CATERPILLAR®

# Axle Service Manual

## Models

## TL642, TL642C, TL642D, TH357D, TH408D, TH3510D, TH514D, TH414C GC, TH417C GC, TH314D, TH417D

SN TBK00100 to Present
SN THG00150 to Present, SN THL00150 to Present,
SN ML800150 to Present, SN MLG00150 to Present,
SN TD600150 to Present, SN TD700150 to Present,
SN TH900150 to Present, SN TH400150 to Present,
SN TH200150 to Present, SN TH300150 to Present,
SN MWG00150 to Present, SN MWY00150 to Present,
SN KRF00150 to Present, SN LYN00150 to Present,
SN NAB00150 to Present, SN NMM00150 to Present,
SN MYT00150 to Present, SN MYF00150 to Present,
SN MLZ00150 to Present, SN MKY00150 to Present

***31211009***
***UENR6271-03***

*Revised*
*January 18, 2018*

**DISCLAIMER:** Information provided within (excluding Section 1) is supplied directly from the component manufacturer. Information within the machine Operation & Maintenance or Service Manuals supersedes any discrepancies which may be found within this manual. Due to continuous improvements, the component manufacturer reserves the right to make changes without prior notification.

# EFFECTIVITY PAGE

| DATE | REVISION | DESCRIPTION |
|---|---|---|
| September 3, 2014 | A | Original Issue of Manual |
| June 19, 2017 | B | Revised cover to include TL642, TL642C, TL642D, TH314D and TH417D models with respective serial numbers<br>Revised pages 2-1, 2-3, 2-7, 2-8, 2-10, 3-2, 4-2, 5-2, 6-2, 7-3, 7-11, 7-12, 8-2, 9-2, 11-2, 12-2, 13-2, 14-2, 15-2, 16-2, 17-2, 18-2, 19-2, 19-8, 19-11, 19-12, 20-2 |
| June 21, 2017 | C | Revised cover to include TH3510D and TH514D models with respective serial numbers |
| January 18, 2018 | D | Revised cover to include TH357D and TH408D models with respective serial numbers |

# EFFECTIVITY PAGE

# SECTION CONTENTS

# Section 1
# Safety Practices

## 1.1 INTRODUCTION

This service manual provides general directions for accomplishing service and repair procedures. Following the procedures in this manual will help assure safety and equipment reliability.

Read, understand and follow the information in this manual, and obey all locally approved safety practices, procedures, rules, codes, regulations and laws.

These instructions cannot cover all details or variations in the equipment, procedures, or processes described, nor provide directions for meeting every possible contingency during operation, maintenance, or testing. When additional information is desired consult the local *Caterpillar* dealer.

Many factors contribute to unsafe conditions: carelessness, fatigue, overload, inattentiveness, unfamiliarity, even drugs and alcohol, among others. For optimal safety, encourage everyone to think, and to act, safely.

Appropriate service methods and proper repair procedures are essential for the safety of the individual doing the work, for the safety of the operator, and for the safe, reliable operation of the machine. All references to the right side, left side, front and rear are given from the operator seat looking in a forward direction.

Supplementary information is available from the manufacturer in the form of Service Bulletins, Service Campaigns, Service Training Schools, the service website, other literature, and through updates to the manual itself.

## 1.2 DISCLAIMER

All information in this manual is based on the latest product information available at the time of publication. The manufacturer reserves the right to make changes and improvements to its products, and to discontinue the manufacture of any product, at its discretion at any time without public notice or obligation.

## 1.3 OPERATION AND MAINTENANCE MANUAL

The mechanic must not operate the machine until the Operation & Maintenance Manual has been read and understood, training has been accomplished and operation of the machine has been completed under the supervision of an experienced and qualified operator.

An Operation & Maintenance Manual is supplied with each machine and must be kept in the manual holder located in the cab. In the event that the Operation & Maintenance Manual is missing, consult the local *Caterpillar* dealer before proceeding.

## 1.4 DO NOT OPERATE TAGS

Place Do Not Operate Tags on the ignition key switch and the steering wheel before attempting to perform any service or maintenance. Remove key and disconnect battery leads.

## 1.5 SAFETY INFORMATION

To avoid possible death or injury, carefully read, understand and comply with all safety messages.

In the event of an accident, know where to obtain medical assistance and how to use a first aid kit and fire extinguisher/ fire suppression system. Keep emergency telephone numbers (fire department, ambulance, rescue squad/ paramedics, police department, etc.) nearby. If working alone, check with another person routinely to help assure personal safety.

## 1.6 SAFETY ALERT SYSTEM AND SIGNAL WORDS

**DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

## 1.7 SAFETY INSTRUCTIONS

Following are general safety statements to consider ***before*** performing maintenance procedures on the telehandler. Additional statements related to specific tasks and procedures are located throughout this manual and are listed prior to any work instructions to provide safety information before the potential of a hazard occurs.

For all safety messages, carefully read, understand and follow the instructions ***before*** proceeding.

### 1.7.1 Personal Hazards

PERSONAL SAFETY GEAR: Wear all the protective clothing and personal safety gear necessary to perform the job safely. This might include heavy gloves, safety glasses or goggles, filter mask or respirator, safety shoes or a hard hat.

LIFTING: **NEVER** lift a heavy object without the help of at least one assistant or a suitable sling and hoist.

### 1.7.2 Equipment Hazards

LIFTING OF EQUIPMENT: Before using any lifting equipment (chains, slings, brackets, hooks, etc.), verify that it is of the proper capacity, in good working order, and is properly attached.

**NEVER** stand or otherwise become positioned under a suspended load or under raised equipment. The load or equipment could fall or tip.

**DO NOT** use a hoist, jack or jack stands only to support equipment. Always support equipment with the proper capacity blocks or stands properly rated for the load.

HAND TOOLS: Always use the proper tool for the job; keep tools clean and in good working order, and use special service tools only as recommended.

### 1.7.3 General Hazards

SOLVENTS: Only use approved solvents that are known to be safe for use.

HOUSEKEEPING: Keep the work area and operator cab clean, and remove all hazards (debris, oil, tools, etc.).

FIRST AID: Immediately clean, dress and report all injuries (cuts, abrasions, burns, etc.), no matter how minor the injury may seem. Know the location of a First Aid Kit, and know how to use it.

CLEANLINESS: Wear eye protection, and clean all components with a high pressure or steam cleaner before attempting service.

When removing hydraulic components, plug hose ends and connections to prevent excess leakage and contamination. Place a suitable catch basin beneath the machine to capture fluid run off.

It is good practice to avoid pressure-washing electrical/ electronic components. In the event pressure-washing the machine is needed, ensure the machine is shut down before pressure-washing. Should pressure-washing be utilized to wash areas containing electrical/electronic components, it is recommended a maximum pressure of 52 bar (750 psi) at a minimum distance of 30,5 cm (12 in) away from these components. If electrical/electronic components are sprayed, spraying must not be direct and for brief time periods to avoid heavy saturation,

Check and obey all Federal, State and/or Local regulations regarding waste storage, disposal and recycling.

### 1.7.4 Operational Hazards

ENGINE: Stop the engine before performing any service unless specifically instructed otherwise.

VENTILATION: Avoid prolonged engine operation in enclosed areas without adequate ventilation.

SOFT SURFACES AND SLOPES: **NEVER** work on a machine that is parked on a soft surface or slope. The machine must be on a hard level surface, with the wheels blocked before performing any service.

FLUID TEMPERATURE: **NEVER** work on a machine when the engine, cooling or hydraulic systems are hot. Hot components and fluids can cause severe burns. Allow systems to cool before proceeding.

FLUID PRESSURE: Before loosening any hydraulic or diesel fuel component, hose or tube, turn the engine OFF. Wear heavy, protective gloves and eye protection. **NEVER** check for leaks using any part of your body; use a piece of cardboard or wood instead. If injured, seek medical attention immediately. Diesel fluid leaking under pressure can explode. Hydraulic fluid and diesel fuel leaking under pressure can penetrate the skin, cause infection, gangrene and other serious personal injury.

Refer to the engine manufacturers manual for specific details concerning the fuel system.

Relieve all pressure before disconnecting any component, part, line or hose. Slowly loosen parts and allow release of residual pressure before removing any part or component. Before starting the engine or applying pressure, use components, parts, hoses and pipes that are in good condition, connected properly and are tightened to the proper torque. Capture fluid in an appropriate container and dispose of in accordance with prevailing environmental regulations.

COOLANT SYSTEM CAP: The cooling system is under pressure, and escaping coolant can cause severe burns and eye injury. To prevent personal injury, NEVER remove the coolant system cap while the cooling system is hot. Wear safety glasses. Turn the coolant system cap to the first stop and allow pressure to escape before removing the cap completely. Failure to follow the safety practices could result in death or serious injury.

Properly disconnect battery(s) prior to service the fuel or hydraulic systems.

FLUID FLAMABILTITY: **DO NOT** service the fuel or hydraulic systems near an open flame, sparks or smoking materials.

**NEVER** drain or store fluids in an open container. Engine fuel and hydraulic fluid are flammable and can cause a fire and/or explosion.

**DO NOT** mix gasoline or alcohol with diesel fuel. The mixture can cause an explosion.

PRESSURE TESTING: When conducting any test, only use test equipment that is correctly calibrated and in good condition. Use the correct equipment in the proper manner, and make changes or repairs as indicated by the test procedure to achieve the desired result.

LEAVING MACHINE: Lower the forks or attachment to the ground before leaving the machine.

TIRES: Always keep tires inflated to the proper pressure to help prevent tipover. **DO NOT** over inflate tires.

**NEVER** use mismatched tire types, sizes or ply ratings. Always use matched sets according to machine specifications.

MAJOR COMPONENTS: Never alter, remove, or substitute any items such as counterweights, tires, batteries or other items that may reduce or affect the overall weight or stability of the machine.

BATTERY: **DO NOT** charge a frozen battery.Charging a frozen battery may cause it to explode. Allow the battery to thaw before jump starting or connecting a battery charger.

## 1.8 SAFETY DECALS

Check that all safety decals are present and readable on the machine. Refer to the Operation & Maintenance Manual supplied with machine for information.

# Section 2
# General Information and Specifications

## 2.1 INTRODUCTION

The efficiency and continued operation of mechanical units depend on constant, correct maintenance and also on efficient repair work, should there be a break-down or malfunction. The instructions contained in this manual have been based on a complete overhaul of the unit. However, it is up to the mechanic to decide whether or not it is necessary to assemble only individual components, when partial repair work is needed. The manual provides a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows accurate work to be performed.

All the information needed for correct disassembly, checks and assembly of each individual component is set out below. In order to remove the differential unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

**IMPORTANT:** In order to facilitate work and protect both working surfaces and operators, it is advisable to use proper equipment such as: trestles or supporting benches, plastic or copper hammers, appropriate levers, pullers and specific spanners or wrenches.

Before going on to disassemble the parts and drain the oil, it is best to thoroughly clean the unit, removing any encrusted or accumulated grease. Before going on to disassemble the parts and drain the oil, it is best to thoroughly clean the unit, removing any encrusted or accumulated grease.

**INTRODUCTORY REMARKS**

All the disassembled mechanical units should be thoroughly cleaned with appropriate products and restored or replaced if damage, wear, cracking or seizing have occurred.

In particular, thoroughly check the condition of all moving parts (bearings, gears, crown wheel and pinion, shafts) and sealing parts (O-rings, oil shields) which are subject to major stress and wear. In any case, it is advisable to replace the seals every time a component is overhauled or repaired. During assembly, the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one component requires the replacement of the other one. During assembly, the prescribed pre-loading, backlash and torque of parts must be maintained.

**SPECIFIC EQUIPMENT AND SPARE PARTS**

The drawings of all specific tools required for maintenance and repair work can be found at the end of this manual; spare parts may be ordered from your Caterpillar dealer.

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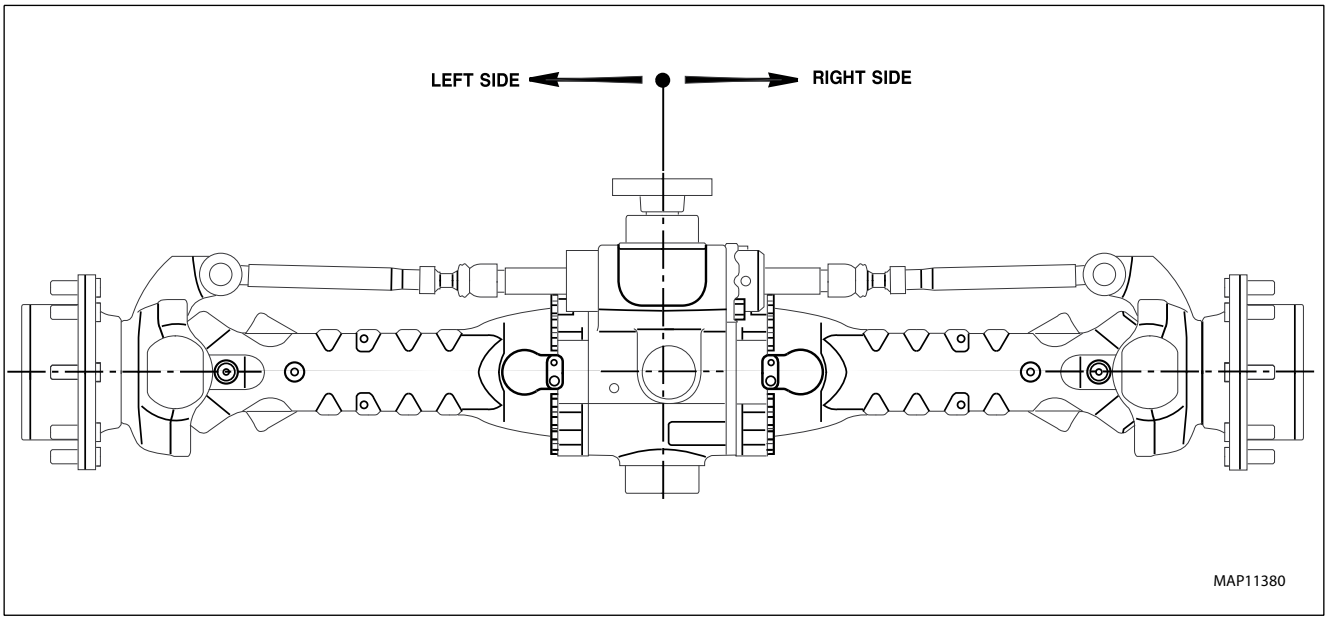
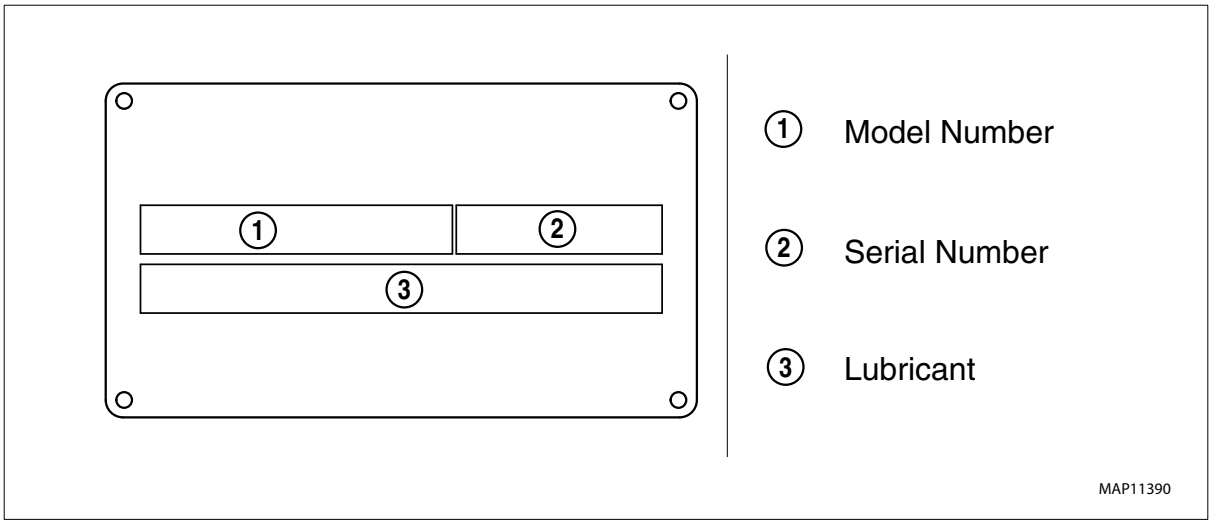
## 2.2 SPECIFICATIONS

### 2.2.1 DEFINITION OF VIEWPOINTS




### 2.2.2 DATA PLATE



## 2.3 CONVERSION TABLES

### 2.3.1 UNITS OF PRESSURE

| UNIT | Atm | Bar | MPa | Pa | PSI |
|---|---|---|---|---|---|
| Atm | 1 | 1 | 0.1 | $10^5$ | 14.4 |
| Bar | 1 | 1 | 0.1 | $10^5$ | 14.4 |
| MPa | 10 | 10 | 1 | $10^6$ | 144 |
| Pa | 0.00001 | 0.00001 | $10^{-6}$ | 1 | - |
| PSI | - | - | - | - | 1 |

### 2.3.2 UNIT OF WEIGHT

| UNIT | N | daN | kN | kg | lbs |
|---|---|---|---|---|---|
| 1N | 1 | 0.1 | 0.001 | 0.102 | 0.225 |
| 1daN | 10 | 1 | 0.01 | 1.02 | 2.25 |
| 1kN | 1000 | 100 | 1 | 102 | 225 |
| 1kg | 9.81 | 0.981 | 0.00981 | 1 | 2.205 |

### 2.3.3 UNITS OF TORQUE

| UNIT | Nm | daNm | kNm | kg.m | lb.in |
|---|---|---|---|---|---|
| 1N·m | 1 | 0.1 | 0.001 | 0.102 | 8.854 |
| 1daN·m | 10 | 1 | 0.01 | 1.02 | 88.54 |
| 1kN·m | 1000 | 100 | 1 | 102 | 8854 |
| 1kg·m | 9.81 | 0.981 | 0.00981 | 1 | 86.8 |
| 1 lb·in | 0.1129 | 0.01129 | 0.0001129 | 0.01152 | 1 |

## 2.4 TORQUE SPECIFICATIONS

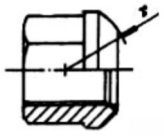
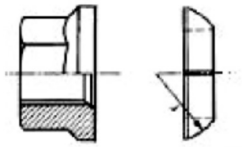
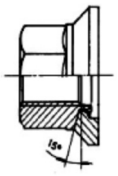
### 2.4.1 BOLT TIGHTENING TORQUES

Unit - Nm

| SIZE OF BOLT | | TYPE OF BOLT | | | | | |
|---|---|---|---|---|---|---|---|
| | | 8.8 | 8.8 + Loctite 270 | 10.9 | 10.9 + Loctite 270 | 12.9 | 12.9 + Loctite 270 |
| COARSE PITCH | M6 x 1 mm | 9.5 – 10.5 | 10.5 – 11.5 | 14.3 – 15.7 | 15.2 – 16.8 | 16.2 – 17.8 | 18.1 – 20 |
| | M8 x 1.25 mm | 23.8 – 26.2 | 25.6 – 28.4 | 34.2 – 37.8 | 36.7 – 40.5 | 39 – 43 | 43.7 – 48.3 |
| | M10 x 1.5 mm | 48 – 53 | 52 – 58 | 68 – 75 | 73 – 81 | 80 – 88 | 88 – 97 |
| | M12 x 1.75 mm | 82 – 91 | 90 – 100 | 116 – 128 | 126 – 139 | 139 – 153 | 152 – 168 |
| | M14 x 2 mm | 129 – 143 | 143 – 158 | 182 – 202 | 200 – 221 | 221 – 244 | 238 – 263 |
| | M16 x 2 mm | 200 – 221 | 219 – 242 | 283 – 312 | 309 – 341 | 337 – 373 | 371 – 410 |
| | M18 x 2.5 mm | 276 – 305 | 299 – 331 | 390 – 431 | 428 – 473 | 466 – 515 | 509 – 562 |
| | M20 x 2.5 mm | 390 – 431 | 428 – 473 | 553 – 611 | 603 – 667 | 660 – 730 | 722 – 798 |
| | M22 x 2.5 mm | 523 – 578 | 575 – 635 | 746 – 824 | 817 – 903 | 893 – 987 | 974 – 1076 |
| | M24 x 3 mm | 675 – 746 | 732 – 809 | 950 – 1050 | 1040 – 1150 | 1140 – 1260 | 1240 – 1370 |
| | M27 x 3 mm | 998 – 1103 | 1088 – 1202 | 1411 – 1559 | 1539 – 1701 | 1710 – 1890 | 1838 – 2032 |
| | M30 x 3.5 mm | 1378 – 1523 | 1473 – 1628 | 1914 – 2115 | 2085 – 2305 | 2280 – 2520 | 2494 – 2757 |
| | | | | | | | |
| FINE PITCH | M8 x 1 mm | 25.7 – 28.3 | 27.5 – 30.5 | 36.2 – 39.8 | 40 – 44 | 42.8 – 47.2 | 47.5 – 52.5 |
| | M10 x 1.25 mm | 49.4 – 54.6 | 55.2 – 61 | 71.5 – 78.5 | 78 – 86 | 86 – 94 | 93 – 103 |
| | M12 x 1.25 mm | 90 – 100 | 98 – 109 | 128 – 142 | 139 – 154 | 152 – 168 | 166 – 184 |
| | M12 x 1.5 mm | 86 – 95 | 94 – 104 | 120 – 132 | 133 – 147 | 143 – 158 | 159 – 175 |
| | M14 x 1.5 mm | 143 – 158 | 157 – 173 | 200 – 222 | 219 – 242 | 238 – 263 | 261 – 289 |
| | M16 x 1.5 mm | 214 – 236 | 233 – 257 | 302 – 334 | 333 – 368 | 361 – 399 | 394 – 436 |
| | M18 x 1.5 mm | 312 – 345 | 342 – 378 | 442 – 489 | 485 – 536 | 527 – 583 | 580 – 641 |
| | M20 x 1.5 mm | 437 – 483 | 475 – 525 | 613 – 677 | 674 – 745 | 736 – 814 | 808 – 893 |
| | M22 x 1.5 mm | 581 – 642 | 637 – 704 | 822 – 908 | 903 – 998 | 998 – 1103 | 1078 – 1191 |
| | M24 x 2 mm | 741 – 819 | 808 – 893 | 1045 – 1155 | 1140 – 1260 | 1235 – 1365 | 1363 – 1507 |
| | M27 x 2 mm | 1083 – 1197 | 1178 – 1302 | 1520 – 1680 | 1672 – 1848 | 1834 – 2027 | 2000 – 2210 |
| | M30 x 2 mm | 1511 – 1670 | 1648 – 1822 | 2138 – 2363 | 2332 – 2577 | 2565 – 2835 | 2788 – 3082 |

## 2.4.2 WHEEL NUT TIGHTENING TORQUES

Wheel nut tightening torques recommended from rim's manufacturer with reference to the quality of the rim's material.

| WHEEL NUTS CHARACTERISTIC | WHEEL STUD THREAD | RECOMMENDED WHEEL NUTS TORQUE | | NUT FIXING'S SOLUTION |
|---|---|---|---|---|
| | | RIM MATERIAL QUALITY | | |
| | | ST 37 | **ST 52 | |
| WHEEL NUTS WITH INTEGRATED SPHERICAL COLLAR | M18 X 1.5 mm | 330 Nm (243 ft. lb.) | 460 Nm (339 ft. lb.) |  MAP3930 |
| | M20 X 1.5 mm | 490 Nm (361 ft. lb.) | 630 Nm (464 ft. lb.) | |
| | M22 X 1.5 mm | 630 Nm (464 ft. lb.) | 740 Nm (545 ft. lb.) | |
| FLAT COLLAR WHEEL NUTS WITH SEPARATE SPHERICAL LOCK WASHER | M18 X 1.5 mm | 270 Nm (199 ft. lb.) | 360 Nm (265 ft. lb.) |  MAP3940 |
| | M20 X 1.5 mm | 360 Nm (265 ft. lb.) | 450 Nm (332 ft. lb.) | |
| | M22 X 1.5 mm | 460 Nm (339 ft. lb.) | 550 Nm (406 ft. lb.) | |
| WHEEL NUTS WITH INTEGRATED SEAT CAPTIVE WASHER | M18 X 1.5 mm | 260 Nm (192 ft. lb.) | 360 Nm (265 ft. lb.) |  MAP3950 |
| | M20 X 1.5 mm | 350 Nm (258 ft. lb.) | 500 Nm (369 ft. lb.) | |
| | M22 X 1.5 mm | 450 Nm (332 ft. lb.) | 650 Nm (479 ft. lb.) | |

***IMPORTANT:*** ***Rim's material ST 52 is recommended by manufacturer on axle application. it is the optimum material for tightening the rim to the hub.*

***Note:*** *The wheel nut tightening torque is related only on nut thread and stud thread dry. (Without oil or any lubricant).*

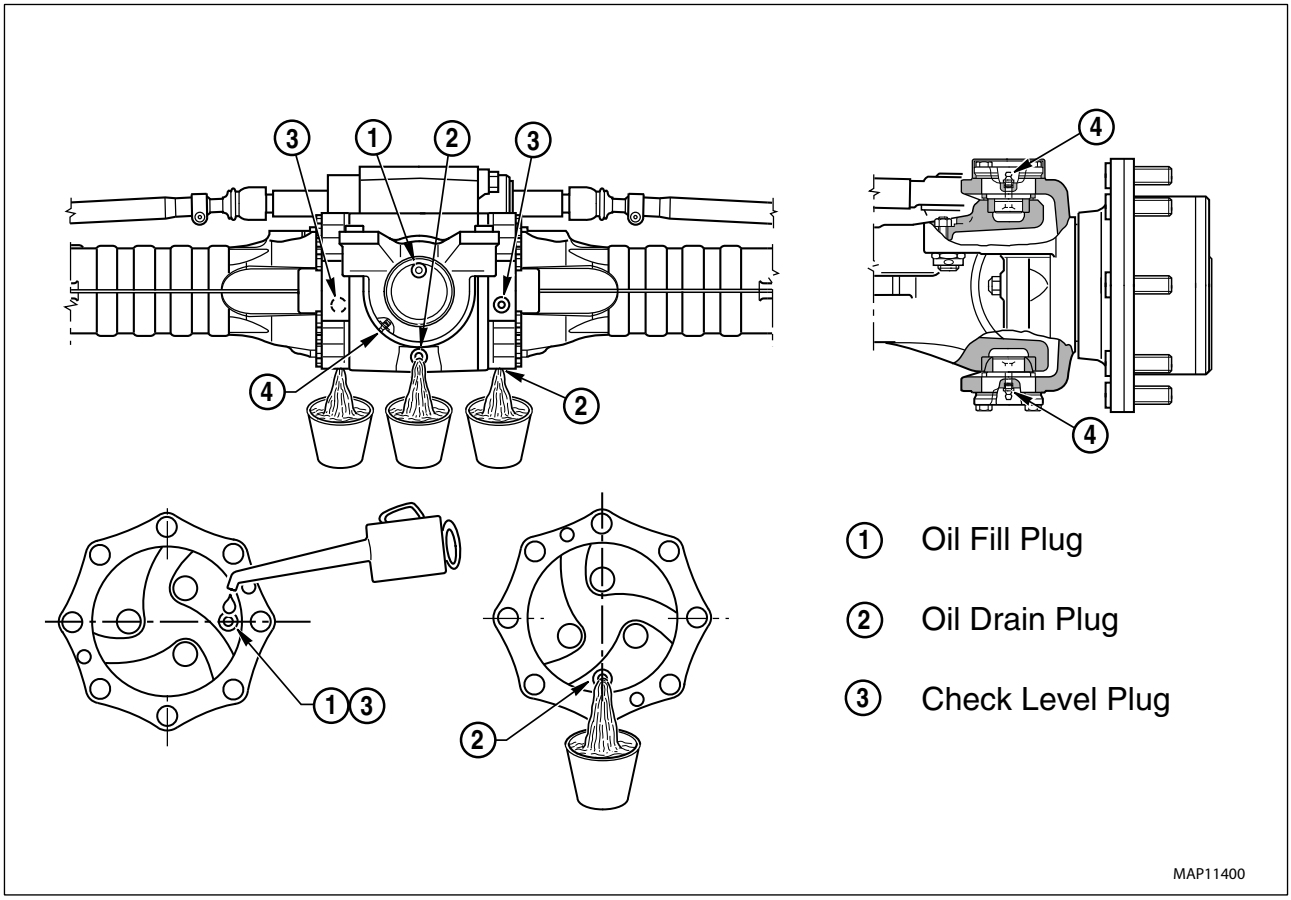
***Note:*** *The wheel nut tightening torque takes into consideration not only the nut + stud characteristics, but also the quality of the rim material.*

| TIGHTENING TORQUE TABLE, SHOWS THE TORQUE FIGURE RELATED TO THE BOLT CHARACTERISTIC ONLY. | | |
|---|---|---|
| TIGHTENING TORQUE TABLE | | |
| NUT MATERIAL QUALITY 8.8 & 10.9 | STUD MATERIAL QUALITY | *TORQUE RANGE |
| M18 x 1.5 mm | M18 x 1.5 mm | 442 - 489 Nm/ 326 - 360 ft.lb. |
| M20 x 1.5 mm | M20 x 1.5 mm | 613 - 677 Nm/ 452 - 499 ft.lb. |
| M22 x 1.5 mm | M22 x 1.5 mm | 822 - 908 Nm/ 606 - 669 ft.lb. |

***Note:*** *The torque figure on nut and stud coupling must be related on stud material quality*

## 2.5 MAINTENANCE

### 2.5.1 MAINTENANCE POINTS



## 2.6 OIL DRAINING MANDATORY PROCEDURE

### 2.6.1 OIL DRAINING MANDATORY PROCEDURE

**WARNING**

Do not attempt any maintenance if the axle is hot (40 - 50° C/ 104 - 122° F). Hot oil and components can cause personal injury. Avoid skin contact. Wear protective gloves and glasses.

Make sure all fluids are contained during inspection, maintenance, tests, adjustment and repair of the product. Prepare a suitable container to collect the fluid before removing any component containing fluids. Dispose of all fluids following legal and local regulations.

**a. Central Housing**

Before draining oil it is mandatory to loosen the oil filling plug or the breather (if present), and wait until the internal pressure is completely released. Remove the oil draining plug and drain oil only when the pressure is completely released.

**b. Planetary Gear Reduction**

Before draining oil it is mandatory to rotate the planetary gear reduction in order to move the oil plug in filling position, then loosen the oil plug and wait until the internal pressure is completely released. Remove the oil plug and drain oil only when the pressure is completely released.

| OPERATION | COMPARTMENT | 1ST CHANGE / CHECK (hours) | INTERVAL (hours) | LUBRICANTS | REMARKS |
|---|---|---|---|---|---|
| Oil level check | All | 10 hours | Monthly | For details see below | Clean carefully oil plug magnet |
| Oil change | Differential | 100 - 250 hours max. * | 1000 hours | Central body standard bevel gears - UTTO (API GL4), or gear: J20/C, MF M1143, or gear: SAE80W/90 (API GL4 or GL5) | If with limited slip differential, and/or wet brakes, use LS additivated oils. Clean carefully oil plug magnet. |
| | | | | Central body hypoid bevel gears - SAE80W/90 (API GL5) | |
| | Hub Reduction | 100 - 250 hours max. * | | UTTO (API GL4) J20/C; or gear: SAE80W/90 (API GL4 or GL5) | Clean carefully oil plug magnet. |
| | Dropbox (if any) | 100 - 250 hours max. * | | Gears with wet discs clutch - ATF GM Dexron IIE, Dexron III | Clean carefully oil plug magnet. * in accordance with Machine Service requirements |
| | | | | Only gears - UTTO J20/C, or gear: SAE80W/90 (API GL4 or GL5) | |
| Adjustment | Negative brake (SAHR) | 100 hours | Every 500 hrs | For hydraulic actuations (brakes, SAHR, 100% diff. lock, etc.) use ATF oil e.g. GM Dexron IIE, Dexron III | Not applicable |
| | Service brake | | | | DOT brake fluids oils are NOT compatible w/std oils |
| Tightening | Wheel nuts | 10 hours | Every 200 hrs | No lubricant allowed | Check for any damage or corrosion of treads or mating surfaces |
| Greasing | King Pin Tapered Bearings | 10 hours | Normal work - Weekly or Severe duty - Daily | NLGI2 EP or NLGI3 EP | Supply grease until clean grease is visible from outside. Grease performance level acc. to: According to DIN 51825 level KP2K-30 (NLGI2) or KP3K-20 (NLGI3); ASTM D4950 NLGI2 GC-LB |
| | Seals | 10 hours | | | |
| | King Pin Bushings | 10 hours | | NLGI2 EP or NLGI3 EP with Moly Addittive | |
| | Trunnion Bushings | 10 hours | | | |

***Note:***

*In case of severe duty, half oil change intervals must be applied.*

*In case of extreme enviroments, chatter noise, reduce oil change intervals accordingly.*

*In case of extremely low ambient temperatures (<-20°C), use appropriate oils w/ low viscosity: UTTO J20/D (std Bevel Gears), SAE 75W/90 API GL5 LS (Hypoid Bevel Gears: models 192, 193, 194).*

*API GL5: Acc. To MIL L-2105-B*

*See PSB 00279 (latest update) for more info regarding lubricants and viscosity grades.*

## 2.7.2 LUBRICANT & SEALANT SPECIFICATIONS

1. Locking, sealing and lubricating materials referred to in this manual are the same used in the shop-floor.
2. The table below gives an account of the typical applications of each single material, in order to facilitate replacement with similar products marketed by different brand names with different trade marks.

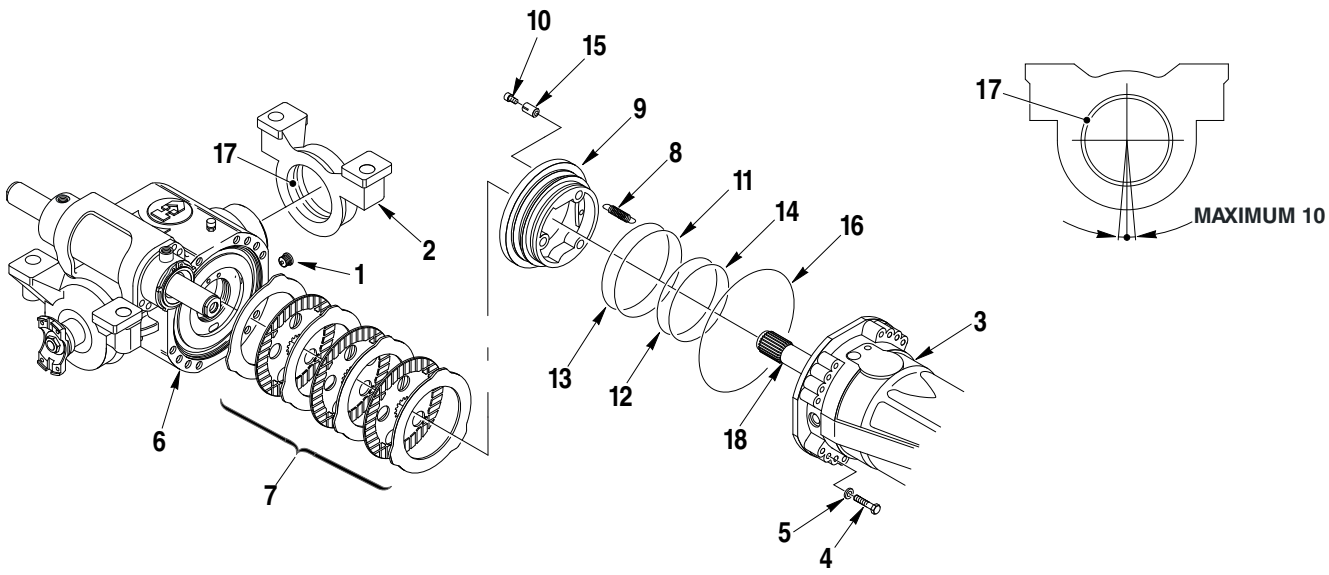
| TYPE | APPLICATION |
|---|---|
| **LOCTITE 242** | Anaerobic product apt to prevent the loosening of screws, nuts and plugs. Used for medium-strength locking. Before using it, completely remove any lubricant by using the specific activator. |
| **LOCTITE 243** | The oleo compatible alternative to 242. Does not require the activation of lubricated surfaces. |
| **LOCTITE 270** | Anaerobic product for very-high strength locking of screws and nuts. Before using it, completely remove any lubricant by using the specific activator. To remove parts, it may be necessary to heat them at 80° C approximately. |
| **LOCTITE 275** | Anaerobic product suitable for high-strength locking and sealing of large threaded parts, bolts and stud bolts, for pipe sealing and for protecting parts against tampering; suitable for sealing coupling surfaces with a maximum diametrical clearance of 0.25 mm. |
| **LOCTITE 510** | Anaerobic product for the hermetic sealing of flanged units and screw holes communicating with fluids. Can seal clearances between flanges up to 0.2 mm. |
| **LOCTITE 577** | Quick anaerobic sealant for sealing threaded portions of conical or cylindrical unions up to M80. Before using it, remove any lubricant with the specific activator. After polymerisation, disassembly may result rather difficult, so heating may be necessary for larger diameters. |
| **LOCTITE 638** | Anaerobic adhesive for fast and high-strength gluing of cylindrical metal joints (hub on shaft). Can glue together parts with clearance ranging between 0.1 and 0.25 mm. |
| **LOCTITE 648** | Anaerobic adhesive for fast and medium-strength gluing of cylindrical metal joints (hub on shaft). Can glue together parts with radial clearance below 0.1 mm. |
| **(AREXONS) Repositionable jointing compound for seals** | Solvent-based sealing compound for elastic seals, drying through evaporation. Used for sealing the outer diameter of sealing rings for rotating shafts with outer metal reinforcement. |
| **CAT RTV Silicone Adhesive Sealant** | Semi-fluid adhesive material used for sealing and filling and to protect components from environmental and physical elements. Polymerises with non-corrosive dampness. |
| **CAT Multi Purpose Grease** | Highly adhesive synthetic grease, with silicone compounds added. Applied to adjustment screws with hole communicating with oil-type fluids. Used when frequent adjusting is required. |
| **CAT Molybdenum Paste** | Lubricating compound containing molybdenum disulphide, used to lubricate articulation pins and to prevent sticking and oxidation of parts that are not lubricated on a regular basis. |
| **CAT White Assembly Grease** | Applied to bearings, sliding parts and used to lubricate seals or parts during assembly. |

## 2.8 SAFETY PRECAUTIONS

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 torque wrenches have been checked and calibrated.
6. During maintenance operations, always wear protective glasses, safety footwear, protective gloves and allP.P.E. (Personal Protective Equipment) in function of the risks which the workers may be exposed to.
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. For agricultural axles, the terms RIGHT and LEFT refer to the position from operator's seat. For construction axle, the terms RIGHT and LEFT refer to the position outside facing the machine (with the input drive facing forward).
12. After repair work has been completed, accurately touch up any coated part that may have been damaged.
13. Follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.
14. Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.

# Section 3
# Braking Discs

## 3.1 EXPLODED VIEW



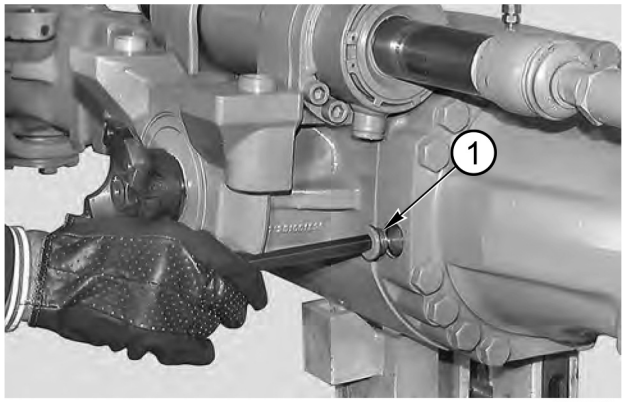
## 3.2 BRAKING DISCS - DISASSEMBLY

**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.

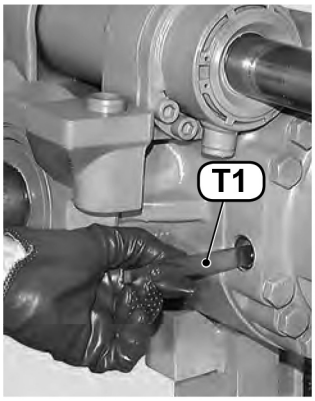
**CAUTION**

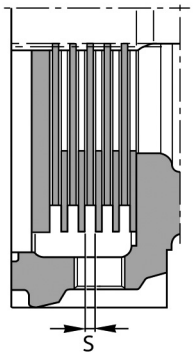
Perform all operations on both arms.




MAP6010

1. Remove the oil-level plug (**1**).



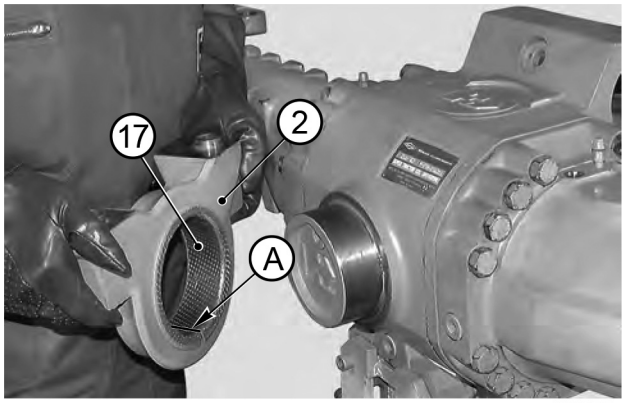




MAP6020

2. Apply the brakes and keeping them under pressure, check the linings "S" between the disks using tool (**T1**). Minimum "S": 4.5 mm.

**CAUTION**

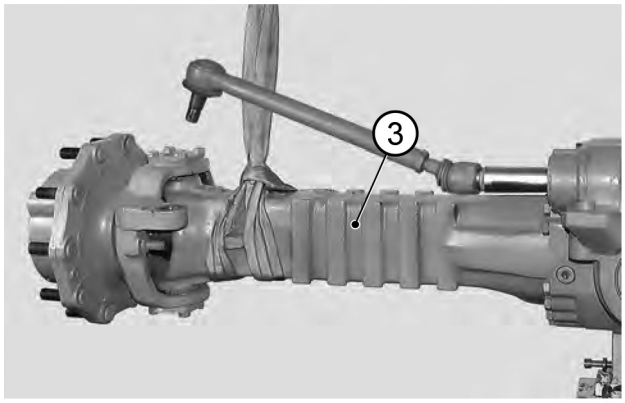
Replace the braking disks and the intermediate disks on both sides if necessary.




MAP6030

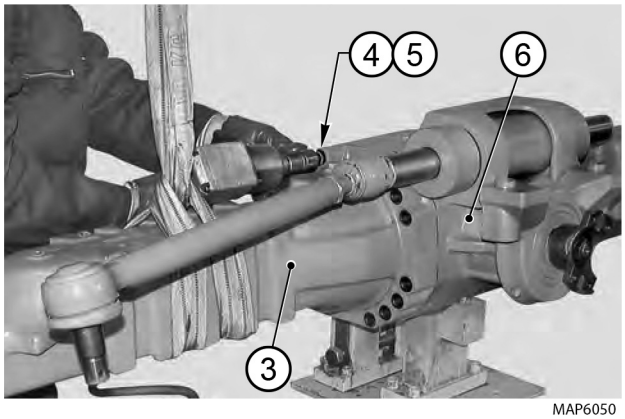
3. Remove the swinging support (**2**) on the side opposite the drive.

***Note:*** *If the bushing (**17**) is worn and needs replacing, write down the assembly side of the connection notch "A".*



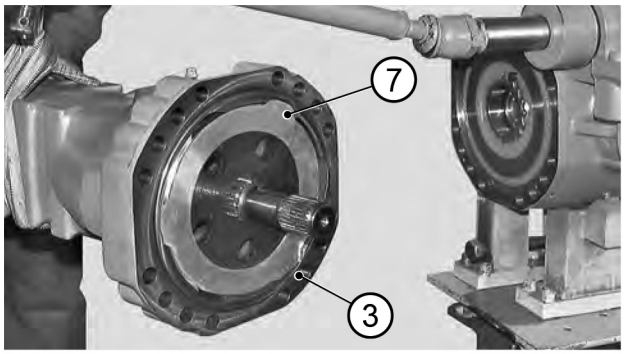

MAP6040

4. Disconnect the pins of the steering bars from the steering case (See Steering Cylinder).
5. Sling the arm (**3**) to be removed and put the rod under slight tension.



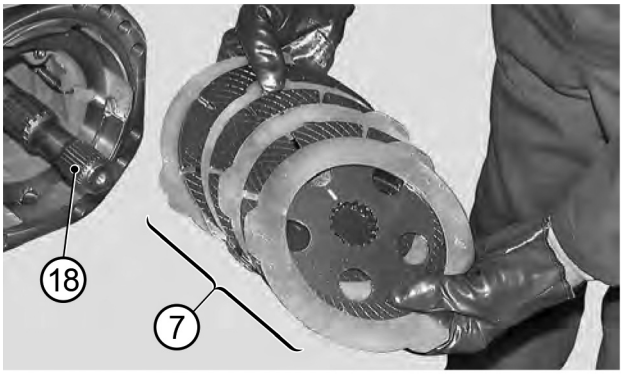

MAP6050

6. Loosen and remove the screws (**4**) and the washers (**5**) that fix the arm (**3**) to the central body (**6**).




MAP6060

7. Remove the arm (**3**) together with the pack of the braking disks (**7**).
8. Place the arm on a bench.

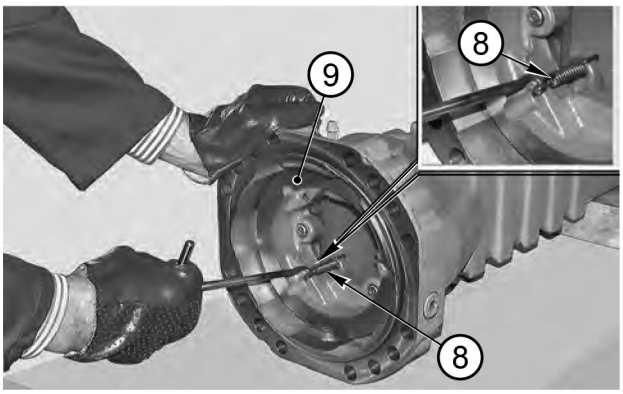



MAP6070

9. Remove the braking disks (**7**) and write down their order of assembly.

***Note:*** *If the disks do not need replacing, avoid switching their position.*

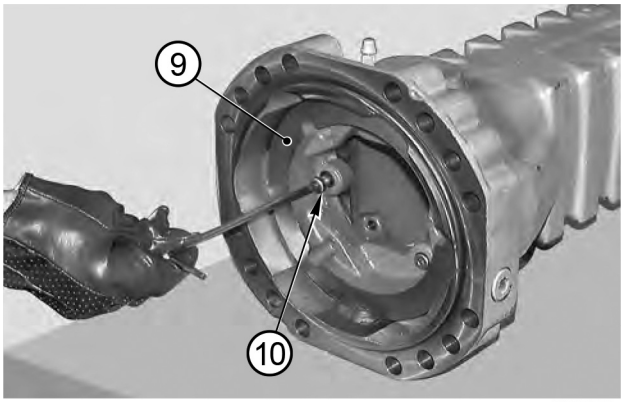
***Note:*** *Extract the u-joint (**18**).*




MAP6080

10. Remove the reversal springs (**8**) from the piston (**9**).

***Note:*** *If the springs (**8**) are weak or deformed they must be replaced.*

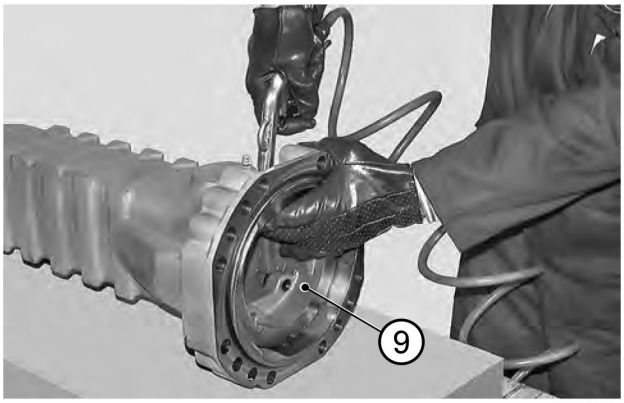


MAP6090

11. Remove the pin screws (**10**) guiding the piston (**9**).

**CAUTION**

If the screws are to be replaced, write down the different colors for the different brake gap.



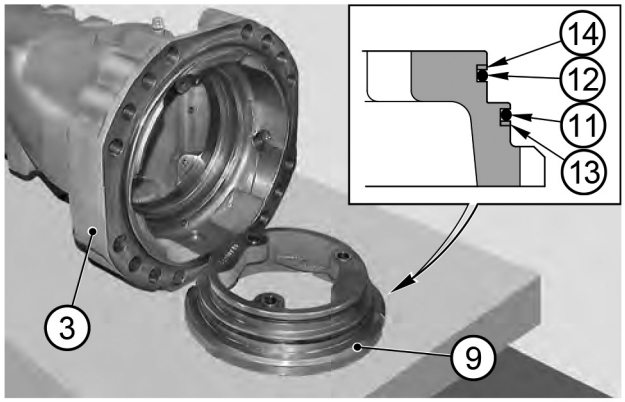
MAP6100

12. Slowly introduce compressed air through the connection of the braking circuit in order to extract the entire piston.

**CAUTION**

Hold on to the piston as it may be suddenly ejected and damaged.

## 3.3 BRAKING DISCS - ASSEMBLY

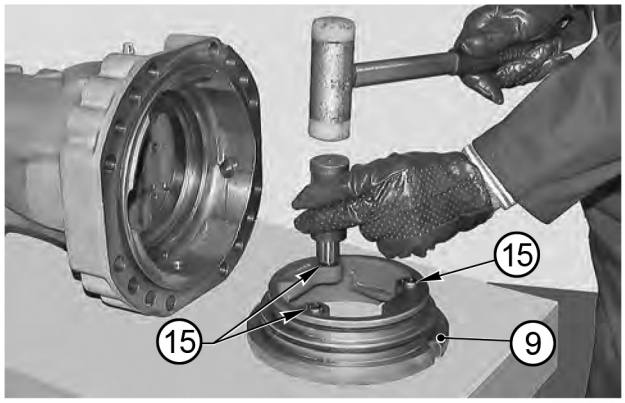


MAP6110

13. Accurately clean the piston (**9**) and the seats of slide and seal.
14. Replace the o-rings (**11**) and (**12**) and the anti-extrusion rings (**13**) and (**14**); make sure that the assembly side is correct.

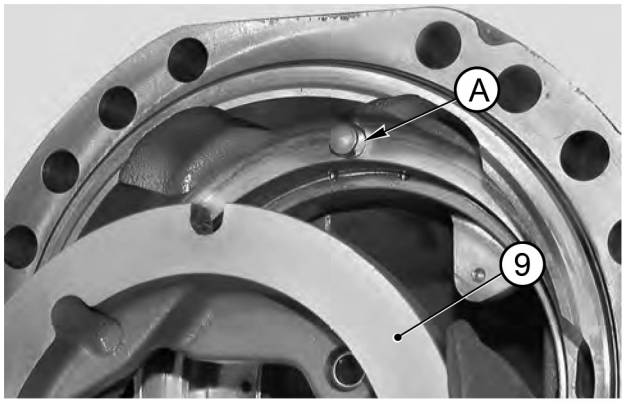
**CAUTION**

Accurately check the positioning of the anti-extrusion rings (**13**) and (**14**).



MAP6120

15. Insert the stroke automatic regulation springs (**15**); place them in line with the piston (**9**).

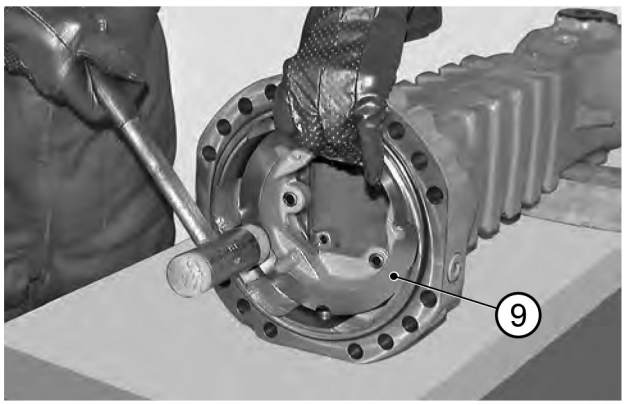


MAP6130

16. Lubricate the seals (**11**) and (**12**) and fit the piston (**9**) into the arm (**3**).

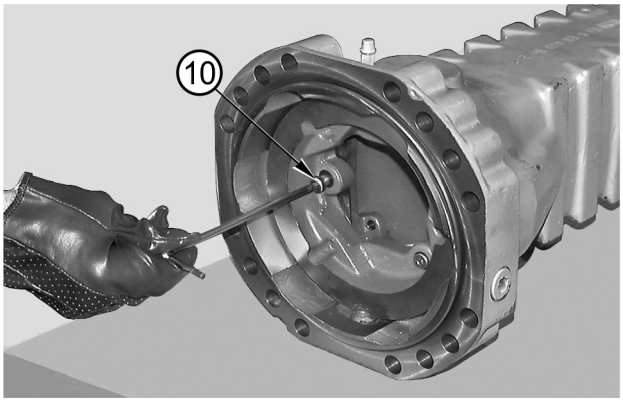
**⚠ CAUTION**

Make sure that the piston seat fits into the stop pin (**A**) inside the arm.



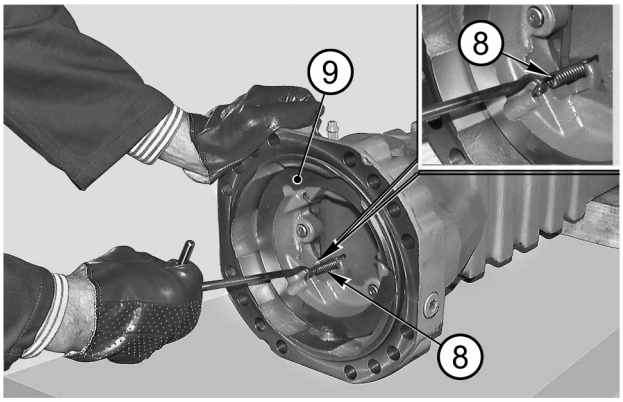
MAP6140

17. Assist the insertion of the piston (**9**) by lightly hammering around the edge with a plastic hammer.



MAP6150

18. Fit the pin screws (**10**) making sure that they are all of the same color.
19. See Service Part List “Brake” section for bolt color detail.
20. Apply Loctite 270 to the thread.
21. Torque wrench setting: 5 - 7 Nm (4 - 5 ft.lb.)

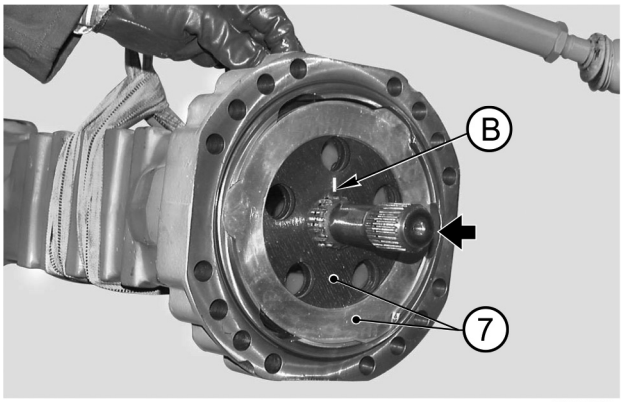


MAP6160

22. Fit the reversal springs (**8**) on the piston (**9**).

**⚠ CAUTION**

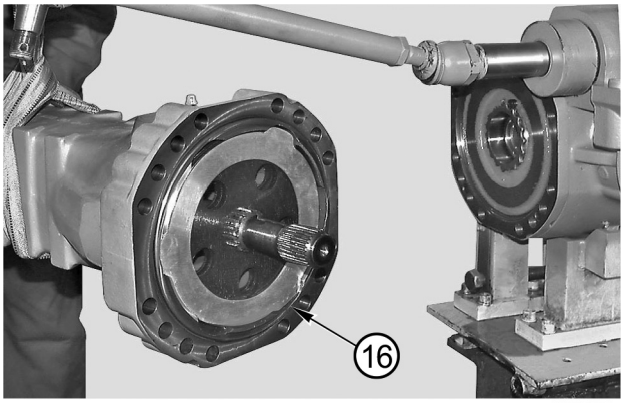
Pay attention not to deform the connections of the springs.




MAP6170

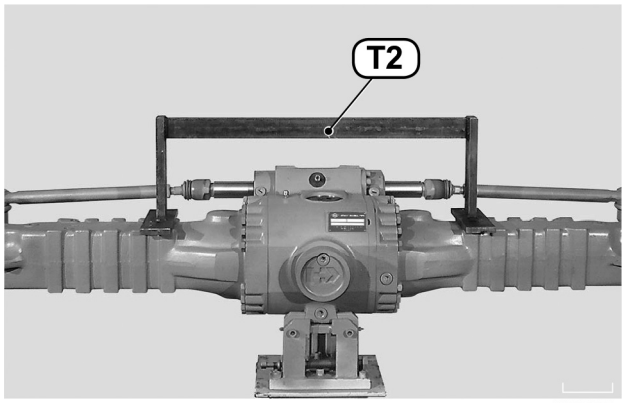
23. Slightly lubricate the braking disks (**7**) and fit them in the arm following the correct sequence; orient them so that the oil circulation holes and the marks “B” are perfectly lined up.

***Note:*** *When installing the steel discs, the slot corresponding to the oil level cap should always be kept free.*




MAP6180

24. Check that the positioning of the sealing ring (**16**) on the arm is intact; install the complete arm.
25. Lock it into position using two screws (**4**) and washers (**5**).

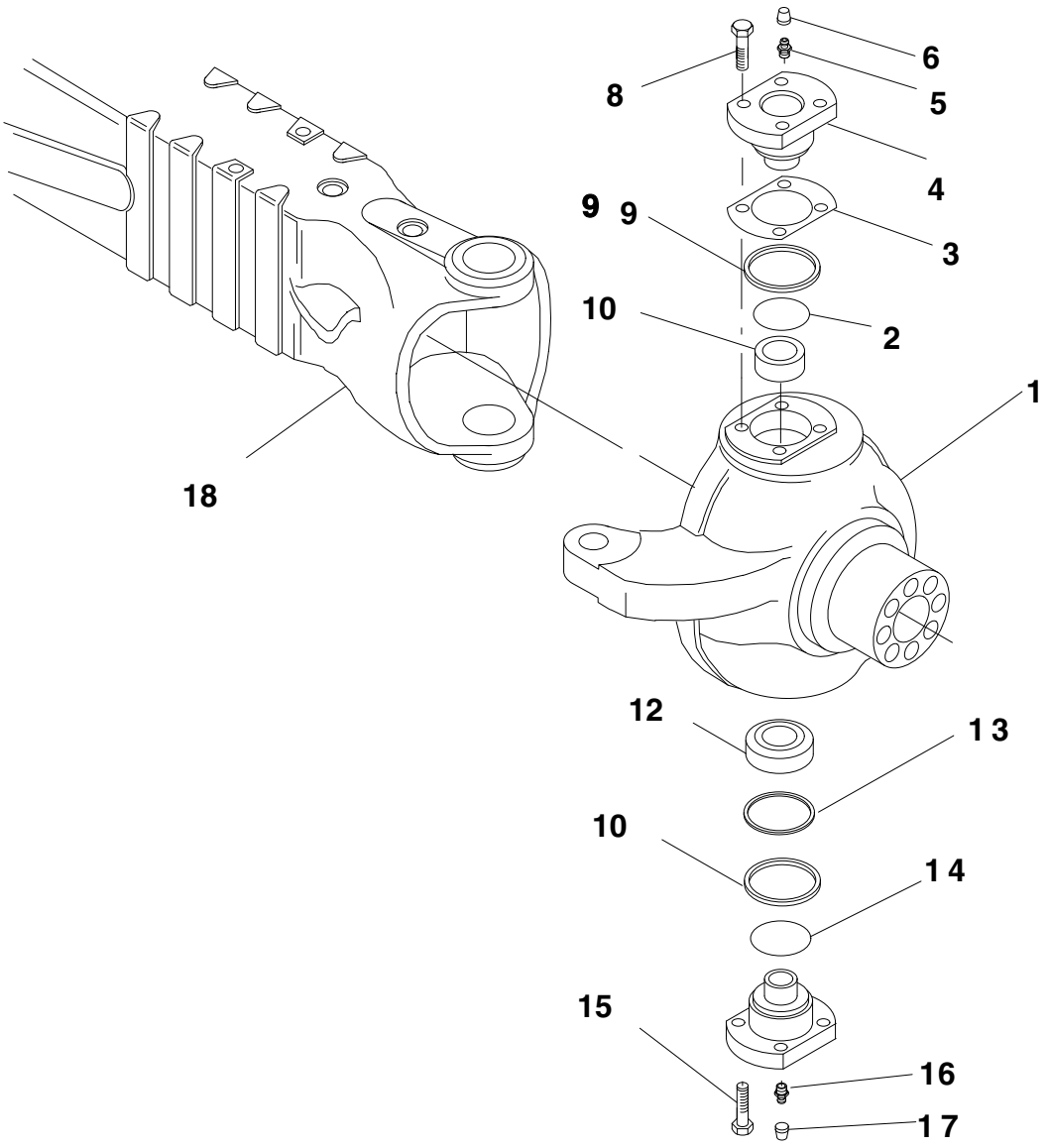



MAP6190

26. Check the flatness of the arms using tool (**T2**) and finally lock the arms with the screws (**4**) and the washer (**5**) using the criss-cross method.
27. Torque wrench setting: 298 Nm (220 ft.lb.)

# Section 4
# Complete Steering Case

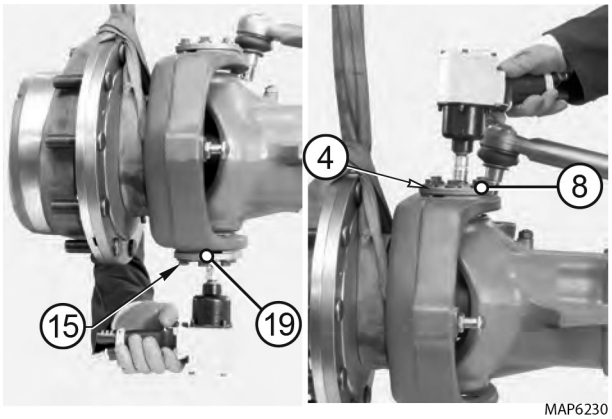
## 4.1 EXPLODED VIEW



## 4.2 COMPLETE STEERING CASE - DISASSEMBLY

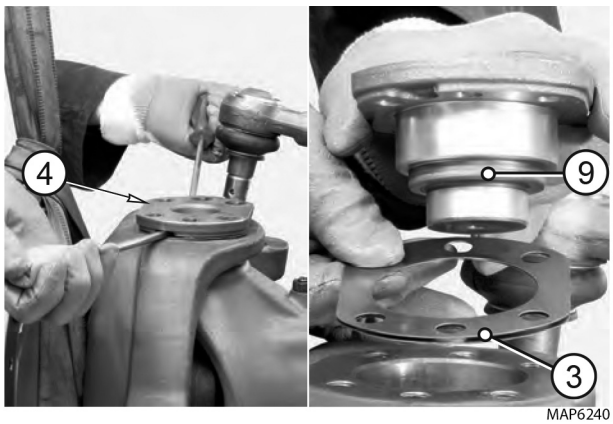
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP6230

1. Loosen and remove the capscrews (**15**) and (**8**) from the articulation pin (**19**) and (**4**).

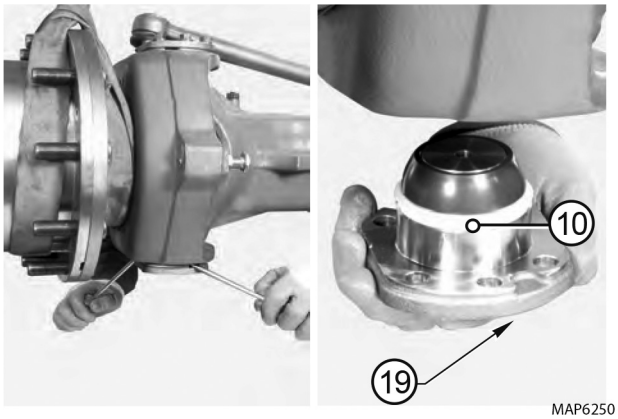



MAP6240

2. Using two levers, remove the top articulation pin (**4**) complete with front seal (**9**) and shims (**3**).

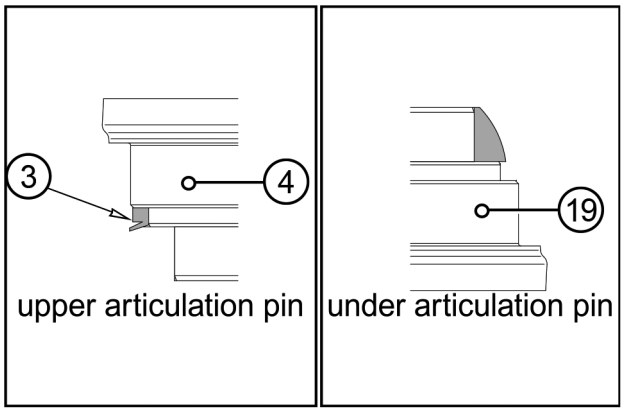
**CAUTION**

Pay attention not to damage the surfaces.

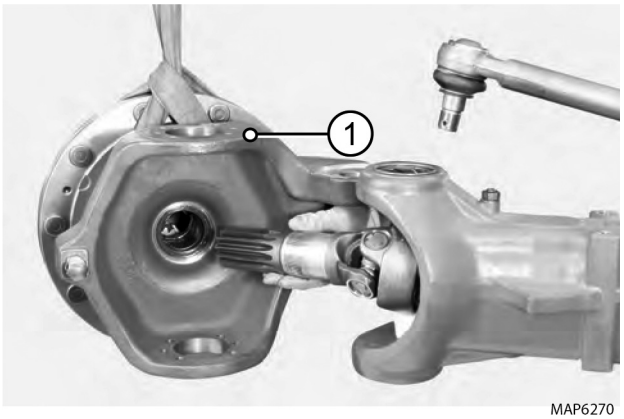



MAP6250

3. Remove the bottom articulation (**19**) pin complete with front sealing ring (**10**).



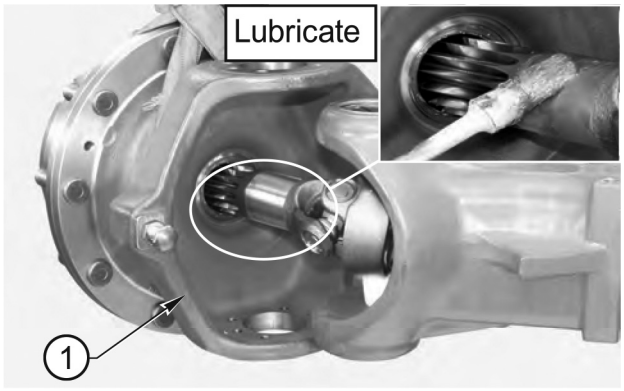

MAP6260




MAP6270

4. Remove the complete steering case (**1**).

## 4.3 COMPLETE STEERING CASE - ASSEMBLY

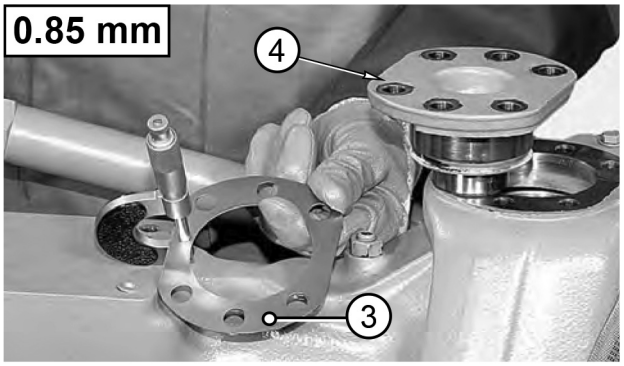



MAP6280

5. Lubricate the terminal of the u-joint and install the steering case (**1**).

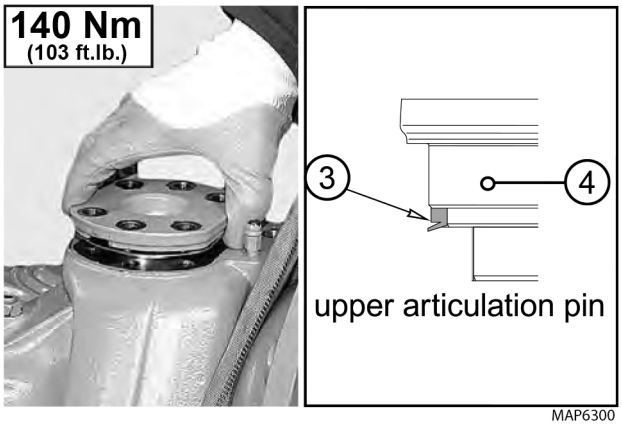
**⚠ CAUTION**

Pay due attention not to damage the dust cover rings and the sealing rings.




MAP6290

6. Prepare a series of shims (**3**) of 0.85 mm. To be assembled under the upper pin (**4**).

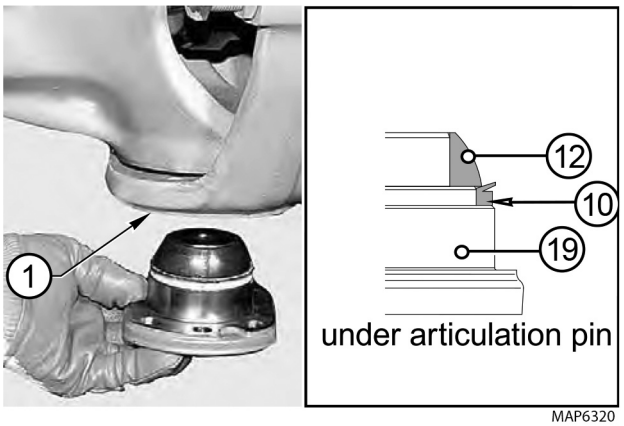



MAP6300

7. Fit a new seal (**3**) onto the top articulation pin (**4**). Lubricate and install the unit in the steering case.
8. Position the screws (**8**) and tighten with torque wrench 140 Nm (103 ft.lb.)
9. Check the correct assembly side of the seal (**3**).

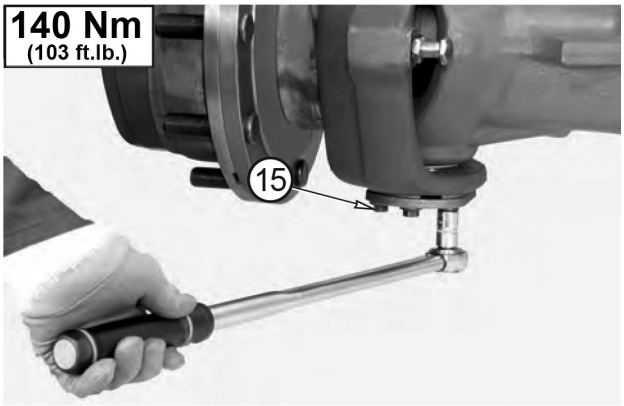
MAP6310

10. Lubricate steering case.




MAP6320

11. Fit the unit (**19**) in the steering case (**1**). Position the screws (**15**) and tighten.
12. Check for the correct assembly side of the seal (**10**).

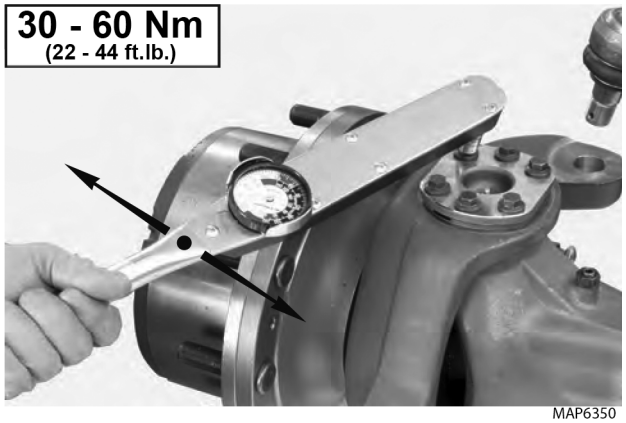



MAP6330

13. Tighten the new capscrews (**15**) of top and bottom articulation pins in sequence using the criss-cross method.
14. Torque wrench setting: 140 Nm (103 ft.lb.)

MAP6340

15. Check with a lever that there is no vertical gap. In case there is any gap, determine the width and reduce it by removing shims.

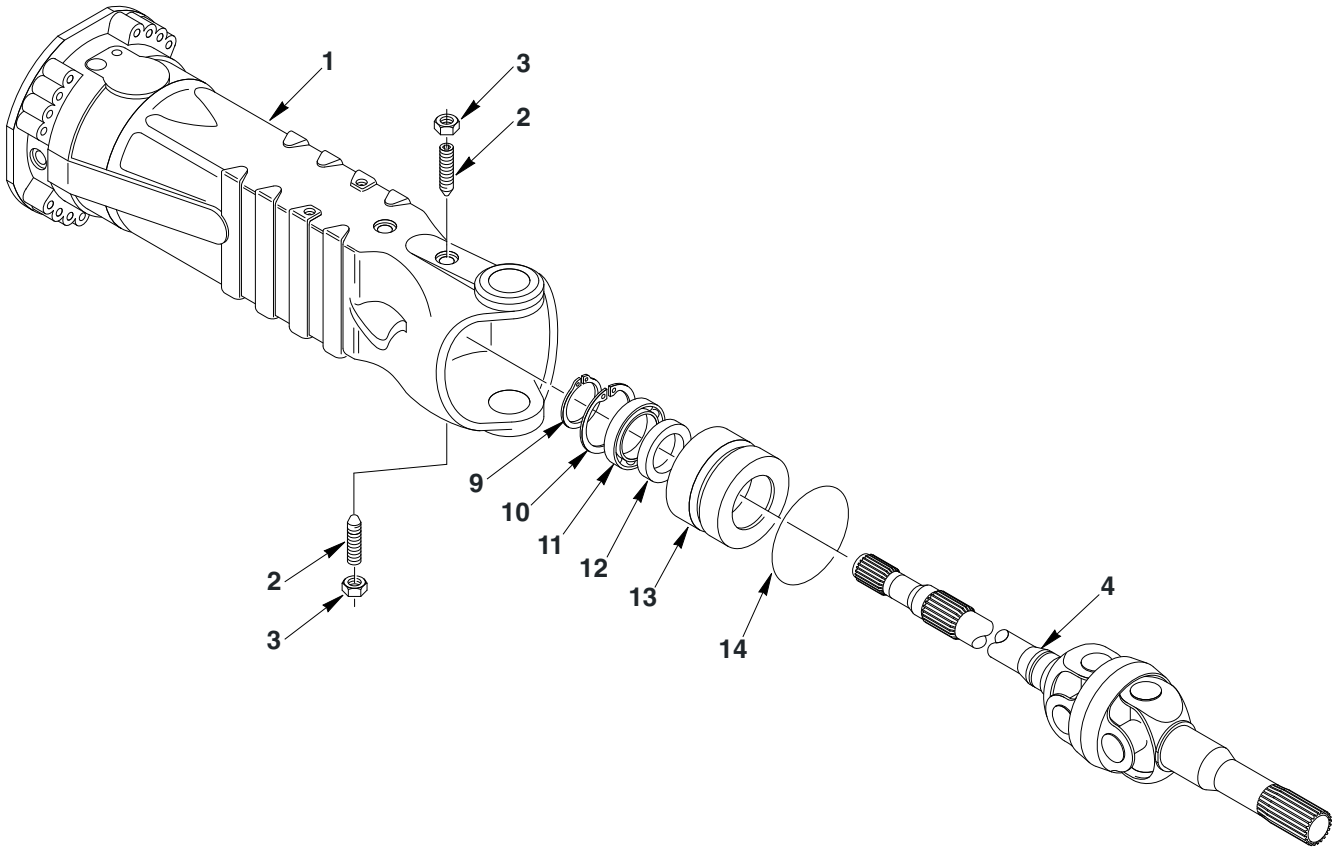



MAP6350

16. Check the torque of the pins, which has to be between 30 - 60 Nm (22 - 44 ft.lb.)
17. If the preliminary measured value is too high, the shims have to be increased.

# Section 5
# Double U-joint

## 5.1 EXPLODED VIEW

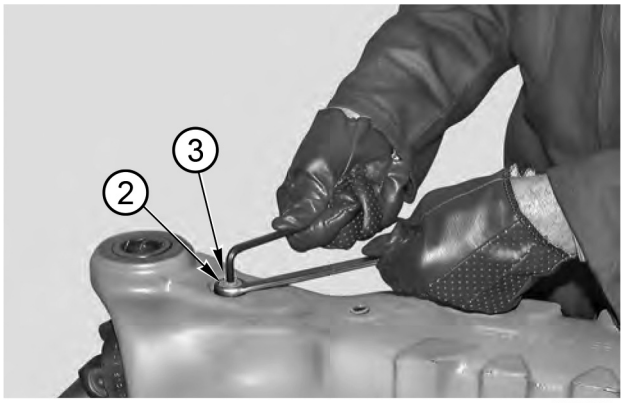



MAP6360

## 5.2 DOUBLE U-JOINT - DISASSEMBLY

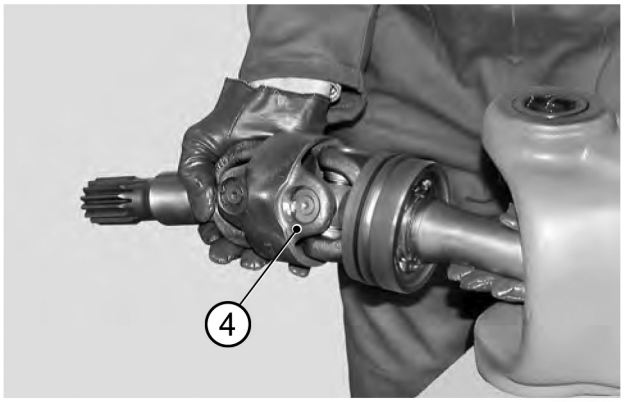
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP6370

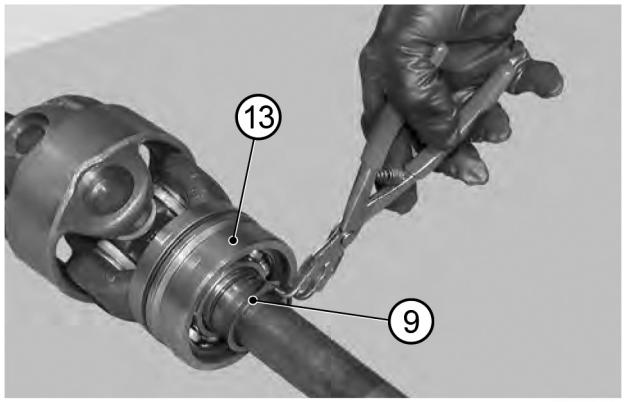
1. Loosen and remove the top and bottom check nuts (**2**) from the studs (**3**).




MAP6380

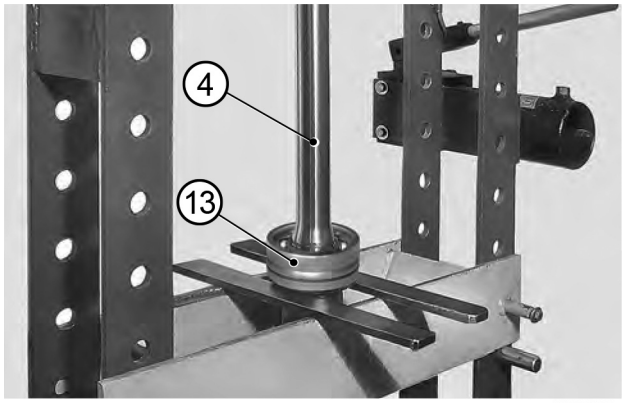
2. Remove the entire u-joint (**4**).

***Note:*** *If necessary, for the extraction of the double U-joint use a plastic mallet or a lever.*



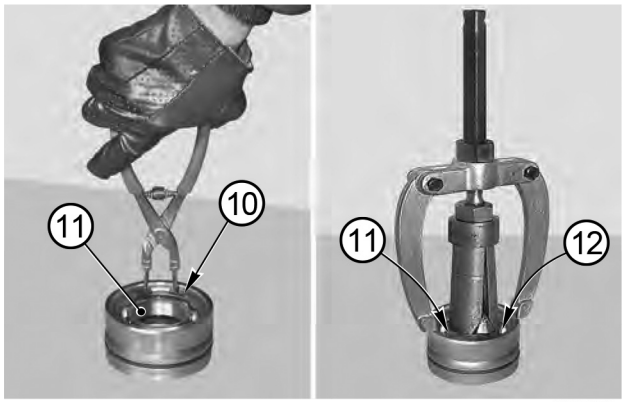

MAP6390

3. Remove the snap ring (**9**) from the bushing unit (**13**).




MAP6400

4. Position the entire u-joint (**4**) under a press and remove the complete bushing (**13**).

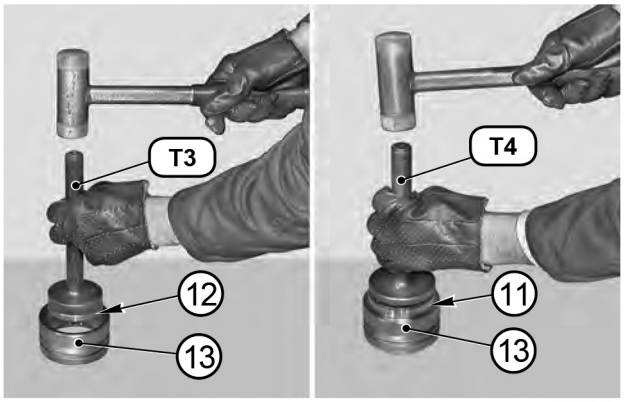


MAP6410

5. Remove the snap ring (**10**) from the bearing (**11**).
6. Use a puller to remove the bearing (**11**), the sealing ring (**12**) and the o-ring (**14**).

***Note:*** *Write the assembly side of the ring (**12**).*

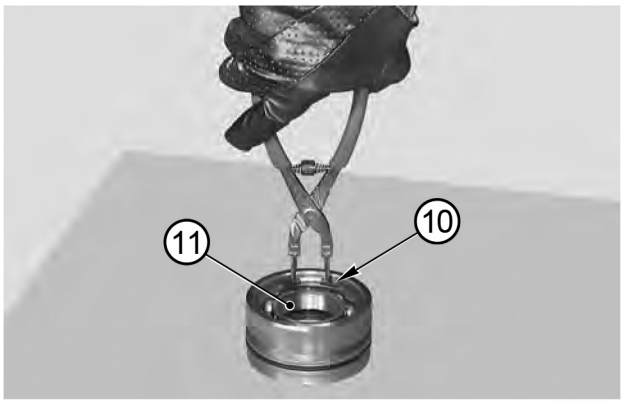
## 5.3 DOUBLE U-JOINT - ASSEMBLY



MAP6420

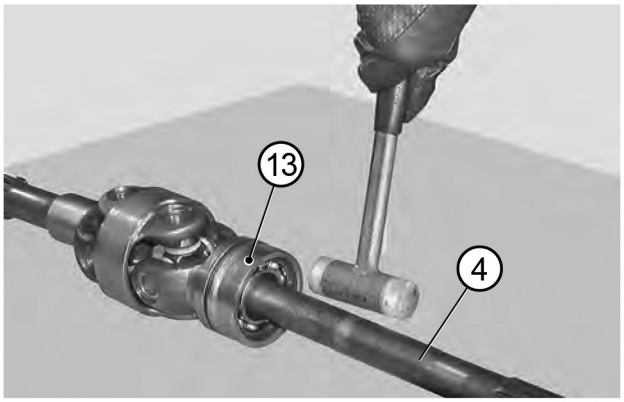
7. Using tools (**T3**) and (**T4**) insert the sealing ring (**12**) and the bearing (**11**) in the bushing (**13**).

***Note:*** *Carefully check the assembly side of the seal (**12**).*



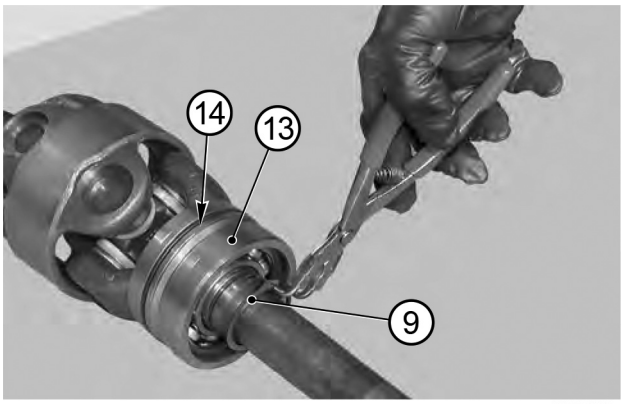
MAP6430

8. Fit the snap ring (**10**) on the bearing (**11**).



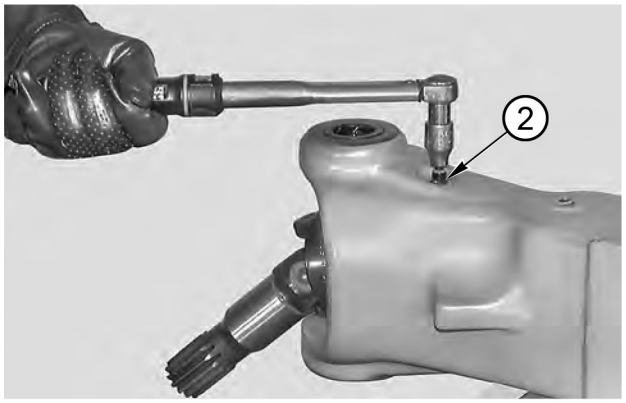

MAP6440

9. Heat the bearing in oil at an approximate temperature of 100°C and fit the entire bushing (**13**) on the u-joint (**4**).




MAP6450

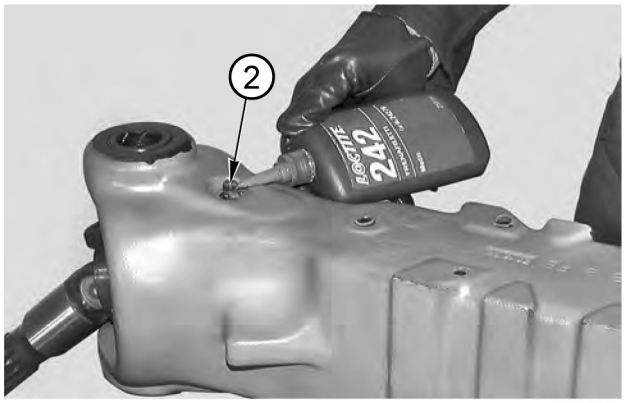
10. Fit the check ring (**9**) on the bushing unit (**13**); also put the o-ring (**14**) into position.




MAP6460

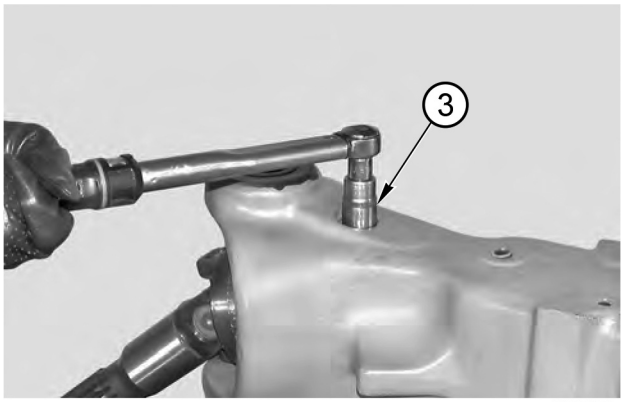
11. Insert the u-joint and tighten the top and bottom studs (**2**).
    Torque wrench setting: maximum 15 Nm (11 ft.lb.)

***Note:*** *For u-joint coming with a bushing, center the point of the check studs in the slot.*




MAP6470

12. Apply Loctite 242 to the jutting parts of the studs (**2**).




MAP6480

13. Install the nuts (**3**) on the studs (**2**) and tighten them using a torque wrench.
    Torque wrench setting: 122 Nm (90 ft.lb.)

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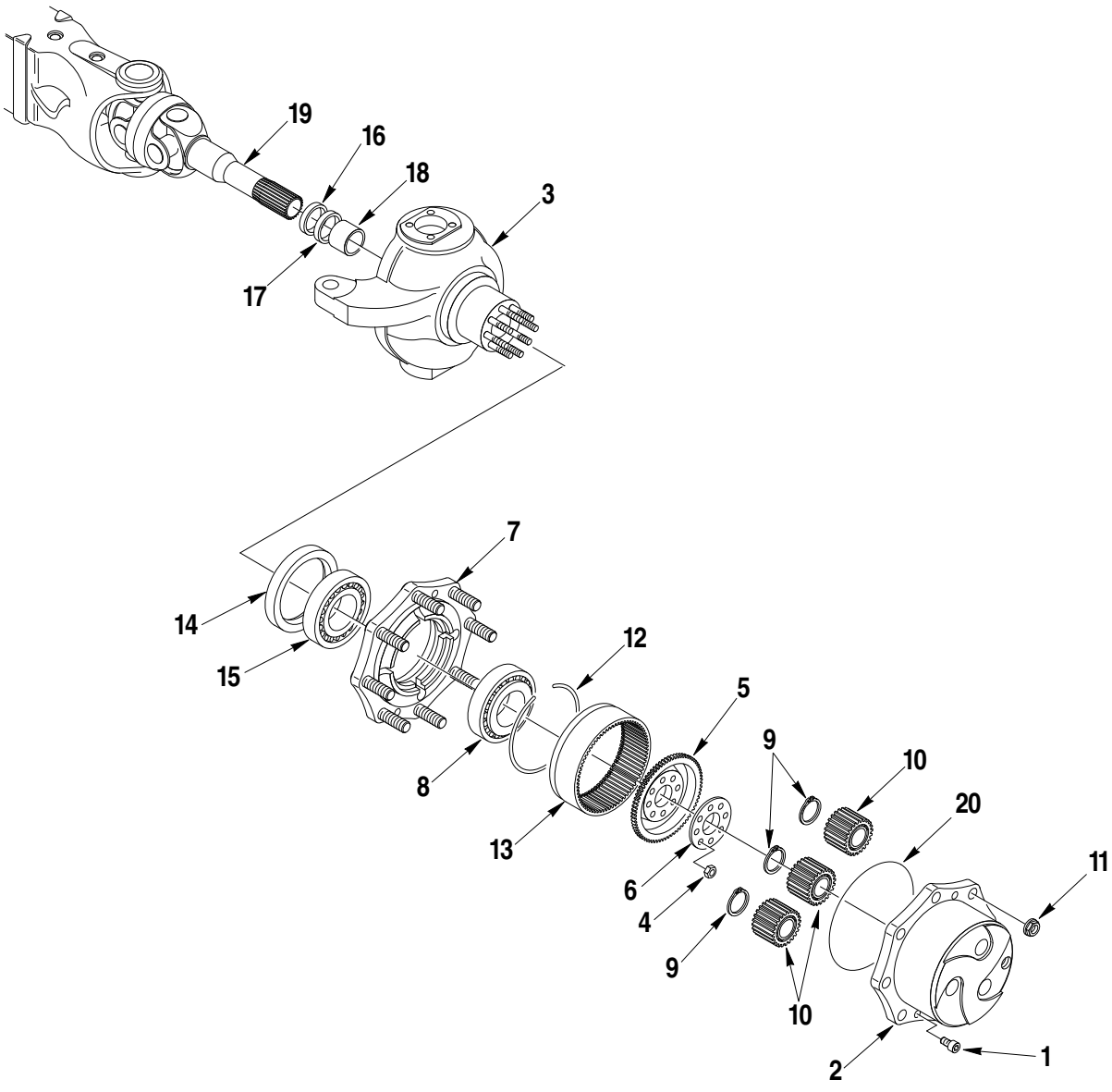
# Section 6
# Planetary Reduction Gear

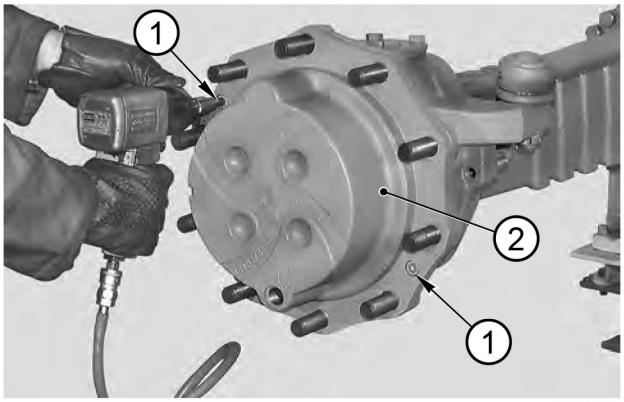
## 6.1 EXPLODED VIEW



## 6.2 PLANETARY REDUCTION GEAR - DISASSEMBLY

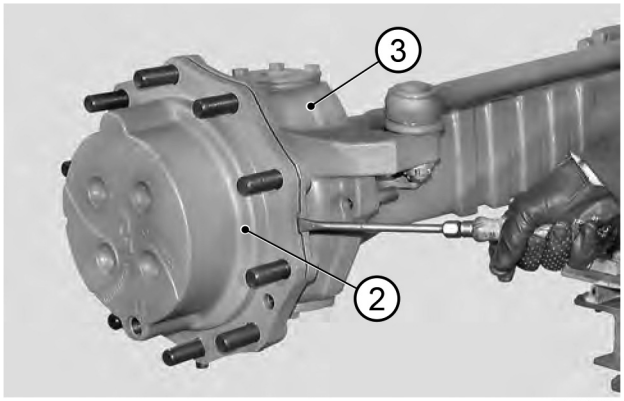
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



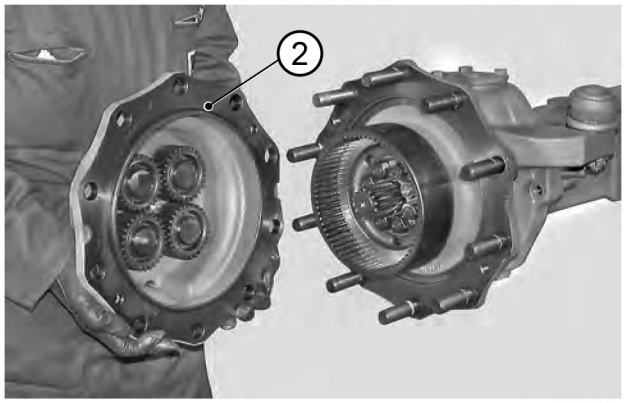

MAP6520

1. Disconnect the steering bars from the steering case (**3**). For details, see Complete Steering Case.
2. Remove the securing screws (**1**) from the planetary carrier cover (**2**).




MAP6530

3. Disjoint the planetary carrier cover (**2**) from the steering case (**3**) by alternatively forcing a screwdriver into the appropriate slots.

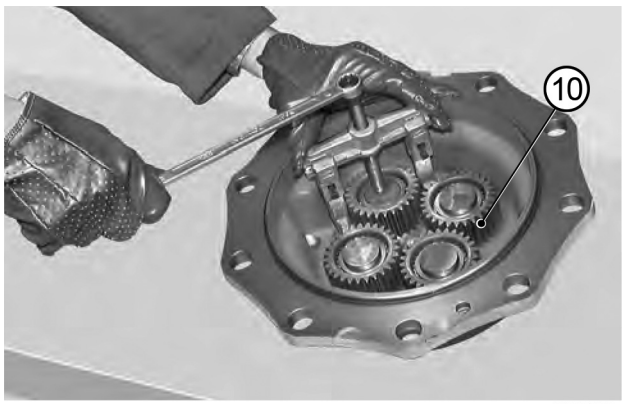



MAP6540

4. Remove the complete planetary carrier cover (**2**).


MAP6550

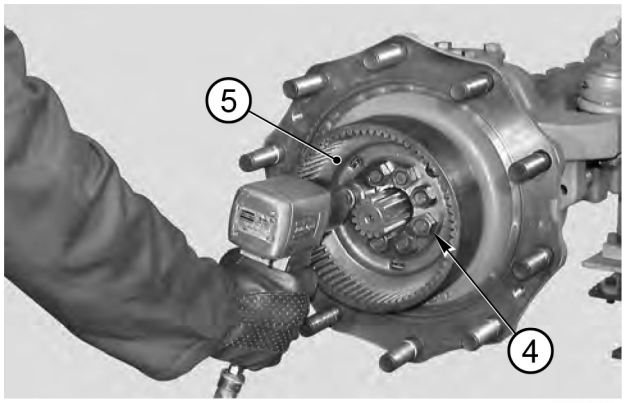
5. Remove the snap rings (**9**).




MAP6560

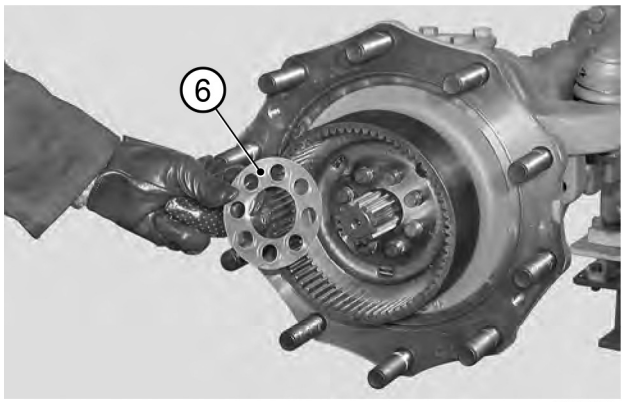
6. With the help of a puller, remove the planetary wheel gears (**10**).

***Note:*** *Write down the assembly side of planetary wheels.*



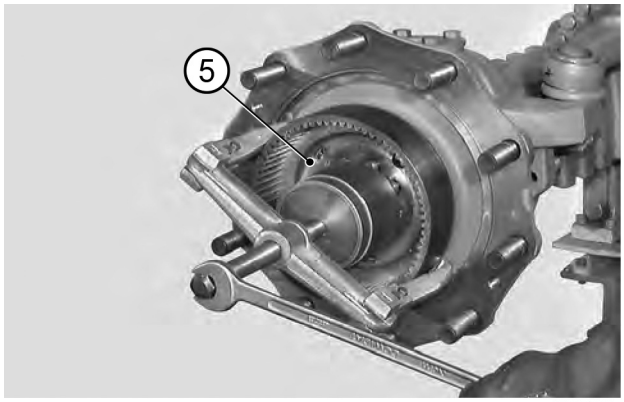

MAP6570

7. Loosen and remove the tightening nuts (**4**) from the crown flange (**5**).



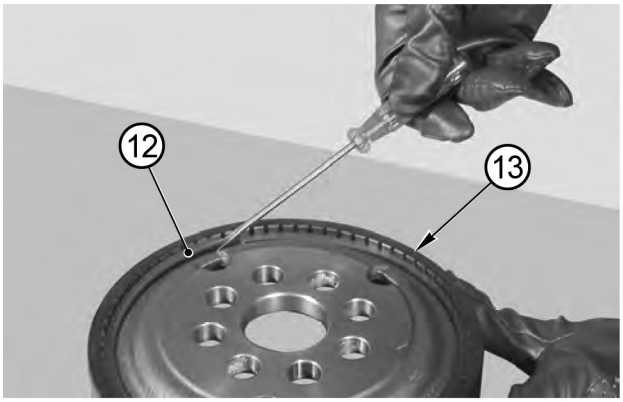

MAP6580

8. Remove the safety flange (**6**).



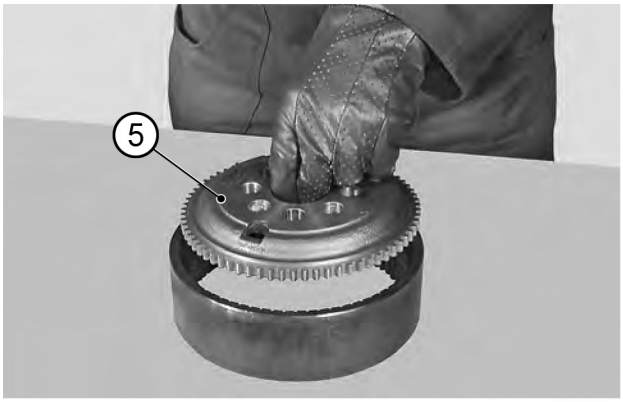

MAP6590

9. Using a puller, remove the complete crown flange (**5**) by acting on the stud bolts.



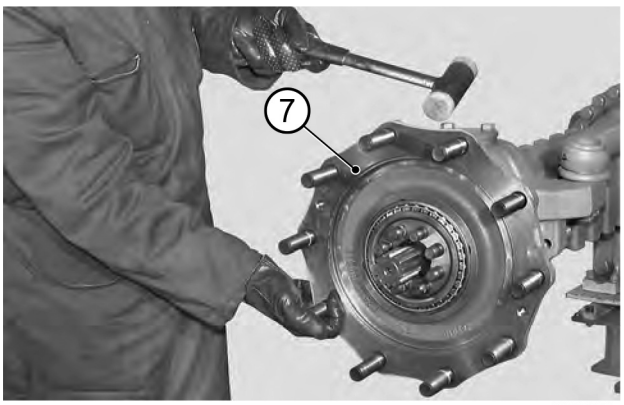

MAP6600

10. Remove the snap ring (**12**) from the crown (**13**).




MAP6610

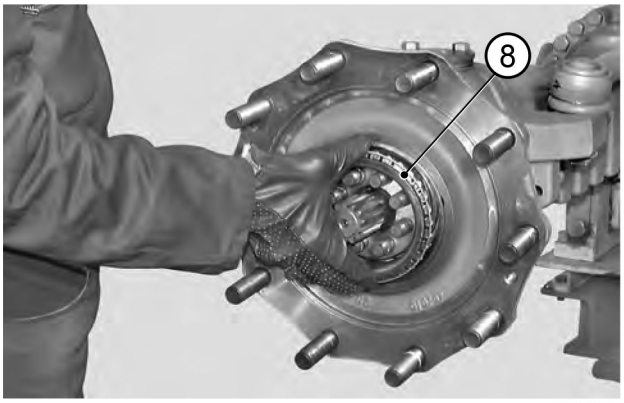
11. Remove the crown flange (**5**).




MAP6620

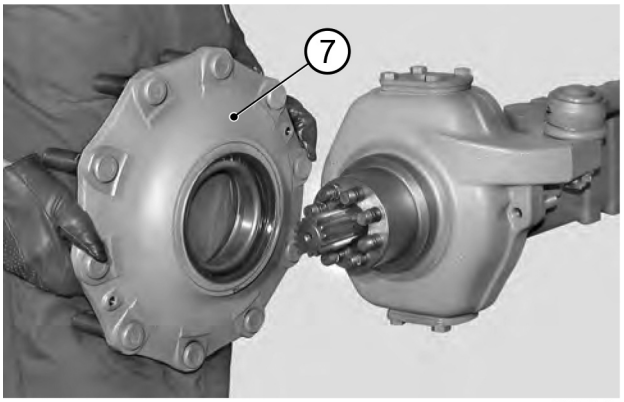
12. Partially extract the hub (**7**) using a plastic hammer.

***Note:*** *Alternately hammer on several equidistant points.*



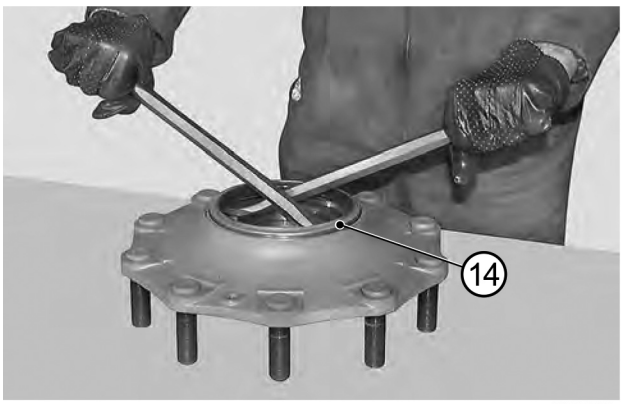

MAP6630

13. Remove the external bearing (**8**).



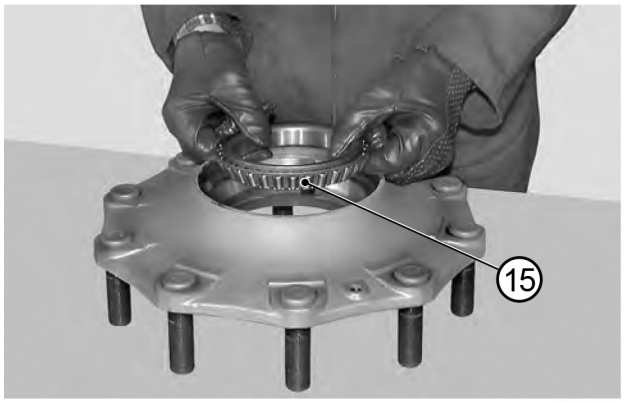

MAP6640

14. Remove the complete hub (**7**).




MAP6650

15. Remove the sealing ring from the hub (**14**).



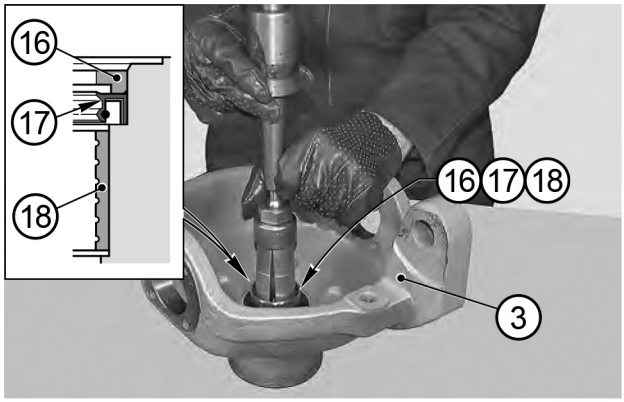

MAP6660

16. Remove the internal bearing (**15**).


MAP6670

17. Remove the external thrust blocks from the bearings (**8**) and (**15**) force a pin-driver into the appropriate slots on the hub (**7**).

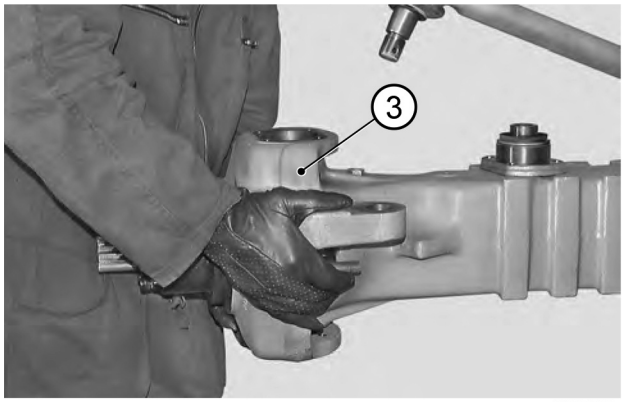
***Note:*** *Hammer in an alternate way so as to avoid clamping or deformation of the thrust blocks.*




MAP6680

18. Use a puller to remove the centering ring (**16**), the sealing ring (**17**) and the bearing (**18**) from the steering case (**3**).

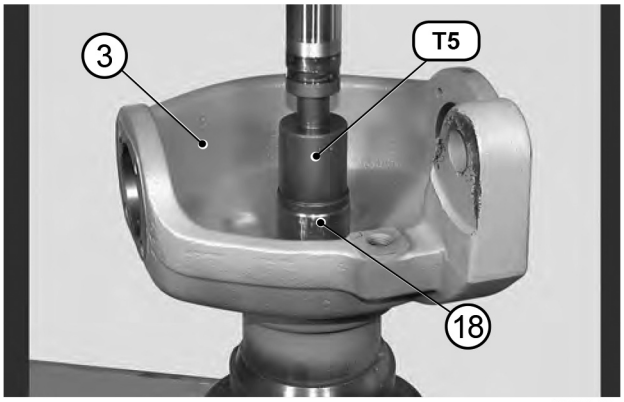
***Note:*** *Write down the orientation of both centering ring (**16**) and sealing ring (**17**).*




MAP6690

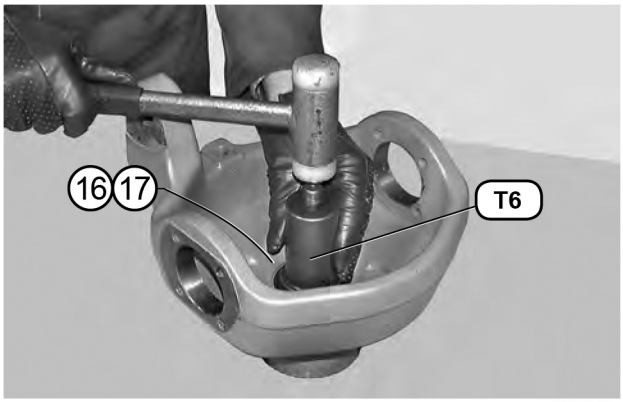
19. Remove the pins and remove the steering case (**3**). For details, see Complete Steering Case.

## 6.3 PLANETARY REDUCTION GEAR - ASSEMBLY



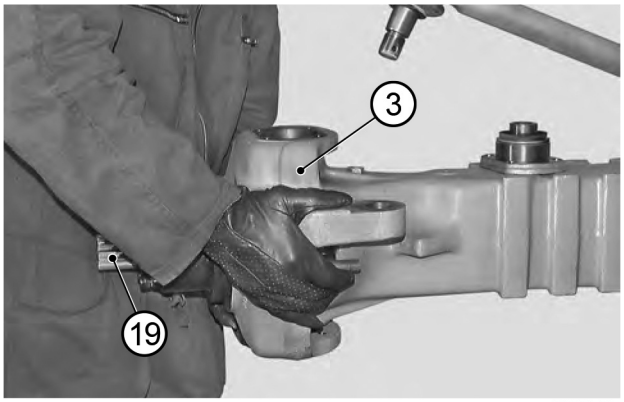

MAP6700

20. Lubricate the bushing (**18**) and the seat of the steering case (**3**).
21. Install the bushing (**18**), using tool (**T5**).



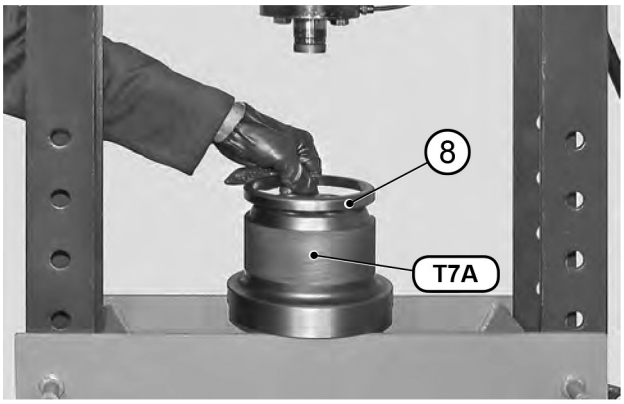

MAP6710

22. Lubricate the outer surface of the sealing ring (**17**) and centering ring (**16**); fit them into their seat using tool (**T6**).



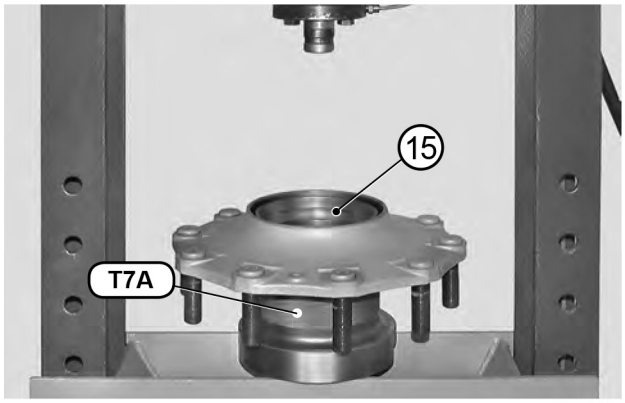

MAP6720

23. Fit the steering case (**3**) onto the U-joint (**19**) and install the articulation pins. For pin assembly details, see Complete Steering Case.




MAP6730

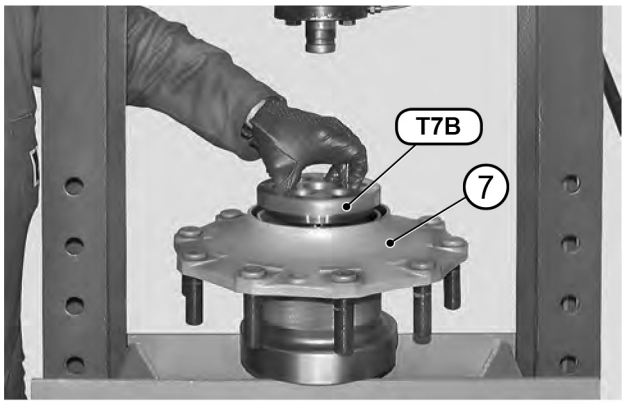
24. Position the lower part of tool (**T7A**) and the thrust block of the external bearing (**8**) under the press.




MAP6740

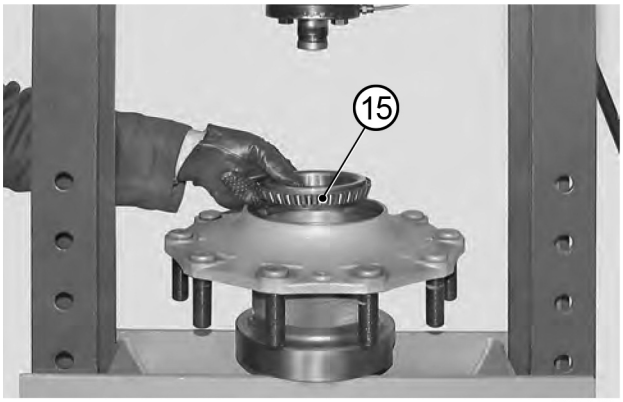
25. Lubricate the seats of the bearings and position the hub (**7**) on tool (**T7A**); position the thrust block of the internal bearing (**15**).

***Note:*** *Check that the thrust block is correctly oriented.*



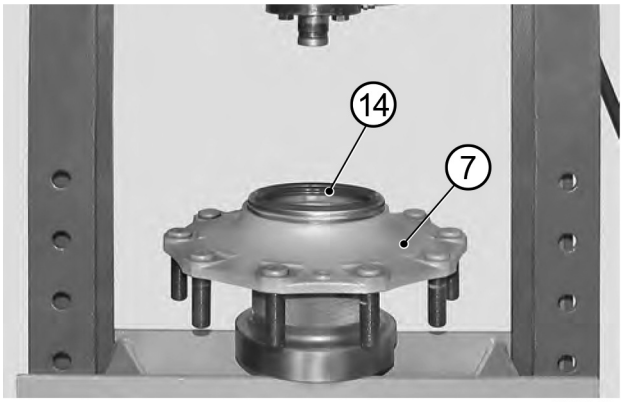

MAP6750

26. Position the upper part of tool (**T7B**) and press the thrust blocks into the hub (**7**) all the way down.




MAP6760

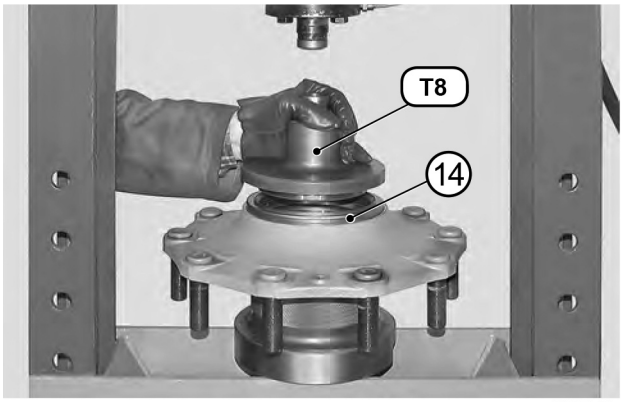
27. Fit the bearing (**15**) into the internal thrust block.




MAP6770

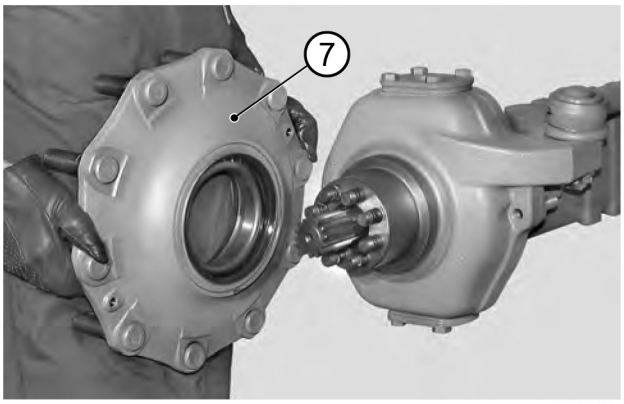
28. Apply a repositionable jointing compound for seals to the outer surface of the sealing ring (**14**). Position the sealing ring (**14**) in the hub (**7**).

***Note:*** *Check that the ring (**14**) is correctly oriented.*



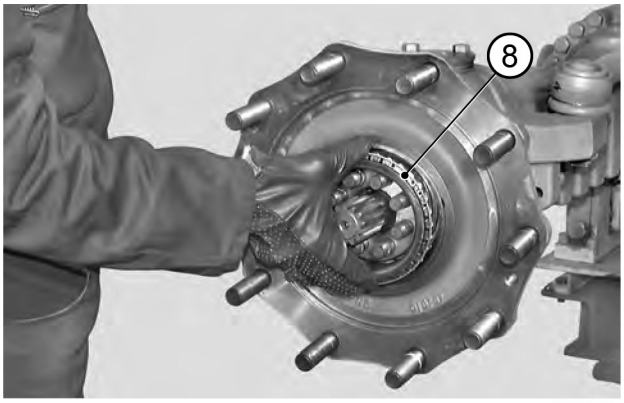

MAP6780

29. Position tool (**T8**) and press the sealing ring (**14**) into its seat.




MAP6790

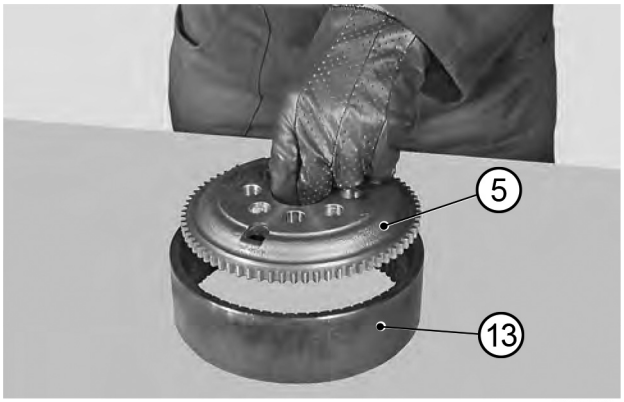
30. Install the hub (**7**).




MAP6800

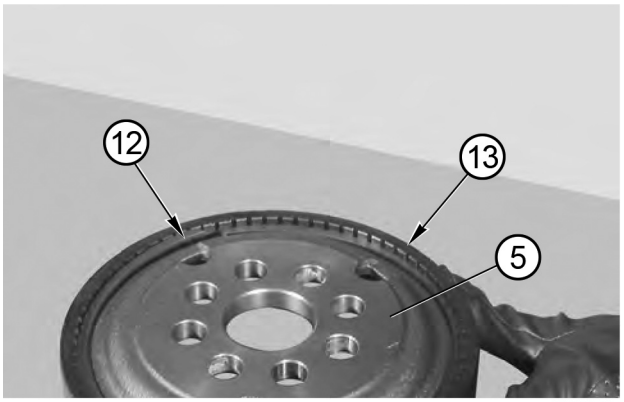
31. Install the external bearing (**8**).

***Note:*** *Using a plastic hammer, drive the bearing to the limit stop by lightly hammering around the edge.*




MAP6810

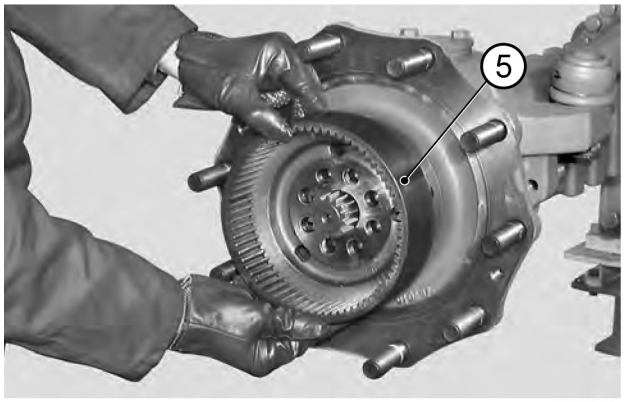
32. Insert the flange (**5**) in the crown (**13**).




MAP6820

33. Insert the snap ring (**12**) in order to fix the flange (**5**) in the crown (**13**).

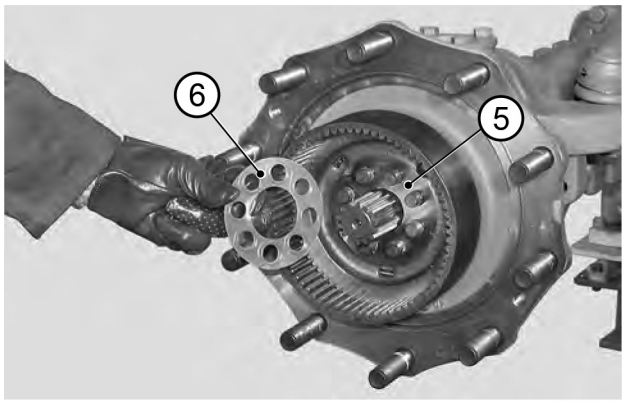
***Note:*** *Carefully check that ring (**12**) is properly inserted in the slot of the crown (**13**)*




MAP6830

34. Fit the complete crown flange (**5**).

***Note:*** *In order to fasten the flange (**5**), use a plastic hammer and alternately hammer on several equidistant points.*

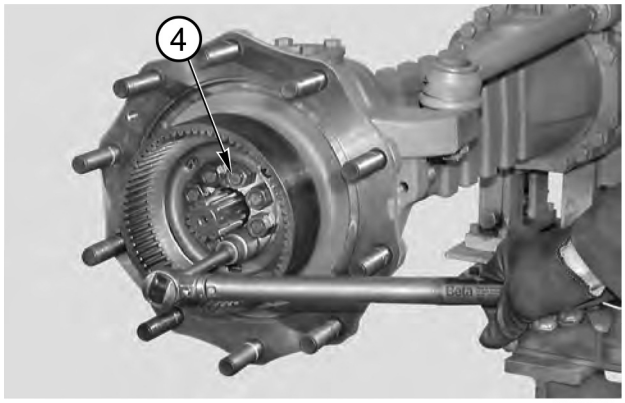



MAP6840

35. Apply Tecnolube Seal 101 grease to the surface of the safety flange (**6**) which touches the crown flange (**5**). Fit the safety flange (**6**).

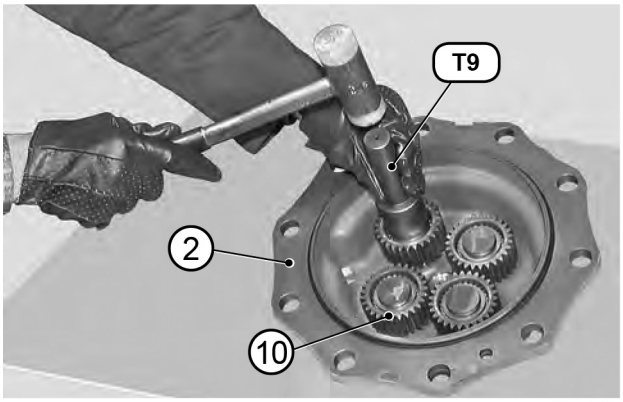

MAP6850

36. Apply Loctite 242 to the studs and fit on the nuts (**4**).



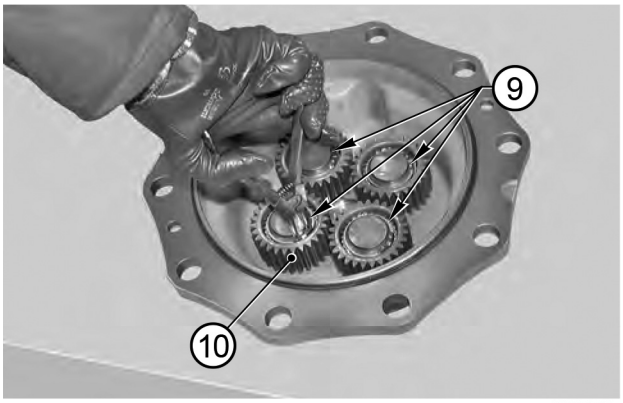

MAP6860

37. Tighten the nuts (**4**) using criss-cross method in two stages.
38. Initial torque wrench setting: 120 Nm (89 ft.lb.)
    Final torque wrench setting:
    255 - 285 Nm (188 - 210 ft.lb.)



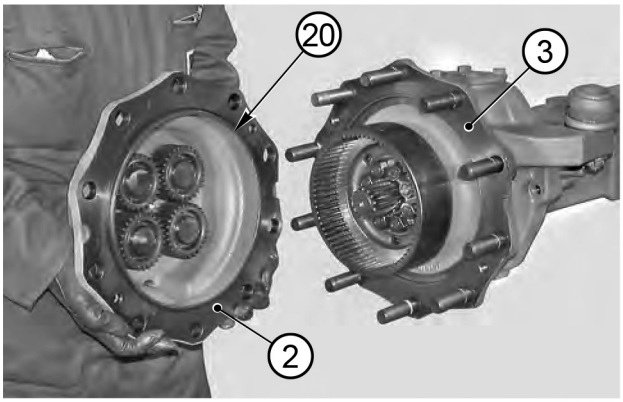

MAP6870

39. With the help of tool (**T9**) insert the planetary wheel gears (**10**) into the cover (**2**). Accurately check the orientation.




MAP6880

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

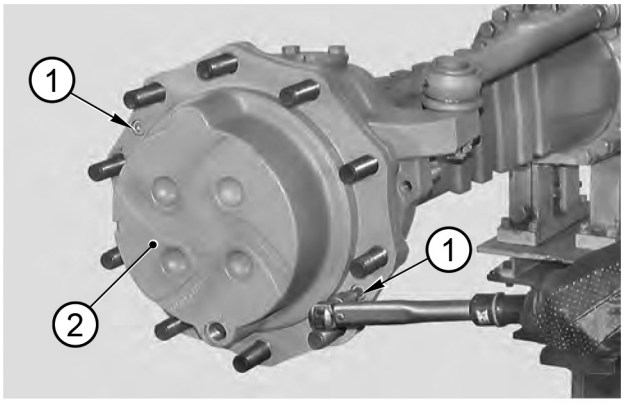



MAP6890

41. Fit the planetary carrier cover (**2**) onto the hub (**3**).

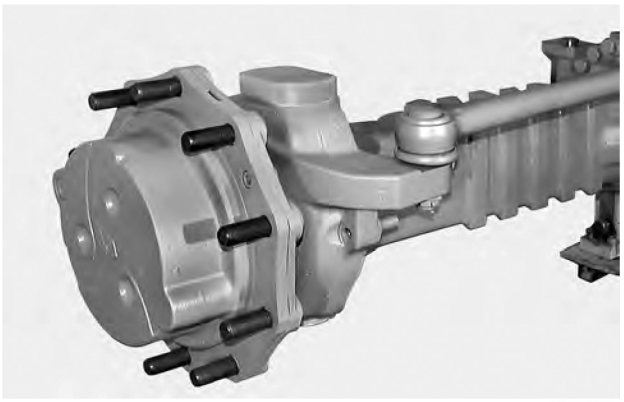
**CAUTION**

Check that the o-ring (**20**) is in good condition and in position.




MAP6900

42. Lock the planetary carrier cover (**2**) by tightening the screws (**1**).
43. Torque wrench setting for screws:
    40 - 50 Nm (29 - 36 ft.lb.)

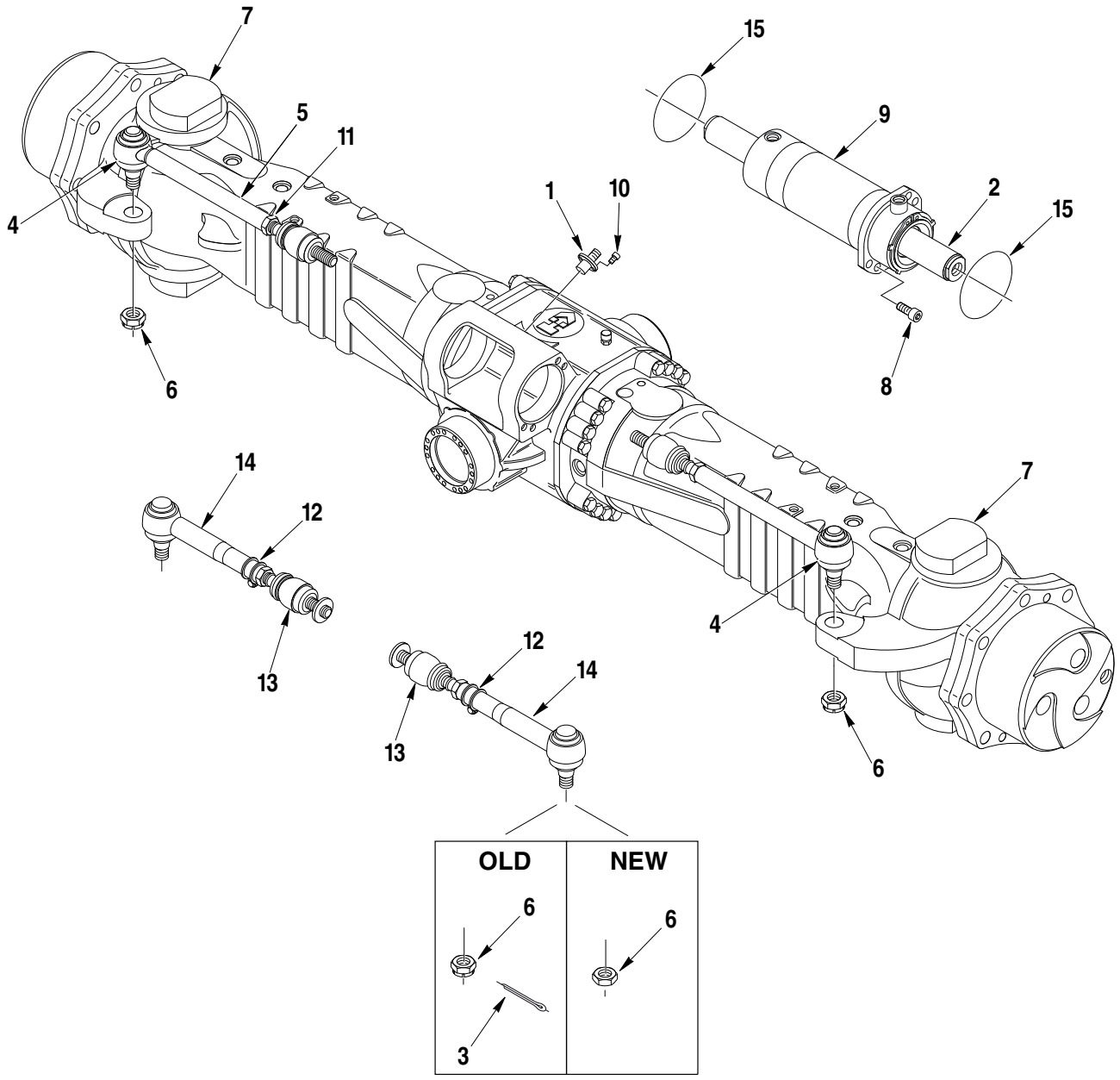


MAP6910

44. Connect the steering bars.
    For details, see Complete Steering Case.

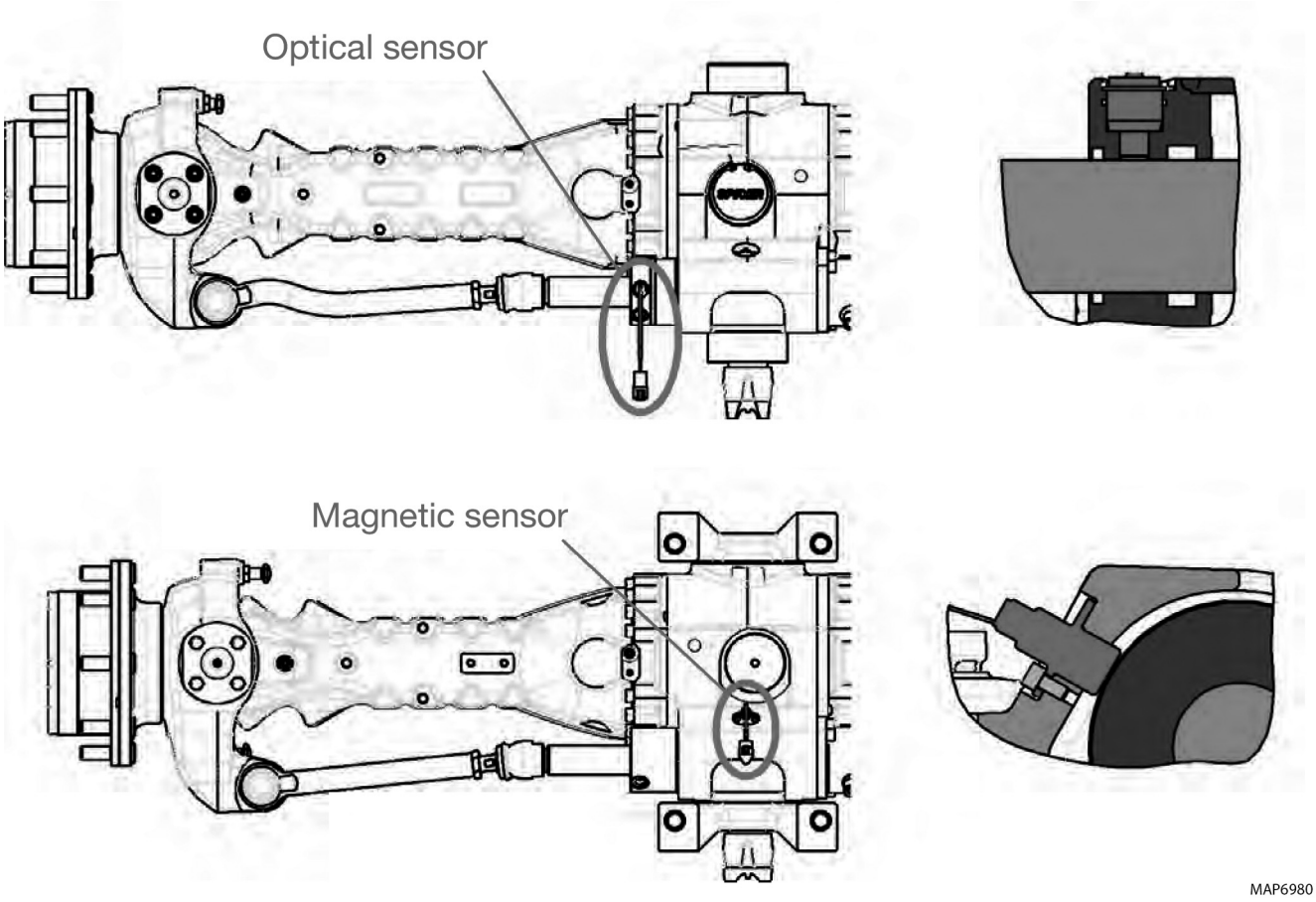
# Section 7
# Steering Cylinder

## 7.1 EXPLODED VIEW




MAP6970

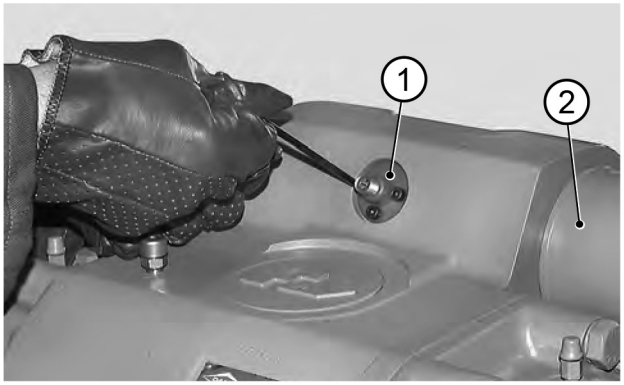
## 7.2 OPTICAL SENSOR AND MAGNETIC SENSOR



## 7.3 STEERING CYLINDER - DISASSEMBLY

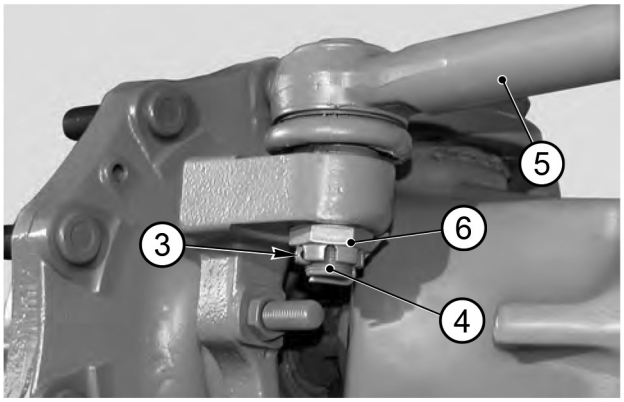
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP6990

1. Remove the centering sensor (**1**) of the steering piston (**2**), if supplied.

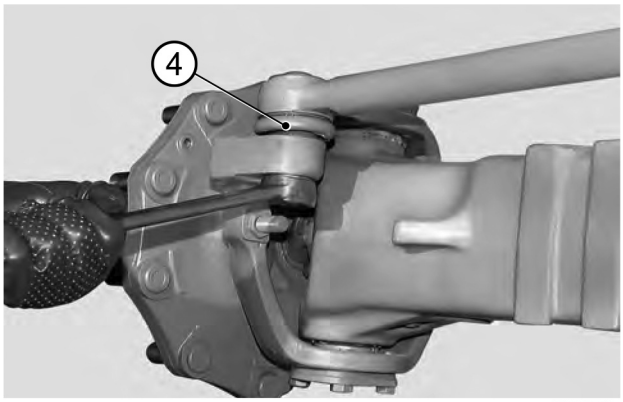



MAP7000

2. OLD VERSION
   Remove the safety cotter pins (**3**) from the articulation pins (**4**) of the steering bars (**5**). Remove the castellated nuts (**6**) that lock the articulation pins (**4**).

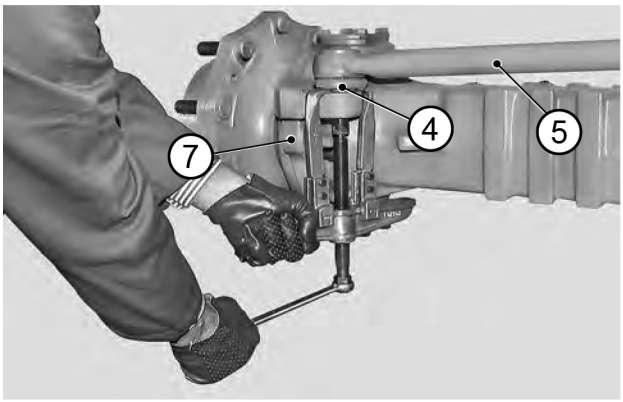
**CAUTION**

Dispose of used cotter pins.



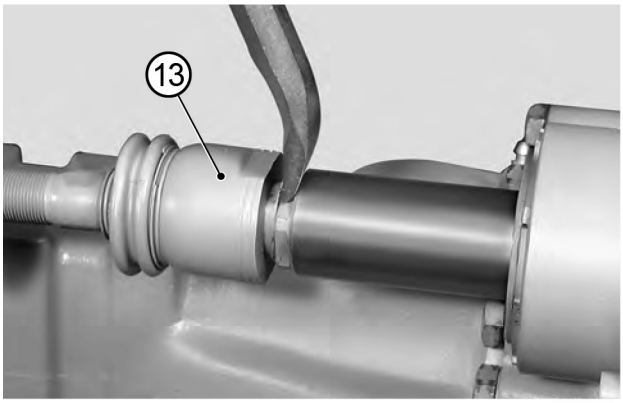

MAP7010

3. NEW VERSION
   Remove the nuts (**6**) that lock the articulation pins (**4**).



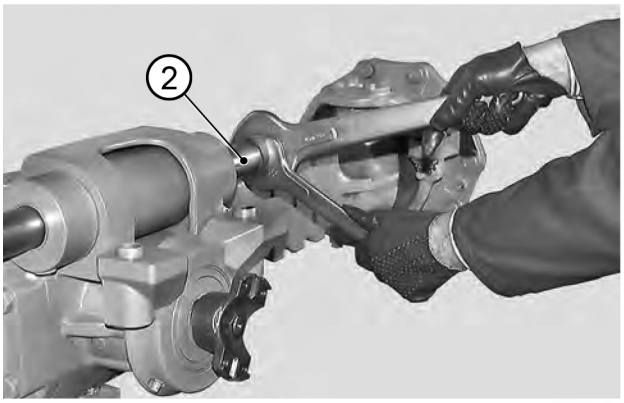

MAP7020

4. Disconnect the tapered pins of the articulation (**4**) from the steering case (**7**) by means of a puller.



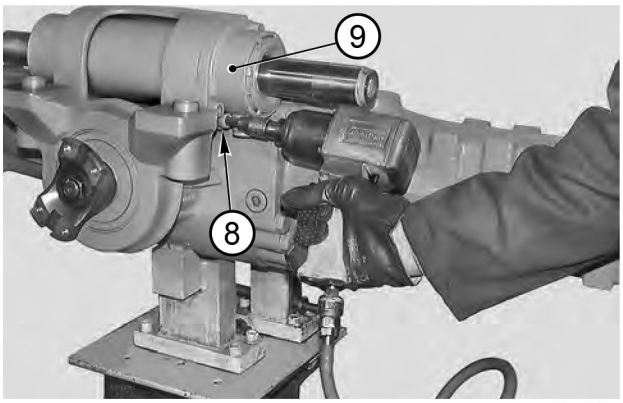

MAP7030

5. If the connection of the steering bars includes a safety collar (**13**), raise the border.



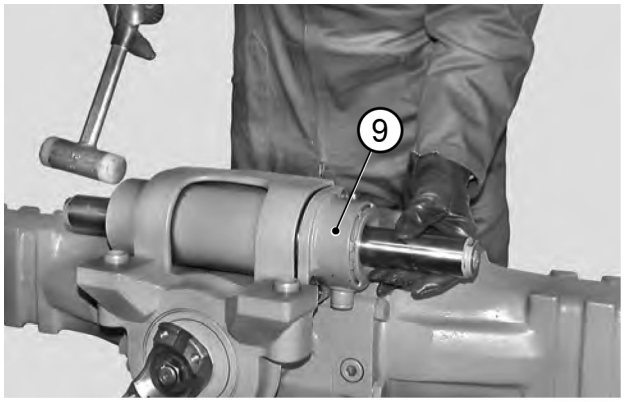

MAP7040

6. Disconnect left and right steering bars (**5**) from the piston (**2**).




MAP7050

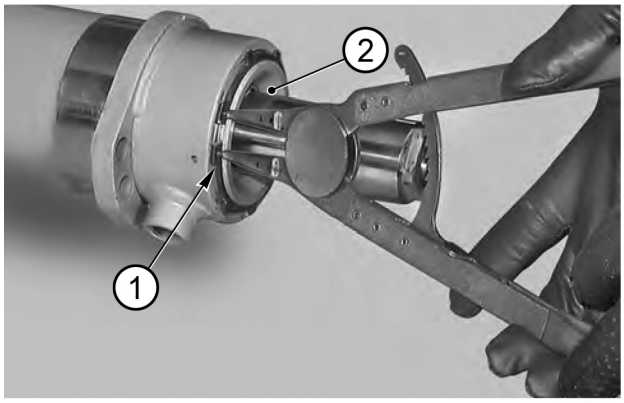
7. Remove the securing screws (**8**) from the steering cylinder (**9**).




MAP7060

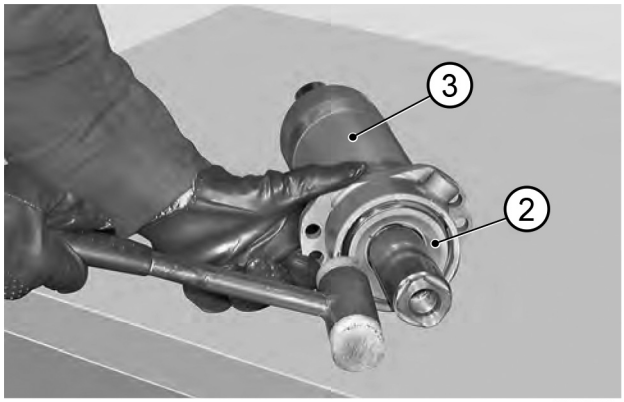
8. Extract the cylinder (**9**) using a plastic hammer.

***Note:*** *For cylinder disassembly, refer to Complete Steering Case.*




MAP7070

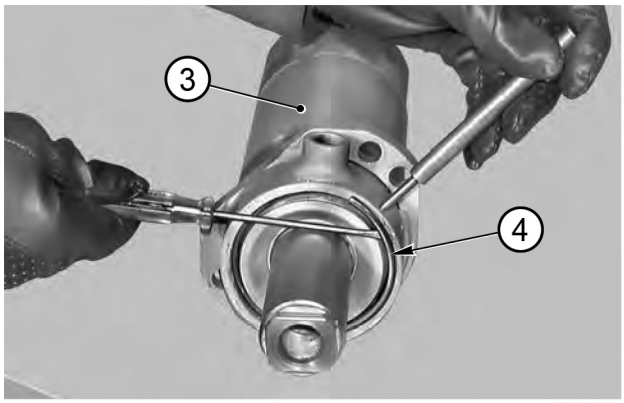
9. Remove the snap ring (**1**) from the cylinder head (**2**).




MAP7080

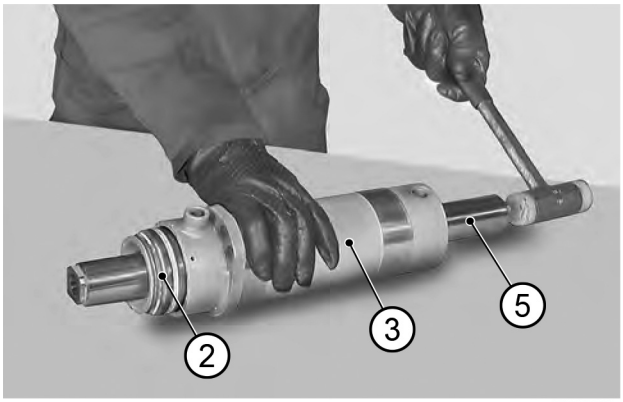
10. With the help of a plastic hammer, push the head (**2**) inside the cylinder (**3**).

***Note:*** *The head should line up with the edge of the cylinder.*



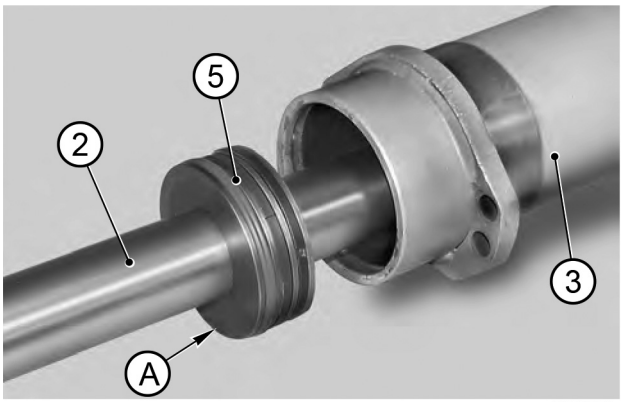

MAP7090

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




MAP7100

12. Hammer the piston (**5**) on the rear of the head (**2**) using a plastic hammer.
13. Continue hammering until the head (**2**) is ejected from the cylinder (**3**).




MAP7110

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

**⚠ CAUTION**

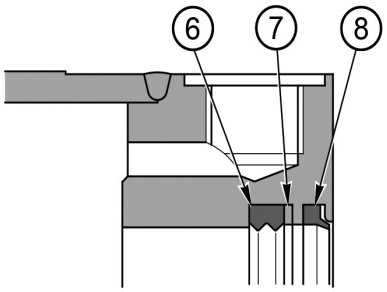
Write the assembly side of the piston (**5**). The beveled part "A" of the piston is oriented towards the head (**2**).

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

***Note:*** *All seals must be replaced every time the unit is disassembled.*

***Note:*** *Particular attention must be paid not to damage the seats of both seals and piston slide.*

## 7.4 STEERING CYLINDER - ASSEMBLY

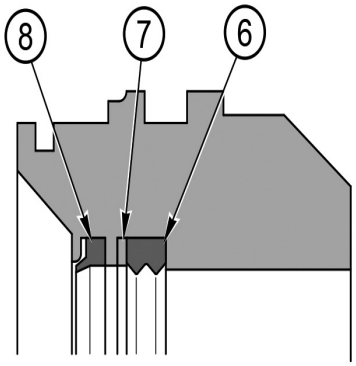



MAP7120

16. 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**).

**CAUTION**

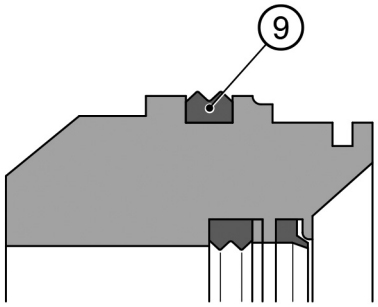
Thoroughly check that positioning of the anti-extrusion ring (**7**) is correct.




17. 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**).

**CAUTION**

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



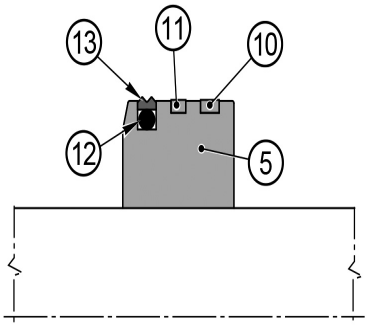

MAP7140

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

**CAUTION**

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

2 - Do not roll the seal (**9**) up.



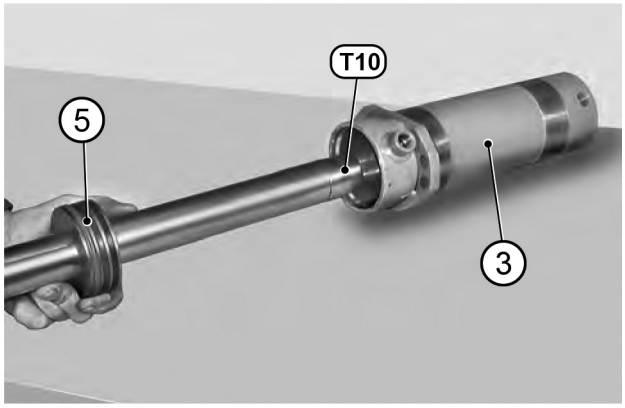

MAP7150

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

**CAUTION**

1 - In order to facilitate assembly, apply grease.

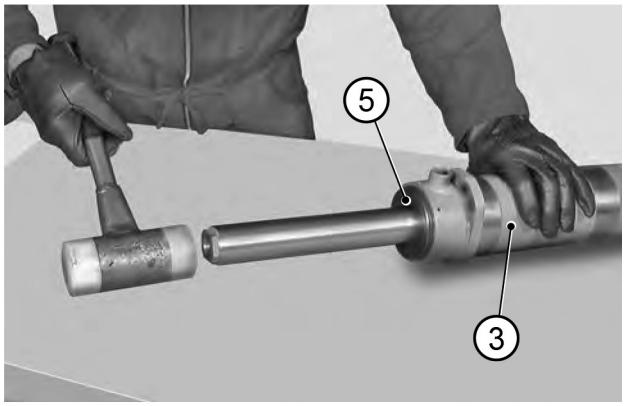
2 - If a centering sensor is not fitted, then the magnetic ring (**11**) should be replaced by another guide ring (**10**).




MAP7160

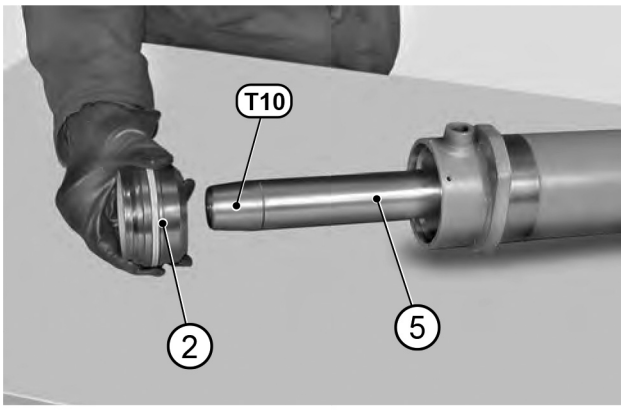
20. Apply tool (**T10**) to the shaft on the opposite side of the head (**2**) and center it on the cylinder (**3**) so that it fits into the piston (**5**).

***Note:*** *Apply a little grease to seals and cylinder.*



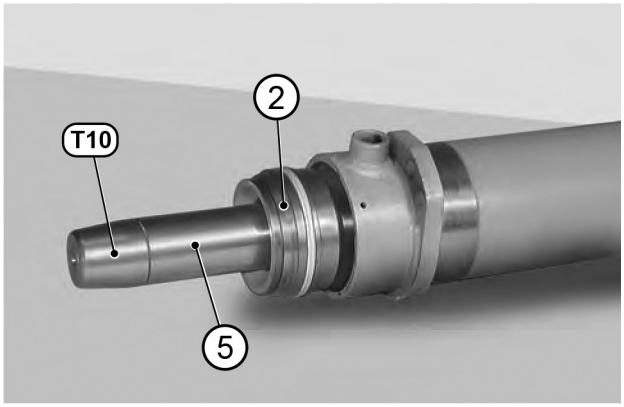

MAP7170

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




MAP7180

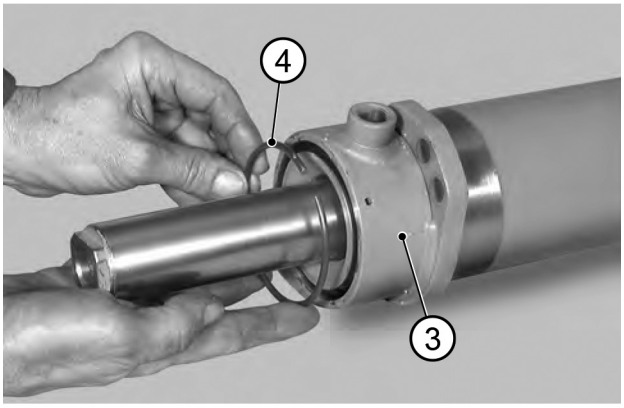
22. Remove tool (**T10**) and apply it to the opposite side of the piston (**5**).




MAP7190

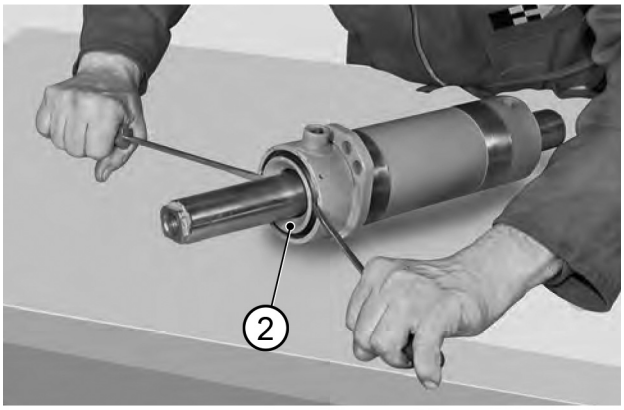
23. Apply grease to head (**2**) seals, fit the head onto the piston and push it into the cylinder (**3**) using a plastic hammer.

***Note:*** *Insert the head as to line it up with the edge of the cylinder.*



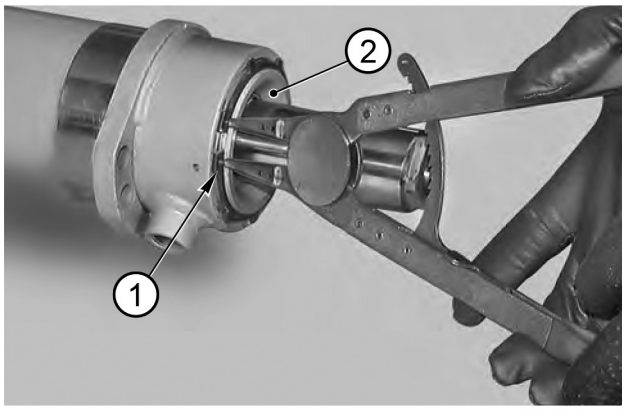

MAP7200

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




MAP7210

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

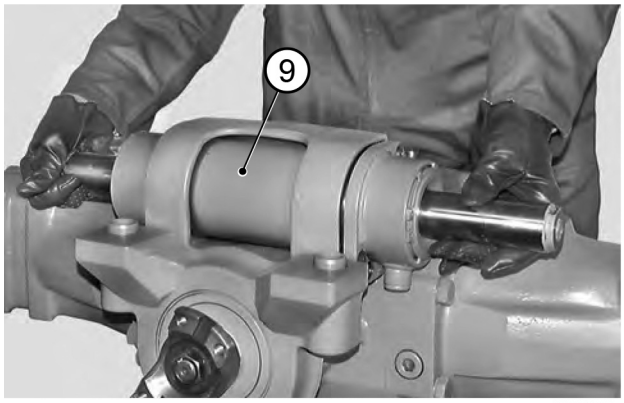



MAP7220

26. Fit the snap ring (**1**) on the head (**2**).

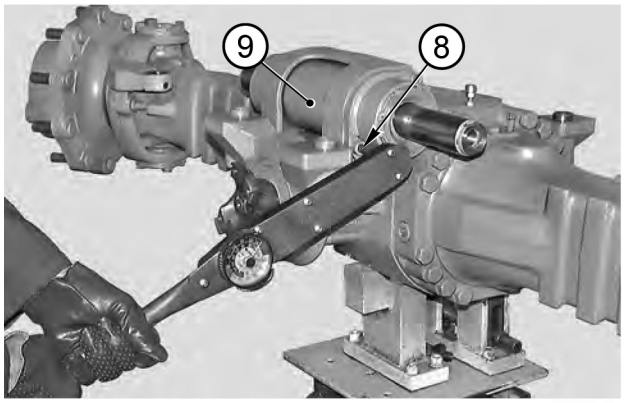
**⚠ CAUTION**

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.



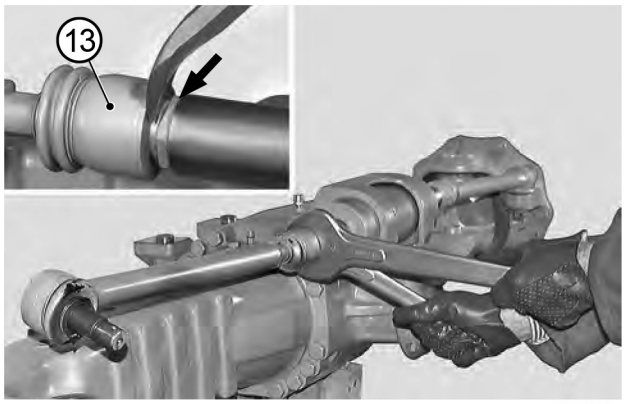

MAP7230

27. Check that the o-rings (**15**) of the axle unit are in good condition; lubricate the seats of the seals (**15**) and fit the steering cylinder (**9**) into its seat.



MAP7240

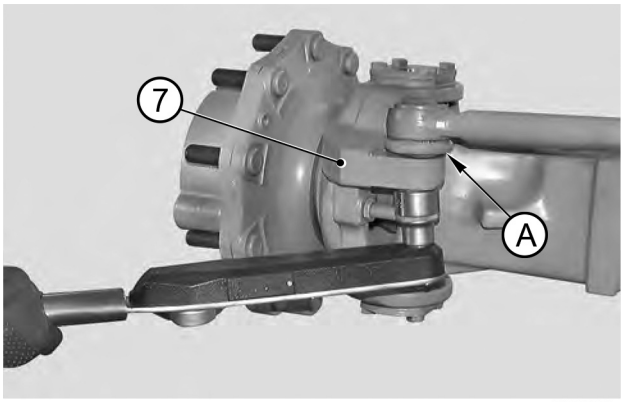
28. Lock the cylinder by criss-cross method the screws (**8**).
    Torque wrench setting: 116 - 128 Nm (85 - 94 ft.lb.)



MAP7250

29. 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 (177 - 199 ft.lb.)

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

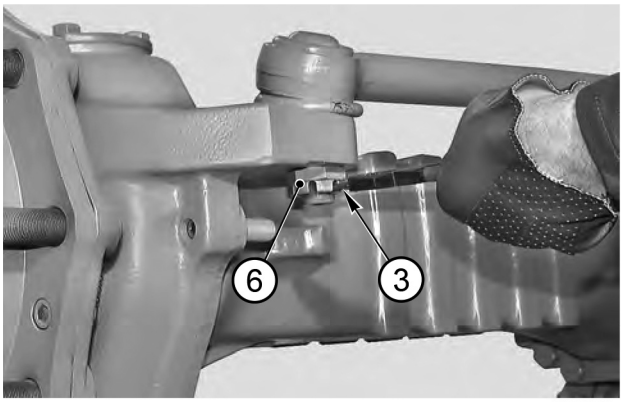


MAP7260

30. OLD VERSION
    Insert the pins (**4**) in the steering case (**7**) and lock into position using a torque wrench setting of
    260 - 290 Nm (191 - 213 ft.lb.)
31. Find the position of the notching in relation to the hole of the cotter pins and tighten the nut (**6**) further.

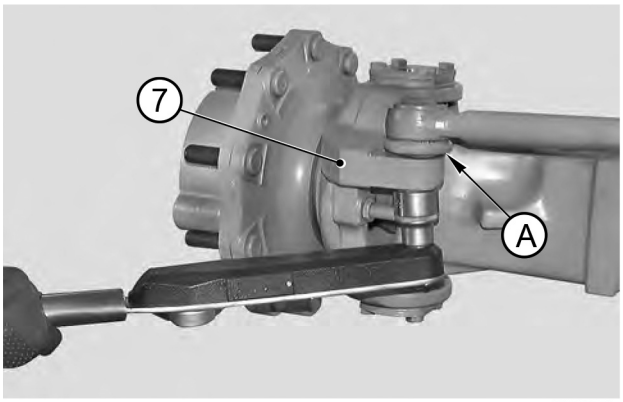
**⚠ CAUTION**

Check that rubber guards (**A**) are intact.



MAP7270

32. OLD VERSION
    Insert the cotter pins (**3**) and bend the safety stems.

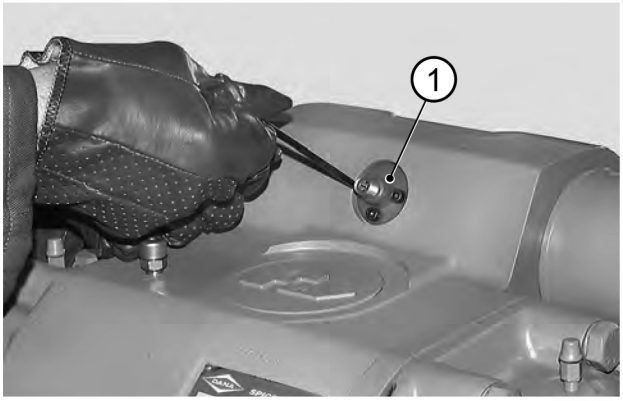



MAP7280

33. NEW VERSION
    Insert the pins (**4**) in the steering case (**7**) and lock into position using a torque wrench setting of 260 - 290 Nm (191 - 213 ft.lb.)

**⚠ CAUTION**

Use new cotter pins.

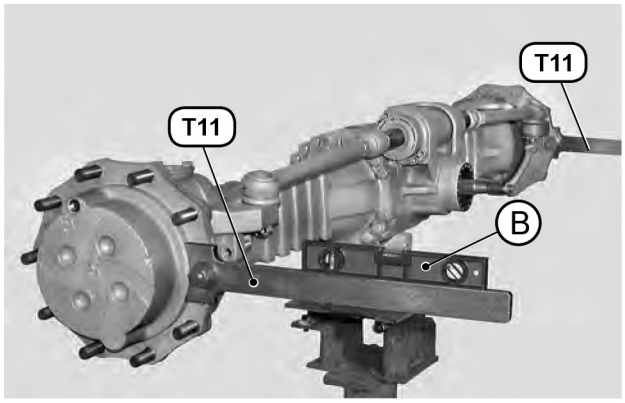



MAP7290

34. Install the centering sensor (**1**) for checking piston centering - if applicable - and tighten the screws (**10**). Torque wrench setting: 5 - 6 Nm (3.6 - 4.4 ft.lb.)

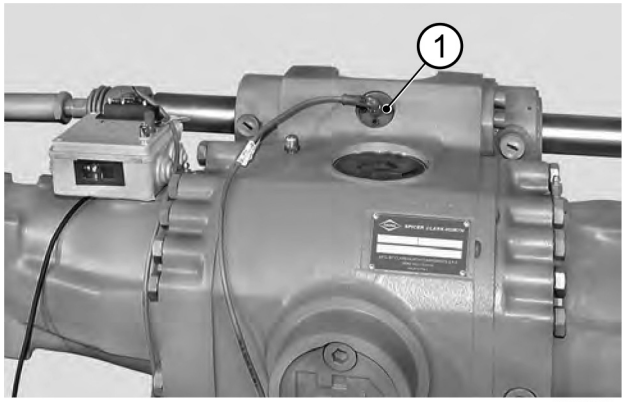
**⚠ CAUTION**

Eliminate the action of the negative brake, if fitted.



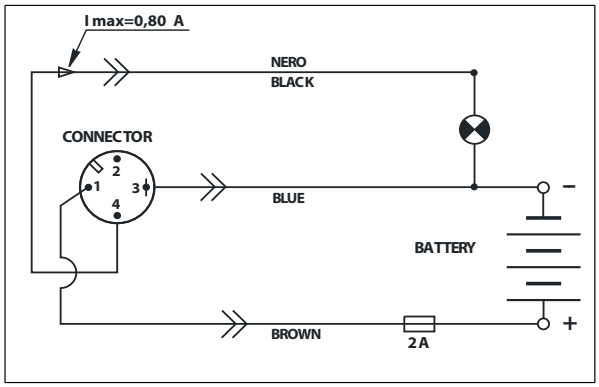

MAP7300

35. Apply tools (**T11**) to the hubs and lock them. Using a level "B".
36. Check that tools are perfectly flat and parallel to each other.



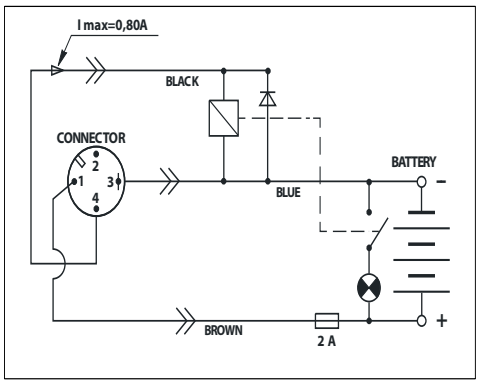

MAP7310

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



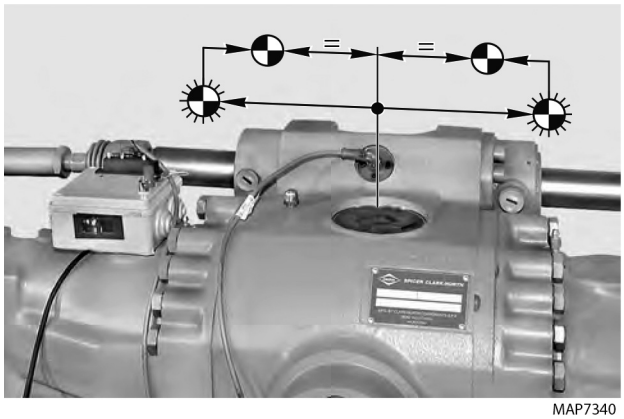

MAP7320

38. Sensor connection card, STANDARD version.



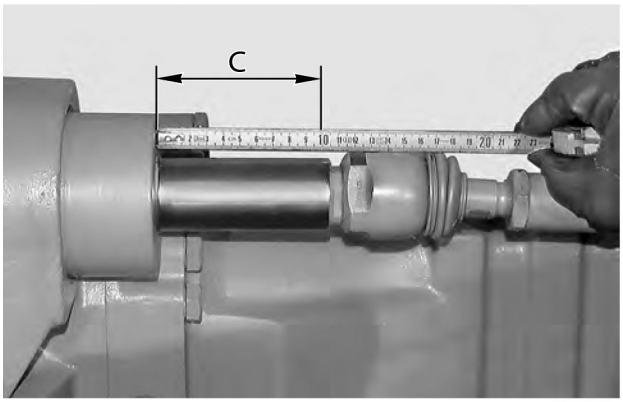

MAP7330

39. Sensor connection card, OPTIONAL version.



MAP7340

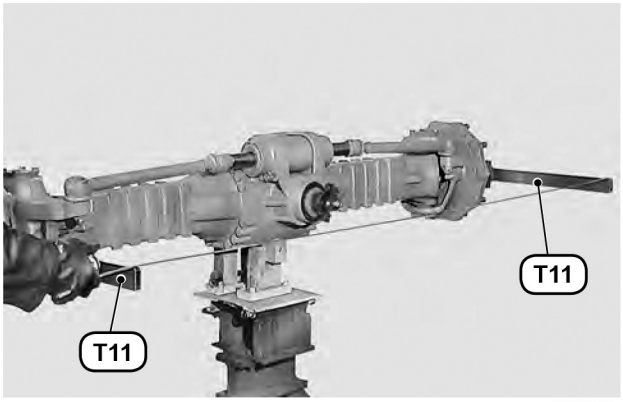
40. Center the piston by slowly moving it first in one direction then in the other. Position it half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.




MAP7350

41. Inspect distance “C” on one side of the piston and write down the size for checking later adjustments.

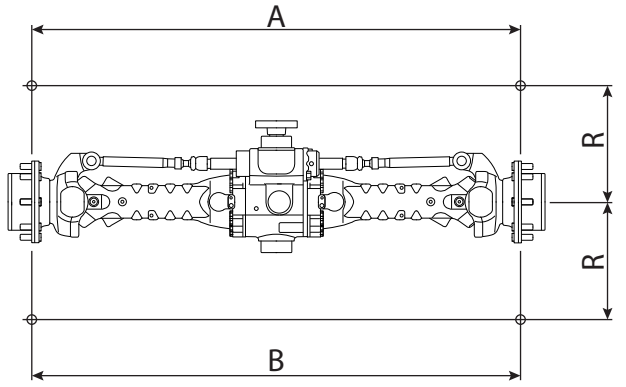
***Note:*** *If cylinders come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.*




MAP7360

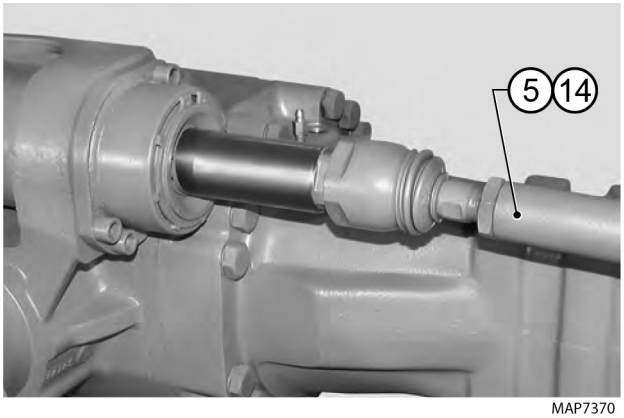
42. Without moving the piston, check front “B” and rear “A” using tool T11 at “R” value.
R = 400 mm (see picture below).

***Note:*** *In order to check the rear size, rotate the bevel pinion and check that tools (**T11**) are flat.*




MAE20430

43. Adjust the convergence with a difference between "A" and "B" of maximum 2,5 mm.
    A ± B = 2,5 mm
    R = 400 mm



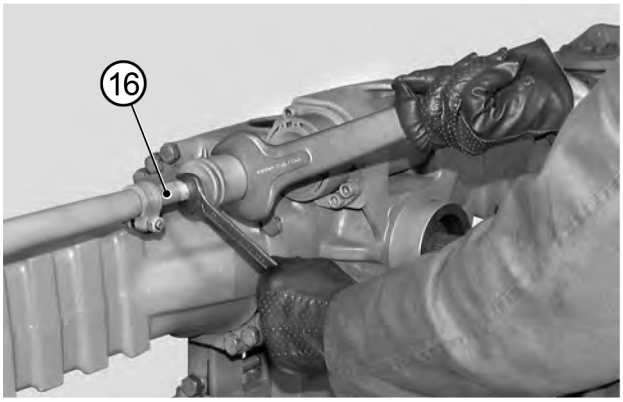

MAP7370

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

***Note:*** *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.*

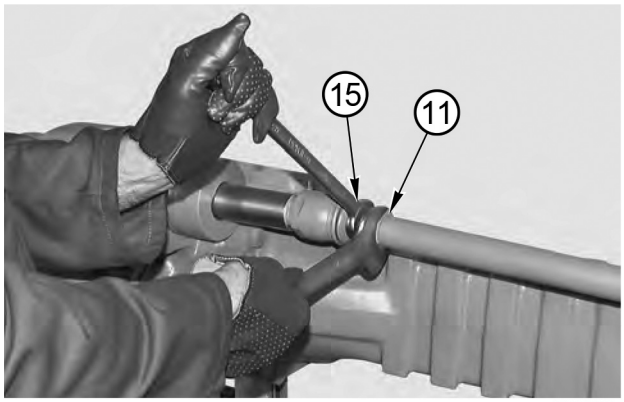

MAP7380

45. **CONVERGENCY ADJUSTMENT ON UNITS WITH COLLAR**
    Loosen the nuts on the collars (**12**).



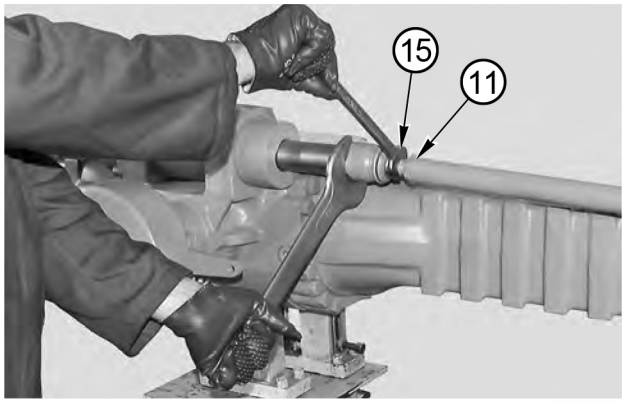

MAP7390

46. Rotate the ball-and-socket joints (**16**) until convergence has been obtained.
    Check that articulations move easily and lock the collars (**12**). Torque wrench setting for nuts:
    42 - 52 Nm (30 - 38 ft.lb.)




MAP7400

47. **CONVERGENCY ADJUSTMENT ON ALTERNATIVE VERSIONS**
    Loosen the nuts (**11**) and screw them onto the ball-and-socket joints (**15**).



MAP7410

48. Hold the articulations still and rotate the ball-and-socket joints (**15**).
    Once the convergence has been adjusted, lock the nuts (**11**). Torque wrench setting for nuts:
    298 - 328 Nm (219 - 241 ft.lb.)

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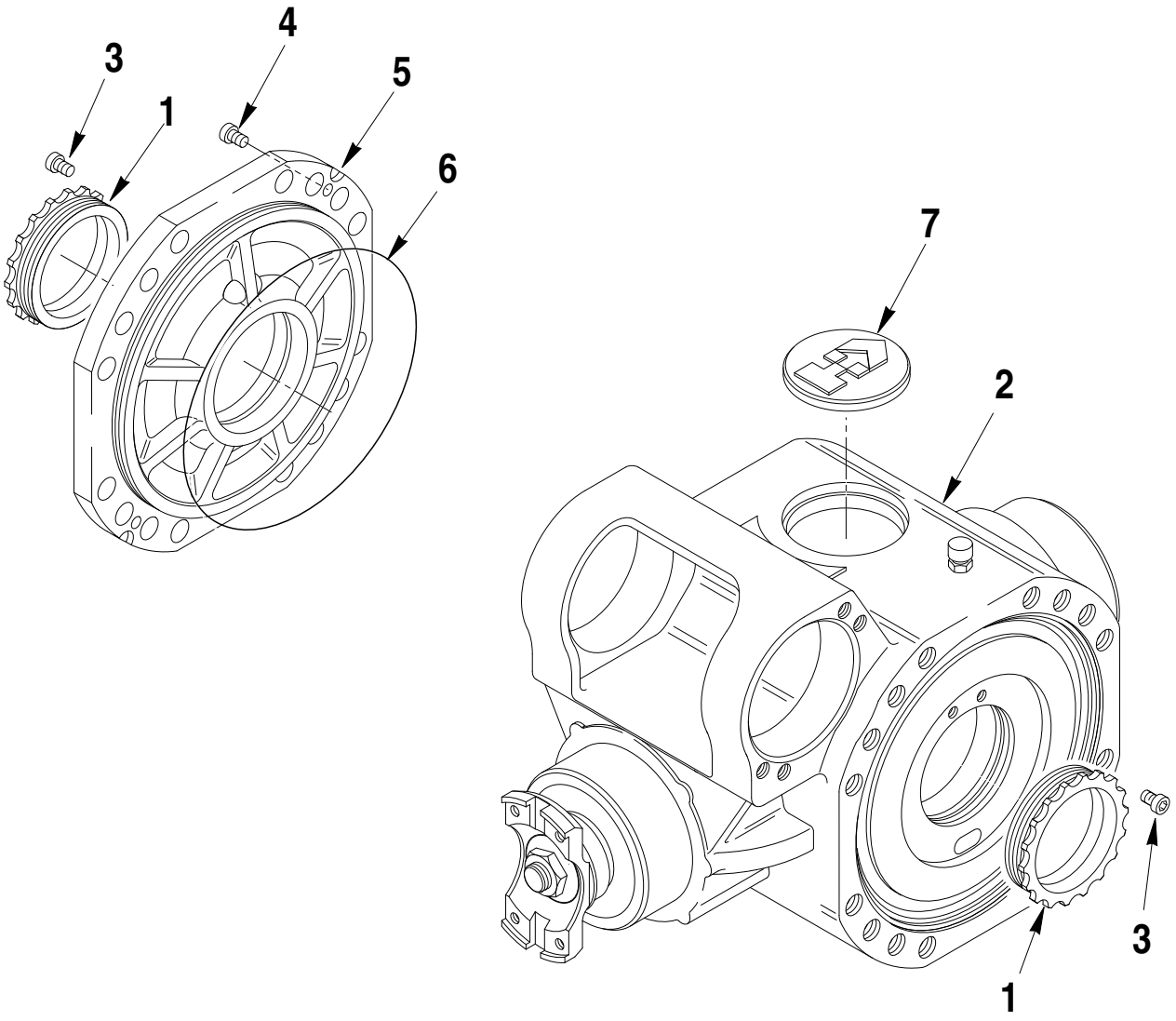
# Section 8
# Differential Unit

## 8.1 EXPLODED VIEW

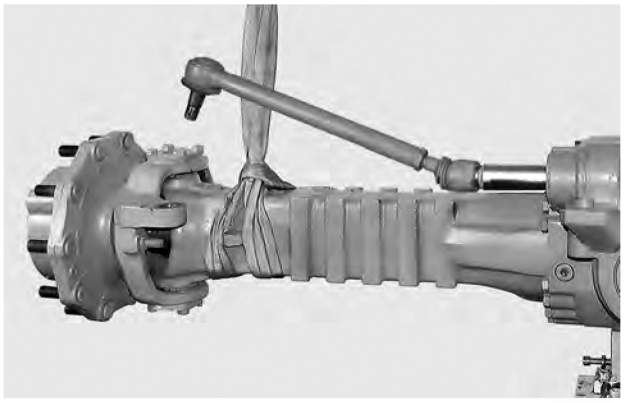



MAP7440

## 8.2 DIFFERENTIAL UNIT - DISASSEMBLY

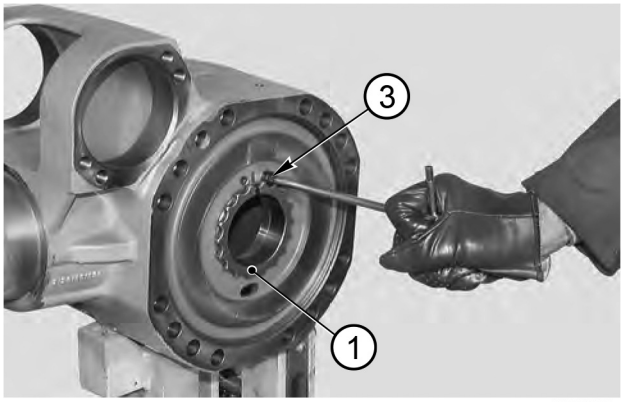
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



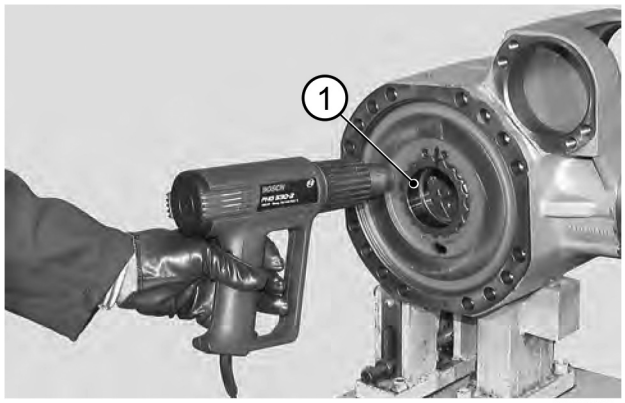
MAP7450

1. Remove the complete arms.
   For details, see Braking Discs.



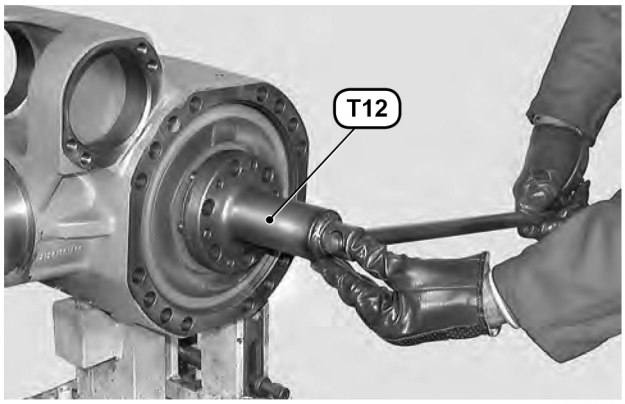

MAP7460

2. Mark the position of the ring nuts (**1**). Remove the capscrews (**3**) from the ring nuts (**1**).




MAP7470

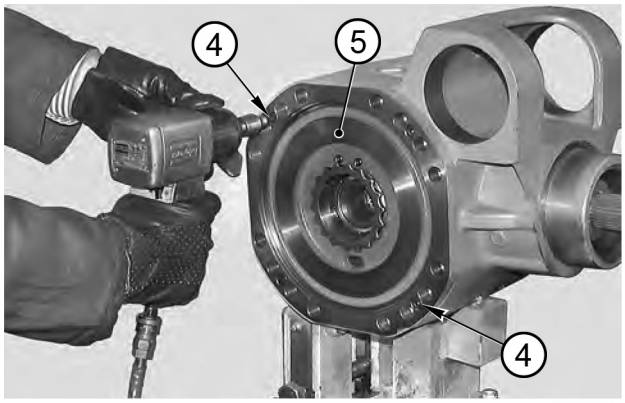
3. Uniformly heat the ring nuts (**1**) up to a temperature of 80° C.




MAP7480

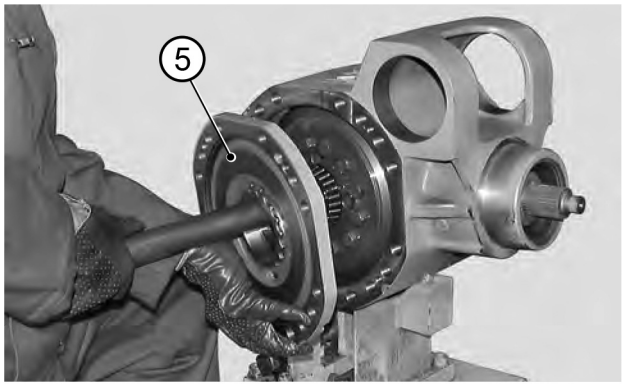
4. Apply tool (**T12**) and remove the ring nuts.

***Note:*** *Accurately clean the threaded portions on ring nuts of body and cover.*




MAP7490

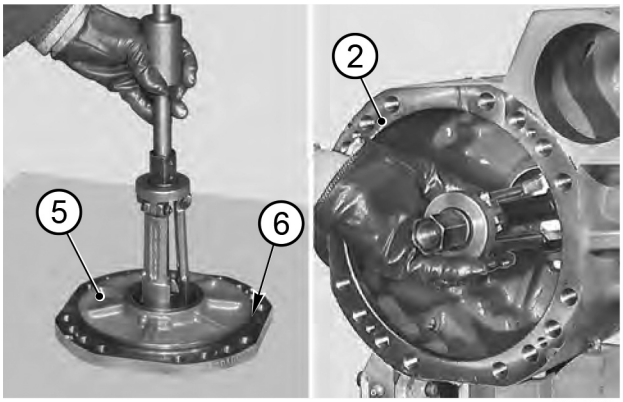
5. Remove the capscrews (**4**) from the middle cover (**5**).




MAP7500

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

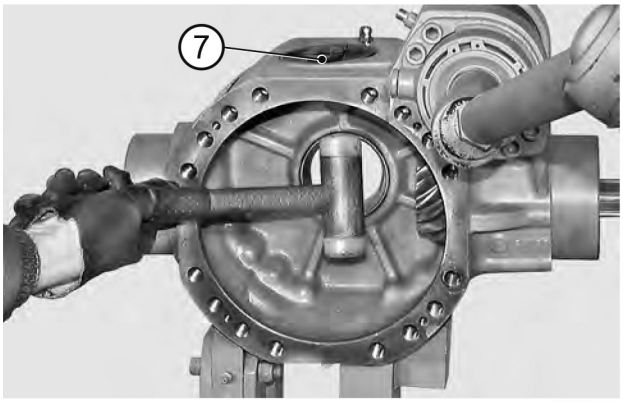
***Note:*** *Support the pieces using a rod.*




MAP7510

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

***Note:*** *Accurately check the o-ring (**6**).*

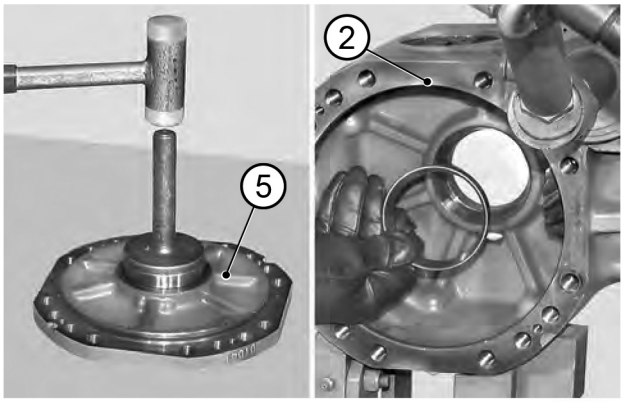



MAP7520

8. Remove the top plug (**7**).

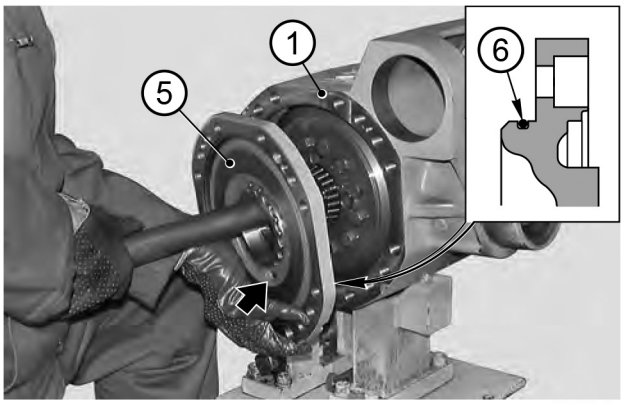
***Note:*** *The cap must be replaced each time the unit is disassembled.*

## 8.3 DIFFERENTIAL UNIT - ASSEMBLY




MAP7530

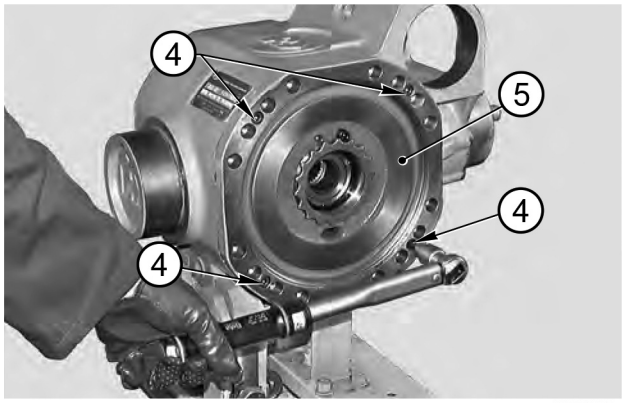
9. If the bearings are replaced, insert the external thrust blocks in the middle cover (**5**) and in the central body (**2**).




MAP7540

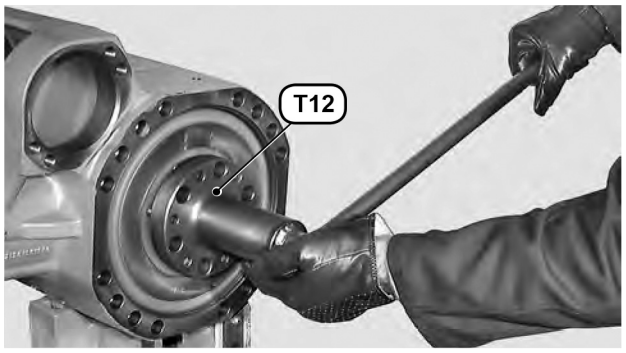
10. Position the differential unit in the central body (**2**) with the help of a bar and fit the middle cover (**5**).

***Note:*** *Thoroughly check the state of the o-ring (**6**) and make sure that the cover is fitted with the oil discharge in the lower position.*




MAP7550

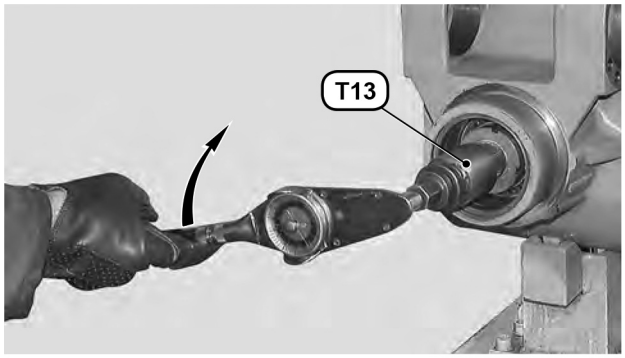
11. Lock the middle cover (**5**) with screws (**4**).
Torque wrench setting for screw:
23.8 - 26.2 Nm (17 - 19 ft.lb.)




MAP7560

12. 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.

***Note:*** *If the ring nuts (**1**) are removed, coat them with Loctite 242.*

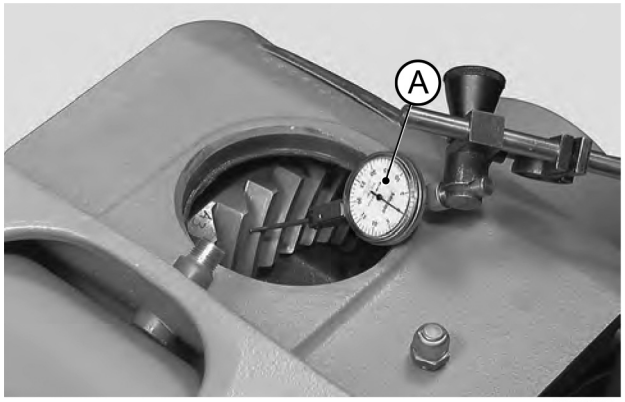


MAP7570

13. Pre-set the bearings by means of the ring nut situated on the opposite side of the crown, so as to increase pinion torque up to 1.4 - 2.1 Nm (1.03 - 1.54 ft.lb.)

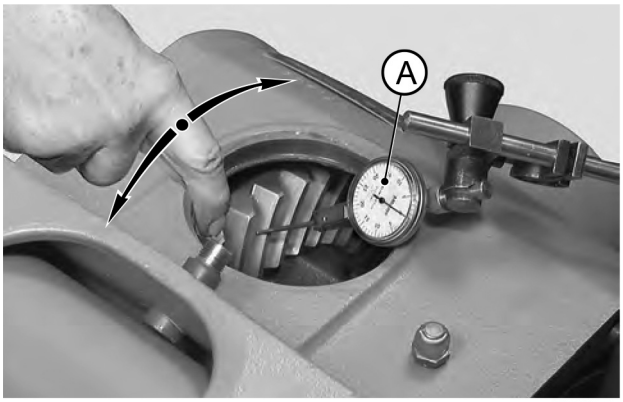
**⚠ CAUTION**

If bearings are not new, check the static torque; if bearings are new, check the continuous torque.



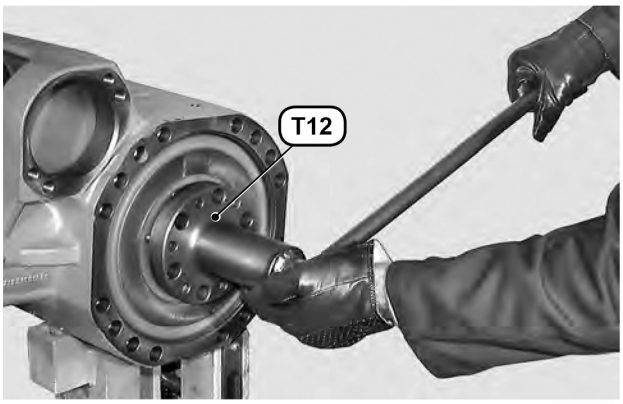
MAP7580

14. Introduce a dial indicator with rotary key “A” through the top plug hole (**7**).
Position the dial indicator on the center of one of the teeth of the crown, pre-set it to 1mm and reset it.



MAP7590

15. Manually move the crown in both directions in order to check the existing backlash between the pinion and the crown.



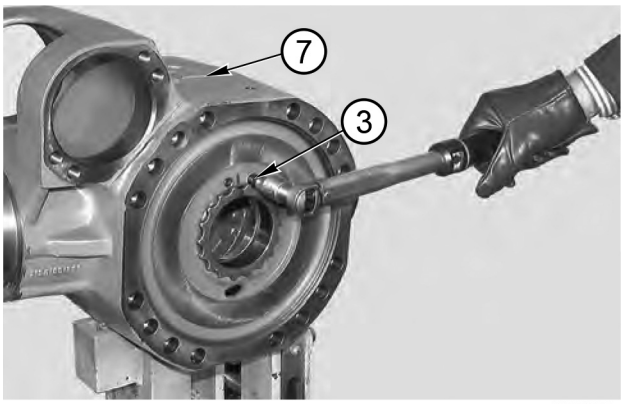
MAP7600

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

| RATIO - RAPPORTO VERHÄLTNIS RAPORTE - RAPPORT | CLEARANCE - GIOCO - SPIEL JUEGO - JEU | |
|---|---|---|
| | 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 |

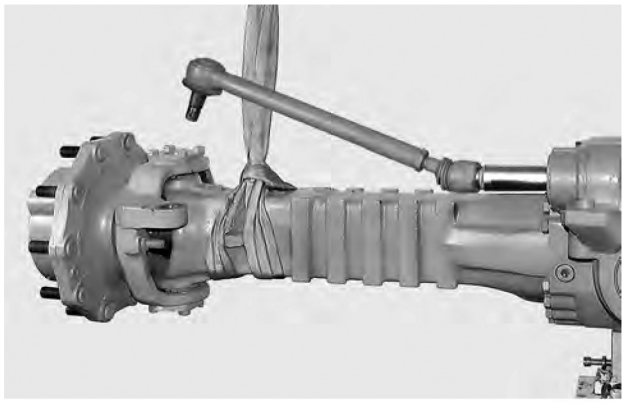
MAP7610

17. Difference between MIN and MAX clearance for whole circumference should not exceed 0.09 mm.




MAP7620

18. 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 (17 - 19 ft.lb.)
19. Fit the top plug (**7**) after applying repositionable jointing compound for seals to the rims.

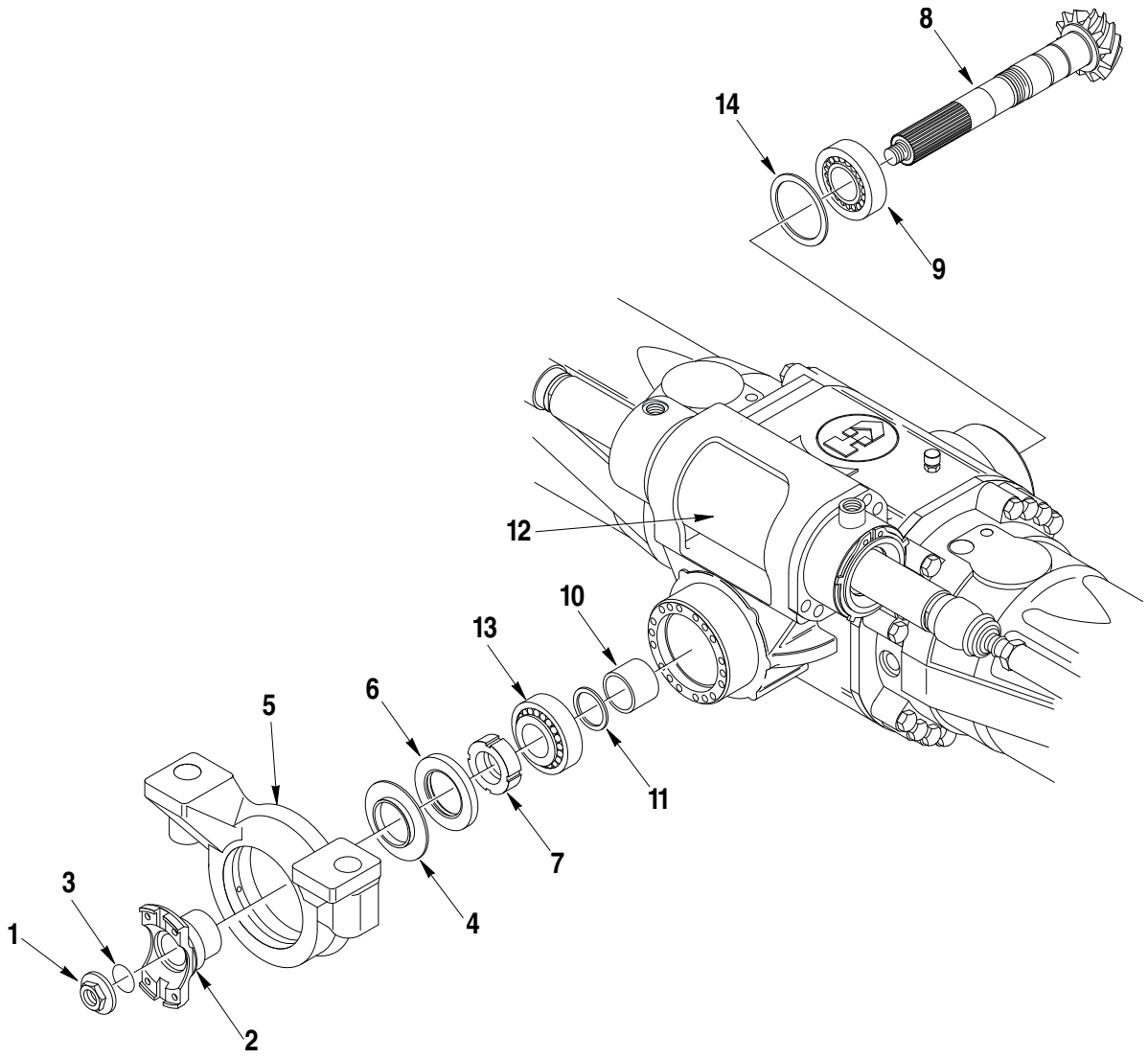


MAP7630

20. Re-install the complete arms.
    For details, see Braking Discs.

# Section 9
# Bevel Pinion

## 9.1 EXPLODED VIEW

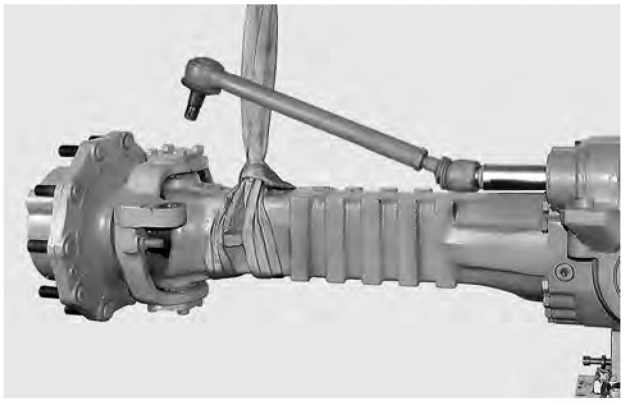



MAP7660

## 9.2 BEVEL PINION - DISASSEMBLY

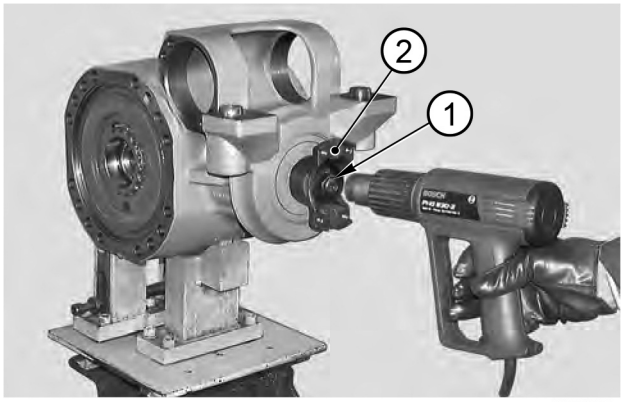
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



MAP7670

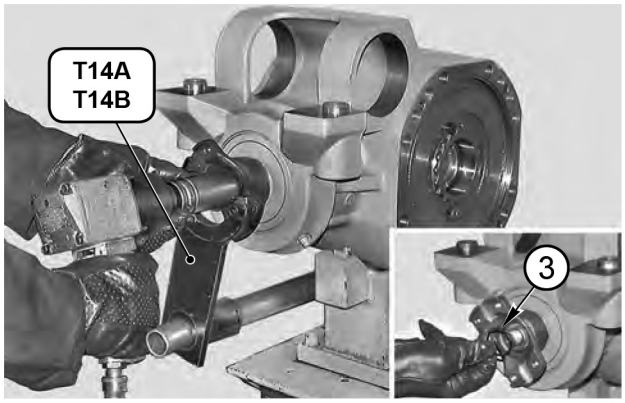
1. Remove the complete arms and the differential unit. For details, see Braking Discs and Differential Unit.




MAP7680

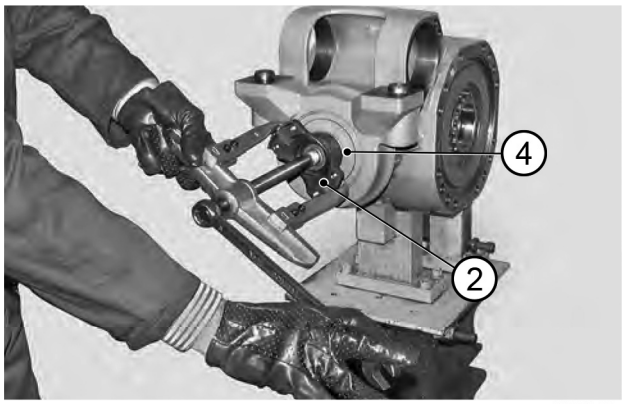
2. If disassembly is awkward, heat the check nut (**1**) of the flange (**2**) at 80°C.

***Note:*** *Heating is meant to loosen the setting of Loctite on the nut (1).*



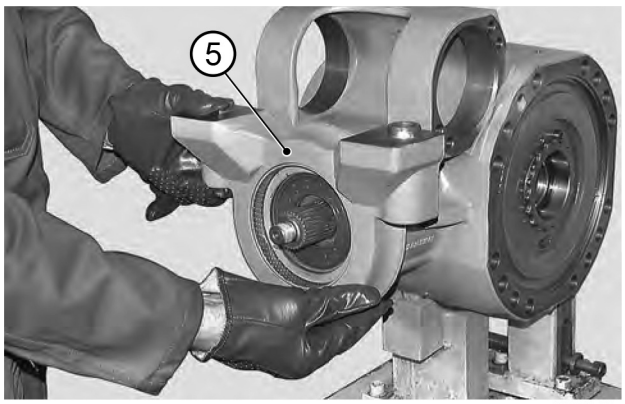

MAP7690

3. Position tool (**T14A**) or (**T14B**), so as to avoid pinion rotation.
4. Loosen and remove the nut (**1**); also remove the o-ring (**3**).



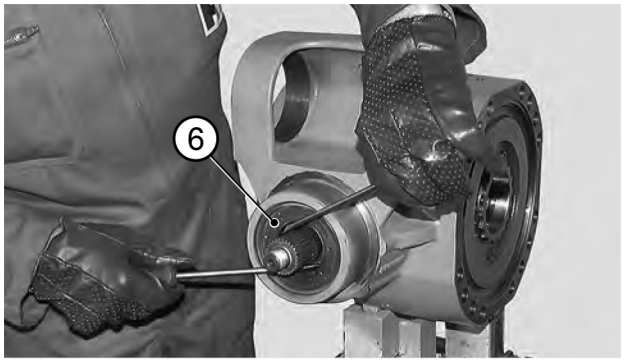

MAP7700

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



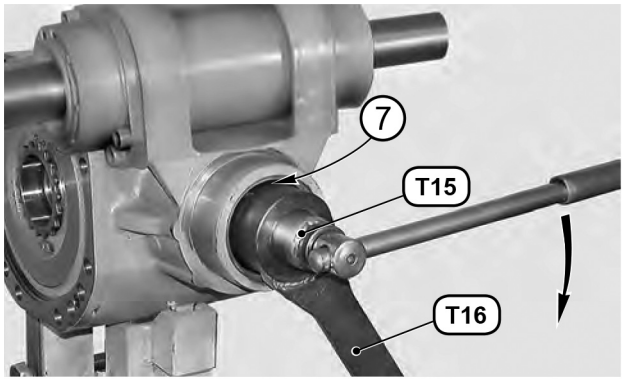

MAP7710

6. Remove the swinging support (**5**).




MAP7720

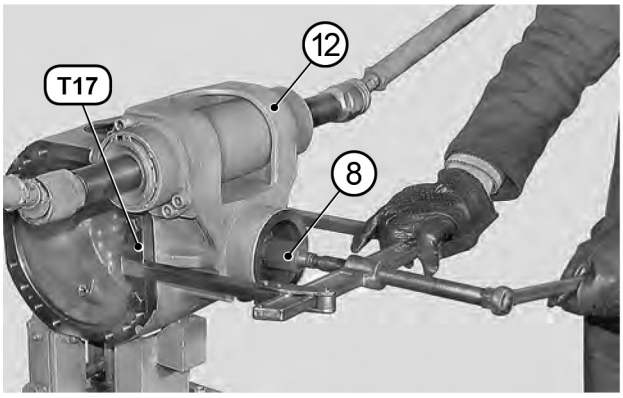
7. Remove the sealing ring (**6**).




MAP7730

8. Position wrench (**T16**) onto the ring nut (**7**) and apply bar hold (**T15**) to the pinion (**8**). Stop wrench (**T16**) and rotate the pinion so as to release and remove the ring nut (**7**).

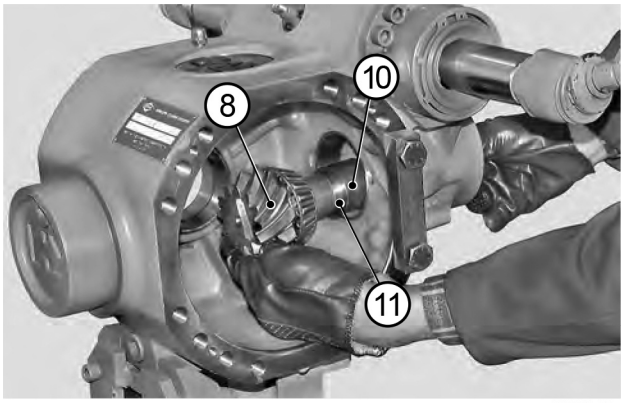
***Note:*** *If disassembly proves awkward, heat the ring nut to approximately 80°C.*




MAP7740

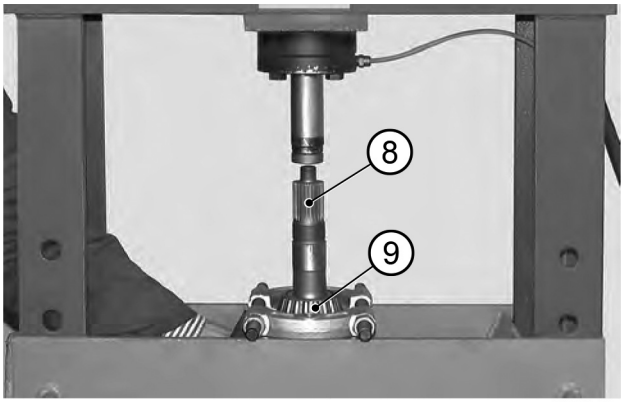
9. Apply blocks (**T17**) and, with the help of a puller, extract the pinion (**8**) complete with the internal bearing (**9**), the spacer (**10**) and shims (**11**).

***Note:*** *The thrust blocks of the bearings remain in the central body (**12**).*



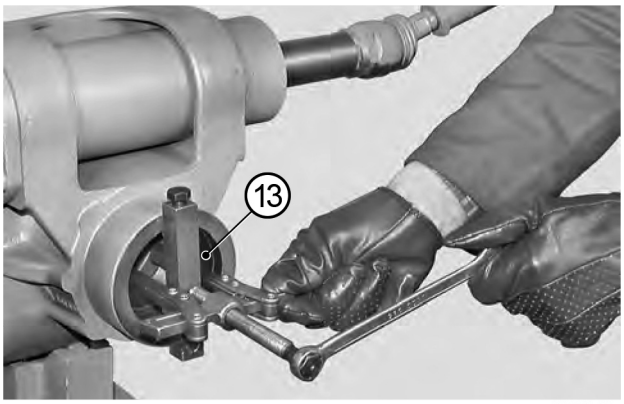

MAP7750

10. Remove the pinion (**8**), shims (**11**) and spacer (**10**).



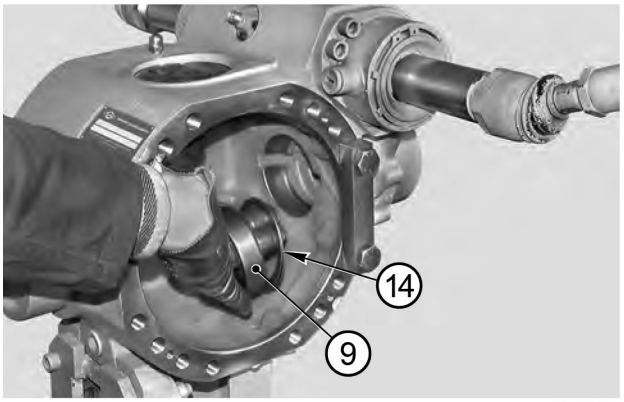

MAP7760

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




MAP7770

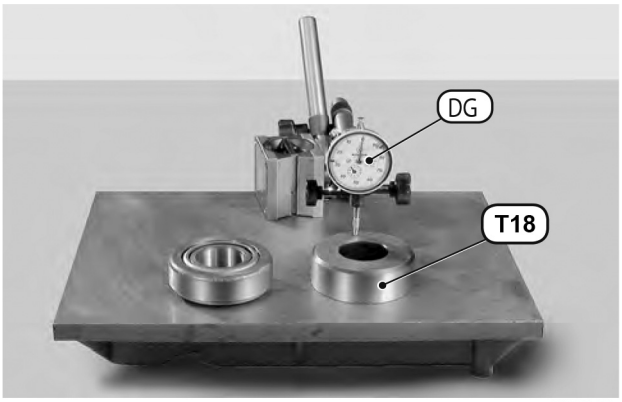
12. Remove the thrust block of the external bearing (**13**).




MAP7780

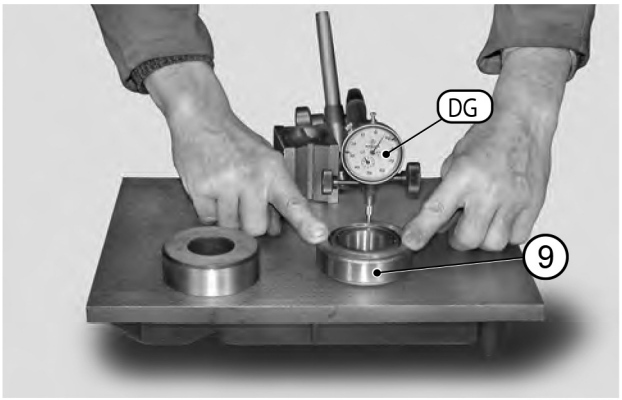
13. Insert a drift in the appropriate holes and remove the thrust block of the internal bearing (**9**) as well as the shim washers (**14**).

## 9.3 BEVEL PINION - ASSEMBLY




MAP7790

14. Using a surface plate, reset a dial indicator “DG” and place it on the measurement ring (**T18**) (with a thickness of 30.2 mm).
15. Preset the depth gauge to approximately 2 mm.

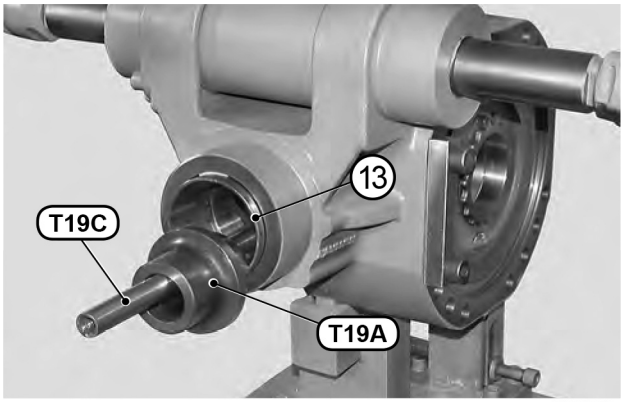



MAP7800

16. Bring the internal bearing (**9**), complete with its thrust block, under dial indicator. Determine overall thickness “D” of the bearing checking the discrepancy between this size and the size of the measurement ring.

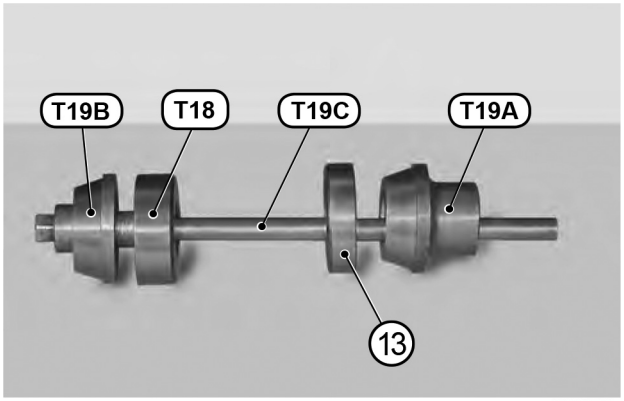
**⚠ CAUTION**

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



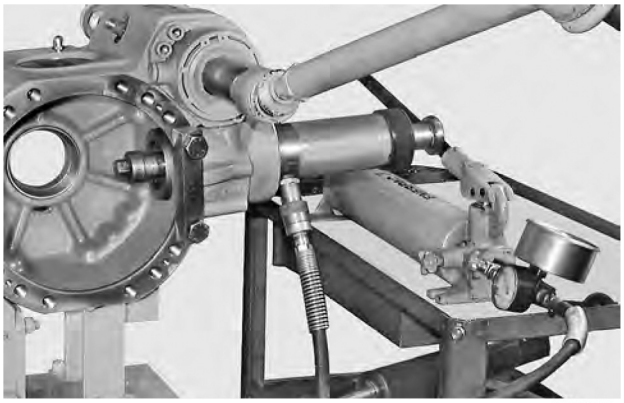

MAP7810

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




MAP7820

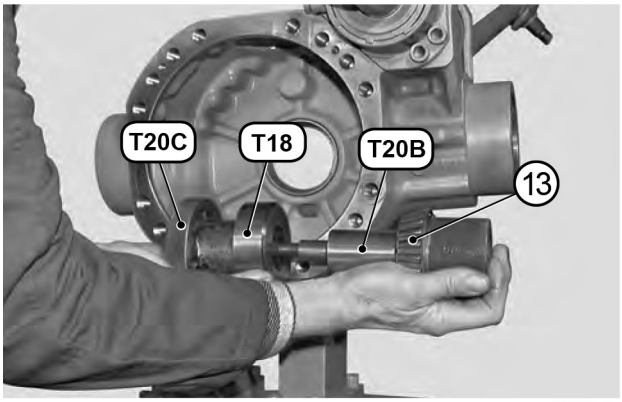
18. Install tension rod (**T19C**), measurement ring (**T18**) and front guide tool (**T19A**) on the thrust block of the external bearing (**13**).



MAP7830

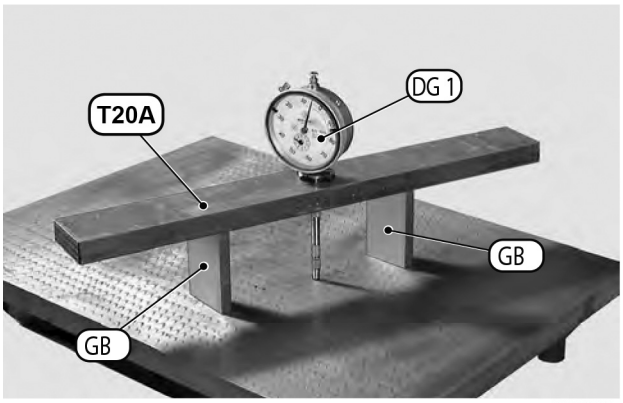
19. Connect the tension rod to the press and move the thrust block of the external bearing (**13**) into its seat. Disconnect the press and remove the tension rod.

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



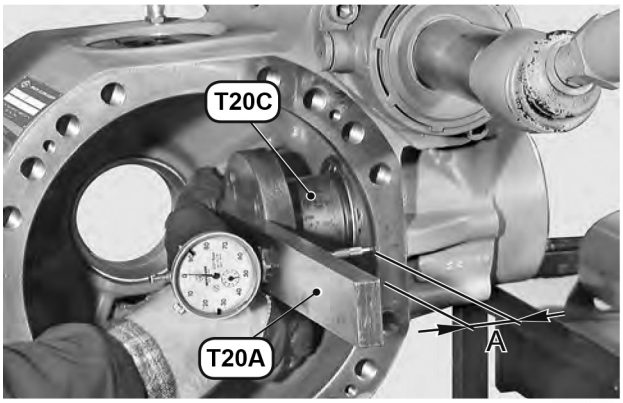

MAP7840

20. Insert tool (**T20B**) complete with external bearing (**13**), measurement ring (**T18**) and gauge ring nut (**T20C**). Manually tighten.



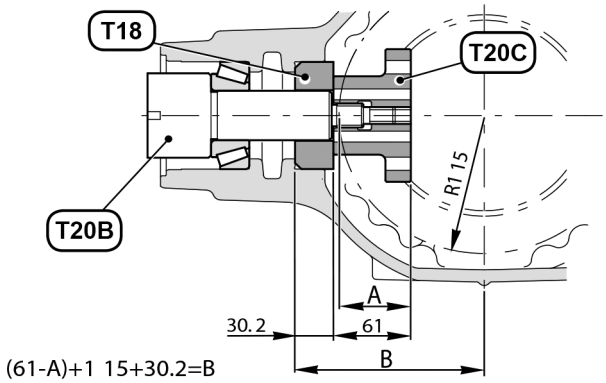

MAP7850

21. Fit a dial indicator "DG1" with long stem into bar (**T20A**); when the bar rests on two size blocks "GB" of 57 mm, reset the gauge. Preset the gauge to approximately 2 mm and reset.



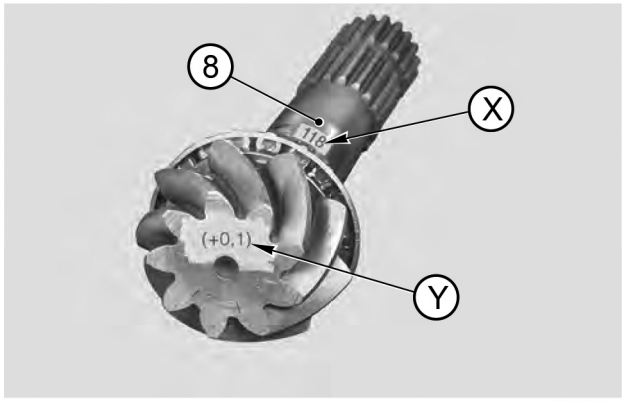

MAP7860

22. Lay bar (**T20A**) on gauge nut (**T20C**) and take the measurement "A" at about 57 mm corresponding to the maximum diameter of arms centering.



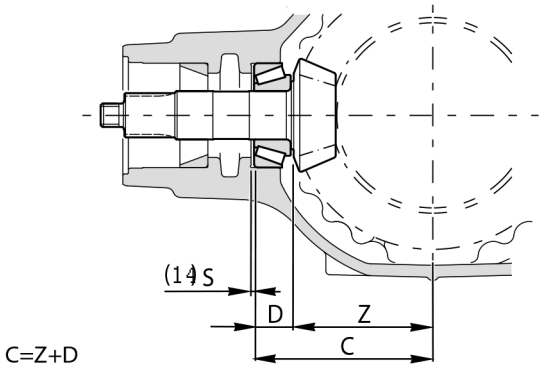

MAP7870

23. 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**).



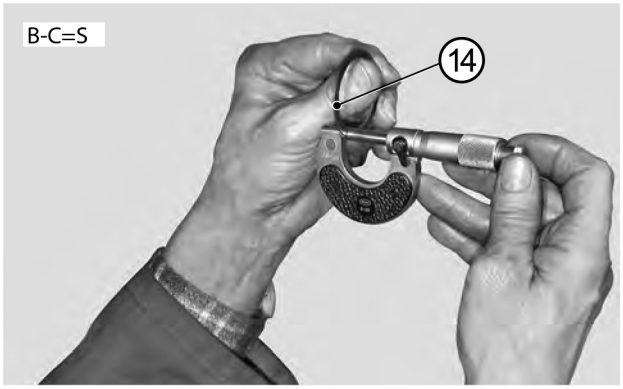

MAP7880

24. 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



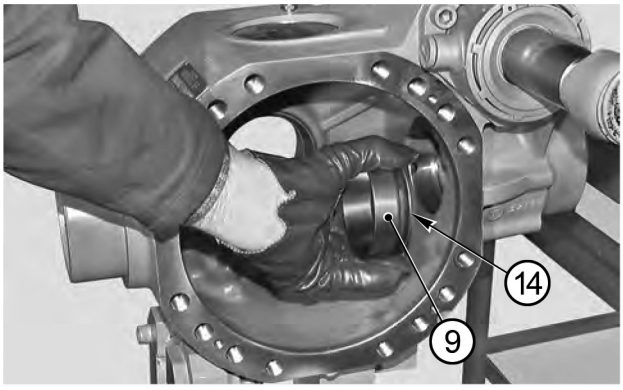

MAP7890

25. 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**).




MAP7900

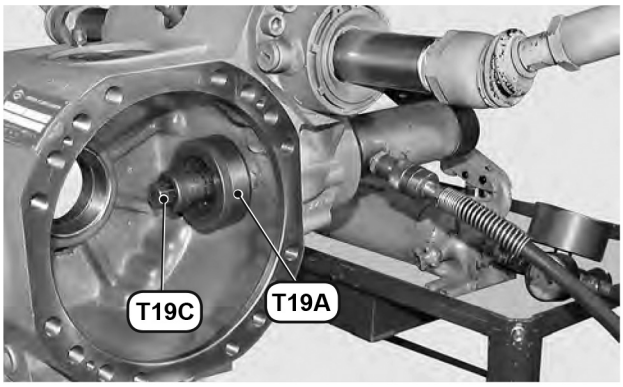
26. Calculate the difference between sizes “B” and “C” so as to obtain the size “S” of the shim (**14**) that will go under the thrust block of the internal bearing (**9**).




MAP7910

27. Insert shim “S” (**14**) and the thrust block of the internal bearing (**9**) in the central body.

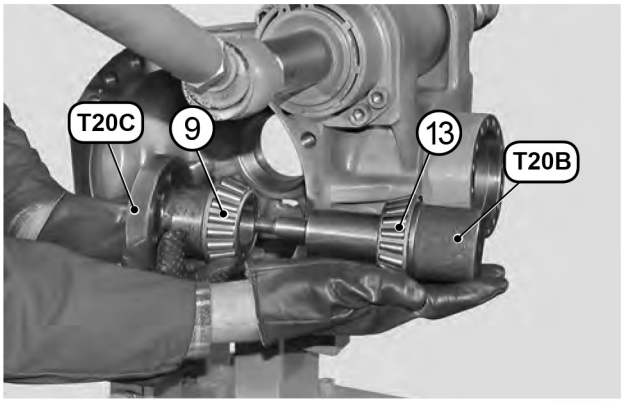
***Note:*** *To hold shim “S” (**14**) in position, apply grease.*




MAP7920

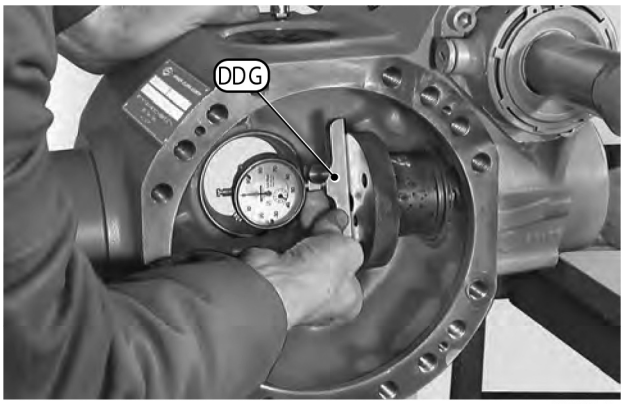
28. Position tool (**T19A**) and tension rod (**T19C**). Connect the tension rod to the press, fasten the thrust block and then remove the tools.

***Note:*** *Before going on to the next stage, make sure that the thrust block has been completely inserted.*



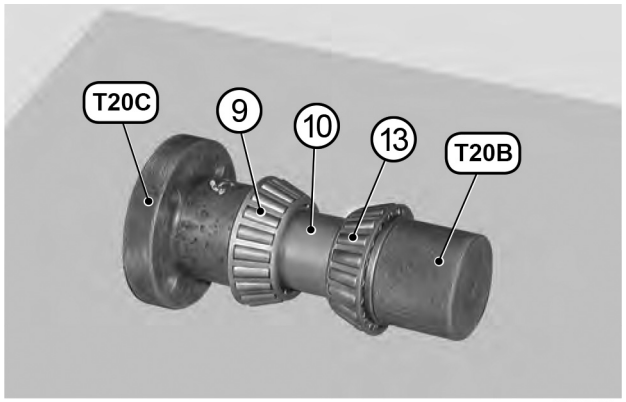

MAP7930

29. Position tools (**T20C**) and (**T20B**) complete with tapered bearings (**9**) and (**13**); manually tighten until a rolling torque has been obtained.



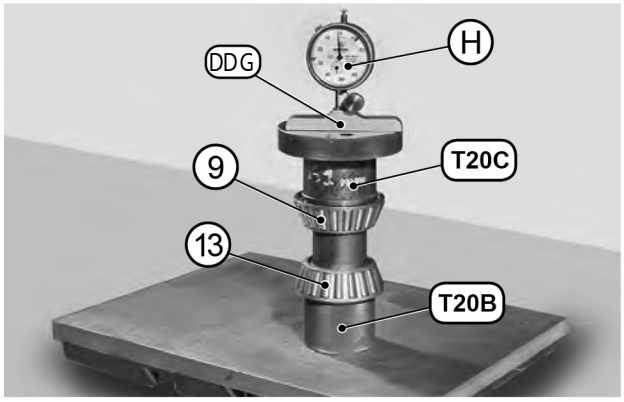

MAP7940

30. Insert the stem of a depth gauge “DDG” in either side hole of tool (**T20C**); reset the gauge with a presetting of approximately 3 mm.



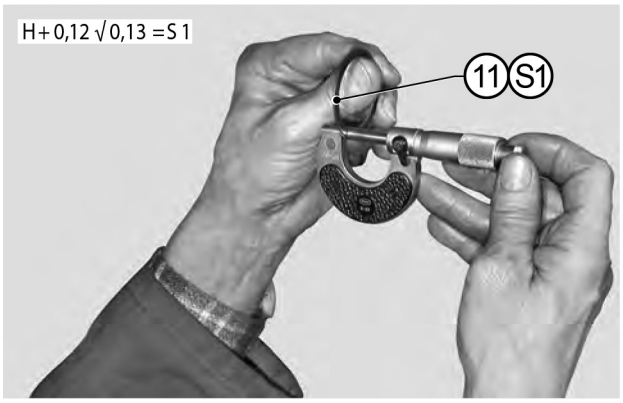

MAP7950

31. Remove the depth gauge and release tools and bearings from the central body.
Re-install all and insert the spacer (**10**) between bearings (**9**) and (**13**); manually tighten the whole pack.



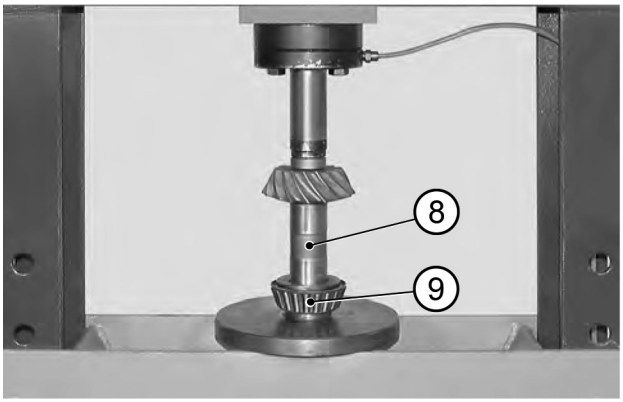

MAP7960

32. Insert depth gauge “DDG” into tool (**T20B**), (**T20C**) and measure variation “H” in relation to the zero setting performed back at Figure 28.



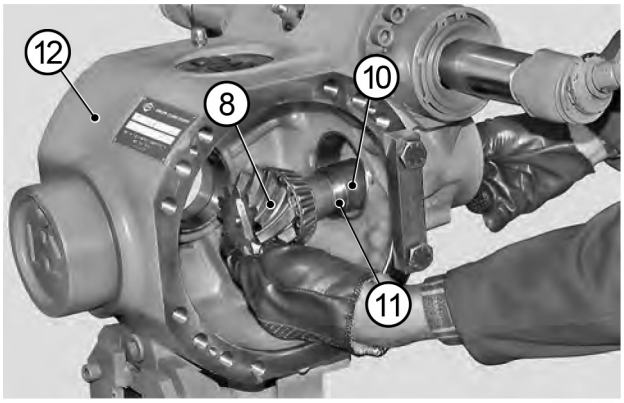

MAP7970

33. 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 spacer (**10**) and subsequently, to determine the preload for the bearings.




MAP7980

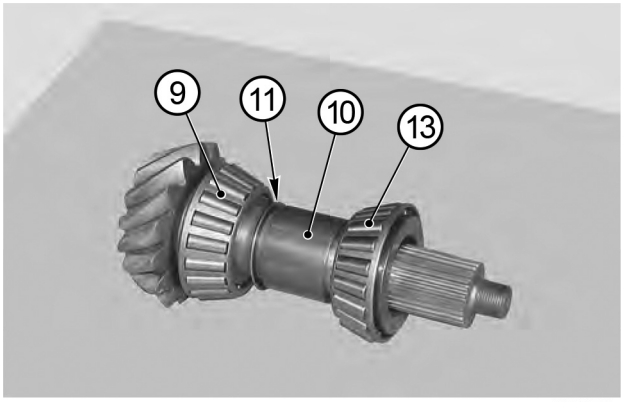
34. Position the internal bearing (**9**) and the pinion (**8**) under a press; force the bearing onto the pinion.




MAP7990

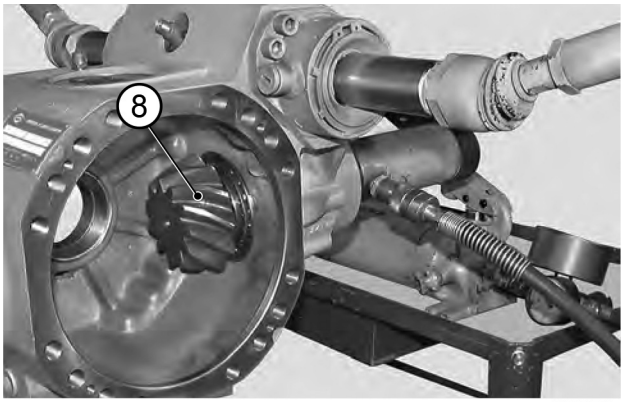
35. Fit the pinion (**8**), shim "S1" (**11**) and spacer (**10**) in the main body (**12**).

***Note:*** *The thinner shims must be placed in-between the thicker ones.*



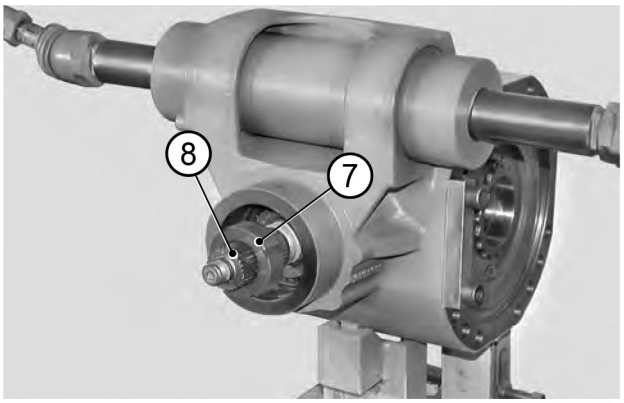

MAP8000

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



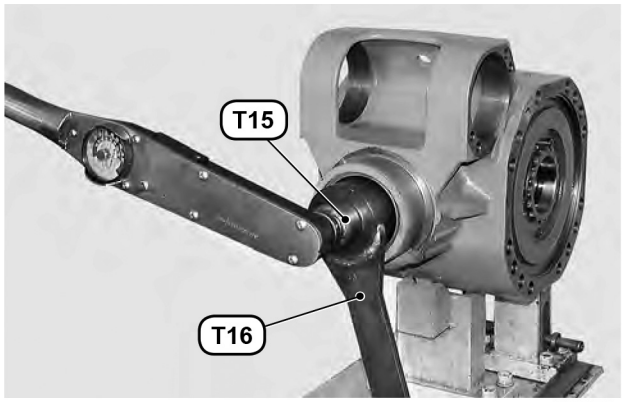

MAP8010

37. Connect the pinion (**8**) to the tie rod (**T21A**) and (**T21B**); connect the tie rod (**T21C**) to the press and block.



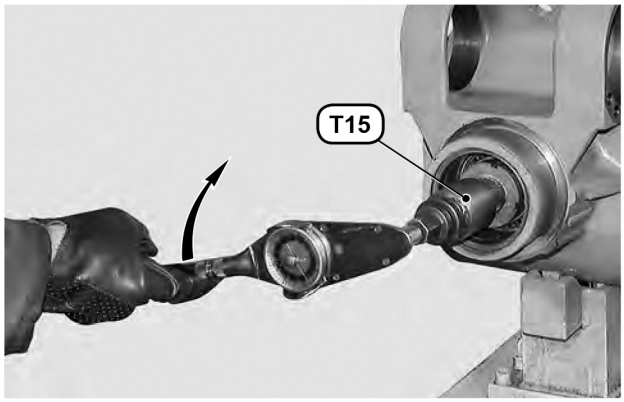

MAP8020

38. **STANDARD INPUT FLANGE VERSION**
Apply Loctite 242 to the thread of the ring nut (**7**) and screw the nut onto the pinion (**8**).




MAP8030

39. **STANDARD INPUT FLANGE VERSION**
Apply special wrench (**T16**) to the ring nut (**7**) and bar-hold (**T15**) to the pinion (**8**). Lock the wrench (**T16**) and rotate the pinion using a torque wrench, up to a minimum required torque setting of 500 Nm (368 ft.lb.)




MAP8040

40. **STANDARD INPUT FLANGE VERSION**
Apply onto the pinion (**8**) the bar-hold and with the help of a torque wrench, check the torque of the pinion (**8**).
Torque: 1.2 - 2.0 Nm (0.89 - 1.48 ft.lb.)

# ⚠ CAUTION

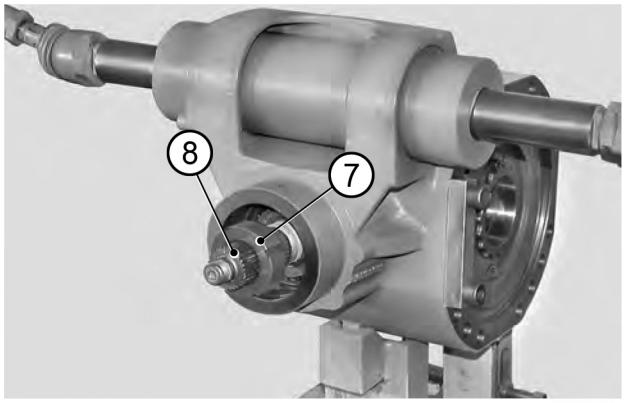
**STANDARD INPUT FLANGE VERSION**

If torque exceeds the maximum value, then the size of shim "S1" (**11**) between the bearing (**13**) and the spacer (**10**) needs to be increased.

If torque does not reach the set value, increase the torque setting of the ring nut (**7**) in different stages to obtain a maximum value of 570 Nm (420 ft.lb.)

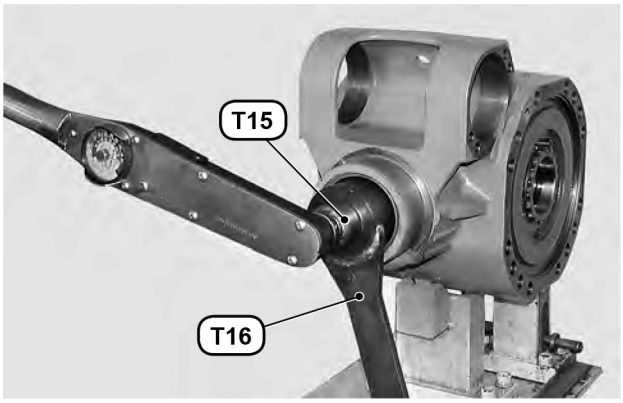
If torque does not reach the minimum value, then the size of shim "S1" (**11**) needs to be reduced.

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 0.6 Nm (0.44 ft.lb.) in the torque of the pinion (**8**).



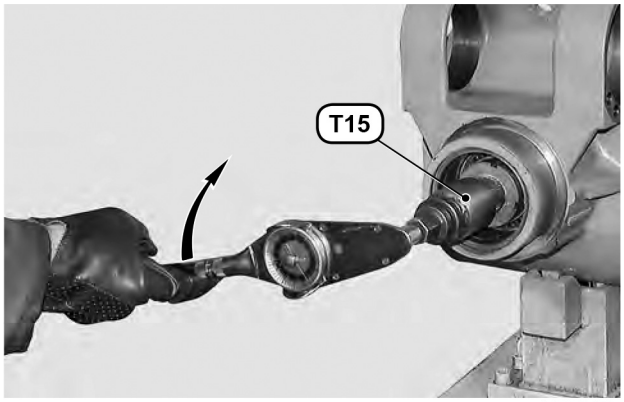

MAP8050

41. **FLANGED GEARBOX VERSION**
    Apply Loctite 270 to the thread of the ring nut (**7**) and screw the nut onto the pinion (**8**).




MAP8060

42. **FLANGED GEARBOX VERSION**
    Apply special wrench (**T16**) to the ring nut (**7**) and bar-hold (**T15**) to the pinion (**8**). Lock the wrench (**T16**) and rotate the pinion using a torque wrench, up to a minimum required torque setting of 900 Nm (663 ft.lb.)




MAP11420

43. **FLANGED GEARBOX VERSION**
    Apply onto the pinion (**8**) the bar-hold and with the help of a torque wrench, check the torque of the pinion (**8**).
    Torque: 1.2 - 2.0 Nm (0.89 - 1.48 ft.lb.)

## ⚠ CAUTION

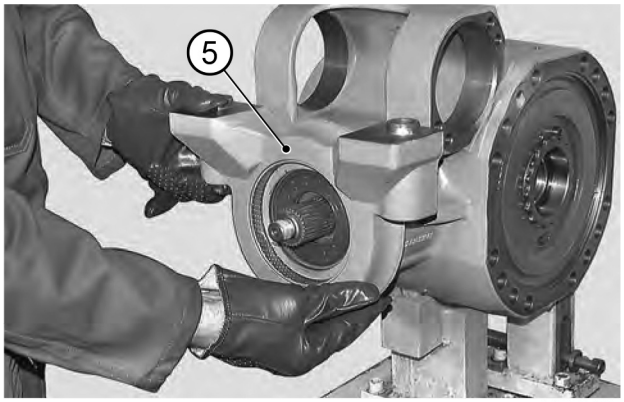
**FLANGED GEARBOX VERSION**

If torque exceeds the maximum value, then the size of shim "S1" (**11**) between the bearing (**13**) and the spacer (**10**) needs to be increased.

If torque does not reach the set value, increase the torque setting of the ring nut (**7**) in different stages to obtain a maximum value of 1000 Nm (737 ft.lb.)

If torque does not reach the minimum value, then the size of shim "S1" (**11**) needs to be reduced.

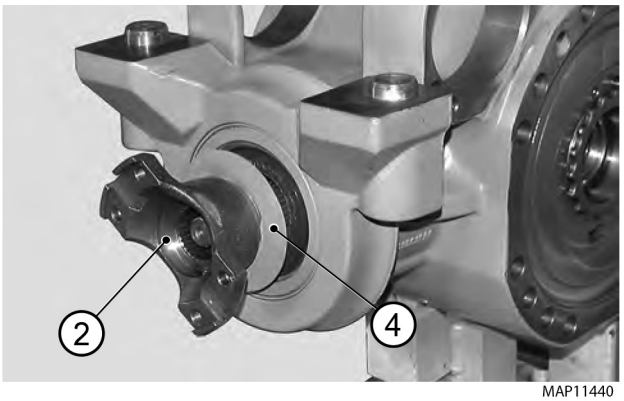
When calculating the increase or decrease in size of shim "S1", bear in mind that a variation of shim (**11**) of 0.01 mm corresponds to a variation of 0.6 Nm (0.44 ft.lb.) in the torque of the pinion (**8**).




MAP11430

44. Install the swinging support (**5**).

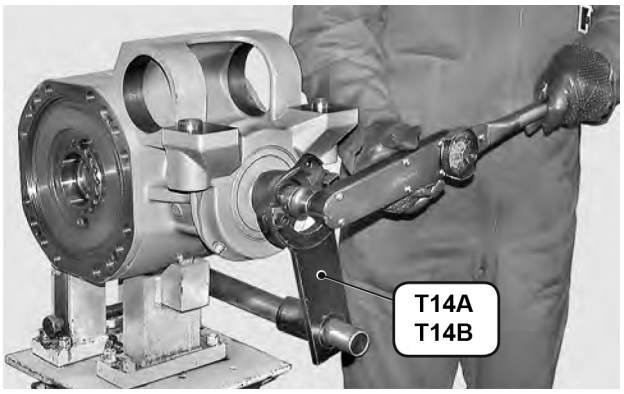
***Note:*** *Check that it is properly oriented.*




MAP11440

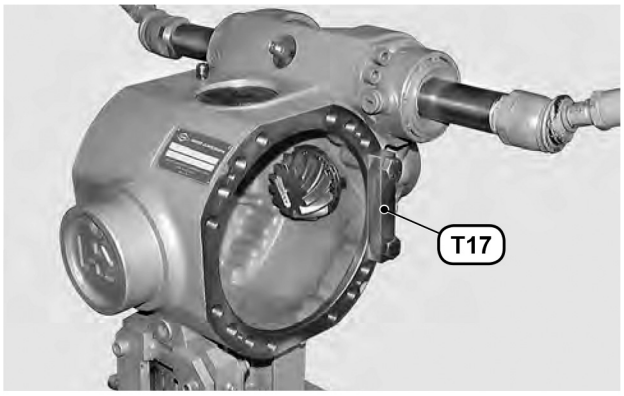
45. Fit the flange (**2**) complete with the guard (**4**) and fasten it.
    For seating the flange (**2**), use a plastic hammer if necessary.

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




MAP11450

46. Apply Loctite 242 to the threaded part of the pinion (**8**). Position tool (**T14A**) or (**T14B**) and fasten it in order to avoid rotation. Insert o-ring (**3**) the nut (**1**) and tighten it using a torque wrench.
    Torque wrench setting:
    280 - 310 Nm (206 - 228 ft.lb.)




MAP11460

47. Remove blocks (**T17**) (used for extracting the pinion) and re-install the arms. For details, see Braking Discs.

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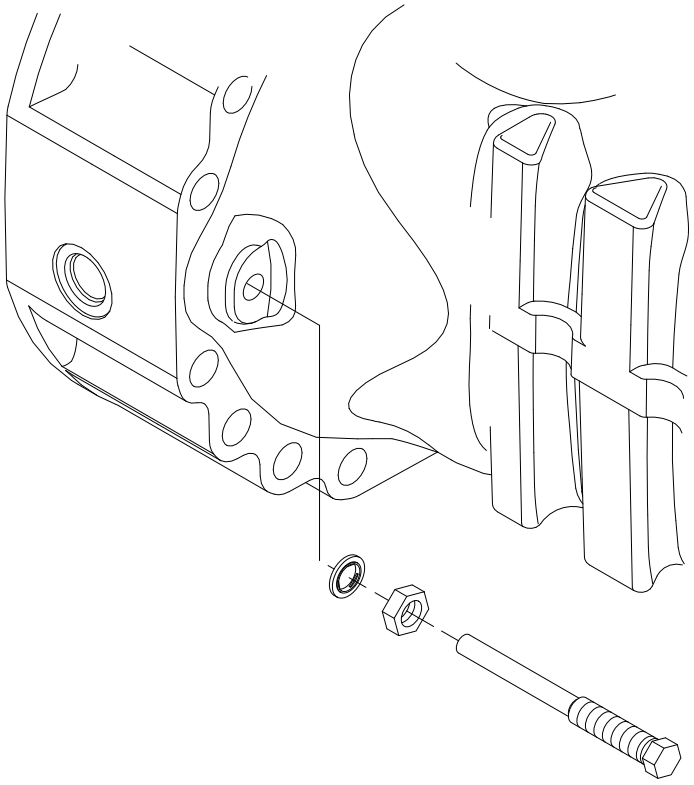
# Section 10
# Manual Emergency Release

## 10.1 EXPLODED VIEW

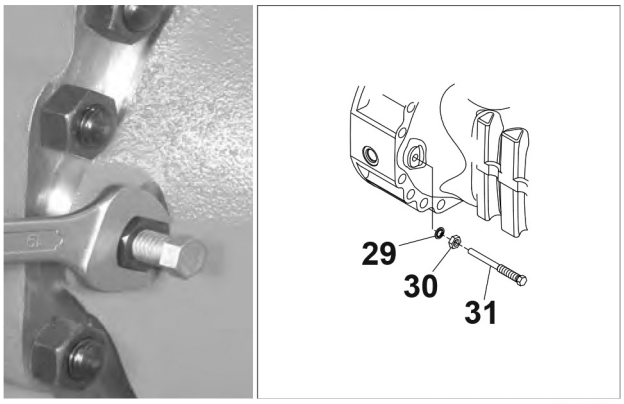


MAP8160

## 10.2 MANUAL EMERGENCY - RELEASE

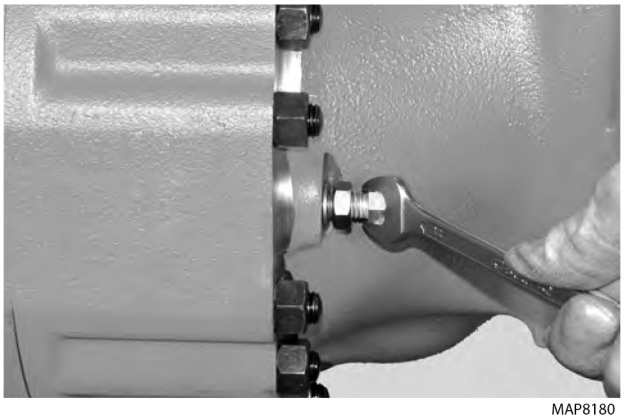
**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.



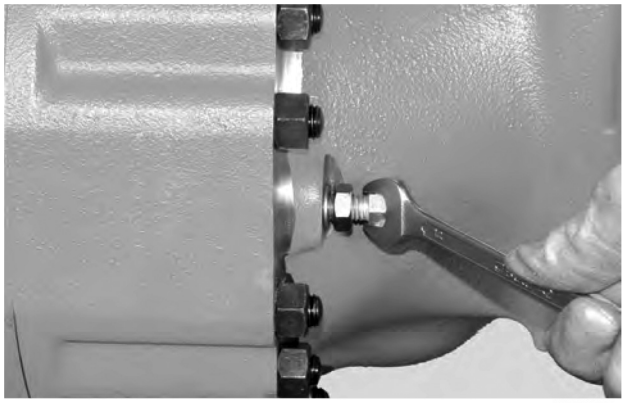

MAP8170

1. Loosen nuts (**30**) of screws (**31**) provided for the mechanical and manual release of the braking units, then move the nuts backwards by approximately 8 mm.



MAP8180

2. Tighten screws (**31**) so as to fasten them onto the pressure plate (**23**).



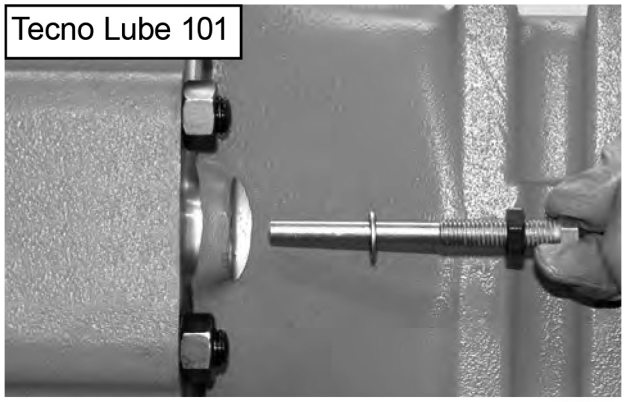
MAP8190

3. Using a wrench, tighten the screws (**31**) in an alternate sequence by 1/4 turn at a time so as to compress the Belleville washers (**29**) and disengage the braking disks.

**CAUTION**

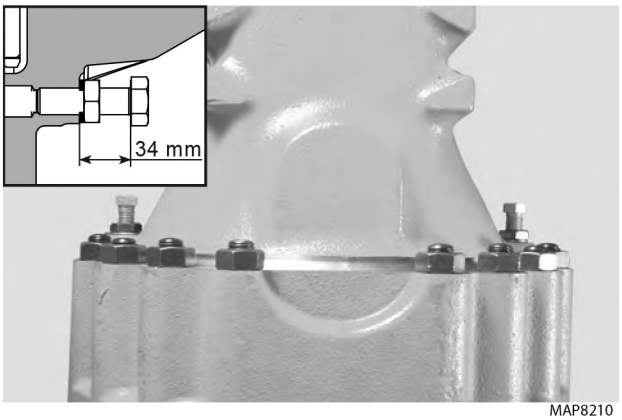
Tighten maximum by one turn.

## 10.3 MANUAL EMERGENCY RELEASE - ADJUST



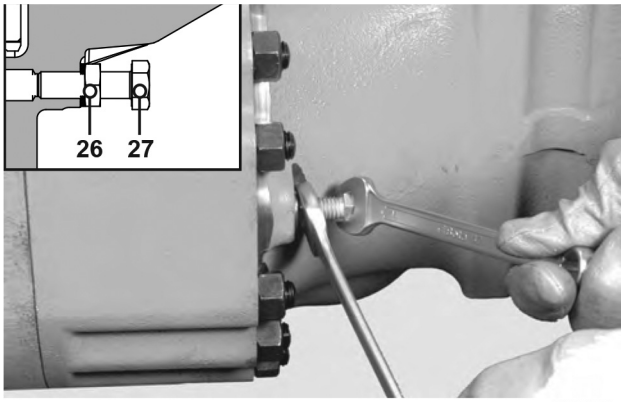

MAP8200

4. Remove screws complete with nuts and seals. Replace seals, apply silicone-based Tecnolube /101 grease to the screws and install all parts into the arm.




MAP8210

5. Adjust screws (**31**) to obtain a distance of 34 ± 0.5 mm between axle machined surface and screw under head.




MAP8220

6. Lock into position with nuts (**30**).

**⚠ CAUTION**

Hold screws (**31**) into position while locking the nuts (**30**); after locking, check the distance of screws (31) once more.

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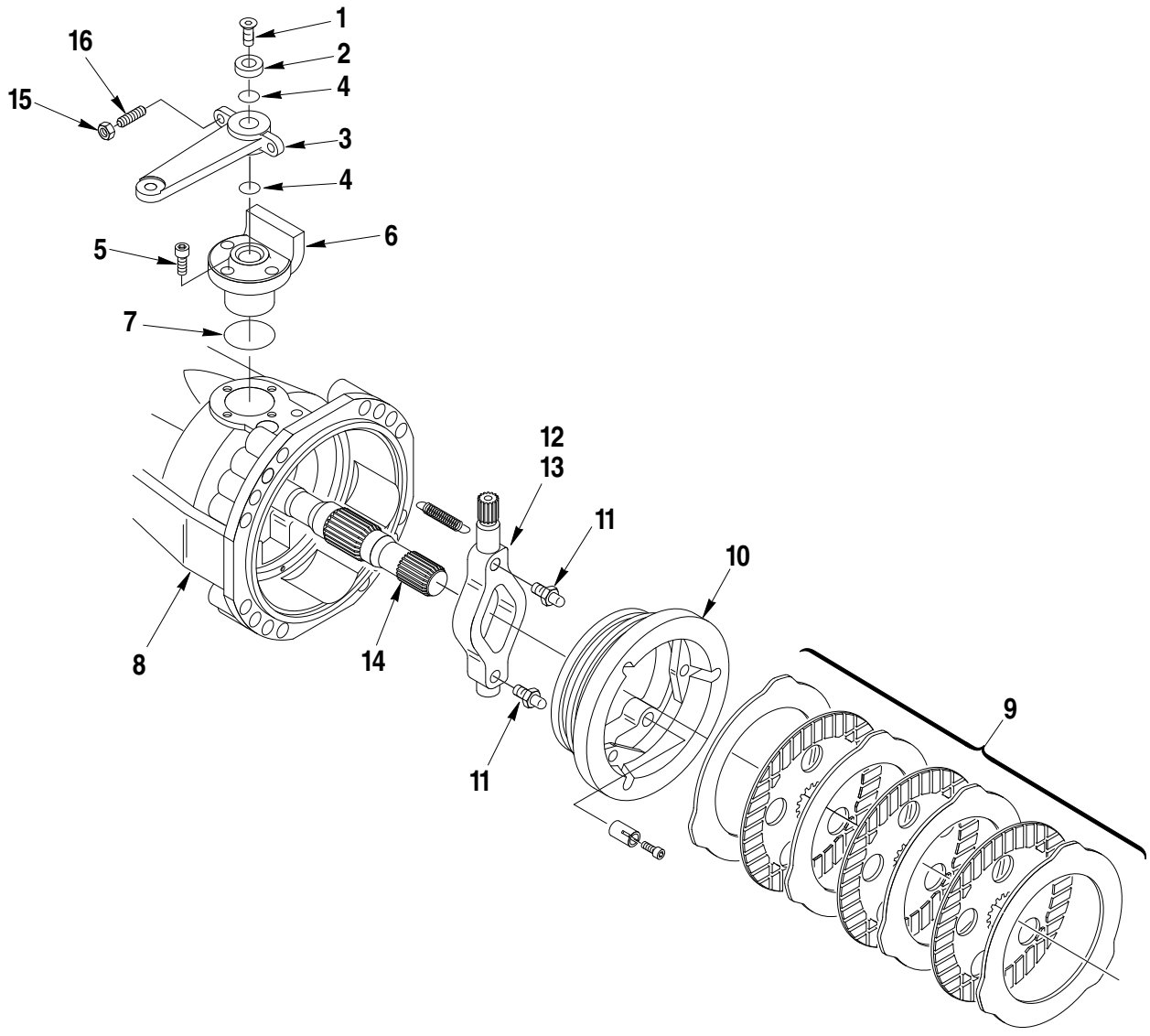
# Section 11
# Mechanical Parking Brake

## 11.1 EXPLODED VIEW




MAP8230

## 11.2 MECHANICAL PARKING BRAKE - DISASSEMBLY

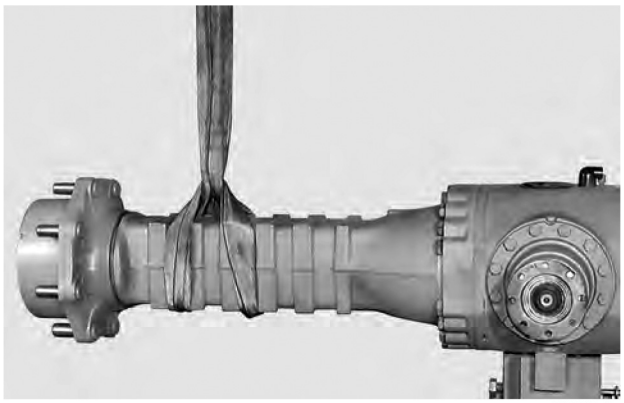
**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

**CAUTION**

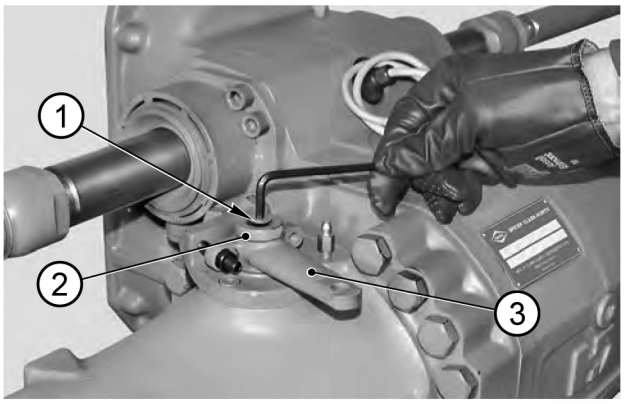
Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.

***Note:*** *Though the photos in this manual refer to a steering and oscillating axle, the operations described apply anyway.*



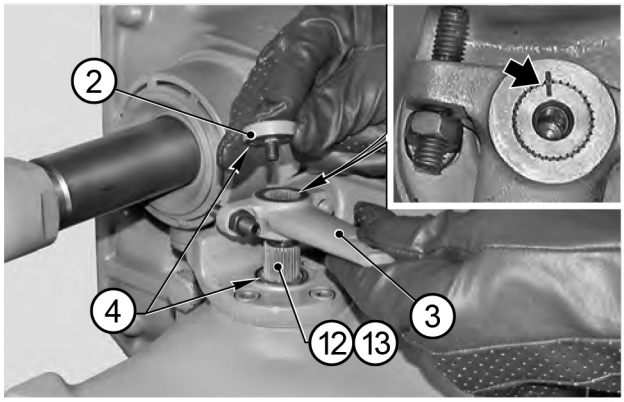
MAP8240

1. Disconnect the steering bars from the steering case. For details, see Complete Steering Case.



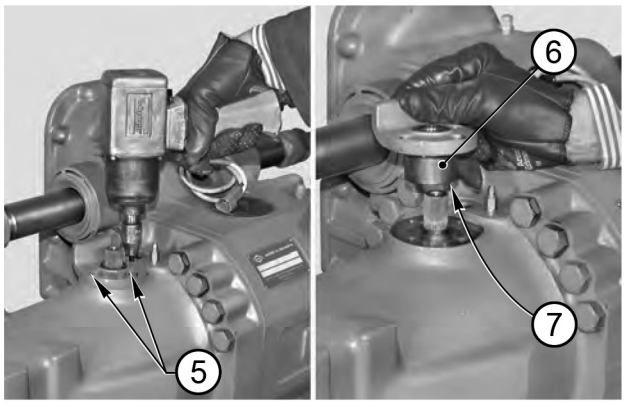

MAP8250

2. Draw out the screw (**1**) locking the washer (**2**) that stops the lever (**3**).



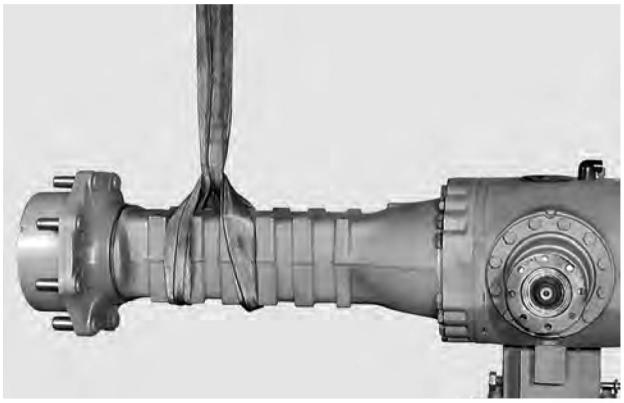

MAP8260

3. Remove washer (**2**), lever (**3**) and o-rings (**4**). Mark the positions of levers (**3**) in relation to the thrust levers (**12**) and (**13**).



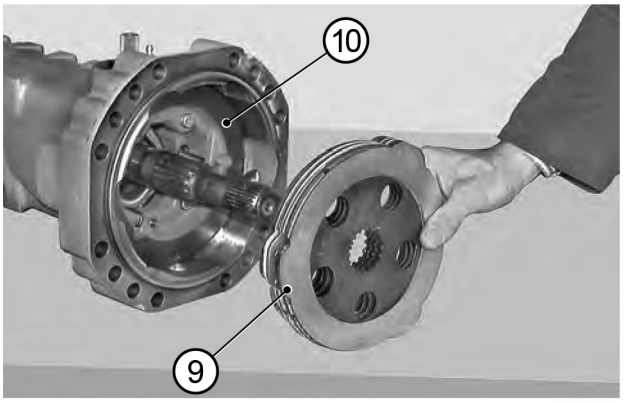

MAP8270

4. Draw out the screws (**5**) and remove bushing (**6**) along with o-ring (**7**).



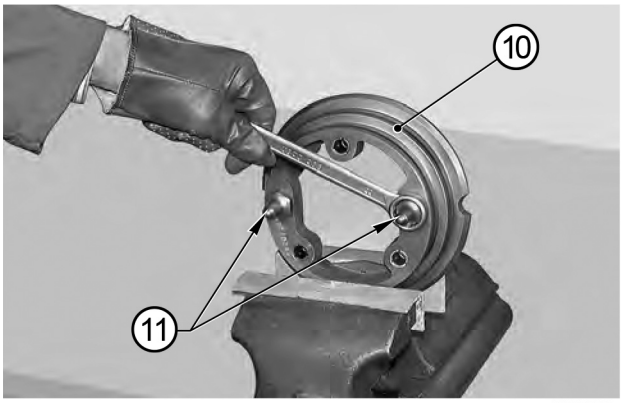
MAP8280

5. Connect the whole arm (**8**) to the hoist and put the rod under light tension.
   Remove the whole arm; for details, see Braking Discs.



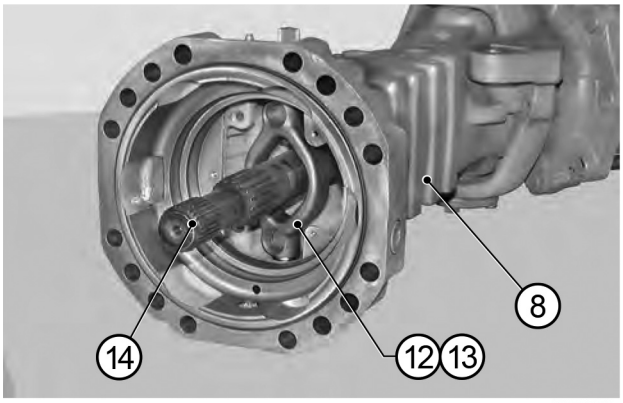

MAP8290

6. Remove the braking disks (**9**) and the whole piston (**10**). For details, see Braking Discs.




MAP8300

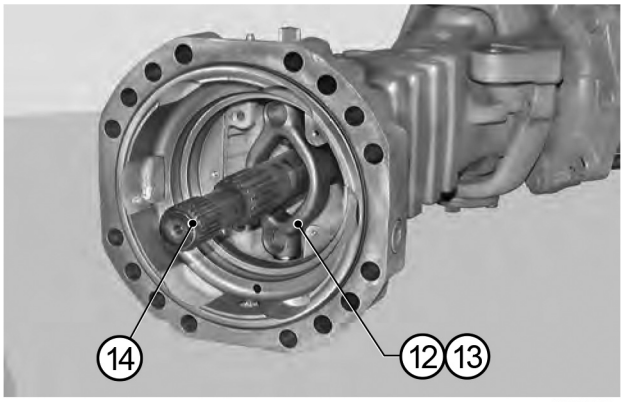
7. If pins (**11**) need replacing, block the piston (**10**) into a vice whose jaws are covered in smooth material and remove the pins.




MAP8310

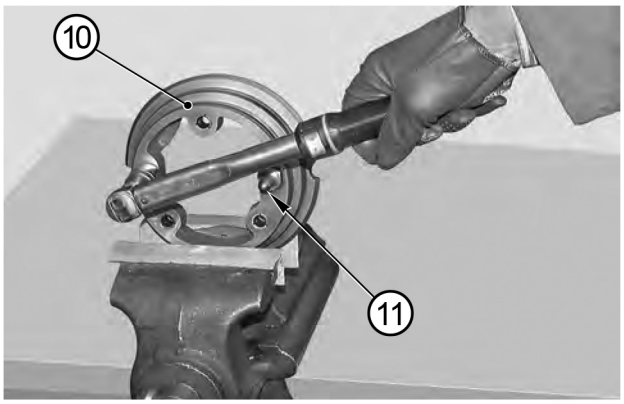
8. If thrust levers (**12**) and (**13**) need replacing, remove the U-joint (**14**) before removing the arms (**8**).
   For details, see Double U-joint.

## 11.3 MECHANICAL PARKING BRAKE - ASSEMBLY



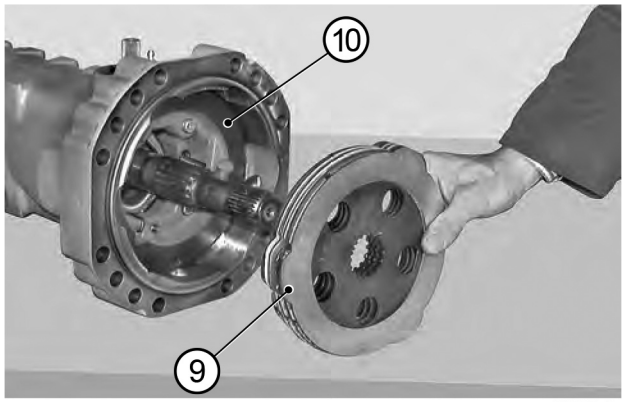

MAP8320

9. Install thrust levers (**12**) and (**13**), then install the U-joint (**14**).
   For details, see Double U-joint.



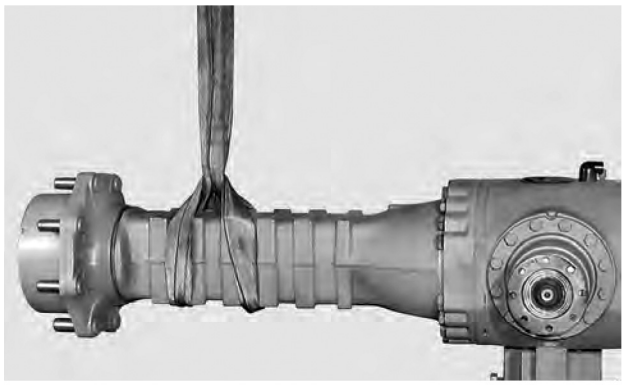

MAP8330

10. Apply Loctite 270 to the threaded portion of the pins (**11**) and fit them onto the piston (**10**). Block them: torque wrench setting 30 - 35 Nm (22.12 - 25.81 ft.lb.)



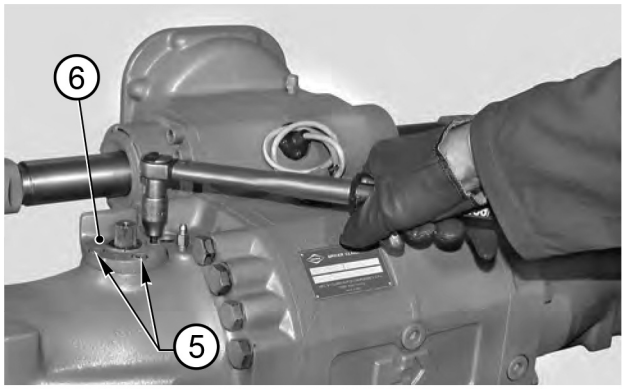

MAP8340

11. Re-install the piston (**10**) and the braking disks (**9**).
    For details, see Braking Discs.



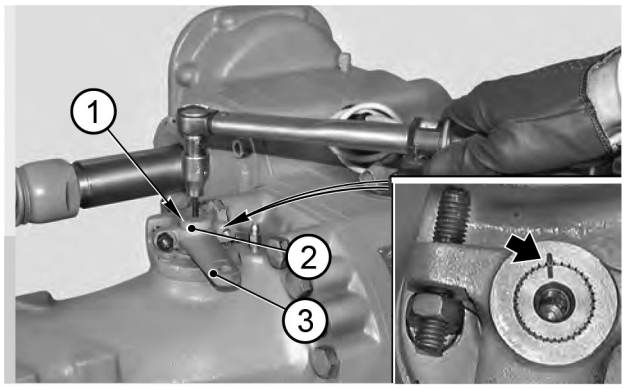
MAP8350

12. Install the arms (**8**) into the main body; check flatness and block arms following the appropriate procedures illustrated in section Mechanical Parking Brake and External Hydraulic Negative Brake.




MAP8360

13. Install the bushing (**6**) complete with o-ring (**7**) and block it with screws (**5**). Tighten screws with a torque wrench setting of 23.8 - 26.2 Nm (17.56 - 19.32 ft.lb.)

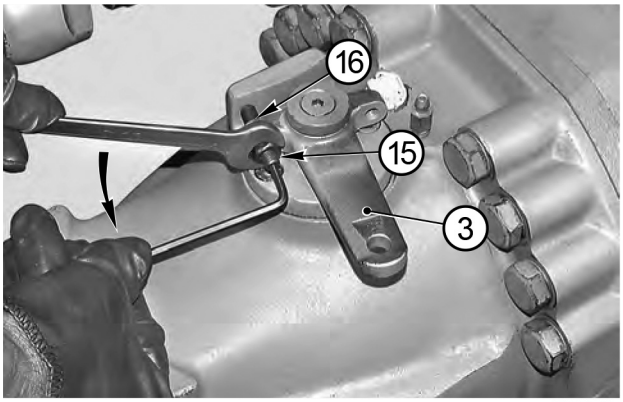



MAP8370

14. Install in sequence the lower o-ring (**4**), the lever (**3**) and the washer (**2**) with the relative o-ring (**4**). Block with screw (**1**) and tighten using a torque wrench setting of 23.8 - 26.2 Nm (17.56 - 19.32 ft.lb.)

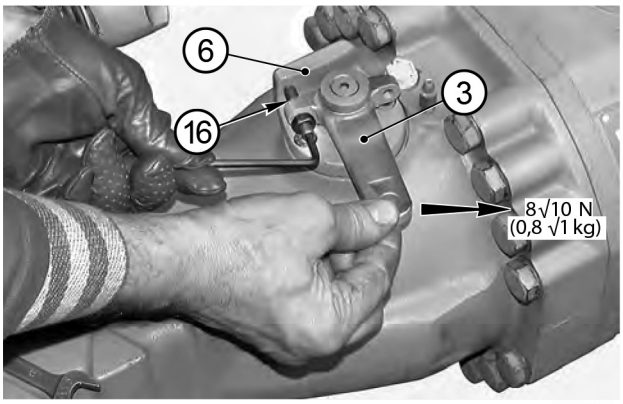
**⚠ CAUTION**

Refer and keep to the positions marked during disassembly.



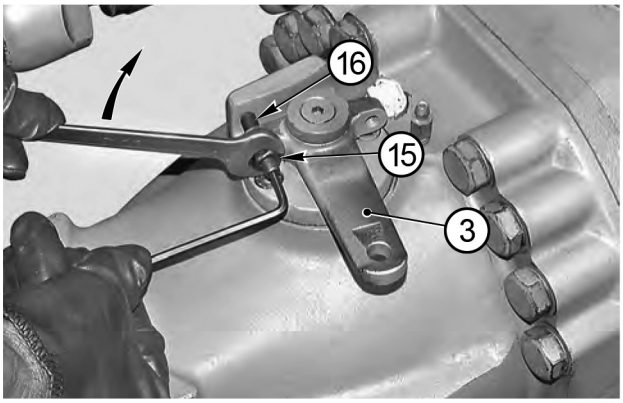

MAP8380

15. Connect the braking circuit and apply maximum working pressure to set the disks.
Release the pressure, loosen nut (**15**) and unscrew stud (**16**) by a few turns.




MAP8390

16. Apply a force of 8 - 10 N (0.8 - 1 kg) to lever (**3**). Direct the force towards the braking direction in order to eliminate the idle stroke.
While the force is being applied, tighten stud (**16**) until it is caused to rest onto bushing (**6**).



MAP8400

17. Lock stud (**16**) in this position with nut (**15**). Torque wrench setting: 20 - 25 Nm (14.76 - 18.43 ft.lb.)

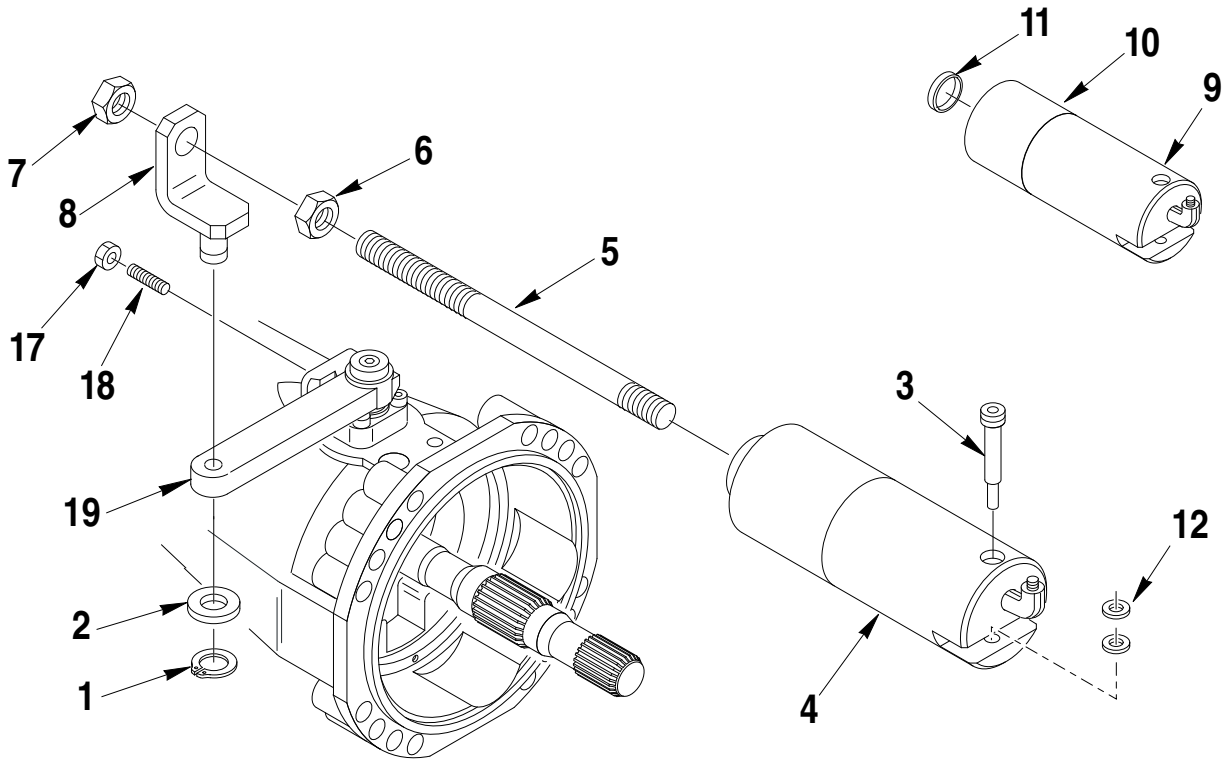
**CAUTION**

The idle stroke should be eliminated without preloading thrust levers (**12**) and (**13**).

18. After connecting the control cable, check that when brakes are released both studs (**16**) do lean against bushing (**6**).

# Section 12
# External Hydraulic Negative Brake

## 12.1 EXPLODED VIEW




MAP8410

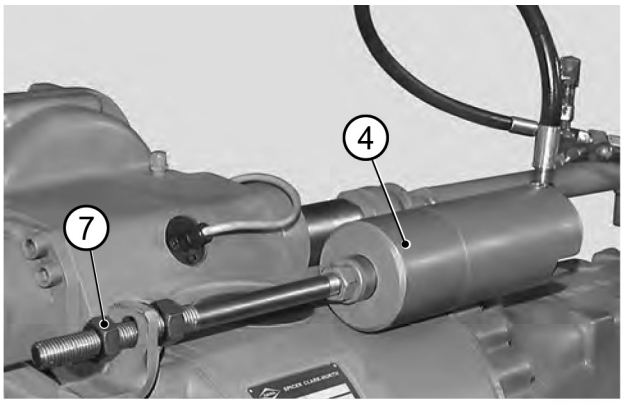
## 12.2 EXTERNAL HYDRAULIC NEGATIVE BRAKE - DISASSEMBLY

**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

**CAUTION**

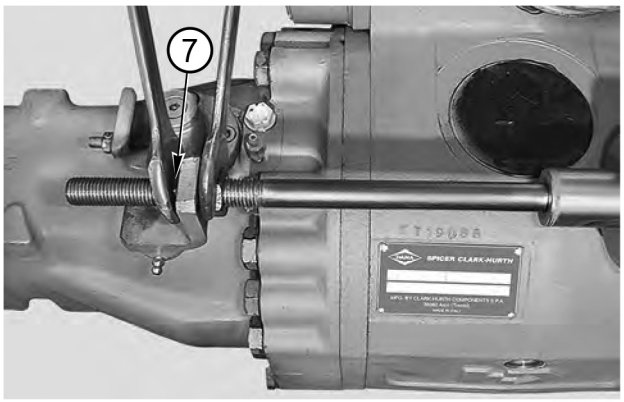
Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP8420

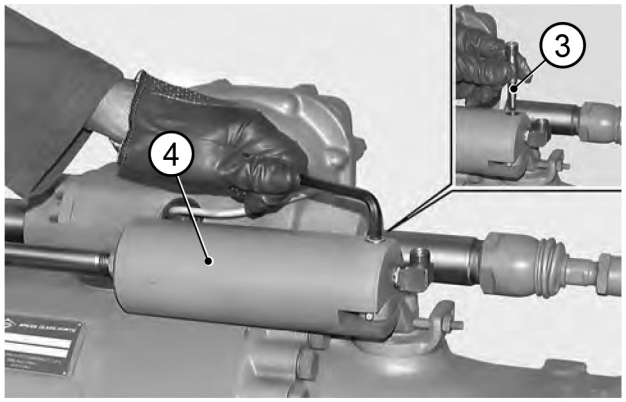
1. Insert pressure into cylinder (**4**) in order to release the brakes.

***Note:*** *If the machine hydraulic system cannot be used, use an external manual pump.*



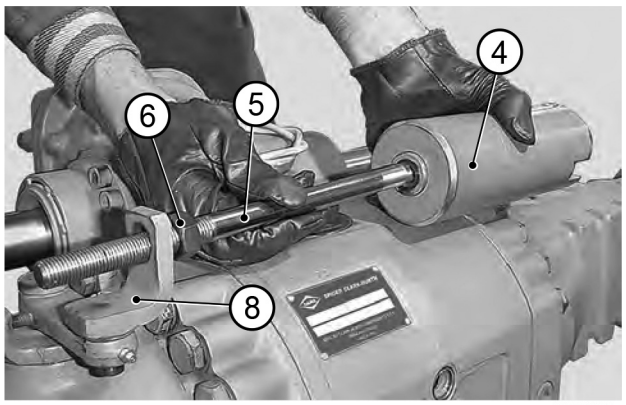

MAP8430

2. Loosen and remove the external nut (**7**).



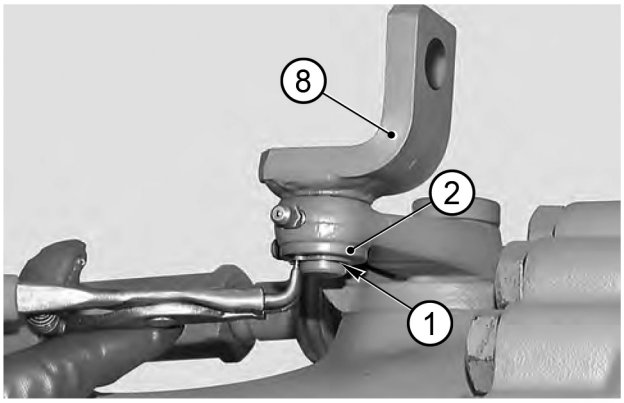

MAP8440

3. Release the pressure in the cylinder and disconnect the pressure delivery tube.
4. Remove the fulcrum pin (**3**) from the cylinder (**4**) complete with washers (**12**).




MAP8450

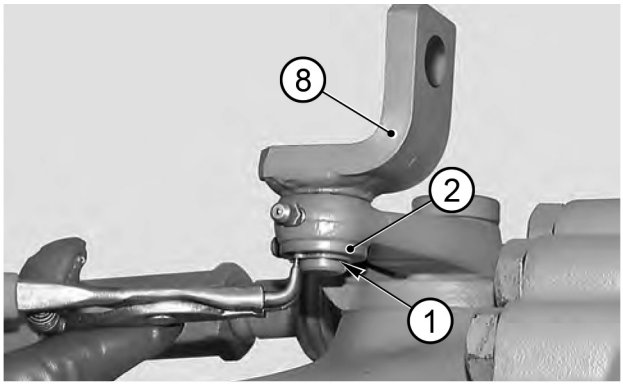
5. Remove the cylinder assembly (**4**) complete with rod (**5**), internal nut (**6**) and support (**8**).




MAP8460

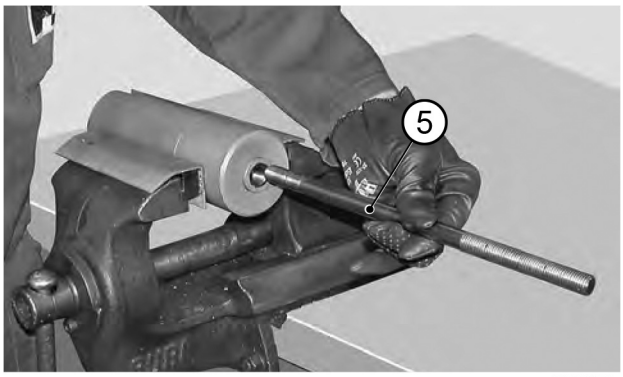
6. Remove the snap ring (**1**) that checks the support (**8**) and remove the spacer (**2**).

## 12.3 EXTERNAL HYDRAULIC NEGATIVE BRAKE - ASSEMBLY



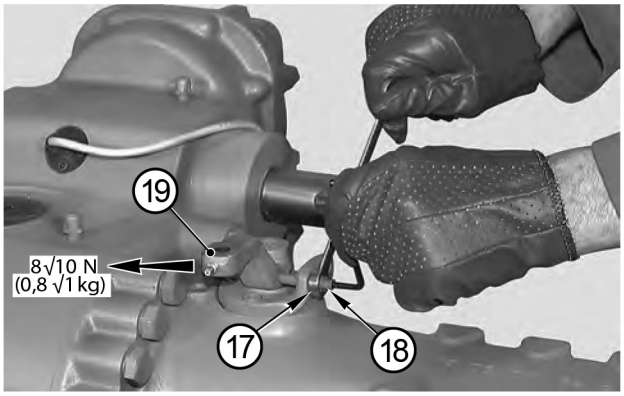

MAP8470

7. Install spacer (**2**) and insert the pin of support (**8**) into the right-hand braking lever. Fit the second spacer (**2**) and snap ring (**1**).




MAP8480

8. Apply Loctite 270 to the rod (**5**) and screw it in the piston (**13**) as far as it will go.

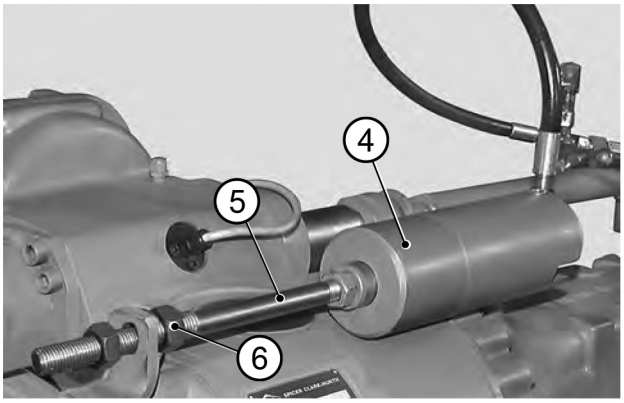



MAP8490

9. Loosen nuts (**17**) and set braking levers (**19**) clearances to zero by turning studs (**18**); lock nuts (**17**) with a torque wrench setting of 20 - 25 Nm (14.76 - 18.43 ft.lb.)

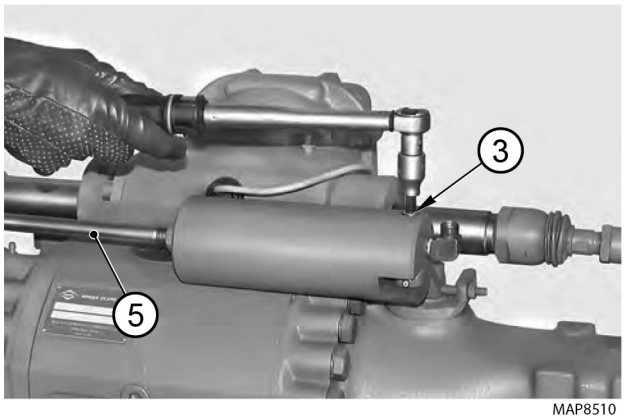
**CAUTION**

Clearances should be set to zero without causing any preloading.



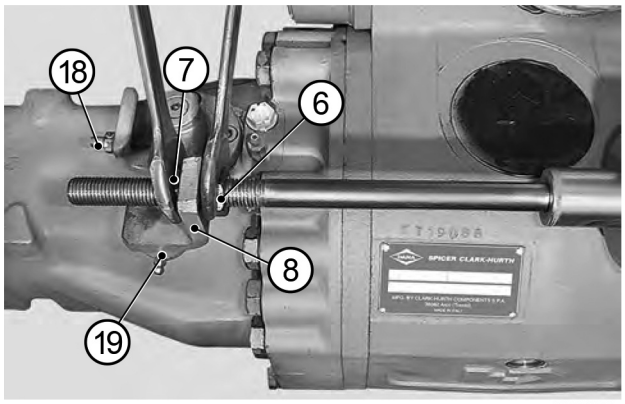

MAP8500

10. Install cylinder (**4**) complete with rod (**5**) and internal nut (**6**).



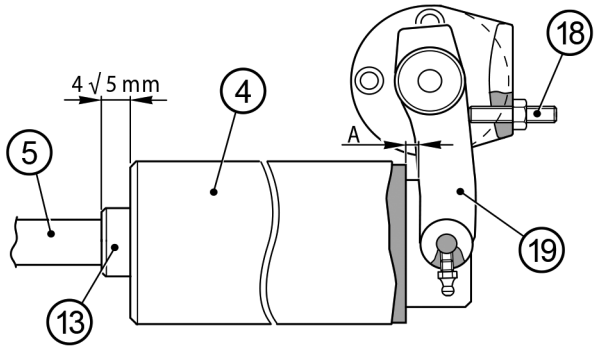

MAP8510

11. Center the hole of fulcrum pin (**3**) and washers (**12**). Apply Loctite 242 to the pin thread, screw and tighten pin with a torque wrench set at 25 - 30 Nm (18.43 - 22.12 ft.lb.)




MAP8520

12. Introduce pressure into the cylinder (**4**) and while holding both levers (**19**) back against the adjusting screws (**18**), move nuts (**6**) and (**7**) so that they are made to rest against support (**8**); lock the nuts with a torque wrench setting of 50 - 60 Nm (36.88 - 44.26 ft.lb.)




MAP8530

13. Check that, when the brakes are released (pressure inserted), levers (**19**) lean against the screws (**18**) without pre-stressing them and make sure that a clearance “A” is left between cylinder (**4**) and lever (**19**). Also check that when pressure is released, piston (**13**) projects out by 4 - 5 mm.

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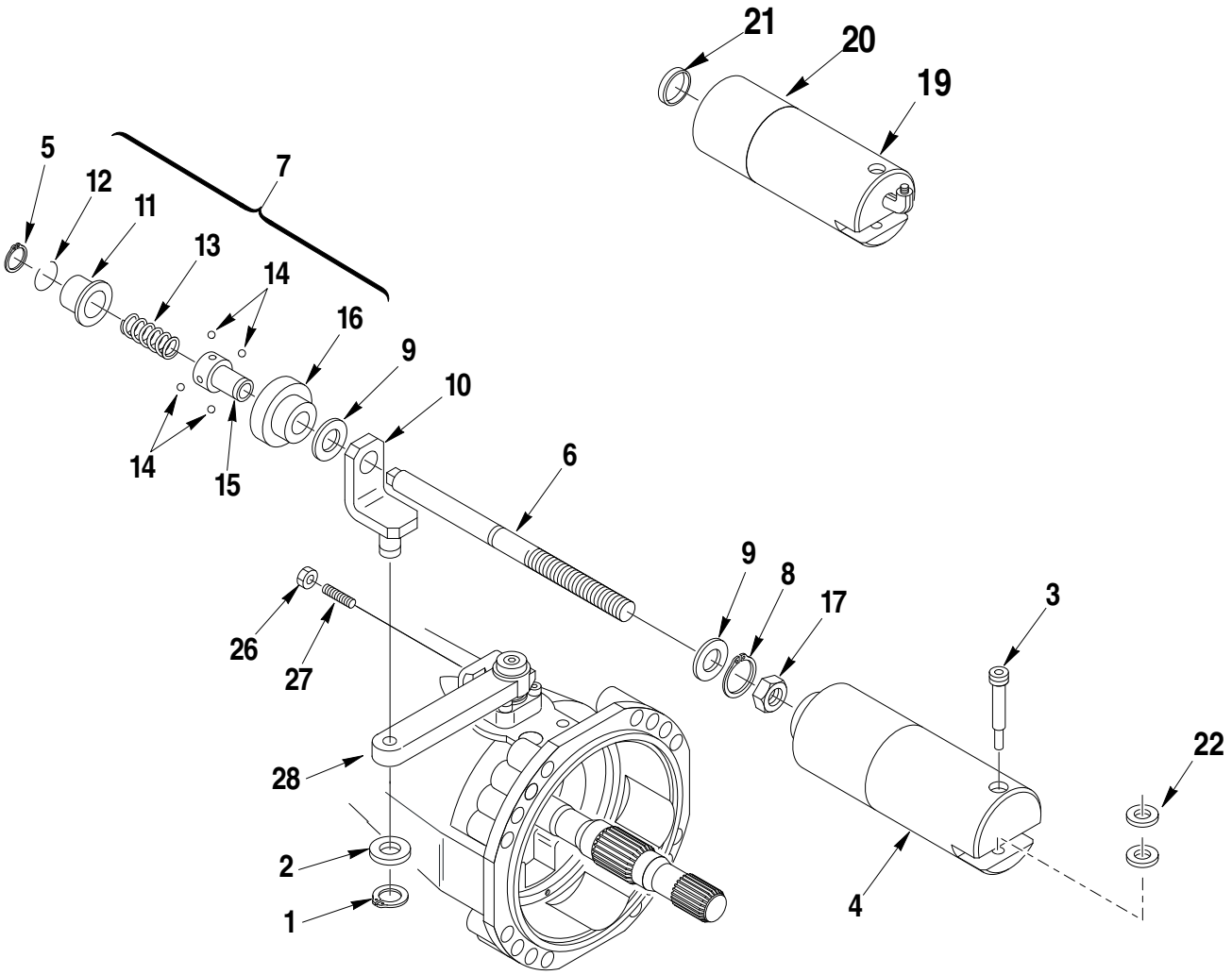
# Section 13
# External Hydraulic Negative Brake With Quick Release

## 13.1 EXPLODED VIEW




MAP8540

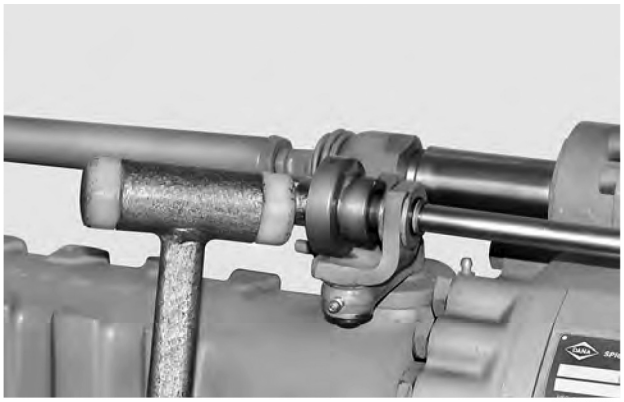
## 13.2 EXTERNAL HYDRAULIC NEGATIVE BRAKE WITH QUICK RELEASE - DISASSEMBLY

**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

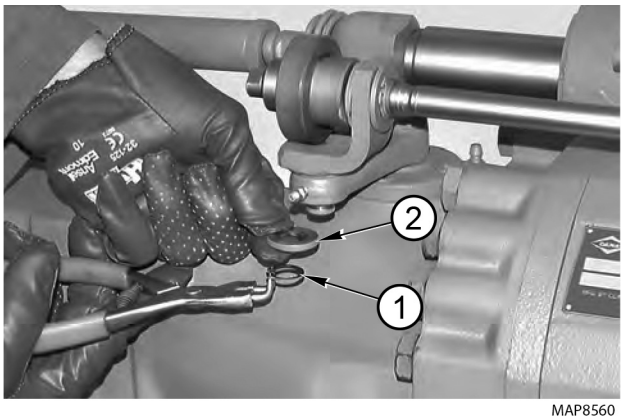
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



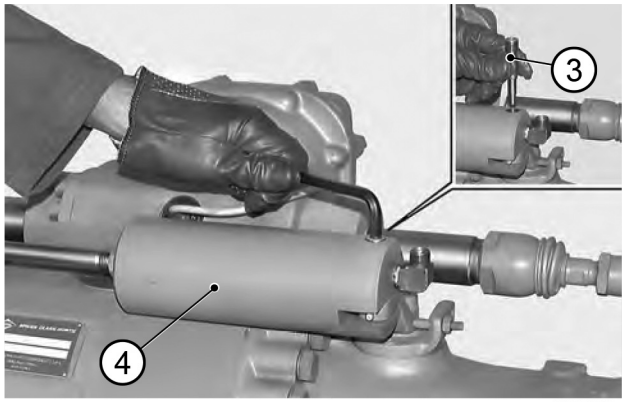
MAP8550

1. Before starting any operation on the assembly, disable the cylinder by giving a light hammer blow to the external ring of the check unit.



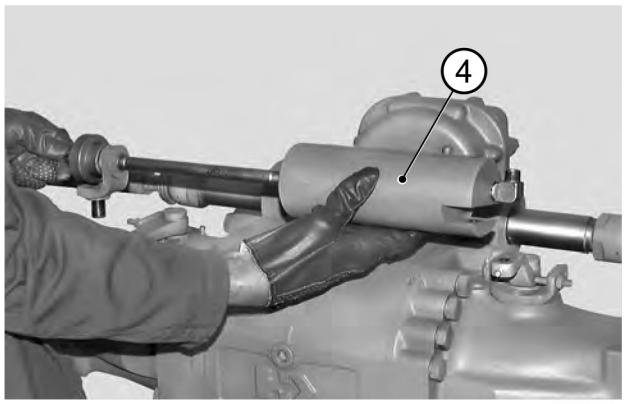

MAP8560

2. Remove snap ring (**1**) and extract spacer (**2**).



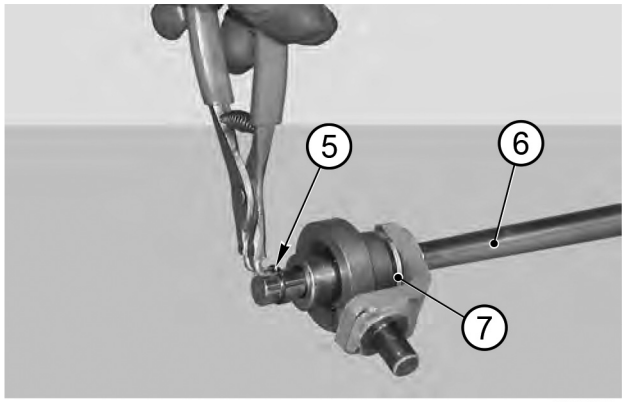

MAP8570

3. Remove the fulcrum pin (**3**) from the cylinder (**4**) complete with washers (**22**).



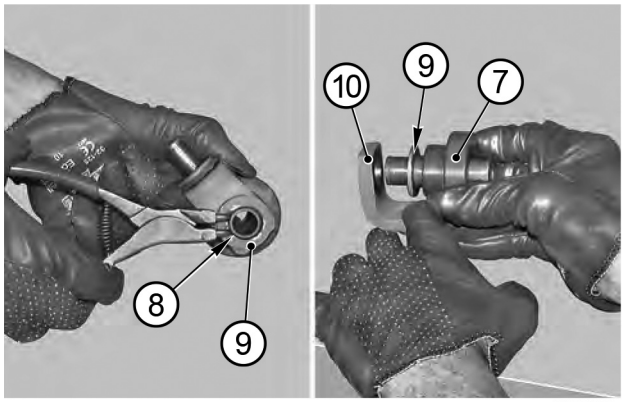

MAP8580

4. Remove the complete cylinder set (**4**).



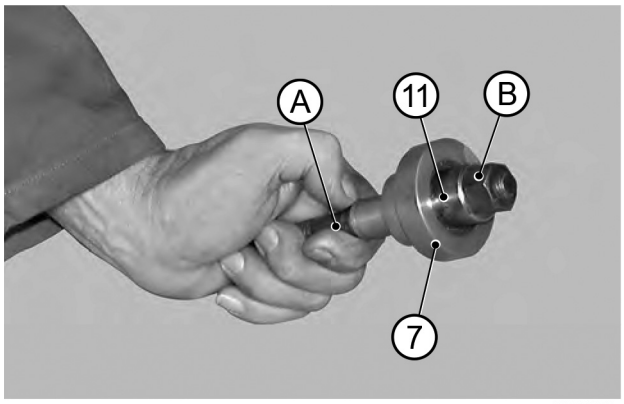

MAP8590

5. Remove snap ring (**5**) from stem (**6**) and extract the check unit (**7**).




MAP8600

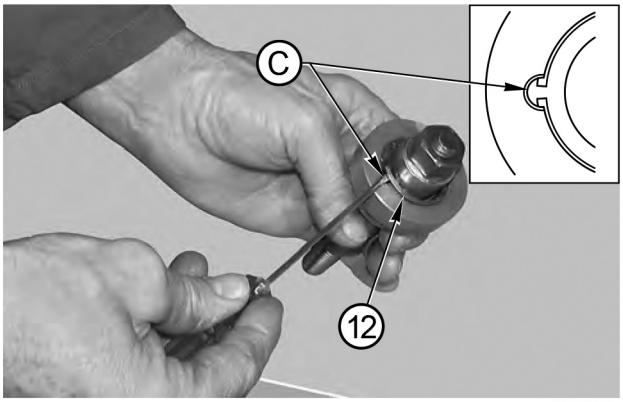
6. Remove snap ring (**8**) and washer (**9**) and separate support (**10**) and second washer (**9**) from the check unit (**7**).




MAP8610

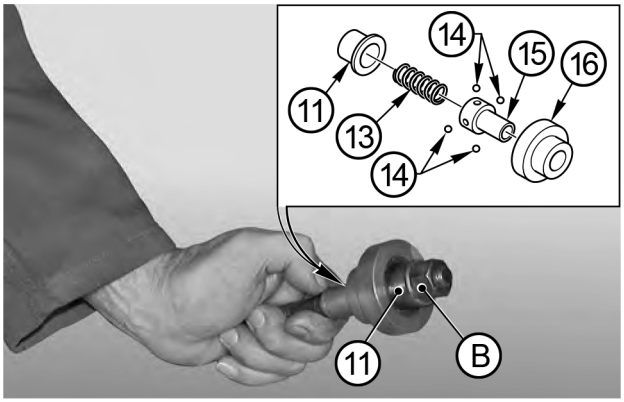
7. Introduce a M14x100 screw (**A**) into the hole of the check unit (**7**) and screw a nut (**B**) until the spring seat (**11**) is moved to the end of stroke.

***Note:*** *Use a hex bolt.*



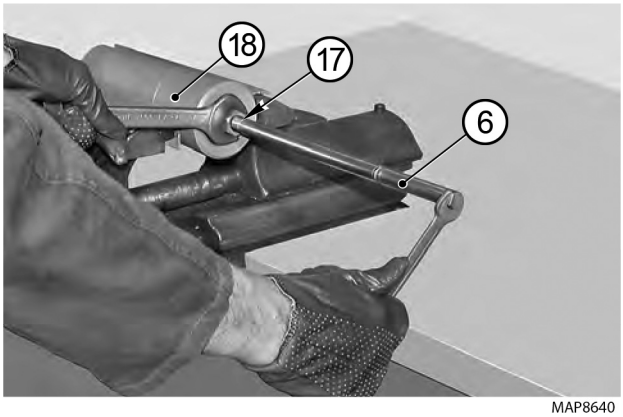

MAP8620

8. Rotate snap ring (**12**) until ring ends match slot (**C**).
9. Remove snap ring (**12**).




MAP8630

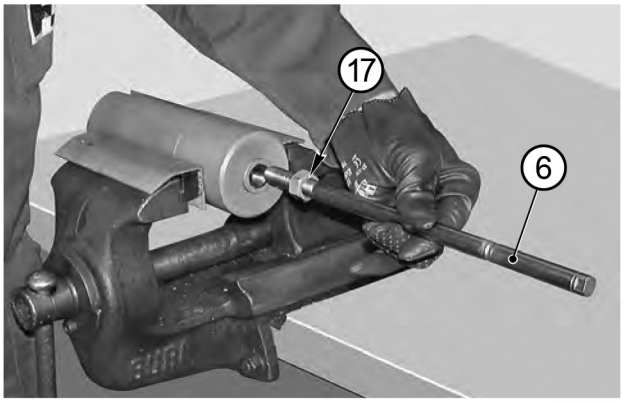
10. Slowly release nut (**B**) and disassemble the check unit.




MAP8640

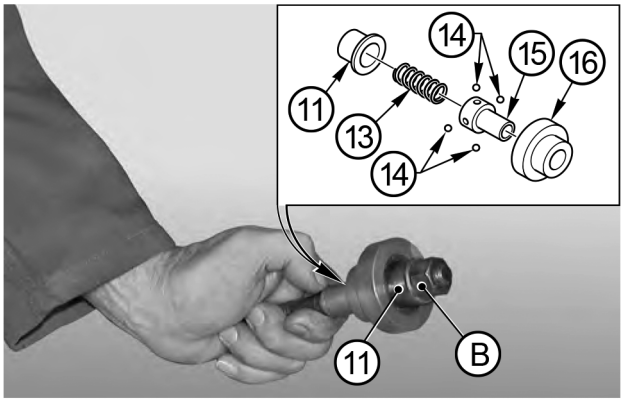
11. Loosen nut (**17**) and remove stem (**6**) from the cylinder (**18**).

## 13.3 EXTERNAL HYDRAULIC NEGATIVE BRAKE WITH QUICK RELEASE - ASSEMBLY



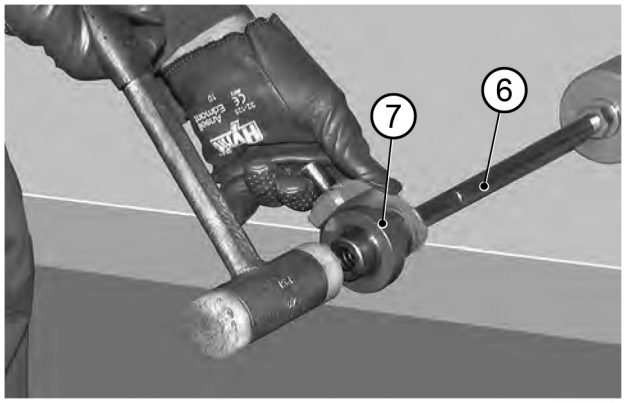

MAP8650

12. Screw stem (**6**) into the piston without locking the nut (**17**).



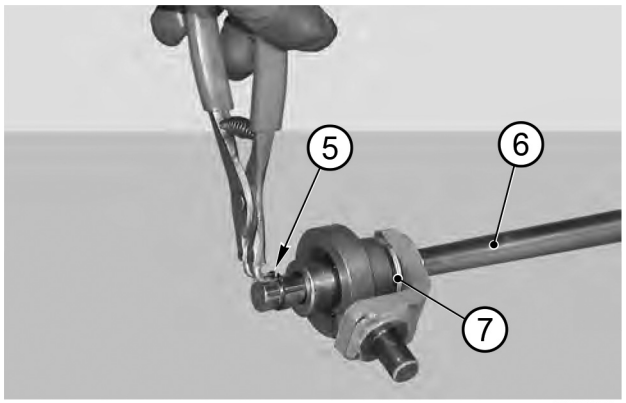

MAP8660

13. Assemble the check unit (**7**) by inverting the steps followed in the disassembly procedure.




MAP8670

14. Using a plastic hammer, install the check unit (**7**) onto the stem (**6**).

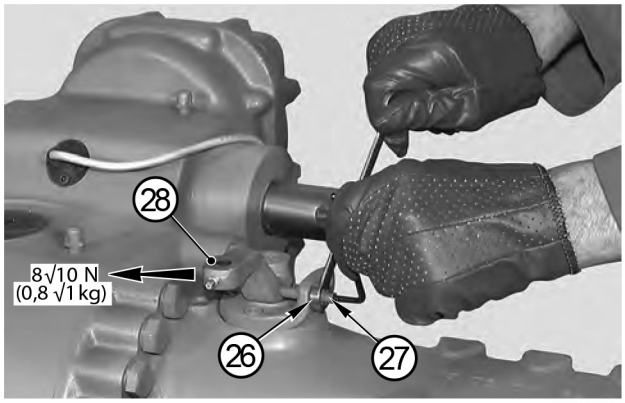



MAP8680

15. Fit the safety snap ring (**5**) onto the stem (**6**).

**⚠ CAUTION**

In case the braking disks have been replaced or if brake pistons have been removed: before adjusting the negative braking unit, apply the brakes several times at maximum pressure in order to set clearances.

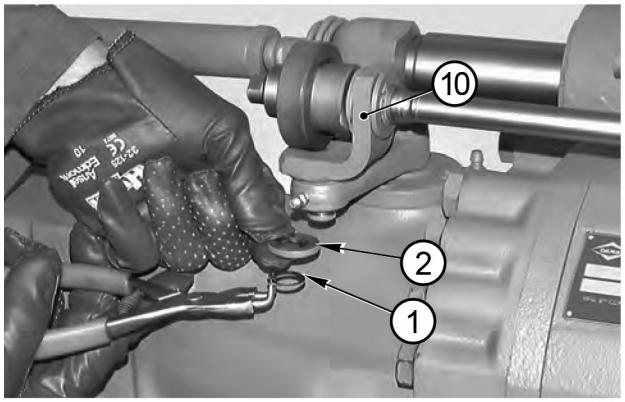



MAP8690

16. Loosen nuts (**26**) and apply a force of 8 - 10 N (0.8 - 1 kg) to levers (**28**). Direct the force towards the braking direction to eliminate the clearances by using studs (**27**); lock nuts (**26**) to a torque wrench setting of 20 - 25 Nm (14.76 - 18.43 ft.lb.)

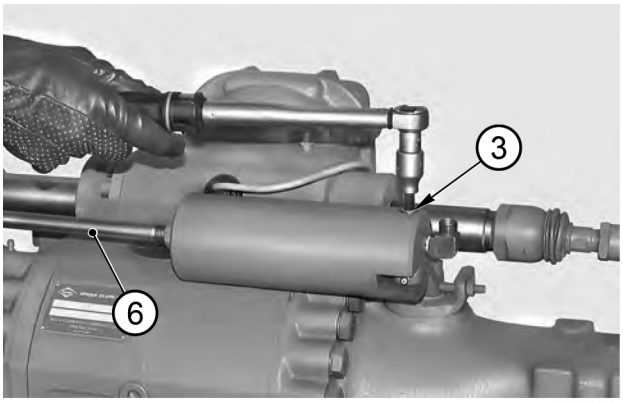
**⚠ CAUTION**

The idle stroke should be eliminated without causing any pre-loading.



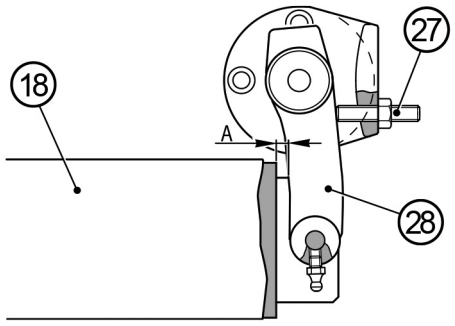

MAP8700

17. Fit the spacer (**2**) and insert the pin of support (**10**) in the right-hand braking lever. Fit the snap ring (**1**).



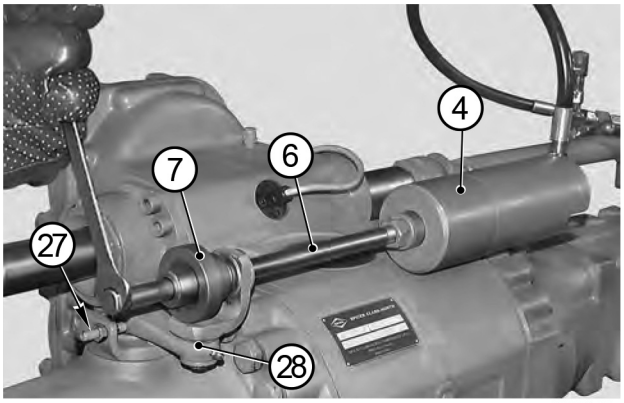

MAP8710

18. Rotate stem (**6**) to center the hole of the fulcrum pin (**3**).
19. Apply Loctite 242 to the thread of the fulcrum pin (**3**), screw and tighten pin with a torque wrench set to 25 - 30 Nm (18.43 - 22.12 ft.lb.)



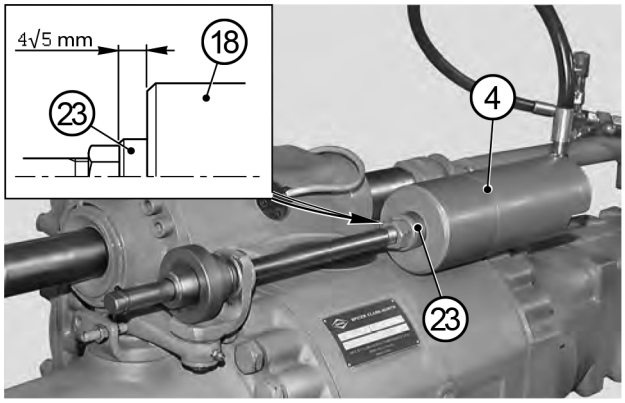

MAP8720

20. Check that a clearance “A” is left between the lever (**28**) on the cylinder side (resting against the adjustment stud) and cylinder (**18**).
21. If necessary, remove the lever, turn it by one tooth in relation to the spline and repeat idle stroke elimination procedure.



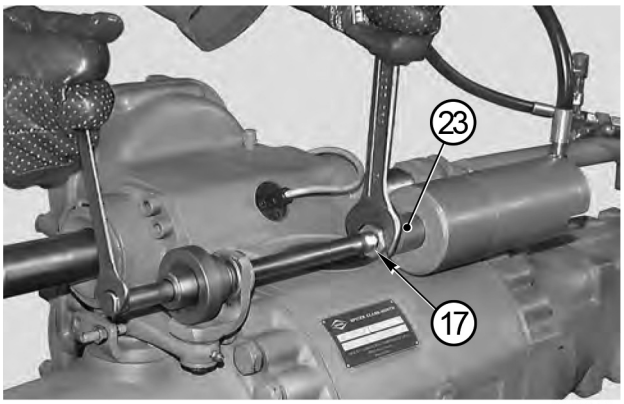

MAP8730

22. Introduce pressure into the cylinder (**4**) and, with the levers (**28**) resting against the adjustment studs (**27**), screw rod (**6**) to engage the quick release (**7**) in the slot.



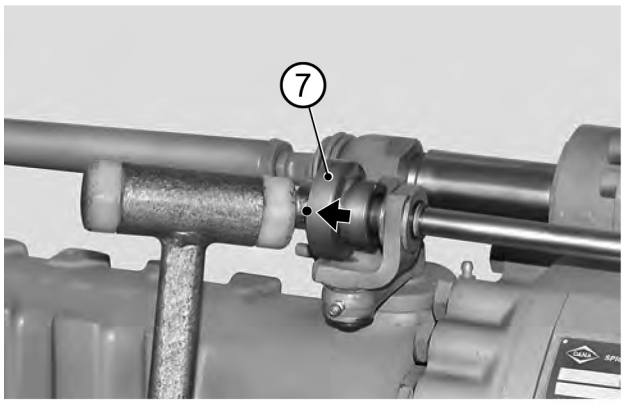

MAP8750

25. Release the pressure and check that piston (**23**) returns and stops in a position where it projects out from the cylinder head (**4**) by 4 - 5 mm.




MAP8740

23. Lock nut (**17**) in position against the stem of the piston (**23**).
24. Torque wrench setting for the nut: maximum 40 Nm (29.50 ft.lb.)

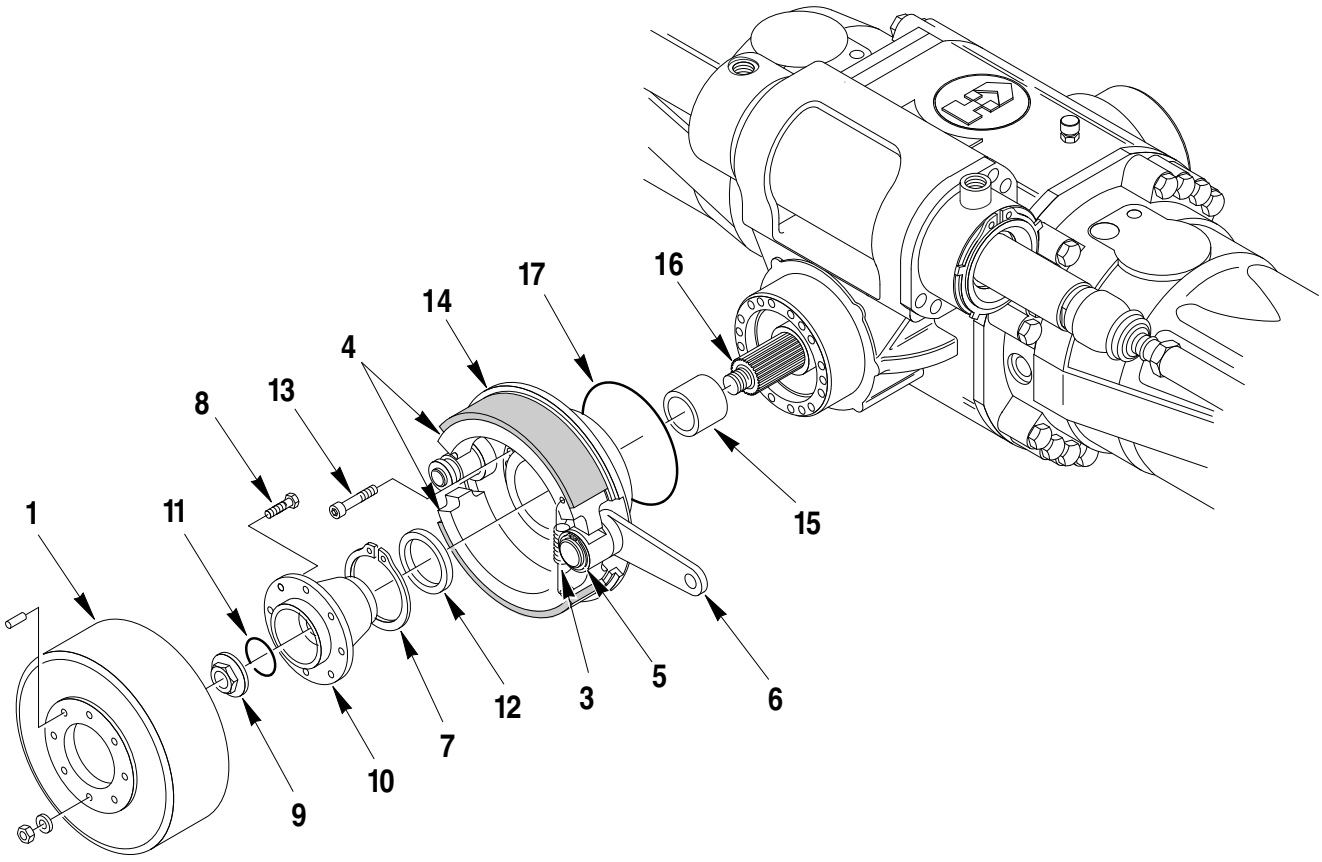



MAP8760

26. Release the check unit (**7**) by giving a hammer blow to the external ring.
27. Introduce pressure again and check that at the end of piston stroke, the check unit (**7**) is actually engaged onto the rod (**6**).

# Section 14
# Incoming Drum Brake

## 14.1 EXPLODED VIEW




MAP8770

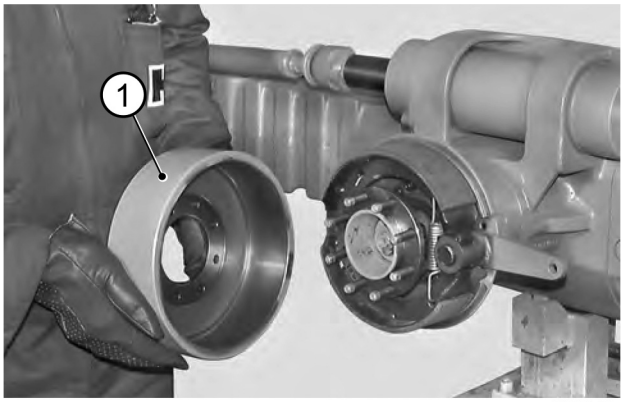
## 14.2 INCOMING DRUM BRAKE - DISASSEMBLY

**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.

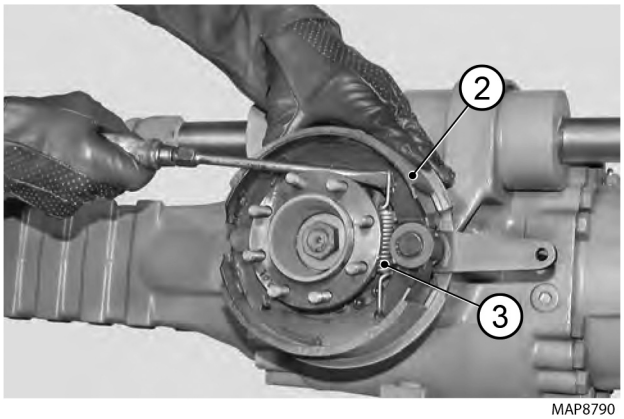



MAP8780

1. Pull out the drum (**1**) and remove dust from friction surfaces.

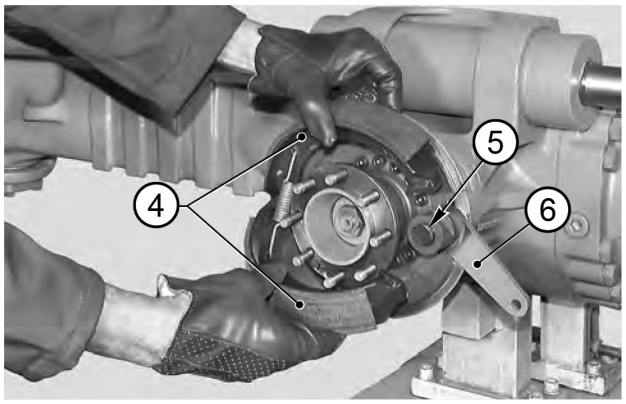
**CAUTION**

Use only brush-type vacuum cleaners.



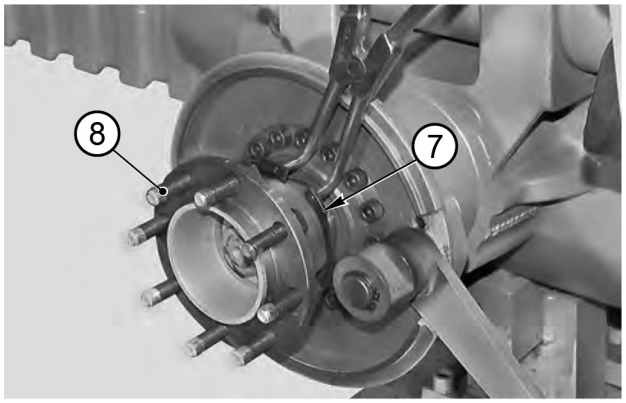

MAP8790

2. Hold the upper shoe into position (**2**) and release the spring (**3**).



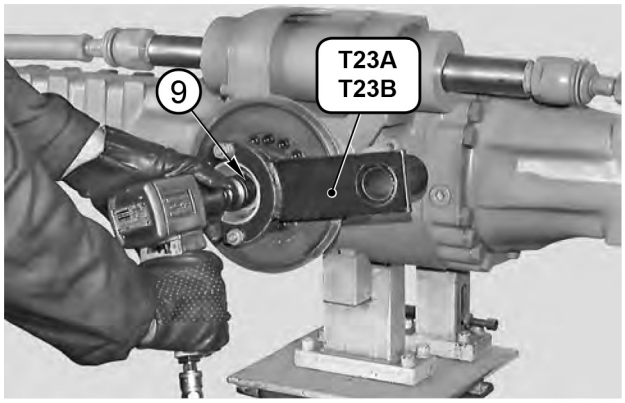

MAP8800

3. Remove the shoe assembly (**4**).
4. If necessary, remove the snap ring (**5**) and pull out the lever (**6**).



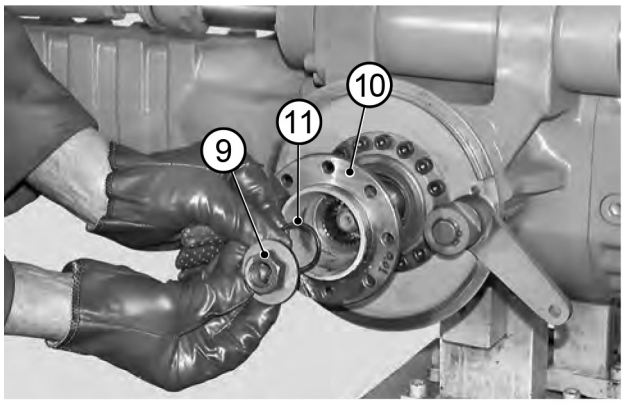

MAP8810

5. Remove the snap ring (**7**) from its seat around the screws (**8**).
6. Remove the screws (**8**).



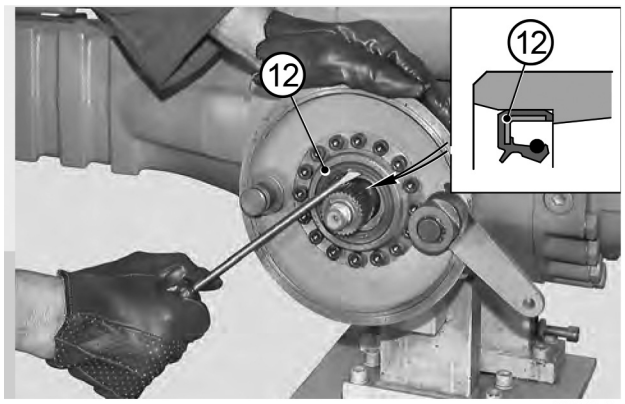

MAP8820

7. Fit tool (**T23A**) or (**T23B**), engage the stop rod and loosen the check nut (**9**) of the flange (**10**).




MAP8830

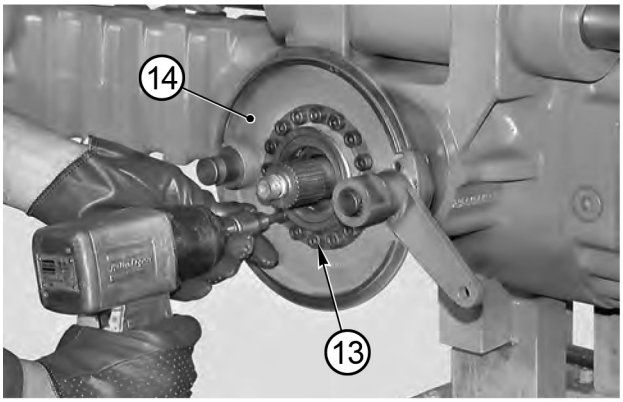
8. Remove parts in the following sequence: nut (**9**), o-ring (**11**), flange (**10**) and stop ring (**7**).




MAP8840

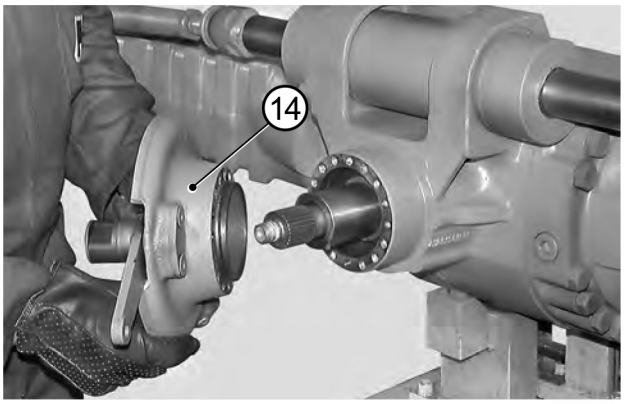
9. Remove the seal (**12**) and discard it.

***Note:*** *Write down assembly direction.*



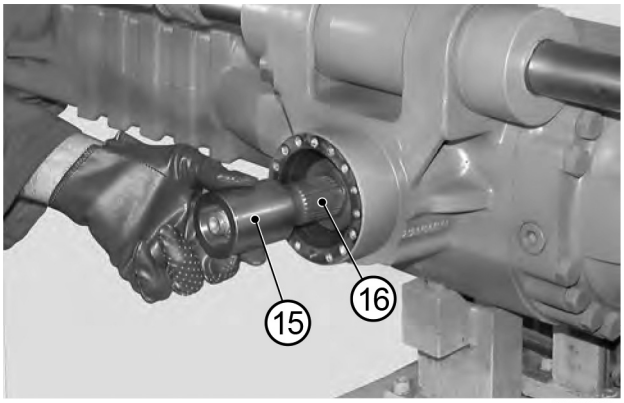

MAP8850

10. Remove the securing screws (**13**) from brake support (**14**).




MAP8860

11. Remove brake support (**14**).

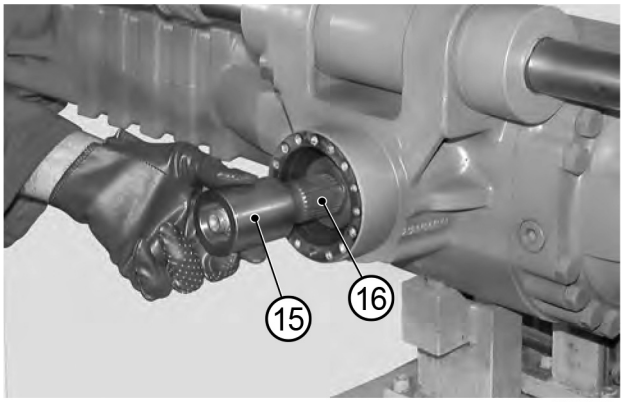



MAP8870

12. Remove the spacer (**15**).

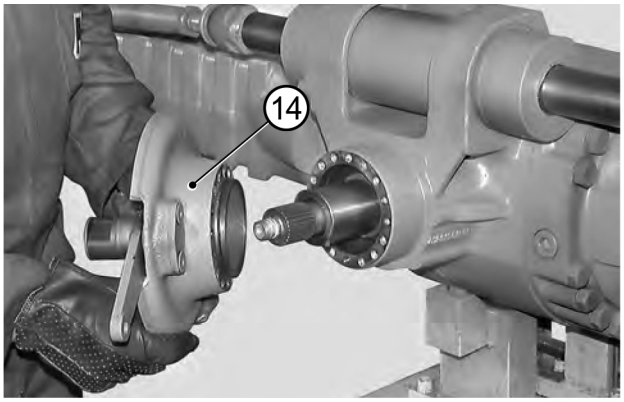
***Note:*** *If operations are to be carried out the bevel pinion, see the specific axle section.*

## 14.3 INCOMING DRUM BRAKE- ASSEMBLY



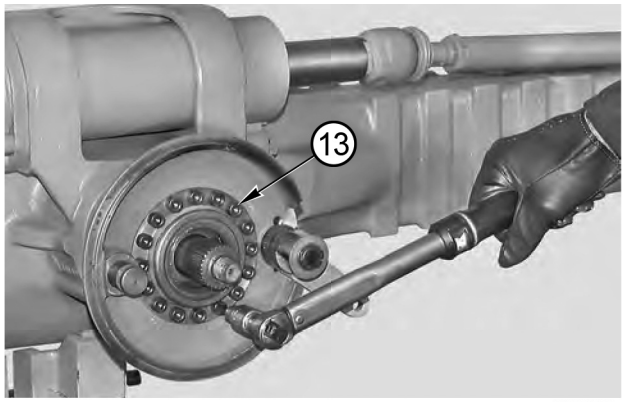

MAP8880

1. Fit the spacer (**15**) onto the pinion (**16**).



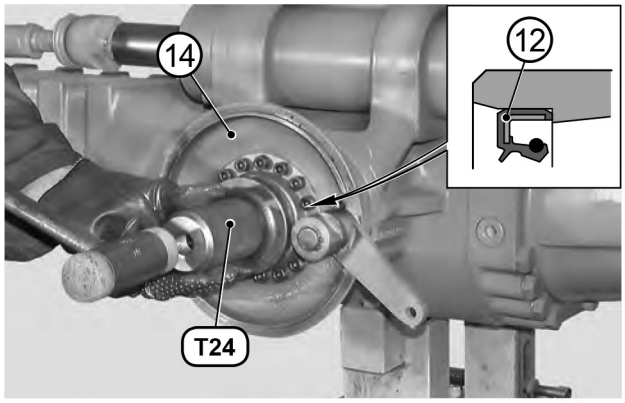

MAP8890

2. Lubricate the coupling surfaces and position brake support (**14**).
3. Check that the o-ring (**17**) is intact.




MAP8900

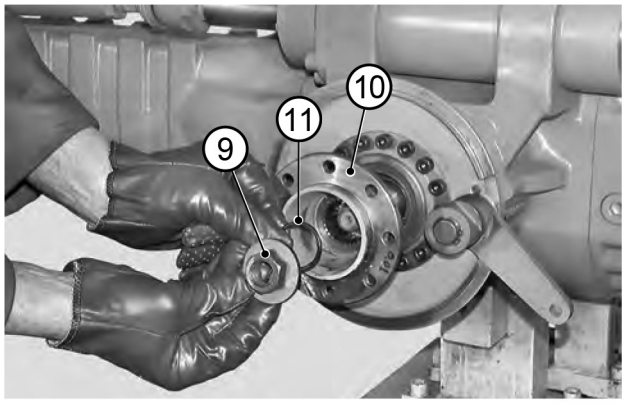
4. Apply Loctite 242 to the screws (**13**) and tighten using the criss-cross method. Torque wrench setting: 34.2 - 37.8 Nm (25.22 - 27.88 ft.lb.)




MAP8910

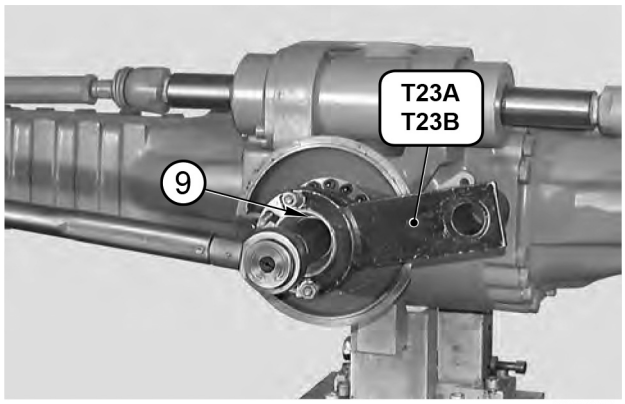
5. Lubricate the outer part of the seal (**12**) and insert it into the brake support (**14**) using tool (**T24**).

***Note:*** *Carefully check assembly direction.*



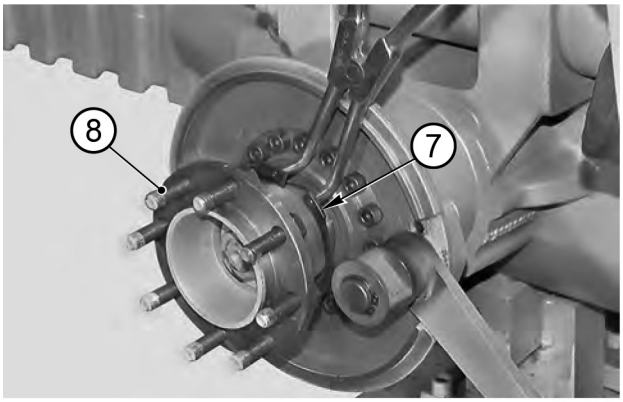
MAP8920

6. Install parts in the following sequence: flange (**10**), o-ring (**11**) and nut (**9**).
7. Spread Loctite 242 on the threaded portion of the pinion (**16**).



MAP8930

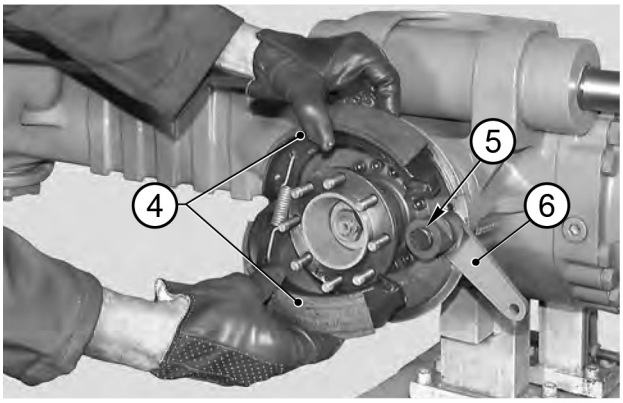
8. Fit tools (**T23A**) or (**T23B**), engage the stop rod and tighten the nut (**9**).
   Torque wrench setting:
   280 - 310 Nm (206.51 - 228.64 ft.lb.)



MAP8940

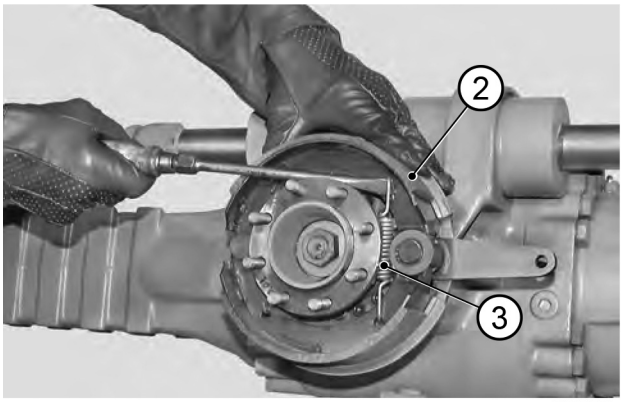
9. Insert the screws (**8**) and hold them in position with the snap ring (**7**).

***Note:*** *Make sure that the ring is properly set in its seat.*



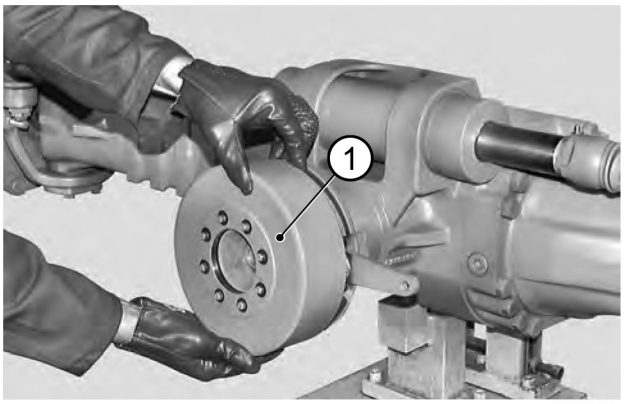
MAP8950

10. If the lever (**6**) has been removed, install it and hold it in position with the snap ring (**5**).
11. Fit the shoes assembly (**4**).




MAP8960

12. Make sure that the shoes (**4**) center the slot of the fulcrum pin and rest on the surface of the lever (**6**).



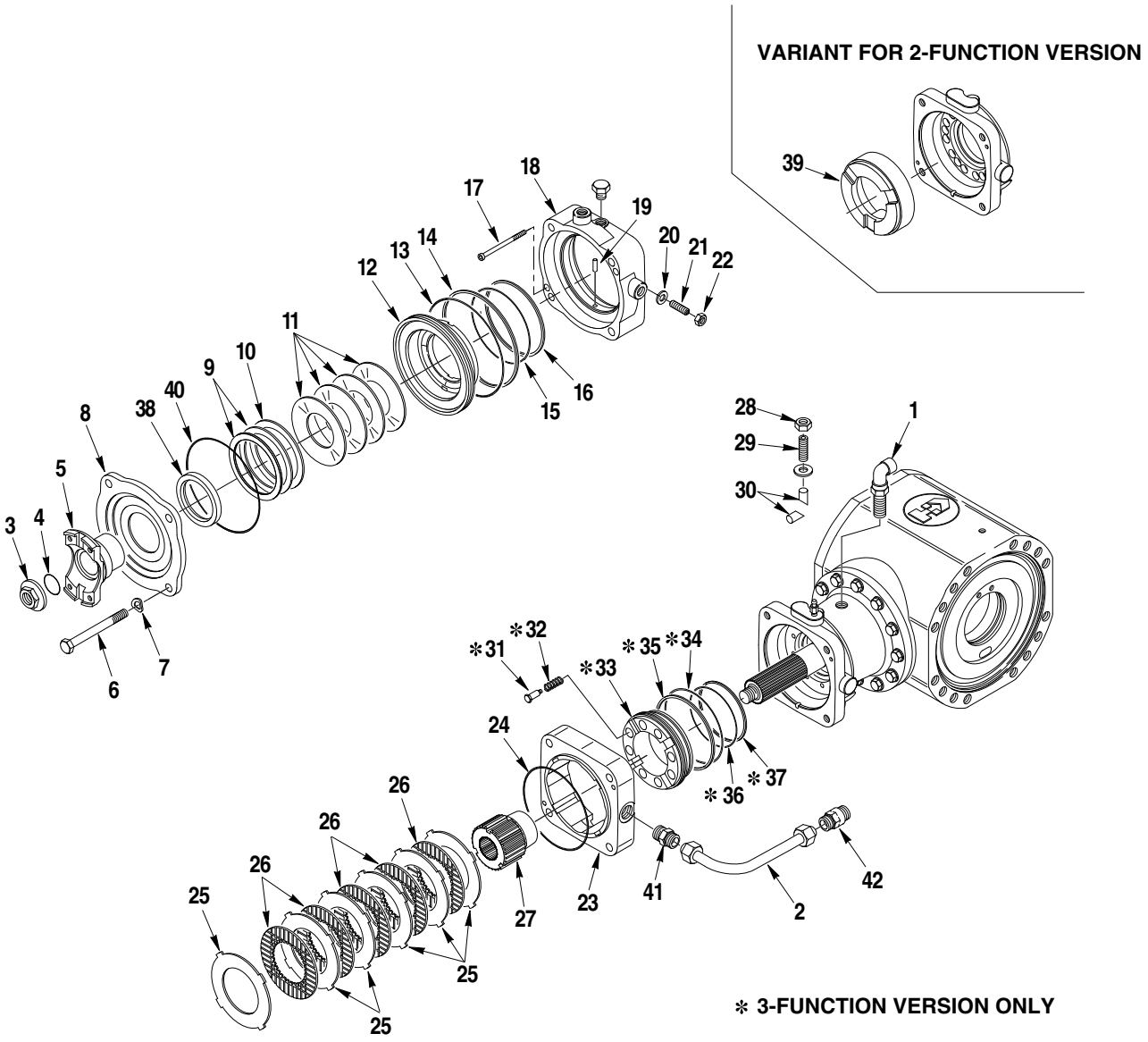

MAP8970

13. Fit the drum (**1**).

***Note:*** *Make sure that the friction surface of the drum carries no trace of grease and is perfectly clean.*

# Section 15
# 4" Incoming Brake (2 and 3 Function Versions)

## 15.1 EXPLODED VIEW



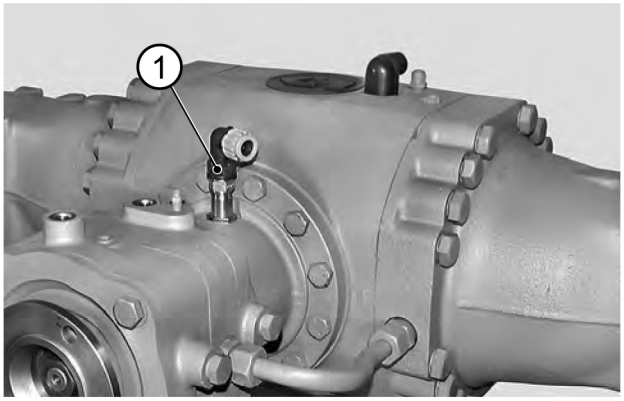
## 15.2 4" INCOMING BRAKE (2 AND 3 FUNCTION VERSIONS)- DISASSEMBLY

**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

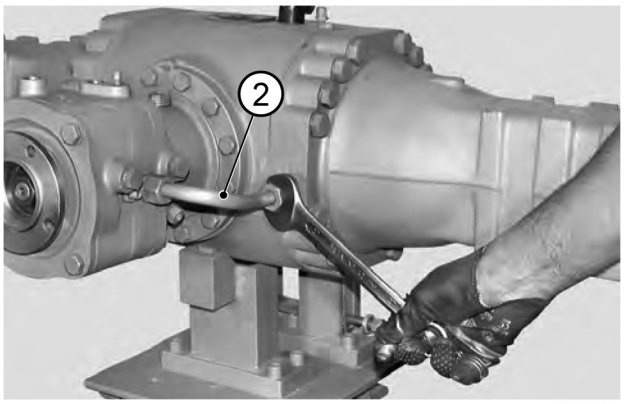
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



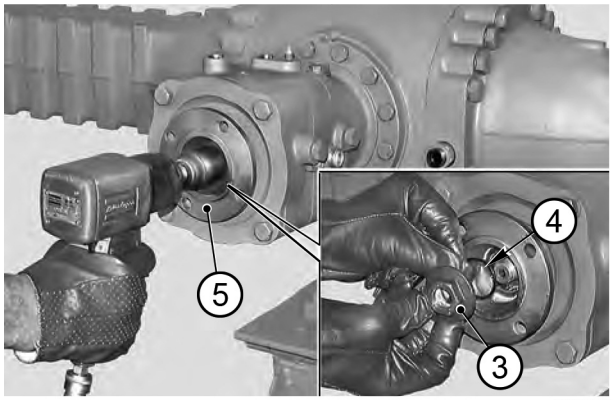

MAP9010

1. Remove electronic sensor (**1**), if fitted.




MAP9020

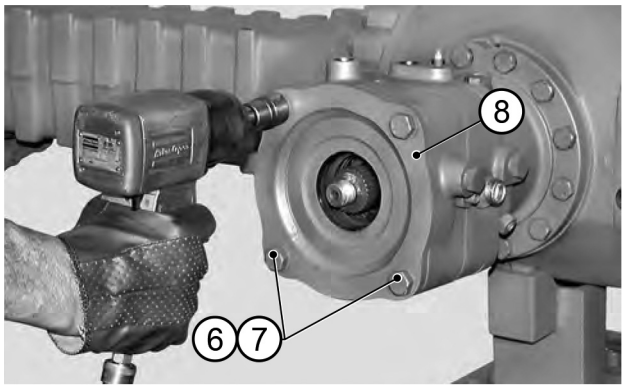
2. Loosen the two nuts and remove lubrication tube (**2**).




MAP9030

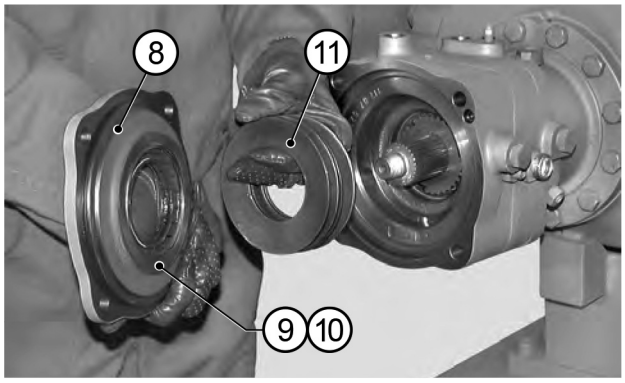
3. Remove nut (**3**), o-ring (**4**) and flange (**5**).

***Note:*** *If disassembly is awkward, heat nut (**3**) about 176 F° (80C°).*




MAP9040

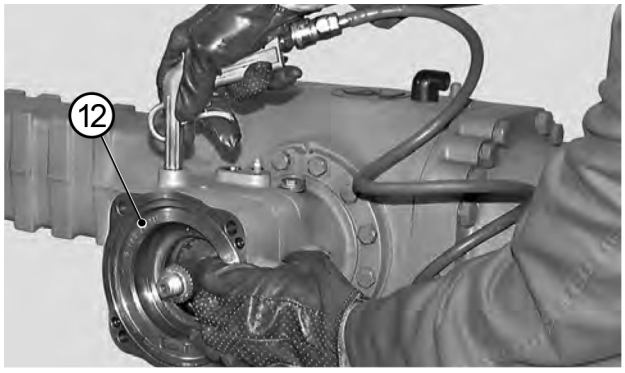
4. Loosen screws (**6**) in an alternate and criss-cross method until the action of Belleville washers (**11**) becomes null. Remove screws (**6**) and spring washers (**7**) of cover (**8**).




MAP9050

5. Pull out cover (**8**), shims (**9**) separating ring (**10**) and Belleville washers (**11**).

***Note:*** *Take note of the assembly direction of: shims (**9**) and Belleville washers (**11**).*

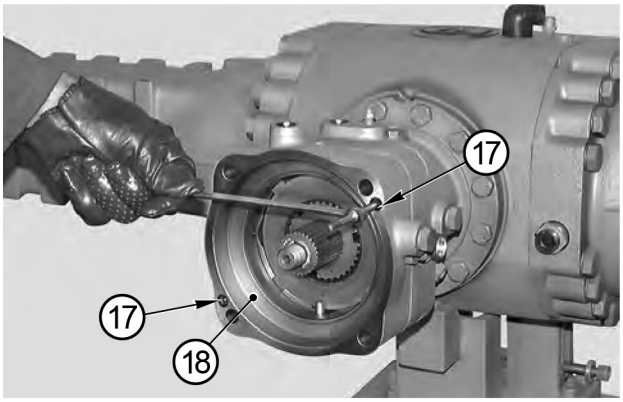



MAP9060

6. Slowly introduce compressed air through the negative brake connection point in order to extract the piston (**12**).

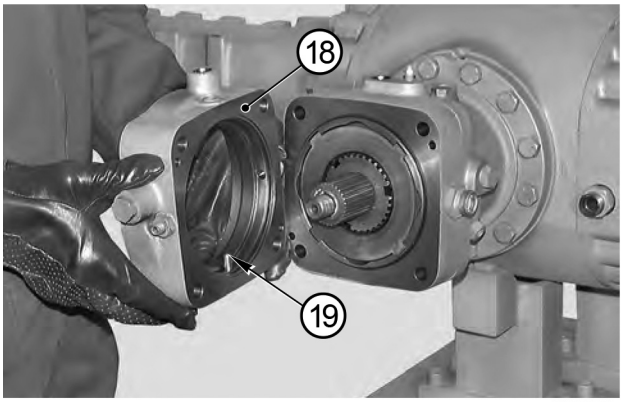
**⚠ CAUTION**

Hold piston (**12**) as it may be rapidly ejected and damaged.




MAP9070

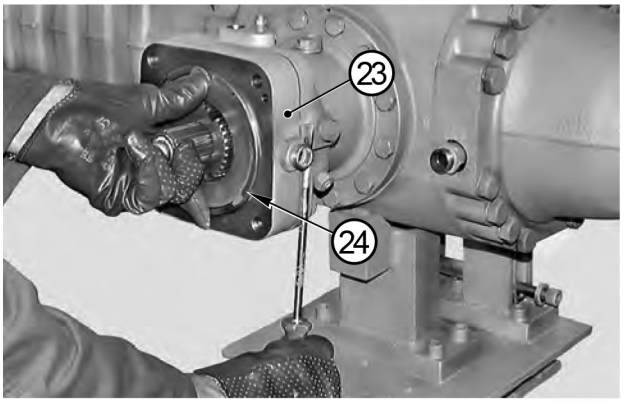
7. Remove check screws (**17**) from cylinder (**18**).




MAP9080

8. Remove cylinder (**18**) complete with guide pin (**19**) of piston (**12**).

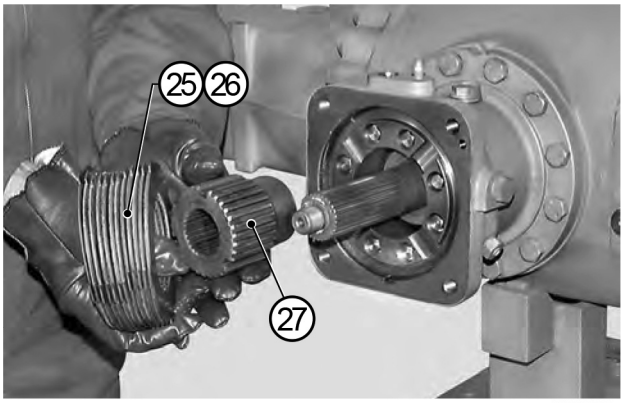
***Note:*** *Take note of direction of assembly.*




MAP9090

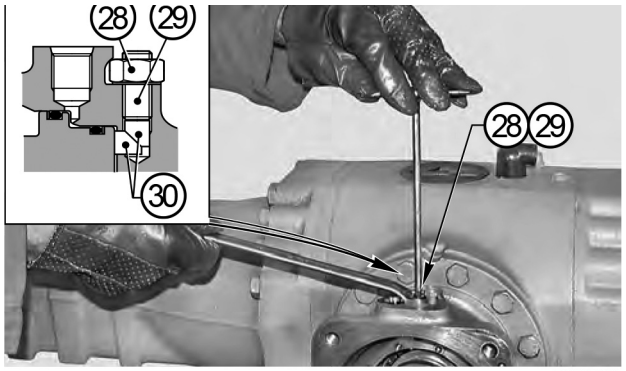
9. With the help of a lever, pry off the cover (**23**) complete with o-ring (**24**).

***Note:*** *Thoroughly clean the face of bevel pinion support where the hub rests, check the o-ring (**24**) and replace it if necessary.*




MAP9100

10. Remove friction discs (**25**), (**26**) and hub (**27**).




MAP9110

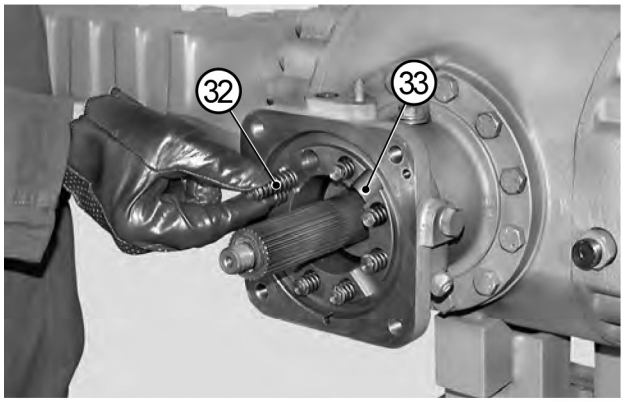
11. 3-FUNCTION VERSION ONLY:
    Loosen nuts (**28**) and unscrew studs (**29**) to retract the adjustment points (**30**).
12. ONLY IF NECESSARY: Remove points (**30**).

***Note:*** *Loosen studs (**29**) in an alternate manner until the piston comes to end of backstroke.*


MAP9120

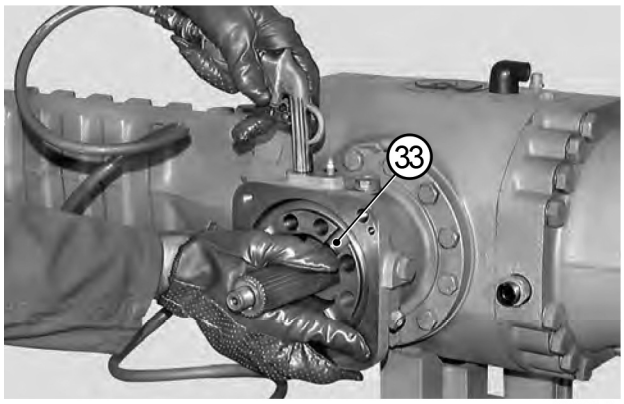
13. 3-FUNCTION VERSION ONLY:
    Loosen and remove the pin-type screws (**31**).

***Note:*** *Loosen screws (**31**) in an alternate and criss-cross method.*



MAP9130

14. 3-FUNCTION VERSION ONLY:
    Remove springs (**32**) of piston (**33**) backward movement.

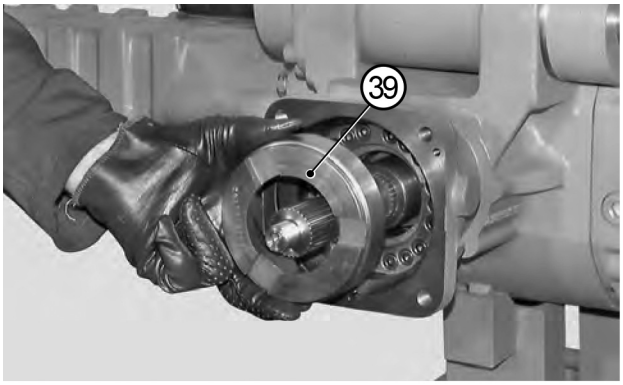


MAP9140

15. 3-FUNCTION VERSION ONLY:
    Slowly introduce compressed air through the connection point of the service brake to extract the piston (**33**).

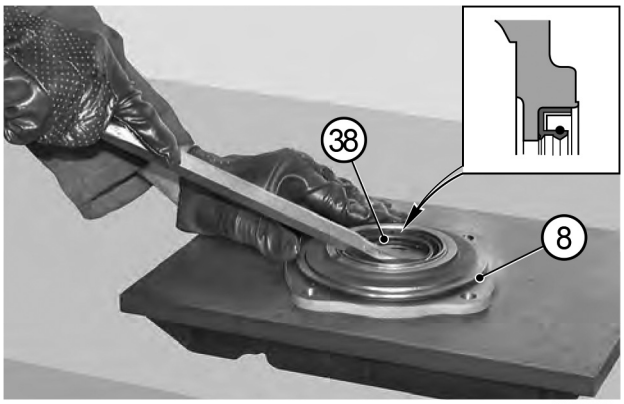
**⚠ CAUTION**

Hold piston (**33**) as it may be rapidly ejected and damaged.



MAP9150

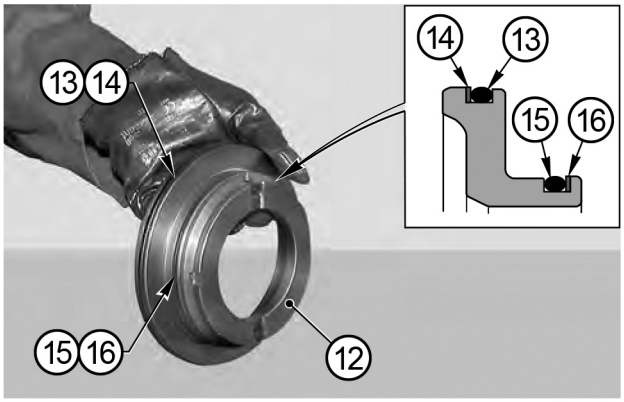
16. 2-FUNCTION VERSION ONLY:
    Remove the spacer (**39**).



MAP9160

17. Remove sealing ring (**38**) from cover (**8**).

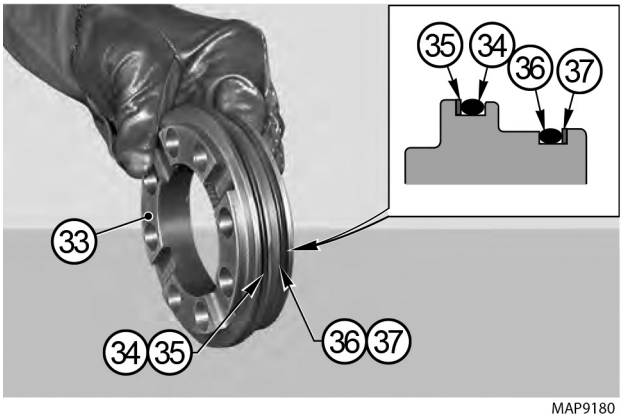
***Note:*** *Take note of direction of assembly of ring (**38**) and replace ring every time the unit is disassembled.*




MAP9170

18. Remove sealing rings (**13**) and (**15**) and anti-extrusion rings (**14**) and (**16**) from the piston (**12**).

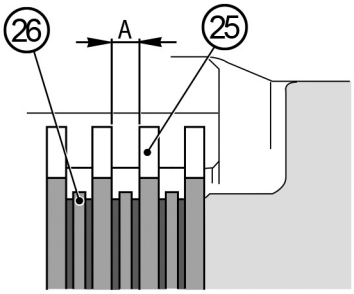
***Note:*** *Sealing rings (**13**) and (**15**) and anti-extrusion rings (**14**) and (**16**) must be replaced each time the unit is disassembled.*




MAP9180

19. **3-FUNCTION VERSION ONLY:**
Remove sealing rings (**34**) and (**36**) and anti-extrusion rings (**35**) and (**37**) from piston (**33**).

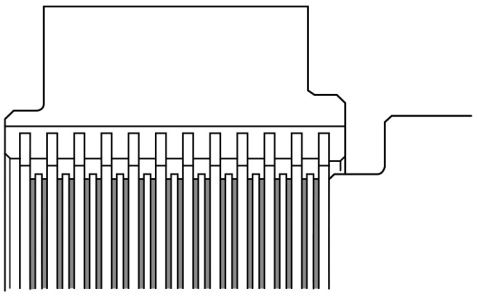
***Note:*** *Sealing rings (**34**), (**36**) and anti-extrusion rings (**35**), (**37**) must be replaced each time the unit is disassembled.*




A min. =1,36 mm

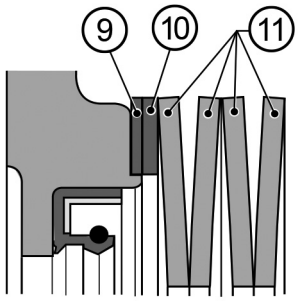
MAP9190

20. Always check the thickness of braking discs (**26**), even if the braking unit is being disassembled for other reasons than this.
21. If thickness “A” of one of the discs (**26**) is close to the minimum admissible size of 1.36 mm, replace the whole pack.



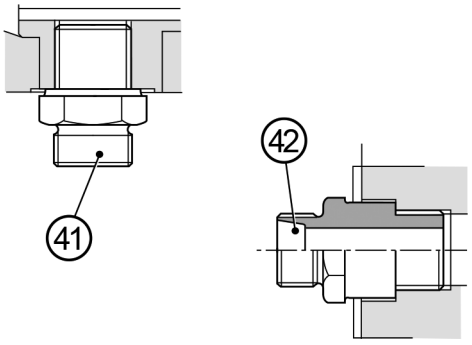
MAP9200

22. **BRAKING DISCS PACK CONTENTS:**
The braking discs pack is comprised of: 11 braking discs and 12 steel counter discs.




MAP9210

23. If the braking discs unit is replaced, shims (**9**) which determine the pre loading of Belleville washers (**11**) must to be restored.

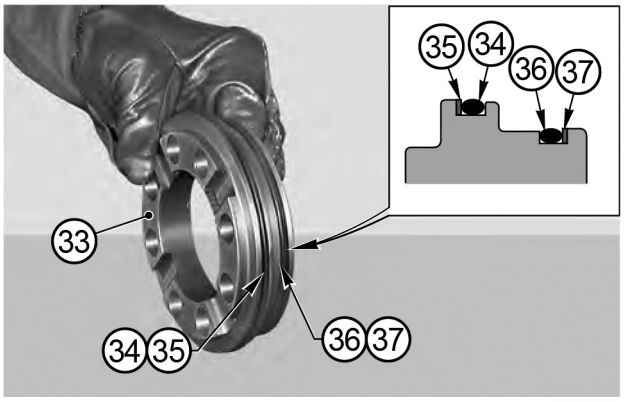



MAP9220

24. ONLY WHEN REPLACEMENT IS NECESSARY:
    Remove the union pieces (**41**) and (**42**) connecting the lubrication tube (**2**).

***Note:*** *During the assembly stage, union pieces (**41**) and (**42**) must be coated with Loctite 577 and tightened to a torque wrench setting of 35 - 50* Nm (25.81 - 36.88 ft.lb.)

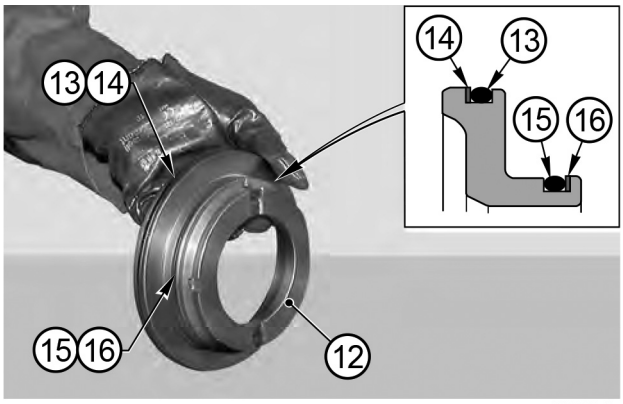
## 15.3 4" INCOMING BRAKE (2 AND 3 FUNCTION VERSIONS) - ASSEMBLY




MAP9230

1. 3-FUNCTION VERSION ONLY:
   Fit the sealing rings (**34**), (**36**) and the anti-extrusion rings (**35**), (**37**) onto the piston (**33**) of the service brake.

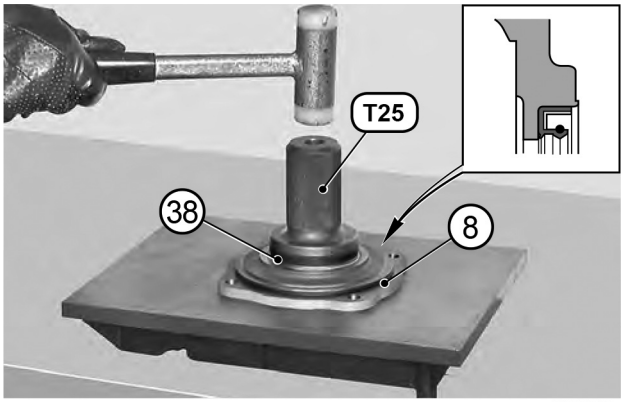
***Note:*** *Carefully check the assembly position of anti-extrusion rings.*




MAP9240

2. Fit the sealing rings (**13**), (**15**) and the anti-extrusion rings (**14**), (**16**) onto the piston (**12**) of the negative brake.

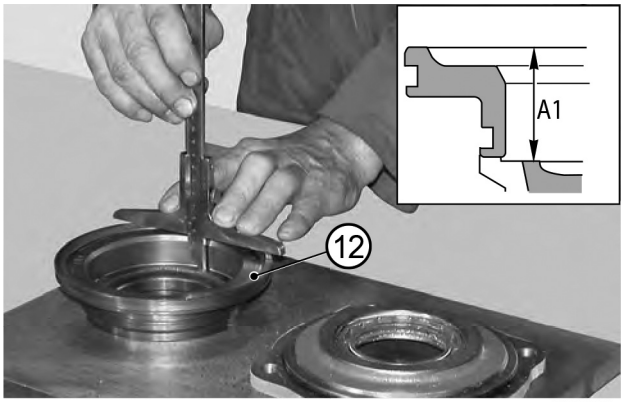
***Note:*** *Carefully check the assembly position of the anti-extrusion rings.*




MAP9250

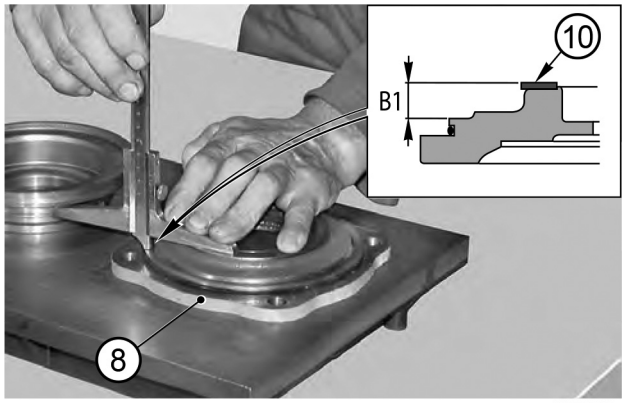
3. Lubricate sealing ring (**38**) and, using tool (**T25**), fit it into the cover (**8**).

***Note:*** *Carefully check the direction of ring (**38**).*



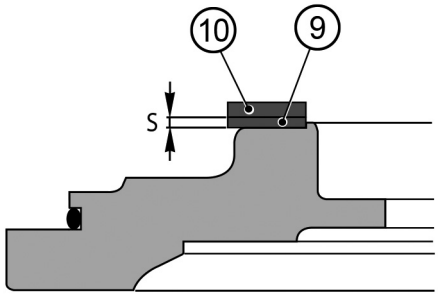

MAP9260

4. 3-FUNCTION VERSION ONLY:
   Measure size “A1” of piston (**12**) and note it down.



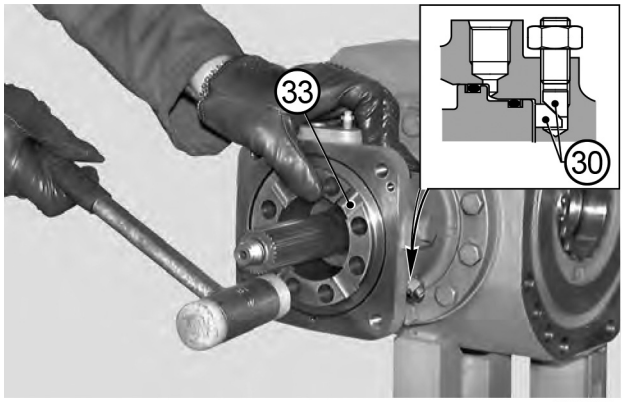

MAP9270

5. 3-FUNCTION VERSION ONLY:
   Fit the separating ring (**10**) of Belleville washers onto the cover (**8**), measure size “B1” and note it down.




MAP9280

6. 3-FUNCTION VERSION ONLY:
   Using the measurements just taken, calculate thickness “S” of shims (**9**) as follows: S=(A1+1.5)±(B1+18.4) where: S= Shim thickness - 1.5 mm= fixed measure of braking discs clearance - 18.4 mm= fixed measure of Belleville washers.

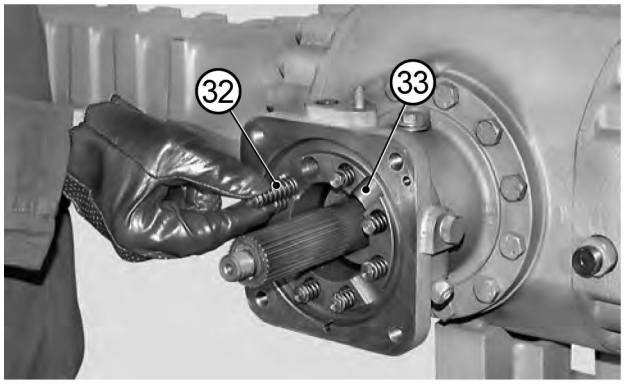



MAP9290

7. 3-FUNCTION VERSION ONLY:
   Lubricate the o-rings and install the whole piston (**33**). Orient the piston with the help of a lever and push it to end of stroke with a plastic hammer.

**⚠ CAUTION**

Check that the adjusting stakes (**30**) are thoroughly inserted and make sure they perform a sliding motion in relation to each other.



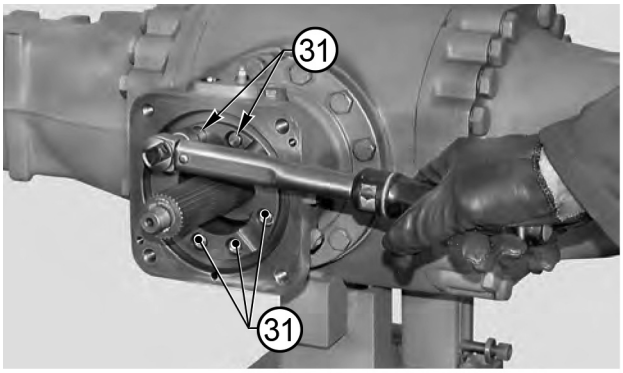

MAP9300

8. 3-FUNCTION VERSION ONLY: Insert springs (**32**) for piston (**33**) backward movement.


MAP9310

9. 3-FUNCTION VERSION ONLY: Apply Loctite 242 to the thread of screws (**31**) and tighten.

***Note:*** *Tighten the screws with a normal wrench in an alternate and criss-cross method.*

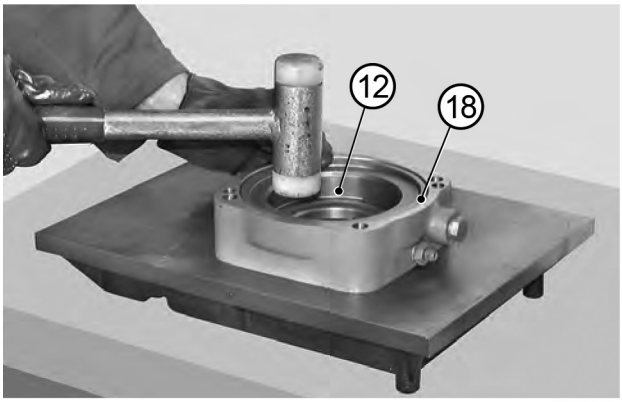



MAP9320

10. 3-FUNCTION VERSION ONLY: Lock screws (**31**) in a criss-cross method by using a torque wrench set to a maximum torque of 10 Nm (7.38 ft.lb.)

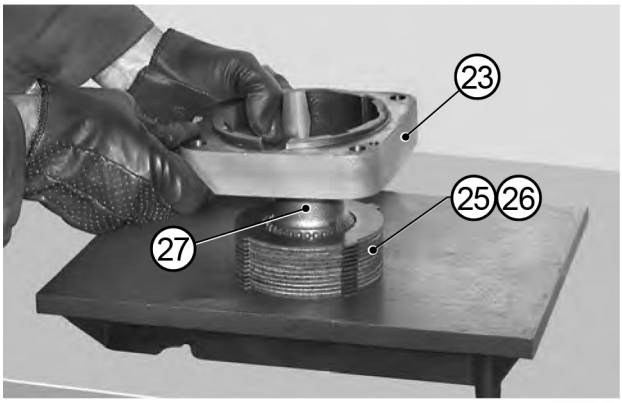
**⚠ CAUTION**

Do not exceed the specified torque setting.




MAP9330

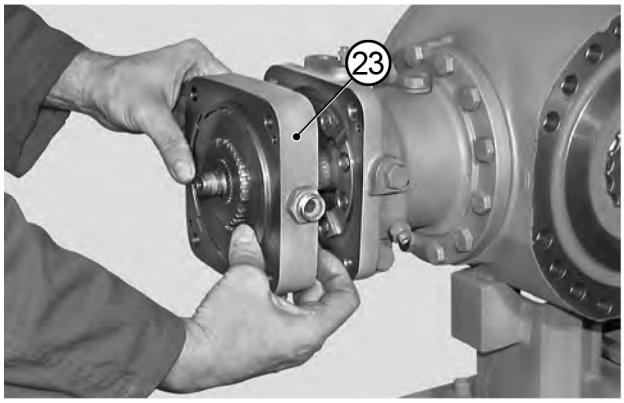
11. Lubricate seals (**13**), (**15**) and fit the piston (**12**) into the cylinder (**18**). Engage piston on the pin (**19**). For the assembly, use a plastic hammer and push the piston (**12**) to end of stroke.




MAP9340

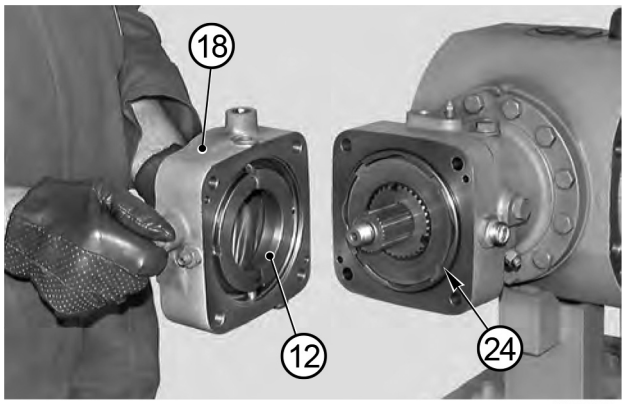
12. Lightly lubricate the braking discs (**25**), (**26**) and fit them onto the hub (**27**).
13. Align discs (**25**) and fit the cover (**23**).

***Note:*** *The braking discs pack starts and ends with steel discs (**25**).*



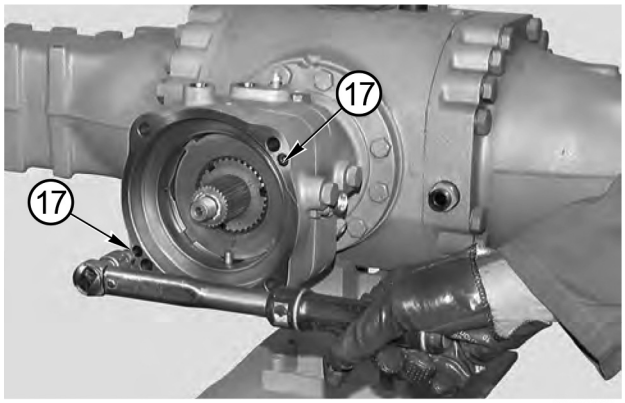

MAP9350

14. Apply Loctite 510 on the face of the cover (**23**). Fit the discs-hub-cover assembly prepared in the previous stages onto the pinion and engage it.




MAP9360

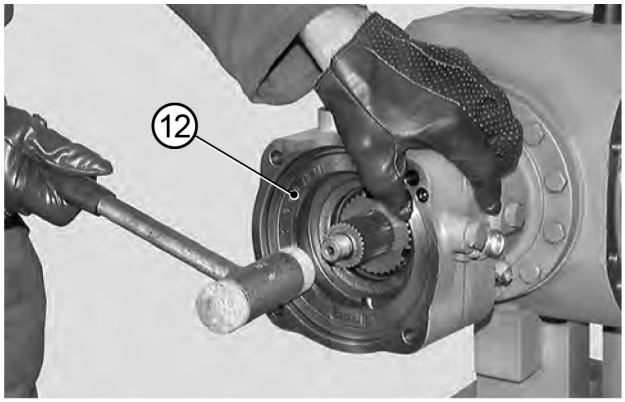
15. Lubricate the o-ring (**24**) and fit cylinder (**18**) complete with piston (**12**).




MAP9370

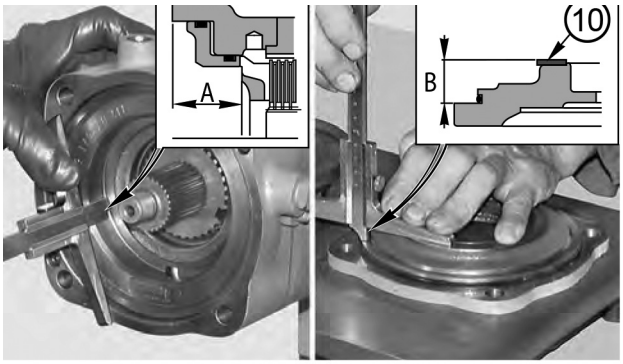
16. Introduce screws (**17**) and tighten in a crisscross method. Use a torque wrench setting of 9.5 - 10.5 Nm (7.00 - 7.74 ft.lb.)

***Note:*** *Before giving the final tightening, align the external surfaces of the components.*




MAP9380

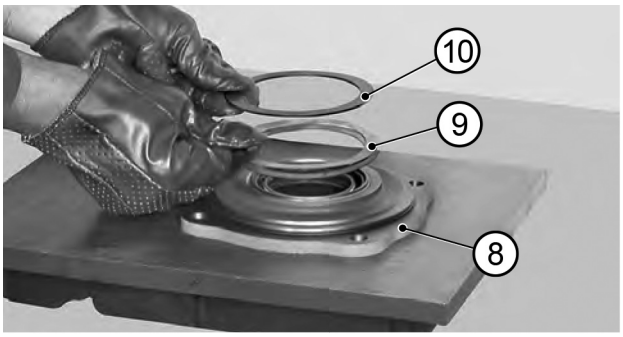
17. 3-FUNCTION VERSION ONLY:
Using a plastic hammer, push the piston (**12**) to the end of stroke.




MAP9390

18. 2-FUNCTION VERSION ONLY:
Fit the separating ring (**10**) of Belleville washers onto the cover (**8**), measure size “B” and note it down.

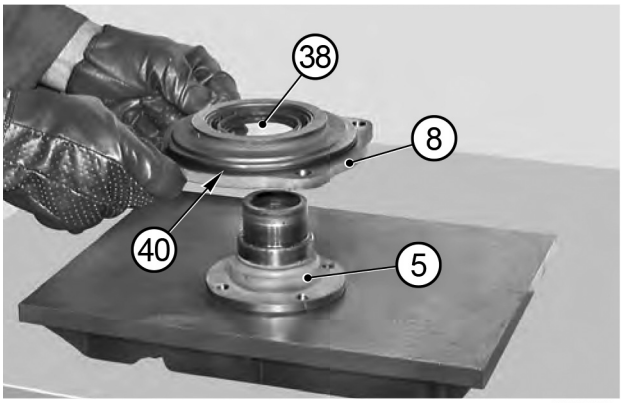
19. Measure size “A” which you will need for calculating the shims (**9**) according to the following: S= A±(B+18.4) where: S= Shim thickness - 18.4 mm= fixed measure of Belleville washers.




MAP9400

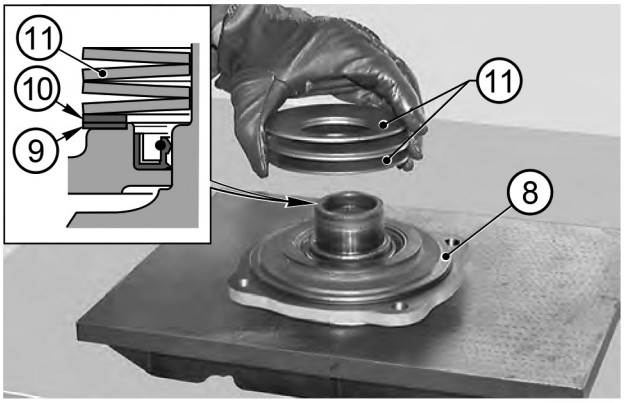
20. Lightly lubricate the shims (**9**) required according to calculations and the separating ring (**10**) of the Belleville washers. Fit shims and ring on the cover (**8**).

***Note:*** *Position the larger shim so that it leans against the cover.*



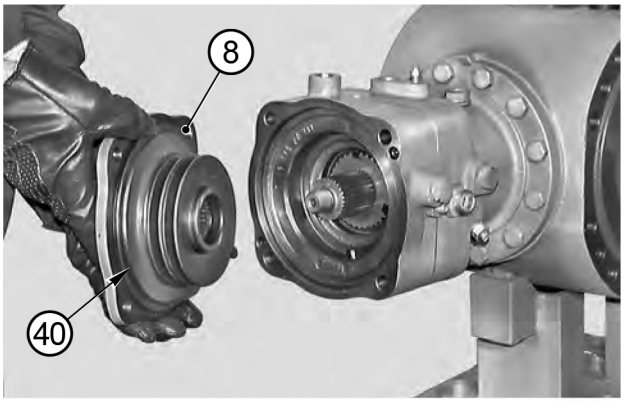
MAP9410

21. Check the state of the o-ring (**40**).
22. Lubricate sealing ring (**38**) and fit flange (**5**) into the cover (**8**).



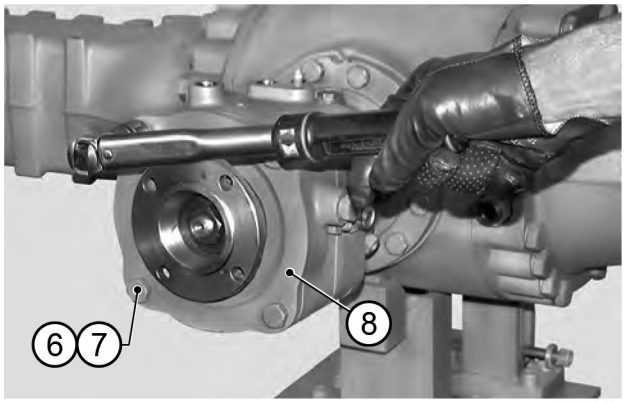
MAP9420

23. Fit the Belleville washers (**11**) onto the cover (**8**), thoroughly checking washers orientation.



MAP9430

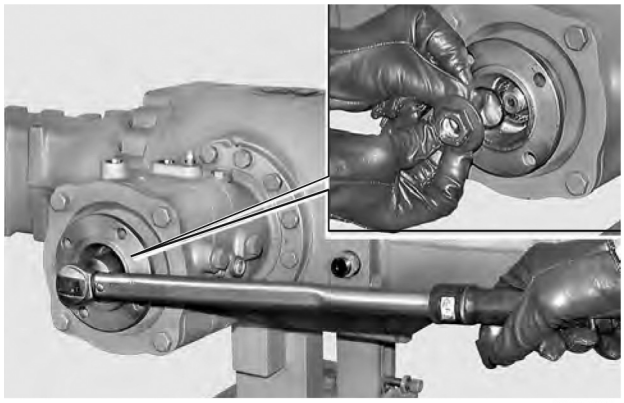
24. Lubricate the o-ring (**40**) and install the cover assembly (**8**).



MAP9440

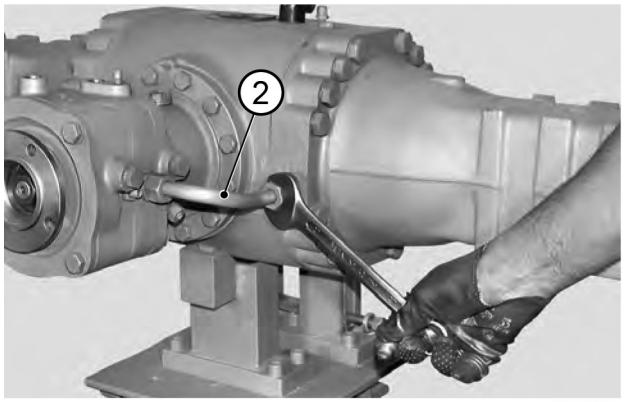
25. Install screws (**6**) and washers (**7**). Lock the cover with a torque wrench setting of 116 - 128 Nm (85.56 - 94.40 ft.lb.)

***Note:*** *Tighten in an alternate and criss-cross method.*


MAP9450

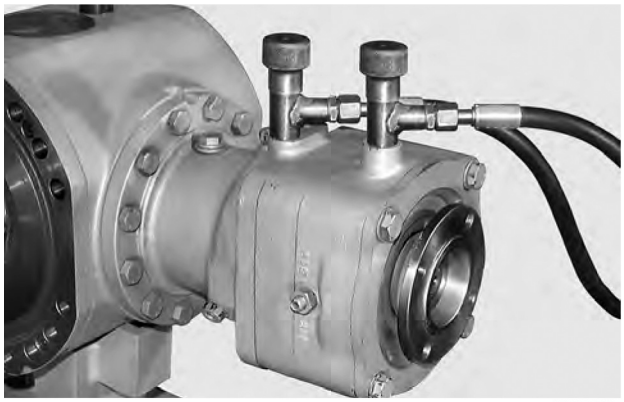
26. Apply Loctite 242 to the threaded portion of the pinion, fit o-ring (**4**) and nut (**3**). Tighten the nut with a torque wrench set to 280 - 310 Nm (206.51 - 228.64 ft.lb.)

***Note:*** *Use tools (**T25**) and (**T26**).*




MAP9460

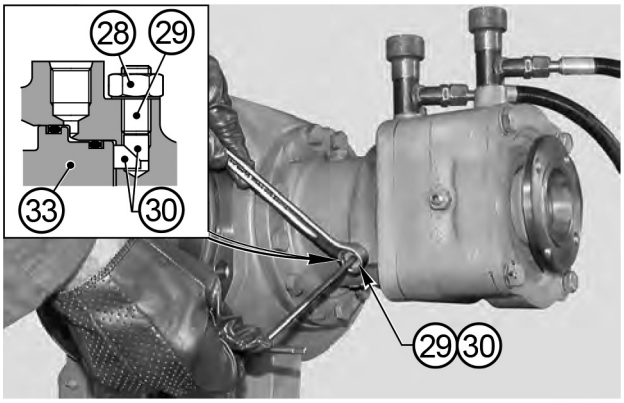
27. Install the lubrication tube (**2**).



MAP9470

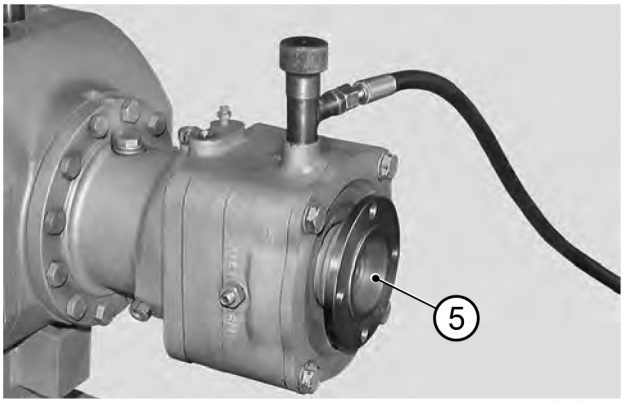
28. 3-FUNCTION VERSION ONLY:
    Connect the service and negative brakes to an external pump; introduce pressure up to a value of 20 - 25 Nm (14.76 - 18.43 ft.lb.)

***Note:*** *Check that pressure is kept stable for at least 5 minutes and make sure there are no leaks.*



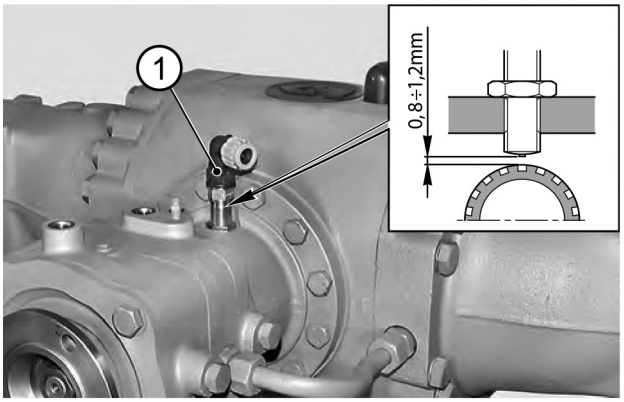

MAP9480

29. 3-FUNCTION VERSION ONLY: Screw studs (**29**) until pins (**30**) position themselves against the piston (**33**), then unscrew studs by one turn to obtain a 1.5 mm stroke.
30. Lock studs (**29**) into position with the nuts (**28**) tightened at 15 Nm (11 ft.lb.)
31. Release pressure.




MAP9490

32. Check negative brake release by introducing a pressure of 16 - 35 bar and by manually rotating the flange (**5**).
33. Release pressure.

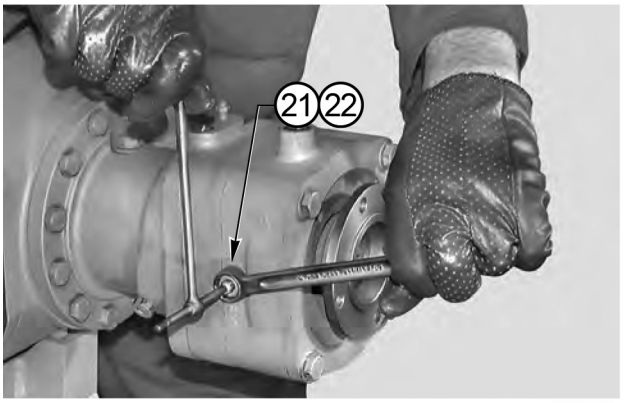


MAP9500

34. Fit the electronic sensor (**1**) and screw it up to the limit stop. Unscrew sensor by 3/4 turn and lock into position with nut. Locking torque: maximum 30 Nm (22.12 ft.lb.)

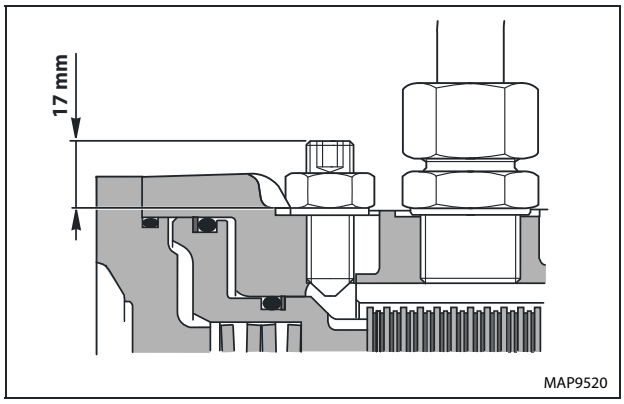
**CAUTION**

Do not exceed the specified torque setting.



MAP9510

35. To release the negative brake during an emergency, (lack of pressure due to vehicle breakdown), loosen nuts (**22**) and screw studs (**21**) in an alternate and gradual manner until you notice some pre loading; continue by giving another 1.5 turns.

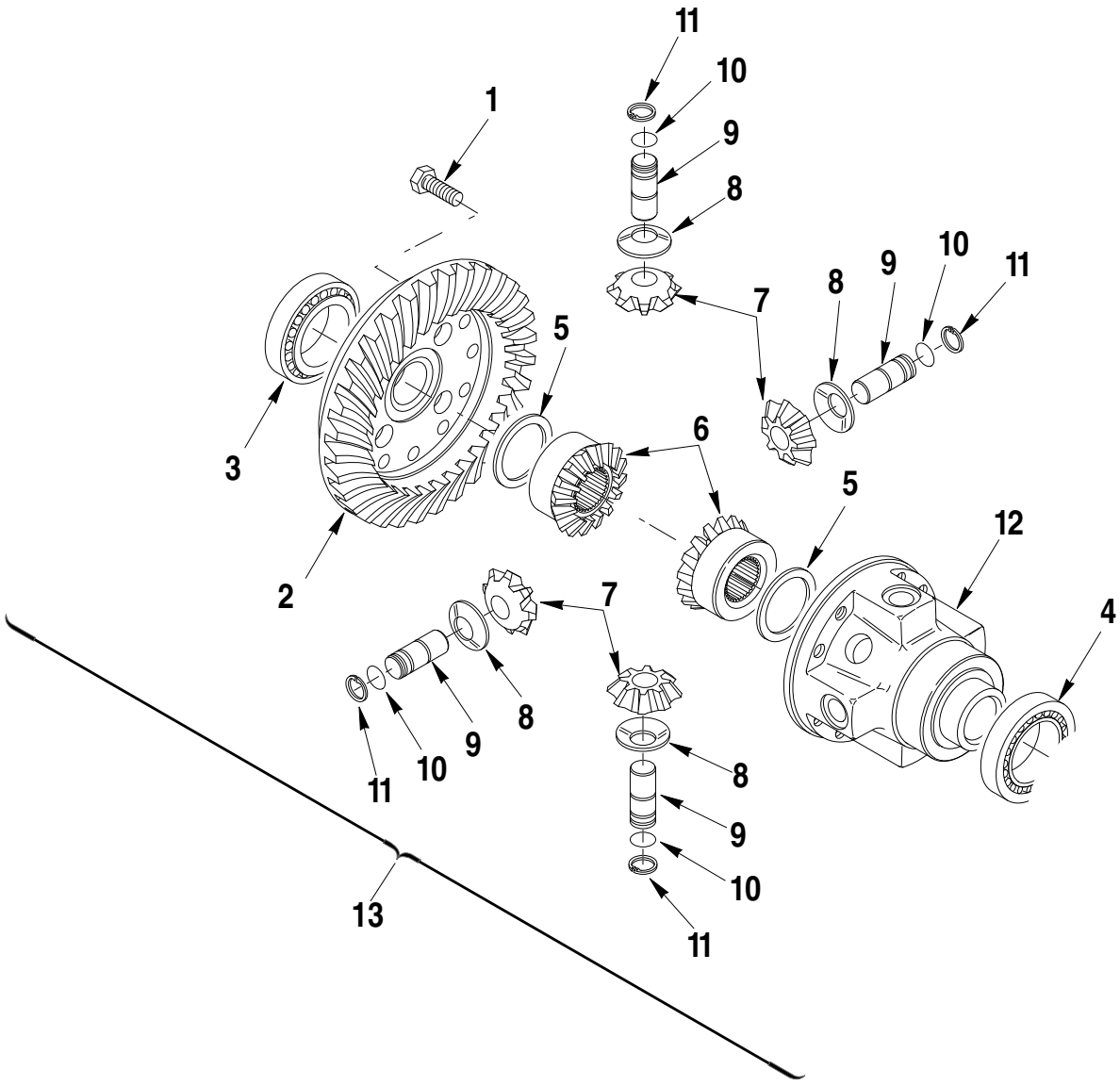


MAP9520

36. When the emergency is over, loosen the studs in an alternate manner until a 17 mm projection is obtained; lock into position with the nuts (**22**) tightened to 15 Nm (11 ft.lb.)

# Section 16
# Normal Differential Unit

## 16.1 EXPLODED VIEW

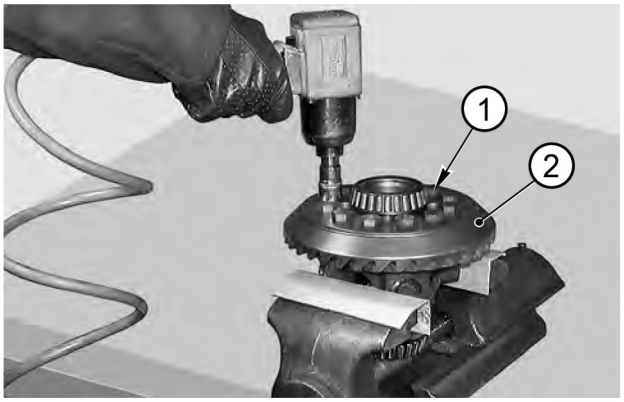



MAP9560

## 16.2 NORMAL DIFFERENTIAL UNIT- DISASSEMBLY

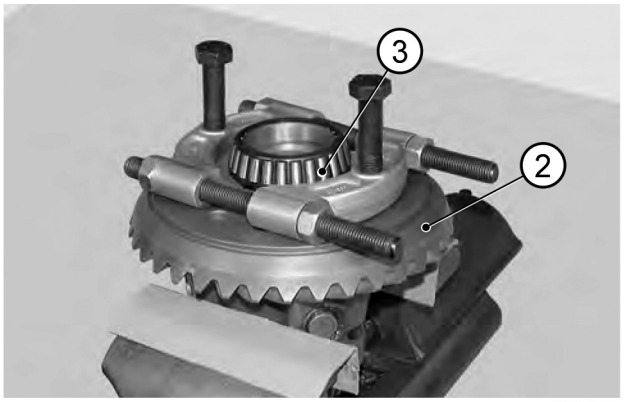
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP9570

1. Remove the cap screws (**1**) from the crown (**2**).

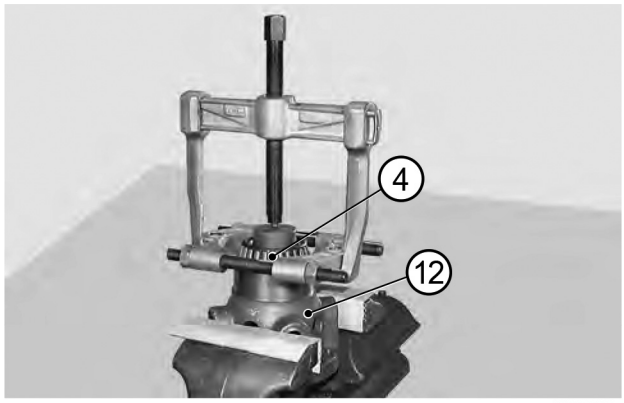



MAP9580

2. If the bearing needs replacing, extract the bearing (**3**) and remove the crown (**2**).

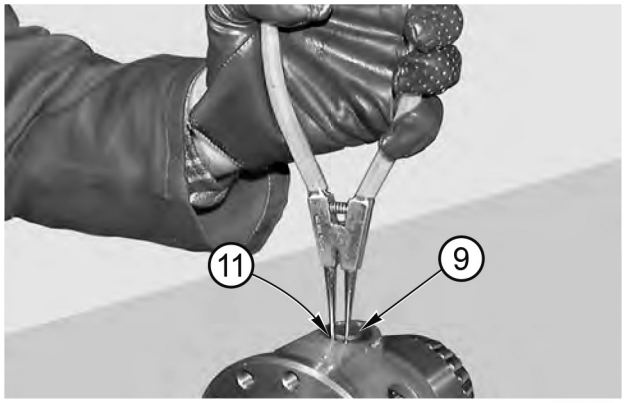

MAP9590

3. Remove the shim washer (**5**) and the planetary gear (**6**).



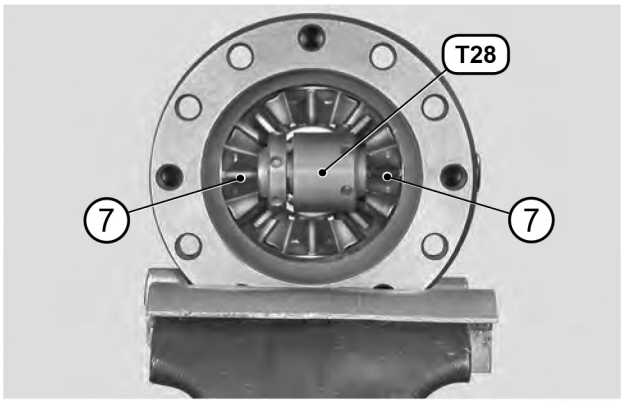

MAP9600

4. If the bearing need replacing, extract the bearing (**4**) from the differential carrier (**12**).



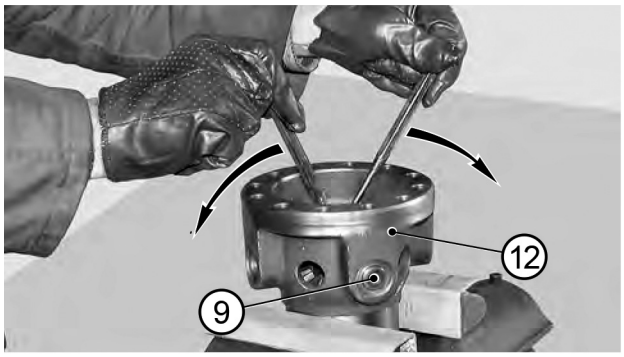

MAP9610

5. Remove the snap rings (**11**) from the two pins (**9**) of the planetary gears (**7**).




MAP9620

6. Insert tool (**T28**) between the planetary gears (**7**).

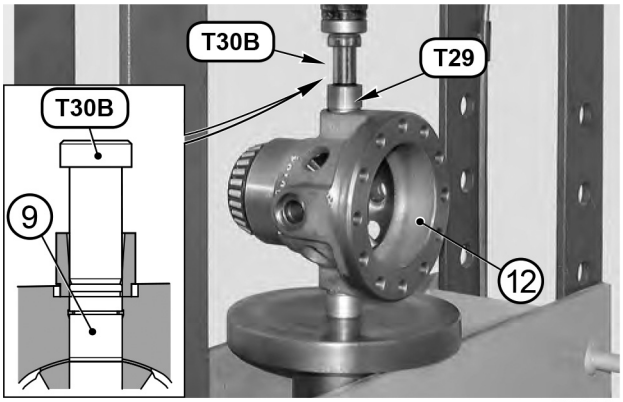



MAP9630

7. Force tool (**T28**) in-between the planetary gears (**7**) using two pin-drivers.

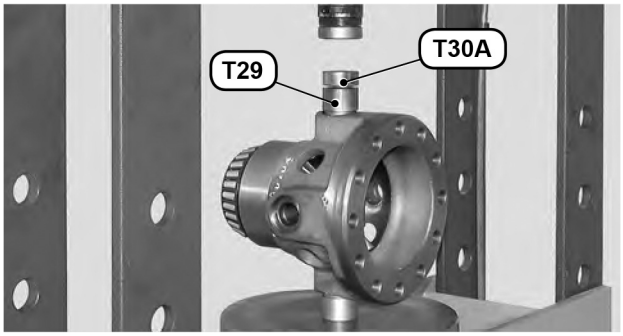
**⚠ CAUTION**

Make sure that tool (**T28**) is perfectly lined up with the pins (**9**) when locked.




MAP9640

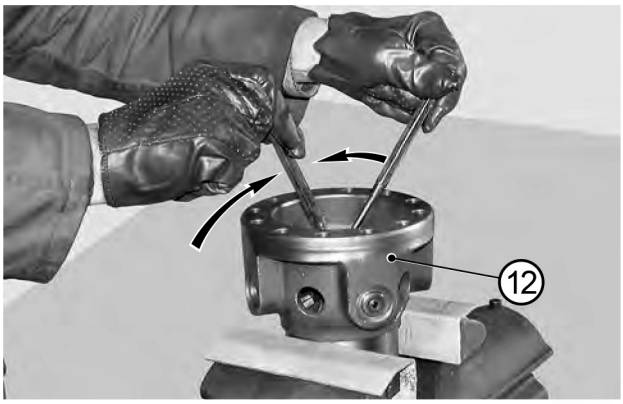
8. Place the differential carrier (**12**) under a press, position guide bushing (**T29**) and insert press tool (**T30A**). Press (**T30B**) pin to limit position.




MAP9650

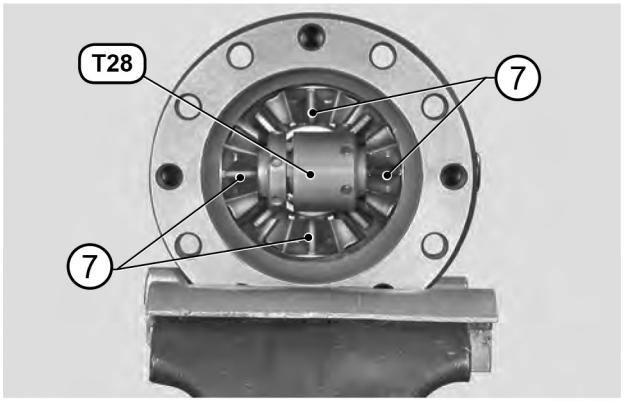
9. Remove press tool (**T30A**) and guide bushing (**T29**).

***Note:*** *In this condition the tool (**T28**) contains pin (**9**).*



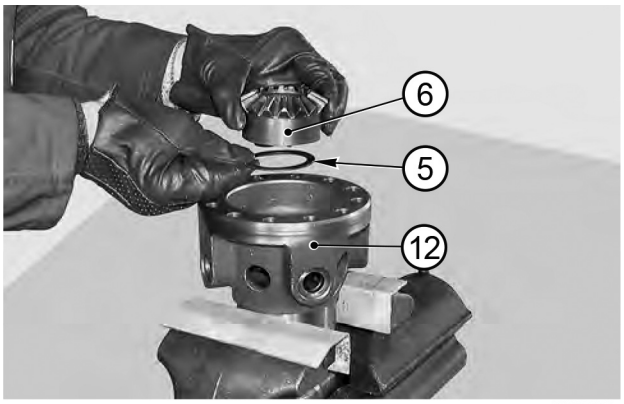

MAP9660

10. Remove tool (**T28**) together with the pin (**9**) of the planetary gear.




MAP9670

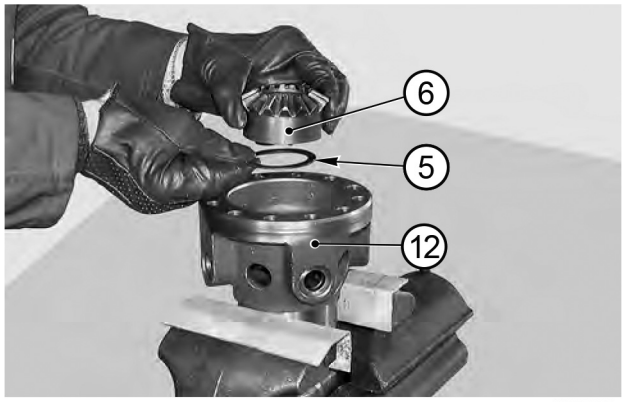
11. Leave the released planetary gear in position and again lock tool (**T28**).
12. Repeat the operations for the extraction of the pin of the 2nd planetary gear (**9**).
13. Repeat the operations for all other pins.




MAP9680

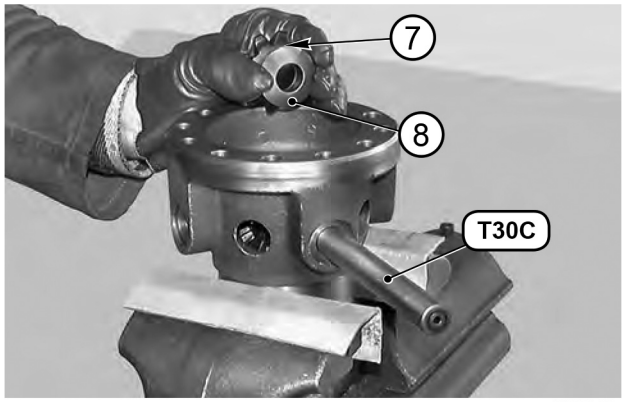
14. Remove tool (**T28**) and remove the last two planetary gears (**7**), the 2nd differential side gear (**6**) and the relative shim washer (**5**) from the differential carrier.

## 16.3 NORMAL DIFFERENTIAL UNIT-ASSEMBLY



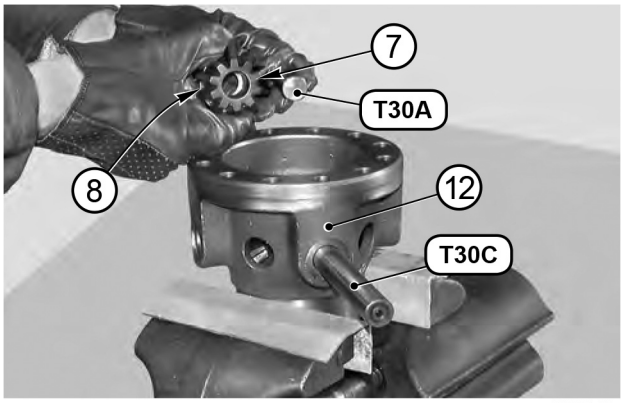

MAP9690

1. Insert the shim washer (**5**) and the differential side gear (**6**) in the differential carrier (**12**).



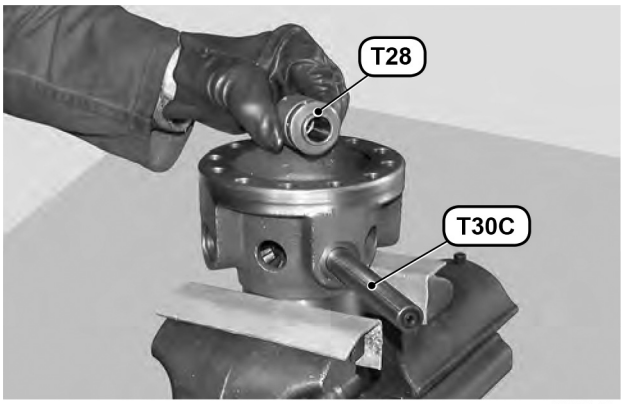

MAP9700

2. Position the shim washer (**8**) and the first planetary gear (**7**).
3. Hold them in position using bar (**T30C**).



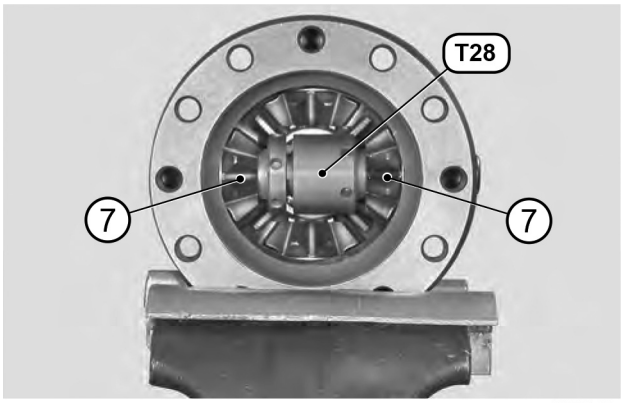

MAP9710

4. With the help of press tool (**T30A**), position the second planetary gear (**7**) and the relative shim washer (**8**).



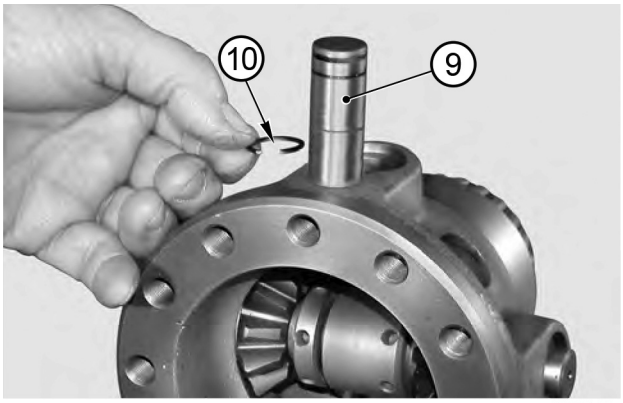

MAP9720

5. Insert tool (**T28**) between the two planetary gears (**7**). Line up the entire unit by pushing bar (**T30C**) all the way down until press tool (**T30A**) is ejected.



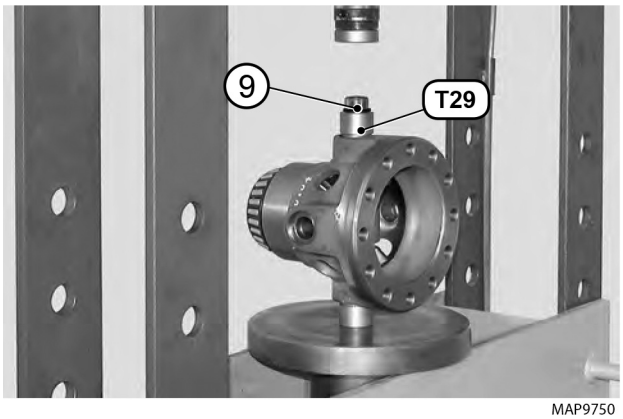

MAP9730

6. Lock tool (**T28**) behind the planetary gears (**7**).
7. After locking, remove bar (**T30C**).



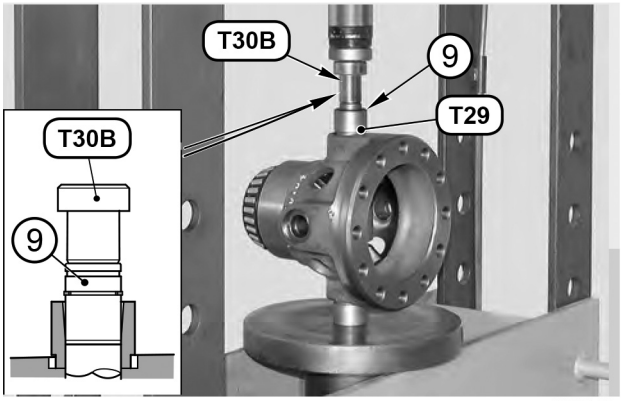

MAP9740

8. Fit the snap rings (**11**) onto the pins (**9**).



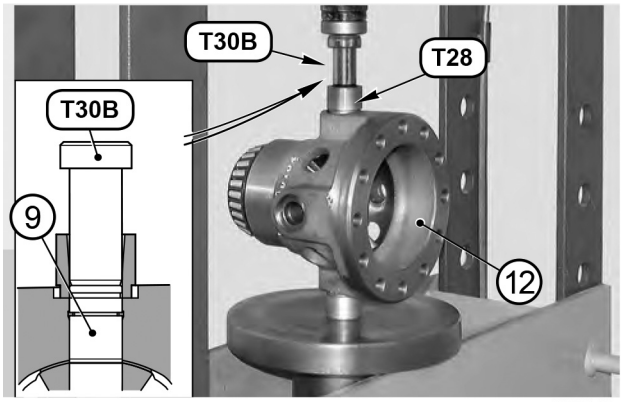

MAP9750

9. Place the differential carrier (**12**) under the press, position guide bushing (**T29**) and insert the planetary pin (**9**).



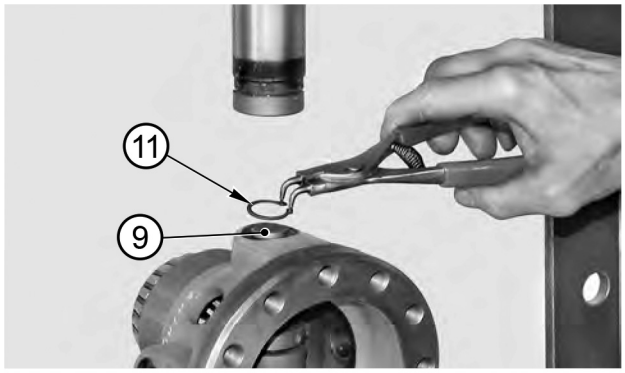

MAP9760

10. Put press tool (**T30B**) on top of the planetary wheel pin (**9**)




MAP9770

11. Press (**T30B**) pin all the way down.

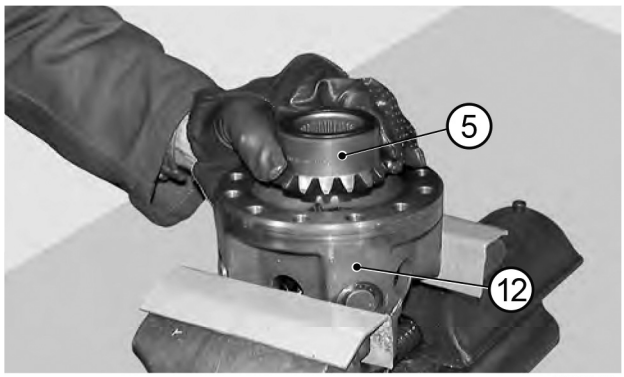



MAP9780

12. Remove press tool (**T30B**), bushing (**T29**) and fit the snap ring (**11**) on the pin (**9**).

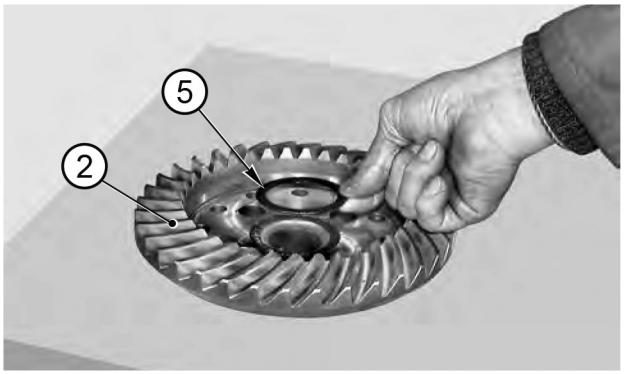
**⚠ CAUTION**

Make sure that the snap ring centers the seat and that it rests on the surface of the differential carrier. Repeat the operations on the other planetary pins.




MAP9790

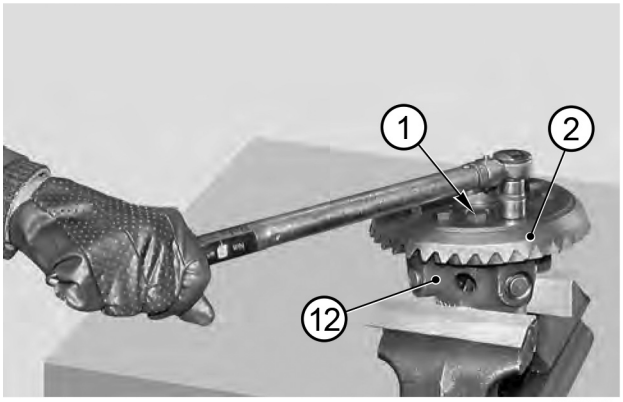
13. Position the second planetary gear (**6**) in the differential carrier (**12**).




MAP9800

14. Position the shim washer (**5**) on the crown (**2**).

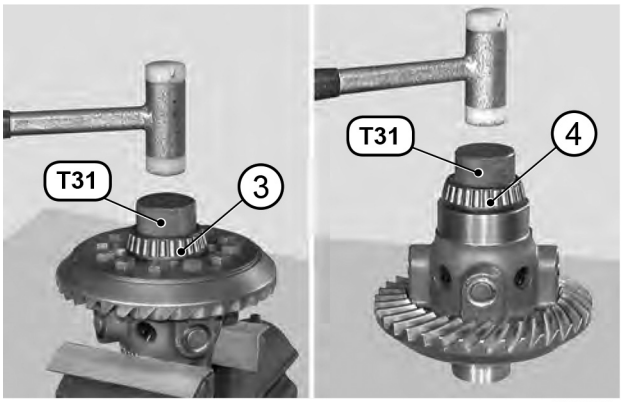
***Note:*** *In order to hold the shim washer (**5**) in position, apply grease to it.*




MAP9810

15. Position the crown (**2**) on the differential carrier (**12**) and lock it with screws (**1**) applied with Loctite 242. Torque wrench setting for screws:
128 - 142 Nm (94.40 - 104.73 ft.lb.)

***Note:*** *Secure the screws using the criss-cross method.*




MAP9820

16. Install the bearings (**3**) and (**4**) using tool (**T31**).

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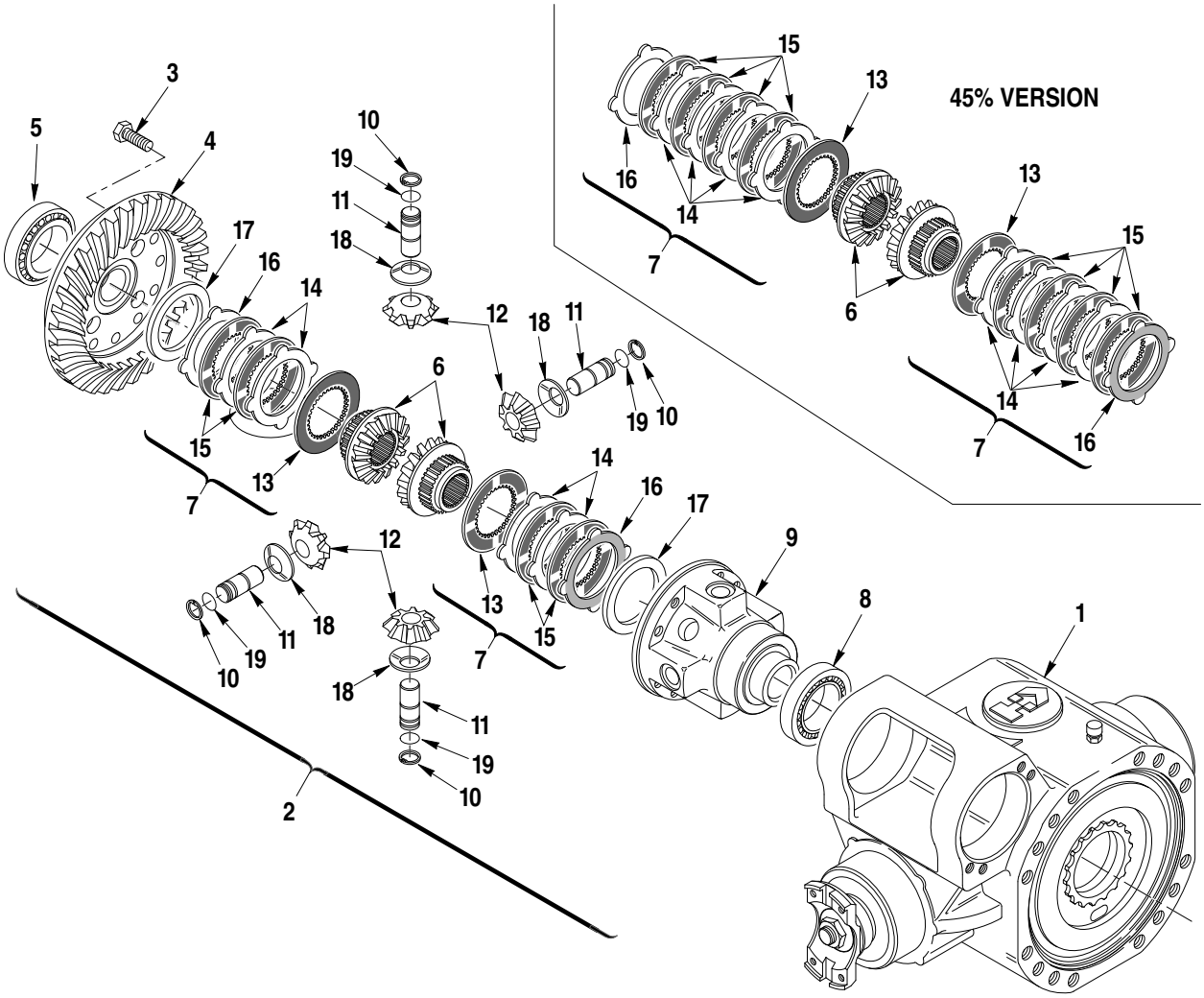
# Section 17
# Limited Slip Differential Unit (25% and 45%)

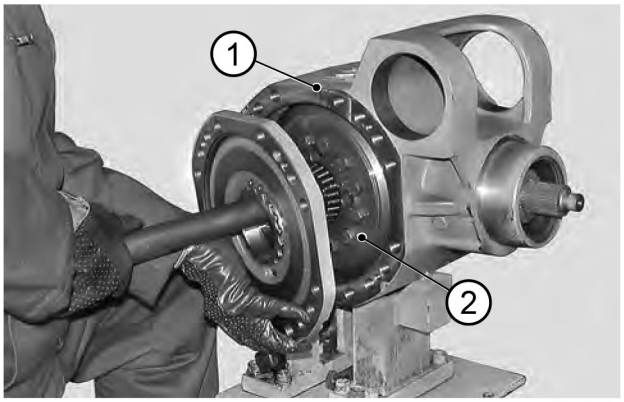
## 17.1 EXPLODED VIEW



## 17.2 LIMITED SLIP DIFFERENTIAL UNIT (25% AND 45%)- DISASSEMBLY

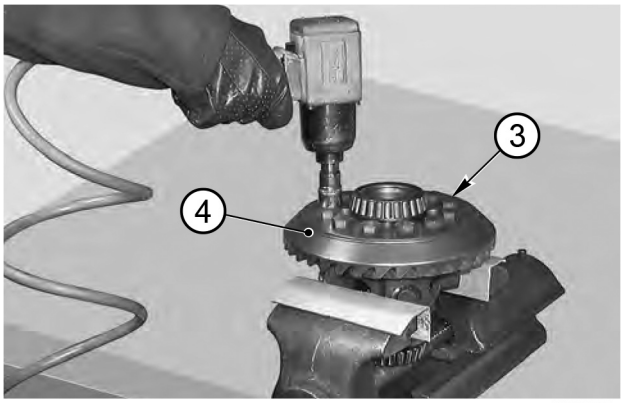
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP9880

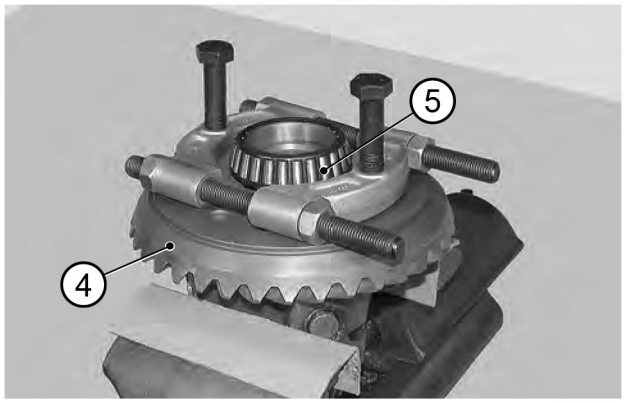
1. Remove the whole differential unit (**2**) from the central axle unit (**1**). For details, see Differential Unit.




MAP9890

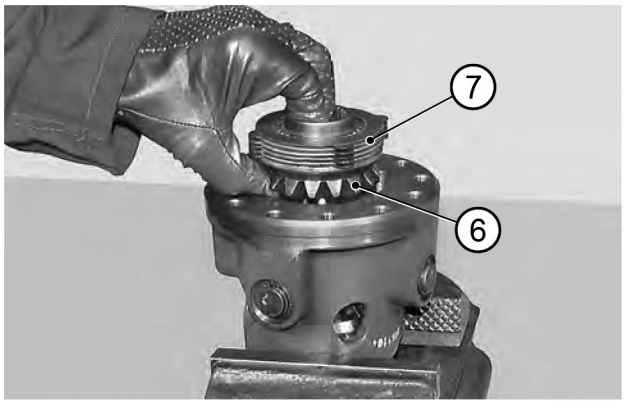
2. Remove the check screws (**3**) of the crown (**4**).

***Note:*** *Write down the position of the notches of the central hole in relation to the protrusions of the friction unit steel discs.*



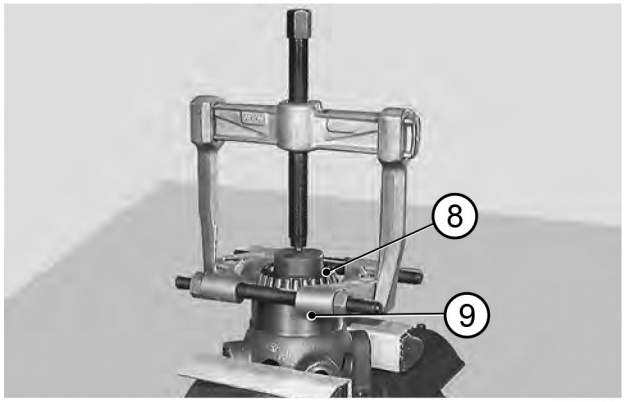

MAP9900

3. If bearing (**5**) needs replacing, remove it; remove crown (**4**).



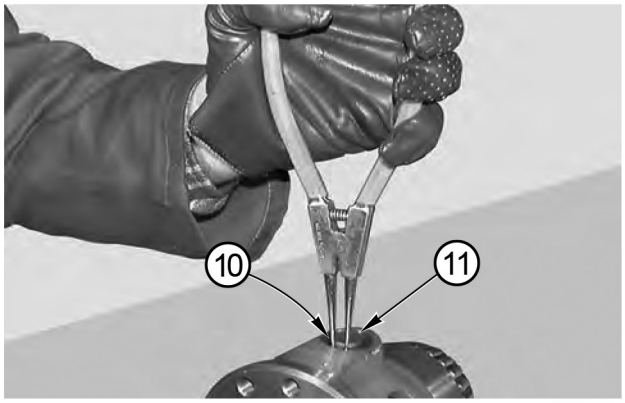

MAP9910

4. Remove the planetary gear (**6**) and the whole friction unit (**7**).



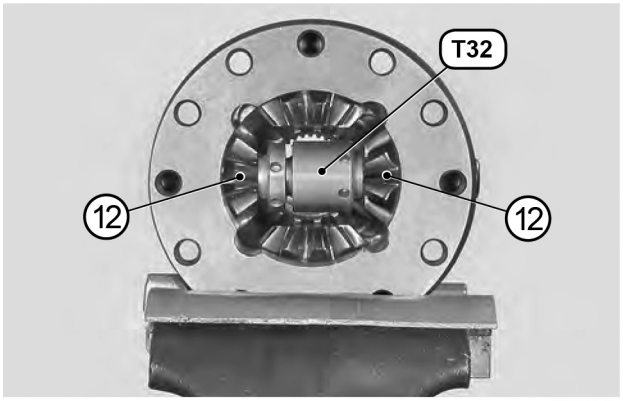

MAP9920

5. If bearing (**8**) needs replacing, extract it from the differential unit (**9**).



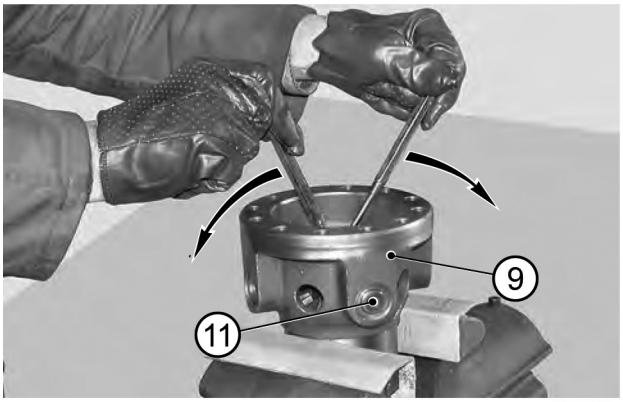

MAP9930

6. Remove the snap rings (**10**) from the pins (**11**) of the planetary gears (**12**).




MAP9940

7. Introduce tool (**T32**) in between the planetary gears (**12**).

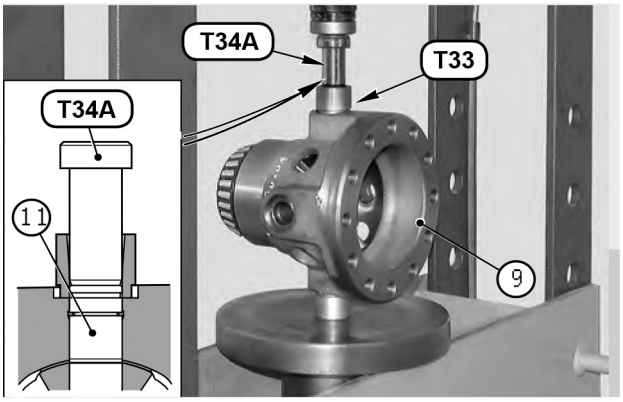



MAP9950

8. Using two pin-drivers, engage tool (**T32**) in between the planetary gears (**12**).

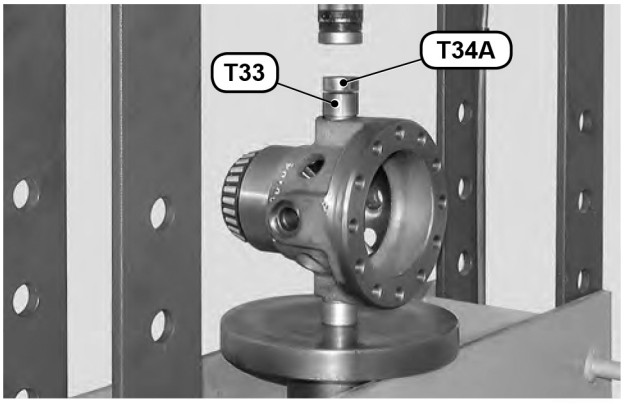
**⚠ CAUTION**

Carefully check that tool (**T32**) keeps in an aligned position with the pins (**11**) when locked.




MAP9960

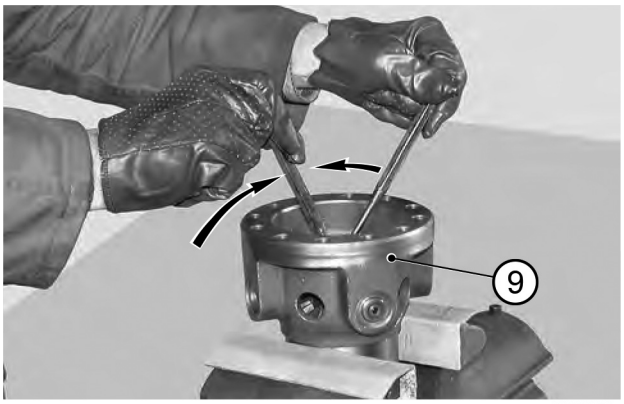
9. Place the differential unit (**9**) under a press, position guide bushing (**T33**) and insert press tool (**T34A**). Press press tool (**T34A**) to end of stroke.




MAP9970

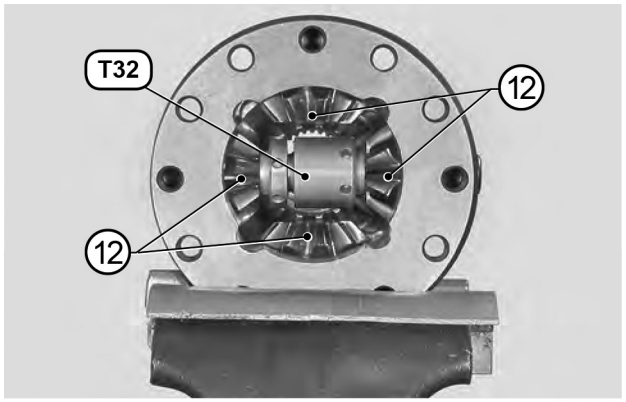
10. Remove press tool (**T34A**) and bushing (**T33**).

***Note:*** *In this state, the pin (11) is contained within tool (**T32**).*



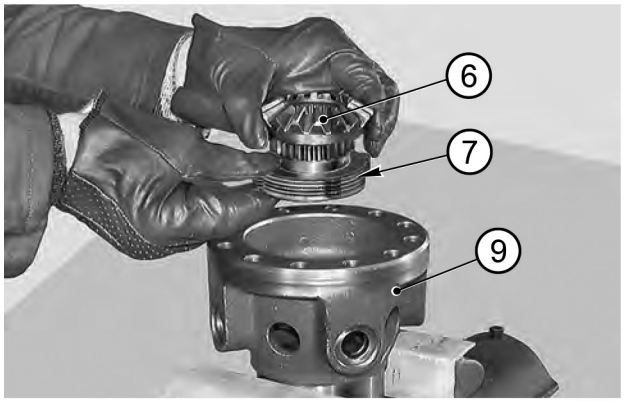

MAP9980

11. Remove tool (**T32**) and planetary pin (**11**) with it.




MAP9990

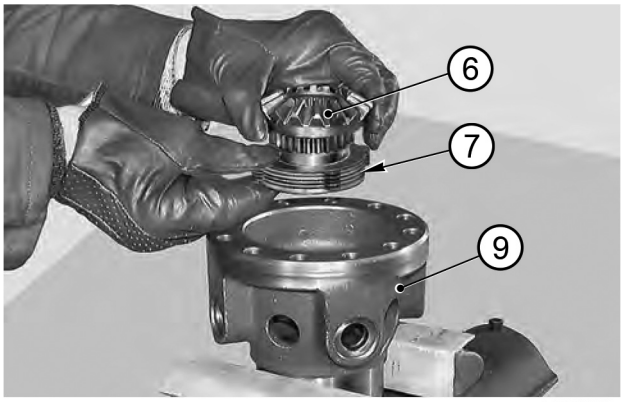
12. Leaving the released planetary in its position, lock again tool (**T32**).
13. Repeat pin extraction operation on the second planetary pin (**11**).
14. Repeat the same operations on the remaining pins.




MAP10000

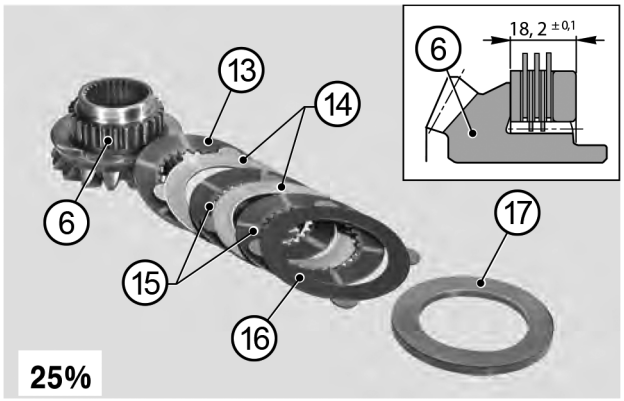
15. Remove tool (**T32**) and extract from the differential unit (9) the two final planetary gears (**12**), the 2nd differential side gear (**6**) and the whole friction assembly concerned (**7**).

## 17.3 LIMITED SLIP DIFFERENTIAL UNIT (25% AND 45%)- ASSEMBLY




MAP10010

1. Place the friction disc assembly (**7**) - suitable for the specific type of slipping and differential side gear (**6**) into the differential unit (**9**).
2. The composition of the unit is illustrated in the points below.

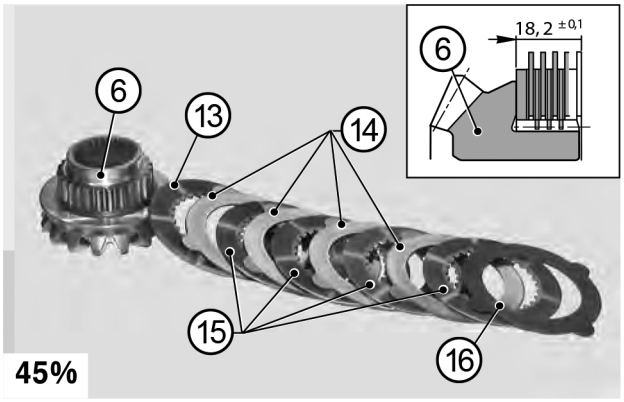



MAP10020

3. 25% FRICTION UNIT COMPOSITION:
   Friction ring with inner disc (**13**), intermediate discs (**14**) and friction discs (**15**) alternated, outer disc (**16**) and spacer (**17**).

**CAUTION**

As to rings (**13**) and (**16**), the side without notches must face outwards.

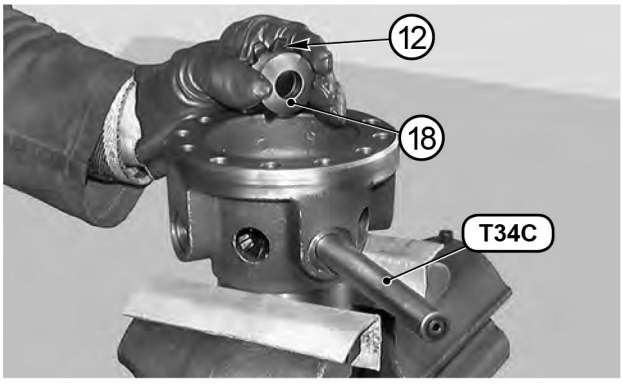



MAP10030

4. 45% FRICTION UNIT COMPOSITION:
   Friction ring with inner disc (**13**), intermediate discs (**14**) and friction discs (**15**) alternated, outer disc (**16**) and spacer (**17**).

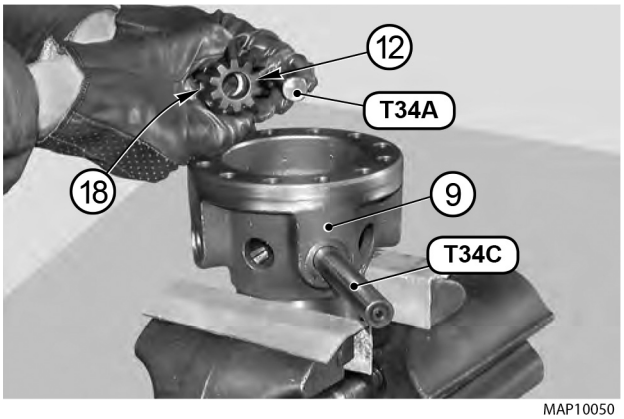
**CAUTION**

As to rings (**13**) and (**16**), the side without notches must face outwards.



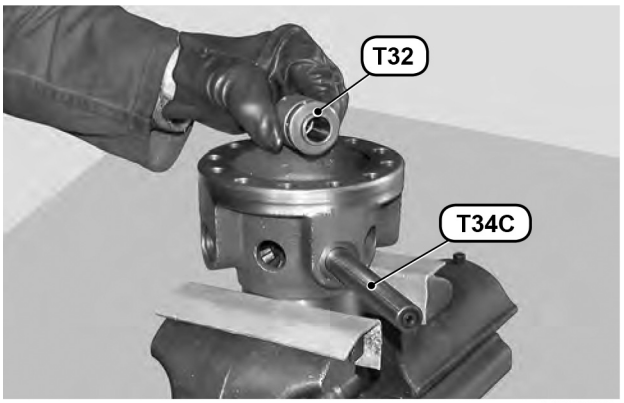

MAP10040

5. Position shim washer (**18**) and the first planetary gear (**12**).
6. Hold in position with bar (**T34C**).



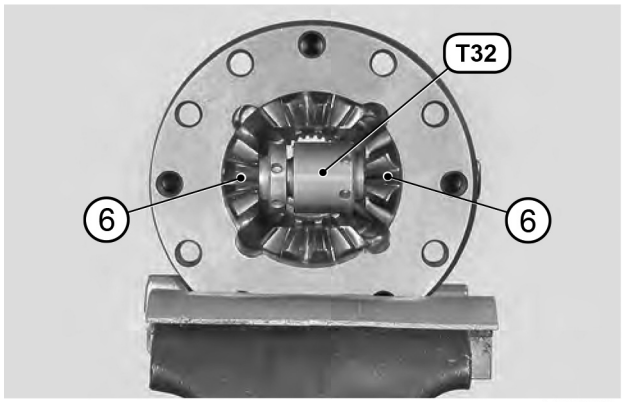

MAP10050

7. Using press tool (**T34A**), position the second planetary gear (**12**) and relative shim washer (**18**).



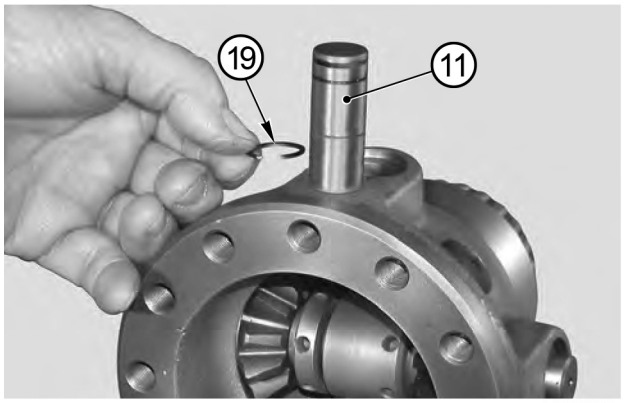

MAP10060

8. Insert tool (**T32**) in-between the two planetary gears (**12**).
9. Align the whole unit, pushing bar (**T34C**) in as far as it will go, until press tool (**T34A**) is expelled.



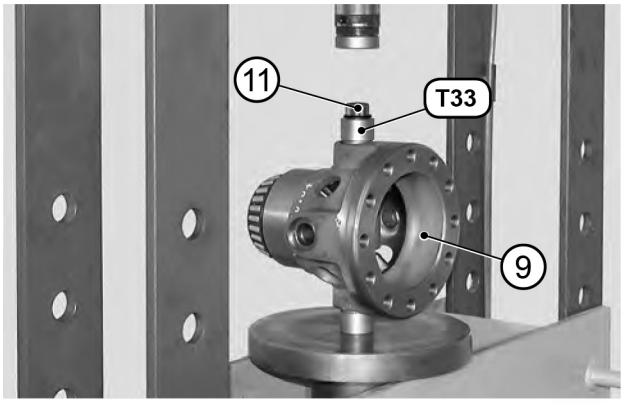

MAP10070

10. Lock tool (**T32**) behind the planetary gears (**12**).
11. After locking the tool, remove bar (**T34C**).



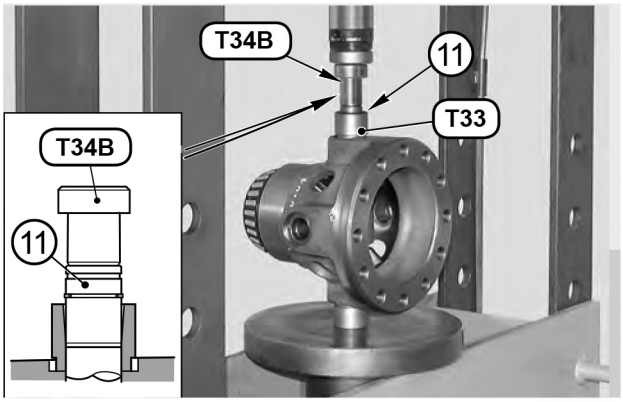

MAP10080

12. Fit snap rings (**19**) onto the pins (**11**).



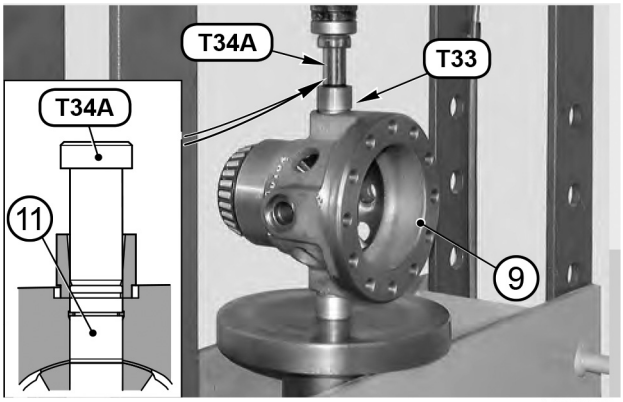
MAP10090

13. Position the differential unit (**9**) under the press, position bushing (**T33**) and insert the planetary pin (**11**).



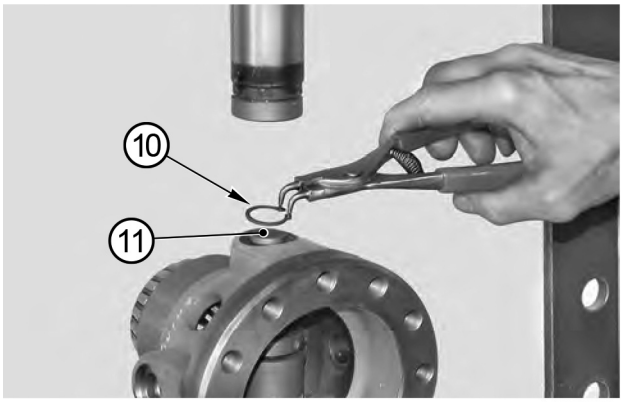
MAP10100

14. Place press tool (**T34B**) on top of the planetary pin (**11**).



MAP10110

15. Press press tool (**T34B**) as far down as it will go.



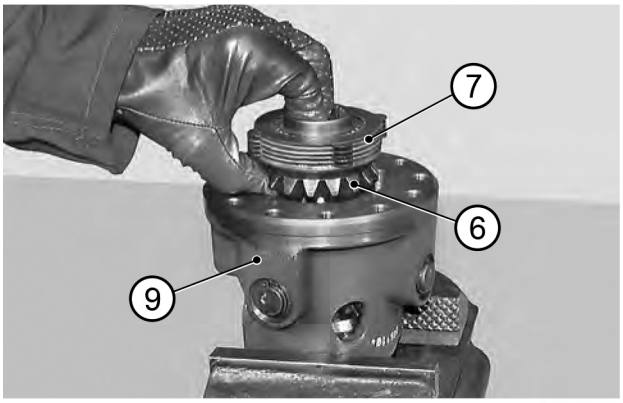
MAP10120

16. Remove press tool (**T34B**), bushing (**T33**) and fit the snap ring (**10**) onto the pin (**11**).

**⚠ CAUTION**

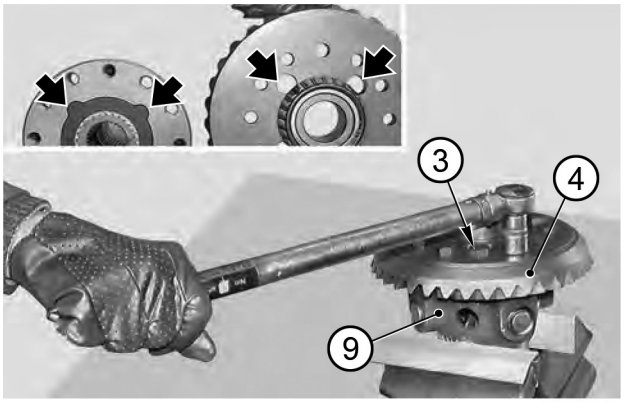
Make sure that the snap ring centers seat and positions itself on the differential unit face.

Repeat the operations on the other planetary pins.



MAP10130

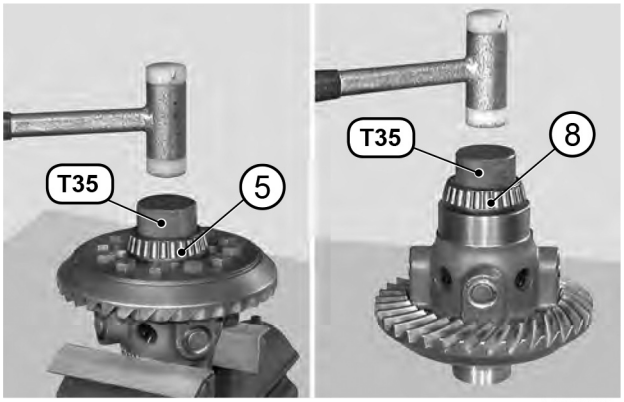
17. Check that planetary have a light clearance in relation to the first planetary gear.
18. Position the second differential side gear (**6**) and the second friction disc assembly (**7**) into the differential unit (**9**).




MAP10140

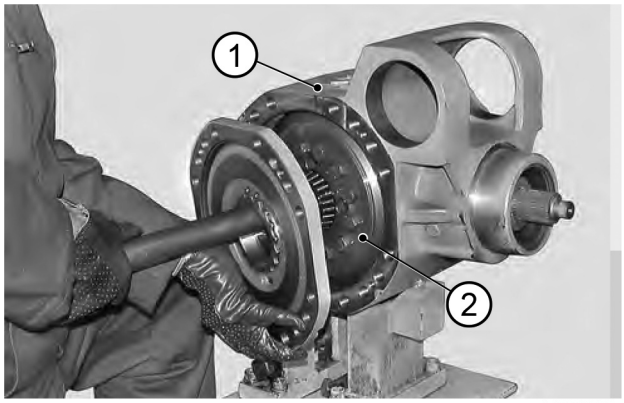
19. Line the lubrication holes up with the slots in the differential carrier. Orient the holes of the crown (**4**) towards the protrusions of the braking unit. Position the crown (**4**) on the differential unit (**9**) and lock it with the screws (**3**) previously coated with Loctite 242.
20. Torque wrench setting for screws:
    128 - 142 Nm (94.40 - 104.73 ft.lb.)

***Note:*** *Tighten screws using the criss-cross method.*




MAP10150

21. If bearings (**5**) and (**8**) have been removed, install them using tool (**T35**).

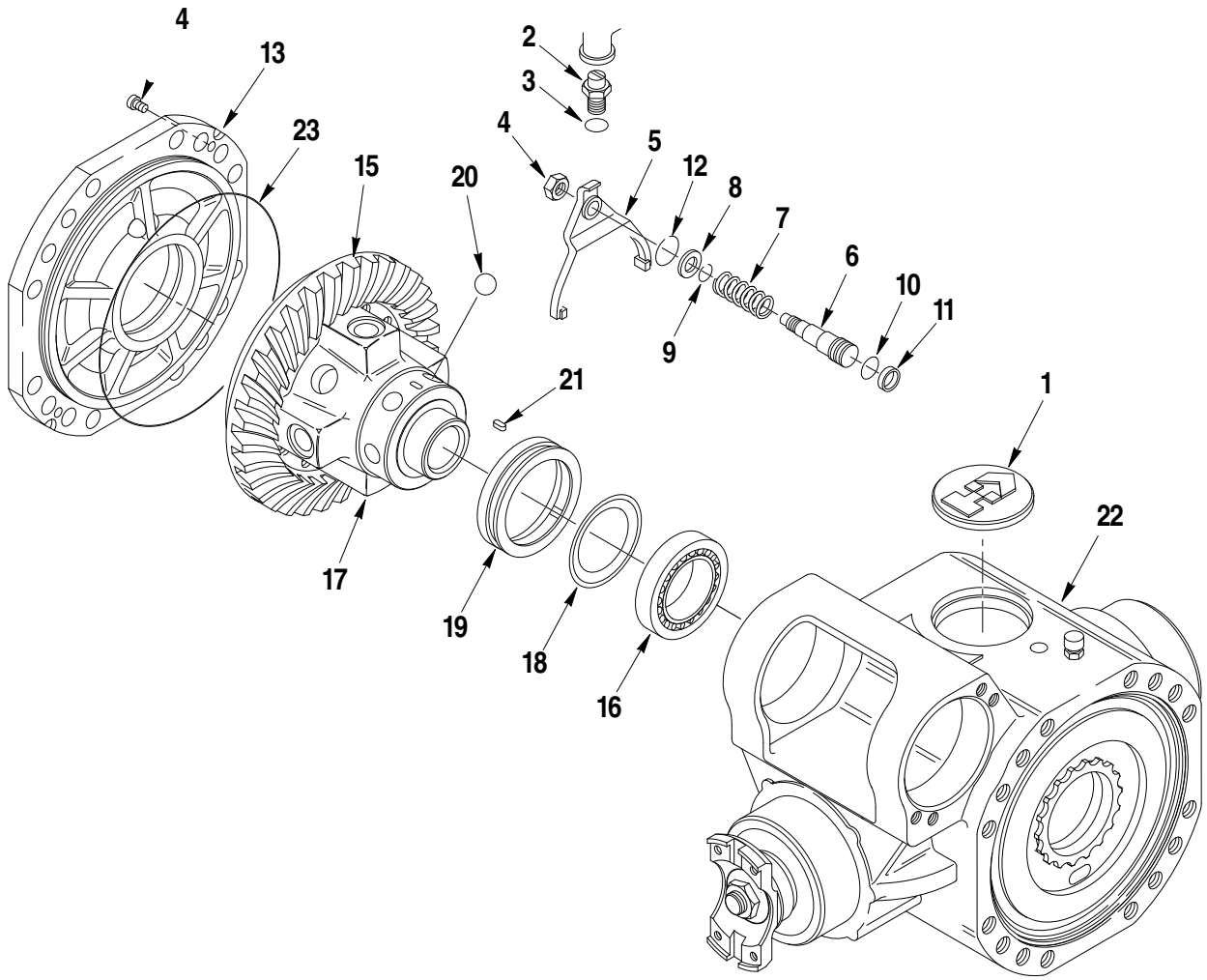



MAP10160

22. Install the whole differential assembly (**2**) into the central body (**1**). For details, see Differential Unit.

# Section 18
# Hydraulic Differential Lock

## 18.1 EXPLODED VIEW

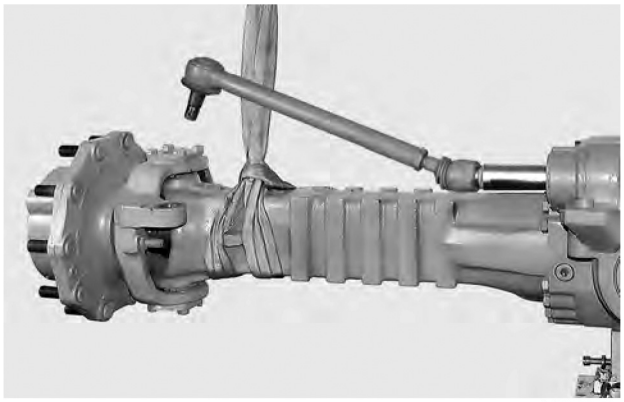



MAP10210

## 18.2 HYDRAULIC DIFFERENTIAL LOCK-DISASSEMBLY

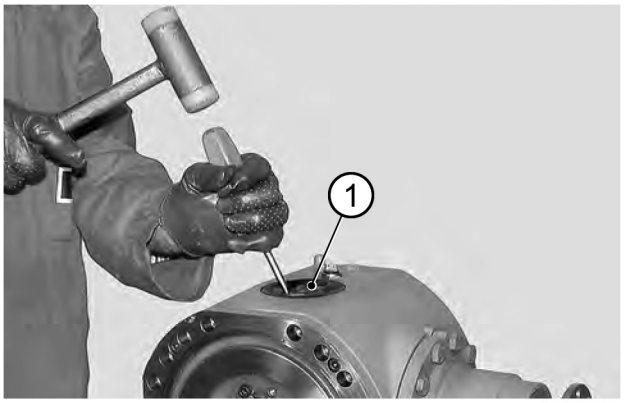
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



MAP10220

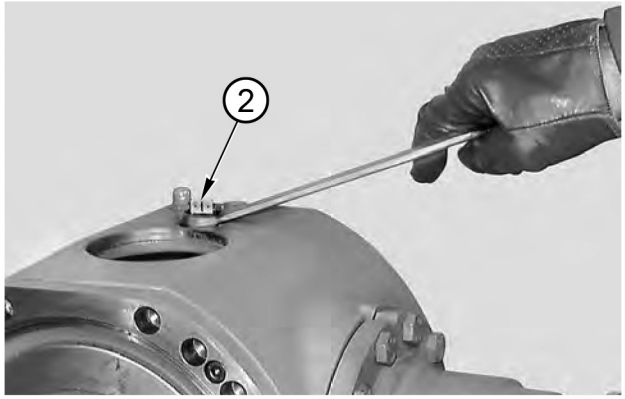
1. Remove the arms.
   For details, see Braking Discs.




MAP10230

2. Remove the top cap (**1**).

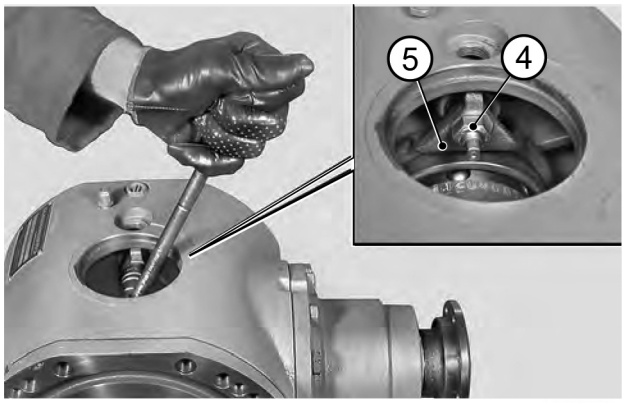
***Note:*** *The cap must be replaced each time the unit is disassembled.*




MAP10240

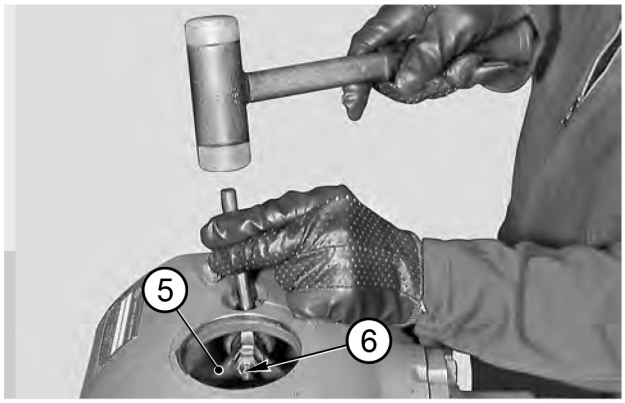
3. Remove the security switch (**2**).

***Note:*** *Check the state of the o-ring (**3**).*



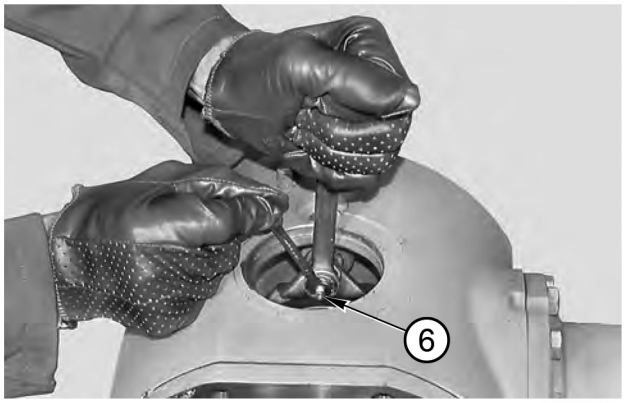

MAP10250

4. Loosen the lock nut (**4**) of selector fork (**5**) by approximately 2 turns.



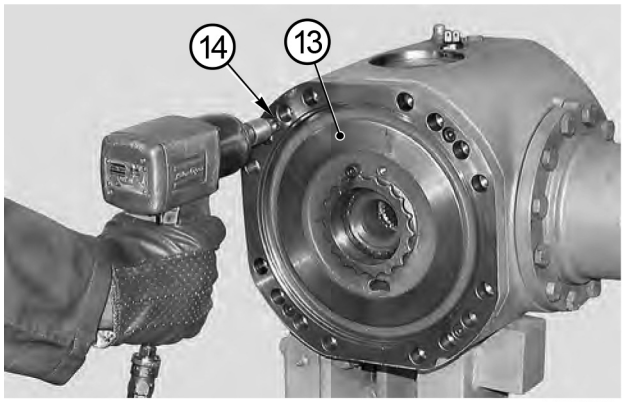

MAP10260

5. Using a metal punch and a hammer, disengage selector fork (**5**) from piston cone (**6**).




MAP10270

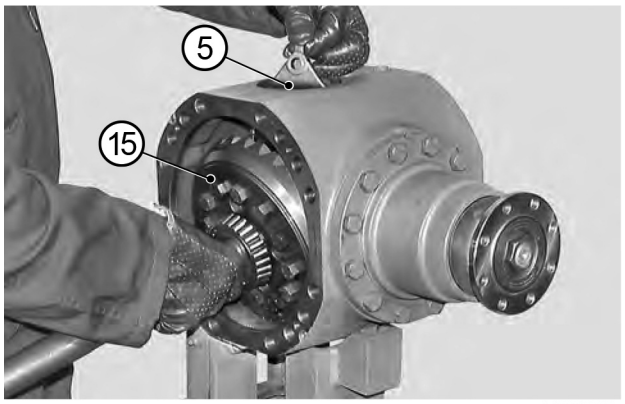
6. Using two wrenches, lock piston (**6**) and remove nut (**4**).




MAP10280

7. Remove screws (**14**) and remove the intermediate cover (**13**).

***Note:*** *Support the differential unit with a lever.*

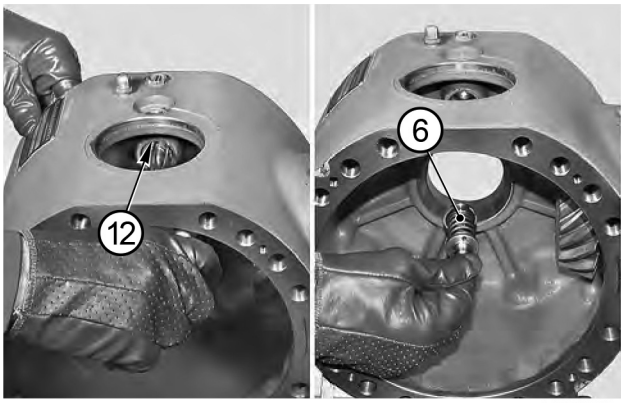



MAP10290

8. Disconnect selector (**5**) from piston (**6**). While holding the selector up, remove the differential unit (**15**).

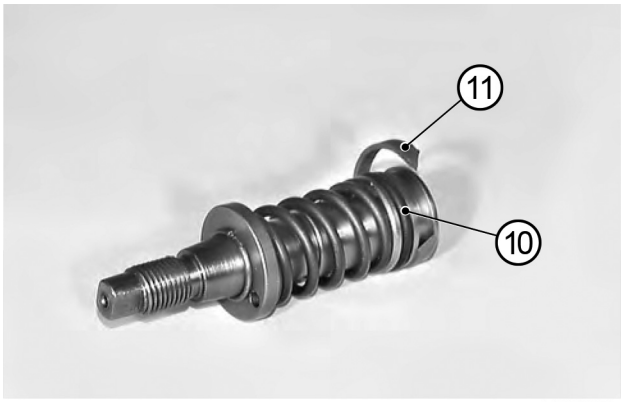

MAP10300

9. Extract selector fork (**5**).




MAP10310

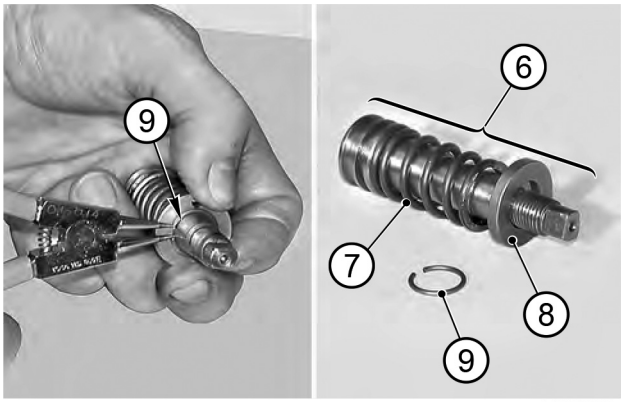
10. Remove snap ring (**12**) and whole piston (**6**).




MAP10320

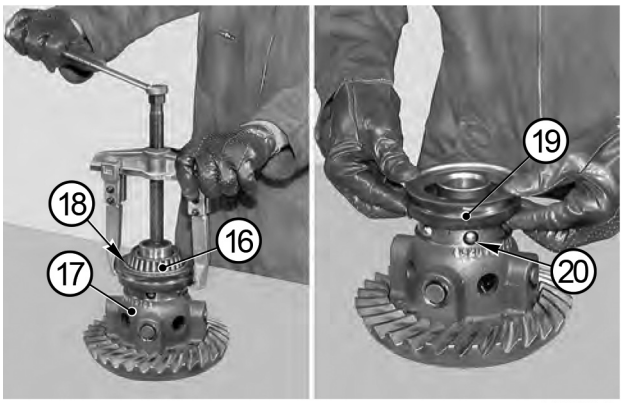
11. Remove guide ring (**11**) and o-ring (**10**).

***Note:*** *The guide ring (**11**) and o-ring (**10**) must be replaced each time the unit is disassembled.*




MAP10330

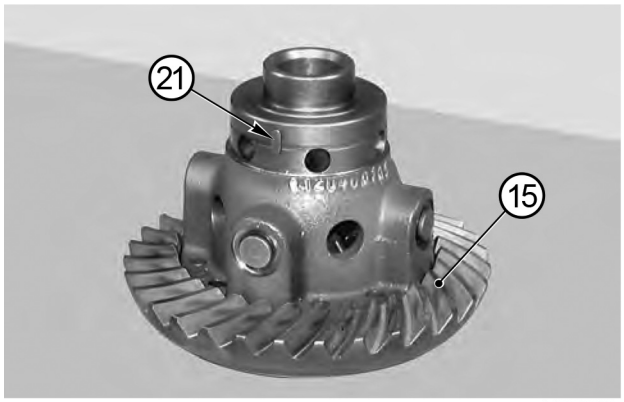
12. Remove snap ring (**9**) and take piston unit (**6**) apart. Remove all component parts.




MAP10340

13. Remove bearing (**16**) from the differential carrier (**17**) as well as the stop ring (**18**), the sleeve (**19**) and the spheres (**20**).

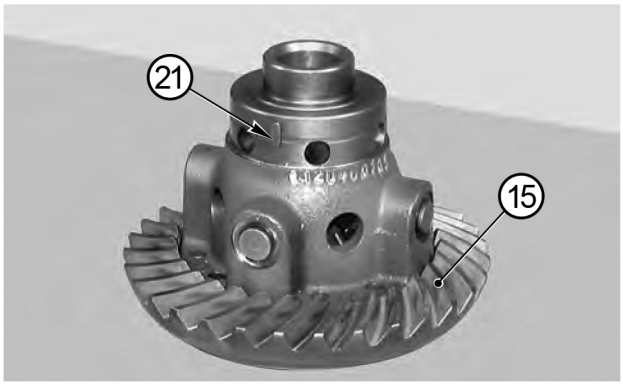
***Note:*** *Write down the direction of assembly of the stop ring (**18**).*




MAP10350

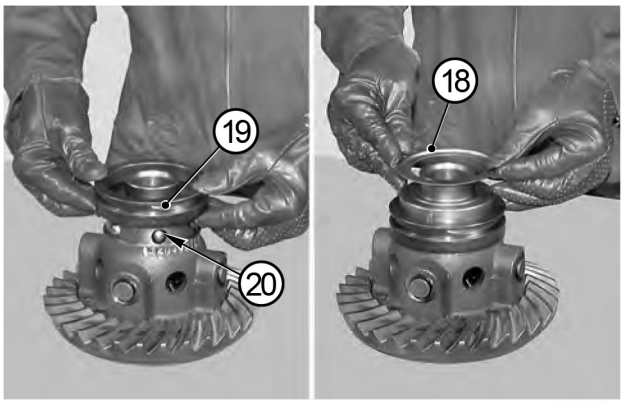
14. **ONLY IF NECESSARY**: Remove the key (**21**) and disassemble the differential unit (**15**). For details, See Differential Unit.

## 18.3 HYDRAULIC DIFFERENTIAL LOCK-ASSEMBLY




MAP10360

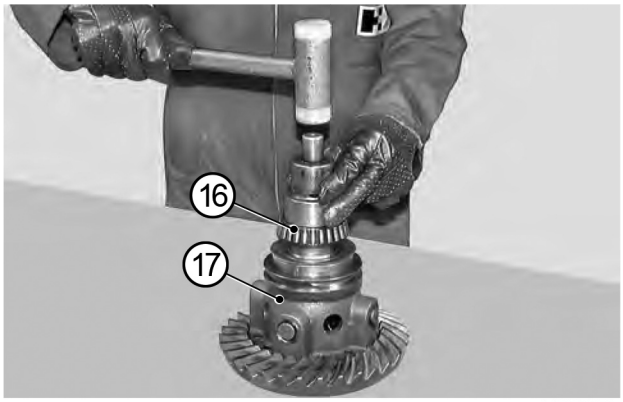
1. ONLY IF PREVIOUSLY DISASSEMBLED: Assemble the differential unit (**15**). (For details see Differential Unit). Position the key (**21**) in the differential unit (**19**).




MAP10370

2. Install spheres (**20**), sleeve (**19**) and stop ring (**18**).

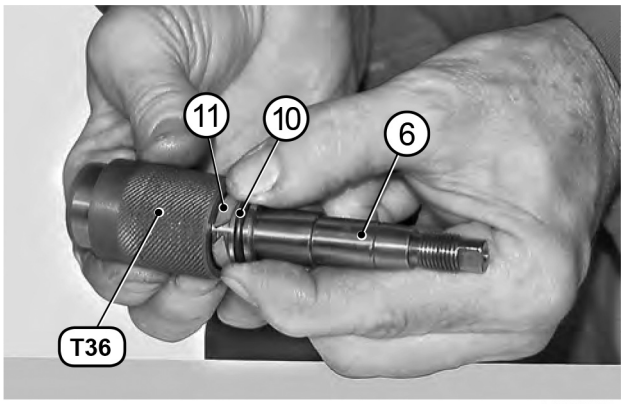
***Note:*** *Pay great attention to ring orientation (**18**).*




MAP10380

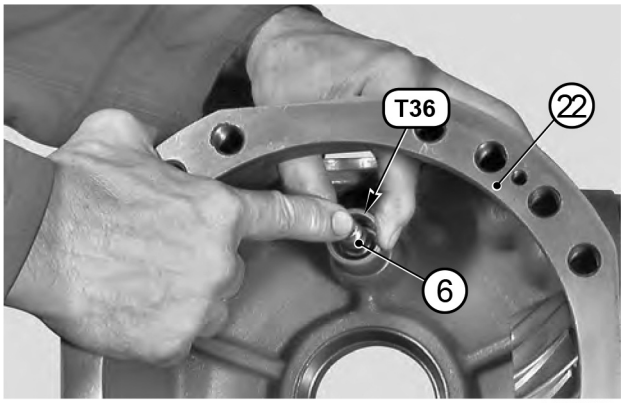
3. Install bearing (**16**) onto the differential carrier (**17**).

***Note:*** *Make sure that the bearing is well set in the differential carrier.*



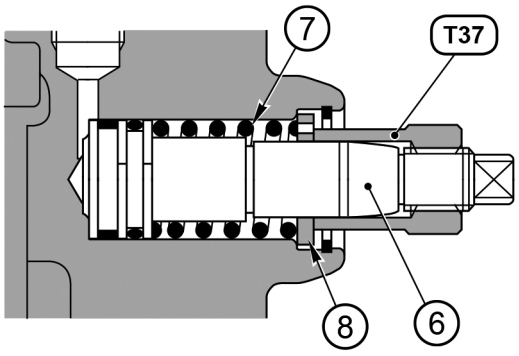

MAP10390

4. Fit o-ring (**10**) and guide ring (**11**) onto the piston (**6**). Lubricate seals and insert the assembly into tool (**T36**).



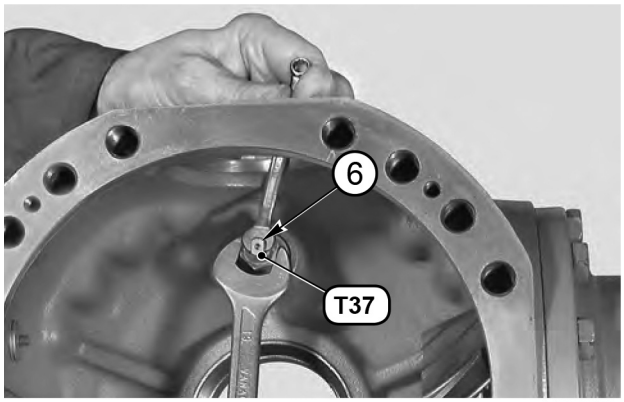

MAP10400

5. Insert tool (**T36**) in the central unit (**22**) and push the piston (**6**) into the seat. Remove tool (**T36**).



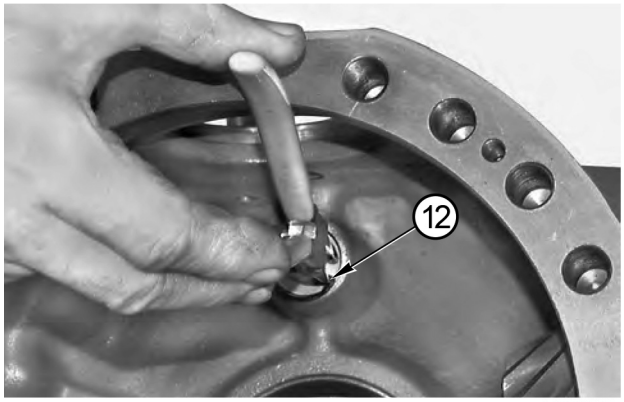

MAP10410

6. Install spring (**7**) and washer (**8**) on the piston (**6**) and install tool (**T37**).



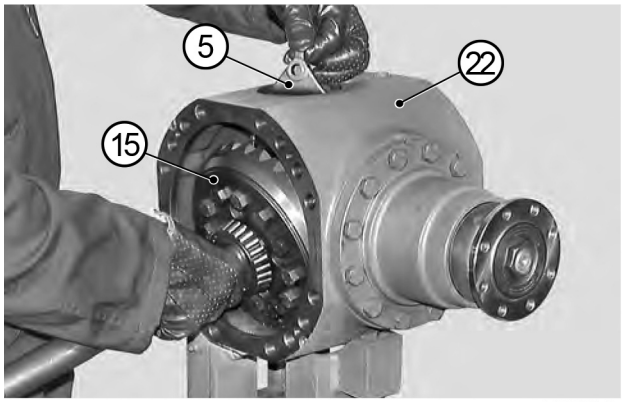

MAP10420

7. Screw tool (**T37**) on the thread of the piston (**6**) to compress the spring (**7**) and vacate the seat for installing the snap ring (**12**).



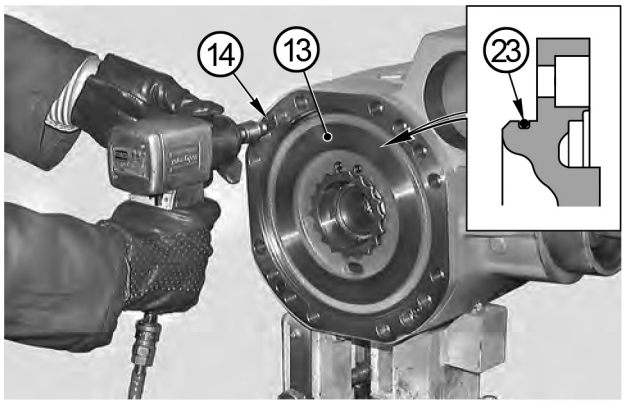

MAP10430

8. Install the snap ring (**12**).
9. Remove tool (**T37**) and fit the snap ring (**9**) of spring (**7**).



MAP10440

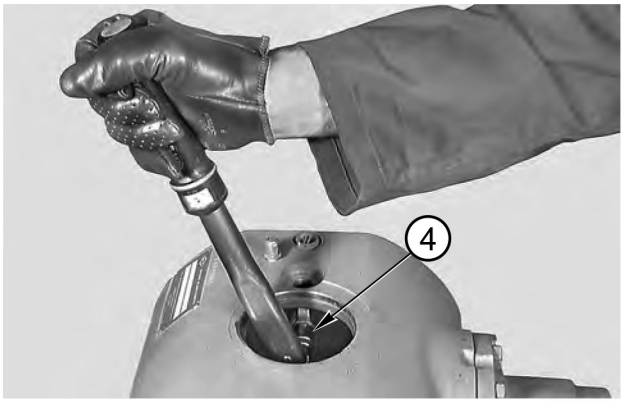
10. Insert the selector fork (**5**) and the differential unit (**15**) into the central unit (**22**).
11. Engage the selector fork (**5**) in the coupling (**19**) and on the piston (**6**).



MAP10450

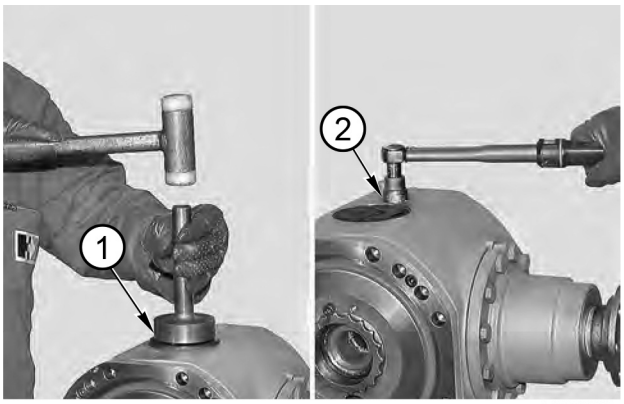
12. Install the intermediate cover (**13**) and lock it with screws (**14**). Tighten screws using a torque wrench setting of 23.8 - 26.2 N·m.(17.6 - 19.3 ft. lb.).

***Note:*** *Carefully check the state of the o-ring (**23**).*



MAP10460

13. Install the lock nut (**4**) of the selector fork (**5**) and lock it with a torque wrench set to a torque of 70 - 75 Nm (51.6 - 55.3 ft.lb.).



MAP10470

14. Install the security switch (**2**) complete with o-ring; torque wrench setting: maximum 30 N·m.(22.1 ft. lb.).
15. If necessary, adjust differential unit clearances. See Differential Unit.
16. Install the top cap (**1**) and the arms. See Braking Discs.

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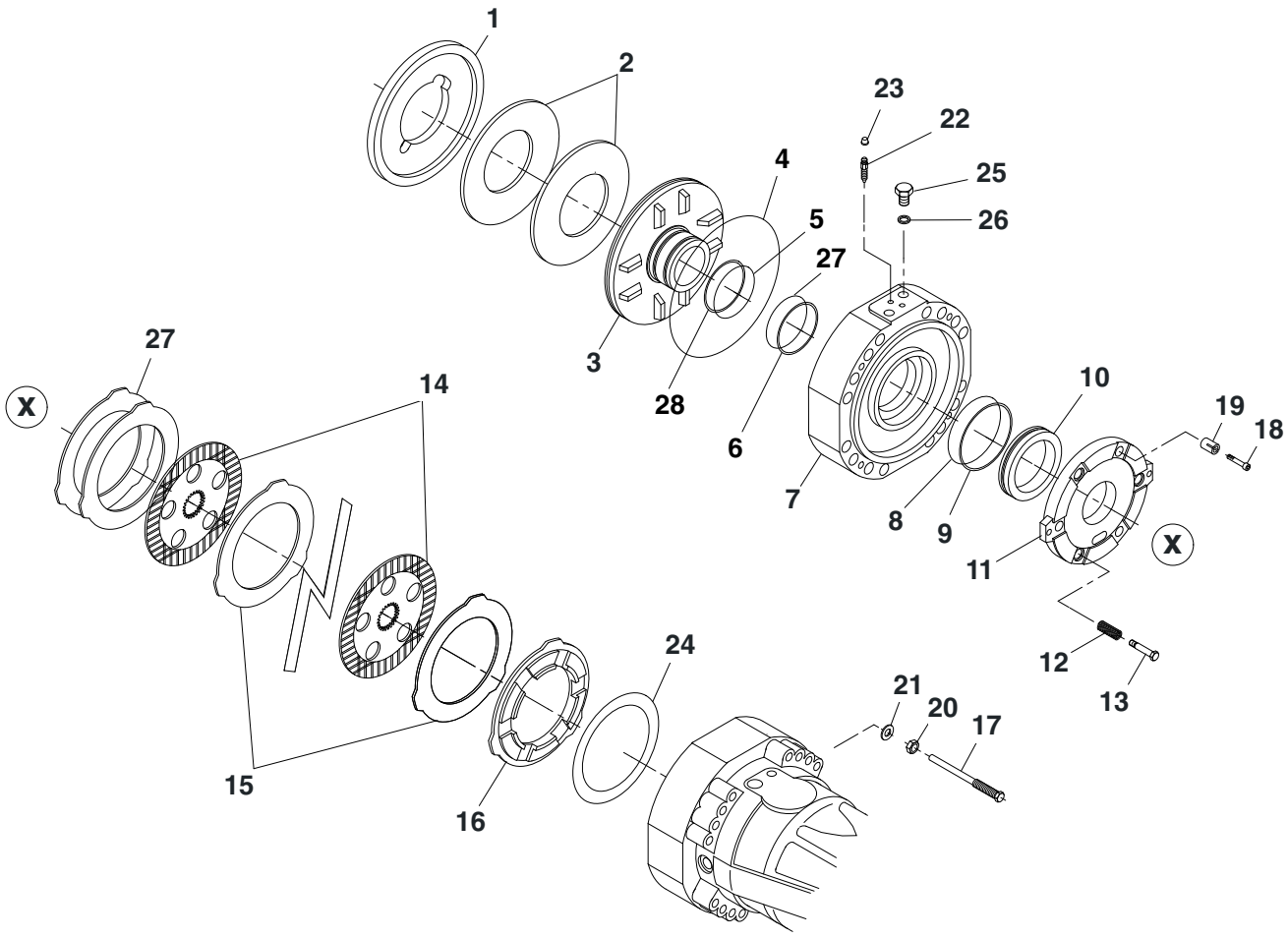
# Section 19
# Hydraulic Negative Brake

## 19.1 EXPLODED VIEW




MAP10490

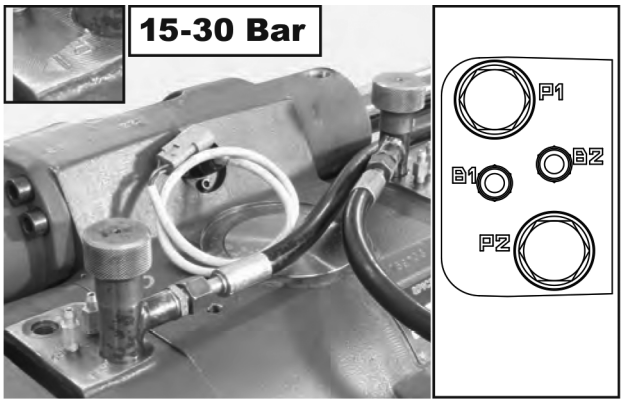
## 19.2 HYDRAULIC NEGATIVE BRAKE- DISASSEMBLY

**DANGER**

Before maintaining brakes, when the axle is installed on the vehicle, follow all safety instructions in the Original Equipment Manufacturer (OEM) manual that came with the vehicle.

**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.




MAP10500

1. Connect an external pump to the union piece “P1“of the negative brake and introduce a pressure of 15 - 30 bar to eliminate the pressure of the Belleville washers (**2**).

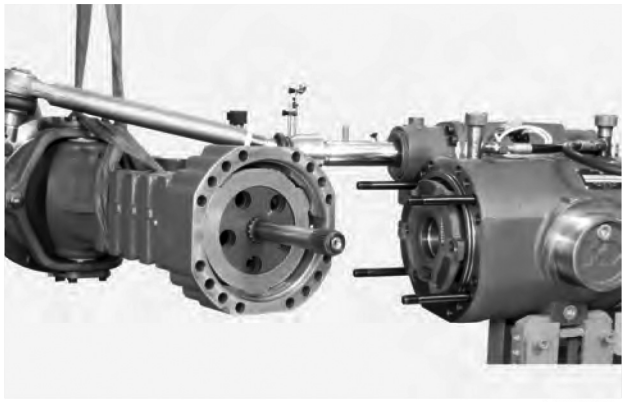
**DANGER**

Always check that the hydraulic circuit test for leaks under pressure. Always use a cardboard or a panel to control the loss.

A leak from a hole of the size of a pin can cause serious injury. If fluid is injected into the skin it is necessary to seek immediate medical care.

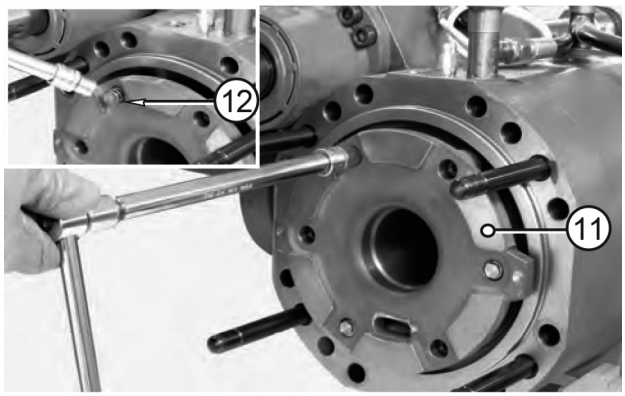
MAP10510

2. Sling the arm to be removed and connect it to a hoist.
3. Loosen and remove screws (**17**).



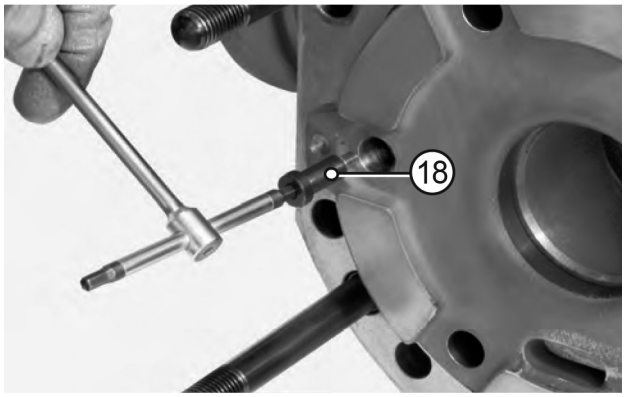
MAP10520

4. Remove arm together with brakes and axle shafts; lay down the arm vertically.
5. Release pressure.




MAP10530

6. Remove the reversal springs (**12**) from the cover (**11**).

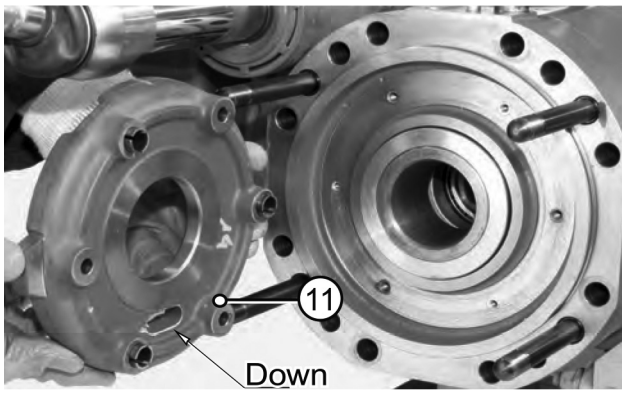



MAP10540

7. Remove the pin screws (**18**) guiding the cover (**11**).

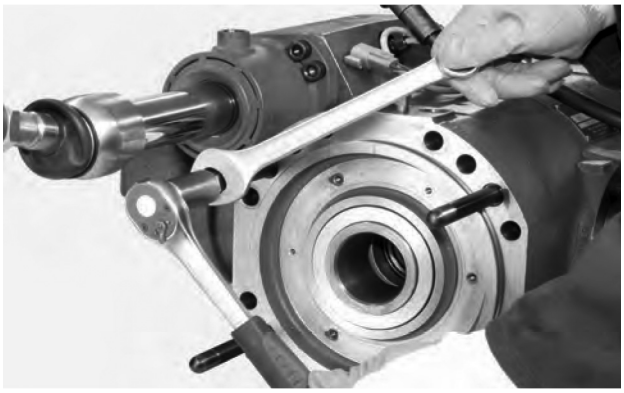
**CAUTION**

If the screws are to be replaced, write down the different colors for the different brake gaps.




MAP10550

8. Write down their order of assembly and remove the counter washer (**11**).

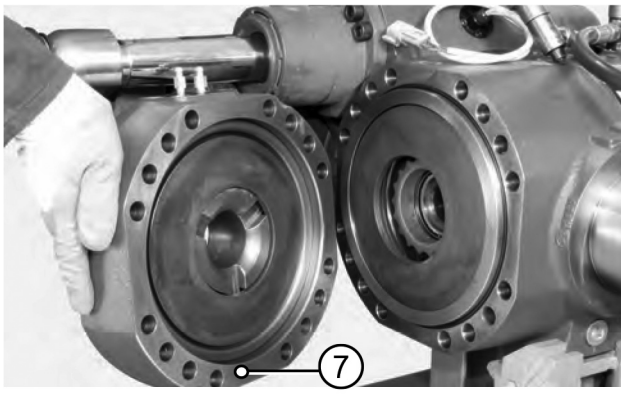


MAP10560

9. Loosen the studs and remove two of them.

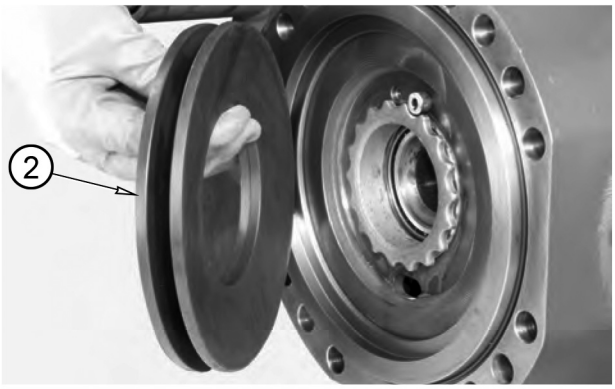
MAP10570

10. Loosen the studs and remove two of them.




MAP10580

11. Move the cover (**7**) outwards.

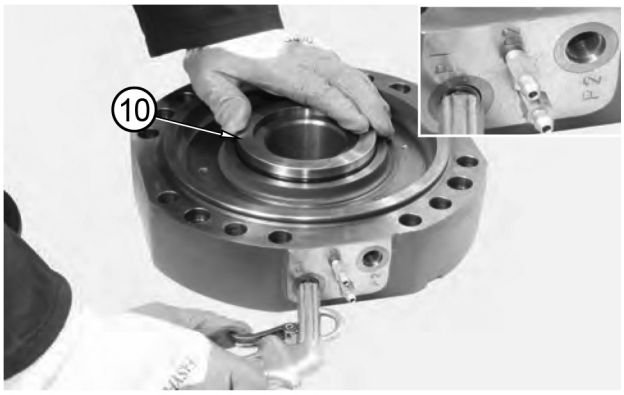



MAP10590

12. Remove the Belleville washers (**2**) and write down direction of assembly.

MAP10610

14. Write down their order of assembly and mark and remove negative piston sign the position.




MAP10600

13. Slowly introduce low-pressure compressed air through the connection member for the service brake, in order to extract the piston (**10**).


MAP10620

15. Slowly introduce low-pressure compressed air through the connection member for the negative brake, in order to extract the piston (**3**).

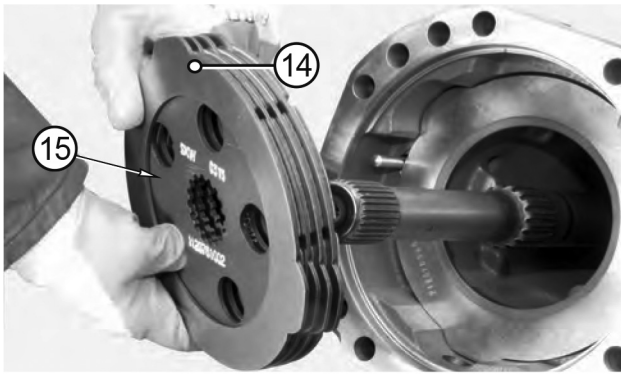
**⚠ CAUTION**

Hold the piston (**10**) back, as it may be suddenly ejected and damaged.

**⚠ CAUTION**

Hold the piston (**3**) back, as it may be suddenly ejected and damaged.

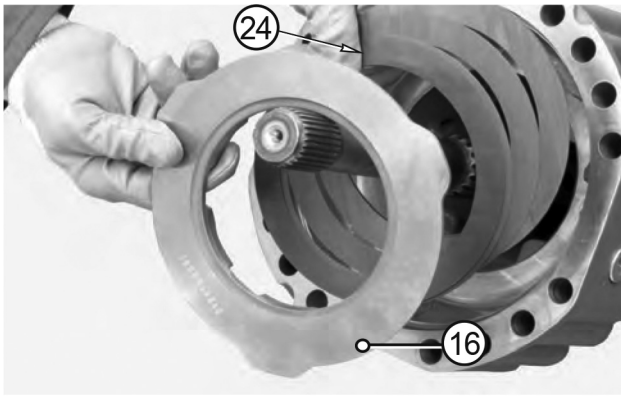
***Note:*** *The o-rings must be replaced each time the unit is disassembled.*




MAP10630

16. Remove brake discs (**14**) and (**15**), writing down direction of assembly.

***Note:*** *If disks are not to be replaced, avoid changing their position.*

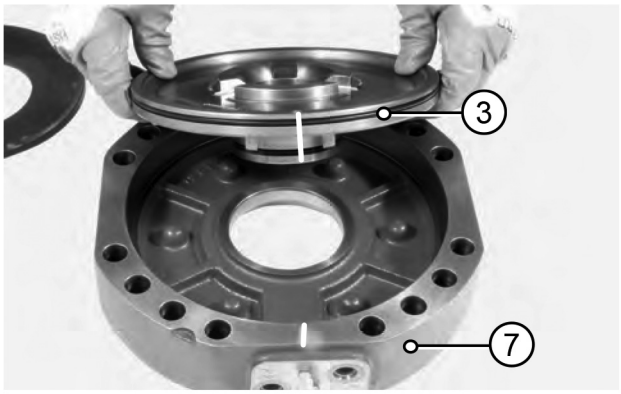



MAP10640

17. Remove braking discs (**16**) and shims (**24**), writing down direction of assembly.

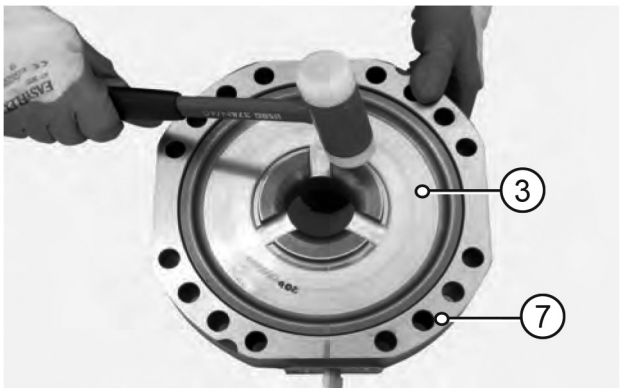
***Note:*** *If disks are not to be replaced, avoid changing their position.*

## 19.3 HYDRAULIC NEGATIVE BRAKE ASSEMBLY




MAP10650

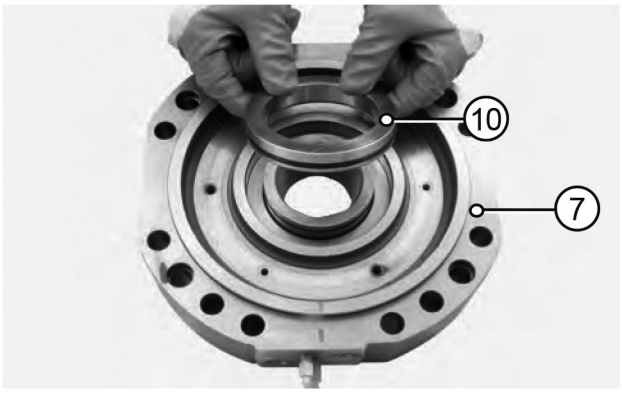
1. Fit o-rings (**4**), (**28**), (**27**), (**5**), (**6**) onto the piston (**3**). Lubricate the piston and the o-rings and install the unit into the cylinder (**7**).




MAP10660

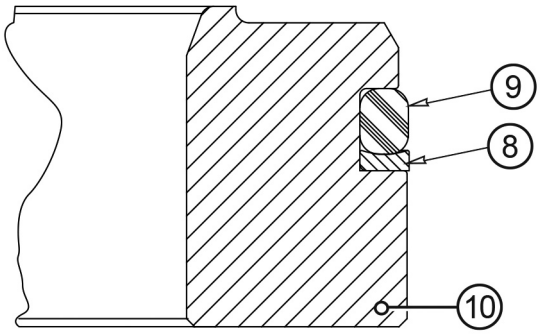
2. Using a plastic hammer, insert the piston (**3**) into the cylinder (**7**).

***Note:*** *Lightly hammer all around the edge in an alternate sequence.*

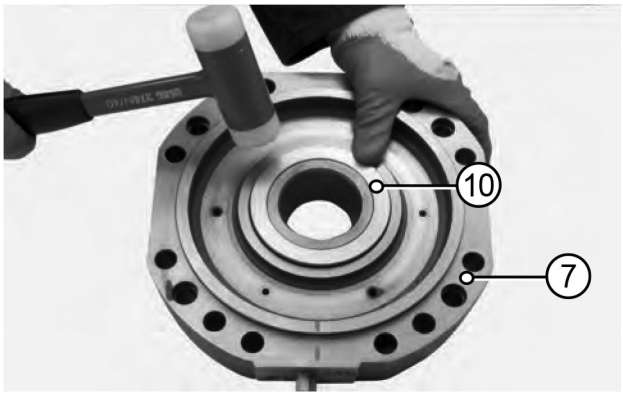



MAP10670

3. Fit o-rings (**9**) and (**8**) onto the piston (**10**). Lubricate the piston and the o-rings and install the unit into the cylinder (**7**).



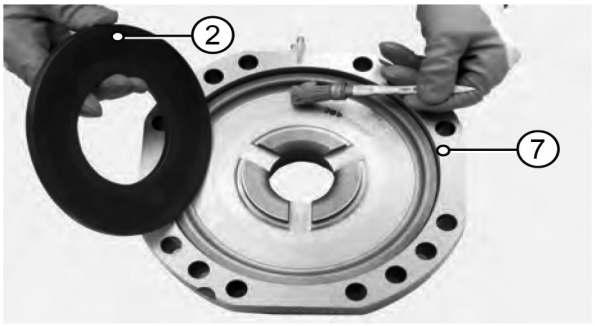

MAP10680




MAP10690

4. Using a plastic hammer, insert the piston (**10**) into the cylinder (**7**).

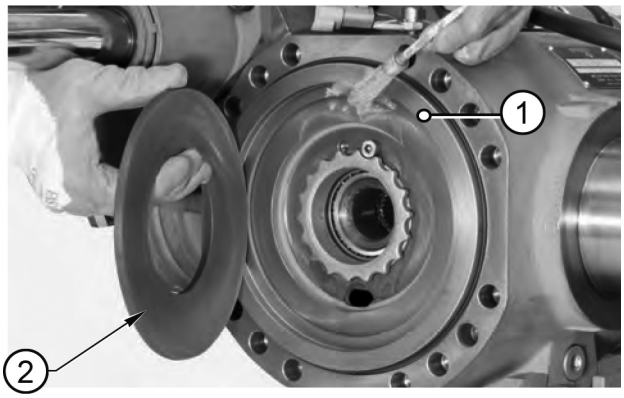
***Note:*** *Lightly hammer all around the edge in an alternate sequence.*




MAP10700

5. Apply grease and position the Belleville washers (**2**) and engage the cylinder (**7**).

***Note:*** *Check the sense of direction of washers (**7**) and relative centering.*



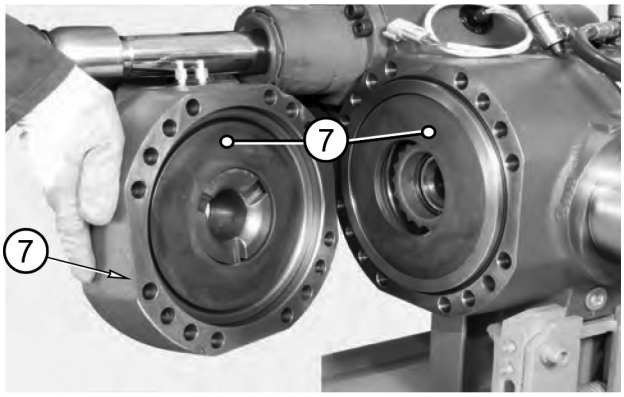

MAP10710

6. Apply grease and position the Belleville washers (**2**) and engage the cylinder (**1**).

***Note:*** *Check the sense of direction of washers (**2**) and relative centering.*

MAP10720

7. Check quality and position of the cylinder's O-ring.



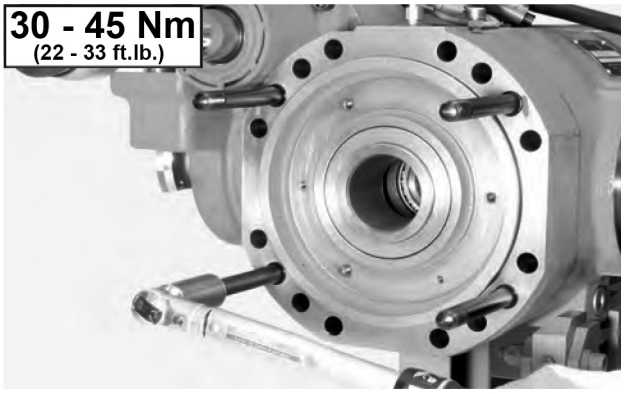

MAP10730

8. Position the Belleville washers (**2**) and engage the cylinder (**7**).

***Note:*** *Check the sense of direction of washers (**2**) and relative centering.*

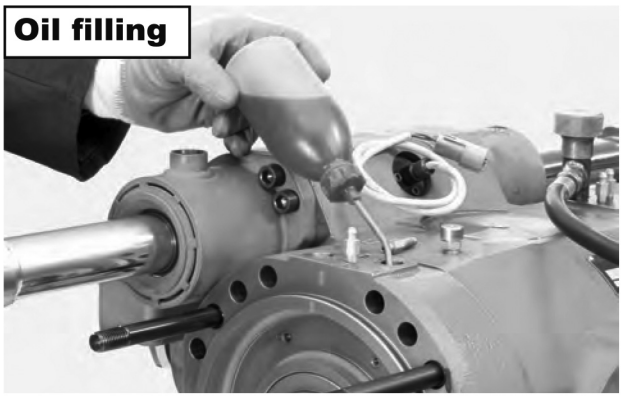
MAP10740

9. Lock the cylinder.



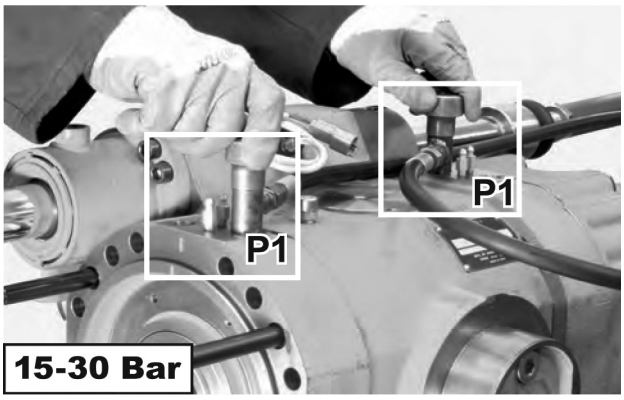

MAP10750

10. Tightening the studs with a torque wrench set to a torque of 30 - 45 N·m.(22.1 - 33.1 ft. lb.)




MAP10760

11. Fill with ATF oil. For details Oil Draining Mandatory Procedure.



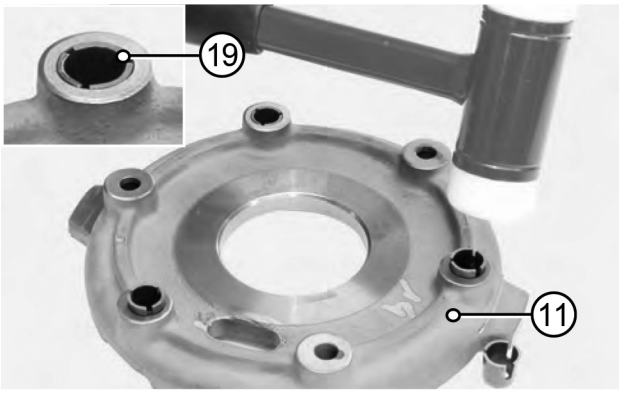

MAP10770

12. Connect an external pump to the negative brake and introduce pressure to 15 - 30 bar.

**DANGER**

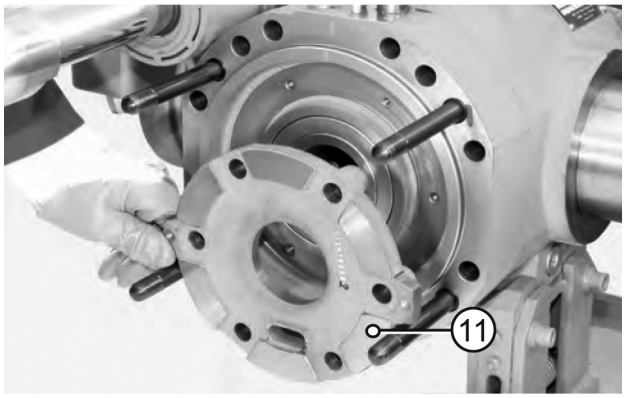
Always check that the hydraulic circuit test for leaks under pressure. Always use a cardboard or a panel to control the loss.

A leak from a hole of the size of a pin can cause serious injury. If fluid is injected into the skin it is necessary to seek immediate medical care.



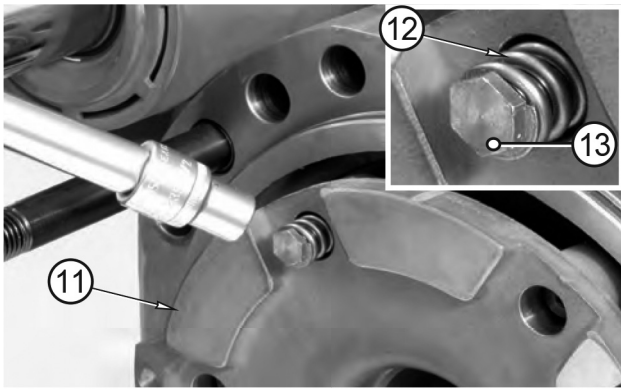

MAP10780

13. Insert the stroke automatic regulation springs (**19**); place them in line with the piston (**11**).




MAP10790

14. Insert the intermediate disk (**11**).

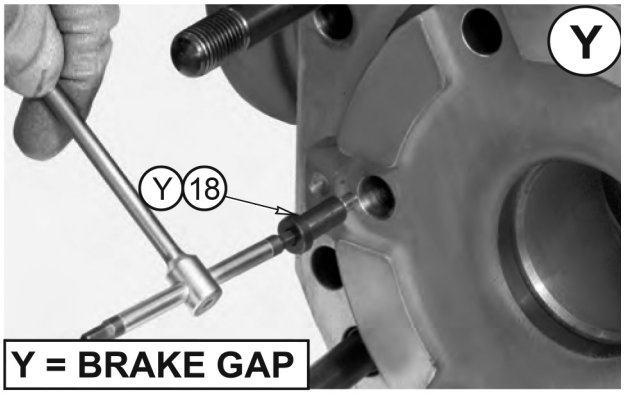



MAP10800

15. Fit the reversal springs (**12**), (**13**) on the piston (**11**).

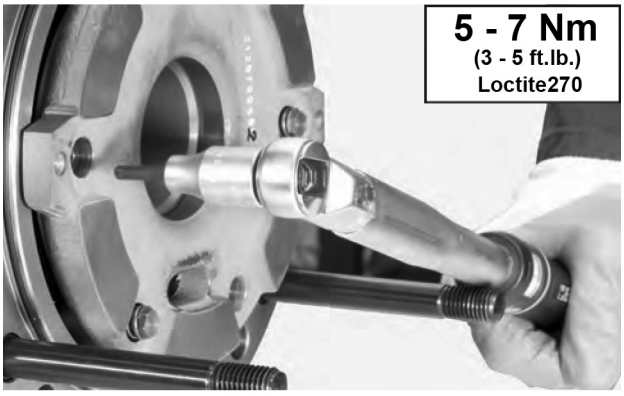

MAP10810

16. Apply Loctite 270 to the thread of the piston adjustment nut.
17. Tighten with torque wrench setting of 10 - 15 N·m.(7.3 - 11.0 ft.lb.).



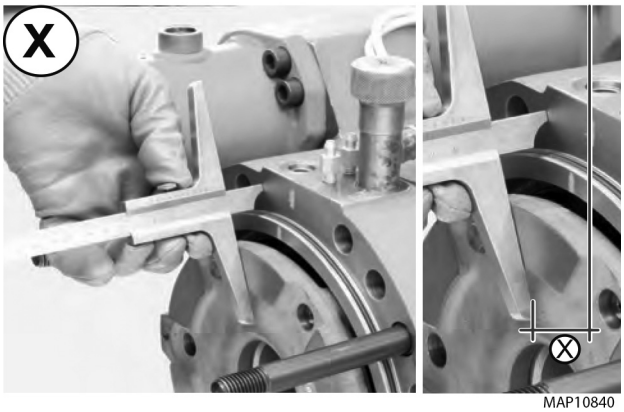

MAP10820

18. Y= brake gap: 0,75mm 1,00mm 1,25mm 1,50mm
    Depending on axle configuration.



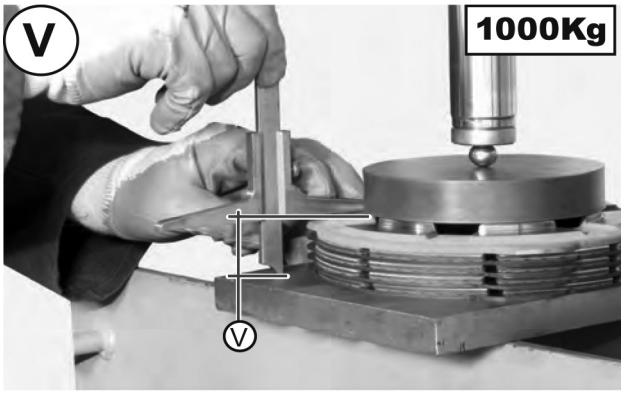

MAP10830

19. Fit the pin screws making sure that they are all of the same color.
20. Apply Loctite 270 to the thread.
21. Torque wrench setting: 5 - 7 N·m.(3.7 - 5.1 ft.lb.).



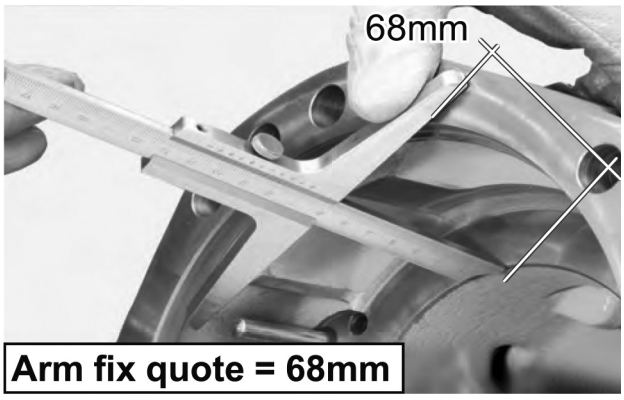

MAP10840

22. Take the measurement from the surface of the intermediate disk to the cover sealing surface with 30 bar of pressure introduced.
    EXAMPLE: 25.4 mm



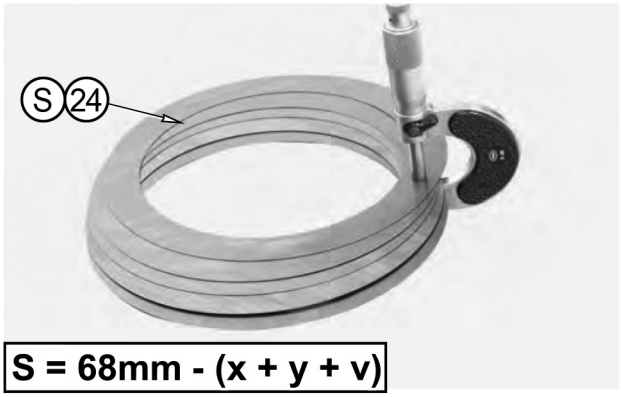

MAP10850

23. Put the brake disc pack including the shim under a press, load with 1000 kg and take the measure “V”. EXAMPLE: V = 40 mm



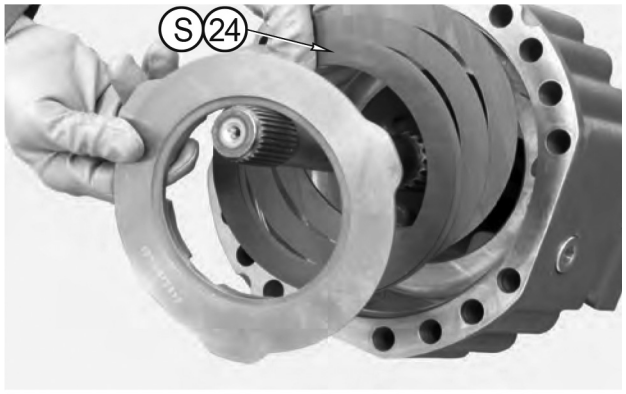

MAP10860

24. Arm fix quote = 68 mm

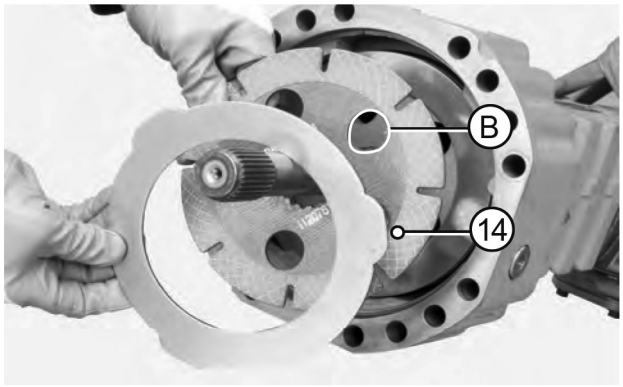



MAP10870

25. S = 68 mm - (x + y + v) = Thickness of shims to insert under the shim washer.

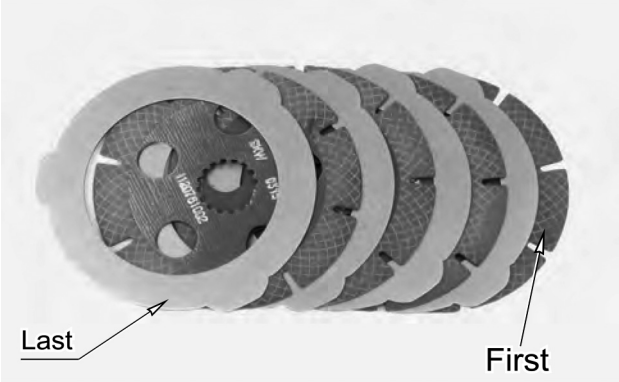



MAP10880

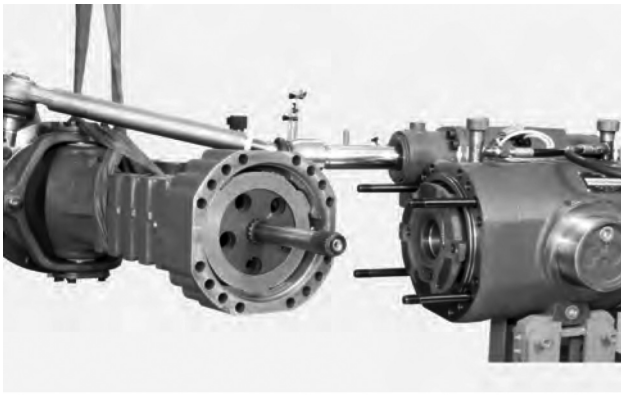



MAP10890

26. Slightly lubricate the braking disks (**14**) and fit them in the arm following the correct sequence; orient them so that the oil circulation holes and the marks “B” are lined up.
27. When installing the steel discs, the slot corresponding to the oil level cap should always be kept free.



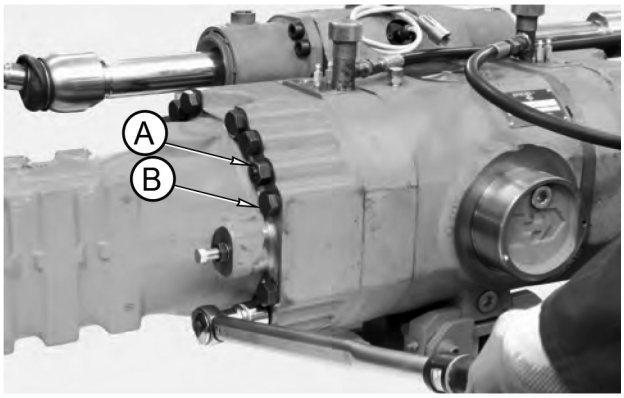

MAP10900



MAP10910

28. Check integrity and position of the arm's o-ring; install the complete arm.

***Note:*** *To assist axle shaft centering, slightly move the wheel hub.*




MAP10920

29. Torque wrench setting:

    A = 200 Nm (147.5 ft.lb)

    B = 283 Nm (208.7 ft.lb)

***Note:*** *Tighten using the criss-cross method.*

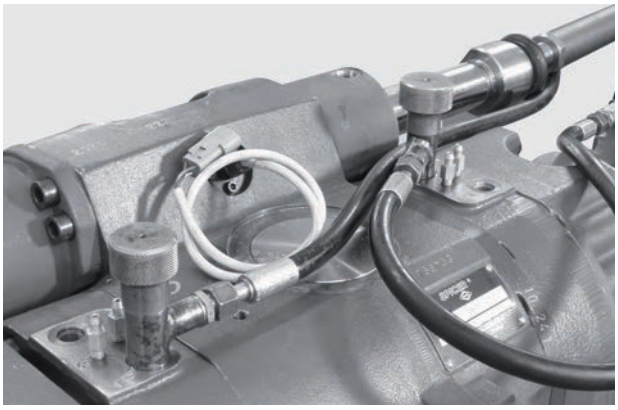

MAE20440

30. Gradually release the pressure in the braking circuit, bringing it to zero through the external pump.

**DANGER**

Do not remove any part of the hydraulic circuit without having completely released the hydraulic pressure.

The removal of pressurized parts or loss caused from releasing these components can cause serious injuries and even death. A leak from a hole of the size of a pin can cause serious injury. If fluid is injected into the skin it is necessary to seek immediate medical care.



MAE20450

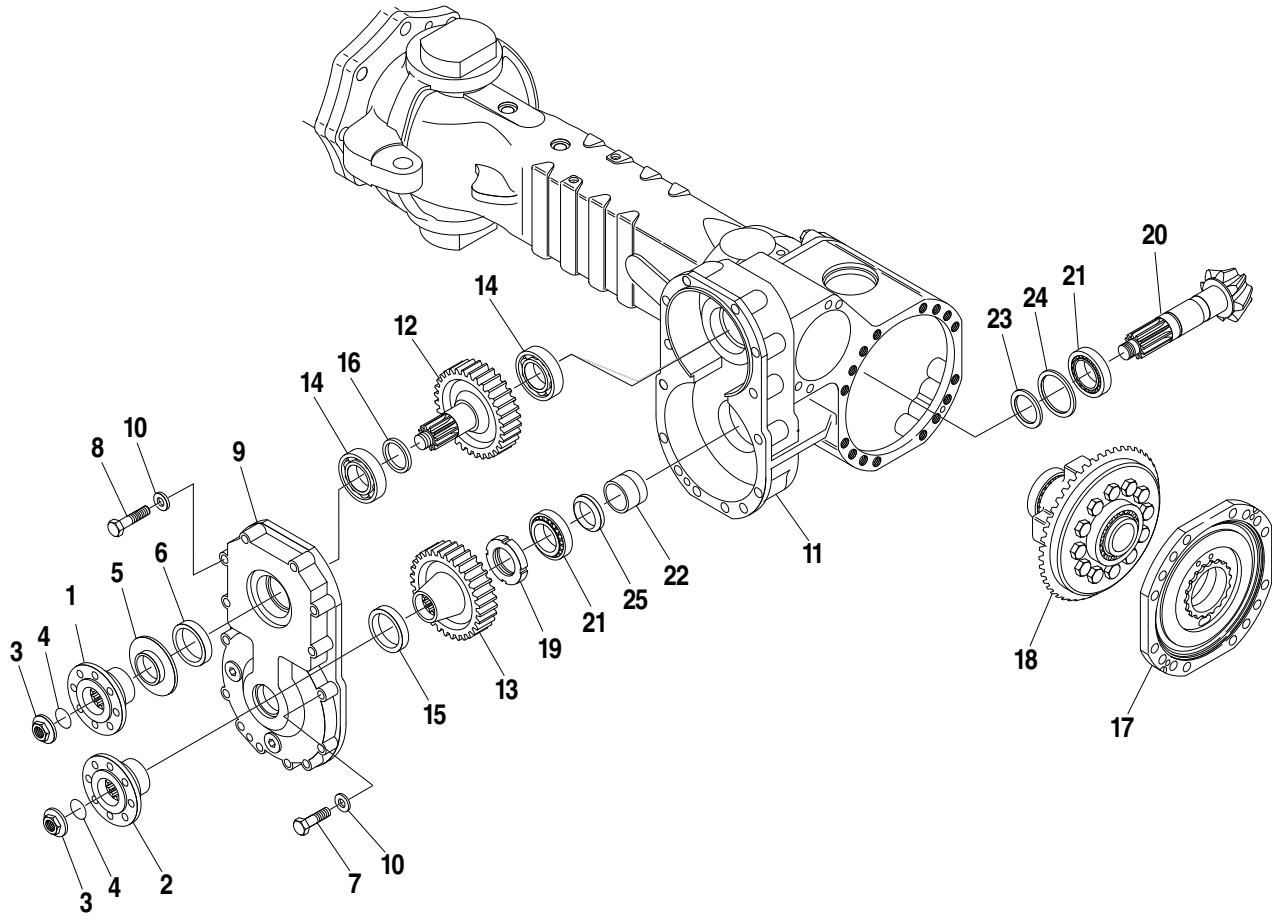
31. Gradually loosen the sleeve and remove.

**DANGER**

Carefully check that the hydraulic pressure is discharged completely before removing the external pump sleeve connected to the brake.

# Section 20
# Incorporated Reduction Gear and Pinion 602

## 20.1 EXPLODED VIEW

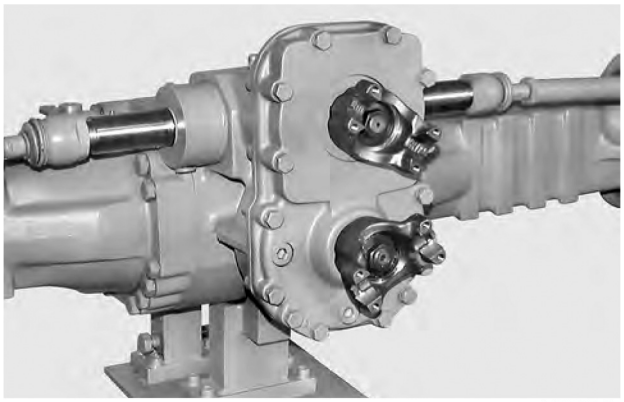



MAP10930

## 20.2 INCORPORATED REDUCTION GEAR AND PINION 602 - DISASSEMBLY

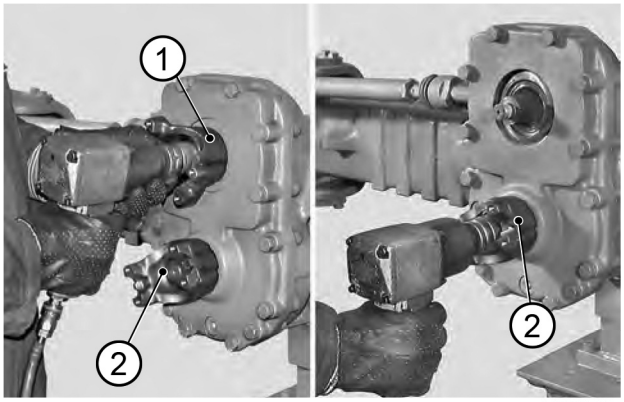
**CAUTION**

Before draining oil, release the internal pressure, for details see Oil Draining Mandatory Procedure.



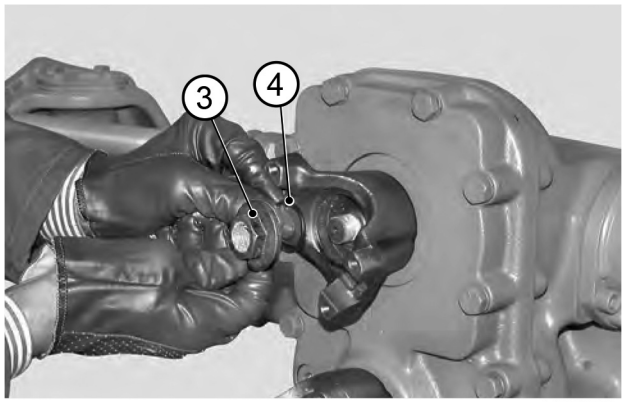
MAP10940

1. The figure shows the axle with incorporated reduction gear with Mechanic flanges; disassembly and assembly procedures also apply to DIN flanges.



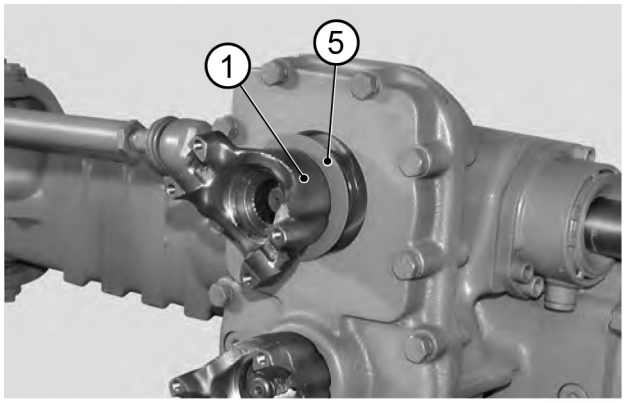

MAP10950

2. Loosen the check nuts on upper (**1**) and lower (**2**) flange.



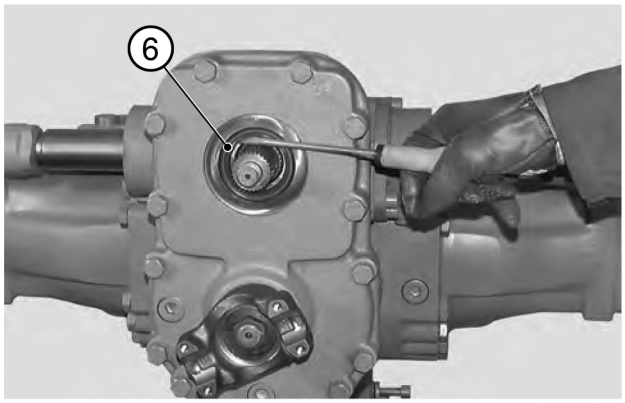

MAP10960

3. Draw out nuts (**3**) and o-rings (**4**).



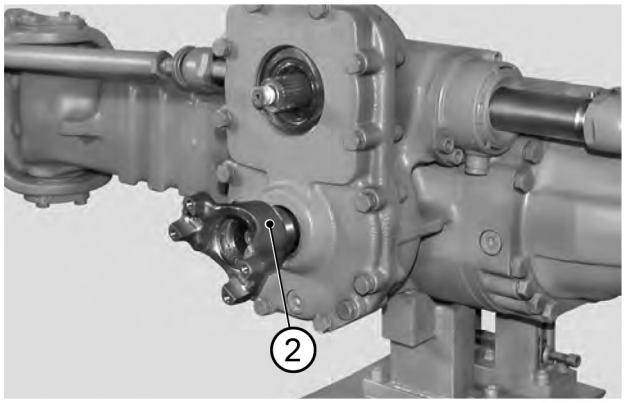

MAP10970

4. Remove the upper flange (**1**) together with dust ring (**5**).



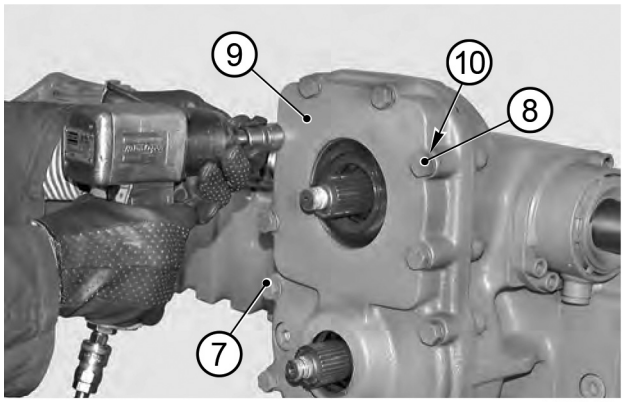

MAP10980

5. Remove the snap ring (**6**) and discard it.



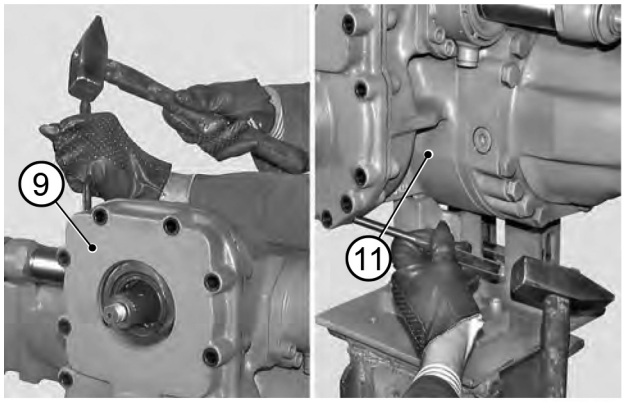
MAP10990

6. Remove the lower flange (**2**).



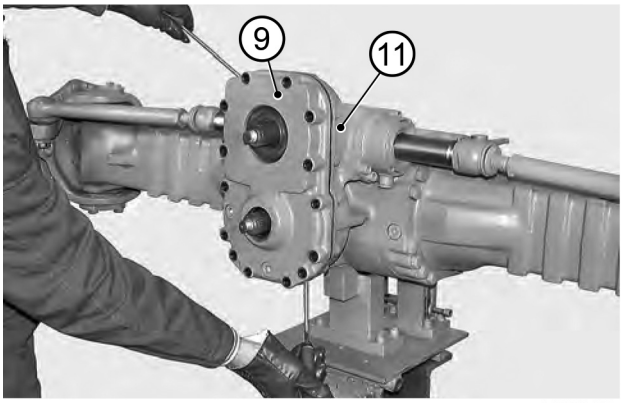
MAP11000

7. Remove check screws (**7**), (**8**) and relative washers (**10**) from cover (**9**).



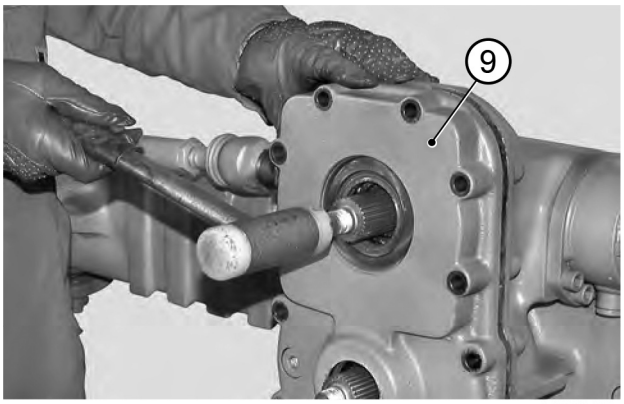
MAP11010

8. In turn, insert a punch in the slots provided and, tapping lightly with a hammer, separate the cover (**9**) from the body of the reduction gear (**11**).



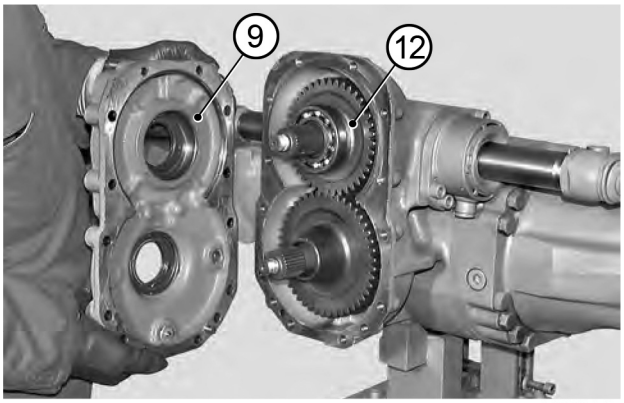
MAP11020

9. Insert two levers in the provided slots and move the cover (**9**) away from the body of the reduction gear (**11**).



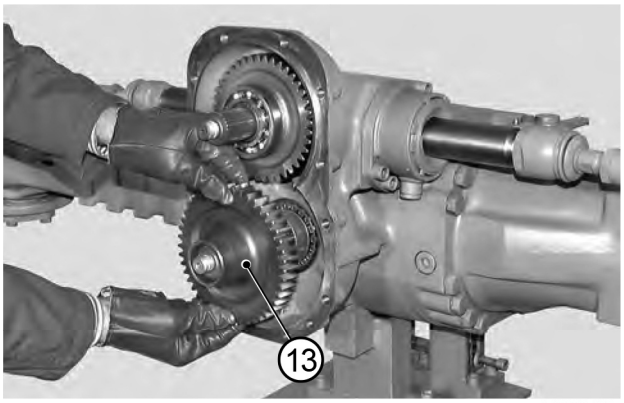
MAP11030

10. Lightly tap with a hammer to disengage cover (**9**) from upper gear (**12**).



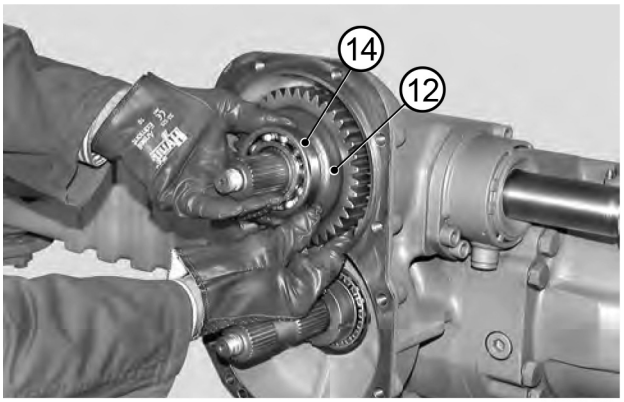
MAP11040

11. Draw out cover (**9**) and remove any sealant left.



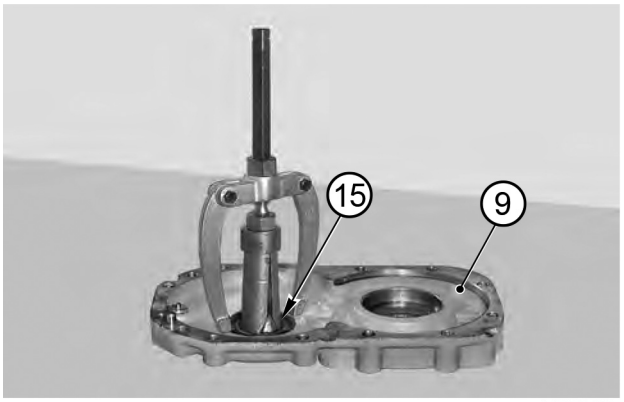

MAP11050

12. Remove lower gear (**13**).




MAP11060

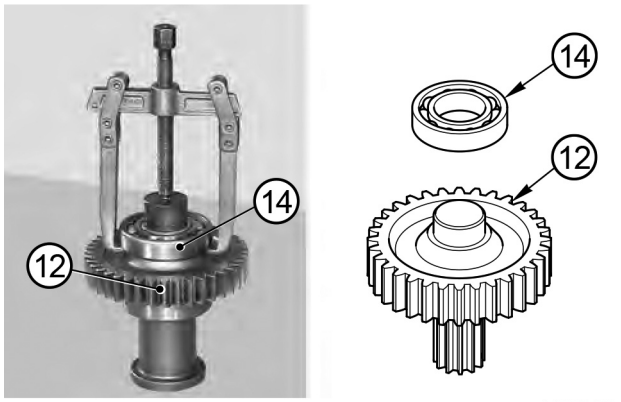
13. Remove upper gear assembly (**12**) complete with bearings (**14**).




MAP11070

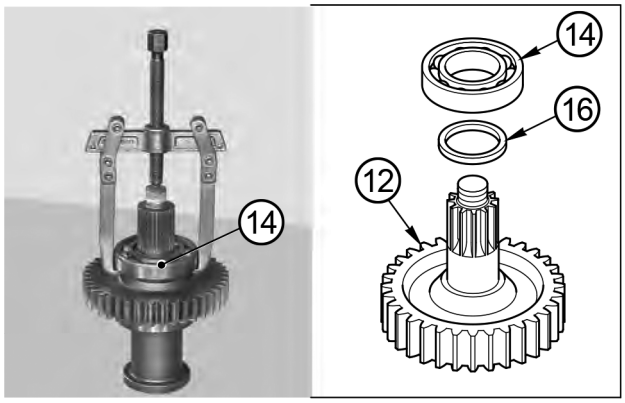
14. Using a puller, remove snap ring (**15**) from cover (**9**) and discard it.

***Note:*** *Write down direction of installation.*



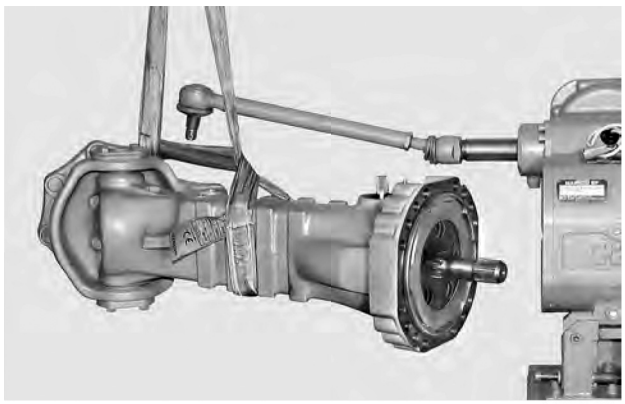

MAP11080

15. Remove inner bearing (**14**) from gear assembly (**12**).



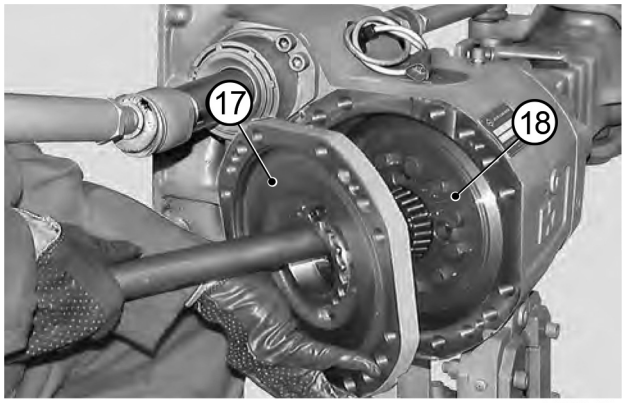

MAP11090

16. Remove outer bearing (**14**) and spacer (**16**).



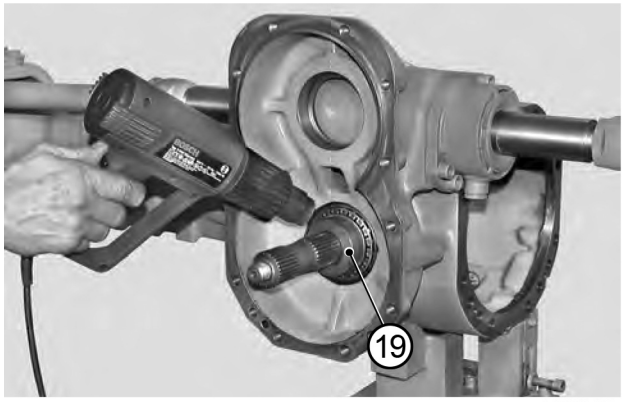
MAP11100

17. Disjoin from the steering case the steering bar located by the side of the intermediate cover (**17**).
18. Remove the complete arm.
    For details, see Braking Discs.



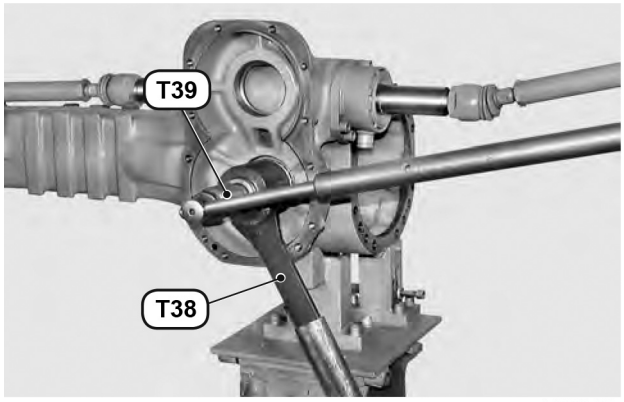

MAP11110

19. Remove the intermediate cover (**17**) and the whole differential unit (**18**).
    For details, see Differential Unit.



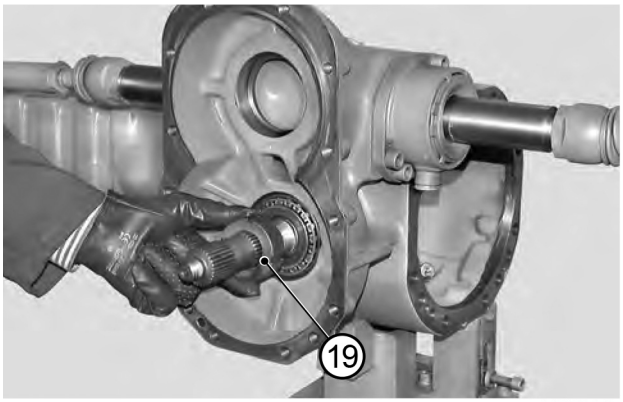

MAP11120

20. Heat the ring nut (**19**) at approx. 80°C.



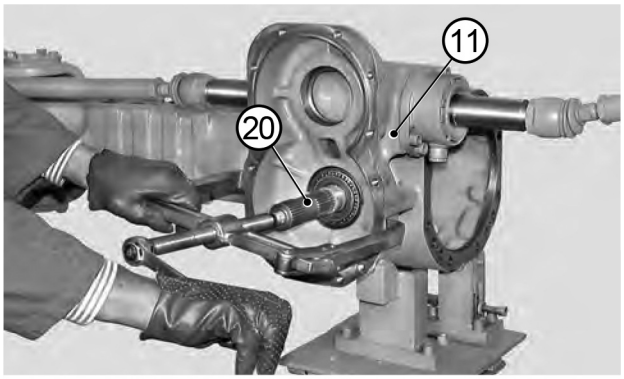

MAP11130

21. Engage special wrench (**T38**) on the ring nut (**19**) and apply bar-hold (**T39**) on the pinion (**20**).




MAP11140

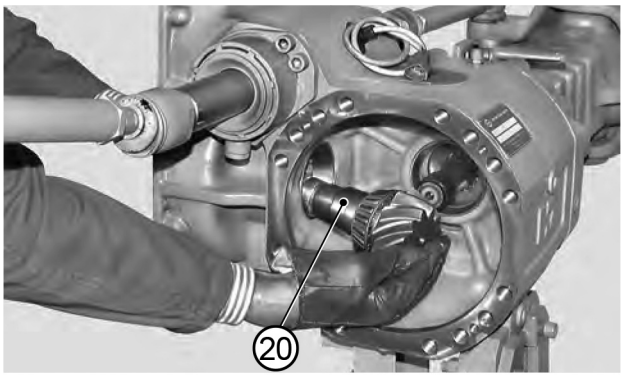
22. Remove ring nut (**19**).




MAP11150

23. Using a puller, extract pinion (**20**) complete with inner bearing (**21**), spacer (**22**) and distance washers.

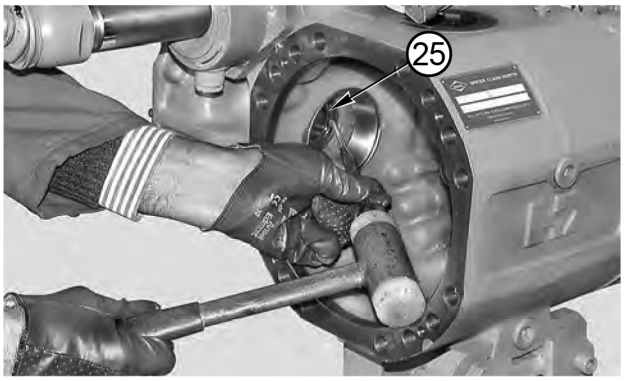
***Note:*** *The thrust blocks of the bearings remain in the central body (**11**).*




MAP11160

24. Remove the complete pinion (**20**).

***Note:*** *Carefully check and note direction of installation of spacer.*

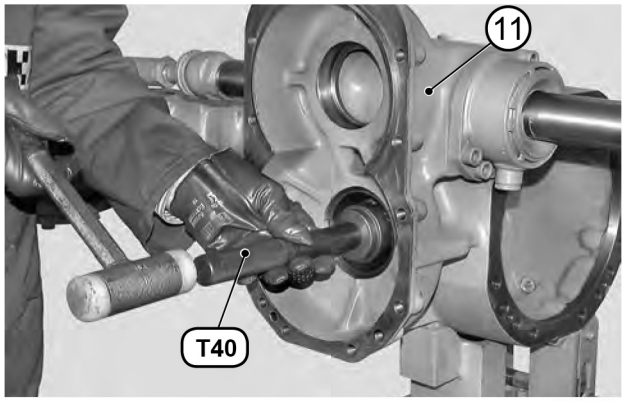



MAP11170

25. Using a punch and a hammer, extract the snap ring (**25**).

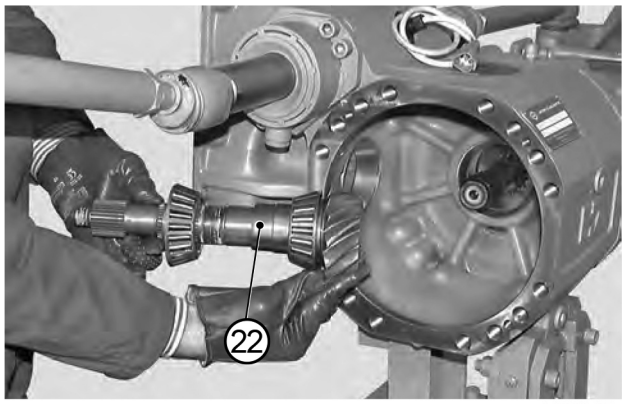
***Note:*** *Note direction of installation of snap ring (**24**).*

## 20.3 INCORPORATED REDUCTION GEAR AND PINION 602 - ASSEMBLY




MAP11180

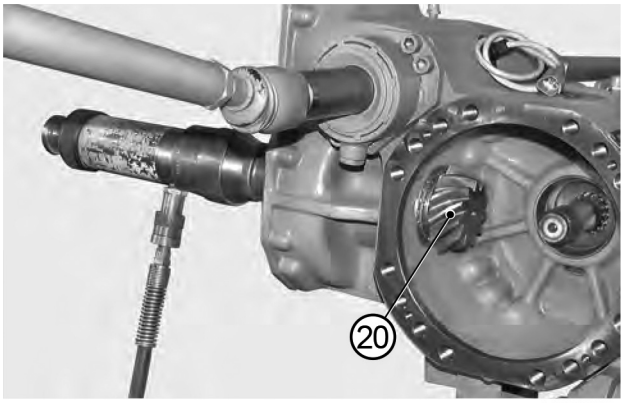
1. Find the value of the distance washers (**23**) and (**24**) and insert the thrust blocks of the conical bearing of the pinion into the body of the reduction gear (**11**). See Bevel Pinion.
2. Using tool (**T40**) insert the snap ring (**25**) previously lubricated with grease.




MAP11190

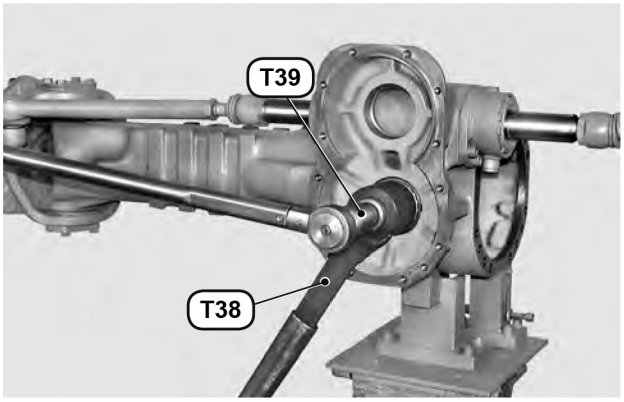
3. Assemble the pinion assembly as shown in the picture, checking that spacer (**22**) is correctly oriented.

***Note:*** *Apply grease to the outer surface of the spacer (**22**).*



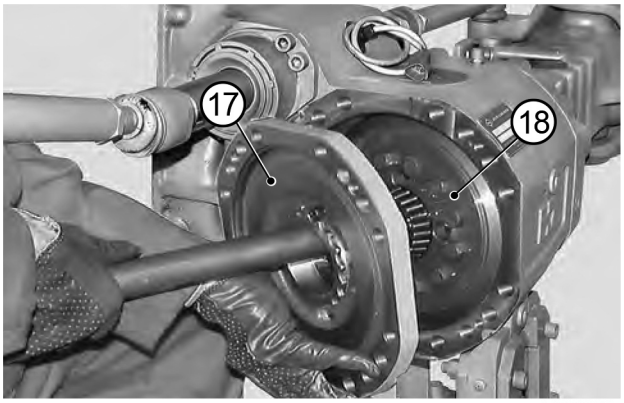

MAP11200

4. With tools (**T41C)**, (**T41D**) and (**T41B**) connected to a press, insert the complete pinion assembly (**20**).



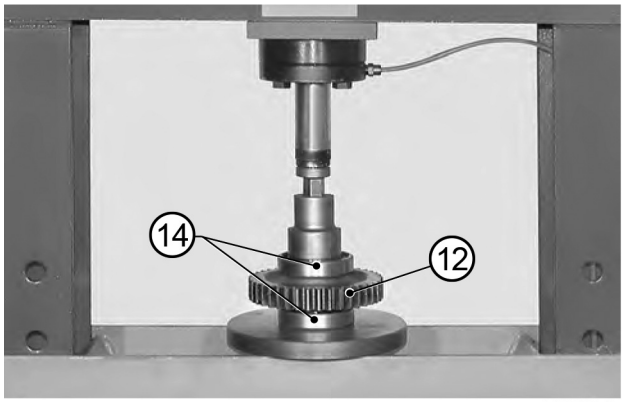

MAP11210

5. Apply Loctite 242 to the thread of the pinion and screw the ring nut (**19**). Engage special wrench (**T38**) on the ring nut and apply bar-hold (**T39**) to the pinion (**20**).
6. Tighten the ring nut (**19**) following the appropriate procedure (See Bevel Pinion) and check that torque is 170 - 220 Nm (125.3 - 162.2 ft.lb.)



MAP11220

7. Re-install the differential unit (**18**) and the intermediate cover (**17**).



MAP11240

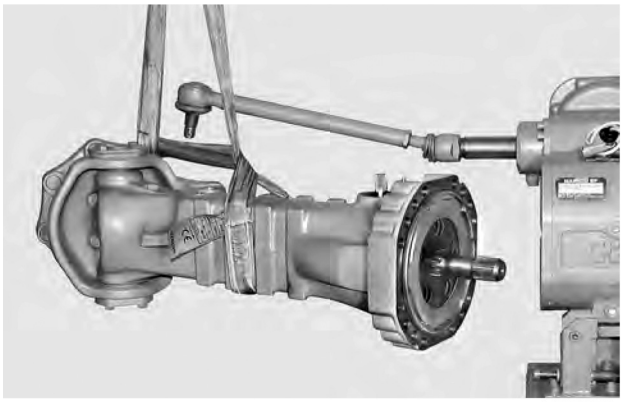
9. Using a press, fit the bearings (**14**) and the spacer (**16**) on the upper gear (**12**).

**⚠ CAUTION**

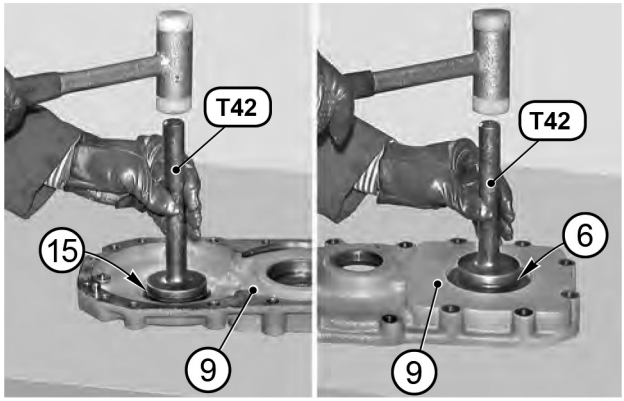
If the crown has been replaced, reinstate clearances. For details, see Differential Unit.

**⚠ CAUTION**

The distance piece (**16**) must be positioned between the outer bearing and the gear.

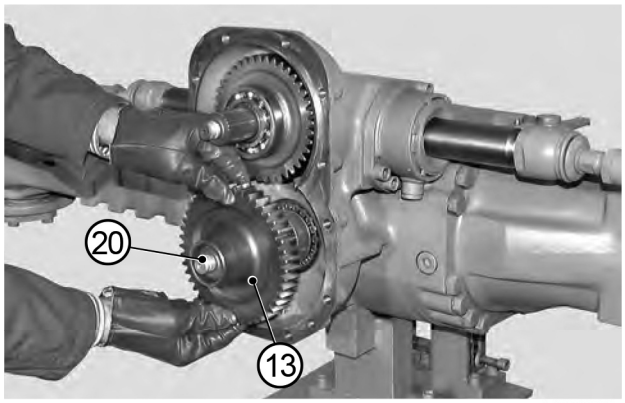

MAP11230

8. Re-install the complete arm checking flatness and blocking the arm by keeping to the appropriate procedures illustrated in Braking Discs. Also connect the steering bar.



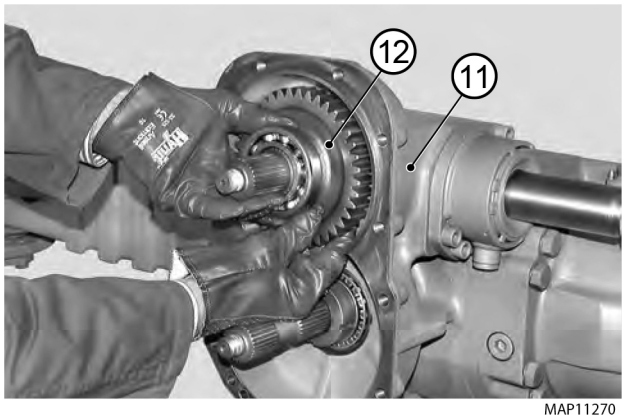
MAP11250

10. Grease snap rings (**15**) and (**6**); position the snap rings in the cover (**9**) using tool (**T42**).



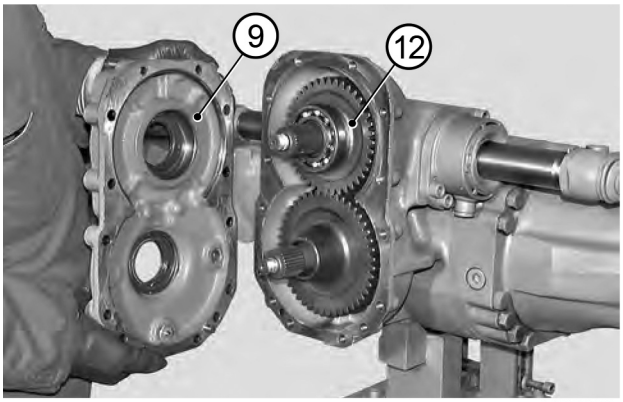
MAP11260

11. Fit the lower gear (**13**) onto the pinion (**20**).



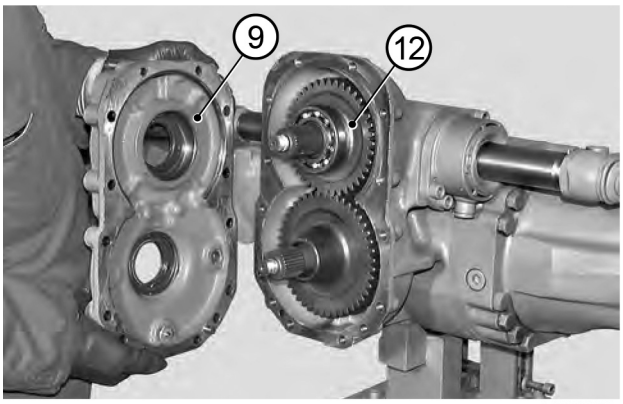
MAP11270

12. Insert the upper gear unit (**12**) into the body of the reduction gear (**11**).



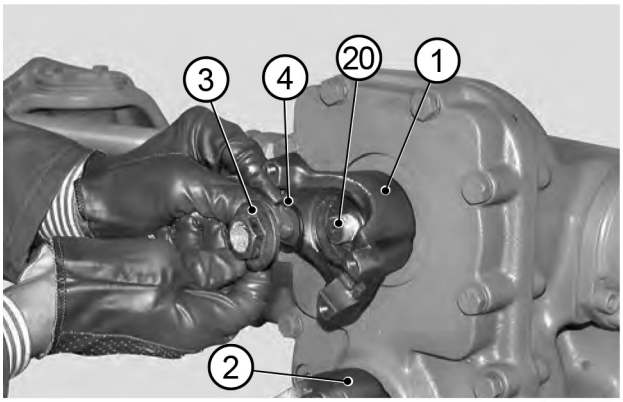
MAP11280

13. Apply Loctite 510 to the locking surface of the body of the reduction gear (**11**).
14. Lubricate snap rings (**6**) and (**15**); fit cover (**9**) and set cover (if necessary) by lightly tapping with a plastic hammer.



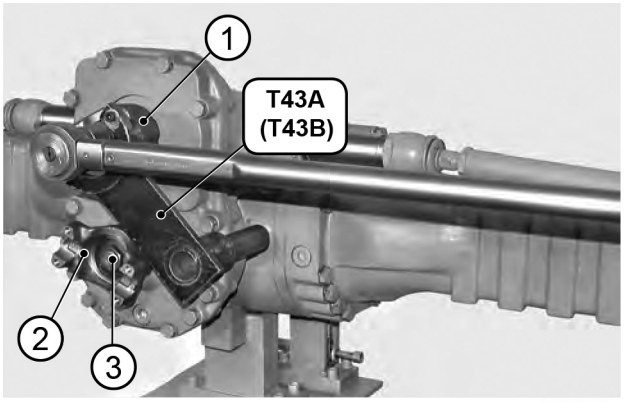
MAP11280

15. Block cover (**9**) with screws (**7**) and (**8**) and relative washers (**10**). Tighten using the criss-cross method. Torque wrench setting: 82 - 91 N·m.(60.5 -67.1).




MAP11300

16. Fit the upper (**1**) and lower (**2**) flanges.
17. Apply Loctite 242 to the threaded portion of pinion (**20**) and upper gear (**12**).
18. Fit o-rings (**4**) and nuts (**3**).



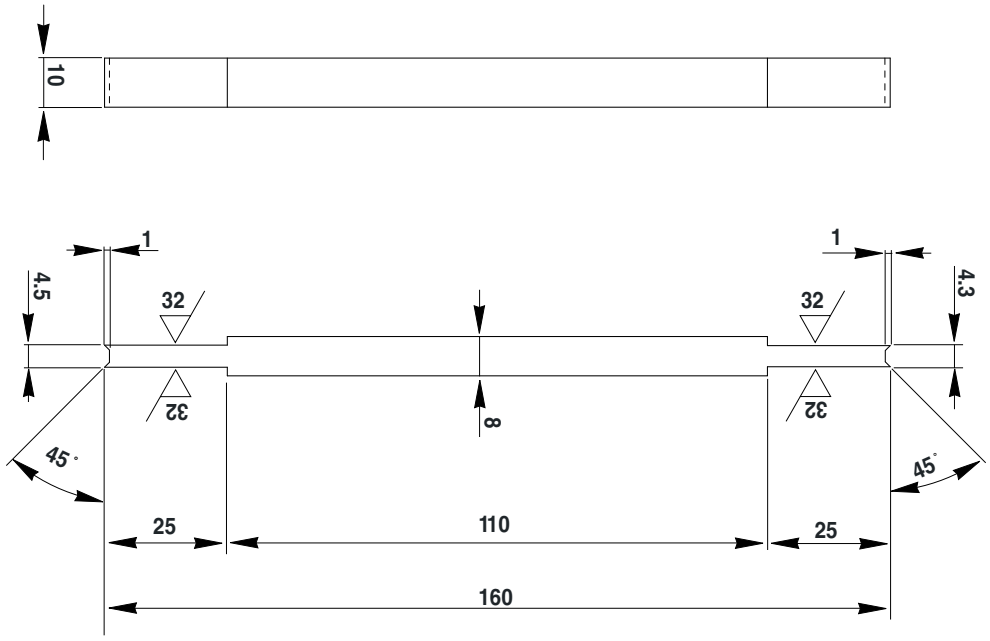

MAP11310

19. Apply tool (**T43A**) (or **T43B**) to flanges (**1**) and (**2**) and tighten nuts (**3**) using a dynamo metric wrench. Torque wrench setting: 280 - 310 N·m.(206.5 - 228.6 ft.lb.)

# Section 21
# Special Tools

## 21.1 T1

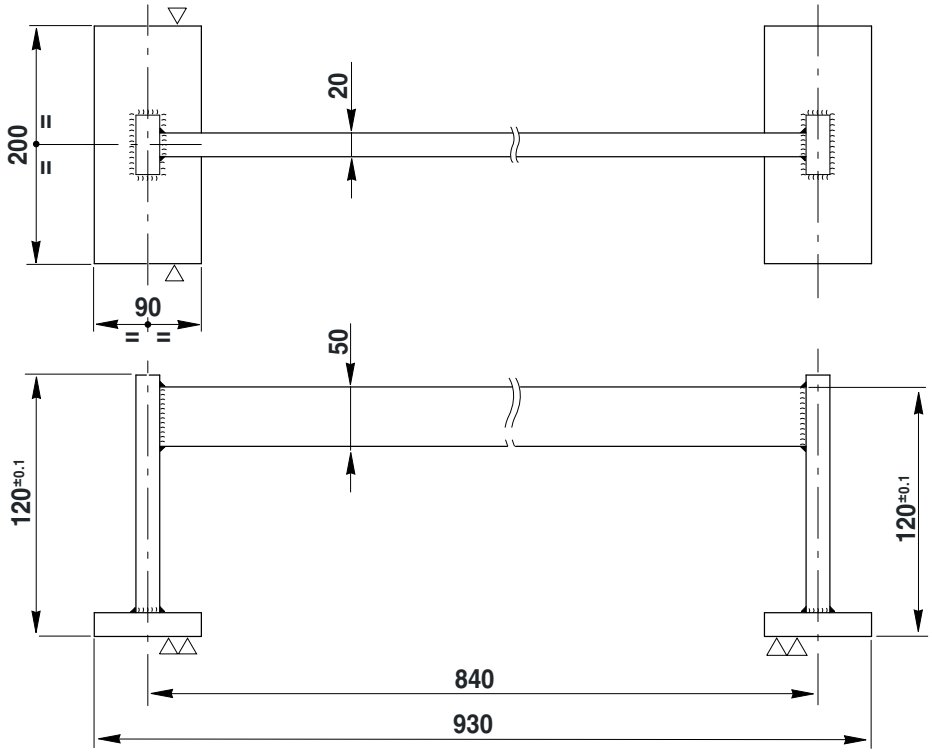
**2313**




MAP6200

## 21.2 T2

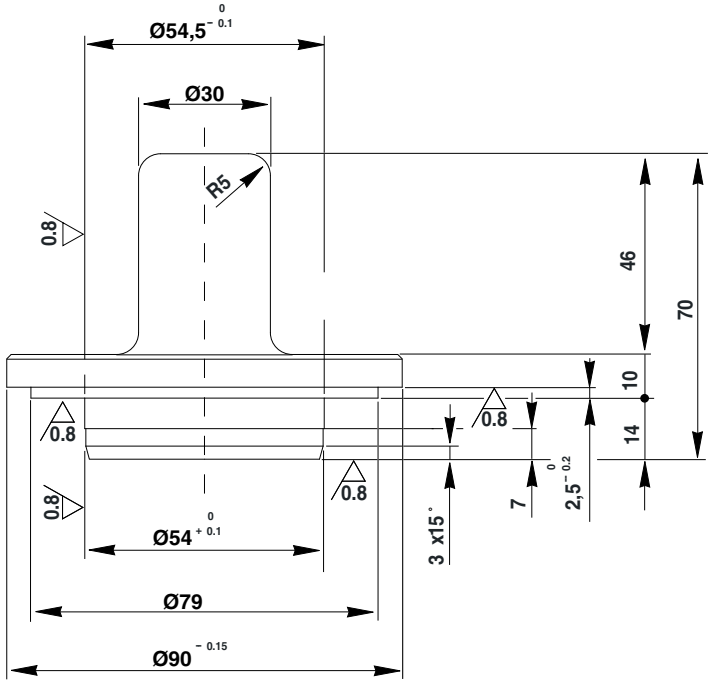
**2305**




MAP6210

## 21.3 T3

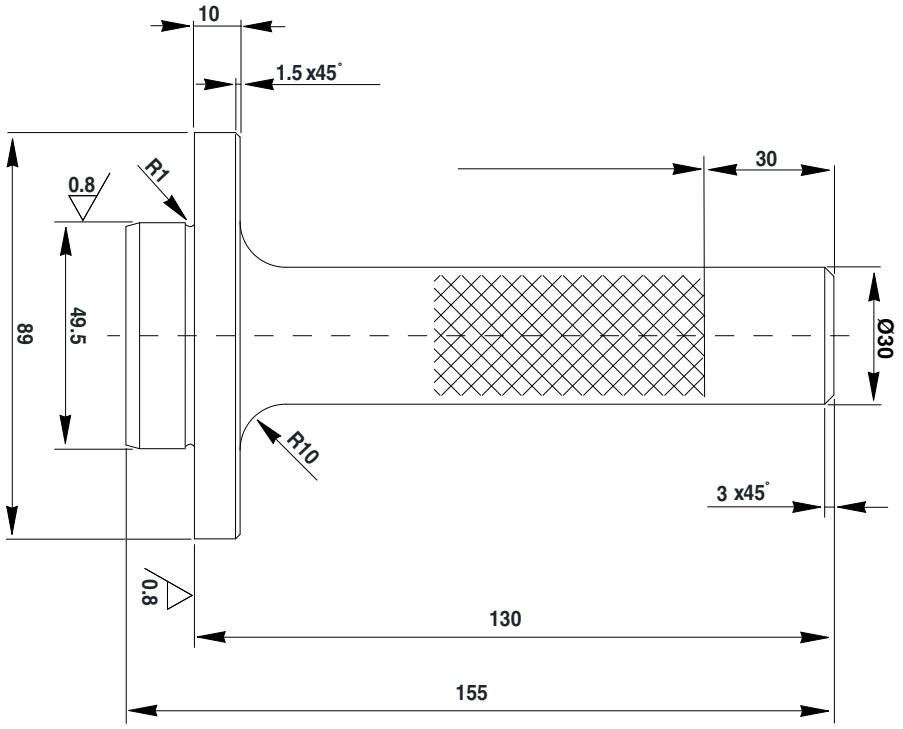
**3342**




MAP6490

## 21.4 T4

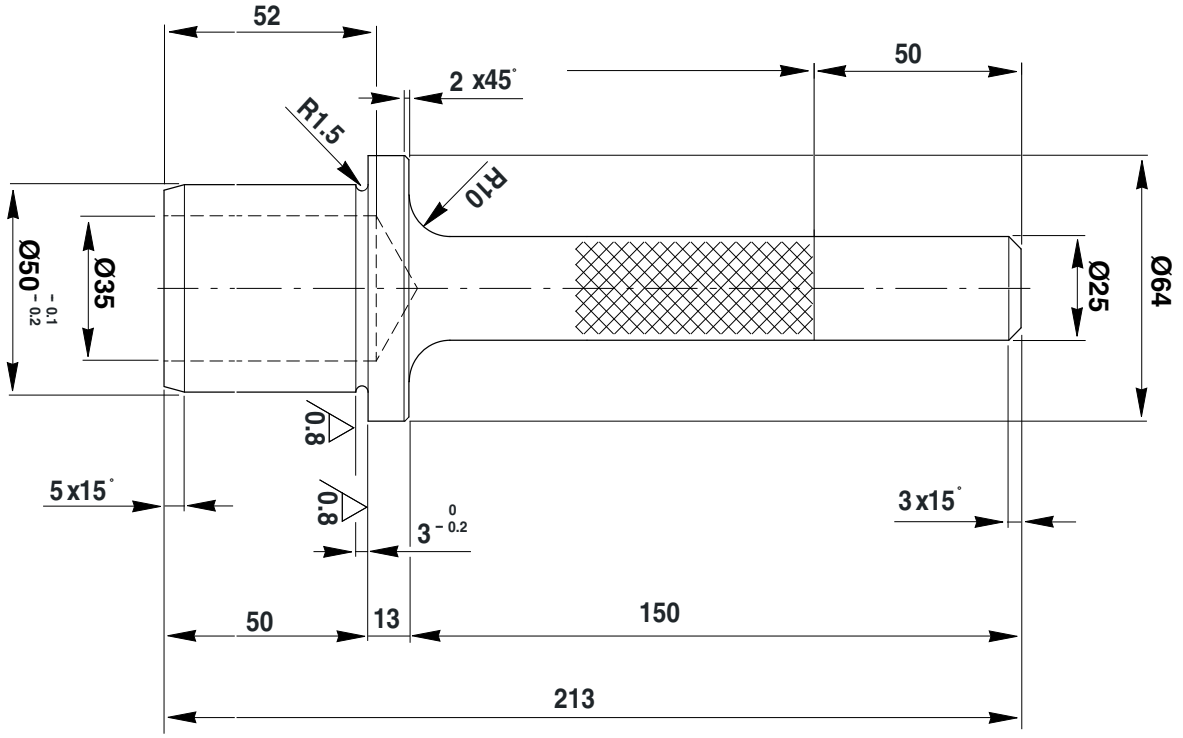
**3342**




MAP6500

## 21.5 T5

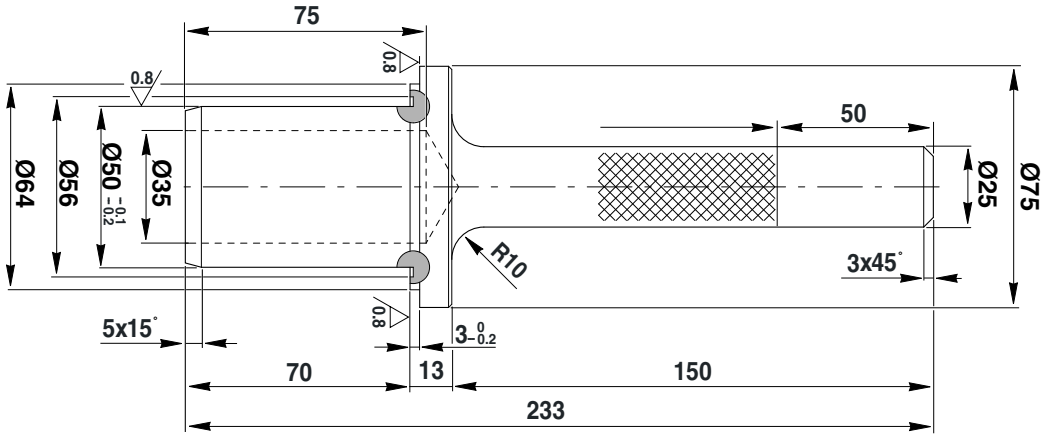
**2303**




MAP6920

## 21.6 T6

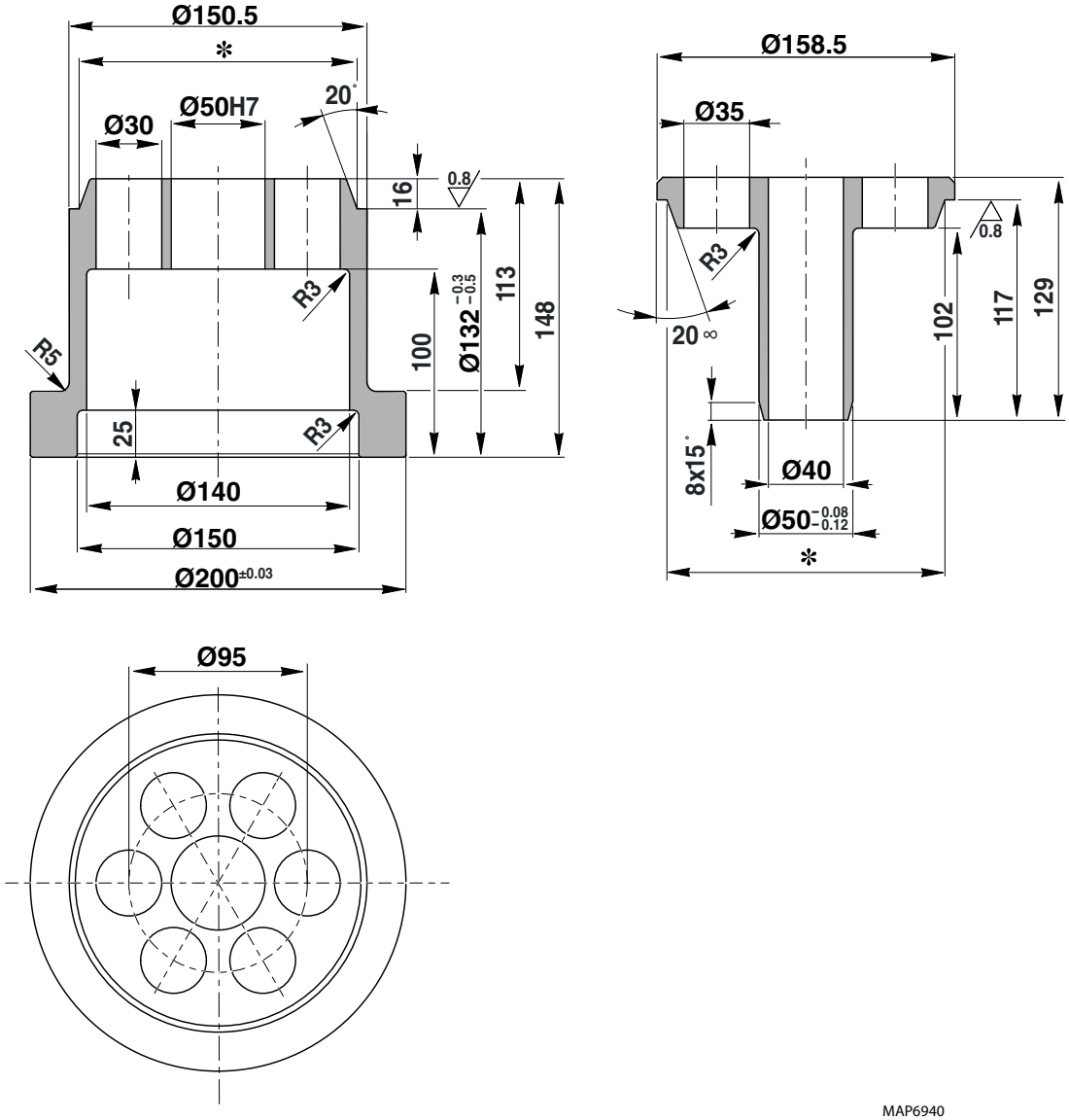
**3363**




MAP6930

## 21.7 T7

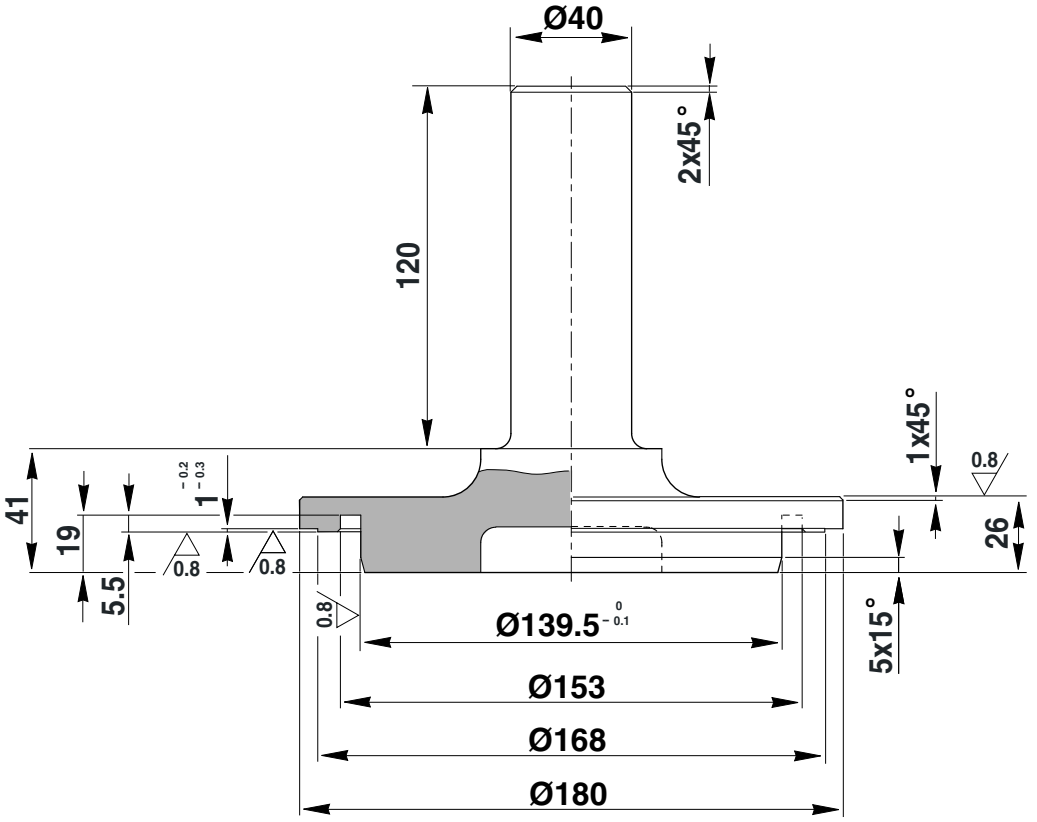
**3354**




MAP6940

## 21.8 T8

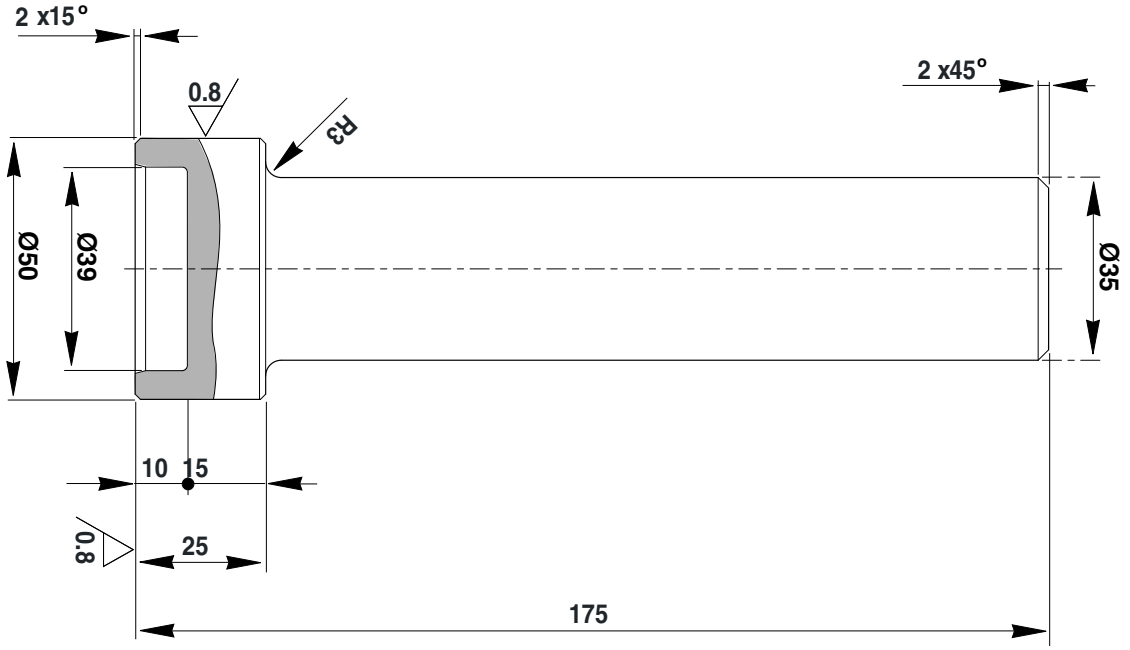
**3502**




MAP6950

## 21.9 T9

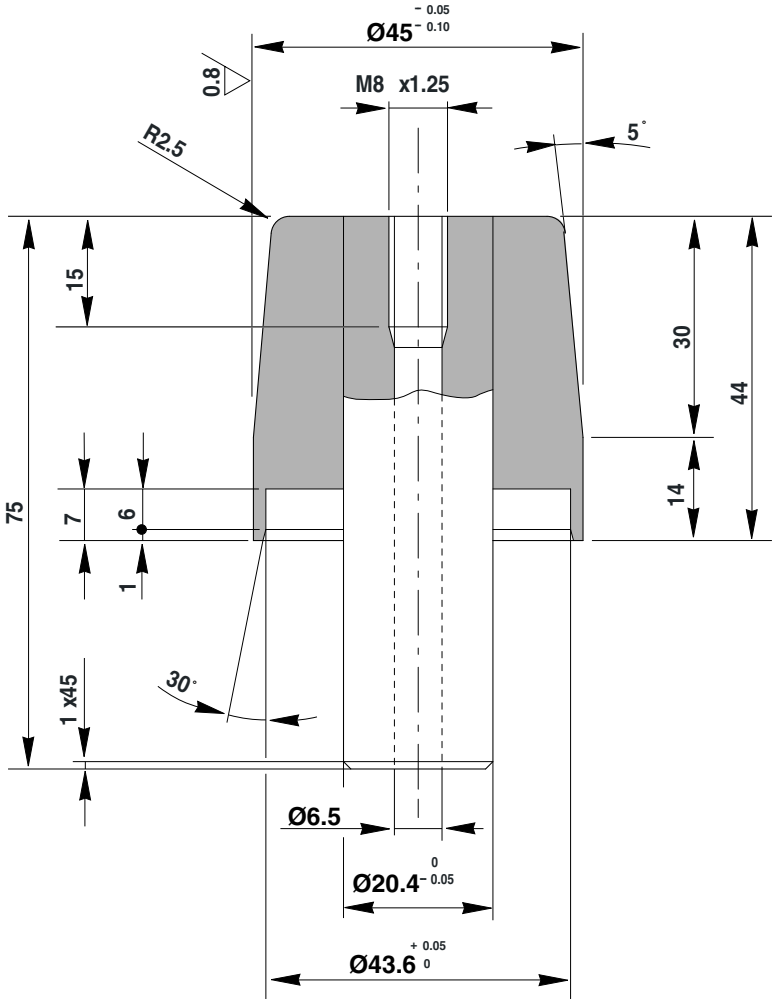
**2304**




MAP6960

## 21.10 T10

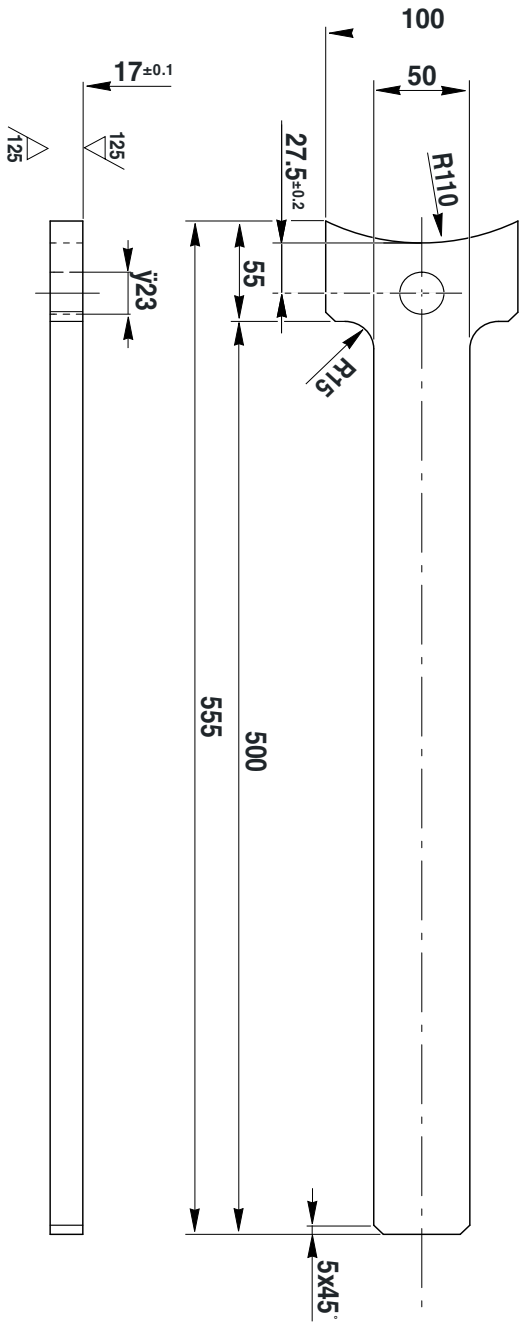
**2724**




MAP7420

## 21.11 T11

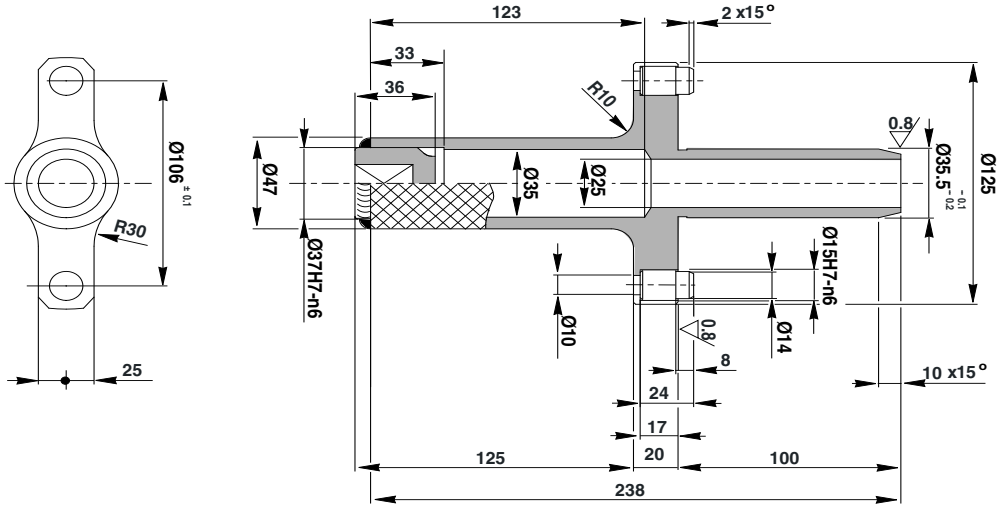
**1867**




MAP7430

## 21.12 T12

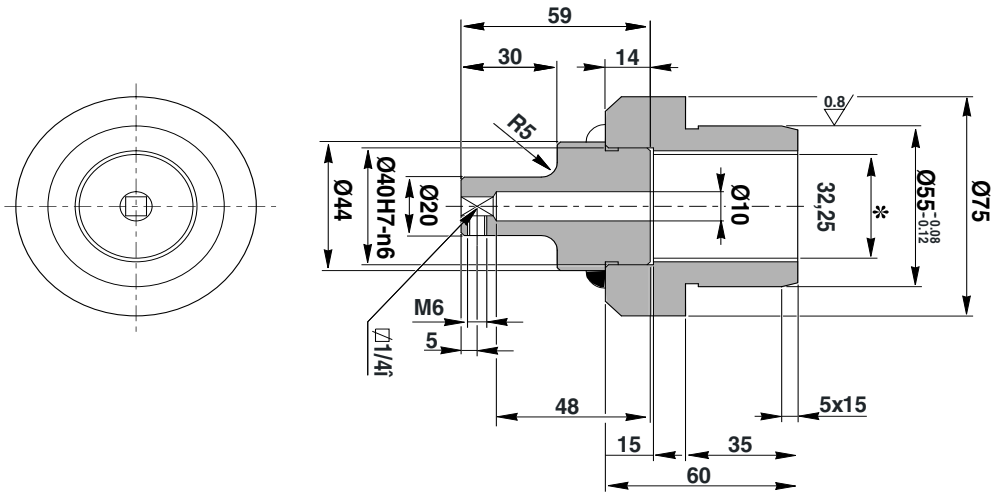
**3333**




MAP7640

## 21.13 T13

**3317/4**

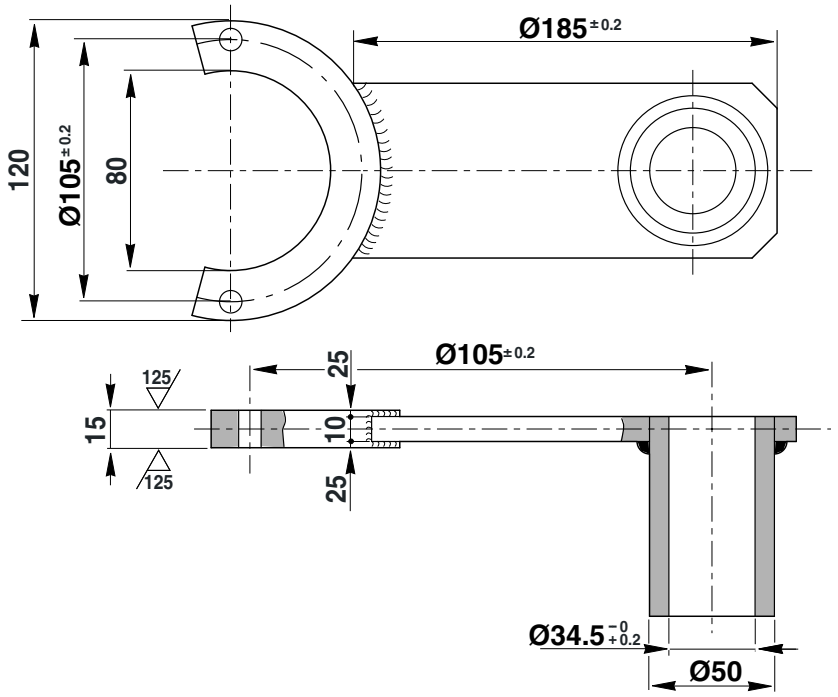



MAP7650

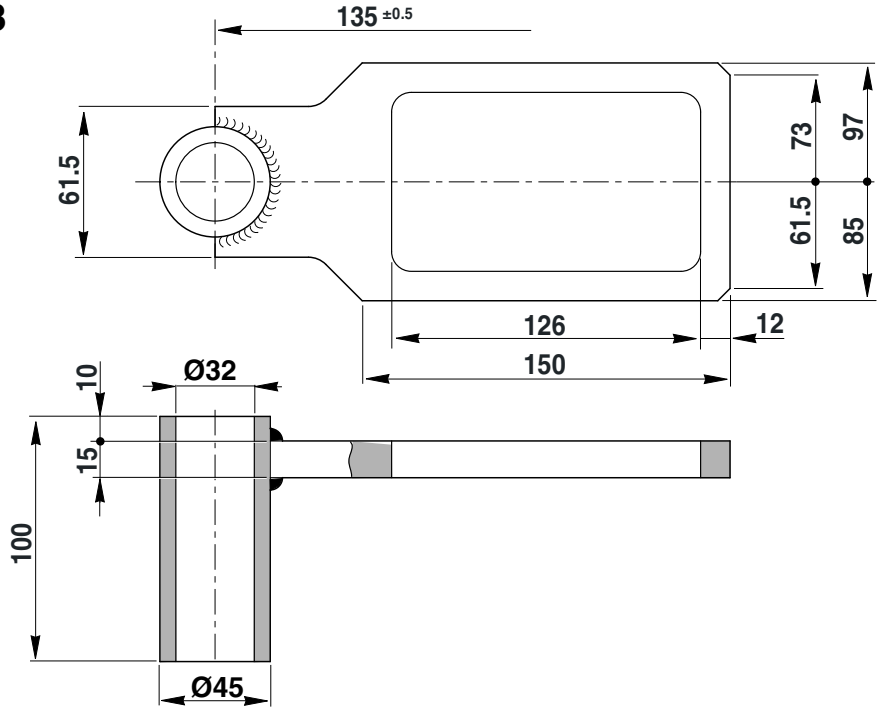
## 21.14 T14

**2308**

### T14A



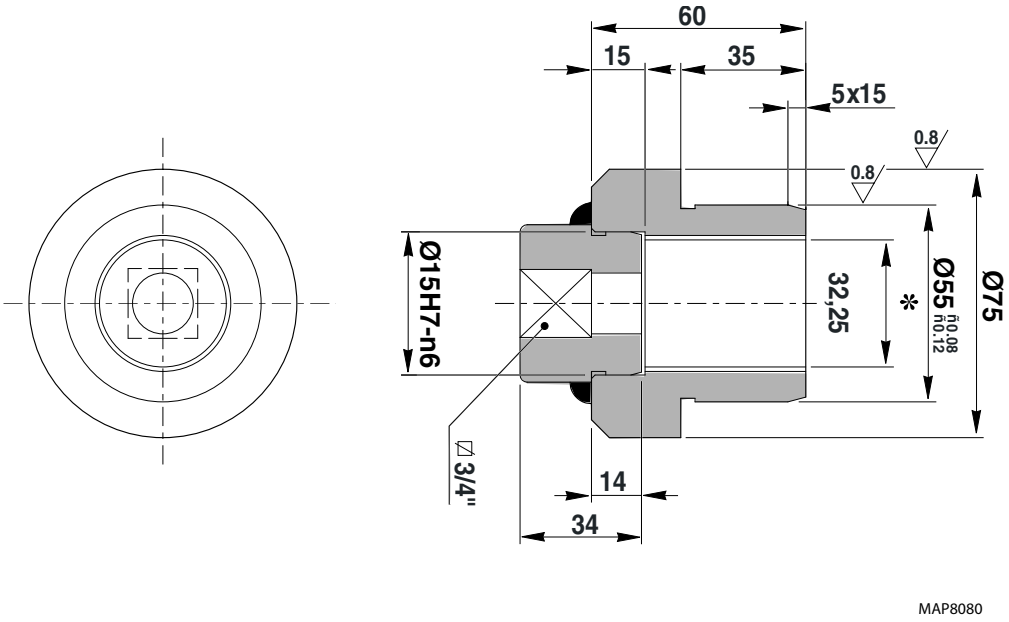

### T14B




MAP8070

## 21.15 T15

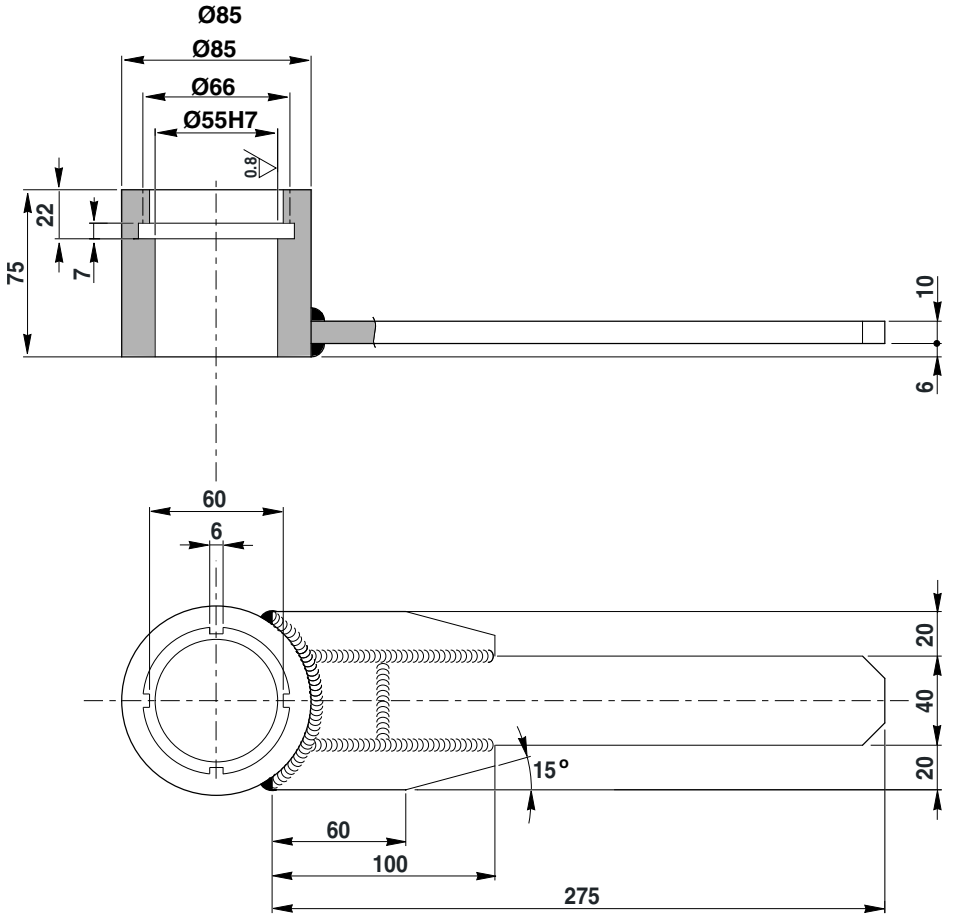
**3317/3**




MAP8080

## 21.16 T16

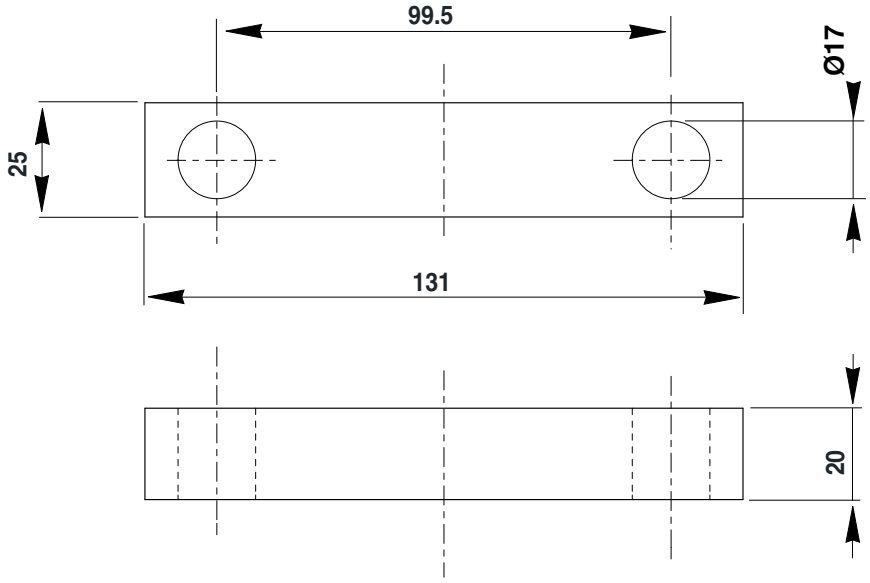
**3317/A**




MAP8090

## 21.17 T17

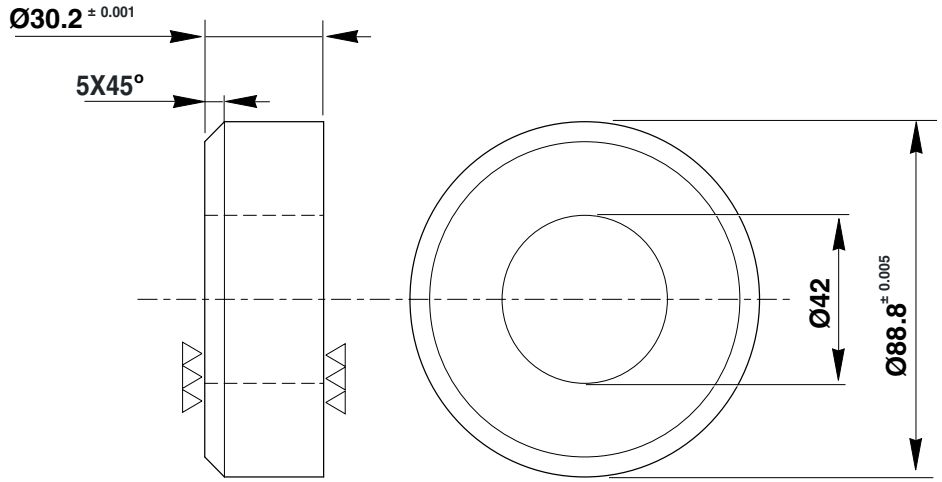
**2309**




MAP8100

## 21.18 T18

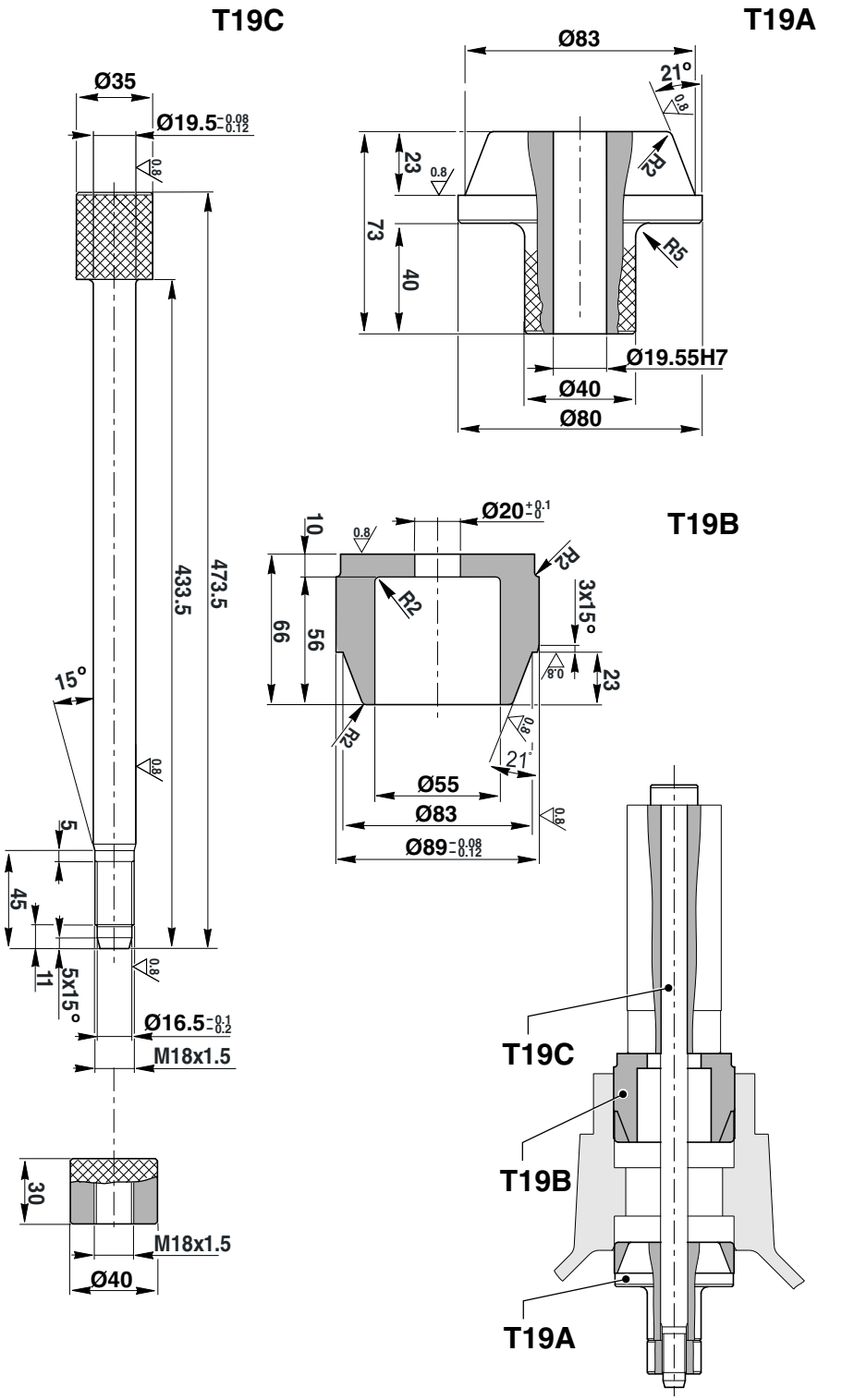
**2310**




MAP8110

## 21.19 T19

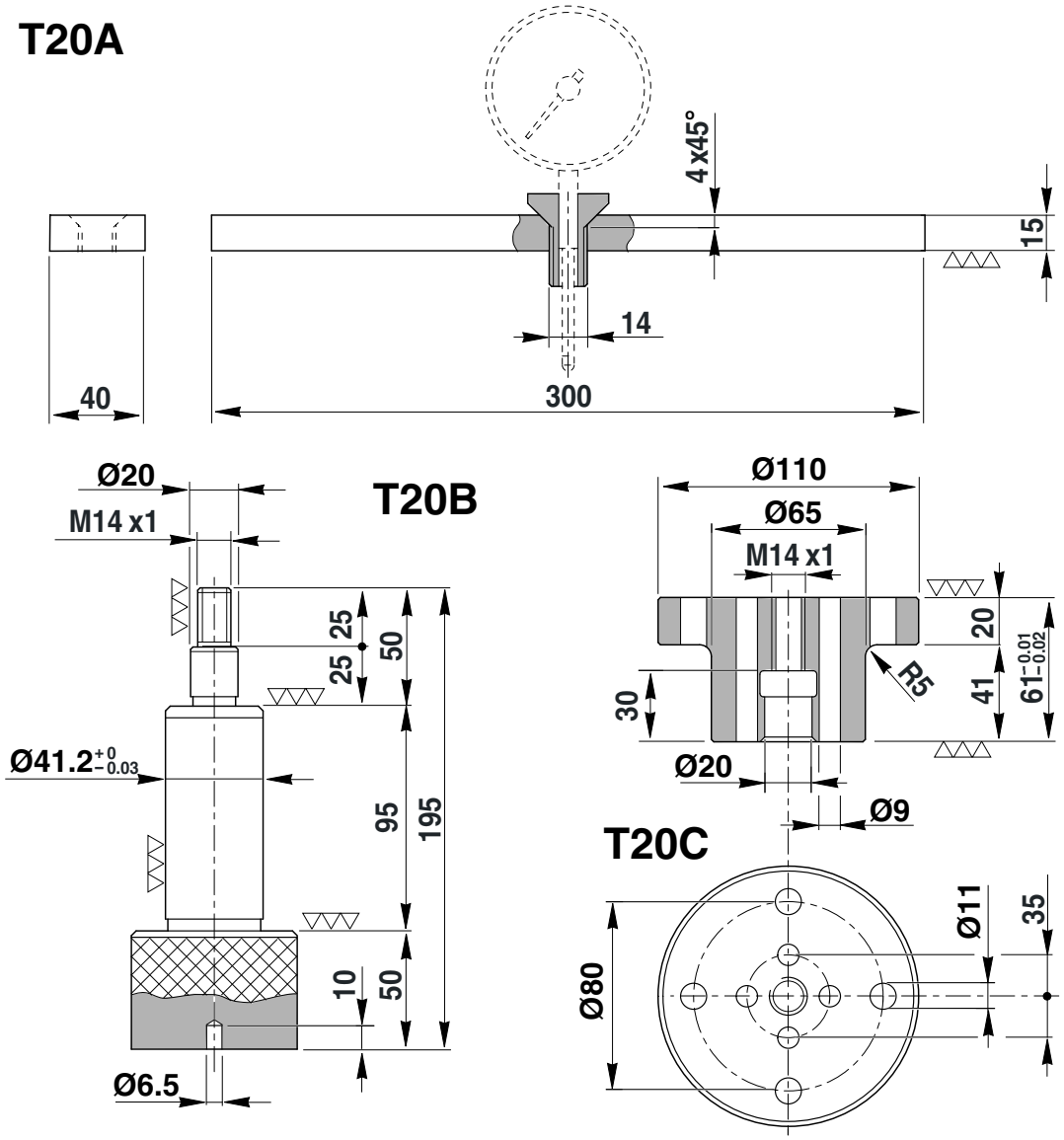
**3329/3**




MAP8120

## 21.20 T20

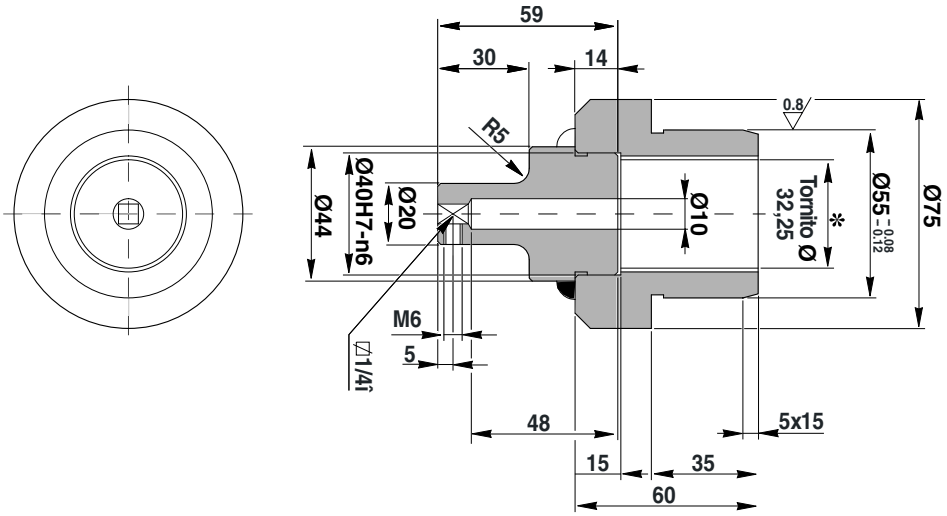
2312




MAP8130

## 21.21 T21

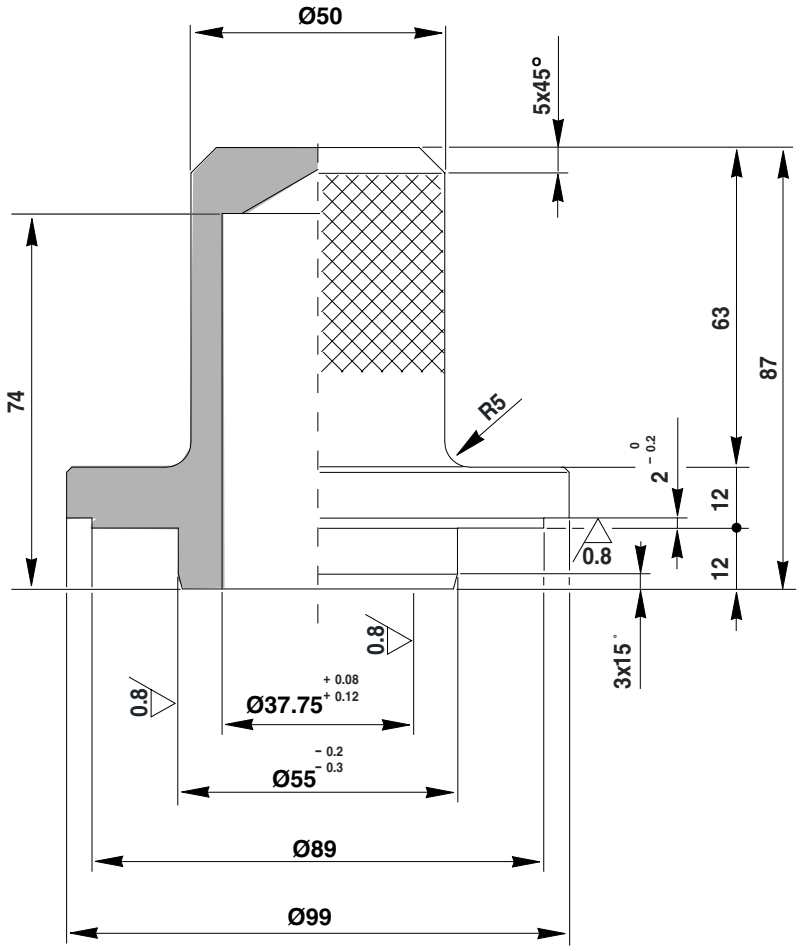
**3354**




MAP8140

## 21.22 T22

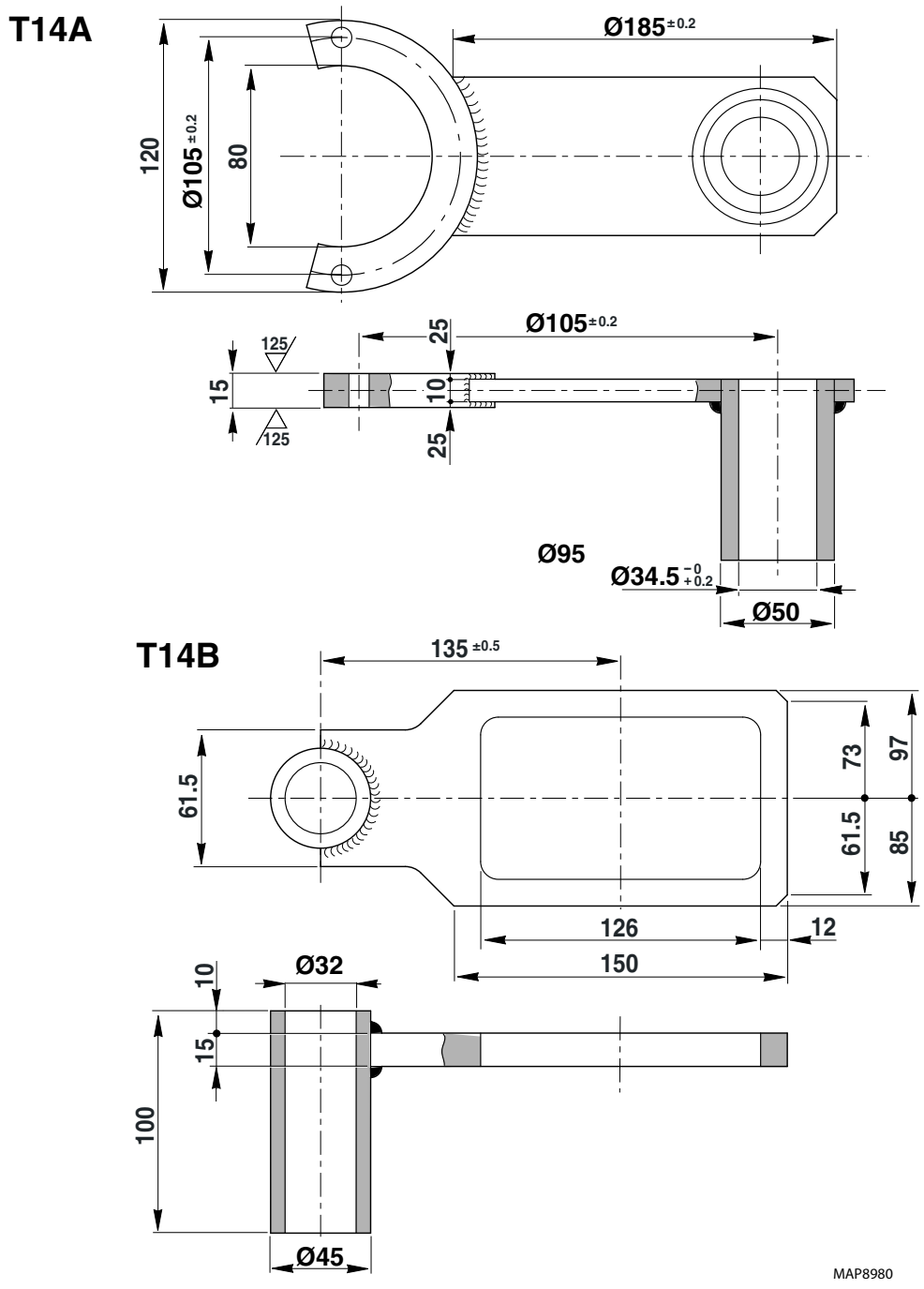
**3327**




MAP8150

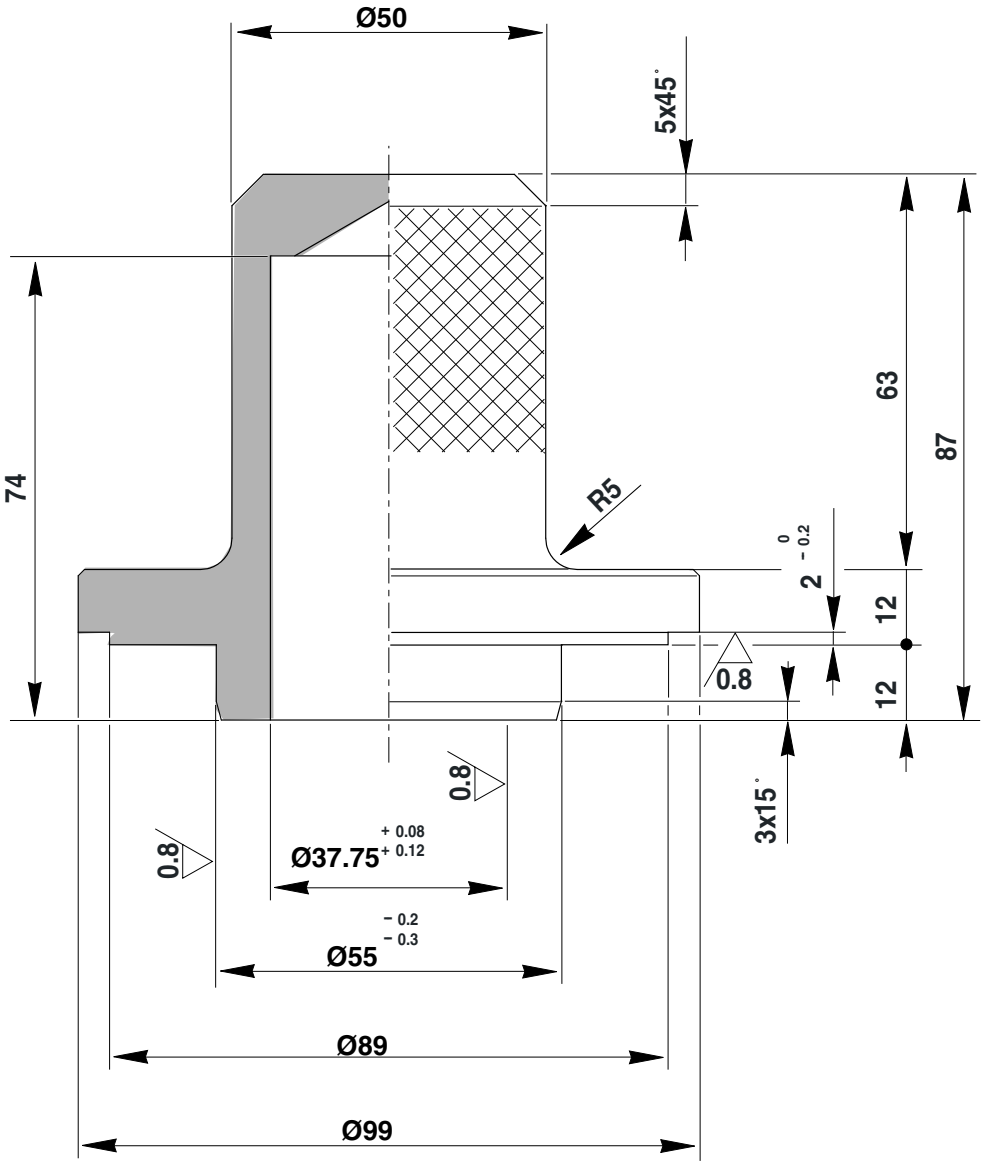
## 21.23 T23

**2308**



## 21.24 T24

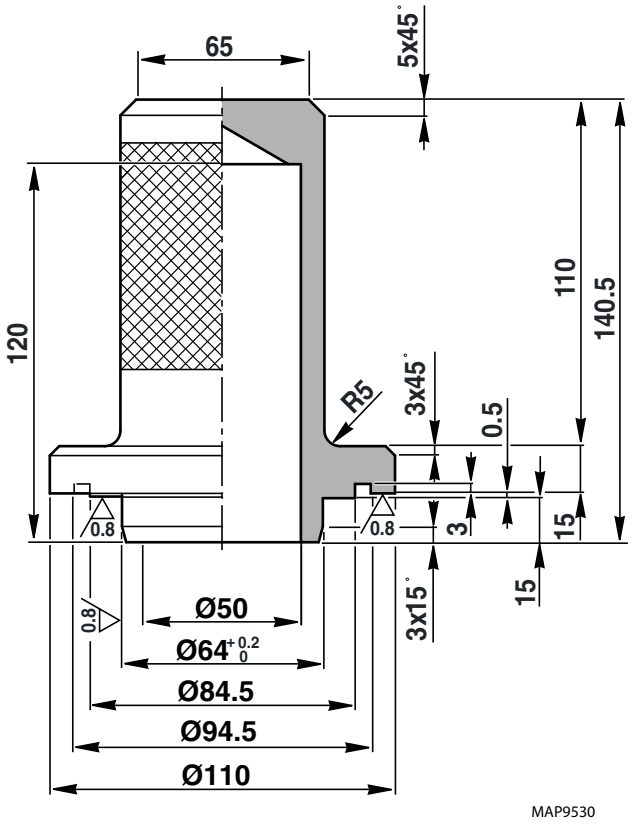
**3327**




MAP8990

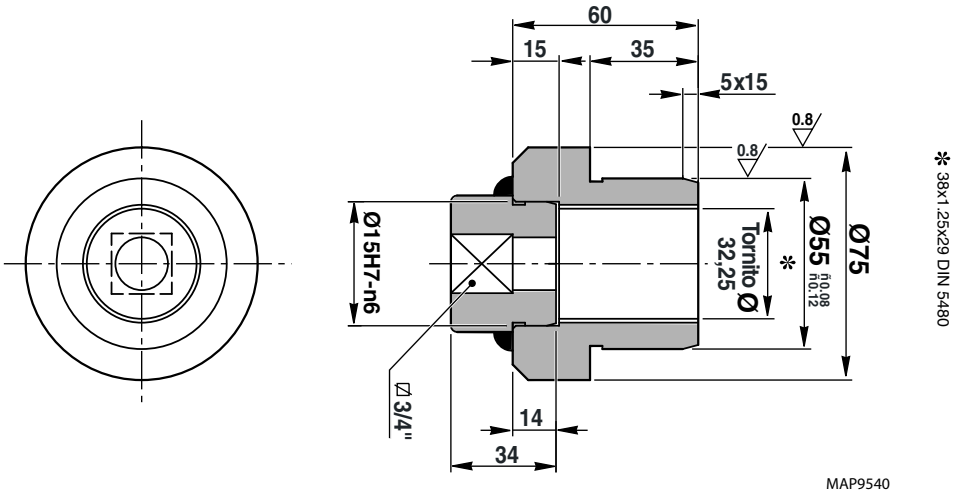
## 21.25 T25

**3739**



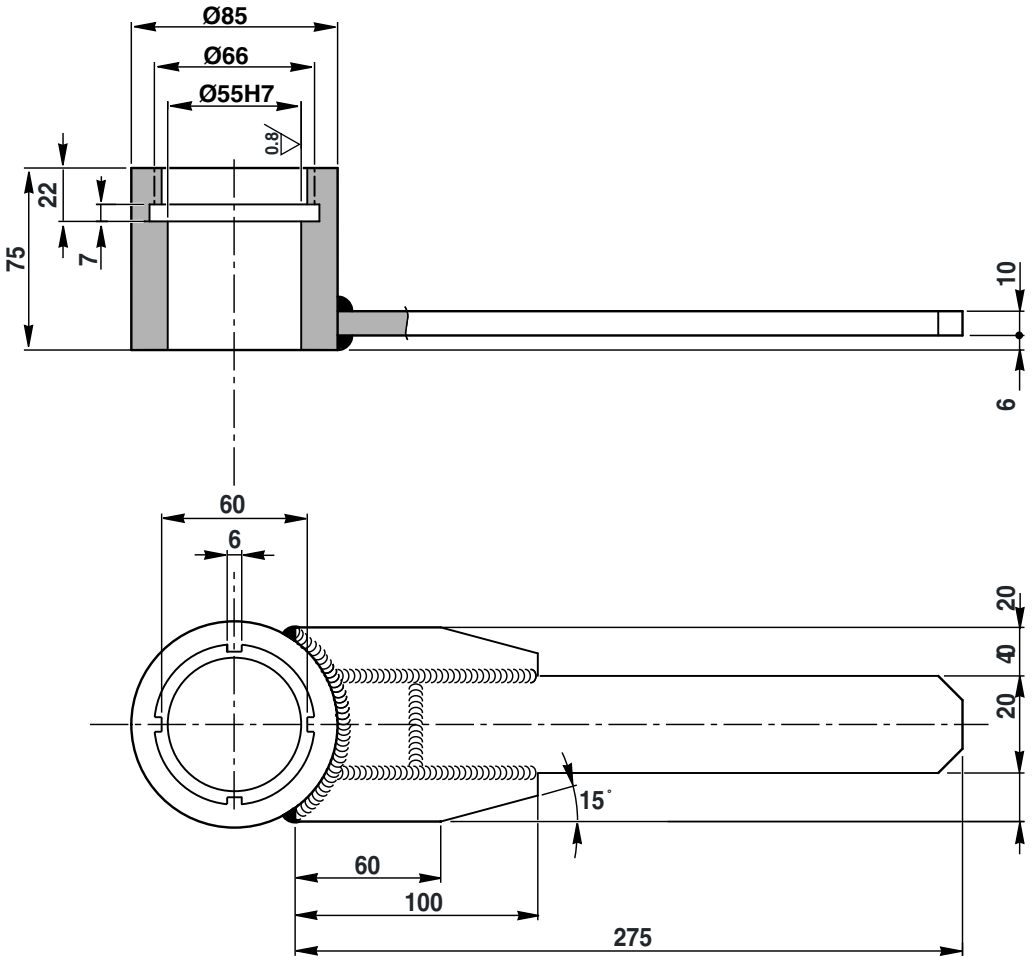
## 21.26 T26

**3317/3**



## 21.27 T27

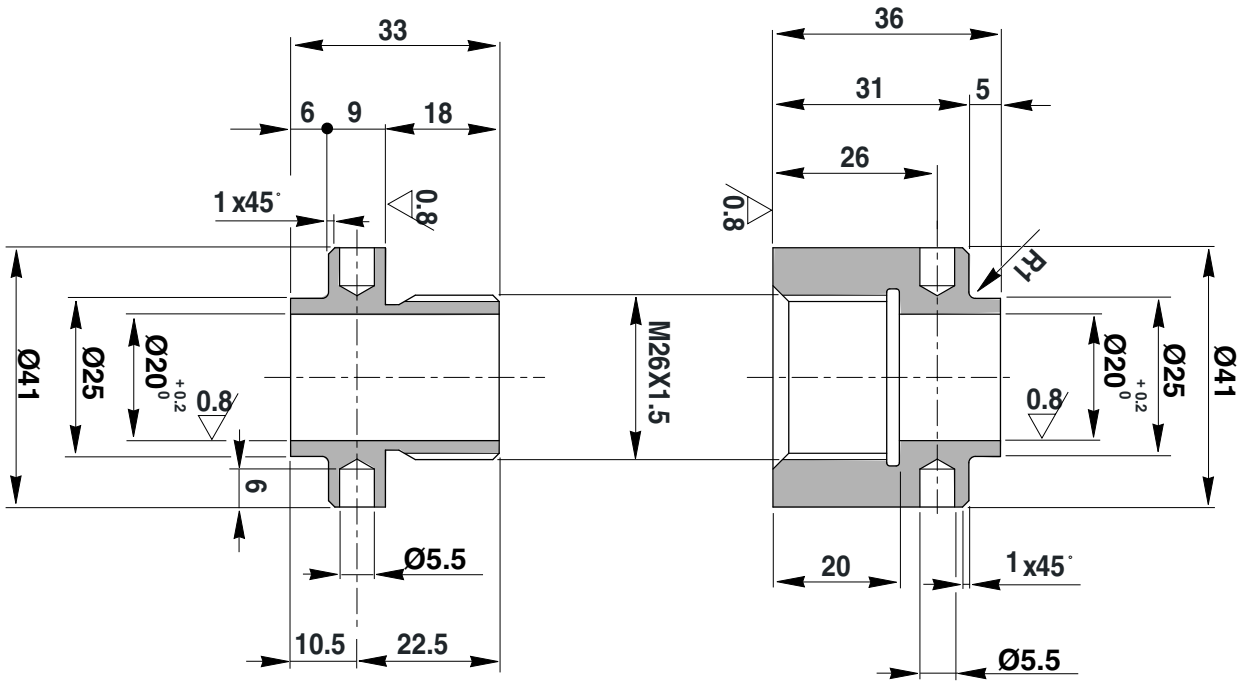
**3317/A**




MAP9550

## 21.28 T28

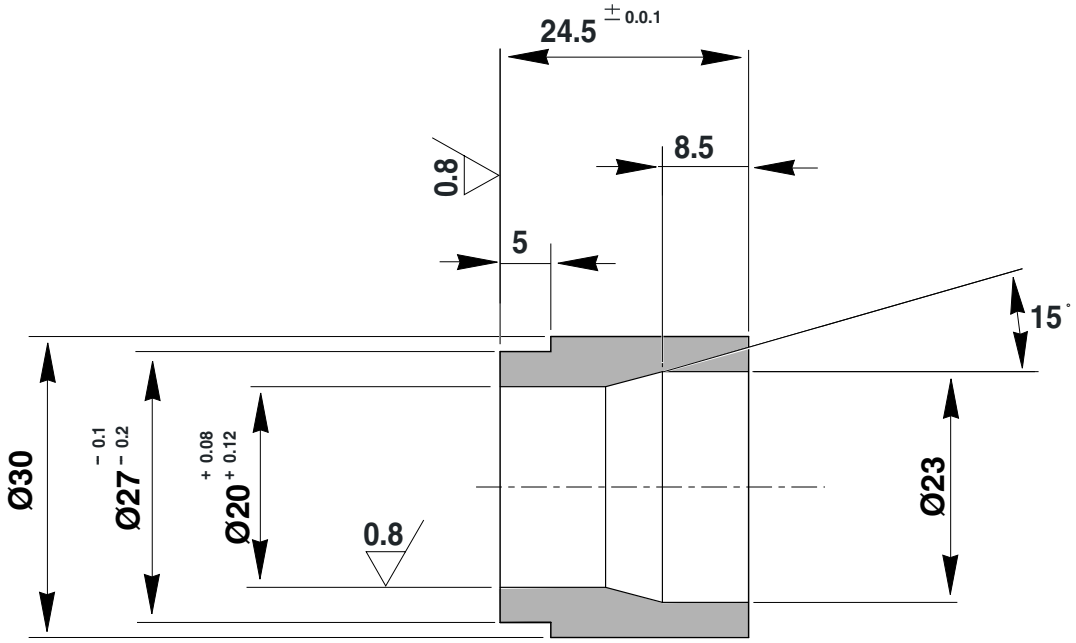
**3708**




MAP10170

## 21.29 T29

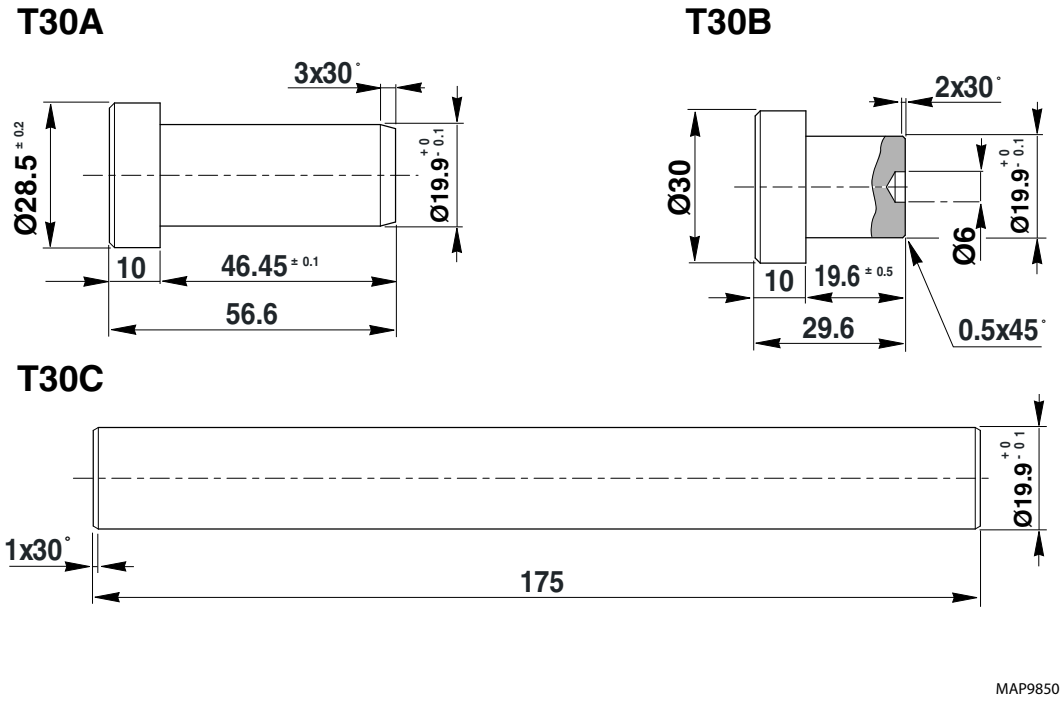
**3424**




MAP9840

## 21.30 T30

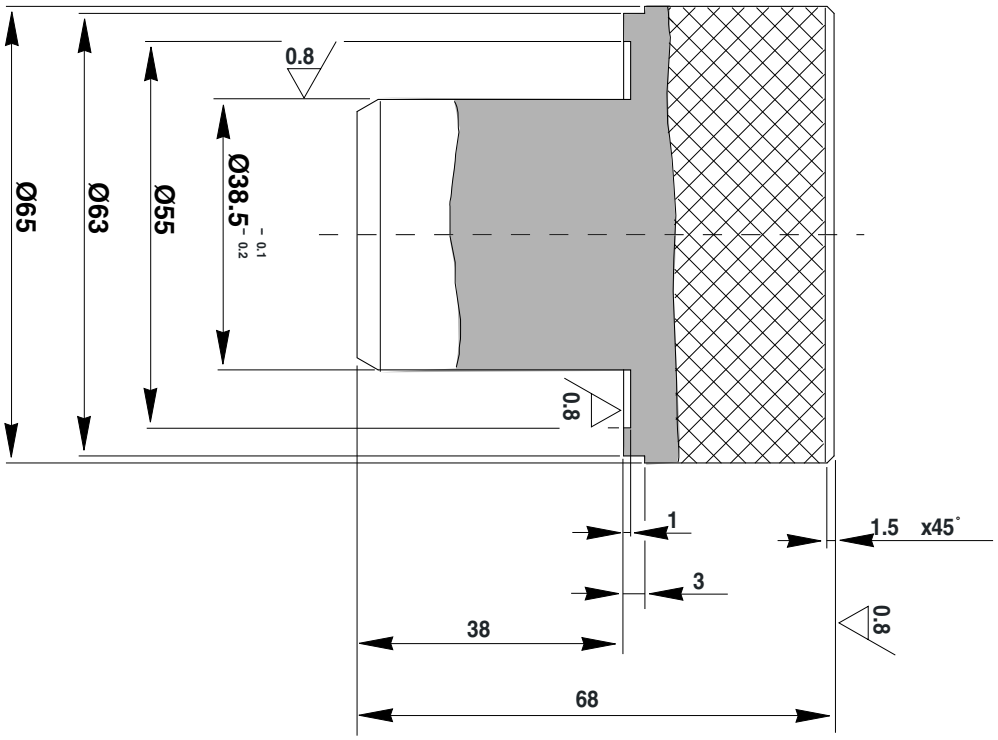
2306




MAP9850

## 21.31 T31

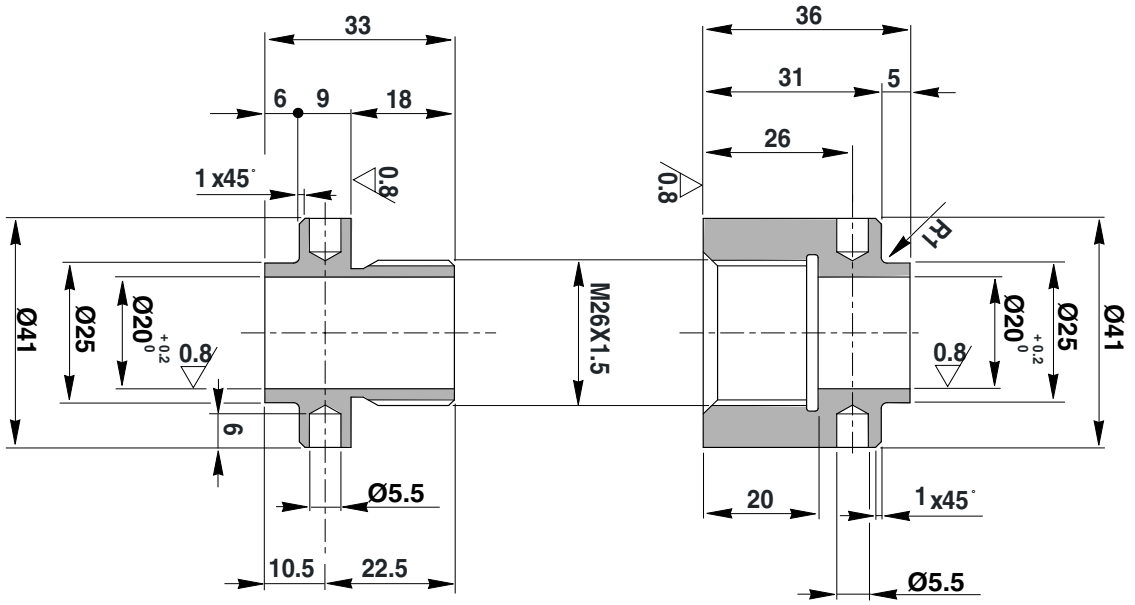
**3332**




MAP9860

## 21.32 T32

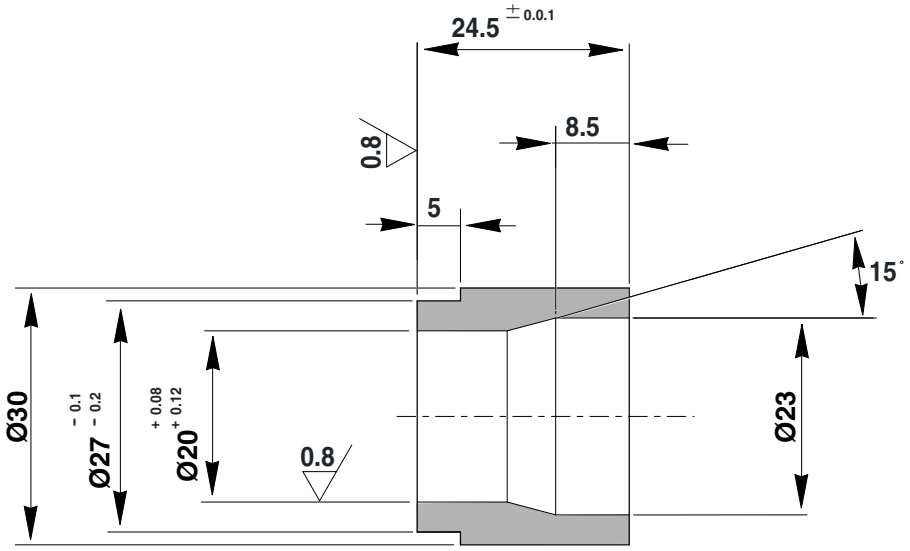
**3708**




MAP10170

## 21.33 T33

**3424**

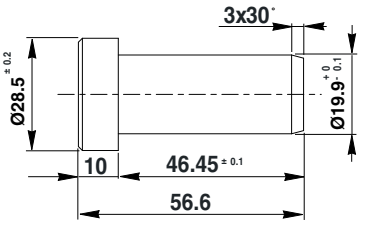



MAP10180

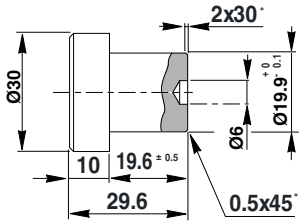
## 21.34 T34

**2306**

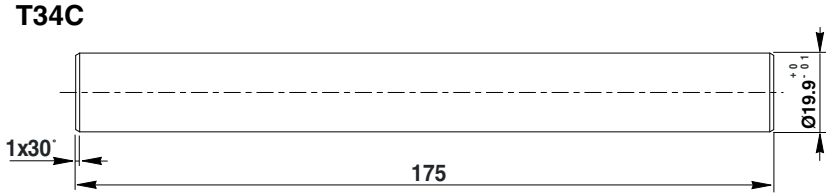
**T34A**




**T34B**



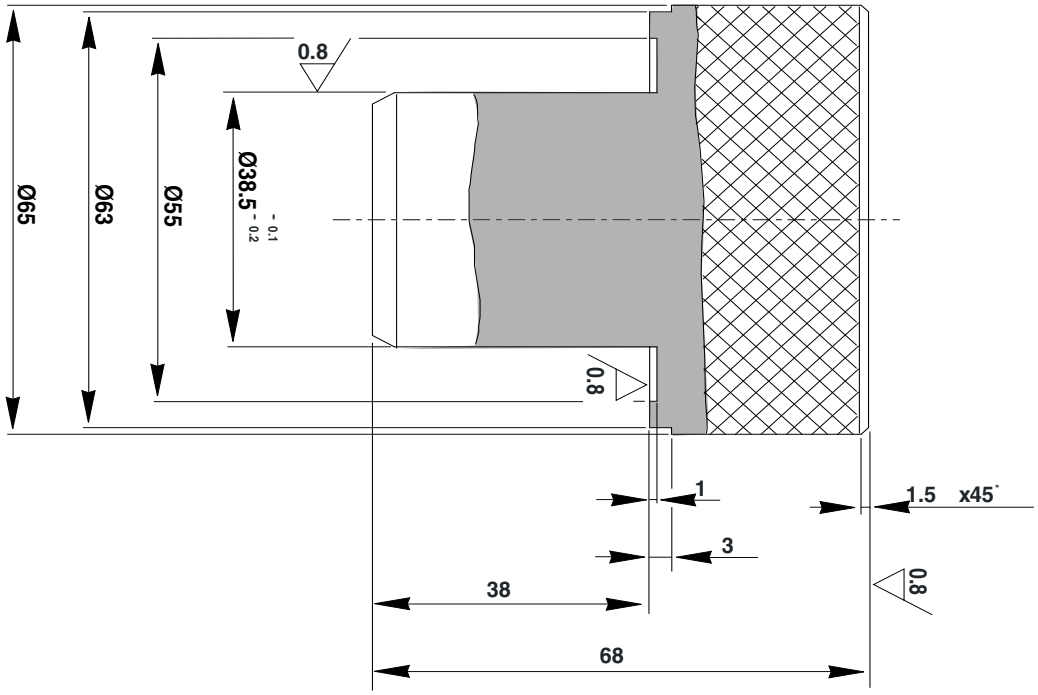

**T34C**




MAP10190

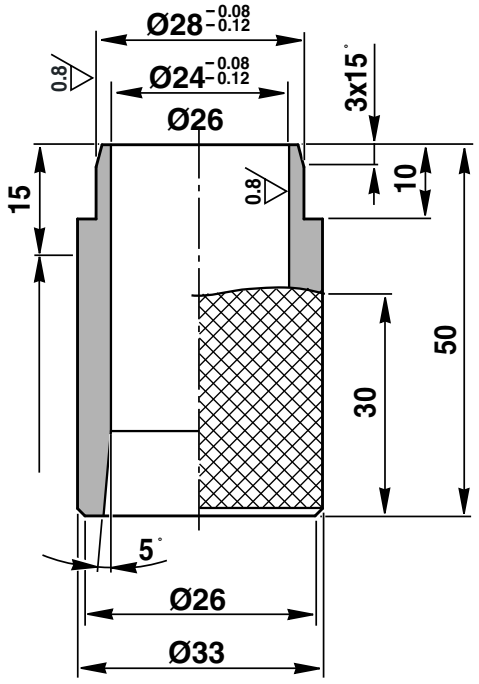
## 21.35 T35

**3332**



## 21.36 T36

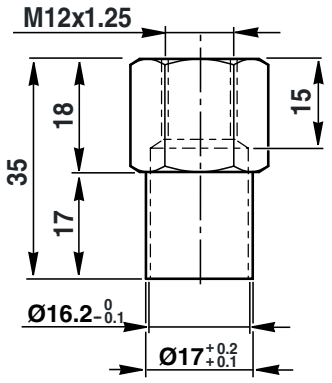
**3543**




MAP10480

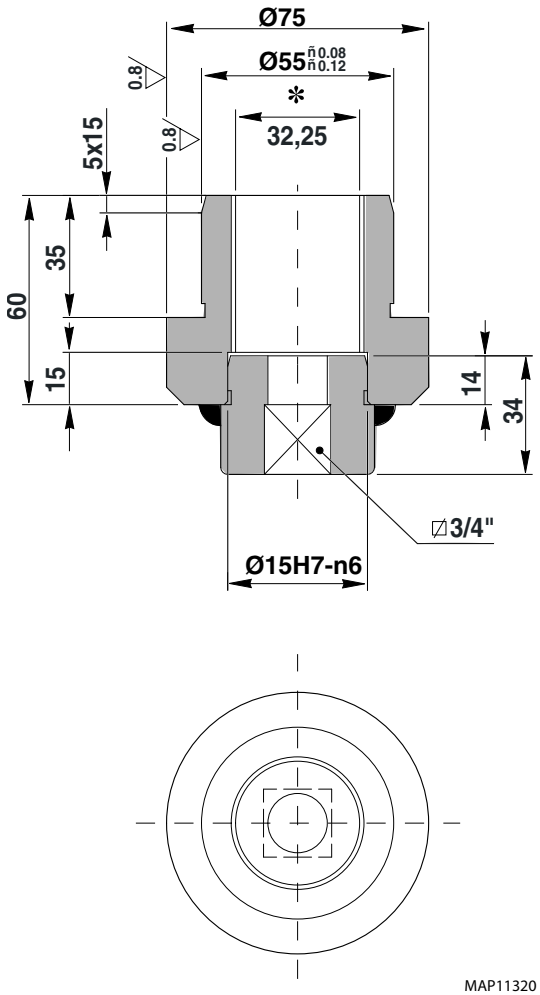
## 21.37 T37

**2316**

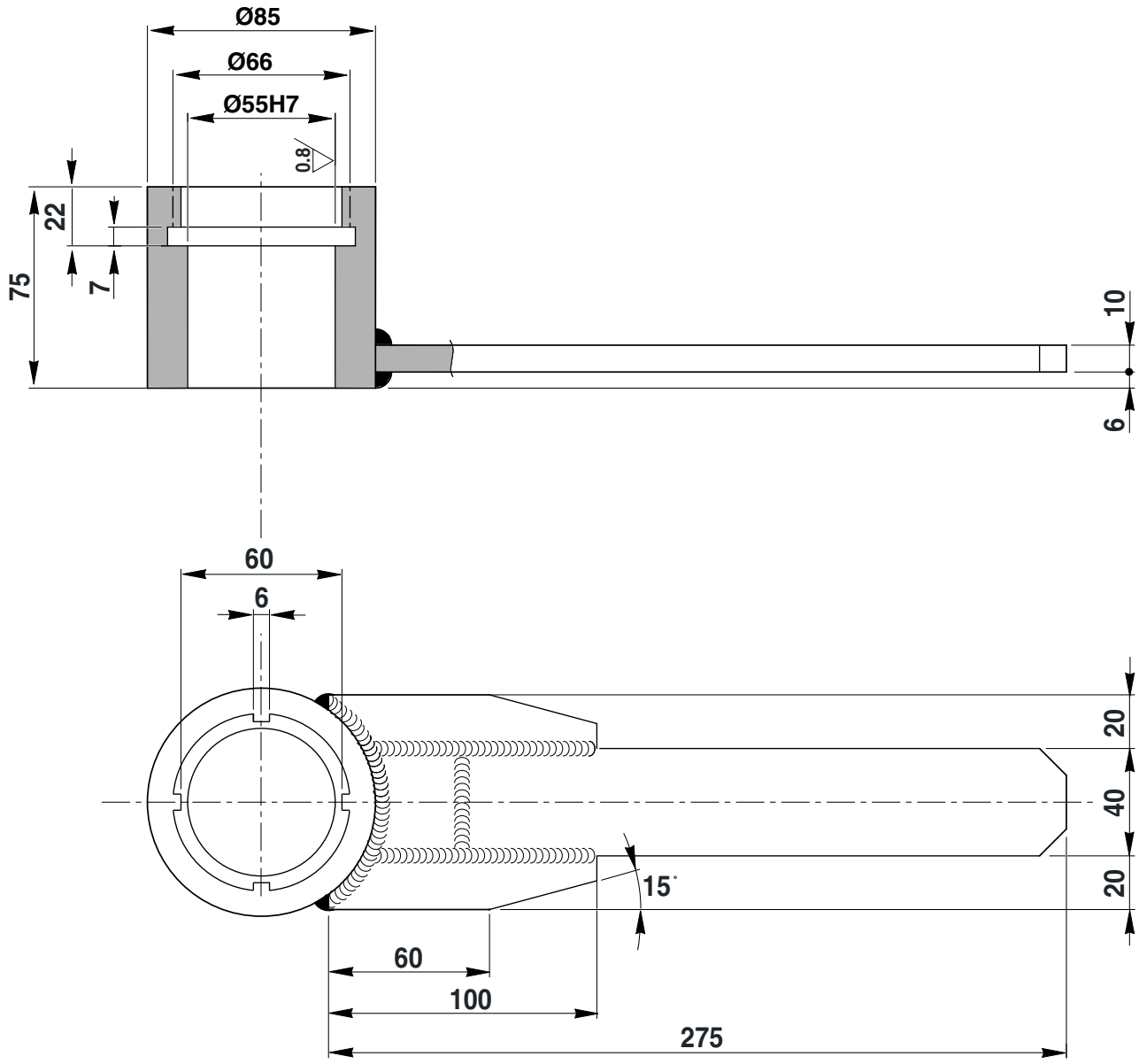



MAP11470

## 21.38 T38

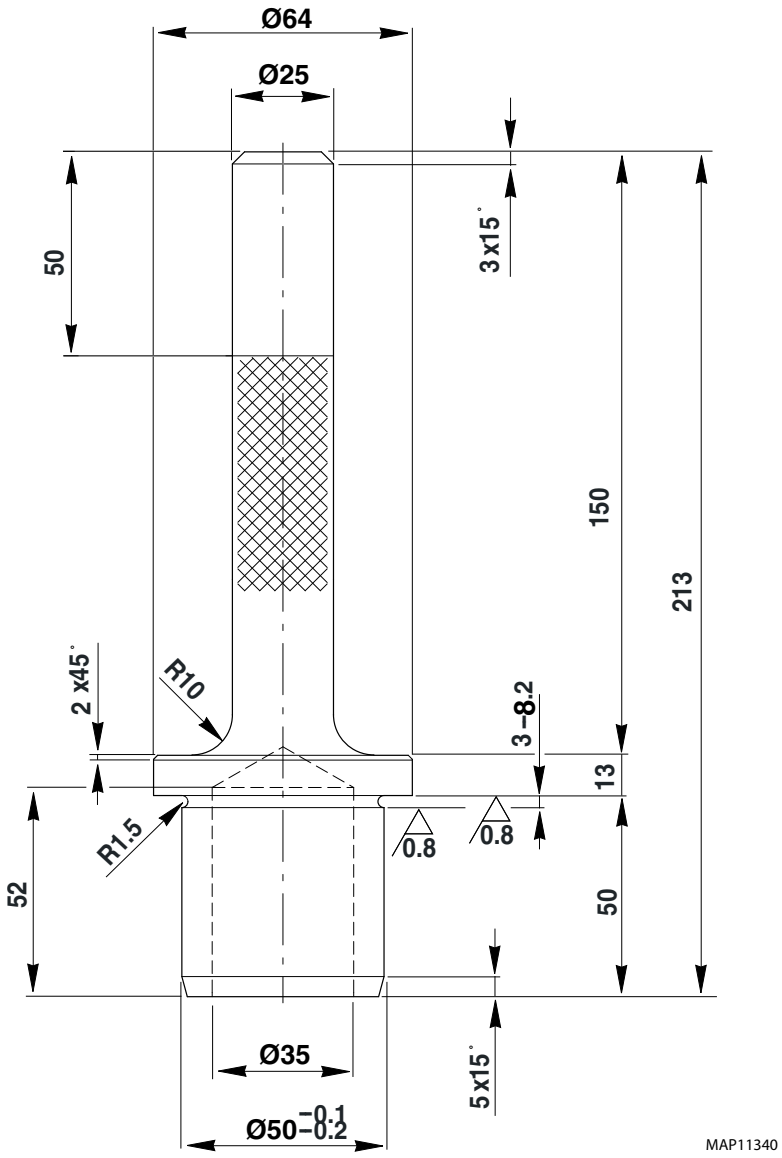

Ø75
Ø55 ñ0.08 ñ0.12
*
32,25
0.8
0.8
5x15
60
35
15
14
34
⍁3/4"
Ø15H7-n6
MAP11320

## 21.39 T39

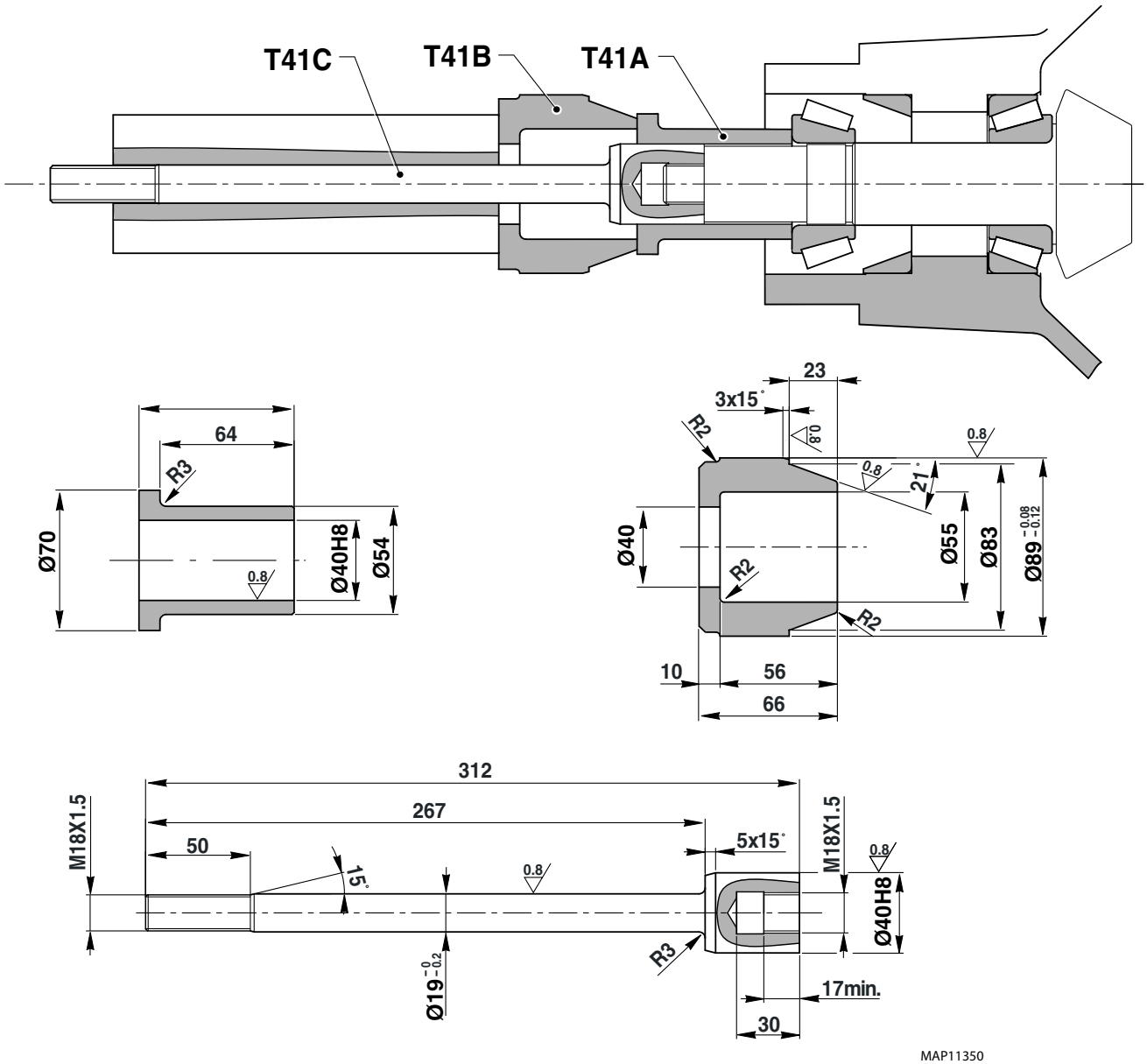



MAP11330

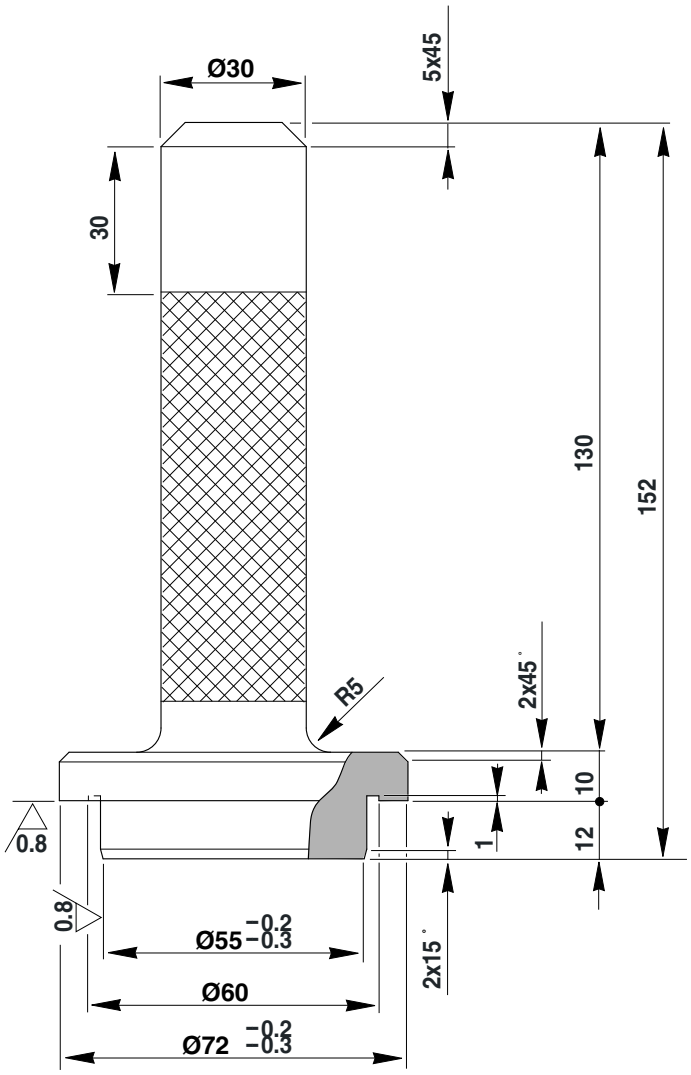
## 21.40 T40


Ø64
Ø25
50
3 x15°
150
213
2 x45°
R10
3 –8.2
13
R1.5
0.8
0.8
52
50
Ø35
5x15°
Ø50 –0.1 –0.2
MAP11340

## 21.41 T41

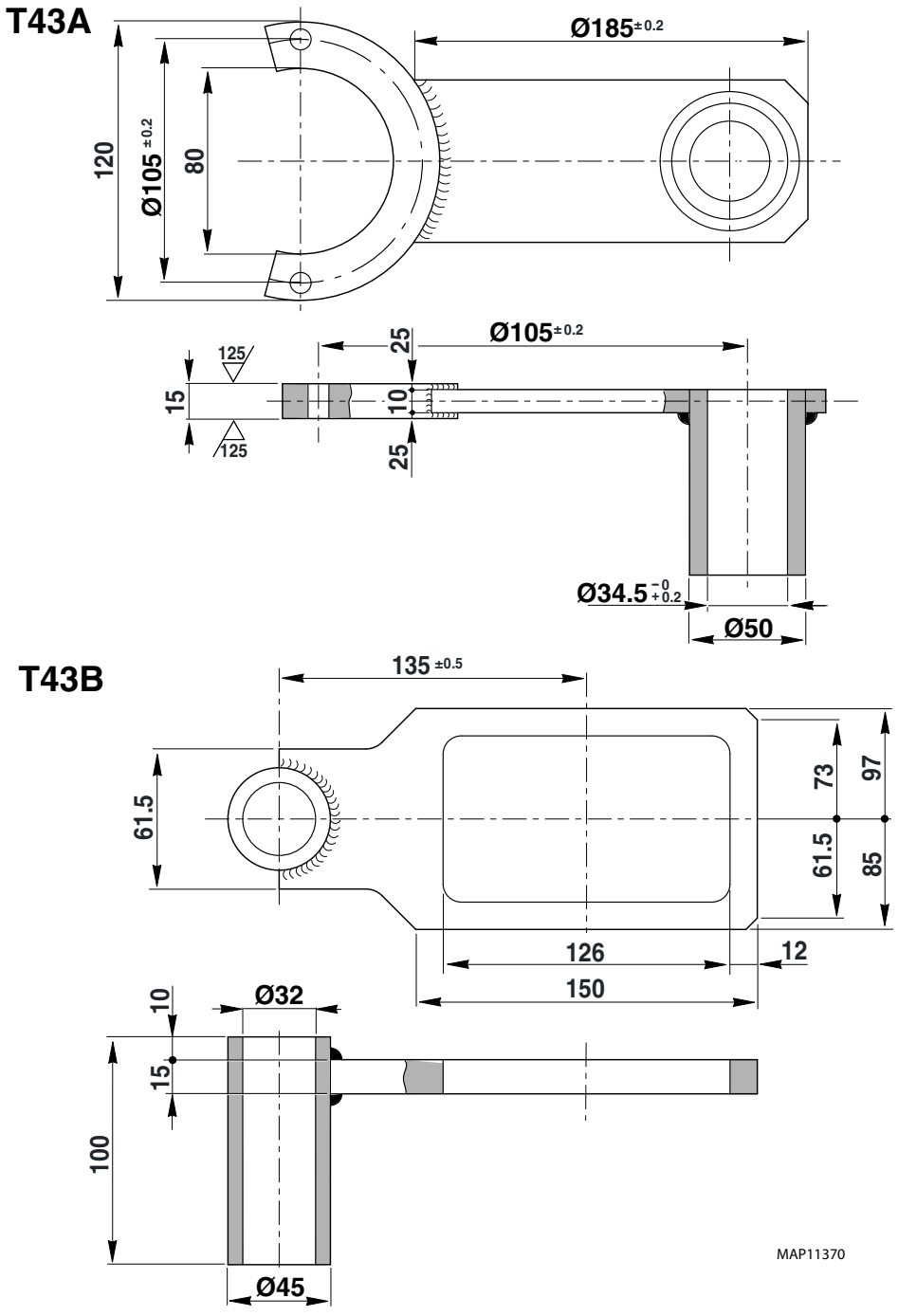

T41C
T41B
T41A
64
R3
Ø70
0.8
Ø40H8
Ø54
23
3x15°
R2
0.8
0.8
21°
Ø40
R2
Ø55
Ø83
Ø89 -0.08 -0.12
R2
10
56
66
312
267
50
M18X1.5
15°
0.8
5x15°
M18X1.5
0.8
Ø40H8
R3
Ø19 -0 -0.2
17min.
30
MAP11350

## 21.42 T42




MAP11360

## 21.43 T43


T43A
Ø185±0.2
120
Ø105 ±0.2
80
Ø105±0.2
125
25
15
10
125
25
Ø34.5 −0 +0.2
Ø50
T43B
135 ±0.5
61.5
73
97
61.5
85
126
12
150
10
Ø32
15
100
Ø45
MAP11370

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