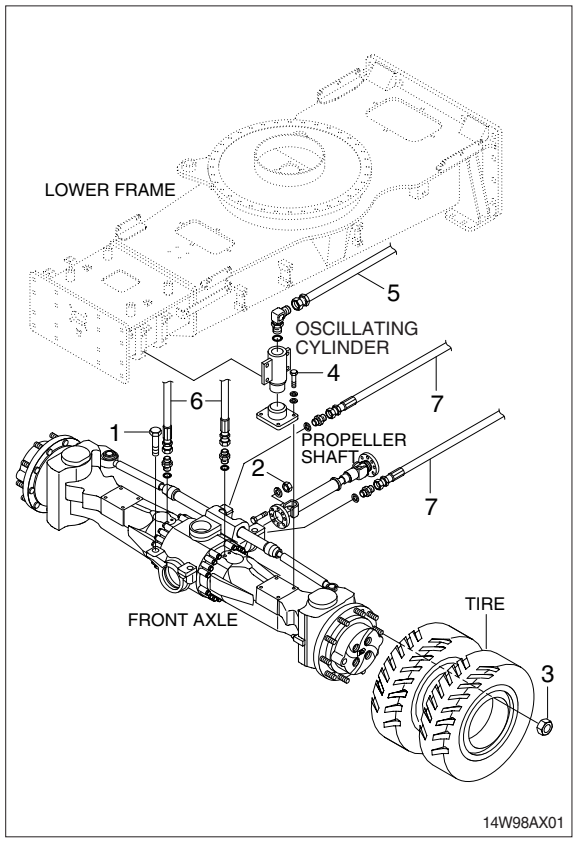
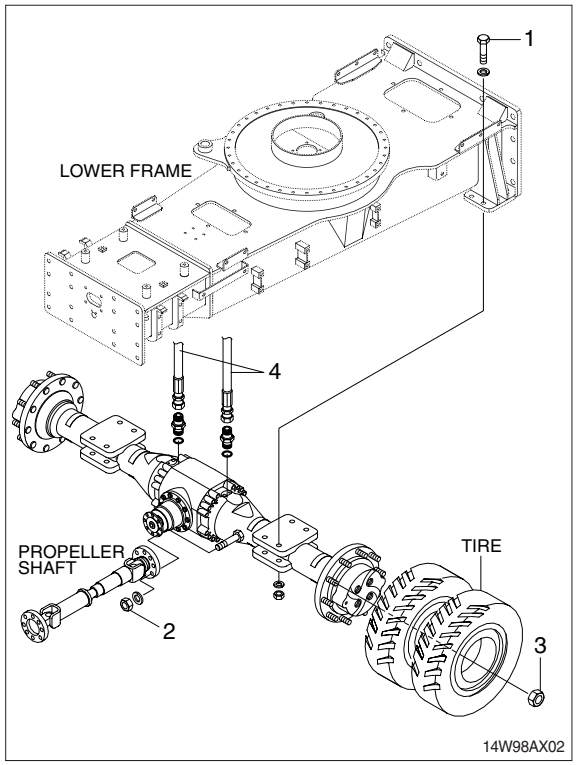
1. REMOVAL FRONT AXLE

1) Front axle mounting bolt (1, M22)
   · Tightening torque : 83.2±9.2 kgf · m
   (602±66.5 lbf · ft)
2) Propeller shaft mounting nut (1, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)
3) Wheel nut (2, M22)
   · Tightening torque : 60 $^{+0}_{-5}$ kgf · m
   (433 $^{+0}_{-36.2}$ lbf · ft)
4) Oscillating cylinder supporting mounting bolt (3, M12)
   · Tightening torque : 12.3±2.5 kgf · m
   (88.9±18.1 lbf · ft)
5) Pipe assy (4)
6) Hose assy (5)
7) Front axle weight : 520 kg (1150 lb)



2. REMOVAL REAR AXLE

1) Rear axle mounting bolt and nut (1, M20)
   · Tightening torque : 58±6.3 kgf · m
   (419±45.5 lbf · ft)
2) Propeller shaft mounting nut (2, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)
3) Wheel nut (3)
   · Tightening torque : 60 $^{+0}_{-5}$ kgf · m
   (433 $^{+0}_{-36.2}$ lbf · ft)
4) Hose assy (4)
5) Rear axle weight : 480 kg (1060 lb)



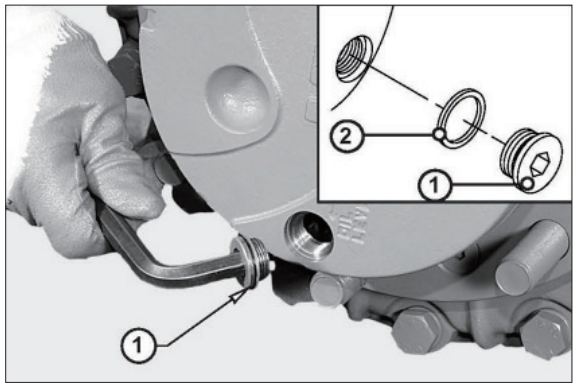
3. GENERAL INSTRUCTIONS

1) During all operations described in this manual, the axle should be fastened onto a trestle, while the other parts mentioned should rest on supporting benches.
2) When removing one of the arms, an anti-tilting safety trestle should be placed under the other arm.
3) When working on an arm that is fitted on the machine, make sure that the supporting trestles are correctly positioned and that the machine is locked lengthways.
4) Do not admit any other person inside the work area; mark off the area, hang warning signs and remove the ignition key from the machine.
5) Use only clean, quality tools; discard all worn, damaged, low-quality or improvised wrenches and tools. Ensure that all dynamometric wrenches have been checked and calibrated.
6) Always wear gloves and non-slip rubber shoes when performing repair work.
7) Should you stain a surface with oil, remove marks straight away.
8) Dispose of all lubricants, seals, rags and solvents once work has been completed. Treat them as special waste and dispose of them according to the relative law provisions obtaining in the country where the axles are being overhauled.
9) Make sure that only weak solvents are used for cleaning purposes; avoid using turpentine, dilutants and toluol-, xylol- based or similar solvents; use light solvents such as kerosene, mineral spirits or water-based, environment friendly solvents.
10) For the sake of clarity, the parts that do not normally need to be removed have not been reproduced in some of the diagrams.
11) The terms RIGHT and LEFT in this manual refer to the position of the operator facing the axle from the side opposite the drive.
12) After repair work has been completed, accurately touch up any coated part that may have been damaged.

4. THE PLANETARY REDUCTION AND AXLE SHAFT

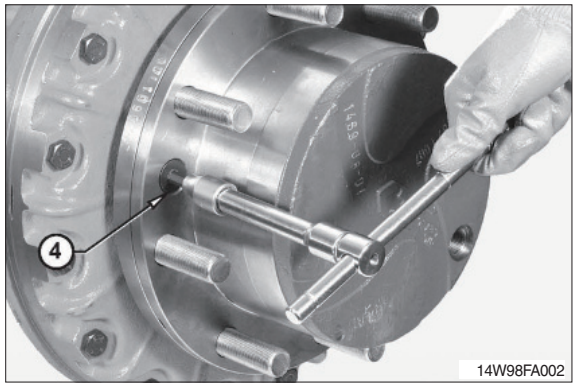
1) DISASSEMBLE

(1) Remove oil-level plug (1) and oil.



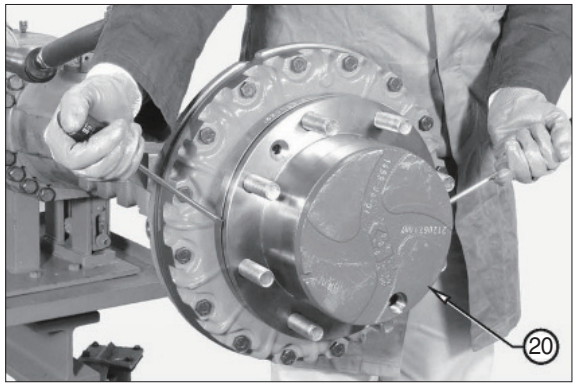
14W98FA001

(2) Remove the securing screws (4) from the planetary carrier cover.



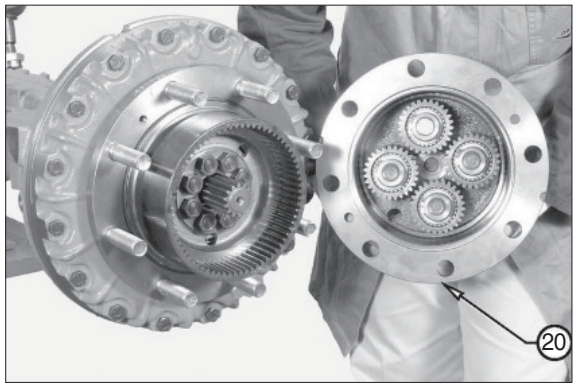
14W98FA002

(3) Disjoint the planetary carrier cover (20) by alternatively forcing a screwdriver into the appropriate slots.



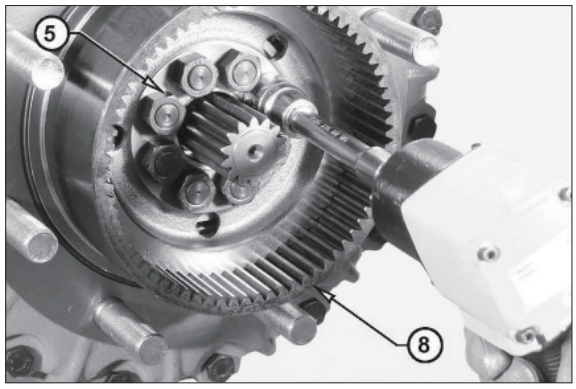
14W98FA003

(4) Remove the complete planetary carrier cover (20) .



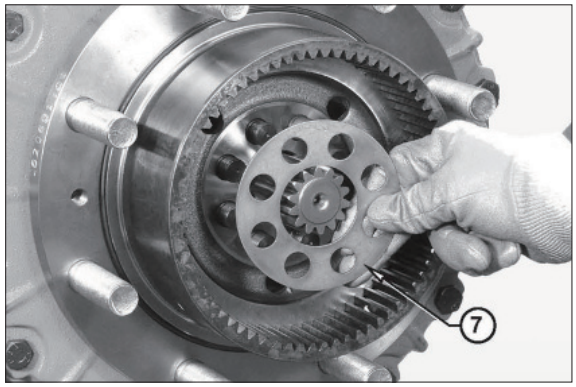
14W98FA004

(5) Unloose and remove the tightening nuts (5) from the crown flange (8).



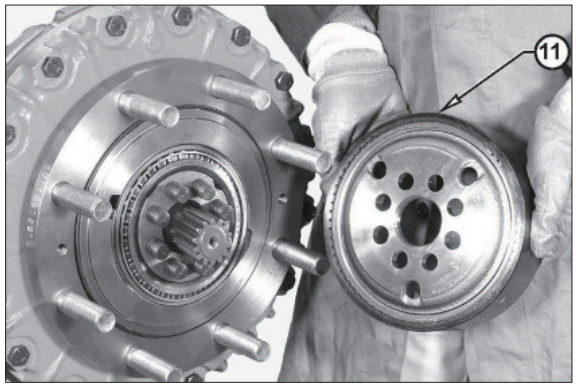
14W98FA005

(6) Remove the safety flange (7).



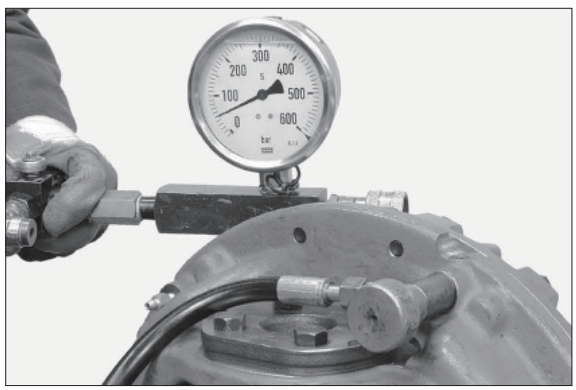
14W98FA006

(7) Using a puller, remove the complete crown flange (11) by acting on the stud bolts.



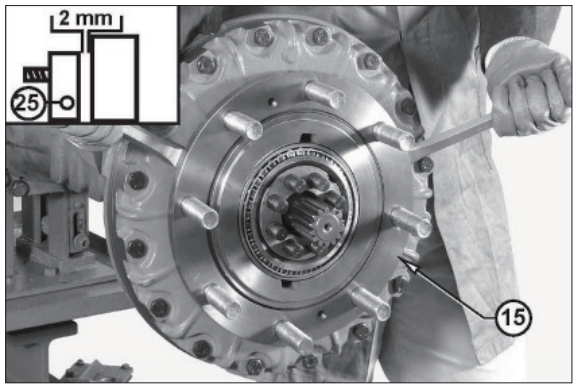
14W98FA007

(8) Engage break circuit pressure at min. 7 bar to block the break discs in position.



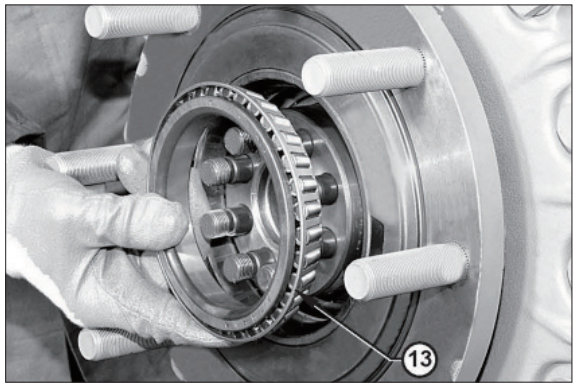
14W98FA008

(9) Using two levers, by hand disjoin the complete hub (15).



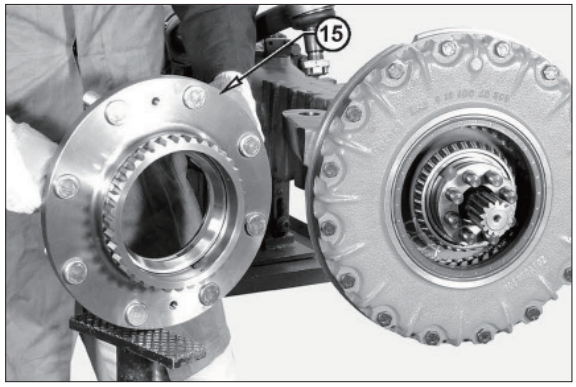
14W98FA009

(10) Remove the external bearing (13).



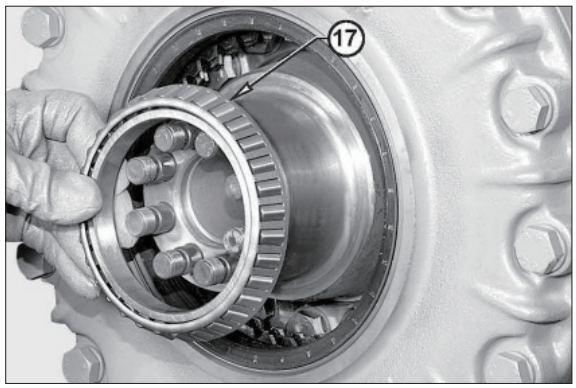
14W98FA010

(11) Extract the hub (15).



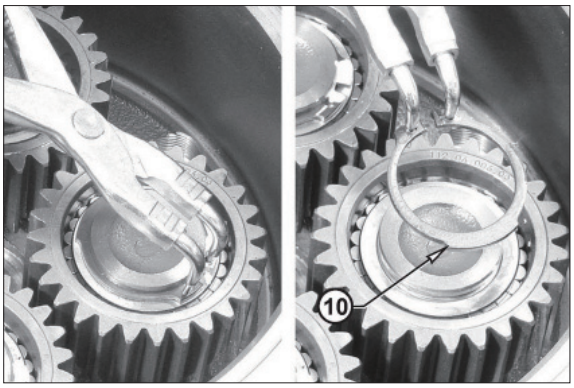
14W98FA011

(12) Remove the internal bearing (17).



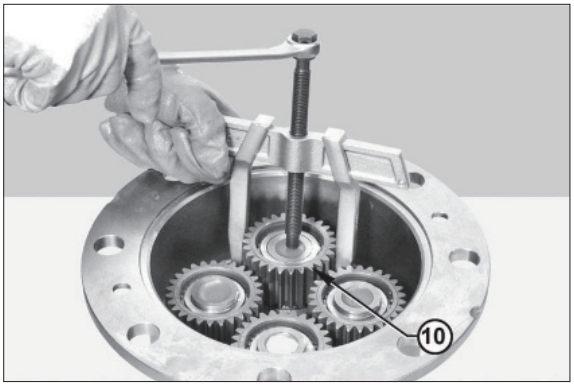
14W98FA012

(13) Remove the snap rings (10).



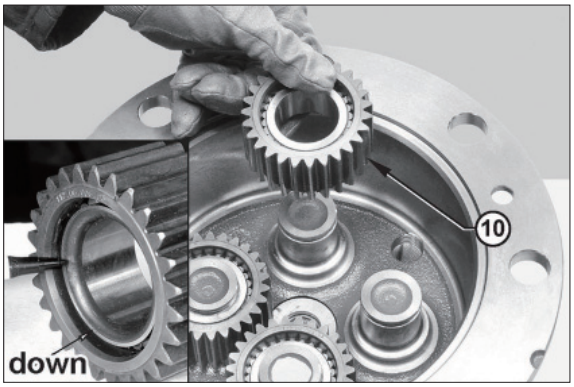
14W98FA013

(14) With the help of an puller, remove the planet wheel gears (10).



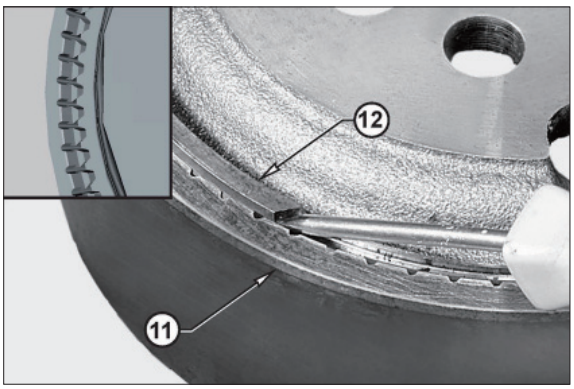
14W98FA014

※ Note down the assembly side of planet wheels.



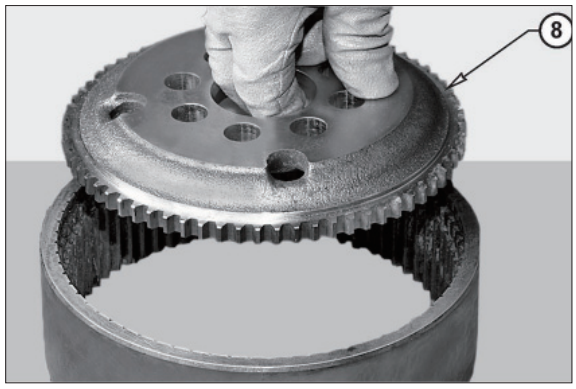
14W98FA015

(15) Remove the snap ring (12) from the crown (11).



14W98FA016

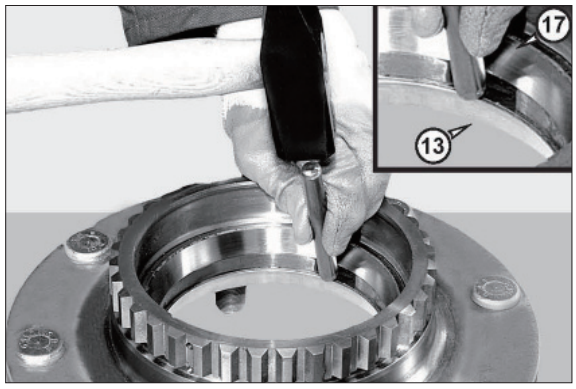
(16) Remove the crown flange (8).



14W98FA017

(17) Remove the thrust blocks (13, 17) from the bearings forcing a pin driver into the appropriate slots on the hub (15).

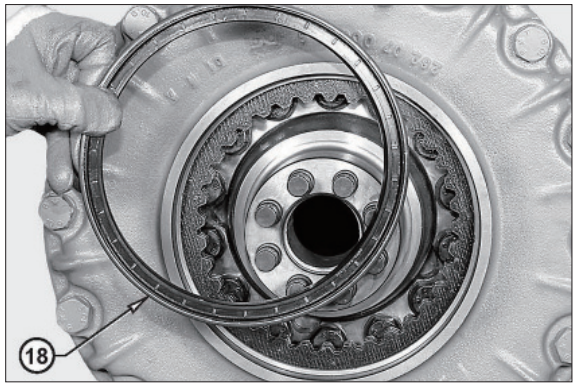
※ Hammer in an alternate way so as to avoid crawling or deformation of the thrust blocks.



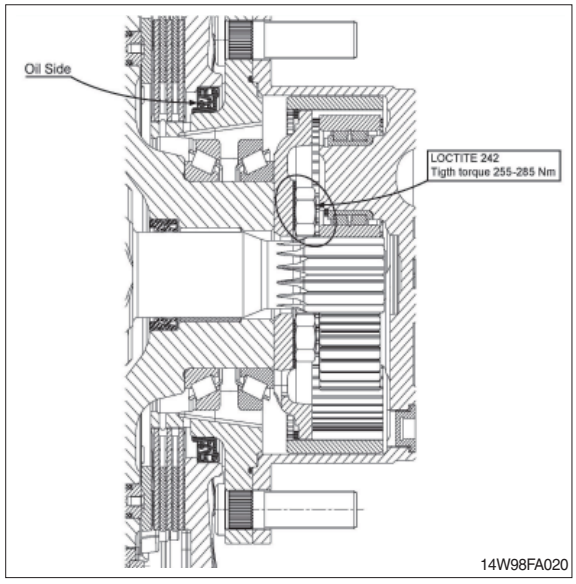
14W98FA018

(18) Remove the sealing ring (18) from the hub.

Note down the assembly sequence.



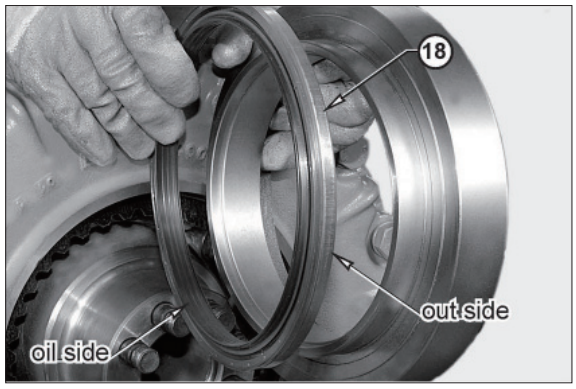
14W98FA019



14W98FA020

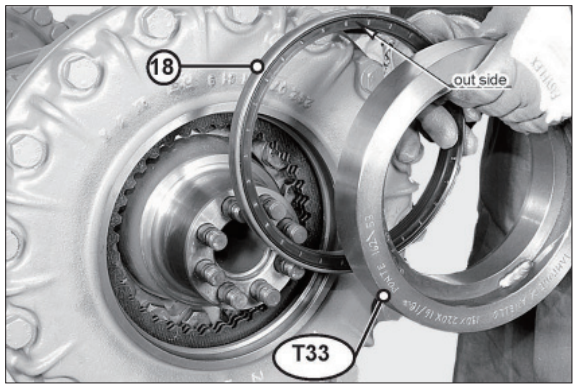
2) ASSEMBLE

(1) Check that the ring (18) is correctly oriented.



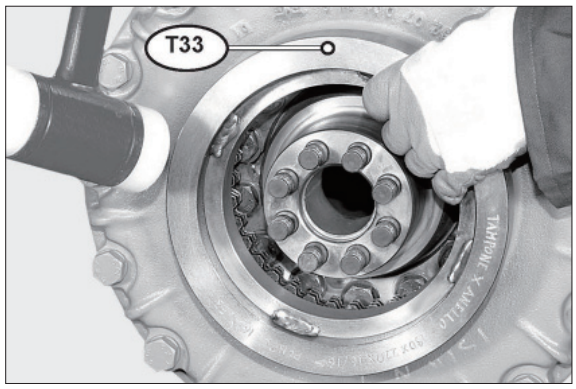
14W98FA021

(2) Apply a sealant for removable seals to the outer surface of the sealing ring (18). Position the sealing ring (18) in the hub.

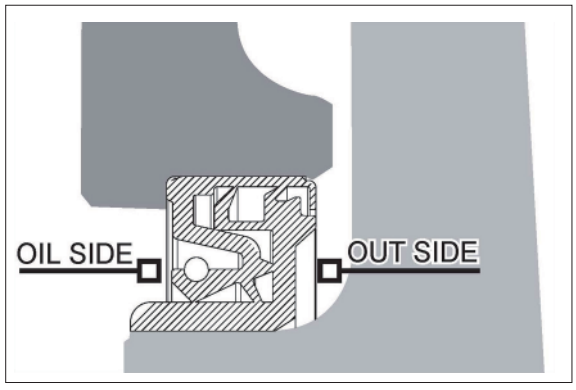


14W98FA022

(3) Assist the insertion of the sealing ring by lightly hammering around the edge with a plastic hammer.

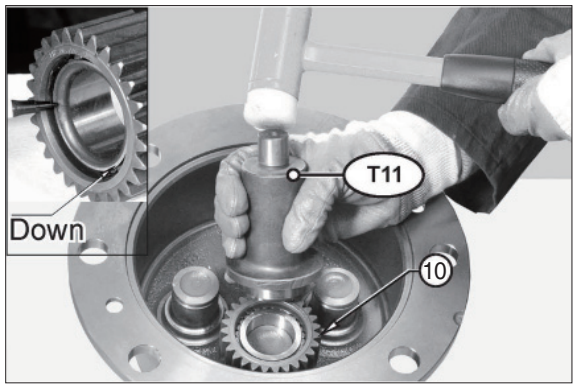


14W98FA023



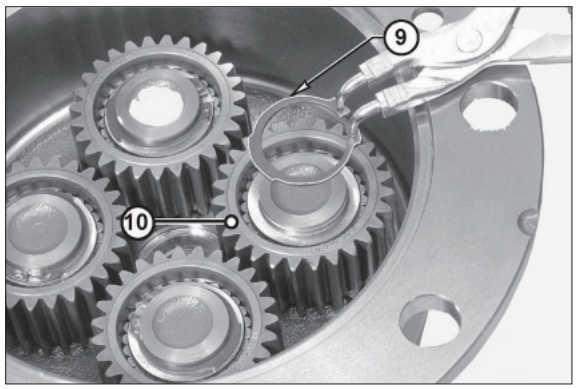
14W98FA024

(4) With the help of tool T11, insert the planet wheel gears (10) into the cover (4). Accurately check the orientation.



14W98FA025

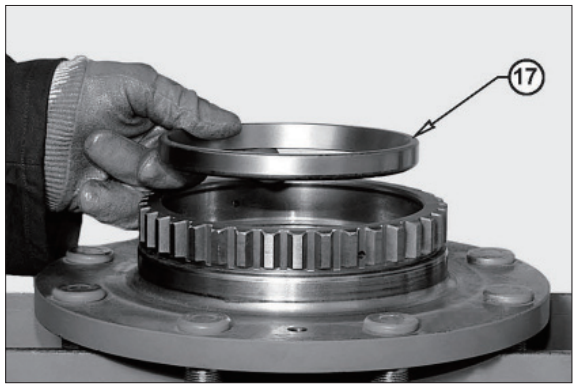
(5) Lock the gears (10) into position by fitting the snap rings (9).



14W98FA026

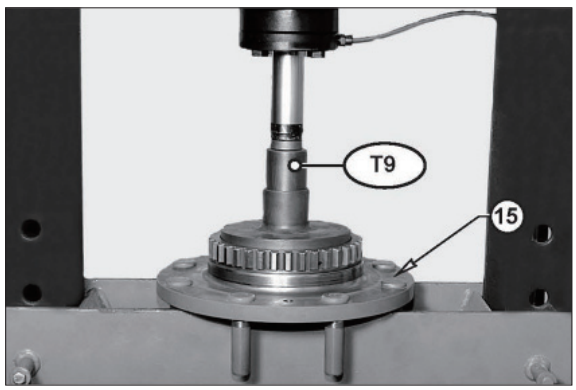
(6) Position the thrust block of the internal bearing (17).

※ Check that the thrust block is correctly oriented.



14W98FA027

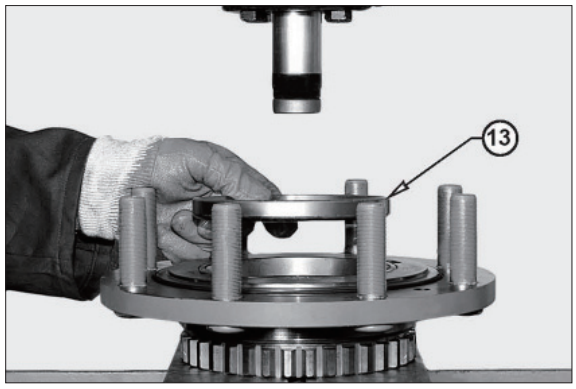
(7) Position the upper part of tool T9 and press the thrust block into the hub (15) all the way down.



14W98FA028

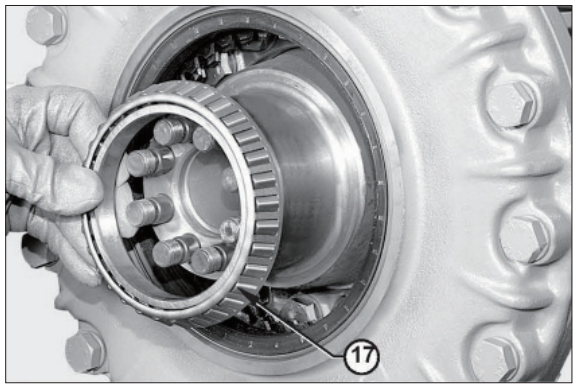
(8) Position the thrust block of the external bearing (13).

※ Check that the thrust block is correctly oriented.



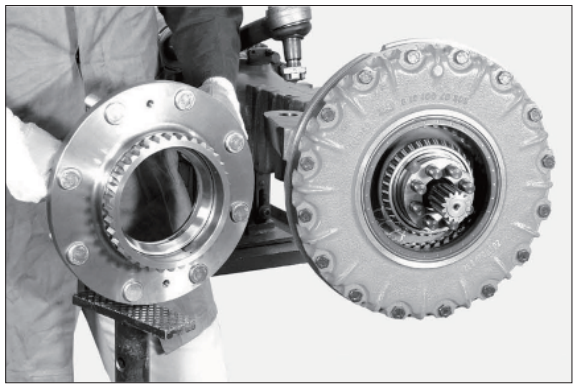
14W98FA029

(9) Install the internal bearing (17).



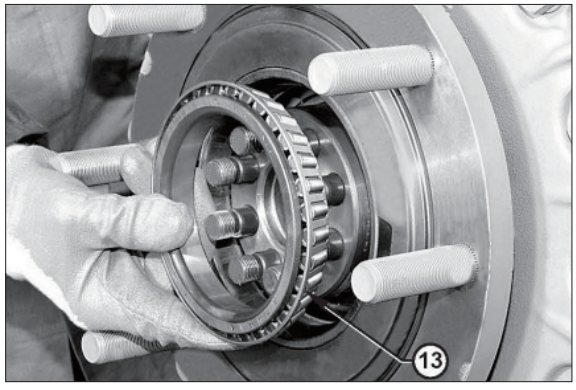
14W98FA030

(10) Install the hub (15).

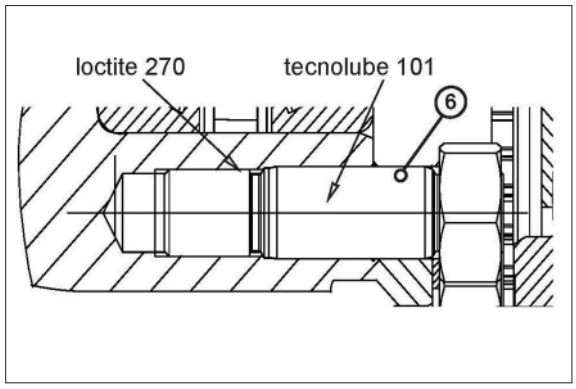


14W98FA031

(11) Install the external bearing (13).

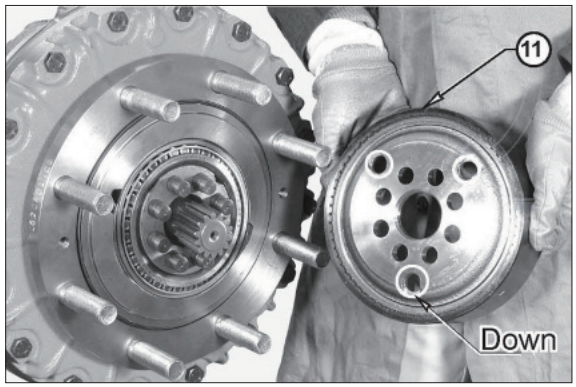


14W98FA032



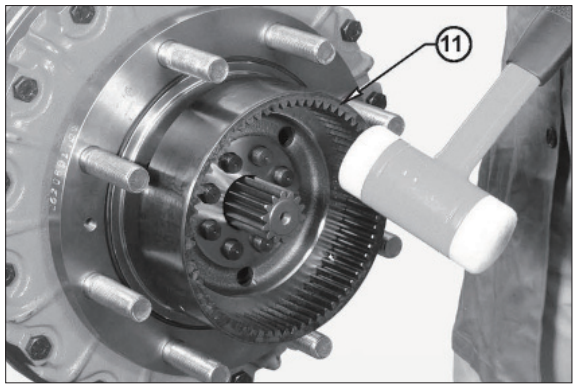
14W98FA033

(12) Fit the complete crown flange (11).



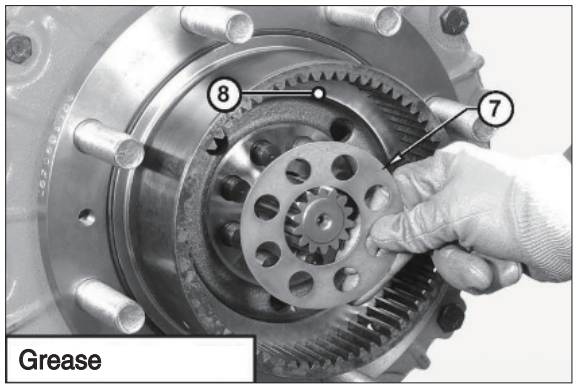
14W98FA034

※ In order to fasten the flange (11), use a plastic hammer and alternately hammer on several equidistant points.



14W98FA035

(13) Apply grease to the surface of the safety flange (7) which touches the crown flange (8).
Fit the safety flange (7).

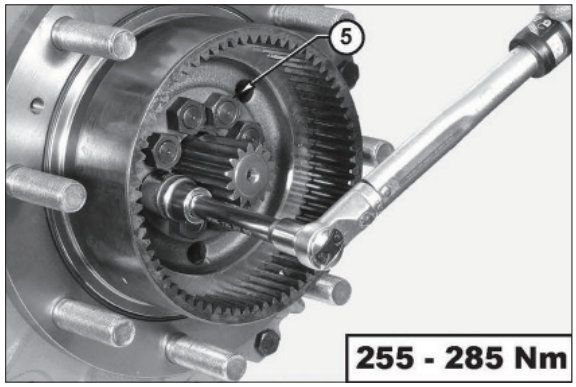


14W98FA036

(14) Apply loctite 242 to the studs and fit in the nuts (5).

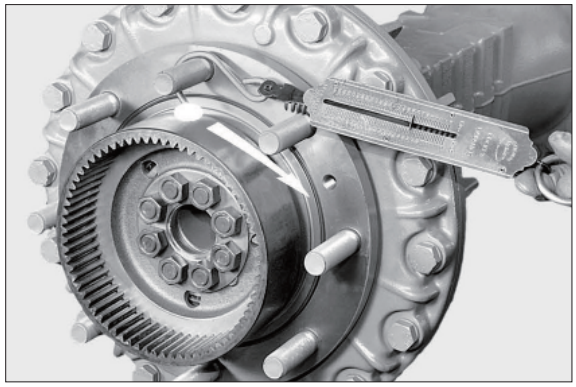
14W98FA037

(15) Cross tighten the nuts (5) in two stages.
Initial torque wrench setting : 120 Nm
Final torque wrench setting : 255~285 Nm



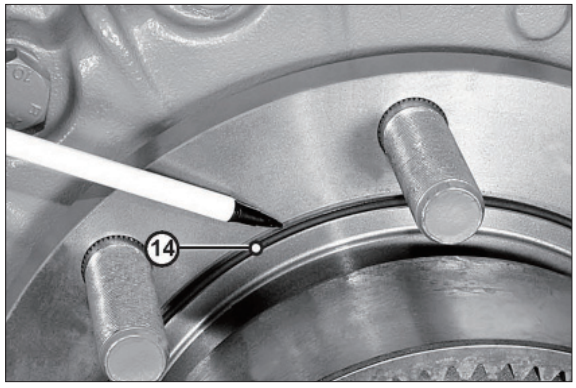
14W98FA038

(16) Check the continuous rolling torque on the hub.
Torque 10~30 Nm.



14W98FA039

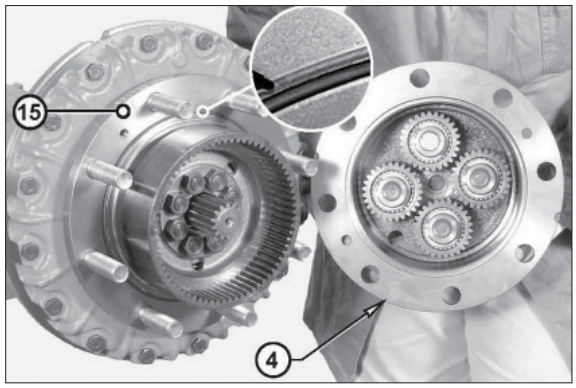
(17) In order to facilitate assembly, apply grease on the O-ring (14).



14W98FA040

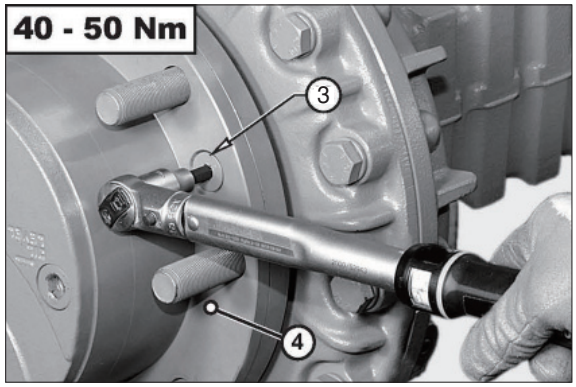
(18) Fit the planetary carrier cover (4) onto the hub (15).

※ Check that the O-ring is in good condition and in position.



14W98FA041

(19) Lock the planetary carrier cover (4) by tightening the screws (3).
Torque wrench setting for screws: 40~50 Nm

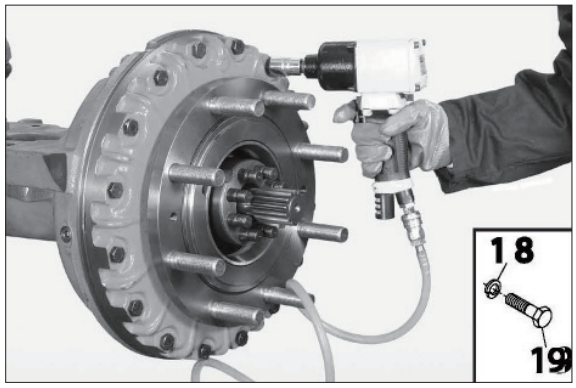


14W98FA042

5. CHECKING WEAR AND REPLACING THE BRAKING DISKS

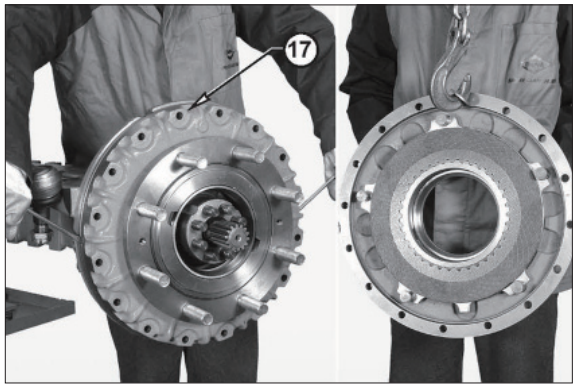
1) DISASSEMBLE THE BRAKING UNIT

(1) Remove fix in screws (19).



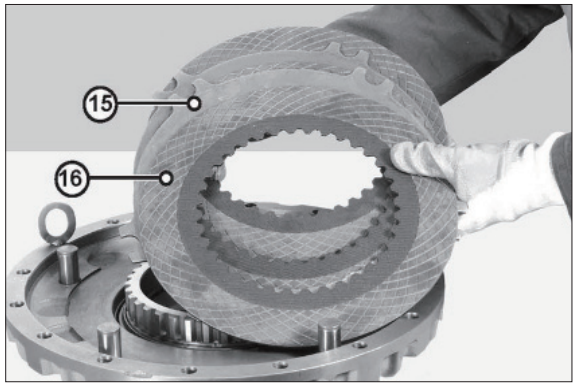
14W98FA043

(2) Disjoin the cover (17) from the hub by alternatively forcing a screwdriver into the appropriate slots.



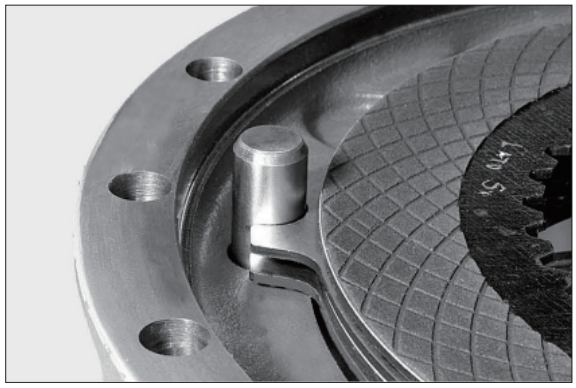
14W98FA044

(3) Remove the braking disks (15, 16) and note down their order of assembly.



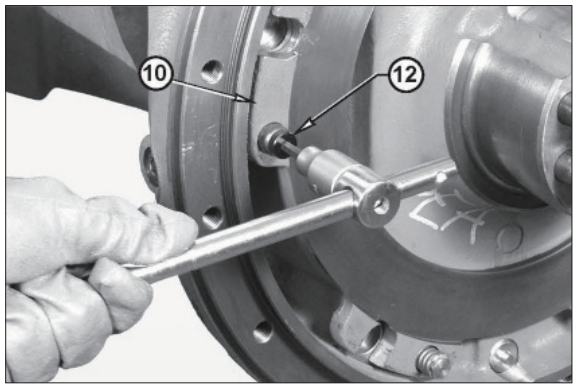
14W98FA045

(4) If the disks do not need replacing, avoid switching their position.



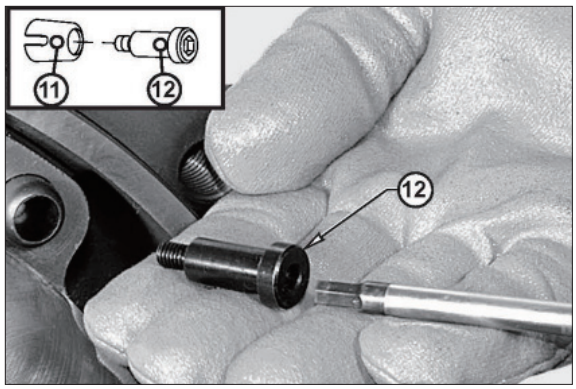
14W98FA046

(5) Remove the pin screws (12) of the counter plate (10).



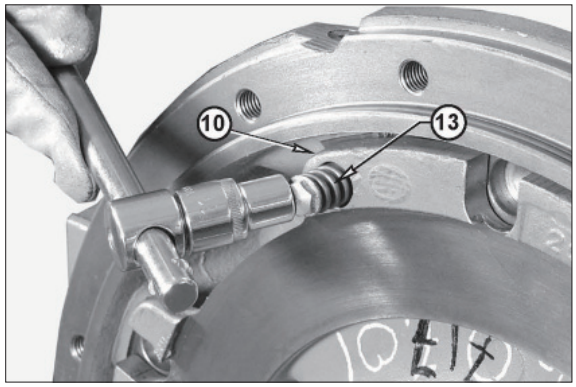
14W98FA047

※ If the screws are to be replaced, note down the different colours for the different brake gap.



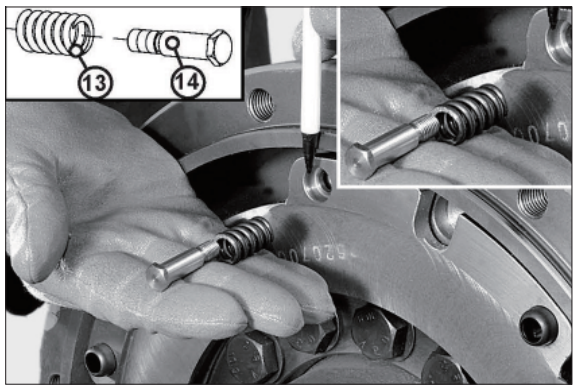
14W98FA048

(6) Remove the reversal springs (13) from counter plate (10).



14W98FA049

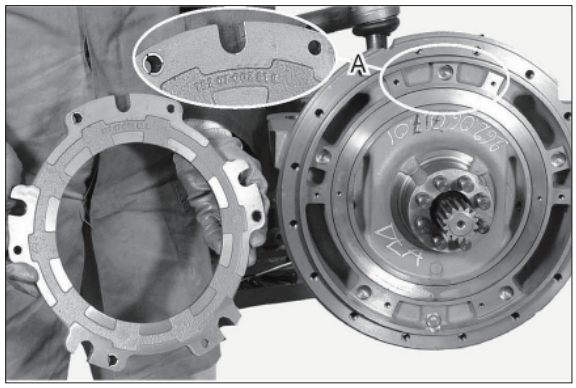
※ If the springs (13) are weak or deformed they must be replaced.



14W98FA050

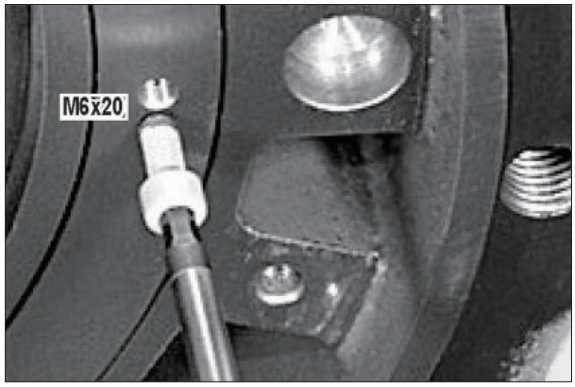
(7) Remove the intermediate plate (10).

※ Note down the direction the montage (A).



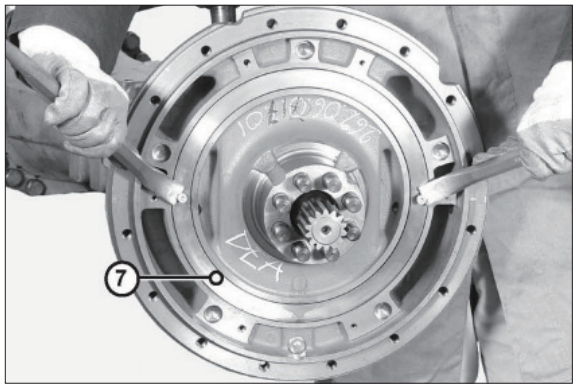
14W98FA051

(8) Tighten two screws M6 × 20 on the piston.



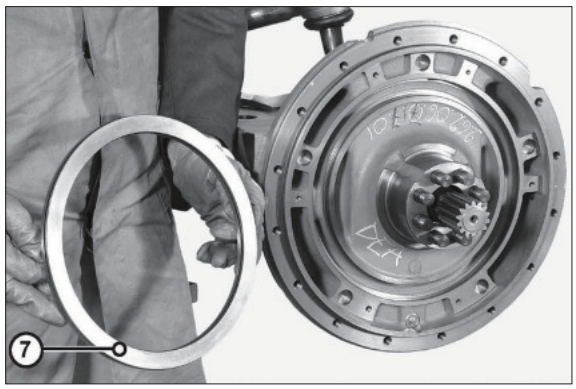
14W98FA052

(9) Using two levers, remove the piston (7).



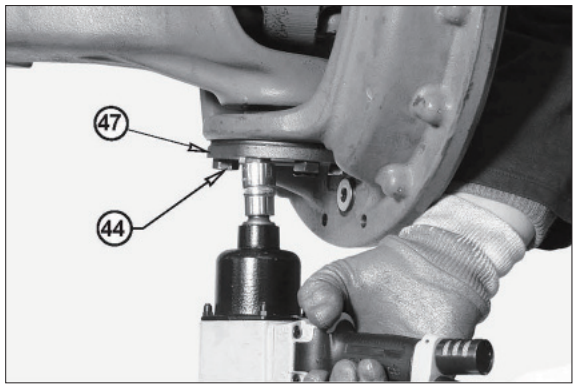
14W98FA053

※ Note down the side for assembly.



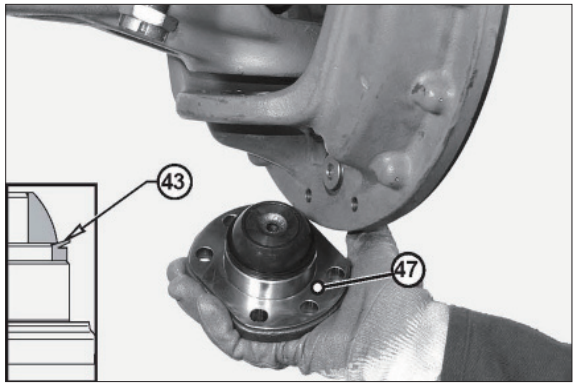
14W98FA054

(10) Unloose and remove the screws (44) from the articulation pin (47).



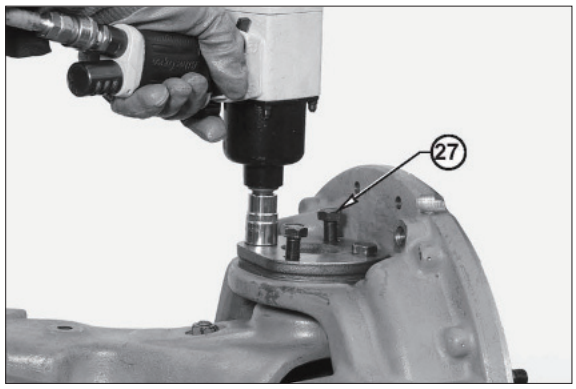
14W98FA055

(11) Remove the bottom articulation pin (47) complete with front sealing ring (43).



14W98FA056

(12) Unloose and remove the screws (27) from the articulation pin (26).

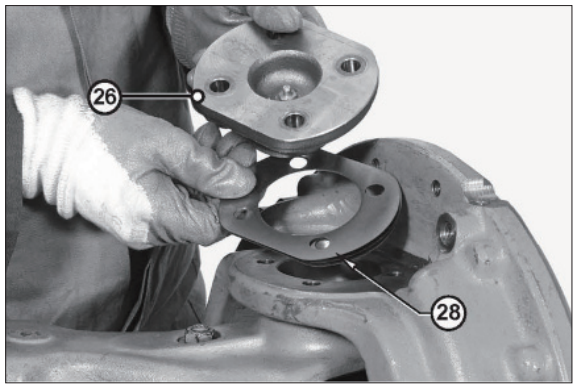


14W98FA057

(13) Using two levers, remove the top articulation pin (26) complete with front seal (29).

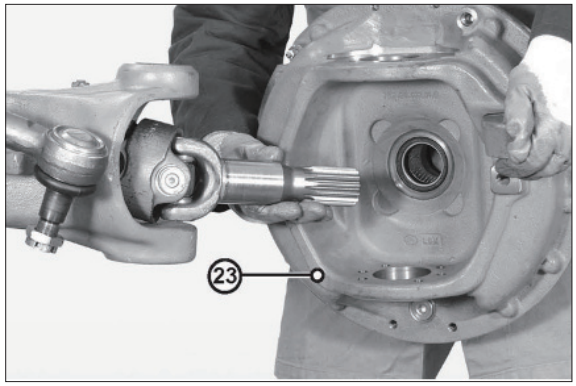
※ Pay attention not to damage the surfaces.

14W98FA058



14W98FA059

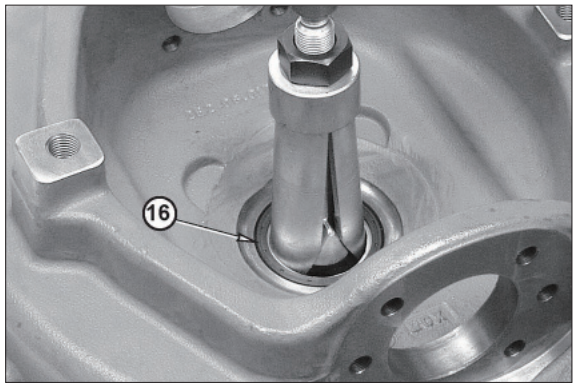
(14) Remove the complete steering case (23).



14W98FA060

(15) Using a puller, take off the sealing ring (16) from the steering case.

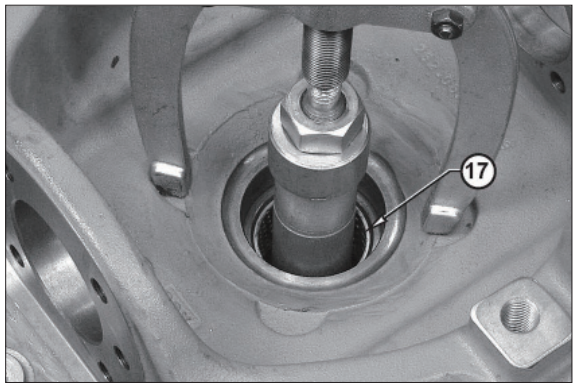
※ Note down the orientations of the sealing rings (16).



14W98FA061

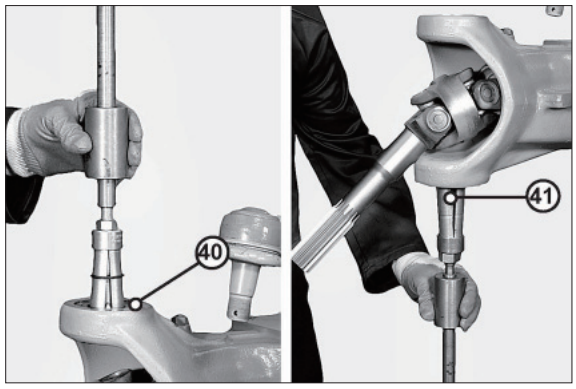
(16) Using a puller, take off the bush (17) from the steering case.

※ Note down the orientations.



14W98FA062

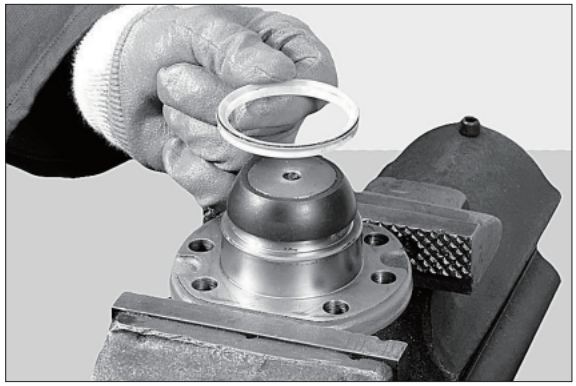
(17) Using a puller for inner parts, remove the top bush (40) and the bottom ball-bush (41).



14W98FA063

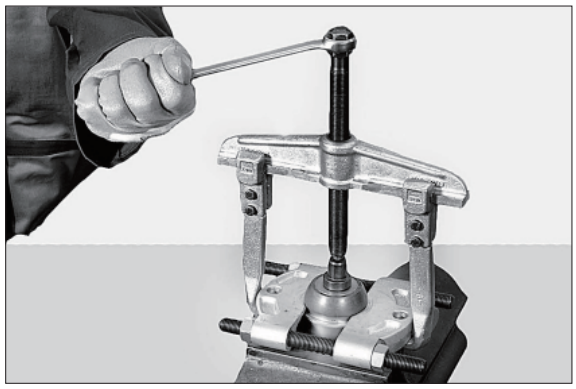
(18) Remove the articulation pins (41) and the front sealing rings (43).

※ Note down the side for assembly.

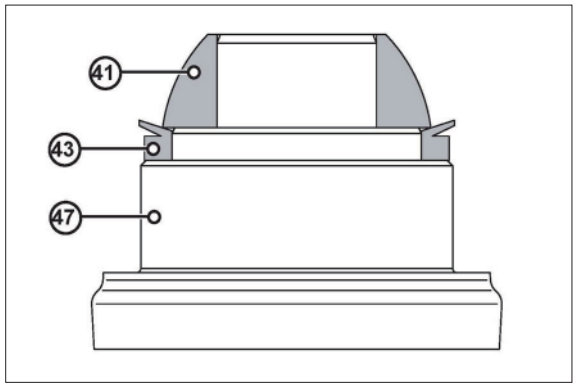


14W98FA064

(19) If the ball cover needs replacing, remove it from the bottom articulation pin.



14W98FA065



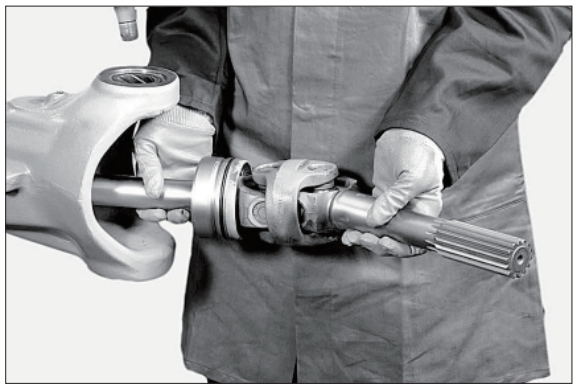
14W98FA066

(20) Unloose and remove the top and bottom check nuts from the dowels.
Remove top and bottom check dowels from the flange or bushing.

14W98FA067

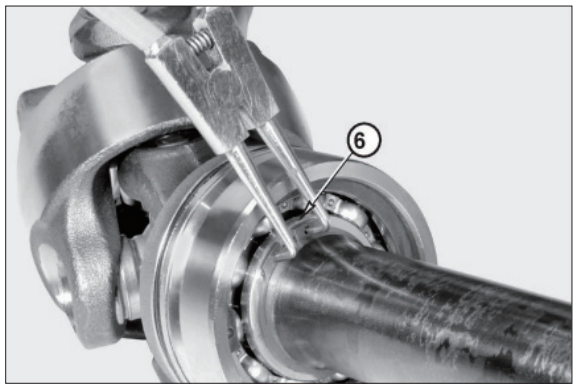
(21) Remove the U-joint.

※ To remove the U-joint use, if necessary, a plastic hammer or a lever.



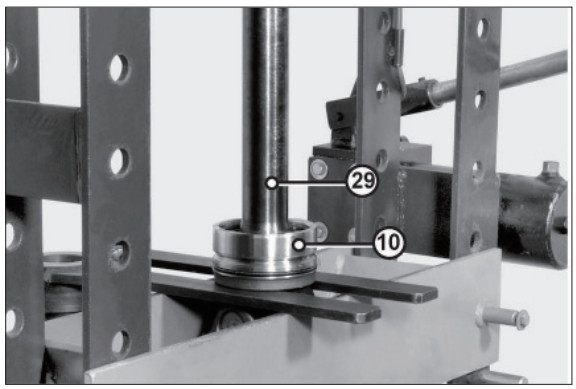
14W98FA068

(22) Remove the snap ring (6) from the bearing.



14W98FA069

(23) Position the entire U-joint (29) under a press and remove the complete bush (10).



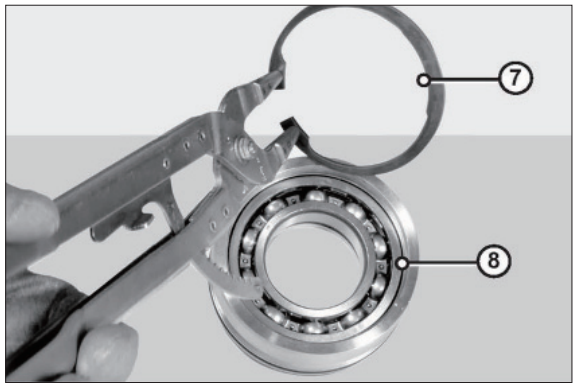
14W98FA070

6. UNIVERSAL-JOINT

※ Front axle only

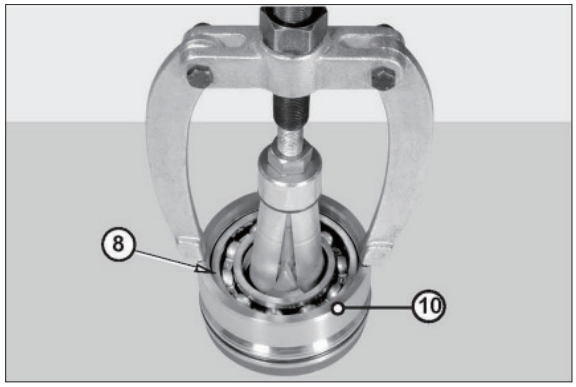
1) REMOVE THE U-JOINT

(1) Remove the snap ring (7) from the bearing (8).



14W98FA071

(2) Use a puller to remove the bearing (8) and by using a tool remove the sealing ring.



14W98FA072

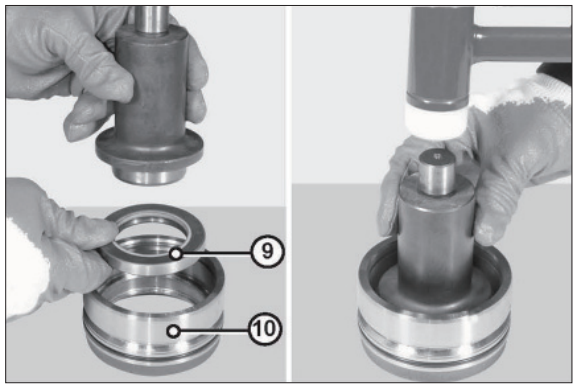
7. STEERING CASE

※ Front axle only

1) INSTALL THE COMPLETE STEERING CASE

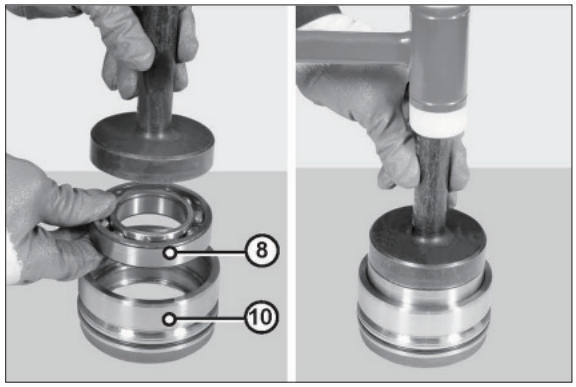
(1) Using tools T3, insert the sealing ring (9) in the bush (10).

※ Carefully check the assembly side of the seal.



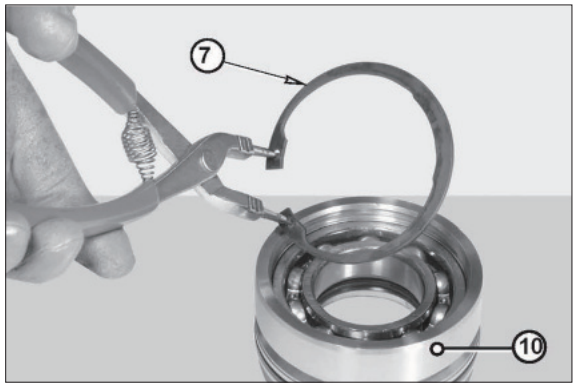
14W98FA073

(2) Using tools T4, insert the bearing (8) in the bush (10).



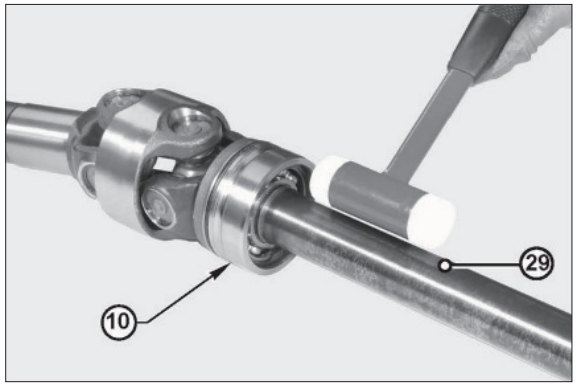
14W98FA074

(3) Fit the snap ring (7) on the bearing (10).



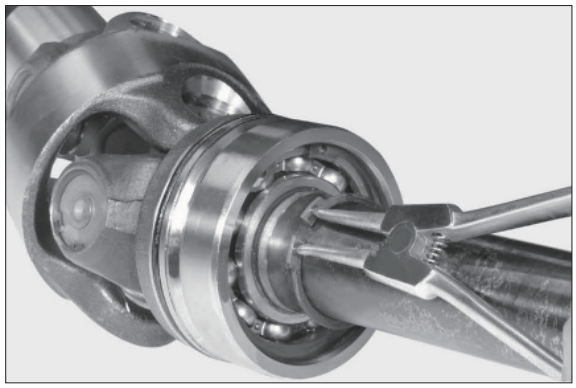
14W98FA075

(4) Fit the flange (10) onto the U-joint (29).

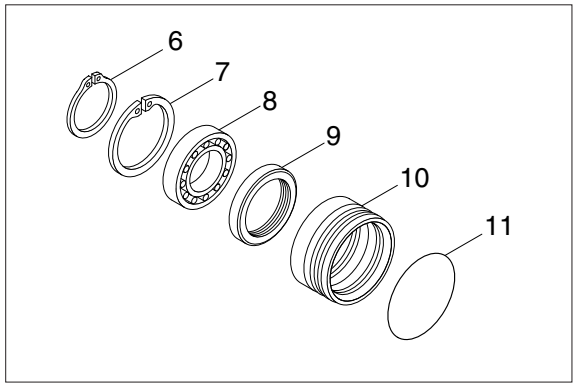


14W98FA076

(5) Fit the snap ring (6) of the bearing (8).



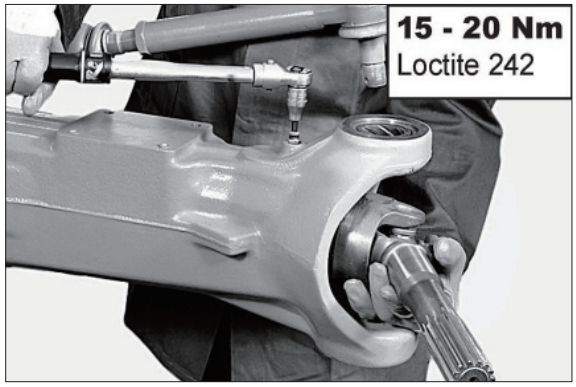
14W98FA077



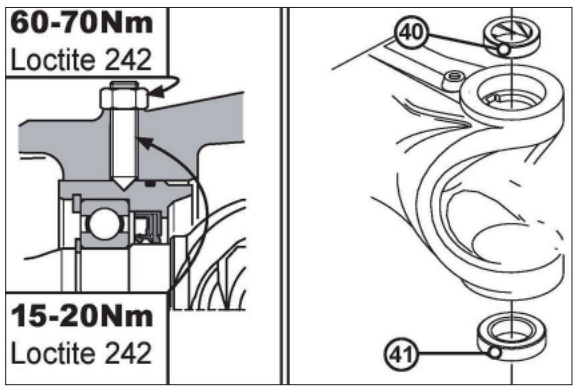
14W98FA078

(6) Insert the U-joint and tighten the top and bottom dowels.
· Torque wrench setting : 15~20 Nm.

※ For U-joint coming with a bush, center the point of the check dowels in the slot.

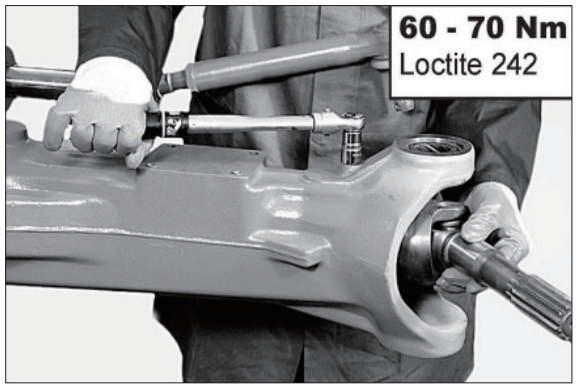


14W98FA079



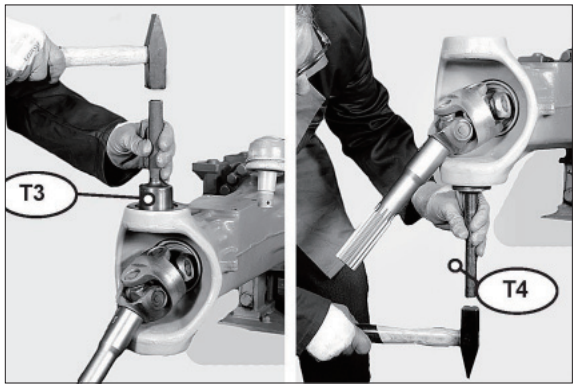
14W98FA080

(7) Screw the check nuts of the dowels and lock them using a dynamometric wrench.
· Torque wrench setting : 60~70 Nm



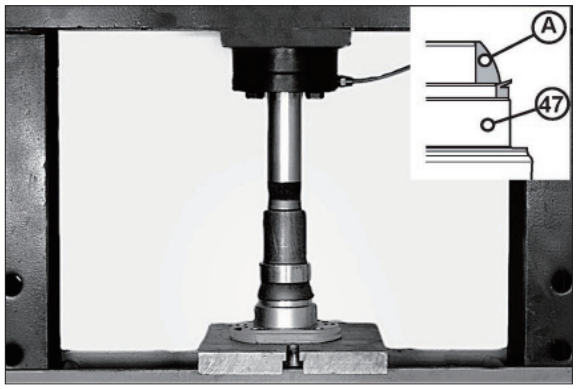
14W98FA081

(8) Lubricate the top bush (7) or the bottom ball bush (10) and fit them into the fulcrum holes of the arm.
Use tools T3 and T4.



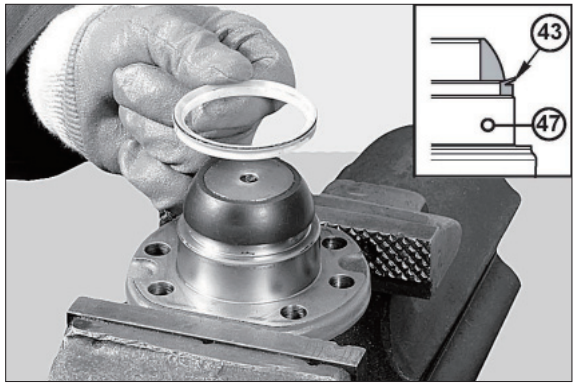
14W98FA082

(9) If the bottom articulation pin (47) has been extracted, position the pin under a press and fit the ball cover A.



14W98FA083

(10) Fit the front sealing ring (43) onto the articulation pin (47).
※ Carefully check that the rings are properly oriented.

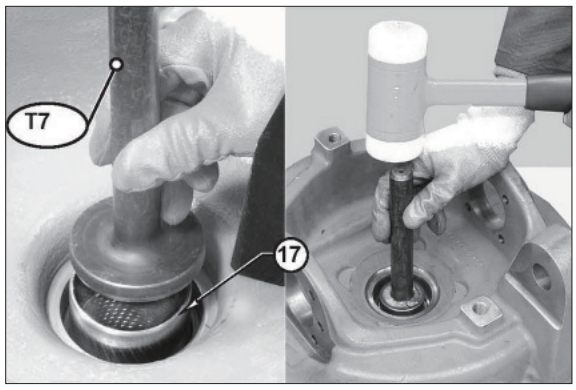


14W98FA084

8. BRAKING UNITS

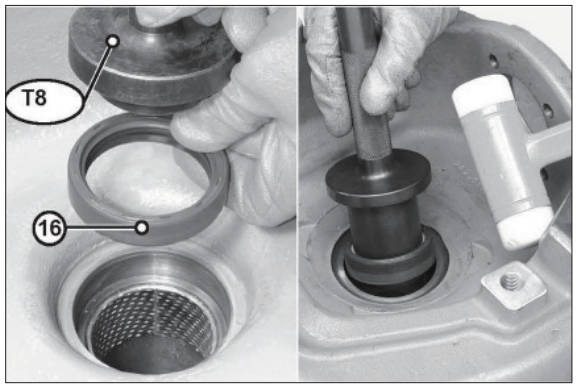
1) ASSEMBLE THE BRAKING UNITS

(1) Using tool T7, lubricate and assemble bearing (17).



14W98FA085

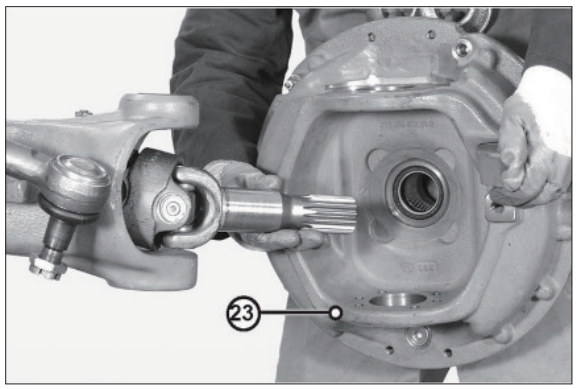
(2) Lubricate the outer surface of the sealing ring (16) and assemble it into it's position by using the tool T8.



14W98FA086

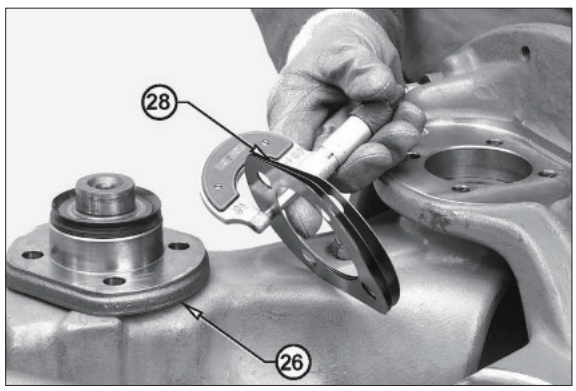
(3) Lubricate the terminal of the U-joint and install the steering case (23).

※ Pay attention don't damage the dust cover rings and the sealing rings.



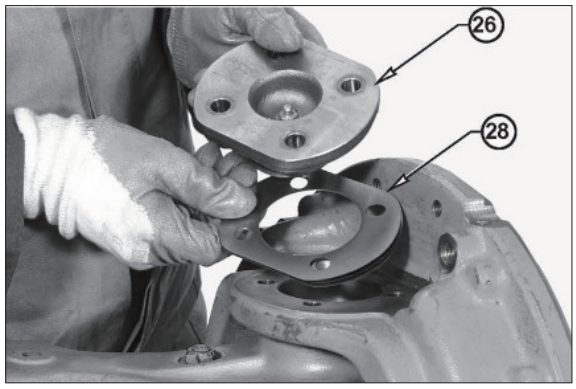
14W98FA087

(4) Prepare a series of shims (28) of 0.4 up to 0.7 mm.
To be assembled under the upper pin (26).



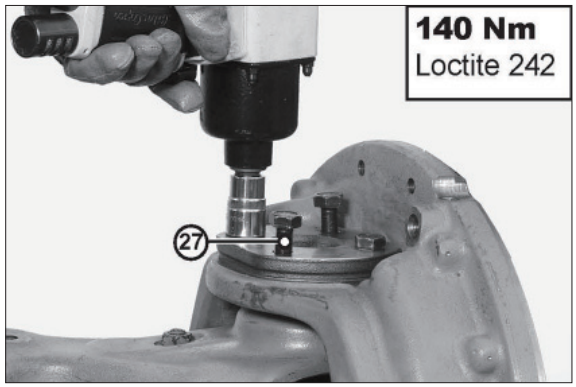
14W98FA088

(5) Lubricate and install the unit in the steering case.



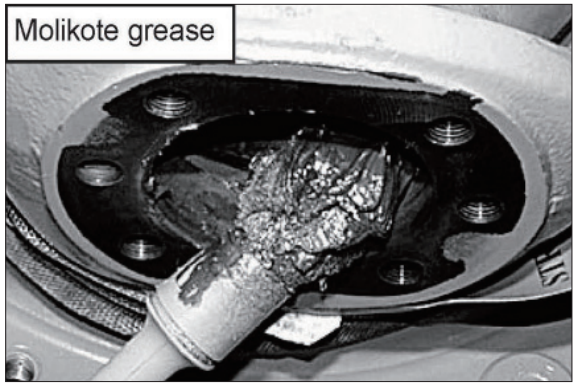
14W98FA089

(6) Tighten the new fittin screws (27) of top articulation pins in sequence using the cross tightening method.
· Torque wrench setting : 140 Nm



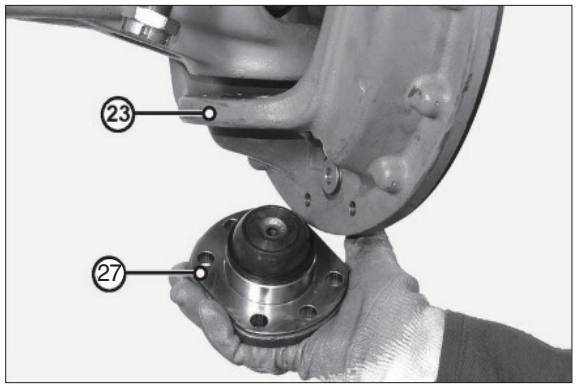
14W98FA090

(7) Lubricate the steering case.



14W98FA091

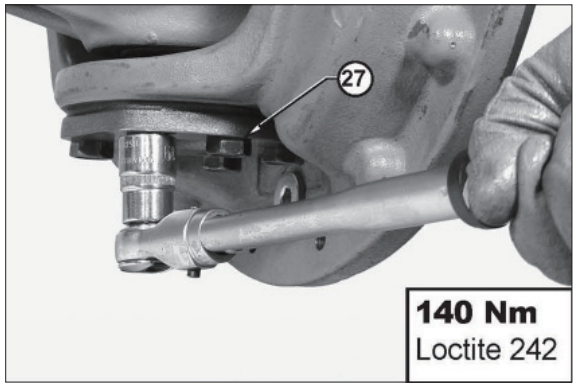
(8) Fit the unit (43) in the steering case (23). Position the screws (27) and tightly tighten.



14W98FA092

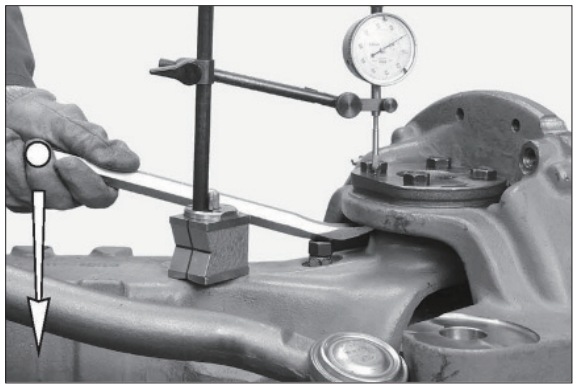
14W98FA093

(9) Tighten the new screws (27) of bottom articulation pins in sequence using the cross tightening method.
· Torque wrench setting : 140 Nm



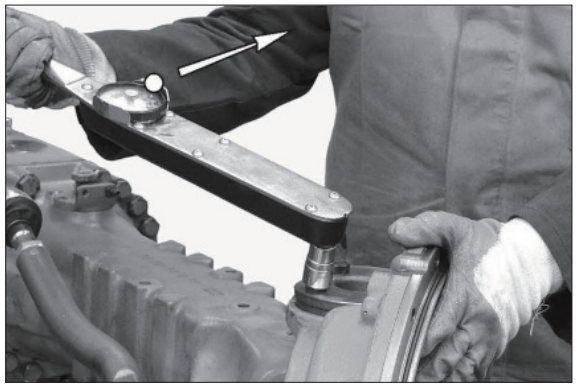
14W98FA094

(10) Check by means of a lever that there is no vertical gap.
In case there is any gap, determine the width and reduce it by removing shims.



14W98FA095

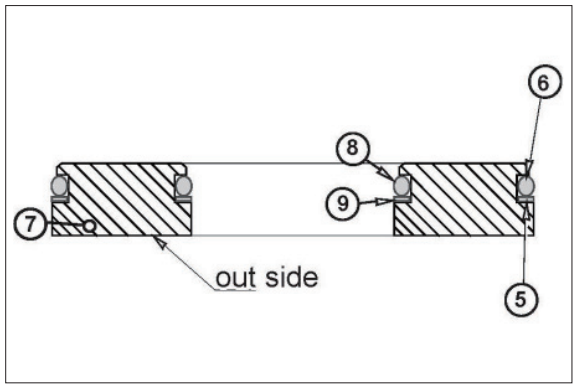
(11) Check the torque of the pins, which has to be between 40 and 80 Nm.
If the preliminary measured value is too high, the shims have to be increased.



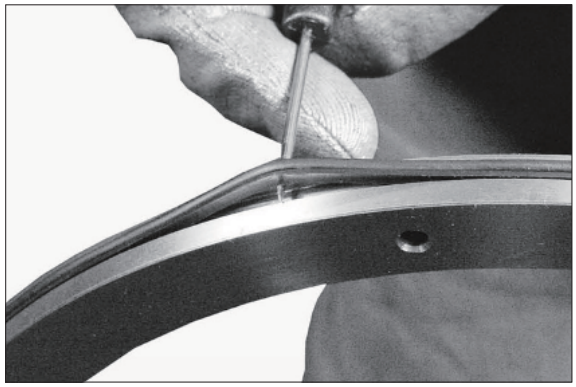
14W98FA096

(12) Accurately clean the piston (9) and the seats of slide and seal.
Replace the O-rings (5) and (8) and the back up rings (6) and (9) ; make sure that the assembly side is correct.

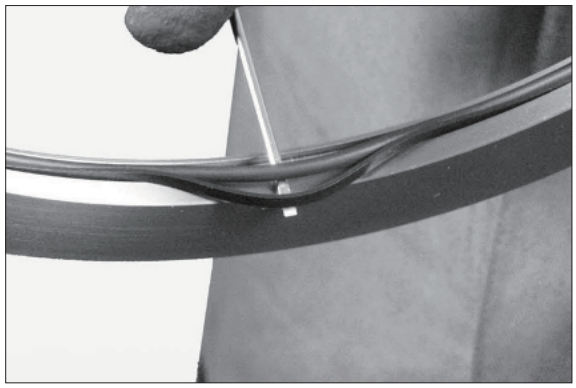
※ Accurately check the positioning of the back up rings (6) and (9).



14W98FA097



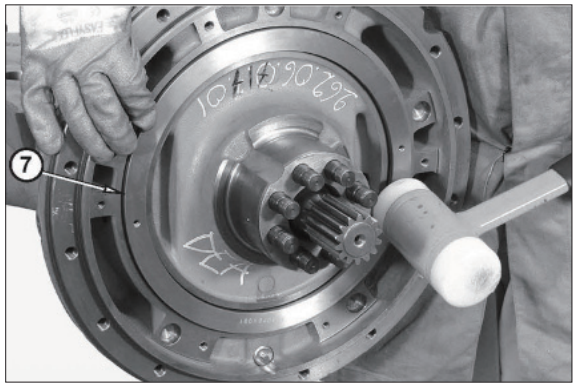
14W98FA098



14W98FA099

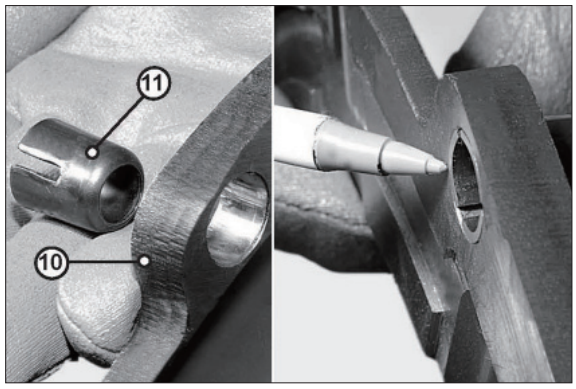
(13) Insert the piston (7).

※ Check that the O-ring (5, 8) and back-up rings are in good condition and in position.



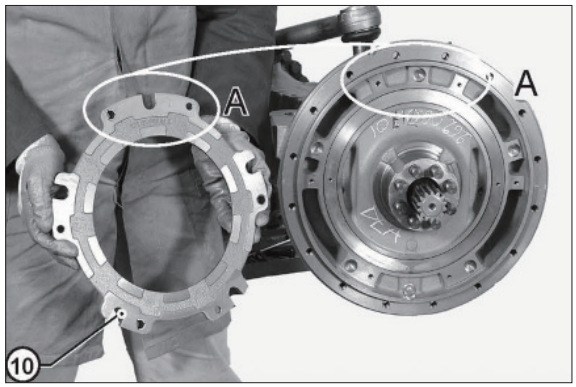
14W98FA100

(14) Before installing the intermediate disk, insert the stroke automatic regulation springs (11) ; place them in line with the intermediate disk (10).



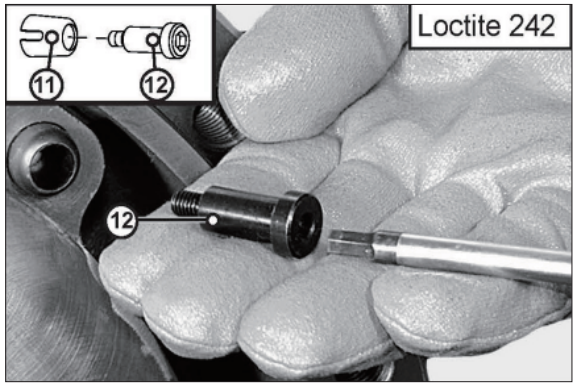
14W98FA101

(15) Install the intermediate disk (10) with the sign position (A).



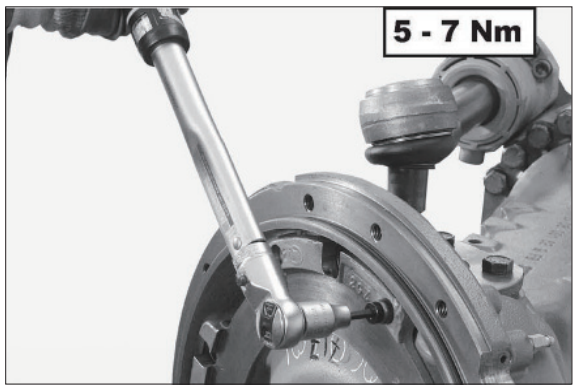
14W98FA102

(16) Apply loctite 270 to the thread, fit the pin screws (12).



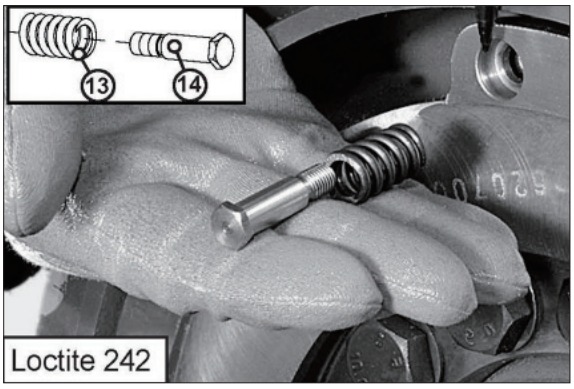
14W98FA103

(17) Use a torque wrench setting of 5~7 Nm.



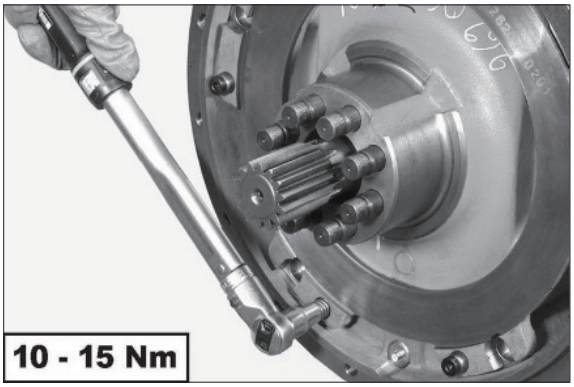
14W98FA104

(18) Apply loctite 270 to the thread, fit the pin screws (14).



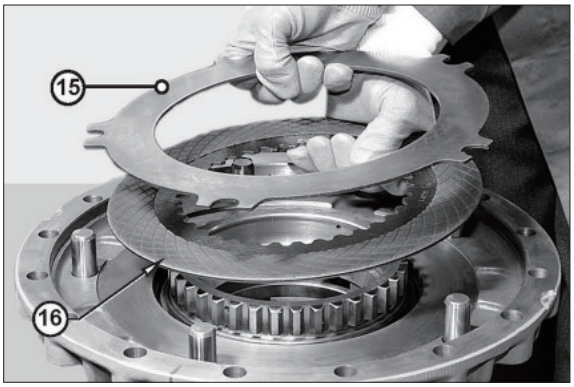
14W98FA105

(19) Use a torque wrench setting of 10-15 Nm.

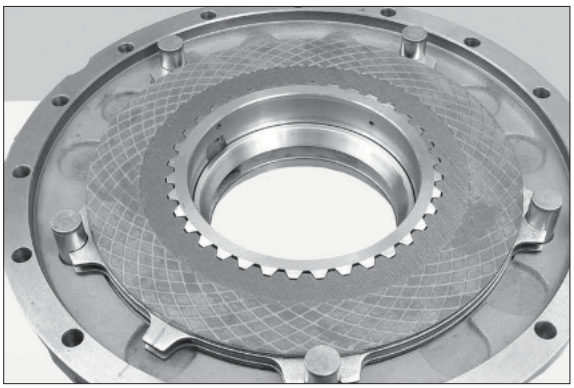


14W98FA106

(20) Slightly lubricate the braking disks (15 ,16).
Fit the braking disks (15, 16) in the arm following the correct sequence.

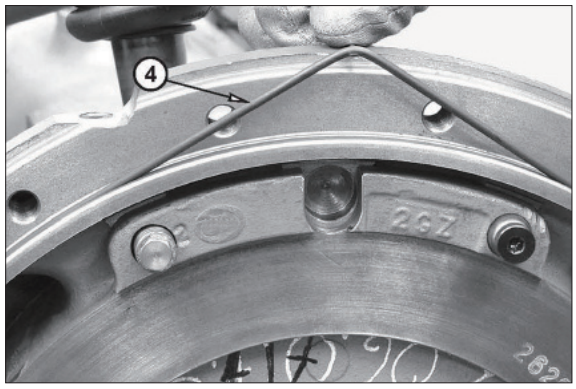


14W98FA107



14W98FA108

(21) Install a new O-ring (4).

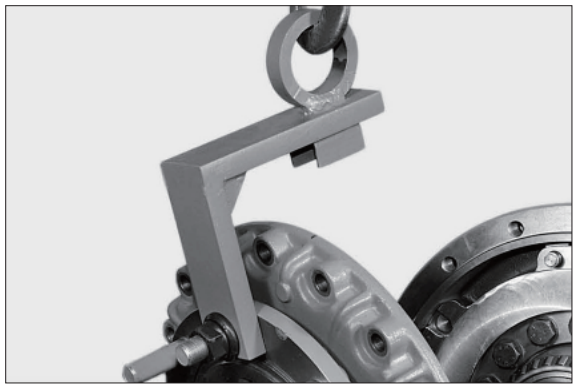


14W98FA109

(22) Install internal bearing.

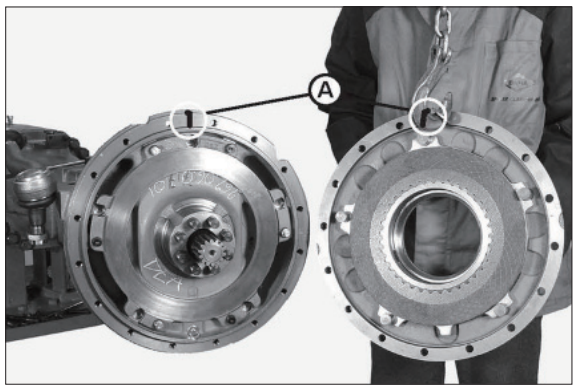
14W98FA110

(23) Before install the cover, secure them onto an appropriate tool.



14W98FA111

(24) Install the cover and hub complete with braking disks with the sign position (A).

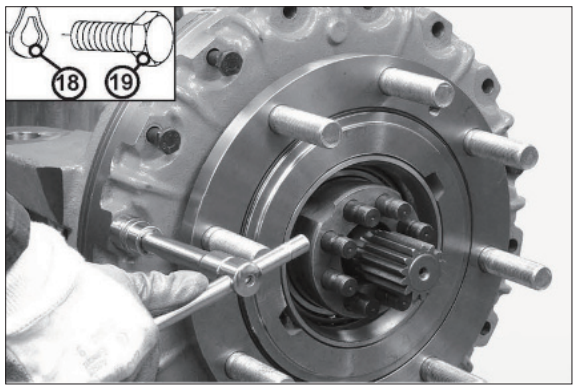


14W98FA112

(25) Slowly install for don't drop the brake disks (15, 16).

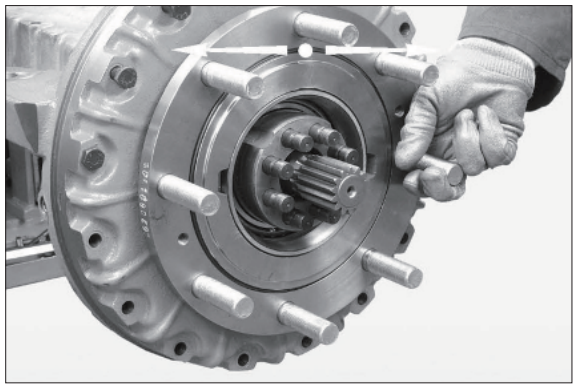
14W98FA113

(26) Turning two screws alternately until the cover is well set, fix the assembly.



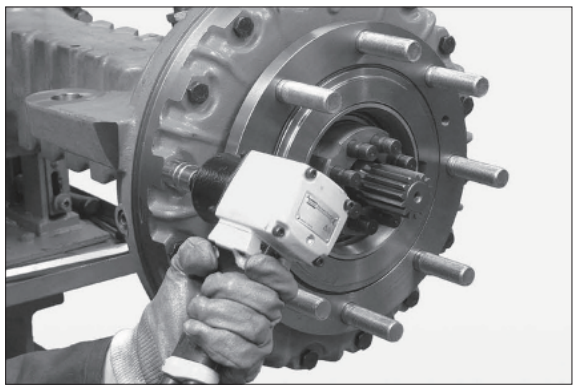
14W98FA114

※ Turn the hub and control the free motion. If it blocks, repeat the operation.



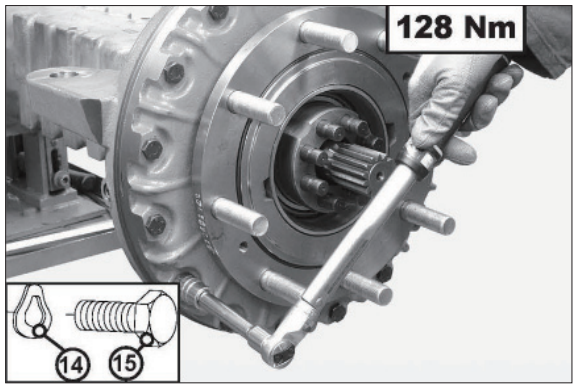
14W98FA115

(27) Screw.



14W98FA116

(28) Lock the screws (14, 15) crosswise with a torque wrench setting of 128 Nm.



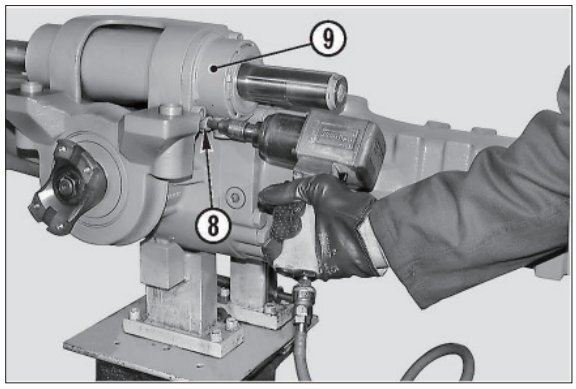
14W98FA117

9. THE STEERING CYLINDER

※ Front axle only

1) REMOVAL

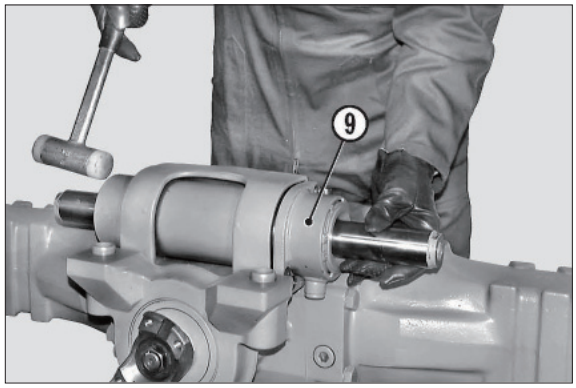
(1) Remove the securing screws (8) from the steering cylinder (9).



14W98FA118

(2) Extract the cylinder (9) using a plastic hammer.

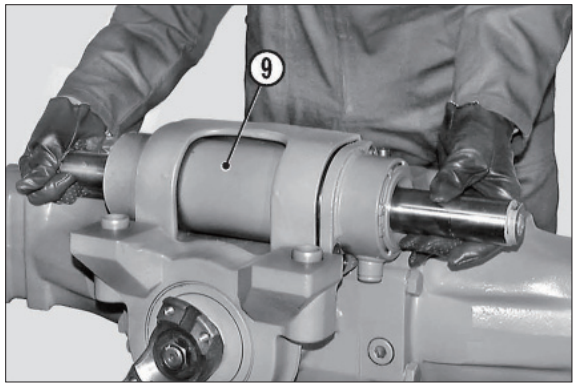
※ For cylinder disassembly, refer to "HOW TO DISASSEMBLE THE STEERING CYLINDER."



14W98FA119

2) INSTALLATION

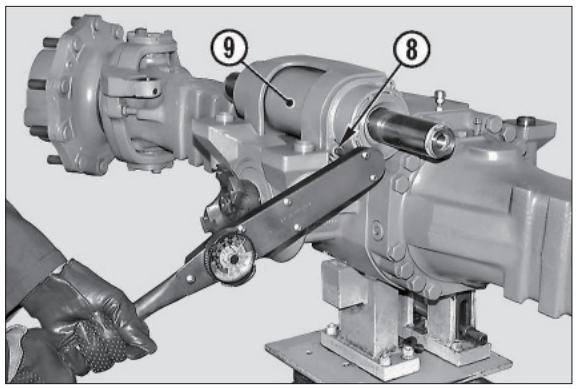
(1) Check that the O-rings (15) of this axle unit are in good condition ; lubricate the seats of the seals (15) and fit the steering cylinder (9) into ins seat.



14W98FA120

(2) Lock the cylinder by cross-tightening the screws (8).

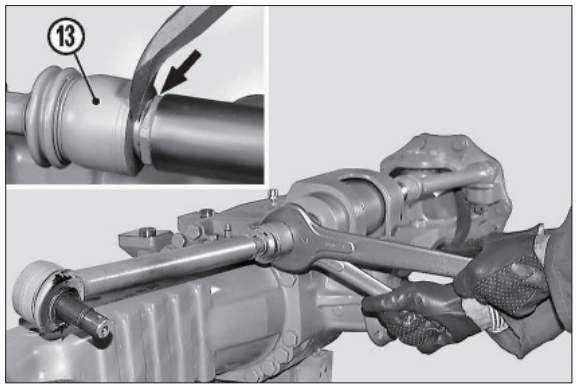
· Torque wrench setting : 116~128 Nm.



14W98FA121

(3) Apply loctite 242 to the thread and connect the steering bars by screwing the terminals onto the piston stem.
· Torque wrench setting : 240~270 Nm

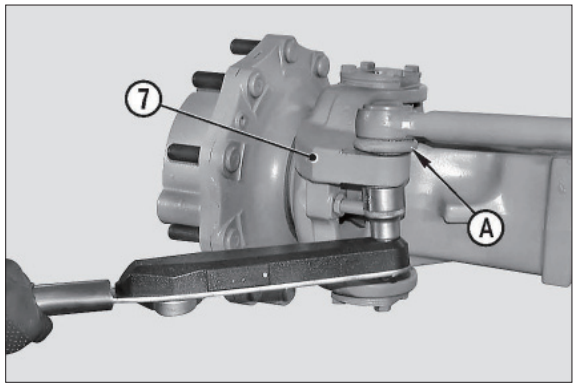
※ Versions with coupling require that the rim of the articulation (13) is riveted onto the surfaces of the piston stem.



14W98FA122

(4) Insert the pins (4) in the steering case (7) and lock into position using a torque wrench setting of 260-290 Nm.
Find the position of the notching in relation to the hole of the cotter pins and tighten the nut (6) further.

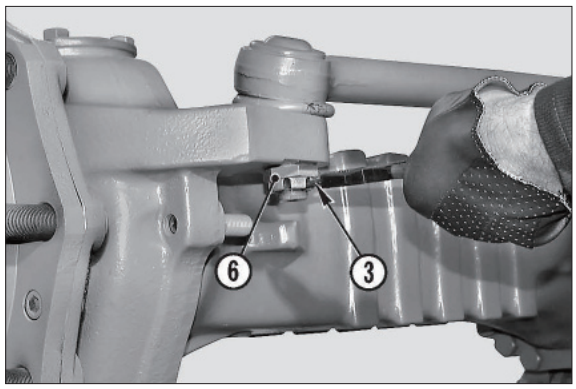
※ Check that rubber guards (A) are intact.



14W98FA123

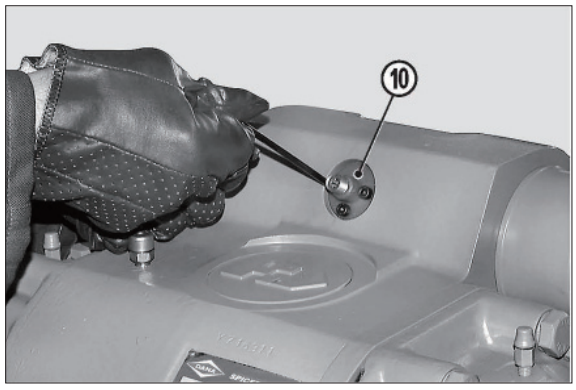
(5) Insert the cotter pins (3) and bend the safety stems.

※ Use new cotter pins.



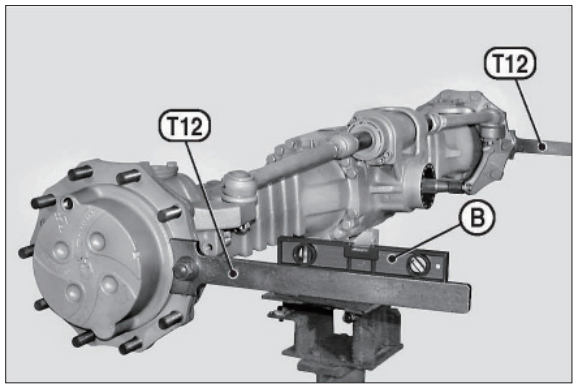
14W98FA124

(6) Install the proximity (1) for checking piston centering - if applicable and tighten the screw (10).
· Torque wrench setting : 5~6 Nm



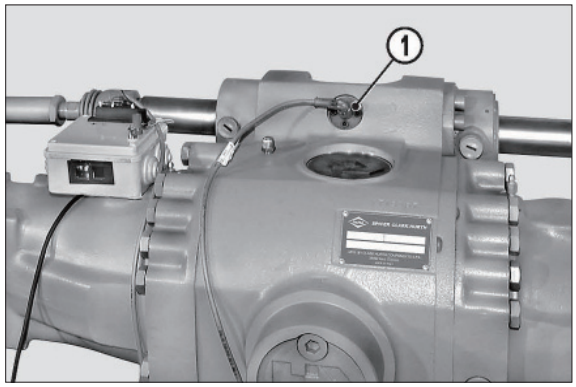
14W98FA125

※ Eliminate the action of the negative brake, if fitted. Apply tools T12 to the hubs and lock them.
Using a level "B", check that tools are perfectly flat and parallel to each other.



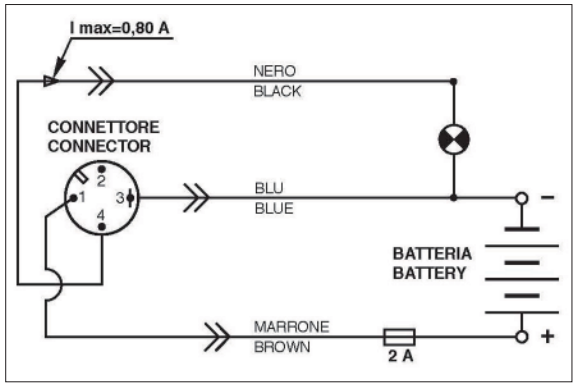
14W98FA126

(7) Connect the sensor (1) to the inspection device according to either diagram.



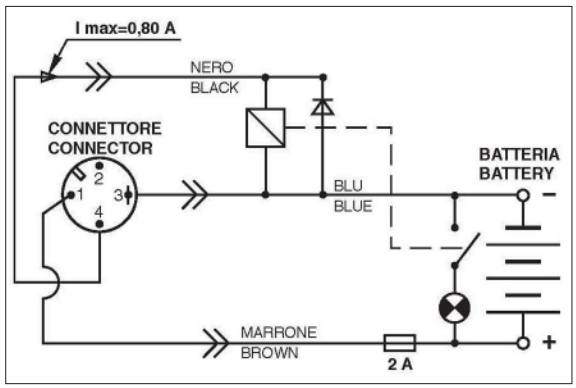
14W98FA127

(8) Sensor connection card, STANDARD version.



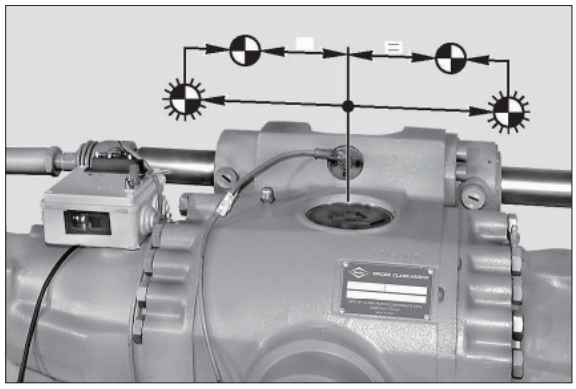
14W98FA128

(9) Sensor connection card, OPTIONAL version.



14W98FA129

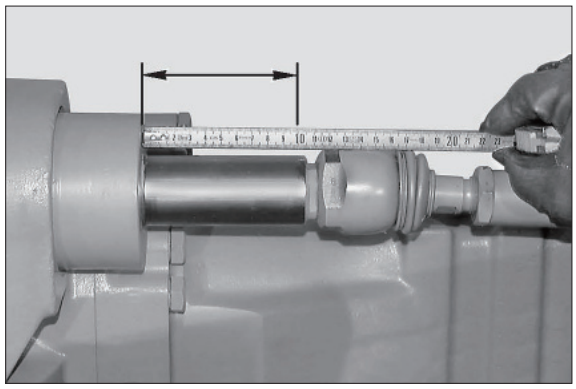
(10) Center the piston by slowly moving it first in one direction then in the other position if half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.



14W98FA130

(11) Inspect jut "C" in one side of the piston and note down the size for checking later adjustment.

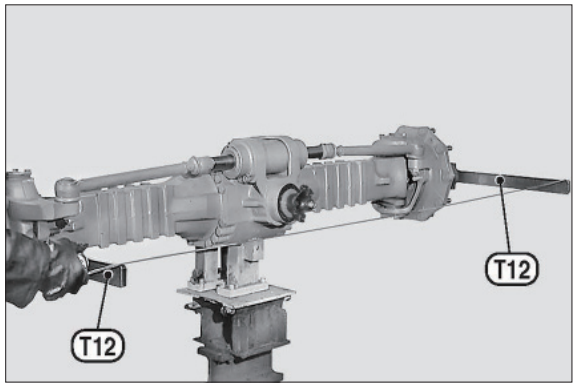
※ If cylinder come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.



14W98FA131

(12) Without moving the piston, check front and rear size at the edge of tools T12.

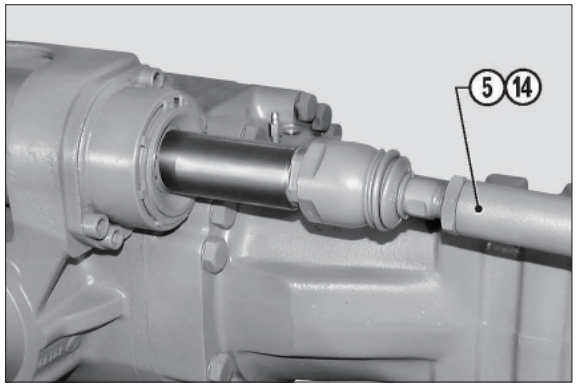
※ In order to check the rear size, rotate the bevel pinion and check that tools T12 are flat.



14W98FA132

(13) If necessary, adjust convergency without moving the centering of the piston and adjust the length of the steering bars (5) or (14).

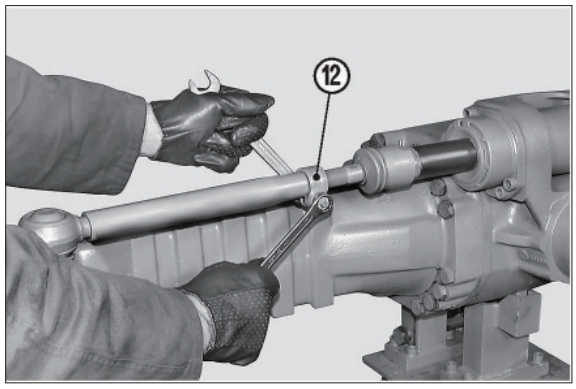
※ With a half turn of screw, the front size is reduced by about 3 mm, whereas the rear one is increased by about 3 mm.



14W98FA133

(14) CONVERGENCY ADJUST ON UNITS WITH COLLAR

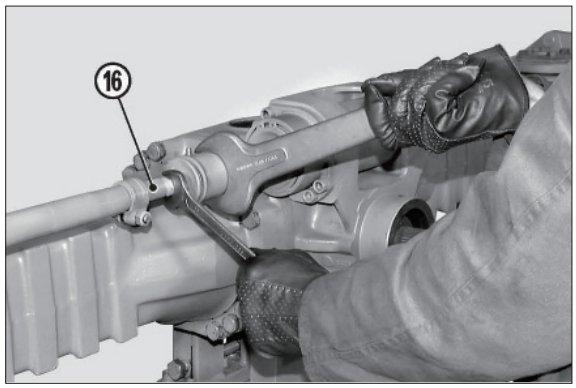
① Unloose the nuts on the collars (12).



14W98FA134

② Rotate the ball-socket joints (16) until convergency has been obtained.
Check that articulations move easily and lock the collars (12).

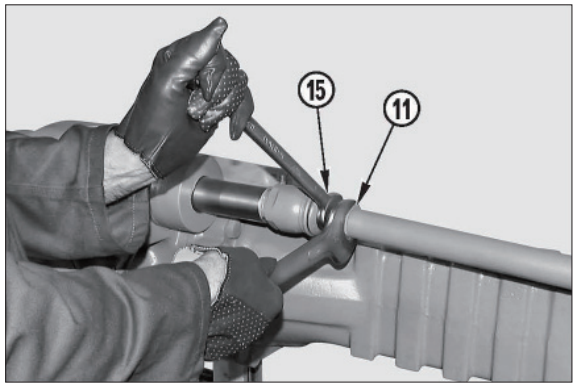
· Torque wrench setting for nuts :
42~52 Nm.



14W98FA135

(15) CONVERGENCY ADJUSTMENT ON ALTERNATOR VERSIONS

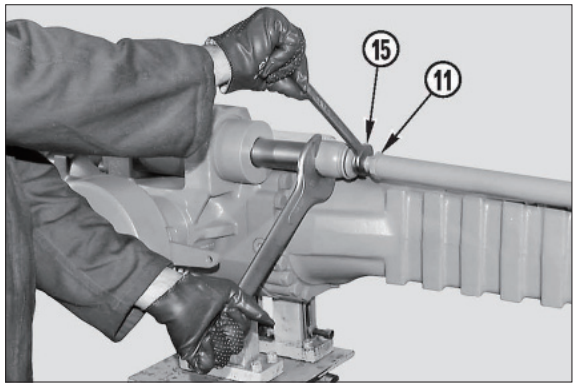
① Unloose the nuts (11) and screw them onto the ball-and-socket joints (15).



14W98FA136

② Hold the articulations still and rotate the ball-and-socket joints (15). Once the convergency has been adjusted, lock the nuts (11).

· Torque wrench setting for nuts :
298-328 Nm

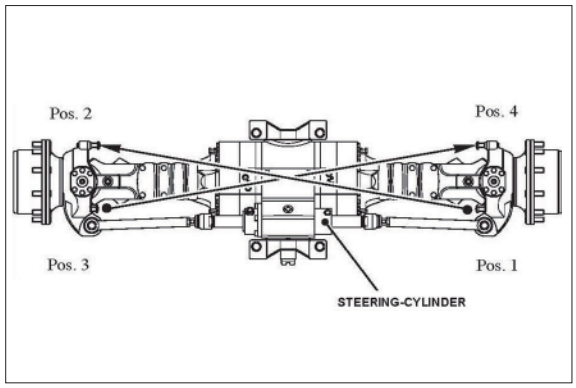


14W98FA137

(16) ADJUSTMENT THE STEERING ANGLE

※ Form the same operations on both sides see diagram.

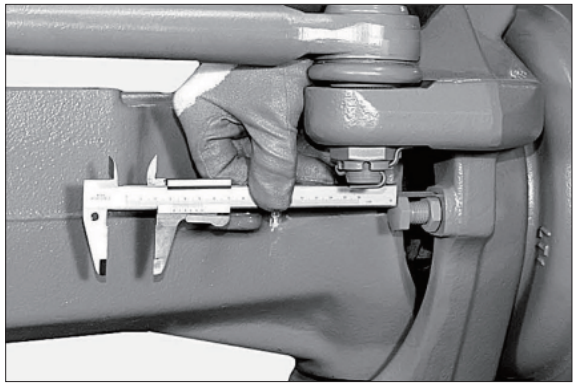
① Loosen the nut of one of the adjusting screw on cylinder side.



14W98FA138

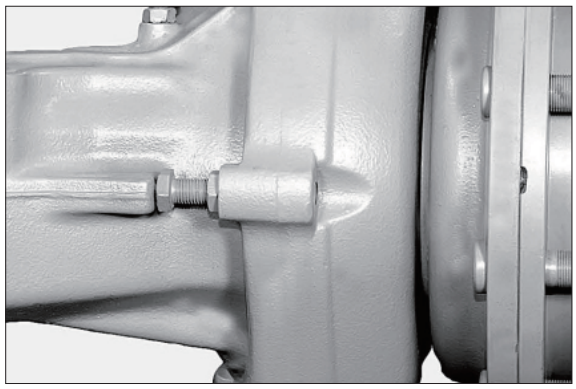
② Adjust the jutting portion of the screw according to data shown in the table.
Lock into the position with nut tightening to max 148 Nm.

Steering angle	43˚	45˚	35˚	55˚	40˚	40˚
Distance (mm)	58.5	53.5	51.6	23.8	36.6	38.2



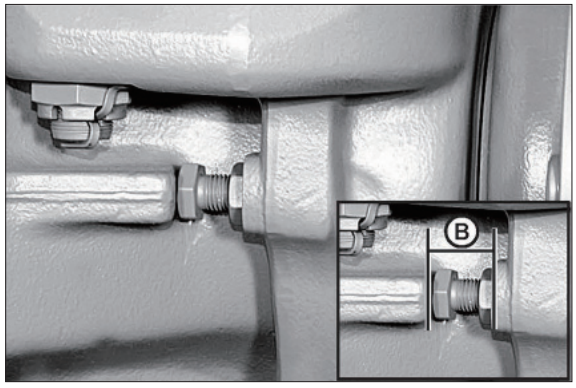
14W98FA139

③ Perform one full steering operation until the adjusted screw leans against the arm stop.



14W98FA140

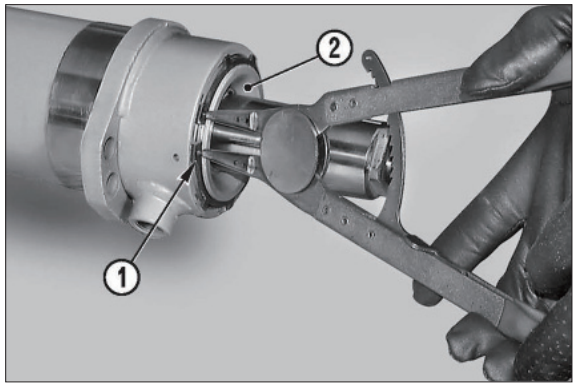
④ Adjust the jutting portion.



14W98FA141

3) DISASSEMBLE THE STEERING CYLINDER

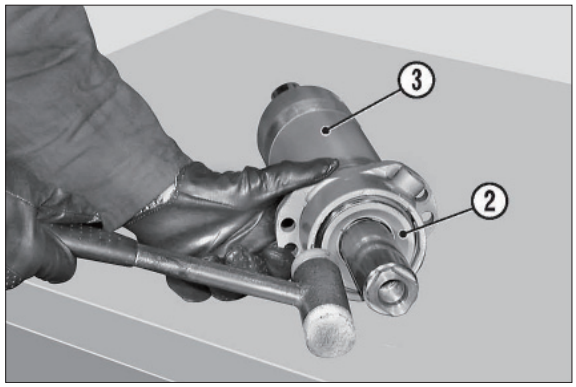
(1) Remove the snap ring (1) from the cylinder head (2).



14W98FA142

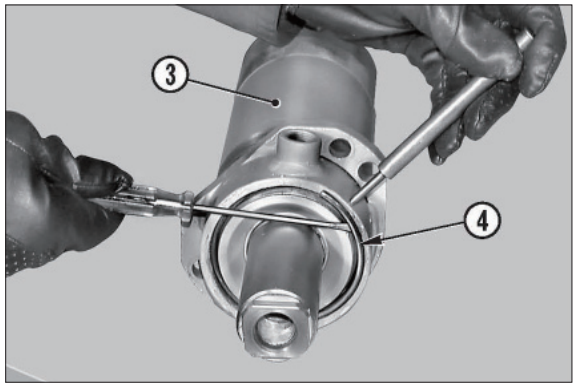
(2) With the help of a plastic hammer, push the head (2) inside the cylinder (3).

※ The head should line up with the edge of the cylinder.



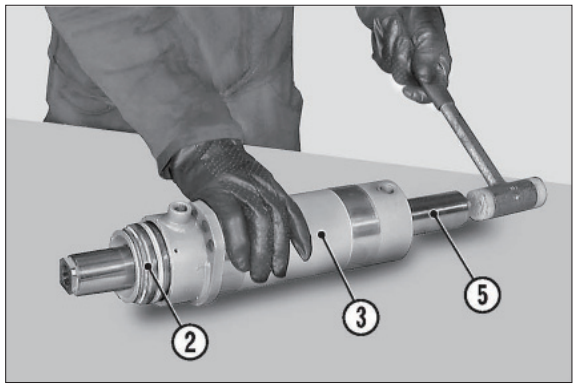
14W98FA143

(3) With the help of a dirty, apply pressure to the stop ring (4) that is placed inside the cylinder (3) and extract the ring using a screwdriver.



14W98FA144

(4) Hammer the piston (5) in the rear head (2) using a plastic hammer.
Continue hammering until the head (2) is ejected from the cylinder (3).



14W98FA145

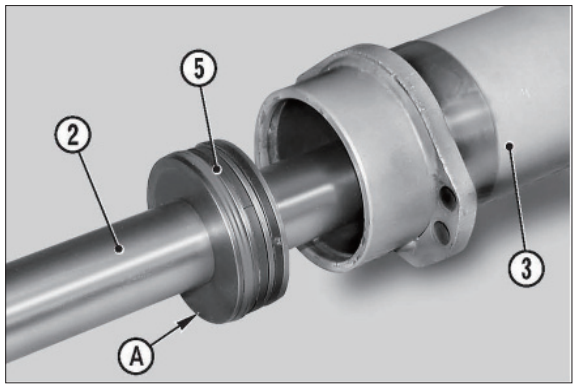
(5) Disassemble the cylinder unit (3) by extracting first the head (2), then the piston (5).

※ Note down the assembly side of the piston (5). The bevelled part "A" of the piston is oriented towards the head (2).

(6) Remove all seals, anti-extrusion rings and scraper rings from head (2), cylinder (3) and piston (5).

※ All seals must be replaced every time the unit is disassembled.

※ Particular attention must be paid not to damage the seals of both seals and piston side.

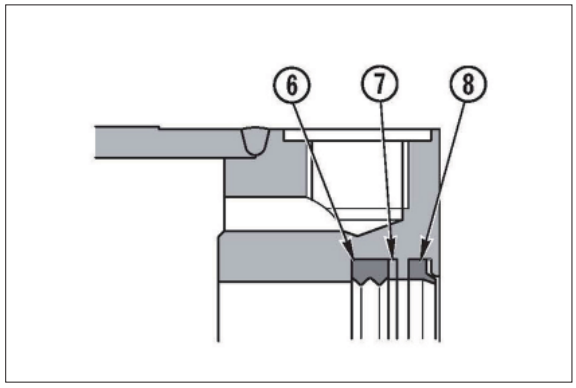


14W98FA146

4) ASSEMBLE THE STEERING CYLINDER

(1) After applying grease, install the sealing ring (6) of the shaft, the anti-extrusion ring (7) and the scraper ring (8) inside the cylinder (3).

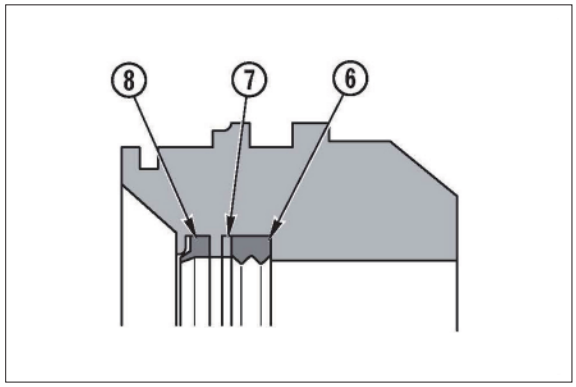
※ Thoroughly check that position of the anti-extrusion ring (7) is correct.



14W98FA148

(2) After applying grease, install the sealing ring (6) of the shaft, the anti-extrusion ring (7) and the scraper ring (8) in the head (2).

※ Thoroughly check that positioning of the anti-extrusion (7) ring is correct.

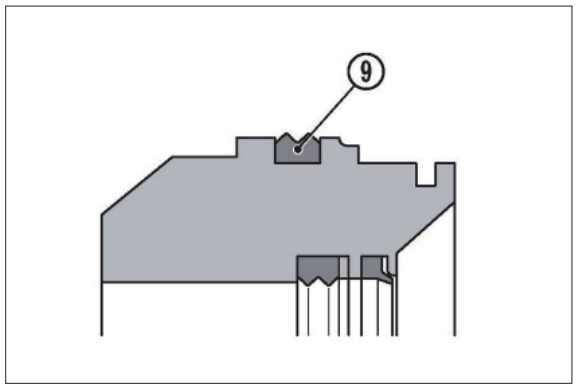


14W98FA149

(3) Fit the seal (9) onto the outside of the head (2).

※ In order to facilitate assembly, apply grease to the outer surface of the piston.

※ Do not roll the seal (9) up.

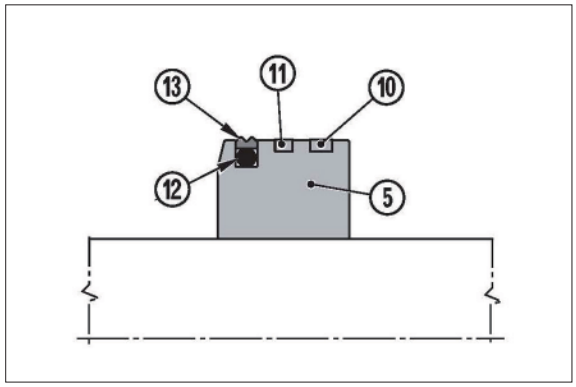


14W98FA150

(4) Prepare the piston (5) by fitting it with the guide ring (10), the magnetic ring (11), the O-ring (12) and the seal (13).

※ In order to facilitate assembly, apply grease.

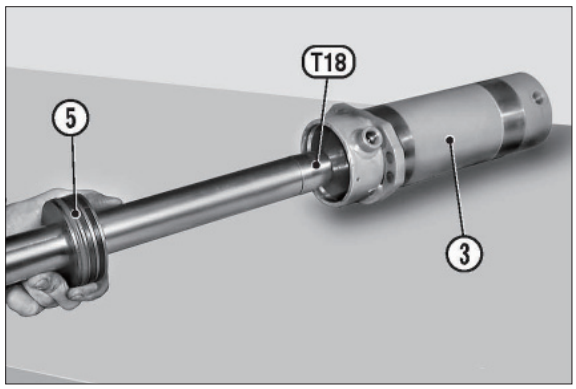
※ If a centering sensor is not fitted, then the magnetic ring (11) should be replaced by another guide ring (10).



14W98FA151

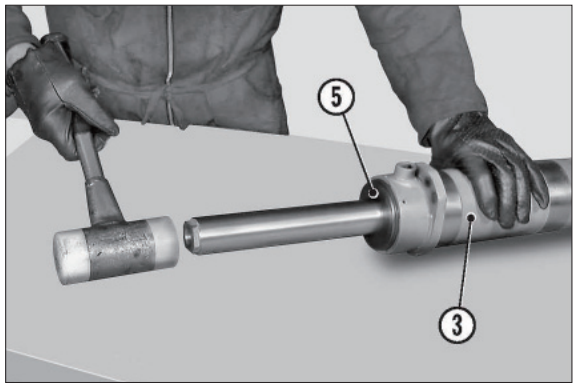
(5) Apply tool T18 to the shaft on the opposite side of the head (2) and center it on the cylinder (3) so that of fits into the piston (5).

※ Apply a little grease to seals and cylinder.



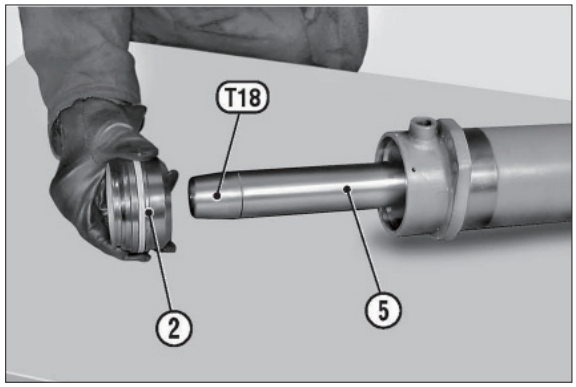
14W98FA152

(6) Push the piston (5) into the cylinder for 100 mm using a plastic hammer.



14W98FA153

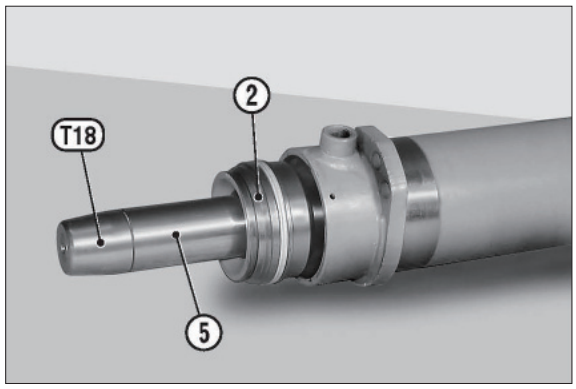
(7) Remove tool T18 and apply of to the opposite side of the piston (5).



14W98FA154

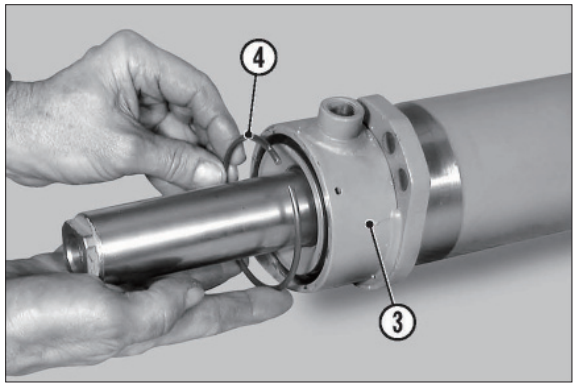
(8) Apply grease to head (2) seals, fit the head onto the piston and push it into the cylinder (3) using a plastic hammer.

※ Insert the head as to line up with edge of the cylinder.



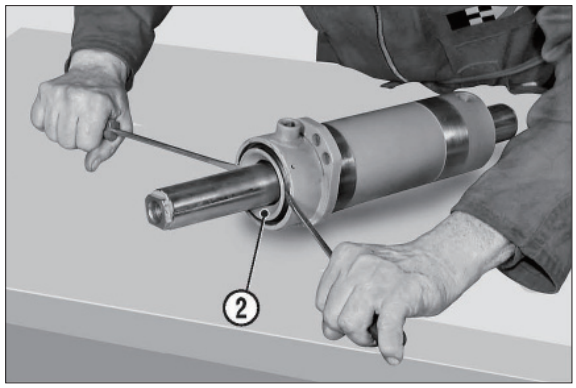
14W98FA155

(9) Insert the stop ring (4) ensuring that it fits into the seat of the cylinder (3).



14W98FA156

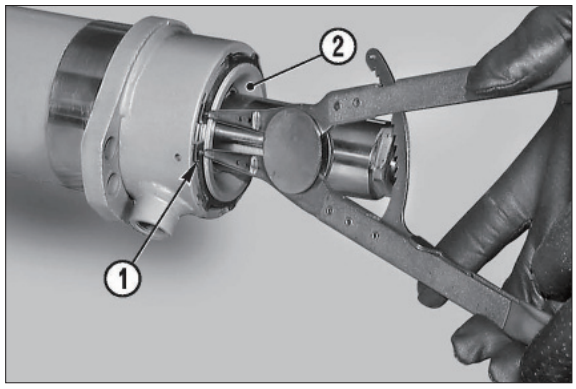
(10) Apply pressure to the head using two screwdrivers or levers until the head is fastened onto the stop ring (4).



14W98FA157

(11) Fit the snap ring (1) on the head (2).
Make sure that the snap ring (1) is securely fastened in its seat.

※ If necessary, force it into its seat using a drift and a hammer.

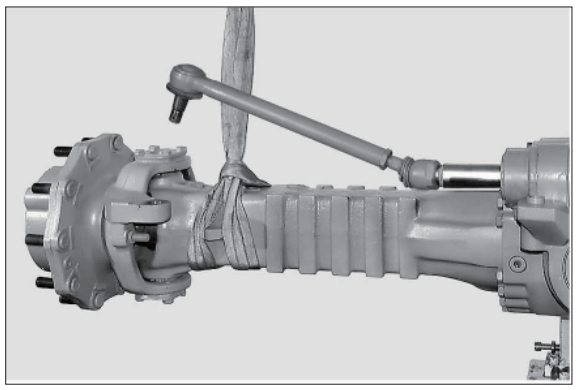


14W98FA158

10. THE BEVEL PINION

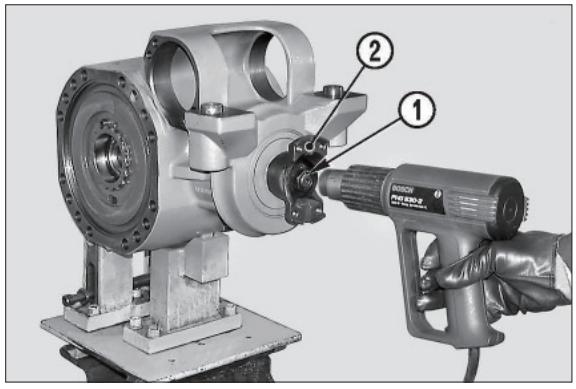
1) REMOVE THE BEVEL PINION

(1) Remove the complete arms and the differential unit.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS" and "REMOVING THE DIFFERENTIAL UNIT".



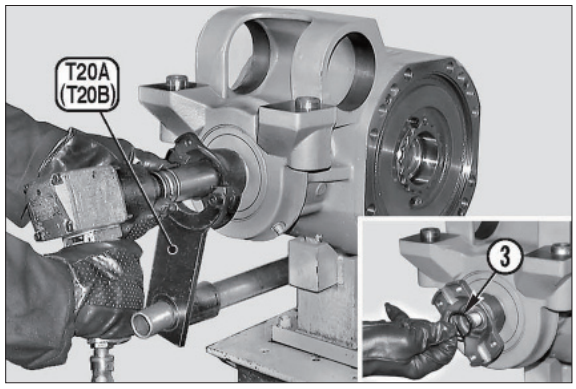
14W98FA159

(2) If disassembly is awkward, heat the check nut (1) of the flange (2) at 80˚C.



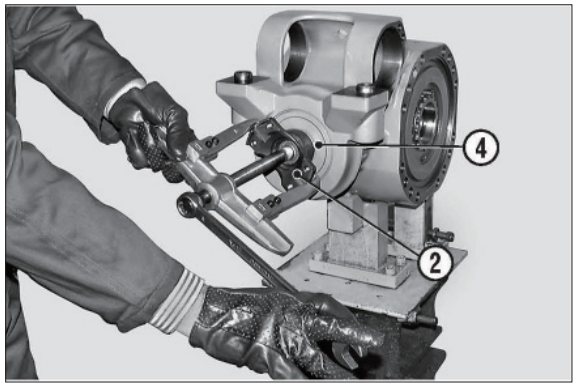
14W98FA160

(3) Position tool T20A (or T20B), so as to avoid pinion rotation. Unloose and remove the nut (1) ; also remove the O-ring (3).



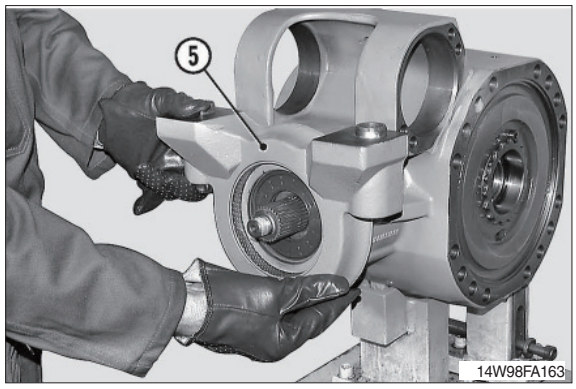
14W98FA161

(4) Remove the flange (2) complete with guard (4) by means of a puller.



14W98FA162

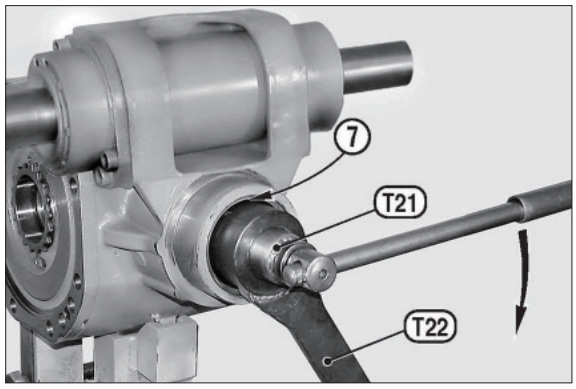
(5) Remove the swinging support (5).



(6) Remove the sealing ring (6).

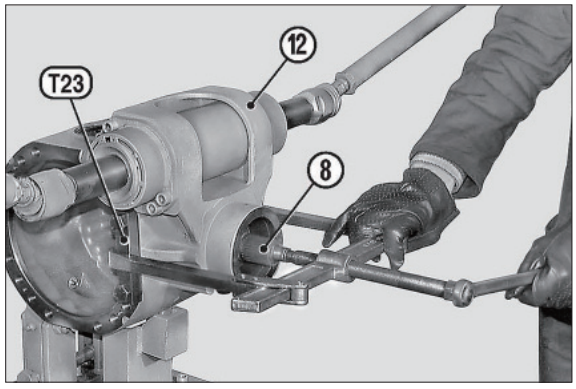
(7) Position wrench T22 onto the ring nut (7) and apply bar hold T21 to the pinion (8). Stop wrench T22 and rotate the pinion so as to release and remove the ring nut (7)

※ If disassembly proves awkward, weld the ring nut at approx 80˚C.

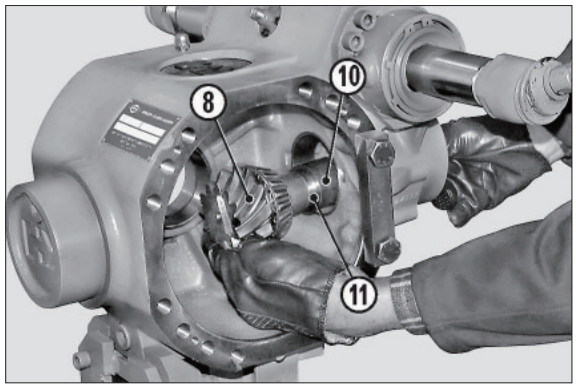


(8) Apply blocks T23 and, with the help of a puller, extract the pinion (8) complete with the internal bearing (9), the distance piece (10) and shims (11).

※ The thrust blocks of the bearing remain in the central body (12).

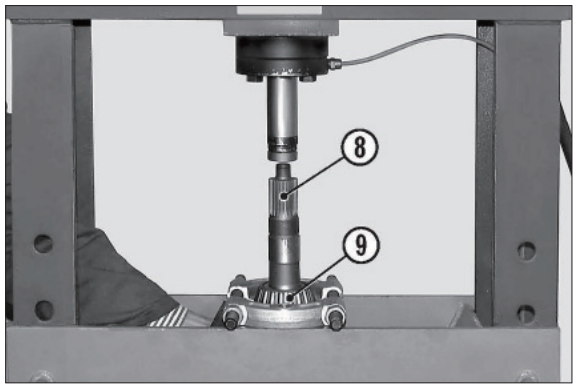


(9) Remove the pinion (8), shims (11) and distance piece (10).



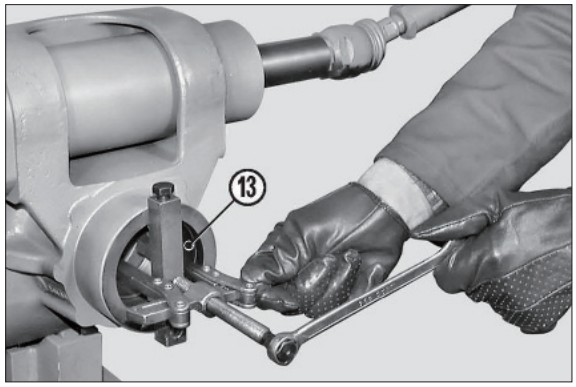
14W98FA167

(10) Using a puller and a press, remove the inner bearing (9) from the pinion (8).



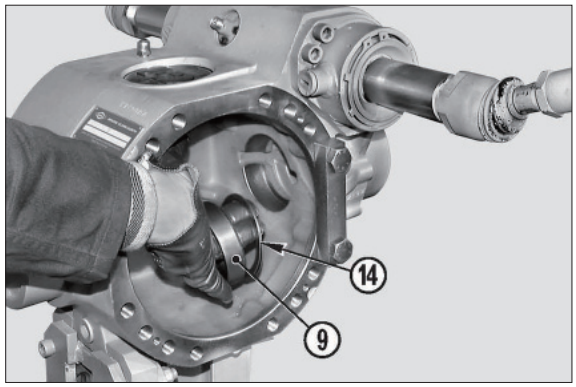
14W98FA168

(11) Remove the thrust block of the external bearing (13).



14W98FA169

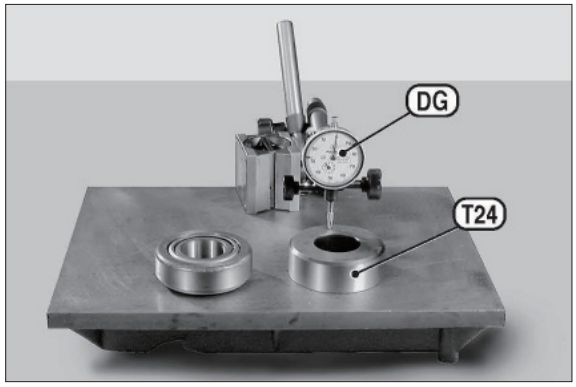
(12) Insert a drift in the appropriate holes and remove the thrust block of the internal bearing (9) as well as the shim washers (14).



14W98FA170

2) INSTALL AND ADJUST THE BEVEL PINION

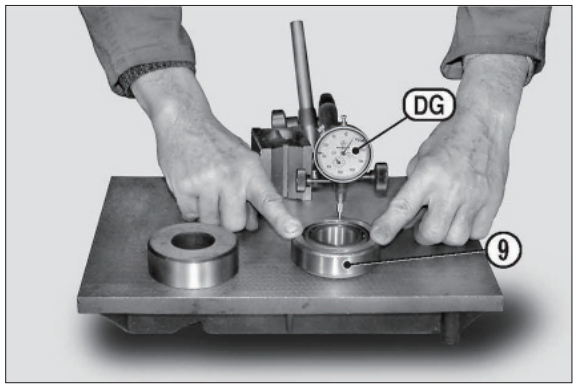
(1) Using a surface plate, reset a centesimal comparator "DG" and place it on the measurement ring T24 (with a thickness of 30.2 ㎜).
Preset the comparator to approx 2 ㎜.



14W98FA171

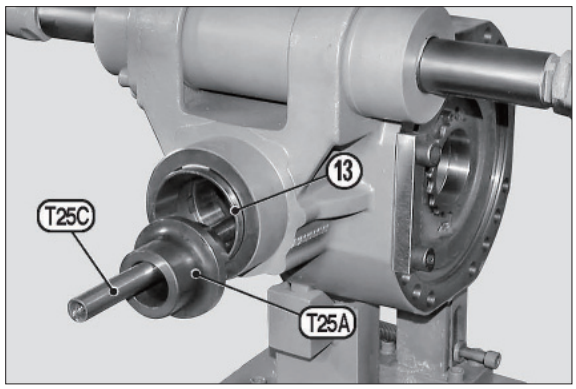
(2) Bring the internal bearing (9), complete with its thrust block, under the comparator "DG".
Determine overall thickness "D" of the bearing checking the discrepancy between this size and the size of the measurement ring.

※ Press the thrust block in the center and take several measurements while rotating the thrust block.



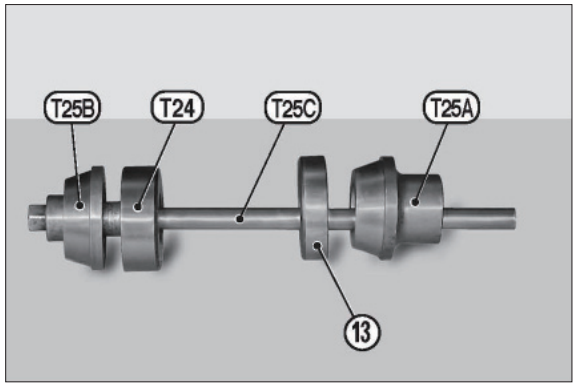
14W98FA172

(3) Partially insert the thrust block of the external bearing (13).



14W98FA173

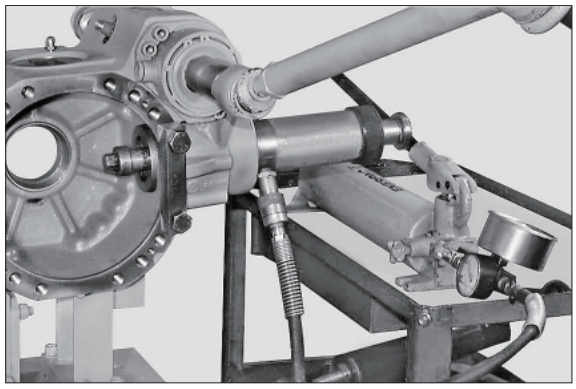
(4) Install tension rod T25C, measurement ring T24 and front guide tool T25A on the thrust block of the external bearing (13).



14W98FA174

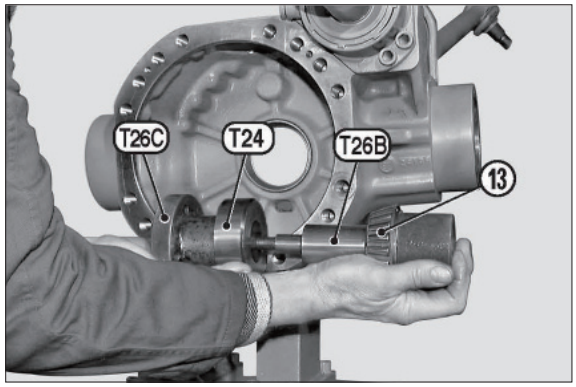
(5) Connect the tension rod to the press and move the thrust block of the external bearing (13) into its seat.
Disconnect the press and remove the tension rod.

※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.



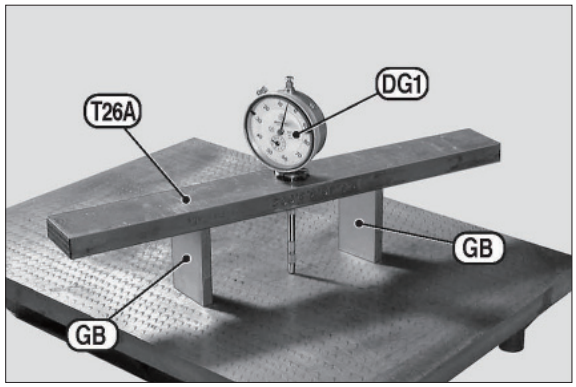
14W98FA175

(6) Insert tool T26B complete with external bearing (13), measurement ring T24 and gauged ring nut T26C.
Manually tighten.



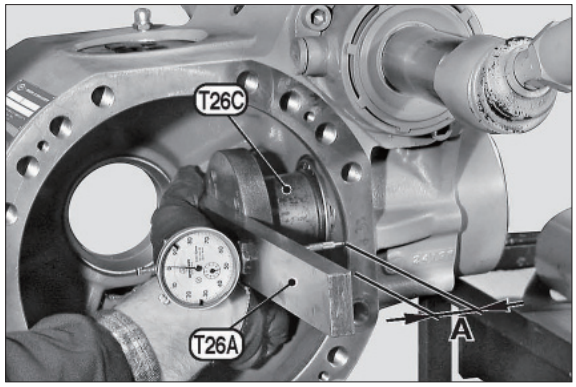
14W98FA176

(7) Fit a centesimal comparator "DG1" with long stem into bar T26A ; when the bar rests on two size-blocks "GB" of 57 mm , rest the comparator.
Preset the comparator to approx. 2 mm and reset.



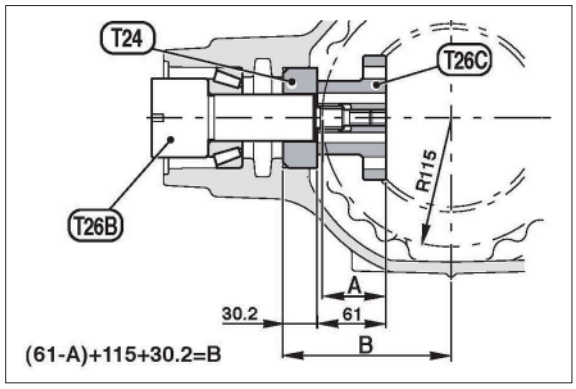
14W98FA177

(8) Lay bar T26A on gauge nut T26C and take the size "A" at about 57 mm corresponding to the maximum diameter of arms centering.



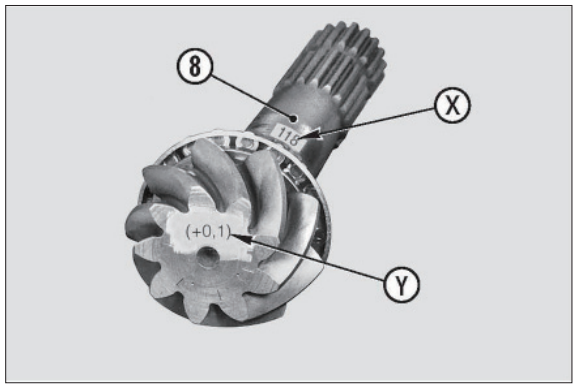
14W98FA178

(9) Calculate size "B" which will be the first useful value for calculating the size of the shims (14) that are to be inserted under the thrust block of the internal bearing (9).



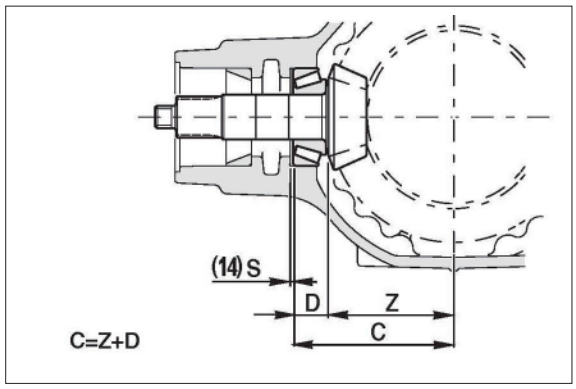
14W98FA179

(10) Check the nominal size (X) marked on the pinion and add or subtract the indicated variation (Y) so as to obtain size "Z".
e.g. : Z =118 + 0.1 = 118.1
Z = 118 - 0.2 = 117.8



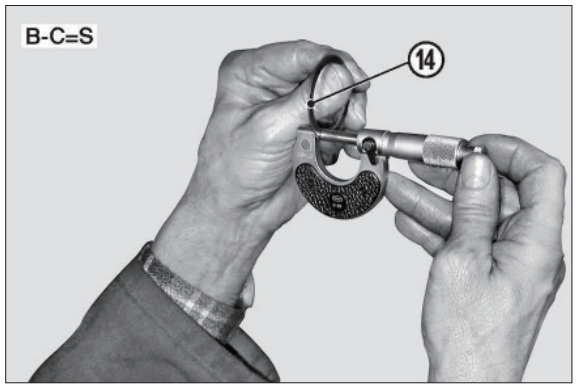
14W98FA180

(11) Calculate size "C" which represents the second value for calculating the size of the shims "S" that are to be placed under the thrust block of the internal bearing (9).



14W98FA181

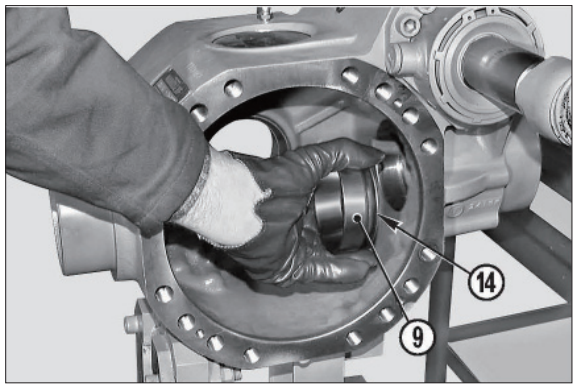
(12) Calculate the difference between sizes "B" and "C" so as to obtain the size "S" of the shim (14) that will go under the thrust block of the internal bearing (9).



14W98FA182

(13) Insert shim "S" (14) and the thrust block of the internal bearing (9) in the central body.

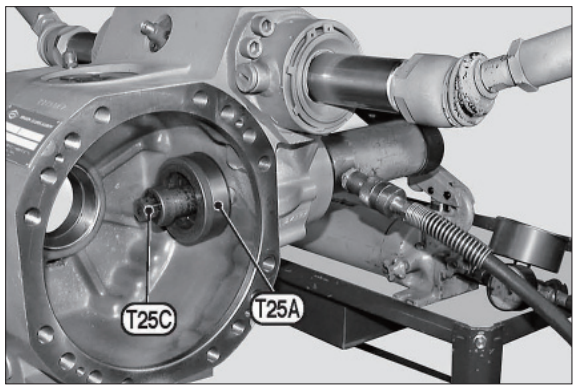
※ To hold shim "S" (14) in position, apply grease.



14W98FA183

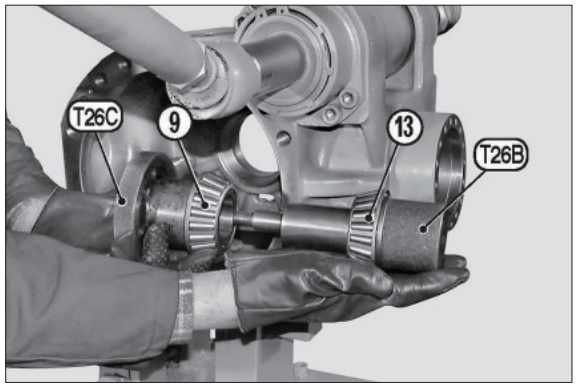
(14) Position tool T25A and tension rod T25C. Connect the tension rod to the press, fasten the thrust block and then remove the tools.

※ Before going on the next stage, make sure that the thrust block has been completely inserted.



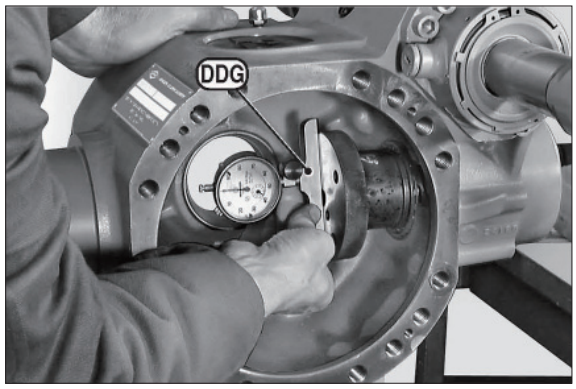
14W98FA184

(15) Position tools T26C and T26B complete with tapered bearing (9) and (13) ; manually tighten until a rolling torque has been obtained.



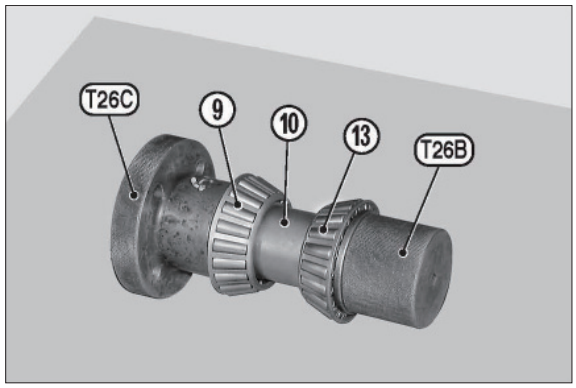
14W98FA185

(16) Insert the stem of a depth comparator "DDG" in either side hole of tool T26C ; reset the comparator with a presetting of approx. 3 mm.



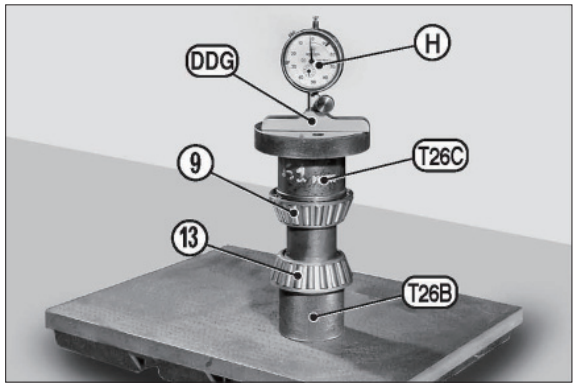
14W98FA186

(17) Remove the comparator and release tools and bearing from the central body. Re-install all and insert the distance piece (10) between bearings (9) and (13) ; manually tighten until a rolling torque has been obtained.



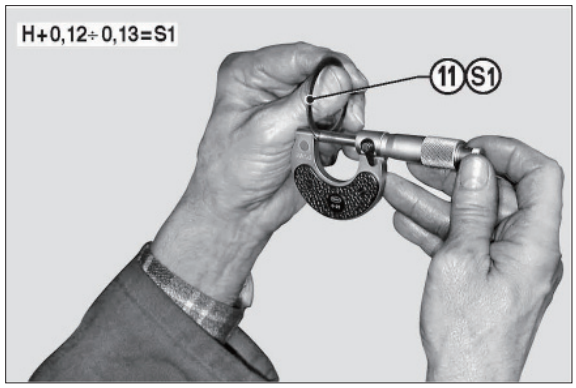
14W98FA187

(18) Insert the stem of a depth comparator "DDG" into tool T26B-T26C and measure variation "H" in relation to the zero setting performed back at point d.



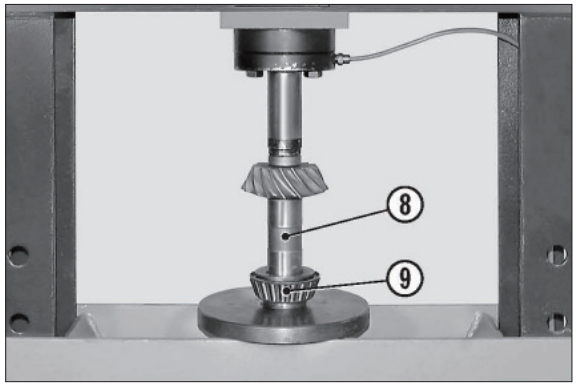
14W98FA188

(19) The variation is to be added to a set value of 0.12-0.13 mm., so as to obtain the size of shim "S1" (11) which will be inserted between the external bearing (13) and the distance piece (10) and subsequently, to determine the preload for the bearings.



14W98FA189

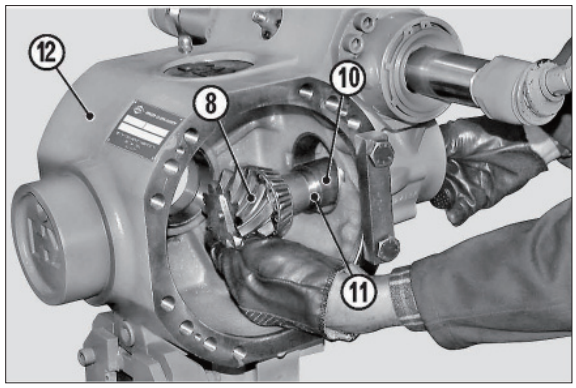
(20) Position the internal bearing (9) and the pinion (8) under a press ; force the bearing onto the pinion.



14W98FA190

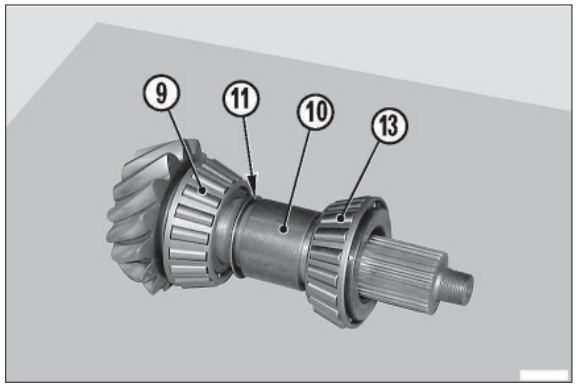
(21) Fit the pinion (8), shim "S1" (11) and distance piece (10) in the main body (12).

※ The finer shim must be placed in between the thicker ones.



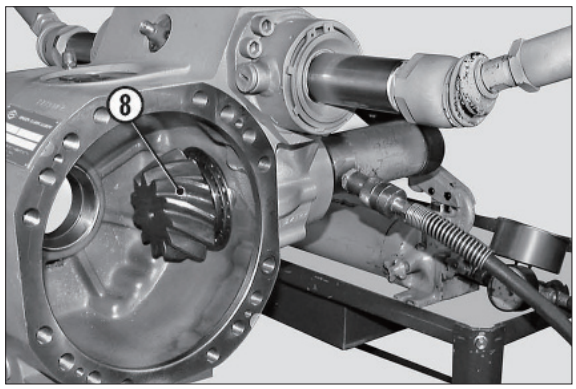
14W98FA191

(22) Insert the external bearing (13) in the central body in order to complete the pack arranged as in the figure.



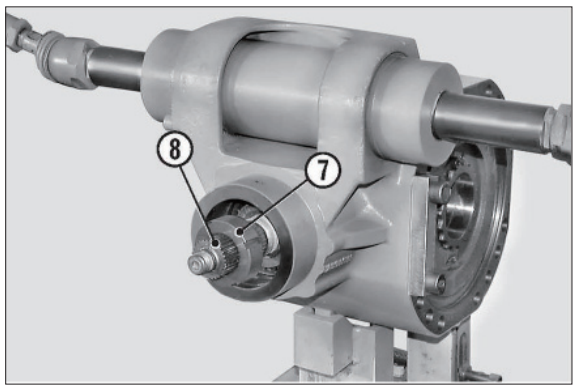
14W98FA192

(23) Connect the pinion (8) to the tie rod T28A and T28B ; connect the tie rod T28C (see special tools) to the press and block.



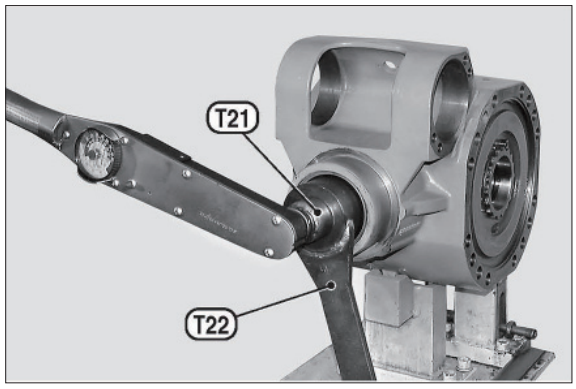
14W98FA193

(24) Apply loctite 242 to the thread of the ring nut (7) and screw the nut onto the pinion (8).



14W98FA194

(25) Apply special wrench T22 to the ring nut (7) and bar-hold T21 to the pinion (8).
Lock the wrench T22 and rotate the pinion using a dynamometric wrench, up to a minimum required torque setting of 500 Nm.



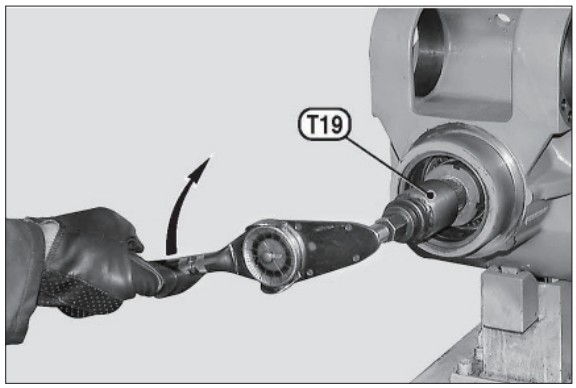
14W98FA195

(26) Apply onto the pinion (8) the bar-hold and with the help of a torque meter, check the torque of the pinion (8).
Torque : 120-170Ncm

※ If torque exceed the maximum value, then the size of shim "S1" (11) between the bearing (13) and the distance piece (10) needs to be increased.

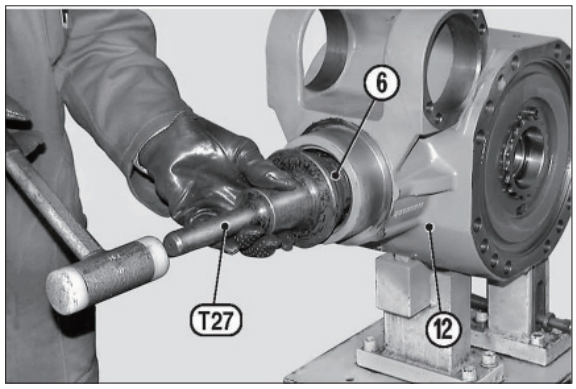
※ If torque does not reach the set value, increase the torque setting of the ring nut (7) in differential stages to obtain a maximum value of 570 Nm.
If torque does not reach the minimum value, then the size of shim "S1" (11) needs to be reduced.

※ When calculating the increase or decrease in size of shim "S1", bear in mind that a variation of shim (11) of 0.01 mm corresponds to a variation of 60 Ncm in the torque of the pinion (8).



14W98FA196

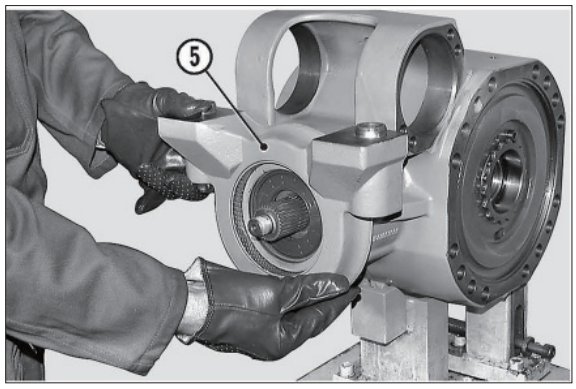
(27) Lubricate the outer surface of the new sealing ring (6) and fit it onto the central body (12) using tool T27.



14W98FA197

(28) Install the swing support (5).

※ Check that it is properly oriented.

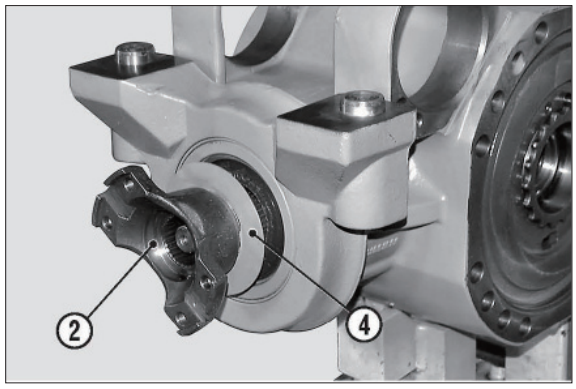


14W98FA198

(29) Fit the flange (2) complete with the guard (4) and fasten it.

For keying the flange (2), use a plastic hammer if necessary.

※ Make sure that the guard (4) is securely fastened onto the flange and that it is not deformed.



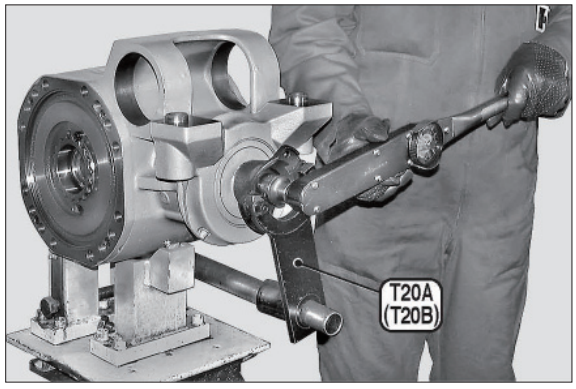
14W98FA199

(30) Apply loctite 242 to the threaded part of the pinion (8).

Position tool T20A (or T20B) and fasten it in order to avoid rotation.

Insert O-ring (3) and the nut (1) and tighten it using a dynamometric wrench.

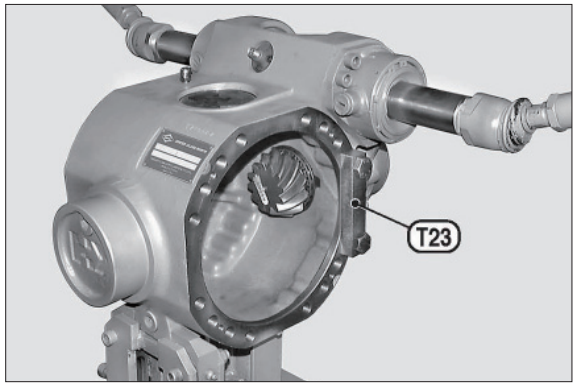
· Torque wrench setting : 280-310 Nm



14W98FA200

(31) Remove blocks T23 (used for extracting the pinion) and re-install the arms.

For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS."

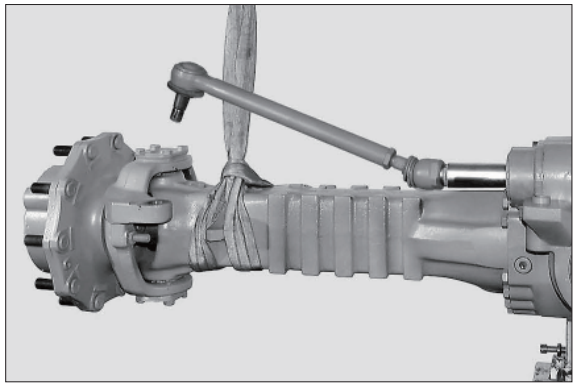


14W98FA201

11. THE DIFFERENTIAL UNIT

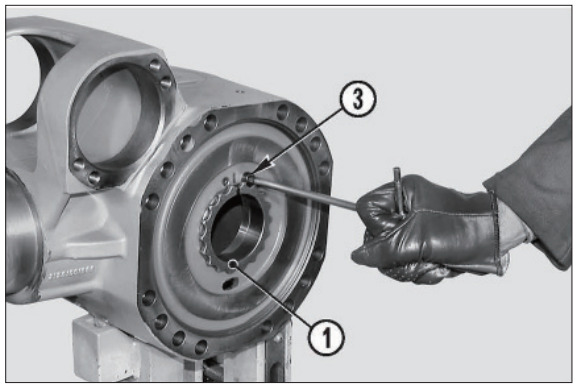
1) REMOVE AND DISASSEMBLE THE DIFFERENTIAL UNIT

(1) Remove the complete arms.
For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS".



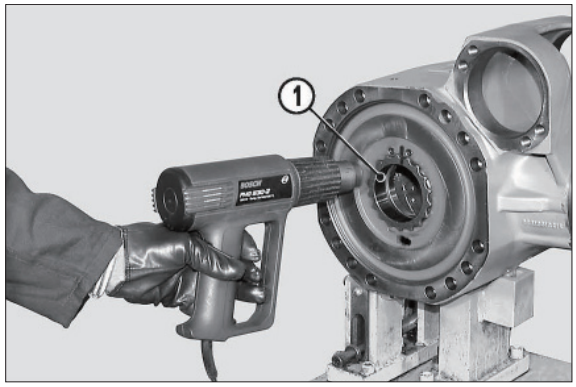
14W98FA202

(2) Make the position of the ring nuts (1).
Remove the screws (3) from the ring nuts (1).



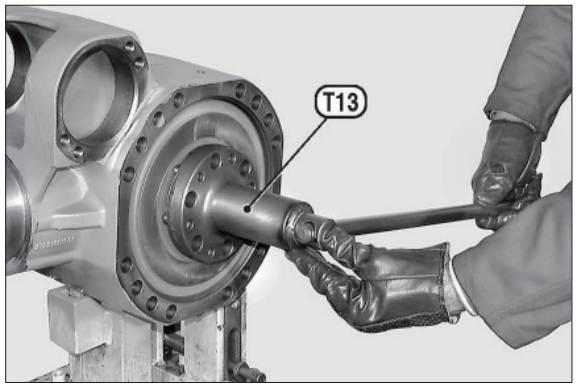
14W98FA203

(3) Uniformly heat the ring nuts (1) up to a temperature of 80˚C.



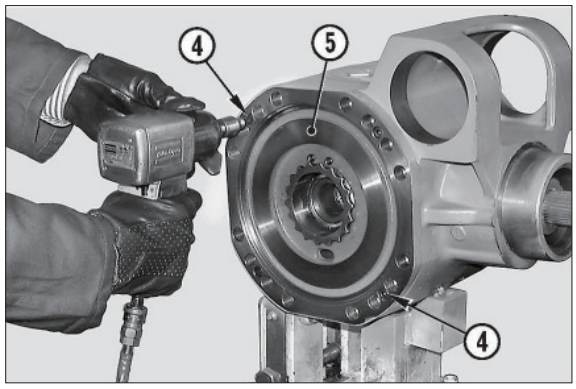
14W98FA204

(4) Apply tool T13 and remove the ring nuts.
※ Accurately clean the threaded portions on ring nuts of body and cover.



14W98FA205

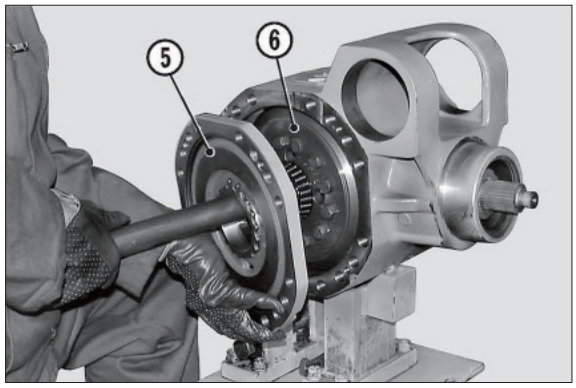
(5) Remove the fittin screws (4) from the middle cover (5).



14W98FA206

(6) Insert a screw-driver in the opposing slots then force and remove the middle cover (5) and the complete differential unit (6).

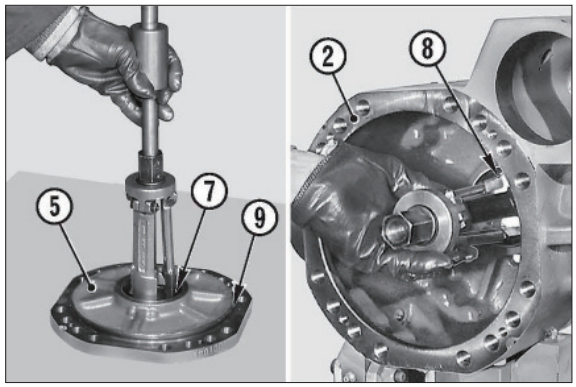
※ Support the pieces using a rod.



14W98FA207

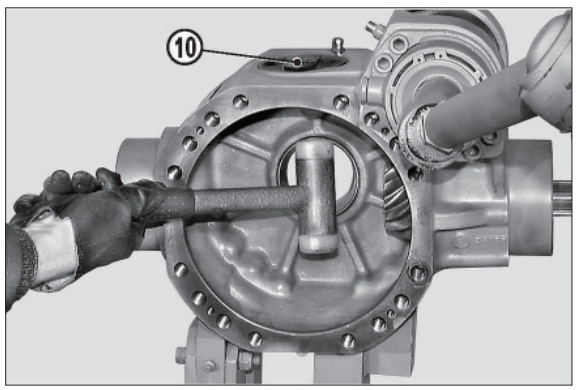
(7) If the bearing need replacing, extract the external thrust blocks of the bearing (7) and (8) from middle cover (5) and central body (2).

※ Accurately check the O-ring (9).



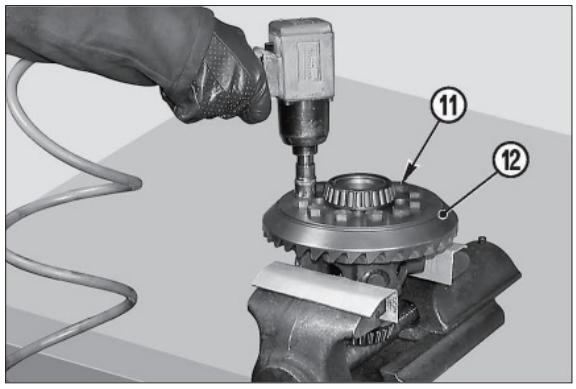
14W98FA208

(8) Remove the top plug (10).



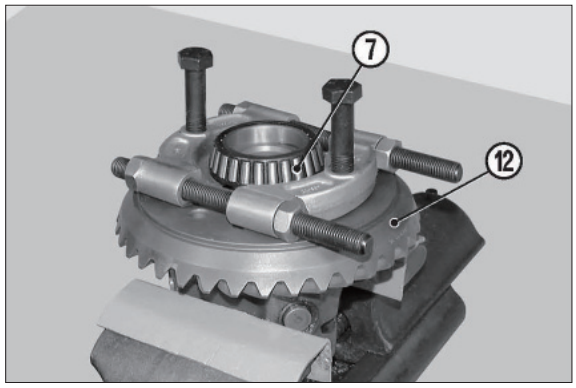
14W98FA209

(9) Remove the screw (11) from the crown (12).



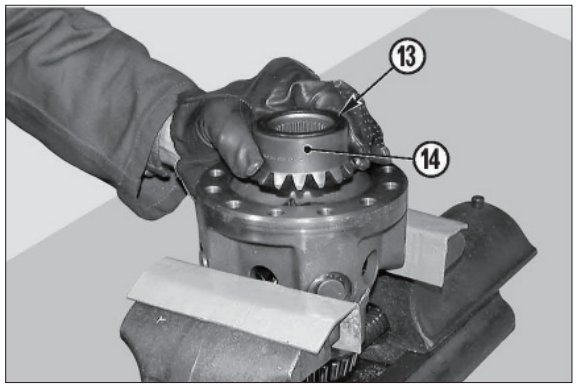
14W98FA210

(10) If the bearing need replacing, extract the bearing (7) and remove the crown (12).



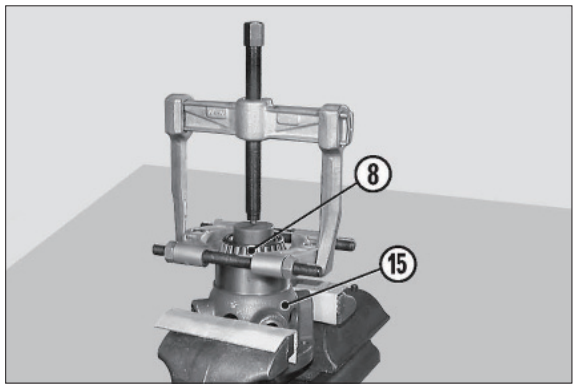
14W98FA211

(11) Remove the shim washer (13) and the planetary gear (14).



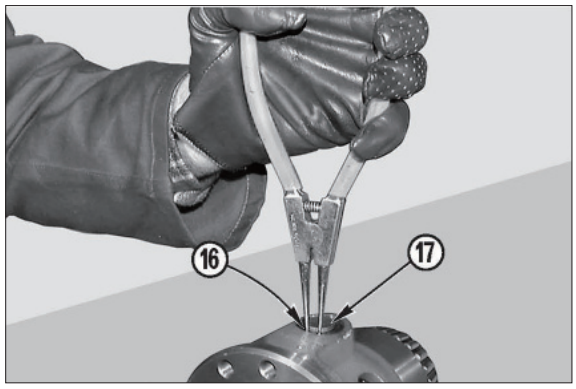
14W98FA212

(12) If the bearing need replacing, extract the bearing (8) from the differential carrier (15).



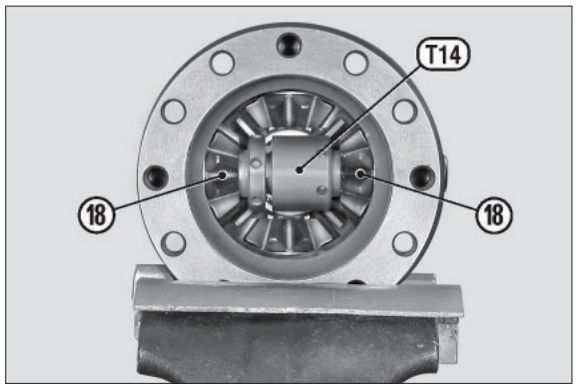
14W98FA213

(13) Remove the snap rings (16) from the two pins (17) of the planet wheel gears (18).



14W98FA214

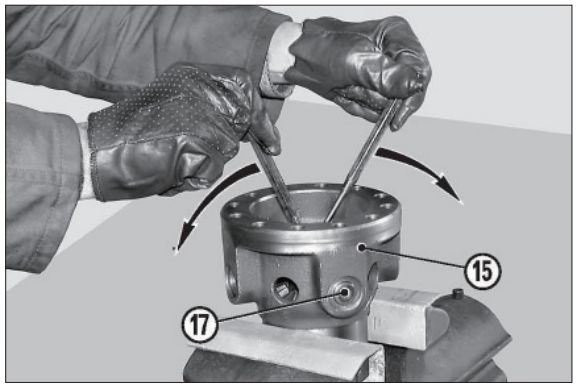
(14) Insert tool T14 between the planet wheel gears (18).



14W98FA215

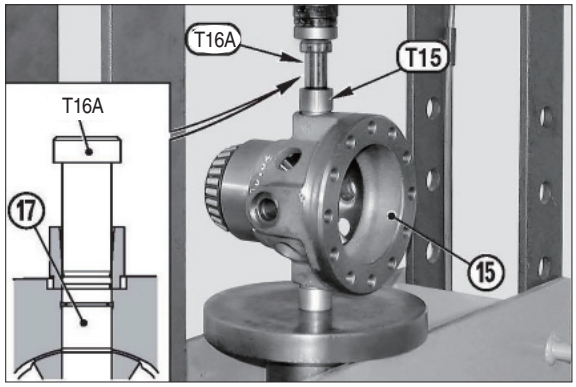
(15) Force tool T14 in-between the planet wheel gears (18) using two pin-drivers.

※ Make sure that tool T14 is perfectly lined up with the pins (17) when locked.



14W98FA216

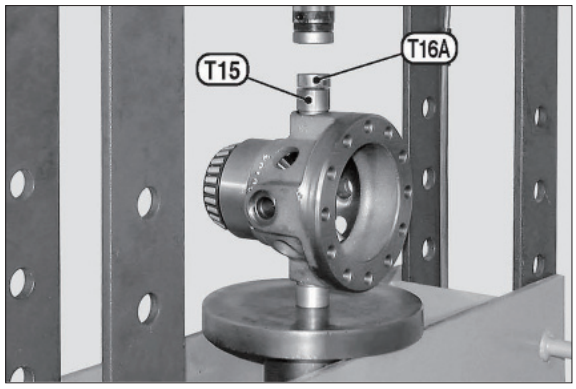
(16) Place the differential carrier (15) under a press, position bush T15 and insert gudgeon T16A. Press T16A pin to limit position.



14W98FA217

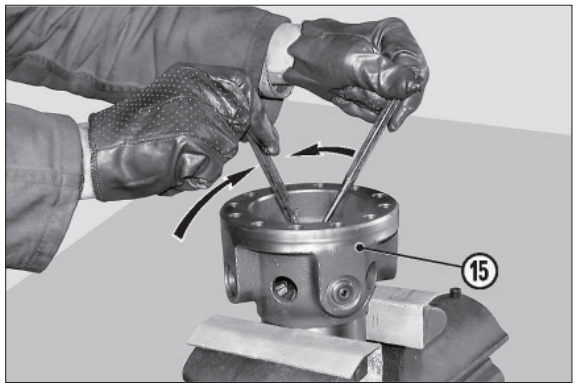
(17) Remove gudgeon T16A and bush T15.

※ In this condition the tool T14 contains pin (17)



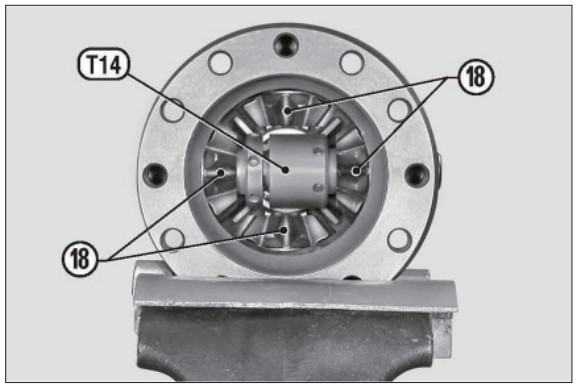
14W98FA218

(18) Remove tool T14 together with the pin (17) of the planet wheel.



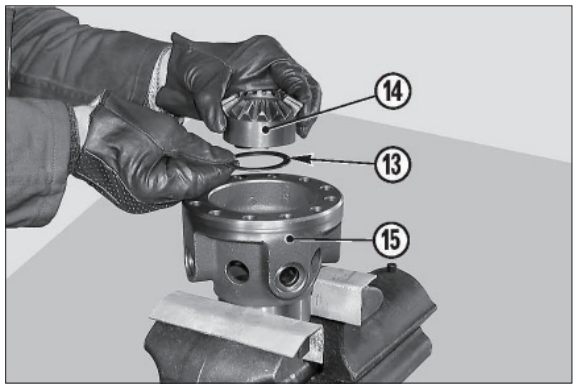
14W98FA219

(19) Leave the released planetary gear in position and again lock tool T14.
Repeat the operations for the extraction of the 2nd planet wheel (17).
Repeat the operations for all other pins.



14W98FA220

(20) Remove tool T14 and remove the last two planet wheel gears (18), the 2nd differential unit gear (14) and the relative shim washer (13) from the differential carrier.

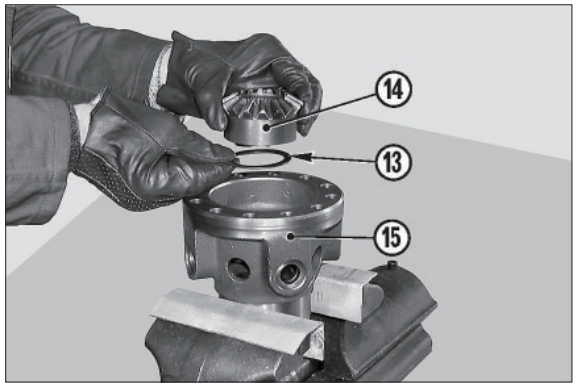


14W98FA221

2) ASSEMBLE AND INSTALL THE DIFFERENTIAL UNIT

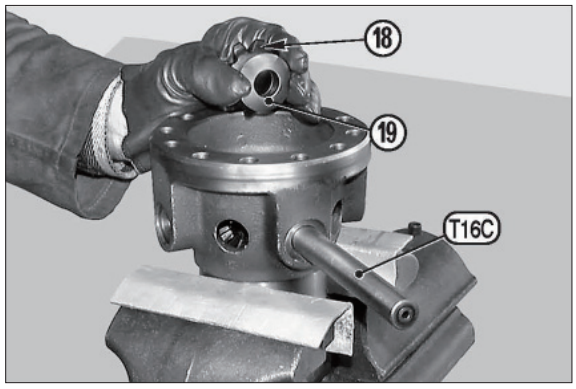
· ASSEMBLING

(1) Insert the shim washer (13) and the planetary gear (14) in the differential carrier (15).



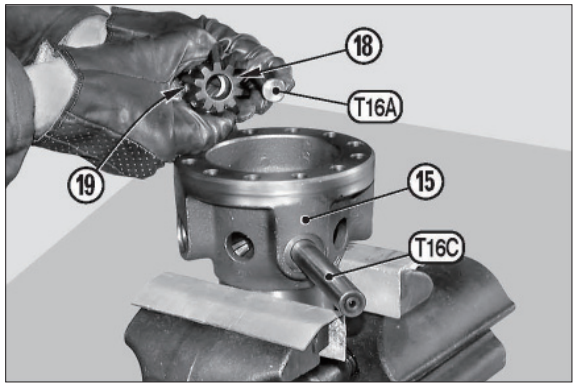
14W98FA222

(2) Position the shim washer (19) and the first planet wheel gear (18).
Hold them in position using bar T16C.



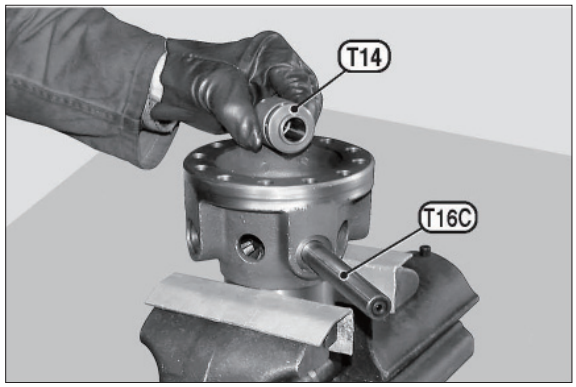
14W98FA223

(3) With the help of gudgeon T16A, position the second planet wheel gear (18) and the relative shim, washer (19).



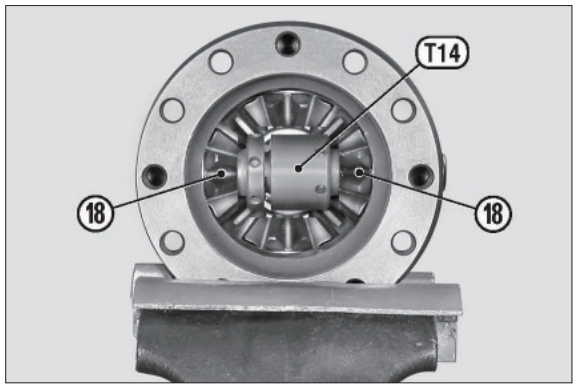
14W98FA224

(4) Insert tool T14 between the two planetary gears (18). Line up the entire unit by pushing bar T16C all the way down until gudgeon T16A is ejected.



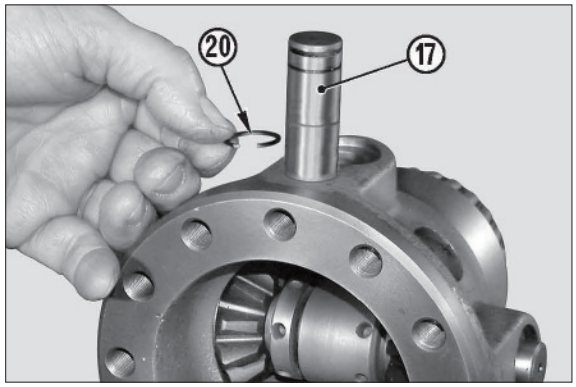
14W98FA225

(5) Lock tool T14 behind the planet wheel gears (18). After locking, remove bar T16C.



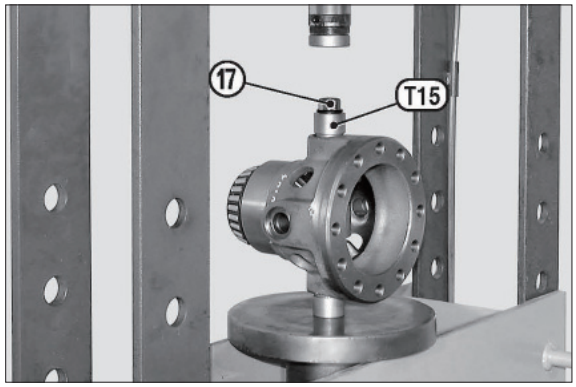
14W98FA226

(6) Fit the snap rings (20) onto the pins (17).



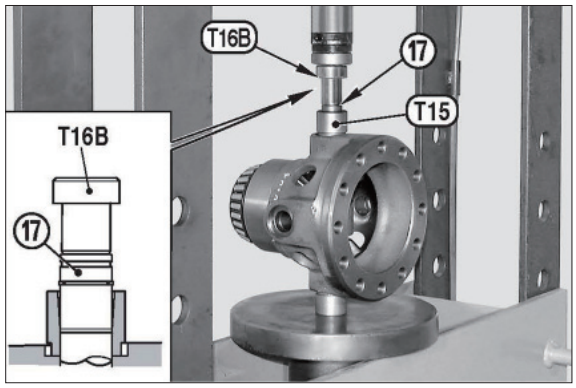
14W98FA227

(7) Place the differential carrier (15) under the press, position bush T15 and insert the planet wheel pin (17).



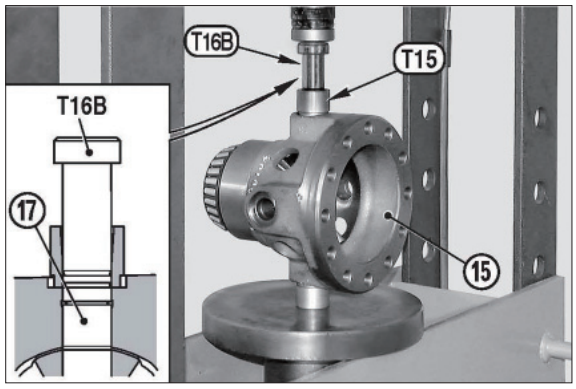
14W98FA228

(8) Put gudgeon T16B on top if the planet wheel pin (17).



14W98FA229

(9) Press T16B pin all the way down.

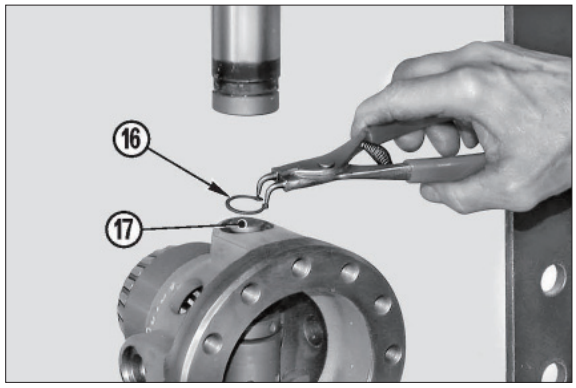


14W98FA230

(10) Remove gudgeon T16B, bush T15 and fit the snap ring (16) on the pin (17).

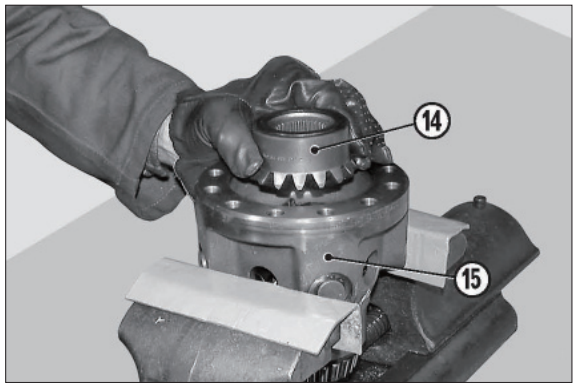
※ Make sure that the snap ring centers the seat and that it sets on the surface of the differential carrier.

Repeat the operations on the other planet wheel pin or planet wheel axle.



14W98FA231

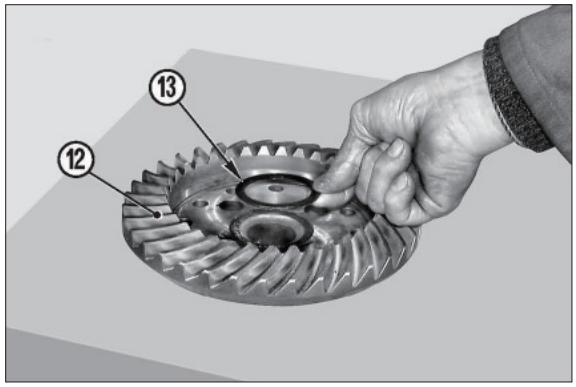
(11) Position the second planetary gear (14) in the differential carrier (15).



14W98FA232

(12) Position the shim washer (13) on the crown (12).

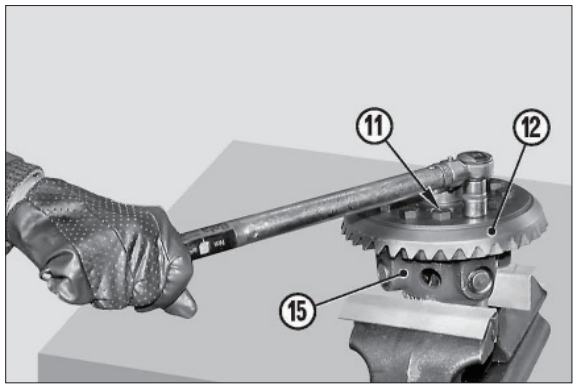
※ In order to hold the shim washer (13) in position, apply grease to it.



14W98FA233

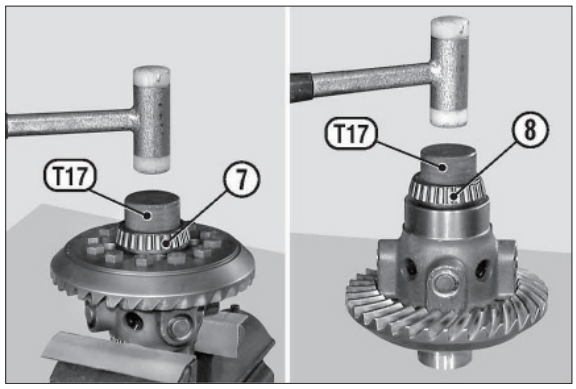
(13) Position the crown (12) in the differential carrier (15) and lock it with screws (11) applied with loctite 242.
Torque wrench setting for screws : 128-142 Nm

※ Secure the screws using the cross-tightening method.



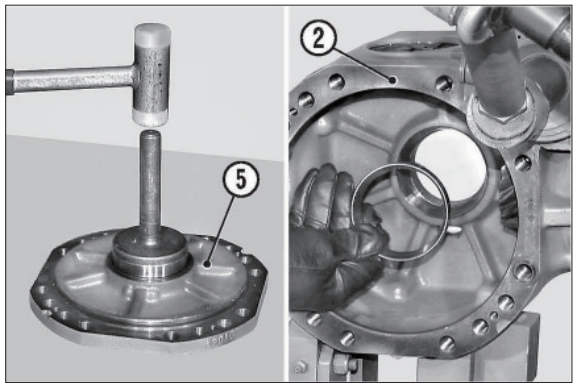
14W98FA234

(14) Install the bearings (7) and (8) using tool T17.



14W98FA235

(15) If the bearings are replaced, insert the external thrust blocks in the middle cover (5) and in the central body (2).

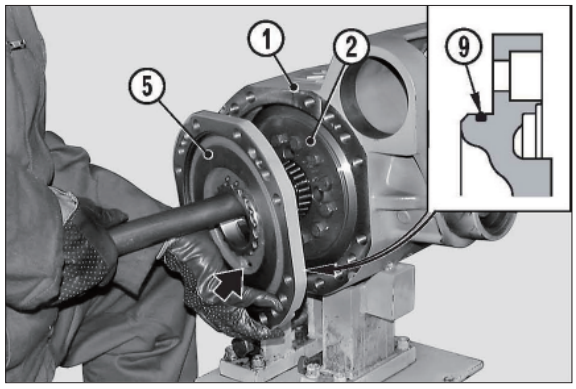


14W98FA236

· INSTALLING

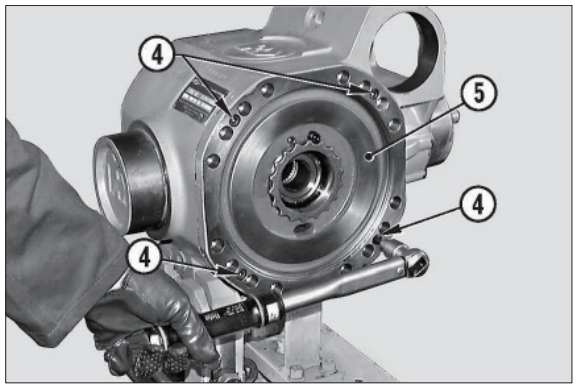
(16) Position the differential unit (6) in the central body (2) with the help of a bar and fit the middle cover (5).

※ Thoroughly check the state of the O-ring (9) and make sure that the cover is fitted with the oil discharge in the lower position.



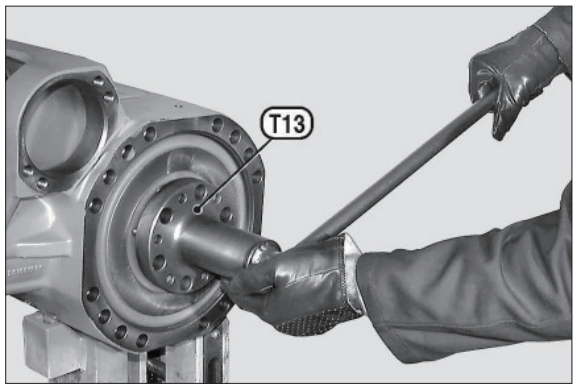
14W98FA237

(17) Lock the middle cover (5) with screws (4).
· Torque wrench setting for screw :
23.8 - 26.2 Nm



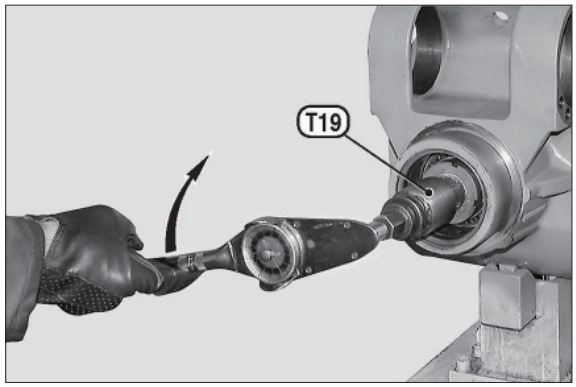
14W98FA238

(18) Tighten ring nuts on the crown side until clearance between pinion and crown is zero, then lock the crown ; go back 1/4～1/2 turn.
※ It the ring nuts (1) are removed, spread them with loctite 242.



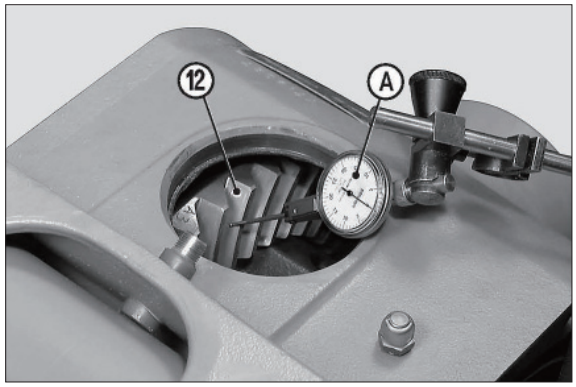
14W98FA239

(19) Pre-set the bearing by means of the ring nut situated on the opposite side of the crown, so as to increase pinion torque up to 140～210 Ncm.
※ If bearings are not new, check the static torque ; if bearing are new, check the continuous torque.



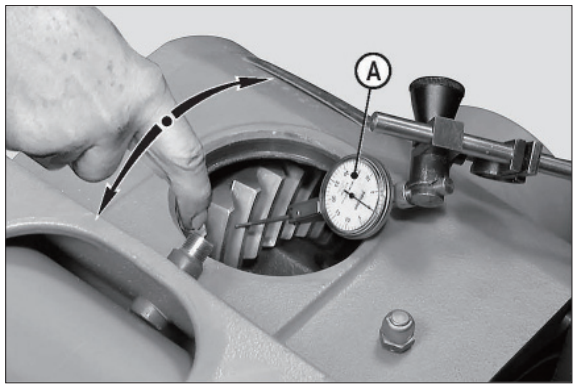
14W98FA240

(20) Introduce a comparator with rotary key "A" through the top plug hole (10).
Position the comparator on the center of one of the teeth of the crown (12), pre-set it to 1 mm and reset it.



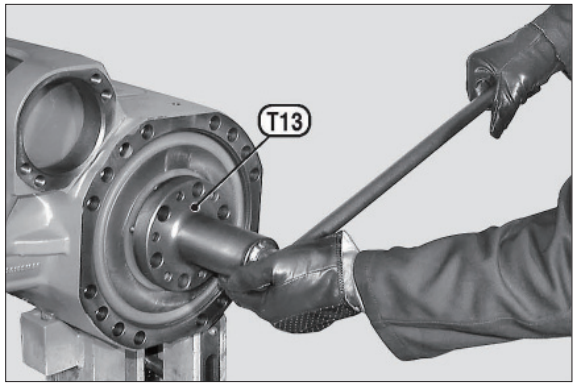
14W98FA241

(21) Manually move the crown (12) in both directions in order to check the existing backlash between the pinion and the crown.



14W98FA242

(22) Adjust the backlash between the pinion and the crown by unloosing one of the ring nuts (1) and tightening the opposite to compensate.
Normal backlash : see table.



14W98FA243

※ Differential between MIN and MAX clearance for whole circumference should not exceed 0.09 mm.

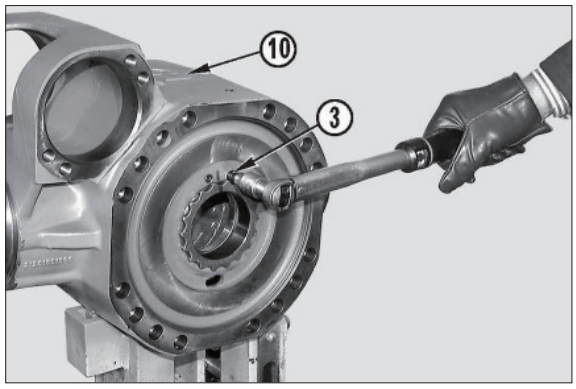
TABLE

Ratio	Clearance	
	Min.	Max.
9:34	0.18	0.23
9:35	0.13	0.18
11:31	0.20	0.28
11:35	0.13	0.18
12:35	0.13	0.18
12:41	0.15	0.20
14:32	0.18	0.23
14:36	0.15	0.20
14:41	0.15	0.20
15:32	0.18	0.23
15:47	0.13	0.18

(23) Apply loctite 242 to the screws (3), fit them into one of the two holes and tighten.

· Torque wrench setting : 23.8 - 26.2 Nm

Fit the top plug (10) after applying repositionable jointing compound for seals to the rims.



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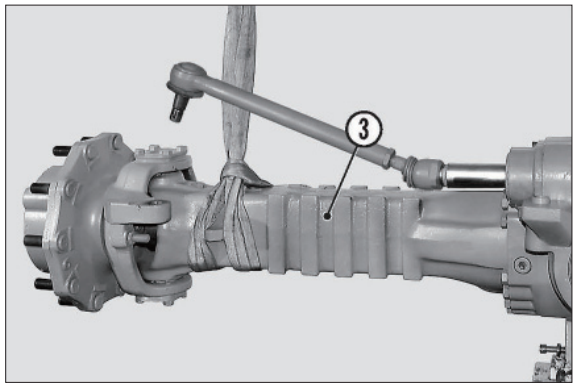
(24) Re-install the complete arms.

For details, see "CHECKING WEAR AND REPLACING THE BRAKING DISKS".



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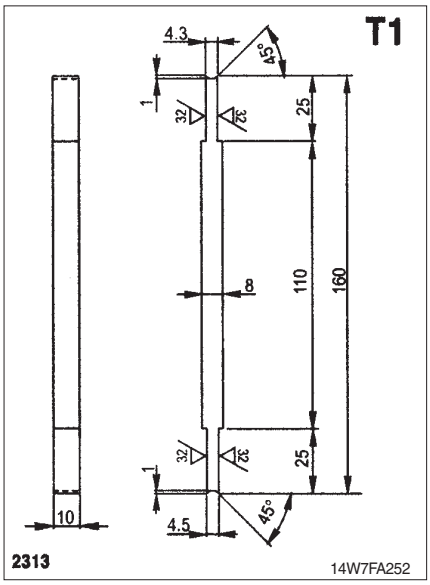
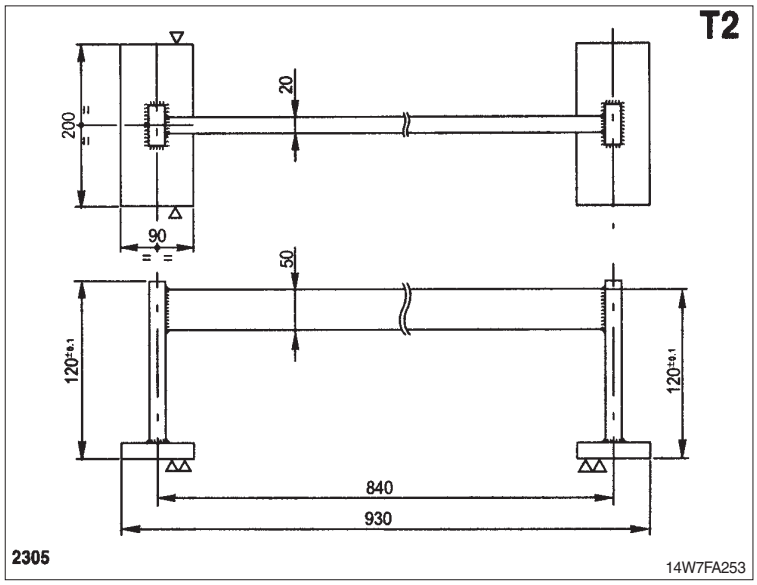
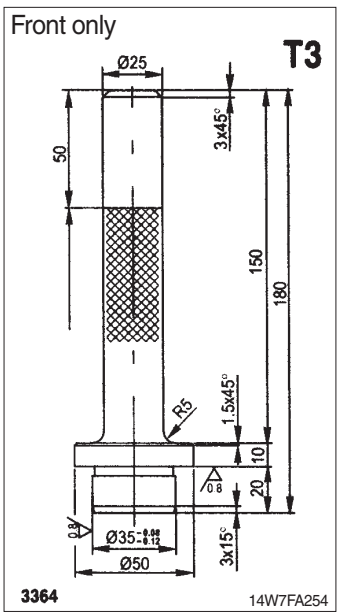
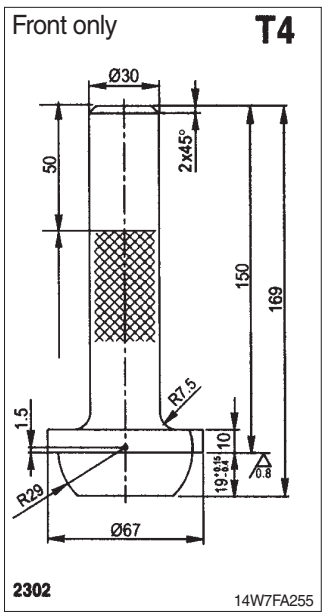
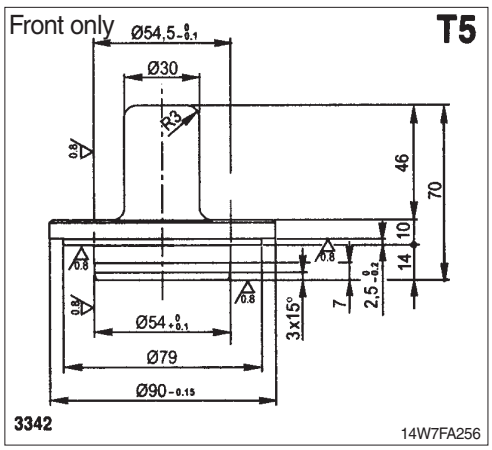
12. SPECIAL TOOLS

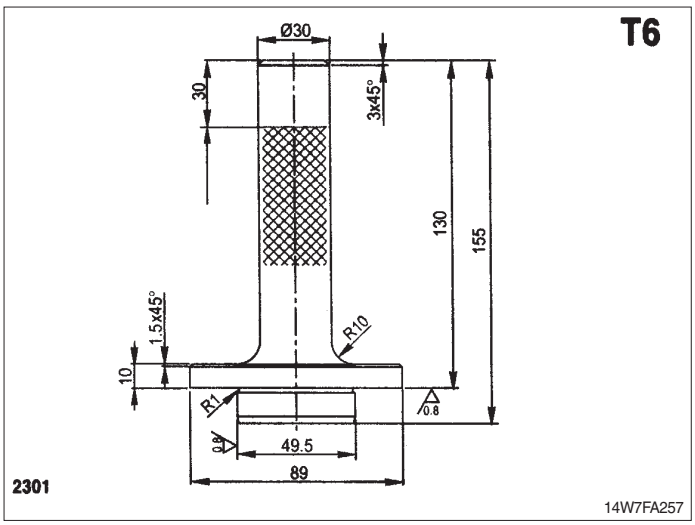


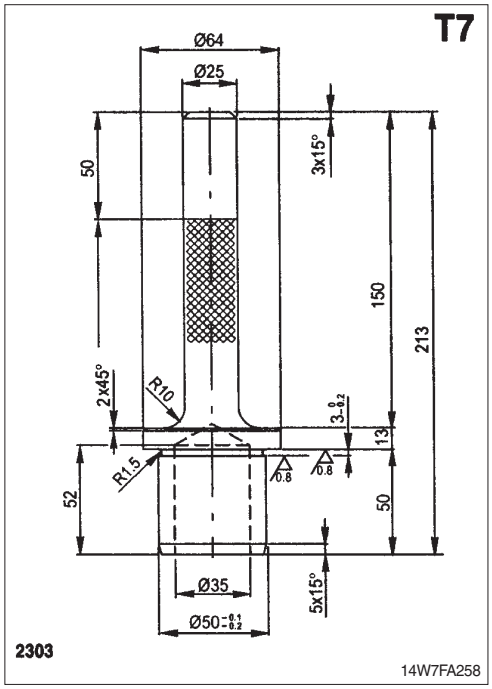






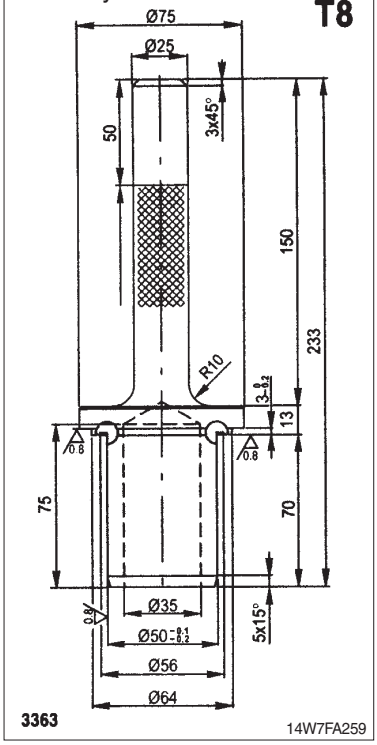






Front only

T8



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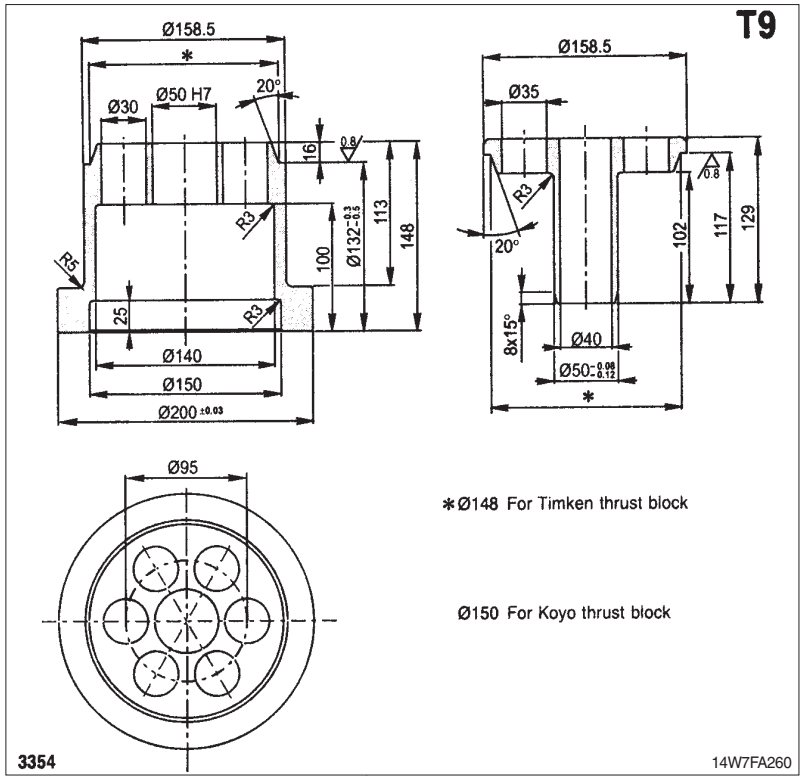
T9



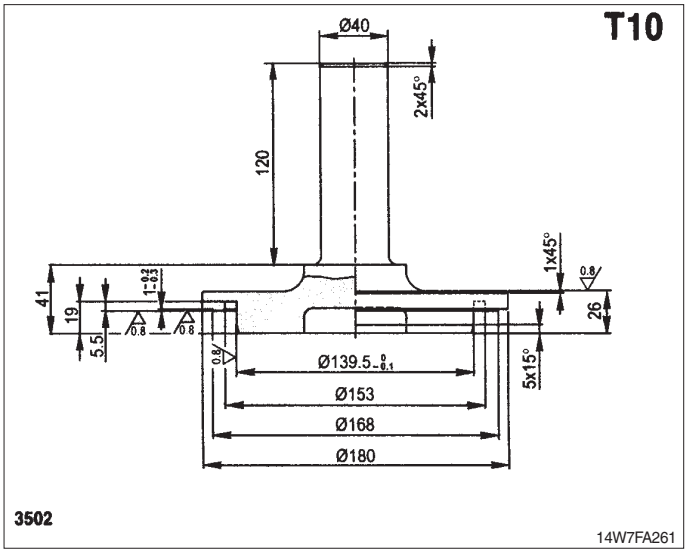
*Ø148 For Timken thrust block

Ø150 For Koyo thrust block

3354

14W7FA260

T10



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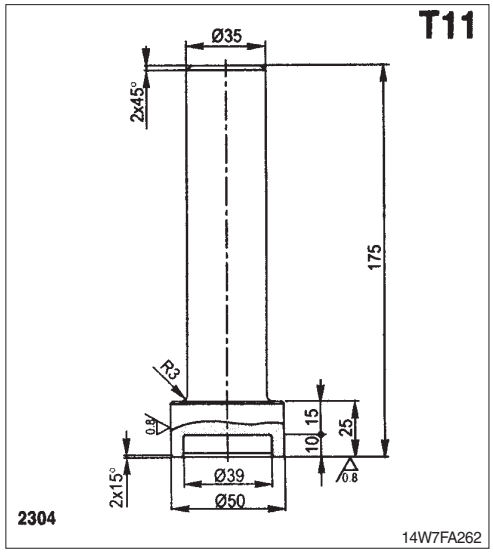

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Front only

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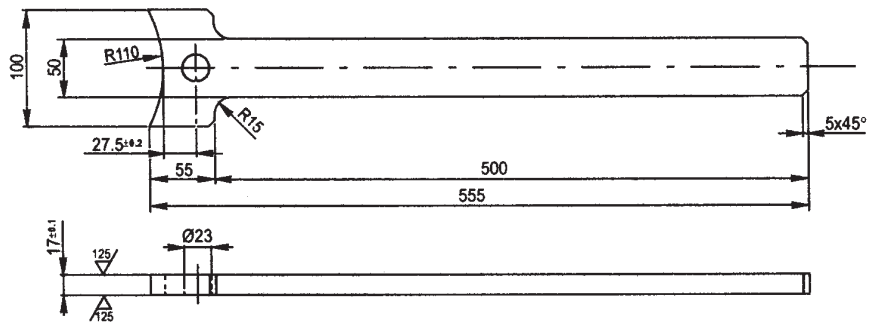

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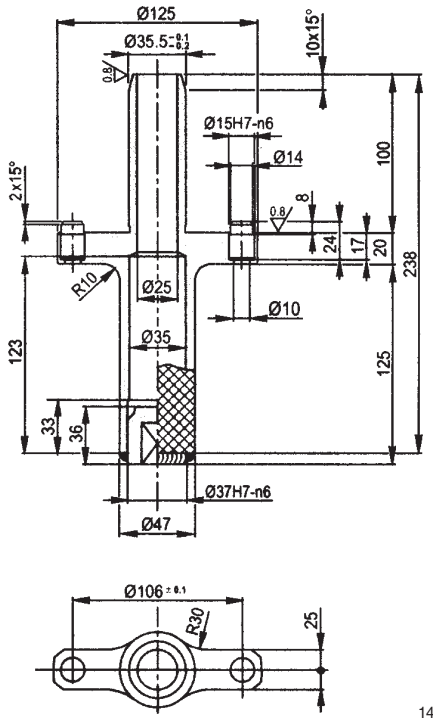

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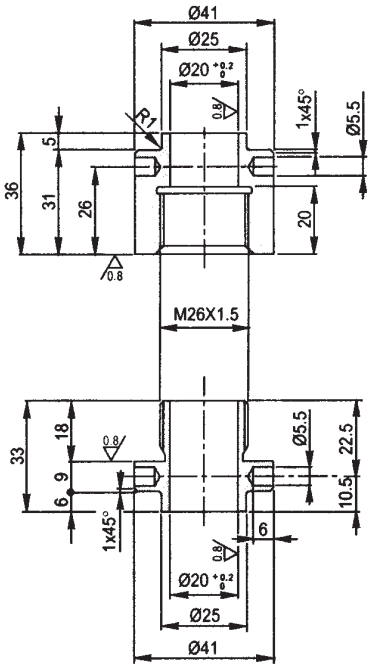

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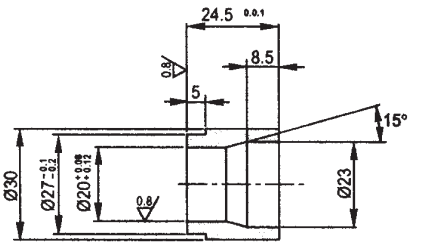

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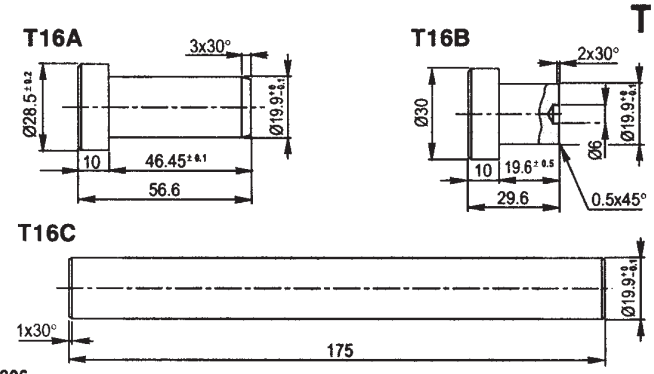

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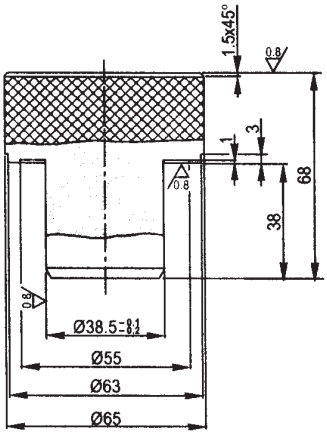

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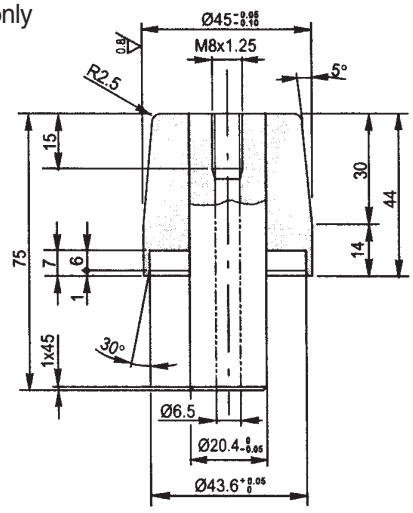
T18

Front only



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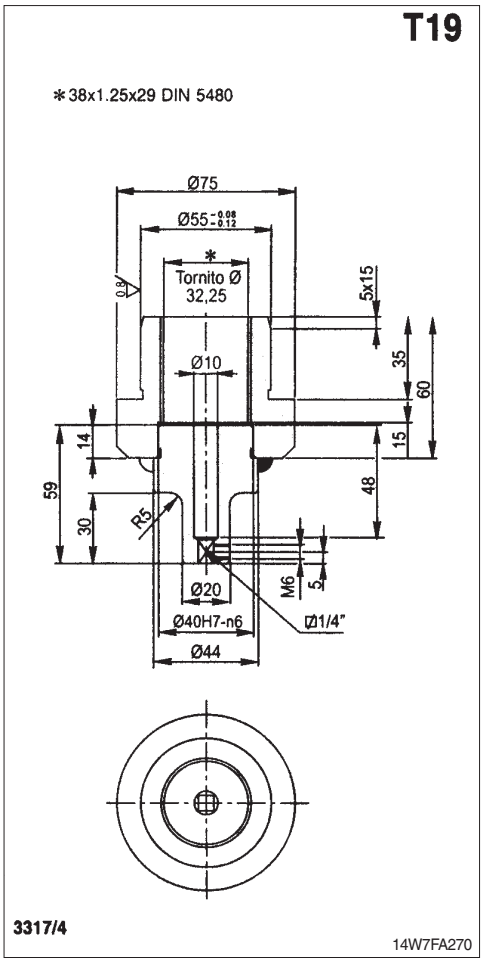

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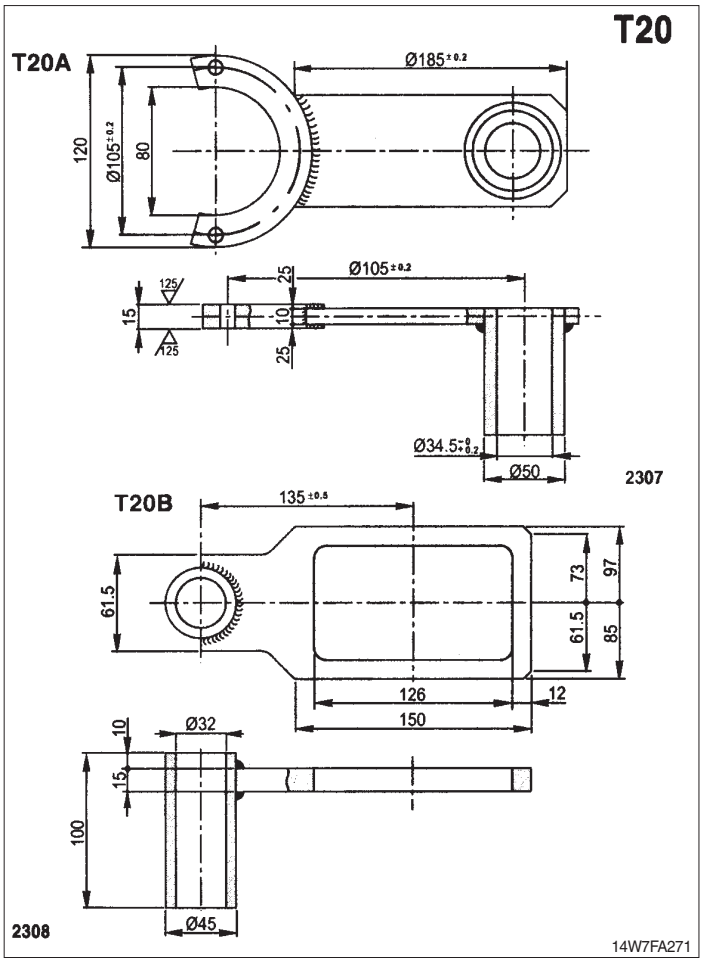

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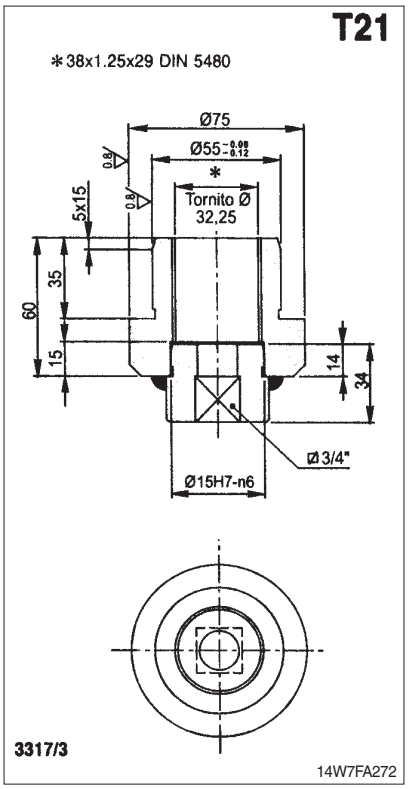

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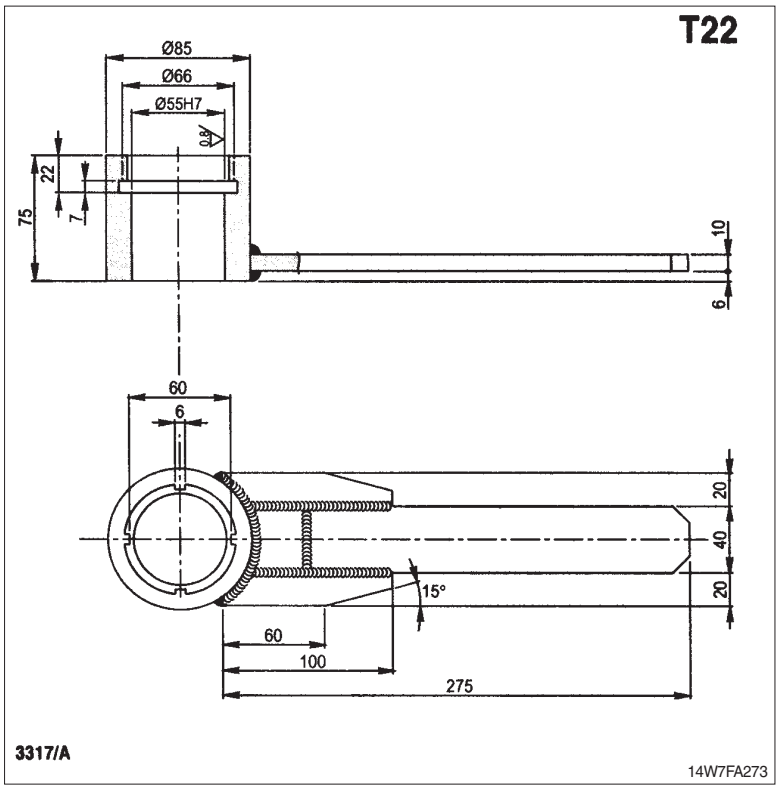

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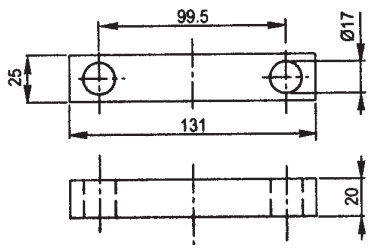

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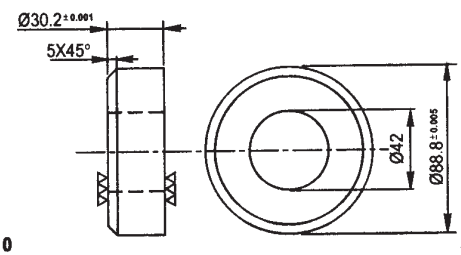

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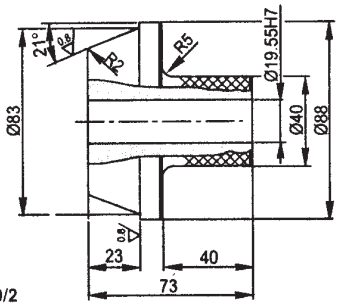

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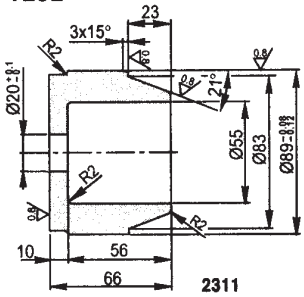

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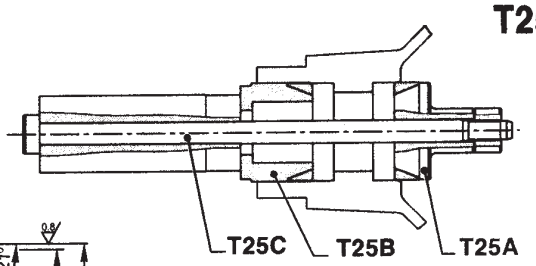

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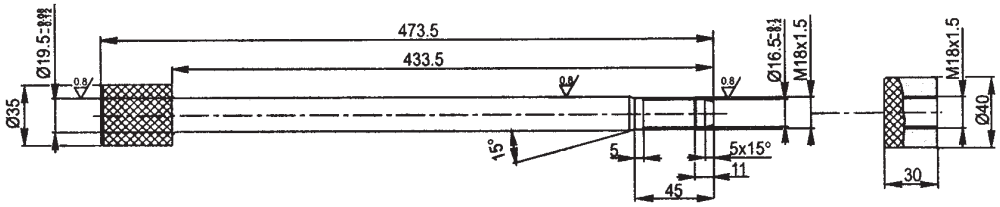

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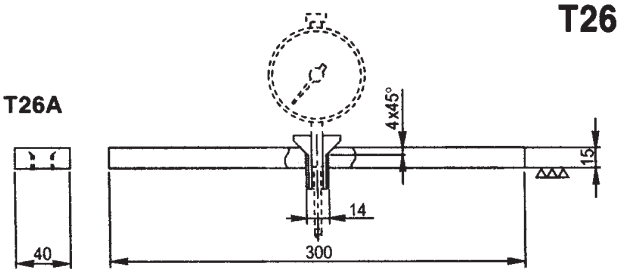
T26

T26A



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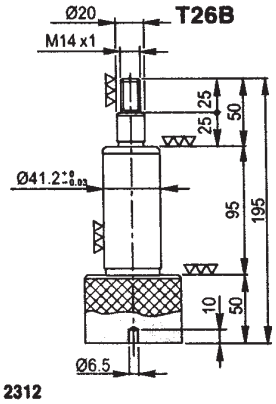

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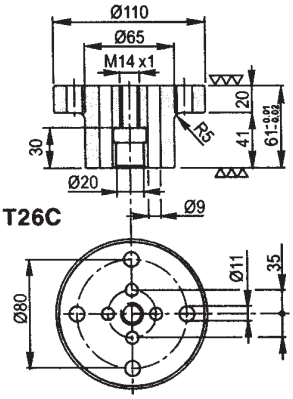

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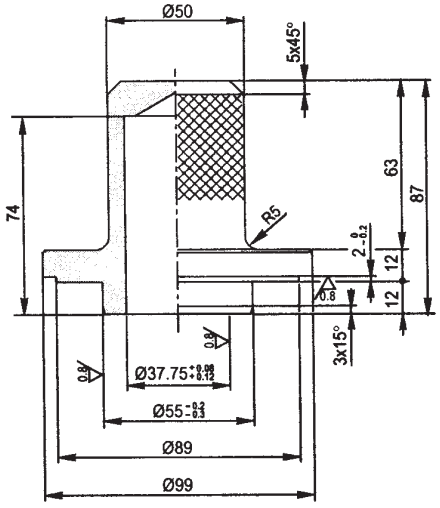

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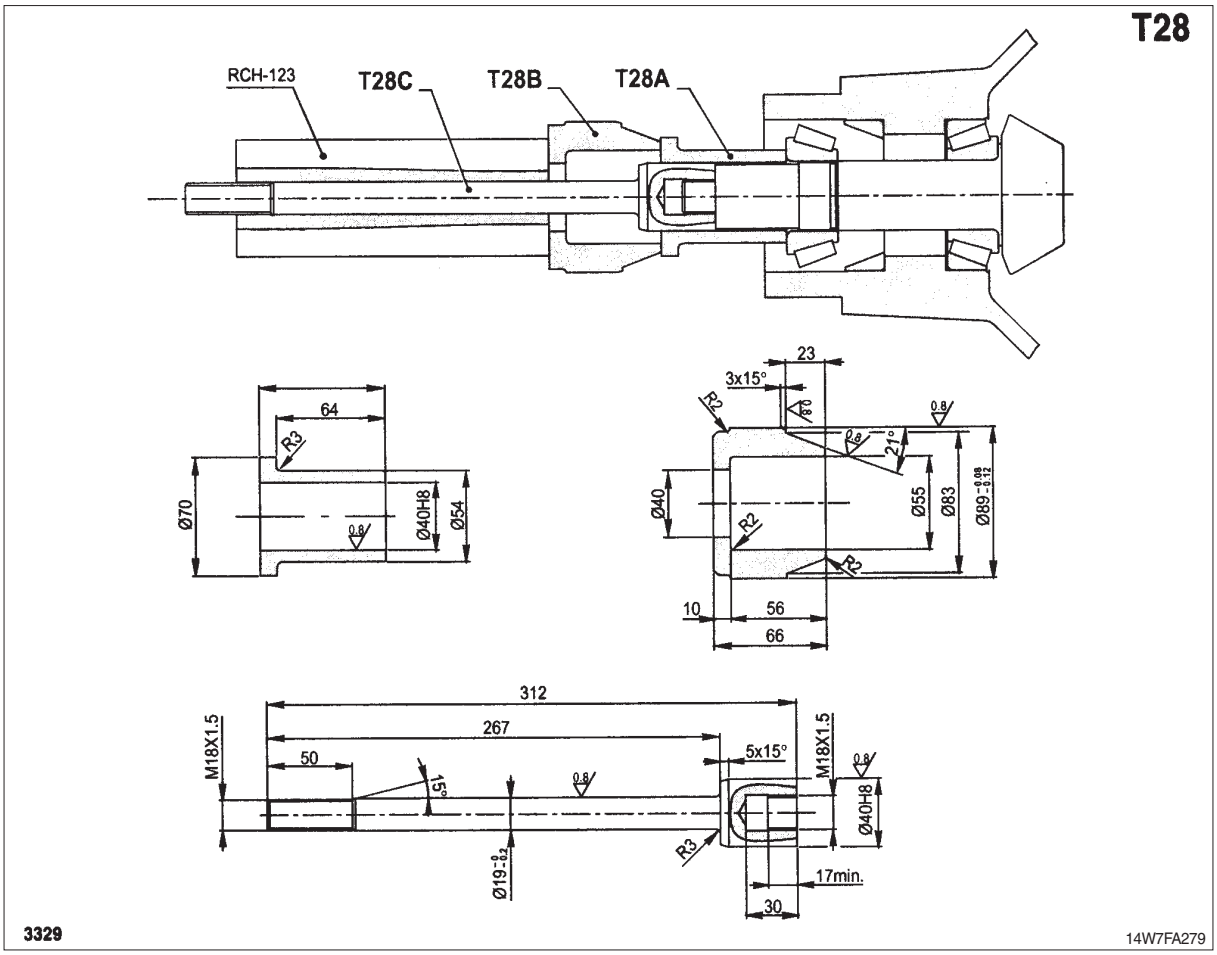

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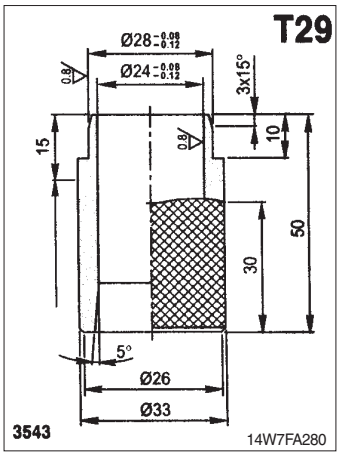

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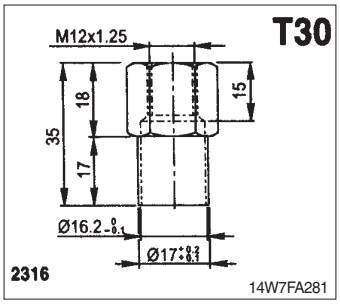

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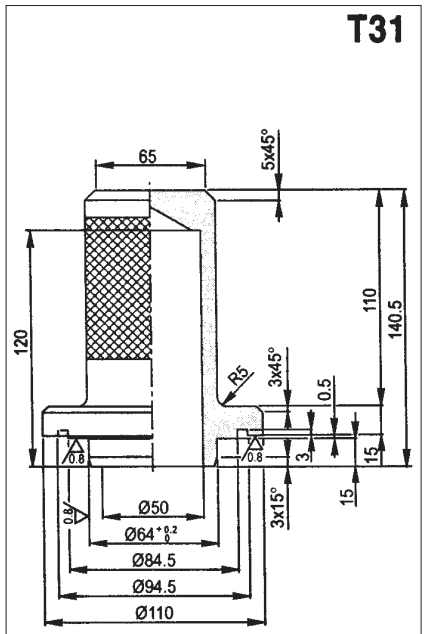

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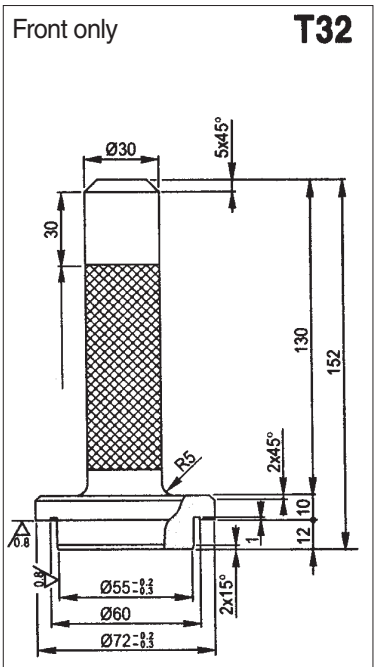
T32

Front only



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