SECTION 3 POWER TRAIN SYSTEM

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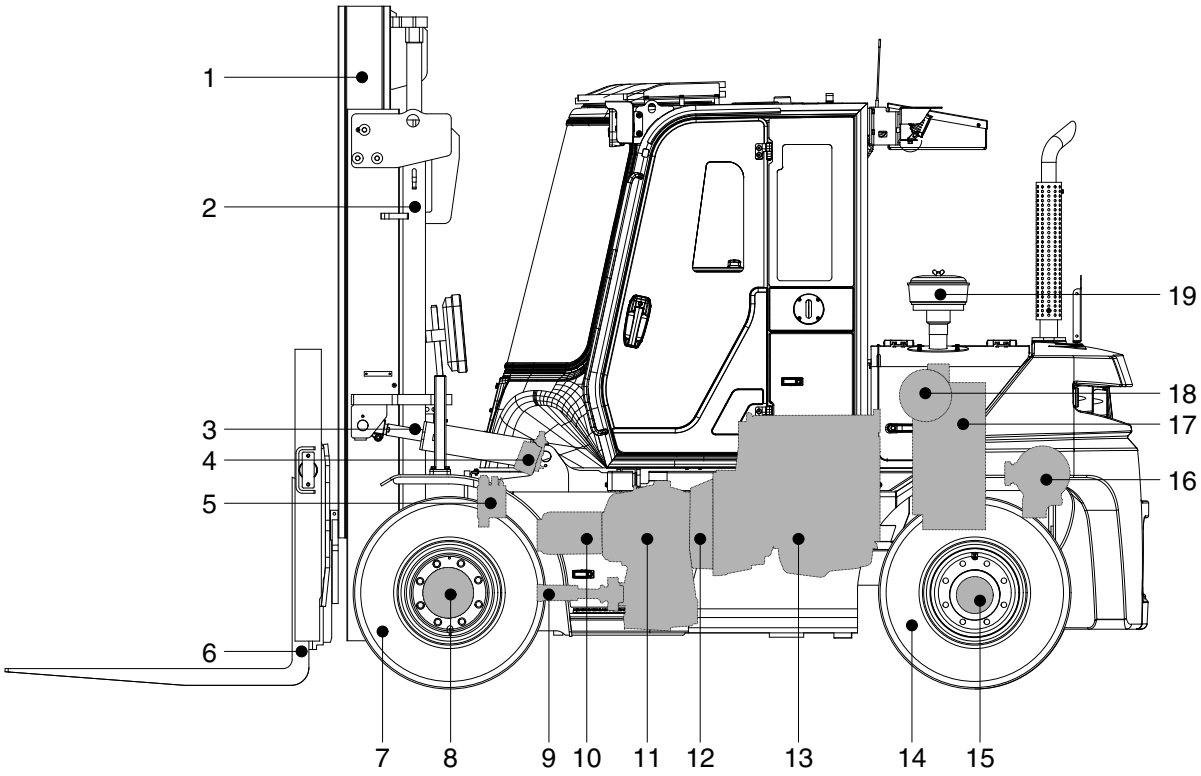
GROUP 1 STRUCTURE AND OPERATION

1. STRUCTURE



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1	Mast	8	Drive axle	15	Steering axle
2	Lift cylinder	9	Propeller shaft	16	Aftertreatment
3	Tilt cylinder	10	Hydraulic pump	17	Radiator
4	Steering unit	11	Transmission	18	Air cleaner
5	Main control valve	12	Torque converter	19	Precleaner
6	Fork	13	Engine		
7	Front wheel	14	Rear wheel		

The power train consists of the following components :

- Torque converter
- Transmission
- Drive shaft
- Drive axle

Engine power is transmitted to the transmission through the torque converter.

The transmission is a hydraulically engaged 2 speed forward, 1 speed reverse power shift type transmission.

The transmission outputs through the universal joints of the drive shaft to drive axle assembly.

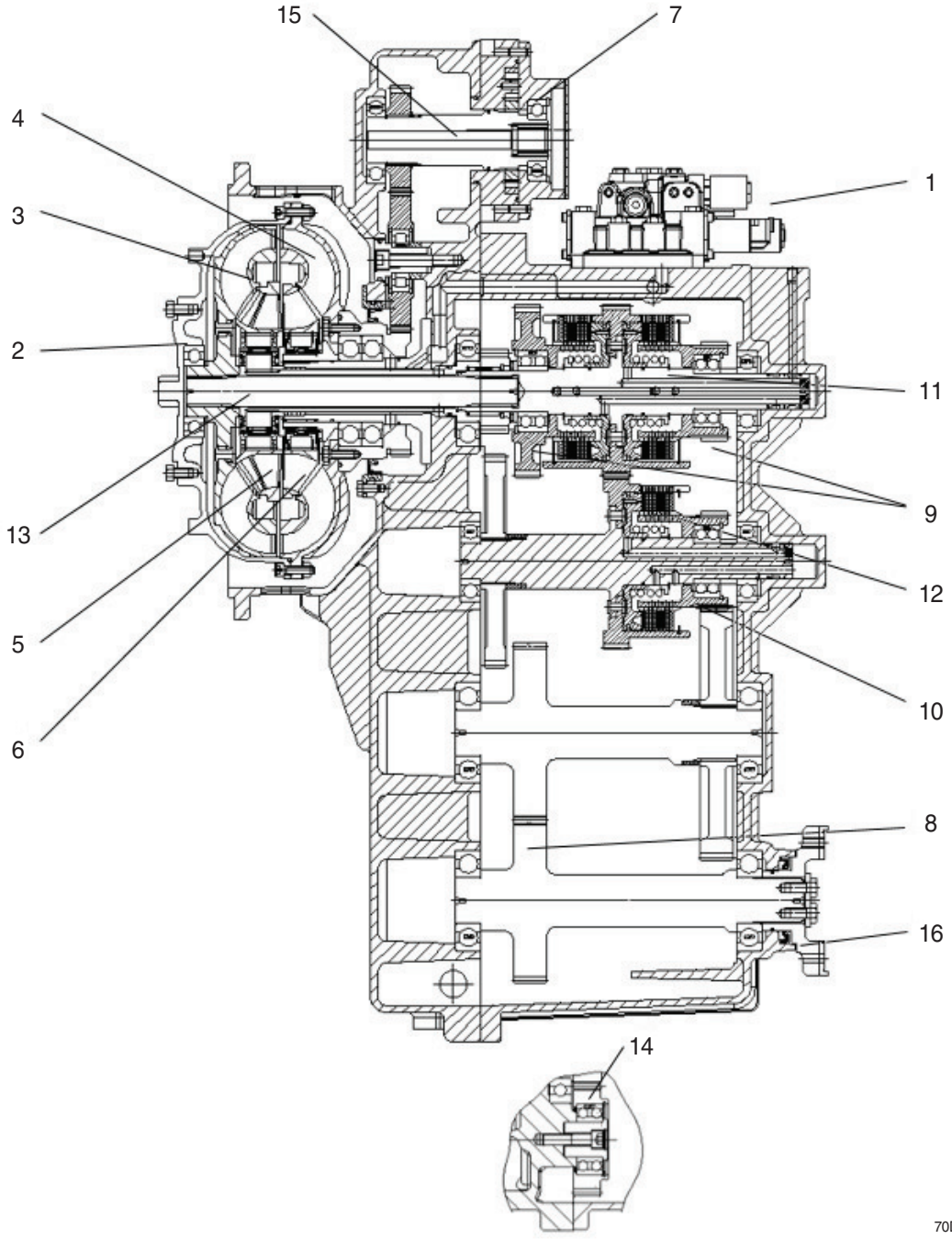
The power transmitted to front axle drives front wheels.

2. SPECIFICATION

Item			Specification
Torque converter	Type		3 Element, 1 stage, 2 phases
	Stall ratio		5.3 : 1
Transmission	Type		Full auto, power shift
	Gear shift (FR/RR)		2/1
	Adjustment		Electrical single lever type
	Overhaul ratio	FR	1 : 2.456 2 : 0.946
		RR	1 : 2.494
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		10.668
	Gear		Ring & pinion gear type
Wheels	Q'ty (FR/RR)		Double : 4/2
	Front (drive)		8.25-15-14 PR
	Rear (steer)		8.25-15-14 PR
Brakes	Travel		Front wheel, wet disc brake
	Parking		Wet disc (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		75.87° to both right and left angle, respectively

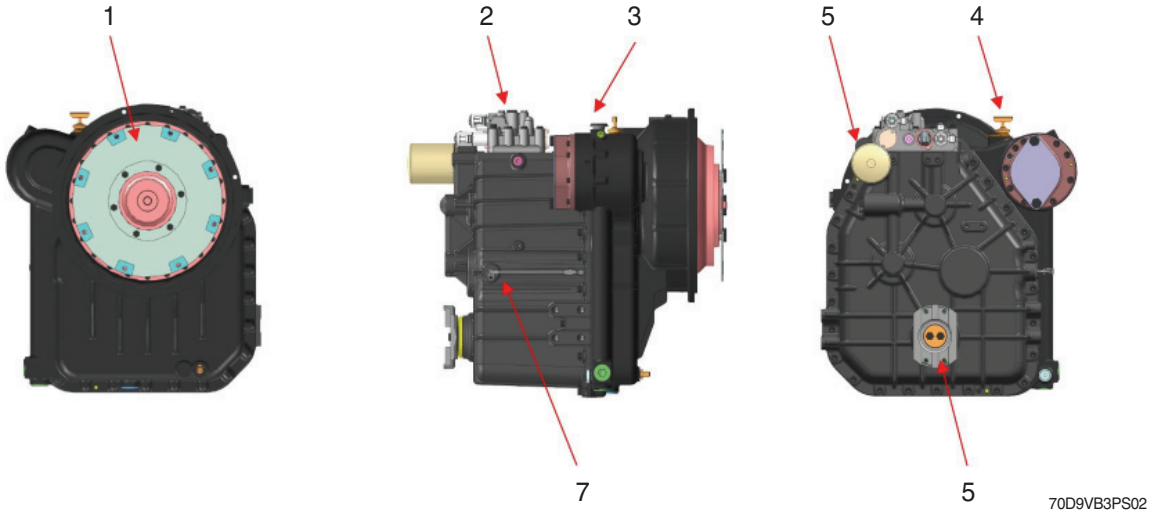
3. TRANSMISSION

1) STRUCTURE



1	Control valve	7	Charging pump	13	PTO shaft
2	Torque converter	8	Output gear	14	Intermdiate gear
3	Turbine	9	Forward clutch gear	15	PTO pump shaft
4	Impeller	10	Reverse clutch gear	16	Flange yoke
5	1st stator	11	Forward clutch pack		
6	2nd stator	12	Reverse clutch pack		

2) INSTALLATION VIEW



1	Torque converter	4	Oil level gauge and tube	7	Speed sensor
2	Control valve	5	Oil filter		
3	Air breather	6	Output (Universal joint link part)		

3) OPERATION

(1) Torque converter

① Converter equipment

a. The outside of Impeller is connected with flywheel of engine through cover wheel, front cover and Input plate. The inside of it is supported by Inner race of free wheel through angular contact bearing.

b. The engine power is transmitted to Impeller wheel, and that is transmitted to turbine wheel assembly through fluid.

c. Turbine wheel assembly is connected with turbine shaft by spline, A gear is fixed in other side of turbine shaft. This gear is working with a gear on output shaft. They are a reduction gear and transmit power to output shaft with flange.

d. Stator wheel 2 is fixed in transmission housing through free wheel cam, one way clutch bearing and 2nd stator shaft. When the fluid returns to Impeller wheel from turbine wheel assembly, the reaction torque occurs in Stator wheel. This reaction torque is added to the turbine torque. Therefore, the turbine torque becomes larger than the input torque. In addition when turbine wheel speed is high. Stator wheel does not occur the reaction torque by idling itself.

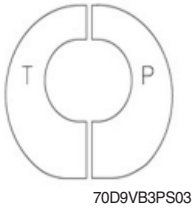
② Power transmission principle of torque converter

a. The mechanism that transmits power through fluid id called "Hydraulic Clutch". This is divided into about two types.

b. One is called "Fluid coupling", another is called "Torque Converter". Those main part structures are such as below figures.

Fluid Coupling

Torque Converter



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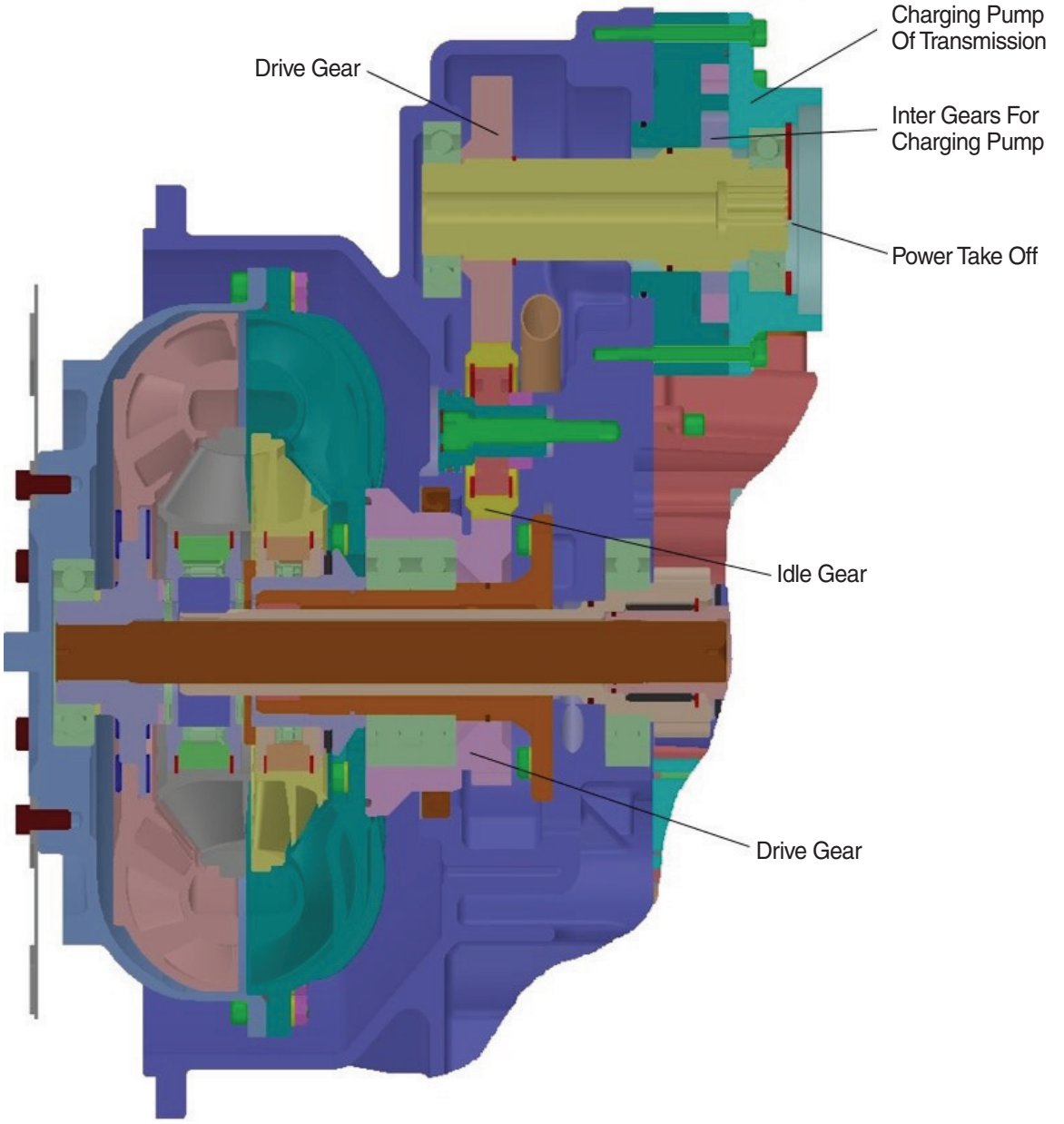
P : Pump Wheel (Impeller Wheel)
T : Turbine Wheel
S1 : Stator Wheel 1
S2 : Stator Wheel 2

c. Fluid coupling consists of impeller and turbine. This is the same principle that the electric fan transmits revolution (power) to the windmill when they are laid face to face.
d. When the Impeller rotates by engine, the fluid (oil) starts rotating around the axis of rotation and moves outside by centrifugal force.
e. The fluid flows from the outside of Impeller blades, and flows into the outside of turbine blades faced to Impeller blades.
f. While the fluid is flowing to the inside along turbine blades, that gives turbine wheel rotation (power). And that returns to the inside of Impeller blades.
g. Therefore as for the flow of the fluid, at first according as impeller rotates, the rotary flow that the rotary center is the axis of impeller occurs. As a result the eddy flow that circulates between impeller and turbine occurs by centrifugal force.
h. Fluid coupling must be used the oil as continuous power transmitting medium in the space closed up.
i. When the difference between impeller speed and turbine speed is large, namely when the load is large for example in case of starting, or in case of going up slope, and so on, the efficiency is low. And it is necessary for turning turbine to input large impeller torque.
j In other to exclude this loss. Stator wheel is set between the outlet of turbine and the inlet of impeller. In this way Torque converter is what the transmission efficiency when the load is large is improved.
k. In fluid coupling, the flow of oil which returns to impeller from turbine makes the power which disturbs impeller rotation.
l In torque converter, the flow direction of oil from turbine is changed to the direction which turns impeller by stator wheel. Therefore the efficiency is high when the load is large. Besides, the torque increased than the input torque is transmitted to turbine.
m. Stator improves the ability of torque converter by idling itself or stopping according to the flow direction of oil in the outlet of turbine.
n. For example like the vehicle which is running fast, when the load of turbine is small, the difference between impeller speed and turbine speed becomes small.
o. According as those speeds become this condition, the oil flowing in the outlet of turbine changes the flow angle to the direction of stator rotation. Finally that becomes hitting against the back of stator blade.
p. And stator becomes large resistance which disturbs the flow, and the efficiency goes down. Then stator of torque converter has a one-way clutch (free wheel) which is pushed by the flow of oil and idles when the fluid (oil) becomes hitting against the back of blade.
q. In other words, stator is fixed in one direction and increases the torque. If the rotation of stator is reverse direction, stator idles. And stator becomes functioning as fluid coupling when the load is small.

③ 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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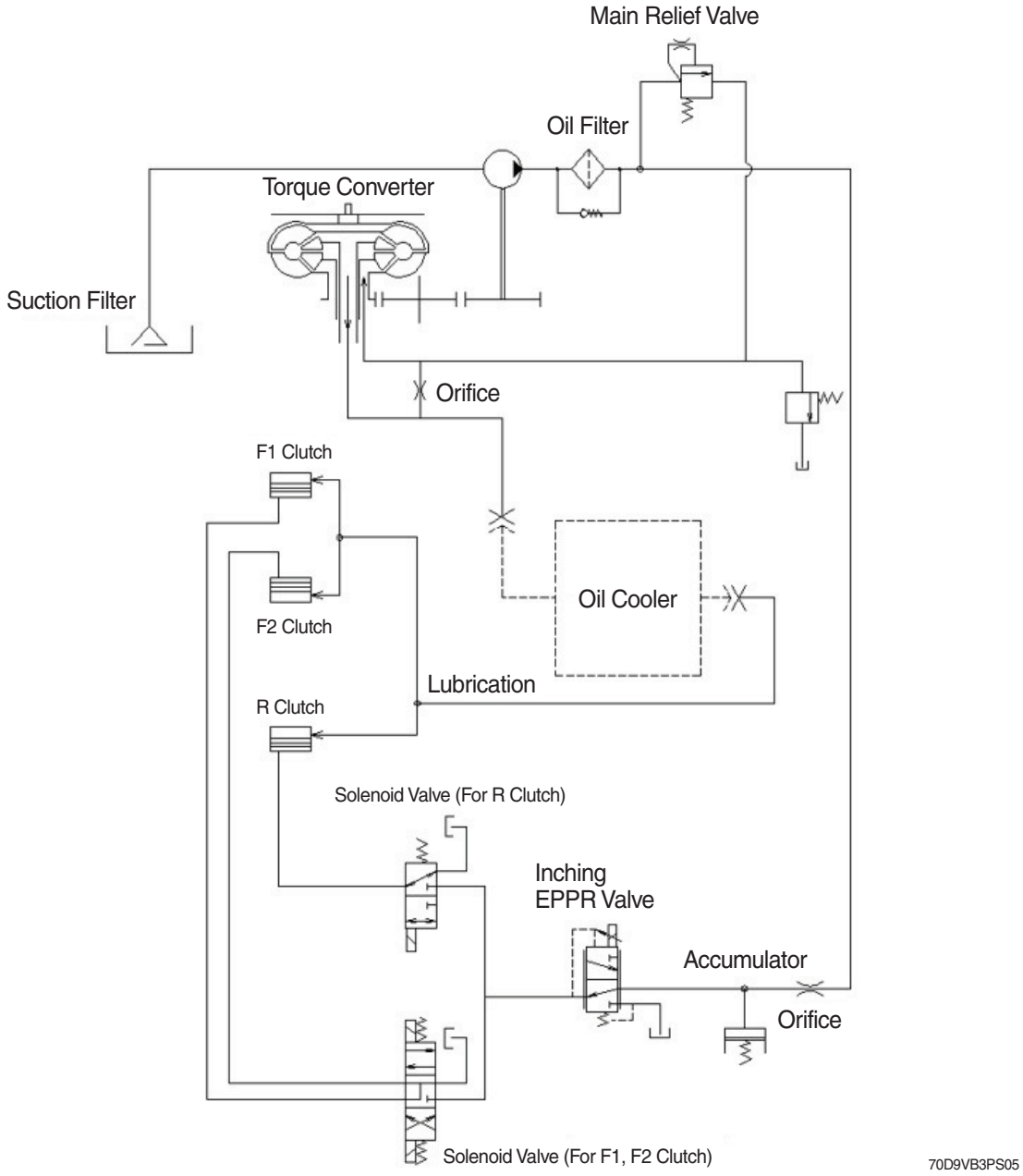
4) HYDRAULIC CIRCUIT



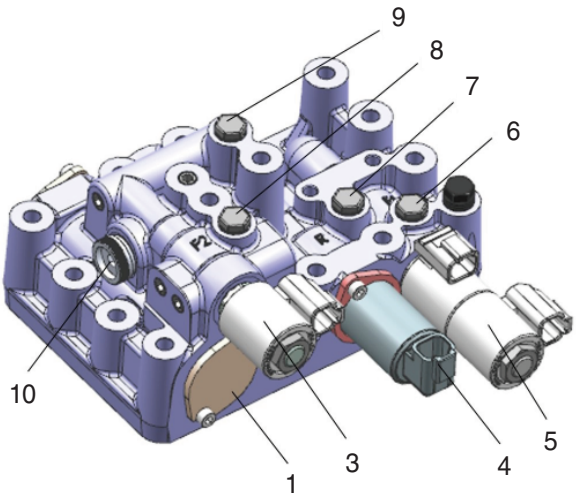
(1) The oil that is pumped up through the strainer from the oil pump of transmission by charging pump of transmission. And this oil is sent to torque converter through the relief valve for the main pressure of hydraulic clutches.

(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) CONTROL VALVE

(1) Structure



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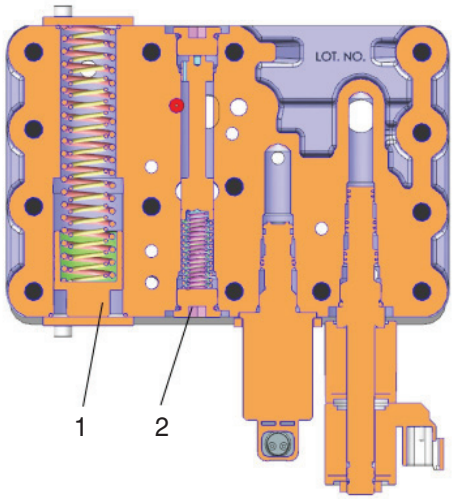

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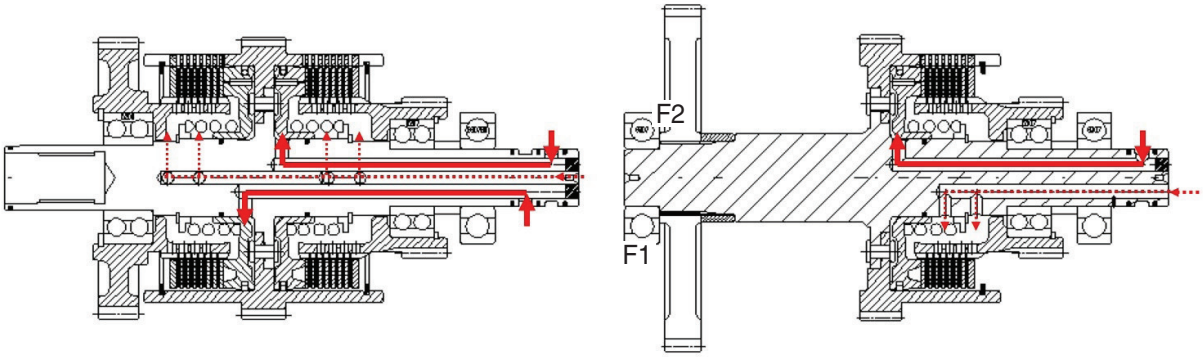
1	Modulation	6	Check port for F1 clutch
2	Main relief	7	Check port for R clutch
3	Solenoid valve for F2 clutch	8	Check port for F2 clutch
4	EPPR valve for inching	9	Check port main pressure
5	Solenoid valve for F1 & R clutch	10	Pressure sensor port

(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.
Accumlator Valve	This valve adjusts the pressure of clutch for smooth start when the operator wants to move and change the direction.
Solenoid Valve For Dierction (F1, F2, 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



Forward 1, 2 clutch

Reverse clutch

: Pressure line

: Lubrication line

70D9VB3PS08

(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.

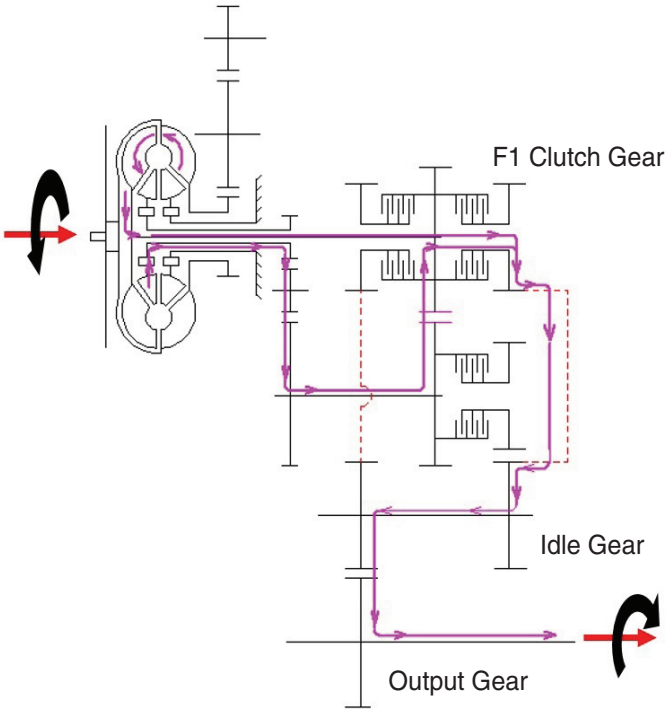
⑤ When the clutch engagement concludes and the hydraulic oil becomes regular pressure.

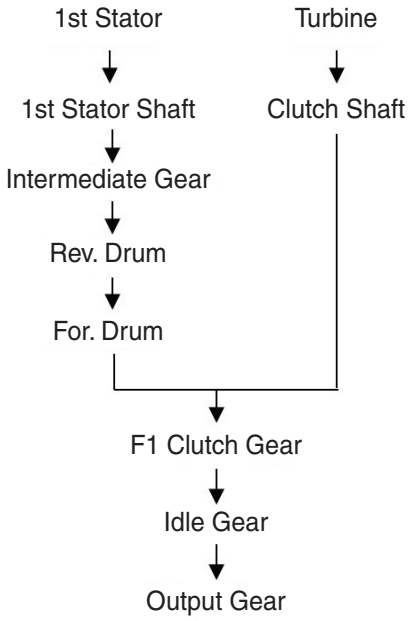
⑥ The hydraulic oil in the piston room presses the piston, and make the steel plates and the friction plates stick strongly against the force of the return spring.

⑦ Therefore the torque that is transmitted to the clutch shaft assembly transmits to the reduction gears.

7) POWER FLOW

(1) Forward 1





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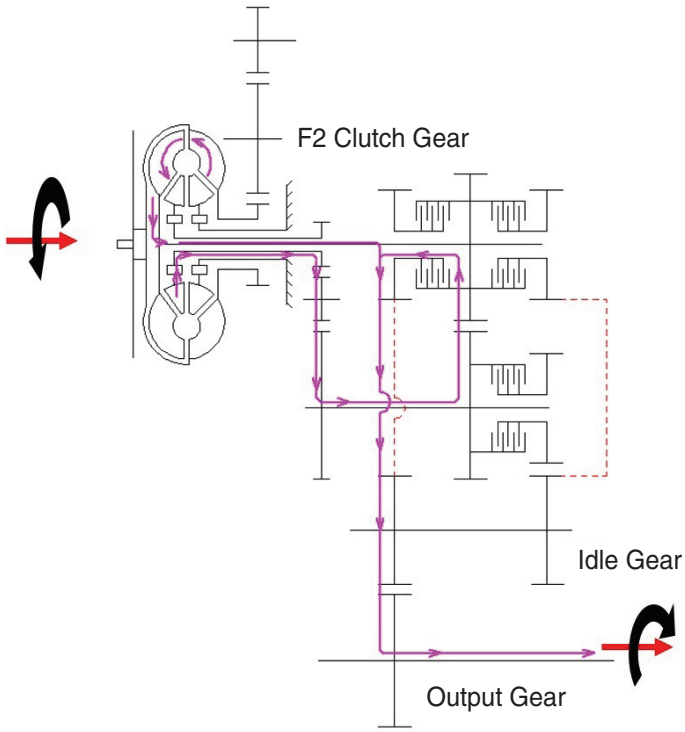
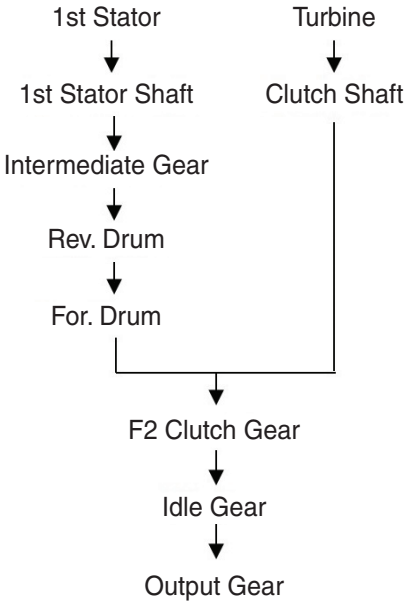
(2) Forward 2





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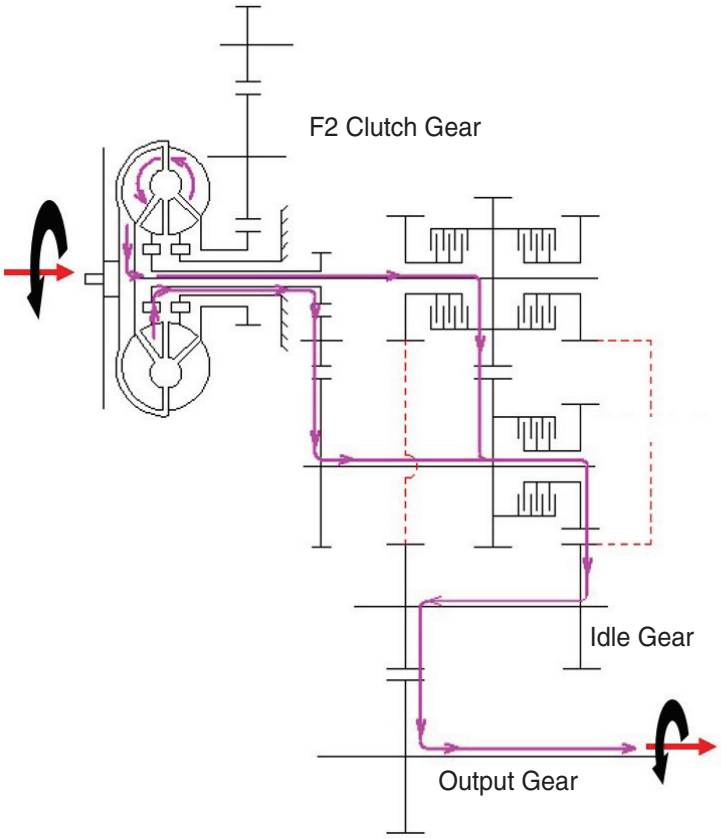
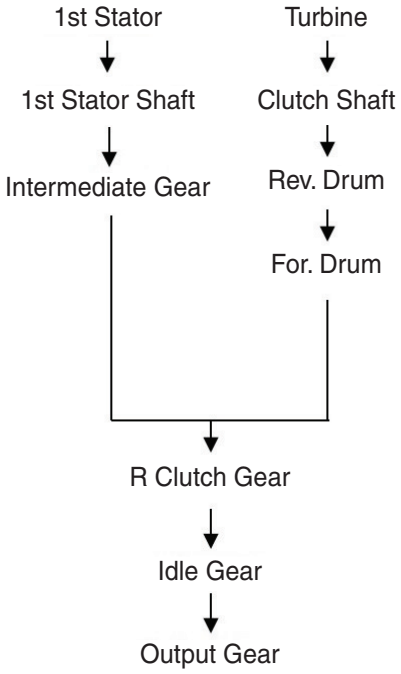
(3) Reverse





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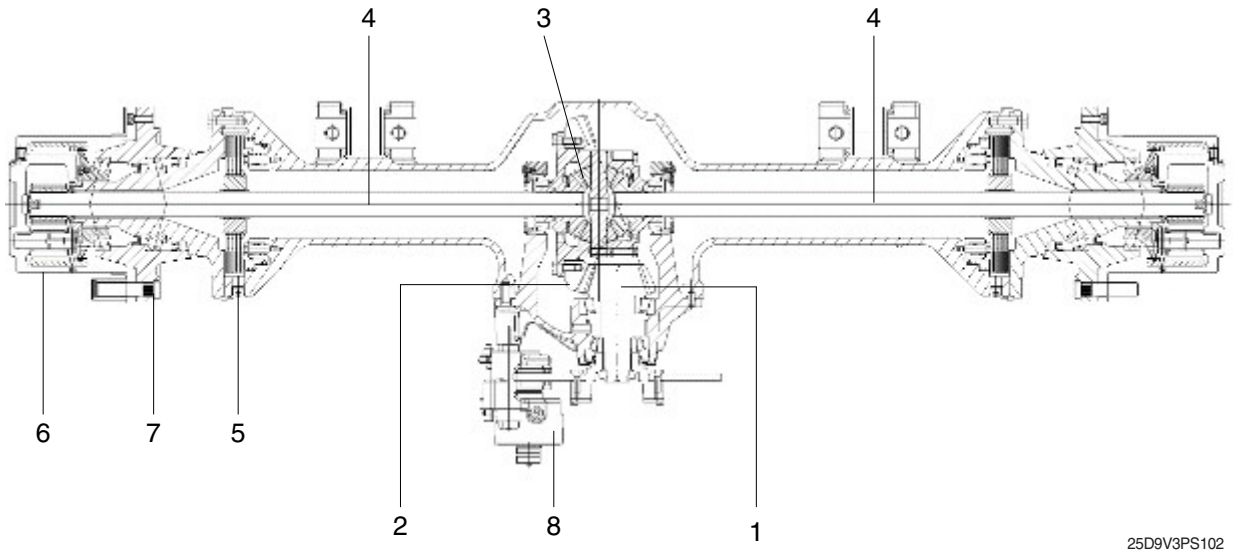
4. DRIVE AXLE

1) STRUCTURE

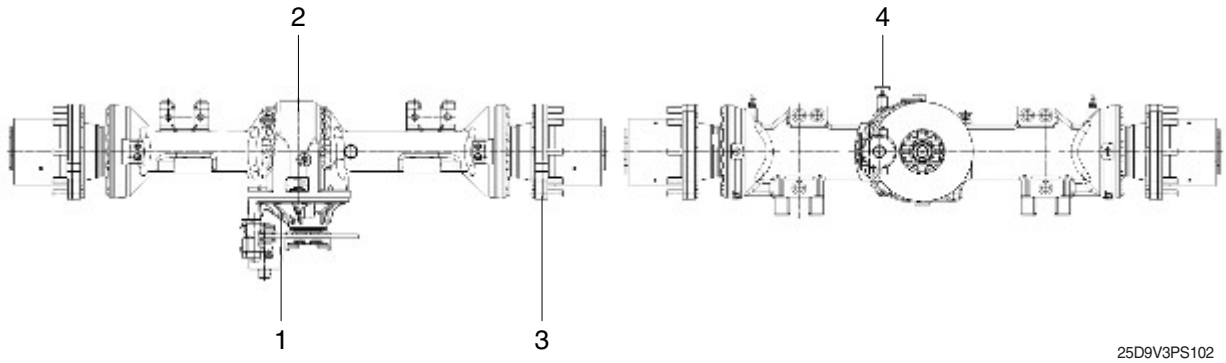


1	Pinion shaft	4	Axle shaft	7	Hub
2	Ring gear	5	Service brake	8	Parking brake
3	Differential device	6	Hub reduction		

2) SPECIFICATION

Item		Specification
		70D-9VB
Axle	Type	Front-wheel drive type, fixed location
	Gear ratio	10.668
	Gear	Ring & pinion gear type
Brakes	Travel	Front wheel, wet disc brake
	Parking	Wet disc, SHAR (Spring Actuate Hydraulic Release) type

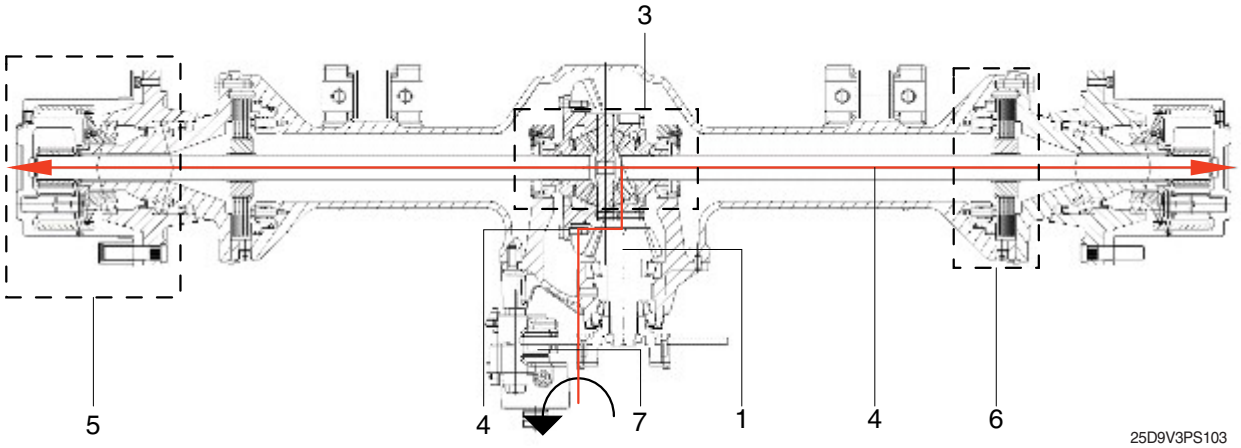
3) LAYOUT



1	Carrier sub assembly	3	Hub	4	Oil level gauge
2	Axle housing				

2) OPERATION

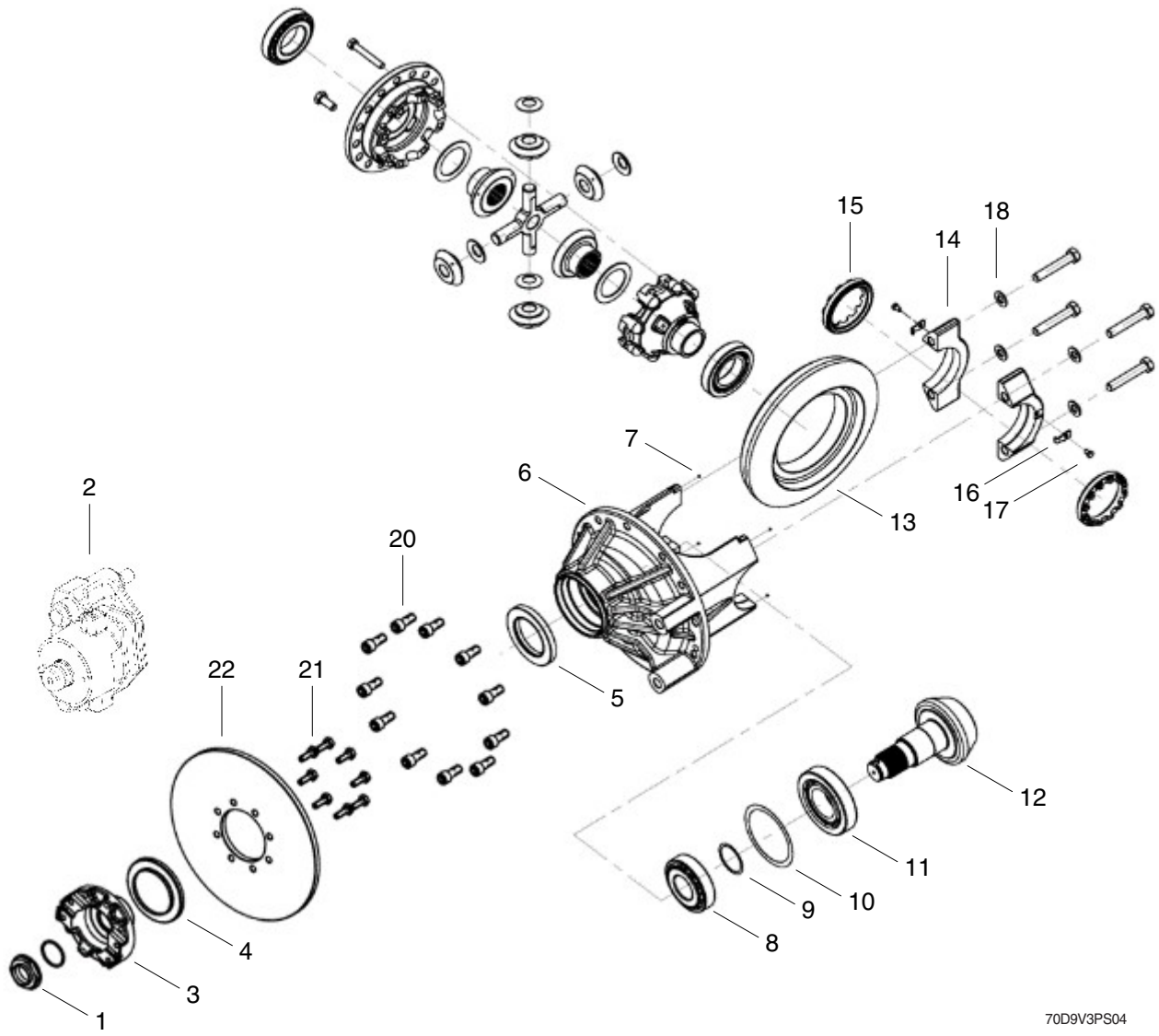
The drive axle is connected with the transmission output gear by drive shaft assembly. The power transferred by the drive shaft assembly is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear. The differential device deliver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



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

3) Carrier sub assembly

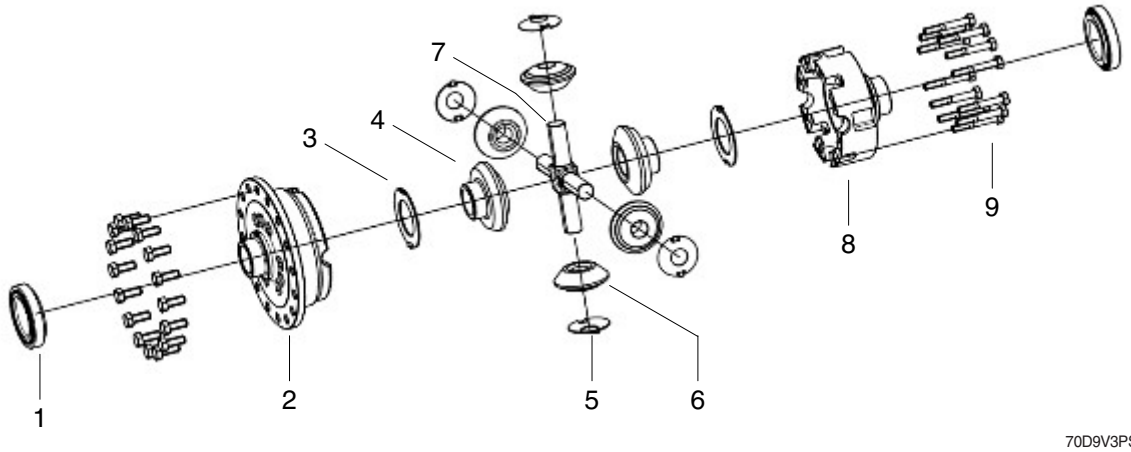
(1) Structure



1	Lock nut	12	Pinion shaft	17	Hex bolt
2	Parking brake	13	Ring gear	18	Plain washer
3	Flange yoke	14	Carrier cap	19	Hex bolt
4	Output cover	15	Adjust screw	20	Socket bolt
5	Oil seal	16	Lock plate	21	Hex bolt
6	Carrier case	9	Shim	22	Parking disk
7	Steel ball	10	Shim		
8	Taper roller bearing	11	Taper roller bearing		

4) Differential deivce

(1) Structure



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1	Taper roller bearing	4	Diff side gear	7	Spider
2	Diff case (RH)	5	Thrust washer	8	Diff case (LH)
3	Thrust washer	6	Diff pinion gear	9	Hex bolt

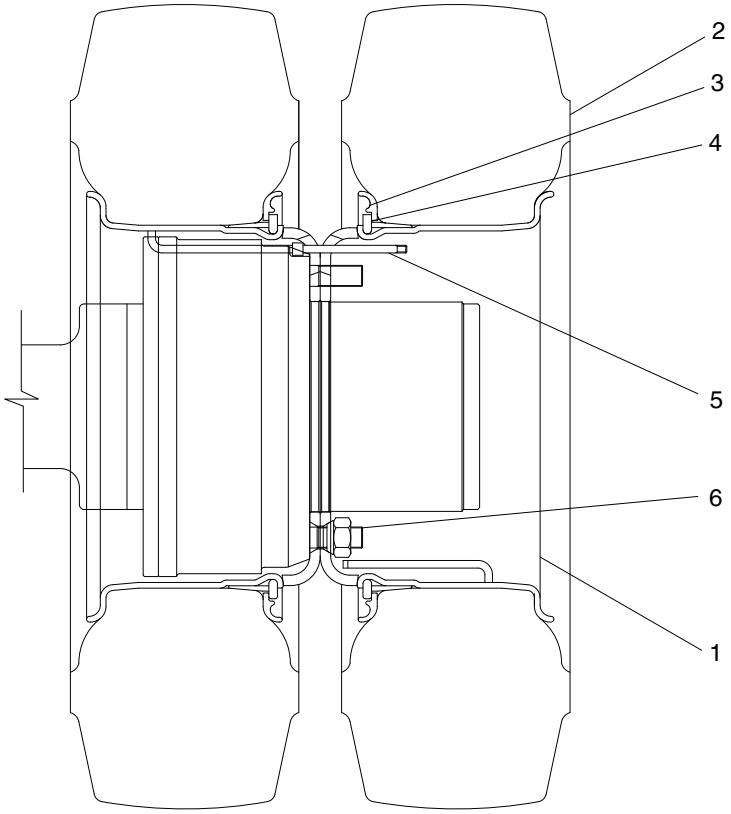
(2) Performance property

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.

5. TIRE AND WHEEL



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1	Wheel rim	3	Lock ring	5	Valve assembly
2	Tire	4	Side ring	6	Wheel nut

1) The tire acts to absorb the shock from the ground surface to the machine, and at the same time they must rotate in contact with the ground to gain the power which drives the machine.

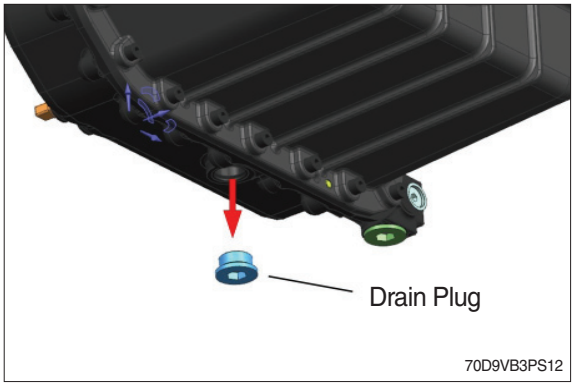
2) Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work.

GROUP 2 DISASSEMBLY AND ASSEMBLY

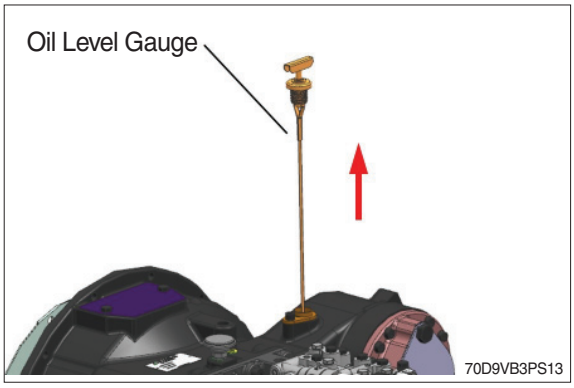
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION

(1) Remove the drain plug. Discharge the transmission oil.

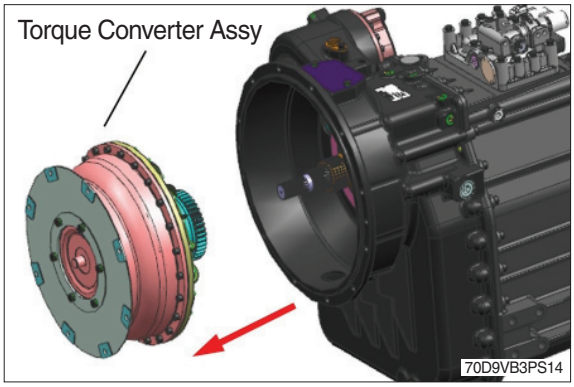


(2) Remove the oil level gauge.

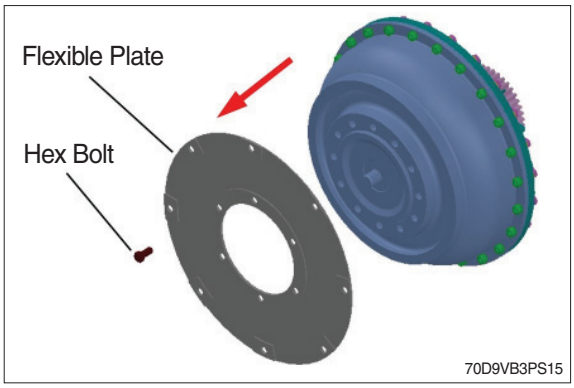


(3) Disassemble the torque converter assy.

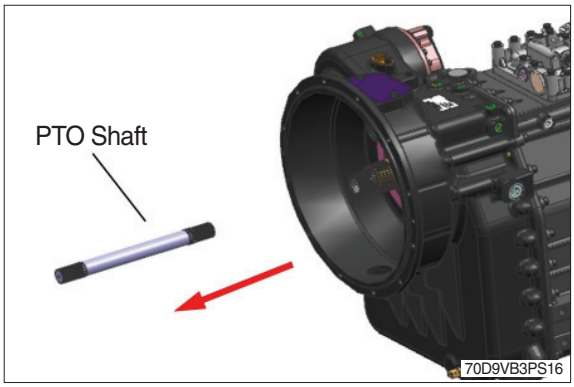
① Disassemble the torque converter assy.



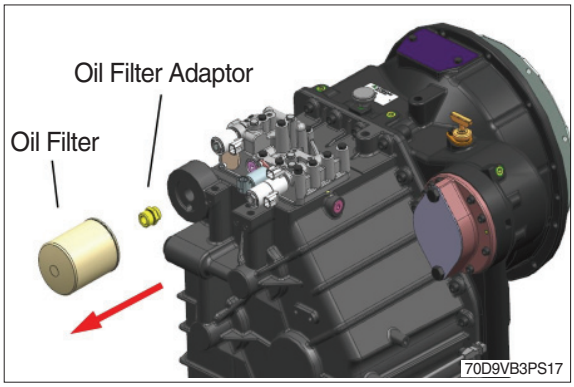
② Loosen the hex bolts and separate the flexible plate



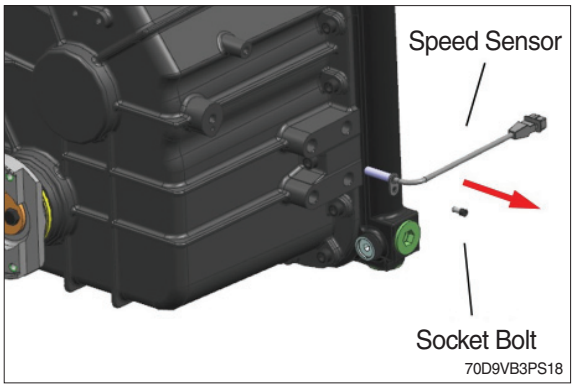
(4) Disassemble PTO shaft.



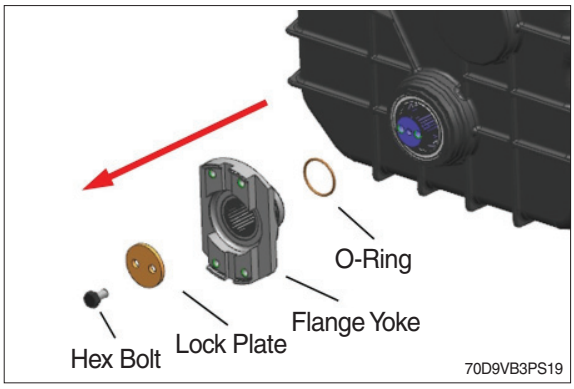
(5) Remove the oil filter and oil filter adaptor.



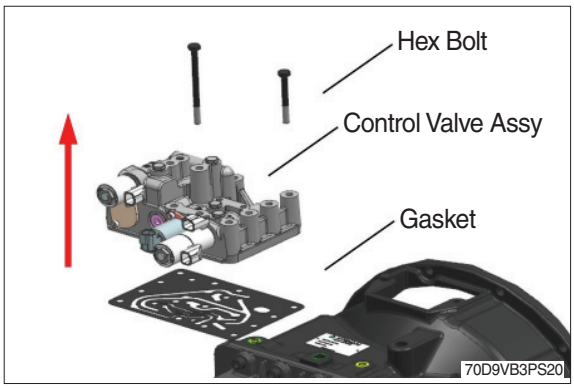
(6) Disassemble the socket bolt and speed sensor.



(7) Disassemble the hex bolt. And disassemble the lock plate, flange yoke and O-ring.

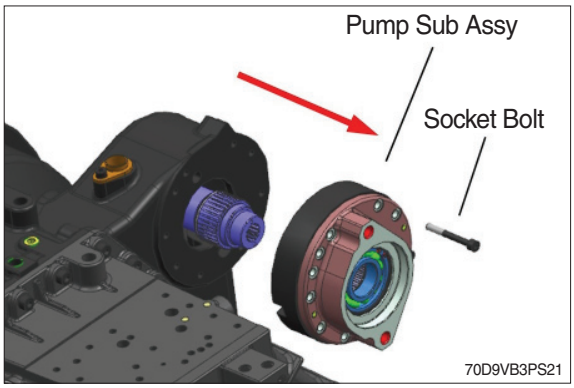


(8) Disassemble the control valve assy. Loosen the hex bolts (M8×60L 2EA, M8×75L 1EA, M8×110L 2EA, M8×70L 9EA). Separate the control valve ass'y and gasket.

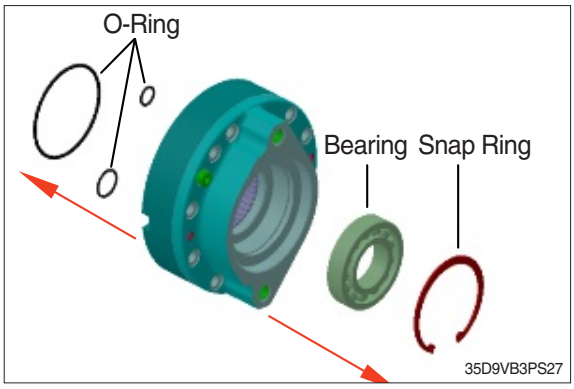


(9) Disassemble the pump sub assy.

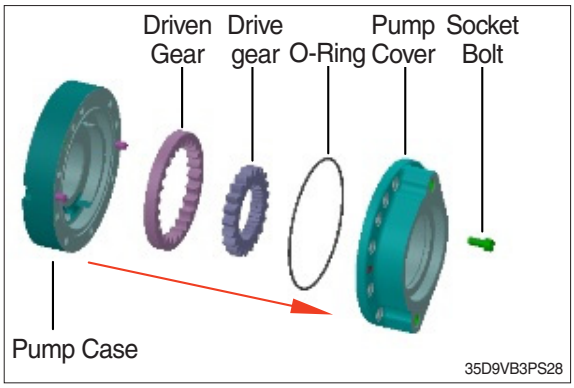
① Disassemble the socket bolts and pump assy.



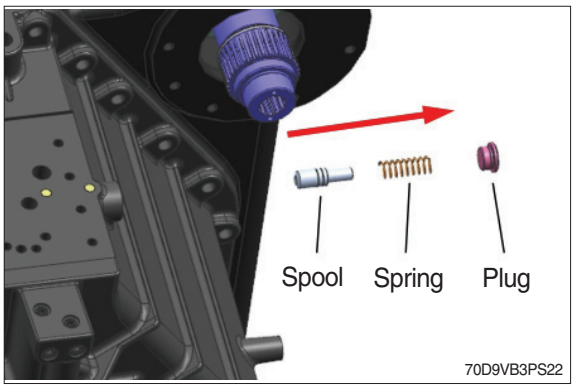
② Disassemble the snap ring, bearing and O-rings (3 EA).



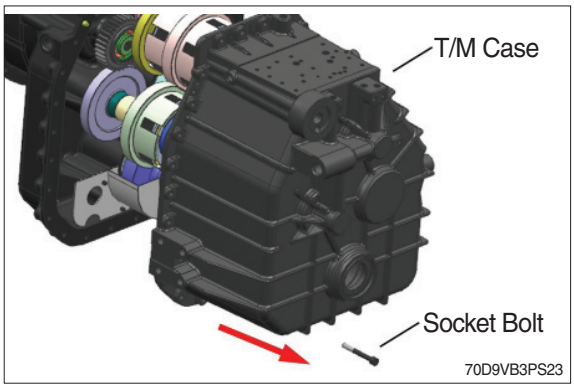
② Disassemble the socket bolts. And separate the O-ring, drive gear and driven gear from the pump case.



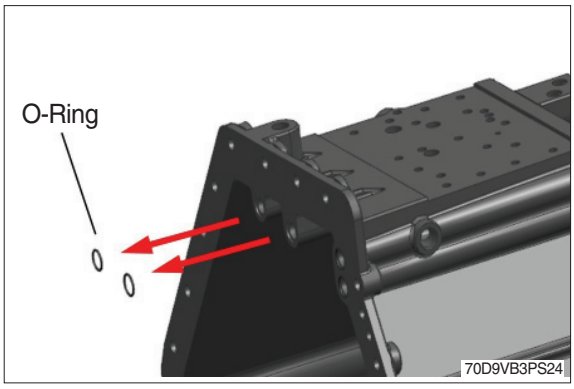
(10) Remove the plug, spring, spool.



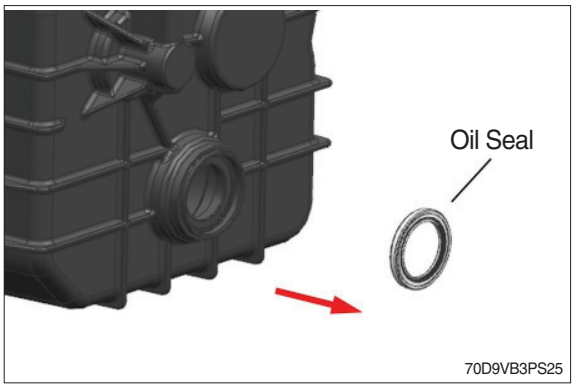
(11) Loosen the socket bolts. Then separate the T/M case.



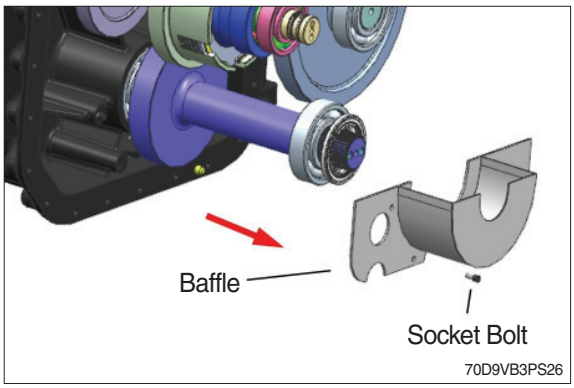
(12) Remove the O-rings.



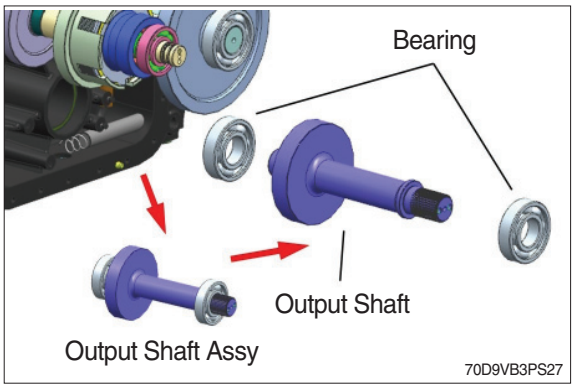
(13) Remove the oil seal.



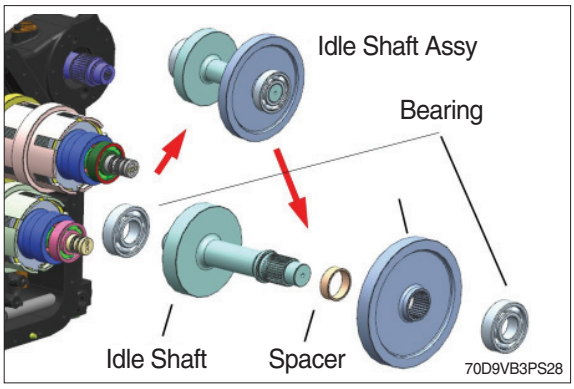
(14) Loosen the socket bolts and remove the baffle.



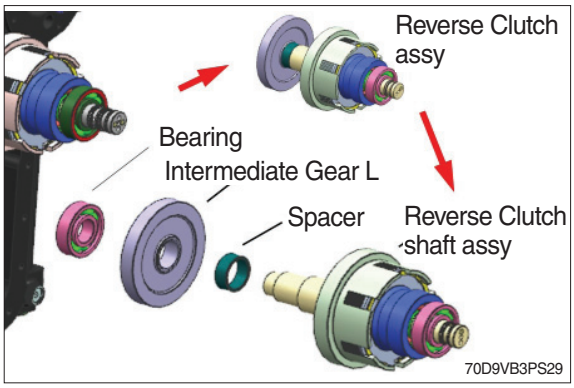
(15) Remove the output shaft assy and disassemble the bearings.



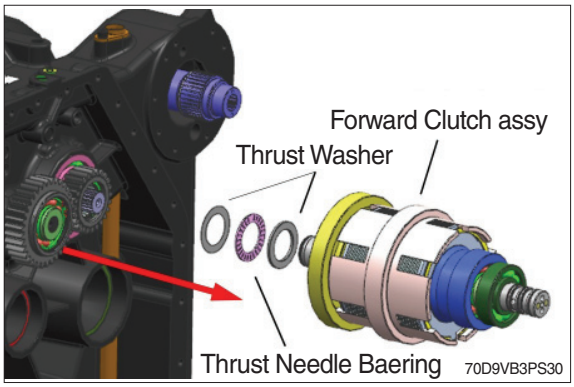
(16) Remove the Idle shaft assy and dissassemble the bearings and spacer.



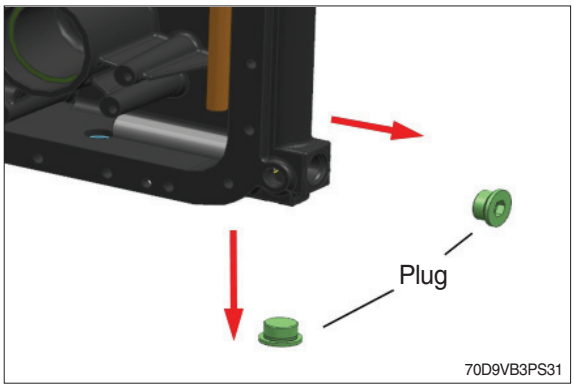
(17) Remove the reverse clutch assy and dis-sassemblethe reverse clutch shaft assy, baering and spacer.



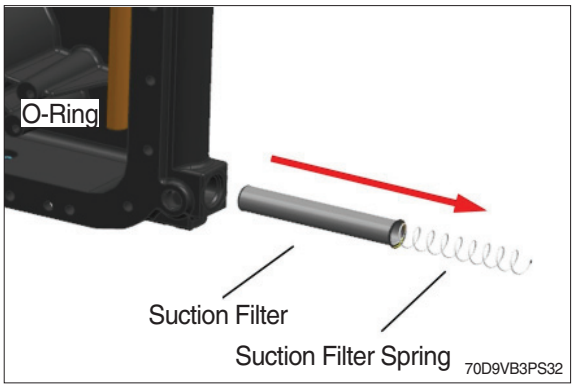
(18) Remove the Forward clutch assy and dis-sassemble the thrust bearing and wash-ers.



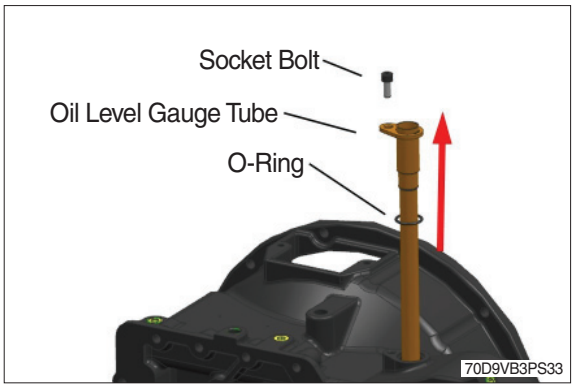
(19) Remove the plugs.



(20) Remove the suction filter spring and suc-tion filter.

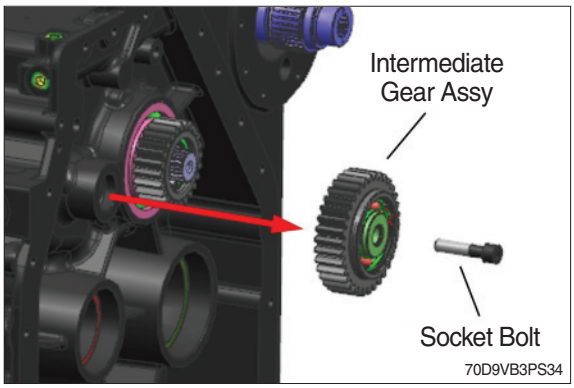


(21) Loosen the socket bolt. And remove the oil level gauge and O-ring.



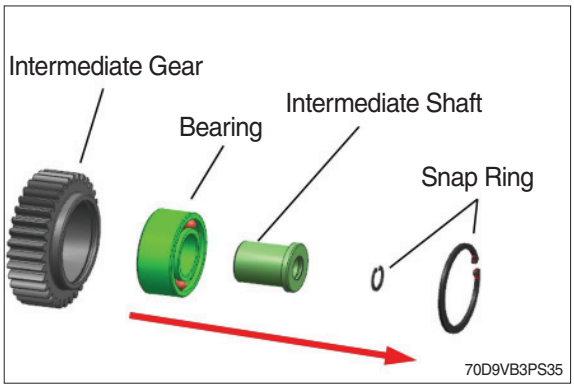
(22) Disassemble intermediate gear sub part.

① Loosen the socket bolt and remove the intermediate gear assy.



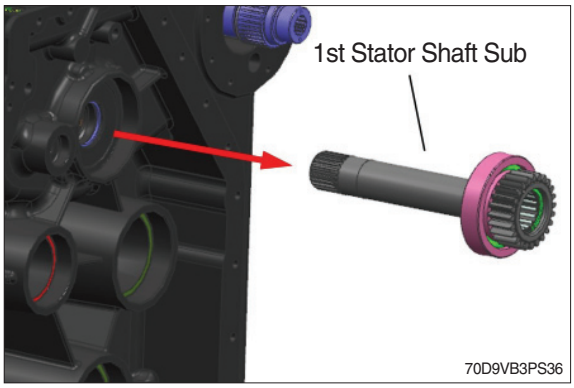
② Remove the snap ring (large) from the intermediate gear. And remove the intermediate shaft and bearing.

③ Remove the snap ring (small) from the intermediate shaft.

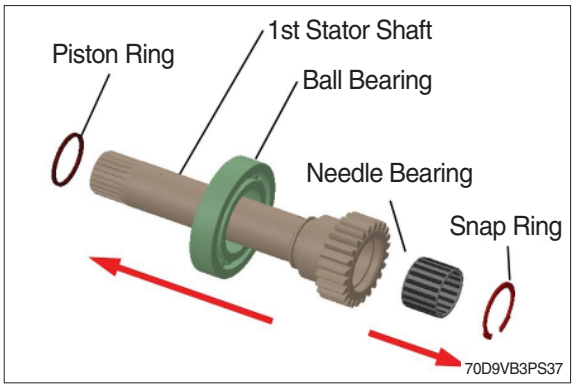


(23) Disassemble the 1st stator sub part.

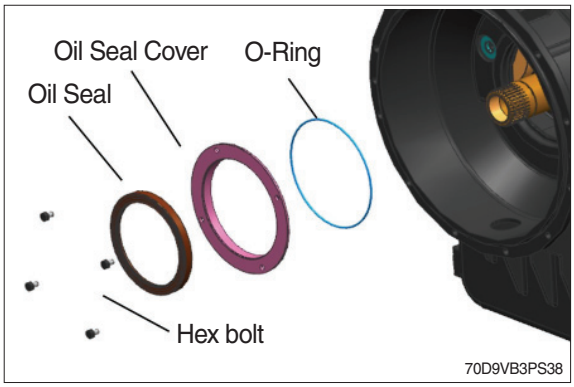
① Remove the 1st stator shaft sub.



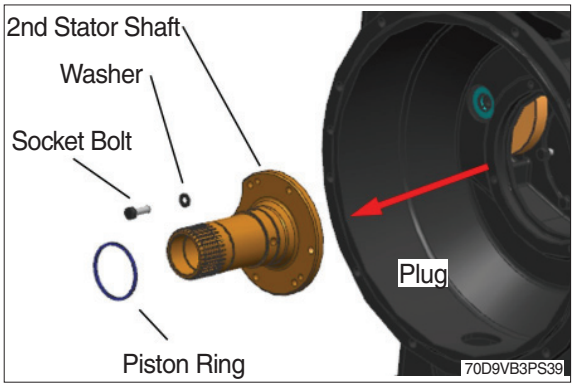
② Remove the snap ring and needle bearing. And disassemble the needle bearing.
③ Pull off the bearing and remove the thrust piston ring.



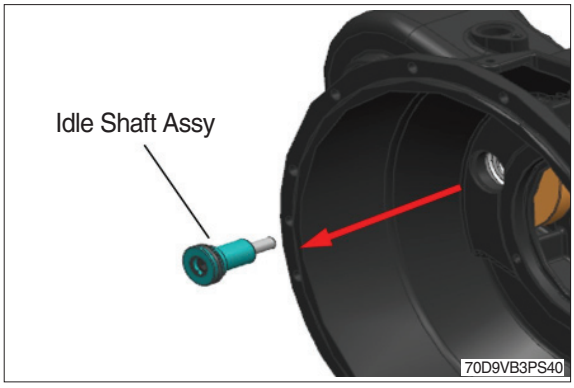
(24) Loosen the hex bolts and remove the oil seal cover, oil seal, and O-ring.



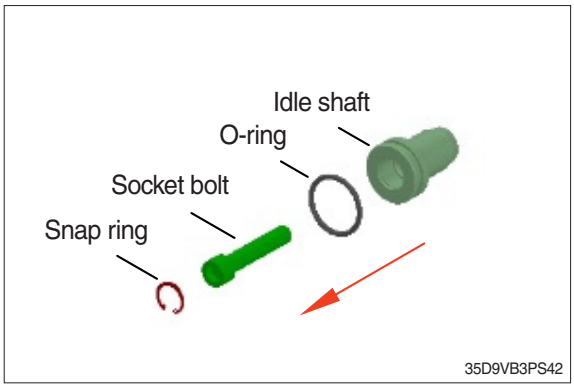
(25) Loosen the socket bolts and Remove washers, 2nd stator shaft, piston ring.



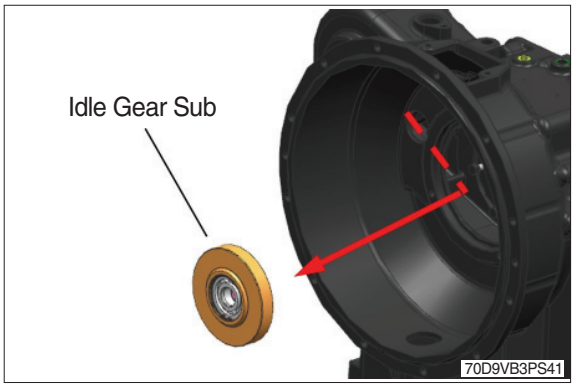
(26) Disassemble the PTO idle gear part.
① Loosen socket bolt and remove idle shaft assy.
※ Do not remove the snap ring.



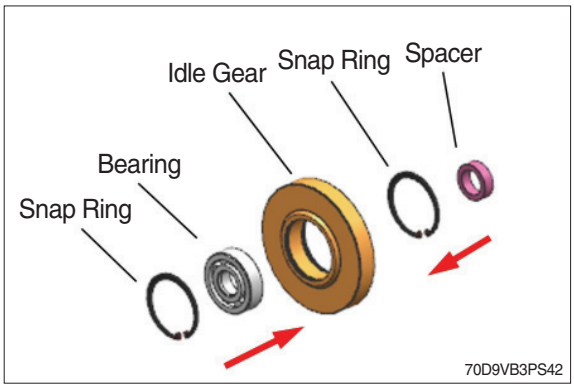
② Remove the sanp ring, socket bolt, and O-ring from the idle shaft.



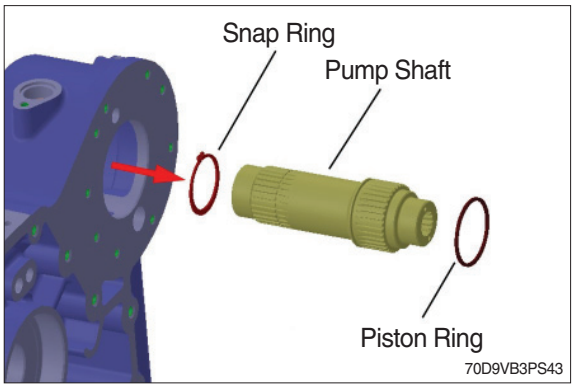
③ Remove the idle gear sub through the hole in the T/C housing.



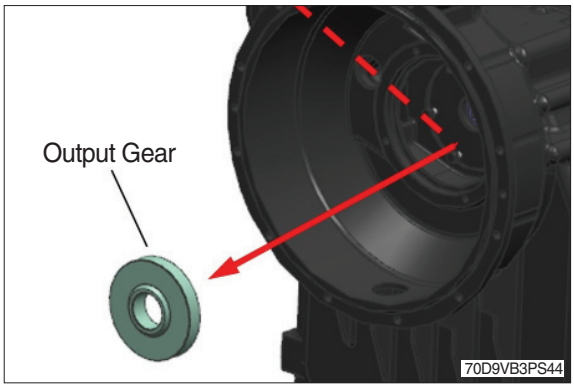
④ After disassembling the snap rings, remove the spacer & spacer.



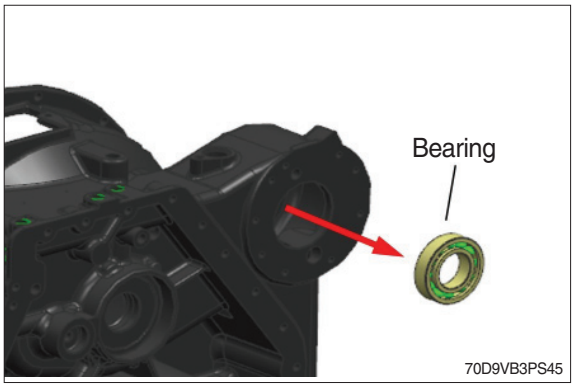
(27) After remove the pump shaft sub, then disassemble the piston ring and the snap ring.



(28) Remove the output gear through the hole in the T/C housing.

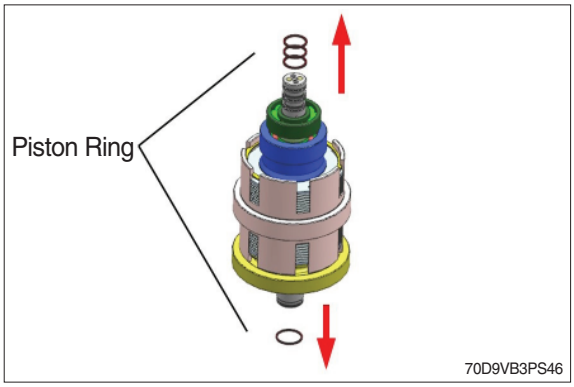


(29) Remove the bearing.

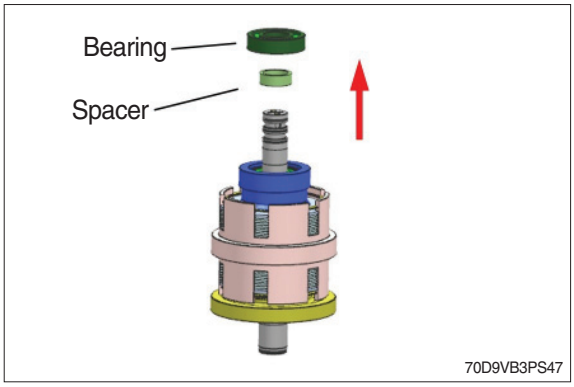


2) DISASSEMBLY OF CLUTCH SUB ASSEMBLY

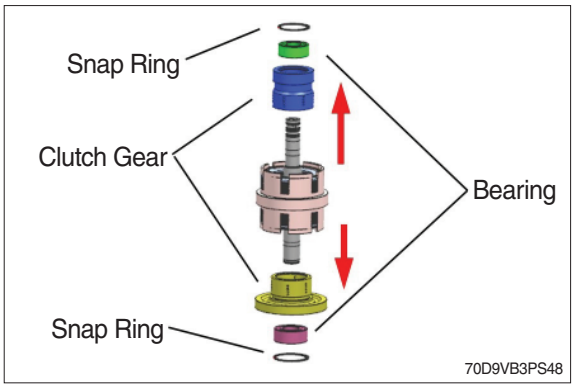
(1) Disengage the piston rings.



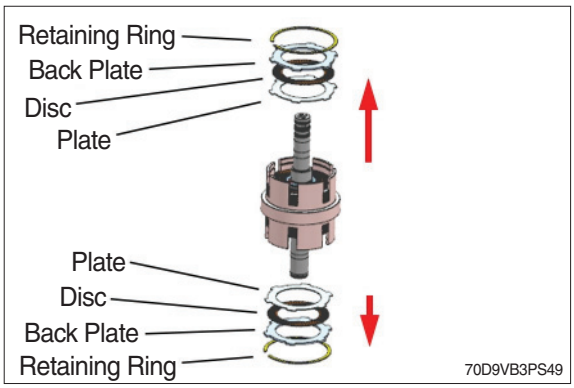
(2) Pull off the bearings and remove the spacer.



(3) Disassemble the snap rings, pull off the bearings, and disassemble the clutch gears.

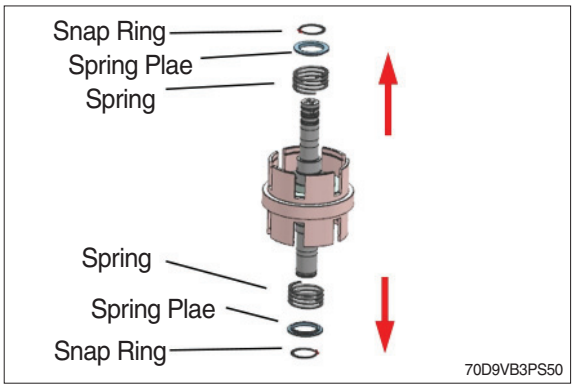


(4) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.

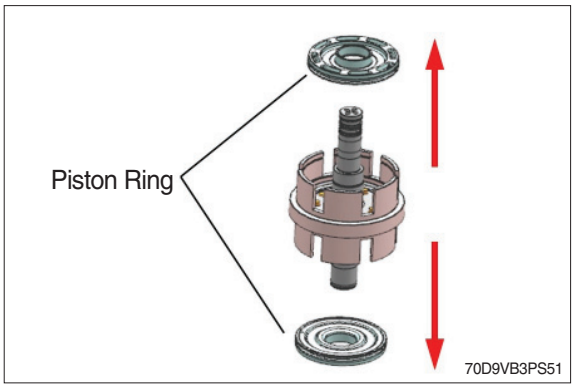


(5) Remove the snap rings, spring plates and springs.

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



(6) By means of compresed air, press the piston sub off and remove them.



2. ASSEMBLY OF TRANSMISSION

1) SUB ASSEMBLY OF CLUTCH

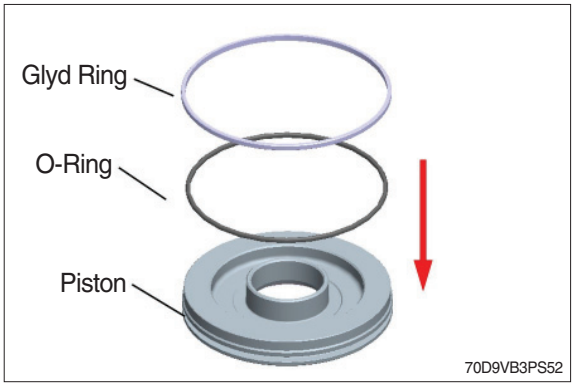
(1) Assemble the piston groove in the O-ring and glyd ring.

※ **Apply T/M oil when assembling the O-ring.**

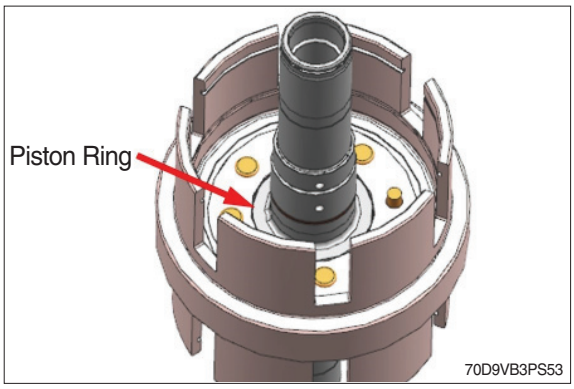
※ **How to assemble the glide ring.**

① Heat the glide ring.

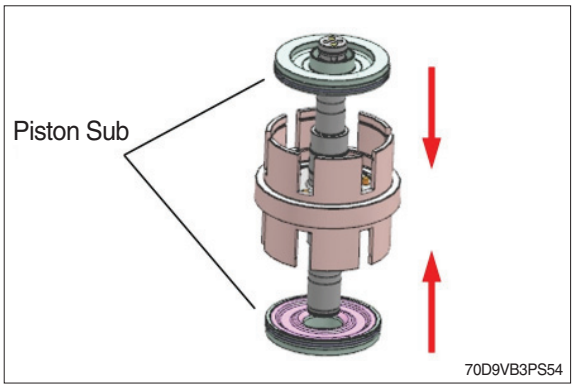
② Assemble the gliding when it becomes loose.



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

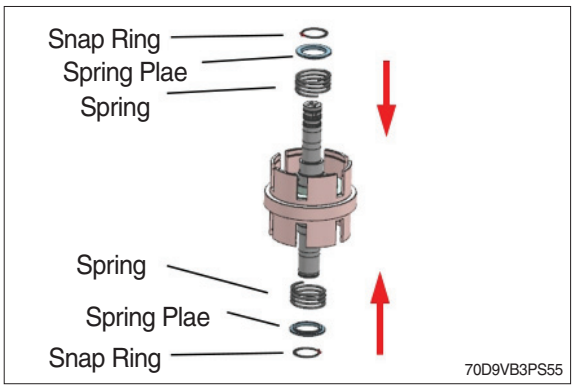


(3) Insert the piston sub into the drum gear.

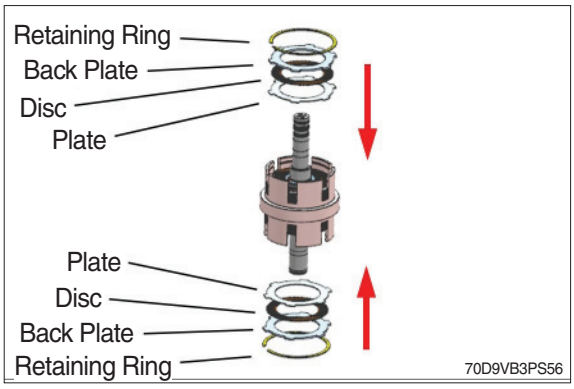


(4) Assemble the spring, spring plate & snap ring.

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

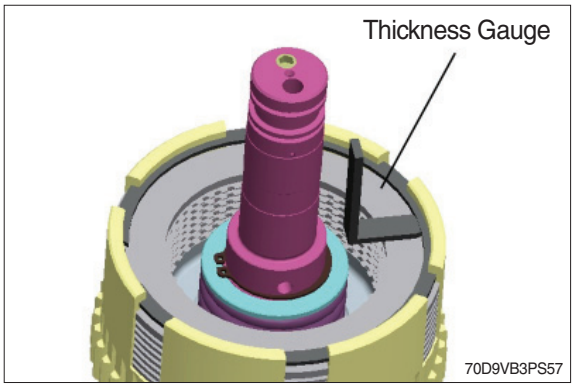


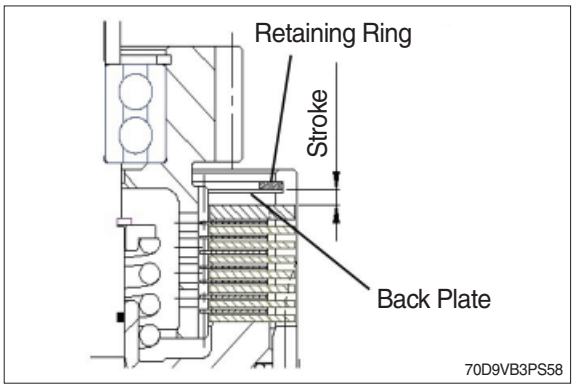
(5) Install the opp. plates and friction plates alternately into the drum gear. Then install the back plate and retaining ring.



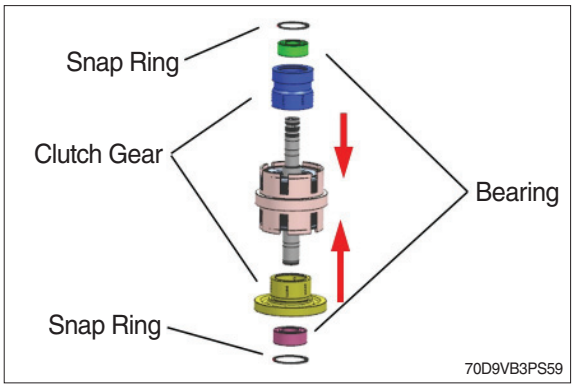
(6) Measure clearance between the back plate and retaining ring using thickness gauge.

※ **Stroke specification : 3.6 ~ 4.0 mm**
If the measureed value id out of the specified range, replace with a suitable retaining ring.
Retaining ring thickness : 2, 2.2, 2.5, 3.1 mm

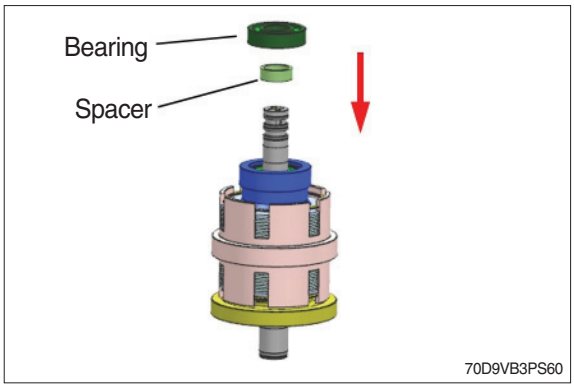




(7) After assembling the clutch gear and bearing, fasten the snap ring.

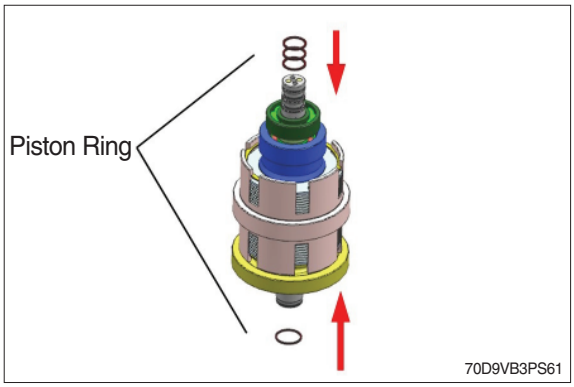


(8) Assemble the spacer and bearing.

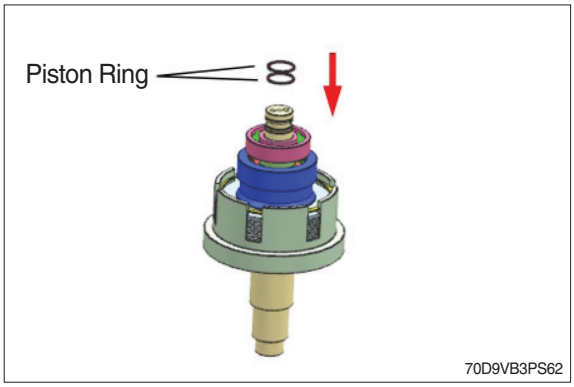


(9) Assemble piston ring.

① Forward clutch : fit the piston rings (4 EA) at groove of clutch shaft and oil them.

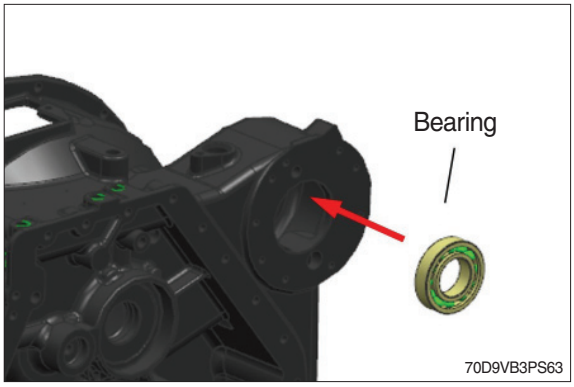


② Reverse clutch : fit the piston rings (2 EA) at groove of clutch shaft and oil them.

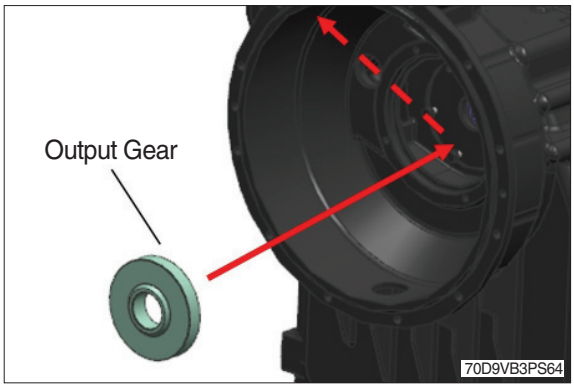


2) ASSEMBLY OF TRANSMISSION

(1) Insert the bearing into the T/C housing.



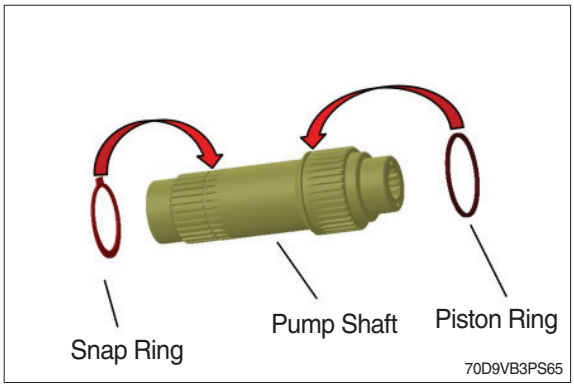
(2) Insert the output gear through the central hole of the T/C housing.



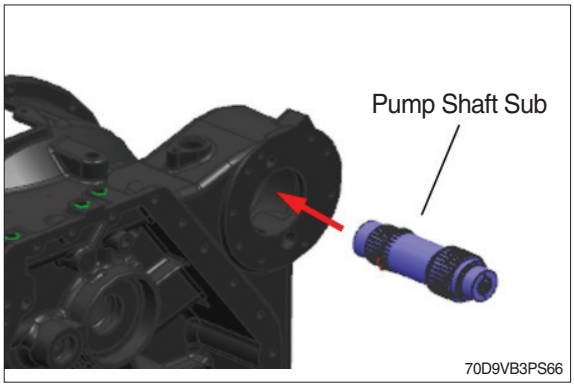
(3) Assemble pump shaft sub part.

① Assemble the snap ring & piston ring on pump shaft.

※ **Cover grease on piston ring.**



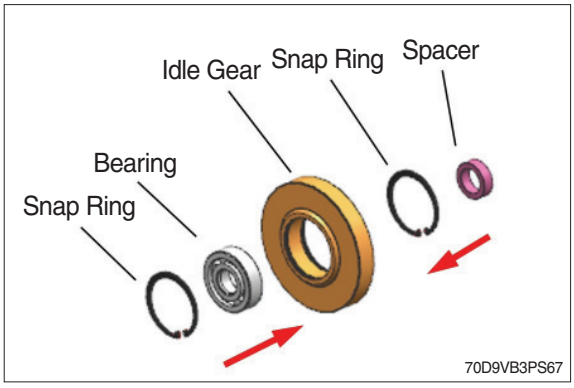
② Assemble the pump shaft sub.



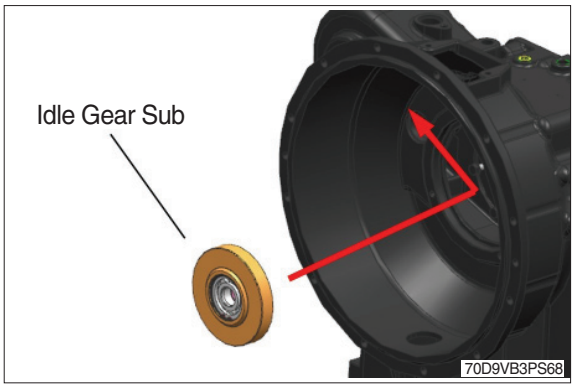
(4) Assemble the idle gear sub.

① Insert bearing into idle gear and assemble snap rings on both sides.

※ **Assemble the spacer on one side of the idle gear.**

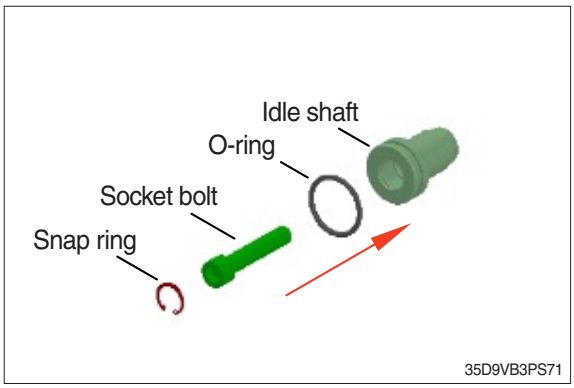


② Insert the idle gear sub through the central hole of the T/C housing.



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

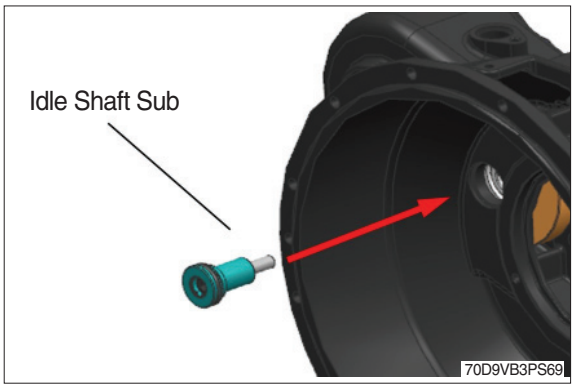
※ **Cover grease on o-ring.**



④ Assemble idle shaft sub.

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

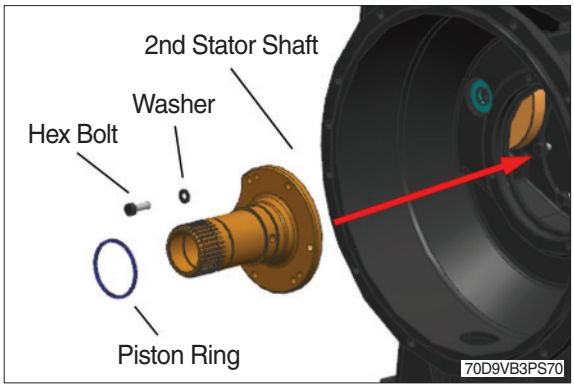
※ Cover Loctite #277 on the screw side of bolt.



(5) Assemble piston ring on 2nd stator shaft. And assemble 2nd stator shaft, hex bolts and washers 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.**

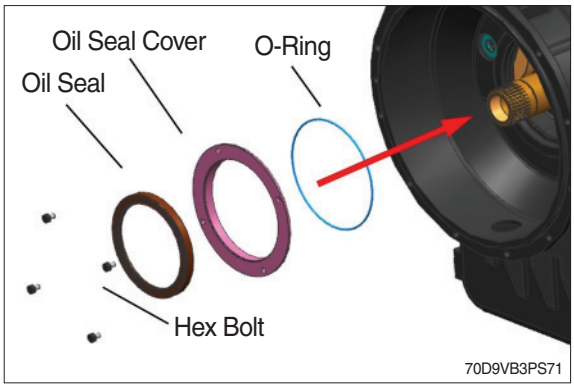


(6) Assemble the oil seal onto the oil seal cover in advance. After that, assemble the oil seal on the oil seal cover and tighten the bolts.

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

※ **Spread grease on the seal lip of oil seal.**

※ **Cover loctite #277 on the screw side of bolt and grease the O-ring when assembling.**

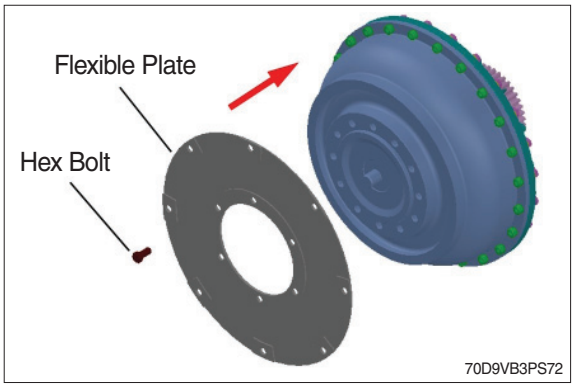


(7) Assemble torque converter part.

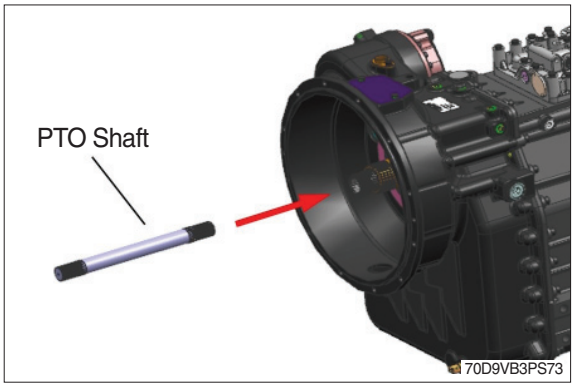
① Assemble the flexible plate and hex bolt on torque converter.

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

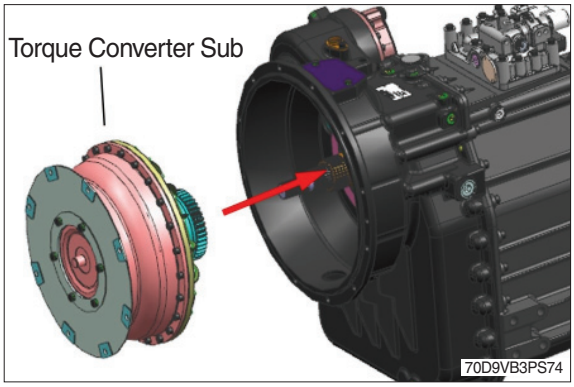
※ **Cover loctite #277 on the screw side of bolt.**



② Assemble PTO shaft.

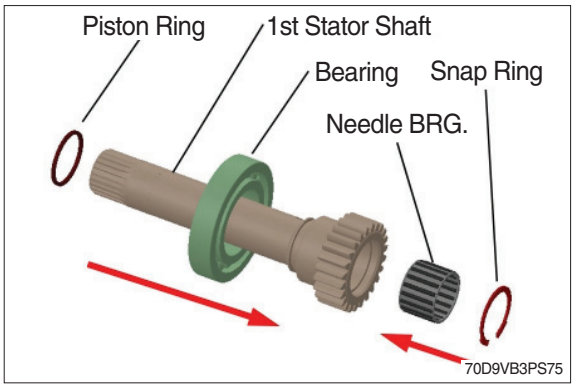


③ Assemble the torque converter sub.

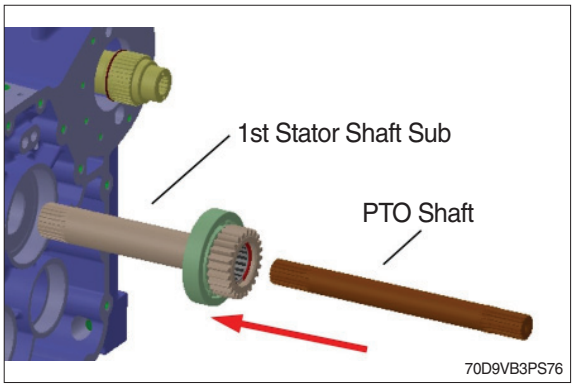


(8) Assemble the needle BRG. & snap ring on 1st stator shaft. And assemble the bearing and piston ring.

※ **Cover grease on piston ring.**

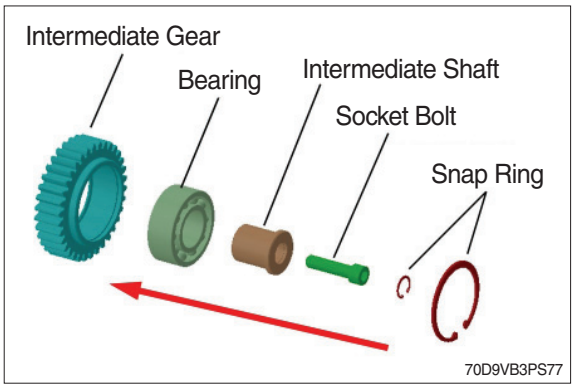


(9) Assemble 1st stator shaft sub and PTO shaft.



(10) Assemble the intermediate shaft sub part.

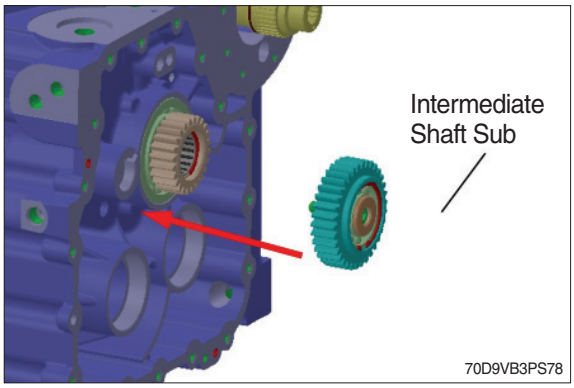
① Assemble the socket bolt and snap ring (small) on intermediate shaft. And assemble the bearing, intermediate shaft and snap ring (large) on intermediate gear.



② Assemble the flexible plate and hex bolt on torque converter.

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

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



(11) Assemble oil level gague and tube part.

① Assemble the O-ring on oil level gauge tube.

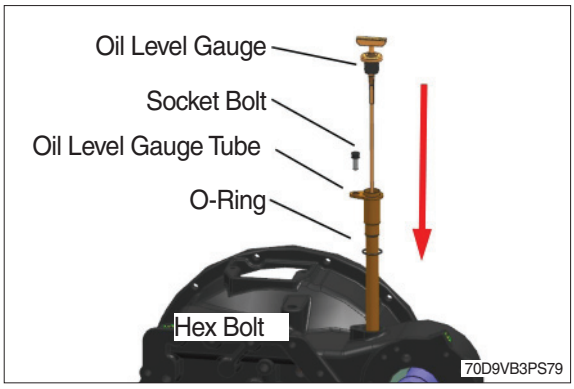
※ **Cover grease on O-ring.**

② Assemble the oil level gauge tube and bolt on the T/C housing.

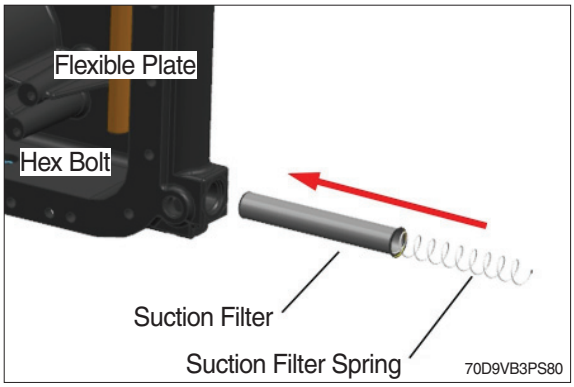
· Tightening torque : 3.1 ~ 3.5 kgf·m (22.4 ~ 25.3 lbf·ft)

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

③ Assemble the oil level gauge.



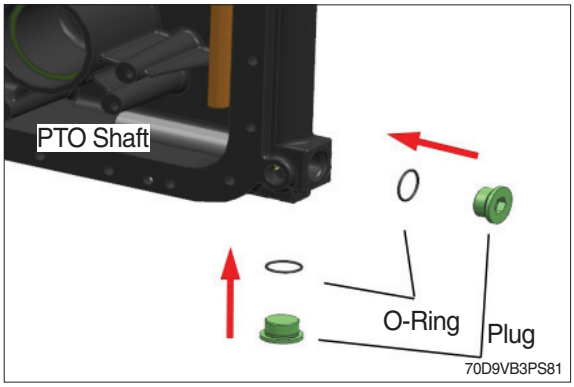
(12) Assemble the suction filter and spring.



(13) Assemble O-ring and plug. Assemble the plugs, o-rings.

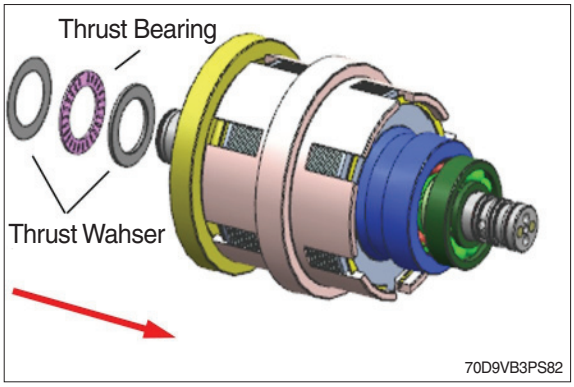
· Tightening torque : 4.1 ~ 4.9 kgf·m (29.7 ~ 35.5 lbf·ft)

※ **Cover grease on O-ring.**

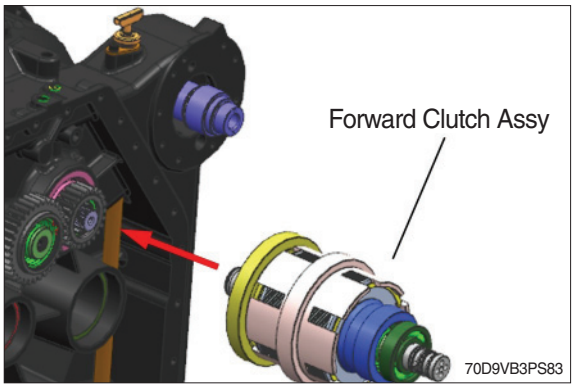


(14) Assemble the thrust washers and bearing on forward clutch sub.

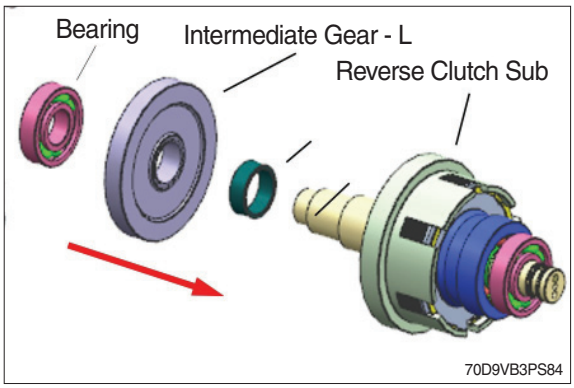
※ **Cover grease on the washers and bearing.**



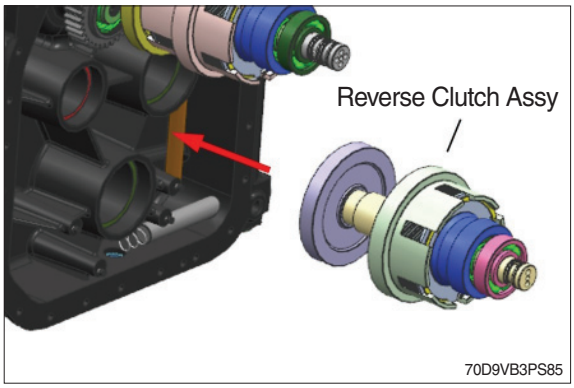
(15) Assemble the forward clutch assy.



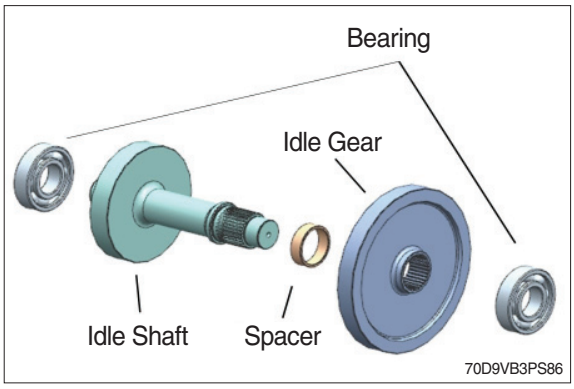
(16) Assemble the spacer, intermediate gear-L, and bearing.



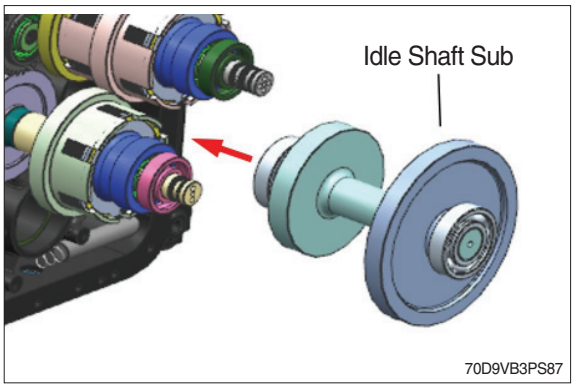
(17) Assemble the forward clutch assy.



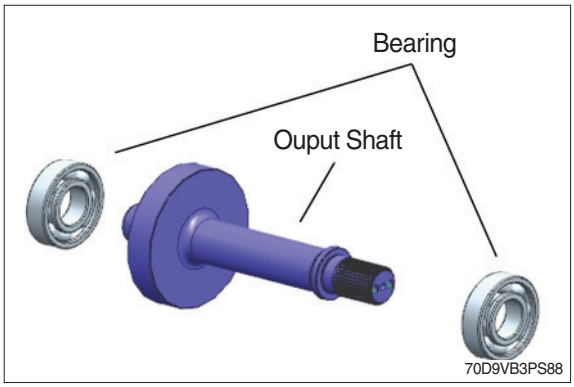
(18) Assemble the spacer, idle gear, and bearings on idle shaft.



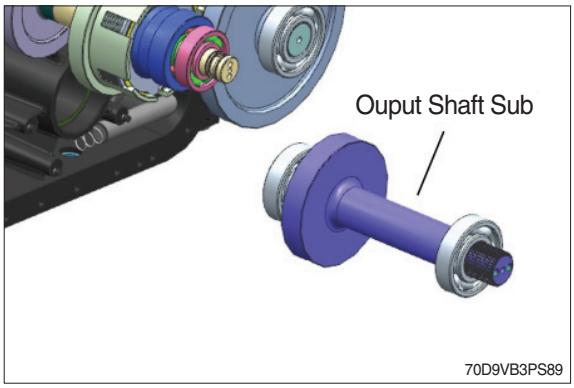
(19) Assemble the idle shaft sub.



(20) Assemble the bearings on output shaft.



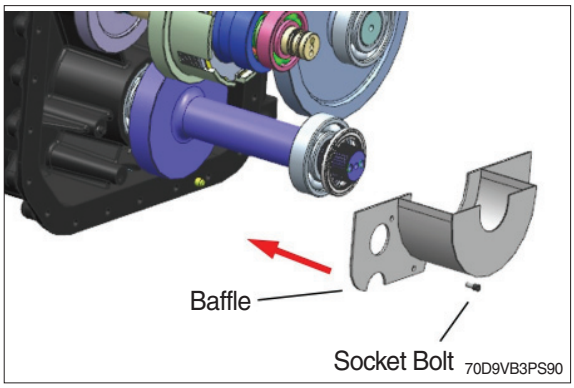
(21) Assemble the ouput shaft sub.



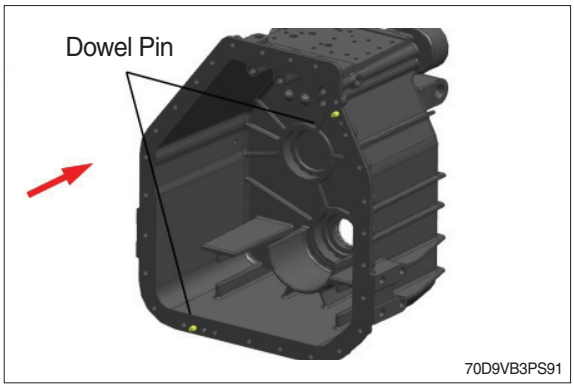
(22) Assemble the baffle and socket bolts.

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

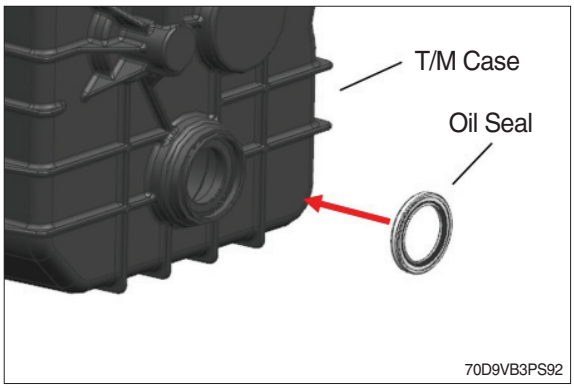
※ **Cover Loctite #277 on the screw side of bolt.**



(23) Press in the dowel pins (2 EA).



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

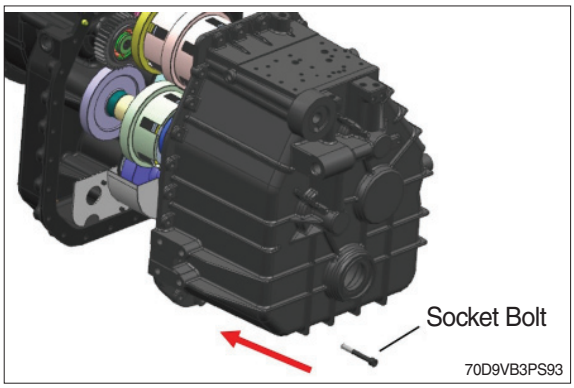


(25) Assemble the T/M case. Tighten the socket bolts.

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

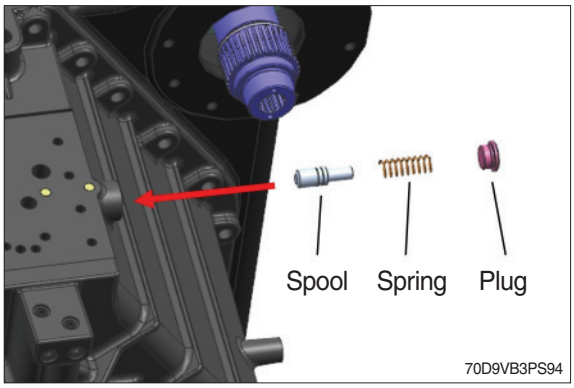
※ **Cover Loctite #5127 on the joint surface of T/M case. Do not apply to the bolt holes.**

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



(26) Assemble the spool, spring and tighten the plug.

· Tightening torque : 4.1 ~ 5.1 kgf·m
(29.7 ~ 36.9 lbf·ft)



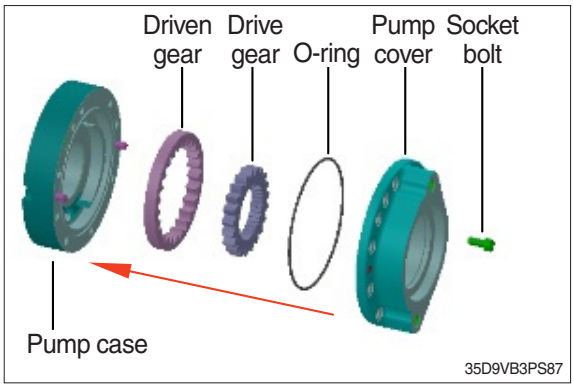
(27) Assemble oil pump sub part.

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

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

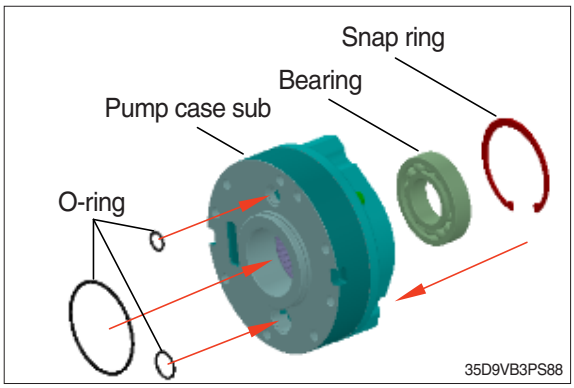
※ Cover grease on the o-ring.

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



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

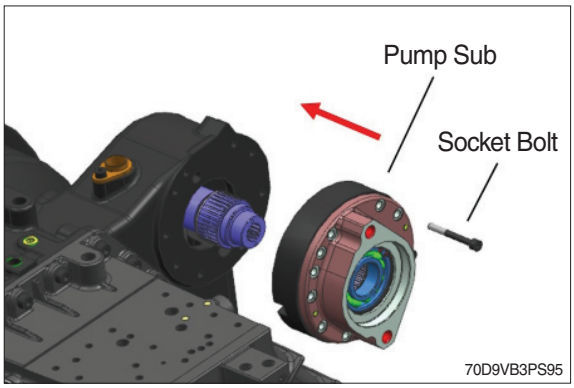
※ Cover grease on O-ring.



③ Assemble the pump case sub and socket bolt.

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

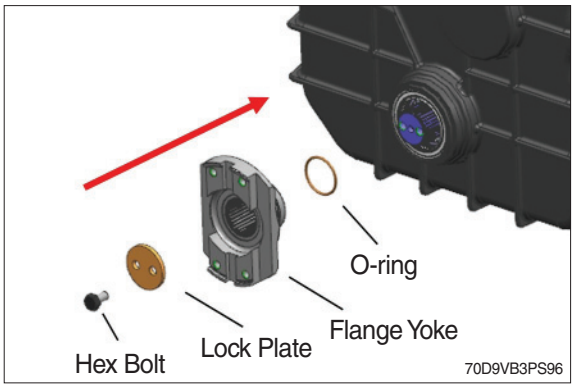
※ Cover Loctite #277 on the screw side of bolt.



(28) Assemble the o-ring, flange yoke, lock plate and hex bolts.

· Tightening torque : 6.1 ~ 6.6 kgf·m (44.1 ~ 47.7 lbf·ft)

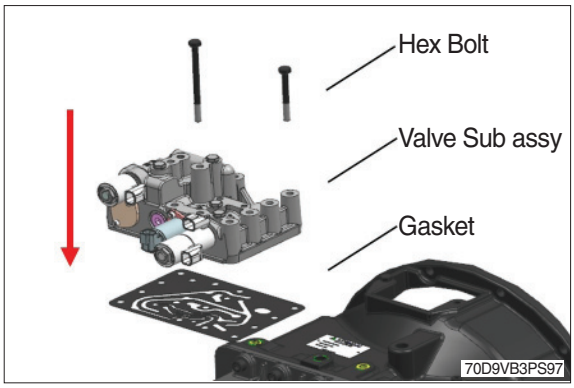
※ Cover Loctite #277 on the screw side of bolt.



(29) Assemble the gasket, valve sub and hex bolt.

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

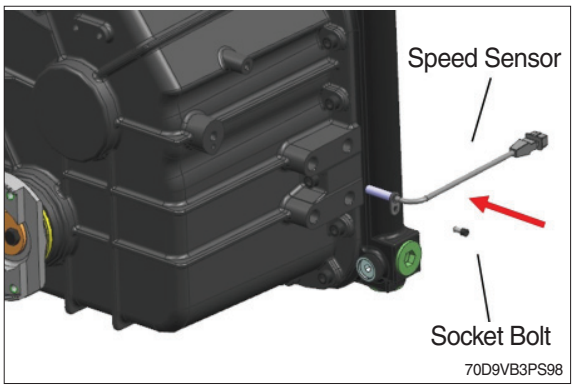
※ **Cover Loctite #277 on the screw side of bolt.**



(30) Assemble the speed sensor and socket bolt.

· Tightening torque : 0.9 ~ 1.1 kgf·m
(6.5 ~ 8.0 lbf·ft)

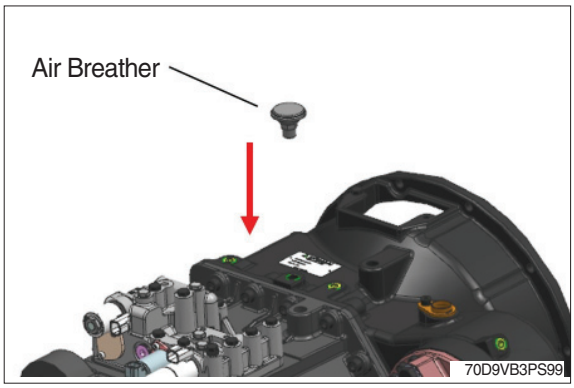
※ **Cover Loctite #277 on the screw side of bolt.**



(31) Assemble the air breather.

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

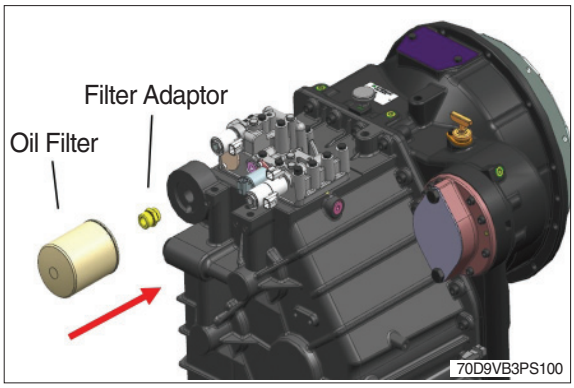
※ **Cover Loctite #577 on the screw side.**



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

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

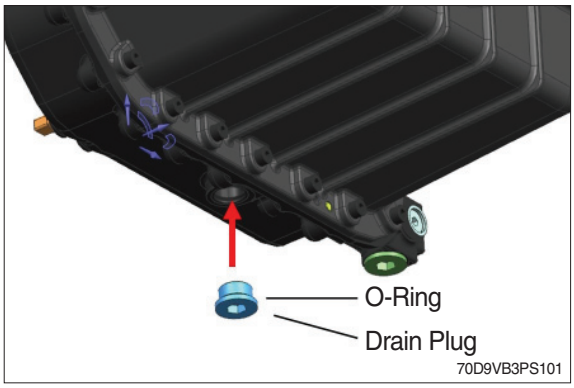
· Tightening torque : 13.3 ~ 14.7 kgf·m
(96.2 ~ 106.3 lbf·ft)



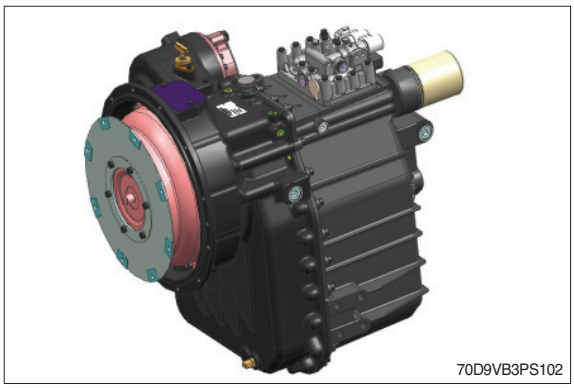
(33) After assembling the O-ring to the plug, assemble it to the T/M case.

· Tightening torque : 4.1 ~ 5.1 kgf·m
(29.7 ~ 36.9 lbf·ft)

※ **Grease the O-ring when assembling it.**



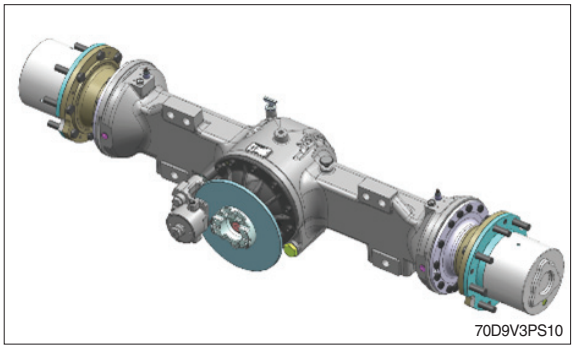
(34) Complete the transmission assembly.



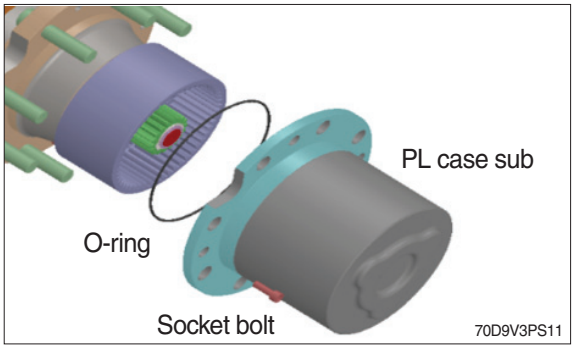
3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY OF HUB

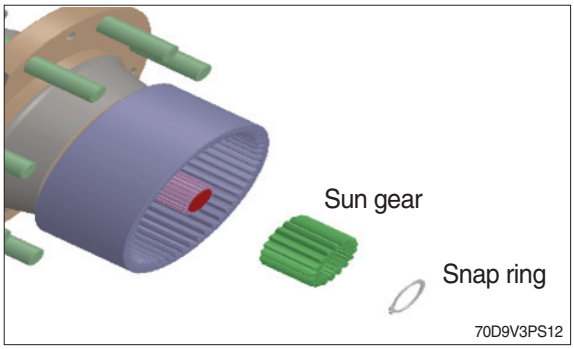
(1) Disaasemble drive axle assy.



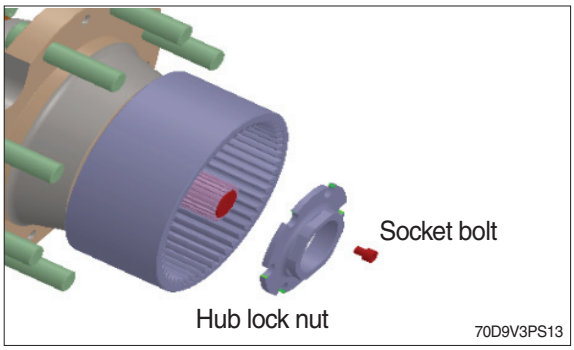
(2) Disassemble PL case sub assy, the socket bolt, and O-ring.



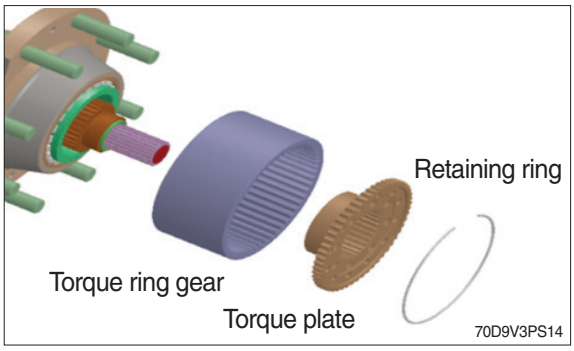
(3) Disassemble snap ring and sun gear at the end of axle shaft.



(4) Disassemble socket bolt and hub lock nut.

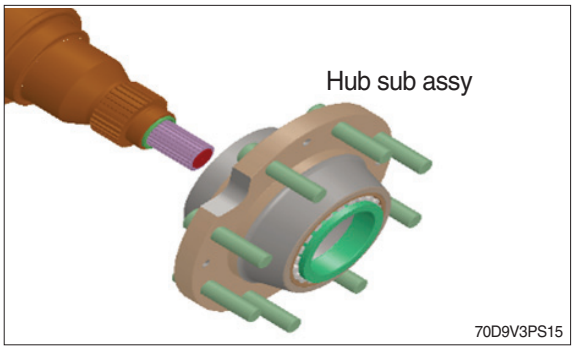


(5) Disassemble retaining ring, torque plate, and torque ring gear.

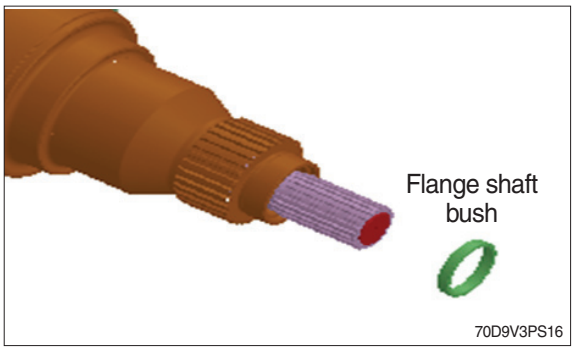


(6) Disassemble hub sub assy.

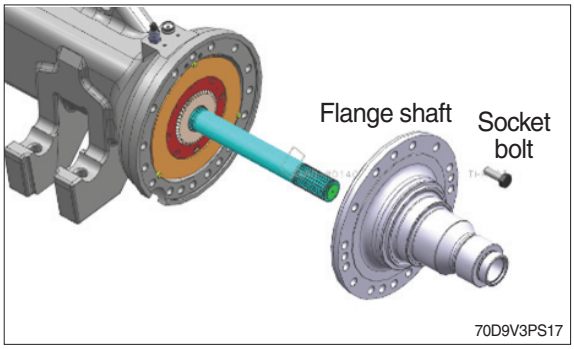
△ **When you disassemble hub sub assembly, the hub sub assembly will be prevention of falling from lift system. Falling of hub sub assembly will make engineers harm and product damage. You must be careful.**



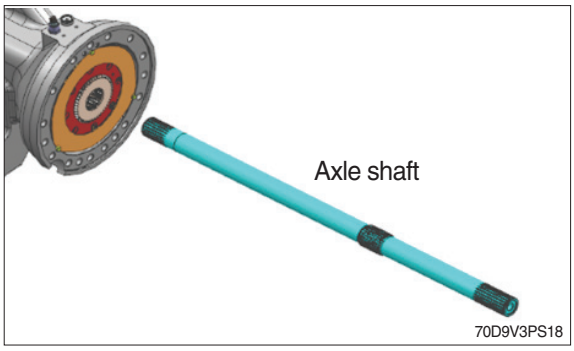
(7) Disassemble flange shaft bush.



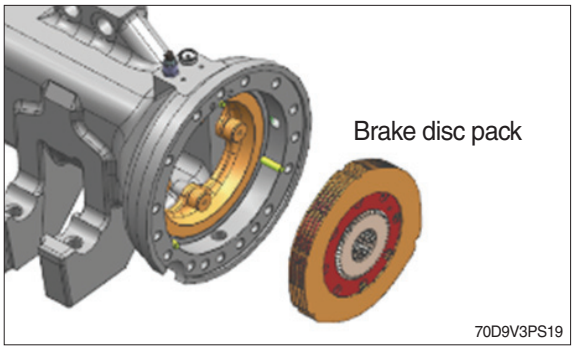
(8) Disassemble flange shaft and socket bolt.



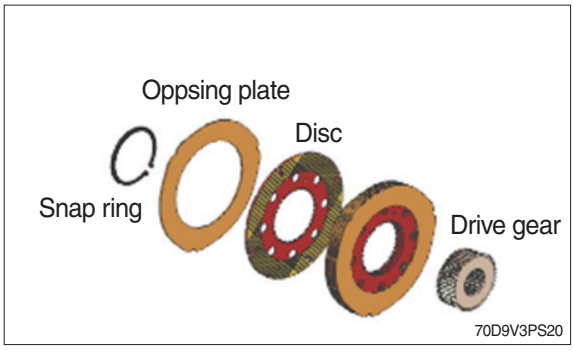
(9) Disassemble axle shaft.



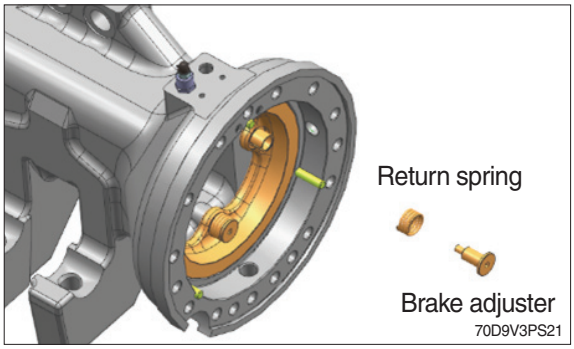
(10) Disassemble brake disc pack.



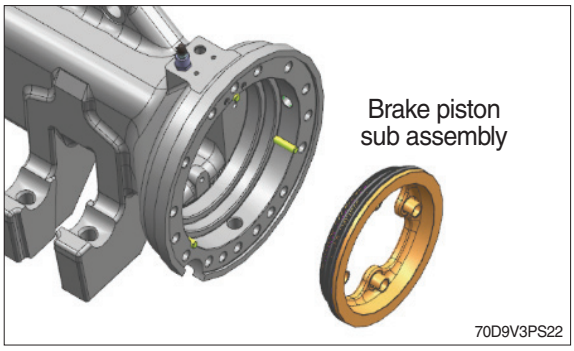
(11) Disassemble snap ring, opposing plate, disc, and drive gear.



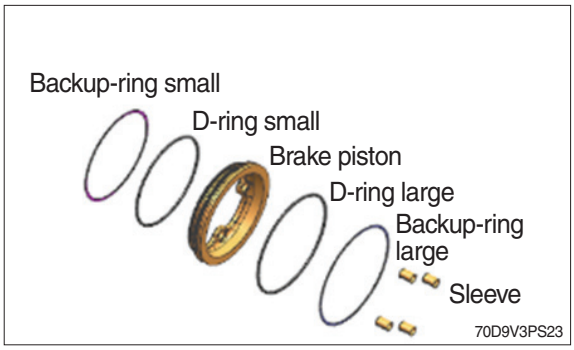
(12) Disassemble return spring, brake adjuster.



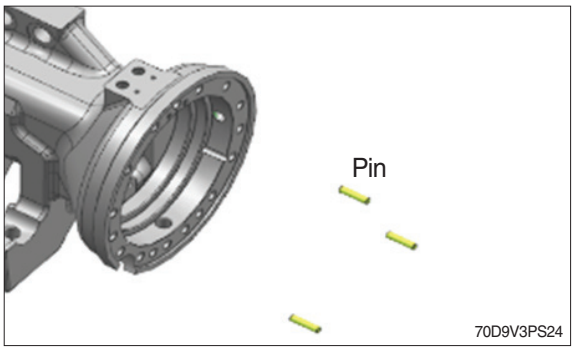
(13) Disassemble brake piston sub assembly.



(14) Disassemble sleeve, backup ring, D-ring.

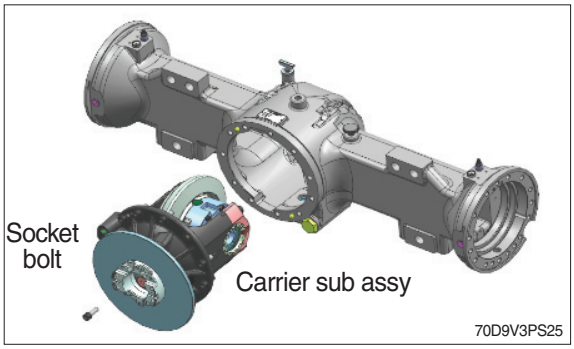


(15) Disassemble pin.

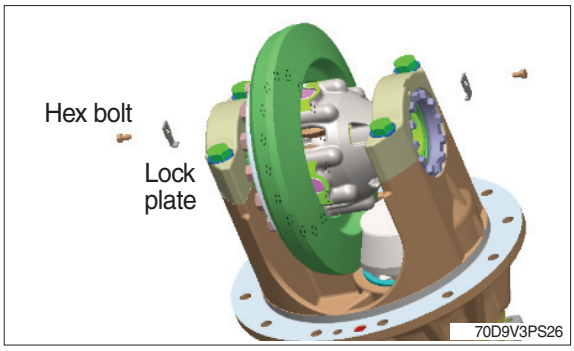


2) DISASSEMBLY OF CARRIER SUB ASSEMBLY

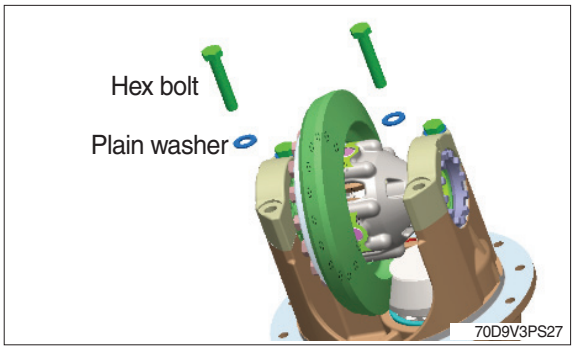
(1) Disassemble hex bolt and carrier sub assembly.



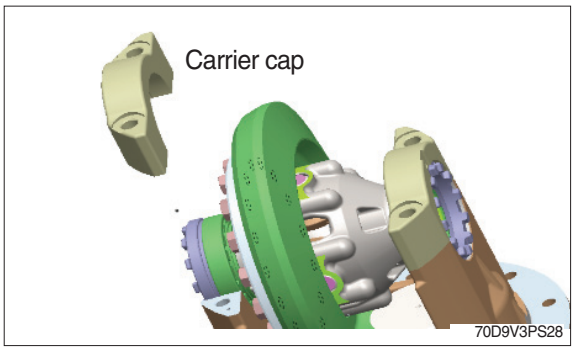
(2) Disassemble hex bolt and lock plate.



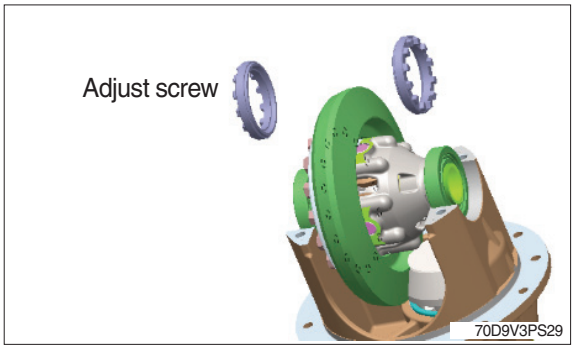
(3) Disassemble hex bolt and plain washer.



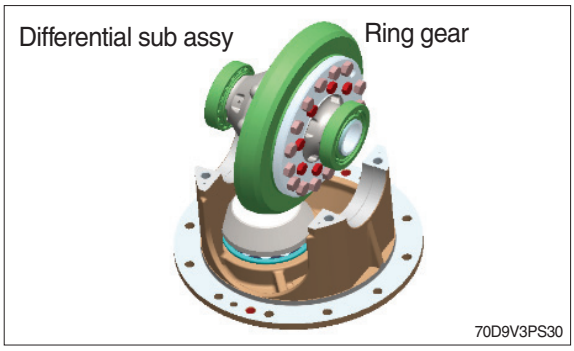
(4) Disassemble carrier cap.



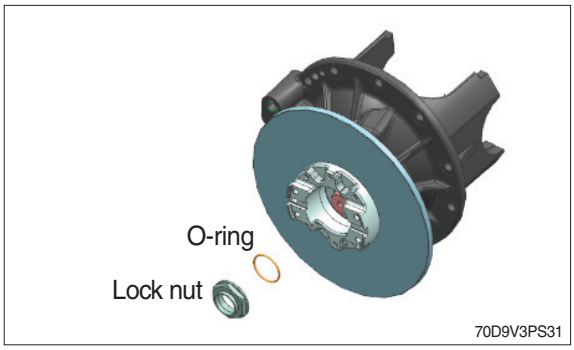
(5) Disassemble adjust screw.



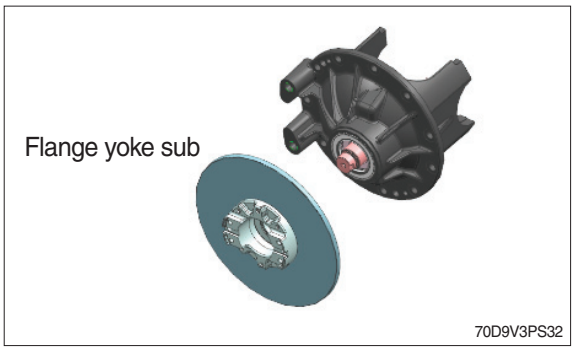
(6) Disassemble differential sub assembly and ring gear.



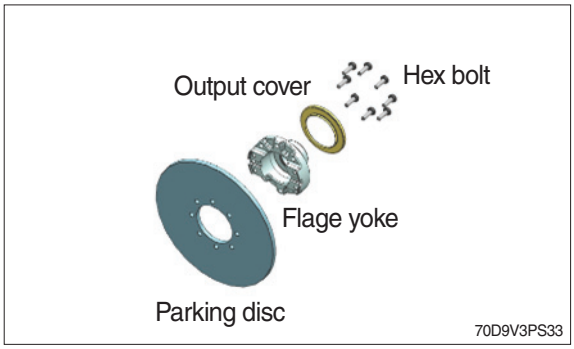
(7) Disassemble lock nut and O-ring.



(8) Disassemble flange yoke sub.

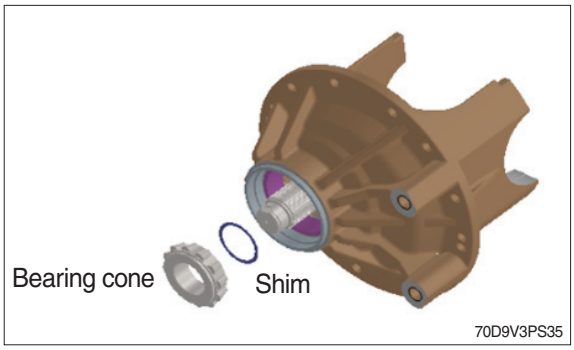


※ **Flage yoke sub**

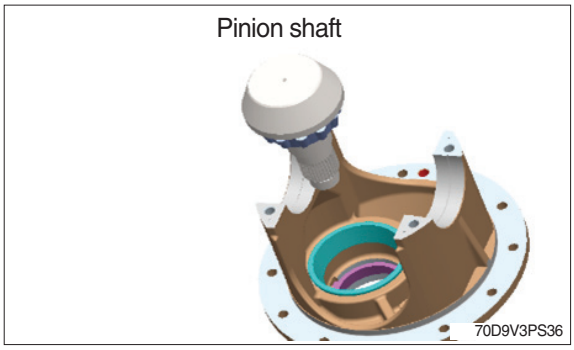


(9) Disassemble oil seal.

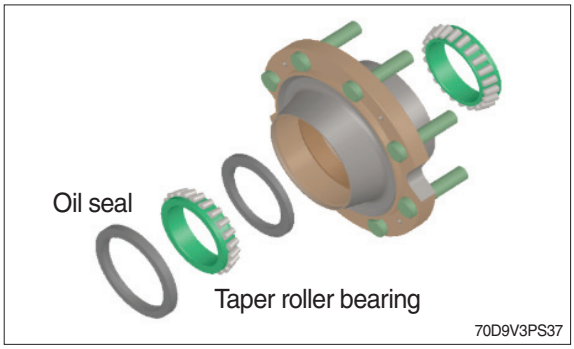
(10) Disassemble bearing cone and shim.



(11) Disassemble pinion shaft.

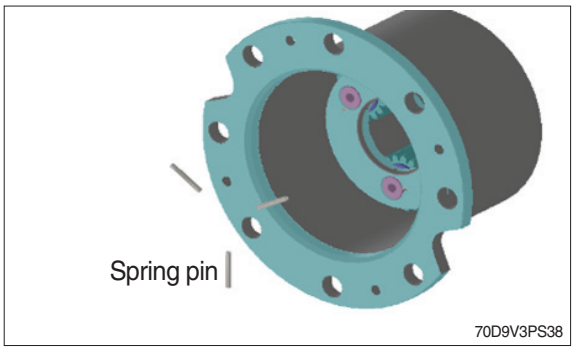


(12) Disassemble oil seal and taper rooler bearing.

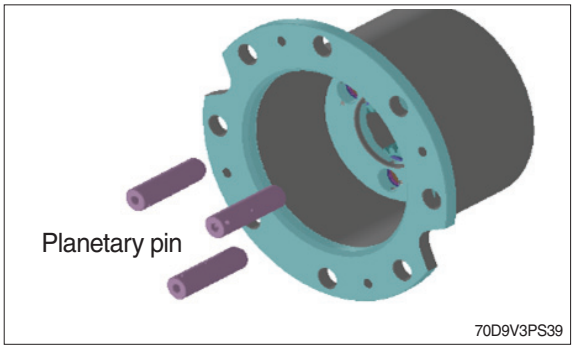


3) DISASSEMBLY OF PLANETARY CASE

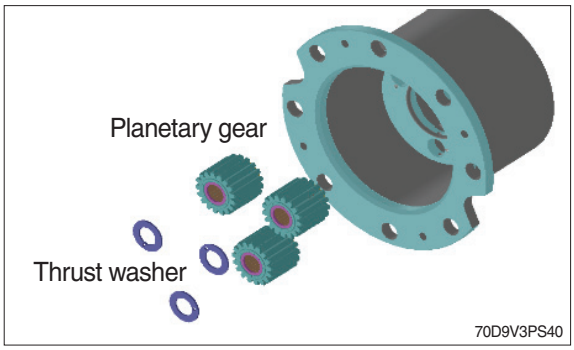
(1) Disassemble spring pin.



(2) Disassemble planetary pin.



(3) Disassemble planetart gear and thrust washer.

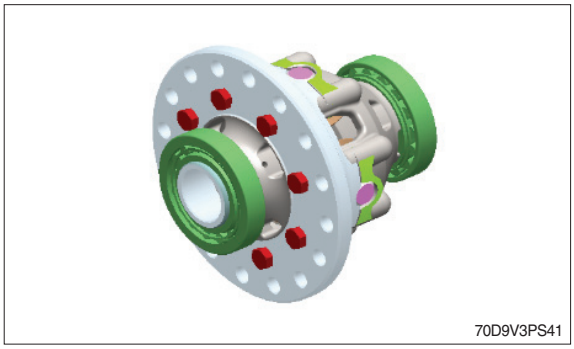


4. ASSEMBLY OF DRIVE AXLE

1) ASSEMBLY OF CARRIER SUB ASSEMBLY

(1) Assembly of differential device

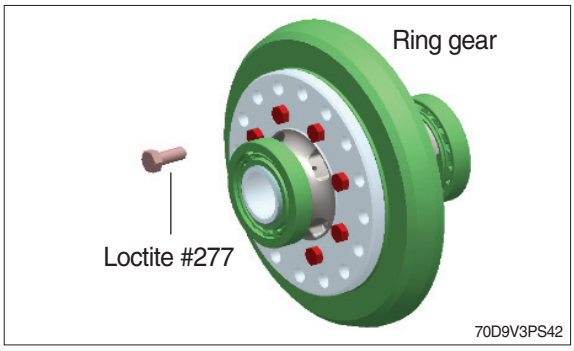
① Make preparation for diffdrential assy.



② Assemble ring gear by bolt.

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

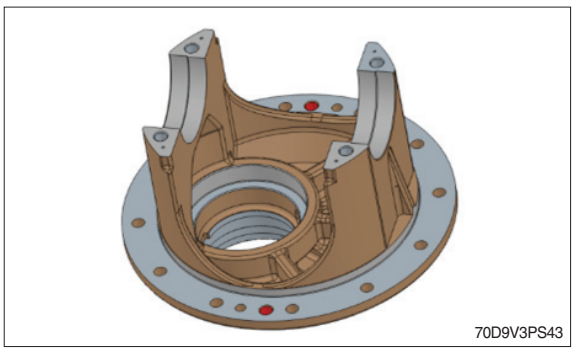
※ Cover loctite #277 on the screw side of bolt.



(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.

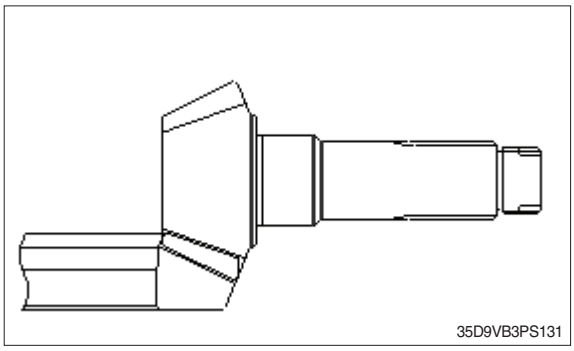


a. Part number

a) Example of gearset part number
· Ring gear, HA80-20100
· Conventional pinion gear, HA80-20110

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 : - (12-32 gearset is maning of 12-tooth drive pinion and 32-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

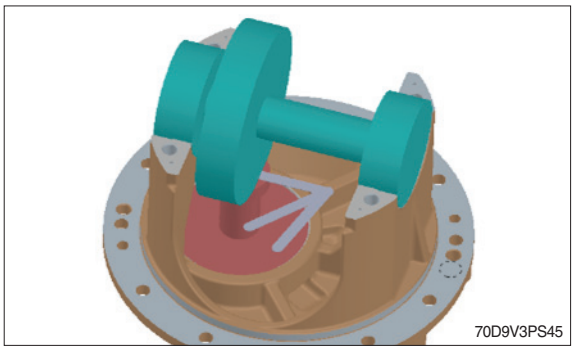
c. Pinion cone variation number

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

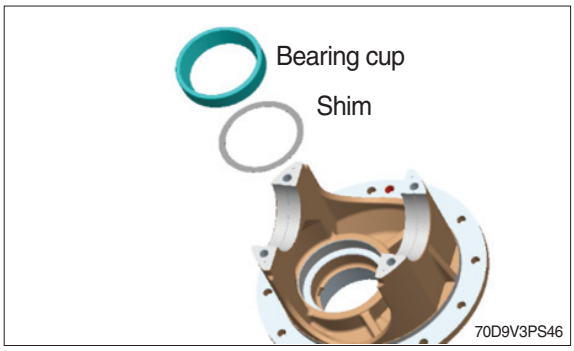
a) For example - pinion cone variation nubmers : +2 (+0.01 mm), -1 (0.02 mm)

b) The place of gearset : end of pinion shaft head or outer diameter of ring gear

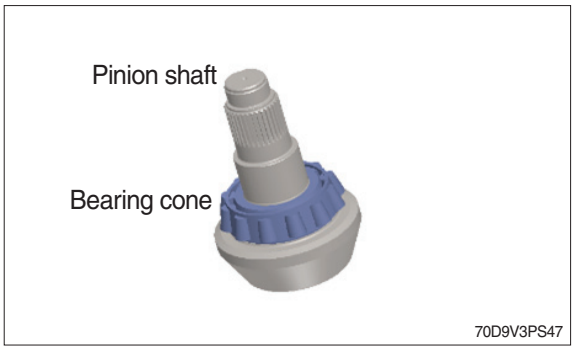
② The THK of the shim will be decided of measured value of gauge and machine.
(basic gap step between bearing and carrier case : A)
(Mounting distance of pinion shaft : B)
· THK of shim
X = A - B + Carrier case bearing step depth
ex) A= 0.5, B= -0.1, Bearing setp depth = +0.1
→ X= 0.5 + 0.1 + 0.1 =0.7 mm
ex) A= 0.5, B= +0.1, Bearing setp depth = -0.1
→ X= 0.5 - 0.1 - 0.1 =0.3 mm



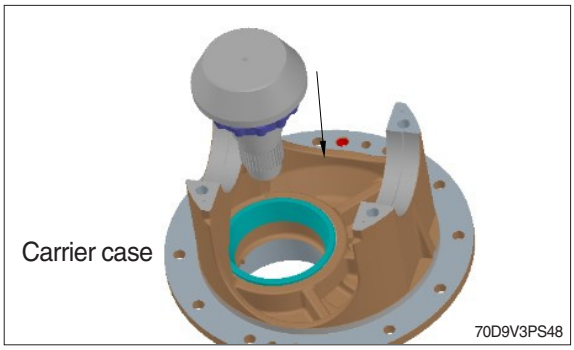
③ Assemble shim and press the bearing cup.
· Sort of shim : 0.1, 0.15, 0.3 mm



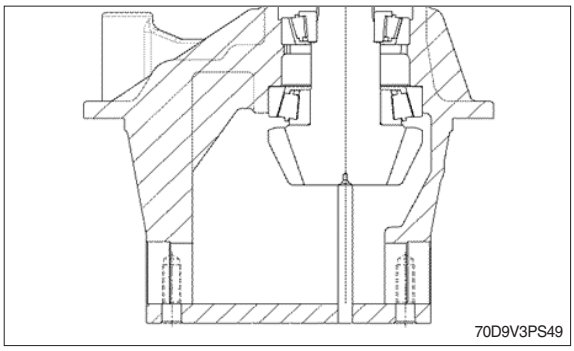
④ Press bearing cone on pinion shaft.



⑤ Assemble carrier case on pinion shaft.



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

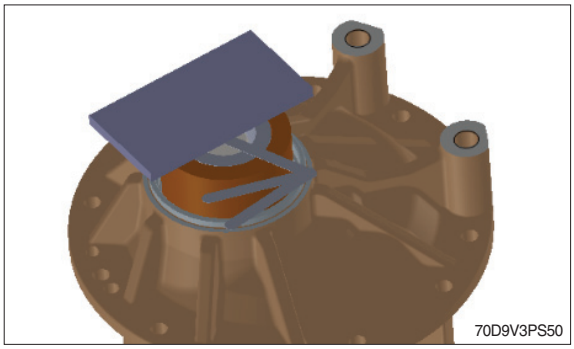


⑦ The THK of shim will be decided of measured value of gauge and machine. (THK: B)

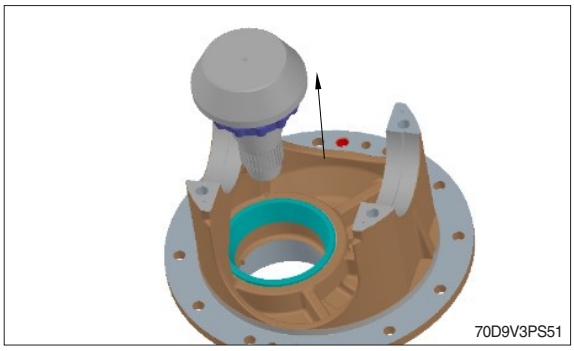
※ THK of shim : X = B - end play (0.03~0.06)

ex) B = 0.4

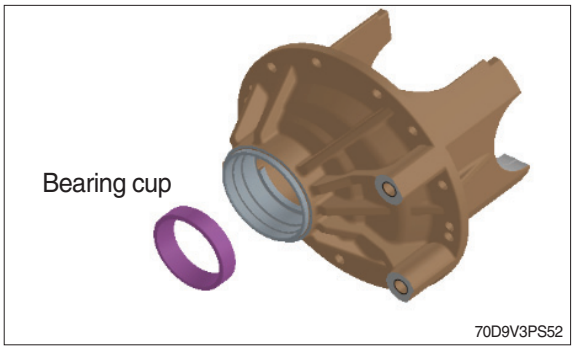
X = 0.4 - (0.03~0.06) = 0.34~0.37 mm



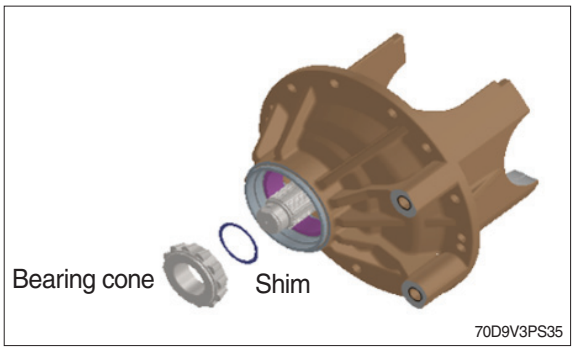
⑧ Disassemble pinion shaft from carrier case.



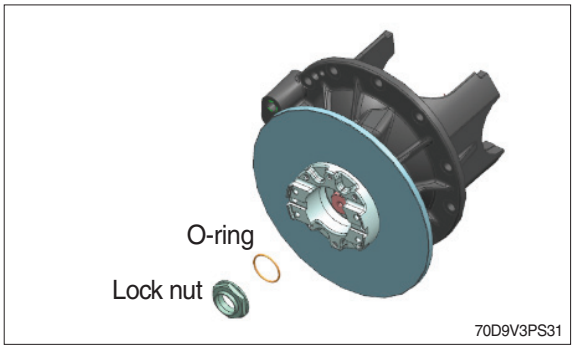
⑨ Assemble bearing cup.



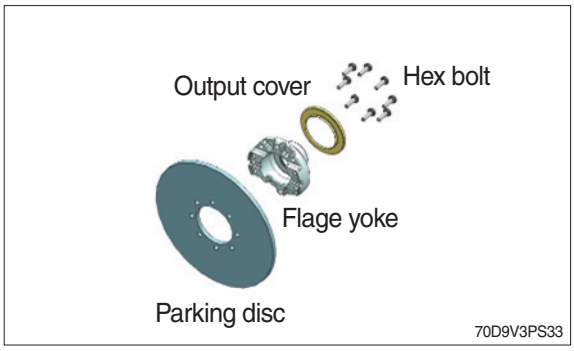
⑩ Reassemble pinion shaft and assemble shim and master bearing.
· Sort of shim : 0.1 , 0.15 , 0.3 mm



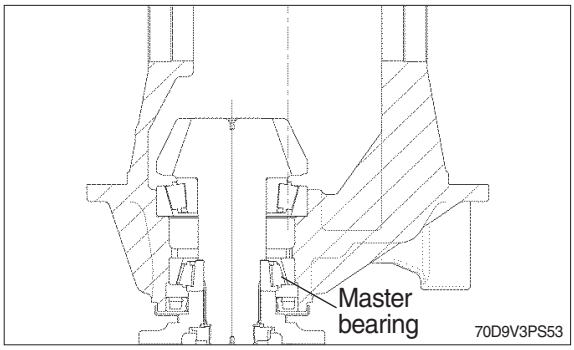
⑪ Assemble flange yoke sub, o-ring, and lock nut.



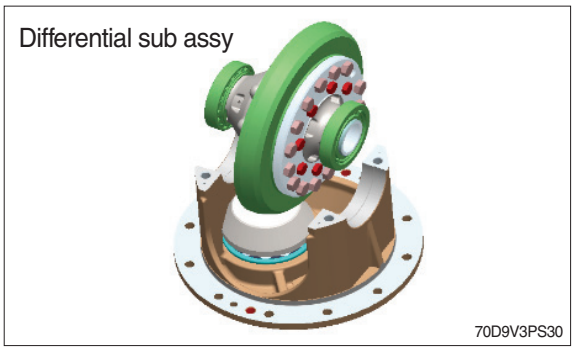
※ **Flage yoke sub**



⑫ Over turn (180˚) carrier case assembly.



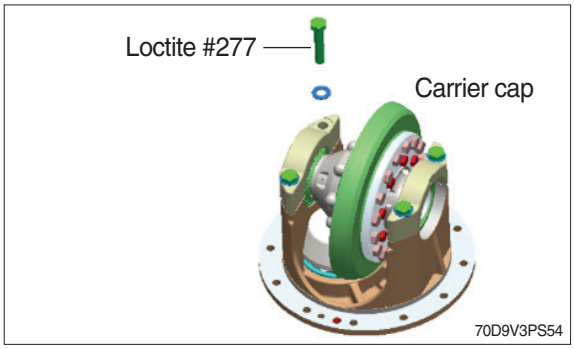
⑬ Assemble differencial assembly on carrier case.



⑭ Assemble hex bolt on carrier cap.

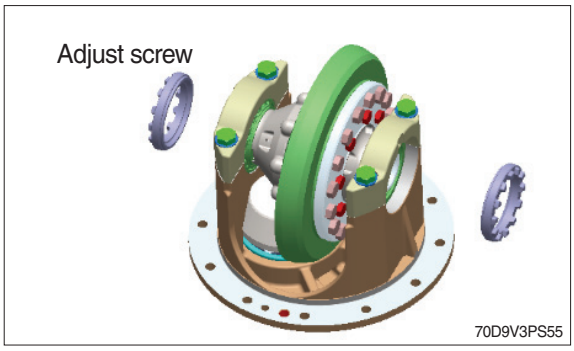
· Tightening torque : 15.8 ~ 18.4 kgf·m
(114 ~ 133 lbf·ft)

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

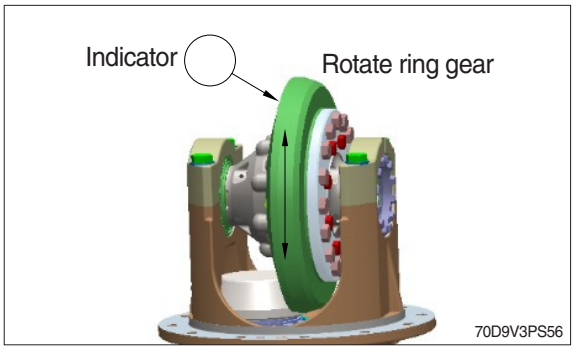


(3) Control of gearset backlash

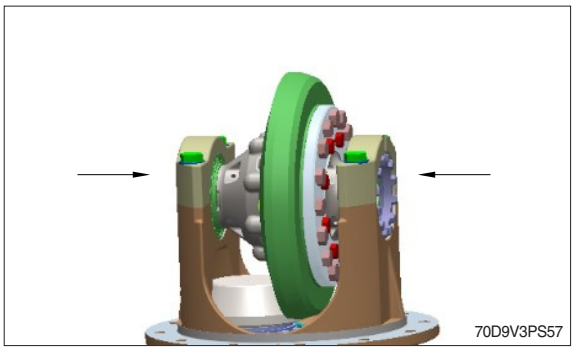
① Assemble differencial assembly on carrier case.



② Measure backlash as turn ring gear slowly.



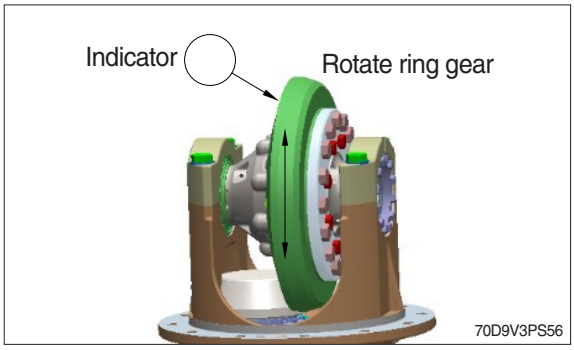
③ Lock adjust screw.



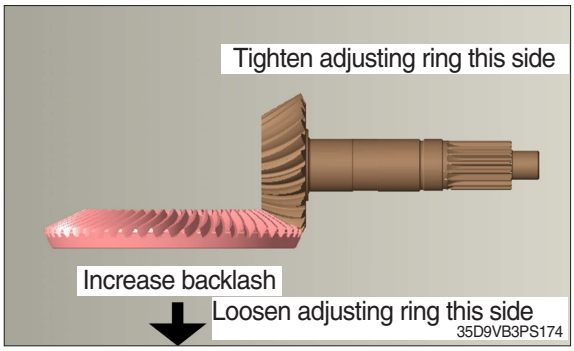
④ Remeasure Backlash.

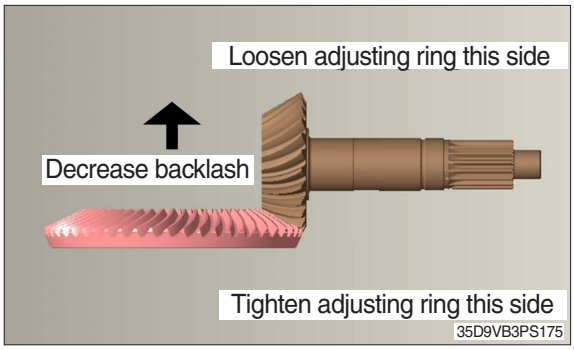
· Backlash of pinion and ring gear : 0.18 ~ 0.23 mm

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



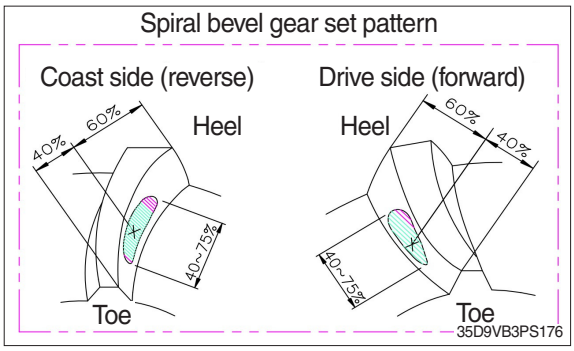
※ If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.



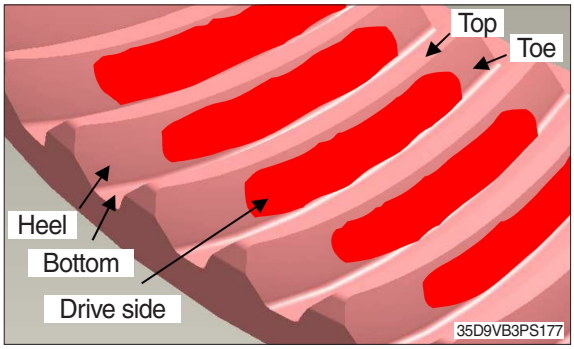


(4) Measurement of tooth contact pattern

※ 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.

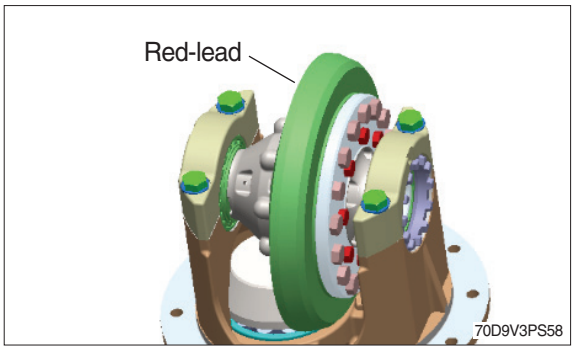


※ Always check tooth contact pattern on the driving side of gear teeth.



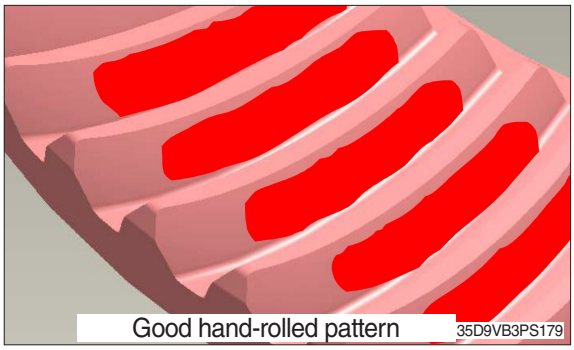
① Marking red-lead on 6 tooth surface of ring gear.

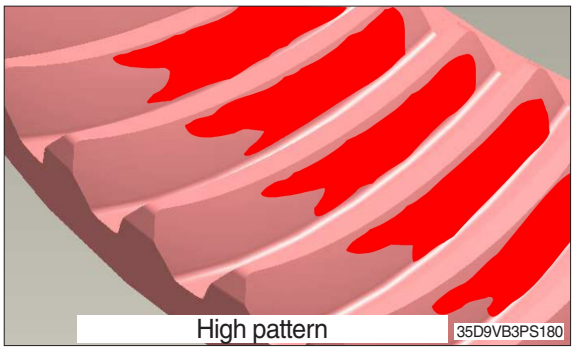
② Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.

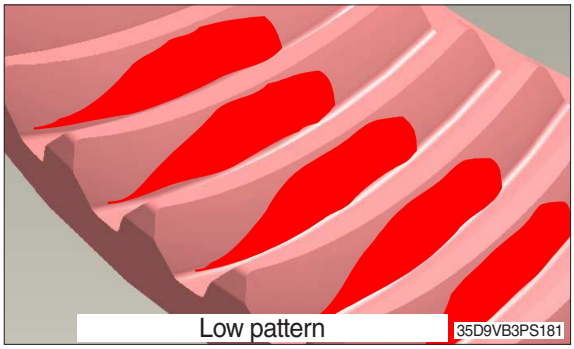


③ Compare the contact pattern with illustrations.

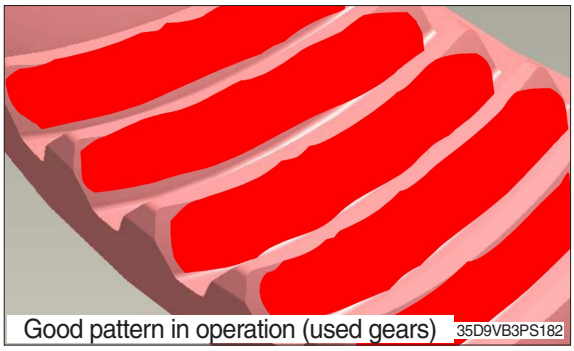
※ **The good contact pattern of gearset is appeared what the length of tooth has had.**





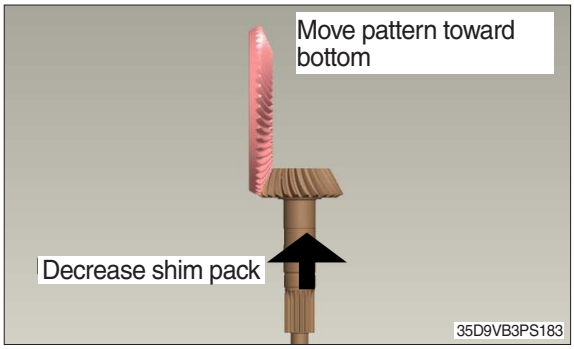


※ **The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.**

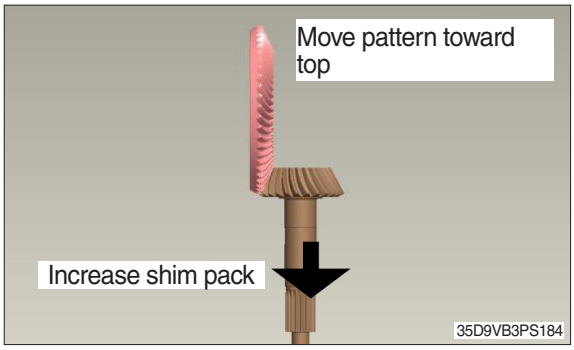


④ If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps a-b.
If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps c-d.

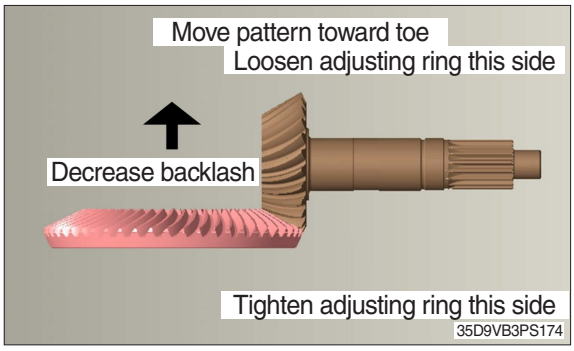
a. High pattern
If A high contact pattern appear it which pinion was installed shallowly in carrier.
To modify, move the pinion toward the ring gear by decreasing the shim pack between pinion spigot and inner bearing cone.



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.

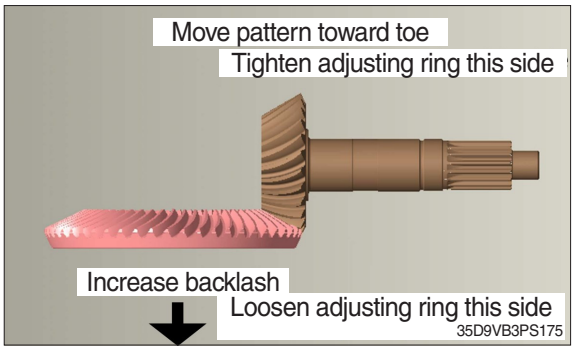


c. Heel pattern
Decrease the gearset backlash (within specified range) to move contact pattern toward toe and away from heel. Refer to "Adjusting the gearset backlash".



d. Toe pattern

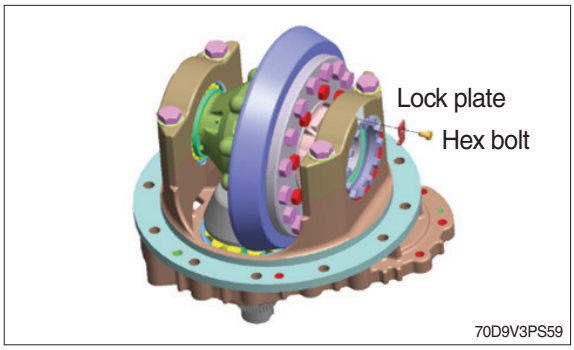
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



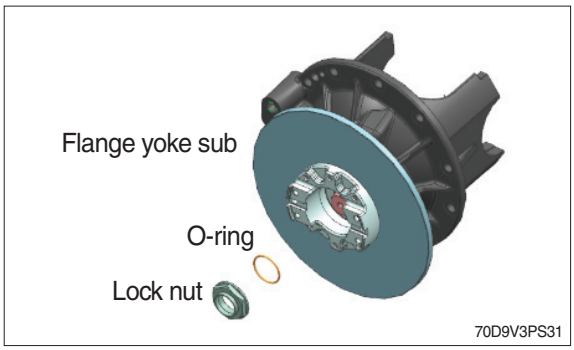
⑤ Assemble lock plate and hex bolt.

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

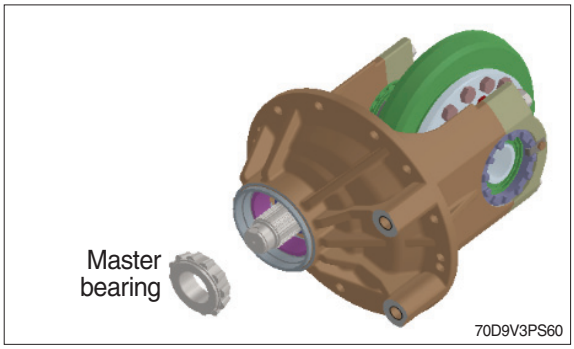
※ Cover loctite #277 on the screw side of bolt.



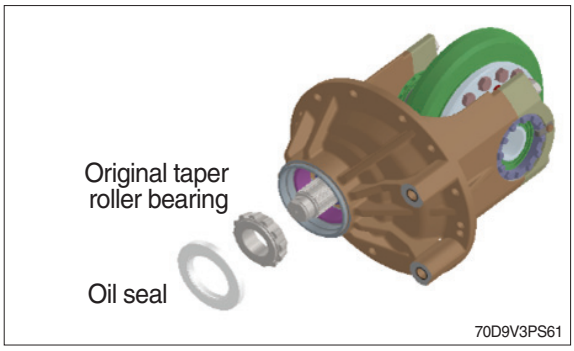
⑥ Disassemble lock nut, O-ring, and flange yoke.



⑦ Disassemble master bearing.



⑧ Assemble original taper roller bearing and oil seal.

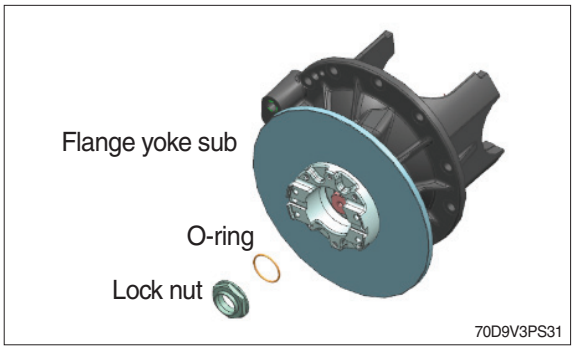


⑨ Assemble o-ring and lock nut.

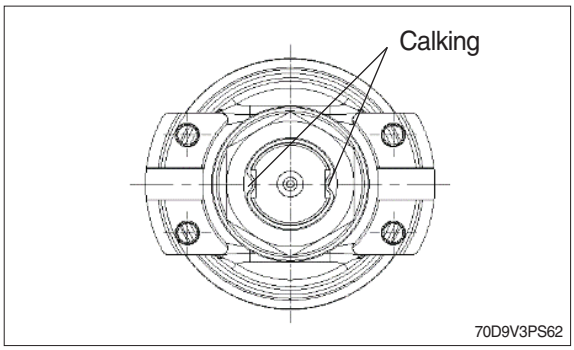
· Tightening torque : 0.92 ~ 1.2 kgf·m
(6.7 ~ 8.7 lbf·ft)

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

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

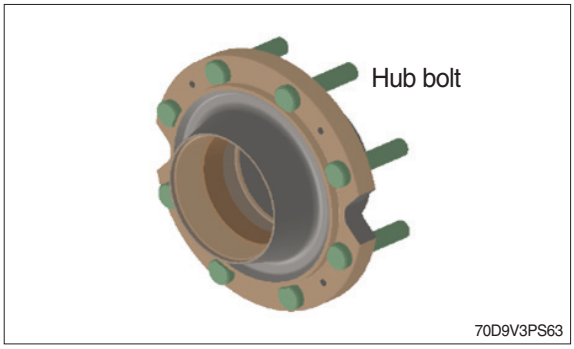


⑩ Calking (2 EA).

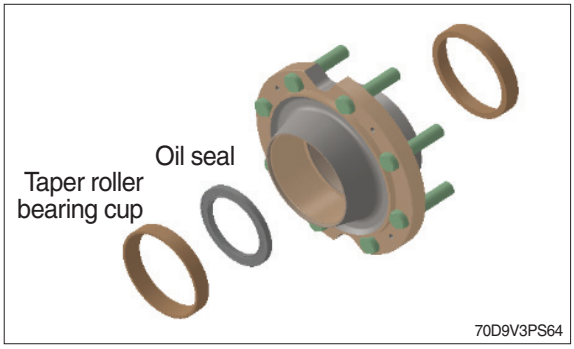


2) ASSEMBLY OF HUB SUB

(1) Press hub bolt into hub.

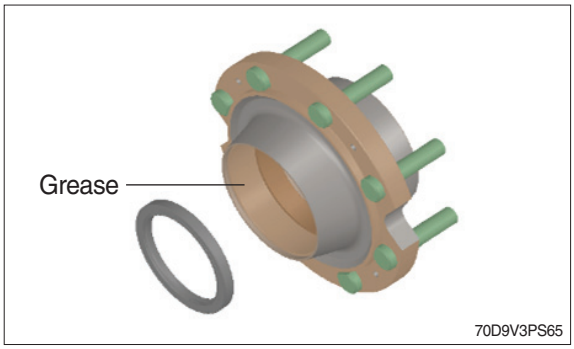


(2) Press hub oil seal. Assemble bearing cup (2 EA) on each left and right hub.



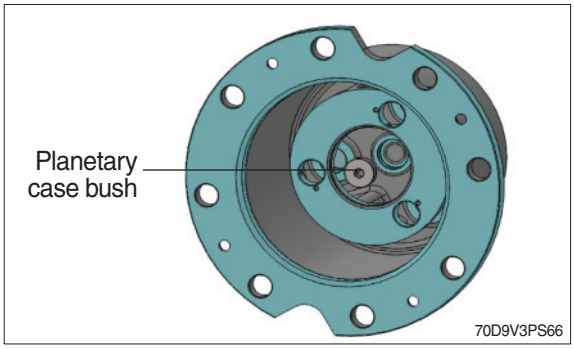
(3) Press hub bolt into hub.

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

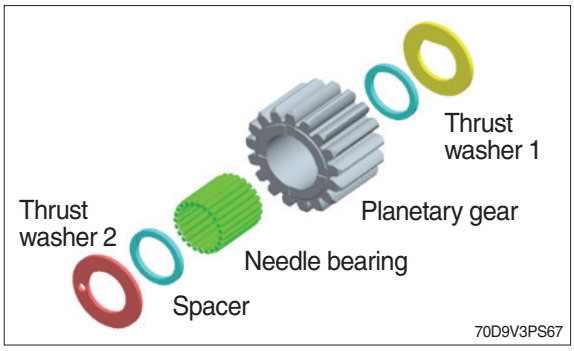


3) ASSEMBLY OF PLANETARY CASE

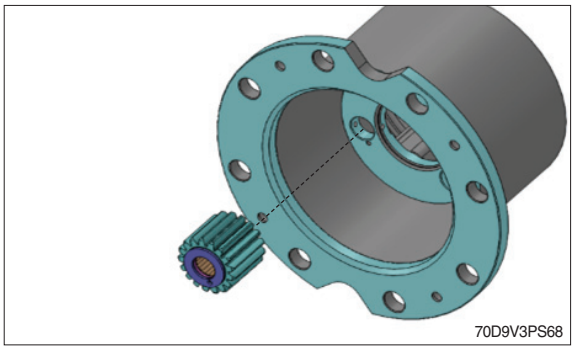
(1) Assemble planetary case bush at the middle of planetary case.



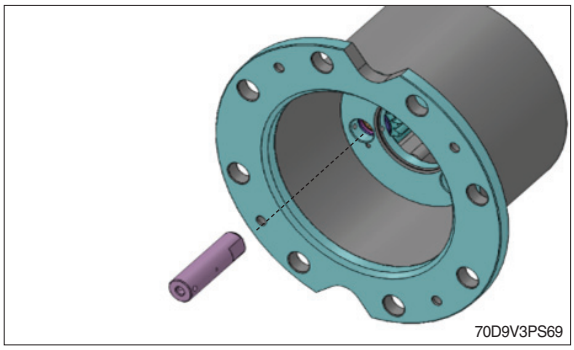
(2) Thrust washer 1 → Spacer → Needle bearing → Planetary gear → Washer → Thrust washer 2
Assemble planetary gear (3 EA) as above in order.



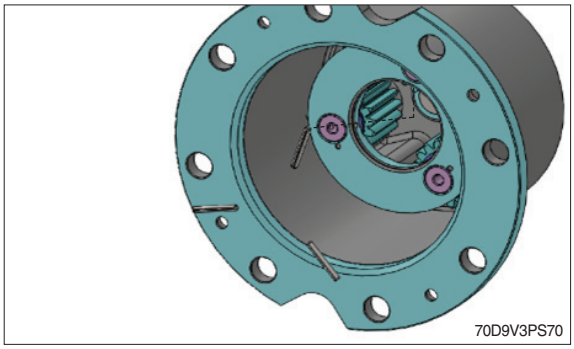
(3) Assemble planetary gear (3 EA)



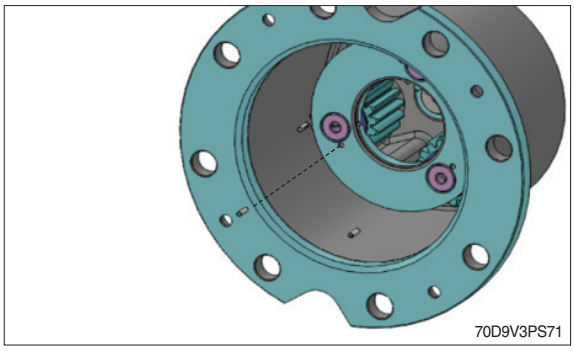
(4) Assemble planetary pin (3 EA).



(5) Assemble spring pin (3 EA).

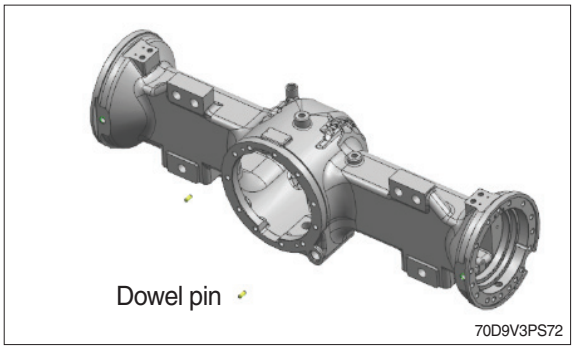


(6) Assemble spring pin (3 EA).



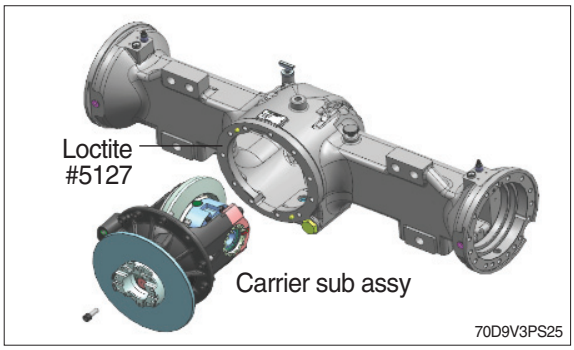
5) ASSEMBLY OF DRIVE AXLE

(1) Assemble dowel pin on axle housing.



(2) Assemble carrier assy.

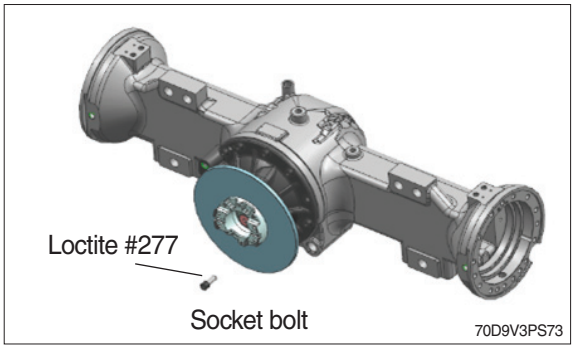
※ **Cover loctite #5127 on axle housing.**



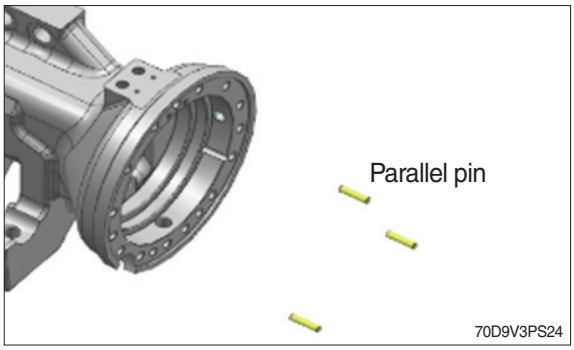
(3) Assemble socket bolt.

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

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

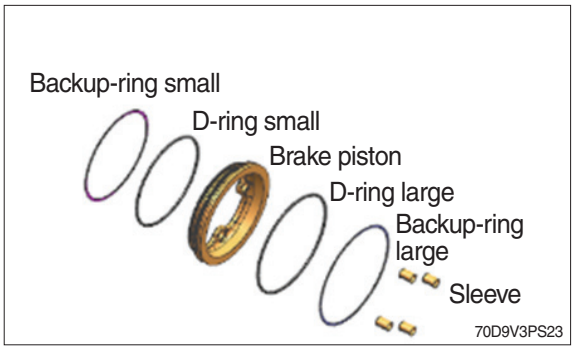


(4) **Assemble parallel pin.**

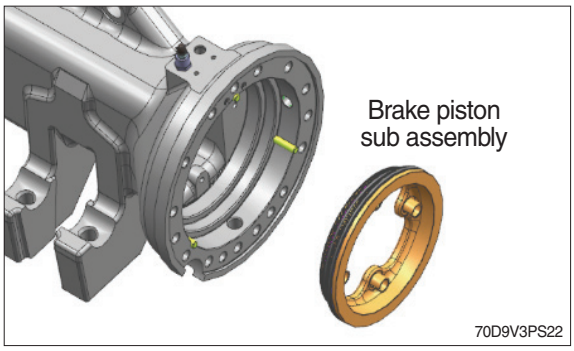


(5) Assemble sleeve, backup ring, and D-ring

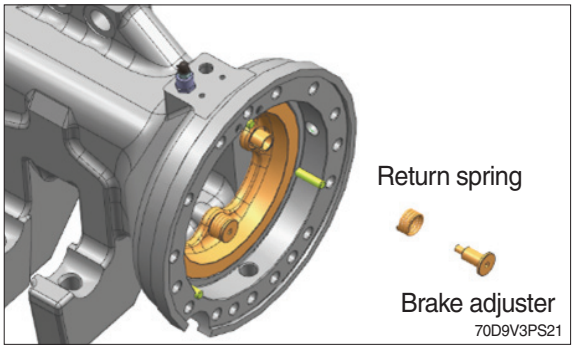
※ **Spread grease on D-ring.**



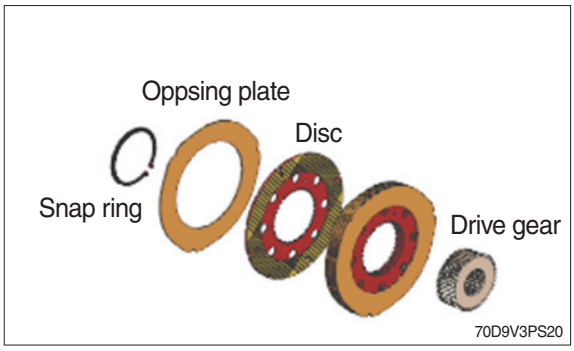
(6) **Assemble piston sub assy.**



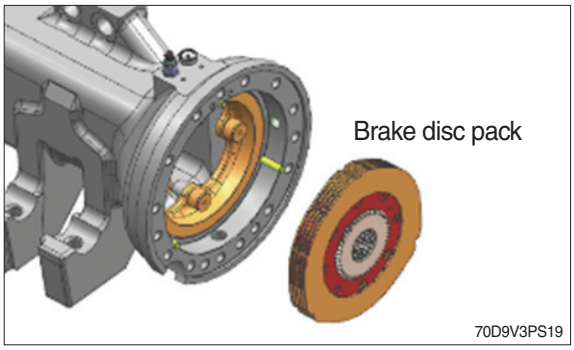
(7) **Assemble return spring and brake adjuster.**



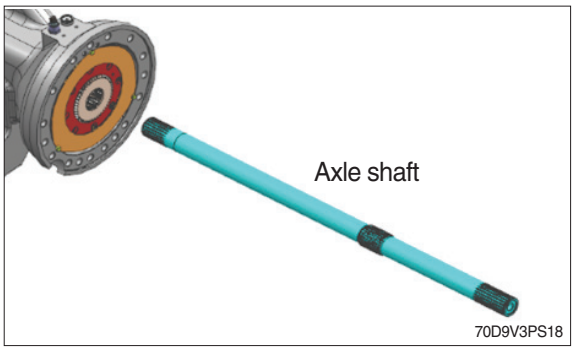
(8) Assemble disc, opposing plate, drive gear, and snap ring.



(9) Assemble brake disc pack sub assy.

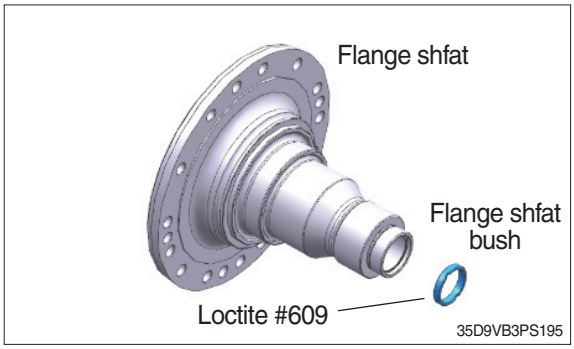


(10) Assemble axle shaft.



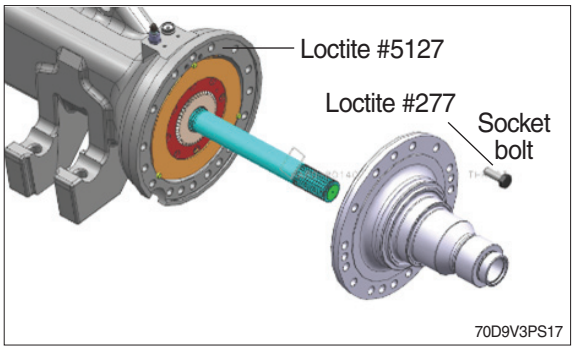
(11) Assemble parallel pin on beam.

※ **Cover loctite #609 on the bush side.**

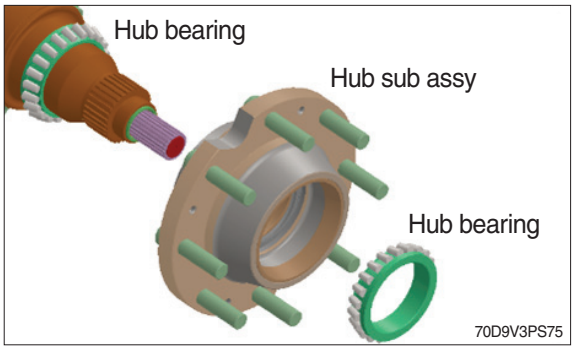


(12) Assemble flange shfat and socket bolt.
· Tightening torque : 18.4 ~ 21.4 kgf·m
(133 ~ 155 lbf·ft)

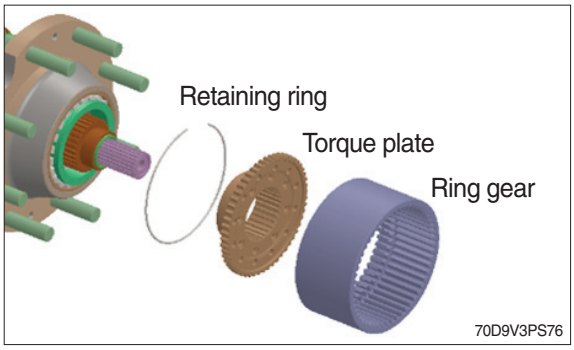
※ **Cover loctite #277 on the screw side of bolt and loctite #5127 on axle housing**



(13) Hub bearing → Hub sub assy → Hub bearing
Assemble in as above in order.



(14) Retaining ring → Torque plate → Ring gear
Assemble in as above in order.

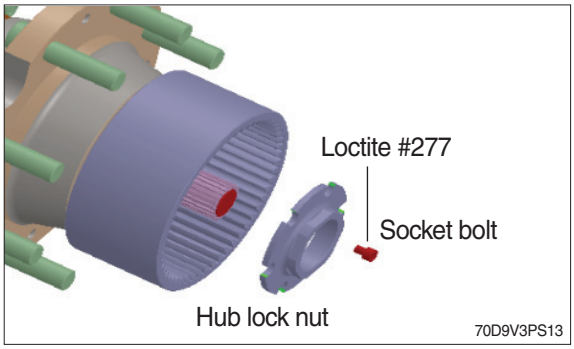


(15) Assemble hub lock nut and tighten socket bolt on hub lock nut.
· Tightening torque : 6.1 ~ 6.6 kgf·m
(44.0 ~ 47.6 lbf·ft)

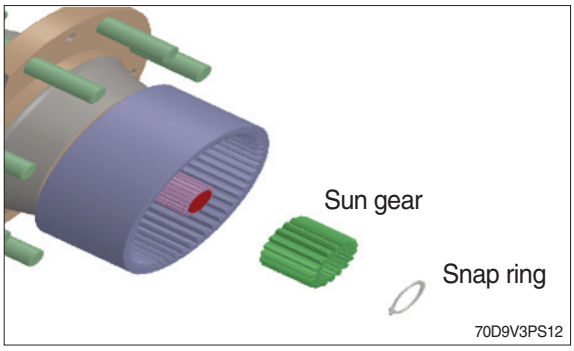
※ **Cover loctite #277 on the screw side of bolt.**

※ **Measure preload : settle down hub lock nut, hub move around each left and right 5 times and measure it.**

※ **Measured value : 1.5 ~ 3.0 kgf·m**
(10.8 ~ 21.7 lbf·ft)



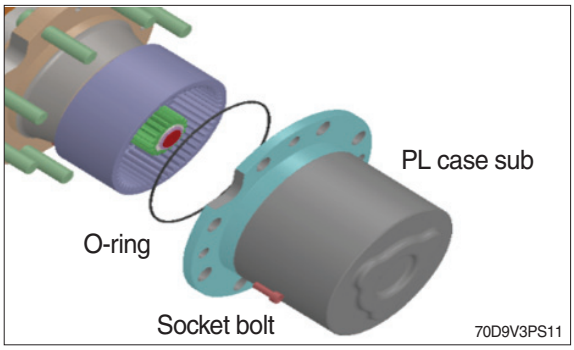
(16) Assemble sun gear and snap ring.



(17) Assemble O-ring, PL case sub, and socket bolt.

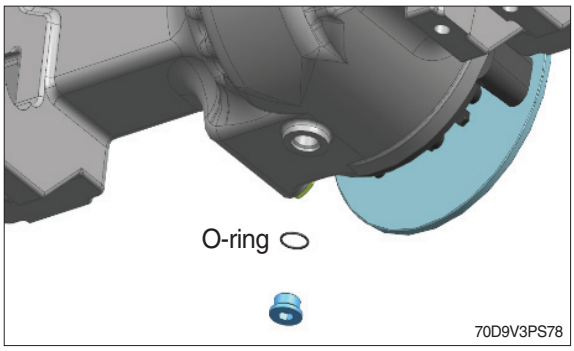
· Tightening torque : 6.1 ~ 6.5 kgf·m
(44.1 ~ 47.0 lbf·ft)

※ **Spread grease on O-ring.**



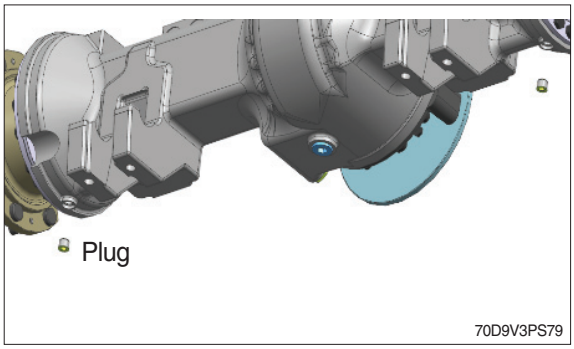
(18) Assemble O-ring and drain plug.

· Tightening torque : 4.0 ~ 5.0 kgf·m
(28.9 ~ 36.2 lbf·ft)

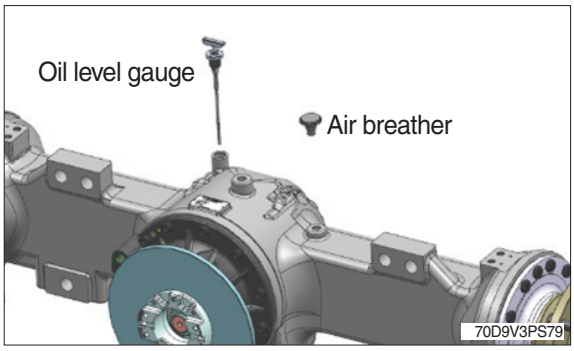


(19) Assemble plug.

· Tightening torque : 4.0 ~ 5.0 kgf·m
(28.9 ~ 36.2 lbf·ft)

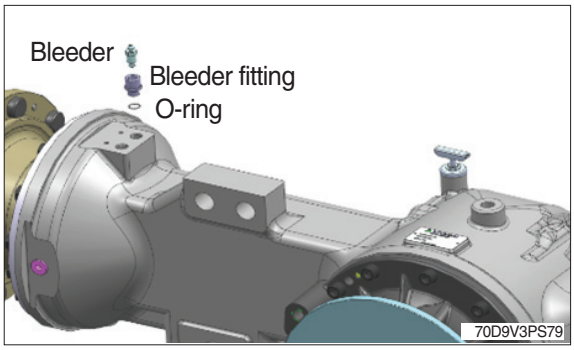


(21) Assemble oil level gauge and air breather on axle housing.

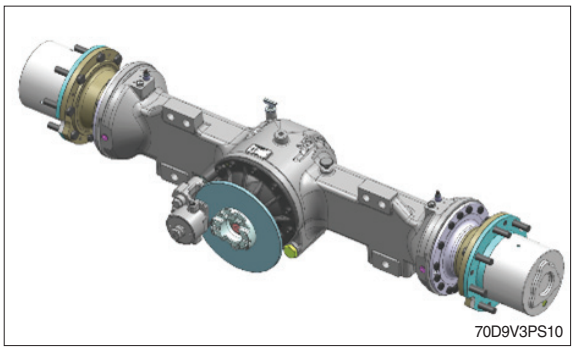


(21) Assemble O-ring, bleeder, and bleeder fitting.

· Tightening torque
- Bleeder : .4.0 kgf·m (28.9 lbf·ft)
- Bleeder fitting : 1.8 kgf·m (13.1 lbf·ft)



(22) Complete Drive axle assembly



GROUP 3 MAINTENANCE AND TROUBLESHOOTING

1. MAINTENANCE

1) TRANSMISSION

(1) Recommend oils

The property that needs for auto transmission oil.

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

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

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

(2) Point of exchange oil

① Pulling out oil

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.

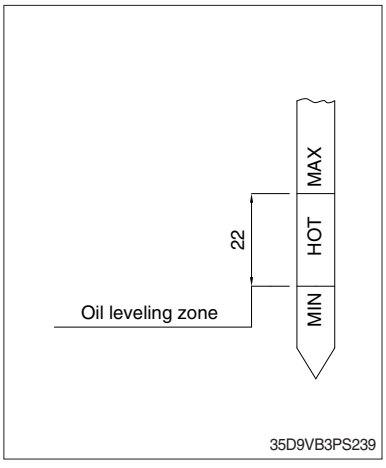
b. Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.

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).

※ 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 20 liters.



(3) Period of overaul

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

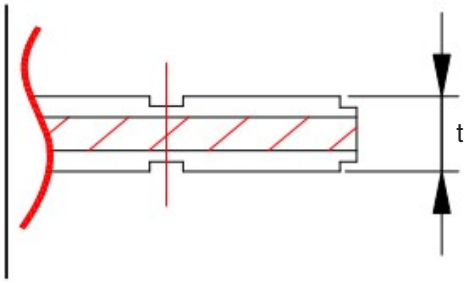
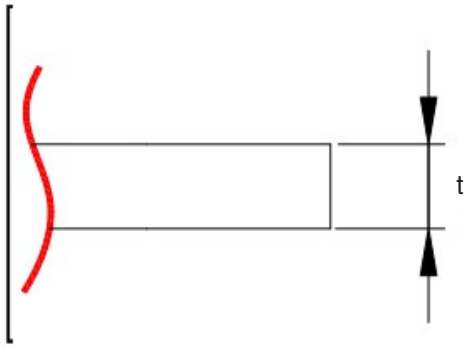
② Please change the oil seal, rubber such as o-ring, and gasket, copper gasket, if it has damaged.

③ Please check the part by your eyes which you disassembled whether they have the crack, the scar, abnormal wear and corrosion etc. If the parts have such abnormal condition, please change or repair.

④ Seal ring, snap ring, friction disc, plate → Change the part that exceeds the wear limits.

⑤ Bearing, bush → Check the bearing to see if it rotates freely. If in doubt about the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft → if it is abnormal you have to change.

	Item in the F&R clutch	Standard	Limit
Friction disk		2.06	1.56
Plate		2	1.85
Back plate		4	3.85

(4) Period of exchanging parts

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

(5) Standard of exchanging parts

Classfication	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 its abnormally you have to chage.	Gear, Shaft	Each gear, Clutch shaft, Turbine shaft, Flange

(6) Test

① **Operation check**

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

· The abnormal sound dose not occur.

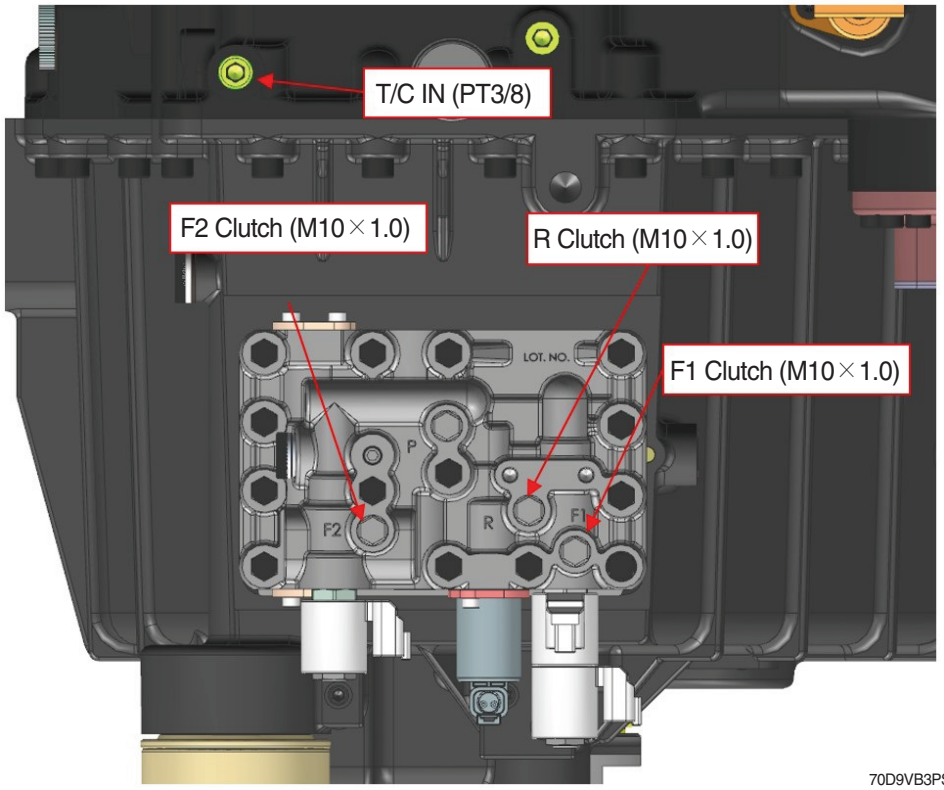
· The abnormal oscillation dose not occur.

· The oil is not leaking.

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

② **Oil pressure measurement**

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



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

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

c. 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	1.7±0.2	1.7±0.2
Forward 1st	1.7±0.2	1.7±0.2
Forward 2nd		
Reverse		
T/C inlet	0.3 ~ 0.7	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 F1 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

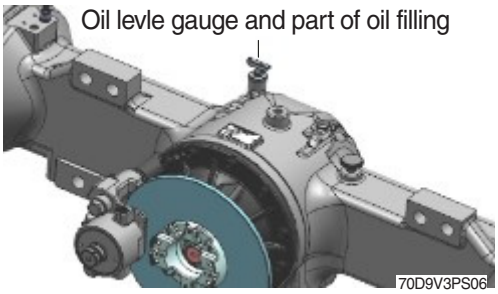
(1) General information

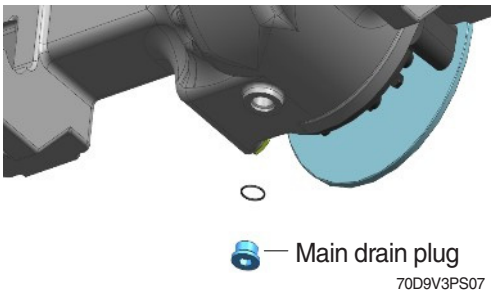
Drive axles generate small metal wear particles during operating, especially hard particles are allowed to circulate in the lubricant, along with external moisture. In these case the internal components can be more faster damaged.

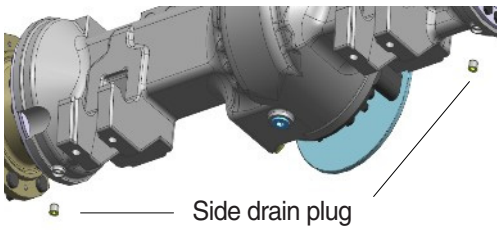
(2) Oil level

① Check and adjust oil

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







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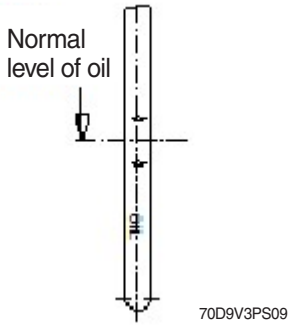
a. Park the truck on flat ground.

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 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.**

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 12 liters.

b. **Available oil list**

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

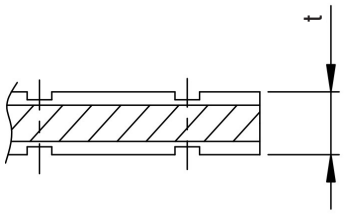
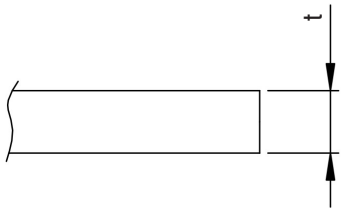
(3) Maintenance

① The Axle oil needs to be replaced per every 1,000 hours.

② O-ring, oil seal, rubber, gasket : Change all parts at every overhaul.

③ Check internal leakage of brake system (Brake seal) : Every 2,000 hours, replace as necessary.

④ **Disc, opposing plate : Change the part that exceeds the wear limits.**

Item		Part no.	Standard	Limit
Disc		HA50-60220	t=4	t=3.36
Opposing plate		HA50-60200	t=2.5	t=2.35

⑤ Bearing : 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 the gear or shaft is damaged or in an abnormal condition, replace it.

⑦ Spring : If the springs are deformed by more than ±10% of the free length, replace the parts.

⑧ **Oil exchange and level check cycle**

First time	100 hours after deliver
Check oil level	Every 250 hours
Regular exchange	Every 1000 hours (at least once a year)

2. TROUBLESHOOTING

1) TRANSMISSION

(1) Output does not go up

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

(2) Power is not transmitted

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

(3) Oil temperature rises abnormally

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

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

(4) Clutch or converter oil pressure is too high

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

(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 swtich 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 necesary.
	Wrong cooling and/or actuation fluid used	Check piston seals for swelling or damage. Purge system and use specified fluid.
	Parking brake not adjusted prorerly	Adjust parking brakeing 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 leakge and correct cause.
	Inadequate pressure to apply brakes	Check brkaes apply system. Check for leakage in brake system or brakes, and correct cause.
	Worn or damaged discs	Inspect and replace discs if necssary.
		※ **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 fell spongy/soft	Brakes or brake system not proerly bled.	Bleed brakes and brake system.