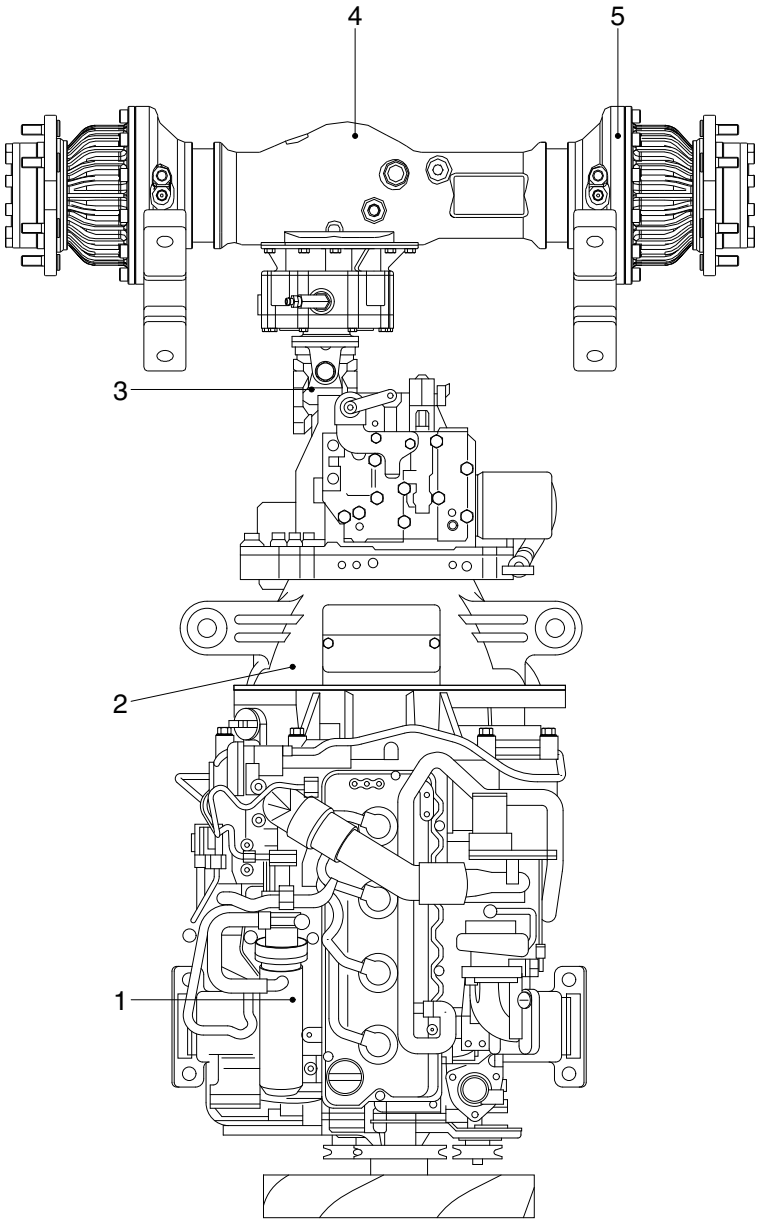
SECTION 3 POWER TRAIN SYSTEM
(Option, HD Transmission and Drive Axle)

1. POWER TRAIN DIAGRAM

1) STRUCTURE



22D9PT26

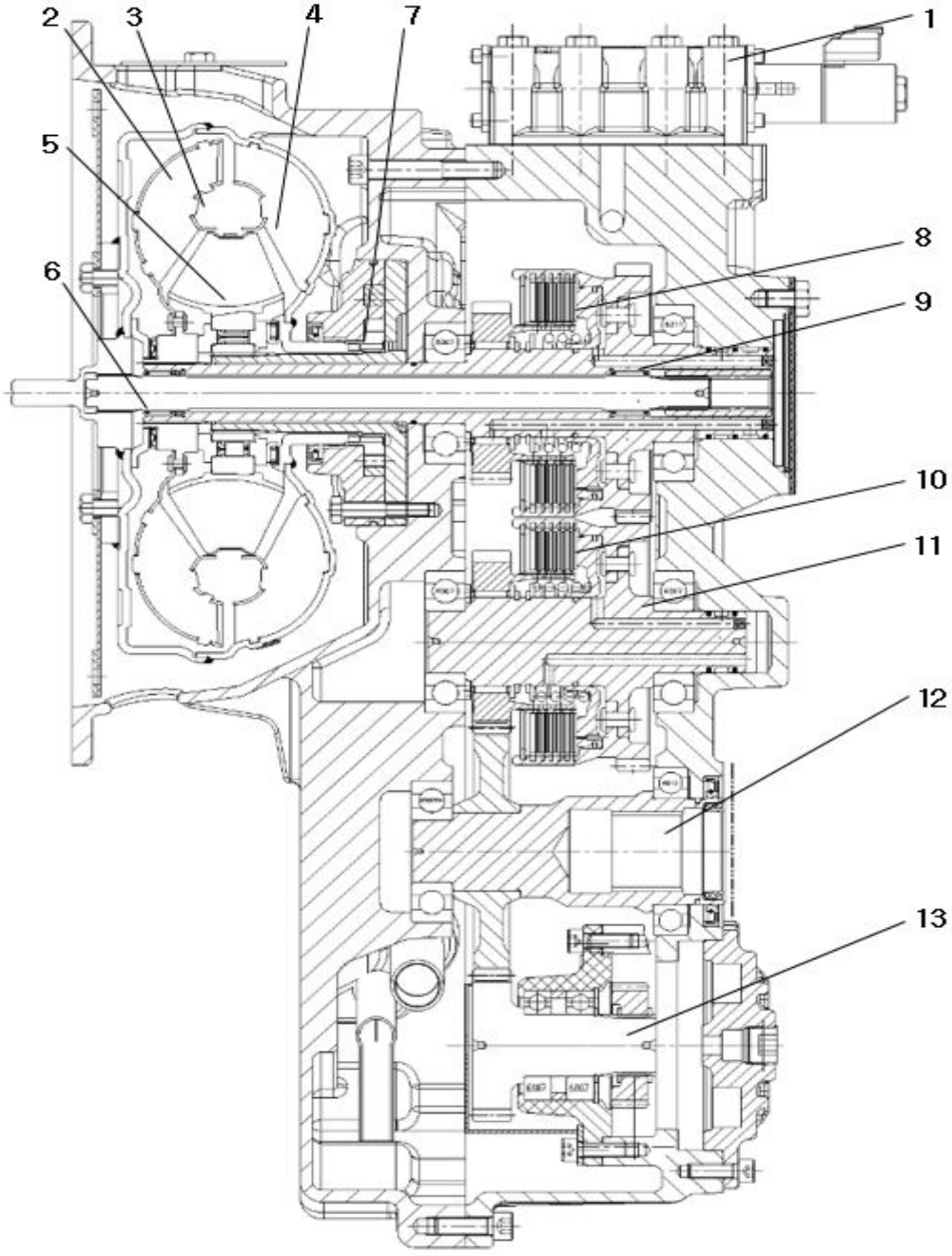
1	Engine	3	Drive shaft	5	Brake
2	Transmission	4	Drive axle		

2) SPECIFICATION

Item			Specification
Torque converter	Model		KAPEC 280DJ
	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.87
Transmission	Type		Power shift
	Gear shift(FWD/REV)		1/1
	Control		Solenoid ON/OFF type
	Overhaul ratio	FWD	1.4375
		REV	1.4375
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		11.568 : 1
	Gear		Spiral bevel gear type
Wheels	Q'ty (FR/RR)		Single : 2/2, Double : 4/2
	Front (drive)	2.2/2.5	Single : 7.00-12-14 PR
			Double : 6.00-15-10 PR
		3.0/3.3/3.5	Single : 28×9-15-14PR
			Double : 6.00-15-10 PR
	Rear (steer)	2.2~3.5	Single : 6.50-10-14 PR
			Double : 6.50-10-12 PR
Brakes	Travel		Front wheel, wet disk brake
	Parking		Wet disk (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		78.9˚ to both right and left angle, respectively

2. TRANSMISSION

1) STRUCTURE



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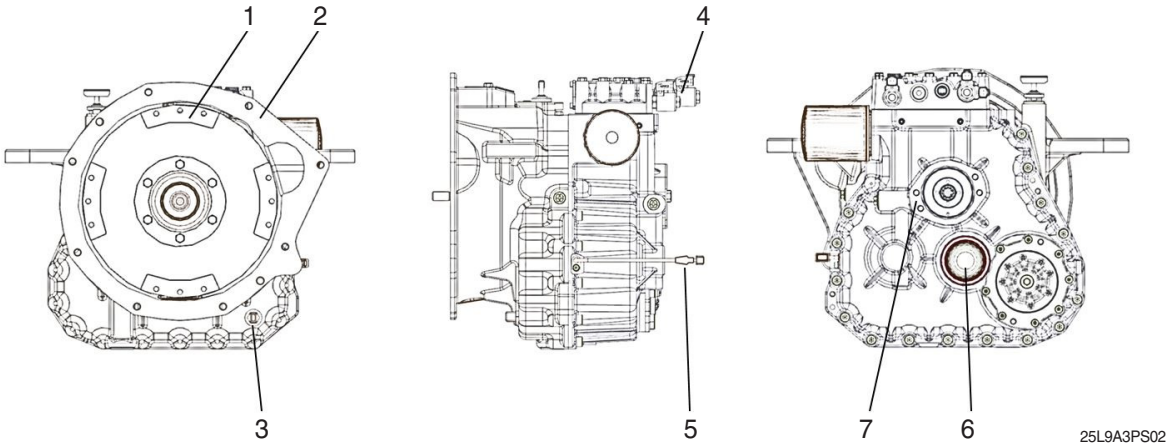
1	Control valve	6	PTO shaft	11	Reverse clutch shaft
2	Torque converter	7	Charging pump	12	Output shaft
3	Turbine wheel	8	Forward clutch pack	13	Parking brake
4	Impeller wheel	9	Forward clutch shaft		
5	Stator	10	Reverse clutch pack		



1	Torque converter	4	Control valve	7	PTO pump mounting
2	Torque converter housing	5	Speed sensor		
3	Temp sensor	6	Output (Universal joint link part)		

2) OPERATION

(1) The torque converter acts as a fluid coupling to smoothly transfer engine power to the transmission. It also increases the torque by the force applied to the stator while oil is circulating inside the torqueconverter.

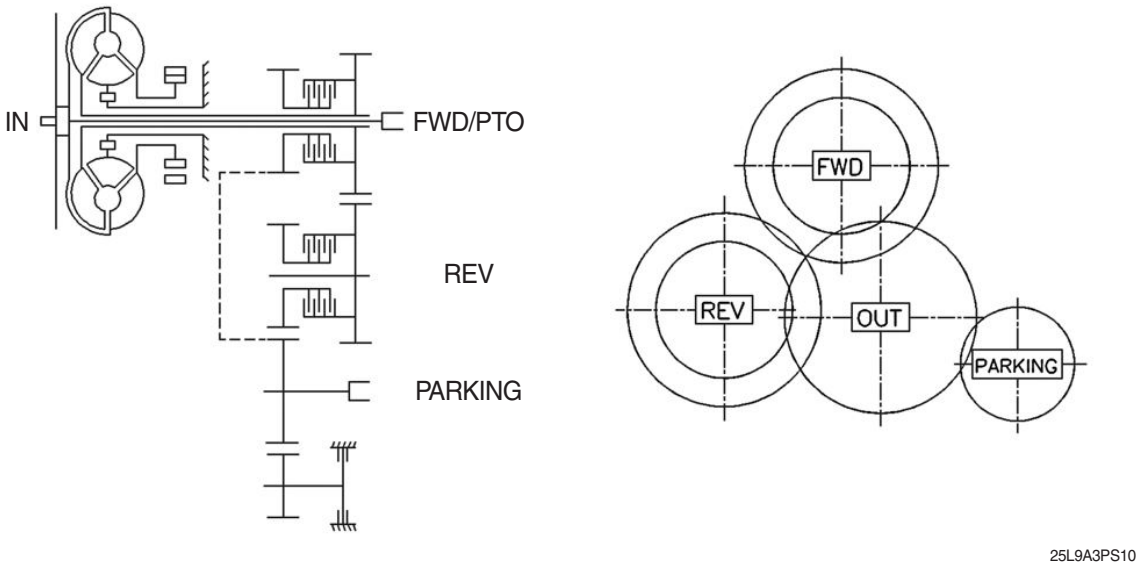
(2) The engine power transferred through the flexible plate is then transferred to the impeller on the torque converter in order to drive the oil pump. The oil pump circulates oil to the oil filter by pumping the oil in the oil tank on the transmission. Oil from which foreign matter has been filtered is supplied to the control valve and the inside of the torque converter.

(3) The oil supplied to the control valve produces the level of pressure necessary to operate the clutch on the main relief valve. Pressure is applied to the forward/reverse clutch via operation of the solenoid valve using the electric signal delivered at the time of forward/reverse driving of the vehicle, and thus power can be transferred through the gear.

(4) The oil supplied to the torque converter is transmitted to the turbine in a state in which centrifugal force is generated by the rotation of the impeller, and becomes a driving force for rotating the turbine.

(5) The oil which rotates the turbine circulates, and the force of the reaction produced when it passes through the stator increases the torque. The oil that comes out of the torque converter enters the air cooled passage and, after cooling down, is supplied to the clutch shaft where it cools down the plate of the clutch, and returns to the transmission. The process described above proceeds continuously, completing the transmission operations.

3) GEAR BOX SCHEMATIC



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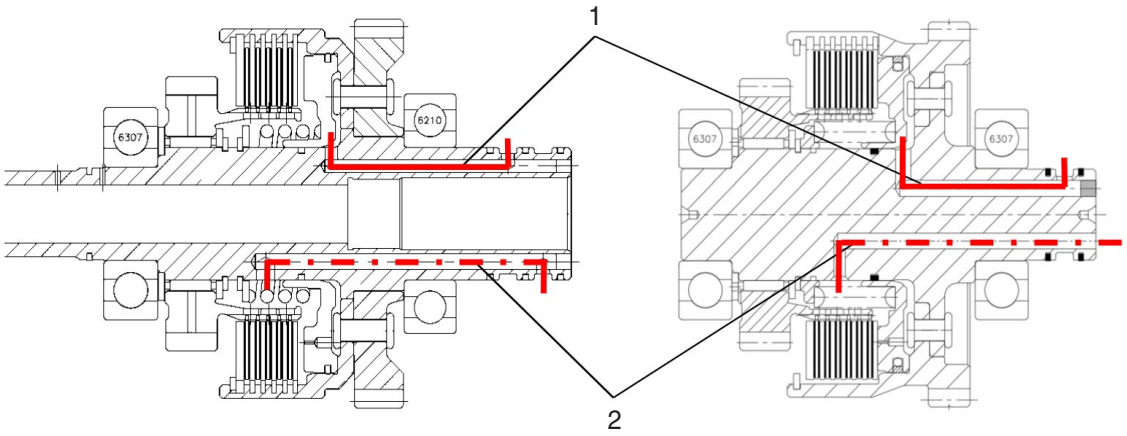
IN =Input
FWD = FWD Clutch
REV = REV Clutch
PTO = Power Take Off
OUT =Output
PARKING = Parking brake

4) CLUTCH



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

25D9V3PS10

(1) Gear shift refers to the action of shifting the vehicle from neutral to forward/reverse.

(2) When forward or reverse is decided by the vehicle's shift lever, the corresponding electric signal switches the forward/reverse solenoid to the ON state.

(3) The high-pressure oil produced in the main relief relieves the flow rate and oil speed before it is supplied to the clutch through the solenoid valve while passing through the orifice and modulation valve.

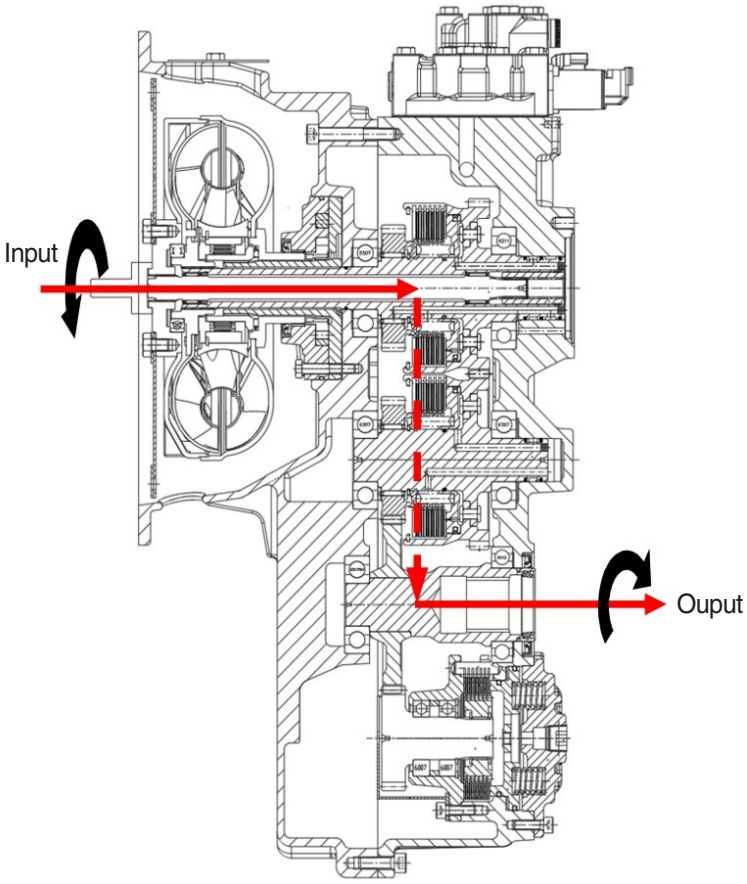
(4) Oil whose flow rate and speed have been relieved is slowly supplied to the piston of the corresponding clutch through the solenoid valve to prevent impact at the time of gear shift.

(5) As hydraulic oil applies pressure to the piston and the force of the return spring is exceeded, it compresses the friction plate and disc.

(6) When the clutch friction plate and disc are fully compressed, power is transferred to the gear connected to the friction plate through the spline.

5) POWER FLOW

(1) Forward



Input
↓
Torque converter
↓
Forward clutch shaft
↓
Forward clutch gear
↓
Output gear
↓
Output

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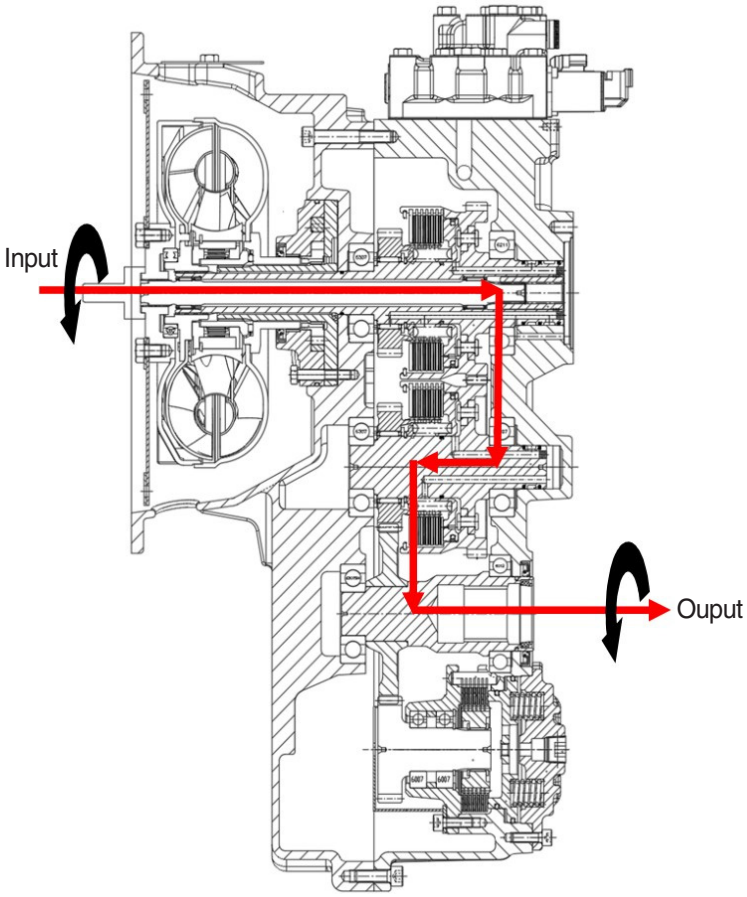
(2) Reverse



Input
↓
Torque converter
↓
Forward clutch shaft
↓
Forward drum gear
↓
Reverse drum gear
↓
Reverse clutch shaft
↓
Clutch gear
↓
Output gear
↓
Output

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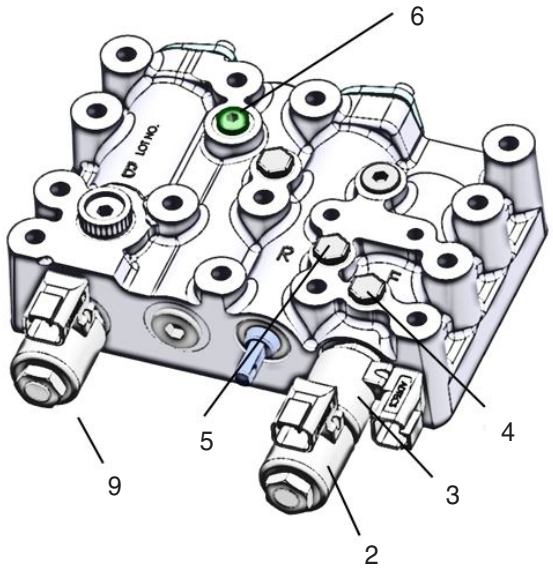
6) CONTROL VALVE

(1) Structure



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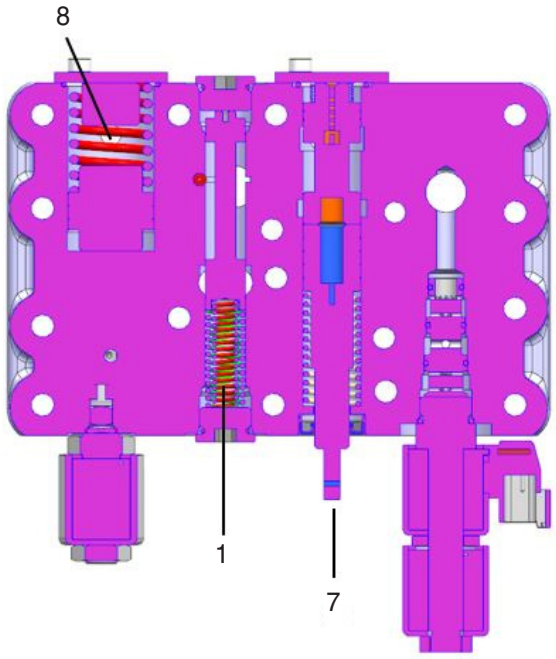


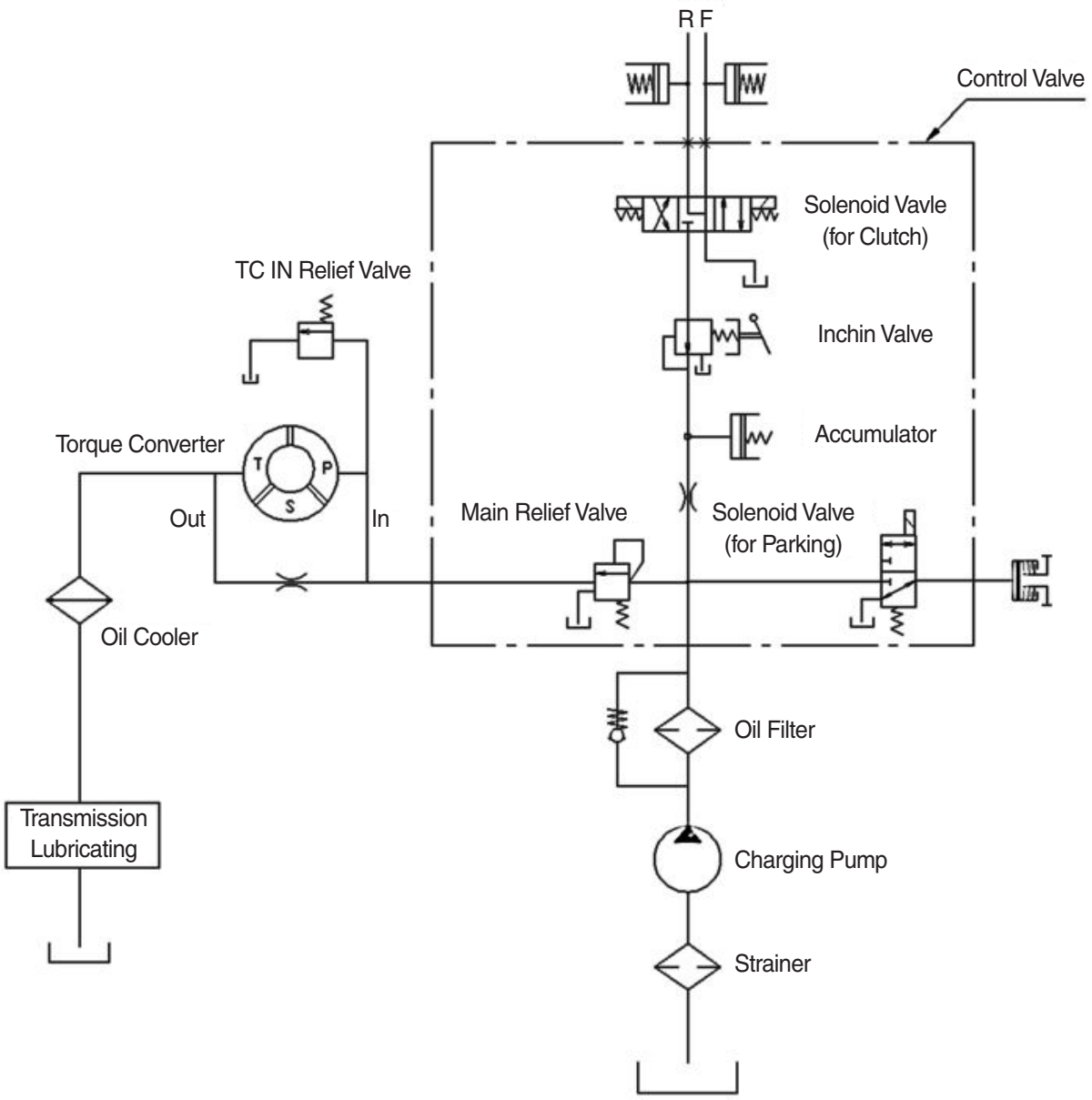
25L9A93PS07

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

(2) Function

Item	Function
Main relief	Maintains constant clutch pressure.
Forward/Reverse solenoid valve	Change direction of flow path to receive electrical signals when shifting forward and backward and to transfer main pressure to the clutch.
Inching	A function for increasing the engine speed temporarily in order to lift the mast quickly while maintaining a low travel speed by reducing forward/reverse clutch pressure.
Modulation	A function for softening the impact at the time of a gear shift through soft contact of the clutch plate by adjusting the flow rate and the speed of the oil supplied to the clutch during forward/ reverse gear shift.
Parking solenoid valve	The ability to release the park brake operation

(3) Hydraulic circuit



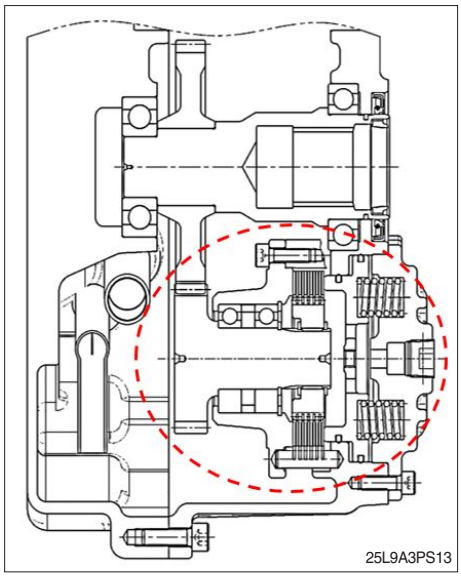
① The charging pump of the transmission draws oil in the transmission through the strainer, and the oil is delivered to the torque converter through the main relief valve to form the main pressure of the forward and reverse clutch.

② The oil delivered to the torque converter flows between the turbine shaft and the inner wheel of the free wheel and flows into the converter circuit through the space between the stator wheel and the turbine wheel.

③ The oil discharged from the torque converter is cooled through the vehicle's oil cooler. This cooled oil also lubricates and cools each part of the transmission, such as bearings and clutches.

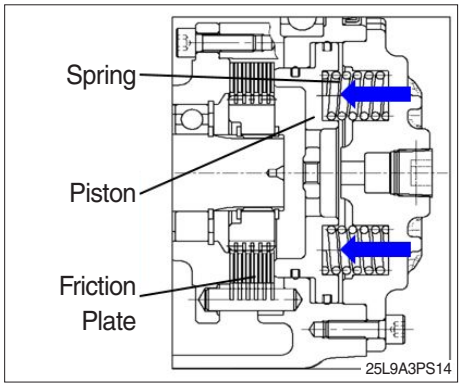
(4) Parking brake

The transmission includes a parking brake.



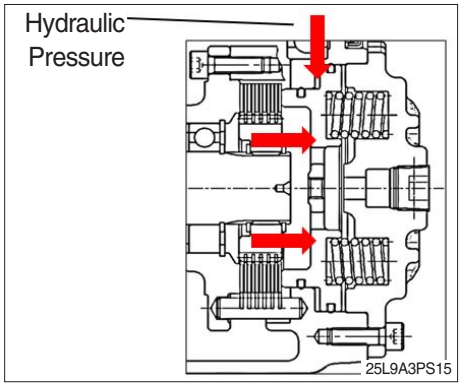
① Parking brake operation

The parking spring pushes the piston to squeeze the plate, causing parking brake force by friction force.



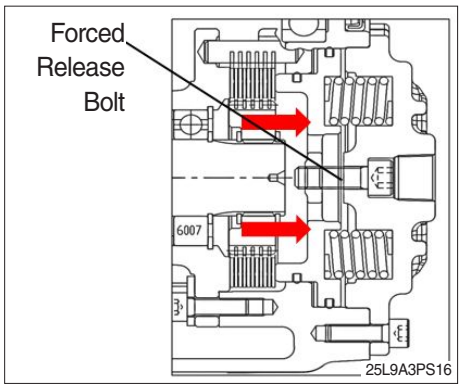
② Parking brake release

Hydraulic pressure is applied to the piston from the TM control valve as the piston compresses the spring, the plate is released.



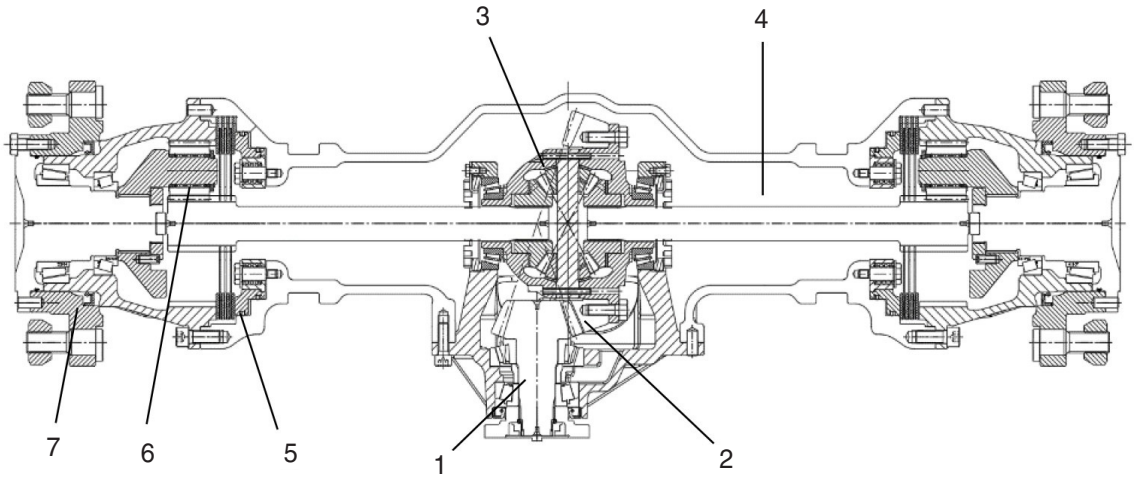
③ Parking brake forced release

If no parking release pressure is formed due to engine failure or other causes, vehicle can be moved after forced release of the parking brake.



3. DRIVE AXLE

1) STRUCTURE



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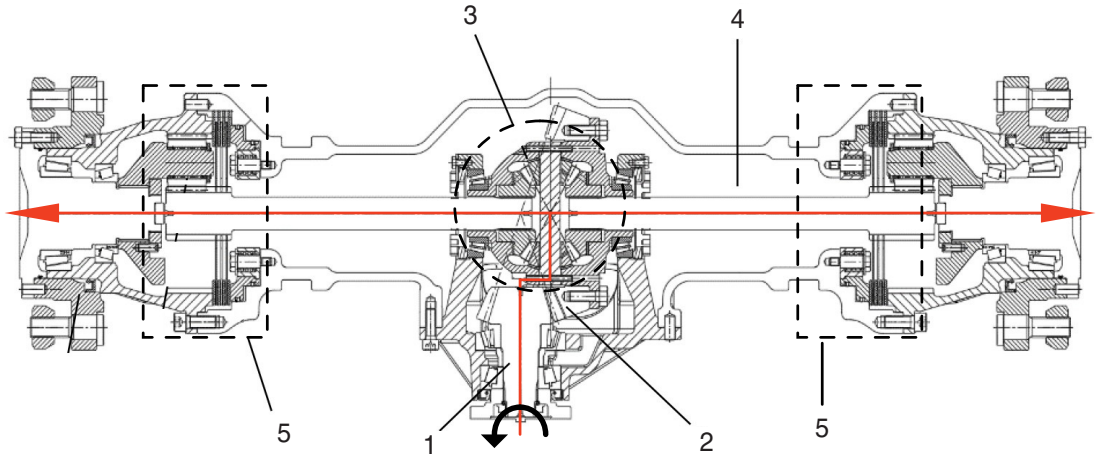
1	Pinion shaft	4	Axle shaft	7	Hub
2	Ring gear	5	Service brake		
3	Differential device	6	Hub reduction		

2) OPERATION

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



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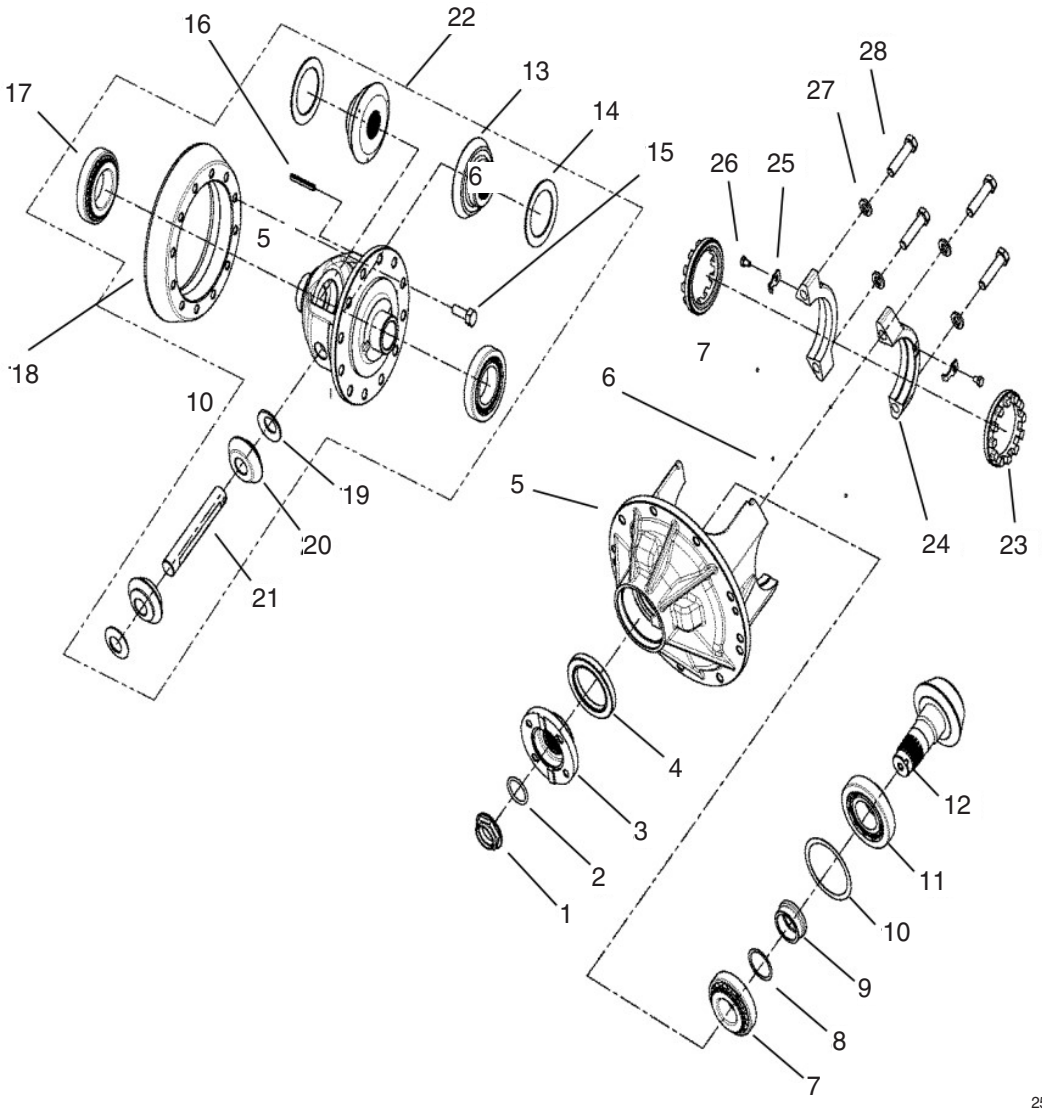
1	Pinion shaft	3	Differential device	5	Hub reduction
2	Ring gear	4	Axle shaft	6	Service brake

3) Carrier sub assembly

(1) Structure



25D9V3PS104

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

(2) Performance property

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

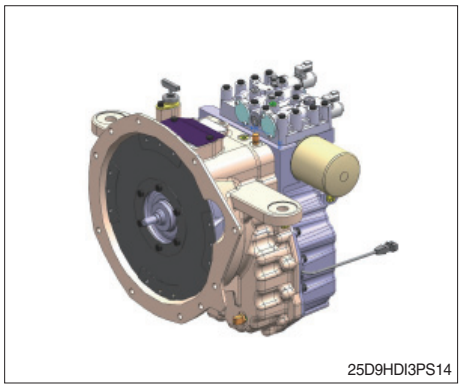
And also, the differential case are connected with the left and right of the axle shaft and the spline respectively, it delivers the power to the final drive.

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

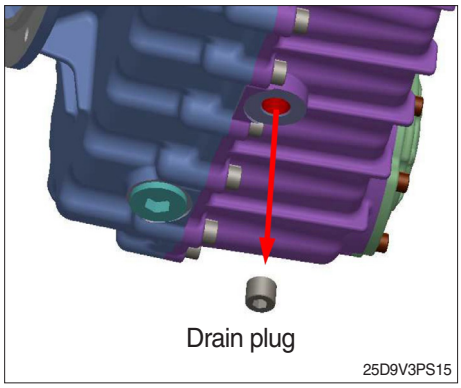
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION ASSEMBLY

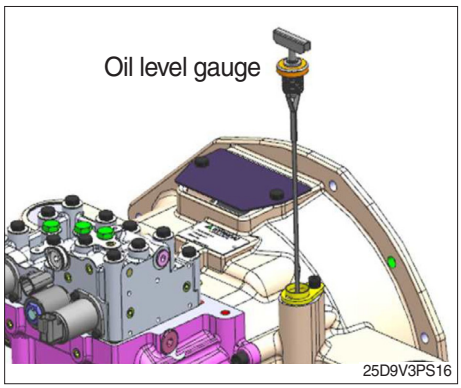
(1) Disassembly the transmission assembly.



(2) Loosen the drain plug and discharge the oil before starting the parts disassembly.

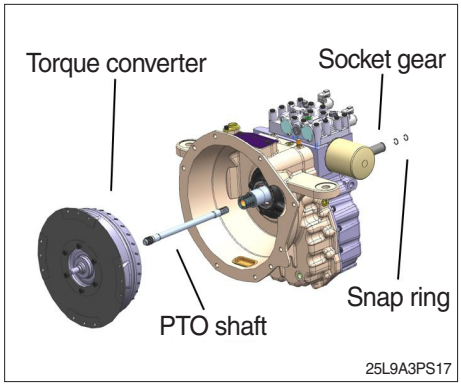


(3) Remove the oil level gauge.

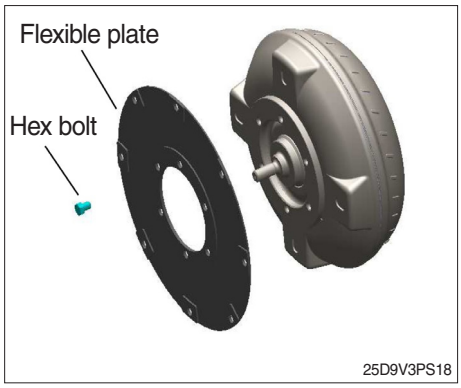


(4) Disassembly of the torque converter, PTO shaft, socket gear, speed/temp sensor, oil filter

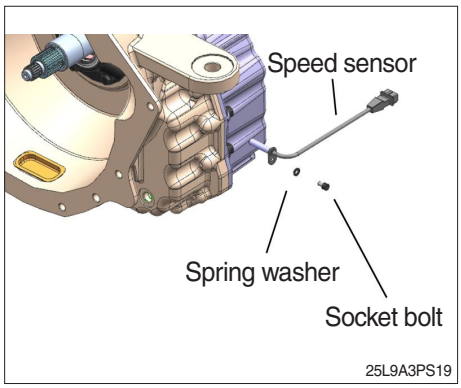
① Remove torque converter, PTO shaft, socket gear and snap ring.



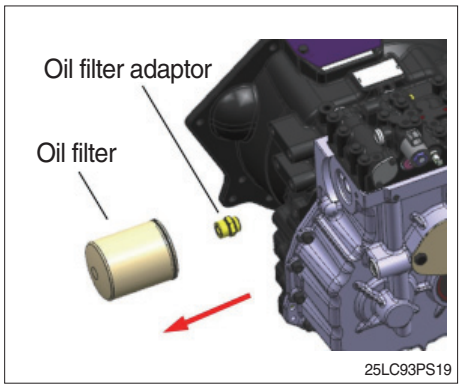
② Loosen the hex bolts and separate the flexible plate.



③ Loosen the socket bolt and remove the spring washer and the speed sensor.



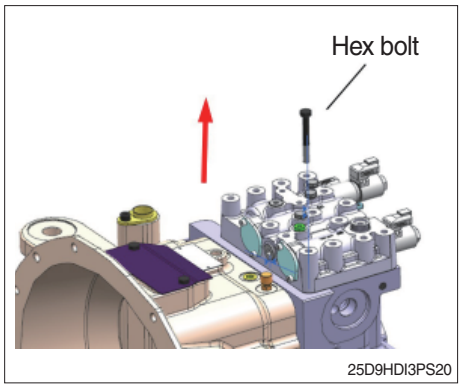
(5) Remove the oil filter and oil filter adaptor.



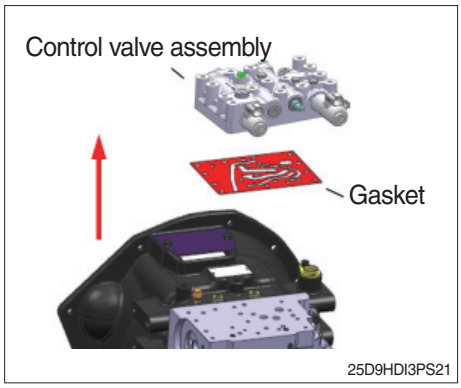
(6) Disassemble the control valve assembly.

① Loosen the hex bolts.

· M8×70 L : 14 EA



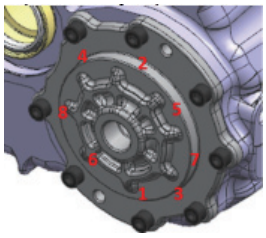
② Remove the control valve and gasket.

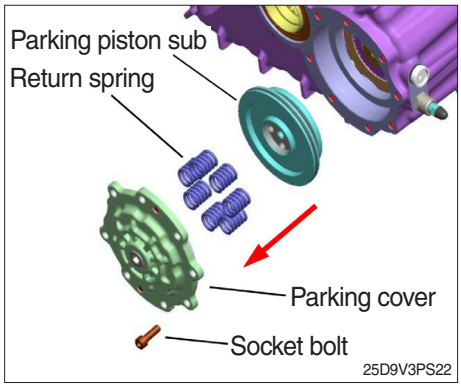


(7) Disassembly of parking piston

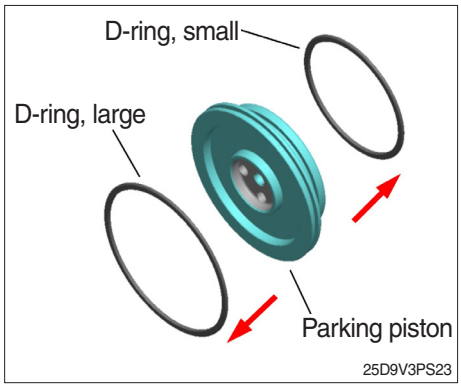
① Loosen the socket bolts (M8×25L, 8 EA).

※ Disassemble slowly and follow the number. It prevent to jump out the cover by return spring. Then remove the return springs and parking piston sub.





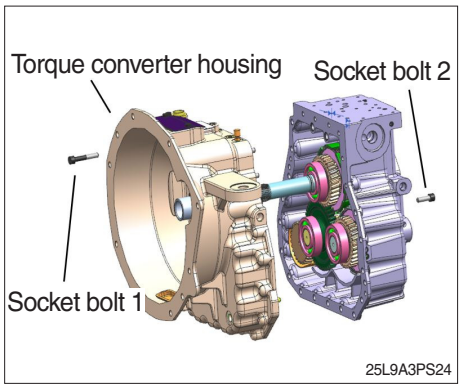
② Remove the D-rings.



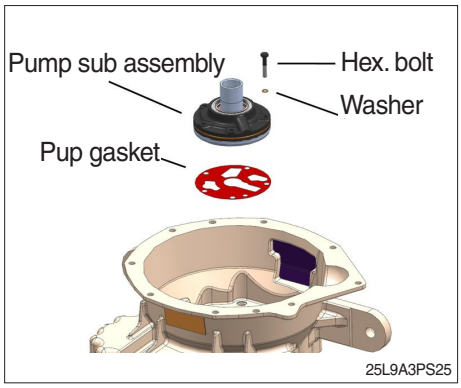
(8) Loosen the socket bolts. Then separate the T/C housing.

① M10×60 L : 6 EA

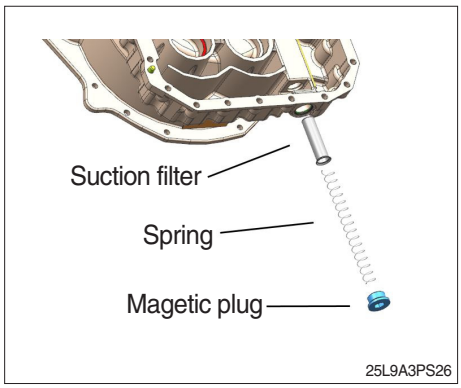
② M10×30 L : 16 EA



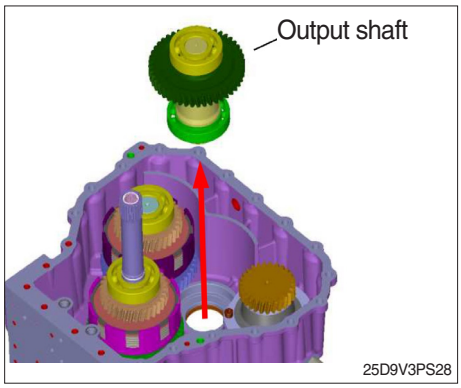
(9) Loosen the hex bolts and remove the washers, charging pump and gasket.



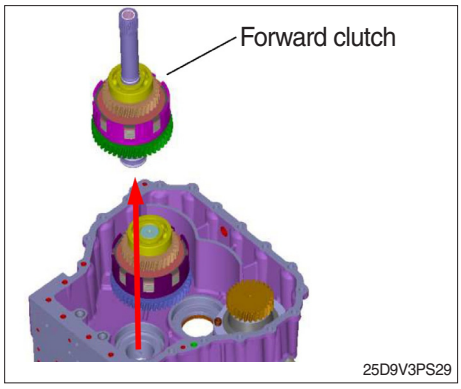
(10) Loosen the magnetic plug and remove the spring and suction filter.



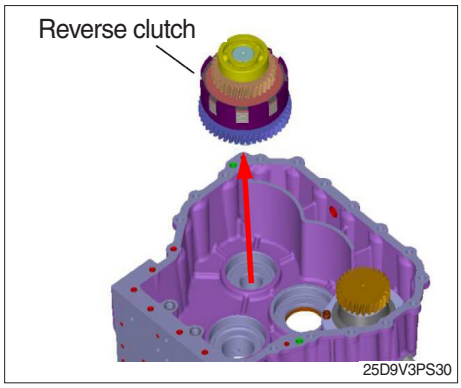
(11) Remove the output shaft.



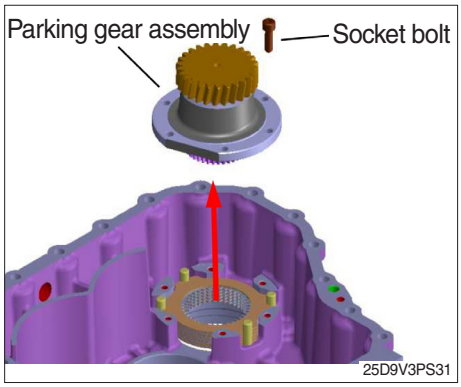
(12) Remove the forward clutch.



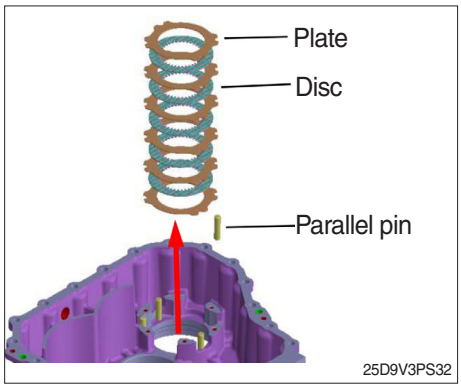
(14) Remove the reverse clutch.



(15) Loosen the socket bolts and remove the parking gear assembly.
· M8×25 L : 6 EA

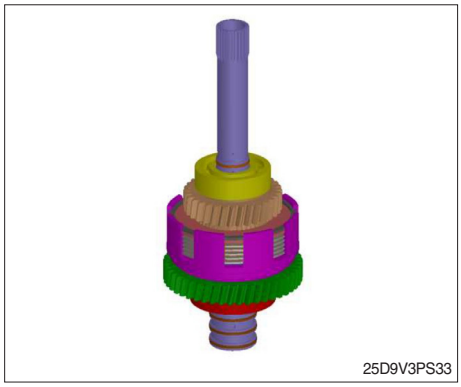


(16) Remove the plates (6 EA) and discs (5 EA), parallel pins (4 EA).

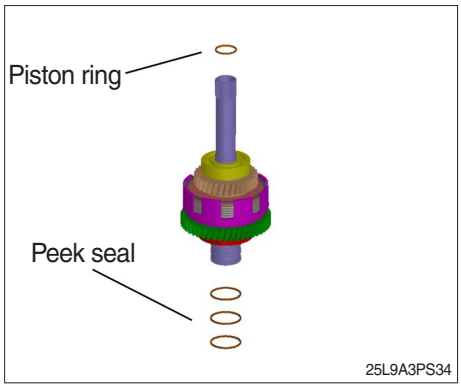


2) DISASSEMBLY OF CLUTCHES

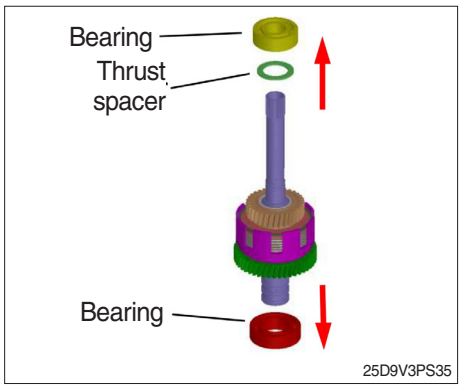
(1) Disassemble the forward clutch.



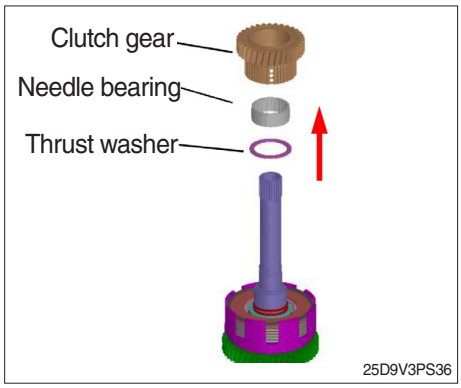
(2) Remove the piston ring and peek seals.



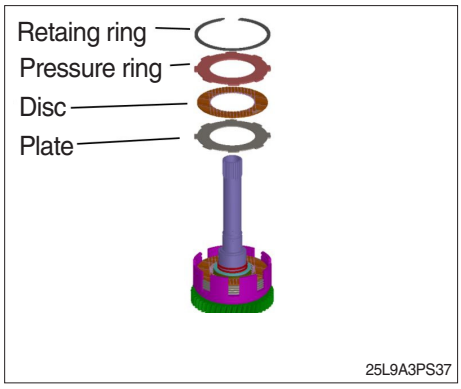
(3) Remove the bearings and thrust spacer.



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

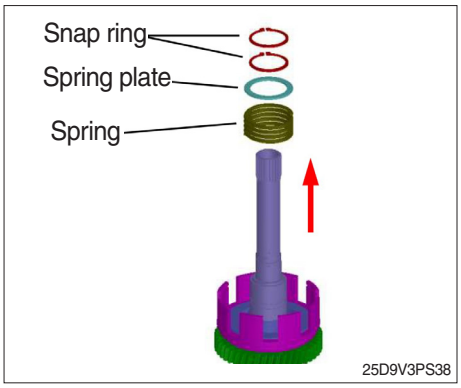


(5) Remove retaining ring, pressure plate, plates and discs.

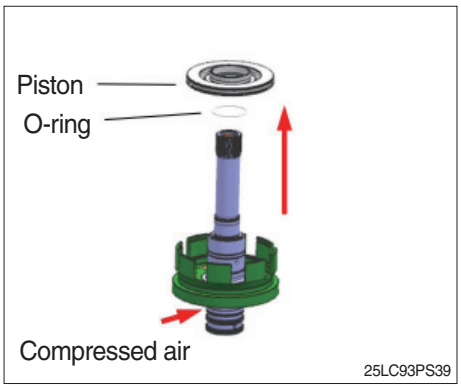


(6) Disassemble snap ring, spring plate and spring from shaft.

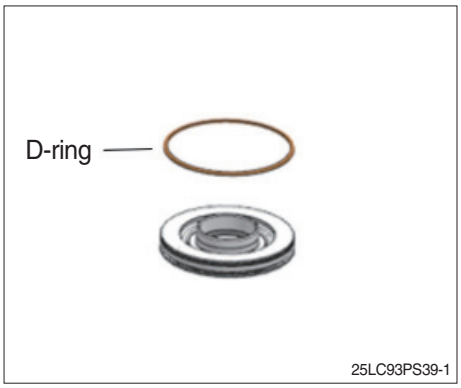
⚠ **Snap ring can bounce by the force of the spring, so fix the spring and remove it. Pay attention to safety when disassembling snap ring.**



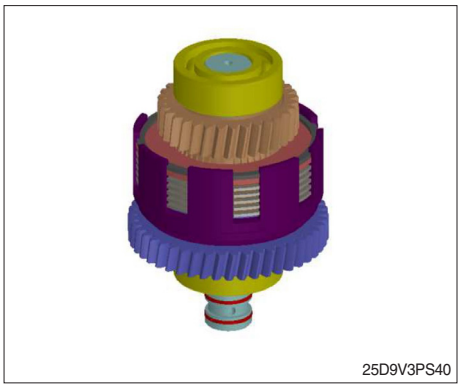
(7) By means of compresed air, press the piston off and remove it. Then remove the O-ring.



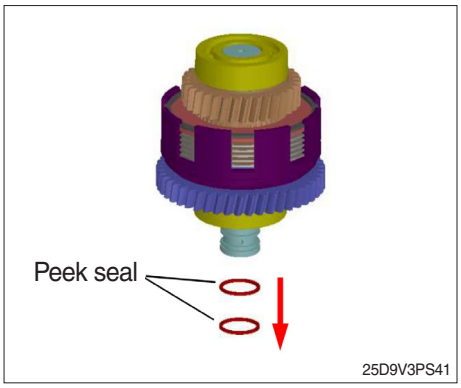
(8) Remve the D-ring from the piston.



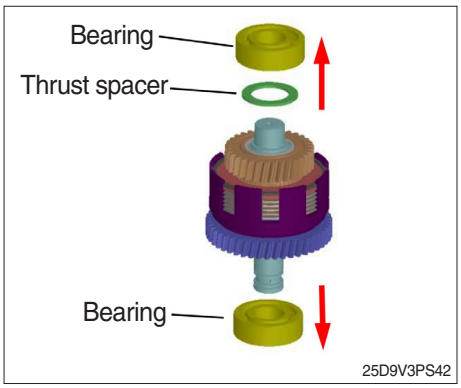
(9) Disassemble the reverse clutch.



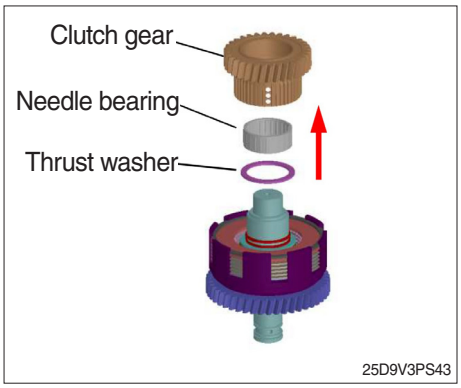
(10) Remove the peek seals.



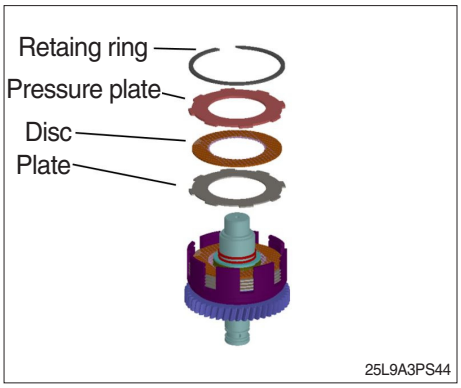
(11) Remove the bearings and thrust spacer.



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

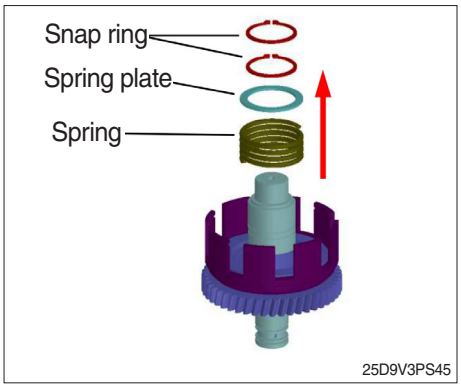


(13) Remove retaining ring, pressure plate, plates and discs.

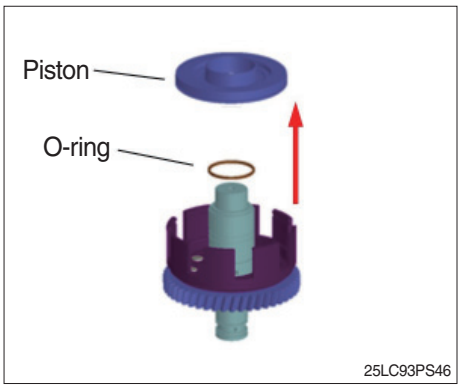


(14) Remove the snap rings, spring plate and spring.

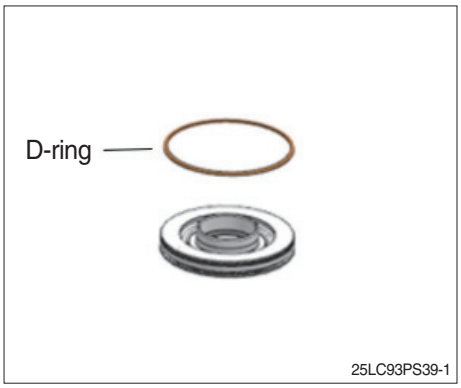
⚠ **Snap ring can bounce by the force of the spring, so fix the spring and remove it. Pay attention to safety when disassembling snap ring.**



(15) By means of compressed air, remove piston and then remove O-ring.

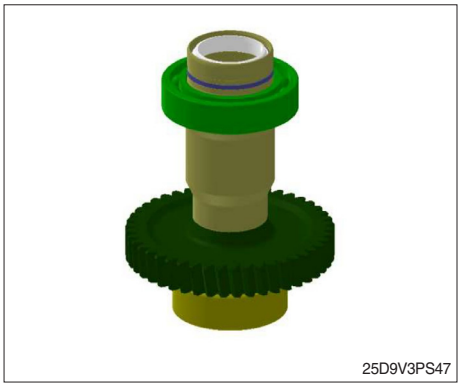


(16) Remve the D-ring from the piston.

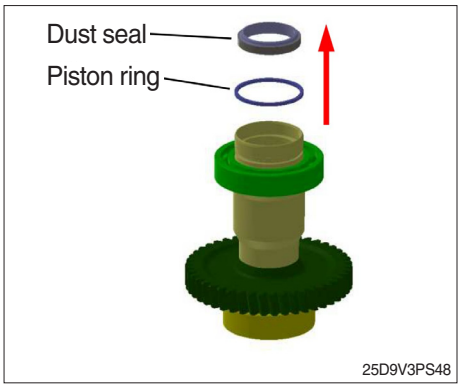


3) DISASSEMBLY OF OUTPUT SHAFT

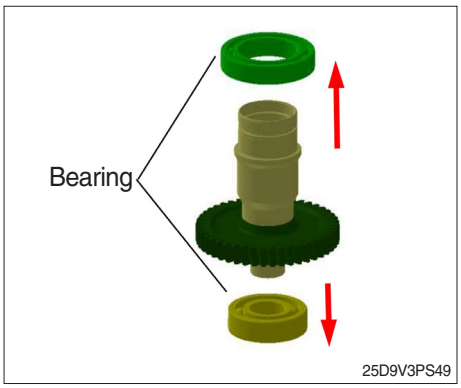
(1) Disassemble the output shaft.



(2) Remove the dust seal and piston ring.

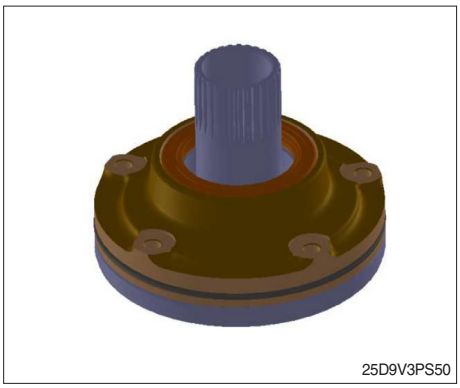


(3) Remove the bearings.

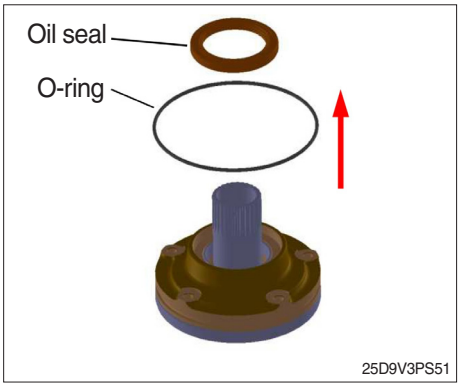


4) DISASSEMBLY OF CHARGING PUMP

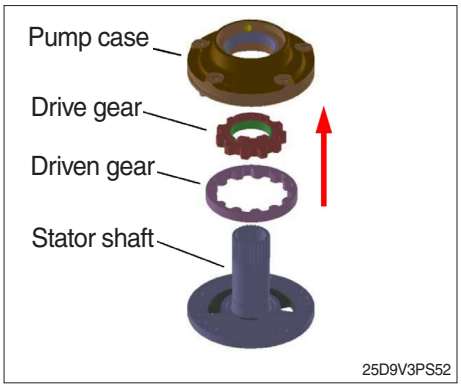
(1) Disassemble charging pump.



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

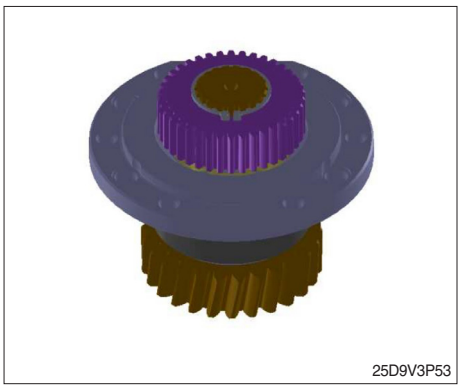


(3) Remove the pump case, drive and driven gear.

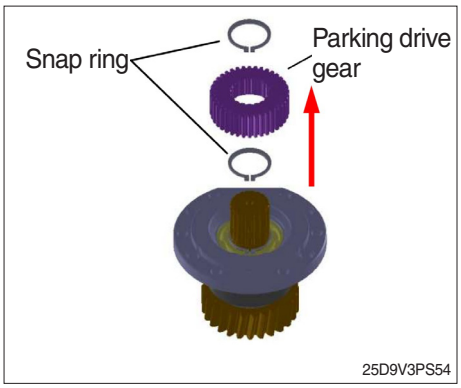


5) DISASSEMBLY OF PARKING GEAR ASSEMBLY

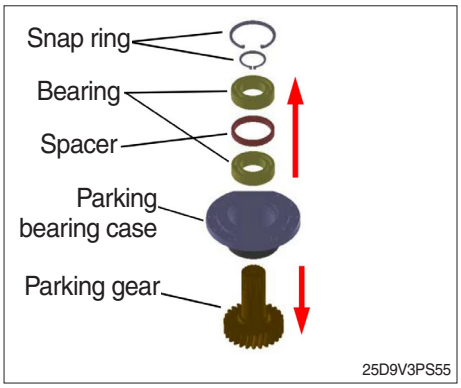
(1) Disassemble parking gear assembly.



(2) Remove the snap rings, bearings, spacer, and parking gear.



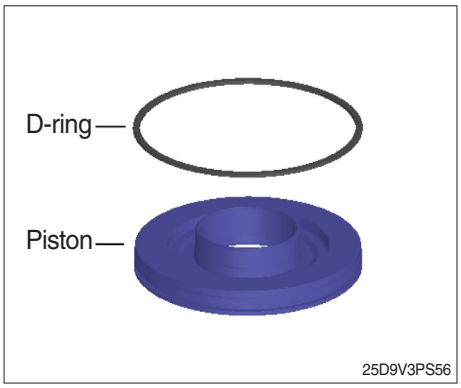
(3) Remove the snap rings, bearings, spacer, parking gear from the parking BRG case.



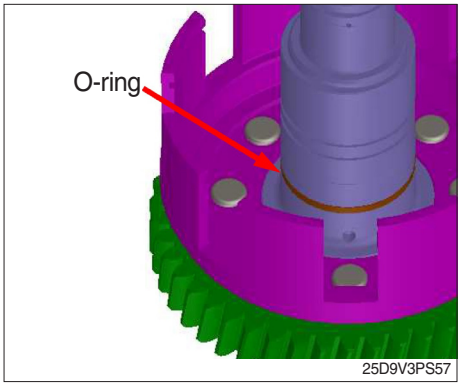
2. ASSEMBLY OF TRANSMISSION

1) REASSEMBLY OF CLUTCHES

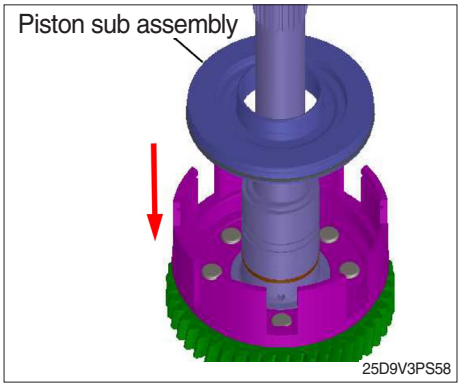
(1) Insert the D-ring into the piston groove and oil it.



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

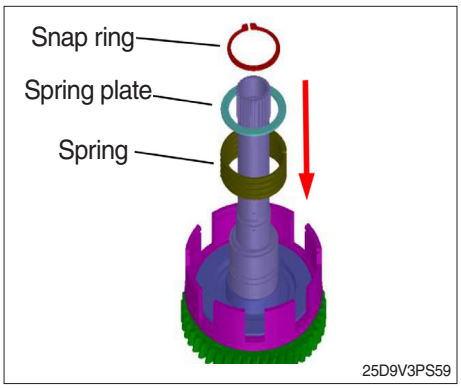


(3) Assemble the piston sub assembly.

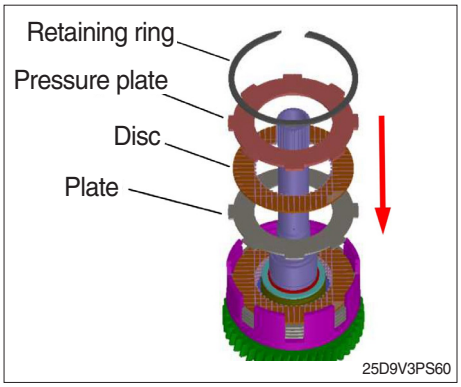


(4) Assemble the spring, spring plate, and snap ring.

⚠ **Snap ring can bounce by the force of the spring, so fix the spring and assemble it. Pay attention to safety when assembling snap ring.**



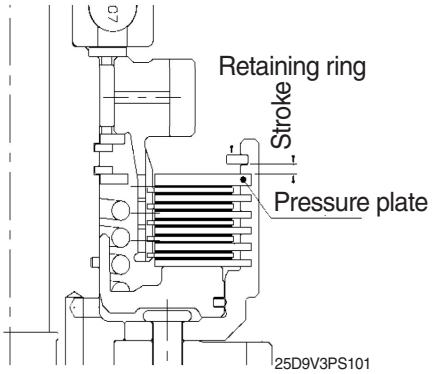
(5) After assembling the plate, disc and pressure plate, the retaining ring is assembled.

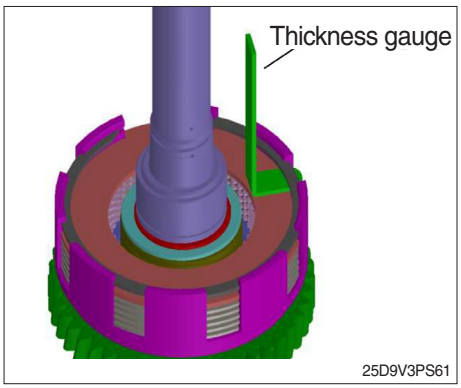


(6) Measure clearance between the back plate and retaining ring using thickness gauge.

※ **Replace the retaining ring if the measured value is out of spec. (Stroke spec : 2.2 ~ 2.6 mm)**

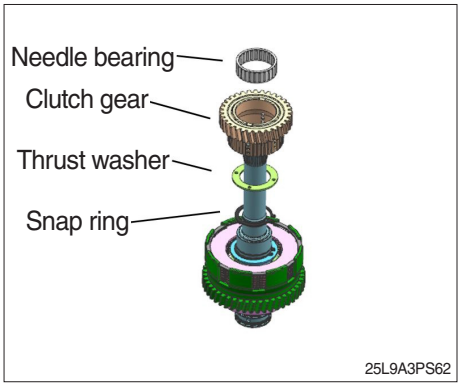
※ **Retaining ring thickness type : 2, 2.2, 2.5, 3.1 mm**



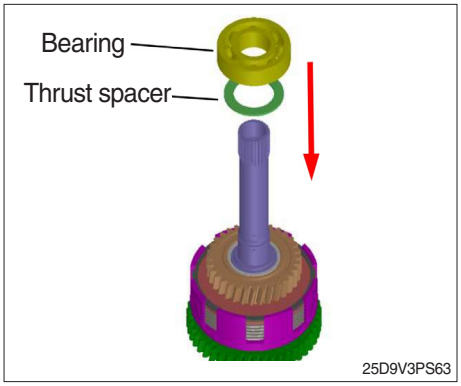


(7) Insert the snap ring into the groove of the clutch shaft. Apply oil to the thrust washer and assemble. Assemble the clutch gear.

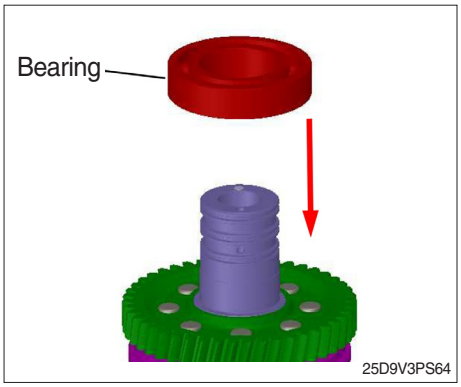
※ **Assemble the clutch gear by rotating it shortly clockwise and counterclockwise. Apply oil to the needle bearing and assemble it.**



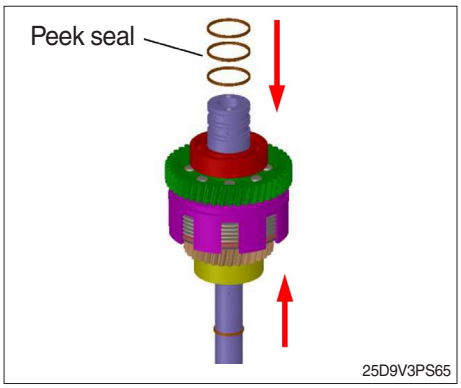
(8) Assemble the thrust spacer and bearing.



(9) Assemble the other bearing.

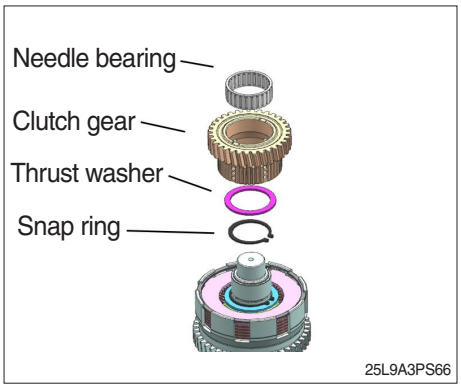


(10) Assemble the peek seals on the groove of the clutch shaft.

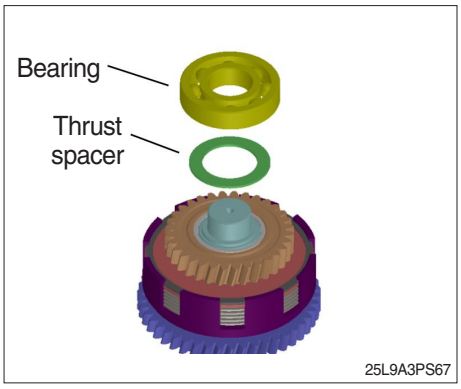


(11) Insert the snap ring into the groove of the clutch shaft. Apply oil to the thrust washer and assemble. Assemble the clutch gear.

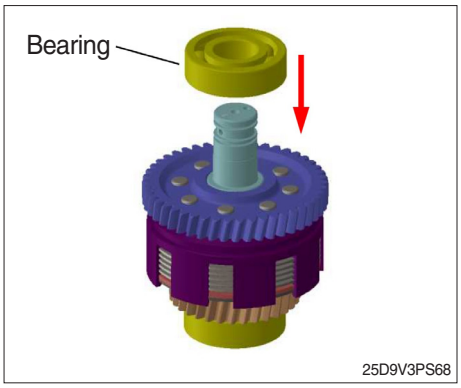
※ **Assemble the clutch gear by rotating it shortly clockwise and counterclockwise. Apply oil to the needle bearing and assemble it.**



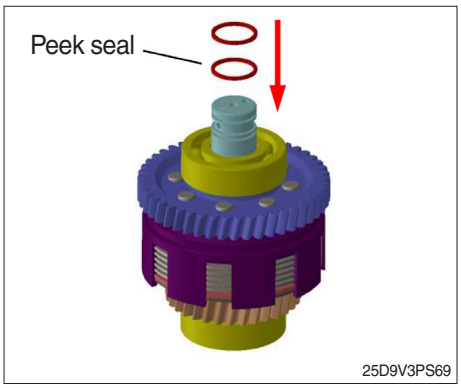
(12) Assemble the thrust spacer and bearing.



(10) Assemble the other bearing.

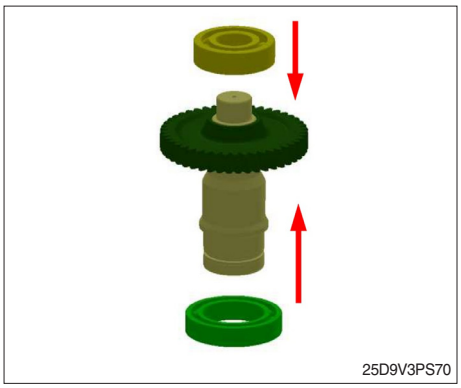


(11) Assembly the peek seals on the groove of the clutch shaft.

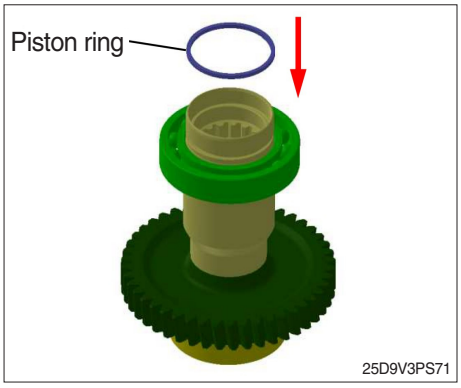


2) REASSEMBLY OF OUTPUT SHAFT

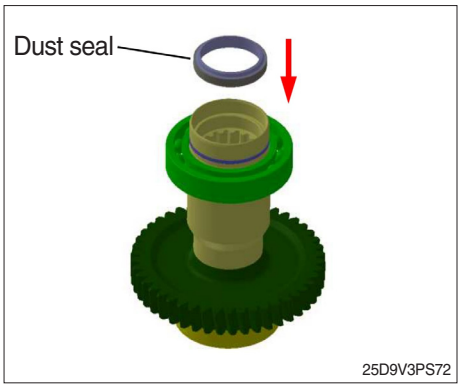
(1) Assemble the bearings.



(2) Assembly the piston ring in the groove of the shaft.

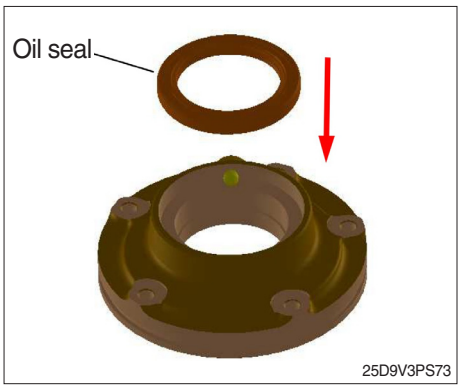


(3) Assemble the dust seal and grease the seal rib.

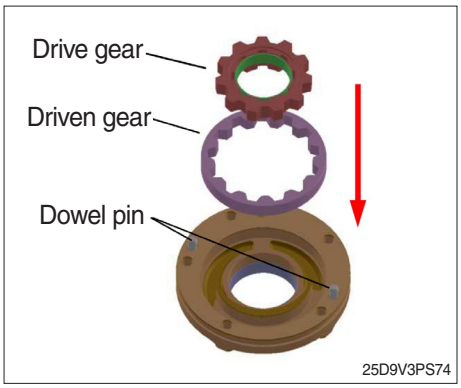


3) RESSEMBLY OF CHARGING PUMP

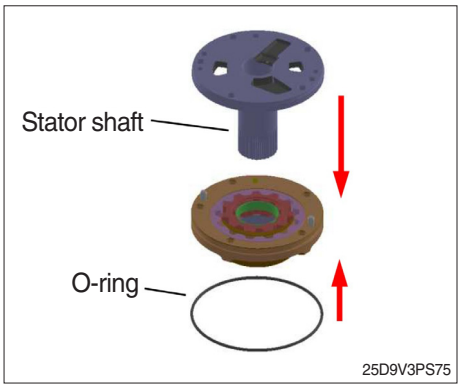
(1) Assemble the oil seal and grease the seal rib.



(2) Assemble the drive and driven gear.

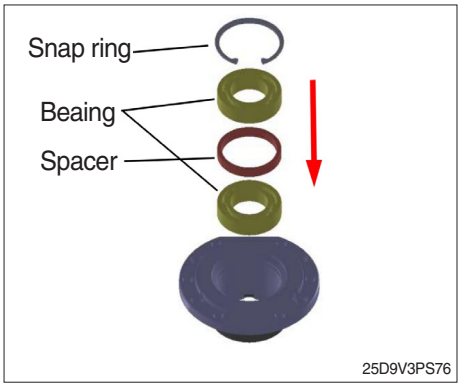


(3) Assemble the stator shaft in the pump case. Assemble the O-ring in the groove of the pump case and apply grease.

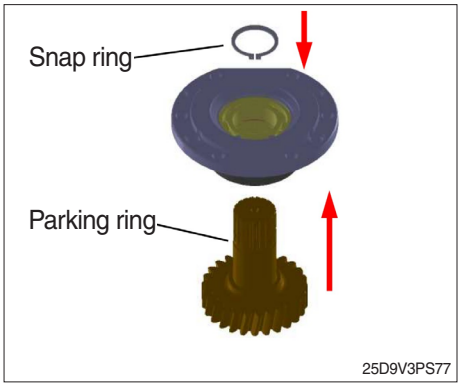


4) ASSEMBLY OF PARKING GEAR ASSEMBLY

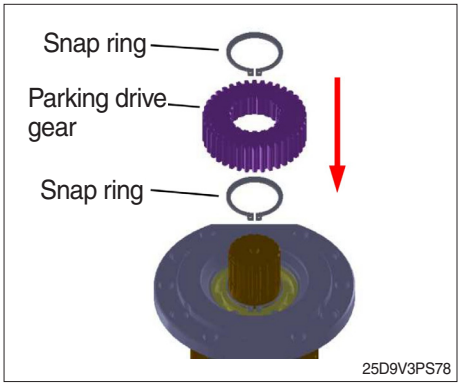
(1) Assemble the bearings, spacer, snap ring.



(2) Assemble the parking gear and snap ring.

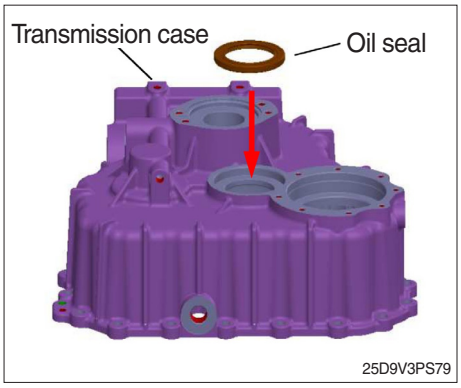


(3) Assemble the snap rings and the parking drive gear.

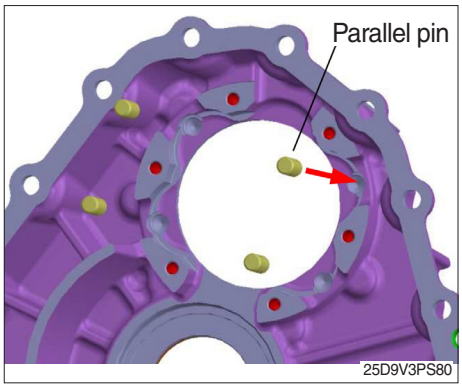


4) REASSEMBLY OF TRANSMISSION

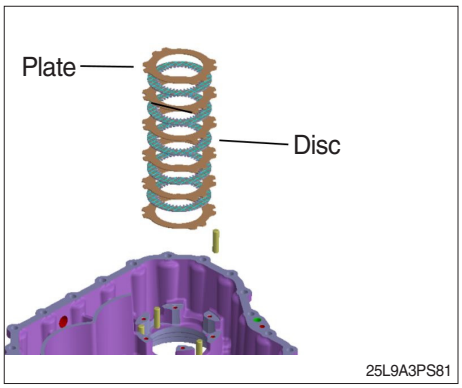
(1) Assemble the oil seal and grease the seal rib.



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



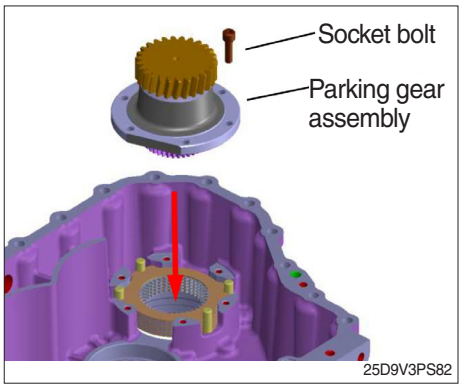
(3) Assemble the discs (5 EA) and plates (6 EA).



(4) Assemble the parking gear assembly and the socket bolts (M8×25L, 6 EA).

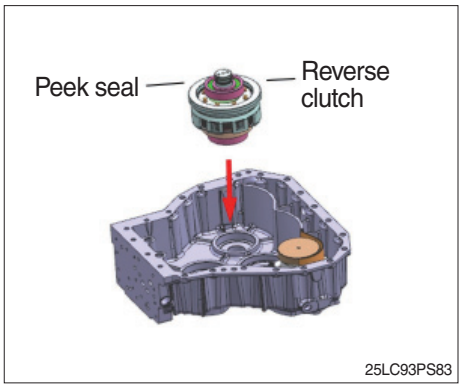
※ **Apply Loctite #277 on socket bolt.**

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



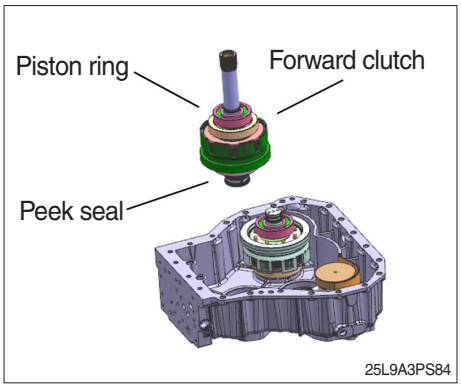
(5) Installl the reverse clutch.

※ **Grease the peek seals and align them.**



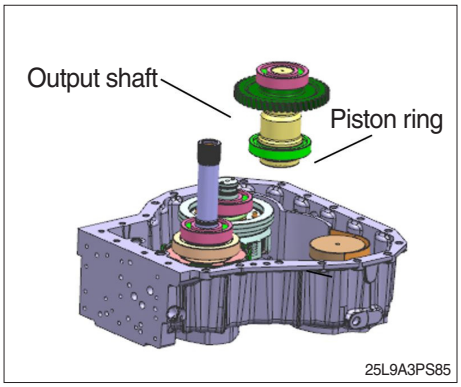
(6) Installl the forward clutch.

※ **Grease the peeks seal and align them.**

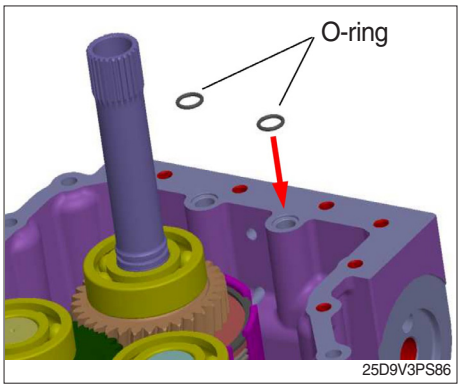


(7) Install the output shaft.

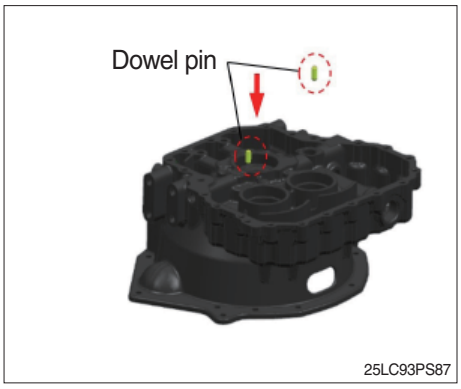
※ **Grease the piston ring seal and align it.**



(8) Assemble the O-ring and apply the grease.



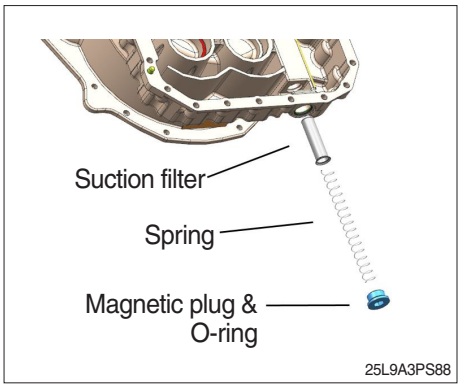
(9) Assemble the dowel pins (2 EA).



(10) Assemble the suction filter, spring, magnetic plug and O-ring.

※ **Grease the O-ring before assembling.**

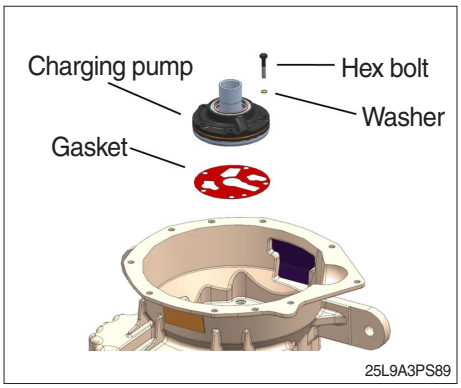
· Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.4 lbf·ft)



(11) Assemble the gasket, charging pump, washer, and hex bolt (M8×45L, 5 EA).

※ **Apply Loctite #277 on hex bolt.**

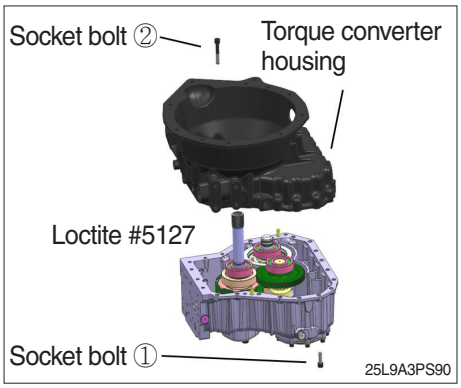
· Tightening torque : 2.0 ~ 2.6 kgf·m
(14.5 ~ 18.8 lbf·ft)



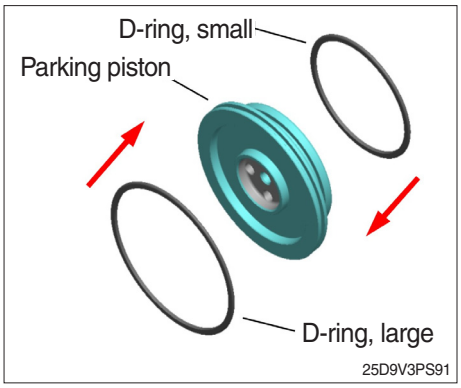
(12) Apply the liquid gasket (Loctite #5127) to the mounting surface of the T/M case. Tighten the socket bolts (① : M10×1.5-30L, 16EA / ② : M10×1.5-60L, 16EA) after assembling the torque converter housing.

※ **Assemble slowly so that there is no impact or jam on the part.**

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



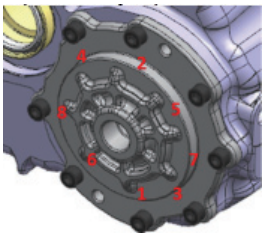
(13) Assemble the D-ring into the parking piston groove and grease it.

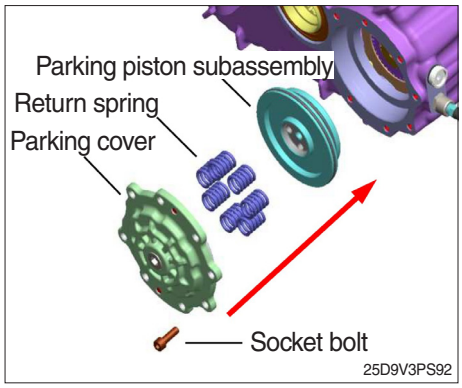


(14) Assemble parking piston subassembly, return spring, parking cover, and socket bolts (M8×25L, 6 EA).

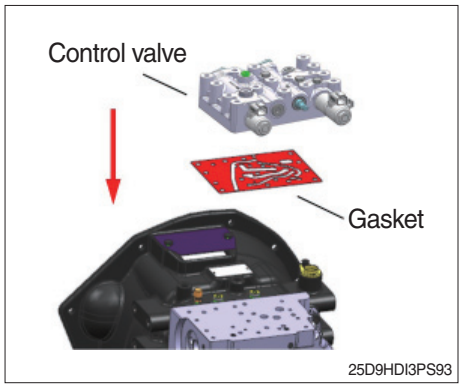
※ **Apply Loctite #277 on socket bolt.**

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





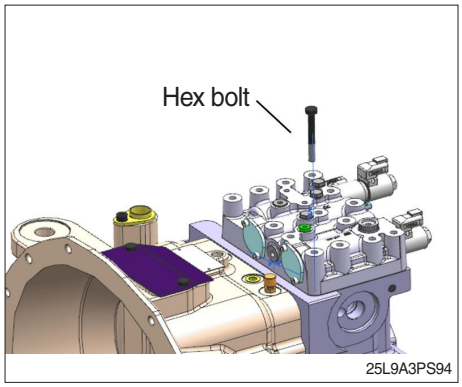
(15) Install the gasket and control valve.



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

※ **Apply Loctite #277 on hex bolt.**

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

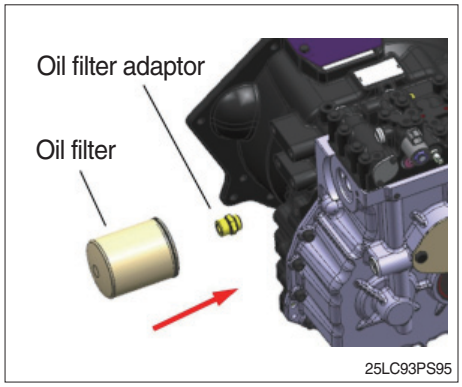


(17) Tighten the oil filter adaptor and assemble the oil filter.

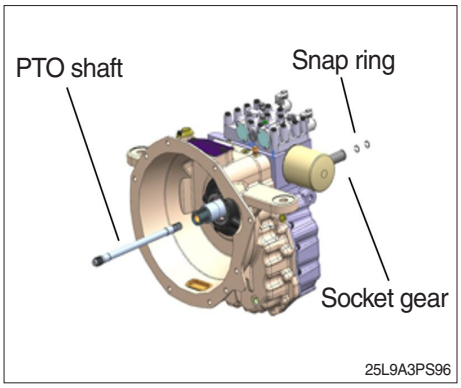
※ **Apply oil to the seal of the oil filter and tighten the oil filter.**

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

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



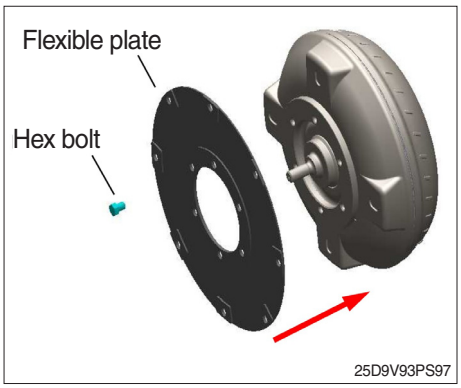
(18) Assemble the snap rings (2 EA) in the socket gear. Assemble the PTO shaft and socket gear.



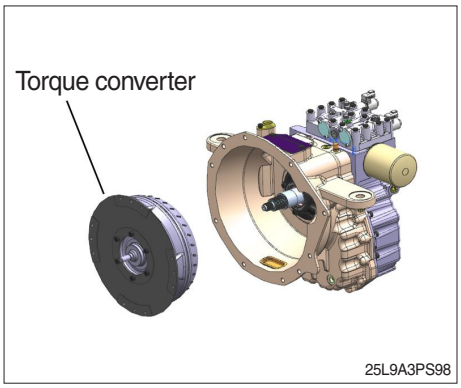
(19) Assemble the flexible plate and hex bolts (3/8-24-UNF, 6EA).

※ **Apply Loctite #277 on hex bolt.**

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



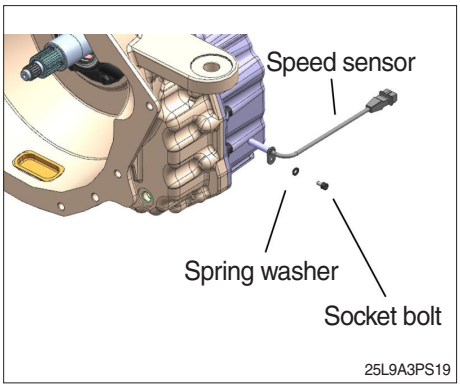
(20) Assemble the torque converter.



(21) Assemble the sensor guide seal, sensor plate, spring washer, and socket bolt (M6×12L, 1 EA).

※ **Apply Loctite #277 on hex bolt.**

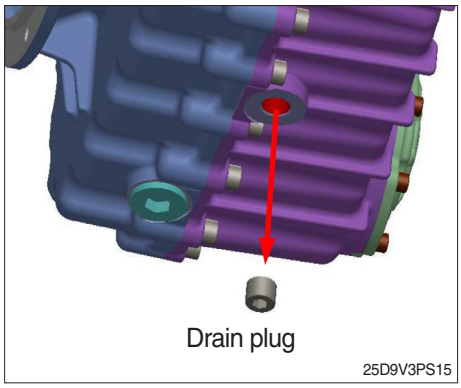
· Tightening torque : 0.9 ~ 1.0 kgf·m
(6.5 ~ 7.2 lbf·ft)



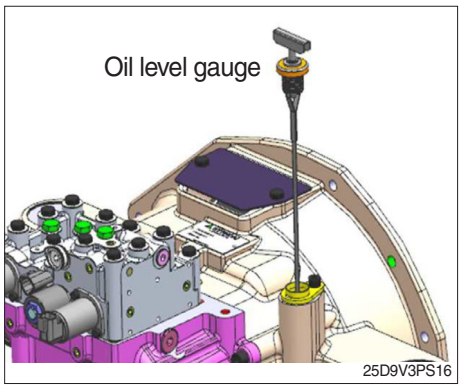
(22) Assemble the drain plug.

※ **Apply Loctite #277 on hex bolt.**

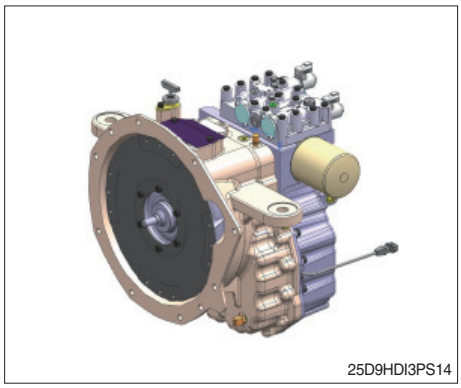
· Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.4 lbf·ft)



(23) Assemble the oil level gauge.



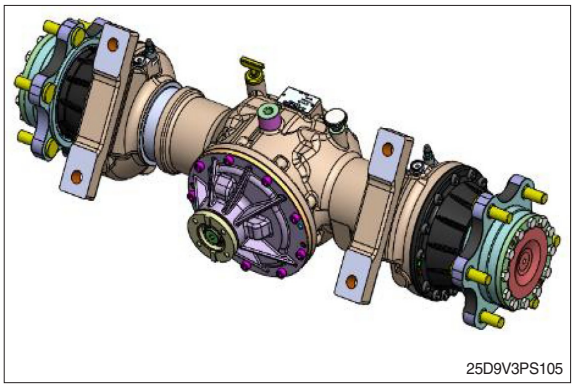
(24) Before putting the transmission into operation, fill it with oil according to operator's manual.



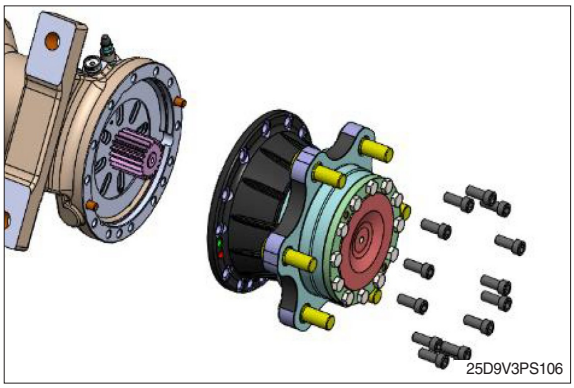
3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY

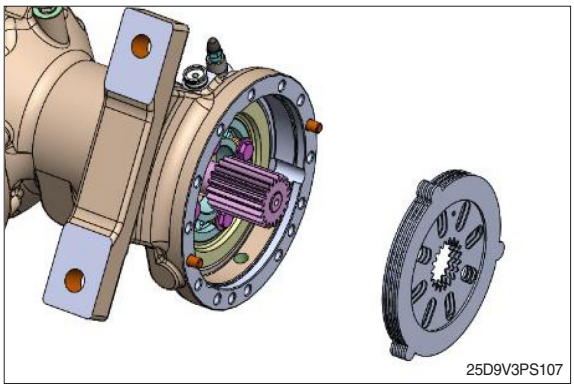
(1) Disassemble drive axle assembly.



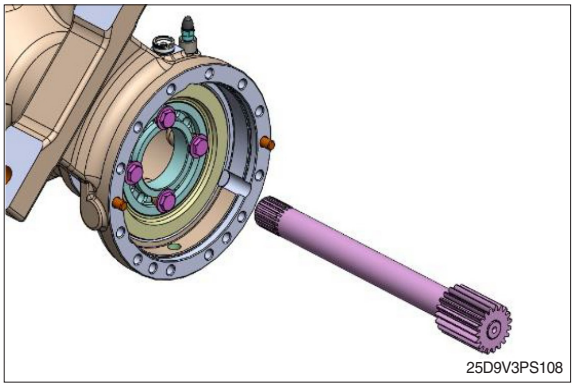
(2) Disassemble carrier hsg. sub assembly.



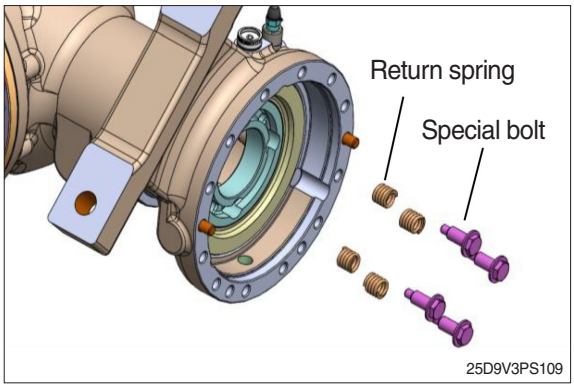
(3) Disassemble disc, opposing plate.



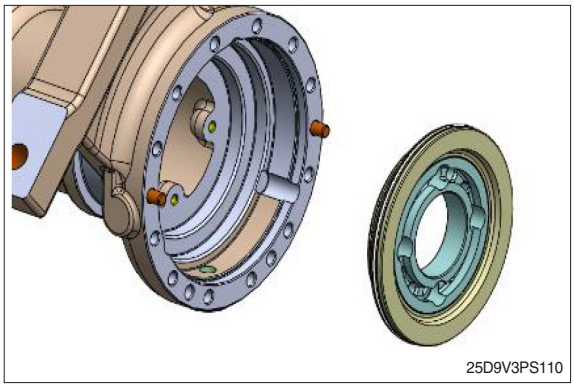
(4) Disassemble axle shaft.



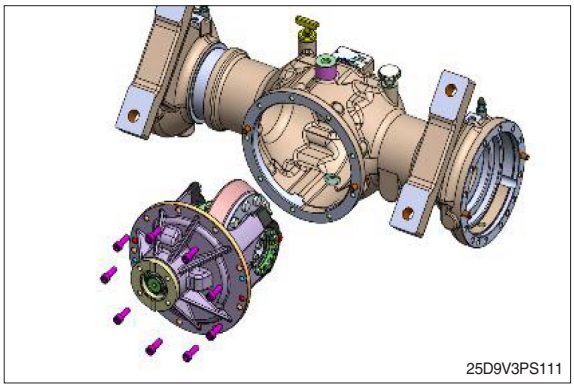
(5) Disassemble special bolt, return spring.



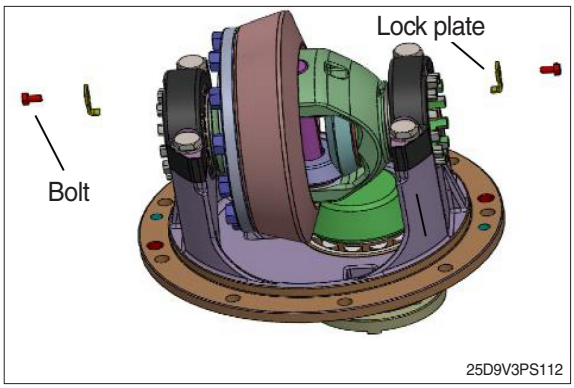
(6) Brake piston sub assembly



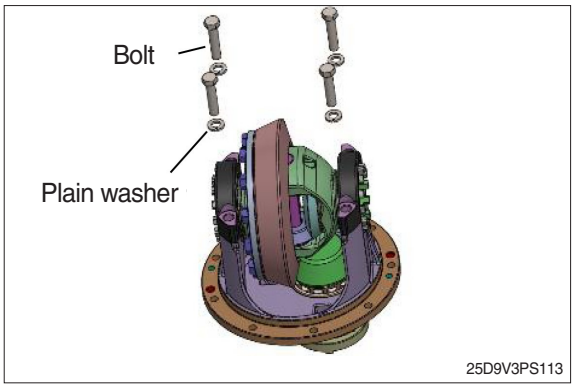
(7) Disassemble bolt, carrier sub assembly.



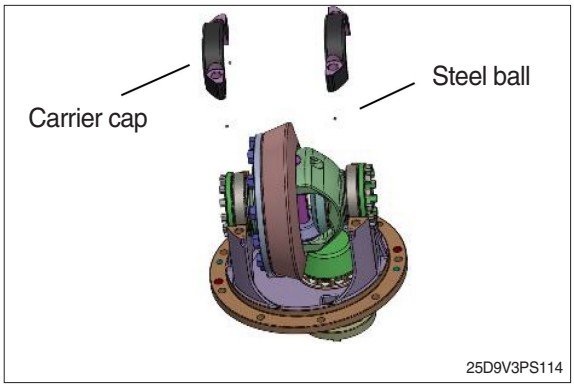
(8) Disassemble Bolt, lock plate.



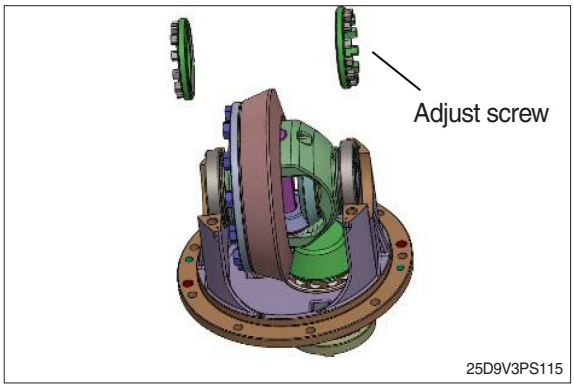
(9) Disassemble bolt, plain washer.



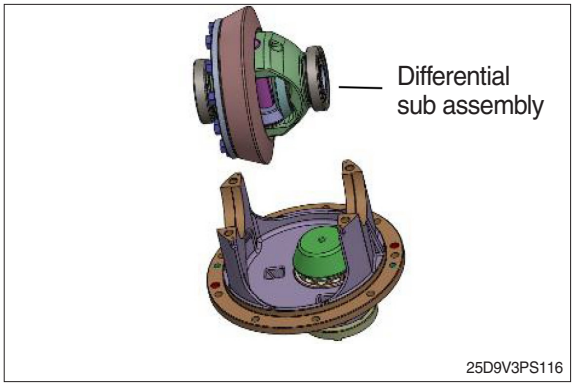
(10) Dissassemble carrier cap, steel ball.



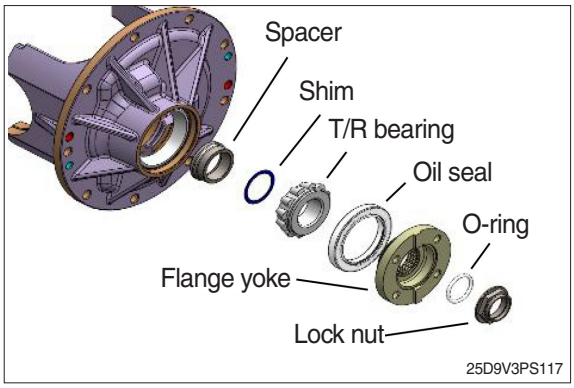
(11) Disassemble adjust screw.



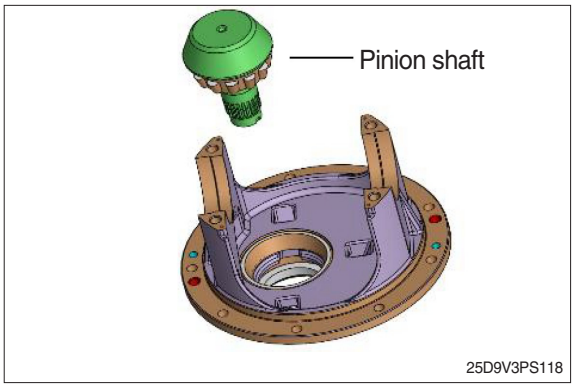
(12) Disassemble differential sub assembly.



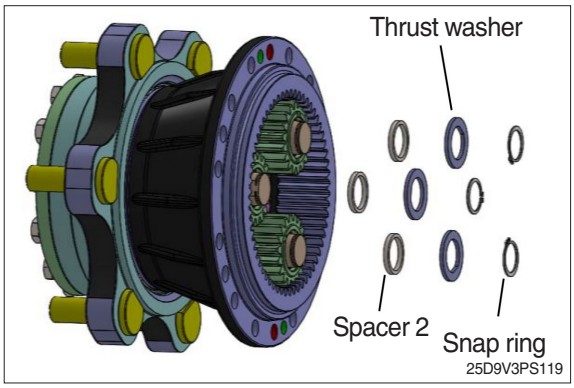
(13) Dissassemble carrier cap, steel ball.



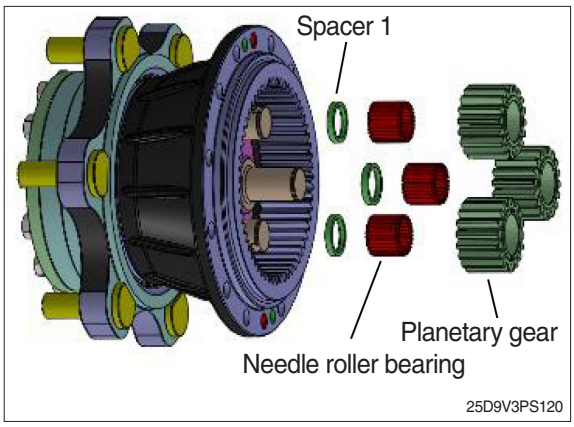
(14) The Lock nut from the decomposition order.



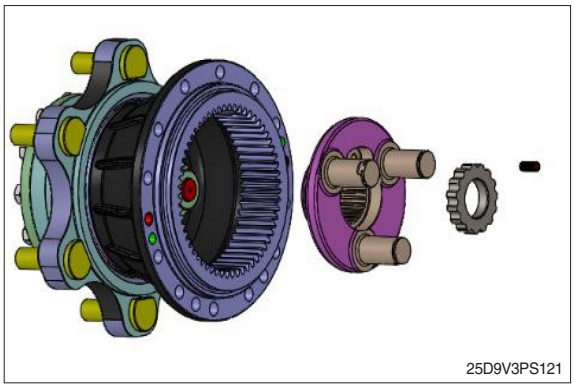
(15) Disassemble Pinion shaft.



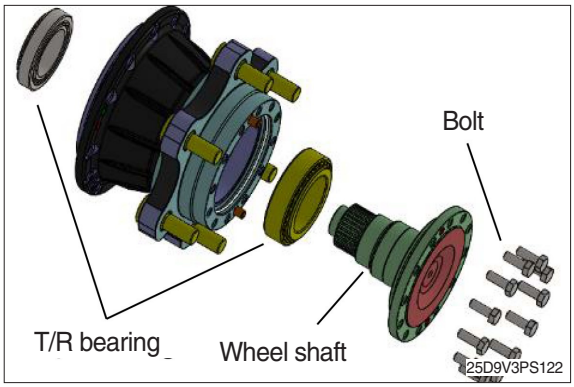
(16) Disassemble planetary gear, needle roller bearing (58EA × 3= 174EA), spacer 1.



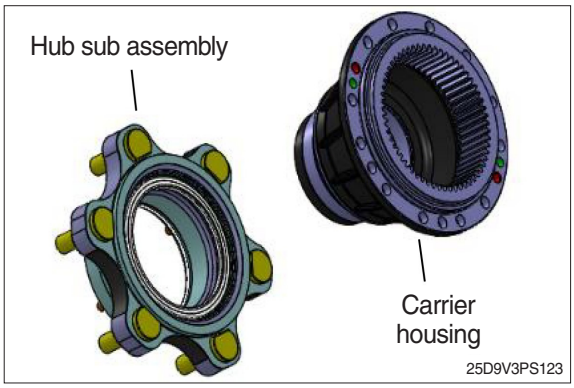
(17) Disassemble set screw, hub lock nut and PL carrier



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



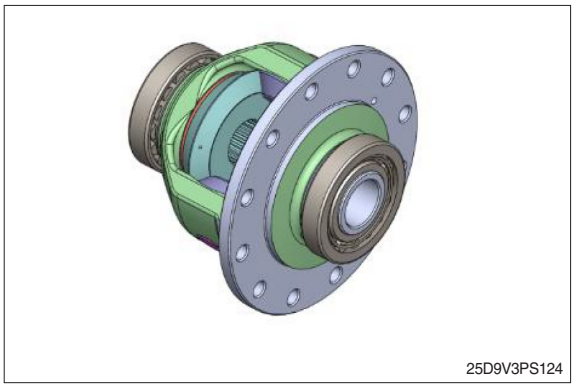
(19) Disassemble hub sub assembly, carrier housing.



3.ASSEMBLY OF DRIVE AXLE

1) ASSEMBLY OF DIFFERENTIAL DEVICE

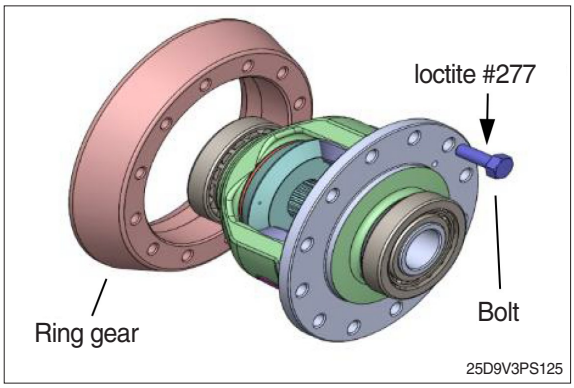
(1) Make preparation for diffdrential assembly.



(2) Assemble Ring gear by Bolt.

※ **Spread loctite #277.**

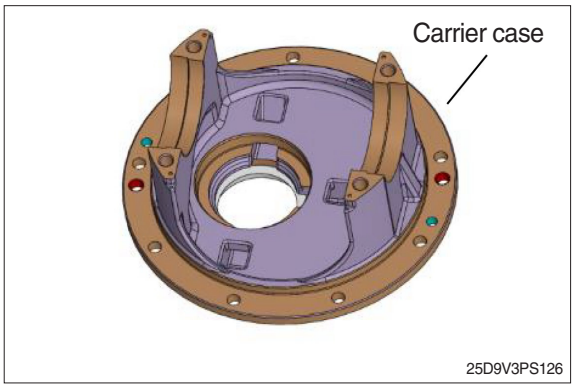
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.8 ~ 81.0 lbf·ft)

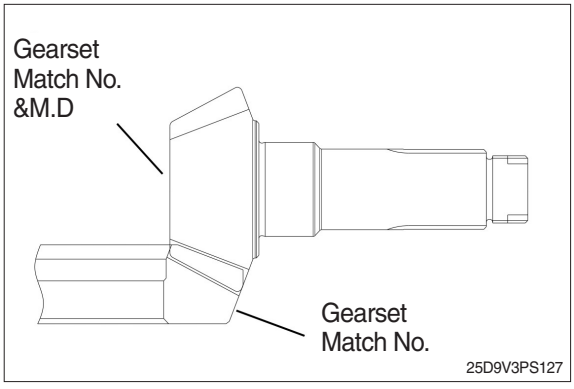


2) ASSEMBLY OF CONTROL OF SHIM & PINION

(1) Fix carrier case to jig.

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





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

① Dimensional drawings of the alphabet (mm)

a : 107 b : 25.25 c : Engraved value

d : 132.75 e : 33.75 f : 32.5 g : 1.75

② Basic shim thickness

"A" : 0.5 "B" : 0.5

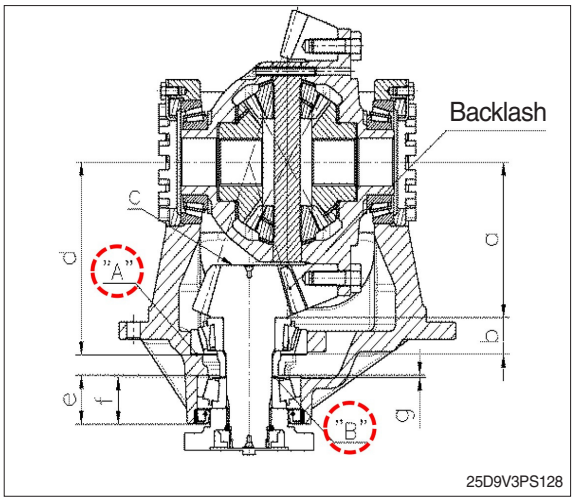
③ Shim thickness calculation

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

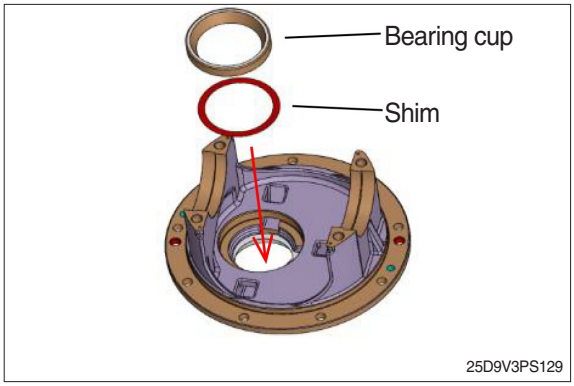
ex) 132.7 - { 106.9 + 25.22 + (-0.2) } = 0.83 → 0.85 mm

"B" : g-(e-f)

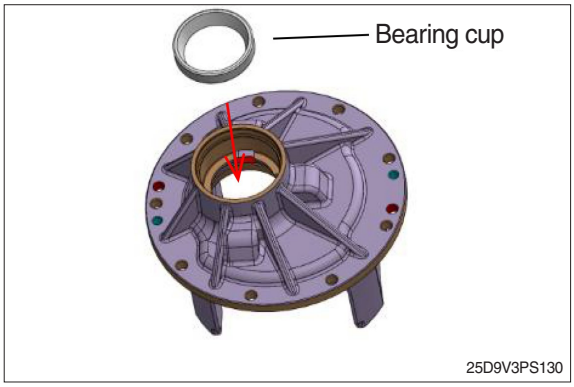
ex) 1.77 - (33.71 - 32.42) = 0.48 → 0.5 mm



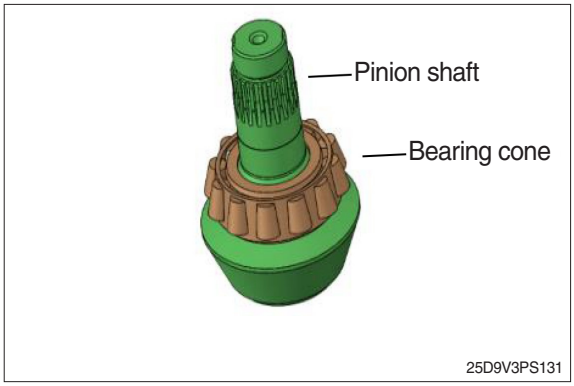
(3) Assemble shim. Sort of shim : 0.1, 0.15, 0.25, 0.5 mm. Press the bearing cup.



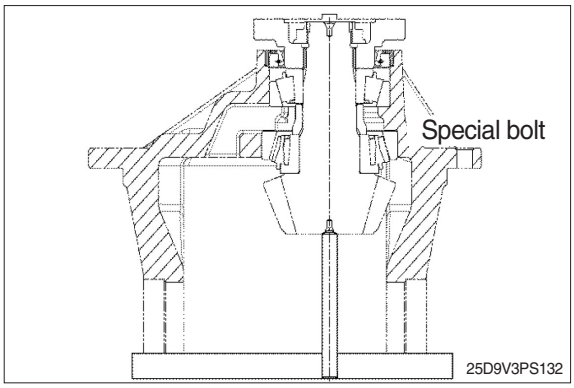
(4) Turn carrier case a on-eighty (180˚) and press bearing cup.



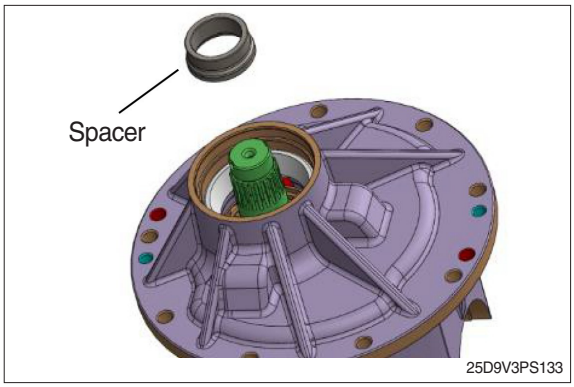
(5) Pressurize bearing cone on pinion shaft. Put into pinion shaft.



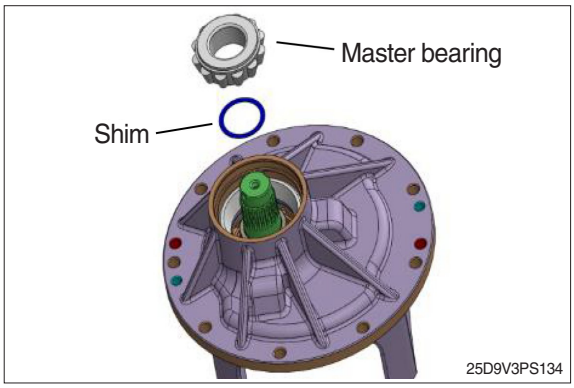
(6) Turn carrier case a one-eighty (180˚) and fix it on jig.



(7) Assemble pinion shaft on spacer.

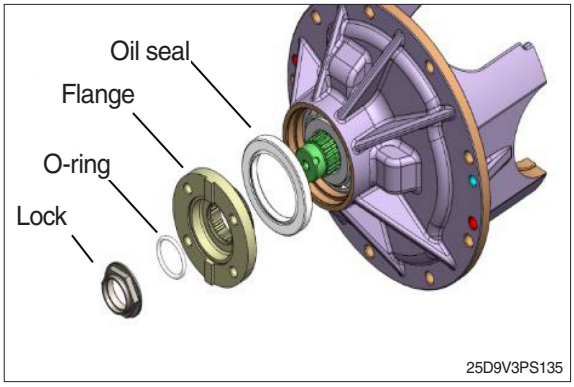


(8) Assemble pinion shaft, and assemble shim & master bearing sort of shim : 0.1, 0.15, 0.3 mm

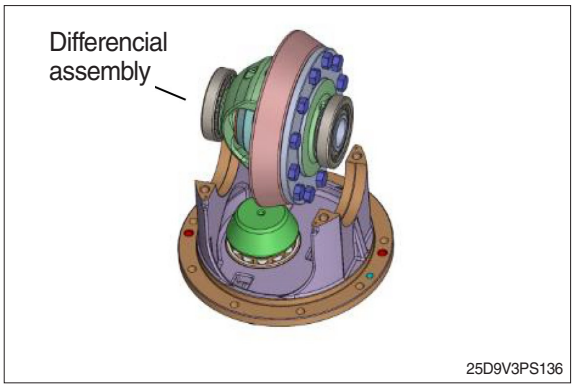


(9) Assemble oil seal, flange yoke, O-ring and lock nut.

· Tightening torque : 26.5 ~ 29.6 kgf·m
(192 ~ 214 lbf·ft)



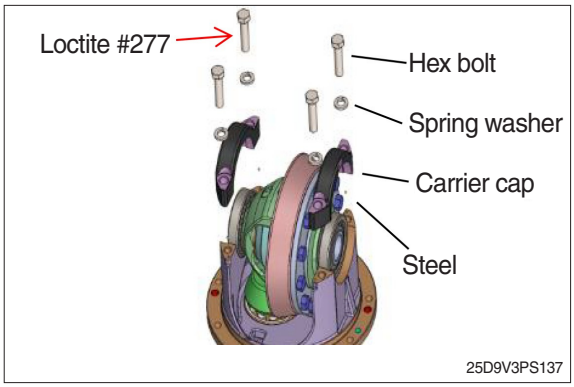
(10) Turn carrier case a one-eighty (180˚) and assemble differencial assembly on carrier case.



(11) Assemble hex bolt on carrier cap.

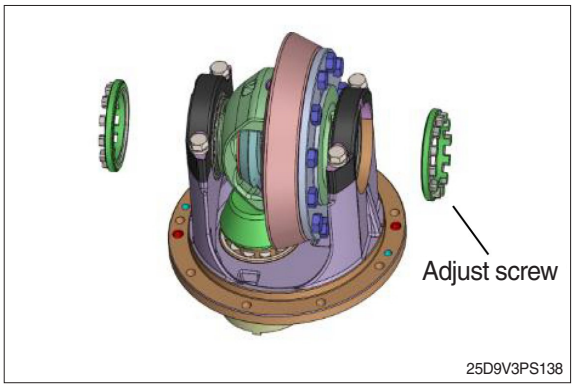
※ **Spread loctite #277 on the bolt.**

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

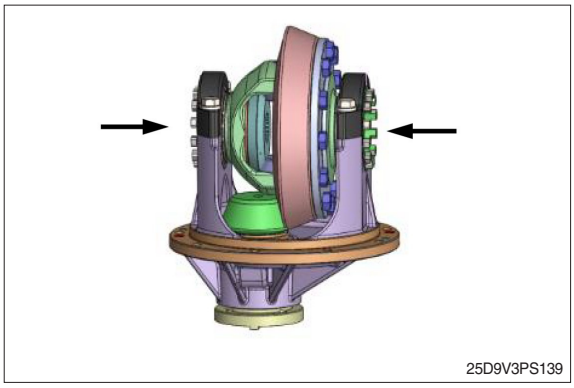


3) CONTROL OF GEARSET BACKLASH

(1) Assemble adjust screw on carrier case.



(2) Lock adjust screw.

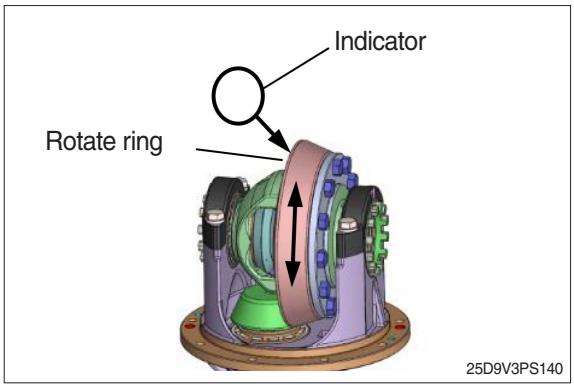


(3) Measure Backlash.

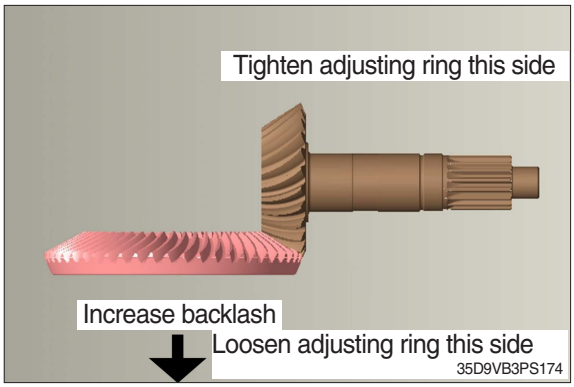
※ Backlash of pinion & ring gear : 0.18~0.23 mm

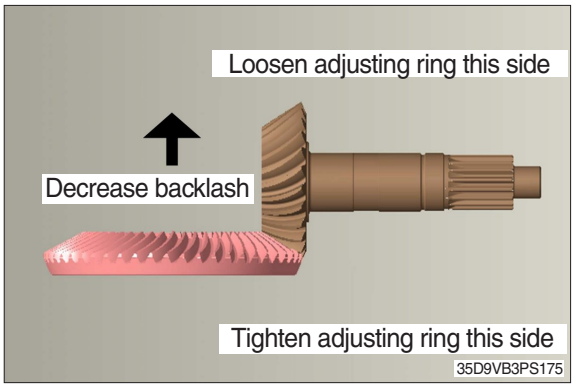
※ If it is wrong backlash, you can adjust value as moving each step.

※ If ring gear takes from pinion shaft far, the value of backlash will be increased. If ring gear takes from pinion shaft close, the value of backlash will be decreased.



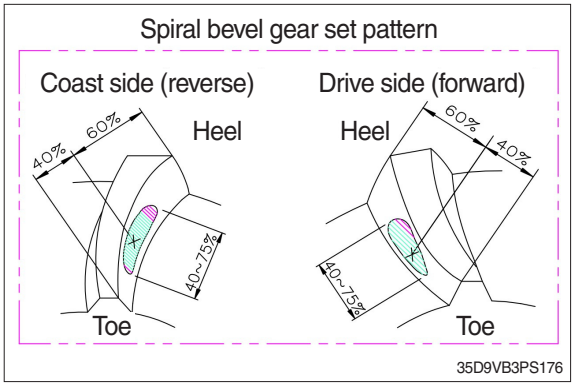
(4) If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.



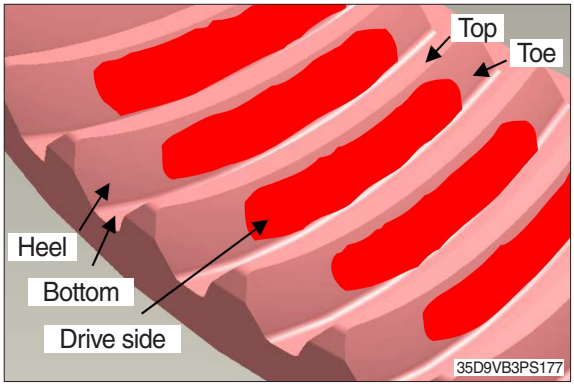


4) MEASUREMENT OF TOOTH CONTACT PATTERN

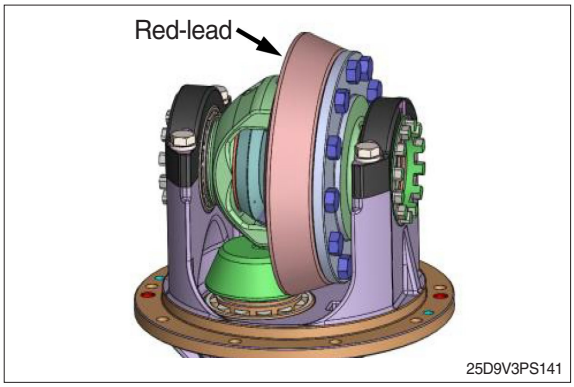
※ **After assemble , adjust pattern of the gear and pinion shaft figure. If pattern is not adjusted, take a measure as measuring backlash again and then reassemble.**



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

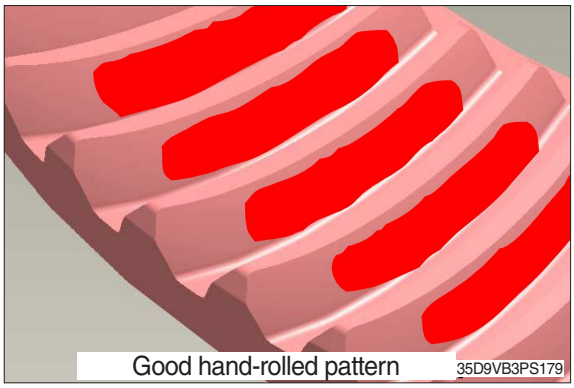


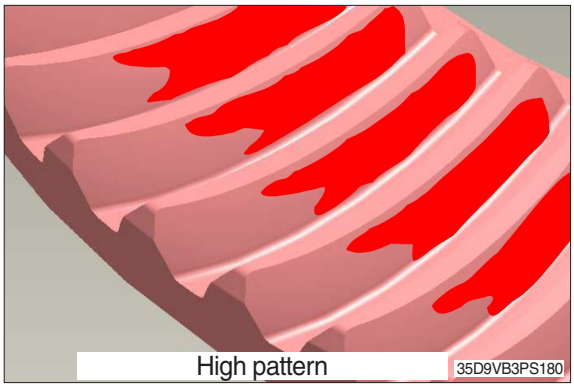
(1) Marking red-lead on 6 tooth surface of ring gear.
(2) Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.

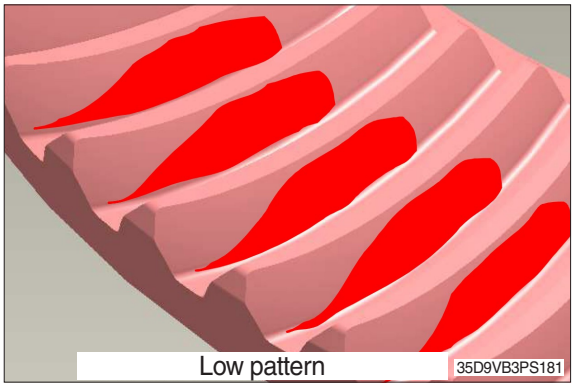


(3) Compare the contact pattern with illustrations.

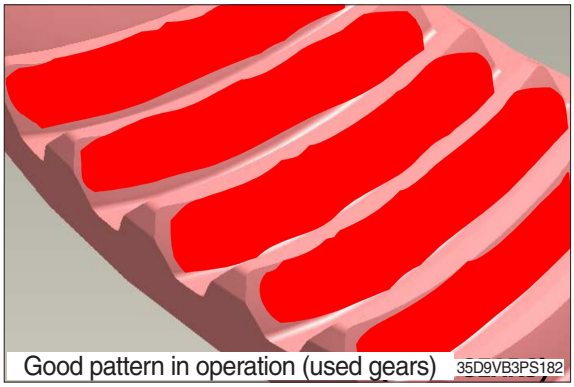
※ **The good contact pattern of gearset is appeared what the length of tooth has had.**







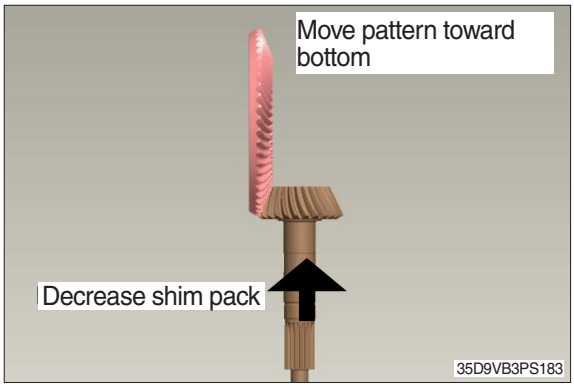
※ **The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.**



(4) If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps ①-②.
If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps ③-④.

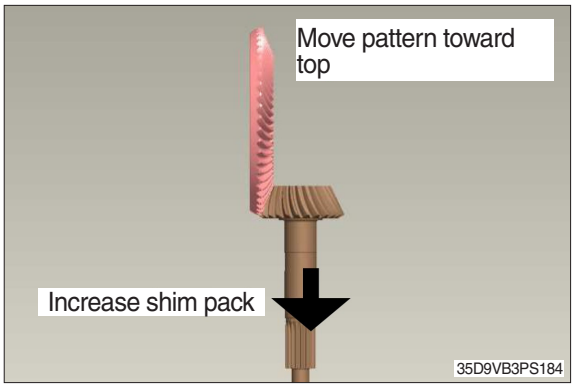
① High pattern

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



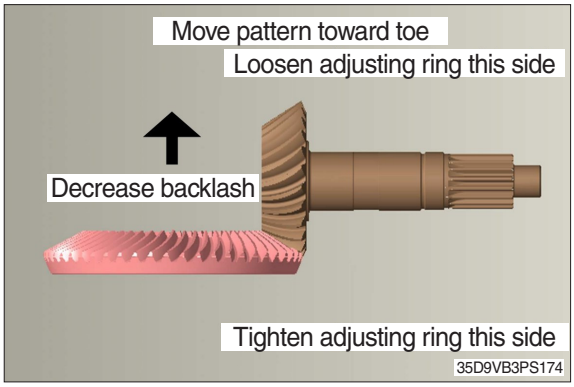
② Lower pattern

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



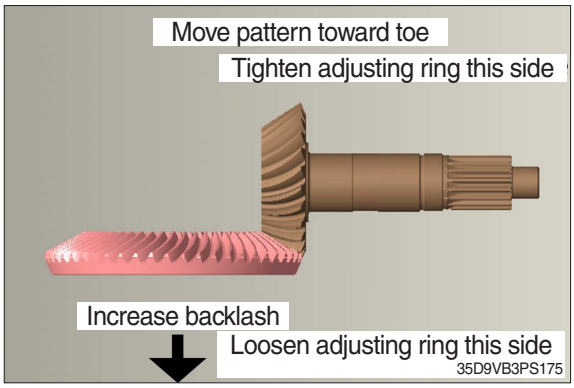
③ Heel pattern

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

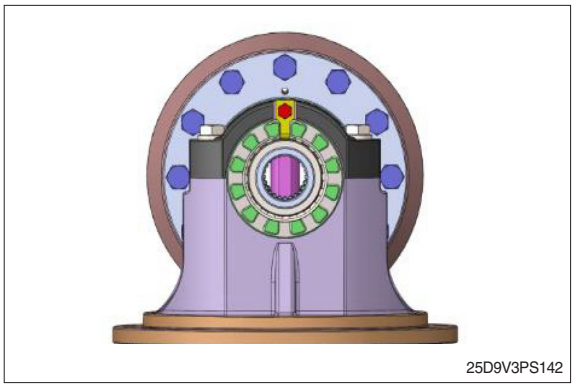


④ Toe pattern

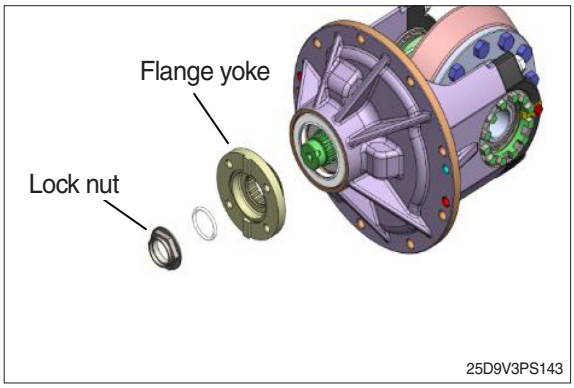
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



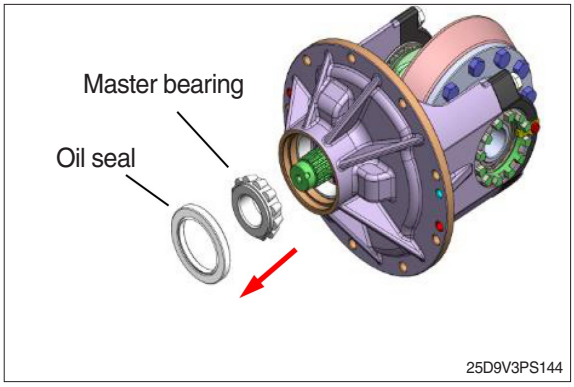
(5) Fix spring pin to adjusted Ring bearing. And then, assemble all of them.



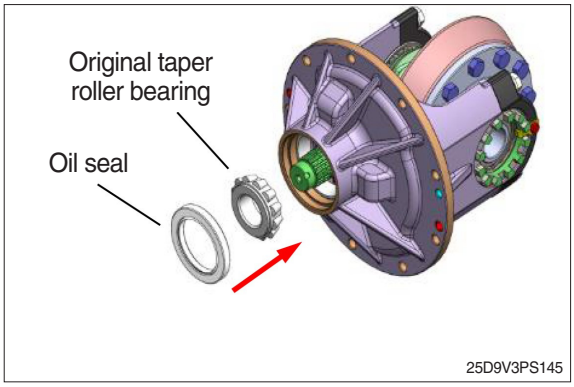
(6) Disassemble lock nut & O-ring & flange yoke.



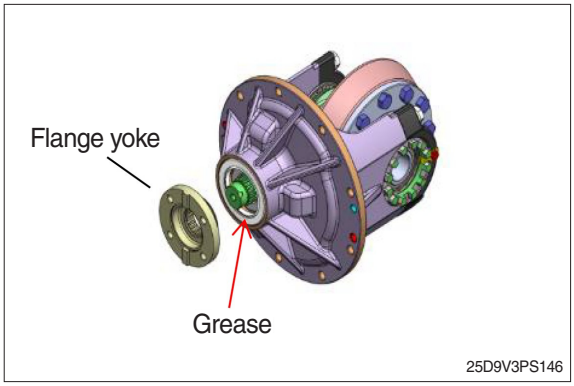
(7) Disassemble oil seal & master bearing.



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



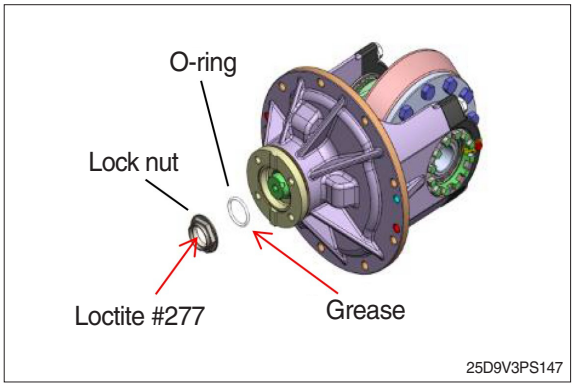
(9) Spread grease on seal rip and assemble flange yoke.



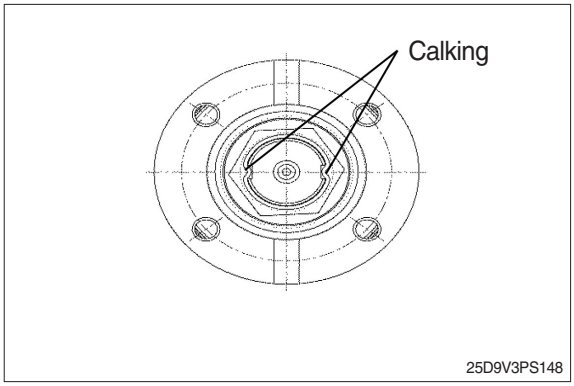
(10) spread grease on O-ring assemble O-ring and spread loctite #277 on lock nut and tighten it.

· Tightening torque : 46.9 ~ 50 kgf·m
(339 ~ 362 lbf·ft)

· Preload : 0.2 ~ 0.4 kgf·m
(1.4 ~ 2.9 lbf·ft)

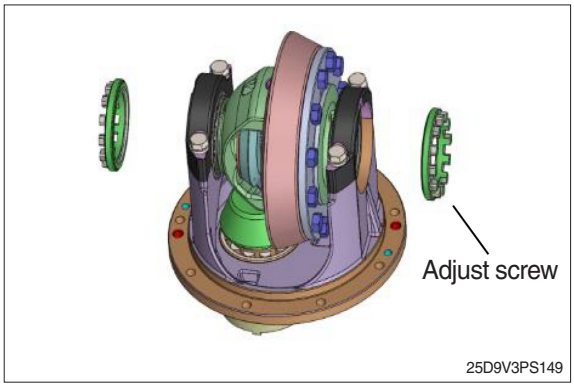


(11) Calking (2EA)



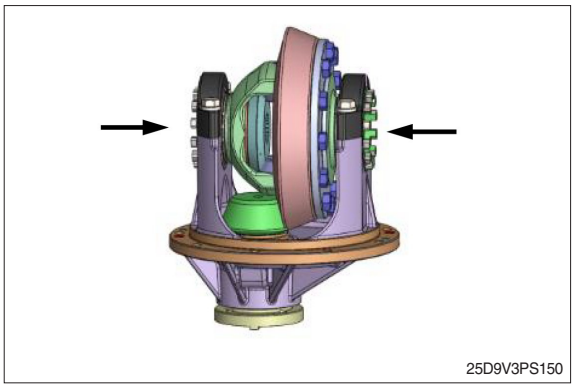
5) ASSEMBLY OF HUB

(1) Press hub bolt into hub.



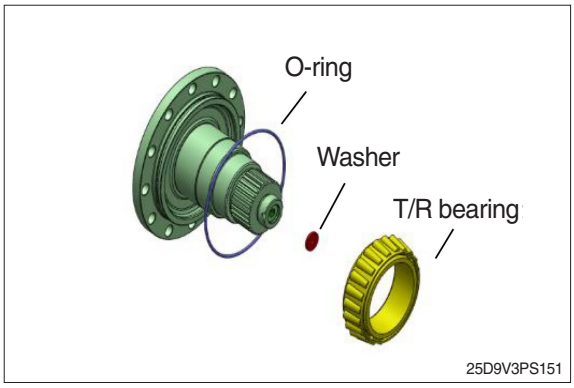
(2) Press hub outer oil seal. Before assemble, spread grease at inside hub.

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



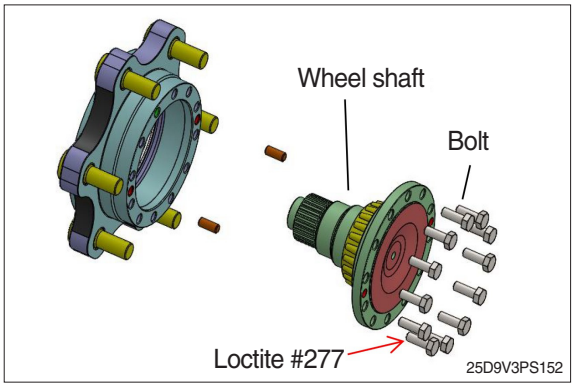
6) ASSEMBLY OF CARRIER HSG. SUB ASSEMBLY

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

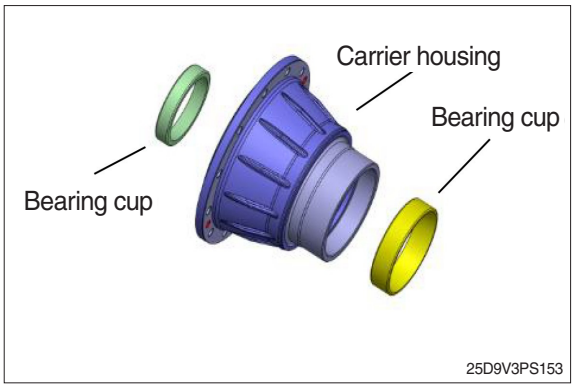


(2) Spread loctite #277 on socket bolt and assemble wheel shaft.

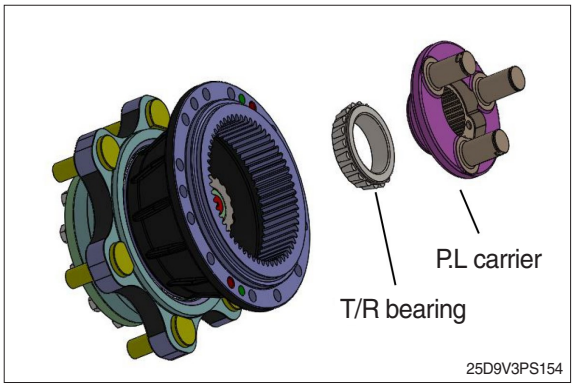
· Tightening torque : 0.69 ~ 0.73 kgf·m
(5.0 ~ 5.3 lbf·ft)



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



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



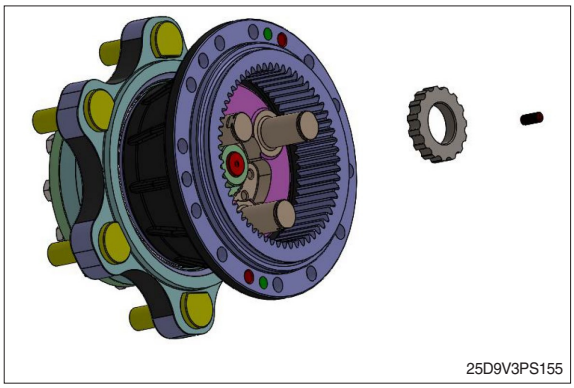
(5) Fastening hub lock nut and assemble the set screw.

※ **Spread loctite #277.**

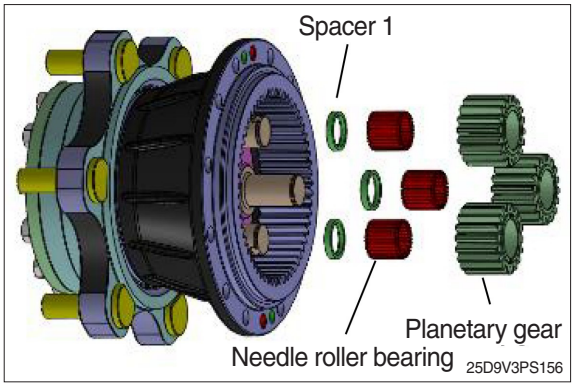
· lock nut tightening toruqe : 25.5 kgf·m (184 lbf·ft)

· Preload : 0.56 ~ 0.61 kgf·m (4.1 ~ 4.4 lbf·ft)

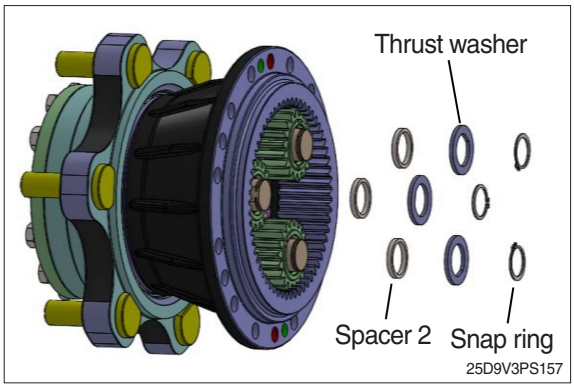
· set screw tightening toruqe : 1.3 kgf·m (9.4 lbf·ft)



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

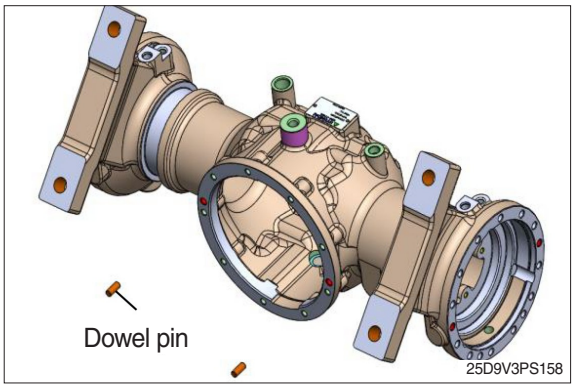


(7) Assemble spacer 2, thrust washer, snap ring.

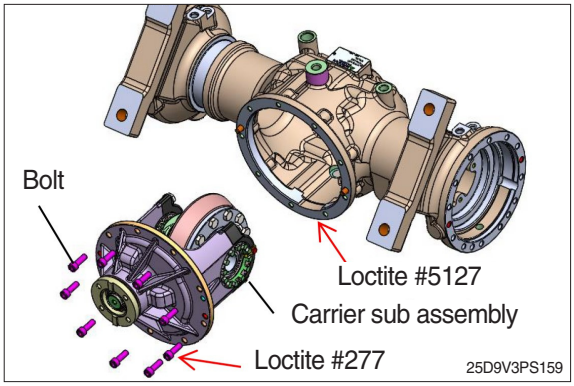


6) ASSEMBLY OF DRIVE AXLE

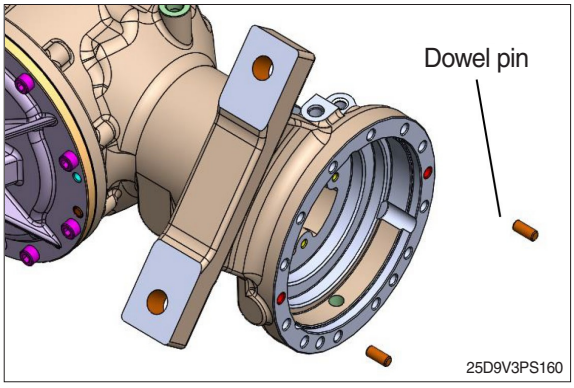
(1) Press dowel pin on axle housing.



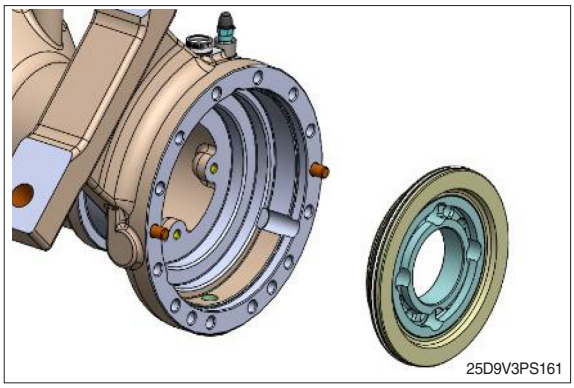
(2) Spread loctite #5127 on axle housing and assemble carrier sub assembly. Spread loctite #277 on the bolt and assemble bolt.



(3) Assemble dowel pin on axle housing.



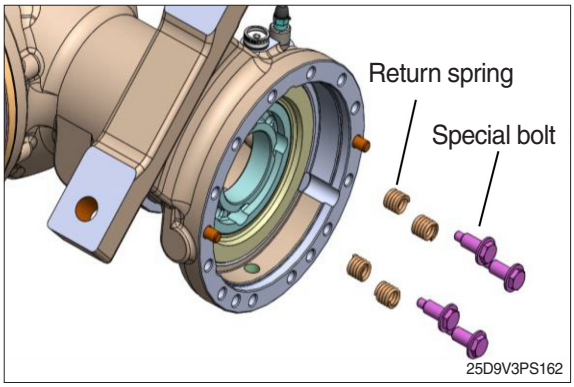
(4) Assemble piston sub.



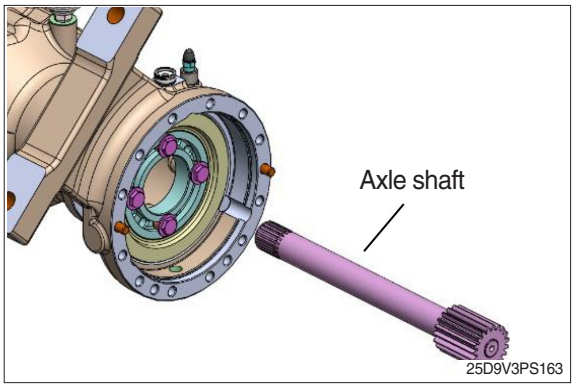
(5) Return spring, Sprecial bolt.

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

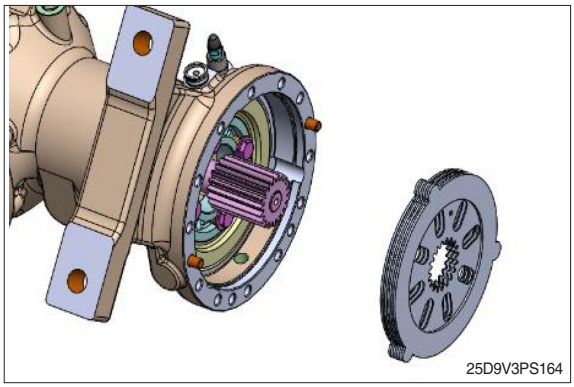
· Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)



(6) Assemble axle shaft.



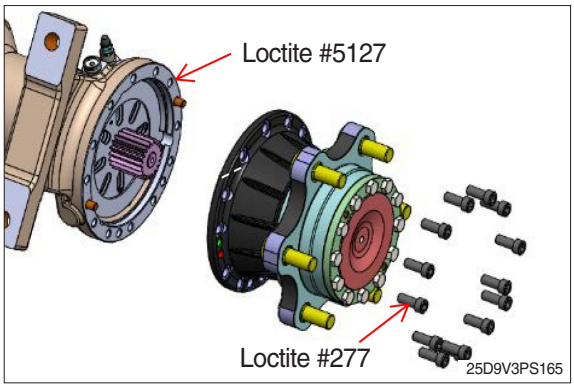
(7) Assemble brake disc pack



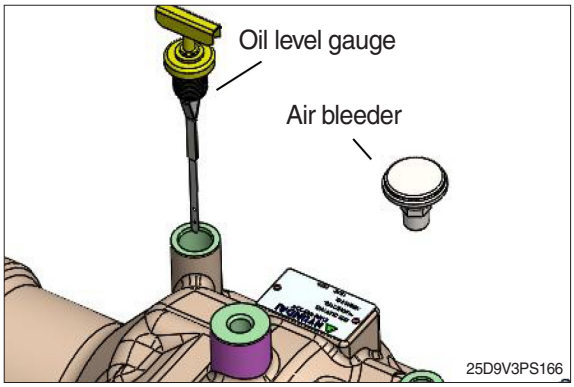
(8) Spread loctite #5127 on axle housing and assemble carrier hsg. sub assembly.

※ **Spread loctite #277.**

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

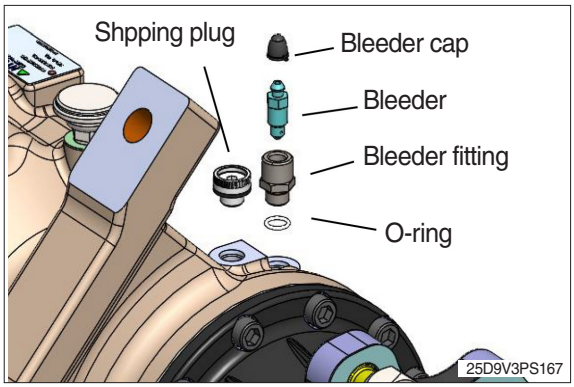


(9) Assemble oil level gauge & air breather on axle housing.



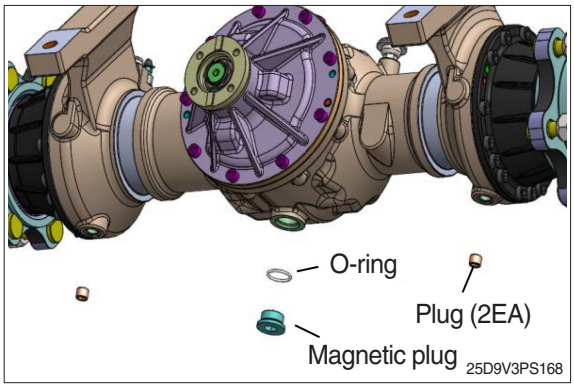
(10) Assemble O-ring, bleeder & bleeder fitting, bleeder cap.

· Tightening torque
Bleeder : 4.0 kgf·m (28.9 lbf·ft)
Bleeder fitting : 1.8 kgf·m (13.0 lbf·ft)

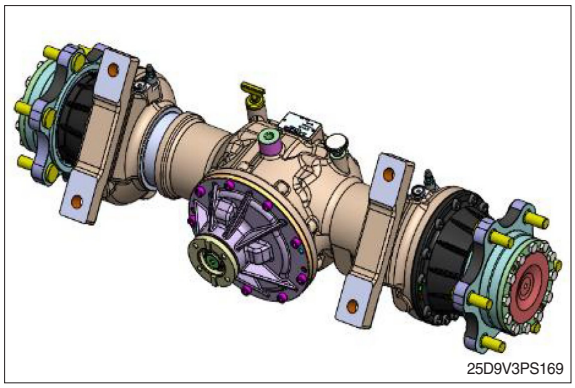


(11) Assemble O-ring, drain plug (magnetic), and plug.

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



(12) Complete drive axle assembly.



GROUP 3 MAINTENANCE AND TROUBLESHOOTING

1. MAINTENANCE

1) TRANSMISSION

(1) Recommend oils

The property that needs for auto transmission oil.

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

① Oil volume is approximately 6 liters (without torque converter).

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

(2) Point of exchange oil

① Pulling out oil

a. Please take off the drain plug where under of the transmission, and then discharge the old oil.

b. Please take off the hose join part, and then discharge the old oil that remained in the oil cooler and in the hose.

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

② Oil supply

a. Please stop the engine (ok), then refuel the oil into transmission until「HOT」level of oil level gauge.

b. Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.

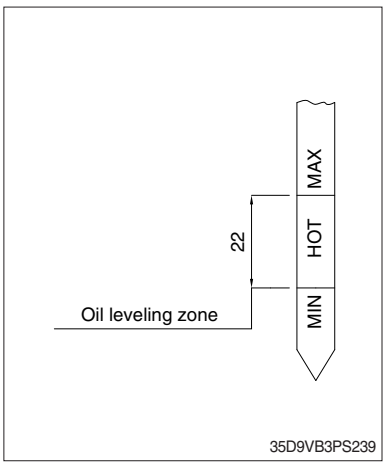
c. The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the engine. Then oil level sink down.

d. 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).

※ Be careful not to incorporate foreign substances or moisture when injecting oil for exchange.

※ Inject only the specified oil amount. If there is too little or many, it causes failure.

※ Check the oil level, when the oil temperature is 50℃ ~ 60℃.
Amount of all oil : about 14 liters.



(3) Period of overaul

① As for the overhaul, we recommend either every 5 years or 7000 hours coming early to be done as a limit.

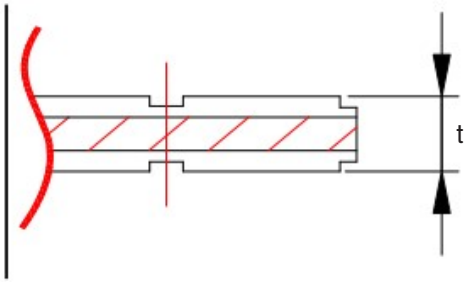
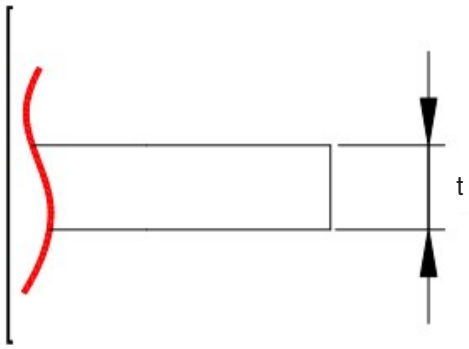
② Please change the oil seal, rubber such as O-ring, and gasket, copper gasket, if it has damaged.

③ Please Check the disassembled parts and check for cracks, marks and abnormal wear and corrosion etc. If the parts are in abnormal condition, change or repair parts.

④ Disc, plate, pressure plate → Change the part that exceeds the wear limits.

⑤ Bearing → Check appearance and rotation. If it does not rotate smoothly, wash it with a metal cleaner and apply oil to check the rotation state again. At this time, if it does not rotate smoothly, it will be changed for a new product.

⑥ Gear, shaft → If there are abnormalities such as fitting, crack, bending, abrasion, corrosion, etc., change it with a new product.

Item in the F&R clutch		Standard (mm)	Limit (mm)
Disc		2.4	1.9
Plate		1.8	1.65
Pressure plate		3	2.85

(4) Test

① **Operation check**

· Please change the change lever to 「N」 position and hold this position, then please change the engine speed from low idle to high idle, and check the below condition.

· The abnormal sound dose not occur.

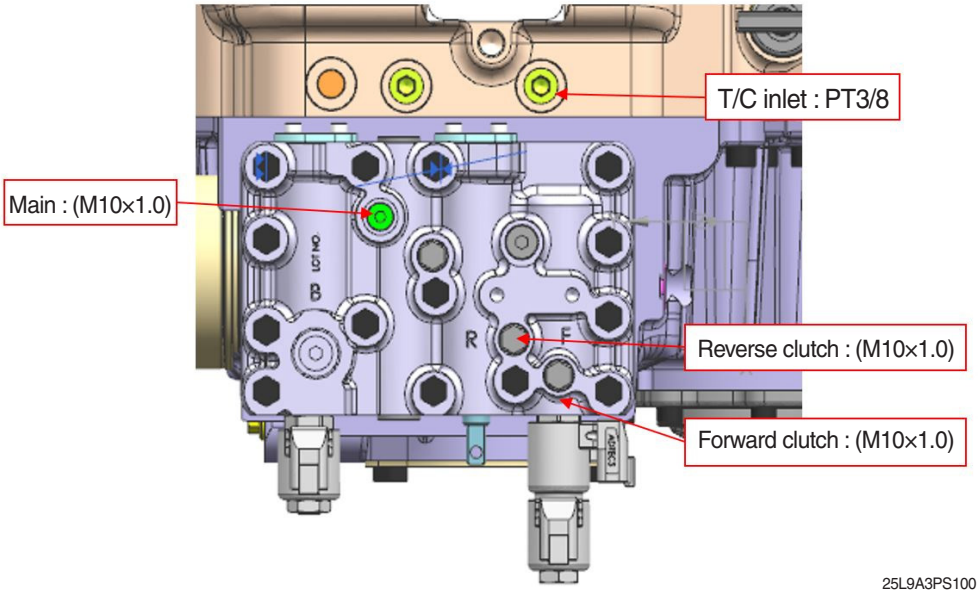
· The abnormal oscillation dose not occur.

· The oil is not leaking.

· Overheating, a strong odor of overheated oil is a major trouble sign.

② **Oil pressure measurement**

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



a. Please warming up the engine until the transmission oil temperature becomes about 50~60˚C.

b. Please measure the oil pressure of every required part as below under the low and high idle speed of engine.

c. When measuring the forward or reverse clutch pressure, measure it with the shaft connected to the drive axle removed or with the wheels of the vehicle in the air.

· Measure the oil pressure of clutch and T/C inlet at the 800 ~ 2400 rpm.

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

③ **Stall torque output test**

· Before testing, install a brace on the vehicle's tires and pay attention to prevent front and rear collisions.

※ **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).

- Transmission check required if exceeded / Engine inspection required if not met

2) DRIVE AXLE

(1) General information

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

(2) Magnets and magnetic drain plugs

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

(3) Breather

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

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

(4) Oil level

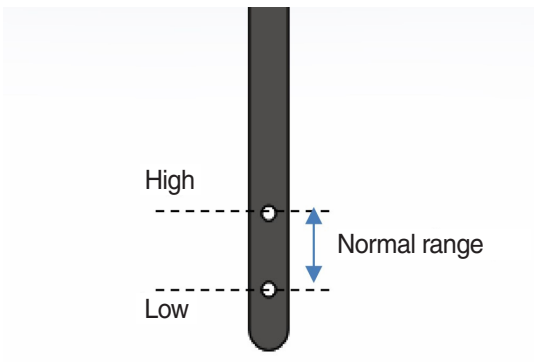
① **Check and adjust oil**

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

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

a. Park the truck on flat ground.

b. Pull out oil level gauge from axle, then check the height of oil.



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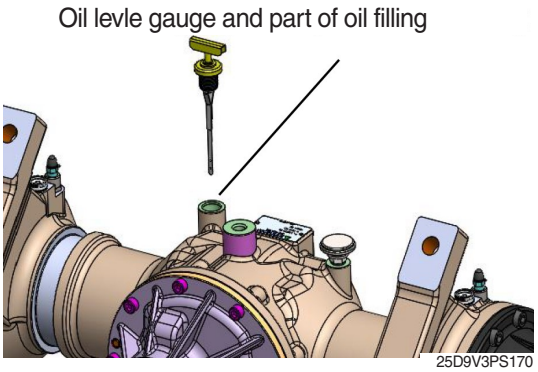
c. If the height of oil of level gauge is higher than the upper limit, drain the oil outby after loosening main drain plug , if the height of oil is lower than the lowest limit, replenish oil.



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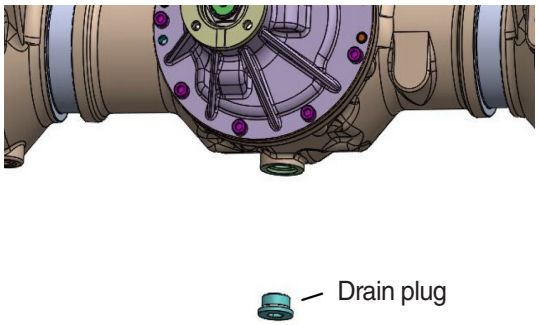

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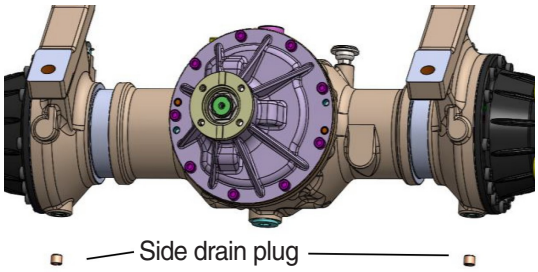

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② Oil change

⚠ 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.

a. Make sure the vehicle is on level surface.

b. Raise lift of vehicle and drain oil by loosening main drain plug and 2 places of side plug.

c. After drain all oil, clean the magnetic plug.

d. Fill oil with checking the height of level with level gauge.

③ Oil volume and available of list

a. Oil volume is approximately 8.2 liters.

b. Available oil list

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

(5) Period of overhul

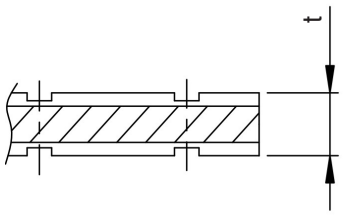
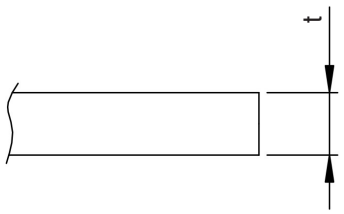
① Period of drive axle assembly overhaul : Every 5 year or 7,000 hours.

② The Axle oil needs to be replaced per every 1,000 hrs, to prevent brake noise.

③ O-ring, oil seal, rubber, gasket : Change all parts at every overhaul.

※ Check internal leakage of brake system(Brake seal) : Every 2,000 hours, replace as necessary.

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

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

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

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

2. TROUBLESHOOTING

1) TRANSMISSION

(1) Output does not go up

Defects and causes			Measures
Torque converter	Torque converter oil	Lack of oil supply	Replenish the oil.
		Oil use that does not fit the regulations	Change to recommended oil.
		Air mixed with oil	Tighten each joint coupling and the pipe further.
		As converter pressure decreases, air bubbles occur	Check and adjust the torque converter pressure.
		Water mixed with oil	Check the cooler, and Change all oil.
	Main body of torque converter	Damaged stator free wheel	Change the torque converter.
		Sticking Stator free wheel	Change the torque converter.
		Blade of the wheel is damaged or in contact with other components	Change the torque converter.
Charging pump		Charging Pump does not work normally	Change the charging pump.
Transmission	Control valve	Reduced clutch pressure due to excessive spring deformation or breakage	Change the spring.
		The valve does not move with the valve opens.	Repair or Change the control valve.
		Orifice clogging	Clean the orifice.
Oil filter		Oil filter clogging	Clean or Change the oil filter.

(2) Power is not transmitted

Defects and causes			Measures
Torque converter	Flexible plate breakage		Change the flexible plate.
	Lack of oil supply		Replenish the oil.
	Spline wear		Change the torque converter.
Charging Pump	Drive/Driven gear damage		Change the charging pump.
	Charging Pump does not working		Change the charging pump.
Transmission	Clutch Assembly	Plate/friction disc wear or damage	Change the plate/friction disc.
		Plate/friction disc sticking	Change the plate/friction disc.
		Spline wear	Change the worn parts.
		Peek seal wear or damage	Change the peek seal.
	Output Shaft.	Spline wear	Change the output shaft.
		Gear breakage	Change the gear.
	Catridge Valve	Catridge Valve breakage	Change the Catridge Valve.
		Abnormal operation of spool	Change the Catridge Valve.
		Spool does not operate normally.	Please change the solenoid valve.

(3) Oil temperature rises abnormally

Defects and causes			Measures
Torque converter	Main body of torque converter	Damage to internal parts such as state freewheel devices	Change the torque converter.
		Bearing wear or sticking	Change the torque converter.
	Torque converter oil	Lack of oil supply	Replenish the oil.
		Oil use that does not fit the regulations	Change to recommended oil.
		Air mixed with oil	Tighten each joint coupling and the pipe further.
		Water mixed with oil	Check the cooler, and change all oil.
Transmission	The clutch is dragging	Plate/friction disc sticking	Change the plate/friction disc.
		Abnormal clutch piston operation	Change the clutch piston.
		Reduced clutch pressure	Check the clutch pressure.
	Bearing wear or sticking		Change the bearing.

(4) Clutch or converter oil pressure is too high

Defects and causes			Measures
Torque converter	Viscosity of oil is too high.		Change to recommended oil.
Transmission	Control valve	The valve does not operate normally because spring is broken or spools are sticked in the valve.	Repair the valve assembly or change to new parts.

(5) Clutch or converter oil pressure is too low

Defects and causes			Measures
Transmission	Lack of oil supply		Replenish the oil.
	Oil use that does not fit the regulations		Change to recommended oil.
	Charging pump wear or break		Change the charging pump.
	Piston ring or O-ring wear/damage		Change the piston ring or O-ring.
	Filter clogging		Clean or Change the filter.
	Control Valve	Excessive spring deformation or breakage	Change the spring.
		The valve does not move with the valve opens.	Repair or Change the control valve.
		Orifice clogging	Clean the orifice.
	Clutch	Peek seal or piston ring wear	Chagge the peek seal or O-ring.

(6) Noise occurs

Defects and causes		Measures
Noise only at neutral	Gear or bearing wear inside the charging pump.	Change the Charging pump.
	Torque converter stator wear.	Change the torque converter.
	Lack of oil supply	Replenish the oil.
	Gear parts of engine and T/M pump's misalignment with that of torque converter housing and pump.	Reassemble or change the parts
Pump noise	Loud noise irregularly repeats if there's contaminants in the T/M hydraulic components.	Clean or change the parts.
	Regular noise means pump defect	Change the parts.
Transmission noise	Converter housing and pump gear misalignment with engine or T/M case	Reassemble or change the parts.
	Gear damage	Change the gear.
	Clutch plate and fricition disc slip noise	Change the plate/friction disc.
	Thrust washer defect.	Change the thrust washer.
	Another components wear or damage.	Change the problem part.
Control valve noise	Air mixed into hydraulic system.	Tighten each joint coupling and the pipe further.
	Clogged oil passage.	Clean or change the parts.
	Abnormal spool movement.	Reassemble or change the parts.

(7) Shifting is impossible

Defects and causes		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.
Differencial	Loosened bolt for assembling ring gear	Disassemble, check and reassemble the ring gear.
	Damaged ring gear	Replace the ring gear.
	Loosened or worn differencial bearing	Disassemble, check, reassemble or replace the differencial bearing.
	Damaged bevel gear bearing	Replace the bevel gear bearing.
	Worn or damaged diff pinion and side gear.	Replace the diff pinion and side gear.
	Worn or damaged thrust washer.	Replace the thrust washer.
	Excessive backlash of diff pinion and side gear.	Replace the diff pinion and side gear.
Brake	Incorrect axle fluid and/or friction material used	Use only meritor specified or approved materials.
		Drain and flush fluid from axle. Replace with approved fluid.
		Replace all friction discs. Throughly clean or replace stationary discs.

(2) Oil leakage

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