

SECTION 3 POWER TRAIN SYSTEM

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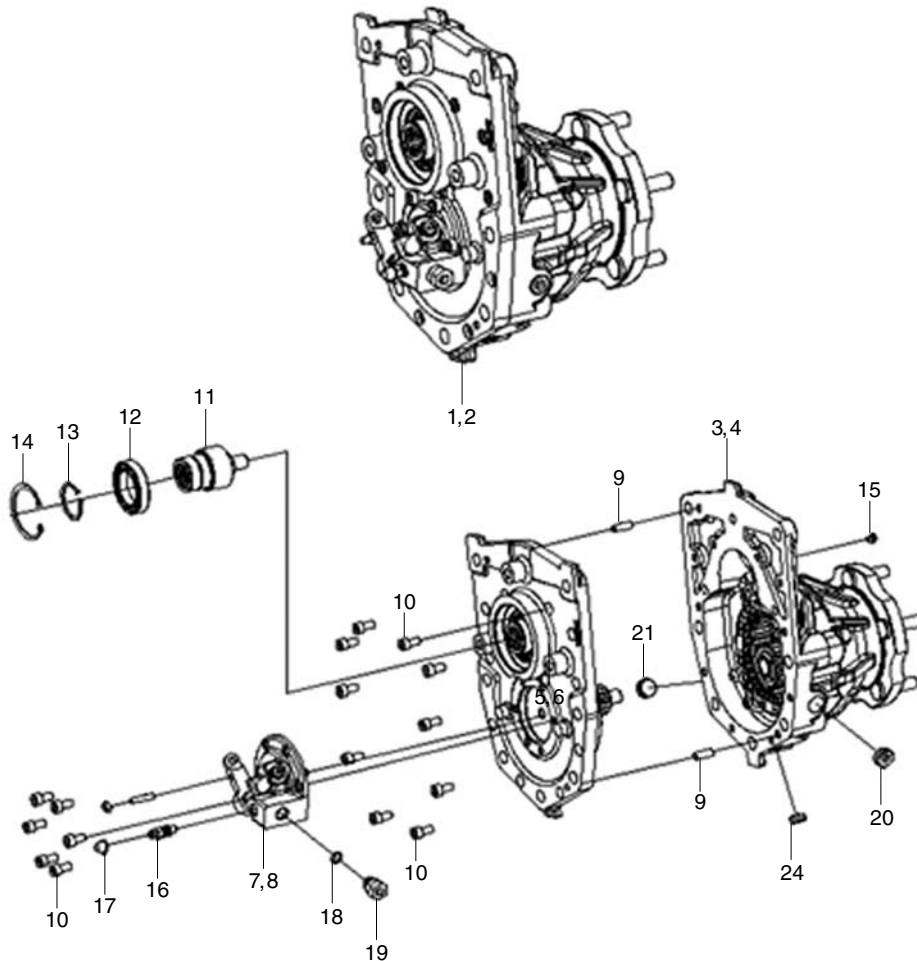
SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

1. DRIVE UNIT

1) STRUCTURE

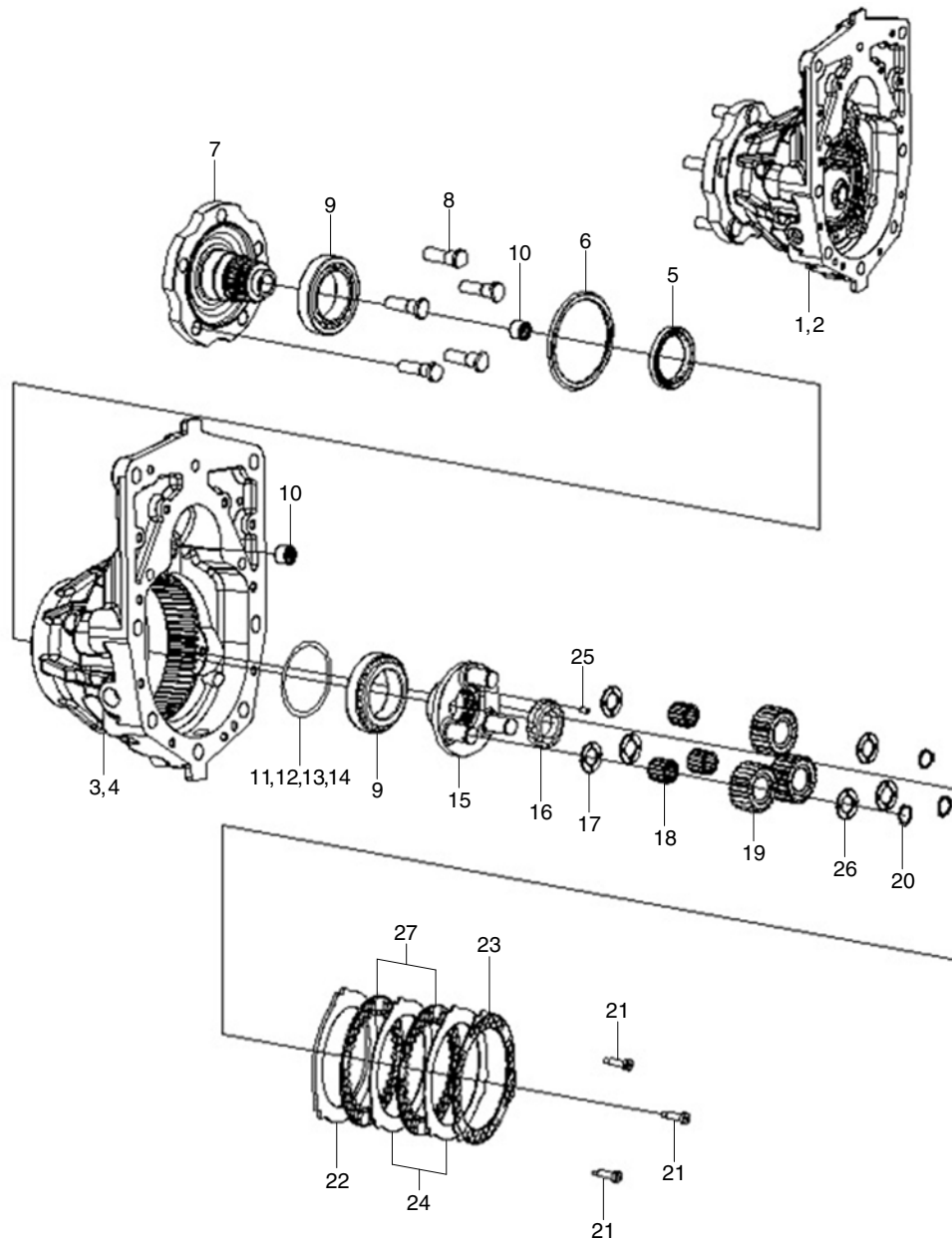
(1) Drive unit assembly



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- | | | | |
|----|-----------------------------|----|-----------------------|
| 1 | Dirve unit assembly (LH) | 13 | Snap ring (for shaft) |
| 2 | Dirve unit assembly (RH) | 14 | Snap ring (for hole) |
| 3 | Housing sub assembly (LH) | 15 | Air breather |
| 4 | Housing sub assembly (RH) | 16 | Breather |
| 5 | Cover out sub assembly (LH) | 17 | Rubber cap |
| 6 | Cover out sub assembly (RH) | 18 | O-ring |
| 7 | Parking sub assembly (LH) | 19 | Brake plug |
| 8 | Parking sub assembly (RH) | 20 | Plug |
| 9 | Dowel pin | 21 | Magnetic plug |
| 10 | Socket bolt | 22 | Set screw |
| 11 | Input pinion | 23 | Hex nut |
| 12 | Ball bearing | 24 | Plug |

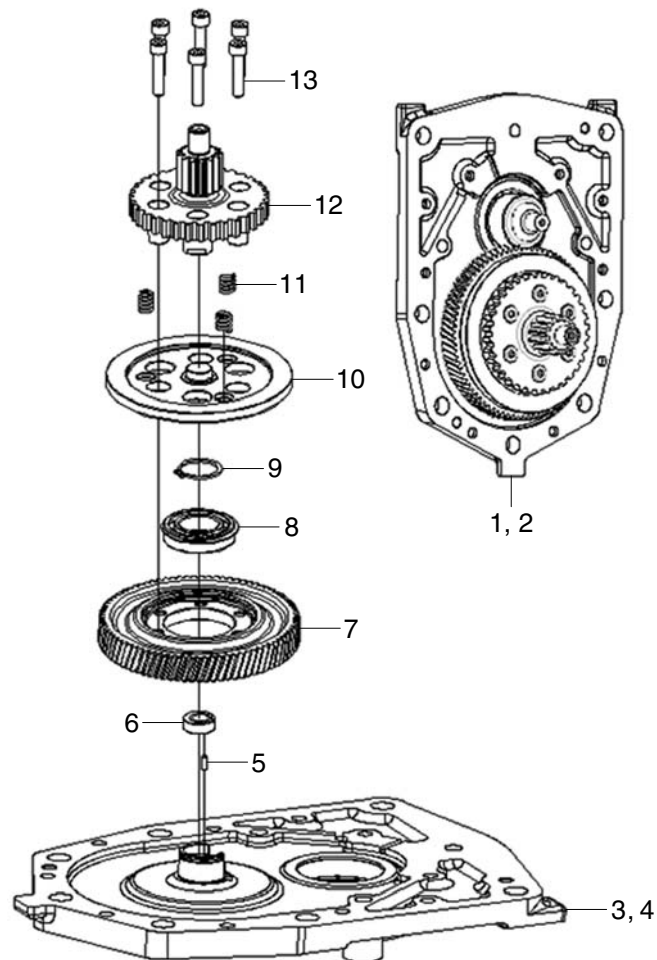
(2) Housing sub assembly



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- | | | | |
|----|---------------------------|----|-------------------|
| 1 | Housing sub assembly (LH) | 15 | Planetary carrier |
| 2 | Housing sub assembly (RH) | 16 | Lock nut |
| 3 | Housing carrier (LH) | 17 | Thrust washer |
| 4 | Housing carrier (RH) | 18 | Needle bearing |
| 5 | Oil seal | 19 | Planetary gear |
| 6 | Gamma seal | 20 | Snap ring |
| 7 | Wheel hub | 21 | Special bolt |
| 8 | Hub bolt | 22 | Back plate |
| 9 | Taper roller bearing | 23 | Friction disc 1 |
| 10 | Needle bearing | 24 | Plate |
| 11 | Shim | 25 | Set screw |
| 12 | Shim | 26 | Thrust washer |
| 13 | Shim | 27 | Friction disc 2 |
| 14 | Shim | | |

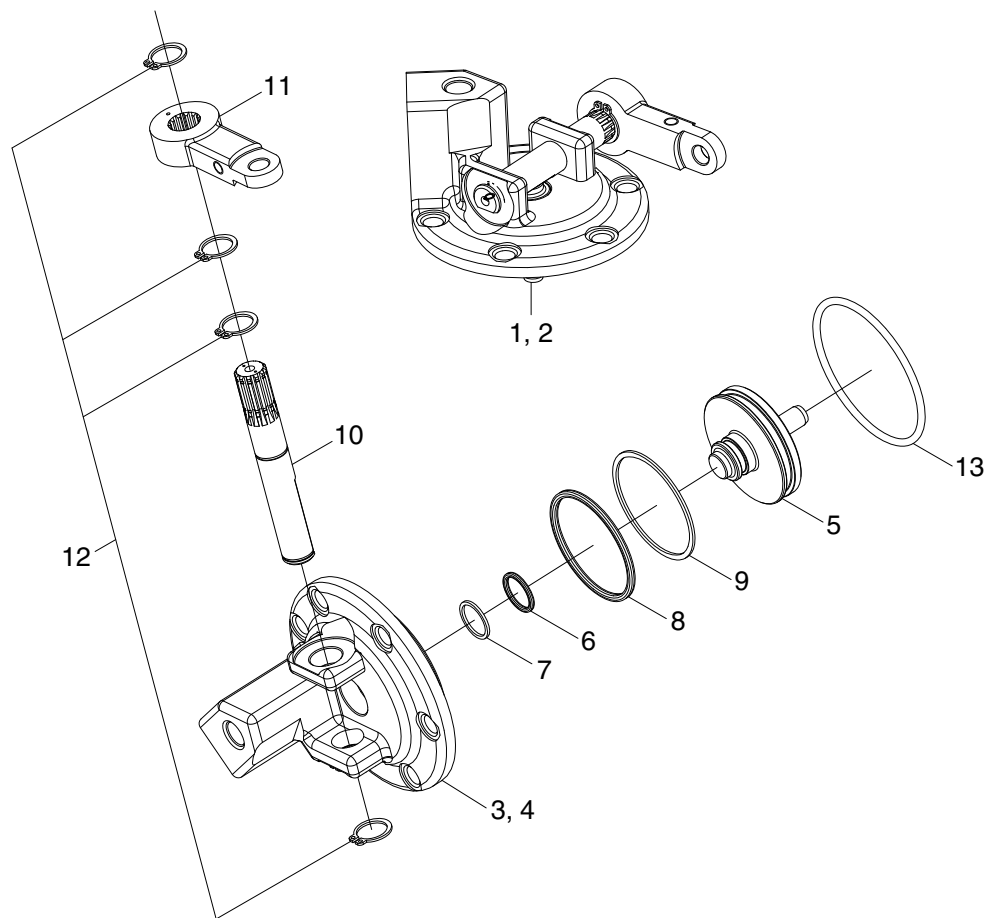
(3) Cover out sub assembly



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- | | | | |
|---|-------------------------|----|---------------|
| 1 | Cover out assembly (LH) | 8 | Ball bearing |
| 2 | Cover out assembly (RH) | 9 | Snap ring |
| 3 | Cover out (LH) | 10 | Actuator |
| 4 | Cover out (RH) | 11 | Return spring |
| 5 | Parallel pin | 12 | Sun pinion |
| 6 | Friction block | 13 | Socket bolt |
| 7 | Ring gear (83T) | | |

(4) Parking sub assembly



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- | | | | |
|---|---------------------------|----|-------------|
| 1 | Parking sub assembly (LH) | 8 | Quad ring |
| 2 | Parking sub assembly (RH) | 9 | Backup ring |
| 3 | Parking cover (LH) | 10 | Shaft |
| 4 | Parking cover (RH) | 11 | Lever |
| 5 | Piston | 12 | Snap ring |
| 6 | Quad ring | 13 | O-ring |
| 7 | Backup ring | | |

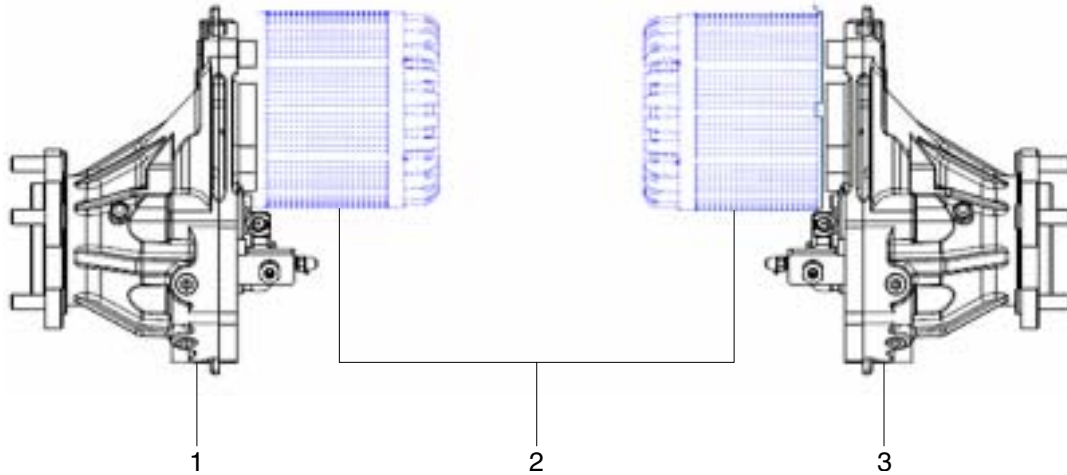
2) SPECIFICATION

Item	Unit	Specification
Max. output torque (wheel)	N · m	2260
Max. axle load	kg/lb	2700/5953
Max. input speed	rpm	5000
Gear ratio	-	20
Weight without fluid	kg/lb	35/77
Oil quantity(ATF)	l /U.S. · qt	0.67/0.71

3) PRINCLPLE OF OPERATION

(1) Outline of the power transmission system

The drive units are composed of the drive unit (LH) and the drive unit (RH) which are connected with the motor as a power transmission system to assemble the drive wheel for the battery type fork lift.



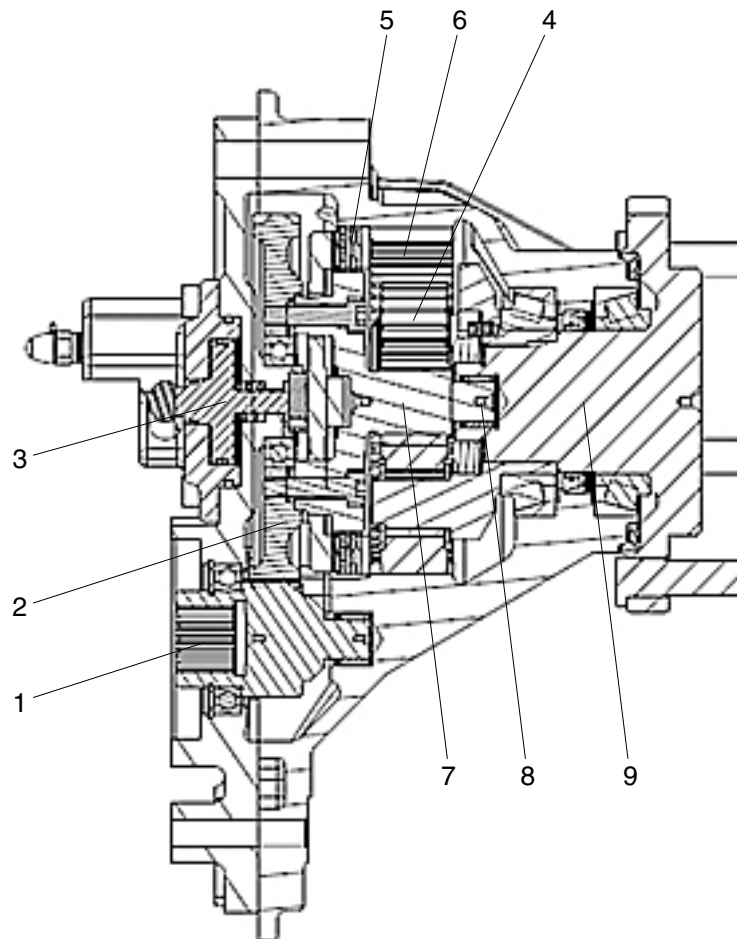
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- 1 Drive unit (LH)
- 2 Motor
- 3 Drive unit (RH)

The power of the drive motor which is received from signal of the controller transmits to the drive gear and the power transferred from the drive gear transmits to the drive wheel via the planetary gear and wheel hub. As a result, it is able to drive to forward and reverse of the fork lift.

(2) Principle of the operation

① Structure of the drive unit



- 1 Input pinion
- 2 Ring gear
- 3 Brake piston
- 4 Planetary gear
- 5 Brake pack

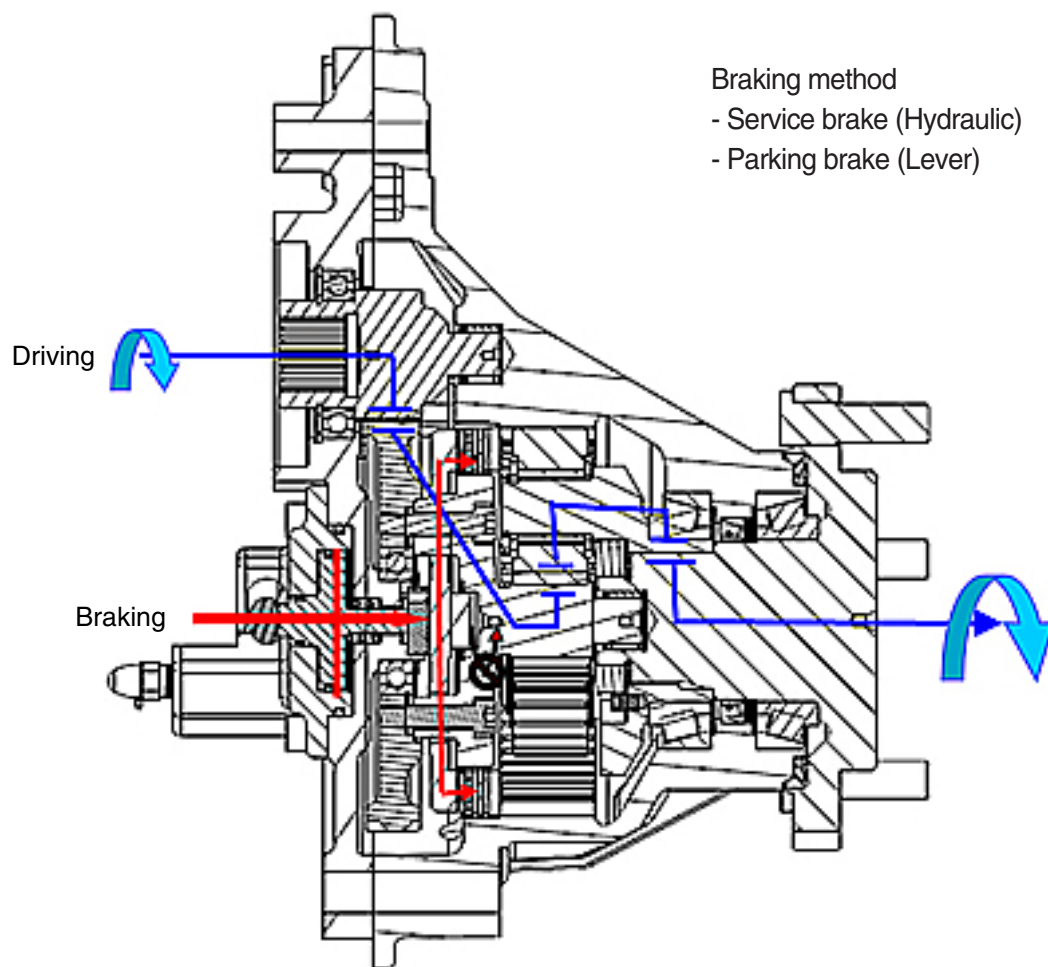
- 6 Housing (Ring gear)
- 7 Sun pinion
- 8 Planetary carrier
- 9 Wheel hub

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② The path of the power transmission

Driving : Motor → Input pinion → Ring gear → Sun pinion → Planetary gear → Wheel hub
→ Drive wheel

Braking : Pressurization of hydraulic power through the brake port
Forwarding of the brake piston → Forwarding of the actuator
→ Contact between plate and friction disc
→ Holding back the revolution of the planetary carrier
→ Holding back the revolution of the wheel hub → Holding back of the driving



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GROUP 2 TROUBLESHOOTING

Problem	Cause	Remedy
1. Consecutive noise in the housing	• Lack of oil	• Refill the oil
	• Incorrect contact between planetary gear and driving gear	• Disassemble, check and readjusting
	• Damage, wear planetary gear and driving gear	• Replace damaged or wear gear
	• Loosened or worn wheel hub bearing	• Disassemble, check and readjusting or replace the components
2. Abnormal noise during rotation	• Excessive back lash the driving gear and planetary gear	• Replace the driving gear and the planetary gear
	• Damage, worn of the gear	• Replace the gear
	• Damage, worn of the bearing	• Disassemble, check and readjusting or replace the bearing
3. Oil leakage	• Overfill to the specified level	• Readjust oil level
	• Plugged air breather	• Clean or replace the air breather
	• Damage, worn, poor assembly for oil seal of wheel hub	• Replace oil seal
	• Poor assembly of the drain plug	• Disassemble, check and readjusting
	• Damage O-ring for motor connection	• Replace the O-ring
4. No rotation of the drive wheel	• Breakage, deformation the shaft	• Replace the shaft
	• Damage, breakgae the gear	• Replace the gear
	• Damage, breakgae the bearing	• Replace the bearing
5. Brake No operation the brake	• Damage, deformation the friction disc or plate	• Disassemble, check, replace
No smooth operation the brake pedal	• Damage, deformation the friction disc of the brake	• Disassemble, check, replace
No release the brake	• Defect the brake disc assembly	• Disassemble, check, replace
Frequent refilling the brake oil	• Leakage from the piston seal	• Disassemble the piston seal and replace it
Available braking when depressing the brake pedal with maximum	• Excessive clearance of the discs due to wear of the friction disc for operation	• Adjust the stroke of the brake pedal • Disassemble the brake pack, check and replace it • Readjust the stroke of the piston

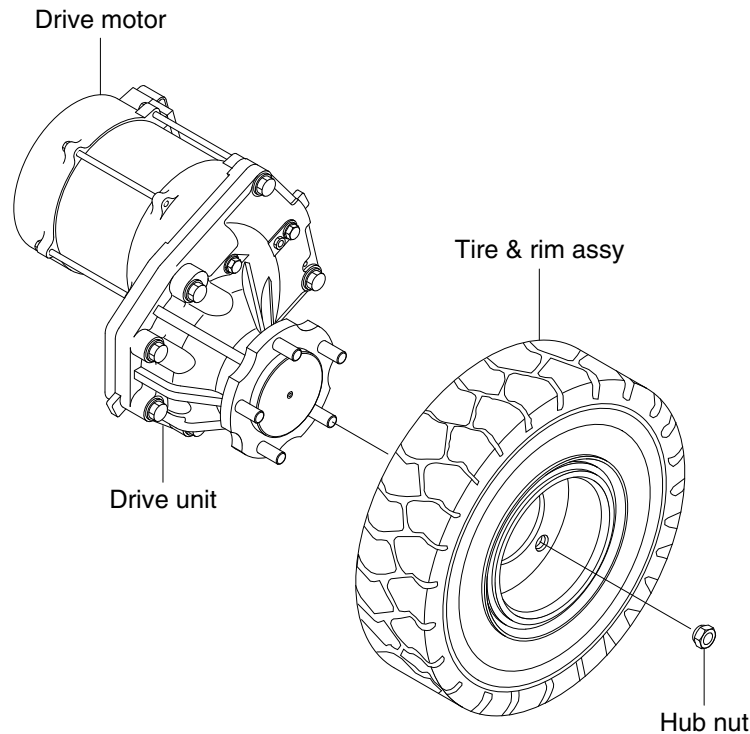
GROUP 3 DISASSEMBLY AND ASSEMBLY

1. Disassembly

Drain oil from transmission before removal of the drive unit. Loosen and remove the wheel nuts as well as take off the drive wheel. For further work on the drive motor of the drive unit see chapter.

1) REMOVAL OF THE DRIVE UNIT

(1) Removal of Drive unit. (refer to see page 2-8)



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2) REMOVAL OF THE DRIVE MOTOR

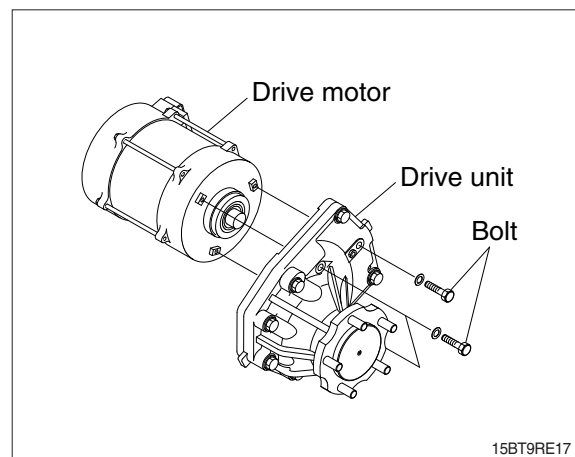
(1) Drive motor and accessories mounted to the drive motor have to be disconnected.

(2) Take off cautiously the drive motor from the drive unit.

▲ Do not damage the teeth of the motor pinion and the spur gear. Damages can cause louder running noises.

※ In case of an inadequate removal of the drive motor from the drive unit there is danger to damage the sealing surface for the O-ring in the housing.

If only the drive motor is removed, the released drive unit opening is to be sealed in order to avoid that dirt can get inside the drive unit.



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2. GENERAL INSTRUCTIONS FOR CORRECT DISASSEMBLY AND REASSEMBLY

Cleanliness is essential for a correct work.

Drive unit removed from the vehicle have to be cleaned prior to opening.

Special care and cleanliness are essential for a correct disassembly and reassembly of the unit as well as for the installation of each spare part. A fault during installation can result in an early wear and chips as well as foreign particles in the unit could cause fatal damage in the drive unit.

Prior to reassembly all parts must be cleaned and inspected for wear and other defects.

It would be a false economy to reinstall parts which are not in a perfect condition.

All parts have to be oiled carefully during reassembly. Apply a sealing compound onto housing-and cover faces, which must be tight towards the outside.

For heating of bearings etc. use heating plates, heating elements or heating furnaces.

Never heat directly with an open flame.

This avoids damage to the bearings.

If not otherwise indicated heat ball bearings, gears, flanges etc. to approx. 90-100°C.

Parts which have been mounted in a warm condition must be subsequently installed after cooling down to ensure a perfect contact.

Lubricate both parts before shafts, bearings etc. are pressed into position.

For reassembly all of the indicated setting values, test data and tightening torques must be observed.

HYUNDAI-units will be filled with oil after repair work.

※ The following description of disassembly and reassembly serves to inform both the after-sales service centers of HYUNDAI and of the vehicle manufacturer, where adequate workshop facilities and trained specialists are present.

3. DISASSEMBLY OF THE DRIVE UNIT

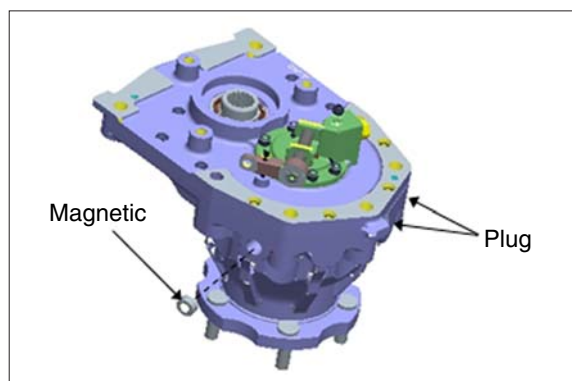
1) Disassembly of the drive unit assy.

※ Always keeps clean working area when disassembling the drive unit.



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2) Drain out oil in the drive unit assy by removing the magnetic plug.

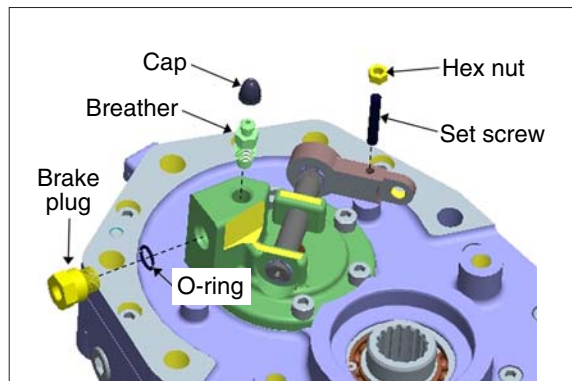


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3) Disassemble the external components of the drive unit assy.

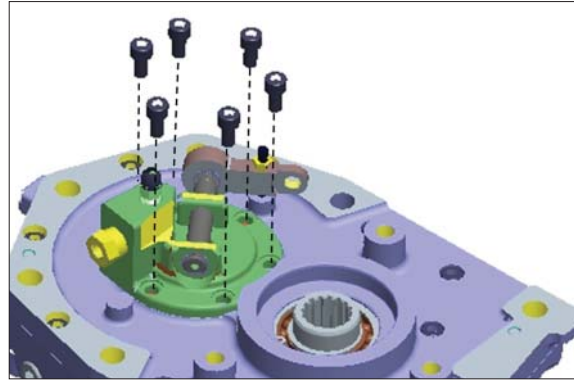
Disassemble brake plug, breather, cap, set screw and nut from the drive unit assy.

※ The components stock to the proper place and they should be replaced with new O-ring when reassembling.



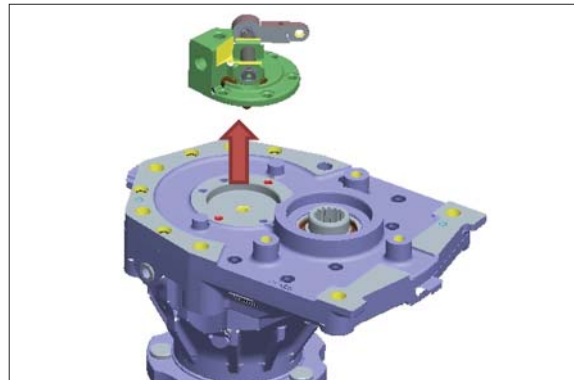
15BT9DU003

- 4) Loosen 6-socket bolts which are fixing for the parking sub assy.



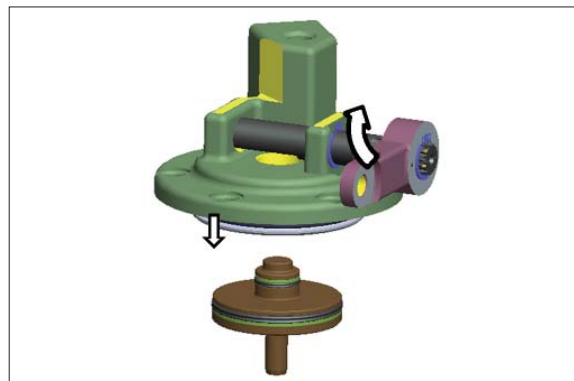
15BT9DU004

- 5) Disassemble the parking sub assy.



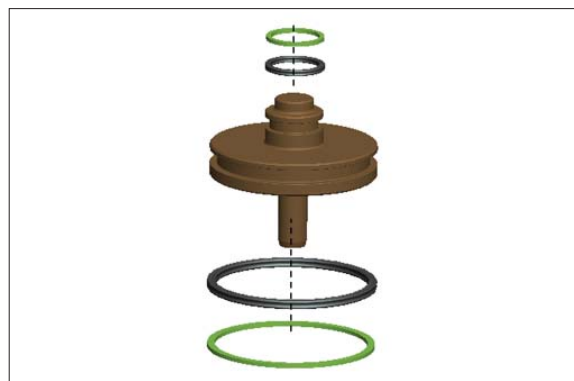
15BT9DU005

- 6) Disassemble the piston sub assy after pushing away the lever of the parking sub assy.



15BT9DU006

- 7) Remove the quad ring and back up ring from the piston sub assy.



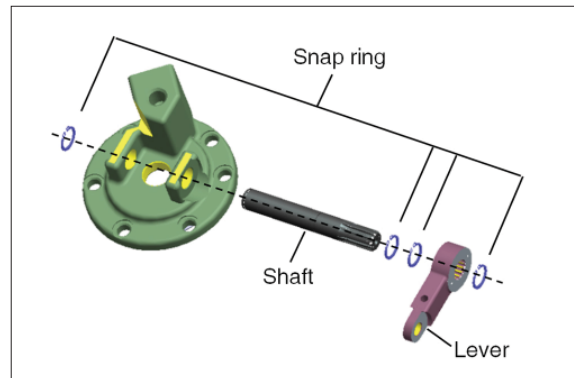
15BT9DU007

- 8) Remove the O-ring from the parking sub
assy.



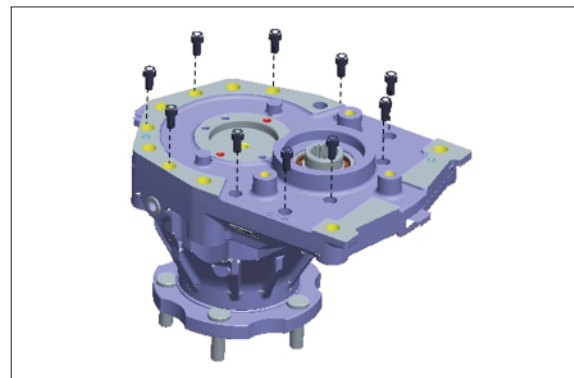
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- 9) Disassemble the snap rings, lever, and
shaft from the parking sub assy.



15BT9DU009

- 10) Loosen the socket bolts (10EA) from the
drive unit assy.



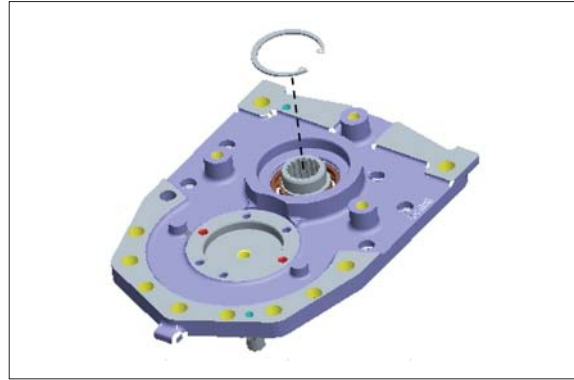
15BT9DU010

- 11) Disassemble the cover out sub assy from
the housing sub assy.

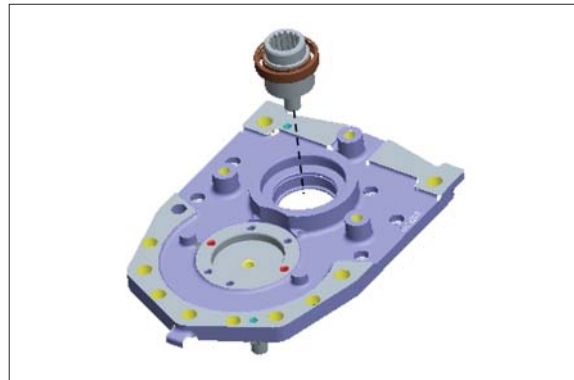


15BT9DU011

- 12) Remove the snap ring from the housing sub assy.

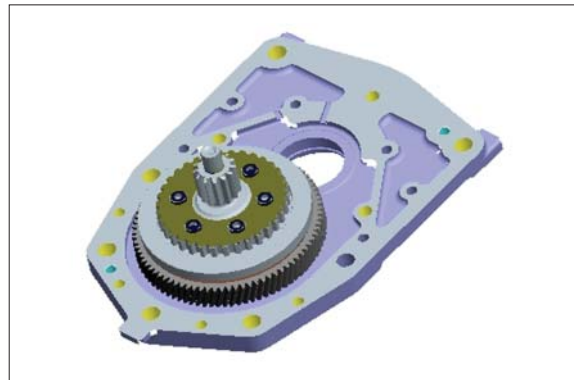


- 13) Disassemble the input pinion assembly from the housing sub assembly.

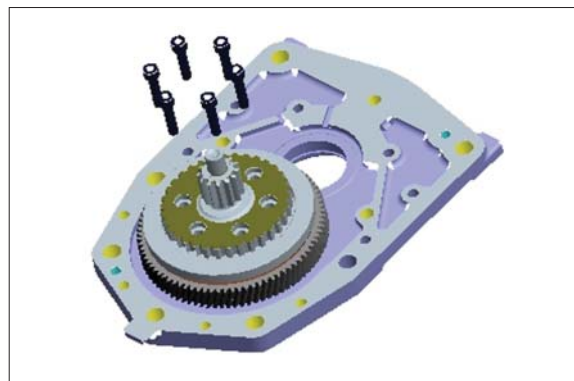


DISASSEMBLY OF THE COVER OUT SUB ASSY

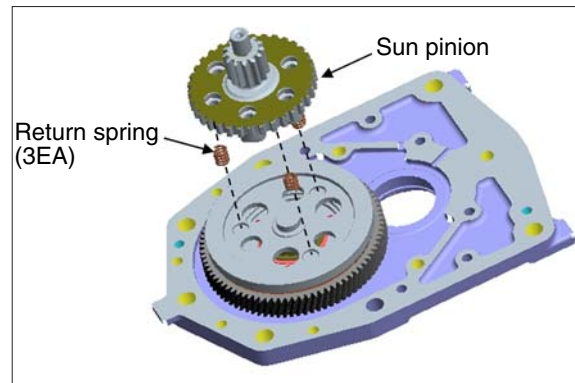
- 14) Cover out sub assy.



- 15) Loosen the socket bolts (6EA) from the cover out sub assy.



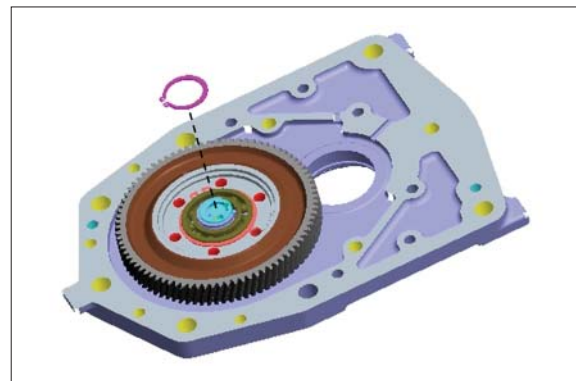
- 16) Disassemble the sun pinion and return springs (3EA) from the cover out sub Assy.



- 17) Disassemble the actuator from the cover out sub Assy.



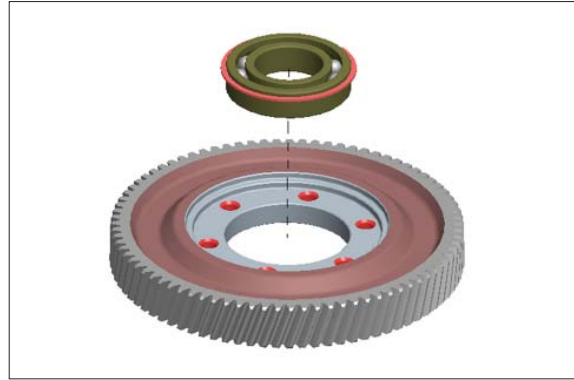
- 18) Remove the snap ring from the cover out sub Assy.



- 19) Disassemble the ring gear from the cover out sub Assy.

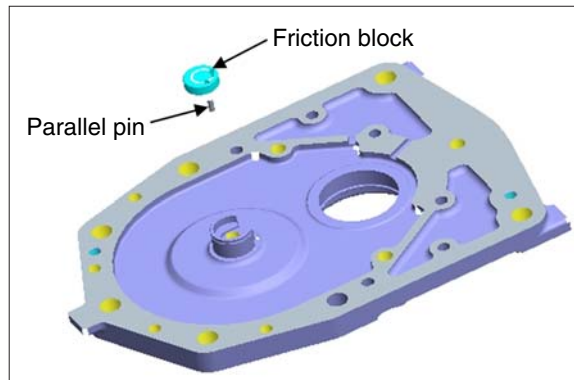


20) Remove the bearing from the ring gear.



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21) Remove the friction block and the parallel pin from the cover out sub assy.



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DISASSEMBLY OF THE HOUSING SUB ASSY

22) Housing sub assy.



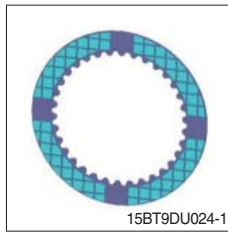
15BT9DU022

23) Loosen the special bolts (3EA) from the housing sub assy.

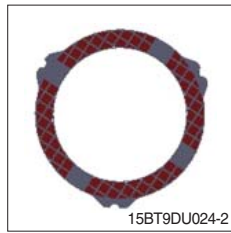


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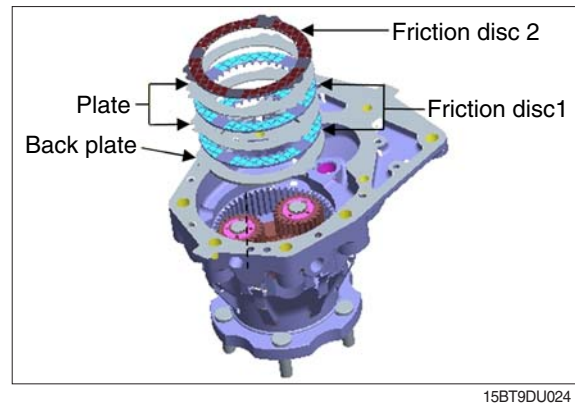
- 24) Disassemble the friction disc 1 (2EA), friction disc 2 (1EA), plates (2EA), back plate (1EA).



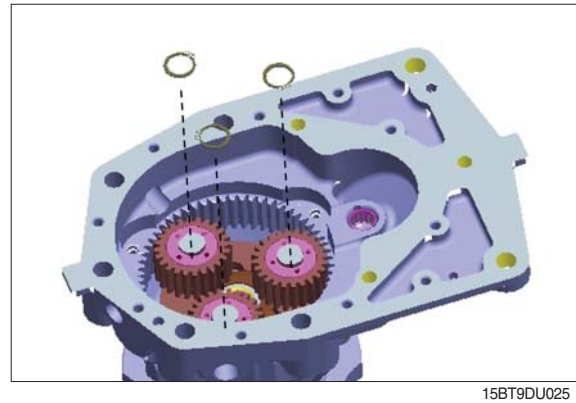
Friction disc 1



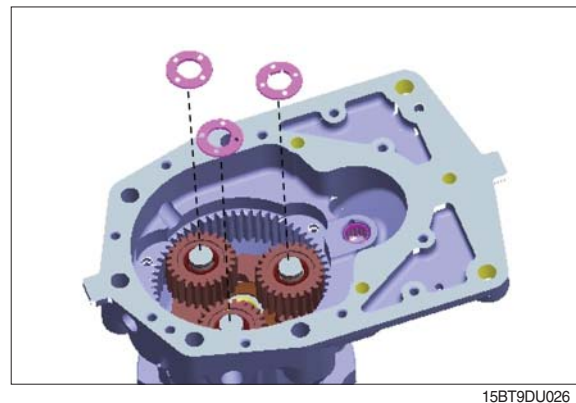
Friction disc 2



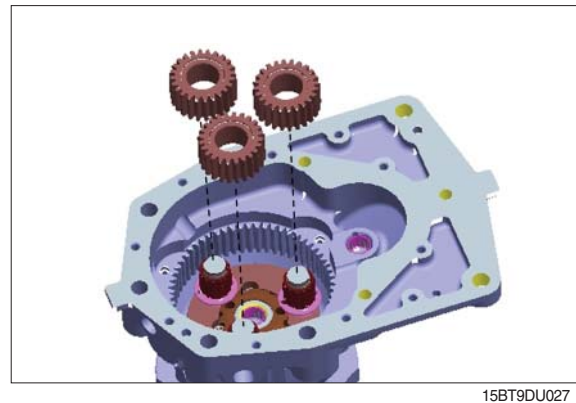
- 25) Remove the snap rings (3EA) from the housing sub assy.



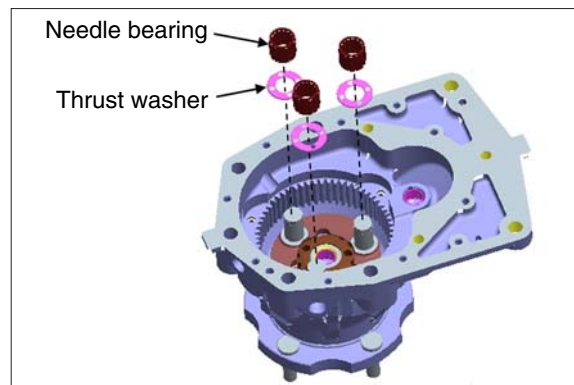
- 26) Remove the thrust washers (3EA) from the housing sub assy.



- 27) Disassemble the planetary gears (3EA) from the housing sub assy.

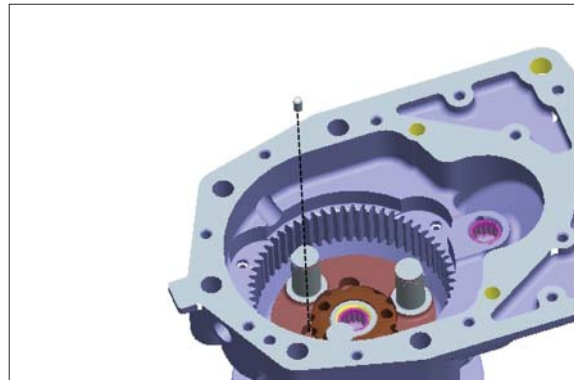


- 28) Remove the thrust washers (3EA), the needle bearings (3EA) from the housing sub assy.



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- 29) Remove the set screw from the housing sub assy.



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- 30) Remove the lock nut from the housing sub assy.

- ※ When removing the lock nut from the housing sub assy, it should be used the special tool.



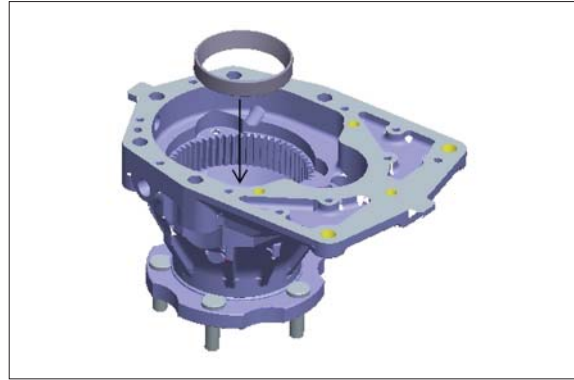
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- 31) Disassemble the planetary carrier and bearing cone from the housing sub assy.



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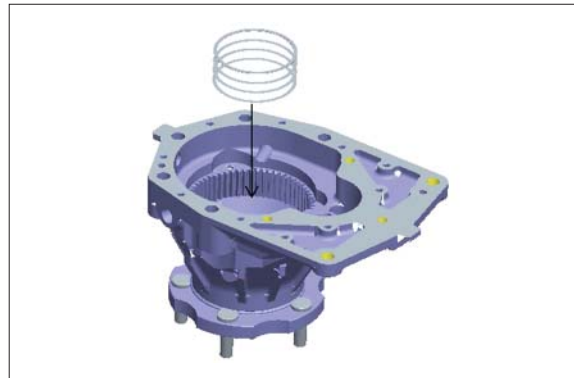
32) Remove the bearing cap from the housing sub assy.



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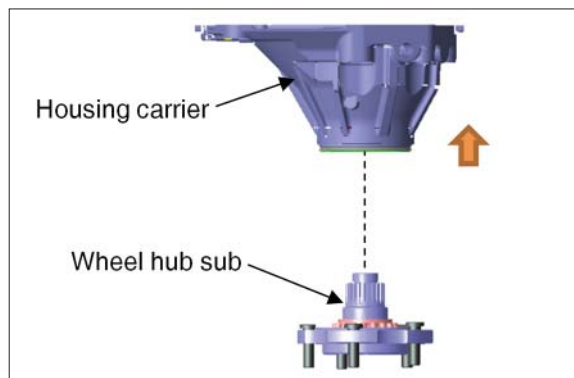
33) Remove the shims from the housing sub assy.

※ If the bearings are not replaced with new one, take care to safe keep the shims to the proper place.



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34) Disassemble the wheel hub sub assy from the housing sub assy.



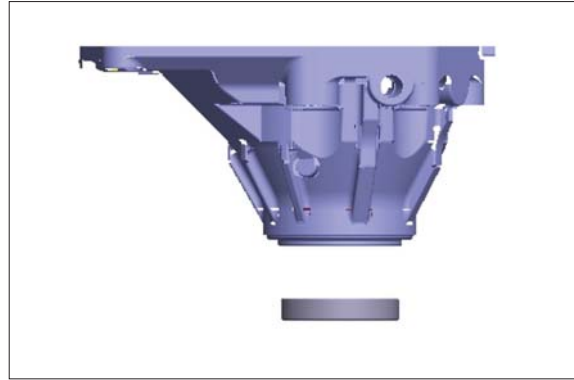
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35) Remove the Gamma seal from the housing carrier.



15BT9DU035

36) Remove the bearing cup from the housing carrier.



15BT9DU036

37) Remove the oil seal from the housing carrier.

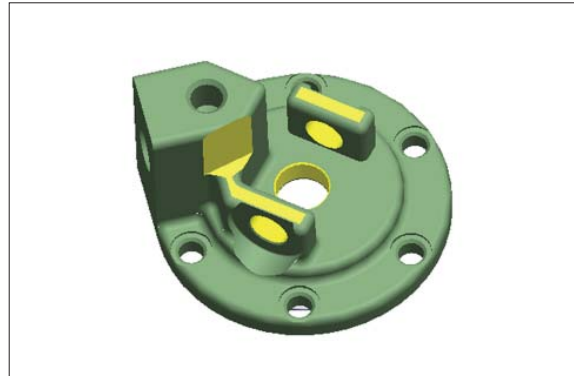


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4. ASSEMBLY OF THE DRIVE UNIT

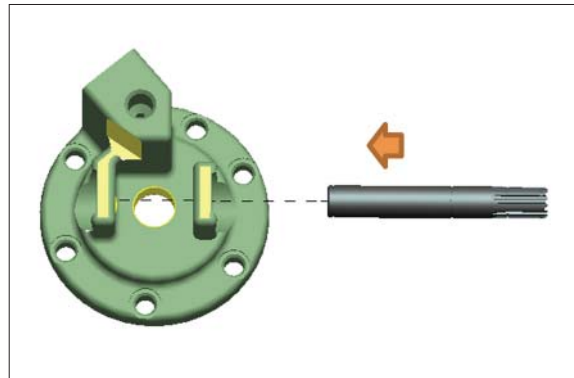
1) ASSEMBLY OF THE HOUSING SUB ASSY

(1) Assembly of the parking sub assy.



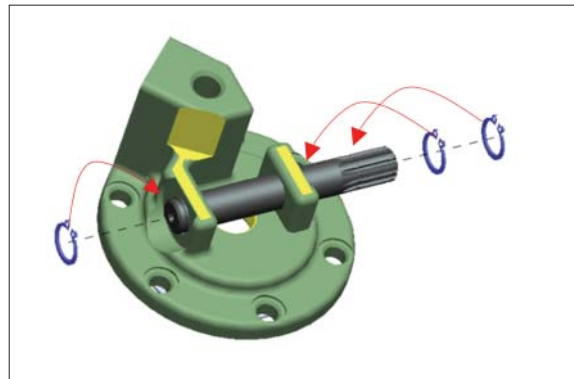
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(2) Assemble the shaft to the parking cover.



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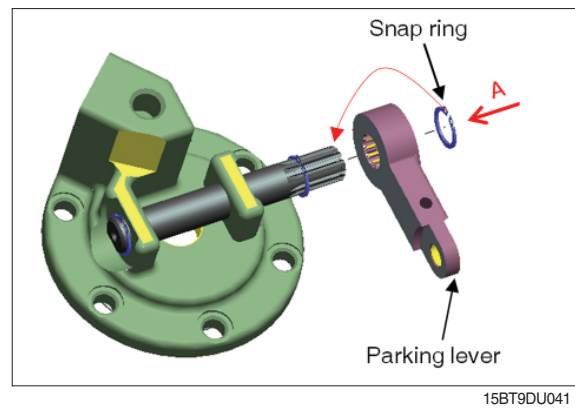
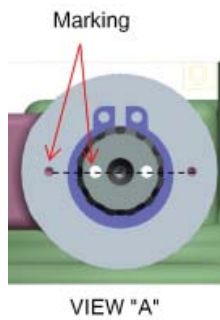
(3) Assemble the snap rings (3EA) to the shaft.



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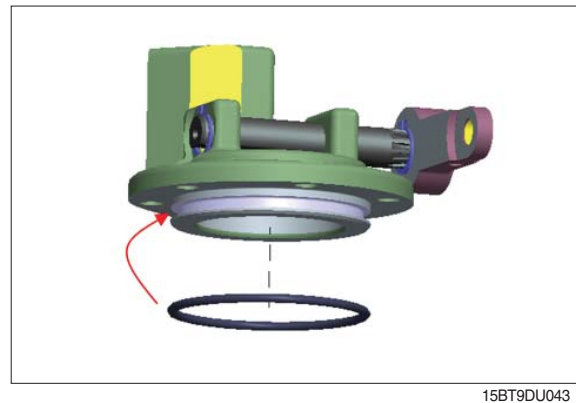
- (4) Assemble the parking lever to the shaft and fix with snap ring.

※ Be sure that the marking on the parking lever gets into inline to the marking on the shaft (Refer to VIEW "A")



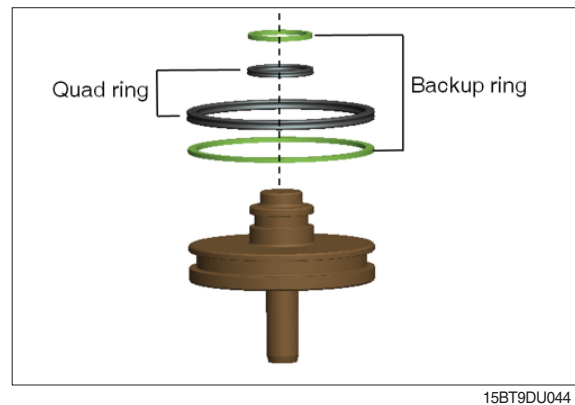
- (5) Assemble the O-ring to the parking cover.

※ Apply oil on the O-ring surface prior to assembling.

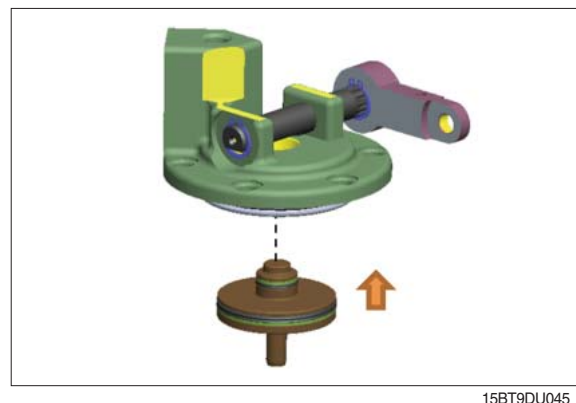


- (6) Assemble the backup ring and the quad ring.

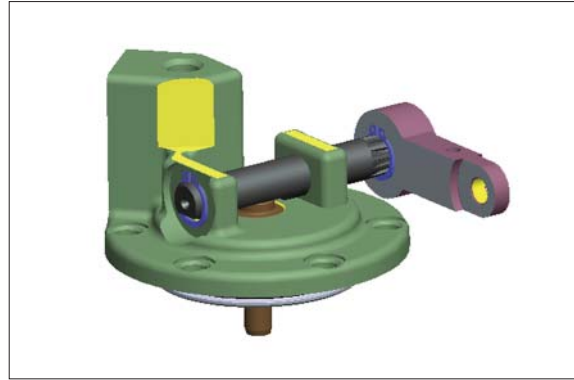
※ Apply oil on the quad ring surface before assembling and check the twisting for quad ring after assembling.



- (7) Assemble the piston to the parking sub assembly.



- (8) Completion of assembly of the parking sub assy.

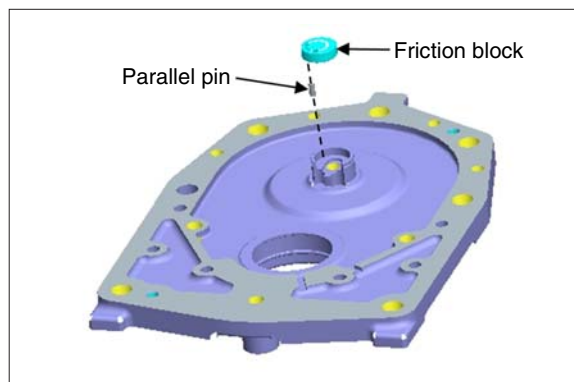


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2) ASSEMBLY OF THE COVER OUT SUB ASSY

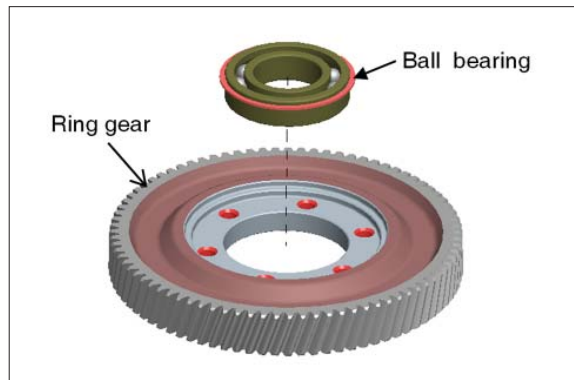
- (1) Assemble the friction block after inserting the parallel pin.

※ When assembling the friction block, take care to the direction of assembling of it. Refer to the following figure for the location of the lubrication hole.



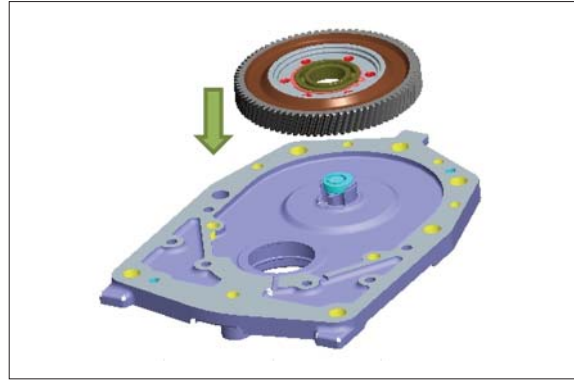
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- (2) Assemble the ball bearing to the ring gear.



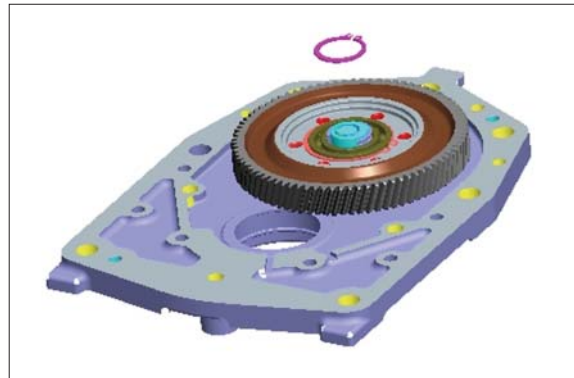
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- (3) Assemble the ring gear to the cover out
assy.



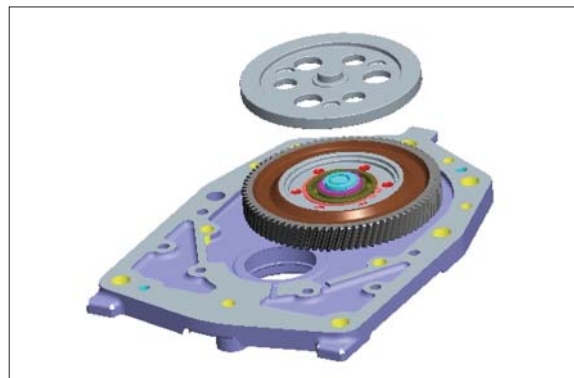
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- (4) Assemble the snap ring to the cover out
assy.



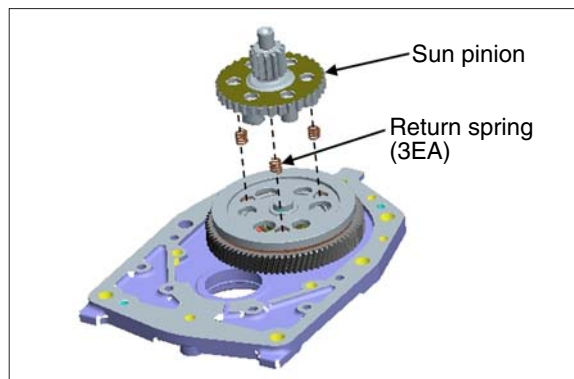
15BT9DU051

- (5) Assemble the actuator to the cover out
assy.



15BT9DU052

- (6) Assemble the sun pinion after assembling
the return springs (3EA).



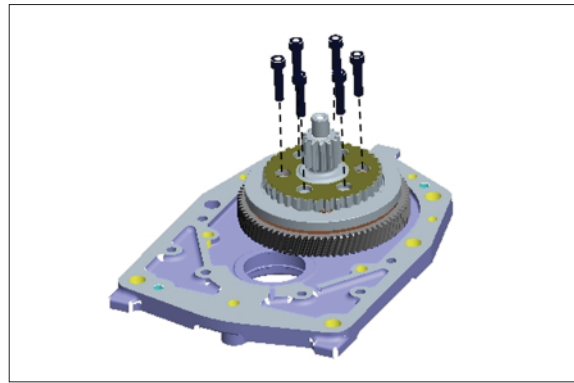
15BT9DU053

(7) Assemble the bolts (6EA) to the sun pinion.

- Tightening torque : 3.5~3.8 kgf · m

※ Apply the Loctite #277 on the thread of the bolts.

When assembling the bolts, it should be fixed the ring gear using the filter wrench.



15BT9DU054

3) ASSEMBLY OF THE HOUSING SUB ASSY



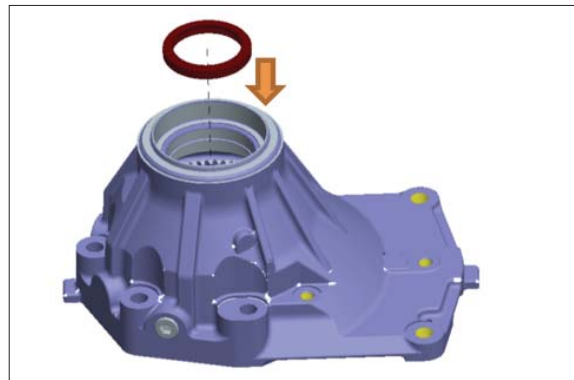
15BT9DU056

(1) Assemble the oil seal in the housing sub assy.

※ When assembling the oil seal to the housing sub assy, it should be used the special tool.

- Inner race : Apply with grease

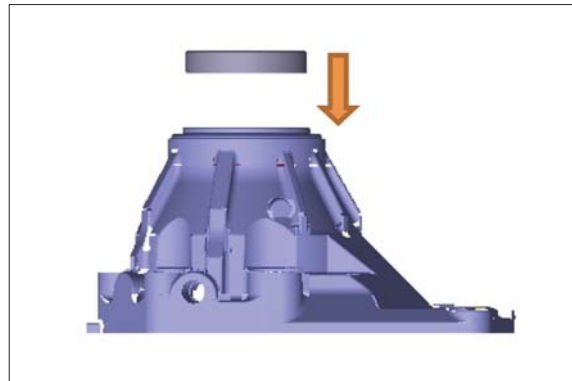
- Outer race : Apply with Loctite #592



15BT9DU057

(2) Assemble the bearing cup in the housing sub assy.

※ When assembling the bearing cup, it should be used the special tool.

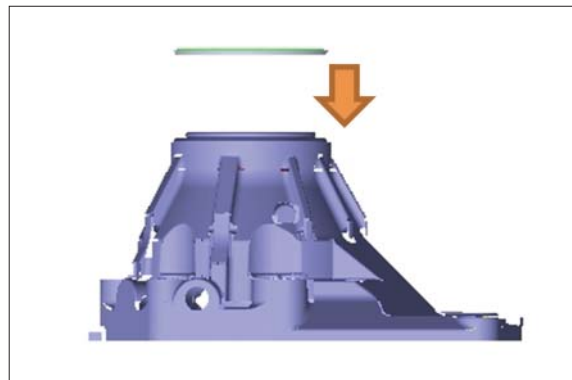


15BT9DU058

(3) Assemble the Gamma seal in the housing sub assy.

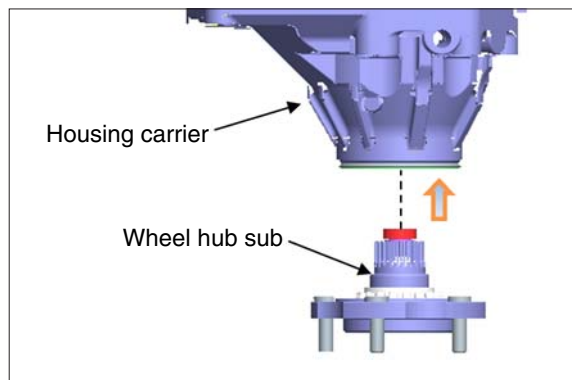
※ When assembling the Gamma seal in the housing sub assy, it should be used the special tool.

- Seal : Apply with grease
- Compression area (steel) : Apply with Loctite #609



15BT9DU059

(4) Assemble the wheel hub sub to the housing carrier.



15BT9DU060

(5) Using the DB torque wrench before shim assembly 0.5 mm shim assembly after measure and record the resistance value.



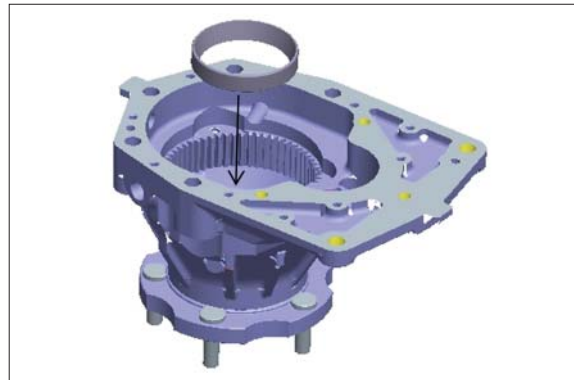
15BT9DU061



15BT9DU062

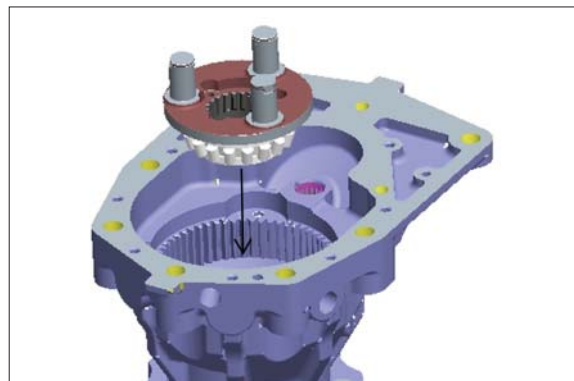
(6) Assemble the bearing cup in the housing carrier.

- ※ It should be used the special tool when assembling the bearing cup in the housing carrier.



15BT9DU063

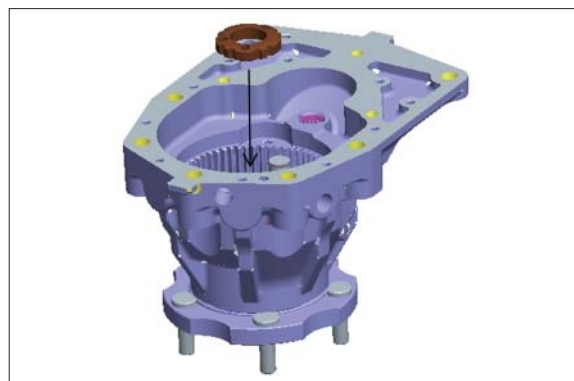
(7) Assemble the planetary carrier and bearing cone in the housing carrier.



15BT9DU064

(8) Assemble the lock nut in the housing carrier.

- ※ Apply with Loctite #277 after removing the oil and the foreign material on the thread of the bolts.
 - Tightening torque : 25~28 kgf · m
 - Preload : 0.4~0.5 kgf · m

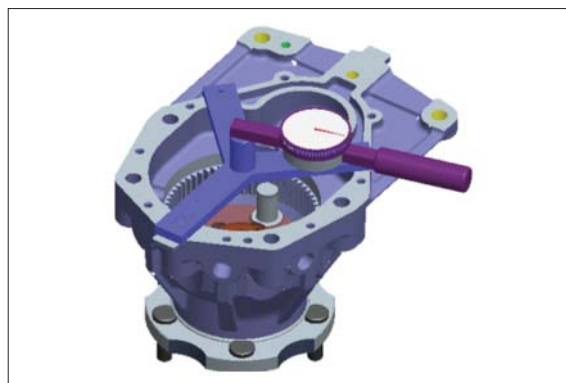


15BT9DU065

- ※ After the locknut tightening, the preload value is measure in the DB torque wrench, it must be value below. (Seal resistance value $+0.45 \text{ kgf} \cdot \text{m}$)

If it is not gotten the specified free load, rework repeatedly according as (5)~(8) procedure and it should be set with the specifed preload as an adding or removing the shims properly.

ex) Seal resistance value $0.25 \text{ kgf} \cdot \text{m}$ is measured at 5) final preload bearing is $0.25 + (0.45 \pm 0.05) = 0.65 \sim 0.75 \text{ kgf} \cdot \text{m}$

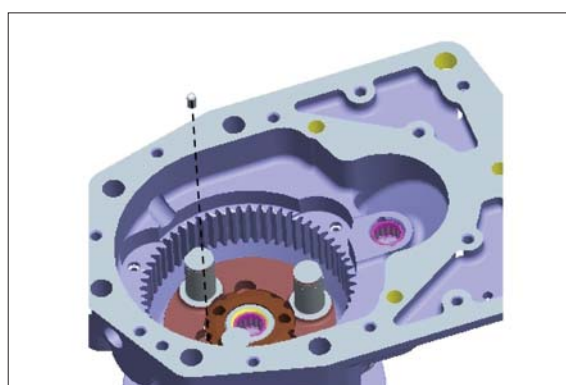
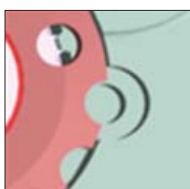


15BT9DU066

- (9) Assemble the set screw to the housing carrier.

- Tightening torque : $1.5 \sim 1.8 \text{ kgf} \cdot \text{m}$
- Apply with Loctite #242

- ※ Take care to confirm the assembly location. (Refer to the right figure)

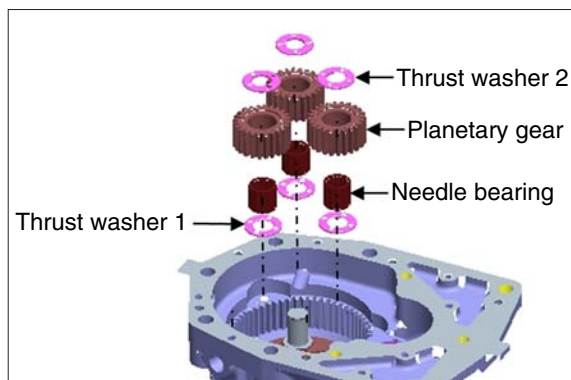


15BT9DU067

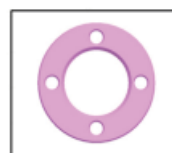
- (10) Assemble the components according as the following sequence.

Thrust washer 1 → Needle bearing
→ Planetary gear → Thrust washer 2

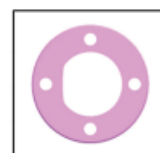
- ※ Apply with oil to the roller area of the needle bearing
- ※ Take care to observe the assembly sequence of the thrust washers.



15BT9DU069



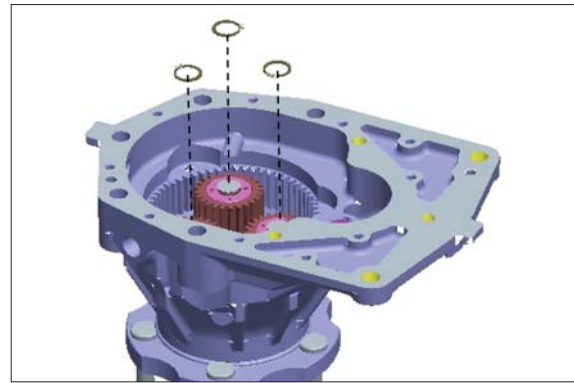
Thrust washer 1



Thrust washer 2

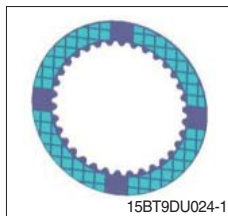
15BT9DU070

- (11) Assemble the snap rings (3EA) in the housing carrier.

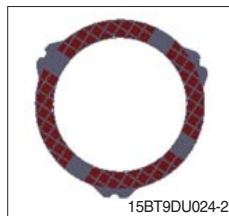


15BT9DU071

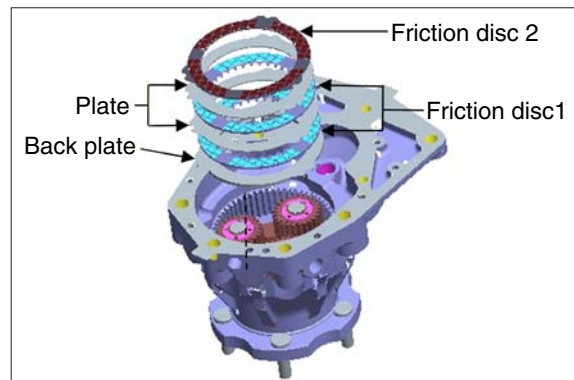
- (12) Assemble the components according as the following sequence.
Back plate → (Friction disc 1 → plate) × 2
→ Friction disc 2



Friction disc 1



Friction disc 2

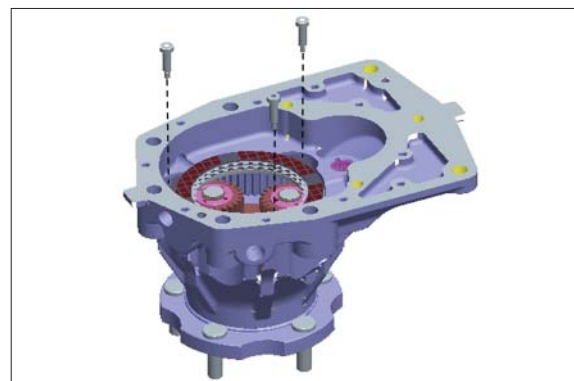


15BT9DU024

- (13) Assemble the special bolts (3EA) to the housing carrier.

• Tightening torque : 1.5~1.8 kgf · m

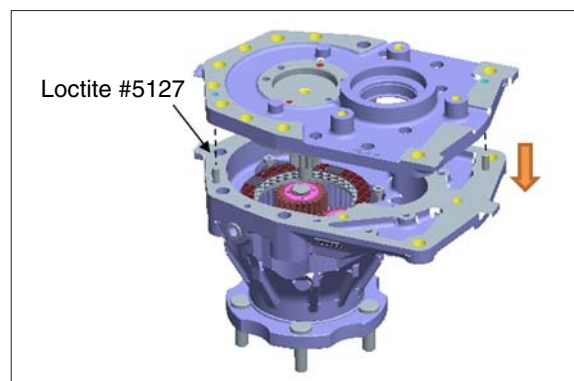
- ※ Apply with Loctite #242 on the thread of the special bolts.



15BT9DU073

- (14) Assemble the cover out sub to the housing carrier.

- ※ Apply with Loctite #5127 on the surface of the assembly.

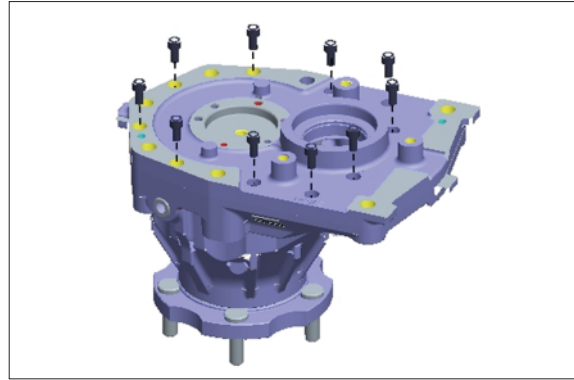


15BT9DU074

(15) Assemble the socket bolts (10EA) to the housing carrier.

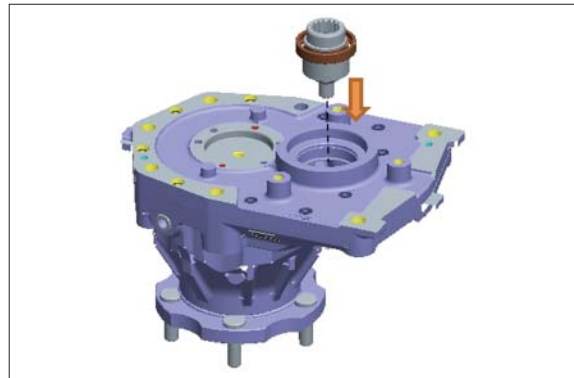
• Tightening torque : 3.5~3.8 kgf · m

※ Apply with Loctite #277 on the thread of the socket bolts.



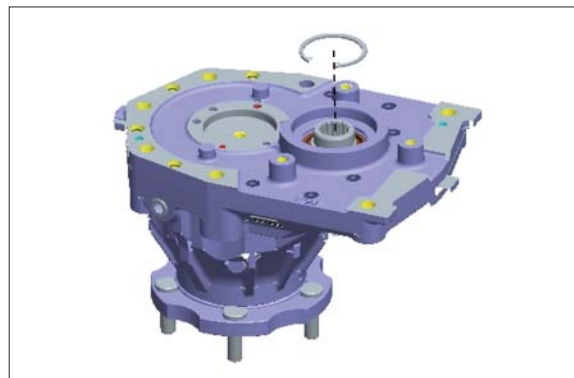
15BT9DU075

(16) Assemble the input pinion in the housing carrier.



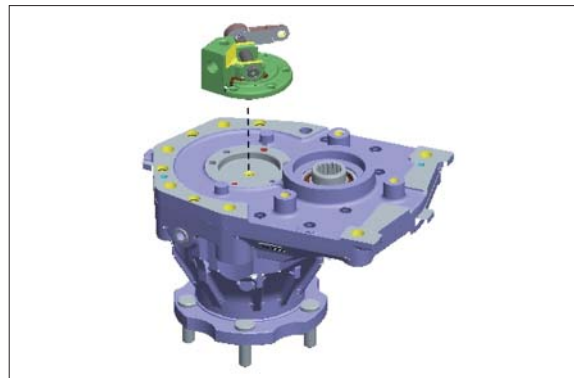
15BT9DU076

(17) Assemble the snap ring to the housing carrier.



15BT9DU077

(18) Assemble the parking cover sub to the housing carrier.

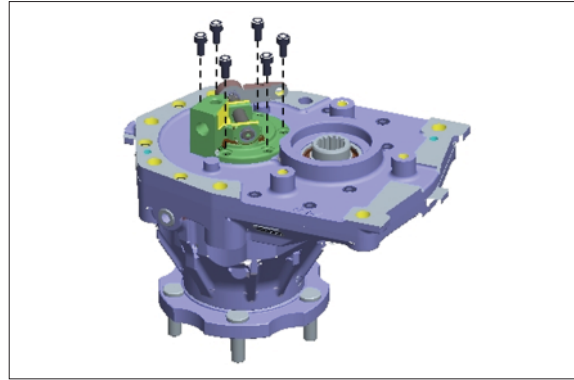


15BT9DU078

(19) Assemble the bolts (6EA) to the housing carrier.

• Tightening torque : 3.5~3.8 kgf · m

※ Apply with Loctite #277 on the thread of the bolts.

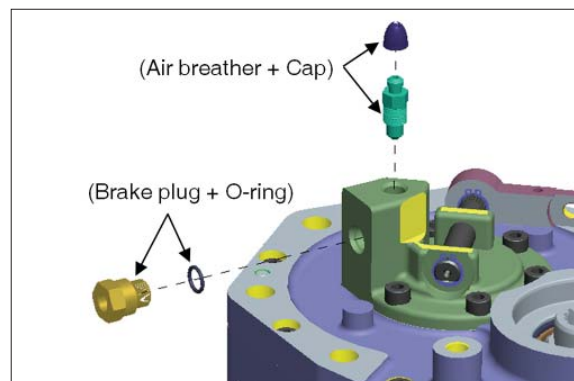


15BT9DU079

(20) Assemble the brake plug, O-ring, air breather, and cap to the housing carrier.

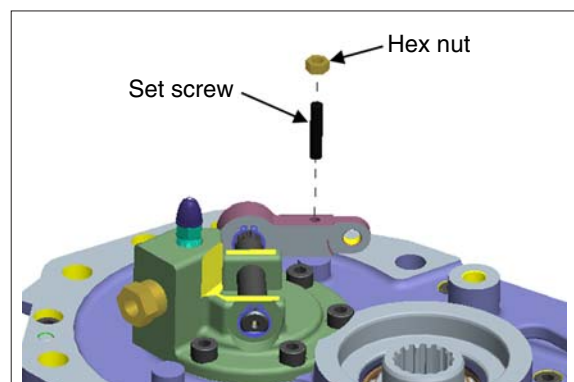
• Tightening torque : 1.5~2.0 kgf · m

※ Apply with oil on the O-ring surface.



15BT9DU080

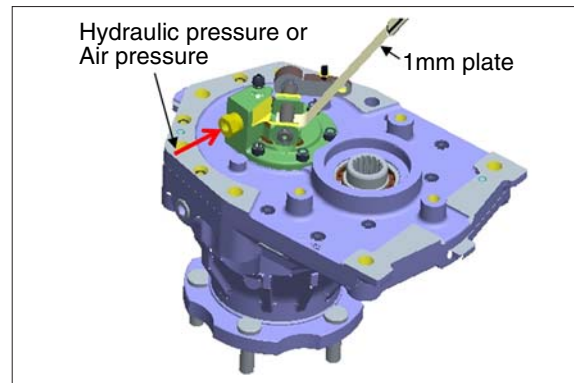
(21) Assemble the set screw and hex nut to the housing carrier.



15BT9DU081

(22) SETTING OF THE PISTON STROKE (1 mm)

- ① Retain the space between the piston and the lever by pouring the hydraulic pressure or air pressure into the brake plug.
- ② Insert 1 mm thickness plate between lever and piston.
- ③ Tighten the set screw which is assembled to the lever with maximum.
- ④ After the set screw is rotated with 2 revolution to counterclockwise, remove 1mm thickness plate.
- ⑤ Tighten the set screw with 2 revolution to clockwise.
- ⑥ Assemble the hex nut after completion of the setting for the piston stroke.
 - Tightening torque : 1.0~1.5 kgf · m



15BT9DU082

(23) Assemble the air breather and plug to the housing carrier.

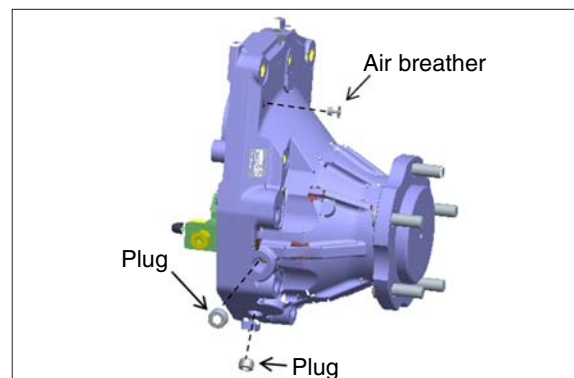
- Air breather

Tightening torque : 3.0~4.1 kgf · m

- Plug

Tightening torque : 3.0~4.1 kgf · m

Apply with Loctite #577



15BT9DU084