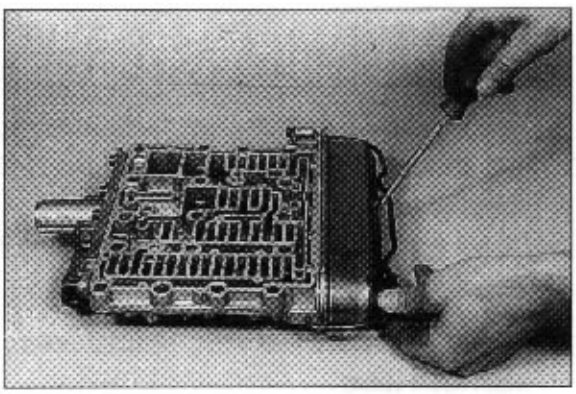
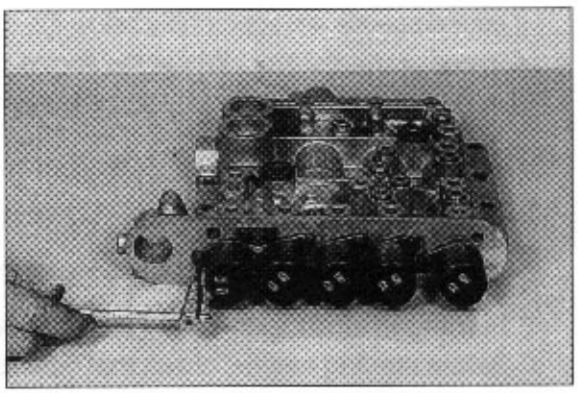
1. CONTROL VALVE

1) DISASSEMBLY

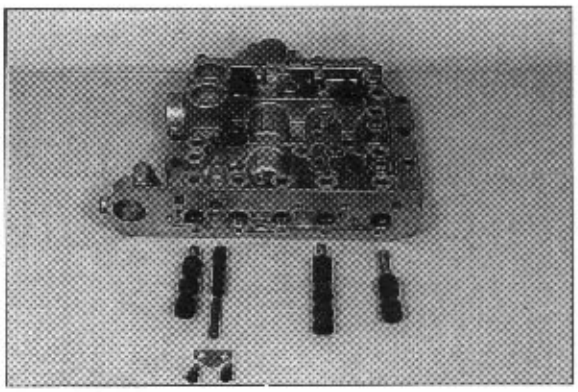
(1) Relax spring clip and remove cover.



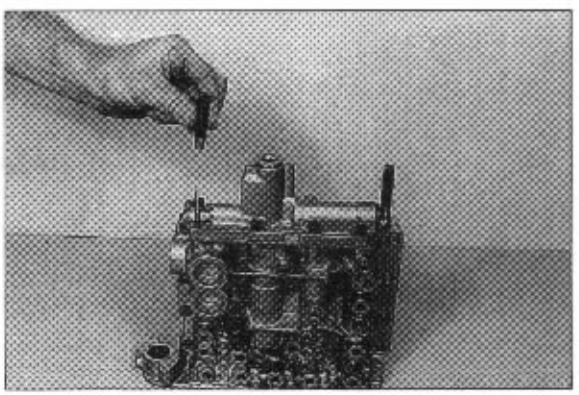
(2) Pull off cable shoes, loosen the socket head screws and demount solenoid valves.



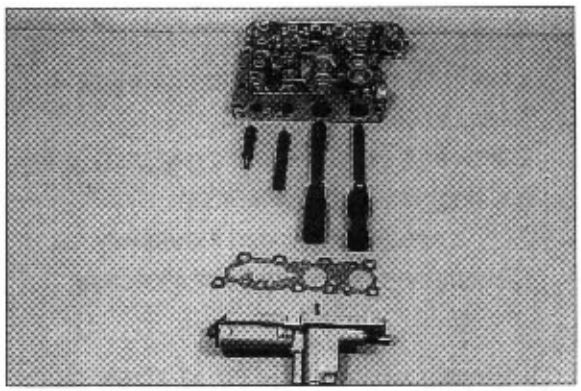
(3) Remove components, see figure on the right.



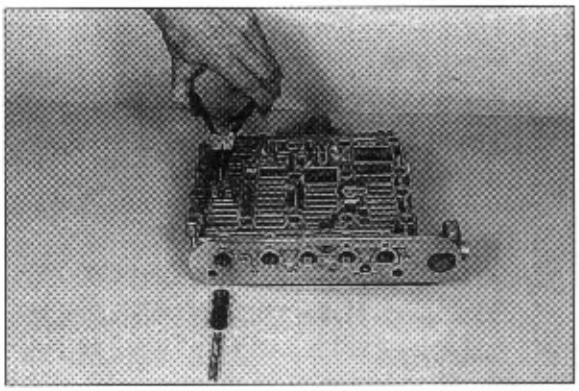
(4) Loosen two socket head screws and fix shift-control housing provisionally, using a adjusting screws(M6) with nut.
Now, loosen the remaining socket head screws and separate shift-control housing (Is springloaded) from the valve body by uniform loosening of the nuts.



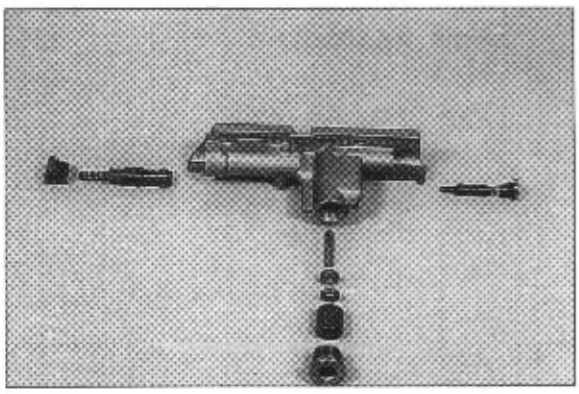
(5) Remove components.



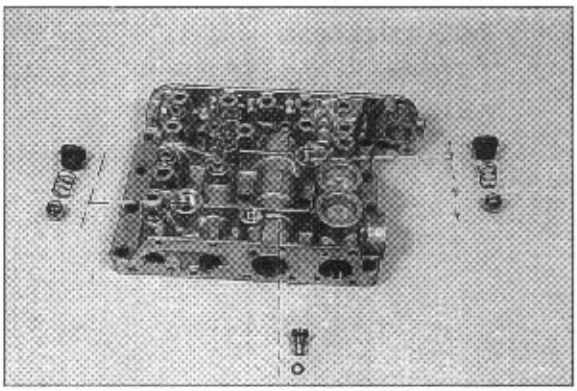
(6) Remove stop plate and demount spool as well as spring.



(7) Disassemble pressure control valve, see figure on the right.



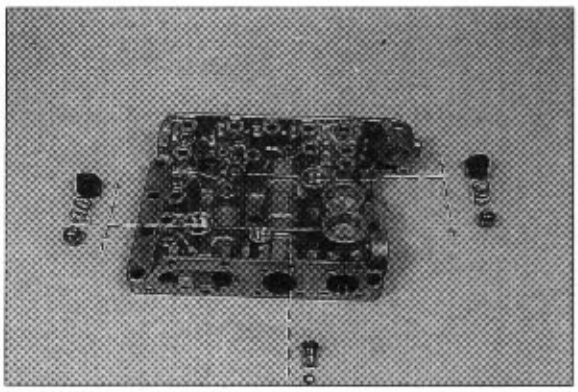
(8) Remove diaphragm and check valves.



2) ASSEMBLY

※ Check all components for damage and renew if necessary.
Check free travel of the moving parts in the housing prior to the installation.
Spools can be exchanged individually.
Oil components prior to the reassembly.

(1) Employ new O-rings for all screw plugs and install them.
Install check valves and diaphragm .

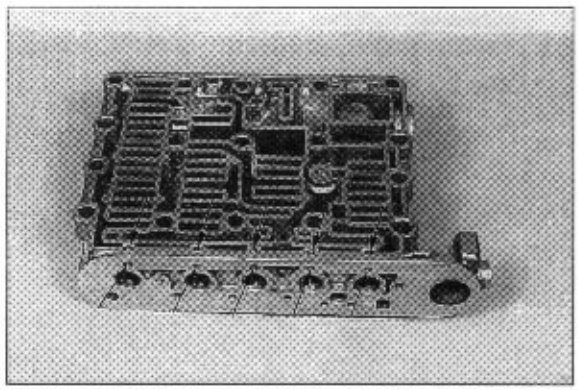


※ Mount new O-rings.
Fasten O-ring 6 × 1.5mm(Arrow) with grease on the end face of the diaphragm - makes the reassembly easier.

Torque limit :

Screw plugs M10 × 1	2.0kg · m(14.8lb · ft)
Screw plugs M18 × 1.5	3.6kg · m(25.8lb · ft)
Diaphragm	2.0kg · m(14.8lb · ft)

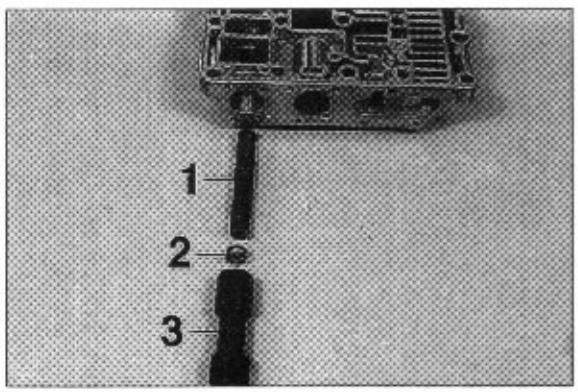
(2) Close the bores by means of balls(10 pieces, ø 4.50mm).



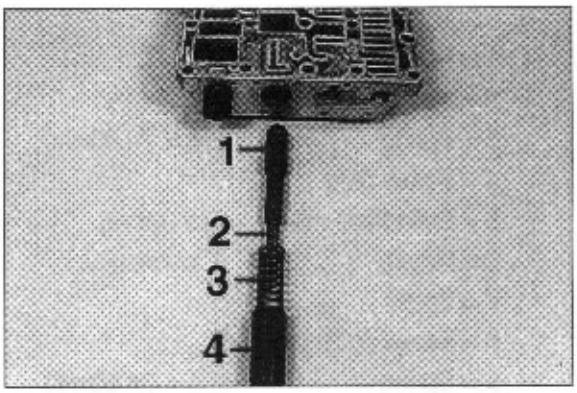
(3) Control pressure valve

① Install components

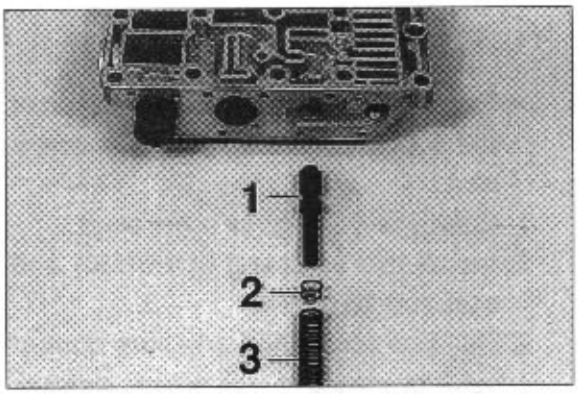
1 = Spring (Lo = 96.20mm)
2 = Disk(s) (Optional)
3 = Spool



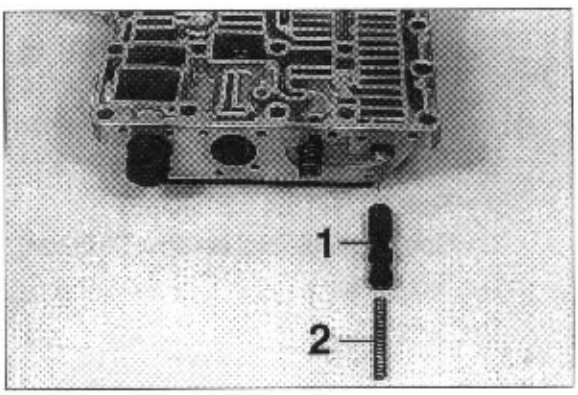
② Install components
1 = Control spool
2 = Spring (Lo= 124.10mm)
3 = Spring (Lo= 77.10mm)
4 = Displacement spool



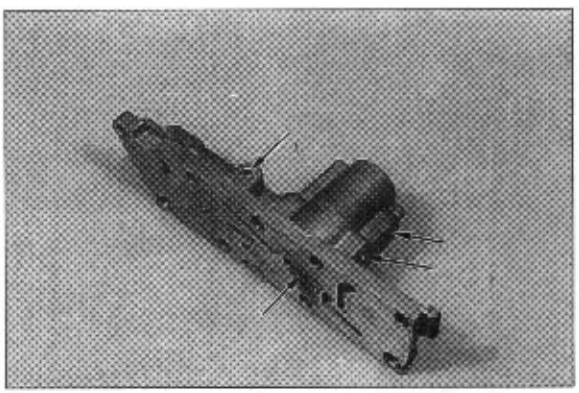
③ Install components
1 = Reversing spool
2 = Disk(s) (Optional)
3 = Spring (Lo = 56.30mm)



④ Install components
1 = Control spool(Total length = 55.50mm)
2 = Spring (Lo = 51.30mm)
※ Pay attention to the installation position of the spool, see figure on the right.

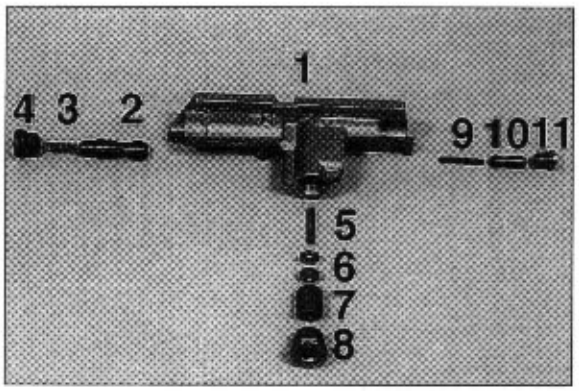


(4) Pre-assemble and attach 2-stage pressure control valve
① Close the bores by means of balls(4 pieces, ø 4.50mm).



② Install components

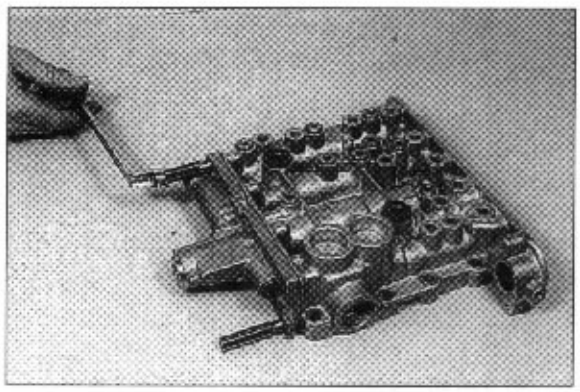
1 = Shift-control housing
2 = Spool
3 = Spring (Lo = 70.90mm)
4 = Screw plug
5 = Cylindrical roller (6 × 32mm)
6 = Ring(s) (Optional)
7 = Spool
8 = Screw plug
9 = Spring (Lo = 34.90mm)
10 = Spool
11 = Screw plug



※ Pay attention to the installation position of the spool(7), bore is facing the screw plug.
Employ new O-rings for screw plugs.

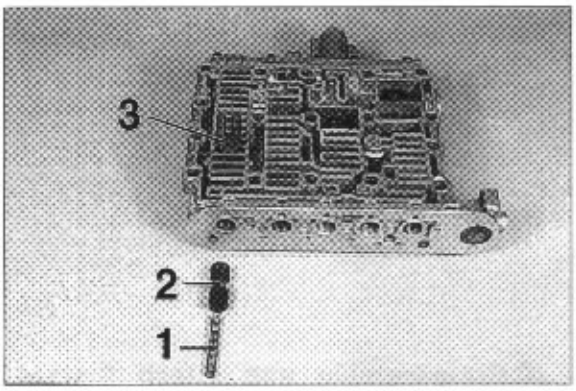
③ Install two adjusting screw(M6) and assemble flat gasket.

④ Pull pre-assembled pressure control valve by means of nuts against shoulder and fasten it subsequently by means of socket head screws(Mount flat washers).
· Torque limit(M6/8.8) 0.9kg · m(7.0lb · ft)



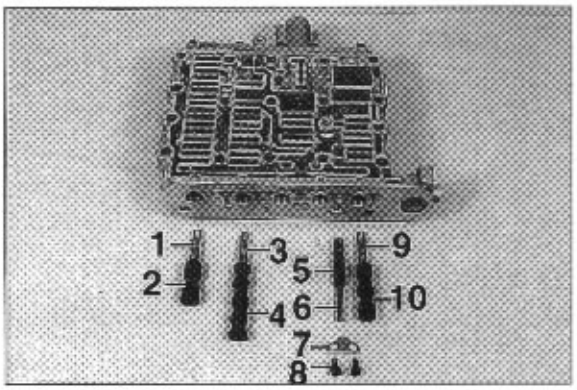
(5) Introduce spool(2) and spring(1), preload and fix them by means of stop plate(3).

1 = Spring (Lo = 51.30mm)
2 = Control spool(Total length = 39.50mm)
3 = Stop plate



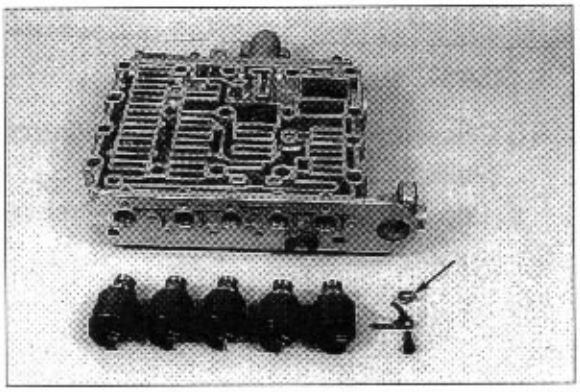
(6) Install components

1 = Spring (Lo = 51.30mm)
2 = Control spool (Total length = 39.50mm)
3 = Spring (Lo = 51.30mm)
4 = Control spool
5 = Spool (Reducing valve)
6 = Spring (Lo = 37.10mm)
7 = Retaining plate
8 = Socket head screws (2 Pieces)
9 = Spring (Lo = 51.30mm)
10 = Pilot spool (Total length = 52.50mm)



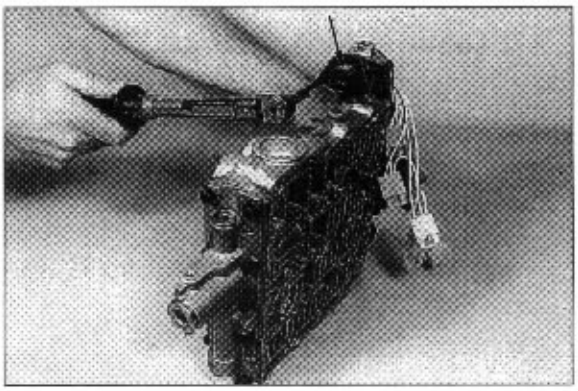
(7) Insert the solenoid valves and fix them by means of disks, retaining plates and socket head screws.
· Torque limit(M5/8.8) 0.6kg · m(4.3lb · ft)

※ Pay attention to the installation position of the disk(Mount between valve body and retaining plate), see arrow.
Pay attention to the radial installation position of the solenoid valves, see figure (9).

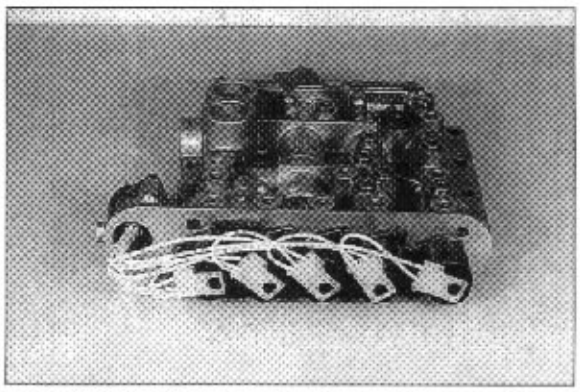


(8) Install cable harness.

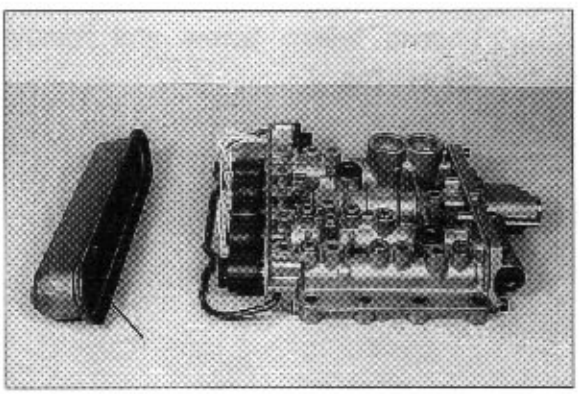
※ Mount new gaskets.
Pay attention to the location of the plug nose, see arrow.



(9) Connect the solenoid valves according to the illustration on the right.



(10) Mount new O-ring, see arrow, and fix the cover by means of clamping collar.

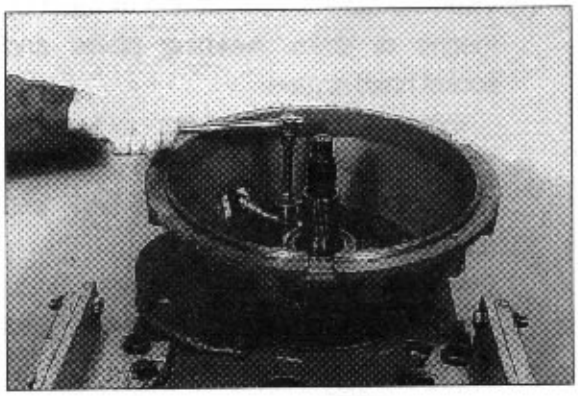


2. GEAR BOX

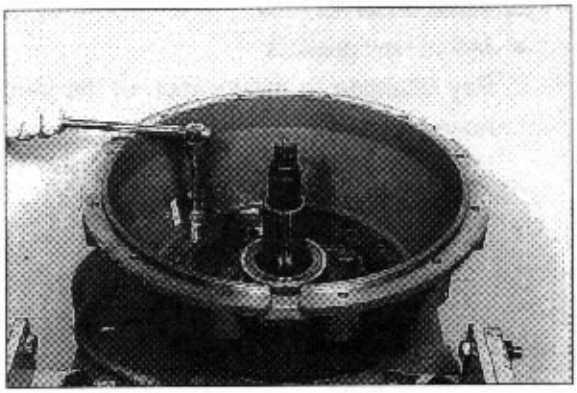
1) DISASSEMBLY

(1) Converter charge pump and control pressure pump

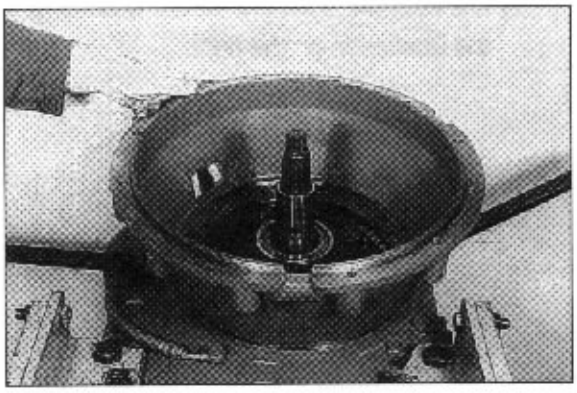
① Loosen hollow screw and remove delivery line.



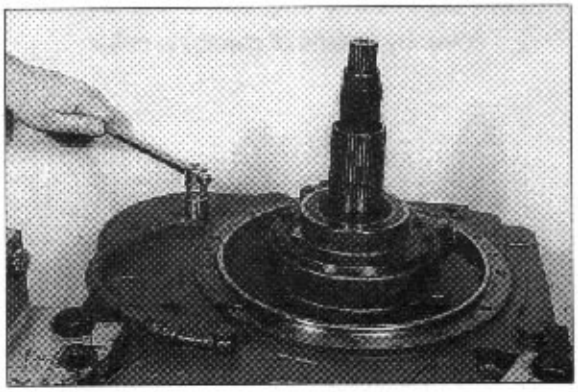
② Loosen screwed connection.



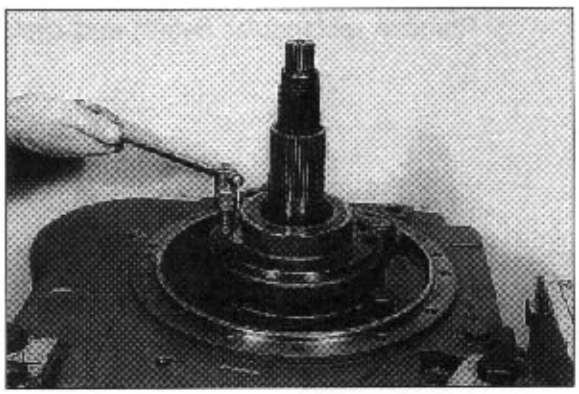
③ Separate engine connecting case from gear case by means of pry bars.



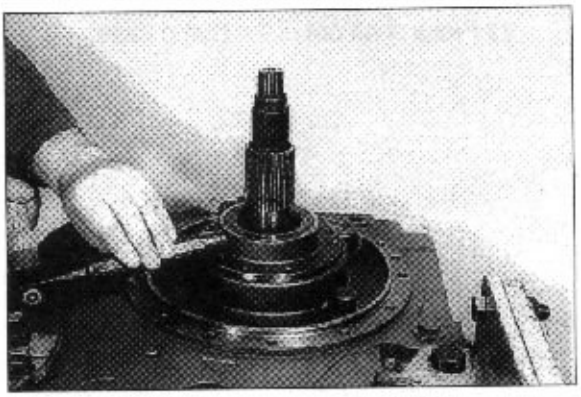
④ Loosen hollow screw and remove delivery line.



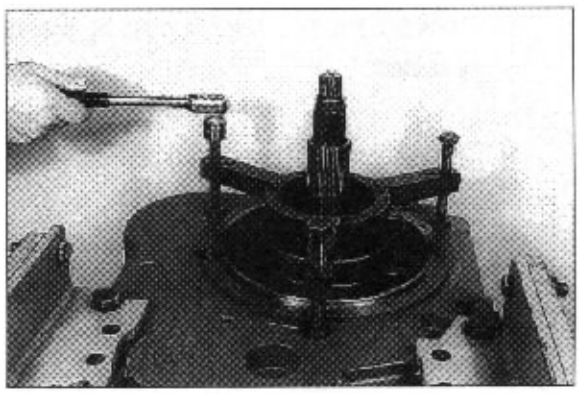
⑤ Loosen hexagon head screws.



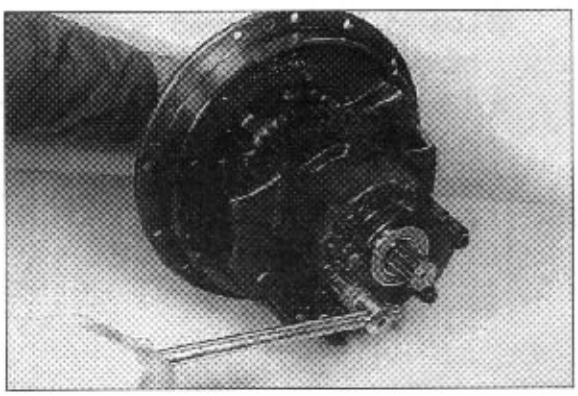
⑥ Tap loose and remove bearing cap.



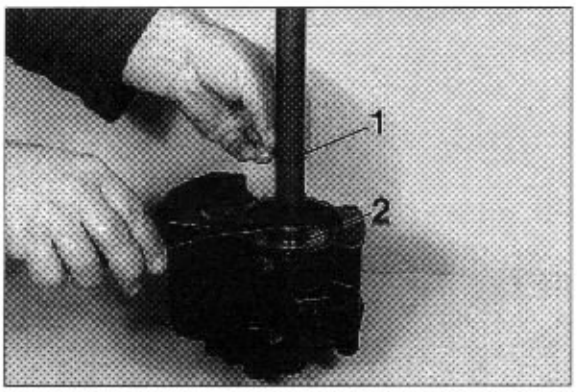
⑦ Fasten puller device at the oil supply flange by means of hexagon head screws.
Pull converter charge pump and control pressure pump(Complete) out of the housing bore.



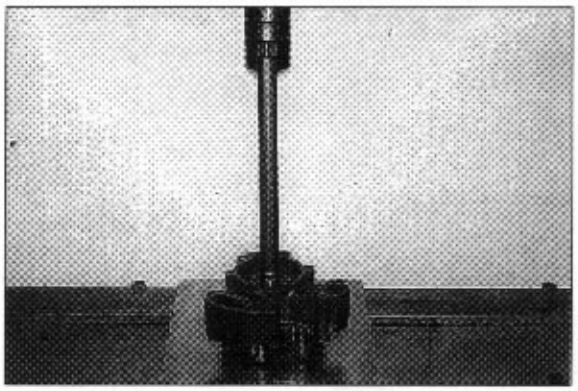
⑧ Loosen hexagon head screws and separate pump from oil supply flange.



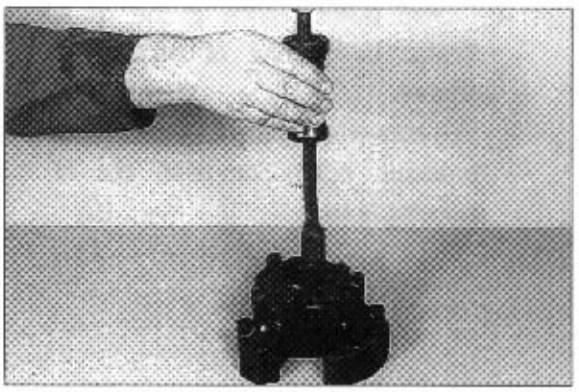
⑨ Remove rectangular ring(1) and circlip (2).



⑩ Press shaft out of the pump case.

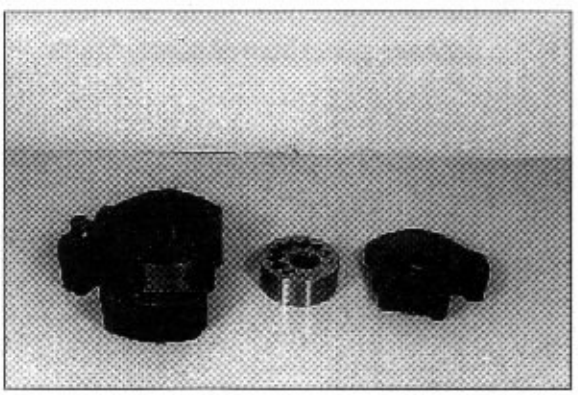


⑪ Remove the two straight pins by means of striker.

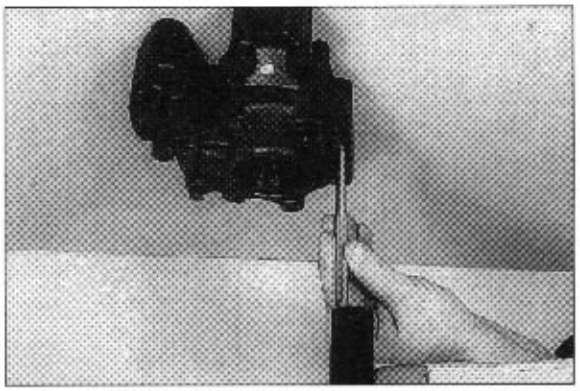


⑫ Loosen hexagon head screws and remove cover.

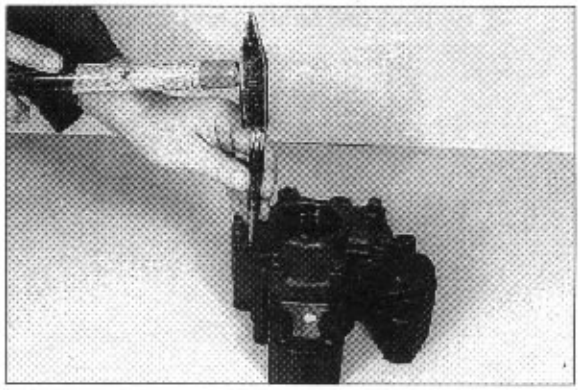
※ If traces of wear should be encountered in the pump case or on the housing cover, the complete pump has to be renewed.



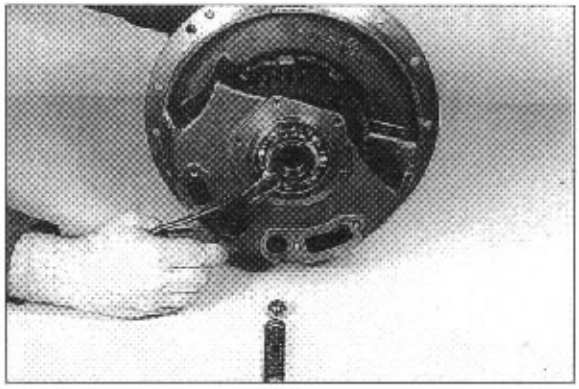
⑬ Install rotor set, fix cover provisionally by means of hexagon head screws and insert the straight pins(With the tapped hole showing upwards) until contact is obtained.



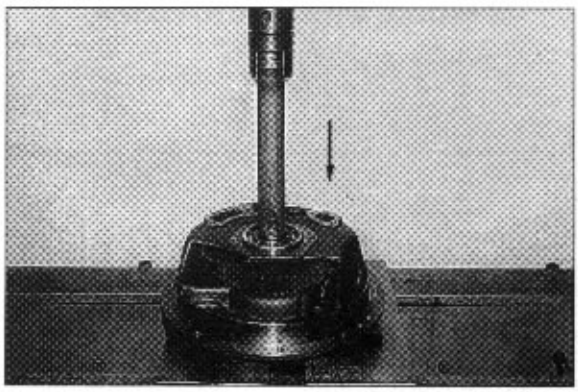
⑭ Fix the straight pins axially by means of caulkings and tighten hexagon head screws finally.



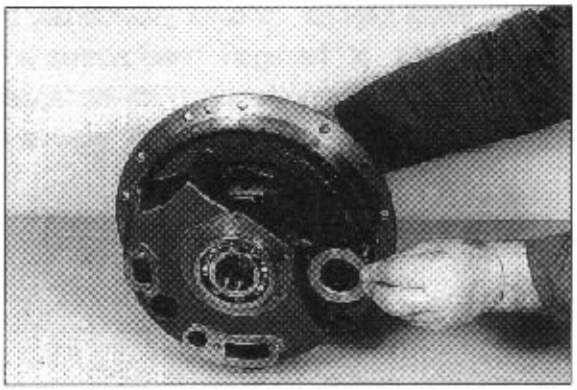
⑮ Remove converter relief valve(Ball and spring).
Squeeze out circlip.



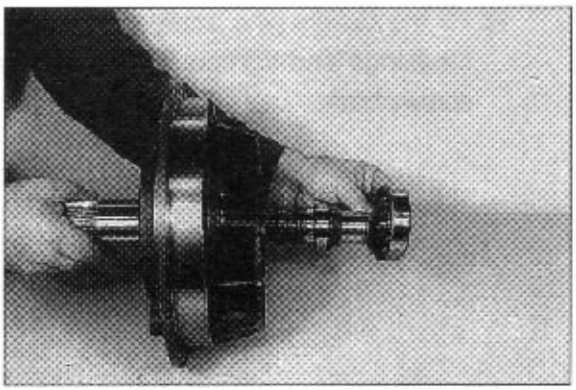
⑯ Press drive shaft in direction of arrow until the spur gear is released.



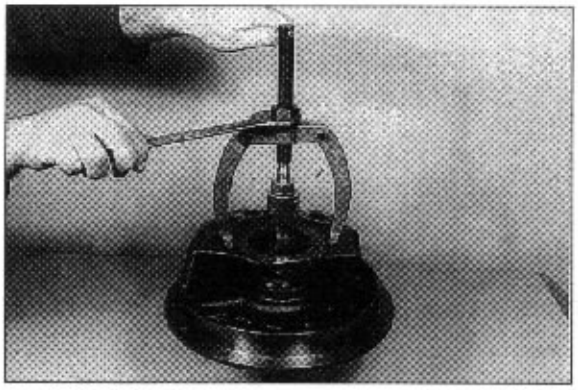
⑰ Remove disk and spur gear.



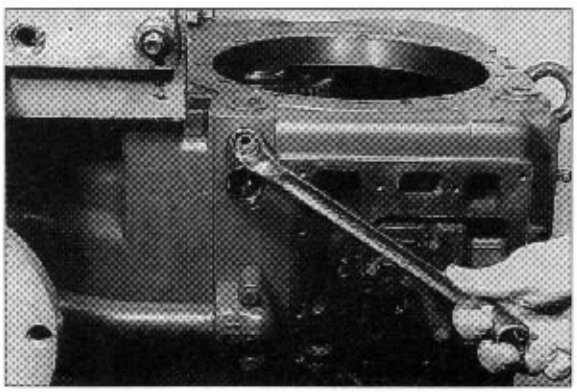
⑱ Remove ball bearing and drive shaft.



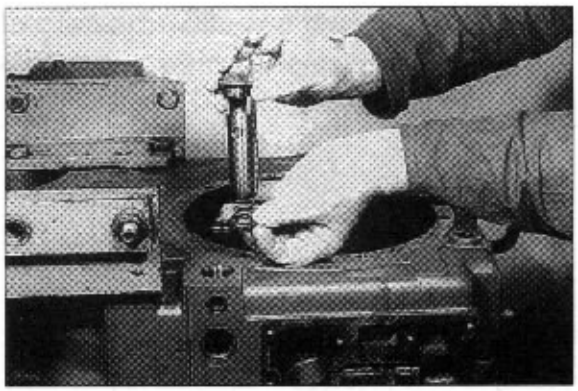
⑲ Pull roller bearing out of the bore.



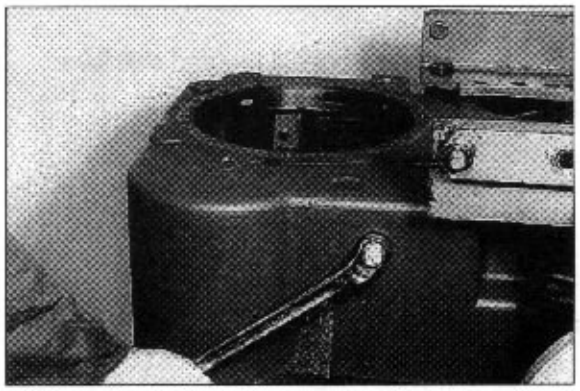
⑳ Remove temperature connection.



㉑ Loosen screw plug and remove converter control valve, composed of disk, compression spring, spool and valve sleeve.

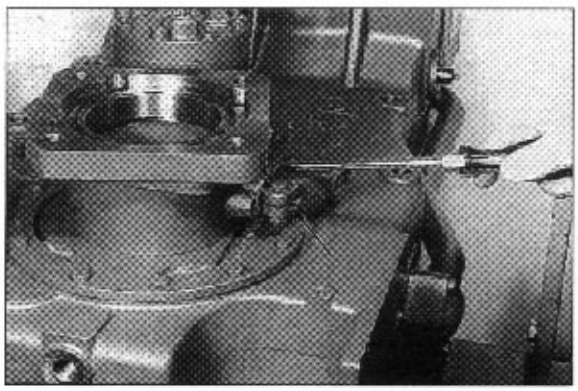


㉒ Remove drive side inductive transmitter.

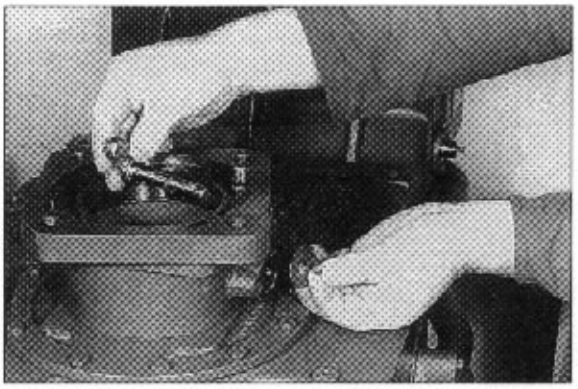


(2) Coaxial power take-off(Mechanical control)

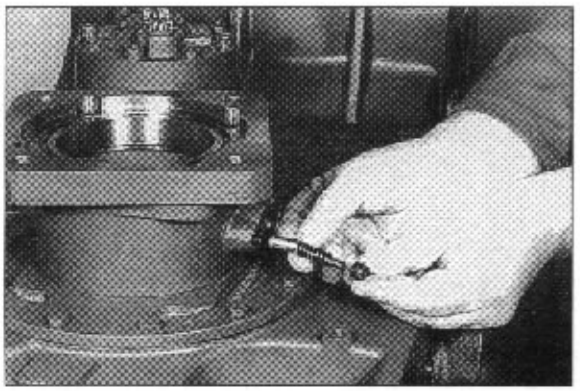
① Loosen clamping screw and remove lever(Arrow).



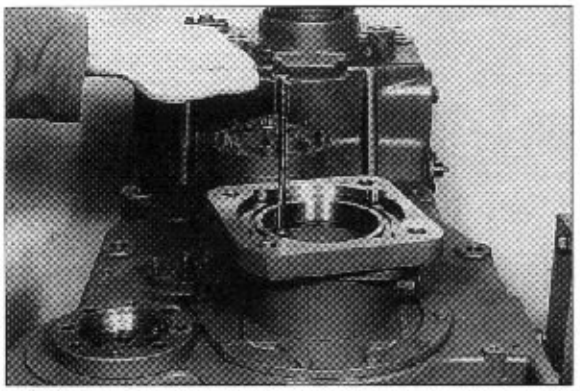
② Remove woodruff key and shift lever.



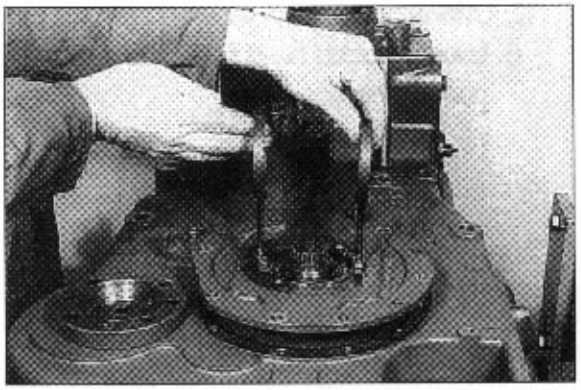
③ Remove locking device.



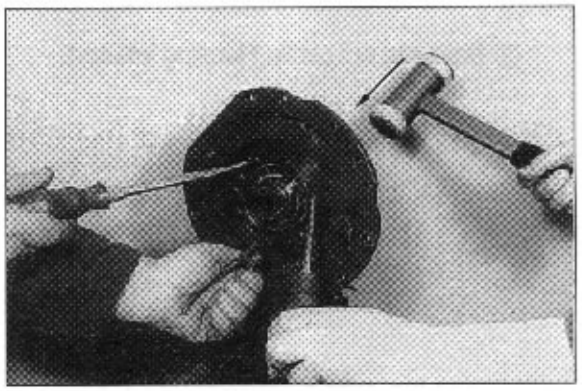
④ Loosen socket head screws and remove housing.



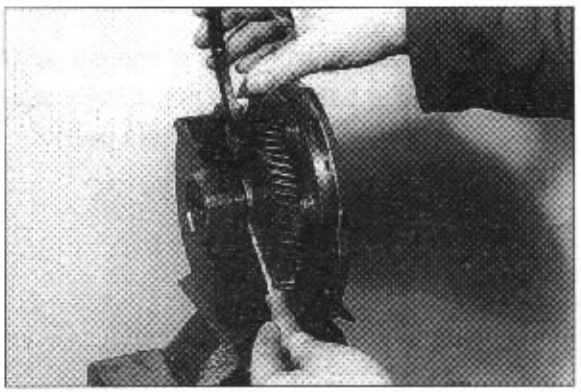
⑤ Loosen hexagon head screws and lift complete power take-off housing out of the bore.



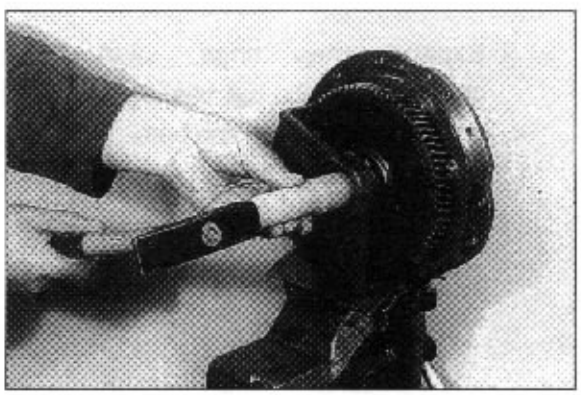
⑥ Fasten power take-off in a vise.
Expand the two snap rings, align them centrically and drive the drive dog provisionally about 5~10mm ahead (Direction of arrow).
For this step, an assistant is absolutely necessary.



⑦ Squeeze out snap ring.

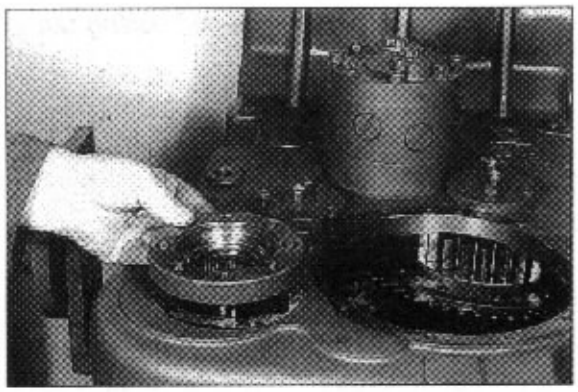


⑧ Tap the drive dog loose and drive it out of the spur gear, respectively housing bore.
Pay attention to the released components.

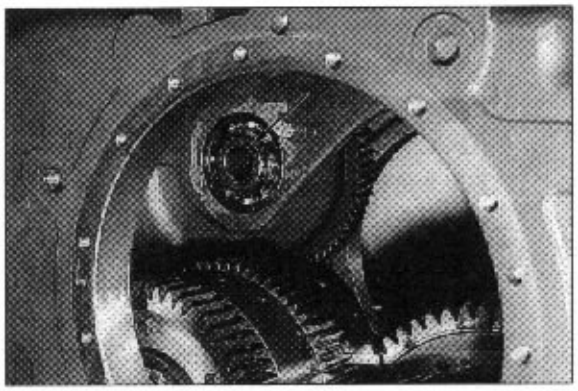


(3) Lateral power take-off

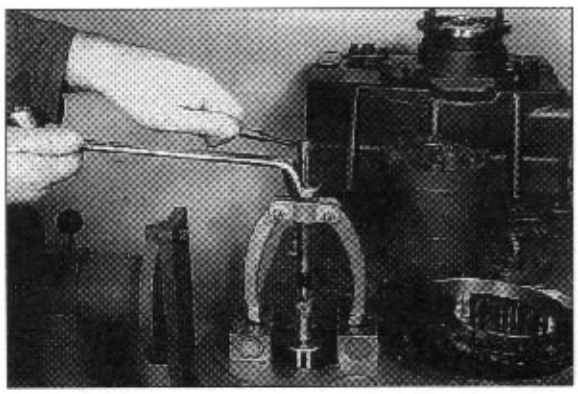
① Loosen socket head screws and remove pump flange.



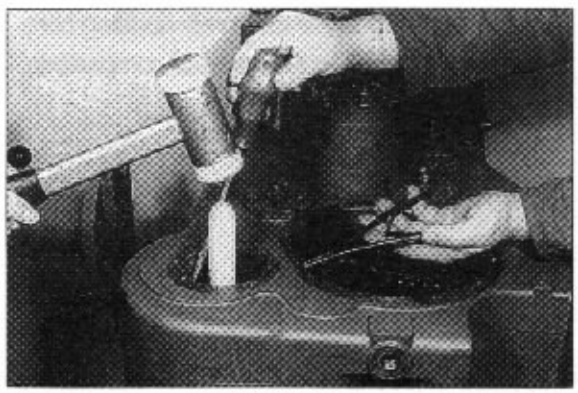
② Squeeze out circlip(Housing interior).



③ Pull drive dog by means of internal puller out of the ball bearing, respectively spur gear and remove released spur gear.

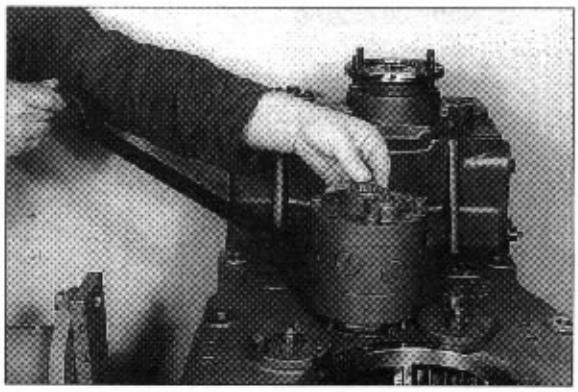


④ Expand snap rings, align them centrically, tap the ball bearing loose and drive it out of the housing bore.
Assistant necessary.



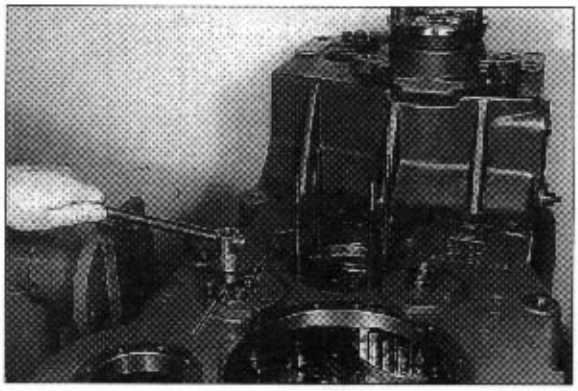
(4) Remove emergency steering pump

① Loosen hexagon nuts andn separate emergency steering pump from gear case.

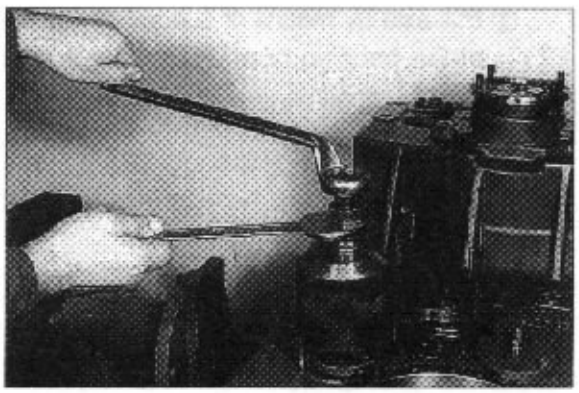


(5) Remove multi-disk clutches

※ In case of versions with spur gear fixing K1, the two set screw(Arrows) have to be removed prior to the disassembly of the axle, see figure on the right.

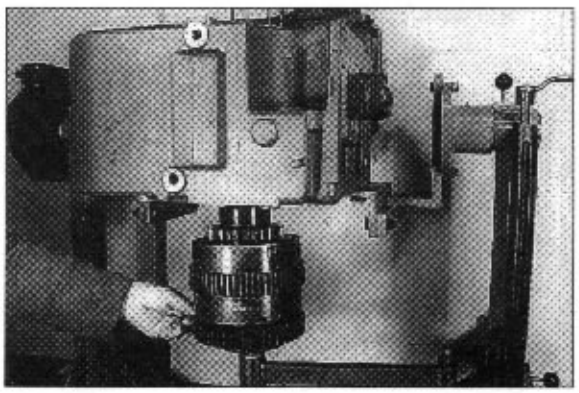


① Loosen hexagon nuts and pull axle by means of special device out of the clutch, respectively gear case.



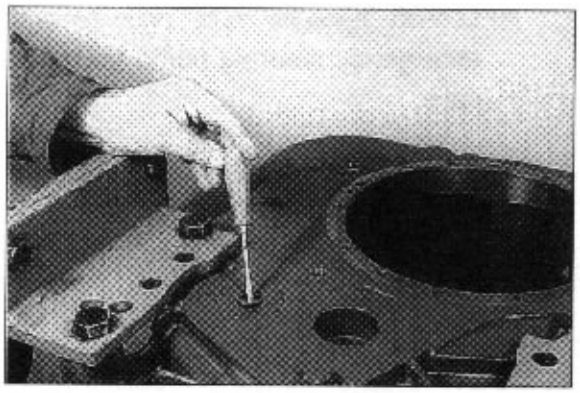
② Lift clutch out of the gear case and deposit it.

※ Use lifting device.
Remove clutch KR, K2 accordingly.
In the case of clutch K4/K3, push the lower spacing washer to the rear. Only then, the clutch can be removed.

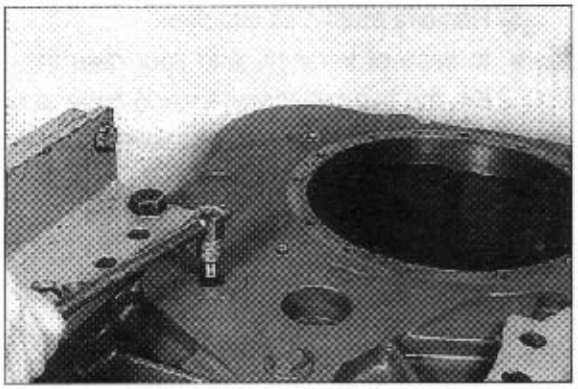


(6) Remove countershaft assembly

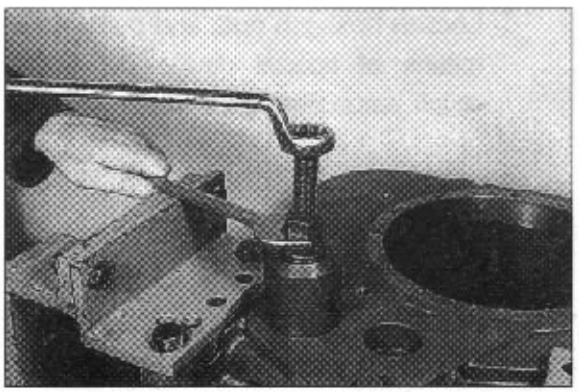
① Remove closing cover.



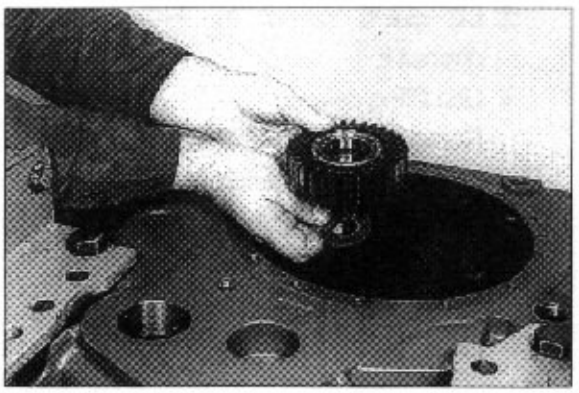
② Loosen socket head screw.



③ Pull axle by means of special device out of the housing bore, respectively spur gear bearing.



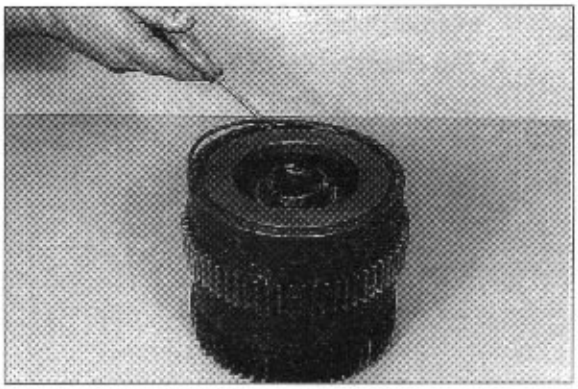
④ Remove spur gear and disk.



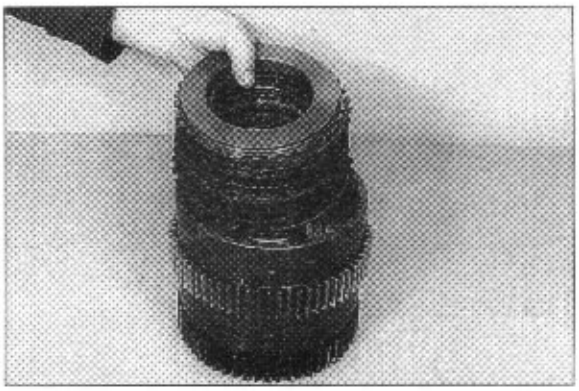
(7) Disassemble multi-disk clutch

① Remove spur gear K1 and demount components.

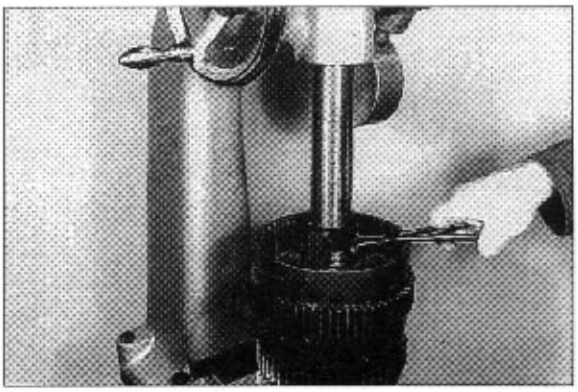
② Squeeze out snap ring.



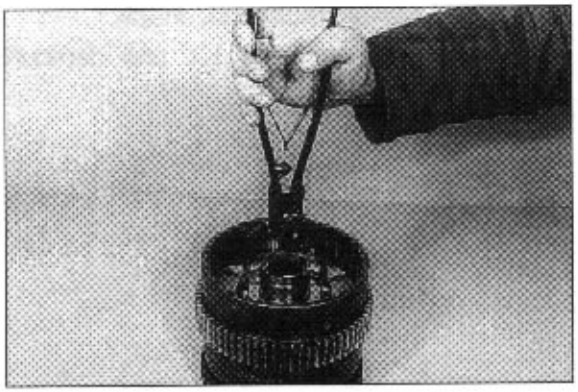
③ Remove plate pack.



④ Preload compression spring, squeeze out circlip and remove components.

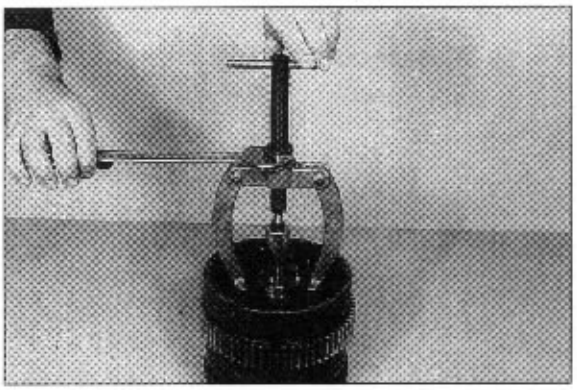


⑤ Remove piston by means of clamping pliers.



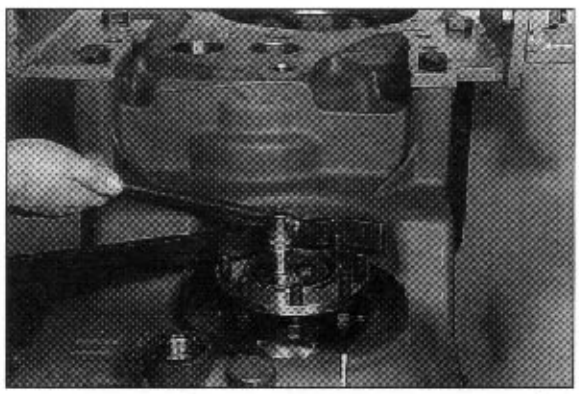
⑥ Pull needle bush out of the bore, using internal puller.

※ The disassembly of the clutch KV, KR/K2 and K4/K3 has to be carried out accordingly.

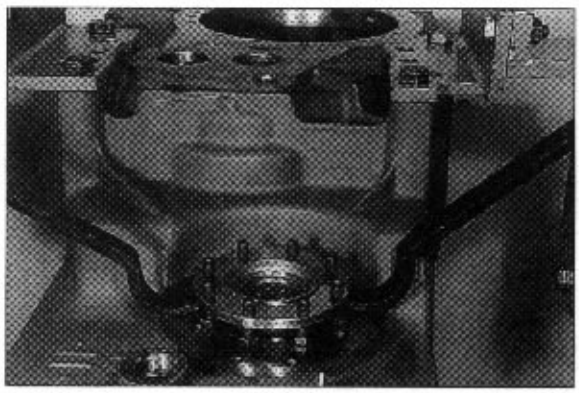


(8) Final drive(Version with drum brake)

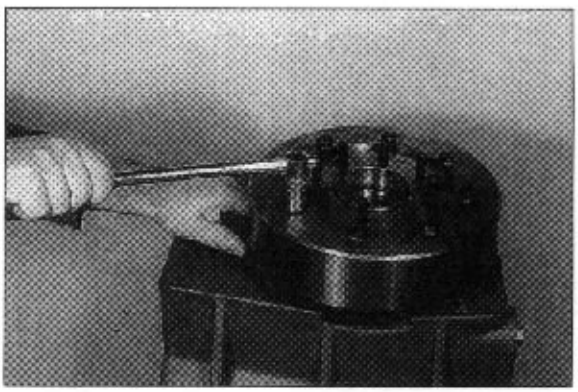
① Remove lock plate and loosen hexagon head screws.



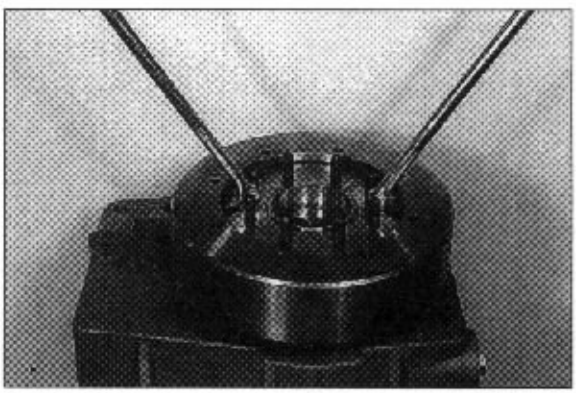
② Pry output flange off the shaft.



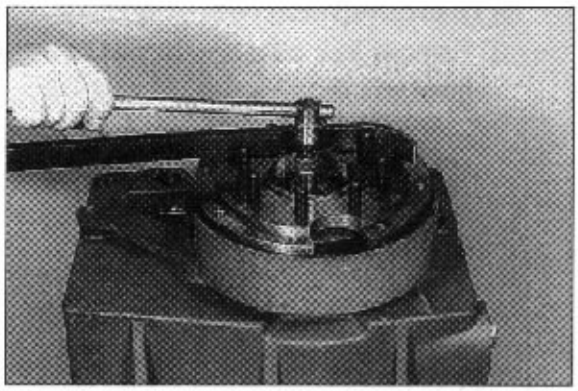
③ Tilt gear case 180 degree.
Loosen hexagon head screws.



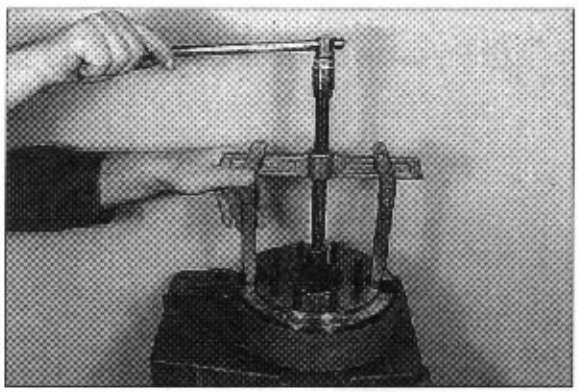
④ Separate brake drum from output flange.



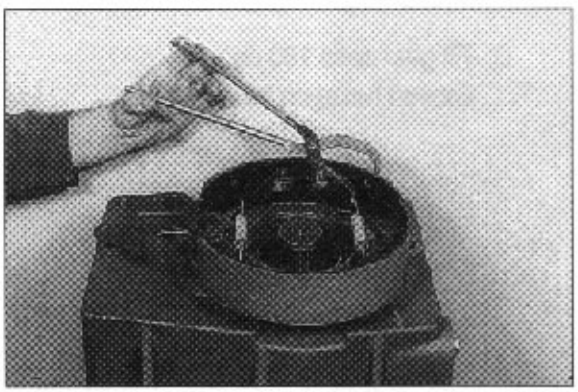
⑤ Remove lock plate and loosen hexagon head screws.



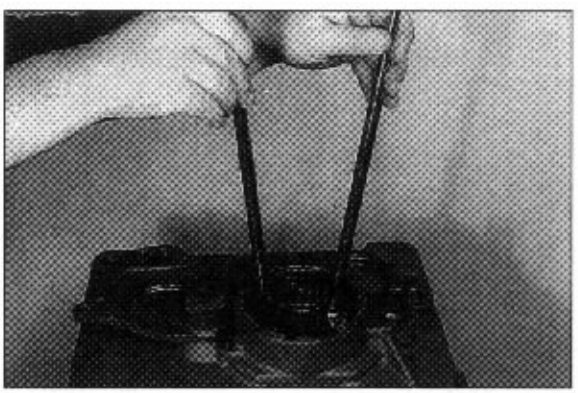
⑥ Pull output flange from the shaft.



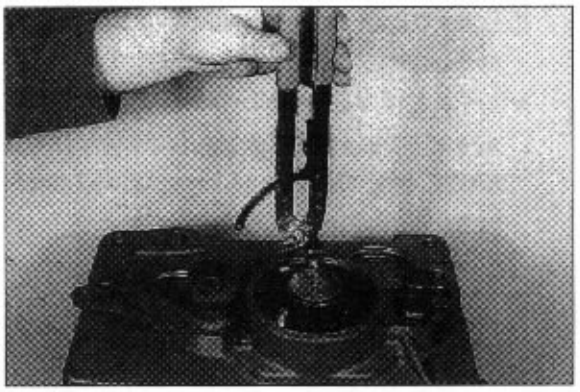
⑦ Unhook return springs and remove brake shoes.



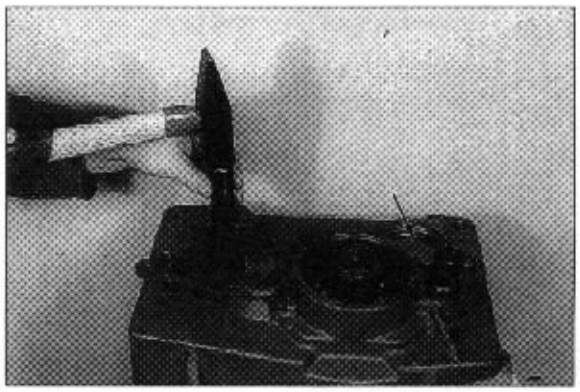
⑧ Pry shaft seal out of the housing bore.



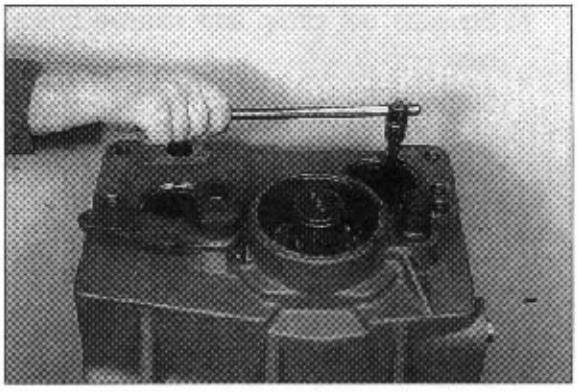
⑨ Squeeze out circlip and remove shim.



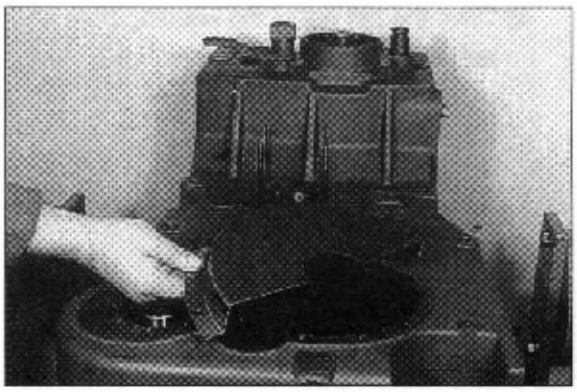
⑩ Loosen the two closing covers by central tapping and remove them.



⑪ Loosen the two hexagon head screws and remove them along with flat washers.

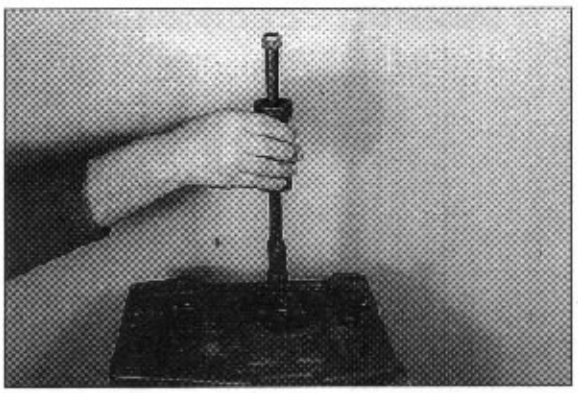


⑫ Remove upper oil retainer.

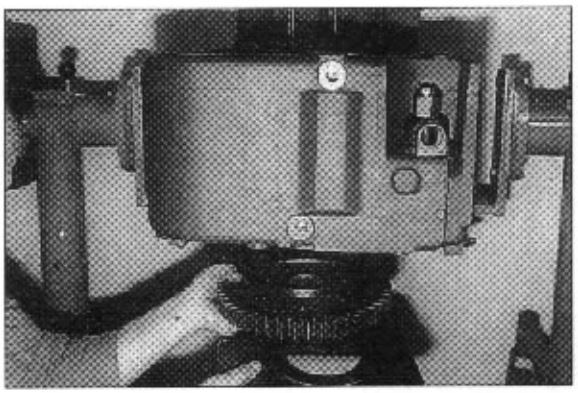


⑬ Drive output shaft by means of striker out of the output gear and remove it.

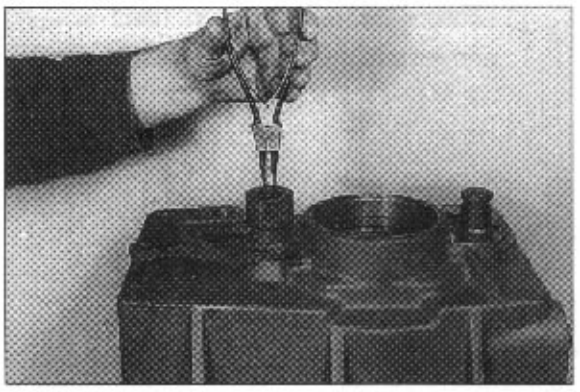
※ In case of the version with a mechanical speedometer, the speedometer-drive shaft(Complete) has to be removed prior to the disassembly of the output shaft.



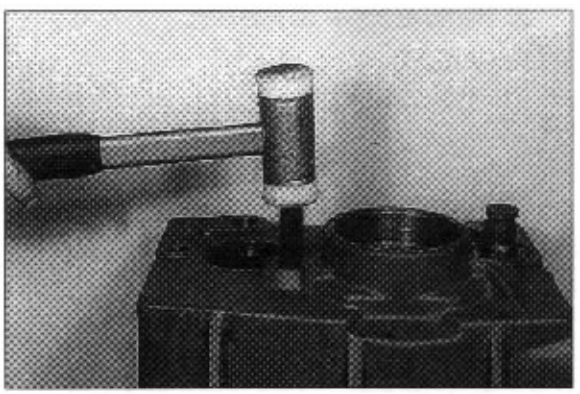
⑭ Remove output gear and plate.



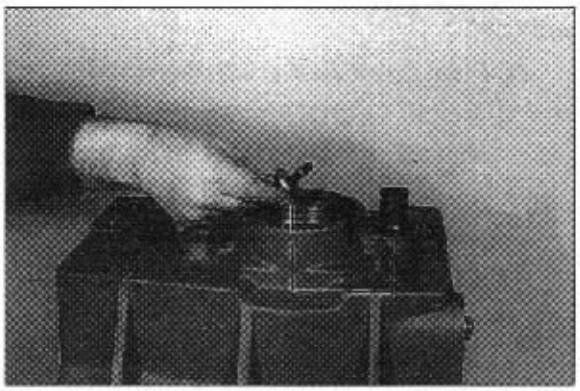
⑮ Squeeze out circlip and remove brake cam.



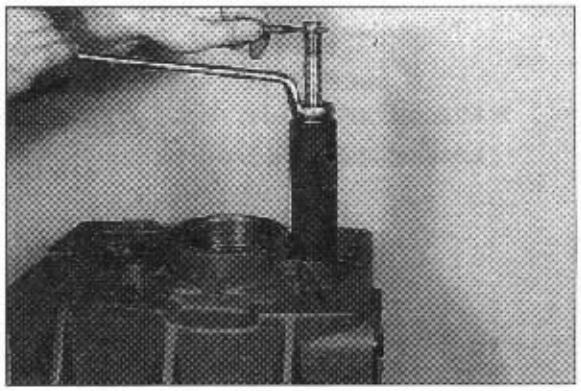
⑯ Drive the pin out of the housing bore and remove it.



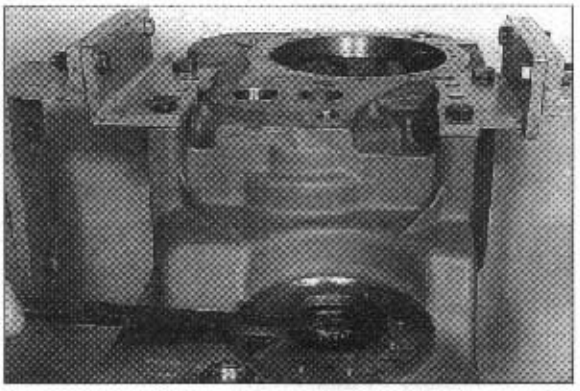
⑰ Loosen hexagon head screws.



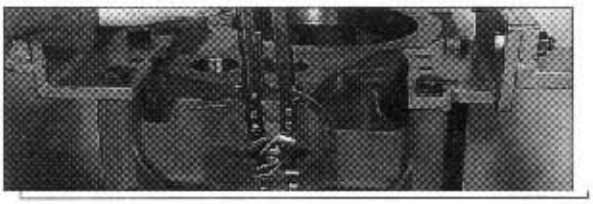
⑱ Pull pin by means of special device out of the housing bore.



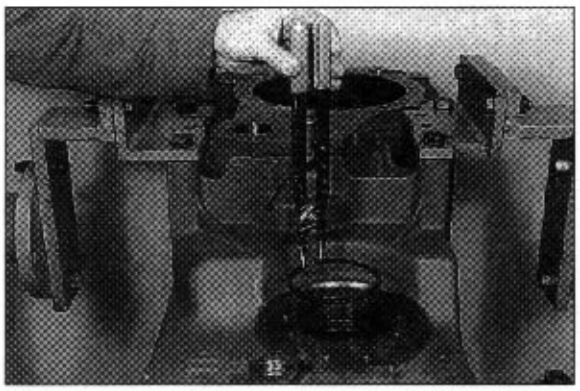
⑲ Tilt gear case 180 degree.
Pry shaft seal out of the housing bore.



⑳ Squeeze out circlip and remove spacing washer.

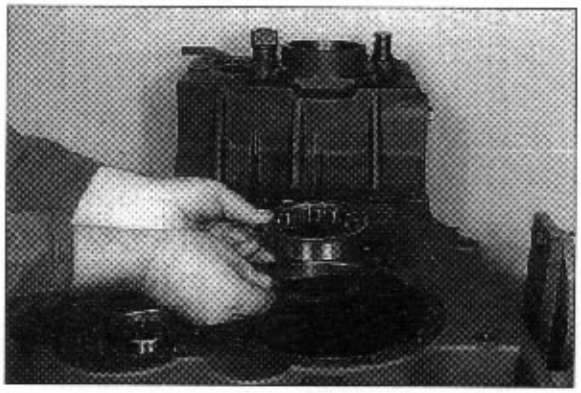


③ Squeeze in circlip 1.
Tilt gear case 180 degree.

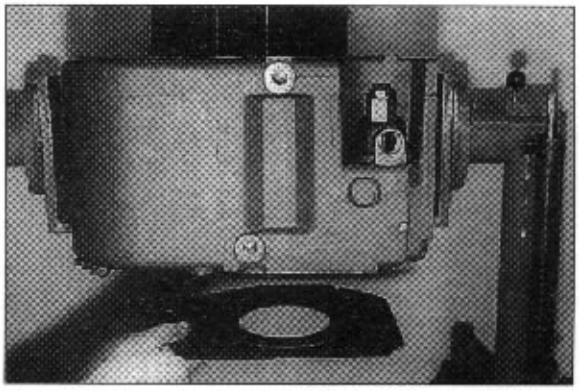


④ Lay shim 2(s = 0.7㎜/Empirical value) and roller bearing 3 upon circlip 1.

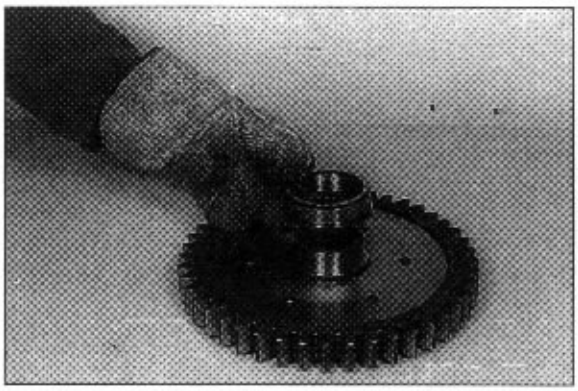
※ The end play of the output shaft bearing is determined by means of shim 2. However, a later check of the end play (See ⑬ to **EXAMPLE A**)is absolutely essential.



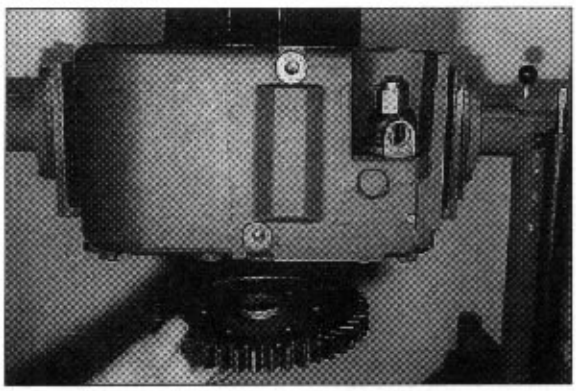
⑤ Introduce plate 4 through the large housing bore and lay it over the roller bearing 3.



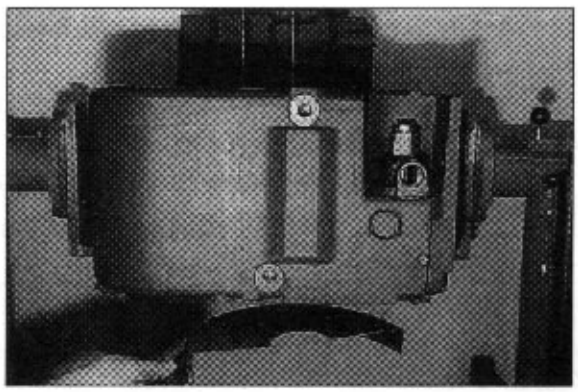
⑥ Heat bearing inner race 5 and assemble it until contact is obtained.



⑦ Position spur gear 6, see draft.



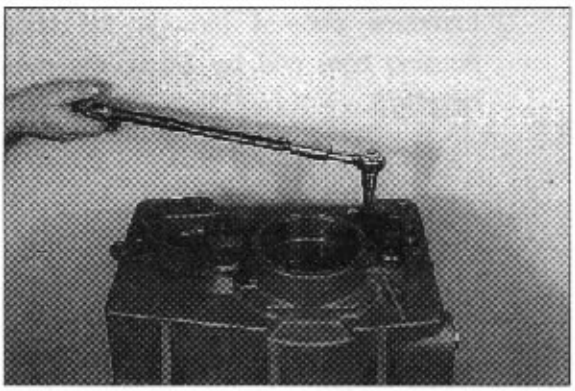
⑧ Position oil retainer 7, see draft.



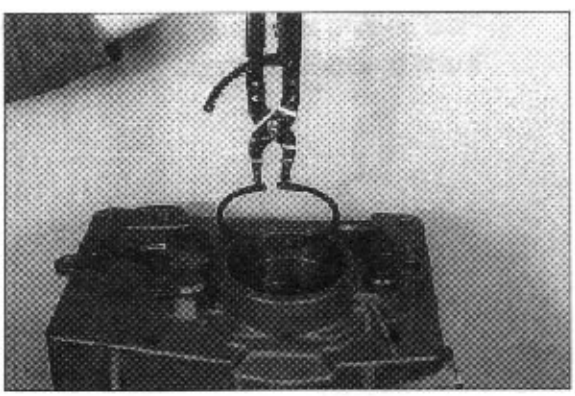
⑨ Fasten both plates by means of hexagon head screws(Install flat washers).

· Torque limit(M8/8.8) 2.6kg · m(17.0lb · ft)

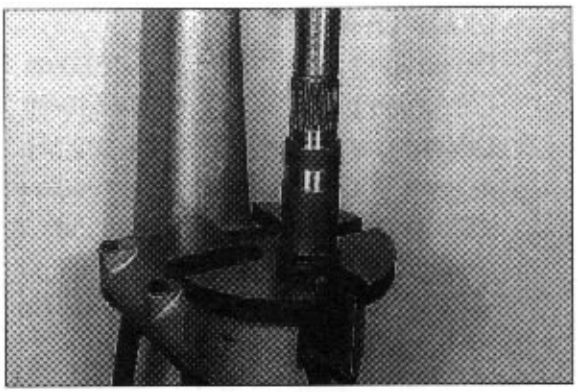
※ Secure hexagon head screws with loctite.



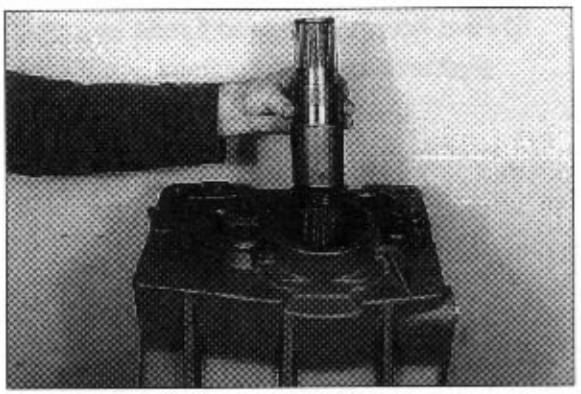
⑩ Squeeze in circlip 8.



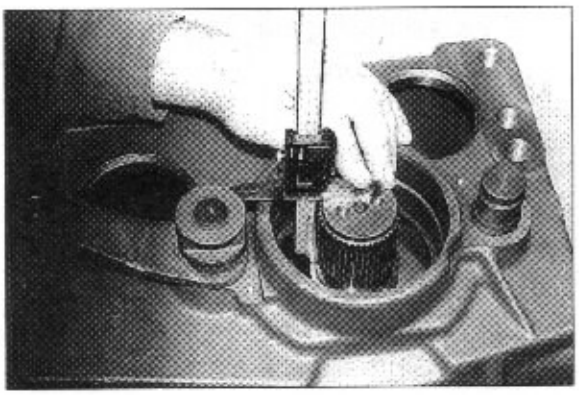
⑪ Press the speedometer-drive worm against shoulder.



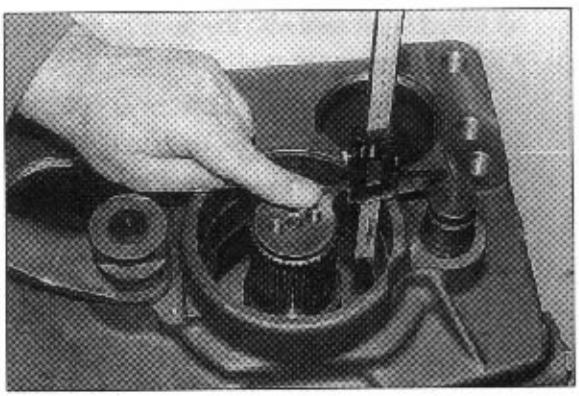
⑫ Thread up output shaft 9 until contact is obtained.



⑬ Check end play of the output shaft bearing = 0.3~0.5㎜**(EXAMPLE A)**.
Measure dimension Ⅰ from the end face/output shaft to the contact face(Ball bearing).
Dimension Ⅰ 79.60㎜

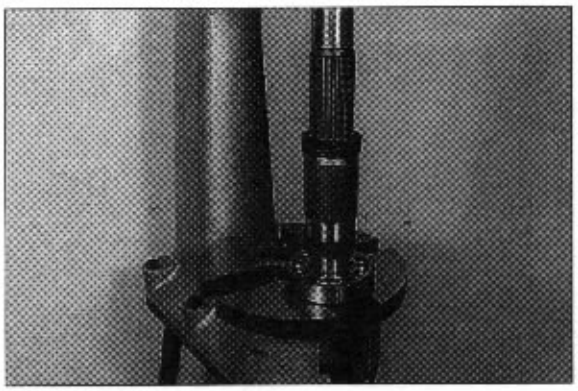


⑭ Determine dimension Ⅱ from the end face/output shaft to the upper plane surface of the circlip.
Dimension Ⅱ 79.10㎜



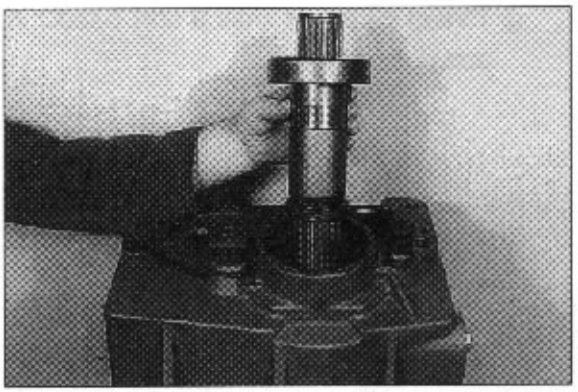
- **EXAMPLE A**

Dimension I 79.60mm
Dimension II -79.10mm
Difference end play = 0.50mm
In case of deviations from the required end play, correct by means of a corresponding shim(2), see ④.

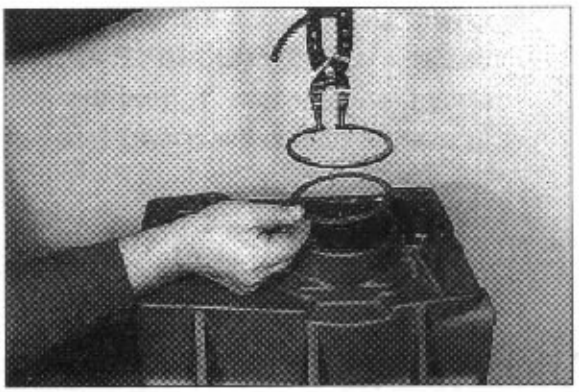


⑮ Press ball bearing against shoulder.

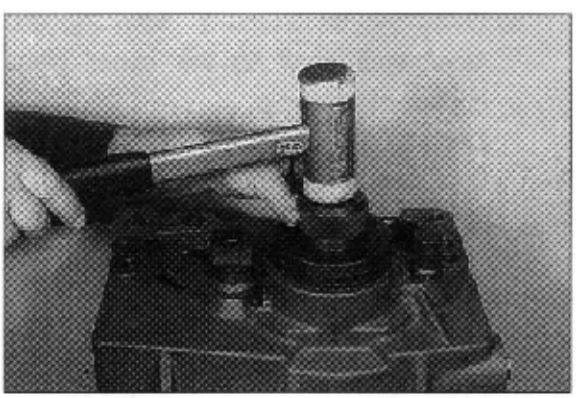
⑯ Heat housing bore and thread up output shaft until contact is obtained.



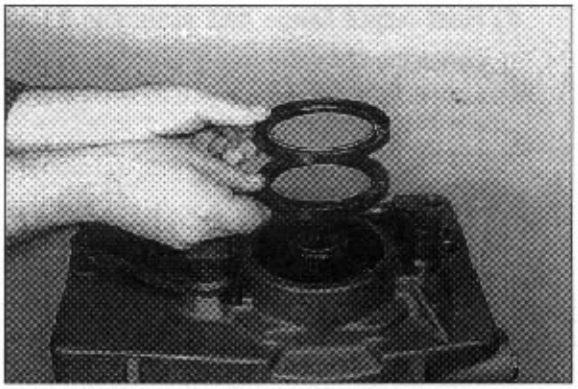
⑰ Fix ball bearing free of play by means of shim and circlip.



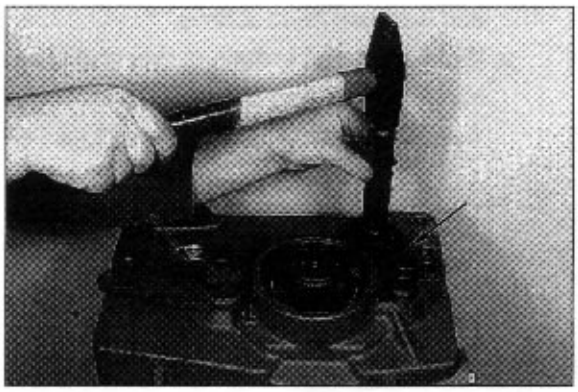
⑱ Install shaft seal with the sealing lip facing the oil chamber.
The exact installation position is obtained by application of the prescribed driver.
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit.
If not, use sealing compound(Curl T).
Grease sealing lip.



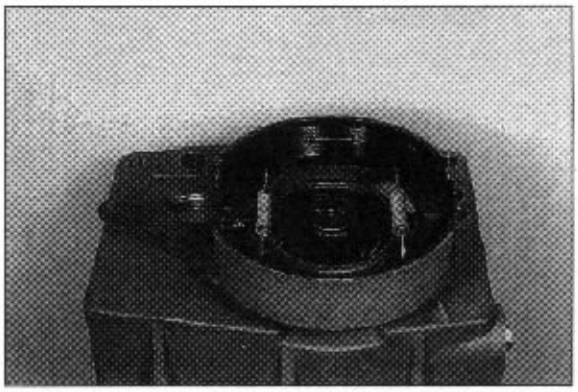
⑲ The figure on the right shows a version with two shaft seals (Version with fording ability)
Installation position : Sealing lip of inner shaft seal is facing the oil chamber. Sealing lip of outer shaft seal is showing outwards.
The installation depth is given by application of the prescribed driver.
Fill space between upper and lower sealing lip with grease.



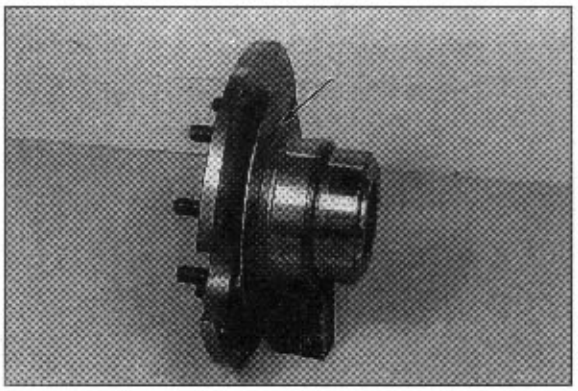
⑳ Install the two closing covers.
※ Wet sealing surfaces with loctite.



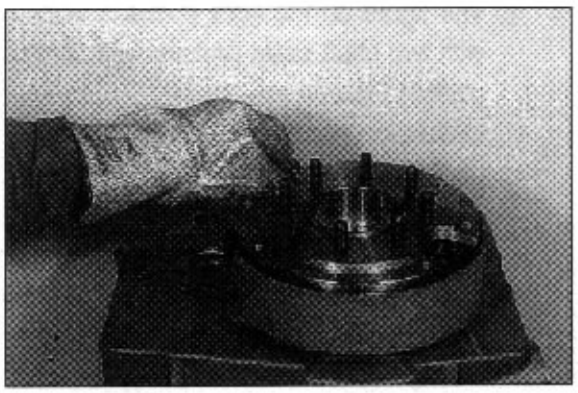
㉑ Install brake shoes and engage return springs.



㉒ Insert hexagon head screws in the bores of the output flange and press retaining plate(Arrow) against shoulder.

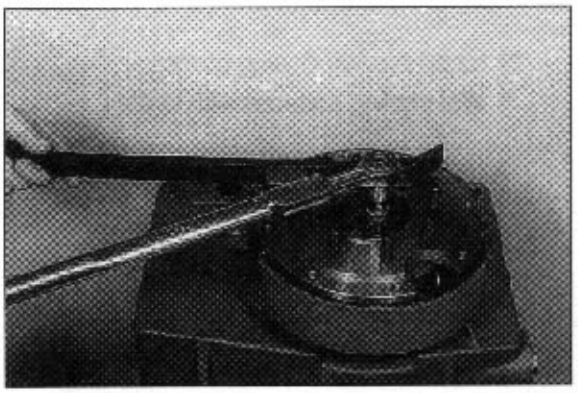


㉓ Heat output flange and assemble it until contact is obtained.

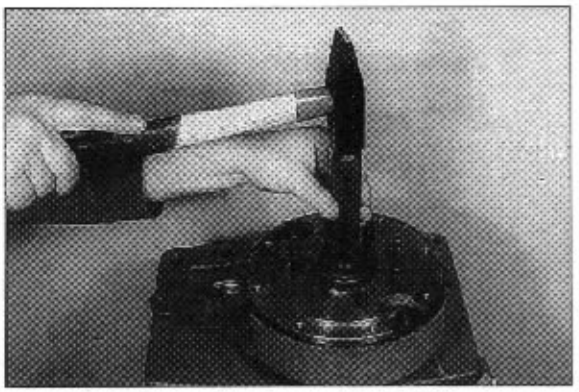


㉔ Fasten output flange by means of disk and hexagon head screws.

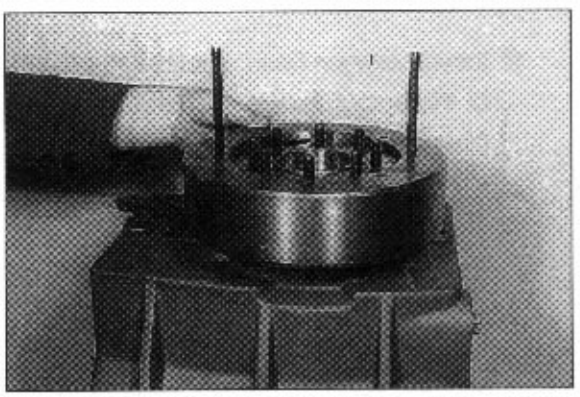
※ Wet the contact surface of disk and screw heads with sealing compound.
Torque limit(M10/8.8) 4.7kg · m(33.9lb · ft)



㉕ Fix hexagon head screws by means of lock plate.

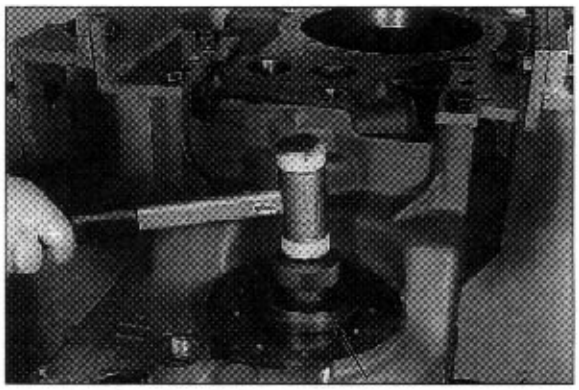


㉖ Assemble brake drum and fasten it by means of hexagon head screws(Mount flat washers).
Torque limit(M10/10.9)6.9kg · m(50.1lb · ft)



㉗ Tilt gear case 180 degree.
Install shaft seal(Arrow) with the sealing lip facing the oil chamber.

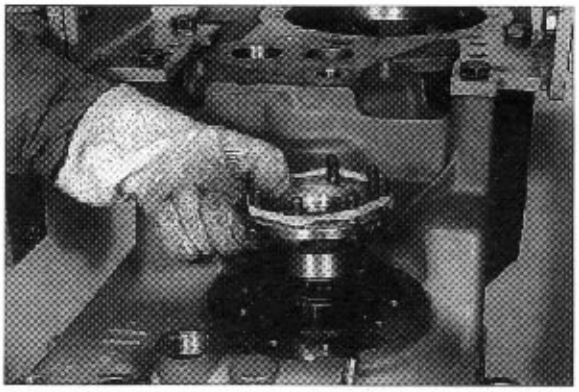
※ The exact installation position is obtained by application of the prescribed driver.
If the outer diameter of the shaft seal is rubberized, wet the sealing surface with spirit.
If not, use sealing compound.
Grease sealing lip.



㉘ The figure on the right shows a version with 2 shaft seals(Version with fording ability).
Installation position : Sealing lip of inner shaft seal is facing the oil chamber.
Sealing lip of outer shaft seal is showing outwards.
The installation depth is obtained by application of the prescribed driver.

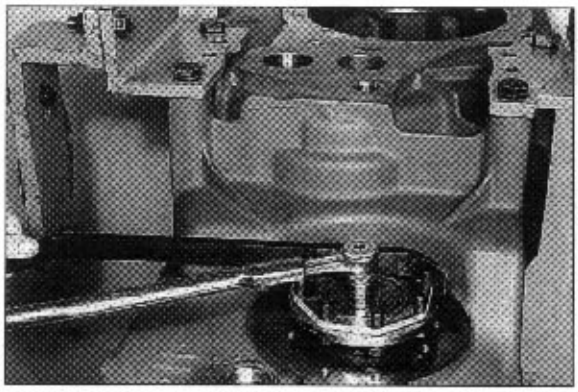
※ Fill space of upper and lower sealing lip with grease.

㉙ Insert hexagon head screws in the bores, heat the output flange and assemble it until contact is obtained.

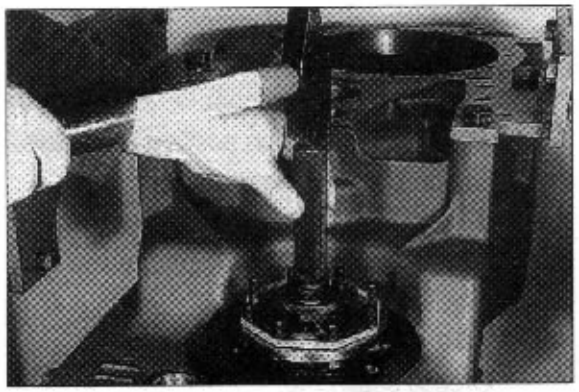


㉚ Fasten output flange by means of disk and hexagon head screws.

※ Wet contact areas of disk and screw head with sealing compound.
Torque limit(M10/8.8) 4.7kg · m(33.9lb · ft)

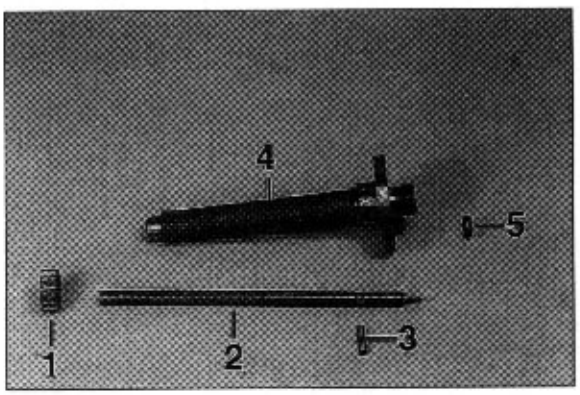


㉛ Fix hexagon head screws by means of lock plate.

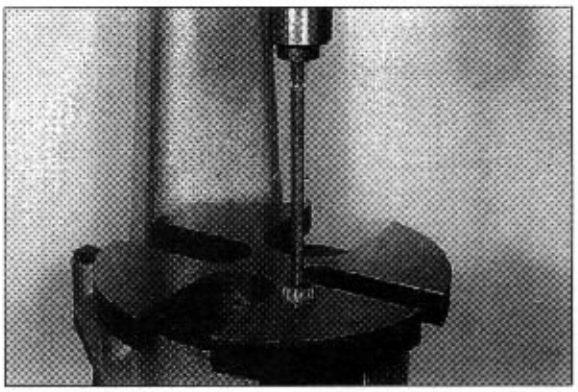


(2) Speedometer

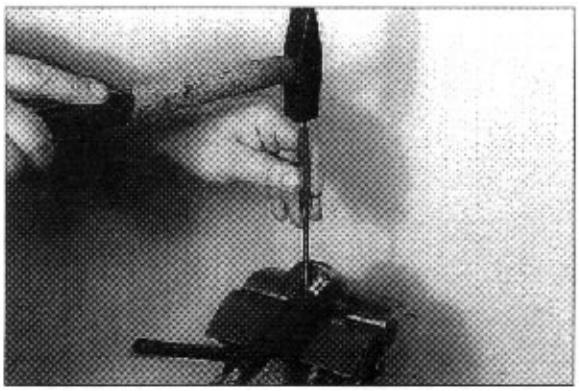
① The illustration on the right shows the components.
1 = Speedometer-drive gear
2 = Speedometer-drive shaft
3 = Straight pin
4 = Speedometer connecting piece
5 = Shaft seal



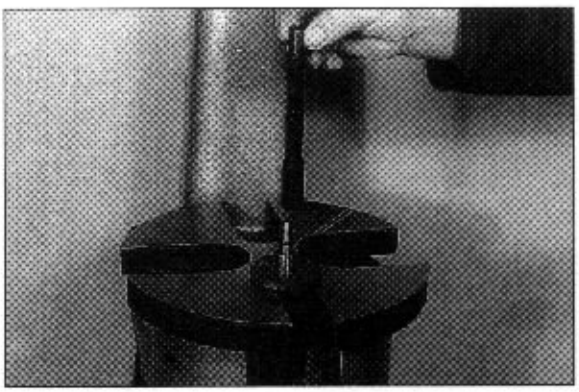
② Press drive gear flat against the end face/speedometer-drive shaft.



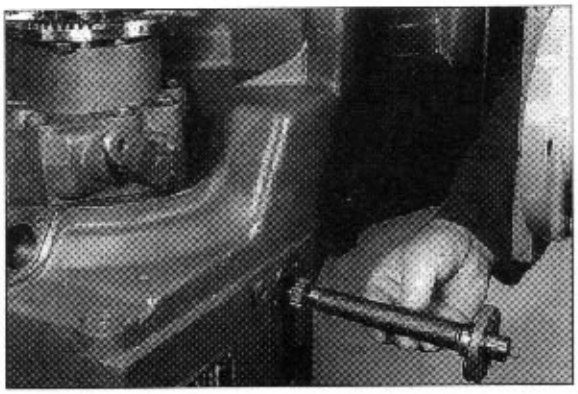
③ Introduce speedometer-drive shaft and fix it by means of straight pin.



④ Guide installer over the speedometer drive shaft and install shaft seal(Arrow) with the sealing lip facing the oil chamber.

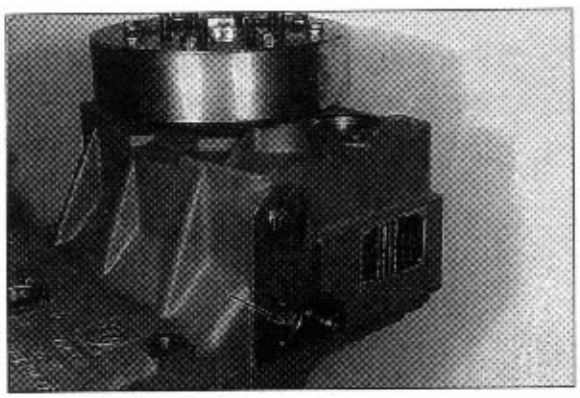


⑤ Assemble flat gasket and fasten pre-assembled speedometer by means of hexagon head screws.
Torque limit(M8/8.8) 2.4kg · m(17.0lb · ft)



⑥ In case of the version without speedometer, close the bore by means of cover(Arrows).

※ Wet sealing surfaces with loctite.



(3) Clutch K4/K3

Pre-assemble plate carrier K4/K3

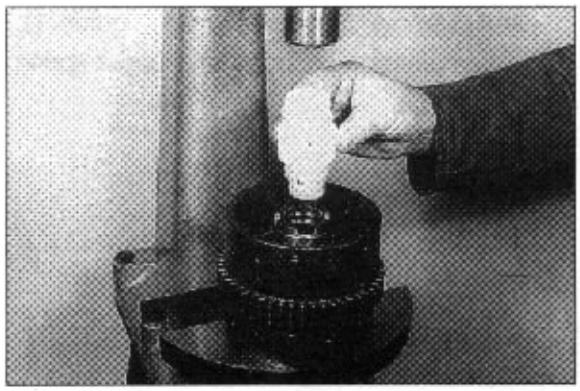
※ The following steps have to be carried out on both sides of the plate carrier.

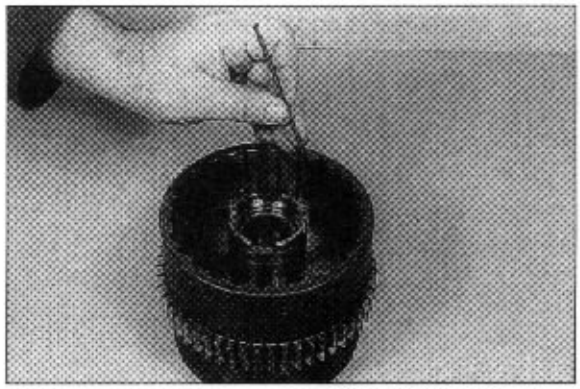
① Press needle bush carefully against shoulder, using drift(S).

※ The needle bush is marked on one end face.
At the pressing in, the marking must be showing upwards(To the drift).

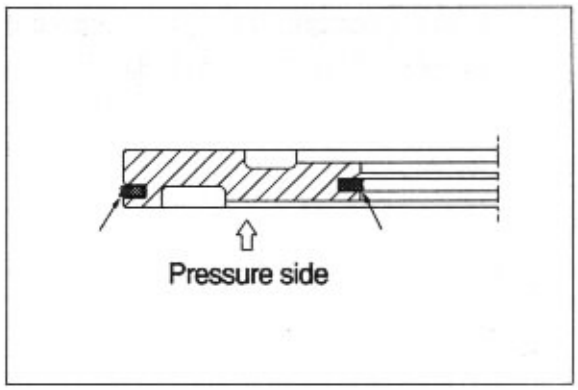
② Check operation of the bleeder valves.

※ Ball may not stick, if necessary, clean it by means of compressed air or renew it.

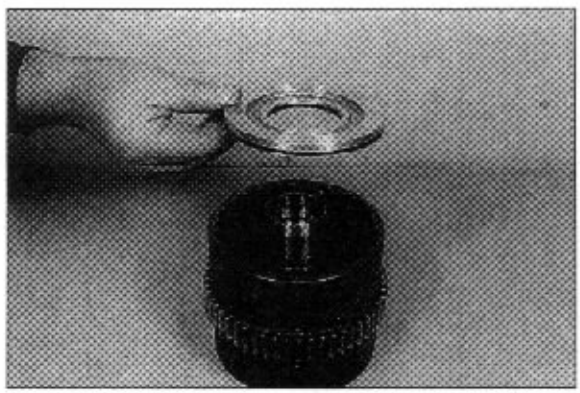




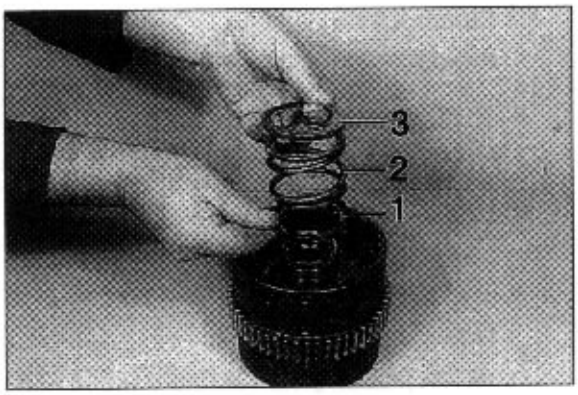
③ Insert the profiled sealing rings(Arrows) in the recesses of the piston with the sealing lip facing the pressure chamber.



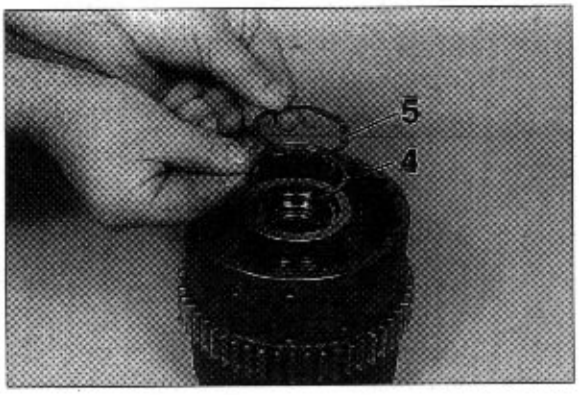
④ Oil profiled sealing rings and insert piston until contact is obtained.
Use installer(S).



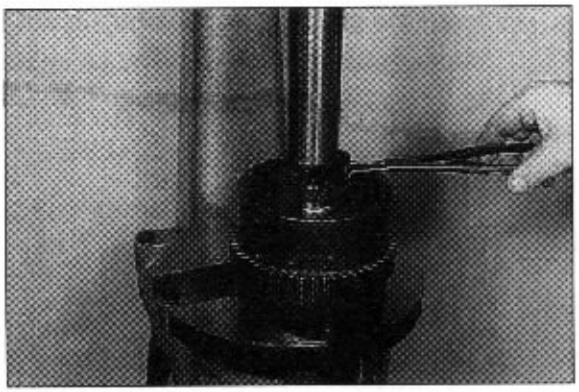
⑤ Assemble lower spring guide(1), compression spring(2) and upper spring guide(3).



⑥ Mount guide ring(4) and circlip(5).

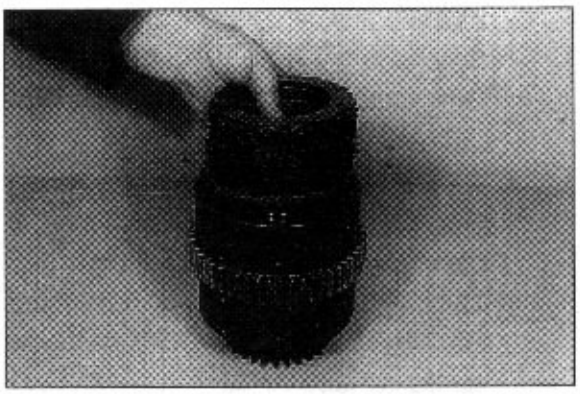


⑦ Preload compression spring and fix the components by means of circlip.

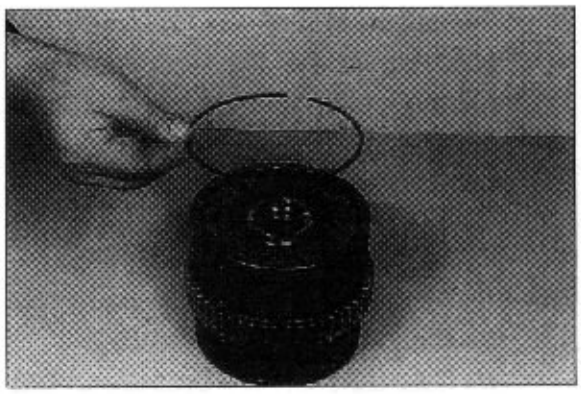


Install plate pack K4

⑧ Install plate pack and replace backing plate.

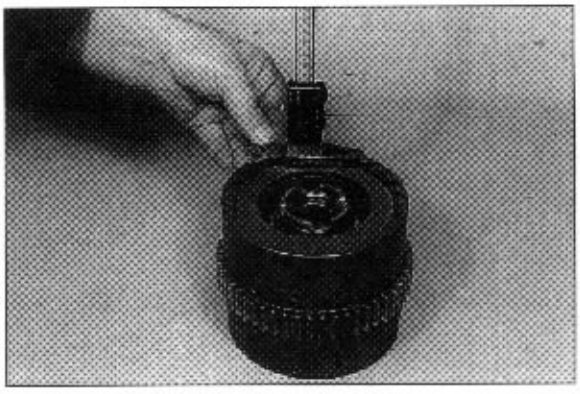


⑨ Fix plate pack by means of snap ring.

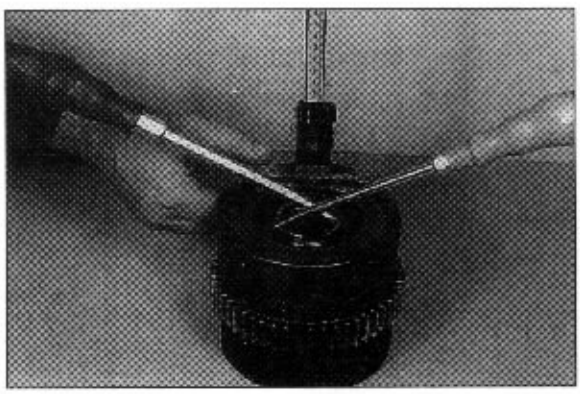


※ Check plate clearnce(The right figure to **EXAMPLE B)**

⑩ Measure dimension Ⅰ from the end face of the plate carrier to the backing plate.
Dimension Ⅰ 3.2mm



⑪ Place backing plate against snap ring until contact is obtained(Upwards), and determine dimension Ⅱ.
Dimension Ⅱ 3.2mm



- **EXAMPLE B**

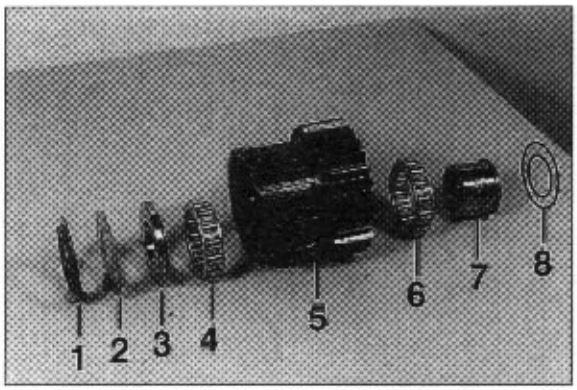
Dimension Ⅰ	5.3mm
Dimension Ⅱ	-3.2mm
Difference = Plate clearance	2.1mm

※ In case of deviations from the required plate clearance, correct by means of corresponding compensating plates.
The pre-assembly of the remaining clutches(K3,KV/K1 and KR/K2) has to be carried out accordingly.

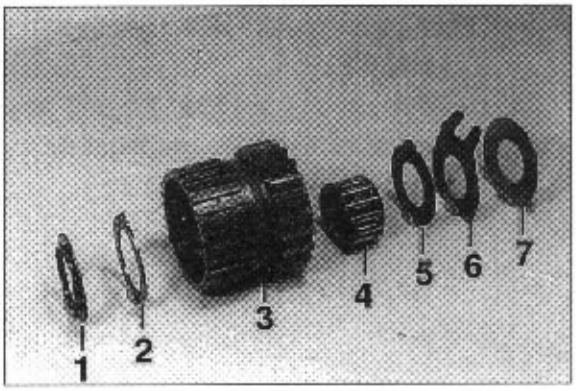
Pre-assemble and install spur gear K4

※ According to the transmission version, respectively operating conditions, different spur gear bearings are possible, see corresponding spare parts list as well as figure on the right.
Spur gear K4, version **A**(The right figure).

1 = Thrust plate	5 = Spur gear
2 = Thrust washer	6 = Roller cage
3 = Collar shim	7 = Bearing inner race
4 = Roller cage	8 = Shim

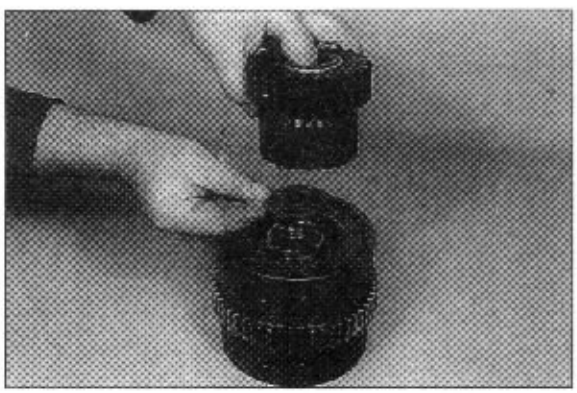


Spur gear K4, version **B**(The right figure).
1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Needle cage
5 = Thrust washer
6 = Thrust washer
7 = Compensating plate(Optional)



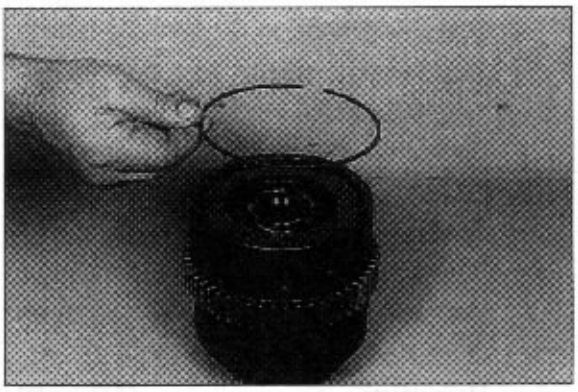
⑫ Install components 2~6, respectively 2~4, replace thrust plate(1) and introduce spur gear until all inner plates are received.

※ Make thrust plate(2) adhere with grease.



Install plate pack K3

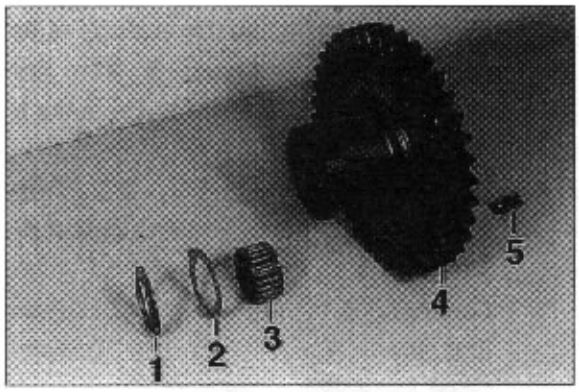
⑬ Install plate pack and check clearance.



Pre-assemble and install spur gear K3

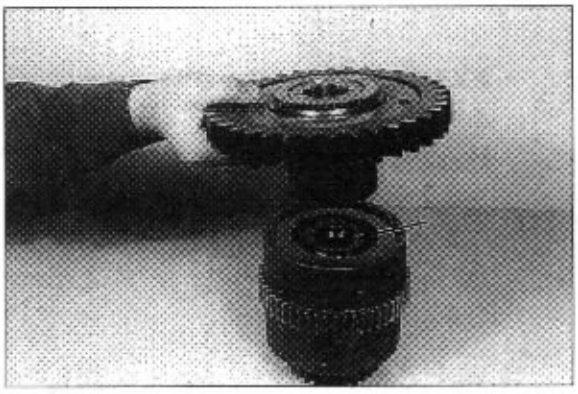
1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Cylindrical rollers

※ Exchange cylindrical rollers 5 in sets only.



⑭ Install components 2~5, replace thrust plate 1(Arrow) and introduce spur gear until all inner plates are received.

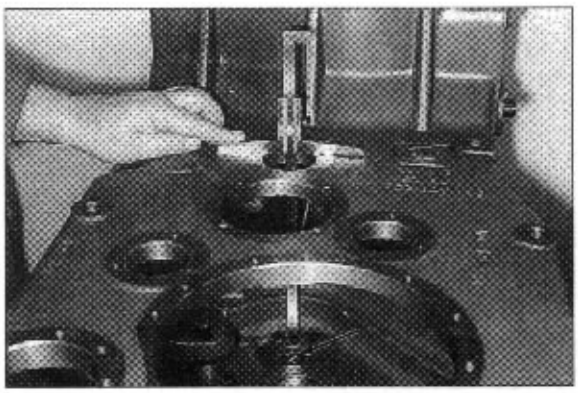
※ Make thrust washer 2 and cylindrical rollers 5 adhere with grease.



Install clutch K4/K3

Adjust end play of clutch 0.1~0.3mm (Figure on the right to **EXAMPLE E**)
Determine dimension I from the flange-mounted surface/axle to the plane surface/housing(Arrow).
Dimension I 251.15mm

※ In case of spur gear bearing K4, version **B**, lay forked washer and thrust washer upon the plane surface of the housing and measure up to the thrust washer.

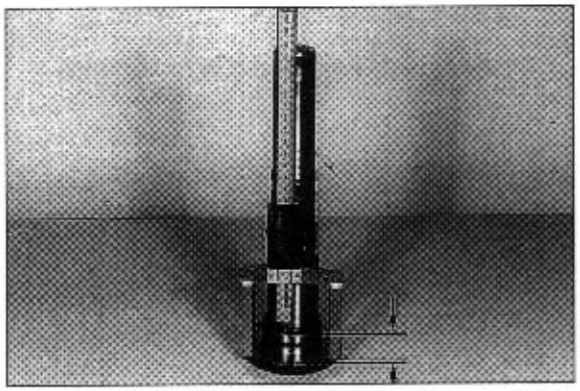


⑮ Measure dimension Ⅰ from the butting face/bearing rollers to the flange-mounted surface.

Dimension Ⅰ 21.00mm

- **EXAMPLE C**, for the determination of the housing dimension.

Dimension Ⅰ 251.15mm
Dimension Ⅱ -21.00mm
Difference = Housing Dimension 230.15mm

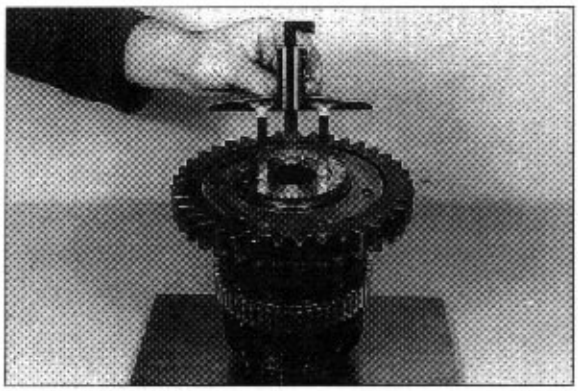


⑯ Place clutch on a suitable surface plate and determine dimension Ⅱ from the end face/cylindrical rollers to the surface plate.

Dimension Ⅱ 227.20mm

- **EXAMPLE D**, for the determination of the installation dimension.

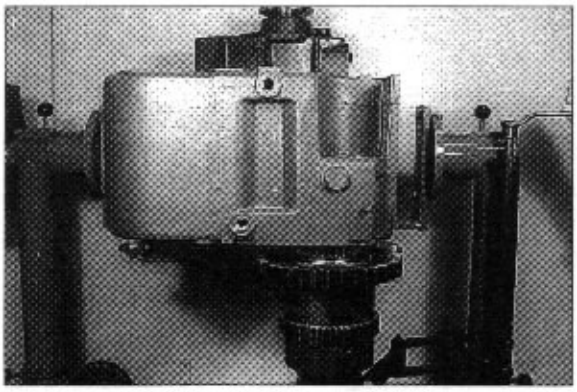
Dimension Ⅱ 227.20mm
End play + 0.20mm
Gives installation dimension
- Clutch 227.40mm



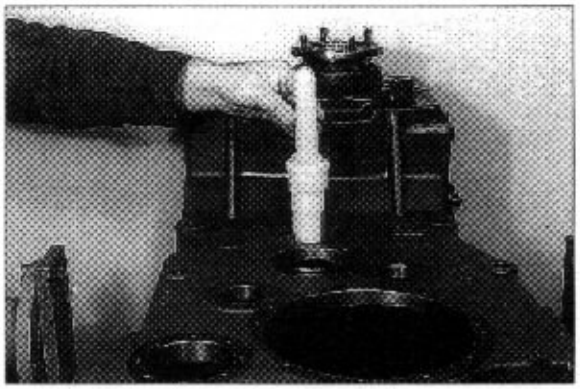
- **EXAMPLE E**, for the determination of the shim.

Housing dimension 230.15mm
Installation dimension
- Clutch 227.40mm
Difference = Shim 2.75mm

⑰ Insert clutch K4/KR by means of lifting device into the housing and position it.

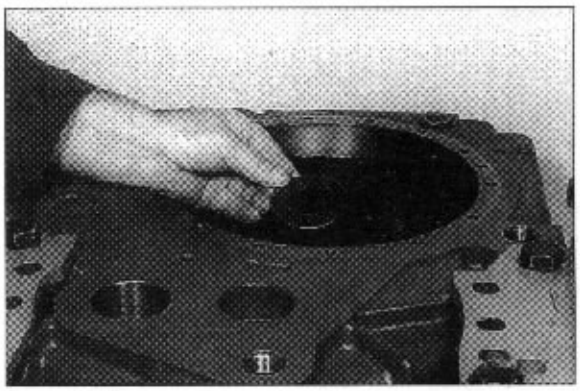


⑱ Align clutch by means of drift and fix it provisionally.



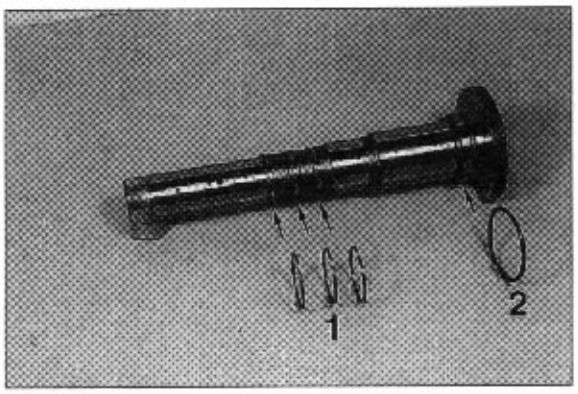
⑲ For the moment, tilt gear case 90 degree and push the complete clutch opposite to the drive side against shoulder until contact is obtained.
Now, tilt gear case forward in the horizontal position.

⑳ Pull drift downward until the shim(s = 2.75mm, see **EXAMPLE E**) can be installed.
Now, align the complete clutch as well as the shim by means of drift again and fix it.
In case of spur gear bearing K4, version
※ **A** without forked washer and thrust washer(Figure on the right).
In case of spur gear bearing K4, version **B**, another forked washer as well as one thrust washer have to be installed in addition to the shim.
※ Pay attention to the radial installation position of the forked washer.
Now, tilt gear case back in the original position(180 degree).



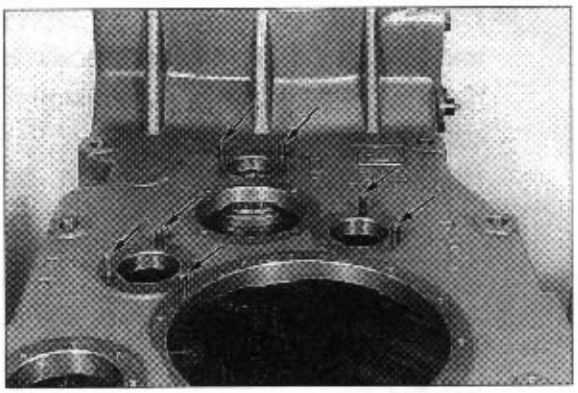
㉑ Squeeze in and engage rectangular rings(1).
Install O-ring(2).

※ Grease and align rectangular rings centrically.

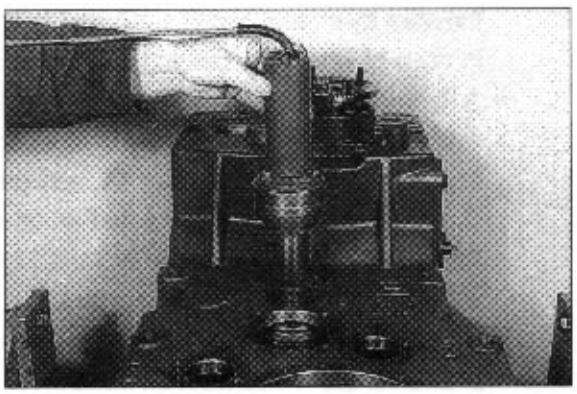


㉒ Install stud bolts, see arrows.

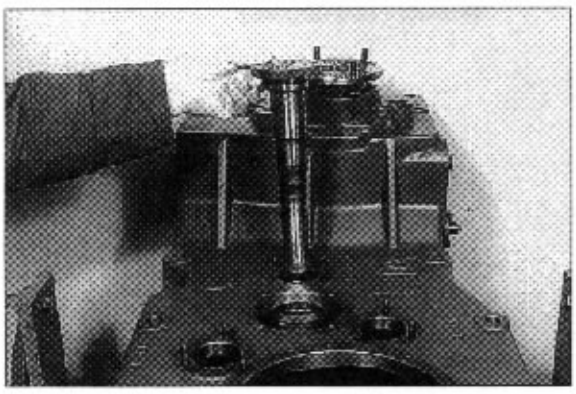
※ Secure the stud bolts with loctite.



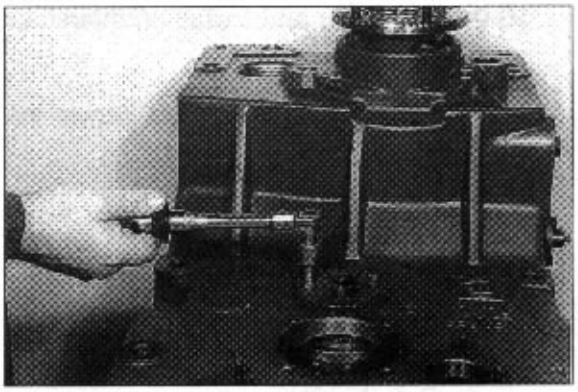
㉓ Heat housing bores(About 90°C).



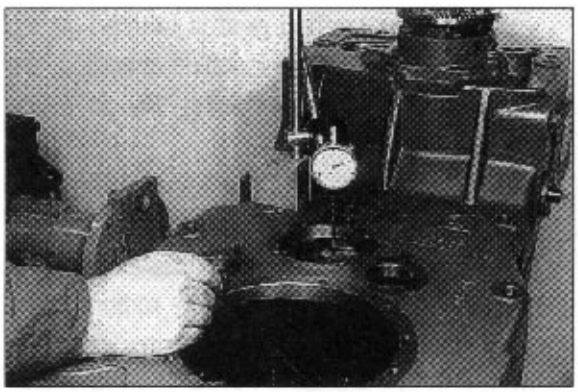
㉔ Thread up axle(Complete) until contact is obtained.



㉕ Fasten axle by means of hexagon nuts.
Torque limit(M8/8.8) 2.4kg · m(17.0lb · ft)

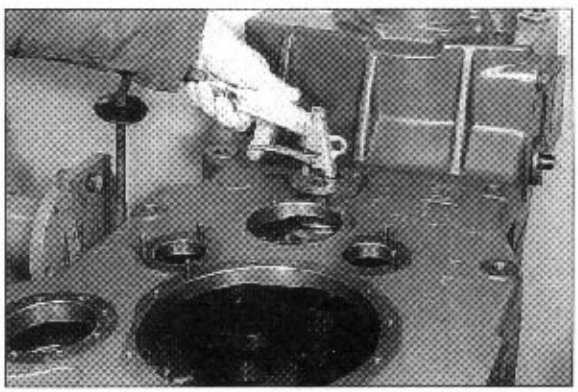


㉖ Check end play of the clutch 0.1~0.3mm again and correct if necessary.



㉗ Check operation of the clutches K4 and K3 by means of compressed air.

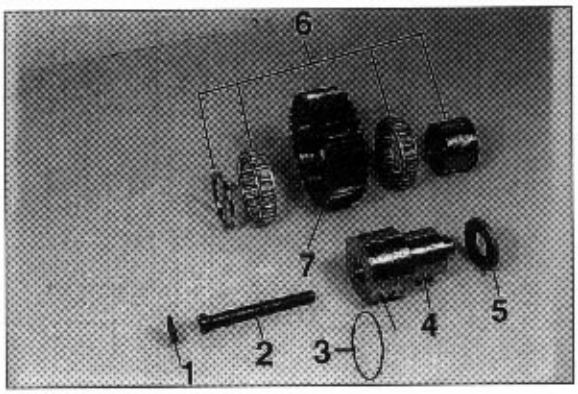
※ If the components are correctly installed, the closing, respectively opening of the clutches is clearly audible.



(4) Pre-assemble and install countershaft assembly

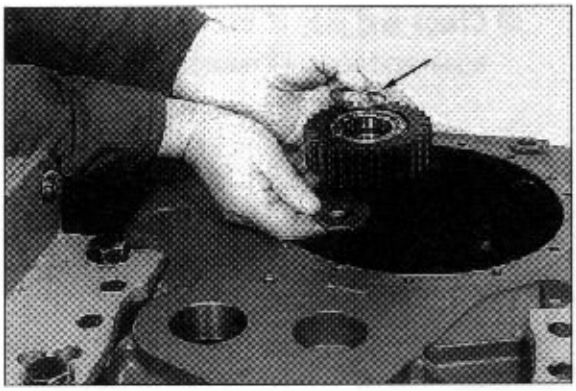
① The illustration on the right shows the components.
1 = Closing cover
2 = Socket head screw
3 = O-ring(Installation position, see arrow)
4 = Axle
5 = Shim
6 = Roller bearing
7= Spur gear

※ The countershaft gear is marked on the end face. In the installed condition, the marking must be facing the drive side (Upwards).

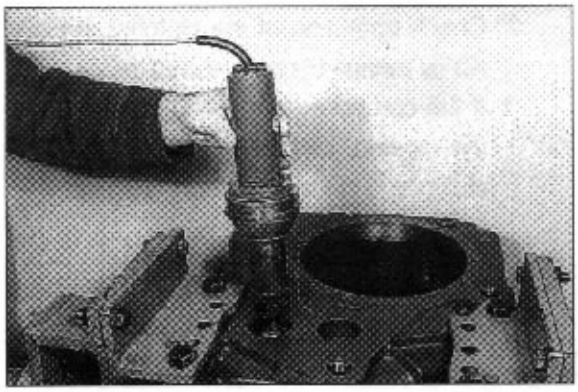


② Insert shim and pre-assembled spur gear.

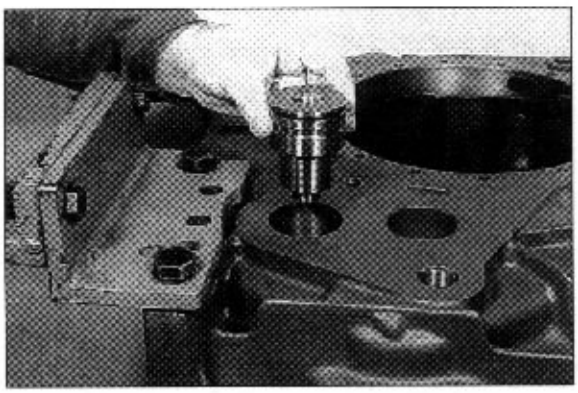
※ Pay attention to the installation position of the collar shim(Arrow) - radius on the inner diameter must show upwards.



③ Heat bearing bores and bearing inner race(About 90°C).



④ Insert axle until contact is obtained.

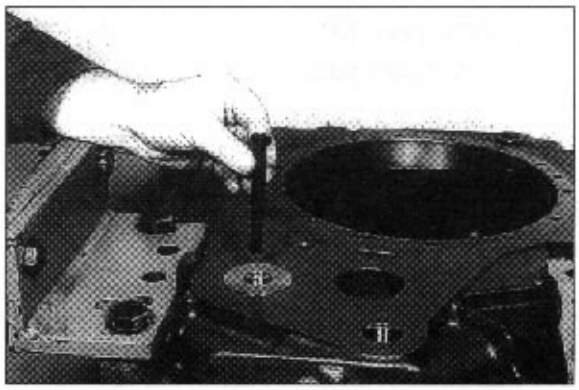


⑤ Fix the axle by means of socket head screw.

Torque limit(M12/10.9, DIN 7984)

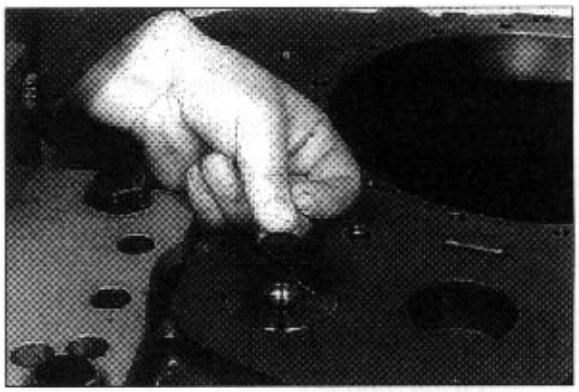
8.2kg · m(59.7lb · ft)

※ Secure socket head screw with loctite.



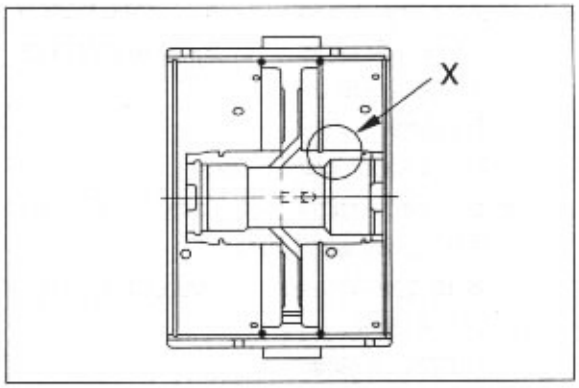
⑥ Install closing cover.

※ Wet contact areas with loctite.



(5) Clutch KR/K2

※ The pre-assembly of the plate carrier KR /K2 has to be carried out accordingly like that of the plate carrier K4/K3.



※ Pay attention to the different plate carriers.

Plate carrier KR/K2 in the zone X without oil hole.

Plate carrier KV/K1 in the zone Y with oil hole.

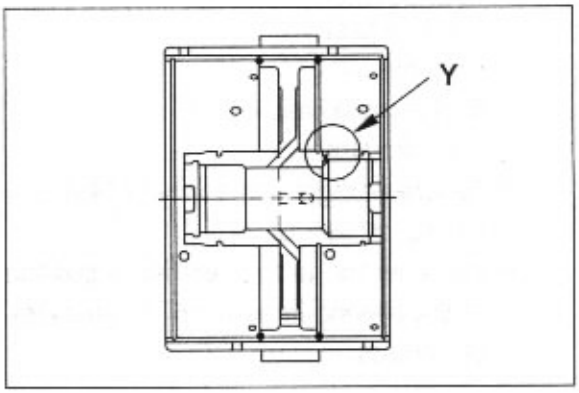
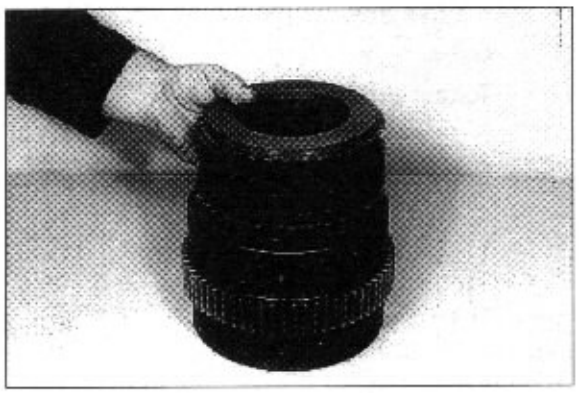


Plate pack KR

Install plate pack and check clearance.



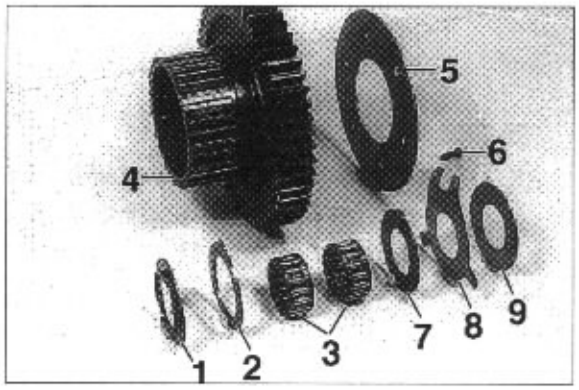
Pre-assemble and install spur gear KR

※ According to the transmission version, respectively operating conditions, different spur gear bearings are possible, see corresponding spare parts list, as well as ①, ②, ③.

① Spur gear bearing KR, version **A** (Figure on the right).

1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Plate
6 = Hexagon head screws
7 = Thrust washer
8 = Forked washer
9 = Shim(Optional)

※ Secure hexagon head screws(M6/8.8 = 0.97kg · m) with loctite.

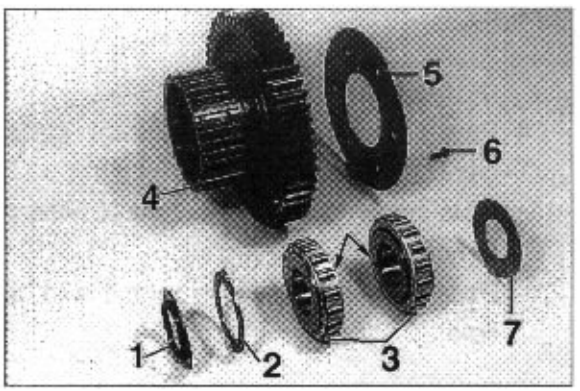


② Spur gear bearing KR, version **B**(Figure on the right).

1 = Thrust plate
2 = Thrust washer
3 = Roller bearing(Complete)
4 = Spur gear
5 = Plate
6 = Hexagon head screw
7 = Shim(Optional)

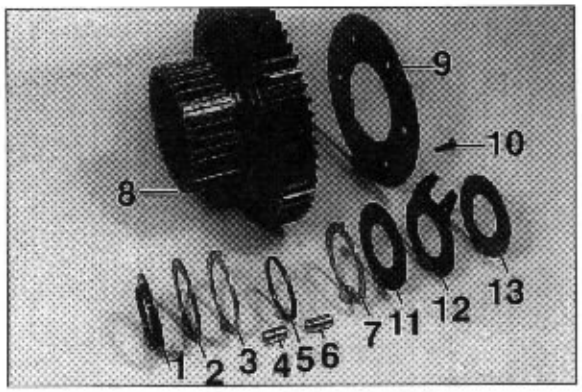
※ Secure hexagon head screws(M6/8.8 = 0.97kg · m) with loctite.

※ Pay attention to the installation position of the bearing inner races(Oil grooves), see arrows.



③ Spur gear bearing KR, version **C**(Figure on the right)

1= Thrust plate
2 = Thrust washer
3 = Thrust washer
4 = Cylindrical rollers(Short)
5 = Disk
6 = Cylindrical rollers(Long)
7 = Thrust washer
8 = Spur gear
9 = Plate
10 = Hexagon head screws
11 = Thrust washer
12 = Forked washer
13 = Shim(Optional)



※ Secure hexagon head screws(M6/8.8 = 0.97kg · m) with loctite.
Install components 2~6 respectively 2~10.
Replace thrust plate 1(Arrow) and thread up spur gear until all inner plates are received.

※ Make thrust washers and cylindrical rollers adhere with grease.

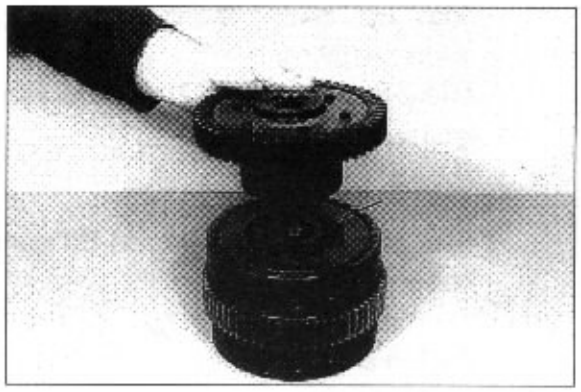
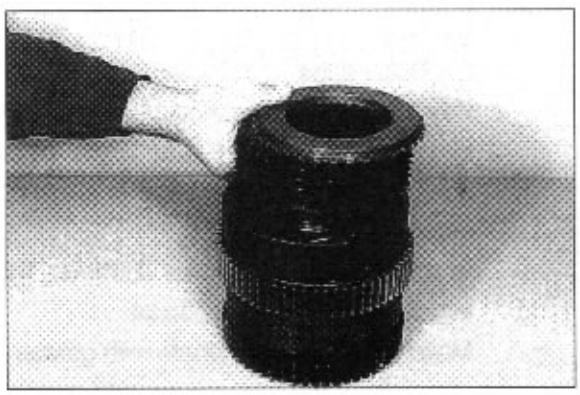


Plate pack K2

④ Install plate pack and check clearance.



Pre-assemble and install spur gear K2

※ According to the transmission version, respectively operating conditions, different spur gear bearings are possible, see corresponding spare parts list as well as the following ⑤, ⑥.

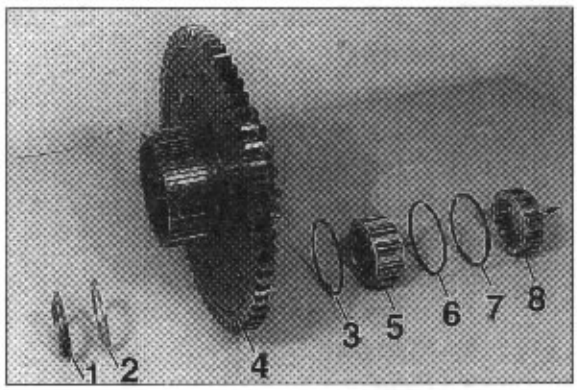
⑤ Spur gear bearing K2, version **A**(Figure on the right)

1= Thrust plate
2 = Thrust washer
3 = Angle ring
4 = Spur gear
5 = Roller cage(Long)
6 = Angle ring
7 = Angle ring
8 = Roller cage(Short)

※ Pay attention to the installation position of the roller cage(8), the larger inner diameter of the brass cage is showing outwards(Arrow).

The broad butting faces of the angle rings are always facing the bearing rollers.

Make thrust washer(2) adhere with grease.



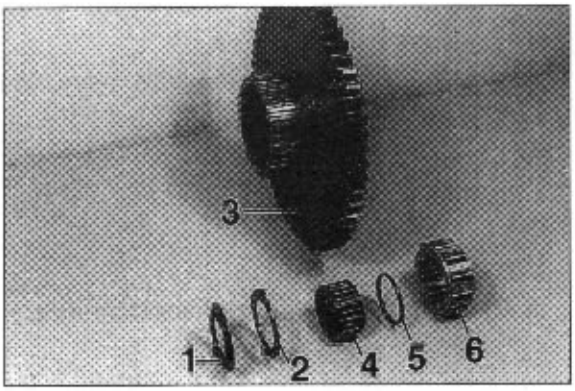
⑥ Spur gear bearing K2, version **B**(Figure on the right)

1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Needle cage
5 = Ring
6 = Roller cage

※ Pay attention to the installation position of the roller cage(5), the larger inner diameter of the brass cage is showing outwards(Arrow).

In case of an equal inner diameter, the installation position is optional.

Make thrust washer adhere with grease.



⑦ Install components 2~8(Figure ⑤), respectively 2~6(Figure ⑥).
Replace thrust plate 1(Arrow) and thread up spur gear until all inner plates are received.

※ Make thrust washer adhere with grease.

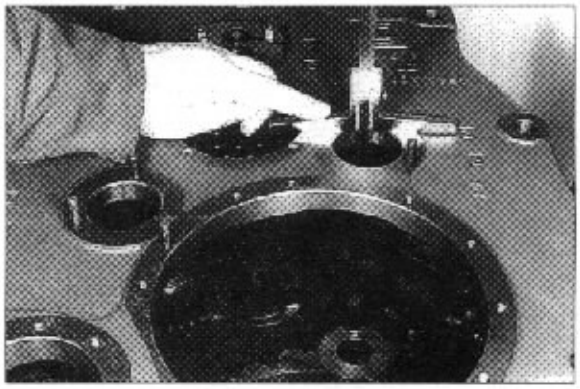
Install clutch KR/K2

Adjust end play of the clutch 0.1~0.3mm (Figure on the right to **EXAMPLE H**).

⑧ Insert forked washer and thrust washer (Arrow) and measure dimension Ⅰ from the flange-mounted surface to the thrust washer.
Dimension Ⅰ 252.20mm

⑨ Now, remove forked washer and thrust washer again.

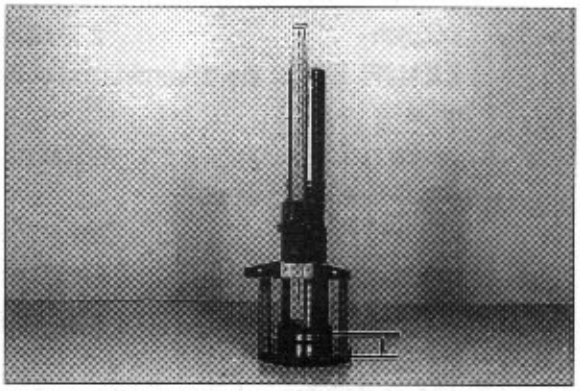
※ In case of spur gear bearing KR, version **B**, measure up to the plane surface /housing(Without forked washer and thrust washer).



⑩ Measure dimension Ⅱ from the butting face/bearing rollers to the flange-mounted surface.
Dimension Ⅱ 22.55mm

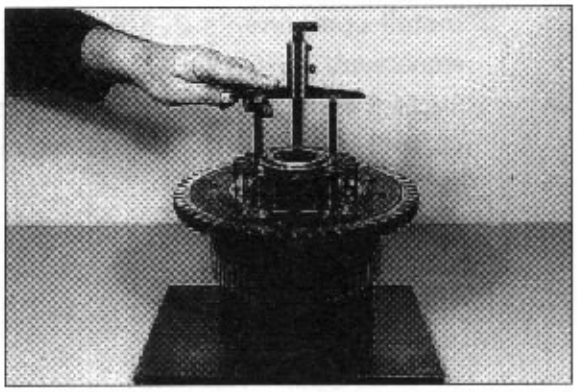
- **EXAMPLE F** for the determination of the housing dimension.

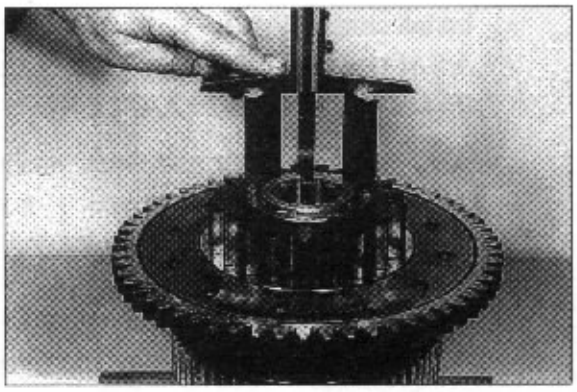
Dimension Ⅰ	252.20mm
Dimension Ⅱ	- 22.55mm
Difference = Housing Dimension	229.65mm



⑪ Put the clutch on a suitable surface plate and determine dimension Ⅲ from the end face/cylindrical rollers to the surface plate.

Dimension Ⅲ 227.65mm





- **EXAMPLE G** for the determination of the installation dimension.

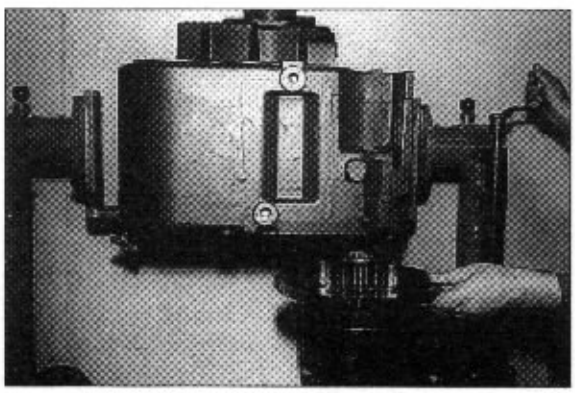
  Dimension Ⅲ 227.65mm
  End play + 0.20mm
  Gives installation dimension
  - Clutch 227.85mm

- **EXAMPLE H** for the determination of the shim.

  Housing dimension 229.65mm
  Installation dimension
  - Clutch - 227.85mm
  Difference = Shim s = 1.80mm

⑫ Insert clutch KR/K2 in the housing, using lifting device.

※ The installation o f the shims and the fixing of the clutch KV/K1.



(6) Clutch KV/K1

※ The pre-assembly of the plate carrier KV/K1 has to be carried out accordingly like that of the plate carrier K4/K3.

※ Pay attention to the different plate carriers.

Plate pack KV

Install plate pack and check clearance.

Pre-assemble and install spur gear KV

※ According to the transmission version, respectively operating conditions, different spur gear bearings are possible.

① Spur gear bearing KV, version **A**(Figure on the right)

1 = Thrust plate
2 = Thrust washer
3 = Roller bearing
4 = Spur gear
5 = Plate
6 = Hexagon head screws
(M6/8.8 = 0.97kg · m)
7 = Shim(Optional)

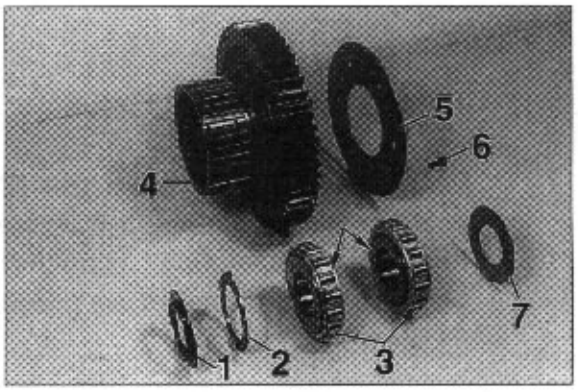
※ Secure hexagon head screws(5) with loctite. Pay attention to the installation position of the bearing inner races(Oil grooves), see arrows.

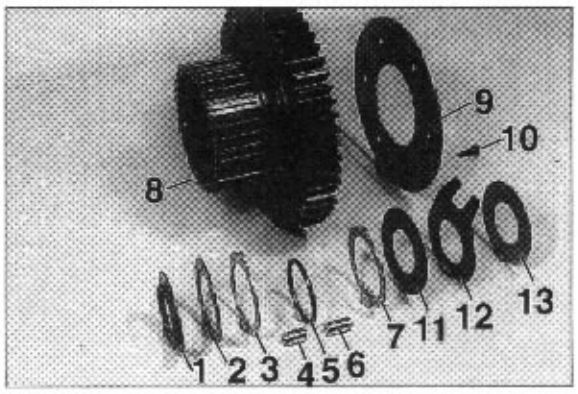
② Spur gear bearing KV, version **B**(Figure on the right)

1 = Thrust plate
2 = Disk
3 = Thrust washer
4 = Cylindrical rollers(Short)
5 = Disk
6 = Cylindrical rollers(Long)
7 = Thrust washer
8 = Spur gear
9 = Plate
10 = Hexagon head screws
(M6/8.8 = 0.97kg · m)
11 = Thrust washer
12 = Forked washer
13 = Shim(Optional)

※ Secure hexagon head screws(10) with loctite.

Install long cylindrical rollers(According to the version)on the converter side.



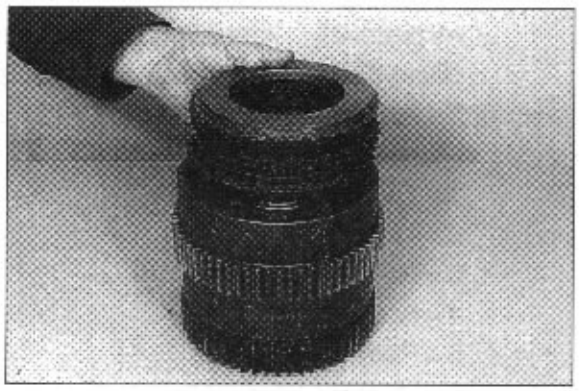


③ Install components 2~6, respectively 2~10 (Figure ②).
Replace thrust plate 1 and thread up spur gear until all inner plates are received.

※ Make thrust washers as well as cylindrical rollers adhere with grease.

Plate pack K1

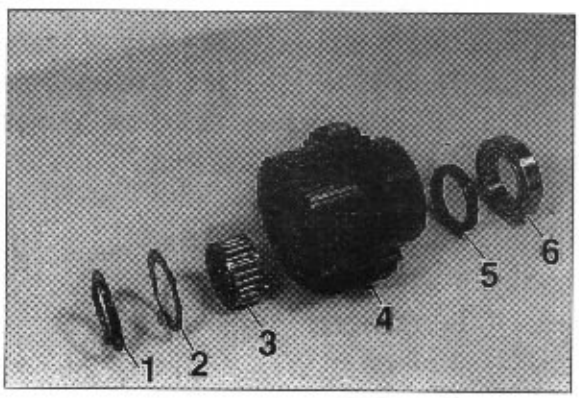
※ Install plate pack and check clearance.



Pre-assemble and install spur gear K1

※ According to the transmission version, respectively operating conditions, different spur gear bearings are possible (Figure ⑤, ⑥, ⑦).

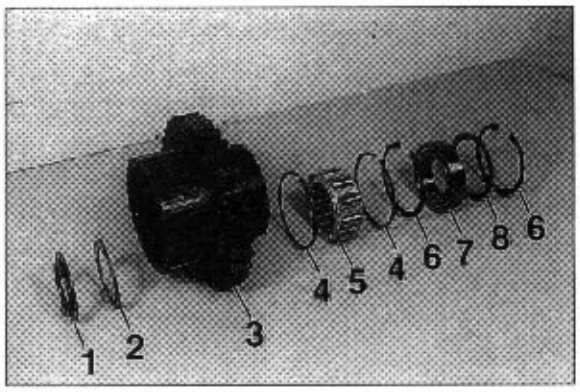
⑤ Spur gear bearing K1, version **A.**
1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Sleeve
6 = Ball bearing



⑥ Spur gear bearing K1, version **B**.

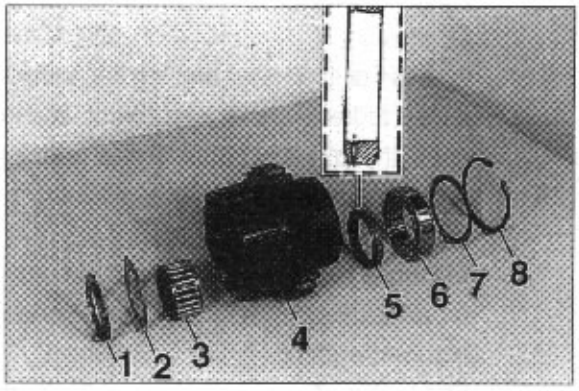
1 = Thrust plate
2 = Thrust washer
3 = Spur gear
4 = Angle ring
5 = Roller cage
6 = Circlip(2x)
7 = Ball bearing
8 = Disk(Optional)

※ Make thrust washer(2) adhere with grease.
Install broad butting faces of angle rings(4) always facing the bearing rollers.
Adjust ball bearing(7) free of play by means of disk.



⑦ Spur gear bearing K1. Version **C**(K1-fixing, figure ⑦, ⑧).

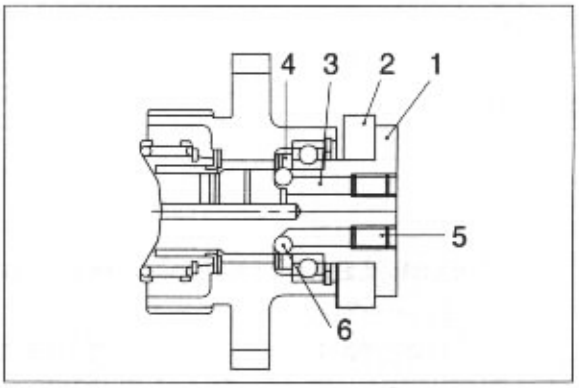
1 = Thrust plate
2 = Thrust washer
3 = Needle cage
4 = Spur gear
5 = Sleeve
6 = Ball bearing
7 = Disk(Optional)
8 = Circlip



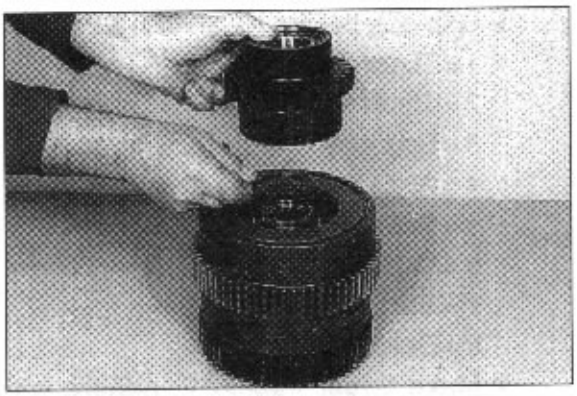
※ Make thrust washer adhere with grease. Pay attention to the installation position of the sleeve. (Figure ⑦).
Adjust ball bearing(6) free of play by means of disk.

⑧ Figure on the right shows the fixing of the spur gear after the installation of the clutch.

1 = Clutch shaft
2 = Housing
3 = Cylindrical roller
4 = Sleeve
5 = Set screw
6 = Ball

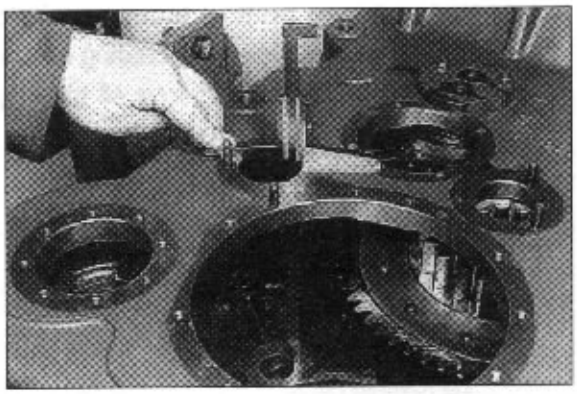


⑨ Install components according to figure ⑤, ⑥, ⑦.
Replace thrust plate(1) and thread up spur gear until all inner plates are received.

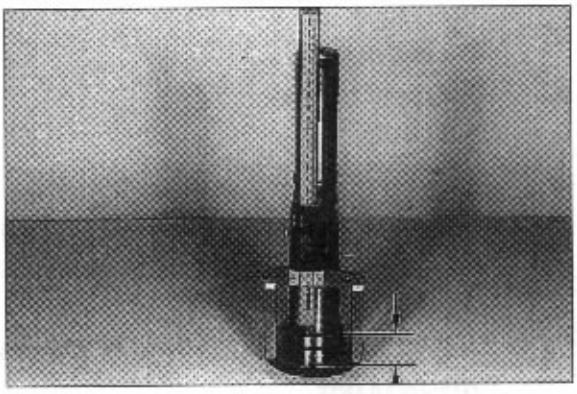


Install clutch KV/K1

⑩ Adjust end play of clutch 0.1 ~ 0.3mm
Determine dimension Ⅰ from the flange-mounted surface/axle to the plane surface/housing.
Dimension Ⅰ 254.40mm
In case of spur gear bearing KV, version **B**, lay forked washer and thrust washer upon the plane surface of the housing and measure up to the thrust washer.



⑪ Measure dimension Ⅱ from the butting face/bearing rollers to the flange-mounted surface.
Dimension Ⅱ 27.00mm



⑫ **EXAMPLE J**, for the determination of the housing dimension.

Dimension Ⅰ	254.40mm
Dimension Ⅱ	- 27.00mm
Difference = Housing Dimension	227.40mm

⑬ Place clutch on a suitable surface plate and determine dimension Ⅲ from the end face of the bearing inner race to the surface plate.

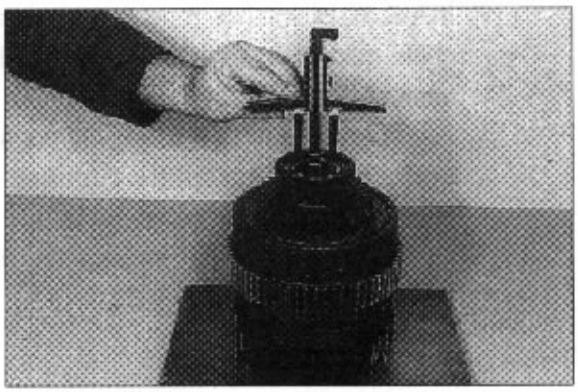
Dimension Ⅲ 223.80mm

- **EXAMPLE K**, for the determination of the installation dimension.

Dimension Ⅲ 223.80mm
End play + 0.20mm
Gives installation dimension
- Clutch 224.00mm

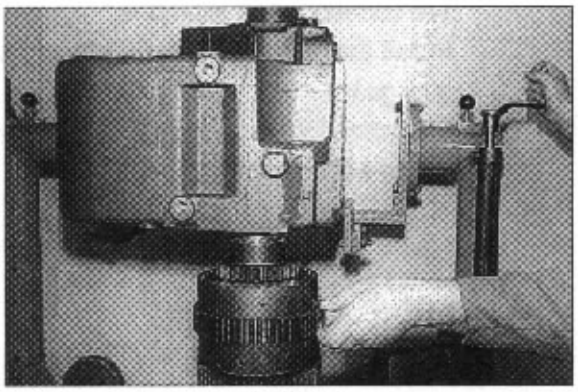
- **EXAMPLE L**, for the determination of the shim.

Housing dimension 227.40mm
Installation dimension
- Clutch -224.00mm
Difference = Shim s = 3.40mm

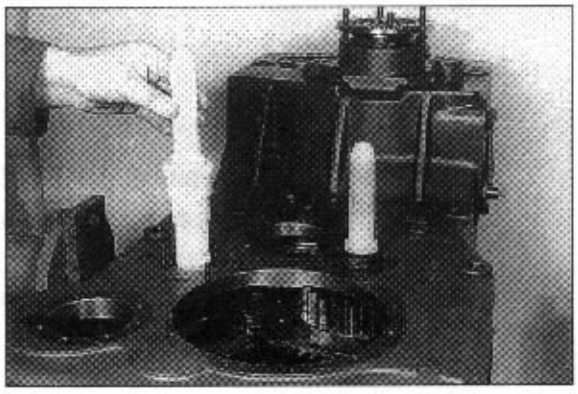


⑭ Insert clutch KV/K1 by means of lifting device in the housing and position it.

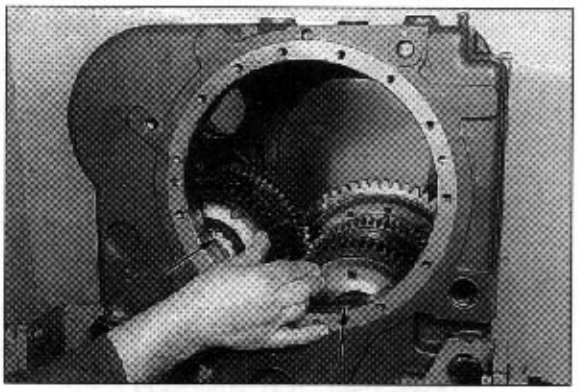
※ For different transmission variants, the output gear of the lateral power take-off must be installed prior to the installation of the clutch axles KV/K1 and KR/K2 (Narrow installation space).



⑮ Align the two clutches(KV/K1 and KR /K2) by means of drift and fix them provisionally.

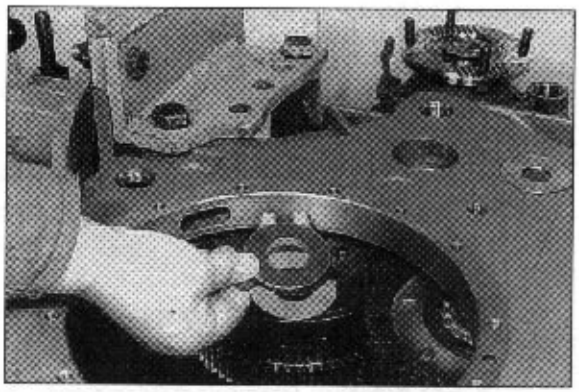


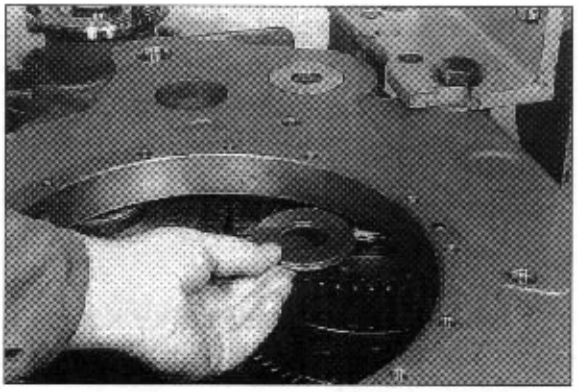
⑯ Install thrust washer, forked washer and shim, respectively shim(According to the version).
For the moment, tilt housing 90 degree and place the complete clutches in direction of arrow against shoulder.
Now, tilt gear case forward in the horizontal position.



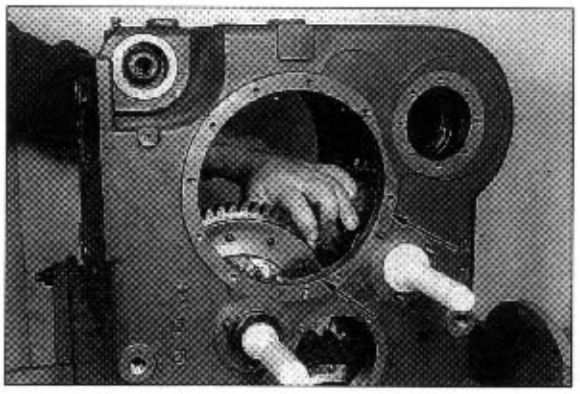
⑰ Pull drift downward until the thrust washer, forked washer and shim, respectively the shim can be installed.
Now, align the complete clutch as well as the shims again, using drift, and fix them.

※ Shim thickness for KV/K1 and KR/K2, see corresponding examples.
Install thrust washer(Plastic) facing the spur gear.
Pay attention to a correct fixing of the forked washer.

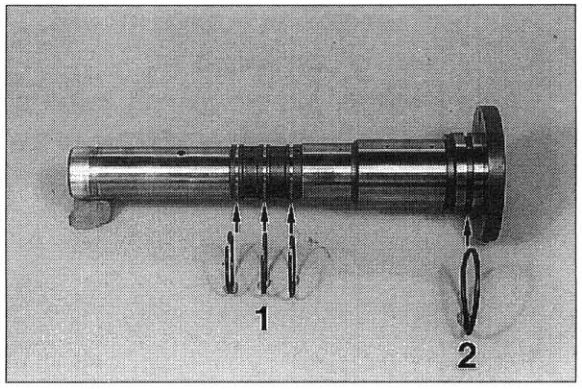




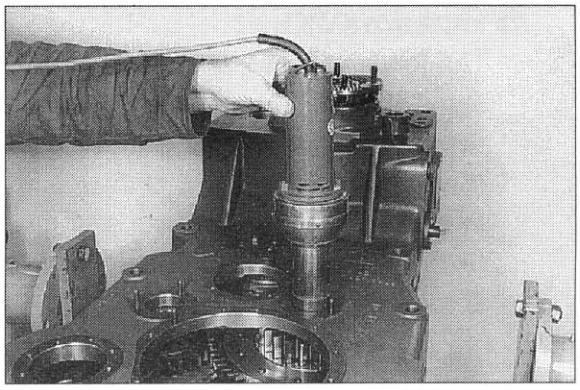
⑱ Tilt gear case in a vertical position(90 degree) and place the complete clutches in direction of arrow against shoulder.
Now, tilt forward in the original position. (Figure ⑮).



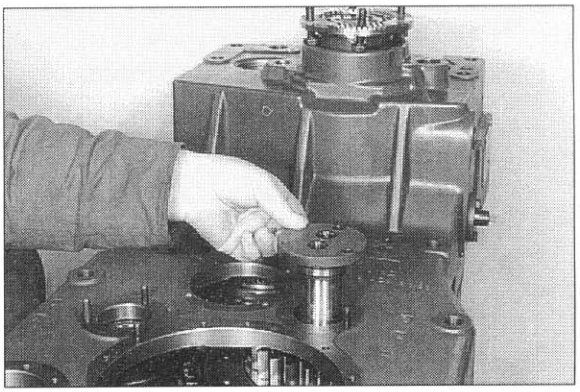
⑲ Install axle KR/K2
Squeeze in rectangular rings(1) and engage them.
Install O-ring(2).
※ Grease rectangular rings and align them centrically.



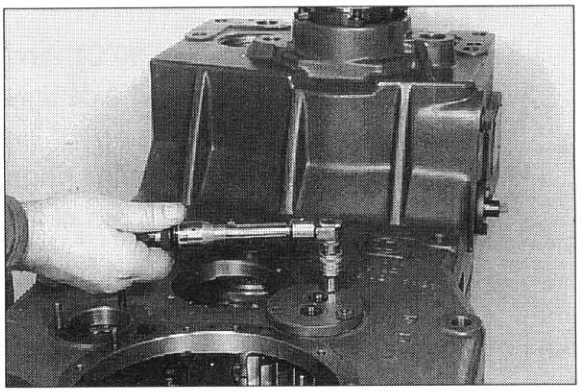
⑳ Heat housing bore(About 90°C).



㉑ Thread up axle(Complete) until contact is obtained.

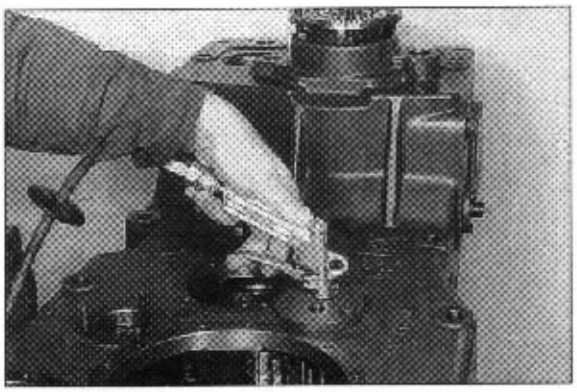


㉒ Fasten axle by means of hexagon nuts.
· Torque limit(M8/8) 2.3kg · m(17.0lb · ft)



㉓ Check operation of clutches KR and K2 by means of compressed air.

※ If the components are correctly installed, the closing, respectively opening of the clutches is clearly audible.

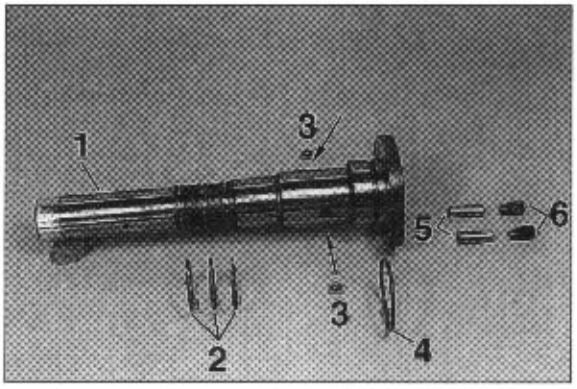


㉔ Install axle KV/K1.

※ The following steps are describing the installation of the clutch axle for the version with internal spur gear fixing K1 (See also figure ⑦, ⑧).
In case of the version without spur gear fixing, install the clutch axle KV/K1 accordingly as KR/K2(Figure ⑲ ~ ㉓).

㉕ The illustration on the right shows the components.

1 = Clutch axle
2 = Rectangular rings (3 Pieces)
3 = Ball (2 Pieces)
4 = O-ring
5 = Cylindrical roller (2 Pieces)
6 = Set screw (2 Pieces)

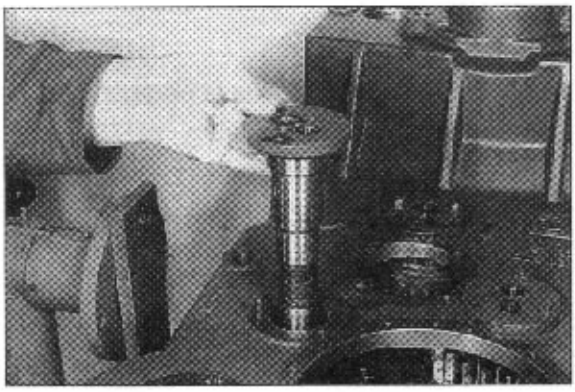


㉖ Squeeze in and engage rectangular rings. Install O-ring.
Insert the two balls with grease in the bores(Arrow).

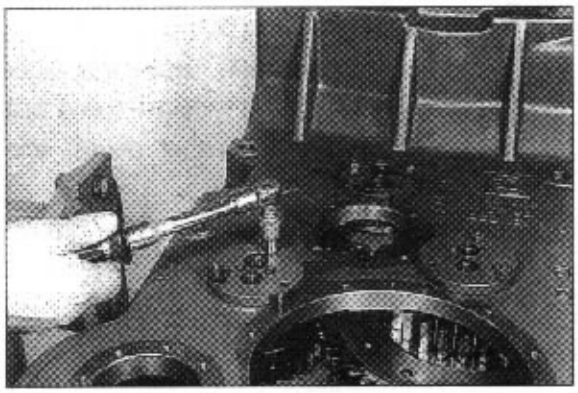
※ Cylindrical rollers and set screws will be installed later.

㉗ Heat housing bore(About 90°C) and introduce the pre-assembled axle until contact is obtained.

※ Grease and align rectangular rings centrically prior to the introduction of the axle.

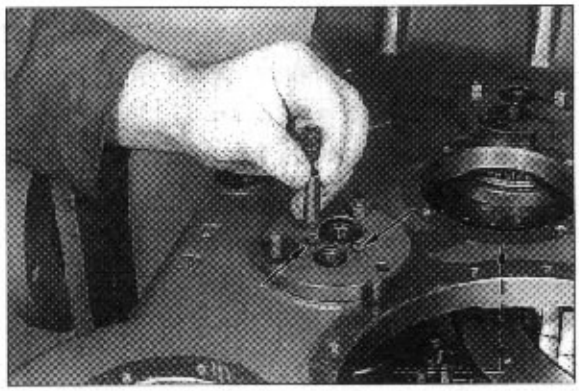


㉘ Fasten axle by means of hexagon nuts(2 pieces).
Torque limit(M8/8.8) 2.3kg · m(17.0lb · ft)



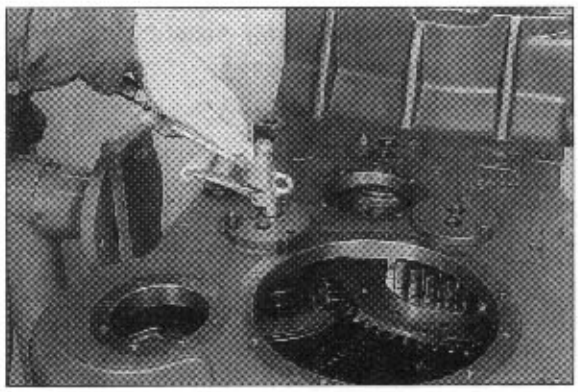
㉙ Insert cylindrical rollers with the conical surface showing downward in the bores (Arrows), and fix them by means of set screws.
Torque limit 1.0kg · m(7.4lb · ft)

※ To ensure the correct fixing of the spur gear, the spur gear K1 must be lifted, at the uniform tightening of the two set screws, in direction of the arrow.
Insert set screws with loctite.

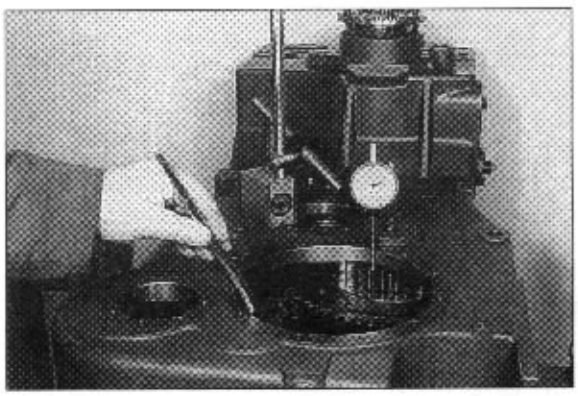


㉚ Check operation of the clutches K1 and KV by means of compressed air.

※ If the components are correctly installed, the closing, respectively opening of the clutches is clearly audible.

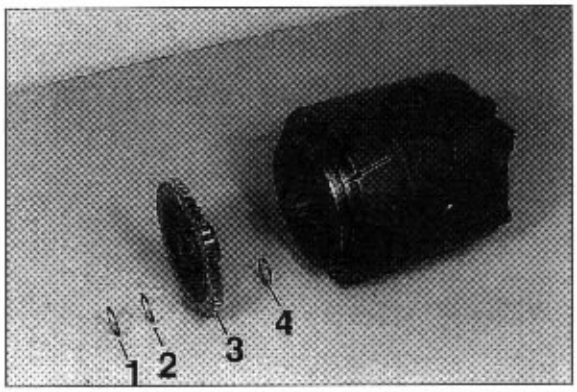


㉛ Check end play of the clutches 0.1~0.3mm again and correct if necessary.



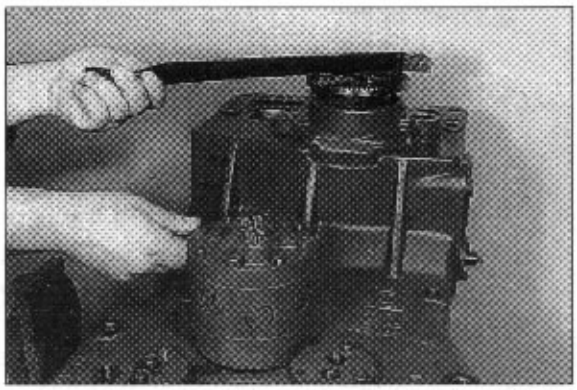
(7) Emergency steering pump

① Squeeze in circlip(4), assemble spur gear(3) until contact is obtained and fix it free of play by means of disk(2) and circlip(1).
Introduce O-ring into the annular groove (Arrow) and grease it.

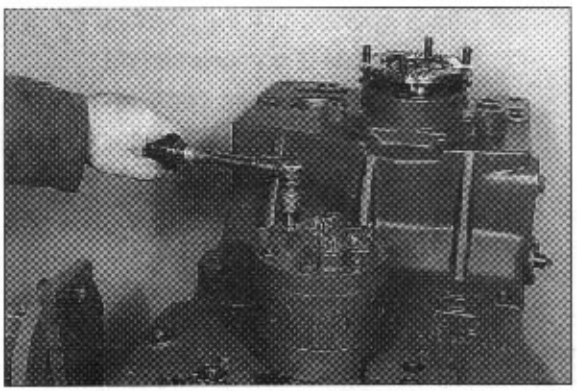


② Insert studs(4 Pieces) with loctite and assemble emergency steering pump until contact is obtained.

※ Pay attention to the radial installation position.
A slight rotation on the final drive makes the threading up easier.

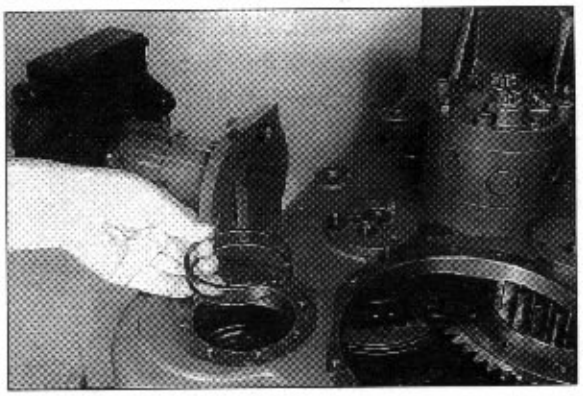


③ Fasten emergency steering pump by means of hexagon nuts.
Torque limit(M8/8) 2.3kg · m(17.0lb · ft)



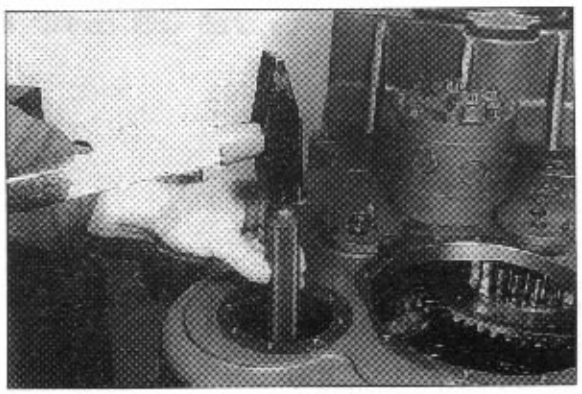
(8) Lateral power take-off

① Squeeze the two snap rings into the groove of the lower housing bore.

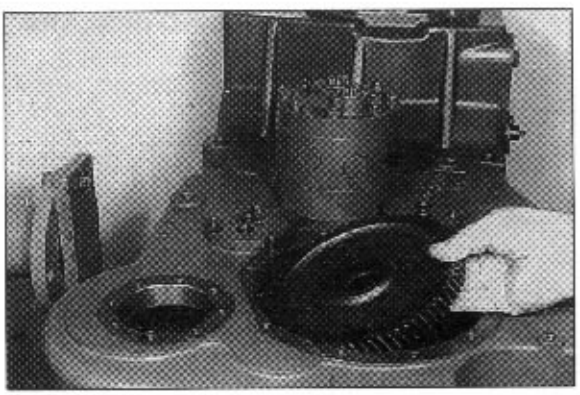


② Lay expanding ring(S) upon the snap rings and mount ball bearing, with the recess showing upwards.

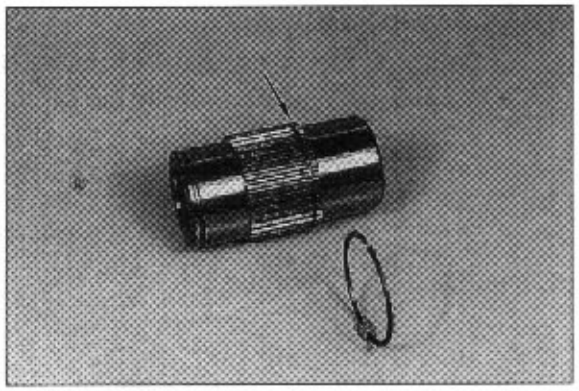
③ Now, tap and drive ball bearing in, until the upper snap ring engages in the ball bearing groove.



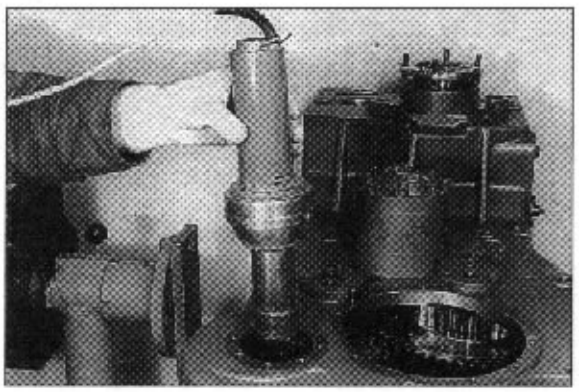
④ Position spur gear with the long hub side showing downward.



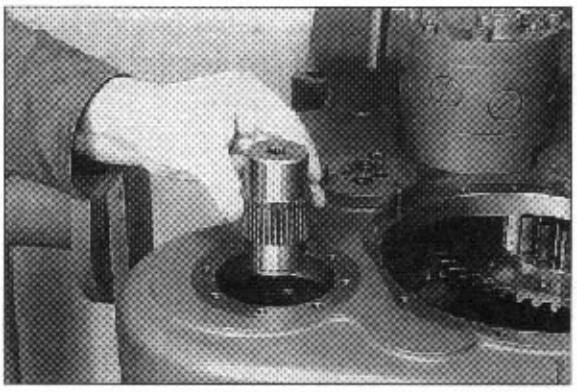
⑤ Squeeze snap ring into the annular groove(Arrow) of the driving shaft.



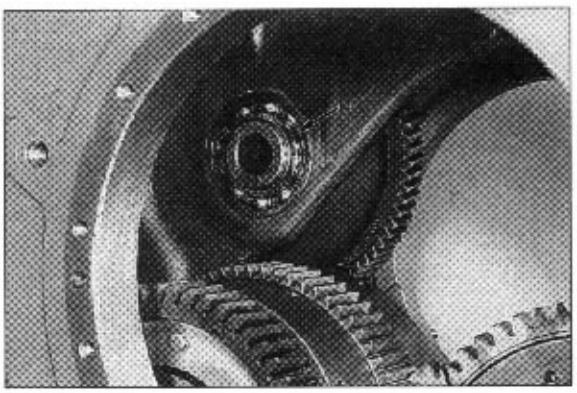
⑥ Heat ball bearing.



⑦ Introduce driving shaft until contact is obtained.

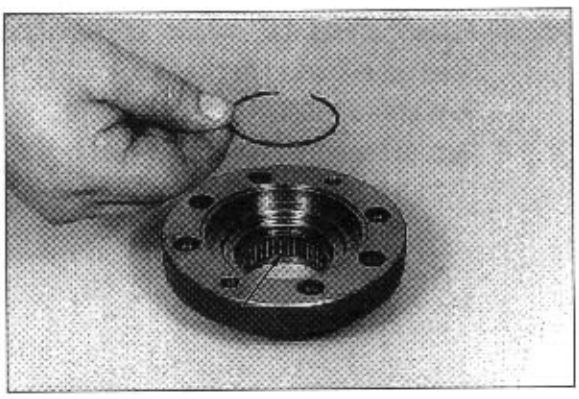


⑧ Fix driving shaft by means of circlip(Arrow).

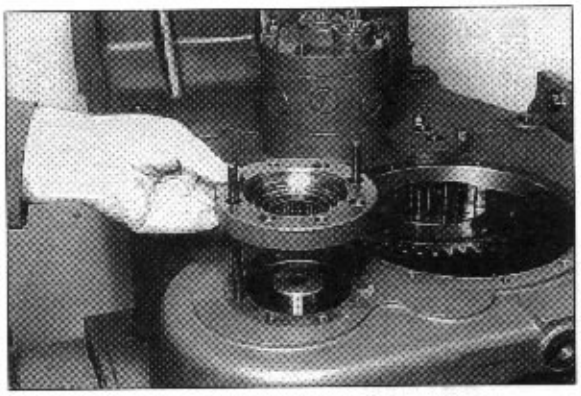


⑨ Press needle bush(Arrow) by means of drift into the pump flange until contact is obtained and fix it by engaging the snap ring.

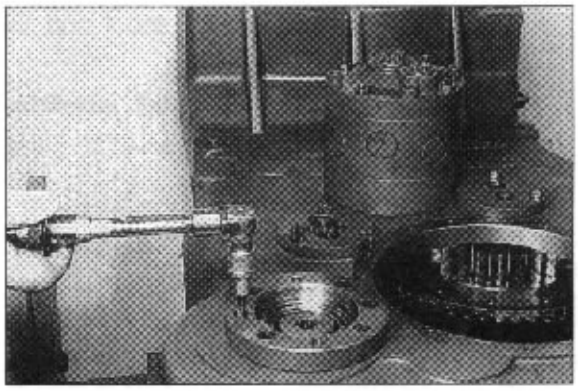
※ The needle bush is marked on one end face.
At the pressing in, the marking must be facing the drift(Upwards).



⑩ Install two adjusting screws(M8), mount flat gasket and place pump flange against shoulder.

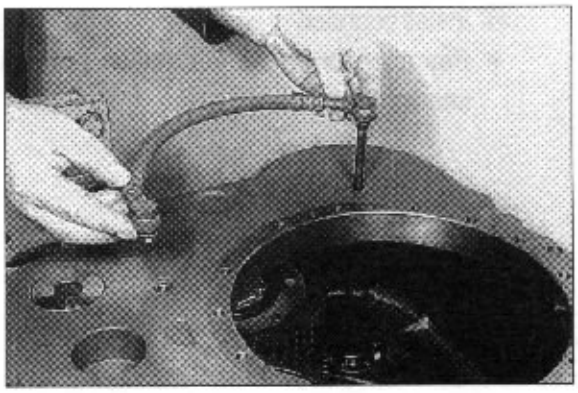


⑪ Fasten pump flange by means of socket head screws.
Torque limit(M8/8.8, DIN 6912)
1.6kg · m(11.8lb · ft)



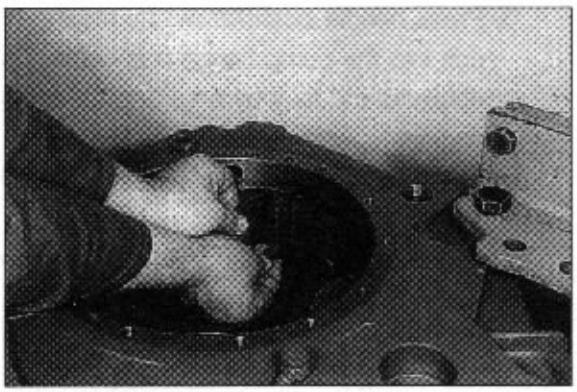
⑫ Install oil supply - power take-off.

※ Use new sealing rings.



⑬ Fasten shield by means of hexagon head screw(mount flat washer).
Torque limit(M8/8.8) 2.3kg · m(17.0lb · ft)

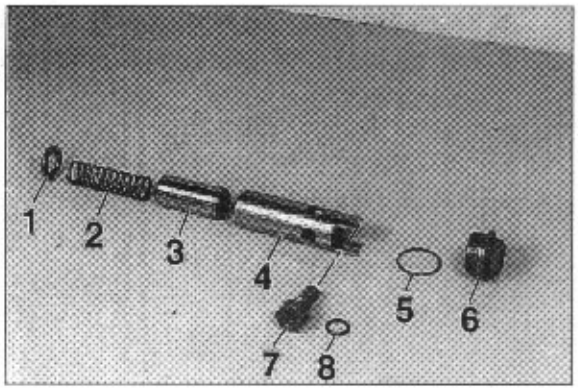
※ Secure hexagon head screw with loctite.



(9) Converter control valve

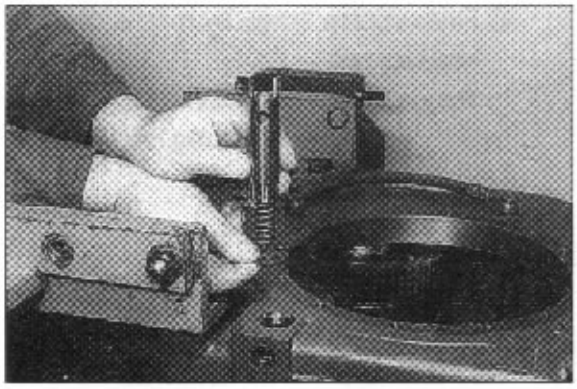
① Components

1 = Disk
2 = Spring
3 = Spool
4 = Valve sleeve
5 = O-ring
6 = Screw plug
7 = Connecting piece(Temperate)
8 = O-ring



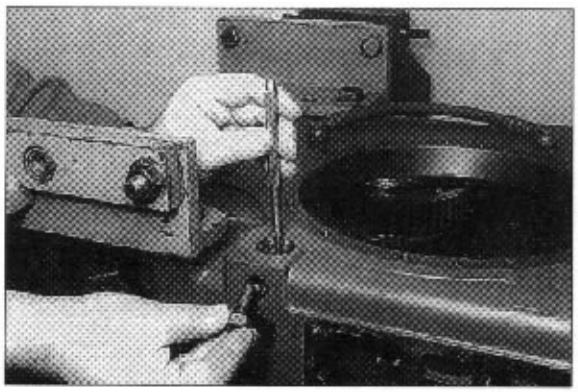
② Thread up disk, spring, spool and the valve sleeve.

※ Pay attention to the radial installation position of the valve sleeve.



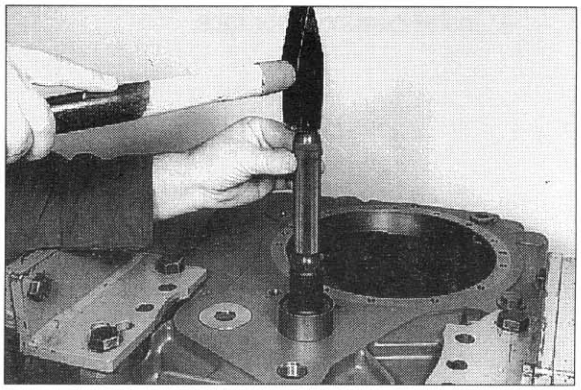
③ Install connecting piece.

※ Pay attention to the installation position, see figure ①.



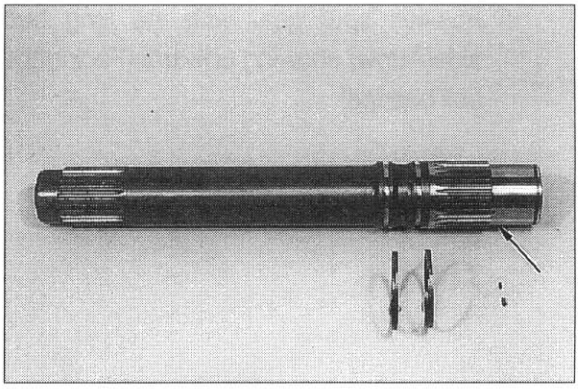
④ Install screw plug.

⑤ Mount closing cover until it is flush.
※ Wet sealing surface with loctite.

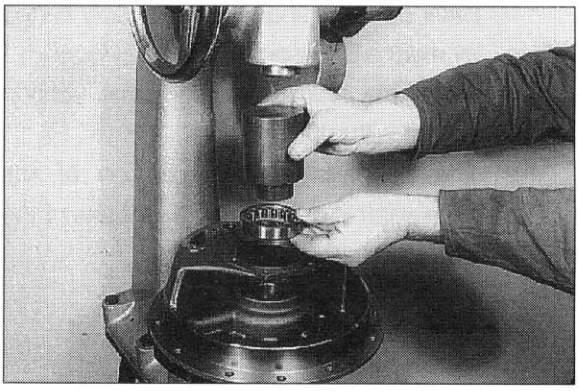


(10) Converter charge pump and control pressure pump

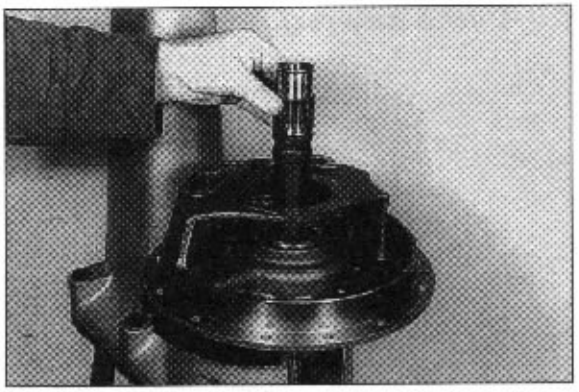
① Squeeze rectangular rings into annular grooves of the drive shaft and engage them.
Insert the two roll pins(1.5×5 and 2.5 x5mm) flush-mounted in the bore (Arrow).



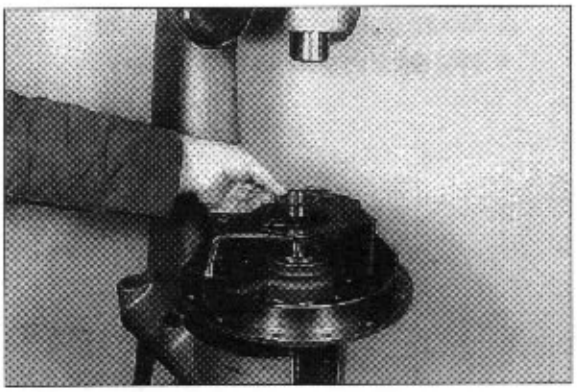
② Press bearing outer race firmly against shoulder.



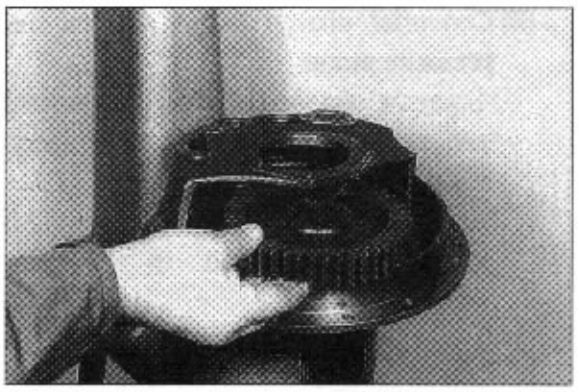
③ Thread up drive shaft.



④ Install bearing inner race.

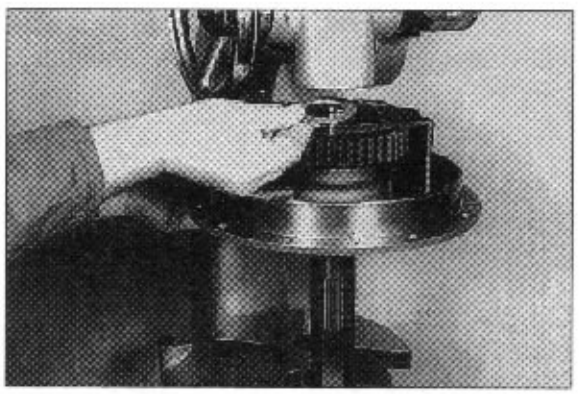


⑤ Position spur gear with the long hub side(Arrow) showing upwards(Facing the ball bearing).

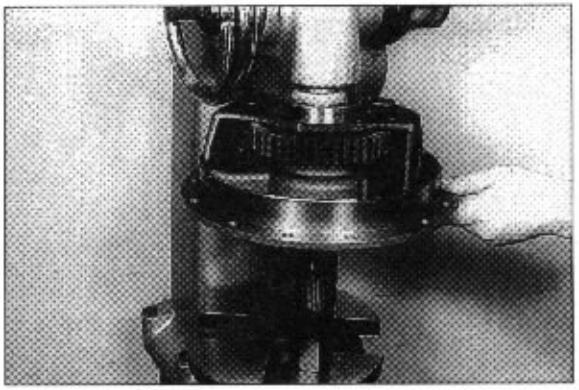


⑥ Back up drive shaft and oil supply flange by means of assembly aid(S).
Assemble disk(According to the version with or without).

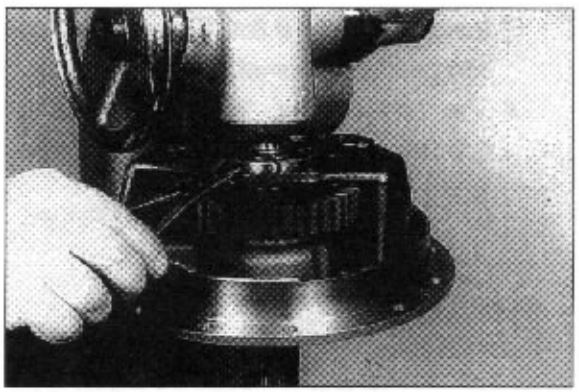
※ The exact installation position of the drive shaft is determined by means of the assembly aid.



⑦ Press ball bearing against shoulder.

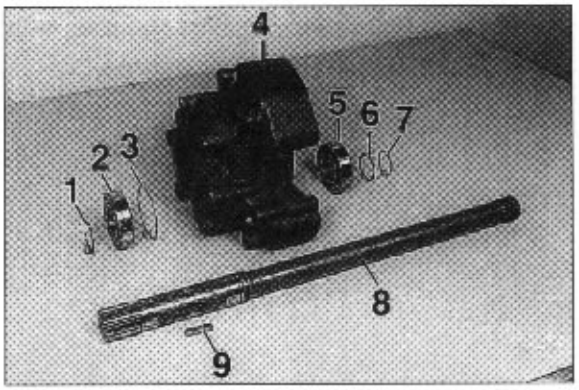


⑧ Squeeze circlip into the annular groove of the drive shaft.



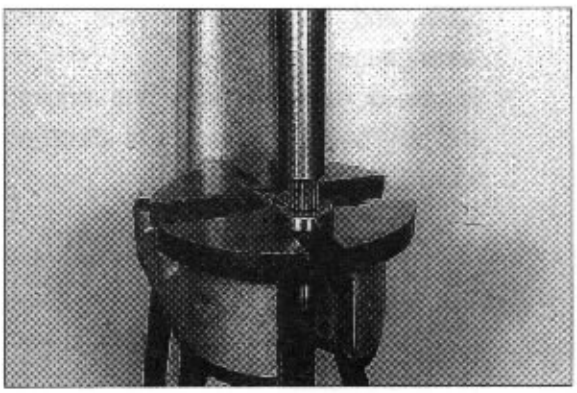
⑨ The Illustration on the right shows the output shaft along with bearing as well as the pump.

1 = Circlip
2 = Ball bearing
3 = Shim(Optional)
4 = Pump
5 = Ball bearing
6 = Circlip
7 = Rectangular ring
8 = Output shaft
9 = Adjusting spring

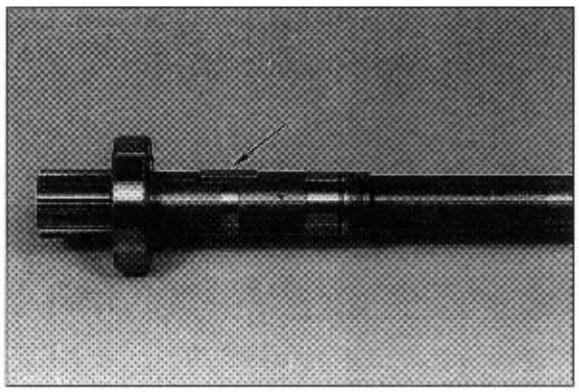


⑩ Squeeze in circlip(Arrow).
Press ball bearing against circlip until contact is obtained.

※ Pay attention to the installation position of the ball bearing, closed bearing side is gacing the circlip(Upwards)!

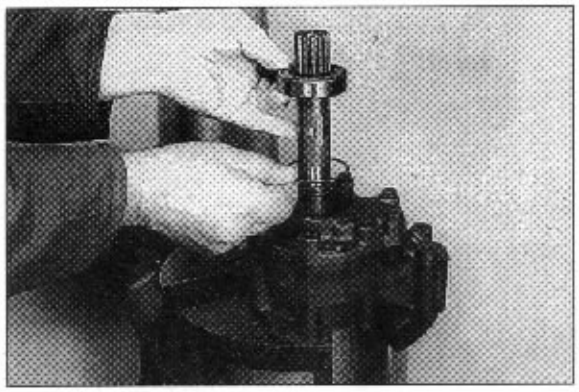


⑪ Install adjusting spring(Arrow).

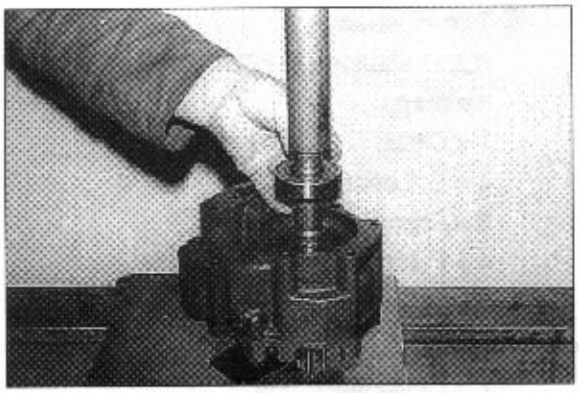


⑫ Install shim s = 0.8mm(Empirical value) and press output shaft against shoulder.

※ The end play of the output shaft of 0.2~0.4mm is adjusted by means of shim (s = 0.8mm).

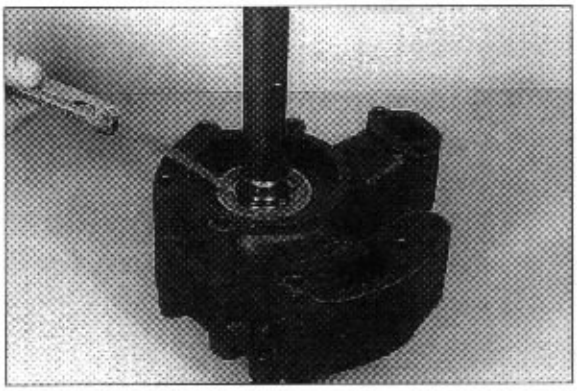


⑬ Press ball bearing against shoulder, with the closed side showing upwards.



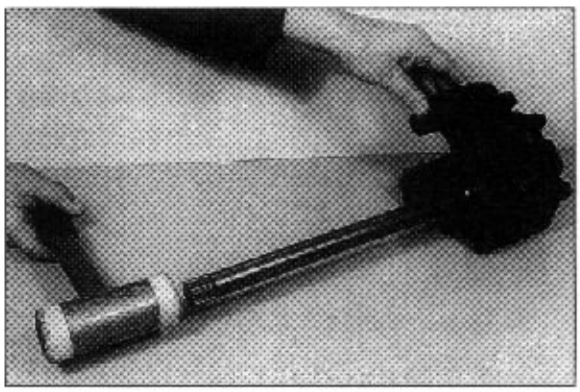
⑭ Squeeze in circlip.
Check end play 0.2~0.4mm between circlip and bearing inner race, using feeler gauge.

※ In case of deviations from the required end play, correct by means of shim(See figure ⑫).

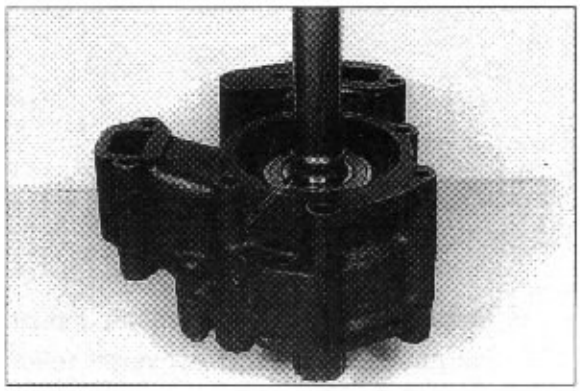


⑮ Relax the output shaft bearing by tapping.

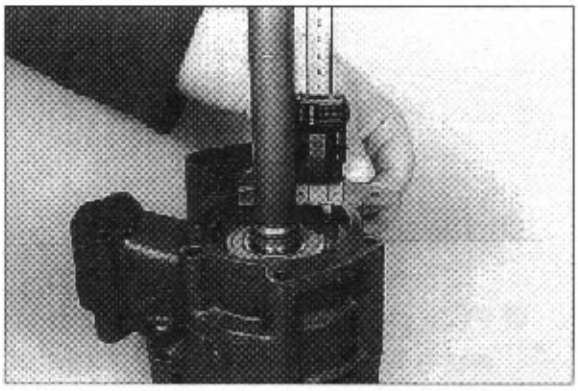
※ Use plastic hammer.



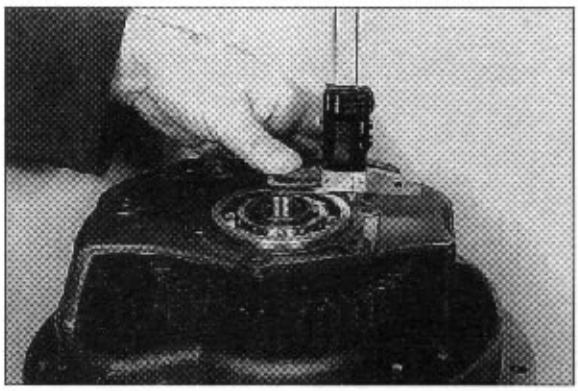
⑯ Squeeze in rectangular ring(Arrow) and engage it.
Now, grease rectangular ring and align it centrically.



⑰ Adjust the end play of the drive shaft bearing 0.2~0.4mm(Figure ⑰,**EXAMPLE M**).
Determine dimension Ⅰ from the flange-mounted surface to the contact area/ball bearing.
Dimension Ⅰ 7.10mm



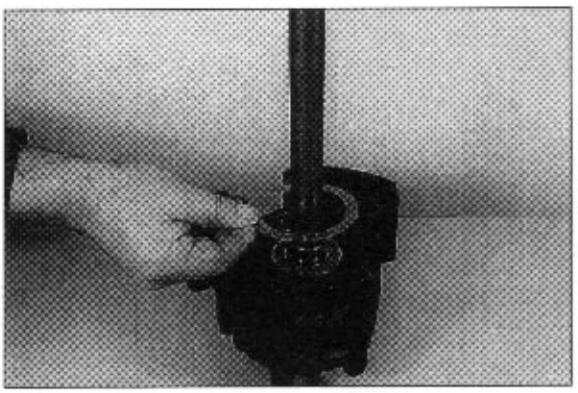
⑱ Replace gasket and measure dimension Ⅱ from the end face/ball bearing to the gasket(Flange-mounted surface).
Dimension Ⅱ 6.05mm



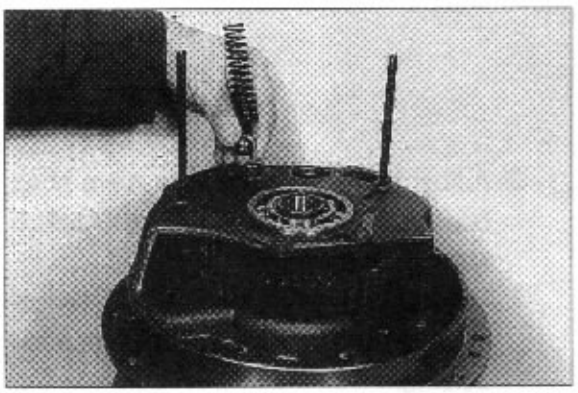
- **EXAMPLE M**

Dimension Ⅰ	7.10mm
Dimension Ⅱ	-6.05mm
Difference	1.05mm
Required end play	-0.30mm
Gives shim	s = 0.75mm

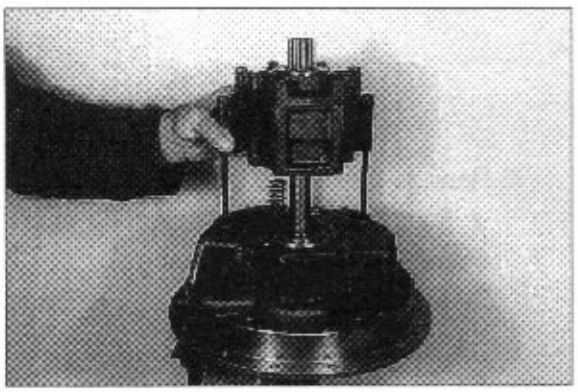
⑲ Make shim(s = 0.75mm) adhere with grease.



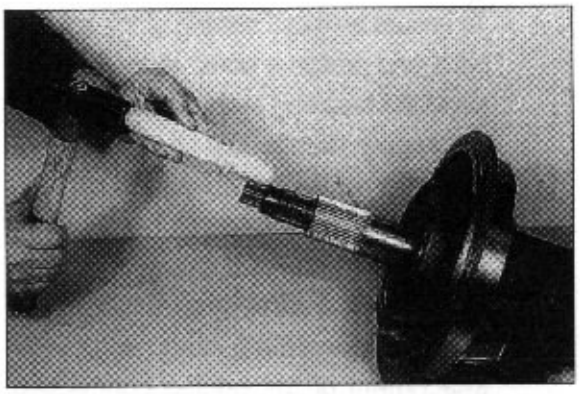
⑳ Install two adjusting screws (M8), mount flat gasket and install converter relief valve (Ball and spring).



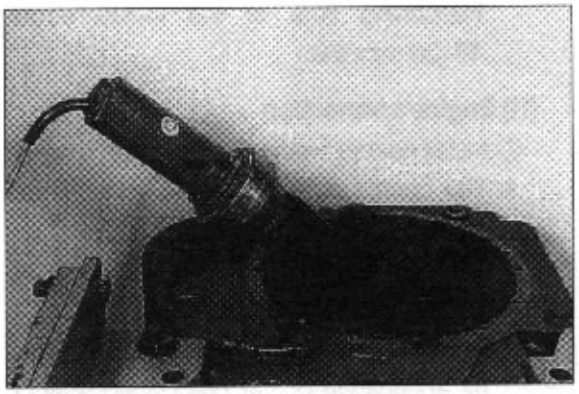
㉑ Place pre-assembled pump against oil supply flange and fasten it by means of hexagon head screws.
Torque limit(M8/8.8) 2.3kg · m(17.0lb · ft)



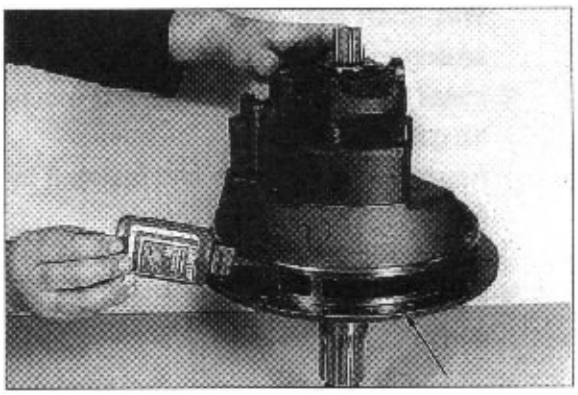
㉒ Relax the output shaft bearing by tapping and check the free movement of the spur gear.



㉓ Heat housing bore.

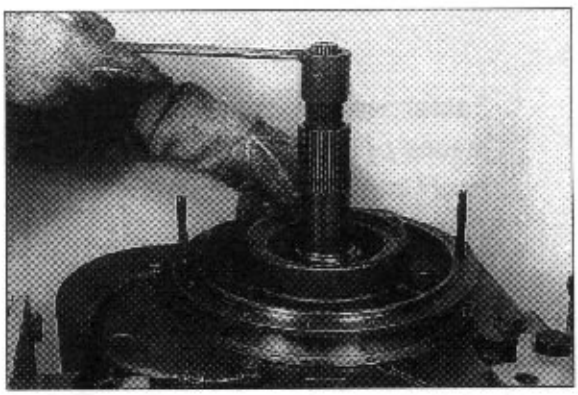


㉔ Wet oil supply flange in the area of suction ports and pressure ports with loctite.

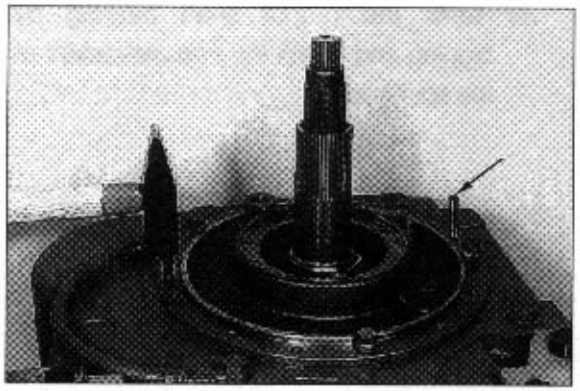


㉕ Install two adjusting screws. Install flat gasket(Arrow) and thread up oil supply flange until contact is obtained.

※ For different transmission versions, one O-ring must be installed instead of the flat gasket.
Installation position of the O-ring see arrow/see figure ㉑.



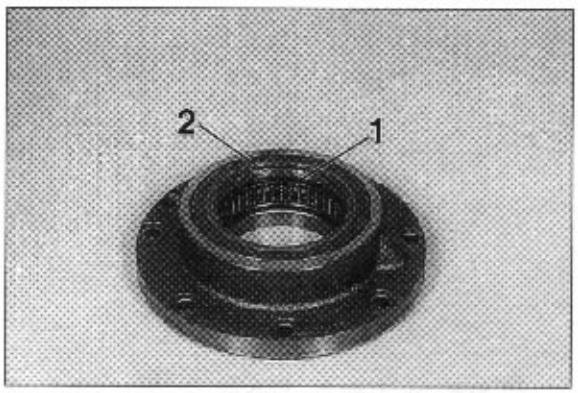
※ To ensure an exact sealing of the suction ports and pressure ports, respectively to avoid the breaking away of the loctite, fix oil supply flange by a provisional installation of the two outer roll pins(10 × 50mm) as well as hexagon head screws (3 Pieces) radially and axially, see figure on the right. The inner roll pins(6 × 50mm) are installed only after the attachment of the engine connecting case (Figure (11)-③).
Hardening time of the loctite about 10~30 minutes.



(11) Engine connection

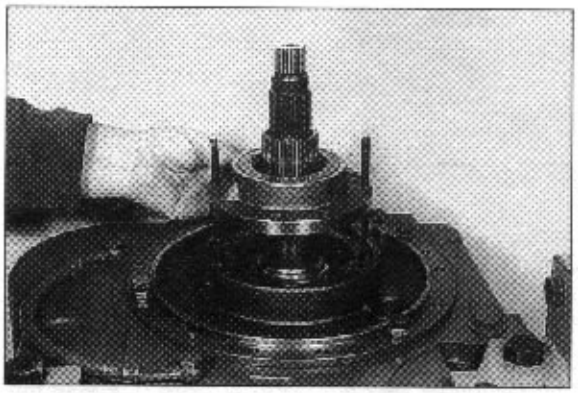
① Install needle bearing(1) and shaft seal(2).

※ The needle bush is marked on one end face.
At the pressing in, the marking must be facing the drift(Upwards).
The exact installation position is obtained by application of the prescribed special tool.
Wet shaft seal outer diameter with sealing compound.

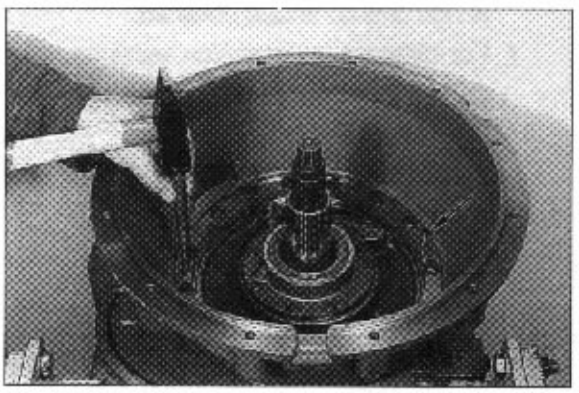


② Install two adjusting screws and mount flat gasket.
Assemble bearing cap and fasten it by means of hexagon head screws.
Torque limit(M8/8.8) 2.3kg · m(17.0lb · ft)

※ Pay attention to the radial installation position.

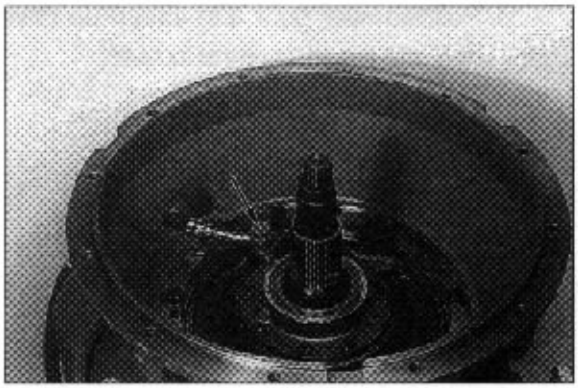


③ Fasten engine connecting case by means of hexagon head screws and mount the two inner roll pins(6 × 50mm).
Torque limit(M10/10.9)
6.7kg · m(50.1lb · ft)



④ Mount oil line(Arrow).

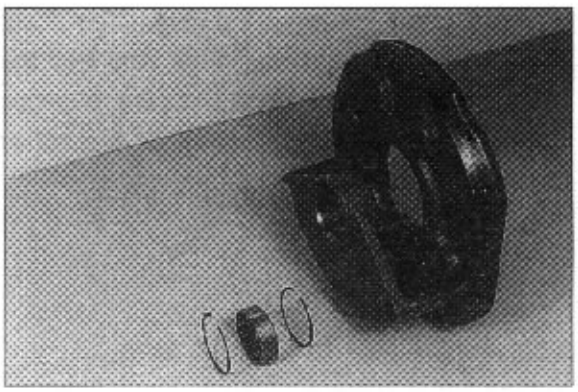
※ Use new sealing rings.



(12) Coaxial power take-off(Controllable)

① Install snap rings and needle bush.

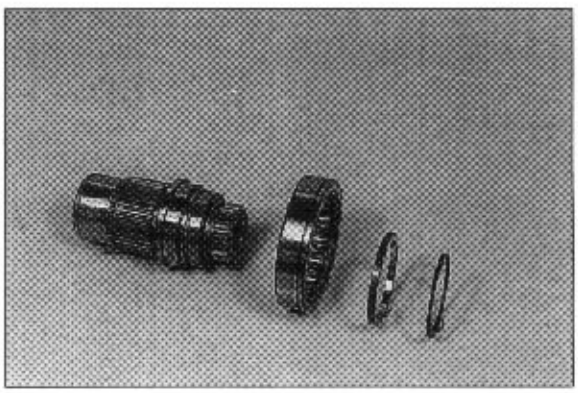
※ The needle bush is marked on one end face.
At the pressing in, the marking must be facing the drift.



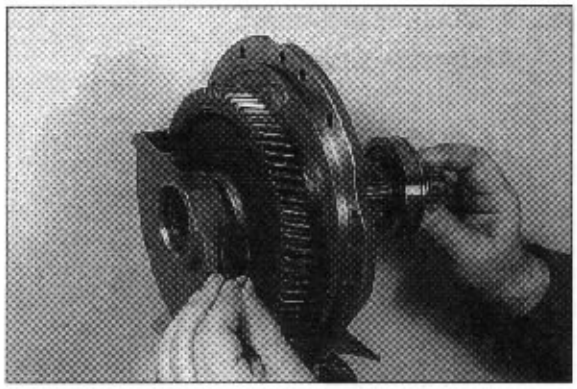
② Squeeze the two snap rings into the annular groove of the housing.

③ Assemble roller cage and collar shim, and fix them by means of circlip.

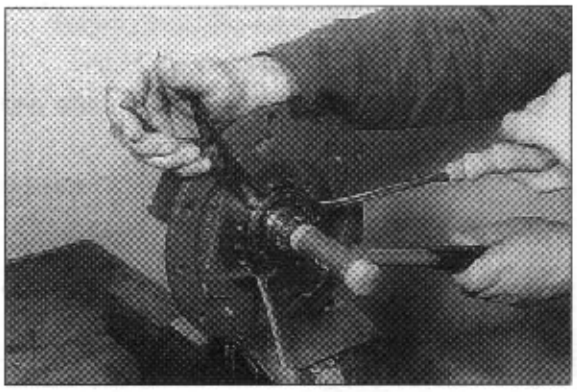
※ Pay attention to the installation position of the roller cage(Annular groove).



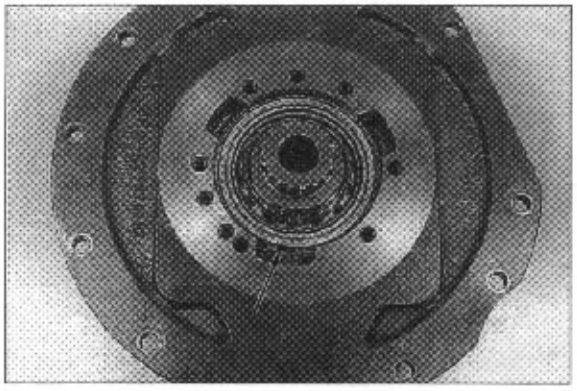
④ Position spur gear and thread up drive dog until the snap ring is located.



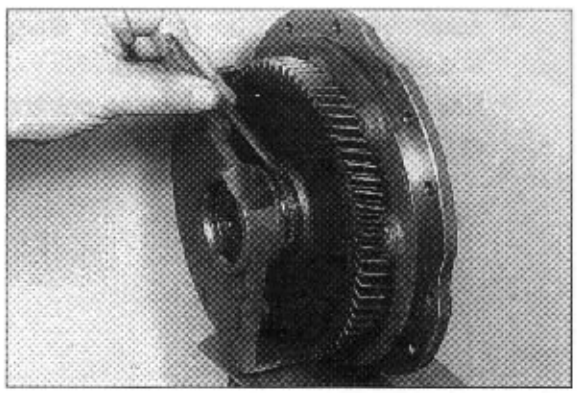
⑤ Expand the two snap rings, align them centrically and tap drive dog into the housing until the first snap ring engages in the annular groove of the roller bearing.



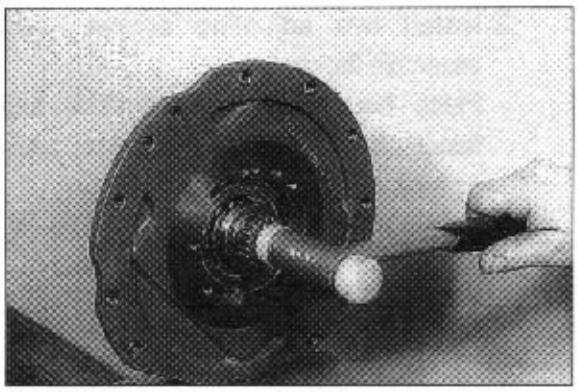
⑥ The illustration on the right shows the installation position of the snap rings, see arrow.



⑦ Locate snap ring finally, thus fixing the spur gear.

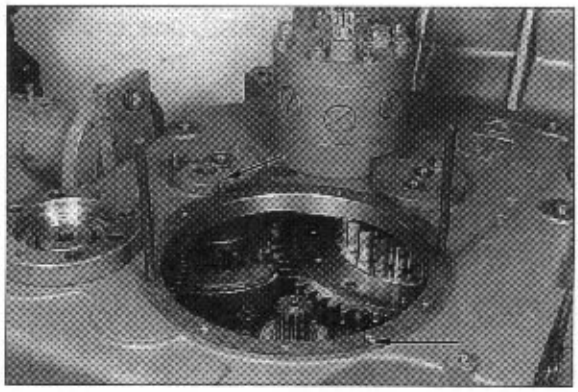


⑧ Relax the bearing by tapping.

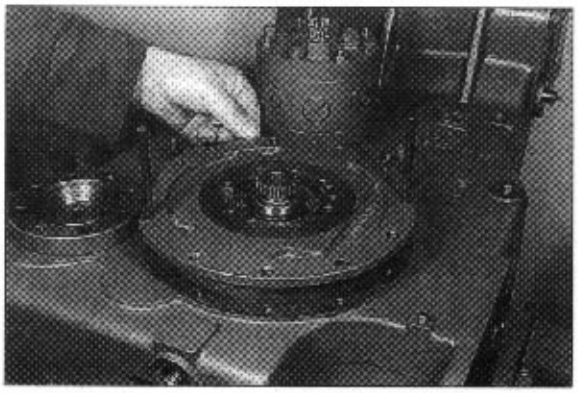


⑨ Insert stud(Arrow 1), install two adjusting screws and assemble flat gasket(Arrow 2).

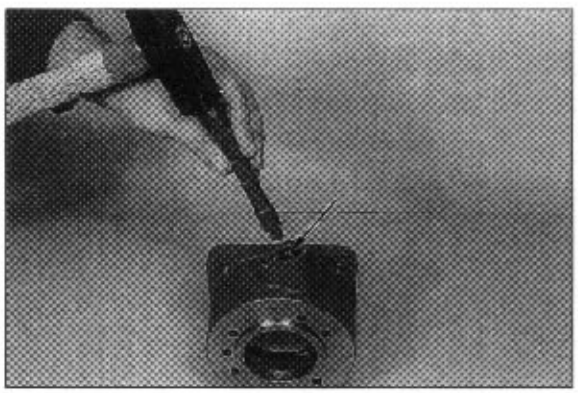
※ Insert stud with loctite.



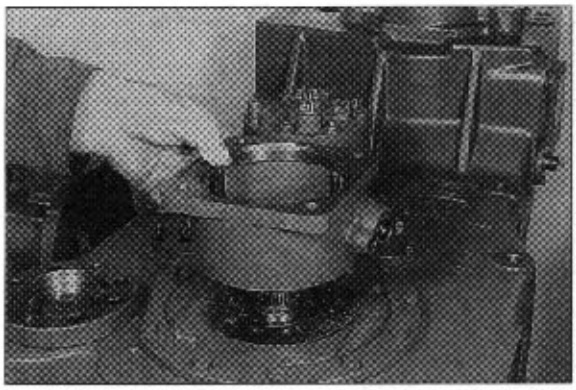
⑩ Thread up pre-assemble power take-off and fasten it by means of hexagon head screws and hexagon nuts.
Torque limit(M8/8.8) 2.3kg · m(17.0lb · ft)



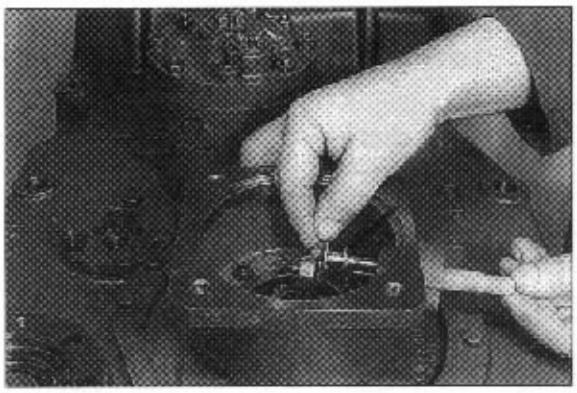
⑪ Install shaft seal(Arrow) flush-mounted with the sealing lip showing inwards.



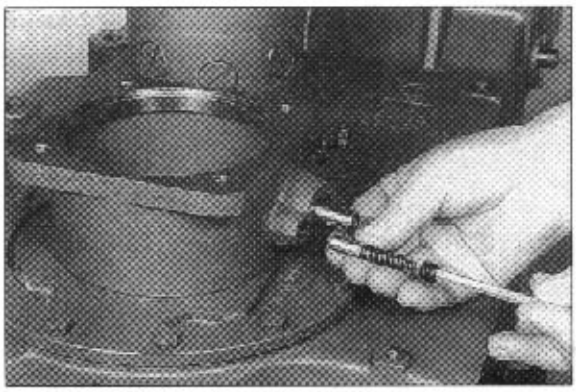
⑫ Install two adjusting screws and assemble flat gasket.
Place housing against shoulder and fasten it by means of socket head screws.
Torque limit(M8/10.9) 3.5kg · m(25.1lb · ft)



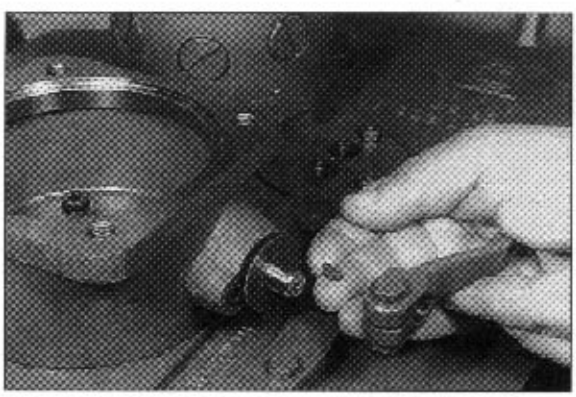
⑬ Install shim(s= 3.0mm), see arrow and thread up shift fork.
※ Use installer(S).



⑭ Thread up locking device composed of pin and two compression springs, and fix it by means set screw.
※ Insert the set screw with loctite.

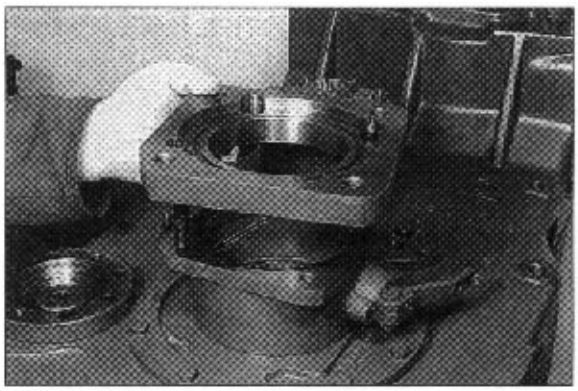


⑮ Assemble shim(s= 1.5mm) and install adjusting spring.
Install shift lever free of pressure(A small end play is permitted), and fix it by means of hexagon head screw.



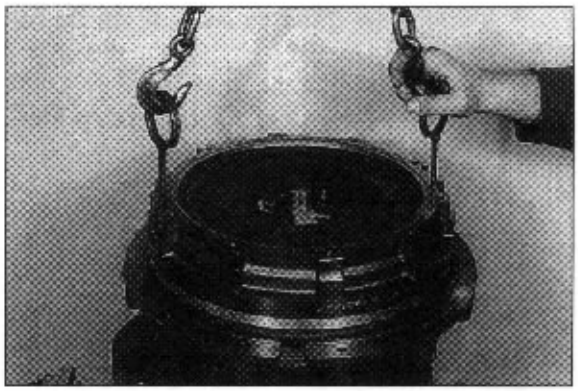
⑯ Insert O-ring(Arrow), assemble pump flange and fasten it by means of socket head screws.
Torque limit(M12/8.8 DIN 7984)
5.6kg · m (40.6lb · ft)

※ Pay attention to the radial installation position of the pump flange.
Install sliding collar and sliding block prior to the reassembly of the pump.

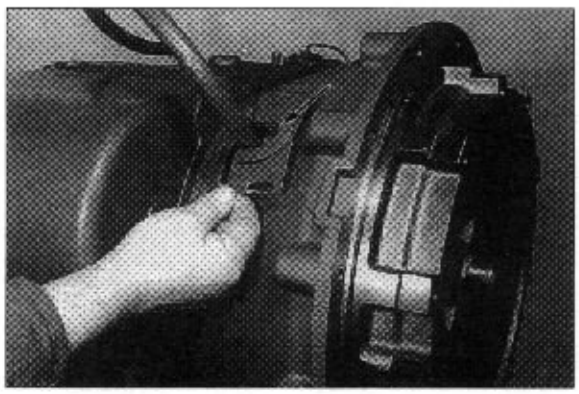


※ The following description and illustrations show the attachment and installation of different assemblies and components, in relation to a specific transmission variant.
Deviating steps of other possible versions can be carried out without difficulty by trained personnel.
In this connection, see also the perspective illustration of the corresponding spare parts lists.

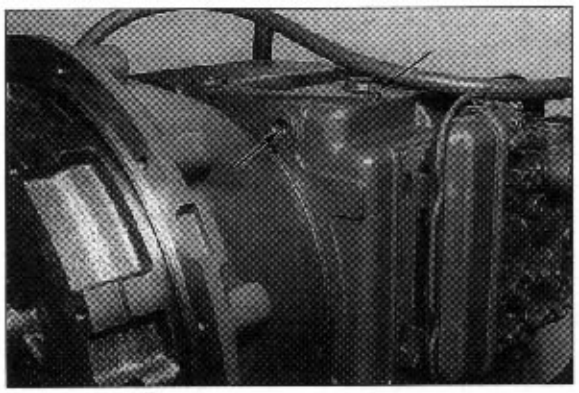
⑰ Thread up torque converter by means of lifting device until contact is obtained.



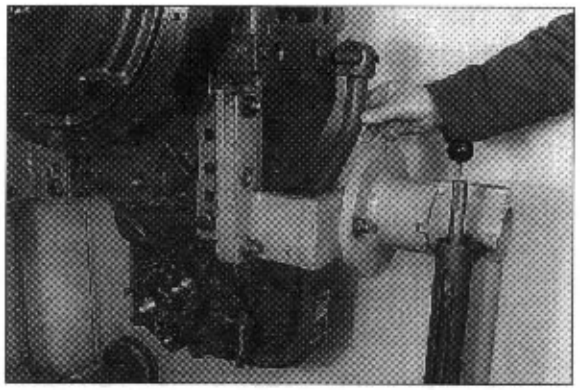
⑱ Mount edge protection(Arrow) and fasten cover plate by means of hexagon head screws(Mount flat washers).
Torque limit (M6/8.8) 0.97kg · m(7.0lb · ft)



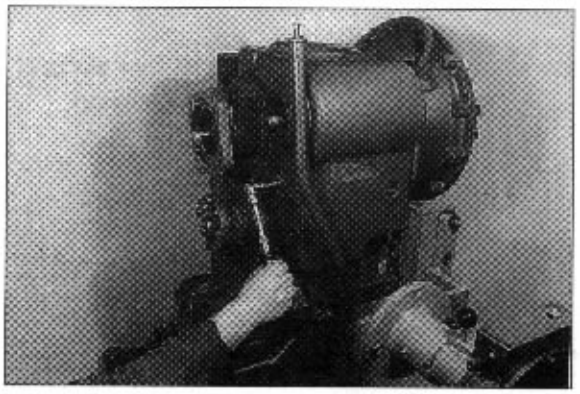
⑲ Install screw plug(Arrow 1) and breather (Arrow 2).



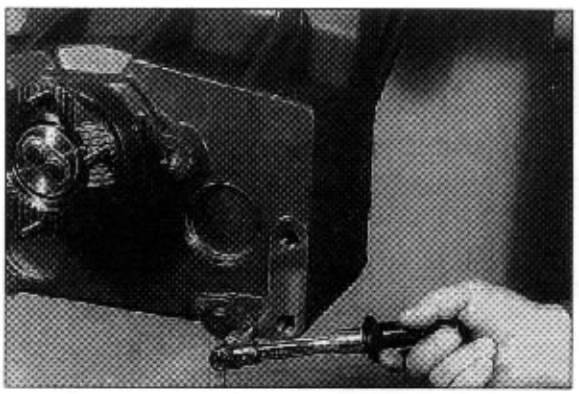
⑳ Mount suction pipe.
※ Install new gaskets.



㉑ Install oil level pipe.
※ Install new gaskets as well as baffle plate.

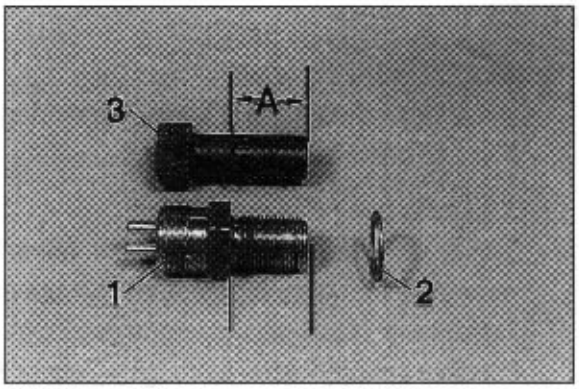


㉒ Install complete cover plate.
※ Install new gaskets.

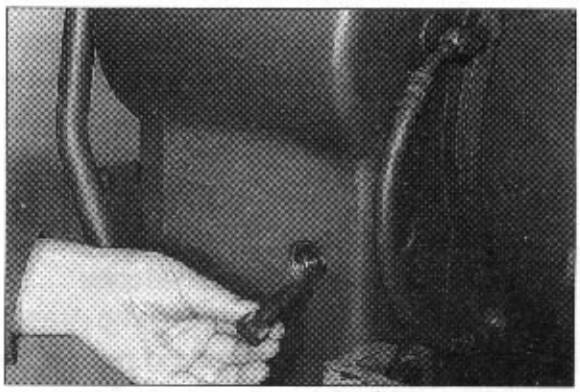


(13) Inductive transmitter

① Adust required gap $0.5^{+0.3}$mm between the contact area/inductive transmitter and the spur gear(Tooth tip).
Figure on the right to **EXAMPLE N.**
1 = Inductive transmitter
2 = Shim
3 = Measuring ping



② Insert measuring pin until the end face has got contact on the tooth tip of the spur gear as well as the circlip is located on screwing surface of the housing.
※ The tooth tip must be centrically located to the housing bore, if necessary, align the spur gear accordingly.



③ Remove measuring pin and measure dimension **A** from the end face /measuring pin to the circlip(See ①).
Dimension **A** 26.00mm

④ Determine dimension **B** from the contact surface/inductive transmitter to the contact area(See ①).
Dimension **B** 27.10mm

- **EXAMPLE N**

Dimension **A**	26.00mm
Required gap	- 0.60mm
Difference = Adjustment dimension	25.40mm
Dimension **B**	27.10mm
Adjustment dimension	-25.40mm
Difference = Shim(s)	1.70mm

⑤ Assemble corresponding shim and install the inductive transmitter.
※ Wet thread of inductive transmitter with sealing compound.

3. AXLE

1) GENERAL INSTRUCTIONS

Before starting operations for disassembling, overhauling and reassembling the following points should be borne in mind.

(1) Cleaning components

△ **Never use gasoline, solvents or other inflammable fluids to clean components. Use approved commercial solvents that are uninflammable and non-toxic.**

① Maximum cleanness is recommended when working on an assembly, consequently, all components should be thoroughly cleaned before reassembly.

② Ambient where operations are carried out should be dust free and as clean as possible.

③ Make sure that tools and equipment are at hand, particularly those listed and shown in this manual. Components that have been misplaced may be cause of failures on assembly operations as well as chips or foreign matters.

④ When overhauling the assembly we suggest to replace the following parts with new ones:

- Seal rings
- Gaskets
- O-ring
- Threaded rings with notched collar
- Any component damaged during disassembly

⑤ In case of failure and breaking inside of assembly, all ducts and casings should be duly cleaned up so as to remove all material left to prevent further damage after assembling components.

⑥ In order to heat bearings use proper heating plates, pipings or suitable ovens.
Never heat parts by using a torch. Oil bath, heated by a torch, may be used to warm up components.

⑦ Lubricate all sections concerned when reassembling shafts, bearings, etc.

⑧ When mounting heat fitted components make sure of their proper position after they cooled off.

⑨ Lubricate O-ring seals before installing them in relevant seats to prevent kinking during assembly, such a position would impair proper sealing.

(2) Assembling leakproof components

Use of proper sealing compounds is recommended when assembling matched parts to be sealed against fluid leakages(Oil or water) and no sealing gasket is used.

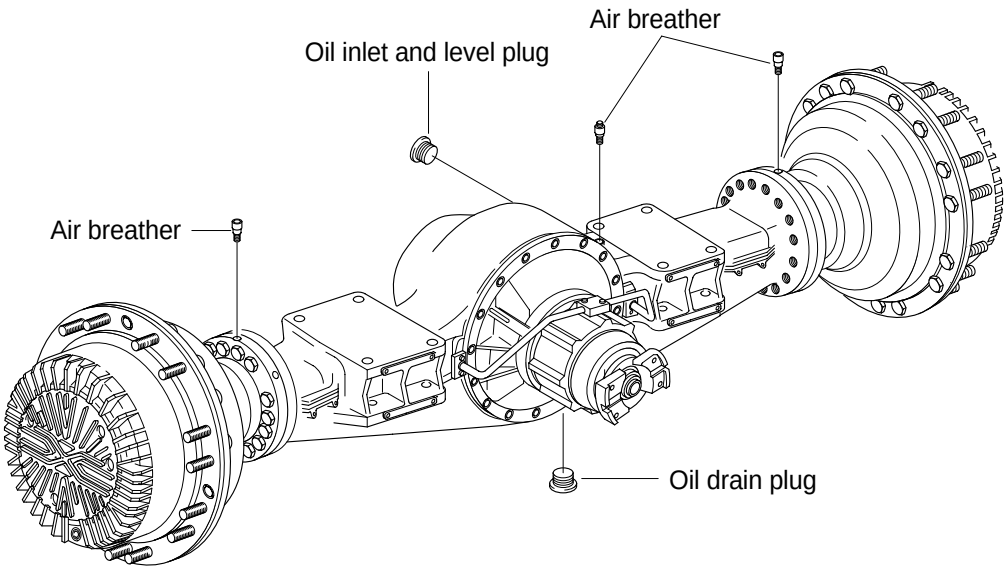
Best results are reached, with said compounds, if matching surfaces are duly cleaned and degreased prior a uniform coat is spread all over the contact area.

We suggests the following sealing compounds:

· RHODORSIL CAF 1

· LOCTITE PLASTIC GASKET

· SILASTIC 732 RTV



※ Use only **genuine spare parts** to warrant proper operations and prevent interchangeability problems.

2) TIGHTENING TORQUES(Front and rear)

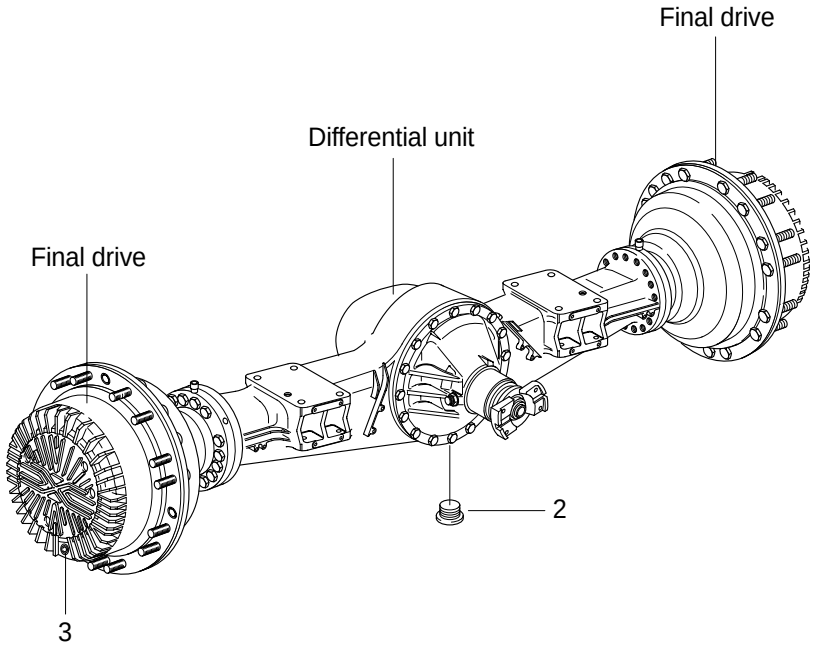
No.	Item	Torque	
		kg · m	lb · ft
1	Screws fixing sleeves to axle case	92 ±4.6	665 ±33
2	Screws securing bevel ring gear to differential case	49 ±2.4	354 ±17
3	Screws fixing differential half-cases	12 ±0.6	87 ±4
4	Screws securing differential caps	66 ±3.3	477 ±24
5	Screws securing differential to axle case	22 ±1.1	159 ±8
6	Screw securing pinion support	-	-
7	Screws fixing side gear carrier to wheel hub	7.1 ±0.4	51 ±3
8	Screws fixing side cover	3.6 ±0.2	26 ±3

9	Standard backlash of bevel gear set	0.25 ~ 0.33㎜

3) DISASSEMBLING AND ASSEMBLING AXLE UNITS

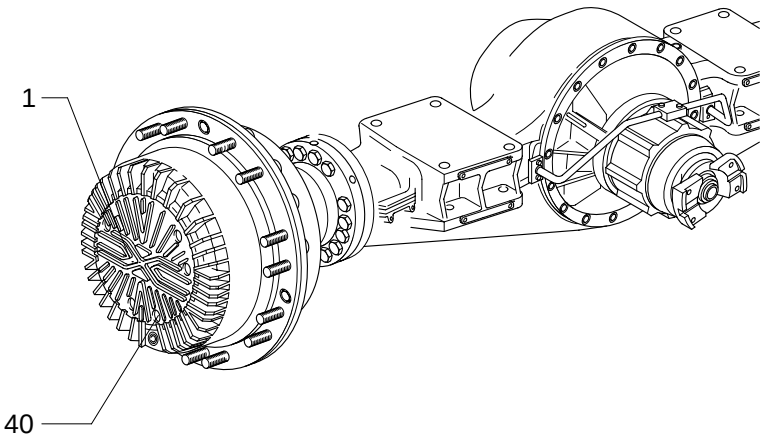
⚠ **Lift and handle all heavy components by using proper equipment.**
Make sure that assemblies or components be held up by proper slings close to the unit to be lifted.

Location of oil filling and draining plugs on axle casing and side final drives.



- Oil drain
  Drain oil from central section thru plug 2.
  Drain oil from side final drives thru plug 3.

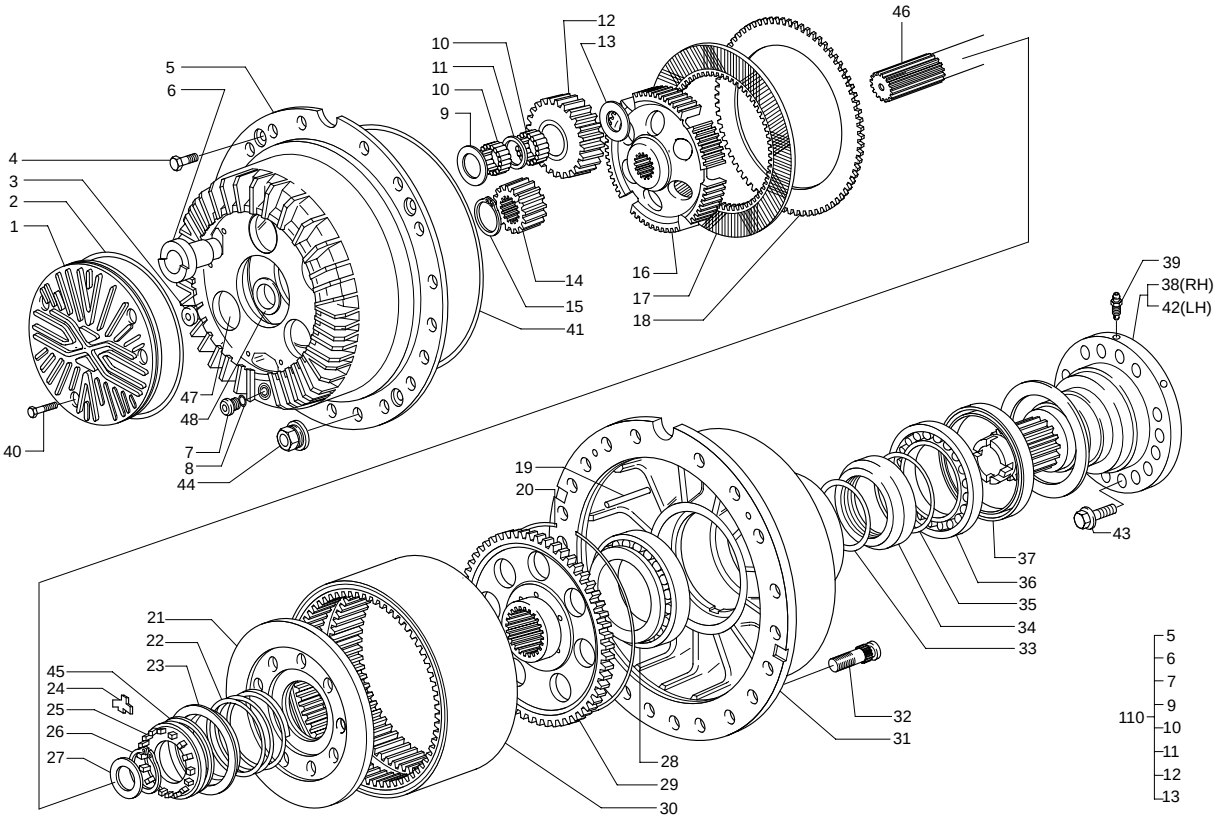
4) DISASSEMBLING SIDE FINAL DRIVES



(1) Remove final drive cover releasing the six screws(40).

※ Cover(1) is provided with three threaded holes for puller screws.

DISASSEMBLING SIDE FINAL DRIVES



(2) Remove O-ring seal(2).

(3) Pull out axle shaft backing plate(3) using puller screw.

(4) Undo screws(4) fixing side gear carrier(5) to wheel hub(31).

(5) Suitably support side gear carrier(5), pry it off to separate carrier from wheel hub(31).

(6) Pull out side gear carrier assy(5).

(7) Remove lockring(15) retaining sun gear(14) on wheel shaft(46).

(8) Pull out sun gear(14).

(9) Remove disk carrier hub(16) along with thrust washer(27) resting against wheel hub sleeve.

(10) Remove solid and lined disks(17,18) of brake.

(11) Remove wheel shaft(46).

(12) Pull out lockring(26), securing ring nut(25) and lock plates(24).

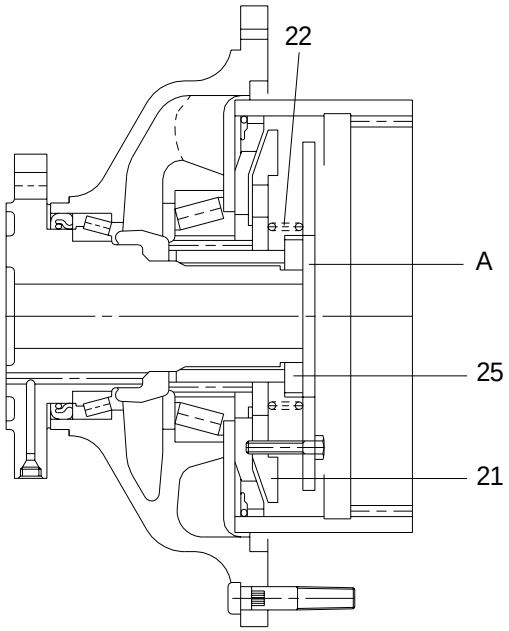
(13) Remove lock plates(24).

(14) Install the specific spring retainer.
Secured thru the three threaded holes of disk pressure plates(21) - to compress brake return spring(22) and allow ring nut (25) removal.

(15) Unlock and turn out ring nut(25) from sleeve(38).

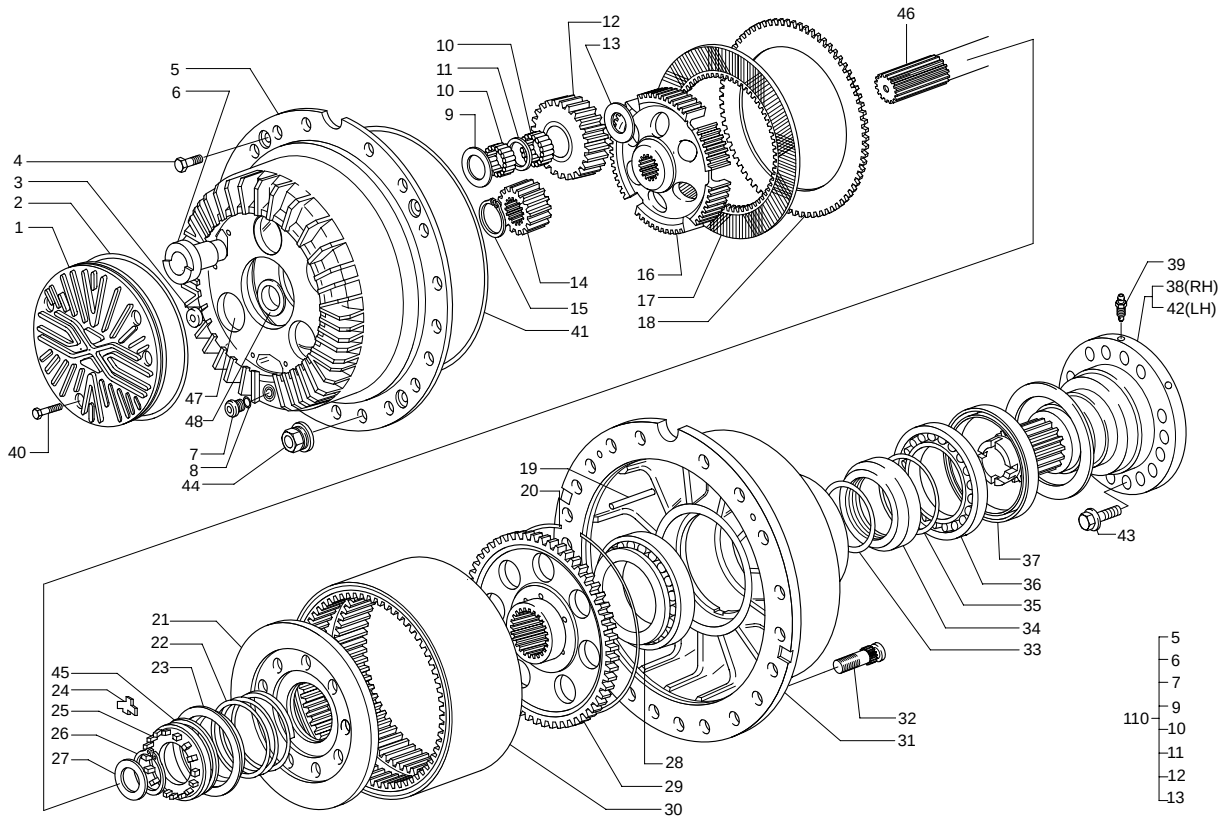
(16) Remove pressure plate(21) along brake return spring retainer.

Spring retainer installed



A	Spring retainer
21	Pressure plate
22	Return spring
25	Ring nut

DISASSEMBLING SIDE FINAL DRIVES



(17) Suitably support wheel hub(31) and pull out ring gear unit(30) and relevant support(29).

(18) Pick up the six rods(19) located in relevant seats on ring gear support(29).

(19) Pry off lockring(20) from ring gear(30) by using a screwdriver.

(20) Disassemble ring gear support(29) from ring gear(30).

(21) Should replacement of outer wheel bearing(28) inner race be mandatory, old part can be removed by a proper puller or by a remover that can be inserted in the specific holes of ring gear support (29).

(22) Remove retainer of brake unit spring, disassemble spring(22), retaining cup(23) and pressure plate(21).

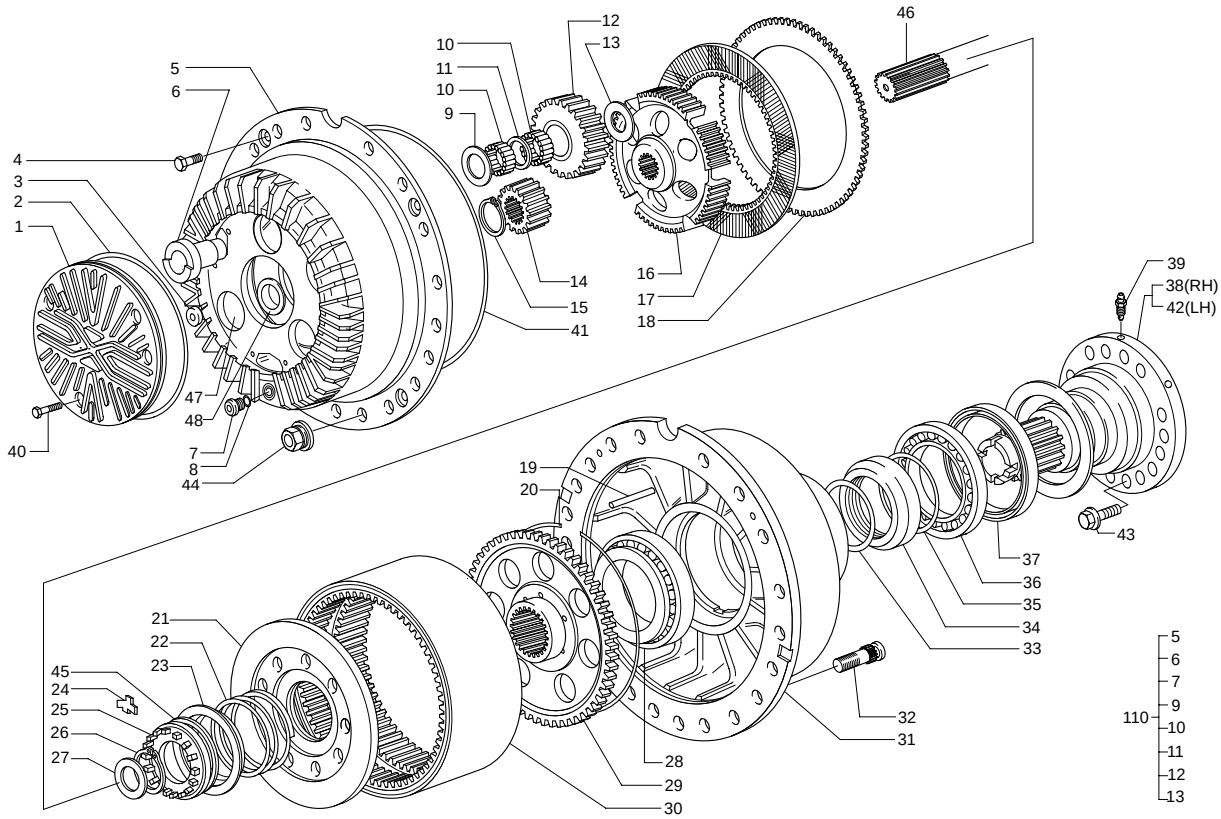
(23) Remove brake actuating piston(34) from wheel hub sleeve(38) by compressed air thru brake oil ducting.

(24) Remove and replace the two O-ring seals(33 and 35) in relevant seats on brake actuating piston.

(25) Pull out the complete wheel hub(31).

(26) Remove O-ring seal(41).

DISASSEMBLING SIDE FINAL DRIVES



(27) Pry off from wheel hub(31), seal(37) and remove inner race with roller cage of inner wheel bearing (36).

(28) Push out, by a proper remover, outer races of outer and inner wheel bearings(28 and 37) from hub(31).

(29) Should sleeve(38) be damaged, it can be removed by undoing relevant fixing screws(43). At reassembly, smear proper sealing compound on axle case joining flange and tighten screws with a torque of : See tightening torque No.1

(30) Mark side gear pins(6), various components and seats(47) for identification of original position at reassembly.

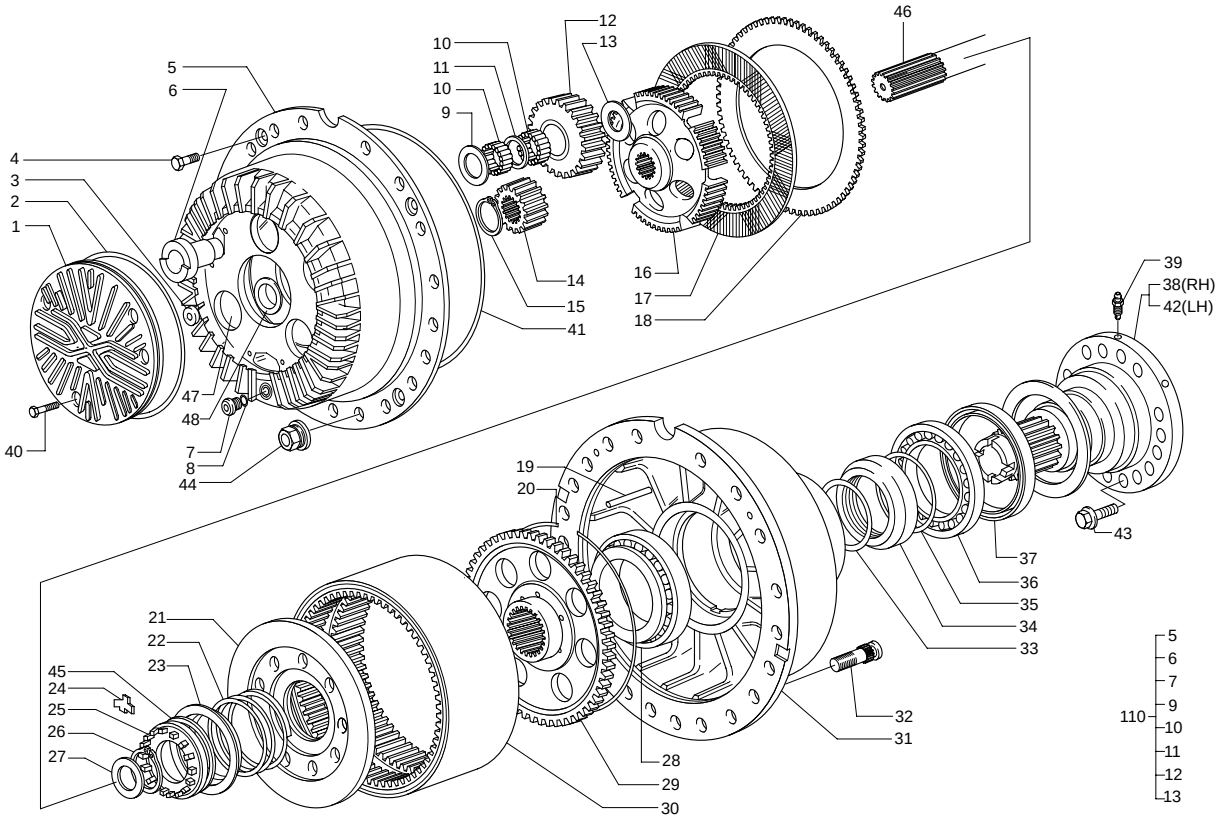
(31) Arrange side gear carrier(5) on wooden blocks and push out pins(6) with a proper remover.

(32) Pick up all needle rollers(10,11).

(33) It is important to keep matched needle rollers and thrust washers(9) with relevant pin(6), this is consequent to predetermined assembly tolerance limits.

(34) Remove side gears(12) and relevant thrust washers(13) no gear can be removed prior having released all of them.

5) ASSEMBLING SIDE FINAL DRIVE



(1) Reinstall wheel hub(31), first fit outer races of wheel inner and outer bearings(36 and 28), make sure they rest against relevant seats. Position inner race with roller cage of wheel inner side bearing(36) before fitting lip seal(37).

(2) Refit O-ring seal(41).

(3) Support suitably wheel hub(31) during the assembling stage to prevent seal damages, then, fit wheel inner bearing(36) in sleeve(38).

(4) Lubricate seals(33 and 35) on piston(34), insert it at travel end on wheel hub sleeve(38).

(5) Fit inner race of wheel outer bearing(28) on ring gear support(29), by heating equipment or proper installer ; then, mount support(29) in ring gear(30) and secure by lockring(20).

(6) Mount ring gear and support unit(30 and 29) on sleeve(38).

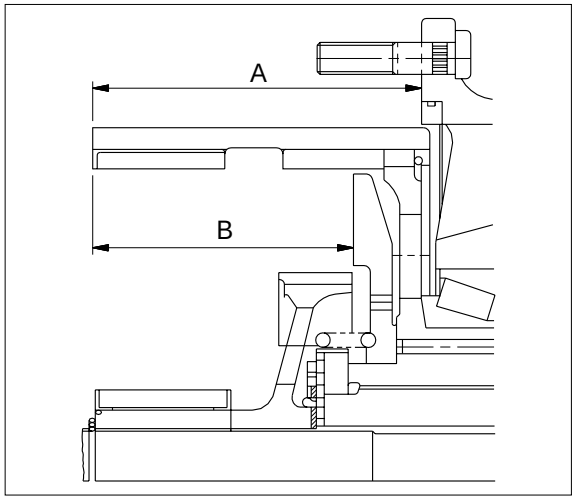
(7) Fit the six rods(19) in relevant seats on ring gear support(29).

(8) Install the spring retainer(Figure at page 3-140) and compress spring(22) with relevant retaining cup(23) on pressure plate(21).

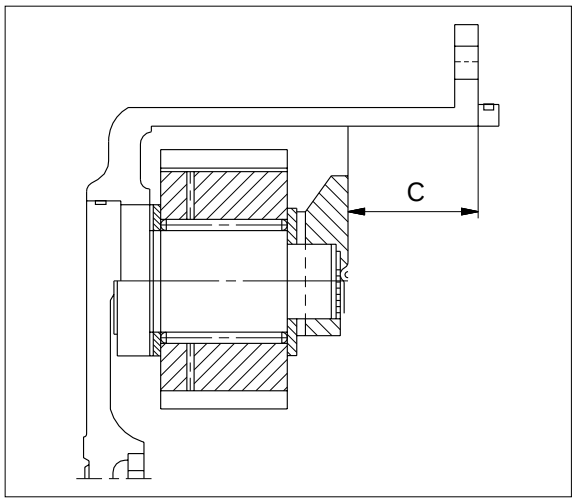
(9) Mount the pressure plate-spring assembly on ring gear support(29).

※ **Determining the space available to form the brake disk pack**

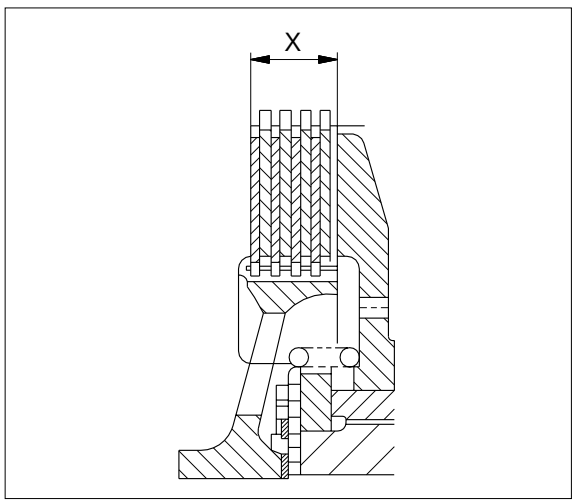
Record depth from seating surface of side gear carrier on wheel hub to outer edge of ring gear, identify said value as **A**.
Record depth from ring gear outer edge to brake pressure plate, identify said value as **B**. Subtract the value recorded from value **A** recorded on previous step, identify it a **D**.
i.e. : **A - B = D**



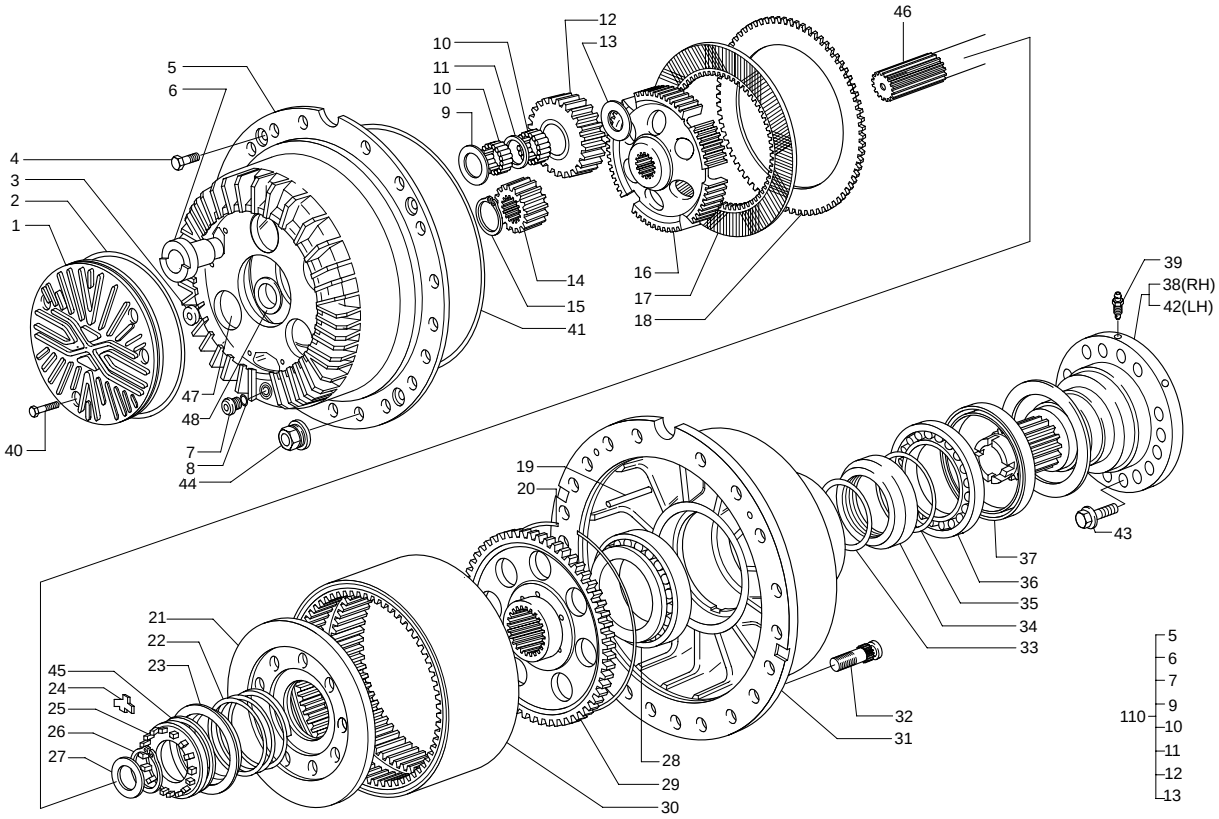
Record depth from disk reaction face to outer edge of side gear carrier.
Value recorded as **C** should be subtracted from value **D** previously recorded.
i.e. : **C + D = X**
This is the space available to form the brake disk pack.



Forming the disk pack
Computing thickness of disk pack(Solid + lined ones) it is necessary to subtract the clearance of 1㎜ for each brake disk plus the total thickness of the lined disks from the space available for the remaining clearance with solid disks(Outer teeth) of proper thickness with a tolerance of ± 0.25㎜.



ASSEMBLING SIDE FINAL DRIVE



(10) Hand screw ring nut(25) on wheel hub sleeve(38).

(11) Tighten ring nut(25) by the proper wrench so as to reach the prescribed pre-load for wheel bearings and corresponding to a revolving torque of 1.5-3.1kgf · m(10.8-22.4lbf · ft) checking alignment for the lockplates(24).

※ To prevent wrong recording of torque values, it is advisable to seat bearing properly before checks by revolving repeatedly the wheel hub.

(12) Remove spring retainer compressing brake actuator return spring.
Insert lockplates(24), securing ring nut(25) and fit lockring(26).

(13) Side gear carrier(5).

※ Arrange the three side gears(12) in proper carrier seat.

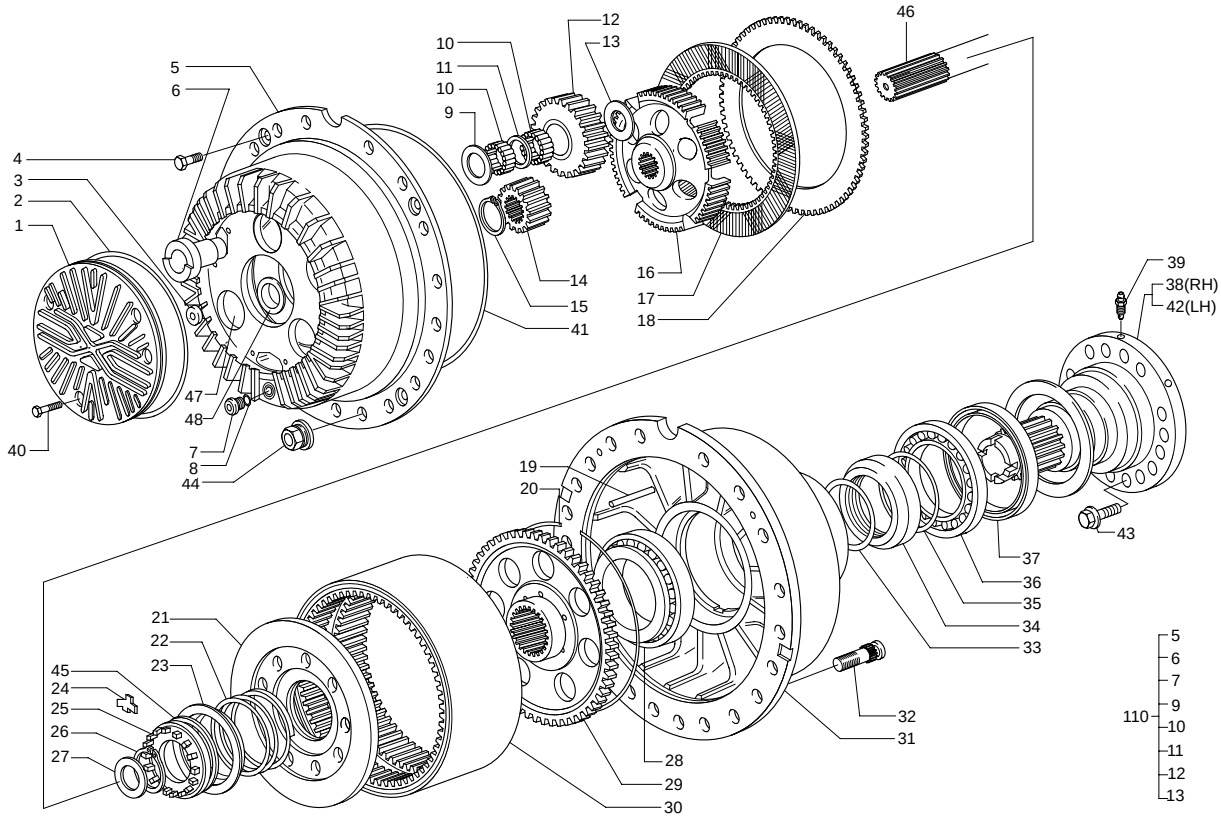
※ Two rows of needle rollers of the same selection class should be used for replacement in each single side gear pin.

(14) Insert outer thrust washers(13), smear with grease pin lower portion(Head end) and position the first row of needle rollers, fit spacer, smear with grease pin upper portion and position the second row of needle rollers(10,11).

(15) Position outer thrust washers(9) of side gear on side gear carrier and aline holes.

(16) Insert and force fit complete pins(6) and avoid any bump or knock that could cause roller fall.

ASSEMBLING SIDE FINAL DRIVE



(17) Insert wheel shaft(46).

(18) Insert thrust washer(48).

(19) Mount disk carrier hub(16) on wheel shaft(46).

(20) Mount alternately solid disks and lined disks.

※ Insert a solid disk(Outer teeth) facing the pressure plate(27).

(21) Insert sun gear(14) and secure with lockring(15).

(22) Mount the side gear carrier assembly (5) on side gear unit and secure on wheel hub(31) locking fixing screws(4) with a tightening torque of : See tightening torque No.7.

(23) Force fit wheel shaft backing plate(3).

(24) Mount O-ring seal(2) on edge.

(25) Rotate and aline pins (6) to allow mounting of cover(1) which act also as pin lock to prevent their rotation.

(26) Fit side final drive cover(1).

(27) Smear fixing screws(40) with sealing compound, then, lock with a tightening torque of : See tightening torque No.7.

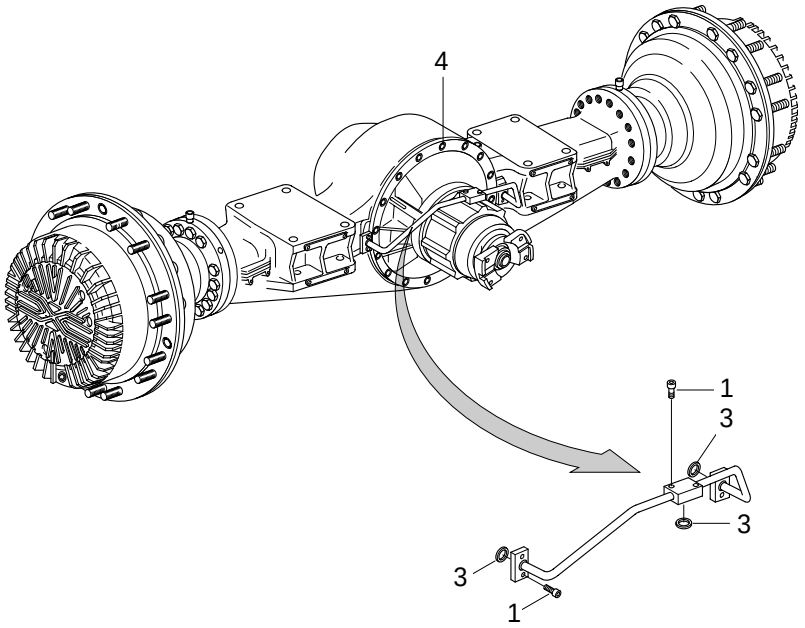
6) DISASSEMBLING DIFFERENTIAL UNIT (Front axle)

(1) Disassembling outer oil recirculation piping

① Release and remove the sixs screws(1) that secure the outer oil recirculation piping(2) and the three seals(3).

※ Check wear condition of components and replace as required.

② Unlock and undo screws(4) retaining differential unit then, remove it from axle case.



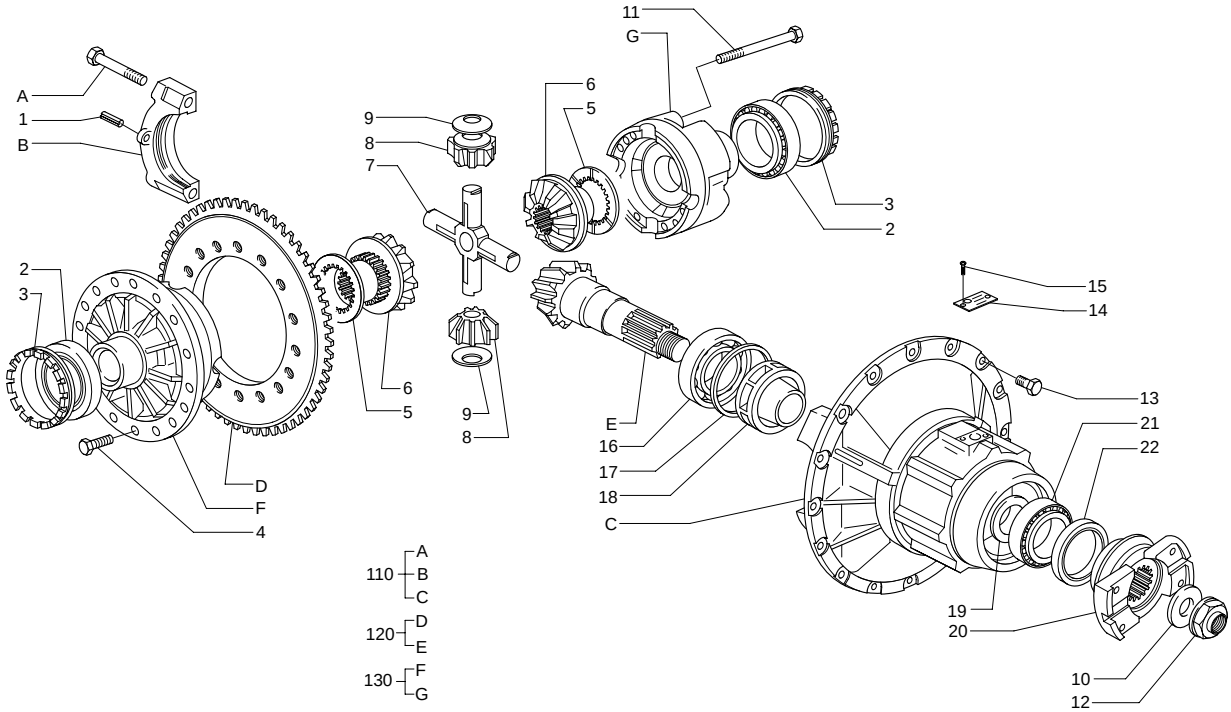
(2) Assembling outer oil recirculation piping

Clean thorougly matching surfaces, apply sealing compound and mount differential unit on axle case, lock the screws(4) with a tightening torque of : See tightening torque No.5.

Refit outer oil recirculation piping(2) with relevant seals(3).

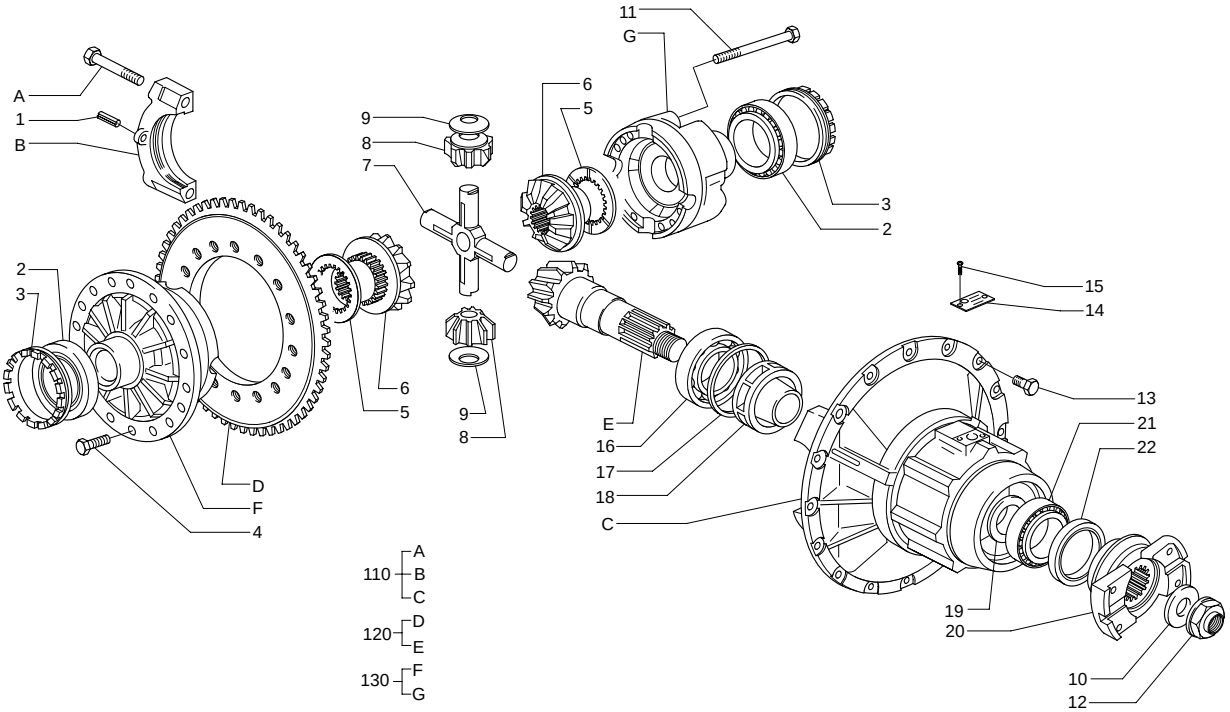
Secure items with the six screws(1).

(3) Disassembling differential unit(Front axle)



① Hammer out spring pins(1) locking slotted rings(3) and release then.
② Mark caps(B) to match parts at reassembly.
③ Release fixing screws(A) and remove caps(B) and relevant threaded rings(3).
④ Remove differential case unit from support(C).
⑤ Straighten locking notches on pinion nut collar(12), position reaction tool on drive flange to unlock nut(12), release pinion nut, remove drive flange(20) from pinion shank along with washer(10).
⑥ Pry off seal(22) from drive flange.
⑦ Remove bevel pinion(E) from differential support(C), hammer pinion shank with a proper remover, care not to damage threads.
⑧ Pick up inner race of pinion shank bearing(21).
⑨ Remove from differential support(C) outer races of outer and inner pinion bearings(21 and 16). Pick up shims(17) for pinion axial position adjustment.
⑩ Remove impeller(18) and shims(17) for bearing pre-load adjustment; Remove inner race of pinion underhead bearing(16) by using a proper puller.
⑪ Mark differential half-cases(F and G) for reference at reassembly.

Disassembling differential unit(Front axle)



⑫ Remove fixing screws(11) and separate half-cases(F and G).

⑬ Have a visual and dimensional check of wear on sun and side gears(6 and 8) relevant thrust washers(5 and 9) and spider(7).

⑭ Remove bearings(2) from half-cases(F and G) by a proper puller.

⑮ Fit inner races of differential bearings(2) on half-cases(F and G).

※ This operation should be carried out by heating equipment or proper installer.

⑯ Clamp ring gear(D) in a vise fitted with soft caps and remove screws(4) securing ring gear(D) to case(F).

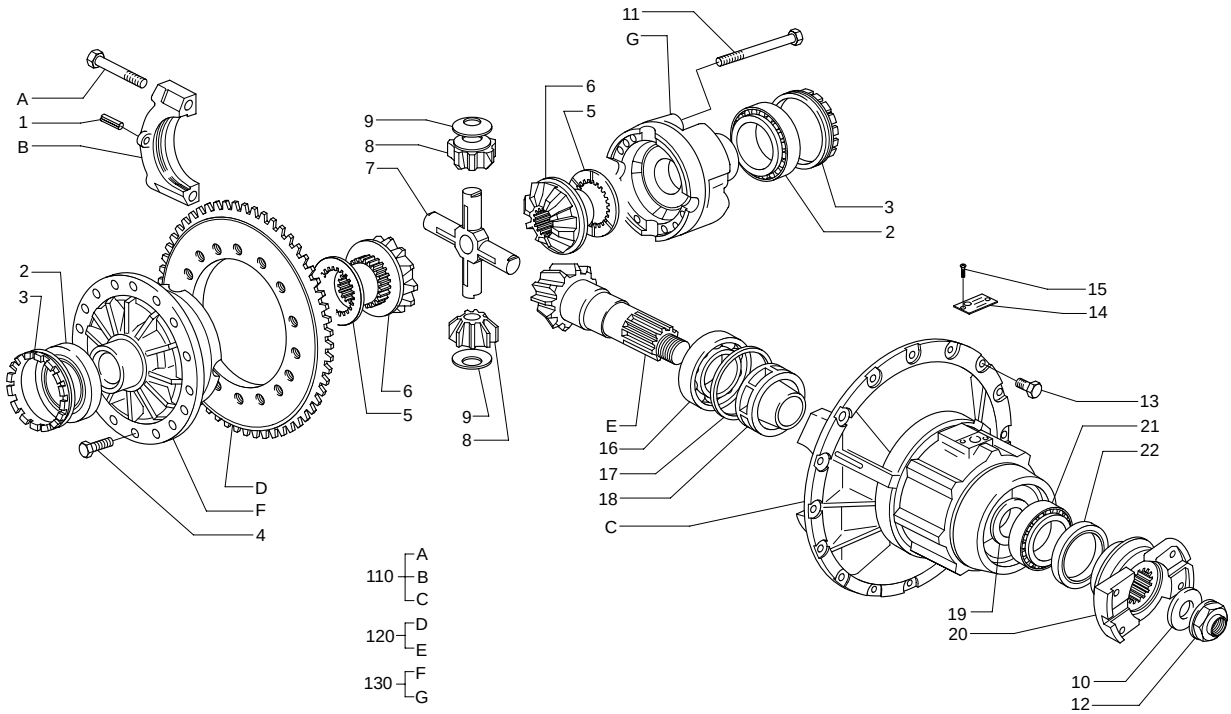
⑰ Mount bevel ring gear(D) on case(F) lock relevant fixing screws(4) with a tightening torque of : See tightening torque No. 2

⑱ Position differential components in relevant seats, then, join half-cases(F and G) matching reference marked prior disassembly.

⑲ Mount and lock half-cases fixing screws(11) with a tightening torque of : See tightening torque No.3.

7) ASSEMBLING DIFFERENTIAL UNIT(Front axle)

Determining thickness of adjustment shims(Axial position of bevel pinion) : See clause 8 at page 3-153.



(1) Press fit inner race of inner(Underhead) bearing(16) on pinion by heating equipment or proper installer.

(2) Position shim(17), computed as per clause 8 at page 3-153, in its seat and press fit outer races of inner(Underhead) and outer bearings(16 and 21) of pinion.

(3) Fit impeller(18) on pinion for bearing pre-load adjustment; Then, mount inner race of pinion outer bearing(21).

※ To facilitate proper pre-load computation, it is advisable to mount as many shims as required to warrant a pinion end play and not a pre-load(That could be excessive) on bearings.

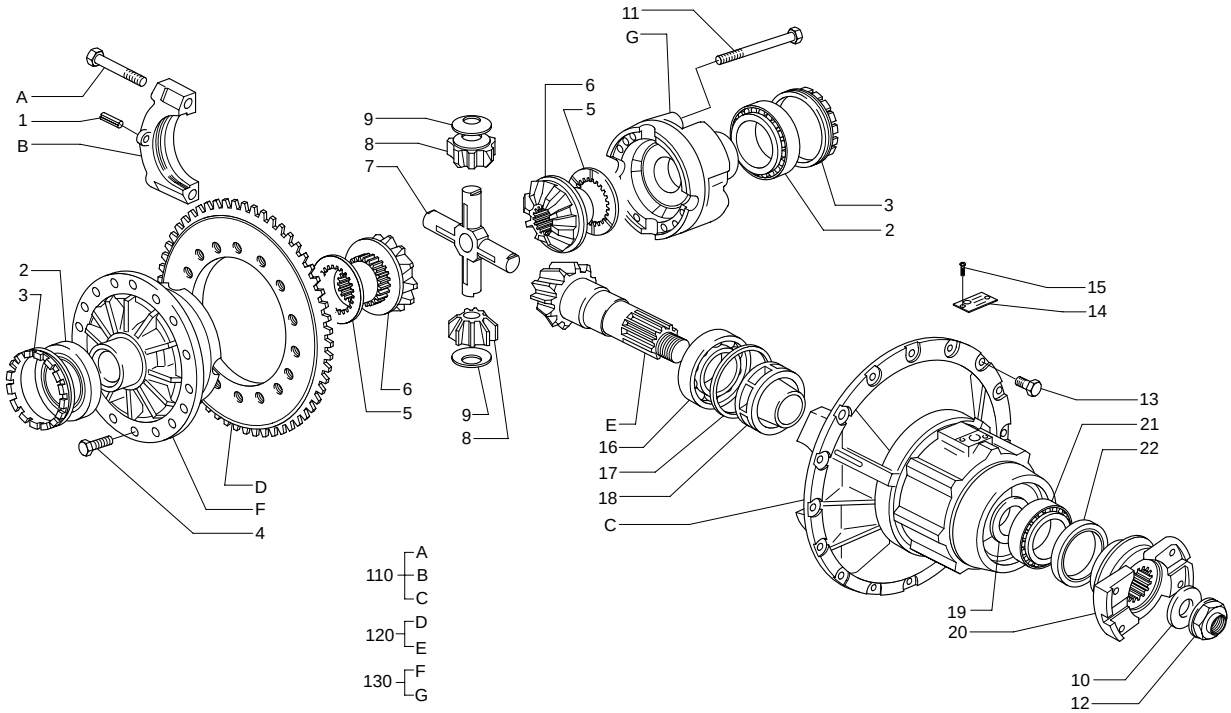
(4) Fit drive flange(20) on pinion(E), position the specific reaction screw and tighten nut(12) with a torque of 5.8-6.4kg · m(42-46lb · ft).

※ Check pinion end play by means of a dial gauge; then, disassemble parts and change shims so as to eliminate all end play and reach the intended pre-load.

※ Reassemble components, check that proper pre-load of bearing be corresponding to a revolving torque(No seal installed) of 0.02-0.04kg · m(0.14-0.29lb · ft).

(5) As the prescribed pre-load of bearings as been reached remove drive flange(20) and fit lip seal (22) in relevant seat.

ASSEMBLING DIFFERENTIAL UNIT(Front axle)



(6) Remount drive flange again and tighten a specified above.

(7) Position differential assembly with ring gear on support(C) ; Insert ring nut(3) and adjust temporarily backlash.

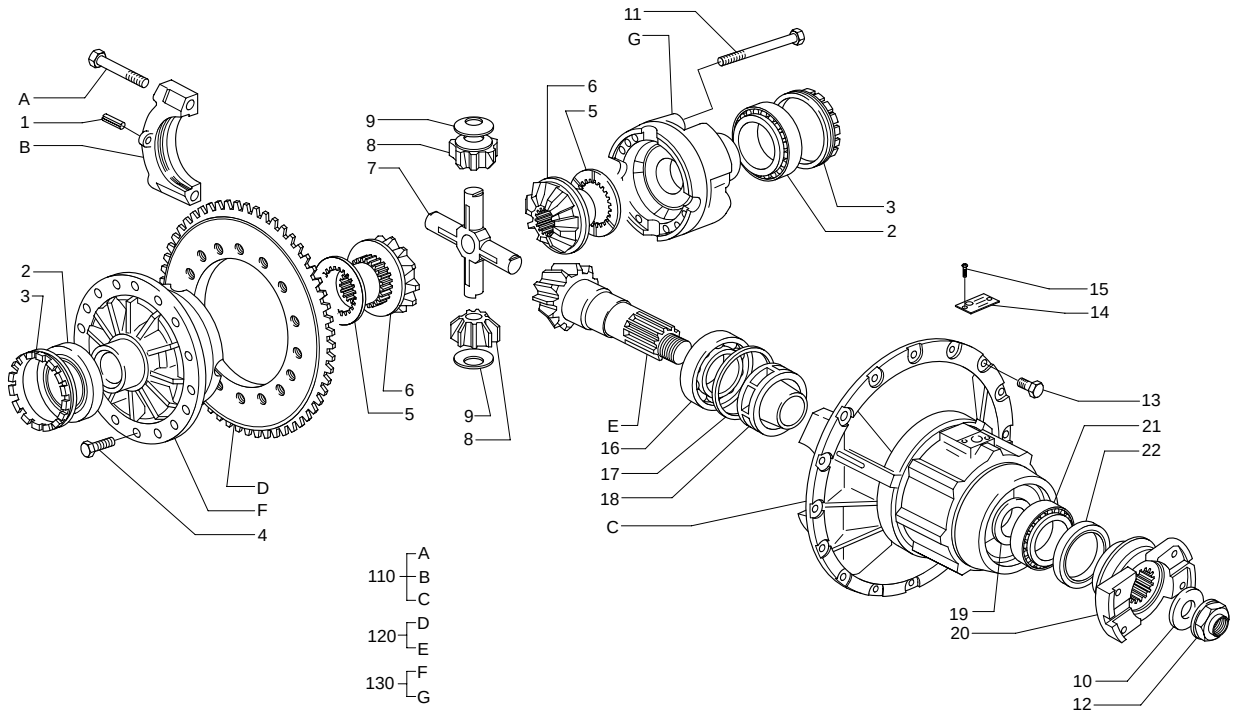
(8) Mount caps(B), minding not to invert position and lock screws(A) fixing support to differential with a torque of : See tightening torque No.4.

※ Check differential end play by a dial gauge.

※ Screw in a ring nut so as to have a notch alined against the slot of lock plate and actuate the opposite nut up to eliminate end play.

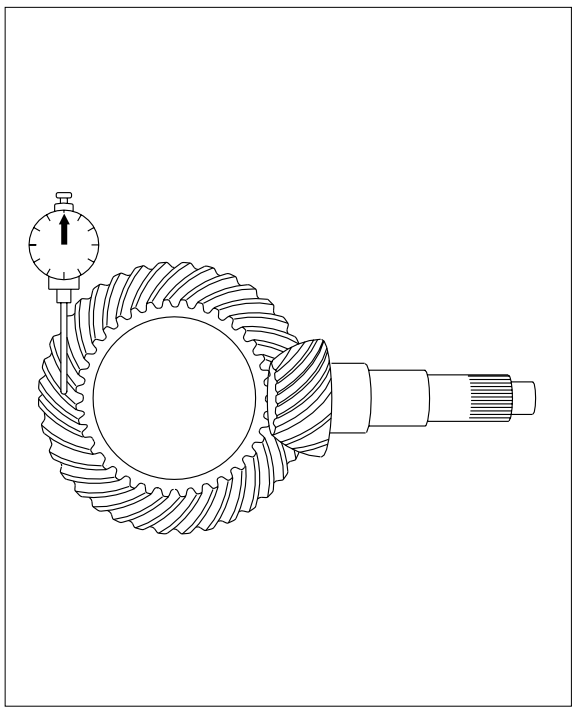
※ As such a condition has been reached go on with bearing pre-load by screwing in ring nut further one more notch.

ASSEMBLING DIFFERENTIAL UNIT(Front axle)



(9) Position a dial gauge perpendicular the ring gear(D) tooth(See figure) and check that, with pinion steady, backlash be of : See tightening torque No.9, otherwise rotate both ring nuts(3), displacing them of a same number of notches and nearing ring gear to pinion if backlash is excessive and moving away on the contrary.

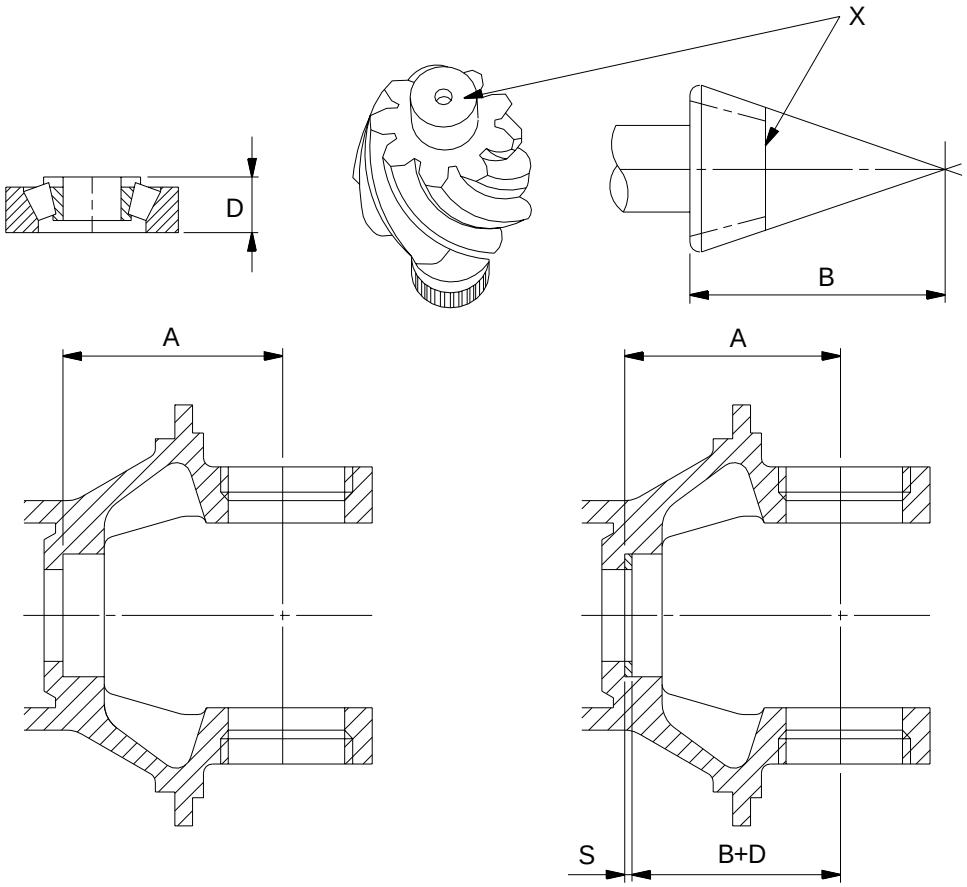
※ Brush red lead on some ring gear teeth, rotate to mesh pinion and ring gear repeatedly so as to make evident tooth contact. Proper and correct tooth contact marks are visible on a new bevel gear set as a result of an optimum contact approached on the tester, consequently, a proper axial position of pinion against ring gear will emphasize remarking of previous tester contact marking.



(10) Fit spring pins (1) to lock differential ring nuts.

(11) Make two lock notches on pinion nut collar(12).

8) DETERMINING THICKNESS OF ADJUSTMENT SHIMS(Front axle)



(1) Some dimensions should be recorded before starting reassembly of bevel pinion to determine thickness of spacer to be fitted between inner(Underhead) pinion bearing and backing of relevant seat in differential support.
Record dimension from ring gear axis to seat of inner(Underhead) pinion bearing(That will be identified as **A**).
Example : In our case **A** = 266.1㎜

(2) A number **X** prefixed by symbol ± is marked on bevel pinion face.
Said value, expressed in tenth of millimeter, indicate the deviation from the theoretical distance from pinion underhead to ring gear axis :
i.e. : + 1 = 0.1㎜
Consequently, the true distance(Identified as **B**) will be :
B = 208 ± Deviation
In our case : **B** = 208 + 0.1 = 208.1㎜

(3) Measure thickness of pinion head bearing and identify as **D**.
Example : In our case **D** = 54.15㎜

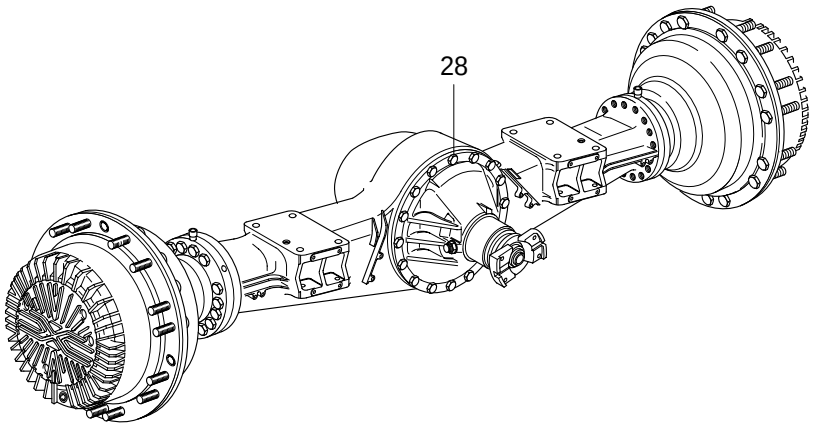
(4) Compute thickness of shim **S** for proper axial position of bevel pinion :
S = A - (B + D)
Example : In our case **S** = 266.1 - (208.1 + 54.15) = 3.85㎜

(5) Increase by 0.05㎜ the computed thickness value to compensate subsequent bearing pre-load.
Round off to the nearest tenth of millimeter to the computed thickness value :
i.e. : 4.02 rounded off = 4㎜
3.88 rounded off = 3.9㎜

9) DISASSEMBLING DIFFERENTIAL UNIT(Rear axle)

(1) Disassembly

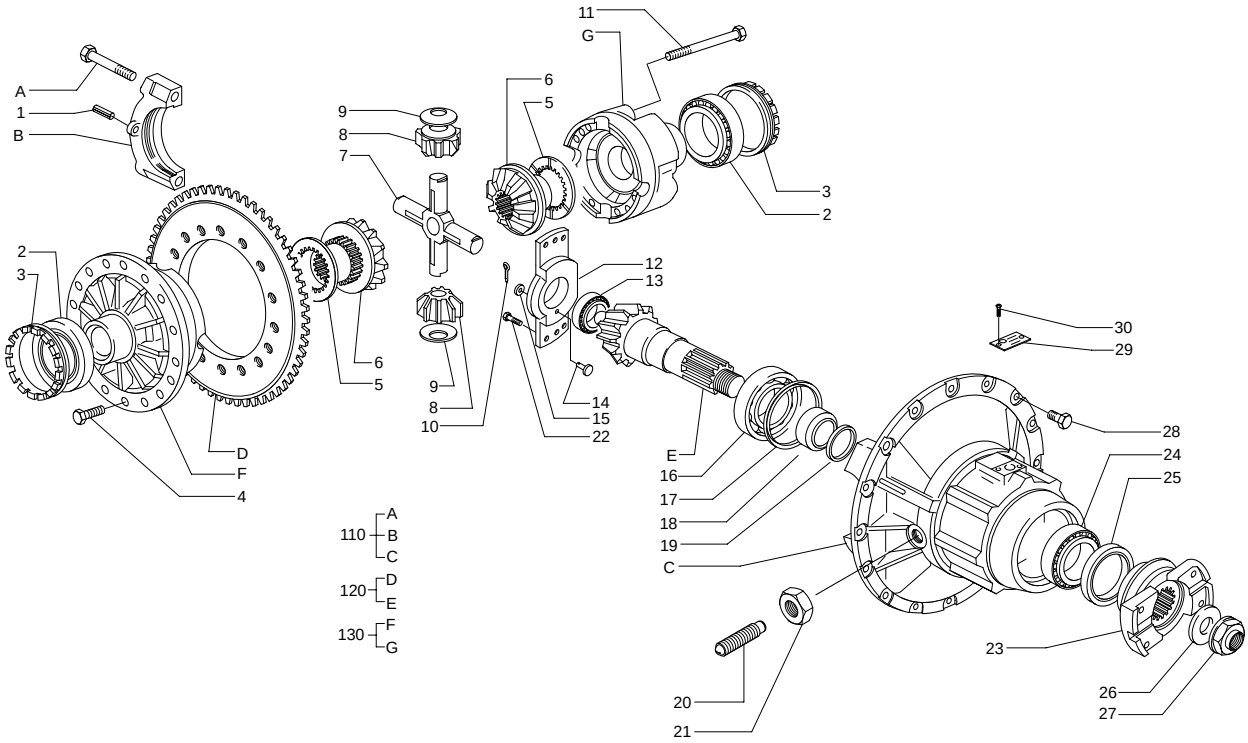
Unlock and undo screws(28) retaining differential unt then, remove it from axle case.



(2) Assembly

Clean throughly matching surfaces, apply selaling compund and mount differential unit on alxle case, lock the screws(28) with a tightening torque of : See tightening torque No. 5.

(3) Disassembling differential unit(Rear axle)



① Hammer out spring pins(1) locking slotted rings(3) and release then.

※ Mark caps(B) to match parts at reassembly.

② Release fixing screws(A) and remove caps(B) and relevant threaded rings(3).

③ Release and remove screws(22) securing support(12) of bearing(13) of bevel pinion shank.

④ Remove support(12) of bevel pinion bearing by means of puller screws.

⑤ Lift up differential unit from differential support(C), along with bearing support(12).

⑥ Remove ring gear deflection plunger(20) and relevant counternut(21).

⑦ Insert a screw in the seat of plunger(20) to react against unscrewing torque of pinion ring nut(27).

※ This screw should have a threaded length of 100㎜, its tip should shaped so as not to be damaged when contacting pinion teeth.

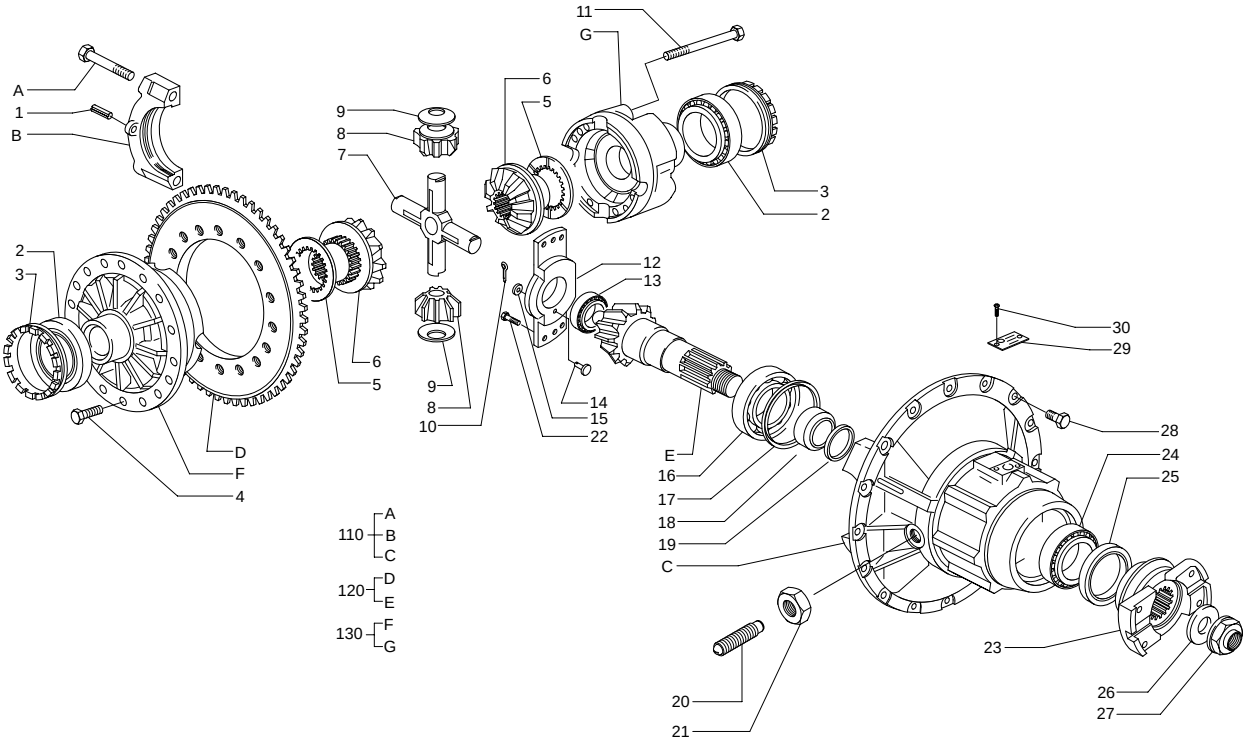
※ Make sure that screw be correctly engaged in pinion teeth.

⑧ Straighten notches on pinion ring nut(27).

⑨ Unlock and undo ring nut.

⑩ Remove drive flange(23), washer and pinion ring nut, then, back up reaction screw.

Disassembling differential unit(Rear axle)



⑪ Pry off seal(25) from drive flange.

⑫ Remove bevel pinion(E) from differential support(C), hammer pinion shank with a proper remover, care not to damage threads.

⑬ Pick up inner race of pinion shank bearing(24).

⑭ Remove from differential support(C) outer races of outer and inner pinion bearings(24 and 16). Pick up shims(17) for pinion axial position adjustment, spacer(18) and shim(19).

⑮ Flatten notches retaining bearing(13) race on pinion(E) shank.

⑯ Remove bearing(13) race from pinion(E) shank by a proper puller.

⑰ Remove pinion underhead bearing (16) by a proper puller.

※ Mark differential half-cases(F and G) for reference at reassembly.

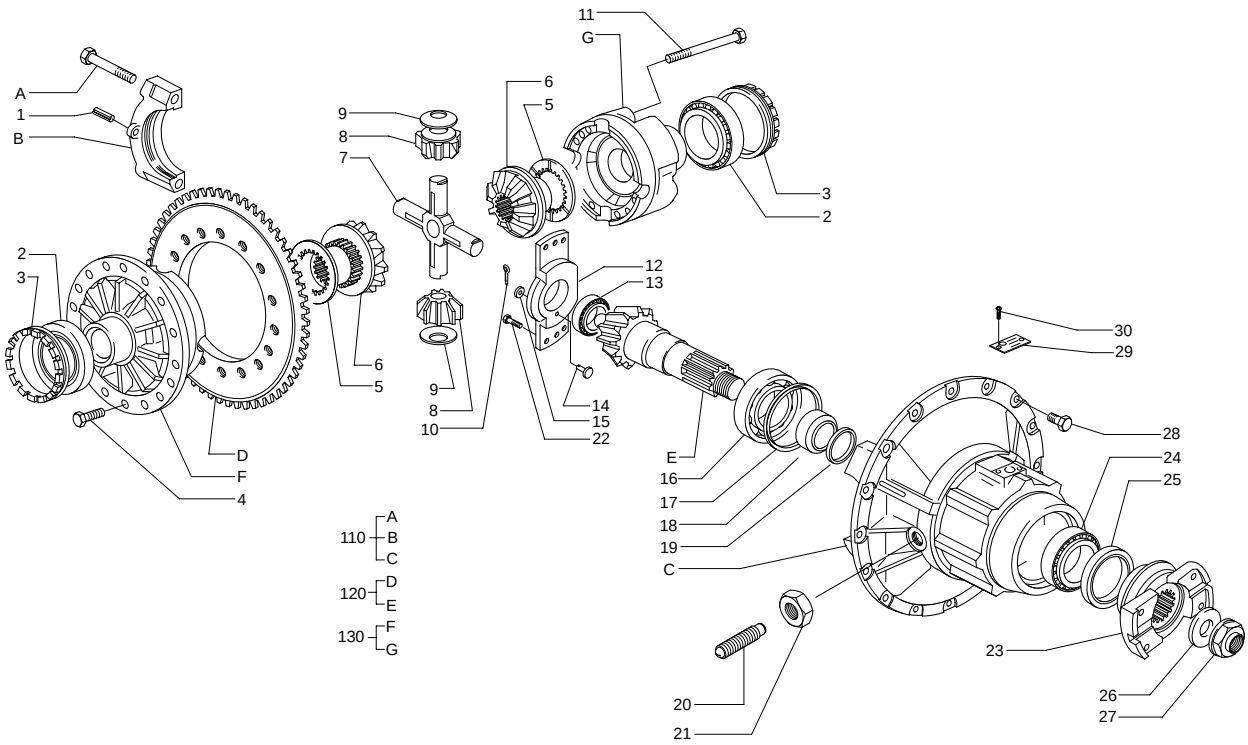
⑱ Remove fixing screws(11) and separate half-cases(F and G).

※ Have a visual and dimensional check of wear on sun and side gears(6 and 8) relevant thrust washers(5 and 9) and spider(7).

⑲ Remove bearings(2) from half-cases(F and G) by a proper puller.

⑳ Fit inner races of differential bearings(2) on half-cases(F and G).

Disassembling differential unit(Rear axle)



※ This operation should be carried out by heating equipment or proper installer.

㉑ Clamp ring gear(D) in a vise fitted with soft caps and remove screws(4) securing ring gear(D) to case(F).

㉒ Overhauling pinion bearing support(12).

㉓ Remove split pin(10), washer(15) and pin(14).

㉔ Remove bearing outer race from support(12) of pinion(E).

㉕ Check wear conditions of components, renew as required.

㉖ Finally, press fit outer race of bearing(13) on support(12) of pinion(E).

㉗ Finally, reassemble retaining washer(15), pin(14) and split pin(10) on support(12).

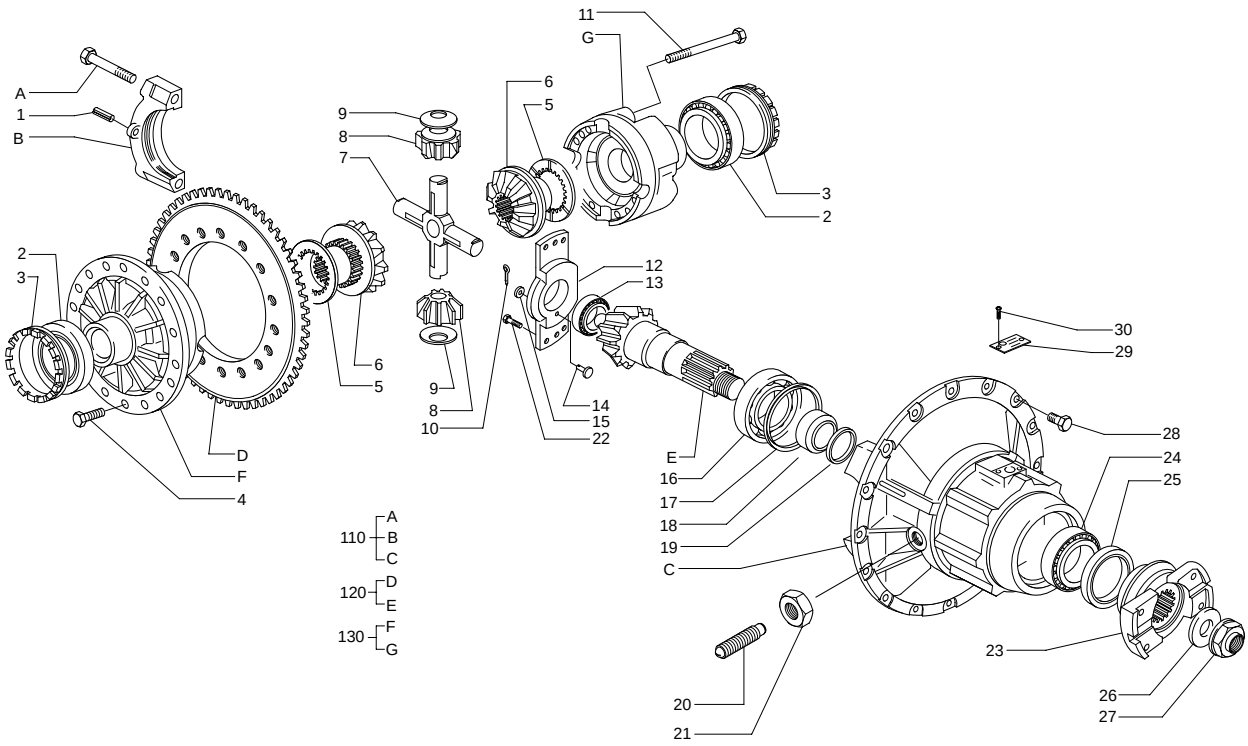
㉘ Mount bevel ring gear(D) on case(F) lock relevant fixing screws(4) with a tightening torque of : See tightening torque No.2.

※ Position differential components in relevant seats, then, join half-cases(F and G) matching reference marked prior disassembly.

㉙ Mount and lock half-cases fixing screws(11) with a tightening torque of : See tightening torque No.3.

10) ASSEMBLING DIFFERENTIAL UNIT(Rear axle)

Determining thickness of adjustment shims(Axial position of bevel pinion) : See clause 11 at page 3-161.



(1) Press fit inner race of inner(Underhead) bearing(16) on pinion by heating equipment or proper installer.

(2) Position shim(17), computed as per clause 11 at page 3-161, in its seat and press fit outer races of inner(Underhead) and outer bearings(16 and 24) of pinion.

(3) Fit spacer(18) on pinion along with shims(19) for bearing pre-load adjustment; Then, mount inner race of pinion outer bearing(24).

※ To facilitate proper pre-load computation, it is advisable to mount as many shims as required to warrant a pinion end play and not a pre-load(That could be excessive) on bearings.

(4) Fit drive flange(23) on pinion(E), position the specific reaction screw and tighten nut(27) with a torque of 58.2 - 64.3kgf · m(420 - 464lbf · ft).

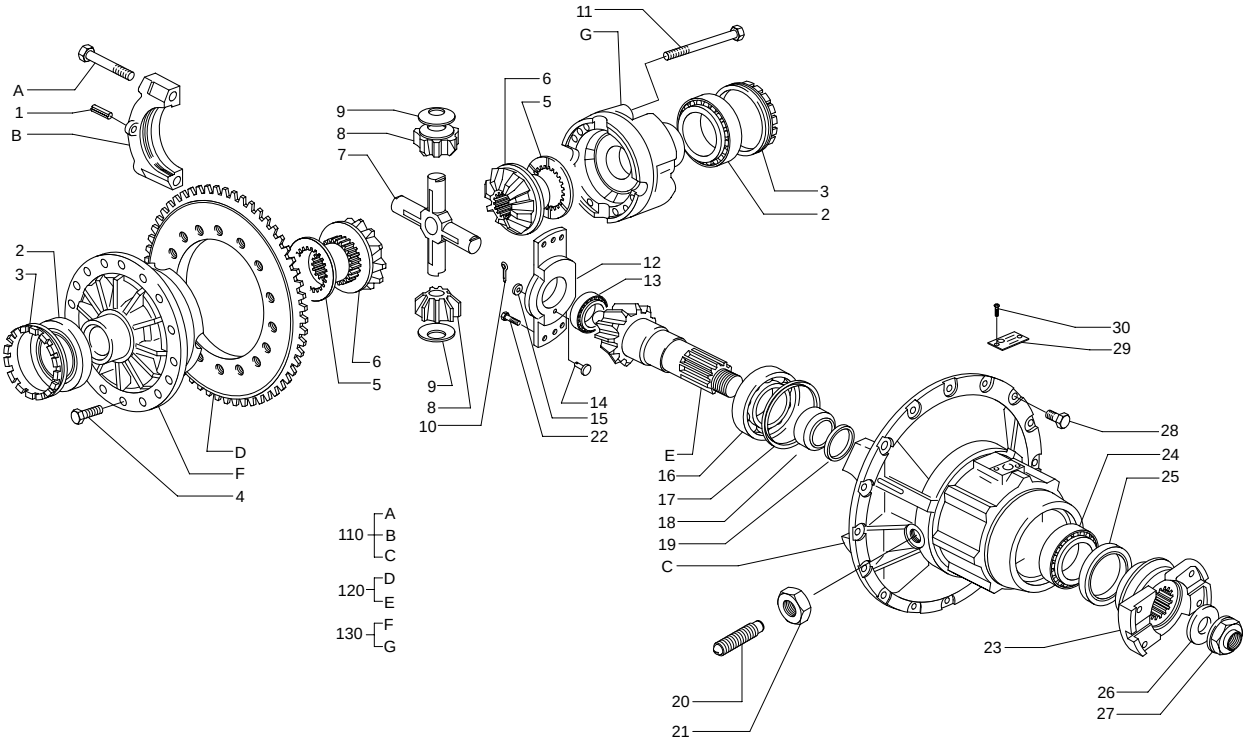
(5) Back up reaction screw from pinion.

※ Check pinion end play by means of a dial gauge; Then, disassemble parts and change shims so as to eliminate all end play and reach the intended pre-load.

※ Reassemble components, check that proper pre-load of bearing be corresponding to a revolving torque(No seal installed) of 0.2 - 0.4kgf · m(1.4 - 2.9lbf · ft).

(6) As the prescribed pre-load of bearings as been reached remove drive flange(23) and fit lip seal (25) in relevant seat.

ASSEMBLING DIFFERENTIAL UNIT(Rear axle)



(7) Remount drive flange again and tighten a specified above.

(8) Remove definitively, reaction screw from differential support.

(9) Position differential assembly with ring gear on supportC).

(10) Insert support(12) of bearing(13) while differential is lowered and tighten fixing screw(22) with a torque of : See tightening torque No.6.

(11) Insert ring nut(3) and adjust temporarily backlash.

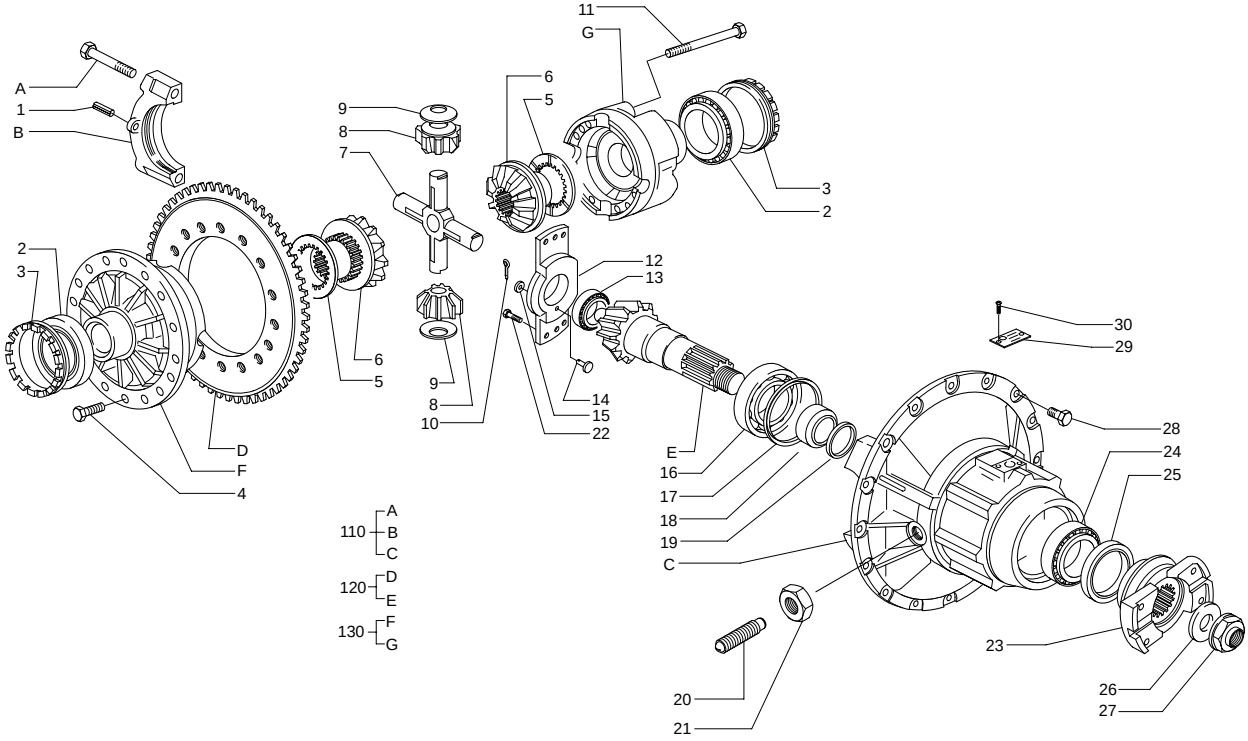
(12) Mount caps(B), minding not to invert position and lock screws(A) fixing support to differential with a torque of : See tightening torque No.4.

※ Check differential end play by a dial gauge.

※ Screw in a ring nut so as to have a notch alined against the slot of lock plate and actuate the opposite nut up to eliminate end play.

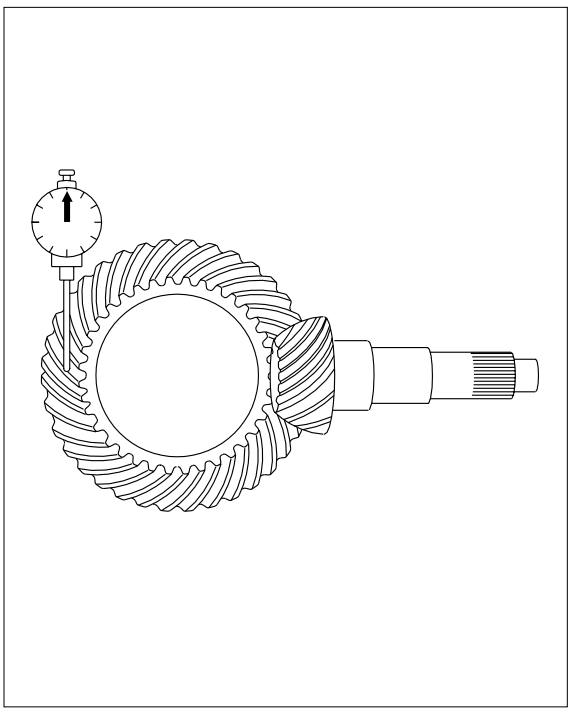
※ As such a condition has been reached go on with bearing pre-load by screwing in ring nut further one more notch.

ASSEMBLING DIFFERENTIAL UNIT(Rear axle)



(13) Position a dial gauge perpendicular the ring gear(D) tooth(See figure) and check that, with pinion steady, backlash be of : See tightening torque No.9, otherwise rotate both ring nuts(3), displacing them of a same number of notches and nearing ring gear to pinion if backlash is excessive and moving away on the contrary.

※ Brush red lead on some ring gear teeth, rotate to mesh pinion and ring gear repeatedly so as to make evident tooth contact. Proper and correct tooth contact marks are visible on a new bevel gear set as a result of an optimum contact approached on the tester, consequently, a proper axial position of pinion against ring gear will emphasize remarking of previous tester contact marking.

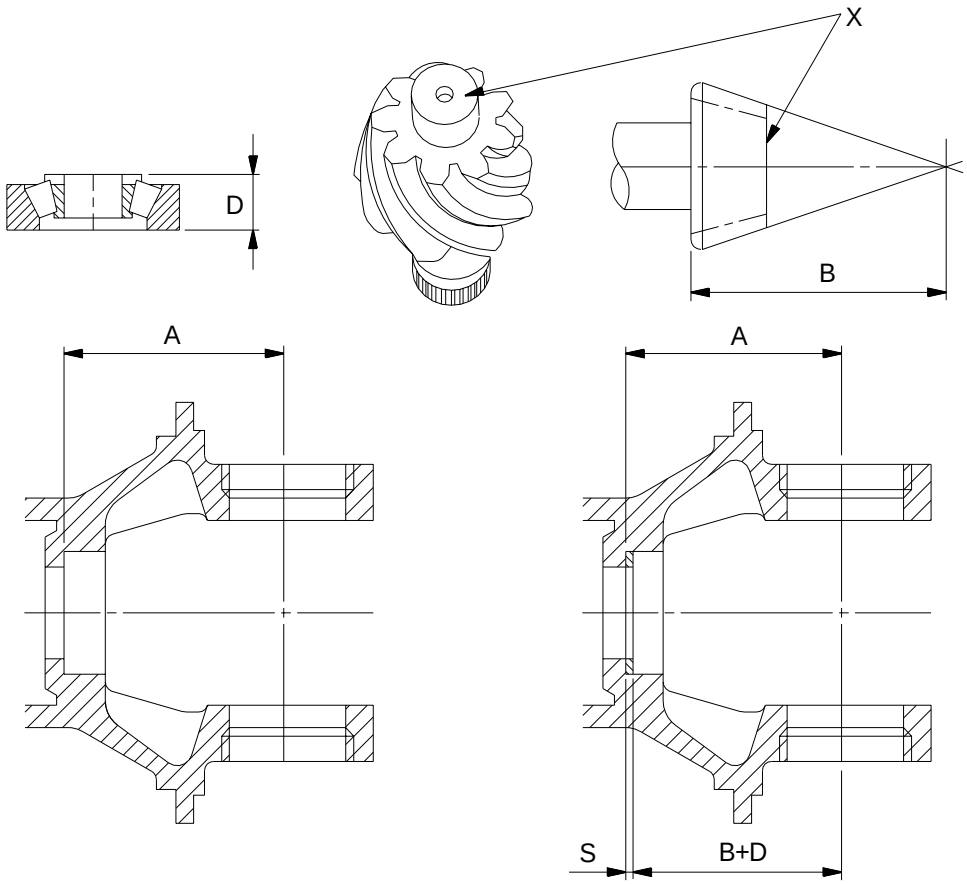


(14) Fit spring pins(1) to lock differential ring nuts.

(15) Make two lock notches on pinion nut collar(27).

※ Apply sealing compound to bevel ring gear deflection plunger(20), then, screw in up to contact; Turn back by about 90 degree to leave the required clearance and lock counternut holding plunger steady.

11) DETERMINING THICKNESS OF ADJUSTMENT SHIMS(Rear axle)



(1) Some dimensions should be recorded before starting reassembly of bevel pinion to determine thickness of spacer to be fitted between inner(Underhead) pinion bearing and backing of relevant seat in differential support.
Record dimension from ring gear axis to seat of inner(Underhead) pinion bearing(That will be identified as **A**).
Example : In our case **A** = 225.1㎜

(2) A number **X** prefixed by symbol ± is marked on bevel pinion face.
Said value, expressed in tenth of millimeter, indicate the deviation from the theoretical distance from pinion underhead to ring gear axis :
i.e. : + 1 = 0.1㎜
Consequently, the true distance(Identified as **B**) will be :
B = 184 ± Deviation
In our case : **B** = 184 + 0.1 = 184.1㎜

(3) Measure thickness of pinion head bearing and identify as **D**.
Example : In our case **D** = 37.15㎜

(4) Compute thickness of shim **S** for proper axial position of bevel pinion :
S = A - (B + D)
Example : In our case **S** = 225.1 - (184.1 + 37.15) = 3.85㎜

(5) Increase by 0.05mm the computed thickness value to compensate subsequent bearing pre-load.
Round off to the nearest tenth of millimeter to the computed thickness value :
i.e. : 4.02 rounded off = 4㎜
3.88 rounded off = 3.9㎜