

SECTION 3 POWER TRAIN SYSTEM

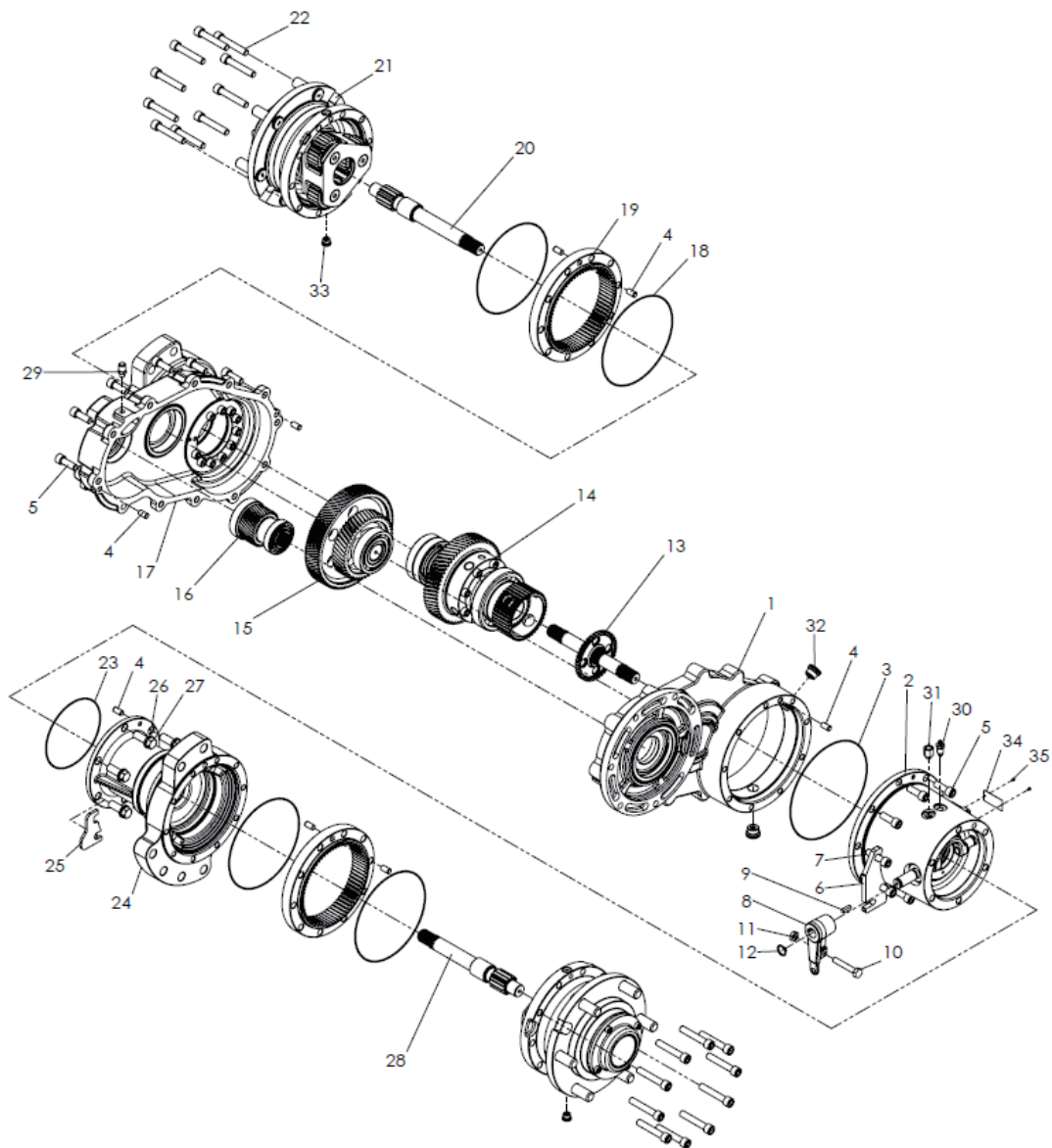


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SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

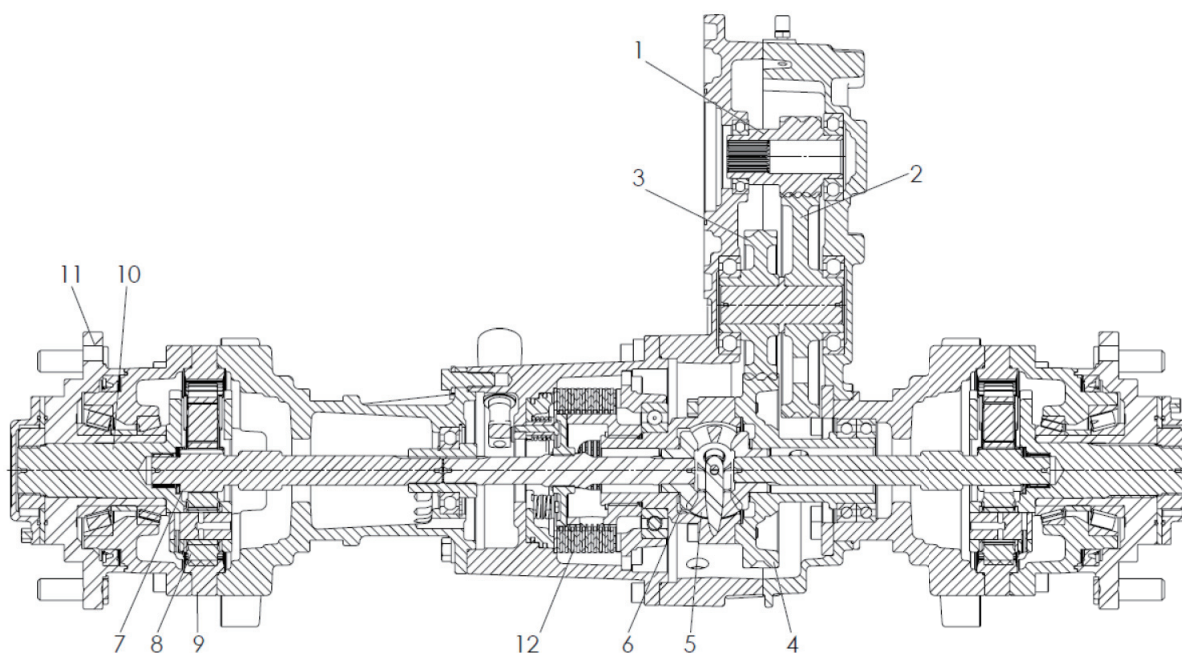
1. STRUCTURE



25BX3PS01

1	Motor case	13	Center axle assembly	25	Parking stopper plate
2	Brake assembly	14	Differential gear assembly	26	Spring washer
3	O-ring	15	Second gear assembly	27	Hexagonal bolt
4	Dowel pin	16	First gear assembly	28	RH axle shaft
5	Socket-head bolt	17	LH axle housing	29	Air breather
6	Bracket	18	O-ring	30	Air breather
7	Socket-head bolt	19	Gear ring	31	Brake port
8	Parking lever	20	LH axle shaft	32	Drain A plug
9	Key	21	Wheel assembly	33	Drain B plug
10	Hexagonal bolt	22	Socket	34	Axle name plate
11	Nut	23	O-ring	35	Rivet
12	Snap ring	24	RH axle housing		

2. OPERATION



25BX3PS02

The drive axle is a power train system consisted of a service brake and a parking brake, and assembled in the drive wheel of a battery-powered forklift truck.

Drive axle transfers torque of drive motor to drive wheel through the following procedures:

Gear trains of major gear box consist of helical gears (1) to (4). Torque is transferred from drive motor to helical gear (1). Torque is transferred to differential gear through helical gear (4), and further to planetary gears (7) and (8) through axle (9). Planetary gear plays a role of transferring torque to carrier shaft (10) and wheel adapter (11).

Service brake and parking brake (12) are configured on the shaft on one side of differential gear, and work in the wet disk mode.

3. SPECIFICATIONS

Item	Unit	Specifications
Max. axle load	kg	9000
Max. input speed	rpm	4000
Gear ratio	-	24.34
Weight (excluding oil)	kg	190
Oil volume	l	7.0

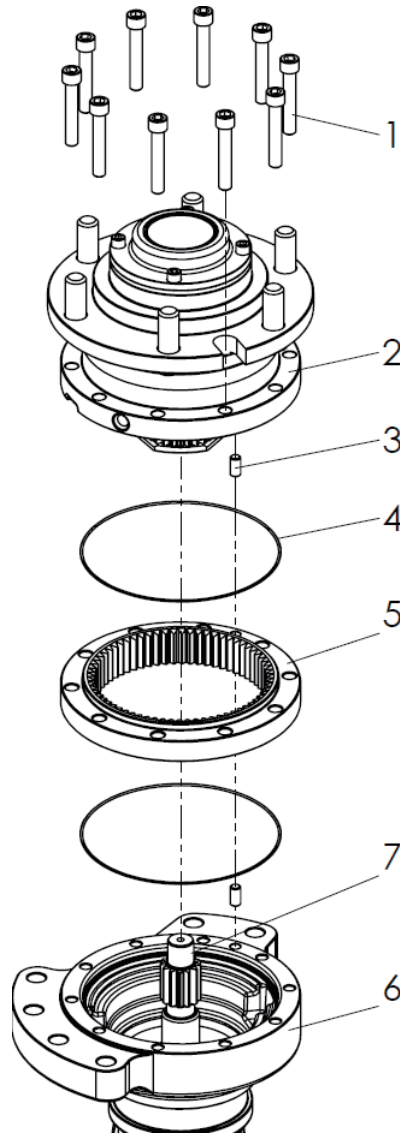
GROUP 2 FAILURE DIAGNOSIS AND CORRECTIVE ACTIONS

Trouble	Cause	Corrective action
1. Noise 1) High frequency noise 2) Abnormal noise 3) Internal grinding noise	<ul style="list-style-type: none"> · Misaligned mounting of input gear and drive motor · Incorrect connection of motor · Defective motor bearing · Defective wheel bearing <ul style="list-style-type: none"> - Low level of gear oil - Extreme pre-stress of bearing · Damage of planetary gear <ul style="list-style-type: none"> - Low level of gear oil - Excessive play of wheel bearing 	1. Remove the drive motor. 2. Check tooth face and helical gear of backlash for damage. 3. Check connection, and dimensions of spline. 4. Check input gear and drive motor for correct mounting. <ul style="list-style-type: none"> - Check the motor connection. - Check bearings of motor and axle. - Check bearing at the shop. <ul style="list-style-type: none"> - Check planetary gear and wheel bearing at the shop.
2. Oil leak 1) Air breather valve 2) Drive motor 3) Wheel adaptor and housing 4) Parking lever	<ul style="list-style-type: none"> · Excessive level of gear oil · Valve trouble · High pressure inside gear box · O-ring damaged · Housing damaged · Damage on oil sealing and adaptor of wheel housing · O-ring damaged · Housing damaged 	<ul style="list-style-type: none"> - Checking gear oil level - Checking valve for damage - Checking inside pressure - Remove drive motor, and check O-ring and housing surface for damage. - Replace oil seal between drive housing and adaptor. 1. Remove parking lever, and check O-ring and housing surface. 2. Contact the shop or your dealer.
2. High temperature 1) High temperature of drive motor	<ul style="list-style-type: none"> · Excessively high or low level of gear oil · Excessive load on wheel bearing · No play on brake disk · Parking brake being caught 	<ul style="list-style-type: none"> - Checking gear oil level - Checking play on wheel shaft - Checking play on brake disk - Checking parking brake conditions

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. WHEEL ASSEMBLY

1) DISASSEMBLING



25BX3PS03

1	Socket-head bolt	4	O-ring	7	Axle shaft
2	Wheel hub assembly	5	Ring gear		
3	Dowel pin	6	Axle housing		

(1) Disassemble oil injection port, and three drain plugs from the bottom of axle to drain gear oil.

(2) Remove socket-head bolt (1) from axle housing (6).

(3) Remove wheel hub assembly (2) from axle housing (6).

(4) Remove axle shaft (7) from axle assembly.

※ Care should be exercised to protect O-ring from damage after disassembling drain plug.

※ Store LH and RH axle shafts respectively.

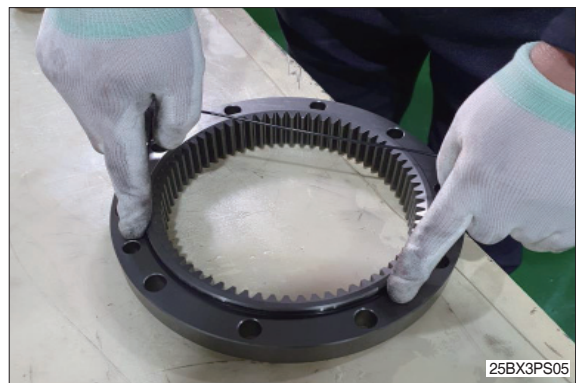
2) ASSEMBLING

(1) Mount axle shaft (7) on spline hub.

※ Assemble correct LH or RH axle shaft.



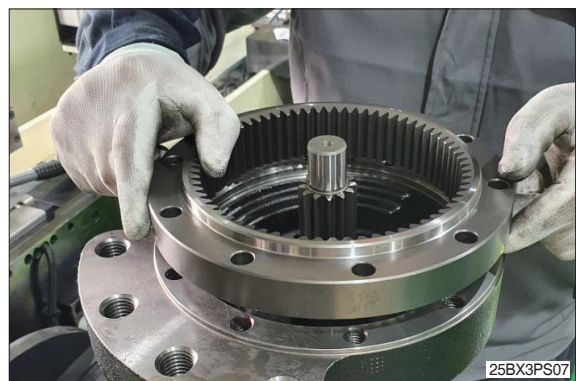
(2) Care shall be exercise to protect O-ring (4) from damage when assembling it on ring gear (5).



(3) Lubricate the surface of O-ring with grease.



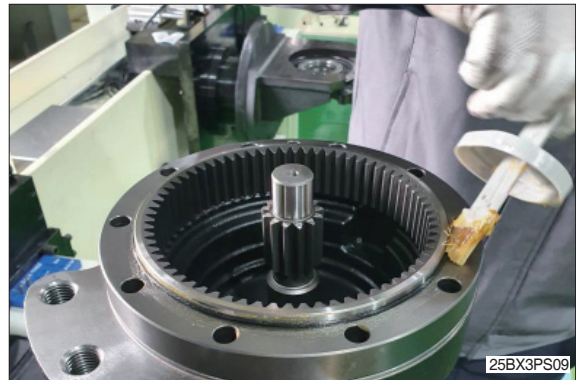
(4) Assemble ring gear assembly on axle housing (6).



- (5) Care shall be exercise to protect O-ring (4) from damage when assembling it on ring gear (5).



- (6) Lubricate the surface of O-ring with grease.



- (7) Assemble dowel pin (3) on ring gear (5).



- (8) Assemble wheel hub assembly (2) on axle housing (6).



- (9) Never forget to coat 10 socket-head bolts (1) with Loctite 277.



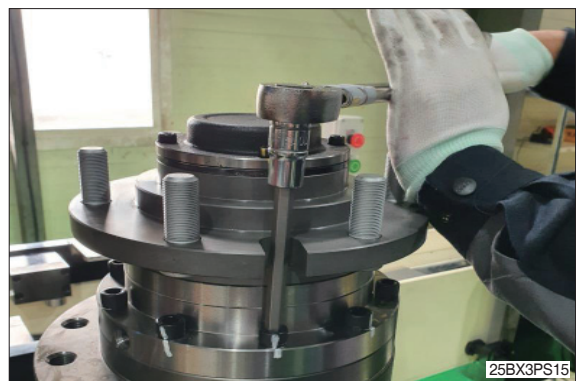
- (10) Assemble socket-head bolt (1) on axle housing (6).



- (11) Mark on bolt head and housing for checking correct assembling.

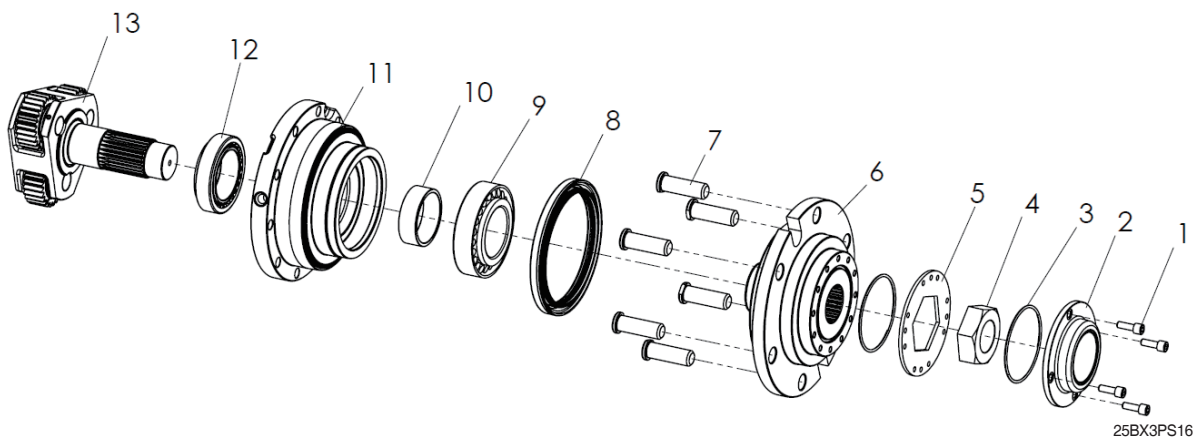


- (12) Fasten socket-head bolt (1).
· Fastening torque : $9 \pm 0.5 \text{ kgf} \cdot \text{m}$



2. WHEEL HUB ASSEMBLY

1) DISASSEMBLING



- | | | | | | |
|---|------------------|----|----------------------|----|------------------------|
| 1 | Socket-head bolt | 6 | Adaptor | 11 | Final housing |
| 2 | Wheel cap | 7 | Stud bolt | 12 | Taper roller bearing |
| 3 | O-ring | 8 | Oil seal | 13 | Carrier shaft assembly |
| 4 | Lock nut | 9 | Taper roller bearing | | |
| 5 | Lock plate | 10 | Spacer | | |

- (1) Remove socket-head bolt (1) from wheel cap (2).
- (2) Remove wheel cap (2), O-ring (3), lock nut (4) and lock plate (5) in order.
- (3) Press the top of carrier shaft down to remove carrier cap assembly (13).
- (4) Remove final housing (11) from adaptor (6).
- (5) Remove stud bolt (7) and oil seal (8) from adaptor (6).

2) ASSEMBLING

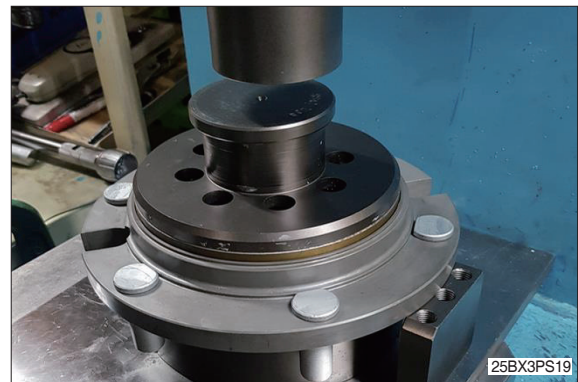
- (1) Make use of jig and press to assemble stud bolt (7) on adaptor (6).



- (2) Apply ThreeBond on the outer surface of oil seal (8).



- (3) Make use of jig and press to assemble oil seal (8) on adaptor (6).



- (4) Lubricate ring surface inside adaptor (6) with proper amount of grease.



- (5) Make use of jig and press to assemble taper roller bearing (9) on adaptor (6).



(6) Assemble space (10) on adaptor (6).



(7) Make use of jig and press to assemble final housing (11) and taper roller bearing (12) on adaptor (6).



(8) Make use of jig and press to assemble carrier shaft assembly (13) on adaptor (6).



(9) Make use of push-pull gauge to check bearing preload.
· Set preload : 0.12-0.16 kgf · m



- (10) Assemble lubricated O-ring on adaptor (6).



- (11) Assemble lock plate on carrier shaft, and then fasten lock nut lubricated with Loctite 277 on carrier shaft.
· Fastening torque : 15 ± 0.5 kgf · m



- (12) Make use of push-pull gauge to check bearing preload.
· Set preload : 0.12-0.16 kgf · m



- (13) Assemble O-ring (3) lubricated with grease on wheel cap (2).



- (14) Lubricate assembled O-ring with grease, and assemble wheel cap (2) on adaptor (6).

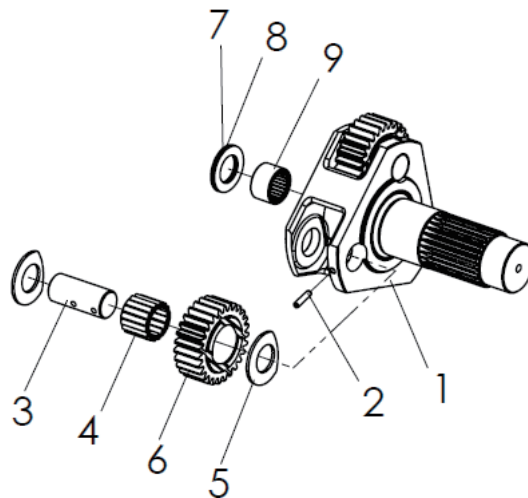


- (15) Fasten socket-head bolt (1) lubricated with Loctite 277 on wheel cap (2).
· Fastening torque : $3.3 \pm 0.2 \text{ kgf} \cdot \text{m}$



3. CARRIER SHAFT ASSEMBLY

1) DISASSEMBLING



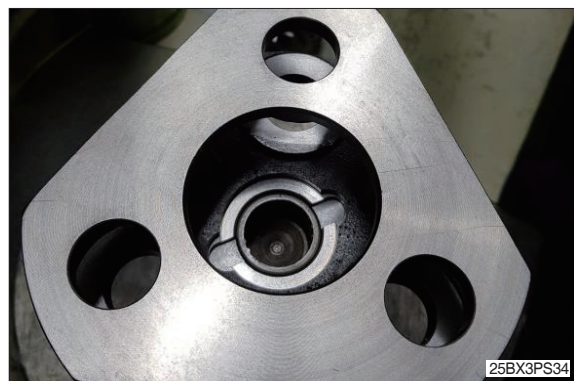
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- | | | | | | |
|---|----------------------|---|-----------------------|---|------------------------------|
| 1 | Carrier shaft | 4 | Needle roller bearing | 7 | Thrust washer |
| 2 | Spring pin | 5 | Thrust washer | 8 | Thrust needle roller bearing |
| 3 | Planetary gear shaft | 6 | Planetary gear | 9 | Needle roller bearing |

- (1) Strike spring pin (2) in vertical direction with round pin and mallet to remove planetary gear (6).
- (2) Once planetary gear is removed, remove thrust washer (7) and thrust needle roller bearing (8).

2) ASSEMBLING

- (1) Make use of jig and press to assemble needle roller bearing (9) on carrier adaptor (1).



- (2) Assemble thrust washer and needle valve bearing (7, 8) on grease-lubricated carrier shaft.



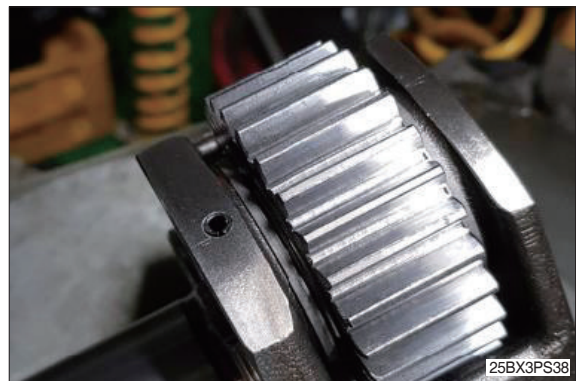
- (3) Assemble 3 planetary gear assemblies on carrier shaft (1).



- (4) Assemble planetary gear shaft (3) on carrier shaft (1) by aligning with hole of the latter.



- (5) Assemble 3 spring pins (2) on carrier shaft (1).

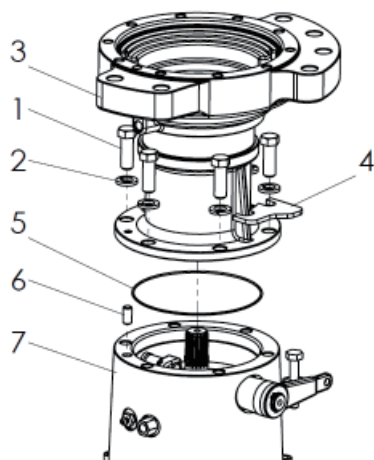


- (6) Caulk with a tool to prevent spring pin from removal from carrier shaft.



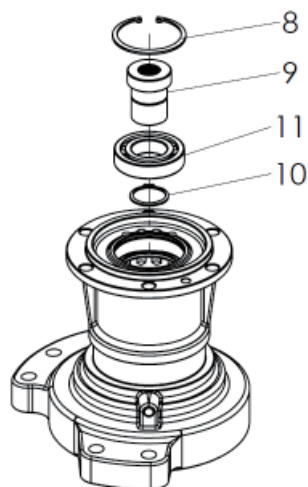
4. RH AXLE HOUSING ASSEMBLY

1) DISASSEMBLING



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- 1 Hexagonal bolt
- 2 Spring washer
- 3 RH axle housing
- 4 Parking stopper plate



25BX3PS41

- 5 O-ring
- 6 Dowel pin
- 7 Brake housing
- 8 Snap ring
- 9 Spline hub
- 10 Snap ring
- 11 Ball bearing

- (1) Loosen hexagonal bolt (1), and then remove RH axle housing assembly from brake housing.
- (2) Turn RH axle housing assembly up side down, and remove snap ring (8).
- (3) Remove spline hub (9), snap ring (1) and ball bearing (11) from RH axle housing (3).
- (4) Remove snap ring (10) and ball bearing (11) from spline hub (9).

2) ASSEMBLING

- (1) Assemble ball bearing (11) on spline hub (9).

※ Check ball bearing for smooth revolution.



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- (2) Make use of snap ring puller to assemble snap ring (10) on spline hub (9).



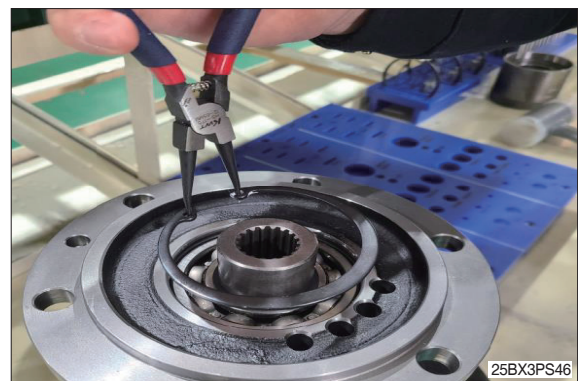
- (3) Mark a point on snap ring for checking for proper assembling.



- (4) Assemble spline hub assembly on RH axle housing (3).



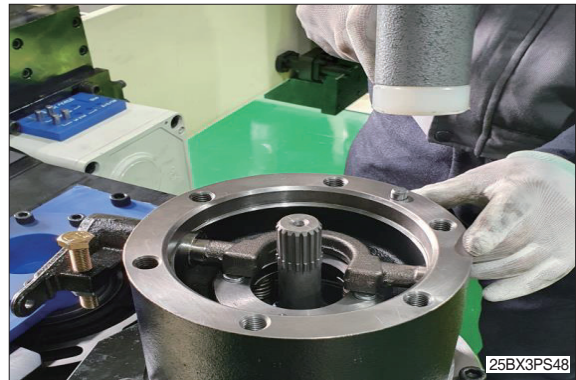
- (5) Make use of snap ring puller to assemble snap ring (8) on RH axle housing (3).



- (6) Assemble O-ring (5) on RH axle housing (3).



- (7) Assemble dowel pin (6) on brake housing (7).



- (8) Assembly RH axle housing assembly on brake housing (7).

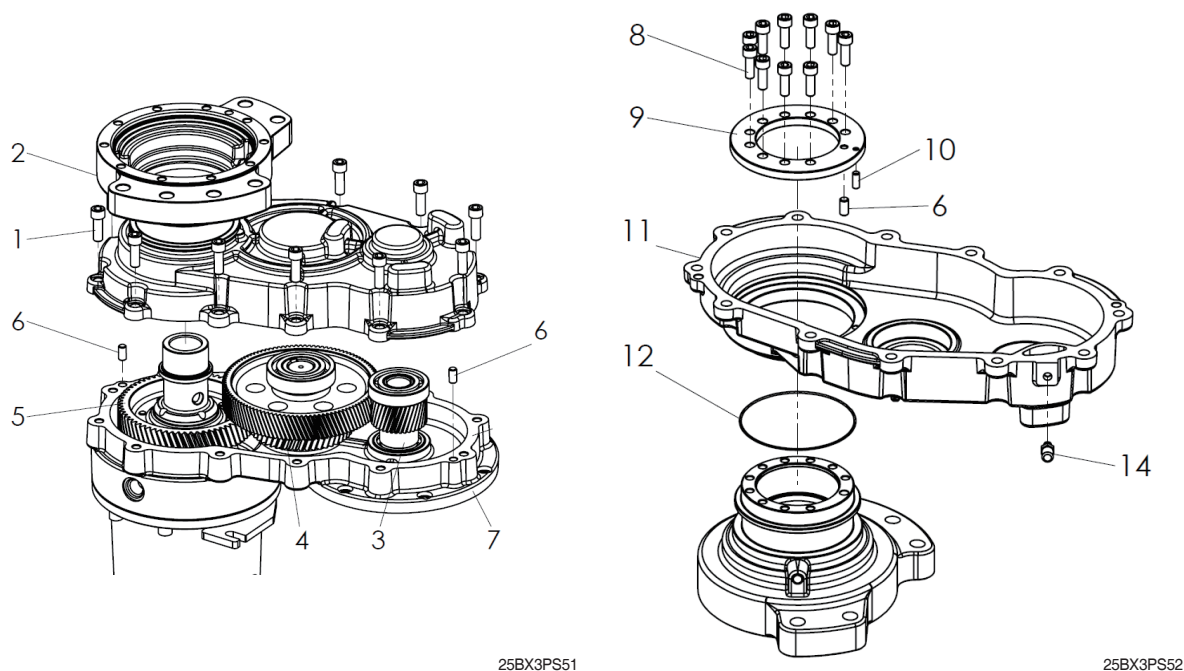


- (9) Fasten 7 hexagonal bolts (1) and spring washers (2) lubricated each with Loctite 277 on the assembly.
· Fastening torque : 14 ± 0.5 kgf · m



5. LH AXLE HOUSING ASSEMBLY

1) DISASSEMBLING



- | | | | | | |
|---|----------------------------|----|------------------|----|--------------|
| 1 | Socket-head bolt | 6 | Dowel pin | 11 | Gear case |
| 2 | LH axle housing | 7 | Motor case | 12 | O-ring |
| 3 | First gear assembly | 8 | Socket-head bolt | 13 | Air breather |
| 4 | Second gear assembly | 9 | Stopper plate | | |
| 5 | Differential gear assembly | 10 | Dowel pin | | |

- (1) Loosen socket-head bolt (1), and remove LH axle housing from motor case.
- (2) Turn LH axle housing up side down, loosen socket-head bolt (8), and then remove stopper plate (9).
- (3) Remove spline hub (9), snap ring (1) and ball bearing (11) from axle housing (3).
- (4) Remove first and second assemblies (3, 4), and differential gear assembly (5).

2) ASSEMBLING

- (1) Assemble O-ring (12) on LH axle housing (2).



- (2) Never forget to lubricate the surface of O-ring (12) with grease.



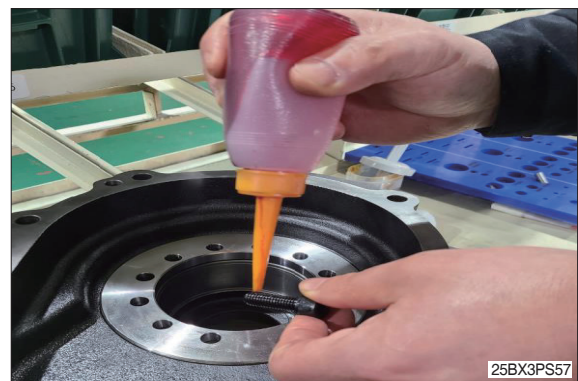
- (3) Assemble differential gear case (11) on LH axle housing (2).



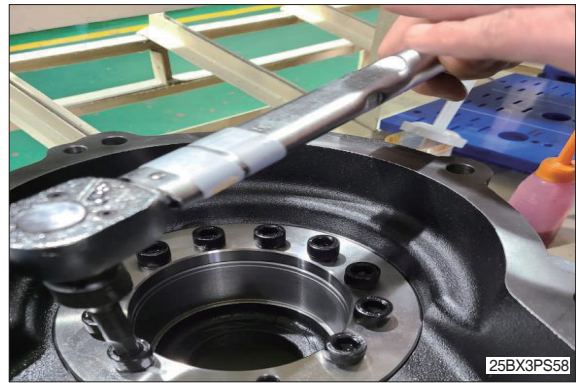
- (4) Assemble 2 dowel pins (6, 10) on LH axle housing (2).



- (5) Assemble stopper plate on gear case (11), and lubricate sock-head bolt (8) with Loctite 277.



- (6) Fasten 10 socket-head bolts (8).
· Fastening torque : 6 ± 0.5 kgf · m



- (7) Mark points on LH axle housing and the heads of socket-head bolts for checking for proper assembling.



- (8) Assemble first and second assemblies (3, 4), and differential gear assembly (5).

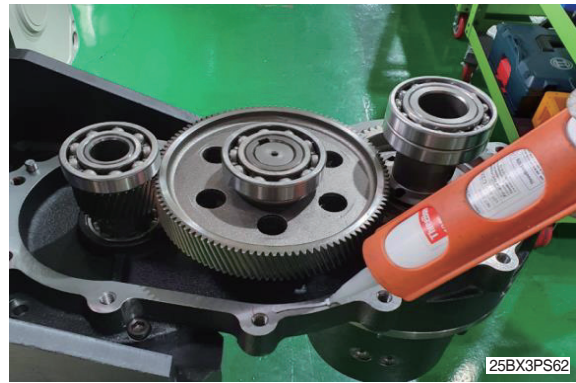


- (9) Assemble dowel pin (6) on gear case (11) with a mallet.

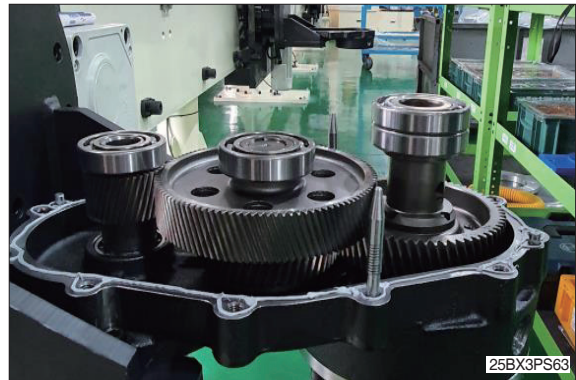


(10) Apply ThreeBond evenly on the surface of oil sealing of gear case (11).

※ Uneven applying may cause oil leak.



(11) Assemble guide bolt to prevent leak of ThreeBond.



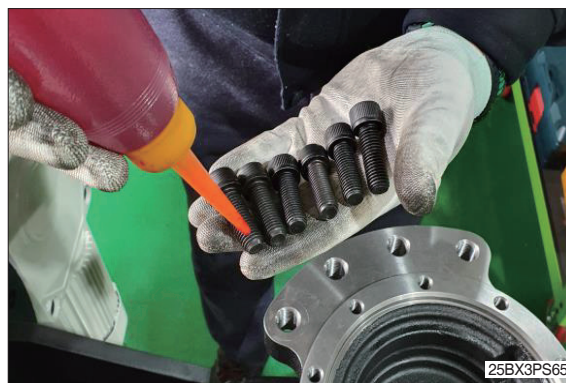
(12) Assemble LH axle housing assembly on differential gear assembly (5) while paying attention to ThreeBond-applied surface.



(13) Lubricate socket-head bolts (1) with Loctite 277.

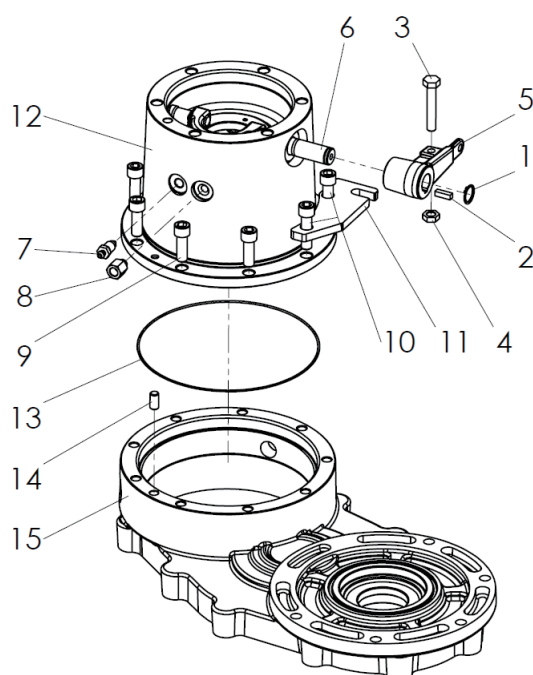


- (13) Fasten 11 socket-head bolts.
 · Fastening torque : $9 \pm 0.5 \text{ kgf} \cdot \text{m}$



6. BRAKE HOUSING ASSEMBLY

1) DISASSEMBLING



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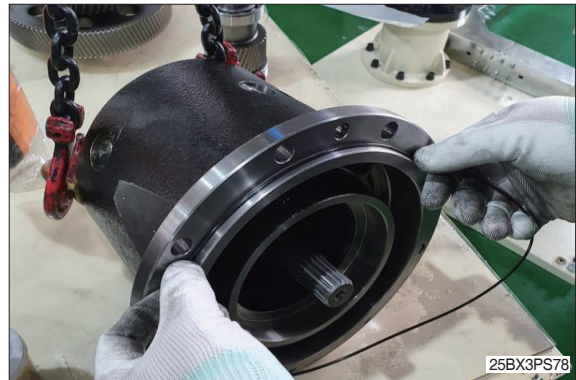
1	Snap ring	6	Parking lever pushing	11	Parking cable bracket
2	Key	7	Brake air breather	12	Brake assembly
3	Hexagonal bolt	8	Brake port	13	O-ring
4	Nut	9	Socket-head bolt	14	Dowel pin
5	Parking lever pulling	10	Socket-head bolt	15	Motor case

- (1) Once snap ring (1) is removed, remove parking lever pulling (5) from parking lever pushing (6).
- (2) Remove brake air breather (7) and port (8) from brake assembly (12).
- (3) Loosen socket-head bolt (10), and then remove parking cable bracket (11) from motor case (15).
- (4) Loosen socket-head bolt (9), and then remove parking assembly (12) from motor case (15).

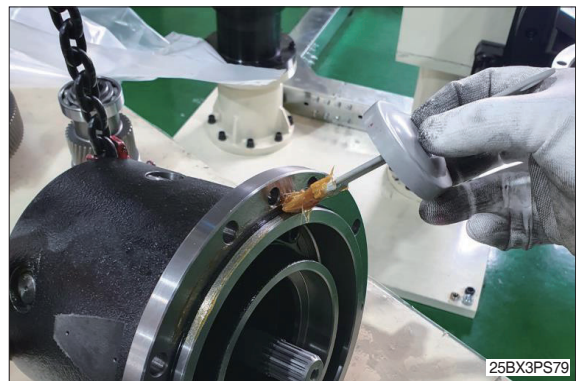
- (1) Assemble dowel pin (14) on motor case (15) with a mallet.



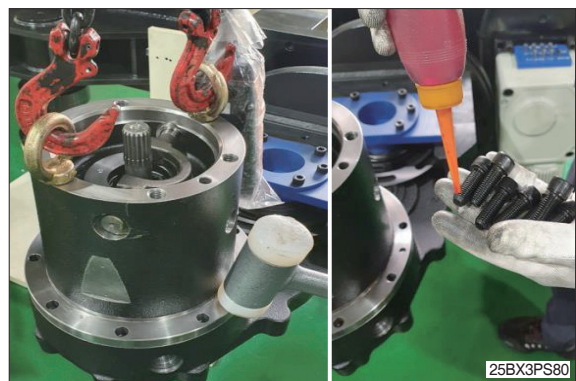
- (2) Assemble O-ring (13) on brake assembly (12).



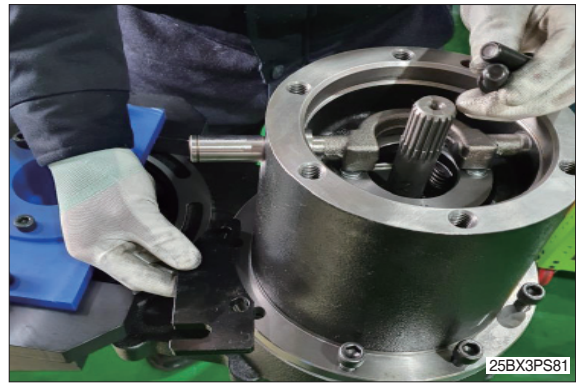
- (3) Lubricate the surface of O-ring with grease.



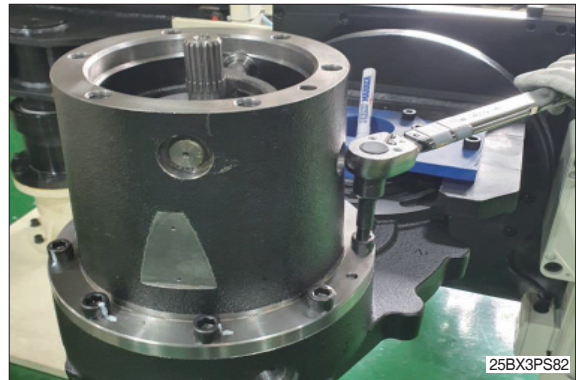
- (4) Mount brake assembly on motor case (15).



- (5) Fasten 2 socket-head bolts (10) lubricated with Loctite 277 on parking cable bracket (11) and brake assembly (12).
- Fastening torque : $9 \pm 0.5 \text{ kgf} \cdot \text{m}$



- (6) Fasten 7 socket-head bolts (9) lubricated with Loctite 277 on brake assembly (12) and motor case (15).
- Fastening torque : $9 \pm 0.5 \text{ kgf} \cdot \text{m}$



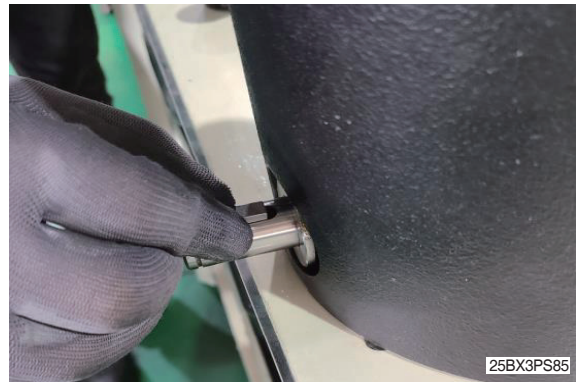
- (7) Assemble hexagonal bolt (3) on parking lever pulling (6).



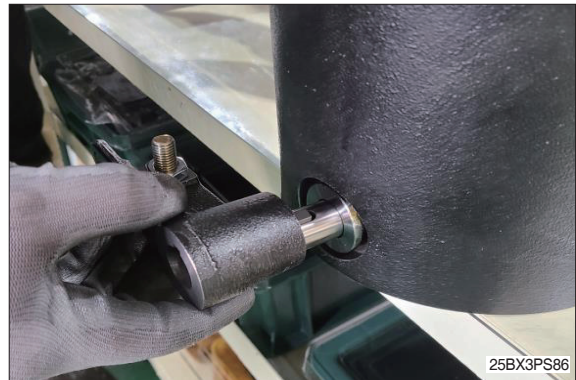
- (8) Assemble nut (3) hexagonal bolt (3) assembled on parking lever pulling (6).



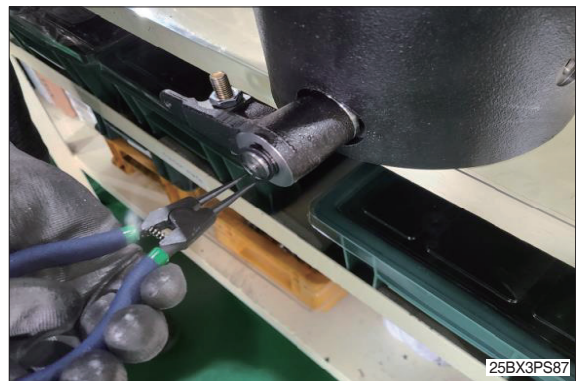
(9) Assemble key (2) on parking lever pushing (6).



(10) Assemble parking lever pulling assembly on parking lever pulling (6).

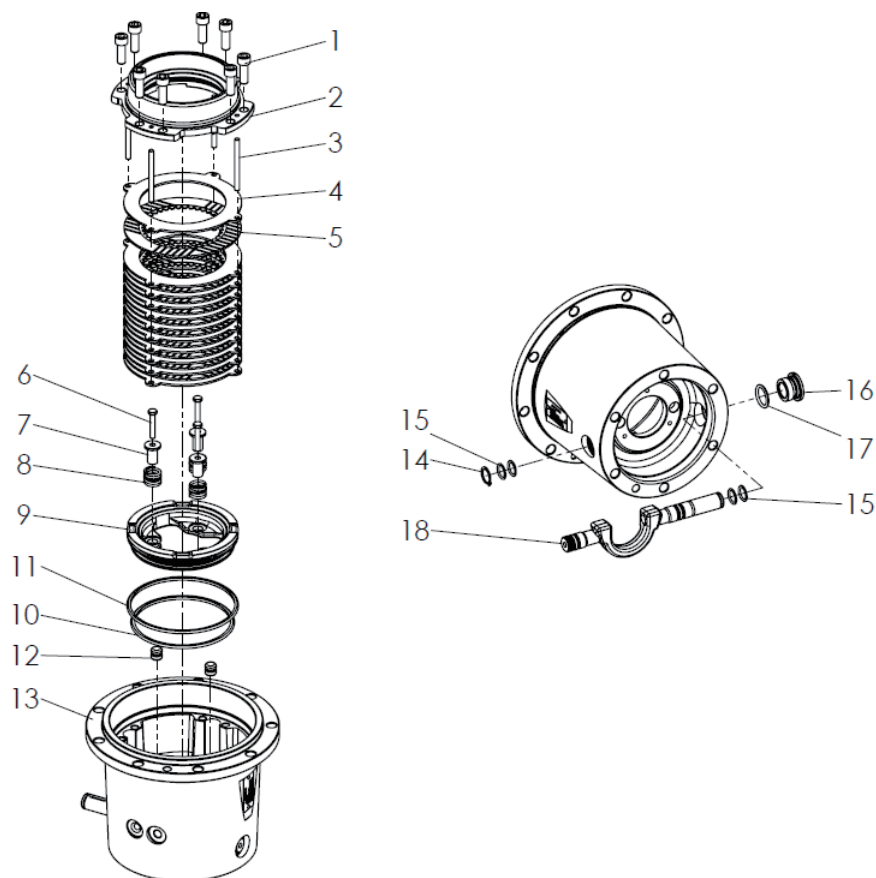


(11) Assemble snap ring (1) on parking lever pushing (6). Mark a point for checking proper assembling.



7. BRAKE ASSEMBLY

1) DISASSEMBLING



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1	Socket-head bolt	7	Brake spring spacer	13	Brake housing
2	Bearing metal	8	Brake return spring	14	Snap ring
3	Guide pin	9	Brake Piston	15	O-ring
4	Brake reaction plate	10	D-ring (large)	16	Parking lever
5	Friction plate	11	D-ring (small)	17	O-ring
6	Hexagonal bolt	12	Parking pin	18	Parking lever pushing

(1) Loosen socket-head bolt (1), and then remove bearing metal (2) from brake housing (13).

(2) Once guide pin (3) is removed, remove brake reaction plate (4) and friction plate (5).

(3) Once hexagonal bolt (6) is loosened, remove brake piston (9).

(4) Remove snap ring (14) and O-ring (15) from brake housing (13).

(5) Remove parking spacer (16) and O-ring (17) from brake housing (13).

(6) Remove parking lever pushing (18) from brake housing (13).

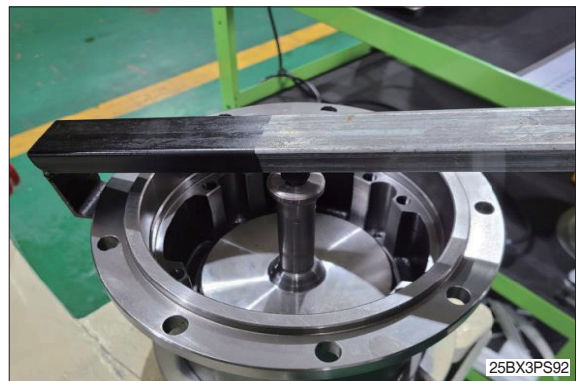
- (1) Assemble D-rings (10, 11) on brake piston (9). Clean the contact surface of piston clear that is assembled on brake housing.



- (2) Lubricate assembly surface with grease.



- (3) Make use of jig and press to assemble brake piston assembly on brake housing (13).



- (4) Assemble spring space (7) and return spring (8) on brake piston (9). Assemble 3 hexagonal bolts (6) lubricated with Loctite 277.



- (5) Fasten hexagonal bolts (6) on brake piston (9).
- Fastening torque : 1.5 ± 0.2 kgf · m



- (6) Assemble friction plate (5) and brake reaction plate (4) on brake housing (13)

※ **Never forget to assemble reaction plate only after assembling friction plate.**



- (7) Assemble bearing housing on brake housing (13).
- Brake play setting : 1.2 mm



- (8) Lubricate socket-head bolt (1) with Loctite 277.



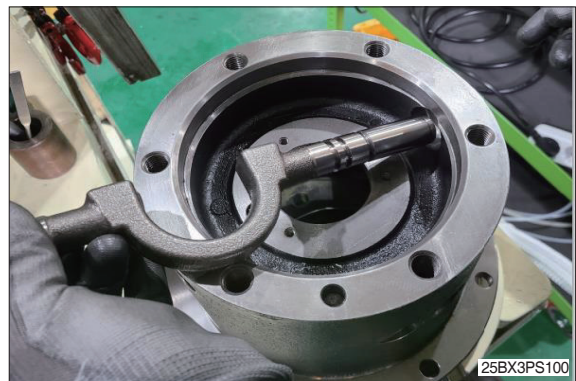
- (9) Fasten socket-head bolt (1) on brake housing (13).
· Fastening torque : $6 \pm 0.5 \text{ kgf} \cdot \text{m}$



- (10) Assemble parking pin (12) on brake housing (13).



- (11) Assemble parking lever pushing (18) on brake housing (13).



- (12) Assemble 2 O-rings on parking lever pushing (18).



(13) Lubricate the surface of O-ring with grease.



(14) Assemble snap ring (14) on parking lever pushing (18). Mark a point for checking for proper assembling.



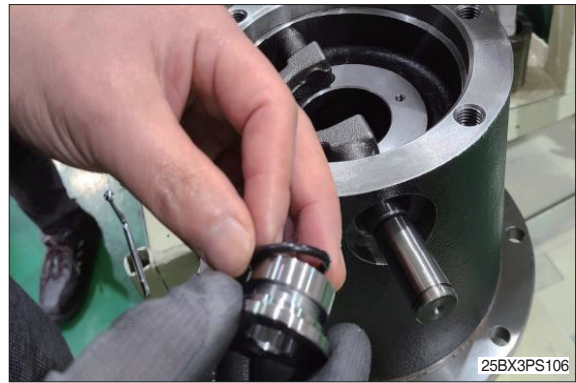
(15) Assemble 2 O-rings on parking lever pushing (18).



(16) Lubricate the surface of O-ring with grease.



- (13) Assemble O-ring (17) on parking space (16), and lubricate it with grease. Mark a point for checking for proper assembling.



- (14) Assemble assembly on brake housing (13).



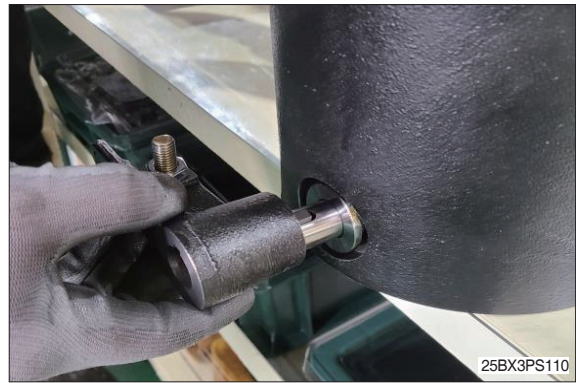
- (15) Assemble hexagonal bolt on parking lever pulling.



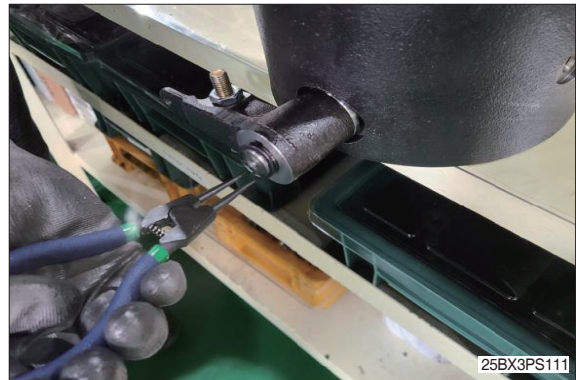
- (16) Assemble key on parking lever pushing (18).



(17) Assemble parking lever pulling assembly on parking lever pushing (18).

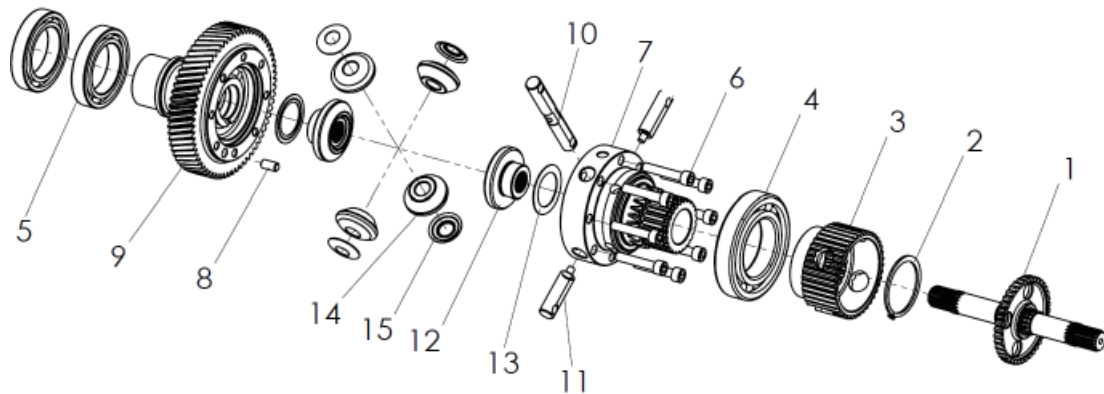


(18) Assemble snap ring on parking lever pushing (18). Mark a point for checking for proper assembling.



8. DIFFERENTIAL GEAR ASSEMBLY

1) DISASSEMBLING



25BX3PS112

- | | | | | | |
|---|----------------------|----|-------------------------------|----|-------------------------------|
| 1 | Center axle assembly | 6 | Socket-head bolt | 11 | Differential pinion shaft (B) |
| 2 | Snap ring | 7 | Differential gear case | 12 | Differential side gear |
| 3 | Brake hub | 8 | Dowel pin | 13 | Thrust washer |
| 4 | Ball bearing | 9 | Differential cover gear | 14 | Differential pinion gear |
| 5 | Ball bearing | 10 | Differential pinion shaft (A) | 15 | Differential pinion washer |

- (1) Remove center shaft assembly (1) from differential gear assembly.
- (2) Remove snap ring (2) and brake hub (3) from differential gear case (7).
- (3) Remove ball bearing (4) from differential gear case (7).
- (4) Remove ball bearing (5) from differential cover gear (9).
- (5) Remove socket-head bolt (6) and differential gear case (7) from differential cover gear (9).
- (6) Remove differential gear and pinion.

2) ASSEMBLING

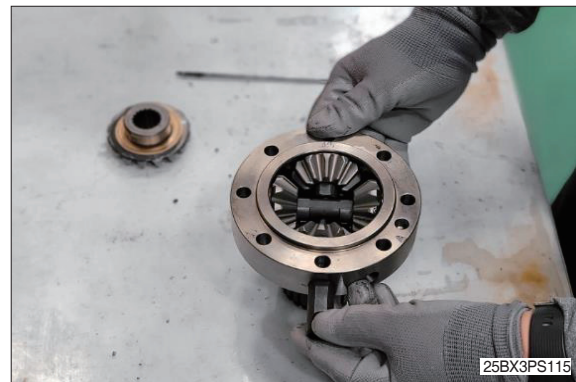
- (1) Lubricate differential gear case (7) with grease.



- (2) Lubricate gear, washer and shaft with grease.



- (3) Assemble pinion gear, shaft and washer on differential gear case (7) and differential cover gear (9).



- (4) Assemble washer, differential side gear (12) and dowel pin (8) on differential gear case (7) and differential cover gear (9).



- (5) Lubricate socket-head bolt (6) with Loctite 277.



- (6) Assemble 8 socket-head bolts (6) on differential gear case (7).



- (7) Fasten 8 socket-head bolts (6) on differential gear case (7).
· Fastening torque : $6 \pm 0.5 \text{ kgf} \cdot \text{m}$



- (8) Assemble ball bearing (5) on differential cover gear (9).



- (9) Assemble ball bearing (4) and brake hub (3) on differential case assembly.



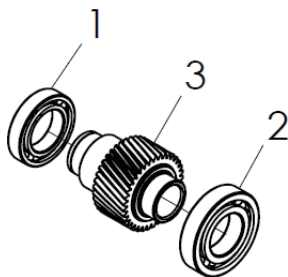
- (10) Assemble snap ring (2), and then mark a point for checking proper assembling.



9. FIRST AND SECOND GEAR ASSEMBLIES

1) DISASSEMBLING

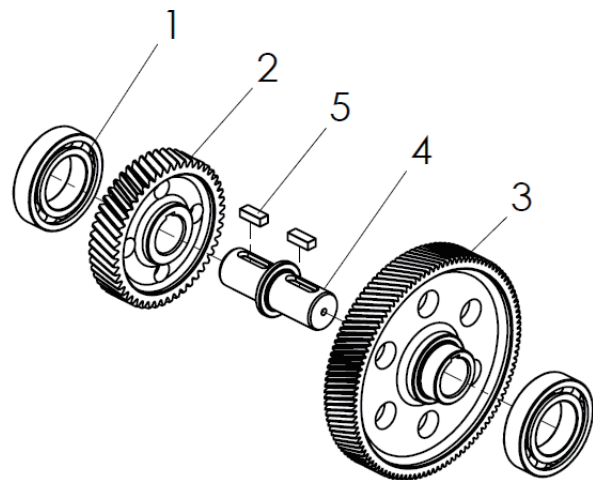
First gear



25BX3PS123

- 1 Ball bearing
- 2 Ball bearing
- 3 Input gear

Second gear



25BX3PS124

- 1 Ball bearing
- 2 Helical gear
- 3 Helical gear
- 4 Gear shaft
- 5 Key

(1) Disassembling first gear assembly

- ① Remove ball bearing (1) from input gear (3).
- ② Remove ball bearing (2) from input gear (3).

(2) Disassembling second gear assembly

- ① Remove ball bearing (1) from second gear assembly.
- ② Remove ball bearing (1) from second gear assembly.
- ③ Remove helical gear (2) and key (5) from gear shaft (4).
- ④ Remove helical gear (2) and key (5) from gear shaft (4).

2) ASSEMBLING

(1) Assembling first gear assembly

- ① Make use of heating device to assemble bearing on input gear (3).



(2) Assembling second gear assembly

- ① Once key (5) is assembled on gear shaft (4), assemble helical gears (3, 4).



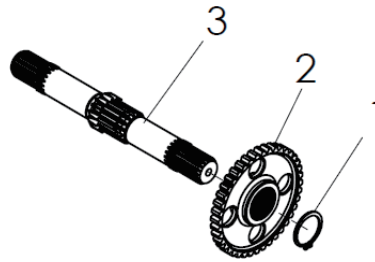
- ② Make use of heating device to assemble ball bearing (1) on gear shaft (4).

※ **Check ball bearing for smooth revolution.**



10. CENTER SHAFT ASSEMBLY

1) DISASSEMBLING



25BX3PS128

- 1 Snap ring
- 2 Brake hub
- 3 Center shaft

(1) Remove snap ring (1) and brake hub (2) from center shaft (3).

2) ASSEMBLING

(1) Assemble brake hub (2) on center shaft (3).



(2) Assemble snap ring (1) on center shaft (3).

