

SECTION 3 POWER TRAIN SYSTEM

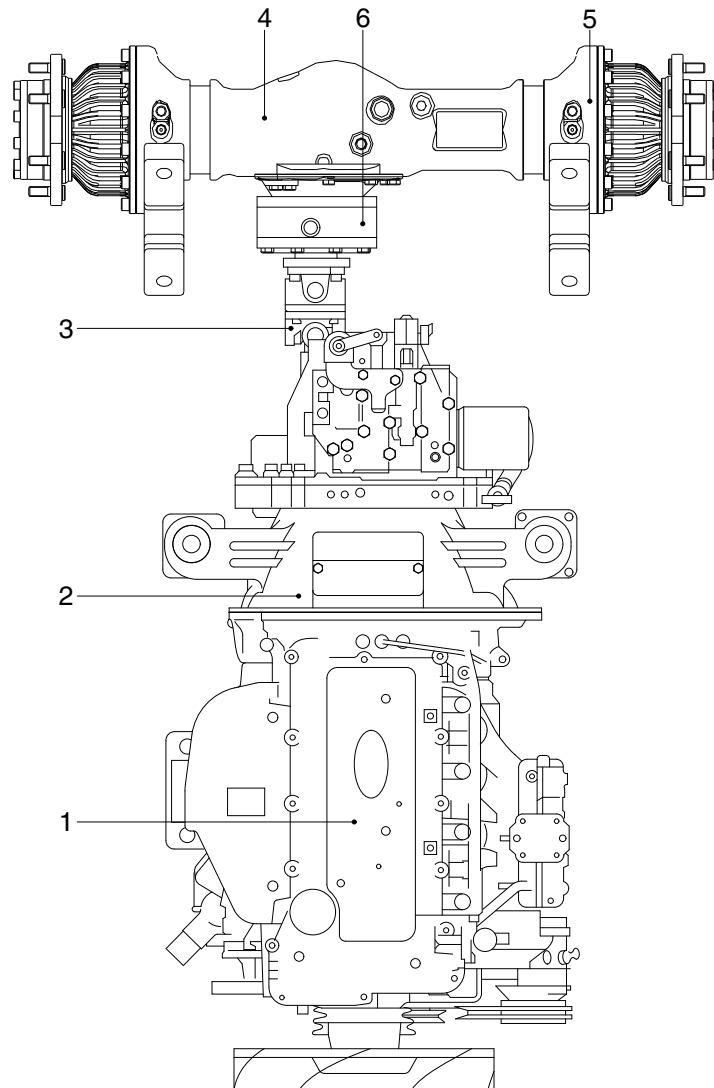
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SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

1. POWER TRAIN DIAGRAM

1) STRUCTURE



25L9APT26

1 Engine
2 Transmission

3 Drive shaft
4 Drive axle

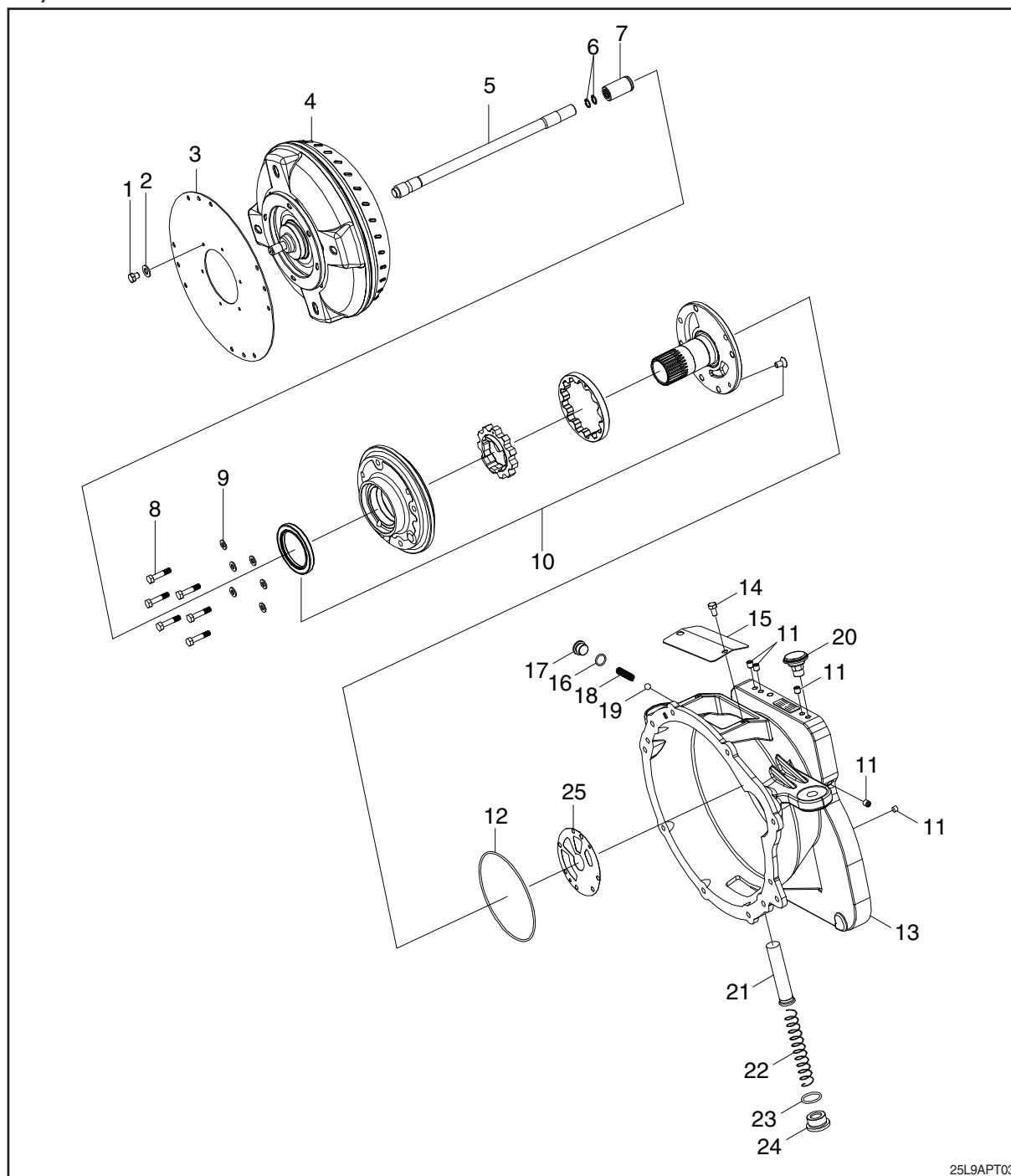
5 Service brake
6 Parking brake

2) SPECIFICATION

Item		Specification
Torque converter	Model	KAPEC 280 DB
	Type	3 Element, 1 stage, 2 phase
	Stall ratio	2.9 : 1
Transmission	Type	Power shift
	Gear shift (FR/RR)	1/1
	Control	Electrical single lever type, kick-down system
	Overhaul ratio	FR 1.308 : 1
		RR 1.308 : 1
Axle	Type	Front-wheel drive type, fixed location
	Gear ratio	14.2 : 1
	Gear	Spiral bevel gear type
Wheels	Q'ty (FR/RR)	Single : 2/2, Double : 4/2
	Front (drive)	2.5 ton Single : 7.0-12-12 PR
		Double : 6.0-15-14 PR
		3.0-3.3 ton Single : 8.5-15-14 PR
		Double : 6.0-15-14 PR
	Rear (steer)	2.5-3.3 ton 6.5-10-12 PR
Brakes	Travel	Front wheel, wet disc brake
	Parking	Wet disc brake (negative)
Steering	Type	Full hydraulic, power steering
	Steering angle	79° to both right and left angle, respectively

2. TORQUE CONVERTER

1) STRUCTURE



25L9APT03

- | | | |
|-----------------------------|-----------------------------|------------------------|
| 1 Hexagon bolt | 10 Charging pump assembly | 19 Ball |
| 2 Plain washer | 11 Plug | 20 Air breather |
| 3 Flexible plate | 12 O-ring | 21 Inner oil strainer |
| 4 Torque converter assembly | 13 Torque converter housing | 22 Oil strainer spring |
| 5 Shaft | 14 Hexagon bolt | 23 O-ring |
| 6 Snap ring | 15 Torque converter cover | 24 Oil strainer plug |
| 7 Socket gear | 16 O-ring | 25 Gasket |
| 8 Hexagon bolt | 17 Plug | |
| 9 Copper washer | 18 Spring | |

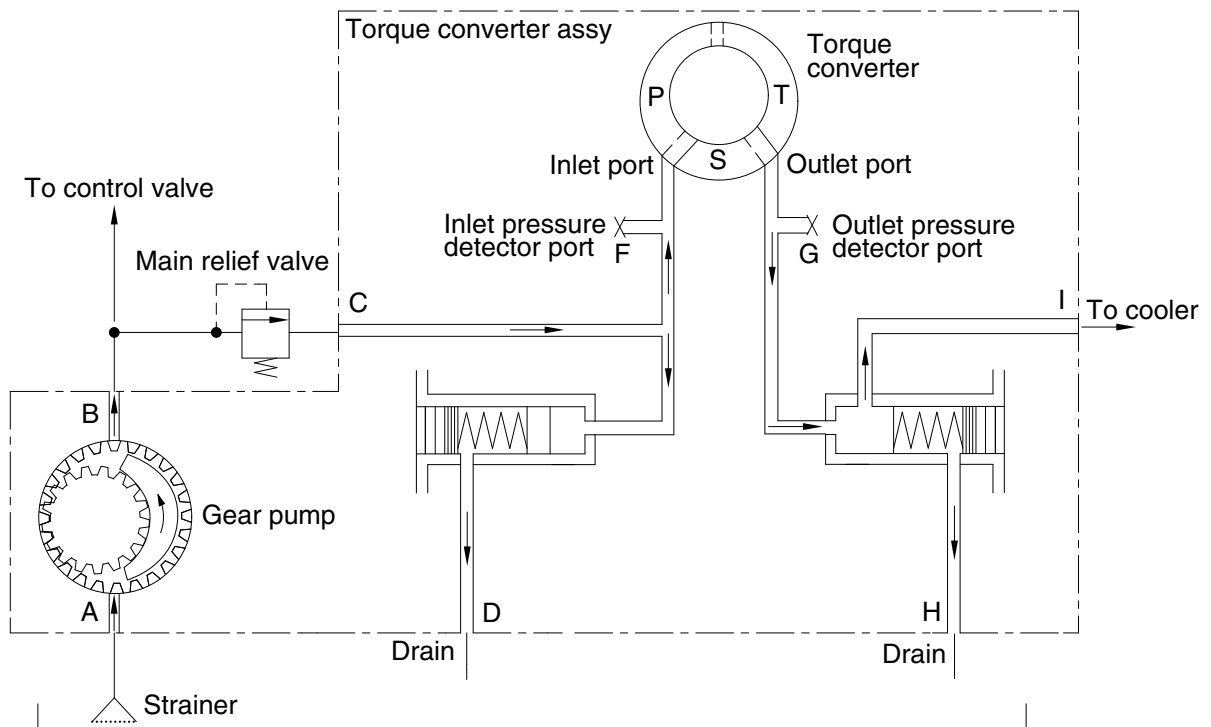
2) OPERATION

The torque converter is connected with a flywheel by a flexible plate, engine output is delivered from the flywheel to the flexible plate.

The exterior of the torque converter is protected by the torque converter housing.

The torque converter housing forms the oil path for the oil pump, it includes the oil strainer filtering sucked oil through this oil path and the oil level gauge measuring oil level of the transmission inside.

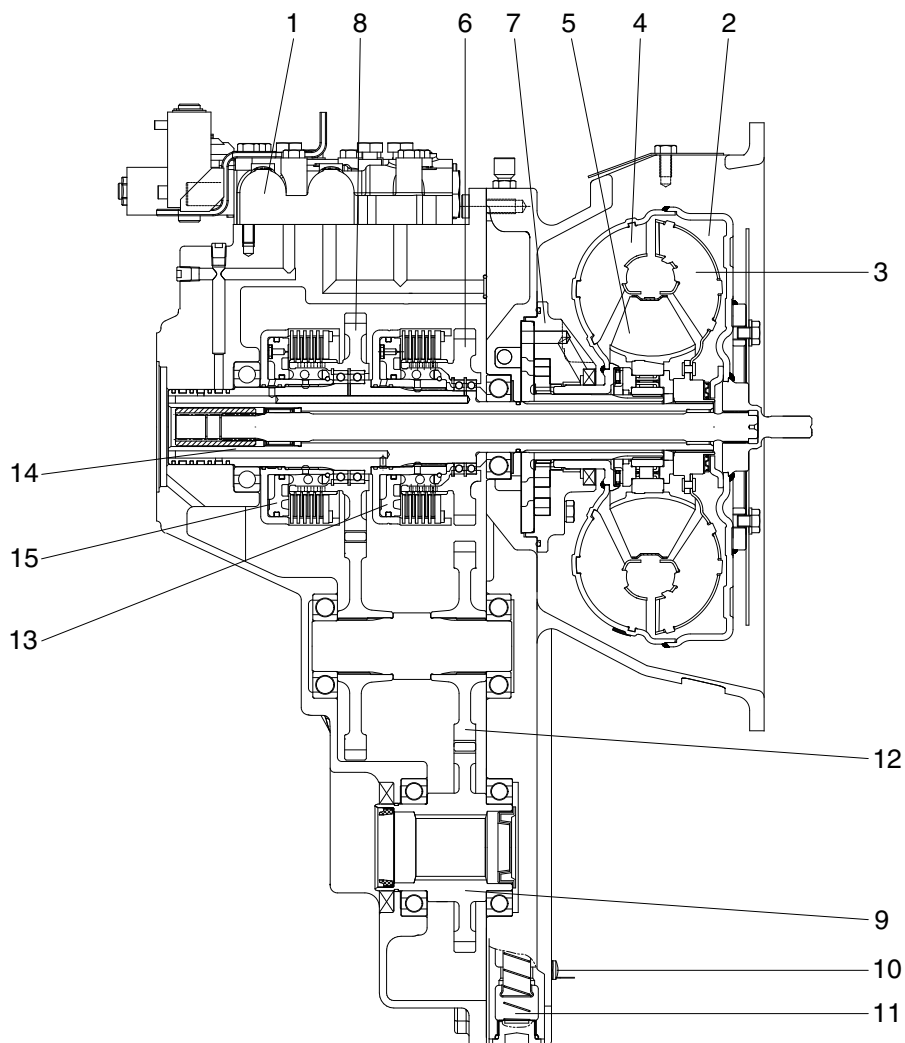
3) TORQUE CONVERTER HYDRAULIC CIRCUIT



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3. TRANSMISSION

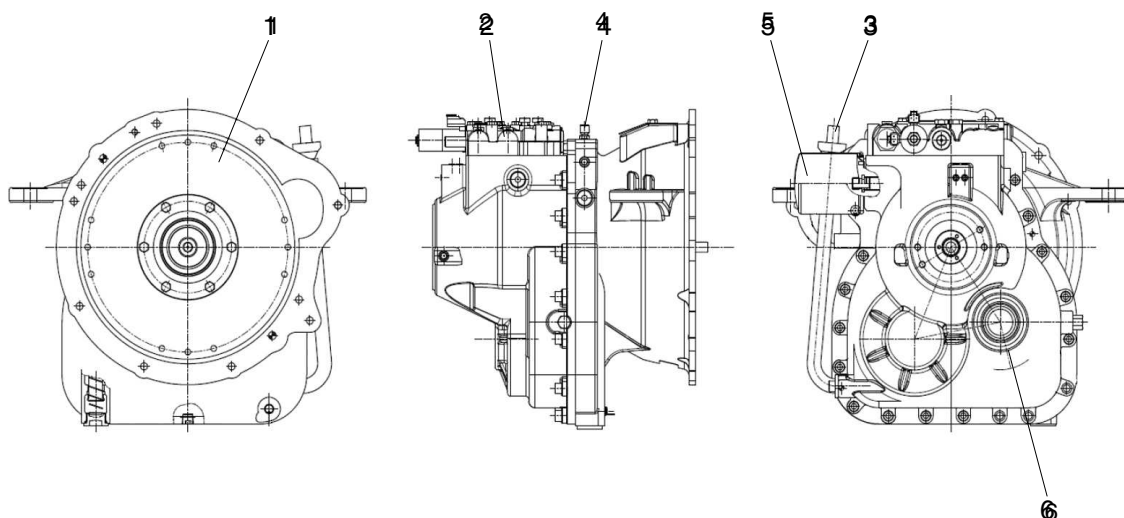
1) STRUCTURE



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|---|---------------------|----|---------------------|
| 1 | Control valve | 9 | Output gear |
| 2 | Torque converter | 10 | Temperature sensor |
| 3 | Turbine wheel | 11 | Oil strainer |
| 4 | Impeller wheel | 12 | Idle gear |
| 5 | Stator wheel | 13 | Forward clutch pack |
| 6 | Forward clutch gear | 14 | Input shaft |
| 7 | Oil pump | 15 | Reverse clutch pack |
| 8 | Reverse clutch gear | | |

2) INSTALLATION VIEW



22D9PT05

- | | |
|-------------------------------|---|
| 1 Torque converter | 5 Transmission oil filter |
| 2 Control valve | 6 Transmission output (Universal joint link part) |
| 3 Oil level pipe and dipstick | |
| 4 Air breather | |

3) OPERATION

The torque converter is an automatic fluid drive.

It transmits engine torque by means of hydraulic force.

The torque converter leads and the power which is delivered rotated the charging pump.

Oil is drawn from the transmission reservoir by the charging pump.

The pump delivers its entire output to a full-flow oil filter for cleaning.

From the oil filter, the oil supply is sent to the control valve.

The main pressure regulator valve provides pressure for clutch pack, directs oil to the solenoid valve.

Moving the solenoid valve allows oil to charge the selected (forward or reverse) clutch line and to engage that clutch.

The remaining oil appropriating clutch pressure flows into the torque converter.

A converter pressure regulator valve in the converter-in line limits the oil pressure there.

The oil pressure input to the torque converter is adjusted 4~7 kgf/cm² (57~100 psi).

The oil pressure output from the torque converter is adjusted below 2~4.5 kgf/cm² (28.4~64 psi).

The torque converter is continuously filled with oil during operation.

Rotation of the converter impeller imparts energy to the oil which, in turn, drives the turbines.

The oil then flows between the stator vanes which redirect it to the impeller.

At this time, torque is increased.

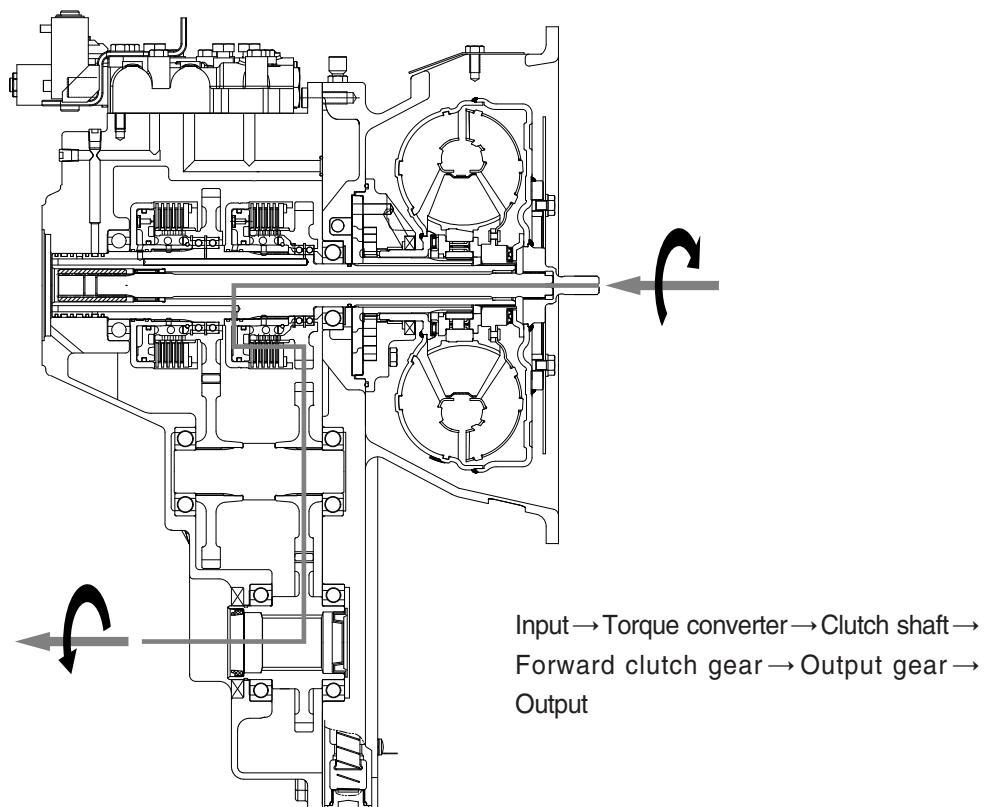
The oil from the torque converter enters the cooler.

The cooler is a heat exchanger in which the oil flows through air cooled passages.

After refrigerated, it is in charge of clutch lubrication through the lubrication oil path of the clutch shaft. A lubrication valve between the cooler and lubrication system returns all excess oil to the transmission reservoir.

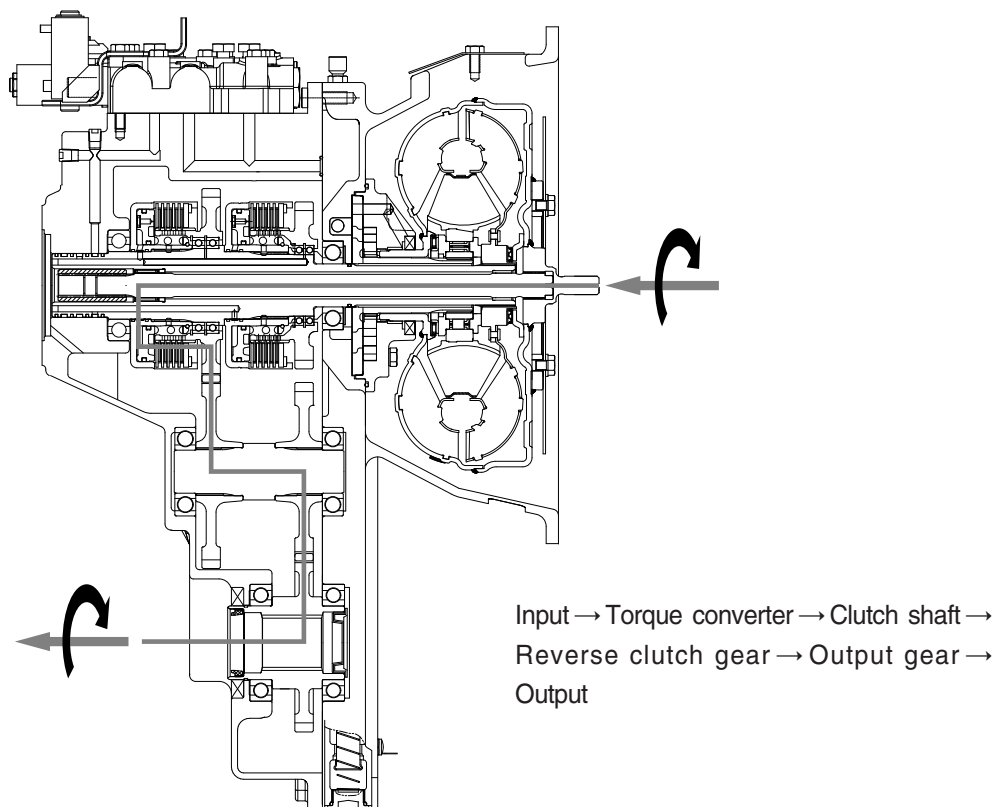
4) OPERATING MODES

(1) Forward



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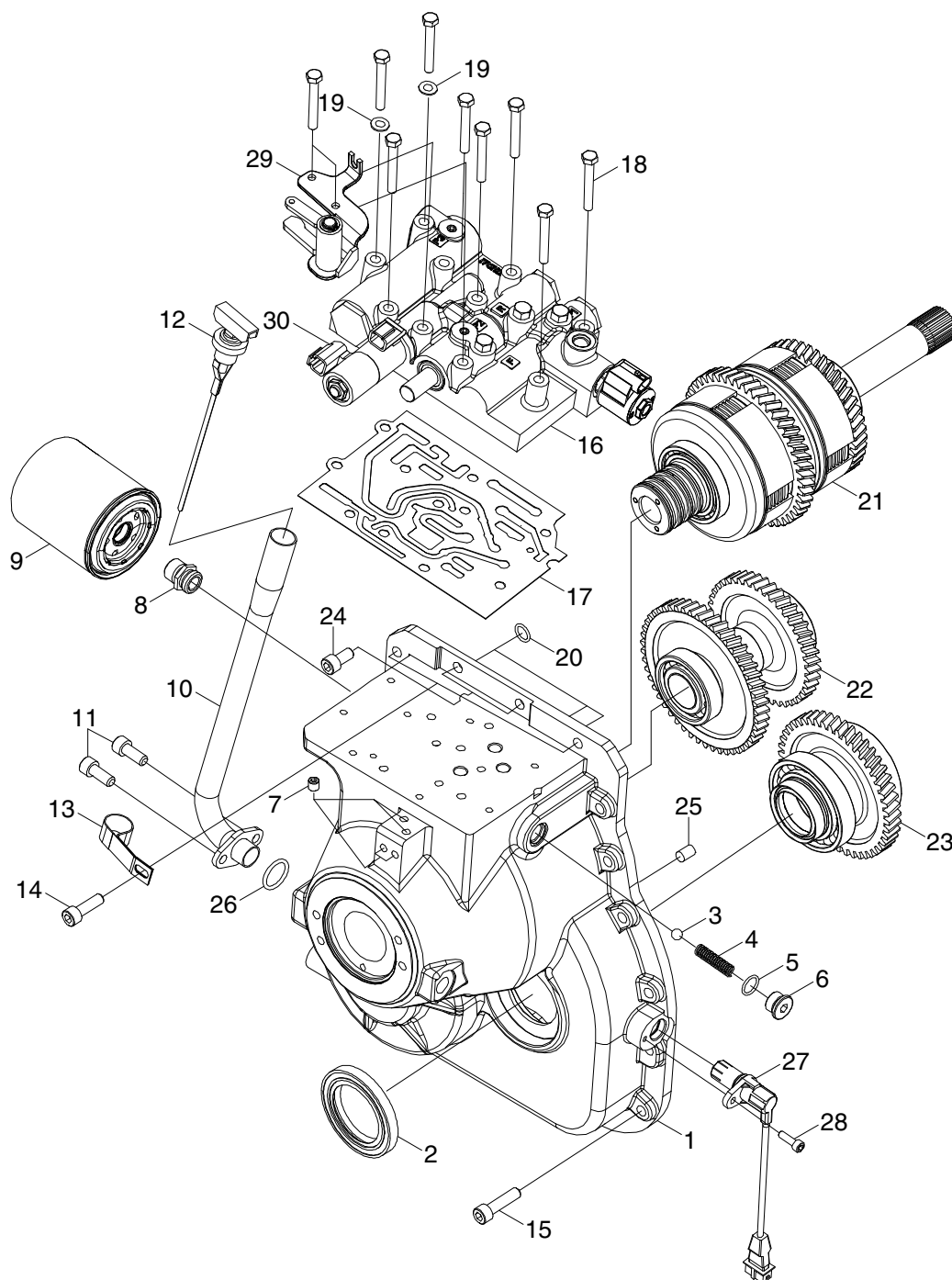
(2) Reverse



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5) TRANSMISSION CASE AND CONTROL VALVE

(1) Structure



22D9PT07

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|----|-------------------------|----|---------------|----|-------------------|
| 1 | Transmission case | 11 | Socket bolt | 21 | Cylinder gear |
| 2 | Oil seal | 12 | Oil gauge | 22 | Idle gear |
| 3 | Ball | 13 | Clamp | 23 | Output gear |
| 4 | Spring | 14 | Socket bolt | 24 | Socket bolt |
| 5 | O-ring | 15 | Flange bolt | 25 | Dowel pin |
| 6 | Plug | 16 | Control valve | 26 | O-ring |
| 7 | Plug | 17 | Gasket | 27 | Speed sensor |
| 8 | Bolt | 18 | Hexagon bolt | 28 | Socket bolt |
| 9 | Transmission oil filter | 19 | Plain washer | 29 | Inching link assy |
| 10 | Dipstick pipe | 20 | O-ring | 30 | Solenoid valve |

(2) Operation

The transmission case includes the function of a control valve and an oil filter.

The oil filter is charge of filtering sucked oil by an oil pump before transmitting sucked oil to a control valve and a torque converter.

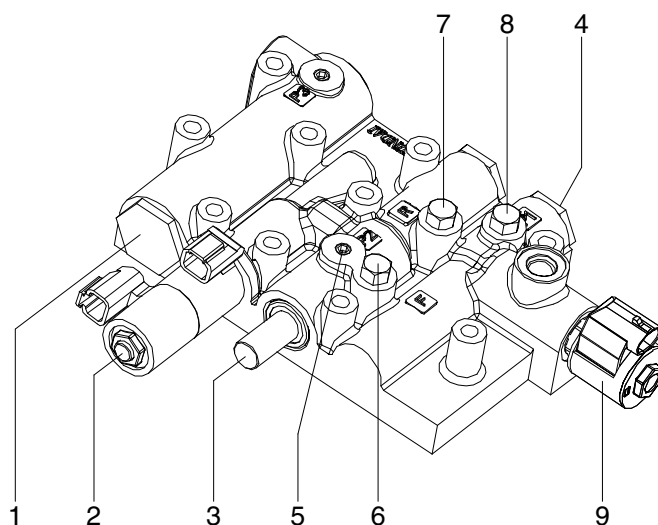
Oil transmitted through an oil filter delivers oil pressure to the piston of the forward and reverse clutch through the solenoid valve.

At this time, the solenoid valve is in charge of the important function of transmitting oil pressure for forward and reverse through an electric signal by the forward and reverse selection lever of the truck.

Oil pressure chosen for forward or reverse by the solenoid valve is transmitted to the forward clutch through the formed oil path between transmission case or the reverse clutch through the pipe of transmission outside.

6) CONTROL VALVE

(1) Operation



22D9TPT08

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|-------------------------------------|--------------------------------------|
| 1 Modulation | 6 Forward clutch pressure check port |
| 2 Fwd/rev solenoid valve | 7 Reverse clutch pressure check port |
| 3 Inching spool | 8 Main pressure check port |
| 4 Main relief valve | 9 Parking solenoid valve |
| 5 Inching valve pressure check port | |

The control valve consists of the main relief valve, solenoid valve, modulation valve and inching valve.

The discharged oil from the gear pump enters main relief valve of the control valve and its pressure is adjusted 10.8~14.9 kgf/cm² (154~212 psi).

The oil adjusted pressure by the main relief valve is decided on the direction of forward or reverse by the solenoid valve.

The decided oil is delivered the power transferred from the torque converter to drive axle through the oil path between torque converter housing and transmission case.

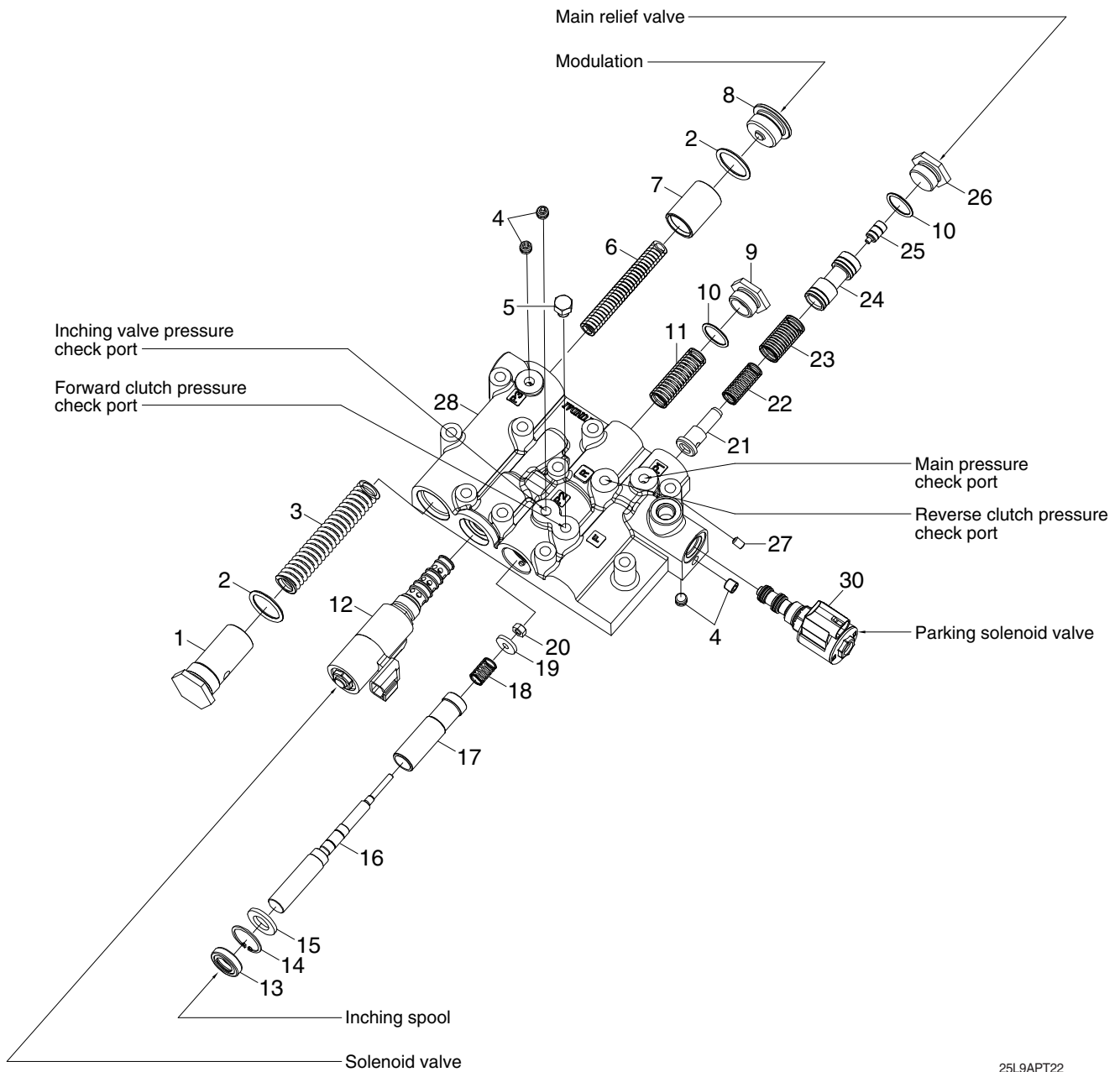
The modulation valve provide a soft plugging when changing gears.

The modulation valve to absorb the small shocks of rapid pressure build up and quick release during gear changes.

When full pressure builds up, the modulation valve shuts the modulation off and allows it to empty, so it is ready to function again during gear change.

The inching valve permits the clutch to partially disengage, so that engine rpm can be increased for lifting while travel speed remains low.

(2) Structure

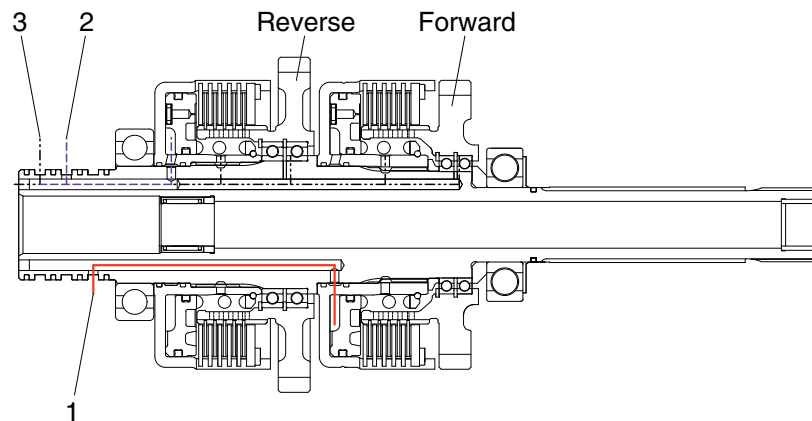


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|---------------|-----------------------------|-----------------------------|
| 1 Guide plug | 11 Spring | 21 Stopper |
| 2 O-ring | 12 Solenoid valve (fwd/rev) | 22 Spring |
| 3 Spring | 13 Oil seal | 23 Spring |
| 4 Socket plug | 14 Snap ring | 24 Valve |
| 5 Plug | 15 Plate | 25 Piston |
| 6 Spring | 16 Spool | 26 Plug |
| 7 Piston | 17 Valve | 27 Screw |
| 8 Socket plug | 18 Spring | 28 Body |
| 9 Plug | 19 Stopper | 30 Solenoid valve (parking) |
| 10 O-ring | 20 Nut | |

7) CLUTCH

(1) Operation



15L7APT31

- 1 Forward clutch plugging pressure delivery line (———)
- 2 Reverse clutch plugging pressure delivery line (- - - - -)
- 3 Clutch pack lubrication line (·······)

When (forward/reverse) mode is selected through the solenoid valve of control valve, the flux flowed by the oil pump flows into forward (reverse) clutch pack in 10.5~14.9 kgf/cm² (149~212 psi) of pressure through the oil path of transmission inside.

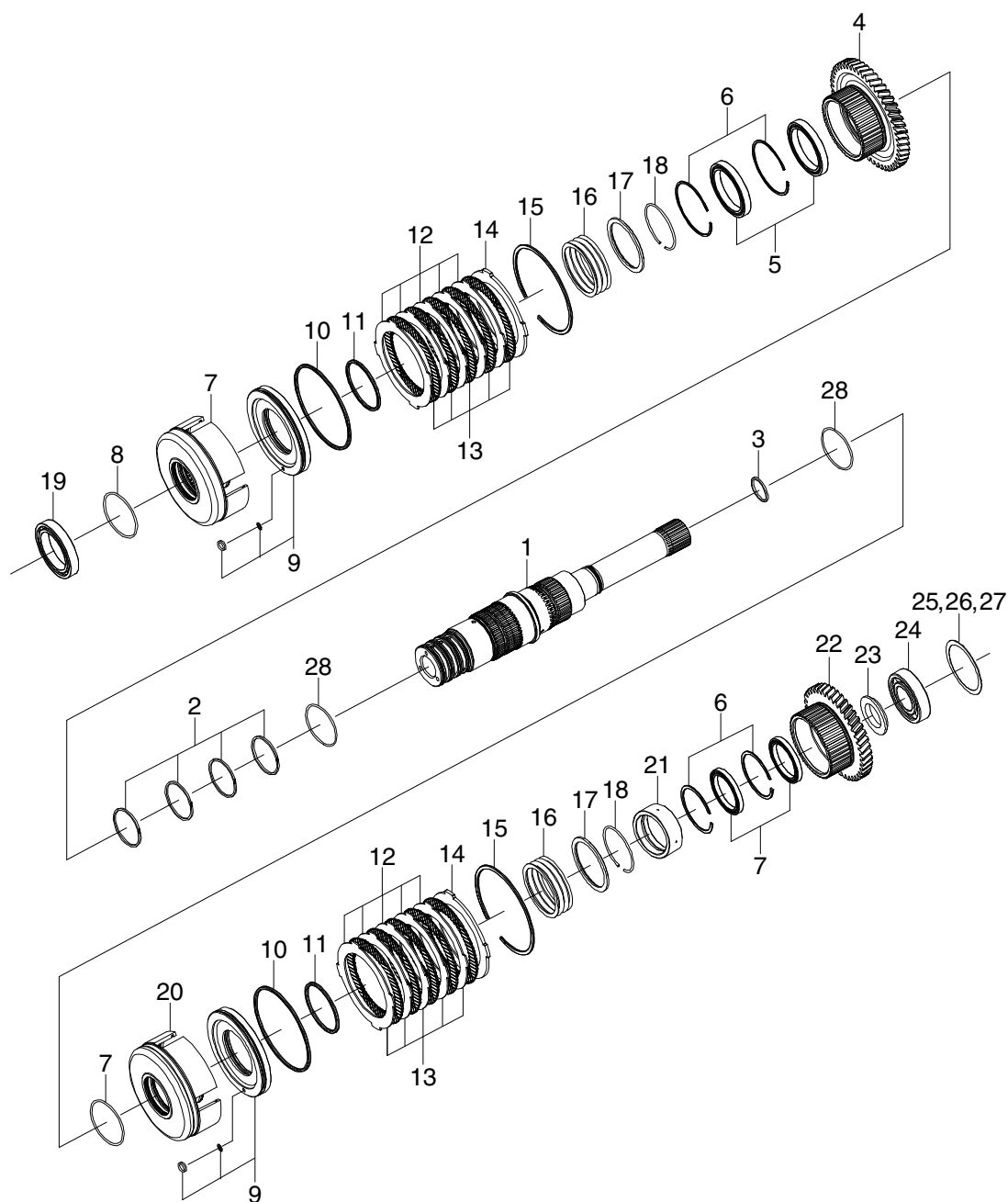
This oil make plugging of clutch pack by giving pressure at the piston of clutch pack.

At this time, the clutch shaft is always revolving while connected with the turbine of torque converter.

According to be plugging, the clutch gear is connected and revolved with drum.

This power is delivered with linking output gear in touch with clutch gear.

(2) Structure



22D9TPT11

- | | | |
|-----------------------|-------------------|-------------------------|
| 1 Shaft | 11 Quad ring | 21 Spacer |
| 2 Peek seal | 12 Plate | 22 Forward clutch gear |
| 3 Small seal ring | 13 Friction plate | 23 Spacer |
| 4 Reverse clutch gear | 14 Plate | 24 Ball bearing |
| 5 Ball bearing | 15 Snap ring | 25 Clutch shim (0.1 t) |
| 6 Snap ring | 16 Spring | 26 Clutch shim (0.15 t) |
| 7 Clutch drum | 17 Back plate | 27 Clutch shim (0.2 t) |
| 8 O-ring | 18 Wire ring | 28 O-ring |
| 9 Piston | 19 Ball bearing | |
| 10 Quad ring | 20 Clutch drum | |

8) OUTPUT GEAR

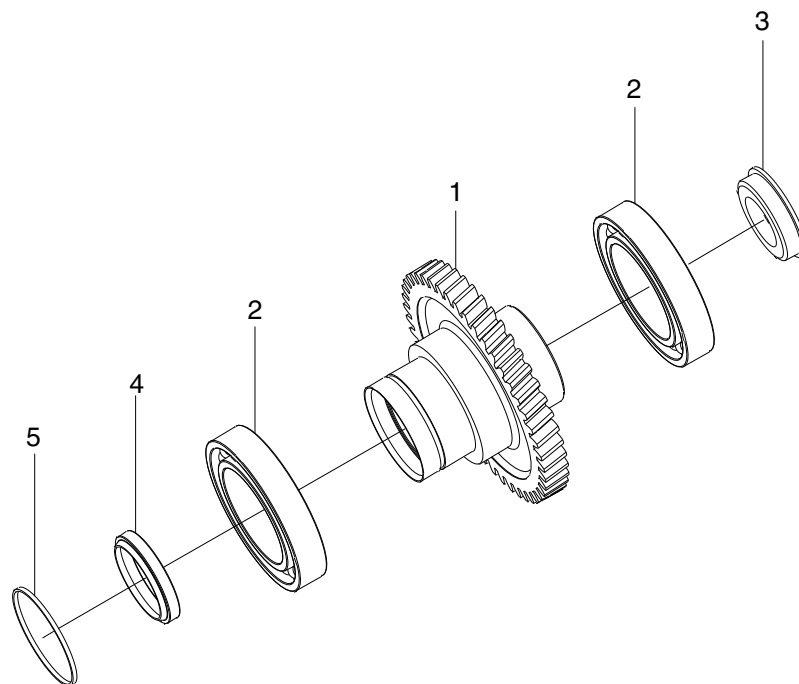
(1) Operation

The output gear is engaging the forward clutch gear and reverse clutch gear together.

If a driver selects forward, the forward clutch gets plugging, the forward clutch gear revolves and the power of forward clutch gear is delivered to output gear.

If a driver selects reverse, the reverse clutch gets plugging, the reverse clutch gear revolves and the power of reverse clutch gear is delivered to output gear.

(2) Structure



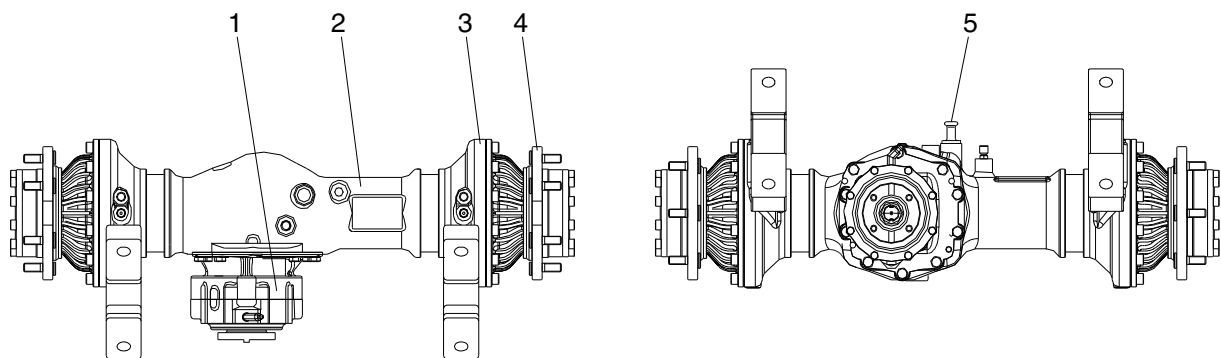
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- 1 Output gear
- 2 Ball bearing
- 3 Cover

- 4 Oil seal
- 5 Seal ring

4. DRIVE AXLE

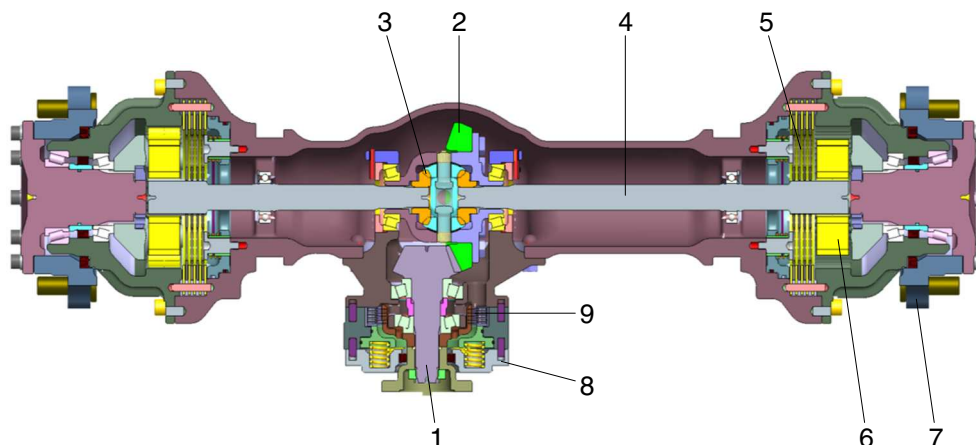
1) INSTALLATION VIEW



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|---|----------------------|---|---------------|---|--------------|
| 1 | Carrier sub assembly | 3 | Service brake | 5 | Oil dipstick |
| 2 | Drive axle housing | 4 | Hub | | |

2) STRUCTURE



22D9PT16

- | | | | | | |
|---|---------------------|---|---------------|---|------------------|
| 1 | Piston shaft | 4 | Axle shaft | 7 | Wheel hub |
| 2 | Ring gear | 5 | Service brake | 8 | Carrier sub assy |
| 3 | Differential device | 6 | Hub reduction | 9 | Parking brake |

The drive axle is connected with the transmission output gear and universal joint.

The power transferred by the universal joint is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear.

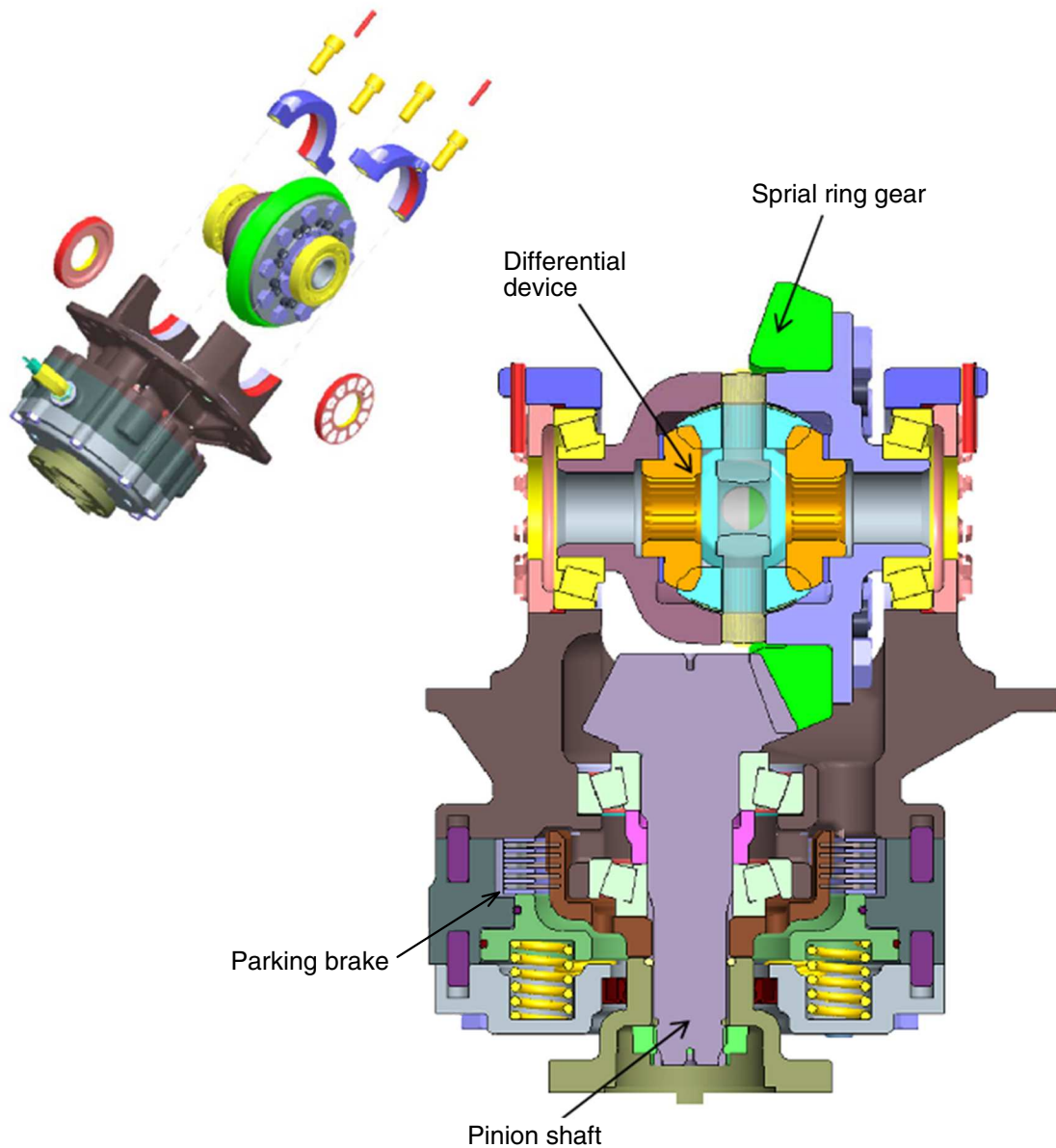
The power transferred to the differential gear is delivered to final drive through the axle shaft in reduced at the hub reduction.

3) CARRIER ASSEMBLY

(1) Operation

Carrier sub assembly include spiral bevel gear for transfer the power of transmission to axle.

Also, including differential device for separate power of transmission to left/right axle shaft and parking brake.



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4) DIFFERENTIAL DEVICE

(1) Operation

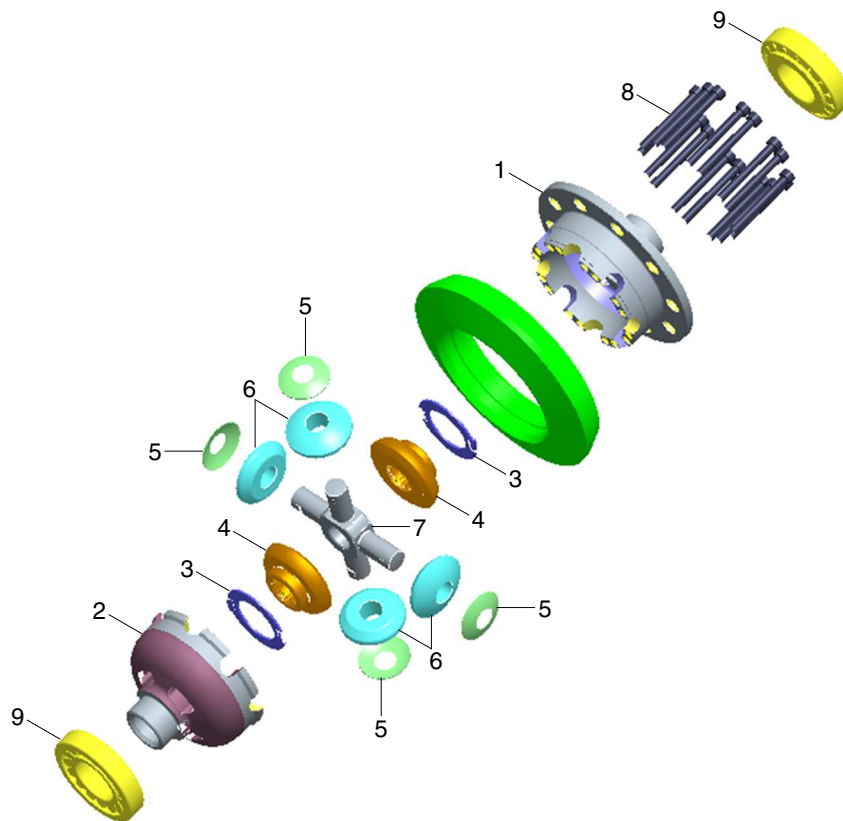
Since the ring gear is linked with the right of the differential case and the bolt, the power transferred to the ring gear makes the differential device revolve.

And also, the left and right of 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.

(2) Structure



22D9TPT19

- | | | |
|--------------------------|---------------------|------------------------|
| 1 Differential case (RH) | 4 Differential gear | 7 Differential spider |
| 2 Differential case (LH) | 5 Thrust washer | 8 Socket bolt |
| 3 Thrust washer | 6 Differential gear | 9 Taper roller bearing |

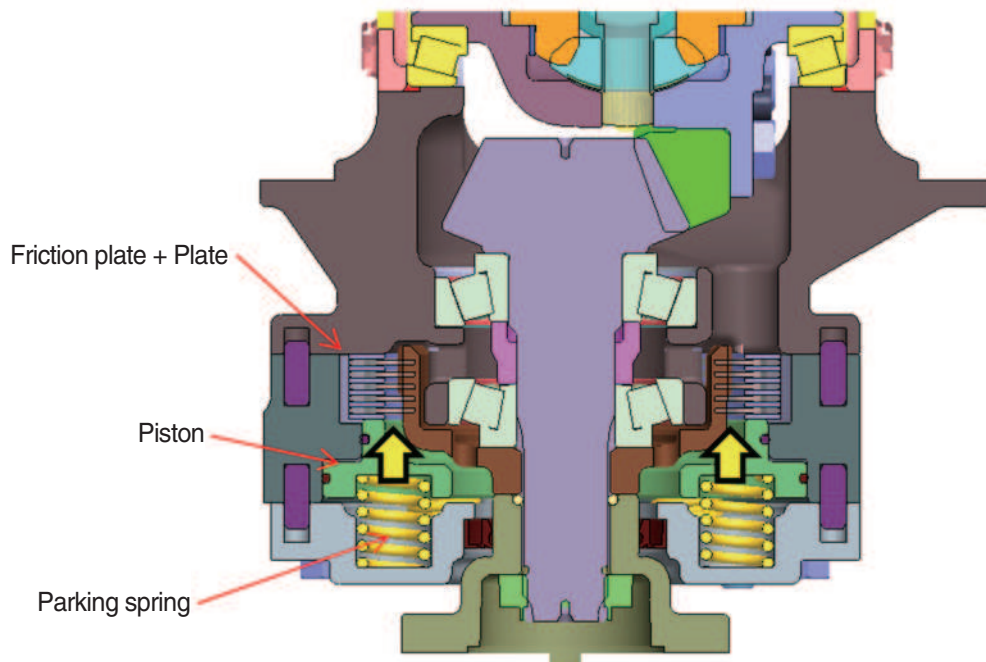
5) PARKING BRAKE (NEGATIVE BRAKE)

(1) Operation

In case of start switch OFF at truck, active parking brake from parking spring push parking piston, and then piston pressured friction plate. It has force distribution.

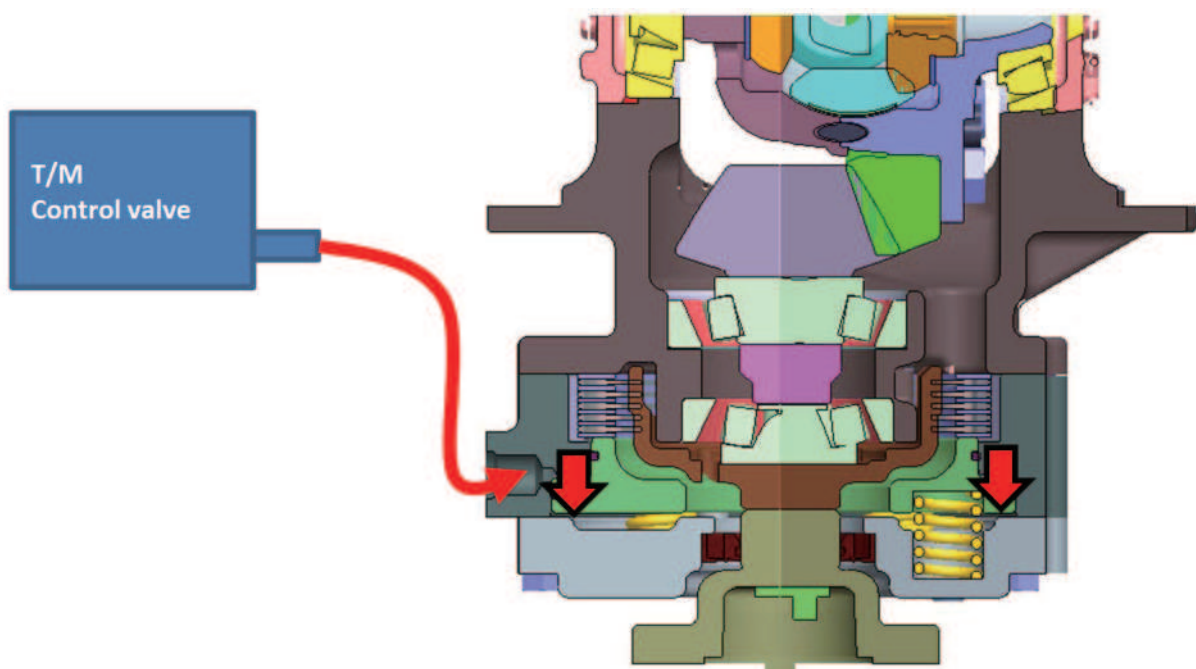
In case of start switch ON at truck, the main pressure at control valve on transmission main pressure supply to parking brake port, and then released pressure at piston and friction plate finally the parking brake is released.

Status of start switch OFF (Active parking brake)



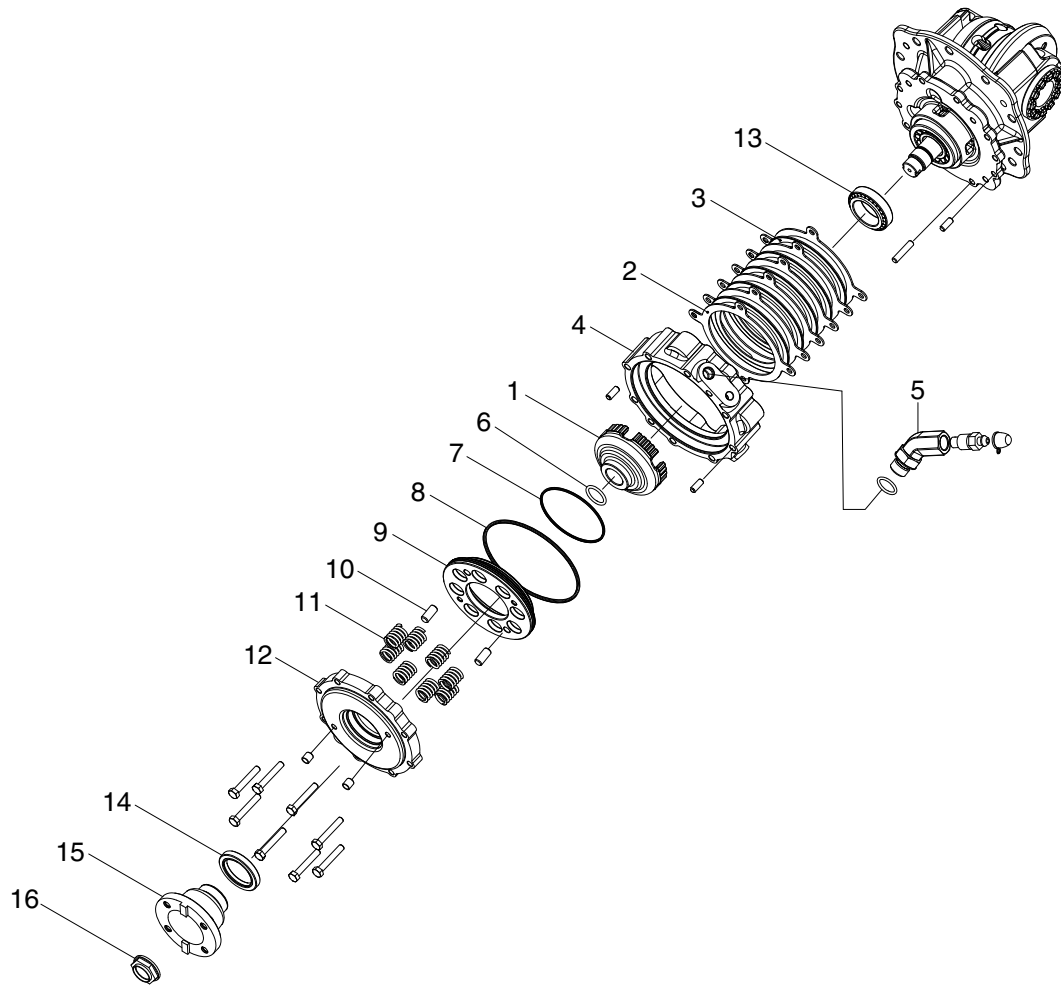
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Status of start switch ON (Release parking brake)



22D9TPB02

(2) Structure



25L9APB03

- | | | | | | |
|---|----------------|----|----------------|----|--------------------------|
| 1 | Parking spline | 7 | Quad ring - S | 13 | Taper roller bearing |
| 2 | Plate | 8 | Quad ring - L | 14 | Oil seal |
| 3 | Friction plate | 9 | Brake piston | 15 | U-joint flange |
| 4 | Piston housing | 10 | Parallel pin | 16 | Taper roller bearing nut |
| 5 | Elbow 45 | 11 | Parking spring | | |
| 6 | O-ring | 12 | Parking cover | | |

GROUP 2 TROUBLESHOOTING

1. TRANSMISSION

Trouble symptom	Probable cause	Remedy
1. Output does not go up 1) Torque converter <ul style="list-style-type: none"> - Torque converter oil - Main body of torque converter 	<ul style="list-style-type: none"> • The oil is in short supply. • The oil that is not regulated is used. • The air has mixed into oil. • The oil filter is clogging. • The stator free wheel is broken. • The stator free wheel is sticking. • The wheel with blades is broken or it is touching other components. 	<ul style="list-style-type: none"> • Replenish oil. • Change the oil to regular oil. • Tighten each joint coupling and the pipe further. • Wash the oil filter or change it. • Change the stall revolution then if the revolution is extremely low, change the free wheel inner race, free wheel cam and roller. • Check the rise of the temperature of oil at no load. Change the free wheel inner race, free wheel cam and roller when the temperature of oil rises abnormally. • Check whether the aluminum powder and the like has mixed into torque converter oil. Change the wheel with blades if the aluminum powder and the like has mixed in.
2) Transmission <ul style="list-style-type: none"> - Charging pump - Torque converter oil - Valve assy - Clutch 	<ul style="list-style-type: none"> • The pump does not operates normally. • The oil is in short supply. • The oil that is not regulated is used. • The air bubble occurs because the torque converter pressure decrease. • The water has mixed into oil. • The clutch oil pressure has de-creased, because the spring is setting or break. • The valve does not move with the valve opens. • The orifice is clogging. • The seal ring of the clutch piston are damaged. • The clutch plate slips because the clutch oil pressure decrease. • The clutch plate is worn out or damaged. • The clutch piston down not operate normally. 	<ul style="list-style-type: none"> • Change the pump. • Replenish oil. • Change the oil to regular oil. • Check and adjust the torque converter pressure. • Check the cooler, and change all oil. • Change the spring. • Repair or change the valve. • Wash the orifice. • Change the seal ring. • Measure the clutch pressure. • Change the clutch plate. • Repair or change the clutch piston.

Trouble symptom	Probable cause	Remedy
2. Power is not transmitted		
1) Torque converter	<ul style="list-style-type: none"> • The flexible plate is broken. • The oil is in short supply. • The shaft and spline are worn. • The gear is broken. • The charging pump does not operate normally. 	<ul style="list-style-type: none"> • Change the flexible plate. • Replenish oil. • Change the shaft and the spline. • Change the gear. • Change the charging pump.
2) Transmission		
<ul style="list-style-type: none"> - Hydraulic converter oil - Clutch part 	<ul style="list-style-type: none"> • The oil is in short supply. • The clutch plate is worn and broken. • The clutch plate is sticking. • The clutch shaft spline is worn. • The clutch pressure has decreased because the seal of the clutch piston do not operate normally. 	<ul style="list-style-type: none"> • Replenish oil. • Change the clutch plate. • Change the clutch plate. • Change clutch shaft. • Change the clutch.
<ul style="list-style-type: none"> - Output gear - Solenoid valve 	<ul style="list-style-type: none"> • The gear is broken. • The solenoid lines are broken. • Spool does not operate normally. 	<ul style="list-style-type: none"> • Change the gear. • Change the solenoid. • Repair or change the solenoid valve.
<ul style="list-style-type: none"> - Valve assy 	<ul style="list-style-type: none"> • The clutch pressure has decreased because the spring is setting or brake. • The valve does not move with the valve opens. 	<ul style="list-style-type: none"> • Change the spring. • Repair or change the valve.
3) Electric circuit	<ul style="list-style-type: none"> • The orifice is clogging. • The switches or the relays are broken. • Wiring has come off and they are broken. 	<ul style="list-style-type: none"> • Wash the orifice. • Refer to the electric circuit figure and repair the broken points. • Refer to the electric circuit figure and repair the broken points.
3. Oil temperature rise abnormally		
1) Torque converter		
<ul style="list-style-type: none"> - Torque converter oil 	<ul style="list-style-type: none"> • Amount of oil is not appropriate. • The oil that is not regulated is used. • The air has mixed into oil. 	<ul style="list-style-type: none"> • Check the oil level. • Change the oil to regular oil. • Tighten each joint coupling and the pipe further.
<ul style="list-style-type: none"> - Flows resistance 	<ul style="list-style-type: none"> • The water has mixed into oil. • The oil cooler is sticking. 	<ul style="list-style-type: none"> • Check the cooler and change the all oil. • Wash the oil cooler or change them.
2) Transmission		
<ul style="list-style-type: none"> - The clutch is dragging. 	<ul style="list-style-type: none"> • The clutch plate is sticking. • The clutch piston does not operate normally. • The pressure of clutch has decreased. • The bearing are worn or sticking. 	<ul style="list-style-type: none"> • Change the clutch plate. • Repair the clutch piston or change them. • Check the clutch pressure. • Change the bearing.

Trouble symptom	Probable cause	Remedy
4. Clutch or converter oil pressure is too high 1) Torque converter 2) Transmission - Valve assy	<ul style="list-style-type: none"> • Viscosity of oil is too high (at cold time). • The oil that is not regulated is used. • The valve does not operate normally because the valve has damage and the valve catch rubbishy in valve. 	<ul style="list-style-type: none"> • Warm up the torque converter if the temperature of torque converter oil is below outside air temperature. • Change the oil to regular oil. • Repair the valve assy and change them.
5. Clutch or converter oil pressure is too low 1) Torque converter 2) Transmission - Valve assy - Clutch	<ul style="list-style-type: none"> • The oil is in short supply. • The oil that isn't regulated is used. • The charging pump is worn and broken. • The oil seal ring or O-ring is worn. • The spring is setting and broken. • The valve does not move with the valve opens. • The orifice is clogging. • The seal ring of the clutch piston are damaged. 	<ul style="list-style-type: none"> • Replenish oil. • Change the oil to regular oil. • Change the charging pump. • Change the oil seal ring or the O-ring. • Change the spring. • Repair the valves or change it. • Wash the orifice. • Change the clutch piston.
6. Noises occurs 1) Transmission	<ul style="list-style-type: none"> • The clutch is sticking and dragging. • The bearings are sticking are worn. • The gear is broken. • The spline is worn. • The bolt is loosen or broken. 	<ul style="list-style-type: none"> • Change the clutch. • Change the bearing. • Change the gear. • Change the spline. • Tighten the bolt or change it.

2. DRIVE AXLE

Trouble symptom	Probable cause	Remedy
1. Noise and vibration		
1) Drive axle	<ul style="list-style-type: none"> • Lubricating oil shortage. • Using different lubricating oil. • Maladjustment or defect of wheel bearing. • Incorrect contact between ring gear and pinion shaft. • Damage or wear of ring gear and pinion shaft. • Loosened or worn bearing of pinion shaft. 	<ul style="list-style-type: none"> • Check oil level and refill lubricating oil. • Change lubricating oil. • Change wheel bearing. • Disassemble, check or readjusting. • Change the damaged gear. • Disassemble, check or change bearing.
2) Differential		
- In operation a differential	<ul style="list-style-type: none"> • Loosened bolt of ring gear. • Burned ring gear. • Loosened or worn differential bearing. 	<ul style="list-style-type: none"> • Disassemble, check or reassemble. • Disassemble, check or change.
- Occurrence for only revolution	<ul style="list-style-type: none"> • Damaged bevel gear bearing. • Tightened excessively differential pinion gear on diff spider. • Tightened excessively side gear in differential case • Damaged diff pinion or side gear. • Worn or damaged thrust washer. • Excessive backlash between diff pinion and side gear. 	<ul style="list-style-type: none"> • Disassemble, check, repair or change. • Disassemble, check or change. • Change pinion gear or spider. • Change the side gear. • Change diff pinion or side gear. • Change thrust washer. • Change diff pinion or side gear.
3) Brake		
- Brakes produce noise, chatter, vibration	<ul style="list-style-type: none"> • Incorrect axle fluid and/or friction material used. 	<ul style="list-style-type: none"> • Use only MS precision specified or approved materials. • Drain and flush fluid from axle. Replace with approved fluid. • Replace all friction discs. Thoroughly clean or replace stationary discs.

Trouble symptom	Probable cause	Remedy
2. Oil leakage 1) External leakage	<ul style="list-style-type: none"> Excess of oil. Using different oil. Blocking air breather. Damaged of hub oil seal. Leakage at pinion shaft. <ul style="list-style-type: none"> Excess of oil. Using different oil. Blocking air breather. Worn or maladjustment pinion shaft oil seal. Loosened bleeder screw. Loosened inlet fitting or plugs. Damaged inlet fitting or plugs or damaged seats. 	<ul style="list-style-type: none"> Check oil level. Set of oil amount. Change oil. Washing or change air breather. Disassemble, check and change. Check oil level. Set of oil amount. Change oil. Washing or change air breather. Change oil seal. Tighten bleeder screw to 150~200 kgf · cm Tighten inlet fitting to 380~420 kgf · cm Replace inlet fitting or plug and O-ring if used. Repair or resurface area; or replace as necessary.
2) Internal brake <ul style="list-style-type: none"> Fluid bypasses seals into and fills axle with fluid and blows out breather or emptied brake fluid reservoir. 	<ul style="list-style-type: none"> Worn or damaged piston seal. Melted or extruded piston seals. Corrosion, pitting wear or other damage, marks, scratches to piston and/or brake housing bore in area seal/sealing lips. 	<ul style="list-style-type: none"> Replace piston seals. Correct cause of overheating and replace seals. Clean, smooth, rework or replace affected parts.
3. Axle does not revolution 1) Axle shaft	<ul style="list-style-type: none"> Injured axle shaft. Loosened and injured wheel bearing. A short shaft. Injured disc spline. 	<ul style="list-style-type: none"> Disassemble and change wheel bearing. Change axle shaft Change axle shaft
2) Hub	<ul style="list-style-type: none"> Injured axle shaft. Injured lock nut. Loosened and injured wheel bearing. Loosened and damaged bolt between wheel shaft and hub flange. Loosened or injured hub bolt and hub nut. 	<ul style="list-style-type: none"> Change lock nut. Reassemble or change wheel bearing. Reassemble or change bolt. Reassemble or change hub bolt.
3) Differential	<ul style="list-style-type: none"> Damaged diff pinion and side gear. Damaged diff spider. Damaged differential case. Damaged ring gear and pinion gear. 	<ul style="list-style-type: none"> Change the damaged part. Change the damaged part. Change the damaged part. Change the damaged part.

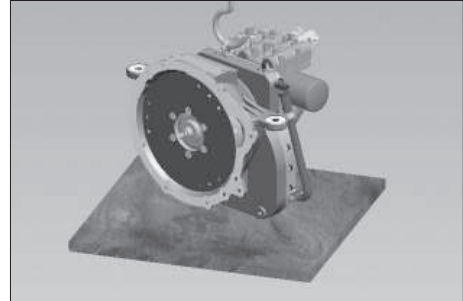
GROUP 3 DISASSEMBLY AND ASSEMBLY

1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLING OF TRANSMISSION ASSY

- (1) Drain the transmission oil.
Remove the drain plug at T/C housing.
- (2) Lay the wood plate (or plastic plate) on the workshop's table (bottom).
And put the T/M assy on the wood plate (or plastic plate) : For an (dis) assembly at the time of damage prevent.

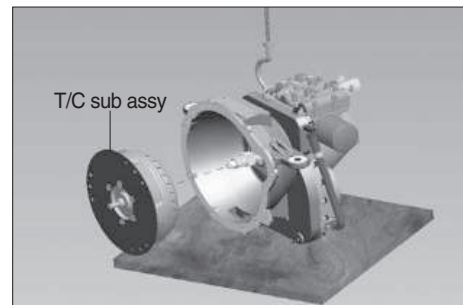
▲ To avoid serious personal injury and possible damage to components, be very careful when using lifting devices during removal and disassembly procedures.



15L7ATM001

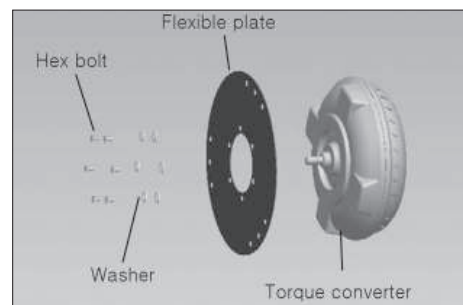
- (3) Removal torque converter part.

- ① Remove the torque converter sub assy.



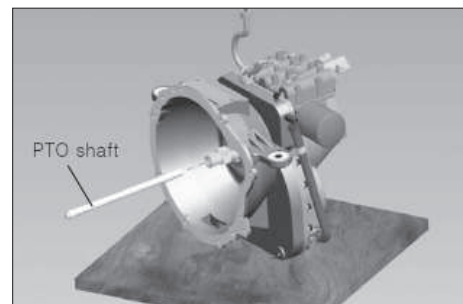
15L7ATM002

- ② Remove the hexagon bolt , washer, flexible plate.



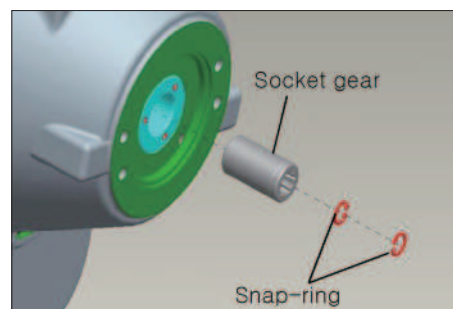
15L7ATM003

- (4) Remove the PTO shaft.



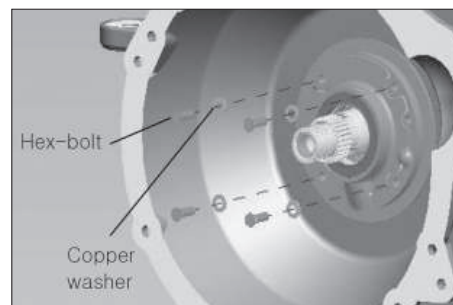
15L7ATM004

- (5) Remove the socket gear.
Next remove the snap-ring at socket gear.



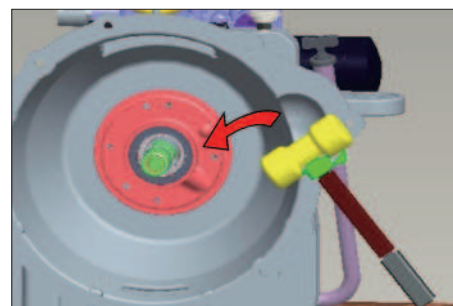
22D9TTM005

- (6) Removal the oil pump sub assy.
- ① Remove the hexagon bolt ($M8 \times 1.25P \times 38L$), and then remove the copper washer.



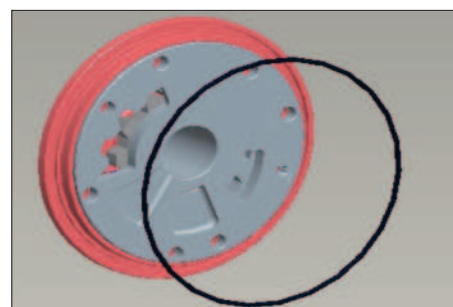
15L7ATM006

※ Use a plastic mallet to decomposition.



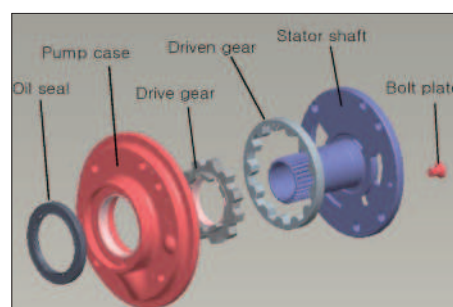
22D9TTM007

- ② Remove the O-ring at pump sub assy.



22D9TTM008

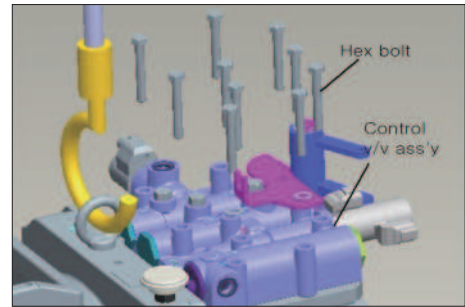
- ③ Remove the oil seal, pump case, drive gear, driven gear, stator shaft and bolt plate.



22D9TTM009

(7) Removal the control valve sub assy.

- ① Remove the hexagon bolt (M8 × 1.25P × 60L).



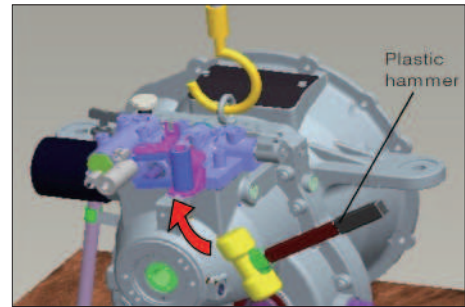
22D9TTM010

- ② Remove the part slowly with hit the end side softly.

※ Using a plastic hammer .

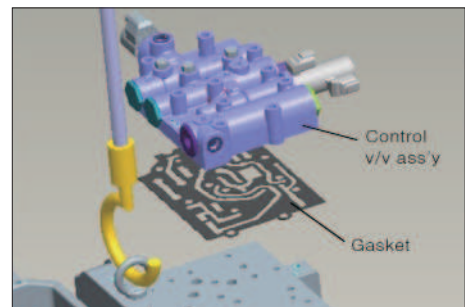
Do not hit steel parts with a steel hammer.

Pieces of a part can break off and cause serious personal injury.



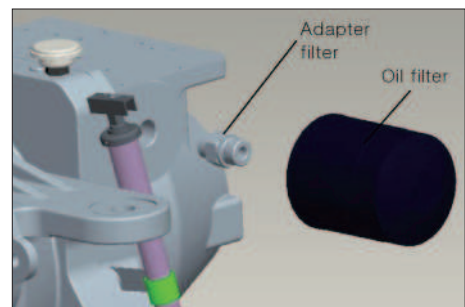
22D9TTM011

- ③ Remove the control valve assy, and then remove the gasket.



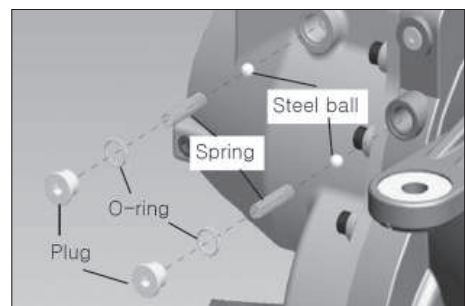
22D9TTM012

- (8) Remove the oil filter, and then remove the filter adapter.



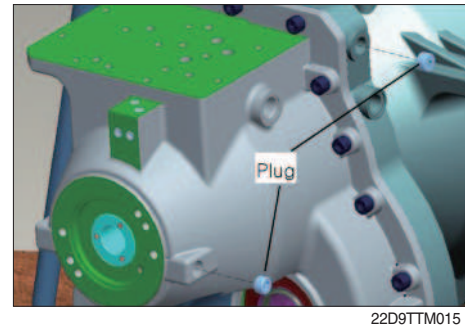
22D9TTM013

- (9) Remove the (T/C in relief, cooler relief) plug, and then remove the spring, steel ball.
Next remove the O-ring at relief plug.

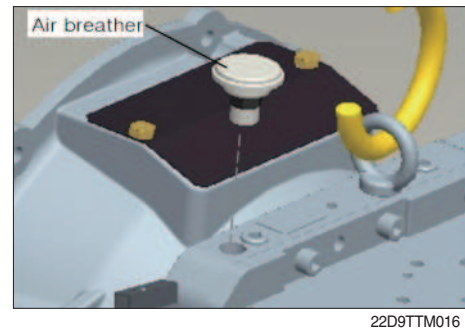


15L7ATM014

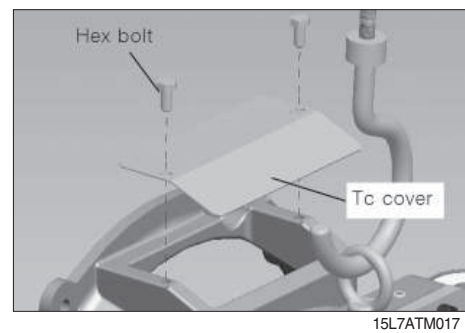
(10) Remove the cooler (in/out) plug.(M16)



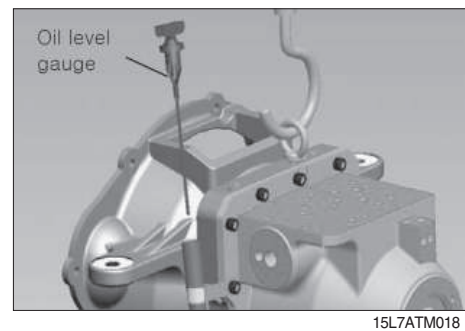
(11) Remove the air breather.



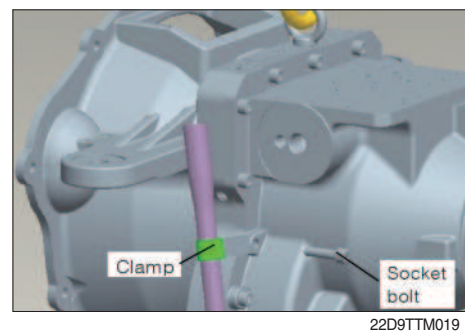
(12) Remove the hexagon bolt, and then remove the T/ C cover.



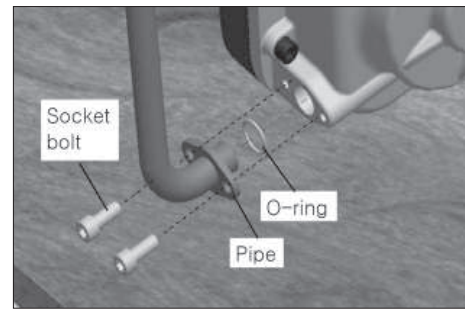
(13) Remove the oil level gauge.



(14) Remove the socket bolt, and then remove the clamp.

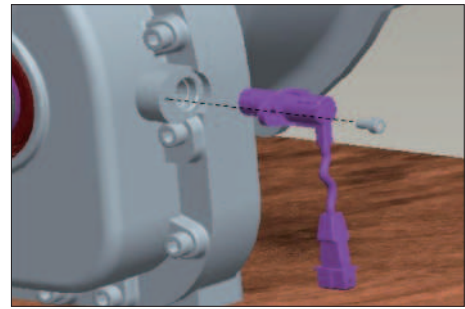


- (15) Remove the socket bolt, and then remove the pipe.
Next remove the O-ring at the pipe.



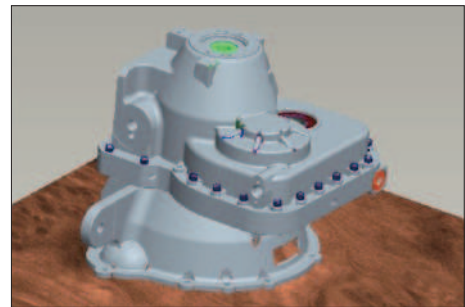
15L7ATM020

- (16) Remove the socket bolt, and then remove the speed sensor.



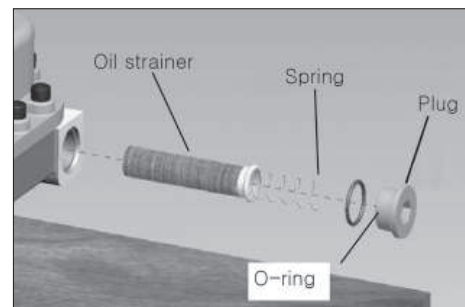
22D9TTM021

- (17) Lay the T/M assy without damage to the T/C housing.(engine mounting surface)



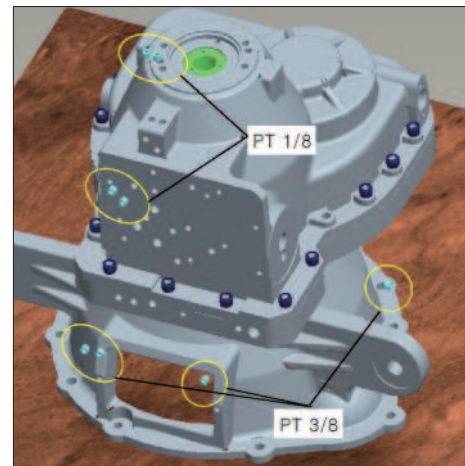
22D9TTM022

- (18) Remove the plug, and then remove the spring, oil strainer.
Next remove the O-ring at the plug.



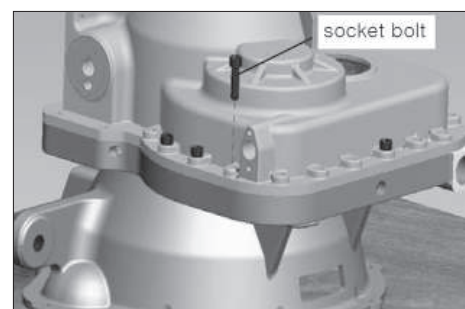
15L7ATM023

(19) Remove the plug.(PT 1/8 × 4EA, PT3/8 × 4EA)

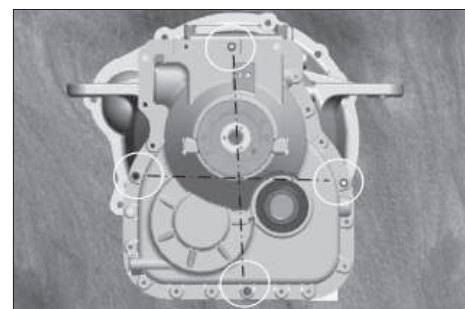


22D9TTM024

(20) Remove the socket bolt (T/M case + T/C housing fastening bolt) 4 socket bolt exclusions.

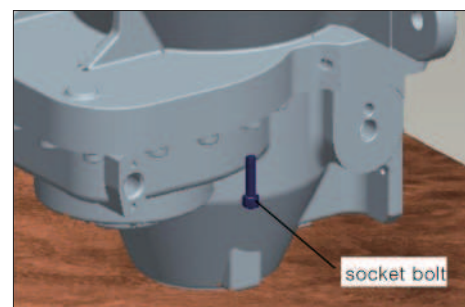


15L7ATM025



15L7ATM026

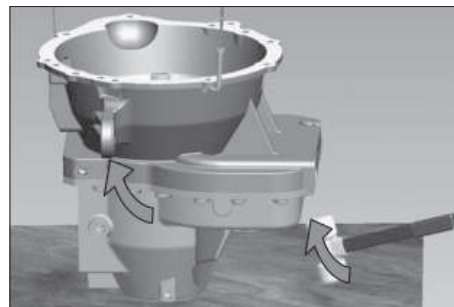
(21) To turn over T/M assy without damage to the T/M case. (main pump mounting surface)
Next remove the 4 socket bolt.



22D9TTM027

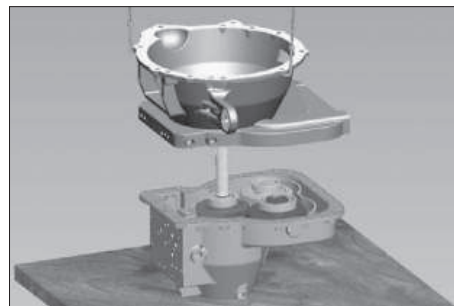
(22) Remove the part slowly with hit the end side softly.

※ Using a plastic hammer.



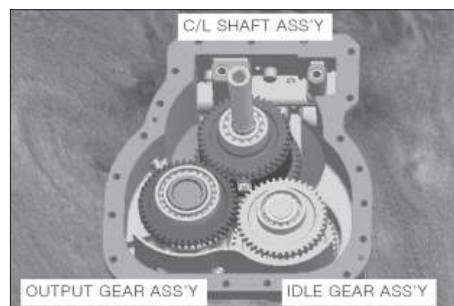
15L7ATM028

(23) Remove the T/C housing.



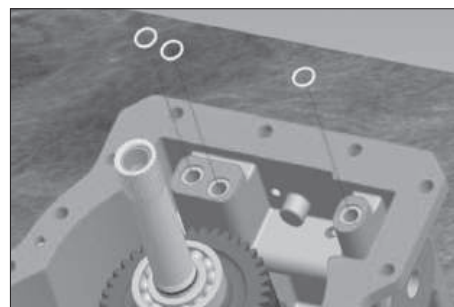
15L7ATM029

(24) Gear assemblies arrangements.



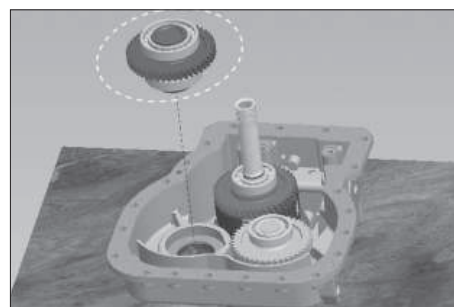
15L7ATM030

(25) Remove the O-ring.



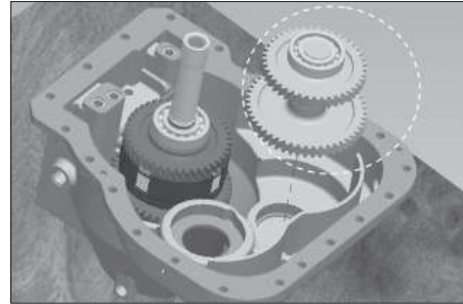
15L7ATM031

(26) Remove the output gear assy.



15L7ATM032

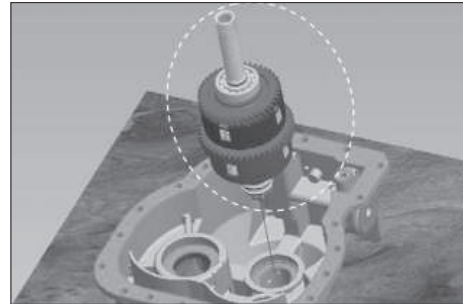
(27) Remove the idle gear assy.



15L7ATM033

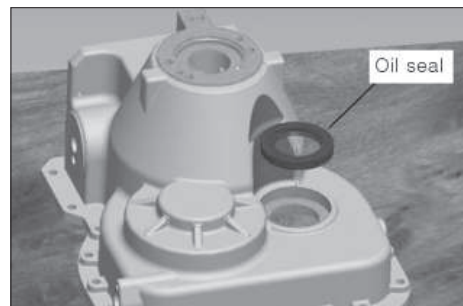
(28) Remove the clutch gear assy.

※ Store each gear assembly in separate box.



15L7ATM034

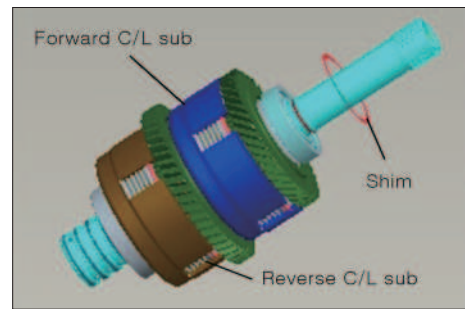
(29) Remove the oil seal.



15L7ATM035

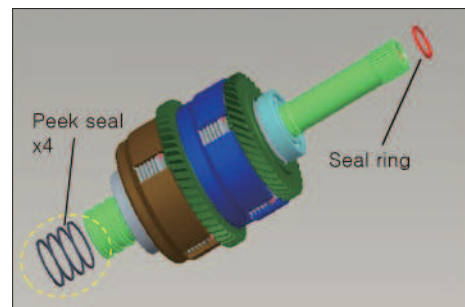
2) DISASSEMBLING OF GEAR ASSEMBLIES

(1) Disassembling clutch gear assy.



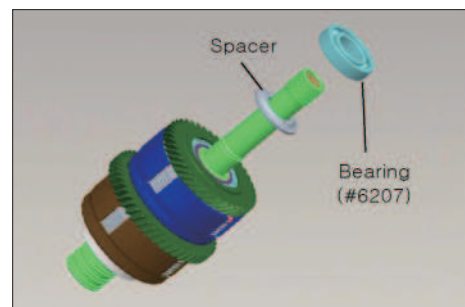
22D9TTM036

① Remove the peek seal and seal ring.



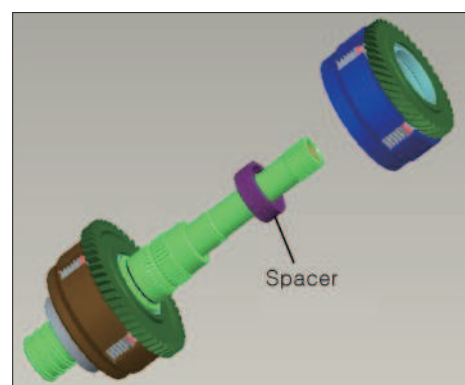
22D9TTM037

② Pull out the bearing (#6207) and spacer from the shaft.



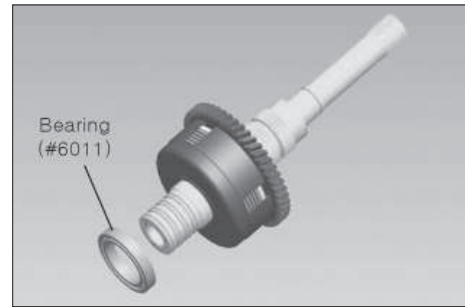
22D9TTM038

③ Pull out the forward clutch sub assy and space.



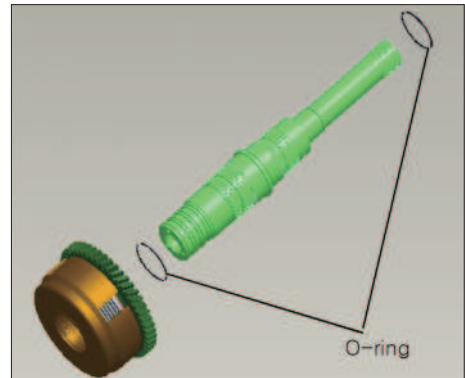
22D9TTM039

- ④ Pull out the bearing (#6911) from the shaft.



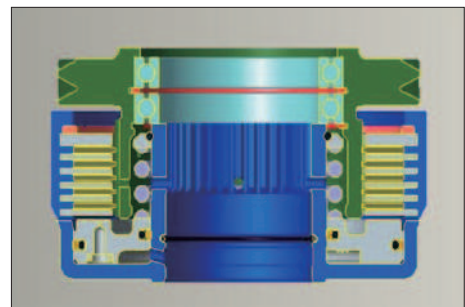
22D9TTM040

- ⑤ Pull out the reverse clutch sub assy and remove the O-ring.



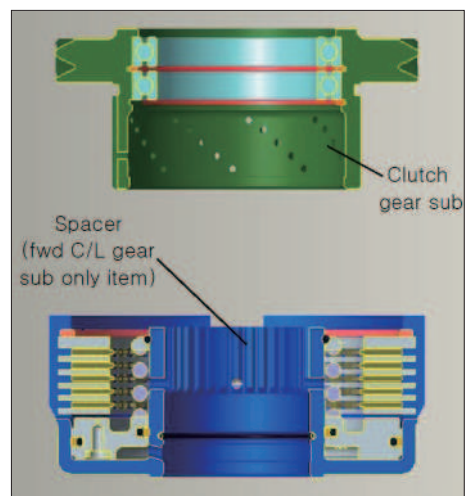
22D9TTM041

- ⑥ Forward clutch sub assy.



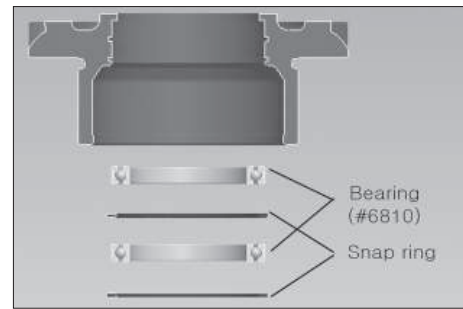
22D9TTM042

- ⑦ Remove the forward clutch gear sub, and then remove the spacer.



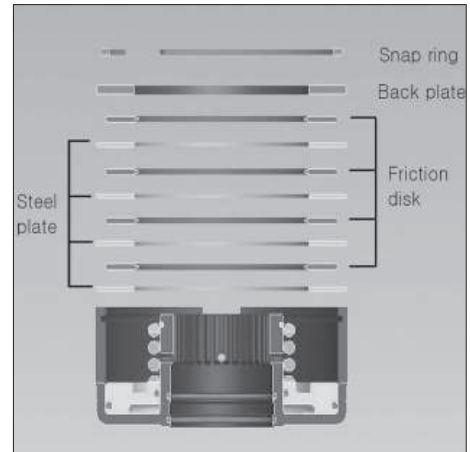
22D9TTM043

- ⑧ Remove the snap ring, and then remove the bearing.



15L7ATM044

- ⑨ Remove the snap ring, and then remove the back plate, friction disk, and steel plate.

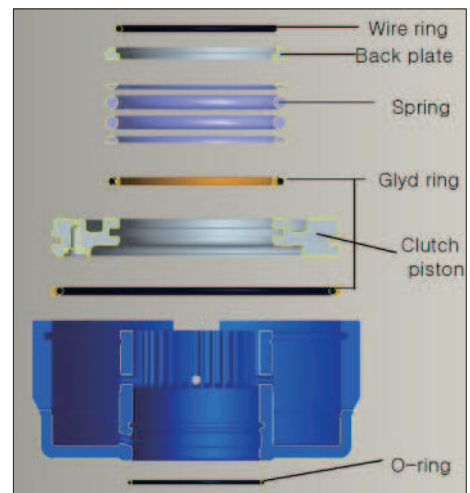


15L7ATM045

- ⑩ Remove the wire ring, and then remove the back plate and spring.

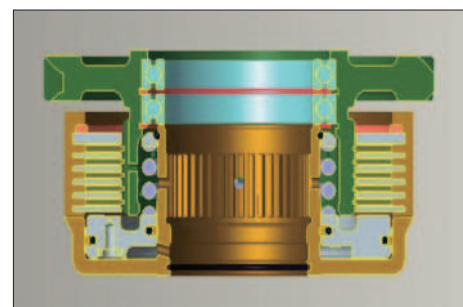
⚠ When you remove the wire-ring, it might be shot out by impact of spring. Certainly fixing the spring, will have to remove.

- ⑪ Pull out the clutch piston, and then remove the O-ring.
Next remove the glyd ring at the clutch piston.



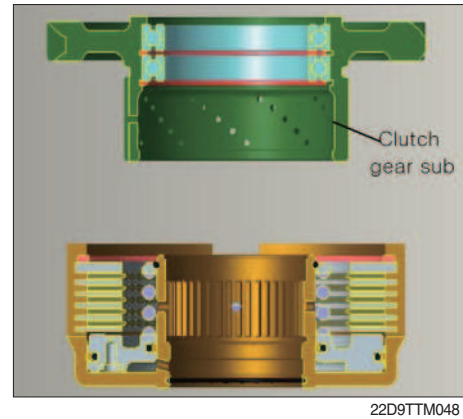
22D9TTM046

- ⑫ Reverse clutch sub assy.

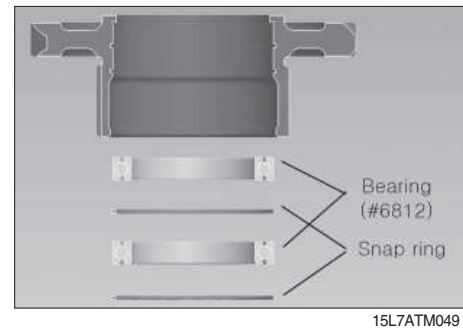


22D9TTM047

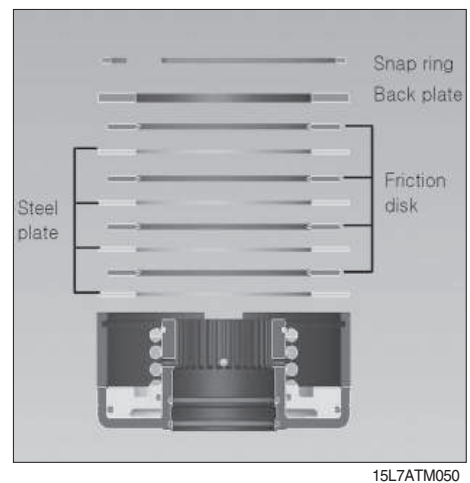
- ⑬ Remove the reverse clutch gear sub.



- ⑭ Remove the snap ring, and then remove the bearing.



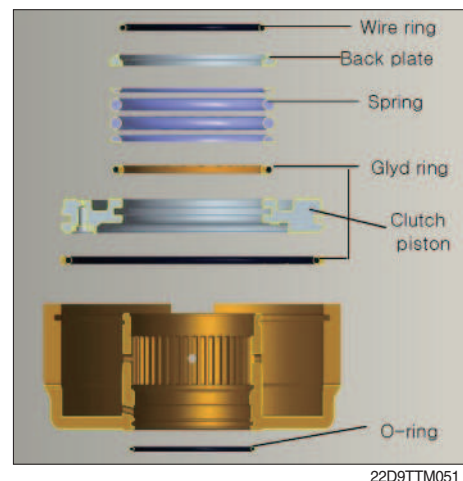
- ⑮ Remove the snap ring, and then remove the back plate, friction disk, and steel plate.



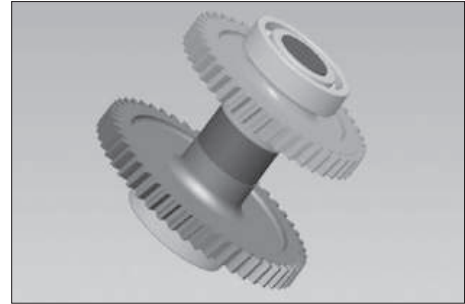
- ⑯ Remove the wire ring, and then remove the back plate and spring.

⚠ When you remove the wire-ring, it might be shot out by impact of spring.
Certainly fixing the spring, will have to remove.

- ⑰ Pull out the clutch piston, and then remove the O-ring.
- Next remove the glyd ring at the clutch piston.

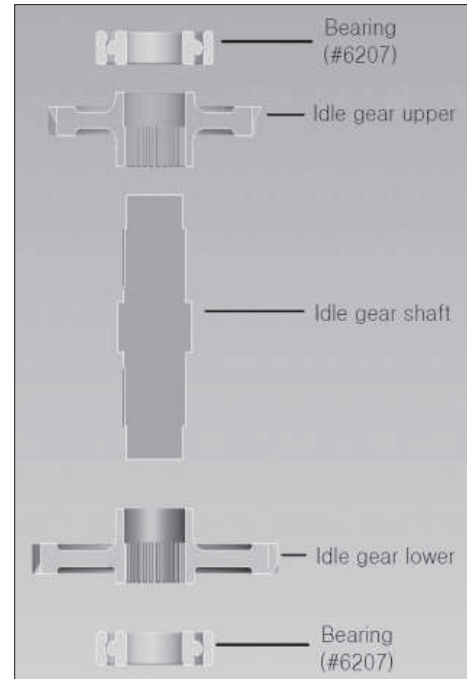


(2) Disassembling of Idle gear assy.



15L7ATM052

- ① Pull out the bearing, and then remove the idle gear upper (lower).



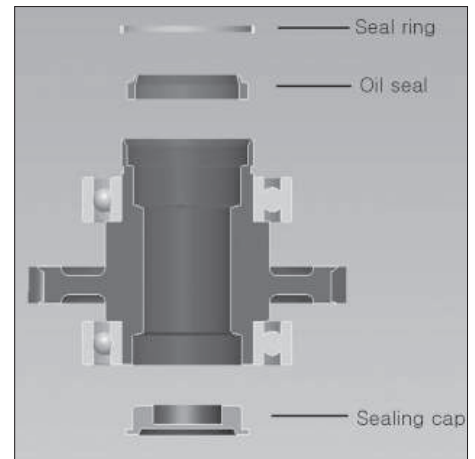
15L7ATM053

(3) Disassembling of output gear assy.



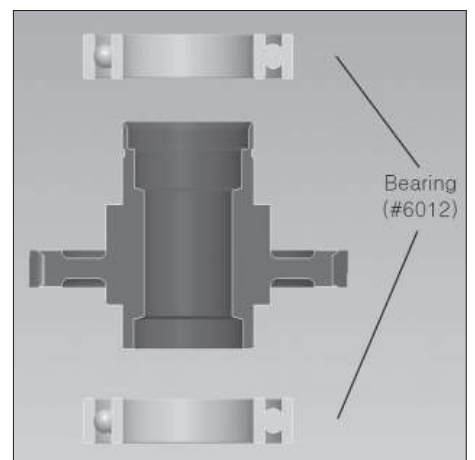
15L7ATM054

- ① Remove the seal ring, oil seal and sealing cap.



15L7ATM055

- ② Pull out the bearing.



15L7ATM056

2. ASSEMBLY OF TRANSMISSION

1) ASSEMBLING OF GEAR ASSEMBLIES

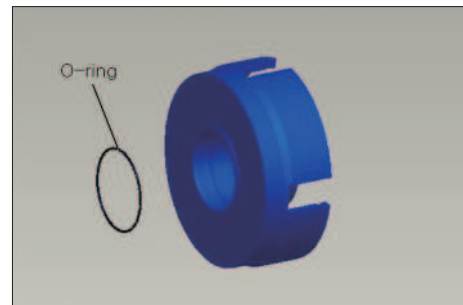
※ Assemble the part with reverse the aforementioned disassemble procedure.

· Assembling of clutch gear assembly.

(1) Forward clutch drum sub assembly.

① In drum internal groove O-ring assembly.

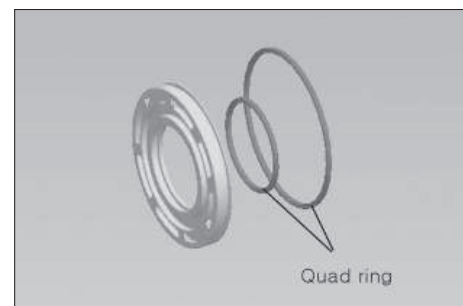
※ Spread grease on seal ring.



22D9TTM057

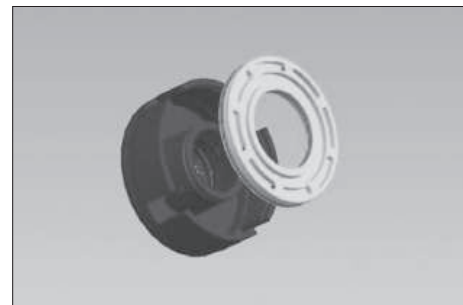
② In piston groove glyd ring assembly.

※ Spread grease on glyd ring.



15L7ATM058

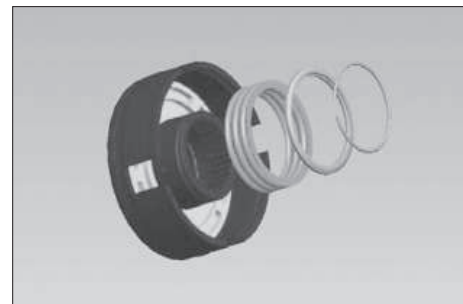
③ Assemble piston at the drum.



15L7ATM059

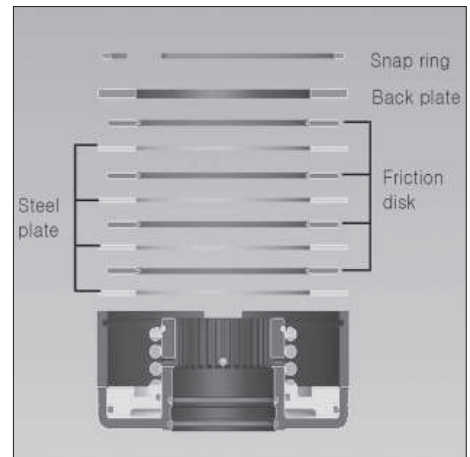
④ Assemble return spring, plate back and wire ring at the drum sub.

▲ When you assemble the wire ring, it might be shot out by impact of spring.
Certainly fixing the spring, will have to assemble.



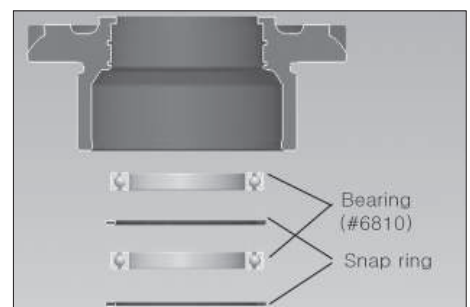
15L7ATM060

- ⑤ First insert steel plate, and then insert friction disk alternately.
Next insert the back plate, and then assemble the snap ring.



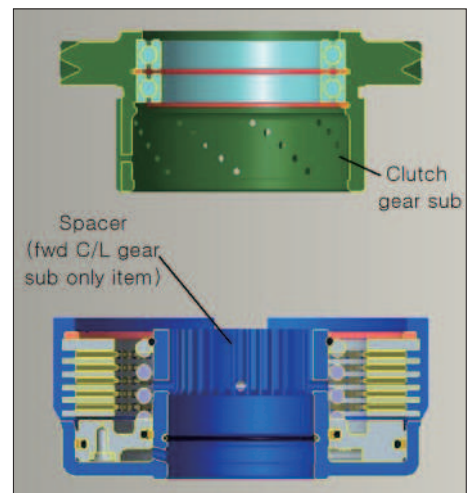
15L7ATM061

- ⑥ Assemble the bearing, and then assemble the snap ring alternately.



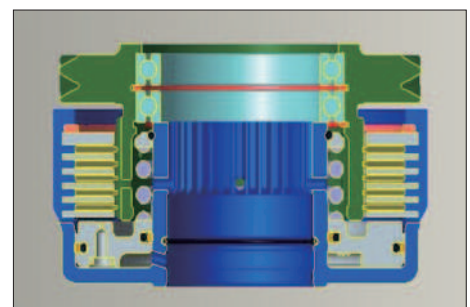
15L7ATM062

- ⑦ Arrange serration of the friction disk, and then assemble the spacer, clutch gear sub.



22D9TTM063

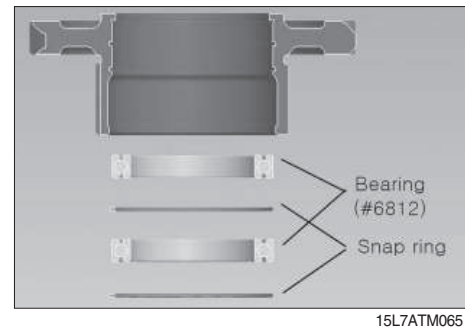
- ⑧ Forward clutch drum sub assembly.



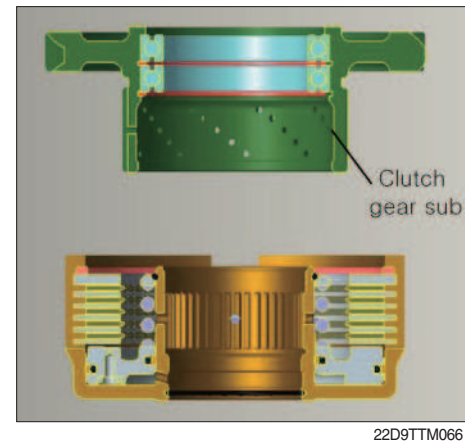
22D9TTM064

(2) Reverse clutch drum sub assembly.

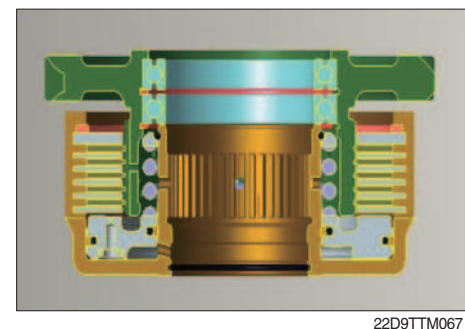
- ① Do work as the same way like forward clutch drum sub assembly procedure 1) ① ~ ⑤.
- ② Assemble the bearing, and then assemble the snap ring alternately.



- ③ Arrange serration of the friction disk, and then assemble the clutch gear sub.

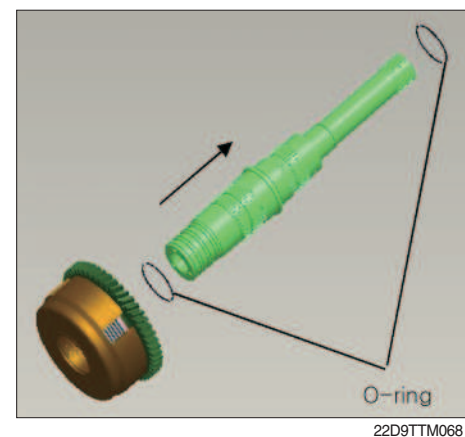


- ④ Reverse clutch drum sub assembly.

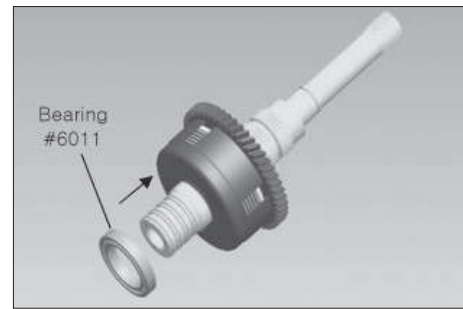


(3) Clutch gear assembly

- ① Assemble the reverse clutch drum sub assy and O-ring at the shaft sub assy.

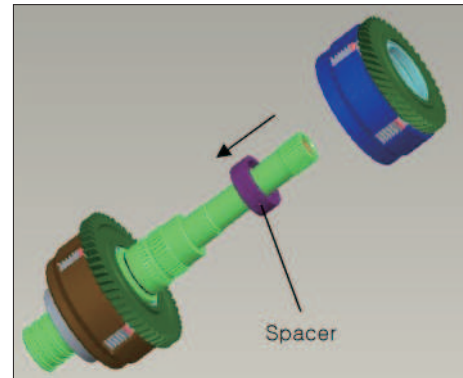


- ② Assemble the bearing.
 - Used method of heating bearing.
 ※ All bearings should never be heated above 120 °C.



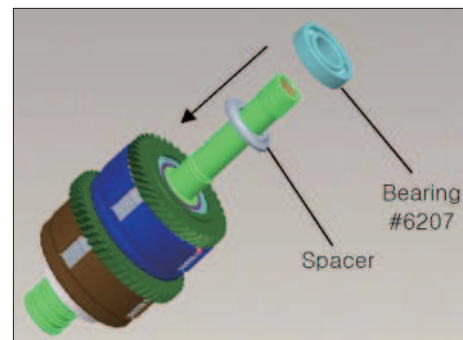
15L7ATM069

- ③ Assemble the forward clutch drum sub assy and space at the shaft sub assy.



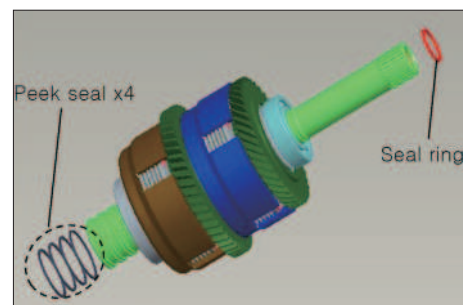
22D9TTM070

- ④ Assemble the spacer and bearing.
 - Used method of heating bearing.



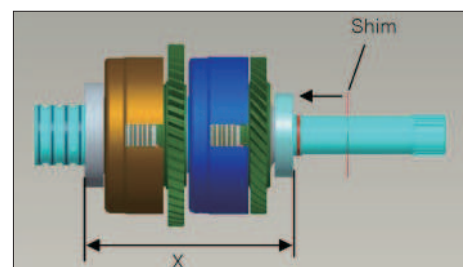
22D9TTM071

- ⑤ Assemble the peek seal and seal ring.
 ※ Spread grease on peek seal and seal ring.



22D9TTM072

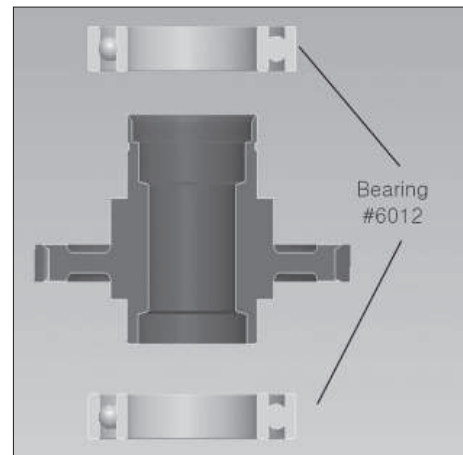
- ⑥ Clutch gear assy. (assemble the shim)
 ※ Bearing distance (191.5) - X = The amount of shim
 (It will manage bearing distance $191.5^{0}_{-0.1}$)



22D9TTM073

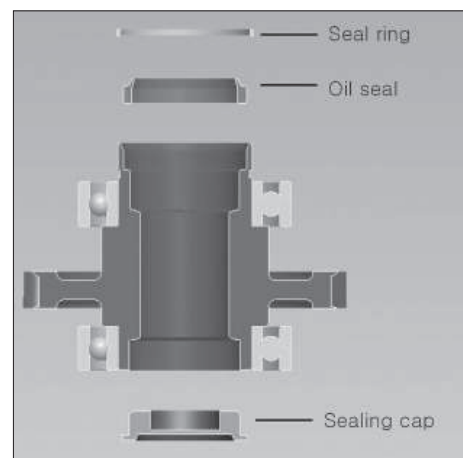
Assembling of output gear assembly.

- ① Assemble the bearing.
 - Used method of heating bearing
- ※ All bearings should never be heated above 120 °C.



15L7ATM074

- ② Assemble the oil seal, seal ring and sealing cap.
 - ※ Spread loctite #609 on the out wheel of oil seal, spread grease on inside wheel of oil seal.
 - ※ Spread grease on seal ring.
 - ※ Spread loctite #592 on the out wheel of sealing cap.



15L7ATM075

- ③ Output gear assy.

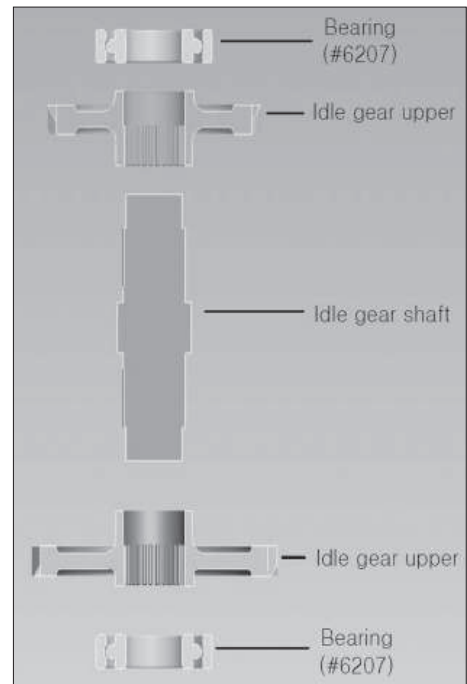


15L7ATM076

Assembling of idle gear assembly.

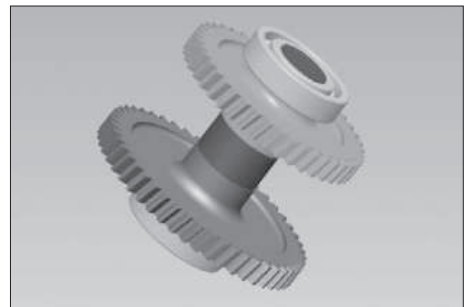
- ① Press the idle gear upper and idle gear lower at the idle gear shaft, and then assemble the bearing.
- Used method of heating bearing

※ All bearings should never be heated above 120 °C.



15L7ATM077

- ② Idle gear assy.

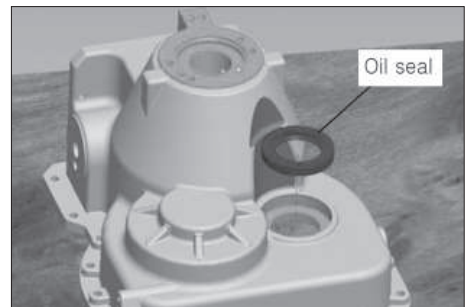


15L7ATM078

2) ASSEMBLING OF TRANSMISSION ASSY

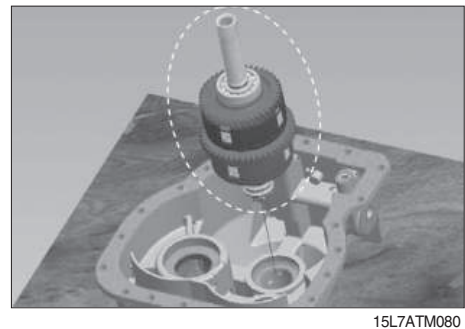
(1) Press the oil seal.

- ※ Spread loctite #592 on the out wheel of oil seal, spread grease on inside wheel of oil seal.

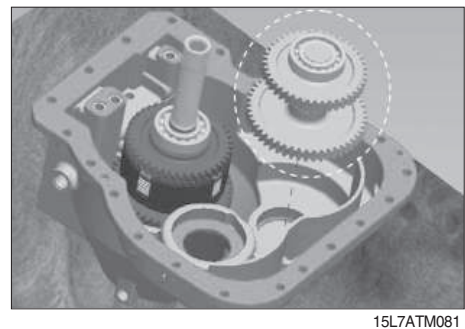


(2) Assemble the clutch gear assy.

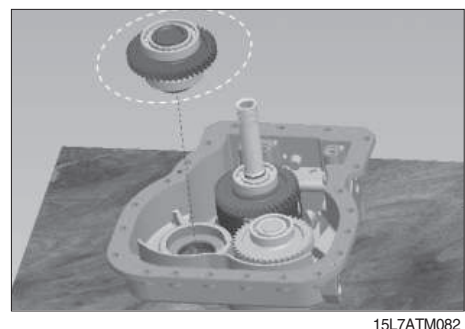
- ※ When you insert the shaft after install the seal ring in the shaft, please insert the shaft with turning it into the shaft side and hole side of shaft for prevent the damage of shaft.



(3) Assemble the idle gear assy.

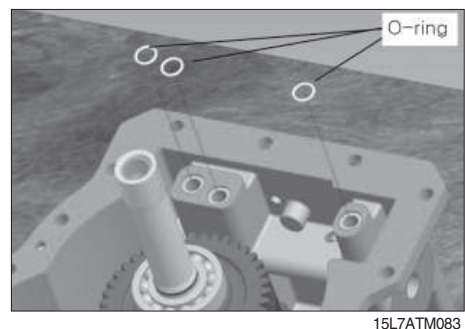


(4) Assemble the output gear assy.



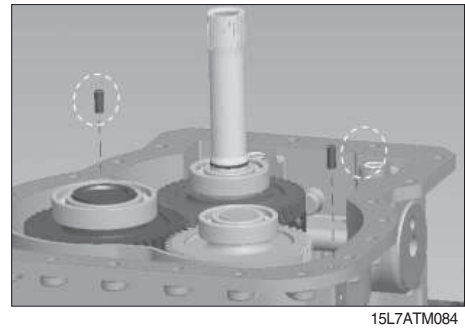
(5) Assemble the O-rings.

- ※ Spread grease on O-ring.

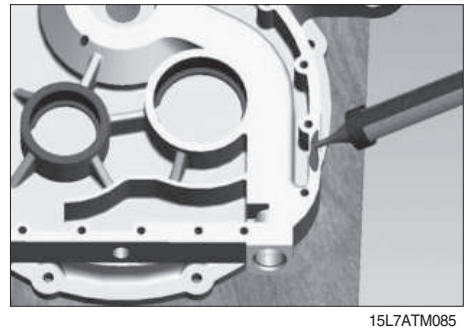


(6) Press the lock-pins.

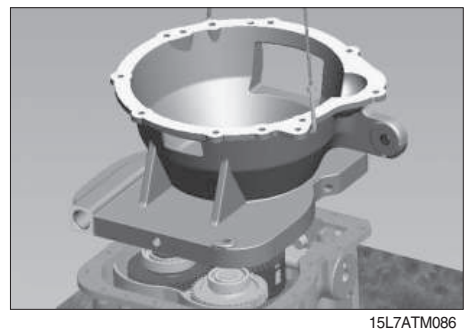
※ After the assembling, please check whether you can turn the input (output) gear lightly by your hand.



(7) Spread loctite #5127 on T/C housing space.

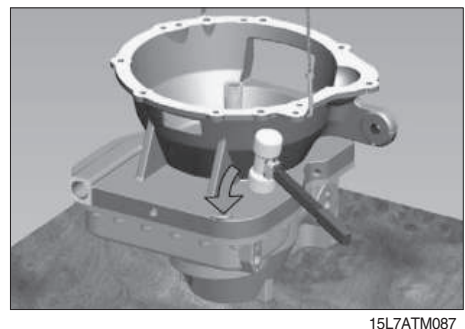


(8) Assemble the T/C housing.



(9) Assemble the part slowly with hit the end side softly.

※ Using a plastic hammer.



(10) Assemble the socket bolts.
(T/M case + T/C housing softly fastening)

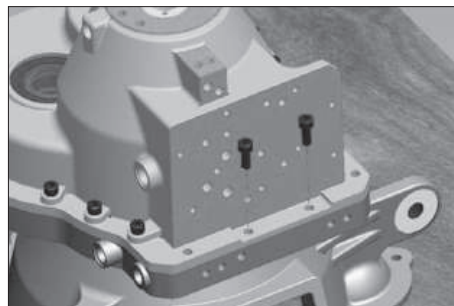


- (11) Turn over T/M assy without damage to the T/C housing.(engine mounting surface)
Next assemble the socket bolts.
- Socket bolt (M10 × 1.5p × 40 mm) × 16EA
 - Tightening torque : 6.5~7.0 kgf · m (47~50.5 lbf · ft)
- ※ Spread loctite #277 on socket bolt.



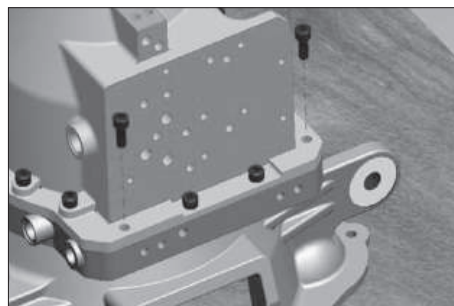
15L7ATM089

- (12) Assemble the socket bolts.
- Socket bolt (M10 × 1.5p × 25mm) × 2EA
 - Tightening torque : 6.5~7.0 kgf · m (47~50.5 lbf · ft)
- ※ Spread loctite #277 on socket bolt.



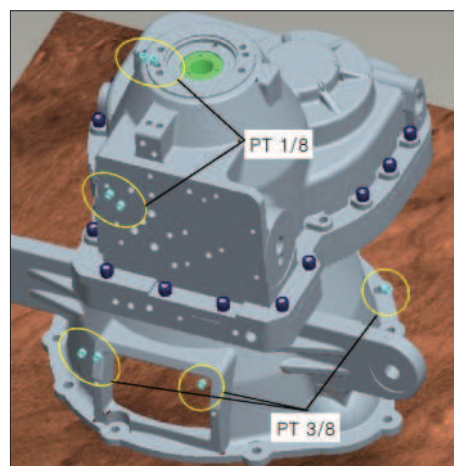
15L7ATM090

- (13) Assemble the socket bolts.
- Socket bolt (M10 × 1.5p × 30 mm) × 2EA
 - Tightening torque : 6.5~7.0 kgf · m (47~50.5 lbf · ft)
- ※ Spread loctite #277 on socket bolt.



15L7ATM091

- (14) Assemble the plugs(PT 1/8, PT 3/8) × 4EA
- PT 1/8 Tightening torque : 1.0~1.5 kgf · m (7.0~11 lbf · ft)
 - PT 3/8 Tightening torque : 3.0~4.5 kgf · m (21.5~29.0 lbf · ft)
- ※ Spread loctite #577 on plug.

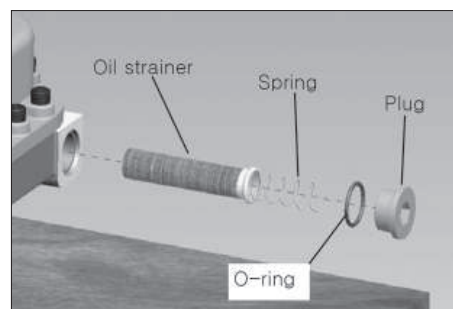


22D9TTM092

- (15) Assemble the O-ring at the plug.
Insert the oil strainer, spring, and then assemble O-ring+plug assy.

- Plug tightening torque : 8~10 kgf · m
(58~72 lbf · ft)

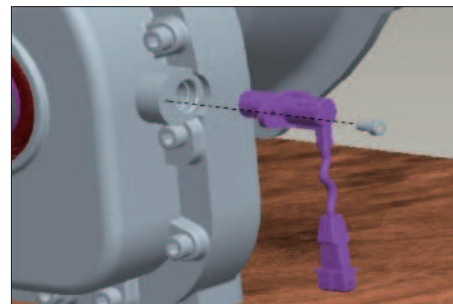
※ Spread grease on O-ring.



15L7ATM093

- (16) Assemble the speed sensor, next assemble the socket bolts.

- Tightening torque : 0.5~0.8 kgf · m (3.5~5.5 lbf · ft)



22D9TTM094

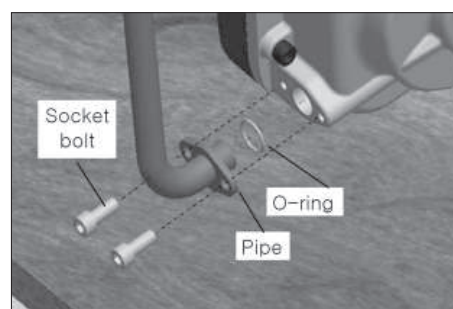
- (17) Assemble the O-ring at the pipe, and then assemble the pipe+O-ring assy.

Next assemble the socket bolts.

- Socket bolt (M8 × 1.5p × 15 mm) × 2EA
- Tightening torque : 3.2~3.6 kgf · m (23~26 lbf · ft)

※ Spread grease on O-ring.

※ Spread loctite #277 on socket bolt.

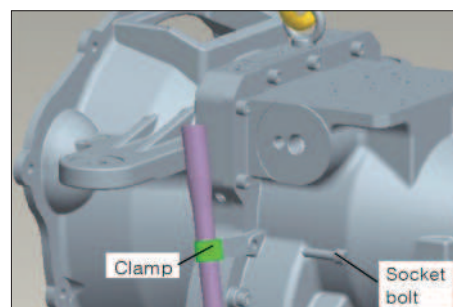


15L7ATM095

- (18) Assemble the clamp at the pipe,
and then assemble the socket bolt.

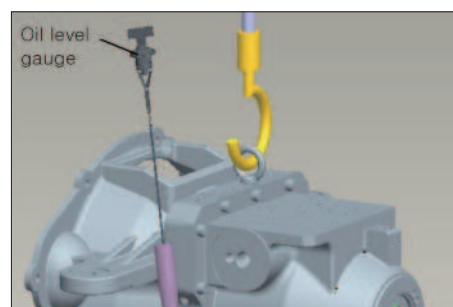
- Socket bolt (M10 × 1.5p × 30 mm)
- Tightening torque : 5.5~6.5 kgf · m (40~47 lbf · ft)

※ Spread loctite #277 on socket bolt.



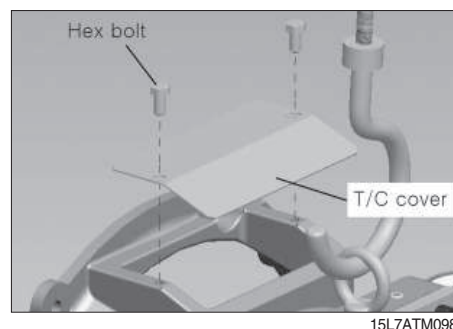
22D9TTM096

- (19) Assemble the oil level gauge at the pipe.

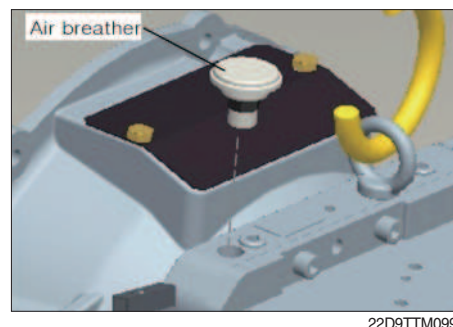


22D9TTM097

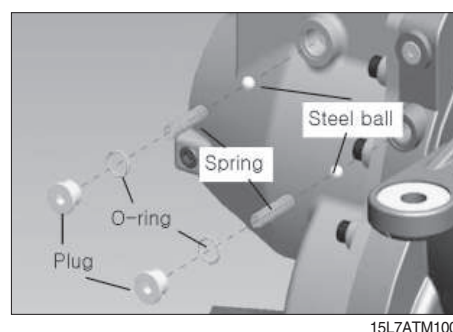
- (20) Assemble the T/C cover and hexagon bolts.
- Hexagon bolt (M8 × 1.25p × 16 mm) × 2EA
 - Tightening torque : 3.2~3.6 kgf · m (23~26 lbf · ft)
- ※ Spread loctite #277 on socket bolt.



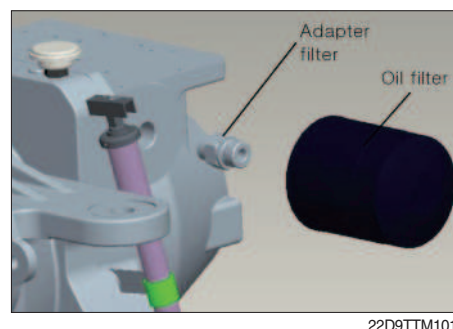
- (21) Assemble the air breather.
- Tightening torque : 3.0~4.0 kgf · m (21.5~29 lbf · ft)
- ※ Spread loctite #577 on air breather.



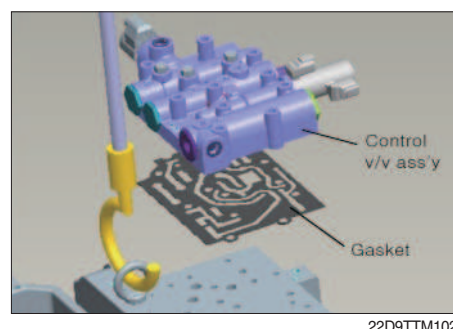
- (22) Assemble the O-ring at the plug, and then insert steel ball, spring.
- Next assemble O-ring+plug assy.
- Plug (3/4-16 UNF) × 2EA
 - Tightening torque : 3.5~4.5 kgf · m (25~33 lbf · ft)
- ※ Spread loctite #577 on plug.
- ※ Spread grease on O-ring.



- (23) Assemble the adapter filter, and then assemble the oil filter.
- Adapter filter
 - Tightening torque : 3.5~4.5 kgf · m (25~32 lbf · ft)
- ※ Spread loctite #277 on adapter filter.
- Oil filter
 - Tightening torque : 2.2~2.5 kgf · m (16~18 lbf · ft)

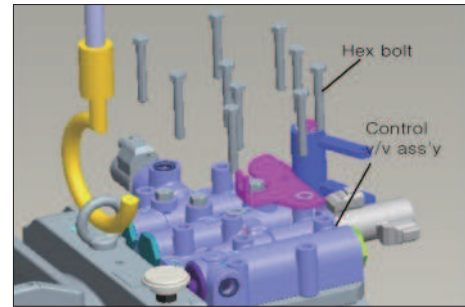


- (24) Install the gasket, and then install the control valve assy.
- ※ Spread grease on gasket.



(25) Assemble the hex bolt.

- Hexagon bolt (M8 × 1.25p × 60 mm) × 10EA
- Tightening torque : 3.2~3.6 kgf · m (23~26 lbf · ft)

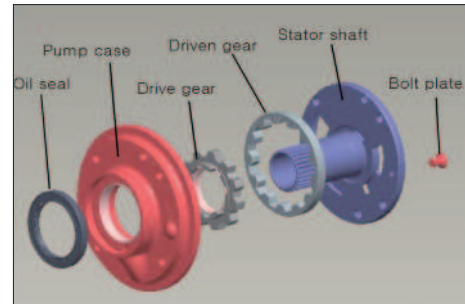


22D9TTM103

(26) Assemble the drive gear, driven gear and stator shaft at the pump case and assemble the bolt plate and then oil seal.

- Bolt plate
- Tightening torque : 3.0~4.0 kgf · m (21~29 lbf · ft)

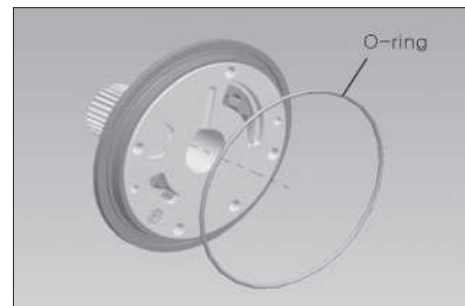
※ Spread Loctite #592 on the out wheel of oil seal, spread grease on inside wheel of oil seal.



22D9TTM104

(27) Assemble the O-ring at the charging pump assy.

※ Spread grease on O-ring.



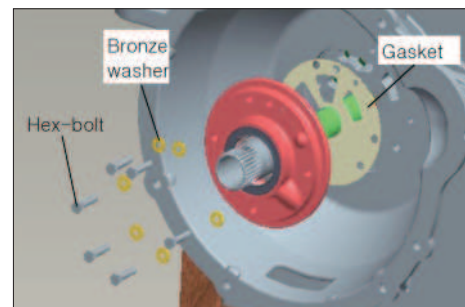
15L7ATM104

(28) Install the gasket at the T/C housing, and then install the charging pump assy.

Next assemble the hexagon bolt and bronze washer.

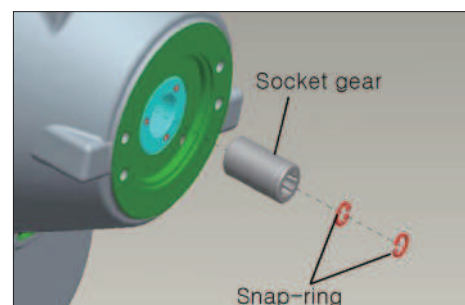
- ※ Spread grease on gasket.
- Hexagon bolt (M8 × 1.25p × 38L) × 6EA
- Tightening torque : 3.2~3.6 kgf · m (23~26 lbf · ft)

※ Spread loctite #242 on hexagon bolt.



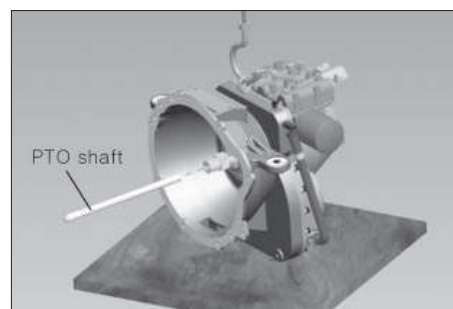
22D9TTM105

(29) Assemble the snap ring at the socket gear, and then insert the socket gear sub assy at the cylinder gear assy.



22D9TTM106

(30) Insert the PTO shaft.

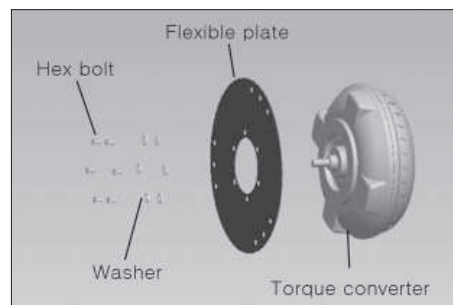


15L7ATM107

(31) Install the flexible plate at the torque converter, and then install the hexagon bolt and washer.

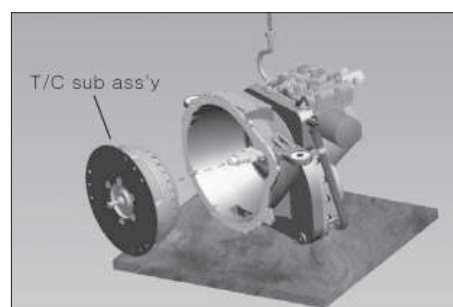
- Hexagon bolt (3/8-24UNF-2B) × 6EA
- Tightening torque : 3.0~3.5 kgf · m
(21.6~25.3 lbf · ft)

※ Spread loctite #277 on hexagon bolt



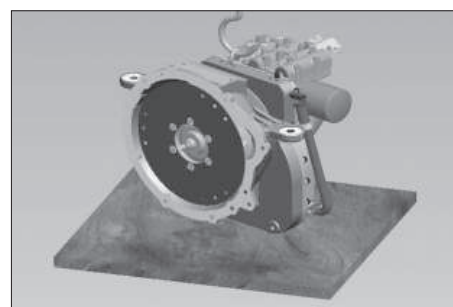
15L7ATM108

(32) Insert the T/C sub ass'y at the T/M sub ass'y.



15L7ATM109

(33) Transmission assy.

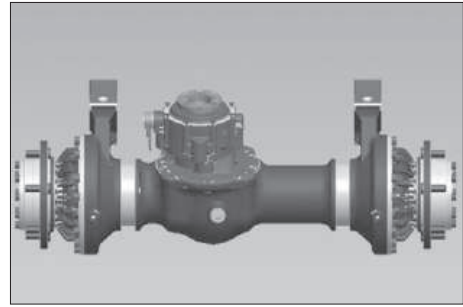


15L7ATM110

3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY

(1) Disassembling of drive axle assy.

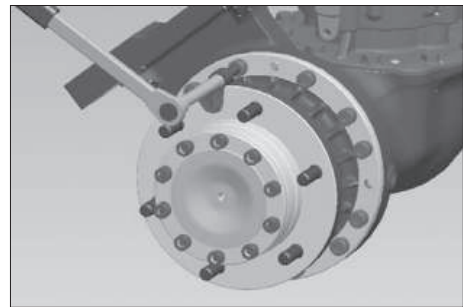


15L7ADA001

(2) Remove bolts of hub sub assembly.

▲ To avoid serious personal injury and possible damage to components, be very careful when using lifting devices during removal and disassembly procedures.

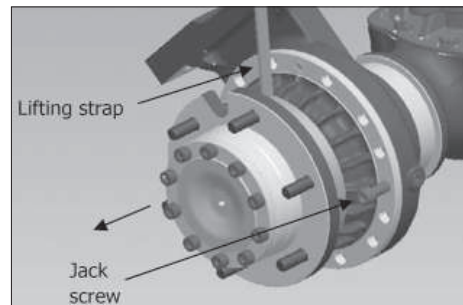
- Inspect to make sure that neither lifting strap is damaged.
- Do not subject lifting straps to any shock or drop loading.



15L7ADA002

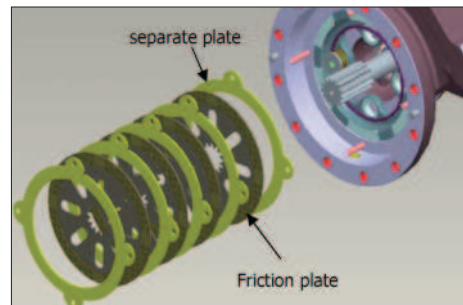
(3) After support hub sub assembly by lifting device, make hub sub assembly separate at the same intervals by tightening two jack screw.

▲ Use care when you remove the hub assembly to prevent the hub assembly from falling off of the lifting device. Do not drop the hub assembly. Damage to the hub assembly and serious personal injury can result.



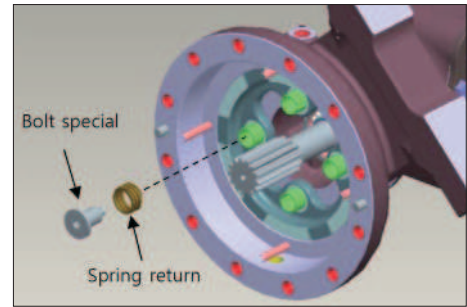
15L7ADA003

(4) Disassemble in order of separate plate → friction plate.



22D9TDA004

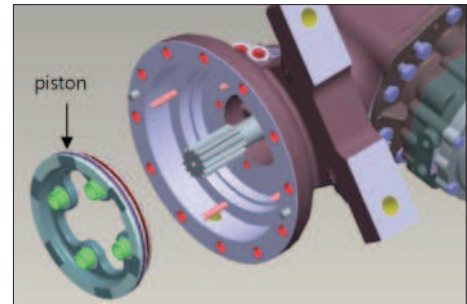
- (5) Disassemble in order of special bolt → return spring.



22D9TDA006

- (6) Remove the brake piston.

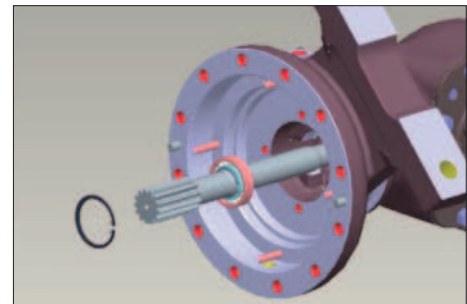
※ Caution of the quad ring damage.



22D9TDA007

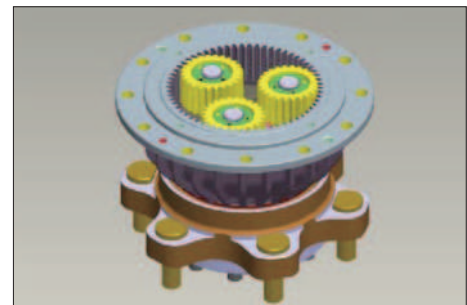
- (7) After remove retaining ring, pull out left axle shaft.
(Do work as the same way like right axle shaft)

**▲ Use a brass, leather or rubber mallet for assembly and disassembly procedures.
Do not hit steel parts with a steel hammer.
Pieces of a part can break off and cause serious personal injury.**



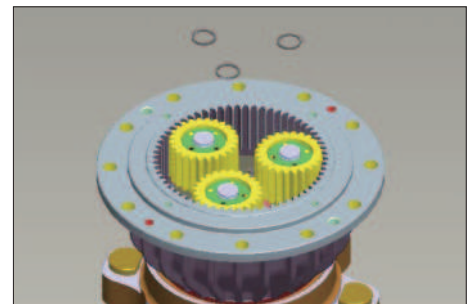
22D9TDA008

- (8) Disassembling of hub sub assy.



22D9TDA009

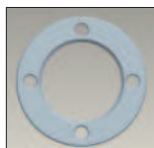
- (9) Remove all snap rings.



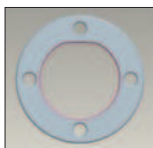
22D9TDA010

(10) Remove all each parts in order of thrust washer → planet gear → needle bearing → thrust washer.

※ Check to be sure that the needle roller quantity.
(19 EA/1 gear)

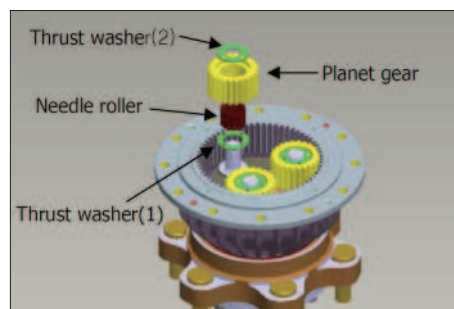


22D9TDA011-1



22D9TDA011-2

Thrust washer (1) Thrust washer (2)



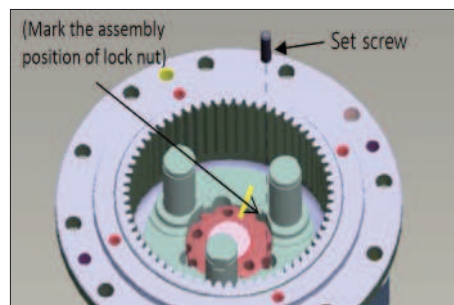
22D9TDA011

(11) Disassemble the set screw.

When hard to disassemble by loctite, heating the set screw on 1 min by heating device. And then try to disassemble.

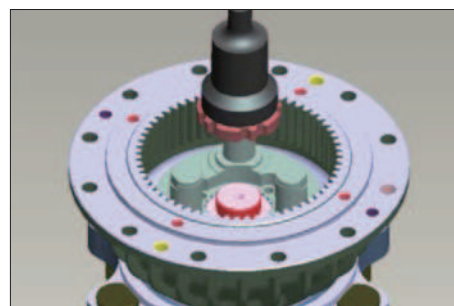
Mark the position, before disassemble.

When the bearings, wheel shaft, housing is not replaced, use the replaced shim.



22D9TDA011A

(12) Loose lock nut by using jig.

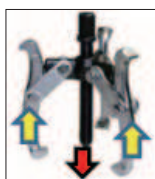


22D9TDA012

(13) Extract planet carrier.

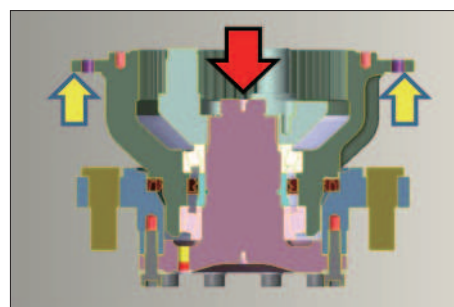
Disassemble hub sub.

※ Extract using a gear puller.



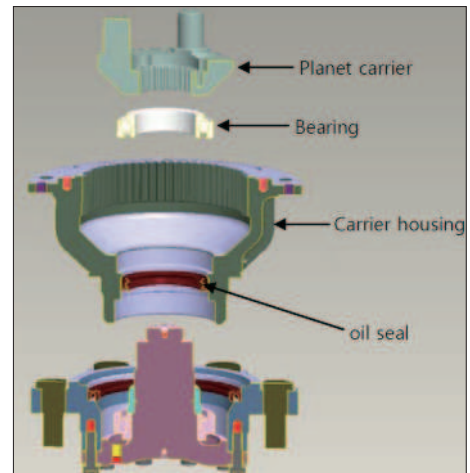
22D9TDA013-1

Gear puller



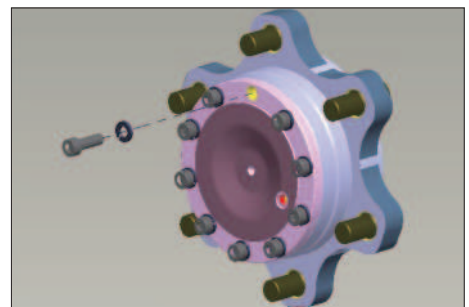
22D9TDA013

(14) Extract carrier housing with bearing.



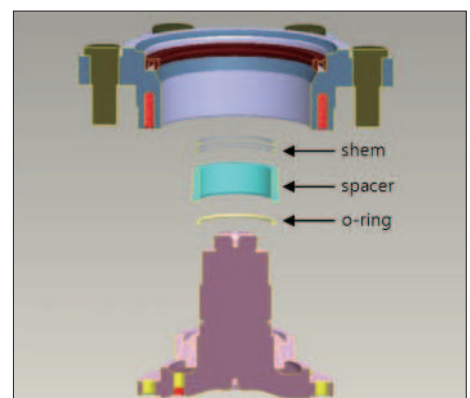
22D9TDA014

(15) Remove bolts and spring washer.



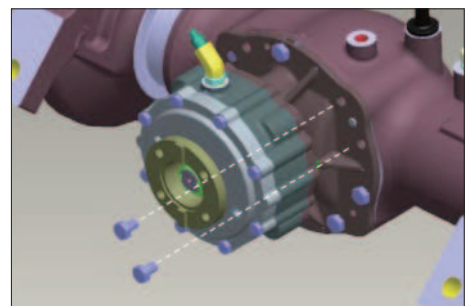
22D9TDA015

(16) Remove flange hub, shim, spacer and O-ring.
If you do not replace the bearing or spacer,
disassemble and reassemble the shim to accept.



22D9TDA016

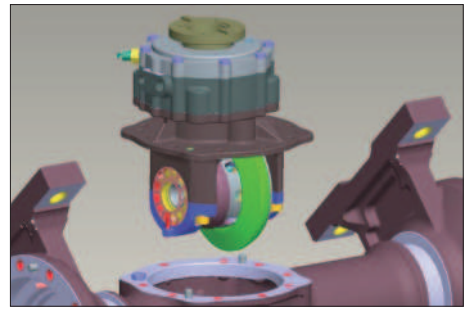
(17) Extract the fixing bolt of carrier assembly.



22D9TDA017

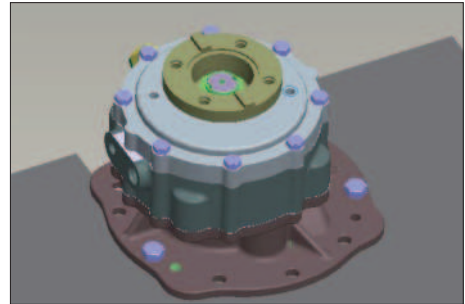
(18) Extract carrier assembly.

※ Using lifting device.



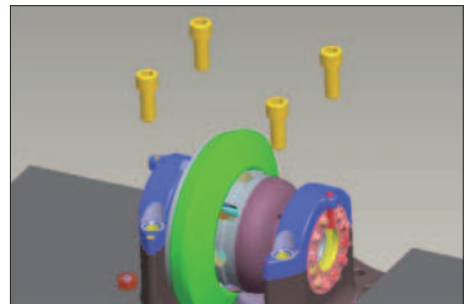
22D9TDA018

(19) Fix carrier assembly to a jig.



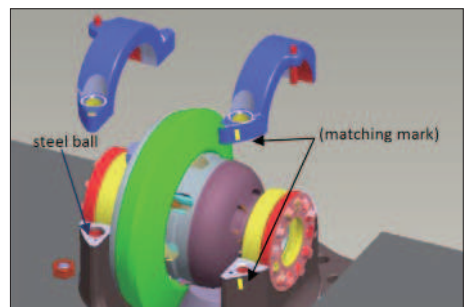
22D9TDA019

(20) Remove carrier cap bolt.



22D9TDA020

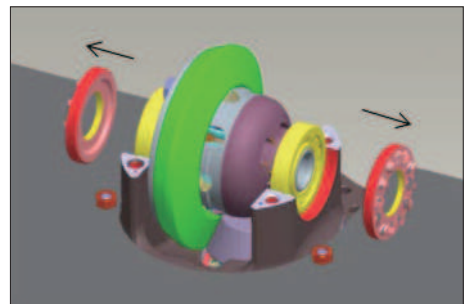
(21) Extract the carrier cap (apply marking a match).



22D9TDA021

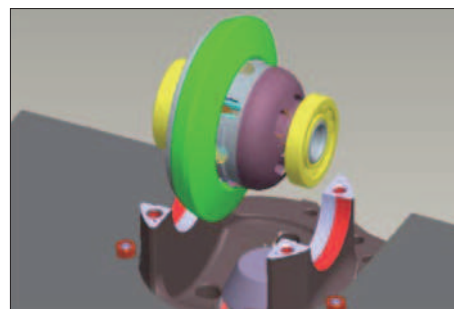
(22) Remove adjusting ring of both sides bearing cup.

※ Using dedicated fixtures and brass drift punch.



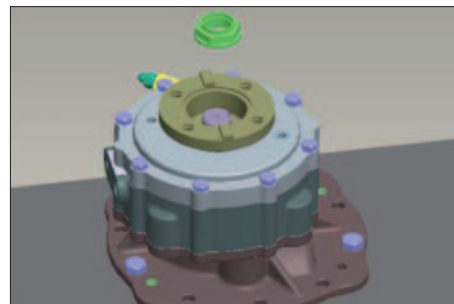
22D9TDA022

(23) Extract differential assembly.



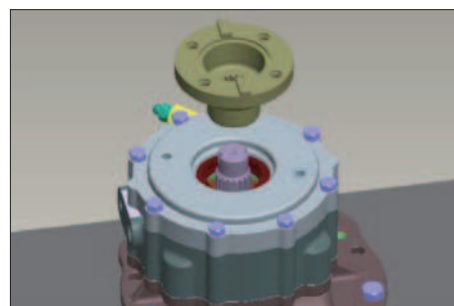
22D9TDA023

(24) After turn over carrier assy and fix it, remove nut.



22D9TDA024

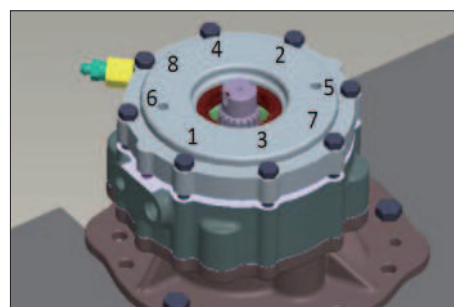
(25) Remove U-joint flange.



22D9TDA025

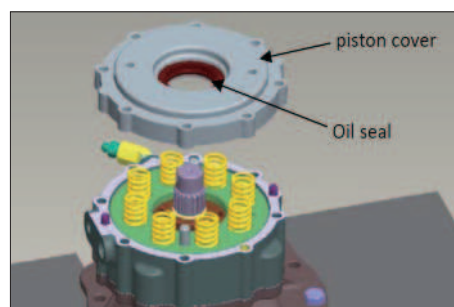
(26) Remove carrier case cover bolts.

- ※ Disassemble slowly and follow the No. in regular.
It prevent to jump out the cover by inner spring



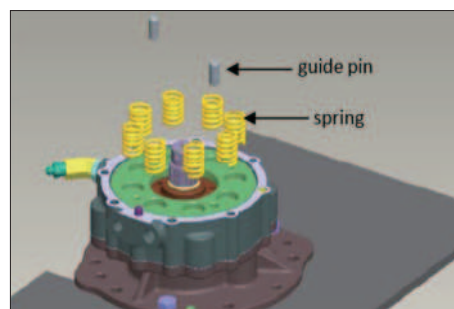
22D9TDA026

(27) Extract carrier case cover assembly.



22D9TDA027

(28) Remove spring and guide pin.

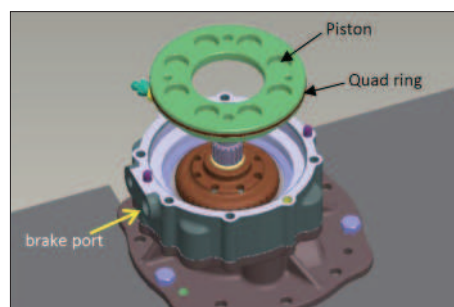


22D9TDA028

(29) Disassemble the piston.

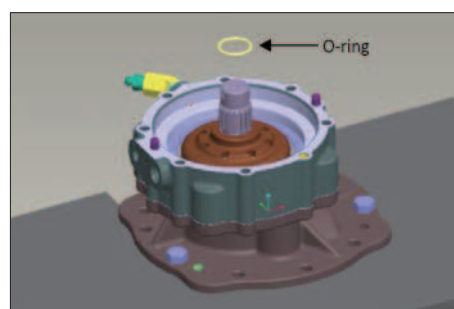
When disassembling, apply oil or air pressure at brake port.

Caution of damage on quad ring



22D9TDA029

(30) Remove the O-ring



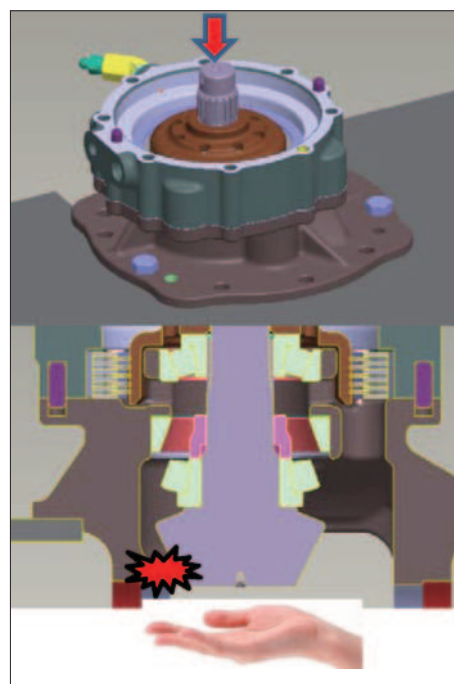
22D9TDA030

(31) Disassemble the pinion shaft.

Hit the pinion shaft by rubber hammer.

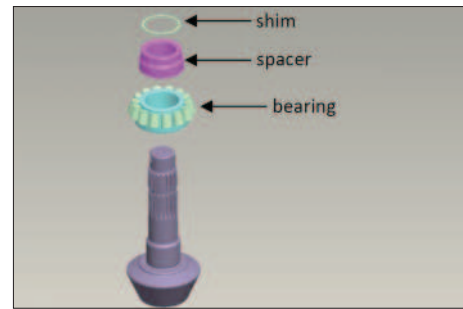
※ To avoid personal injury and possible damage to component.

Be very carefully to disassemble.



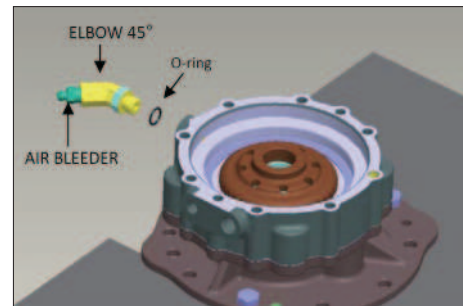
22D9TDA031

- (32) Disassemble shim, spacer, and bearing.
If do not replace the spacer and bearing, it use original shim.



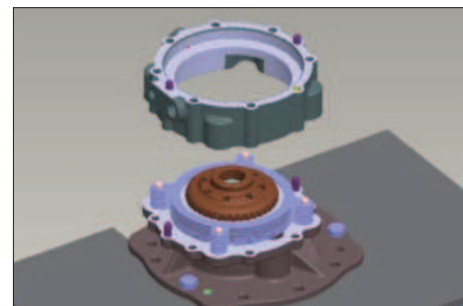
22D9TDA032

- (33) Remove the O-ring.



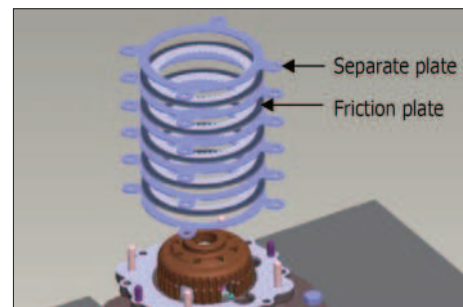
22D9TDA033

- (34) Extract piston housing.



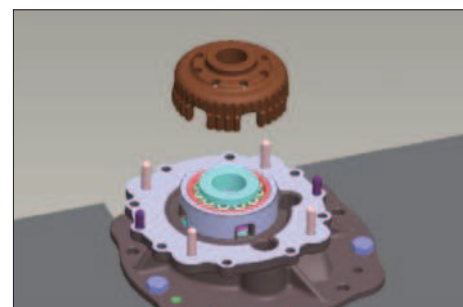
22D9TDA034

- (35) Remove parking friction plate and separate plate.



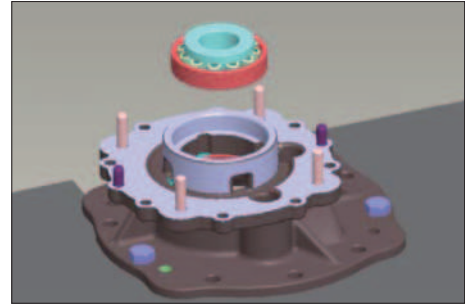
22D9TDA035

- (36) Remove spline parking.



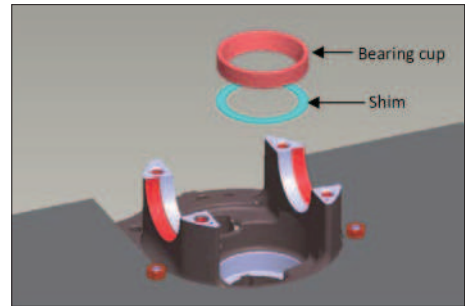
22D9TDA036

(37) Remove bearing cup and shim.



22D9TDA037

(38) Bearing cup and shim parts.



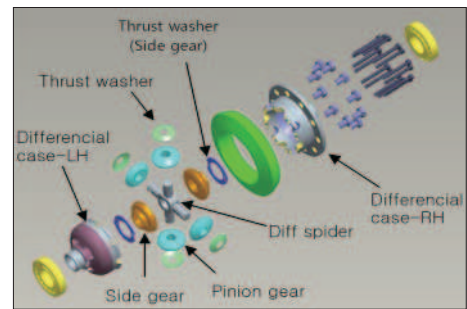
22D9TDA038

2) ASSEMBLY

(1) Carrier sub assembly

Differential device assembly

- ① Prepare parts for assembly of differential.

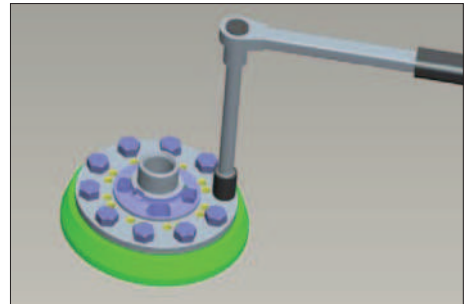


22D9TDA138

- ② Fix differential case RH and spiral ring gear with bolt.

After paste loctite #277 on spiral of bolt.

Confirm torque : 7.1~7.6 kgf · m



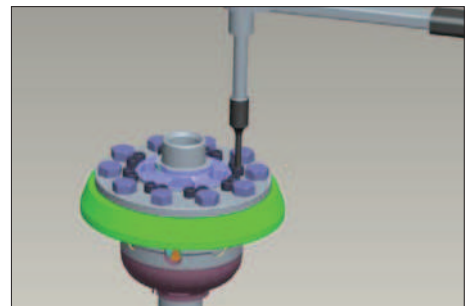
22D9TDA139

- ③ Assemble the carrier sub of a sequential development.

Differential case RH and LH with bolt

After paste loctite #277 on spiral of bolt.

Confirm torque : 1.6~1.7 kgf · m

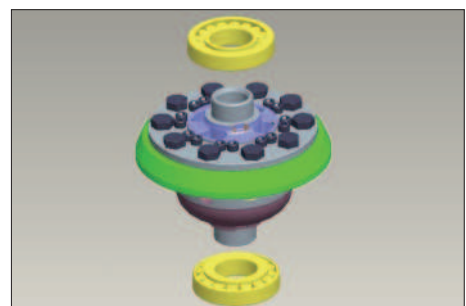


22D9TDA140

- ④ Assemble bearing.

Heating pressurize bearing cone.

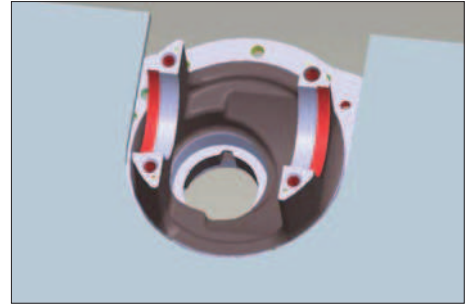
※ Control the heating temperature 100 °C or less.



22D9TDA141

Adjusting shim and pinion shaft assembly

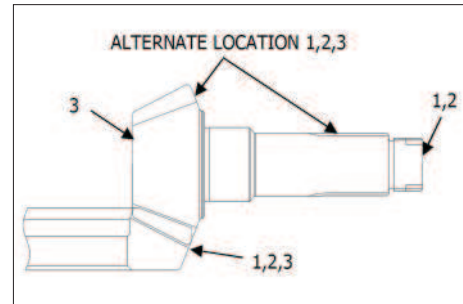
- ① Fix carrier case to the jig.
- ※ Read the following information before installing new gear set in the carrier. Always inspect the gear set for correct marks to make sure the gears are a matched set.



22D9TDA036A

The locations of the gear set marks are shown in right figure.

- Part number
 - a. Examples of gear set part numbers
 - Conventional ring gear, 21DA-20041
 - Conventional pinion shaft, 21DA-20051
 - ※ Part No. : Refer to parts manual.
 - b. Location on pinion shaft : Shaft end
 - c. Location on ring gear : Front face or outer diameter
- Tooth combination number
 - a. Example of a tooth combination number : 13-32
(An 13-32 gear set has an 13-tooth drive pinion and a 32-tooth ring gear)
 - b. Location on pinion shaft : Shaft end
 - c. Location on ring gear : Front face or outer diameter
- Pinion cone variation number
(The pinion cone variation number is not used when checking for a matched gear set. The number is used when you adjust the depth of the pinion in the carrier.)
 - a. Examples - Pinion cone variation numbers
 - +2 : +0.02 mm
 - -1 : -0.01 mm
 - b. Location on gear set
End of pinion shaft head or outer diameter of ring gear

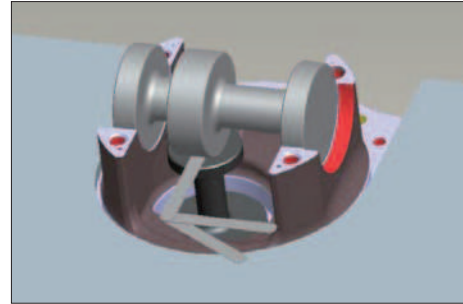


22D9TDA037

- c. Decide thickness of shim by gauge and measuring apparatus (Standard gap between bearing and carrier case step : A)
(Mounting distance (MD) of pinion shaft : B)

※ Thickness of shim

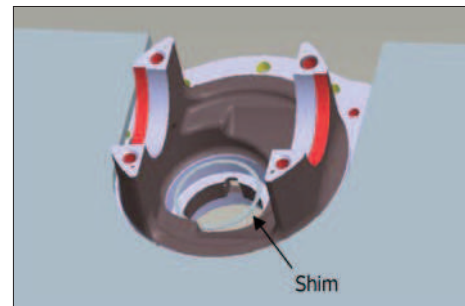
- $X = A - B + \text{Carrier case bearing step depth}$
ex1) $A=0.35$, $B=-0.1$, Bearing step depth= $+0.1$
 $X=0.35 + 0.1 + 0.1 = 0.55 \text{ mm}$
ex2) $A=0.35$, $B=+0.1$, Bearing step depth= -0.1
 $X=0.35 - 0.1 - 0.1 = 0.15 \text{ mm}$



22D9TDA038A

- ② Assemble shim and bearing cup.

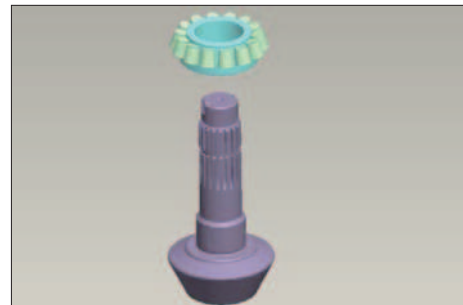
※ Using dedicated fixtures.



22D9TDA039

- ③ Put with heating bearing cone on pinion shaft.

※ The heating temperature below 100°C or less administration.



22D9TDA041

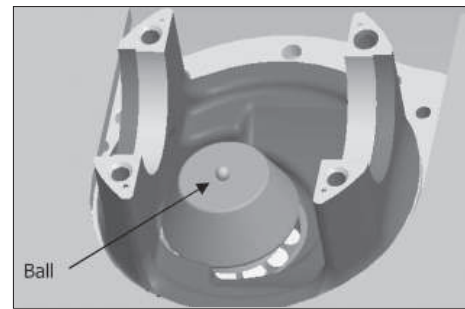
- ④ Put into pinion shaft.

※ Applied oil or grease on the bearing roller area.



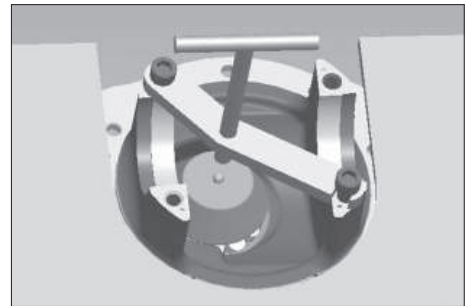
22D9TDA042

⑤ Set a ball.



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⑥ Equip jig for fixing.



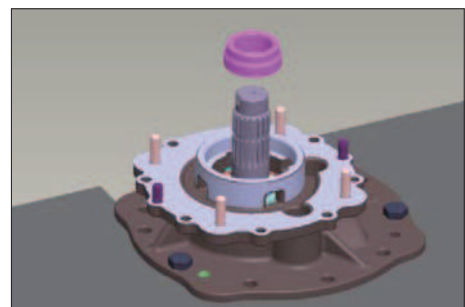
15L7ADA044

⑦ Fasten the ball.



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⑧ Put into spacer.



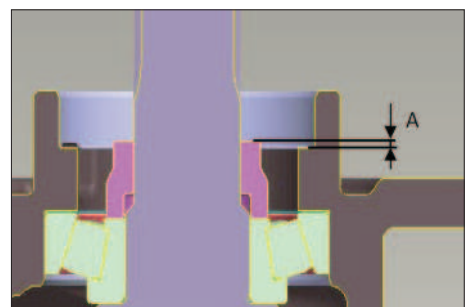
22D9TDA047

⑨ Decide thickness of shim by depth gauge
(thickness : A)

- If there is no set work-related replacement parts required. Re-use the existing parts.

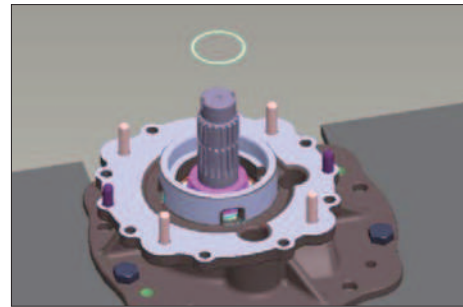
Thickness of shim = $A - (0.03 \sim 0.06)$

A : short distance between the bearing assembly
and spacer



22D9TDA048

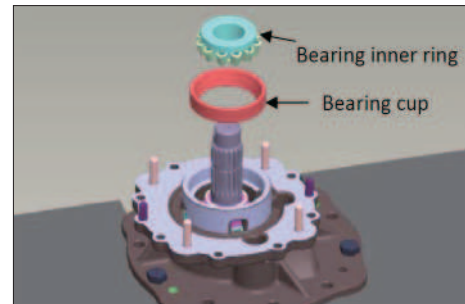
⑩ Assemble shim.



22D9TDA052

⑪ Assemble bearing.

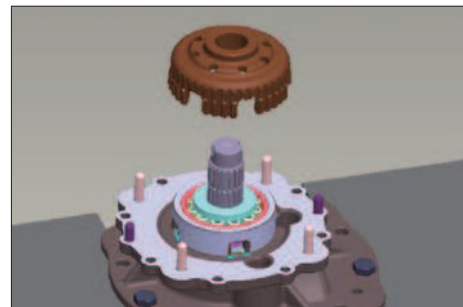
- ※ Bearing cup is assembled using a dedicated jig.
- ※ Put heated bearing inner ring, and control heating temperature 100 °C or less.



22D9TDA053

Assemble of parking sub assembly

① Assemble spline parking.



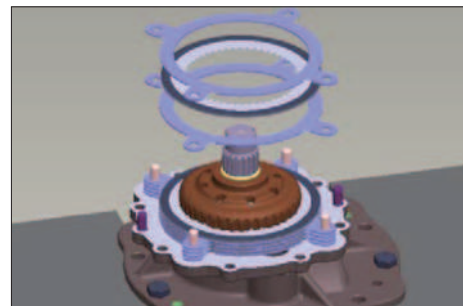
22D9TDA054

② Assemble O-ring



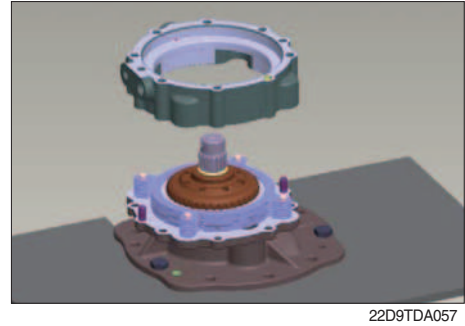
22D9TDA055

③ Assemble in order of separate plate (plate → friction plate).

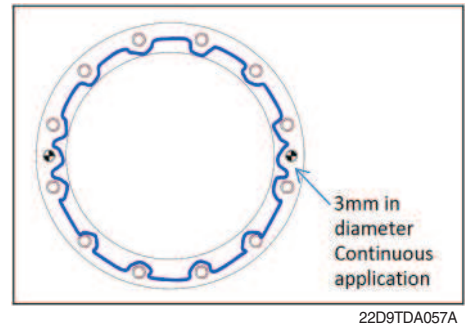


22D9TDA056

- ④ Assemble the piston housing. (paste loctite #5127)

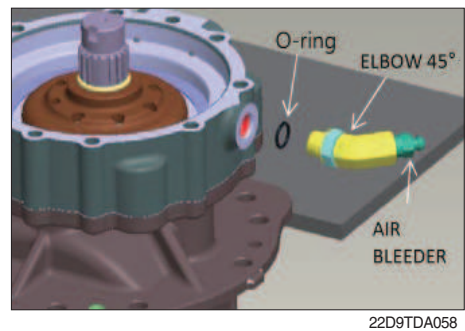


※ Example of paste loctite.

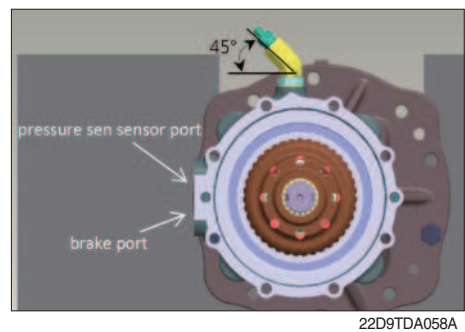


- ⑤ Assemble O-ring, air bleeder and elbow 45°.
(when assemble O-ring, paste oil or grease).

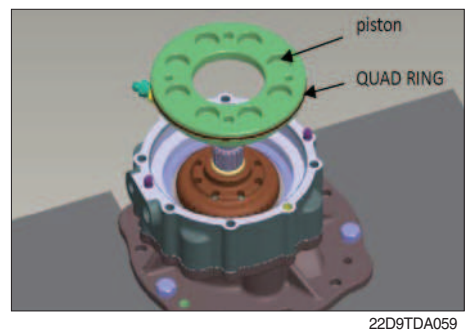
- Tightening torque of elbow 45° : 3.8~4.2 kgf·m
- Tightening torque of air bleeder : 1.5~2.0 kgf·cm



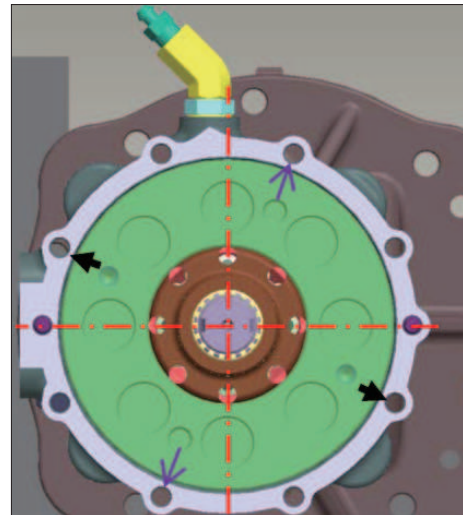
※ Attention of direction on assembly.



- ⑥ Assemble piston.
Check twist of quad ring.
Paste oil or grease on surrounding of quad ring.

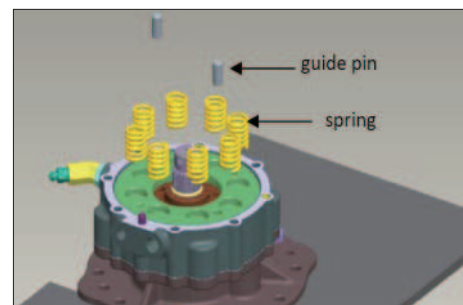


- ※ Assembly direction
 ← : Top of parking release
 ↙ : Assembly of guide pin



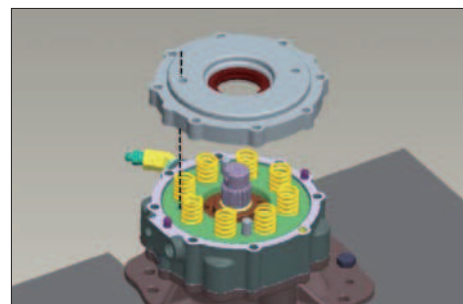
22D9TDA059A

- ⑦ Guide pin + spring assembly.



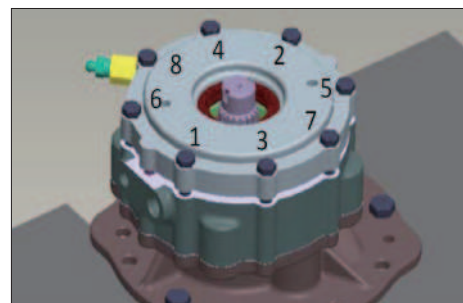
22D9TDA060

- ⑧ Parking cover + oil seal assembly.
 (Match the parking position tap and cover hole)



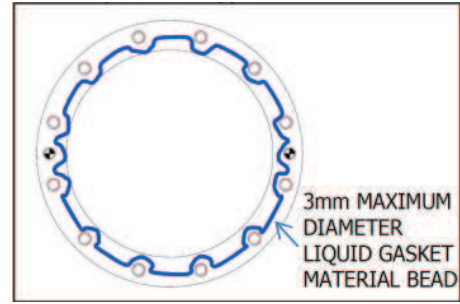
22D9TDA061

- ⑨ Assemble bolt.
 Paste loctite #5127 on side assembling.
 Paste loctite #277 on bolt, tightening torque 3~
 4 kgf · m.



22D9TDA062

- ※ Follow the direction at the cover assembly symmetry, for proper seating of the spring.



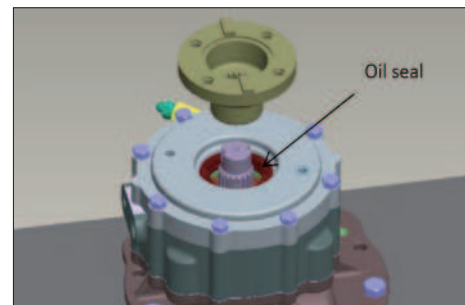
22D9TDA062A

⑩ Check the performance of parking brake.

- ※ The following procedure describes how to test brake oil leakage, return state of piston.
 - a. Remove residual air in brake line.
 - b. Actuate the piston at least five times with 10 bar.
Check the performance of brake.
 - c. Preset 10 bar at piston, blank the oil line. If it has variation of pressure under 2 bar in 3 min, It is normal condition.
 - d. When oil leakage, disassemble parking cover, check brake oil leakage and solve the problem from inspection.
- ※ Major inspection part
 - Check damage of wet movement.
 - Check damage of brake seal.
 - Check incorrect assembly at brake seal.

⑪ Assemble flange U-joint.

Oil or grease before assemble oil seal inner ring part application.



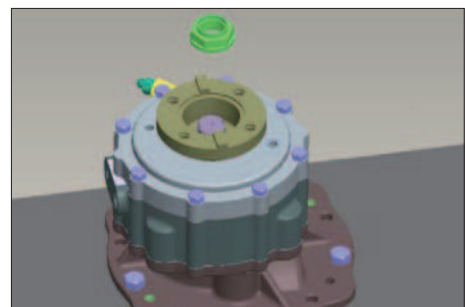
22D9TDA063

⑫ Fasten nut.

Assemble paste loctite #242.

Confirm torque : 26~29.5 kgf · m

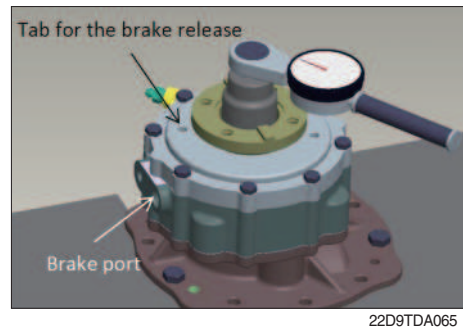
- ※ Preload : 10~19 kgf · cm



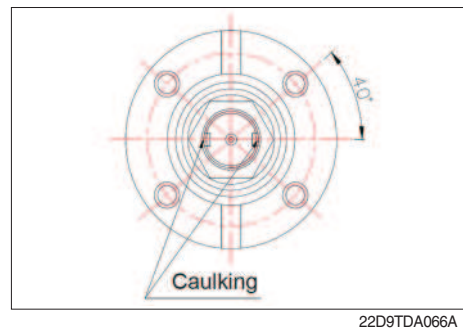
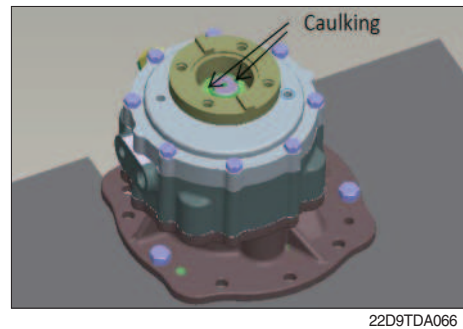
22D9TDA064

- ⑬ Preload measurement. (Spec : 10~19 kgf · cm)
If preload is over the spec, follow the procedure.
(refer to ⑨, ⑩ page 3-65, 3-66)
Adjust the thickness of shim.

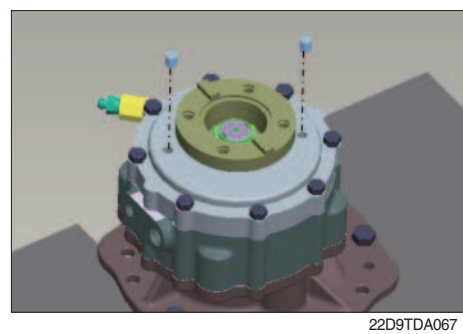
※ Always remember that the hydraulic oil circuit is under pressure.
When carrying out inspection and maintenance, release the pressure first. (Using release bolt)



- ⑭ Caulking. (2 EA)
Brass drift punch used.

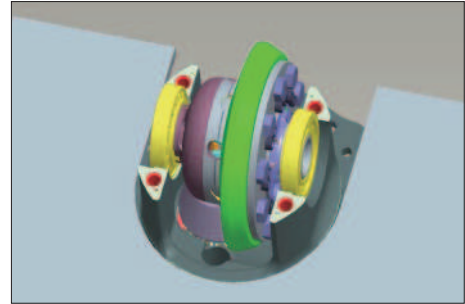


- ⑮ Assemble plug.
Applied, Loctite 577 tightening torque 1.0~1.5 kgf·m



Adjusting the gear set backlash

- ① Assemble differential sub in carrier case.



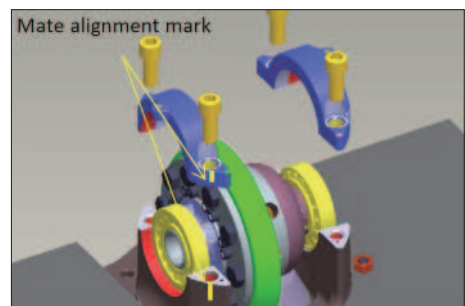
22D9TDA076

- ② Sub-assembly differential carrier case de suffren.
Threaded steel ball assembly for positioning.



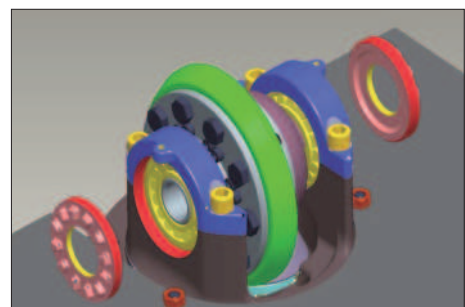
22D9TDA077

- ③ Fit carrier cap with steel ball.
Bolt : paste loctite #277
Confirm torque : 11.7~13.1 kgf · m



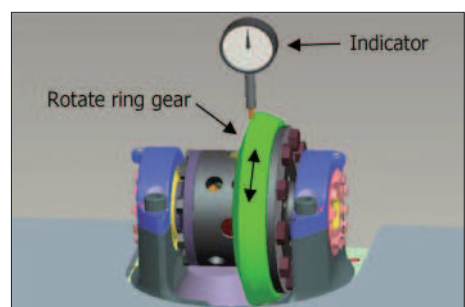
22D9TDA078

- ④ Fasten bearing adjust ring.
Lightly tighten bearing only about to be in close contact.



22D9TDA079

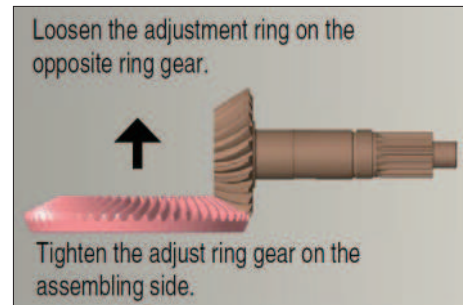
- ⑤ Measure again backlash.
※ Backlash of pinion and ring gear : 0.15~0.20 mm
※ If backlash is wrong, carry out adjusting work.
Adjust the left/right of ring bearing adjust by one and one clip.



22D9TDA080

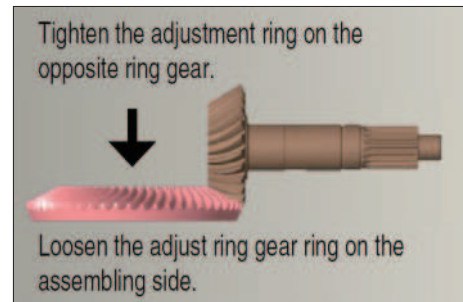
- ※ When the ring gear away from the pinion shaft will increase the backlash.

Backlash reduction methods



22D9TDA082

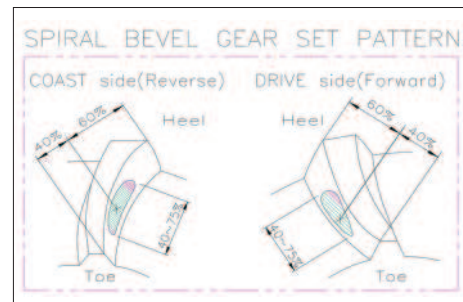
How to increase backlash



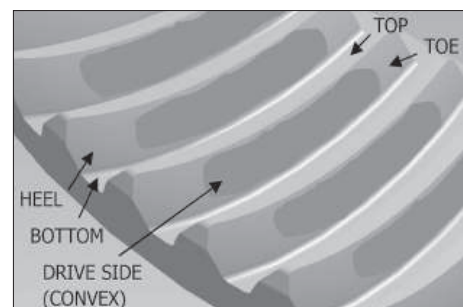
22D9TDA081

Adjusting tooth contact pattern of the gear set

- ※ After assembling, 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 drive side of the gear teeth.

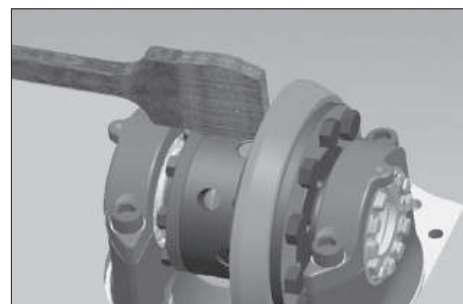


22D9TDA083



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- ① Apply marking compound to approximately 5~6 teeth of the ring gear.



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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 patterns.

※ In new gear sets, a good contact pattern is toward the toe of the tooth, and centered between the top and bottom of the tooth.



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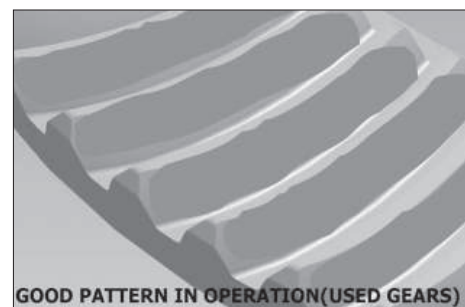


15L7ADA087



15L7ADA088

※ In used gear sets, a good contact pattern fills approximately the full length of the tooth. The top of the pattern is near the top of the tooth. The location should match the wear pattern on the tooth.



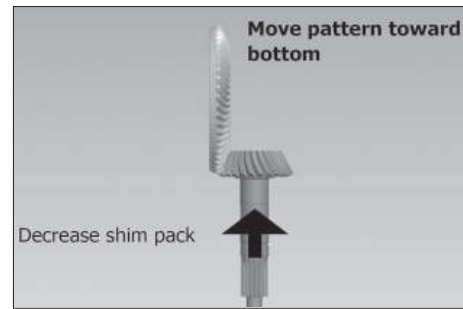
15L7ADA089

- ④ If the contact patterns require adjustment along the width of tooth (top/bottom), follow steps ①-②. If the contact patterns require adjustment along the length of tooth (toe/heel), follow steps ③-④.

- ① High pattern : A high contact pattern indicates that the pinion was installed too shallow into the carrier. Figure DA087.

To correct, move the pinion toward the ring gear by decreasing the shim pack between pinion spigot and inner bearing cone.

Figure DA090.

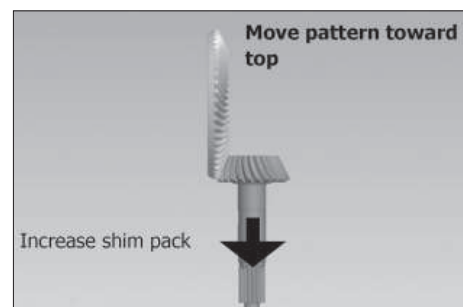


15L7ADA090

- ② Low pattern : A high contact pattern indicates that the pinion was installed too deep into that the pinion was installed too deep into the carrier. Figure DA088.

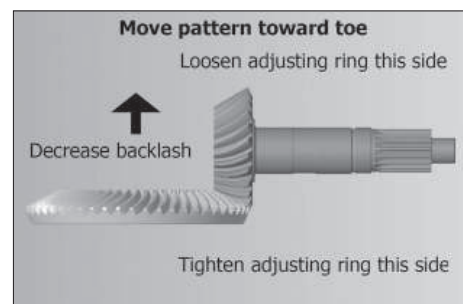
To correct, move the pinion away from the ring gear by increasing the shim pack between pinion spigot and inner bearing cone.

Figure DA091.



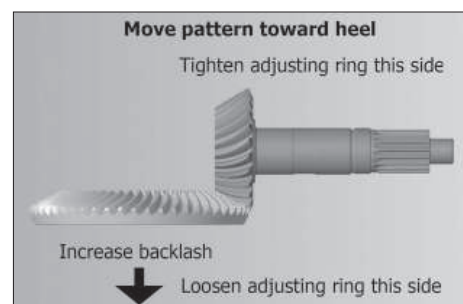
15L7ADA091

- ③ Heel pattern : Decrease the gear set backlash (within specified range) to move contact pattern toward toe and away from heel. Refer to page 3-71 "Adjusting the gear set backlash". Figure DA092.



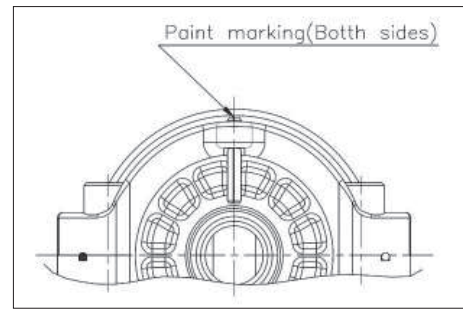
15L7ADA092

- ④ Toe pattern : Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to the pate 3-72 "Adjusting the gear set backlash". Figure DA093.



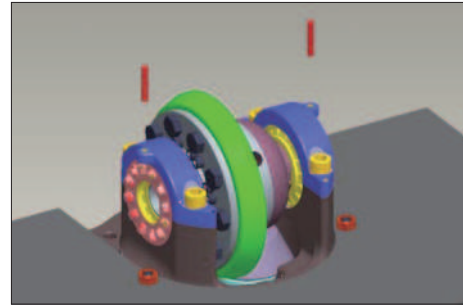
15L7ADA093

- ⑤ Fix spring pin with ring bearing adjust.
And assemble them.



15L7ADA094

- ⑥ After completion of the pattern adjustment, the
spring pin assembly.
Adjust the bearing ring to be fixed.



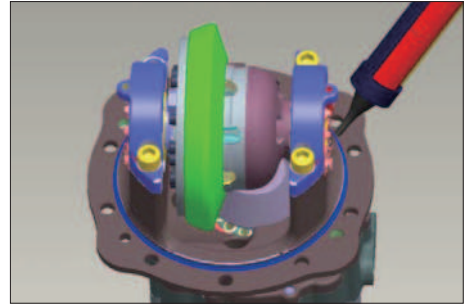
22D9TDA096



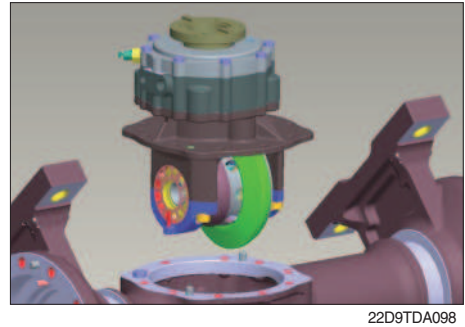
15L7ADA095

(2) Assemble of carrier assembly

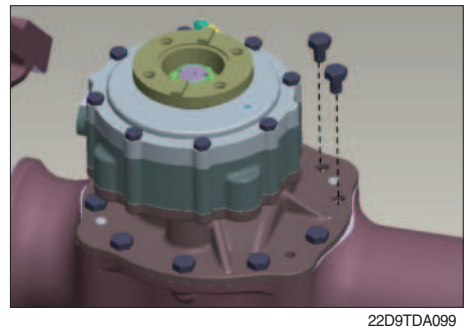
- ① Paste sealant on axle housing.
(Loctite #5127)



- ② Assemble carrier assembly on axle housing.



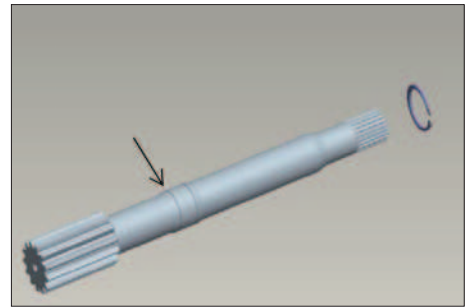
- ③ Fasten bolt.
Assemble bolt after spread loctite #277.
Confirm torque : 6.1~6.5 kgf · m



(3) Traveling brake system assembly

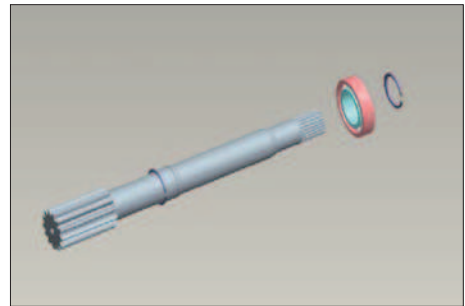
Axle shaft assembly

- ① Insert snap ring on the axle shaft.



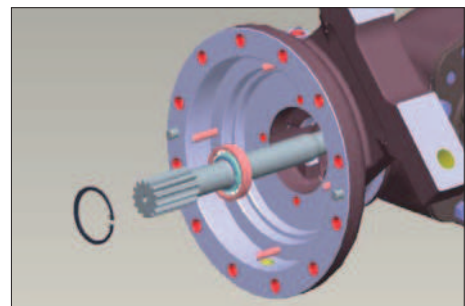
22D9TDA100

- ② After put the ball bearing, fix it with snap ring.



22D9TDA101

- ③ After put axle shaft into axle housing fix with snap ring.

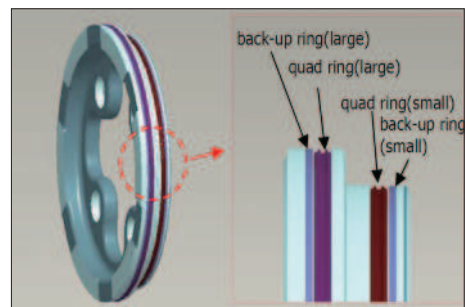


22D9TDA102

Brake piston assembly

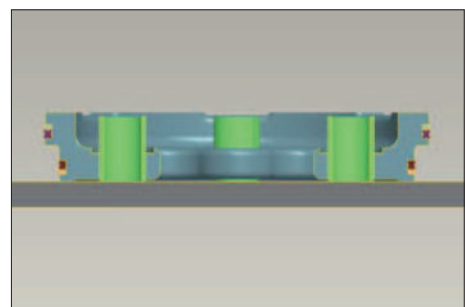
- ① Assemble ring (Quad ring + Back up ring) at piston brake.

- ※ When assembling seal pay attend to chopping.
- ※ Before assemble ring coating oil or grease.
- ※ Careful assembly direction of Quad ring + Back up ring



22D9TDA103

- ② Assemble sleeve at piston.
Same with sleeve and piston surface on floor.

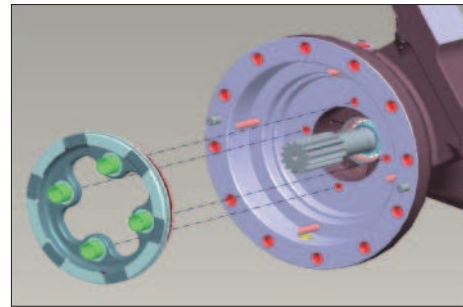


22D9TDA104

③ Assemble the piston.

Match assembly tap of special bolt and position of sleeve.

Before assemble Quad ring coating oil or grease.

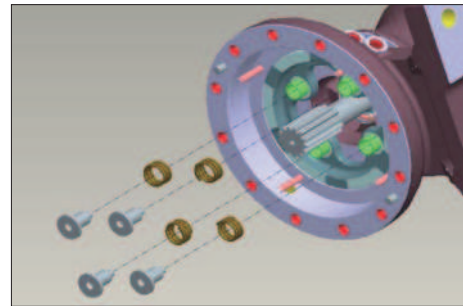


22D9TDA105

④ Assemble return spring and special bolt.

Paste loctite #277.

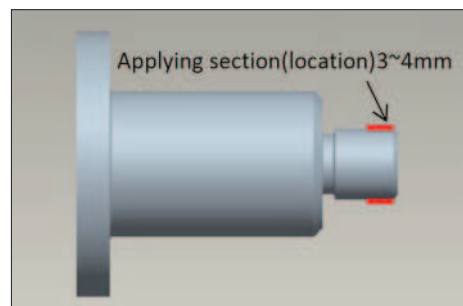
· Tighten torque :1.8~2.0 kgf · m



22D9TDA106

※ Example) Paste loctite on special bolt.

If paste loctite too much on sleeve & special bolt, piston has malfunctioned by jam.



22D9TDA106A

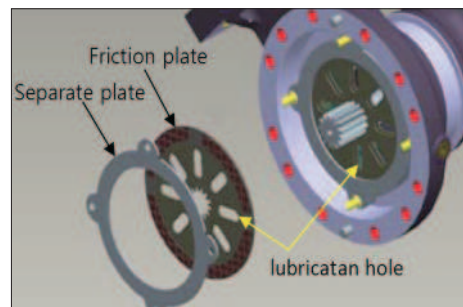
⑤ Assemble in order of separate plate → Friction plate.

But assemble separate plate first and lastly.

Separate plate : 5EA

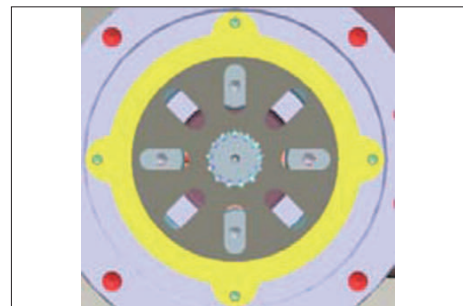
Friction plate : 4EA

Assemble plate to according to the hole on plate.



22D9TDA107

※ Do not cover the hole each others.

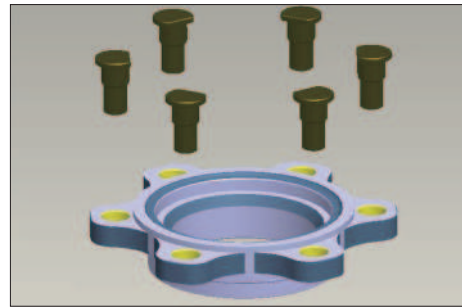


22D9TDA107A

(4) Hub assembly

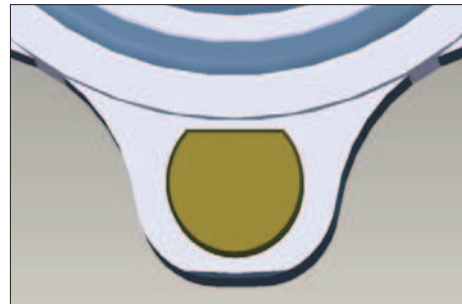
Hub sub assembly

- ① Assemble hub bolt. (Use jig and press)



22D9TDA110

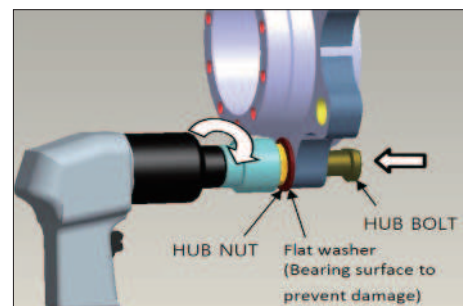
- ※ Assemble direction example.
Careful assemble with head of bolt and hub flange.



22D9TDA110A

If you do not press or dedicated fixtures.
Assemble the hub nuts, hub bolt assembly can be tightened.

To prevent damage to the bearing surface
between the hub and the hub nut.
Bore $\varnothing 20$, $\varnothing 40 \sim \varnothing 50$ diameter flat washer insert.



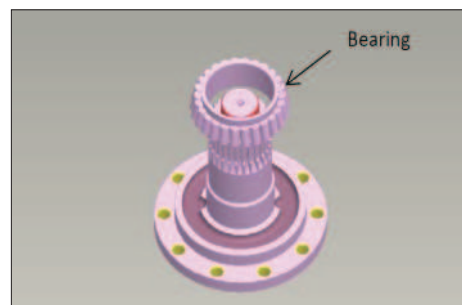
22D9TDA110B

- ② Pressurize oil seal with loctite #592.
Spread grease inside of oil seal.



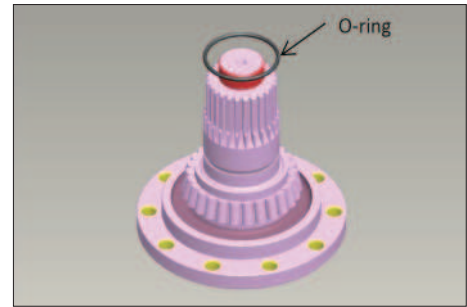
22D9TDA111

- ③ Put with heating bearing cone on wheel shaft.
Assemble after paste axle oil on roll of bearing cone.



22D9TDA112

- ④ Assemble O-ring coated grease at wheel shaft.



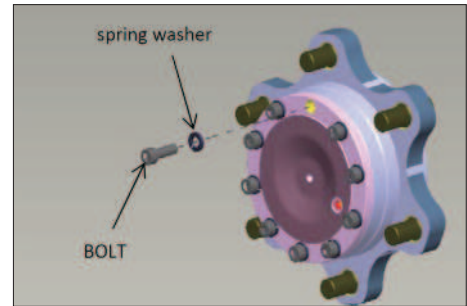
22D9TDA113

- ⑤ Assemble flange hub and wheel shaft.

※ Paste loctite #5127

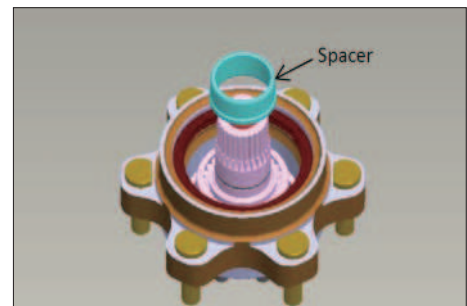
Confirm torque : 6.0~7.0 kgf · m

Bolt : Spread loctite #277



22D9TDA114

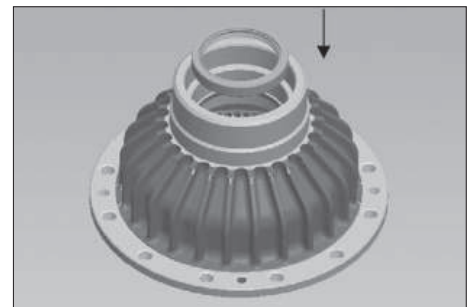
- ⑥ Fix spacer.



22D9TDA115

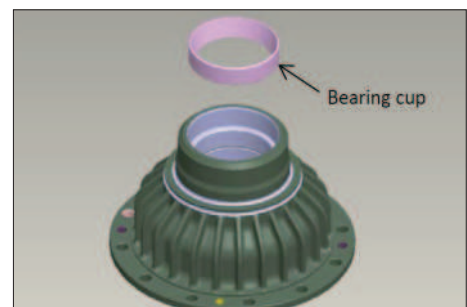
- ⑦ Assemble oil seal at carrier housing.

Oil seal with loctite #592.



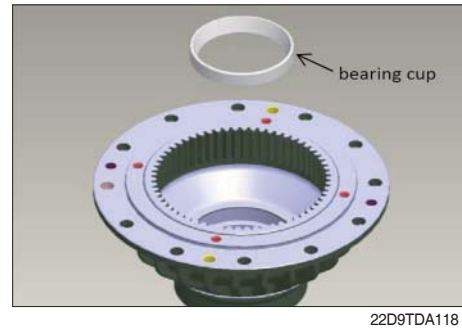
15L7ADA116

- ⑧ Assemble bearing cup at carrier housing.

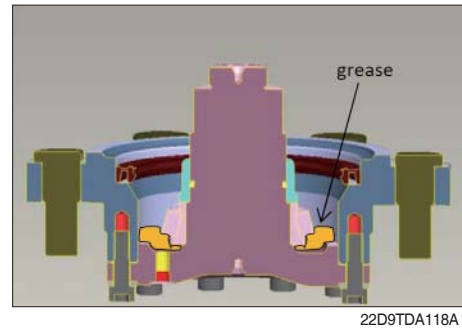


22D9TDA117

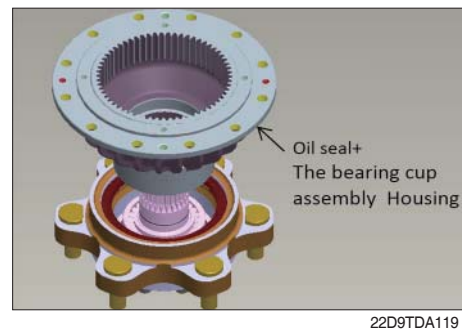
- ⑨ Assemble bearing cup at upper side of carrier housing.



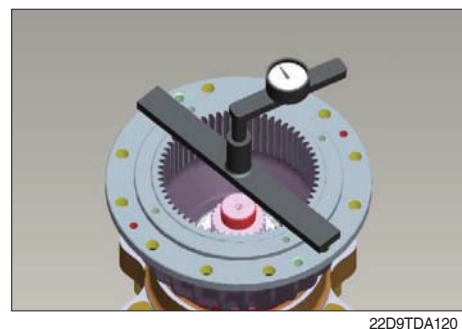
- ⑩ Hub + wheel shaft assemble in grease charge.
 ·Charge amount :
 Grease outer ring of wealth space 60~80%.
 ※ Recommend Grease : Shell Retinax 0419



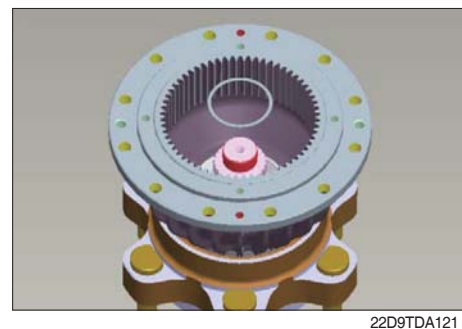
- ⑪ Assemble the carrier housing on flange hub and wheel shaft.



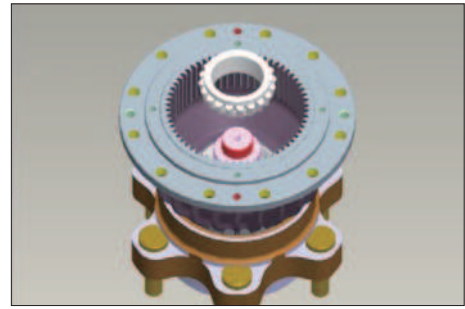
- ⑫ Adjust preload for fix shim.
 ·Preload : 40~50 kgf·cm



- ⑬ Put into shim. (Basic shim : 0.65 mm)
 ※ Sort of shim : 0.1, 0.12, 0.15, 0.25, 0.5 (mm)

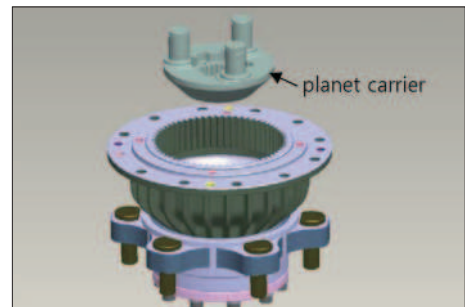


- ⑭ Pressurize bearing cone.
Before assembling, paste axle oil on roller of bearing cone.



22D9TDA122

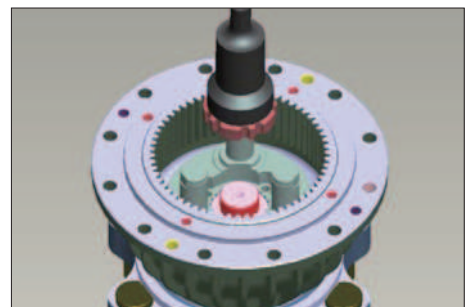
- ⑮ Assemble planet carrier.



22D9TDA123

- ⑯ Assemble the locknut to confirm the bearing preload. Use designated jig or brass drift punch. Loosen and tighten repeatedly 2~3 time with 35~38 kgf · m

- ※ If there is no parts replacement from bearing, shaft, housing and spacer, initially assembled shims can be re-used.
- ※ When brass drift punch is used, assemble the locknut in accordance with its initially marked position.



22D9TDA124

- ⑰ Preload check.

- ※ Preload setting price = Oil seal resistance price + Bearing preload

⑫ Process check price $\pm 40 \sim 50$ kgf · cm

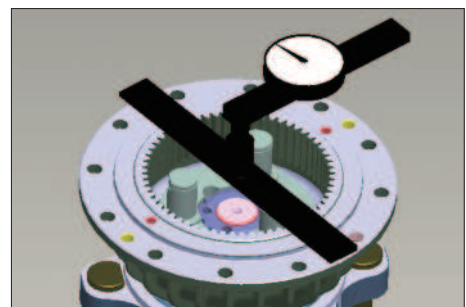
- ※ If measurements are not satisfied with the preloaded.

Decomposition ⑫ to ⑭ and proceeds to step, measured value is greater than the preload thickness of shim set to increase.

Measured value is less than the preload is set to decrease thickness of shim.

After the completion of the assembly ⑪ to ⑯ proceeds the process again.

- ※ If hub bearing preload is wrong.
It should cause damage to the shaft.
In order to prevent major accent, should be sure the preload.



22D9TDA124A

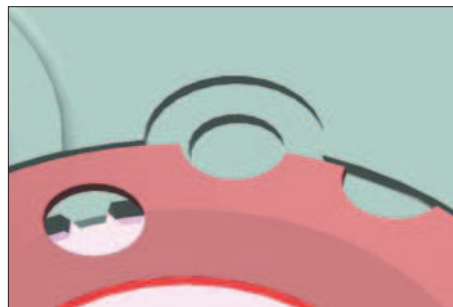
⑱ Fasten lock nut.

Spread the Loctite #277 on screw.

- Confirm torque : 3.5~3.8 kgf · m

Mate lock nut slot and planet carrier's hole.

- Preload : 40~50 kgf · cm

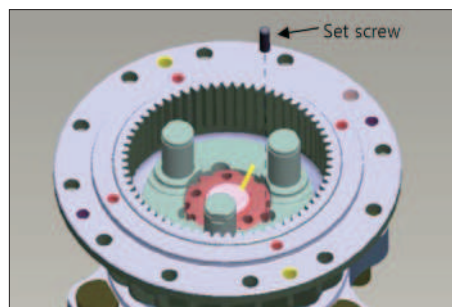


22D9TDA124B

⑲ Fasten set screw.

Spread the Loctite #277.

- Confirm torque : 105~150 kgf · cm

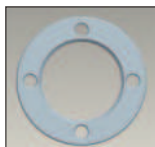


22D9TDA124C

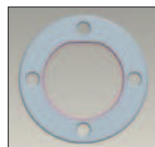
⑳ Assemble in order of washer → needle bearing → planet gear → washer .

Before assembling washer, paste oil, spread grease on needle bearing.

※ Needle roller quantity check : 19 EA/1 gear

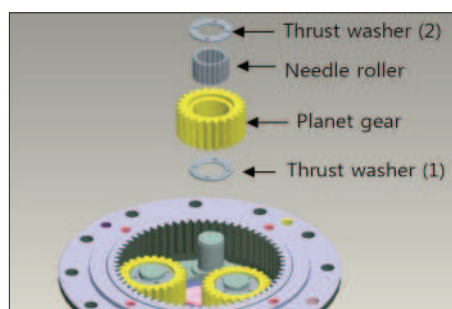


22D9TDA011-1



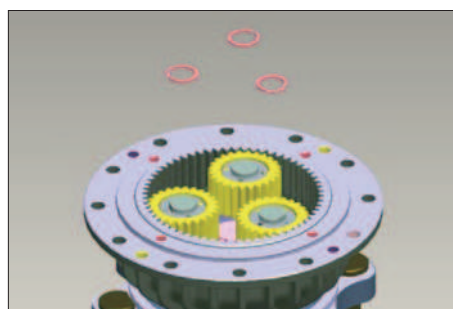
22D9TDA011-2

Thrust washer (1) Thrust washer (2)



22D9TDA125

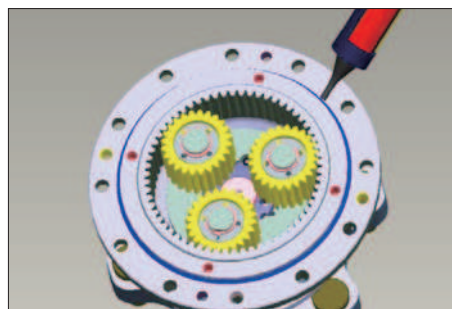
㉑ Fix snap ring.



22D9TDA126

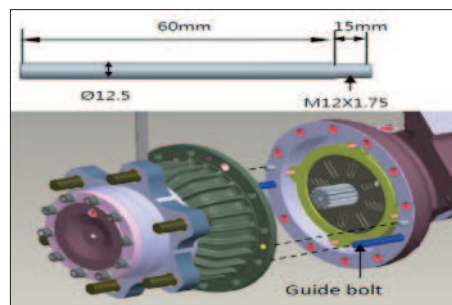
(5) Assemble of hub sub assembly

- ① Paste loctite #5127 on axle housing.
 - ※ About 3 mm wide circle around the front of the application.



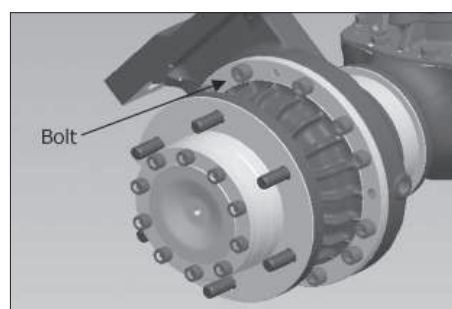
22D9TDA127

- ② Assemble the hub assembly on the axle housing.
Lifting device or the guide bolts.
Field, using the following guide bolt.
Can be easily assembled.



22D9TDA127A

- ③ Assemble hub sub assembly.
Bolt : Assemble after spread loctite #277.
Confirm torque : 11.7~13.1 kgf · m
Plug : Assemble after spread loctite #577
Confirm torque : 1.0~1.5 kgf · m
 - ※ Assemble hub sub assembly after support it by lifting device as like the same way of disassembling.

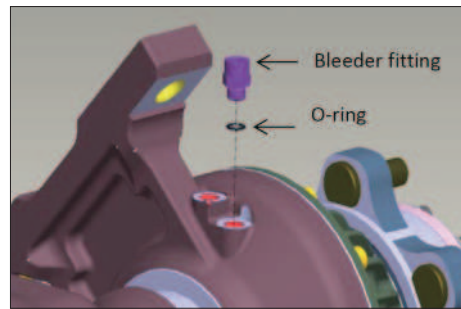


15L7ADA128

(6) The rest part assembly

- ① Assemble O-ring and fitting bleeder for LH and RH.

· Confirm torque : 3.8~4.2 kgf · m

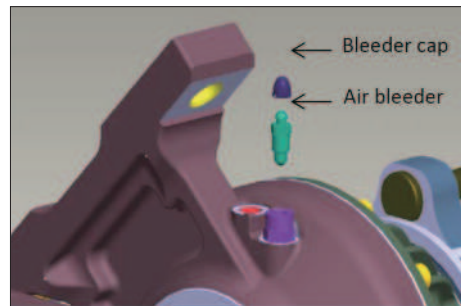


22D9TDA129

- ② Assemble bleeder and cap.

Screw : Assemble after spread loctite #577.

Confirm torque : 1.5~2.0 kgf · m

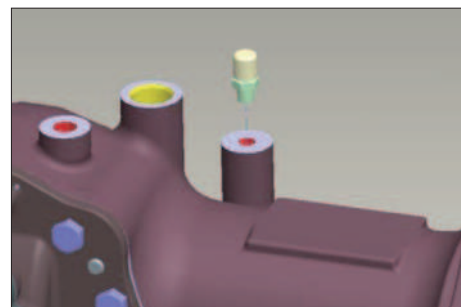


22D9TDA130

- ③ Assemble air breather.

Screw : Assemble after spread loctite #577.

Confirm torque : 0.5~0.7 kgf · m

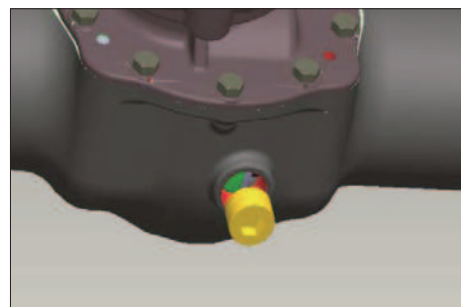


22D9TDA131

- ④ Assemble drain plug (magnetic).

Screw : Assemble after spread loctite #577.

Confirm torque : 7.0~9.0 kgf · m



22D9TDA132

- ⑤ Assemble drain plug (magnetic).

Screw : Assemble after spread loctite #577.

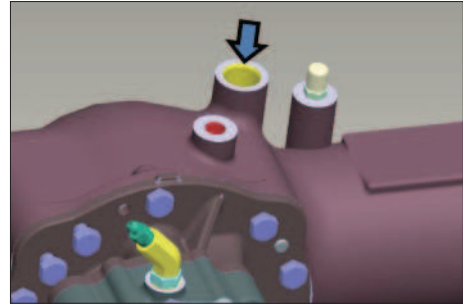
Confirm torque : 3.0~4.1 kgf · m



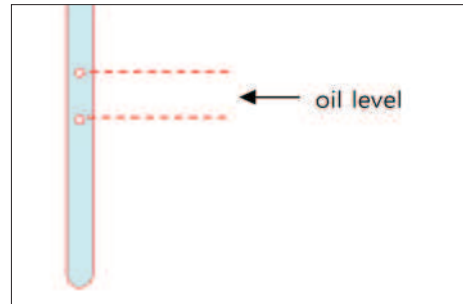
22D9TDA133

⑥ Put in dipstick.

- ※ Fill axle oil as much as standard.
Standard between the upper limit and the lowest limit.

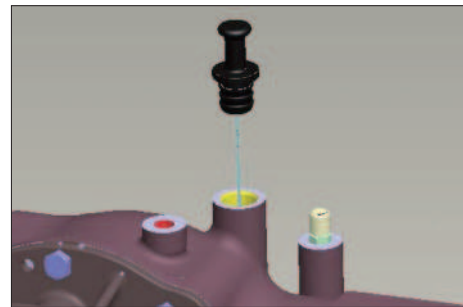


22D9TDA135



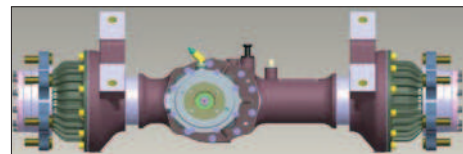
22D9TDA134

⑦ Assemble dipstick gauge.



22D9TDA136

⑧ Finish drive axle assembly.



22D9TDA137

(7) Functional test of hydraulic apply brake

- ※ The following procedure describes how to test the hydraulic apply brake system only.

To perform this test, use a device that allows you to observe possible leaks through oil seals and that also allows you to verify that the piston return system works correctly . For an accurate evaluation, the device must allow piston displacement of 0.4~0.6 mm.

- ① Brake bleeder valve while supplying hydraulic oil to the pressure inlet. Pump oil through the brake until oil coming out of the bleeder does not contain air bubbles.
Close the brake bleeder valve.
- ② Actuate the piston at least five times with 60 bar.
Check for leaks and free movement of piston.
- ③ If you find a leak : Disassemble the hub sub assembly. Determine the cause of the leak and correct the problem. Check the seal surfaces for sharp edges, nicks and burrs.
- ④ Wait five minutes. Apply 60 bar to the piston and lock pressure on. Pressure must not drop after one minute.
- ⑤ If pressure drops off : Disassemble the hub sub assembly. Determine the cause of the leak and correct the problem. Repeat step ① - ⑤.

- ※ You must check that the brake completely releases after you apply the brake.
Do not operate the brake system with the brake partially released. Damage to brake components can result.