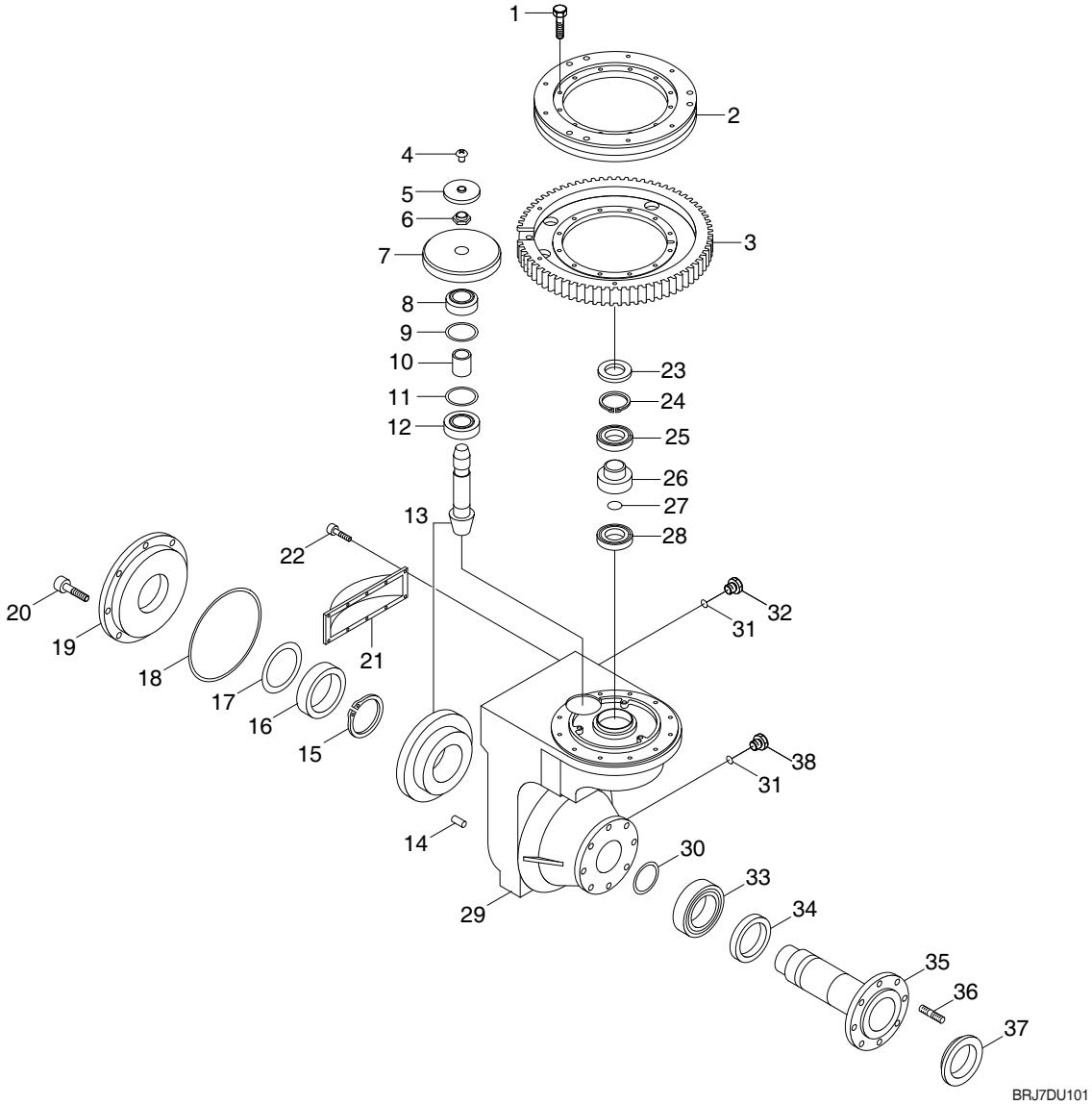
SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND FUNCTIONS

1. DRIVING AXLE UNIT

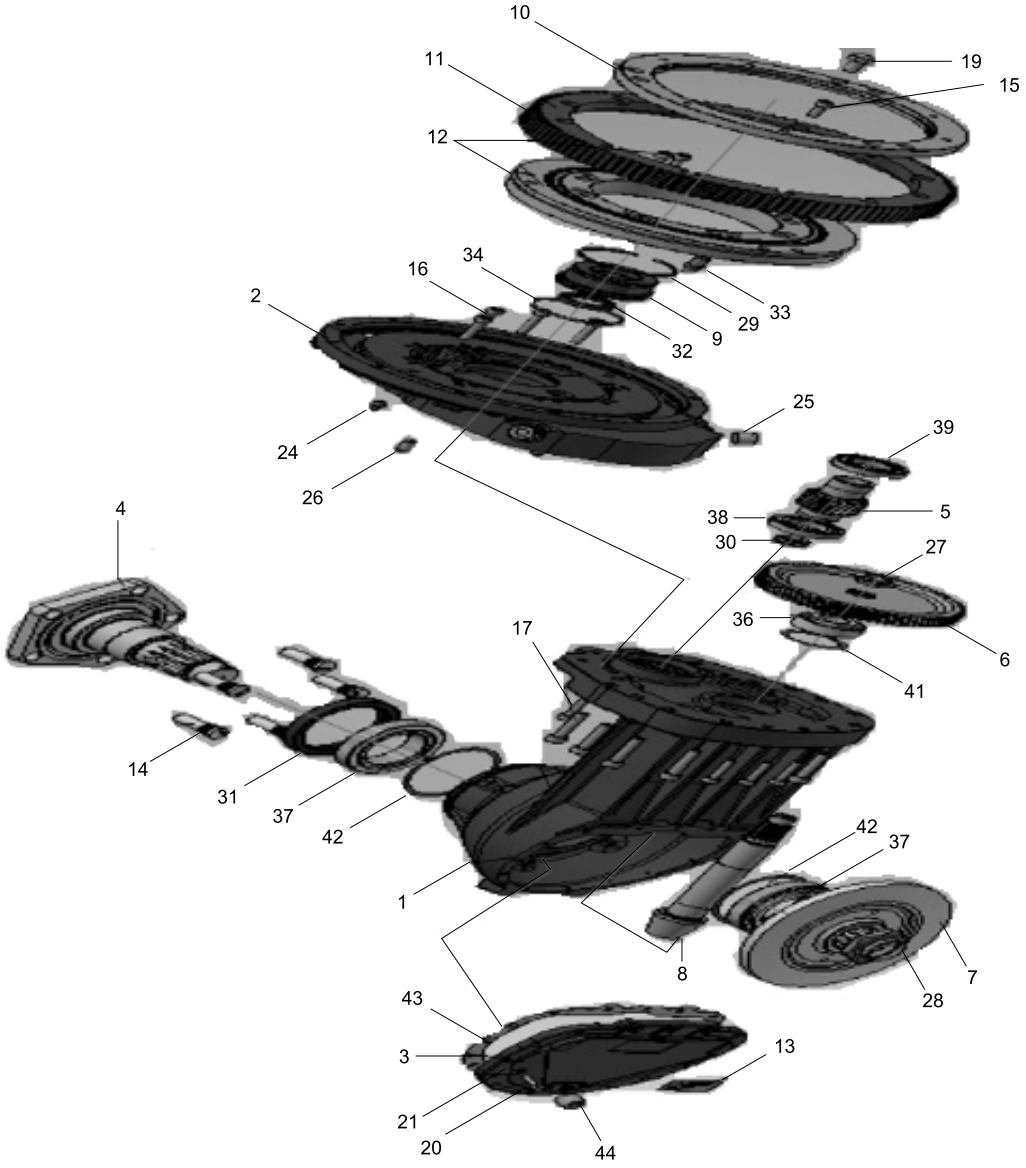
1) STRUCTURE

(1) 15/18BR-X



1	Hexagon screw	14	Slot-type pin	27	Protective cap
2	Turn table bearing	15	Retaining ring	28	Bearing ball
3	Steering gear	16	Taper roller bearing	29	Housing
4	Breather valve	17	Shim	30	Shim
5	Protective cap	18	O-ring	31	Sealing ring
6	Hexagon nut	19	Bearing cover	32	Plug
7	Spur gear	20	Cap screw	33	Taper roller bearing
8	Taper roller bearing	21	Cover	34	Taper roller bearing
9	Shim	22	Hexagon screw	35	Wheel shaft
10	Spacer	23	Shaft sealing ring	36	Wheel bolt
11	Shim	24	Retaining ring	37	Wheel shaft shield
12	Taper roller bearing	25	Bearing ball	38	Plug
13	Bevel gear set	26	Input pinion		

(2) 20/25BR-X



1	Gear case	14	Serration bolt	29	Snap ring
2	Steering housing	15	Wrench bolt	30	End cover seal
3	Gear case cover	16	Wrench bolt	31	Oil seal
4	Drive shaft	17	Wrench bolt	32	End cover seal
5	Input gear 23T	18	Wrench bolt	33	Air breather
6	Driven gear 80T	19	Hexagonal bolt	34	O-ring
7	Spiral bevel gear 42T	20	Hexagonal bolt	35,36,37	Taper roller bearing
8	Spiral bevel pinion 7T	21	Spring washer	38	Ball bearing
9	Drive sleeve	24	Grease nipple	39	Ball bearing
10	Sleeve, outer ring	25	Socket, H plug	40	Shim kit 1
11	Steering gear	26	Dowel pin	41	Shim kit 2
12	Rotating bearing assembly	27	Locking nut	42	Shim kit 3
13	Nameplate	28	Locking nut	43	Gasket
				44	Magnet plug

2. SPECIFICATION

1) 15/18BR-X

Item	Unit	Spec.
Gear ratio	-	20.2
Oil Qty.	l	3.3

2) 20/25BR-X

Item	Unit	Spec.
Gear ratio	-	20.8
Oil Qty.	l	4.0

GROUP 2 FAILURE DIAGNOSIS AND CORRECTIVE ACTIONS

Nature of Trouble	Cause	Remedy
Continuous mechanical noise		
1) On acceleration	· Gear abrasion.	- Adjust tension or replace the gear.
	· Pinion and bevel gear interlocked too deeply.	
	· Insufficient gear oil	- Supplement
	· Gear abrasion.	- Replace
2) On constant-speed driving	· Bearing loosening or abrasion.	- Adjust the preliminary load or replace.
	· Bevel gear wheel released	- Replace the bolt and washer. Fasten the new bolt and washer
	· Differential gear or thrust washer abrasion.	- Replace
3) When turning on the corner		
Continuous knocking sound		
1) On constant-speed driving	· Gear tooth damage.	- Replace
	· Foreign substances on the axle case.	- Clean
	· Driving shaft spline abrasion.	- Replace
Oil leakage		
1) Differential gear housing	· Oil level too high	- Reduce the oil level
Oil leakage on the housing.	· Oil seal damage	- Replace
2) Oil leakage on the axle case	· Mounting bolt loosening on the housing.	- Re-fasten
	· Crack on the damaged packing case.	- Replace
	· Hub grease seal abrasion.	- Replace
3) Hub, oil leakage	· Oil seal abrasion.	- Replace
	· Bearing abrasion or damage for eccentric rotation.	- Replace
Power is not delivered.		
1) Driving shaft, gear	· Driving shaft damage or slip.	- Repair or replace
	· Gear tooth damage or abrasion.	- Replace
	· Differential gear case damage.	- Replace
Oil leakage on the wheel shaft	· Incorrect installation of damage on the radial shaft.	· Remove the wheel shaft to install a new radial shaft.
	· Lace damage on the wheel shaft.	· Remove the wheel shaft. Check whether the wheel shaft can be reused, and replace if possible.
Oil leakage on the housing cover	· Housing cover is not sealed.	· Housing cover is sealed with Loctite #574.
	· Housing cover or flat surface of the housing is not uniform.	· Modification of the flat surface with the oil rubber.
	· Bolt was not fastened according to the designated tightening torque.	· Bolt fastening with the specified tightening torque.

Nature of Trouble	Cause	Remedy
Oil leakage on the oil inlet or oil discharge plug	· Dust between the sealing ring and housing. · Oil sealing ring was used. · Bolt was not fastened according to the designated tightening torque.	· Clean if required. · Use a new sealing ring · Bolt fastening with the specified tightening torque.
Oil leakage between the housing and the upper part	· Seal surface was not sealed or not uniform. · Burr on the cylinder pin. · Bolt was not fastened according to the designated tightening torque.	· Apply Loctite #574 on the seal surface, and modify the seal surface with the oil rubber. · Use a new cylinder pin. · Bolt fastening with the specified tightening torque.
Oil leakage on the upper part in the helical gear stage/input	· Excessive oil on the transmission. · Defective O-ring on the cover. · Defective breather valve.	· Check the oil level. · Install a new O-ring. · Replace the breather valve.
Tapping noise on the helical gear stage	· Damage from incorrect installation of the input pinion and/or helical gear tooth.	· Check the damage on the tooth side and modify the damaged part with the oil rubber.
Buzzing noise	· Helical gear stage is operating without oil.	· Check the oil level. Replenish oil.
Friction noise	· Preliminary load or backlash on the bearing not adjusted appropriately.	· Check and adjust newly.
Bearing damage on the input pinion	· No axle flow.	· Install a new bearing and adjust the axle flow.
Pivot bearing is not rotating appropriately or noticeable backlash.	· Cover disk loosening and penetration of foreign substances on the bearing. · Cage segment damage. · Permanent deformation of the ball or ball lace. · Lubrication not performed again on the bearing. · Grease is not spread.	· Replace the pivot bearing. · Replace the pivot bearing. · Replace the pivot bearing. · Supply the lubricant again to the pivot bearing. · Rotating the pivot bearing by hand several times.

GROUP 3 DISASSEMBLY AND ASSEMBLY

■ 15/18BR-X

1. INSTRUCTIONS

1) Take caution on cleanliness and maintain the professional manner on all work. The transmission removed from the vehicle must be cleaned before opening. Special caution and cleanliness are essential conditions for proper transmission disassembly and re-assembly, and for installing each part. Inappropriate installation can cause early abrasion and defect, and there can be critical damage when foreign substances are penetrated into the transmission.

2) All parts must be cleaned before assembly, and any damage and other defects must be inspected.

3) When the removed parts are damaged or worn out, they must not be installed immediately, and replaced with new parts.

4) Unless indicated separately, relevant sealing components must be installed to the section in contact with the housing and cover forming the oil-tight connection during the assembly.

5) Special equipment and tools other than the standard tools are required. These equipment and tools must be used for technically appropriate disassembly and assembly. Special equipment, tools and other fixture must be applied and used according to the circumstances of the user.

6) Commercial tools and fixtures included in the basic equipment are also considered to be possible for use.

7) Unless indicated separately, all pressing work shall be used with the hand lever press for performance.

8) All screws and screw thread of this transmission shall be used with the meter dimension. Only the spanner and socket spanner in meter specification are permitted of use.

9) All set value, test data and tightening torque indicated during the re-assembly shall be followed.

10) The sequence of the work stages described shall be complied.

11) All figures are examples for purpose of description, and they are not mandatory instructions for the work.

2. SPECIAL TOOLS REQUIRED FOR DISASSEMBLY OR RE-ASSEMBLY

Reference No.	Item	Use
225296	Fixture for extraction	Removal of driving pinion
62513	Support fixture	Loosen the taper press fit
62507-1	Counter holder	Measure the shim thickness
62523	Assembly fixture	Install the driving pinion
62478	Mandrill for hitting	Roller, bearing, driving pinion
62507	Fixture for positioning	Jack for determining the transaction location
62508	Mandrill for hitting	Bearing, outer ring and driving pinion floor
62625	Mandrill for hitting	Install the roller, bearing and housing
63428	Fixture for compression/extrusion	Wheel shaft and crown gear
62521	Mandrill for hitting	Shaft seal and driving pinion
62522	Mandrill for hitting	Breather cover
63290	Sleeve for compression	Groove-type ball bearing and driving pinion
63293	Mandrill for hitting without a handle	Screw protective shield
63292	Mandrill for hitting without a handle	Shaft seal, wheel shaft
63291	Mandrill for hitting without a handle	Shaft seal, wheel shaft
62542	Mandrill for hitting without a handle	Bearing, outer ring, crown gear
63294	Mandrill for hitting without a handle	Bearing, inner ring, wheel shaft
62749	Mandrill for hitting	Bearing, outer ring, cover
63296	Handle	Mandrill for hitting
62228	Gear lock	Helical gear lock
62222	Hydraulic oil system	For press fit release
223705, 009	Sleeve for compression	Bearing, inner ring, pinion shaft
62746	Mandrill for hitting	Bearing, outer ring, pinion shaft top
62846	Mandrill for hitting	Helical gear on the pinion shaft
62828	Measurement fixture	Housing dimension wheel shaft
62231	Measurement fixture	Housing dimension wheel shaft
62829	Measurement fixture	Housing dimension crown shaft
62232	Measurement fixture	Housing dimension crown shaft
222863.2	Fixture for extraction	Remove by pulling the outer ring on the taper roller bearing
62515	Fixture for extraction	Bearing friction torque wheel shaft

3. SAFETY INSTRUCTIONS

1) For safe use of the equipment, detailed matters related to the installation, disassembly, re-assembly, initial operation and maintenance must be followed strictly.
2) Everyone involved in the installation, disassembly/re-assembly, initial operation and maintenance of the transmission shall read and understand all instructions in the manual, and especially the safety instructions.
3) All work methods inhibiting the safety shall be prohibited.
4) Remodeling and changes performed without receiving appropriate permit shall not be allowed as they can have impact to the safety.
5) Only the genuine parts of HYUNDAI GENUINE shall be used. Parts and components not supplied by HYUNDAI GENUINE shall be considered that they were not inspected and approved by HYUNDAI GENUINE. HYUNDAI GENUINE shall not have any liability of compensation on those parts and components, and shall not be acknowledged as the genuine parts and components of HYUNDAI GENUINE.
6) Described work shall be performed only by the skilled workers who completed the training and acquired the permit.
7) Technical expert who completed proper training is required for proper repair of this product. The repair engineer shall have responsibility of receiving the training.
8) Contact with stimulatory detergents to the skin shall be avoided, and they shall not be taken orally or inhaled of the detergent vapor. Safety gloves and glasses must be worn at all times. Emergency measures are required immediately on intake of the detergent by mistake. Instructions from the manufacturer shall be strictly followed.
9) Detergents or transmission oil shall not be discharged directly into the sewage or into the soil.
10) The wheels shall be fixed with a block when starting the work on the transmission installed or mounted.
11) Power supplied to the motor and the switch shall be turned OFF when performing the work (Ex.: oil exchange) on the mounted transmission or on the part installed to the transmission.
12) Local safety and accident prevention regulations shall be followed.

4. COMPLETE DISASSEMBLY

1) GENERAL DISASSEMBLY GUIDE

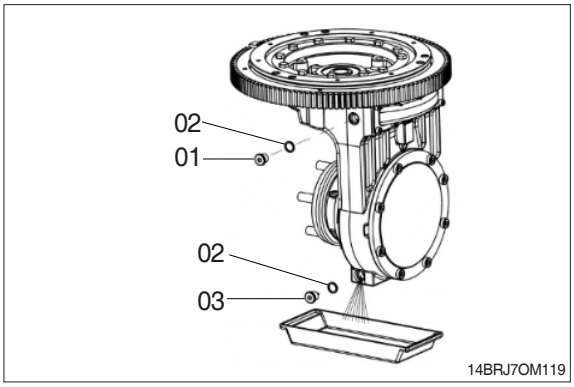
(1) Cleaning shall be performed in detail when disassembling the transmission. Parts possible for use only as the assembly shall not be disassembled additionally.
As shown in the figure on the right, it is recommended to install the fixture for positioning. Fixture for positioning plays a role of rotating the device, and convenience in the disassembley and reassembly work.
(S) Fixture for positioning 62507

2) TRANSMISSION OIL DISCHARGE

(1) The oil collection container of appropriate size is placed under the oil drain plug.
(2) 6 mm Allen wrench is used to loosen the oil inlet plug (#01). Inlet plug and sealing ring (#02) are removed.
(3) 6 mm Allen wrench is used to loosen the oil drain plug (#03). Oil drain plug and sealing ring (#02) are removed.
(4) Discharge the transmission oil completely inside the container.

※ **Do not discharge the transmission oil directly into the ground or to the sewage. Examine the type and amount of the debris.**

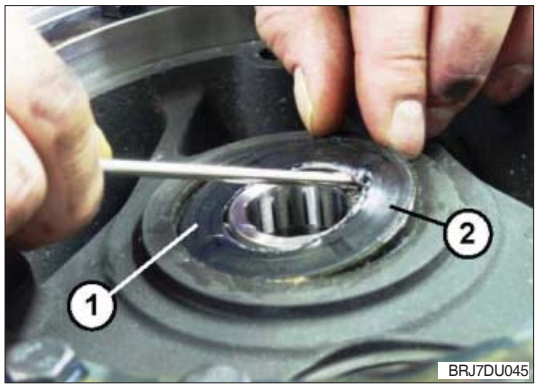
⚠ **Wear heat-resistant gloves as the oil temperature is high after continuous operation of the transmission.**



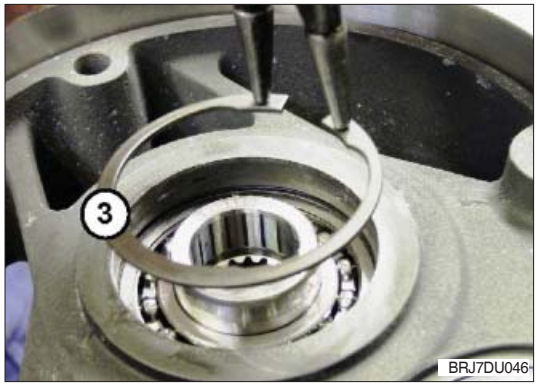
3) REMOVAL OF DRIVING PINION

(1) Use the screw driver to press the radial sealing ring (#2) upward to remove from the bore sheet of the housing.

Discharge the radial sealing ring according to Section 6.

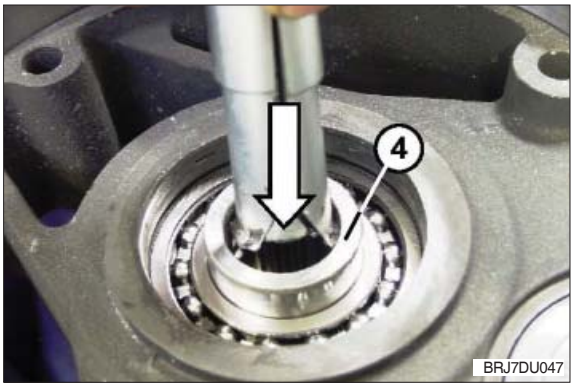


(2) Use the counter-sunk plier to remove the retaining ring (#3) for removal from the housing.



(3) Fixture for extraction (225296) is required to remove the driving pinion (#4) from the bore.

Insert the fixture for extraction into the bore of the driving pinion.

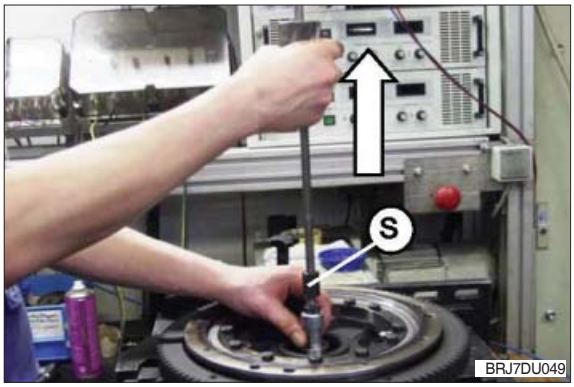


(4) Fasten the hexagon screw of the bearing puller manually with the hand to form sufficient pre-load on the clamping jaw.

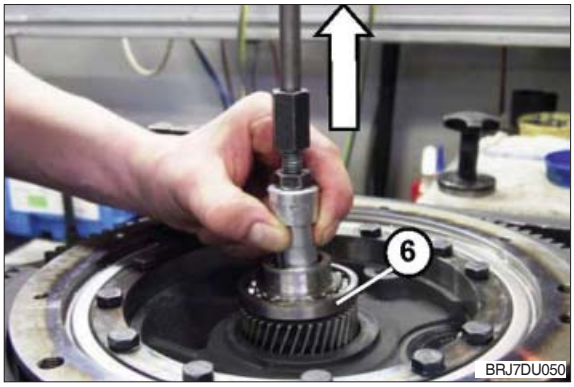
Fasten the hexagon screw to spread the clamping jaw of the bearing puller (#5) inside the driving pinion bore.

(5) As shown in the figure on the right, operate the fixture for extraction (S) manually by hand. Move the handle of the bar upward until the driving pinion is loosened completely from the bearing sheet.

⚠ **In the next work stage, caution is required on not damaging the gear of the driving pinion. Noise can be increased during the operation when the gear is damaged, and there can be bigger damages occurred.**



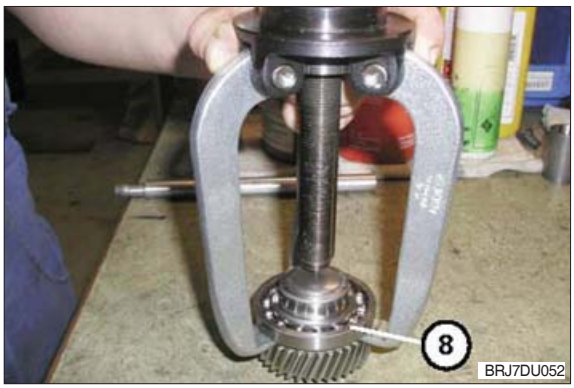
(6) Use the fixture for extraction to pull the driving pinion (#6) for removal from the housing bore.



(7) Loosen the hexagonal bolt (#7) to remove the fixture for extraction from the driving pinion.

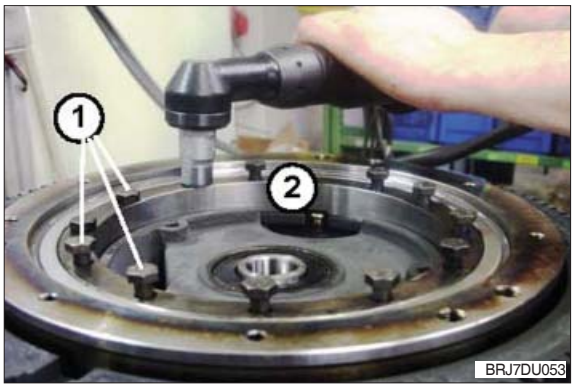
⚠ **Caution is required on not damaging the gear of the driving pinion. Noise can be increased during the operation when the gear is damaged, and there can be bigger damages occurred.**

(8) Use the puller or tools for separation to pill the groove-type ball bearing (#8) from the bearing sheet of the driving pinion for discharge according to Section 6.

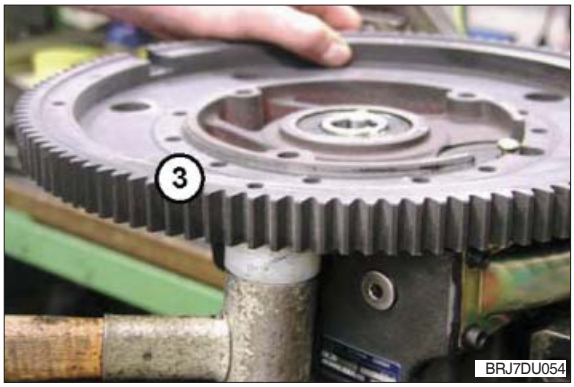


4) REMOVAL OF GEAR RING AND PIVOT-TYPE BOGIE BEARING

(1) Loosen 12 hexagon screws (#1) on the pivot-type bogie bearing (#2) for removal and disposal.



(2) Use the bounce-free rubber hammer to hit the bottom of the gear ring (#3) softly to loosen the connection. Take out the pivot-type bogie bearing and gear ring for removal.



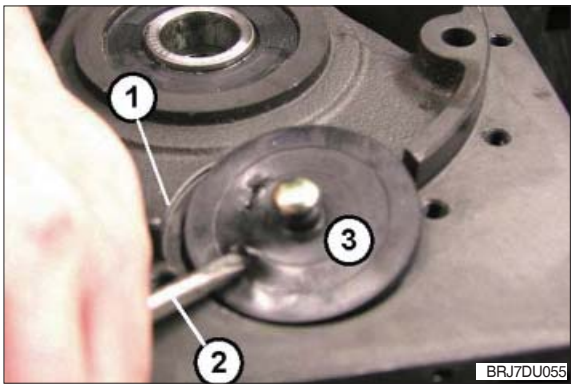
5) DISASSEMBLY OF TRANSMISSION HOUSING AND COMPONENTS

(1) Sealing cap removal

⚠ The surface (#1) mounted with the sealing cap must not be damaged. The sealing cap itself shall not be destroyed and not reused.

① Insert the screw driver (#2) into the sealing cap (#3) and use the leverage effect to apply the force upwards carefully to remove for disposal.

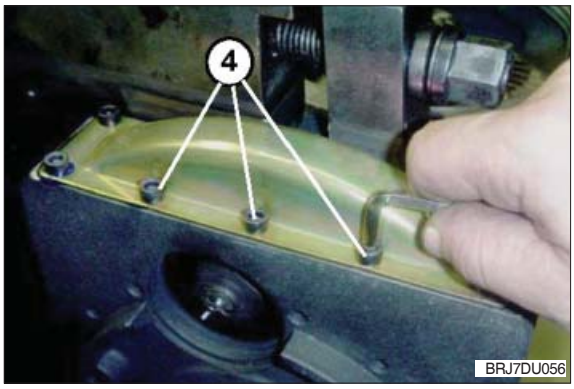
② Do not dispose the breather valve.



(2) Side cover removal

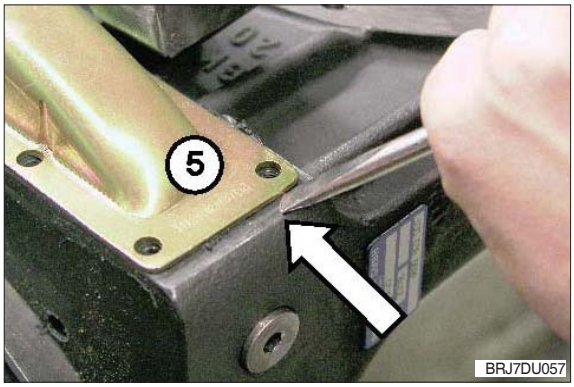
① Loosen 10 cap screws (#4) on the side cover for removal.

⚠ In the next work stage, caution is required on not damaging the housing surface. Remove the bur and other damage parts on the sealing surface occurred during the removal. Use the oil stone to modify the damaged sealing surface on the housing.



② Use an appropriate screw driver to separate the side cover (#5) from the sealing compound. Place the tool between the housing and the cover to apply force on the housing to lift slightly.

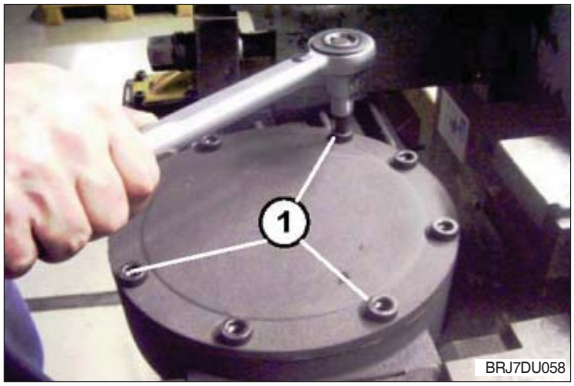
③ Hit the outer part of the side cover gently to loosen the cover from the housing for removal, and discard according to Section 6.



(3) Wheel shaft and crown gear removal

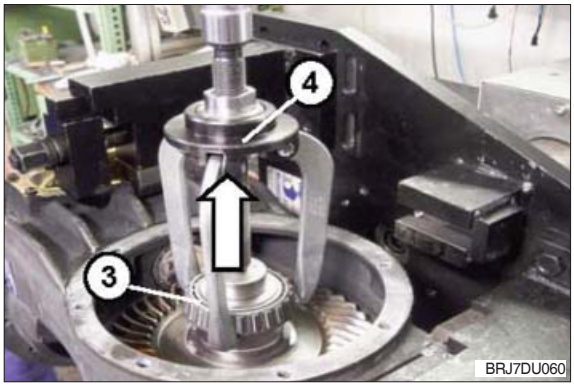
① Loosen 8 cap screws (#1) on the housing cover for removal.

⚠ Care should be exercised for protecting the housing and cover surface from damage. Remove the bur and other damage parts on the sealing surface occurred during the removal. Use the oil stone to modify the damaged sealing surface on the housing.

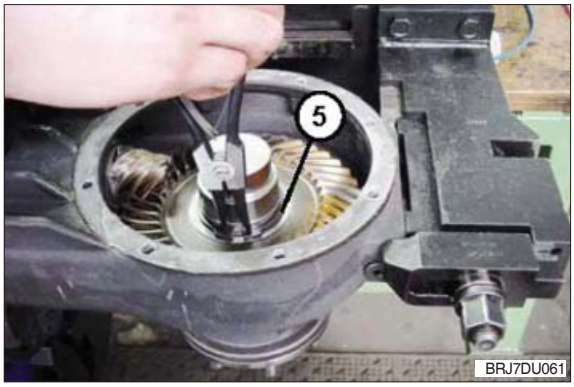


② Hit the outer end of the housing cover (#2) for removal. Here, use two grooved parts on the housing.

③ Use the tri-puller (#4) to pull the taper roller bearing inner ring (#3) from the bearing sheet of the bearing wheel shaft for removal.



④ Use the counter-sunk plier to remove the retaining ring (#5) for removal.



(4) Loosen the taper press fit

※ When using high hydraulic pressure for releasing the taper press fit, there is risk of injury to the eyes and skin due to the high-pressure oil spurting out. Safety glasses and gloves shall be worn at all times. Instructions from the hydraulic system manufacturer shall be followed.

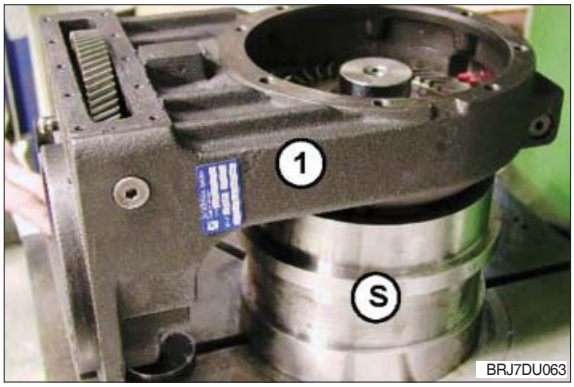
① The hydraulic system with maximum pressure of 300 Mpa is required for spreading the taper press fit. As described below, there are two methods of extracting the shaft wheel from the crown gear.

(S) Hydraulic system 62222

② Extrusion by using the press

As shown in the figure, place the housing (#1) on the fixture for extrusion on the press (S).

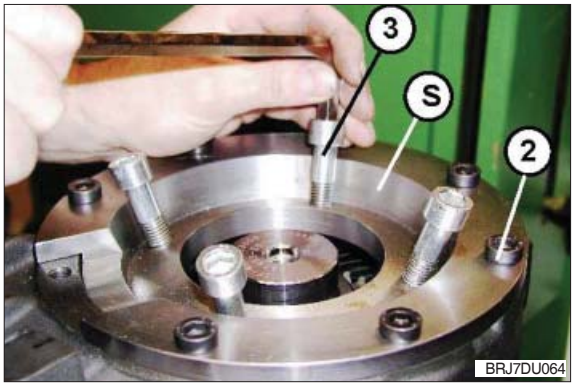
(S) Fixture for extrusion 63428



③ Use an appropriate cap screw (#2) on the fixture for support ('S') that plays a role of stopping the wheel shaft from slipping to connect to the cover surface.

Fasten 4 support bolts (#3) manually with the hand until they are contact with the crown gear.

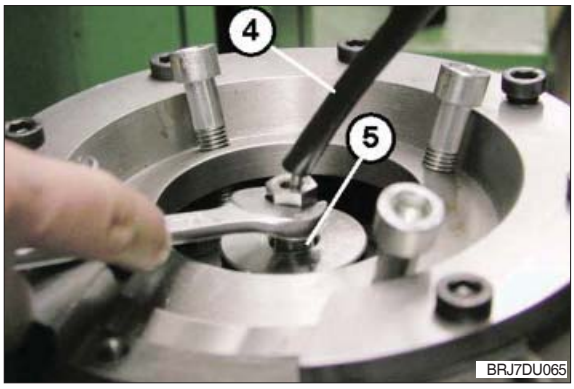
(S) Support Fixture 62513



④ Connect the high-pressure flexible pipe (#4) from the hydraulic system to the connection hole on the wheel shaft (#5).

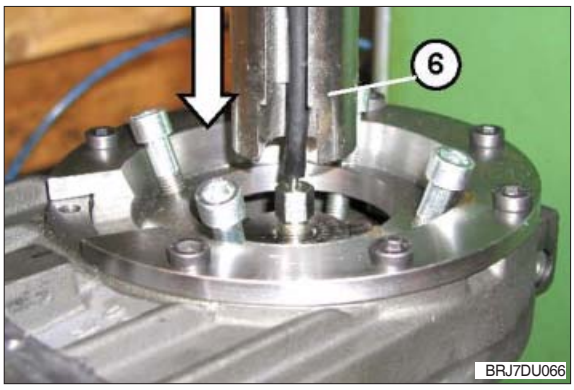
Use a spanner to fasten the connection nipple firmly.

⚠ **Caution is required on checking whether there is sufficient space in the extrusion direction to prevent the wheel shaft from hitting the ground during the extrusion. The wheel shaft shall not be damaged or stuck during the extrusion.**

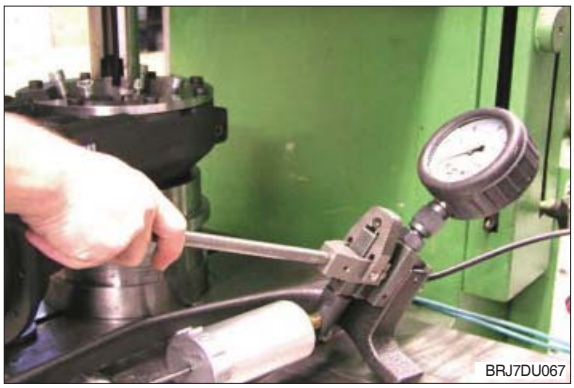


⑤ Mount the stamp (#6) of the support fixture (Refer to Figure 64) into the press.

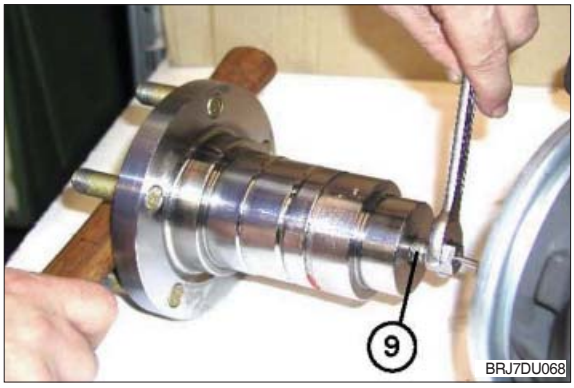
Adjust the pressure applied to the press from 80 kN to maximum of 120 kN.



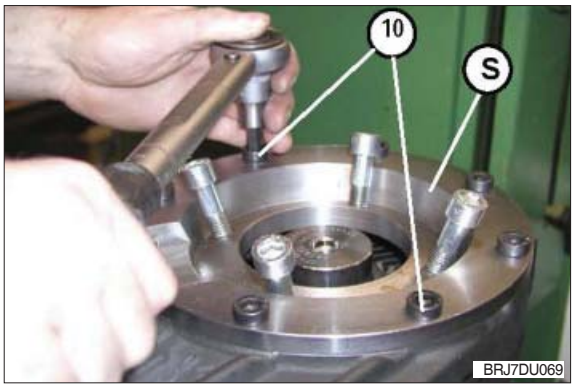
⑥ At the same time, use the fixture 62222 to apply the pressure necessary for the wheel shaft to be removed from the crown gear.



⑦ Separate the wheel shaft for handling to have the flexible high-ressure pipe to be separated from the connection hole of the wheel shaft (#9) from the wheel base.



⑧ Loosen the cap screw (#10) to remove the support fixture (S) from the housing.



⑨ Extrusion by using the secondary hand pump

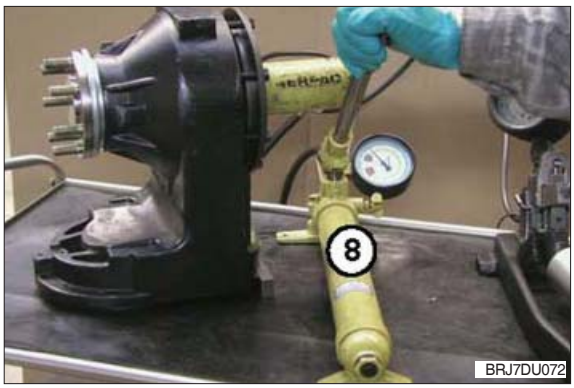
As an alternative, secondary extrusion cylinder can be used to remove the wheel shaft (Ex.: On moving work). It is performed as follows.

Connect the fixture for disasssembly and assembly to the extrusion (press-out) cylinder for the wheel shaft, and use a bolt to combine with the transmission completely.

(S) Cylinder for extrusion 63428

⑩ Operate the hydraulic system (#7) until reading approximately 30 MPa/4300 psi. Bevel gear is expanded sufficiently in this pressure.
Continue pumping until the wheet shaft is completely loosened to maintain this pressure constantly.

⑪ Operate the secondary hydraulic system (#8) until the hydraulic cylinder loosens the wheel shaft from the bevel gear completely.



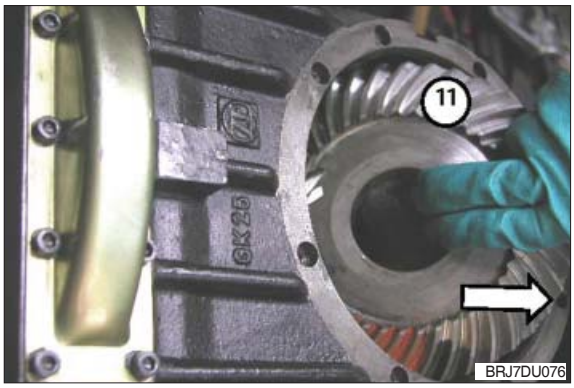
⑫ Remove the wheel shaft from the transmission.

⑬ Loosen the screw to remove the hydraulic hose from the cylinder 1 on the wheel shaft. Wipe off the leaked oil.

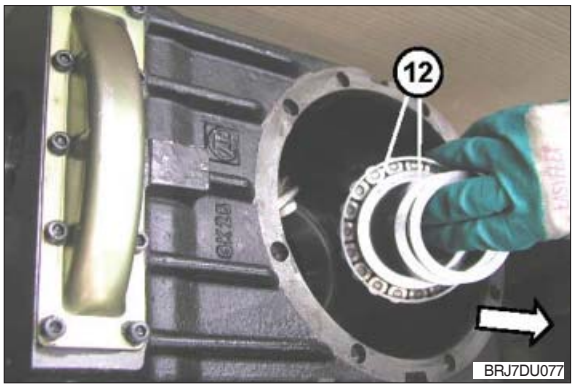
⑭ Loosen the screw to remove the fixture for disassembly and assembly from the transmission.

⚠ **When the gear is damaged, noise may occur and lead to bigger damages, so the bevel gear set must be replaced.**

⑮ As shown in the fiture, remove the crown gear (#11) carefully from the housing.



⑯ Afterwards, remove the following parts from the housing (#12).
Shim, spacer ring and taper roller bearing



(5) Bevel pinion shaft removal

① Insert the gear lock (S) inside the housing bearing bore of the driving pinion to fix the helical gear.

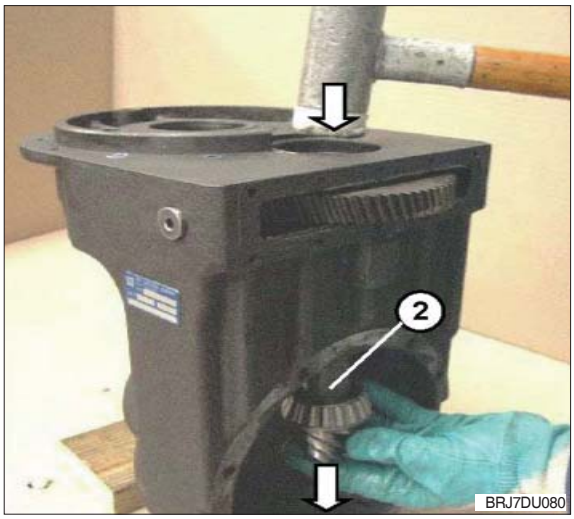
(S) Gear Lock 62228

② Release the lock on the hexagon nut (#1). Loosen the hexagon nut for removal.

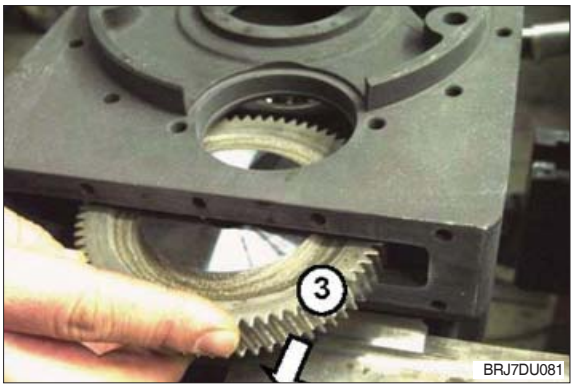
③ Take out the gear lock for removal.

⚠ **Take caution on damage to remove the bevel pinion shaft according to the following procedure.**

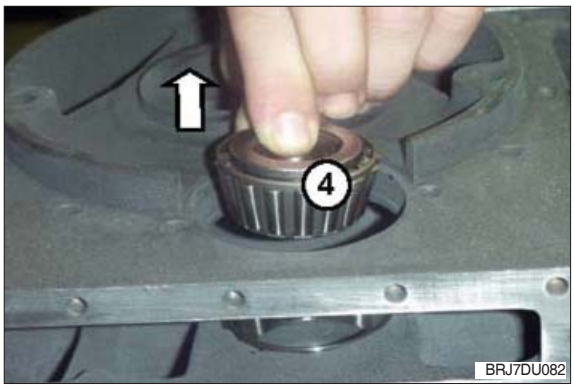
④ Use a bounce-free rubber hammer to hit the bevel pinion shaft (#2) to take out the inner gear and bearing.



⑤ Pull the helical gear (#3) from the cover opening of the housing for removal and storage.



⑥ Take out the inner ring of the taper roller bearing (#4) upwards to remove from the bearing bore.



⑦ Pull the inner ring of the tape roller bearing (#6) upwards to remove from the bevel pinion shaft.

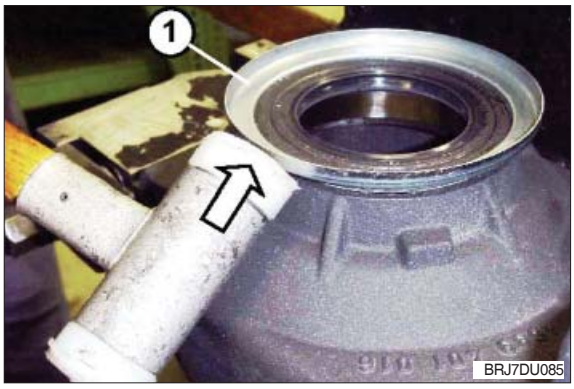
⚠ When the inner ring of the bearing cannot be disassembled by using a special tool and puller,
destroy the bearing cage to heat the inner ring for removal.

⚠ When the gear is damaged, noise may occur and lead to bigger damages, so the bevel gear set must be replaced.

(6) Screw protective shield and radial sealing ring removal

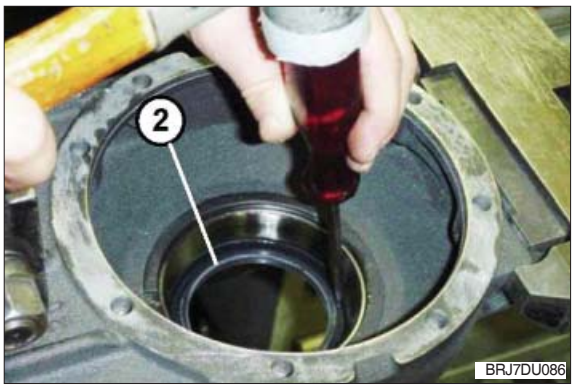
① Use a hammer to remove the screw thread protective shield (#1) from the joint of the housing.

⚠ Care should be exercised for protecting the housing and support from damage.



② Use a screw driver and hammer to take out the radial sealing ring (#2) carefully, and remove from the housing sheet.

⚠ Take caution on not damaging the surface that is set with the radial sealing ring. In this work stage, destroy the radial sealing ring completely.



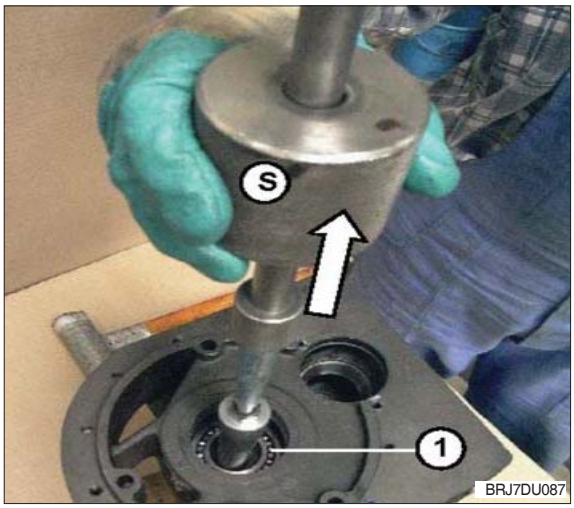
(7) Bearing Disassembly
Driving pinion bearing disassembly

① Use a fixture for extraction (S) to pull the groove-type bearing (#1) from the bore of the housing sheet for disposal according to Section 6.

② As shown in Figure 47~51, the method of using the fixture for extraction (S) is similar.

(S) Fixture for extraction 225296

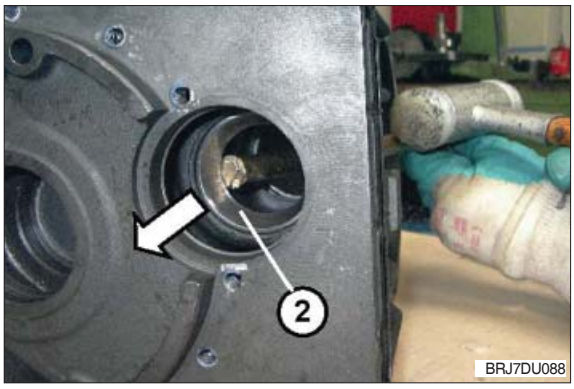
⚠ Remove the outer ring of the bearing for arrangement on each inner ring of the bearing.



Bevel pinion shaft bearing disassembly

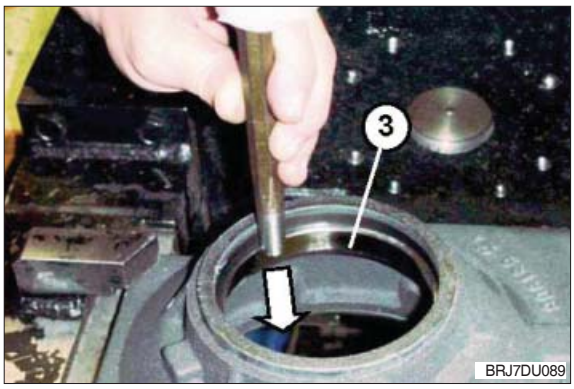
① Hit the outer ring of the taper roller bearing (#2) on both sides carefully to remove from the housing sheet.

② The damaged shim shall be replaced with the new part in the same specification.



Wheel shaft bearing disassembly

① Use a copper mandrill and hammer to hit the outer ring of the taper roller bearing (#3) carefully to remove from the housing.



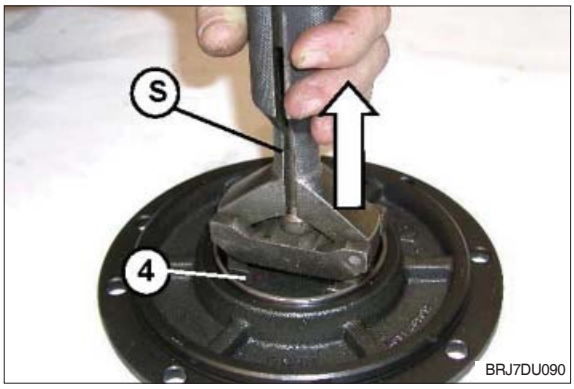
② Use a fixture for bearing extraction (S) to pull the second taper bevel bearing (#4) for removal from the housing cover bore.

③ As shown in Figure 49~50, the method of using the fixture for extraction (S) is similar.

④ The damaged shim shall be replaced with the new part in the same specification.

(S) Fixture for extraction 222863.2

This completes the disassembly.



5. COMPLETE RE-ASSEMBLY

1) RE-ASSEMBLY INSTRUCTIONS

(1) If required, use a detergent to clean the components, and remove the Loctite residue.

(2) Check for abrasion, damage and crack on all components, and replace the components if required.

(3) Maintain all connection surfaces and planes clean and smooth.

2) CONSUMABLES

Use an appropriate low-temperature cleaner (Ex.: Loctite).

Use only the appropriate detergent in the market without toxicity and flammability. Benzene, solvent or other flammable substances shall not be used for cleaning.

Item	Use
Loctite #243	Fix M10 or larger size of screw
Loctite #270	Fix stud screw
Loctite #574	Attaching the shaft seal to the housing and sealing the housing and cover
Loctite #5910	Sealing the side cover to the housing
Grease 'Shell Alvania R3'	Lubricating or damping the sealing lip on the shaft seal
Silicon Grease 704 or transmission oil (Product equivalent to API GL-5 or MIL-L-2105C/D)	For lubricating or damping the O-ring

3) ITEMS AND SYMBOLS USED

All items used are described in the following section along with the calculation formula.

Item	Symbol
Bearing width (taper roller bearing)	Dimension "B"
Housing dimension	Dimension "G"
Housing bearing bore 1	L1
Housing bearing bore 2	L2
Housing bearing bore 3	L3
Fixture I for dial gauge attachment measurement Zero-point position on (Part I)	Dimension "1"
Bevel pinion shaft dimension calculation difference on L3	Dimension "2"
Zero-point position on fixture II (Part I) for dial gauge attachment measurement	Dimension "3"
Crown gear dimension calculation difference on L3	Dimension "4"
Mounting dimension, bevel pinion shaft	Dimension "E"
Bearing dimension difference	Dimension "D"
Constant	K1
Constant	K2
Free Constant	a
Shim Dimension	Dimension "P"
Bushing Width	Dimension "H"
Shim Thickness	Dimension "X"

4) UTILIZATION METHOD IN THE STANDARD OF THE SHIM REMOVED DURING RE-ASSEMBLY

(1) The bevel gear set composed of the bevel pinion shaft and crown gear is set with a mounting dimension. However, the transmission housing and taper roller bearing must be measured.
When the removed shim is used as the reference, measurement of the transmission housing is unnecessary.

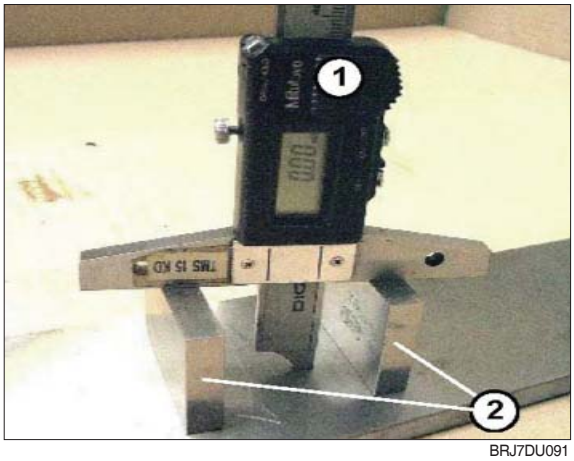
(2) When all removed components are reused, the original shim thickness must be applied again.

(3) When the taper roller bearing is removed with the bevel gear set, measurement is required only on the taper roller bearing.

5) DETERMINATION OF BEARING WIDTH DIFFERENCE ON THE TAPER ROLLER BEARING

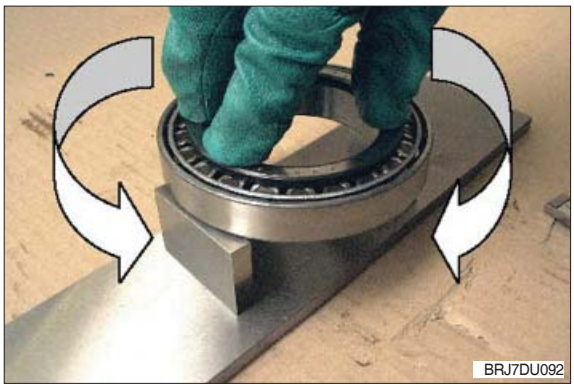
(1) Determination of general bearing width

① Gauge block (#2) is used to initialize the depth gauge (#1).

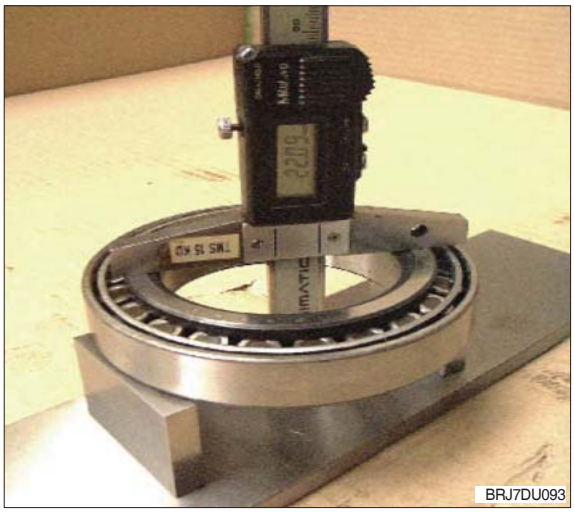


BRJ7DU091

② A new bearing is placed on top of two gauge blocks to rotate as shown in the figure.


BRJ7DU092

③ Dimension "B" is determined.
Example : Dimension "B" = 22.09 mm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(2) Determination of the bearing difference for mounting the removed shim

① The difference of D" on the dimension of the new bearing and the bearing for replacement shall be corrected with the shim dimension.

Example :

New bearing dimension	"B" 22.09 mm
Difference	"D" 0.10 mm
Existing bearing	- 21.99 mm

The set height of the existing shim shall be reduced by 0.1 mm.

6) DETERMINATION OF THE BASIC MOUNTING DIMENSION

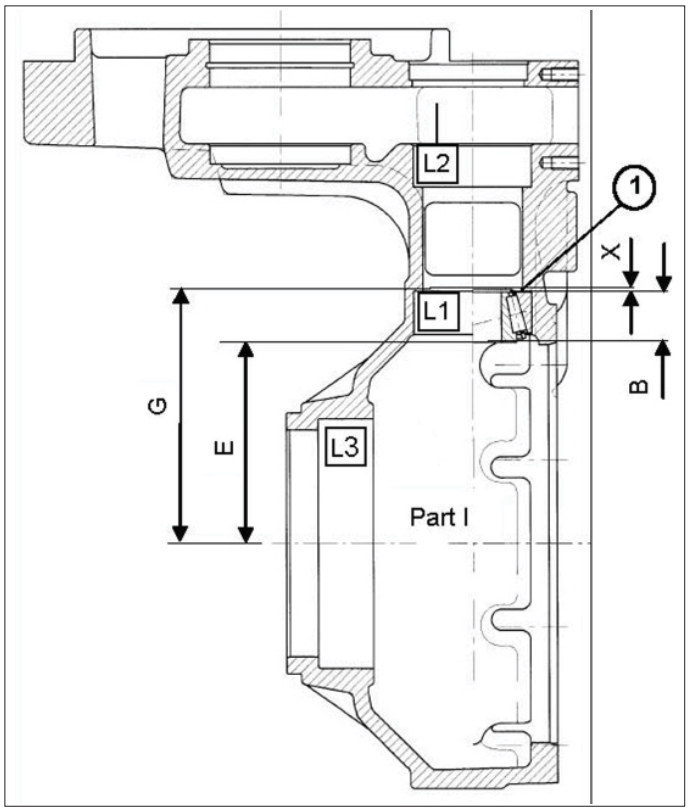
(1) Determination of the shim thickness required for accurate mounting dimension setting on the bevel pinion shaft.

Accurate position of the bevel pinion shaft is required for maximizing the life of the transmission. The following each method is used to determine the shim (#1) thickness and accurate setting of the bevel pinion shaft.

① Insert the fixture part I for measurement (refer to Figure 95) into the housing bearing bore L1 until there is contact.

② Insert the fixture part II for measurement (refer to Figure 96) into the housing bearing bore L2 until there is contact, and use the fixture part I for measurement to fasten manually by hand firmly.

③ Place the fixture part I for measurement on the zero-point position.
(S) Fixture I for measurement
62828



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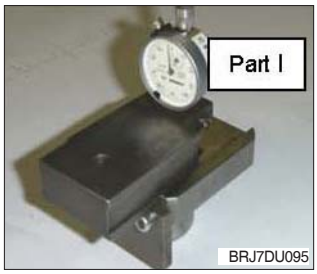


The following reference may be taken from the zero-point position of the dial gauge.
Dimension "1" = 117.00 mm

Dimension "2" is determined from the housing bearing bore L3 (Figure 94) to add on each dimension "1".

Example :

Dimension	"1" 117.00 mm
Dimension	"2" 0.05 mm
Housing Dimension "G"	**116.95 mm**

Formula

X = G - E - B can be used

to calculate the required shim (Figure 94 #1) thickness. "E" is the mounting dimension of the bevel pinion shaft.

Dimension "E" : 95.00 mm

Calculation Example :

Dimension "**G**"	- 116.95 mm
Dimension "**B**"	- 22.09 mm

X = G - E - B

X = 116.95 - 95.00 - 22.09 = **0.14 mm**

Shim is added according to the thickness X = **0.14 mm.**

(2) Determination of the shim thickness required for optimum setting of the distortion backlash on the crown gear

Accurate crown gear setting is required for securing the optimum distortion backlash on the bevel gear.

The bearing width "B" of the taper roller bearing on the crown gear can be measured according to "Determination of the bearing width and difference on the taper roller bearing" in Page 3-25, Section 5).

Accurate setting of the shim thickness and crown gear is determined by the following method.


BRJ7DU098

① The fixture for measurement is inserted into the housing bearing bore (L3) until there is contact (Refer to Figure 100 or Figure 101).
(S) Fixture for measurement 62232


BRJ7DU099

② Place dial gauge of the fixture for measurement on the zero-point position.
The following reference may be taken from the zero-point position of the dial gauge.
Dimension "3" = 110.50 mm

Dimension "4" is determined from the housing bearing bore (L3) to add on each dimension "3".

Example :

Dimension "3"	110.50 mm
Dimension "4"	0.01 mm
Housing Dimension "G"	110.51 mm

Calculation formula

X = G-E-B-H-K2 may be used to calculate the required shim (#3) thickness as follows.

Dimension "E" = 64.50 mm

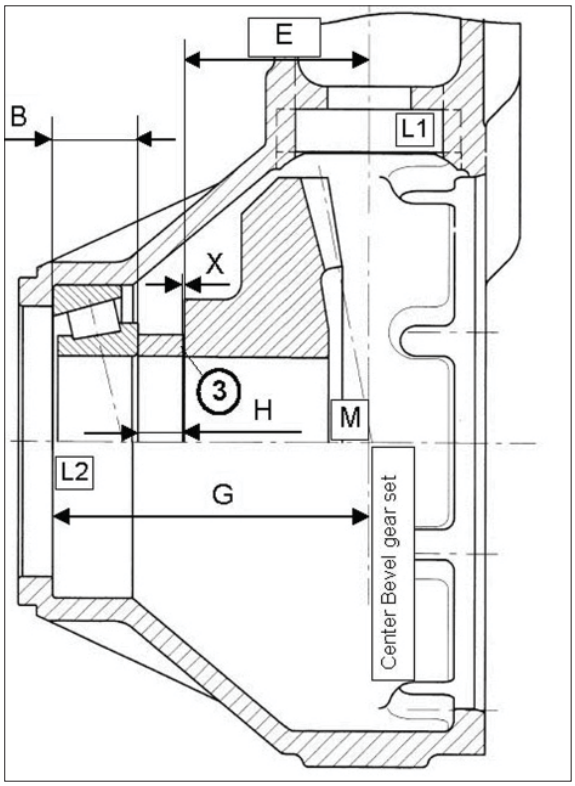
Shim Thickness (X) Calculation Example

Dimension "G"	110.51 mm
Dimension "B"	29.85 mm
Dimension "H"	15.69 mm
Dimension "E"	64.50 mm
Dimension "K2"	0.13 mm

According to X = G-E-B-H-K2,

X = 110.51-64.50-29.85-15.69-0.13

= 0.34 mm



BRJ7DU101

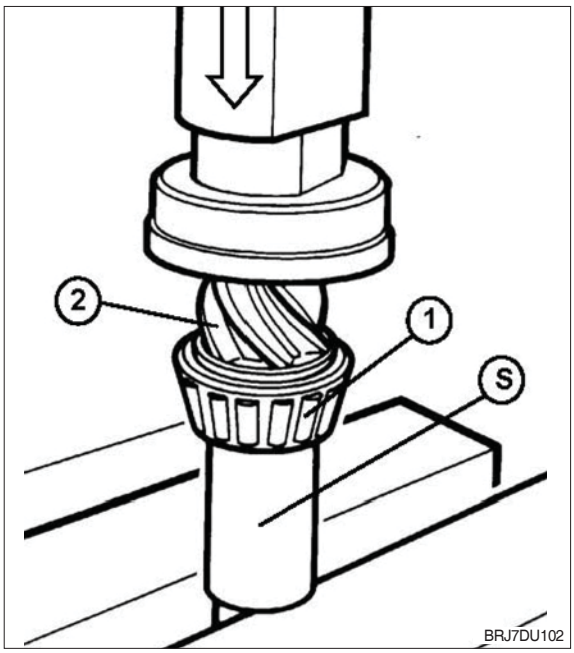
7) BEARING MOUNTING AND ACCURATE BEARING PRE-LOAD SETTING ON THE BEVEL PIN-

(1) Pre-assembly of the bevel pinion shaft and bearing

① Hand lever press is used to place the inner ring of the taper roller bearing (#1) and sleeve for compression (S) on the bevel pinion shaft (#2) for careful compression until there is contact.

⚠ Caution is required on the gear when mounting the bearing of the bevel pinion shaft. There can be noise issues when occurred with damage.

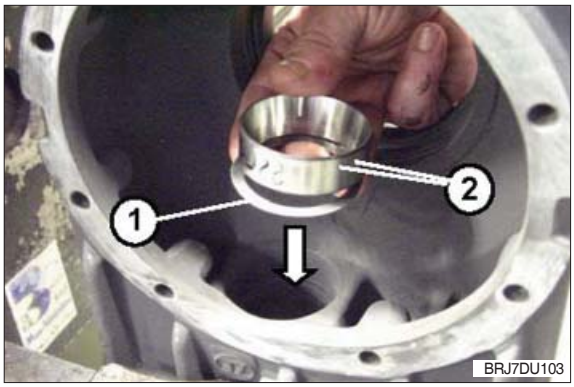
(S) Sleeve for compression 223705.009



(2) Mounting the outer ring of the bearing on the housing

① Various thicknesses of shims are used to prepare the shim thickness prepared according to "Determination of the the shim thickness required for setting the accurate mounting dimension on the bevel pinion shaft" in Page 3-26, Section (1).

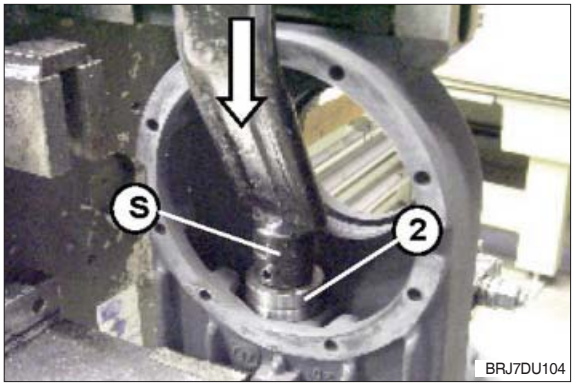
② Insert the shim (#1) and outer ring of the bearing (#2) inside the bearing sheet.



③ Mandrill for hitting (S) is used to mount the shim and outer ring of the bearing on the bearing sheet of the housing until there is contact.

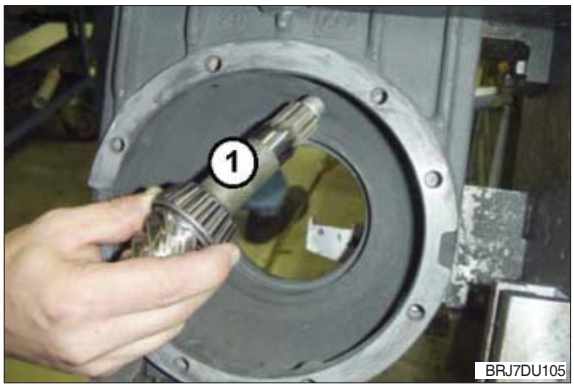
⚠ Repeated measurement of the bearing height is permitted only when the maximum deviation is ±0.05 mm.
In other cases, the shim thickness calculation process shall be repeated.

(S) Mandrill for hitting 62508

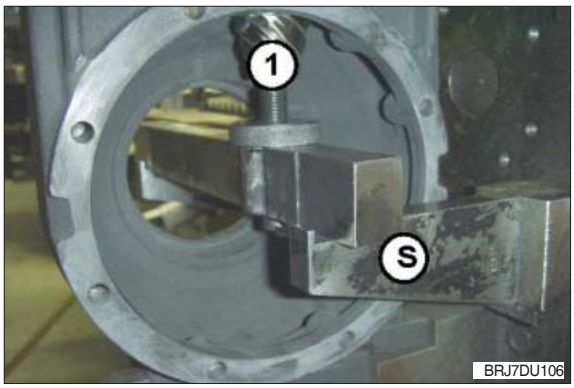


(3) Calculation of clearance dimension between the color bevel pinion shaft and housing

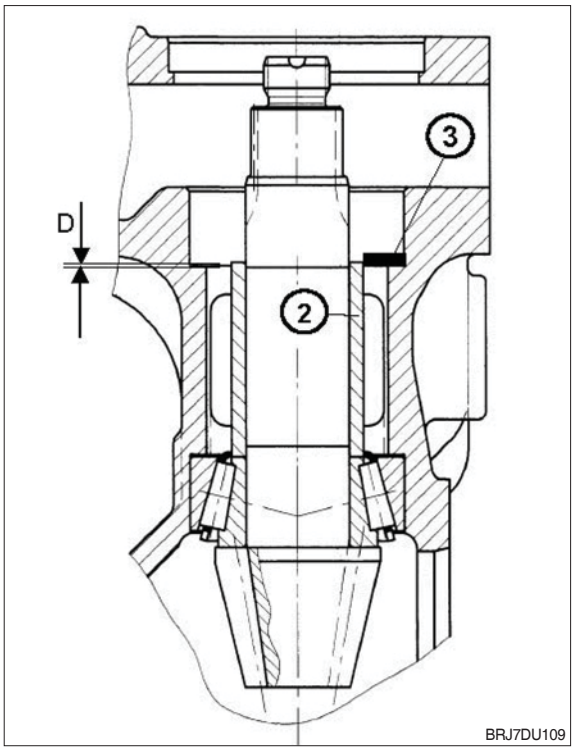
① Insert the pre-assembled bevel pinion shaft (#1) into the housing from the floor for mounting.



② Use the counter holder (S) to apply force by hand on the outer ring of the bearing inside the housing to form the pre-load.
(S) Counter holder 62507-1

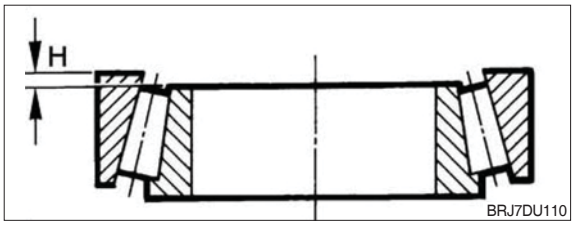


Use the depth gauge to determine the clearance dimension of "D" between the collar of the bevel pinion shaft and the outer ring of the bearing on the housing. (#3 is the requried shim thickness.)



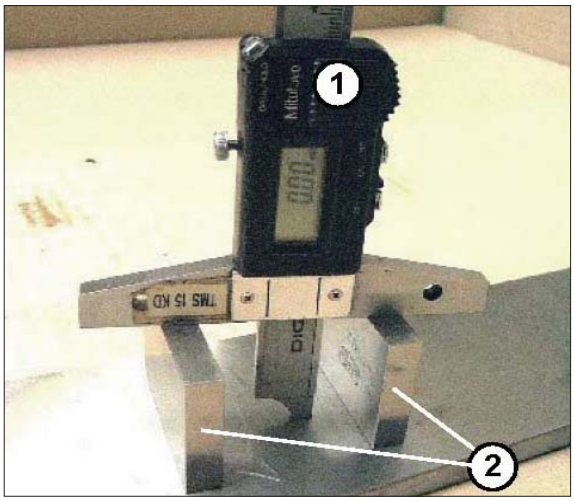
(4) Determination of bearing relaxation dimension on the taper roller bearing

① Clearance (Arrow) = Bearing Relaxation H



According to the following stage, use the fixture for measurement and gauge block/ ledge for measurement to measure the bearing relaxation (H).

① Gauge block (#2) is used to initialize the depth gauge (#1).



BRJ7DU111

② Bearing is rotated in various directions.


BRJ7DU112

③ Measure the bearing relaxation (H).

Example : Dimension "H" = 0.10 ㎜


BRJ7DU113

(5) Calculation of the shim required for the top bevel pinion shaft bearing

Formula

X = D-H can be used

to calculate the required shim (#3, Figure 108 and Figure 109) thickness as follows.

Dimension "D" Clearance with the bevel pinion shaft collar

Dimension "H" Bearing relaxation of the taper roller bearing

Dimension "a" Constant = 0.04 mm

Example:

Clearance dimension : Dimension measured on the housing **D** - 0.7 mm

Bearing relaxation : Dimension measured on the housing **H** - 0.10 mm

X = D-H-a

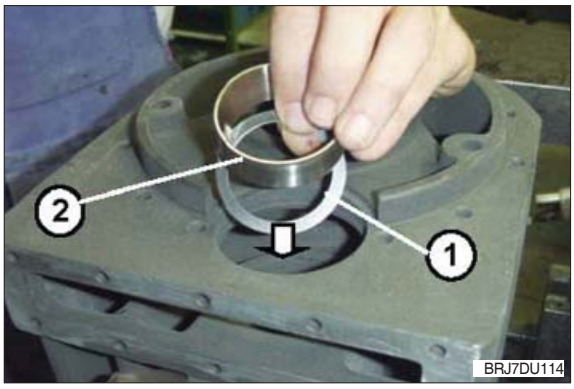
X = 0.7-0.10-0.04 = 0.56 mm

Shim relevant to thickness X = 0.56 mm is added.

8) TOP TAPER ROLLER BEARING MOUNTING ON THE BEVEL PINION SHAFT

Use various thicknesses of shims to prepare the shim thickness determined according to "Calculation of the shim required for the top bevel pinion shaft bearing" in Section (5) above, and mounting is continued as follows.

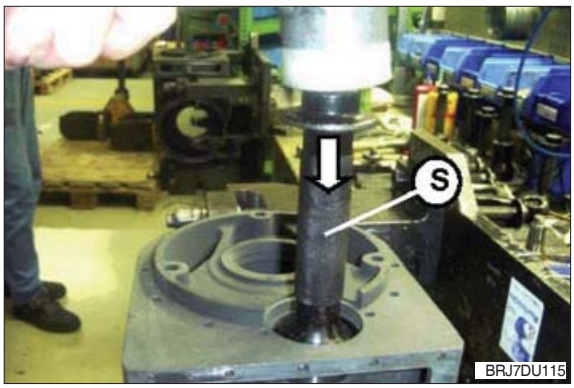
① Insert the shim (#1) and outer ring of the bearing (#2) inside the bearing sheet.



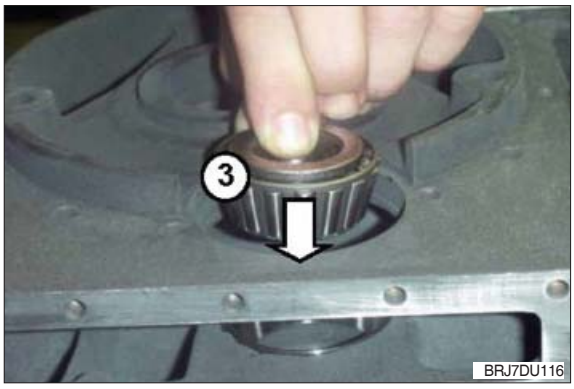
② Mandrill for hitting (S) is used to mount the shim and outer ring of the bearing in the bearing sheet of the housing until there is contact.

⚠ **Repeated measurement of the bearing height is permitted only when the maximum deviation is ±0.05 mm.**

(S) Mandrill for hitting 62746



③ Insert the inner ring of the bearing (#3) into the outer ring of the taper roller bearing.

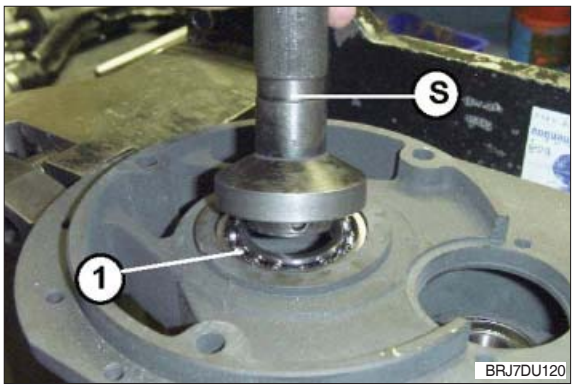


(1) Mounting of the groove-type ball bearing on the driving pinion

① Mandrill for hitting (S) is used to mount the groove-type ball bearing in the bearing sheet of the housing until there is contact.

(S) Mandrill for hitting 62625

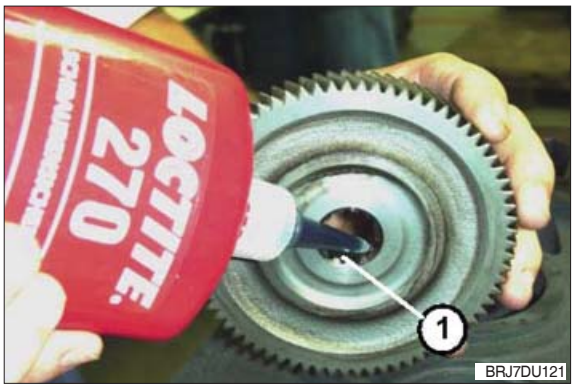
⚠ Mount the groove-type ball bearing inside the housing bearing bore before the helical gear is mounted.



(2) Helical gear mounting on the bevel pinion shaft

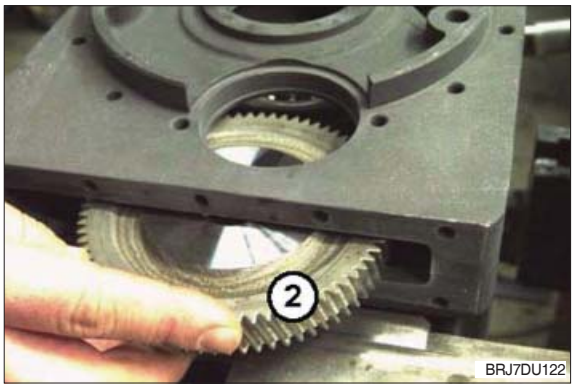
① Apply Loctite #270 thin and evenly on the inner gear of the helical gear (#1).

⚠ Wear the safety gloves to follow the instructions on using the Loctite when performing the work using additives.

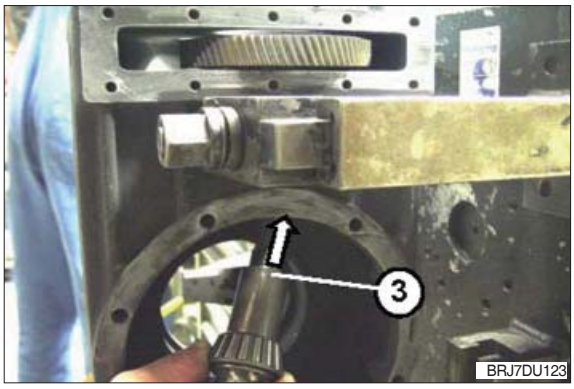


② Insert the helical gear (#2) through the opening on the side of the housing to align in the center, and place on top of the taper roller bearing.

⚠ Take caution on not damaging the gear when inserting the helical gear. There can be noise issues when occurred with damage.

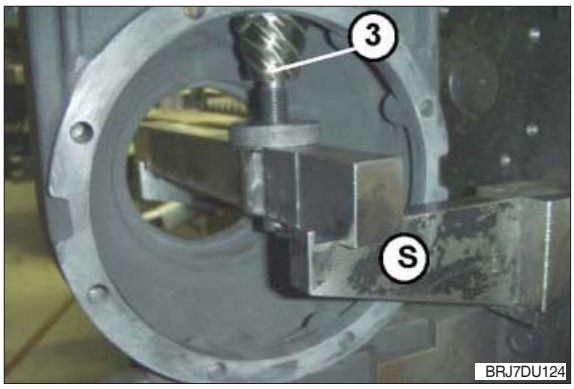


③ Mount the bevel pinion shaft inside the housing through the floor. The assembly passes through thr protruded sheet on the helical gear bore.



④ Hand is put on the outer ring of the bearing on the housing to apply force on the counter holder (S) for pre-load on the bevel pinion shaft.

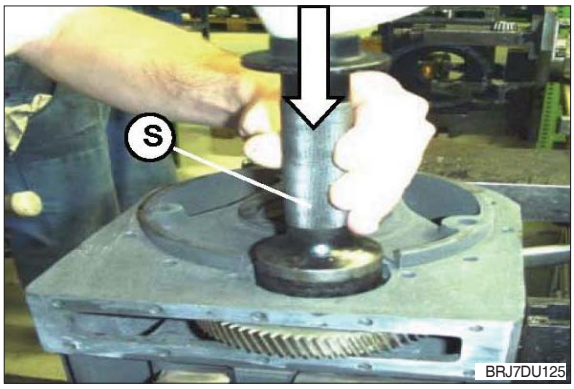
(S) Counter holder 62507-1



⑤ Use the mandrill for hitting (S) to mount the helical gear until there is contact. Fasten the adjusting screw on the counter holder by hand repeatedly to enable the accurate postitioning of all components such as the taper roller bearing, spacer busing and shim.

⑥ The counter holder can be removed again when all components are positioned accurately and firmly.

(S) Mandrill for hitting 62846

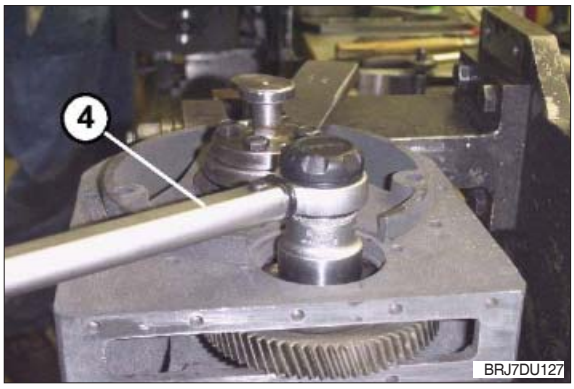


⑦ Insert the gear lock (S) inside the housing bearing bore of the driving pinion to fix the helical gear.

(S) Gear lock 62228

⑧ Place the hexagon nut of M20×1.5 on top of the bevel pinion shaft to fasten by using the torque spanner (#4).

Fastening torque : 150 Nm

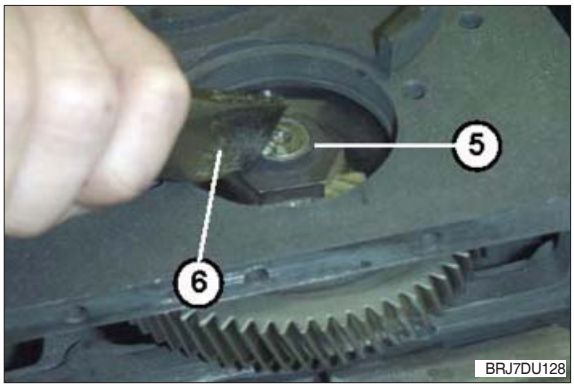


⚠ **Do not hit the hexagon nut yet with the bevel pinion shaft. The hexagon nut pinning (hitting) must be performed after the bearing pre-load is set and inspected. The hexagon nut is used only once.**

⑨ Turn the bevel pinion shaft and helical gear each several times to align the taper roller inside the bearing ring.

⑩ Use the drag torque spanner attached with the dial gauge to check the bearing pre-load.
The bearing pre-load is adjusted accurately when the bearing friction torque raeches 0.5 ~ 1.0 Nm on the bevel pinion shaft.
The procedure must be repeated when there is difference with this number.

⑪ Chisel or bore (#6, the radius of the edge on the chiesel shall be approximately 2.0 ㎜) shall be placed on the flexure of the bevel pinion shaft for pinning. Hexagon nut is pinned and locked.

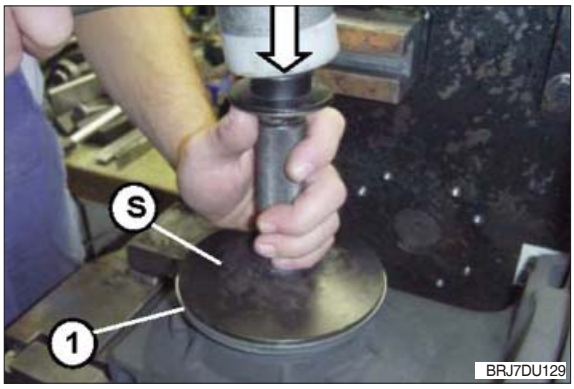


9) MOUNTING THE CROWN GEAR AND WHEEL SHAFT ON THE HOUSING

(1) Mounting the screw protective shield and radial sealing ring

① Apply Loctitie #270 evenly on the screw protective shield (#1) placed on top of the sheet, and use the mandrill for hitting (S) for mounting until there is contact.

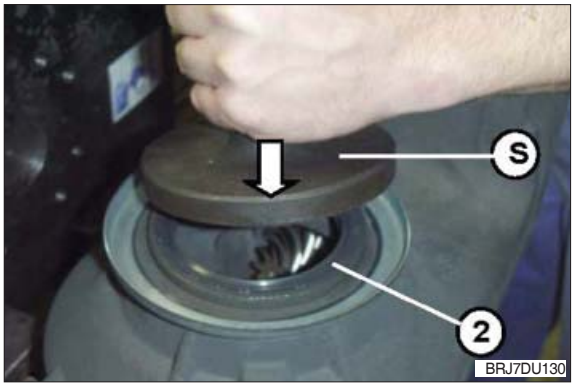
(S) Mandrill for hitting 63293



② Apply Loctitie #574 thin and evenly on the outer diameter of the radial sealing ring.

③ Use the mandrill for hitting (S) to pin the radial sealing ring (#2) inside the sheet until the mandrill is in contact with the housing sheet.

(S) Mandrill for hitting 63292



⚠ Caution is required on not having the radial sealing ring stuck until mounted. There can be leakage when the ring is stuck.

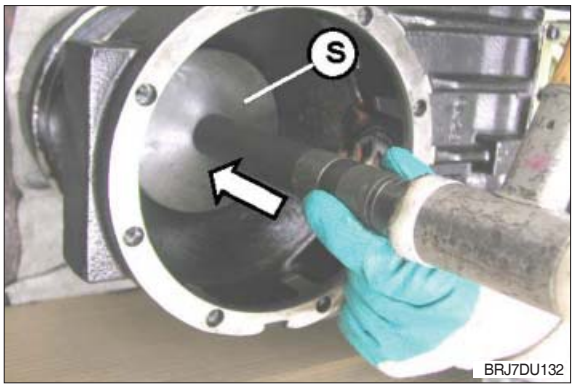
⚠ Take caution on not damaging the sealing lip of the radial sealing ring.

③ Apply grease (Example : Shell Avania R3) slightly on the sealing lip of the radial sealing lip.

(2) Mounting the taper roller bearing on the housing

① Mandrill for hitting (S) is used to pin the shim and outer ring of the bearing in the bearing sheet of the housing until there is contact.

(S) Mandrill for hitting 62542

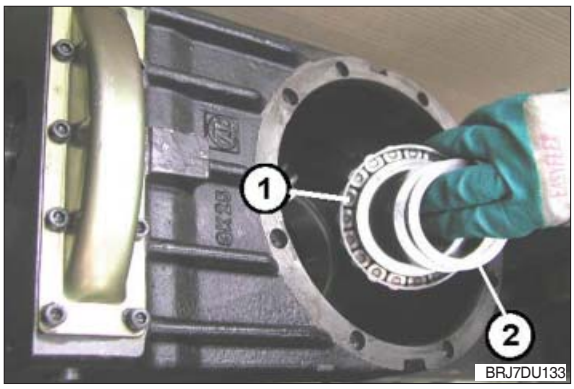


② Insert the inner ring of the bearing (#1) into the outer ring of the taper roller bearing.

③ Insert the bushing into the housing.

④ Use various thicknesses of shims according to the value set in "Calculation of the shim required for the top bevel pinion shaft bearing" in Page 3-34, Section 7) to prepare the shim thickness (X).

⑤ Insert the shim (#2).



(3) Determination of the sheet management dimension

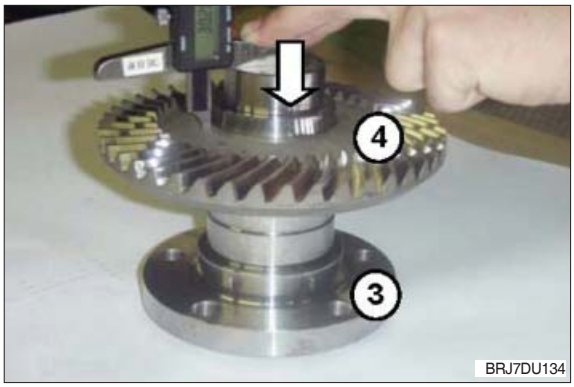
① Place the wheel shaft (#3) on top of a flat and firm support. Mount the crown gear (#4) on top of the taper sheet on the wheel shaft, and take caution on pressing weakly by hand.

As shown in Figure 135, the clearance is determined between the flat surface of the wheel shaft of P and surface of the crown gear of S.

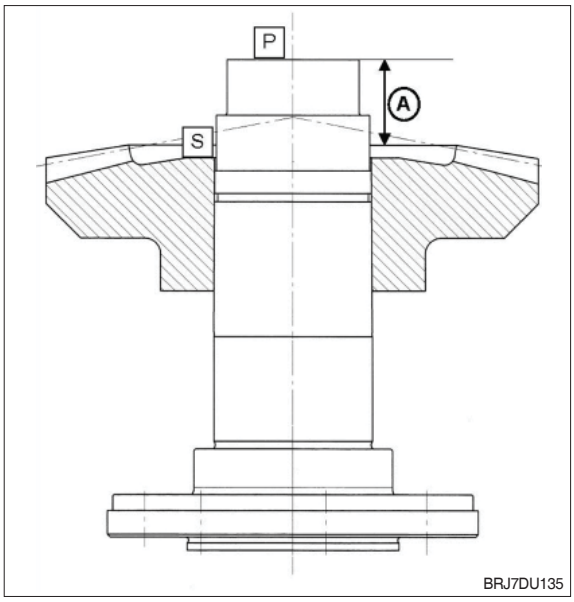
In the example, the dimension "A" is 30.85 mm.

⚠ Perform this procedure exactly up to 1/100 mm.

⚠ Take caution on not damaging the crown gear when mounting the crown gear to the wheel shaft. There can be noise issues when occurred with damage.

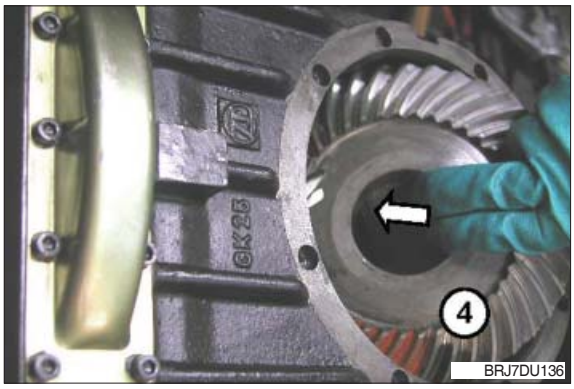


⚠ **Take caution on not damaging the gear on assembly of the crown gear.**



① Take caution to assemble the crown gear (#4) on the housing, and insert into the gear of the bevel pinion shaft at the same time. Take caution to align the crown gear on the center of the shim and bushing.

② Set the center of the inner ring of the taper roller bearing, shim, crown distance and bushing.

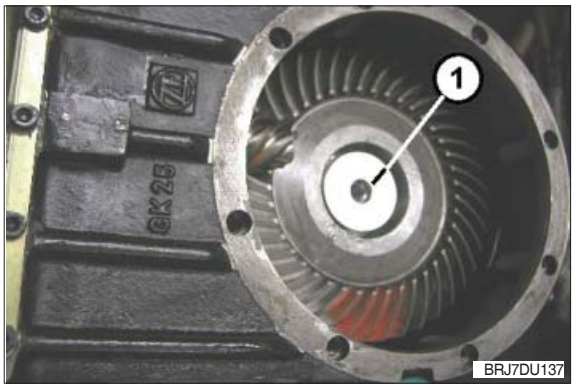


(4) Wheel shaft compression

⚠ There must be no grease and oil on the taper press fit. Check whethere there are any flaws on the surface of the press fit. Use a new wheel shaft when damaged.
All components must be aligned and set to the center for the press work.
Press work using the compressive force possible for control is required for mounting the wheel shaft.

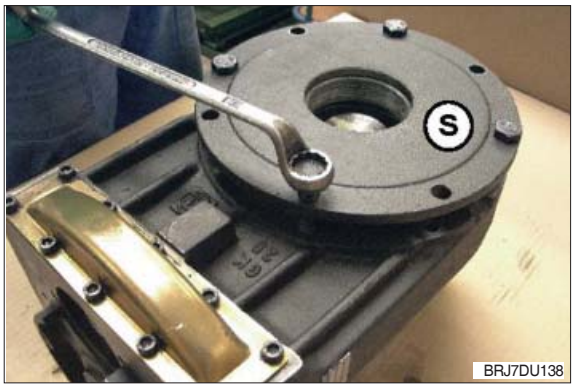
Compressive force : 250 kN ~ Max 300 kN.

① Assemble the wheel shaft (#1) carefully, and insert until there is contact for mounting.



② Fasten the scre of the fixture for compression (S).

(S) Fixture for compression 63428



③ Compression is required on the wheel shaft to the crown gear.
In this process, compression is performed until there is contact of the shim, inner ring of the taper roller bearing and bushing.

⚠ Compressive force shall be applied only on the wheel shaft when compressing the wheel shaft.

(5) Determination of the sheet dimension

⚠ Sheet dimension must be 10 ~ 15 mm.

① Measure the dimension again from the wheel shaft/flat surface to the crown gear/ surface A (Refer to Page 3-39, Section 9) (3) "Determination of the Sheet Management Dimension").

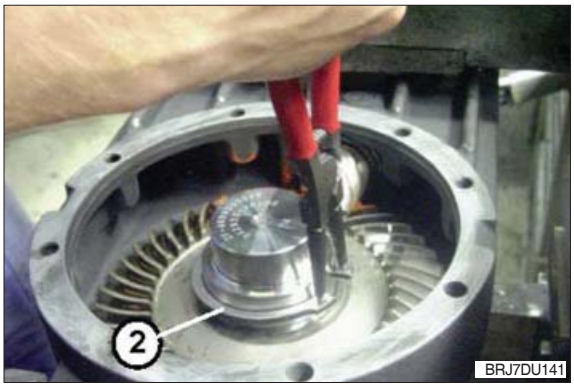
Dimension "A" (Example) 44.34 mm

Example :
Dimension "A" (After compression) 44.43 mm
Dimension "A" (After compression) 30.85 mm
Final difference = Sheet 13.49 mm


BRJ7DU140

⚠ New wheel shaft and corwn gear must be mounted when the determined sheet dimension is not 10 ~ 15 mm.

② Mount the retaining ring (#2).

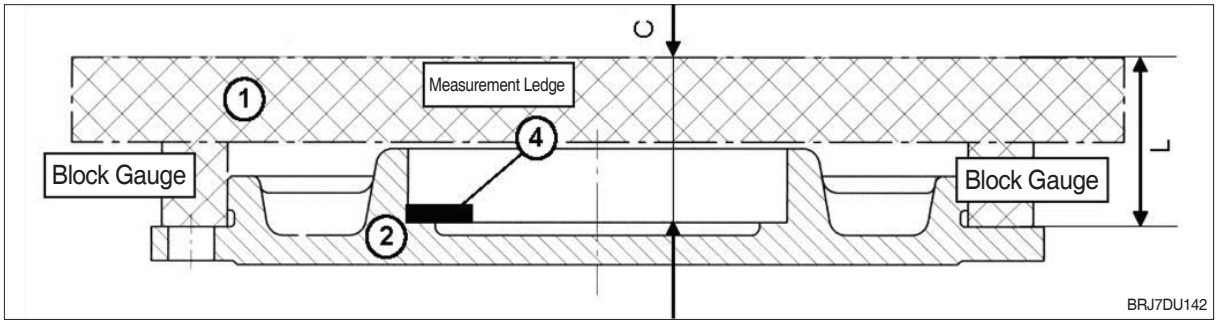


BRJ7DU141

10) MOUNTING THE WHEEL SHAFT BEARING

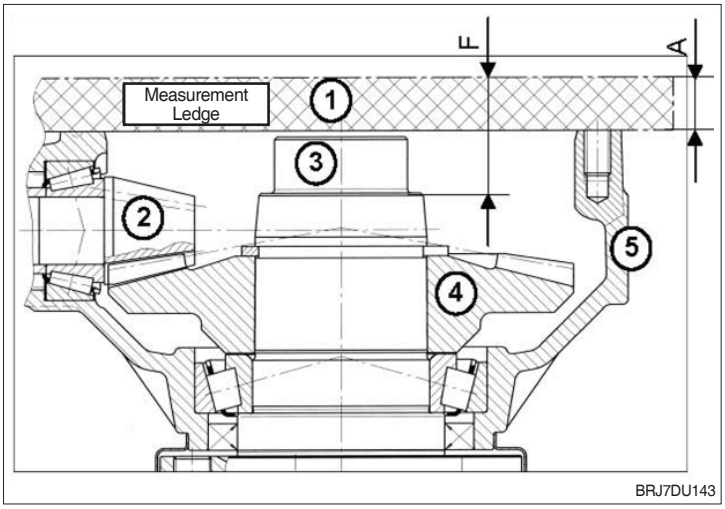
(1) Determination of the shim thickness required for bearing pre-load of the wheel shaft

The shim (#4) thickness for addition can be determined through the following method.



1 Measurement ledge
2 Housing cover

Dimension "L" Clearance between the mounting surface/housing cover and zero point of the measuring instrument
Dimension "C" Measurement gap from the contact shim/housing cover
Dimension "L" Example : Zero-point on the measurement instrument = 0
Dimension "C" Example : 0.85 mm



1 Measurement ledge
2 Bevel pinion shaft
3 Wheel shaft
4 Crown gear
5 Housing

Dimension "A"
Distance from the mounting surface/housing to the measurement instrument

Dimension "F"
Measurement gap from the inner ring/wheel shaft of the contact bearing

Dimension "A"
Example : Zero-point position on the measurement instrument = 0

Dimension "F"
Example : 23.01 mm

(2) Calculation of required shim thickness

Shim thickness can be calculated by using the specified dimension.

Calculation Example

Cover dimension : Dimension measured on the dimensional housing cover of C 0.85 mm

Housing dimension : Dimension measured on the dimensional housing F 23.01 mm Bearing

Dimension : Dimension measured on the bearing in the dimensional pre-load state of B 21.85 mm

$$X1 = F - (C + B)$$

$$X1 = 23.01 - (0.85 + 21.85) = 0.31 \text{ mm}$$

Constant : $a = 0.20$ @ $X1 \geq 0.31$

$a = 0.25$ @ $X1 \leq 0.30$

$$X = X1 + a$$

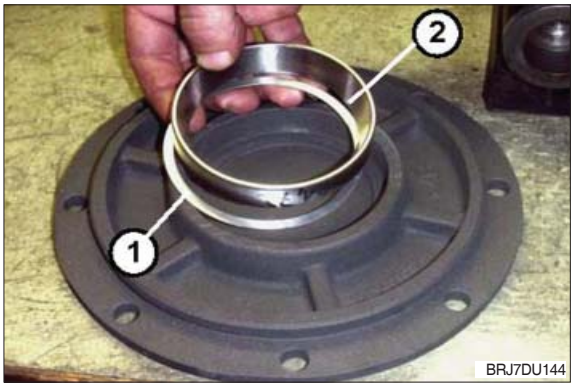
$$X = 0.31 + 0.20 \text{ mm} = 0.51$$

Shim is added according to the thickness X.

(3) Mounting the bearing on the housing cover and wheel shaft

① Use various thicknesses of shims to prepare the shim thickness set in "Calculation of required shim thickness" on Section (2) above.

② Insert the shim (#1) and outer ring of the bearing (#2) inside the bearing sheet.

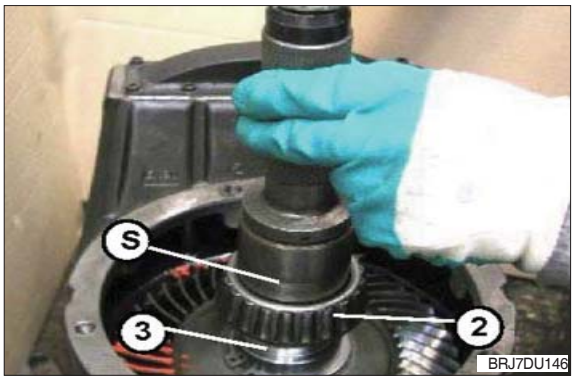


③ Use the mandrill for hitting (S) to insert the shim and outer ring of the bearing (#1) inside the bearing sheet of the housing until there is contact.

(S) Mandrill for hitting 62749

④ Insert the counter holder (N) inside the fixture for assembly, and apply force on the wheel shaft through the hand to form the pre-load (Refer to Figure 124).
(N) Counter holder 62507-1

⑤ Use the mandrill for hitting (S) to mount the inner ring of the taper roller bearing (#3) on the bearing sheet of the wheel shaft (3) until there is contact.
(S) Mandrill for hitting 63294



(4) Mounting the housing cover

⚠ Use a new O-ring when mounting. Apply transmission oil or grease on the O-ring. Take caution on not damaging the flat surface of the housing cover to clean carefully.

① Place the O-ring (#4) on the groove of the housing cover.

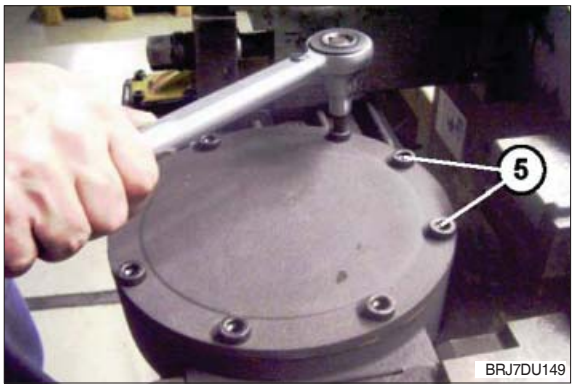
② Clean the flat surface of the housing cover in detail to prevent grease.

③ Apply Loctite #574 thin and evenly on the flat surface.

④ Place the housing cover carefully, and hit softly with the bounce-free hammer for mounting until there is contact.

Use the cap screw M10×25 (#5) to fasten the cover on the housing. Fasten the cap screw equally in order.

Cap screw fastening torque : 46 Nm.



(5) Inspection of the bearing friction torque on the wheel shaft

Roll ring

To measure the bearing friction torque, place the tool (S) on top of the shaft in the state aligned with the wheel bolt, and use the torque spanner to turn the wheel shaft several times.

(S): Fixture for measurement
62515 : 20/25BRJ-9

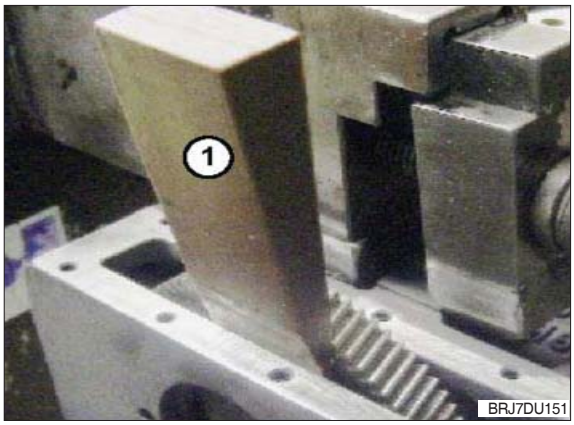
The bearing pre-load is adjusted accurately when the bearing friction torque is measured

as 8.0 ~ 22 Nm on the whee shaft.

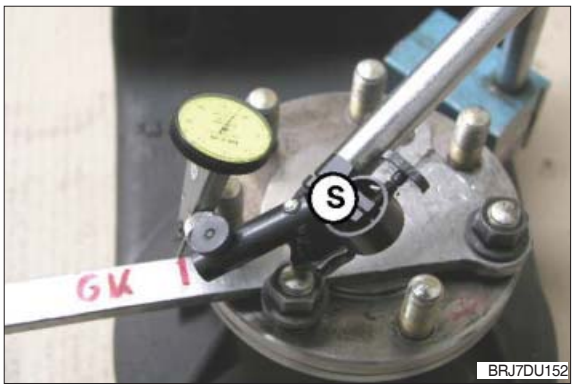
The work stage in Section 10) (2) must be repeated when this value is not reached. The cover must also be removed again.
When the measurement value is larger than the above value, the shim thickness value "X" obtained in "Calculation of shim thickness required" in Section 10) (2) must be reduced.

When the measurement value is smaller than the above value, the shim thickness value "X" obtained in "Calculation of shim thickness required" in Page 3-44, Section 10) (2) must be increased.

(6) Maesurement of the distortion backlash on the wheel shaft



① The bevel pinion shaft must be fixed to prevent the distortion for measurement of the distortion backlash.
(Example : Wooden wedge /#1 is used for fixation)



② Measure the distortion backlash by using the stop (S) for measurement.

(S) Stop for measurement 62819

Acceptable distortion backlash :
0.13 ~ 0.18 mm

The distortion backlash can be adjusted by adding or removing the shim (Refer to "Determination of the shim thickness required for optimum setting of the distortion backlash on the crown gear" in Page 3-28, Section 6) (2)). The wheel shaft must be removed again.

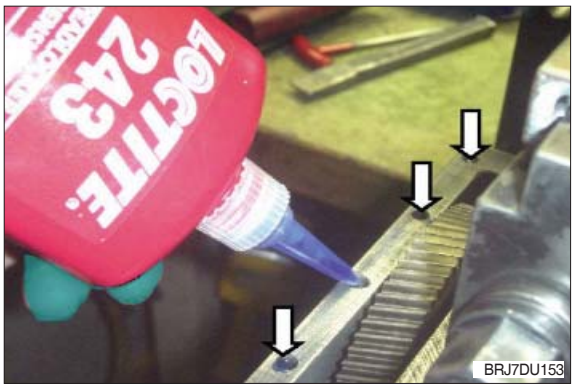
(7) Mounting the side cover

Clean the sealing surface on the housing and remove the residual oil before mounting the side cover. Do not damage the sealing surface.

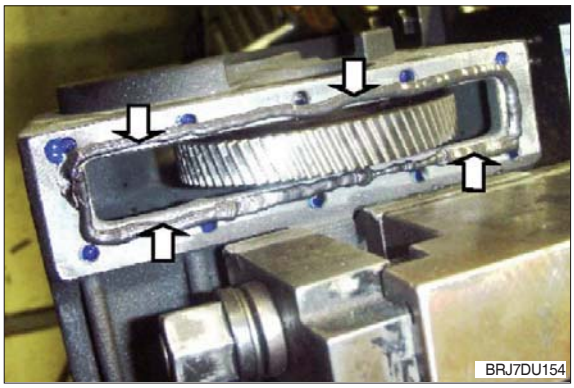
⚠ Wear the safety gloves to follow the instructions on using the Loctite when performing the work using additives.

⚠ The next stage must be performed within 10 minutes as the Loctite is hardened.

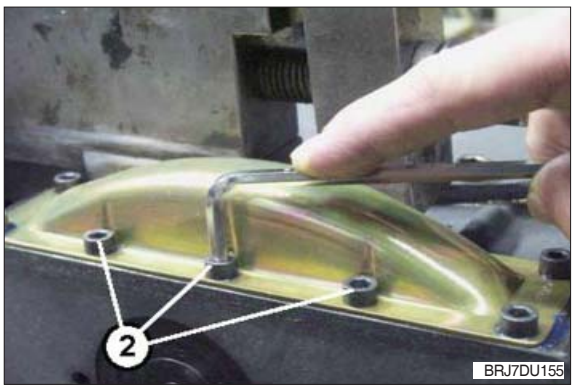
① The following sealing products are required for the sealing through the hole and sealing around the screw.
Loctite #243 : As the product used on the screw-type blind hole (M6), sealing is performed by overflowing.



② Cover sealing
Loctite #5910 : As the adhesive product, sealing is performed through unform application on the sealing surface of the housing.



③ Place the side cover (seat cover) on top of the housing, and fasten 10 cap screws of M6×10 (#2) by hand.

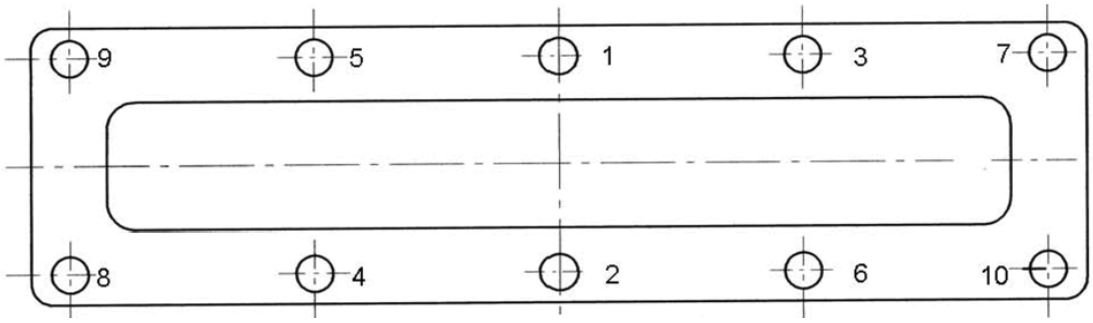


⚠ The cap screw is not fastened with the relevant tightening torque yet.

10 cap screws are fastened uniformly only in the fastening order indicated in Figure 156.
Fastening order :

Start from No. 1 ..... Finish on No. 10

Cap screw fastening torque : 9.5 Nm



BRJ7DU156

11) PRE-ASSEMBLY AND INSTALLATION OF THE DRIVING PINION

(1) Mounting the ball bearing

① Use the fixture for assembly (S) as shown in the figure when mounting the bearing on the driving pinion.

(S) Fixture for assembly 62523

Place the driving pinion (#1) on top of the guide mandrill (#2) on the fixture for assembly, and mount until the contact is enabled.

② Place the ball bearing (#4) and compressive sleeve (#3). Use the hand lever press for compression of the ball bearing and compressive sleeve to the driving pinion (#1) until contact is made.

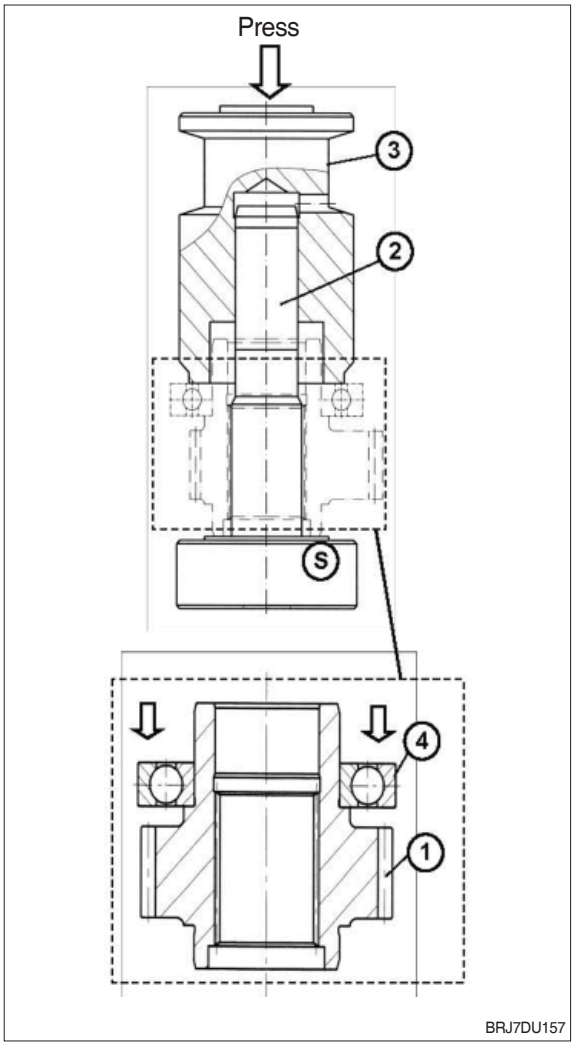
③ (#3) Compressive Sleeve 63290

④ The bearing can be mounted when there is no hand press.

⚠ Burn Hazard! Wear safety gloves.

⑤ Heat the ball bearing up to maximum of 90˚C to mount on the driving pinion until contact.

⑥ Mount the bearing after cooling.



BRJ7DU157

(2) Mounting the sealing cap

Sealing cap (#5) must be mounted for bore sealing of the driving pinion. The following sealing products are required for sealing.

① Loctite #5910 : As the adhesive product used on the support surface and around the bore of the driving pinion, sealing is performed by applying for overflowing.

② Insert the sealing cap.

③ Use the press to compress on the sealing cap until there is contact.

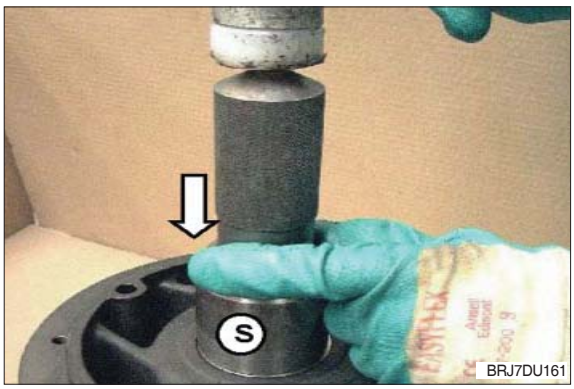
(3) Install the driving pinion

⚠ Take caution on not damaging the gear part on the driving pinion and helical gear when inserting the driving pinion. Noise can be increased during the operation when the gear is damaged, and there can be bigger damages occurred.

① Mount the pre-assembled driving pinion (#1) carefully on the housing bearing bore. Turn the wheel shaft of the transmission carefully for combination until the driving pinion is interlocked with the helical gear.

② Use the mandrill for hitting (S) to mount the driving pinion until there is contact.

(S) Mandrill for hitting 62478



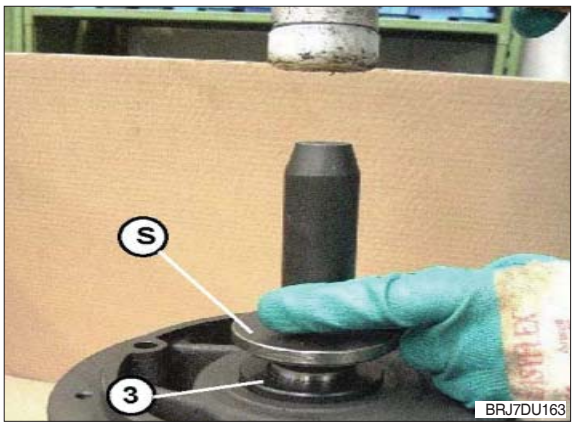
③ Use the counter-sunk plier to insert the retaining ring (#2) into the groove of the housing bore, and mounted until there is contact.

④ Apply grease (Example : Shell Avania R3) slightly on the sealing lip of the radial sealing lip.

⑤ Apply Loctitie #574 thin and evenly on the outer diameter of the radial sealing ring.

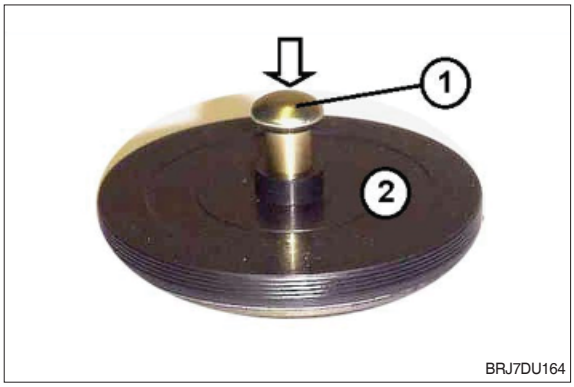
⑥ Use the mandrill for hitting (S) to mount the radial sealing ring on the housing sheet to have the closed surface facing upwards until there is contact with the mandrill.

(S) Mandrill for hitting 62521



(4) Mounting the sealing cap

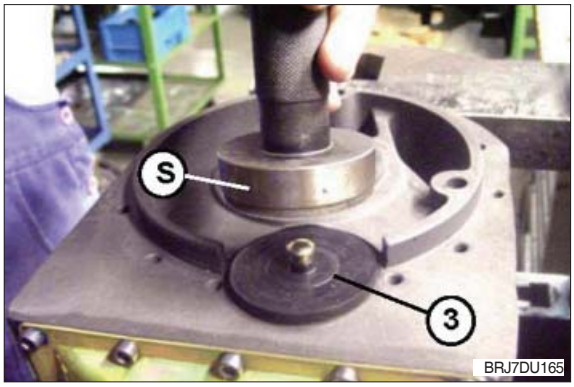
① Press the breather valve (#1) into the central bore of the sealing cap (#2) slightly by hand (Reference depth of approxmiately 5 mm).



③ Insert the sealing cap along with the breather valve (#3) into the bore sheet of the housing bore on the bevel pinion shaft.

④ Also, use the mandrill for hitting (S) to mount the sealing cap until there is contact.

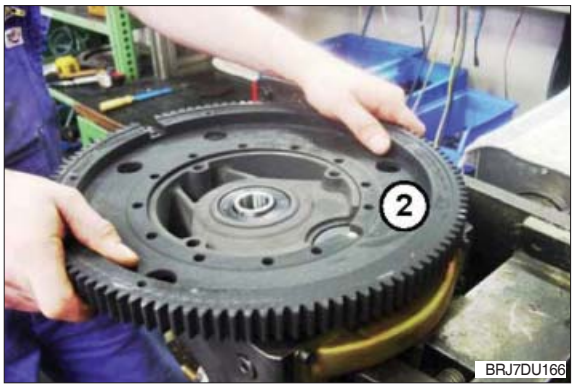
(S) Mandrill for hitting 62522



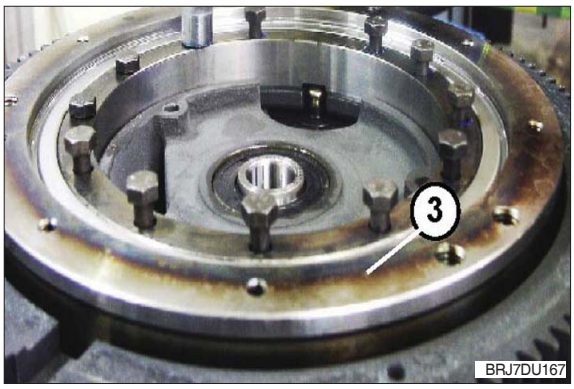
(5) Mounting the pivot-type connection and gear ring

① Place the gear ring (#2) and turn to have the bolt hole match the screw thread hole of the connection structure.

② Use the bounce-free rubber hammer to mount on the gear ring until there is contact.



③ Place the pivot-type bogie bearing (#3) to enable the surrounding flexure to face upwards, and turn the bolt hope of the pivot-type bogie bearing to match the gear ring and housing hole.



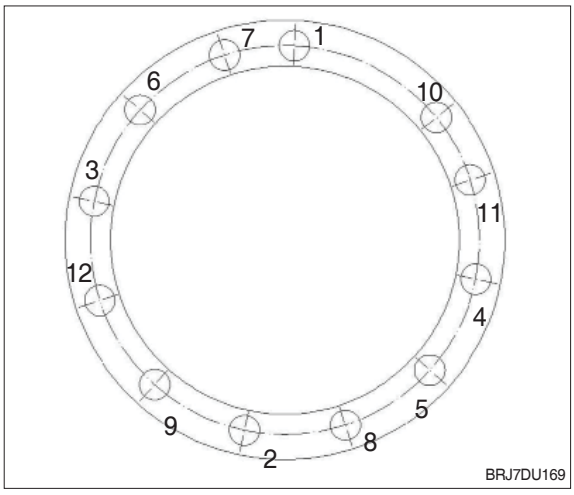
④ Damp the screw M80×40-10.9 with Loctite #243.

⑤ Use the screw to fasten the pivot-type bogie bearing and gear ring on the connection structure.

⑥ Cap screws are fastened uniformly in the fastening order indicated in Figure 169.

Fastening order :
Start from No. 1 Finish on No. 12

Cap screw fastening torque : 34 Nm



Re-assembly complete

⚠ Take caution on not damaging the gear part on the driving pinion and helical gear when mounting the driving pinion. Noise can be increased during the operation when the gear is damaged, and there can be bigger damages occurred.

12) GENERAL INSTRUCTIONS AFTER RE-ASSEMBLY

(1) Follow the mounting guideline in Page 2-9 when re-mounting the transmission on the vehicle.

(2) Replenish the oil according to the driver's manual.

(3) The transmission and vehicle can be operated after 24 hours of more from re-assembly.

6. DISPOSAL

The replaced components, materials and substances shal be disposed according to the appropriate and eco-friendly method, and also according to the regulations and law on disposal of the relevant substance.

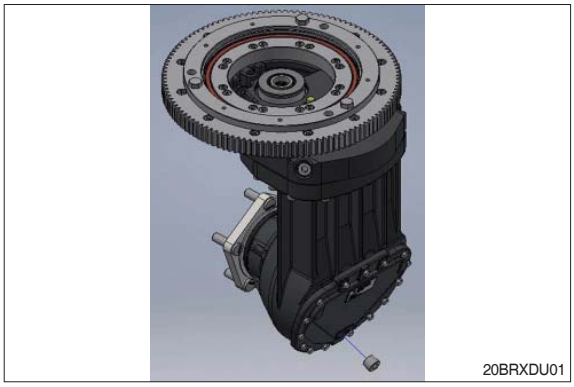
Components	Materials	Subject for disposal according to the regulation
Transmission oil		Waste oil
Side cover	Sheet	Waste metal
Radial sealing ring	Sheet	
Shim	Sheet	
Wheel bolt	Iron	
Groove-type ball bearing	Iron	
Screw	Iron	
O-ring	PE	PE Plastic Material
Shaft Seal	PE	
Sealing Cap	PE	

■ 20/25BR-X

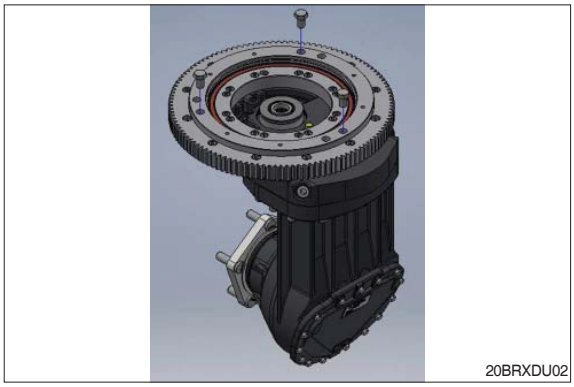
1. DRIVING AXLE UNIT

(1) Disassemble the magnetic plug (44) to discharg the gear oil inside.

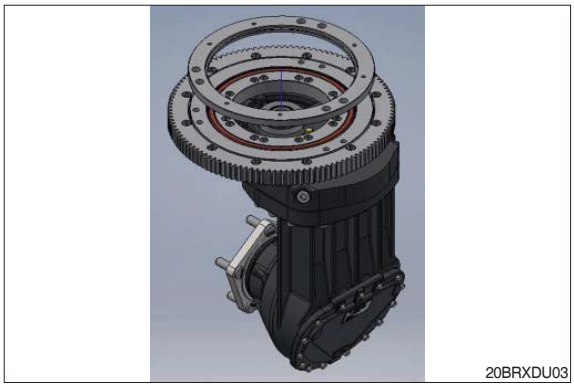
Use 8 mm L-wrench



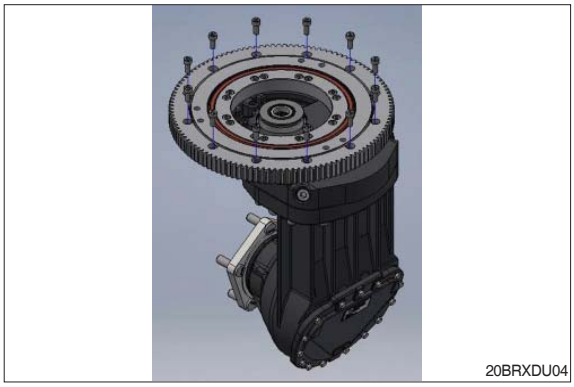
(2) Use the 19 box socket or spanner to disassemble 3 hexagon bolts (19).



(3) Remove the sleeve and outer ring (10).

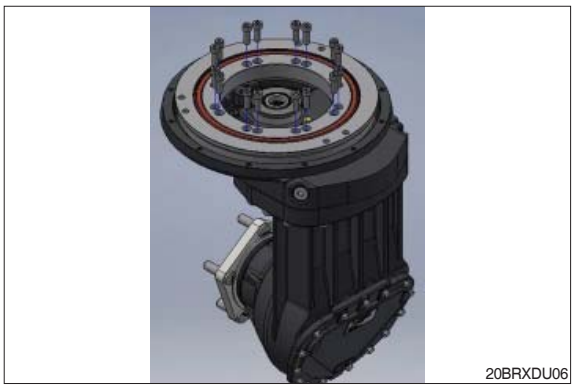


(4) Disassemble 12EA of wrench bolts (15).



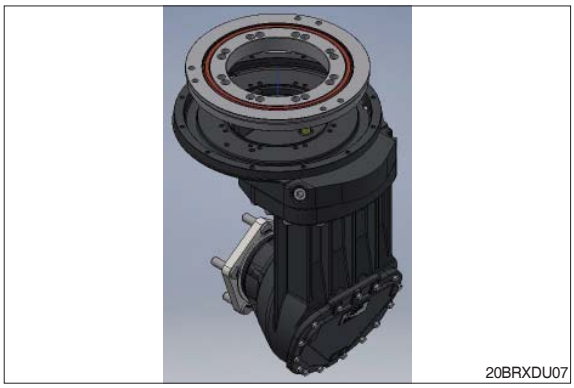
(5) Disassemble the steering gear (11).

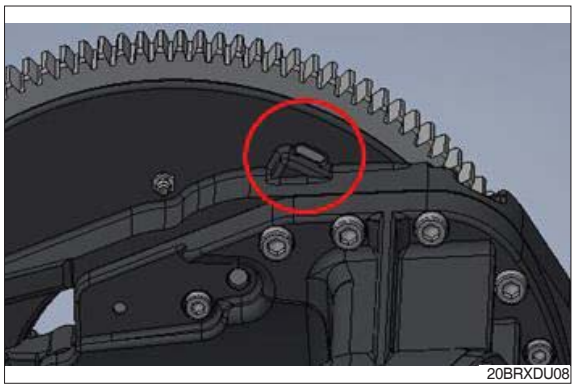
(6) Disassemble 16EA of wrench bolts (M8×25).



(7) Disassemble the rotating bearing assembly (12).

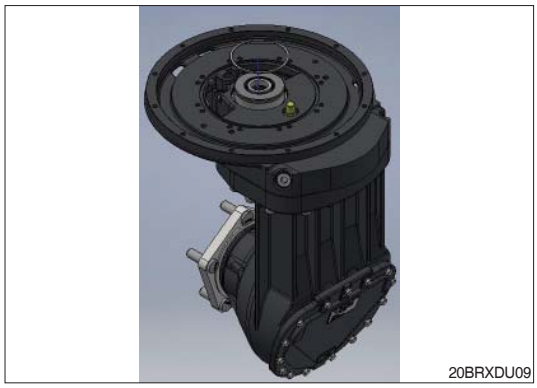
※ **When the parts are not removed appropriately, refer to the figure below to push the parts up for disassembly.**

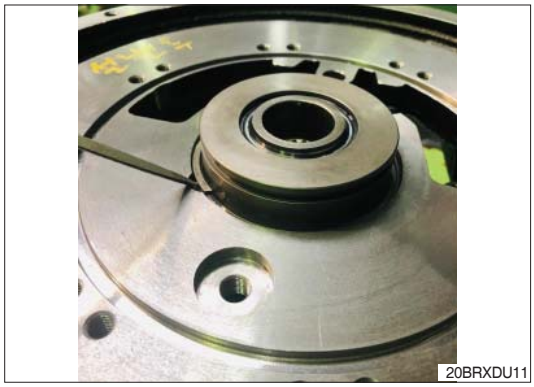




(8) Disassemble the snap ring (29).

※ **Refer to the below image.**

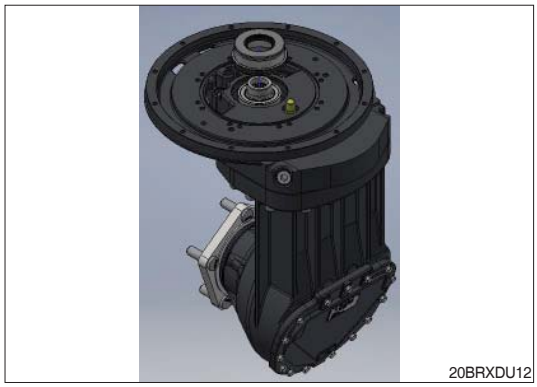


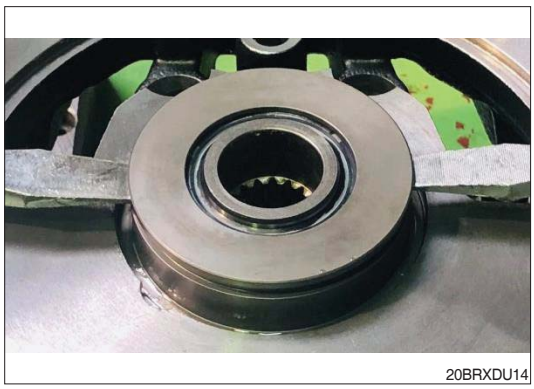


※ **Use the gimlet or small driver for disassembly.**

(9) Disassemble the drive sleeve (9).

※ **Refer to the below image.**

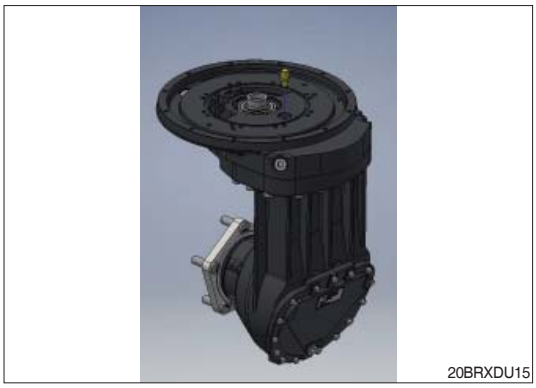




※ **Use the large driver to lift the groove processing part of the part from the left and right for disassembly.**

(10) Disassemble the air breather (33).

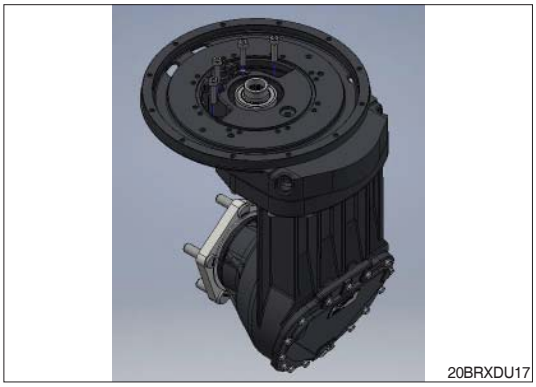
※ **Remove the Teflon tape remaining on the air breather during the disassembly.**



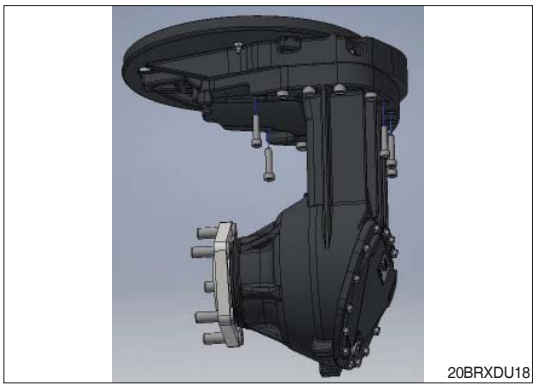
(11) Disassemble 2EA of the socket and, H plug (25).

※ **Remove the Teflon tape remaining on the socket and H plug (25) during the disassembly.**

(12) Disassemble 4EA of wrench bolts (16).



(13) Disassemble 5EA of wrench bolts (17).

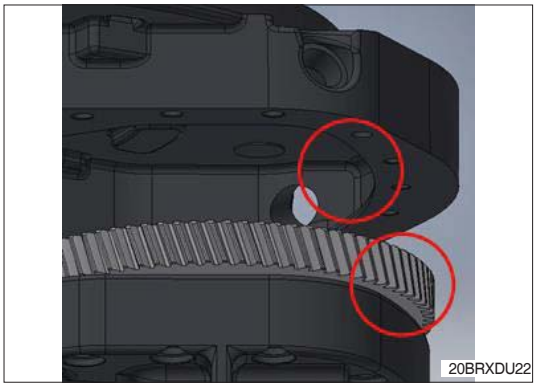


(14) Disassemble 4EA of wrench bolts (18).

(15) Disassemble 4EA of wrench bolts (18).

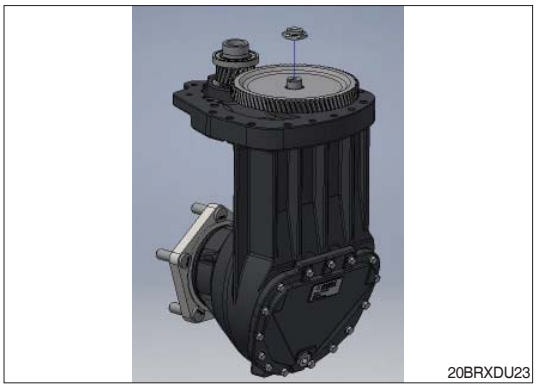
(16) Disassemble the steering housing (2).

※ **Take caution on the gear tooth surface dent during the diassembly.**



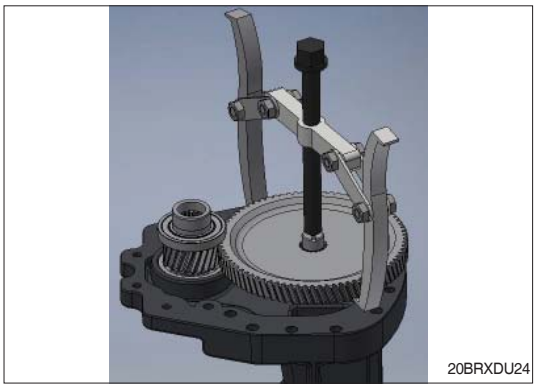
(17) Disassemble the locking nut (27).

※ **Disassembled locking nut is disposed as it is not possible for reuse.**

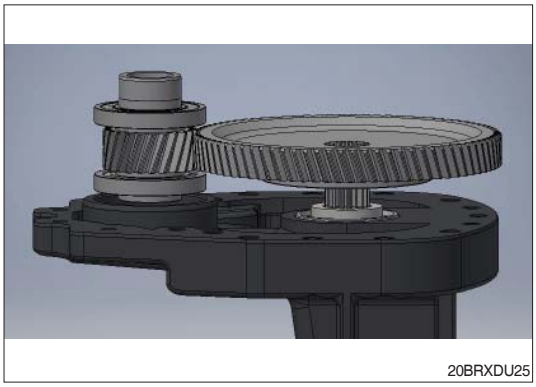


(18) Use the puller for partial diassemblyof the driven gear 80T (6).

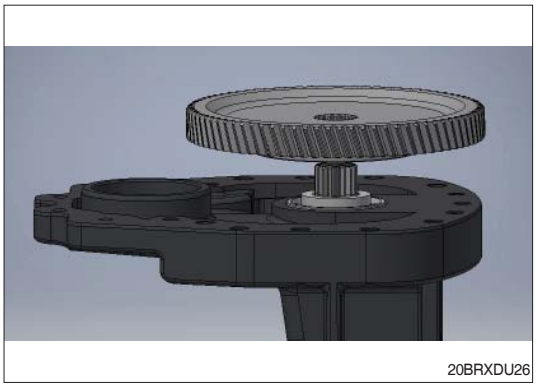
※ **Take caution on being stuck with the input gear (5) during the disassembly.**



(19) Disassemble the input gear 23T (5).

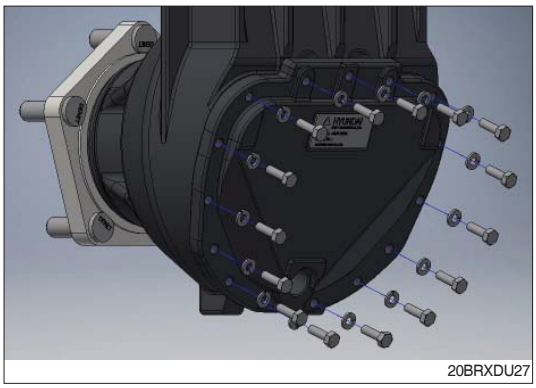


(20) Disassemble the driven gear 80T (6) completely.

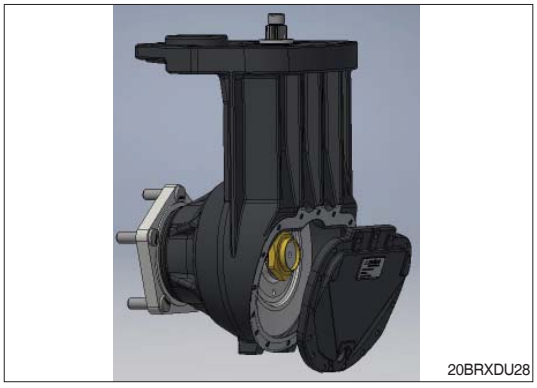


(21) Disassemble 15EA of hexagon bolts (20).

※ **Store the spring washers (21) with the bolts as they must be reused.**

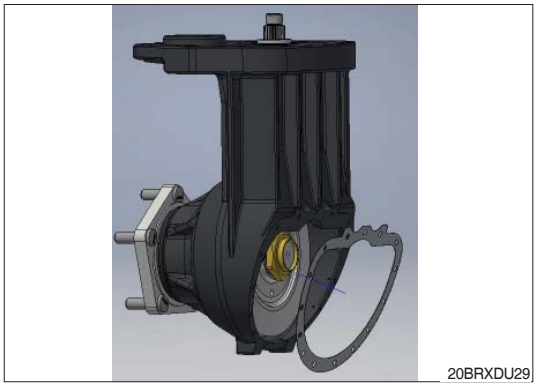

20BRXDU27

(22) Disassemble the gear case cover (3).


20BRXDU28

(23) Remove the gasket (43).

※ **When disassembling the previous gear case cover, use the hera attached to the gasket for primary removal, and apply thinner or alcohol on a cloth to remove any liquid gasket.**

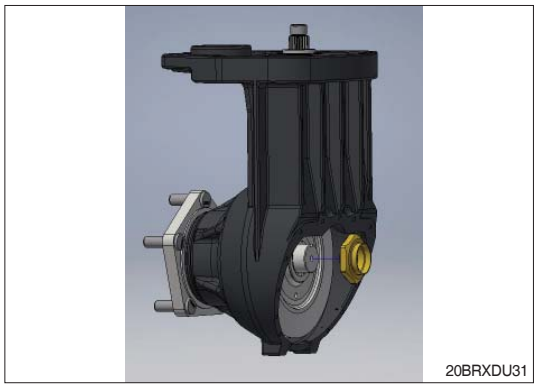

20BRXDU29

※ **Liquid gasket used on assembly**
PERMATEX FORM-A-GASKET #80017

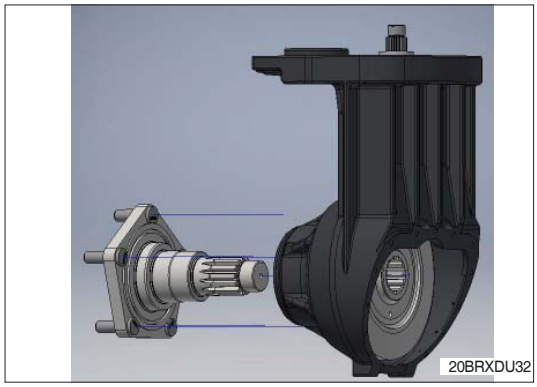
20BRXDU30

(24) Disassemble the lock nut (28).

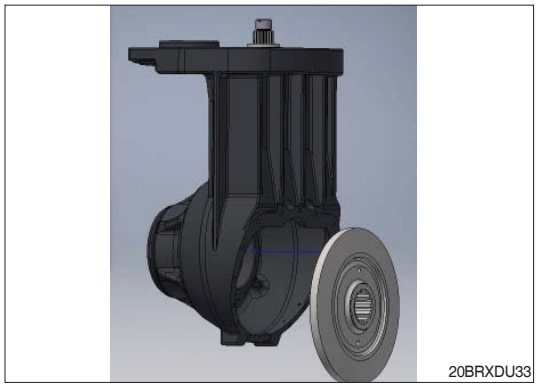
※ **Take caution on not damaging the drive shaft screw thread when disassembling the part performed with caulking. Disassembled lock nut is disposed as it is not possible for reuse.**



(25) Disassemble the drive shaft (4).



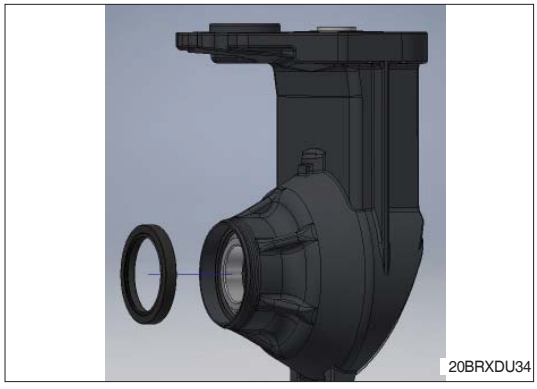
(26) Disassemble the bevel gear 42T (7).



(27) Separate the oil seal (31) with the gear case.

※ **Tilt the taper roller bearing inside and oil seal gap from the inside to the outside with the driver used while disassembling the drive sleeve (9) to perform the disassembly. During the disassembly, dispose the oil seal as it is not possible for use.**

※ **Take caution when removing the oil seal as the inner taper roller bearing is not fixed to result in falling.**

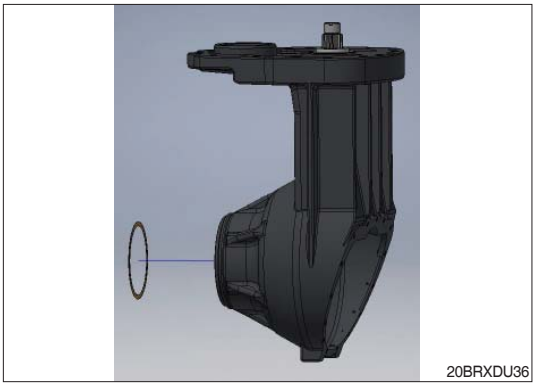


(28) Disassemble the taper roller bearing (37).

※ **Take caution on removing the oil seal as damage can occur from falling.**

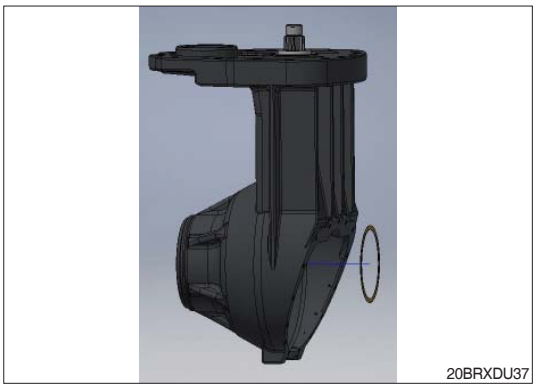
(29) Disassemble the shim kit 3 (42).

※ **As the shim kit can be reused, take caution on deformation for management.**



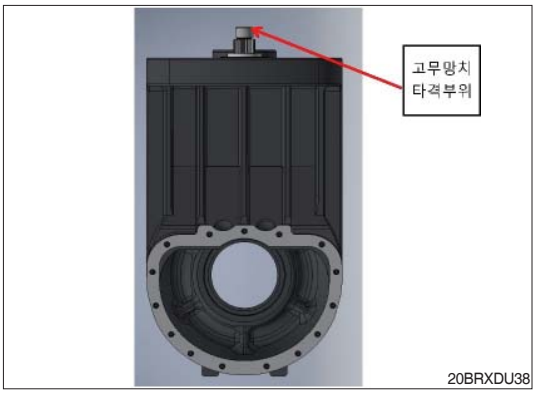
(30) Disassemble the bevel gear 42T (7).

※ **As the shim kit can be reused, take caution on deformation for management.**



(31) Disassemble the bevel pinion 7T (8) by using a rubber hammer.

※ **Hit the pinning site with the rubber hammer to disassemble as shown in the figure on the right side.**
Take caution on bevel pinion dent during the diassembly.



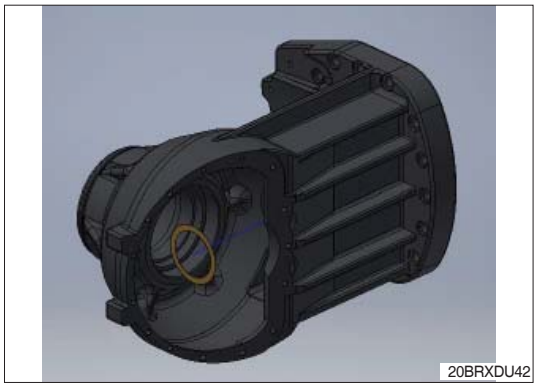
(32) Disassemble the taper roller bearing (36).

(33) Disassemble the taper roller bearing (35).

※ **Push from the inside through the bearing (36) assembly part for disassembly.**

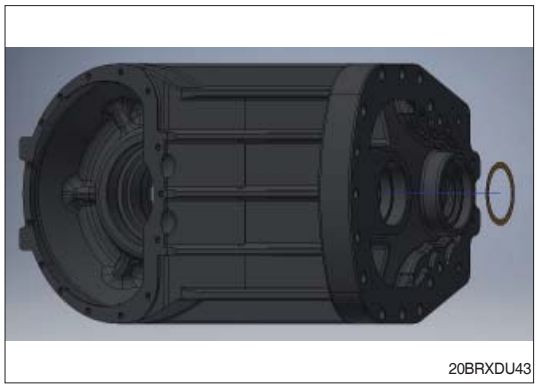
(34) Disassemble the shim kit 2 (41).

※ **As the shim kit can be reused, take caution on deformation for management. However, replace the shim with the equal amount of new parts when deformed due to dent, etc.**



(35) Disassemble the shim kit 1 (40).

※ **As the shim kit can be reused, take caution on deformation for management.**



2. RE-ASSEMBLY

Reference when assembling the drive unit assembly

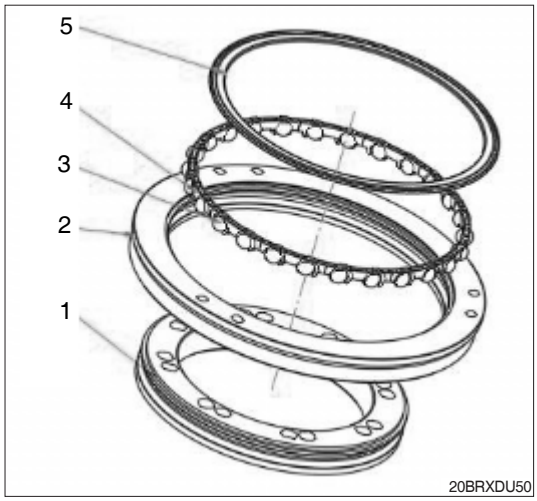
1. Indicate with a marking pen for visual verification to fasten the torque.
2. Take caution on damage of the bolt and assembly take during the fastening to perform the assembly.
   (Follow the torque value specified in the maintenance manual.)
3. Apply small amount of Loctite on the bolt screw thread. (Apply 2~3 EA on the screw thread ned)
4. Apply the Loctite on the bolt and do not leave for over 5 minutes. (Hardening performed before assembly)
5. Great on the rotating bearing assembly is applied after verifying during the periodic inspection of the equipment.
6. For the replacement cycle of the gear oil inside the drive unit, replace the oil after operation for 2000 hours.
   (Replacement possible due to the reasons such as replacing the parts from leakage, etc.)

(1) Position the inner ring (1) and the outer ring (2) on the assembly jig, and assemble the bearing (3) and bearing spacer (4).

※ **Assemble to have 2EA of bearing balls (3) positioned per 1EA of the bearing (4).**

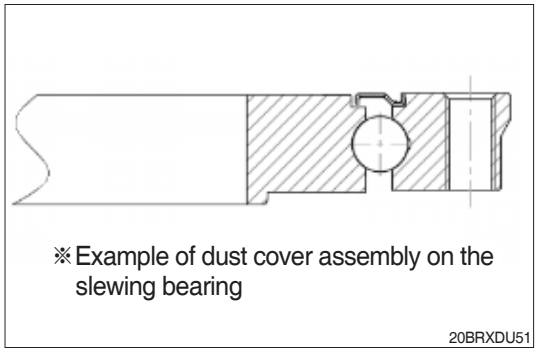
(2) After assembling, apply 50g of grease on the bearing ball (3) and bearing spacer (4) assembly.

※ **The bearing assembly must rotate smoothly.**

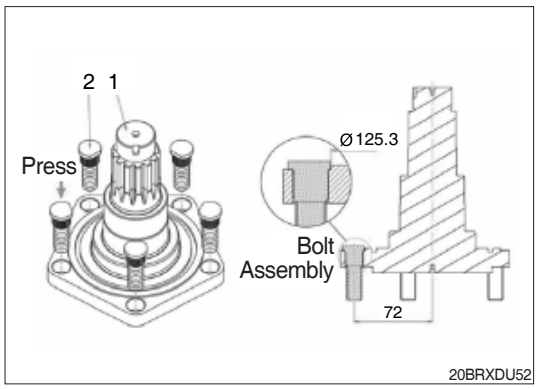


(3) Rotating bearing

Assemble the dust cover as shown in the assemble example.



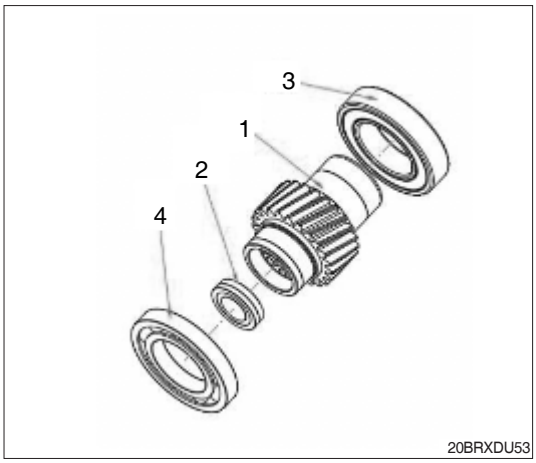
(4) Press in the serration bolt (2) on the drive shaft (1).
Perform bolt press-in by taking caution on the Ø125.3 part.



(5) Press-in the bearing (3) on the input sleeve (1).
(6) Press-in the bearing (4) on the input sleeve (1).
(7) Assemble the seal cap (2) on the input sleeve (1).

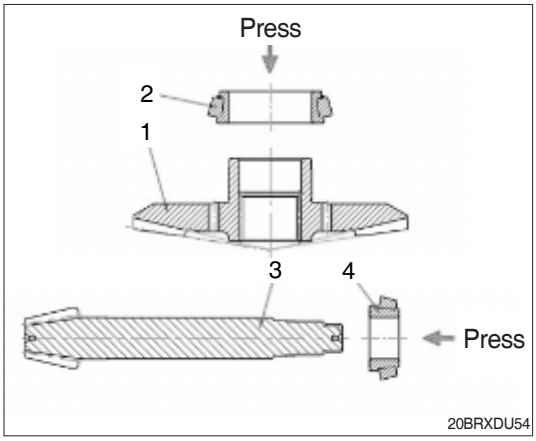
※ **Take caution on not protruding more than the end of the seal cap input sleeve.**

※ **Check for any issues during the rotation of the bearing after the assembly.**



(8) Press-in the roller bearing to the bevel gear (1).
(9) Press-in the taper roller bearing to the bevel pinion (3).

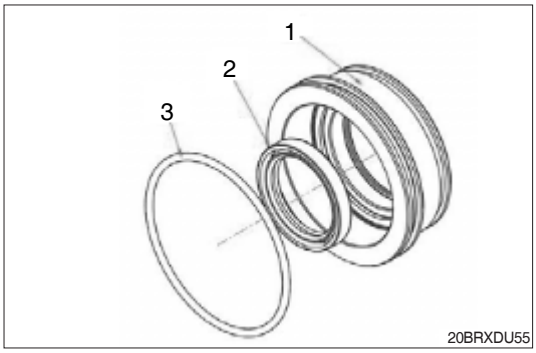
※ **Check for any issues during the rotation after the bearing assembly.**



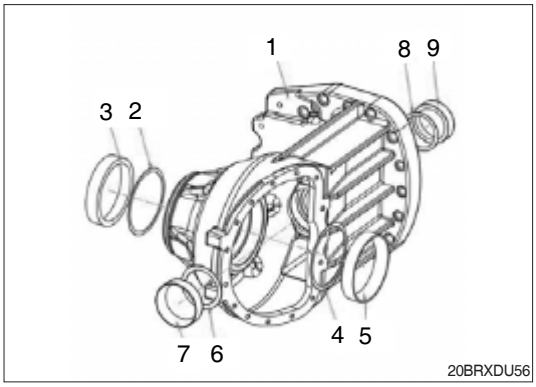
(10) Press in the oil seal (2) on the drive sleeve (1).

※ **Take caution on damage when assembling the oil seal.**

(11) Insert the O-ring (3) on the drive sleeve (1) for assembly.

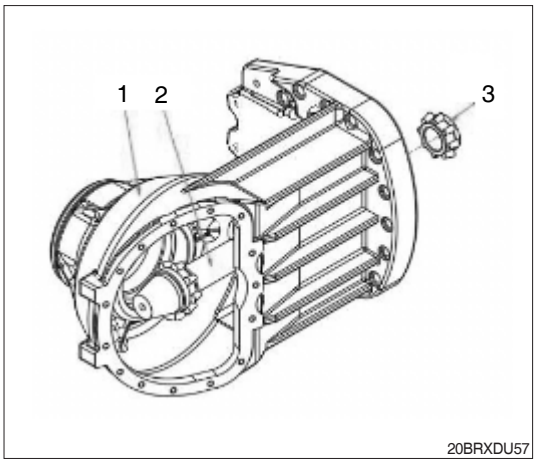


(12) Insert the shim (4) on the gear case (1) to assemble the cup (3, 5).
(13) (12) Insert the shim (6, 8) as shown in the above section to assemble the cup (7, 9).



(14) Assemble the bevel pinion (2) and taper roller bearing (3) on the gear case (1).

※ **Check for any issues during the rotation after the assembly.**



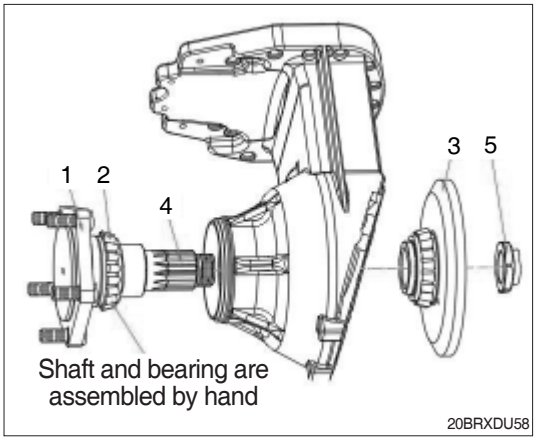
(15) Assemble the taper roller bearing on the drive shaft (1) along with the assembly of the bevel gear (3).

(16) Use the torque wrench on the box socket (56 mm) to fasten in 160~170 Nm for the locking nut (5).

(17) Measure the backlash after the assembly to assemble in the range of 0.17~0.25.

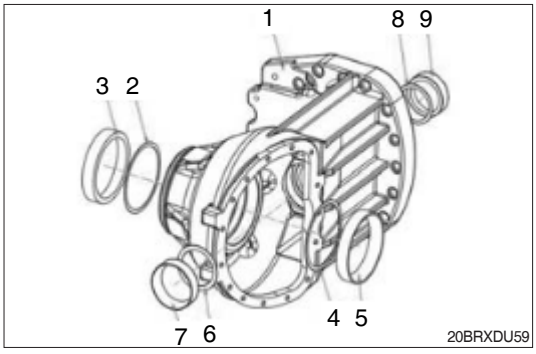
※ **Adjust the shim when outside the backlash measurement range to perform re-assembly.**

(18) Complete the assembly when there are no issues for caulking of the locking nut.



Details of backlash adjustment method

- When the backlash (Specification : 0.17~0.25) is not satisfied on the bevel gear set, adjust the shim (6) and shim (4) to assemble the backlash according to the specification.
- Perform re-assembly by replacing the set when the bevel gear, pinion dent, backlash and contact are not adjusted.



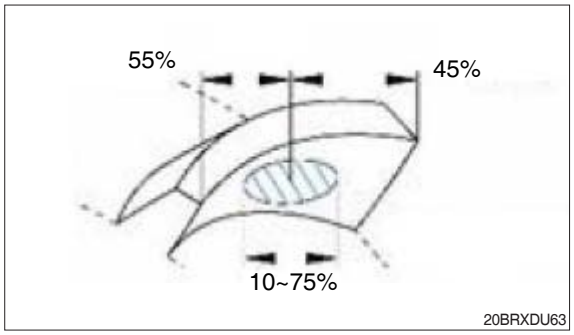
- Refer to caulking (Caulking on 2 sites.) - Refer to backlash measurement

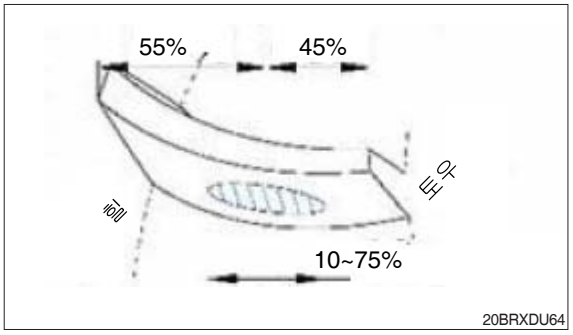

20BRXDU60


20BRXDU61


20BRXDU62

Details of contact adjustment method

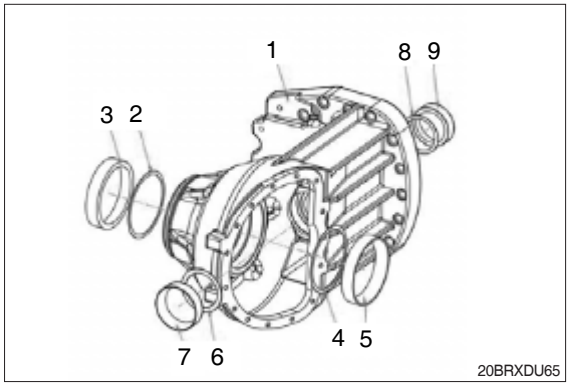




Refer to the contact pattern

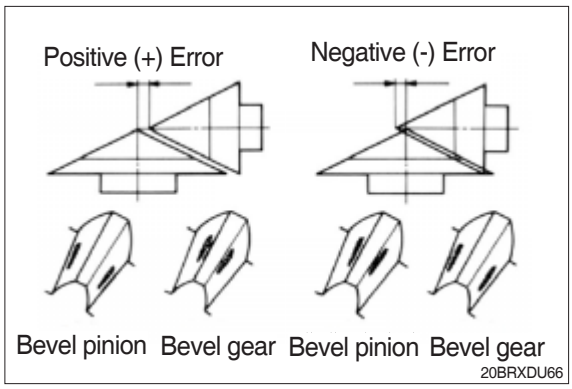
- When the contact is different from the reference image, adjust the shim (6) and shim (4) additionally to readjust the contact.
- Adjust the shim (6) and shim (4) when adjusting the contact, and remove shim (8) when shim (6) is added. When shim (6) is removed, add shim (8).

※ **Also, adjust shim (2) as shown in the above method to complete the assembly.**



- Backlash and contact adjustment are performed in the same method, and remove the shim for positive (+) error as shown in the above figure. For negative (-) error, add the shim for adjustment.

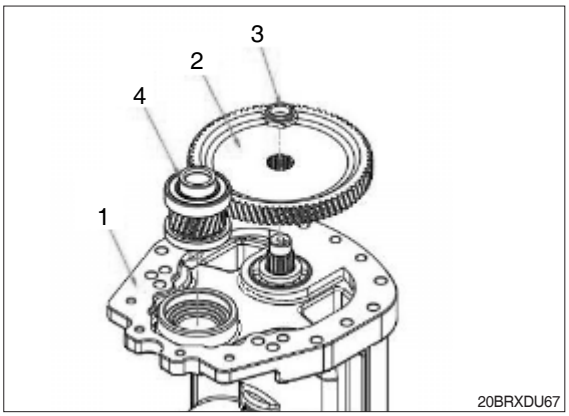
※ **The backlash is increased for positive (+) error, and backlash is decreasedon negative (-) error.**

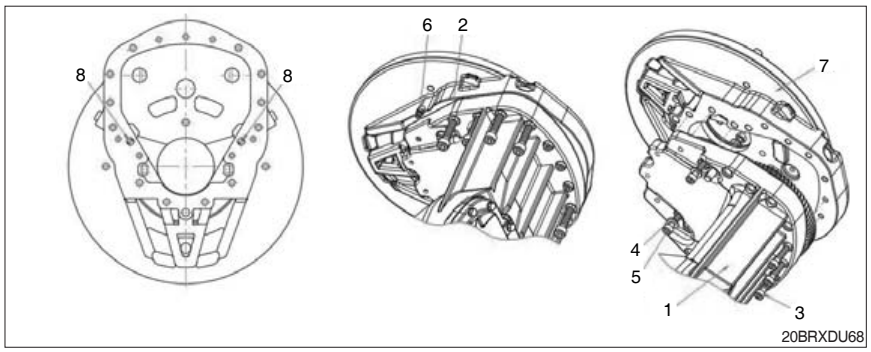


(19) Set the driven gear (2) on the bevel gear spline to interlock the input gear assembly (5) with the driven gear to assemble at the same time.

(20) Use the box socket (30 mm) to fasten the locking unit (3) in 60~70 Nm.

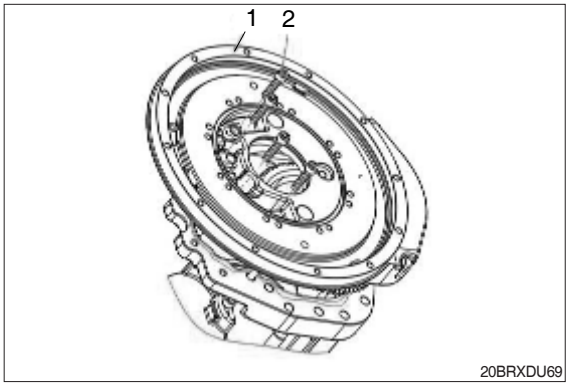
(21) Measure the friction moment in push poll gauge in the distance of 100 mm from the center of the input gear (8~25 kg/cm).



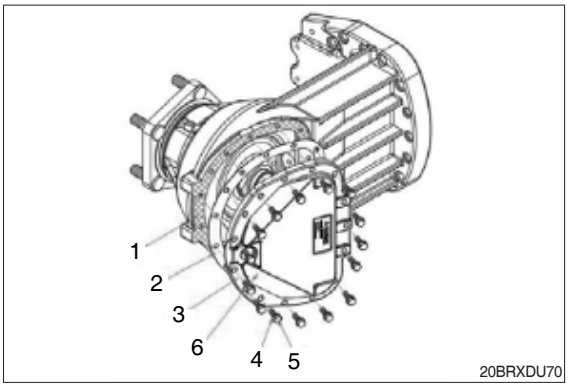


(22) Assemble 2EA of dowel pin on the 8 sites of the steering housing (7) (Apply Loctite #648).
(23) Assemble 2EA of the grease nipple (6) on the steering housing (7) (Fastening torque : 5 Nm).
(24) Assemble the steering housing (7) on the gear case (1) (Apply Loctite #5910 on the assemble surface).
※ **Take caution on driven gear dent when assembling the steering housing (7).**
(25) Interlock the spring washer (4) with 2EA of the wrench bolt (5, M8x60) for fastening.
(26) Assemble 3EA of the wrench bolt (3, M8x35) (Fastening torque : 22 Nm).
(27) Assemble 8EA of the wrench bolt (2, M10x45) (Fastening torque : 44 Nm).

(28) Assemble 4EA of the wrench bolt (M8×35) on the gear case (1) (Fastening torque : 22 Nm).

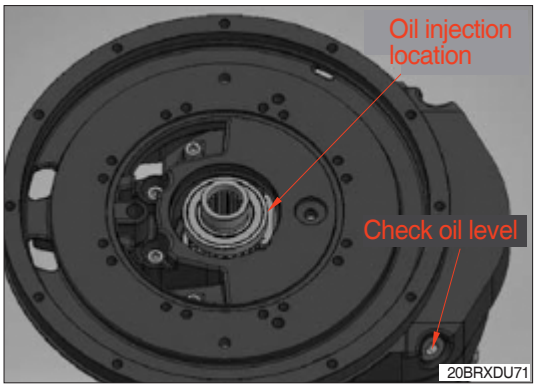


(29) Apply PERMATEX FORM-A-GASKET #80017 liquid gasket to the gear case (1) and case cover assembly surface, and fix the gasket (2) according to the bolt position for assembling the spring washer (4) and hexagon bolt (5, M6×20) (Fastening torque: 10 Nm).

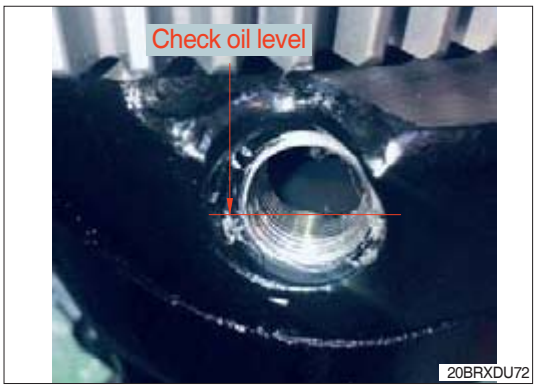


(30) Inject oil by using the injection location marking.
(31) Use 2000 ml beaker to inject the oil.
(32) Inject 2000 ml of oil additionally, and check the level to inject total of 4000 ml.

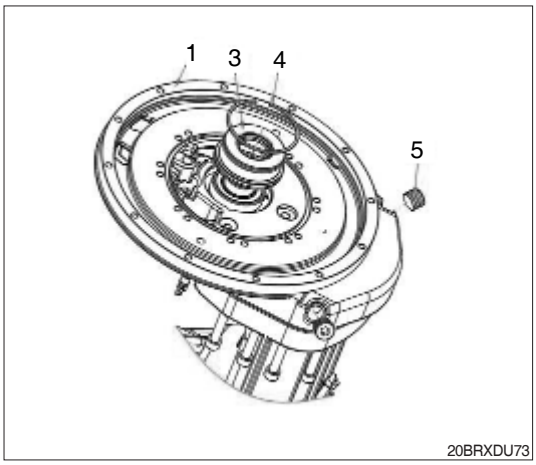
- Oil Specification
  SHELL SPIRAX S2 G 80W-90



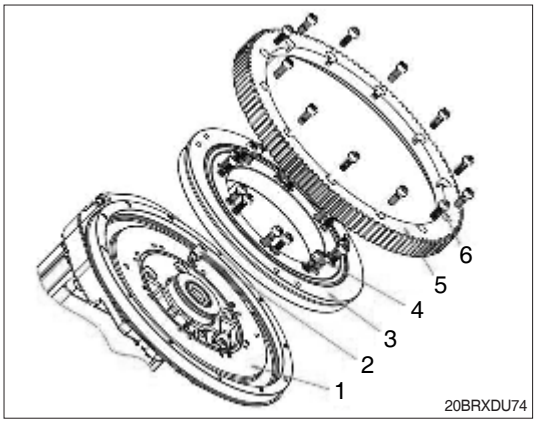
- Check oil level
  Take caution on not having the oil flowing inside the input gear (5) while filling the oil.



(33) Assemble the socket and H plug (5) on the steering housing (1).
※ **After assembling 1EA fasten the additional 1EA after checking the oil level (Fastening torque: 35 Nm).**
(34) Assemble the drive sleeve (3) on the steering housing (1). The bearing of the input gear is assembled inside the drive sleeve, so use the rubber hammer to assemble up to the snap ring (4) groove position.
(35) Assemble the snap ring (4).



(36) Assemble the air breather (2) in 10 Nm.
(37) Position the rotating bearing assembly (3) according to the tap hole of the steering housing (1) to assemble 12EA of the wrench bolt (4, M8x30) (Fastening torque : 22 Nm).



(38) Position the sleeve and outer ring (1) on the rotating bearing assembly screw hole and assemble 3EA of the hexagon bolts (2, M12×20) (Fastening torque: 20~30 Nm).