

SECTION 3 POWER TRAIN SYSTEM

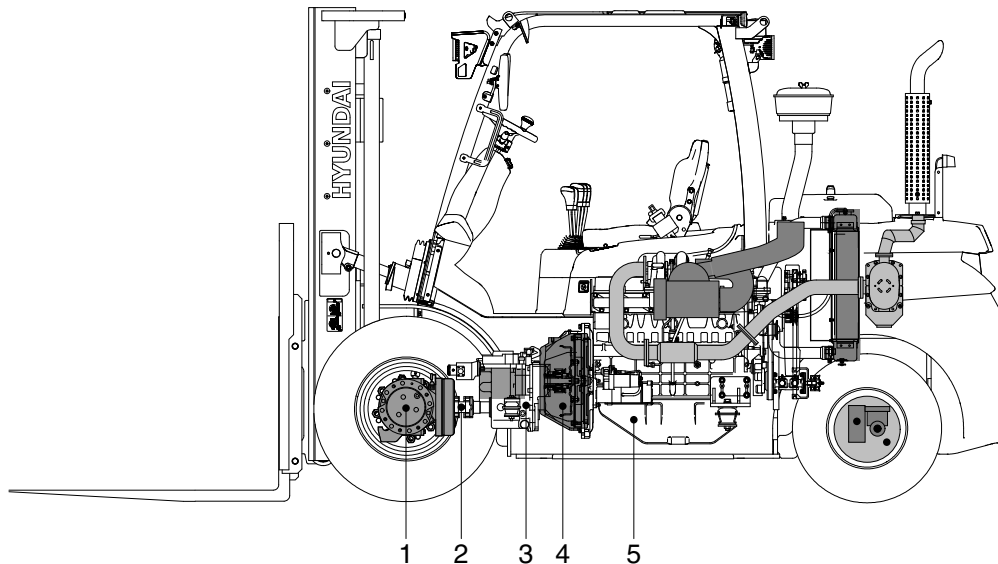
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SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

1. POWER TRAIN COMPONENT OVERVIEW

1) STRUCTURE



- | | | | | | |
|---|-------------|---|------------------|---|--------|
| 1 | Drive axle | 3 | Transmission | 5 | Engine |
| 2 | Drive shaft | 4 | Torque converter | | |

2) OPERATION

Power train system consists of engine (5), torque converter (4), transmission (3), drive shaft (2), drive axle (1).

Engine power is transmitted to the transmission (3) through the torque converter (4).

Transmission (3) which operates as a type of regularly and continuously engaged counter shaft shifting by 1 stage both forward and reverse consists of 4 hydraulic clutch packs.

Clutch piston is released by tension of spring.

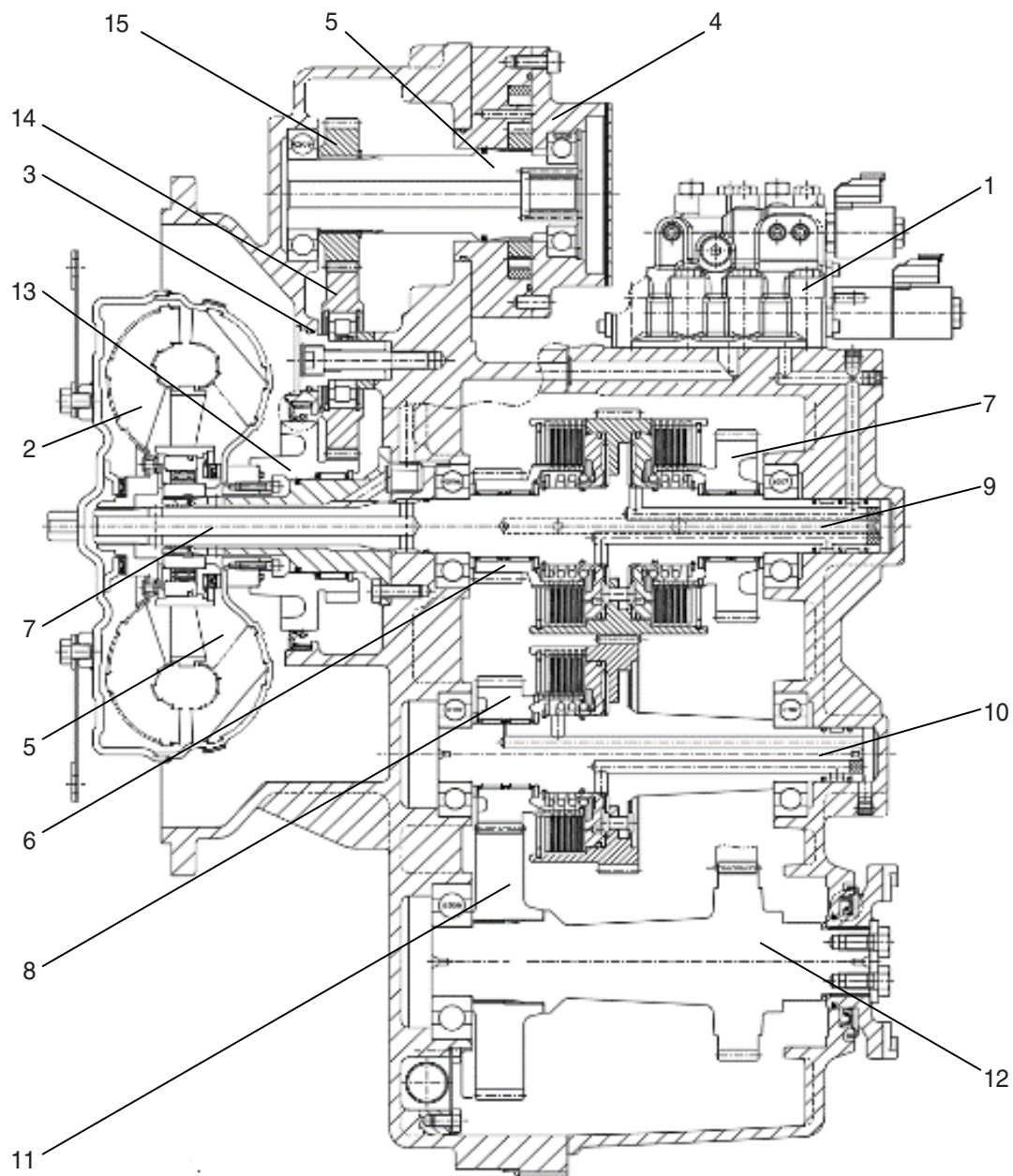
The power is transmitted to spiral gear and bevel gear set of differential through the output gear and then goes to the drive wheel via drive axle.

3) SPECIFICATION

Item		Specification
Torque converter	Model	KAPEC 2.25
	Type	3 Element, 1 stage, 2 phase
	Stall ratio	2.25 : 1
Transmission	Type	Power shift
	Gear shift(FWD/REV)	2/1
	Control	Electrical single lever type
	Overhaul ratio	FWD 1st : 2.667 2nd : 1.024
		REV 1.838
Drive axle	Type	Front-wheel drive type, fixed location
	Gear	Spiral bevel gear type
Brakes	Travel	Front wheel, wet disk brake
	Parking	SAHR (Spring Actuate Hydraulic Release) type

2. TRANSMISSION

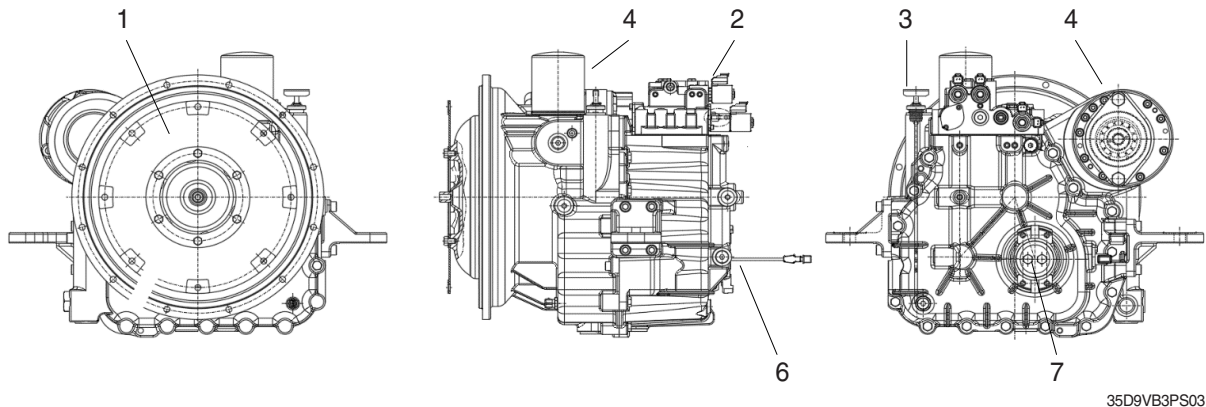
1) STRUCTURE



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|--------------------|---------------------------|--------------------|
| 1 Control valve | 6 Forward 1st clutch gear | 11 Output gear |
| 2 Torque converter | 7 Forward 2nd clutch gear | 12 Output shaft |
| 3 PTO shaft | 8 Reverse clutch gear | 13 PTO input gear |
| 4 Oil pump | 9 Forward clutch pack | 14 PTO idle gear |
| 5 PTO pump shaft | 10 Reverse clutch pack | 15 PTO output gear |

2) INSTALLATION VIEW



- | | | | | | |
|---|------------------|---|-----------------------------|---|--------------|
| 1 | Torque converter | 3 | Oil level pipe and dipstick | 5 | Flange yoke |
| 2 | Control valve | 4 | Oil filter | 6 | Speed sensor |

3) OPERATION

(1) Torque converter

① Converter equipment

The torque converter is an automatic fluid drive. It transmits engine torque by means of hydraulic force. The torque converter leads and the power which is delivered rotated the charging pump. Oil is drawn form the transmission reservoir by the charging pump. The pump delivers its entire output to a full-flow oil filter for cleaning. From the oil filter, the oil supply is sent to the control valve.

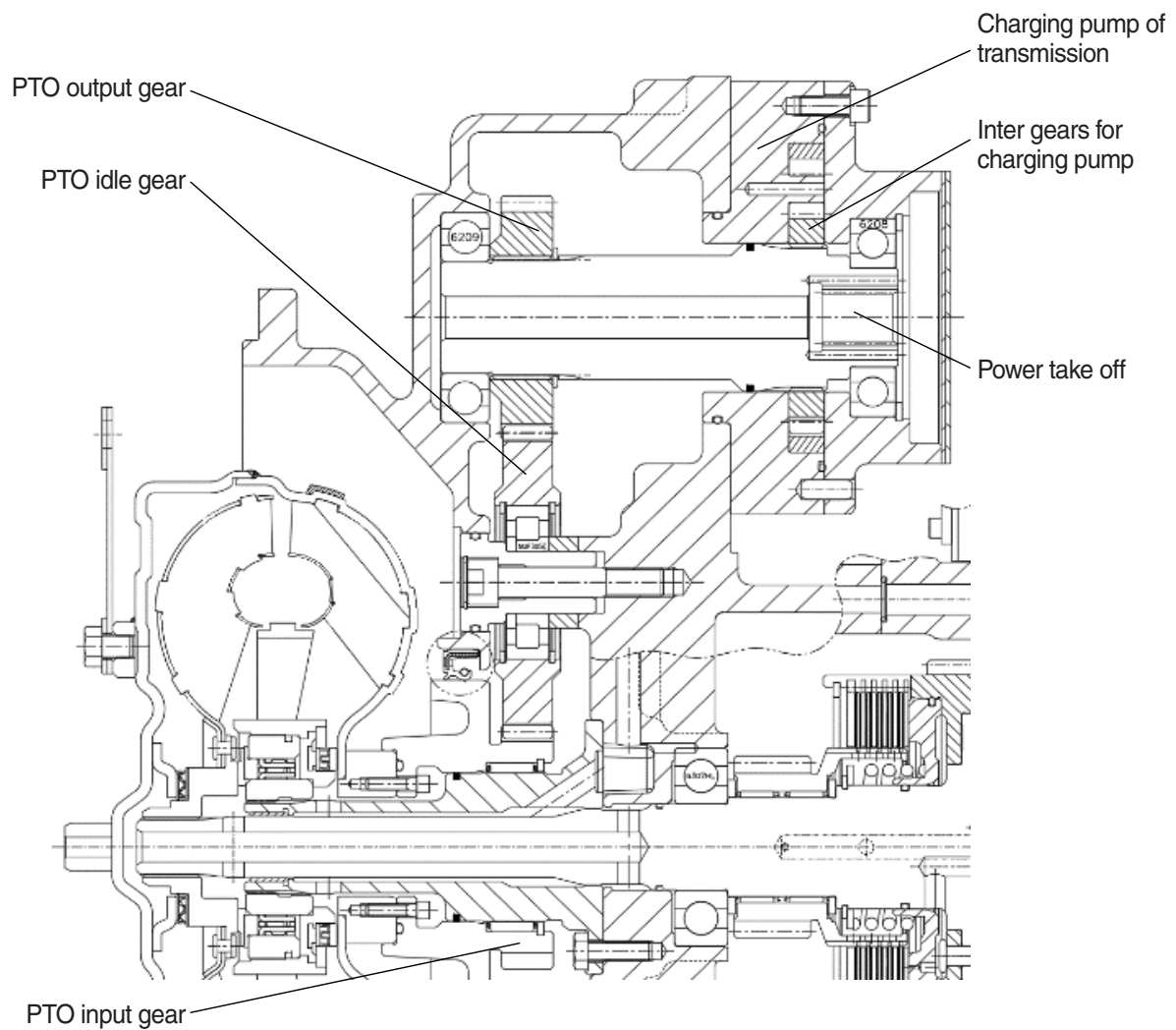
The main pressure regulator valve provides pressure for clutch pack, directs oil to the solenoid valve. Moving the solenoid valve allows oil to charge the selected (forward or reverse) clutch line and to engage that clutch.

The remaining oil appropriating clutch pressure flows into the torque converter, A converter pressure regulator valve in the converter-in line limits the oil pressure there. {The oil pressure input to the torque converter is adjusted 3~7 kgf/cm² (42.7~64 psi).} {The oil pressure output from the torque converter is adjusted below 1~4 kgf/cm² (14.2~64 psi).} The toeque converter is continuously filled with oil during operation, Rotation of the converter impeller imparts energy to the oil which, is turn, drives the turbines. The oil then flows between the stator vane which redirect it to the impeller. At thist time, torque is increased.

The oil from the torque converter enters the cooler, The cooler is a heat exchanger in which the oil flows through air cooled passages. Ater refrigerated, it is in charge of clutch lubrication through the lubrication oil pach of the clutch shaft. A lubrication valve between the cooler and lubrication system returns all excess oil to the transmission reservoir.

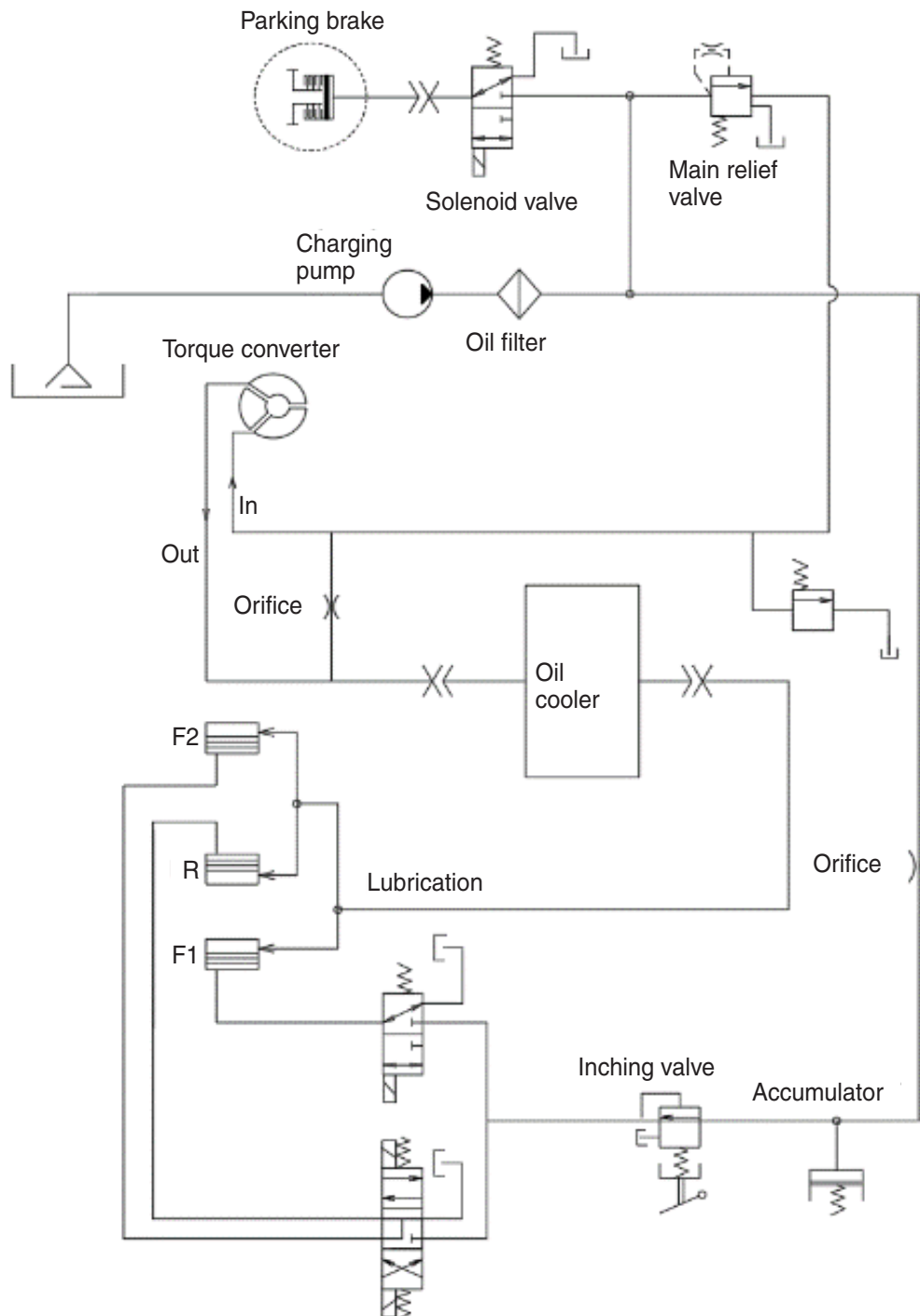
② Pump drive device

There is pump device beside torque converter as below picture which is for charging pump of transmission and power take off (PTO).



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4) HYDRAULIC CIRCUIT

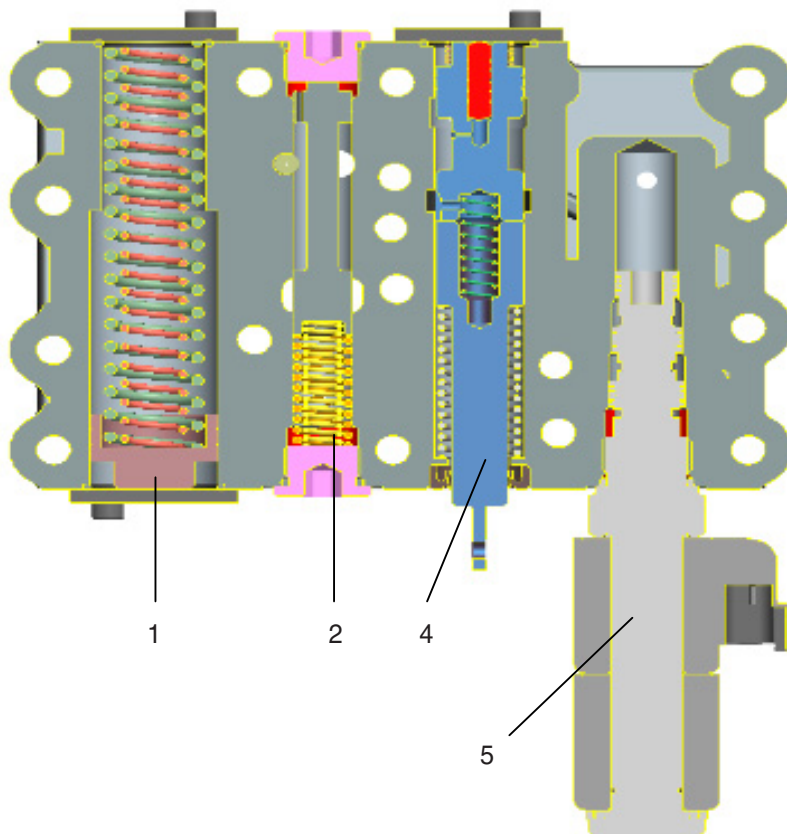
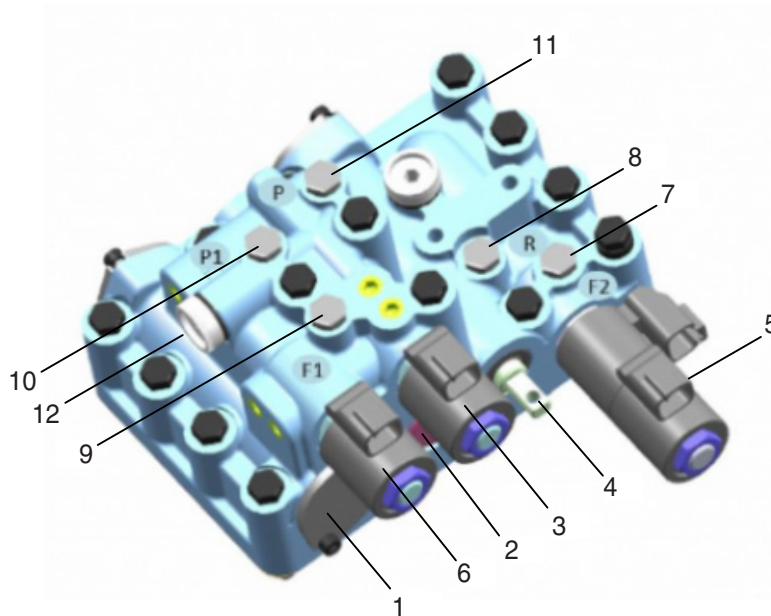


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- (1) The oil that is pumped up through the strainer from the oil pump of transmission by charging pump of transmission. And this oil is sent to Torque converter through the relief valve for the main pressure of hydraulic clutches.
- (2) The oil that is sent to torque converter flows between the turbine shaft and Inner race of free wheel, and flows into the circuit of converter through the space between stator wheel and turbine wheel.
- (3) The oil which is drained from torque converter is cooled by the external cooler of the vehicle. And this cooled oil lubricates and cools each parts of Transmission like bearings, clutches and so on.

5) CONTORL VALVE

(1) Structure



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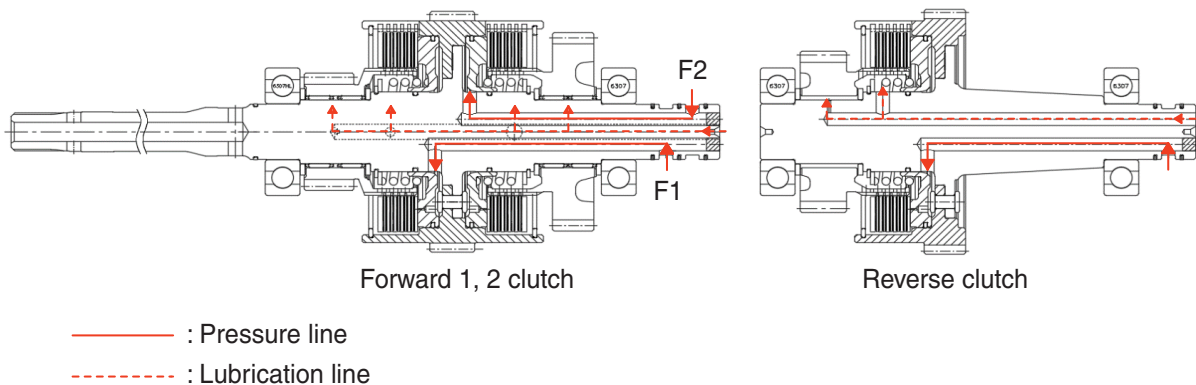
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|---|----------------------------|----|---|
| 1 | Modulation | 7 | For. 2 clutch pressure check port |
| 2 | Main relief | 8 | Rev. clutch pressure check port |
| 3 | Parking solenoid valve | 9 | For. 1 clutch pressure check port |
| 4 | Inching spool | 10 | Parking pressure check port |
| 5 | For 2, rev. solenoid valve | 11 | Main pressure check port |
| 6 | For 1. solenoid valve | 12 | Outlet port for releasing parking brake |

(2) Assembly

Control valve assembly contains main relief valve for regulating pressure of hydraulic clutch assembly, inching valve for adjusting clutch pressure, accumulator valve for rising up clutch pressure smoothly, solenoid valves for selecting direction (F1, F2 & R) and controlling parking brake.

Structure	Operation
Main relief valve	This valve regulates the clutch pressure stably.
Inching valve	This valve adjusts the pressure of clutch through the controlling Inching pedal.
Accumulator valve	This valve adjusts the pressure of clutch for smooth start when the operator wants to move and change the direction.
Solenoid valve for direction (F&R)	These valve control the oil flow for moving forward 1, 2 & reverse through voltage signal which is given by direction selector.
Solenoid valve for parking	This valve control the oil flow for applying and releasing parking brake.

6) CLUTCH



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(1) Summary

- ① This transmission consists of the forward and reverse shift equipments which is the wet multipic disc type of hydraulic clutch.
- ② There are 7 discs per each clutch which is made by carbon paper.

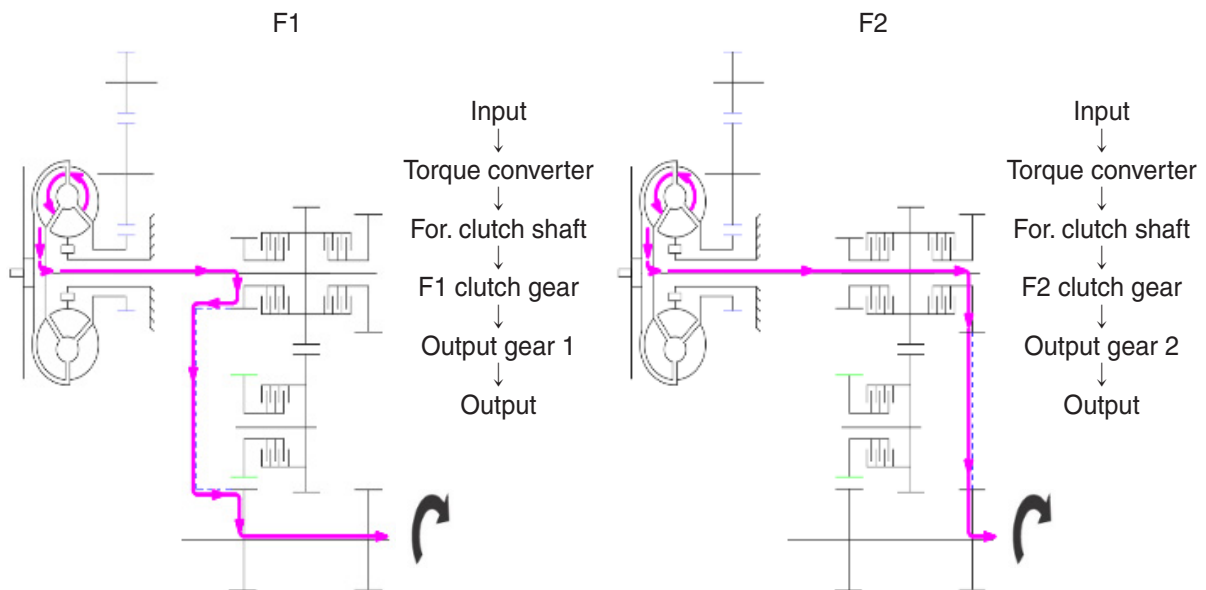
(2) Clutch shifting

- ① The explain of shift is represented in case of the shift "N (neutral) → F or R" in the vehicle.
- ② F & R solenoid valve become "ON" by voltage signal which is given by gear selector on the vehicle.
- ③ The hydraulic oil that is charged in accumulator valve discharges to the clutch port, and the port is filled.
- ④ After the filling of the port concludes, the oil that comes through the orifice "A" presses the piston of the accumulator slowly. And the clutch is engaged by the prescribed characteristic of pressure up, and the shock in clutch engagement is relieved.

- ⑤ When the clutch engagement concludes and the hydraulic oil becomes regular pressure.
- ⑥ The hydraulic oil in the piston room presses the piston, and make the steel plates and the friction plates stick strongly against the force of the return spring.
- ⑦ Therefore the torque that is transmitted to the clutch shaft assembly transmits to the reduction gears.

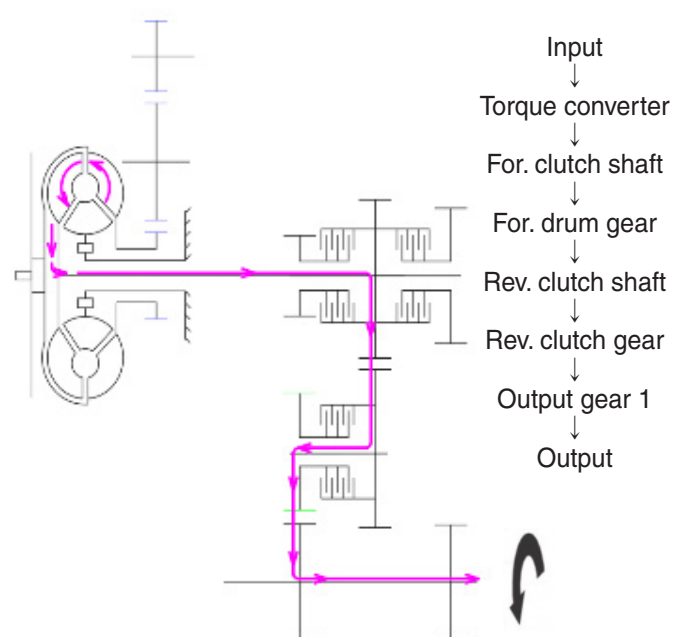
7) POWER FLOW

(1) Forward 1, 2



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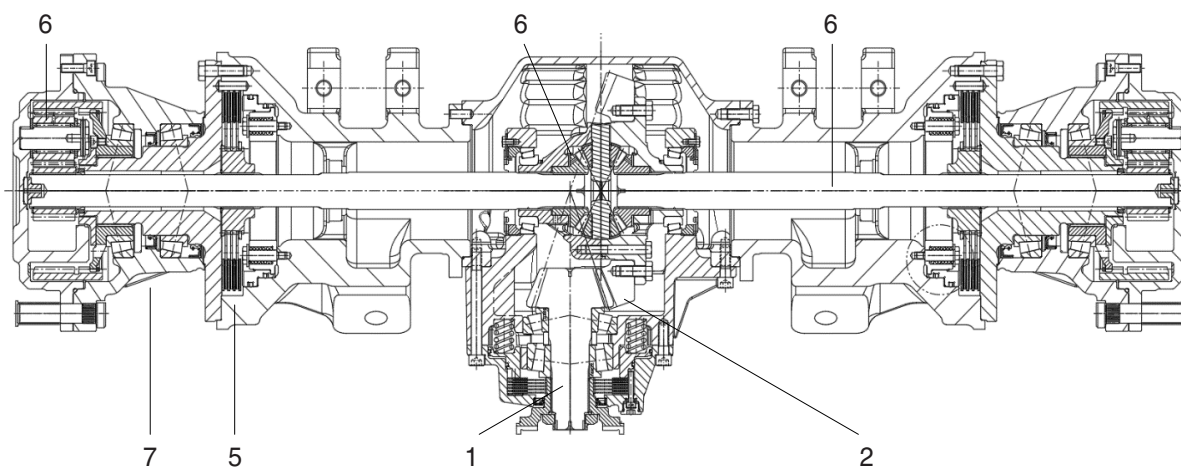
(2) Reverse



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3. DRIVE AXLE

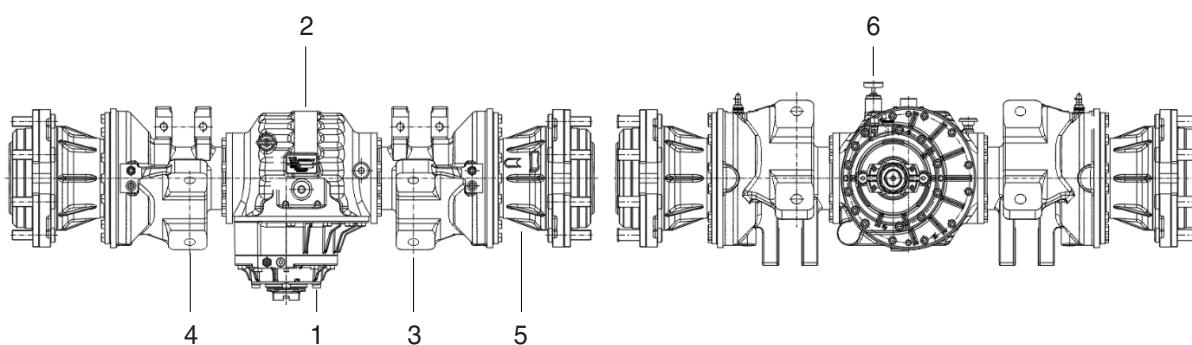
1) STRUCTURE



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

2) INSTALLATION VIEW

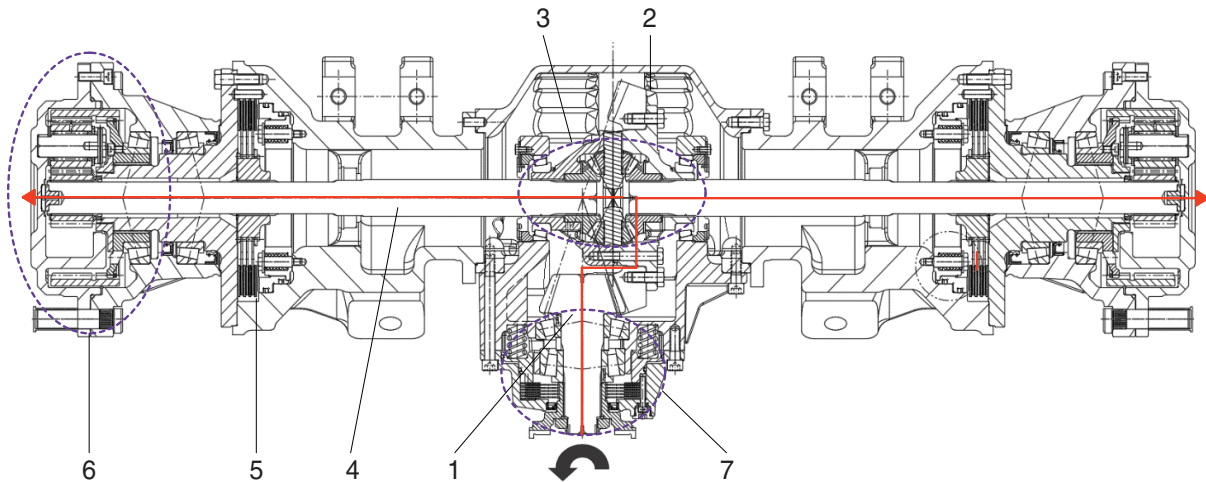


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|------------------------------|-----------|-------------------|
| 1 Input carrier sub assembly | 3 Beam RH | 5 Hub |
| 2 Axle housing | 4 Beam LH | 6 Oil level gauge |

3) 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.

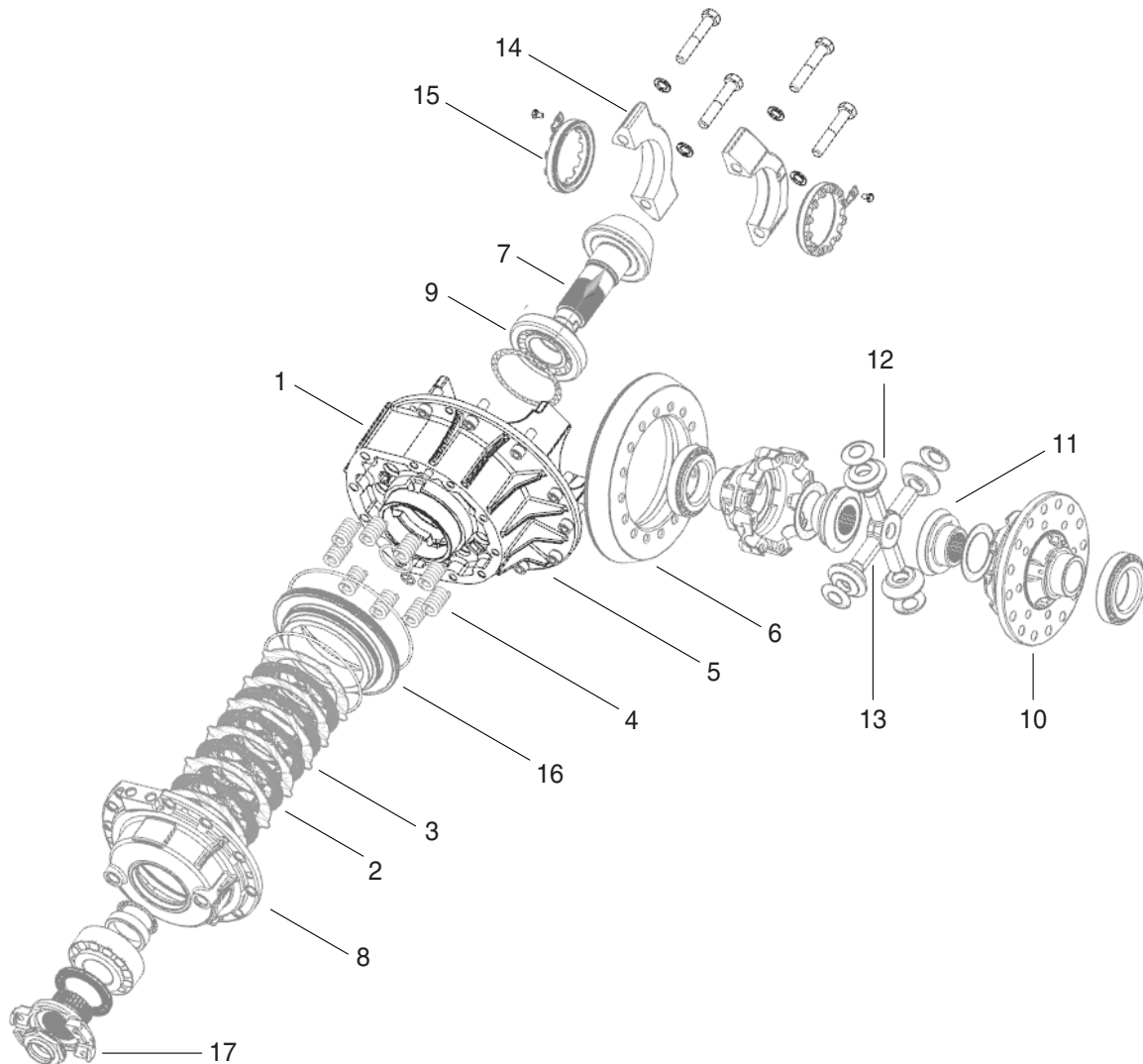


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|---|---------------------|---|---------------|---|----------------------|
| 1 | Pinion shaft | 4 | Axle shaft | 7 | Parking brake device |
| 2 | Ring gear | 5 | Service brake | | |
| 3 | Differential device | 6 | Hub reduction | | |

4) Input carrier sub assembly

(1) Structure



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- | | | |
|------------------|----------------------|-------------------------|
| 1 Pin-parallel | 7 Pinion shaft | 13 Spider |
| 2 Clutch disk | 8 Parking cover | 14 Carrier cap |
| 3 Opposing plate | 9 T/R bearing | 15 Adjust screw |
| 4 Return spring | 10 Diff. case | 16 Parking brake piston |
| 5 Input case | 11 Diff. side gear | 17 Flange yoke |
| 6 Ring gear | 12 Diff. pinion gear | |

(2) Performance property

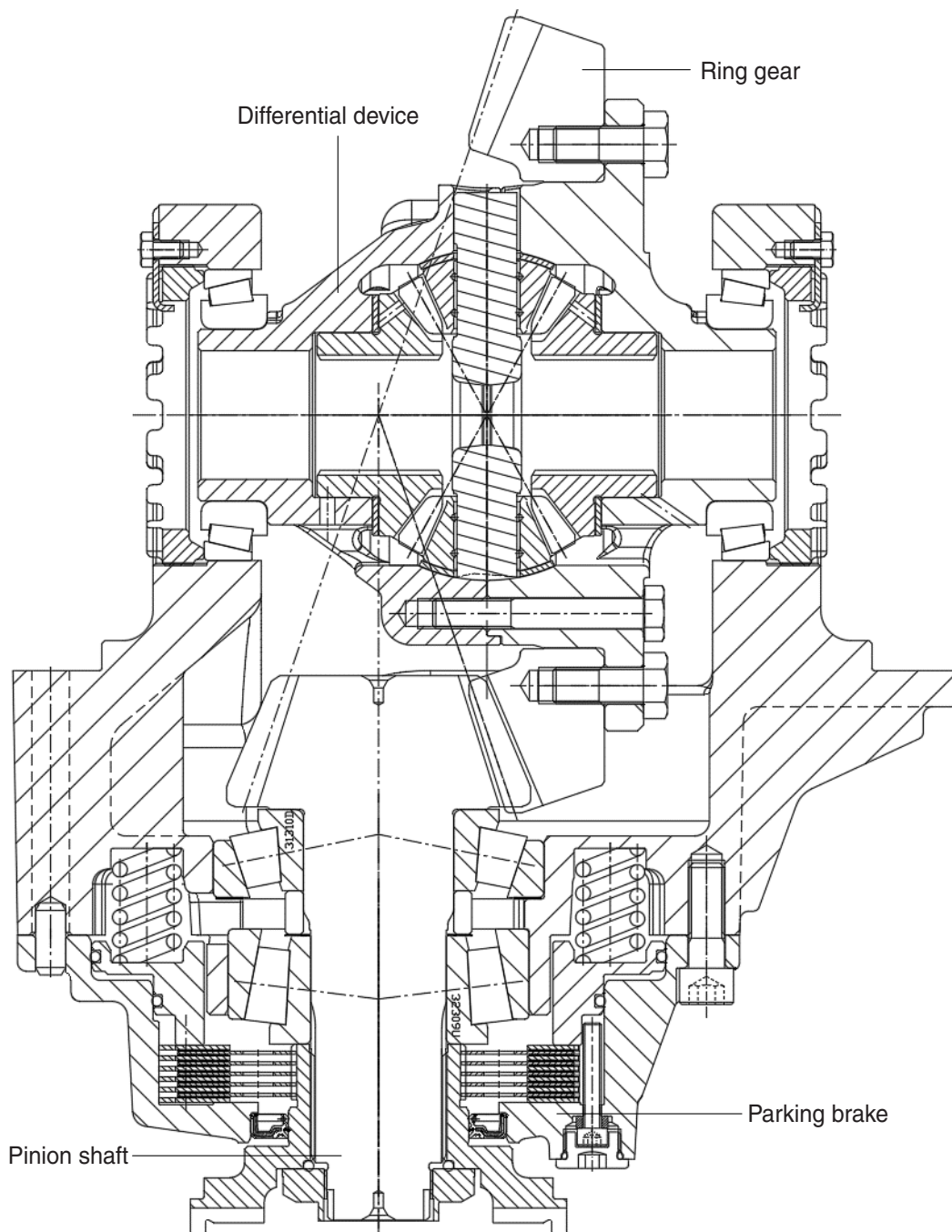
Input carrier sub assembly includes differential device and parking brake.

The pinion shaft is supported by the taper roller bearing in the carrier case and the bolt at the end of pinion shaft and transfers the power which is delivered from the drive shaft assembly to the ring gear assembled from bolts at a differential device.

This power makes the differential device run.

Since the differential device is connected with an axle shaft and a spindle, the power transferred to differential device is delivered to final drive through the axle shaft.

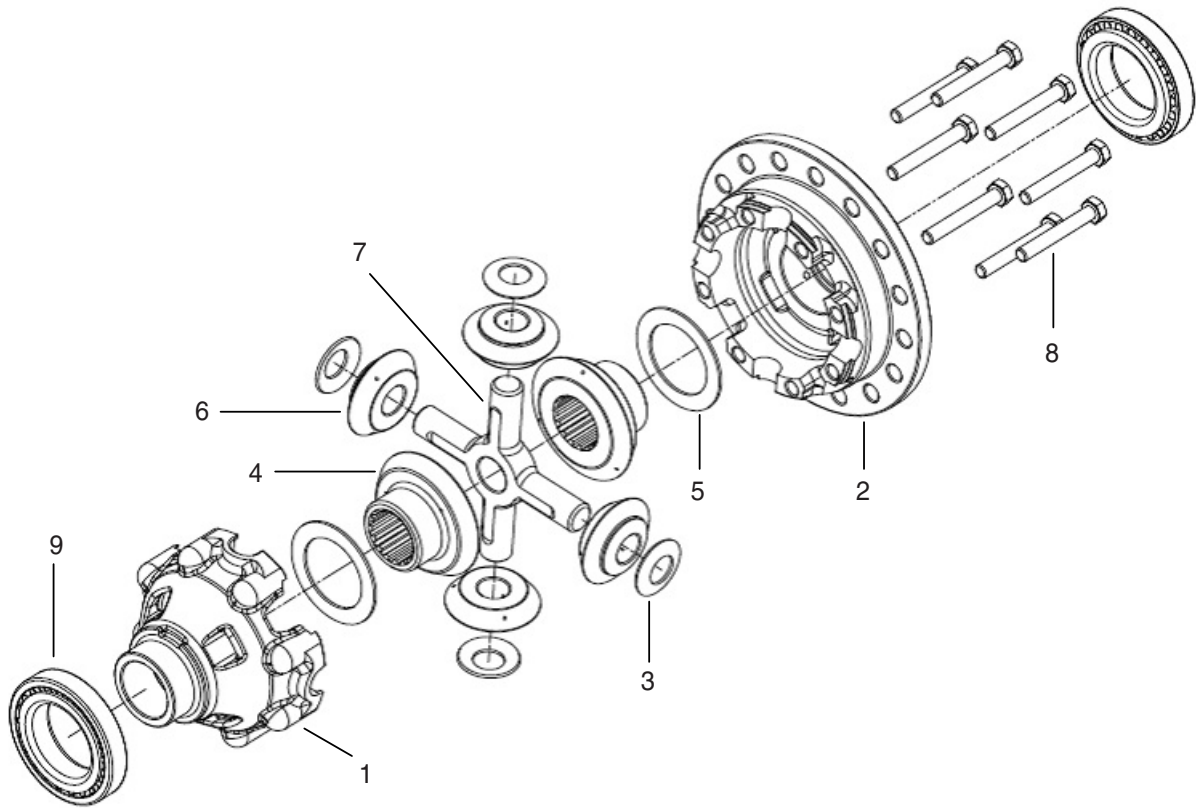
Parking brake, like as traveling brake system is consists of several friction plate functions braking by sticking to each friction plate when pull parking had hand lever.



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4) Differential sub assembly

(1) Structure



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- | | | | | | |
|---|---------------|---|------------------|----|-------------|
| 1 | Diff case RH | 4 | Diff side gear | 13 | Spider |
| 2 | Diff case LH | 5 | Thrust washer | 14 | Hex bolt |
| 3 | Thrust washer | 6 | Diff pinion gear | 15 | T/R bearing |

(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.

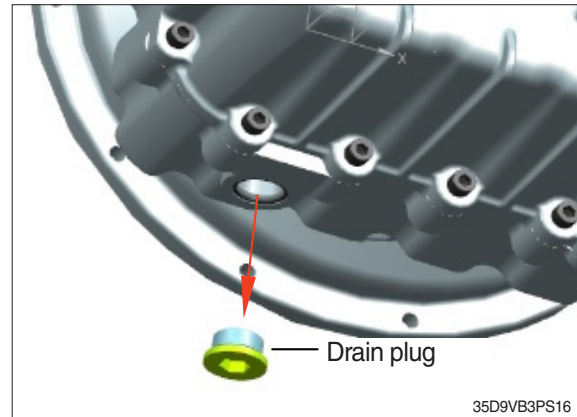
If the load concerning in the left and right of the final drive is different, the shock is transferred to the drive axle, the differential gear in the differential device runs, the power transferred to the differential device adjusts the delivering rate to the left and right axle shaft. Consequently,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

GROUP 2 DISASSEMBLY AND ASSEMBLY

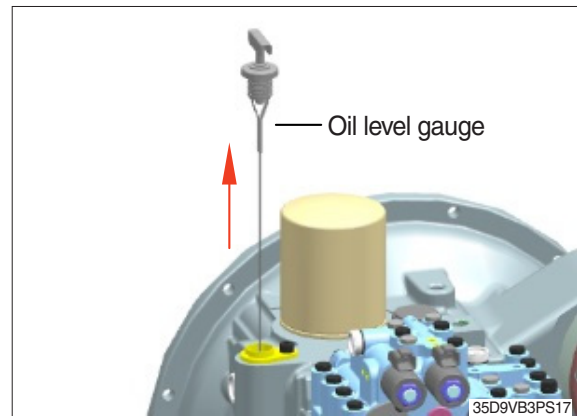
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION

- (1) Discharge transmission oil. Disassemble drain plug of T/C housing.

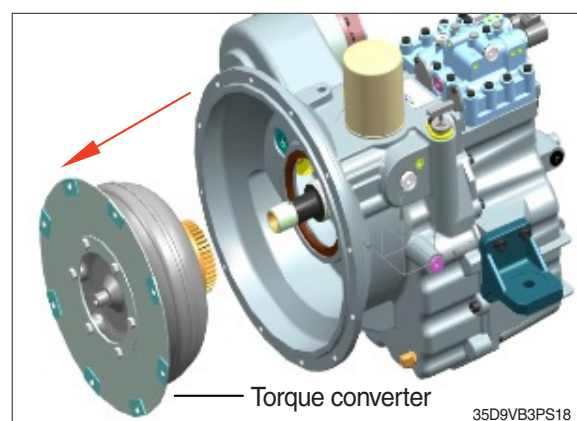


- (2) Disassemble oil level gauge. Check oil residue in T/M.

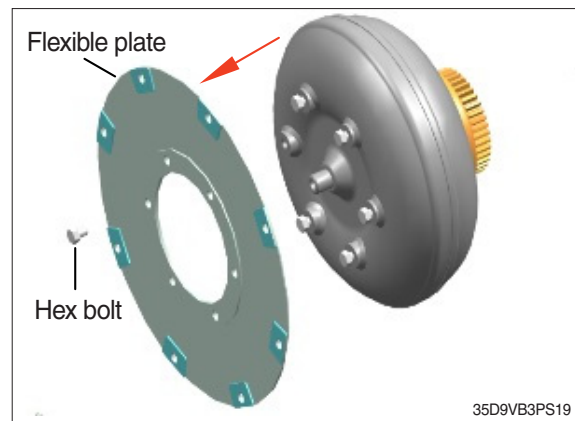


(3) Disassemble T/C part.

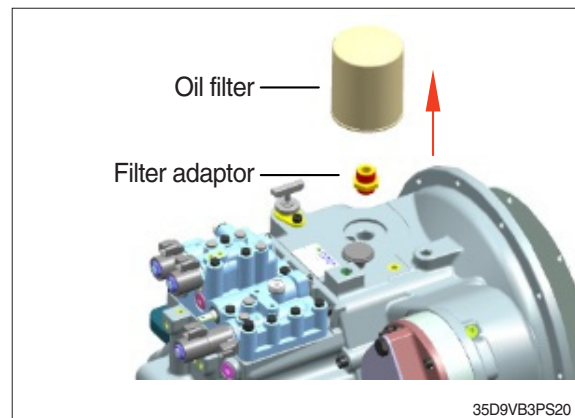
- ① Disassemble T/C sub assembly.



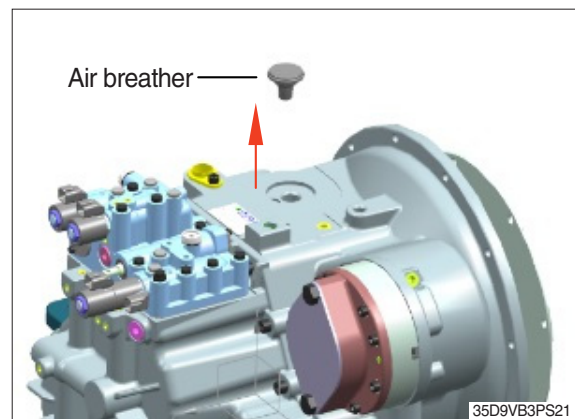
② Disassemble hex bolt and flexible plate.



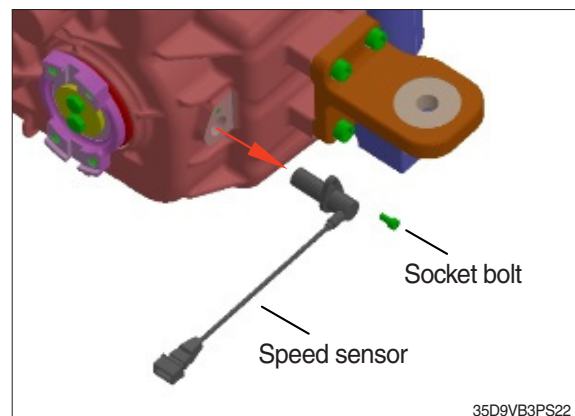
(4) Disassemble oil filter and filter adaptor.



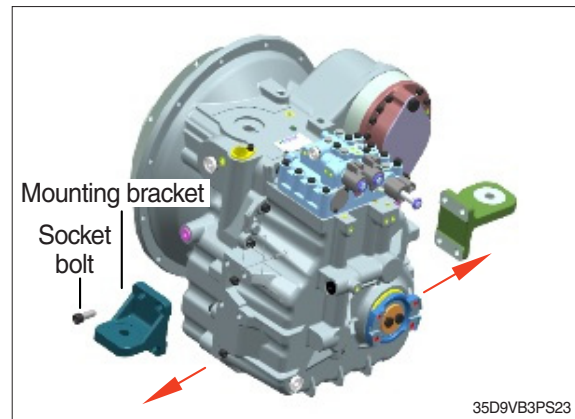
(5) Disassemble air breather.



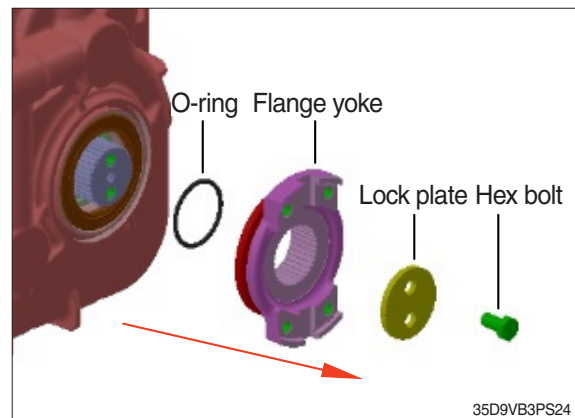
(6) Disassemble socket bolt and speed sensor.



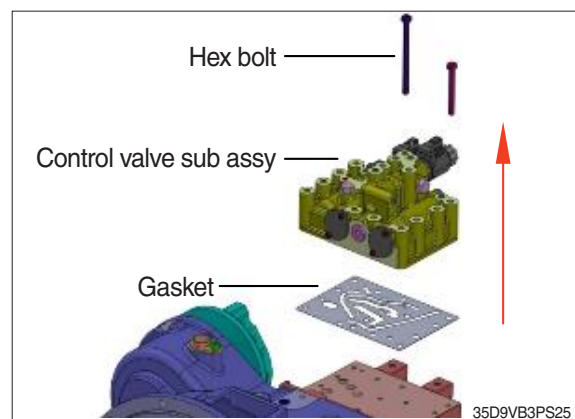
(7) Disassemble socket bolt and mounting bracket.



(8) Disassemble hex bolt, lock plate, flange yoke and o-ring.

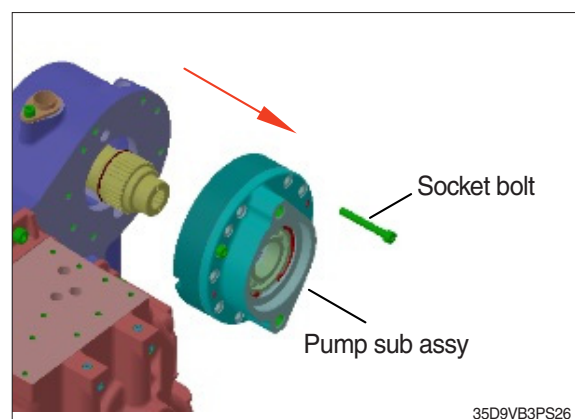


(9) Disassemble hex bolt, control valve sub assembly and gasket.

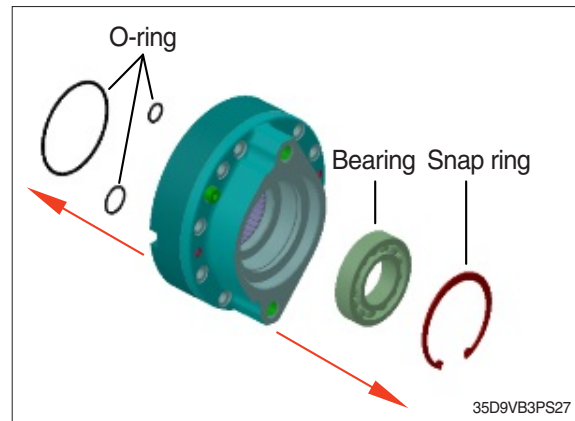


(10) Disassemble oil pump sub part.

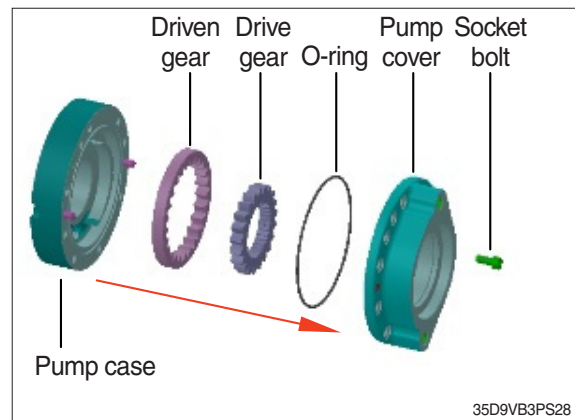
① Disassemble socket bolt and pump sub assembly.



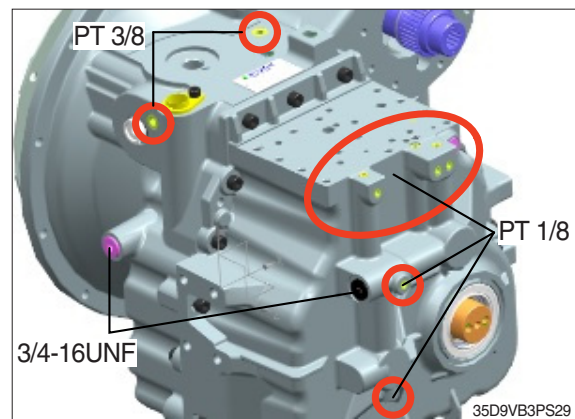
- ② Disassemble snap ring, ball bearing and o-ring (3 EA).



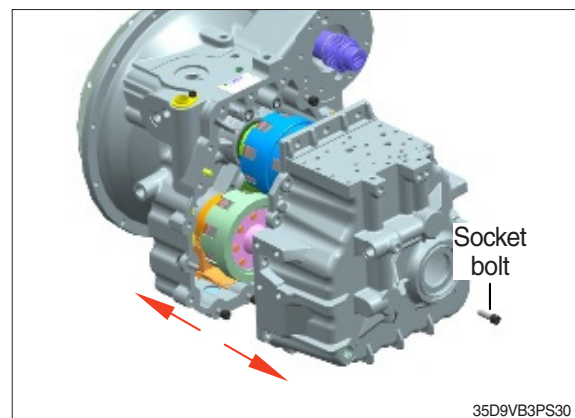
- ③ Disassemble socket bolt, o-ring, drive gear and driven gear of pump case.



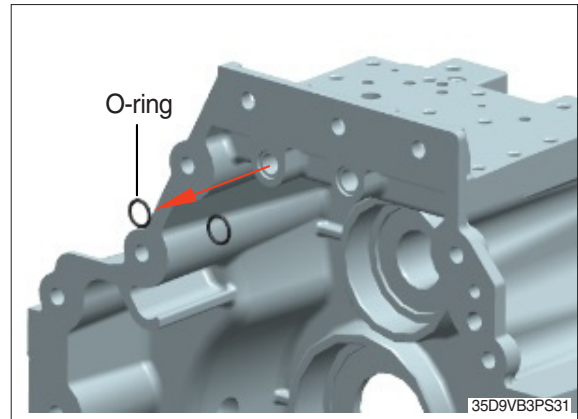
- (11) Disassemble plug.



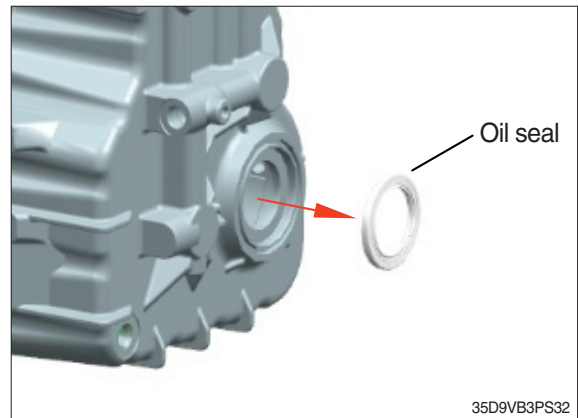
- (12) Disassemble socket bolt and T/M case of T/C housing.



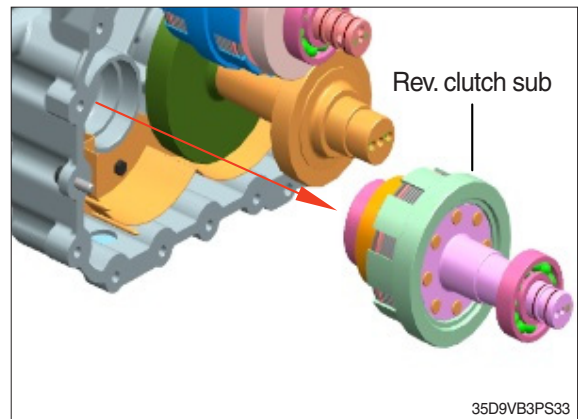
(13) Disassemble o-ring.



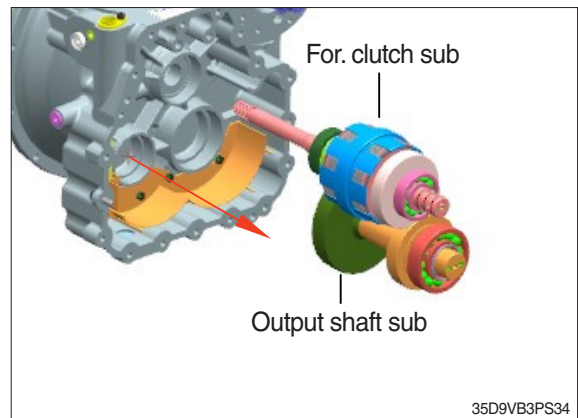
(14) Disassemble oil seal.



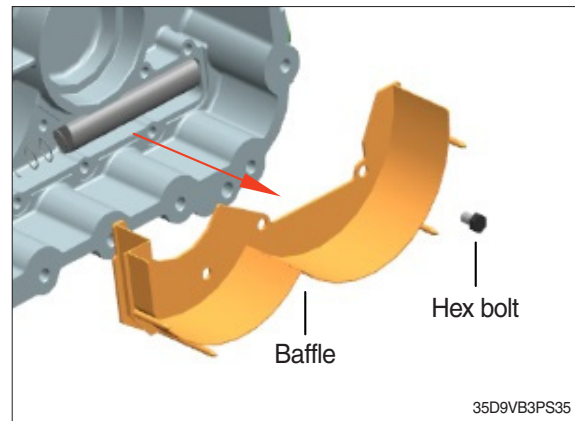
(15) Disassemble rev. clutch sub Assy.



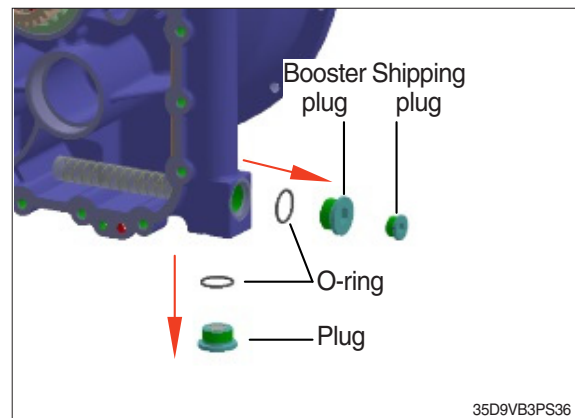
(16) Disassemble rev. clutch sub Assy and output shaft sub Assy.



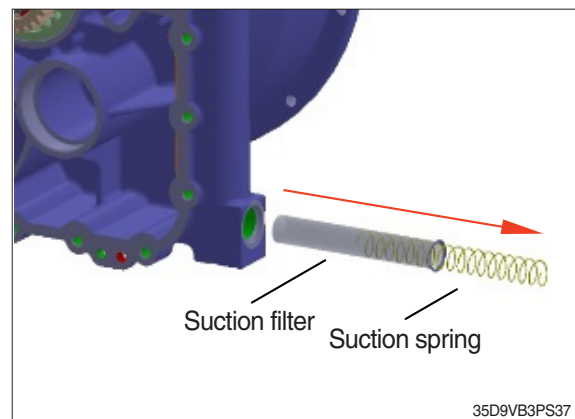
(17) Disassemble baffle and hex bolt.



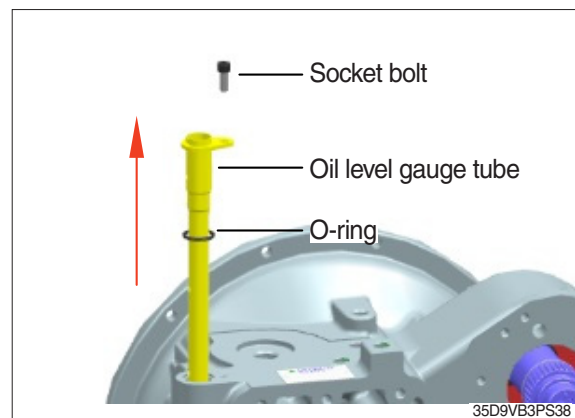
(18) Disassemble plug and o-ring.



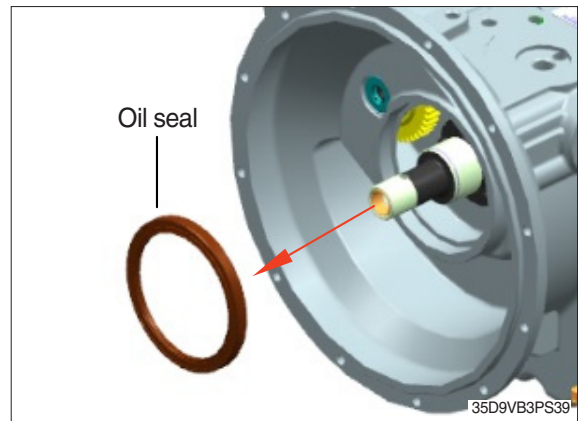
(19) Disassemble suction filter and spring.



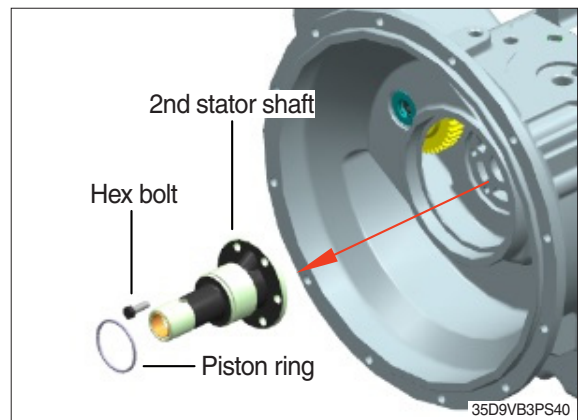
(20) Disassemble socket bolt, oil level gauge and o-ring.



(21) Disassemble oil seal.

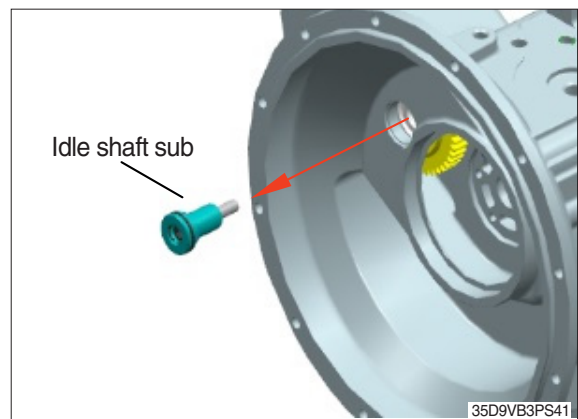


(22) Disassemble hex bolt, 2nd stator shaft and piston ring.

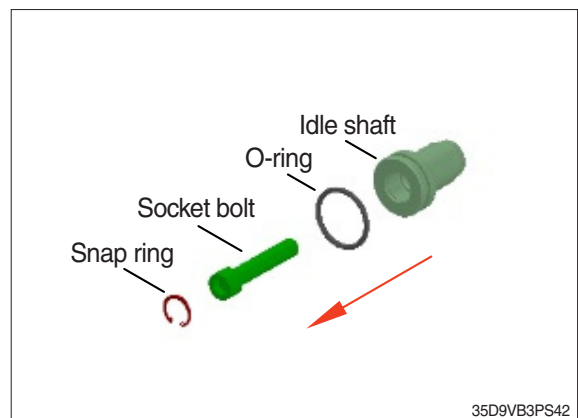


(23) Disassemble idle gear part.

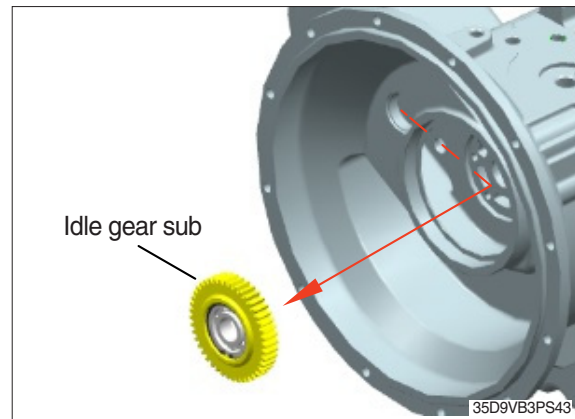
① Disassemble idle shaft sub.



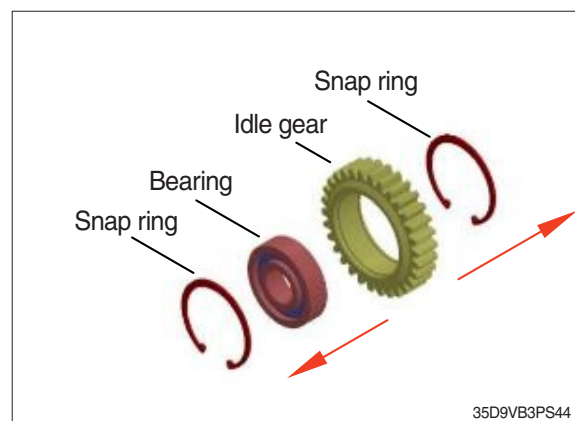
② Disassemble o-ring, snap ring of idle shaft and socket bolt.



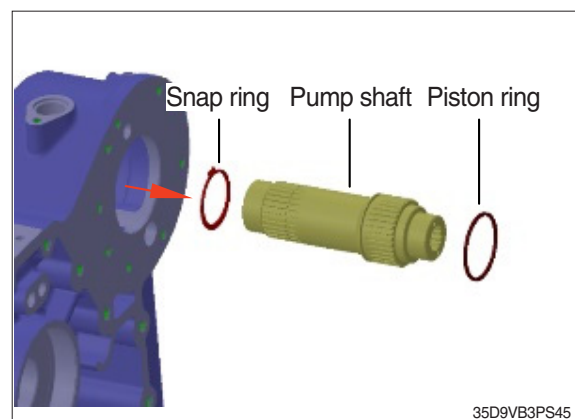
③ Disassemble idle gear sub.



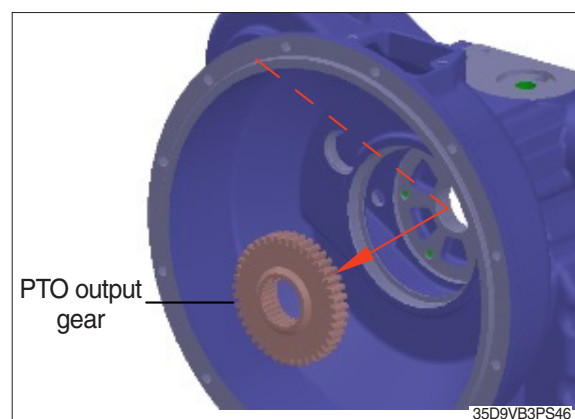
④ Disassemble snap ring of idle gear and bearing.



(24) Disassemble pump shaft and snap ring of pump shaft.

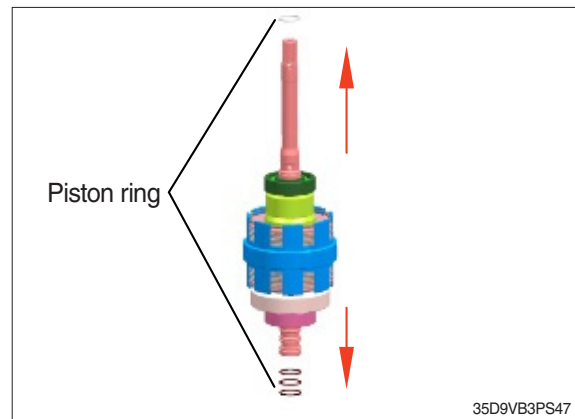


(25) Disassemble PTO output gear.

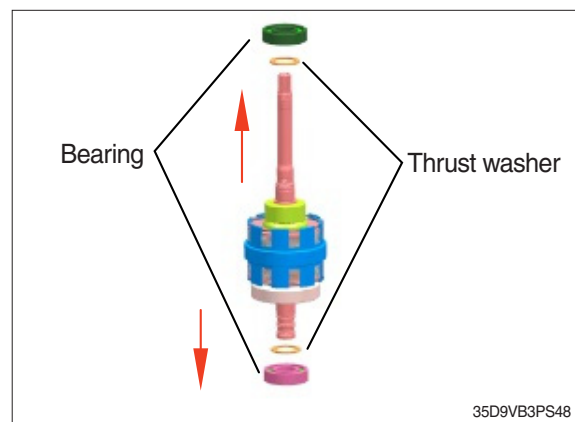


2) DISASSEMBLY OF CLUTCH SUB ASSEMBLY

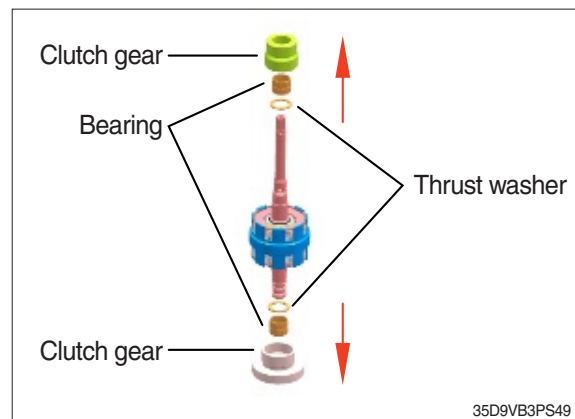
(1) Disassemble piston ring.



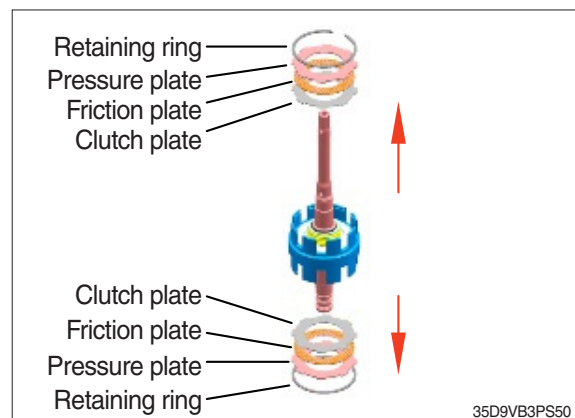
(2) Disassemble bearing and thrust washer.



(3) Disassemble clutch gear, bearing and thrust washer.

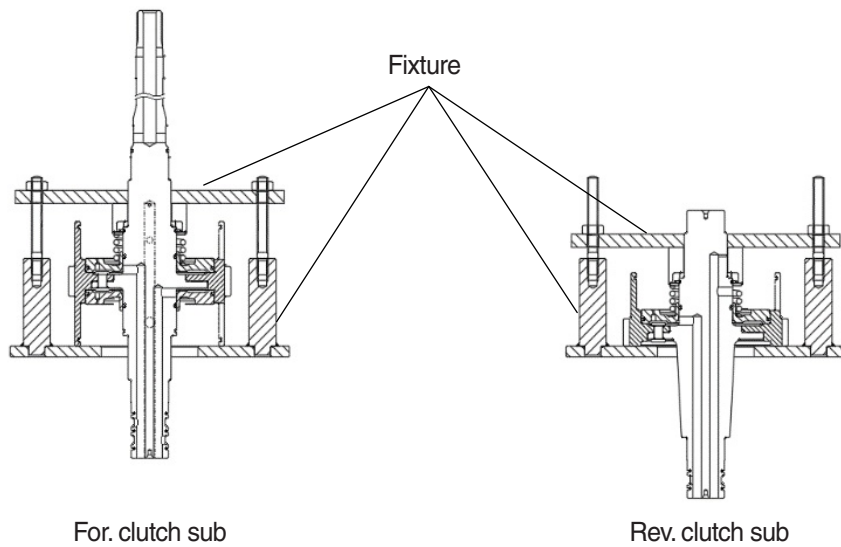
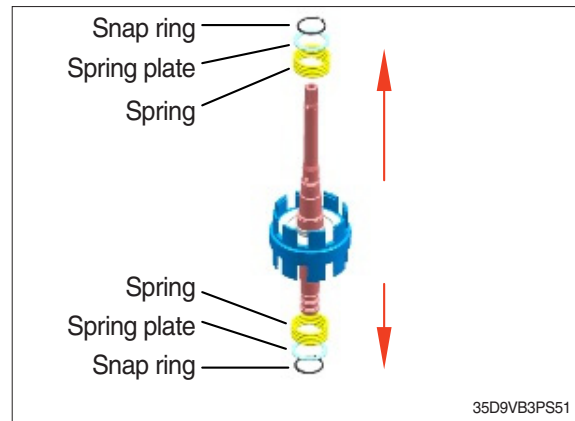


(4) Disassemble retaining ring, plate and friction plate.



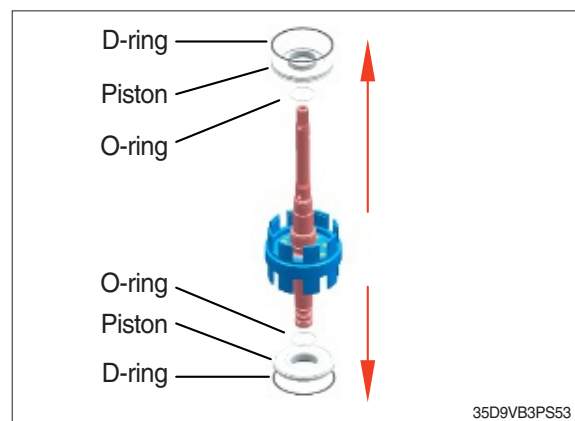
(5) Disassemble snap ring, spring plate and spring.

△ If you take out snap ring, spring should be shocked in damage. And, you should fix the spring and take out it.



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(6) Disassemble piston sub, o-ring and d-ring of piston.

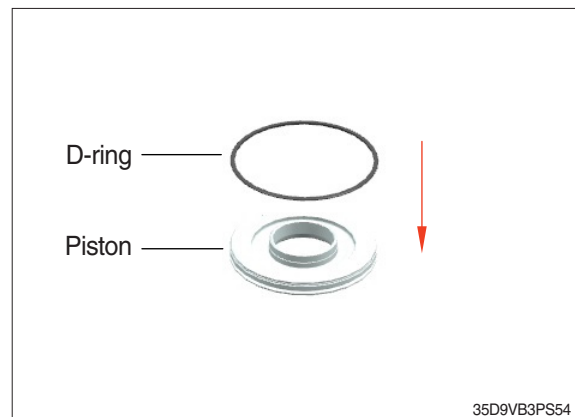


2. ASSEMBLY OF TRANSMISSION

1) ASSEMBLY OF CLUTCH SUB ASSEMBLY

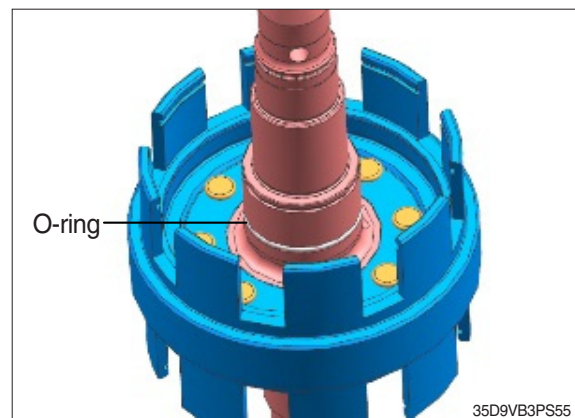
(1) Assemble d-ring.

※ **Cover T/M oil on d-ring.**

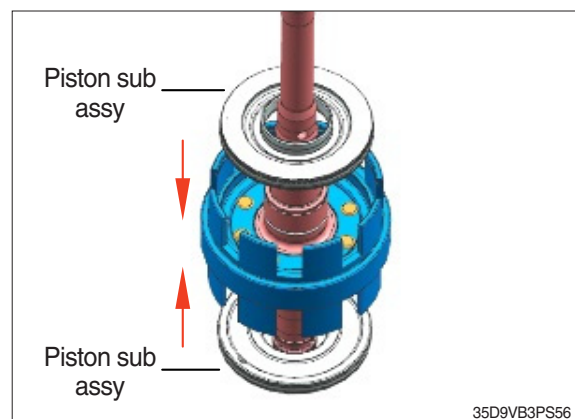


(2) Assemble piston ring on groove face of piston ring to clutch shaft.

※ **Cover T/M oil on o-ring.**

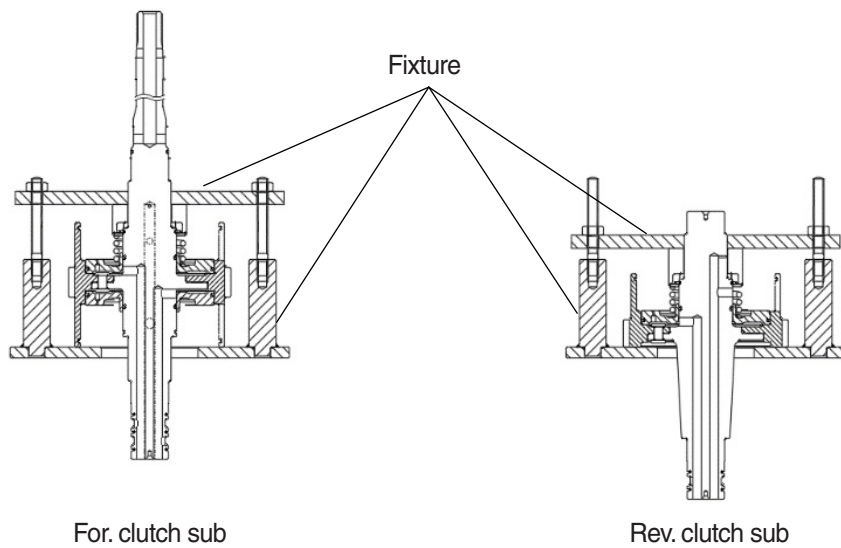
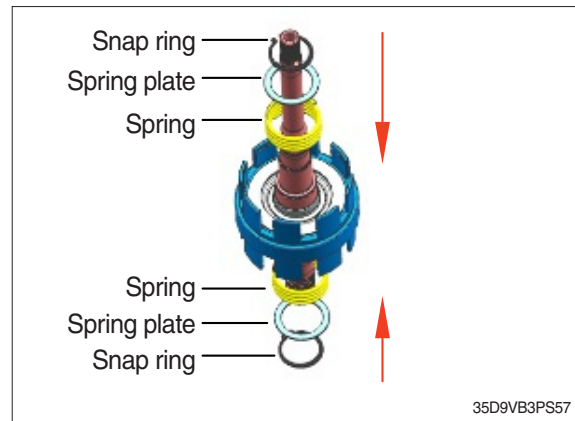


(3) Assemble piston sub assy.

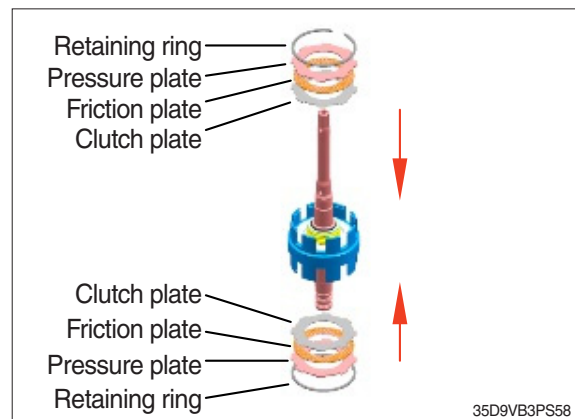


(4) Assemble spring, spring plate and snap ring.

△ If you take out snap ring, spring should be shocked in damage. And, you should fix the spring and take out it.



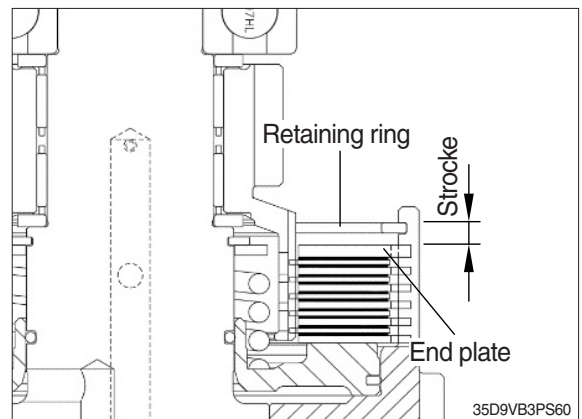
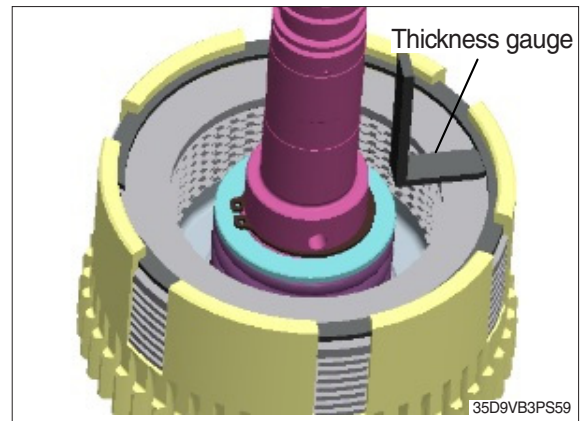
(5) Put in clutch plate, friction plate, pressure plate and retaining ring.



(6) Calculate the distance between end plate and retaining ring.

※ **Use thickness gauge.**

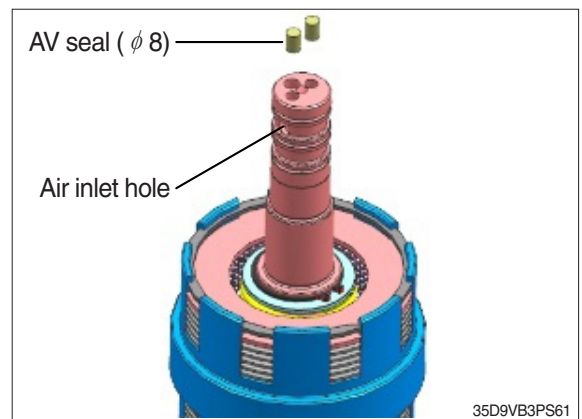
Stroke : 2.7 ~ 3.1 mm (0.11 ~ 0.12 in)



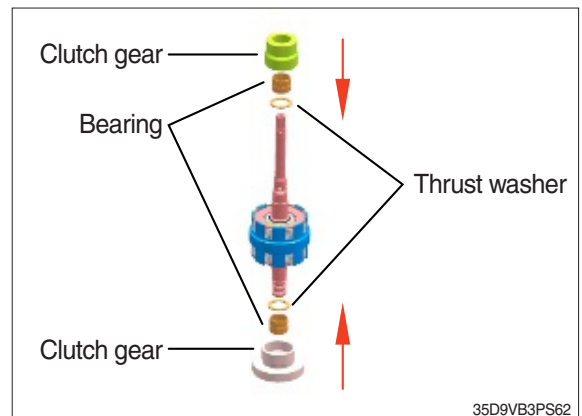
(7) Assemble AV seal.

※ **Check smooth operation of piston.**

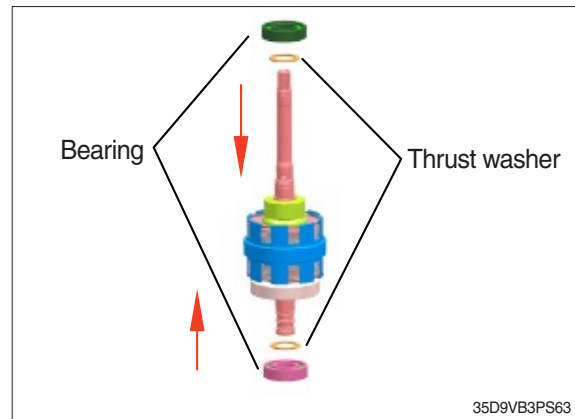
Air inject : 1.0 ~ 3.0 bar (14.5 ~ 43.5 psi)



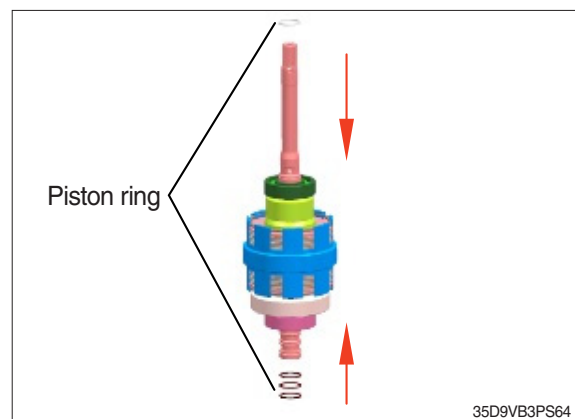
(8) Assemble clutch gear, bearing and thrust washer.



(9) Assemble thrust washer and bearing.

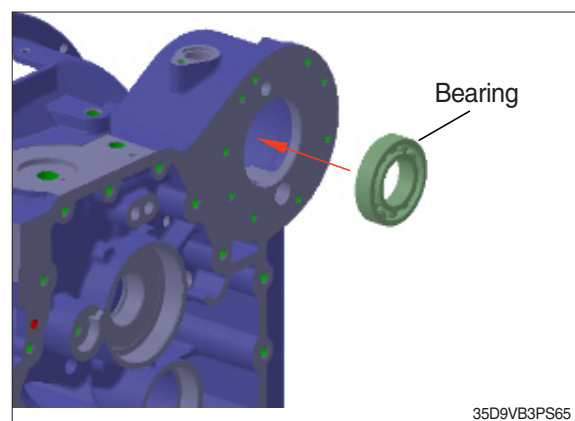


(10) Assemble piston ring.

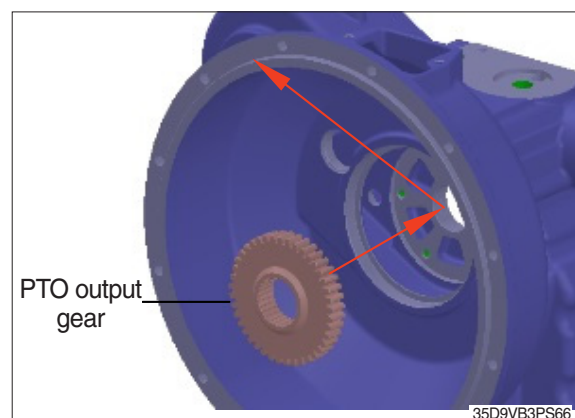


2) ASSEMBLY OF TRANSMISSION

(1) Assemble ball bearing.

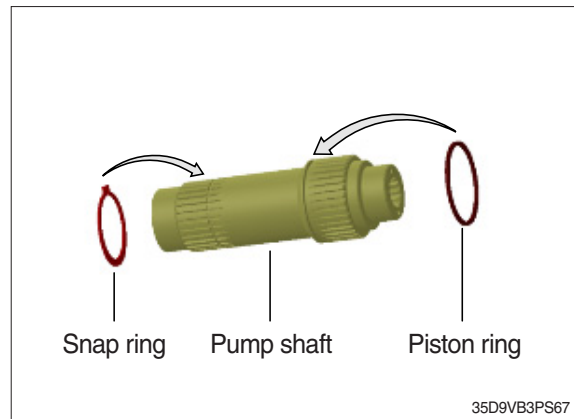


(2) Assemble clutch gear, bearing and thrust washer.

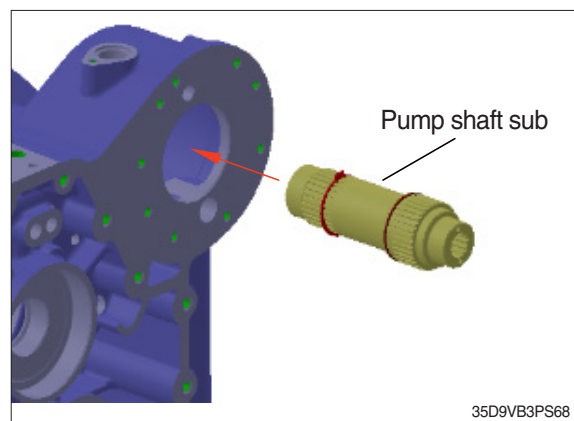


(3) Assemble pump shaft sub part.

- ① Assemble snap ring and piston ring on pump shaft.
- ※ Cover grease on piston ring.

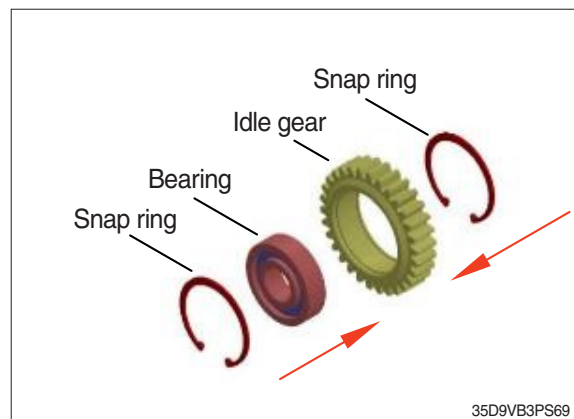


- ② Assemble pump shaft sub.

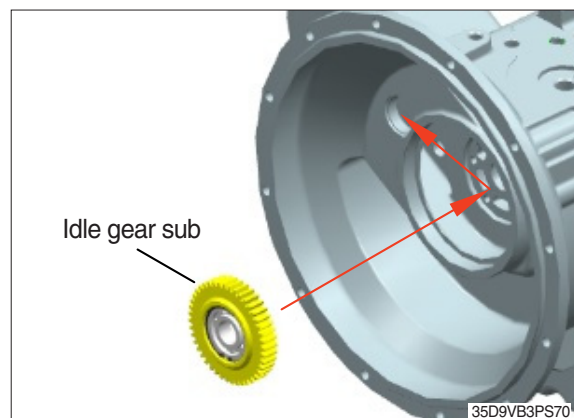


(4) Assemble idle gear sub part.

- ① Assemble bearing and snap ring on idle gear.

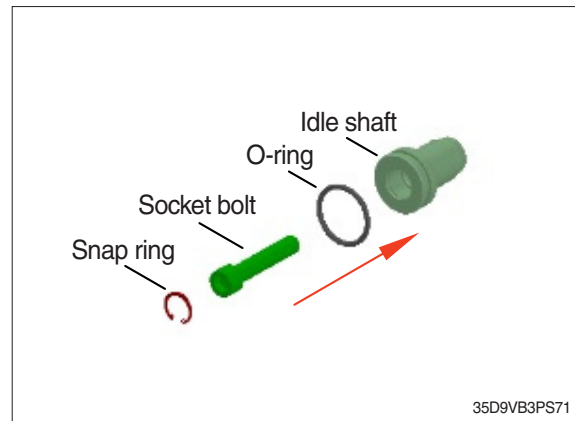


- ② Assemble idle gear sub through center hole of T/C housing.



- ③ Assemble socket bolt, snap ring on idle shaft and o-ring.

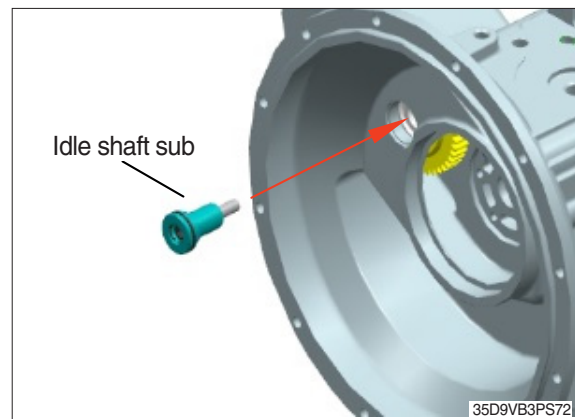
※ **Cover grease on o-ring.**



- ④ Assemble idle shaft sub.

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

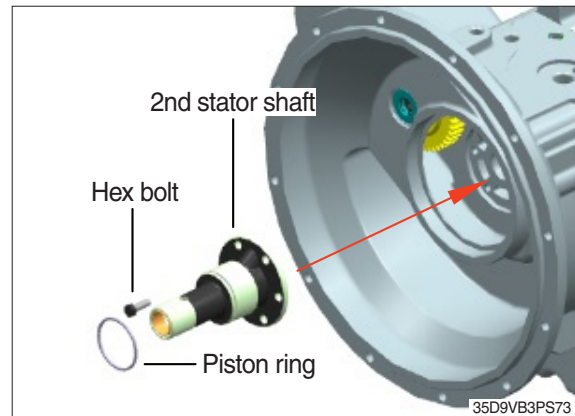
※ **Cover loctite #277 on the screw side of bolt.**



- (5) Assemble piston ring on 2nd stator shaft.
And assemble 2nd stator shaft, hex bolt and washer on T/C housing.

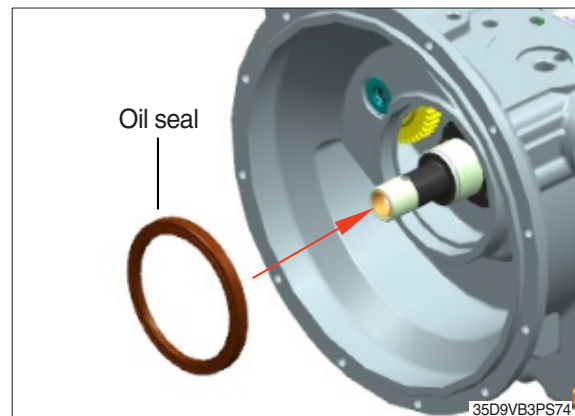
· Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt and grease on piston ring.**



- (6) Assemble oil seal.

※ **Cover loctite #592 on the side of oil seal.**

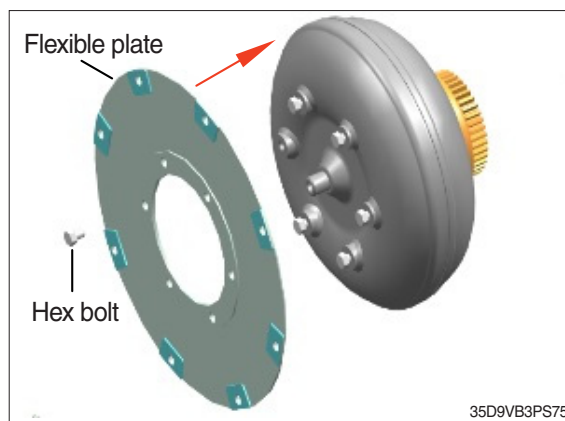


(7) Assemble T/C part.

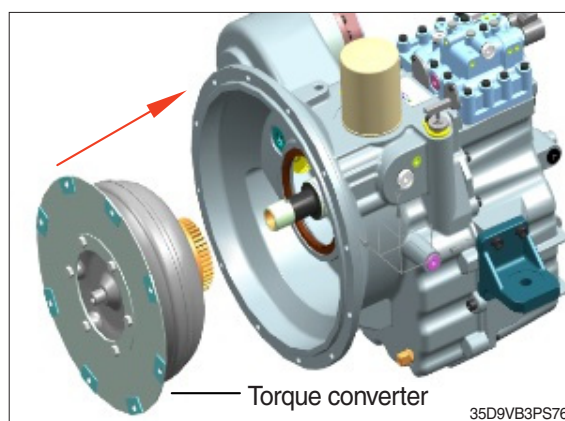
- ① Assemble flexible plate and hex bolt on torque converter.

· Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.5 lbf·ft)

※ Cover loctite #277 on the screw side of bolt.



- ② Assemble torque converter sub.



(8) Assemble oil level gauge and tube part.

- ① Assemble o-ring on oil level gauge tube.

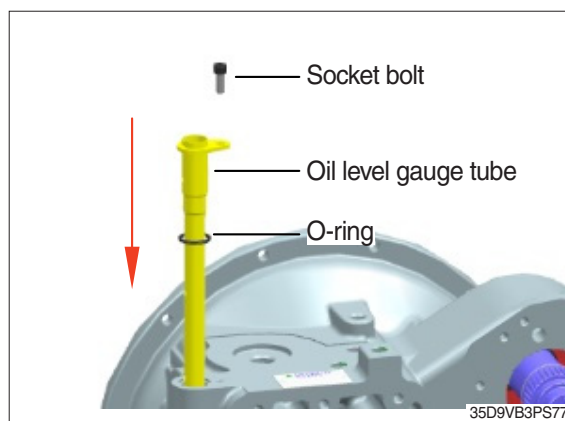
※ Cover grease on o-ring.

- ② Assemble oil level gauge tube and bolt.

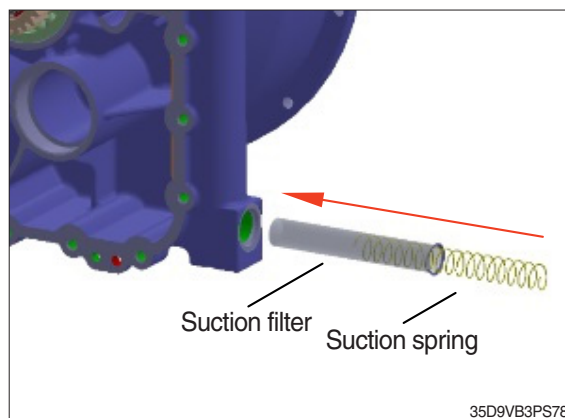
· Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)

※ Cover loctite #277 on the screw side of bolt.

- ③ Assemble oil level gaguge.



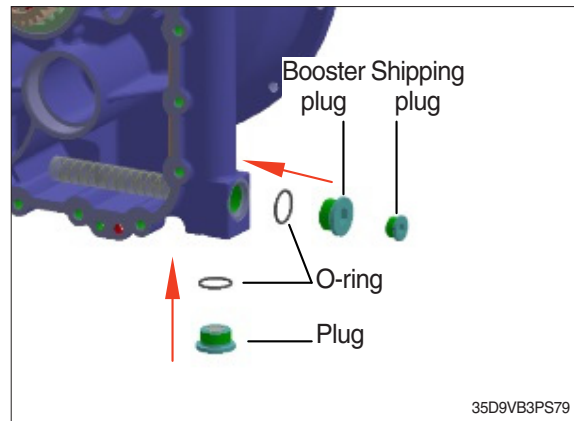
(9) Assemble suction filter and spring.



(10) Assemble O-ring, plug, booster plug, o-ring and shipping plug.

- Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.5 lbf·ft)

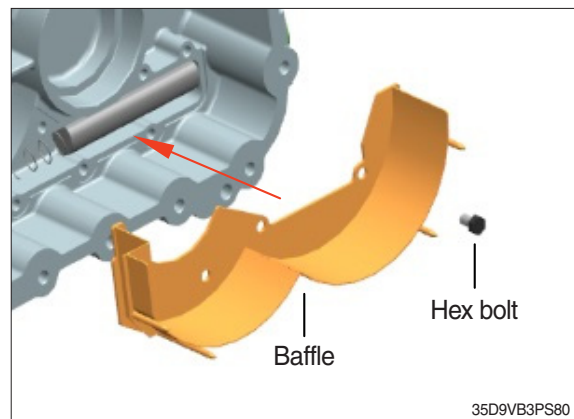
※ Cover grease on o-ring.



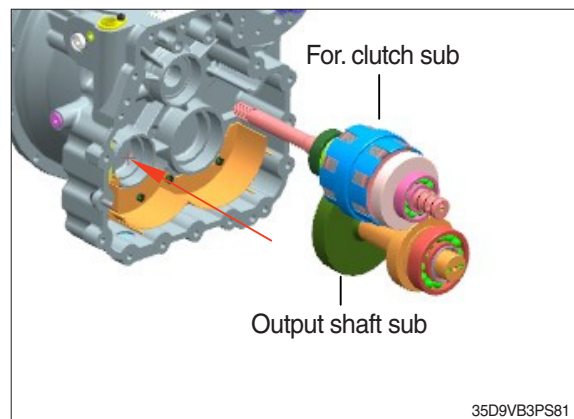
(11) Assemble baffle plate and hex bolt.

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

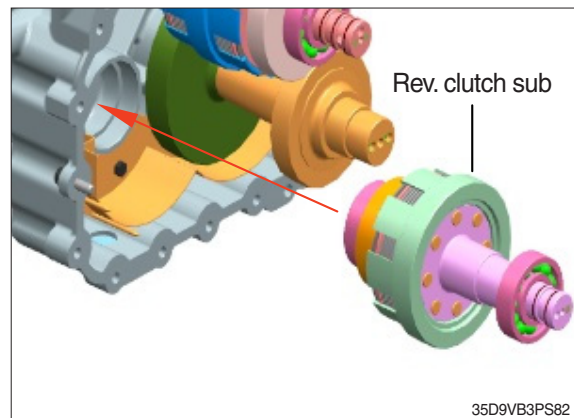
※ Cover loctite #277 on the screw side of bolt.



(12) Assemble for. clutch sub and output shaft sub.

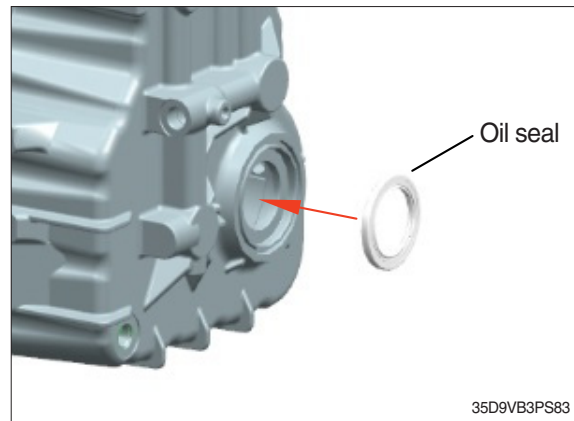


(13) Assemble rev. clutch sub.



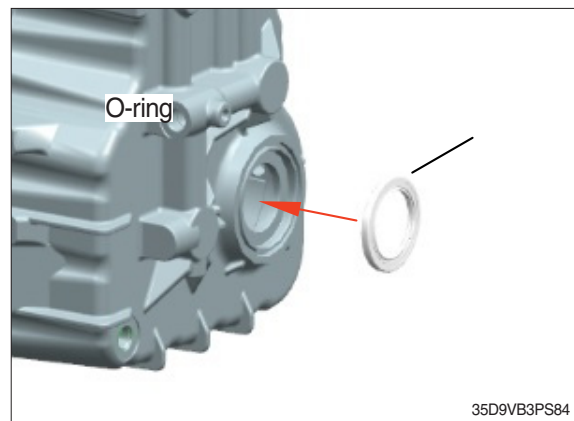
(14) Assemble oil seal.

※ **Cover loctite #592 on the side oil seal.**

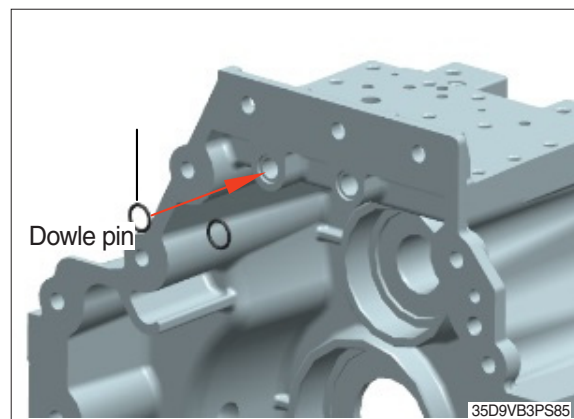


(15) Assemble o-ring.

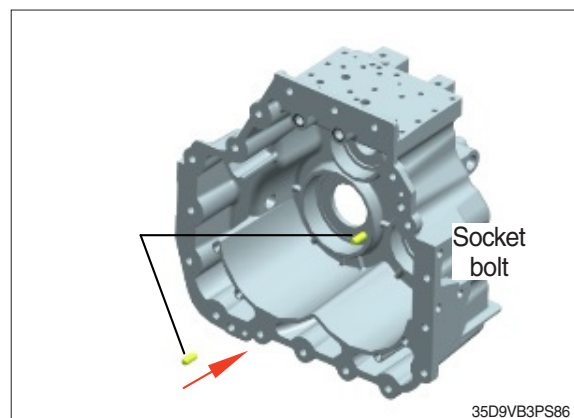
※ **Cover grease on o-ring.**



(16) Assemble dowel pin (2 EA).



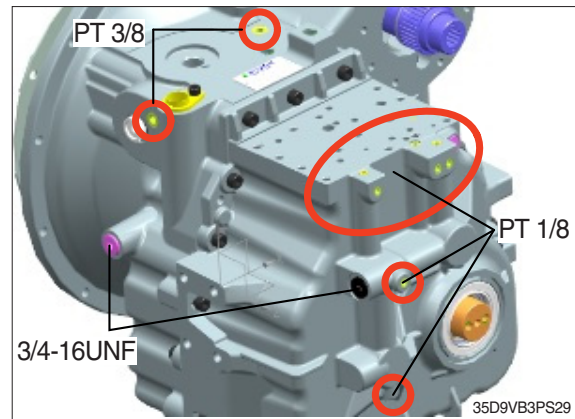
(17) Assemble T/M case sub on T/C housing sub.



(18) Assemble plug.

- Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.5 lbf·ft)
- Tightening torque : 1.0 ~ 1.4 kgf·m
(7.2 ~ 10.1 lbf·ft)

※ Cover loctite #577 on the screw side of plug.

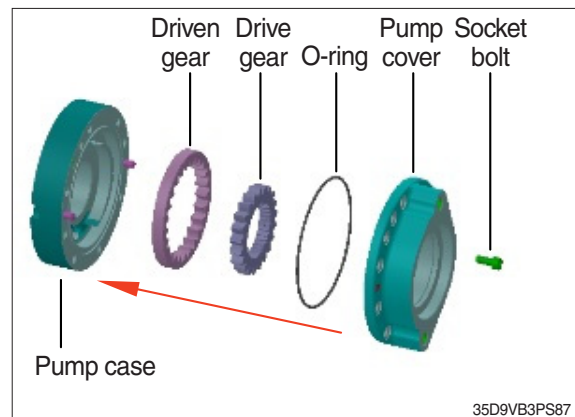


(19) Assemble oil pump sub part.

- ① Assemble driven gear, drive gear and o-ring on pump case. And assemble pump cover and socket bolt.

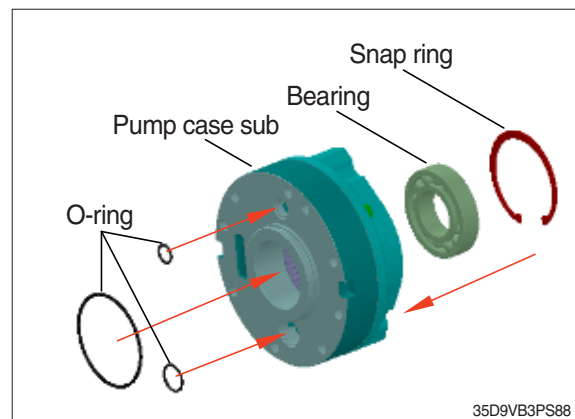
- Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)

※ Cover grease on o-ring and loctite #277 on the screw side of bolt.



- ② Assemble o-ring (3 EA) on pump case sub. Overturn assemble bearing and snap ring.

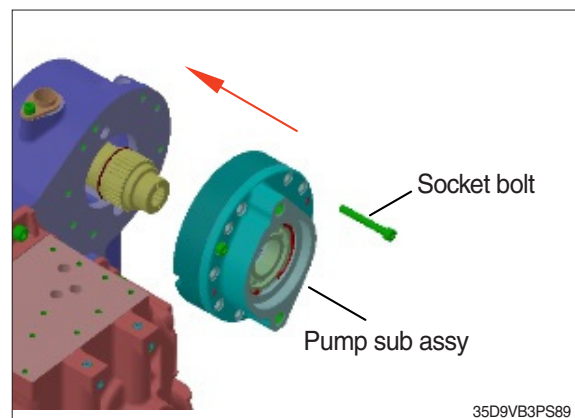
※ Cover grease on o-ring.



- ③ Assemble pump case sub and socket bolt.

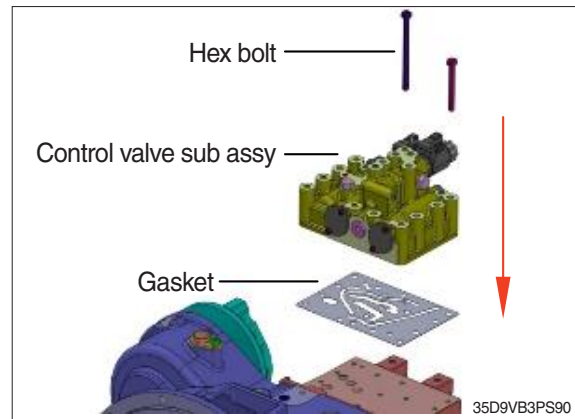
- Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)

※ Cover loctite #277 on the screw side of bolt.



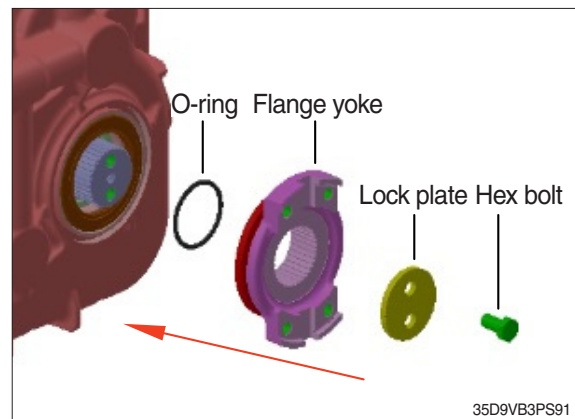
- (20) Assemble gasket, valve sub and hex bolt.
 · Tightening torque : 3.1 ~ 3.5 kgf·m
 (22.4 ~ 25.3 lbf·ft)

※ **Cover loctite #277 on the screw side of plug.**



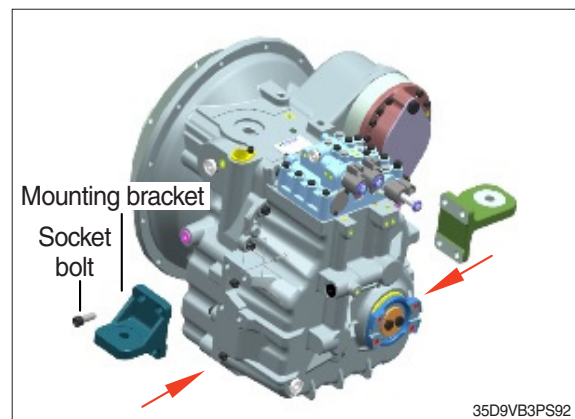
- (21) Assemble o-ring, flange yoke, lock plate and hex bolt.
 · Tightening torque : 6.1 ~ 6.6 kgf·m
 (44.1 ~ 47.8 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**



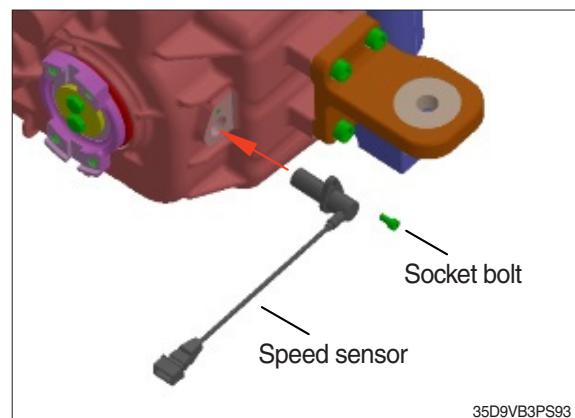
- (22) Assemble mounting bracket and socket bolt.
 · Tightening torque : 11.7 ~ 13.1 kgf·m
 (84.7 ~ 94.8 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**



- (23) Assemble speed sensor and socket bolt.
 · Tightening torque : 0.92 ~ 1.1 kgf·m
 (6.7 ~ 8.0 lbf·ft)

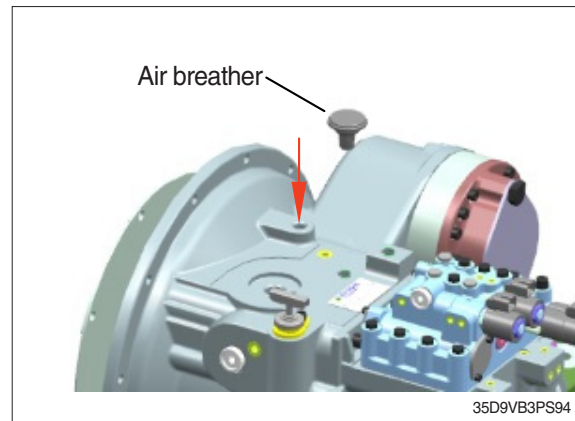
※ **Cover loctite #277 on the screw side of bolt.**



(24) Assemble air breather

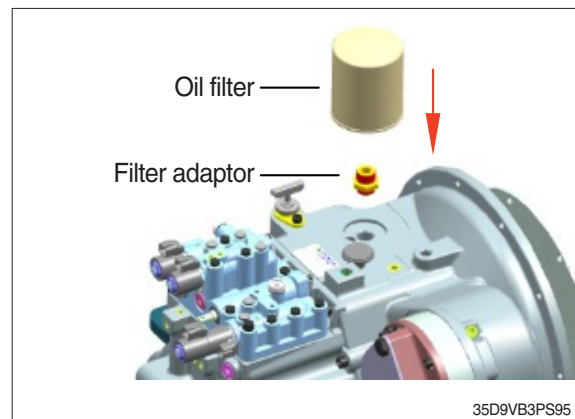
- Tightening torque : 1.0 ~ 1.4 kgf·m
(7.2 ~ 10.1 lbf·ft)

※ Cover loctite #577 on the screw side of plug.

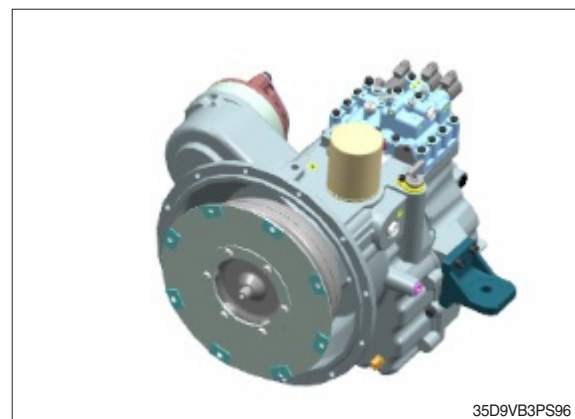


(25) Assemble filter adaptor and oil filter.

- Tightening torque : 13.3 ~ 14.7 kgf·m
(96.2 ~ 106 lbf·ft)



(26) Complete transmission assembly.



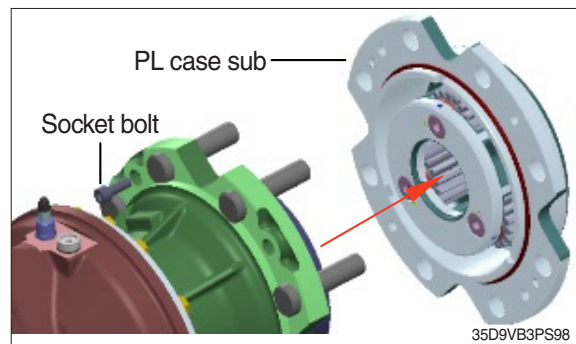
3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY OF HUB

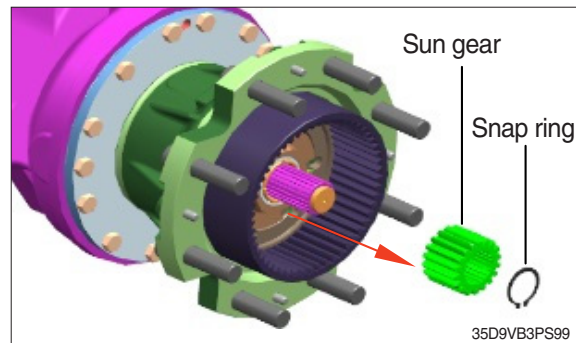
(1) Disassemble drive axle assy.



(2) Disassemble the socket bolt and PL case sub assy.

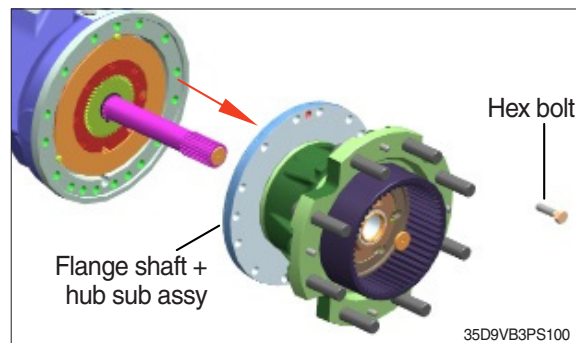


(3) Disassemble snap ring and sun gear at the end of axle.

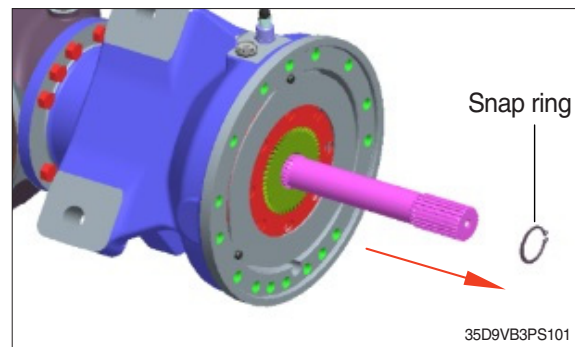


(4) Disassemble hex bolt of flange shaft and hub + flange shaft sub assy.

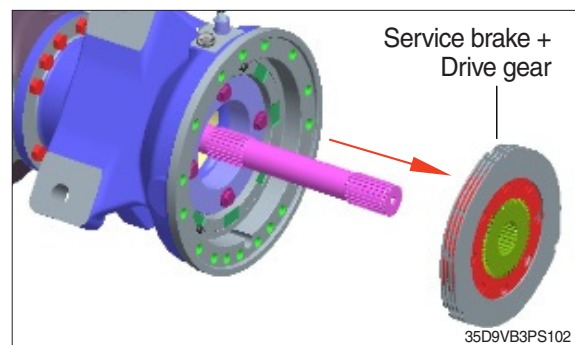
△ When you disassemble hub sub assembly, the hub sub assembly will be prevention of falling from lift system. Falling of hub sub assembly will make engineers harm and product damage. You must be careful.



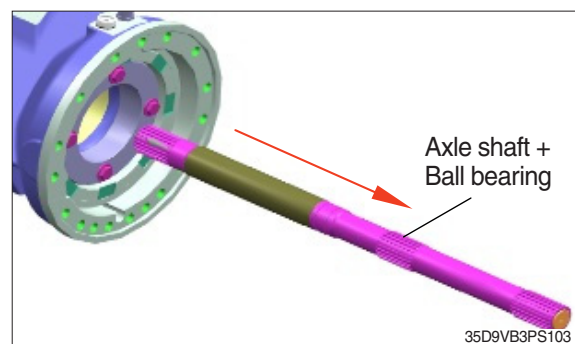
(5) Disassemble snap ring.



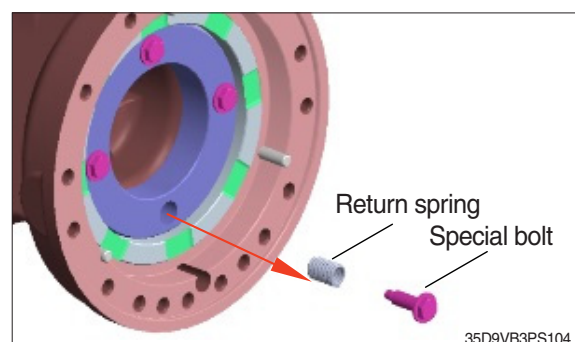
(6) Disassemble service brake + drive gear.



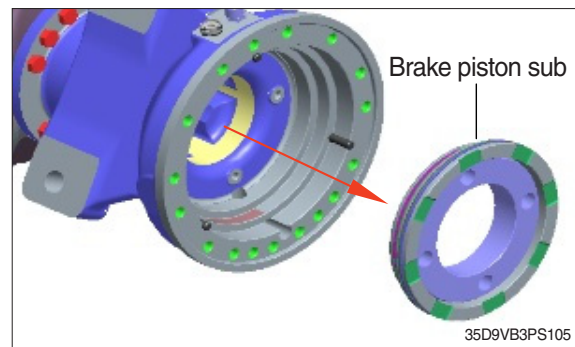
(7) Pick out axle shaft and the opposite side of axle shaft as same way.



(8) Disassemble special bolt & return spring.

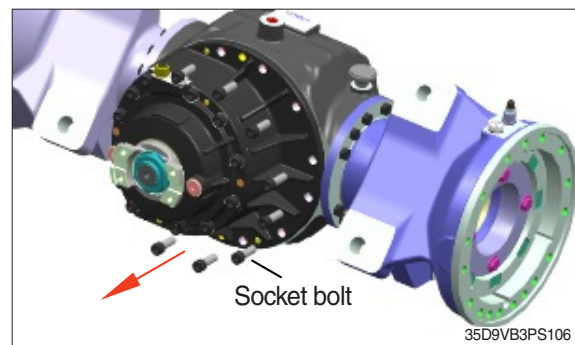


(9) Disassemble brake piston sub assy.

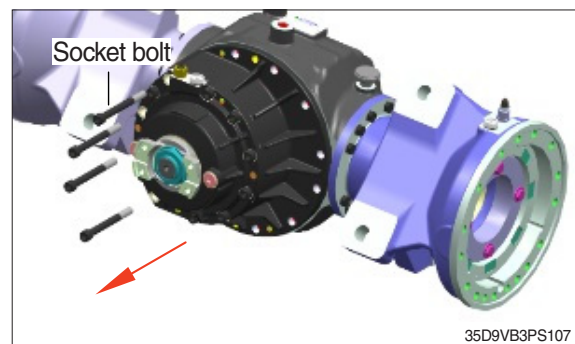


2) DISASSEMBLY OF CARRIER SUB ASSY

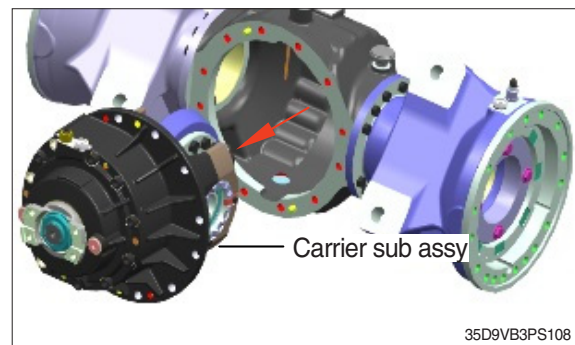
(1) Disassemble socket bolt.



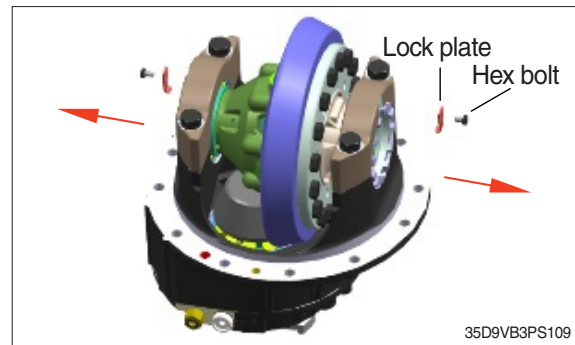
(2) Disassemble socket bolt (4 EA).



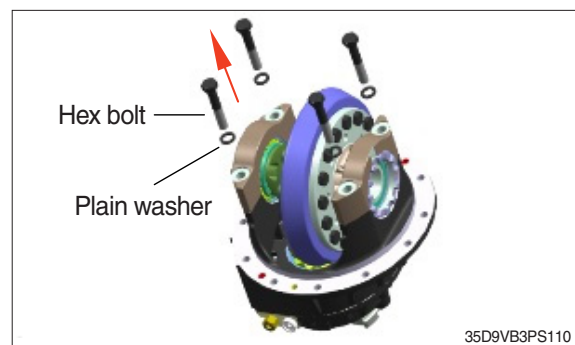
(3) Disassemble carrier sub assy.



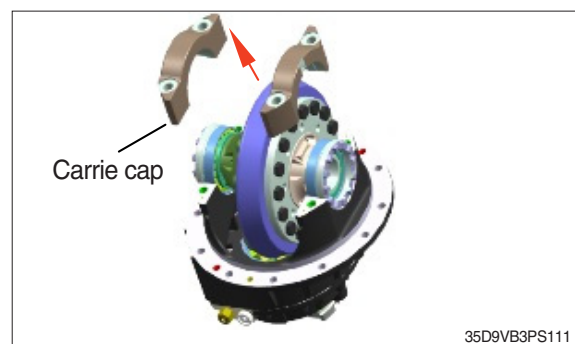
- (4) Disassemble hex bolt and lock plate from carrier sub assembly.



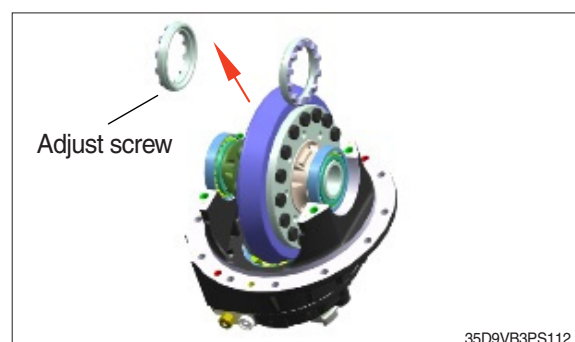
- (5) Disassemble hex bolt and plain washer.



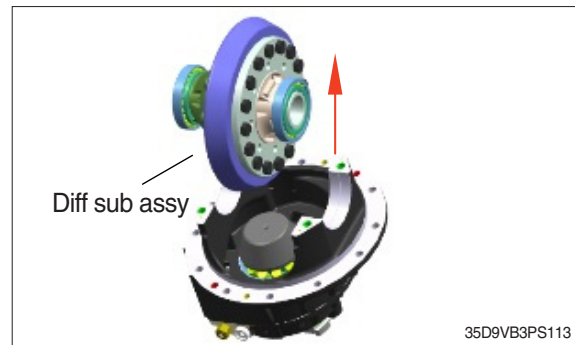
- (6) Disassemble carrier cap.



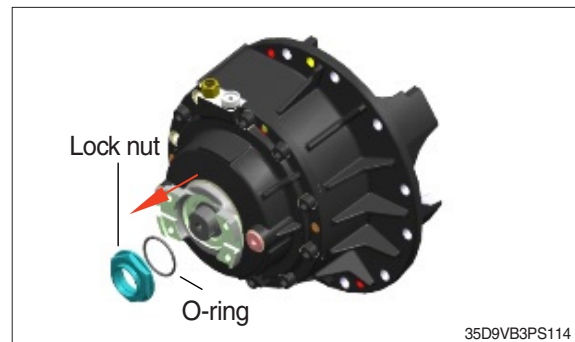
- (7) Disassemble adjust screw.



(8) Disassemble differential sub assy from carrier sub assy.



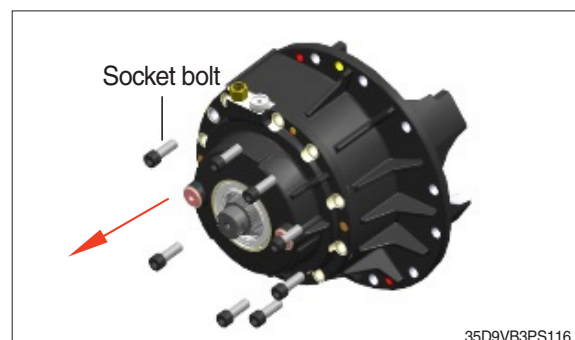
(9) Disassemble lock nut and o-ring from carrier sub assy.



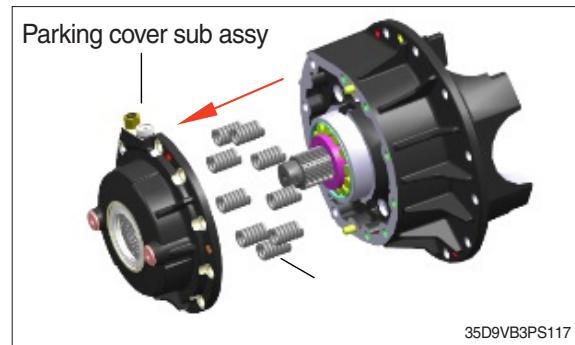
(10) Disassemble flange yoke.



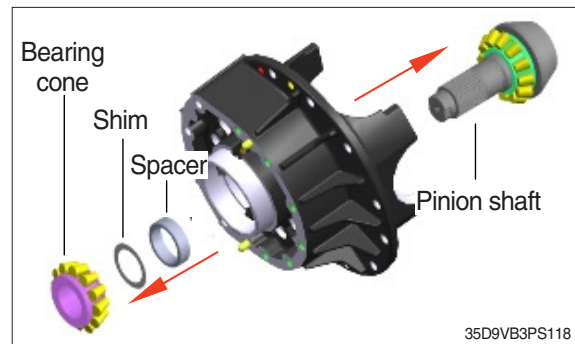
(11) Disassemble socket bolt.



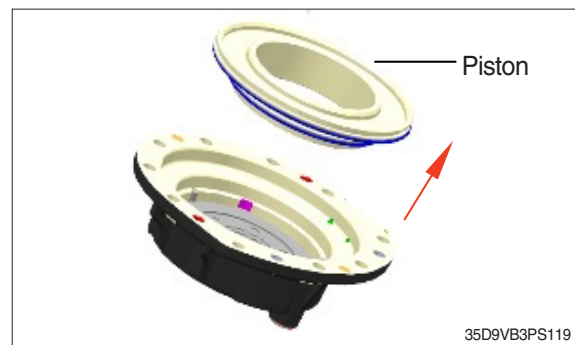
(12) Disassemble parking cover sub assy and return spring.



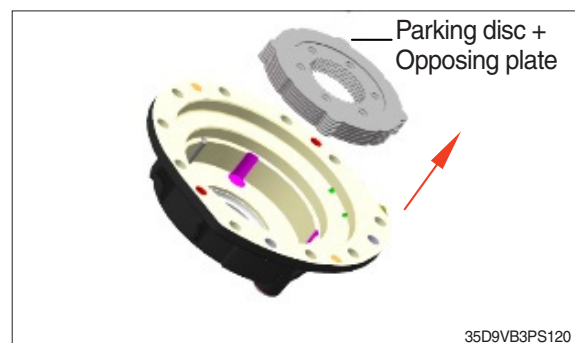
(13) Disassemble pinion shaft, spacer, bearing cone, and shim.



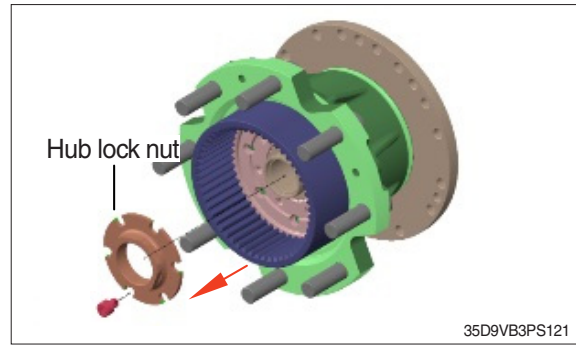
(14) Disassemble piston.



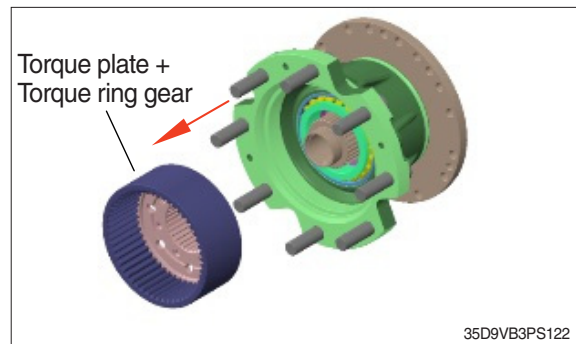
(15) Disassemble parking disk and opposing plate.



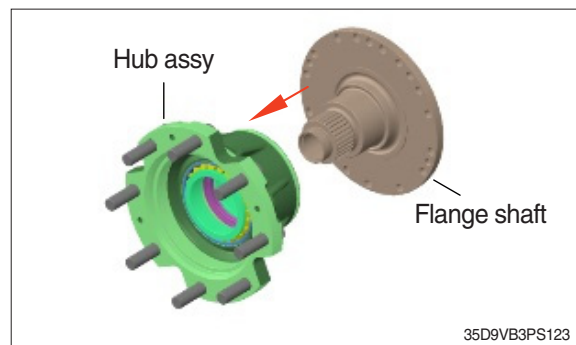
(16) Disassemble socket bolt and hub lock nut.



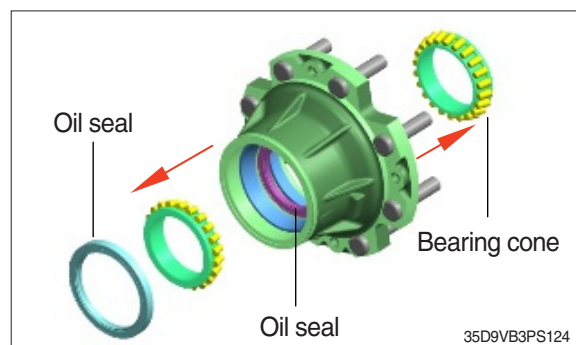
(17) Disassemble torque plate and torque ring gear.



(18) Disassemble flange shaft from hub assy.

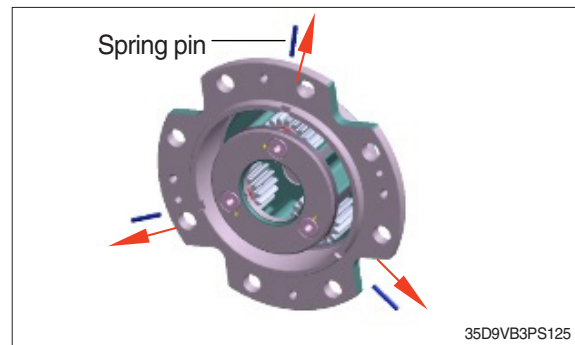


(19) Disassemble bearing cone and oil seal from.

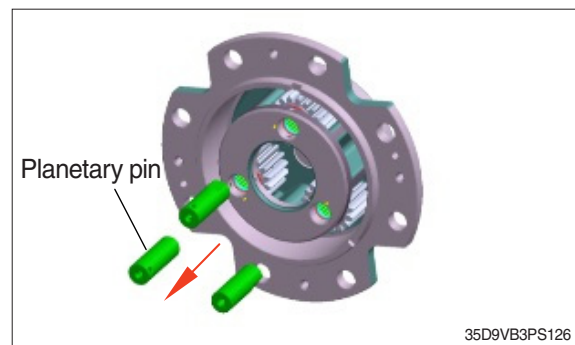


3) DISASSEMBLY OF PLANETARY CASE

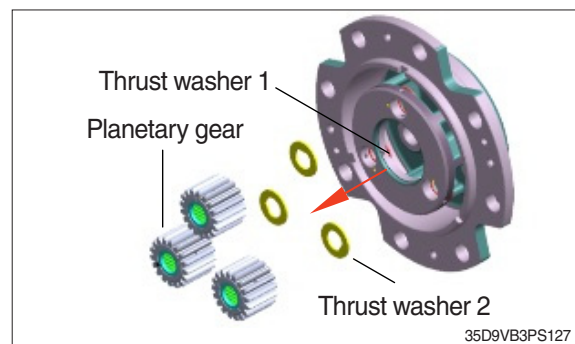
(1) Disassemble spring pin from planetary case assy.



(2) Disassemble planetary pin.



(3) Disassemble needle roller with planetary gear and then, disassemble thrust washer.

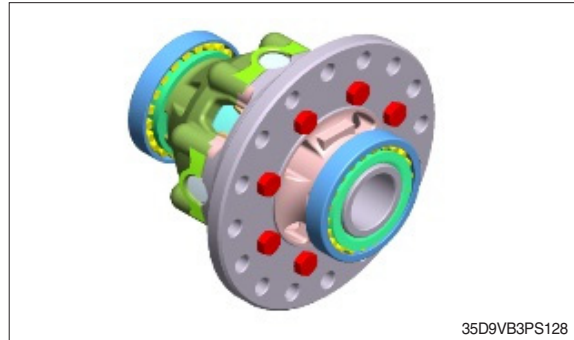


4. ASSEMBLY OF DRIVE AXLE

1) ASSEMBLY OF CARRIER SUB ASSY

(1) Assembly of differential device

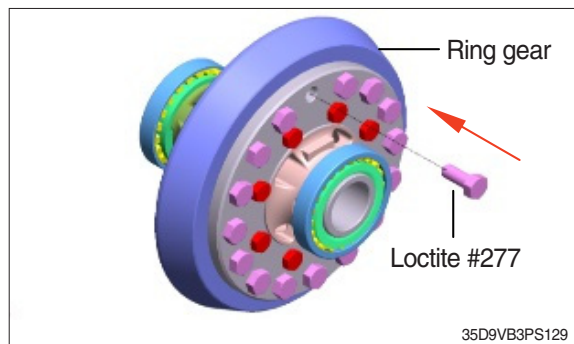
- ① Make preparation for differential assy.



- ② Assemble ring gear by bolt.

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

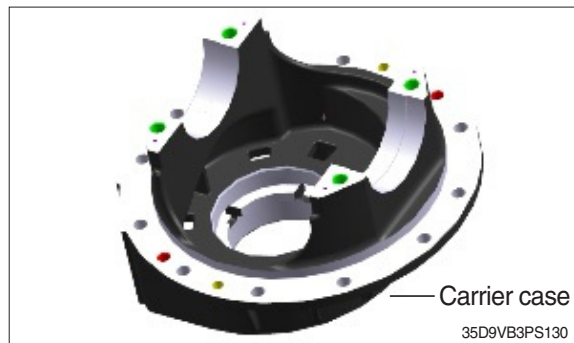
- ※ Cover loctite #277 on the screw side of bolt.



(2) Control of shim and pinion shaft assy

- 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. The mark of gearset supposed to look like the illustration.



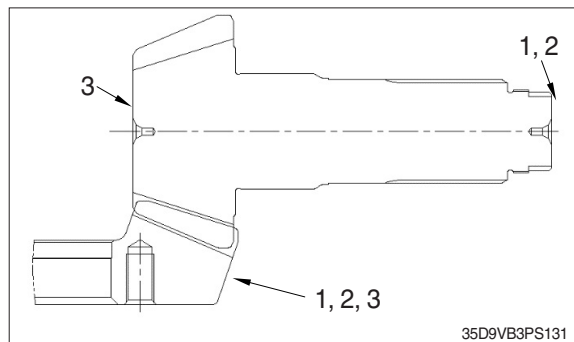
a. Part number

- a) Example of gearset part number

· Conventional ring gear, C11D00280
· Conventional pinion gear, C11D00291

- b) The place of Pinion shaft : At the end of Shaft

- c) The place of Ring gear : Front face or outer diameter



b. Tooth combination number

- a) Example of tooth combination number :
13-38 (13-38 gearset is making of
13-tooth drive pinion and 38-tooth ring
gear.
- b) The place of pinion shaft : at the end of
shaft
- c) The place of ring gear : front face or
outer diameter

c. Pinion cone variation number

(The pinion cone variation number is
disused in match checking the gearset.
The number is using in carrier for adjust-
ing the depth of pinion.)

- a) For example - pinion cone variation
numbers : +2 (+0.01 mm), -1 (0.02 mm)
- b) The place of gearset : end of pinion
shaft head or outer diameter of ring
gear

- ② The thickness of the shim is determined
by a gauge and a measuring device.

(Final clearance of the carrier case : A)

(Correction value of the pinion shaft : B)

(Bearing width measurement : C)

· Thickness of shim

$X = \text{"Actual measurement value"} - \text{"M.D value"} - C$

(Actual measurement value = 160.95+A)

(M.D value = 131.2+B)

ex) A= 0.15, B= -0.05, C= 29.25

$X = (160.95+0.15)-(131.2+(-0.05))-29.25=0.7$

→ Thickness of shim : 0.7 t



- ③ Assemble shim and press the bearing
cup.

- Sort of shim : 0.1, 0.15, 0.3 mm
(0.004, 0.006, 0.012 in)



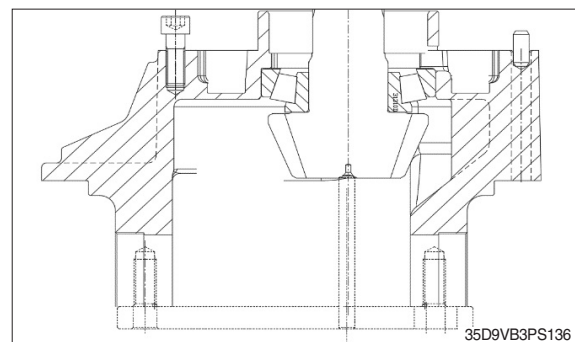
- ④ Press bearing cone on pinion shaft.



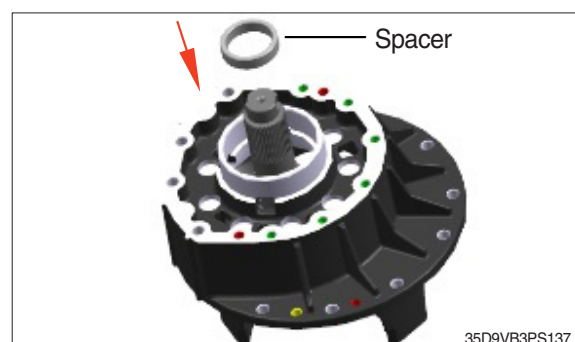
- ⑤ Assemble carrier case on pinion shaft.



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



- ⑦ Turn carrier case a one-eighty (180°) and fix it on jig.



- ⑧ The thickness of the shim is determined by a gauge and a measuring device.

· Thickness of shim

$$X = ("E" + \text{measurement value}) - ("F" - \text{measurement value}) + 0.15$$

"E" : The gap between BRG. cup and cone
(the left illustration)

"F" : The gap between carrier and spacer
(the right illustration)

"0.15" : Correction value.

ex) "E"=0.25, measurement value : 0.1

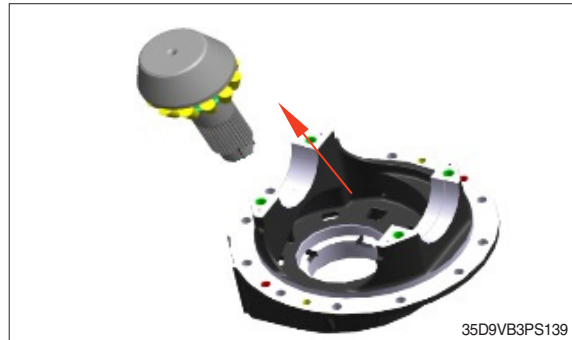
"F"=1.85, measurement value : 0.1

$$X = (2.25 + 0.1) - (1.85 - 0.1) + 0.15 = 0.75$$

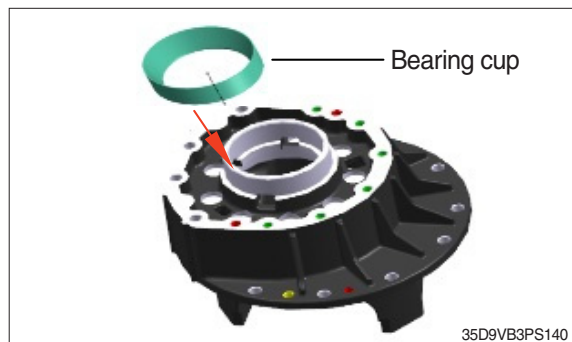
→ Thickness of shim : 0.75 t



- ⑨ Disassemble pinion shaft from carrier case.

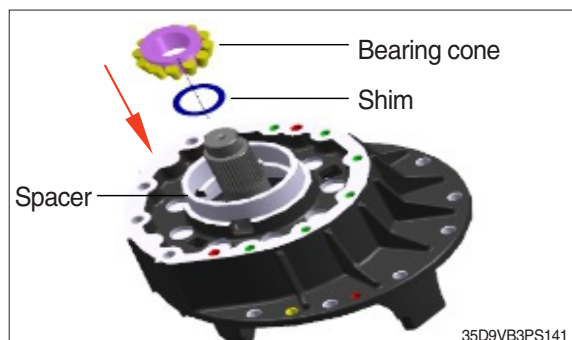


- ⑩ Assemble bearing cup.

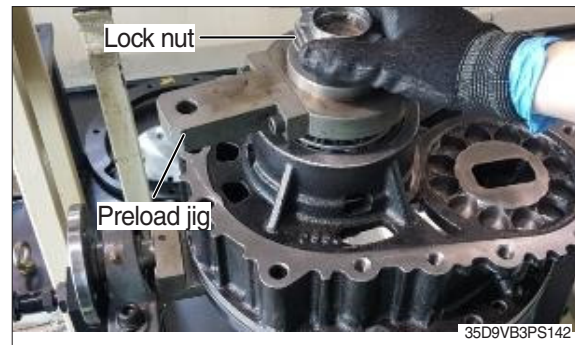


- ⑪ Reassemble pinion shaft and assemble shim & master bearing.

· Sort of shim : 0.1 , 0.15 , 0.3 mm
(0.004, 0.006, 0.012 in)



- ⑫ Assemble preload measurement jig and lock nut.

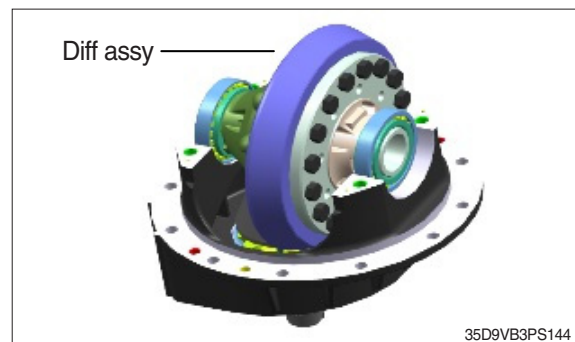


- ⑬ Measure the preload in the clockwise direction. After completion of measurement, disassemble the lock nut and jig.



(3) Control of gearset backlash

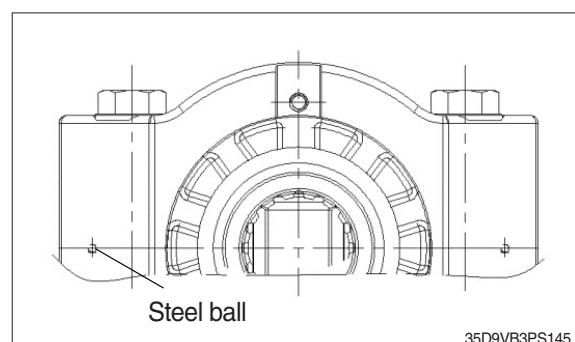
- ① Assemble differential assembly on carrier case.



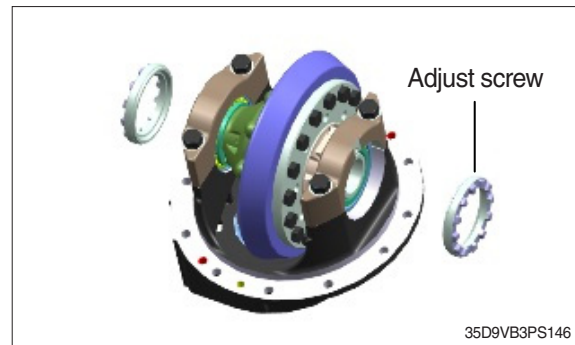
- ② Assemble washer and hex bolt on carrier cap.

· Tightening torque : 15.8 ~ 18.4 kgf·m
(114 ~ 133 lbf·ft)

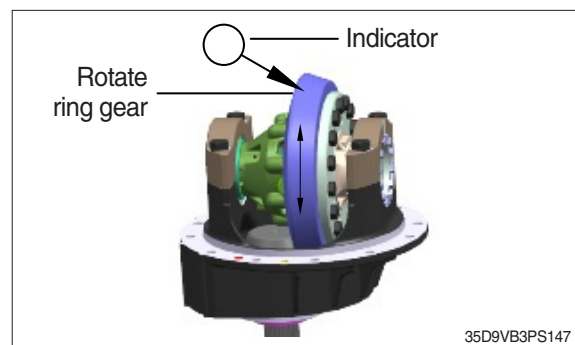
- ※ Cover loctite #277 on the screw side of bolt.



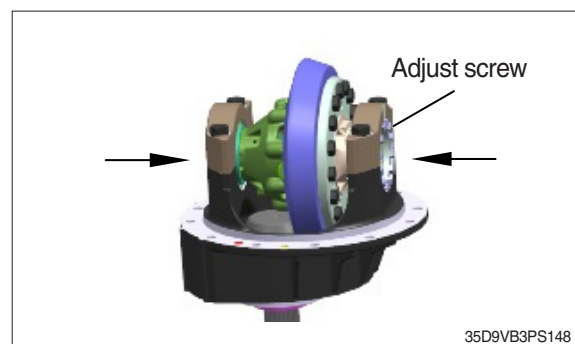
③ Assemble adjust screw on carrier case.



④ Measure backlash as turn ring gear slowly.



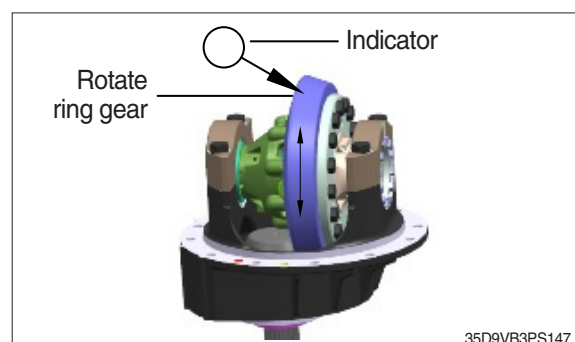
⑤ Lock adjust screw.



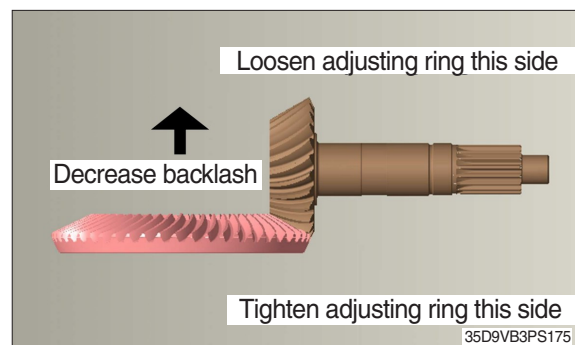
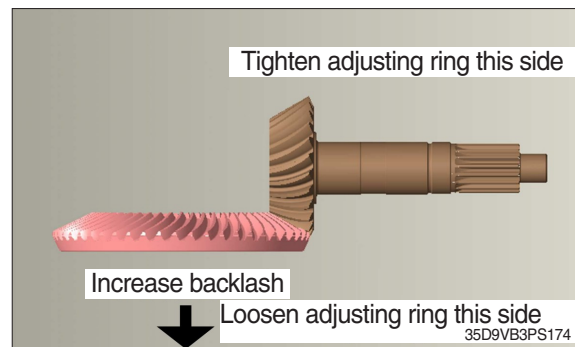
⑥ Remeasure Backlash.

· Backlash of pinion and ring gear : 0.18 ~ 0.23 mm
(0.007 ~ 0.009 in)

※ 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.

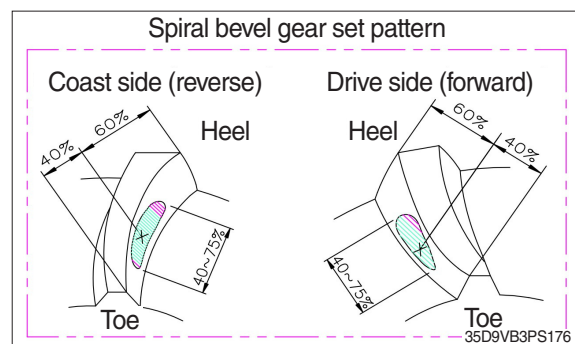


- ⑦ If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.

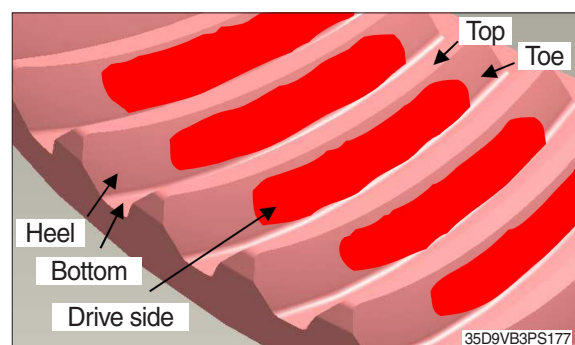


(4) Measurement of tooth contact pattern

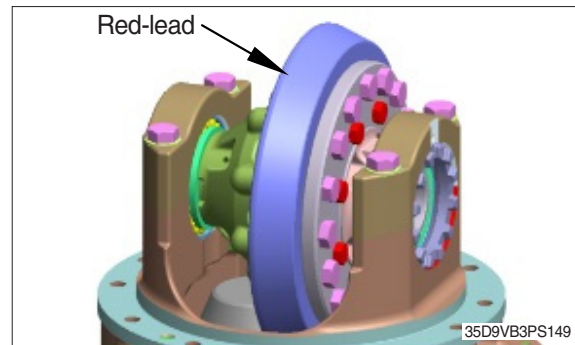
- ※ After assemble, adjust pattern of the gear and pinion shaft figure. If pattern is not adjusted, take a measure as measuring backlash again and then reassemble.



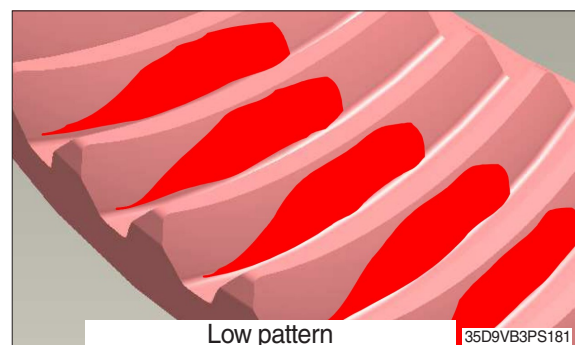
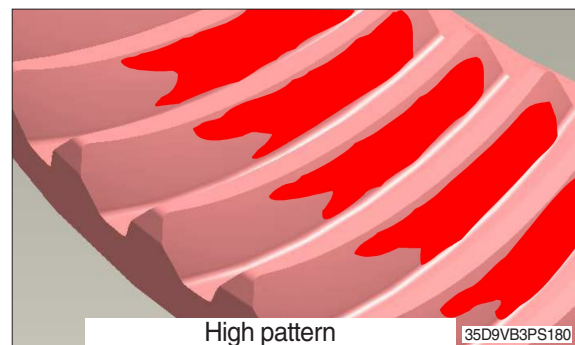
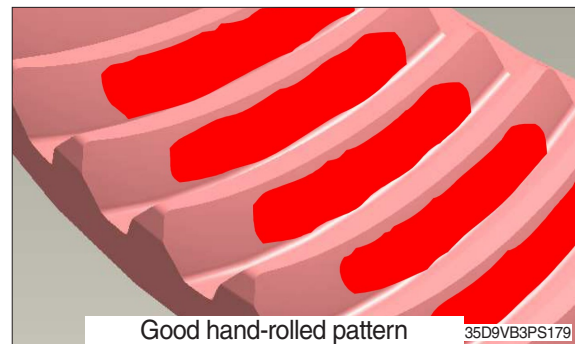
- ※ Always check tooth contact pattern on the driving side of gear teeth.



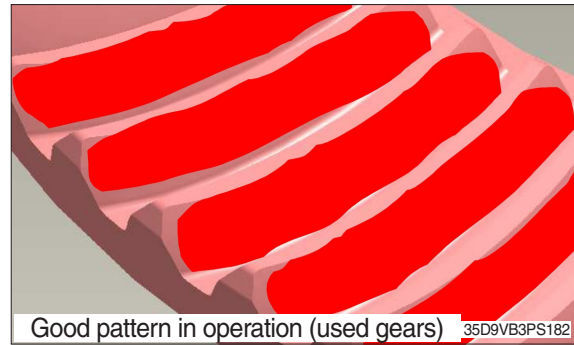
- ① Marking red-lead on 6 tooth surface of ring gear.
- ② Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.



- ③ Compare the contact pattern with illustrations.
- ※ The good contact pattern of gearset is appeared what the length of tooth has had.



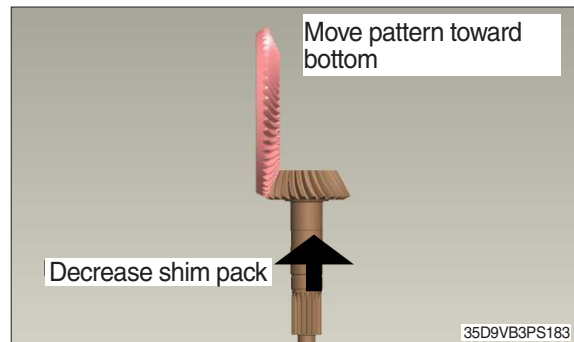
- ※ The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.



- ④ If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps a-b.
If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps c-d.

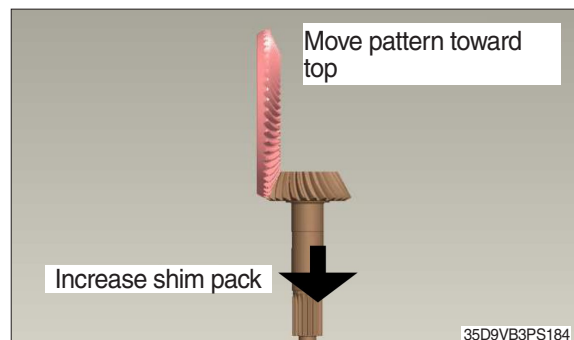
a. High pattern

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.



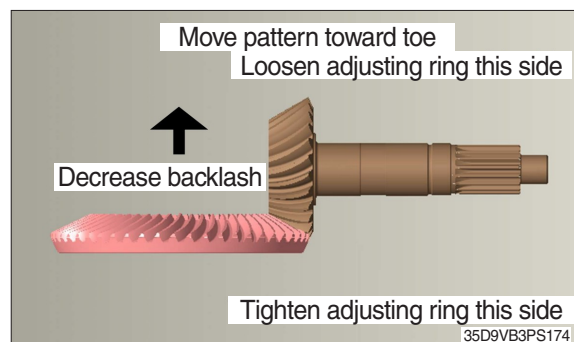
b. Lower pattern

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.



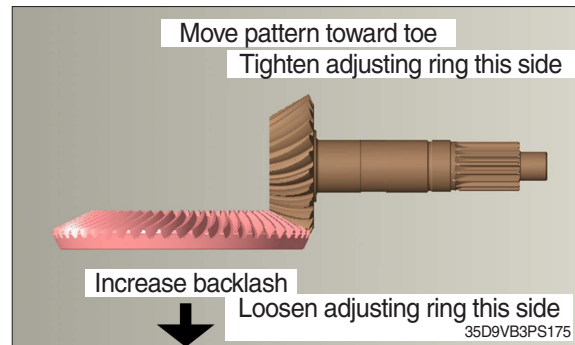
c. Heel pattern

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



d. Toe pattern

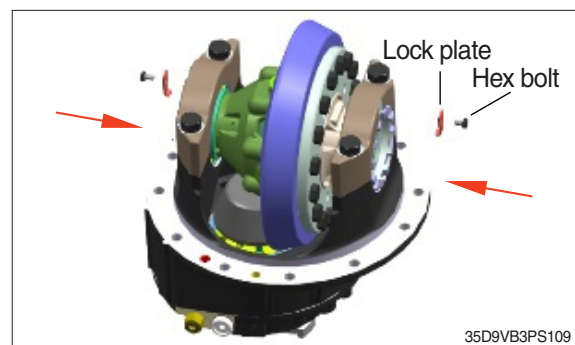
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



④ Assemble lock plate and hex bolt.

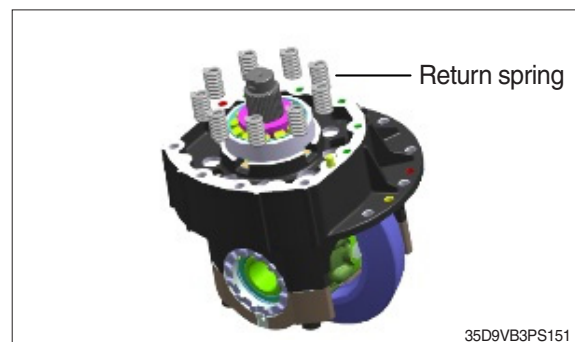
· Tightening torque : 0.92 ~ 1.2 kgf·m
(6.7 ~ 8.7 lbf·ft)

※ Cover loctite #277 on the screw side of bolt.



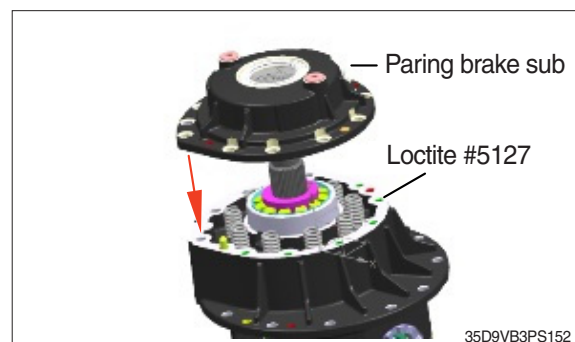
(5) Assembly of parking sub

① Assemble return spring.



② Assemble parking brake sub on carrier case.

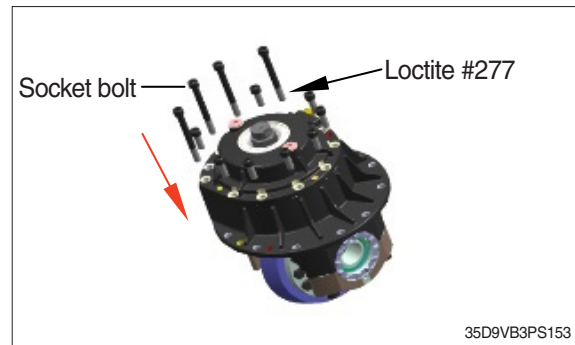
※ Cover loctite #5127 on carrier case.



③ Assemble socket bolt.

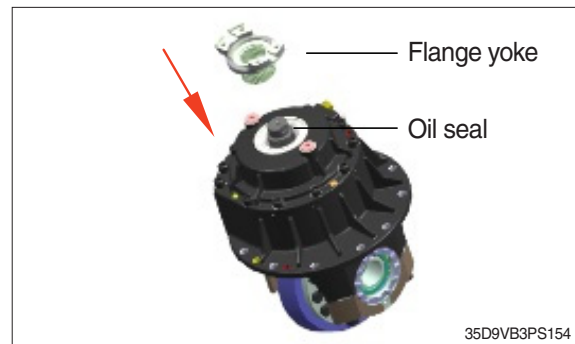
- Tightening torque : 10.2 ~ 11.2 kgf·m
(73.8 ~ 81.0 lbf·ft)

※ Cover loctite #277 on the screw side of bolt.



④ Assemble flange yoke.

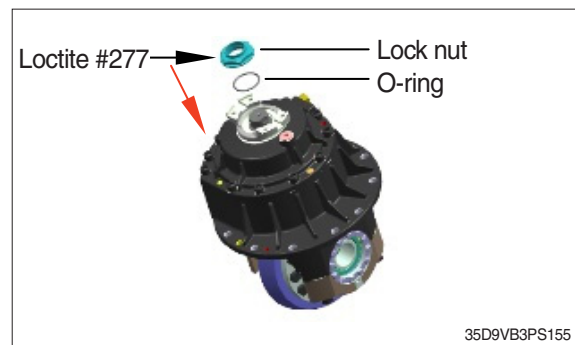
※ Cover grease on seal rip.



⑤ Assemble o-ring and lock nut.

- Tightening torque : 44.9 ~ 50.0 kgf·m
(324 ~ 361 lbf·ft)

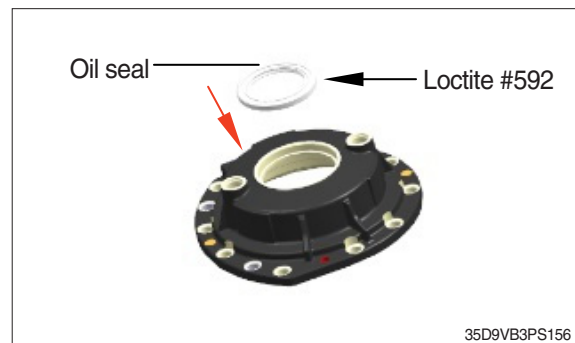
※ Cover grease on o-ring and loctite #277 on lock nut.



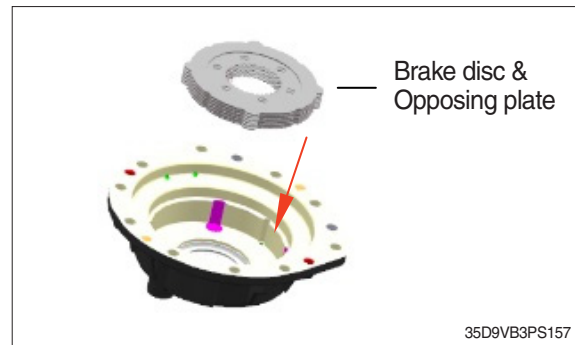
(6) Assembly of parking cover

① Assemble oil seal on parking cover.

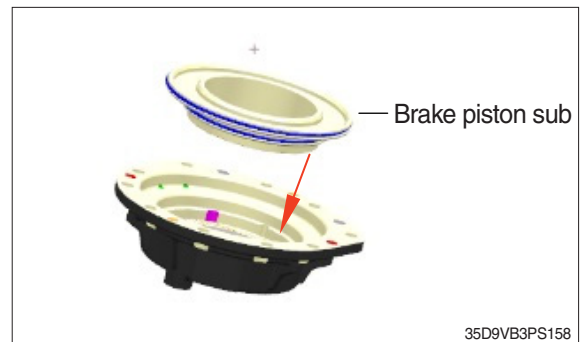
※ Cover loctite #592 on outer diameter of oil seal and grease on internal diameter.



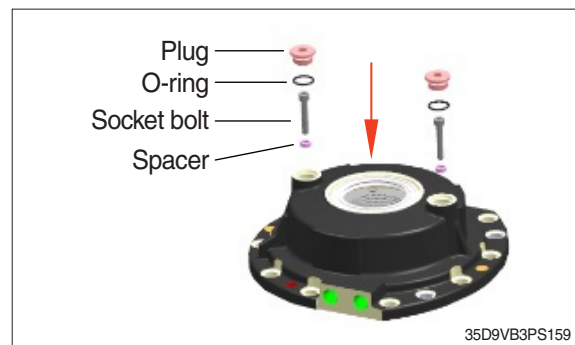
- ② Assemble brake disk and opposing plate.
- Brake disk : 6EA
 - Opposing plate : 6EA



- ③ Assemble brake piston sub.
- ※ Cover grease on o-ring.

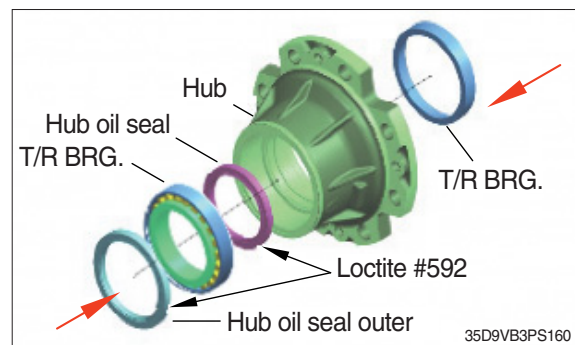


- ④ Assemble spacer and socket bolt.
- Tightening torque : 0.8 ~ 1.1 kgf·m
(5.9 ~ 8.1 lbf·ft)
- ⑤ Assemble o-ring and plug.
- Tightening torque : 4.2 ~ 4.9 kgf·m
(30.2 ~ 35.3 lbf·ft)
- ※ Cover grease on o-ring.



2) ASSEMBLY OF HUB SUB

- (1) Press hub oil seal. Assemble bearing cup (2 EA) on each left and right hub.

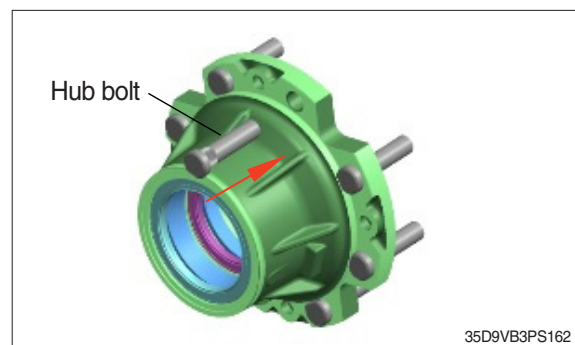


(2) Press hub outer oil seal.

※ Cover grease at inside hub. (grease : Shell Retinax 0434 - 45 ~ 80cc spread)

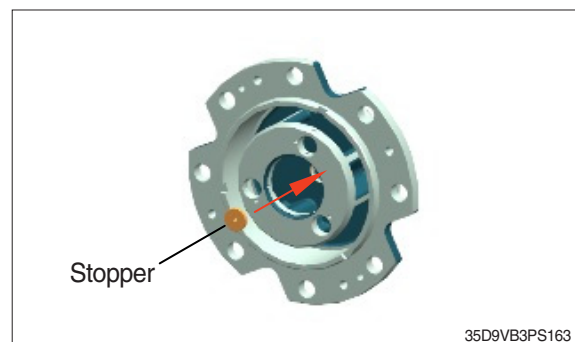


(3) Press hub bolt into hub.

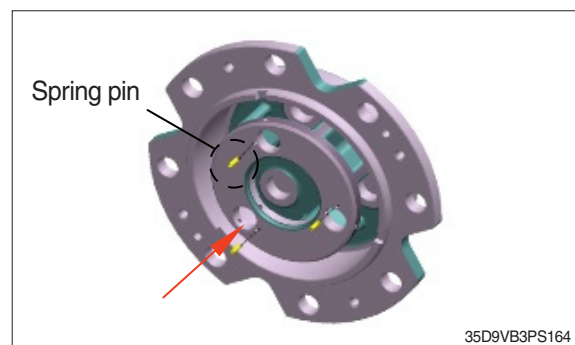


3) ASSEMBLY OF PLANETARY CASE

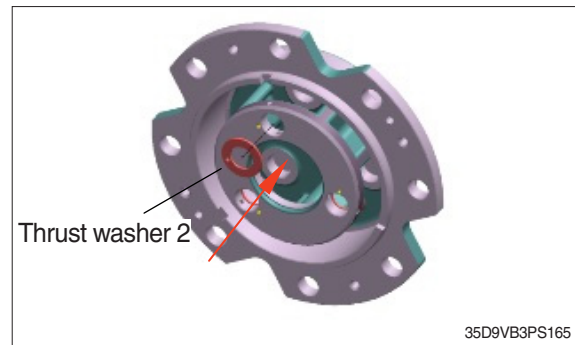
(1) Assemble stopper.



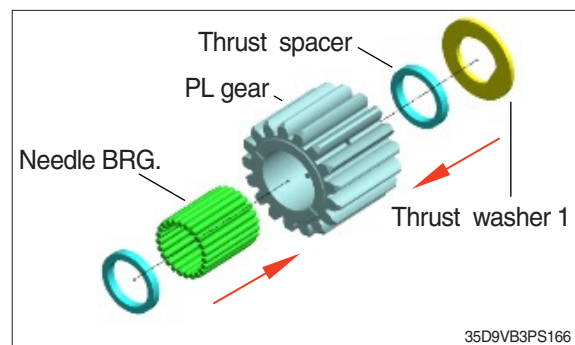
(2) Assemble spring pin (3 EA).



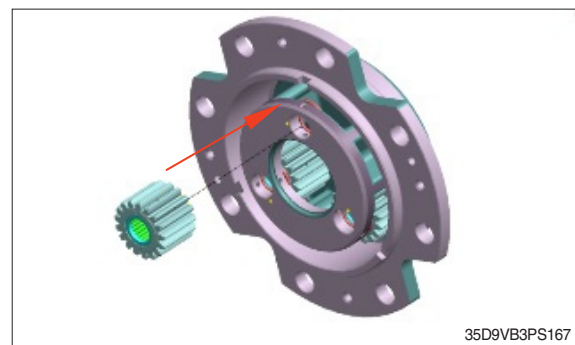
(3) Assemble thrust washer 2 (3EA).



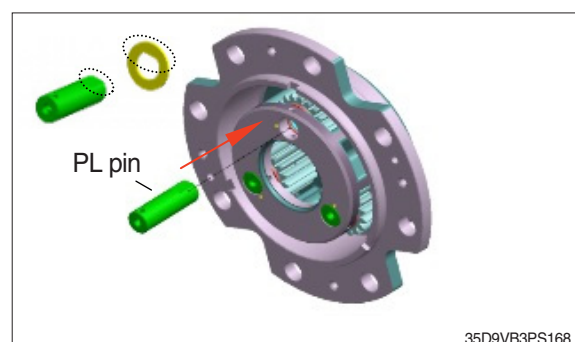
(4) Needle bearing → thrust spacer → thrust washer 1. Assemble planetary gear (3 EA) as above in order.
· Needle bearing 69 EA (1 Gear)



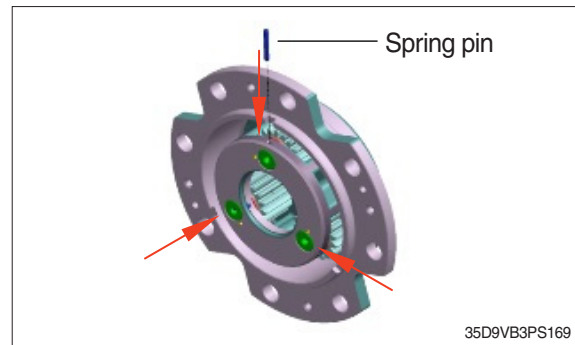
(5) Assemble planetary gear (3 EA).



(6) Assemble planetary pin (3 EA).

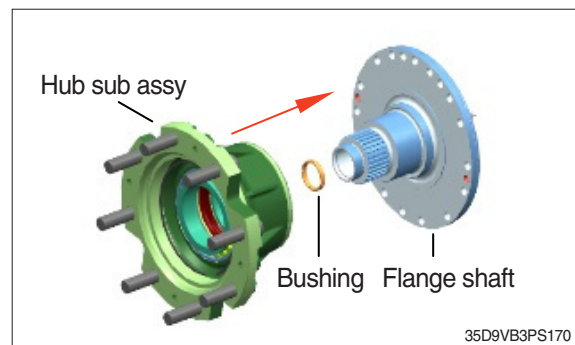


(7) Assemble spring pin (3 EA).

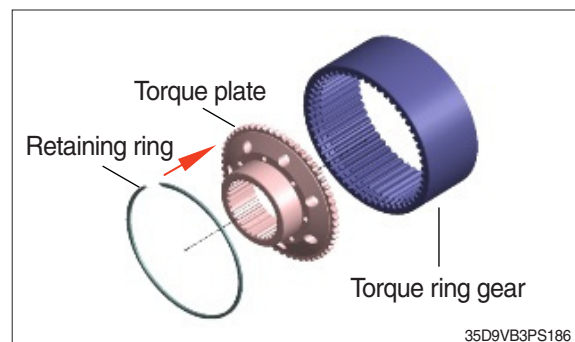


4) ASSEMBLY OF FLANGE SHAFT AND HUB SUB ASSY

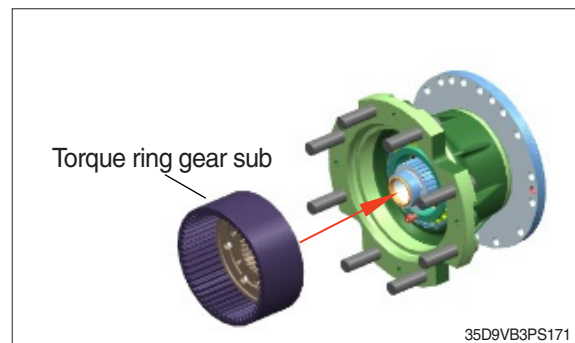
(1) Assemble hub sub assy on flange shaft.



(2) Assemble torque plate and retaining ring on torque ring gear.

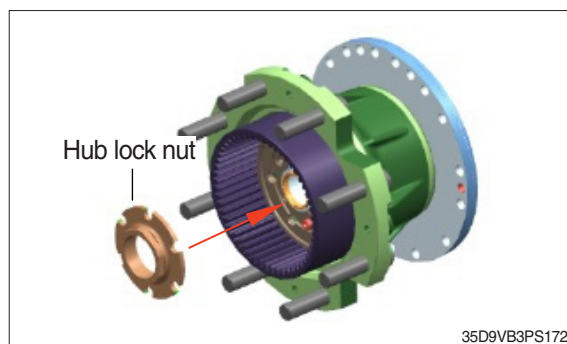


(3) Assemble torque ring gear sub.



- (4) Tighten the hub lock nut as much as possible and turn it 2 or 3 times to the left and right. After loosening the nut, tighten the torque.

· Tightening torque : 25 ~ 30 kgf·m
(180 ~ 217 lbf·ft)



- (5) Measure the preload after torque tightening. If the results are different, repeat step (4). If the hub bearing preload is different, the shaft may be damaged. You should check the preload to prevent serious accidents.

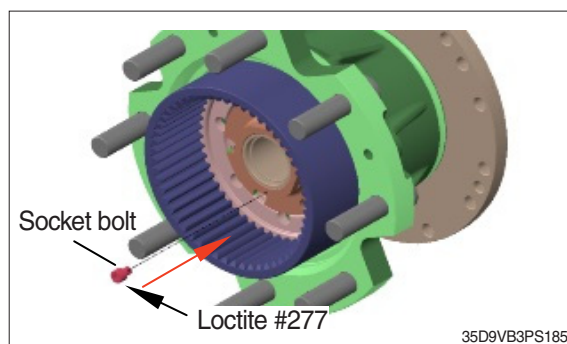
· Hub preload : 150 ~ 300 kg·cm
(10.8 ~ 21.7 lb·ft)



- (6) Assemble socket bolt.

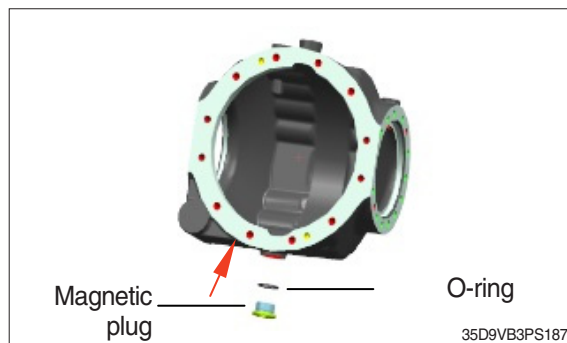
· Tightening torque : 1.8 ~ 2.4 kgf·m
(13.0 ~ 17.4 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**



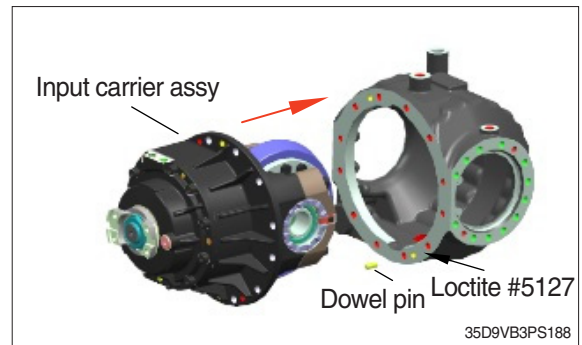
5) ASSEMBLY OF DRIVE AXLE

- (1) Assemble oil level gauge and drain plug (magnetic).



(2) Assemble dowel pin on axle housing and carrier assy.

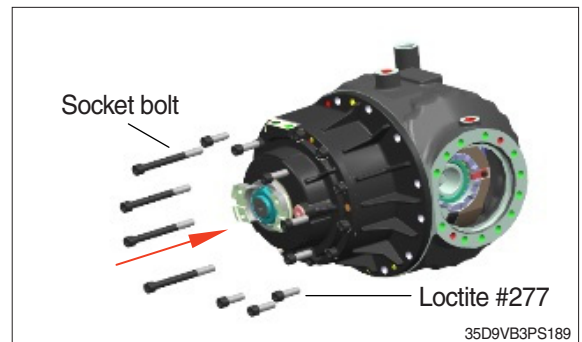
※ **Cover loctite #5127 on axle housing.**



(3) Assemble socket bolt.

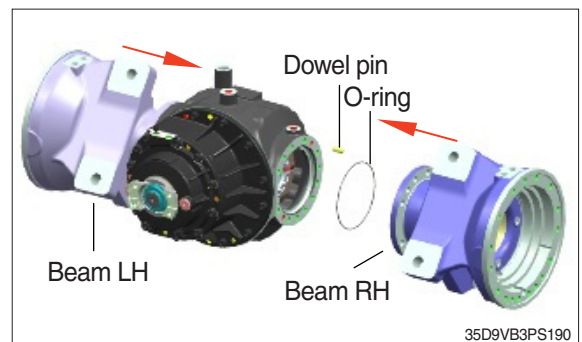
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.3 ~ 80.6 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**



(4) Assemble dowel pin on axle housing, o-ring and beam LH, RH.

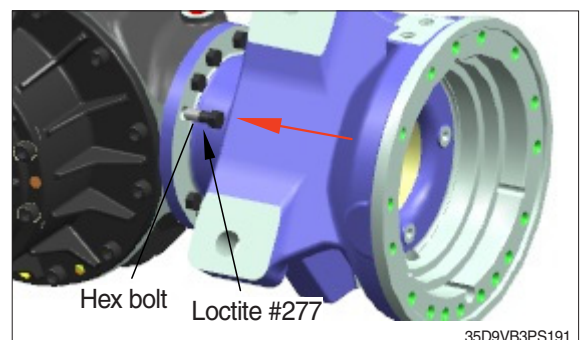
※ **Cover grease on O-ring.**



(5) Assemble hex bolt.

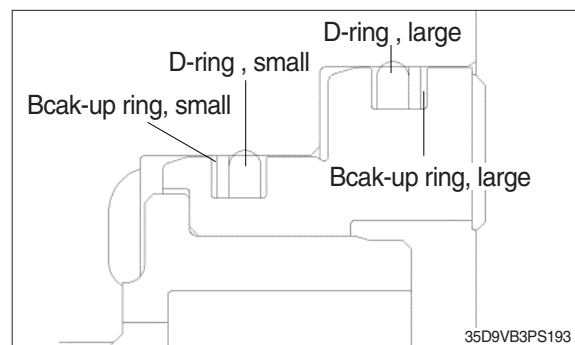
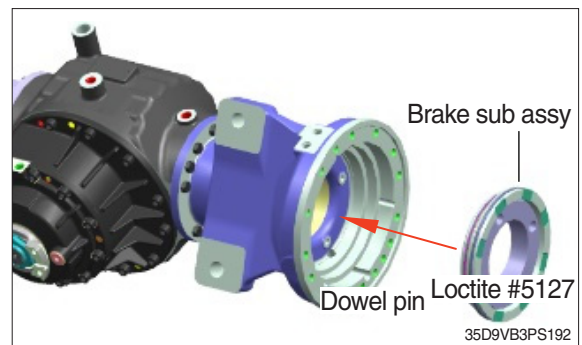
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.3 ~ 80.6 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**



(6) Assemble brake sub assy.

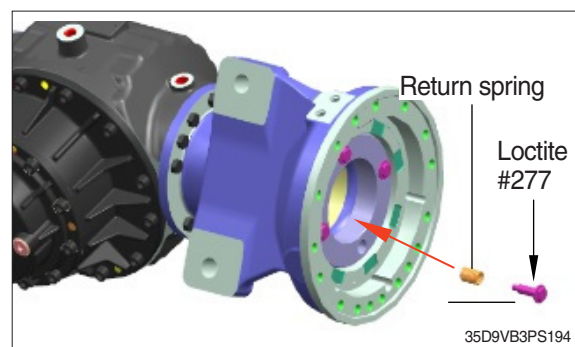
※ **Cover grease on D-ring.**



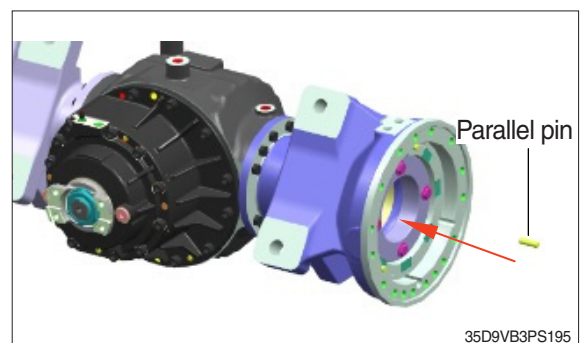
(7) Assemble return spring and special bolt.

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.1 ~ 25.8 lbf·ft)

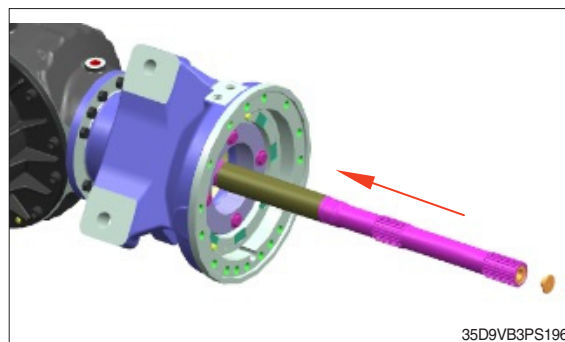
※ **Cover loctite #277 on the screw side of bolt.**



(8) Assemble parallel pin on beam.



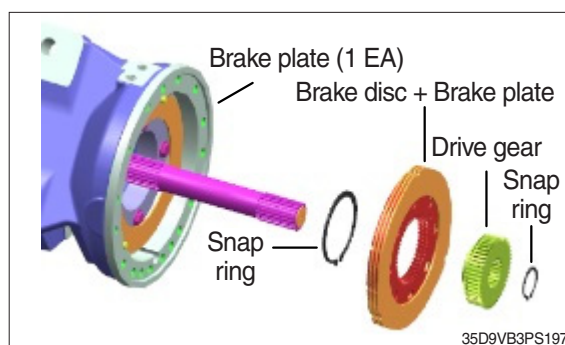
(9) Assemble axle shaft and bushing.



(10) Assemble snap ring, brake disc and plate on drive gear.

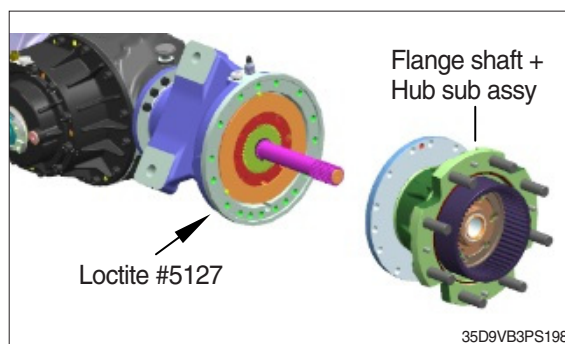
- Brake disc : 3 EA
- Brake plate : 3 EA

Assemble brake plate (1 EA) on beam and drive gear sub and snap ring on drive axle assy.



(11) Assemble flange shaft + hub sub assy.

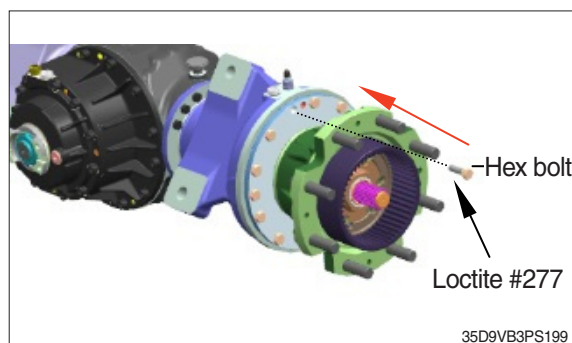
※ **Cover loctite #5127 on beam.**



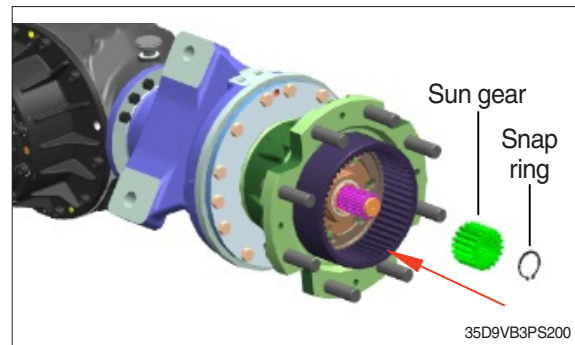
(12) Assemble hex bolt.

- Tightening torque : 10.2 ~ 11.2 kgf·m
(73.3 ~ 80.6 lbf·ft)

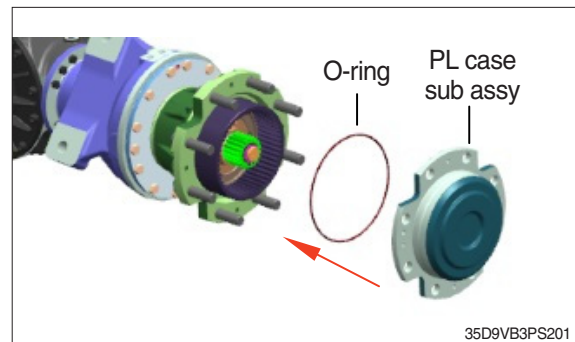
※ **Cover loctite #277 on the screw side of bolt.**



(13) Assemble snap ring and sun gear.



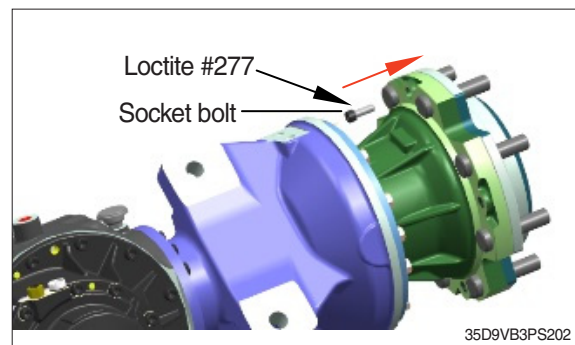
(14) Assemble o-ring and PL case sub assy.



(15) Assemble socket bolt.

- Tightening torque : 6.1 ~ 6.6 kgf·m
(44.0 ~ 47.6 lbf·ft)

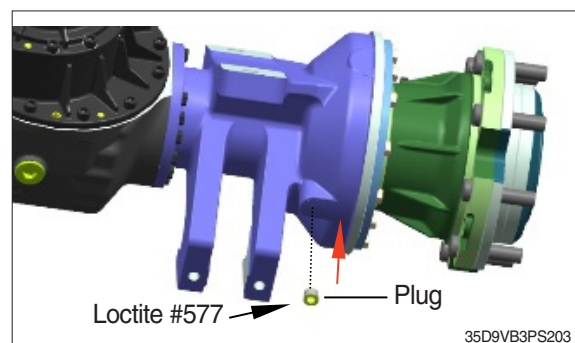
※ **Cover loctite #277 on the screw side of bolt.**



(16) Assemble plug.

- Tightening torque : 4.0 ~ 5.0 kgf·m
(29.1 ~ 36.3 lbf·ft)

※ **Cover loctite #577 on the screw side of plug.**



(17) Assemble o-ring → bleeder fitting → bleeder → bleeder cap.

- Fitting tightening torque : 3.8 ~ 4.2 kgf·m
(27.2 ~ 30.2 lbf·ft)
- Bleeder tightening torque : 1.6 ~ 2.0 kgf·m
(11.4 ~ 14.4 lbf·ft)

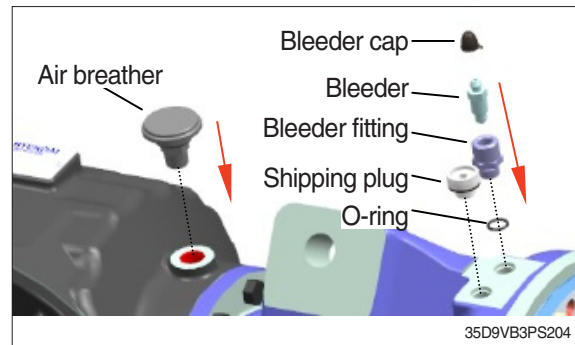
※ **Spread grease on o-ring.**

Assemble air breather on axle housing.

- Tightening torque : 0.5 ~ 0.6 kgf·m
(3.7 ~ 4.3 lbf·ft)

※ **Cover loctite #577 on the screw side.**

Assemble shipping plug.

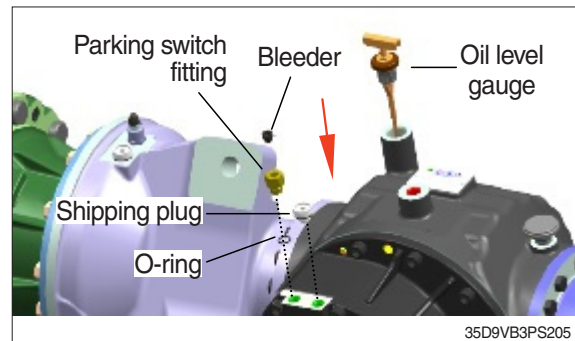


(18) Assemble o-ring → parking switch fitting → Bleeder cap.

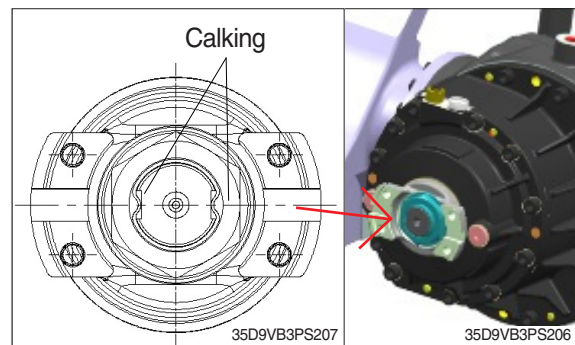
- Fitting tightening torque : 3.8 ~ 4.2 kgf·m
(27.2 ~ 30.2 lbf·ft)
- Bleeder tightening torque : 1.0 ~ 1.2 kgf·m
(7.2 ~ 8.6 lbf·ft)

※ **Spread grease on o-ring.**

Assemble shipping plug and oil level gauge.



(19) Caulking of lock nut (2 EA) on carrier assy.



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 ℓ (2.1 U.S. gal, 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 hour, and then every 1000 hour**

② Oil supply

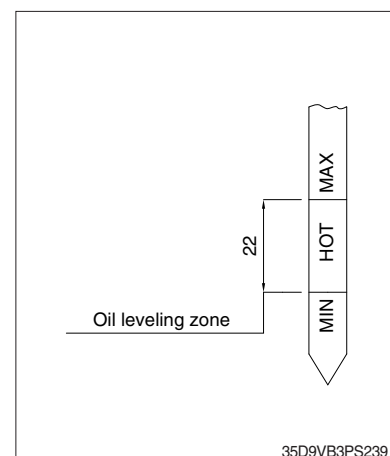
- Please stop the engine (ok), then refuel the oil into transmission until 「HOT」 level of oil level gauge.
- Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.
- The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the 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.

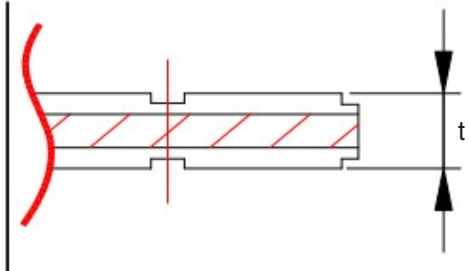
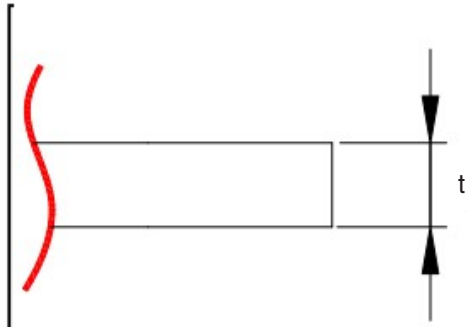
※ **Check the oil level, when the oil temperature is 50℃ ~ 60℃.**

Amount of all oil : about 14 ℓ (3.7 U.S. gal)



(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.

	Item in the F&R clutch	Standard	Limit
Friction disk		2.4	2.1
Plate		1.8	1.6
Back plate		3	2.8

(4) Period of exchanging parts

Item name \ time	At the first overhaul	At the overhaul after the second times
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 nd and 4 th time.
Seal ring race plane		Please change the part that exceeds the wear limit.
Friction disk		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

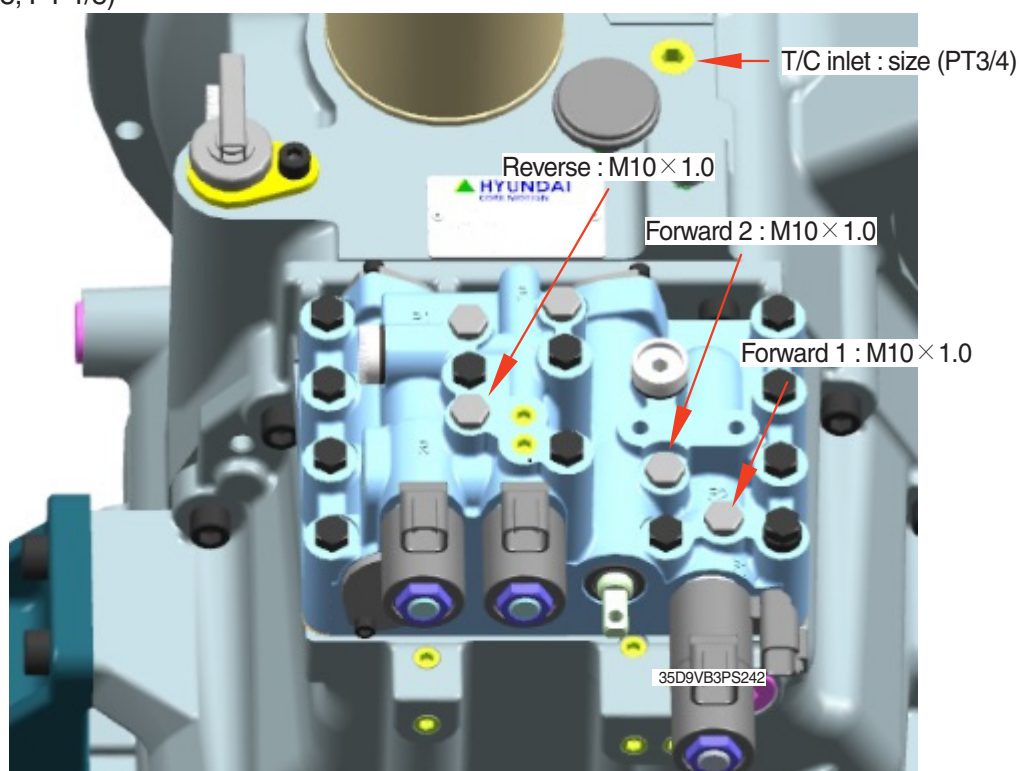
(6) Test

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, PT 1/8)



- 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	1.5 ± 0.2	1.5 ± 0.2
Forward	1.5 ± 0.2	1.5 ± 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.**

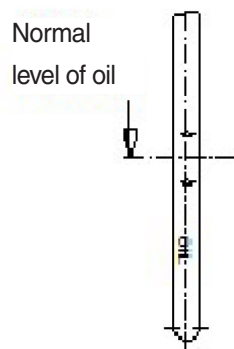
(4) Oil level

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.**

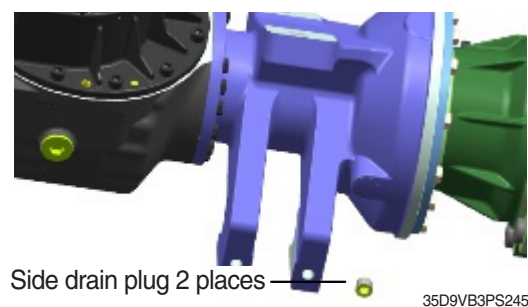
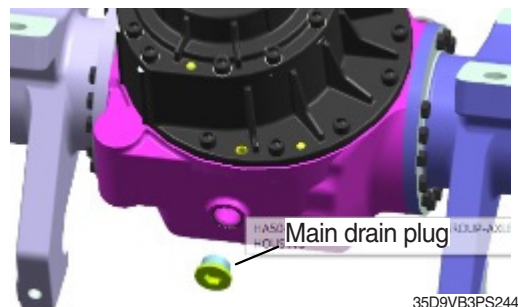
The part for oil filling and drain plugs are located in the axle housing.

- 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 which is described the below figure, if the height of oil is lower than the lowest limit, replenish up to normal level.



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 13 ℓ (3.4 U.S. gal)

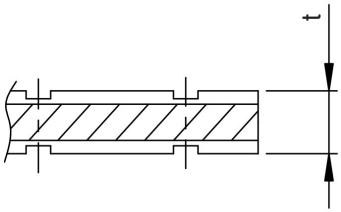
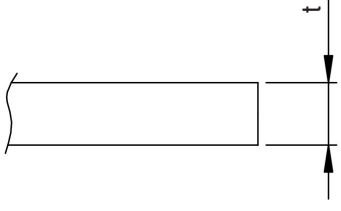
b. Available oil list

Manufacture name	Brand name
Mobil corporation	Mobil fluid 424
Sheel oil corporation	Shell spriax S4 TXM

(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 hours, 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.

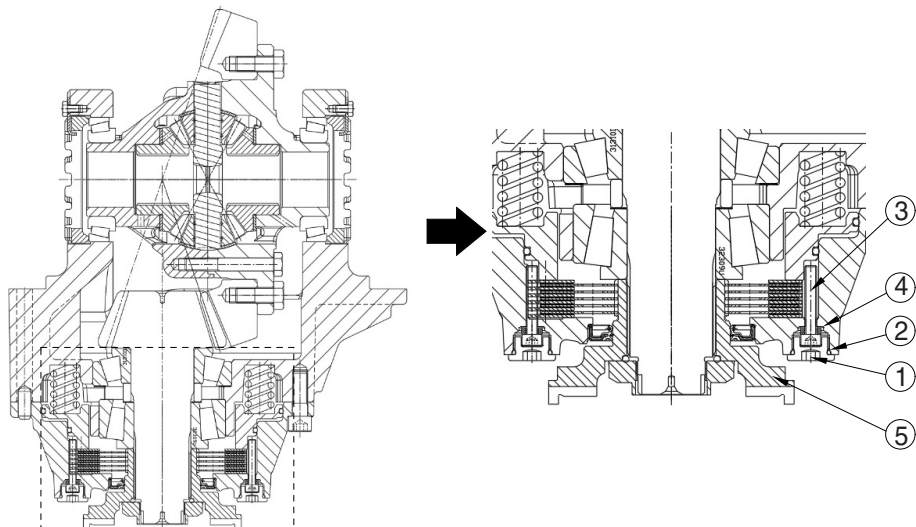
④ Snap ring, disc, opposing plate : Change the part that exceeds the wear limits.

Item		Part no.	Standard	Limit
Disc		C11D00760 (Service brake)	t=4	t=3.4
		C11D00571 (Parking brake)	t=2.0	t=1.7
Opposing plate		C11D00750 (Service brake)	t=2.5	t=2.3
		C11D00581 (Parking brake)	t=1.4	t=1.2

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.

(6) Emergency release operation method F50 parking



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① Emergency release operation method

- Part ①, ② (plug and o-ring) disassembly.
- Part ③ (socket bolt) and part ④ (parking spacer) disassembly.
- Reassemble ③ (socket bolt) and tighten until part ③ (socket bolt) stops.
- Operation check of part ⑤ : release completed when rotating part ⑤ (flange yoke).

② Restoration after emergency release

- Disassemble part ③ (socket bolt) and assemble part ④ (parking spacer).
- Tighten until part ③ (socket bolt) stops.
- Assemble part ①, ② (plug and o-ring).
- Operation check of part ⑤ : completed when part ⑤ (flange yoke) is not rotating.

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 torque convertor.
		The stator free wheel is sticking.	Please check the rise of the temperature of oil at no load. And please change torque convertor 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 torque convertor.
	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.
		The orifice is clogging.	Please wash the orifice.

(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 worn 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.

Locating fault and cause		Measures
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.
	Loosened 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.

(3) Service brake

① Brake overheats.

Locating fault and cause		Measures
Overheating due to excessive duty cycle	Inadequate coolant flow or heat exchange	Install brake cooling system if not already installed on truck.
		Re-analyze and re-size brake cooling system if necessary.
Inadequate coolant flow	Low pump output, blocked filter or coolant lines	Check pump output at different operating modes. Replace filter and check lines.
Low or no coolant	Improper fill or leaks	Check for proper fill level.
	leaking face seal	Replace or reinstall face seal assembly.
	Loosened or damaged plugs.	Tighten drain, fill or forced cooling plug. Replace if damaged.
	Deteriorated or inadequate sealant used at joint.	Disassemble, clean, re-seal and re-assemble bake housing joint.
Brake drags	More than 0.14 MPa pressure applies when brakes released.	Repair hydraulic system so pressure is less than 0.14 MPa when brakes released and while machine is operating in any mode.
	Damaged piston return spring assy	Repair or replace for piston return spring assy.
	Piston not returning	Check piston seals and seal separator.
	Wrong cooling and/or actuation fluid used.	Check piston seals and seal separator for swelling or damaged. Replace as necessary. Purge system and use correct fluid.
	Tighten or damaged splines (ex. friction disc-to-hub driver)	Repair or replace parts.

② Brake does not apply.

Locating fault and cause		Measures
Low or no pressure to brake	Empty fluid reservoir	Fill reservoir to correct level with specified fluid.
	Damaged hydraulic system	Repair hydraulic system.
	Leaked of brake actuation fluid	Refer to "brake leaks actuation fluid" in this manual.
	Parking brake not adjust properly	Adjust parking brake switch as described in assy of this manual.

③ Brake does not release.

Locating fault and cause		Measures
Truck does not move.	Damaged hydraulic system	Repair hydraulic system.
Brakes dragging	More than 0.14 MPa pressure applied when brakes released.	Repair hydraulic system so pressure is less than 0.14 MPa when brakes released and while machine is operating in any mode.
	Damaged piston return spring assy	Repair or replace piston return spring assy.
	Piston not returning.	Check piston seals for swelling or damage. Replace as necessary.
	Wrong cooling and/or actuation fluid used	Check piston seals for swelling or damage. Purge system and use specified fluid.
	Parking brake not adjusted properly	Adjust parking brake lever as described in assy of this manual.

④ Braking performance

Locating fault and cause		Measures
Noticeable change or decrease in stopping performance.	Inadequate actuation fluid supply to brakes	Replenish fluid in brake system. Check for leakage and correct cause.
	Inadequate pressure to apply brakes	Check brakes apply system. Check for leakage in brake system or brakes, and correct cause.
	Worn or damaged discs	Inspect and replace discs if necessary. ※ As disc wear occurs, make sure brake system can supply adequate fluid to fully apply brakes.
	Overheated seals and/or discs	Inspect and replace discs and seals if necessary.
Brake does not fully apply.	Dirty or contaminated cooling fluid.	Drain and flush cooling fluid from brakes and entire brake system. Replace with approved fluid. In some case, it may necessary to replace discs. Clean or replace filter.
Brake does not fully apply.	Empty fluid reservoir.	Fill reservoir to correct level with specified fluid.
	Damaged hydraulic system	Repair hydraulic system
	Leakage of brake actuation fluid.	Refer to "brake leaks actuation fluid" in this manual.
Brake felt spongy/soft	Brakes or brake system not properly bled.	Bleed brakes and brake system.