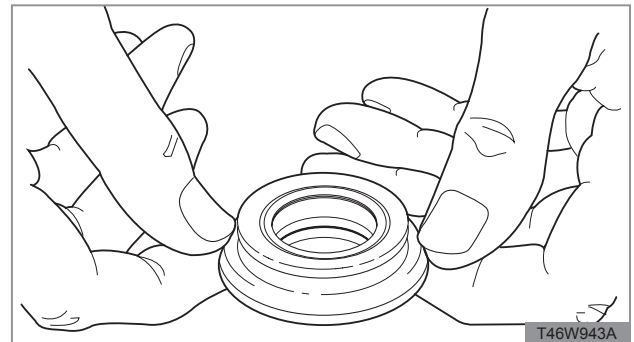
(1) Steering motor housing (2) Sleeve

6. Place the spool and sleeve (2) so that the pin is parallel with the bench and carefully insert the assembly into the bottom of the steering motor housing (1).
Rotate the assembly slightly while inserting it for ease installation.
Position the spool and sleeve so that their ends are flush with the bottom of steering motor housing (1) and make sure that the assembly can turn freely in the housing.

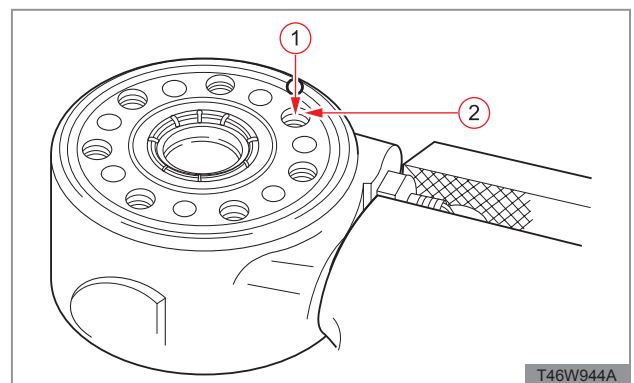


(1) Thrust bearing race (2) Thrust bearing

7. Insert the thrust bearing race (1) and the thrust bearing (2) and make sure that the opposite thrust bearing race (1) is seated on the sleeve and spool.

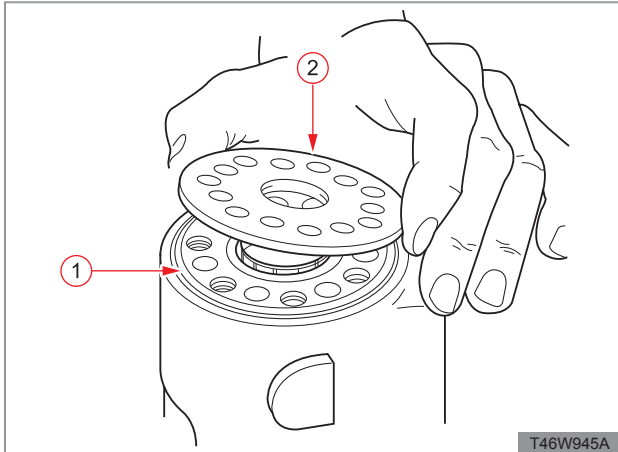


8. Install a new O-ring, dust seal and oil seal in the gland bushing, and then insert the bushing into the housing while rotating it.
9. Install the retaining ring in the housing groove.



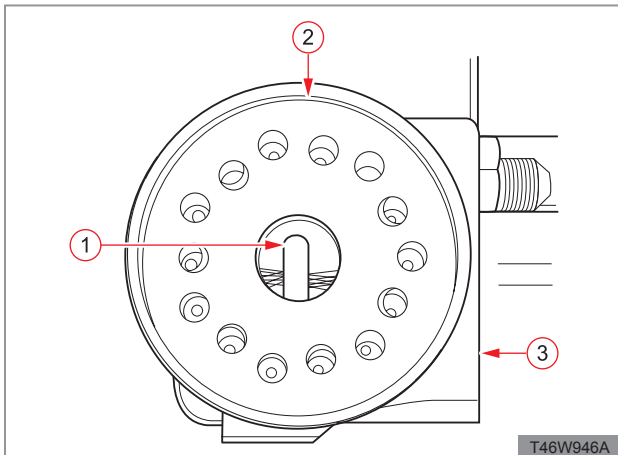
(1) Check valve ball (2) Retainer bolt hole

10. Grip the bottom end of steering motor housing with a vise. To avoid damaging the steering motor, use soft-faced jaw and do not apply excessive force.
11. Position the spool and sleeve assembly below the bottom face of the motor housing, and then install the check valve ball (1) into its retainer bolt hole (2).



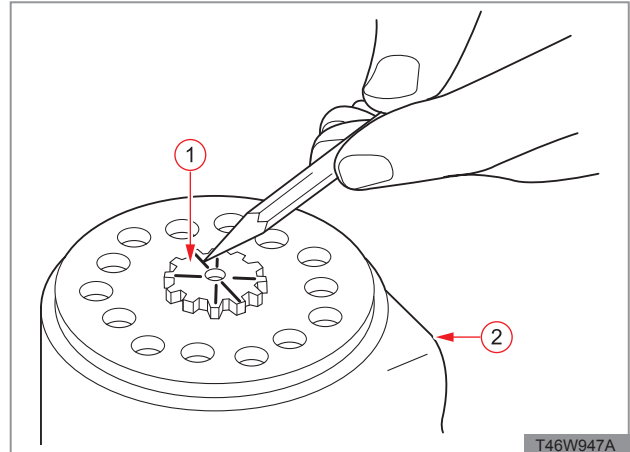
(1) O-ring (2) Spacer

12. Install a new O-ring (1) in the housing and position the spacer (2) on the O-ring so that the holes are aligned with the holes in housing.

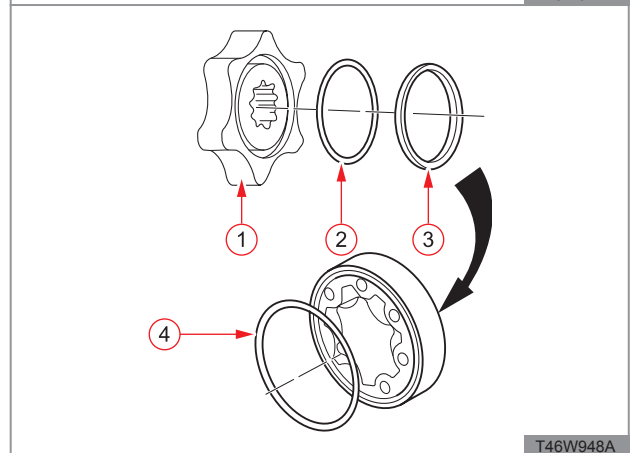


(1) Pin (2) Spacer (3) Steering port side

13. Position the spool and sleeve so that the pin (1) is parallel with the steering port face (3) of the steering motor housing.



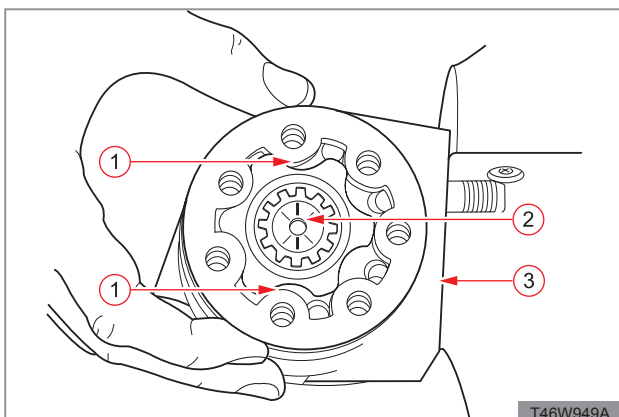
(1) Motor (2) O-ring (3) Seal (4) O-ring



14. Insert the drive shaft (1) into the motor so that its slotted end engages with the pin in the spool and sleeve. Mark a line (2) places) on the face of the drive shaft so that the pin is parallel with the port face of the steering motor housing (3).
15. Coat a new O-ring (2) and seal ring (3) with clean hydraulic fluid and install them on the rotor (1). Install a new O-ring (4) in the groove of the stator, and then fit the rotor and stator together so that their O-rings are on opposite sides.

⚠ CAUTION

- The orientation of the rotor and stator on the drive shaft will determine valve timing in the steering motor. These parts must be installed as described.

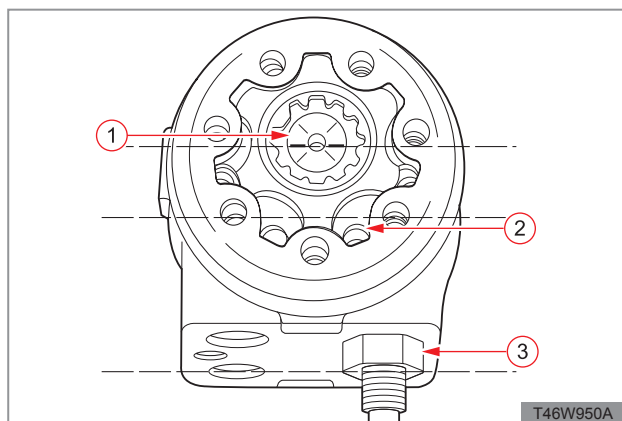


- (1) Valley
(2) Mark
(3) Steering port side

16. Position the rotor and stator on the steering motor. Align the holes in the spacer and stator. Before connecting the drive shaft splines with the rotor, align mark (2) on the end of the drive shaft so that of the line is extended across the rotor and stator and it would cross two grooves of the rotor.

CAUTION

- A sign that the rotor is positioned correctly is that the tip of one rotor lobe is resting halfway between the groove in stator directly above the port face side of the steering motor (3) and on the opposite side a lobe is resting in the bottom of stator groove.

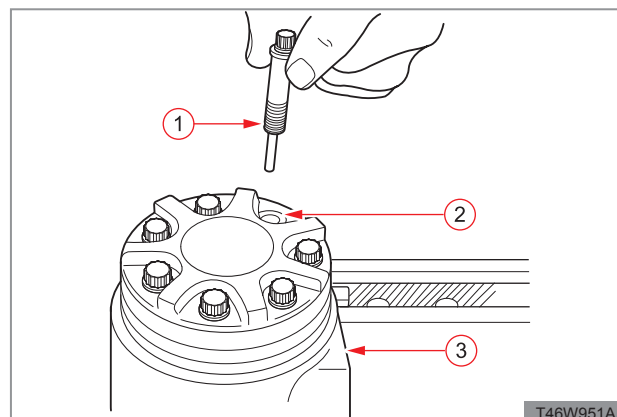


- (1) Line
(2) Pin
(3) Port face

17. When installing the steering motor, the following should be aligned for correct installation:

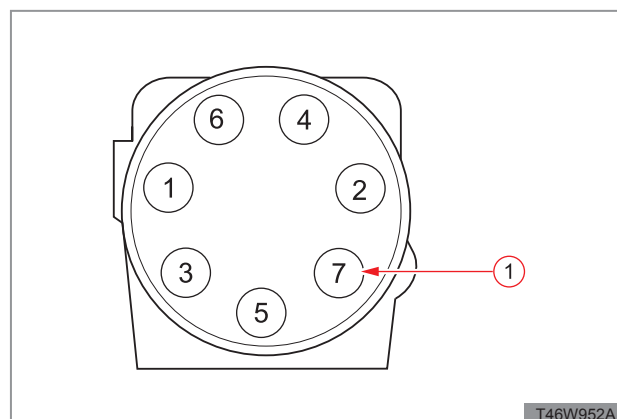
- The port face (3) of the steering motor housing
- The pin (2) through the spool and sleeve
- The line drawn on the drive shaft
- The middle of the two grooves in the rotor

If any of these components are not aligned, the steering motor will not operate properly.



- (1) Check ball retainer bolt
(2) Hole
(3) Steering motor

18. Replace the O-ring with new one. Position the end cap on the steering motor (3) and align its bolt holes with the holes on the stator. Install the 7th end cap retainer bolt and tighten by hand after making sure that the 7th check ball retainer bolt (1) is in the correct hole (2).



- (1) End cap retainer bolt

19. Tighten the end cap retainer bolts (1), in the sequence shown in figure in two stages. At first, tighten them to approx. 10.8 Nm (1.1 kgf-m, 8 lb-ft) and then to 28.4 Nm (2.9 kgf-m, 21 lb-ft).

After tightening the bolts, check that the spool turns freely in the motor.

MEMO

