

## SECTION 3 POWER TRAIN SYSTEM

### (25/30D-9VS, 35DN-9VS)

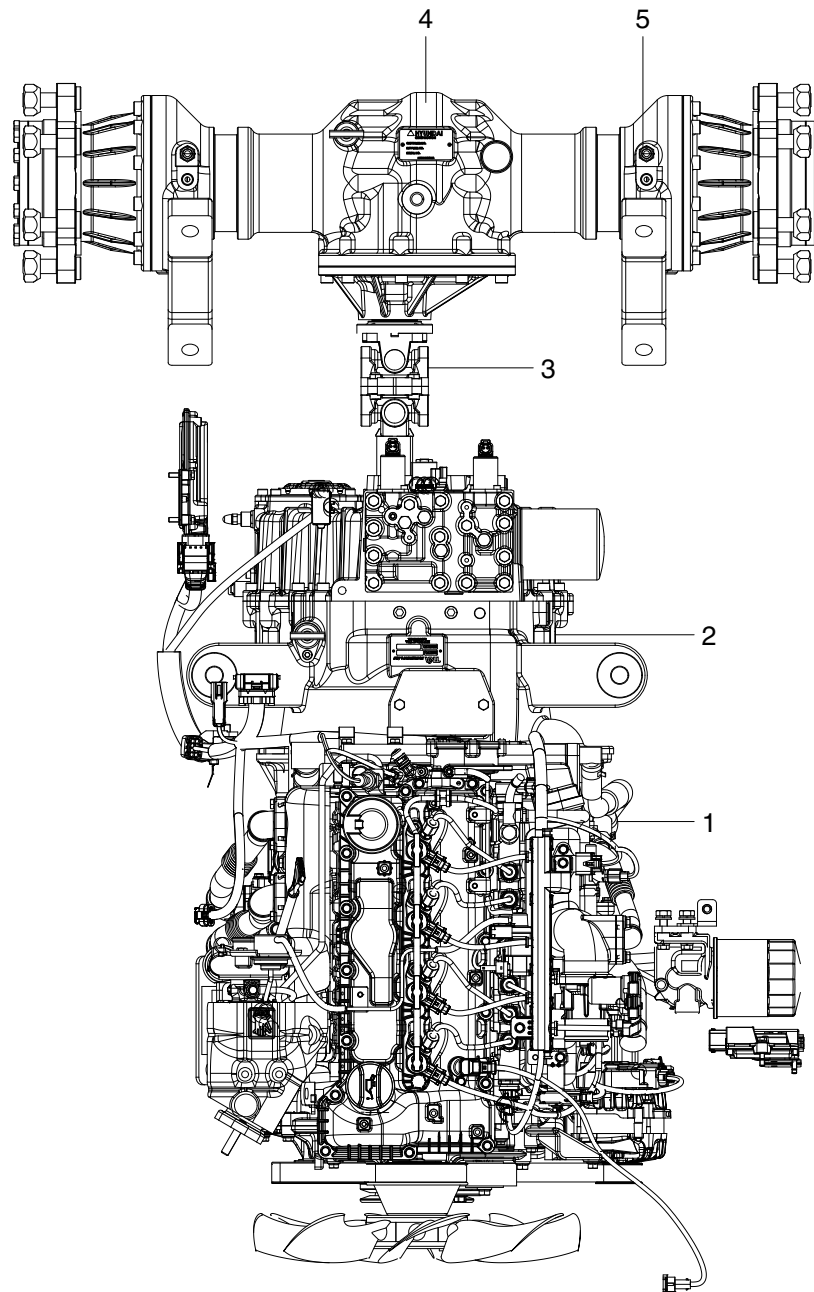
Group 1	Structure and operation .....	3-74
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Group 3	Maintenance and troubleshooting .....	3-130

## SECTION 3 POWER TRAIN SYSTEM

### GROUP 1 STRUCTURE AND OPERATION

#### 1. POWER TRAIN DIAGRAM

##### 1) STRUCTURE



1 Engine  
2 Transmission

3 Drive shaft  
4 Drive axle

5 Brake

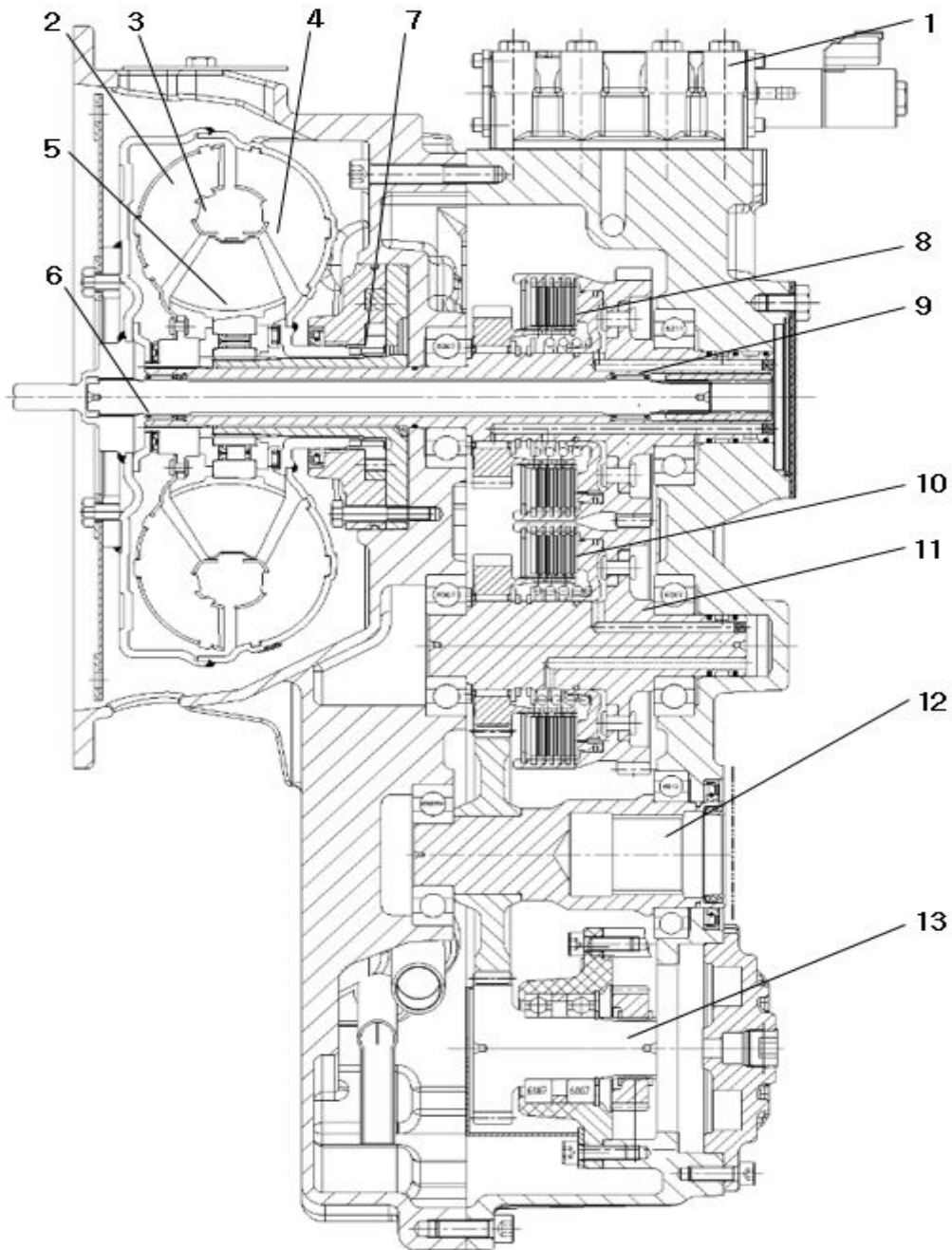
25D9V3PS01

## 2) SPECIFICATION

Item			Specification
Torque converter	Model		KAPEC 280 DJ
	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.87
Transmission	Type		Power shift
	Gear shift(FWD/REV)		1/1
	Control		Electric On/Off Solenoid Valve
	Overhaul ratio	FWD	1.437
		REV	1.437
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		11.568 : 1
	Gear		Spiral bevel gear type
Wheels	Q'ty (FR/RR)		Single : 2/2, Double : 4/2
	Front (drive)	2.5 T	Single/Double : 7.00-12-14 PR
		3.0 T	Single : 28×9-15-16 PR
		3.5 T	Double : 7.00-12-12 PR
	Rear (steer)	2.5 T	6.50-10-12 PR
		3.0 T	
		3.5 T	
Brakes	Travel		Front wheel, wet disk brake
	Parking		Wet disk (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		78.5° to both right and left angle, respectively

## 2. TRANSMISSION

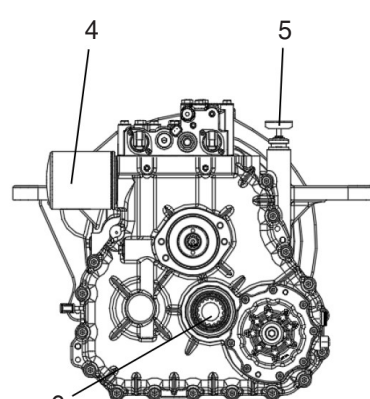
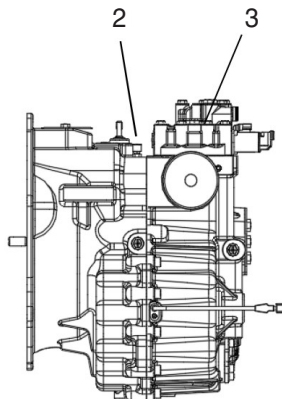
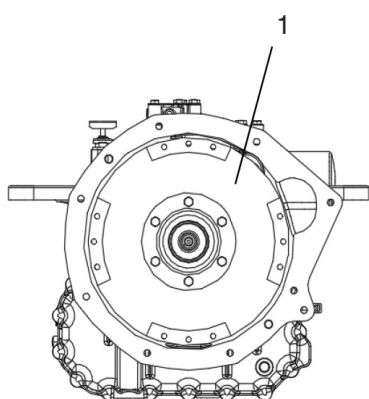
### 1) STRUCTURE



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- |                    |                        |                         |
|--------------------|------------------------|-------------------------|
| 1 Control valve    | 6 PTO shaft            | 11 Reverse clutch shaft |
| 2 Torque converter | 7 Oil pump             | 12 Output shaft         |
| 3 Turbine wheel    | 8 Forward clutch pack  | 13 Parking brake        |
| 4 Impeller wheel   | 9 Forward clutch shaft |                         |
| 5 Stator           | 10 Reverse clutch pack |                         |





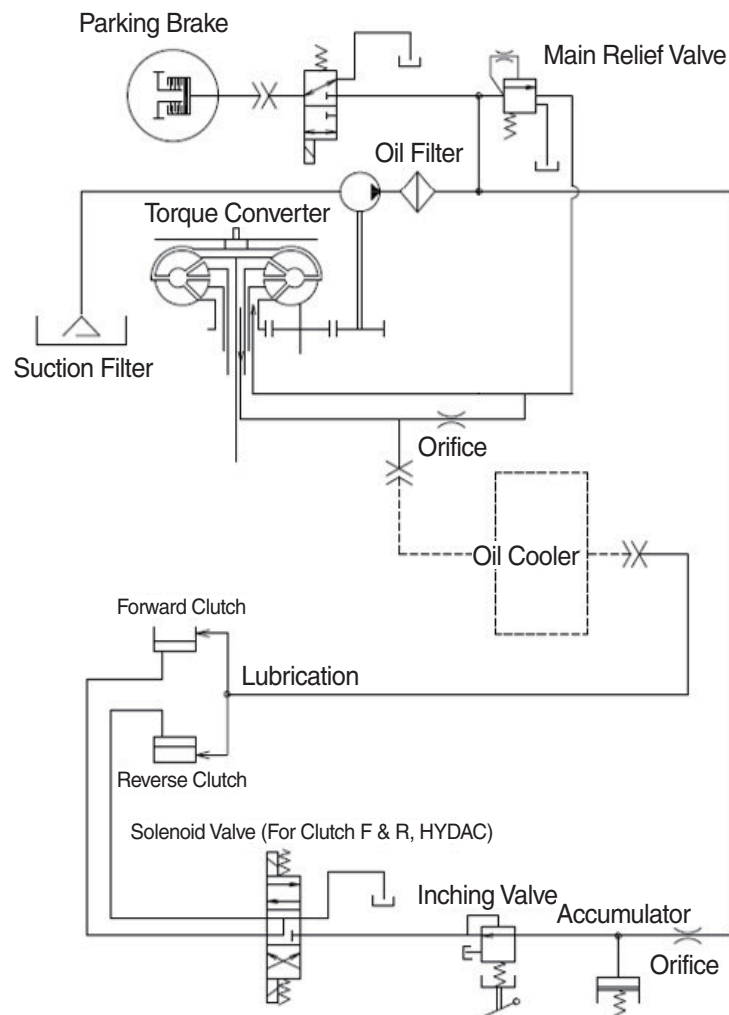
25D9V3PS02

1 Torque converter  
2 Air breather

3 Control valve  
4 Oil filter

5 Oil level gauge and tube  
6 Output (Universal joint link part)

## 2) HYDRAULIC CIRCUIT

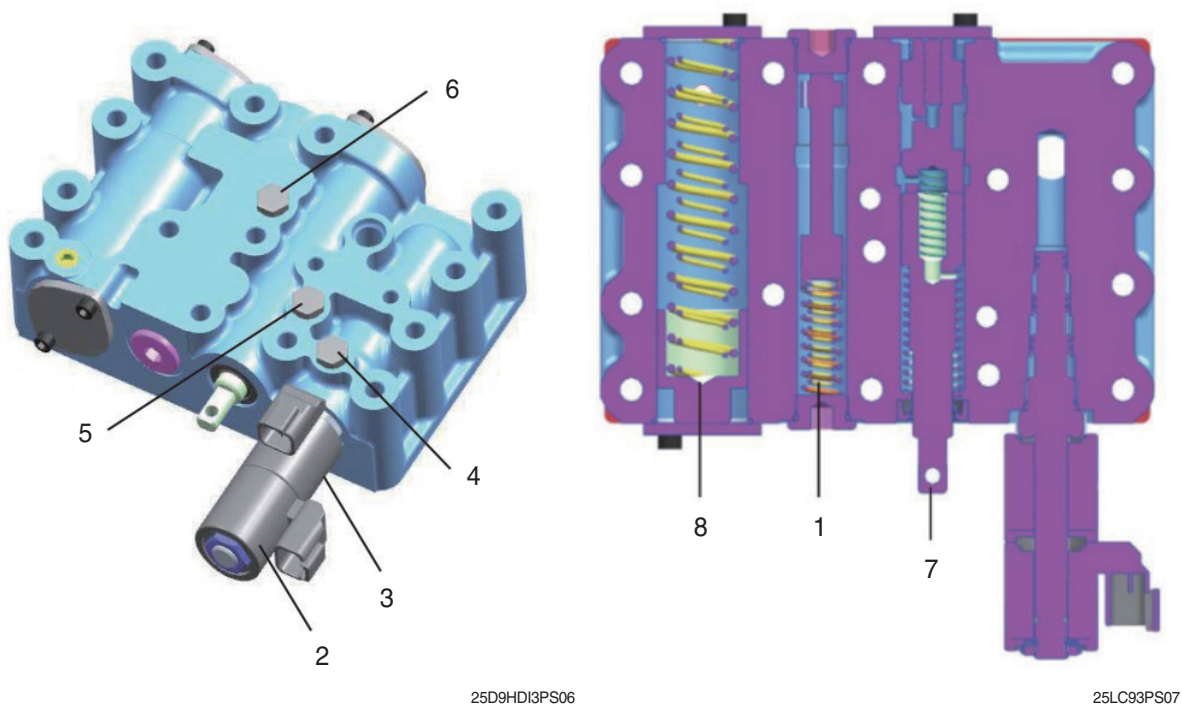


25LC93PS05

- (1) The torque converter acts as a fluid coupling to smoothly transfer engine power to the transmission. It also increases the torque by the force applied to the stator while oil is circulating inside the torque converter.
- (2) The engine power transferred through the flexible plate is then transferred to the impeller on the torque converter in order to drive the oil pump. The oil pump circulates oil to the oil filter by pumping the oil in the oil tank on the transmission. Oil from which foreign matter has been filtered is supplied to the control valve and the inside of the torque converter.
- (3) The oil supplied to the control valve produces the level of pressure necessary to operate the clutch on the main relief valve. Pressure is applied to the forward/reverse clutch via operation of the solenoid valve using the electric signal delivered at the time of forward/reverse driving of the vehicle, and thus power can be transferred through the gear.
- (4) The oil supplied to the torque converter is transferred to the turbine by rotation of the impeller, thus producing centrifugal force which becomes the driving force for rotating the turbine.
- (5) The oil which rotates the turbine circulates, and the force of the reaction produced when it passes through the stator increases the torque. The oil that comes out of the torque converter enters the air cooled passage and, after cooling down, is supplied to the clutch shaft where it cools down the friction plate of the clutch, and returns to the transmission. The process described above proceeds continuously, completing the transmission operation.

### 3) CONTROL VALVE

#### (1) Structure

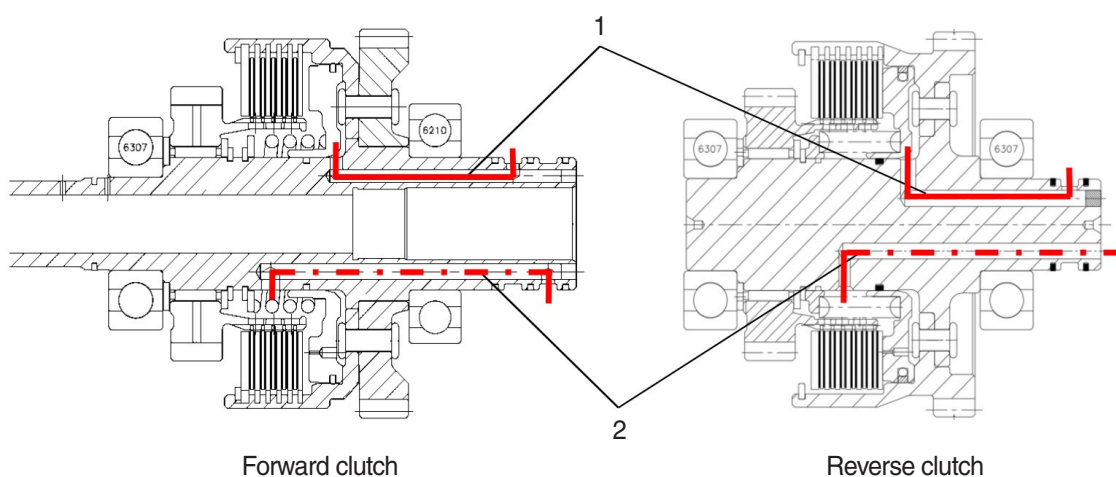


- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1 Main relief                        | 5 Reverse clutch pressure check port |
| 2 Forward solenoid valve             | 6 Main pressure check port           |
| 3 Reverse solenoid valve             | 7 Inching                            |
| 4 Forward clutch pressure check port | 8 Modulation                         |

#### (2) Function

Item	Function
Main Relief	Main relief maintains constant clutch pressure.
Forward/Reverse Solenoid Valve	Receives an electric signal at time of forward and reverse gear shift and switches the oil passage direction to ensure that the main pressure is delivered to the clutch.
Inching	A function for increasing the engine speed temporarily in order to lift the mast quickly while maintaining a low travel speed by reducing forward/reverse clutch pressure.
Modulation	A function for softening the impact at the time of a gear shift through soft contact of the clutch friction plate by adjusting the flow rate and the speed of the oil supplied to the clutch during forward/reverse gear shift.

#### 4) CLUTCH



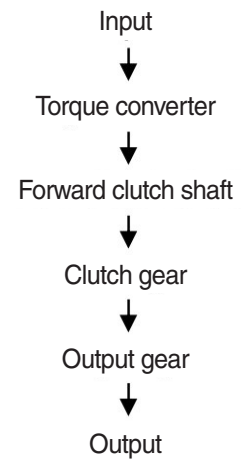
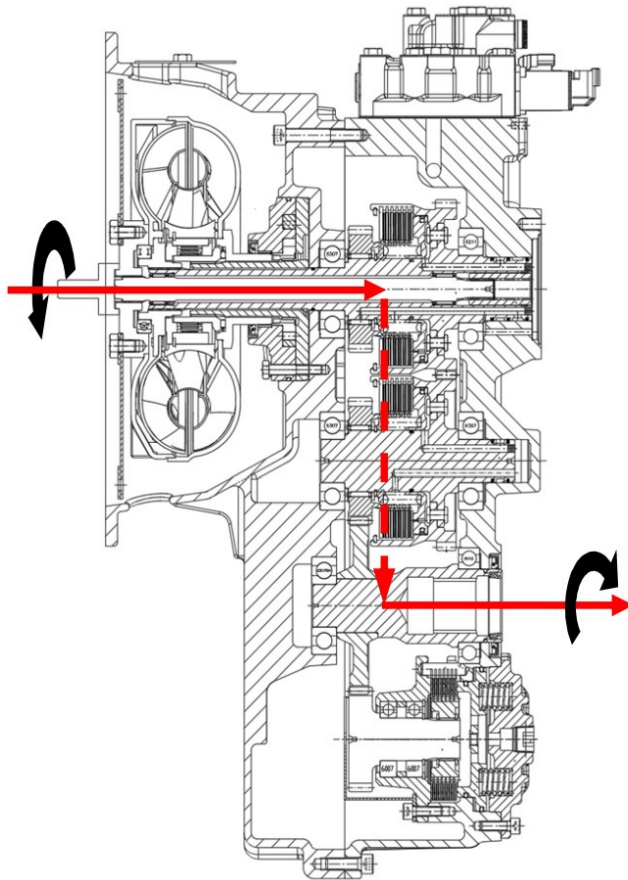
- 1 Pressure line ( ——— )  
 2 Lubrication line ( - - - - )

25D9V3PS10

- (1) Gear shift refers to the action of shifting the vehicle from neutral to forward/reverse.
- (2) When forward or reverse is decided by the vehicle's shift lever, the corresponding electric signal switches the forward/reverse solenoid to the ON state.
- (3) The high-pressure oil produced in the main relief relieves the flow rate and oil speed before it is supplied to the clutch through the solenoid valve while passing through the orifice and modulation valve.
- (4) Oil whose flow rate and speed have been relieved is slowly supplied to the piston of the corresponding clutch through the solenoid valve to prevent impact at the time of gear shift.
- (5) As hydraulic oil applies pressure to the piston and the force of the return spring is exceeded, it compresses the friction plate and disk.
- (6) When the clutch friction plate and disk are fully compressed, power is transferred to the gear connected to the friction plate through the spline.

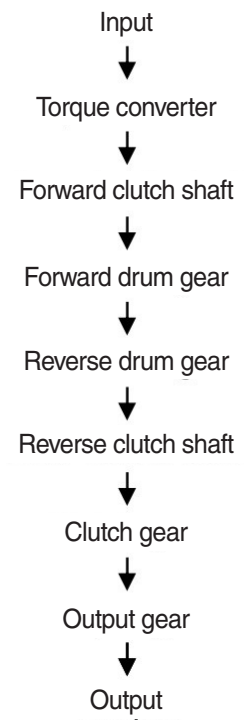
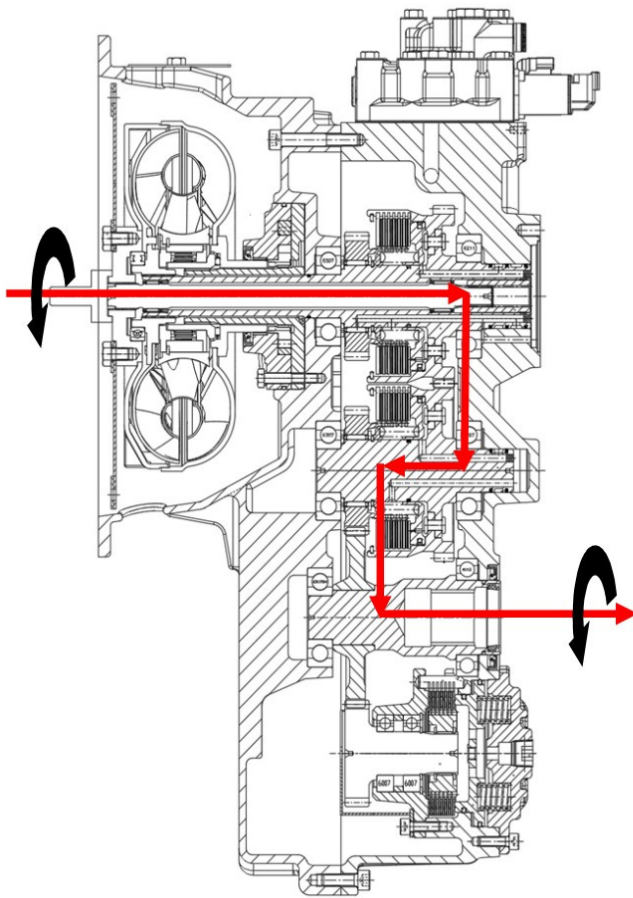
## 5) POWER FLOW

### (1) Forward



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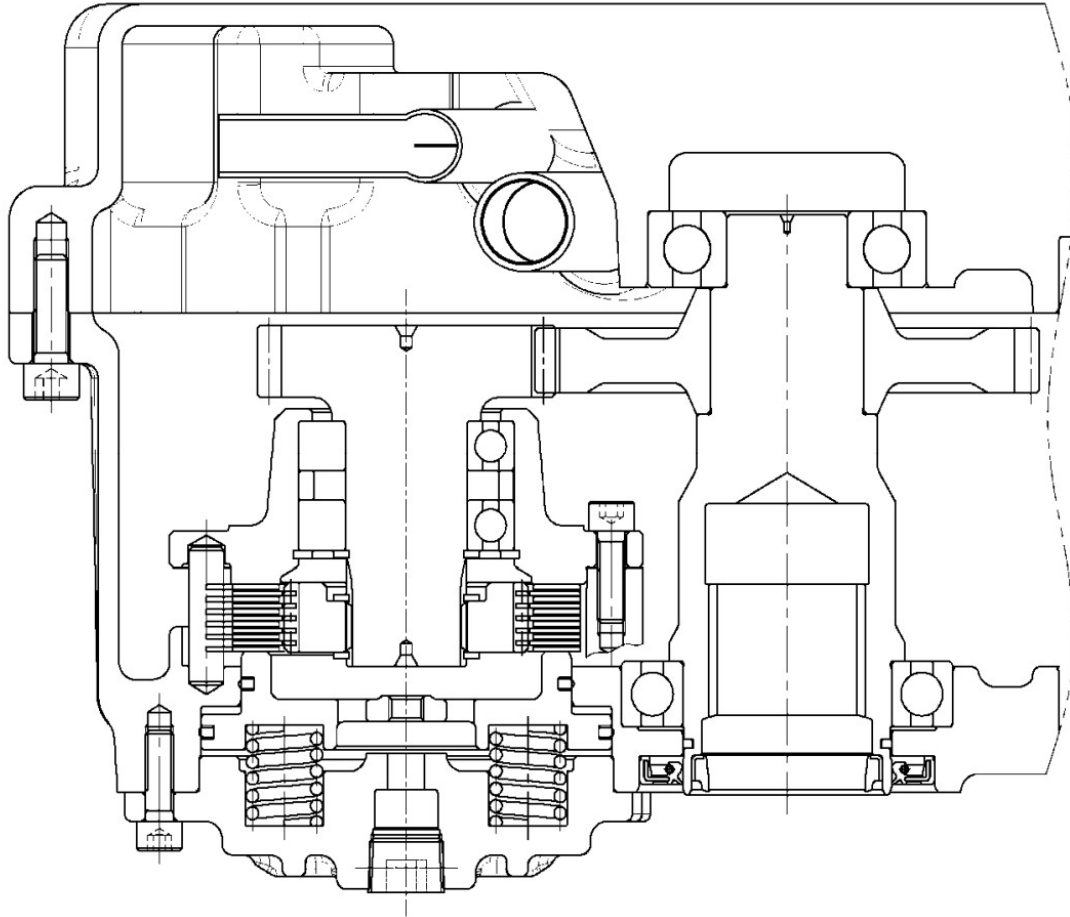
(2) Reverse



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## 6) PARKING BRAKE

Transmission includes differential device and parking brake. Parking brake, like as traveling brake system is consists of several friction plate functions braking by sticking to each friction plate when parking brake switch is operated.

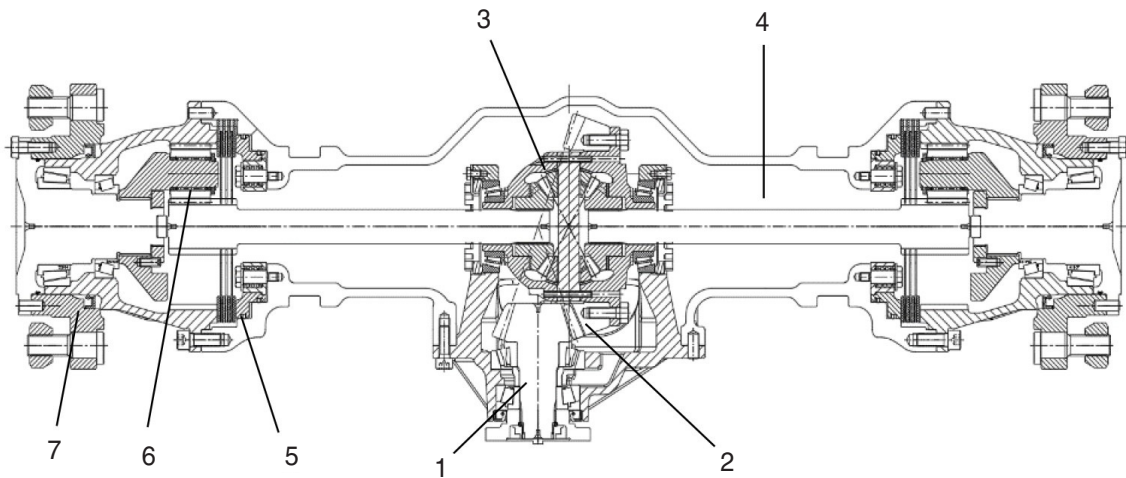


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### 3. DRIVE AXLE

#### 1) STRUCTURE

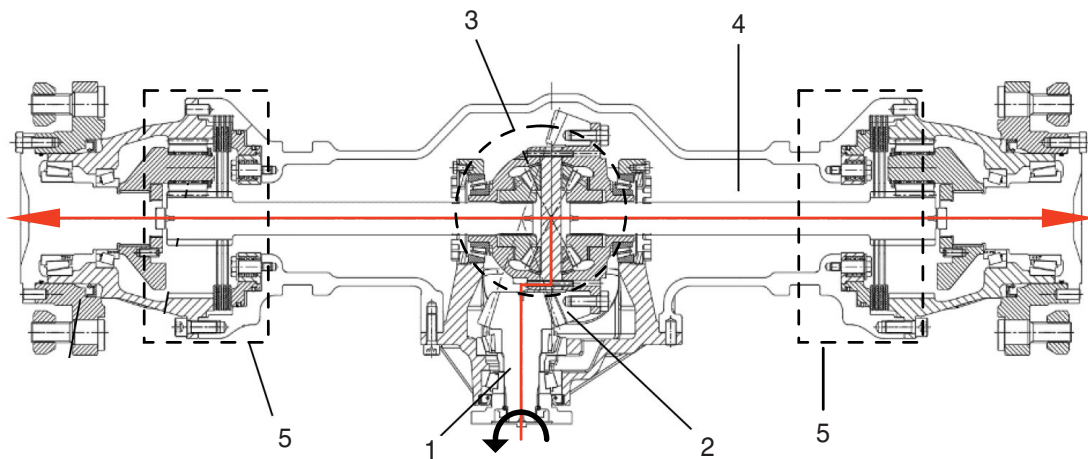


25D9V3PS102

- |                       |                 |       |
|-----------------------|-----------------|-------|
| 1 Pinion shaft        | 4 Axle shaft    | 7 Hub |
| 2 Ring gear           | 5 Service brake |       |
| 3 Differential device | 6 Hub reduction |       |

#### 2) OPERATION

The drive axle is connected with the transmission output gear by drive shaft assembly. The power transferred by the drive shaft assembly is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear. The differential device deliver the power to hub reduction through axle shaft.



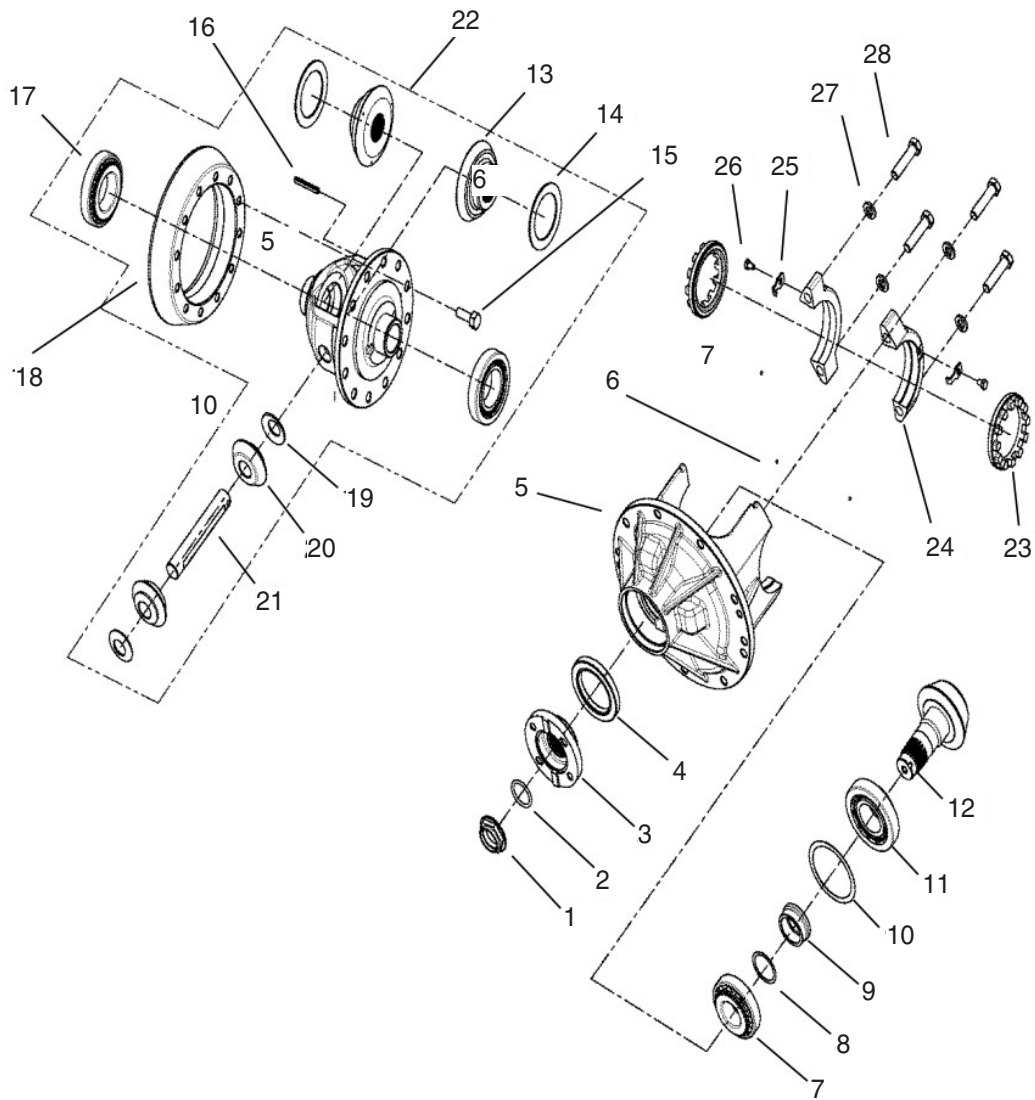
25D9V3PS103

- |                |                       |                 |
|----------------|-----------------------|-----------------|
| 1 Pinion shaft | 3 Differential device | 5 Hub reduction |
| 2 Ring gear    | 4 Axle shaft          | 6 Service brake |



### 3) Carrier sub assy

#### (1) Structure



25D9V3PS104

- |                |                     |                 |
|----------------|---------------------|-----------------|
| 1 Lock nut     | 11 T/R bearing      | 21 Spider       |
| 2 O-ring       | 12 Pinion shaft     | 22 Diffsub assy |
| 3 Flange yoke  | 13 Diff side gear   | 23 Adjust screw |
| 4 Oil seal     | 14 Thrust washer    | 24 Carrier cap  |
| 5 Carrier case | 15 Hex bolt         | 25 Lock plate   |
| 6 Steel ball   | 16 Spring pin       | 26 Hex bolt     |
| 7 T/R bearing  | 17 T/R bearing      | 27 Plain wahser |
| 8 Shim         | 18 Ring gear        | 28 Hex bolt     |
| 9 Spacer       | 19 Thrust washer    |                 |
| 10 T/R bearing | 20 Diff pinion gear |                 |

(2) Performance property

Since the ring gear is linked with the right of the differential case and the bolt, the power transferred to the ring gear makes the differential device revolve.

And also, the differential case are connected with the left and right of the axle shaft and the spline respectively, it delivers the power to the final drive.

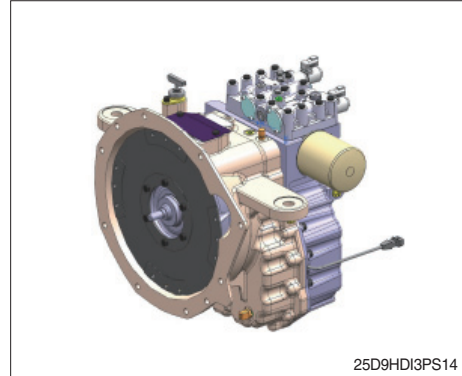
If the load concerning in the left and right of the final drive is different, the shock is transferred to the drive axle, the differential gear in the differential device runs, the power transferred to the differential device adjusts the delivering rate to the left and right axle shaft. Consequently, it guarantees for safety of drivers.

## GROUP 2 DISASSEMBLY AND ASSEMBLY

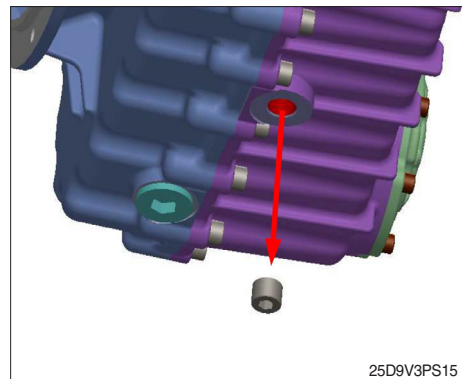
### 1. DISASSEMBLY OF TRANSMISSION

#### 1) DISASSEMBLY OF TRANSMISSION ASSEMBLY

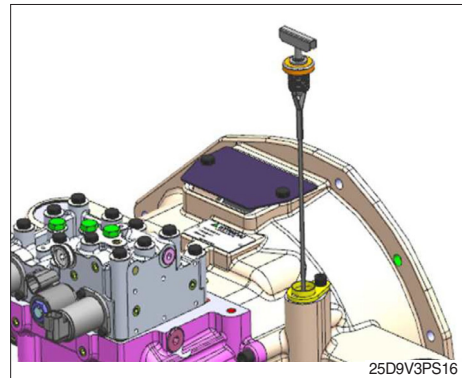
(1) Disassembly the transmission assy.



(2) Remove the drain plug and then drain the transmission oil.

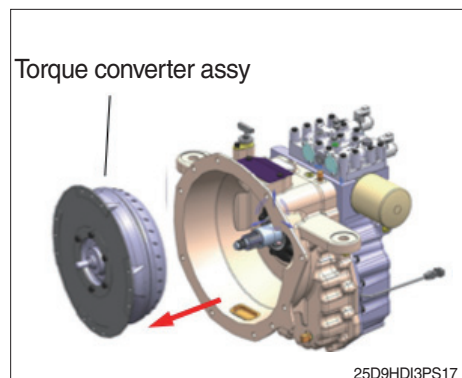


(3) Remove the oil level gauge.

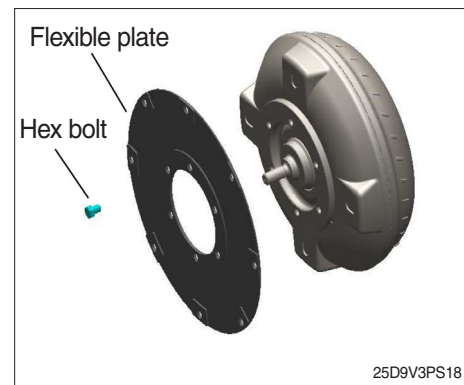


(4) Disassemble torque converter assy.

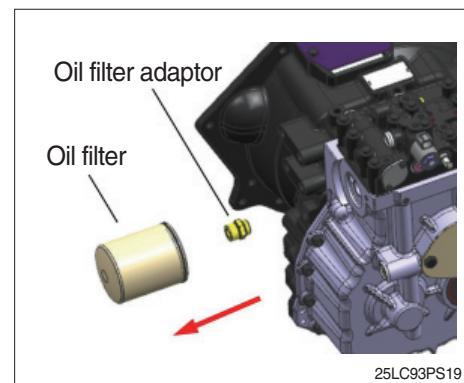
① Disassemble the torque converter assy.



- ② Loosen the hex bolts and separate the flexible plate.

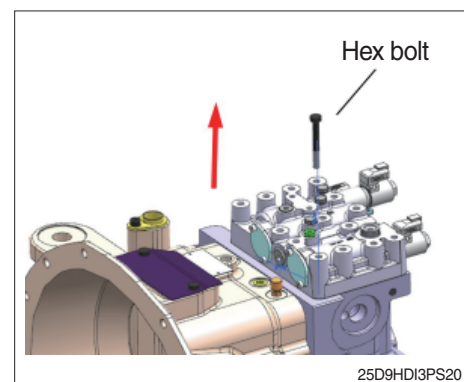


- (5) Remove the oil filter and oil filter adaptor.

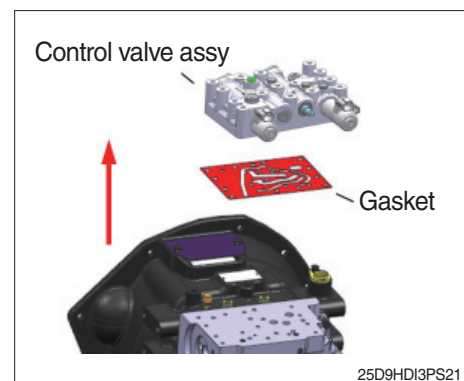


- (6) Disassemble the control valve assy.

- ① Loosen hex bolt.  
· M8×70 L : 14 EA

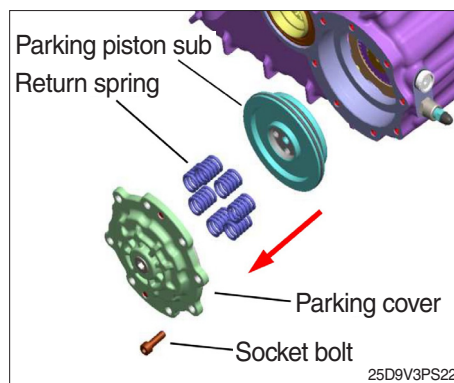
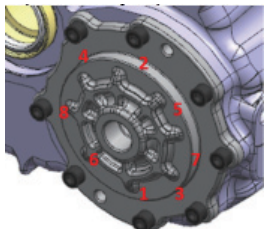


- ② Separate the control valve assy and gasket.

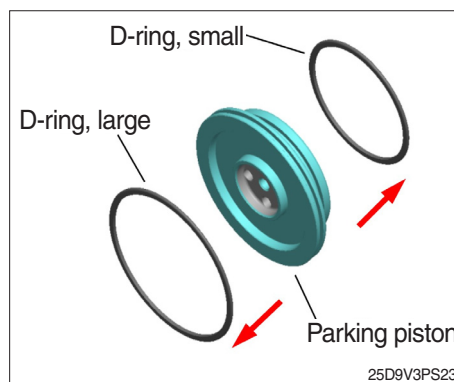


**(7) Separate the parking brake parts.**

- ① Loosen the socket bolts (M8 × 25L, 8 EA).
- ※ Disassemble slowly and follow the number. It prevent to jump out the cover by return spring. Then remove the return springs and parking piston sub.

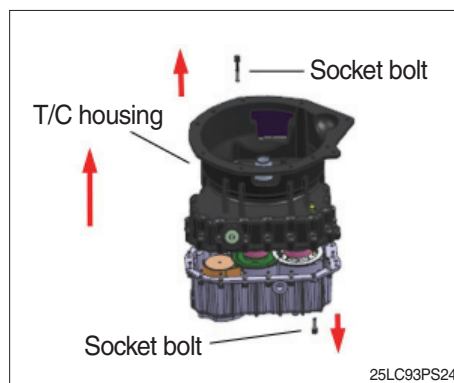


- ② Remove the large d-rings(large and small).

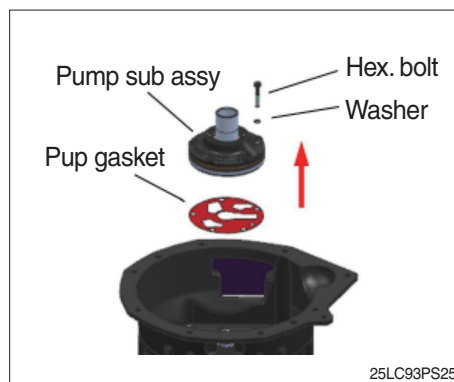


**(8) Loosen the socket bolts. Then separate the T/C housing.**

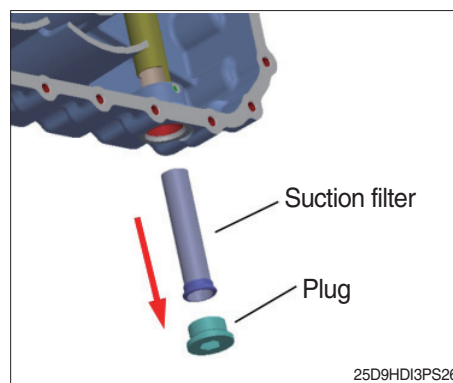
- M10 × 60 L : 6 EA
- M10 × 30 L : 16 EA



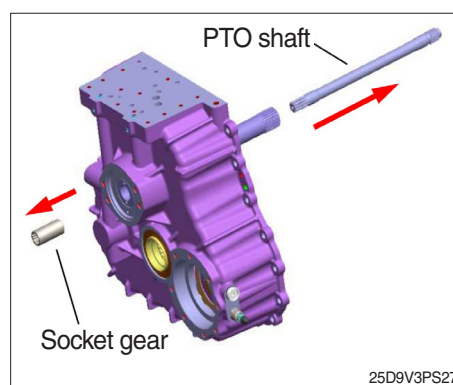
**(9) Loosen the hex. bolts and remove washers. Then separate the pump sub assy and gasket.**



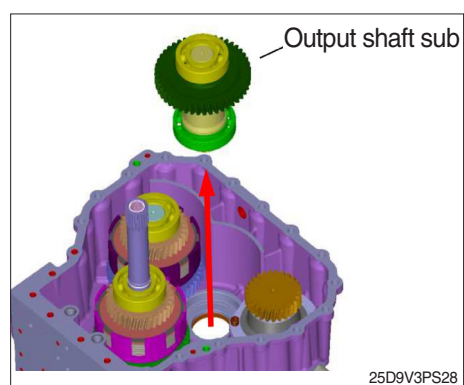
(10) Remove the plug, suction filter spring and suction filter.



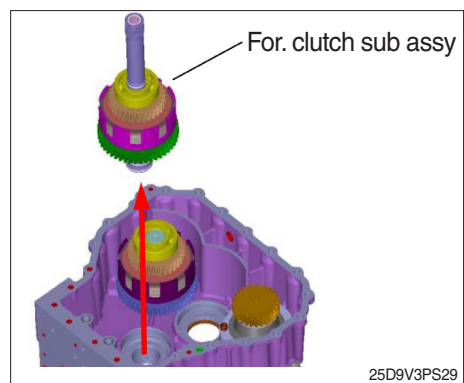
(11) Pull the PTO shaft and socket gear.



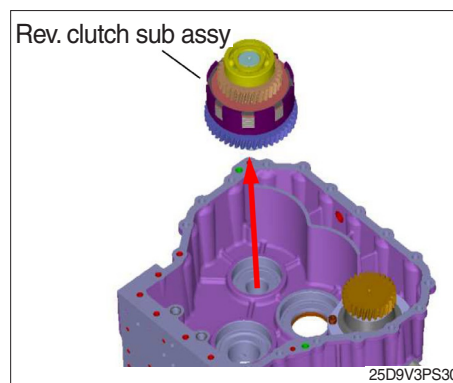
(12) Remove the output shaft sub assy.



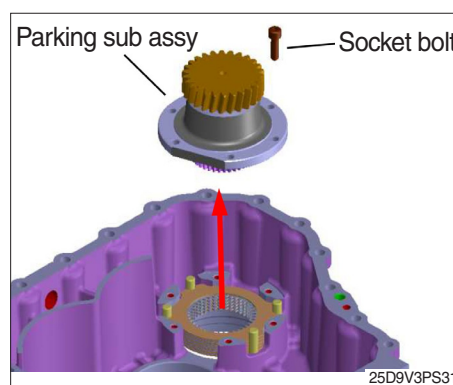
(13) Remove the for. clutch sub assy.



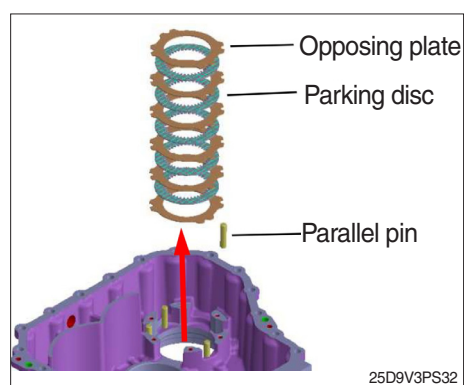
(14) Remove the rev. clutch sub assy.



(15) Disassemble socket bolt and parking sub assy.

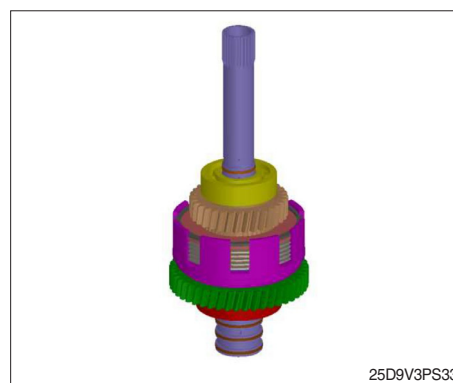


(16) Remove the opposing plates and parking discs.  
Then remove parallel pins.

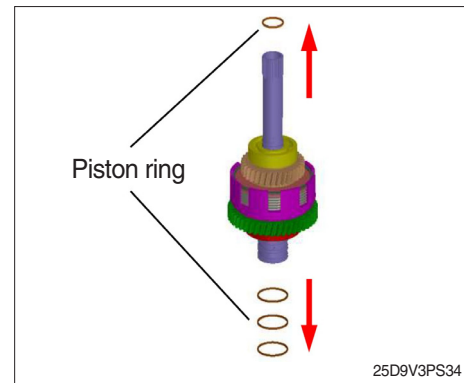


## 2) DISASSEMBLY OF CLUTCH SUB ASSEMBLY

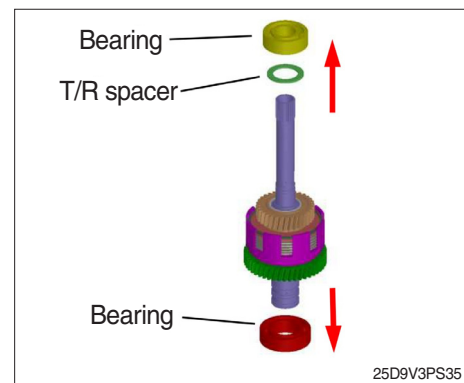
(1) Disassemble the For. clutch sub assembly.



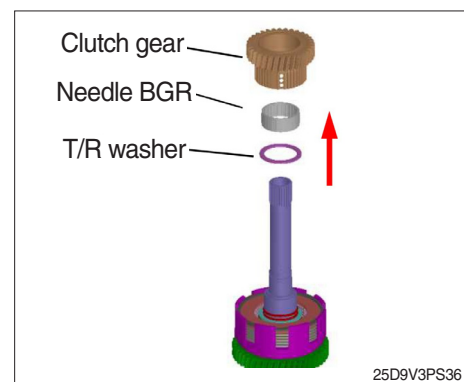
(2) Disengage the piston rings.



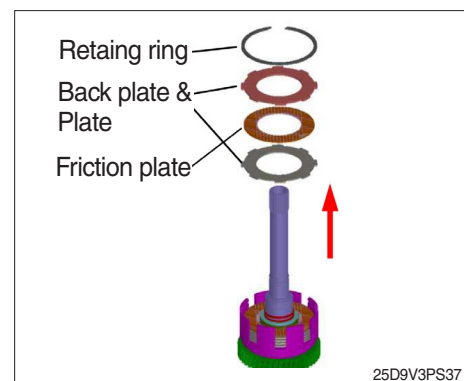
(3) Pull off the bearings and remove the thrust spacer.



(4) Remove the clutch gear, needle BRG and thrust washer.



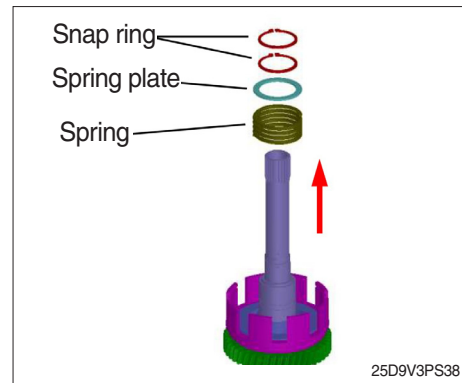
(5) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.



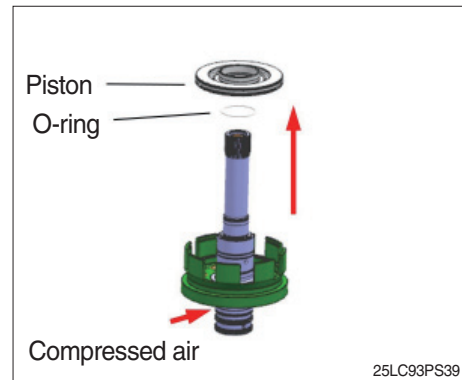


(6) Disassemble snap ring, spring plate and spring from shaft.

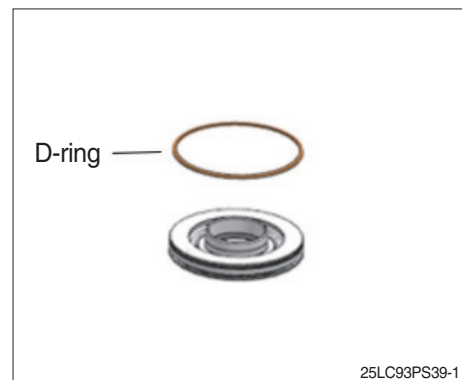
⚠ When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.



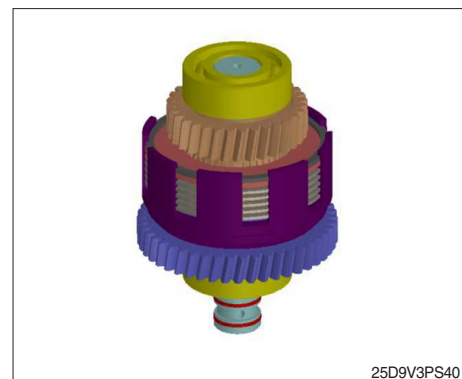
(7) By means of compressed air, press the piston off and remove it. Then remove the o-ring.



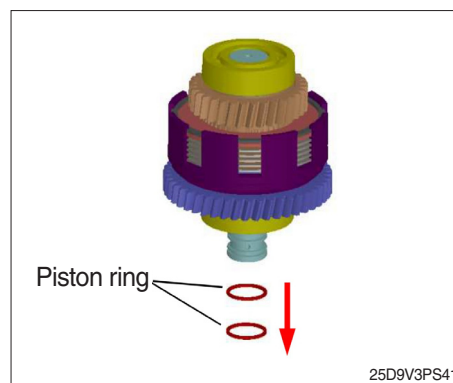
(8) Remove the D-ring.



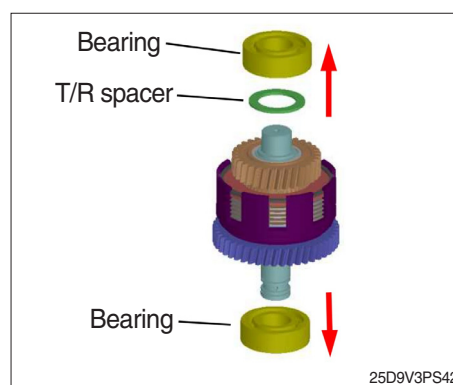
(9) Disassemble Rev. clutch sub assembly.



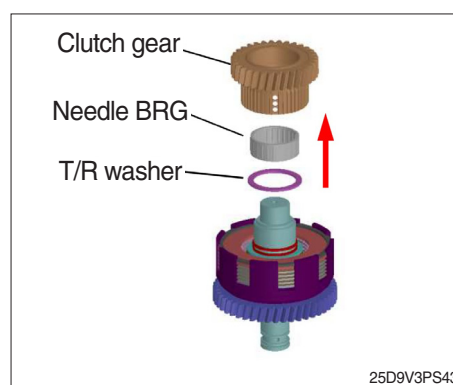
(10) Disengage the piston rings.



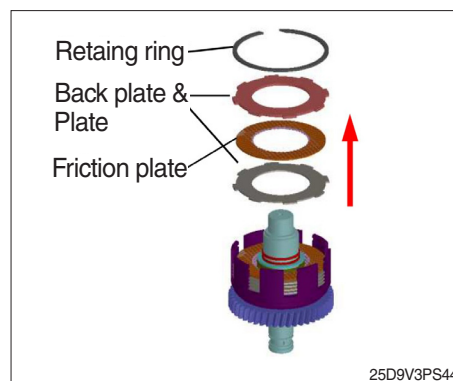
(11) Pull off the bearings and remove the thrust spacer.



(12) Remove the clutch gear, needle BRG and thrust washer.

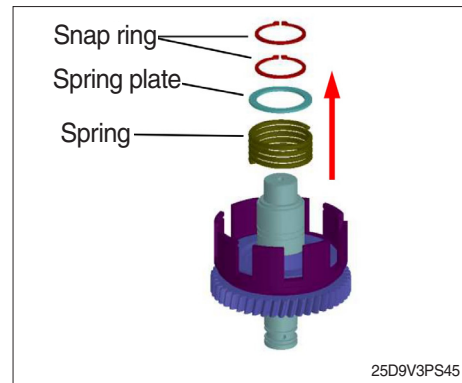


(13) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.

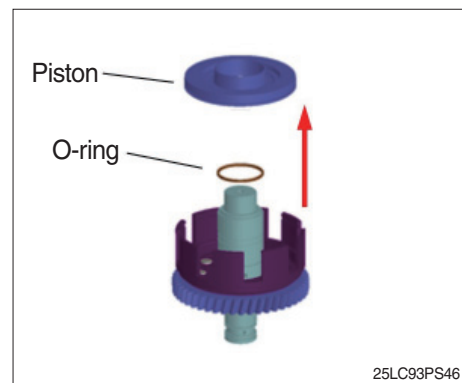


(14) Remove the snap rings, spring plate and spring.

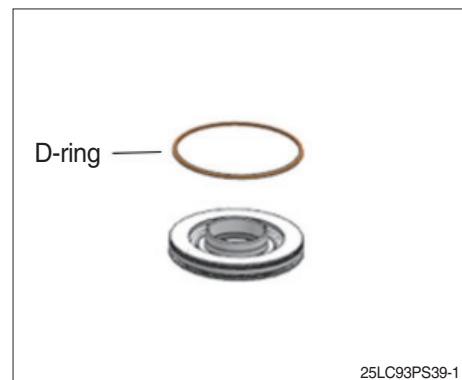
**⚠ When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.**



(15) By means of compressed air, press the piston off and remove it. Then remove the o-ring.

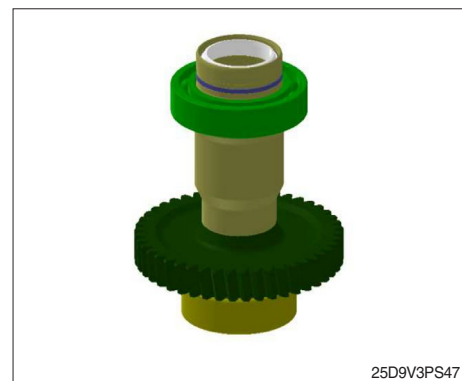


(16) Remove the D-ring.

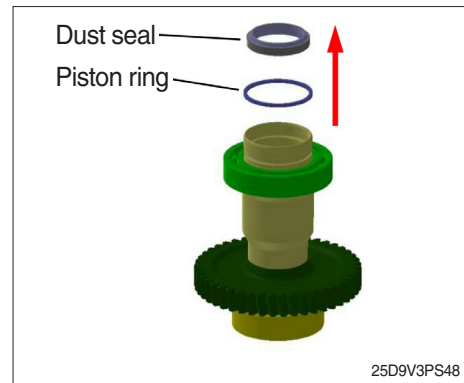


### 3) DISASSEMBLY OF OUTPUT SHAFT SUB ASSY

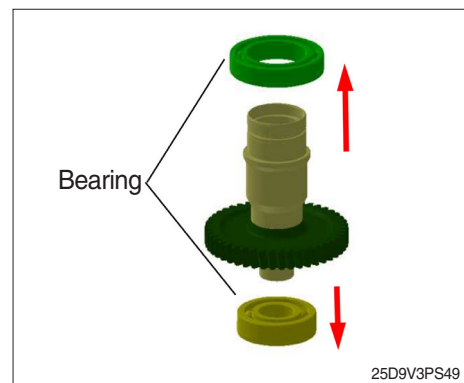
(1) Disassemble output shaft sub assembly.



(2) Remove the dust seal and piston ring.

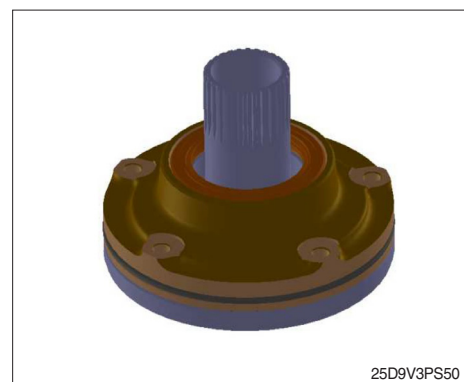


(3) Pull off the bearings.

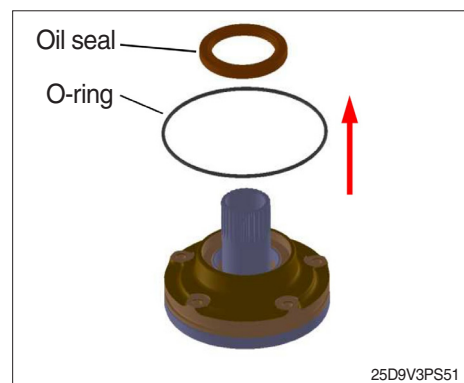


#### 4) DISASSEMBLY OF PUMP SUB ASSY

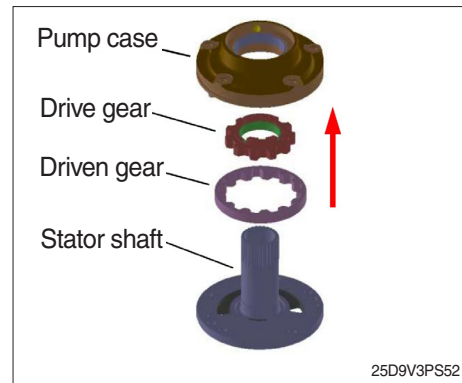
(1) Disassemble pump sub assembly.



(2) Remove the oil seal and o-ring.

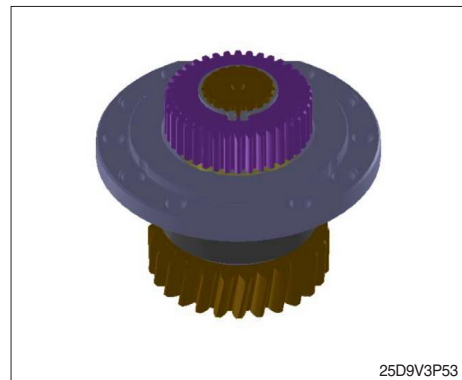


- (3) Separate the pump case, drive and driven gear from the stator shaft.

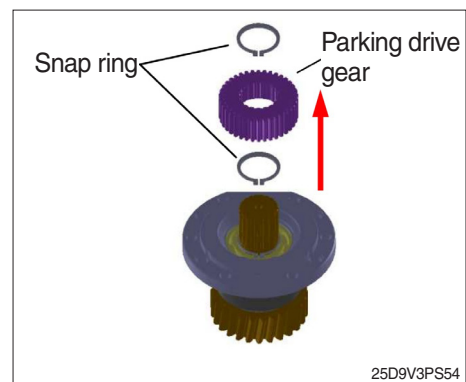


## 5) DISASSEMBLY OF PARKING SUB ASSEMBLY

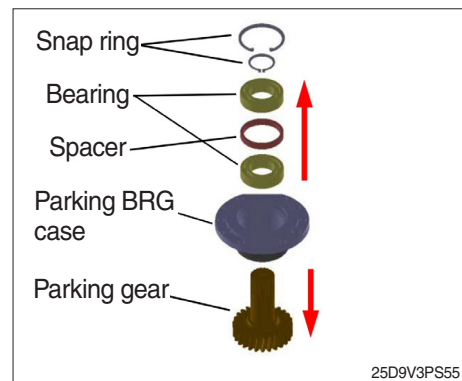
- (1) Disassemble parking sub assembly.



- (2) Remove the snap rings and parking drive gear.



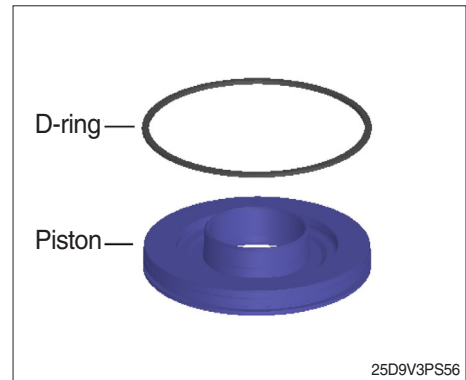
- (3) Remove the snap rings, bearings, spacer, parking gear from the parking BRG case.



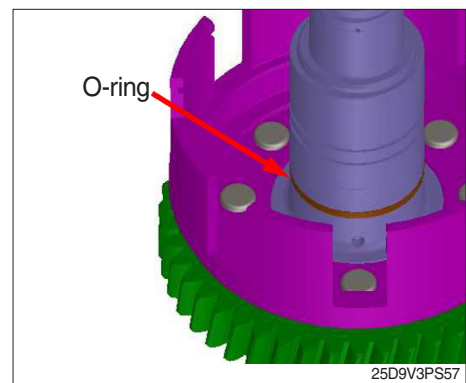
## 2. ASSEMBLY OF TRANSMISSION

### 1) SUB-ASSEMBLY OF CLUTCH

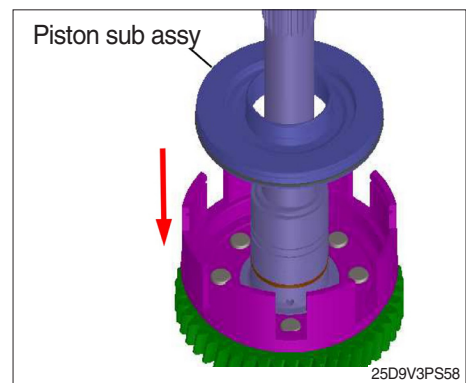
(1) Insert the d-ring into the piston groove and oil it.



(2) Insert the o-ring into the shaft groove and oil it.

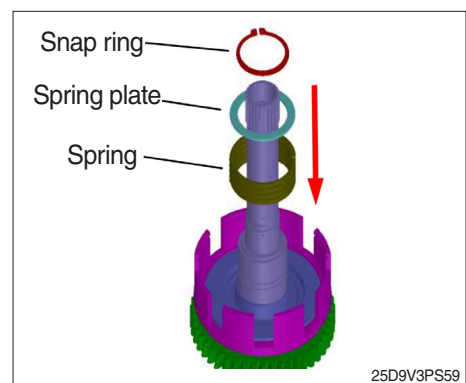


(3) Insert the piston sub assembly into the drum gear.

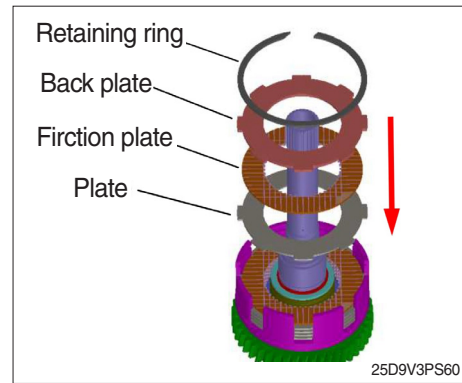


(4) Assemble spring, spring plate and snap ring.

**⚠ When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.**

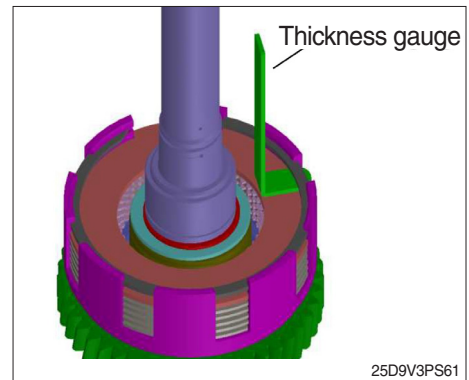
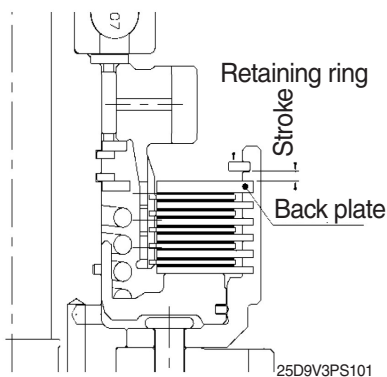


- (5) Install the opp. plates and friction plates alternately into the drum gear. Then install the back plate and retaining ring.

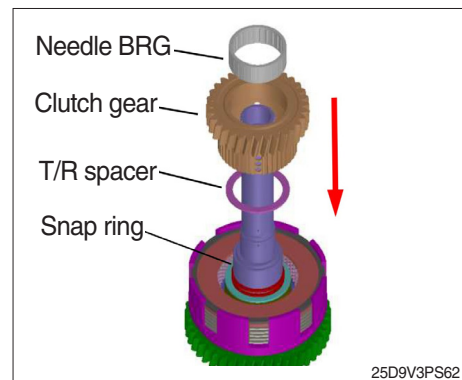


- (6) Measure clearance between the back plate and retaining ring using thickness gauge.

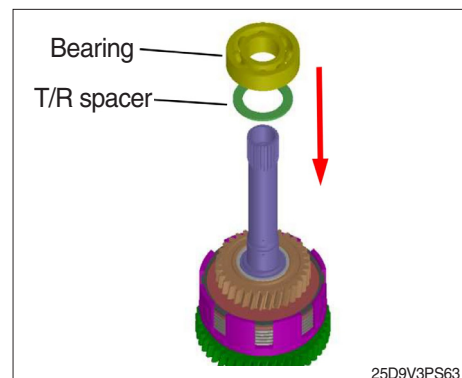
- ※ Calculate the distance between back plate and retaining ring. (Stroke : 2.2 ~ 2.6 mm)  
Use thickness gauge.



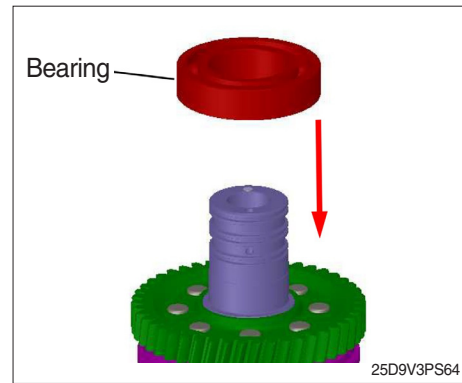
- (7) Assemble the For. clutch shaft sub assy. Assemble the snap ring into the groove of clutch shaft. Mount the thrust washer and oil it. Mount the clutch gear until contact is obtained. Mount the needle bearing and oil it.



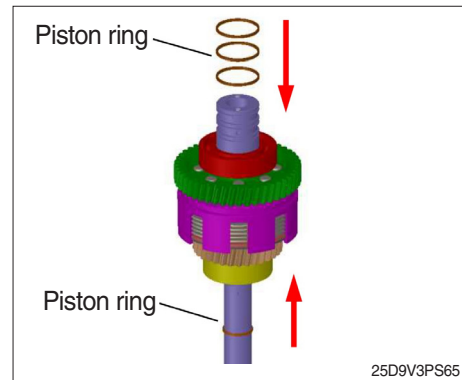
- (8) Mount the thrust spacer and oil it. Press the bearing onto the forward clutch shaft.



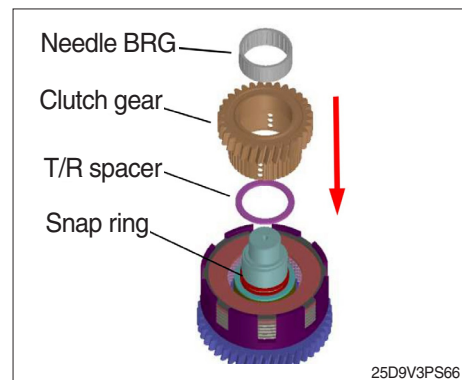
(9) Press the bearing onto the forward clutch shaft.



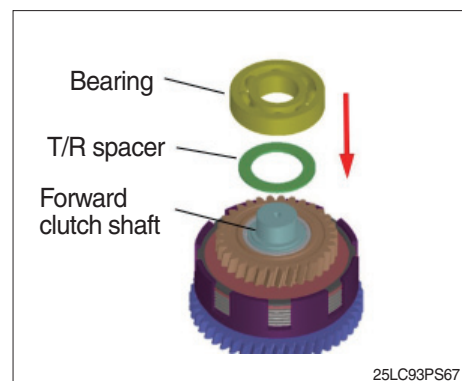
(10) Fit the piston rings at groove of clutch shaft and oil them.



(11) Assemble the Rev. clutch shaft sub assy. Assemble the snap ring into the groove of clutch shaft. Mount the thrust washer and oil it. Mount the clutch gear until contact is obtained. Mount the needle bearing and oil it.

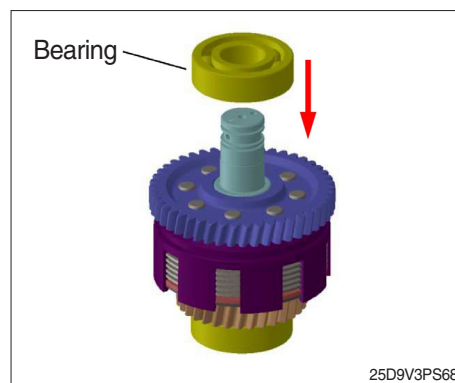


(12) Mount the thrust spacer and oil it. Press the bearing onto the reverse clutch shaft.

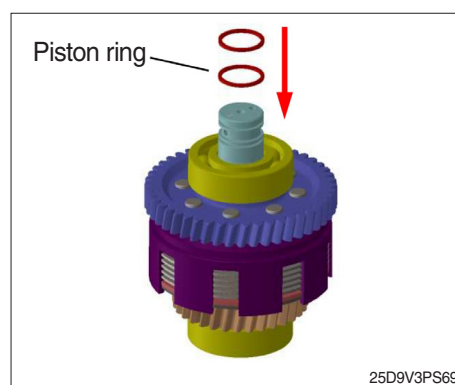




(10) Press the bearing onto the reverse clutch shaft.

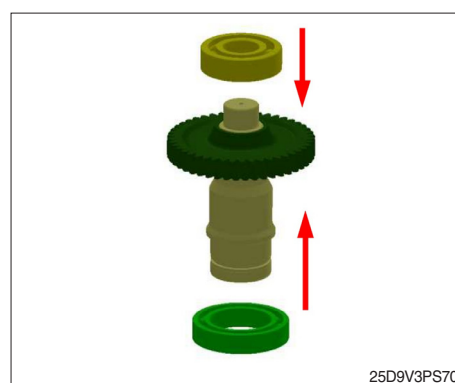


(11) Fit the piston rings at groove of clutch shaft and oil them.

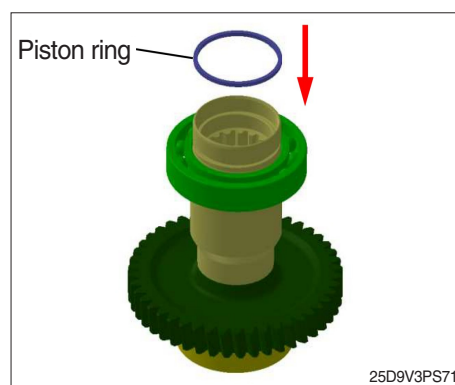


## 2) ASSEMBLY OF OUTPUT SHAFT

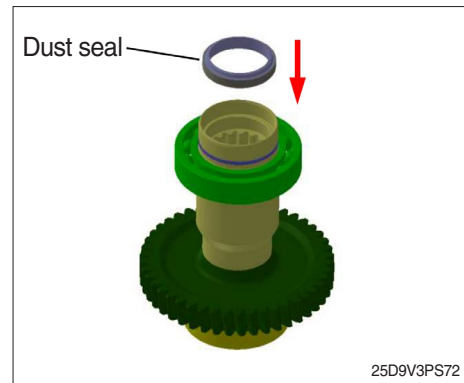
(1) Press the bearing onto the output shaft.



(2) Fit the piston ring at groove of output shaft and oil it.



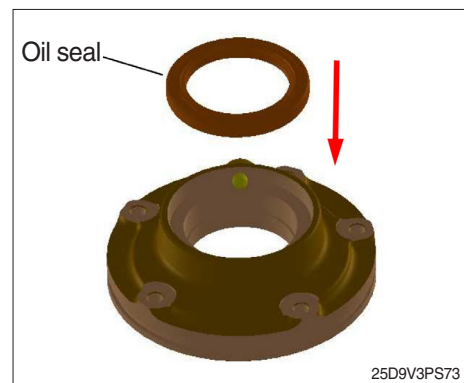
(3) Insert the dust seal into the output shaft.



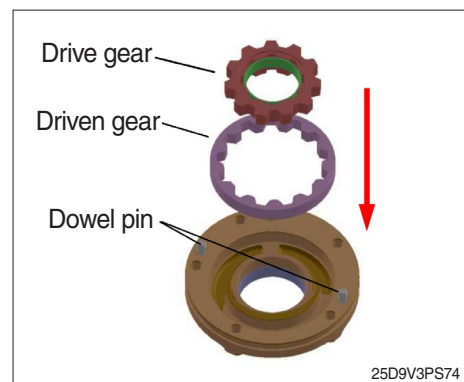
### 3) ASSEMBLY OF PUMP

(1) Insert the oil seal into the pump case.

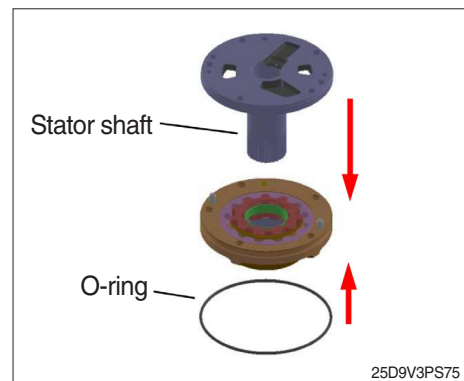
※ Spread grease on the seal lip of oil seal



(2) Mount the driven and drive gear and oil them.

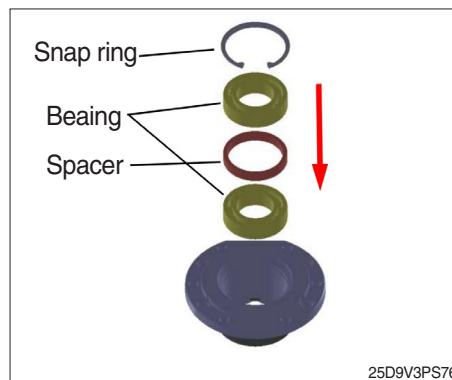


(3) Fit the stator shaft. Insert the o-ring at groove of pump case and oil it.

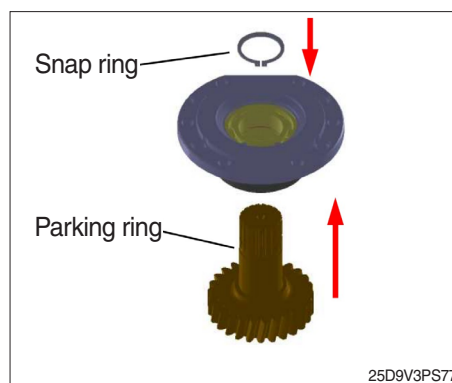


#### 4) ASSEMBLY OF PARKING

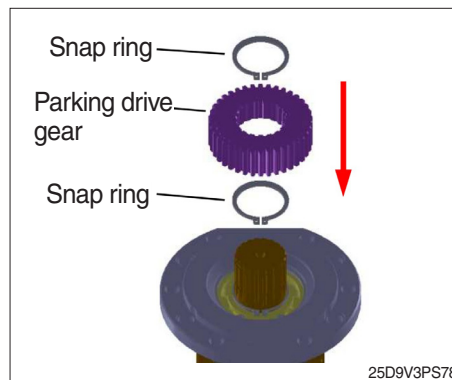
- (1) Press the bearing 1 into the parking case. Mount spacer. Press the bearing 2 into the parking case. Install the snap ring into the groove of parking case.



- (2) Fit the parking gear and install the snap ring onto the groove of parking gear.



- (3) Install snap the ring and parking drive gear.

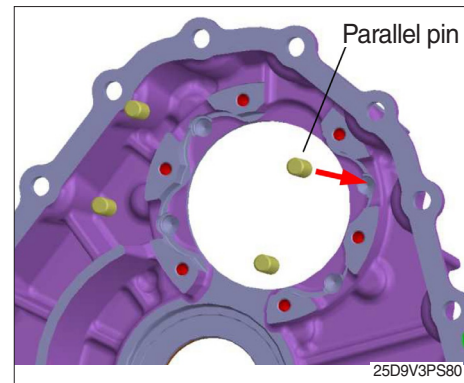


#### 4) ASSEMBLY OF TRANSMISSION

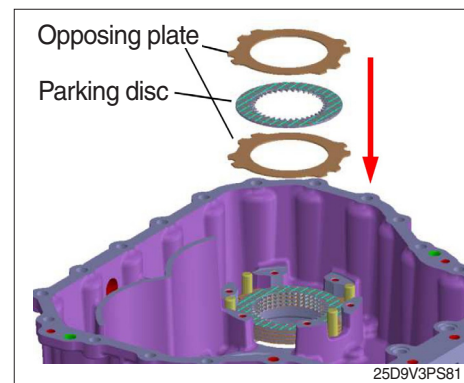
- (1) Insert the oil seal into the T/M case.  
※ Spread grease on the seal lip of oil seal.



(2) Press in parallel pin. (4 EA)



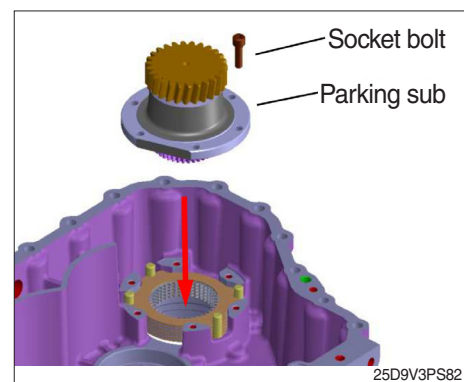
(3) Install the opposing plates and parking discs alternately into the T/M case.



(4) Install the parking sub ass'y and socket bolts (M8 × 25L, 6 EA).

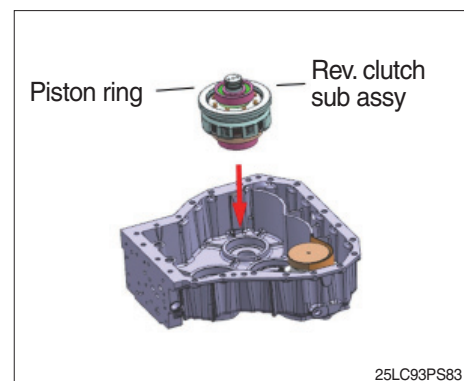
※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m  
(22.4 ~ 26.04 lbf·ft)



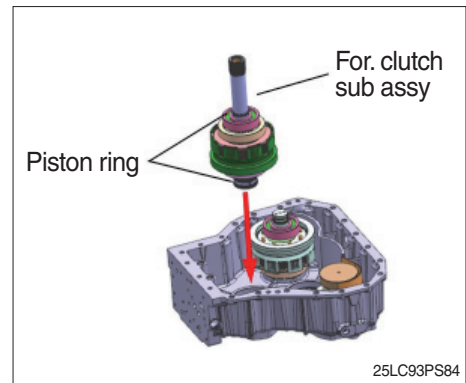
(5) Install the rev. clutch sub ass'y.

※ **Align and grease piston rings.**



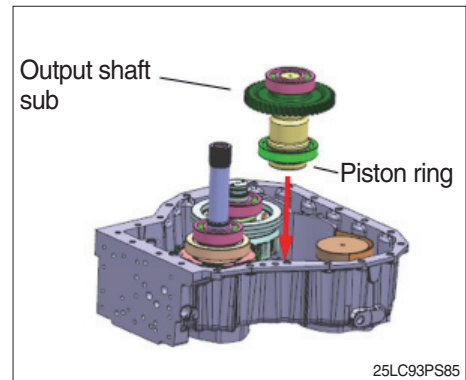
(6) Install the for. clutch sub assy.

※ **Align and grease piston rings.**

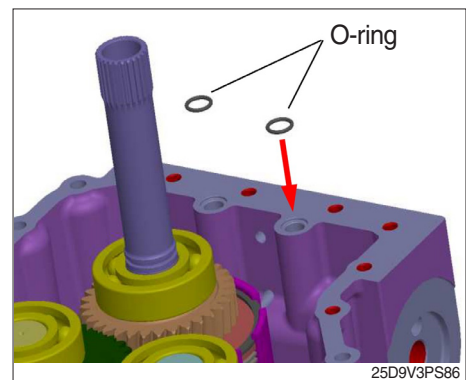


(7) Install the output shaft sub assy.

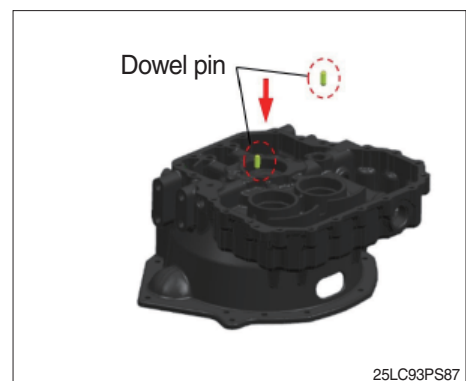
※ **Align and grease piston rings.**



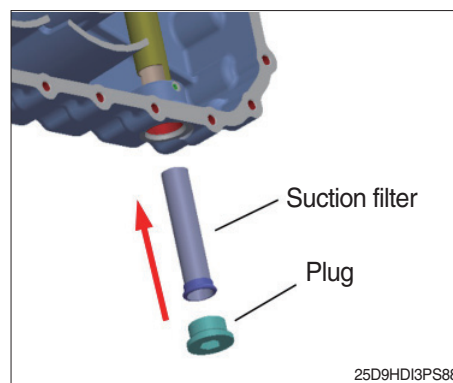
(8) Insert the o-rings and oil them.



(9) Press in dowel pin. (2 EA)



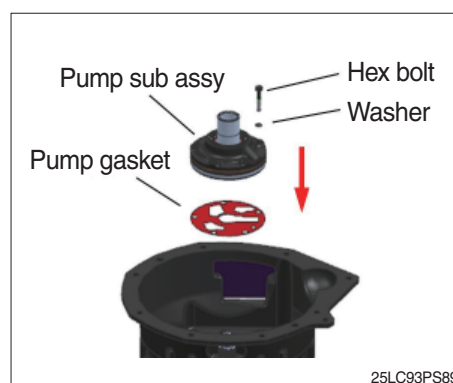
(10) Install the suction filter, suction filter spring and plug.



(11) Mount the pump gasket and pump sub assy,

※ **Cover Loctite #277 on hex bolt.**

- Tightening torque : 2.0 ~ 2.6 kgf·m  
(14.5 ~ 18.8 lbf·ft)

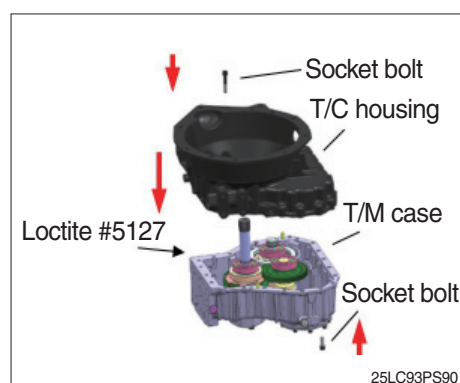


(12) Install the T/M case and T/C housing. Assemble socket bolt (M10×1.5-30L, 16EA / M10×1.5-65L, 16EA).

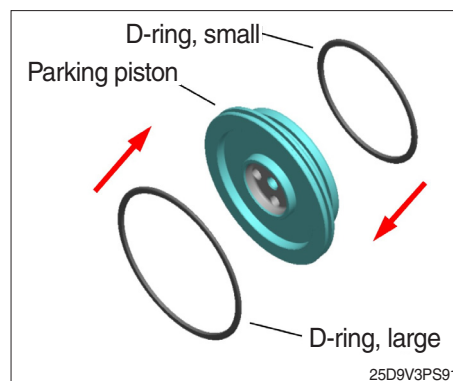
※ **Cover Loctite #5127 on the joint surface of T/M case. Do not apply to the bolt holes.**

※ **Cover Loctite #277 on socket bolt.**

- Tightening torque : 7.1 ~ 7.7 kgf·m  
(51.4 ~ 55.7 lbf·ft)



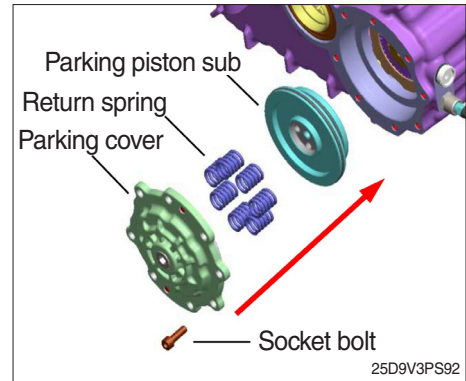
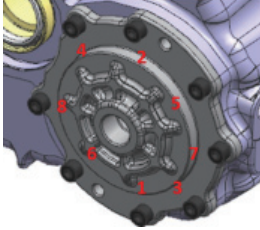
(13) Insert the d-rings (large and small) on the groove of parking piston and oil them.



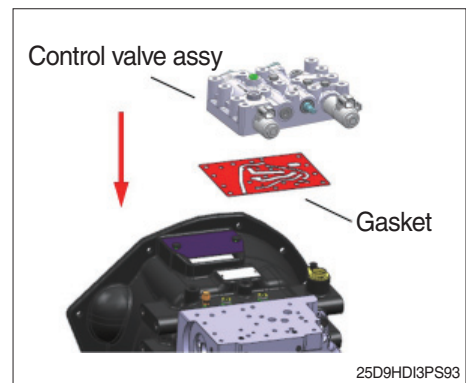
- (14) Assemble parking piston sub assy, return spring, parking cover and socket bolts (M8×25L, 8 EA).

※ **Cover Loctite #277 on socket bolt.**

- Tightening torque : 3.1 ~ 3.6 kgf·m  
(22.4 ~ 26.04 lbf·ft)



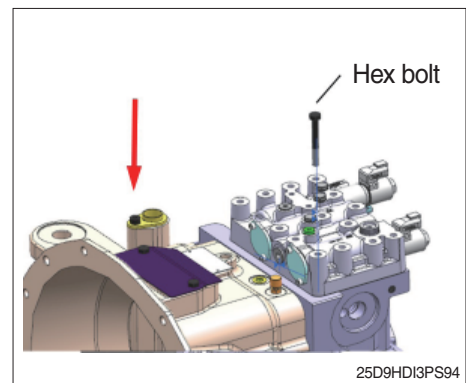
- (15) Mount the valve gasket and control valve assy.



- (16) Tighten the hex bolts. (M8×1.25-70L, 14 EA)

※ **Cover Loctite #277 on hex bolt.**

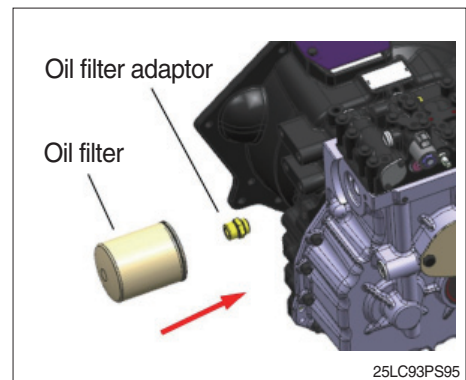
- Tightening torque : 3.1 ~ 3.6 kgf·m  
(22.4 ~ 26.04 lbf·ft)



- (17) Tighten the oil filter adaptor and assemble the oil filter.

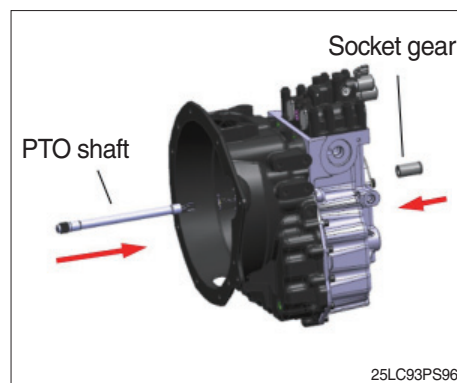
※ **Slightly oil the seal on the oil filter. Turn in the oil filter until contact with the sealing surface is obtained, and then tighten it by hand with approx. 1/3 to 1/2 rotation.**

- Tightening torque : 4.6 ~ 5.1 kgf·m  
(33.3 ~ 36.9 lbf·ft)



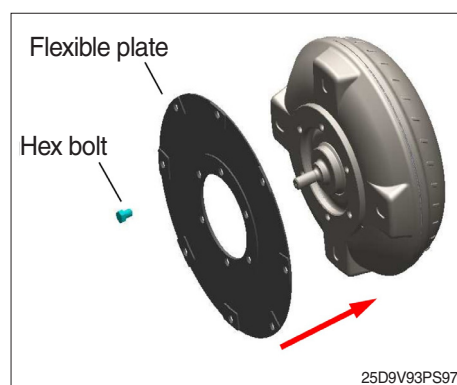


(18) Mount the PTO shaft and socket gear.

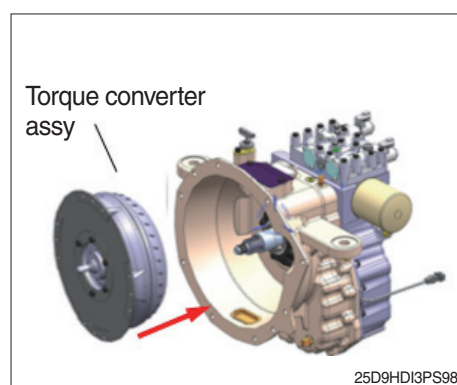


(19) Assemble the flexible plate and hex bolts (3/8-24-UNF, 6EA).

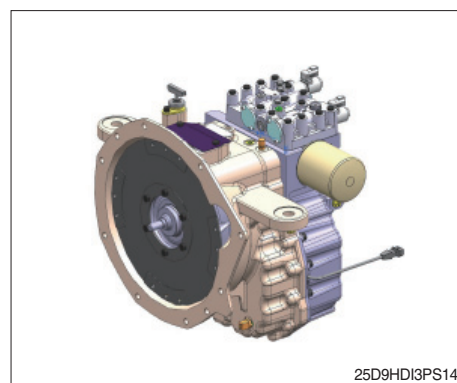
- ※ **Cover Loctite #277 on socket bolt.**
  - Tightening torque : 4.6 ~ 5.1 kgf·m  
(33.3 ~ 36.9 lbf·ft)



(20) Assemble the torque converter assy.



(21) Complete the transmission assembly.

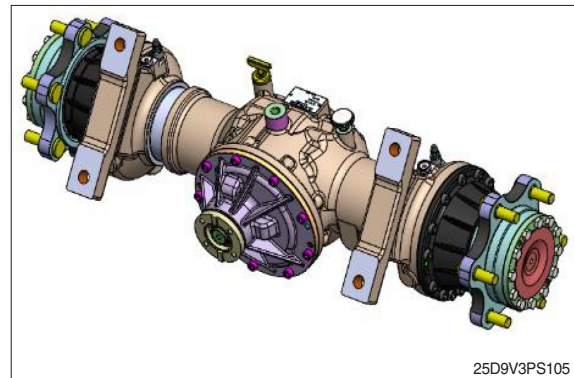




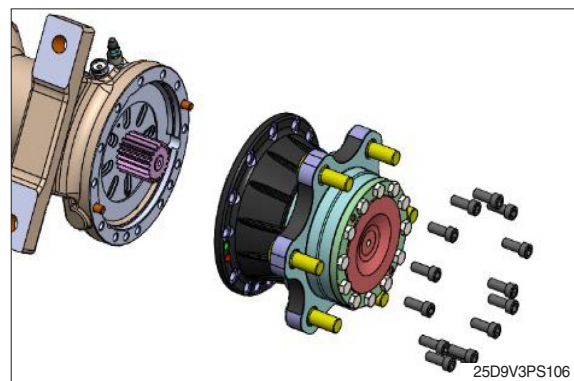
### 3. DISASSEMBLY OF DRIVE AXLE

#### 1) DISASSEMBLY

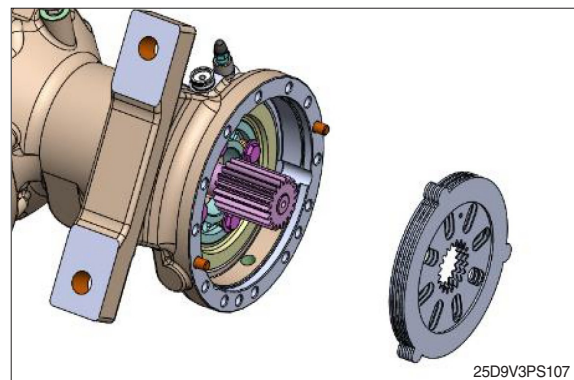
(1) Disassemble drive axle assy.



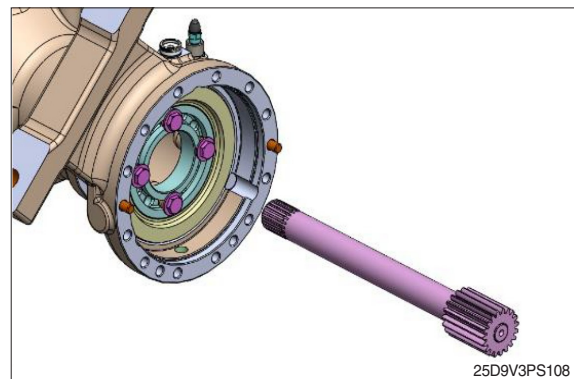
(2) Disassemble carrier hsg. sub assy.



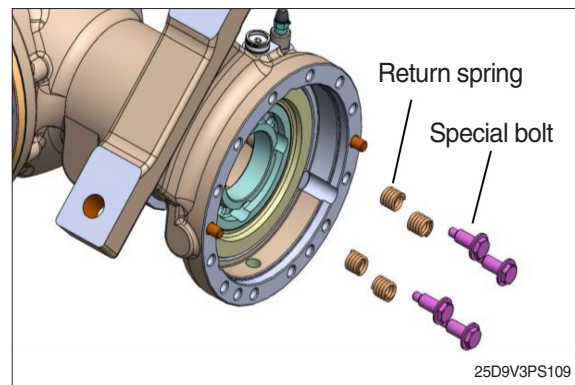
(3) Disassemble disc, opposing plate.



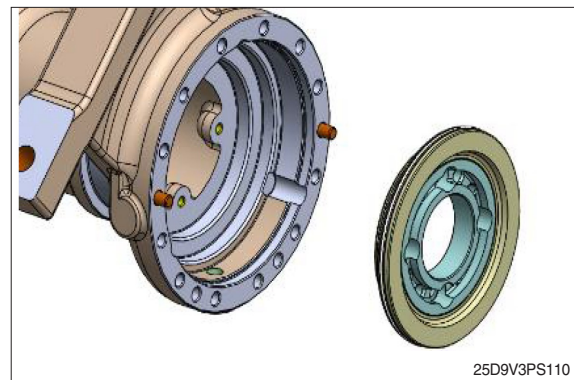
(4) Disassemble axle shaft.



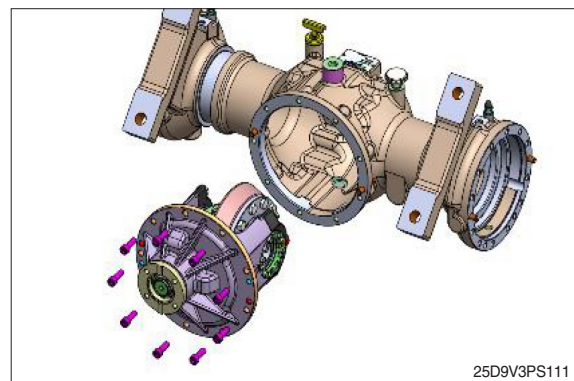
(5) Disassemble special bolt, return spring.



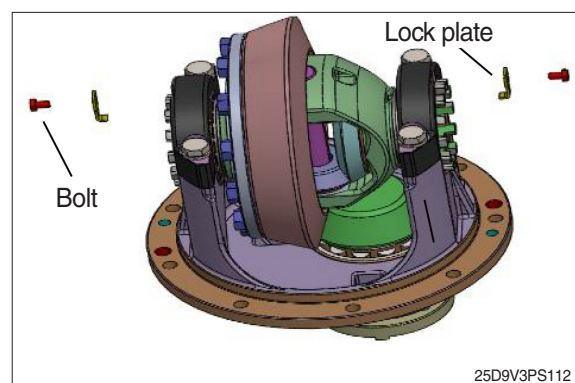
(6) Brake piston sub assy



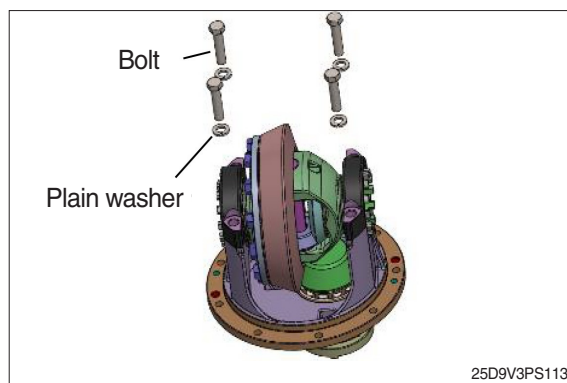
(7) Disassemble bolt, carrier sub assy.



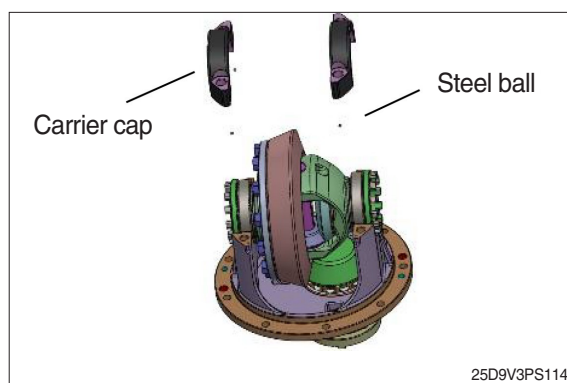
(8) Disassemble Bolt, lock plate.



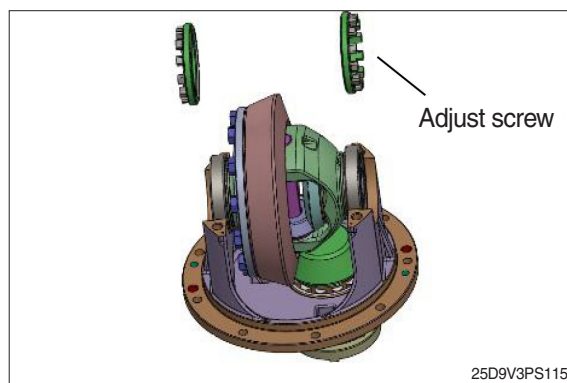
(9) Disassemble bolt, plain washer.



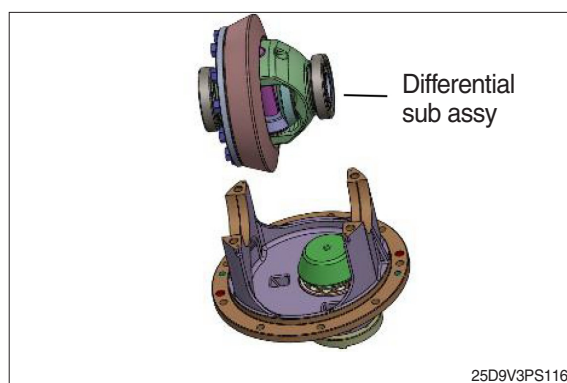
(10) Dissassemble carrier cap, steel ball.



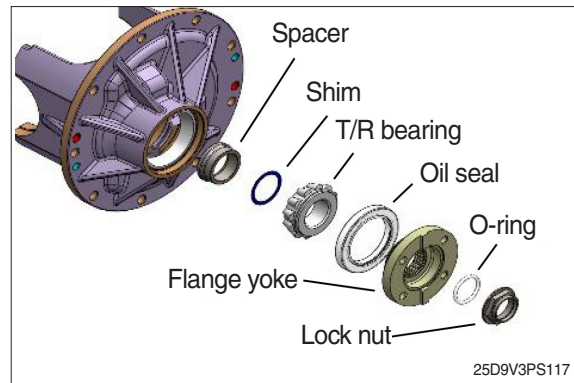
(11) Disassemble adjust screw.



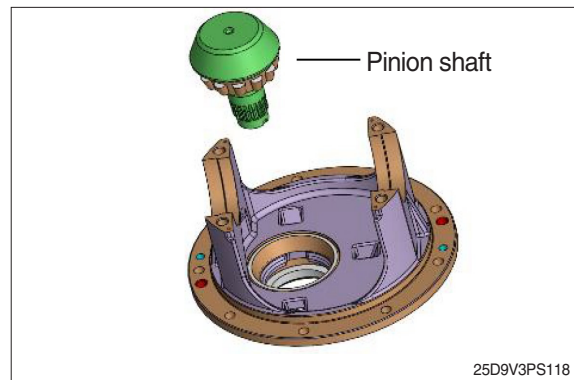
(12) Disassemble differential sub assy.



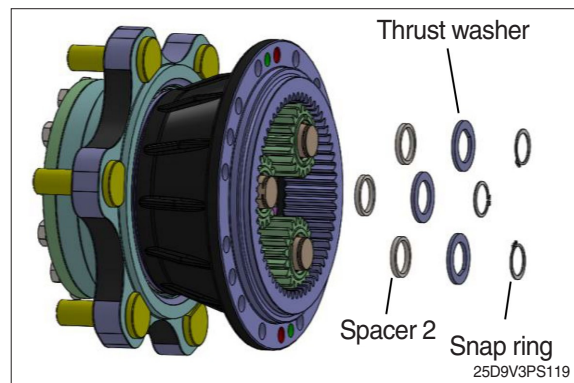
(13) Dissassemble carrier cap, steel ball.



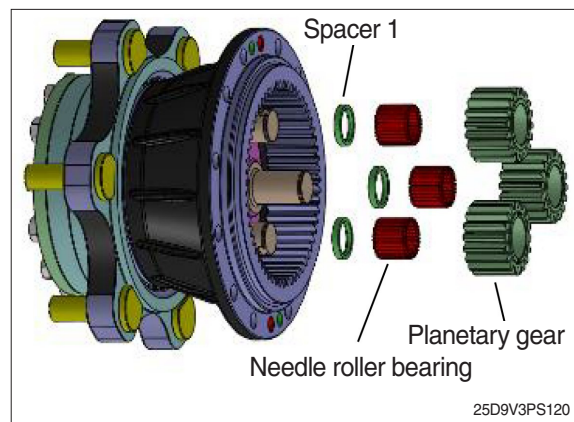
(14) The Lock nut from the decomposition order.



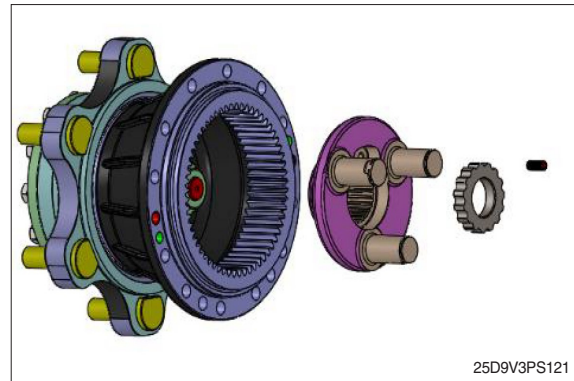
(15) Disassemble Pinion shaft.



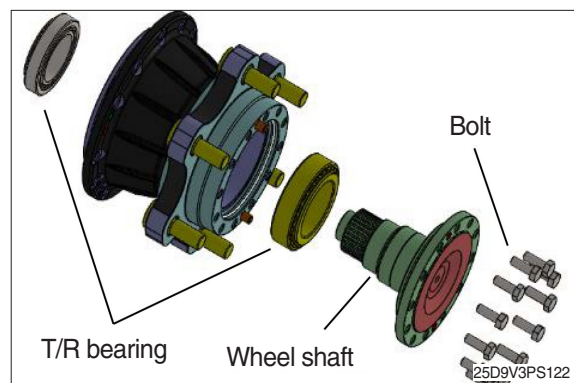
(16) Disassemble planetary gear, needle roller bearing (58EA  $\times$  3= 174EA), spacer 1.



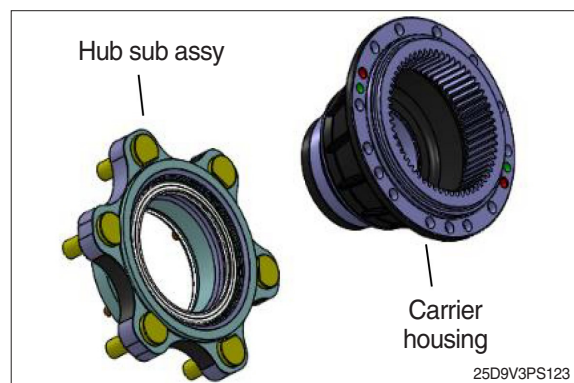
- (17) Disassemble set screw, hub lock nut and PL carrier



- (18) Disassemble bolt, wheel shaft and T/R bearing.



- (19) Disassemble hub sub assy, carrier housing.

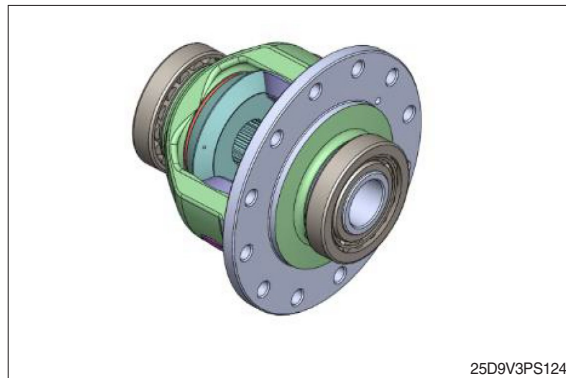




### 3.ASSEMBLY OF DRIVE AXLE

#### 1) ASSEMBLY OF DIFFERENTIAL DEVICE

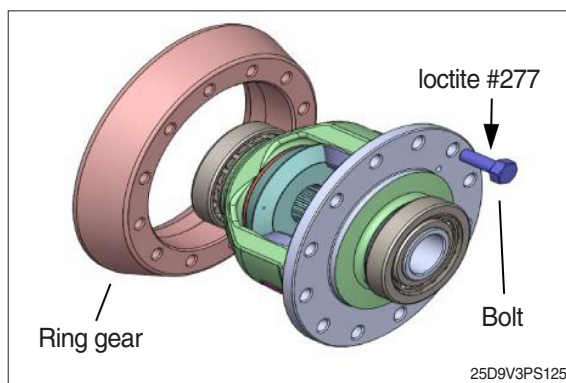
(1) Make preparation for diffdrential assembly.



(2) Assemble Ring gear by Bolt.

※ **Spread loctite #277.**

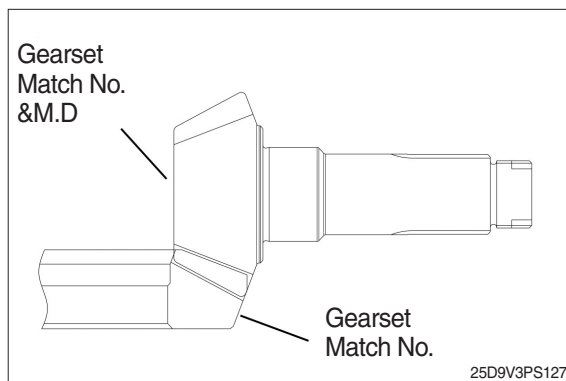
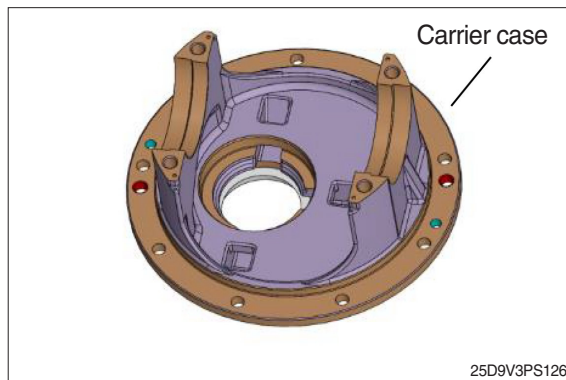
· Tightening torque : 10.2 ~ 11.2 kgf·m  
(73.8 ~ 81.0 lbf·ft)



#### 2) ASSEMBLY OF CONTROL OF SHIM & PINION

(1) Fix carrier case to jig.

※ **Before install gearset to carrier, you must recognize information. You always have tested the mark at gear set which each pair of gear suits it.**



(2) The THK of shim will be decided of measured value of gauge & machine.

① Dimensional drawings of the alphabet (mm)  
 a : 107    b : 25.25    c : Engraved value  
 d : 132.75    e : 33.75    f : 32.5    g : 1.75

② Basic shim thickness

"A" : 0.5    "B" : 0.5

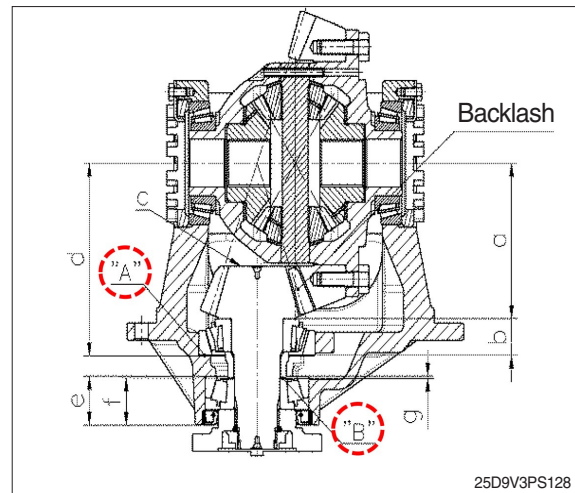
③ Shim thickness calculation

"A" :  $d - (a + b + c)$

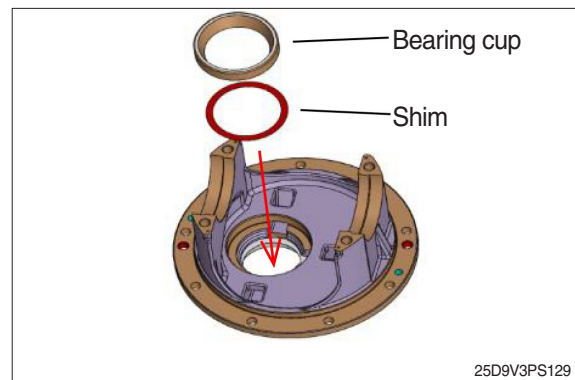
ex)  $132.7 - \{ 106.9 + 25.22 + (-0.2) \} = 0.83 \rightarrow 0.85 \text{ mm}$

"B" :  $g - (e - f)$

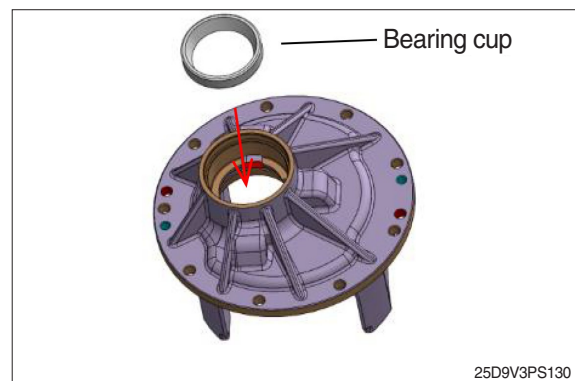
ex)  $1.77 - (33.71 - 32.42) = 0.48 \rightarrow 0.5 \text{ mm}$



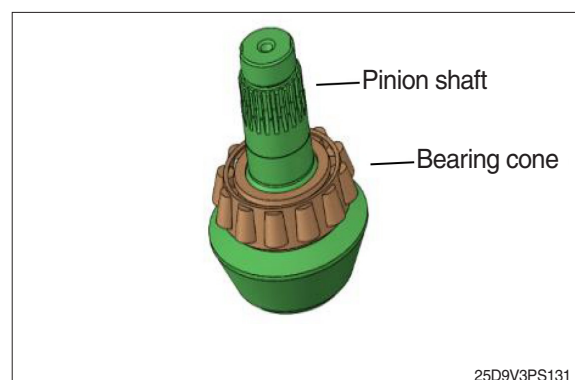
(3) Assemble shim. Sort of shim : 0.1, 0.15, 0.25, 0.5 mm. Press the bearing cup.



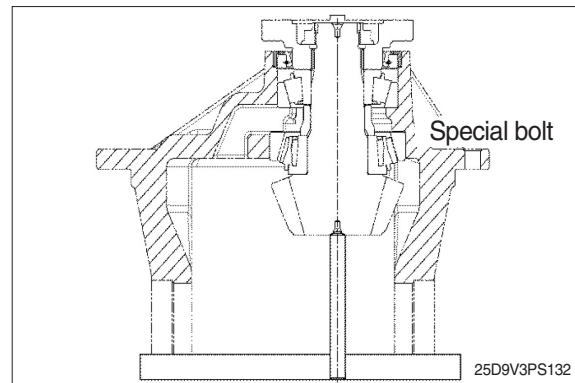
(4) Turn carrier case a on-eighty (180°) and press bearing cup.



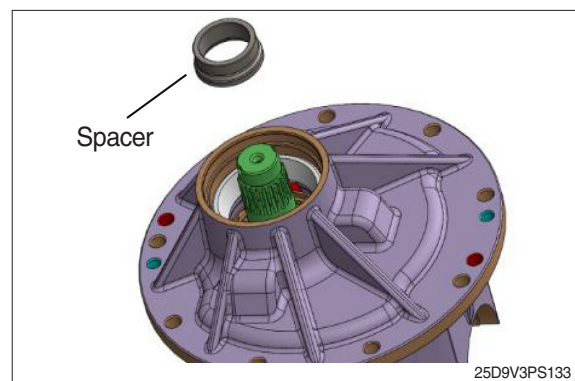
(5) Pressurize bearing cone on pinion shaft. Put into pinion shaft.



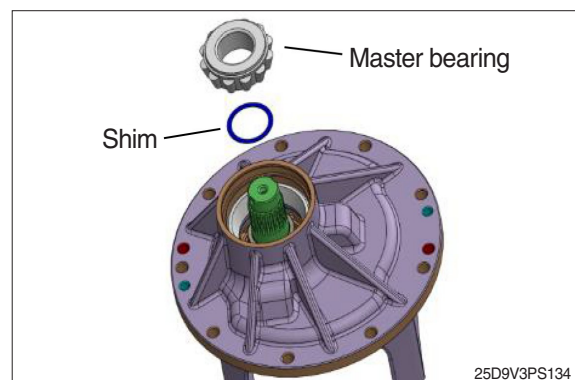
- (6) Turn carrier case a one-eighty (180°) and fix it on jig.



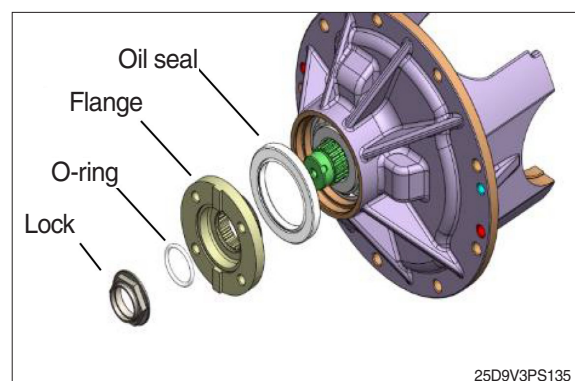
- (7) Assemble pinion shaft on spacer.



- (8) Assemble pinion shaft, and assemble shim & master bearing sort of shim : 0.1, 0.15, 0.3 mm

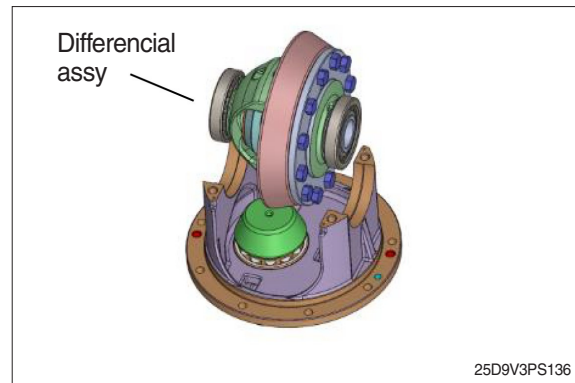


- (9) Assemble oil seal, flange yoke, o-ring and lock nut.
- Tightening torque : 26.5 ~ 29.6 kgf·m (192 ~ 214 lbf·ft)





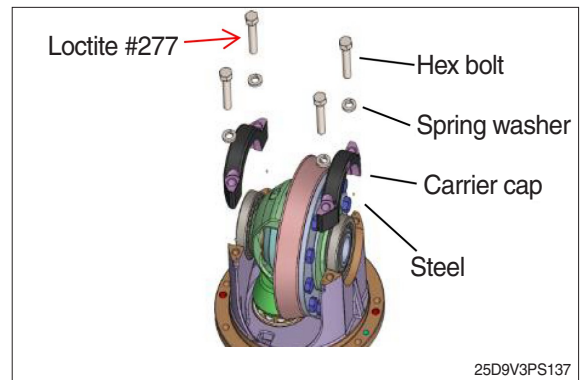
- (10) Turn carrier case a one-eighty (180°) and assemble differential assembly on carrier case.



- (11) Assemble hex bolt on carrier cap.

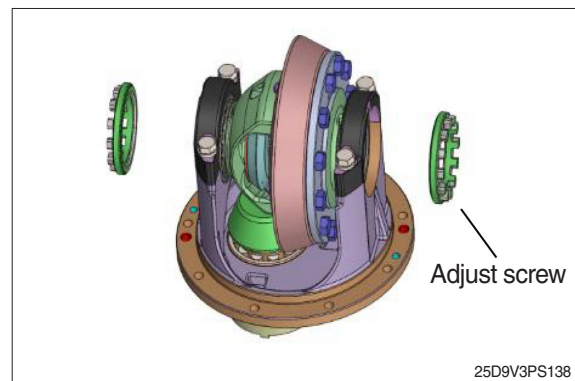
※ **Spread loctite #277 on the bolt.**

- Tightening torque : 11.7 ~ 12.5 kgf-m  
(84.6 ~ 90.4 lbf-ft)

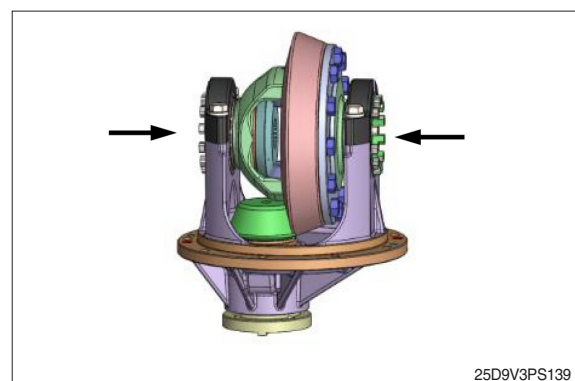


### 3) CONTROL OF GEARSET BACKLASH

- (1) Assemble adjust screw on carrier case.

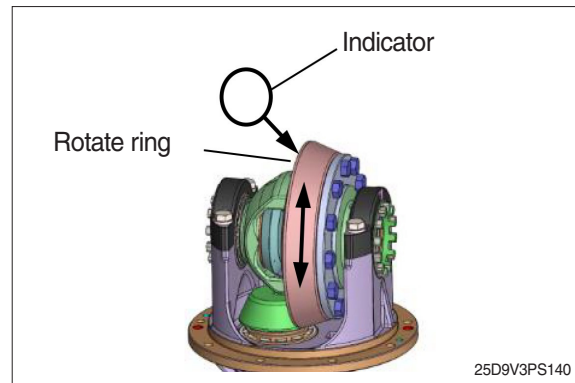


- (2) Lock adjust screw.

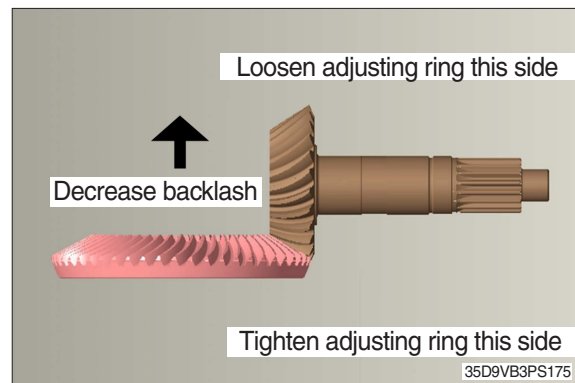
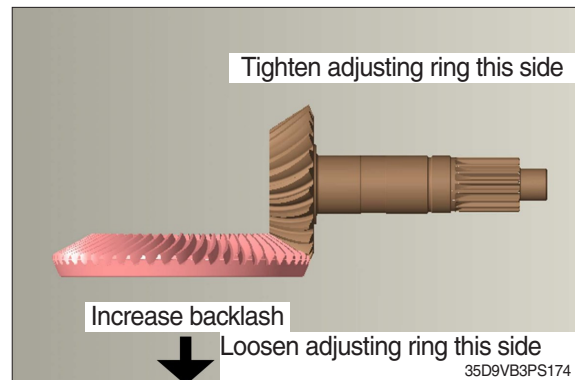


(3) Measure Backlash.

- ※ Backlash of pinion & ring gear : 0.18~0.23 mm
- ※ If it is wrong backlash, you can adjust value as moving each step.
- ※ If ring gear takes from pinion shaft far, the value of backlash will be increased. If ring gear takes from pinion shaft close, the value of backlash will be decreased.

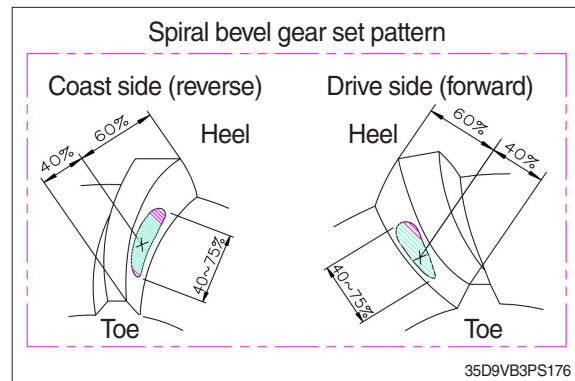


- (4) If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.

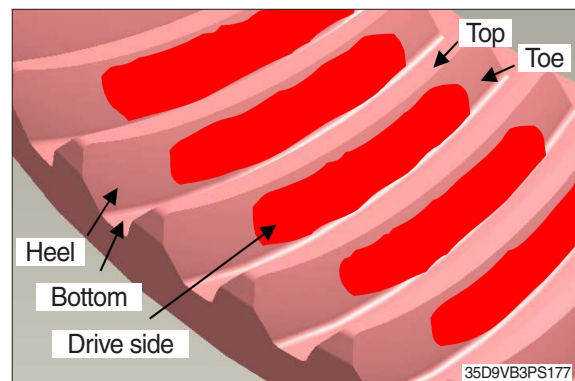


#### 4) MEASUREMENT OF TOOTH CONTACT PATTERN

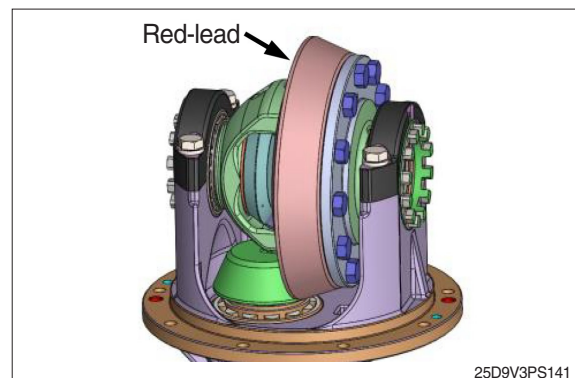
※ After assemble , adjust pattern of the gear and pinion shaft figure. If pattern is not adjusted, take a measure as measuring backlash again and then reassemble.



※ Always check tooth contact pattern on the driving side of gear teeth.

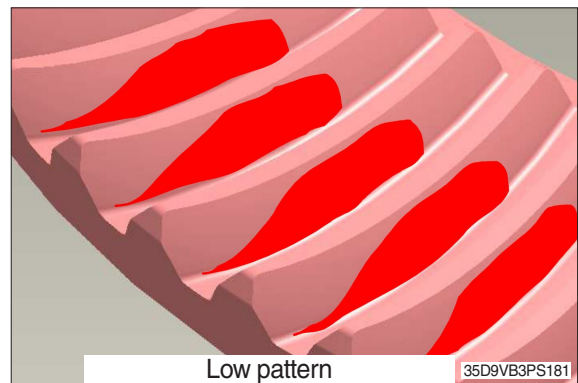
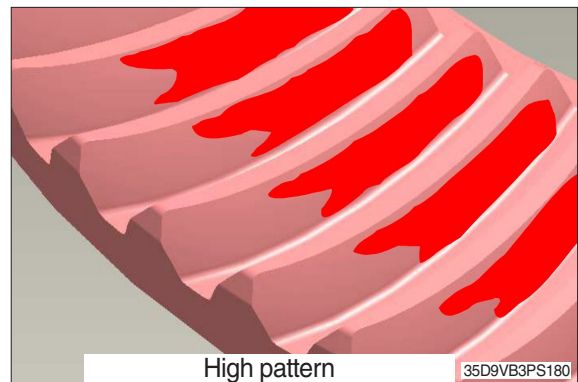
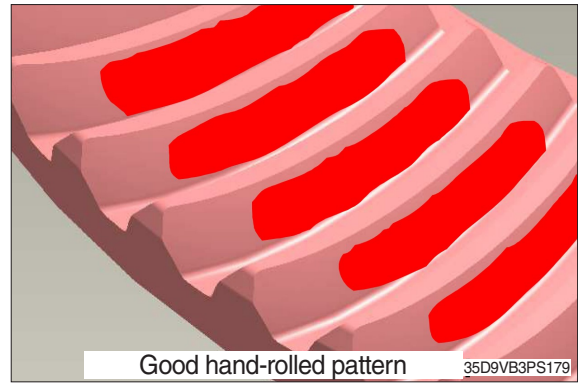


- (1) Marking red-lead on 6 tooth surface of ring gear.
- (2) Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.

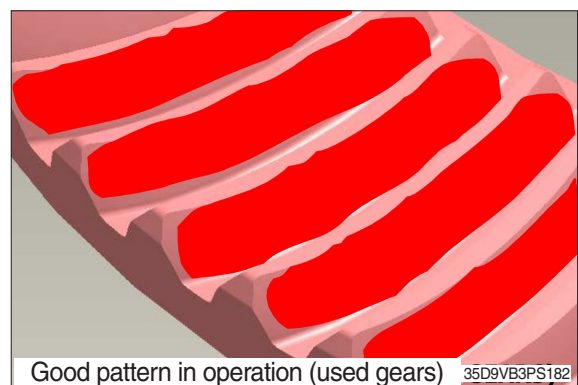


(3) Compare the contact pattern with illustrations.

※ The good contact pattern of gearset is appeared what the length of tooth has had.



※ The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.

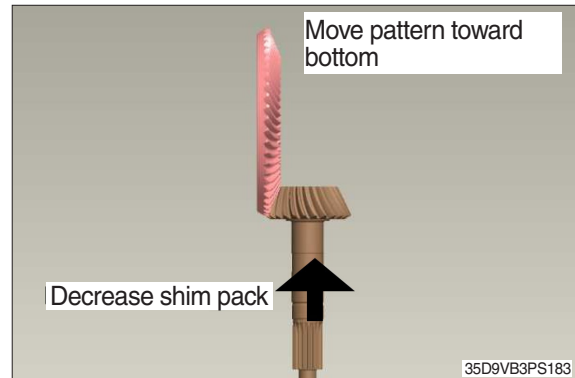


(4) If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps ①-②.

If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps ③-④.

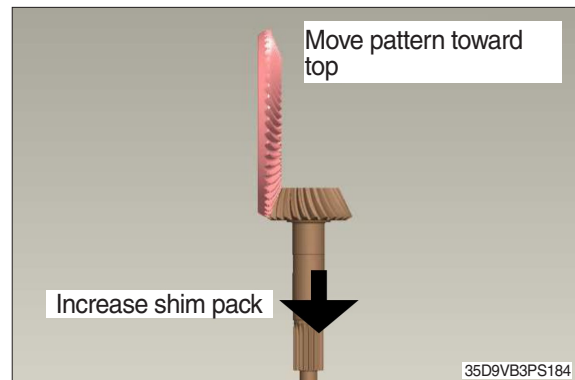
① High pattern

If A high contact pattern appear it which pinion was installed shallowly in carrier. To modify, move the pinion toward the ring gear by decreasing the shim pack between pinion spigot and inner bearing cone.



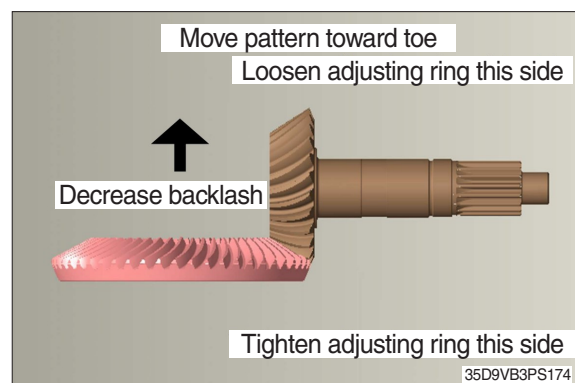
② Lower pattern

If A low contact pattern appear it which pinion was installed deeply in carrier. To modify, move the pinion away from the ring gear by increasing the shim pack between pinion spigot and inner bearing cone.



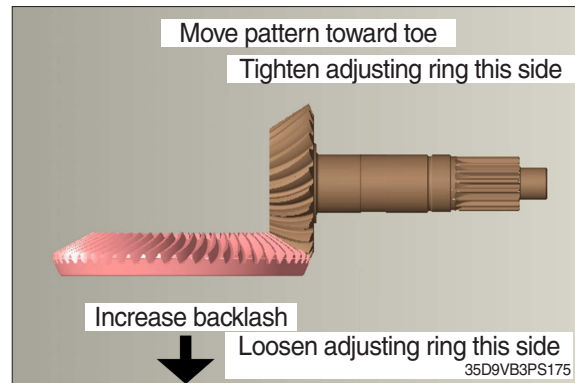
③ Heel pattern

Decrease the gearset backlash (within specified range) to move contact pattern toward toe and away from heel. Refer to "Adjusting the gearset backlash".

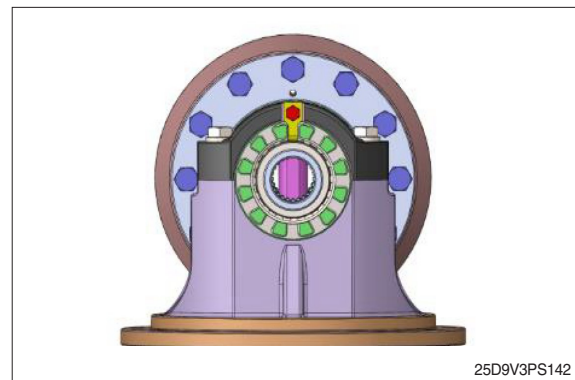


④ Toe pattern

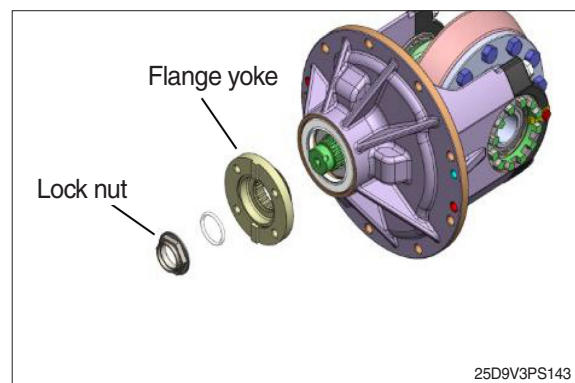
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



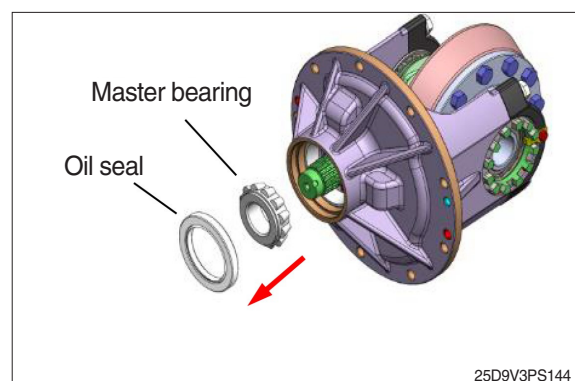
- (5) Fix spring pin to adjusted Ring bearing.  
And then, assemble all of them.



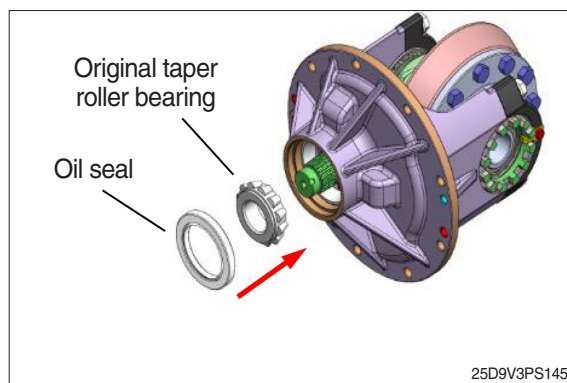
- (6) Disassemble lock nut & o-ring & flange yoke.



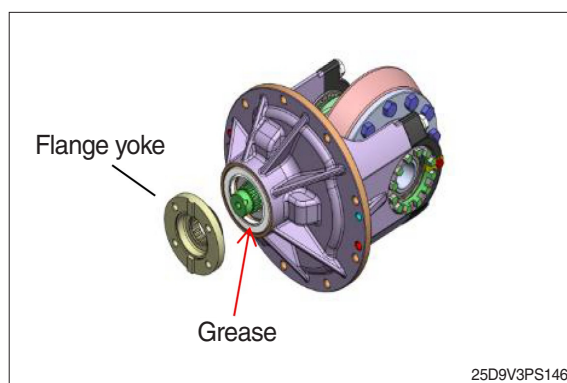
- (7) Disassemble oil seal & master bearing.



(8) Assemble original taper roller bearing & oil seal.

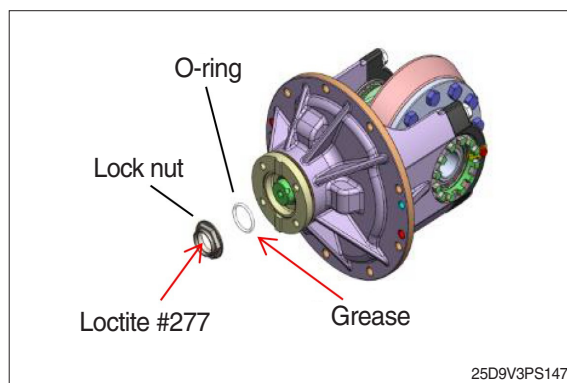


(9) Spread grease on seal lip and assemble flange yoke.

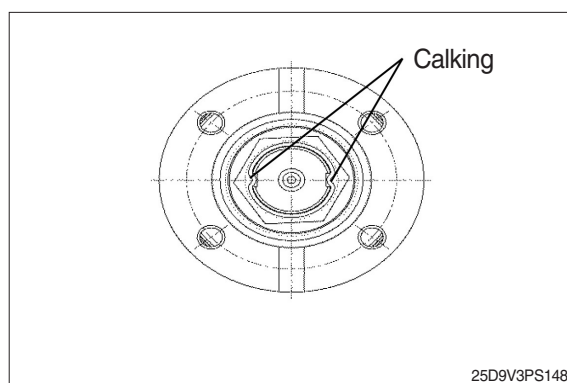


(10) spread grease on o-ring assemble o-ring and spread loctite #277 on lock nut and tighten it.

- Tightening torque : 46.9 ~ 50 kgf·m  
(339 ~ 362 lbf·ft)
- Preload : 0.2 ~ 0.4 kgf·m  
(1.4 ~ 2.9 lbf·ft)



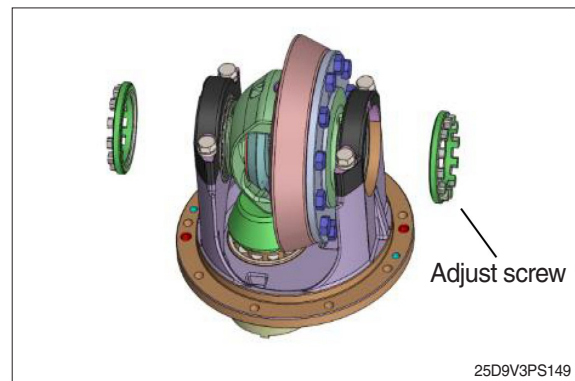
(11) Calking (2EA)





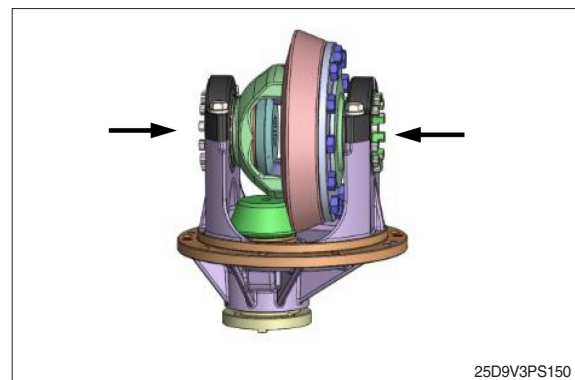
## 5) ASSEMBLY OF HUB

- (1) Press hub bolt into hub.



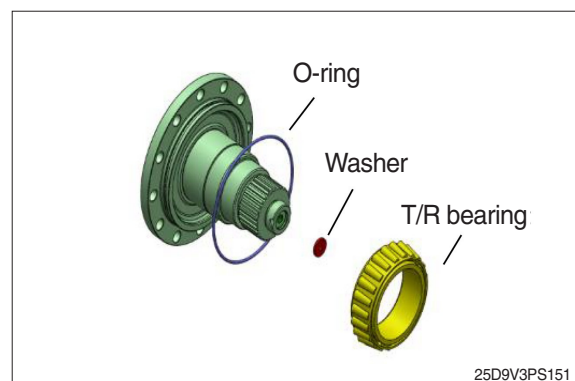
- (2) Press hub outer oil seal. Before assemble, spread grease at inside hub.

※ Grease : Shell Retinax 0434 - 60 ~ 80 % spread



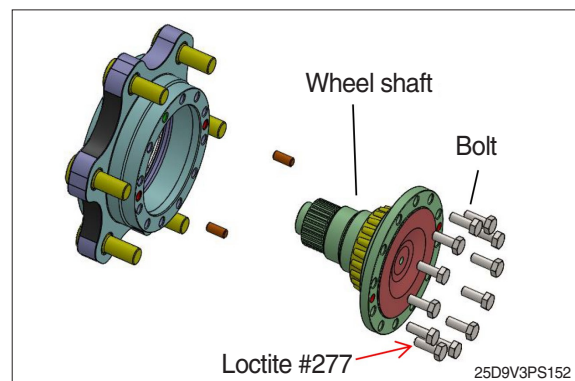
## 6) ASSEMBLY OF CARRIER HSG. SUB ASSY

- (1) Cover grease on o-ring assemble o-ring and assemble washer & T/R bearing.



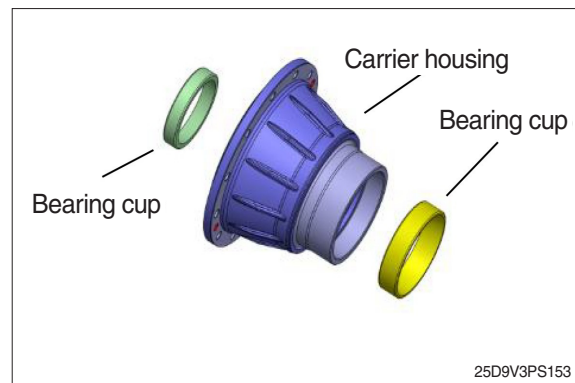
- (2) Spread loctite #277 on socket bolt and assemble wheel shaft.

· Tightening torque : 0.69 ~ 0.73 kgf·m  
(5.0 ~ 5.3 lbf·ft)

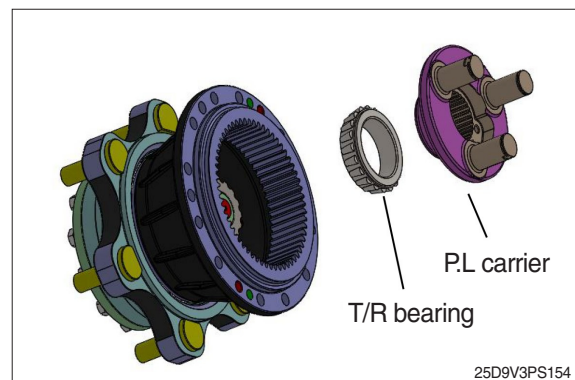




- (3) Press bearing cup into carrier housing both side.



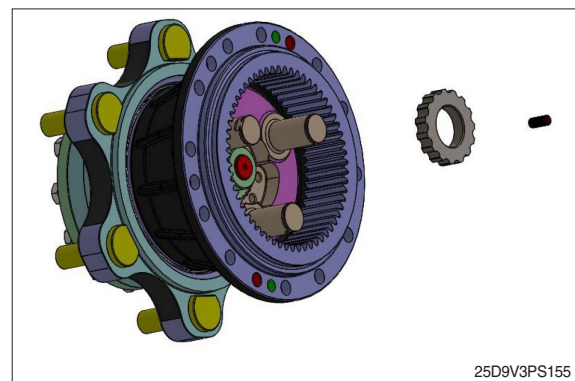
- (4) Press T/R bearing and P.L. carrier sub assembly.



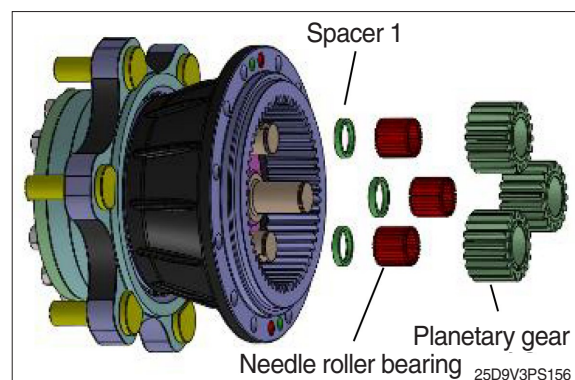
- (5) Fastening hub lock nut and assemble the set screw.

※ **Spread loctite #277.**

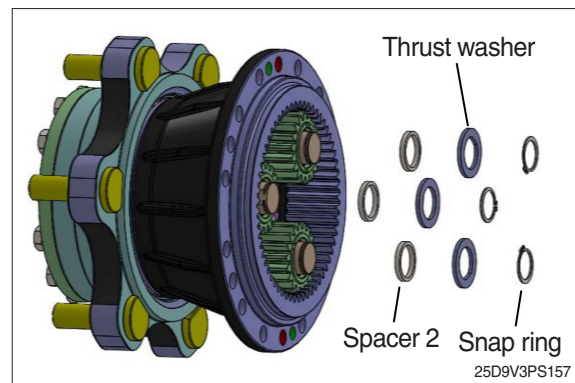
- lock nut tightening torque : 25.5 kgf·m  
(184 lbf·ft)
- Preload : 0.56 ~ 0.61 kgf·m  
(4.1 ~ 4.4 lbf·ft)
- set screw tightening torque : 1.3 kgf·m  
(9.4 lbf·ft)



- (6) Assemble spacer 1, N.D roller bearing and planetary gear. Spread grease on N.D rooler bearing.

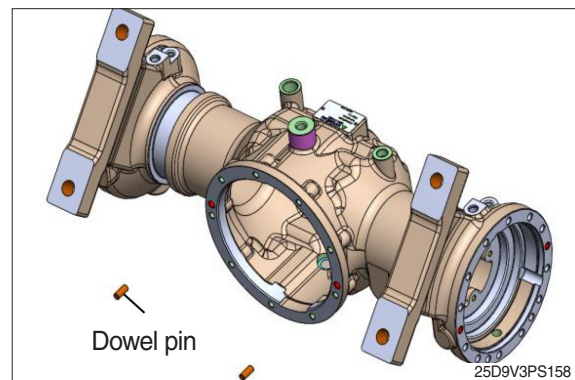


- (7) Assemble spacer 2, thrust washer, snap ring.

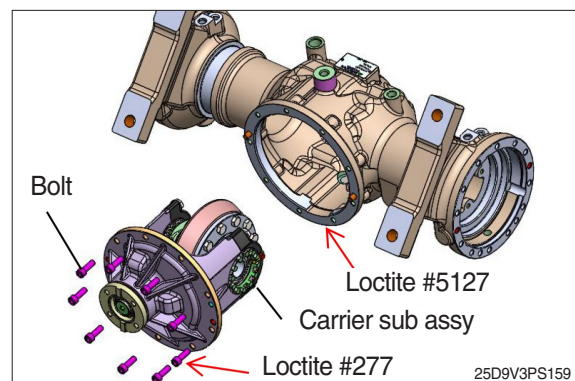


## 6) ASSEMBLY OF DRIVE AXLE

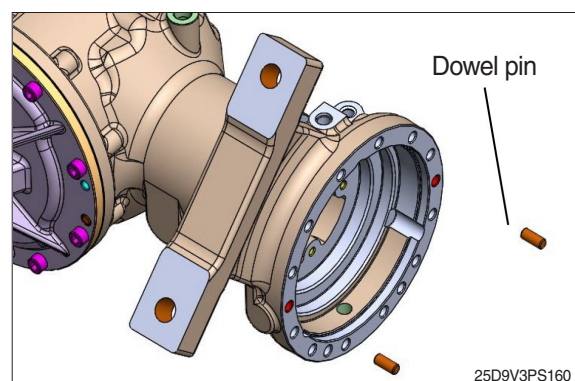
- (1) Press dowel pin on axle housing.



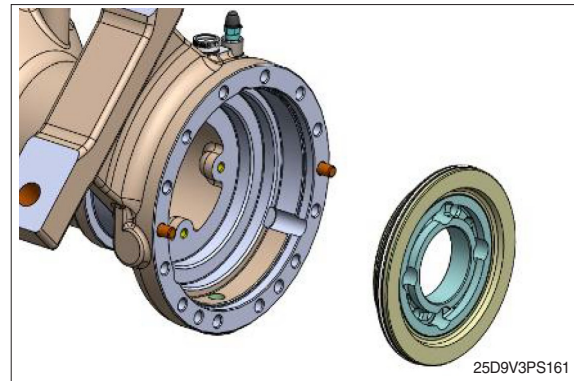
- (2) Spread loctite #5127 on axle housing and assemble carrier sub assy. Spread loctite #277 on the bolt and assemble bolt.



- (3) Assemble dowel pin on axle housing.



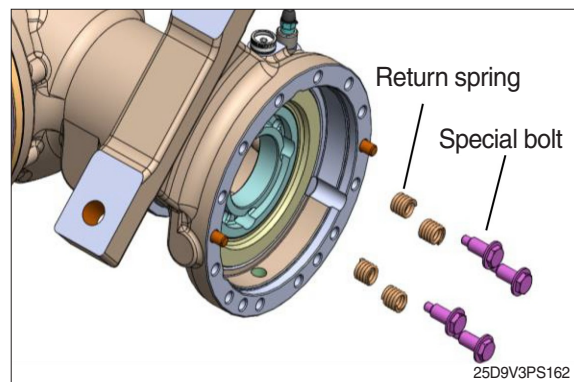
(4) Assemble piston sub.



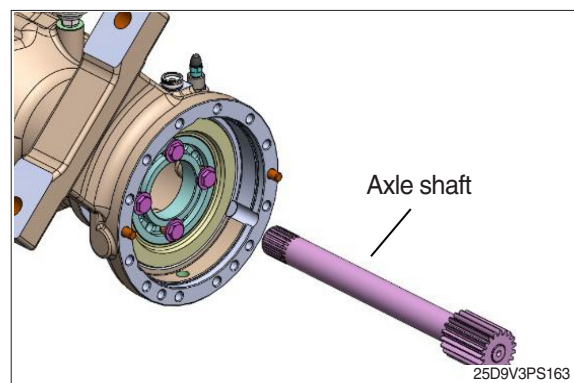
(5) Return spring, Special bolt.

※ Spread loctite #277 on the bolt.

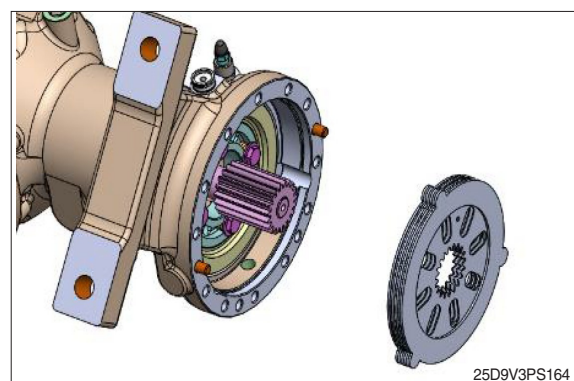
· Tightening torque : 3.1 ~ 3.5 kgf·m  
(22.4 ~ 25.3 lbf·ft)



(6) Assemble axle shaft.



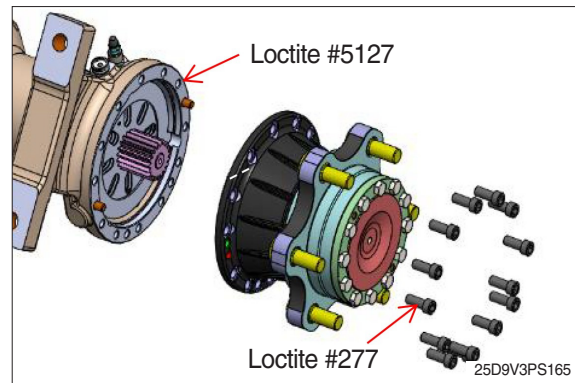
(7) Assemble brake disc pack



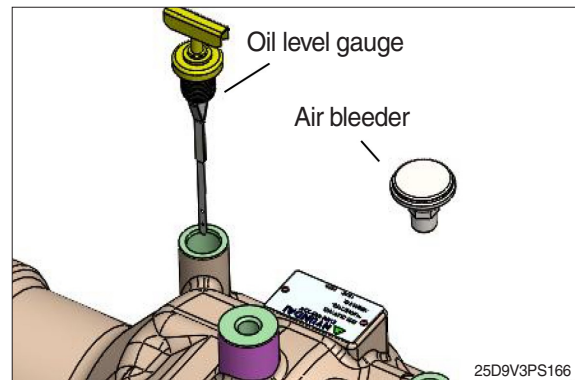
(8) Spread loctite #5127 on axle housing and assemble carrier hsg. sub assy.

※ **Spread loctite #277.**

· Tightening torque : 10.2 kgf·m  
(73.8 lbf·ft)



(9) Assemble oil level gauge & air breather on axle housing.

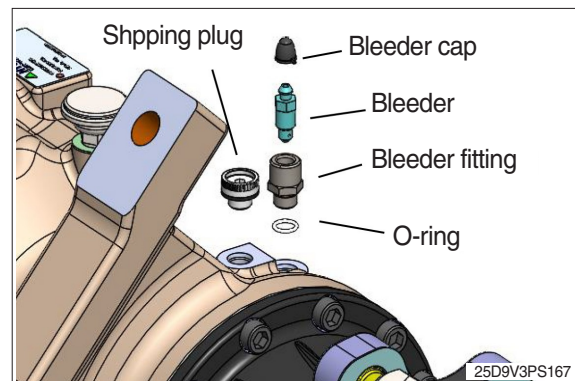


(10) Assemble o-ring, bleeder & bleeder fitting, bleeder cap.

· Tightening torque

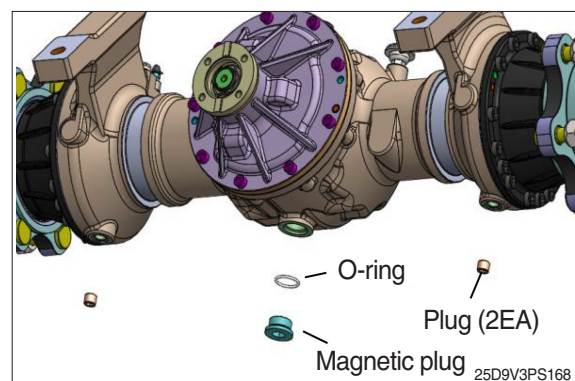
Bleeder : 4.0 kgf·m (28.9 lbf·ft)

Bleeder fitting : 1.8 kgf·m (13.0 lbf·ft)

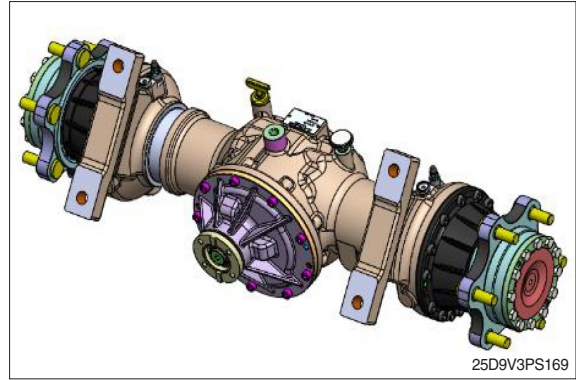


(11) Assemble o-ring, drain plug (magnetic), and plug.

· Tightening torque : 4.2 ~ 5.2 kgf·m  
(30.4 ~ 37.6 lbf·ft)



(12) Complete drive axle assembly.





## GROUP 3 MAINTENANCE AND TROUBLESHOOTING

### 1. MAINTENANCE

#### 1) TRANSMISSION

##### (1) Recommend oils

The property that needs for auto transmission oil.

- It has suitable viscosity at the height temperature.
- It has suitable fluidity at the low temperature.
- It has excellent oxidation stability.
- It has property which remove bubble, and property of lubricant.
- Therefore please be sure to use following the oil when you supply or change oil. In addition, please use the same oil that you supplied already.

① Oil volume is approximately 8 liters (without torque converter).

② Suggested oil : ATF (Auto Transmission oil, Dexron type)

##### (2) Point of exchange oil

###### ① Pulling out oil

- Please take off the drain plug where under of the transmission, and then discharge the old oil.
- Please take off the hose join part, and then discharge the old oil that remained in the oil cooler and in the hose.

※ **Period of exchange oil filter : initial time 100 hr, and then every 1000 hr**

###### ② Oil supply

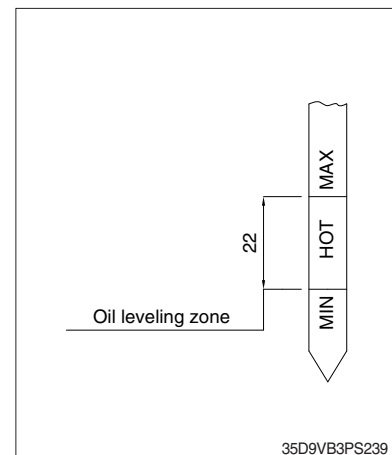
- Please stop the engine (ok), then refuel the oil into transmission until 「HOT」 level of oil level gauge.
- Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.
- The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the engine. Then oil level sink down.
- Please drive the engine about 5 minutes at low idle speed, then refuel the oil gradually the oil level settle in regular position (between 「MAX」 and 「MIN」 position).

※ **Please refuel the oil carefully, without get rubbish or water and so on in the oil.**

**Lack of oil or excess of oil becomes cause of breakdown. So please be careful.**

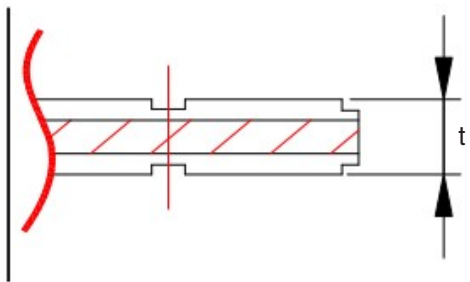
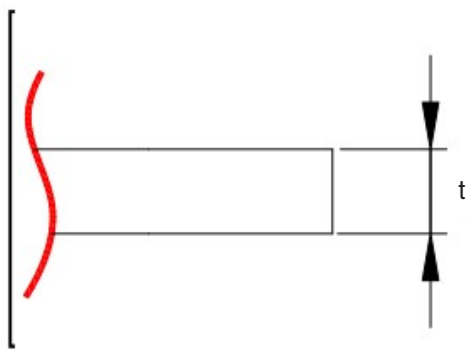
※ **Check the oil level, when the oil temperature is 50℃ ~ 60℃.**

**Amount of all oil : about 14 liters.**



### (3) Period of overaul

- ① As for the overhaul, we recommend either every 5 years or 7000 hours coming early to be done as a limit.
- ② Please change the oil seal, rubber such as o-ring, and gasket, copper gasket, if it has damaged.
- ③ Please check the part by your eyes which you disassembled whether they have the crack, the scar, abnormal wear and corrosion etc. If the parts have such abnormal condition, please change or repair.
- ④ Seal ring, snap ring, friction disc, plate → Change the part that exceeds the wear limits.
- ⑤ Bearing, bush → Check the bearing to see if it rotates freely. If in doubt about the wear or lack of lubrication, replace this bearing.
- ⑥ Gear, shaft → if it is abnormal you have to change.

	Item in the F&R clutch	Standard	Limit
Friction disk		2.4	1.9
Plate		1.8	1.65
Back plate		3	2.85

#### (4) Period of exchanging parts

Item name \ time	Item in the F&R clutch	Standard
Oil seal	Please change all parts.	Please change all parts at every overhaul.
O-ring		
Gasket		
Copper gasket		
Oil seal ring	Please check the each part.	Please change all parts at 2 <sup>nd</sup> and 4 <sup>th</sup> time.
Seal ring race plane		Please change the part that exceeds the wear limit.
Sinter plate		Please change the part that exceeds the wear limit.
Stator free wheel part		Please change the abnormal leaf spring.
Sliding surfaces of oil seal		Please change the part that exceeds the wear limit.
Sliding section of clutch piston		
Inside diameter or bush		
Each bearing		
Spring		

#### (5) Standard of exchanging parts

Classification	Contents	Object parts	Item name
A	The part that you should change the part to new one whenever overhauling and for check cleaning.	Gasket, Rubber	Gasket, O-ring, Copper gasket, Oil seal
B	The part that wear of the part is extreme comparatively, so the change time is high frequency.	Seal ring, Clutch plate	Oil seal ring, Snap ring, Friction plate&steel plate in clutch
C	The part that you do not have to change every overhauling but it is abnormally when overhauling you have to change the part.	Bearings, Race side of seal ring	Bearing, Bush, Part of free wheel, Seal race
D	The part that you usually do not have to change to new part but when if it is abnormally you have to change.	Gear, Shaft	Each gear, Clutch shaft, Turbine shaft, Flange



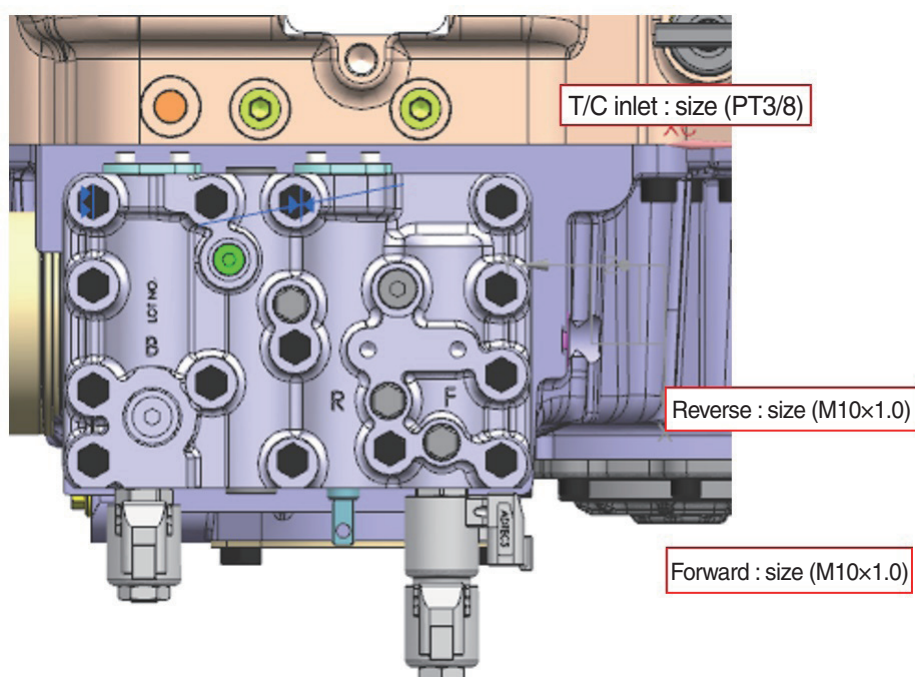
(6) Test

① Operation check

- Please change the change lever to 「N」 position and hold this position, then please change the engine speed from low idle to high idle, and check the below condition.
- The abnormal sound dose not occur.
- The abnormal oscillation dose not occur.
- The oil is not leaking.
- Overheating, a strong odor of overheated oil is a major trouble sign.

② Oil pressure measurement

- If you measure each part pressure, remove the plug and then install the pressure gauge. (PT 3/8, M10×1.0)



25D9HDI3PS100

- Please warming up the engine until the torque converter oil temperature becomes about 50~60°C.
  - Please measure the oil pressure of every required part as below under the low & high idle speed of engine.
  - When if you measure the individual pressure of clutch and pressure of lubricating. Please install the pressure gauge on the hole which take out the pressure then check the pressure while up the crane.
- Measure the oil pressure of clutch and T/C inlet at the 800 ~ 2400 rpm.

Description	Standard (MPa)	
	800 rpm	2400 rpm
Main relief	1.2±0.2	1.2±0.2
Forward	1.2±0.2	1.2±0.2
Reverse		
T/C inlet	0.1 ~ 0.4	0.3 ~ 0.7

### ③ Stall torque output test

- Please pay attention to the truck starts suddenly, because the torque converter generates largest torque.
- ※ **When the torque converter is stall condition, heat generate suddenly inside of the torque converter. So do not drive the engine when you drive over 30 seconds and the torque converter oil temperature is over 90℃.**
- a. Please use the parking brake and service brake securely.
- b. Please set the lever to F or R.
- c. Please step on the accelerator pedal until limit position, then check the engine speed when the engine speed become constant.
- d. Standard of engine maximum speed in stall condition is around 1,800~2,000 rpm. (depends on the standard performance of engine and torque converter)

## 2) DRIVE AXLE

### (1) General information

Drive axles generate small metal wear particles during operating, especially hard particles are allowed to circulate in the lubricant, along with external moisture. In these case the internal components can be more faster damaged and the brake can be made a noise.

### (2) Magnets and magnetic drain plugs

The axle has magnetic drain plugs which has minimum 0.5 kg of capacity for picking-up low carbon steel. This drain plug must be checked if there are metal particles at every oil change interval.

### (3) Breather

Breathers release the air pressure inside and help to minimize the condensation of oil.

- ※ **Please clean the plug if it has particles on the surface. Cover the breather when steam cleaning the housing. If the breather is not covered, water can enter the housing and contaminate the oil.**

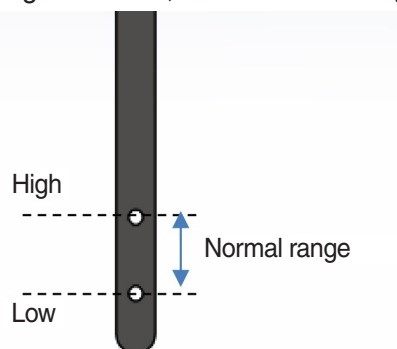
### (4) Oil level

#### ① Check and adjust oil

- ▲ **To prevent serious eye injury, please always wear the glass for safe when you perform the truck maintenance or service.**

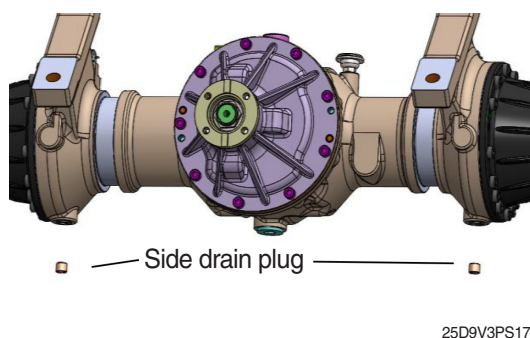
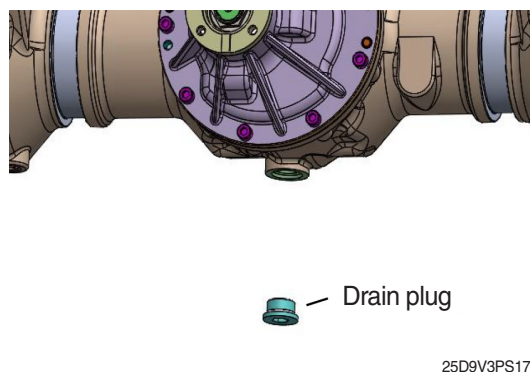
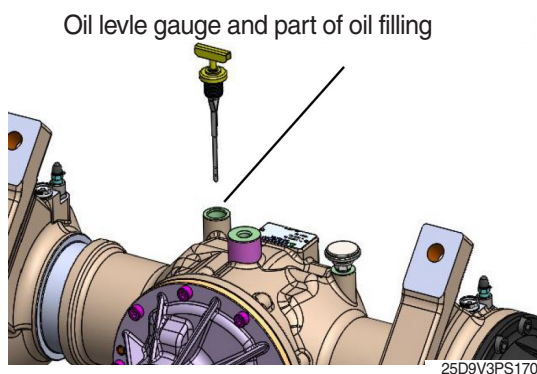
The part for oil filling and drain plugs are located in the axle housing.

- a. Park the truck on flat ground.
- b. Pull out oil level gauge from axle, then check the height of oil.



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- c. If the height of oil of level gauge is higher than the upper limit, drain the oil outby after loosening main drain plug , if the height of oil is lower than the lowest limit, replenish oil.



## ② Oil change

**▲ Park the truck on flat ground. Block the wheels to prevent the truck moving during maintenance.**

**Do not work under the truck supported only jacks for safe. Because Jacks can slip and fall over.**

- Make sure the vehicle is on level surface.
- Raise lift of vehicle and drain oil by loosening main drain plug and 2 places of side plug.
- After drain all oil, clean the magnetic plug.
- Fill oil with checking the height of level with level gauge.

## ③ Oil volume and available of list

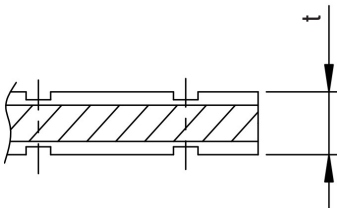
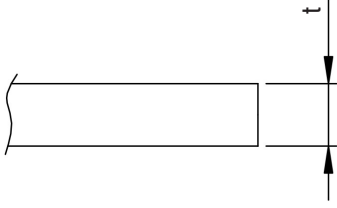
- Oil volume is approximately 8.2 liters.
- Available oil list**

Manufacture name	Brand name
Mobil corporation	Mobil fluid 424
	Mobil Infilex33 85W90
Sheel oil corporation	Shell spriax S4 TXM
	Donax TD 10W30 (2009 ver.)

## (5) Period of overhul

- Period of drive axle assy overhaul : Every 5 year or 7,000 hours.
  - The Axle oil needs to be replaced per every 1,000 hrs, to prevent brake noise.
  - O-ring, oil seal, rubber, gasket : Change all parts at every overhaul.
- ※ Check internal leakage of brake system(Brake seal) : Every 2,000 hours, replace as necessary.

④ Snap ring, disc, opposing plate : Change the part that exceeds the wear limits.

Item		Part no.	Standard	Limit
Disc		HA30-60220 (Service brake)	t=2.5	t=2.2
Opposing plate		HA30-60200 (Service brake)	t=2.5	t=2.35

⑤ Bearing, spring : Check the release bearing the see if it rotates freely. If it has doubt for the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft : If it is abnormal you have to change.

## 2. TROUBLESHOOTING

### 1) TRANSMISSION

#### (1) Output does not go up

Locating fault and cause			Measures
Engine	The engine speed is abnormal.		When the gear is neutral position and torque converter is stall state, please measure the engine speed. Then if the engine speed does not become proper speed, please adjust the engine or repair it. (Please refer to page of stall test.)
Torque converter	Torque converter oil	The oil is in short supply.	Please replenish oil.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The air bubble occurs because the torque converter pressure decrease.	Please check and adjust the torque converter pressure.
		The water has mixed into oil.	Please check the cooler, and change all oil.
		The oil filter is clogging.	Please wash the oil filter of change it.
	Main body of torque converter	The stator free wheel is broken.	Please change the stall revolution then if the revolution is extremely low, please change the free wheel inner race, free wheel cam and roller.
		The stator free wheel is sticking.	Please check the rise of the temperature of oil at no load. And please change the free wheel inner race, free wheel cam and roller when the temperature of oil rises abnormally.
		The wheel with blades is broken or it is touching other components.	Please check whether the aluminum powder and the like has mixed into torque converter oil. Please change the wheel with blades if the aluminum powder and the like has mixed in.
	Charging pump	The pump dose not operates normally.	Please change the pump.
Transmission	Control valve assy	The clutch oil pressure has decreased because the spring is settling or break.	Please change the spring.
		The valve does not move with the valve opens.	Please repair or change the valve.

## (2) Power is not transmitted

Locating fault and cause			Measures
Torque converter	The input plate wheel is broken.		Please change the input plate.
	The oil is in short supply.		Please replenish oil.
	The shaft and spline are worn.		Please change the shaft and the spline.
	The gear is broken.		Please change the gear.
	The charging pump does not operate normally.		Please change the charging pump.
Transmission	Torque converter oil	The oil is in short supply.	Please replenish oil.
	Clutch assembly	The clutch plate is worn and broken.	Please change the clutch plate.
		The clutch plate is sticking.	Please change the clutch plate.
		The clutch shaft spline is worn.	Please change the clutch shaft spline.
		The clutch pressure has decreased because the shaft end of the clutch and the oil seal ring of the clutch piston do not operate normally.	Please change the clutch assembly.
	Output shaft	The shaft spline is worn.	Please change the part which has worned spline.
		The gear is broken.	Please change the gear.
	Solenoid valve	The solenoid valve is broken.	Please change the solenoid.
		Spool does not operate normally.	Please change the solenoid valve.

## (3) Oil temperature rises abnormally

Locating fault and cause			Measures
Torque converter	Main body of torque converter	The device of stator free wheel is broken.	Please check the stall speed, and then if the speed is out of regular valve, please change the stator assembly to new part.
		The wheel with blades are touching each other.	If the foreign material (the aluminum powder and the like) has entered in torque converter oil, please change the wheel with blades to new one.
		The bearings are worn or sticking.	Please repair the bearings or change them.
	Torque converter oil	Amount of oil is not appropriate.	Please check the oil level.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The water has mixed into oil.	Please check the cooler and change the all oil.
	The piping resistance is large	The hose is bending, or it is broken.	Please repair the hose or change it.
		The oil cooler is sticking.	Please wash the oil cooler or change them.

Locating fault and cause			Measures
Transmission	The clutch is dragging	The clutch plate is sticking.	Please change the clutch plate.
		The clutch piston does not operate normally.	Please repair the clutch piston or change it.
		The pressure of clutch has decreased.	Please check the clutch pressure.
	The bearings are worn or sticking.		Please change the bearings.

#### (4) Clutch or converter oil pressure is too high

Locating fault and cause			Measures
Torque converter	Hose of outlet side is bending, and the hose is broken and the oil cooler is clogging.		Please repair or change the hose and oil filter, cooler
	Viscosity of oil is too high. (At cold time)		Please warm up the torque converter if the temperature of torque converter oil is below outside air temperature.
	The oil that is not regulated is used.		Please change the oil to regular oil.
Transmission	Control valve assembly	The valve does not operate normally because spring is broken or spools are stuck in the valve.	Please repair the valve assembly or change to new one.

#### (5) Clutch or converter oil pressure is too low

Locating fault and cause			Measures
Transmission	The oil is in short supply.		Please replenish oil.
	The oil that is not regulated is used.		Please change the oil to regular oil.
	The charging pump is worn and broken.		Please change the charging pump.
	The oil seal ring or o-ring is worn or damaged.		Please change the oil seal ring or the o-ring.
	The filter is clogging.		Please wash the oil filter or change it.
	control valve assembly	The spring is settling, and broken.	Please change the spring.
		The valve does not move with the valve opens.	Please repair the valves or change it.
		The restriction is clogging.	Please wash the restriction.
	The filter is clogging.	The end of the shaft and the seal ring of the clutch piston are damaged.	Please change the clutch piston.

**(6) Noise occurs**

Locating fault and cause		Measures
Torque converter	The input plate is broken.	Please change the input plate.
	The bearing is broken or bearings are worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The wheel with blades are touching each other.	Please change the wheel with blades.
	The bolt and rivet are loosen or broken.	Please repair the bolt and rivet or change it.
	The spline is worn.	Please change the part which has worn spline.
	The pump does not operate normally.	Please change the pump.
Transmission	The clutch is sticking and dragging.	Please change the clutch.
	The bearings are sticking and worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The spline is worn.	Please change the spline.
	The bolt is loosen or broken.	Please repair the bolt or change it.

**(7) Shifting is impossible**

Locating fault and cause		Measures
Transmission	The clutch plate is sticking.	Please change the clutch plate.
	The solenoid valve does not operate normally.	Please repair the solenoid valve or change it.
	The gear is broken.	Please change the gear.



## 2) DRIVE AXLE

### (1) Noise and vibration

Locating fault and cause		Measures
Drive axle	Shortage of oil	Check oil level or refill lubricating oil.
	Inappropriate oil	Replace the oil.
	Damaged wheel bearing	Replace the wheel bearing.
	Damaged ring gear and pinion shaft	Replace the ring gear and pinion shaft.
	Loosened or worn bearing of pinion shaft	Disassemble, check or replace the bearing.
Differential	Loosened bolt for assembling ring gear	Disassemble, check and reassemble the ring gear.
	Damaged ring gear	Replace the ring gear.
	Loosened or worn differential bearing	Disassemble, check, reassemble or replace the differential bearing.
	Damaged bevel gear bearing	Replace the bevel gear bearing.
	Worn or damaged diff pinion and side gear.	Replace the diff pinion and side gear.
	Worn or damaged thrust washer.	Replace the thrust washer.
	Excessive backlash of diff pinion and side gear.	Replace the diff pinion and side gear.
Brake	Incorrect axle fluid and/or friction material used	Use only meritor specified or approved materials.
		Drain and flush fluid from axle. Replace with approved fluid.
		Replace all friction discs. Thoroughly clean or replace stationary discs.

### (2) Oil leakage

Locating fault and cause			Measures
External leakage	Excess supply of oil		Check oil level. set of oil amount.
	Inappropriate oil		Replace the oil.
	Blocking air breather		Cleaning, replace the air breather
	Damaged hub oil seal		Replace the hub oil seal.
	Worn or damaged bevel pinion shaft oil seal		Replace the oil seal.
	Loosened bleeder screw		Tighten bleeder screw.
	Losened brake inlet fitting and plugs		Tighten brake inlet fitting.
	Damaged brake inlet fitting, plug and o-ring		Replace the brake inlet fitting, plug and o-ring.
Brake	Internal leak : Fluid bypasses seals into axle and fills axle with fluid and blows out breather or empties brake fluid reservoir.	Worn or damaged piston seal	Replace the piston seals.
		Melted or extruded piston seals	Correct cause of overheating and replace seals.
		Corrosion, pitting, wear or other damage, marks scratches to piston and/or brake housing bore in area of seal/sealing lips	Clean, smooth, rework or replace affected parts.
	External leak	Loosened bleeder screw	Tighten bleeder screw to 2 ~ 2.7 kgf·m (14.5 ~ 19.6 lbf·ft).
		Loosened inlet fitting or plugs	Tighten inlet fitting to 3.4 ~ 4.8 kgf·m (24.7 ~ 34.8 lbf·ft).
		Damaged inlet fitting or plugs or damaged seats	Replace inlet fitting or plug and o-ring if used.