JLG® GRADALL®

SERVICE MANUAL

GRADALL®

TF6-42

9150-4002

March 2003

Starting Serial No.
0192001 thru 0192007
& 0160000052 thru Current

CORPORATE OFFICE

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JLG® GRADALL®

OWNER/OPERATOR MANUAL

GRADALL®

TF6-42

9150-4003

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TF6-42 MATERIAL HANDLER
"TRANSFORMER SERIES"

OWNER/OPERATOR MANUAL

COVERING OPERATION & PERIODIC MAINTENANCE

GRADALL®

material handler

IMPORTANT!

Read and understand this Manual, the Transformer Series Work Platform Owner/Operator Manual, the Gradall Material Handler Safety Manual, the ANSI A92.5 Responsibilities Manual, and the EMI Aerial Work Platform Safety Manual before starting, operating or performing maintenance procedures on this machine.

KEEP OPERATOR AND SAFETY MANUALS IN CAB

A JLG Company

Form No. 20136

COVERS MATERIAL HANDLER TF6-42
STARTING SERIAL NUMBER 0192001 THRU 0192007
AND SERIAL NUMBER 0160000052 THRU CURRENT

JLG®

Part No. 9150-4003

IMPORTANT SAFETY NOTICE

Safe operation depends on reliable equipment and proper operating procedures. Performing the checks and services described in this Manual will help keep your JLG/GRADALL Material Handler in reliable condition. Following recommended operating procedures can help you avoid accidents. Because some procedures may be new to even the experienced operator, we require that this Manual be read, understood and complied with by all who operate this machine.

Strict attention to and compliance with instructions provided in this Manual, the Transformer Series Work Platform Owner/Operator Manual, the GRADALL Material Handler Safety Manual, the ANSI A92.5 Responsibilities Manual, the EMI Aerial Work Platform Safety Manual, as well as instructional decals and plates affixed to the machine and attachments will help prevent injuries to personnel and damage to the equipment. The information provided herein is not intended to cover all situations; it is impossible to anticipate and evaluate all possible applications and methods of operation for this equipment.

This Manual covers recommended operating procedures and basic maintenance checks and services for the Material Handler. Detailed maintenance information is available in the appropriate Service Manual.

Any procedure not specifically recommended by JLG/GRADALL must be thoroughly evaluated from the standpoint of safety before it is placed in practice. If you are not sure, contact your JLG/GRADALL Material Handler Distributor before operating.

Use only JLG/GRADALL authorized parts. The use of counterfeit parts may cause premature failure which could lead to injuries and/or machine damage.

Do not modify this machine without written permission from JLG/GRADALL. Use only genuine JLG/GRADALL replacement parts.

OTHER NOTICES

JLG/GRADALL retains all proprietary rights to the information contained in this Manual.

JLG/GRADALL reserves the right to change specifications without notice.

GRADALL is a registered trademark for Hydraulic Excavators, Hydraulic Material Handlers and Attachments manufactured by The JLG/Gradall Company.

REVISIONS

This page is provided so you may determine that this Manual is complete and current with respect to JLG/ Gradall Engineering Specifications.

Page	Date	Revision

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General

This Manual provides important information regarding safe operating and maintenance requirements for JLG/GRADALL Material Handlers. Refer to front cover for specific model and serial number range.

If you have any questions regarding the material handler, contact your JLG/GRADALL Distributor.

Operator Qualifications

Operators of the material handler must be in good physical and mental condition, have normal reflexes and reaction time, good vision and depth perception and normal hearing. He must not be using medication which could impair abilities nor be under the influence of alcohol or any other intoxicant during the work shift.

The operator should possess a valid, applicable driver's license and must have completed a training course for this type of equipment.

In addition, the operator must read/view, understand and comply with instructions contained in the following material furnished with the material handler:

- This Owner/Operator Manual
- The Transformer Series Work Platform Owner/Operator Manual
- ANSI Responsibilities Manual
- EMI Aerial Work Platform Safety Manual
- GRADALL Material Handler Safety Manual
- All instructional decals and plates
- Any optional equipment instructions furnished

The operator must also read, understand and comply with all applicable Employer, Industry and Governmental rules, standards and regulations.

Orientation

When used to describe the location of components in the material handler, the directions "front'", "rear", "right" and "left" relate to the orientation of a person sitting in the operator's seat. **(See figure I-1)**

Related Manuals & Decals

Separate publications are furnished with the material handler to provide information concerning safety, replacement parts, maintenance procedures, theory of operation and vendor components. Replacement manuals, decals and instruction plates can be ordered from your JLG/GRADALL Distributor.

Models Covered

This Manual covers basic information for JLG/Gradall Material Handlers. Detailed information for each particular machine is in the maintenance section in the back of this manual. Be certain to refer to proper information for your unit and the optional equipment furnished on your machine.

Serial Number Location (See figure I-2)

Specify Model Number and Serial Number when ordering parts and when discussing specific applications and procedures with your Distributor. The model/serial number plate is located inside the operator's cab, right wall.

NOTE!

"Material handler" and handler are used interchangeably throughout this Manual.

NOTE!

Though no offense or discrimination is intended, only the masculine pronouns will be used throughout the remainder of this Manual.

NOTE!

In the U.S.A., the operator must have completed a training course meeting the OSHA Powered Industrial Truck Operator Training Requirements (CFR 1910.178)

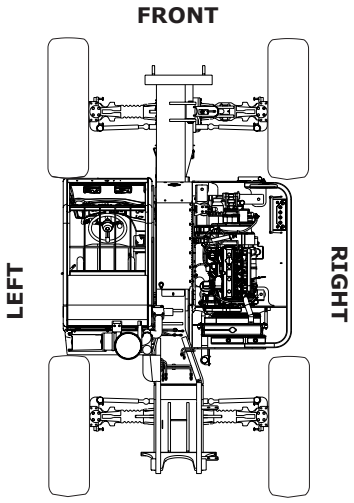


Figure I-1

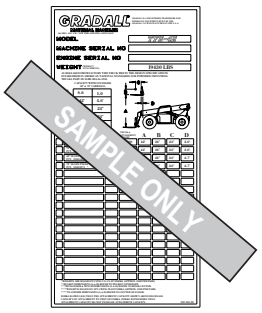


Figure I-2

Important Notice !

This machine has been equipped with a serial number specific Transformer Series Personnel Work Platform. Do not exchange transformer platforms between machines. Doing so will require calibration changes to the controller that must be performed by a qualified service technician. This platform assembly is designed soley for use with the Transformer Model Machines only.

SAFETY HIGHLIGHTS

Read and understand all manuals and instructional material listed on cover, inside front cover and introduction page of this Manual before starting, operating or performing maintenance procedures on this equipment.

Regardless of previous experience operating similar equipment, the operator must be given sufficient opportunity to practice with the handler in a safe, open area (not hazardous to people or property) to gain operating skills and the proper "feel" for controls and operating clearances required for safe, efficient operation.

JLG/GRADALL Material Handlers are equipped with a right-side rearview mirror. This mirror is intended as an operator's aid and does not replace the requirement for line-of-sight. Certain job site and machine conditions may require use of a signal person to help the operator when picking, placing or transporting a load. Never operate the handler until you know pick-up point, line of travel and landing point are clear. Always be aware that objects in mirror are closer than they appear.

Safety Precautions

Make sure all **DANGER, WARNING, CAUTION and INSTRUCTIONAL DECALS** are in place and can be read. Clean or replace decals as required.

Ensure handler is on a firm, level surface before lifting or placing load. Have surface leveled if necessary. **Unit can tip over if load is raised with handler on a soft or uneven surface.**

Be aware that when rotating the platform within indicated area on capacity charts, it can swing into tires. Be sure to allow clearance to avoid damage to tires.

When traveling at high rates of speed, use two wheel front steer mode and **slow the machine prior to turning.**

Do not change steer mode while the machine is traveling. Change the steer mode only when machine is stopped.

Always look in the direction of travel. **Reduce speed and be especially careful when traveling in reverse and/or turning.** Bring the machine to a complete stop before changing the direction of travel.

Travel in reverse only at slow rates of speed.

When turning, the forks on the four wheel steer machine sweep through an arc beyond the turn radius of the tires. **Maintain adequate clearance between the forks/load and other objects.**

If load or conditions obstruct view, **use a signal person** when lifting, carrying or placing a load.

Loose clothing can get caught in moving machinery and can also cause accidental actuation of controls. **Dress properly for the job.**

Be alert to any unusual response to controls. If unusual response is noticed, position handler in a safe area, lower forks to ground, apply parking brake, stop engine and remove key from ignition switch. Tag steering wheel to forbid operation and **notify maintenance personnel.**

WATCH FOR THESE SYMBOLS ; THEY CALL YOUR ATTENTION TO SAFETY NOTICES.

⚠ DANGER

This symbol indicates an extreme hazard which will result in high probability of death or serious injury if proper precautions are not taken.

⚠ WARNING

This symbol indicates a hazard which could result in death or serious injury if proper precautions are not taken.

⚠ CAUTION

This symbol indicates a hazard which may result in injury or damage to equipment or property if proper precautions are not taken.

⚠ WARNING

Operator must be seated with seat belt fastened, transmission control lever in "Neutral" position, parking brake applied and all hydraulic controls in "Neutral" before starting engine.

Keep hands, gloves, shoes, control knobs and pedals clean. **Slippery controls can cause accidents.** Keep a firm grip on the steering wheel when traveling.

Load capacities are based on load center being within .6m (24 inches) from front vertical face of forks.

Release trapped pressure before disconnecting, opening or removing any hydraulic component.

Keep all windows and mirror(s) clean. Adjust mirror(s) as required for maximum visibility, before and during operation.

Do not increase engine speed with the transmission in forward or reverse and the service brake pedal depressed in an attempt to get quicker hydraulic performance. This could cause unexpected machine movement.

After bringing the material handler to a stop using the service brake, place the directional control lever in neutral, and set the park brake prior to lifting a load.

Allow the handler to slow down, or use the service brakes prior to down-shifting. **Do not downshift more than one gear at a time.**

When traveling on downhill slopes, downshift to a lower gear and use the service brake as necessary to maintain a slow speed. **Do not shift into neutral and coast downhill.**

Never permit diesel engine to run out of fuel. Doing so can cause severe engine damage.

DO NOT burn or drill holes in forks. Modifying any part of machine or attachment affects it's capacity and/or stability of machine.

Keep head, arms, hands, legs and all other body parts inside the operator's cab at all times.

DO NOT approach power lines, overhead or underground cables or other power sources with any part of your material handler or load unless all local, state/provincial and federal regulations have been met and the appropriate utility company's hotline has been contacted to de-energize the lines.

Whenever leaving the cab, perform standard shut-down procedure:

Standard Shut-Down Procedure

Position the handler in a safe location, lower forks/attachment to ground, apply park brake, move all controls to "Neutral", allow engine to run at low idle for 3 to 5 minutes. Rotate control station selector switch to "off", remove key and place emergency stop button in run mode. Chock wheels.

⚠ WARNING

Contact The JLG/Gradall Company prior to welding on machine.

⚠ WARNING

Do not operate the "transformer series" platform without proper installation, including electrical and hydraulic connections in place.

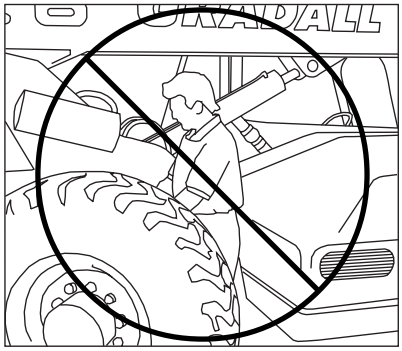
⚠ WARNING

Do not allow personnel to tamper with or operate the machine from the cab with personnel in the platform equipped with controls, except in an emergency.

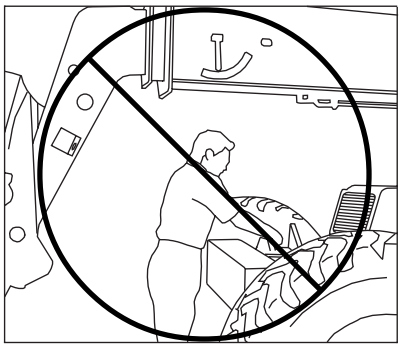
Do not allow others to occupy cab while platform controls are in use.

Pinch Points

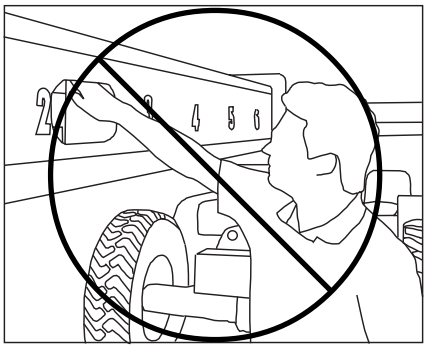
Stay clear of pinch points and rotating parts on the material handler. Getting caught in a pinch point or a moving part can cause serious injury or death. Before performing any maintenance on machine, follow the "STANDARD SHUT-DOWN PROCEDURE" on page 1.1.



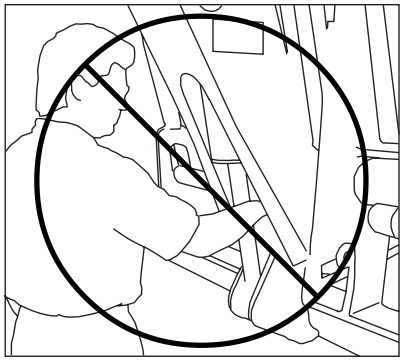
Front & Rear Steering Axles



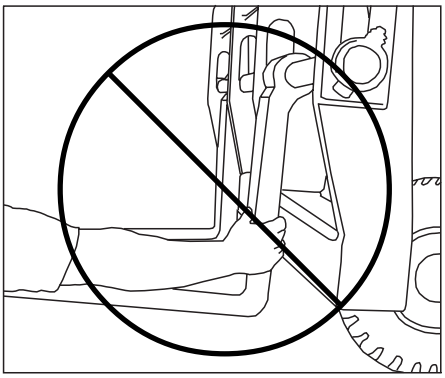
Boom



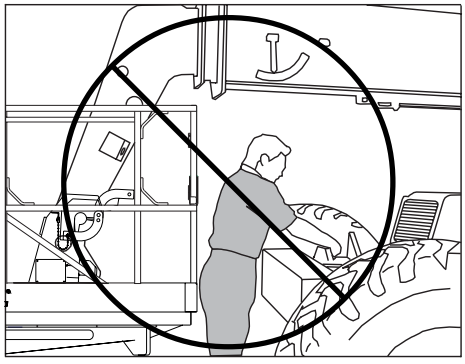
Boom Holes



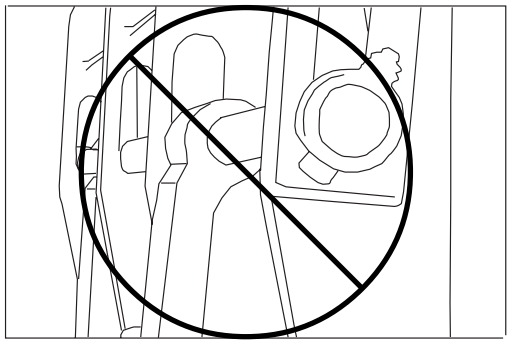
Attachment Tilt Cylinder



Carriage Forks

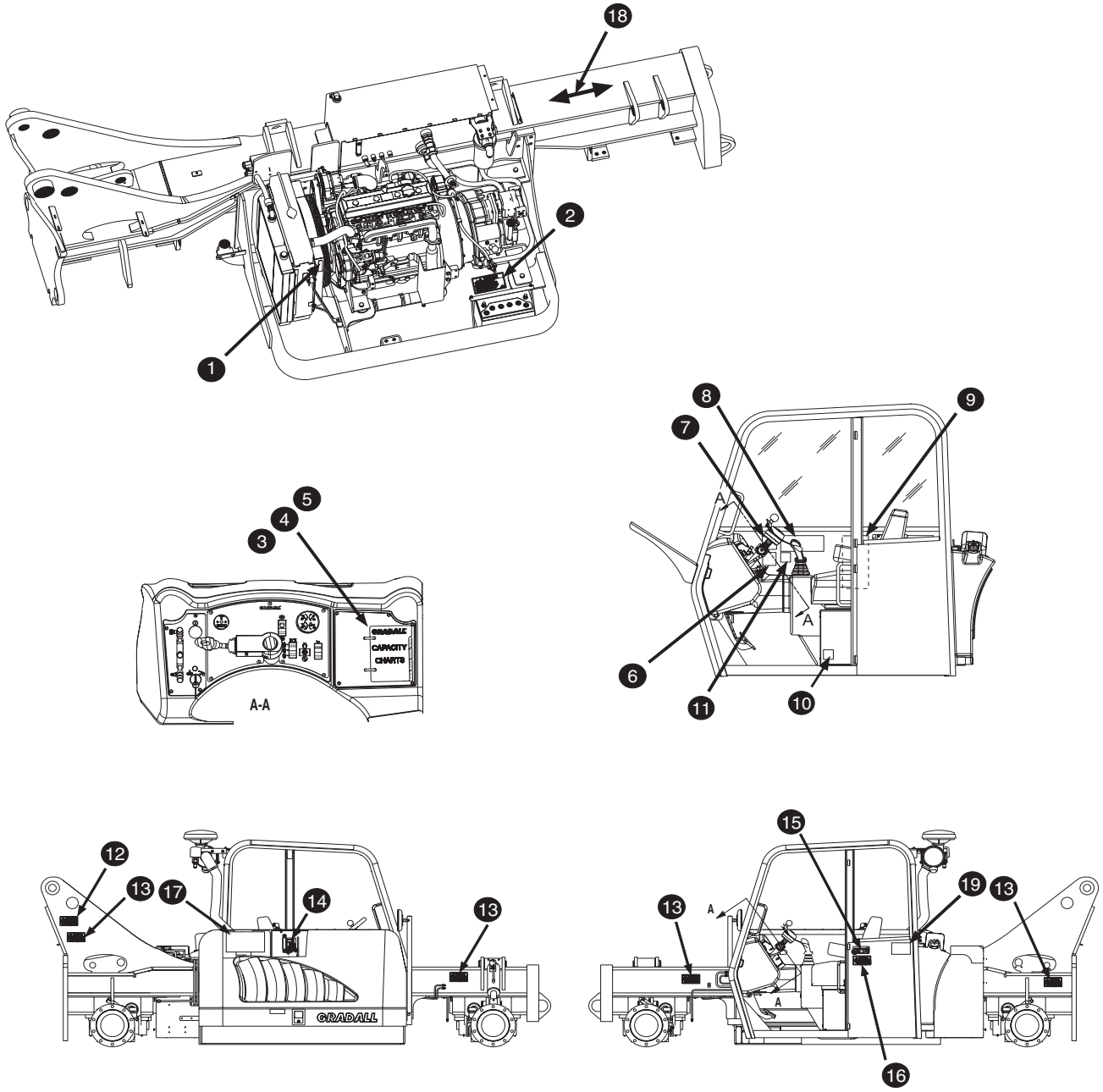


Platform & Tires

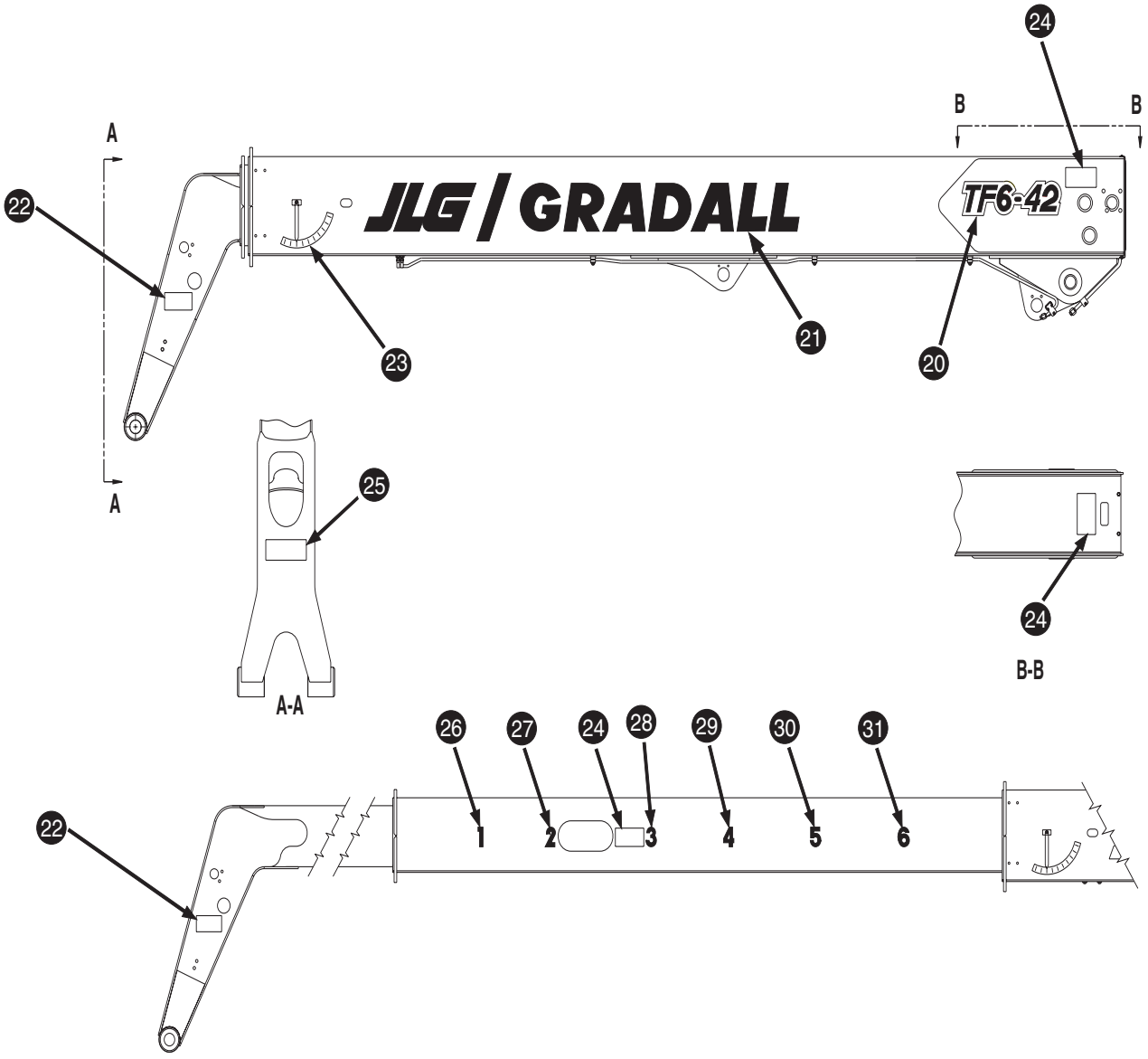


Fork Pin Area on Carriages

DECAL LOCATIONS

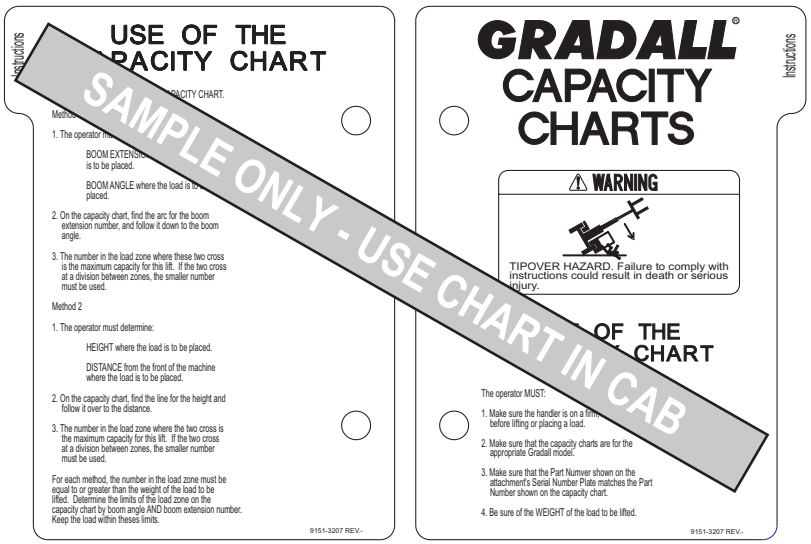


1	9150-3097	Warning Decal, moving parts	9	9150-3088	Serial No. & Attaching Plate
2	9150-3099	Warning Decal, battery	10	9150-3112	Aux. Hyd. De-Press Decal
3	9151-3207	Load Chart Cover	11	9150-3102	Boom Operation Decal
4	9150-3083	Carriage Chart - TF6-42	12	9150-3101	Inspection Decal
5	9150-3084	Swing Carriage - TF6-42	13	9150-3108	Warning Decal, pinch point
	9150-3085	Swing Mast - TF6-42	14	9150-3107	Oil Level Decal
	9150-3086	Truss Boom - TF6-42	15	7733-3027	Made in USA Decal
	9150-3087	Platform Chart - TF6-42	16	9150-3109	Warning Decal, no riders
6	9150-3096	Warning Decal, lifting personnel	17	9150-3113	Service Instruction Plate
7	9150-3110	Danger Decal, high voltage	18	1701529	Decal
8	9150-3098	Warning Decal, operation	19	7702-3008	Fuel Decal



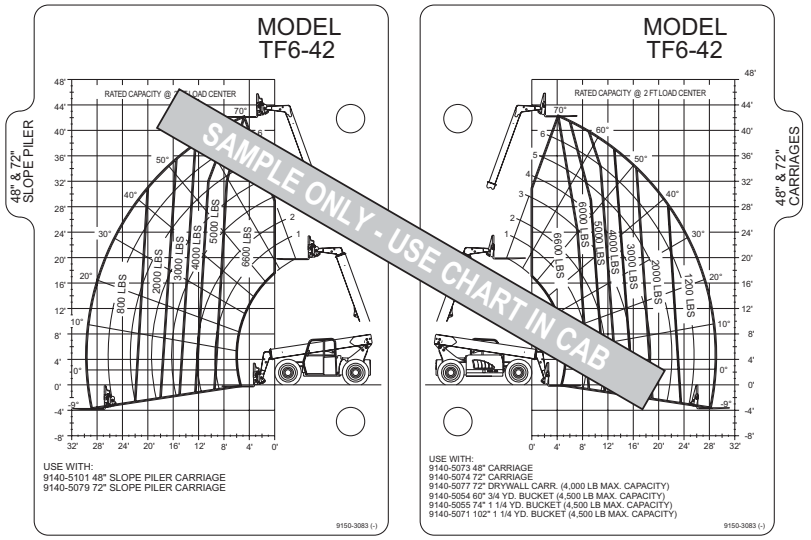
20	9150-3128	TF6-42 Decal	26	9100-3016	“1” Decal
21	9147-3132	Gradall Decal	27	9100-3018	“2” Decal
22	9114-3282	Warning Decal, pinch point	28	9112-3042	“3” Decal
23	9100-3031	Boom Angle Decal	29	9100-3020	“4” Decal
24	9151-3210	Warning Decal, moving parts	30	9112-3044	“5” Decal
25	9150-3096	Warning Decal, lifting personnel	31	9116-3077	“6” Decal

DECALS



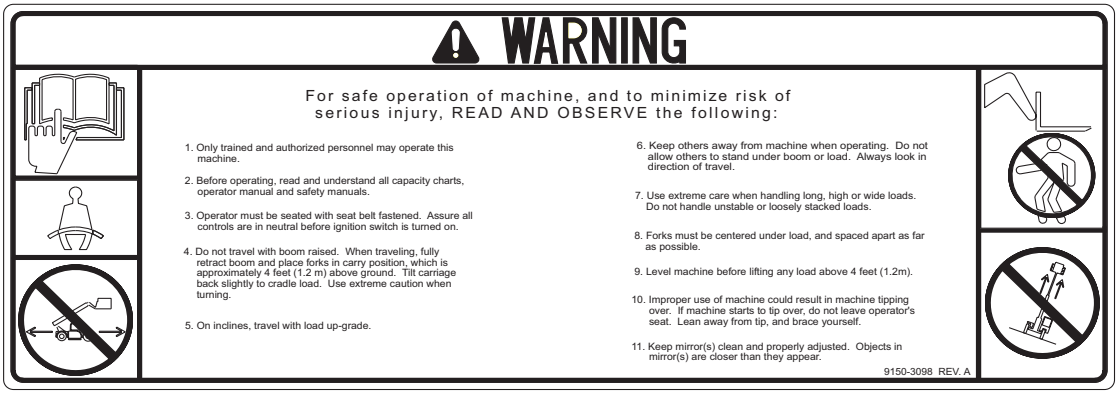
BACK FRONT

Located on dashboard
P/N 9151-3207

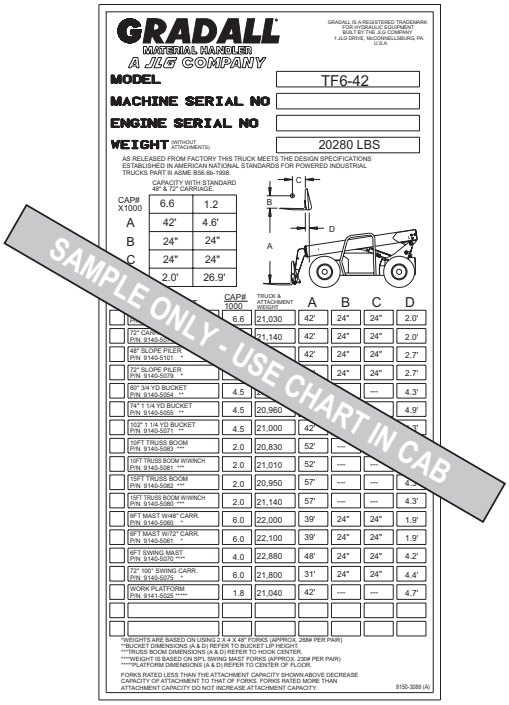


BACK FRONT

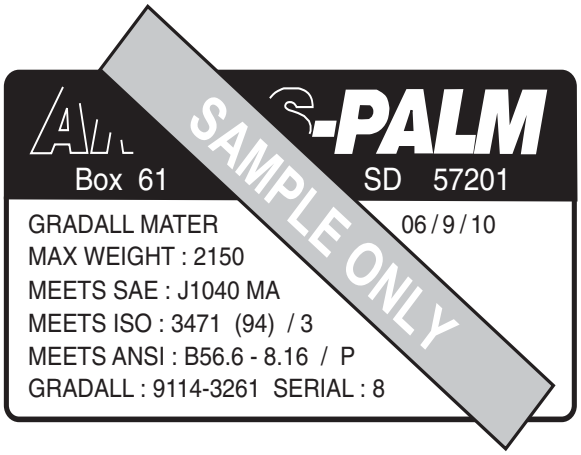
Located on dashboard
P/N 9150-3083



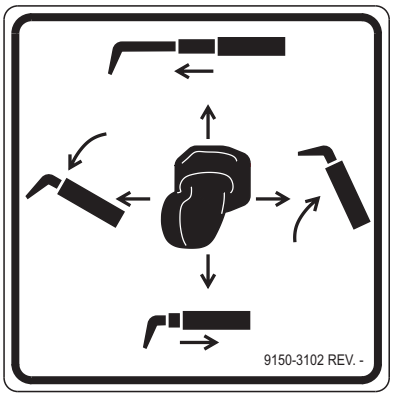
Located on right cab wall
P/N 9150-3098



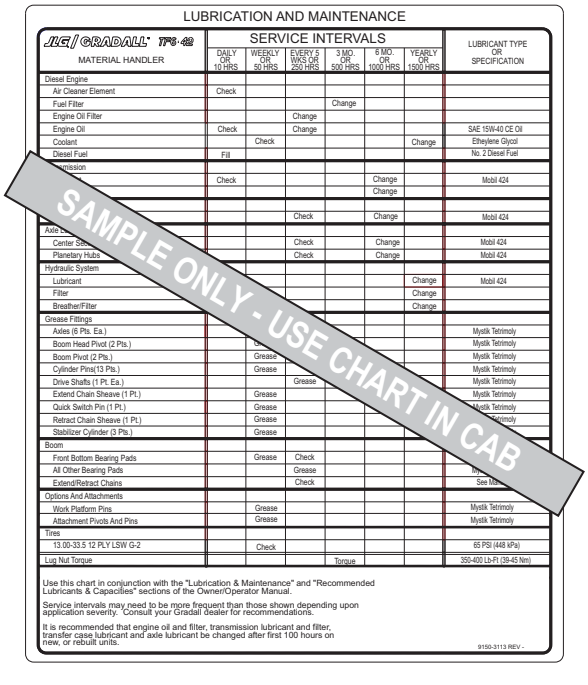
Located on right cab wall
P/N 9150-3088



Located on back wall, behind operator's seat
P/N N/A (enclosed cab)
P/N N/A (open cab)



Located on right cab wall
P/N 9150-3102

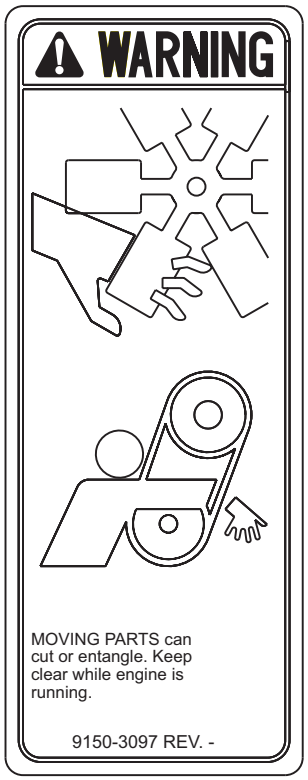


Located inside engine cover
P/N 9150-3113

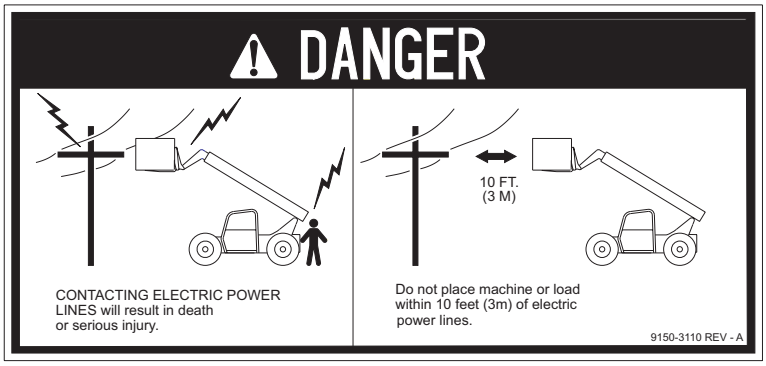
Located on left side, front cab plate
P/N 9116-4094

DECALS

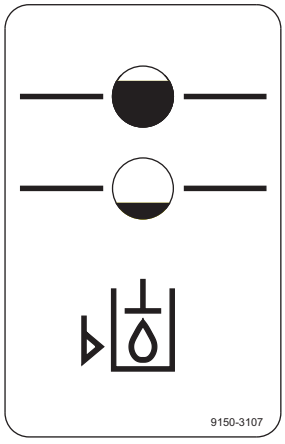
Located in engine compartment
P/N 9150-3099



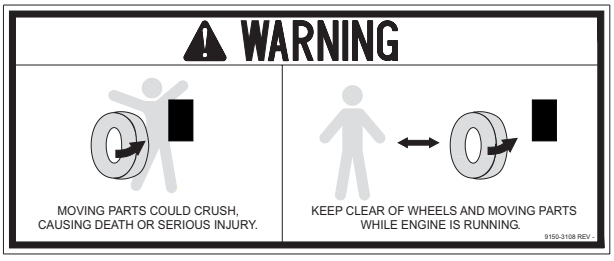
Located in engine compartment
P/N 9150-3097



Located on right cab wall
P/N 9150-3110

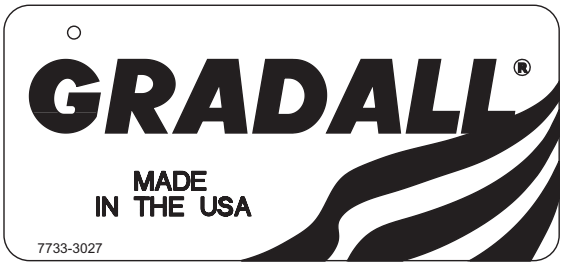


Located on hydraulic reservoir
P/N 9150-3107

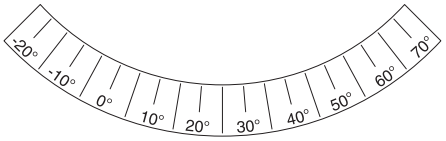


Located on right and left frame,
front & rear
P/N 9150-3108

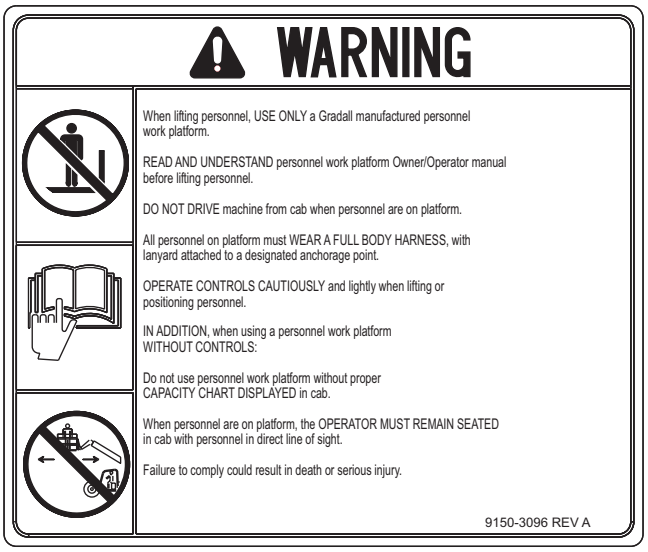
Located on left cab outside wall
P/N 9150-3109



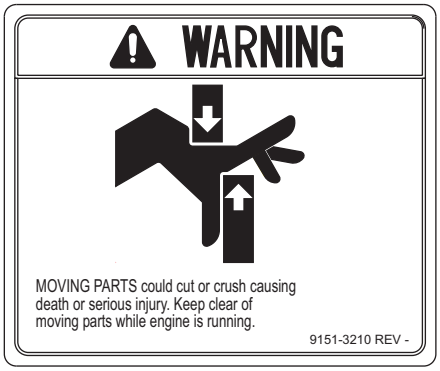
Located on left outside cab wall
P/N 7733-3027



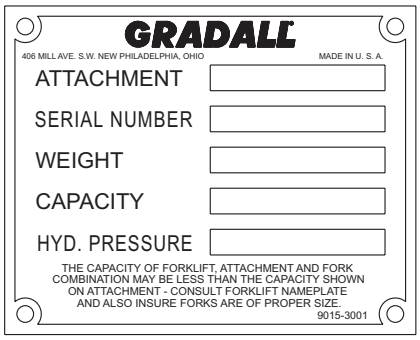
Located on left side of boom
P/N 9100-3031



Located on boom head,
and inside right cab wall
P/N 9150-3096



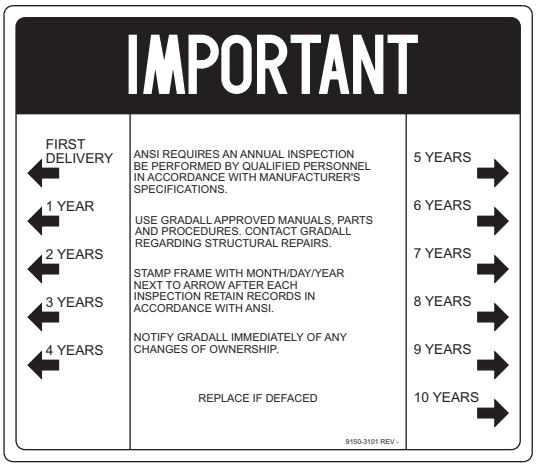
Located on boom
P/N 9151-3210



Located on attachment
P/N 9015-3001

DECALS

Located on Frame
P/N 1701529



Located on Boom Pivot Frame
P/N 9150-3101

Located on outside of Cab
P/N 7702-3008

OPERATOR'S CAB

The cab permits vision from all sides and includes an overhead guard to provide protection from falling objects.

A fully-enclosed cab with windows and a lockable door is available as an option. The top half of the cab door must be secured in either the fully-opened or closed position. The bottom half of the cab door must be secured in the closed position only. Be sure the door is fully secured when operating the handler.

The operator's seat is equipped with a seat belt and includes fore and aft adjustment to compensate for variations in operator size. The adjustment release/lock is located on the side of seat. **Wear seat belt when operating machine.**

An optional windshield wiper/washer is available for use with enclosed cabs. A control switch is located on the instrument panel.

A variable-speed defroster fan is available for use with enclosed cabs. An "On/Off" control switch and speed control are located on the base of the fan.

The heater fan speed is controlled by a knob on the panel to the right of the operator's seat. Hot water to the heater can be controlled by a knob on the same panel or a valve in the engine compartment.

The operator's cab is an S.A.E. "FOPS/ROPS" structure. Do not make any modification to this structure. If damaged, the cab cannot be repaired. It must be replaced.

WARNING

Never operate the handler unless the overhead guard is in good condition.

WARNING

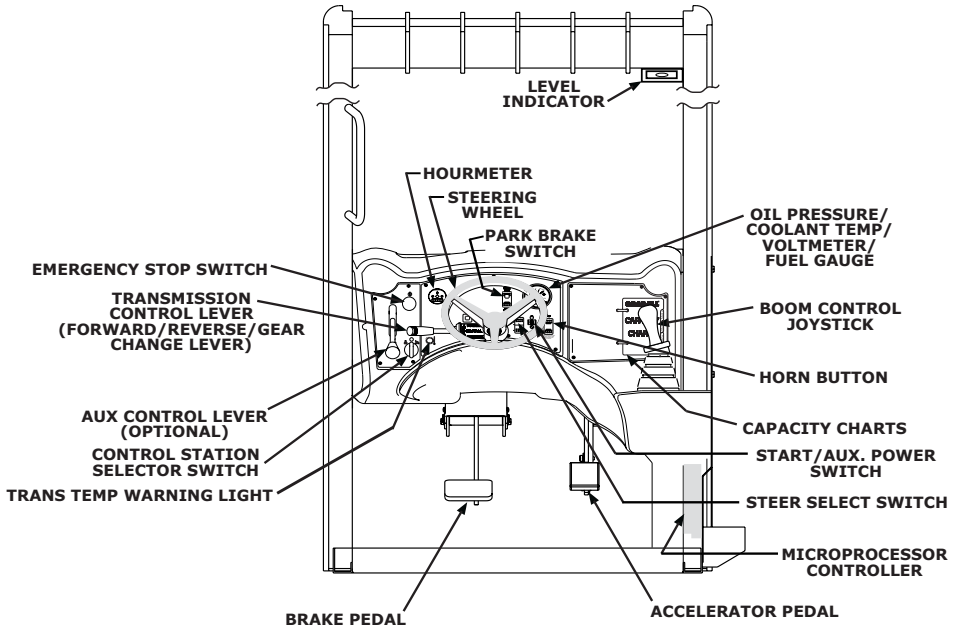
Any modification to this machine must be approved by JLG/GRADALL to assure compliance with FOPS/ROPS certification for this cab/machine configuration.

NOTE!

Relevant S.A.E. Recommended Practices:
S.A.E. J1040 for ROPS
S.A.E. J231 for FOPS

CONTROL AND INSTRUMENT IDENTIFICATION

Figure 3-1



OPERATOR'S CAB

Accelerator Pedal: Depress pedal to increase speed and release pedal to decrease speed.

Attachment Tilt Lever: This lever controls tilt of the fork carriage. Speed is proportional to lever actuation and engine RPM. Push lever forward to tilt down; pull lever back to tilt up.

Attachment Tilt Switch (optional): Depress left side of switch to tilt down; depress right side of switch to tilt up.

Auxiliary Control Lever (optional): This lever is used to control optional hydraulic attachments. Follow decal instructions for lever/handler movements.

Auxiliary Light Switch (optional): This switch turns auxiliary lights on and off.

Boom Control Joystick: This joystick controls boom elevation and extension. Pull joystick back to raise boom; push joystick forward to lower boom. Move joystick to right to extend boom; move to left to retract boom. Speed of boom movement is proportional to joystick actuation and engine RPM.

Control Station Selector Switch: Rotate key activated switch to "Platform" to transfer power to platform controls. Rotate key activated switch to "Cab" to transfer power to cab controls. When not in use, turn the selector switch to "Off". If the switch is not positioned in the "Off" position during shutdown and emergency stop button is in run mode, the battery will drain.

Decompression Valve: Used only for connecting/disconnecting Auxiliary Hydraulics. Located in cab, left side of seat pedestal.

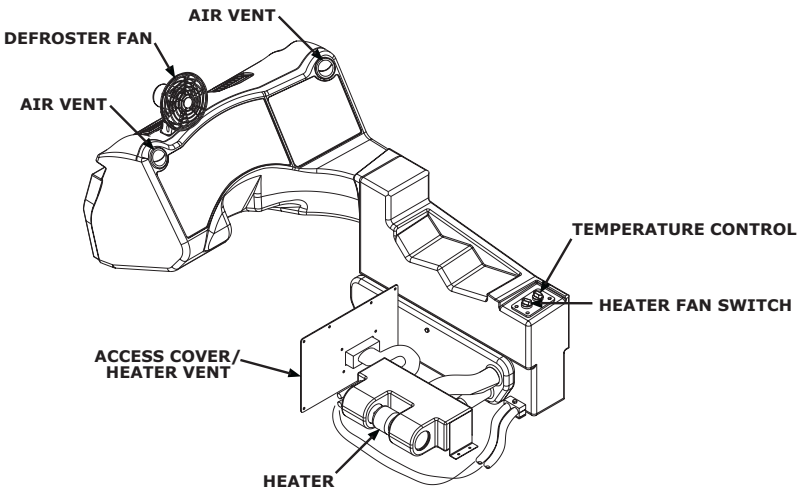
Emergency Stop Button: Pushing the button stops engine operation.

Engine Coolant Temperature Gauge: This gauge displays engine coolant temperature.

Engine Oil Pressure Gauge: This gauge displays engine oil pressure.

Fuel Gauge: This gauge displays level of fuel in fuel tank.

Heater Fan Switch (optional): This switch turns heater fan on and off.



Horn Button: Depress button to sound horn.

WARNING

A brief description of controls and instruments is provided here as a convenience for the operator. These descriptions DO NOT provide complete operation instructions. Read & understand this Manual, the Transformer Series Work Platform Manual, the ANSI A92.5 Responsibilities Manual, the EMI Aerial Work Platform Safety Manual, and the GRADALL Material Handler Safety Manual.

Hourmeter: This meter indicates total time of engine operation in hours and tenths of hours.

Start/Aux. Switch: The control selector switch must be in cab position for start/aux. switch to be operational. Momentarily push switch up to start engine. With engine off, simultaneously push switch down and activate controls to activate auxiliary power.

Level Indicator: This bubble level indicator enables the operator to determine the left to right level condition of the handler.

Lights Switch (optional): This switch controls optional lighting which may be provided with the handler.

Machine Level Lever: This lever controls the relationship of the handler frame to the front axle. Move the lever left to tilt frame to left, move the lever right to tilt frame to right.

Microprocessor Controller: This unit processes information for the transmission.

Neutral Lock Lever: The transmission control lever is equipped with a switch that locks the transmission control lever in neutral when activated.

Parking Brake Switch: This switch controls the application and release of the parking brake. Indicator light on switch glows (red) to indicate brake is applied.

Seat lock Release Lever: This lever unlocks and locks seat position adjustment.

Service Brake: This pedal operates the service brakes. The further the pedal is depressed, the slower the travel speed. Full depression of pedal causes full service brake application.

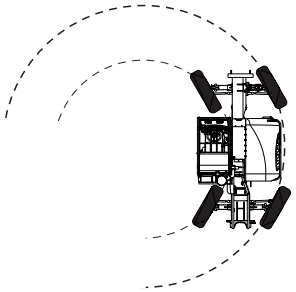
Steer Select Switch: This switch has three positions to allow selection of 4-wheel circle steer, 4-wheel crab steer and 2-wheel steer. 4-wheel circle steer allows the front and rear wheels to steer in opposite directions for tight turns. 4-wheel crab steering turns the front and rear tires in the same direction for moving the machine to the side. 2-wheel steer allows only the front wheels to steer.

Steering Wheel: The steering wheel controls the angle of wheels. Turning the steering wheel to the right causes a right turn. Turning the steering wheel to the left causes a left turn.

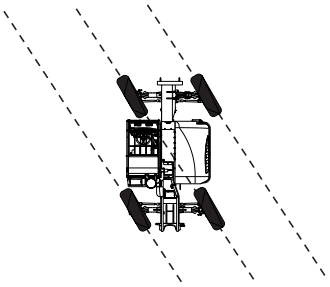
Transmission Control: This lever engages forward or reverse travel. Push lever fully forward for forward travel; pull lever fully backward for reverse travel. Move lever to centered position for "Neutral." Twist hand grip to select gear.

Transmission Temperature Light: This light will illuminate during starting procedure for a bulb check. If transmission temperature exceeds 250° light will glow indicating the need for service.

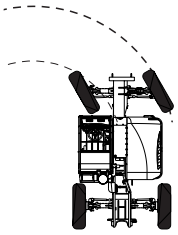
Voltmeter: This gauge indicates alternator output and battery condition.



4-Wheel Circle Steer



4-Wheel Crab Steer



2-Wheel Front Steer

⚠ CAUTION

If transmission temperature light glows, move material handler to a safe location and shut down.

⚠ CAUTION

When traveling at higher speeds use 2-wheel front steering.

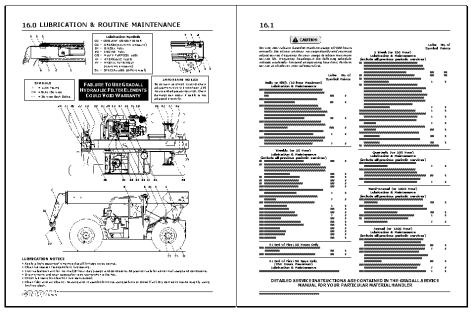
CHECKS & SERVICES BEFORE STARTING ENGINE

To be performed at the beginning of each work shift.

PERFORM "WALK-AROUND INSPECTION" AS DESCRIBED ON PAGES P6.2 & P6.3 IN THE TRANSFORMER SERIES WORK PLATFORM MANUAL LOCATED IN THE BACK OF THIS MANUAL. THIS INSPECTION IS A DAILY REQUIREMENT BEFORE OPERATING THIS MACHINE.

- Check to be sure the material handler is equipped with the proper load/capacity chart and that it is legible before operating.
- If spark arrestors are required, be sure they are in place and in good working order.
- Check to be certain that windows and mirror(s) are clean and undamaged. Also make certain that mirror(s) are properly adjusted for operator's view.
- Before removing filler caps or fill plugs, wipe all dirt and grease away from the ports. If dirt enters these ports, it can severely reduce component life.
- When adding fluids, refer to lubrication section of Manual to determine proper type.

Complete all required maintenance before operating unit.



Service the unit in accordance with the ***"Lubrication and Routine Maintenance" schedule, pages 19.2 and 19.3.***

Inspect all structural members, including attachment, for signs of damage.

(Optional Turbo Charged Engine Shown)

Inspect unit for obvious damage, vandalism and necessary maintenance. Check for signs of fuel, lubricant, coolant and hydraulic leaks. Open all access doors and look for loose fittings, clamps, components and attaching hardware. Replace hydraulic lines that are cracked, brittle, cut or which show signs of leakage or abrasion.

⚠ WARNING

Use extreme caution when checking items beyond your normal reach. Use an approved safety ladder.

⚠ WARNING

Before operating handler, complete all required maintenance. Replace or repair all damaged, worn or missing components before starting or operating. Failure to properly maintain handler could cause serious injury or death.

⚠ WARNING

*Use a piece of cardboard or paper to search for leaks. **DO NOT** use bare hands. If anyone is injured by hydraulic fluid, including penetration of the skin, obtain medical help **immediately**!*

To be performed at beginning of each work shift.
PERFORM "WALK-AROUND INSPECTION" AS DESCRIBED ON PAGES P6.2 & P6.3 IN THE TRANSFORMER SERIES WORK PLATFORM MANUAL LOCATED IN THE BACK OF THIS MANUAL. THIS INSPECTION IS A DAILY REQUIREMENT BEFORE OPERATING THIS MACHINE.

The safety, efficiency and service life of your handler will be increased by performing the operational checks listed below. Items preceded by an asterisk (*) are optional and may not be furnished on your machine.

Before entering the operator's cab, check:

1. Engine oil level.
2. Hydraulic oil level.
3. Air Filter Restriction Indicator. If needle is in red area, filter is clogged and element must be cleaned or changed.

During warm-up period, check:

* 4. Heater, defroster and windshield wiper.
* 5. Operating lights and rotating beacon.
6. Voltmeter-should show 13.5 to 14 volts.

When engine warms to operating range, check:

7. Transmission fluid level.
8. Service brake and parking brake.
9. Forward and reverse travel.
10. Each of the gear ranges.
11. Steering (in both directions) with engine at low idle. Check in each steering mode.
12. Horn and back-up alarm. Must be audible from inside operators cab with engine running.
13. All boom and attachment functions - operate smoothly and correctly.
14. Hydraulic Filter Condition Indicator - observe engine coolant temperature gauge after starting normal operation. When needle has been in operating range for an hour or so, stop handler in a safe area, apply parking brake, lower forks fully, shift forward/reverse lever to "Neutral" position and chock wheels. With engine running at full throttle, have an assistant check the Hydraulic Filter Condition Indicator. When bar gauge is in red area, filter is clogged and hydraulic oil is bypassing filter. Filter element must be changed before reaching bypass condition (change before needle reaches red area).

Complete all required maintenance before operating unit.

⚠ WARNING

Check all tires and rims periodically for damage due to impact. Replace before use if damage is detected.

⚠ CAUTION

Keep engine cover closed while engine is running except when checking Transmission Oil Level and hydraulic filter condition indicator.

⚠ CAUTION

Continued operation with hydraulic fluid bypassing the filter may cause severe damage to hydraulic system components.

ENGINE OPERATION

Starting the Engine

1. Make sure all controls are in "Neutral" and all electrical components (lights, heater, defroster, etc.) are turned off. Set parking brake.

2. Depress accelerator pedal approximately 1/4 to 1/3 of travel from top.

3. Turn control station selector switch to cab, pull up emergency stop, and push up on start/aux. switch to engage starting motor. If engine fails to start within 20 seconds, release start/aux. switch and allow starting motor to cool for a few minutes before trying again.

4. After engine starts, observe oil pressure gauge. If gauge remains on zero for more than ten seconds, stop engine and determine cause. Correct malfunction before restarting engine. Minimum pressure at operating temperature:
   Low idle: 10 PSI (69kPa)

5. Warm up engine at approximately 1/2 throttle until engine coolant temperature reaches operating range.

⚠ WARNING

Operator must be seated with seat belt fastened, transmission control lever in "Neutral" position, parking brake applied and all hydraulic controls in "Neutral" before starting engine.

NOTE!

Engine will not start unless transmission control lever is in "Neutral" and parking brake switch is applied.

Cold-Weather Starting Aids

In cold weather situations, a supplemental starting aid may be required. Gradall-approved starting aids employ ether. If your handler is equipped with an ether starting aid, the following applies:

- All employed ether is triggered by temperature gauge located on engine.
- At start-up, temperature gauge on engine will detect if ether is needed. Follow normal start-up procedure, shown above.
- Ether is employed and additional will be released if needed, to keep engine running.
- A second battery is added for additional cold-cranking capacity.

⚠ CAUTION

If your machine is equipped with a cold start aid, do not spray additional ether into air cleaner.

If machine is not equipped with cold start aid, follow instructions listed in the engine manual supplied with machine.

Battery-Boosted Starting

If you ever have to battery-boost start (jump-start) your handler, proceed as follows:

- Never allow vehicles to touch
- Connect the positive (+) jumper cable to positive (+) post of discharged battery
- Connect opposite end of positive (+) jumper cable to positive (+) post of booster battery
- Connect the negative (-) jumper cable to negative (-) post on booster battery
- Connect opposite end of negative (-) jumper cable to ground point on machine away from discharged battery
- Follow standard starting procedures
- Remove cables in reverse order after machine has started

Normal Engine Operation

Observe gauges frequently to be sure all engine systems are functioning properly.

The voltmeter shows the "charge/discharge" state of the battery charging system. With the engine running, meter should indicate 13.5 to 14 volts. With engine stopped, meter indicates battery charge (12 volts).

Be alert for unusual noises or vibration. When an unusual condition is noticed, park machine in safe position and perform standard shut-down procedure. **(See Page 1.1)** Report condition to your supervisor or maintenance personnel.

Avoid prolonged idling. Idling causes engine temperature to drop and this permits formation of heavy carbon deposits and dilution of lubricating oil by incompletely-burned fuel. If the engine is not being used, turn it off.

Stopping the Engine

- **To stop engine, perform standard shut-down procedure shown on page 1.1.**
- Operate engine at low idle for 3 to 5 minutes before **turning it off.** This allows engine coolant and lubricating oil to carry excessive heat away from critical engine areas, including turbocharger.
- **Do not "gun" engine before shut down:** This practice causes incompletely-burned fuel to remove oil film from cylinder walls and dilute lubricant in crankcase.

BRAKE SYSTEM

General

The brake system includes a service brake and a parking brake. Service and parking brakes are applied through wet disc brake packs located within axle housing.

Service Brakes

Depressing the service brake pedal causes controlled hydraulic pressure to be applied to service brakes. The greater the pedal travel, the greater the braking force.

If power-assist fails, it will require much greater force on pedal to apply brake and stopping distance will be greater.

Parking Brakes

The parking brakes are spring-applied and hydraulically-released.

Pressure to release parking brakes is provided by the hydraulic system and is controlled by the parking brake switch located on the dashboard.

With the engine running and the parking brake switch "Off", parking brakes are disengaged. Moving the switch to "On" releases hydraulic pressure to apply the parking brakes. With switch in "On" position, the transmission will not engage forward or reverse.

⚠ WARNING

If power-assist feature should fail for any reason, it would require greater effort to apply service brake. If power assist fails, stop as soon as possible. Do not drive the handler until problem has been corrected.

⚠ WARNING

Always move parking brake switch to "On" position before leaving cab. Never stop engine while traveling. Parking brake will be fully-applied and unit could stop abruptly. A sudden stop could cause load loss.

⚠ WARNING

Always ensure that transmission control lever is in neutral before releasing park brake. Releasing park brake in either forward or reverse could cause the machine to move abruptly.

Precautions

- Avoid parking on slopes or near an excavation.
- Park on level ground and chock wheels.
- Avoid parking on roads or highways. If it cannot be avoided, be sure to display warning flags during day and flares or flashing lights at night.
- Position boom-head or attachment on ground; never leave machine with boom in air.
- If parking on a slope cannot be avoided, position the handler at a right angle across the slope, straighten and chock all wheels.

Parking procedure

1. Using service brake, stop the handler in an appropriate parking area.
2. Move parking brake switch to "On".
3. Shift transmission control lever to "Neutral".
4. Position attachment on ground.
5. Allow engine to cool at idle speed for 3 to 5 minutes, stop engine. Rotate control station selector switch to "off", remove key and place emergency stop button in run mode.
6. Chock wheels as an extra precaution against rolling.
7. Fill fuel tank to minimize condensation.
8. Lock cab and install protective covers, if so-equipped.

STEERING SYSTEM

- Three modes of steering are provided as standard equipment. A three position switch on the dashboard allows the operator to select the steering mode.
    - 4-wheel circle steer allows for tight turns and better maneuverability in close quarters.
    - 4-wheel crab steering allows the machine to move sideways at an angle.
    - 2-wheel front steer is used for high speed travel.
- It is imperative that the operator practice maneuvering the handler in a safe, open area to become thoroughly familiar with steering response and clearance required for fork swing and load when turning.

⚠ WARNING

Be alert for any increase in effort needed to steer. If any difference is noted, notify maintenance personnel immediately. If power assist feature should fail for any reason, IT WOULD BECOME VERY DIFFICULT TO STEER. For this reason it is extremely important that you NEVER TURN ENGINE OFF WHILE TRAVELING. In the event power steering fails, stop as soon as possible. Do not drive handler until problem has been corrected.

⚠ WARNING

Use only 2-wheel steer when traveling at high speeds. Never use 4-wheel circle steer at high speeds, sharp turns could cause machine roll-over.

General

This model material handler is equipped with a powershift transmission. With this type of transmission, the operator simply selects a gear, selects the direction of travel, releases brakes and depresses the accelerator pedal to move the handler.

Operation

Gear Selection: Gear selection is accomplished by rotating the twist grip handle on the transmission control lever. It is best to begin travel in a lower gear, however the machine will move away from rest in any gear. Upshifts are most smoothly accomplished by lifting off the throttle pedal when shifting. Caution should be taken of downshifting to ensure that the ground speed of the material handler has slowed sufficiently so as not to over-speed the engine.

Select the appropriate gear for the task being performed. Use a lower gear when transporting a load. Use a higher gear only when traveling longer distances without a load. When traveling through deep mud, or up slopes, use a lower gear. Downshift a gear when traveling down a long hill. Use the service brakes, if necessary, to prevent over-speeding the engine.

Direction of Travel: Direction of travel is selected by moving the transmission control lever towards the front of the machine for forward travel, and towards the rear of the machine for reverse travel. Neutral is selected by moving the transmission control lever to the center position. If neutral is selected while the machine is moving, the machine will continue rolling in the direction of travel.

Always bring the machine to a complete stop before changing direction of travel. This will prevent damage to the transmission or torque converter.

Forward or reverse travel can be selected while in any gear.

⚠ WARNING

Bring handler to a complete stop before shifting transmission control lever. A sudden change in direction of travel could reduce stability and/or cause load to shift or fall.

LEVELING THE HANDLER

"Leveling" means positioning the handler so that it is level from side to side (left to right). A level indicator is located in upper right corner of front window frame to permit operator to determine whether the handler frame is level.

There are four very important things to remember about handler leveling:

1. Never engage a load or lift a load more than 1.2m (four feet) above ground unless handler is level.

2. A handler with the boom raised and/or an attachment installed is a partially-loaded handler.

3. Once the handler frame is level and the operator has raised a load more than 1.2m (four feet) above ground, it must not be moved from this position if such movement could change the level condition. Do not use sway to level handler with load more than 1.2m (four feet) above ground.

4. The combination of side tilt and load could cause the handler to tip over.

Level the handler:
The surface which will support the handler can be leveled. This method must be chosen if it will be necessary to move the handler from its position after the load has been raised over 1.2m (four feet) from ground AND such movement could change the level condition.

Remember: The supporting surface must be large enough, smooth enough and firm enough to keep the handler level when it is moved from its position.

The handler may be leveled by means of the frame-leveling system. This method may be chosen when it will not be necessary to move the handler from its position after the load has been raised above 1.2m (four feet) from ground - OR - when such movement will not change the level condition of the handler.

Always determine best position for handler to raise load from its present location and also to position load at its destination. **THEN** determine which method of leveling will be required at each location.

FINALLY, consider terrain between present location of load and its destination. Never attempt to transport a load across terrain which could cause handler to tip over.

Leveling Handler Frame:

The handler is designed to permit tilting main frame 10° to left or right to compensate for uneven ground conditions.

Leveling Procedure:

Position machine in best location to lift or place load, position forward/reverse lever in neutral and apply parking brake. Observe level indicator to determine whether machine must be leveled and level machine with the machine level lever.

⚠ WARNING

Raising the boom (loaded or unloaded) when handler is leaning to one side could cause machine to tip over with little or no warning and cause serious injury or death.

⚠ WARNING

Always move boom to carry position (horizontal or below) before leveling frame. Attempting to level machine with boom raised could cause it to tip over.

⚠ WARNING

If handler cannot be leveled using leveling system, do not attempt to raise or place load. Have surface leveled.

Hydraulic Controls

All boom and attachment movements are governed by hydraulic controls. Rapid, jerky operation of hydraulic controls will cause rapid, jerky movement of the load. Such movements can cause the load to shift or fall or may cause the machine to tip over.

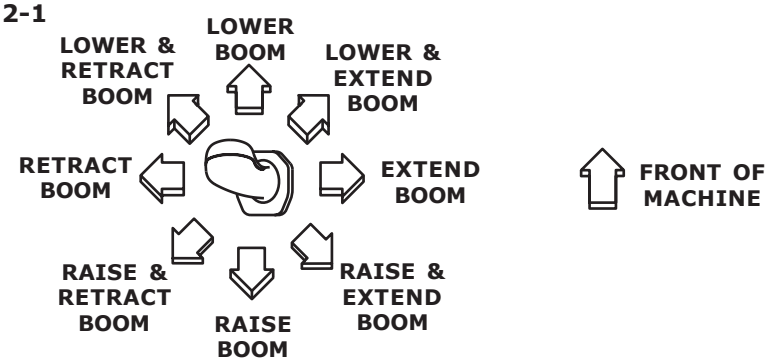
Feathering

Feathering is a control operation technique used for smooth operation. To feather controls, move control lever very slowly until function begins to move, then gradually move lever further until function is moving at desired speed. Gradually move lever toward "Neutral" as load approaches destination. Continue to reduce load speed to bring load to a smooth stop. Feathering effect can be increased by reducing engine speed at beginning and near end of load movement.

Boom Control Joystick

The boom control joystick can be positioned to activate individual boom movements or combinations of boom movements as illustrated:

Figure 12-1



With boom raised above horizontal, forks can be inserted under a load by moving boom control joystick forward and to the right until forks move forward horizontally.

With boom raised above horizontal, forks can be removed from a load by moving boom control joystick back and to the left until forks move rearward horizontally.

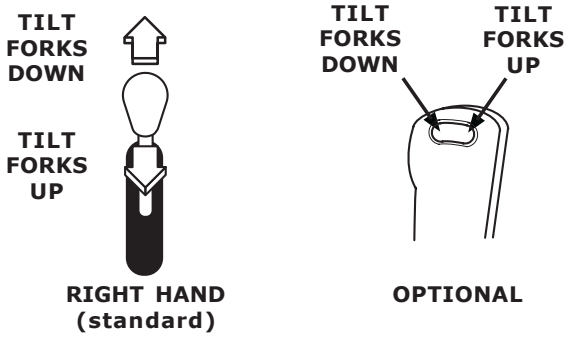
With boom lowered below horizontal, forks can be inserted under a load by moving boom control joystick back and to the right until forks move forward horizontally.

With boom lowered below horizontal, forks can be removed from a load by moving boom control joystick forward and to the left until forks move rearward horizontally.

The closer the boom is to horizontal, the less boom raise/lower movement required for inserting and removing forks.

Carriage Tilt Controls

Figure 12-2



NOTE!

Much of the material in this section may be new to even the experienced operator.

WARNING

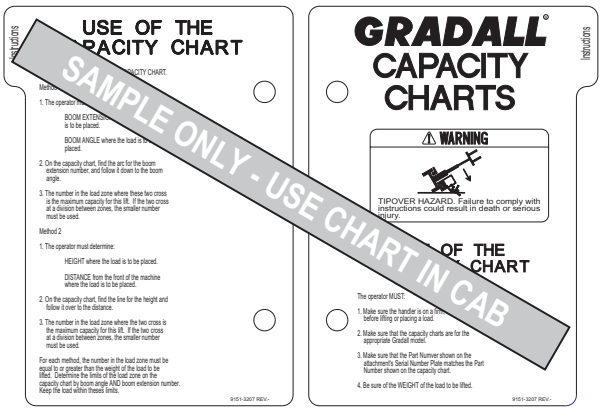
Do not permit lift cylinders to hit the end of their stroke. The jolt could topple loads, causing a hazard to personnel and equipment nearby.

UNDERSTANDING RATED CAPACITY CHARTS

Rated Capacity Chart

The rated capacity chart, located on dashboard, indicates maximum load capacities for handlers equipped with GRADALL-furnished carriage/fork or other attachment combinations. These capacities apply to standard carriage/fork and other attachment combinations except as stated on the capacity chart.

Figure 12-3



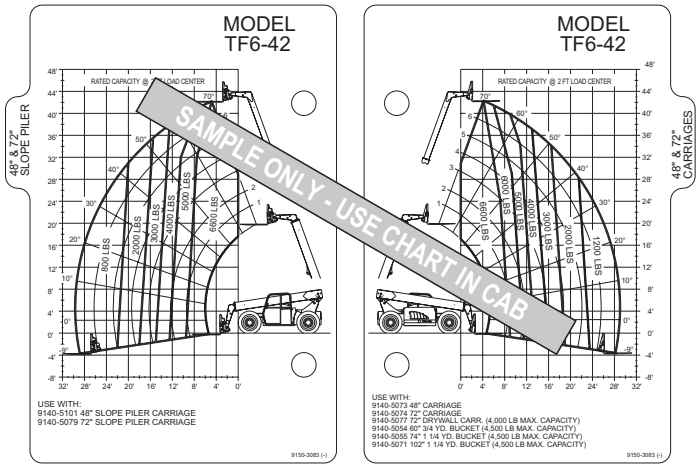
BACK FRONT

NOTE!

See page 13-2 for instructions on how to read capacity charts.

WARNING

All loads shown on rated capacity chart are based on machine being on firm, level ground; the forks being positioned evenly on carriage; the load being centered on forks; proper size tires being properly inflated; and the handler being in good operating condition.



BACK FRONT

Elevation

Numbers at left side of sample chart represent elevation to top of horizontal fork as measured from level ground (in feet). Elevation relates to dimension "A" shown on serial number plate inside operator's cab.

Boom Extension

Numbers across bottom of sample chart and numbers parallel to boom represent boom reach as measured from front of front tires to extended position.

Number decals on boom relate directly to boom extension. The largest number which can be read from operator's seat indicates total boom extension and must be matched with boom angle to determine load capacity.

Boom extension relates to dimension "D" shown on serial number plate.

Boom Angle

Numbers shown at ends of angled lines represent angle of boom to horizontal as measured from horizontal. Maximum angles are -9° below horizontal with boom fully lowered to 70° above horizontal with boom fully raised.

A boom angle indicator is located on left side of boom-section 1 to show boom angle. **Be sure machine is level from front to rear or indicator will provide incorrect reading.**

Load Center

Loads shown on rated capacity chart are based on the load center being 610mm (two feet) above and 610mm (two feet) forward of surfaces of horizontal forks.

The load center of a load is the center of gravity of the load. For regularly-shaped loads of the same material, such as a pallet of blocks, the center of gravity can be located by measuring the load to find its center. For irregular loads, or loads of dissimilar materials, keep the heaviest part of the load as close to the heel of the forks as possible.

In all cases, the load center must be centered between the forks.

Load Limits

Some capacities shown on the rated capacity chart are based on machine stability and some are based on hydraulic lift capacity.

WARNING

Exceeding load limits can cause damage, or, in some cases, cause the machine to tip over.

Items needed to Use a Capacity Chart

There are five items you must know and/or have in order to properly use a Capacity Chart:

1. The weight of the load to be lifted
2. The angle of the boom
3. How much boom extension will be needed
4. The proper Capacity Chart
5. A Gradall-approved Attachment

NOTE!

Some attachments may not be approved for use with certain machine models.

Every Gradall attachment comes with its own Identification Plate. This Plate has the Attachment Serial Number, Part Number, Attachment Capacity and Attachment Weight stamped on it. Make sure that the Capacity Chart you are using matches the attachment exactly. This may be done by matching the attachment part number on the Capacity Chart to the part number stamped on the Identification Plate. The Machine Serial Number Plate is mounted inside the cab and lists all standard attachments that may be used with the machine by part number, at the time it was shipped from the factory. Be aware that a specific Capacity Chart must not only match the attachment, but also the machine model.

The boom angle can be determined by looking at the angle indicator mounted on the side of the boom (see figure 12-5).

The boom extension can be determined by looking at the second boom section. As the second boom section slides out of the main boom, numbers are revealed starting with 1. Each number represents approximately 5’ of total boom extension (see figure 12-5). **It is important to remember that these numbers are designed to be read from the *operator’s seat only!***

How to read a Capacity Chart

When reading the capacity chart you must check to be sure the correct model number is listed (see figure 12-6). The next thing to look for is that the part number of your attachment is listed under the "Use With" section.
Identify and find the amount of boom extension required, along with the angle of the boom. Trace the boom extension arc down until it intersects with the appropriate boom angle. If the intersection of the boom extension arc and the boom angle line occur within a weight region, the value within that region is the maximum capacity for that particular lift. If the intersection occurs on a bold line separating capacity regions, the smaller of the two values must be used. The regions are clearly marked with heavier outlines as shown on page 12.4. If you do not have the correct capacity chart for your machine and/or attachment, contact your Distributor or Gradall to order one.

Example (this is for instructional purpose only - use capacity chart located in your cab):

A contractor has purchased a TF6-42 with the 48" Slope Piler Carriage Attachment (see figure 12-6). He knows his attachment may be used with this model since the attachment part number, 9140-5101, matches the attachment part number stamped on the machine Serial Number Plate. He also knows that the Capacity Chart is correct since it is clearly marked for use with a TF6-42 and that the attachment he is using is listed at the bottom by part number. He has determined the weight of the load to be lifted is 400 lbs. and that he needs to place the load at a boom extension of 6 at a boom angle of 20°. By tracing the boom extension arc down to where the 20° line intersects it, the contractor can see that the maximum weight he can lift is 800 lbs. In this case, he may lift the load.

Figure 12-5: Where to look on the machine

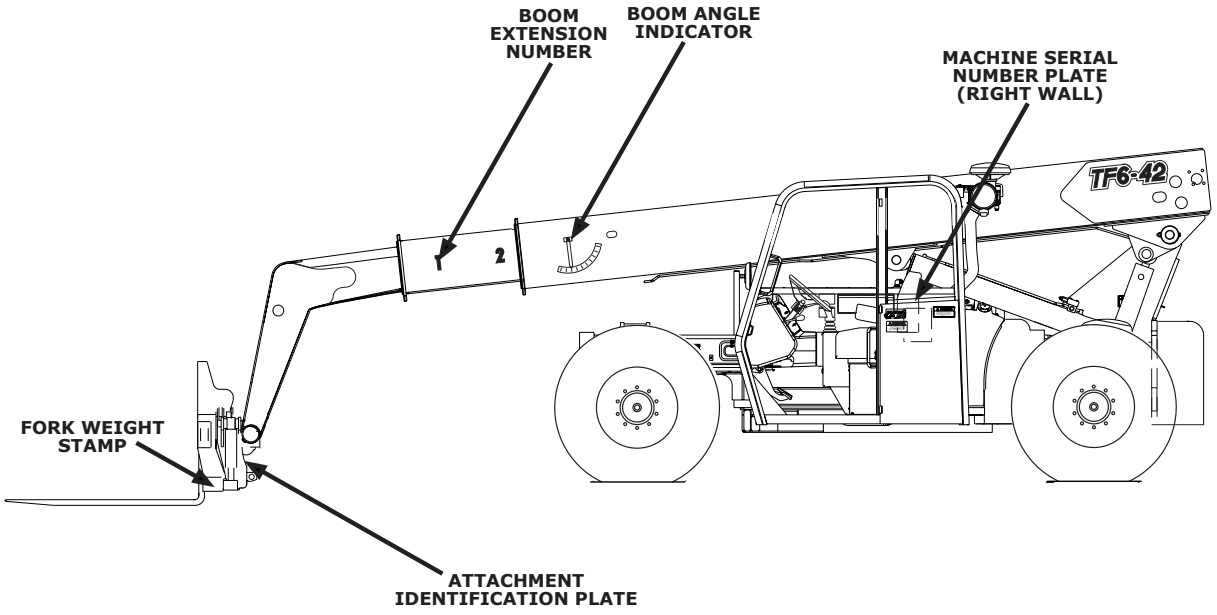
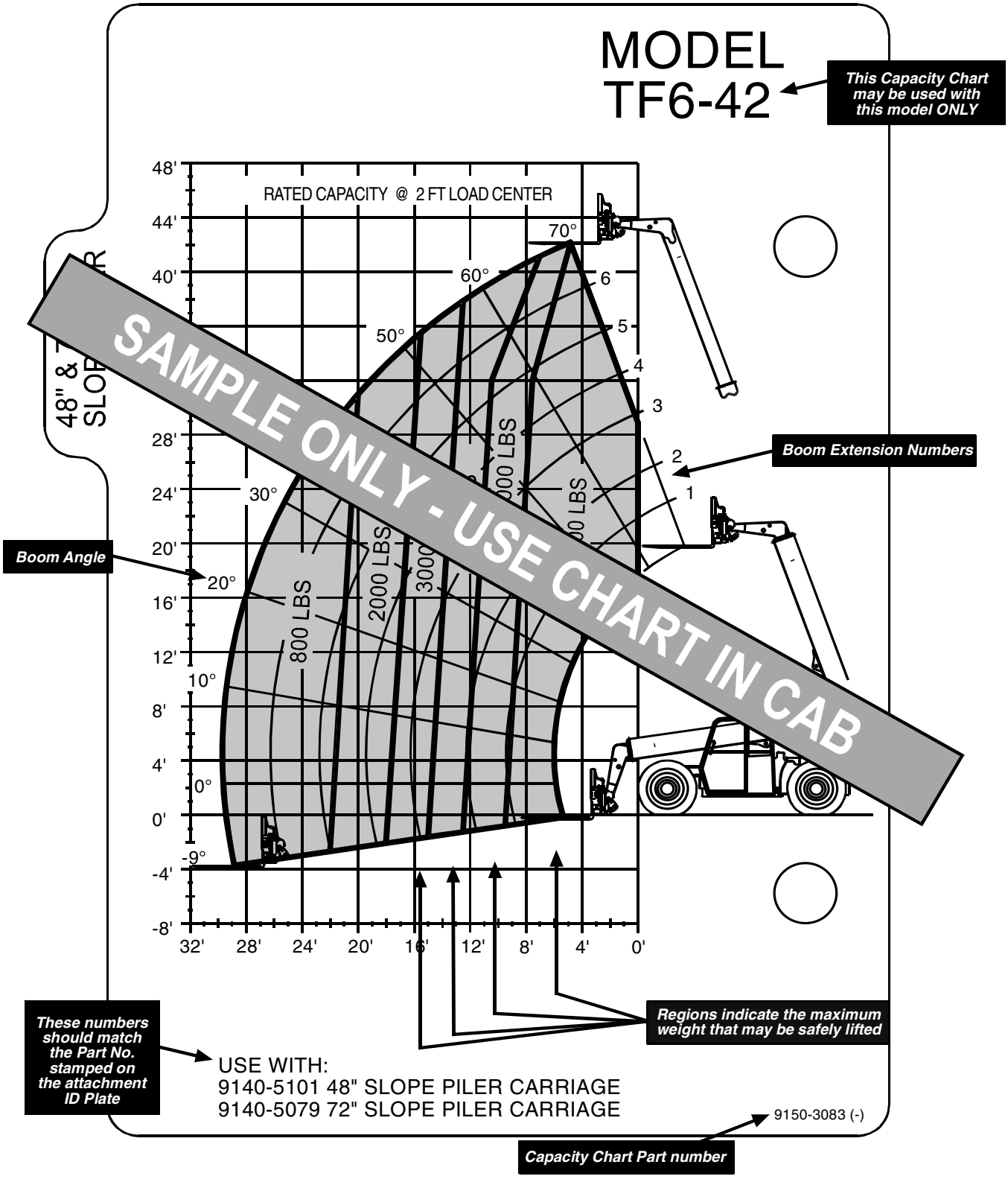


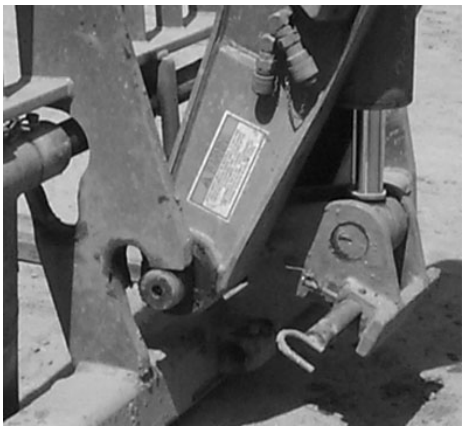
Figure 12-6: Description of items on a Capacity Chart

NOTE!
This is a sample Capacity Chart ONLY ! Do not use this chart, use the one located in your cab.



ATTACHMENT INSTALLATION PROCEDURES

INSTALLATION PROCEDURE FOR MOST ATTACHMENTS (items 1 thru 6):

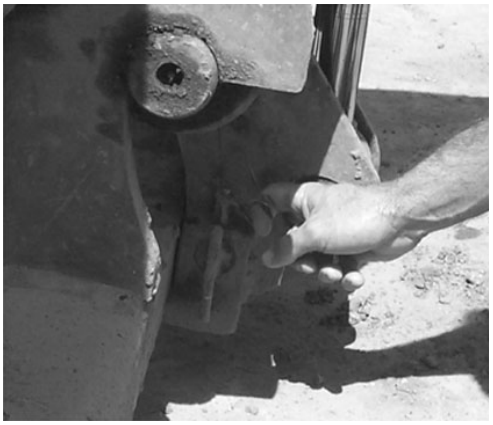


1. Retract Quick Switch™ (attachment tilt lever forward) to provide clearance. Check to be sure lock pin is secured in out position with retainer pin.

2. Align boom head pivot with recess in attachment. Raise boom slightly to engage boom head pivot in recess.

3. Engage Quick Switch™ (attachment tilt lever backward).

4. Remove retainer pin and slide lock pin in fully.



5. Secure lock pin in locked position using retainer pin.

6. Swing saddles down and pin in place.

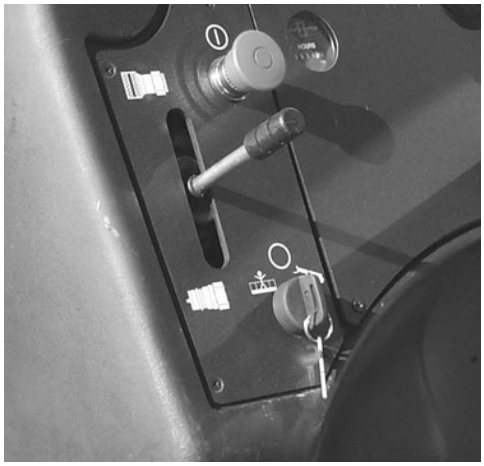
⚠ WARNING

This installation procedure is designed for one-man operation. If a helper is involved, shut off the engine before proceeding to steps 4, 5, and 6.

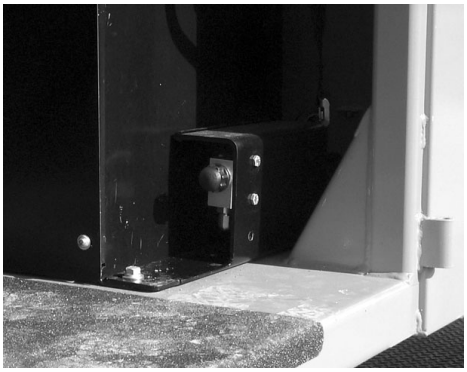
⚠ WARNING

Always be certain that carriage or other attachment is properly positioned on boom head and is secured by lock pin and retainer pin. Failure to ensure proper installation could permit attachment to disengage and cause serious injury or death.

ADDITIONAL STEPS TO INSTALL TRANSFORMER SERIES PLATFORM (items 7 thru 10):



7. Always turn off the machine before performing the next several steps.



8. Press the decompression valve located in cab, this takes the pressure out of the auxiliary hydraulic lines located on boom head.

9. Attach the electric harness lines as shown to the front of boom.

10. Attach the hydraulic lines to the side of boom as shown.

NOTE!

When hooking up the Transformer Series platform, the hydraulic hoses are run through the Quick Switch™. Pull these hoses and electrical cables back to prevent pinching when attaching and hooking up hydraulic hoses to the front of the boom.

Important Notice !

This machine has been equipped with a serial number specific Transformer Series Personnel Work Platform. Do not exchange transformer platforms between machines. Doing so will require calibration changes to the controller that must be performed by a qualified service technician. This platform assembly is designed soley for use with the Transformer Model Machines only.

ATTACHMENTS

Approved Attachments

Several JLG/GRADALL-approved attachments are available for use with your material handler. Contact your JLG/GRADALL Distributor or JLG/Gradall for information on approved attachments designed to solve special material handling problems.

The serial number plate lists attachments approved for use with your Transformer Series Material Handler. However, there may be additional approved attachments available. Contact your JLG/GRADALL Distributor for further information.

⚠ WARNING

Attachments which have not been approved for use with your handler could cause machine damage or an accident resulting in injury or death.

Non-Approved Attachments

Do not use non-approved attachments for the following reasons:

- JLG/GRADALL cannot establish range and capacity limitations for "will fit", homemade, altered, or other non-approved attachments.
- An overextended or overloaded handler can tip over with little or no warning and cause serious injury or death to the operator and/or those working near the handler.
- JLG/GRADALL cannot assure the ability of a non-approved attachment to perform its intended function safely.
- Non-approved attachments may cause structural or other damage to the handler. Such damage could cause dangerous operating conditions resulting in serious injury or death.

Carriage/Fork Capacities

The standard carriage/fork capacity chart (located on the dashboard) indicates maximum reach and load capacities for handlers equipped with an approved carriage/fork combination. **These limitations apply to standard, JLG/GRADALL-approved carriage/fork combinations, except as stated on the capacity chart.**

Non-standard carriage/fork combinations (greater or lesser capacity) may be furnished by JLG/GRADALL at customer's request or may be available for installation because they were furnished for a different application.

If a carriage/fork combination of lesser capacity is used, **the overall machine capacity is reduced** to carriage/fork capacity as indicated on carriage/fork serial number plate.

If a carriage/fork combination of greater capacity is used, the overall machine capacity may be reduced because of additional attachment weight and/or other considerations. **Contact your local JLG/GRADALL Distributor to determine capacity limitations.**

⚠ CAUTION

The capacity of forklift, attachment and fork combination may be less than the capacity shown on attachment. Consult forklift nameplate and also ensure forks are of proper size.

Forks rated less than the attachment capacity decrease capacity of attachment to that of forks. Forks rated more than attachment capacity do not increase attachment capacity.

Other Attachment Capacities

A serial number/capacity plate is attached to all JLG/GRADALL-furnished attachments. **Do not assume that any JLG/GRADALL attachment may be used on any JLG/GRADALL Material Handler.**

First, check the listing of approved attachments on handler serial number plate. If the attachment in question is not included in the list, contact your local JLG/GRADALL Distributor to check whether or not the attachment is approved.

Next, **if the attachment is approved for use** with your handler, compare maximum capacity from attachment serial number plate and value stamped on forks to maximum capacity for that **attachment** as indicated on material handler serial number plate. **The smallest of these values is correct for your handler**

⚠ WARNING

Never use an attachment without the appropriate, JLG/GRADALL supplied capacity chart for that particular attachment installed on the handler.

Attachment Operation

Operation of the handler equipped with carriage/fork combination is covered in the **GRADALL Material Handler Safety Manual and this Manual.**

Operation of the handler when equipped with other approved attachments is covered in this section or in separate instructions furnished with the attachment. Any separate instructions must be kept in Manual Holder in cab with this **Owner/ Operator Manual,** an additional copy must be kept with the attachment if it is equipped with a manual holder.

Operate a handler equipped with an attachment as a partially-loaded handler. Pay special attention to capacity and range limits for the handler/attachment combination.

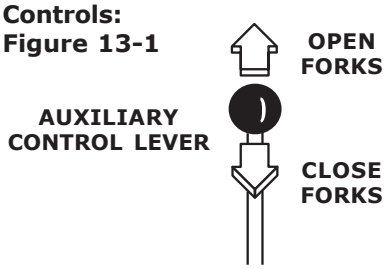
Practice operation of handler and attachment in a safe, open area, not hazardous to yourself, other persons, equipment or property. Become thoroughly familiar with response of handler and attachment to controls before operating in a work situation.

Always consider terrain between present location of load and delivery point. Never attempt to transport a load across terrain which could cause handler to tip over.

Fork Positioner

Capacity:
Maximum load capacity for fork positioner carriage is the same as standard carriage without fork positioner. **Refer to Attachment Capacity Chart.** Capacity varies with boom extension and elevation positions.

Controls:
Figure 13-1



The auxiliary control lever is used to adjust fork position. Pull lever back to close forks, push lever forward to open forks.

Installation Procedure:
1. Remove standard carriage/fork combination or other attachment from boom head. See ***"Attachment Installation" page 14.1***.
2. Install carriage/fork combination with positioner.
3. Connect auxiliary hydraulic hoses to positioner cylinders.

Operation:
- Always adjust fork position before engaging load. Moving forks after engaging load could cause load to fall from forks.

WARNING

PRECAUTIONS
- *Always adjust fork position before engaging load.*
- *As with all other attachments, handler must be level before handling a load more than 1.2m (four feet) above ground level.* ***See "Leveling The Handler," page 11.0.***

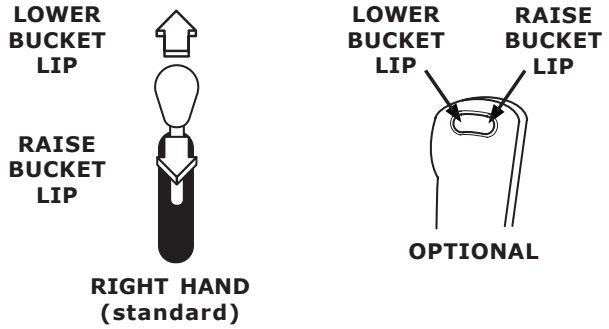
WARNING

Observe all precautions and load capacity limits (listed previously) when handling loads with carriage/fork positioner.

Light Material Bucket

Capacity:
Maximum capacity of light material bucket is shown on the attachment serial number plate and may be used in areas where it does not exceed capacities shown on standard carriage/fork capacity chart. Capacity must be reduced for areas where maximum bucket capacity would exceed standard carriage/fork capacity chart.

Attachment Tilt Controls:
Figure 13-2



Because the carriage tilt cylinder is used to tilt the bucket, the carriage tilt lever is used to control the bucket. Pull lever back to raise bucket lip push lever forward to lower bucket lip.

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.1***.
2. Install light material bucket on boom head.
3. Retract boom fully and tilt bucket up or down as required to position bottom of bucket parallel with ground.

WARNING

PRECAUTIONS
- *Handler must be level before handling a load more than 1.2m (four feet) above ground level.* ***See page 11.0***.
- *Retract boom fully before loading bucket. Loading bucket with boom extended could damage structural members or extension chains/cables.*
- *Avoid shock loads; drive into stockpile smoothly to load bucket.*
- *Do not use bucket as a lever to pry heavy material. Excessive prying forces could damage the bucket.*
- *Do not use bucket for "back dragging." This could cause severe damage to Quick Switch fittings.*

WARNING

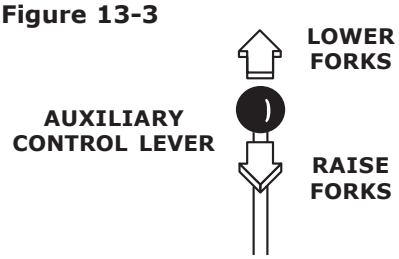
Observe all precautions and load capacity limits (listed previously) when handling loads with light material bucket.

Operation:
- Raise or lower boom to appropriate height for loading material from stockpile.
- Align handler with face of stockpile and drive slowly and smoothly into pile to load bucket. Do not corner-load bucket.
- Tilt bucket up far enough to retain load and back away from pile.
- Lower bucket to carry position 1.2m (4 feet) or less above ground and travel carefully to unloading point. Turn bucket down to dump load.

Mast (1.8m [6'] with 1.2m [4’] or 1.8m [6’] carriage)

Capacity:
Maximum lift capacity (indicated on attachment serial number plate) applies only to certain areas within boom extension/elevation pattern of handler/mast combination. A separate capacity chart must be used for handlers equipped with mast. Study and understand this chart before attempting to handle a load with mast attachment.

Attachment Tilt Controls:
Figure 13-3



The carriage tilt cylinder is used to tilt the mast and the carriage tilt lever controls mast tilt. The auxiliary control lever is used to raise and lower the forks in the mast. Pull lever back to raise forks; push lever forward to lower forks.

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.1.***
2. Install mast on boom head.
3. Connect auxiliary hydraulic hoses to mast cylinder.

Operation:
- Always level handler before raising the boom or the forks, with or without a load.
- To travel with a load, lower forks fully in mast and lower boom to position load 1.2m (4 feet) or less above ground, allowing for best visibility.
- Use mast as required to increase vertical reach of handler.
- Use a signal man to assist in positioning the load if necessary.

⚠ WARNING

PRECAUTIONS
- *Read additional capacity information under "Capacity" heading.*
- *Because the mast increases lift height, it isespecially important to level the handler before lifting a load more than 1.2m (four feet) above ground.* ***See page 11.0.***

⚠ WARNING

Do not handle a load with Mast attachment until you study and understand the "Mast Capacity Chart." If your handler does not have a "Mast Capacity Chart," ask your supervisor to get one before using the attachment.

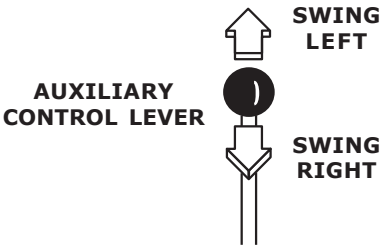
Swing Forks

Capacity:
Maximum lift capacity for swing forks is shown on the attachment capacity chart. However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/swing forks combination. A separate capacity chart must be used for handlers equipped with swing forks. Study and understand this chart before attempting to handle a load with swing forks attachment.

⚠ WARNING

Do not handle a load with Swing Forks attachment until you study and understand the "Swing Forks Capacity Chart." If your handler does not have a "Swing Forks Capacity Chart," ask your supervisor to get one before using the attachment.

Attachment Tilt Controls:
Figure 13-4



The carriage tilt cylinder is used to tilt the swing forks up and down and the carriage tilt lever controls fork tilt.

The auxiliary control lever is used to swing the forks to the left and right. Pull lever back to swing forks right; push lever forward to swing forks left.

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.1.***

2. Install swing forks attachment on boom head.

3. Connect auxiliary hydraulic hoses to swing forks attachment.

Operation:
- Always position forks straight ahead before engaging load.
- To travel with load, keep forks in straight ahead position and lower load to 1.2m (4 feet) or less above ground allowing for best visibility.
- Inspect supporting surface at delivery point and have it leveled if necessary.
- Use a signal man to assist in positioning the load if necessary.

WARNING

PRECAUTIONS
- *Read and understand additional capacity information under "Capacity" heading.*
- *Always level forks (horizontally) before swinging load to side. Swinging unlevel forks could result in load slipping from forks.*
- *Because the swing forks can swing the load to the side, it is especially important that the handler be level when handling a load more than 1.2m (four feet) above ground.* ***See page 11.0.***

Slope Piler Carriage

Capacity:
Maximum lift capacity for the slope piler carriage is shown on the attachment serial number plate. However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/slope piler carriage combination. A separate capacity chart must be used for handlers equipped with slope piler carriage. Study and understand this chart before attempting to handle a load with slope piler carriage.

Attachment Tilt Controls:
Figure 13-5

The carriage tilt lever controls carriage tilt.

The auxiliary control lever is used to tilt slope piler carriage. Push lever forward to tilt carriage counter-clockwise; pull lever back to tilt clockwise.

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.1.***

2. Install slope piler carriage on boom head.

Operation:
- Connect auxiliary hydraulic hoses to slope piler carriage attachment.
- Approach load with forks centered on load and stop handler.
- Level handler before tilting carriage to engage load.

WARNING

PRECAUTIONS
- *Level handler before tilting carriage to engage load.*
- *Always level handler before lifting a load more than 1.2m (four feet) above ground.* ***See page 11.0.***

WARNING

Do not handle a load with Slope Piler Carriage attachment until you study and understand the "Slope Piler Carriage Capacity Chart." If your handler does not have a "Slope Piler Carriage Capacity Chart," ask your supervisor to get one before using the attachment.

WARNING

A side load or a swinging load could cause the handler to tip over and/or damage the boom.

- Tilt carriage to left or right to align forks with load and engage load.
- Raise load slightly and then level carriage.
- Travel with load lowered to travel position 1.2m (4 feet) or less above ground.

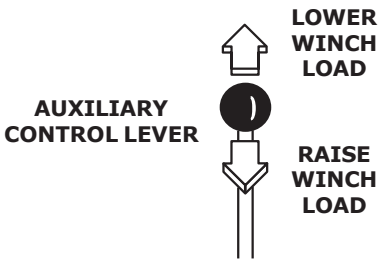
Truss Boom & Truss Boom with Winch

Capacity:
Maximum capacity for the truss boom (with or without winch) is shown on attachment serial number plate. However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/truss boom combination. A separate capacity chart must be used for handlers equipped with truss boom. Study and understand this chart before attempting to handle a load with truss boom.

Observe the following Special Precautions:

- Never drag the load; lift vertically.
- Use tag line to guide and steady a suspended load. Tag lines must be long enough to keep helpers clear of load and handler.
- Beware of wind. Wind can cause a suspended load to swing and cause dangerous side loads - even with tag lines.
- Start, travel, turn, and stop slowly to prevent load from swinging.
- Weight of all rigging (slings, etc.) must be included as part of load.
- Do not attempt to use handler frame-leveling to compensate for load swing.

Attachment Tilt Controls:
Figure 13-7



The carriage tilt cylinder is used to tilt the truss boom up and down from the handler boom head. The carriage tilt lever controls truss boom tilt.

The auxiliary control lever is used when the truss boom is furnished with a winch. Pull the lever back to raise winch load; push the lever forward to lower winch load.

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.1.***
2. Install truss boom on boom head.

Operation:
- If truss boom winch is furnished, connect auxiliary hydraulic hoses to winch.
- Approach truss or truss bundle with boom above and parallel to load.
- Position truss boom approximately parallel with main boom.

⚠ WARNING

PRECAUTIONS
- *Because the truss boom extends the reach of the handler, maximum load capacity is reduced.*
- *Because of extended reach, it is especially important to level the handler before lifting a load.* ***See page 11.0.***
- *Travel with load and boom lowered to travel position 1.2m (4 feet) or less above ground.*
- *Always lower load to rest before leaving handler.*

⚠ WARNING

Do not handle a load with Truss Boom & Truss Boom with Winch attachment until you study and understand the "Truss Boom & Truss Boom with Winch Capacity Chart." If your handler does not have a "Truss Boom & Truss Boom with Winch Capacity Chart," ask your supervisor to get one before using the attachment.

⚠ WARNING

A side load or a swinging load could cause the handler to tip over and/or damage the boom.

Truss Boom & Truss Boom with Winch (cont.)

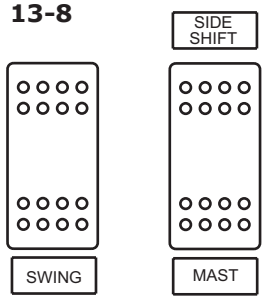
Operation continued:

- Position truss boom/winch hook as close as possible to balance point of load and secure load to boom using short slings or other rigging. Be sure rigging will not allow load to slip in any direction.
- Open clamps at heel of truss boom far enough to clear load and tilt truss boom up until truss/bundle contacts heel of truss boom.
- Close clamps to hold load lightly and secure clamps.
- Transport load to delivery site and attach tag lines if load will be freely suspended.

Swing Mast

Capacity:
Maximum lift capacity is shown on attachment serial number plate. However, maximum lift capacity applies only to certain areas within boom extension/elevation pattern of handler/swing mast combination. A separate capacity chart must be used for handlers equipped with mast. Study and understand this chart before attempting to handle a load with swing mast attachment.

Controls:
Figure 13-8



The carriage tilt cylinder is used to tilt the mast and the carriage. Tilt lever controls mast tilt.

- Press right switch up to "SIDE SHIFT" to activate side shift function. Move auxiliary hydraulic lever in appropriate direction.
- Press left switch down to "SWING" to activate swing function. Move auxiliary lever in appropriate direction.
- Press right switch down to "MAST" to activate mast function. Move auxiliary lever in appropriate direction.

Installation Procedure:

1. Remove carriage/fork combination or other attachment from boom head. **See page 14.1.**
2. Install swing mast on boom head and connect auxiliary hydraulic hoses to swing mast diversion valve hoses. Also connect electrical cable at boom head.

⚠ WARNING

PRECAUTIONS

- *Always level forks (horizontally) before swinging load to side. Swinging unlevel forks could result in load slipping from forks.*
- *The swing mast attachment has a smaller load capacity than the standard carriage/fork attach. Study and understand the swing mast capacity chart before handling a load with swing mast.*
- *Read additional capacity information under "Capacity" heading on chart.*
- *Because the swing mast increases lift height and can swing load to side; it is especially important to level handler before lifting a load more than 1.2m (four feet) above ground level.* ***See page 11.0.***

⚠ WARNING

Do not handle a load with Swing Mast attachment until you study and understand the "Swing Mast Capacity Chart." If your handler does not have a "Swing Mast Capacity Chart," ask your supervisor to get one before using the attachment.

Operation:
- Always lower carriage fully in mast and position forks straight ahead before engaging load.
- To travel with a load, keep forks straight ahead and lower load to travel position 1.2m (4 feet) or less above ground.
- Inspect supporting surface at delivery point and have it leveled if necessary.
- Level handler before raising load.
- If necessary, perform a "dry-run" (unloaded) of delivery to determine best position for handler.
- Use a signal person to assist in positioning the load if necessary.

WARNING

Observe all precautions and load capacity limits when handling loads.

Personnel Work Platform (without controls on Platform)

The material handler operator and personnel in the platform must read and understand the separate personnel work platform manual included with the attachment prior to using the platform.

WARNING

Do not use the Personnel Work Platform until you study & understand the " Capacity Chart". If your handler does not have the correct "Personnel Work Platform Capacity Chart", ask your supervisor to get one before using the attachment.

Capacity:
The Gradall personnel work platform is designed to carry a maximum of 3 occupants. The load includes personnel, materials, tools, etc. The maximum capacity of your work platform is based on specific model material handler/ work platform combination. To determine maximum load capacity for given operating ranges, consult the proper load capacity chart (furnished with platform) for the material handler and work platform in use. **If your handler is not equipped with the proper personnel work platform capacity chart, get one before using the attachment.**

Installation Procedure:
1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.0 & 14.1.***

Operation:
- Gradall Personnel Work Platforms are approved for use **only** on Gradall Material Handlers equipped with the proper platform capacity chart.
- When lifting personnel, **use only a Gradall manufactured personnel work platform**. No other platform is approved for use on Gradall Material Handlers.

"Transformer Series" Personnel Work Platform

(with controls on Platform)

For proper operation of the "Transformer Series" Platform, refer to the appropriate Owner/Operator manual P/N 9150-4004 located at the back of this manual and included with the attachment prior to using the platform.

Capacity:
Refer to capacity decal on platform and capacity indicator located on control console. The load includes personnel, materials, tools, etc. The maximum capacity of your work platform is based on specific model material handler/ work platform combination. To determine maximum load capacity for given operating ranges, consult the proper load capacity chart (furnished with platform) for the material handler and work platform in use. **If your handler is not equipped with the proper personnel work platform capacity chart, get one before using the attachment.**

Installation Procedure:

1. Remove carriage/fork combination or other attachment from boom head. ***See page 14.0 & 14.1.***

Changing controls for operation from platform:

In Cab:

- Control Station Selector switch should be set to platform operation.
- Emergency Stop button must be pulled up.
- Steer Select Switch should be set to front wheel steer.
- Transmission control lever should be set to neutral with 1st gear selected.

Proceed to work platform

- When starting engine, the footswitch must be in the released (up) position.
- Push "UP" on Engine Start/Auxiliary Power switch to start engine. If engine fails to start within 20 seconds, release Engine Start/Auxiliary Power switch and allow starting motor to cool for a few minutes before trying again.

In Platform Mode:

- Maximum travel speed is 3.5 MPH with boom retracted and lowered (travel position).
- When boom is extended approximately 3.5 feet and/or raised above 7°, the machine will slow to creep mode (.5 MPH).
- When in creep mode and returning boom to travel position, the travel control must be returned to neutral and reactivated to increase speed above .5 MPH.

⚠ WARNING

Do not use the Personnel Work Platform until you study & understand the " Capacity Chart". If your handler does not have the correct "Personnel Work Platform Capacity Chart", ask your supervisor to get one before using the attachment.

⚠ WARNING

Do not switch control for platform to cab with personnel in platform except in emergency.

⚠ WARNING

The TF6-42 Handler is designed as a single station operation machine. *Do not allow anyone in cab while machine is being operated in platform mode, and restrict personnel from the work platform while traveling or operating from cab.*

OBTAINING HYDRAULIC OIL SAMPLE

1. Operate unit until hydraulic oil reaches normal operating temperature.

2. Apply parking brake, lower boom to rest and shift Forward/Reverse lever to "Neutral" Observe Hydraulic Filter Bypass Indicator with engine running at full throttle. Replace filter elements if necessary.

3. Obtain a container to receive waste oil and a **CLEAN** container to receive oil sample.

4. With gauge removed from hose, attach mini-check and hose to test port located on frame (see diagram below). Hose end must be positioned in waste oil container.

5. Allow at least one pint of oil to flow into waste oil container to eliminate any contamination from hose.

6. Move hose to **CLEAN** container to collect sample for analysis.

7. Return hose to waste oil container and disconnect adapter from mini-check test port.

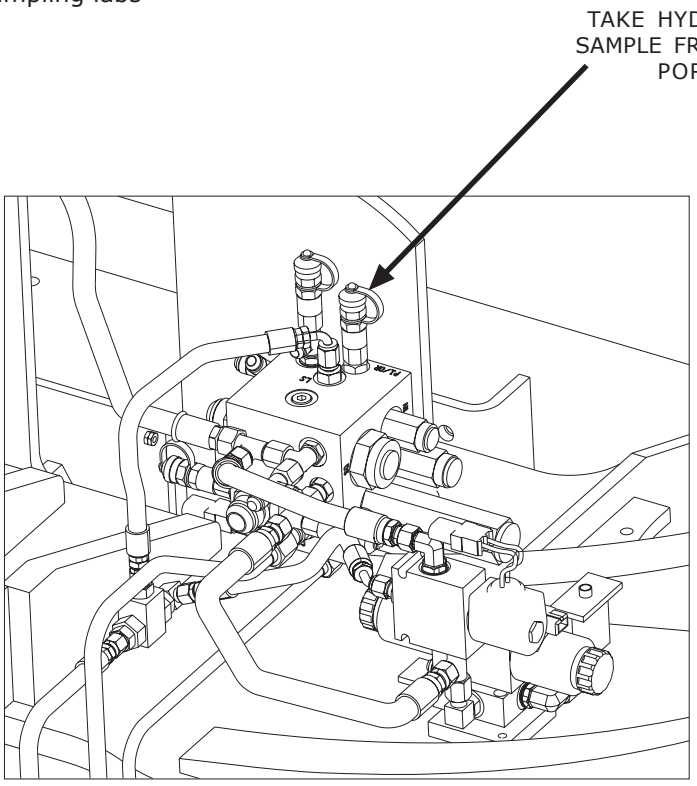
8. Cover sample container immediately with **CLEAN** cap.

9. Stop engine and check oil level in reservoir and replenish as required. For ease of filling reservoir, use a funnel with a hose or flexible tube for best results.

10. Contact your GRADALL Distributor for information concerning oil analysis.

Oil sample containers are available from several sources:

- Oil companies
- Oil suppliers
- Sampling labs



NOTE!

OIL CLEANLINESS IS CRITICAL The filtration system is designed to maintain a minimum ISO cleanliness level of 18/15.

LOADING & SECURING FOR TRANSPORT

Loading & Securing Handler For Transport

1. Level the material handler prior to loading.
2. Using a spotter, load the handler with boom as low as possible to keep a low center of gravity.
3. Once loaded, apply parking brake and lower boom until boom or attachment is resting on deck. Move all controls to "Neutral", stop engine and remove the control station selector key.
4. Secure machine to deck by passing chains through four tie-down lugs on front and rear of machine. **(See figures 15-1 & 15-2)**
5. Secure work platform by passing restraining strap through center as shown in figure 15-3.
6. Do not tie down front of boom.

⚠ WARNING

Before loading handler for transport, make sure deck, ramps and handler wheels are free of mud, snow and ice. Failure to do so could cause handler to slide, resulting in an accident causing serious injury or death.

Figure 15-1 (front view)

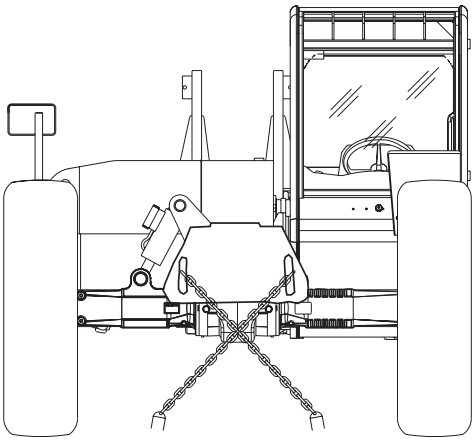


Figure 15 -2 (rear view)

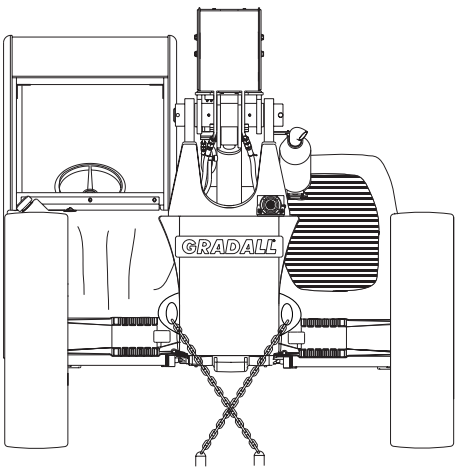
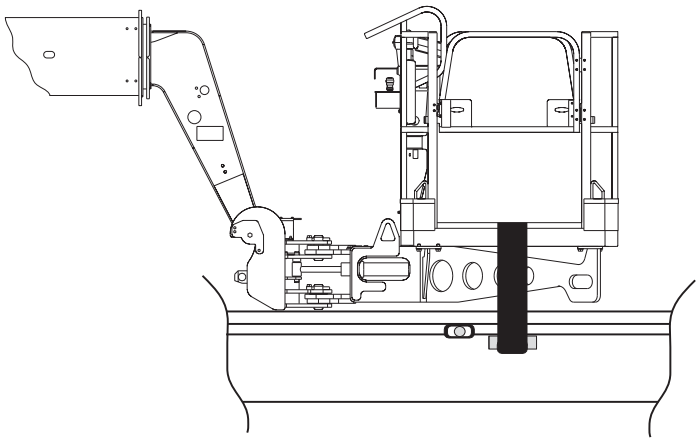


Figure 15 -3 (work platform view)



The following information assumes the handler cannot be moved under its own power.

Before moving the handler, read all of the following information to understand options available. Then select the appropriate method.

The steering system permits manual steering if engine or power assist feature fails.

Remember:
- Although manual steering is possible without power assist, **steering will be slow and will require much greater force.**

- Response to manual steering will be increased if parking brake is released and front axle drive is bypassed, permitting front wheels to roll.

MOVING SHORT DISTANCES

If it is only necessary to move handler a short distance less than 30m (100 feet), it is permissible to use a vehicle of sufficient capacity to tow the unit with no previous preparation. Drive wheels will not roll. If the unit must be moved more than 30m (100 feet), but less than 182m (200 yards), it is permissible to use a vehicle of sufficient capacity to tow unit after you:

- Release parking brake. ***See page 18.1.***

MOVING LONGER DISTANCES

If the handler must be moved more than 182m (200 yards), it must be loaded on to a trailer of sufficient capacity.

MOVING HANDLER IN EMERGENCY

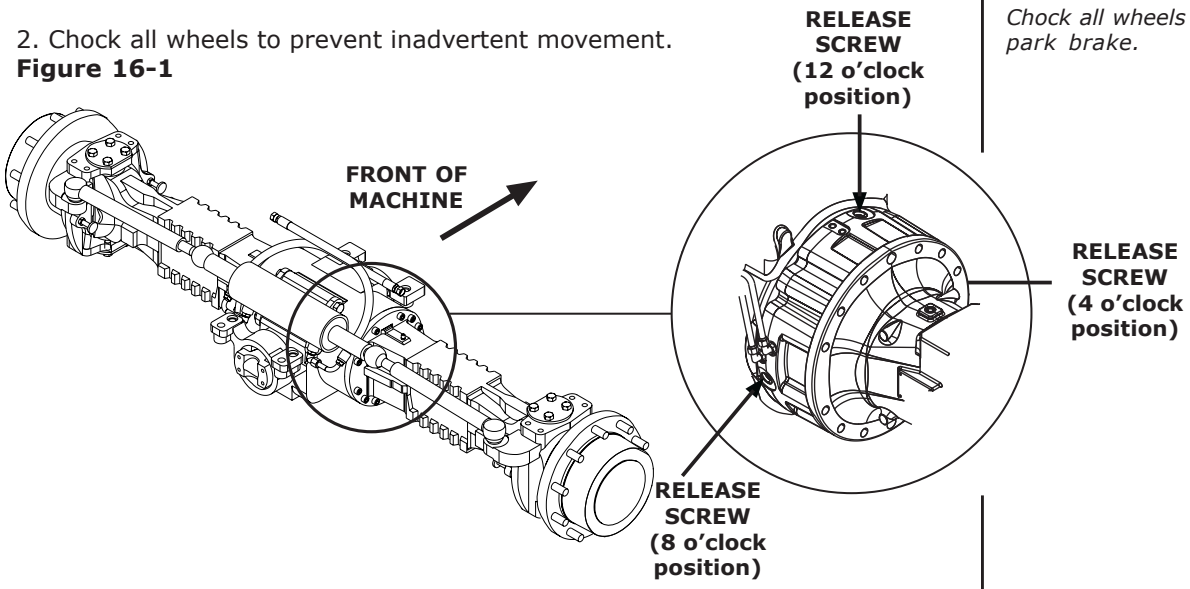
CARRARO AXLE:

TO RELEASE PARKING BRAKE

1. If possible position unit on level ground, lower attachment to approximately .3m (one foot) from ground, move forward/reverse lever to "Neutral", apply parking brake and stop engine.

2. Chock all wheels to prevent inadvertent movement.

Figure 16-1



3. Working one side at a time, remove three plugs from differential housing (located at 12 o'clock, 4 o'clock and 8 o'clock). Put plugs aside.

5. Tighten each release screw revealed by the plugs, lightly until it just makes contact with guide pin.

6. Working carefully, tighten each release screw only 1/4 turn (90°) at a time, in sequence, until all three screws have been turned one full turn 360° approximately 67 n.m (50 ft.-lb.). Larger turns could cause components to bind and cause brake failure.

7. Repeat this procedure on other side of differential. Parking brake should be released.

TO RESTORE PARKING BRAKE

Make certain engine is stopped and all wheels are chocked.

Loosen each release screw, only 1/4 turn at a time, in sequence, until each screw has lost contact with guide pin. Then back out each screw until it bottoms out against the stop. Install plugs over each release screw.

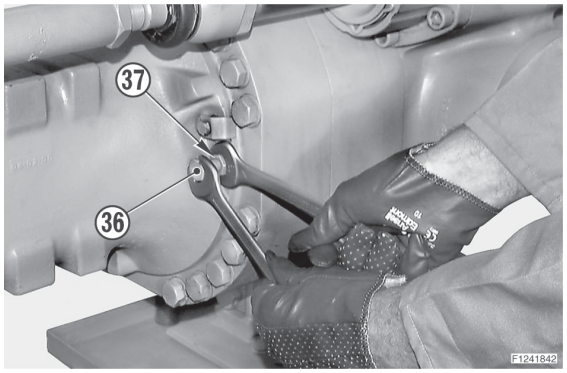
Repeat procedure on other side of differential. Parking brake should be restored to operation.

⚠ WARNING

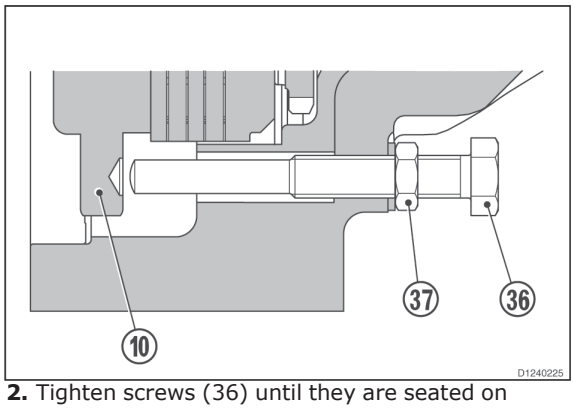
If you release the park brake without first chocking the wheels, the material handler could roll. Chock all wheels before releasing park brake.

DANA AXLE:

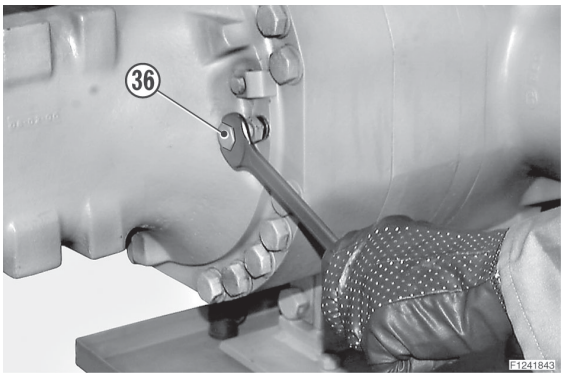
AXLE MANUAL RELEASE (steps 1-3)
Chock wheels before performing this procedure.



1. Loosen the nuts (37) of the screws (36) for the manual release of the braking units. Draw the nuts back about 6mm.



2. Tighten screws (36) until they are seated on the driving plate (10).

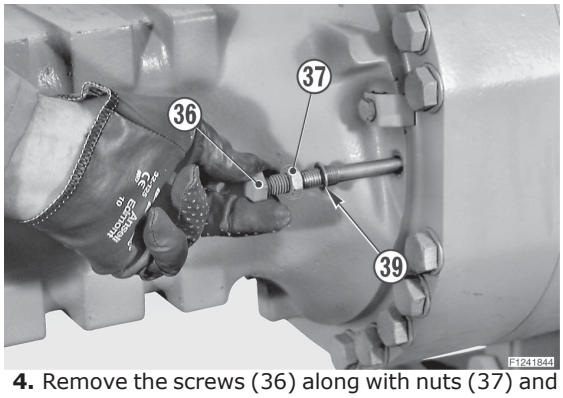


3. Using a wrench, tighten two screws (36) in an alternate manner by 1/4 turn at a time in order to compress the Belleville washer (24) and release the braking discs. The stroke required for brake release corresponds to 1 turn.
Attention! Do not exceed this value.

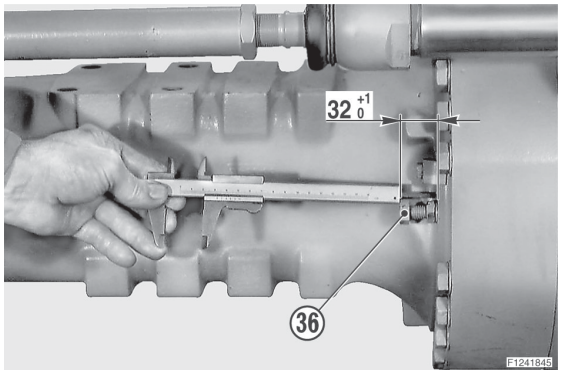
WARNING

The front axle service brakes will not operate when the park brakes are manually disengaged. The rear brakes may only provide half of the machine's normal braking capability. Always reset the brake release screws before allowing machine back in to regular service.

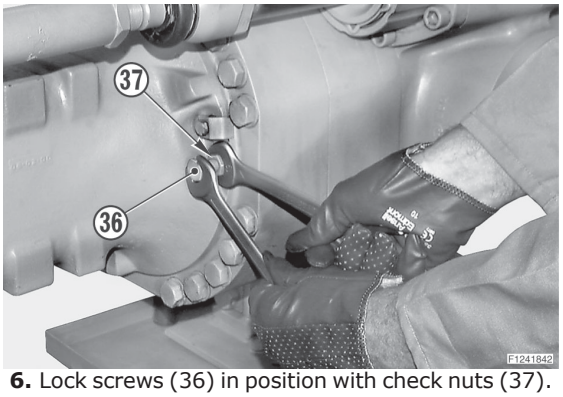
ADJUSTMENTS AFTER MANUAL RELEASE (steps 4-6)



4. Remove the screws (36) along with nuts (37) and seals. Replace seals (39), lubricate screws (36) with silicone-based TECNO LUBE 101 grease and re-install the screws along with the nuts.

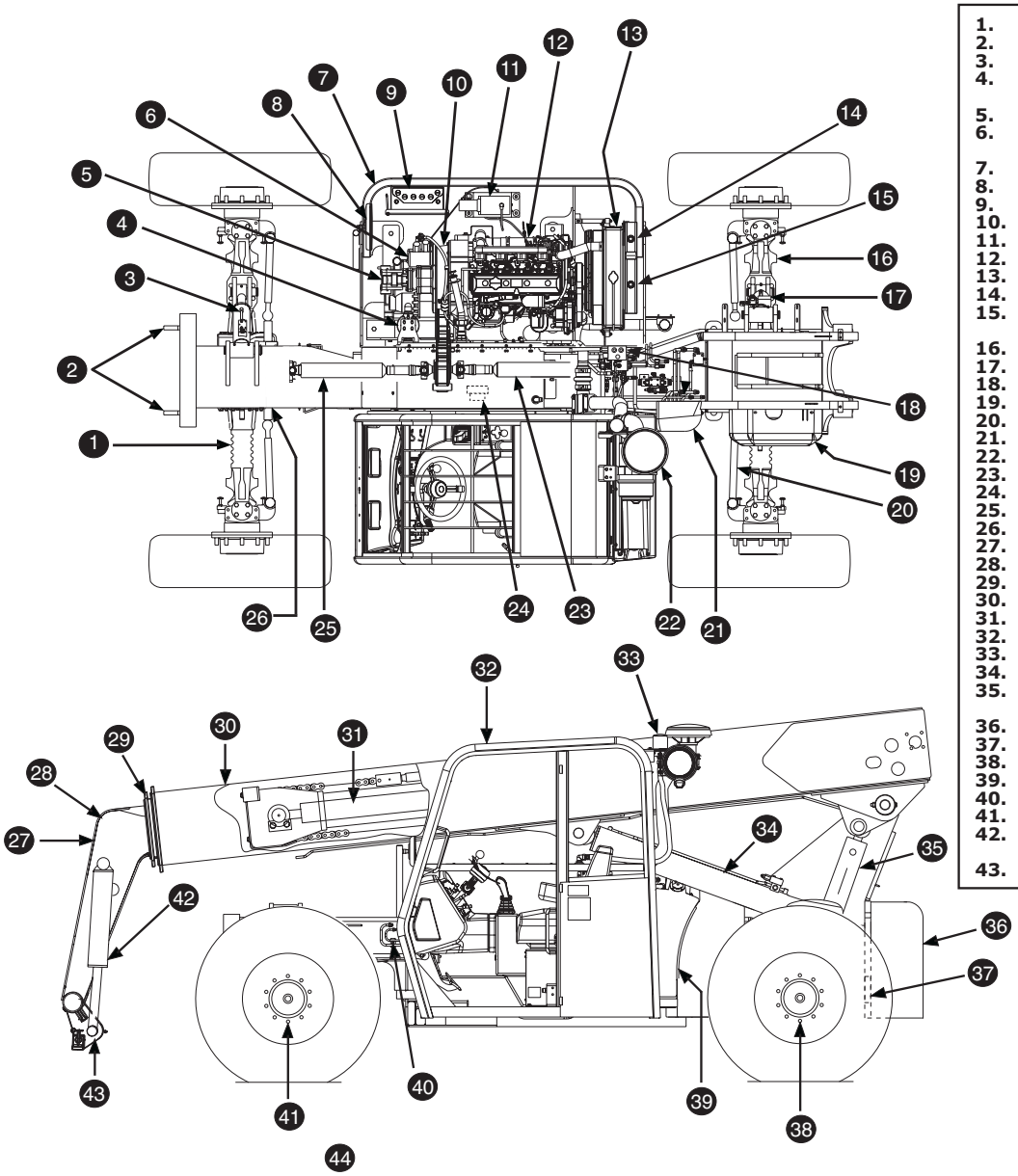


5. Adjust jut of screw heads (36) in relation to the arm by 32^{+1}_{0} mm.



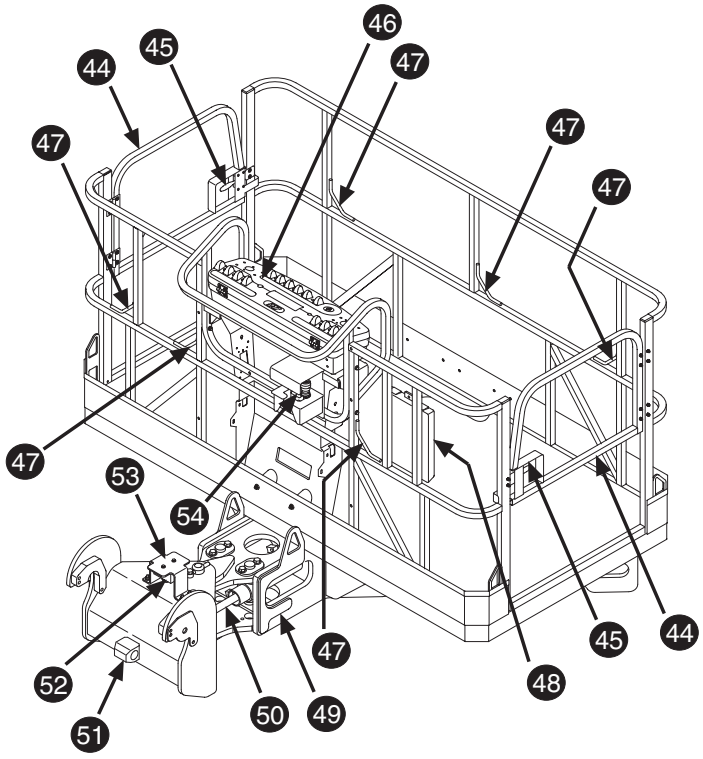
6. Lock screws (36) in position with check nuts (37).
Attention! Check screw jut over with maximum care.

NOMENCLATURE



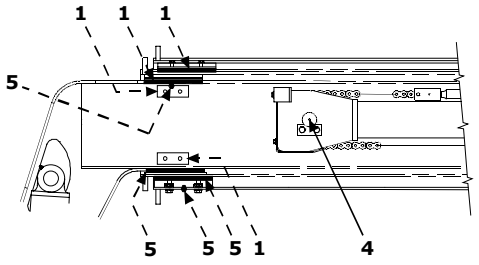
1.	FRONT AXLE
2.	TIE-DOWN LUGS
3.	SWAY CYLINDER
4.	HYDRAULIC TANK & FILTER
5.	IMPLEMENT PUMP
6.	TRANSMISSION OIL FILTER
7.	ENGINE COMPARTMENT
8.	MIRROR
9.	BATTERY
10.	TRANSMISSION
11.	AUXILIARY HYD PUMP
12.	ENGINE
13.	RADIATOR
14.	HYDRAULIC OIL COOLER
15.	TRANSMISSION OIL COOLER
16.	REAR AXLE
17.	STABILIZER CYLINDER
18.	PRIORITY VALVE
19.	PILOT CONTROL VALVE
20.	STEERING CYLINDER
21.	MAIN CONTROL VALVE
22.	AIR CLEANER
23.	REAR DRIVE SHAFT
24.	STEER SELECT VALVE
25.	FRONT DRIVE SHAFT
26.	STEERING CYLINDER
27.	BOOM HEAD
28.	THIRD BOOM SECTION
29.	SECOND BOOM SECTION
30.	FIRST BOOM SECTION
31.	CROWD CYLINDER
32.	OPERATOR'S CAB
33.	HYD TANK BREATHER
34.	LIFT CYLINDER
35.	COMPENSATION CYLINDER
36.	COUNTERWEIGHT
37.	TIE-DOWN LUGS
38.	REAR LUG NUTS
39.	FUEL TANK
40.	REMOTE BRAKE VALVE
41.	FRONT LUG NUTS
42.	ATTACHMENT TILT CYLINDER
43.	QUICKSWITCH™

NOMENCLATURE



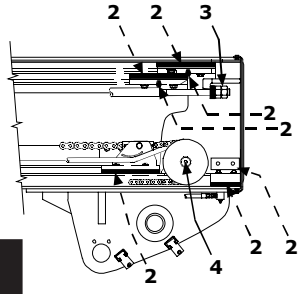
44.	ENTRY/EXIT GATE
45.	LATCH
46.	ELECTRONIC CONTROL PANEL
47.	LANYARD ANCHORAGE POINT
48.	MANUAL STORAGE BOX
49.	PLATFORM SUPPORT WELDMENT
50.	ROTATING CYLINDER
51.	QUICKSWITCH WELDMENT
52.	DOUBLE PILOT CHECK VALVE
53.	VALVE MOUNTING PLATE
54.	ELECTRICAL CONNECTOR STORAGE

LUBRICATION & ROUTINE MAINTENANCE



Lubrication Symbols

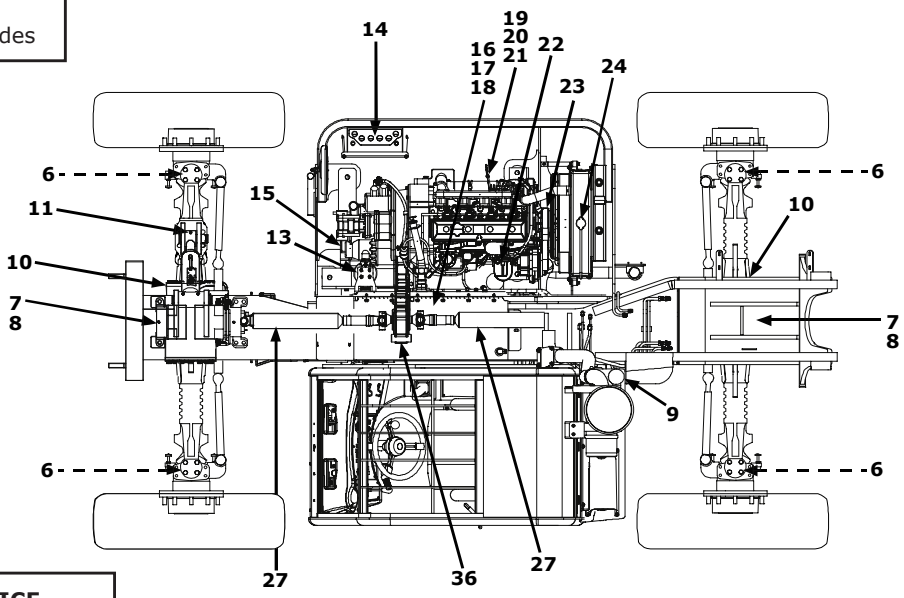
DF - DIESEL FUEL
EO - ENGINE FUEL
HF - HYDRAULIC FLUID
HM - MOLY LUBE (extreme pressure)



SYMBOLS

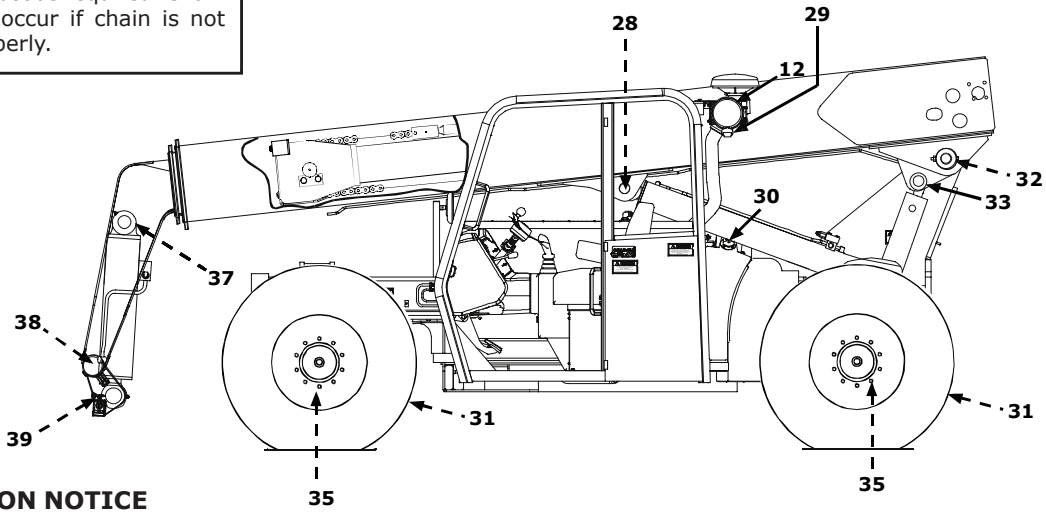
● = Lube Fitting
→ = Other Service
– – = Service Both Sides

FAILURE TO USE GRADALL HYDRAULIC FILTER ELEMENTS COULD VOID WARRANTY



IMPORTANT NOTICE

Be certain to check extend chain adjustment every 5 weeks or 250 hours and adjust as required. Chain damage can occur if chain is not adjusted properly.



LUBRICATION NOTICE

- After greasing machine, cycle all functions several times to distribute lubricants. Perform this maintenance procedure without attachment or forks installed.
- Apply a light coating of engine oil to all linkage pivot points.
- Clean lubrication fittings before lubricating.
- Intervals shown are for normal (8-hour day) usage and conditions. Adjust intervals for abnormal usage and conditions.
- Drain engine and gear cases after operating when oil is hot.
- Check lubricant levels when lubricant is cool. For ease of filling hydraulic reservoir, use a funnel with a hose or flexible tube for best results.
- Clean filter and air cleaner housing and reusable elements using solvent or diesel fuel. Dry components thoroughly using lint free cloth.

PERFORM PRE-START & FUNCTION CHECK ON PAGE P6.1 AND THE "WALK-AROUND INSPECTION" AS DESCRIBED ON PAGES P6.2 & P6.3 IN THE TRANSFORMER SERIES WORK PLATFORM MANUAL SECTION LOCATED IN THE BACK OF THIS MANUAL. THIS INSPECTION IS A DAILY REQUIREMENT BEFORE OPERATING THIS MACHINE.

⚠ CAUTION

Service intervals are based on machine usage of 1500 hours annually. Use of your unit may vary significantly and you must adjust service frequency for your usage to obtain maximum service life. Frequency headings in the following schedule indicate a calender limit and an operating hour limit. Perform service at whichever interval occurs first.

Daily or Shift (10 hour Maximum) Lubrication & Maintenance

	Lube Symbol	No. of Points
12. Air Cleaner Element Condition Indicator (check for clogged condition (red band showing) and clean or replace element as required)	-	1
13. Hydraulic Return Filter Condition Indicator (check indicator with oil at normal operating temperature and engine running at full throttle - replace filter element before by-pass indication is reached or at least annually)	-	1
15. Transmission Fluid Level	HF	1
18. Hydraulic Level Sight Gauges (level handler, retract all other cylinders and check sight gauges - refill as required)	HF	1
19. Engine Crankcase Dipstick (level handler and check fluid level - refill as required	EO	1
30. Fuel Filler Cap (fill at end of work shift to minimize condensation)	DF	1

Weekly (or 50 Hour) Lubrication & Maintenance (include all previous periodic services)

4. Extend/Retract Chain Sheaves	HM	3
5. Boom Bottom, Front Slide Bearings (extend boom fully and lube all wear paths - retract and extend boom fully three times and wipe excess lube from bearings)	HM	4
11. Sway Cylinder Pivots	HM	2
14. Battery (check terminals)	-	1
22. Fuel Filter/Water Separator (with Drain) (replace element)	-	1
24. Radiator Fill Cap (check level and refill as required - refer to John Deere Manual for coolant conditioner ratio)	-	1
28. Boom Lift Cylinder Pivots	H M	2
31. Tires (check for damage and proper inflation) 13.00 x 24, 12 ply - 445 kpa (65 psi) 13R24, 12 Ply - 482 kpa (70 psi) 15.5-25, 12 Ply - 400 kpa (58 psi)	-	4
32. Boom Pivots	H M	2
33. Compensating Cylinder Pivots	H M	2
37. Carriage Tilt Cylinder Pivots	H M	2
38. Boom Head/Carriage Pivot	H M	2
39. Quick Switch Latch	H M	1

At End of First 50 Hours Only

10. Differential Drain Plug (drain and refill)	HF	2
20. Special engine break-in oil (drain & refill) (replace filter)	EO	1
35. Planetary Drain Plugs (drain while draining differential)	HF	4
15. Transmission Oil & Filter (drain & refill) (replace filter)	HF	1

At End of First 30 Days Only (250 Hours Maximum) Lubrication & Maintenance

- Check torque of all items listed in **Torque Chart** (pg 20.0)

5 Week (or 250 Hour) Lubrication & Maintenance (include all previous periodic services)

	Lube Symbol	No. of Points
1. Boom Front Top and Side Slide Bearings (extend boom fully and lube all wear paths - retract and extend boom fully three times and wipe excess lube from bearings)	HM	12
2. Boom Rear Slide Bearings (lube paths)	HM	12
3. Boom Extend Chain (check adjustment and adjust as required)	-	2
5. Boom Front Bottom Slide Bearings (to be performed by experienced maintenance person - check for damage and excessive wear - no wear permitted past bevel - maximum clearance at top bearings is 3mm (1/8 inch), shim or replace as required; when these bearings require service, check all other slide bearings - shims are 1.5mm (1/16 inch) thick	-	4
6. Axle Kingpins	H M	8
7. Axle Level Plug (check level and refill as required)	HF	2
8. Axle Trunnions	HM	4
20. Engine Crankcase Filler Cap (drain oil and refill top level)	EO	1
21. Engine Oil Filter (replace filter element)	-	1
23. Drive belts (check condition - replace as required)	-	1
27. Drive Shaft Slip Joints	HM	4
29. Vacuator Valve (rubber cone on bottom - check to be sure cone is clear and undamaged)	-	1
35. Planetary Level Plug	HF	4
36. Transfer Case (check and top off)	H F	1

- Check torque of all items listed in Torque Chart (pg 20.0)

Quarterly (or 500 Hour) Lubrication & Maintenance (include all previous periodic services)

16. Hydraulic System (we recommend that hydraulic fluid be analyzed to determine condition - drain and refill reservoir if required	HF	1
17. Hydraulic Reservoir Screen (remove, clean, and install when hydraulic oil is drained)	-	1
22. Fuel Filter/Water Separator (with Drain) (replace element)	-	1

Semi-Annual (or 1000 Hour) Lubrication & Maintenance (include all previous periodic services)

9. Hyd. Tank Filter/Breather (replace)	-	1
10. Axle Drain Plug (drain and refill)	HF	2
15. Transmission Drain Plug (drain, fill to level, replace filter)	HF	1
32. Rear Hub Drain Plug (drain and refill)	HF	2
35. Planetary Drain Plugs (drain while draining differential)	H F	4
36. Transfer Case (drain & refill)		

Annual (or 1500 Hour) Lubrication & Maintenance (include all previous periodic services)

13. Hydraulic Return Filter (replace filter element)	-	1
16. Hydraulic System (unless fluid is analyzed quarterly to determine degree of contamination, reservoir must be drained and refilled on an annual basis)	HF	1
17. Hydraulic Reservoir Screen (remove, clean, and install when hydraulic oil is drained)	-	1
24. Engine Cooling System (drain, flush and refill on basis of period suggested by anti-freeze manufacturer and add Liquid Coolant Additive refer to John Deere manual for coolant conditioner ratio)	-	1

DETAILED SERVICE INSTRUCTIONS ARE CONTAINED IN THE GRADALL SERVICE MANUAL FOR YOUR PARTICULAR MATERIAL HANDLER

RECOMMENDED LUBRICANTS & CAPACITIES

⚠ CAUTION *When replacing foam filled tires, replace the complete tire and rim assembly.*

APPLICATION	SYMBOL	WHEN USED	GRADE	SPECIFICATION	CAPACITY*	
Boom Chain	CL (chain lube)	All Year	-	P/N 1440-4751	-	-
Boom Bearing Paths	HM (extreme pres. lube)	All Year	NLGI #2	P/N 1440-4595	-	-
Coolant Additive (refer to engine man.)	(SCA supplemental coolant additive)	All Year	-	-	0.5 qts	0.48 L
Transfer Case	HF (hydraulic fluid)	All Year	**	**	0.8 qts	0.8 L
Transmission	HF (hydraulic fluid)	All Year	**	**	16.7 qts	15.8 L
Engine Cooling System	AF (anti-freeze)	All Year	50/50	Permanent	15.5 qts	14.7 L
Engine Crankcase	EO (engine oil)	All Year	15W-40-CD	MIL-L-2104D	14.5 qts	13.8 L
Front/Rear Axle Center Section (Carraro) Center Section (Dana) Ea. Wheel End (Carraro) Ea. Wheel End (Dana)	HF (hydraulic fluid) HF (hydraulic fluid) 	All Year All Year 	** ** 	** ** 	 24.4 pints 13.0 pints 3.2 pints 3.4 pints	 11.5 L 6.1 L 1.5 L 1.6 L
Fuel Tank	DF (diesel fuel)	All Year	#2	-	38 gal	143.8 L
Grease Fittings	HM (extreme pres. lube)	All Year	NLGI #2	P/N 1440-4595	-	-
Hydraulic System	HF (hydraulic fluid)	All Year	***	***	43 gal	163 L

* Capacities are approximate - check level to be sure.

** Fill to level using **Mobilfluid® 424** (GRADALL P/N 1440-4535)

*** Fill to level using **Mobilfluid® 424** -OR- *Citgo Tractor Hydraulic Fluid* (product code 33310)

TORQUE CHART

To check GRADALL torque values, set the torque wrench at 95% of rated torque value and check fastener. If the torque wrench releases before the fastener moves, assume fastener torque is correct. When setting GRADALL torque values, use the values given on the following chart. Do not exceed allowances.

ITEM	FREQUENCY*	THREAD SIZE (GRADE)	TORQUE (lubricated)			
			FT.-LB.		Nm	
			MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Boom Slide Bearings (front)	5 Weeks (250 hrs) 5 Weeks (250 hrs)	3/8-24 (5) 1/2-20 (5)	32 68	37 78	43 92	50 106
Boom Slide Bearings (rear)	If front bearings have worked loose	3/8-24 (5) 1/2-20	32 76	37 86	43 103	50 117
Boom Chain Jam Nuts	Annually (1500 hrs)	7/8-14	100	125	136	169
Cab Mounting Bolts (upper) (lower)	Annually (1500 hrs) Annually (1500 hrs)	7/8-9 3/4-10	530 340	565 365	719 461	766 495
Engine Assembly Flywheel Housing Bolts	Annually (1500 hrs)	M10	40	45	54	61
Engine Mounts	Annually (1500 hrs)	M12 M16	66 166	76 181	89 225	103 245
Front Axle Mounting Bolts	Annually (1500 hrs)	3/4-10	340	365	461	495
Wheel Lug Nuts	3 Months (500 hrs)	-	350 (hand)	400 (hand)	475	543

* Check torque at whichever interval occurs first.

Checking & Adjusting Boom

Boom Bearing Pads

Boom bearing pads are to be adjusted for all boom sections. This should be done at boom assembly, however, some adjustments may be required after assembly.

- Add shims as required so that front and sides of boom have no more than 1.5mm (.06 inch) clearance.
- Add shims as required so that rear of boom has no more than 1.5mm (.06 inch) total clearance.
- Number of shims at each pad may vary, however shims at bottom front pads must not vary more than one shim between sides.
- Pads must not directly contact shims, thus a spacer must be inserted between pad and shims.
- Use Loctite 242 (Gradall P/N 1440-3364) on screws when adding or removing shims.

Boom Chain

Check boom chain adjustment. With boom horizontal, extend boom 1.2m to 1.5m (4 to 5 feet), then fully retract boom. Measure gap between all bevel washers on extend chain rod, and add them together. If total of all gaps exceeds 3.04mm (.12 inch), boom chain will need to be adjusted. Adjust as follows:

A. Loosen lock nut on extend chain rod.
B. Tighten adjusting nut on extend chain rod until all washers are just flat (no gap between any washers).
C. Torque lock nut to 100 lb.-ft. (apply Loctite 242 on lock nut)

After adjusting, check that boom sections and / or access holes in side of boom are aligned. If they are not, retract chain will require adjustment as follows:

A. Fully retract boom.
B. Measure distance between 2nd and 3rd boom sections. Determine amount of misalignment.
C. Loosen extend chain lock nut and adjusting nut as far as possible.
D. Loosen retract chain lock nut and adjusting nut.
E. Tighten retract chain adjusting nut until proper distance between 2nd and 3rd boom sections and proper access hole alignment is obtained.
F. Torque lock nut to 100 lb.-ft. (apply Loctite 242 on lock nut)
G. Adjust extend chain per instructions above.

For more detailed information, including boom chain checks and adjustments, see the appropriate **Service Manual.**

INSPECTION AND MAINTENANCE LOG

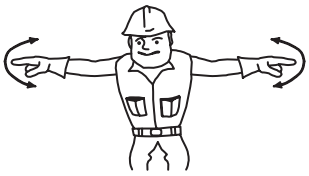
Date	Hourmeter Reading	Comments

HAND SIGNALS

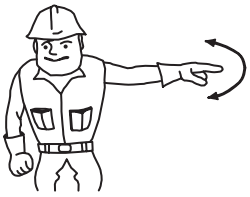
Standard Signals - When handler work conditions require hand signals, they shall be provided or posted conspicuously for the use of both signalman and operator. No handler motions shall be made unless signals are clearly understood by both signalman and operator.

Special Signals - When signals for auxiliary equipment functions or conditions not covered are required, they shall be agreed upon in advance by the operator and signalman.

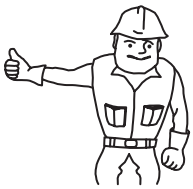
Instructions - When it is desired to give instructions to the operator other than provided by the established signal system, all handler motions shall first be stopped.



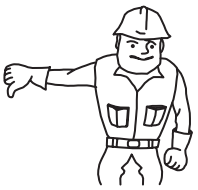
EMERGENCY STOP - With both arms extended laterally, hands open downward, move arms back and forth.



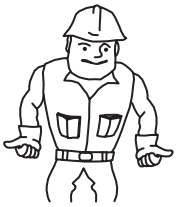
STOP - With either arm extended laterally, hand open downward, move arm back and forth.



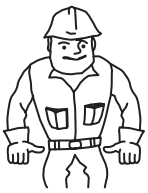
RAISE BOOM - With either arm extended horizontally, fingers closed, point thumb upward.



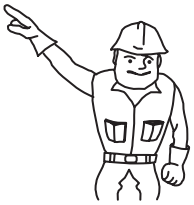
LOWER BOOM - With either arm extended horizontally, fingers closed, point thumb downward.



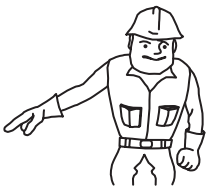
EXTEND TELESCOPIC BOOM - With both hands clenched, point thumbs outward.



RETRACT TELESCOPIC BOOM - With both hands clenched, point thumbs inward.



TILT FORKS UP - With one arm held at side, extend other arm upward at about 45°.



TILT FORKS DOWN - With one arm held at side, extend other arm downward at about 45°.

CLOSE BUCKET - Hold one hand closed and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at closed hand.

OPEN BUCKET - Hold one hand open and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at open hand.

MOVE SLOWLY - Place one hand motionless in front of hand giving motion signal. (Raise load slowly is shown)

THIS FAR TO GO - With hands raised and open inward, move hands laterally, indicating distance to go.

STOP ENGINE - Draw thumb or forefinger across throat.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

CALIFORNIA

Proposition 65 Warning

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

GRADALL® Hydraulic Equipment

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http://www.gradall.com

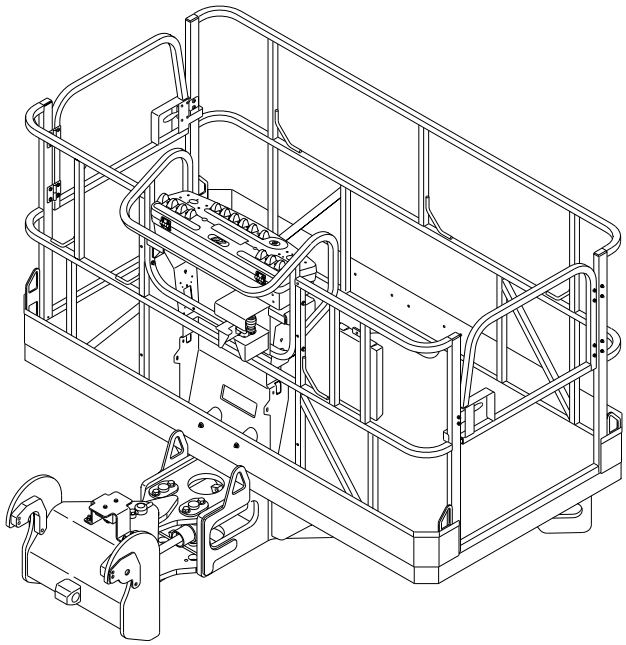
Printed in USA

Transformer Series
PERSONNEL WORK PLATFORM MANUAL

COVERING OPERATION & SAFETY

personnel work platform

GRADALL®



IMPORTANT!

Read and understand this Manual, the TF6-42 Owner/ Operator Manual, the Gradall Material Handler Safety Manual, the ANSI A92.5 Responsibilities Manual, and the EMI Aerial Work Platform Safety Manual before starting, operating or performing maintenance procedures on this machine.

DUPLICATE COPIES OF THIS MANUAL (PART NUMBER 9150-4004) ARE PROVIDED

KEEP ONE COPY WITH WORK PLATFORM AND ONE COPY IN CAB WITH OPERATOR AND SAFETY MANUALS

A JLG Company

Form No. 20140

USE ONLY WITH GRADALL TRANSFORMER SERIES MATERIAL HANDLERS STARTING SERIAL NUMBER 0192001 THRU 0192007 AND SERIAL NUMBER 0160000052 THRU CURRENT

Part No. 9150-4004

IMPORTANT SAFETY NOTICE

Safe operation depends on reliable equipment and proper operating procedures. The operating procedures and checks and services provided in this manual are in addition to those supplied with your JLG/Gradall Material Handler. Performing the checks and services described in this Manual and the Owner/Operator Manual furnished with your material handler will help to keep your JLG/Gradall Material Handler and personnel work platform in reliable condition. Following recommended operating procedures can help you avoid accidents. Because some procedures may be new to even the experienced operator and work plaftorm occupants, JLG/Gradall requires that the material handler Owner/Operator Manual and this personnel work platform Manual be read, understood, and complied with by all who operate the material handler and occupy the work platform.

Strict attention to and compliance with instructions provided in this Manual, TF6-42 Owner/Operator Manual, the GRADALL Material Handler Safety Manual, the GRADALL Operator Orientation Video, the ANSI A92.5 Responsibilities Manual, the EMI Aerial Work Platform Safety Manual, as well as instructional decals and plates affixed to the machine and attachments will help prevent injuries to personnel and damage to the equipment. The information provided herein is not intended to cover all situations; it is impossible to anticipate and evaluate all possible applications and methods of operation for this equipment.

The operating procedures, checks and services provided in this manual are in addition to those supplied with your JLG/Gradall Material Handler.

Any procedure not specifically recommended by JLG/GRADALL must be thoroughly evaluated from the standpoint of safety before it is placed in practice. If you are not sure, contact your JLG/GRADALL Material Handler Distributor before operating.

Do not modify this personnel work platform or the material handler without written permission from Gradall.

Use only JLG/GRADALL authorized parts. The use of counterfeit parts may cause premature failure which could lead to injuries and/or machine damage.

Do not modify this personnel work platform or the material handler without written permission from JLG/GRADALL. Use only genuine JLG/GRADALL replacement parts.

OTHER NOTICES

JLG/GRADALL retains all proprietary rights to the information contained in this Manual.

JLG/GRADALL reserves the right to change specifications without notice.

Gradall is a registered trademark for Hydraulic Excavators, Hydraulic Material Handlers and Attachments manufactured by The JLG/Gradall Company.

REVISIONS

This page is provided so you may determine that this Manual is complete and current with respect to Gradall Engineering Specifications.

Page	Date	Revision

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TRANSFORMER SERIES WORK PLATFORM

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Important Notice !

This machine has been equipped with a serial number specific Transformer Series Personnel Work Platform. Do not exchange transformer platforms between machines. Doing so will require calibration changes to the controller that must be performed by a qualified service technician. This platform assembly is designed soley for use with the Transformer Model Machines only.

General

This manual provides important information regarding safe operating procedures for JLG/Gradall Transformer Series work platform. If you have any questions regarding the JLG/Gradall personnel platform contact your JLG/Gradall Material Handler Distributor.

Operator/Platform Occupant Qualifications

Material Handler operators and platform occupants must be in good physical and mental condition, have normal reflexes and reaction time, good vision and depth perception and normal hearing. They must not be using medication which could impair abilities nor be under the influence of alcohol or any other intoxicant during the work shift.

The operator must be familiar with Sections 6, 7, 8, 9, 10 of ANSI A92.5-1992. These sections contain the responsibilities of the operator concerning safety, training, inspection, maintenance, application and operation.

In addition, the operator must read/view, understand and comply with instructions contained in the following material furnished with the material handler:

- This JLG/Gradall Transformer Series Work Platform Manual
- The /Gradall TF6-42 Material Handler Owner/Operator Manual
- ANSI A92.5 Responsibilities Manual
- EMI Aerial Work Platform Safety Manual
- GRADALL Material Handler Safety Manual
- All instructional decals and plates
- Any optional equipment instructions furnished

The operator and platform occupant(s) must also read, understand and comply with all applicable Employer, Industry and Government rules, standards and regulations.

Related Manuals & Decals

Separate publications are furnished with the material handler to provide information concerning safety, replacement parts, operation & maintenance procedures and vendor components. Replacement manuals, decals and instruction placards can be ordered from your JLG/GRADALL Material Handler Distributor.

Capacity Limitations

Refer to the capacity decal on Platform and capacity indicators located on the control console. The load capacity includes personnel, materials, tools, etc. The maximum capacity of your work platform is based on specific model material handler/work platform combination.

Serial Number Location

Specify Model and Serial Number when ordering parts and when discussing specific applications and procedures with your Distributor. The Serial Number plate is located on the left side of the adapter support.

NOTE!

The terms "Gradall personnel work platform," "Transformer Series work platform," "work platform," and "platform" are used interchangeably throughout this Manual.

"Material handler" and "handler" are used interchangeably throughout this manual.

NOTE!

Though no offense or discrimination is intended, only the masculine pronouns will be used throughout the remainder of this Manual.

Read and understand all manuals and instructional material listed on cover, inside front cover and introduction page of this Manual before putting the Transformer Series personnel work platform into service.

Regardless of previous experience operating similar equipment, the operator must be given sufficient opportunity to practice with the handler in a safe, open area (not hazardous to people or property) to gain operating skills and the proper "feel" for controls and operating clearances required for safe, efficient operation.

General Safety Precautions

Prior to use, make sure all **DANGER, WARNING, CAUTION and INSTRUCTIONAL DECALS** are in place and can be read. Clean or replace decals as required. This manual contains the decals and their locations and can be used as a checklist.

Prior to handling personnel, the material handler and platform shall be thoroughly inspected to ensure controls are functioning properly and all safety features provided are operating properly.

Be aware that when rotating the platform, it can swing into tires. Be sure to allow clearance to avoid damage to tires.

Ensure the footswitch and all other safety devices are operating properly. Do not modify or remove the footswitch or any other safety devices.

Do not change steer mode while the machine is traveling. Change the steer mode only when machine is stopped.

Always look in the direction of travel. **Reduce speed and be especially careful when traveling in reverse and/or turning.** Bring the machine to a complete stop before changing the direction of travel.

It is the operators responsibility to ensure that machine capacity is not exceeded.

Special precautions shall be taken to protect personnel from electrical hazards. **Maintain adequate distances from power sources.**

Do not lift personnel during thunderstorms, strong winds or other inclement weather.

Personnel shall not sit or climb on the platform railings or use planks, ladders or other devices for attaining additional reach or height. Keep both feet firmly positioned on floor of platform.

Do not use railings for lifting loads unless approved in writing by Gradall.

Personnel in platform shall use hand rails to maintain balance while platform is in motion. Keep hands off guard rails and gate during use.

All personnel in platform must wear a full body harness with lanyard attached to a designated point (see page P2.0). Do not attach more than one lanyard to any one lanyard anchorage point.

WATCH FOR THESE SYMBOLS ; THEY CALL YOUR ATTENTION TO SAFETY NOTICES.

⚠ DANGER

This symbol indicates an extreme hazard which will result in high probability of death or serious injury if proper precautions are not taken.

⚠ WARNING

This symbol indicates a hazard which could result in death or serious injury if proper precautions are not taken.

⚠ CAUTION

This symbol indicates a hazard which may result in injury or damage to equipment or property if proper precautions are not taken.

⚠ WARNING

Platform occupants must wear a full body harness with a lanyard attached to designated anchorage point.

If a platform occupant performs welding, electrically connected electrode holders shall be protected from contact with metal components of the platform. **Do not make modifications to the platform**, by welding or any other means. Do not ground through any part of machine.

Platform occupants shall not place any portion of their body between the boom and the platform.

Keep the gate closed at all times unless entering or exiting the platform.

Do not use adapter support to lift or suspend materials or personnel.

Do not allow personnel to tamper with or operate the machine from the cab with personnel in the platform equipped with controls, except in an emergency. Do not allow others to occupy cab while platform controls are in use.

Do not operate or raise the platform from a position on trucks, trailers, railway cars, floating vessels, scaffolds or other equipment unless approved in writing by JLG/Gradall.

Do not assist a stuck or disabled machine by pushing, pulling, or by using boom functions. Assist only by pulling at the chassis tie-down lugs. If machine becomes stuck or disabled, lower and retract boom, exit platform and move unit from cab controls.

Do not replace items critical to stability with items of different weight or specification (for example: batteries, filled tires, engine, platform).

Do not modify unit in any way to affect stability.

WARNING

Failure to perform the recommended lubrication and maintenance service along with daily checks as detailed in the material handler Owner/Operator manual could result in a malfunction that could cause serious injury or death.

Pre-Operation

IMPORTANT: Perform all checks and services as required in the proper Owner/Operator Manual prior to the use of the personnel work platform.

Allow only those authorized and qualified personnel to operate the machine.

Prior to use of platform, check work area for overhead hazards such as electric conductors, bridge cranes, and other potential hazards.

Ensure gate is fastened.

Identify the lanyard anchorage point(s) and securely attach lanyard of an approved fall protection device. Attach only one lanyard per anchorage point.

Avoid accumulation of debris on platform floor. Keep mud, oil, grease, and other slippery substances from footwear and platform deck.

Operation

Do not use the machine with platform attached for any purpose other than positioning personnel, their tools, and equipment.

Always ensure that power tools are properly stowed and never left hanging by their cord from the platform work area.

Do not place boom or platform against any structure to steady the platform or to support the structure.

Trip and Fall Hazards
Keep both feet firmly positioned on the platform floor at all times. Never position ladders, boxes, steps, planks, or similar items on unit to provide additional reach or height.

Never use the boom assembly to gain access to or leave the platform.

Use extreme caution when entering or leaving platform. Ensure that the platform is fully lowered. Always maintain "three point contact" with the platform, using two hands and one foot or two feet and one hand at all times during entry and exit.

Platform-to-structure transfers at elevated positions are discouraged. Where transfer is necessary, enter/exit through the gate only with the platform within 1 foot (0.3m) of a safe and secure structure. 100% tie-off is also required in this situation utilizing two lanyards. One lanyard must be attached to the platform with the second lanyard attached to the structure. The lanyard connected to the platform must not be disconnected until such time that the transfer to the structure is safe and complete.

Electrocution Hazards
Maintain safe clearance from electrical lines, apparatus, or any energized (exposed or insulated) parts in accordance with the Minimum Safe Approach Distance (MSAD) as specified below:

Voltage Range (phase to phase)	**MSAD** in feet (Meters)
0 to 50KV	10 (3)
Over 50KV to 200KV	15 (5)
Over 200KV to 350KV	20 (6)
Over 350KV to 500KV	25 (8)
Over 500KV to 750KV	35 (11)
Over 750KV to 1000KV	45 (14)

Maintain a clearance of at least 10 ft. (3m) between any part of the machine and its occupants, their tools, and their equipment from any electrical line or apparatus carrying up to 50,000 volts. One foot additional clearance is required for every additional 30,000 volts or less.

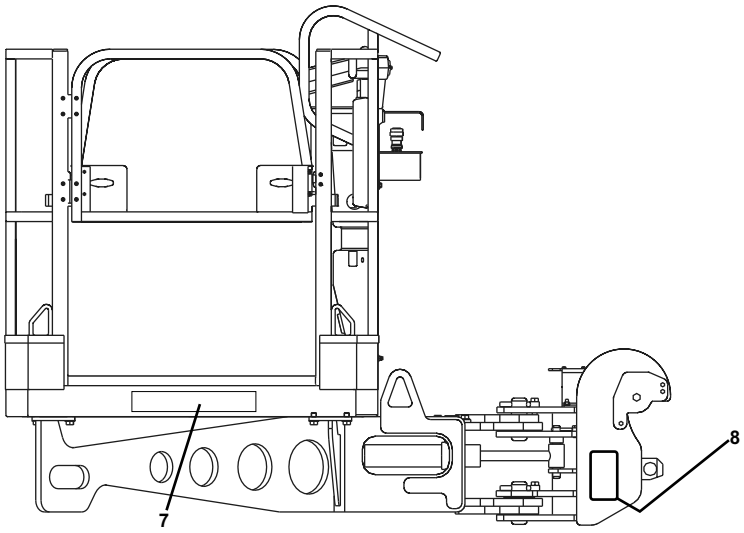
Tipping Hazards
Do not operate platform while on a sloping, uneven, or soft surface. Level the personnel work platform both side to side and front to back before lifting personnel.

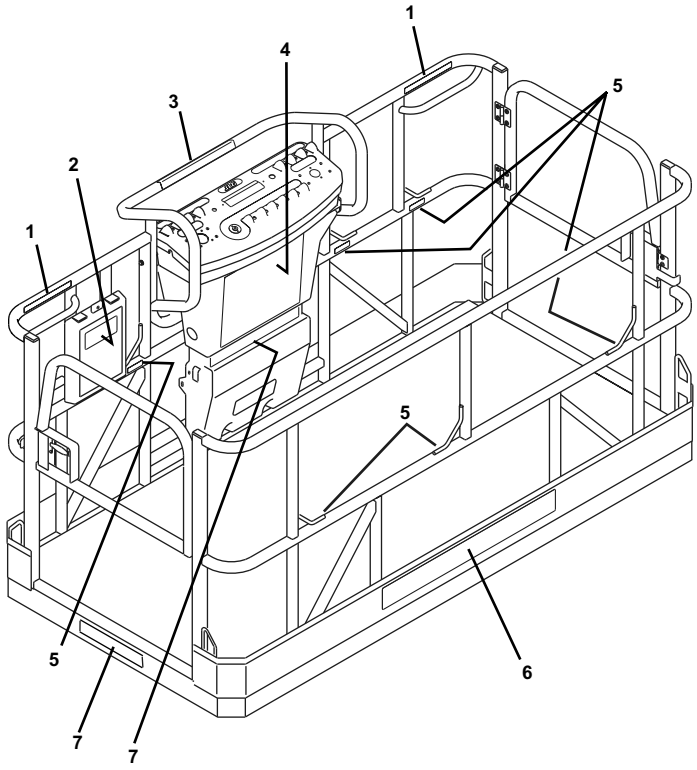
Never exceed the maximum work load as specified on the capacity decal and capacity indicator located on the control console. Distribute load evenly on platform floor. Keep all loads within the confines of the platform unless written authorization is received from Gradall.

Crushing Hazards
Keep hands and limbs away from boom assembly during operation.

Check clearances above, on sides and bottom of platform when moving platform.

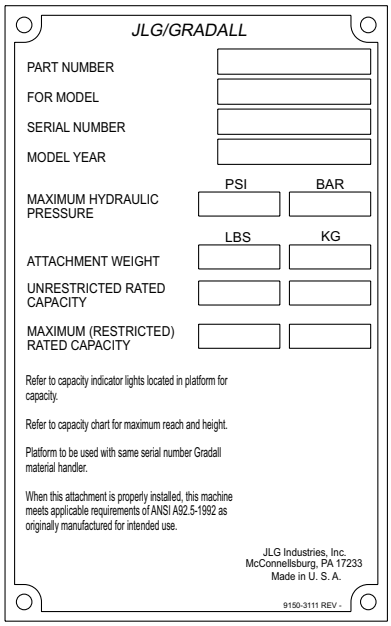
During operation, keep all body parts inside platform railing. Avoid operating over ground personnel. Warn personnel not to work, stand, or walk under a raised boom or platform. Position barricades as necessary.



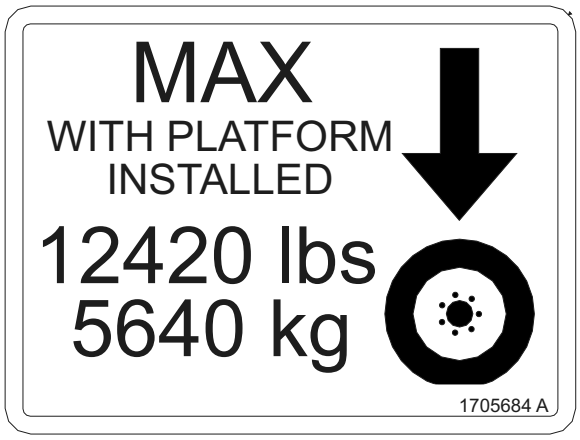


1	9150-4060	Rail Caution Decal
2	9150-4061	Manual Decal
3	9150-4062	Function Decal
4	9150-4063	Safety Precaution Decal
5	9150-4064	Lanyard Attachment Decal
6	9150-4065	JLG/Gradall Decal
7	9150-4066	Capacity Warning Decal
8	9150-3111	Serial Number Plate
9	1705684	Wheel Load Decal (not illustrated)

DECALS



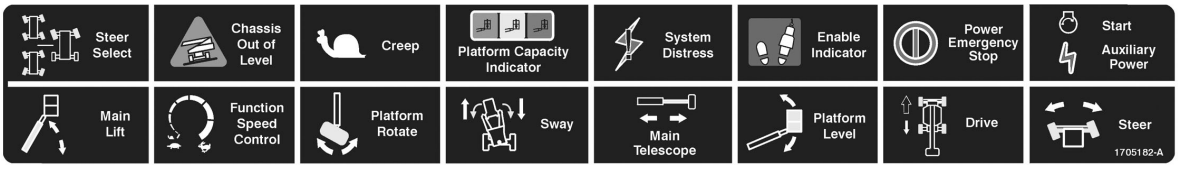
Located on Platform Support Weldment
P/N 9150-3111



Located on Platform
P/N 1705684

JLG / GRADALL®

P/N 9150-4065



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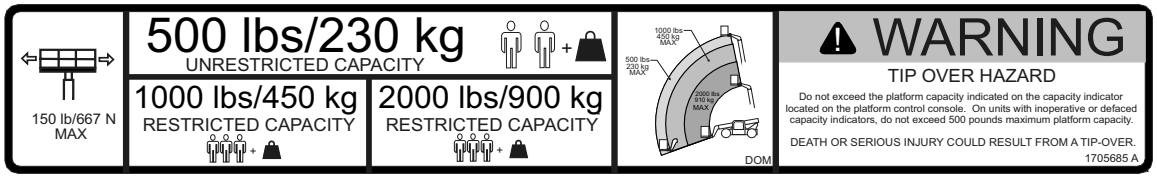

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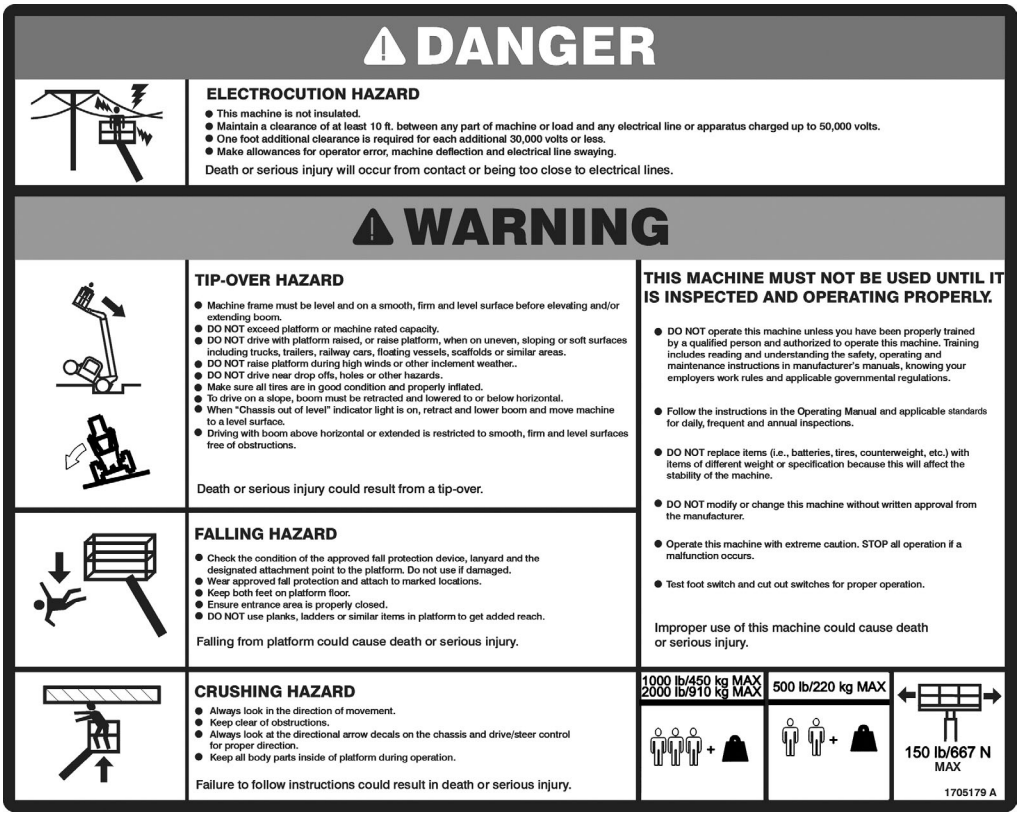

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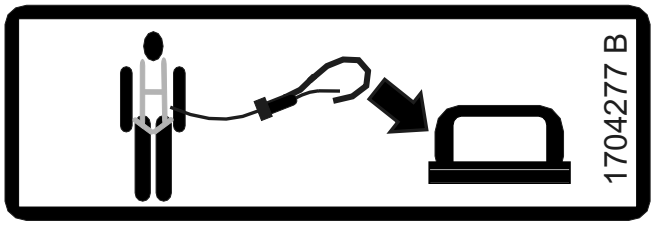
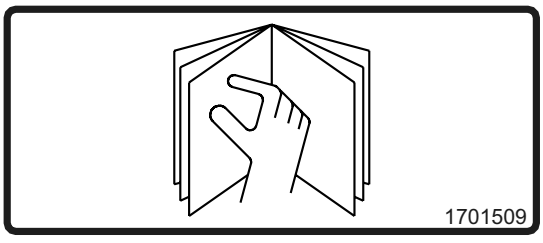
P/N 9150-4060

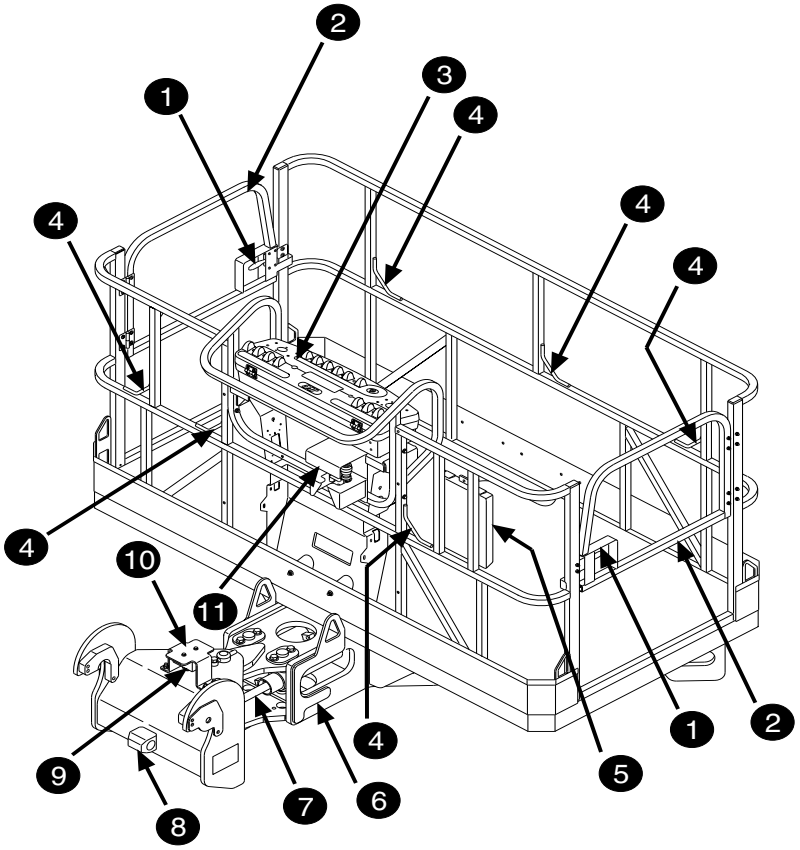


P/N 9150-4064
(6) Locations



P/N 9150-4061

NOMENCLATURE



1.	LATCH
2.	ENTRY/EXIT GATE
3.	ELECTRONIC CONTROL PANEL
4.	LANYARD ANCHORAGE POINT
5.	MANUAL STORAGE BOX
6.	PLATFORM SUPPORT WELDMENT
7.	ROTATING CYLINDER
8.	QUICKSWITCH WELDMENT
9.	DOUBLE PILOT CHECK VALVE
10.	VALVE MOUNTING PLATE
11.	CABLE CONNECTOR STORAGE

Approved Attachments

The Transformer Series Work Platform With Controls has been approved for use with JLG/Gradall Transformer Series Material Handlers. Several other JLG/GRADALL-approved attachments are available for use with your material handler. Contact your JLG/GRADALL Material Handler Distributor for information on approved attachments designed for special material handling situations.

The machine serial number plate lists attachments approved for use with your handler. However, there may be additional approved attachments available. Contact your JLG/GRADALL Material Handler Distributor for further information.

WARNING

Attachments which have not been approved for use with your material handler could cause machine damage or an accident resulting in injury or death.

Non-Approved Attachments

Do not use slip-on fork mounted personnel work platforms. Only JLG/Gradall manufactured personnel work platforms are approved for use with the JLG/Gradall Material Handler.

Do not attach any type of work platform that is not manufactured by JLG/Gradall to the Quick Switch™ adapter support.

WARNING

Fork mounted personnel work platforms are not approved for use on any JLG/Gradall Material Handlers.

Do not use non-approved attachments for the following reasons:

- JLG/GRADALL cannot establish range and capacity limitations for "will fit", homemade, altered, or other non-approved attachments.
- An overextended or overloaded handler can tip over with little or no warning and cause serious injury or death to the operator, platform occupants, and/or those working near the handler.
- JLG/GRADALL cannot assure the ability of a non-approved attachment to perform its intended function safely.
- Non-approved attachments may cause structural or other damage to the handler. Such damage could cause dangerous operating conditions resulting in serious injury or death.

WARNING

Never use an attachment without the appropriate, JLG/GRADALL supplied capacity chart for that particular attachment installed on the handler.

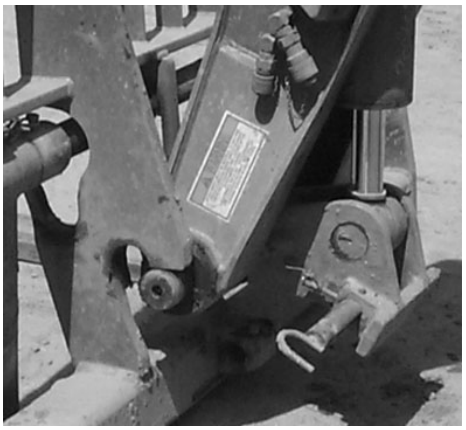
Attachment Operation

Operate a handler equipped with the personnel work platform as a partially-loaded handler. Pay special attention to capacity and range limits for the handler/platform combination in use.

Practice operation of handler and personnel work platform in a safe, open area, not hazardous to yourself, platform occupant(s), equipment or property. Become thoroughly familiar with response of handler and attachment to controls before operating in a work situation.

Perform all "Checks Before Operating Platform" as identified on page P6.0.

WORK PLATFORM INSTALLATION



1. Retract Quick Switch™ (attachment tilt lever forward) to provide clearance. Check to be sure lock pin is secured in out position with retainer pin.

2. Align boom head pivot with recess in attachment. Raise boom slightly to engage boom head pivot in recess.

3. Engage Quick Switch™ (attachment tilt lever backward).

4. Remove retainer pin and slide lock pin in fully.

5. Secure lock pin in locked position using retainer pin.

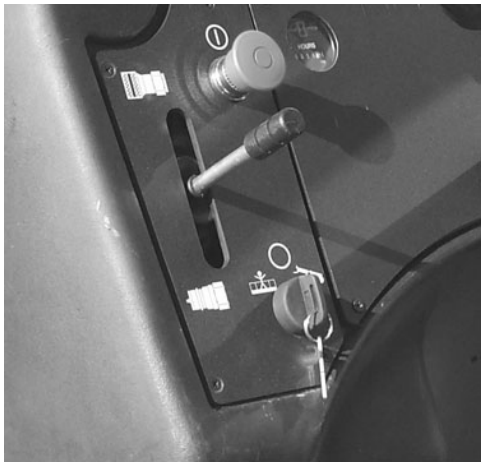
6. Swing saddles down and pin in place.

⚠ WARNING

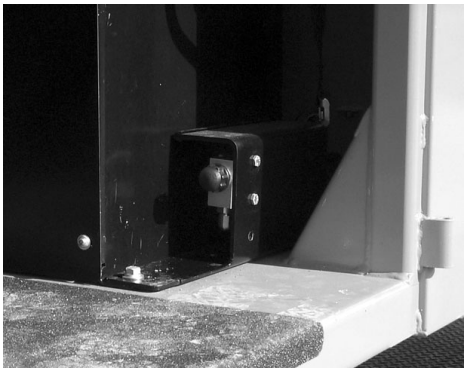
This installation procedure is designed for one-man operation. If a helper is involved, shut off the engine before proceeding to steps 4, 5, and 6.

⚠ WARNING

Always be certain that work platform is properly positioned on boom head and is secured by lock pin and retainer pin. Failure to ensure proper installation could permit attachment to disengage and cause serious injury or death.



7. Always turn off the machine before performing the next several steps.



8. Press the decompression valve located in cab, this takes the pressure out of the auxiliary hydraulic lines located on boom head.

9. Attach the electric harness lines as shown to the front of boom.

10. Attach the hydraulic lines to the side of boom as shown.

NOTE!

When hooking up the Transformer Series platform, the hydraulic hoses are run through the Quick Switch™. Pull these hoses and electrical cables back to prevent pinching when attaching and hooking up hydraulic hoses to the front of the boom.

Important Notice !

This machine has been equipped with a serial number specific Transformer Series Personnel Work Platform. Do not exchange transformer platforms between machines. Doing so will require calibration changes to the controller that must be performed by a qualified service technician. This platform assembly is designed soley for use with the Transformer Model Machines only.

CHECKS BEFORE OPERATING

Be sure to service the Material Handler in accordance with the "Lubrication and Routine Maintenance" schedule, located in the TF6-42 Owner/Operator Manual.

These checks and services are to be performed in addition to those specified in the Owner/Operator Manual for the material handler. Prior to using the material handler with the JLG/Gradall personnel work platform attached, perform the following checks:

- Do not use the platform until it is properly secured to the Quick Switch™. See attachment installation procedures on page P5.1 & P5.2.
- Inspect all platform and handler structural members for signs of damage. Do not use the platform or handler if damage is found.
- Inspect all warning and instructional decals to ensure they are legible and clean. Replace as necessary.
- Inspect access gate hinges and latch for proper operation, damage and security. Do not use the platform if damaged or if latch is inoperable.
- Check the condition of the boom extend cables/chains, boom hoses, and their anchor points. If they are found to be out of adjustment, badly worn, damaged, or not anchored properly, perform necessary boom maintenance before using machine.
- Check to ensure the tires are properly inflated and surface can support the machine.
- Check jobsite and weather conditions. Do not lift personnel during thunderstorms, strong winds or other inclement weather.
- Check work area for overhead hazards such as electric conductors, bridge cranes, and other potential hazards.
- Identify the lanyard anchorage point(s) and securely attach lanyard of an approved fall protection device. Attach only one lanyard per anchorage point.
- Check platform and control console for damage, loose or missing parts, and security.
- Check control switches, levers and electrical connections for tightness and evidence of corrosion, and wiring for defects and chafing damage. Assure that switches function properly.
- Check footswitch for damage, loose or missing parts and security. Assure that footswitch functions properly, is not modified, disabled or blocked.
- Make sure the material handler is equipped with the proper capacity chart.

⚠ WARNING

If structural damage is found or the Quick Switch™ is not properly engaging, do not use the material handler or platform until the proper repairs have been made.

⚠ WARNING

Before use of the boom/platform, the operator shall check for overhead obstructions and electrical conductors. Serious injury or death could result.

⚠ WARNING

Use extreme caution when checking items beyond your normal reach. Use an approved safety ladder.

⚠ WARNING

Before operating handler, complete all required maintenance. Replace or repair all damaged, worn or missing components before starting or operating handler. Failure to properly maintain handler could cause serious injury or death.

To be performed at beginning of each work shift or at each change of operator.

The safety, efficiency and service life of your handler will be increased by performing the operational checks listed below.

Before entering the platform, be sure to complete all necessary warm-up and operational checks outlined in the Operators Manual supplied with the TF6-42.

Also, complete the following pre-start inspection and function checks before use or each time the operator changes.

WARNING

If any function or system does not operate properly, cease operation immediately! Report the problem to proper maintenance personnel. Do not operate machine until it is in a safe and proper operating condition.

PRE-START INSPECTION

1. **Cleanliness -** Check all surfaces for leakage (oil, fuel, or battery fluid) or foreign objects. Report any leakage to the proper maintenance personnel.
2. **Decals & Placards -** Check all decals and placards for cleanliness and legibility. Make sure none of the decals and placards are missing. Make sure all illegible decals and placards are cleaned or replaced.
3. **Operators and Safety Manuals -** Make sure a copy of the Transformer Series Work Platform Operator Manual, the EMI Aerial Platform Safety Manual, and ANSI Manual of Responsibilities is enclosed in the manual storage box.
4. **"Walk-Around" Inspection -** See pages P6.2 and P6.3 for the walk-around inspection procedure. Report any differences to the proper maintenance personnel.
5. **Fuel -** Ensure that fuel reservoir level is adequate. Add proper fuel as necessary.
6. **Hydraulic Oil -** Check the hydraulic oil level. Report low levels to the proper maintenance personnel. Add hydraulic oil as required.
7. **Function Check -** Once the "Walk-Around" Inspection is complete, perform a functional check of all systems in an area free of overhead and ground level obstructions.

WARNING

Check all tires and rims periodically for damage due to impact. Replace before use if damage is detected.

FUNCTION CHECK

1. **From the cab with no load in platform:**
   - **a.** Operate all functions and observe for proper operation.
   - **b.** Check for proper operation of auxiliary power (manual descent) shown on page 3.2 in the TF6-42 Operator Manual.
   - **c.** Ensure that all machine functions are disabled when the Emergency Stop Button is activated.
   - **d.** Perform axle locking test shown on pages P7.0 & P7.1.
2. **From the platform control console:**
   - **a.** Operate all functions and observe for proper operation.
   - **b.** Check all variable speed control switches for proper operation.
   - **c.** Check for proper operation of auxiliary power (manual descent).
   - **d.** Perform axle locking test shown on pages P7.0 & P7.1.

WALK-AROUND INSPECTION

To be performed at beginning of each work shift or at each change of operator.

Begin your walk-around inspection at item 1, as noted below. Continue to your right (counterclockwise when viewed from top) checking each item in sequence for the conditions listed in the following checklist.

1. **Work Platform Assembly -** No loose or missing parts; no visible damage. Platform is properly positioned on boom head and is secured by lock pin and retainer pin. Saddles are swung down and pinned in place. Footswitch in good working order; not modified, disabled or blocked.
2. **Platform Control Console -** No loose or missing parts; no visible damage; placards and decals secure and legible. Control lever and switches return to neutral, control lever lock functions properly; emergency stop switch functions properly.
3. **Rotating Cylinders -** No visible damage; cylinder pins secure; hydraulic hoses undamaged, not leaking.
4. **Boom Sections/Lift, Tilt, Crowd, Compensating Cylinders -** Check front, top, side, & rear slider pads for adequate grease. No visible damage; pivot pins secure; hydraulic hoses undamaged, not leaking. Check extend/retract chains and adjustment blocks for adequate tension.
5. **Front Axle -** No loose or missing parts; steer cylinders undamaged, not leaking; pivot pins secure; hydraulic hoses undamaged, not leaking.
6. **Wheel/Tire Assembly -** Left Front; no loose or missing wheel bolts; no visible damage; proper inflation.
7. **Remote Brake Valve -** Check for leaks, loose wires, etc.
8. **Cab & Electrical -** Check window glass is in place and clean; guages, switches, joysticks, foot controls & horn operational; no visible damage. General appearance; no visible damage; load charts and applicable Operators & Safety manuals located in manual holder. Check decompression valve; operational and functioning properly.
9. **Fuel Tank -** Check fluid level, refill as required; no visible damage or leakage; filler cap is securely fastened.
10. **Air Cleaner -** Air cleaner element condition indicator, check for clogged condition. Replace element as required.
11. **Main Control Valve -** Check for loose connections; no visible damage or leakage.
12. **Wheel/Tire Assembly -** Left Rear; no loose or missing wheel bolts; no visible damage; proper inflation.
13. **Pilot Control Valve -** Check for loose connections; no visible damage or leakage.
14. **Back-up Alarm -** No loose connections; properly secured.
15. **Stabilizer Cylinder -** No visible damage; cylinder pins secure; hydraulic hoses undamaged, not leaking.
16. **Rear Axle -** No loose or missing parts; steer cylinders undamaged, not leaking; pivot pins secure; hydraulic hoses undamaged, not leaking.
17. **Wheel/Tire Assembly -** Right Rear; no loose or missing wheel bolts; no visible damage; proper inflation.
18. **Engine Compartment -** Engine Crankcase, check level & refill as required; radiator fill cap, check level & refill as required; Drive belts, check condition & replace as required; Hydraulic pump & reservoir, recommended fluid level on sight gauges (lubricant must be cool), breather cap secure and working; Battery, check electrolyte level, cables tight, no visible damage or corrosion; Engine cover properly secured and latched.
19. **Wheel/Tire Assembly -** Right Front; no loose or missing wheel bolts; no visible damage; proper inflation.
20. **Double Pilot Check Valve -** Check for loose connections; no visible damage or leakage.
21. **Work Platform Gate -** Latch and hinges in working condition; properly secured; no loose or missing parts.

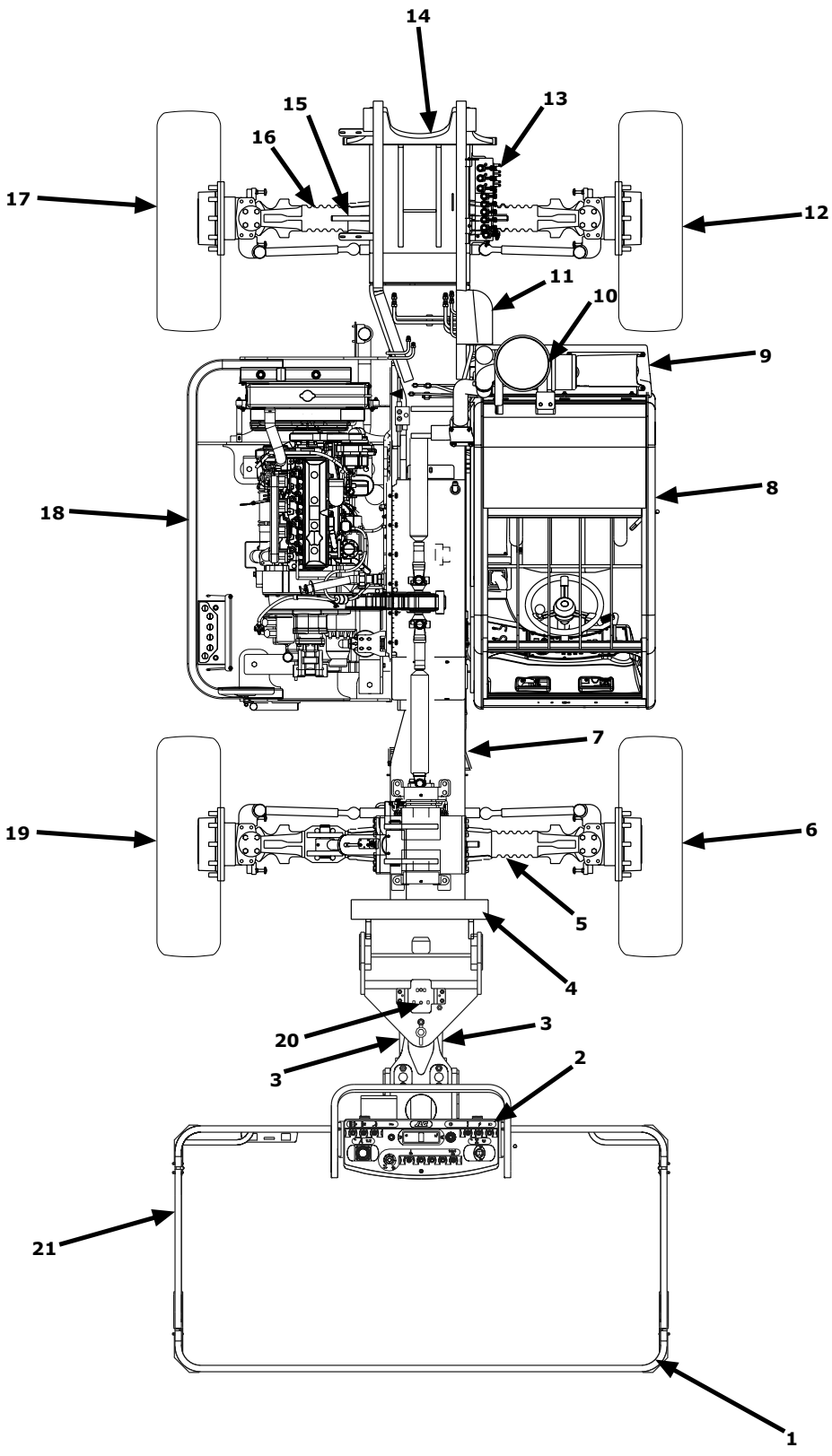
⚠ WARNING

To avoid injury, do not operate machine until all malfunctions have been corrected. Use of a malfunctioning machine is a safety violation.

To avoid possible injury, be sure machine power is off during "walk-around" inspection.

NOTE!

Do not overlook visual inspection of chassis underside. Checking this area may result in discovery of conditions which could prevent extensive machine damage.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DAILY REAR AXLE LOCK-OUT TEST PROCEDURE

TESTING REAR AXLE LOCKING SYSTEM (perform daily test)

The TF6-42 is equipped with a rear axle locking system for use while in work platform mode. In this mode, when the boom is raised above 50 degrees, a cylinder at the rear will lock, preventing oscillation of the rear axle. With the boom below this angle the cylinder will allow the rear axle to oscillate freely.

When the machine is in material handler mode, the rear axle cannot be locked, the rear axle will always oscillate freely.

After attaching the work platform and connecting the electrical cables, the work platform mode should be checked to ensure proper operation of the rear axle stabilization locking system.

Checking the rear axle locking system in work platform mode

Perform the following check from the work platform. No material, equipment, or personnel other than the operator should be on the platform during the performance of this test. This test will require the use of an assistant on the ground.

1.) Position Control Station Selector Key switch to Platform.

2.) Start the machine from the platform. Raise the boom to approximately zero degrees (horizontal) boom angle.

3.) Locate an eight inch curb, and drive the machine's left front wheel up on the curb, leaving all other wheels off the curb.

4.) Level the machine by operating the Sway function. No wheel should leave the ground.

5.) Back the left front wheel off the curb. Again, no wheel should leave the ground.

6.) Drive the left front wheel back up on the curb, and release the drive controller. Use the sway function to level the machine.

7.) While keeping clear of the rear wheels, have an assistant check that the red LED on the proximity switch at the right rear of the machine is "glowing". Have the assistant disconnect the proximity switch from the wire harness. The red LED should be "OFF" (see figure 7-1).

8.) Back the left front wheel off the curb. The rear axle should be locked and one wheel should be off the ground. Set the park brake.

9.) Again, staying clear of wheels, have the assistant reconnect the proximity switch to the wire harness. The raised wheel should immediately return to the ground.

10.) If the machine has passed all of these checks, place the machine on level ground, set the park brake and raise the boom above 50 degrees.

11.) Have the assistant check that the red LED on the proximity switch at the right rear of the machine is "OFF".

⚠ WARNING

Should the machine fail any part of this check, immediately discontinue the checking process. Do not use the machine. Place a "DO NOT OPERATE" tag on the machine, and have it repaired.

⚠ WARNING

Do not raise boom above 5 degrees for steps 1 through 9 of this check.

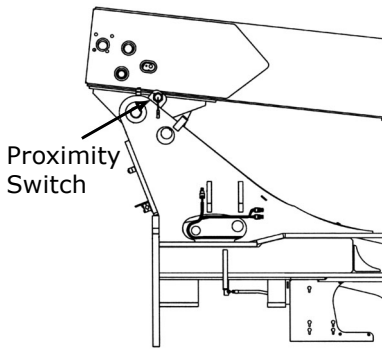


Figure 7-1

DAILY REAR AXLE LOCK-OUT TEST PROCEDURE

Checking the rear axle locking system in material handler mode

Perform the following check from the cab. Disconnect the electrical cables and remove the work platform. **Do not engage a load before performing this check**. This test will require the use of an assistant.

1.) Position Control Station selector Key switch to Cab (see page 3.0 in the TF6-42 Operator Manual).

2.) Start the machine from the cab. Raise the boom to approximately zero degrees (horizontal) boom angle.

3.) Locate an eight inch curb, and drive the machine's left front wheel up on the curb, leaving all other wheels off the curb.

4.) Level the machine by operating the Sway function. No wheel should leave the ground.

5.) Back the left front wheel off the curb. Again, no wheel should leave the ground.

6.) Drive the left front wheel back up on the curb, and use the sway function to level the machine. Set the park brake (shown on page 3.0 in the TF6-42 Operator Manual).

7.) Have an assistant check that the red LED on the proximity switch at the right rear of the machine is "OFF". Have the assistant disconnect the proximity switch from the wire harness (keeping clear of the rear wheels). The red LED should remain "OFF".

8.) Back the left front wheel off the curb. Again, no wheel should leave the ground.

9.) Again, staying clear of wheels, have the assistant reconnect the proximity switch to the wire harness. No movement of the machine should be noticed.

⚠ WARNING

Do not perform this check without attachment properly attached to the material handler.

Controls and Indicators

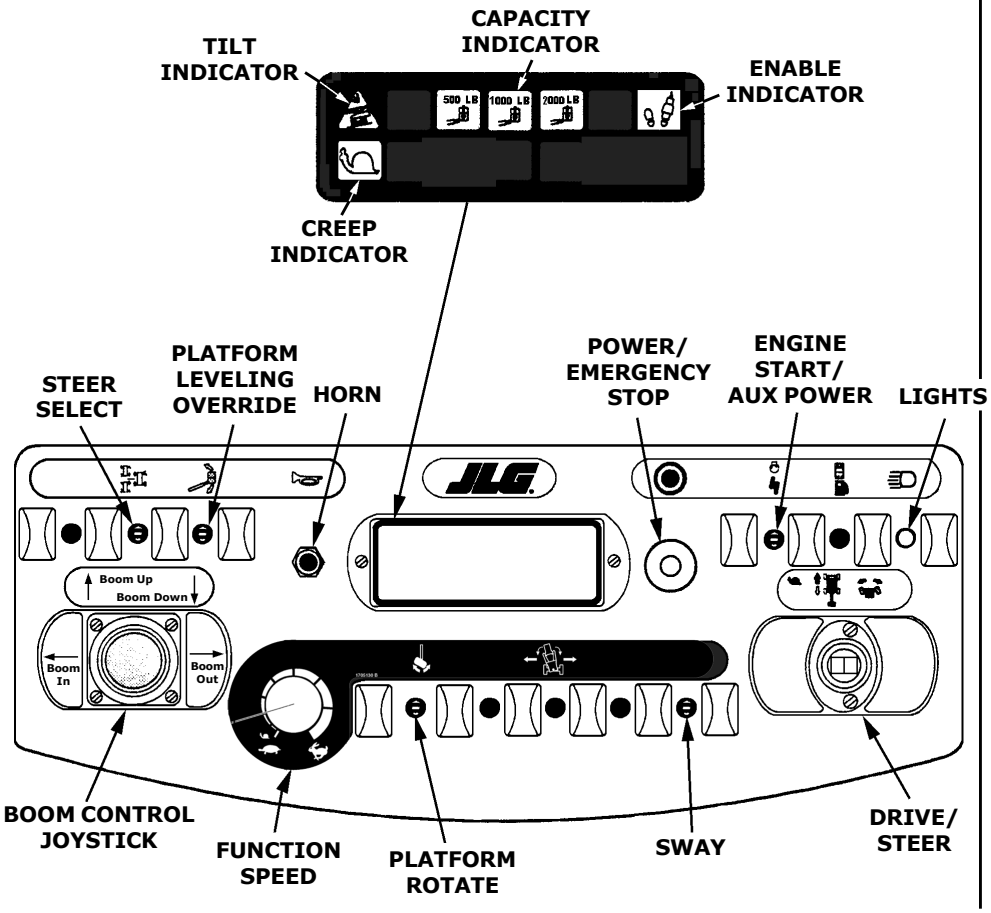
This machine is equipped with a work platform. The intended purpose is to position personnel with their tools and supplies at positions above ground level, and can be used to reach work areas located above machinery or equipment.

The platform has an operator Control Station. From this control station, the operator can drive and steer the machine in both forward and reverse directions. The operator can raise or lower the boom or rotate the platform left or right.

The lift is not intended to be used to lift material other than supplies which personnel in the platform require to do their job. Supplies or tools which extend outside the platform are prohibited unless written approval has been obtained through JLG/Gradall. It must not be used as a forklift, crane, support for overhead structure, or to push or pull another object.

The speeds of boom functions are variable from zero to maximum speed depending upon the position of the function speed control. Functions controlled by toggle switches are either on or off. A foot operated switch in the platform must be depressed before any controls will function and provides a means of emergency stop when the operators foot is removed from the footswitch.

The unrestricted capacity of the lift is 500 lbs. (230 kg). This means that with a platform load of 500 lbs. (230 kg) or less, the platform may be positioned anywhere the boom will reach, with the machine level and on a smooth, firm, and level surface and tires properly inflated.



Boom Control Joystick:

An infinitely proportional dual axis joystick is provided for lifting, lowering, boom extend, and boom retract. Lift detent ring up and push forward to lift, lift detent ring up and pull backward to lower. Lift detent ring up and move joystick left to extend boom, lift detent ring up and move joystick right to retract boom.

Capacity Indicator:

Three lights are used to indicate the maximum platform capacity for the position of the platform. The range decal located below the control console indicates the capacities and approximate ranges.

Creep Speed Indicator:

Illuminated (green) when the Function Speed Control is turned to the creep position, the indicator acts as a reminder that all functions are set to the slowest speed. This indicator also illuminates when the boom angle exceeds 11°.

Drive/Steer:

Controls drive and steering. Lift detent ring up and push forward to drive forward (rear of chassis), lift detent ring up and pull back to drive in reverse. Steering is accomplished via a thumb-activated rocker switch on the end of the handle. Push on the left side of the switch to steer left, on right side to steer right.

Enable Indicator:

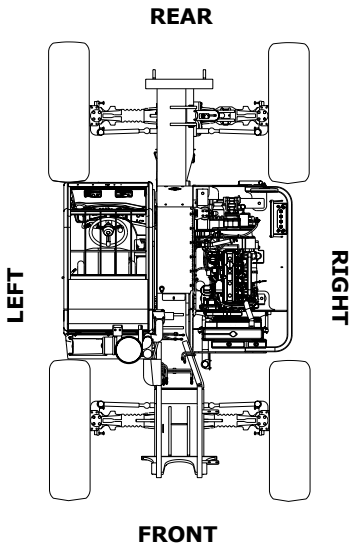
This green illuminator indicates that the footswitch is depressed and the platform controls are ready for use. To enable the controls, depress the footswitch and select any function within seven seconds. The controls will then remain active as long as there is not a delay of seven seconds between stopping one function and starting the next one. If the seven second interval is exceeded, the enable light will go out and the controls will not operate. To enable the controls again, return controls to neutral, remove your foot from the footswitch and depress the footswitch.

Engine Distress Indicator Light (Yellow):

The light turns on and an alarm sounds when machine's power system requires immediate service. Any of the following conditions will turn on light and alarm: low engine oil pressure, high engine coolant temperature, clogged engine air filter, low alternator output, clogged hydraulic oil return filter, or clogged charge pump filter.

NOTE!

When operating from the work platform, the boom pivot and counterweight are considered the front of the machine.



PLATFORM CONTROLS AND INDICATORS

Engine Start/Auxiliary Power:

Engine Start

Push "UP" on Engine Start/Auxiliary Power switch to start engine. If engine fails to start within 20 seconds, release Engine Start/Auxiliary Power switch and allow starting motor to cool for a few minutes before trying again. For engine starting, the footswitch must be in the released (up) position.

Auxiliary Power

A toggle-type Engine Start/Auxiliary Power control switch energizes the electrically operated hydraulic pump, when actuated. (Switch must be held "DOWN" for duration of auxiliary pump use.) The auxiliary pump functions to provide sufficient oil flow to operate the basic machine functions should the main pump or engine fail. The auxiliary pump will operate boom lift, telescope and rotate. It should be noted that the functions will operate at a slower than normal rate.

Auxiliary power is primarily intended for platform lowering in the event of primary power failure. However, auxiliary power may be used for platform positioning when operating in close quarters in the following sequence:

1. Position CONTROL STATION SELECT switch to PLATFORM.
2. Position POWER/EMERGENCY STOP switch to ON.
3. Depress and hold footswitch.
4. Position AUXILIARY POWER switch to ON and hold.
5. Operate appropriate control switch or lever for desired function and hold.
6. Release AUXILIARY POWER switch, selected control switch or lever, and footswitch.
7. Position POWER/EMERGENCY STOP switch to OFF.

Footswitch:

This feature makes it necessary to depress the footswitch to allow operation of the platform controls.

Function Speed:

The knob provides variable speed control of all boom functions grouped together to the right of the knob. For smoothest operation of these functions, use two hands: rotate the knob counterclockwise to the slowest position, select the function switch, and while holding the switch on, rotate the knob to the desired speed. To achieve a smooth stop, rotate the knob counterclockwise to a slow speed prior to letting go of the function switch. Rotating the knob fully counterclockwise until a click is heard puts all controls, including drive, main lift, and swing into "creep" speed. This slow speed is used for fine positioning of the platform when close to obstacles. A snail symbol is used to indicate "creep" speed and is shown at the Function Speed knob as well as near the proportional controllers to act as a reminder.

Horn:

A push-type HORN switch activates an audible warning device when pressed.

Lights Indicator:

Illuminated when lights are turned on.

⚠ WARNING

To avoid serious injury, do not remove, modify or disable the footswitch by blocking or any other means.

NOTE!

The main function of auxiliary power is to lower the platform in the event of primary power failure.

NOTE!

Footswitch must be depressed prior to activating any function control, otherwise the function will not operate.

⚠ CAUTION

Footswitch must be adjusted so that functions will operate when pedal is approximately at its center of travel. If switch operates within last 1/4" of travel, top or bottom, it should be adjusted.

NOTE!

When the boom is raised approximately 7 degrees above horizontal, the high drive function will automatically switch to low drive. This also occurs when Function Speed Control is set to creep.

⚠ WARNING

To avoid serious injury, do not operate machine if any control levers or toggle switches controlling platform movement do not return to the off position when released.

Low Fuel Indicator:

When illuminated the fuel tank is 1/8 full or less. When the light first turns on, there are approximately four usable gallons of fuel remaining.

Platform Leveling Override:

The PLATFORM LEVEL control switch allows the operator to adjust the level of the platform by positioning the switch to UP or DOWN.

Platform Rotate:

The PLATFORM ROTATE control switch allows the operator to rotate the basket to the left or right when positioned to the desired direction.

Power/Emergency Stop Switch:

An ON-OFF POWER/EMERGENCY STOP switch and a separate ENGINE START/ AUXILIARY POWER toggle switch on the platform console supply electrical power to the starter solenoid, when the power/emergency stop switch is pulled out to the "ON" position and the ENGINE START switch is pushed forward. Push in to shut off engine and remove power from the controls. The power/emergency stop switch must be pulled out in the cab to operate either from the cab or platform control. This allows the machine to be shut down in emergency situations.

Steer Select:

The center switch position gives conventional front wheel steering with the rear wheels unaffected. This is the best position for driving at maximum speeds. The forward position is for "crab" steering. When in this mode both front and rear axles steer in the same direction, which allows the chassis to move sideways. This can be used for positioning the machine in aisle ways or against buildings. The back switch position is for "coordinated" steering. In this mode the front and rear axles steer in the opposite directions to produce the tightest turning circle for maneuvering in confined areas. If the steer select switch located in the cab is not set to front wheel steer, the platform steer select switch will not change the steering mode.

Sway Control Switch:

The sway control switch allows the operator to level the machine. Operator must position machine and level prior to raising work platform.

Tilt Alarm Warning Light:

This orange illuminator indicates that the chassis is on a slope (over 5 degrees). If illuminated when boom is raised or extended, retract and lower to below horizontal then reposition machine so that it is level before extending boom or raising boom above horizontal. If the boom is above horizontal and the machine is on a 5 degree slope, an alarm will sound and CREEP mode is automatically activated.

PLATFORM OPERATION

Control Station Selector Switch
The Control Station Selector switch functions to direct power to the desired control station when the POWER/EMERGENCY STOP switch is pulled out (on). With the switch rotated to the CAB position power is supplied to the cab control station. When the switch is rotated to the PLATFORM position, power is supplied to the platform control station.

Loading Platform from Ground Level
1. Position chassis on a smooth, firm and level surface.
2. If total load (personnel, tools and supplies) is 500 lbs. (230 kg) or less, distribute load uniformly on platform floor and proceed to work position.

Loading from Positions Above Ground Level
1. Determine what the total weight will be after additional weight is loaded (personnel, tools and supplies).
2. If total weight in platform will be 500 lbs. (230 kg) or less, proceed with adding weight.

Machine Function Speeds
The Function Speed Control affects the speed of boom functions Lift, Telescope, and Rotate. Turn the control clockwise to increase function speed or counter-clockwise to decrease function speed. When in counterclockwise maximum position, Drive is placed in creep speed.

Platform Level Adjustment
To level up, depress footswitch, position PLATFORM/LEVEL control switch up and hold until platform is level.

To level down, depress footswitch, position PLATFORM/LEVEL control switch to down and hold until platform is level.

Platform Rotation
To rotate platform to the left, depress footswitch. PLATFORM ROTATE control switch is positioned to the left and held until desired position is reached.

To rotate platform to the right, depress footswitch. PLATFORM ROTATE control switch is positioned to the right and held until desired position is reached.

Power/Emergency Stop
This red, mushroom-shaped switch provides battery power to the CONTROL STATION SELECTOR switch, when pulled out (on), for all machine functions. The switch should be pushed in (off) when parking the machine overnight.

Raising and Lowering the Boom
Depress footswitch lift detent ring and position boom control joystick forward to lift boom up or rearward to lower boom until desired height is reached.

NOTE!

Footswitch must be depressed prior to activating any function, otherwise function will not operate.

NOTE!

Always position Emergency Stop switch to the "off" position (pushed in) when machine is not in use.

⚠ WARNING

Do not drive with boom above horizontal except on a smooth, firm and level surface.

Do not drive on sideslopes which exceed 5 degrees.

Use extreme caution when driving in reverse and at all times when driving with platform elevated and when driving with any part of machine within 6 feet of any obstruction.

Steering
Depress footswitch, position thumb switch on Drive/Steer controller to right for steering right, or to left for steering left.

Traveling (driving)
1. If machine is shut down, pull out Emergency Stop at Cab Controls and place Control Station Selector switch to Platform.
2. At Platform Controls, pull out Emergency Stop switch and start engine.
3. Position Drive controller to Forward or Reverse as desired. Angle of controller will determine travel speed.

In AWP Mode:
Maximum travel speed is 3.5 MPH with boom retracted and lowered (travel position).

When boom is extended approximately 3.5 ft. and/or raised above 7°, the machine will slow to Creep Mode (.5 MPH).

When in Creep Mode and returning boom to travel position, the travel control must be returned to neutral and re-activated to increase speed above .5 MPH.

EMERGENCY PROCEDURES

DO NOT ALLOW PERSONNEL TO TAMPER WITH OR OPERATE THE MACHINE FROM THE CAB WITH PERSONNEL IN THE PLATFORM EQUIPPED WITH CONTROLS, EXCEPT IN AN EMERGENCY.

WARNING

The platform must be completely empty. Never allow personnel in platform while towing, lifting, or hauling.

Auxiliary Power
A toggle type auxiliary power control switch is located on the platform control station and another is located in the operators cab. Operation of either switch turns on the electrically driven auxiliary hydraulic pump. This should be used in case of failure of the main power plant. The auxiliary pump will operate any boom function.

To activate auxiliary power from platform:
1. Depress and hold footswitch.
2. Position AUXILIARY POWER switch to ON and hold.
3. Operate appropriate control switch, lever or controller for desired function and hold.
4. Release AUXILIARY POWER switch, select control switch, lever or controller, and footswitch.
5. Position POWER/EMERGENCY STOP switch to OFF.

To activate auxiliary power from the cab control station:
1. Position CONTROL STATION SELECTOR switch to CAB.
2. Position POWER/EMERGENCY STOP switch to ON.
3. Position AUXILIARY POWER switch to ON and hold.
4. Operate appropriate control switch or controller for desired function and hold.
5. Release AUXILIARY POWER switch, and appropriate control switch or controller.
6. Position POWER/EMERGENCY STOP switch to OFF.

WARNING

In emergency situations, operator must retract boom before lowering. Failure to retract boom could cause machine to tip over resulting in injury or death.

Operator Unable to Control Machine
If the platform operator is pinned, trapped or unable to operate or control the machine:
1. Operate the machine from cab controls ONLY with the assistance of other personnel and equipment (cranes, overhead hoists, etc.) as may be required to safely remove the danger or emergency condition.
2. Other qualified personnel on the platform may use the platform controls with regular or auxiliary power. DO NOT CONTINUE OPERATION IF CONTROLS DO NOT FUNCTION NORMALLY.
3. Cranes, forklift trucks or other equipment which may be available are to be used to remove platform occupants and stabilize motion of the machine in case machine controls are inadequate or malfunction when used.

Platform or Boom Caught Overhead
If the platform or boom becomes jammed or snagged in overhead structures or equipment, do not continue operation of the machine from either the platform or the ground until the operator and all personnel are safely moved to a secure location. Only then should an attempt be made to free the platform using any necessary equipment and personnel. Do not operate controls to cause one or more wheels to leave the ground.

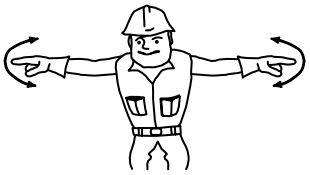
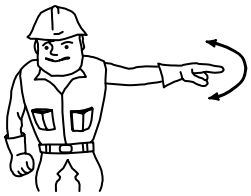
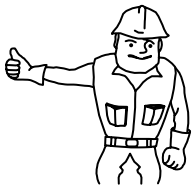
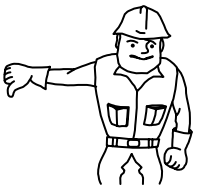
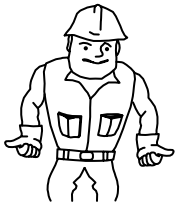
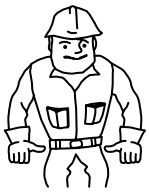
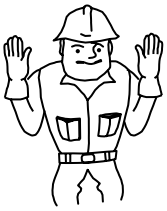
Post Incident Inspection and Repair
Following any incident, thoroughly inspect the machine and test all functions first from the cab controls, then from the platform controls. Do not lift above 10 feet (3 m) until you are sure that all damage has been repaired, if required, and that all controls are operating correctly.

HAND SIGNALS

Standard Signals - When handler work conditions require hand signals, they shall be provided or posted conspicuously for the use of both signalman and operator. No handler motions shall be made unless signals are clearly understood by both signalman and operator.

Special Signals - When signals for auxiliary equipment functions or conditions not covered are required, they shall be agreed upon in advance by the operator and signalman.

Instructions - When it is desired to give instructions to the operator other than provided by the established signal system, all handler motions shall first be stopped.

 EMERGENCY STOP - With both arms extended laterally, hands open downward, move arms back and forth.	 STOP - With either arm extended laterally, hand open downward, move arm back and forth.	 RAISE BOOM - With either arm extended horizontally, fingers closed, point thumb upward.	 LOWER BOOM - With either arm extended horizontally, fingers closed, point thumb downward.
 EXTEND TELESCOPIC BOOM - With both hands clenched, point thumbs outward.	 RETRACT TELESCOPIC BOOM - With both hands clenched, point thumbs inward.	MOVE SLOWLY - Place one hand motionless in front of hand giving motion signal. (Raise load slowly is shown)	 THIS FAR TO GO - With hands raised and open inward, move hands laterally, indicating distance to go.
STOP ENGINE - Draw thumb or forefinger across throat.			

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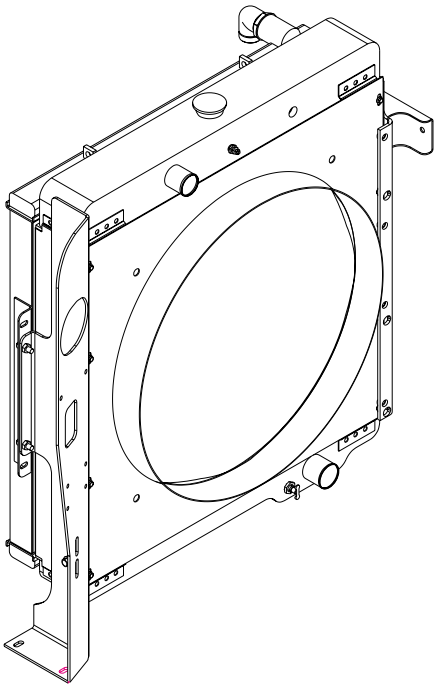
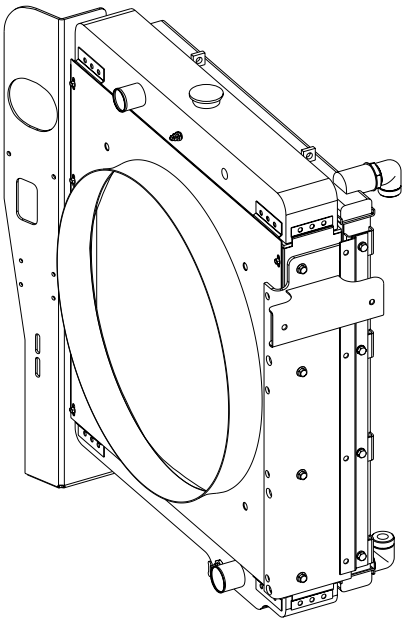
Liquid Coolant

Test Manual





John Deere Liquid Coolant Conditioner

Form No. 20004 / Original Issue 3-2000

ENGINE COOLANT SPECIFICATIONS

Engine coolants are a combination of three chemical components: ethylene glycol, (antifreeze), inhibiting coolant additives and quality water.

Coolant solutions of quality water, ethylene glycol concentrate, (antifreeze), and supplemental coolant additives, (SCAs), MUST be used year-round to protect against freezing, boil-over, liner erosion or pitting, and to provide a stable, non-corrosive environment for seals, hoses and metal engine parts.

Some products, including John Deere PREDILUTED ANTIFREEZE/SUMMER COOLANT and John Deere COOL-GARD, are fully formulated coolants that contain all three components in their correct concentrations. Do not add an initial charge of supplemental coolant additives to these fully formulated products.

Some coolant concentrates, including John Deere ANTIFREEZE/SUMMER COOLANT CONCENTRATE, contain both ethylene glycol antifreeze and inhibiting coolant additives. Mix these products and quality water, but do not add an initial charge of supplemental coolant additives.

Coolants meeting ASTM D5345, (prediluted coolant) or ASTM D4985, (coolant concentrate), require an initial charge of supplemental coolant additives.

Water Quality:

Water quality is important to the performance of the cooling system. Distilled, deionized or demineralized water is recommended for mixing with ethylene glycol base engine coolant concentrate. All water used in the cooling system should meet the following minimum specifications for quality:

Water Quality Specifications

Item	Parts Per Million	Grains Per U.S. Gallon
Chlorides (maximum)	40	2.5
Sulfates (maximum)	100	5.9
Total Dissolved Solids (maximum)	340	20
Total Hardness	170	10
pH Level	5.5-9.0	

Ethylene Glycol Concentrate (Antifreeze):

IMPORTANT: Do not use cooling system sealing additives or use antifreeze that contains sealing additives.

The use of John Deere coolant products is **strongly recommended.**

If John deere coolant products are not used, other low silicate ethylene glycol base coolants for heavy-duty diesel engines may be used when mixed with quality water and supplemental coolant additives, (SCAs), if they meet one of the following specifications:

* ASTM D5345 (prediluted coolant)

* ASTM D4985 (coolant concentrate) in a 40% to 60% mixture of concentrate with quality water.

Coolants meeting these specifications require addition of supplemental coolant additives, (SCAs), formulated for heavy-duty diesel engines, for protection against corrosion and cylinder liner erosion and pitting.

IMPORTANT: Never use automotive-type coolants, (such as those meeting ASTM D3306 or ASTM D4656). These coolants do not contain the correct additives to protect heavy-duty diesel engines. They often contain a high concentra tion of silicates and may damage the engine cooling system.

ENGINE COOLANT SPECIFICATIONS--CONTINUED

Supplemental Coolant Additives (SCAs):

IMPORTANT: DO NOT over-inhibit antifreeze solutions, as this can cause silicate-dropout. When this happens, a gel-type deposit is created which retards heat transfer and coolant flow, causing engine to overheat.

NOTE: John Deere Pre-diluted Antifreeze/Summer Coolant conccentrate, and John Deere COOL-GARD contain supplemental coolant additives (SCAs). However, as the coolant solution loses its effectiveness, additives will need to be added.

Operating without proper coolant additive will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol and water WILL NOT give adequate protection.

The use of supplemental coolant additives reduces corrosion, erosion and pitting. These chemicals reduce the number of vapor bubbles in the coolant and help form a protective film on cylinder liner surfaces. This film acts as a barrier against harmful effects of collapsing vapor bubbles.

Inhibit the antifreeze-coolant mix with a non-chromate inhibitor. John Deere Liquid Coolant Conditioner is recommended as a supplemental coolant additive in John Deere engines.

IMPORTANT: Check inhibitors between drain intervals every 600 hours or 12 months of operation. Replenish inhibitors by the addition of a supplemental coolant additive as necessary.

DO NOT use a soluble oil.

Additives eventually lose their effectiveness and must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner. See TESTING DIESEL ENGINE COOLANT and REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCAs) BETWEEN COOLANT CHANGES, as described later in this group.

John Deere Liquid Coolant Conditioner

TESTING DIESEL ENGINE COOLANT

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion and cylinder liner erosion and pitting.

Test the coolant solution at 600 hours or 12 month interals and whenever excessive coolant is lost through leaks or overheating to ensure the necessary protection.

Coolant Test Strips

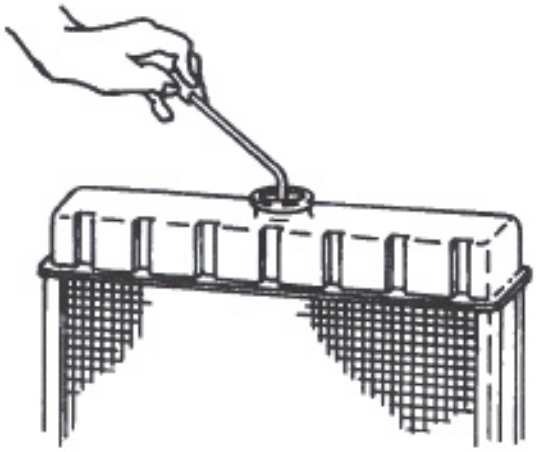
Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

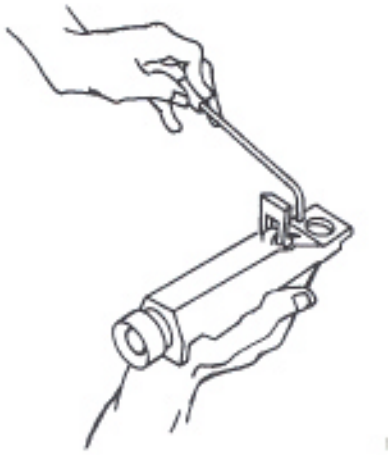
Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere Liquid Coolant Conditioner should be added.

COOLSCAN

For a more thorough evaluation of your coolant, perform a COOLSCAN analysis where available. See your John Deere distributor or servicing dealer for information about COOLSCAN.

REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCAs) BETWEEN COOLANT CHANGES





IMPORTANT: Do not add supplemental coolant additives when the cooling system is drained and refilled with John Deere ANTIFREEZE/ SUMMER COOLANT or John Deere COOL-GARD.

Through time and use, the concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere ANTIFREEZE/SUMMER COOLANT or John Deere COOL-GARD is used. The cooling system must be recharged with additional coolant additives available in the form of liquid coolant conditioner.

Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against rust, liner pitting and corrosion, and freeze-ups due to incorrect coolant dilution.

John Deere LIQUID COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

Test the coolant solution at 600 hours or 12 months of operation using either John Deere coolant test strips or a CoolScan analysis. If a CoolScan analysis is not available, recharge system per instructions printed on label of john Deere Liquid Coolant Conditioner.

IMPORTANT: ALWAYS maintain coolant at correct level and concentration. DO NOT operate engine without coolant for even a few minutes.

If frequent coolant makeup is required, the glycol concentration should be checked with JT05460 Refractometer to assure that the desired freeze point is maintained. Follow manufacturer's instructions provided with refractometer.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

See ENGINE COOLANT SUPPLEMENTS earlier in this group for proper mixing of coolant ingredients before adding to the cooling system.

OPERATING IN WARM TEMPERATURE CLIMATES

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

IMPORTANT: Water may be used as coolant *in emergency situations only.*

Foaming, hot surface aluminum and iron corrosion, scaling and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.

Drain cooling system and refill with recom mended glycol base engine coolant as soon as possible.

FLUSH AND SERVICE COOLING SYSTEM

IMPORTANT: CAUTION: Explosive release of fluids form pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing cap completely.

IMPORTANT: Air must be expelled from cooling system when system is refilled. Follow procedure given in your operator's manual.

The ethylene glycol base, (antifreeze), can become depleted of SCAs allowing various acids to form that will damage engine components. In addition, heavy metals, such as lead, copper and zinc accumulate in the ethylene glycol base. The heavy metals come from corrosion that occurs to some degree within a cooling system. When a coolant is saturated to the point where it can no longer hold heavy metals and other dissolved solids, they settle out and act as abrasives on engine parts.

NOTE: Refer to your operator's manual for a specific service interval.

Flush cooling system and replace thermostats as described in your operator's manual. Clean cooling system with clean water and TY15979 John Deere Heavy-Duty Cooling System Cleaner or an equivalent cleaner such as FLEETGUARD RESTORE or RESTORE PLUS. Follow the instructions provided with the cleaner. Refill the cooling system with the appropriate coolant solution. See ENGINE COOLANT SPECIFICATIONS, earlier in this group.

IMPORTANT: NEVER overfill the system. A pressurized system needs space for heat expansion without overflowing at the top of the radiator. Coolant level should be at tbottom of radiator filler neck.

Air must be expelled from cooling system when the system is refilled. Loosen tempera ture sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Re-tighten fitting or plug when all the air has been expelled.

After adding new coolant solution, run engine until it reaches operating temperature. This mixes the coolant solution uniformly and circulates it through the entire system. After running engine, check coolant level and entire cooling system for leaks.

Contact your authorized servicing dealer or engine distributor if there are further questions.

DISPOSING OF COOLANT

Improperly disposing of engine coolant can threaten the environment and ecology.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

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TF6-42 START-UP PROCEDURES

Documentation

Provide the following:

Performed By (Name and Clock No.)	
Date	
Machine Serial Number	

Instructions

Perform each of the following tasks, without the TF6-42 platform attached. As each task is completed, write your Clock No. in the box next to the task. If the machine does not meet the criteria called for, have the machine repaired or the problem corrected.

Before Starting Engine

Prior to the initial start-up, perform the following:

No.	Description	Checked by
1	Check engine oil level. Bring oil level to "Full" mark. Fill with 15W-40 CE engine oil.	
2	Check engine coolant level. Fill radiator to within one (1) inch of top of filler neck. Fill with 50 / 50 mix of ethylene glycol anti-freeze and water.	
3	Check that transmission has sufficient oil for start-up. The transmission's dipstick should show the transmission to be overfilled by 3 to 4 inches above the "Full" mark. The transmission dipstick will indicate accurate oil level only when the engine is running. Fill	

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TF6-42 START-UP PROCEDURES

	with Mobil 424 tractor / hydraulic fluid.	
4	Check transfer case oil level. Oil must be visible in sight gauge. Fill with Mobil 424 tractor / hydraulic fluid.	
5	Check oil level in axle center section. Remove oil level check plug, and fill to bottom of hole. Fill with Mobil 424 tractor / hydraulic fluid. **Note!** Wheel end oil is checked separately in "After Engine Start-Up" at point No. 4.	
6	Check hydraulic oil level. Bring oil to full mark on sight gauge. Fill with Mobil 424 tractor / hydraulic fluid.	
7	Lubricate all grease fittings. Wipe away excess grease. Use Mystik Tetrimoly NGLI #2 extreme pressure lubricant. Grease fittings are located as follows: **Location** — **No. Of Fittings** Axle King Pins — 8 Axle Trunnions — 4 Boom Head / Carriage Pivot — 2 Boom Lift Cylinder — 4 Boom Pivot — 2 Carriage Tilt Cylinder — 3 Compensation Cylinder — 3 Drive Shaft Slip Joints — 2 Extend Chain Sheave — 1 Quick Switch Latch — 1 Retract Chain Sheave — 1 Stabilization Cylinder — 3 Sway Cylinder — 3 Rotator Cylinders (2 cylinders) — 2 each	

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8	Check that 8 to 9 gallons of fuel is in the fuel tank. Use No. 2 Diesel fuel.	
9	Tire pressures – front and rear. Standard Tires 13.00-33.5 LSW 12 ply G-2 – 65 PSI	
10	Wheel lug nut torque. 350 – 400 Ft. – Lb. (hand)	

Engine Start-Up

The following must be done at engine start-up:

No.	Description	Checked by
1	Check hydraulic control levers to ensure that they move freely and that cables do not bind or stick. Check to see that controls return to their "Neutral" position.	
2	Check that transmission control lever moves freely through it's gear range and directional motions. Place transmission directional control lever in "Neutral".	
3	Check that service brake pedal operates freely. Ensure that it returns to it's released position.	
4	Check that throttle pedal operates freely, and that throttle cable does not bind or stick. Ensure that it returns to it's low idle position.	
5	Turn ignition switch to "PLATFORM" position. No power should be available in the cab. Engine should not start with toggle switch. Turn ignition switch to "CAB" DO NOT start engine. Check the following: □ Voltmeter reads 12 to 14 volts.	

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TF6-42 START-UP PROCEDURES

	□ Fuel level gauge reads approximately ¼ tank. □ Oil pressure gauge and temperature gauge read zero (0). □ Red light on park brake switch must illuminate when park brake switch is in "Engaged" position and must not illuminate when switch is in "Disengaged" position. □ Emergency toggle switch will engage auxiliary motor	
6	Check to ensure that "Neutral Start" function operates correctly: □ Set park brake switch in "Engaged" position. Place transmission directional control lever in "Forward". Push start toggle switch up to "Start" position. Engine starter should not engage. □ Set park brake switch in "Engaged" position. Place transmission directional control lever in "Reverse". Push start toggle switch up to "Start" position. Engine starter should not engage. □ Set park brake switch in "Disengaged" position. Place transmission directional control lever in "Neutral". Push start toggle switch up to "Start" position. Engine starter should not engage. Set park brake switch in "Engaged" position, and place transmission directional control lever in "Neutral" position.	
7	Check to ensure that reverse alarm operates correctly: **Note!** Park brake must be disengaged. □ With ignition switch to "Off" position, place transmission directional control lever in "Neutral", "Forward" and "Reverse". Reverse alarm should not sound.	

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TF6-42 START-UP PROCEDURES

	□ With ignition switch to "CAB" position, place transmission directional control lever in "Neutral" and "Forward". Reverse alarm should not sound. □ With ignition switch to "CAB" position, place transmission directional control lever in "Reverse". Reverse alarm should sound.	
8	Check to ensure that horn sounds when switch is depressed.	
9	Start engine and run at ½ throttle. Transmission charge pump and hydraulic pump are self-priming. Check to ensure that engine oil pressure registers within first 10 seconds after start-up.	
10	Check hydraulic plumbing and transmission cooler plumbing for leaks. Check major components such as transmission, engine, pilot valve, hydraulic pump, etc. for leakage.	

After Engine Start-Up

Perform the following after engine start-up:

No.	Description	Checked
1	With engine running at low idle, check transmission oil level. Bring level up to "Full" mark on dipstick. Fill with Mobil 424 tractor / hydraulic fluid.	
2	Bleed park brakes at front axle. Switch park brakes to "Disengaged" position for bleeding. Use the two inboard brake bleeders to purge air from park brake system.	
3	With the park brake switch in "Disengaged" position,	

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TF6-42 START-UP PROCEDURES

	bleed service brakes at front and rear axles. Apply service brake, and use the two outboard brake bleeders to purge air from front axle service brake system, and the two bleeders on the rear axle.	
4	Check oil level in planetary wheel ends. Move machine slowly either forward or reverse until "Oil Level" line on face of planetary cover is parallel to the ground, and oil level check plug is to the left. Remove oil level check plug, and fill to bottom of hole. Fill with Mobil 424 tractor / hydraulic fluid.	
5	Run engine at ½ throttle to warm engine oil, engine coolant, hydraulic oil and transmission oil for about 5 minutes, or longer as necessary. During this time: • Operate all hydraulic functions to purge air from hydraulic system. Check to ensure that each function moves in direction intended when it's control is actuated. • Operate steering in all modes to purge air from steering system. Check that the machine is steered in direction intended, and that each steering mode operates as intended.	
6	Disengage park brakes. Moving the machine slowly, check transmission directional control lever to ensure that machine moves in direction intended when control is actuated.	
7	Moving the machine slowly, check that service brakes are functional and stop the machine.	
8	Engage park brakes. Check that the machine does not move when transmission control lever is in first gear, and directional control is in either forward or reverse.	

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TF6-42 START-UP PROCEDURES

9	Disengage park brakes. Moving the machine slowly, check transmission gear selector to ensure that each gear can be engaged in both forward and reverse.	
10	After steering system has been purged of air, synchronize all four wheels as follows: A. Place steer select switch in 4-wheel circle steer mode, turn steering wheel full right - creeping forward will assist in bringing axle to full steering lock. B. While holding steering wheel in this position, select 2-wheel front steer mode, and continue to turn steering wheel full right - creeping forward will assist in bringing axle to full steering lock. C. Place steer select switch in 4-wheel circle steer mode, turn steering wheel full left - creeping forward will assist in bringing axle to full steering lock. D. While holding steering wheel in this position, select 2-wheel front steer mode, and continue to turn steering wheel full left - creeping forward will assist in bringing axle to full steering lock. E. Switch to 4-wheel circle steer mode and bring front wheels to the straight ahead position. Drive machine forward to ensure that all four wheels are synchronized.	
11	Ensure that the following cylinders are in fully retracted position: Boom Lift - Lower Fully Boom Crowd - Retract Fully Attachment Tilt - Tilt Quick Switch Fully Back Under	

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TF6-42 START-UP PROCEDURES

	Boom Head. Check hydraulic oil level on sight gauge and add hydraulic oil as necessary to bring level to "Full" mark.	
12	Engage park brake, place transmission directional control lever in "Neutral", and turn ignition switch to the center "off" position to shut down the machine. Restart engine and stop using red "emergency stop button". Then turn ignition switch to center "off" position or battery will run down.	

LEGEND

MAIN PRESSURE & RETURN LINES

PILOT LINES

DRAIN LINES

FRONT STEERING CYLINDER

REAR STEERING CYLINDER

STEER SELECT VALVE

REMOTE STEER VALVE

STEERING ORBITROL

REMOTE LOAD SENSE VALVE

SHUTTLE

SERVICE BRAKE VALVE

OUTLET

INLET

OUTLET

LOAD SENSE

TANK

REMOTE BRAKE VALVE

STABILIZER CYLINDER

LIFT CYLINDER

CROWD CYLINDER

TILT CYLINDER

SWAY CYLINDER

COMPENSATING CYLINDER

AWP ATTACHMENT

COUNTERBALANCE VALVE

ROTATE CYLS.

MAIN CONTROL VALVE

AUX. JOYSTICK

LIFT/CROWD JOYSTICK

TILT/SWAY JOYSTICK

PILOT CONTROL VALVE

FRONT SERVICE BRAKES

PARK BRAKES

REAR SERVICE BRAKES

EMERGENCY PUMP

.244 CU.IN/REV

.073 CU.IN/REV

500 PSI

IMPLEMENT PUMP
1.97 CU. IN./REV

PRIORITY VALVE

600 PSI

2450 PSI

.120

500 PSI

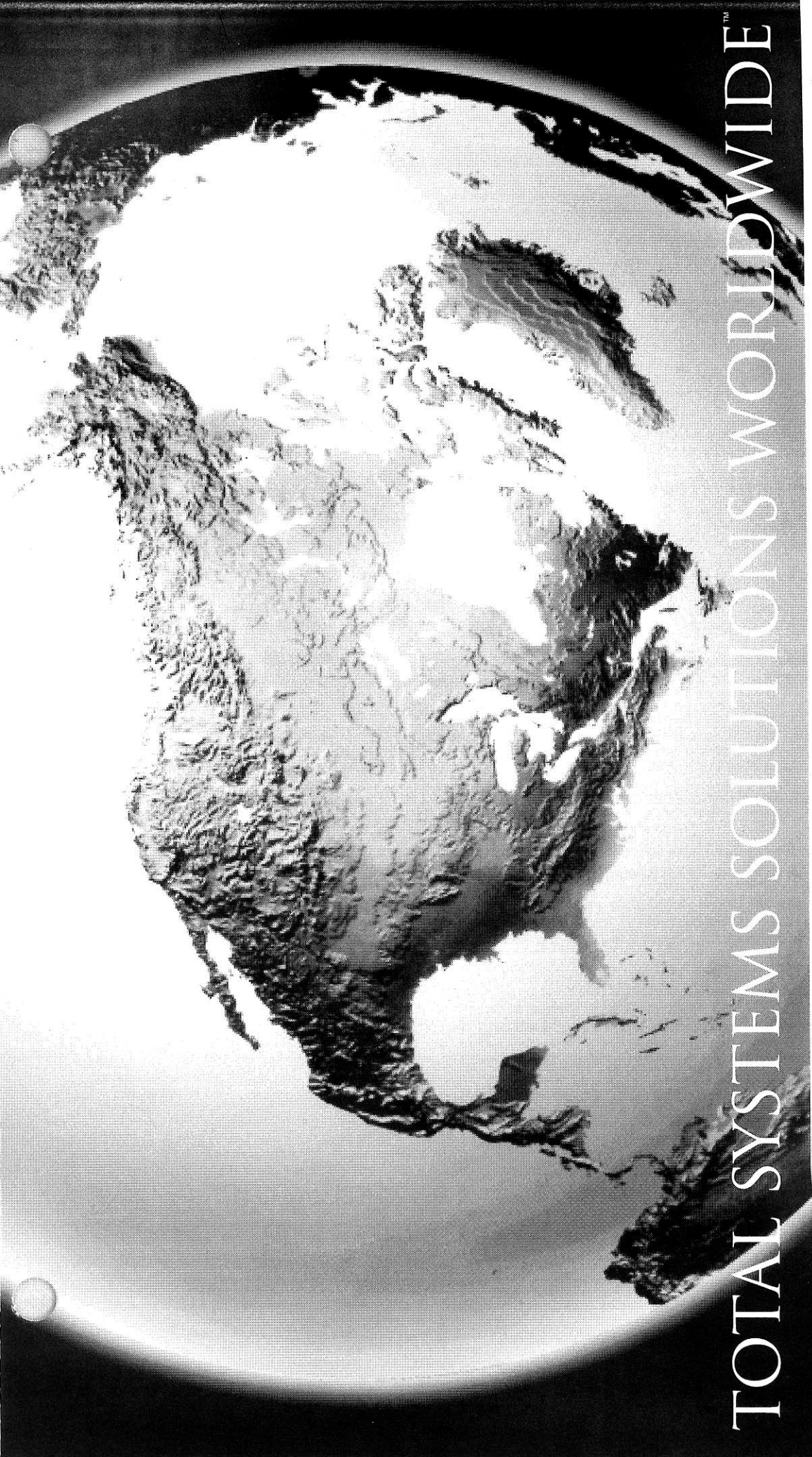
HYDRAULIC OIL COOLER

RETURN FILTER B_8-75

25 PSI

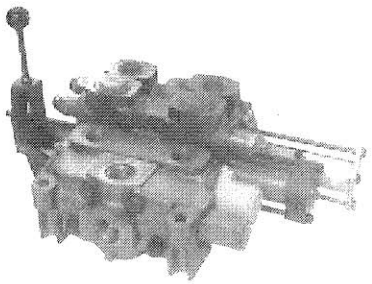
10 MICRON BREATHER

HYDRAULIC SCHEMATIC
9150-9020



Commercial Hydraulics™

VA/VG™ Valve Service Manual



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VA™/VG™ Valve Service Instructions

INTRODUCTION

This manual has been prepared to assist you in the proper maintenance of Commercial Hydraulics VA20™/VA35™ and VG20™/VG35™/VG80™ directional control valves. To facilitate repairs, before any work is done, we suggest that you read the assembly and disassembly instructions completely.

Also, remember that the first rule of good maintenance is cleanliness, this includes a clean environment. MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA. Dirt is the natural enemy of any hydraulic system.

GENERAL INFORMATION

Commercial's VA and VG model valves are contemporary versions of our well-proven A20™ and A35™ units. The VG models are cast from compacted graphite, a high strength iron alloy, which allows the valve to be rated to 3500 psi. VA models are cast from gray iron and are rated at 2500 psi. These open center directional control valves are available in parallel, tandem, and series circuitry. The sectional, stack type, construction provides the flexibility of adding additional work sections to an existing valve bank or subtracting sections. This design also permits the combination of parallel, tandem, and series circuitry in a single bank. The internal coring of each valve section determines its circuitry and the number of gasket seals required.

All sections with optional features such as port relief valves, crossover relief valves, and anti-cavitation checks are dimensionally larger as measured from the top of the port to the bottom of the housing. These are referred to as "hi-boy" sections. Those without work port options can use the low profile casting, also called "lo-boy" sections.

REPLACEMENT PARTS

The illustrations in this manual and the instructions that refer to them apply only to Commercial Intertech assemblies, sub-assemblies, and components. All valve components, except for spools and housings, are available as replacement parts or sub-assemblies. Spools are hone fitted to their individual housings. Therefore, damage to either of these components means the entire section must be replaced.

We recommend that you use only genuine Commercial Hydraulics replacement parts in your service program. Manufactured on the same production lines to the same exacting tolerances and quality controls as the original equipment, genuine Commercial Intertech replacement parts are your best hedge against premature component failure and costly downtime. Service parts and assemblies are available through your original equipment dealer or any authorized Commercial Intertech distributor.

MAINTENANCE

Valves are often used in hazardous environments; therefore, care should be taken to frequently inspect the product for damage due to improper use, corrosion or normal wear. Repairs should be made immediately if needed.

Always refer to the machine owner's manual for the proper procedure to remove the valve from the machine.

Remove the valve bank from the equipment and disconnect all hoses, fittings, control handles, and linkage connectors that might be attached to the valve. Plug all ports and thoroughly clean the exterior of the valve bank, after which the port plugs can be removed.

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Exploded View of Work Section

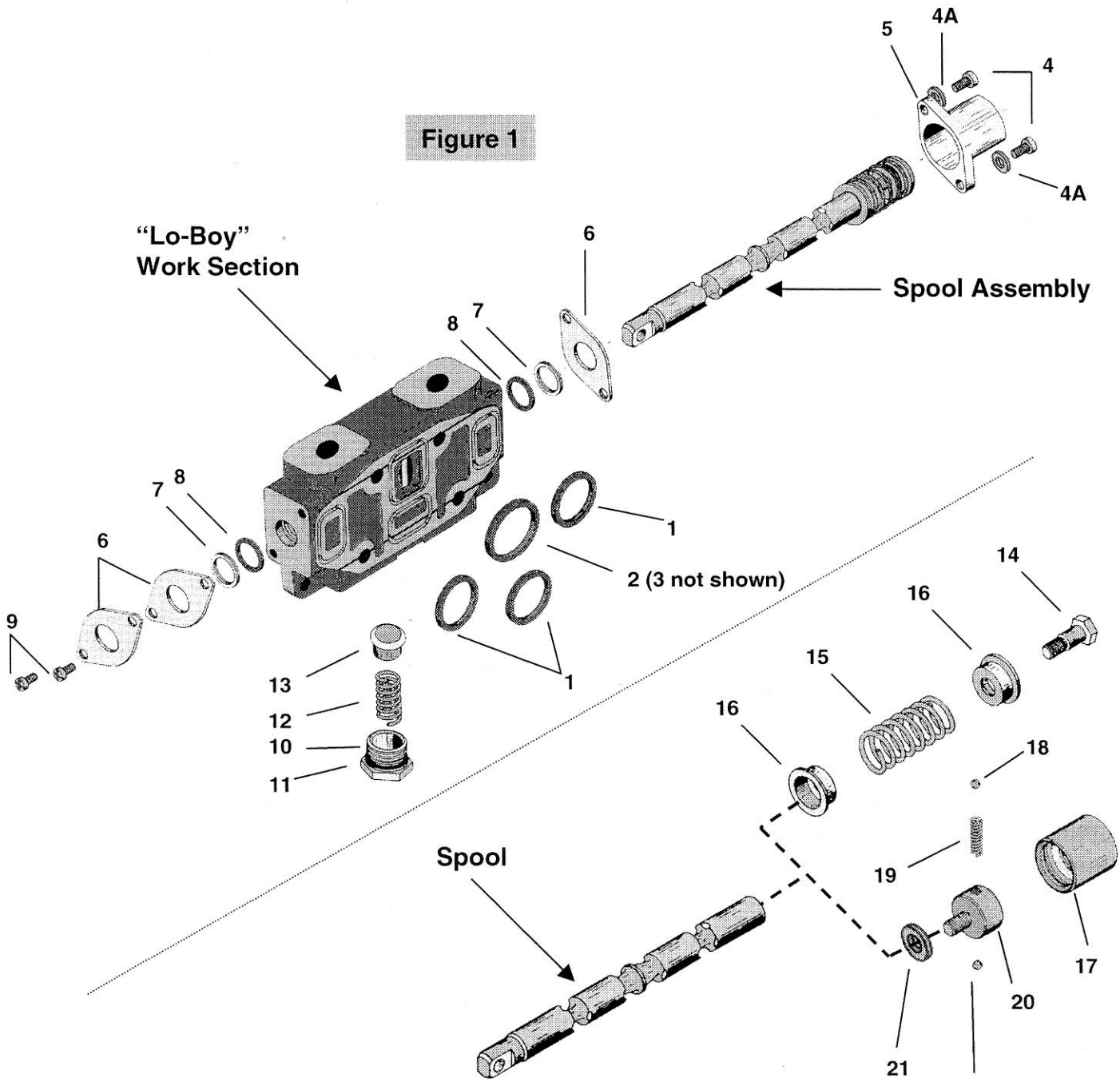


Figure 1

Figure 2

Parts List For Work Section

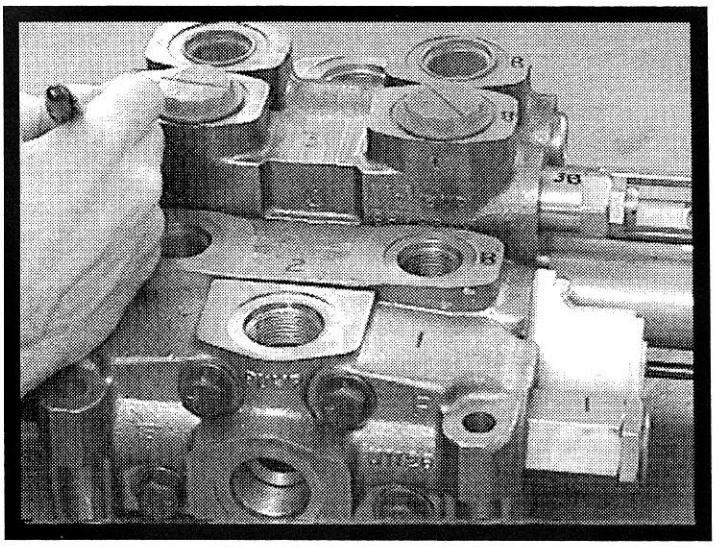
Item	Description	Qty.	VA/VG20 Part No.	VA/VG35 Part No.	VG80 Part No.
Parallel Section Seals* See Figure 1					
1.	Square Seals	3	391-2881-206	391-2881-200	391-2881-433
2.	Square Seal	1	391-2881-200	391-2881-403	391-2881-670
Series Section Seals					
1.	Square Seals	2	391-2881-206	391-2881-200	.....
3.	Square Seal	1	391-2881-627	391-2881-628	.....
Parallel and Series Section Component Parts. See Figure 1					
4.	Back Cap Screws	2	391-1433-020	391-1433-009	(4) 391-1402-068
4A.	Lock washers	8	.....	.....	391-3783-039
5.	Back Cap	1	341-6000-100	342-6000-100	341-0585-099
6.	Retainer Plates	3	391-2183-001	391-2183-005	391-2183-157
7.	Back up Rings	2	391-2681-378	391-2681-426	391-2681-285
8.	Spool Seals	2	391-1985-014	391-2887-212	391-2881-096
9.	Retainer Plate Screws	2	391-1433-015	391-1433-002	(4) 391-1402-015
10.	Check Valve Cap	1	391-0581-044	391-0581-044	391-0585-099
	Or Valve Cap (F.I.N.)	1	391-2281-015	391-2281-015	.....
11.	**O Ring Seal	1	391-2881-204	391-2881-204	391-2881-249
12.	**Check Spring	1	391-3581-713	391-3581-713	391-3581-778
13.	**Check Valve Poppet	1	391-2481-069	391-2481-069	391-2383-091
Spring Centered and Detent Spool Operators. See Figure 2					
14.	Stripper Bolt	1	391-1432-022	391-1432-021	391-1402-452
15.	Centering Spring	1	391-3581-608	391-3581-633	391-3581-330
16.	Spring Guides	2	391-1642-045	391-1642-013	391-1642-161
17.	Detent Sleeve	1	391-3283-015	391-3283-008	391-3384-310
18.	Detent Balls	2	391-0282-010	391-0282-009	391-0282-011
19.	Detent Spring	1	391-3581-130	391-3581-015	391-3581-316
20.	Detent Poppet Retainer	1	391-2583-008	391-2583-006	391-3384-311
21.	Detent Spacer	1	.....	.....	391-3782-208

*Parallel Sealing Face includes inlets and mid-inlets.

**Not required in Float-in-neutral Sections.

Valve Disassembly Instructions

Reference exploded view and parts list for work section detail on page 2 and 3.



Step 1 - Valve Bank

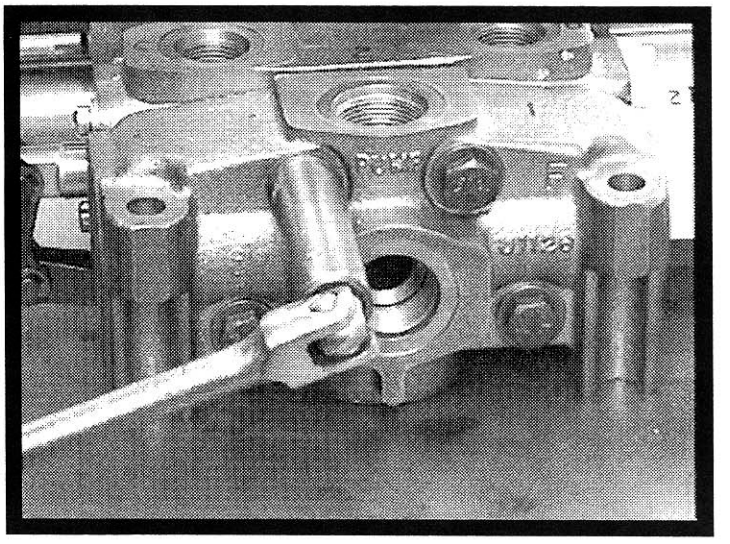
This step is the most critical step in the disassembly procedure. It should be followed very closely to ensure that the valve bank is properly reassembled after repairs have been made.

With a waterproof quick-drying marker, mark each casting with a sequential number. Start by marking the inlet casting with the #1 and finish by marking the outlet with the highest number.

Now mark the port boss closest to the back cap on each work section with a "B" (for back cap end).

Next mark the port boss closest to the spool clevis on each work section with a "C" (for clevis end).

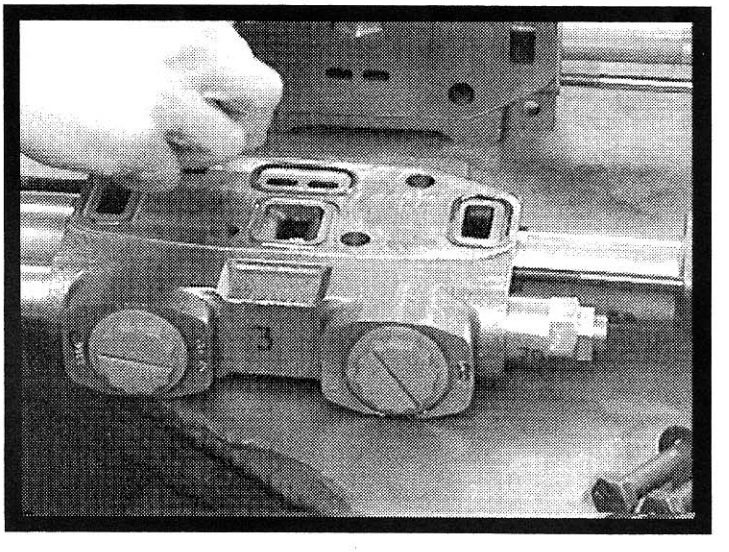
Lastly, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they are removed. Inlet and mid-inlet relief valves are marked with a casting number only.



Step 2 - Tie Bolts

Remove the four tie bolts that hold the bank together and separate the sections.

NOTE: VA valve tie bolts thread into the outlet casting. VG valve tie bolts pass through the entire bank requiring washers and hex nuts to be fastened at both ends of the bolt.

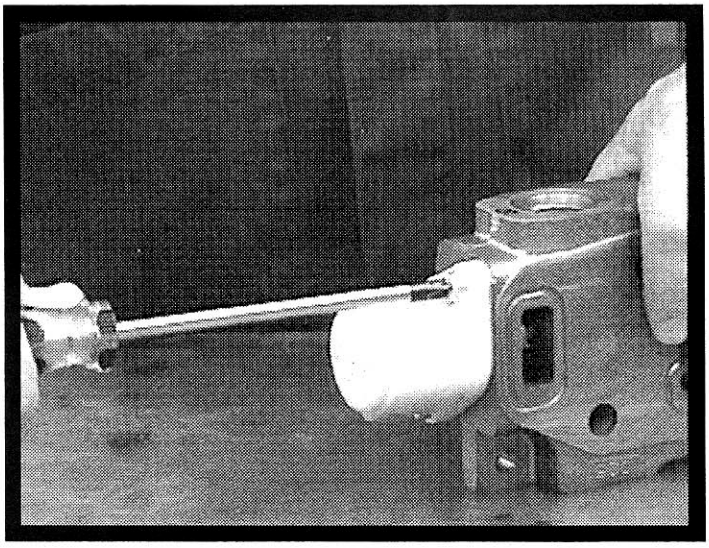


Step 3 - Section Seals

The inlet, mid-inlet, and each parallel work section have four section seals, (Fig. 1, items 1 & 2), on the downstream mating face. Series work sections and the VA/VG35 split flow mid inlets have three section seals on the downstream mating face, Fig. 1, items 1 & 3. These section seals should be removed and discarded.

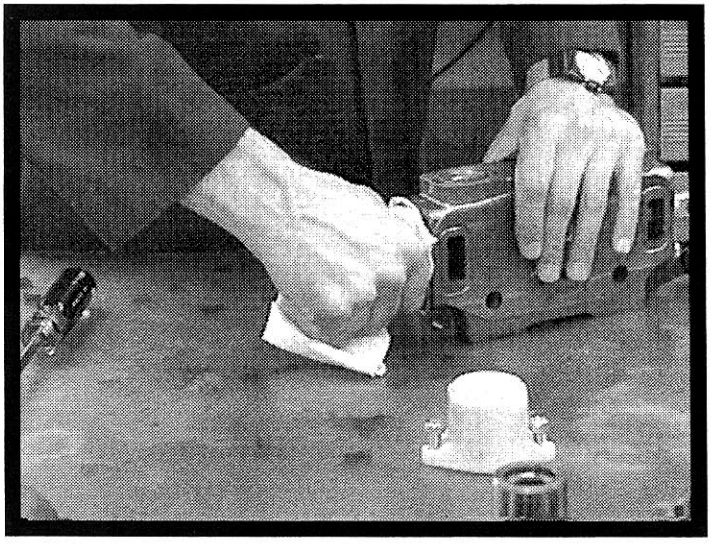
ALL WORK MUST BE PERFORMED IN A CLEAN AREA.

Valve Disassembly Instructions



Step 4 - Valve Back Cap

Remove the two cap screws (fig. 1, item 4) which fasten the back cap to the work section, lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (fig. 1, item 5).

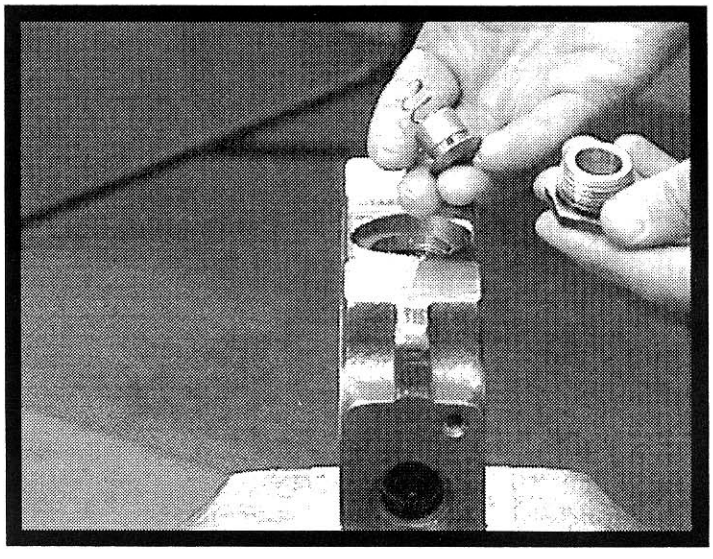


Step 5 - Control Spool and Seals

Grasp the spring end of the spool with a clean rag and pull the spool out of the housing using a twisting motion. Generally the rear retainer plate (item 6, fig. 1), back up ring (item 7, fig. 1), and spool seal (item 8, fig. 1) will come out with the spool.

CAUTION: For detented spool models, be careful not to remove the detent poppet sleeve (item 17, fig. 2) unless it is to be serviced.

Remove the two retainer plate screws (fig. 1, item 9) from the spool clevis end of the work section, lightly tap the end of the screwdriver handle with a hammer to break the adhesive. Remove the two retainer plates (fig. 1, item 6), the back up ring (item 7, fig. 1), and the spool seal (fig. 1, item 8). The spool should now be tagged or marked with the appropriate work section identification number, see Step 1. Spool seals (fig. 1, item 8) and back up rings (item 7, fig. 1) should be discarded.



Step 6 - Transition Check

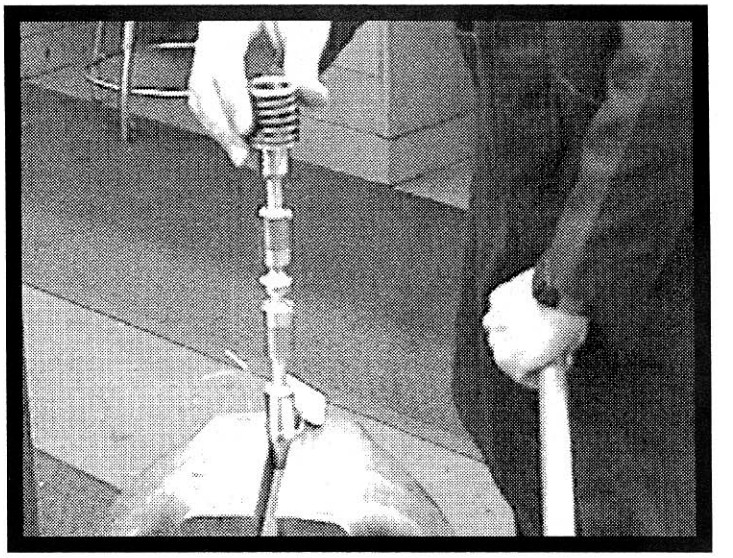
The transition check is located in the bottom center of the work section housing. Carefully clamp the work section in a vise with ports down. Do not clamp on the machined surface. Remove the check valve cap (item 10) and its O-ring seal (item 11, fig. 1). Discard the seal. Remove the check spring (item 12, fig. 1) and the check valve poppet (item 13, fig. 1).

NOTE: Only cylinder (ports blocked in neutral) work sections have a transition check. Motor sections have only a cap plug.

Valve Disassembly Instructions

Spool Disassembly

Spring Centered Spool



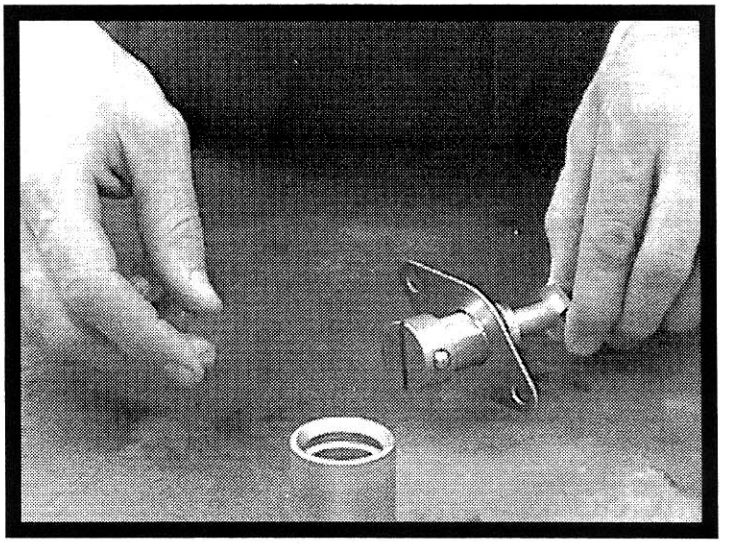
The spring assembly should not be removed from the spool unless these parts need to be replaced. Once the spool is free of the work section housing, it must be handled carefully to avoid damage. Place the spool vertically in a soft jawed vise, clamping on the flat spool clevis, and remove the stripper bolt (item 14, fig. 1) with a wrench.

Lightly tapping the stripper bolt with a hammer and a punch can break the adhesive. Cautious application of heat may be required to free the stripper bolt because an anaerobic thread adhesive is used during the assembly.

CAUTION: Too much heat may distort the spool.

As the stripper bolt threads disengage, the spring (item 15, fig. 2) and spring guides (item 16, fig. 2) will pop free of the spool.

Detent Spool



The detent assembly should not be removed from the spool unless these parts need to be replaced. Wrap the detent sleeve (item 17, fig. 2) with a clean rag. Grip the rag covered sleeve and pull firmly. As the sleeve moves backwards, the detent balls (item 18, fig. 2) and the detent spring (item 19 , fig. 2) will pop free. The rag should capture these parts and prevent their loss.

Next, clamp the spool in a soft jawed vise and remove the detent poppet retainer (item 20, fig. 2), placing an undersized bar through the detent ball bore can serve as a wrench. Lightly tapping the detent poppet retainer with a hammer and a punch can break the adhesive. Cautious application of heat may again be required because an anaerobic adhesive is also used in the detent retainer assembly.

CAUTION: Too much heat may distort the spool!

CLEANING, INSPECTION, AND REPAIR

1. Inspect the spool bore, transition check seat, and spool from each section for deep scratches, gouges, or excessive wear. If any of these conditions exist, replace the section. Minor surface damage on the control spool and check poppet may be carefully polished away with a very fine crocus cloth.

2. Examine the machined surfaces of the valve housing for nicks and burrs that could cause leakage between sections. Lightly stone these surfaces to remove any rough spots.

CAUTION: A shallow milled relief area extends across the O-ring face of the valve housing. This should not be stoned or ground off!

3. Wash all parts thoroughly in a clean solvent and blow dry before beginning reassembly. Pay special attention to the number and letters marked on the parts in Step 1. If any marks are removed during cleaning, remark immediately.

4. Clean adhesive from threads of spool, stripper bolt, housing, cap screws, and hex nut with Loctite™ Chisel Gasket Remover.

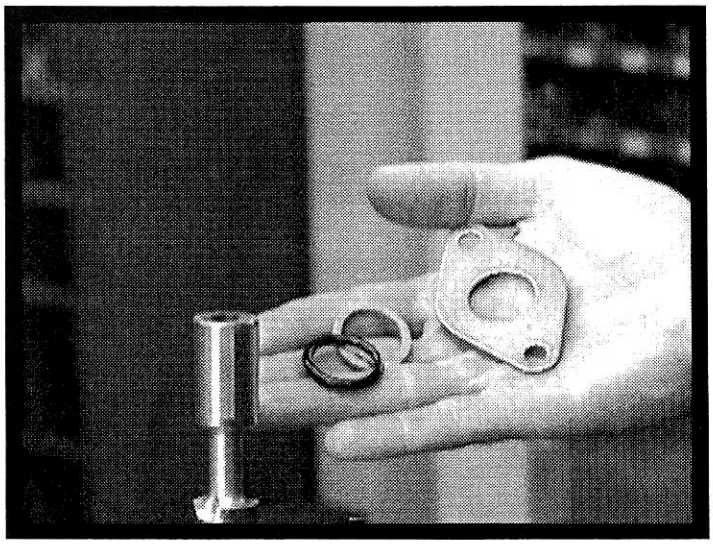
Valve Assembly Instructions

Preparation of Parts

Spray the threads of the new stripper bolt (item 14, fig. 2), tapped threaded spool end, all screws, and screw holes on both ends of the housing with LOCQUIC Primer Grade NF™ and let dry.

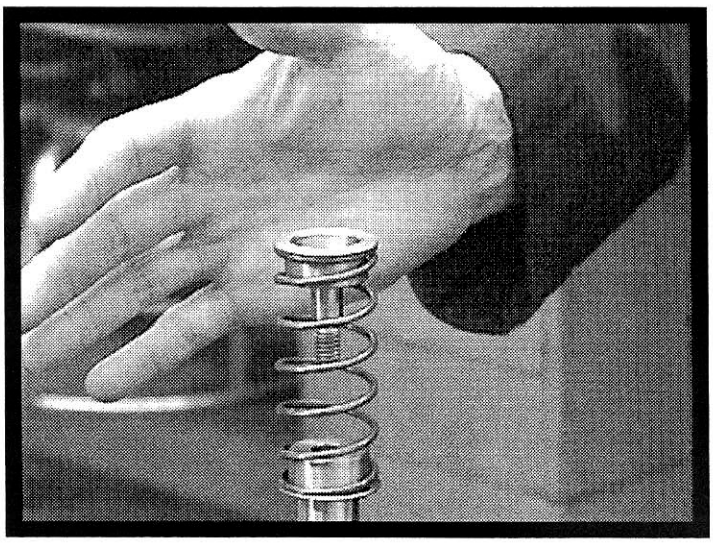
CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or failure of the product. Product should be thoroughly tested to ensure proper operation before the valve is put back into service.

Spring Center Spool Assembly



Step 1 - Spool Assembly-Spring Centered

Clamp the flat clevis end of the control spool in a soft jawed vise. Apply Parker Super-O-lube™ to the spool seal (item 8, fig. 1) and slide it onto the end of the spool away from the clevis. Slide on the back up ring (item 7, fig. 1) and retainer plate (item 6, fig. 1). Slide these items far enough onto the spool to keep them out of the way during assembly of the spool operator mechanism. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



Step 2 - Attach Spring Guides and Spring

Apply 2 - 3 drops of Loctite 262™ or equivalent anaerobic adhesive near the middle of the female threads in the spool. Assemble the spring guides (Item 16, fig. 2), centering spring (item 15, fig. 2), and stripper bolt (item 14, fig.2) onto the spool (Reverse of Step 7). Torque the stripper bolt to 175 in. lbs. +/-4 in. lbs..

CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding. Check for binding by compressing the spring and guides or by rotating the spring guide nearest the housing.

CAUTION: Follow the adhesive manufacturer's instruction for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure!

Lightly coat the spring assembly with high temperature grease to prevent rusting. Set the spool assembly aside and let cure for a minimum of 1 hour. After curing, test the stripper bolt to be sure it withstands 125 in. lbs. of breakaway torque.

Valve Assembly Instructions

Detent Spool Assembly

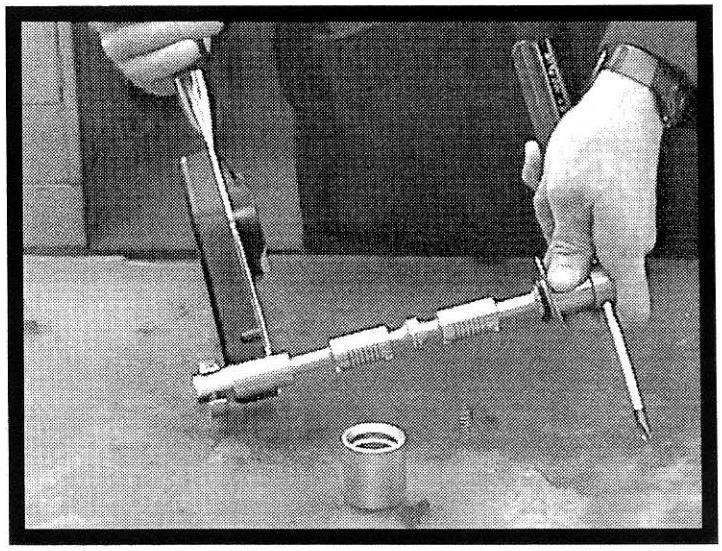
Step 1 - Spool Assembly-Detent

Apply Parker Super-O-lube to the spool seal (item 8, fig. 1) and slide it onto the spool. Slide the back up ring (item 7, fig. 1) and one retainer plate (item 6, fig. 1) onto the spool. Slide these items far enough onto the spool to keep them out of the way during assembly of the spool operator mechanism. Do not allow the O-ring to come in contact with the sharp edge of the spool notches. Apply 2 - 3 drops of Loctite 262 or equivalent anaerobic adhesive near the middle of the female threads in the spool.

CAUTION: Follow the adhesive manufacturer's instruction for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure.

Step 2 - Spool Assembly-Detent

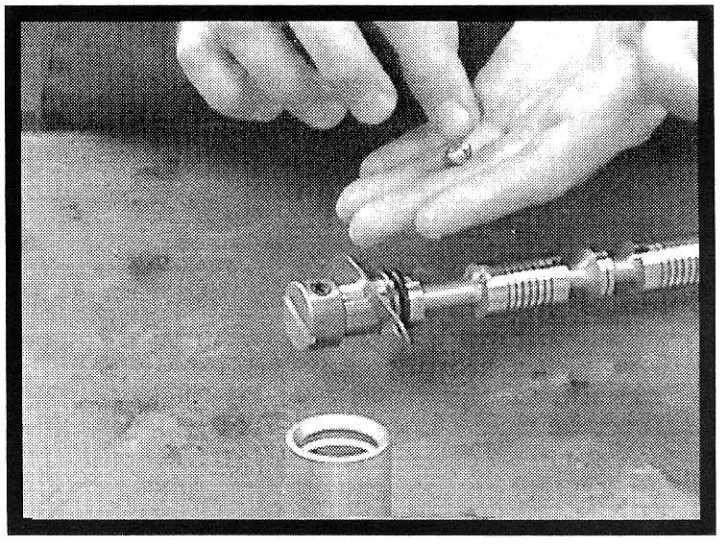
Thread the detent ball retainer (item 20, fig. 2) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs.. This can be accomplished by using a crows foot socket on the flats of the clevis and holding the spool by inserting a round steel rod or screwdriver through the hole in the ball retainer.



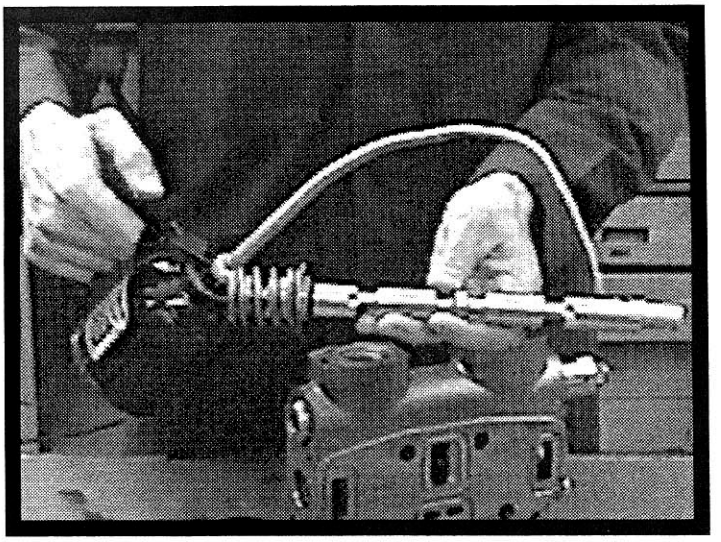
Step 3 - Detent Balls and Spring

Next, lightly coat the detent balls (item 18, fig. 2), detent spring (item 19, fig. 2), and entire I.D. of the detent sleeve (item 17, fig. 2) with high temperature grease.

Insert the detent spring into the through hole in the detent ball retainer. Place the steel balls on the ends of the spring. Compress the balls and spring, then slip on the detent sleeve. Note: The detent sleeve is not symmetrical; one end of the sleeve has a lead-in chamfer, this chamfer must face the spool clevis when assembled. Move the detent sleeve to the neutral or middle position to prevent the sub-assembly from coming apart during subsequent assembly.



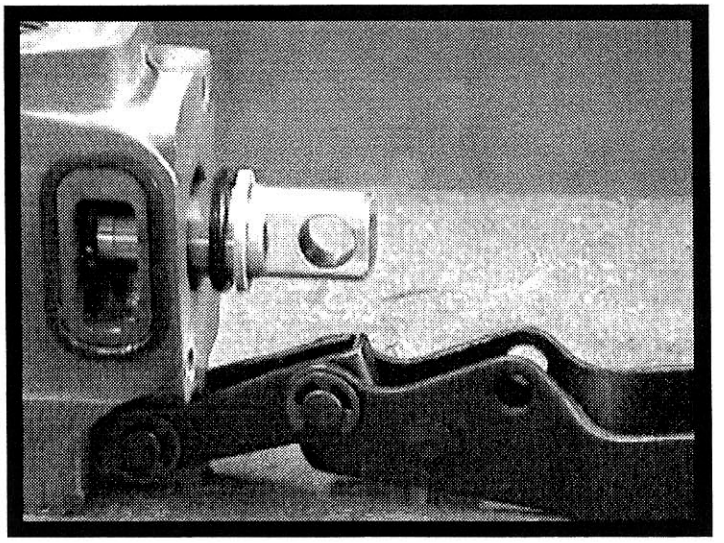
Valve Assembly Instructions



Step 1 - Spool Sub-assembly

Apply 2 - 3 drops of Loctite 262 or equivalent to the fillister screw holes on both ends of the housing.

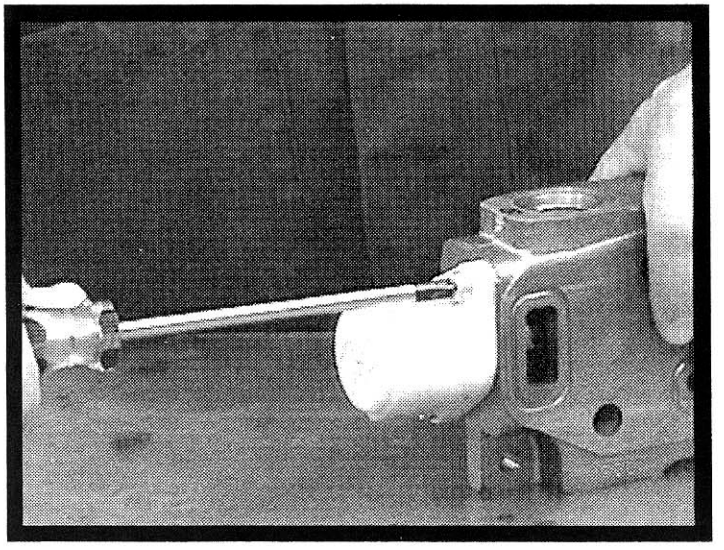
Apply a light coating of clean hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll, or damage the seals. Make sure that the spool and the housing are in the proper orientation (see Step 1, page 6 disassembly).



Step 2 - Spool Seal and Back up

Apply Parker Super-O-lube to the spool seal (item 8, fig. 1) and slide it onto the spool. Slide on the back up ring (item 7, fig. 1). Push both items into the counter-bore until they bottom out.

Assemble the two front retainer plates (item 6, fig. 1). using the two shorter fillister screws (item 9, fig. 1). Check retainer plates for proper alignment. Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs..



Step 3 - Back cap

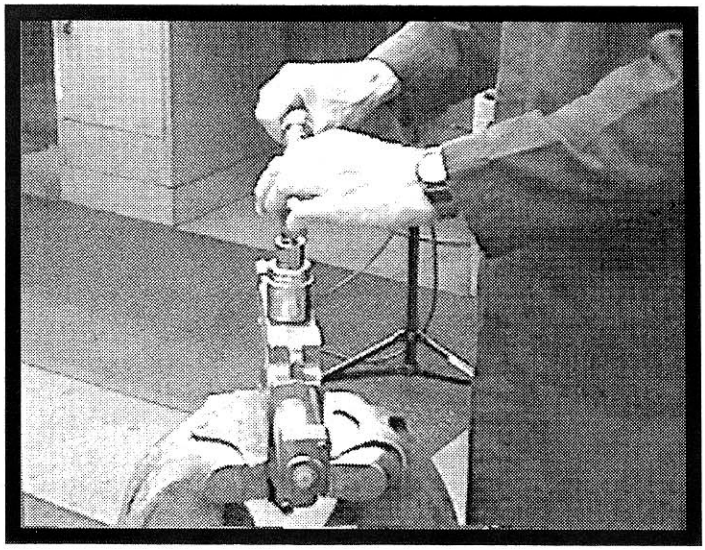
Install back cap with the two longer fillister screws (item 4, fig. 1). Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs..

Caution: Excessive torque will damage back cap ears!

Valve Assembly Instructions

Step 4 - Install Transition Check

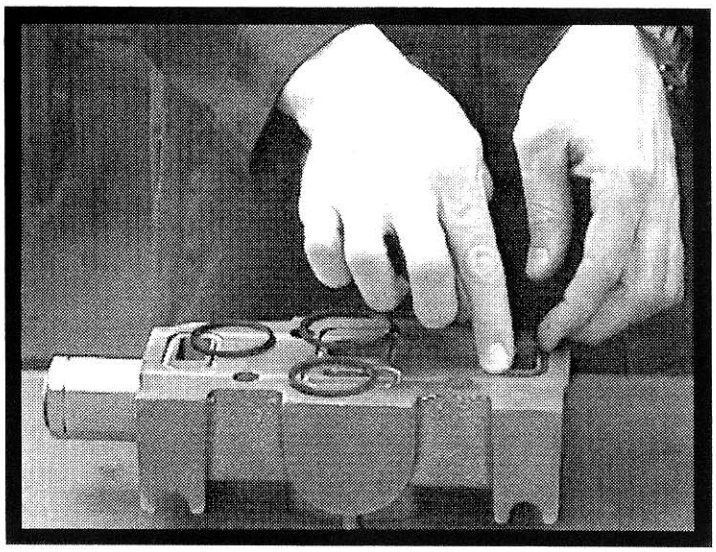
Inspect transition check components for cleanliness. Install check poppet (item 13, fig. 1) into the transition check cavity. Align the check spring (item 12, fig. 1) square to poppet, then carefully start check cap (item 11, fig. 1) over the poppet and spring. Engage several threads by hand. Tighten to a final torque of 75 ft. lbs. +/-4ft. lbs..



Step 5 - Relief Valves

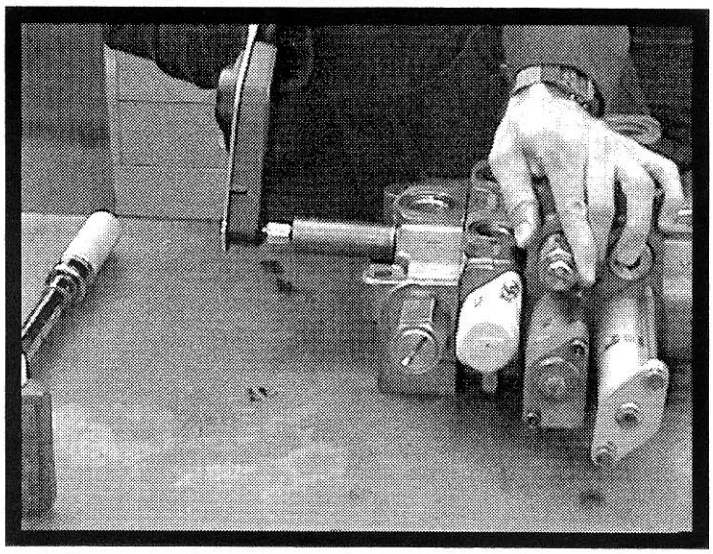
Return all relief valves to their proper positions and torque to 75 ft. lbs..

Install new section seals. Place section seals (items 1 & 2, or items 1 & 3) in the proper grooves (see Figure 1). Be sure seals stay in their grooves during assembly.



Step 6 - Install Tie Bolts

Slide the tie bolts through the inlet casting. If cap screws are used, place a washer on the cap screw prior to installation. Place the valve sections on the tie bolts in their proper sequence (see Step 1, page 4). Engage threads in the outlet several turns by hand. If it is a VG series assembly, assemble nut and washer to one end of the stud and follow above instructions. Torque the tie bolts in a cross corner pattern.



Tie Bolt Torque Values

VA20 - 29 ft. lbs. (348 in. lbs.)

VG20 - 42 ft. lbs. (504 in. Lbs.)

VA35 - 34 ft. lbs. (408 in. Lbs.)

VG35 - 75 ft. lbs. (900 in. Lbs.)

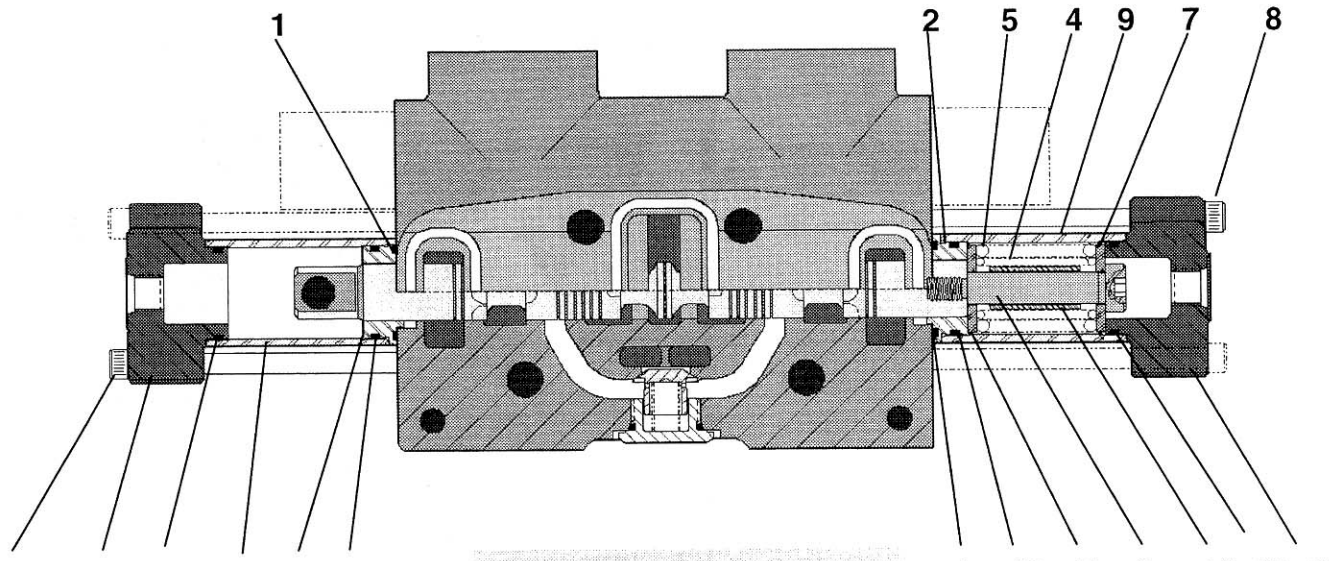
VG80 - 150 ft. lbs. (1800 in. lbs.)

Cutaway for VA/VG Remote Control Operators

Read these instructions carefully. Failure to follow these procedures can result in poor performance or product failure. Make sure all work is done in a clean area.

REMOTE END CAP SEAL PARTS LIST

Item	Description	Qty.	VA/VG20	VA/VG35	VG80
1.	O-rings	2	391 2881 625	391 2881 625	391 2881 124
10.	O-rings	4	391 2881 242	391 2881 242	391 2881 106



Hydraulic Remote Control
Figure 3

REMOTE CAP COMPONENTS - Figure 3

1. O-rings (2)
2. Seal retainers (2)
3. Shoulder bolt
4. Return spring, inner
5. Return spring, outer
6. Valve caps (2)
7. Spring retainers (2)
8. Cap screws (4), (*8)
9. End tubes (2)
10. O-rings (4)
11. Stop tube

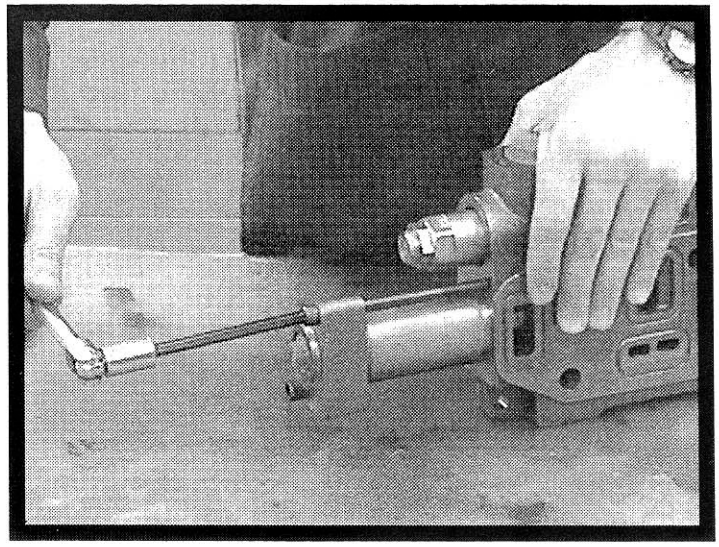
*** Required for VG80**

Remote Control Operator Disassembly

Step 1 - Remote End Caps

Remove cap screws (item 8, fig. 3) from both ends of the valve section. Lightly tapping the cap screw will help break the bond of the anaerobic adhesive.

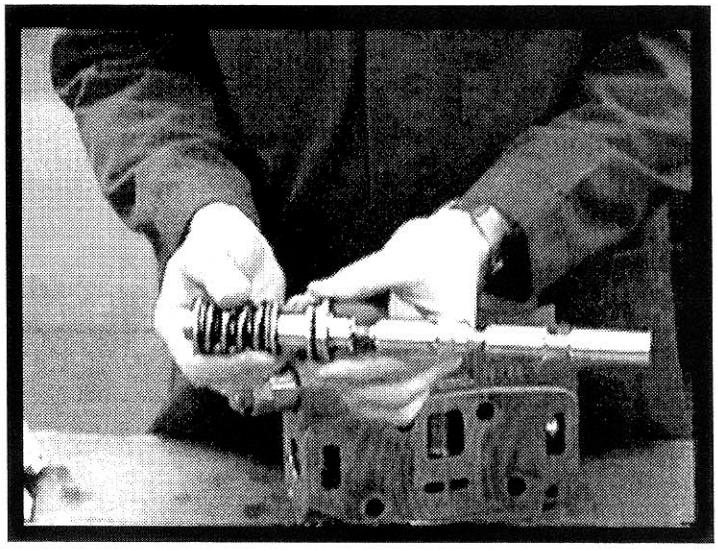
Remove valve caps (item 6, fig. 3), O-ring seals (item 10, fig. 3), and end tubes (item 9, fig. 3) from each end of the valve housing. Discard the O-ring seals.



Step 2 - Spool Sub-assembly

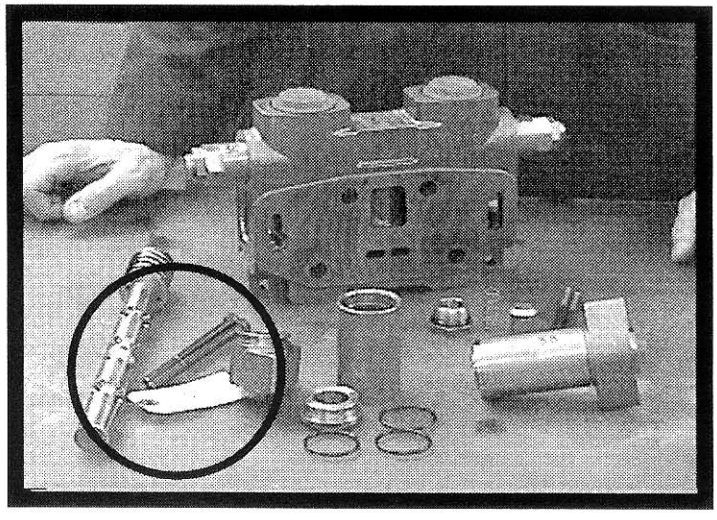
Slide the seal retainer (item 2, fig. 3) from the clevis end of the spool assembly. Grasp the spool assembly by the spring end and slide it out of the housing. Remove the other seal retainer by sliding it over the spool.

Now, remove the O-ring seals (items 1 & 10, fig. 3) from both seal retainers and discard the seals.

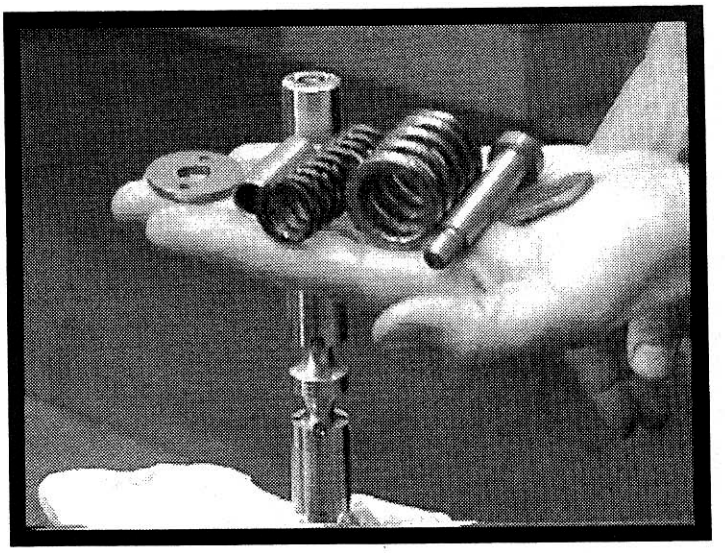


Step 3 - Spool Identification

The spool should now be tagged or marked with the appropriate work section identification number (see Step 1, page 4).



Remote Control Operator Disassembly



Step 4 - Spring Pack

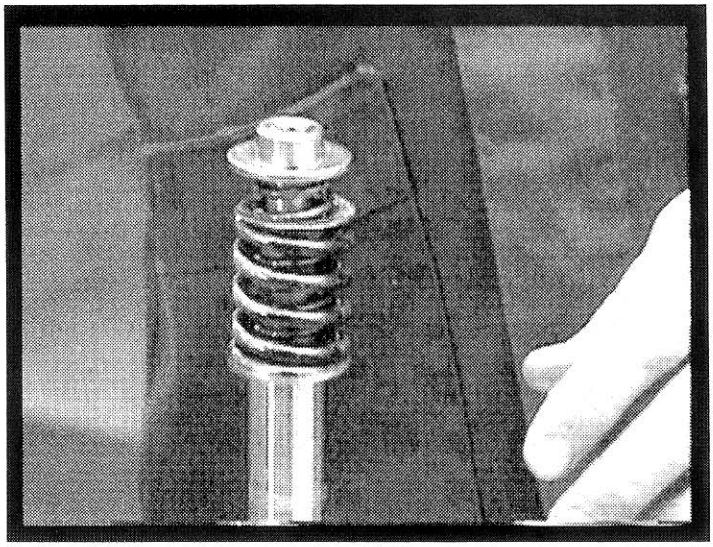
The spring assembly should not be removed from the spool unless it needs to be replaced. Insert the clevis end of the spool in a soft jawed vice. It may be necessary to apply heat to the stripper bolt to loosen the anaerobic adhesive.

Use heat carefully to avoid warping the spool.

Always Work In A Clean Environment

Remote Control Operator Assembly

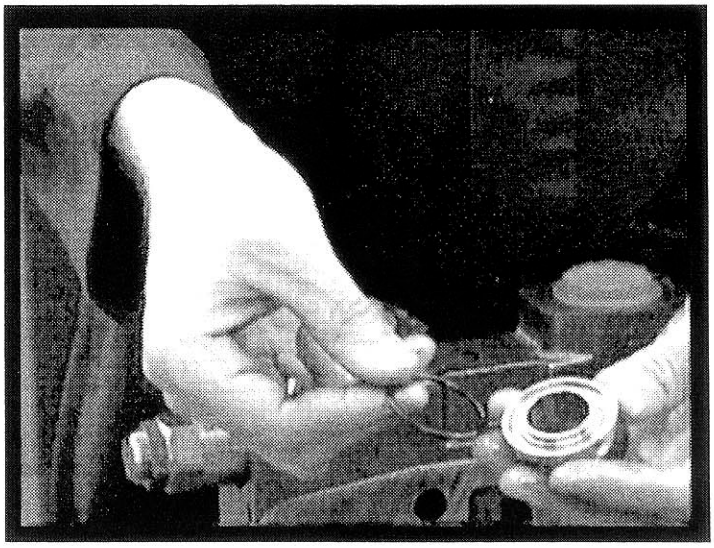
Step 1 - Spring Pack



If the shoulder bolt and spring assembly were disassembled, place the spool in a soft-jawed vise with the tapped and threaded end up. Carefully clamp on the flat spool clevis. Apply 2 - 3 drops of Loctite 262 or equivalent to the middle of the female threads in the spool end. Assembled joints should be allowed to cure for a minimum of one hour before being subjected to hydraulic test.

Slide one of the spring retainers (item 7, fig. 3) onto the shoulder bolt (item 3, fig. 3) followed by the stop tube (item 11, fig. 3). Next, slide springs (items 4 & 5 , fig. 3) onto shoulder bolt. Place the other spring retainer on the end of the spool and start the shoulder bolt into the hole by hand. Torque the shoulder bolt to 175 in. lbs. using a torque wrench.

CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding.

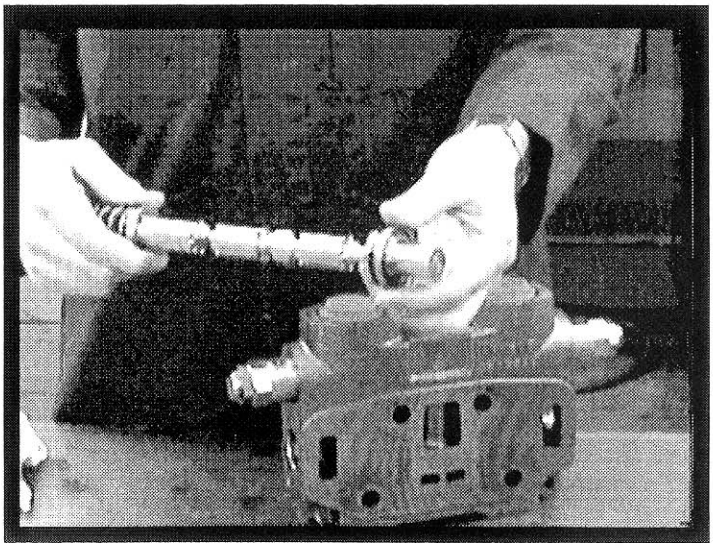


Step 2 - Seal Retainers

Install the two O-ring seals (items 1 & 10, fig. 3) on both seal retainers (item 2, fig. 3). Apply Parker Super-O-Lube to the O-ring seals.

CAUTION: The O-ring seals are similar in size. Be sure to insert O-ring seals 1 & 10 in their proper position. They are not interchangeable!

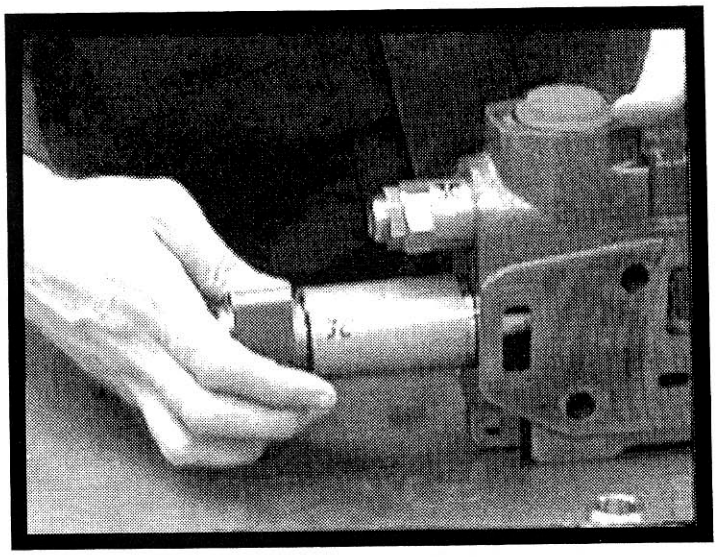
Step 3 - Spool Installation



Apply 2 - 3 drops of Loctite 262 or equivalent to the cap screw holes on both ends of the housing.

Slide one of the seal retainers over the spool and up against the spring retainer. Make sure the O-ring (item 1, fig. 3) is facing the section casting. Apply a light coating of clean hydraulic oil to the valve spool. Carefully insert the spool into the housing. Use caution to avoid causing burrs.

Remote Control Operator Assembly



Step 4 - Assemble End Caps

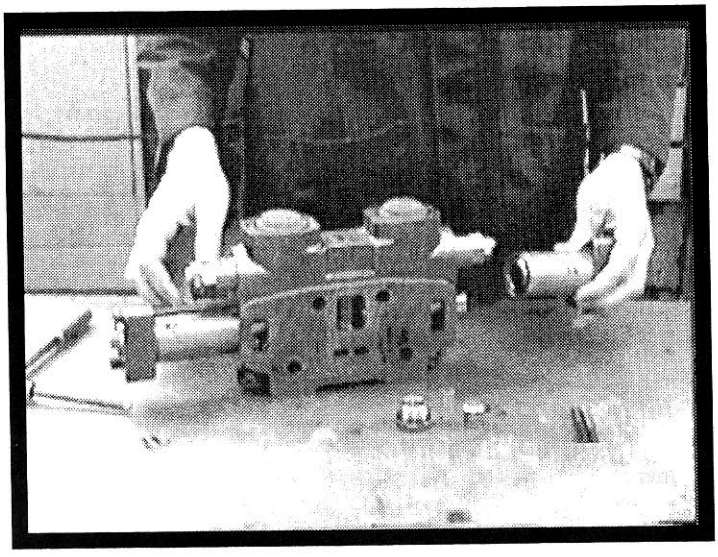
Apply a light coat of grease to the valve cap O-rings (item 10, fig. 3). Assemble the O-rings onto both of the cast iron valve caps (item 6, fig.3). Slide the end tube (item 9, fig. 3) over the spring end of the spool. Position the cast iron valve cap, as shown, on the end tube and push into place. Be careful not to shear the valve cap seal during installation.

Install two cap screws (item 8, fig. 3), tighten evenly and torque to the final specification.

VA20/VG20 to 100 in. lbs.

VA35/VG35 to 175 in. lbs.

VG80 to 175 in. lbs.



Step 5 - Complete End Cap Assembly

Install seal retainer (item 2, fig. 3) with seals on the clevis end of the spool. Install the end cap tube (item 9, fig. 3), the valve cap (item 6, fig. 3), and the cap screws (item 8, fig. 3) as previously described.

Step 6 - Assemble Transition Check

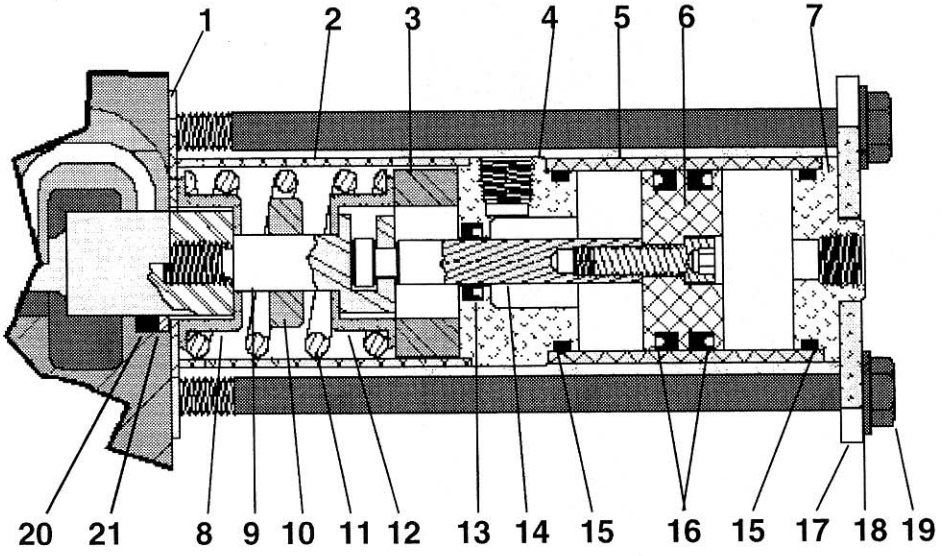
Inspect the transition check components for cleanliness. Install a new O-ring seal (item 11, fig. 1) on the check valve cap. Place the check poppet (item 13, fig. 1) into the housing. Align the check spring (item 12, fig. 1) square to the poppet then carefully start the check cap (item 10, fig. 1) over the check poppet. Engage several threads by hand. Tighten to final torque of 75 ft. lbs. +/- 4 ft. lbs..

CAUTION: Failure to follow these recommended assembly instructions can result in poor performance or failure of the product. Product should be thoroughly tested to ensure proper operation before the valve is put back into service.

USE ONLY ORIGINAL COMMERCIAL HYDRAULICS REPLACEMENT PARTS

Cutaway for Pneumatic Control Operators

SEAL PARTS LIST - Figure 4				
Item	Description	Qty.	VA/VG20	VA/VG35
13.	Wiper seal	1	391 2883 165	391 2883 165
15.	O-rings	2	391 2881 625	391 2881 625
16.	Wiper seals	2	391 2883 164	391 2883 164

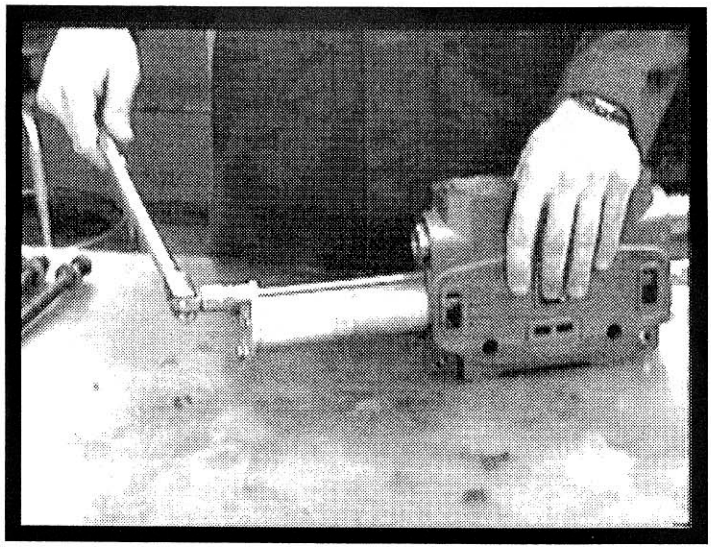


Single Ended Pneumatic Cap
Figure 4

PNEUMATIC CAP COMPONENTS VA/VG20 AND VA/VG35 - Figure 4

1. Retaining Plate
2. Spacer tube
3. Spacer
4. Flange
5. Pressure tube
6. Piston
7. Seal retainer
8. Spring retainer
9. Stripper bolt
10. Stop tube
11. Spring
12. Spring retainer
13. Wiper seal
14. Piston rod
15. O-rings (2)
16. Wiper seals (2)
17. Retainer plate
18. Washers (2)
19. Cap screws (2)
20. Spool Seals (2)
21. Back up rings (2)

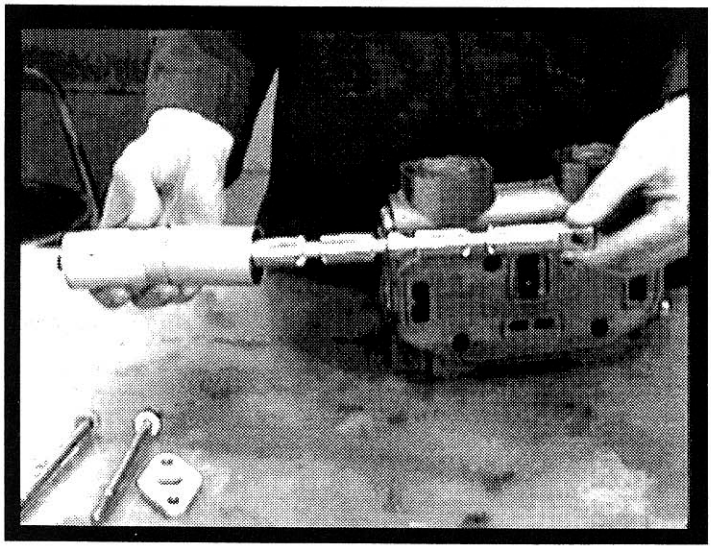
Pneumatic Section Disassembly



Step 1 - Pneumatic End Cap

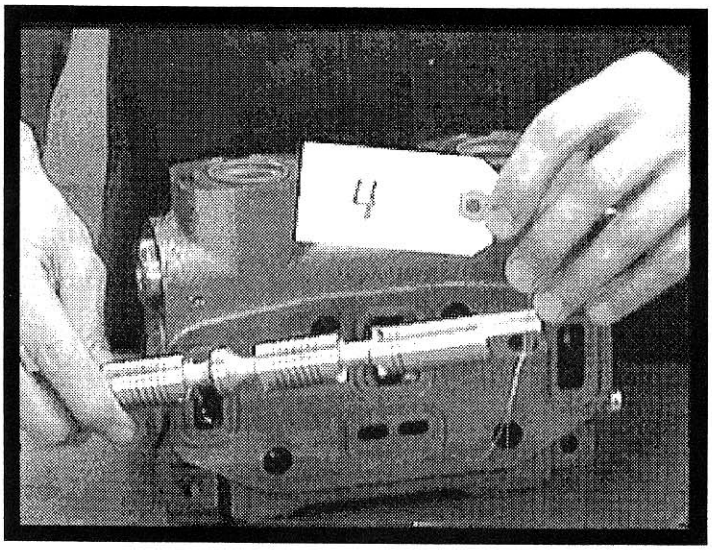
Remove the two hex head cap screws (item 19, fig. 4) and retainer plate (item 17, fig. 4) . Loctite was used to hold fasteners. Slide the end cap and spool assembly out of the valve body as one assembly.

Remove the two retainer screws (not shown) from the clevis end of the spool, lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the two retainer plates, back up ring, and spool seal. Discard the spool seals and back up rings from both ends of the work section.



Step 2 - Spacer Tube

Now slide the spacer tube (item 2, fig. 4) off of the spool to expose the spring (item 11, fig. 4) and spring retainers (items 8 and 12, fig. 4). Disconnect the piston rod (item 14, fig.4) from the stripper bolt (item 9, fig. 4). Slide the spacer (item 3, fig. 4) and flange (item 4, fig. 4) off the piston rod. Remove the wiper seal (item 13, fig. 4) and O-ring (item 15, fig.4) from the flange and discard.



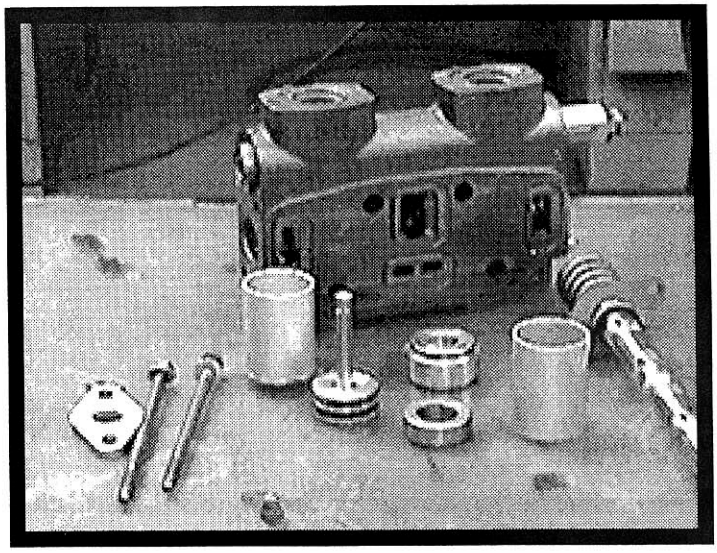
Step 3 - Spool Identification

The spool should now be tagged or marked with the appropriate work section identification number (see Step 1, page 6).

Pneumatic Section Disassembly

Step 4 - Pneumatic End Cap

Slide piston (item 6, fig. 4) and piston rod assembly out of the pressure tube exposing the two wiper seals (item 16, fig. 4). Remove the wiper seals and discard. Insert a screwdriver handle into the pressure tube and punch out the seal retainer (item 7, fig. 4). Remove the O-ring (item 15, fig. 4) and discard.

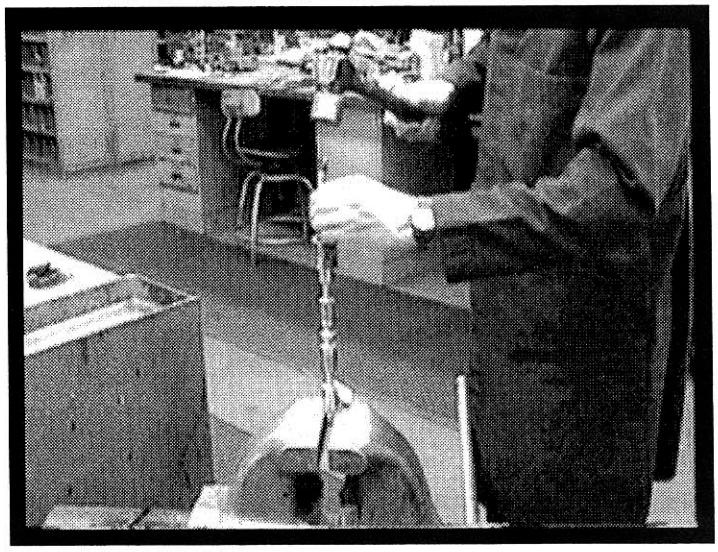


Step 5 - Stripper Bolt

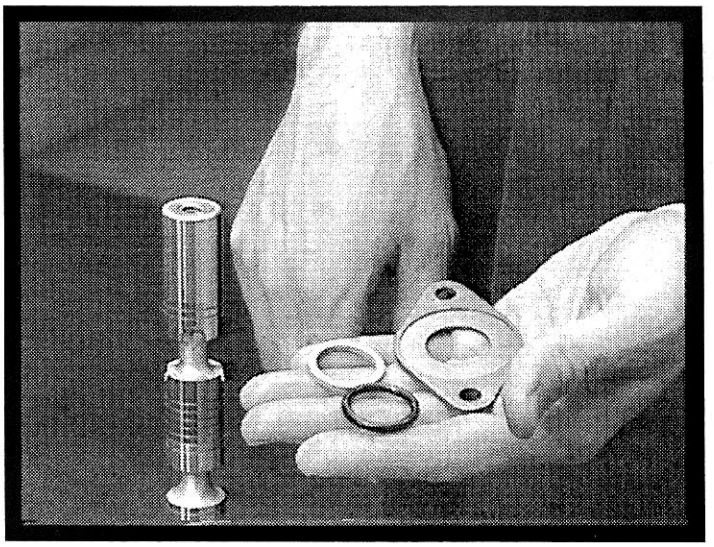
The spring assembly should not be removed from the spool unless these parts are being replaced. Carefully place the spool clevis in a soft jawed vise. Lightly tap the stripper bolt with a hammer and punch to break the adhesive. If it does not break free, cautiously apply heat.

Caution: Too much heat may distort the spool.

As the stripper bolt threads disengage, the spring (item 11, fig. 4) and spring retainers (items 8 and 12, fig. 4) will pop free.

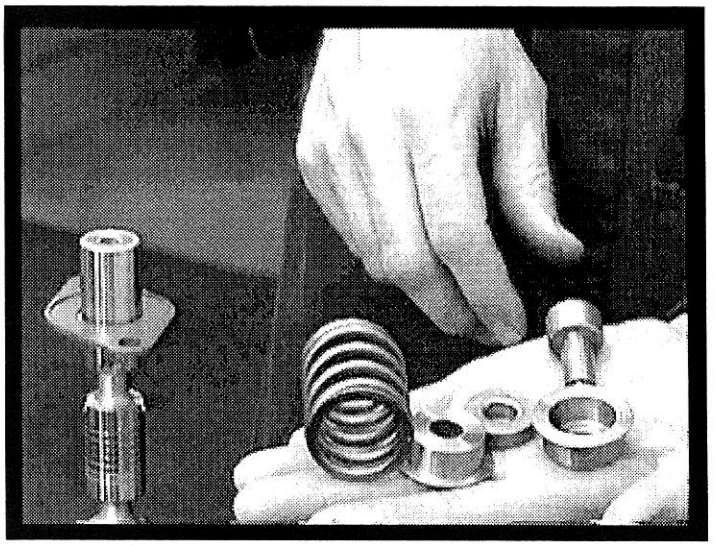


Pneumatic Section Assembly



Step 1 - Spool Assembly

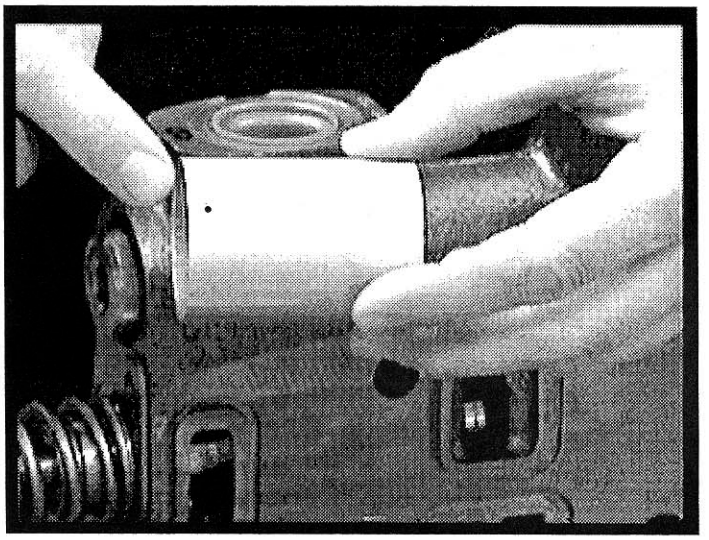
Clamp the flat clevis end of the control spool in a soft jawed vise. Apply Parker Super-O-Lube to the spool seal (Item 20, fig. 4) and slide it onto the end of the spool away from the clevis. Slide on the back up ring (Item 21, fig. 4) and retainer plate (Item 6, fig. 4). Slide these items far enough onto the spool to keep them out of the way during the assembly of the spool operator mechanism. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



Step 2 - Spring Assembly

Apply 2 - 3 drops of Loctite RC680™ or equivalent anaerobic adhesive near the middle of the female threads in the spool. Place the spring retainer (item 8, fig. 4) over the end of the spool followed by the centering spring (item 11, fig. 4). Place the stop tube (item 10, fig. 4) in the spring and cap with the other spring retainer (item 12, fig. 4). Insert the stripper bolt (item 9, fig. 4) and torque to 180 in. lbs..

Apply a light coating of clean hydraulic oil to the valve spool. Carefully insert the spool into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll, or damage seals. Make sure the spool and the housing are in the proper orientation



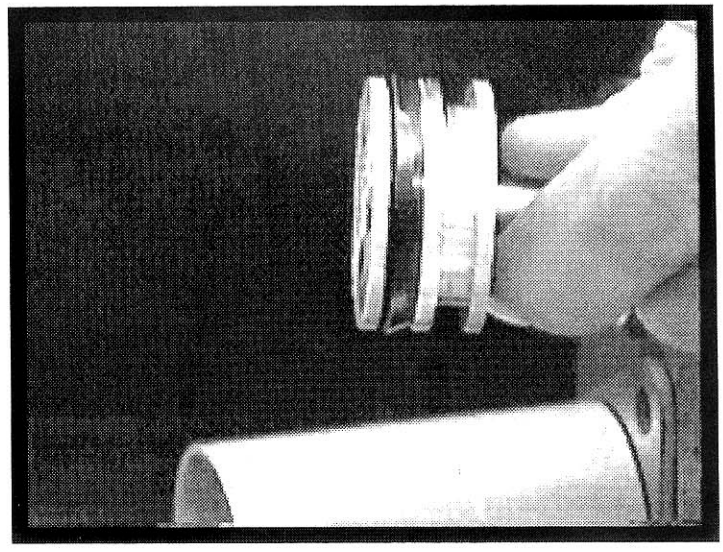
Step 3 - Spacer Tube

Install the spacer tube (item 2, fig. 4) over the spring with the vent hole positioned away from the section casting.

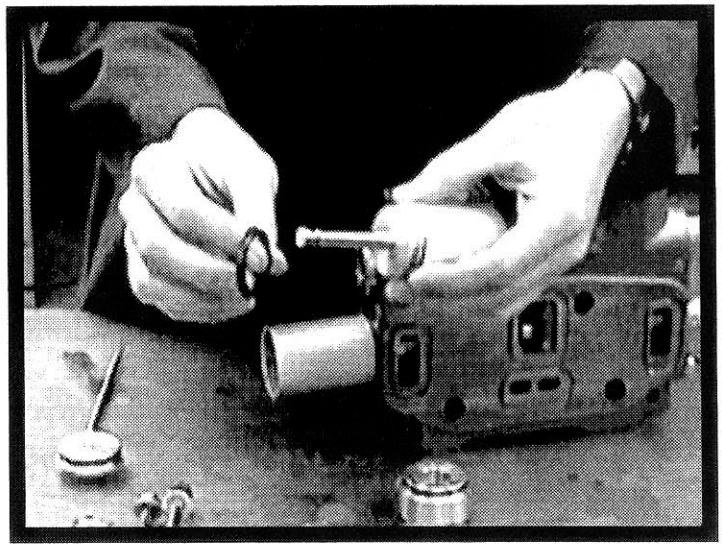
Pneumatic Section Assembly

Step 4 - Air Piston Assembly

Apply Parker Super-O-Lube to the wiper seals (item 16, fig. 4) and install one seal in the groove farthest from the piston rod (item 6, fig. 4). The wiper seal has a cup design that must be installed with the open cup facing the end of the piston. Slide the piston, rod end first, into the the pressure tube (item 5, fig. 4).

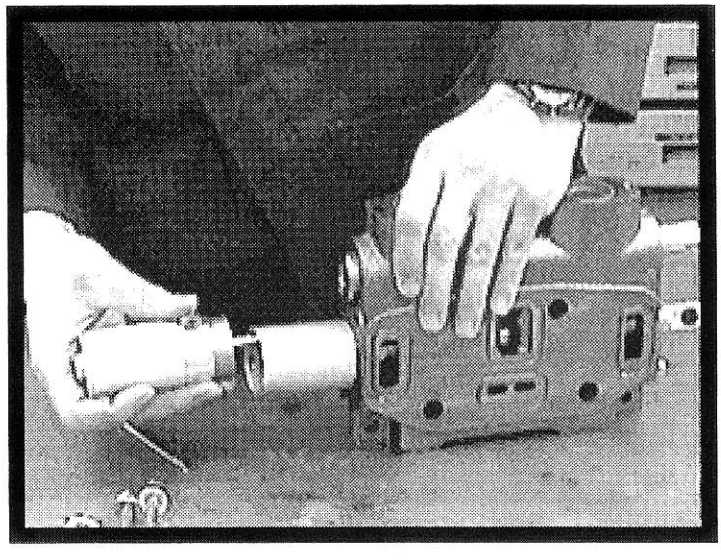


Push the piston through the pressure tube and expose the wiper seal groove closest to the rod. Install the second wiper seal with open cup facing the piston rod. Slide the piston into the pressure tube and leave the piston rod extended beyond pressure tube.

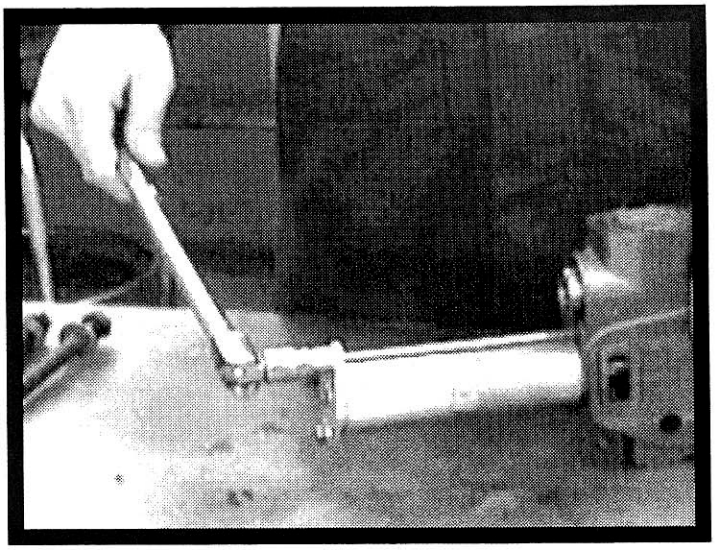


Step 5 - Piston Subassembly

Apply Parker Super-O-Lube to the wiper seal (item 13, fig. 4) and O-rings (item 15, fig. 4). Squeeze the wiper seal and insert it into the seal groove in the flange (item 4, fig. 4) with the open cup facing inward. Install O-ring (item 15, fig. 4) on the flange. Carefully slide the flange onto the piston rod. Pull the piston rod through the flange until the piston bottoms on the flange. Slide the spacer (item 3, fig. 4) over the piston rod. Insert the end of the piston rod into the slot in the stripper bolt.



Pneumatic Section Assembly



Step 6 - End Cap Assembly

Install the retainer plate (item 17, fig. 4) over the seal retainer (item 7, fig. 4). Apply 2 to 3 drops of Loctite 262 inside the tapped holes in the housing. Put the washers (item 18, fig. 4) on the 6 1/4" cap screws (item 19, fig. 4). Push the cap screws through the retainer plate and screw them into the valve housing. Be sure all parts are properly aligned and seated. Torque the cap screws to 25 - 30 in. lbs..

CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or failure of the product. Product should be thoroughly tested to ensure proper operation before the valve is put back into service.

Cutaways for Main Relief Valves

Main System Relief Valve

The main relief valve protects the hydraulic system against overload pressures. It is typically located in the inlet casting, as well as, mid-inlet sections used in the valve bank. Figure 6 illustrates the arrangement of the parts and serviceable seals for the differential area main relief valve. Figure 7 illustrates the serviceable components found in the pilot operated main relief. These cartridge type relief valves are removed from the valve bank as a sub-assembly and replaced or serviced.

VA20/VG20, VA35/VG35 Main Differential Area Relief Valve Part Numbers:

355-9107-035
355-9107-061
355-9107-013
355-9001-082
355-9107-385

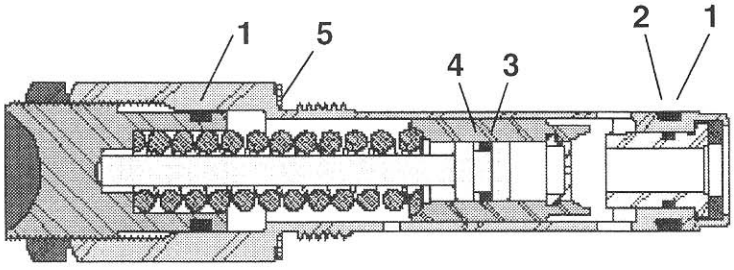


Figure 6

NOTE: When installing relief valve, torque to 75 ft. lbs.

SERVICE PARTS LIST - Figure 6				
Item	Description	Qty	VA/VG20	VA/VG35
1.	O-rings	2	391-2881-332	391-2881-336
2.	Back up Ring	1	391-2681-373	.....
3.	O-ring	1	391-2881-156	391-2881-137
4.	Back up Ring	1	391-2681-163	391-2681-165
5.	Gasket Washer	1	391-1583-013	391-1583-012

*Not all seals in the relief cartridge are serviceable

VG80 Main Pilot Operated Relief Valve Part Numbers:

355-9001-008
355-9001-031

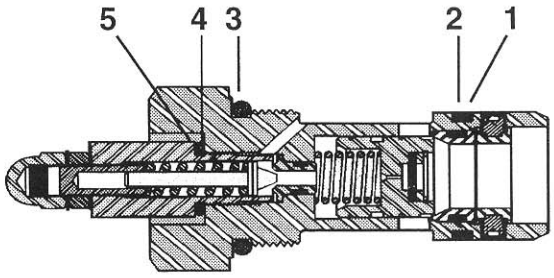


Figure 7

NOTE: When installing relief valve, torque to 75 ft. lbs.

SERVICE PARTS LIST - Figure 7			
Item	Description	Qty	VG80
1.	O-ring	1	391-2881-342
2.	Back up Ring	1	391-2681-303
3.	O-ring	1	391-2881-344
4.	O-ring	1	391-2881-208
5.	Gasket Washer	1	391-1581-001

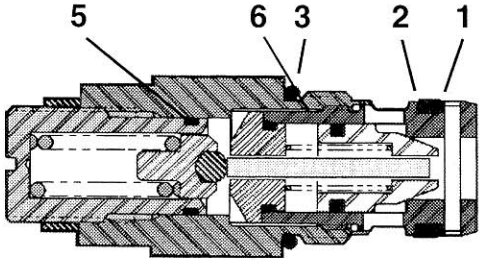
*Not all seals in the relief cartridge are serviceable

Cutaways for Port Relief Valves

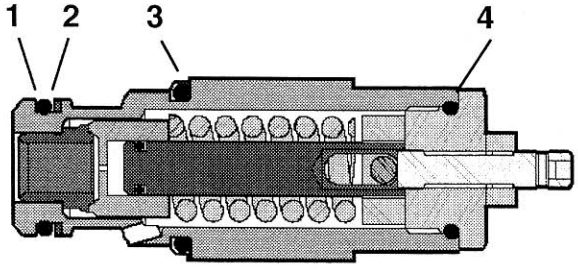
Work Port Relief Valve Options

The full-flow work port relief valve normally functions when the valve spool is in the neutral position. During over pressurization, fluid is discharged from the work port passage into the tank return passage of the valve work section. The pressure setting is normally higher than that of the main relief valve.

Avoid setting the main and port relief valves at the same pressure setting. If these relief valve settings are set too close interaction will occur causing chatter and possible instability of the load.



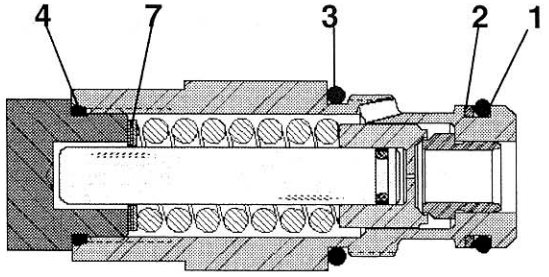
Pilot operated with anti-cavitation
355-9001-115



Differential area - screw adjusted
355-900X-308

NOTE: When installing relief valve, torque to 75 ft. lbs.

The pilot operated port relief with the anti-cavitation check can be used in all hi-boy work sections in the VA20/VG20, VA/VG35 and VG80 series. The differential area work port relief valve shown above can be used in VA20/VG20, VA/VG35 hi-boy sections if the section has the appropriate machining.



Differential area - shim adjusted
355-900X-143

SHIMS	
Part No.	**Pressure**
391-3782-103	502 psi
391-3782-104	122 psi
391-3782-105	40 psi

NOTE: When installing relief valve, torque to 75 ft. lbs.

SERVICE PARTS LIST			
Item	**Description**	**Qty.**	**Part No.**
1.	O-ring	1	391-2881-333
2.	Back up Ring	1	391-2681-510
3.	O-ring	1	391-2881-204
4.	O-ring	1	391-2881-246
5.	O-ring	1	391-2881-801
6.	O-ring	1	391-2881-363
7.	Shims	. . .	see chart above

*Not all seals in the relief cartridge are serviceable

Screw Adjustable Relief Valve Pressure Ranges and Adjustments

R/V Part #	Valve Series	Pressure Range - PSI	* 1/4 turns Equals PSI
355-9107-035	VA/VG20	800 - 2500	165
355-9001-061	VA/VG20	2501 - 3800	160
355-9107-013	VA/VG35	800 - 2000	80
355-9107-082	VA/VG35	2001 - 2500	121
355-9107-385	VA/VG35	2501 - 3500	249
355-9001-008	VG80	1000 - 2500	196
355-9001-031	VG80	2500 - 3500	290
355-9001-115	VA/VG20, 35, 80	500 - 5000	446
355-9001-308	VA/VG20, 35, 80	500 - 1250	95
355-9002-308	VA/VG20, 35, 80	1251 - 2650	138
355-9003-308	VA/VG20, 35, 80	2651 - 4200	188

*Adjustment pressures are an approximation

Guidelines for Setting Hydraulic Relief Valve Pressure :

- Release hydraulic pressure before connecting and disconnecting any gauge.
- Install an accurate pressure gauge as close to the pump as possible.
- Back out the relief valve adjustment screw without removing it.
- Warm the hydraulic oil by idling the engine with the PTO, and hydraulic pump engaged.
- As applicable, fully engage the control valve for the circuit being tested. Allow the cylinder to reach full extension.
- Raise the engine RPM to operating speed.
- If adjustment is necessary, obtain each final pressure by bringing the pressure gradually up to the proper setting. Do not bring the pressure to a higher setting then lower it to the desired setting.
- Tighten the lock nut and apply a sealant to avoid tampering.

⚠ Warning

Relief valve pressures should be set according to the original equipment manufacturer's specifications. Exceeding the specifications could cause a failure in the hydraulic system or with the mechanical structure of the equipment. These failures could cause serious personal injury or death.

DVA20 - DVG20 - VA20 - VG20 - VALVE SEAL KITS

NOTE: BOLD PART NUMBERS ARE DISTRIBUTOR PROGRAM ITEMS

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 035 391 1803 055	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS PARALLEL AND TANDEM WORKSECTIONS MIDSECTION INLET
391 1873 083	SECTION SEAL KIT (BETWEEN SECTIONS)	SERIES WORKSECTIONS
391 1873 036 391 1803 457	WORKSECTION REPAIR KIT (ALL SEALS)	MANUAL, PARALLEL, AND TANDEM WORKSECTIONS
391 1803 846	SPOOL SEAL KIT	STANDARD MANUAL WORKSECTIONS
391 1873 039 391 1803 469	MAIN RELIEF SEAL KIT (ALL SERVICEABLE SEALS)	**391 1873 001, 391 1873 128** 355 9107 035, 355 9001 061
391 1803 674	MAIN RELIEF PLUG SEAL KIT CONVERTIBLE OUTLET PLUG SEAL KIT	**391 1873 002**
391 1873 042 391 1803 737	SCREW ADJUSTED, PILOT OPERATED PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 006, 355 9001 115
391 1823 038	PORT ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	**391 1873 006**, 355 9001 115 **391 1873 007, 008, 009** 355 900X 143 **391 1873 010**, 355 9001 164 **391 1873 011**, 391 2283 075
391 1873 037 391 1823 122	SLUG ADJUSTED RELIEF VALVE KIT (ALL SERVICEABLE SEALS)	**391 1873 007, 008, 009** 355 900X 143
391 1873 207 391 1803 387	PNUEMATIC END CAP SEAL KIT (NEW COMMERCIAL INTERTECH DESIGN)	**391 1873 206**, 391 1803 553
391 1803 694	PNUEMATIC END CAP SEAL KIT (OLD RMH DESIGN)	**391 1873 022**, 391 1803 606 391 1803 767

DVA35 - DVG35 - VA35 - VG35 - VALVE SEAL KITS

NOTE: BOLD PART NUMBERS ARE DISTRIBUTOR PROGRAM ITEMS

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 040 391 1803 093	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS PARALLEL AND TANDEM WORKSECTIONS COMBINED FLOW MIDSECTION INLETS MIDSECTION SELECTORS
391 1803 150	SECTION SEAL KIT (BETWEEN SECTIONS)	SERIES WORKSECTIONS SPLIT FLOW MIDSECTION INLETS
391 1873 041 391 1803 722	WORKSECTION REPAIR KIT (ALL SEALS)	MANUAL, PARALLEL, AND TANDEM WORKSECTIONS
391 1823 121	WORKSECTION REPAIR KIT (ALL SEALS)	MANUAL, SERIES WORKSECTIONS
391 1823 146	WORKSECTION REPAIR KIT (ALL SEALS)	REMOTE, PARALLEL, AND TANDEM WORKSECTIONS
391 1873 044 391 1803 272	MAIN RELIEF VALVE SEAL KIT (ALL SERVICEABLE SEALS)	**391 1873 003**, 355 9107 013 **391 1873 004**, 355 9107 085 **391 1873 137**, 355 9107 385
391 1803 682	MAIN RELIEF VALVE PLUG SEAL KIT CONVERTIBLE OUTLET PLUG SEAL KIT	**391 1873 005**
391 1873 042 391 1803 737	SCREW ADJUSTED, PILOT OPERATED PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	**391 1873 006**, 355 9001 115
391 1823 038	PORT ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	**391 1873 006**, 355 9001 115 **391 1873 007, 008, 009** 355 900X 143 **391 1873 010**, 355 9001 164 **391 1873 011**, 391 2283 075
391 1873 037 391 1823 122	SLUG ADJUSTED RELIEF VALVE KIT (ALL SERVICEABLE SEALS)	**391 1873 007, 008, 009** 355 900X 143
391 1873 207 391 1803 387	PNEUMATIC ENDCAP SEAL KIT (NEW COMMERCIAL INTERTECH DESIGN)	**391 1873 203**, 391 1803 554
391 1803 695	PNUEMATIC ENDCAP SEAL KIT (OLD RMH DESIGN)	**391 1873 203**, 391 1803 591
391 1823 121	WORK SECTION REPAIR KIT (ALL SEALS)	SERIES WORK SECTIONS

DVG80 - VG80 VALVE SEAL KITS

NOTE: BOLD PART NUMBERS ARE DISTRIBUTOR PROGRAM ITEMS

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 160 391 1803 484	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS ALL WORKSECTIONS
391 1873 161 391 1803 594	WORKSECTION REPAIR KIT (ALL SEALS)	MANUAL WORKSECTIONS
391 1823 101	MAIN RELIEF VALVE SEAL KIT (ALL SERVICEABLE SEALS)	355 9001 008, 031
391 1803 041	MAIN RELIEF VALVE SEAL KIT (EXTERNAL SEALS)	355 9001 008, 031
391 1803 054	MAIN RELIEF VALVE AND PLUG SEAL KIT (EXTERNAL SEALS)	**391 1873 146, 391 1873 147** 355 9001 103
391 1803 770	MAIN RELIEF VALVE SEAL KIT (ALL SERVICEABLE SEALS)	**391 1873 146**, 355 9001 103
391 1873 042 391 1803 737	SCREW ADJUSTED, PILOT OPERATED PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	**391 1873 006**, 355 9001 115
391 1823 038	PORT ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	**391 1873 006**, 355 9001 115 **391 1873 011**, 391 2283 075 **391 1873 010**, 355 9001 164
391 1823 175	WORK SECTION REPAIR KIT (ALL SEALS)	HYDRAULIC REMOTE OPERATED

Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks between sections	Pinched, blown or missing section seal	Replace section seal
	Stud fasteners not correctly torqued	Replace section seals and re-torque
	Mounting plate not level	Loosen mounting bolts and shim as required
	Contamination/burrs on seal	Clean seal groove, replace section seal
Oil leaks at either end of spool	Over pressurized tank core	Correct high back-pressure condition
	Worn or damaged spool seals	Replace seals and seal retainers
Spring - centered spools do not return to neutral	Broken centering spring	Replace centering spring
	Misalignment of operating linkage	Check linkage for mechanical binding
	Foreign particles in system	Clean valve and system
Load will not hold	Cylinder leaking or worn	Check cylinder - repair
	Port relief valve not holding	Remove and clean or replace
	Spool or housing scored or worn excessively	Replace section
Load drops when spool moved from neutral	Dirt or foreign particles lodged between check valve poppet and seat	Disassemble, clean & reassemble
	Scored or sticking check valve poppet	Replace poppet
No motion, slow, or erratic system operation	Worn pump	Check flow & pressure
	Defective cylinder or motor	Repair or replace
	Low reservoir oil level	Add oil to specs
	Clogged suction strainer	Clean or replace
	Suction line restricted	Check lines
	Relief valve not properly set	Check pressure setting
	Relief valve poppet or seat scored & sticking open	Replace relief valve
	Valve spool not shifted to full stroke	Check spool linkage travel

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NOTES

Commercial Hydraulics
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FAX (419) 542-8871

Hydrostatic Steering Unit OSPB/OSPC

HN.21.AD.02 replaces HN.21.AC.02

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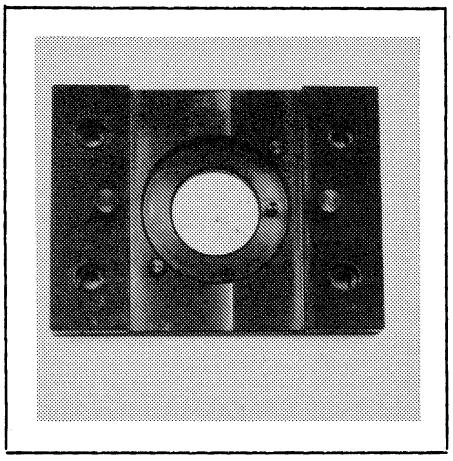
Exploded view: OSPB / OSPC / OSPC LS	29-30

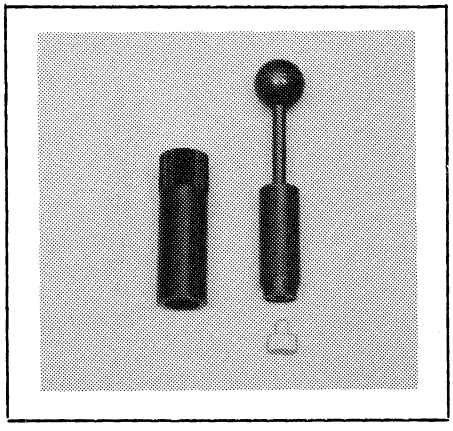
Cost-free repairs

We would point out that cost-free repairs as mentioned in Danfoss General Conditions of Sale, are carried out only at Danfoss Nordborg or at service shops authorized by Danfoss (page 29).

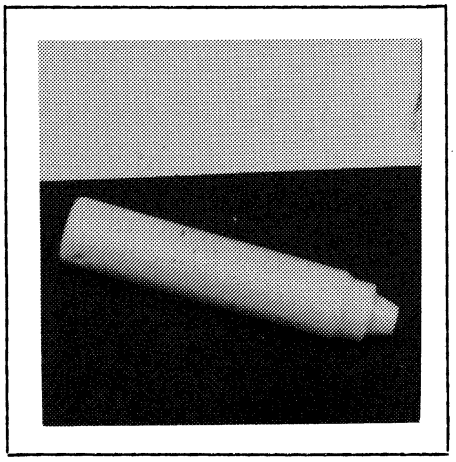
TOOLS



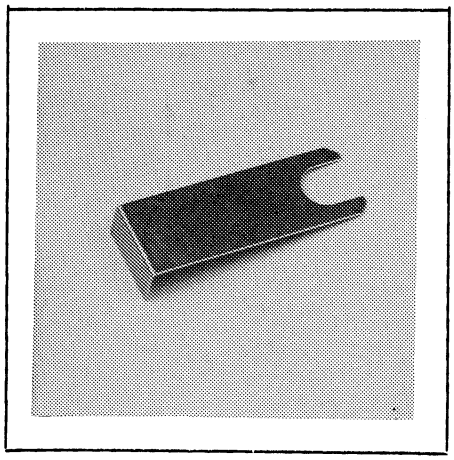
A Holding tool. Code no.: SJ 150-9000-2.



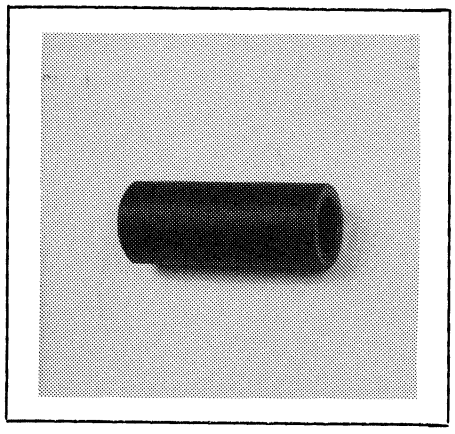
B Assembly tool for o-ring and kin-ring.
Code no. SJ 150-9000-11.



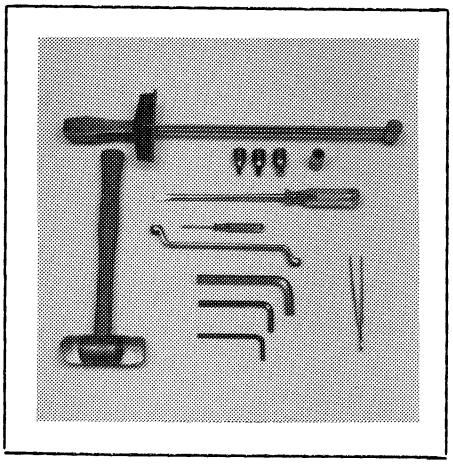
C Assembly tool for lip seal.
Code no. SJ 150-9000-17.



D Assembly tool for cardan shaft.
Code no. SJ 150-9000-3.



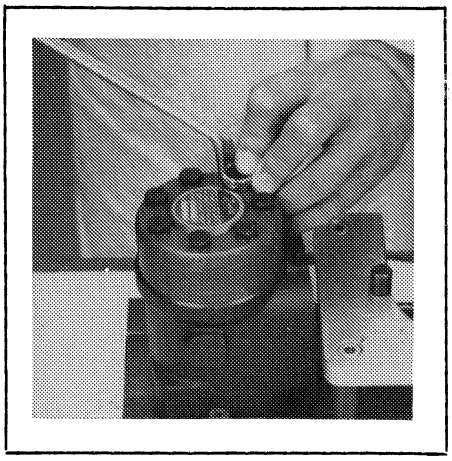
E Assembly tool for dust seal.
Code no. SJ 150-9000-22.



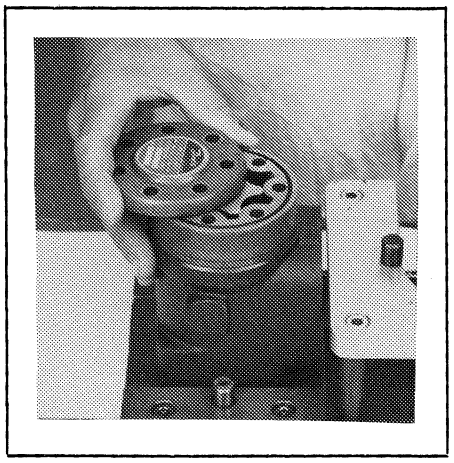
F Torque wrench 0-7 daNm.
13 mm socket spanner.
6, 8 and 12 mm hexagon sockets.
12 mm screwdriver.
2 mm screwdriver.
13 mm ring spanner.
6, 8 and 12 mm hexagon socket spanners.
Plastic hammer.
Tweezers.

The tools named under point F are not available from Danfoss.

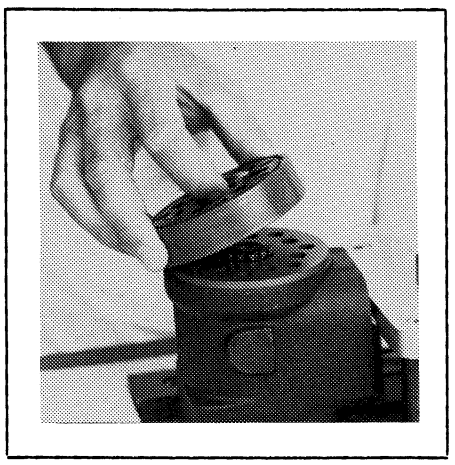
DISMANTLING



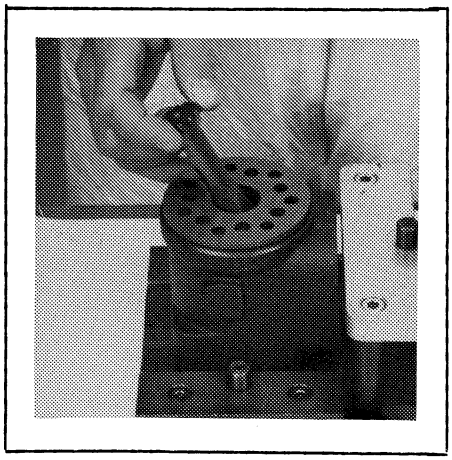
1 Dismantle steering column from steering unit and place the steering unit in the holding tool. Screw out the screws in the end cover (6-off plus one special screw).



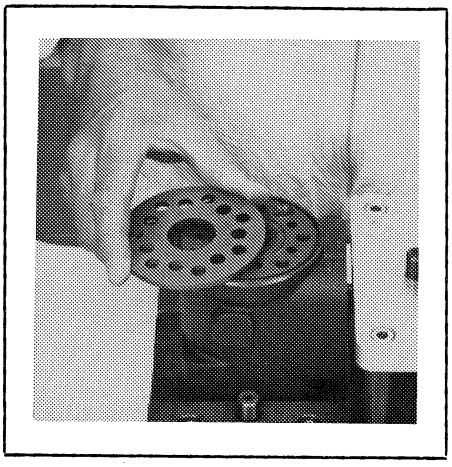
2 Remove the end cover, sideways.



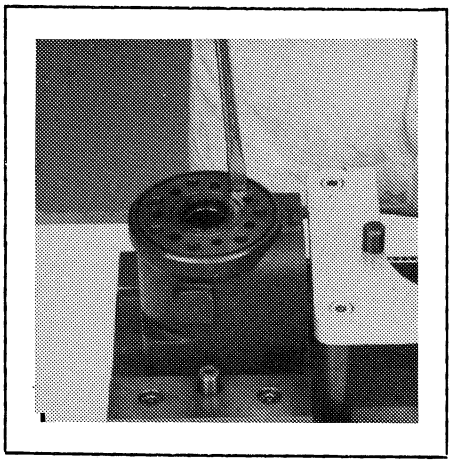
3 Lift the gearwheel set (with spacer if fitted) off the unit. Take out the two o-rings.



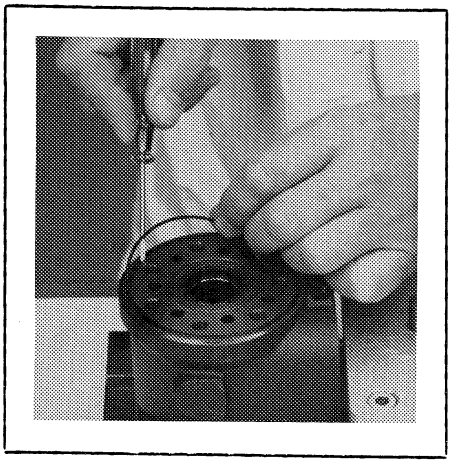
4 Remove cardan shaft.



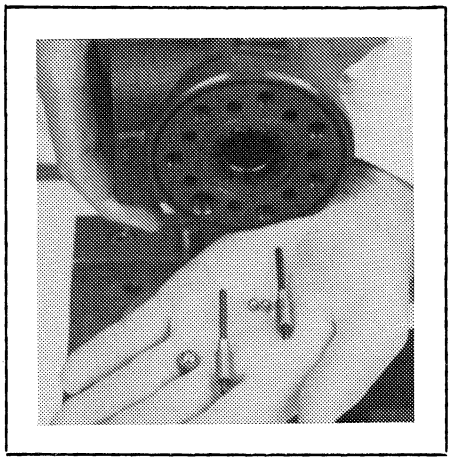
5 Remove distributor plate.



6 Screw out the threaded bush over the check valve.



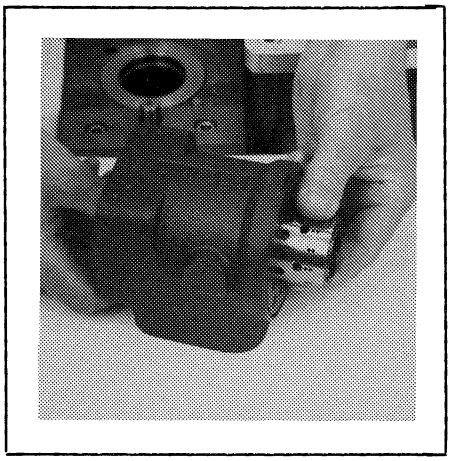
7 Remove o-ring.



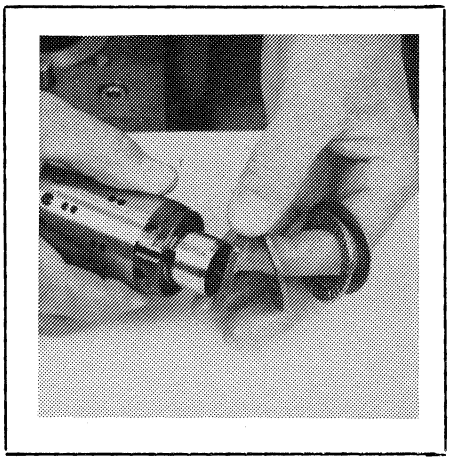
8 OSPB; OSPB LS; OSPBX LS:
Shake out the check valve ball (ø 8 mm).

OSPC; OSPC LS; OSPC LSR:
Shake out the check valve ball and suction valve pins and balls.

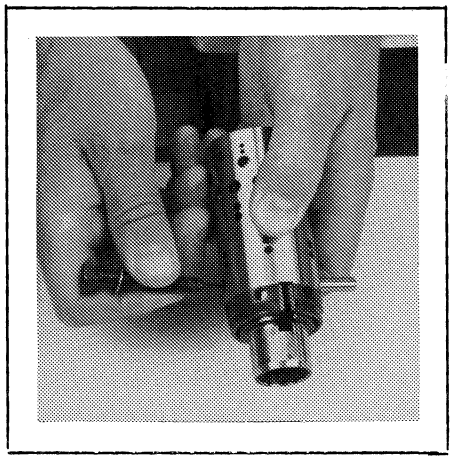
Note: On some pins in the OSPC there are two springs (see page 30, pos. 28). See also spare parts list for OSPC **HN.21.CA.52.**



9 Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.

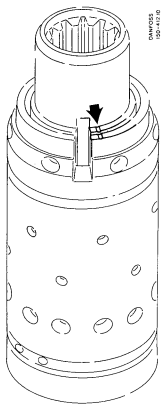


10 Take ring, bearing races and needle bearing from sleeve and spool. The outer (thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



11 Press out the cross pin. Use the special screw from the end cover.

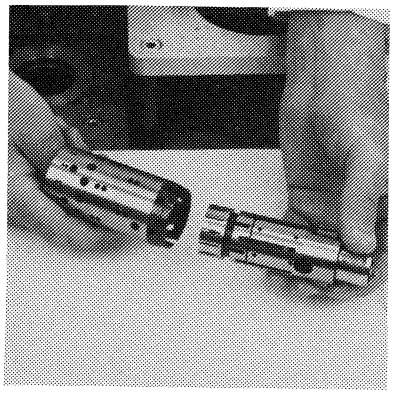
Note 11a!



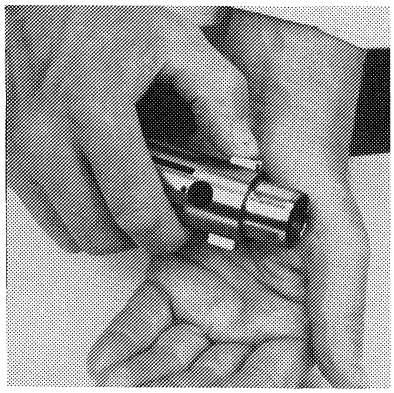
11a OSPB CN and OSPC CN

A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position springs (see drawing).

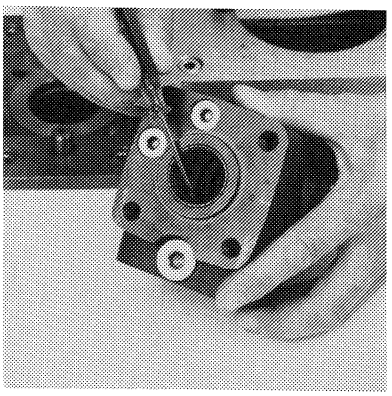
If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are dismantled.



12 Carefully press the spool out of the sleeve.

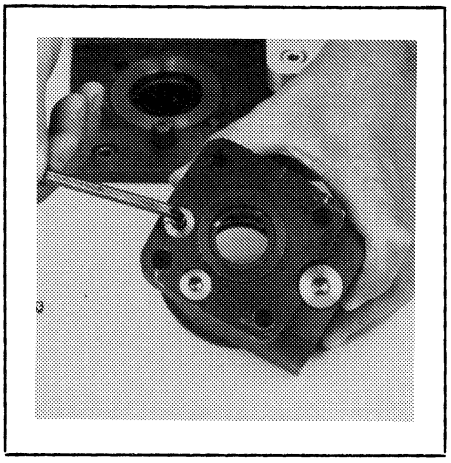


13 Press the neutral position springs out of their slots in the spool.

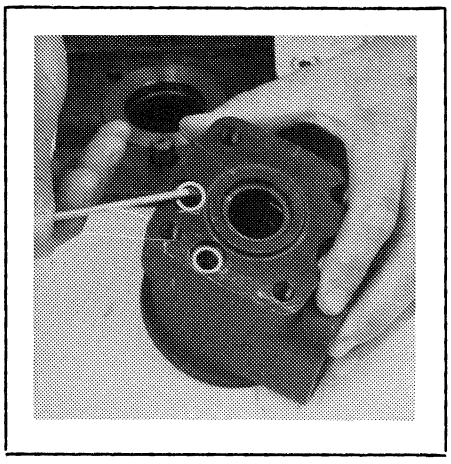


14 Remove dust seal and o-ring/kin-ring.

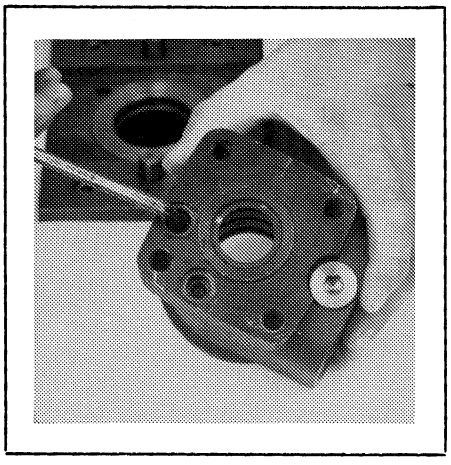
Dismantling the dual shock valves for OSPC/OSPC LS



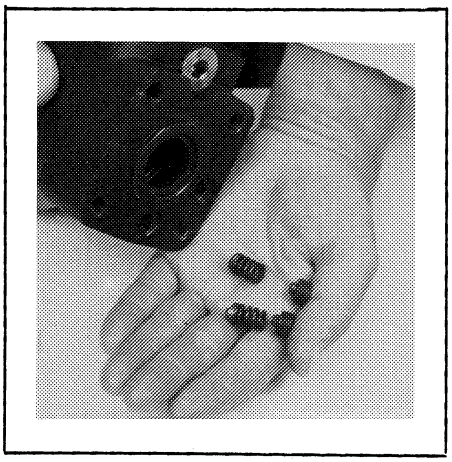
15 Remove plugs from shock valves using a 6 mm hexagon socket spanner.



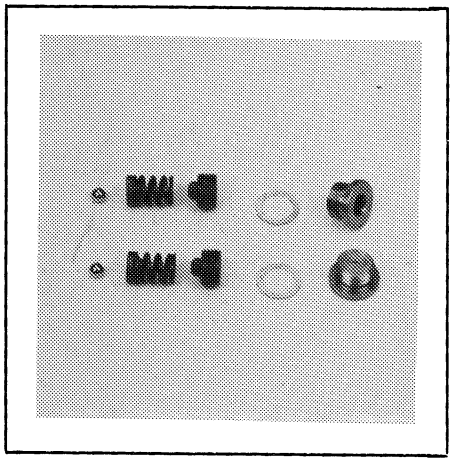
16 Remove seal washers (2-off).



17 Unscrew the setting screws using a 6 mm hexagon socket spanner.

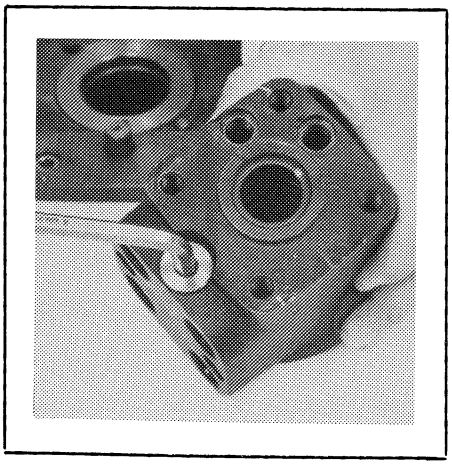


18 Shake out the two springs and two valve balls into your hand. The valve seats are bonded into the housing and cannot be removed.

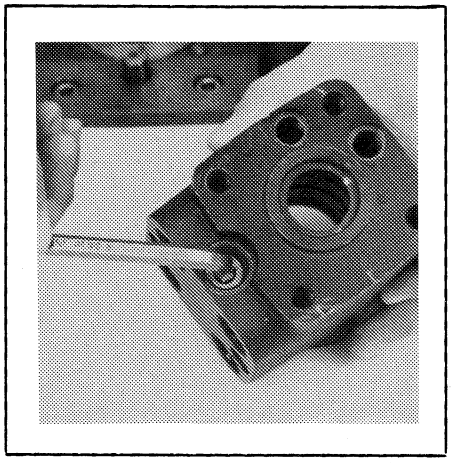


19 The dual shock valves are now dismantled.

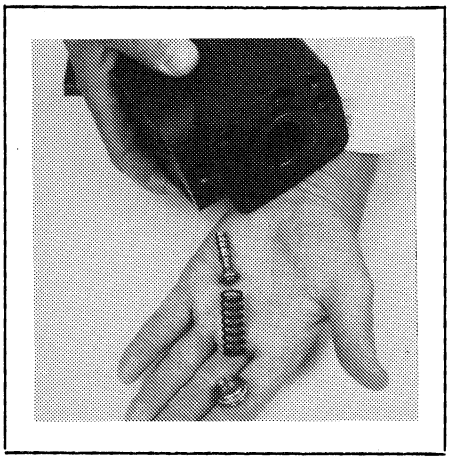
Dismantling the pressure relief valve (cartridge) for OSPC



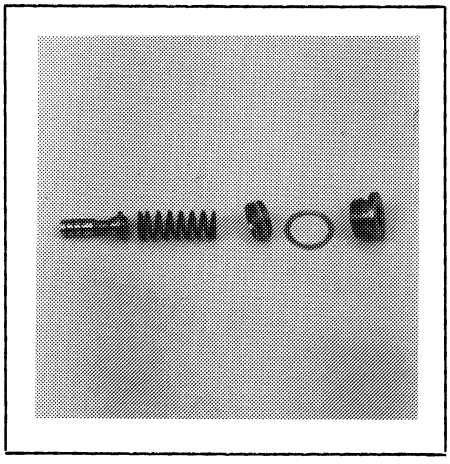
20 Screw out the plug using an 8 mm hexagon socket spanner. Remove seal washers.



21 Unscrew the setting screw using an 8 mm hexagon socket spanner.

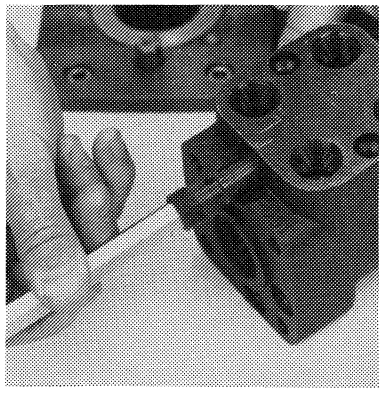


22 Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.

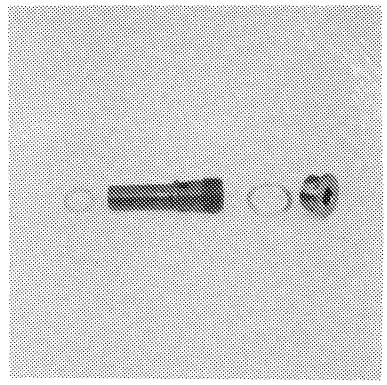


23 The pressure relief valve is now dismantled.

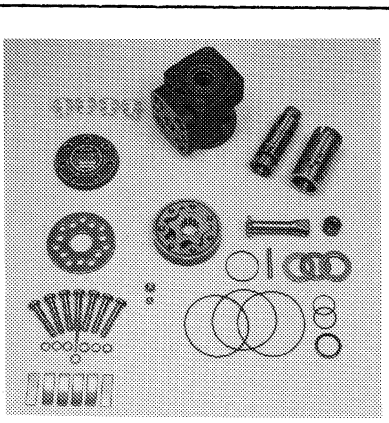
Dismantling the pressure relief valve (cartridge) for OSPC LS/OSPC LSR



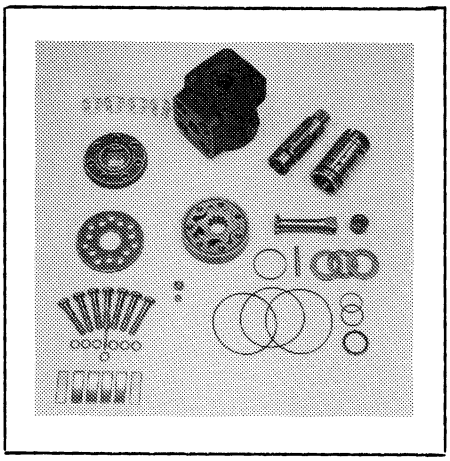
24 Screw out the pressure relief valve using an 8 mm hexagon socket spanner. Remove the seal ring. If the valve is defective it must be replaced (see OSPC spare parts list, **HN.21.CA.52**).



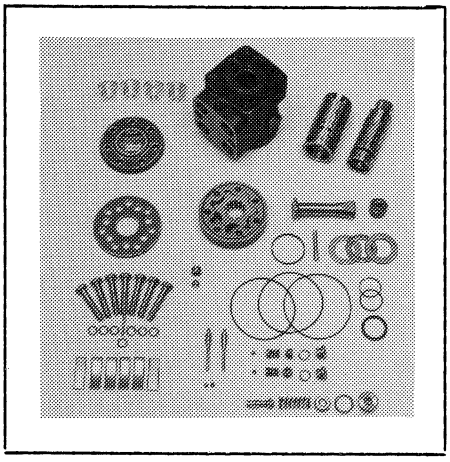
25 The pressure relief valve is now dismantled.



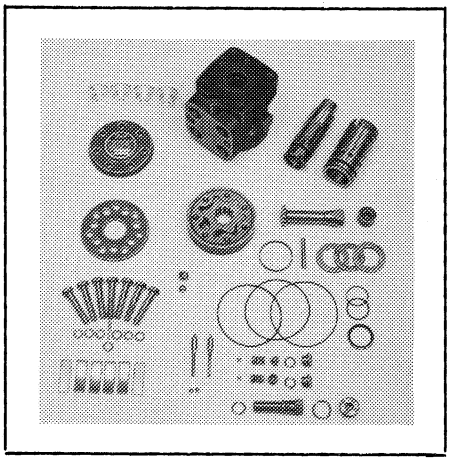
26 The steering unit OSPB is now completely dismantled.



27 The steering unit OSPB LS is now completely dismantled.



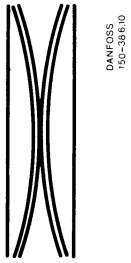
28 The steering unit OSPC is now completely dismantled.



29 The steering unit OSPC LS is now completely dismantled.

Cleaning
Clean all parts carefully in Shellsol K or the like.
Inspection and replacement
Replace all seals and washers. Check all parts carefully and make any replacements necessary.
Lubrication
Before assembly, lubricate all parts with hydraulic oil.

Assembly pattern and colour code for neutral position springs for OSP-steering units



STANDARD SPRINGS (GREY)

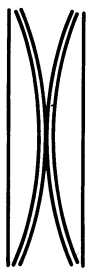
2-off flat, grey: code no. 150-0720
4-off curved, grey: code no. 150-0721

GREY SET
Spare set: code no. 150-4209

WEAK SPRINGS (BLUE)

2-off flat, blue: code no. 150-0748
2-off curved, blue: code no. 150-0749

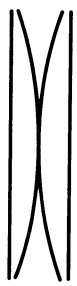
BLUE SET
Spare set: code no. 150-4265



STRONG SPRINGS (GREY AND BLUE)

2-off flat, grey: code no. 150-0720
4-off curved, blue: code no. 150-0749

GREY/BLUE SET
Spare set: code no. 150-4207



STIFF SPRINGS (YELLOW)

2-off flat, yellow: code no. 150N0602
2-off curved, yellow: code no. 150N0603

YELLOW SET
Spare set: code no. 150-4269

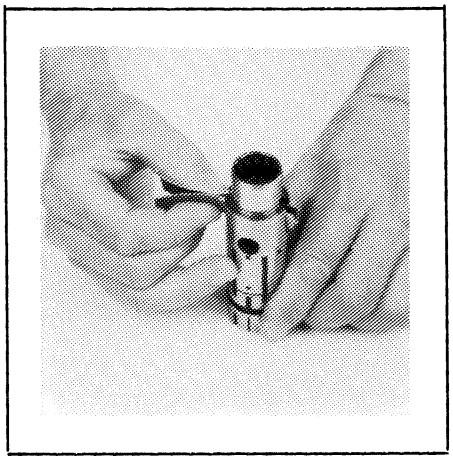
REASSEMBLY

30 Assemble spool and sleeve.

Note

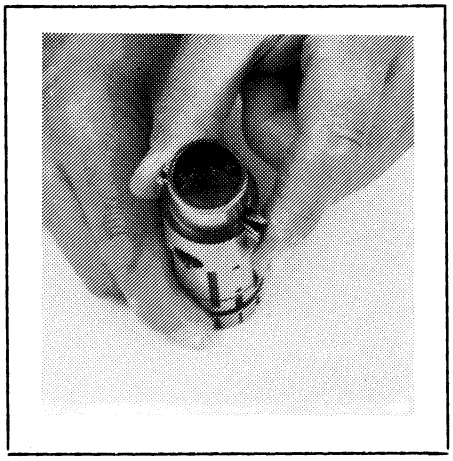
OSPB LS, OSPBX LS, OSPC LS and OSPC LSR
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool/sleeve opposite to the end with spring slots. Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.

OSPB CN and OSPC CN
Assemble the spool/sleeve and make sure the marks on spool and sleeve are opposite each other (see drawing page 7).

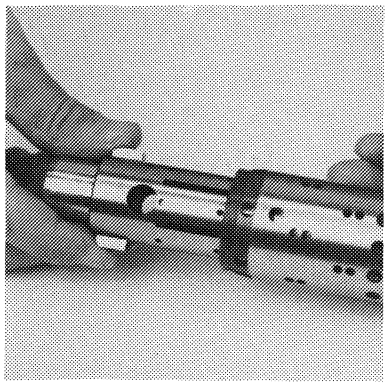


31 Place the two flat neutral position springs in the slot.

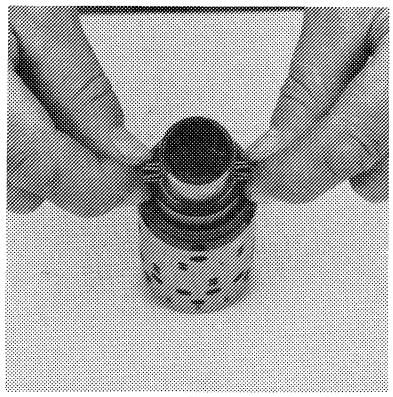
Place the curved springs between the flat ones and press them into place (see assembly pattern, page 13).



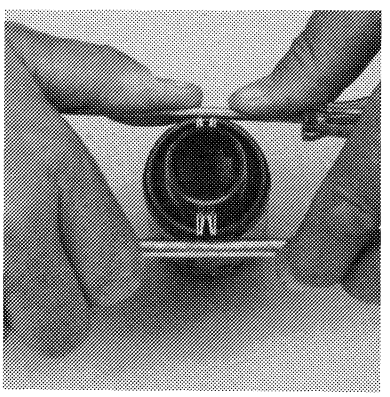
32 Line up the spring set.



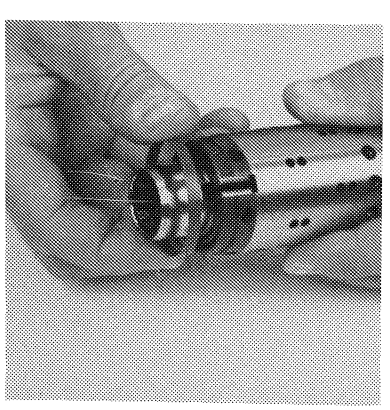
33 Guide the spool into the sleeve. Make sure that spool and sleeve for OSPB LS, OSPBX LS, OSPC LS and OSPC LSR are placed correctly in relation to each other (see page 14).



34 Press the springs togehter and push the neutral position springs into place in the sleeve.

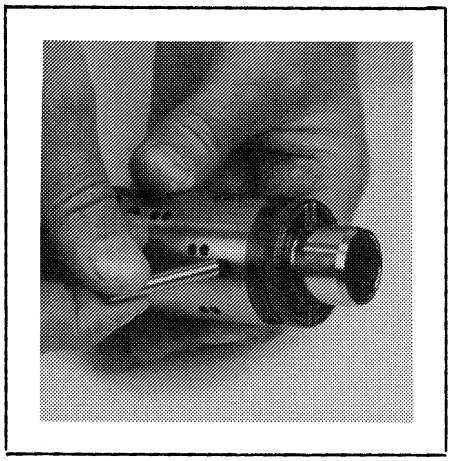


35 Line up the springs and centre them.

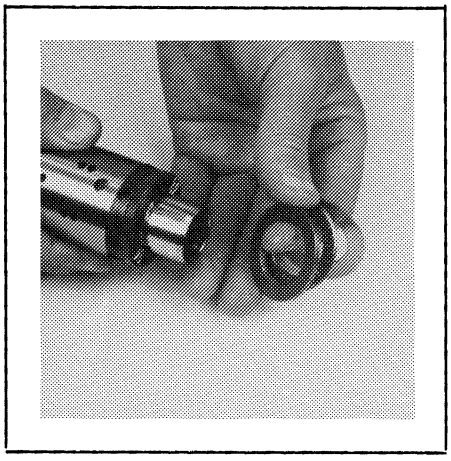


36 Guide the ring down over the sleeve.

Note: The ring should be able to rotate - free of the springs.



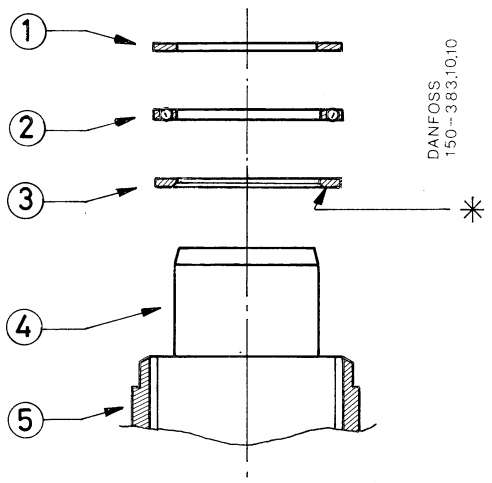
37 Fit the cross pin into the spool/sleeve.



38 Fit bearing races and needle bearing as shown on below drawing.

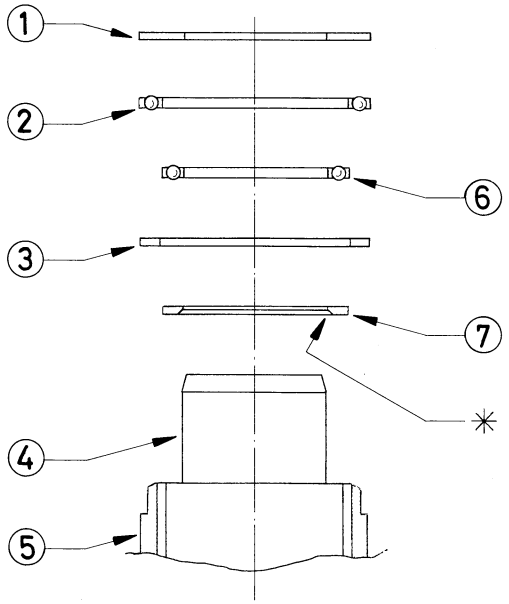
Assembly pattern for standard bearings

1 Outer bearing race
2 Needlebearing
3 Inner bearing race
4 Spool
5 Sleeve



Assembly pattern for double bearings

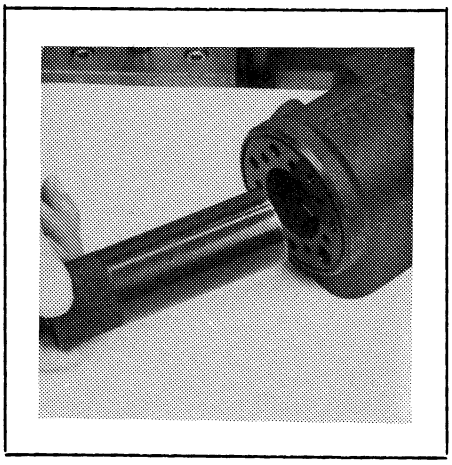
1 Washer for axial bearing
2 Outer needlebearing
3 Outer bearing race
4 Spool
5 Sleeve
6 Inner needlebearing
7 Inner bearing race



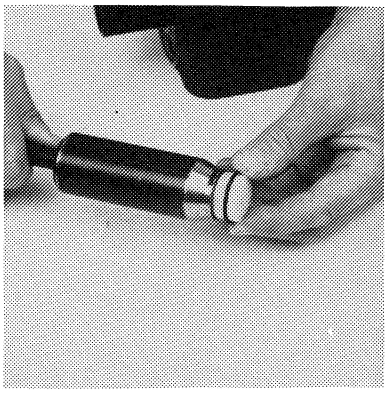
DANFOSS
150-3361021

The inside chamfer on the inner bearing race must face the inner spool.

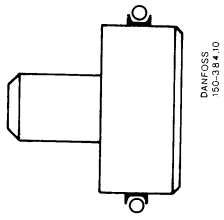
Installation instructions for o-ring/kin-ring (standard)

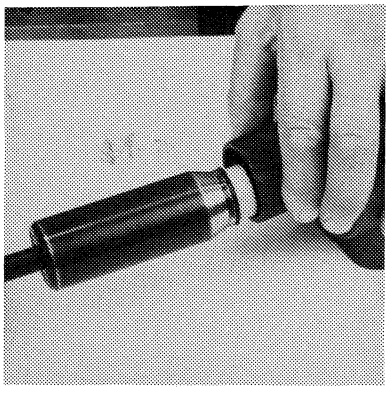


39 Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool/sleeve.

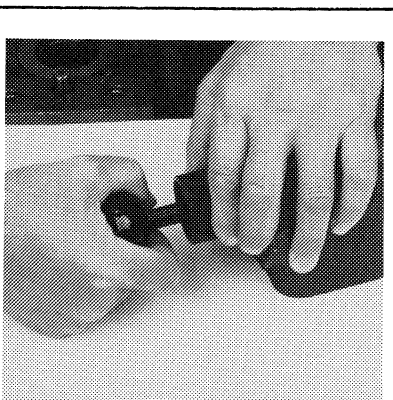


40 Grease o-ring and kin-ring with hydraulic oil and place them on the tool.

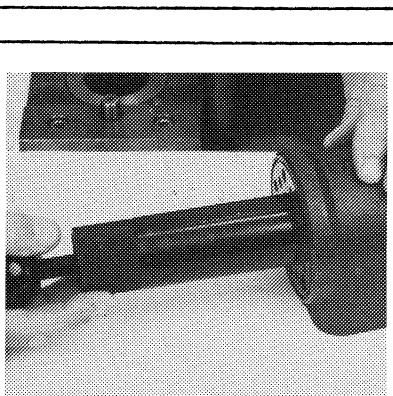




41 Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.

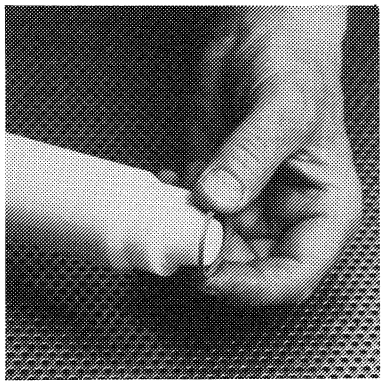


42 Press and turn the o-ring/kin-ring into position in the housing.

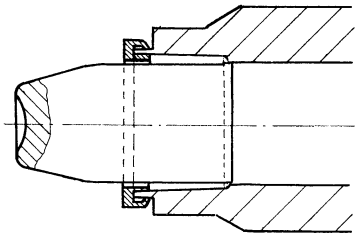


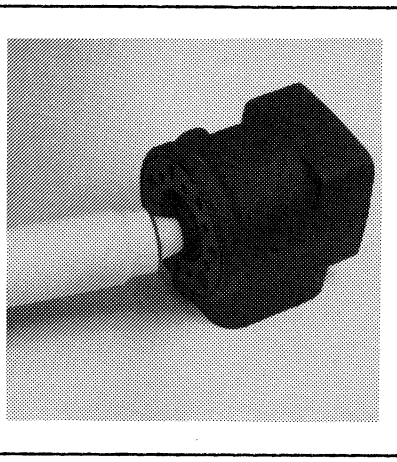
43 Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.

Installation instructions for lip seal



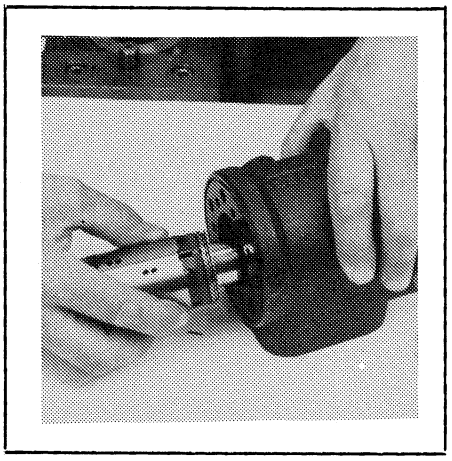
44 Lubricate the lip seal with hydraulic oil and place it on the assembly tool.





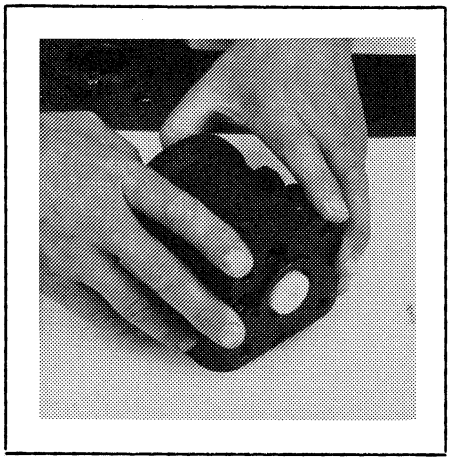
45 Guide the assembly tool right to the bottom.

46 Press and turn the lip seal into place in the housing.

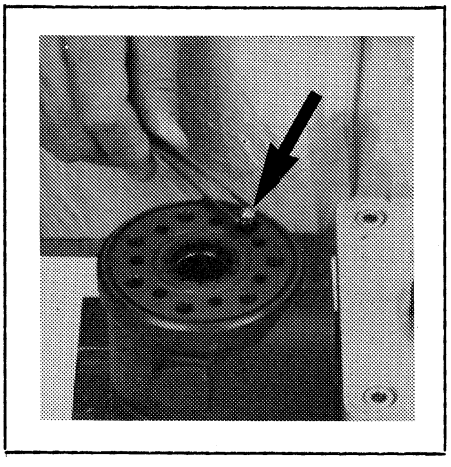


47 With a light turning movement, guide the spool and sleeve into the bore.

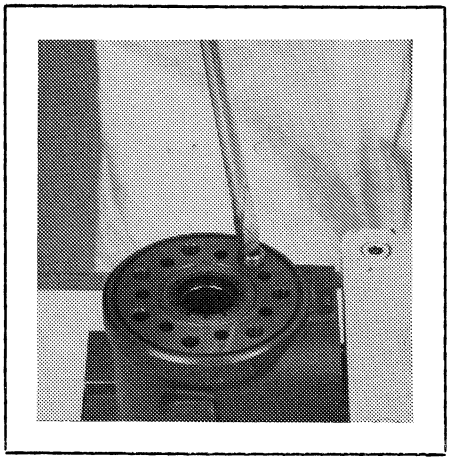
Note: Fit the spool set holding the cross pin horizontal.



48 The spool set will push out the assembly tool guide. The o-ring and kin-ring are now in position.

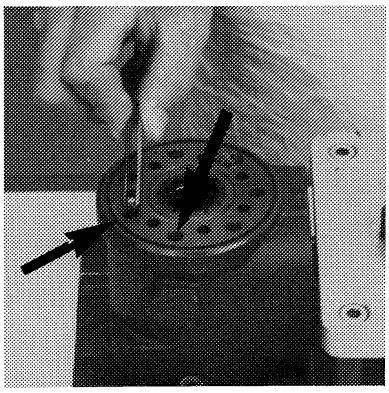


49 Turn the stearing unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.

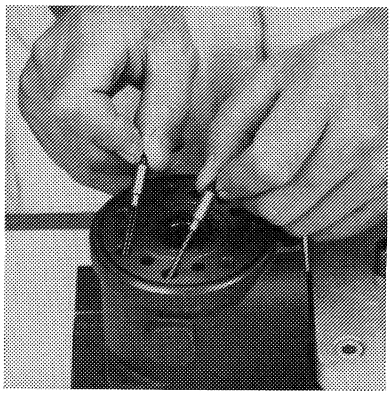


50 Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

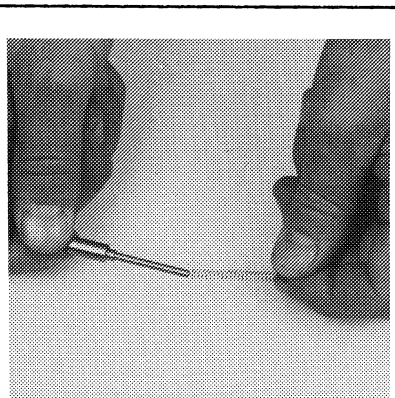
Assembly of the two suction valves for OSPC/OSPC LS/OSPC LSR



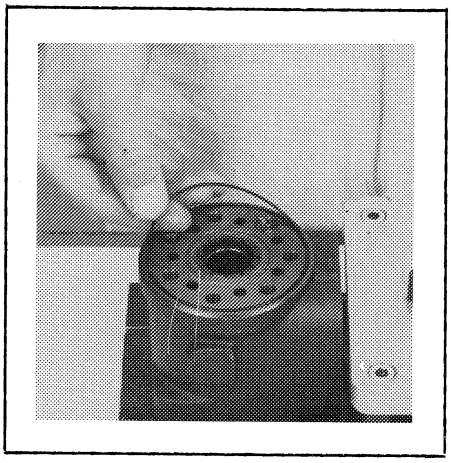
51 Place a ball in the two holes indicated by the arrows.



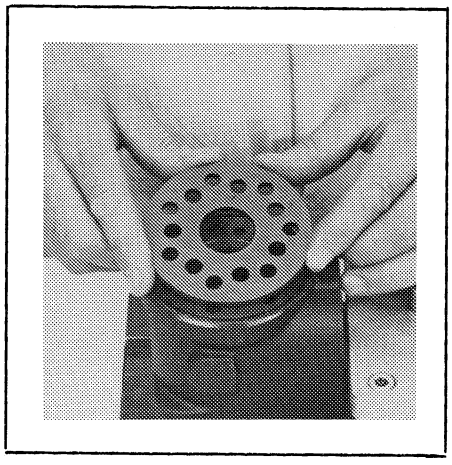
52 Place a pin in the same two holes.



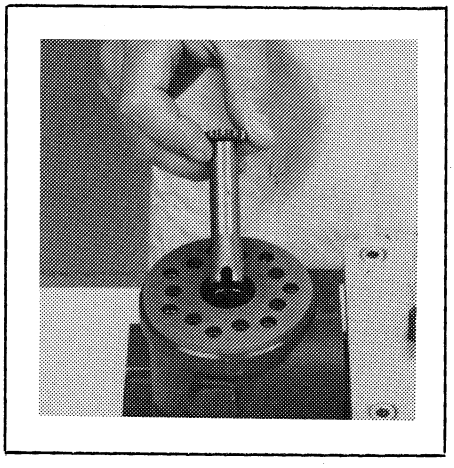
53 In some cases a spring has to be fitted (see page 30, pos. 28) on the pin before it is placed in the housing. (See OSPC spare parts list, HN.21.CA.52).



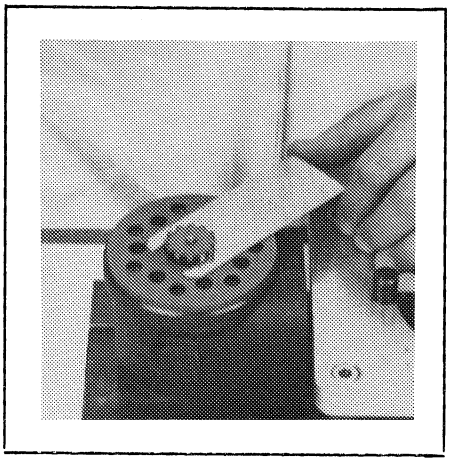
54 Grease the o-ring with mineral oil approx. viscosity 500 cSt at 20°C.



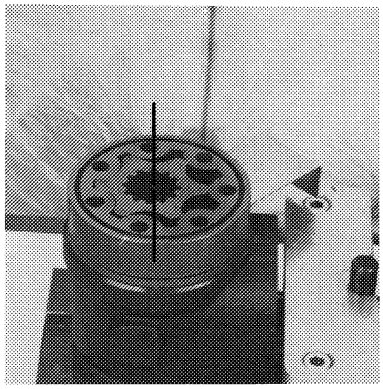
55 Place the distributor plate so that the channel holes match the holes in the housing.



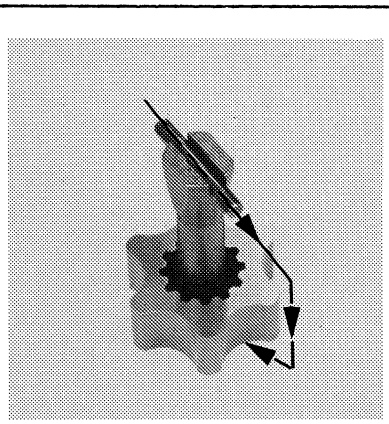
56 Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



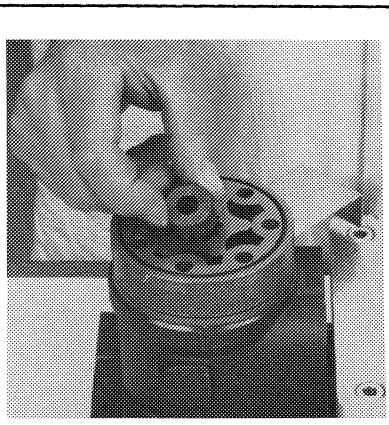
57 Place the cardan shaft as shown - so that it is held in position by the mounting fork.



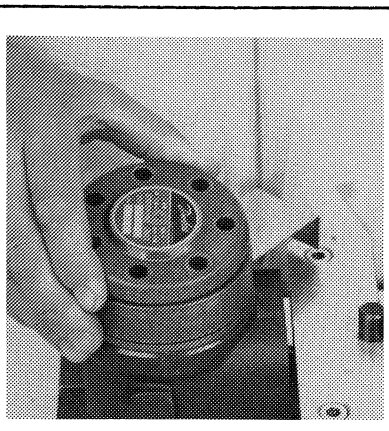
58 Grease the two o-rings with mineral oil approx. viscosity 500 cSt at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



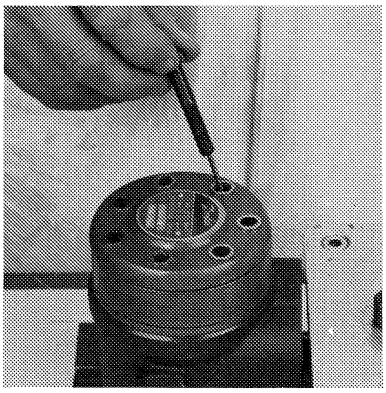
59 Important: Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing



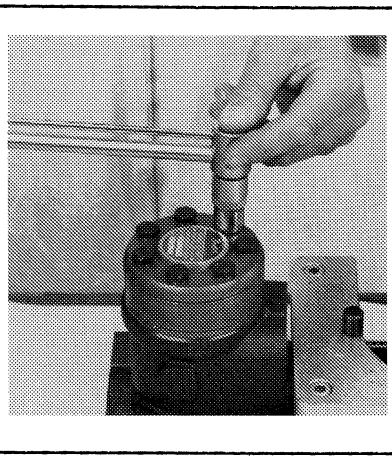
60 Fit the spacer, if any.



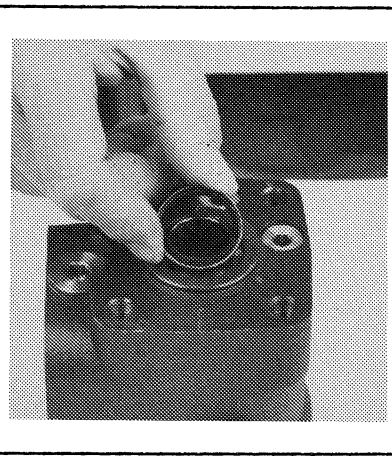
61 Place the end cover in position.



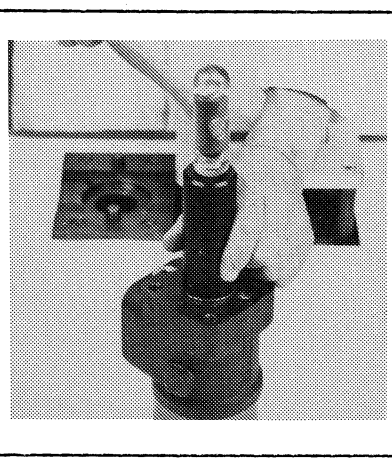
62 Fit the special screw with washer and place it in the hole shown.



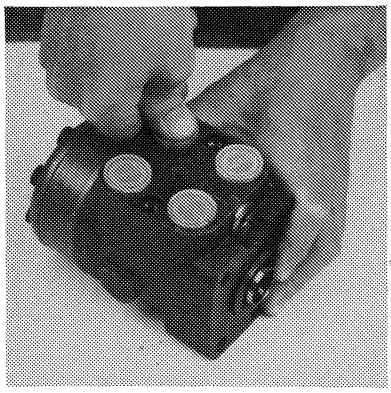
63 Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin with a torque of 3.0 +/-0.6 daNm. The OSPB, OSPB LS and OSPBX LS can now be function tested.



64 Place the dust seal ring in the housing. With the OSPC, PSPC LS and OSPC LSR the dust seal ring must be placed only after the pressure relief valve and shock valves have been fitted.

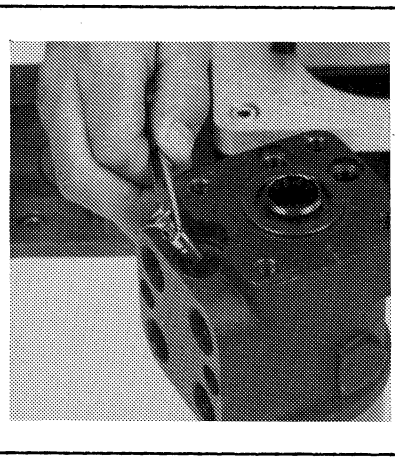


65 Fit the dust seal ring in the housing using special tool SJ 150-9000-22 (see page 3; E) and a plastic hammer.

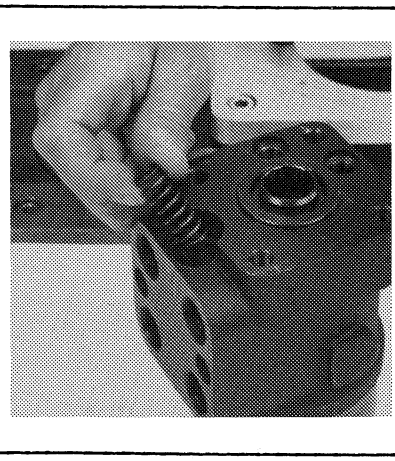


66 Press the plastic plugs into the connection ports. Do not use a hammer!

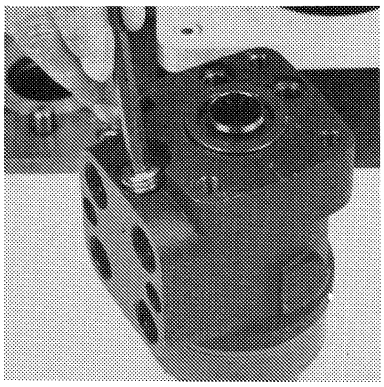
Assembly of the pressure relief valve for OSPC



67 Fit the piston.

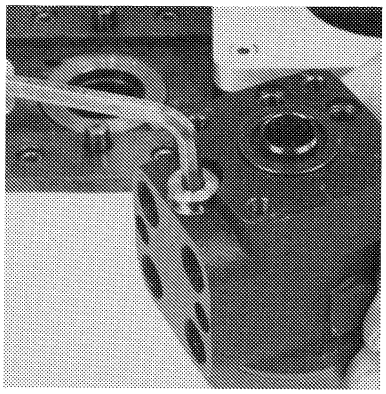


68 Fit the spring.



69 Screw in the setting screw with an 8 mm hexagon socket spanner. Make the pressure setting on a panel or the vehicle.

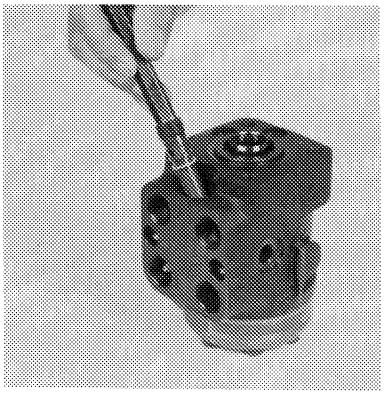
Ø 1.7 spring for 50 - 70 bar.
Ø 1.9 spring for 70 - 105 bar.
Ø 2.1 spring for 110 - 155 bar.
(See OSPC spare parts list **HN.21.CA.52**).



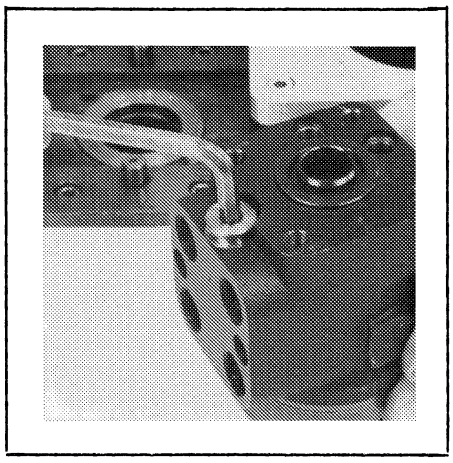
70 Screw plug with dust seal into the housing using an 8 mm hexagon socket spanner.

Tightening torque: 5 +/-1 daNm.

Assembly of the pressure relief valve (cartridge) for OSPC LS/OSPC LSR



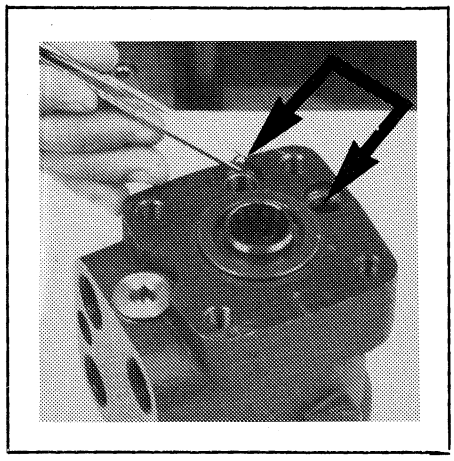
71 Place the seal ring on the cartridge and screw the cartridge into the housing using a 12 mm hexagon socket spanner. Tightening torque: 5 +/-1 daNm. Make the pressure setting on a panel or the vehicle. The cartridge is factory-set at 175 bar. Use a 4 mm hexagon socket spanner. (See OSPC spare parts list **HN.21.CA.52** for setting range).



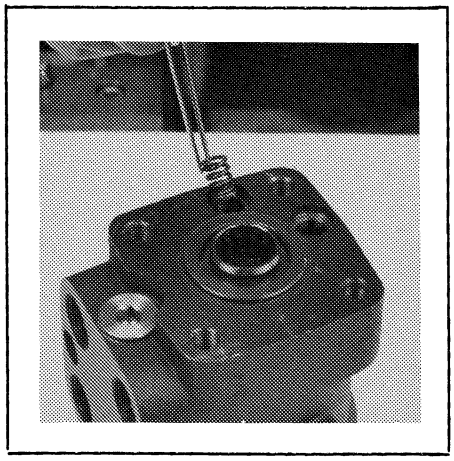
72 Screw plug with seal ring into the housing using an 8 mm Allen key.

Tightening torque: 5 +/-1 daNm.

Assembly of the dual shock valves for OSPC/OSPC LS/OSPC LSR

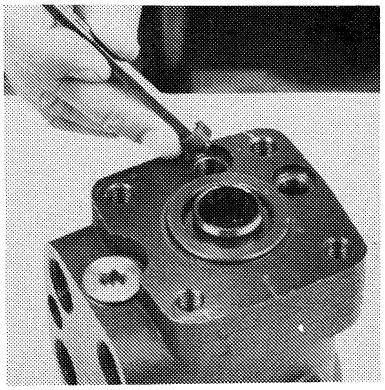


73 Put a ball in the two holes indicated by the arrows.

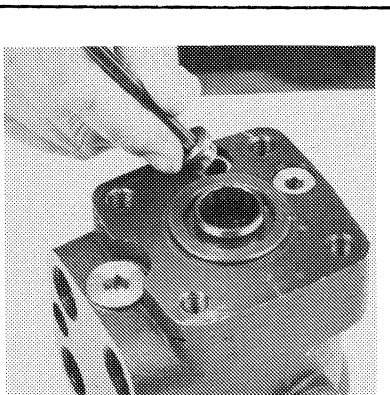


74 Place springs and valve cones over the two balls.

Note: The blue spring applies to setting range 90-180 bar. The untreated spring applies to setting range 190-260 bar. (See OSPC spare parts list **HN.21.CA.52**).



75 Screw in the two setting screws using a 6 mm hexagon socket spanner. Make the pressure setting on a panel or the vehicle. (See OSPC spare parts list HN.21.L1.52).



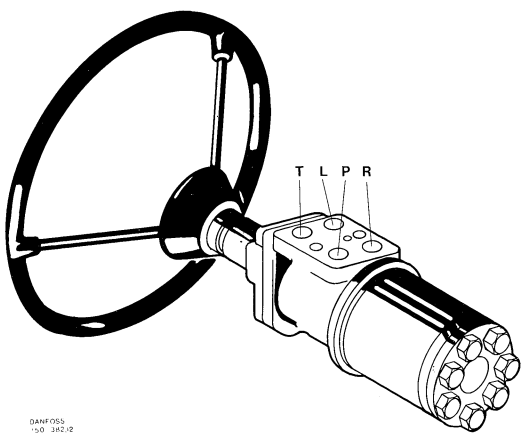
76 Screw plug with seal ring into the two shock valves and tighten them with a torque of 3 +/-0 daNm using a 6 mm hexagon socket spanner.

Steering unit type OSPB, OSPB LS, OSPBX LS, OSPC, OSPC LS or OSPC LSR is now assembled.

Max. tightening torque and hydraulic connections

Screwed connection	Max. tightening torque daNm (lbf in)			
	With cutting edge	With copper washer	With aluminium washer	With O-ring
1/4 BSP.F	4 (350)	2 (180	3 (270)	
3/8 BSP.F	6 (530)	2 (180)	5 (440)	
1/2 BSP.F	10 (900)	3 (270)	8 (700)	
7/16-20 UNF				2 (180)
3/4-16 UNF				6 (530)
M 12 x 1,5	4 (350)	2 (180)	3 (270)	2 (180)
M 18 x 1,5	7 (620)	2 (180)	5 (440)	5 (440)
M 22 x 1,5	10 (900)	3 (270)	8 (700)	7 (620)

L: Left port
R: Right port
T: Tank
P: Pump



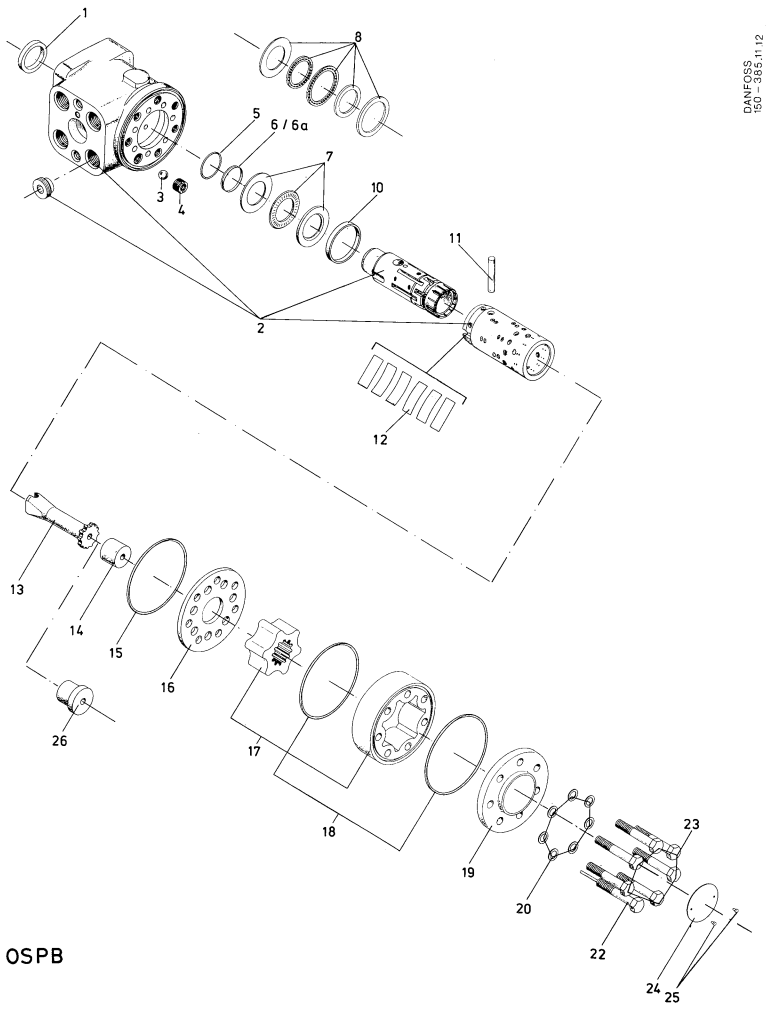
Authorized service shops:

Asean	:	Danfoss Industries Pte. Ltd., Singapore
Australia	:	Danfoss (Australia) Pty. Ltd., Melbourne
Austria	:	Hainzl Industriesysteme, Gesellschaft m.b.H, Linz
Belgium	:	N.V. Danfoss S.A., Bruxelles
Canada	:	Danfoss Mfg. Co. Ltd., Mississauga
Denmark	:	H. Søndergaard A/S, Måløv
Finland	:	OY Danfoss AB, Espoo
France	:	Danfoss S.a.r.l., Trappes (Paris)
FRG (W. Germany)	:	Danfoss GmbH, Offenbach/Main
Great Britain	:	Danfoss Limited, Greenford
Iceland	:	Velsmidjan Hedinn, Reykjavik
Italy	:	Sordella & C. Oleodinamica s.r.l., Torino
Japan	:	Danfoss (Japan) Manufacturing Co., Ltd., Gotemba
Netherlands	:	ITHO B.V., Schiedam
New Zealand	:	Danfoss (New Zealand) Limited, Auckland
Norway	:	Danfoss Norge A/S, Skui
Spain	:	Danfoss S.A., Madrid
Sweden	:	Transventor Hydraulik AB, Mölndal, Göteborg
Switzerland	:	Werner Kuster AG, Frenkendorf
U.S.A.	:	Danfoss Inc., Rockford, Illinois

Service shops:

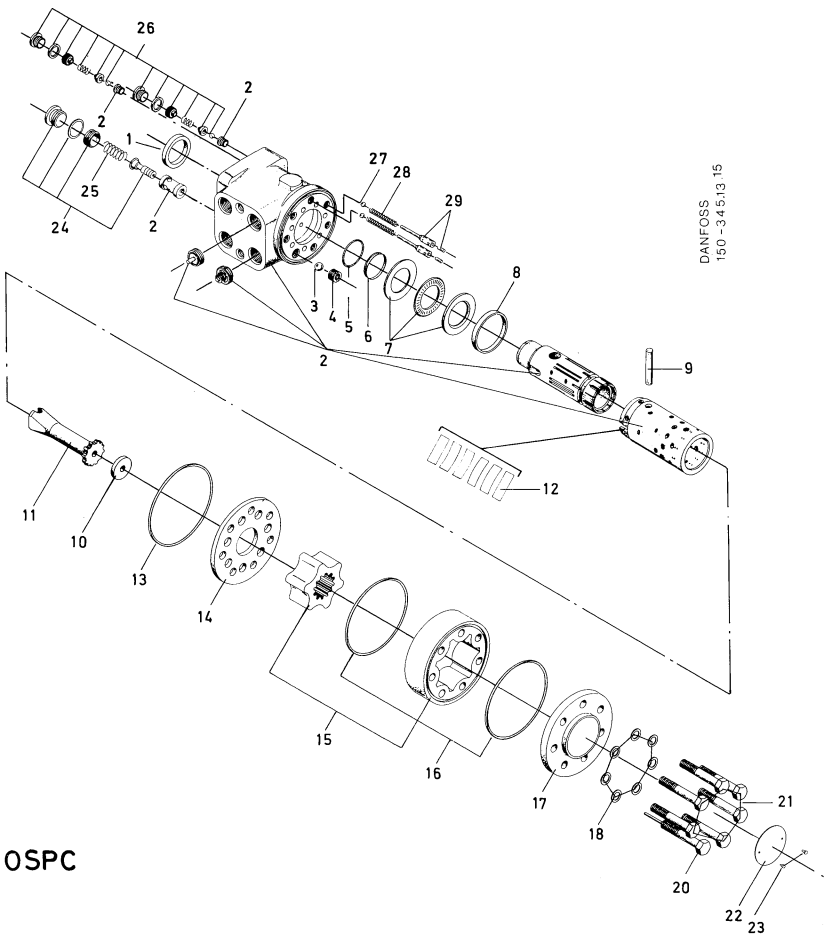
Greece	:	A. Skoura & Co. E.E., Athens
Norway	:	Servi Produksjon A.S., Trondheim

Item	Spare Parts
1	Dust seal ring
2	Housing + spool + sleeve
3	Ball ø 8,5 mm
4	Thread bushing
5	O-ring 25, 12x1,78 mm, is used with kin-ring (item 6)
6	Kin-ring
6a	Lip seal
7	Bearing assembly
8	Bearing assembly
10	Ring I/D 39,6x0,7x4,5 mm
11	Cross pin ø6x41 mm
12	Neutral position spring
13	Cardan shaft
14	Spacer
15	O-ring ø80,5x1,5 mm
16	Distributor plate
17	Gearwheel
18	O-ring ø75,92x1,78 mm
19	End cover
20	Washer ø8,2x11,9x1,0 mm
22	Special screw
23	Screw
24	Rating plate
25	Drive screw
26	Spacer

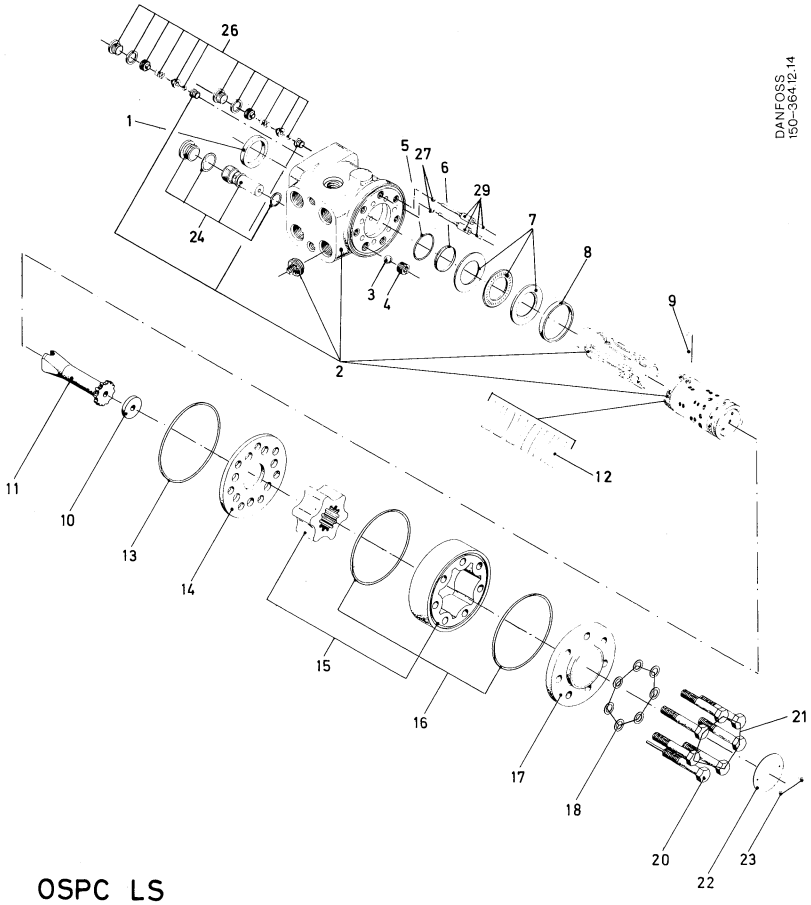


OSPB

Item	Spare Parts
1	Dust seal ring
2	Housing, spool and sleeve Check valve and the seats for relief and dual shock valves are locktited
3	Ball ø8,5 mm
4	Thread bushing
5	O-ring used with kin-ring (item 6)
6	Kin-ring
7	Bearing assembly
8	Ring
9	Cross pin
10	Spacer
11	Cardan shaft
12	Set of springs
13	O-ring
14	Distributor plate
15	Gearwheel set
16	O-ring
17	End cover
18	Washer
20	Special screw
21	Screw
22	Name plate
23	Drive screw
24	Complete relief valve
25	Spring wire ø1,7x36,6 long
26	Complete dual shock valve
27	Ball ø3/16 in
28	Spring
29	Rolled pin

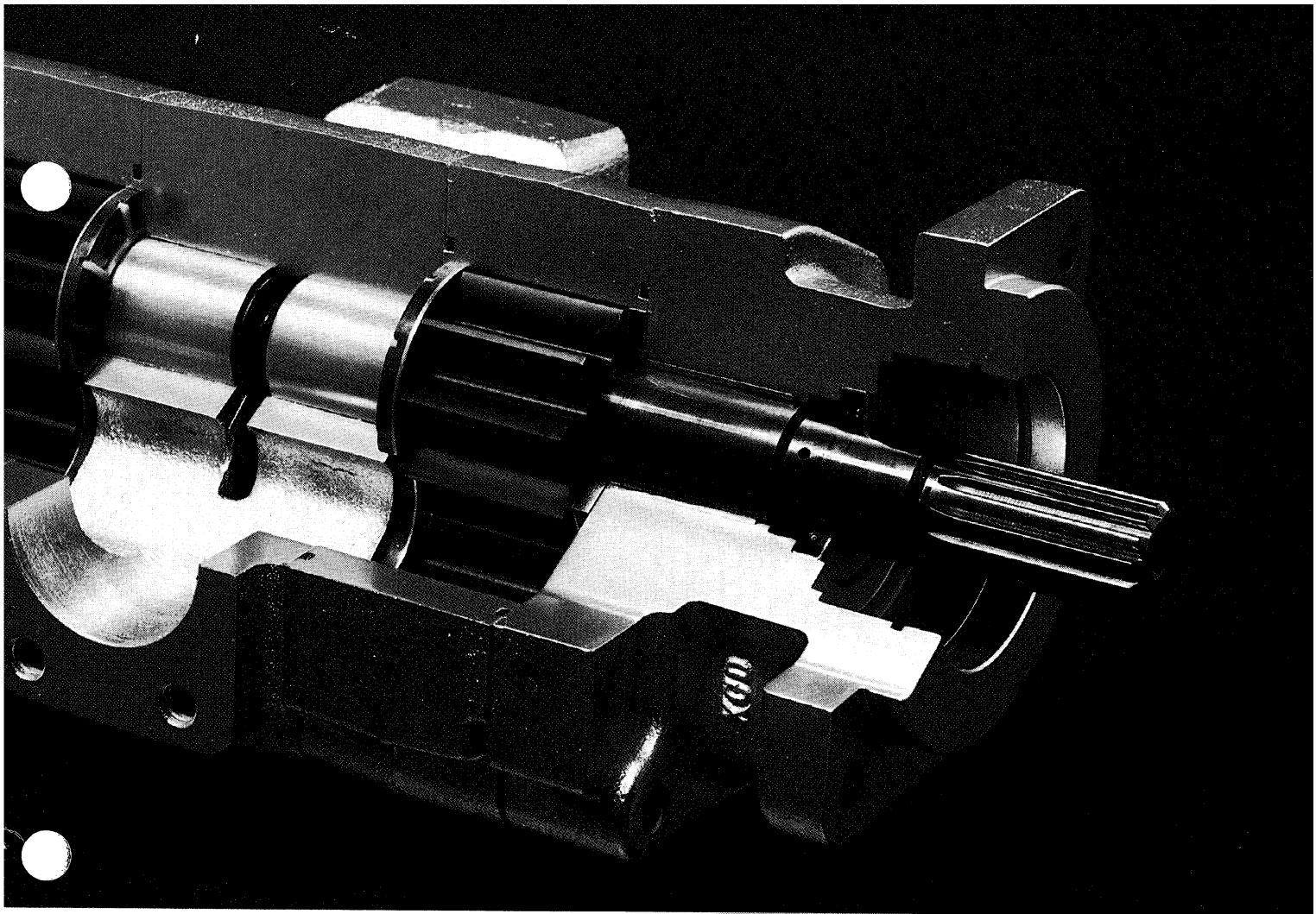


OSPC



OSPC LS

JM/KEJ/LKR



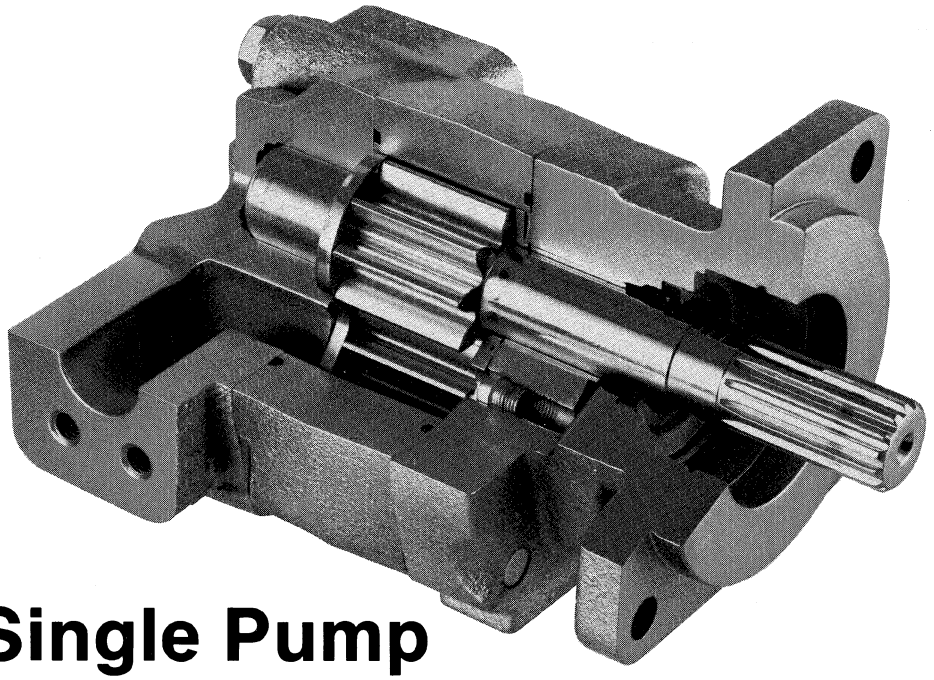
Commercial Intertech

Service Manual 315/330/350/365

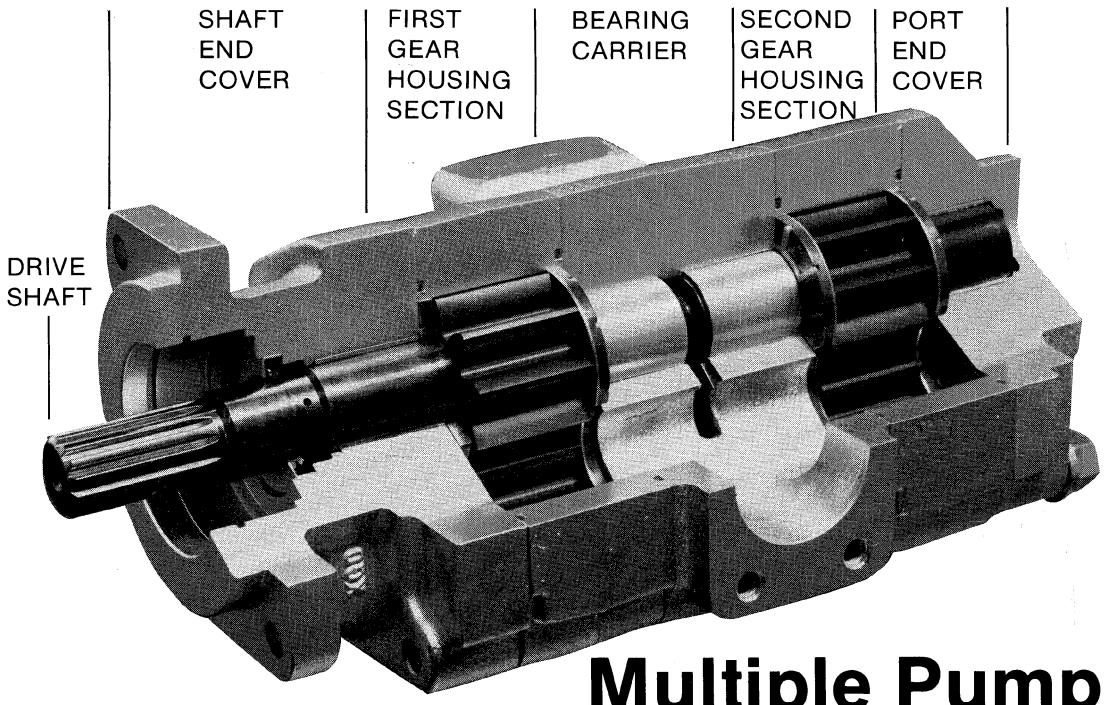
- Single & Tandem Oil Hydraulic Pumps & Motors
- General Instructions & Tool List
- Disassembly & Assembly Instructions
- Lubrication & Oil Recommendations
- Recommended Test Procedure

P

PUMPS



Single Pump



Multiple Pump

Use Genuine Commercial Replacement Parts

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315 / 330
350 / 365
Service Manual
HS-19

GENERAL INSTRUCTIONS

These service instructions will familiarize you with Commercial's single and multiple pumps — their component parts — the relative position of each part — proper methods for assembly or disassembly of the units — care and use of these oil hydraulic power units — so that best performance and longer working life will result for your benefit.

To facilitate the repair of these units — and before any work is done — we suggest that you first read all of the steps used in disassembly and all of the steps used in building up the unit.

Dirt is the enemy of any hydraulic system. The first requirement of good maintenance of hydraulic equipment is cleanliness. MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA.

Our pictures show a Model 365. Notes in the text cover variations between this unit and the other models.

It is important to airblast all parts and wipe them with a clean, lintless cloth before assembly.

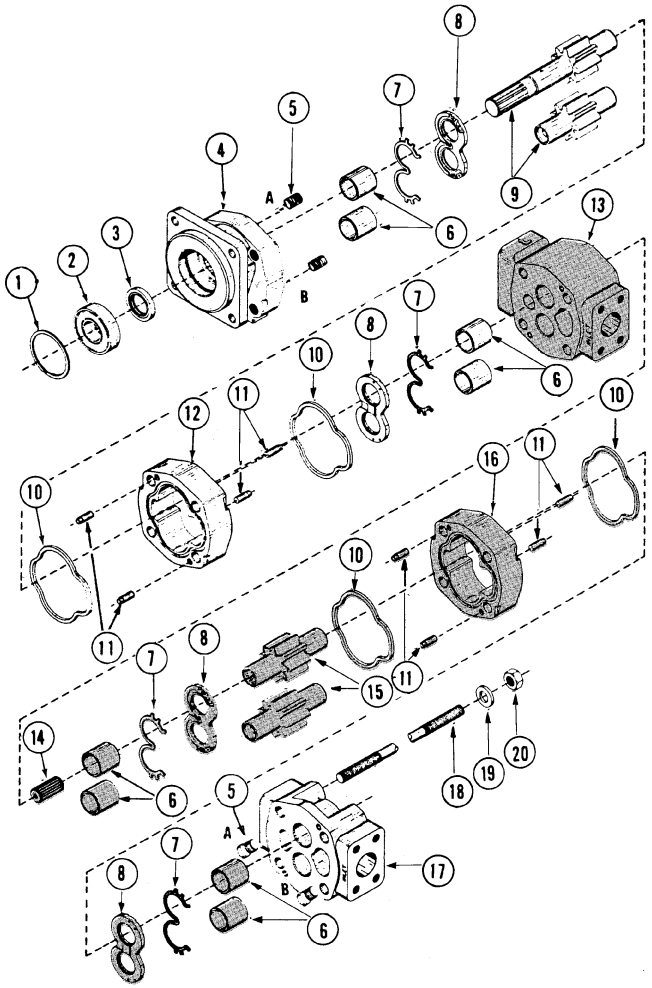
USE CAUTION IN GRIPPING ALL PARTS IN THE VISE TO AVOID DAMAGING MACHINED SURFACES.

A pump must be driven in the direction of rotation for which it was built; otherwise, pressure will blow the shaft seal. Check the exploded view and notes at right for proper direction of rotation.

COMMERCIAL'S REPLACEMENT PARTS

Commercial's replacement parts are of original equipment standards. For assured quality of material and workmanship, and for compatibility in assembly, USE ONLY GENUINE PARTS FROM COMMERCIAL.

Check all replacement parts before installing them to be certain they were not damaged in shipment.



NOTE:
For P315 and P330 ONLY - Plug 5 required in position A and position B.

For P350 and P365 ONLY - Plug 5 in position B gives clockwise rotation. Plug 5 in position A gives counterclockwise rotation.

PARTS LIST

1. Snap Ring
2. Outboard Bearing
3. Seal
4. Shaft End Cover
5. Plug
6. Bushings
7. Channel Seal
8. Thrust Plates
9. Integral Drive Shaft and Gear Set
10. Gasket Seal
11. Dowel Pins (Solid for P315. P330 amd P350. Hollow for P365 - ONLY.)
12. Gear Housing
13. Bearing Carrier
14. Connecting Shaft
15. Matched Gear Set
16. Gear Housing
17. Port End Cover
18. Studs or Cap Screws
19. Washers
20. Nuts

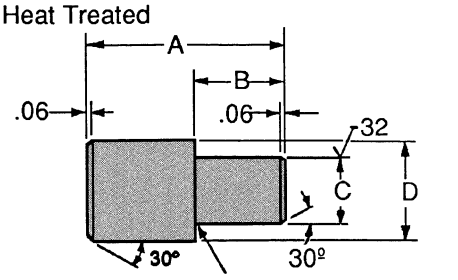
Items shaded apply to multiple assemblies only.

Tool List

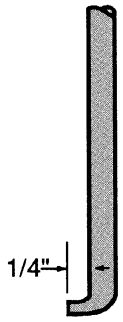
- Arbor press
- Awl
- 1 1/2" Dia. steel ball
- Bearing puller (Owatonna Tool Co. MD - 956 or equivalent)
- Bushing remover tool (See sketch)
- Clean lintless cloths
- Deburring tool (an old file with cutting teeth ground off)
- Machinist's hammer
- Soft hammer
- Permatex Aviation Form-A-Gasket No. 3 non-hardening sealant or equivalent
- Medium grit carborundum stone
- Seal removal tool (see sketch)
- Oil and grease
- Snap ring pliers
- Prick punch
- Bushing installation tool (see sketch)
- Scale (1/32" or 1/64" graduations)
- Small screw driver
- Torque wrench
- Vise with 6" minimum opening.
- Bar for lip seal installation

  Note: For 315 use 1 5/8" dia. x 2" bar.
  For 330 use 1 3/4" dia. x 2" bar.
  For 350 use 2 1/2" dia. x 2" bar
  For 365 use 2 1/2" dia. x 2" bar.
- Special steel sleeve (see sketch)

Bushing Installation Tool
A.I.S.I. 8620 Bearing Quality Steel
Heat Treated



Grind Relief Allowable

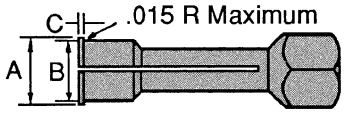


Seal Removal Tool
Easily made from old screw driver. Heat tip and bend as shown. Grind tip to fit notch behind the shaft seal.

	A	B	C Dia.	D. Dia.
P315	2.312	1.15	.937 $^{+.000}_{-.002}$	1.250
P330	3.00	1.47	1.054 $^{+.000}_{-.002}$	1.250
P350	3.00	1.47	1.282 $^{+.000}_{-.002}$	1.625
P365	3.00	1.73	1.492 $^{+.000}_{-.002}$	1.750

Bushing Puller: The bushings in P315, P330, P350 and P365 pumps may be removed from their bores using blind hole collet-type bushing pullers similar to those manufactured by Owatonna Tool Co. The table below illustrates the modifications necessary to adapt the OTC collets to this task. Equivalent pullers from other suppliers may be modified in similar fashion.

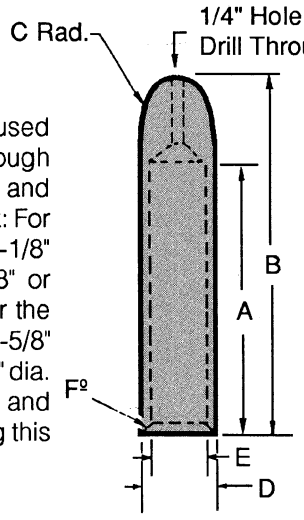
Typical Collet



Pump/Motor	A	B	C	Make From OTC Collet No.
315	.900 / .890	.800 / .790	.100 / .090	33863
330	.980 / .970	.875 / Ref.	.100 / .090	33863
350	1.122 / 1.122	1.000 / 0.990	.072 / .052	33864
365	1.382 / 1.372	1.260 / 1.250	.100 / .120	33865

Special Steel Sleeve

The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock: For the P315 use a 1" dia. x 3-1/8" bar; for the P330 use a 1-1/8" or 1-1/4" dia. x 4- 5/8" bar; for the P350 use a 1-3/8" dia. x 4-5/8" bar; for the P365 use a 1-1/2" dia. x 4-5/8" bar. The drawing and chart give details for making this special tool.



	A	B	C Rad	D Dia.	E. Dia.	Fº chamfer
P315	1-7/8"	3"	9/16"	.944 $^{+.000}_{-.002}$	.885 $^{+.002}_{-.000}$	.050" x 60º
P330	3-3/8"	4-1/2"	9/16"	1.065 $^{+.000}_{-.002}$	1.002 $^{+.002}_{-.000}$	.015" x 45º
P350	3-3/8"	4-1/2"	9/16"	1.290 $^{+.000}_{-.002}$	1.250 $^{+.002}_{-.000}$	.015" x 60º
P365	3-3/8"	4-1/2"	9/16"	1.377 $^{+.000}_{-.002}$	1.250 $^{+.002}_{-.000}$	.015" x 60º

All external surfaces must be free of scratches and burrs.

CAUTION:

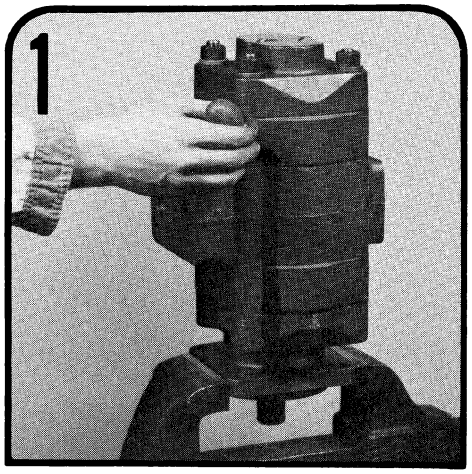
1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.

2. If parts are difficult to fit during assembly, tap gently with a soft hammer (never use an iron hammer).

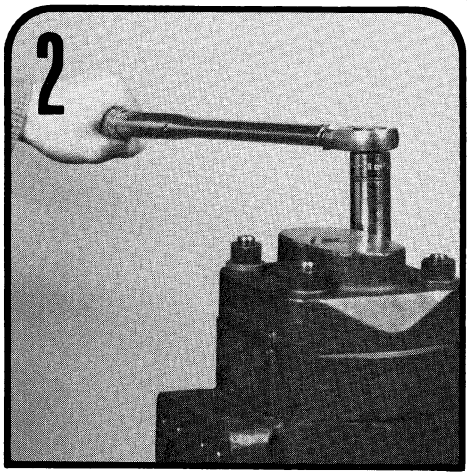
3. Gears are closely matched, therefore they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth. Avoid touching gear journals.

4. Never hammer bushings into bores, use an arbor press.

start disassembly here

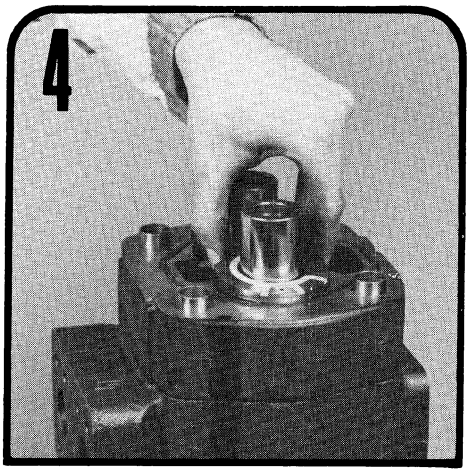


Place the pump in a vise with the drive shaft pointing down. Caution: DO NOT GRIP ON OR NEAR ANY MACHINED SURFACES DURING ASSEMBLY OR DISASSEMBLY. Match-mark all sections. Be sure to align these marks when reassembling.



Use a socket wrench to remove the 4 cap screws on single units or the 4 hex nuts, studs and washers of multiple units.

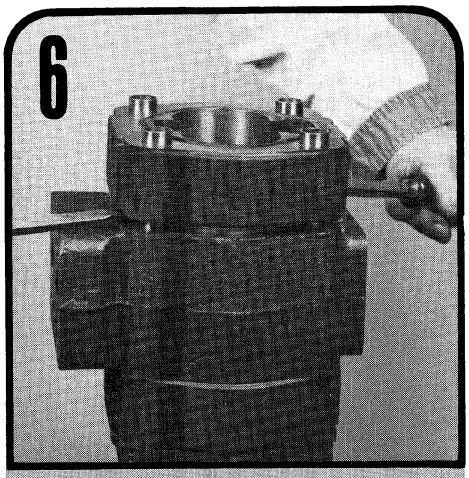
Lift off the port end cover. If prying is necessary, be careful not to damage the machined surfaces. Dowel pins will remain in either port end cover or gear housing. **Do not remove.**



Remove the thrust plate. Examine and replace if necessary. See wear guide page 12.

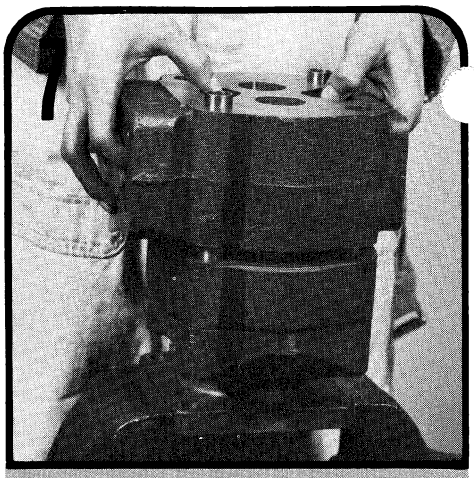
Carefully remove the drive and driven gears. Avoid tapping the gear teeth together or against other hardened surfaces. Keep these gears together because they are a matched set. Examine and replace if necessary. (See page 12). Remove the thrust plate from the bearing carrier. Examine and replace if necessary. *See below.

FOR MULTIPLE ASSEMBLIES ONLY.



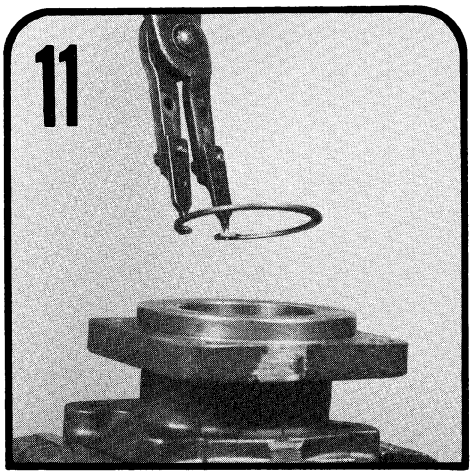
Lift the gear housing from the bearing carrier. If prying is necessary, take care not to damage machined surfaces. Examine and replace if necessary (see page 12).

FOR MULTIPLE ASSEMBLIES ONLY.

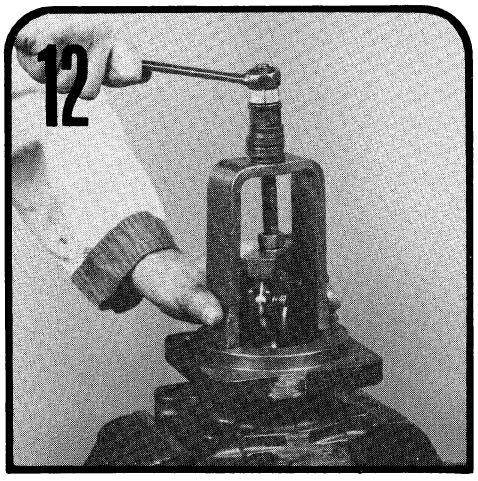


Carefully lift or pry off the bearing carrier to prevent damage to contact face and edges. Dowel pins will remain in either the bearing carrier or the gear housing. **DO NOT REMOVE THEM.**

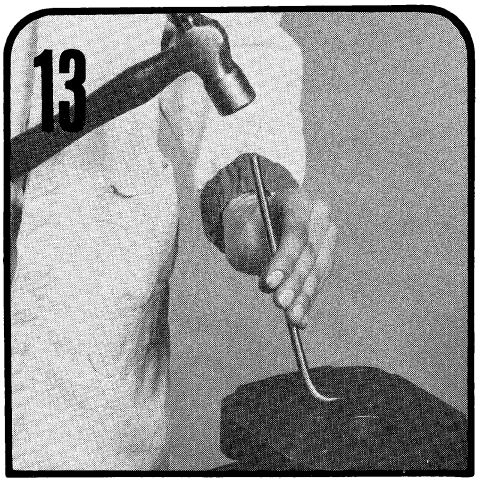
FOR MULTIPLE ASSEMBLIES ONLY.



If the pump is equipped with an outboard bearing, place the shaft end cover in the vise with the mounting face up. Remove the snap ring with snap ring pliers. If unit is equipped with a spiral lock retaining ring, remove with a small screwdriver or awl.

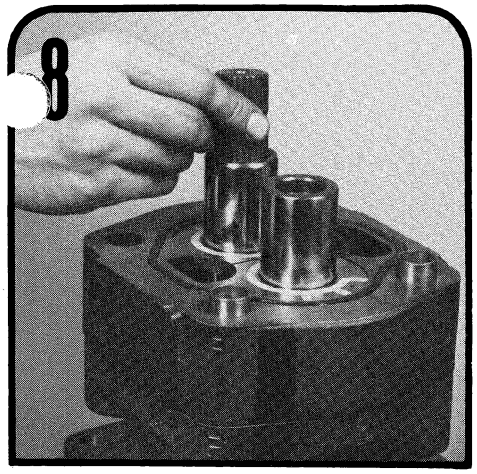


Use a bearing puller to remove the outboard bearing.

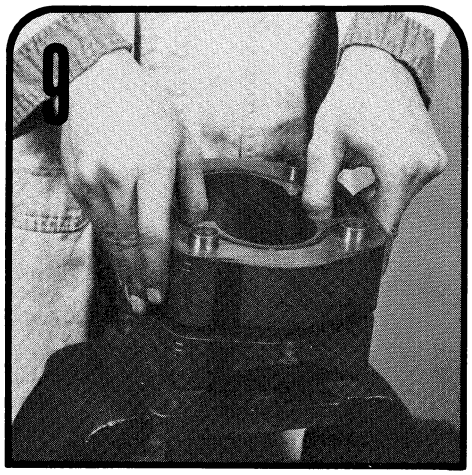


Grip the shaft end cover in a vise with the mounting face down. Remove double lip seal by inserting the special seal removal tool (see Tool List) into the notch between the double lip seal and the shaft end cover. Tap the seal out and discard.

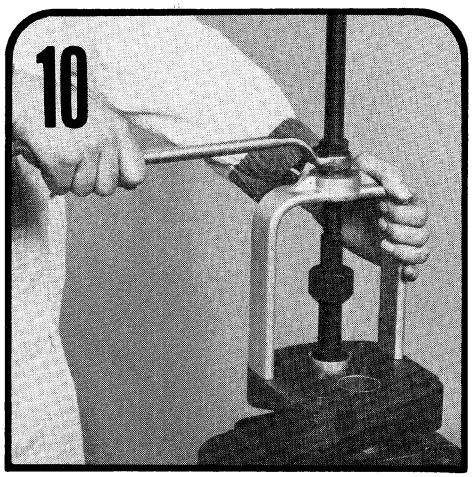
Remove and discard all rubber and polymer seals.



Remove the connecting shaft. Remove the thrust plate. Examine and replace if necessary. (See page 12). Remove the driven gear and the integral gear and drive shaft. Keep these together as they are a matched set. Examine and replace if necessary. *See page 12. Be careful not to damage the machined surfaces of the gears.

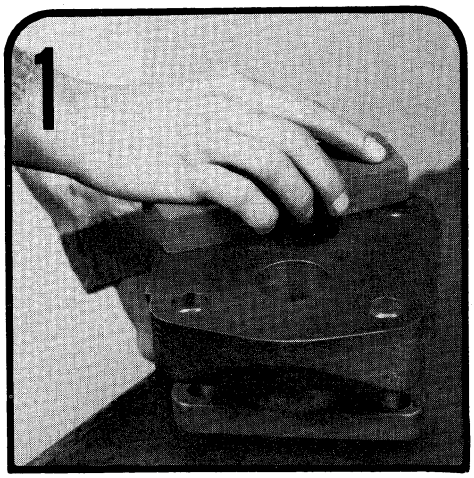


Lift or pry off the first section gear housing. Be careful not to damage machined surfaces. Examine and replace if necessary (see page 12).

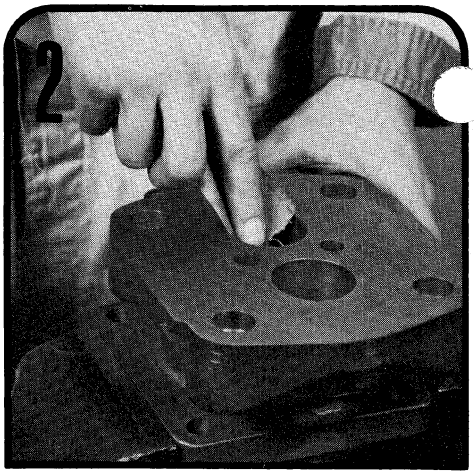


Inspect all bushings for scoring or discoloration and replace if necessary. Use a bushing puller as shown in the tool list to remove bushings (see page 12).

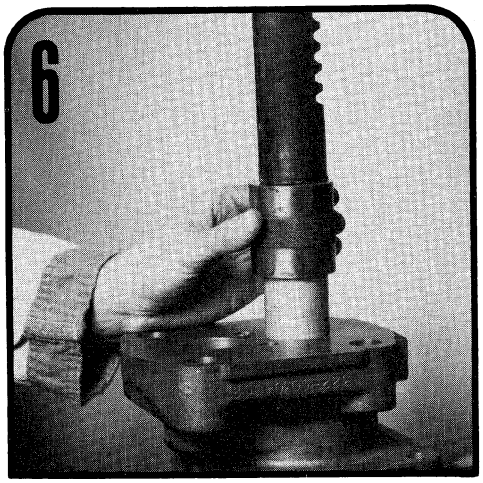
start assembly here



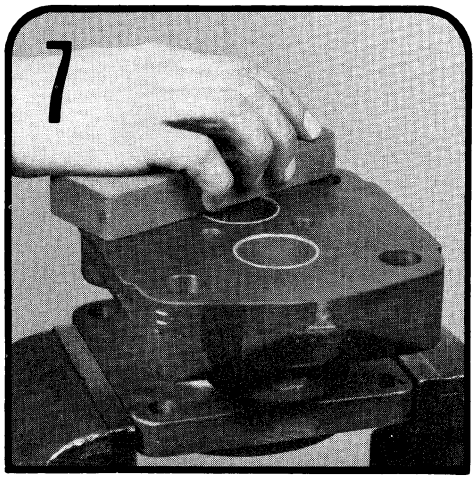
Stone all machined surfaces with a medium grit carborundum stone.



If bushings have been removed, deburr the bushing bores with emery cloth. Rinse parts in a solvent. Air blast all parts and wipe with a clean lintless cloth before starting assembly.

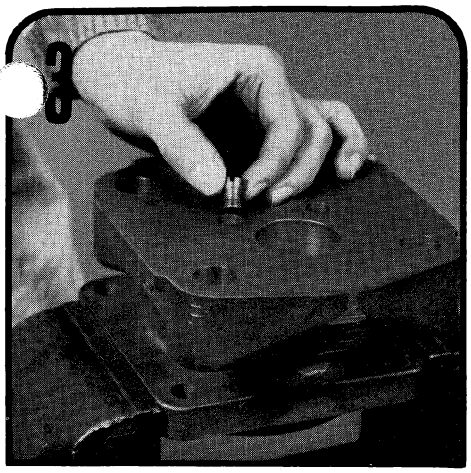


Bushings should be pressed into the bores, one at a time using the special installation tool and an arbor press. Be sure the grooves (or seams) are positioned as stated in Step #5. Bushings must be pressed into the bores flush with the casting face. Be sure to support the castings so they are square and level.



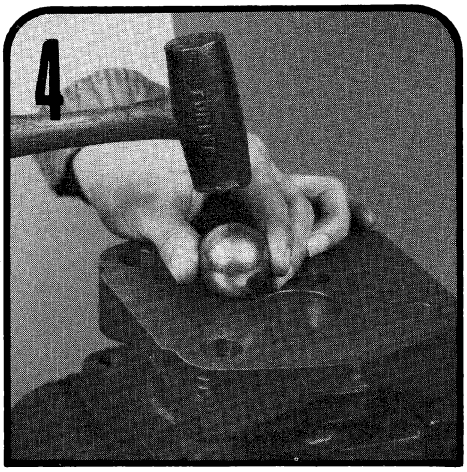
Repeat Steps 1 and 2, stone and rinse parts.

See that dowel pins are in place in any new castings. Examine all dowels. (See page 12). Before inserting make certain the hole is clean and free from burrs. Gently start pin straight into hole and tap lightly with a soft hammer.



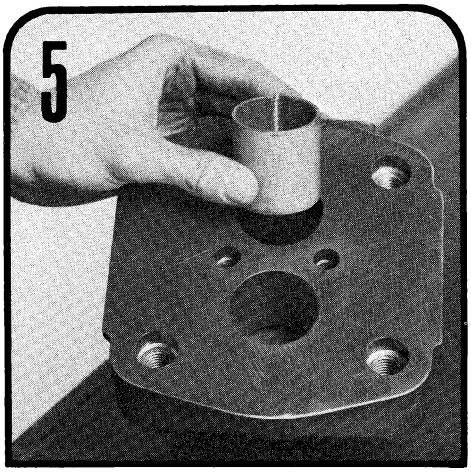
Grip shaft end cover in vise with mounting face down. Examine plug or plugs* to be sure they're tightly in place. Replacement is necessary only if parts are damaged. Remove with screwdriver.

*P315 and P330 have two plugs in both the shaft end and port end covers. P350 and P365 have one plug on the outlet side of their shaft end and port end covers.



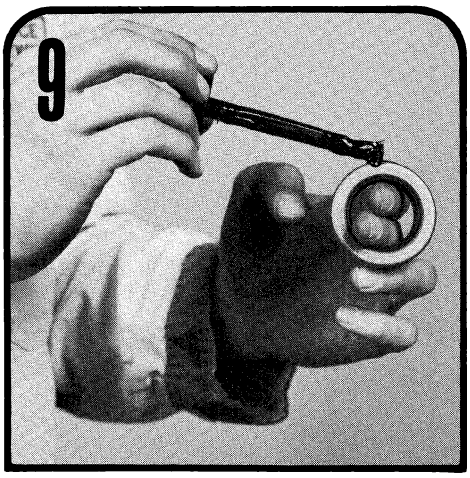
New plugs should be screwed in tightly. Stake plug with prick punch at both ends of screwdriver slot and around edges. Peen edge of hole $^1/_{32}$" to $^1/_{16}$" with $1^1/_2$" diameter steel ball.

NOTE: If new plug or plugs are being installed coat threads with Loctite thread sealant.

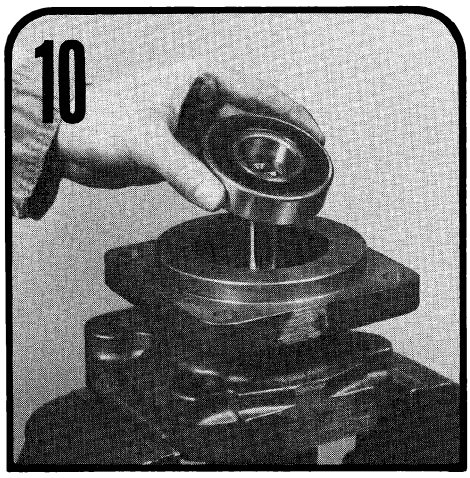


ASSEMBLY STEPS 5, 6, 7 AND 8 APPLY TO SHAFT END COVER, BEARING CARRIERS AND PORT END COVER.

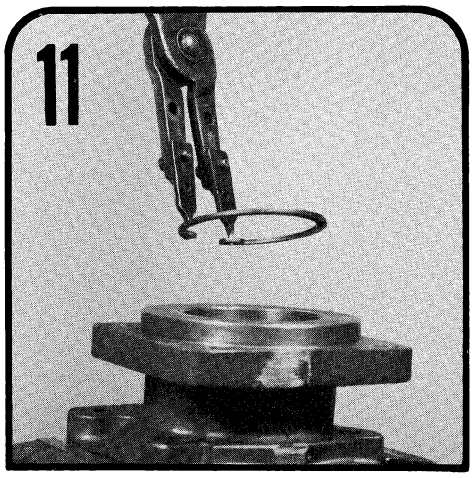
Any bushings removed from the shaft end cover, port end cofver or bearing carrier should be assembled in drive bores with groove to the top of unit (12 o'clock). Assemble bushings in driven bores with the groove to bottom of unit (6 o'clock). The P315 does not have grooved bushings, therefore the bushing seams should be placed at the 12 and 6 o'clock positions.



Before inserting a new lip seal in the shaft end cover, coat the outer edge of the lip seal and its recess with Permatex Aviation Form-A-Gasket No. 3 non-hardening sealant or equivalent. With the metal side of the lip seal up, press it into the mounting flange side of the shaft end cover with an arbor press and bar (see Tool List). Be careful not to damage the lip of the seal. Press in until flush with the recess. Wipe off excess sealant.

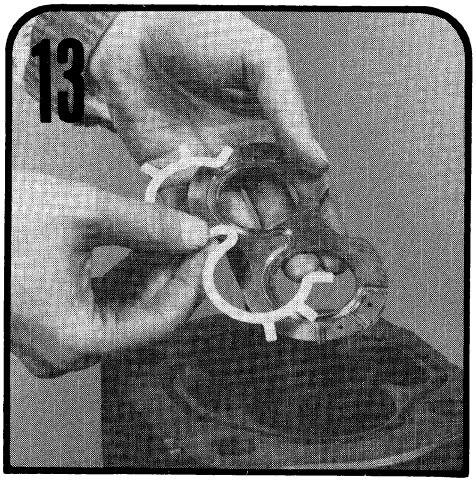


If the unit is equipped with an outboard bearing, guide the bearing into its recess in the shaft end cover. This is a light press fit. It may be necessary to lightly tap the bearing into the bore.

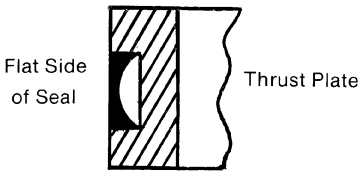


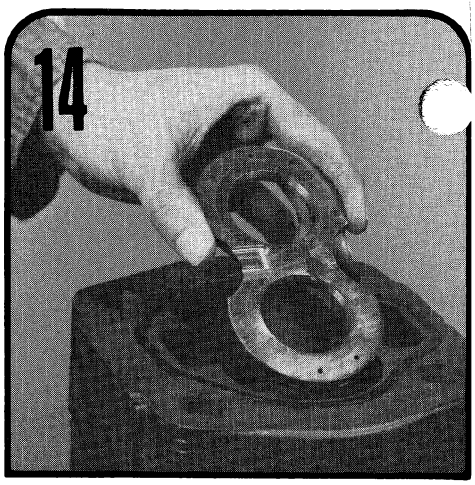
If the pump is equipped with an outboard bearing, place the shaft end cover in the vise with the mounting face up. Install the snap ring in the groove to retain the outboard bearing.

Grease the new gasket seals and insert them into the grooves in both sides of all gear housings. Position the first gear housing over the shaft end cover and dowels. Tap it with a soft hammer until it rests tightly against the shaft end cover. Be careful not to pinch the gasket seal. Also be sure the large rounded core is on the inlet side.



Assemble the channel seals into the grooves in the thrust plates with the flat side of the seal facing away from the thrust plate as shown below.





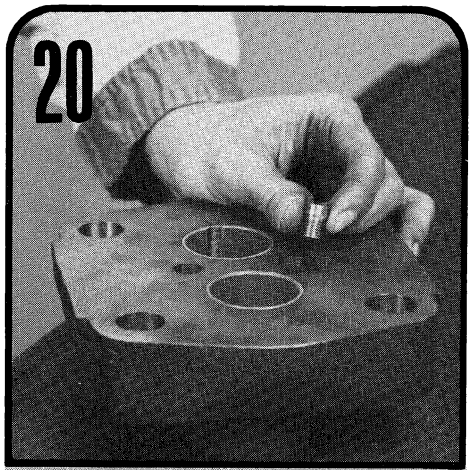
Gently slip the thrust plate through the gear housing and into place on the shaft end cover. The channel seal from Step #13 should face the shaft end cover. The relief groove in the plate should face the outlet side of the pump.

Insert the connecting shaft in the spline of the drive gear. Position and place the second gear housing on the bearing carrier as outlined in Step #12.

FOR MULTIPLE ASSEMBLIES ONLY.

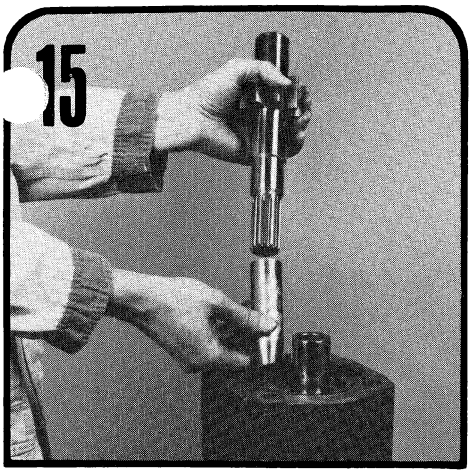
Place the thrust plate in the gear housing per Step #14. Insert the drive and driven gears of the second section in their respective bearings. Make certain gears are in contact with thrust plate face. Place the port end cover plate in the housing per Step #16.

FOR MULTIPLE ASSEMBLIES ONLY.

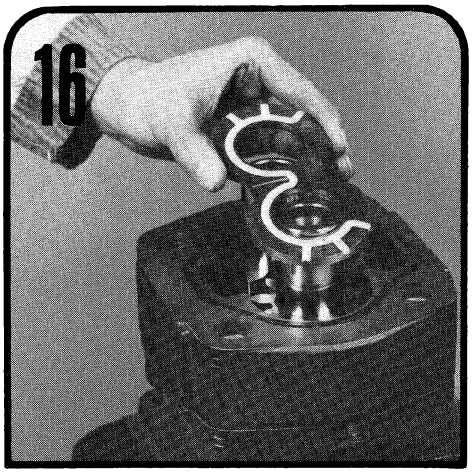


Check the plug or plugs in the port end cover to be sure they are tight. Follow procedure outlined in Step #4 for new plugs.

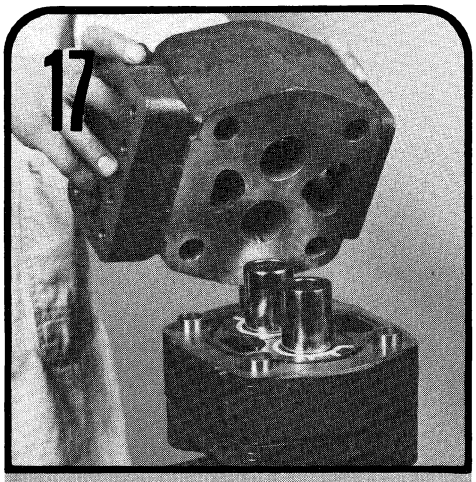
FOR MULTIPLE ASSEMBLIES ONLY.



Slide the driven gear through the housing and into the bushing in the shaft end cover. Coat the steel sleeve tool with grease. Place the lightly greased drive shaft inside the sleeve and slide both through the shaft end cover with a twisting motion until the integral gear rests against the thrust plate. Avoid damaging the double lip seal. Remove the steel sleeve. Squirt clean oil over the gears.



Slip thrust plate with seal over gear journals and into housing bore. The flat side of the seal should face up with the relief groove facing the outlet side. For single pump assemblies go directly to Step #21 as your next step.



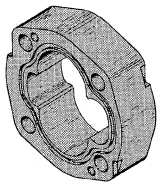
Position the bearing carrier over the gear housing so that the bushings receive the journals of the drive and driven gears. Be sure to line up the dowel holes over the dowel pins. When the parts are parallel, squeeze them together or alternately tap over each dowel until the parts are together.

FOR MULTIPLE ASSEMBLIES ONLY.

Place the port end cover over the gear journals. Align the dowels with the holes in the mating casting. Being careful not to pinch the gasket seal, tap the port end cover lightly in the center between bearing bores to engage the dowels and to move parts together in final seating.

Thread the fasteners into the shaft end cover and tighten alternately or cross corner. Rotate the drive shaft with a 6" wrench to check for binding. If there is no internal binding, torque diagonally opposed fasteners to 200 ft. lbs. (2400 in. lbs.); 141 ft. lbs. (1700 in. lbs.) for P/M315 models; 450 ft. lbs. (5400 in lbs.) for M365.

*As a guide in answering the question, "How much wear is allowed before the part should be replaced?", We offer the following suggestions...

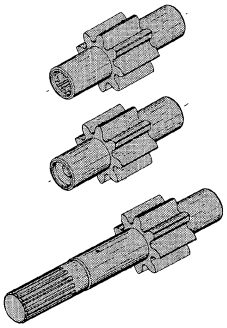


GEAR HOUSINGS:

Wear in excess of .007" cut-out necessitates replacement of the gear housing. Place a straight-edge across bore. If you can slip a .007" feeler gage under the straight-edge in the cut-out area, replace the gear housing.

Pressure pushes the gears against the housing on the low pressure side. As the hubs and bushings wear, the cut-out becomes more pronounced. Excessive cut-out in a short period of time indicates excessive pressure or oil contamination. If the relief valve settings are within prescribed limits, check for shock pressures or tampering. Withdraw oil sample and check it, and tank, for dirt.

Where cut-out is moderate, .007" or less, gear housing is in good condition and may be reused.



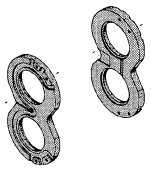
GEARS:

Any scoring on gear hubs necessitates replacement. Scoring, grooving, or burring of outside diameter of teeth requires replacement. Nicking, grooving, or fretting of teeth surfaces also necessitates replacement.

DRIVE SHAFTS:

Replace if there is any wear detectable by touch in the seal area or at the drive coupling. .002" wear is the maximum allowable.

Wear in the shaft seal area indicates oil contamination. Wear or damage to splines, keys, or keyways necessitates replacement.



THRUST PLATES:

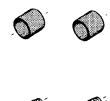
The thrust plates seal the gear section at the sides of the gears. Wear here will allow internal slippage, that is, oil will bypass within the pump.

A maximum of .002" wear is allowable. Replace thrust plates if they are scored, eroded or pitted.

Check center of thrust plates where the gears mesh. Erosion here indicates oil contamination.

Pitted thrust plates indicate cavitation or oil aeration.

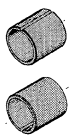
Discolored thrust plates indicate overheating, probably insufficient oil.



DOWEL PINS:

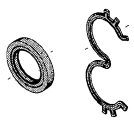
If either the dowel or dowel hole is damaged, the dowel or machined casting, or both, must be replaced.

If more than reasonable force is required to seat dowels, the cause may be poorly deburred or dirty parts; cocking of dowel in the hole; or improper pin-to-hole fit.



BUSHINGS:

If gears are replaced, bushings must be replaced. Bushings should fit into bore with a heavy press fit.



SEALS AND GASKETS:

Replace all rubber and polymer seals, including all "O" rings, thrust plate channel seals, shaft seal and gasket seals.

PLUGS:

Examine the plugs in the shaft end and port end cover to make sure they are in the proper position and tight. The P315 and P330 should have two plugs in both the shaft end and port end in tandem units only. The P350 and P365 have one plug in their shaft and port ends high pressure side only.

lubrication and oil recommendations

All parts, with the exception of the outboard bearing, are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep the oil in the circuit system clean. Whenever there is a pump or motor failure, and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean, and any filter screens thoroughly cleaned or replaced. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Commercial's pumps and motors should meet the following specifications:

Viscosity:
- 50 SSU minimum @ operating temperature
  7500 SSU maximum @ starting temperature
- 150 to 225 SSU @ 100° F. (37.8° C.) (generally)
  44 to 48 SSU @ 210° F. (98.9° C.) (generally)

	Approximate SSU at...	
Oil Grade	100° F. (37.8° C.)	210° F. (98.9° C.)
SAE 10	150	43
SAE 20	330	51

Viscosity Index: 90 minimum

Aniline Point: 175 minimum

Recommended Additives: Foam depressant, rust and oxidation inhibitors.

Filtration: 10 micron recommended for maximum pump life.

Other Desirable Characteristics:

- Stability of physical and chemical characteristics.
- High demulsibility (low emulsibility) for separation of water, air and contaminants.
- Resistant to the formation of gums, sludges, acids, tars and varnishes.
- High lubricity and film strength.

General Recommendations:

A good quality hydraulic oil conforming to the characteristics listed above is essential to satisfactory performance and long life of any hydraulic system.

Oil should be changed on regular schedules in accordance with the manufacturer's recommendations and the system periodically flushed.

Oil temperature in reservoir must not exceed 200° F., (93.3° C.) with a maximum temperature of 180° F. (82.2° C.) recommended. Higher temperatures will result in rapid oil deterioration.

Reservoir capacity should equal in gallons the pump output in gpm or the total gpm of all pumps where there is more than one in the system.

Oil poured into the reservoir should pass through a 100 mesh screen. Pour only clean oil from clean containers into the reservoir. A 100 mesh screen may be used in the suction line leading to the pump. A suction filter should be of sufficient size to handle twice the pump capacity. It must be cleaned and checked regularly to avoid damage due to contamination and cavitation.

Normal Temperatures:

0° F. (—18° C.) to 100° F. (37.8° C.) Ambient
100° F. (37.8° C.) to 180° F. (82.2° C.) System
Be sure your oil is recommended for the temperatures you expect to encounter.

Cold Weather Operation:

Oils for use in cold weather should have a viscosity not exceeding 7500 SSU at the minimum start-up temperature. A pour point of at least 20° F. below start-up temperature is recommended. Start-up procedures should allow for a gradual warm-up until the oil reaches a reasonably fluid state.

The Use of Other Fluids:

- Automatic Transmission Fluid (ATF): General experience here has been satisfactory; however, ATF oils are sometimes too expensive for normal use in hydraulic systems.

- Diesel Fuel or Kerosene (Coal Oil): Sometimes used as dilutants for cold weather operations but are not recommended as they are not sufficiently refined products.

- Fire Resistant Fluids: DO NOT USE ANY FIRE RESISTANT FLUIDS OR NON-PETROLEUM OILS WITHOUT CONSULTING OUR TECHNICAL SERVICE DEPARTMENT.

- These suggestions are intended as a guide only. OBTAIN YOUR FINAL FLUID RECOMMENDATIONS FROM YOUR FLUID SUPPLIER.

recommended start-up procedure for new or rebuilt pump

Before installing a new or rebuilt pump, back off the main relief valve until the spring tension on the adjusting screw is relieved. This will avoid the possibility of immediate damage to the replacement unit in the event that the relief valve setting had been increased beyond the recommended operating pressure prior to removing the old unit.

Before connecting any lines to the pump, fill all ports with clean oil to provide initial lubrication. This is particularly important if the unit is located above the oil reservoir.

After connecting the lines and mounting the replacement unit, operate the pump at least two minutes at no load and at low rpm (400 min.) During this break-in period, the unit should run free and not develop an excessive amount of heat. If the unit operates properly, speed and pressure can then be increased to normal operating settings.

Reset the main relief valve to its proper setting while the pump is running at maximum operating engine (motor) speed for the vehicle.

ALWAYS USE AN ACCURATE GAGE WHEN ADJUSTING THE RELIEF VALVE PRESSURE SETTING.

recommended test procedure

Be sure there is an adequate supply of oil for the pump, at least one gallon of oil for each gpm of pump capacity.

If one section of a tandem pump is being tested, make sure that all other sections not being tested are adequately supplied with oil. If any of the other sections run dry, or if plugs are left in ports, serious and permanent damage will result.

The oil should be a good quality hydraulic oil rated at 150 SSU at 100° F., with the oil temperature held at 120° F. plus or minus 5° F. (Test procedures are described in detail in SAE handbooks; see Hydraulic Power Pump Test Procedure, SAE J745c.)

The feed line must be of adequate size with no more than 5" mercury vacuum adjacent to the pump inlet. As a rule, the feed line must provide a feed flow velocity not in excess of 8 feet per second.

Feeding hot oil into a cold pump may cause the pump to seize. Jog the pump by momentarily starting the driving engine or motor to gradually equalize pump and oil temperatures.

Run the pump at least two minutes at no load and moderate speed (not over 1500 rpm). If the pump becomes excessively hot, shut down immediately and locate the problem source.

Gradually increase pressure on pump, in 500 psi increments until the desired test pressure has been reached. This should take about five minutes.

Delivery should run close to rated catalog performance figures which are averaged from testing several pumps. Something like a 5% lower reading may be used as a rated minimum if new or relatively new parts have been used. When rebuilding the pump with parts from the original pump, which, while worn, appear satisfactory for reuse, a 10% or 15% lower reading may be permitted, depending on the performance expected from the equipment. One's own experience will prove the best guide here.

Many repairmen measure the output at normal operating speed and at zero pressure, then again at 1000 psi (or the operating pressure of the equipment) and allow a volume decrease approximating the listing below. It is a suggested reference only which makes allowance for reused parts.

GPM DELIVERY at 1800 rpm	GPM DROP OFF AT...		
100 psi	1000 psi/70 bar	2000 psi/140 bar	3000 psi/210 bar
10-30	$1\frac{1}{2}$-3	2-$3\frac{1}{2}$	$2\frac{1}{2}$-4
30-50	2-3	$2\frac{1}{2}$-4	3-$4\frac{1}{2}$
50-70	$2\frac{1}{2}$-$3\frac{1}{2}$	3-5	$3\frac{1}{2}$-$5\frac{1}{2}$

At test speeds other than 1800 rpm, gpm delivery will vary almost proportionately, but the same (drop-off) figures should be used.

Be sure to run the pump in the direction for which it was designed and built. Driving pump in the wrong direction will build up pressure behind shaft seal, damaging it and necessitating replacement.

After completing testing procedures, pump is ready for installation and immediate duty operation on equipment. Again, it must be remembered that to prevent seizure, hot oil must not be fed into a cold pump.

Pump Division

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Commercial Intertech Corp. is an international manufacturer of hydraulic systems and their component pumps, motors, valves, and cylinders.

CAT. HS-19, 2.5MYL 7/98

APC160
Transformer TF6-42

Drivetrain Control System Description

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APC160 for Transformer

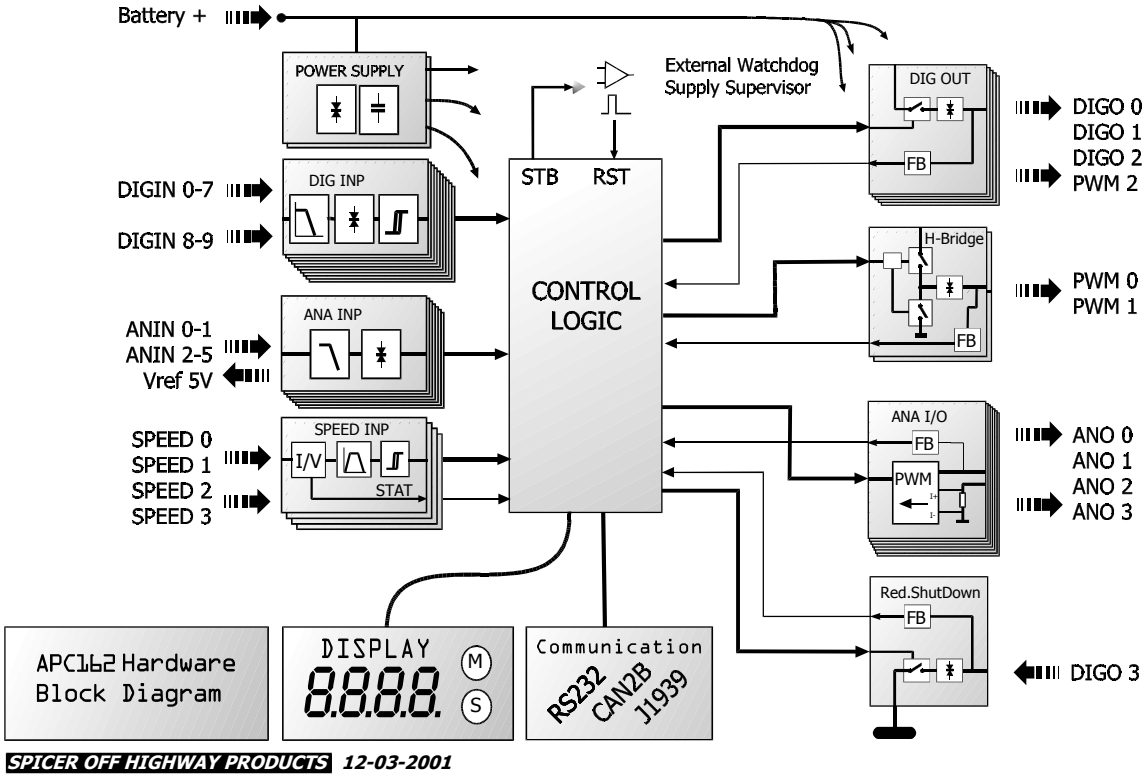
1. Functional specification

SYSTEM BLOCK DIAGRAM

The essential application target is to extend the basic Boom Handler functionality with safe Aerial Work Platform functionality where the man on the platform can precisely control the vehicle speed and direction from the platform.

To reach this goal, besides controlling the transmission solenoids, the APC160 takes care of the engine fuel pump setting, the pressure applied to the service brakes, and the operation of the parking brake.

The built in self-test and trouble shooting features allow fast problem resolution.



Note that in this Control System Description the term APC160 is used to refer to the control system. Where APC160 is a controller family designation, this application requires a specific family member: the APC162-12 - a 12V controller with an output dedicated to servomotor control.

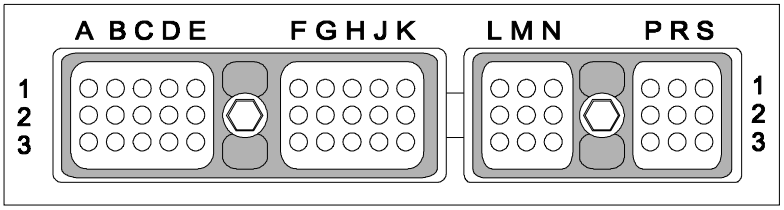
1.1 External interfaces overview

In the following table all references to terminals refer to the APC160 connector pins.

WIRE	PIN	FUNC	TYPE	FUNCTION
A1	***A1***	***PPWR***	***Pwr***	**Permanent Battery Plus**
A2	B1	VFS0+	Pwm	Brake solenoid 0-1000mA
A3	C1	VFS0-	Sns	Brake solenoid 0-1000mA
A4	D1	VFS1+	Pwm	1/2 Solenoid out
A5	E1	VFS1-	Sns	n/c
A6	F1	VFS2+	Pwm	2/3 solenoid out
A7	G1	VFS2-	Sns	n/c
A8	H1	VFS3+	Pwm	Splitter solenoid out
A9	J1	VFS3-	Sns	n/c
A10	K1	DO0	Stp	Parking Brake solenoid out
A11	A2	ANI0	Ptg	Boom Function : 0 Ω = Active / 3.3 kΩ = Inactive
A12	B2	DIGIN0	Ptp	Shift lever 1-2
A13	C2	DIGIN1	Ptp	Shift lever 2-3
A14	D2	DIGIN2	Ptp	Shift lever H/L
A15	E2	DO1	Stp	Forward solenoid out
A16	F2	DO2	Stp	Reverse solenoid out
A17	G2	DIGIN3	Ptp	AWP control: CABIN / AWP 12 V = Cabin Control
A18	H2	DIGIN4	Ptp	Shift lever FWD
A19	J2	DIGIN5	Ptp	Shift lever REV
A20	K2	DO3	Stg	Parking Brake Indicator
A21	A3	GND	Gnd	**Ground**
A22	B3	SS0	Sns	Output speed + (optional)
A23	C3	SS0	Gnd	Output speed - (optional)
A24	D3	SS1	Sns	Turbine speed sensor +
A25	E3	SS1	Gnd	Turbine speed sensor -
A26	F3	SS2	Sns	Engine speed sensor +
A27	G3	SS2	Gnd	Engine speed sensor-
A28	H3	ANI1	Ptg	Boom Pos: 3.050 Ω = Down & In / 1.250 Ω= Up or Extended
A29	J3	ANI2	Ptg	Throttle position 0-5V
A30	K3	GND	Gnd	**Signal Ground**

WIRE	PIN	FUNC	TYPE	FUNCTION
B1	L1	VFS4+	HbrgA	Throttle servo A 0-4A
B2	M1	ANI4	Sns	Ref Voltage out 5V
B3	N1	VFS5+	HbrgB	Throttle servo B 0-4A
B4	P1	ANI5	Sns	Servo position feedback 0-5V
B5	R1	VFS6+	Pwm	Engine Starter: ON = Disabled / OFF = Enabled
B6	S1	ANI6	Sns	Center voltage of Joystick 0-5V
B7	L2	CANL	Comm	CANL needs external 120 Ω
B8	M2	CANH	Comm	CANH
B9	N2	RXD	Comm	RS232 RXD
B10	P2	TXD	Comm	RS232 TXD / WARNING OUT
B11	R2	SS3	Sns	Parking Brake Push Button (short is active)
B12	S2	SPWR	Pwr	**Switched Battery Plus**
B13	L3	DIGIN6	Ptp	Boom Speed Mode Slow / Fast 12 V = Slow
B14	M3	DIGIN7	Ptp	Shift Mode: Manual / Automatic 12 V = Manual
B15	N3	DIGIN8	Ptp	AWP Sensor: Disconnected / Connect 12 V = Disconnected
B16	P3	DIGIN9	Ptp	Platform Enable Switch: Enable / Disable 12 V = Enable
B17	R3	ANI3	Ptg	Joystick Position Sensor: 0 V =100% Rvs / 5 V =100% Fwd
B18	S3	SGND	Gnd	**Power Ground**

Connector layout :



1.2 Controller Modes

1.2.1 Normal Driving Mode

Three Normal Driving Modes are foreseen:

- Handler Mode (See 1.4)
- AWP-Platform Control Mode (See **Error! Reference source not found.**)
- AWP-Cabin Control Mode (See 0)

1.2.2 Self Test Mode

This mode is selected when the 'S' button is pressed during power up.

1.2.3 Limp Home Mode

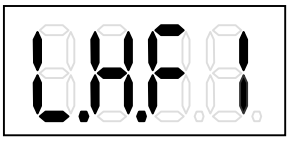
Defaulted to if a fault related to the turbine speed sensor is detected occurs:

If this condition is present, the transmission is first put into Neutral & AWP drive is disabled.

In order to continue driving, Neutral must then be selected on the shift lever. Once the shift lever has been put in Neutral, the driver can re-engage a direction.

In this mode, the user can operate the transmission in either direction in 1st gear only. If the fault occurs at a higher gear position, the user is allowed to shift down manually.

The GPOS / CPOS display indicates the letters 'LH' left of the direction/position indication.



1.2.4 Shutdown Mode

This mode is activated when a severe internal or external problem is detected.

In this mode, the transmission is forced into Neutral, the engine is forced to low-idle and the parking brake is switched ON.

This mode is selected only if an intolerable combination of faults exists. In case of an intermitting problem, **SHUTDOWN** mode is exited and the system can be operated as before again after cycling the shift lever.

1.2.5 Calibration Mode

This mode is selected when the 'S' button is pressed for at least 10 seconds during power up.

See section 4.2 for a detailed description.

1.3 Transitions Between Normal Driving Modes

If a mode transition is detected, the APC160 automatically engages a sequence resulting in a safe stop:

- the transmission is placed in Neutral
- the service brakes are used to bring the machine to standstill
- when stopped, the parking brake is applied (vehicle speed = 0 does have a tolerance)
- the transmission remains in Neutral until the active control device (shift lever or joystick) is cycled through Neutral
- in case the service brakes are not bringing the machine to a stop quickly enough, the parking brake is activated while driving to assist the braking

1.4 Operation in Handler Mode

In handler mode, the APC160 takes care of the following functions

- direction change protection
- overspeeding control
- automatic shifting
- engine control

1.5 Operation in Aerial Work Platform (AWP) Mode

In AWP mode, the APC160 takes care of the following functions

- Direction change protection
- Overspeeding control
- Engine control
- Brake control
- Parking brake control
- Vehicle Speed Control

The machine can be operated in two ways when the AWP is attached to the boom:

- Platform Control Mode
- Cabin Control Mode

The selected mode depends on the position of the key switch in the cabin.

2. Safety Related Aspects

2.1 Considered Faults

- Over voltage
- Under voltage
- Internal faults
- Program out of control
- Intermittent power loss
- Incorrect input patterns
- Faults on speed sensors
- Faults on Analog sensors
- Faults on outputs

2.2 Behaviour in Case of Faults

2.2.1 General

The APC160 has been designed to guarantee automatic selection of Neutral in some conditions. This is accomplished through use of two separate watchdog timers and hard-wired **SHUTDOWN** circuitry in the controller's output circuitry.

The response to faults highly depends on the operating mode at the time the fault occurs. In the description of responses, the following terms are used to relate to each mode:

Platform Control Mode: Operation from the platform

Cabin Control Mode: Refers to driving from the cabin with the platform attached – 2 submodes exist:

- **Cabin-AWP:** Operation from the cabin with speed control while the platform is attached
- **Cabin-Handler:** Operation from the cabin with manual throttle and brake control while the platform is attached

Handler: Operation from the cabin without platform attached

2.2.2 Reset Condition

When power is applied, the APC160 first selects Neutral with 3rd range clutch engaged and starts initialising itself. This includes a series of self-tests to assure system integrity.

This position is believed to be the safest possible condition in case of an intermittent power failure.

The initialisation phase takes about 1 second. It includes **Power On Self Test** and **integrity testing of the redundant SHUTDOWN path**.

After power up, the APC160 is in the so-called Neutral Lock State. This means that the parking brake is ON and the transmission remains in Neutral until the shift lever is cycled physically through Neutral (after turning off the parking brake).

2.2.3 Supply Voltage Out of Range

2.2.3.1 Over Voltage

The APC160 is very tolerant to large transients on its power lines. Even power supply levels up to 40 V will not damage circuit components.

A fault indication on the display is given to warn the driver of the problem.

2.2.3.2 Under Voltage

The APC160 operates at voltages down to 9 Vdc.

Below 9 Vdc however the APC160 can enter the reset condition and shuts off all outputs.

Because the APC160's engine start disable circuit is using a normal closed relay to prevent engine cranking in certain conditions, this is not considered as a problem.

2.2.3.3 Fault Codes for Supply Voltage Faults

30.04	• The operating voltage is too low
30.05	• The operating voltage is too high

2.2.4 Internal Faults

At power up a series of integrity checks is done.

These tests consist of the following:

- CPU integrity check (ALU, registers, operators)
- Internal RAM test (Modified March–C test)
- Program Flash memory integrity check (Modified 16 bit checksum)
- External RAM test (Modified March–C test)
- Parameter Flash memory integrity check (Modified 16 bit checksum per parameter)
- Redundant **SHUTDOWN** Path integrity check

If these tests prevent operation as a transmission controller, then the APC160 locks itself in a reset state, with all outputs off.

If faults related to shift limits are detected prohibiting safe transmission control, the APC160 reverts to **shut-down** mode **(SHDN)**. In this mode, the transmission can not be operated.

2.2.4.1 Fault Codes for Internal Faults

00.50	• There is a problem related to the Internal RAM (in CPU)
00.51	• There is a problem related to the System RAM (in CPU)
00.52	• There is a problem related to the external RAM
00.53	• There is a problem related to the FLASH program memory

2.2.5 Program Out of Control

The watchdog timers reset the APC160 automatically if due to a program disturbance either one is not timely reset (150 ms).

Additionally, during program execution, critical variables are continuously checked for content integrity. If faults are detected, the APC160 defaults to the reset state.

2.2.6 Intermittent Power Loss

In absence of power, the transmission defaults to Neutral 3rd with the parking brake engaged.

After power is restored, the APC160 enters the reset condition, resulting in the immediate confirmation of Neutral – 3rd with the parking brake engaged.

It stays there until the vehicle speed drops to a safe level at which moment normal operation can start.

2.2.7 Drivetrain Shut Down

Sometimes, detected faults may be too critical to allow further operation in the current condition. For instance if while driving from the platform a fault related to the electronic brake is detected, continued operation may lead to accidents. Therefore – in that case – the machine is brought to standstill using the parking brake and driving is disabled until the power is removed and another operating mode is selected.

The conditions leading to **SHUTDOWN** depend on the operating mode and are as follows:

In Platform Control Mode:

- Electronic Brake related faults
- Parking Brake related faults
- Speed sensor related faults
- Any Direction solenoid output related fault
- Any Range solenoid output related fault

Other modes:

- Multiple Direction solenoid output related faults
- Multiple Range solenoid output related faults

Note that when a SHUTDOWN condition occurs while driving from the platform, the controller needs to be turned off to get rid of the SHUTDOWN condition.

2.2.8 Single Faults on Analog Outputs

Faults related to output A2

This output controls the brake pressure modulator.

Faults related to current sense inputs A3,A5,A7,A9

Input A3 is the current sense input for the brake valve. The other inputs are not actually used in the application but could affect the system's operation if connected improperly.

Faults related to outputs A4, A6, and A8

- These Analog outputs are used as ON/OFF outputs is this application. They control the range of the transmission.

Faults related to outputs B1, B3

This pair of outputs forms when combined properly with **an H-bridge DC** motor driver. As such it's used to control a servomotor linked to the engine fuel pump setting.

Faults related to outputs B5

This output controls the engine start disable relay.

Faults on it are flagged, but no further action is taken. Generally, it will always possible to start the engine.

2.2.8.1 Fault Codes for Analog Output Faults

71.00	• Several output wires are shorted to each other • The output's Sense line is shorted to Vbat • The output's Plus line is shorted to Ground
71.01	• The output is not connected or its Plus line is shorted to Vbat
71.02	• The output current exceeds 1400 mA (not quite a short yet)
71.03	• The output current is Out Of Range. Typically, this occurs when the load has the incorrect impedance.

Note that the first two digits identify the output exhibiting the fault:

70	Brake valve related fault	A2, A3
71	Transmission solenoid 1 – 2	A4
72	Transmission solenoid 2 – 3	A6
73	Transmission solenoid 3 – 4	A8
74	Servomotor A	B1
75	Servomotor B	B3
76	Engine start disable relay	B5

2.2.9 Single Faults on Discrete Outputs

Fault detection mechanism

Faults related to ON/OFF outputs are detected by comparing the desired Output State with the actual Output State (using dedicated feedback lines).

Faults related to A15, A16 (Forward – Reverse solenoids)

Faults related to A15, A16 generally result in **selection of Neutral. The engine is forced to Low Idle** and the **parking brake is turned on**.

In **Platform Control Mode**, the controller reverts to **SHUTDOWN** until powerdown.

In **Handler** and in **Cabin Control Mode**, after coming to a stop, drive can be resumed after turning off the parking brake.

Faults related to A10 (Parking Brake solenoid)

Any electrical fault related to the parking brake output is signalled. When such a fault is present, the parking brake functionality is handled by the brake solenoid connected to A2-A3.

Platform drive is disabled resulting in immediate **SHUTDOWN**.

In **Handler** and **Cabin Control Mode** the machine is forced to stop, after which drive can be resumed by turning off the parking.

Faults related to A20 (Parking brake lamp)

Faults related to the parking brake lamp are recognized only in following conditions:

shorts to plus are recognized when the lamp is supposed to be on

open circuit or **short to ground** is recognized when the lamp is supposed to be off

They are flagged but not acted upon.

2.2.9.1 Fault Codes for Discrete Output Faults

81.00	• The output is shorted to Ground
81.01	• The output is not connected or its Plus line is shorted to Vbat

Note that the first two digits identify the output exhibiting the fault:

80	Parking brake solenoid related fault	A10
81	Forward solenoid related fault	A15
82	Reverse solenoid related fault	A16
83	Parking brake lamp related fault	A20

2.2.10 Incorrect Input Patterns

The shift lever pattern presented to the APC160 is continuously check for plausibility.

Direction selection related inputs: 40.06

A selection of Forward and Reverse at the same time immediately results in the selection of Neutral. Neutral can be left only if a valid Neutral signal is first detected.

Range selection related inputs: 41.06

Two inputs are used to encode three ranges, allowing to do some fault checking.

An incorrect pattern is flagged as a fault. During its presence, the last correct position remains selected.

2.2.10.1 Fault Codes for Input Pattern Faults

40.06	• Invalid shift lever direction detected
41.06	• Invalid shift lever position detected

2.2.11 Speed Sensor faults

The fault detection relies on a permanent monitoring of sensor current. If it gets too low, an open circuit condition is assumed. Conversely, if it is too high, a short to ground is signalled.

INCORRECT MOUNTING OF SENSORS CANNOT BE DETECTED.

Any fault related to the drum speed sensor (A24-A25) results in the immediate selection Neutral, after which the machine **can only be operated in limp home mode**. Additionally in **Platform Control Mode** the controller reverts to **SHUTDOWN** permanently**.**

A fault related to the engine speed sensor causes **platform drive and automatic shift to be disabled**. This causes **SHUTDOWN** in **Platform Control Mode** and a forced stop in Cabin-AWP mode. In other modes the machine can be operated.

A sensor specific fault indication on the display is given to warn the driver of the problem.

Note that the **parking brake input switch** (push button) is connected to speed sensor input B11 and uses the short circuit detection capability of this circuit to measure transitions on the button. These 'shorts' are not signalled to the driver. In stead they are used to toggle the state of the parking brake

2.2.11.1 Fault Codes for Speed Sensor Faults

60.00	• The sensor is not connected (= open)
60.01	• The sensor is shorted to Ground

Note that the first two digits identify the speed sensor exhibiting the fault:

60	Optional output speed sensor fault	A22-A23
61	Drum speed sensor fault	A24-A25
62	Engine speed sensor fault	A26-A27
63	Parking brake input fault (open only)	B11

2.2.12 Analog Sensor Faults

Boom Function sensor fault (A11)

Faults related to this input are detected and flagged if properly setup in Flash memory. Any fault is treated a 'not moving'.

Boom position sensor fault (A28)

The boom position sensor is actually a cascade of two proximity switches. The wiring is built up in such way that power loss on the proximity switches simulates the **'extended' (i.e. safest possible)** position.

Accelerator pedal sensor fault (A29)

If the accelerator pedal sensor produces an out of range value, the accelerator position is assumed to be at 0%, causing the engine to return to low idle.

→ **This prevents automatic upshifts when driving in handler mode.**

In **CABIN-AWP** mode the machine is brought to a safe stop using the service brakes.

Engine control servo position sensor fault (B4)

If the servomotor position feedback signal goes out of range, a fault is flagged and the servomotor is turned off.

Joystick position sensor fault (B17, B6)

In **Platform Control Mode** any fault related to the joystick causes a transition Neutral and a deceleration to standstill.

Reference voltage output fault (B2)

The reference voltage is typically 4.3V and supplies current to A29, B4, B6 and B17.

2.2.12.1 Fault Codes for Analog Input Faults

51.00	• The sensor is shorted to Ground (Out of range at low side)
51.01	• The sensor is not connected (Out of range at high side)

Note that the first two digits identify the Analog input exhibiting the fault:

50	Boom function input out of range	A11
51	Boom position sensor out of range	A28
52	Accel. pedal position out of range	A29
53	Joystick wiper voltage out of range	B17
54	Reference voltage out of range	B2
55	Servo position feedback out of range	B4
56	Joyst.center tap voltage out of range	B6

2.2.13 Indication of Faults

When a fault is detected, the E -led starts flashing.

In order to find out which fault is present, select the **'ERR'** display mode by repeatedly pressing the **'M'** button on the APC160 front panel display.

The display normally shows ' — — ' to indicate there are no faults, but if one or more faults are (or have been) detected, the most severe one is shown until you press the **'S'** - button.

A fault that is currently present is shown with its 4-digit fault code. The leftmost digits indicate the fault area. The rightmost digits indicate the fault type.

A flashing fault code indicates a fault that's no longer present (typical for intermittent faults).

Faults are shown in order of severity.

If several faults coexist, pressing the **'S'**- button again selects the next fault for display.

This can be repeated until no more faults are present, at which time again the ' — — ' sign is shown.

When the 'S' button is released more than one second, the most severe fault is again shown.

Below table lists faults in order of severity (severest fault on top) along with possible fault type codes.

2.2.14 Overview of Fault Codes

2.2.14.1 Overview of Fault Types

TYPE		*Comment*
SHORT	.00	the output or input is shorted (or pulled too low)
OPEN	.01	the output or input is unconnected (or pulled too high)
OVERCURRENT	.02	there is an over current condition on the output
OOR	.03	the output current is Out Of Range
TOO_LOW	.04	the fault source has a too low value
TOO_HIGH	.05	the fault source has a too high value
INVALID_PATT	.06	an invalid pattern is detected
ERR_SHDN_BRAKE	.10	**SHUTDOWN** is caused by a problem related to the brake
ERR_SHDN_OUTPUT	.11	**SHUTDOWN** is caused by a problem related to an output
ERR_SHDN_SPEED	.12	**SHUTDOWN** is caused by a problem related to a speed sensor
ERR_SHDN_XMSN	.13	**SHUTDOWN** is caused by a problem related to the transmission
ERR_SHDN_OTHER	.14	**SHUTDOWN** is caused by another problem
IRAM_FAULT	.50	internal RAM fault
SRAM_FAULT	.51	internal system RAM fault
ERAM_FAULT	.52	external RAM fault
CROM_FAULT	.53	FLASH ROM checksum fault
RTST	.98	There is a runtime self test fault detected

2.2.14.2 Fault Areas and Their Types in Order of Severity

Fault	*Fault area*	*Fault Types*
Battery Voltage	**30**	**04, 05**
Power On Self Test	**00**	**50, 51, 52, 53**
Over Current	**21**	**03**
Shut Down	**42**	**10,11,12,13,14**
Digital output 0 **Parking brake solenoid**	**80**	**00, 01**
Analog Output 0 **Brake solenoid**	**70**	**00, 01, 02, 03**
Speed Sensor Supply voltage	**31**	**04, 05**
Drum speed (A24 – A25)	**61**	**00, 01**
Digital output 1 **Forward solenoid**	**81**	**00, 01**
Digital output 2 **Reverse solenoid**	**82**	**00, 01**

Fault	*Fault area*	*Fault Types*
Analog output 1 1st/ 2nd solenoid	**71**	**00, 01**
Analog output 2 2nd/ 3rd solenoid	**72**	**00, 01**
Analog output 3 Lo / Hi solenoid	**73**	**00, 01**
Analog output 4 Servomotor side A	**74**	**00, 01**
Analog output 5 Servomotor side B	**75**	**00, 01**
Digital output 3 Parking brake lamp	**83**	**00, 01**
Engine speed (A26 – A27)	**62**	**00, 01**
Parking brake switch (B11)	**63**	**00, 01**
Shift lever direction	**40**	**06**
Shift lever position	**41**	**06**
Engine Servo feedback	**42**	**03**
Reference voltage (B2)	**54**	**00, 01**
Joystick center tap (B6)	**56**	**00, 01**
Joystick position (B17)	**53**	**00, 01**
Boom position (A28)	**51**	**00, 01**
Accelerator pedal (A29)	**52**	**00, 01**
Boom function (A11)	**50**	**00, 01**
Servo position (B11)	**55**	**00, 01**
Analog output 6 Engine start disable	**76**	**00, 01**
Output speed (A22 – A23)	**60**	**00, 01**
Program related issue Contact SOH service Dept.	**'codE'**	**4-digit code**

2.2.15 Indication of Faults That Have Previously Occurred

If no faults are detected, the E-led will stop flashing.

As indicated above, **faults that have been previously detected** since power-up or since the last time they were shown are shown as flashing text to allow to differentiate them from active faults.

This is an excellent way to detect intermittent faults.

Please note that active faults are shown with higher priority than intermittent faults.

Also note that once an intermittent fault was shown, it will not be shown again until it actually occurs again.

2.3 Behavior when faults are removed

2.3.1 Over Voltage

Normal operation is resumed.

2.3.2 Under Voltage

Not applicable.

2.3.3 Internal Faults

Not applicable.

2.3.4 Program Out of Control

Not applicable.

2.3.5 Intermittent Power Loss

Not applicable.

2.3.6 Single Faults on Outputs

In Platform Control Mode, once **SHUTDOWN** is entered, the fault must be removed and the controller must be reset to regain drive again.

In other normal driving modes, after the fault is removed, normal operation is resumed.

2.3.7 Multiple Faults on Related Outputs

In AWP Mode, once **SHUTDOWN** is entered, the fault must be removed and the controller must be reset to regain drive again.

In other modes, the APC160 remains in **SHUTDOWN** mode until **all faults but one** are resolved, at which time, the controller resumes operation as described with single faults. In any case, the transmission is forced to Neutral until the shift lever (or joystick when in Platform Control Mode) is cycled through Neutral.

2.3.8 Incorrect Input Patterns

Normal operation is resumed.

2.3.9 Speed Sensor Fault

In AWP Mode, once **SHUTDOWN** is entered, the fault must be removed and the controller must be reset to regain drive again.

Normal operation is resumed. Exit from limp-home always occurs through Neutral.

2.3.10 Analog Sensor Fault

Normal operation is resumed.

Note that some faults leave the machine in a mode that is latched until a safe condition is met – e.g. faults related to the boom position sensor cause the machine to behave as if the boom is extended. This remains the case until the problem is corrected AND the transmission is placed in Neutral.

In AWP Mode, once **SHUTDOWN** is entered, the fault must be removed and the controller must be reset to regain drive again.

3. Environmental Conditions

3.1 Nature of Environmental Conditions

The APC160 is intended to be used on mobile **earth moving** and **material handling** machinery and as such is exposed to the severe environmental conditions these machines operate in.

The APC160 should be installed inside the driver's cabin protected from direct exposure to rain, dust, and direct steam cleaning.

3.2 Behaviour of the System Under Certain Conditions

The built in outputs will automatically shut off in case their junction temperature exceeds 150°C.

This can be caused by external short circuits of outputs to ground, but also by over current conditions when the unit is operated at high temperature. After cooling down, they automatically retry to drive their load.

4. Diagnostics and Guidelines

4.1 Diagnostics and Maintenance

4.1.1 General

Principally there are no specific devices required for first level troubleshooting as the APC160 incorporates several self-test features assisting in this process.

Nevertheless, use of digital multi-meters and simple tools such as an indicator lamp will be required to pinpoint exact causes of problems.

More in depth troubleshooting and system tuning involves use of a WIN95 Compatible PC with appropriate software and FLASH parameter programming equipment.

The APC160 allows recall and modification of non-volatile parameters through RS232 and or CAN.

This way, customers can, given the necessary equipment, choose to adapt certain parameters to suit their needs.

From a maintenance point of view, this is relevant in so far that the APC160 allows reading back the (modified) parameters along with serial number, part number and modification date.

4.1.2 Self Test Functions

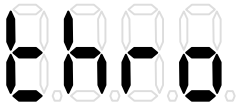
The APC160 has special circuitry to help verifying its operation.

Six self-test groups are built into the APC160 control programs:

- Display test and Version
- Digital input test
- Analog input test
- Speed sensor test
- Output test
- Voltage test

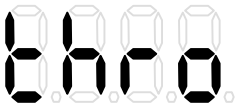
4.2 Control System Calibration

The Calibration Mode should be performed in Cabin Control Mode. Stand-alone calibration mode is activated by pressing the '**S'** button for at least 30 seconds on the APC160 front panel while powering up the APC160. When stand-alone calibration mode is entered the display shows:

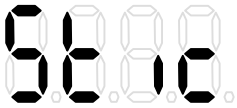


Switching off the power of the APC160 is the only way to leave the calibration display mode.

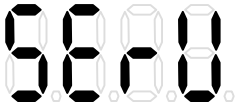
By pressing the **'M'** button, the existing calibration modes are displayed, pushing the **'S'** button starts the calibration of the currently displayed mode. The following modes are supported:



Accelerator pedal (throttle pedal) sensor calibration

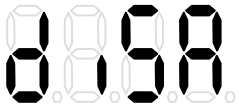


Joystick position sensor calibration



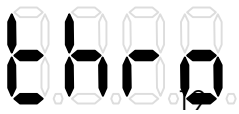
Servomotor sensor calibration

The controller software disables three other calibration modes. When these are selected, when pressing the **'S'** button to start calibration the display shows:



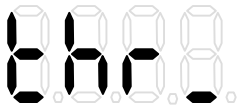
4.2.1 Calibration of the Accelerator Pedal Sensor

Enter stand-alone calibration mode and push the **'M'** button until the display shows:



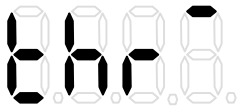
Press the **'S'** button to start the accelerator pedal sensor calibration.

The display shows:



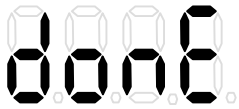
The driver should release the throttle pedal completely and then press the **'S'** button.

Now, the display looks as follows:

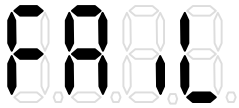


The driver should press the throttle pedal completely and hold it while pressing the **'S'** button. As long as one of the led display segments is blinking, the throttle pedal is not pushed hard enough and pressing the **'S'** button will not continue the calibration process.

When the calibration process is completed and no errors are encountered during the process, the calibration results are memorized in flash memory and will become active at the next power-up of the controller. The display looks as follows:



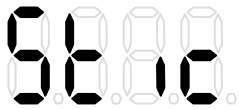
When errors are detected during the calibration process, the calibration results are ignored and the display looks as follows:



Pressing the 'S' button once again returns the display back to the start of the currently active display mode, allowing the user to re-calibrate the current sensor or to use the 'M' button to proceed with the next calibration mode.

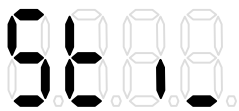
4.2.2 Calibration of the Joystick Sensor

Enter stand-alone calibration mode and push the **'M'** button until the display shows:



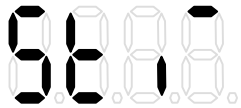
Press the **'S'** button to start the joystick sensor calibration.

The display shows:



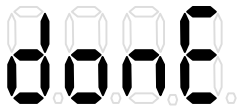
The driver should request someone to push the joystick completely to the reverse driving position (away from you when standing on the platform) and hold it while he presses the **'S'** button.

When the calibration process proceeds the display looks as follows:

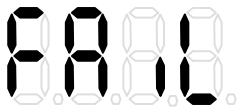


The driver should request someone to pull the joystick lever completely towards him (full stroke forward drive) and hold it there while he presses the **'S'** button. When one of the led display segments is blinking, the new calibrated position (full stroke forward) is not far enough away from the center position to distinguish it well and pressing the **'S'** button will not continue the calibration process.

When the calibration process is completed and no errors are encountered during the process, the calibration results are memorized in flash memory and will become active at the next power-up of the controller. The display looks as follows:



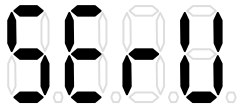
When errors are detected during the calibration process, the calibration results are ignored and the display looks as follows:



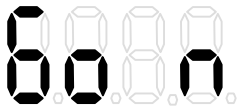
Pressing the 'S' button once again returns the display back to the start of the currently active display mode, allowing the user to re-calibrate the current sensor or to use the 'M' button to proceed with the next calibration mode.

4.2.3 Calibration of the Servomotor Sensor

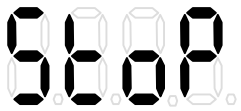
Enter stand-alone calibration mode and push the **'M'** button until the display shows:



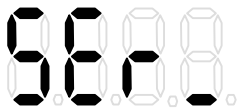
Press the **'S'** button to start the servo sensor calibration. If the position of the shift lever is not in Neutral, the calibration process does not start and the following displays is shown:



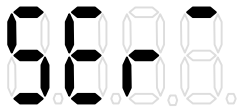
If the vehicle is not standing still, the calibration process does not start and the following display is shown:



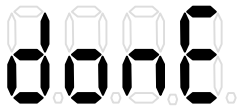
If the shift lever is in Neutral and the vehicle stands still, servomotor calibration starts. The servomotor applies idle throttle and the following display appears for about three seconds (no driver actions are demanded).



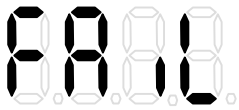
The servomotor automatically applies full throttle (no driver actions are necessary) and the following display appears for about three seconds:



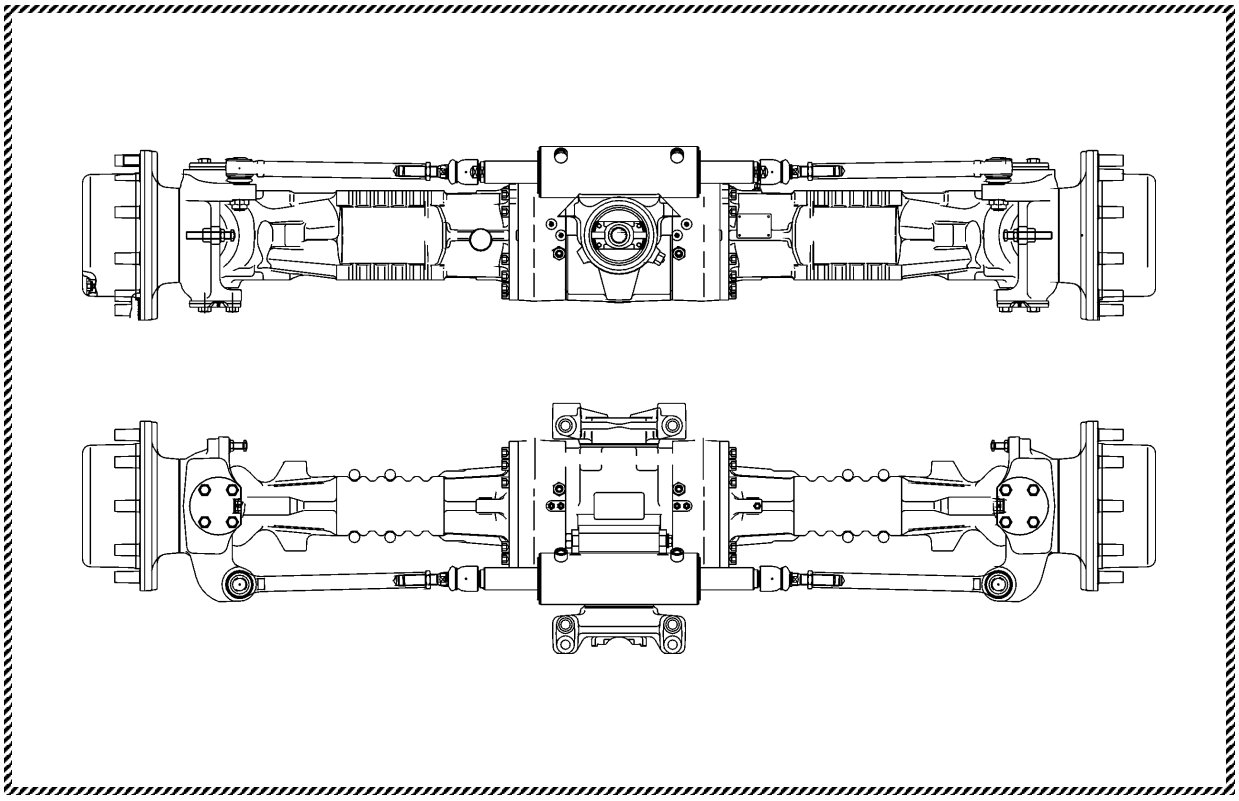
Then, if no errors were encountered during the process, the calibration results are memorised in Flash memory and will become active at the next power-up of the controller. The display looks as follows:



When errors were detected during the calibration process, the calibration results are ignored and the display looks as follows:



Pressing the ‘S’ button once again returns the display back to the start of the currently active display mode, allowing the user to re-calibrate the current sensor or to use the ‘M’ button to proceed with the next calibration mode.



MANUALE DI RIPARAZIONE

REPAIR MANUAL

ASSALE - *AXLE*

Mod. 26.25M FR

Rif. CA143689

1ST Edition date: 06/2001

Revision date: 00/00

P/N: CA357152

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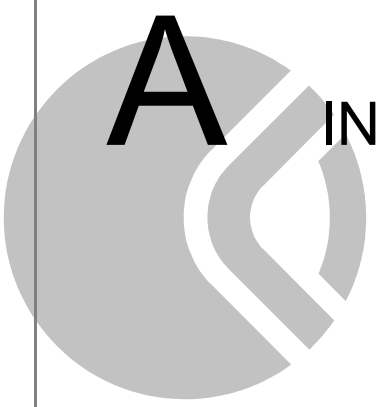

A INFORMAZIONI GENERALI

A *GENERAL INFORMATION*

A.1 Utilizzo del manuale

Destinatari

- Installatore.
- Utilizzatore.
- Manutentore.

Manutenzione

Il buon funzionamento ed il rendimento degli organi meccanici dipendono principalmente da una costante e corretta manutenzione.
PRENDERE VISIONE DI TUTTO IL MANUALE consente di svolgere correttamente le operazioni di manutenzione ordinaria e straordinaria. L'omissione delle operazioni raccomandate può pregiudicare la durata e l'integrità dell'assale e comportare danni o infortuni all'operatore.
Nell'eventualità di guasti o anomalie il tempestivo intervento da parte di personale specializzato garantisce una durata più lunga del gruppo, evitando danni maggiori nel tempo.

Riparazione

Le procedure per lo smontaggio/montaggio dell'assale consentono di eseguire la revisione totale del gruppo e sono descritte in sequenza con l'ausilio di illustrazioni, per una guida completa e sicura all'esecuzione di ogni operazione.
Nella descrizione delle operazioni si presuppone che l'assale sia stato rimosso dal veicolo. Per la rimozione dell'assale dal veicolo si dovrà consultare il manuale fornito a tale proposito dal costruttore del veicolo stesso.
La conoscenza approfondita del gruppo consente la corretta valutazione del tipo di intervento da eseguire, che può richiedere solamente lo smontaggio di alcuni componenti operando solo parzialmente nel gruppo.

Proprietà delle informazioni

Questo manuale contiene informazioni di proprietà riservata. Tutti i diritti sono riservati.

Questo manuale non può essere riprodotto o fotocopiato, tutto o in parte, senza il preventivo consenso scritto di CARRARO S.p.A. L'uso di questo materiale documentale è consentito solo al cliente a cui il manuale è stato fornito come corredo dell'assale, e solo per scopi di uso, manutenzione e riparazione.

A.1 About manual consulting

End users

- *Installer*
- *User*
- *Maintenance operator*

Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine and extraordinary maintenance which could promote the integrity and duration of the axle and avoid damages or any harm to the operator.
In case of any damages or anomalies, quick intervention of specialized personnel can avoid future impairment and lengthen the working life.

Repair

The disassembly/assembly procedures have been outlined for a total group overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.
Operation description presumes that the axle has already been removed from the vehicle. The manual supplied by the vehicle manufacturer should be consulted in case of a overhauling or maintenance intervention requiring the removal of the axle.
Moreover, the attentive group inspection leads to a correct repair work estimation that could merely require dismounting only few components, and thus operating partially on the group.

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CARRARO S.p.A. dichiara che le informazioni contenute in questo manuale sono congruenti con le specifiche tecniche e di sicurezza dell'assale a cui il manuale si riferisce. Il fabbricante non si assume alcuna responsabilità per danni diretti o indiretti a persone, cose o animali, conseguenti all'uso di questo materiale documentale o dell'assale in condizioni diverse da quelle previste.

CARRARO S.p.A. declares that the subject of this manual consists with the technical and safety specifications of the axle that the manual is referred to. The manufacturer shall not be held liable for direct or indirect damages to persons, things or animals due to an improper use of this document or of the axle or to a different use of them, which does not comply with what is provided for in this manual.

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A.2 Convenzioni e definizioni

Convenzioni

Le illustrazioni nel manuale NON sono in scala quindi NON sono attendibili valutazioni delle dimensioni dei componenti basate sulle stesse.
Le illustrazioni hanno il compito di evidenziare le sequenze e le fasi di manipolazione dell'assale e dei suoi componenti, per questo potrebbero non rappresentare esattamente gli elementi di questo assale ma quelli di assali simili.

Definizioni

Lato sinistro: parte sinistra dell'assale vista nel senso di marcia del veicolo.
Lato destro: parte destra dell'assale vista nel senso di marcia del veicolo.

Convenzioni tipografiche

Nota: informazioni importanti, evidenziate al di fuori del testo a cui si riferiscono.
Attenzione: procedure la cui totale o parziale inosservanza può produrre danni alla macchina o alle apparecchiature ad essa collegate.
Pericolo: procedure la cui totale o parziale inosservanza può produrre lesioni o danni alla salute dell'operatore.

Unità di misura

Nel manuale si utilizzano le unità di misura del sistema internazionale (SI). Per la conversione al sistema anglosassone riferirsi alla seguente tabella.

A.2 Agreements and definitions

Agreements

Illustrations like pictures, drawings and components of this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.
Illustrations are supposed to point out the various handling sequences and phases of the axle and its components, therefore they could not display exactly the same group elements.

Definitions

***Left side:** it is the left side of the axle considering the vehicle running conditions.*
***Right side:** it is the right side of the axle considering the vehicle running conditions.*

Typographic agreements

***Note:** The notes, pointed out externally to the text they refer, include important information.*
***Warning:** Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.*
***Danger:** Danger indications point out the procedures, whose partial or complete non-observance can injury the operator.*

Measurements

This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

Tabella di conversione / Conversion table

S.I.		ENGLISH AND USA SYSTEM	
1	(mm)	0.03937	(in)
10	(mm)	0.3937	(in)
25.4	(mm)	1	(in)
6.4516	(cm²)	1	(sq. in)
1	(m²)	1550	(sq. in)
16.378	(cm²)	1	(cu. in)
0.473	(dm²)	1	(U.S. pint)
1	(l)	61.02	(cu. in)
1	(l)	0.2642	(U.S. gal)
1.772	(g)	1	(oz)
0.4536	(kg)	1	(lb)
0.00070308	(kg/mm²)	1	(lb/sq. in)
1	(bar)	14.51	(psi)
1	(kg.m)	7.246	(lb.ft)
1(daN)= 10 (N)= 1,02 (kg.f)		2.24	(lb.f)

Simbologia

Symbology

DESCRIZIONE	SIMBOLI / SYMBOLS	DESCRIPTION
ATTENZIONE avvertenze generali		WARNING general warning
REGOLAZIONI coppie di serraggio / misurazioni		ADJUSTMENTS tightening torques / measurements
ATTREZZATURE SPECIALI		SPECIAL TOOLS
CONTROLLI E SOSTITUZIONI anelli / guarnizioni		CHECK AND REPLACE seals / gaskets
SIGILLANTI COLLANTI		SEALING OR LOCKING FLUIDS
MARCHIARE O SEGNARE		MARK OR INDICATE
RIEMPIMENTO - RABBOCCO OLIO		OIL FILLING OR OIL LEVEL
SCARICO OLIO		OIL DRAIN

A.3 Indicazioni generali

L'assale deve essere controllato e/o riparato solo da personale tecnico specializzato che sia a conoscenza delle sue particolari caratteristiche e delle relative norme di sicurezza (prevenzione infortuni).

Prima di svolgere qualsiasi operazione, pulire accuratamente l'assale rimuovendo eventuali incrostazioni ed accumuli di terriccio e/o grasso.

Tutti gli organi meccanici smontati devono essere accuratamente puliti con prodotti adeguati, per evitare possibili danni. Verificarne l'integrità, sostituendoli in caso di danni, usura, incrinature, grippaggi o difetti che potrebbero compromettere il buon funzionamento dell'assale.
In particolar modo si deve verificare l'integrità delle parti in movimento (cuscinetti, ingranaggi, alberi) e delle parti di tenuta (anelli OR, paraoli), soggette a maggiori sollecitazioni, usura, invecchiamento. Si consiglia di sostituire ad ogni revisione o riparazione gli organi di tenuta.
Si ricordi che la sostituzione di un componente della coppia conica comporta la sostituzione anche dell'altro.

Utilizzare solo le parti di ricambio e la viteria indicate, inoltre usare utensili metrici per la viteria metrica e inglesi per la viteria inglese.

Come indicato nelle istruzioni di disassemblaggio, alcune operazioni sono distruttive per alcuni componenti dell'assale. Leggere attentamente le descrizioni delle varie fasi dell'intervento ed operare con attenzione per non compromettere la funzionalità di altri elementi.

A.3 General description

The axle should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out axle cleaning accurately by removing oil/ grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized, etc. as they could affect proper functioning of the axle.
Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-Ring, oil seals) should be examined carefully, as they are subject to major stress, wearing and ageing.
We highly advice to replace tightening parts during every teardown or repair.
Replacing one part of the bevel gear set requires the replacement of the other part too.

Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and Imperial tools for the others.

Please read the disassembly instructions very carefully because some operations are destructive for some axle components and in order to avoid the elements damage operate advertently.

A.4 Raccomandazioni generali per le operazioni di smontaggio e montaggio

Prima di iniziare le operazioni di smontaggio e montaggio leggere attentamente le seguenti avvertenze.

Anelli di tenuta per alberi

Per il montaggio degli anelli di tenuta attenersi alle seguenti raccomandazioni:
- Pulire accuratamente l'albero ed assicurarsi che non sia danneggiato, rigato od ovalizzato nelle zone di contatto con gli anelli.
- Montare gli anelli in modo che il labbro sia rivolto verso il lato olio.
- Lubrificare il labbro degli anelli (usare preferibilmente olio) e riempire per 3/4 di grasso la camera degli anelli stessi.
- Montare gli anelli usando un appropriato calettatore. Non usare il martello direttamente sugli anelli.
- Non danneggiare gli anelli durante il montaggio dell'albero.

Anelli OR

Lubrificarli adeguatamente prima di inserirli nella propria sede evitando "arrotolamenti" durante il montaggio dell'albero.

Spessori di registro

Per le registrazioni utilizzare gli appropriati spessori di registro, misurandoli singolarmente.
La misurazione del pacco completo o la stampigliatura riportata sugli spessori stessi può risultare non sempre affidabile: verificare.

Cuscinetti

Per un corretto montaggio è consigliabile riscaldarli in forno ad una temperatura di 80°C - 90°C prima di montarli sui rispettivi alberi o raffreddarli prima di inserirli nelle relative sedi con piantaggio esterno.Usare sempre gli estrattori idonei per rimuovere i cuscinetti.
Prima di rimontarli, pulirli, ispezionarli e lubrificarli.

Spine elastiche

Al montaggio delle spine elastiche ad intaglio assicurarsi che l'intaglio delle stesse sia orientato nel senso dello sforzo sollecitante la spina.
Le spine elastiche a spirale invece non necessitano di alcun orientamento di montaggio.

Sigillante

Usare sigillanti secondo le specifiche. Assicurarsi che le parti da sigillare siano pulite, asciutte e completamente prive di grasso.

A.4 General recommendations for disassembly and assembly operations

Before starting any disassembly and assembly operations, read carefully the following recommendations.

Shafts seals

Respect the following recommendations during shaft seal assembly:
- Clean shaft very carefully and ensure that the part in contact with the shaft seal is not damaged, cut or out of roundness.
- Assemble the seals so that the lip is fitted towards the oil side.
- Lubricate seal lips (use oil) and fill 3/4 of seal cavity with grease.
- Use appropriate drivers. Do not use a hammer directly on the seals.
- Do not damage the seals while assembling the shaft.

O-rings

Lubricate adequately before inserting them at the right place and avoid rolling while inserting the shaft.

Adjusting shims

Use appropriate adjusting shims and measure each one separately.
Complete group measurement or stampings on the shims are not always reliable: check

Bearings

Its advisable to heat up bearings to 80°C - 90°C before assembling them onto their respective shafts or to cool them (dry ice) before inserting them into corresponding bore.Always use suitable extractors to remove the bearings. Before reassembling the bearings, clean, check and lubricate them.

Split pins

Before assembling elastic pins, make sure that the notch is oriented towards the stressing force.
Spiral elastic pins do not need orientation.

Sealing

Use sealing as advised by specifications. Ensure that parts to be sealed are clean, dry and completely grease free.

Scarico dell'olio

Prima di intervenire sul prodotto è necessario scaricare l'olio dal gruppo.
ATTENZIONE
Smaltire gli oli esausti nel rispetto delle vigenti norme.

Oil drain

Before disassembly, oil should be drained out.

WARNING
Disposal of used oil must be done according to laws

Pulizia

Lavare accuratamente tutte le parti in movimento relativo (ingranaggi, cuscinetti, ecc.) utilizzando gasolio o cherosene.
E' da evitare l'uso di benzina e soluzioni acquose alcaline. Evitare lavaggi con vapore o acqua calda perché sarebbe difficile eliminare completamente l'umidità superficiale.
Asciugare accuratamente tutti i particolari mediante un getto d'aria o stracci per evitare di rigare le superfici con residui abrasivi.
Tutte le superfici devono essere ricoperte da un leggero strato di lubrificante per proteggerle da eventuali ossidazioni.

Cleaning

Wash all moving parts (gears, bearings, etc.) accurately with diesel fuel or kerosene.
Avoid gasoline and watery alkaline solutions. Do not wash with steam or hot water, as it will be very difficult to eliminate surface humidity.
Dry all parts with a rag or air jet to avoid scratching from abrasive residuals.
All surfaces should be covered with lubricant so as to protect it from future oxidation.

Controlli

Verificare accuratamente tutti i cuscinetti, gli anelli esterni eventualmente ancora piantati nelle proprie sedi e i perni su cui rotolano i rullini. Sostituire quei particolari che presentano tracce di usura o di danneggiamento.
Controllare che tutti gli ingranaggi non presentino avarie od usure eccessive delle dentature: gli smussi dei denti non devono essere deteriorati.
Controllare che tutti i tratti scanalati siano privi di usure eccessive o di altri danneggiamenti.
Sostituire i particolari avariati con ricambi originali.
Dopo ogni smontaggio è buona norma sostituire le guarnizioni di tenuta sugli alberi rotanti.

Checks

Examine accurately all bearings, external rings which may be still stuck in their position and pivot pins on which rolls rotate. Replace those which are worn out or damaged.
Gears should not be spoiled and teething should not be excessively worn out. Teeth smoothing should not be deteriorated.
Check all grooves: assure that they are not worn out or damaged.
Replace spoiled parts with original spare parts.
Replace seals on rotating shafts, before reassembly.

Estremità di flange ed attrezzi

Prestare la massima attenzione quando si martellano le estremità di attrezzi o di flange per evitare di compromettere la funzionalità e l'integrità sia degli attrezzi che dei componenti su cui si opera.

Ends of flanges and tools

Be careful when hammering tool or flange ends, in order to avoid jeopardizing functionality and integrity of either the tools or the components on which you are operating.

Metodi di riassemblaggio

Per riassemblare il gruppo si deve impiegare un'adeguata attrezzatura di sostegno.
Per posizionare il gruppo, per smontare e rimontare la corona dentata e per sostenere la scatola ingranaggi è necessario un sistema di sollevamento.
Per facilitare le operazioni di smontaggio e montaggio utilizzare un disegno di assieme del gruppo.

Reassembly ways

In order to reassemble the group, an appropriate fixture must be used.
In order to position the group, to disassemble and reassemble the ring gear and to support the gear housing, a lifting system is needed.
To make disassembling and assembling operations easier, use a group assembly drawing.

Impiego di lubrificante

Per ottenere una corretta lubrificazione ed una esatta temperatura di funzionamento negli assali CARRARO, è importante usare i lubrificanti raccomandati mantenendone il livello costante secondo quanto indicato nel presente manuale.

Lubricant use

In order to lubricate the CARRARO axles correctly and to reach the exact operation temperature, it is important to use the recommended lubricants , keeping their level constant as indicated in this manual.

B CARATTERISTICHE GENERALI

B GENERAL SPECIFICATIONS

B.1 Usi previsti

Questo assale è stato progettato e costruito per essere installato in macchine di tipo industriale. L'assale è un componente che ha la funzione di trasmettere la potenza dal motore alle ruote.
L'assale in oggetto, costruito secondo specifiche fornite dal cliente, permette:

- l'aumento della forza di trazione riducendo il numero di giri;
- la compensazione della velocità delle ruote interne con quelle esterne durante la sterzata.

Non installare mai questo assale su macchine diverse da quelle per cui e stato progettato e costruito.

L'assale, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto ad "uso non previsto".
CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.
Costituisce inoltre un elemento essenziale, nell'ambito dell'uso previsto, l'osservanza scrupolosa delle modalità di funzionamento e delle regolari manutenzioni e riparazioni specificate da CARRARO SpA.

B.1 Foreseen uses

This axle has been designed and manufactured to be mounted on industrial machines.
The axle is a component that transmits the power from the engine to the wheels.
The axle, manufactured according to the customer's technical specifications, allows:

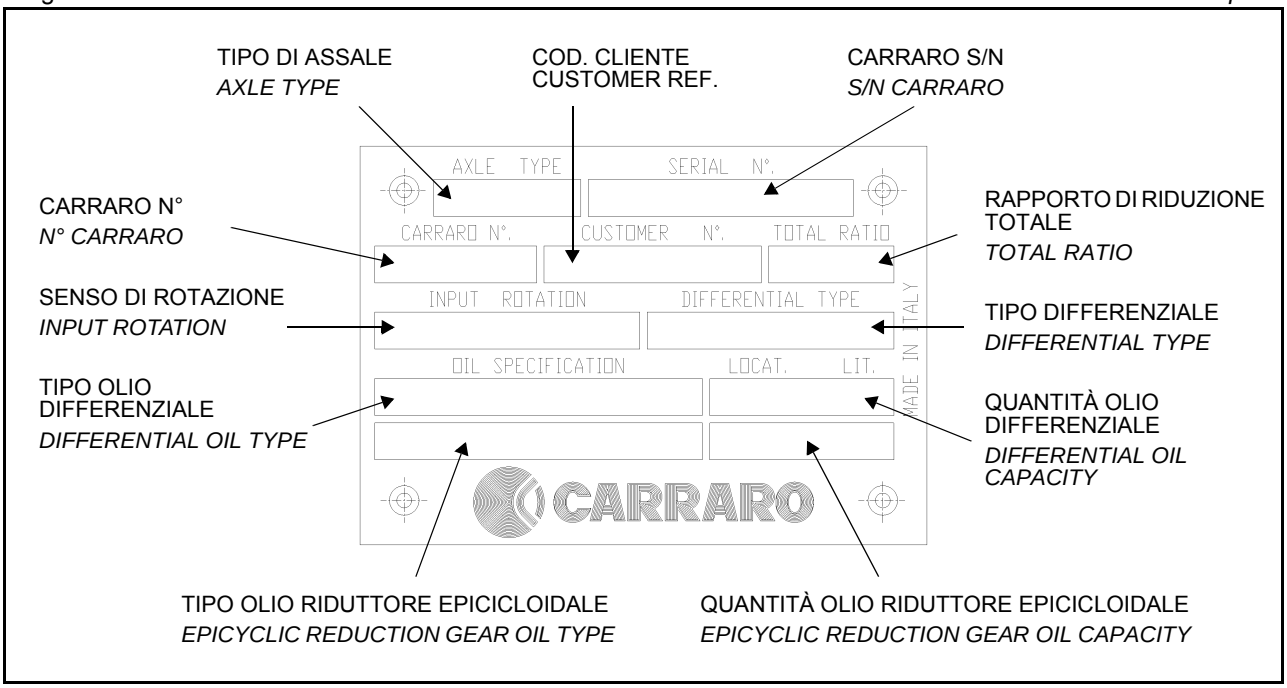
- *increasing of tractive force, reducing the number of revolutions*
- *adjusting of inner wheels' speed with outer wheels' speed during steering.*

Never mount this axle on machines different from the ones for which it has been designed and manufactured

If the axle is used for any other purpose than the one foreseen, CARRARO SpA declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the client.
However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by CARRARO SpA are to be observed strictly.

B.2 Identificazione del prodotto *B.2 Product identification*

Targhetta di identificazione dell'assale *Axle serial plate*



B.3 Descrizione generale

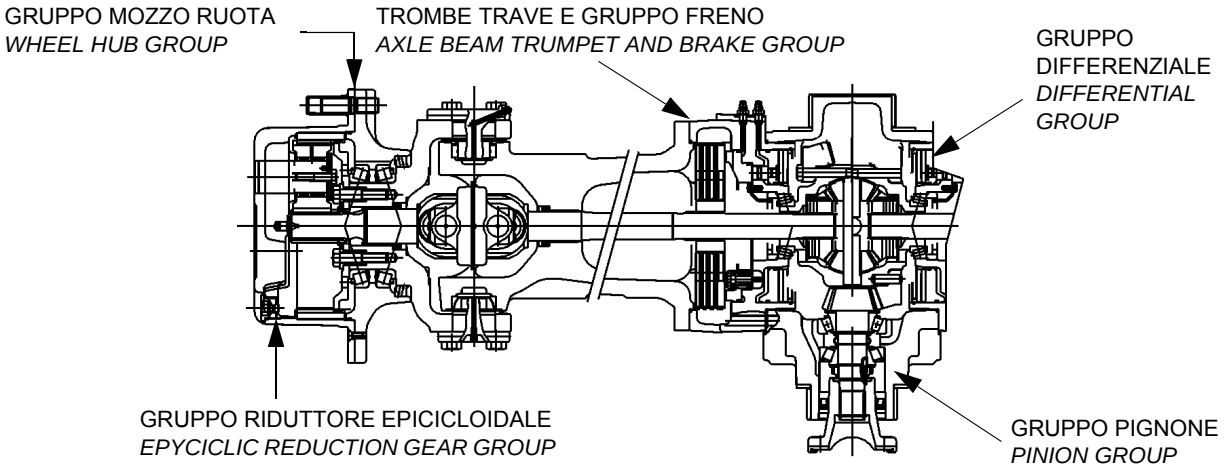
L'assale in oggetto, progettato e costruito secondo le richieste del cliente, è costituito da un corpo trave contenente il gruppo differenziale nella parte centrale e dai gruppi mozzo ruota alle estremità.
Il gruppo differenziale, autobloccante di tipo "limited slip", è supportato da due cuscinetti montati in un'apposita struttura ove è possibile effettuare le operazioni di registrazione della coppia conica.
La posizione della corona conica si registra agendo su due ghiere contrapposte, mentre quella del pignone conico, supportato da due cuscinetti, si effettua mediante interposizione di spessori di registro.
I mozzi ruota contenenti i riduttori epicicloidali, sono supportati da due cuscinetti a rulli conici e vengono comandati da un gruppo sterzante ad azionamento idraulico.
L'assale dispone inoltre di un proprio sistema frenante interno.
La struttura viene completata da una coppia di supporti oscillanti per il fissaggio del veicolo.

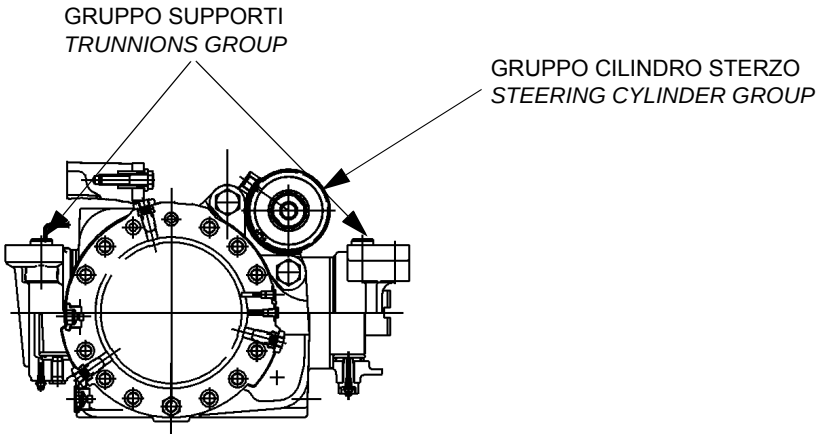
B.3 General description

The axle described in this manual, designed and manufactured following the customer's requests, consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end.
The differential, type "limited slip", is supported by two bearings mounted on a suitable structure allowing the bevel gear set to be adjusted.
The ring bevel gear is adjusted by means of two ring nuts located opposite each other.
The position of the bevel pinion, supported by two bearings, is adjusted by inserting adjusting shims.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings and are powered by a hydraulically-operated steering unit.

Additionally, the axle has its own internal braking system.
The structure is completed with a pair of swing-supports to secure the vehicle.





B.4 Caratteristiche Tecniche *B.4 Technical Features*

CODICE ASSALE	CA143689	*AXLE CODE*
MODELLO ASSALE	26.25M FR	*AXLE MODEL*

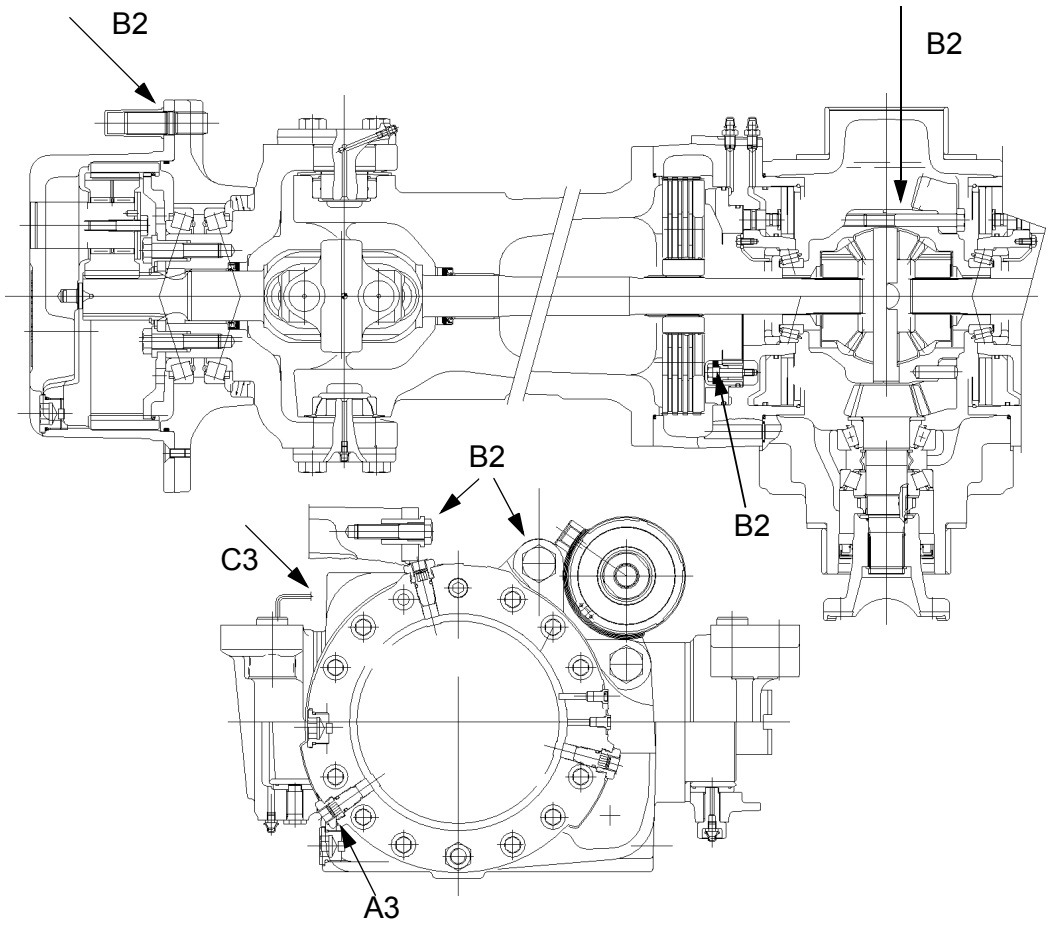
TIPO DIFFERENZIALE		*DIFFERENTIAL TYPE*
Standard	○	*Standard*
Limited Slip	●	*Limited Slip*
Limited Slip “Ball Type”	○	*Limited Slip “Ball Type”*
Bloccaggio meccanico 100% ad attuazione idraulica positiva o negativa	○	*100% Mechanical lock, hydraulically controlled (positive or negative)*
Con frizione multidisco in bagno d’olio	○	*With multidisc clutch in oil bath*
Bloccaggio meccanico 100% ad attuazione elettromagnetica	○	*100% Mechanical, electromagnetically controlled*
“No spin”	○	*“No spin”*

DESCRIZIONE	VALORI VALUES	*DESCRIPTION*
Riduzione coppia conica	3.5 / 1	*Bevel gear ratio*
Riduzione epicicloidale	6.923 / 1	*Epicyclic ratio*
Riduzione Trasmissione	---	*Transfer Box ratio*
Riduzione totale	24.23 / 1	*Total ratio*
Peso a secco	542 Kg	*Dry weight*
Rotazione in entrata SENSO ORARIO SENSO ANTIORARIO	 ● ○	*Input rotation* *CLOCK WISE (C.W.)* *COUNTER CLOCK WISE (C.C.W.)*
Angolo di sterzata	Max 55° $^{0}_{-3}$	*Steering angle*
Convergenza	A $^{0}_{-2}$	*Toe-in*
Specifica olio IN PRESENZA DI DIFFERENZIALE LIMITED SLIP, USARE I TIPI DI OLIO INDICATI OPPORTUNAMENTE ADDITIVATI NOTA: NON USARE OLIO DI SINTESI SENZA IL CONSENSO DEL COSTRUTTORE	SAE 80W - 90 EP to comply API GL4 respectively MIL-L-2105 and MIL-L-2105D	*Oil Specification* *IN PRESENCE OF DIFFERENTIAL LIMITED SLIP, USE RECOMMENDED OIL ENRICHED IN ADDITIVES* *NOTE: DO NOT USE SYNTHETIC OIL WITHOUT CONSENT OF THE MANIFACTURER*
Quantità olio differenziale	11 litri/Liter	*Differential oil capacity*
Quantità olio riduttore epicicloidale	1,3 + 1,3 litri/Liter	*Epicyclic reduction oil capacity*

DESCRIZIONE	VALORI VALUES	*DESCRIPTION*
Grasso	POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2	*Grease*
Gioco di accoppiamento coppia conica	0.16÷0.22 mm	*Bevel gear set backlash*
Precarico cuscinetti pignone conico "P" (misurato sul D=34,8 mm senza anello di tenuta)	P= 9.2÷13.8 daN	*Pinion bearings preload "P" (measured D=34,8 mm without seal)*
Precarico totale cuscinetti corona-pignone "T" (misurato sul D=34,8 mm senza anello di tenuta)	T= (P+3.2)÷(P+4.7) daN	*TPinion / crown gear total preload "T" (measured D=34,8 mm without seal)*
Tipo freno	A dischi in bagno d'olio Wet discs brake	*Type of brake*
N° dischi freno (per lato)	3	*Number of brake discs (each side)*
N° controdischi freno (per lato)	4	*Number of brake counterdiscs (each side)*
Spessore nominale disco freno	4.83 mm	*Nominal brake disc thickness*
Spessore nominale controdisco freno	5/10.8 mm	*Nominal brake counterdisc thickness*
Usura max disco freno (per lato)	0.2 mm	*Maximum brake disc wearing (each side)*
Specifica olio per attuazione freno	Olio minerale Mineral oil	*Oil specification for brake activation*
Volume olio per azionamento freni	13 + 13 cc	*Oil displacement for brakes actuation*
Pressione max di esercizio	44 bar	*Maximum operating pressure*
Tipo flangia pignone	end yoke 1480	*Pinion flange type*

Sigillanti e collanti

Sealing compounds and adhesives



A1= LOCTITE® 510	○	B2= LOCTITE® 270	●
A2= LOCTITE® 573	○	C1= LOCTITE® 405	○
A3= LOCTITE® 518	●	C2= LOCTITE® 496	○
B1= LOCTITE® 542	○	C3= LOCTITE® 638	●

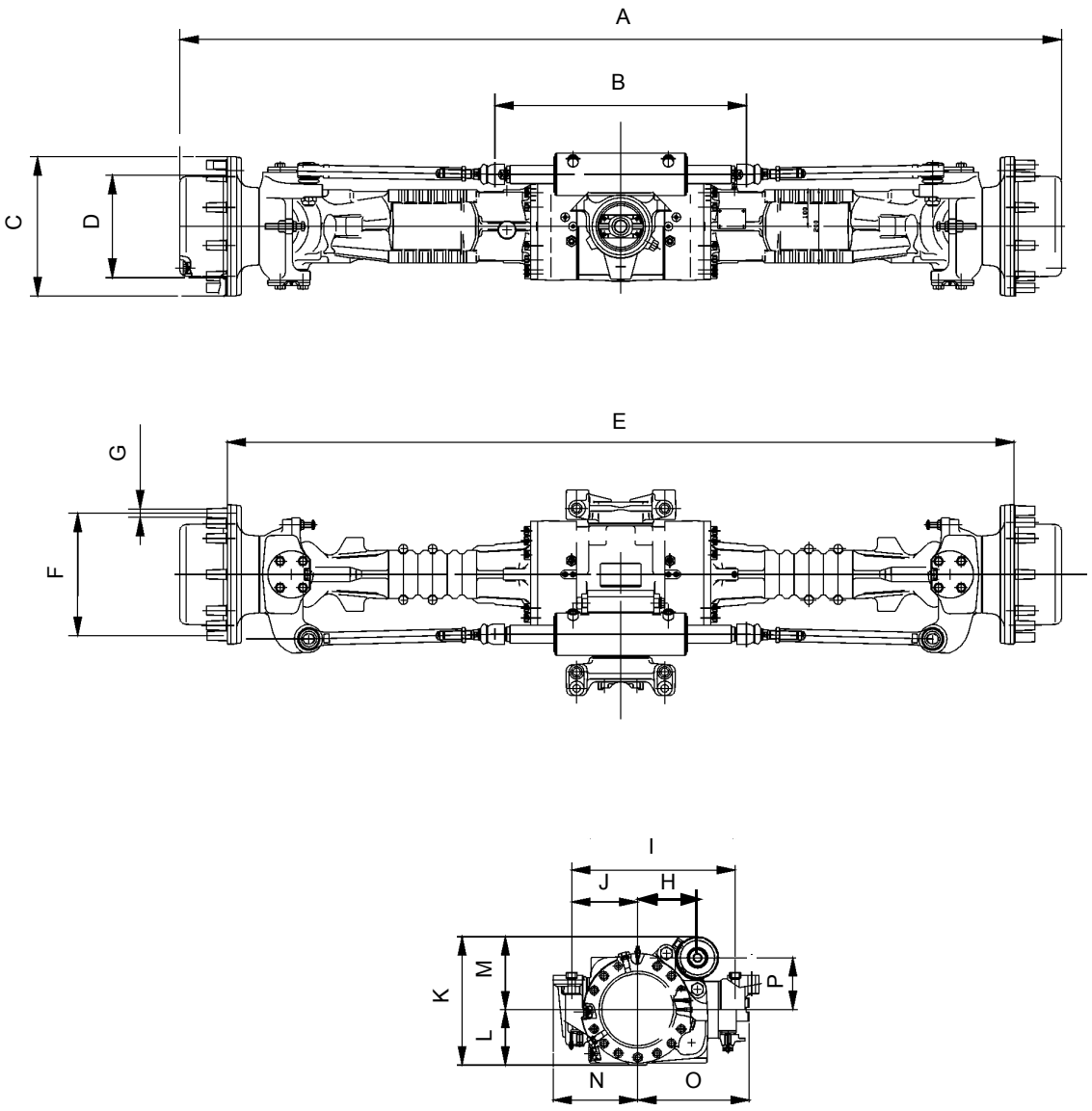
◁ - - - - - -	Applicare sulle superifici a contatto
	Apply on the contact surfaces
←	Applicare sulla filettatura delle viti / sui perni
	Apply on bolt screws / on pins

Dimensioni d'ingombro

Overall dimensions

(in millimetri)

(Millimeter)



A = 2304
B = 686
C = Ø 380
D = Ø 280
E = 2100

F = Ø 335
G = M22 x 1.5
H = 163
I = 446,7 $^{-0,9}_{+0,6}$
J = 180

K = 350
L = 151
M = 199
N = 230
O = 320
P = 142

B.5 Rifornimento e verifiche

B.5 Filling and checks

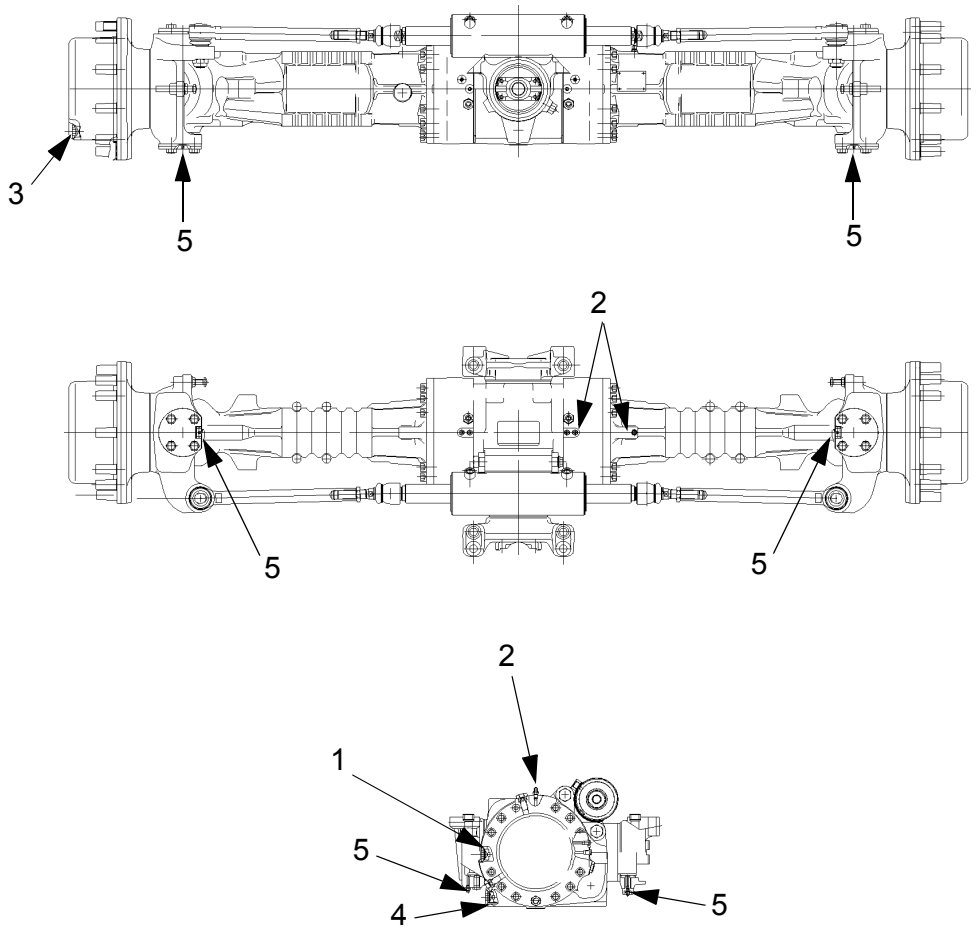
PUNTI DI LUBRIFICAZIONE	POSIZIONE / *POSITION*	*LUBRICATION POINT*
TAPPO CARICO E LIVELLO OLIO DIFFERENZIALE	1	*DIFFERENTIAL OIL FILLING AND LEVEL PLUG*
SFIATO OLIO	2	*OIL BREATHER*
TAPPO CARICO, SCARICO E LIVELLO OLIO RIDUTTORE EPICICLOIDALE	3	*FILL / DRAIN AND LEVEL PLUG OF EPICYCLIC REDUCTION GEAR OIL*
TAPPO SCARICO OLIO DIFFERENZIALE	4	*DIFFERENTIAL OIL DRAIN PLUG*
PUNTI DI INGRASSAGGIO	5	*GREASING POINTS*

Controlli periodici:

Il livello del lubrificante nell'assale deve essere a filo del tappo di controllo (**1**) e (**3**), altrimenti provvedere al rabbocco con olio dello stesso tipo.
Nel caso in cui si riscontri una perdita o altro che determini l'abbassamento del livello, è opportuno intervenire immediatamente onde evitare possibili danni agli organi meccanici.
Per scaricare l'olio dell'assale svitare il tappo (**4** e **3**).

Routine checks:

*In the axle, lubricant should be flush with control plug (**1**) and (**3**). If not, make up level with the same oil.*
If leakage or any other factor determining fall in the oil level is found, then it is advisable to check immediately, in order to avoid damages to the mechanical parts.
*Loosen and remove the drain plug for oil draining (**4** and **3**).*



B.6 Programma di lubrificazione *B.6 Service schedule*

OPERAZIONE	▲ PRIMO INTERVENTO *FIRST TIME*	◆ AD OGNI STAGIONE OD OGNI 1500 ORE(1) *SEASONALLY OR EVERY 1500 OPERATING HOURS(1)*	*OPERATION*
CAMBIO OLIO ASSALE	150 - 200 ore/*hours* ●	◆ ■	*AXLE OIL CHANGE*
OPERAZIONI DI LUBRIFICAZIONE	▲ ■	◆ ■	*LUBRICATION WORKS*
CONTROLLO ED EVENTUALE RABBOCCO OLIO	50 - 100 ore/*hours* ■	mensilmente/*monthly* ●	*CHECK AND IN CASE ADJUST OIL LEVEL*
PULIZIA TAPPO MAGNETICO SCARICO OLIO	150 - 200 ore/*hours* ■	ad ogni cambio olio/ *every oil change* ●	*CLEAN MAGNETIC OIL PLUGS*
PULIZIA SFIATO OLIO	▲ ■	mensilmente/*monthly* ●	*CLEAN OIL BREATHER*
INGRASSAGGIO	150 - 200 ore/*hours* ●	settimanalmente/*weekly* ●	*GREASING*

legenda

● operazioni eseguibili solamente da personale autorizzato dal costruttore

■ operazioni eseguibili solamente da personale addestrato

(1) quale delle due condizioni si verifica prima

remarks

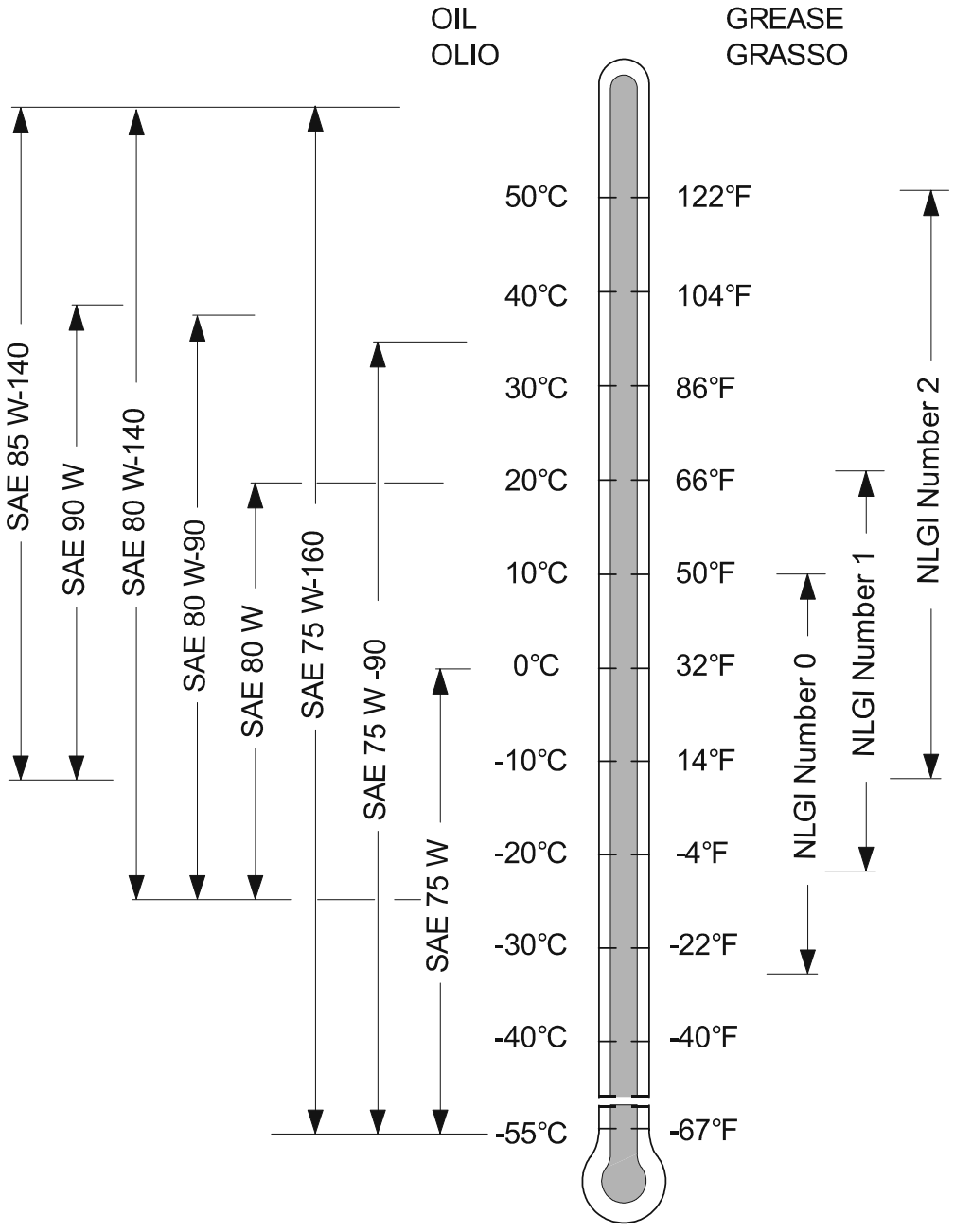
● *operation performed only by personnel authorized by the manufacturer*

■ *operation performed only by trained personnel*

(1) which of both conditions comes first

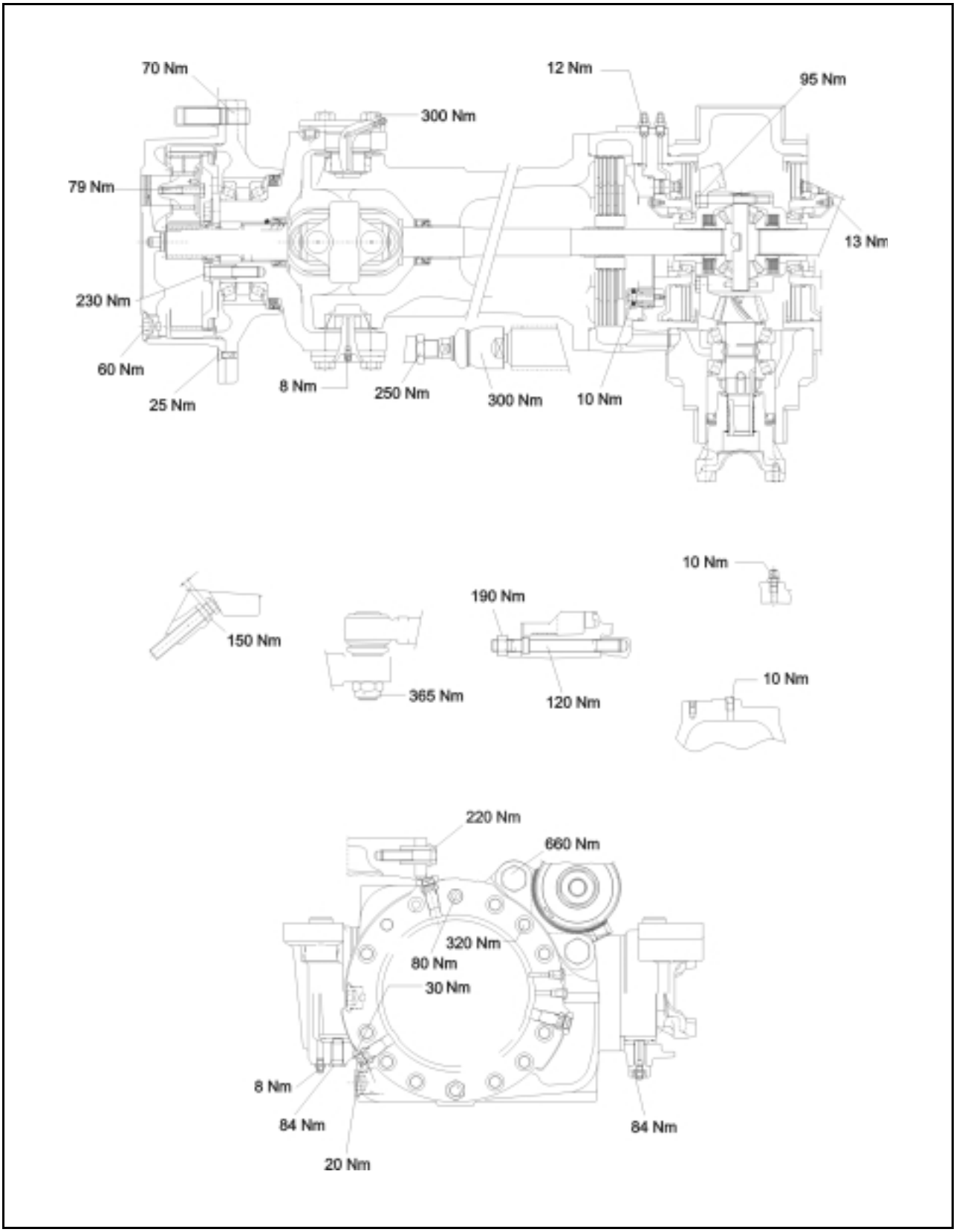
B.7 Lubrificazione / ingrassaggio: gradazioni e relativi campi di applicazione

B.7 Lubrication / greasing: grades and application range



B.8 Coppie di serraggio

B.8 Tightening torques



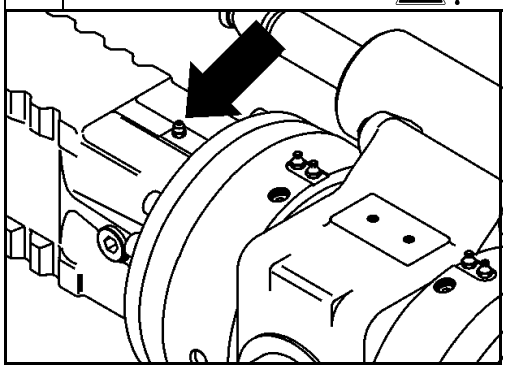
B.9 Controlli generali

Le descrizioni di smontaggio e montaggio presuppongono che il gruppo sia già stato rimosso dal veicolo e posizionato su un adatto banco di lavoro.
Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

B.9 General checks

The disassembly/assembly instructions presume that the unit has been removed from the vehicle and positioned on a suitable workbench.
Some of the following pictures may not show exactly your axle, but the procedure is the same.

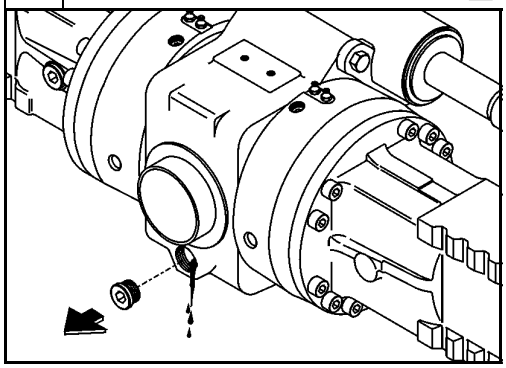
1



Prima di effettuare l'operazione di scarico dell'olio, svitare l'apposito sfiato per eliminare eventuale pressione interna. Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8).

Before draining the oil, loosen the breather to release possible internal pressure, then tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

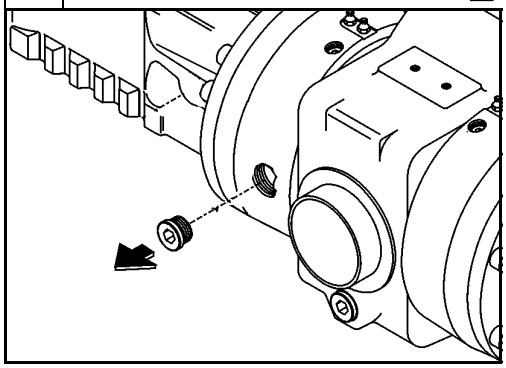
2



Per effettuare lo scarico dell'olio dal corpo centrale svitare il tappo del foro di scarico. Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8).

Drain the oil from the appropriate plug, then tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

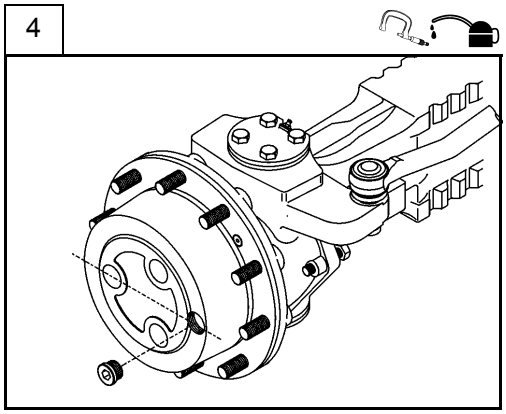
3



Verificare il livello dell'olio ed eventualmente rabboccare attraverso il foro del tappo indicato e richiuderlo poi con una chiave dinamometrica alla coppia prevista (sez. B8).
Nota: prima di agire sul tappo dell'olio, svitare l'apposito sfiato per eliminare l'eventuale pressione interna.

Check the oil level and if necessary top up through the bore of the plug marked with an arrow, then tightenthe plug with a torque wrench to the prescribed torque (sec. B.8).
***Note:** before draining the oil, loosen the breather to release possible internal pressure.*

4



Prima di effettuare l'operazione di scarico o rabbocco dell'olio dal riduttore epicicloidale, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro in modo da eliminare l'eventuale pressione interna, quindi rimuoverlo completamente.
Ruotare gradualmente il mozzo fino a disporlo con il foro all'altezza dell'asse ruota in modo che la linea di livello dell'olio sia orizzontale.
Verificare il livello dell'olio ed eventualmente rabboccare.
Riavvitare il tappo con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8)

Before draining the oil from the epycicloidal reduction, position the wheel hub so that the filer cap is in the highest point, then loosen the plug to release possible internal pressure.
Position the wheel hub so that the filer cap is on the centre line of the horizontal axis.
Check oil level and top up if necessary.
Tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

C INFORMAZIONI SULLA SICUREZZA

C *SAFETY INSTRUCTIONS*

C.1 Raccomandazioni generali per la sicurezza

IMPORTANTE:
Prima di iniziare qualsiasi tipo di operazione leggere attentamente questo capitolo.

Precauzioni per la sicurezza:

Il corretto uso e la corretta riparazione degli assali e dei loro componenti sono molto importanti per la sicurezza e l'affidabilità.
Le procedure raccomandate e descritte in questo manuale sono testate, quindi sono effettivi metodi operativi. Seguire strettamente ogni procedura facendo uso sia del testo che delle illustrazioni.
Alcune di queste procedure mostrano l'uso di appositi strumenti progettati perché le operazioni vengano condotte in modo chiaro e corretto.
Alcuni strumenti specifici devono essere usati dove necessario per eseguire determinate operazioni.
E' impossibile trattare ogni metodo di lavoro o tutte le possibili metodologie per svolgerlo e le rischiose conseguenze di ognuna, perciò chi usa procedure o strumenti non consigliati deve sapere che la sicurezza dell'operatore e del veicolo saranno messi a repentaglio.

Pericolo
Gli occhiali di sicurezza devono essere indossati sempre durante l'esecuzione di tutte le operazioni di montaggio o smontaggio.

C.1 General safety recommendations

IMPORTANT:
Before proceeding with any operations please read this chapter very carefully.

Safety precautions:

Correct use and repair of axles and of their components is very important for safety and reliability.
Recommendations and all described procedures given in this manual have been experimented and hence are effective operational methods. Please follow every procedure. Use the text as well as the illustrations.
Certain procedures show use of special tools, designed so that the operations can be carried out in a clear and correct manner.
Special tools must be used when a particular operation is being carried out.
It is impossible to advice every working method or know all possible methodologies for carrying it out or to predict risky consequences of each operation. Hence, performing procedures or using instruments which have not been advised could be dangerous for the operator/mechanic as well as the vehicle.

Danger
Safety goggles must be worn while carrying out every assembling or disassembling operations.

C.2 Simboli di sicurezza

Identificazione delle informazioni sulla sicurezza

Questo è il simbolo di allarme per la sicurezza; quando lo trovate sulla macchina o sul manuale, siete avvisati del pericolo potenziale di incidenti o danni alla persona. Seguite i suggerimenti e le raccomandazioni per operare in sicurezza.

Significato delle scritte di avvertimento

PERICOLO

AVVISO

ATTENZIONE

Una scritta di avvertimento (PERICOLO, AVVISO o ATTENZIONE), viene usata insieme al simbolo di allarme per la sicurezza.
I segnali PERICOLO o AVVISO sono utilizzati vicino ad aree pericolose. PERICOLO identifica la situazione più pericolosa.
Precauzioni generali sono invece segnalate da ATTENZIONE.

Seguire le istruzioni di sicurezza !

Leggere con cura tutti i messaggi sulla sicurezza di questo manuale.

Modifiche non autorizzate possono compromettere il funzionamento, la sicurezza d'impiego e la durata.
Se non comprendete le istruzioni del manuale, contattate il rappresentante a voi più vicino.

C.2 Safety symbols

Recognize safety information

This is the safety alarm symbol; whenever you find it in the manual or see it on the machine, you are being warned about potential danger of accidents or harm to personnel. Follow the do's and don't's to operate in total safety.

Understanding written warnings

DANGER

WARNING

CAUTION

Written warning (DANGER, WARNING or CAUTION) is used along with an alarm symbol.
DANGER or WARNING signs are used near danger zones, while CAUTION sign indicates general precaution.

Follow safety instructions !

Read all suggestions given in this instruction manual very carefully.

Unauthorized changes could endanger the functioning, work safety and work span.
If you do not understand this instruction manual, contact the nearest sales representative.

C.3 Precauzioni generali

In ogni movimento dovranno essere osservate le norme sulla prevenzione infortuni, tutte le regole generali di sicurezza e di medicina del lavoro.
Prima di procedere nelle operazioni di manutenzione o sistemazione di eventuali problemi, assicurarsi del buon stato e del buon funzionamento delle attrezzature quali banchi di sostegno, cavalletti, martelli, leve, estrattori e chiavi apposite facilitando le operazioni da svolgere in modo ottimale riducendo i rischi sia per gli organi ed i componenti del prodotto che della incolumità dell'operatore.
Tutte le modifiche arbitrarie apportate al prodotto sollevano la CARRARO SpA da ogni responsabilità per qualsiasi danno o incidente.
Il prodotto, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto a "uso non previsto". CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.

Norme per la manutenzione in sicurezza

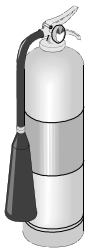
1 Operare in ambiente pulito e asciutto.
2 Non lubrificare, manipolare o registrare il gruppo in moto.
3 Tenere lontani mani, piedi, indumenti da parti in movimento.
4 Essere sempre pronti per i principi di incendio. Tenere a portata di mano estintore e cassetta di pronto soccorso.
5 Tenere in evidenza il n° di telefono di un medico, ambulanza, ospedale e vigili del fuoco presso il proprio telefono.

C.3 General precautions

Observe safety instructions, accident prevention rules and all general safety regulations in each and every step at work.
Before going ahead with maintenance or repair work ensure that all the tools, the supporting bench, stands, levers, extractors and spanners are in good condition so that the work can be carried out easily.
Risks to various parts and components will also be reduced in this way and working condition for the operator will also be safer.
CARRARO SpA declines any responsibility in case of an accident or damage resulting due to changes made arbitrarily on product.
The product is used for any other purpose different from the one foreseen, than CARRARO SpA declines any responsibility.
In this case all consequences will be at the customer's expense.

Safety maintenance rules

1 *Operate in a clean and dry environment.*
2 *Do not lubricate, handle or adjust the group underway.*
3 *Keep off your hands, feet and clothing from moving parts.*
4 *Be always prepared for fires. Keep the extinguisher and the first aid kit within reach.*
5 *Keep the phone numbers of a doctor, of an ambulance, of a hospital and of the fire department within reach near the telephone set.*



6 Usare indumenti e protezioni adatte allo scopo come: tuta, guanti protettivi e cuffie.
7 Usare protezioni auricolari appropriate a salvaguardare l'udito, come tappi o cuffie per le orecchie contro rumori molesti o fastidiosi.

6 *Wear suitable clothing and protections as overalls, safety gloves and ear safety devices.*
7 *Use suitable ear protections, like ear plugs, to keep out noise and prevent injury to the ears.*

Un'esposizione prolungata al rumore può danneggiare l'udito.

8 Le attrezzature richiedono la piena attenzione dell'operatore. Non usare cuffie per ascoltare musica mentre si interviene sul prodotto o gruppo.

Eliminazione dei rischi residui

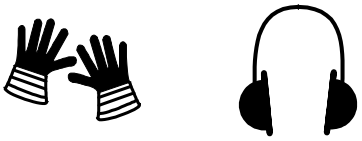
- Rischio di schiacciamento e cesoiamento dovuto alla presenza di elementi in movimento.
  Attenzione
  Eseguire tutte le operazioni di manutenzione a macchina ferma.

- Rischio dovuto all'inalazione di gas nocivi che si possono sviluppare scaldando le vernici durante eventuali saldature.
  Attenzione
  Utilizzare postazioni di lavoro dotate di sistemi di evacuazione di polveri e fumi.
  Lasciate disperdere i fumi per almeno 15 minuti prima di saldare o riscaldare, o riprendere a lavorare sul gruppo.

- Rischio di incendio dovuto ai solventi utilizzati e all'olio presente nell'assale.
  Attenzione
  Tenere lontano dalla zona di lavoro ogni fonte di calore.
  Quando si usano solventi o svernicianti, rimuoverli con acqua e sapone prima di saldare.
  Rimuovere i contenitori di solvente, sverniciante o altri prodotti infiammabili dall'area di lavoro.

- Rischio dovuto alla caduta, allo sganciamento o alla violenta espulsione di oggetti o olio dall'assale.
  Attenzione
  Questi rischi residui e le procedure per eliminarli completamente, sono evidenziati dettagliatamente nelle procedure di montaggio e smontaggio. Seguire attentamente, durante la manutenzione, tutte le procedure di sicurezza indicate nel manuale.

A prolonged exposure to noise can damage your hearing.



8 *The operator must be very careful with the equipment. Do not use headphones to listen music while you are working on the product or on the group.*

Residual risk elimination

- *Risk of squashing and shearing due to the presence of moving parts.*
  Warning
  Carry out all maintenance operations when the machine is stationary.

- *Risk due to inhalation of poison gases that can be produced by heating the varnishes during any welding.*
  Warning
  Use work stations equipped with dust and fume discharging systems.
  Let the fumes disperse for at least 15 minutes, before welding or reheating, or working on the group again.

- *Risk of fire due to the solvents used and to the oil in the axle.*
  Warning
  Keep off any heat sources from the working area.
  When solvents or paint removers are used, they should be removed with soap and water, before welding.
  Remove any containers of solvent, paint remover or any other inflammable products from the working area.

- *Risk due to fall, drop or violent ejection of objects or oil from the axle.*
  Warning
  These residual risks and the suitable relative procedures to eliminate them completely are pointed out, in detail, in the assembly and disassembly procedures. During maintenance, follow carefully all the safety procedures indicated in the manual.

D OPERAZIONI DI SMONTAGGIO

D DISASSEMBLY OPERATIONS

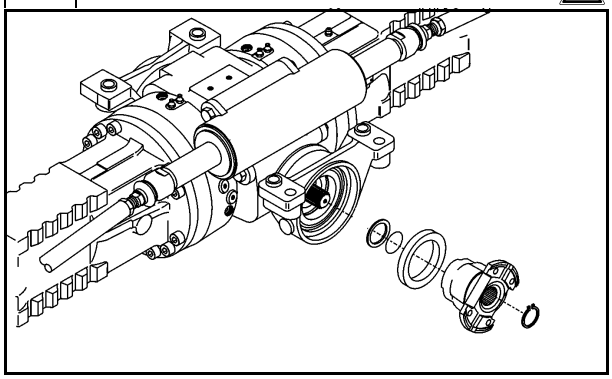
D.1 Smontaggio gruppo supporti assale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.1 Axle trunnions group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

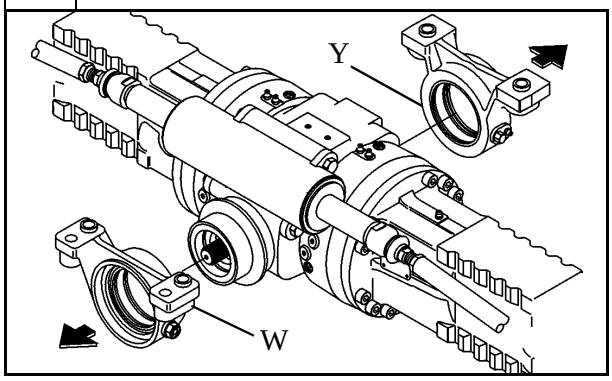
1



Togliere l'anello seeger e sfilare la flangia.
Nota: Attenzione a recuperare l'OR e lo spessore.

Remove the snap ring and the input flange.
***Note:** Collect the O-ring and the washer.*

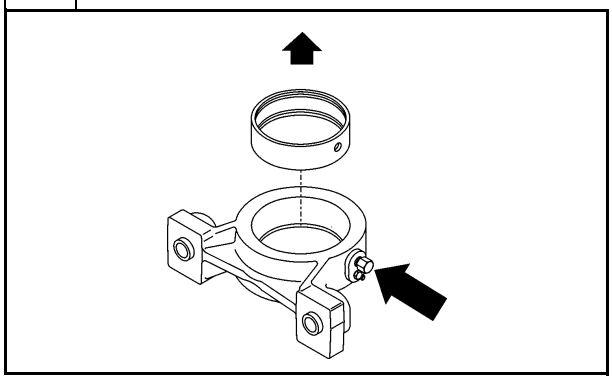
2



Sfilare il supporto posteriore "**W**" e anteriore "**Y**".

*Remove rear "**W**" and front "**Y**" trunnions.*

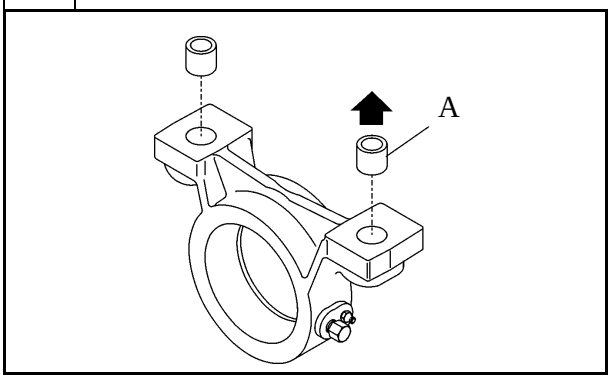
3



Allentare la vite ed estrarre la boccola di rasamento dal supporto anteriore.

Loosen the screw and pull the bushing out of the front trunnion.

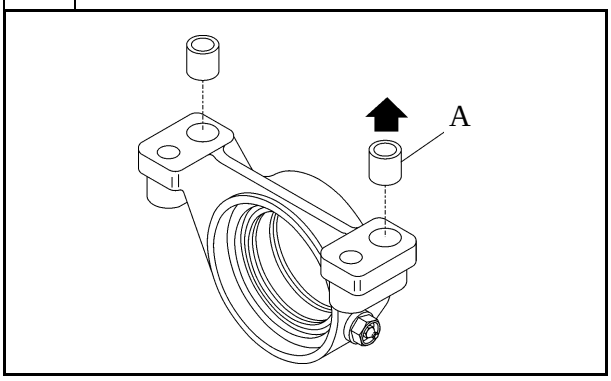
4



Verificare e sostituire, se necessario, le due spine di centraggio "**A**" dal supporto anteriore.

*Check and replace if necessary the "**A**" center pin of front trunnion.*

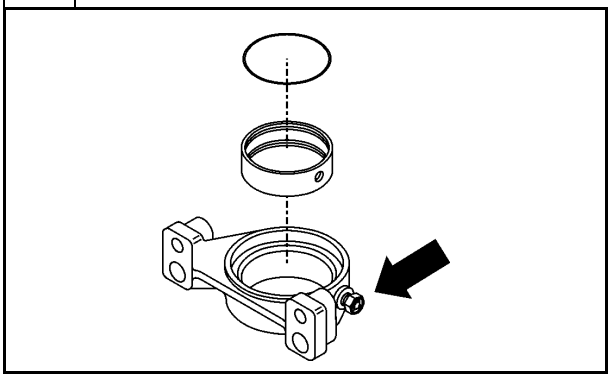
5



Se é necessario verificare e sostituire le due spine di centraggio "**A**" dal supporto posteriore.

*Check and replace if necessary the "**A**" center pin of rear trunnion.*

6



Allentare la vite forata ed estrarre la boccola di rasamento dal supporto posteriore.
Togliere e verificare le condizioni di usura dell'anello OR.
Sostituire se necessario.

Loosen the drilled screw and take the bushing out of the rear support.
Remove the O-ring and inspect it for wear.
Replace if necessary.

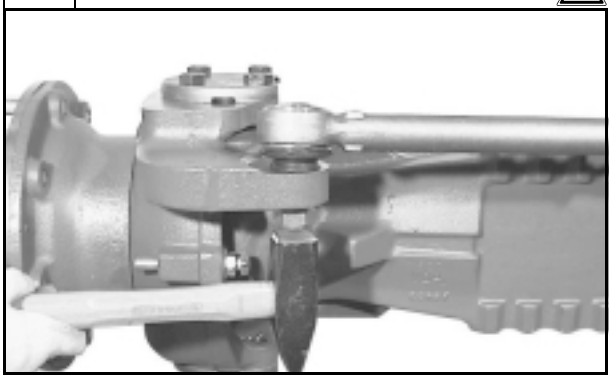
D.2 Smontaggio gruppo cilindro sterzo

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.2 Steering cylinder group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

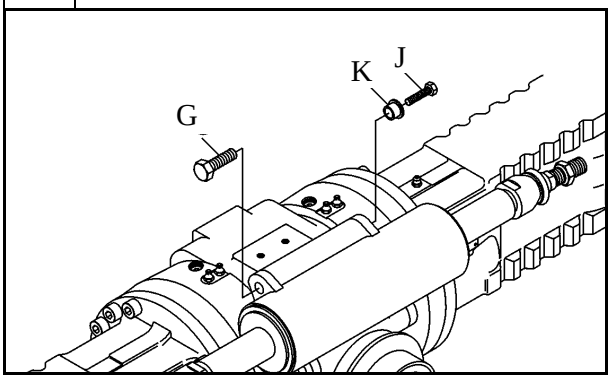
1



Allentare il dado di fissaggio dell'asta guida di qualche giro fino a portarlo a filo del perno filettato.
Con un martello battere sul dado per staccare l'asta guida dalla calotta.
Nota: questa operazione è distruttiva per il dado.

Loose the guide rod locknut of some turns till it is on a level with the threaded pin
Beat on the nut with a hammer in order to disjoin the guide rod from the swivel housing.
Note: *this is a destructive operation for the nut.*

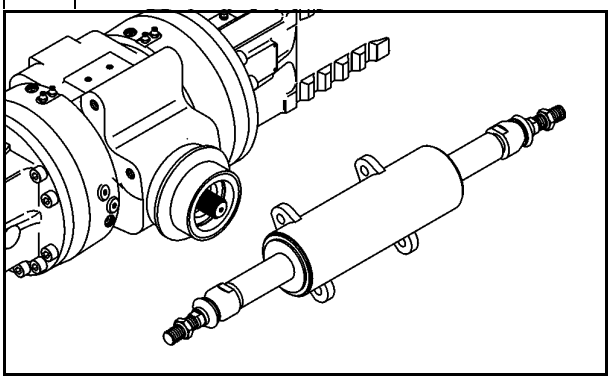
2



Togliere il cilindro sterzo, svitando le viti "**G**" e "**J**", insieme alle boccole "**K**".

*Remove the steering cylinder, by unscrewing bolts "**G**" and "**J**", together with the bushes "**K**".*

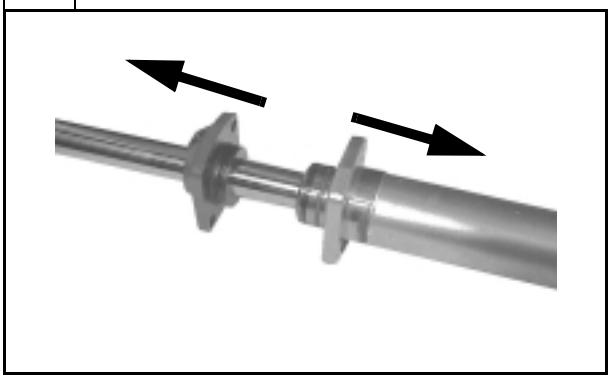
3



Una volta rimosso il cilindro sterzo, verificarne le condizioni. Rimuovere il tirante dell'asta guida allentando con chiave adatta il dado di bloccaggio e controllarne poi le condizioni.

Once removed the steering cylinder, check its conditions. Remove the guide rod link by loosing the tie nut with a suitable wrench, then check its conditions.

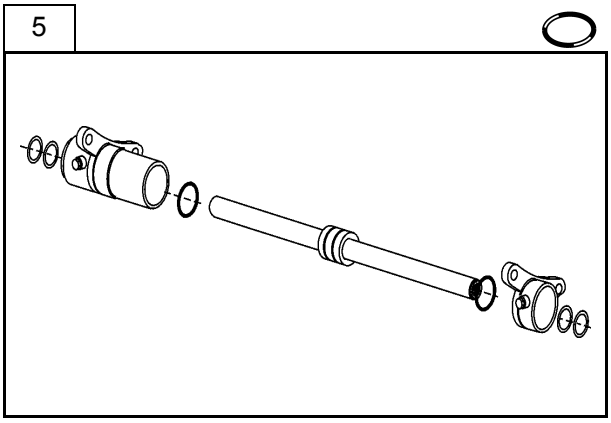
4



Staccare la testata dal corpo del cilindro e sfilare lo stelo.

Detach the cylinder head from the cylinder case and remove off the rod.

5



Sfilare la testata dallo stelo e recuperare tutti gli anelli di tenuta, sia dal corpo cilindro che dallo stelo.

Remove off the cylinder head from the rod, making sure not to lose any of the sealing and O-Rings both from the cylinder head and the rod.

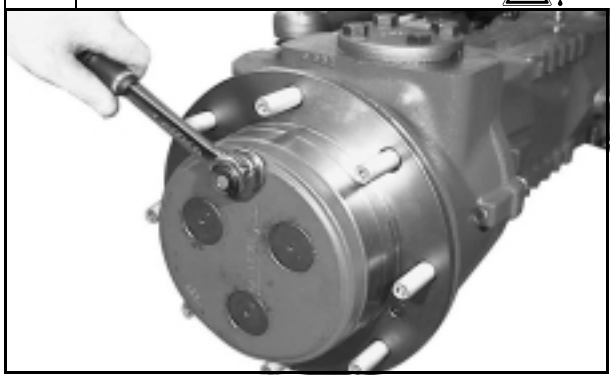
D.3 Smontaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.3 Epicyclic reduction gear disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

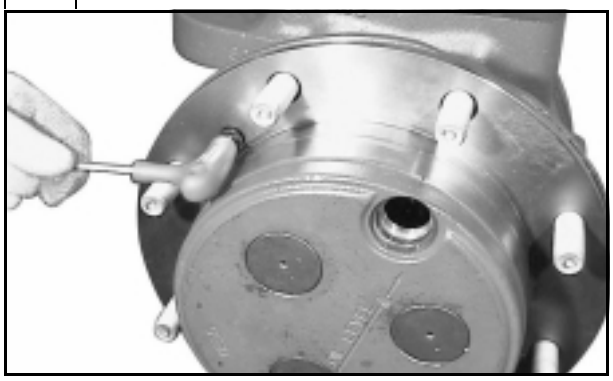
1



Prima di effettuare l'operazione di scarico dell'olio, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro per eliminare eventuale pressione interna, quindi rimuoverlo completamente. Ruotare il mozzo fino a portare il foro nel punto più basso.
Scaricare completamente l'olio.

Before draining the oil, position the hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, and then remove it completely.Turn the hub upside-down till the hole is in the lowest point.
Drain the oil completely.

2



Svitare e togliere le due viti di fissaggio del treno portasatelliti con una chiave da commercio.

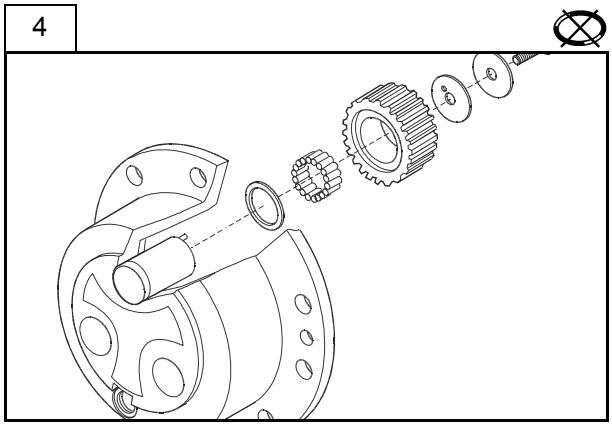
Unscrew and remove the two fastening screws of the planetary carrier with a wrench.

3

Rimuovere il treno portasatelliti dal mozzo ruota.
Posizionare il treno portasatelliti su di un piano e verificarne le condizioni di usura.
Recuperare l'anello O-Ring e controllare le sue condizioni.

Remove the planetary carrier from the wheel hub. Position the planetary carrier on a table and check its wear conditions.
Remove the O-ring and check its conditions

4



Per eseguire l'eventuale sostituzione degli ingranaggi satelliti:
- rimuovere la vite di fissaggio di ogni satellite;
- rimuovere le rondelle;
- estrarre i satelliti dai perni;
- recuperare i relativi rullini verificandone le condizioni;
- rimuovere le rondelle di rasamento.

Nota: con nuovi satelliti è consigliabile montare rullini nuovi.

To carry out any possible replacements of the planetary gears:
- remove the fastening screws on every planetary gear;
- remove the washers;
- take the planetary gears out of the pins;
- collect the needle bearings, checking their conditions;
- remove the thrust washers.

***Note:** with new planetary gears is advisable to assembly new roller bearings.*

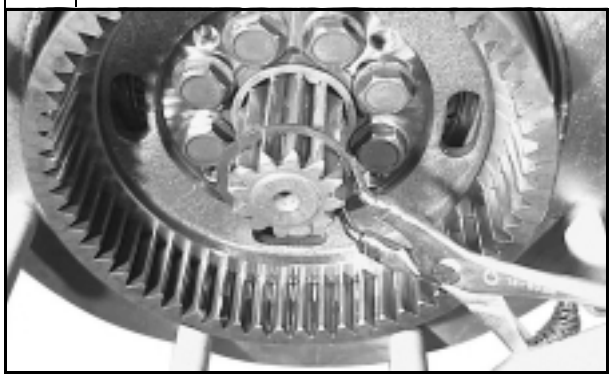
D.4 Smontaggio gruppo mozzo ruota

Prima di smontare il mozzo ruota, assicurarlo con una cinghia o una fune ad un paranco od altro sistema di sostegno, per evitarne la caduta accidentale che potrebbe danneggiare sia l'operatore che il gruppo.

D.4 Wheel hub group disassembly

Before disassembling the splined sleeve, it is advisable to secure it with a belt or a rope on a hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

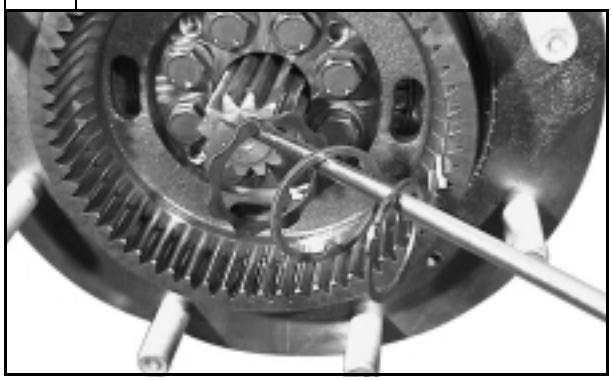
1



Rimuovere l'anello d'arresto dal semiasse con una pinza adatta.

Remove the lock ring from the halfshaft using suitable pliers.

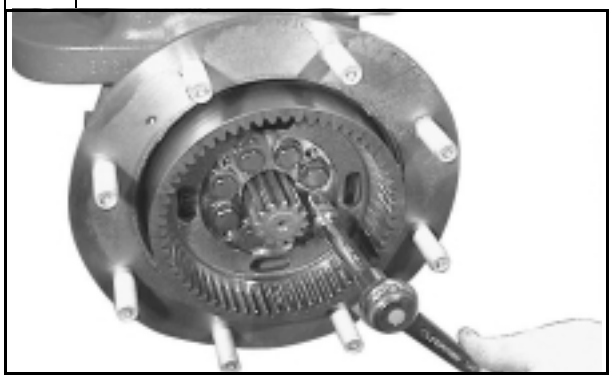
2



Sfilare e recuperare le rondelle dal semiasse.

Remove and collect the half shaft washers.

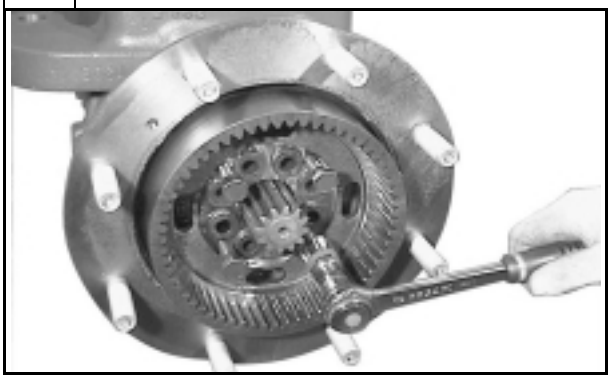
3



Svitare e togliere le viti di fissaggio del mozzo-fermo corona.

Unscrew and remove the fastening screws from the hub-lock ring gear.

4



Per sfilare il mozzo-fermo corona dalla sua sede, recuperare almeno due delle viti appena tolte ed avvitarle nei fori filettati di estrazione.

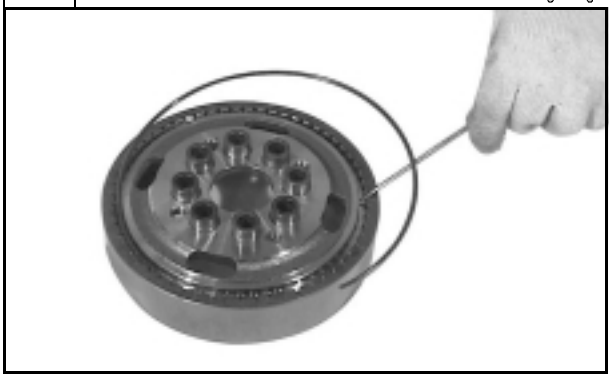
To remove the hub-lock ring gear from its housing, screw at least two of the just removed screws in the threaded extraction holes.

5

Estrarre e rimuovere il mozzo-fermo corona completo di corona epicicloidale.

Extract and remove the hub-lock ring gear together with the epicyclic ring gear.

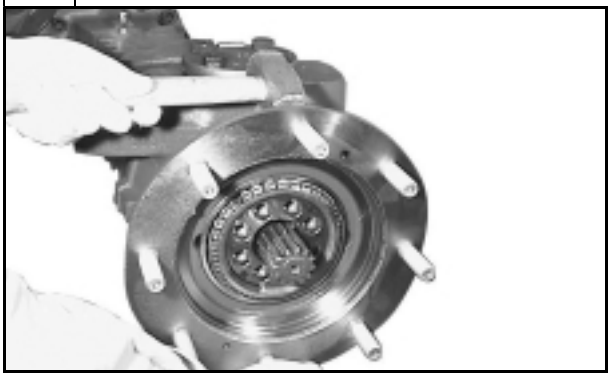
6



Rimuovere l'anello di arresto d'acciaio e separare il mozzo-fermo corona dalla corona epicicloidale.
Verificare lo stato di usura dei particolari.
Solo se necessario, togliere le bussole di centraggio del mozzo-fermo corona con un martello e l'attrezzo cod. CA715027.

Remove the steel stop ring and disjoin the hub-lock ring gear from the epicyclic ring gear. Check the wear conditions of the components. Only if necessary, remove the centering bushes of the hub lock ring gear with a hammer and the special tool code CA 715027.

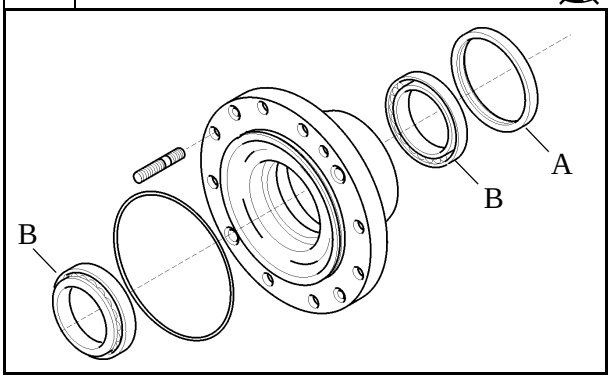
7



Sfilare il mozzo ruota, facilitando lo smontaggio con leve e martello.
Nota: recuperare la pista interna del cuscinetto.

Remove the hub, using levers and a hammer to facilitate the operation.
***Note:** collect the bearing cone.*

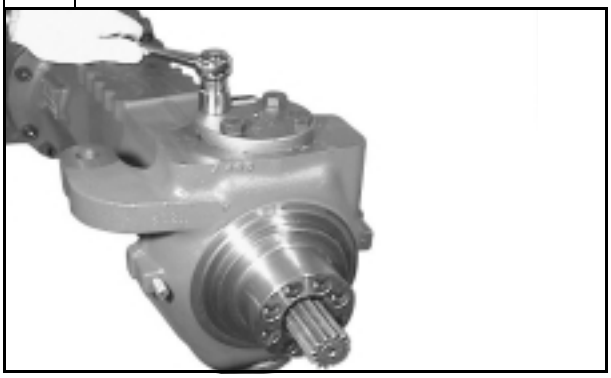
8



Posizionare su di una superficie piana il mozzo ruota ed estrarre l'anello di tenuta (**A**) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Estrarre le piste esterne dei cuscinetti (**B**), da entrambi i lati del mozzo ruota, con un battitoio ed un martello.
Togliere la pista interna del cuscinetto dal codolo della calotta, utilizzando un estrattore da commercio.

*Position on a flat surface the hub and take the seal ring out (**A**) with a lever.*
***Note:** this is a destructive operation for the seal ring.*
*Take the bearing cups out (**B**), on both sides of the hub, using a hammer and a suitable tool to be beaten. Remove the bearing cone from the swivel housing end, using a suitable extractor.*

9



Svitare e togliere le viti di fissaggio del perno snodo superiore ed inferiore.

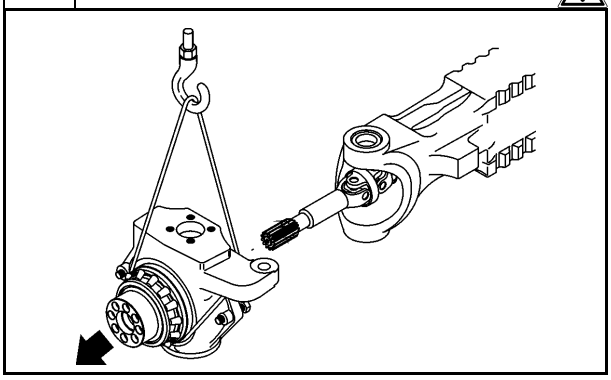
Unscrew and remove the fastening screws from the upper and lower king pin.

10

Prima di rimuovere i perni snodo, assicurare la calotta con una cinghia o una fune ad un paranco od altro sistema di sostegno.
Rimuovere i perni.

Before removing the king pins, secure the swivel housing with a belt or a rope to a hoist or any other supporting device.
Remove the king pins.

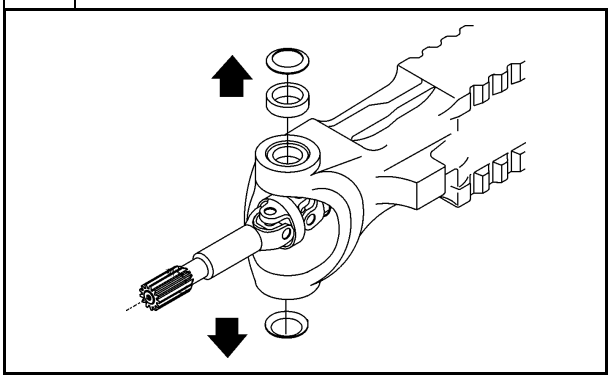
11



Sfilare la calotta dal trave e dal semiasse corto del doppio giunto.

Remove the swivel housing from the axle beam and from the short axle shaft of the U-Joint.

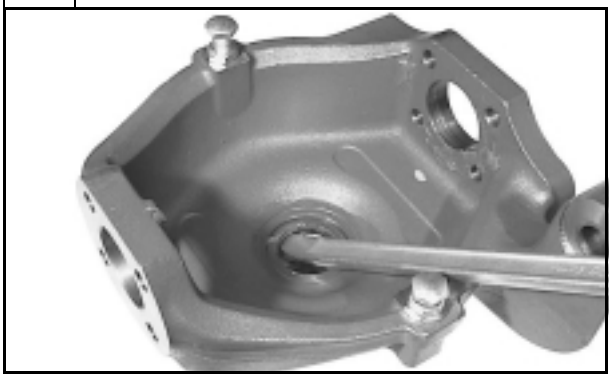
12



Recuperare le molle a tazza e lo spessore dalla parte inferiore e superiore del trave.

Remove the Belleville washers and the shim from the upper and lower side of the axle beam.

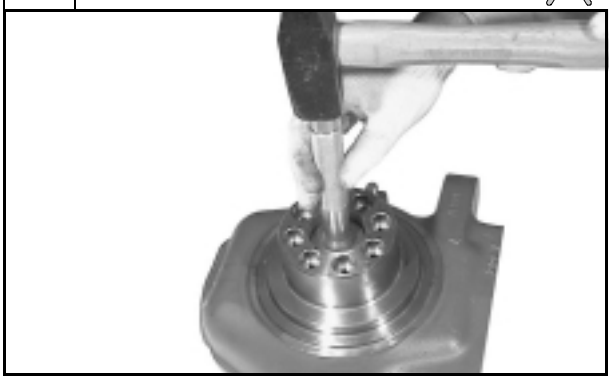
13



Posizionare la calotta su di una superficie piana ed estrarre l'anello di tenuta con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.

Position the swivel housing on a flat surface and take the oil seal ring out with a lever.
***Note:** this is a destructive operation for the seal ring.*

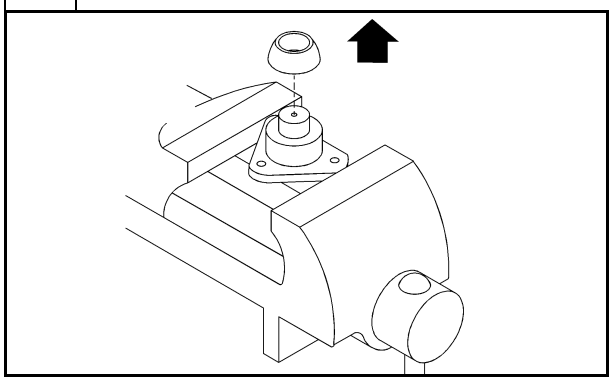
14



Girare la calotta ed estrarre la bronzina utilizzando un battitoio adatto ed un martello.

Turn the swivel housing and take the bushing out, using a suitable tool and a hammer.

15



Estrarre le boccole dai perni snodo con estrattore da commercio.

Take the bushings out of the king pins with a suitable extractor.

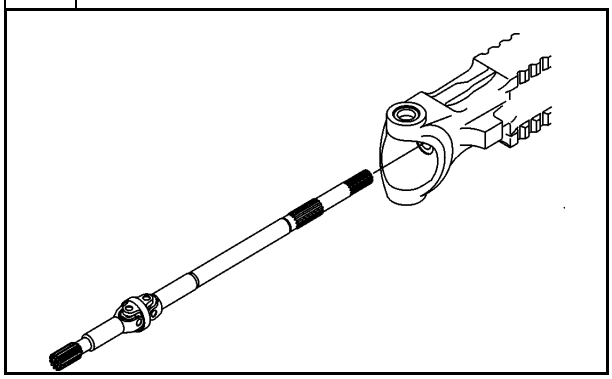
D.5 Smontaggio trombe e gruppi freno

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.5 Trumpets and brake groups disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

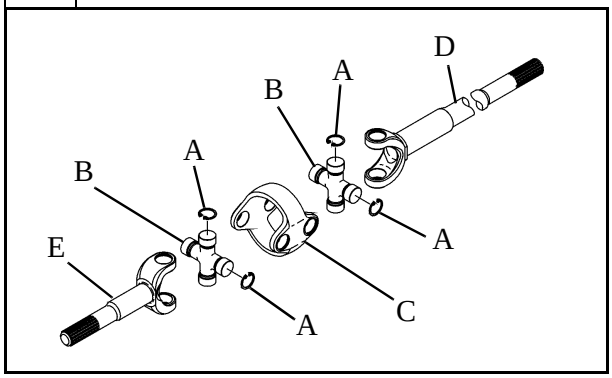
1



Estrarre dal trave il doppio giunto completo.

Remove the complete double-joint from the beam

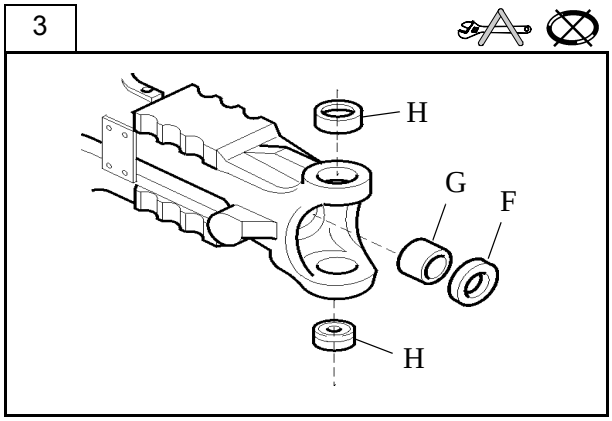
2



Per sostituire un componente del doppiogiunto, rimuovere con pinza adatta gli anelli seeger (**A**) di arresto delle crocere (**B**).
Rimuovere il corpo centrale (**C**) facendo attenzione a non deformarlo o rovinarlo durante l'estrazione dalle crocere (**B**).
Togliere il semiasse lato differenziale (**D**) e il semiasse lato ruota (**E**).

*To replace a component of the double joint, using a suitable pair of pliers, remove the seegers rings (**A**) supplied to stop the spider (**B**).*
*Remove the central body (**C**), taking care not to mis-shape or damage it when with drawing it from the spider (**B**).*
*Remove the half-axle on the differential-gear side (**D**) and the half-axle on the wheel side (**E**).*

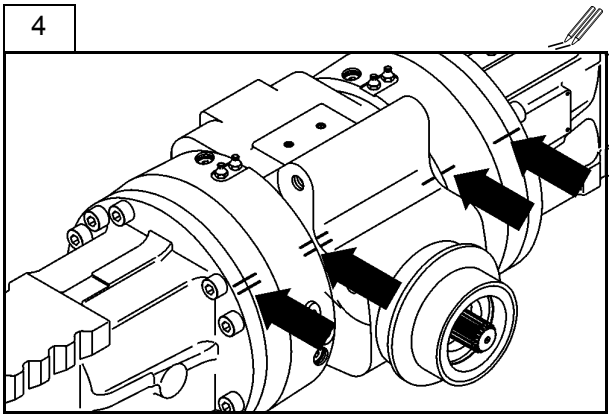
3



Dopo aver sfilato il doppio giunto dal trave estrarre l'anello di tenuta (**F**) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Per eseguire la sostituzione della bronzina (**G**) all'interno del trave è necessario tagliarla, con un cesello.
Estrarre le boccole superiore ed inferiore (**H**) dalle sedi dei perni snodo con estrattore da commercio.

*Once the U-Joint has been removed from the axle beam, extract the seal ring out of the axle beam (**F**) with a lever.*
***Note:** this is a destructive operation for the seal ring.*
*In order to replace it inside the axle beam, the bushing (**G**) needs to be cut and destroyed with a chisel.*
*Take the upper and lower bushing (**H**) out of the king pin'housings with a suitable extractor.*

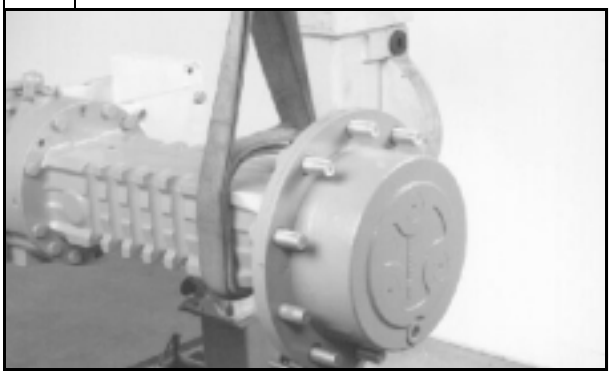
4



Fare dei segni di riferimento indelebili sul corpo trave e sulle flange supporto differenziale, per identificare con sicurezza parte destra e parte sinistra.

Put alignment marks on the axle beam body and on the differential supporting flanges, in order to identify the right side and the left side with certainty.

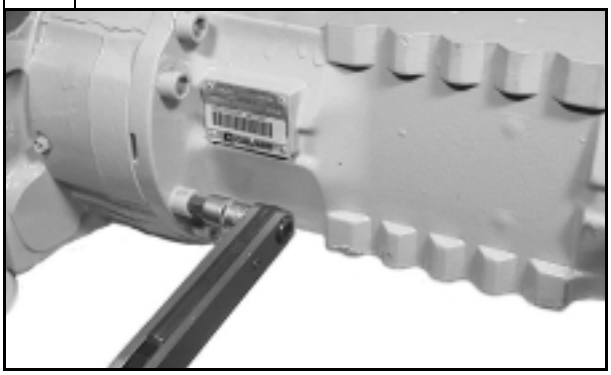
5



Disporre l'assale su supporti adatti a sostenere sia il corpo centrale che le due trombe, anche dopo la loro separazione, o assicurare i tre gruppi separatamente con funi o cinghie ad un sistema di sollevamento.

Position the axle on supports fitted to hold either the central body or the two beam trumpets, even after their disjunction, or secure the three disjointed groups to a lifting device with ropes or belts.

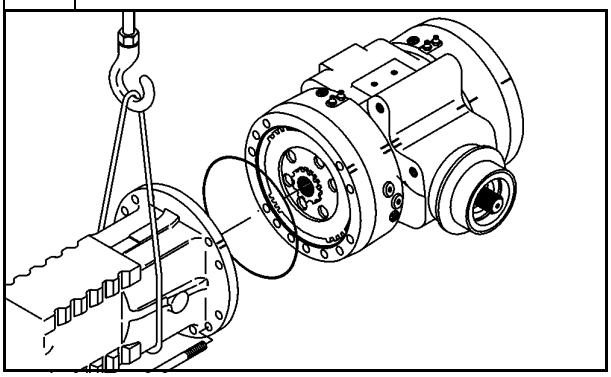
6



Svitare le viti di fissaggio per smontare la tromba trave.

Unscrew the fastening screws to disassemble the axle beam trumpet.

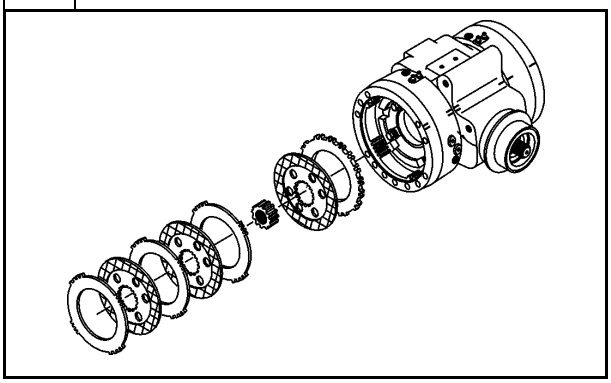
7



Staccare la tromba trave.
Attenzione: rimossa la tromba il gruppo dischi e controdischi freno è libero.
Recuperare il relativo anello O-Ring.

Remove the axle beam trumpet.
***Warning:** once the axle beam trumpet has been removed, the brake disks and counterdisks are free.*
Collect the O-ring.

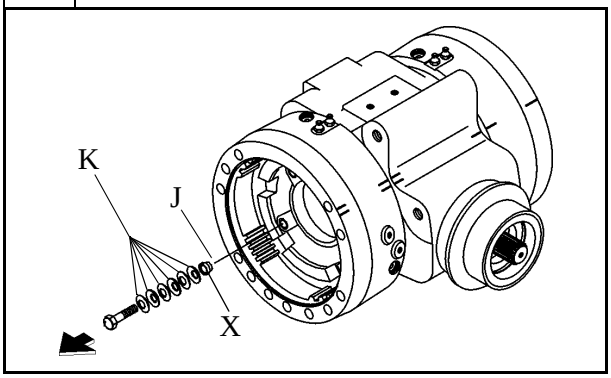
8



Sfilare tutti i componenti del freno dischi, controdischi e manicotto.

Remove all components: brake discs, fixed discs and sleeve.

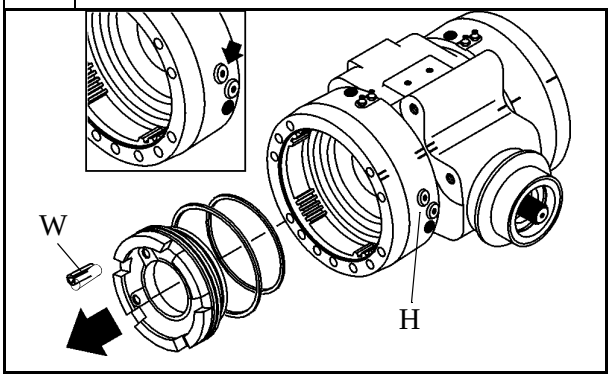
9



Svitare e togliere le viti dei self-adjust ed estrarre le molle a tazza "**K**" la bussola "**X**" e la molla a tazza "**J**".

*Undo and remove the self-adjust bolts and remove the belleville springs "**K**", bush "**X**" and belleville washer "**J**".*

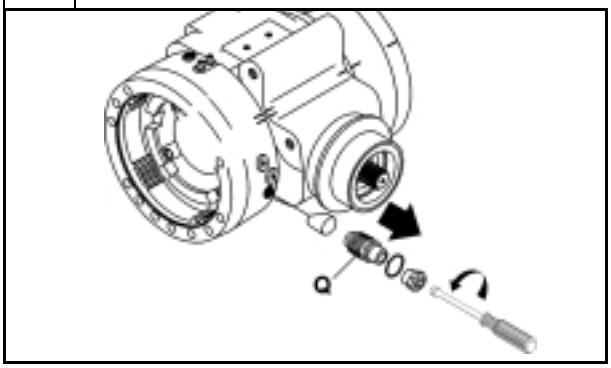
10



Applicare aria od olio in pressione attraverso il foro di mandata del freno negativo "**H**" per espellere il pistone. Utilizzare la minima pressione necessaria per l'espulsione. Rimuovere gli anelli OR e controllare le condizioni. Rimuovere le 3 boccole "**W**" del self adjust dai fori del pistone.
Attenzione: Attenzione all'espulsione!

Apply air or oil pressure through the brake oil inlet port "H" in the positive acting brake assembly to remove the piston. Use the minimum pressure needed to remove the piston. Remove the O-Rings and inspect for wear. Remove the 3 self-adjust split bushings "W" from the piston bores.
***Warning:** exercise extreme care during diassembly!*

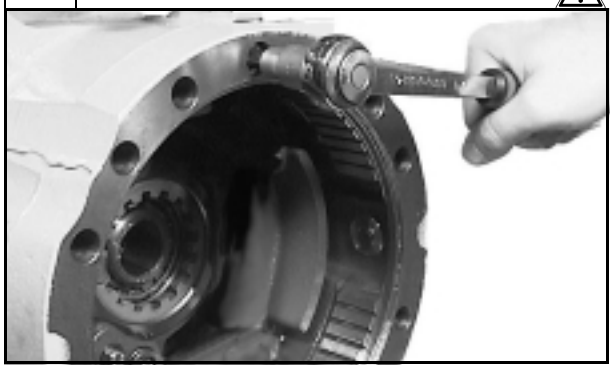
11



Svitare alternativamente le 3 viti speciali "**Q**" fino a rimuoverle completamente.
Togliere e recuperare tutti i particolari della vite freno parcheggio (vedi figura)

*Unscrew alternately three special "**Q**"* screws to remove them completely.
Take away and collect all the particulars of the parking brake screw (see figure).

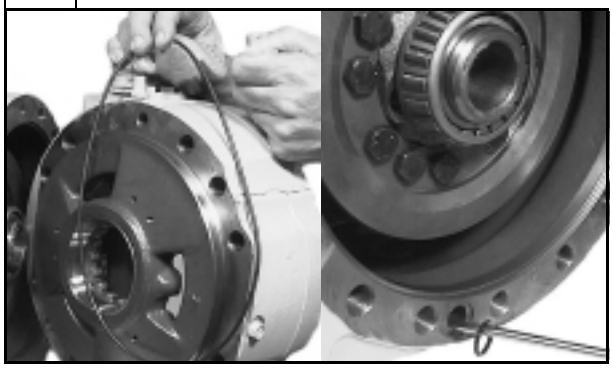
12



Assicurare la flangia freno ad un paranco con funi o cinghie di sicurezza.
Svitare la vite di fissaggio superiore e la vite prigioniera inferiore.
Rimuovere la flangia supporto differenziale dal corpo centrale, completa di ghiera di registro gioco coppia conica.
Pericolo: questa operazione libera la scatola differenziale, che accidentalmente potrebbe cadere.

Secure the brake flange to a hoist with ropes or safety belts.
Unscrew the upper fastening screw and the lower stud bolt.
Remove the differential supporting flange from the central body, together with the bevel gear backlash-adjusting ring nut.
Danger: *this operation frees the differential box, that accidentally could fall.*

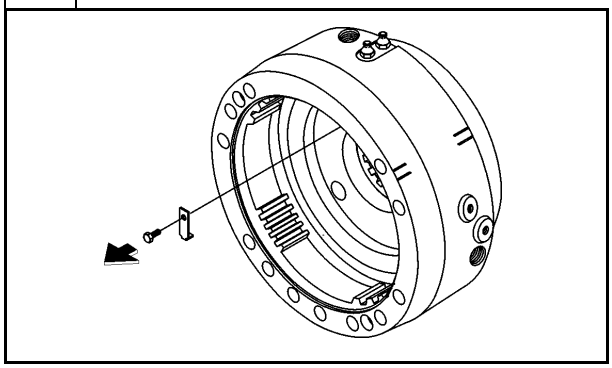
13



Rimuovere l'anello O-Ring dalla sua sede sulla flangia e l'anello O-Ring dal foro passaggio olio, controllarne le condizioni.

Remove the O-ring from its housing and from oil pipe hole and check its conditions.

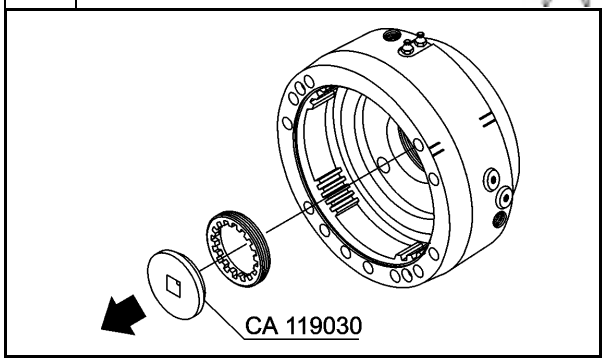
14



Svitare e togliere la vite ed il fermo ghiera.

Undo and remove the bolt and lock nut retainer.

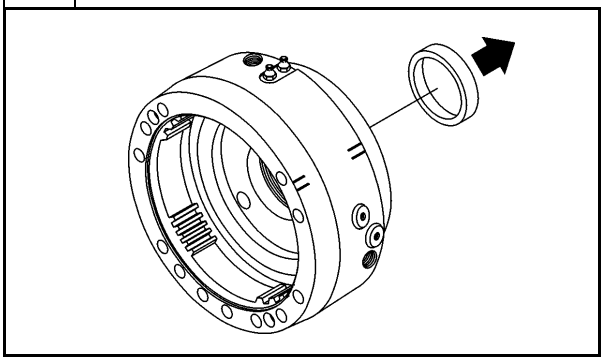
15



Svitare e togliere la ghiera dalla flangia freno con l'attrezzo speciale cod. CA119030

Undo and remove the lock nut from the brake flange using special tool CA119030

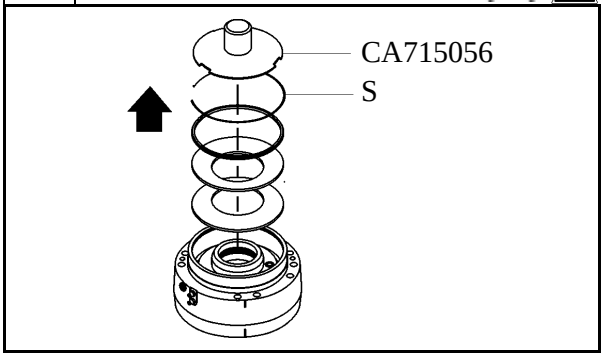
16



Togliere la pista esterna del cuscinetto dalla flangia freno con un battitoio

Use a driver to remove the outer cup of the brake flange bearing

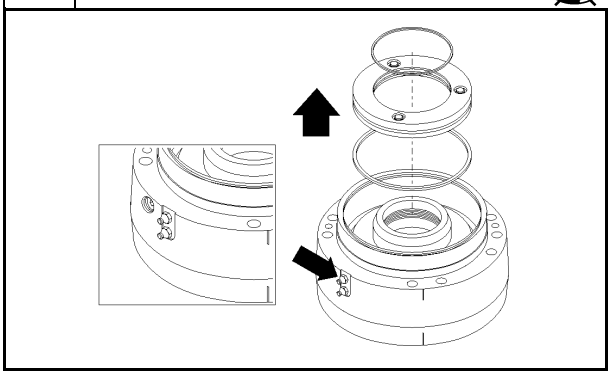
17



Posizionare la flangia freno sotto l'azione di una pressa e con l'ausilio dell'attrezzo cod. CA715056 liberare l'anello "**S**"; togliere l'anello. Eseguire un rilascio della spinta della pressa in modo lento e graduale. Quindi estrarre il manicotto, le molle a tazza ed il pistone.
Attenzione: Operazione pericolosa per l'operatore.

*Position the brake flange under the press and, using special tool CA715056, free circlip "**S**". Relase the load of the press in slowly and gradually.*
Now remove the sleeve, belleville discs and piston.
***Warning :** Exercices extreme care.*

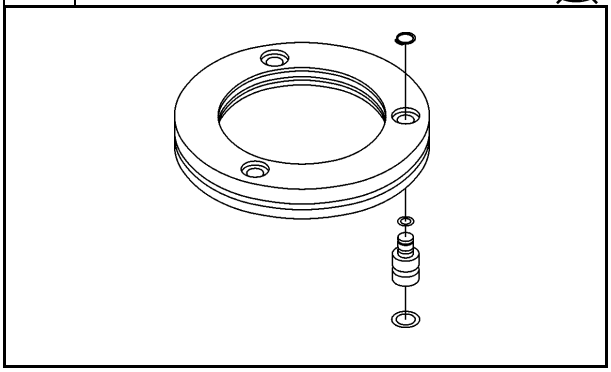
18



Utilizzare il foro di mandata del freno negativo per espellere il pistone dalla flangia freno. Utilizzare la minima pressione d'olio o aria necessaria per l'espulsione. Recuperare il pistone e rimuovere gli anelli OR e controllare le condizioni.
Attenzione: Attenzione all'espulsione!

Use the brake oil inlet port in the negative acting brake assembly to push out the piston. Use the minimum air or oil pressure necessary to dislodge the piston.
Remove the O-Rings and inspect for wear.
***Warning:** Exercise extreme care during disassembly!*

19



Togliere l'anello seeger del pistone, ed estrarre il perno di spinta.
Nota: Recuperare gli anelli OR e controllare le condizioni.

Remove the circlip from piston and extract the thrust pin.
***Note:** Remove the O-rings and inspect for wear.*

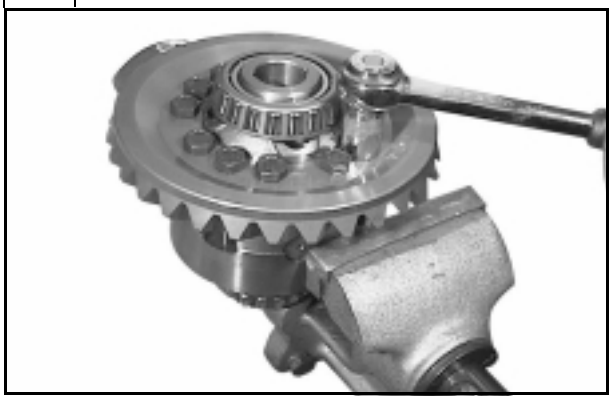
D.6 Smontaggio gruppo differenziale

D.6 Differential group disassembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

1



Recuperare il differenziale e posizionarlo in una morsa.
Svitare tutte le viti di fissaggio della corona conica.

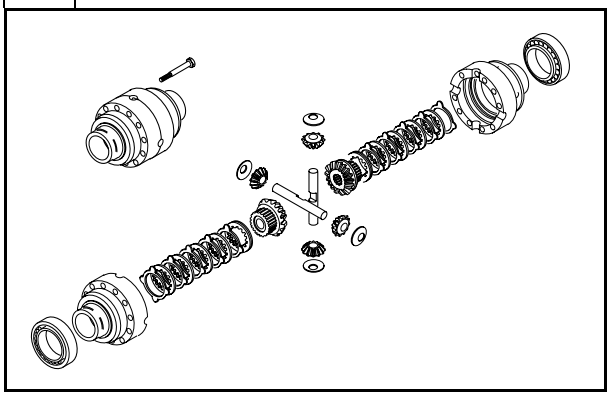
Collect the differential and put it in a clamp.
Unscrew all the fastening screws of the bevel gear crown.

2

Disassemblare la scatola differenziale in due semiscatole complete dei rispettivi elementi.
Nota: fare dei segni di riferimento sulle due semiscatole prima di separarle, per ripristinare la loro posizione relativa in fase di montaggio.

Disassemble the differential box in two half boxes complete with the relative components.
Note: *mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.*

3



Disassemblare tutti i particolari.
Verificare le condizioni di funzionalità e lo stato di usura dei componenti.
Per estrarre il cuscinetto dalla semiscatola differenziale, utilizzare due leve oppure un estrattore a tre punti di presa da commercio.

Disassemble all the components.
Check the operating and wear conditions of the components.
Take the bearing out of the differential half box, using two levers or a three-hold extractor.

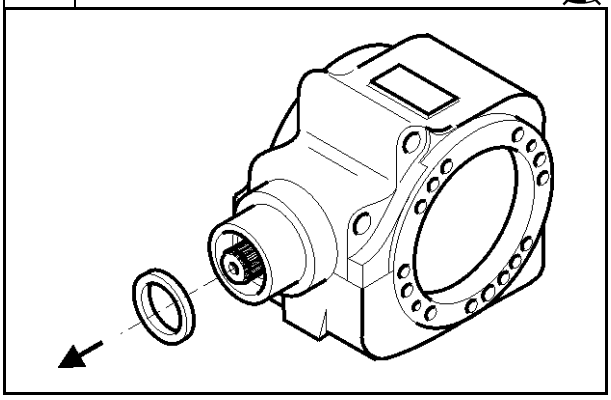
D.7 Smontaggio gruppo pignone

D.7 Pinion group disassembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

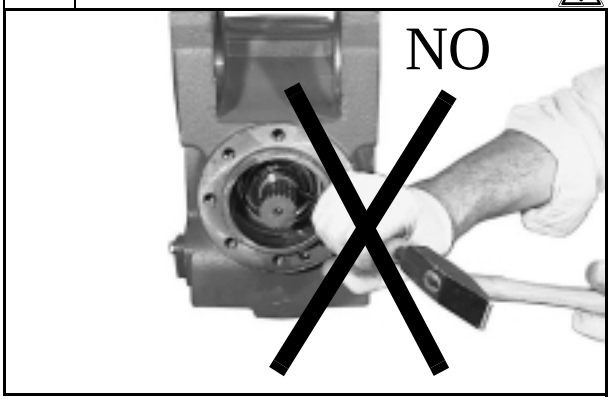
1



Estrarre l'anello di tenuta dal corpo centrale con un estrattore.
Nota: operazione distruttiva per l'anello di tenuta.

Remove the seal ring from the central housing with a puller.
Note: *this is a destructive operation for the seal ring.*

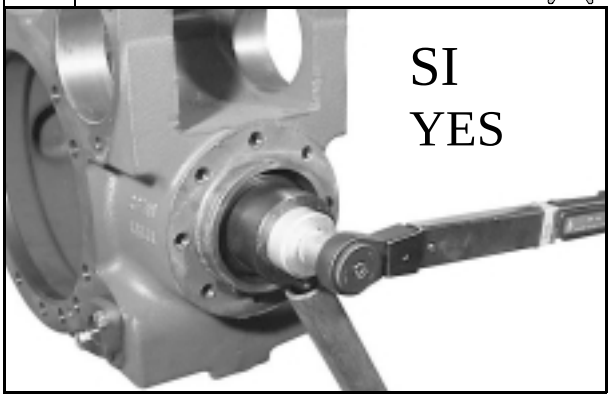
2



Posizionare il corpo centrale su di un piano stabile prima di procedere allo smontaggio.
Non tentare di sollevare la parte cianfrinata.

Position the central body on a steady plane, before disassembling it.
Do not lift the caulked side of the ring nut.

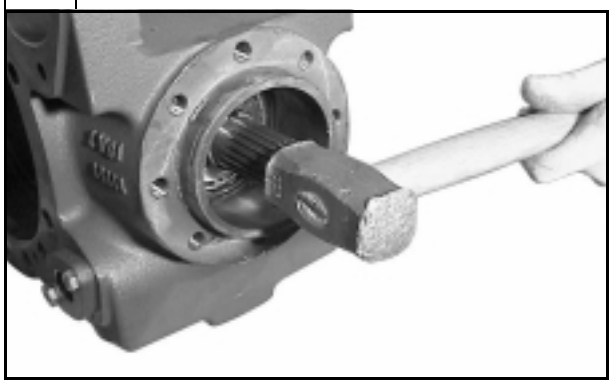
3



Per evitare seri danni alla filettatura del pignone conico, svitare la ghiera con gli attrezzi speciali cod. CA119099 e cod. CA715022

In order to avoid serious damages to the bevel pinion thread, unscrew the ring nut with the special tools code CA119099 and code CA715022.

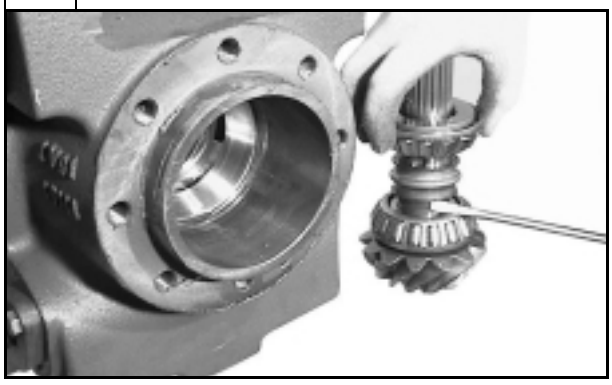
4



Dopo aver sfilato la rondella fermo ghiera, estrarre il pignone conico dalla sua sede battendo con un martello di materiale tenero sull'estremità del codolo scanalato.

Once the ring nut washer has been removed, take the pinion out of its housing, by beating with a hammer made of soft material on the splined end.

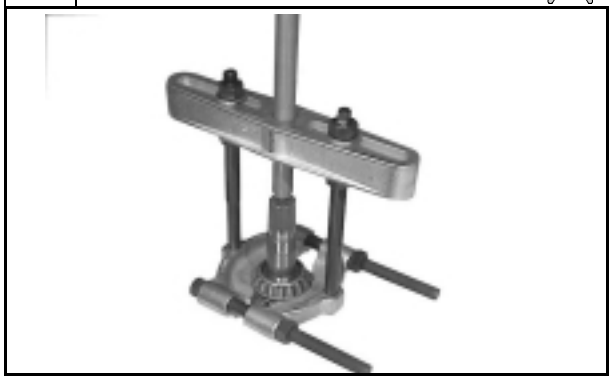
5



Tolto il pignone conico recuperare le rondelle, il distanziale elastico e le piste interne dei cuscinetti a rulli conici.
Nota: Quando il distanziale elastico viene rimosso deve essere sostituito con un distanziale nuovo.

Once the bevel pinion has been removed, collect the washers, the elastic spacer and the cones of the taper roller bearing.
Note: *When the elastic spacer is removed, it should be replaced by a new one.*

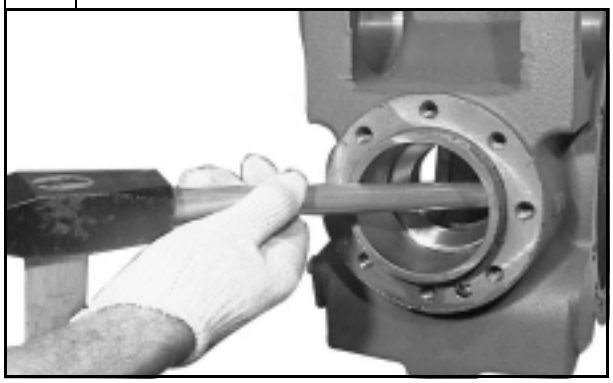
6



Estrarre il cuscinetto dal codolo del pignone conico utilizzando un estrattore a ghigliottina da commercio.
Recuperare lo spessore di registro posto sotto il cuscinetto e verificarne le condizioni di usura.

Take the bearing cone out of the bevel pinion end, using a suitable extractor.
Remove the adjusting shim placed under the bearing and check its wear conditions.

7



Estrarre le piste esterne dei cuscinetti a rulli conici dal corpo centrale utilizzando uno scalpelletto ed un martello.

Take the cups of the taper roller bearing out of the central body, using a chisel and a hammer.

E OPERAZIONI DI MONTAGGIO

E *ASSEMBLY OPERATIONS*

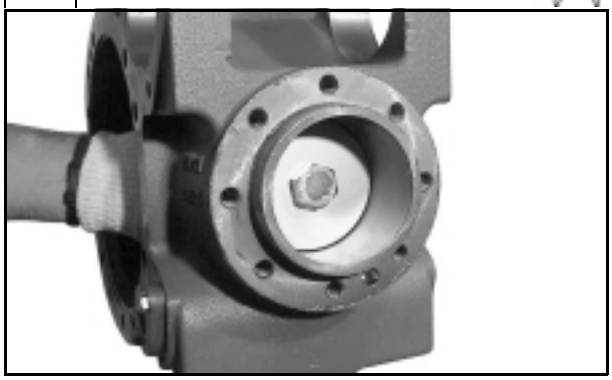
E.1 Montaggio gruppo pignone

E.1 Pinion group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

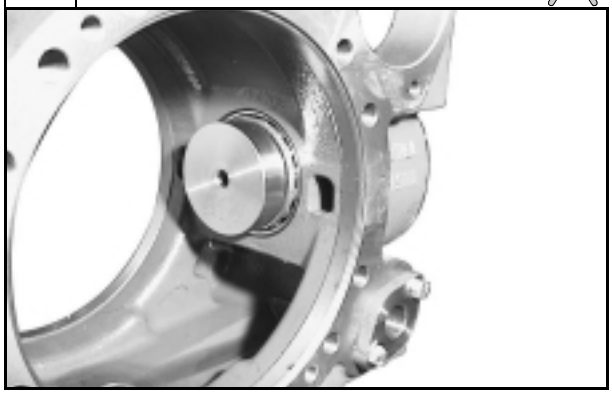
1



Posizionare il corpo centrale su un banco di lavoro.
Piantare le piste esterne dei cuscinetti a rulli conici sulle proprie sedi utilizzando le attrezzature del kit CA715401.

Position the central body on a workbench.
Insert the cups of the taper roller bearings on their housings using the special tools kit CA715401.

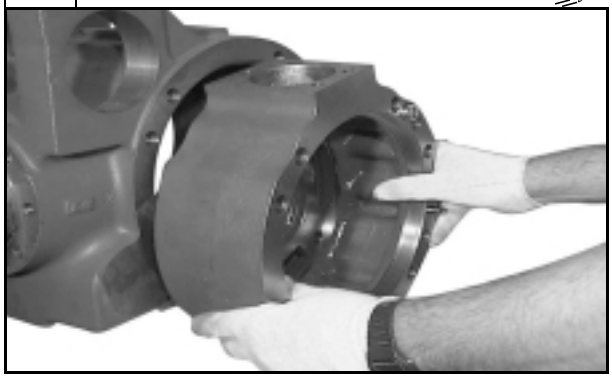
2



Per la rilevazione della distanza si utilizza il kit composto dalle attrezzature CA715040 e CA715041, dette “falso pignone” e “falsa scatola differenziale”.
Inserire nelle sedi per i cuscinetti appena montate, il falso pignone CA715040 con i rispettivi cuscinetti e la ghiera.
Serrare fino ad eliminare il gioco senza eccedere.

In order to measure the distance use the kit composed of the special tools CA715040 and CA715041, respectively called “false pinion” and “false differential box”.
Insert the false pinion CA715040, together with its bearings and its ring nut, in the just mounted housings for the bearings.
Tighten without exceeding, till the backlash is eliminated.

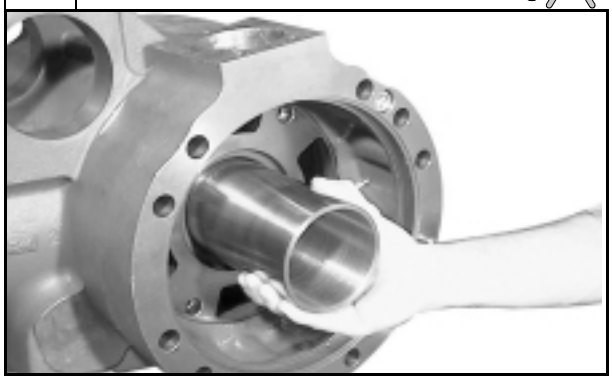
3



Verificare il corretto posizionamento delle flange destra e sinistra utilizzando i riferimenti riportati sulle medesime e sul corpo centrale.
Montare le due flange freno fissandole con le rispettive viti (avvitarne almeno due diametralmente opposte per ogni flangia).

Check the correct positioning of the right and left flanges, using the reference marks on them and on the central body.
Assemble the two brake flanges and fix them with their screws (screw in at least two ones diametrically-opposed for each flange).

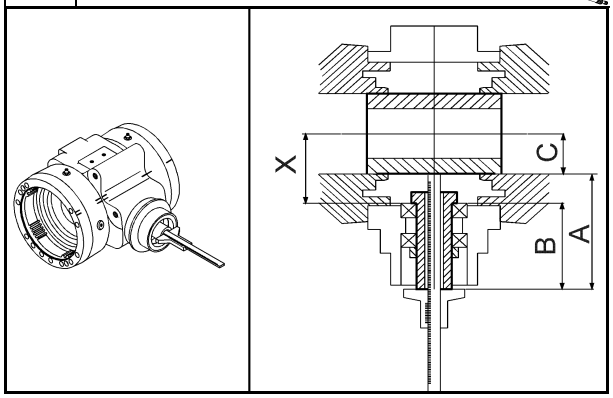
4



Introdurre nel corpo centrale la falsa scatola differenziale cod. CA715041 per la rilevazione della distanza
Verificare che la falsa scatola sia inserita in entrambe le sedi delle flange freno.

Insert the false differential box with code CA715041 into the central body to measure the distance.
Check that the false box is inserted in both brake flanges' housings.

5

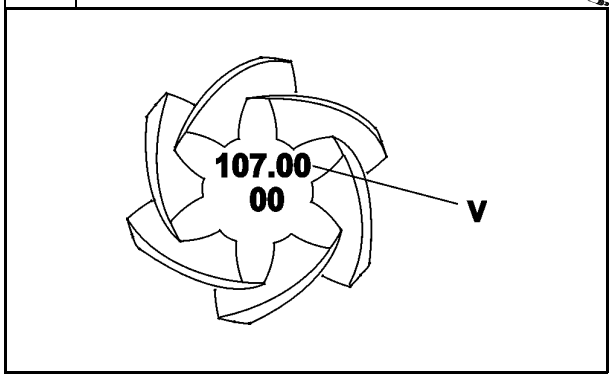


Effettuare la misurazione, con un calibro di profondità, dall'apposito foro del falso pignone.
X=(distanza conica da rilevare)
A= (valore misurato)
B=(valore noto)=100 mm
C=(valore noto)=45 mm

(A + C) - B = X

Carry out the measurement with a depth gauge through the suitable false pinion hole
X*=(conical distance to be measured)*
A*= (measured value)*
B*=(known value)=100 mm*
C*=(known value)=45 mm*

6

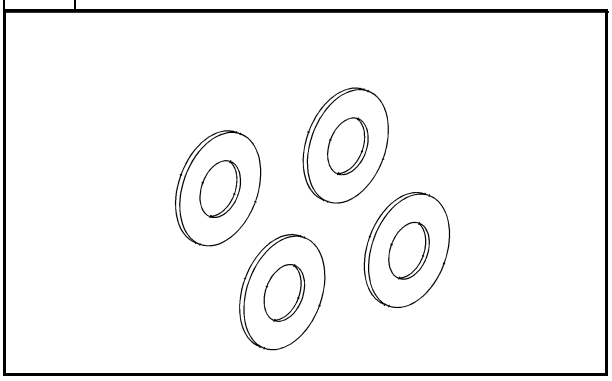


Per determinare lo spessore (**S**) necessario tra il pignone ed il cuscinetto è sufficiente sottrarre dal valore calcolato (**X**) il valore (**V**) stampigliato sulla testa del pignone (**V=**distanza conica prescritta).

S = X - V

*In order to determine the shim (**S**) necessary between the pinion and the bearing, you should subtract the (**V**) value stamped on the pinion head (**V**=requested conical distance) from the (**X**) calculated value.*

7

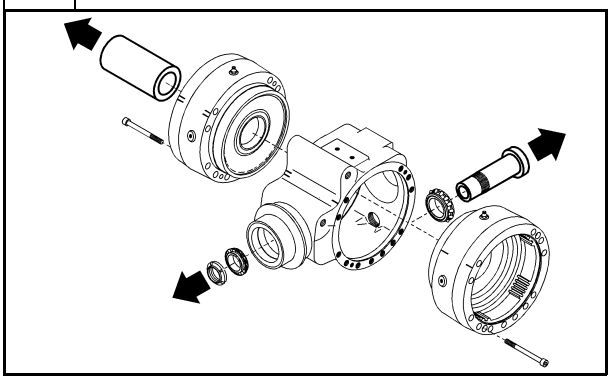


Scegliere tale spessore tra la gamma di spessori a disposizione (vedi tab. GAMMA SPESSORI) ed inserirlo sul codolo sotto la testa del pignone.

Choose the suitable shim between the available shims range (See SHIM RANGE table) and insert it on the end under the pinion head.

GAMMA SPESSORI - SHIM RANGE										
Spess./Thick.	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Quant.	-	-	-	-	-	-	-	-	-	-

8



Rimuovere il falso pignone, i cuscinetti e la ghiera dal corpo centrale.
Smontare la falsa scatola differenziale dalle flange e successivamente svitare le viti per rimuovere le flange.

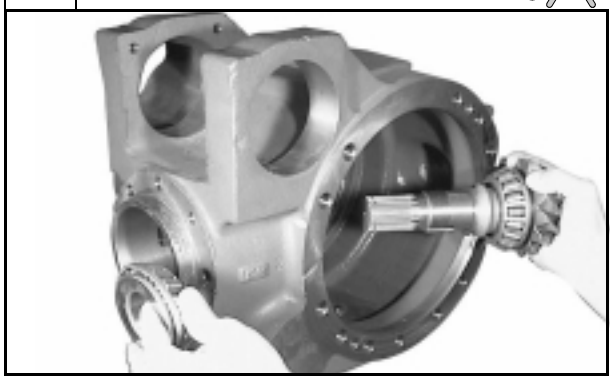
Remove the false pinion, the bearings and the ring nut from the central body.
Disassemble the false differential box from the flanges and then unscrew the screws to remove the flanges.

9

Inserire sull'albero del pignone lo spessore adatto (scelto in precedenza) con lo smusso rivolto verso l'ingranaggio.
Piantare il cuscinetto nell'albero del pignone sotto l'azione di una pressa con il battitoio cod. CA715004, assicurandosi che sia ben assestato.
Inserire sull'albero gli spessori ed un nuovo distanziale elastico.
Nota: utilizzare sempre un distanziale elastico nuovo.

Insert the suitable shim (chosen before) on the pinion shaft with chamfer against the gear.
Force the bearing into the pinion shaft and with CA715004 special tool under a press, making sure that it is well set.
insert the shims and the new elastic spacer into the shaft.
Note: *use always a new elastic spacer.*

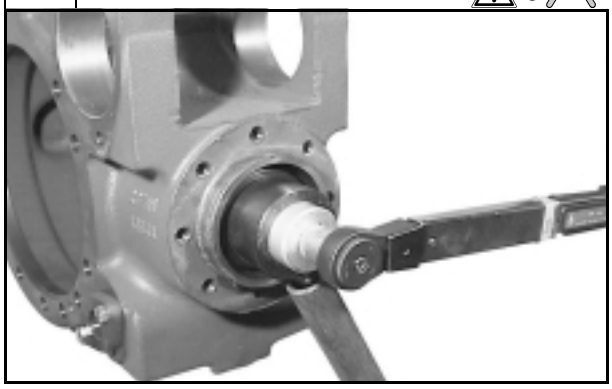
10



Inserire il gruppo pignone conico nella sede del corpo centrale ed il secondo cuscinetto sul codolo pignone.
Eseguire il piantaggio del cuscinetto, utilizzando il battitoio CA715004 ed un martello.
Si consiglia di contrapporre un azione resistente alla forza battente (ad esempio con una mazza).

Insert the bevel pinion unit into the central body housing and the second bearing cone into the pinion end.
In order to force the bearing into position use the special tool code CA715004 and a hammer.
It is advisable to oppose a resistant action against the beating force (e.g. with a sledge hammer).

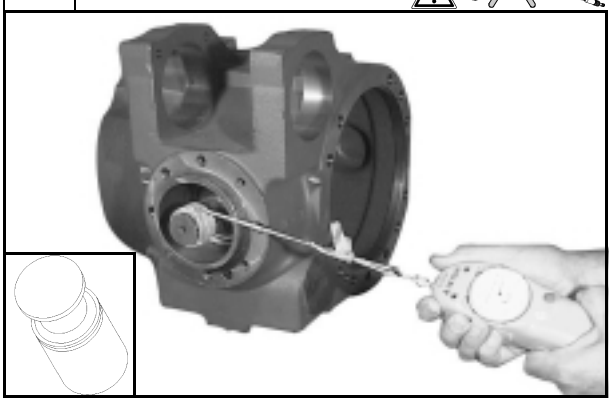
11



Inserire sull'albero del pignone una nuova rondella fermo ghiera e la ghiera di serraggio.
Avvitare la ghiera utilizzando le chiavi per ghiera (cod. CA119099) e fermo pignone (cod. CA715022).
Attenzione: La coppia di serraggio è data dalla misurazione del precarico sui cuscinetti.
Serrare la ghiera progressivamente. Se il serraggio è eccessivo il distanziale elastico dovrà essere sostituito e la procedura ripetuta.
Al momento di verificare il precarico è opportuno dare piccoli colpi con martello in materiale tenero alle estremità del pignone per favorire l'assestamento dei cuscinetti

Insert into the pinion shaft e new ring nut washer and the ring nut retainer.
Screw the ring nut in, using the wrench for ring nut (CA119099) and for pinion retainer (CA715022).
***Warning:** The torque setting is given by the preloading measurement on bearings. Tighten the ring nut step by step. If it is tightened too much, the elastic spacer should be replaced and the procedure repeated. When you check the preloading, it is advisable to beat the pinion ends with a hammer made of soft material slightly to favour the bearing setting.*

12



Montare la prolunga speciale cod. CA715116 sul codolo del pignone.
Effettuare la misurazione del precarico (**P**) dei cuscinetti conici dell'albero del pignone, utilizzando un dinamometro a funicella, avvolta sul diametro 34,7÷34,8 mm della prolunga.
La regolazione si effettua aumentando gradualmente il serraggio della ghiera, facendo attenzione a non eccedere.
Attenzione: tutti i precarichi devono essere misurati senza anello di tenuta.
Ottenuto il prescritto valore di precarico, cianfrinare la ghiera utilizzando martello e scalpello.

P=9.2÷13.8 daN

Assemblethe special tool (cod.CA715116) on the pinion shaft
*Carry out the preloading measurement (**P**) of the pinion taper roller bearings, using a dynamometer whose cord is wound on the 34,7÷34,8 mm diameter of special tool.*
The adjustment is carried out by increasing the ring nut torque setting gradually, being careful not to exceed.
***Warning:** all preloadings should be measured without the seal ring.*
Once you got the requested preloading value, caulk the ring nut, using a hammer and a chisel.

P=9.2÷13.8 daN

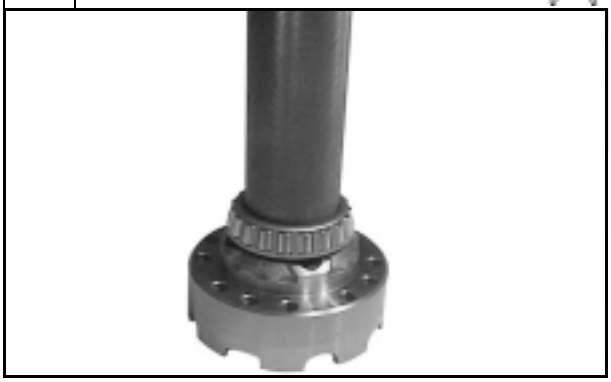
E.2 Montaggio gruppo differenziale

E.2 Differential group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

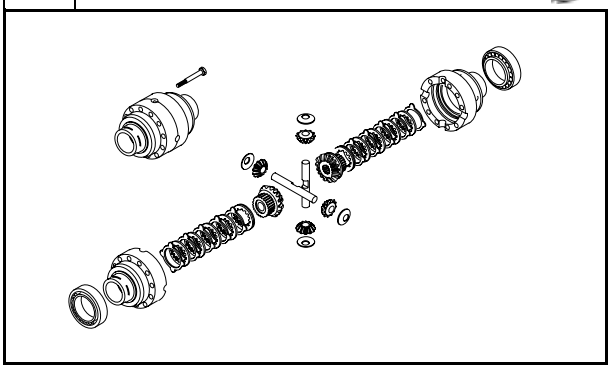
1



Montare le piste interne dei nuovi cuscinetti a rulli conici sulle semiscatole, utilizzando il battitoio cod. CA119230 ed un martello.

Assemble the cones of the new taper roller bearings on the half boxes, using the special tool code CA119230 and a hammer.

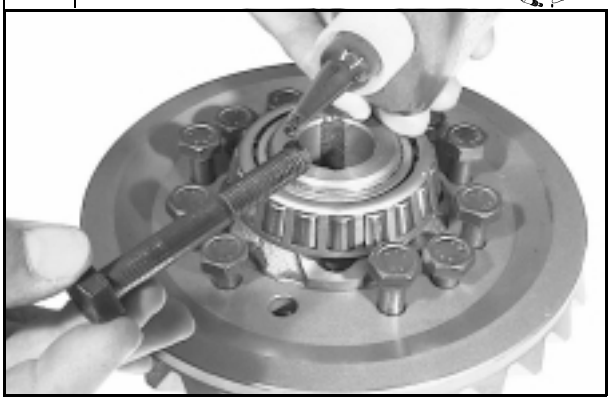
2



Posizionare una semiscatola su di un banco di lavoro e montare tutti i suoi componenti interni (planetari, satelliti, ralle di rasamento, dischi, perni e controdischi), come in figura.
Unire le due semiscatole, allineando i riferimenti praticati sulle stesse.

Position a half box on a workbench and assemble all its inner components (sun gears, planetary gears, thrust washers, discs, pins and counterdiscs) as a figure.
Join the two half boxes, aligning the reference marks made upon them.

3



Posizionare la corona conica e fissare il tutto, dopo aver applicato Loctite® 270 sul filetto, serrando le viti alla coppia prevista (Sez. B.8).

Position the ring bevel gear, apply Loctite® 270 on the thread and then fix the whole by tightening the screws to the requested torque (Sec. B.8).

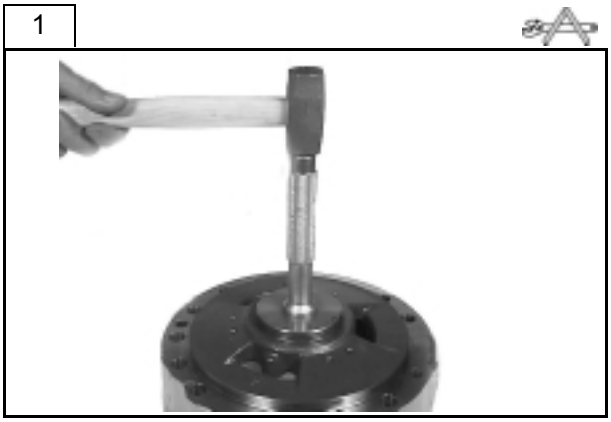
E.3 Montaggio flange e scatola differenziale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.3 Brake flange/differential housing assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

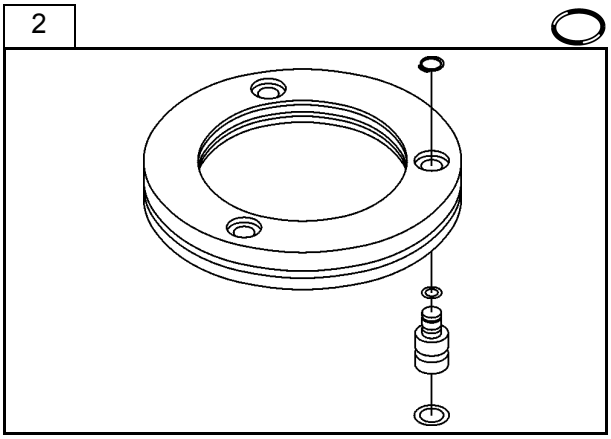
1



Posizionare la flangia su di una superficie piana e piantare la pista esterna del cuscinetto a rulli conici con il battitoio cod. CA715299, il manicotto intercambiabile cod. CA119033 ed un martello.

Position the flange on a flat surface and force the cup of the taper roller bearing in position, using the special tool code CA715299, interchangeable handle code CA119033 and a hammer

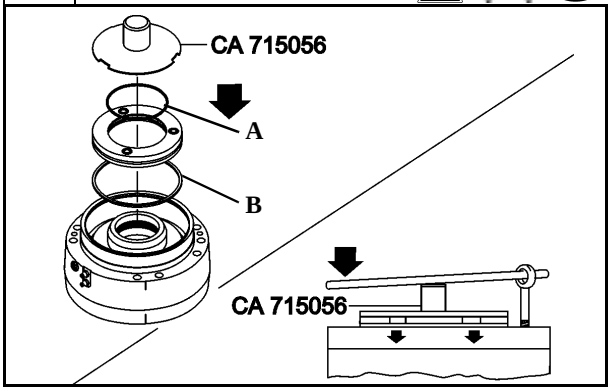
2



Montaggio pistone freno negativo.
Inserire i tre perni di spinta con i relativi OR e anelli seeger nel pistone.

Assembling the negative acting brake piston.
Insert the three thrust pins with their O-rings and circlips into the piston.

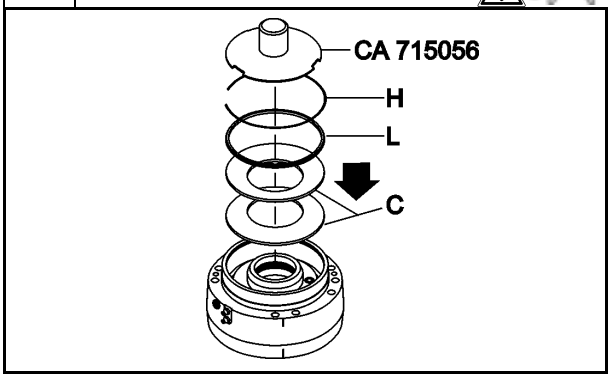
3



Dopo aver steso un leggero strato di grasso sulle superfici di contatto del pistone ed in special modo sugli anelli OR "**A**" e "**B**" già montati, posizionare il pistone sulla flangia freno e l'attrezzo cod. CA715056 sopra il pistone e fare pressione al centro dell'attrezzo; eseguire una pressione appena sufficiente a inserire il pistone sulla flangia freno.

*Put a thin film of grease to the piston contact surfaces and to the O-rings "**A**" e "**B**" already installed. Place the piston on the brake flange and place the special tool CA715056 above the piston. With a lever apply to the centre of the tool a pressure just sufficient to insert the piston into the brake flange.*

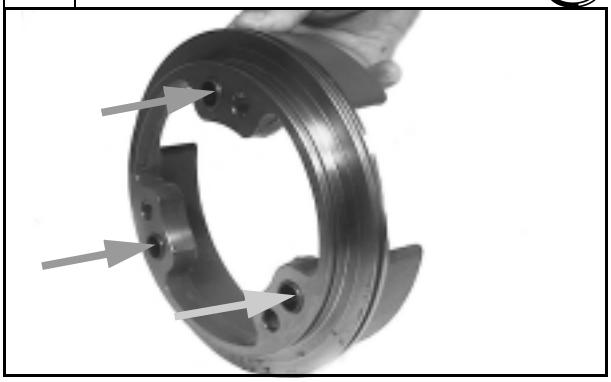
4



Dopo aver inserito il pistone freno negativo completo nella sua sede, posizionare la flangia freno sotto una pressa; inserire poi le molle a tazza "**C**" (in modo che l'ultima sia concava) il manicotto "**L**" (con la sede dell'anello verso l'esterno), ed infine posizionare l'attrezzo cod. CA715056. Verificare il centraggio delle molle nella sede. Sotto l'azione di una pressa schiacciare, il tutto fino a poter montare l'anello d'arresto "**H**".
Attenzione: Operazione pericolosa per l'operatore

*After inserting the brake piston fully into its housing, place the flange under a press. Locate the belleville springs "**C**" (the last disc on top must be concave side up) and the sleeve "**L**" (with the ring seat outermost), then position special tool CA715056.*
*Using a press, apply pressure on the entire assembly until ring "**H**" can be fitted. Ensure the belleville springs are centered in the housing.*
Warning: Dangerous operation.

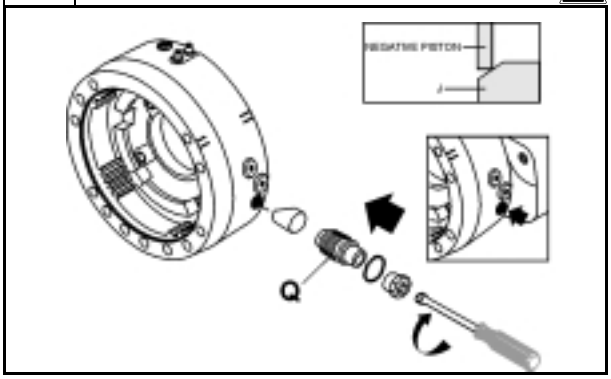
5



Recuperare il pistone freno.
Spingere le boccole nelle sedi dei self-adjust fino a pareggiarle con la superficie interna di appoggio del pistone. Montare gli anelli OR sul pistone e lubrificare con un leggero strato di grasso le superfici di contatto pistone flangia.

Collect the brake piston.
Push the bushes into the self-adjust housings till they are leveled with the piston supporting inner surface.
Assemble the O-rings on the piston and lubricate the faying surface piston/flange with a light layer of grease.

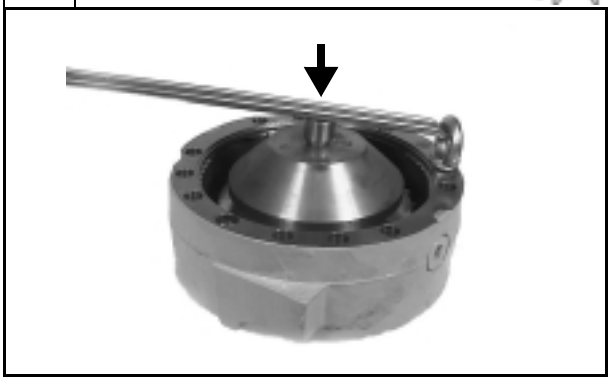
6



Ungere di grasso gli O-ring. Installare le tre viti sblocco freno con relativi componenti, come in figura.
Nota: Il piano inclinato della spina "**J**" deve essere appoggiato contro il pistone "negativo" (vedi ingrandimento). Applicare una pressione d'olio di circa 20 BAR nel cilindro freno negativo, attraverso la mandata indicata, in modo da avvitare a fondo le 3 viti di sblocco freno. Togliere la pressione dal cilindro freno negativo e lasciare appoggiare il pistone negativo all spina "**J**".

Apply a light coating of grease to O-ring. Fit the three brake-release bolts with their respective parts as in the figure.
Note: The flat surface (ramp) of the pin "**J**" must fully seat against the negative piston. *Apply an oil pressure of about 20 BAR in the negative brake cylinder, through the indicate, hydraulic connection, in order to screw completely the three screws of brake release. Drop the pressure from the negative brake cylinder and push the negative piston till the pin "**J**"*

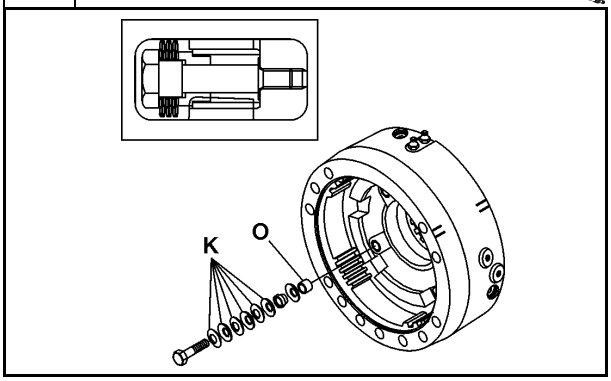
7



Dopo aver steso un leggero strato di grasso nelle superfici di contatto del pistone ed in special modo nei quadring già montati, inserire il pistone nella flangia freno e posizionare l'attrezzo cod. CA715056 o un disco piano sul pistone. Con la leva ben ancorata, magari ad un golfare, esercitare una pressione appena sufficiente ad inserire il pistone nella flangia freno.

Apply a slight coat of grease on the piston surfaces and especiallyon the quadring already inserted, insert the piston into the brake flange and position the special tool code CA715056 or a disk on the piston and with a lever anchored to an eyebolt, exert a pressure just enough to insert the piston into the brake flange.

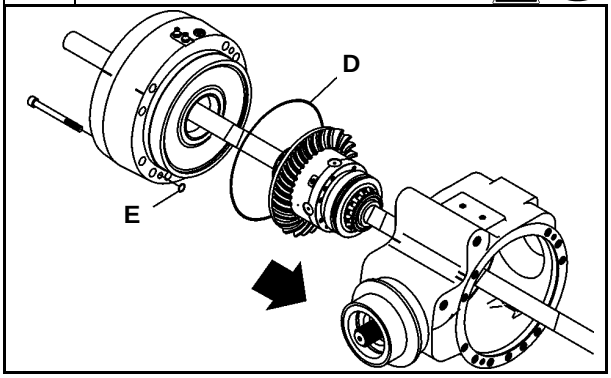
8



Recuperare i componenti dei kit self-adjust e montarli nel pistone come indicato nella figura.
Nota: Fare particolare attenzione al corretto senso di montaggio delle molle a tazza "**K**".
Avvitare le viti di fissaggio del kit self-adjust e serrarle, con chiave dinamometrica, alla coppia di serraggio prevista (sez. B8).

Take the components of the self-adjst kit and fit them on the piston as shown in the figure.
Note: be particulary careful regarding correct installation direction of the "**K**" cup springs.
Screw the securing screws of the self-adjust kit and tighten them with a torque-wrench to the specified tightening torque (sec. B8).

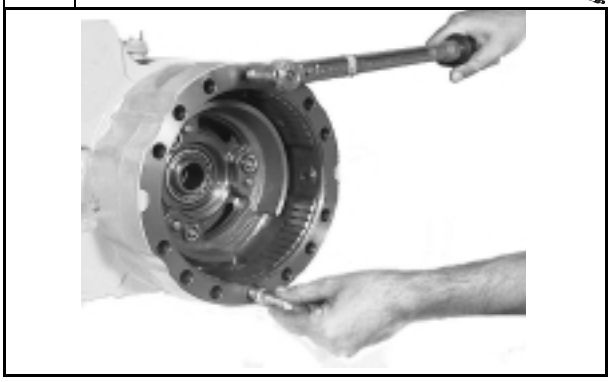
9



Inserire sulla flangia freno un nuovo anello O-ring "**D**".
Sostenere il gruppo scatola differenziale usando un tubo, posizionando per prima la flangia freno dal lato della corona conica.
Attenzione: Rispetare il corretto lato di montaggio della corona conica, che può essere inserita invertita. Prima del montaggio posizionare un nuovo anello "**E**" su foro passaggio olio.

*Insert a new O-ring on the brake flange "**D**".*
Support the differential box with a tube, positioning first the brake flange on the side of the ring bevel gear.
Warning: *respect the correct assembly side of the ring bevel gear, that could be assembled inverted. Insert, before the assembly, a new-ring "**E**"* on the oil hole.

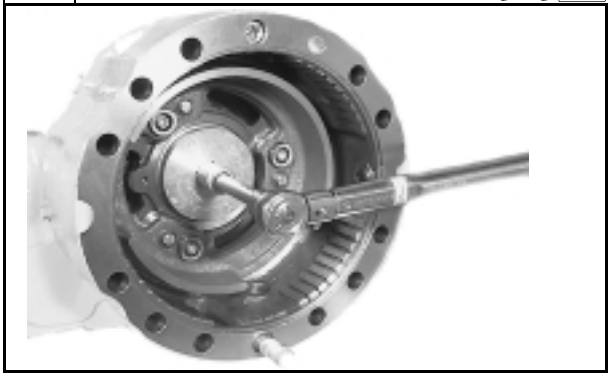
10



Montare e serrare la vite superiore e la vite prigioniera (inferiore) di fissaggio della flangia freno con chiave dinamometrica alla coppia prevista (Sez. B8).

Assemble and tighten the upper fastening screw and the lower fastening stud bolt of the brake flange with dynamometric wrench to the requested torque (Sec. B8).

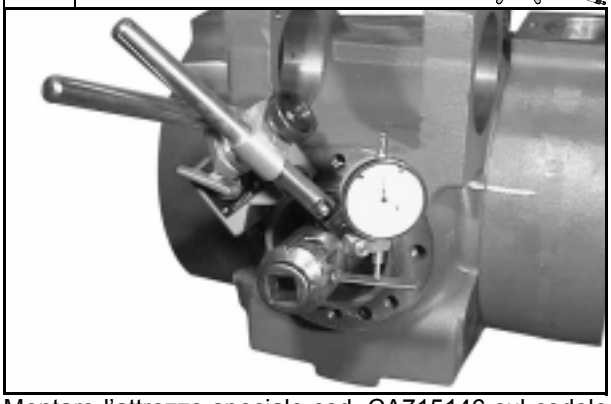
11



Dopo aver verificato il corretto lato di assemblaggio della scatola differenziale, montare la seconda flangia freno dal lato opposto alla corona conica.
Inserire ed avvitare le ghiere di registrazione del gioco pignone-corona, utilizzando la chiave cod.CA119030 fino ad eliminare il gioco dei cuscinetti, quindi procedere al rilievo del gioco pignone-corona.
Nota: serrare le ghiere progressivamente senza eccedere.

Once the correct assembly side of the differential box it has been checked, assemble the second brake flange on the opposite bevel gear side.
Insert and screw the adjusting ring nuts of the pinion-ring, using the wrench with code CA119030 till the bearing backlash is eliminated. Then measure the pinion-ring gear backlash.
***Note:** tighten the ring nuts step by step without exceeding.*

12



Montare l'attrezzo speciale cod. CA715146 sul codolo del pignone.
Muovere il codolo del pignone alternativamente ed annotare il gioco fra pignone e corona, rilevato con un comparatore, in modo che il palpatore sia a contatto ed a 90° con la superficie della staffetta dell'attrezzo speciale in corrispondenza della tacca di riferimento.

Assemble the special tool code CA715146 on the pinion end.
Move the pinion end alternatively and note the pinion-ring gear backlash, measured with a comparator, so that the feeler is in contact and at 90° with the bracket surface of the special tool in correspondance with the reference mark.

Verificare se il valore del gioco rilevato rientra nel campo predefinito:

0.16÷0.22

Effettuare la registrazione agendo sulle due ghiere con l'apposito attrezzo cod. CA119030.

Registrare le ghiere ricordando che:
- se il **gioco rilevato è inferiore** al campo di tolleranza dato, avvitare la ghiera dal lato opposto alla corona e svitare la ghiera opposta della stessa quantità;
- se il **gioco rilevato è superiore** al campo di tolleranza dato, avvitare la ghiera dal lato della corona e svitare la ghiera opposta della stessa quantità.

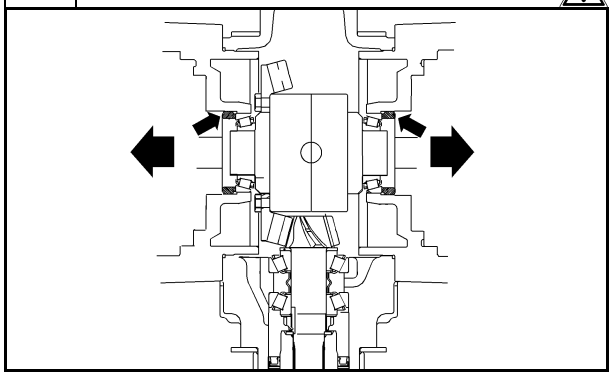
Check if the measured backlash value is within the requested range:

0.16÷0.22

Carry out the adjustment by operating on the two ring nuts with the approppriate tool CA119030.

Adjust the ring nuts, remembering that:
*- if the **measured backlash is less** than the given tolerance range, screw the ring nut from the side opposite to the ring gear and unscrew the opposite one of the same measure;*
*- if the **measured backlash is higher** than the given tolerance range, screw the ring nut from the side of the ring gear and unscrew the opposite one of the same measure.*

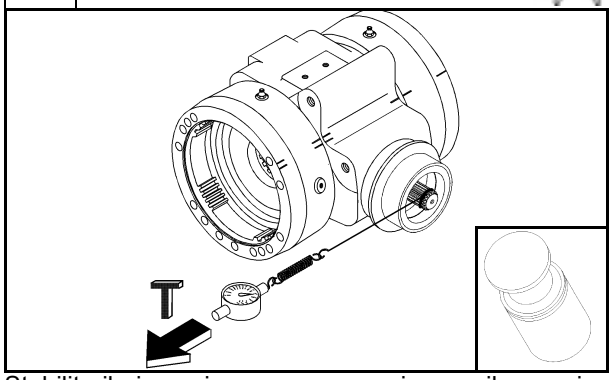
13



Effettuata la registrazione del gioco pignone-corona verificare anche che ci sia un minimo di precarico sui cuscinetti della scatola differenziale
Ripetere l'intera sequenza delle operazioni citate fino al raggiungimento delle condizioni indicate.

Once you have carried out the adjusting of the pinion-ring gear backlash, check also that there is a minimum preloading on the differential box bearings.
Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.

14



Stabilito il gioco pignone-corona, misurare il precarico totale (**T**) dei cuscinetti (sistema pignone-corona), utilizzando un dinamometro a funicella avvolta sul diametro 34,7÷34,8 dell'attrezzo speciale cod. CA715116
Il valore misurato deve rientrare nel seguente campo

T=(P+3.2)÷(P+4.7) daN

dove **P** è il precarico effettivo misurato sul pignone (Sez. "Montaggio gruppo pignone").

*Once the pinion-ring gear backlash has been established, measure the total preloading (**T**) of the bearings (pinion-ring gear system), using a dynamometer whose cord is wound on the D 34,7÷34,8 of the special tool code CA715116. The measured value should be within the following range*

T=(P+3.2)÷(P+4.7) daN

*where **P** is the preloading effectively measured on the pinion (Sec. "Pinion assembly").*

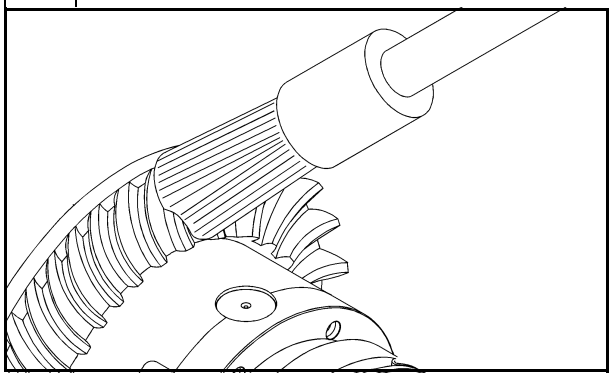
Attenzione: tutti i precarichi vanno misurati senza anello di tenuta.

Se la misurazione non rientrasse nel campo prescritto, controllare bene l'assemblaggio di ogni singolo componente ed intervenire sulle ghiere di registrazione del supporto differenziale:
- se il **precarico totale è inferiore** al campo dato, avvitare della stessa quantità le due ghiere, tenendo inalterato il valore del gioco pignone-corona;
- se il **precarico totale è superiore** al campo dato, svitare della stessa quantità le due ghiere, tenendo inalterato il valore del gioco pignone-corona.

Warning: *all the preloadings should be measured without the seal ring.*

If the measurement is not within the requested range, check well the assembly of each component and operate on the adjusting ring nuts of the differential support:
*- if the **total preloading is less** than the given range, screw the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged;*
*- if the **total preloading is higher** than the given range, unscrew the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged.*

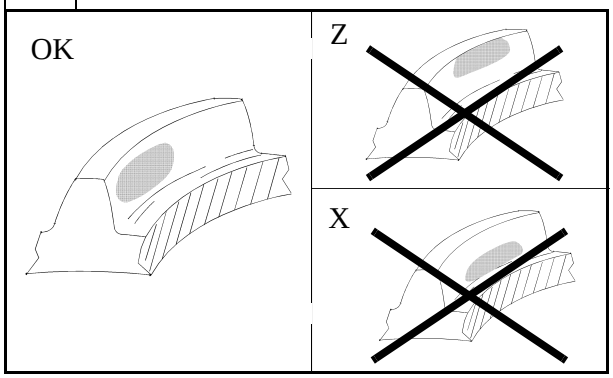
15



INFORMAZIONE
Per verificare l'impronta di contatto dei denti della coppia conica, sporcare con minio la corona e rilevare il contatto.
L'esame dell'impronta di contatto deve essere eseguito sempre sui denti della corona conica e su ambedue i fianchi.

INFORMATION
To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.

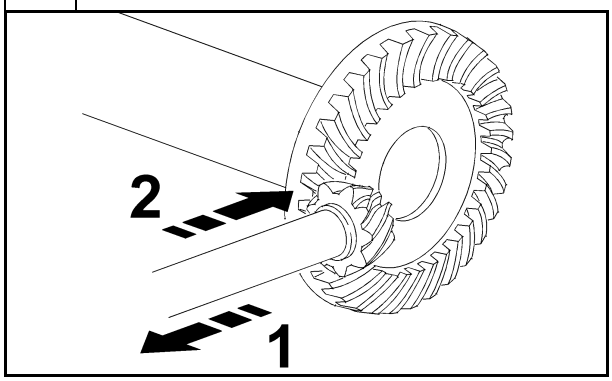
16



OK -> Contatto corretto.
Se la registrazione della coppia conica è ben fatta, il segno del contatto sulle superfici delle dentature risulterà regolare.
Z -> Eccessivo contatto sulla cresta del dente.
Avvicinare il pignone alla corona ed allontanare poi la corona dal pignone per regolare il gioco.
X -> Eccessivo contatto alla base del dente.
Allontanare il pignone dalla corona ed avvicinare poi la corona al pignone per regolare il gioco.

OK *-> Correct contact.*
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.
Z *-> Excessive contact on the tooth tip.*
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.
X *-> Excessive contact at the tooth base.*
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.

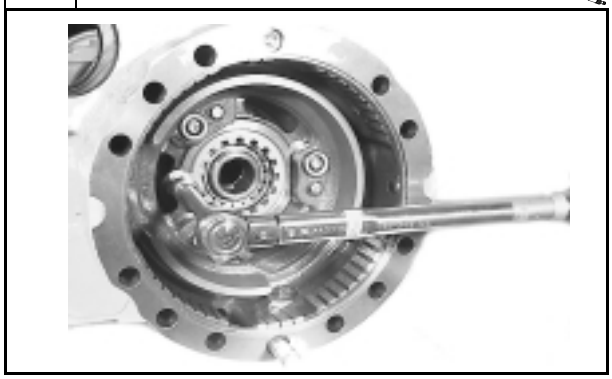
17



Spostamenti per le correzioni:
1 -> spostare il pignone per modifica contatto tipo **X**
2 -> spostare il pignone per modifica contatto tipo **Z**

Movements to correct.
***1** -> move the pinion for type **X** contact adjustment*
***2** -> move the pinion for type **Z** contact adjustment.*

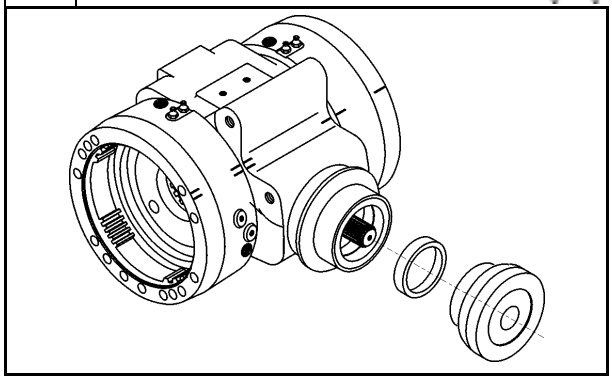
18



Inserire il fermo ghiera ruotando la ghiera il minimo indispensabile per allinearla al fermo.
Inserire la vite di fissaggio del fermo ghiera ed avvitarla con una chiave dinamometrica alla coppia prevista (sez. B8).

Insert the ring nut retainer turning the ring nut slightly in order to align it to the retainer.
Screw in and tighten the screw of the ring nut retainer with a dynamometric wrench to the requested torque (sec. B8).

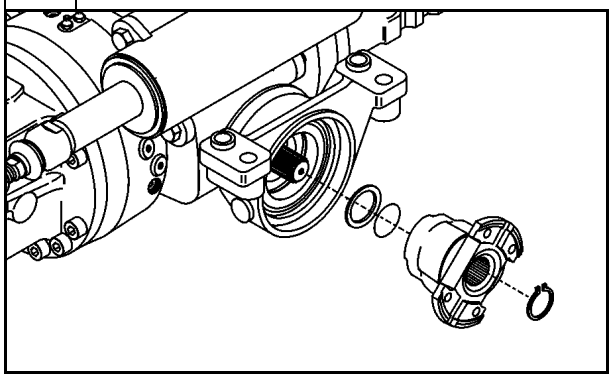
19



Installare nel corpo centrale trave l'anello la tenuta del pignone con battitoio CA715043.
Applicare uno strato di pasta sigillante sul diametro esterno della tenuta.

Install pinion seal into the central housing using seal driver CA715043.
Apply a coating of gasket dressing saelant to outer steel case of seal.

20



Montare sul codolo del pignone lo spessore, un nuovo OR e la flangia di trasmissione. Bloccare poi il tutto con il seeger.
Nota: Lubrificare gli O-ring ed il labbro dell'anello di tenuta.

Insert on the pinion shaft the shim together with a new O-ring and input flange. Secure the assembled parts with the circlip.
***Note:** Coat the seal lip and O-ring with oil.*

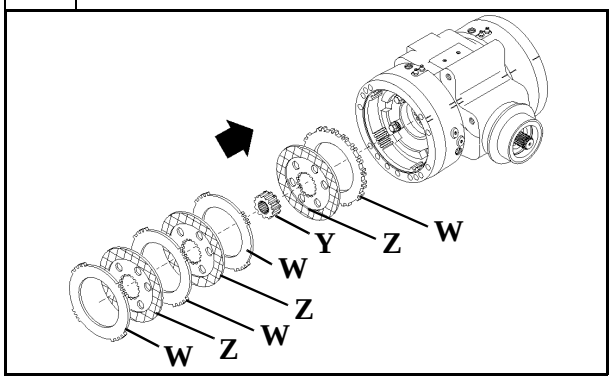
E.4 Montaggio trombe e gruppi freno

E.4 Trumpets and brake groups assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

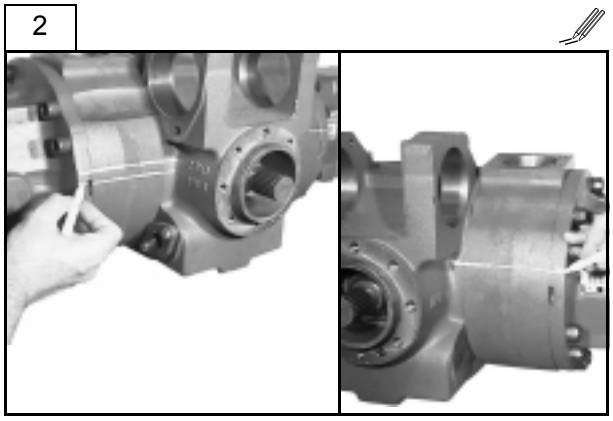
1



Verificare che il disco di attrito ed i controdischi non presentino tracce di bruciatura; in caso contrario sostituirli. Verificare inoltre l'usura del disco di attrito (sez. B4) e sostituirlo se necessario.Rimontare tutti gli elementi del gruppo freno all'interno della flangia come indicato in figura rispettando la sequenza: controdisco "**W**", disco freno "**Z**" manicotto "**Y**" con la sede per l'anello seeger verso l'interno ed i restanti dischi e controdischi "**Z**" e "**W**".
Nota: Se si installano nuovi dischi freno, prima del montaggio, immergerli nell'olio prescritto.

*Check that the friction disc and the counterdiscs do not present any sign of burning; on the contrary, replace them. Furthermore check friction disc wear (sec. B4) and if necessary replace them. Reassemble all the components of the brake group inside the flange as per the sequence in the figure: drive-plate "**W**", disc "**Z**", coupling "**Y**", with the seeger ring housing inward disc and drive-plate "**Z**" e "**W**"*
***Note:** if new brake discs "**Z**" are installed, before assembling, they should be dipped in the required oil.*

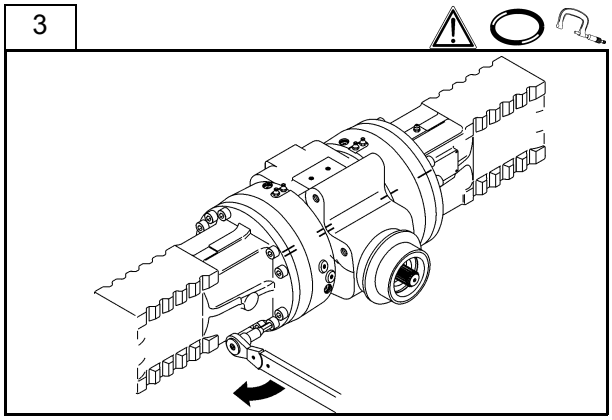
2



Prima del montaggio, verificare i segni di riferimento eseguiti in fase di smontaggio per il corretto posizionamento delle trombe trave.

In oder to place precisely the axle beam trumpets, before assembly, check the reference marks carried out during disassembly.

3



Inserire un nuovo anello O-ring nella sua sede sulla tromba trave. Montare la tromba sulla flangia, facendo attenzione all'allineamento dei fori di fissaggio.
Attenzione: Sostenere oppurtunamente i gruppi come già indicato nella fase di smontaggio. Avvitare e serrare le viti di fissaggio della tromba con una chiave dinamometrica alla coppia prevista (sez. B8).

Insert a new O-ring into the axle beam trumpet housing. Assemble the axle beam trumpet on the flange, being careful to the fastening holes' alignment.
Warning: support the groups properly as already pointed out for disassembly phase. Screw in and tighten the fastening screws of the axle beam trumpet with a dynamometric wrench to the requested torque (sec. B8).

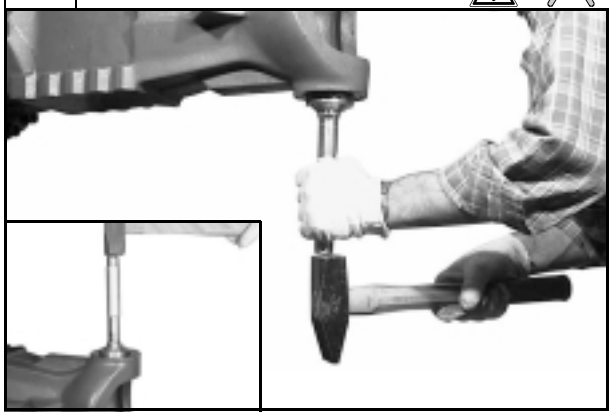
E.5 Montaggio gruppo trave

E.5 Axle beam group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

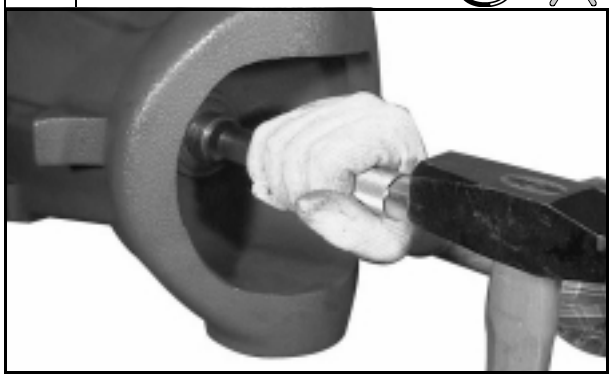
1



Montare la boccola del perno snodo superiore nel trave con battitoio cod. CA715039 e martello.
Infilare la pista esterna della rotula sferica sulla parte inferiore del trave con il battitoio cod. CA715039 e un martello.
Nota: Per facilitare il montaggio, è necessario raffreddare la pista esterna della rotula sferica a temperature inferiori a -100°C.
Attenzione: usare dei guanti di protezione.

Assemble the upper king pin bush on the axle beam with the special tool code CA715039 and a hammer. Insert the cup of the ball bearing on the lower part of the axle beam with the special tool code CA715039 and a hammer
Note: *To make the assembly easier, it is necessary to cool the cup of the ball bearing at a temperature less than 100°C.*
Warning: *wear safety gloves.*

2



Montare nel trave la bronzina con il battitoio cod. CA119055 ed un martello.
Riempire per 3/4 la camera dell'anello con grasso, applicare pasta sigillante sulla sua superficie esterna.
Montare l'anello di tenuta nel trave con il battitoio cod CA119055 ed un martello.

Assemble the bush on the axle beam with the special tool code CA119055 and a hammer.
Fill 3/4 of the ring cavity with grease and apply sealing compound on its outer surface.
Assemble the seal ring on the beam with the special tool code CA119055 and a hammer.

3

Lubrificare la boccola ed il labbro dell'anello di tenuta.
Inserire il doppio giunto all'interno del trave.
Attenzione: non rovinare l'anello di tenuta.

Lubricate the bush and the sealing lips.
Insert the U-Joint inside the axle beam.
Warning: *be careful not to damage the seal.*

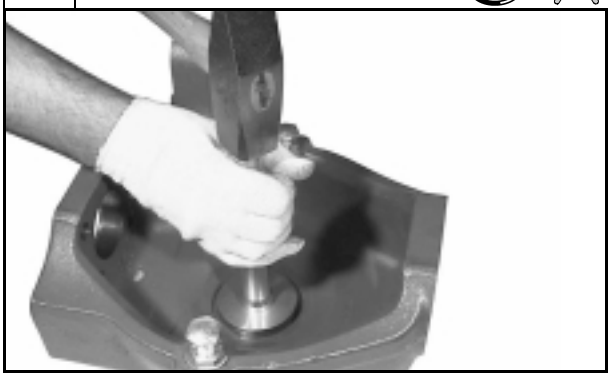
E.6 Montaggio gruppo mozzo ruota

E.6 Wheel hub group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

1



Piantare la bronzina nella calotta con il battitoio cod CA715036 ed un martello o una pressa.
Riempire la camera dell'anello di tenuta per 3/4 con grasso. Applicare pasta sigillante sulla superficie metallica esterna e montare l'anello di tenuta nella calotta con il battitoio cod CA715037 ed un martello.

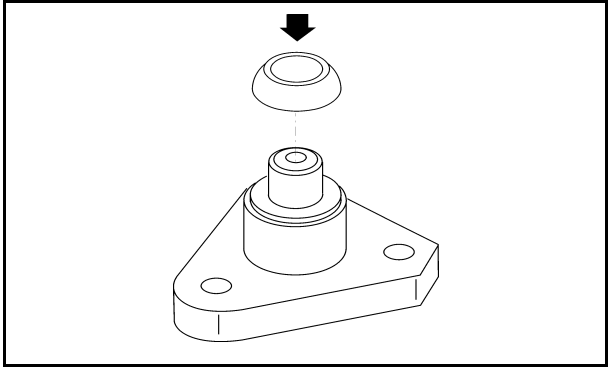
Force the bush in the swivel housing with the special tool code CA715036 and a hammer or a press.
Fill 3/4 of the gasket cavity with grease. Apply sealing compound on the outer metallic surface of the seal and assemble the seal ring on the swivel housing with the special tool code CA715037 and a hammer.

2

Montare lo spessore sotto la molla a tazza nella parte superiore.
Ingrassare bene le sedi dei perni snodo con grasso specifico (Sez. B.4)
Posizionare le molle a tazza sulle sedi perni snodo.

Put the shim under the Belleville washer on the upper part.
Grease well the king pin housings with specific grease (Sec. B.4).
Position the Belleville washers on the king pin housings.

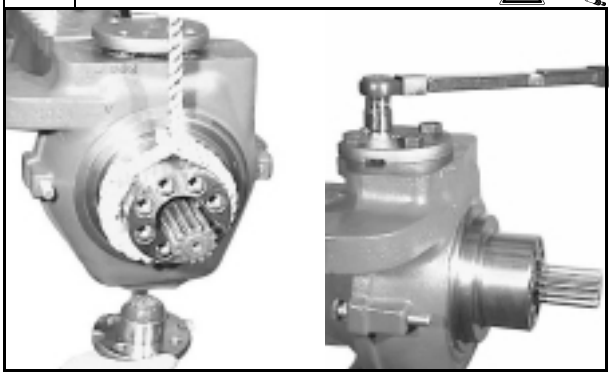
3



Posizionare il perno snodo inferiore su di un banco di lavoro e montare la pista interna della rotula sferica con il battitoio cod. CA715039 sotto l'azione di una pressa.

Position the lower kingpin on a workbench and assemble the cone of the ball bearing with the special tool code CA715039 under a press.

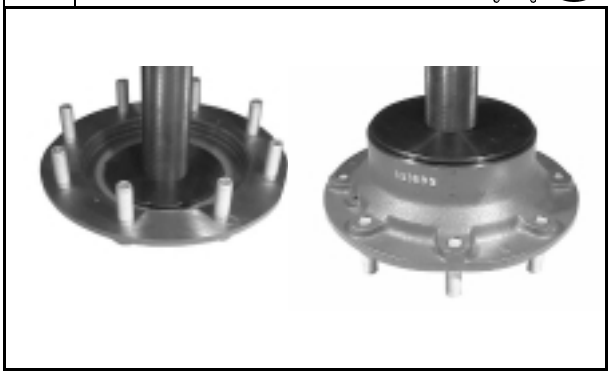
4



Assicurare il gruppo calotta con una fune e montarlo sulla trave.
Pericolo: operazione pericolosa per l'operatore.
Lubrificare il labbro dell'anello di tenuta.
Avvolgere l'estremità scanalata del semiasse con del nastro adesivo sottile per non danneggiare l'anello di tenuta. A montaggio avvenuto, rimuovere il nastro.
Montare i due perni snodo inferiore e superiore e serrare le viti del supporto con chiave dinamometrica alla coppia prevista (Sez. B.8).
Assicurarsi che le molle a tazza rimangano nella loro posizione.

Secure the swivel housing group with a rope and assemble it on the axle beam.
***Danger:** this is dangerous for the operator.*
Lubricate the seal ring lips. Protect the splined end of the axle shaft by winding it with some thin adhesive tape to avoid damaging the seal ring. After assembly, remove the adhesive tape.
Assemble the two king pins, the upper and the lower, and tighten the support screws with dynamometric wrench to the requested torque (Sec. B.8).
Make sure that the Belleville washers remain in their position.

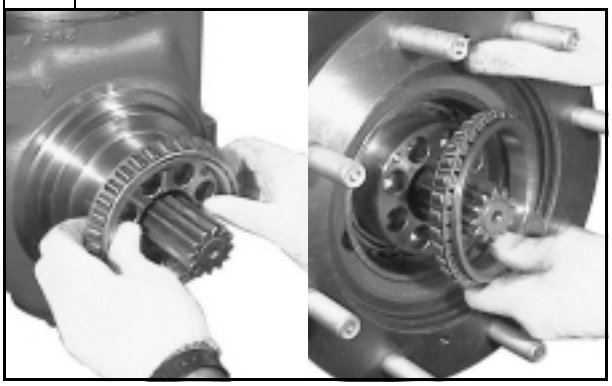
5



Posizionare il mozzo ruota su di un banco di lavoro e piantare le due piste esterne dei cuscinetti a rulli conici con il battitoio cod. CA715026 sotto l'azione di una pressa o di un martello.
Inserire l'anello di tenuta nel mozzo ruota con il battitoio cod. CA119143 ed un martello.

Position the wheel hub on a workbench and force the two cups of the taper roller bearings in position with the special tool code CA715026 under a press or with a hammer.
Insert the seal ring into the wheel hub with the special tool code CA119143 and a hammer.

6



Montare la pista interna del cuscinetto a rulli conici sul codolo della calotta.
Montare il mozzo ruota sulla calotta e piantare l'altra pista interna del cuscinetto a rulli conici.

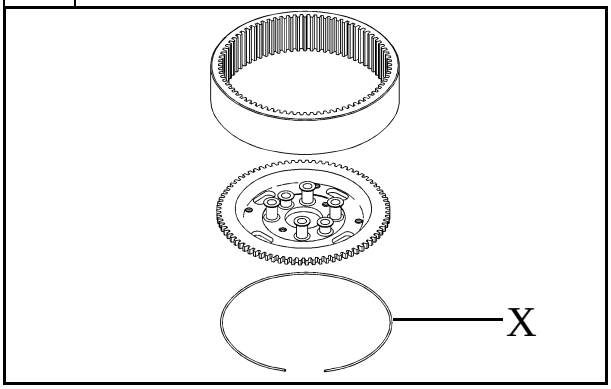
Assemble the cone of the taper roller bearing on the swivel housing end.
Assemble the wheel hub on the swivel housing and force the other cone of the taper roller bearing in position.

7

Posizionare il mozzo fermo corona su banco di lavoro e piantare le boccole a filo con battitoio CA715027.
Almeno due boccole (diametralmente opposte) devono essere piantate leggermente oltre il filo per essere utilizzate come spine di centraggio.

Position the wheel carrier on a workbench and force the bushes to the carrier surface level with the special tool code CA715027.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

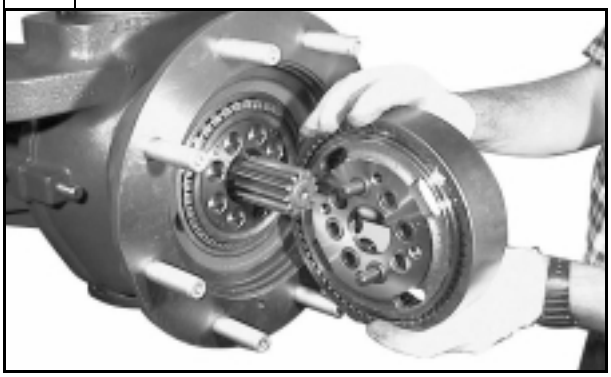
8



Preassemblare il gruppo mozzo fermo corona, corona epicicloidale, con lo speciale anello d'arresto indicato in figura (**X**).

*Preassemble the wheel carrier group, epicyclic ring gear, with the special lock ring shown in the figure (**X**).*

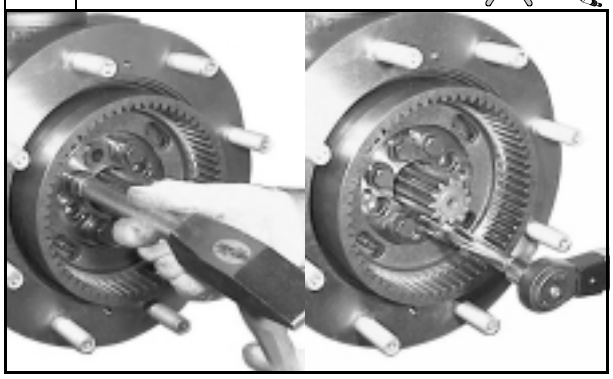
9



Montare il gruppo mozzo fermo corona sul mozzo ruota utilizzando le due boccole sporgenti come spine di centraggio.

Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins.

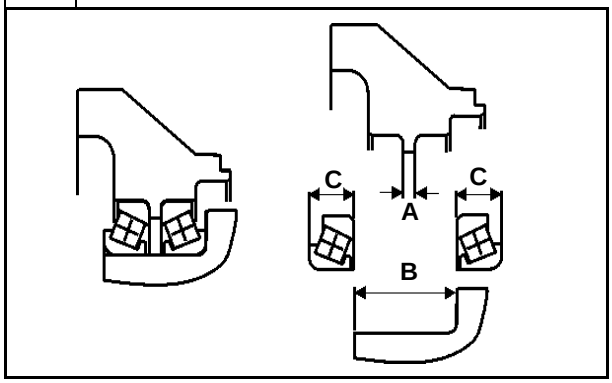
10



Piantare con il battitoio cod CA715027 ed un martello tutte le bussole di centraggio mozzo fino a battuta.
Montare le viti di fissaggio mozzo fermo corona e serrare alla coppia prevista (Sez. B.8).

Force all the hub dowel bushes completely with the special tool code CA715027 and a hammer.
Assemble the wheel carrier fastening screws and tighten to the requested torque (Sec. B.8).

11

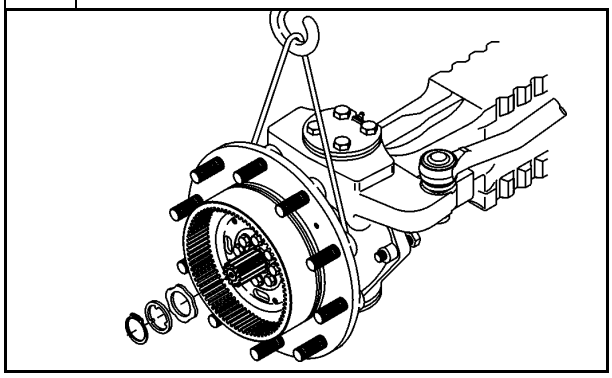


La speciale esecuzione “Set Right” dei cuscinetti non richiede specifiche registrazioni del precarico o del gioco. In ogni caso, prima del montaggio di nuove parti, controllare le dimensioni indicate.

A= 17.950 ÷ 18.000
B= 64.275 ÷ 64.325
C= 23.070 ÷ 23.172

The special operation “Set Right” does not require specific registration of preloading or backlash. At any rate, before assembling new components check the pointed out dimensions.

12



Infilare nel semiasse del doppio giunto le ralle, lo spessore e bloccare alla fine con l’anello d’arresto.

Insert the rings and the shim into the axle shaft of the U-Joint and lock with the seeger ring.

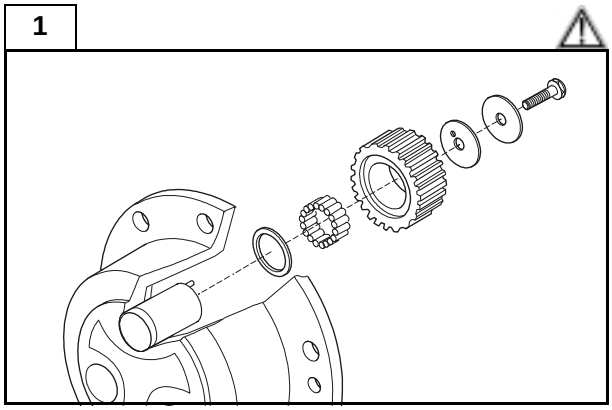
E.7 Montaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.7 Epicyclic reduction gear assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

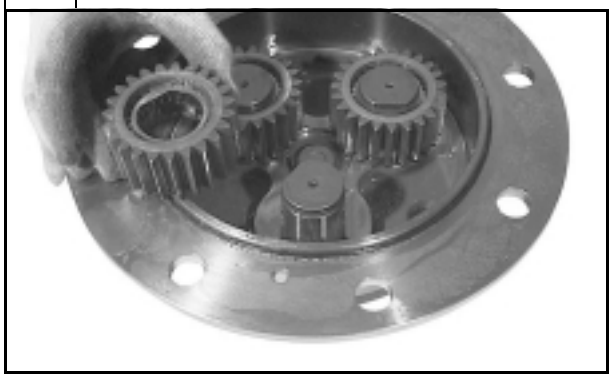
1



Recuperare tutti i componenti del gruppo riduttore epicicloidale.
Nota: Fare attenzione ai rullini.

Collect all the components of the epicyclic reduction gear.
***Note**: Be careful to the rollers.*

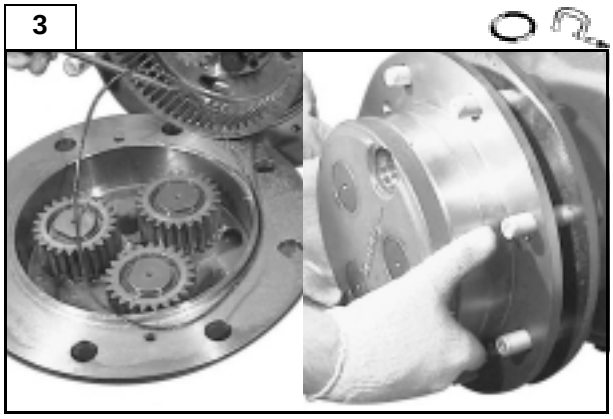
2



Posizionare su un banco di lavoro il treno porta satelliti.
Inserire nei perni del treno portasatelliti: la rondella di rasamento inferiore, i satelliti epicicloidali, i rullini e le due ralle superiori.
Nota: verificare il corretto posizionamento della prima ralla superiore nell'apposito perno d'arresto.
Montare le relative viti di arresto, serrandole con chiave dinamometrica alla coppia prevista (Sez.B.8).

Position the planetary carrier on a workbench.
Insert the thrust washer, the planetary gear, the needle bearings and the two upper trust washers in the planetary carrier pins.
***Note:** check correct positioning of first upper trust washer in the lock pin.*
Assemble the retaining screw, then tighten the screws with dynamometric wrench to the requested torque (Sec. B.8).

3



Inserire un nuovo anello O-Ring sul mozzo ruota.
Montare il gruppo riduttore epicicloidale sul mozzo ruota.
Avvitare le viti di fissaggio e serrare con chiave dinamometrica alla coppia prevista (Sez. B.8).

Assemble a new O-ring on the wheel hub.
Assemble the epicyclic reduction gear on the wheel hub.
Screw in the fastening screws and tighten with dynamometric wrench to the requested torque (Sec. B.8).

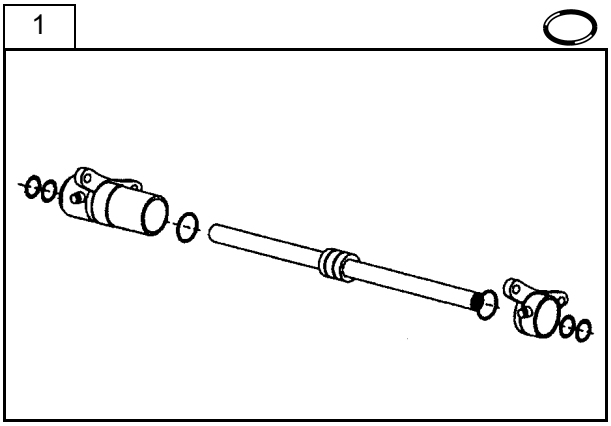
E.8 Montaggio gruppo cilindro sterzo

E.8 Steering group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

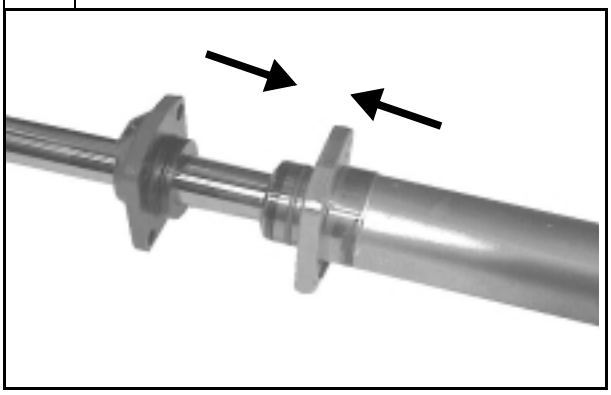
1



Montare nuovi anelli di tenuta: nella testata del cilindro, nel corpo cilindro e sullo stelo.

Fit new seal rings to the cylinder head, to the cylinder body, to the cylinder rod.

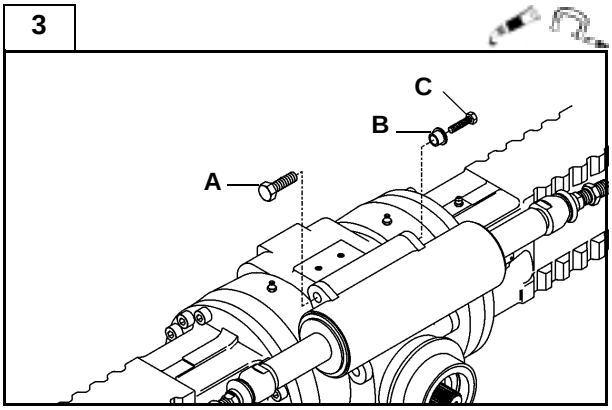
2



Infilare lo stelo premontato nel corpo cilindro.

Slide the pre-assembled rod into the cylinder body

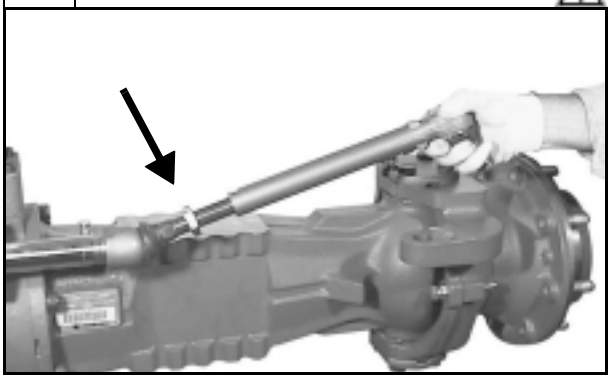
3



Applicare Loctite® 270 sul filetto della vite di fissaggio (**A**) del cilindro sterzo.
Installare sul corpo centrale il cilindro sterzo inserendo la boccola di centraggio (**B**) e le viti di fissaggio (**A**) e (**C**) nelle relative sedi.
Serrare le viti di fissaggio del cilindro sterzo con chiave dinamometrica alla coppia prevista (Sez. B.8)

*Apply Loctite® 270 on the thread of the steering cylinder fastening screw (**A**).*
*Install the steering cylinder on the central body inserting the dowel bush (**B**) and the screws (**A**) and (**C**) in their housings.*
Tighten the steering cylinder fastening screws with dynamometric wrench to the requested torque (Sec. B.8).

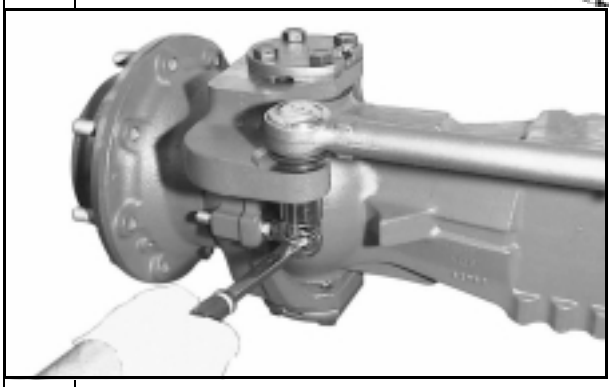
4



Montare alle estremità dello stelo del martinetto le aste guida.
Avvitare o svitare l'asta guida di una quantità tale da poter infilare lo snodo sferico sulla calotta.
Nota: è importante svitare il dado di bloccaggio per eseguire questa operazione.

Fit the tie rods to the ends of the cylinder rod.
Screw in or out the guide rod so that the ball joint can be inserted into the swivel housing.
***Note**: it is important to unscrew the locking nut to carry out this operation.*

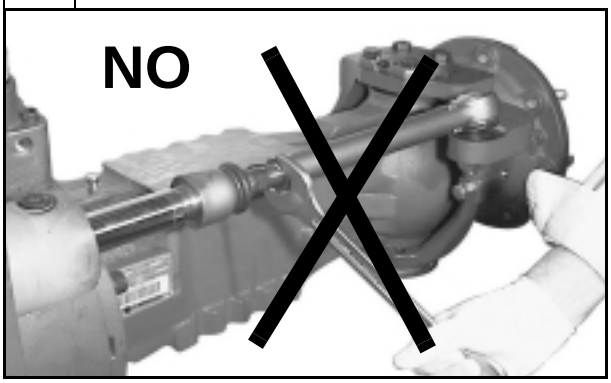
5



Inserire lo snodo sferico nella propria sede sulla calotta.
Montare e serrare il dado di fissaggio con chiave dinamometrica alla coppia prevista (Sez. B.8).

Insert the ball joint into its own housing on the cap.
Assemble and tighten the lock nut with dynamometric wrench to the requested torque (Sec. B.8).

6



Non avvitare il dado di bloccaggio dell'asta guida fino a quando non si è effettuata la registrazione della convergenza.

Screw in the lock nut of the guide rod only when the toe-in adjustment has been carried out.

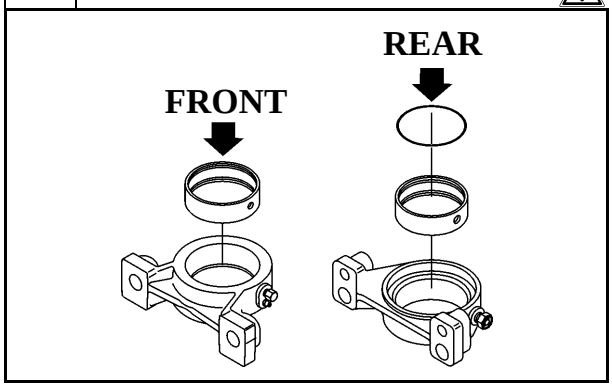
E.9 Montaggio gruppo supporti assale

E.9 Axle trunnions group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

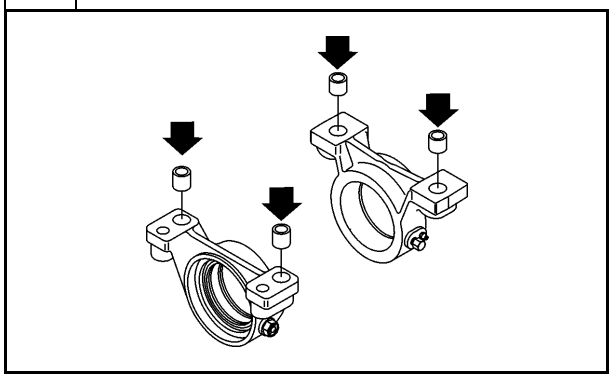
1



Posizionare il supporto posteriore ed anteriore su di un banco di lavoro e montare le rispettive boccole di rasamento, mettendole in fase con i rispettivi fori dei supporti.
Montare le viti forate che bloccano le boccole di rasamento, fissandole con una chiave dinamometrica alla coppia prevista (sez. B8).
Nota: Ricordare di montare un nuovo anello OR sul supporto posteriore.

Place the front and rear supports on a work bench and fit the respective bushings.
The retaining / lubrification hole in the bushings must align with screw hole in the front and rear supports.
Insert the bush retaining bolts and tighten to the prescribed torque (sez. B8).
Note: *Fit a new O-ring to the rear support.*

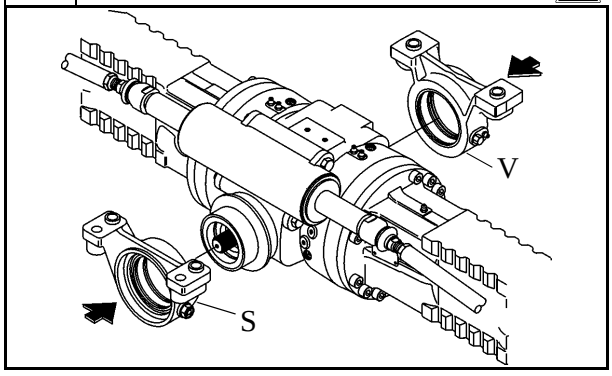
2



Solo se necessario montare le 2 nuove boccole di centraggio con un battitoio adatto.

Only if necessary fit 2 new centering bushes with a suitable driver.

3



Montare il supporto anteriore "**V**" e posteriore "**S**" sul corpo centrale facendo attenzione a non rovinare l'anello OR.

*Fit the front "**V**" and rear "**S**" supports to the central body taking care with the O-ring.*

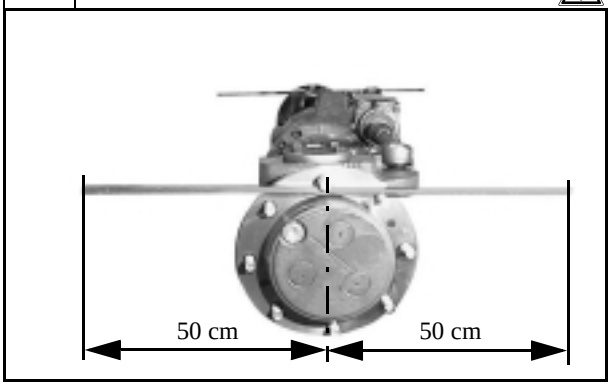
E.10 Registrazione convergenza

E.10 Toe-in adjustment

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

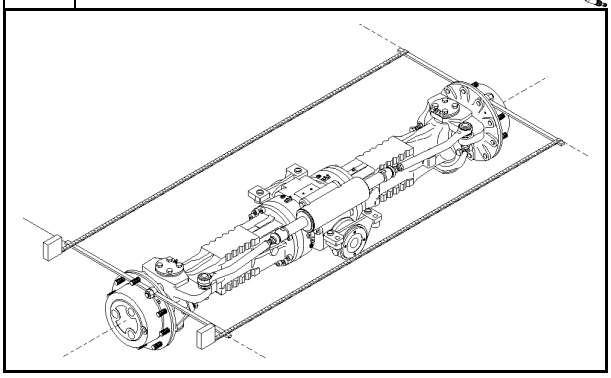
1



Montare 2 barre lineari uguali, lunghe 1 m, sui lati ruota, bloccandole con due dadi, sui prigionieri mozzo ruota.
Nota: Le due barre devono essere fissate alla loro mezzeria, in modo che siano perfettamente perpendicolari alla superficie di appoggio. Allineare al meglio le due barre.

Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.
***Note:** The two bars should be fixed on their middle so that they are perpendicular to the supporting surface. Align the two bars.*

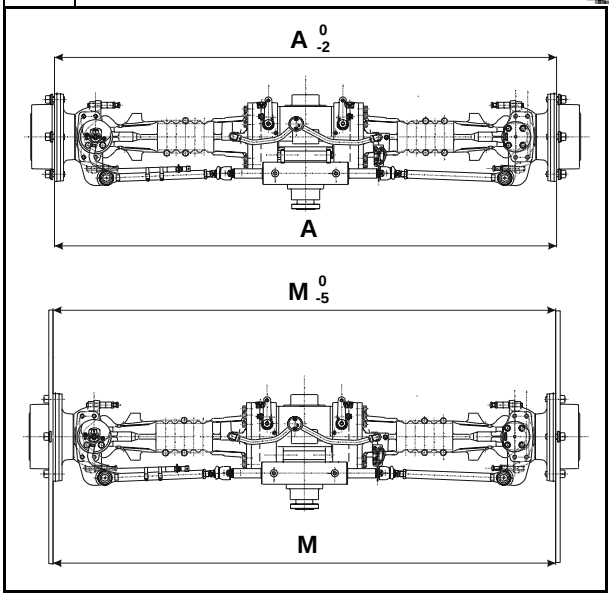
2



Rilevare con un metro a nastro, dai punti più estremi delle barre, la distanza millimetrica.
Nota: Prendere il valore minimo oscillando il punto di misurazione.

Measure the distance in mm. between the bar ends with a tapeline.
***Note:** Keep the minimum value, swinging the measurement point.*

3



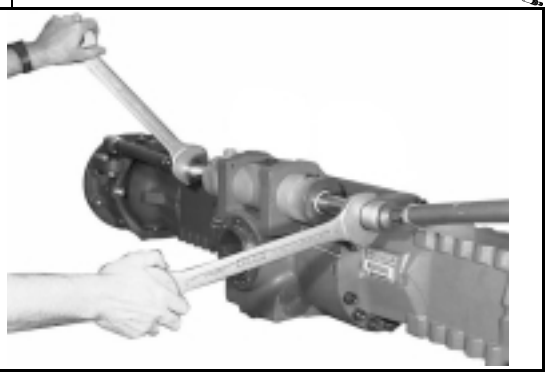
Verificare che la differenza tra le misurazioni alle estremità dei diametri dei mozzi ruota rientri nel campo di tolleranza richiesto (Vedi "convergenza" in Sez. B.4).
Il valore della convergenza nominale (**A**) è riferito al diametro esterno della flangia dei mozzi ruota, quindi il valore misurato (**M**) alle estremità delle barre deve essere rapportato alle loro proporzioni rispetto a tale diametro

converg. nominale (sez.B.4) = A $^{0}_{-2}$ ⟶ converg. misurata = M $^{0}_{-5}$

Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range (See "Toe-in" in sec. B.4).
*The nominal toe-in value (**A**) is referred to the external diameter of the wheel hubs flange, therefore the measured value (**M**) at the bars ends must be related to the ratio between lenght of the bar and flange diameter*

nominal toe-in (sec.B.4) = A $^{0}_{-2}$ ⟶ measured toe-in = M $^{0}_{-5}$

4



Nel caso che la convergenza non sia esatta agire con due chiavi sulle aste guida avvitando e svitando i due tiranti snodo equamente, in modo che alla fine rientri nella tolleranza prevista.

If toe-in is incorrect, operate with two wrenches on the guide rods screwing in and out the two joint tie rods equally till the toe-in is with in the requested tolerance.

5

Eseguita la regolazione, avvitare i dadi di bloccaggio delle aste guida alla coppia di serraggio prevista (sez. B8).

After adjusting, screw in the lock nuts of the guide rods to the requested torque (sec. B8).

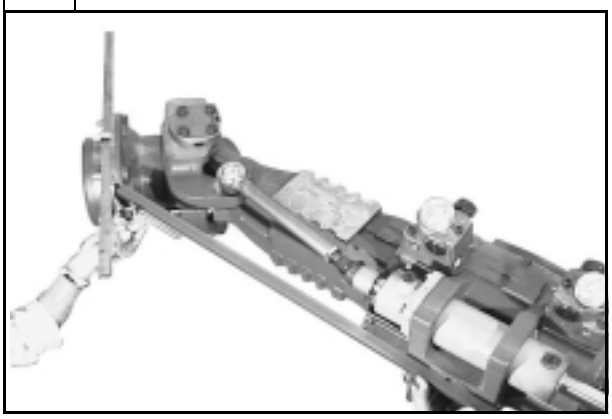
E.11 Registrazione angolo di sterzata

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.11 Steering angle adjustment

Some of the following pictures could not show exactly your axle, but the procedure is the same.

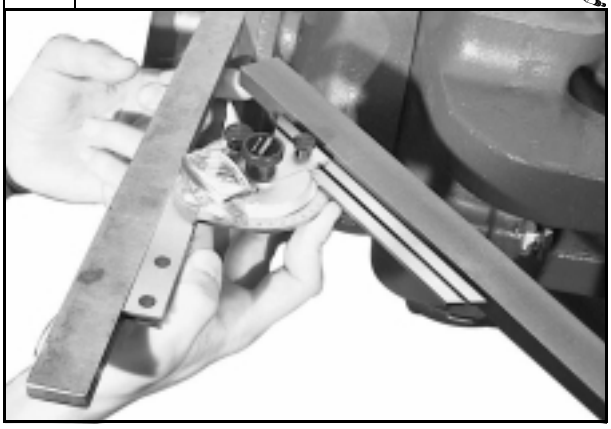
1



Utilizzare le stesse barre montate per la registrazione della convergenza ed una barra lunga, appoggiata perfettamente alla parte lavorata del corpo centrale (lato pignone), in modo che al massimo della sterzata le due barre formino un angolo acuto.

Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

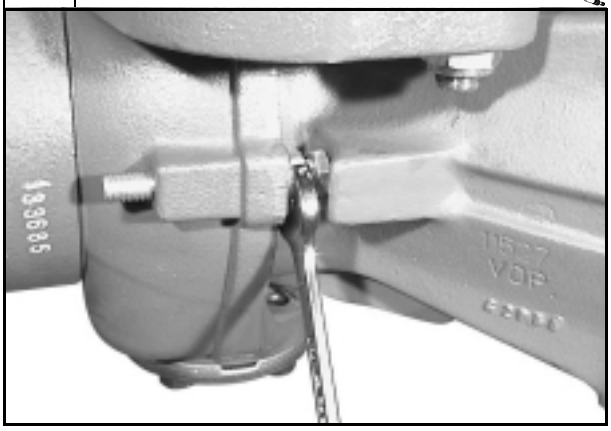
2



Regolare un goniometro all'angolo prescritto (Sez B.4) e posizionarlo sulla barra lunga.
Orientare un lato ruota fino a formare con le due barre l'angolo fissato dal goniometro.

Adjust a goniometer to the requested angle (Sec. B.4) and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the goniometer.

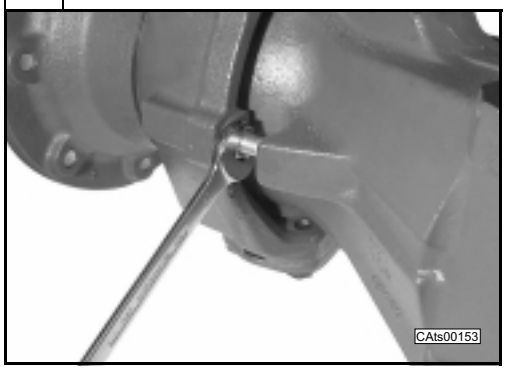
3



Effettuare la regolazione del fermo meccanico di sterzata, avvitando o svitando le apposite viti (in figura), bloccandole poi con controdado alla coppia di serraggio prescritta (Sez. B.8).
Sterzare completamente dal lato opposto e ripetere le stesse operazioni.

Adjust the steering mechanical retainer, screwing in or out the special screws (see figure), locking them with a locknut to the requested torque (Sec. B.8).
Steer completely towards the other side and repeat the same operations.

4



Ripetere l'operazione precedente sia sulle due viti della parte anteriore che sulle due viti della parte posteriore dell'assale.
Sterzare completamente dal lato opposto e ripetere le stesse operazioni.

Repeat the the last operation on the two front and rear screws of the axle.
Steer completely towards the other side and repeat the same operations.

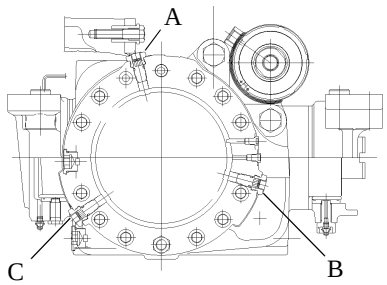
E.12 Sbloccaggio freno parcheggio

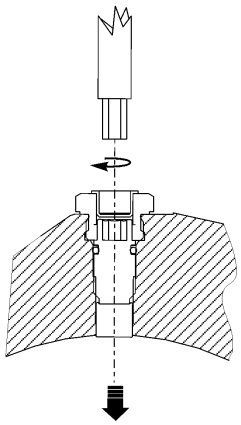
E.12 Parking brakes release

(prima dello smontaggio)

(before disassembly)

1





ATTREZZATURA:

- chiave a punta esagonale 8 mm
- chiave a cricco reversibile da 3/8" + prolunga da 3"

TOOLING:

- 8 mm. hex bit socket
- 3/8" reversible ratchet + 3" extension

OPERAZIONI DI EMERGENZA

DISABLING ALL FOUR WHEELS

ATTENZIONE

WARNING

BLOCCARE LE RUOTE. Il non farlo può essere molto pericoloso o addiritura mortale per l'operatore: il veicolo infatti potrebbe muoversi da solo.

BLOCK ALL FOUR WHEELS. *Failure to do so could result in death or serious injury from vehicle roll away.*

Bloccare tutte e 4 le ruote per impedire il movimento del veicolo una volta che il freno è stato disinserito.
Per disabilitare i freni di parcheggio è necessaria una chiave a brugola da 8 mm.

Block all four wheels to prevent the vehicle from moving once the parking brake is disabled.
An 8 mm Allen head socket will be needed to properly disable the parking brakes.

Fare un segno sulla testa delle viti per poter contare il numero di giri che ciascuna vite dovrà fare mentre eseguite la procedura.

Mark a line on the socket so you can accurately count the number of turn each bolt makes as you perform the procedure.

Sdraiarsi sotto l'assale ed individuate le 6 viti di rilascio (3 per ciascun lato) alla base dell'assale.

Lie down under the front axle and locate the six brake release bolts (three bolts per side) at the base of the front axle.

Avvitare alternativamente di 1/2 giro alla volta in senso orario le viti di rilascio freno A,B e C fino a quando si inizia a sentire una certa resistenza.
Avvitare alternativamente di 1/2 giro alla volta le viti A, B e C per **5 ÷ 5,5** giri.

Alternately screw 1/2 turn brake release bolts A, B & C inxard direction (clockwise) until you first begin to feel resistance.
*Alternately screw 1/2 turn the bolts A, B and C inward direction of **5 ÷ 5,5** turns.*

Spostarsi da sotto il veicolo e liberare l'area circostante dal personale non coinvolto dalle operazioni.

To get out from under the vehicle and clear the area of any unnecessary personnel.

Rimuovere con attenzione i ceppi di bloccaggio dalle quattro ruote e trainare il veicolo in un luogo sicuro.

Carefully remove the blocking from each of the four tires and tow the vehicle to asecure location.

Bloccare nuovamente le quattro ruote e continuare con le operazioni che necessitano.

Block all four wheels and continue following the procedure.

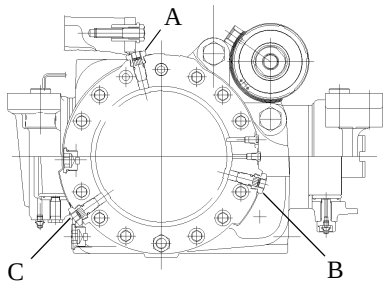
E.13 Riattivazione freno parcheggio

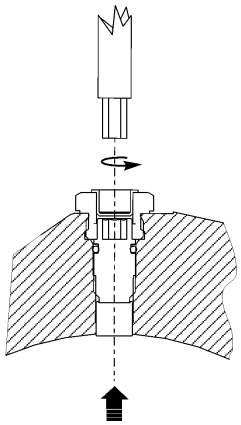
E.13 Re-activating parking brakes

(dopo il montaggio)

(after assembly)

1





ATTENZIONE

BLOCCARE LE QUATTRO RUOTE. Il non farlo può essere molto pericoloso o addirittura mortale per l'operatore: il veicolo infatti potrebbe muoversi da solo.

Bloccare tutte e 4 le ruote, sdraiarsi sotto l'assale e, utilizzando la chiave dinamometrica, svitare alternativamente le viti di rilascio A, B e C (in senso antiorario) di 1/2 giro.

Di nuovo svitare alternativamente di 1/2 giro le viti A, B e C fino a quando la coppia si riduce bruscamente.

Continuare a svitare alternativamente le viti A, B e C fino a quando si avverte che la testa della vite va a contatto con la vite speciale. Riavvitare poi in senso inverso le viti A, B e C di 1/4 di giro.

I freni di parcheggio sono a questo punto riattivati e le ruote anteriori bloccate.
Rimuovere quindi i ceppi dalle quattro ruote.

Verificare l'efficienza delo freno di parcheggio.
Rimuovere i cartelli di pericolo o di avviso dal volante e dalla chiave d'accensione.

WARNING

BLOCK ALL FOUR WHEELS. *Failure to do so could result in death or serious injury from vehicle roll away.*

After you have locked all four wheels, lie down under the axle. Using the torque wrench, alternately unscrew brake release bolts A, B and C outward direction (counterclockwise) 1/2 turn.

Again, alternately unscrew brake release bolts A, B and C outward direction 1/2 turn until the torque drops off sharply.

Alternately unscrew brake release bolts A, B and C outward direction (counterclockwise) until feel the bolts flange begin to contact against the special screw.
Screw the bolts A, B and C inward direction 1/4 turn

The parking brakes should now be re-activated and the front wheels are locked.
Remove the blocking from the four tires.

Verify that parking brake words.
Remove any warning tags from the ignition lock key and from the steering wheel.

E.14 Prove dopo montaggio

Passo 1
A motore spento, sollevare l'assale (**i**) della ruota motrice sino a che i pneumatici si siano staccati da terra.

Passo 2
Ingranare la marcia in modo che il pignone sia bloccato.

Passo 3
Con l'aiuto di un'altra persona collocata al lato opposto, iniziare la prova di montaggio ruotando per quanto possibile entrambe le ruote nel senso di marcia avanti. (Entrambe le ruote dovrebbero bloccarsi dopo poco)

Passo 4
Con il pignone sempre bloccato, liberare la ruota di destra e ruotare la ruota di sinistra nel senso (marcia avanti).
Se il montaggio è corretto si dovrà verificare che la ruota giri liberamente senza eccessivi sforzi, e la ruota di destra ruoti in senso opposto.
Ripetere l'operazione nel senso opposto (retro marcia).

SE UNA DELLE RUOTE NON GIRA LIBERAMENTE IN ENTRAMBE LE DIREZIONI ricontrollare passo passo il montaggio controllare anche che i freni non siano regolati scorrettamente agendo in modo improprio.

E.14 Testing after assembly

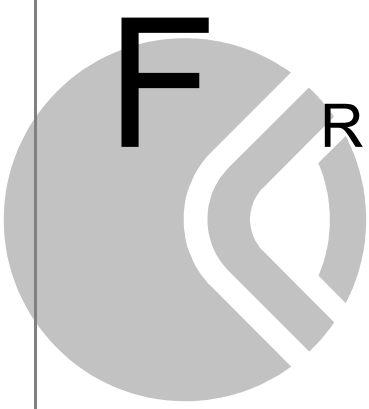
Step 1
*With engine off, lift the axle **(i)** so that the tyres get away from the ground.*

Step 2
Engage the gear so that the pinion gets blocked.

Step 3
With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward. (Both the wheels should get blocked after a while.)

Step 4
Keeping the pinion blocked, free the right wheel and rotate the left one in the line of march. Rotate the right wheels in the opposite direction.
The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.
Repeat the same operation in the opposite direction (reverse gear).

IF ONE OF THE WHEELS DOES NOT ROTATE FREELY IN BOTH THE DIRECTIONS, then check step by step all assembly operations. Check and see that the brakes are regulated correctly and functioning properly.



F RICERCA GUASTI

F TROUBLESHOOTING

PROBLEMA	POSSIBILI CAUSE										
	1	2	3	4	5	6	7	8	9	10	11
- Vibrazioni delle ruote; resistenza del pneumatico anteriore; rottura del/i semiasse/i.	●	●	●		●						●
- Difficoltà nello sterzare; il veicolo tende ad andare dritto mentre è in curva.	●	●	●	●							●
- Non vi è azione del differenziale; inceppamento in curva.	●			●	●						●
- Rumore eccessivo nella trasmissione.	●	●	●	●	●		●		●		●
- Usura eccessiva del pneumatico.	●	●	●	●	●	●	●				●
- Rumore di attrito.	●			●	●			●	●	●	●
- In marcia avanti si avvertono vibrazioni, rumore intermittente.	●	●	●		●						●

PROBLEMS	POSSIBLE CAUSES										
	1	2	3	4	5	6	7	8	9	10	11
- Wheel vibration; front tyre resistance; halfshaft breakage.	●	●	●		●						●
- Steering is difficult; vehicle goes straight while its turning.	●	●	●	●							●
- No differential action; jamming while steering.	●			●	●						●
- No differential action; jamming while steering.	●	●	●	●	●		●		●		●
- Uneven wear of tyre.	●	●	●	●	●	●	●				●
- Friction noise.	●			●	●			●	●	●	●
- Vibration during forward drive, intermittent noise.	●	●	●		●						●

1 Installazione scorretta / assale difettoso

Correggere l'installazione oppure, se il differenziale non supera una delle fasi di prova, ripararlo o sostituirlo.

2 Sovraccarico e/o distribuzione scorretta del peso

Togliere il peso in eccesso e ridistribuire il carico, rispettando le istruzioni relative al veicolo.

9 Incorrect installation / defective axle

Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

10 Overloading/ incorrect weight distribution

Remove excessive weight and redistribute load, following instructions related to the vehicle.

3 Raggio di rotazione dei pneumatici diversi

Un pneumatico con raggio più piccolo provoca un parziale slittamento della ruota quando si applica energia. L'altro pneumatico con raggio maggiore dovrà sopportare tutto il lavoro. Sostituire il pneumatico o regolare la pressione di entrambi sino a che il raggio di rotazione sia uguale.

4 Semiasse rotto

E' sconsigliato usare un veicolo con un solo semiasse. E' possibile tuttavia spostare il veicolo a vuoto con il differenziale bloccato per pochi metri.

5 Semiasse piegato

Sostituire i semiassi.

6 Differenziale bloccato

Funzionamento anomalo del differenziale e/o rottura del dispositivo di comando del bloccaggio di comando. Verificare l'installazione, eventualmente smontare e verificare i componenti.
I veicoli impostati per angoli di sterzata ampi, possono procedere a scatti, avere difficoltà di sterzo e provocare un consumo del pneumatico nelle curve strette.
Ridurre l'angolo di sterzata minimo e decelerare quando il motore inizia a procedere a scatti.

7 Allineamento scorretto della ruota

Verificare l'integrità della struttura, e cuscinetti lato ruota.

8 Parti dell'assale consumate o difettose

Controllare le condizioni della corona dentata, dell'ingranaggio del pignone, dei cuscinetti, delle guarnizioni, ecc. Sostituire dove necessario.

9 Corpi estranei nella scatola dell'assale o montaggio scorretto di alcune sue parti

Controllare se vi sono corpi estranei. Controllare il montaggio delle parti dell'assale.

10 Regolazioni della coppia conica scorrette: parti di trasmissione consumate

(ingranaggi di trasmissione, giunti, ecc.). Sostituire o regolare secondo necessità.

11 Uso scorretto del prodotto

Rivedere le istruzioni rilasciate dal produttore del veicolo.

11 Different rotation radius of the tyres

If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied.The other tyre with bigger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyre.

12 Broken halfshaft

It is not advisable to operate the vehicle with a broken halfshaft. It is acceptable to move the vehicle (engine off unloaded) a few meters away only.

13 Bent halfshaft

Replace halfshaft.

14 Blocked differential

Abnormal functioning of the differential or breakage/ blockage of command device. Verify assembly and all components.
Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns. Reduce the steering angle to minimum and decelerate when the vehicle begins to kick.

15 Incorrect wheel adjustment

Verify group integrity and wheel side bearings.
Adjusting according.

16 Spoiled or worn out axle parts

Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.

17 Contamination in the axle box or incorrect assembly of parts

Look for foreign particles. Check assembly of the various parts of the axle.

18 Incorrect adjustment of bevel gear set: Parts of the transmission worn out.

(transmission gears, U joints, etc.)
Replace or adjust as required.

19 Incorrect use of the product

See the vehicle producer‘s instructions once again.

F.1 Controllo ed esame dei guasti

Questo capitolo offre una guida descrittiva ed esplicativa di problemi che si possono comunemente riscontrare sugli assali o di avarie che si possono verificare. La guida suggerisce anche le corrette procedure di riparazione.

Problema	Causa	Riparazione consigliata
Rottura verso l'estremità esterna del dente corona dentata	1. Carico dell'ingranaggio eccessivo rispetto a quello previsto 2. Regolazione ingranaggio scorretto (gioco eccessivo) 3. Dado del pignone allentato.	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente.
Rottura verso l'estremità interna del dente corona dentata	1. Urto da carico 2. Regolazione ingranaggio scorretto (gioco insufficiente) 3. Dado del pignone allentato	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente
Denti del pignone e della corona dentata erosi o rigati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Lubrificante errato o con additivi impoveriti 4. Cuscinetti del pignone consumati che provocano un gioco assiale del pignone e un contatto tra pignone e corona scorretto.	Sostituire corona dentata e pignone. Sostituire i cuscinetti del pignone facendo attenzione a sistemare correttamente la corona, il pignone e i precarichi dei cuscinetti. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti della corona e del pignone surriscaldati. Guardare se i denti dell'ingranaggio hanno perso la colorazione	1. Funzionamento prolungato a temperatura eccessiva. 2. Lubrificante scorretto 3. Livello dell'olio basso 4. Lubrificante sporco.	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti del pignone di comando butterati	1. Uso estremamente intenso 2. Lubrificazione insufficiente	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Corpo trave dell'assale piegato	1. Sovraccarico del veicolo 2. Veicolo incidentato 3. Urto da carico	Sostituire il corpo trave dell'assale
Cuscinetti consumati o butterati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Uso estremamente intenso 4. Consumo normale 5. Dado del pignone allentato.	Sostituire i cuscinettii. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Le guarnizioni perdono olio	1. Funzionamento prolungato con temperatura dell'olio eccessiva. 2. Guarnizione dell'olio montata male 3. Bordo della guarnizione tagliata o intaccata 4. Lubrificante sporco	Sostituire la guarnizione e la superficie di accoppiamento se danneggiata. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Usura eccessiva della scanalatura della flangia di entrata.	1. Uso intenso 2. Dado del pignone allentato 3. Gioco assiale del pignone	Sostituire la flangia Controllare che la scanalatura del pignone non sia eccessivamente consumata Sostituire corona dentata e pignone, se necessario.

Problema	Causa	Riparazione consigliata
Rottura per fatica del dente dell'ingranaggio del pignone. Guardare se la linea di frattura ad onda è ben delineata (linea di arresto).	1. Uso intenso 2. Sovraccarico continuo	Sostituire corona dentata e pignone.
Rottura denti pignone e corona	Carico d'urto dei componenti del differenziale	Controllare e/o sostituire altri componenti differenziale.
Scanalature dell'ingranaggio planetario consumate (gioco eccessivo)	Uso intenso	Sostituire il gruppo ingranaggi differenziale. Sostituire il semiasse, se necessario.
Superfici della ralla di rasamento consumate o graffiate	1. Lubrificazione insufficiente 2. Lubrificazione scorretta 3. Lubrificante sporco	Sostituire tutte le ralle graffiate e quelle con uno spessore di 0,1mm inferiore a quello di rosette nuove. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Diametro interno del cuscinetto a rulli conici del pignone consumato	1. Uso intenso 2. Gioco assiale del pignone eccessivo 3. Lubrificazione inadeguata 4. Lubrificante sporco	Sostituire il cuscinetto Controllare il gioco assiale del pignone Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Semiasse ritorto o rotto	Funzionamento intenso del veicolo, sovraccarico	Sostituire il semiasse
Semiasse spezzato presso la flangia ruota	1. Supporto della ruota allentato 2. Corpo trave piegato	Sostituire il semiasse Controllare la distorsione del corpo trave. Accertarsi che il sostegno della ruota non sia consumato o mal regolato.

F.1 Troubleshooting

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the repair correct procedures to be followed.

Problem	*Cause*	*Action*
Ring gear tooth broken at the outer side	*1. Excessive gear load compared to the one foreseen* *2. Incorrect gear adjustment (excessive backlash)* *3. Pinion nut loosened*	*Replace bevel gear set* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash*
Ring gear tooth broken side	*1. Load bump* *2. Incorrect gear adjustment (insufficient backlash)* *3. Pinion nut loosened*	*Replace bevel gear set* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash.*
Pinion or ring gear teeth or worn	*1. Insufficient lubrication* *2. Contaminated oil* *3. Incorrect lubrication or depleted additives* *4. Worn out pinion bearings that cause an incorrect pinion axle backlash and wrong contact between pinion and ring.*	*Replace bevel gear set.* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash.* *Use correct lubricants, fill up to the right levels and replace according to the recommended program.*
Overheated ring and pinion teeth. See if gear teeth have faded	*1. Prolong ed functioning at high temperatures* *2. Incorrect lubrication* *3. Low oil level* *4. Contaminated oil*	*Replace bevel gear set.* *Use proper lubrication, fill up to right level and replace at recommended program.*
Pinion teeth pitting	*1. Excessive use* *2. Insufficient lubrication*	*Replace bevel gear set.* *Use correct lubrication, fill up to the right level and substitute at recommended intervals*
Axle beam body bent	*1. Vehicle over loaded* *2. Vehicle's accident* *3. Load bump*	*Replace axle beam body*
Worn out or pitted bearings	*1. Insufficient lubrication* *2. Contaminated oil* *3. Excessive use* *4. Normal wear out* *5. Pinion nut loosened*	*Replace bearings.* *Use correct lubrication fill up, to the right level and replace at recommended intervals*
Oil leakage form gaskets and seals	*1. Prolonged functioning at high temperature of the oil* *2. Oil gasket assembled incorrectly* *3. Seal lip damaged* *4. Contaminated oil*	*Replace the gasket or seal and matching surface if damaged.* *Use correct lubrication and replace at recommended intervals.*
Excessive wearing out of input flange spline	*1. Exhaustive use* *2. Pinion nut loosened* *3. Pinion axle backlash*	*Replace the flange.* *Check that the pinion spline is not excessively worn out.* *Replace bevel gear set if required.*
Fatigue failure of pinion teeth *See if the fracture line is well defined (wave lines, beach lines)*	*1. Exhaustive use* *2. Continuos overload*	*Replace bevel gear set*
Pinion and ring teeth breakage	*1. Crash load of differential components*	*Check and/or replace other differential components.*

Problem	*Cause*	*Action*
Side gear spline worn out. *Replace all scratched washers (Excessive backlash)*	*Excessive use*	*Replace differential gear group.* *Replace halfshaft if required*
Thrust washer surface worn out or scratched.	*1. Insufficient lubrication* *2. Incorrect lubrication* *3. Contaminated oil*	*Use correct lubrication and fill up to right level.* *Replace at intervals recommended.* *Replace all scratched washers and those with 0,1mm thickness lower than the new ones.*
Inner diameter of tapered roller bearing worn out.	*1. Excessive use* *2. Excessive pinion axial backlash* *3. Insufficient lubrication* *4. Contaminated oil*	*Replace bearing.* *Check pinion axial backlash.* *Use proper lubrication, fill up to right level and replace at recommended intervals.*
Bent or broken halfshaft	*Vehicle intensively operated or overloaded*	*Replace*
Halfshaft broken at wheel side	*1. Wheel support loosened* *2. Beam body bent*	*Replace* *Check that wheel support is not worn out or wrongly adjusted.*

F.2 Diagnosi per problemi all'assale

Problema	Causa	Riparazione consigliata
Rumore durante la guida	1. Gioco tra corona dentata e pignone eccessivo 2. Pignone e corona dentata consumati 3. Cuscinetti del pignone consumati 4. Cuscinetti del pignone allentati 5. Gioco assiale del pignone eccessivo 6. Cuscinetti del differenziale consumati 7. Cuscinetti del differenziale allentati 8. Eccessiva scentratura della corona dentata 9. Livello lubrificante basso 10. Lubrificante di grado povero od errato 11. Semiasse piegato	1. Regolare 2. Sostituire 3. Sostituire 4. Regolare 5. Regolare 6. Sostituire 7. Regolare 8. Sostituire 9. Rabboccare 10. Sostituire 11. Sostituire
Rumore durante l'andatura in folle	1. I rumori provenienti dall'assale con il veicolo in movimento di solito si sentono durante l'andatura in folle anche se non molto forti 2. Errato gioco tra pignone e corona (il rumore che si sente decelerando sparisce all'aumentare della velocità). 3. Usura scanalatura pignone o flangia entrata	1. Regolare o sostituire (vedere sopra) 2. Regolare 3. Sostituire
Rumore intermittente	1. Corona dentata danneggiata 2. Bulloni della scatola del differenziale allentati	1. Sostituire coppia conica 2. Serrare a coppia
Rumore costante	1. Danni sui denti della corona dentata o del pignone 2. Cuscinetti usurati 3. Scanalature del pignone consumate 4. Semiasse piegato	1. Sostituire coppia conica 2. Sostituire 3. Sostituire 4. Sostituire
Rumore in curva	1. Satelliti planetari differenziale consumati 2. Scatola differenziale e/o perni del differenziale consumati 3. Ralle di rasamento del differenziale consumate 4. Scanalature del semiasse consumate	1. Sostituire 2. Sostituire 3. Sostituire 4. Sostituire

F.2 Axle problem and diagnosis

Problem	*Cause*	*Recommended repair*
Noise while driving	*1. Excessive backlash between pinion and ring gear* *2. Worn out pinion and gear ring* *3. Worn out pinion bearings* *4. Pinion bearings loosened* *5. Excessive axial pinion backlash* *6. Worn out differential bearings* *7. Differential bearings loosened* *8. Ring gear out of roundness* *9. Low lubricant level* *10. Poor or wrong lubricant* *11. Bent halfshaft*	*1. Adjust* *2. Replace* *3. Replace* *4. Adjust* *5. Adjust* *6. Replace* *7. Adjust* *8. Replace* *9. Oil level* *10. Replace* *11. Replace*
Noise while driving in neutral	*1. Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.* *2. Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed)* *3. Pinion or input flange worn out*	*1. Replace or adjust (see above)* *2. Replace* *3. Adjust*
Intermittent noise	*1. Ring gear damaged* *2. Differential box bolts loosened*	*1. Replace bevel gear set* *2. Tighten to torque*
Constant noise	*1. Ring gear teeth or pinion damaged* *2. Worn out bearings* *3.Pinion spline worn out* *4. Bent halfshaft*	*1. Replace bevel gear set* *2. Replace* *3. Replace* *4. Replace*
Noise while seering	*1. Worn out differential gears* *2. Worn out differential box or spider* *3. Differential thrust washers worn out* *4. Half shaft spline worn out*	*1. Replace* *2. Replace* *3. Replace* *4. Replace*

G ATTREZZI SPECIALI

G *SPECIAL TOOLS*

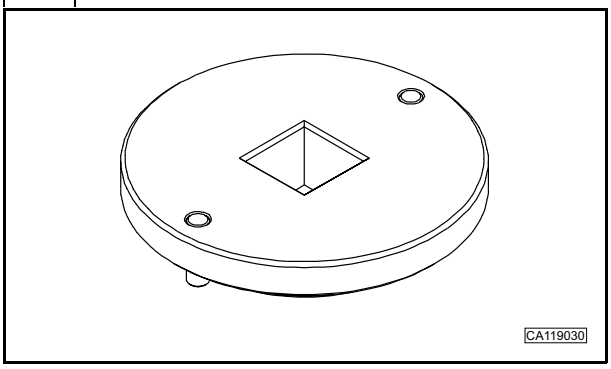
G.1 Attrezzature speciali

Battitoi e tamponi per il montaggio di tenute, cuscinetti e bronzine devono essere utilizzati con il manico intercambiabile CA119033; se ne raccomanda l'uso abbinato ad un'impugnatura di sicurezza per la protezione delle mani (da commercio).

G.1 Special tools

The special drifts/pad used to assembly the seals, bearings and bushes should always be used with the interchangeble handle CA119033; its use is recommended togheter with a suitable safety handle in order to protect the hands.

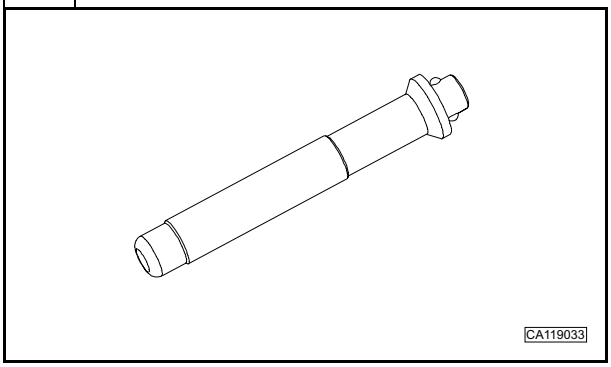
1



Chiave per ghiera
CA119030

Ring nut wrench
CA119030

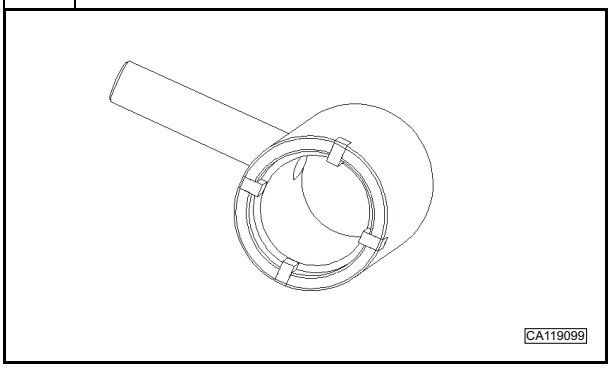
2



Manico intercambiabile
CA119033

Interchangeble handle
CA 119033

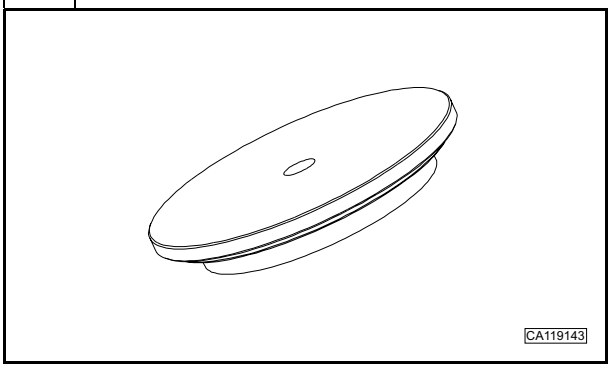
3



Chiave per ghiera pignone
CA119099

Pinion lock nut wrench
CA119099

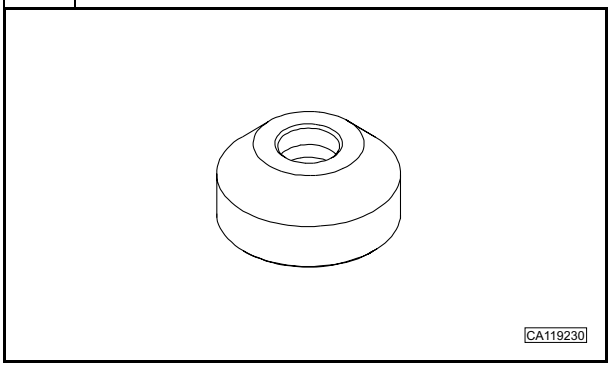
4



Battitoio anello di tenuta
CA119143

Oil seal driver
CA119143

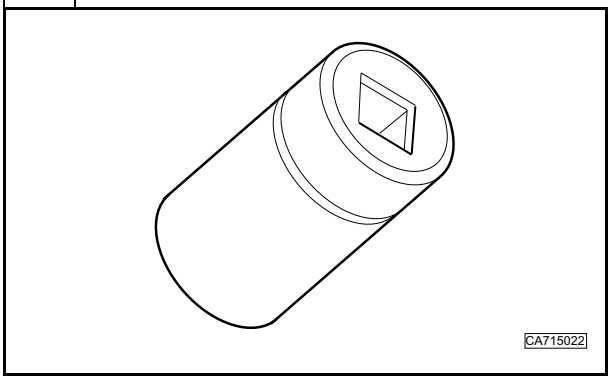
5



Battitoio per cuscinetto
CA119230

Driver for bearing
CA119230

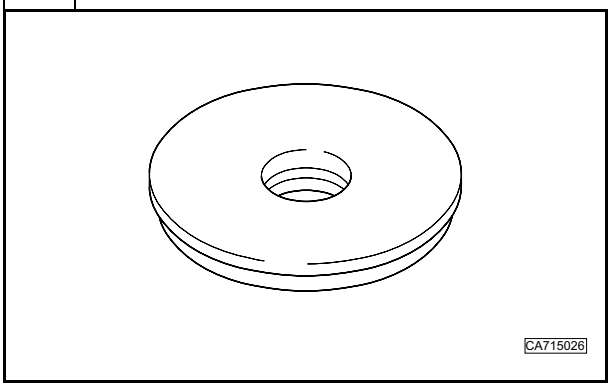
6



Chiave blocca codolo pignone
CA715022

Pinion shaft lock wrench
CA715022

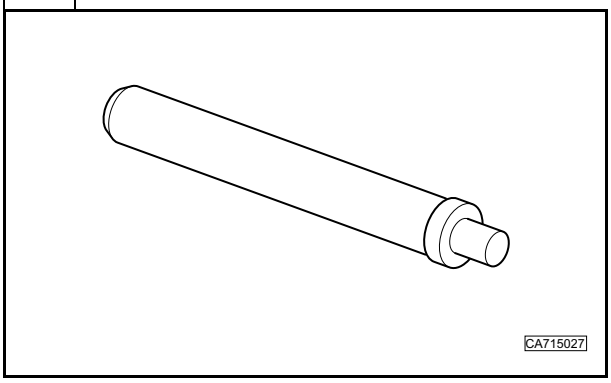
7



Battitoio cuscinetto anello interno
CA715026

Bearing cone driver
CA715026

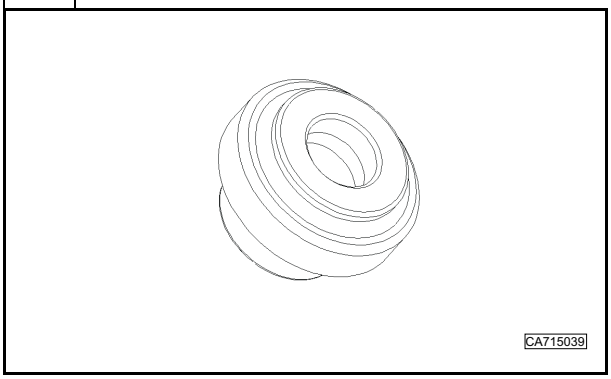
8



Battitoio per bussole
CA715027

Bush driver
CA715027

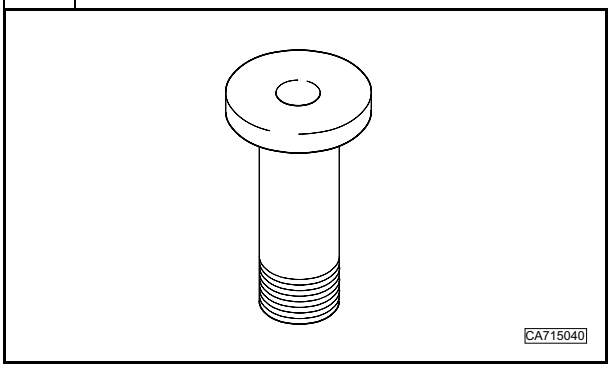
9



Battitoio per boccola
CA715039

Bush driver
CA715039

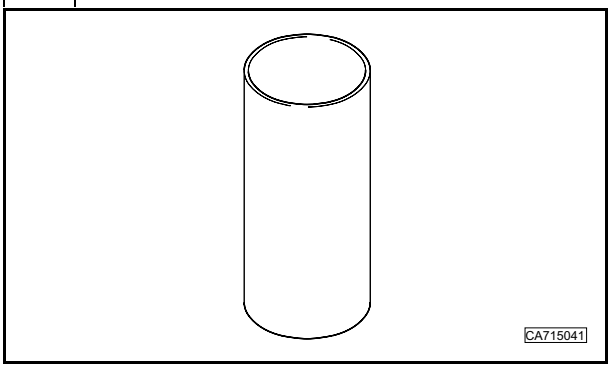
10



Falso pignone
CA715040

Dummy pinion
CA715040

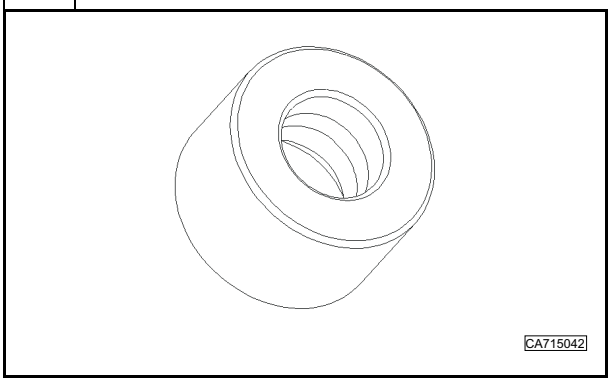
11



Falsa scatola differenziale
CA715041

False differential box
CA715041

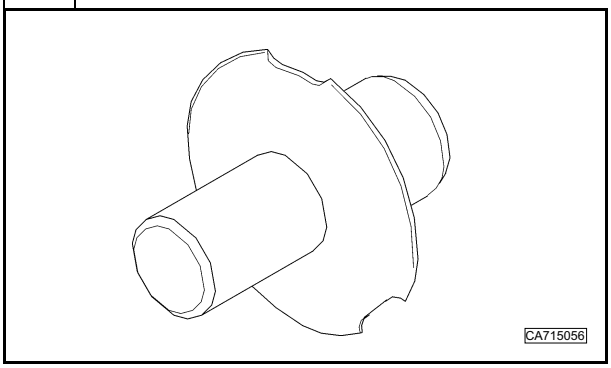
12



Battitoio per boccola snodo sferico
CA715042

Driver for king pin bush
CA715042

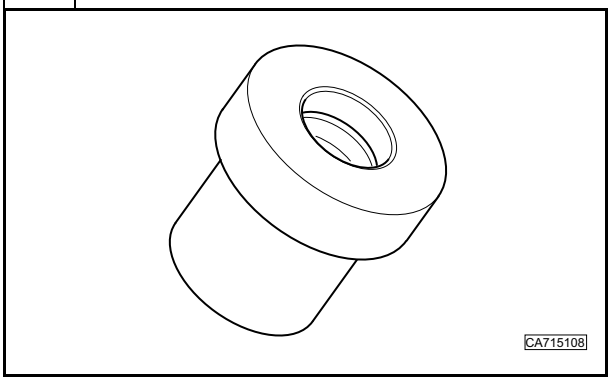
13



Tampone per cilindro freno
CA715056

Driver for oil seal
CA715056

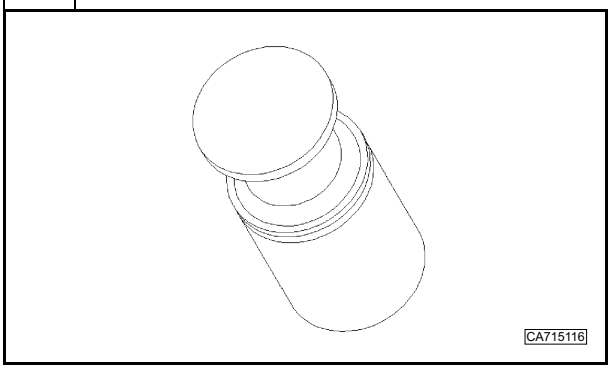
14



Battitoio bronzina
CA715108

Bush driver
CA715108

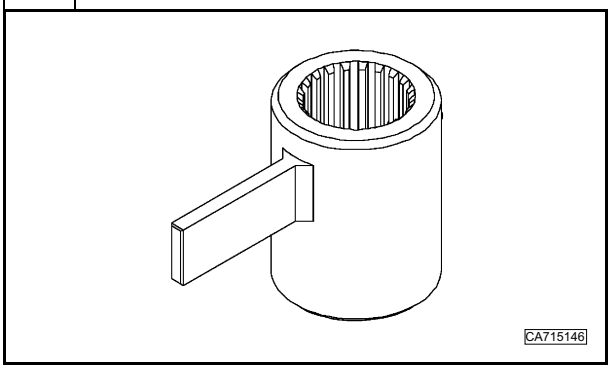
15



Prolunga per rivelazione precarico
CA715116

Extension for preload measurament
CA715116

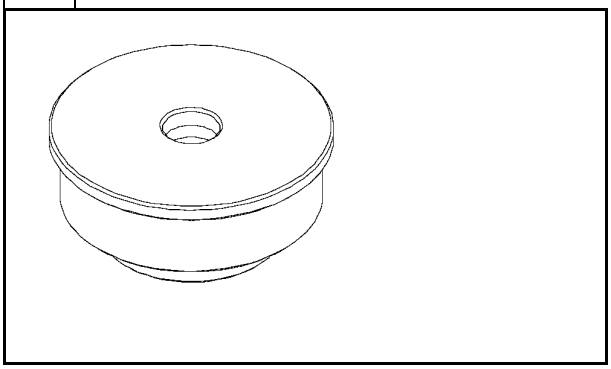
16



Attrezzatura per rilievo gioco
CA715146

Kit for backlash measurament
CA715146

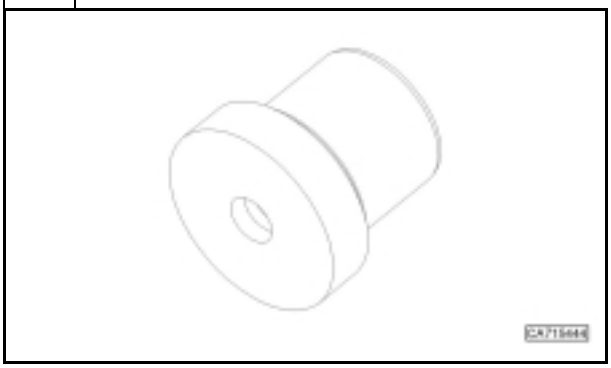
17



Battitoio anello di tenuta
CA715043

Oil seal driver
CA715043

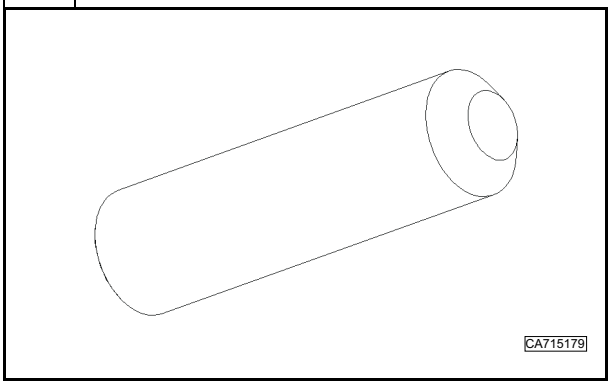
18



Battitoio bronzina
CA715444

Bush driver
CA715444

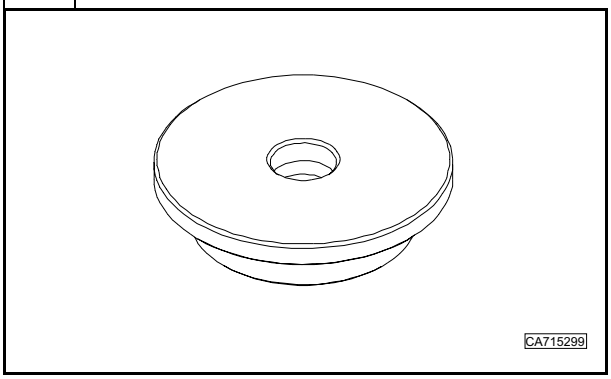
19



Battitoio cuscinetto anello interno
CA715179

Bearing cone driver
CA715179

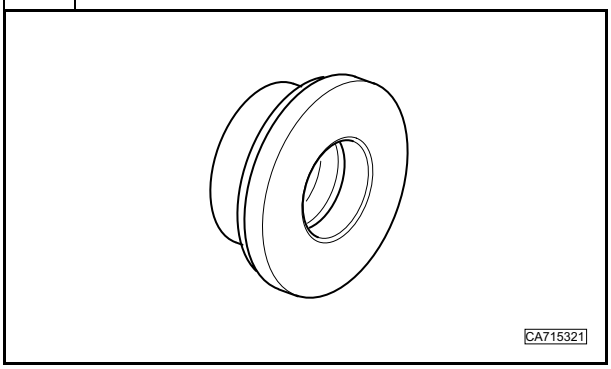
20



Battitoio cuscinetto anello esterno
CA715299

Bearing cup driver
CA715299

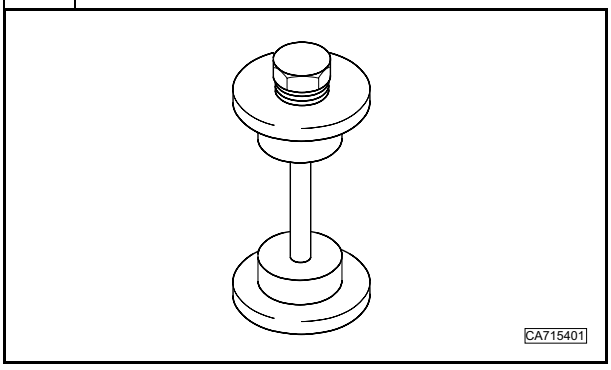
21



Battitoio per anelli di tenuta
CA715321

Driver for oil seal
CA715321

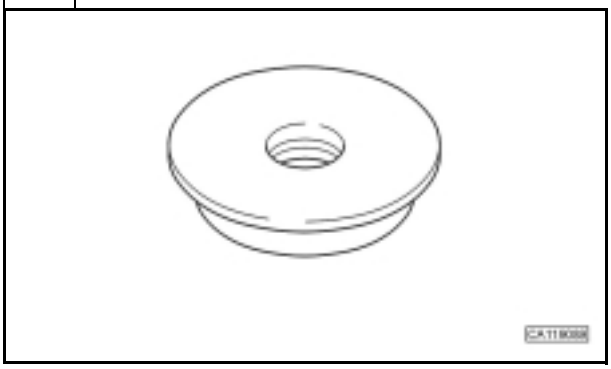
22



Kit inserimento piste cuscinetti
CA715401

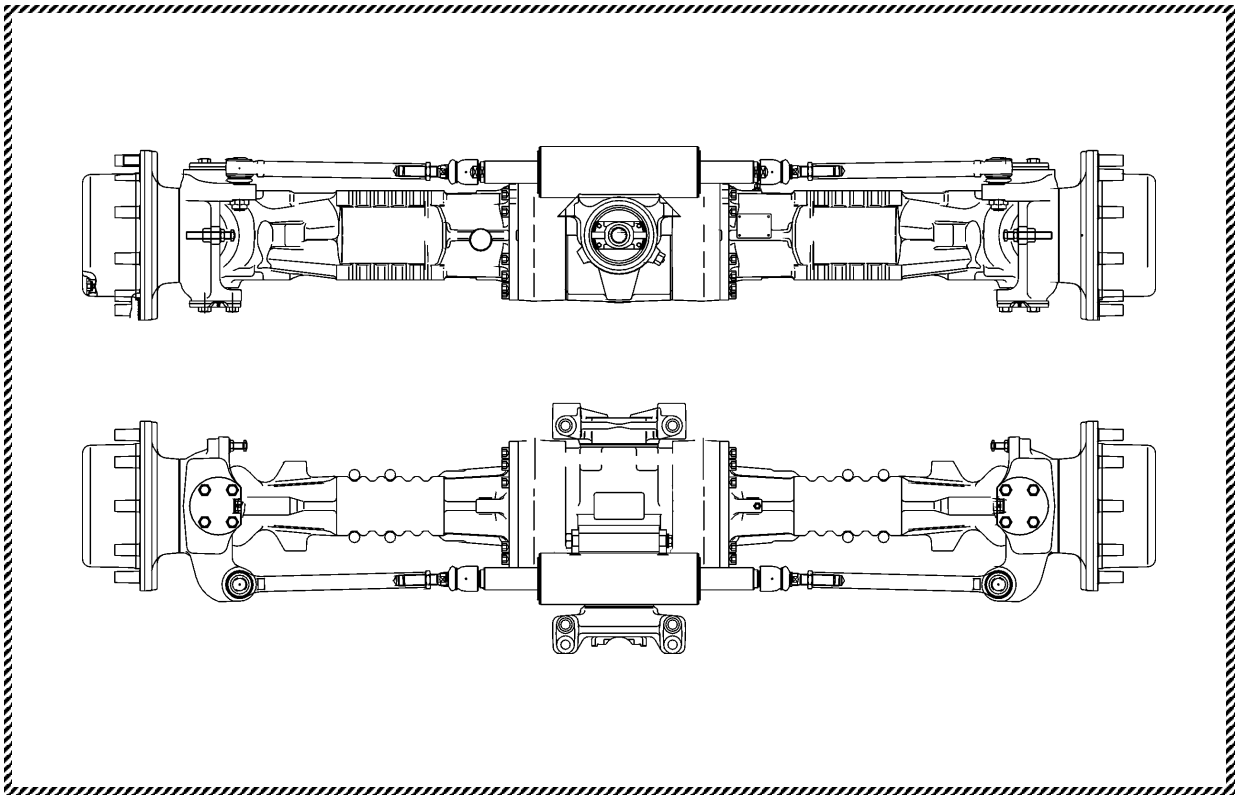
Bearing races insertion kit
CA715401

23



Battitoio per anelli di tenuta
CA119089

Driver for oil seal
CA119089



MANUALE DI RIPARAZIONE

REPAIR MANUAL

ASSALE - *AXLE*

Mod. 26.25M

Rif. CA143690

1ST Edition date: 06/2001

Revision date: 00/00

P/N: CA357153

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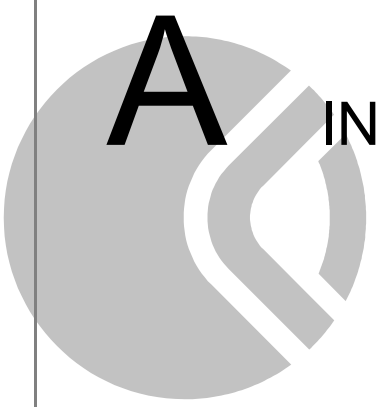

A INFORMAZIONI GENERALI

A GENERAL INFORMATION

A.1 Utilizzo del manuale

Destinatari

- Installatore.
- Utilizzatore.
- Manutentore.

Manutenzione

Il buon funzionamento ed il rendimento degli organi meccanici dipendono principalmente da una costante e corretta manutenzione.
PRENDERE VISIONE DI TUTTO IL MANUALE consente di svolgere correttamente le operazioni di manutenzione ordinaria e straordinaria. L'omissione delle operazioni raccomandate può pregiudicare la durata e l'integrità dell'assale e comportare danni o infortuni all'operatore.
Nell'eventualità di guasti o anomalie il tempestivo intervento da parte di personale specializzato garantisce una durata più lunga del gruppo, evitando danni maggiori nel tempo.

Riparazione

Le procedure per lo smontaggio/montaggio dell'assale consentono di eseguire la revisione totale del gruppo e sono descritte in sequenza con l'ausilio di illustrazioni, per una guida completa e sicura all'esecuzione di ogni operazione.
Nella descrizione delle operazioni si presuppone che l'assale sia stato rimosso dal veicolo. Per la rimozione dell'assale dal veicolo si dovrà consultare il manuale fornito a tale proposito dal costruttore del veicolo stesso.
La conoscenza approfondita del gruppo consente la corretta valutazione del tipo di intervento da eseguire, che può richiedere solamente lo smontaggio di alcuni componenti operando solo parzialmente nel gruppo.

Proprietà delle informazioni

Questo manuale contiene informazioni di proprietà riservata. Tutti i diritti sono riservati.

Questo manuale non può essere riprodotto o fotocopiato, tutto o in parte, senza il preventivo consenso scritto di CARRARO S.p.A. L'uso di questo materiale documentale è consentito solo al cliente a cui il manuale è stato fornito come corredo dell'assale, e solo per scopi di uso, manutenzione e riparazione.

A.1 About manual consulting

End users

- *Installer*
- *User*
- *Maintenance operator*

Maintenance

CONSULT THIS MANUAL THOROUGHLY, as proper functioning and good efficiency of mechanical organs depends mostly on constant and correct routine and extraordinary maintenance which could promote the integrity and duration of the axle and avoid damages or any harm to the operator.
In case of any damages or anomalies, quick intervention of specialized personnel can avoid future impairment and lengthen the working life.

Repair

The disassembly/assembly procedures have been outlined for a total group overhauling. They have also been described in sequence through photographs with relevant explanation for specific interventions, thus obtaining a complete and safe guide for each and every phase of an operation.
Operation description presumes that the axle has already been removed from the vehicle. The manual supplied by the vehicle manufacturer should be consulted in case of a overhauling or maintenance intervention requiring the removal of the axle.
Moreover, the attentive group inspection leads to a correct repair work estimation that could merely require dismounting only few components, and thus operating partially on the group.

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CARRARO S.p.A. dichiara che le informazioni contenute in questo manuale sono congruenti con le specifiche tecniche e di sicurezza dell'assale a cui il manuale si riferisce. Il fabbricante non si assume alcuna responsabilità per danni diretti o indiretti a persone, cose o animali, conseguenti all'uso di questo materiale documentale o dell'assale in condizioni diverse da quelle previste.

CARRARO S.p.A. declares that the subject of this manual consists with the technical and safety specifications of the axle that the manual is referred to. The manufacturer shall not be held liable for direct or indirect damages to persons, things or animals due to an improper use of this document or of the axle or to a different use of them, which does not comply with what is provided for in this manual.

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Fax +39 049 9289111
www.carraro.com

A.2 Convenzioni e definizioni

Convenzioni

Le illustrazioni nel manuale NON sono in scala quindi NON sono attendibili valutazioni delle dimensioni dei componenti basate sulle stesse.
Le illustrazioni hanno il compito di evidenziare le sequenze e le fasi di manipolazione dell'assale e dei suoi componenti, per questo potrebbero non rappresentare esattamente gli elementi di questo assale ma quelli di assali simili.

Definizioni

Lato sinistro: parte sinistra dell'assale vista nel senso di marcia del veicolo.
Lato destro: parte destra dell'assale vista nel senso di marcia del veicolo.

Convenzioni tipografiche

Nota: informazioni importanti, evidenziate al di fuori del testo a cui si riferiscono.
Attenzione: procedure la cui totale o parziale inosservanza può produrre danni alla macchina o alle apparecchiature ad essa collegate.
Pericolo: procedure la cui totale o parziale inosservanza può produrre lesioni o danni alla salute dell'operatore.

Unità di misura

Nel manuale si utilizzano le unità di misura del sistema internazionale (SI). Per la conversione al sistema anglosassone riferirsi alla seguente tabella.

A.2 Agreements and definitions

Agreements

Illustrations like pictures, drawings and components of this manual are NOT in scale, because of limited space and editing limits, therefore they are NOT reliable to obtain values about size or weight.
Illustrations are supposed to point out the various handling sequences and phases of the axle and its components, therefore they could not display exactly the same group elements.

Definitions

***Left side:** it is the left side of the axle considering the vehicle running conditions.*
***Right side:** it is the right side of the axle considering the vehicle running conditions.*

Typographic agreements

***Note:** The notes, pointed out externally to the text they refer, include important information.*
***Warning:** Warning indications point out the procedures, whose partial or complete non-observance can damage the machine or the connected equipment.*
***Danger:** Danger indications point out the procedures, whose partial or complete non-observance can injury the operator.*

Measurements

This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

Tabella di conversione / Conversion table

S.I.		ENGLISH AND USA SYSTEM	
1	(mm)	0.03937	(in)
10	(mm)	0.3937	(in)
25.4	(mm)	1	(in)
6.4516	(cm²)	1	(sq. in)
1	(m²)	1550	(sq. in)
16.378	(cm²)	1	(cu. in)
0.473	(dm²)	1	(U.S. pint)
1	(l)	61.02	(cu. in)
1	(l)	0.2642	(U.S. gal)
1.772	(g)	1	(oz)
0.4536	(kg)	1	(lb)
0.00070308	(kg/mm²)	1	(lb/sq. in)
1	(bar)	14.51	(psi)
1	(kg.m)	7.246	(lb.ft)
1(daN)= 10 (N)= 1,02 (kg.f)		2.24	(lb.f)

Simbologia — Symbology

DESCRIZIONE	SIMBOLI / SYMBOLS	DESCRIPTION
ATTENZIONE avvertenze generali		WARNING general warning
REGOLAZIONI coppie di serraggio / misurazioni		ADJUSTMENTS tightening torques / measurements
ATTREZZATURE SPECIALI		SPECIAL TOOLS
CONTROLLI E SOSTITUZIONI anelli / guarnizioni		CHECK AND REPLACE seals / gaskets
SIGILLANTI COLLANTI		SEALING OR LOCKING FLUIDS
MARCHIARE O SEGNARE		MARK OR INDICATE
RIEMPIMENTO - RABBOCCO OLIO		OIL FILLING OR OIL LEVEL
SCARICO OLIO		OIL DRAIN

A.3 Indicazioni generali

L'assale deve essere controllato e/o riparato solo da personale tecnico specializzato che sia a conoscenza delle sue particolari caratteristiche e delle relative norme di sicurezza (prevenzione infortuni).

Prima di svolgere qualsiasi operazione, pulire accuratamente l'assale rimuovendo eventuali incrostazioni ed accumuli di terriccio e/o grasso.

Tutti gli organi meccanici smontati devono essere accuratamente puliti con prodotti adeguati, per evitare possibili danni. Verificarne l'integrità, sostituendoli in caso di danni, usura, incrinature, grippaggi o difetti che potrebbero compromettere il buon funzionamento dell'assale.
In particolar modo si deve verificare l'integrità delle parti in movimento (cuscinetti, ingranaggi, alberi) e delle parti di tenuta (anelli OR, paraoli), soggette a maggiori sollecitazioni, usura, invecchiamento. Si consiglia di sostituire ad ogni revisione o riparazione gli organi di tenuta.
Si ricordi che la sostituzione di un componente della coppia conica comporta la sostituzione anche dell'altro.

Utilizzare solo le parti di ricambio e la viteria indicate, inoltre usare utensili metrici per la viteria metrica e inglesi per la viteria inglese.

Come indicato nelle istruzioni di disassemblaggio, alcune operazioni sono distruttive per alcuni componenti dell'assale. Leggere attentamente le descrizioni delle varie fasi dell'intervento ed operare con attenzione per non compromettere la funzionalità di altri elementi.

A.3 General description

The axle should be checked and/or repaired only by qualified technicians, acquainted with its peculiar features and well aware of all safety instructions.

Before performing any operation it is advisable to carry out axle cleaning accurately by removing oil/ grease encrustations and accumulation.

All disassembled mechanical parts must be cleaned accurately with suitable products to avoid possible damage. Parts should be replaced if damaged, worn out, cracked, seized, etc. as they could affect proper functioning of the axle.
Rotating parts (bearings, gears, shafts) and that of hardware/fasteners (O-Ring, oil seals) should be examined carefully, as they are subject to major stress, wearing and ageing.
We highly advice to replace tightening parts during every teardown or repair.
Replacing one part of the bevel gear set requires the replacement of the other part too.

Use appropriate spare parts, nuts and bolts to avoid any other problems. Moreover, use metric tools for metric nuts and bolts and Imperial tools for the others.

Please read the disassembly instructions very carefully because some operations are destructive for some axle components and in order to avoid the elements damage operate advertently.

A.4 Raccomandazioni generali per le operazioni di smontaggio e montaggio

Prima di iniziare le operazioni di smontaggio e montaggio leggere attentamente le seguenti avvertenze.

Anelli di tenuta per alberi

Per il montaggio degli anelli di tenuta attenersi alle seguenti raccomandazioni:
- Pulire accuratamente l'albero ed assicurarsi che non sia danneggiato, rigato od ovalizzato nelle zone di contatto con gli anelli.
- Montare gli anelli in modo che il labbro sia rivolto verso il lato olio.
- Lubrificare il labbro degli anelli (usare preferibilmente olio) e riempire per 3/4 di grasso la camera degli anelli stessi.
- Montare gli anelli usando un appropriato calettatore. Non usare il martello direttamente sugli anelli.
- Non danneggiare gli anelli durante il montaggio dell'albero.

Anelli OR

Lubrificarli adeguatamente prima di inserirli nella propria sede evitando "arrotolamenti" durante il montaggio dell'albero.

Spessori di registro

Per le registrazioni utilizzare gli appropriati spessori di registro, misurandoli singolarmente.
La misurazione del pacco completo o la stampigliatura riportata sugli spessori stessi può risultare non sempre affidabile: verificare.

Cuscinetti

Per un corretto montaggio è consigliabile riscaldarli in forno ad una temperatura di 80°C - 90°C prima di montarli sui rispettivi alberi o raffreddarli prima di inserirli nelle relative sedi con piantaggio esterno.Usare sempre gli estrattori idonei per rimuovere i cuscinetti.
Prima di rimontarli, pulirli, ispezionarli e lubrificarli.

Spine elastiche

Al montaggio delle spine elastiche ad intaglio assicurarsi che l'intaglio delle stesse sia orientato nel senso dello sforzo sollecitante la spina.
Le spine elastiche a spirale invece non necessitano di alcun orientamento di montaggio.

Sigillante

Usare sigillanti secondo le specifiche. Assicurarsi che le parti da sigillare siano pulite, asciutte e completamente prive di grasso.

A.4 General recommendations for disassembly and assembly operations

Before starting any disassembly and assembly operations, read carefully the following recommendations.

Shafts seals

Respect the following recommendations during shaft seal assembly:
- Clean shaft very carefully and ensure that the part in contact with the shaft seal is not damaged, cut or out of roundness.
- Assemble the seals so that the lip is fitted towards the oil side.
- Lubricate seal lips (use oil) and fill 3/4 of seal cavity with grease.
- Use appropriate drivers. Do not use a hammer directly on the seals.
- Do not damage the seals while assembling the shaft.

O-rings

Lubricate adequately before inserting them at the right place and avoid rolling while inserting the shaft.

Adjusting shims

Use appropriate adjusting shims and measure each one separately.
Complete group measurement or stampings on the shims are not always reliable: check

Bearings

Its advisable to heat up bearings to 80°C - 90°C before assembling them onto their respective shafts or to cool them (dry ice) before inserting them into corresponding bore.Always use suitable extractors to remove the bearings. Before reassembling the bearings, clean, check and lubricate them.

Split pins

Before assembling elastic pins, make sure that the notch is oriented towards the stressing force.
Spiral elastic pins do not need orientation.

Sealing

Use sealing as advised by specifications. Ensure that parts to be sealed are clean, dry and completely grease free.

Scarico dell'olio

Prima di intervenire sul prodotto è necessario scaricare l'olio dal gruppo.
ATTENZIONE
Smaltire gli oli esausti nel rispetto delle vigenti norme.

Oil drain

Before disassembly, oil should be drained out.

WARNING
Disposal of used oil must be done according to laws

Pulizia

Lavare accuratamente tutte le parti in movimento relativo (ingranaggi, cuscinetti, ecc.) utilizzando gasolio o cherosene.
E' da evitare l'uso di benzina e soluzioni acquose alcaline. Evitare lavaggi con vapore o acqua calda perché sarebbe difficile eliminare completamente l'umidità superficiale.
Asciugare accuratamente tutti i particolari mediante un getto d'aria o stracci per evitare di rigare le superfici con residui abrasivi.
Tutte le superfici devono essere ricoperte da un leggero strato di lubrificante per proteggerle da eventuali ossidazioni.

Cleaning

Wash all moving parts (gears, bearings, etc.) accurately with diesel fuel or kerosene.
Avoid gasoline and watery alkaline solutions. Do not wash with steam or hot water, as it will be very difficult to eliminate surface humidity.
Dry all parts with a rag or air jet to avoid scratching from abrasive residuals.
All surfaces should be covered with lubricant so as to protect it from future oxidation.

Controlli

Verificare accuratamente tutti i cuscinetti, gli anelli esterni eventualmente ancora piantati nelle proprie sedi e i perni su cui rotolano i rullini. Sostituire quei particolari che presentano tracce di usura o di danneggiamento.
Controllare che tutti gli ingranaggi non presentino avarie od usure eccessive delle dentature: gli smussi dei denti non devono essere deteriorati.
Controllare che tutti i tratti scanalati siano privi di usure eccessive o di altri danneggiamenti.
Sostituire i particolari avariati con ricambi originali.
Dopo ogni smontaggio è buona norma sostituire le guarnizioni di tenuta sugli alberi rotanti.

Checks

Examine accurately all bearings, external rings which may be still stuck in their position and pivot pins on which rolls rotate. Replace those which are worn out or damaged.
Gears should not be spoiled and teething should not be excessively worn out. Teeth smoothing should not be deteriorated.
Check all grooves: assure that they are not worn out or damaged.
Replace spoiled parts with original spare parts.
Replace seals on rotating shafts, before reassembly.

Estremità di flange ed attrezzi

Prestare la massima attenzione quando si martellano le estremità di attrezzi o di flange per evitare di compromettere la funzionalità e l'integrità sia degli attrezzi che dei componenti su cui si opera.

Ends of flanges and tools

Be careful when hammering tool or flange ends, in order to avoid jeopardizing functionality and integrity of either the tools or the components on which you are operating.

Metodi di riassemblaggio

Per riassemblare il gruppo si deve impiegare un'adeguata attrezzatura di sostegno.
Per posizionare il gruppo, per smontare e rimontare la corona dentata e per sostenere la scatola ingranaggi è necessario un sistema di sollevamento.
Per facilitare le operazioni di smontaggio e montaggio utilizzare un disegno di assieme del gruppo.

Reassembly ways

In order to reassemble the group, an appropriate fixture must be used.
In order to position the group, to disassemble and reassemble the ring gear and to support the gear housing, a lifting system is needed.
To make disassembling and assembling operations easier, use a group assembly drawing.

Impiego di lubrificante

Per ottenere una corretta lubrificazione ed una esatta temperatura di funzionamento negli assali CARRARO, è importante usare i lubrificanti raccomandati mantenendone il livello costante secondo quanto indicato nel presente manuale.

Lubricant use

In order to lubricate the CARRARO axles correctly and to reach the exact operation temperature, it is important to use the recommended lubricants , keeping their level constant as indicated in this manual.

B CARATTERISTICHE GENERALI

B GENERAL SPECIFICATIONS

B.1 Usi previsti

Questo assale è stato progettato e costruito per essere installato in macchine di tipo industriale. L'assale è un componente che ha la funzione di trasmettere la potenza dal motore alle ruote.
L'assale in oggetto, costruito secondo specifiche fornite dal cliente, permette:

- l'aumento della forza di trazione riducendo il numero di giri;
- la compensazione della velocità delle ruote interne con quelle esterne durante la sterzata.

Non installare mai questo assale su macchine diverse da quelle per cui e stato progettato e costruito.

L'assale, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto ad "uso non previsto".
CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.
Costituisce inoltre un elemento essenziale, nell'ambito dell'uso previsto, l'osservanza scrupolosa delle modalità di funzionamento e delle regolari manutenzioni e riparazioni specificate da CARRARO SpA.

B.1 Foreseen uses

This axle has been designed and manufactured to be mounted on industrial machines.
The axle is a component that transmits the power from the engine to the wheels.
The axle, manufactured according to the customer's technical specifications, allows:

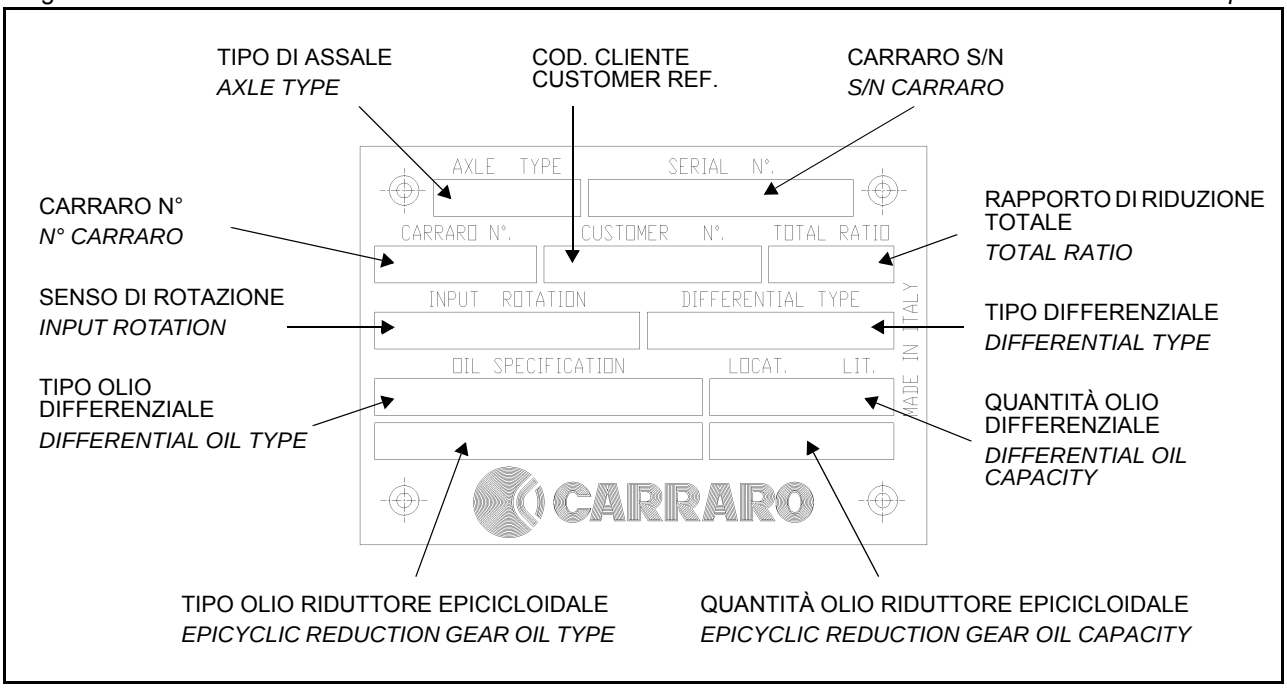
- *increasing of tractive force, reducing the number of revolutions*
- *adjusting of inner wheels' speed with outer wheels' speed during steering.*

Never mount this axle on machines different from the ones for which it has been designed and manufactured

If the axle is used for any other purpose than the one foreseen, CARRARO SpA declines any responsibility regarding damages or accidents caused by it. All consequences will be at the expense of the client.
However, when used as foreseen, operational formalities as well as regular maintenance repair specifications given by CARRARO SpA are to be observed strictly.

B.2 Identificazione del prodotto *B.2 Product identification*

Targhetta di identificazione dell'assale *Axle serial plate*



B.3 Descrizione generale

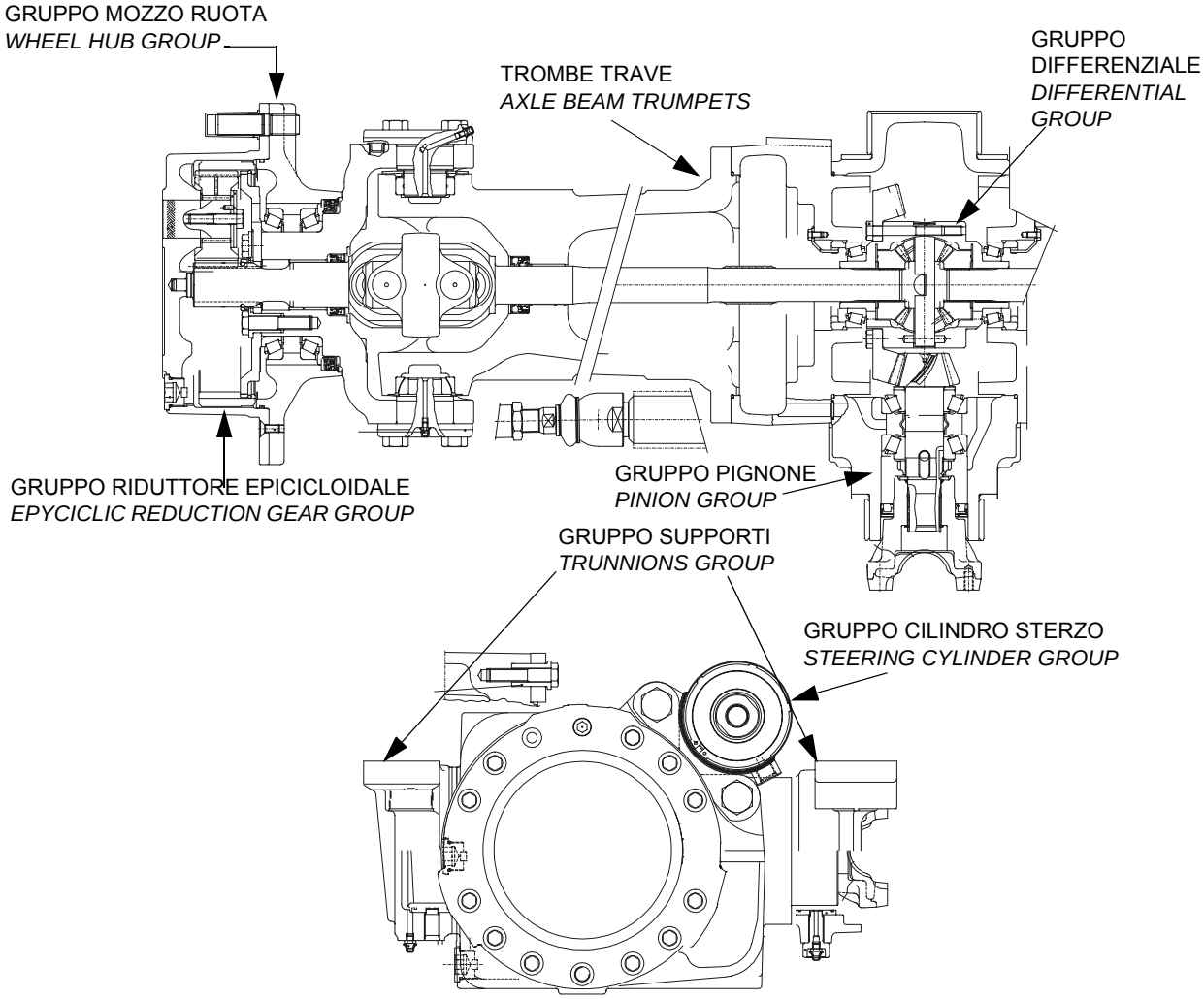
L'assale in oggetto, progettato e costruito secondo le richieste del cliente, è costituito da un corpo trave contenente il gruppo differenziale nella parte centrale e dai gruppi mozzo ruota alle estremità.
Il gruppo differenziale, autobloccante di tipo "standard", è supportato da due cuscinetti montati in un'apposita struttura ove è possibile effettuare le operazioni di registrazione della coppia conica.
La posizione della corona conica si registra agendo su due ghiere contrapposte, mentre quella del pignone conico, supportato da due cuscinetti, si effettua mediante interposizione di spessori di registro.
I mozzi ruota contenenti i riduttori epicicloidali, sono supportati da due cuscinetti a rulli conici e vengono comandati da un gruppo sterzante ad azionamento idraulico.
La struttura viene completata da una coppia di supporti oscillanti per il fissaggio del veicolo.

B.3 General description

The axle described in this manual, designed and manufactured following the customer's requests, consists of a beam casing, housing the differential in the middle and a wheel hub unit at each end.
The differential, type "standard", is supported by two bearings mounted on a suitable structure allowing the bevel gear set to be adjusted.
The ring bevel gear is adjusted by means of two ring nuts located opposite each other.
The position of the bevel pinion, supported by two bearings, is adjusted by inserting adjusting shims.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings and are powered by a hydraulically-operated steering unit.

The structure is completed with a pair of swing-supports to secure the vehicle.



B.4 Caratteristiche Tecniche — *B.4 Technical Features*

CODICE ASSALE	CA143690	*AXLE CODE*
MODELLO ASSALE	26.25M	*AXLE MODEL*

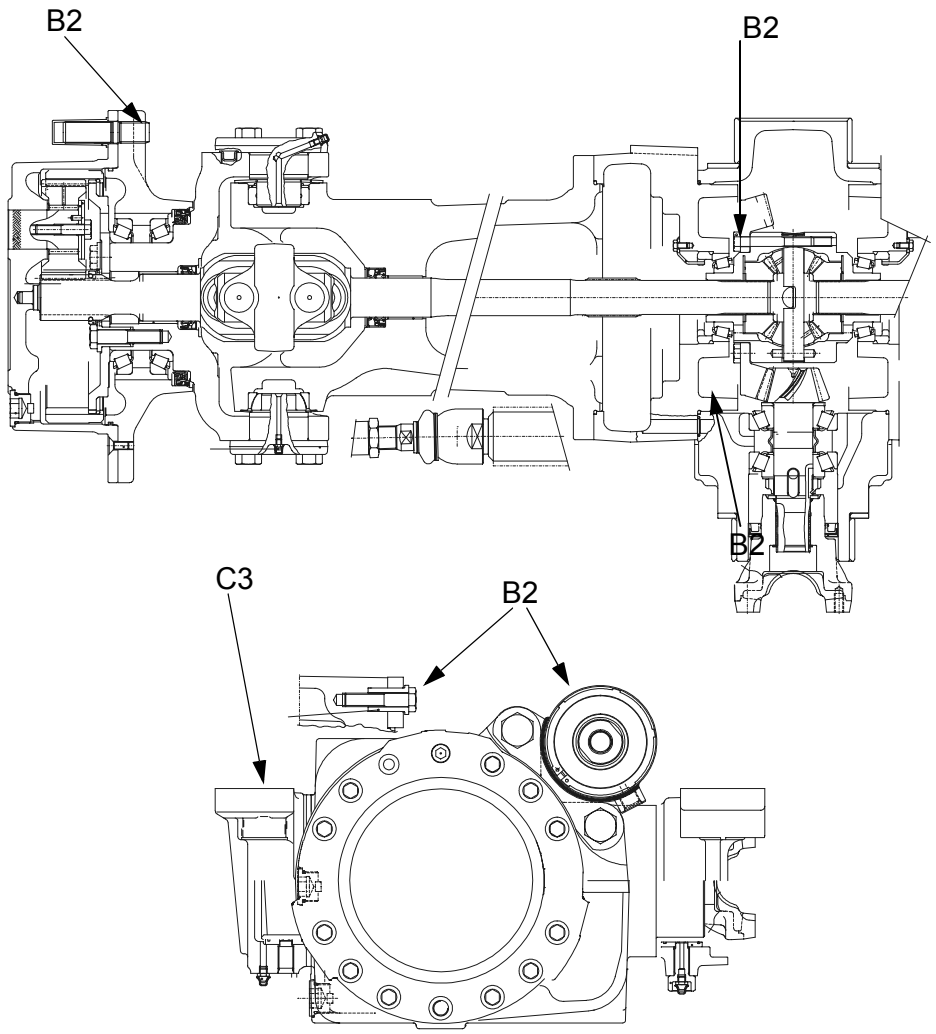
TIPO DIFFERENZIALE		*DIFFERENTIAL TYPE*
Standard	●	*Standard*
Limited Slip	○	*Limited Slip*
Limited Slip “Ball Type”	○	*Limited Slip “Ball Type”*
Bloccaggio meccanico 100% ad attuazione idraulica positiva o negativa	○	*100% Mechanical lock, hydraulically controlled (positive or negative)*
Con frizione multidisco in bagno d’olio	○	*With multidisc clutch in oil bath*
Bloccaggio meccanico 100% ad attuazione elettromagnetica	○	*100% Mechanical, electromagnetically controlled*
“No spin”	○	*“No spin”*

DESCRIZIONE	VALORI VALUES	*DESCRIPTION*
Riduzione coppia conica	3.5 / 1	*Bevel gear ratio*
Riduzione epicicloidale	6.923 / 1	*Epicyclic ratio*
Riduzione Trasmissione	---	*Transfer Box ratio*
Riduzione totale	24.23 / 1	*Total ratio*
Peso a secco	517 Kg	*Dry weight*
Rotazione in entrata SENSO ORARIO SENSO ANTIORARIO	 ● ○	*Input rotation* *CLOCK WISE (C.W.)* *COUNTER CLOCK WISE (C.C.W.)*
Angolo di sterzata	Max 55° $^{0}_{-3}$	*Steering angle*
Convergenza	A $^{0}_{-2}$	*Toe-in*
Specifica olio IN PRESENZA DI DIFFERENZIALE LIMITED SLIP, USARE I TIPI DI OLIO INDICATI OPPORTUNAMENTE ADDITIVATI NOTA: NON USARE OLIO DI SINTESI SENZA IL CONSENSO DEL COSTRUTTORE	SAE 80W - 90 EP to comply API GL4 respectively MIL-L-2105 and MIL-L-2105D	*Oil Specification* *IN PRESENCE OF DIFFERENTIAL LIMITED SLIP, USE RECOMMENDED OIL ENRICHED IN ADDITIVES* *NOTE: DO NOT USE SYNTHETIC OIL WITHOUT CONSENT OF THE MANIFACTURER*
Quantità olio differenziale	11 litri/Liter	*Differential oil capacity*
Quantità olio riduttore epicicloidale	1,3 + 1,3 litri/Liter	*Epicyclic reduction oil capacity*

DESCRIZIONE	VALORI VALUES	*DESCRIPTION*
Grasso	POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2	*Grease*
Gioco di accoppiamento coppia conica	0.16÷0.22 mm	*Bevel gear set backlash*
Precarico cuscinetti pignone conico "P" (misurato sul D=34,8 mm senza anello di tenuta)	P= 9.2÷13.8 daN	*Pinion bearings preload "P" (measured D=34,8 mm without seal)*
Precarico totale cuscinetti corona-pignone "T" (misurato sul D=34,8 mm senza anello di tenuta)	T= (P+3.2)÷(P+4.7) daN	*TPinion / crown gear total preload "T" (measured D=34,8 mm without seal)*
Tipo flangia pignone	end yoke 1480	*Pinion flange type*

Sigillanti e collanti

Sealing compounds and adhesives



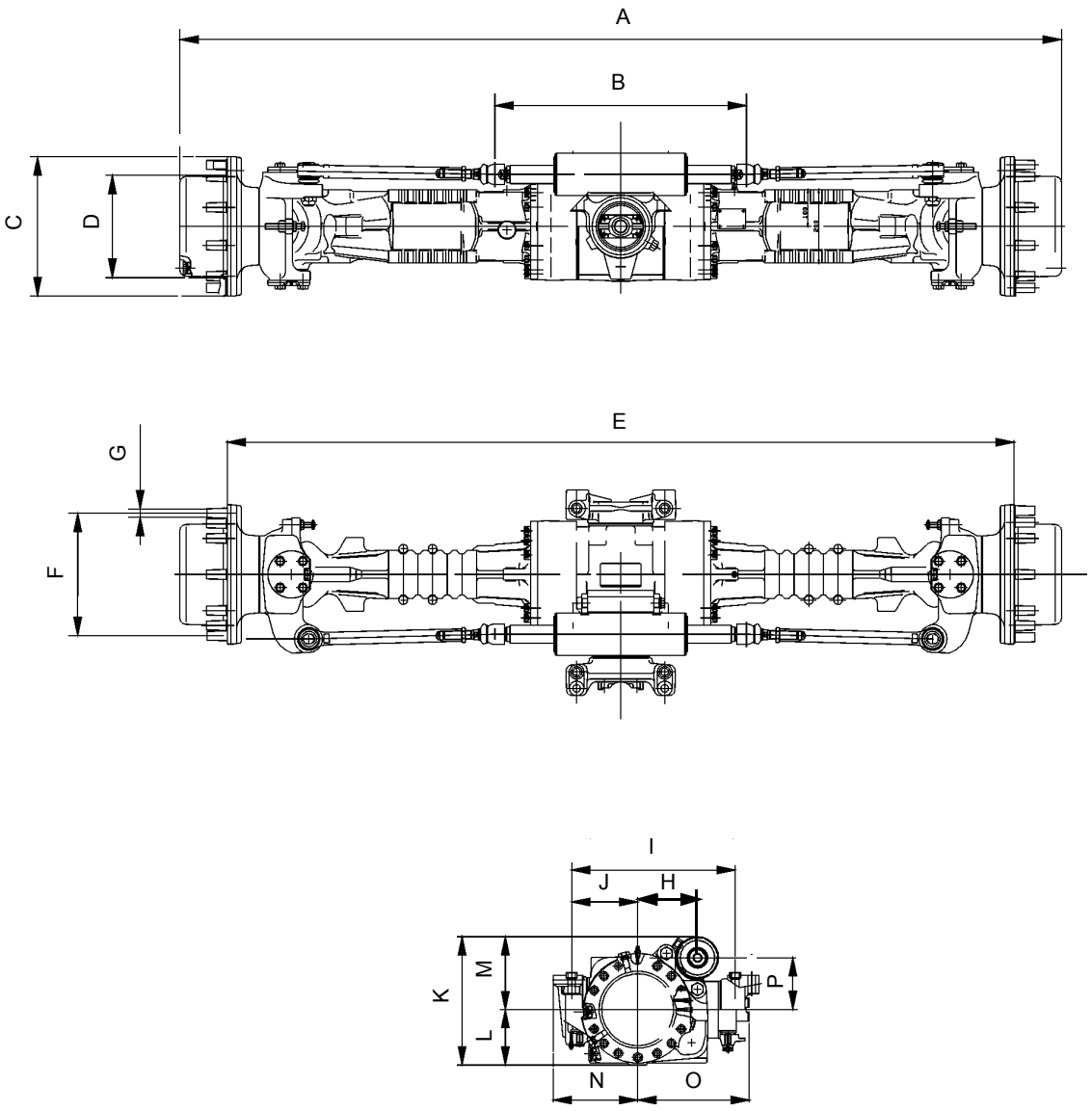
A1= LOCTITE® 510	○	B2= LOCTITE® 270	●
A2= LOCTITE® 573	○	C1= LOCTITE® 405	○
A3= LOCTITE® 518	○	C2= LOCTITE® 496	○
B1= LOCTITE® 542	○	C3= LOCTITE® 638	●
◁- - - - - -	Applicare sulle superifici a contatto		
	Apply on the contact surfaces		
◀——	Applicare sulla filettatura delle viti / sui perni		
	Apply on bolt screws / on pins		

Dimensioni d'ingombro

Overall dimensions

(in millimetri)

(Millimeter)



A = 2304
B = 686
C = Ø 380
D = Ø 280
E = 2100

F = Ø 335
G = M22 x 1.5
H = 163
I = 446,7
J = 180

K = 350
L = 151
M = 199
N = 230
O = 320
P = 142

B.5 Rifornimento e verifiche — *B.5 Filling and checks*

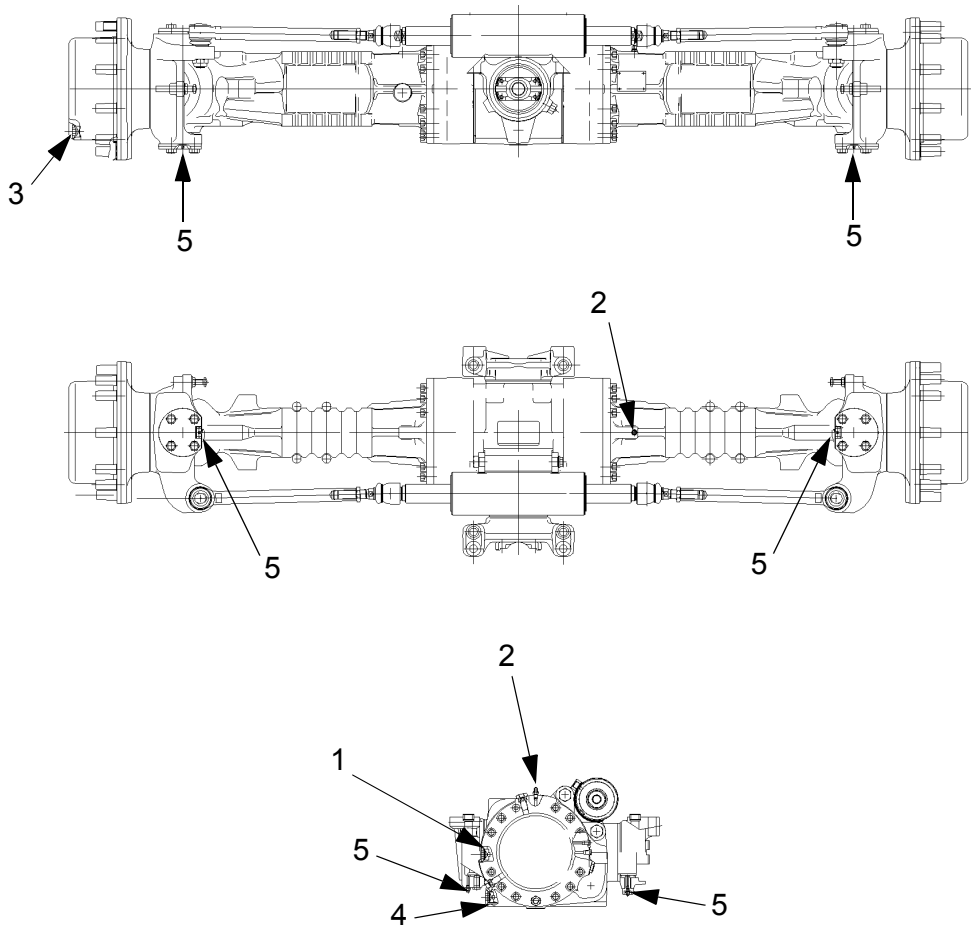
PUNTI DI LUBRIFICAZIONE	POSIZIONE / *POSITION*	*LUBRICATION POINT*
TAPPO CARICO E LIVELLO OLIO DIFFERENZIALE	1	*DIFFERENTIAL OIL FILLING AND LEVEL PLUG*
SFIATO OLIO	2	*OIL BREATHER*
TAPPO CARICO, SCARICO E LIVELLO OLIO RIDUTTORE EPICICLOIDALE	3	*FILL / DRAIN AND LEVEL PLUG OF EPICYCLIC REDUCTION GEAR OIL*
TAPPO SCARICO OLIO DIFFERENZIALE	4	*DIFFERENTIAL OIL DRAIN PLUG*
PUNTI DI INGRASSAGGIO	5	*GREASING POINTS*

Controlli periodici:

Il livello del lubrificante nell'assale deve essere a filo del tappo di controllo (**1**) e (**3**), altrimenti provvedere al rabbocco con olio dello stesso tipo.
Nel caso in cui si riscontri una perdita o altro che determini l'abbassamento del livello, è opportuno intervenire immediatamente onde evitare possibili danni agli organi meccanici.
Per scaricare l'olio dell'assale svitare il tappo (**4** e **3**).

Routine checks:

*In the axle, lubricant should be flush with control plug (**1**) and (**3**). If not, make up level with the same oil.*
If leakage or any other factor determining fall in the oil level is found, then it is advisable to check immediately, in order to avoid damages to the mechanical parts.
*Loosen and remove the drain plug for oil draining (**4** and **3**).*



B.6 Programma di lubrificazione *B.6 Service schedule*

OPERAZIONE	▲ PRIMO INTERVENTO *FIRST TIME*	◆ AD OGNI STAGIONE OD OGNI 1500 ORE(1) *SEASONALLY OR EVERY 1500 OPERATING HOURS(1)*	*OPERATION*
CAMBIO OLIO ASSALE	150 - 200 ore/*hours* ●	◆ ■	*AXLE OIL CHANGE*
OPERAZIONI DI LUBRIFICAZIONE	▲ ■	◆ ■	*LUBRICATION WORKS*
CONTROLLO ED EVENTUALE RABBOCCO OLIO	50 - 100 ore/*hours* ■	mensilmente/*monthly* ●	*CHECK AND IN CASE ADJUST OIL LEVEL*
PULIZIA TAPPO MAGNETICO SCARICO OLIO	150 - 200 ore/*hours* ■	ad ogni cambio olio/ *every oil change* ●	*CLEAN MAGNETIC OIL PLUGS*
PULIZIA SFIATO OLIO	▲ ■	mensilmente/*monthly* ●	*CLEAN OIL BREATHER*
INGRASSAGGIO	150 - 200 ore/*hours* ●	settimanalmente/*weekly* ●	*GREASING*

legenda

● operazioni eseguibili solamente da personale autorizzato dal costruttore

■ operazioni eseguibili solamente da personale addestrato

(1) quale delle due condizioni si verifica prima

remarks

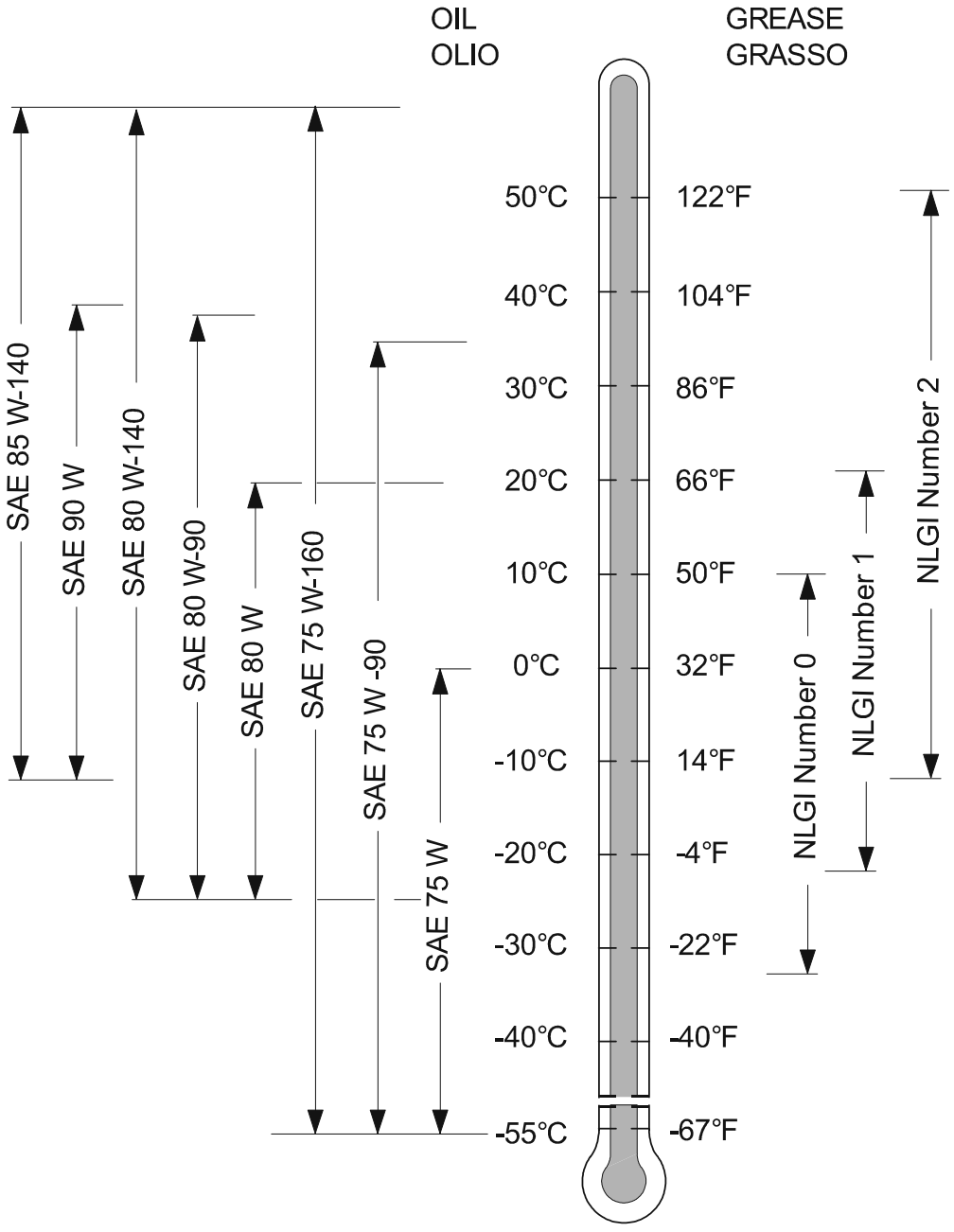
● *operation performed only by personnel authorized by the manufacturer*

■ *operation performed only by trained personnel*

(1) which of both conditions comes first

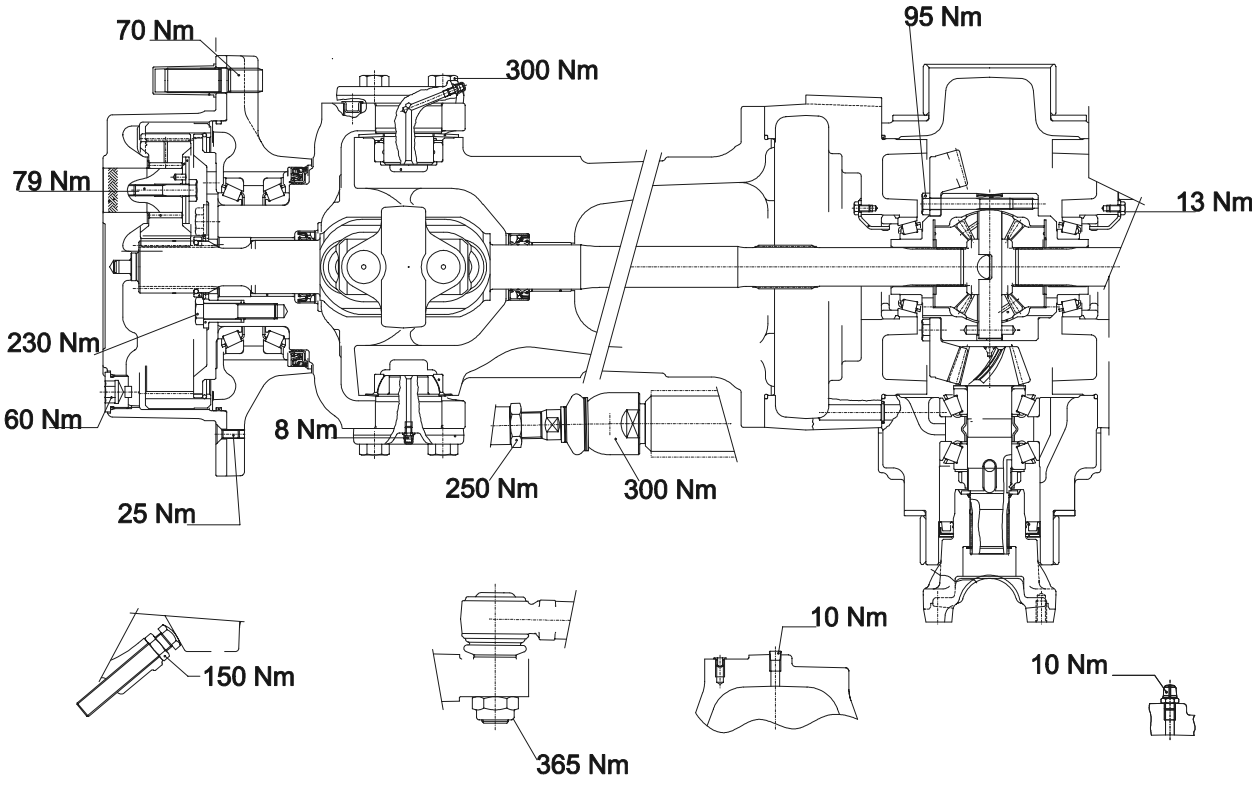
B.7 Lubrificazione / ingrassaggio: gradazioni e relativi campi di applicazione

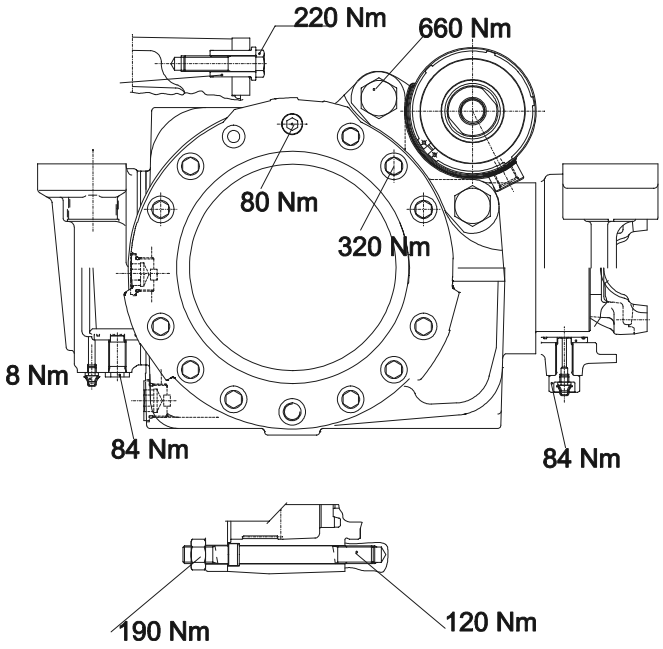
B.7 Lubrication / greasing: grades and application range



B.8 Coppie di serraggio

B.8 Tightening torques





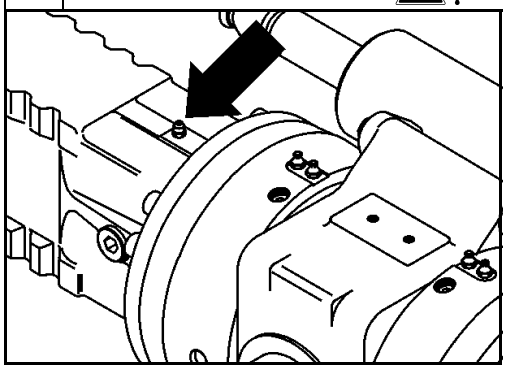
B.9 Controlli generali

Le descrizioni di smontaggio e montaggio presuppongono che il gruppo sia già stato rimosso dal veicolo e posizionato su un adatto banco di lavoro.
Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

B.9 General checks

The disassembly/assembly instructions presume that the unit has been removed from the vehicle and positioned on a suitable workbench.
Some of the following pictures may not show exactly your axle, but the procedure is the same.

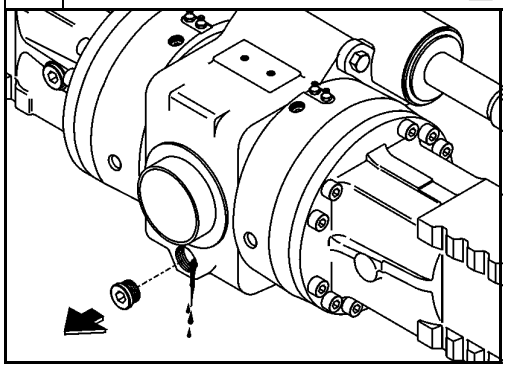
1



Prima di effettuare l'operazione di scarico dell'olio, svitare l'apposito sfiato per eliminare eventuale pressione interna. Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8).

Before draining the oil, loosen the breather to release possible internal pressure, then tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

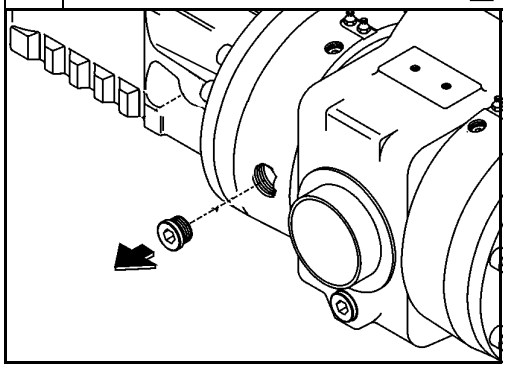
2



Per effettuare lo scarico dell'olio dal corpo centrale svitare il tappo del foro di scarico. Richiuderlo poi con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8).

Drain the oil from the appropriate plug, then tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

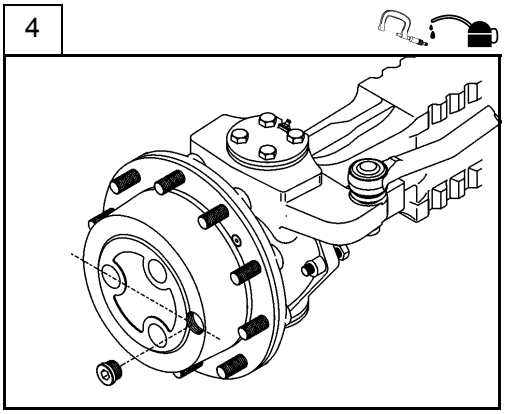
3



Verificare il livello dell'olio ed eventualmente rabboccare attraverso il foro del tappo indicato e richiuderlo poi con una chiave dinamometrica alla coppia prevista (sez. B8).
Nota: prima di agire sul tappo dell'olio, svitare l'apposito sfiato per eliminare l'eventuale pressione interna.

Check the oil level and if necessary top up through the bore of the plug marked with an arrow, then tightenthe plug with a torque wrench to the prescribed torque (sec. B.8).
***Note:** before draining the oil, loosen the breather to release possible internal pressure.*

4



Prima di effettuare l'operazione di scarico o rabbocco dell'olio dal riduttore epicicloidale, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro in modo da eliminare l'eventuale pressione interna, quindi rimuoverlo completamente.
Ruotare gradualmente il mozzo fino a disporlo con il foro all'altezza dell'asse ruota in modo che la linea di livello dell'olio sia orizzontale.
Verificare il livello dell'olio ed eventualmente rabboccare.
Riavvitare il tappo con una chiave dinamometrica serrandolo alla coppia prevista (Sez. B.8)

Before draining the oil from the epycicloidal reduction, position the wheel hub so that the filer cap is in the highest point, then loosen the plug to release possible internal pressure.
Position the wheel hub so that the filer cap is on the centre line of the horizontal axis.
Check oil level and top up if necessary.
Tighten the plug with a torque wrench to the prescribed torque (Sec. B.8).

C INFORMAZIONI SULLA SICUREZZA

C *SAFETY INSTRUCTIONS*

C.1 Raccomandazioni generali per la sicurezza

IMPORTANTE:
Prima di iniziare qualsiasi tipo di operazione leggere attentamente questo capitolo.

Precauzioni per la sicurezza:

Il corretto uso e la corretta riparazione degli assali e dei loro componenti sono molto importanti per la sicurezza e l'affidabilità.
Le procedure raccomandate e descritte in questo manuale sono testate, quindi sono effettivi metodi operativi. Seguire strettamente ogni procedura facendo uso sia del testo che delle illustrazioni.
Alcune di queste procedure mostrano l'uso di appositi strumenti progettati perché le operazioni vengano condotte in modo chiaro e corretto.
Alcuni strumenti specifici devono essere usati dove necessario per eseguire determinate operazioni.
E' impossibile trattare ogni metodo di lavoro o tutte le possibili metodologie per svolgerlo e le rischiose conseguenze di ognuna, perciò chi usa procedure o strumenti non consigliati deve sapere che la sicurezza dell'operatore e del veicolo saranno messi a repentaglio.

Pericolo
Gli occhiali di sicurezza devono essere indossati sempre durante l'esecuzione di tutte le operazioni di montaggio o smontaggio.

C.1 General safety recommendations

IMPORTANT:
Before proceeding with any operations please read this chapter very carefully.

Safety precautions:

Correct use and repair of axles and of their components is very important for safety and reliability.
Recommendations and all described procedures given in this manual have been experimented and hence are effective operational methods. Please follow every procedure. Use the text as well as the illustrations.
Certain procedures show use of special tools, designed so that the operations can be carried out in a clear and correct manner.
Special tools must be used when a particular operation is being carried out.
It is impossible to advice every working method or know all possible methodologies for carrying it out or to predict risky consequences of each operation. Hence, performing procedures or using instruments which have not been advised could be dangerous for the operator/mechanic as well as the vehicle.

Danger
Safety goggles must be worn while carrying out every assembling or disassembling operations.

C.2 Simboli di sicurezza

Identificazione delle informazioni sulla sicurezza

Questo è il simbolo di allarme per la sicurezza; quando lo trovate sulla macchina o sul manuale, siete avvisati del pericolo potenziale di incidenti o danni alla persona. Seguite i suggerimenti e le raccomandazioni per operare in sicurezza.

Significato delle scritte di avvertimento

PERICOLO

AVVISO

ATTENZIONE

Una scritta di avvertimento (PERICOLO, AVVISO o ATTENZIONE), viene usata insieme al simbolo di allarme per la sicurezza.
I segnali PERICOLO o AVVISO sono utilizzati vicino ad aree pericolose. PERICOLO identifica la situazione più pericolosa.
Precauzioni generali sono invece segnalate da ATTENZIONE.

Seguire le istruzioni di sicurezza !

Leggere con cura tutti i messaggi sulla sicurezza di questo manuale.

Modifiche non autorizzate possono compromettere il funzionamento, la sicurezza d'impiego e la durata.
Se non comprendete le istruzioni del manuale, contattate il rappresentante a voi più vicino.

C.2 Safety symbols

Recognize safety information

This is the safety alarm symbol; whenever you find it in the manual or see it on the machine, you are being warned about potential danger of accidents or harm to personnel. Follow the do's and don't's to operate in total safety.

Understanding written warnings

DANGER

WARNING

CAUTION

Written warning (DANGER, WARNING or CAUTION) is used along with an alarm symbol.
DANGER or WARNING signs are used near danger zones, while CAUTION sign indicates general precaution.

Follow safety instructions !

Read all suggestions given in this instruction manual very carefully.

Unauthorized changes could endanger the functioning, work safety and work span.
If you do not understand this instruction manual, contact the nearest sales representative.

C.3 Precauzioni generali

In ogni movimento dovranno essere osservate le norme sulla prevenzione infortuni, tutte le regole generali di sicurezza e di medicina del lavoro.
Prima di procedere nelle operazioni di manutenzione o sistemazione di eventuali problemi, assicurarsi del buon stato e del buon funzionamento delle attrezzature quali banchi di sostegno, cavalletti, martelli, leve, estrattori e chiavi apposite facilitando le operazioni da svolgere in modo ottimale riducendo i rischi sia per gli organi ed i componenti del prodotto che della incolumità dell'operatore.
Tutte le modifiche arbitrarie apportate al prodotto sollevano la CARRARO SpA da ogni responsabilità per qualsiasi danno o incidente.
Il prodotto, se utilizzato in un impiego diverso da quello previsto, è da considerarsi soggetto a "uso non previsto". CARRARO SpA declina ogni responsabilità per danni o incidenti risultanti da un uso diverso da quello previsto; tali conseguenze saranno a carico esclusivo del cliente.

Norme per la manutenzione in sicurezza

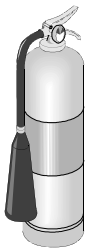
1 Operare in ambiente pulito e asciutto.
2 Non lubrificare, manipolare o registrare il gruppo in moto.
3 Tenere lontani mani, piedi, indumenti da parti in movimento.
4 Essere sempre pronti per i principi di incendio. Tenere a portata di mano estintore e cassetta di pronto soccorso.
5 Tenere in evidenza il n° di telefono di un medico, ambulanza, ospedale e vigili del fuoco presso il proprio telefono.

C.3 General precautions

Observe safety instructions, accident prevention rules and all general safety regulations in each and every step at work.
Before going ahead with maintenance or repair work ensure that all the tools, the supporting bench, stands, levers, extractors and spanners are in good condition so that the work can be carried out easily.
Risks to various parts and components will also be reduced in this way and working condition for the operator will also be safer.
CARRARO SpA declines any responsibility in case of an accident or damage resulting due to changes made arbitrarily on product.
The product is used for any other purpose different from the one foreseen, than CARRARO SpA declines any responsibility.
In this case all consequences will be at the customer's expense.

Safety maintenance rules

1 *Operate in a clean and dry environment.*
2 *Do not lubricate, handle or adjust the group underway.*
3 *Keep off your hands, feet and clothing from moving parts.*
4 *Be always prepared for fires. Keep the extinguisher and the first aid kit within reach.*
5 *Keep the phone numbers of a doctor, of an ambulance, of a hospital and of the fire department within reach near the telephone set.*



6 Usare indumenti e protezioni adatte allo scopo come: tuta, guanti protettivi e cuffie.
7 Usare protezioni auricolari appropriate a salvaguardare l'udito, come tappi o cuffie per le orecchie contro rumori molesti o fastidiosi.

6 *Wear suitable clothing and protections as overalls, safety gloves and ear safety devices.*
7 *Use suitable ear protections, like ear plugs, to keep out noise and prevent injury to the ears.*

Un'esposizione prolungata al rumore può danneggiare l'udito.

8 Le attrezzature richiedono la piena attenzione dell'operatore. Non usare cuffie per ascoltare musica mentre si interviene sul prodotto o gruppo.

Eliminazione dei rischi residui

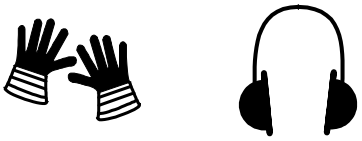
- Rischio di schiacciamento e cesoiamento dovuto alla presenza di elementi in movimento.
  Attenzione
  Eseguire tutte le operazioni di manutenzione a macchina ferma.

- Rischio dovuto all'inalazione di gas nocivi che si possono sviluppare scaldando le vernici durante eventuali saldature.
  Attenzione
  Utilizzare postazioni di lavoro dotate di sistemi di evacuazione di polveri e fumi.
  Lasciate disperdere i fumi per almeno 15 minuti prima di saldare o riscaldare, o riprendere a lavorare sul gruppo.

- Rischio di incendio dovuto ai solventi utilizzati e all'olio presente nell'assale.
  Attenzione
  Tenere lontano dalla zona di lavoro ogni fonte di calore.
  Quando si usano solventi o svernicianti, rimuoverli con acqua e sapone prima di saldare.
  Rimuovere i contenitori di solvente, sverniciante o altri prodotti infiammabili dall'area di lavoro.

- Rischio dovuto alla caduta, allo sganciamento o alla violenta espulsione di oggetti o olio dall'assale.
  Attenzione
  Questi rischi residui e le procedure per eliminarli completamente, sono evidenziati dettagliatamente nelle procedure di montaggio e smontaggio. Seguire attentamente, durante la manutenzione, tutte le procedure di sicurezza indicate nel manuale.

A prolonged exposure to noise can damage your hearing.



8 *The operator must be very careful with the equipment. Do not use headphones to listen music while you are working on the product or on the group.*

Residual risk elimination

- *Risk of squashing and shearing due to the presence of moving parts.*
  Warning
  Carry out all maintenance operations when the machine is stationary.

- *Risk due to inhalation of poison gases that can be produced by heating the varnishes during any welding.*
  Warning
  Use work stations equipped with dust and fume discharging systems.
  Let the fumes disperse for at least 15 minutes, before welding or reheating, or working on the group again.

- *Risk of fire due to the solvents used and to the oil in the axle.*
  Warning
  Keep off any heat sources from the working area.
  When solvents or paint removers are used, they should be removed with soap and water, before welding.
  Remove any containers of solvent, paint remover or any other inflammable products from the working area.

- *Risk due to fall, drop or violent ejection of objects or oil from the axle.*
  Warning
  These residual risks and the suitable relative procedures to eliminate them completely are pointed out, in detail, in the assembly and disassembly procedures. During maintenance, follow carefully all the safety procedures indicated in the manual.

D OPERAZIONI DI SMONTAGGIO

D DISASSEMBLY OPERATIONS

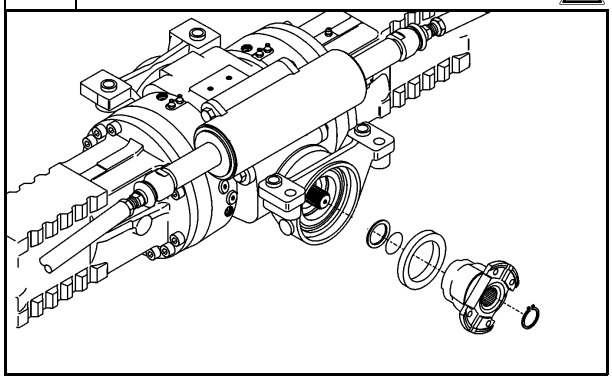
D.1 Smontaggio gruppo supporti assale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.1 Axle trunnions group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

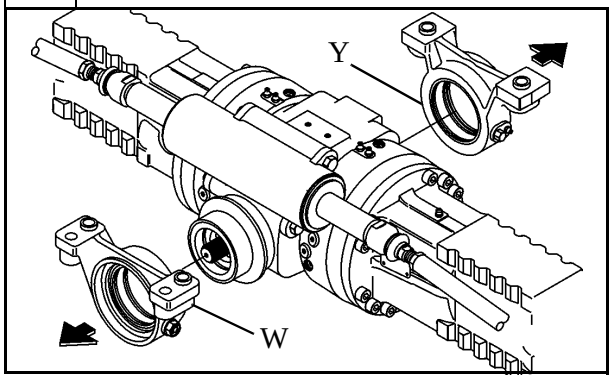
1



Togliere l'anello seeger e sfilare la flangia.
Nota: Attenzione a recuperare l'OR e lo spessore.

Remove the snap ring and the input flange.
***Note:** Collect the O-ring and the washer.*

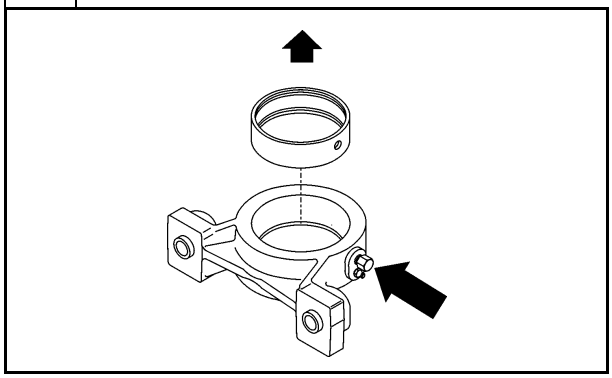
2



Sfilare il supporto posteriore "**Y**" e anteriore "**W**".

*Remove rear "**Y**" and front "**W**" trunnions.*

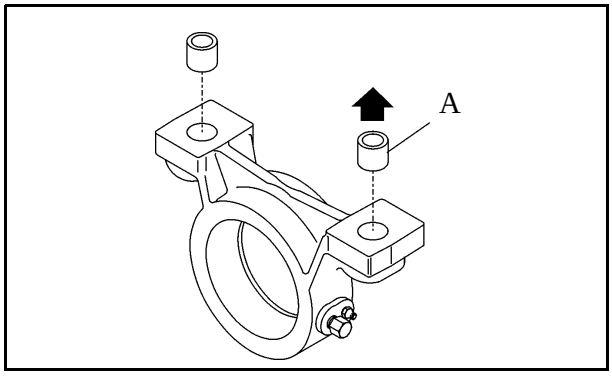
3



Allentare la vite ed estrarre la boccola di rasamento dal supporto posteriore.

Loosen the screw and pull the bushing out of the rear trunnion.

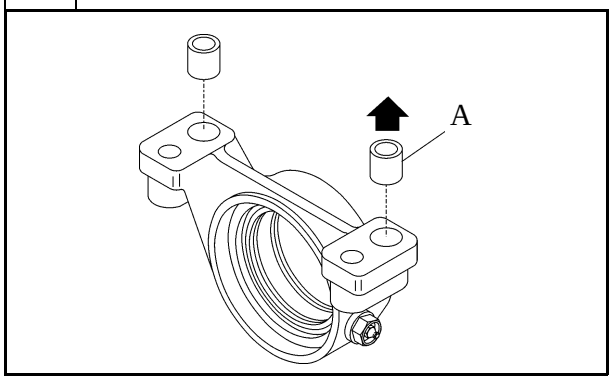
4



Se necessario verificare e sostituire le due spine di centraggio "**A**" dal supporto posteriore.

*Check and replace if necessary the "**A**" center pin of rear trunnion.*

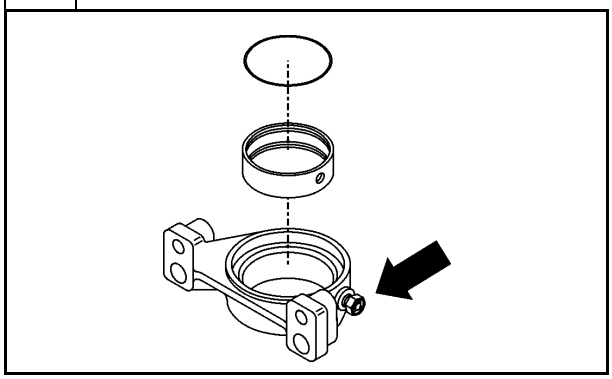
5



Se é necessario verificare e sostituire le due spine di centraggio "**A**" dal supporto anteriore.

*Check and replace if necessary the "**A**" center pin of front trunnion.*

6



Allentare la vite forata ed estrarre la boccola di rasamento dal supporto anteriore.
Togliere e verificare le condizioni di usura dell'anello OR.
Sostituire se necessario.

Loosen the drilled screw and take the bushing out of the front support.
Remove the O-ring and inspect it for wear.
Replace if necessary.

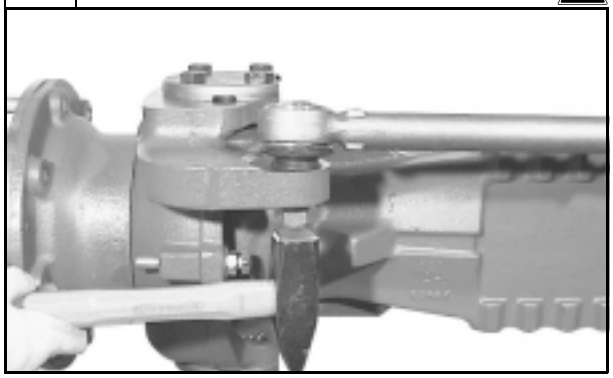
D.2 Smontaggio gruppo cilindro sterzo

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.2 Steering cylinder group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

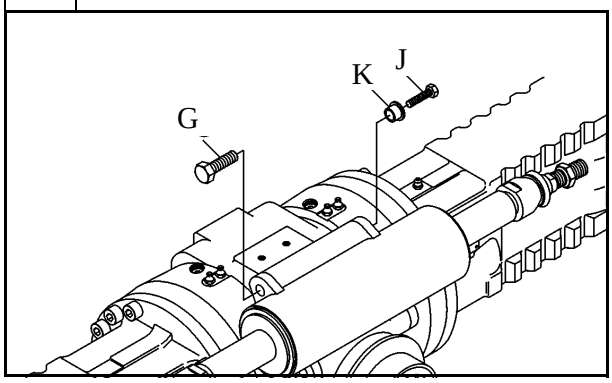
1



Allentare il dado di fissaggio dell'asta guida di qualche giro fino a portarlo a filo del perno filettato.
Con un martello battere sul dado per staccare l'asta guida dalla calotta.
Nota: questa operazione è distruttiva per il dado.

Loose the guide rod locknut of some turns till it is on a level with the threaded pin
Beat on the nut with a hammer in order to disjoin the guide rod from the swivel housing.
Note: *this is a destructive operation for the nut.*

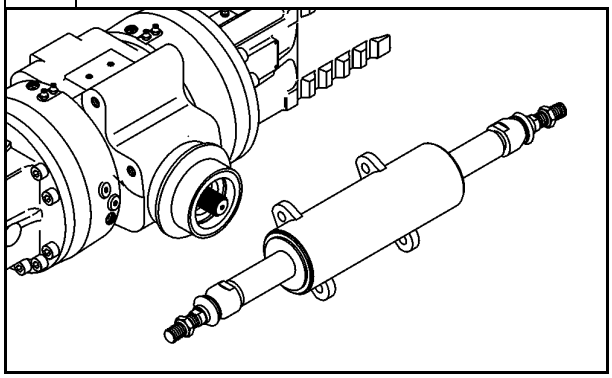
2



Togliere il cilindro sterzo, svitando le viti "**G**" e "**J**", insieme alle boccole "**K**".

*Remove the steering cylinder, by unscrewing bolts "**G**" and "**J**", together with the bushes "**K**".*

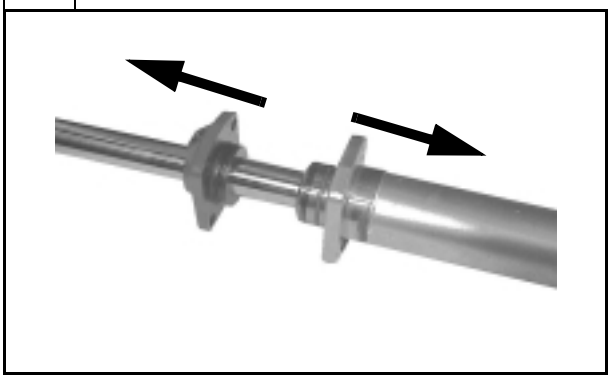
3



Una volta rimosso il cilindro sterzo, verificarne le condizioni. Rimuovere il tirante dell'asta guida allentando con chiave adatta il dado di bloccaggio e controllarne poi le condizioni.

Once removed the steering cylinder, check its conditions. Remove the guide rod link by loosing the tie nut with a suitable wrench, then check its conditions.

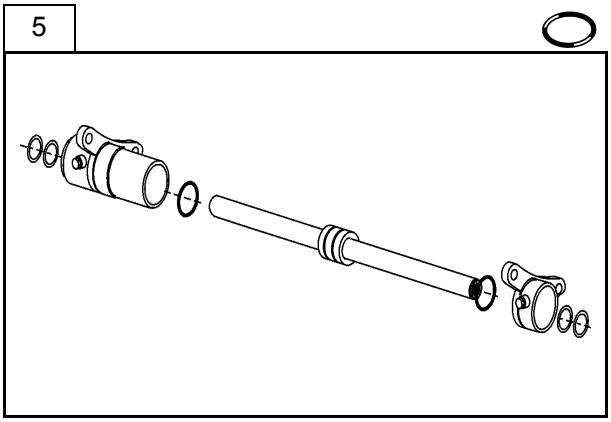
4



Staccare la testata dal corpo del cilindro e sfilare lo stelo.

Detach the cylinder head from the cylinder case and remove off the rod.

5



Sfilare la testata dallo stelo e recuperare tutti gli anelli di tenuta, sia dal corpo cilindro che dallo stelo.

Remove off the cylinder head from the rod, making sure not to lose any of the sealing and O-Rings both from the cylinder head and the rod.

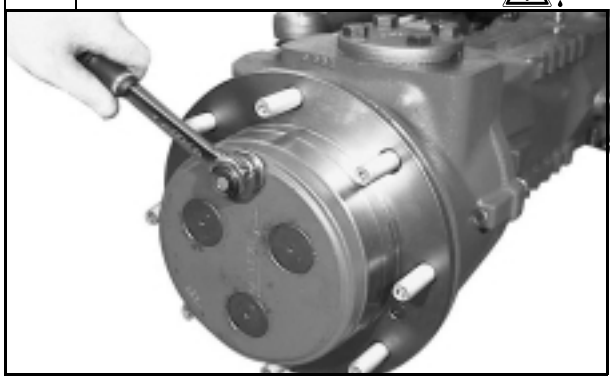
D.3 Smontaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.3 Epicyclic reduction gear disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

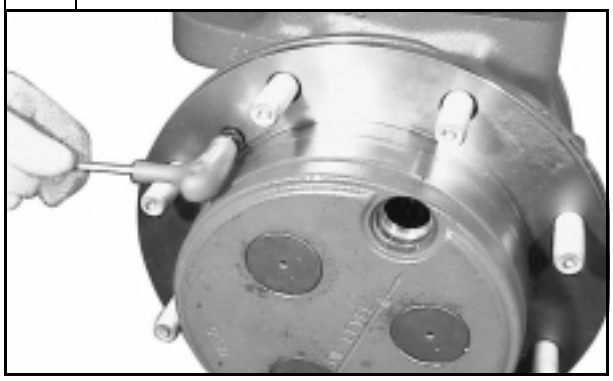
1



Prima di effettuare l'operazione di scarico dell'olio, posizionare il mozzo ruota con il tappo nel punto più alto e svitarlo di qualche giro per eliminare eventuale pressione interna, quindi rimuoverlo completamente. Ruotare il mozzo fino a portare il foro nel punto più basso.
Scaricare completamente l'olio.

Before draining the oil, position the hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, and then remove it completely.Turn the hub upside-down till the hole is in the lowest point.
Drain the oil completely.

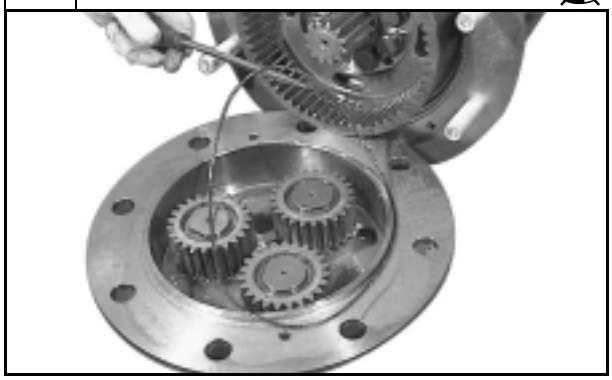
2



Svitare e togliere le due viti di fissaggio del treno portasatelliti con una chiave da commercio.

Unscrew and remove the two fastening screws of the planetary carrier with a wrench.

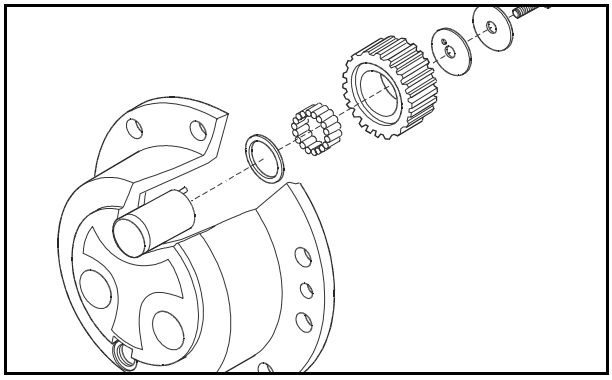
3



Rimuovere il treno portasatelliti dal mozzo ruota.
Posizionare il treno portasatelliti su di un piano e verificarne le condizioni di usura.
Recuperare l'anello O-Ring e controllare le sue condizioni.

Remove the planetary carrier from the wheel hub. Position the planetary carrier on a table and check its wear conditions.
Remove the O-ring and check its conditions

4



Per eseguire l'eventuale sostituzione degli ingranaggi satelliti:
- rimuovere la vite di fissaggio di ogni satellite;
- rimuovere le rondelle;
- estrarre i satelliti dai perni;
- recuperare i relativi rullini verificandone le condizioni;
- rimuovere le rondelle di rasamento.

Nota: con nuovi satelliti è consigliabile montare rullini nuovi.

To carry out any possible replacements of the planetary gears:
- *remove the fastening screws on every planetary gear;*
- *remove the washers;*
- *take the planetary gears out of the pins;*
- *collect the needle bearings, checking their conditions;*
- *remove the thrust washers.*

Note: *with new planetary gears is advisable to assembly new roller bearings.*

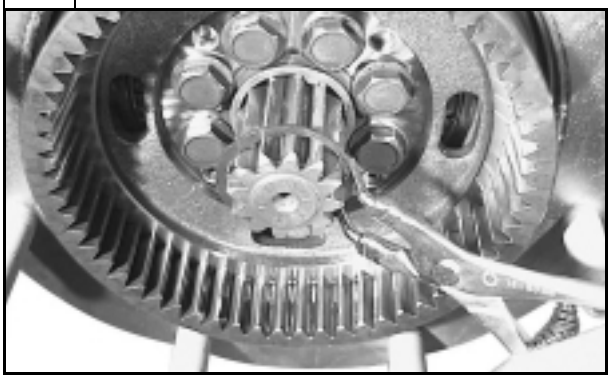
D.4 Smontaggio gruppo mozzo ruota

D.4 Wheel hub group disassembly

Prima di smontare il mozzo ruota, assicurarlo con una cinghia o una fune ad un paranco od altro sistema di sostegno, per evitarne la caduta accidentale che potrebbe danneggiare sia l'operatore che il gruppo.

Before disassembling the splined sleeve, it is advisable to secure it with a belt or a rope on a hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

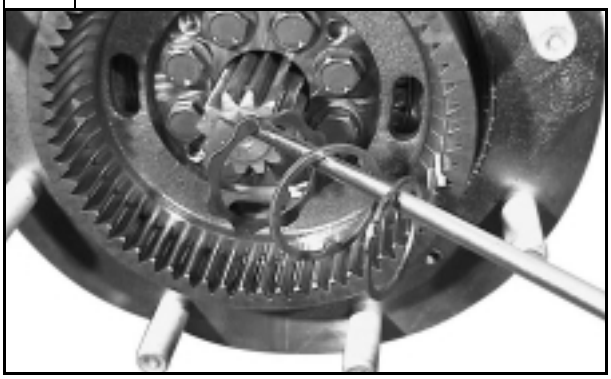
1



Rimuovere l'anello d'arresto dal semiasse con una pinza adatta.

Remove the snap ring from the U-Joint shaft using suitable pliers.

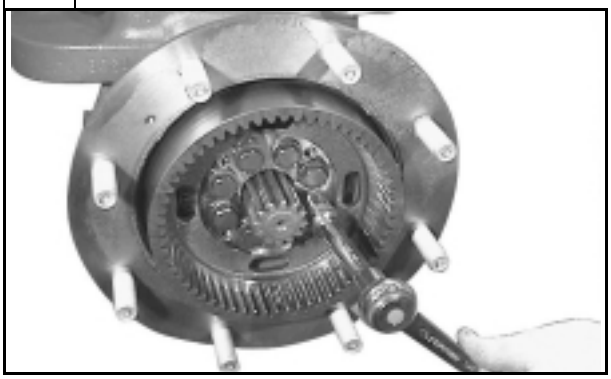
2



Sfilare e recuperare le rondelle dal semiasse.

Remove and collect the axle shaft washers.

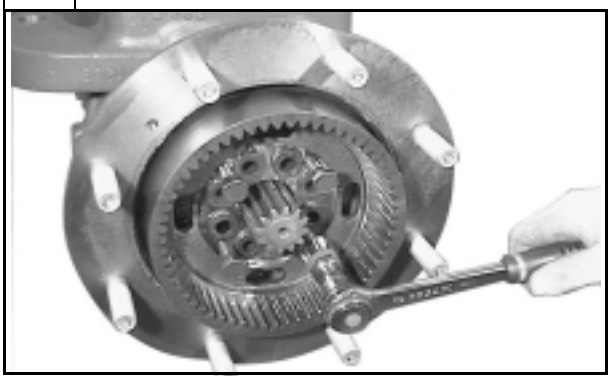
3



Svitare e togliere le viti di fissaggio del mozzo-fermo corona.

Unscrew and remove the fastening screws from the hub-lock ring gear.

4



Per sfilare il mozzo-fermo corona dalla sua sede, recuperare almeno due delle viti appena tolte ed avvitarle nei fori filettati di estrazione.

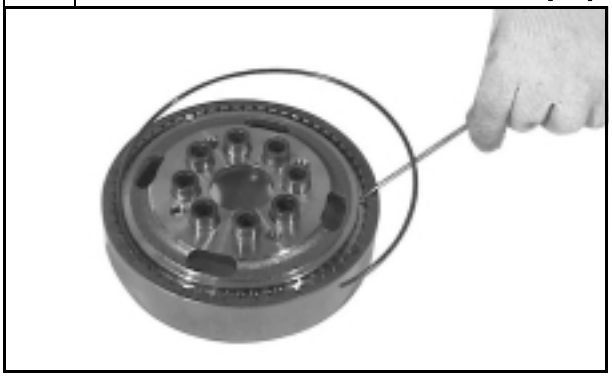
To remove the hub-lock ring gear from its housing, screw at least two of the just removed screws in the threaded extraction holes.

5

Estrarre e rimuovere il mozzo-fermo corona completo di corona epicicloidale.

Extract and remove the hub-lock ring gear together with the epicyclic ring gear.

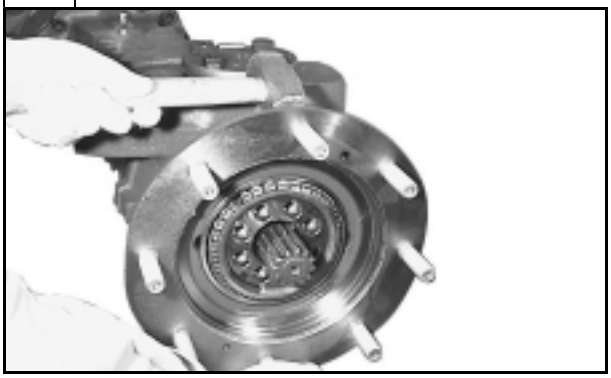
6



Rimuovere l'anello di arresto d'acciaio e separare il mozzo-fermo corona dalla corona epicicloidale.
Verificare lo stato di usura dei particolari.
Solo se necessario, togliere le bussole di centraggio del mozzo-fermo corona con un martello e l'attrezzo cod. CA715027.

Remove the steel stop ring and disjoin the hub-lock ring gear from the epicyclic ring gear. Check the wear conditions of the components. Only if necessary, remove the centering bushes of the hub lock ring gear with a hammer and the special tool code CA 715027.

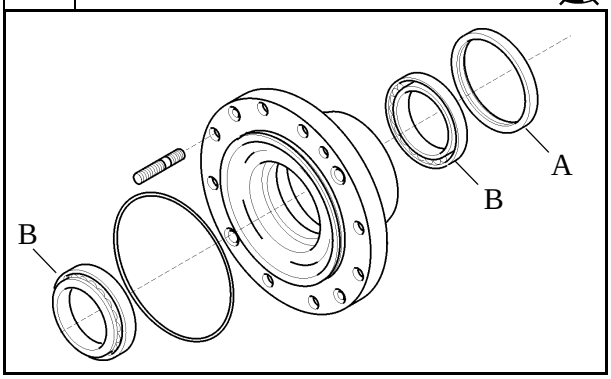
7



Sfilare il mozzo ruota, facilitando lo smontaggio con leve e martello.
Nota: recuperare la pista interna del cuscinetto.

Remove the hub, using levers and a hammer to facilitate the operation.
***Note:** collect the bearing cone.*

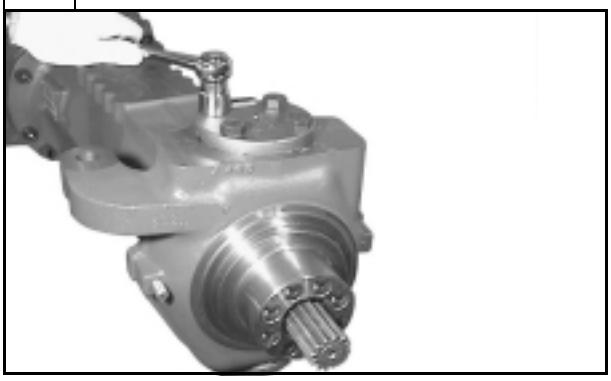
8



Posizionare su di una superficie piana il mozzo ruota ed estrarre l'anello di tenuta (**A**) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Estrarre le piste esterne dei cuscinetti (**B**), da entrambi i lati del mozzo ruota, con un battitoio ed un martello.
Togliere la pista interna del cuscinetto dal codolo della calotta, utilizzando un estrattore da commercio.

*Position on a flat surface the hub and take the seal ring out (**A**) with a lever.*
***Note:** this is a destructive operation for the seal ring.*
*Take the bearing cups out (**B**), on both sides of the hub, using a hammer and a suitable tool to be beaten. Remove the bearing cone from the swivel housing end, using a suitable extractor.*

9



Svitare e togliere le viti di fissaggio del perno snodo superiore ed inferiore.

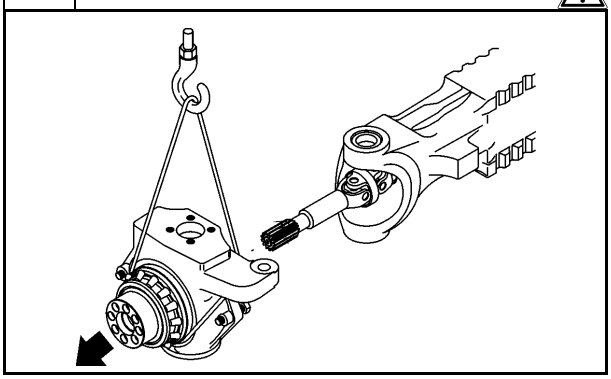
Unscrew and remove the fastening screws from the upper and lower king pin.

10

Prima di rimuovere i perni snodo, assicurare la calotta con una cinghia o una fune ad un paranco od altro sistema di sostegno.
Rimuovere i perni.

Before removing the king pins, secure the swivel housing with a belt or a rope to a hoist or any other supporting device.
Remove the king pins.

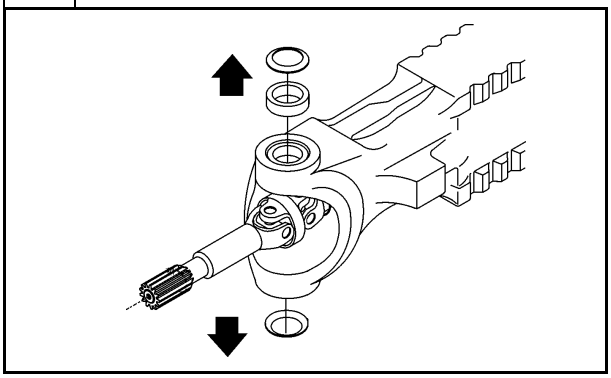
11



Sfilare la calotta dal trave e dal semiasse corto del doppio giunto.

Remove the swivel housing from the axle beam and from the short axle shaft of the U-Joint.

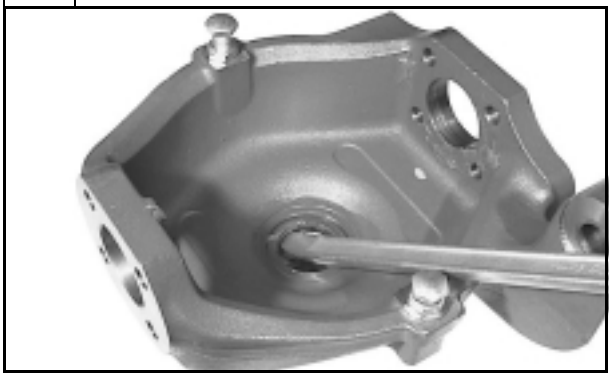
12



Recuperare le molle a tazza e lo spessore dalla parte inferiore e superiore del trave.

Remove the Belleville washers and the shim from the upper and lower side of the axle beam.

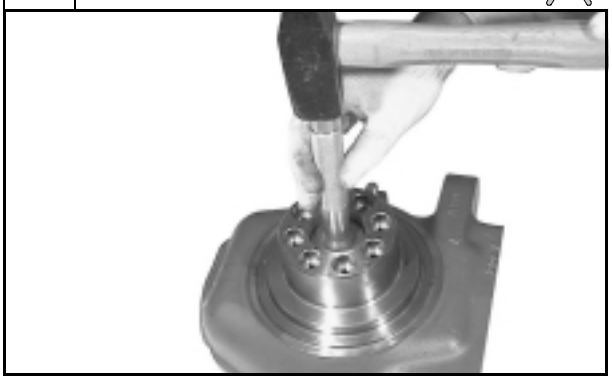
13



Posizionare la calotta su di una superficie piana ed estrarre l'anello di tenuta con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.

Position the swivel housing on a flat surface and take the oil seal ring out with a lever.
***Note:** this is a destructive operation for the seal ring.*

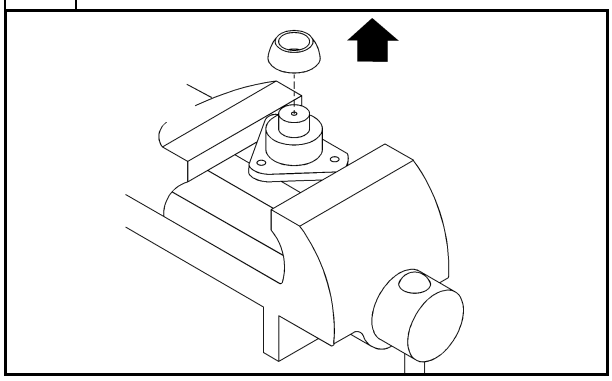
14



Girare la calotta ed estrarre la bronzina utilizzando un battitoio adatto ed un martello.

Turn the swivel housing and take the bushing out, using a suitable tool and a hammer.

15



Estrarre le boccole dai perni snodo con estrattore da commercio.

Take the bushings out of the king pins with a suitable extractor.

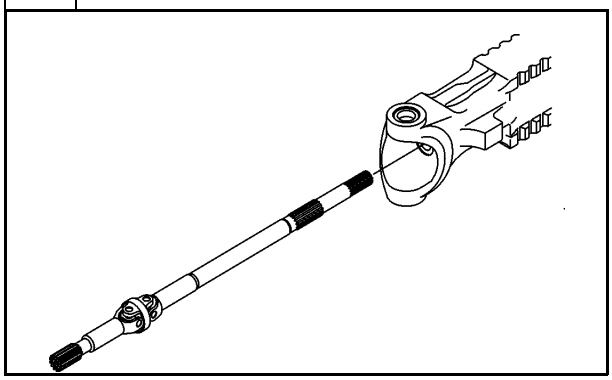
D.5 Smontaggio trombe trave

D.5 Axle beam trumpets disassembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

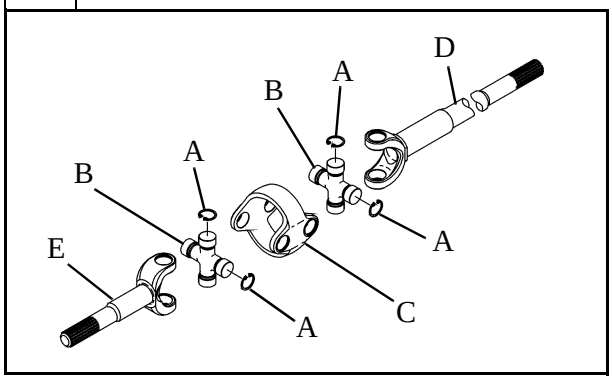
1



Estrarre dal trave il doppio giunto completo.

Remove the complete double-joint from the beam

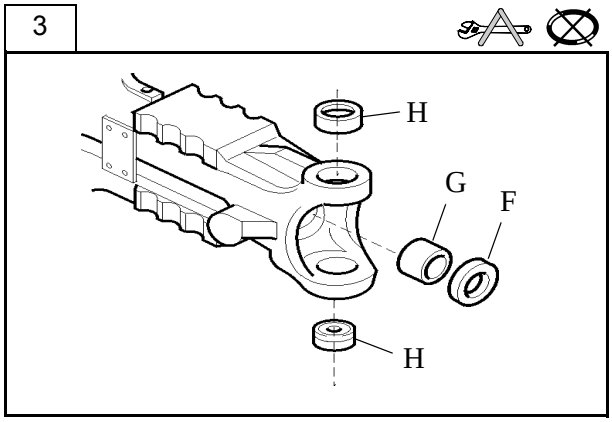
2



Per sostituire un componente del doppiogiunto, rimuovere con pinza adatta gli anelli seeger (**A**) di arresto delle crocere (**B**).
Rimuovere il corpo centrale (**C**) facendo attenzione a non deformarlo o rovinarlo durante l'estrazione dalle crocere (**B**).
Togliere il semiasse lato differenziale (**D**) e il semiasse lato ruota (**E**).

*To replace a component of the double joint, using a suitable pair of pliers, remove the seegers rings (**A**) supplied to stop the spider (**B**).*
*Remove the central body (**C**), taking care not to mis-shape or damage it when with drawing it from the spider (**B**).*
*Remove the half-axle on the differential-gear side (**D**) and the half-axle on the wheel side (**E**).*

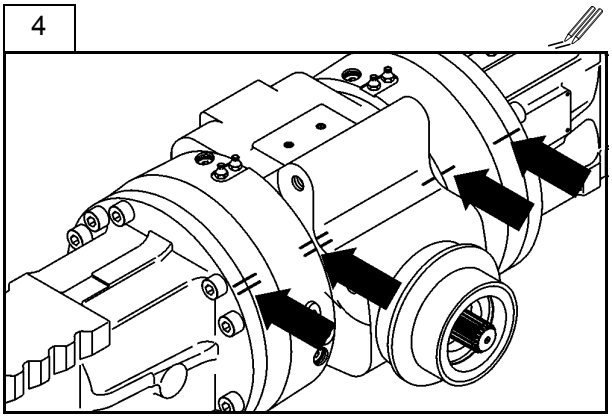
3



Dopo aver sfilato il doppio giunto dal trave estrarre l'anello di tenuta (**F**) con una leva.
Nota: è un'operazione distruttiva per l'anello di tenuta.
Per eseguire la sostituzione della bronzina (**G**) all'interno del trave è necessario tagliarla, con un cesello.
Estrarre le boccole superiore ed inferiore (**H**) dalle sedi dei perni snodo con estrattore da commercio.

*Once the U-Joint has been removed from the axle beam, extract the seal ring out of the axle beam (**F**) with a lever.*
***Note:** this is a destructive operation for the seal ring.*
*In order to replace it inside the axle beam, the bushing (**G**) needs to be cut and destroyed with a chisel.*
*Take the upper and lower bushing (**H**) out of the king pin'housings with a suitable extractor.*

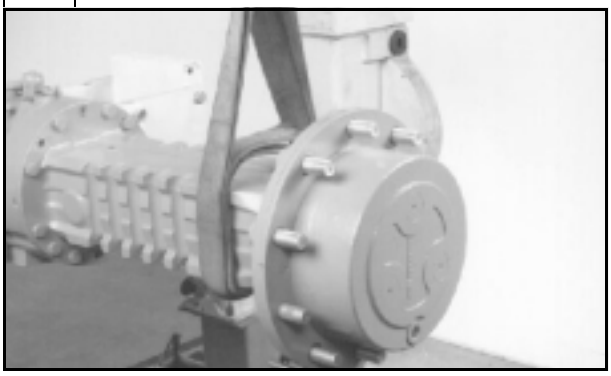
4



Fare dei segni di riferimento indelebili sul corpo trave e sulle flange supporto differenziale, per identificare con sicurezza parte destra e parte sinistra.

Put alignment marks on the axle beam body and on the differential supporting flanges, in order to identify the right side and the left side with certainty.

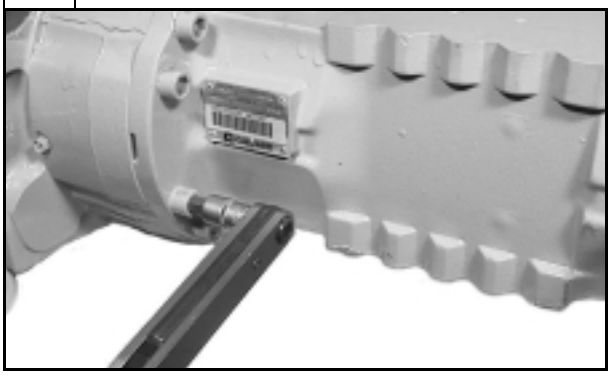
5



Disporre l'assale su supporti adatti a sostenere sia il corpo centrale che le due trombe, anche dopo la loro separazione, o assicurare i tre gruppi separatamente con funi o cinghie ad un sistema di sollevamento.

Position the axle on supports fitted to hold either the central body or the two beam trumpets, even after their disjunction, or secure the three disjointed groups to a lifting device with ropes or belts.

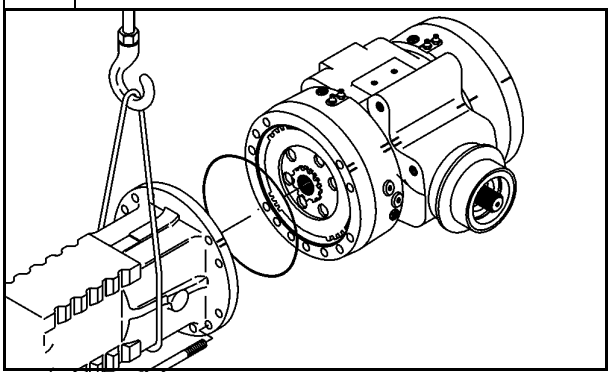
6



Svitare le viti di fissaggio per smontare la tromba trave.

Unscrew the fastening screws to disassemble the axle beam trumpet.

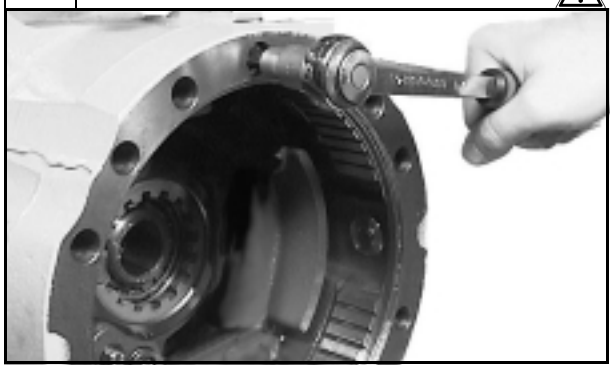
7



Staccare la tromba trave.
Recuperare il relativo anello O-Ring.

Remove the axle beam trumpet.
Collect the O-ring.

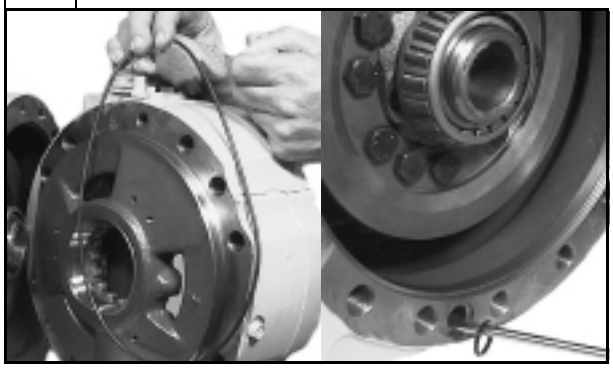
8



Assicurare la flangia ad un paranco con funi o cinghie di sicurezza.
Svitare la vite di fissaggio superiore e la vite prigioniera inferiore.
Rimuovere la flangia supporto differenziale dal corpo centrale, completa di ghiera di registro gioco coppia conica.
Pericolo: questa operazione libera la scatola differenziale, che accidentalmente potrebbe cadere.

Secure the flange to a hoist with ropes or safety belts.
Unscrew the upper fastening screw and the lower stud bolt.
Remove the differential supporting flange from the central body, together with the bevel gear backlash-adjusting ring nut.
Danger: *this operation frees the differential box, that accidentally could fall.*

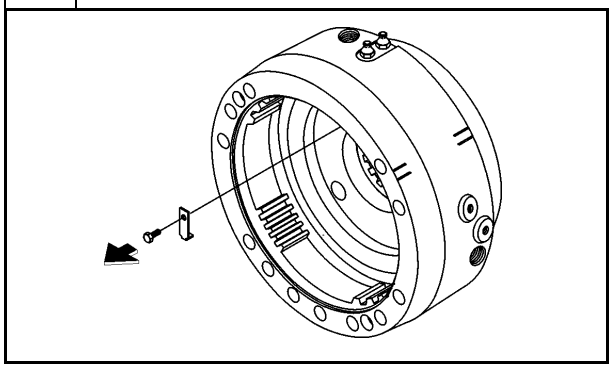
9



Rimuovere l'anello O-Ring dalla sua sede sulla flangia e l'anello O-Ring dal foro passaggio olio, controllarne le condizioni.

Remove the O-ring from its housing and from oil pipe hole and check its conditions.

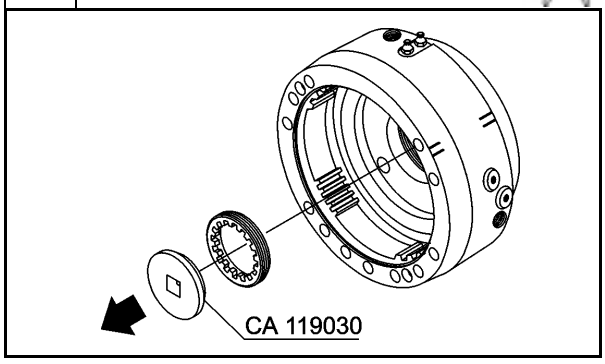
10



Svitare e togliere la vite ed il fermo ghiera.

Undo and remove the bolt and lock nut retainer.

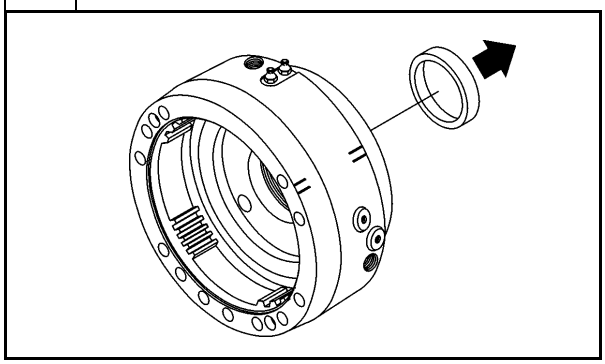
11



Svitare e togliere la ghiera dalla flangia con l'attrezzo speciale cod. CA119030

Undo and remove the lock nut from the flange using special tool CA119030

12



Togliere la pista esterna del cuscinetto dalla flangia con un battitoio

Use a driver to remove the outer cup of the flange bearing

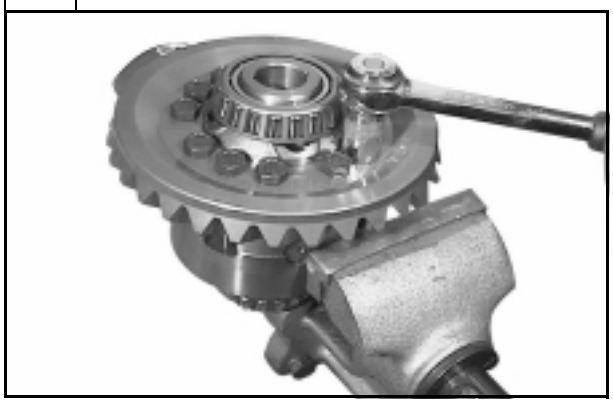
D.6 Smontaggio gruppo differenziale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

D.6 Differential group disassembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

1



Recuperare il differenziale e posizionarlo in una morsa.
Svitare tutte le viti di fissaggio della corona conica.

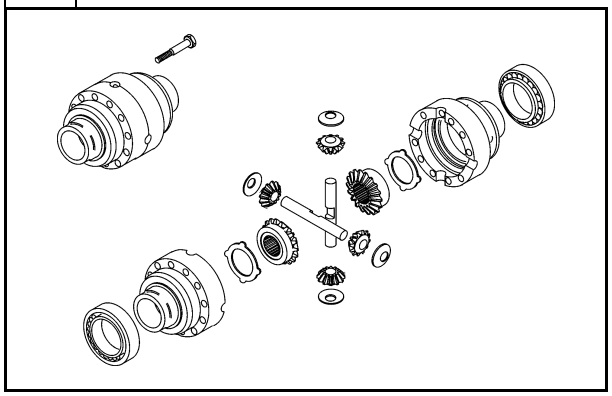
Collect the differential and put it in a clamp.
Unscrew all the fastening screws of the bevel gear crown.

2

Disassemblare la scatola differenziale in due semiscatole complete dei rispettivi elementi.
Nota: fare dei segni di riferimento sulle due semiscatole prima di separarle, per ripristinare la loro posizione relativa in fase di montaggio.

Disassemble the differential box in two half boxes complete with the relative components.
***Note:** mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.*

3



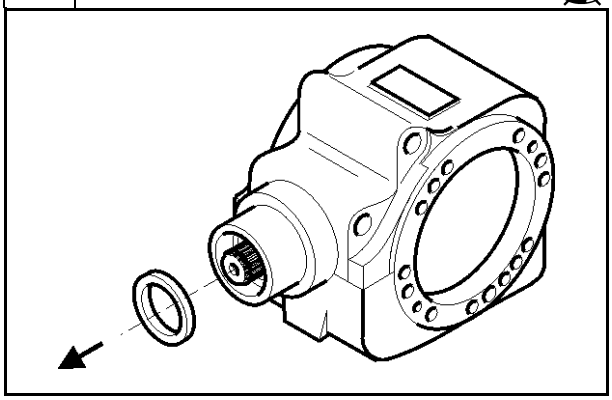
Disassemblare tutti i particolari.
Verificare le condizioni di funzionalità e lo stato di usura dei componenti.
Per estrarre il cuscinetto dalla semiscatola differenziale, utilizzare due leve oppure un estrattore a tre punti di presa da commercio.

Disassemble all the components.
Check the operating and wear conditions of the components.
Take the bearing out of the differential half box, using two levers or a three-hold extractor.

D.7 Smontaggio gruppo pignone

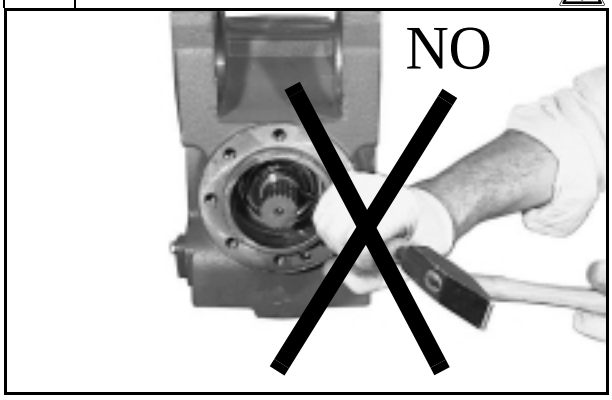
Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

1



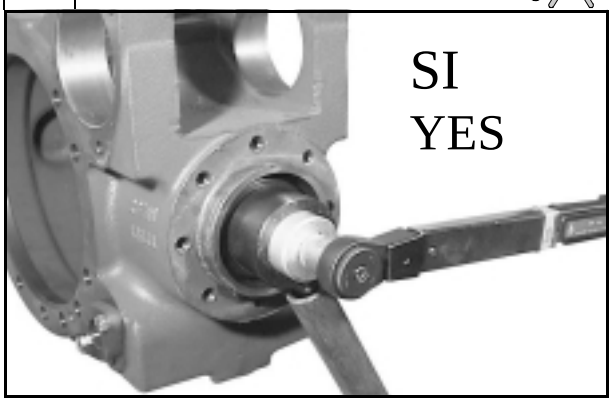
Estrarre l'anello di tenuta dal corpo centrale con un estrattore.
Nota: operazione distruttiva per l'anello di tenuta.

2



Posizionare il corpo centrale su di un piano stabile prima di procedere allo smontaggio.
Non tentare di sollevare la parte cianfrinata.

3



Per evitare seri danni alla filettatura del pignone conico, svitare la ghiera con gli attrezzi speciali cod. CA119099 e cod. CA715022

D.7 Pinion group disassembly

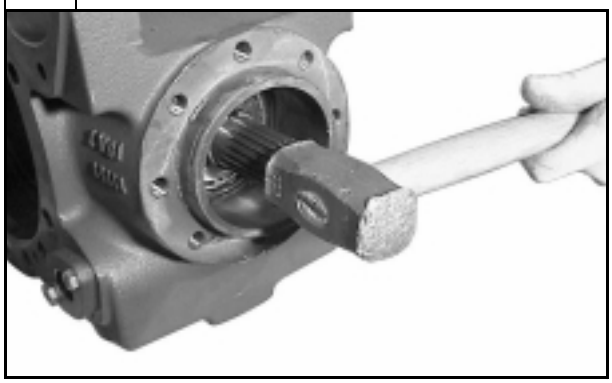
Some of the following pictures could not show exactly your axle, but the procedure is the same.

Remove the seal ring from the central housing with a puller.
***Note:** this is a destructive operation for the seal ring.*

Position the central body on a steady plane, before disassembling it.
Do not lift the caulked side of the ring nut.

In order to avoid serious damages to the bevel pinion thread, unscrew the ring nut with the special tools code CA119099 and code CA715022.

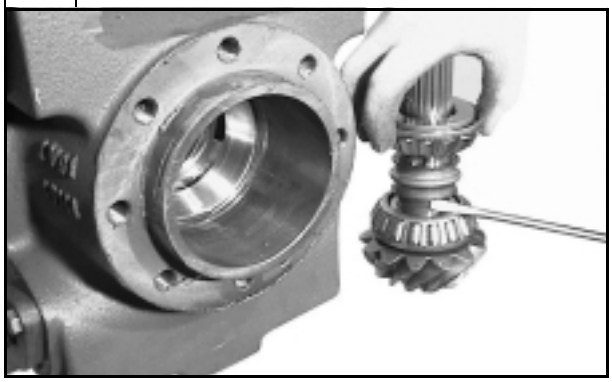
4



Dopo aver sfilato la rondella fermo ghiera, estrarre il pignone conico dalla sua sede battendo con un martello di materiale tenero sull'estremità del codolo scanalato.

Once the ring nut washer has been removed, take the pinion out of its housing, by beating with a hammer made of soft material on the splined end.

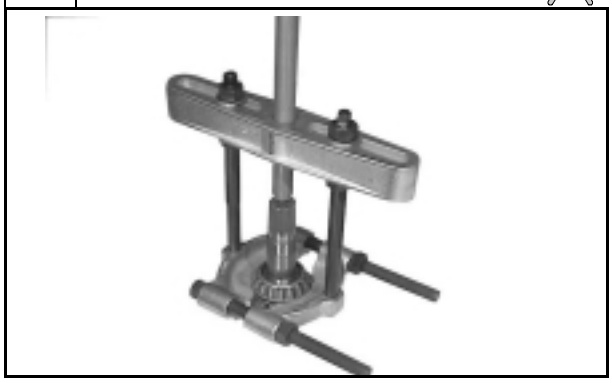
5



Tolto il pignone conico recuperare le rondelle, il distanziale elastico e le piste interne dei cuscinetti a rulli conici.
Nota: Quando il distanziale elastico viene rimosso deve essere sostituito con un distanziale nuovo.

Once the bevel pinion has been removed, collect the washers, the elastic spacer and the cones of the taper roller bearing.
Note: *When the elastic spacer is removed, it should be replaced by a new one.*

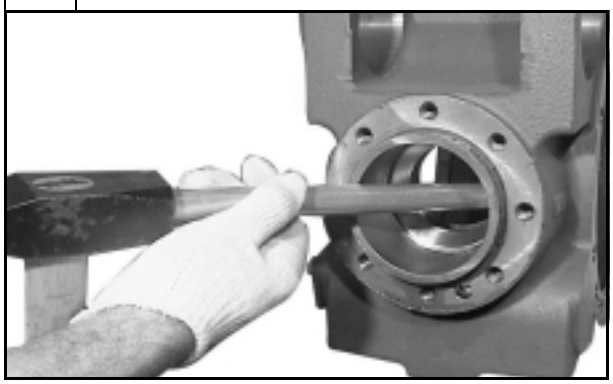
6



Estrarre il cuscinetto dal codolo del pignone conico utilizzando un estrattore a ghigliottina da commercio.
Recuperare lo spessore di registro posto sotto il cuscinetto e verificarne le condizioni di usura.

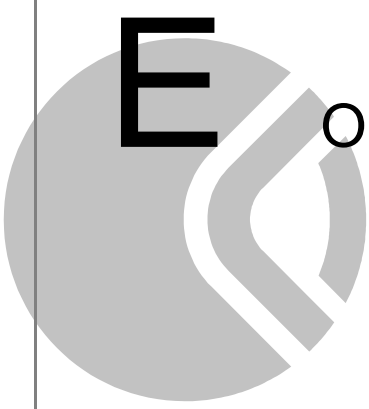
Take the bearing cone out of the bevel pinion end, using a suitable extractor.
Remove the adjusting shim placed under the bearing and check its wear conditions.

7



Estrarre le piste esterne dei cuscinetti a rulli conici dal corpo centrale utilizzando uno scalpelletto ed un martello.

Take the cups of the taper roller bearing out of the central body, using a chisel and a hammer.



E OPERAZIONI DI MONTAGGIO

E *ASSEMBLY OPERATIONS*

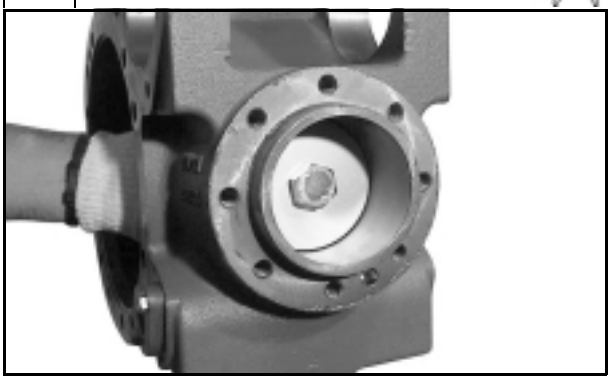
E.1 Montaggio gruppo pignone

E.1 Pinion group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

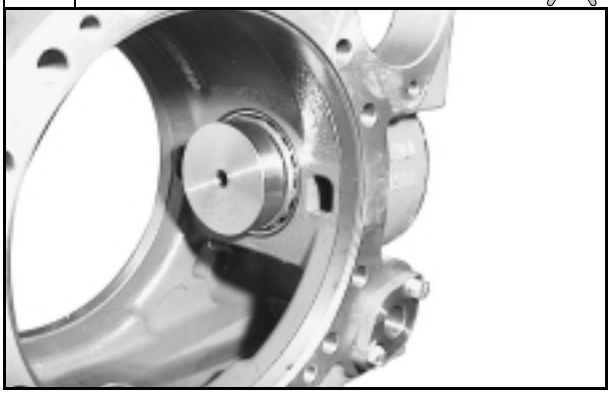
1



Posizionare il corpo centrale su un banco di lavoro.
Piantare le piste esterne dei cuscinetti a rulli conici sulle proprie sedi con gli attrezzi speciali del kit CA715401.

Position the central body on a workbench.
Insert the cups of the taper roller bearings on their housings using the special tools kit CA715401.

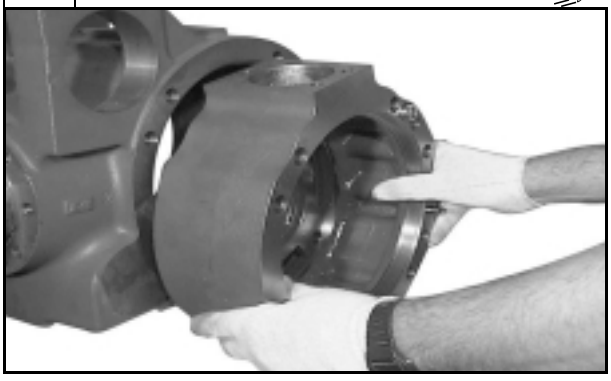
2



Per la rilevazione della distanza si utilizza il kit composto dalle attrezzature CA715040 e CA715041, dette “falso pignone” e “falsa scatola differenziale”.
Inserire nelle sedi per i cuscinetti appena montate, il falso pignone CA715040 con i rispettivi cuscinetti e la ghiera.
Serrare fino ad eliminare il gioco senza eccedere.

In order to measure the distance, the kit composed of the special tools CA715040 and CA715041, respectively called “false pinion” and “false differential box”, is used.
Insert the false pinion with CA715040, together with its bearings and its ring nut, in the just mounted housings for the bearings.
Tighten without exceeding, till the backlash is eliminated.

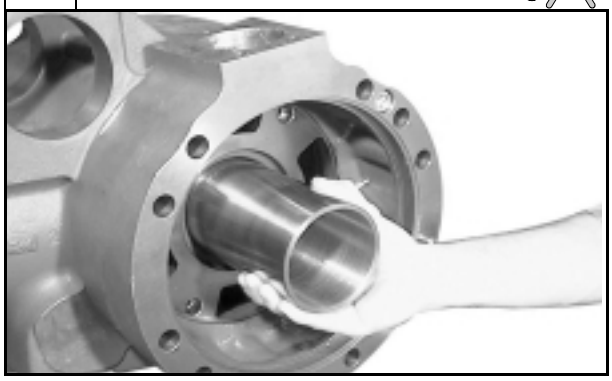
3



Verificare il corretto posizionamento delle flange destra e sinistra utilizzando i riferimenti riportati sulle medesime e sul corpo centrale.
Montare le due flange fissandole con le rispettive viti (avvitarne almeno due diametralmente opposte per ogni flangia).

Check the correct positioning of the right and left flanges, using the reference marks on them and on the central body.
Assemble the two brake flanges and fix them with their screws (screw in at least two ones diametrically-opposed for each flange).

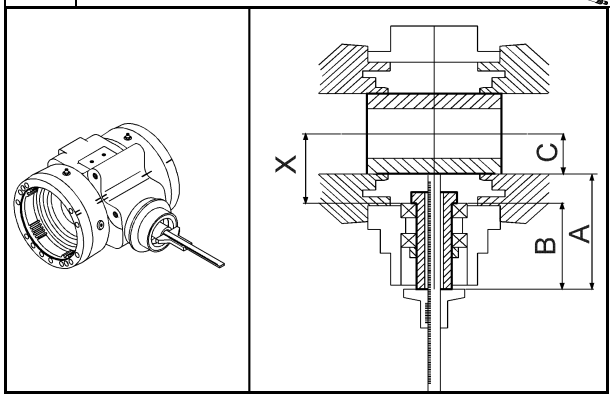
4



Introdurre nel corpo centrale la falsa scatola differenziale cod. CA715041 per la rilevazione della distanza
Verificare che la falsa scatola sia inserita in entrambe le sedi delle flange.

Insert the false differential box with code CA715041 into the central body to measure the distance.
Check that the false box is inserted in both flanges' housings.

5

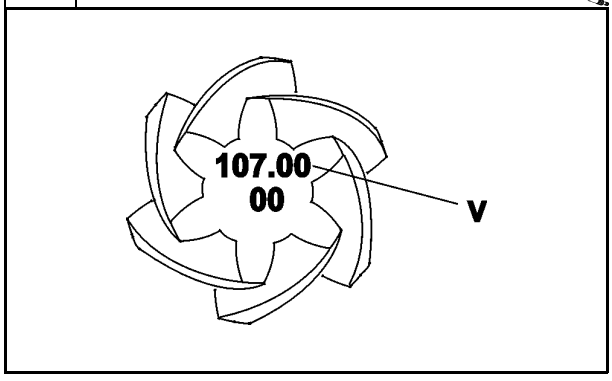


Effettuare la misurazione, con un calibro di profondità, dall'apposito foro del falso pignone.
X=(distanza conica da rilevare)
A= (valore misurato)
B=(valore noto)=100 mm
C=(valore noto)=45 mm

(A + C) - B = X

Carry out the measurement with a depth gauge through the suitable false pinion hole
X*=(conical distance to be measured)*
A*= (measured value)*
B*=(known value)=100 mm*
C*=(known value)=45 mm*

6

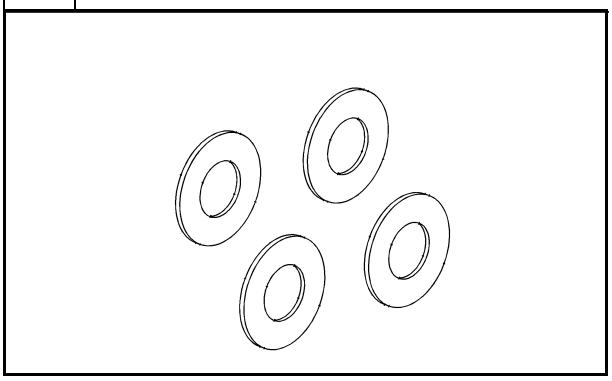


Per determinare lo spessore (**S**) necessario tra il pignone ed il cuscinetto è sufficiente sottrarre dal valore calcolato (**X**) il valore (**V**) stampigliato sulla testa del pignone (**V=**distanza conica prescritta).

S = X - V

*In order to determine the shim (**S**) necessary between the pinion and the bearing, you should subtract the (**V**) value stamped on the pinion head (**V**=requested conical distance) from the (**X**) calculated value.*

7

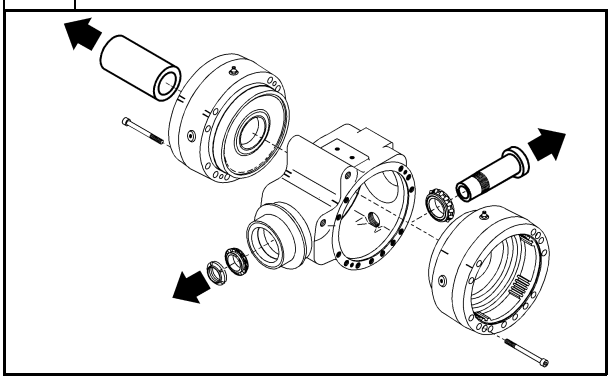


Scegliere tale spessore tra la gamma di spessori a disposizione (vedi tab. GAMMA SPESSORI) ed inserirlo sul codolo sotto la testa del pignone.

Choose the suitable shim between the available shims range (See SHIM RANGE table) and insert it on the end under the pinion head.

GAMMA SPESSORI - SHIM RANGE										
Spess./Thick.	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Quant.	-	-	-	-	-	-	-	-	-	-

8



Rimuovere il falso pignone, i cuscinetti e la ghiera dal corpo centrale.
Smontare la falsa scatola differenziale dalle flange e successivamente svitare le viti per rimuovere le flange.

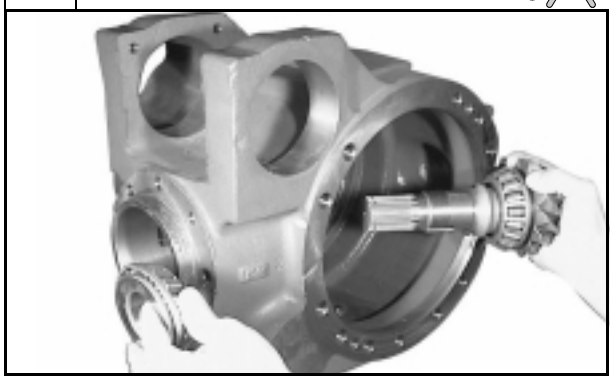
Remove the false pinion, the bearings and the ring nut from the central body.
Disassemble the false differential box from the flanges and then unscrew the screws to remove the flanges.

9

Inserire sull'albero del pignone lo spessore adatto (scelto in precedenza) con lo smusso rivolto verso l'ingranaggio.
Piantare il cuscinetto nell'albero del pignone sotto l'azione di una pressa con il battitoio cod. CA715179, assicurandosi che sia ben assestato.
Inserire sull'albero gli spessori ed un nuovo distanziale elastico.
Nota: utilizzare sempre un distanziale elastico nuovo.

Insert the suitable shim (chosen before) on the pinion shaft with chamfer against the gear.
Force the bearing into the pinion shaft and with CA715179 special tool under a press, making sure that it is well set.
insert the shims and the new elastic spacer into the shaft.
Note: *use always a new elastic spacer.*

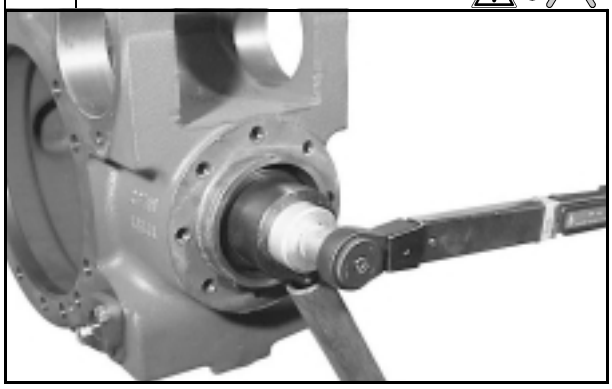
10



Inserire il gruppo pignone conico nella sede del corpo centrale ed il secondo cuscinetto sul codolo pignone.
Eseguire il piantaggio del cuscinetto, utilizzando il battitoio CA715179 ed un martello.
Si consiglia di contrapporre un azione resistente alla forza battente (ad esempio con una mazza).

Insert the bevel pinion unit into the central body housing and the second bearing cone into the pinion end.
In order to force the bearing into position use the special tool code CA715179 and a hammer.
It is advisable to oppose a resistant action against the beating force (e.g. with a sledge hammer).

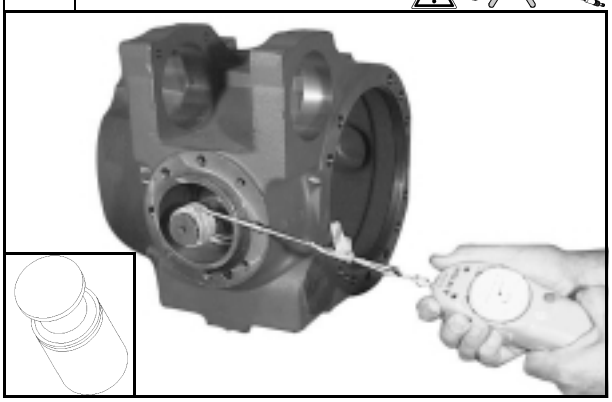
11



Inserire sull'albero del pignone una nuova rondella fermo ghiera e la ghiera di serraggio.
Avvitare la ghiera utilizzando le chiavi per ghiera (cod. CA119099) e fermo pignone (cod. CA715022).
Attenzione: La coppia di serraggio è data dalla misurazione del precarico sui cuscinetti.
Serrare la ghiera progressivamente. Se il serraggio è eccessivo il distanziale elastico dovrà essere sostituito e la procedura ripetuta.
Al momento di verificare il precarico è opportuno dare piccoli colpi con martello in materiale tenero alle estremità del pignone per favorire l'assestamento dei cuscinetti

Insert into the pinion shaft e new ring nut washer and the ring nut retainer.
Screw the ring nut in, using the wrench for ring nut (CA119099) and for pinion retainer (CA715022).
***Warning:** The torque setting is given by the preloading measurement on bearings. Tighten the ring nut step by step. If it is tightened too much, the elastic spacer should be replaced and the procedure repeated. When you check the preloading, it is advisable to beat the pinion ends with a hammer made of soft material slightly to favour the bearing setting.*

12



Montare la prolunga speciale cod. CA715116 sul codolo del pignone.
Effettuare la misurazione del precarico (**P**) dei cuscinetti conici dell'albero del pignone, utilizzando un dinamometro a funicella, avvolta sul diametro 37,7÷34,8 mm della prolunga.
La regolazione si effettua aumentando gradualmente il serraggio della ghiera, facendo attenzione a non eccedere.
Attenzione: tutti i precarichi devono essere misurati senza anello di tenuta.
Ottenuto il prescritto valore di precarico, cianfrinare la ghiera utilizzando martello e scalpello.

P=9.2÷13.8 daN

Assemblethe special tool (cod.CA715116) on the pinion shaft
*Carry out the preloading measurement (**P**) of the pinion taper roller bearings, using a dynamometer whose cord is wound on the 34,7÷34,8 mm diameter of special tool.*
The adjustment is carried out by increasing the ring nut torque setting gradually, being careful not to exceed.
***Warning:** all preloadings should be measured without the seal ring.*
Once you got the requested preloading value, caulk the ring nut, using a hammer and a chisel.

P=9.2÷13.8 daN

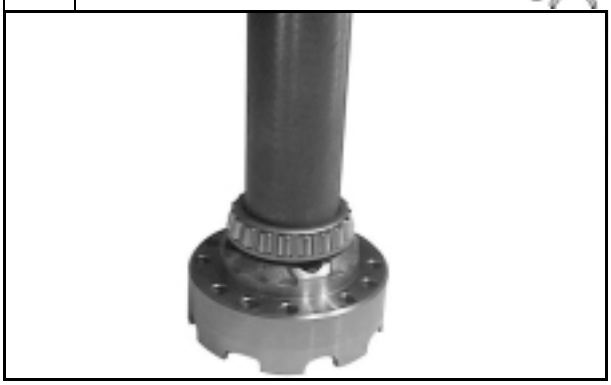
E.2 Montaggio gruppo differenziale

E.2 Differential group assemby

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

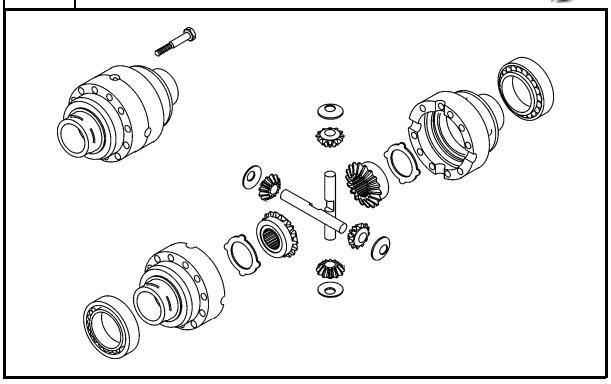
1



Montare le piste interne dei nuovi cuscinetti a rulli conici sulle semiscatole, utilizzando il battitoio cod. CA119230 ed un martello.

Assemble the cones of the new taper roller bearings on the half boxes, using the special tool code CA119230 and a hammer.

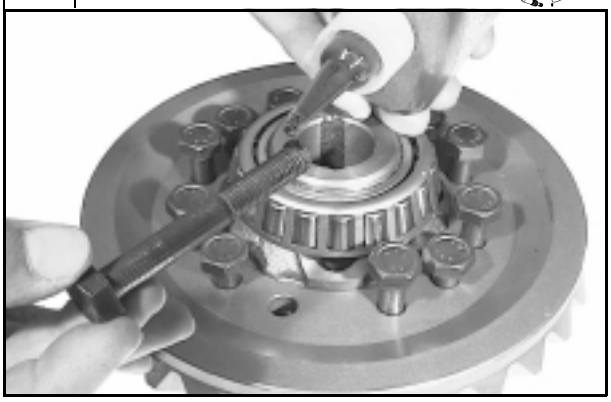
2



Posizionare una semiscatola su di un banco di lavoro e montare tutti i suoi componenti interni (planetari, satelliti, ralle di rasamento, dischi e perni), come in figura.
Unire le due semiscatole, allineando i riferimenti praticati sulle stesse.

Position a half box on a workbench and assemble all its inner components (sun gears, planetary gears, thrust washers, discs and pins) as per figure.
Join the two half boxes, aligning the reference marks made upon them.

3



Posizionare la corona conica e fissare il tutto, dopo aver applicato Loctite® 270 sul filetto, serrando le viti alla coppia prevista (Sez. B.8).

Position the ring bevel gear, apply Loctite® 270 on the thread and then fix the whole by tightening the screws to the requested torque (Sec. B.8).

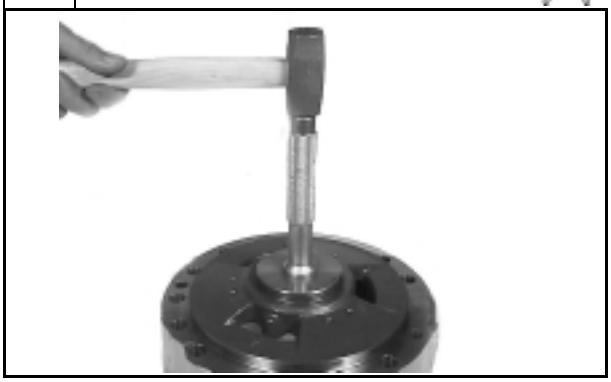
E.3 Montaggio scatola differenziale

E.3 Differential housing assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

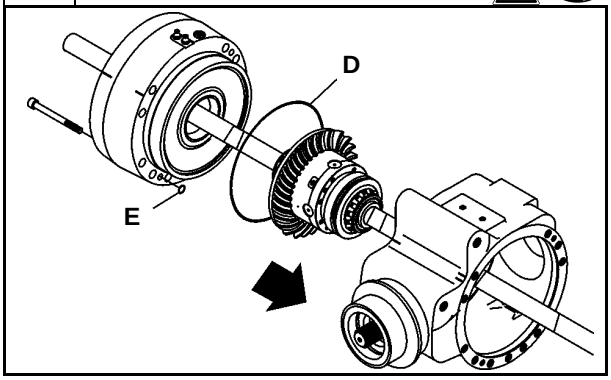
1



Posizionare la flangia su di una superficie piana e piantare la pista esterna del cuscinetto a rulli conici con il battitoio cod. CA715299, il manicotto intercambiabile cod. CA119033 ed un martello.

Position the flange on a flat surface and force the cup of the taper roller bearing in position, using the special tool code CA715299, interchangeable handle code CA119033 and a hammer

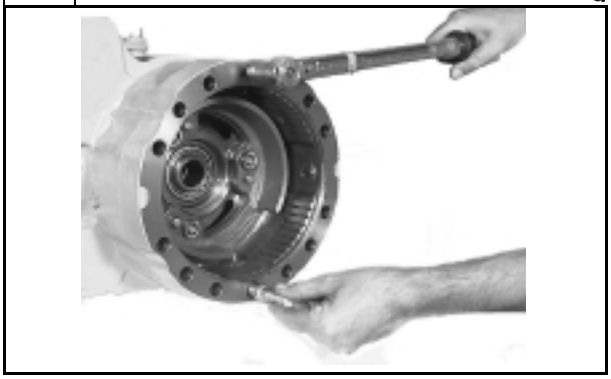
2



Inserire sulla flangia un nuovo anello O-ring "**D**".
Sostenere il gruppo scatola differenziale usando un tubo, posizionando per prima la flangia dal lato della corona conica.
Attenzione: Rispetare il corretto lato di montaggio della corona conica, che può essere inserita invertita. Prima del montaggio posizionare un nuovo anello "**E**" su foro passaggio olio.

*Insert a new O-ring on the flange "**D**".*
Support the differential box with a tube, positioning first the flange on the side of the ring bevel gear.
***Warning:** respect the correct assembly side of the ring bevel gear, that could be assembled inverted. Insert, before the assembly, a new-ring "**E**"* on the oil hole.

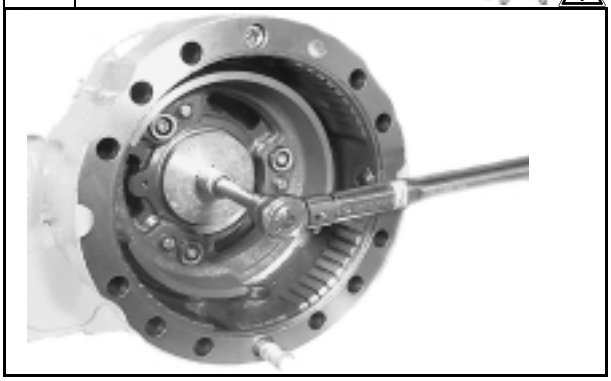
3



Montare e serrare la vite superiore e la vite prigioniera (inferiore) di fissaggio della flangia con chiave dinamometrica alla coppia prevista (Sez. B8).

Assemble and tighten the upper fastening screw and the lower fastening stud bolt of the flange with dynamometric wrench to the requested torque (Sec. B8).

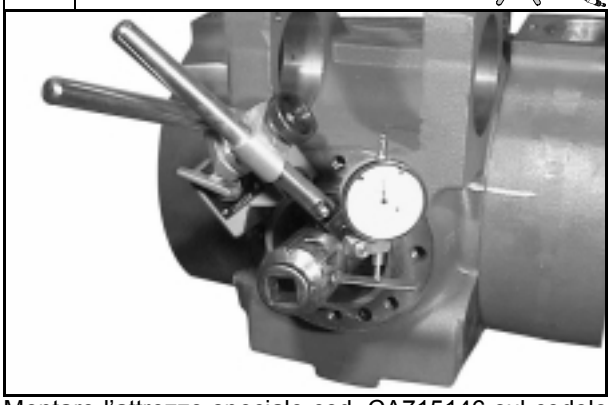
4



Dopo aver verificato il corretto lato di assemblaggio della scatola differenziale, montare la seconda flangia dal lato opposto alla corona conica.
Inserire ed avvitare le ghiere di registrazione del gioco pignone-corona, utilizzando la chiave cod.CA119030 fino ad eliminare il gioco dei cuscinetti, quindi procedere al rilievo del gioco pignone-corona.
Nota: serrare le ghiere progressivamente senza eccedere.

Once the correct assembly side of the differential box it has been checked, assemble the second flange on the opposite bevel gear side.
Insert and screw the adjusting ring nuts of the pinion-ring, using the wrench with code CA119030 till the bearing backlash is eliminated. Then measure the pinion-ring gear backlash.
***Note:** tighten the ring nuts step by step without exceeding.*

5



Montare l'attrezzo speciale cod. CA715146 sul codolo del pignone.
Muovere il codolo del pignone alternativamente ed annotare il gioco fra pignone e corona, rilevato con un comparatore, in modo che il palpatore sia a contatto ed a 90° con la superficie della staffetta dell'attrezzo speciale in corrispondenza della tacca di riferimento.

Assemble the special tool code CA715146 on the pinion end.
Move the pinion end alternatively and note the pinion-ring gear backlash, measured with a comparator, so that the feeler is in contact and at 90° with the bracket surface of the special tool in correspondance with the reference mark.

Verificare se il valore del gioco rilevato rientra nel campo predefinito:

0.16÷0.22

Check if the measured backlash value is within the requested range:

0.16÷0.22

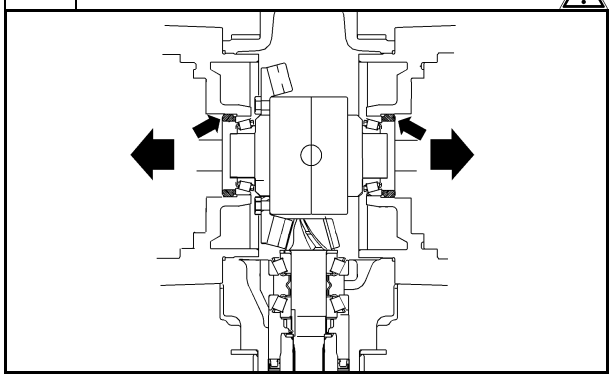
Effettuare la registrazione agendo sulle due ghiere con l'apposito attrezzo cod. CA119030.

Carry out the adjustment by operating on the two ring nuts with the approppriate tool CA119030.

Registrare le ghiere ricordando che:
- se il **gioco rilevato è inferiore** al campo di tolleranza dato, avvitare la ghiera dal lato opposto alla corona e svitare la ghiera opposta della stessa quantità;
- se il **gioco rilevato è superiore** al campo di tolleranza dato, avvitare la ghiera dal lato della corona e svitare la ghiera opposta della stessa quantità.

Adjust the ring nuts, remembering that:
*- if the **measured backlash is less** than the given tolerance range, screw the ring nut from the side opposite to the ring gear and unscrew the opposite one of the same measure;*
*- if the **measured backlash is higher** than the given tolerance range, screw the ring nut from the side of the ring gear and unscrew the opposite one of the same measure.*

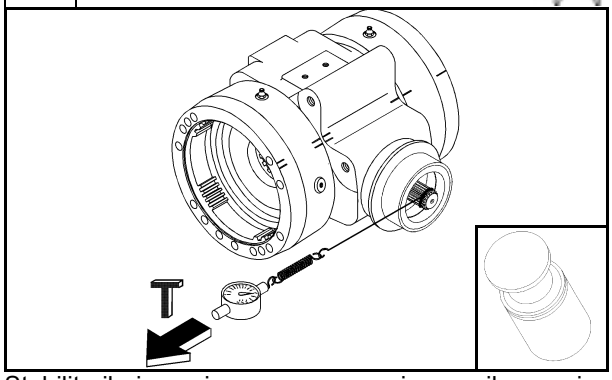
6



Effettuata la registrazione del gioco pignone-corona verificare anche che ci sia un minimo di precarico sui cuscinetti della scatola differenziale
Ripetere l'intera sequenza delle operazioni citate fino al raggiungimento delle condizioni indicate.

Once you have carried out the adjusting of the pinion-ring gear backlash, check also that there is a minimum preloading on the differential box bearings.
Repeat the whole sequence of the above mentioned operations till the indicated conditions are reached.

7



Stabilito il gioco pignone-corona, misurare il precarico totale (**T**) dei cuscinetti (sistema pignone-corona), utilizzando un dinamometro a funicella avvolta sul diametro 34,7÷34,8 dell'attrezzo speciale cod. CA715116
Il valore misurato deve rientrare nel seguente campo

T=(P+3.2)÷(P+4.7) daN

dove **P** è il precarico effettivo misurato sul pignone (Sez. "Montaggio gruppo pignone").

Attenzione: tutti i precarichi vanno misurati senza anello di tenuta.

Se la misurazione non rientrasse nel campo prescritto, controllare bene l'assemblaggio di ogni singolo componente ed intervenire sulle ghiere di registrazione del supporto differenziale:
- se il **precarico totale è inferiore** al campo dato, avvitare della stessa quantità le due ghiere, tenendo inalterato il valore del gioco pignone-corona;
- se il **precarico totale è superiore** al campo dato, svitare della stessa quantità le due ghiere, tenendo inalterato il valore del gioco pignone-corona.

*Once the pinion-ring gear backlash has been established, measure the total preloading (**T**) of the bearings (pinion-ring gear system), using a dynamometer whose cord is wound on the D 34,7÷34,8 of the special tool code CA715116. The measured value should be within the following range*

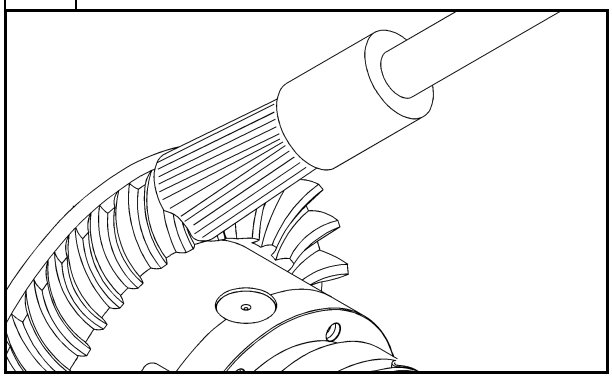
T=(P+3.2)÷(P+4.7) daN

*where **P** is the preloading effectively measured on the pinion (Sec. "Pinion assembly").*

***Warning:** all the preloadings should be measured without the seal ring.*

If the measurement is not within the requested range, check well the assembly of each component and operate on the adjusting ring nuts of the differential support:
*- if the **total preloading is less** than the given range, screw the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged;*
*- if the **total preloading is higher** than the given range, unscrew the two ring nuts of the same measure, keeping the pinion-ring gear backlash value unchanged.*

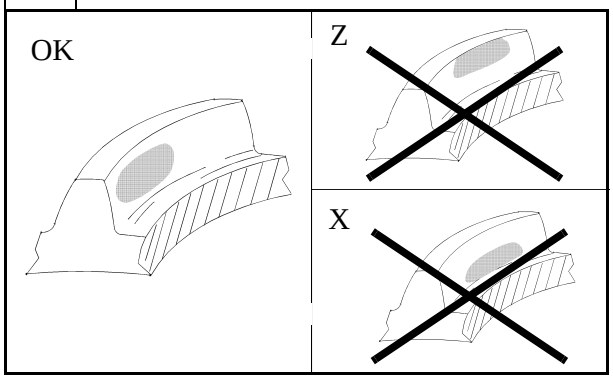
8



INFORMAZIONE
Per verificare l'impronta di contatto dei denti della coppia conica, sporcare con minio la corona e rilevare il contatto.
L'esame dell'impronta di contatto deve essere eseguito sempre sui denti della corona conica e su ambedue i fianchi.

INFORMATION
To test the marks of the bevel gear teeth, paint the ring gear with red lead paint.
The marking test should be always carried out on the ring bevel gear teeth and on both sides.

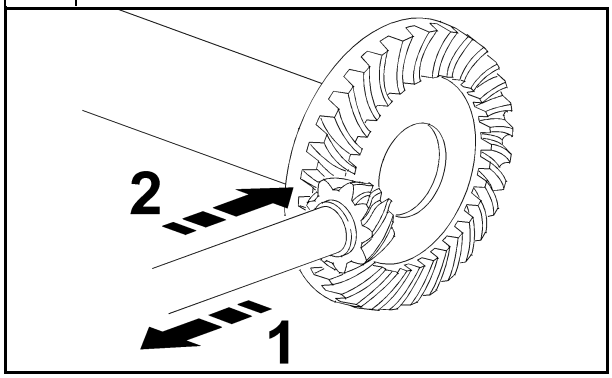
9



OK -> Contatto corretto.
Se la registrazione della coppia conica è ben fatta, il segno del contatto sulle superfici delle dentature risulterà regolare.
Z -> Eccessivo contatto sulla cresta del dente.
Avvicinare il pignone alla corona ed allontanare poi la corona dal pignone per regolare il gioco.
X -> Eccessivo contatto alla base del dente.
Allontanare il pignone dalla corona ed avvicinare poi la corona al pignone per regolare il gioco.

OK *-> Correct contact.*
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.
Z *-> Excessive contact on the tooth tip.*
Approach the pinion to the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.
X *-> Excessive contact at the tooth base.*
Move the pinion away from the ring bevel gear and then approach the ring bevel gear to the pinion in order to adjust the backlash.

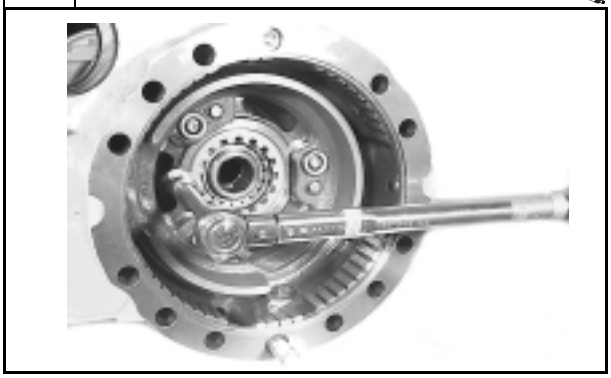
10



Spostamenti per le correzioni:
1 -> spostare il pignone per modifica contatto tipo **X**
2 -> spostare il pignone per modifica contatto tipo **Z**

Movements to correct.
1 *-> move the pinion for type* ***X*** *contact adjustment*
2 *-> move the pinion for type* ***Z*** *contact adjustment.*

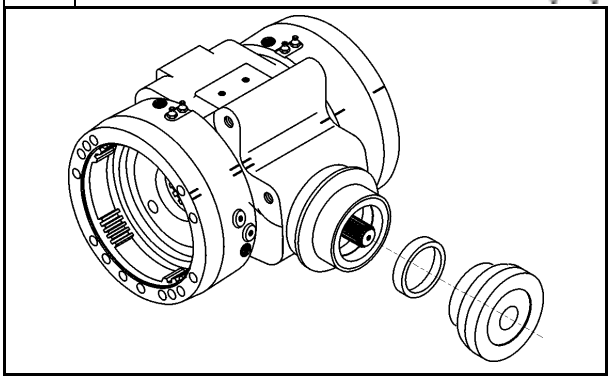
11



Inserire il fermo ghiera ruotando la ghiera il minimo indispensabile per allinearla al fermo.
Inserire la vite di fissaggio del fermo ghiera ed avvitarla con una chiave dinamometrica alla coppia prevista (sez. B8).

Insert the ring nut retainer turning the ring nut slightly in order to align it to the retainer.
Screw in and tighten the screw of the ring nut retainer with a dynamometric wrench to the requested torque (sec. B8).

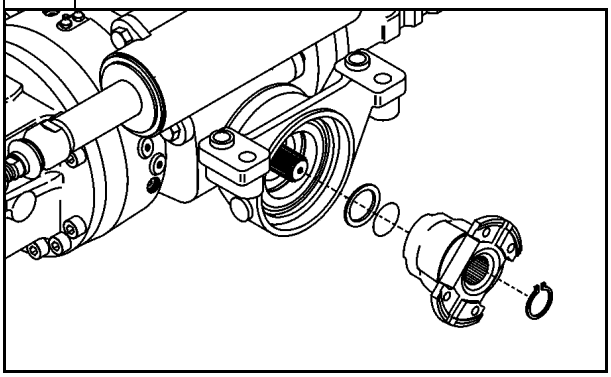
12



Installare nel corpo centrale trave l'anello la tenuta del pignone con battitoio CA715043.
Applicare uno strato di pasta sigillante sul diametro esterno della tenuta.

Install pinion seal into the central housing using seal driver CA715043.
Apply a coating of gasket dressing saelant to outer steel case of seal.

13



Montare sul codolo del pignone lo spessore, un nuovo OR e la flangia di trasmissione. Bloccare poi il tutto con il seeger.
Nota: Lubrificare gli anelli OR ed il labbro dell'anello di tenuta..

Insert on the pinion shaft the shim together with a new O-ring and input flange. Secure the assembled parts with the circlip.
Note: *Coat the seal lip and O-ring with oil.*

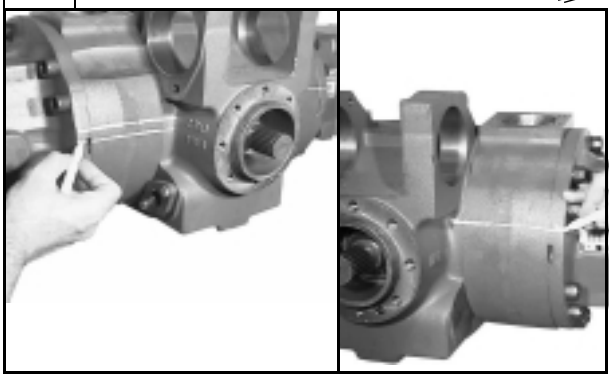
E.4 Montaggio trombe trave

E.4 Axle beam trumpets assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

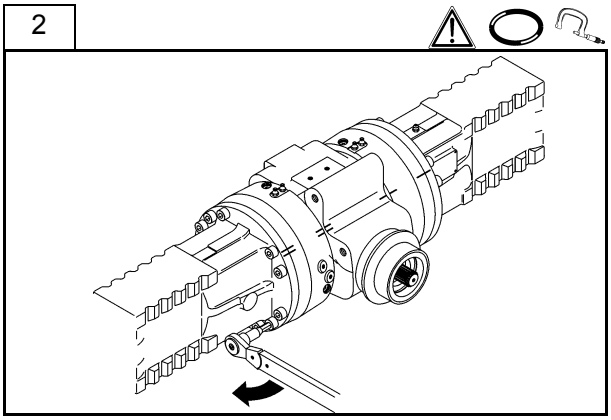
1



Prima del montaggio, verificare i segni di riferimento eseguiti in fase di smontaggio per il corretto posizionamento delle trombe trave.

In oder to place precisely the axle beam trumpets, before assembly, check the reference marks carried out during disassembly.

2



Inserire un nuovo anello O-ring nella sua sede sulla tromba trave. Montare la tromba sulla flangia, facendo attenzione all'allineamento dei fori di fissaggio.
Attenzione: Sostenere oppurtunamente i gruppi come già indicato nella fase di smontaggio. Avvitare e serrare le viti di fissaggio della tromba con una chiave dinamometrica alla coppia prevista (sez. B8).

Insert a new O-ring into the axle beam trumpet housing. Assemble the axle beam trumpet on the flange, being careful to the fastening holes' alignment.
Warning: support the groups properly as already pointed out for disassembly phase. Screw in and tighten the fastening screws of the axle beam trumpet with a dynamometric wrench to the requested torque (sec. B8).

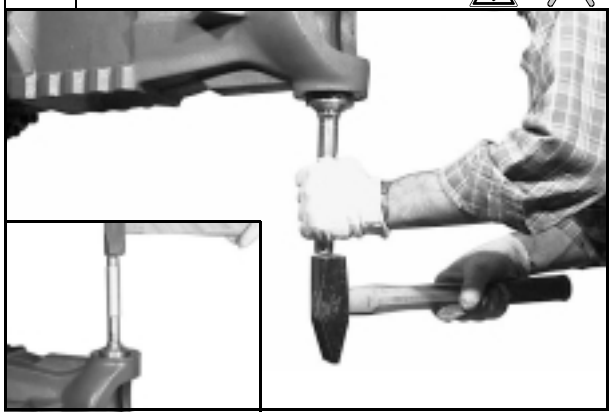
E.5 Montaggio gruppo trave

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.5 Axle beam group assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

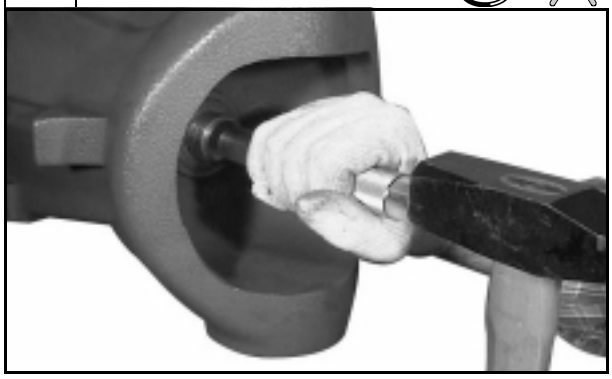
1



Montare la boccola del perno snodo superiore nel trave con battitoio cod. CA715039 e martello.
Infilare la pista esterna della rotula sferica sulla parte inferiore del trave con il battitoio cod. CA715039 e un martello.
Nota: Per facilitare il montaggio, è necessario raffreddare la pista esterna della rotula sferica a temperature inferiori a -100°C.
Attenzione: usare dei guanti di protezione.

Assemble the upper king pin bush on the axle beam with the special tool code CA715039 and a hammer. Insert the cup of the ball bearing on the lower part of the axle beam with the special tool code CA715039 and a hammer
Note: *To make the assembly easier, it is necessary to cool the cup of the ball bearing at a temperature less than 100°C.*
Warning: *wear safety gloves.*

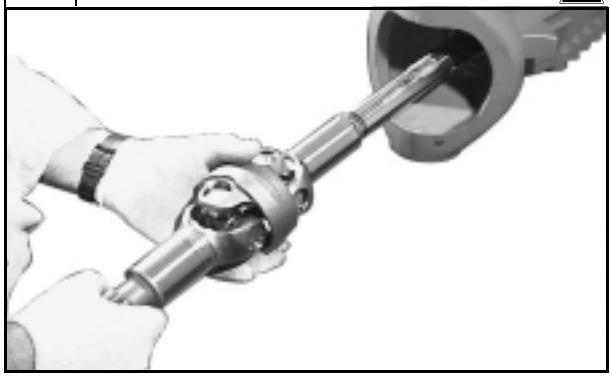
2



Montare nel trave la bronzina con il battitoio cod. CA715444 ed un martello.
Riempire per 3/4 la camera dell'anello con grasso, applicare pasta sigillante sulla sua superficie esterna.
Montare l'anello di tenuta nel trave con il battitoio cod CA119089 ed un martello.

Assemble the bush on the axle beam with the special tool code CA715444 and a hammer.
Fill 3/4 of the ring cavity with grease and apply sealing compound on its outer surface.
Assemble the seal ring on the beam with the special tool code CA119089 and a hammer.

3



Lubrificare la boccola ed il labbro dell'anello di tenuta.
Inserire il doppio giunto all'interno del trave.
Attenzione: non rovinare la tenuta.

Lubricate the bush and the sealing lips.
Insert the U-Joint inside the axle beam.
Warning: *be careful not to damage the seal.*

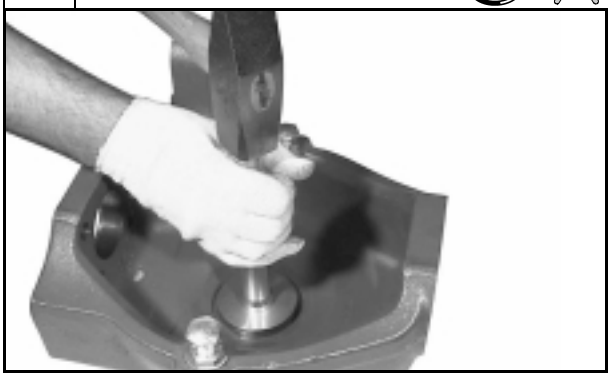
E.6 Montaggio gruppo mozzo ruota

E.6 Wheel hub group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

1



Piantare la bronzina nella calotta con il battitoio cod CA715018 ed un martello o una pressa.
Riempire la camera dell'anello di tenuta per 3/4 con grasso.
Applicare pasta sigillante sulla superficie metallica esterna e montare l'anello di tenuta nella calotta con il battitoio cod CA715321 ed un martello.

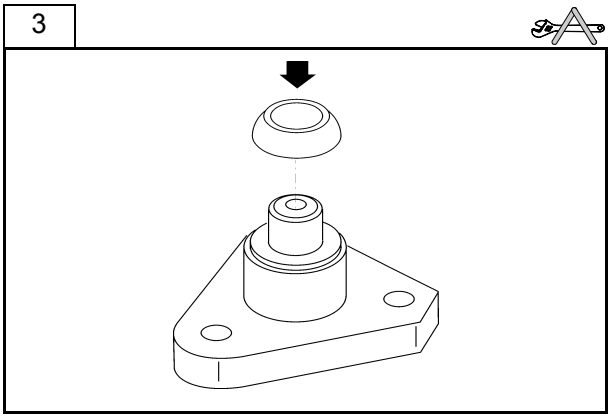
Force the bush in the swivel housing with the special tool code CA715018 and a hammer or a press.
Fill 3/4 of the gasket cavity with grease. Apply sealing compound on the outer metallic surface of the seal and assemble the seal ring on the swivel housing with the special tool code CA715321 and a hammer.

2

Montare lo spessore sotto la molla a tazza nella parte superiore.
Ingrassare bene le sedi dei perni snodo con grasso specifico (Sez. B.4)
Posizionare le molle a tazza sulle sedi perni snodo.

Put the shim under the Belleville washer on the upper part.
Grease well the king pin housings with specific grease (Sec. B.4).
Position the Belleville washers on the king pin housings.

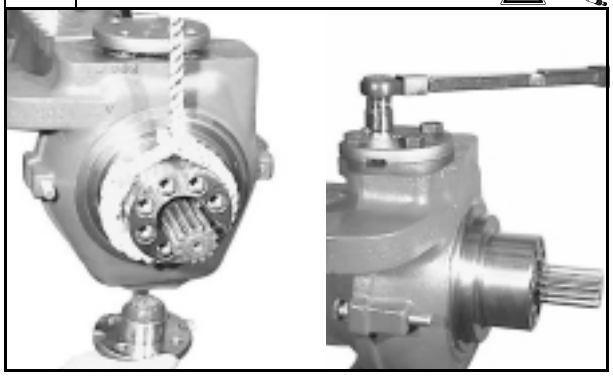
3



Posizionare il perno snodo inferiore su di un banco di lavoro e montare la pista interna della rotula sferica con il battitoio cod. CA715042 sotto l'azione di una pressa.

Position the lower kingpin on a workbench and assemble the cone of the ball bearing with the special tool code CA715042 under a press.

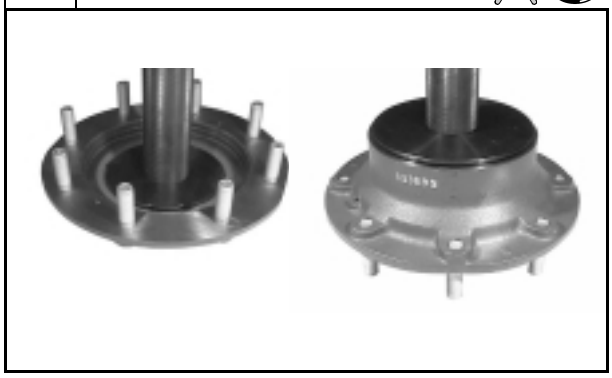
4



Assicurare il gruppo calotta con una fune e montarlo sulla trave.
Pericolo: operazione pericolosa per l'operatore.
Lubrificare il labbro dell'anello di tenuta.
Avvolgere l'estremità scanalata del semiasse con del nastro adesivo sottile per non danneggiare l'anello di tenuta. A montaggio avvenuto, rimuovere il nastro.
Montare i due perni snodo inferiore e superiore e serrare le viti del supporto con chiave dinamometrica alla coppia prevista (Sez. B.8).
Assicurarsi che le molle a tazza rimangano nella loro posizione.

Secure the swivel housing group with a rope and assemble it on the axle beam.
Danger: *this is dangerous for the operator.*
Lubricate the seal ring lips. Protect the splined end of the axle shaft by winding it with some thin adhesive tape to avoid damaging the seal ring. After assembly, remove the adhesive tape.
Assemble the two king pins, the upper and the lower, and tighten the support screws with dynamometric wrench to the requested torque (Sec. B.8).
Make sure that the Belleville washers remain in their position.

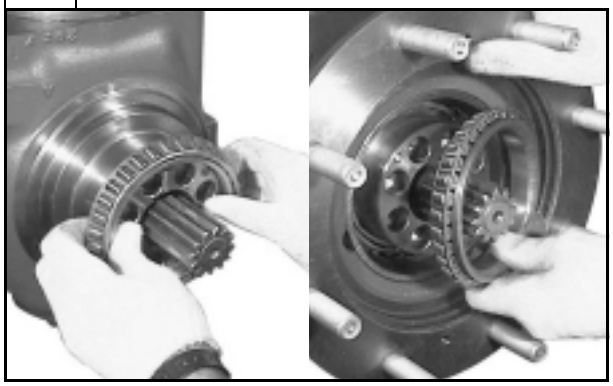
5



Posizionare il mozzo ruota su di un banco di lavoro e piantare le due piste esterne dei cuscinetti a rulli conici con il battitoio cod. CA715026 sotto l'azione di una pressa o di un martello.
Applicare la pasta sigillante sulla circonferenza esterna della tenuta ed inserire l'anello di tenuta nel mozzo ruota con il battitoio cod. CA119143 ed un martello.

Position the wheel hub on a workbench and force the two cups of the taper roller bearings in position with the special tool code CA715026 under a press or with a hammer.
Apply the sealing compound on the seal outer circle and insert the seal ring into the wheel hub with the special tool code CA119143 and a hammer.

6



Montare la pista interna del cuscinetto a rulli conici sul codolo della calotta.
Montare il mozzo ruota sulla calotta e piantare l'altra pista interna del cuscinetto a rulli conici.

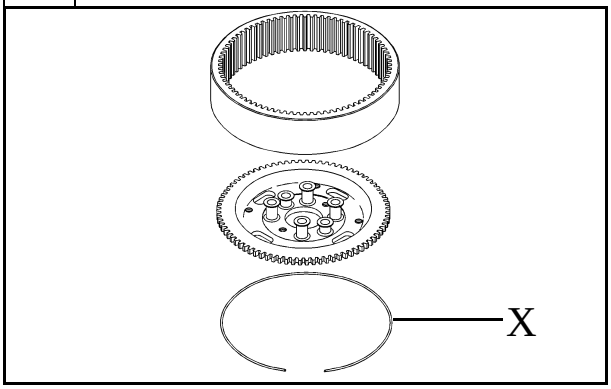
Assemble the cone of the taper roller bearing on the swivel housing end.
Assemble the wheel hub on the swivel housing and force the other cone of the taper roller bearing in position.

7

Posizionare il mozzo fermo corona su banco di lavoro e piantare le boccole a filo con battitoio CA715027.
Almeno due boccole (diametralmente opposte) devono essere piantate leggermente oltre il filo per essere utilizzate come spine di centraggio.

Position the wheel carrier on a workbench and force the bushes to the carrier surface level with the special tool code CA715027.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

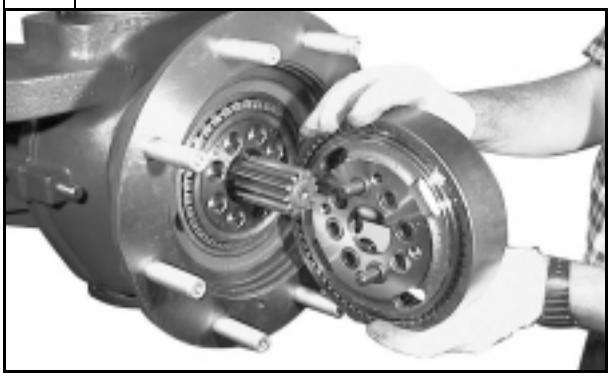
8



Preassemblare il gruppo mozzo fermo corona, corona epicicloidale, con lo speciale anello d'arresto indicato in figura (**X**).

*Preassemble the wheel carrier group, epicyclic ring gear, with the special lock ring shown in the figure (**X**).*

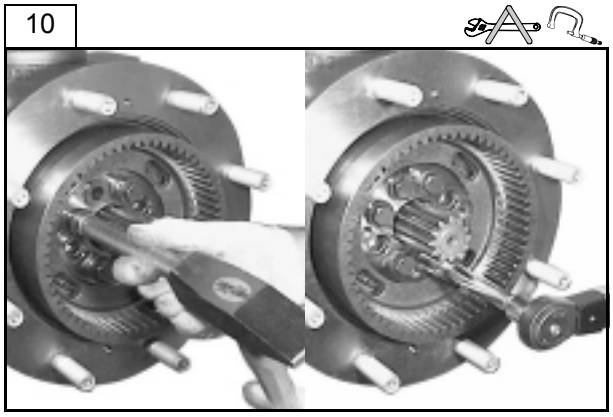
9



Montare il gruppo mozzo fermo corona sul mozzo ruota utilizzando le due boccole sporgenti come spine di centraggio.

Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins.

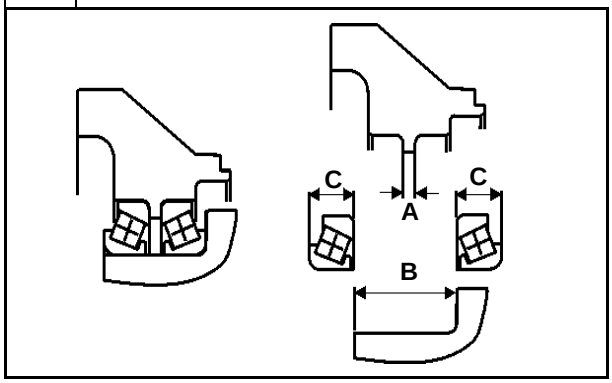
10



Piantare con il battitoio cod CA715027 ed un martello tutte le bussole di centraggio mozzo fino a battuta.
Montare le viti di fissaggio mozzo fermo corona e serrare alla coppia prevista (Sez. B.8).

Force all the hub dowel bushes completely with the special tool code CA715027 and a hammer.
Assemble the wheel carrier fastening screws and tighten to the requested torque (Sec. B.8).

11

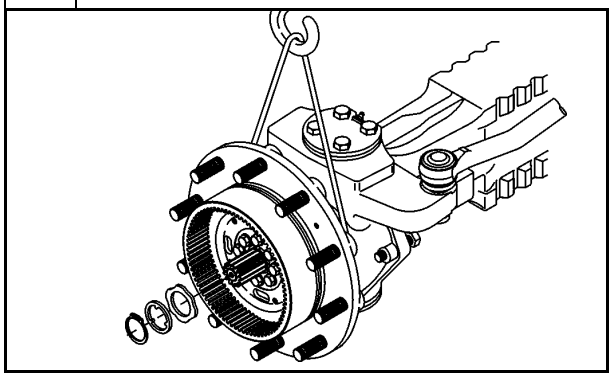


La speciale esecuzione “Set Right” dei cuscinetti non richiede specifiche registrazioni del precarico o del gioco. In ogni caso, prima del montaggio di nuove parti, controllare le dimensioni indicate.

A= 17.950 ÷ 18.000
B= 64.275 ÷ 64.325
C= 23.070 ÷ 23.172

The special operation “Set Right” does not require specific registration of preloading or backlash. At any rate, before assembling new components check the pointed out dimensions.

12



Infilare nel semiasse del doppio giunto le ralle, lo spessore e bloccare alla fine con l’anello d’arresto.

Insert the rings and the shim into the axle shaft of the U-Joint and lock with the snap ring.

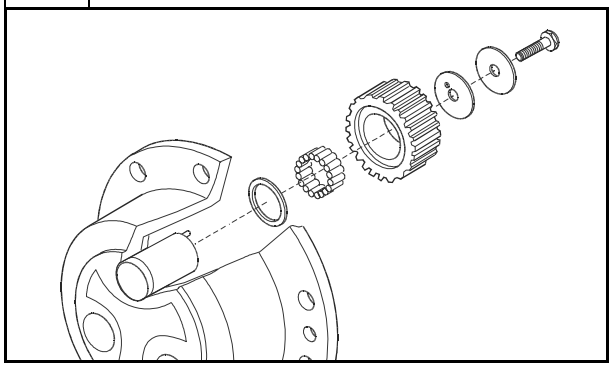
E.7 Montaggio gruppo riduttore epicicloidale

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.7 Epicyclic reduction gear assembly

Some of the following pictures could not show exactly your axle, but the procedure is the same.

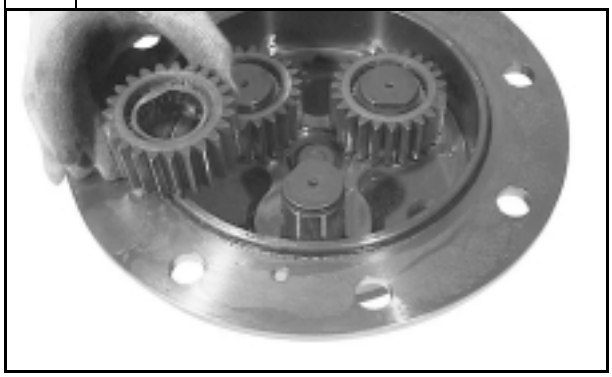
1



Recuperare tutti i componenti del riduttore epicicloidale.

Collect all the components of the epicyclic reduction gear.

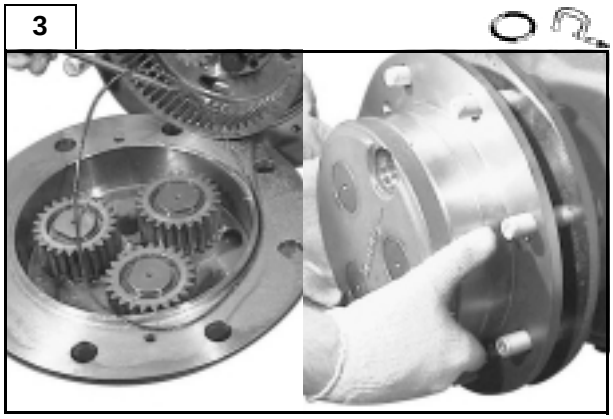
2



Posizionare su un banco di lavoro il treno porta satelliti.
Inserire nei perni del treno portasatelliti: la rondella di rasamento inferiore, i satelliti epicicloidali, i rullini e le due ralle superiori.
Nota: verificare il corretto posizionamento della prima ralla superiore nell'apposito perno d'arresto.
Montare le relative viti di arresto, serrandole con chiave dinamometrica alla coppia prevista (Sez.B.8).

Position the planetary carrier on a workbench.
Insert the thrust washer, the planetary gear, the needle bearings and the two upper trust washers in the planetary carrier pins.
***Note:** check correct positioning of first upper trust washer in the lock pin.*
Assemble the retaining screw, then tighten the screws with dynamometric wrench to the requested torque (Sec. B.8).

3



Inserire un nuovo anello O-Ring sul mozzo ruota.
Montare il gruppo riduttore epicicloidale sul mozzo ruota.
Avvitare le viti di fissaggio e serrare con chiave dinamometrica alla coppia prevista (Sez. B.8).

Assemble a new O-ring on the wheel hub.
Assemble the epicyclic reduction gear on the wheel hub.
Screw in the fastening screws and tighten with dynamometric wrench to the requested torque (Sec. B.8).

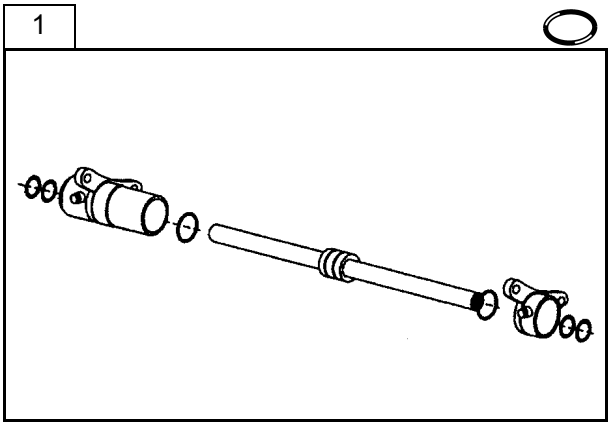
E.8 Montaggio gruppo cilindro sterzo

E.8 Steering group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

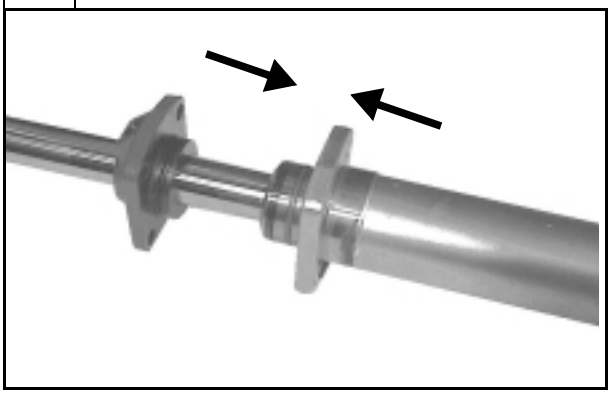
1



Montare nuovi anelli di tenuta: nella testata del cilindro, nel corpo cilindro e sullo stelo.

Fit new seal rings to the cylinder head, to the cylinder body, to the cylinder rod.

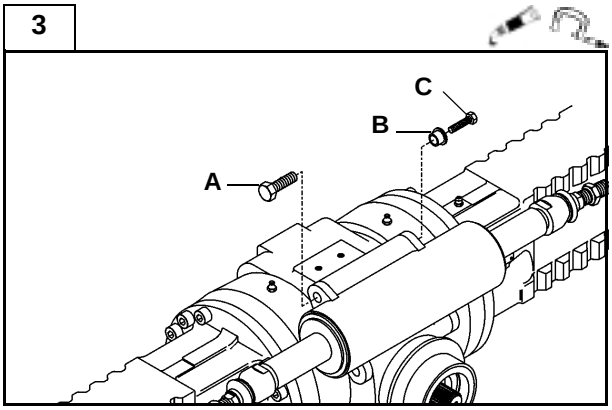
2



Infilare lo stelo premontato nel corpo cilindro.

Slide the pre-assembled rod into the cylinder body

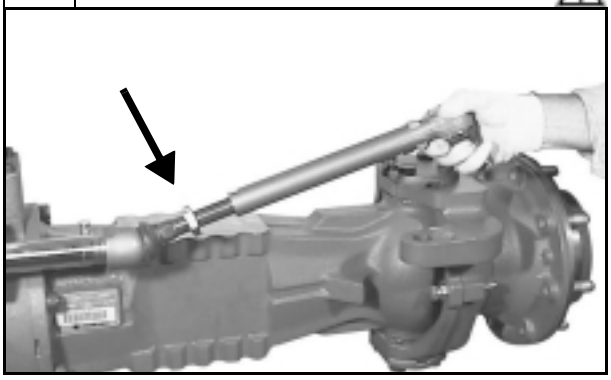
3



Applicare Loctite® 270 sul filetto della vite di fissaggio (**A**) del cilindro sterzo.
Installare sul corpo centrale il cilindro sterzo inserendo la boccola di centraggio (**B**) e le viti di fissaggio (**A**) e (**C**) nelle relative sedi.
Serrare le viti di fissaggio del cilindro sterzo con chiave dinamometrica alla coppia prevista (Sez. B.8)

*Apply Loctite® 270 on the thread of the steering cylinder fastening screw (**A**).*
*Install the steering cylinder on the central body inserting the dowel bush (**B**) and the screws (**A**) and (**C**) in their housings.*
Tighten the steering cylinder fastening screws with dynamometric wrench to the requested torque (Sec. B.8).

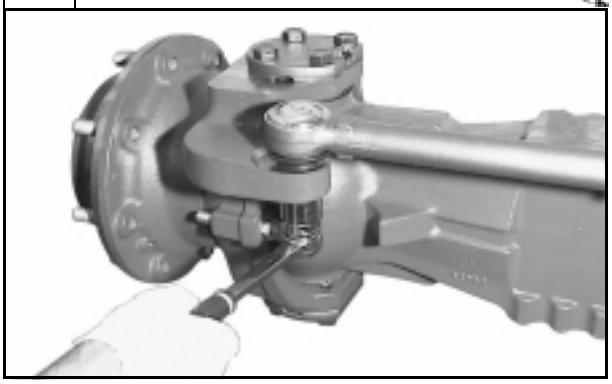
4



Montare alle estremità dello stelo del martinetto le aste guida.
Avvitare o svitare l'asta guida di una quantità tale da poter infilare lo snodo sferico sulla calotta.
Nota: è importante svitare il dado di bloccaggio per eseguire questa operazione.

Fit the tie rods to the ends of the cylinder rod.
Screw in or out the guide rod so that the ball joint can be inserted into the swivel housing.
***Note**: it is important to unscrew the locking nut to carry out this operation.*

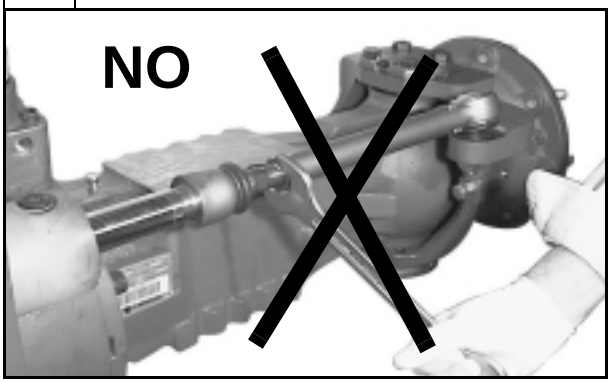
5



Inserire lo snodo sferico nella propria sede sulla calotta.
Montare e serrare il dado di fissaggio con chiave dinamometrica alla coppia prevista (Sez. B.8).

Insert the ball joint into its own housing on the cap.
Assemble and tighten the lock nut with dynamometric wrench to the requested torque (Sec. B.8).

6



Non avvitare il dado di bloccaggio dell'asta guida fino a quando non si è effettuata la registrazione della convergenza.

Screw in the lock nut of the guide rod only when the toe-in adjustment has been carried out.

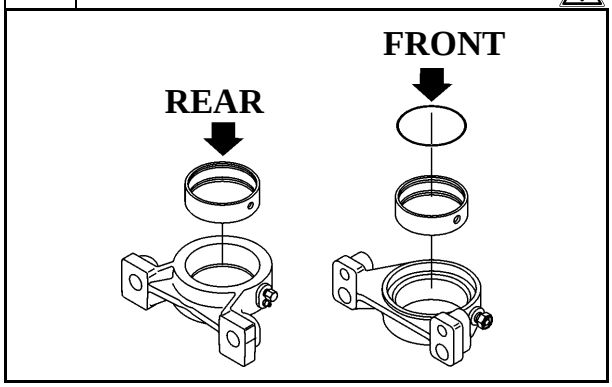
E.9 Montaggio gruppo supporti assale

E.9 Axle trunnions group assembly

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

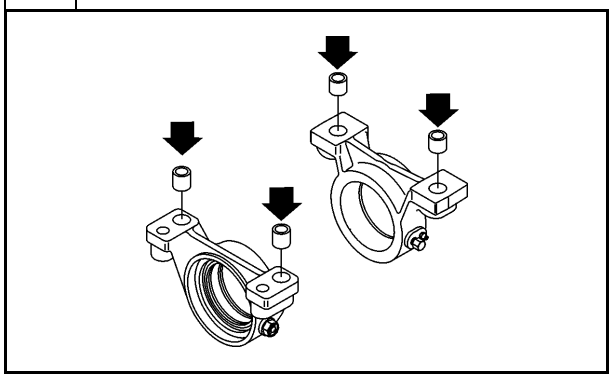
1



Posizionare il supporto posteriore ed anteriore su di un banco di lavoro e montare le rispettive boccole di rasamento, mettendole in fase con i rispettivi fori dei supporti.
Montare le viti forate che bloccano le boccole di rasamento, fissandole con una chiave dinamometrica alla coppia prevista (sez. B8).
Nota: Ricordare di montare un nuovo anello OR sul supporto anteriore.

Place the front and rear supports on a work bench and fit the respective bushings.
The retaining / lubrification hole in the bushings must align with screw hole in the front and rear supports.
Insert the bush retaining bolts and tighten to the prescribed torque (sez. B8).
Note: *Fit a new O-ring to the front support.*

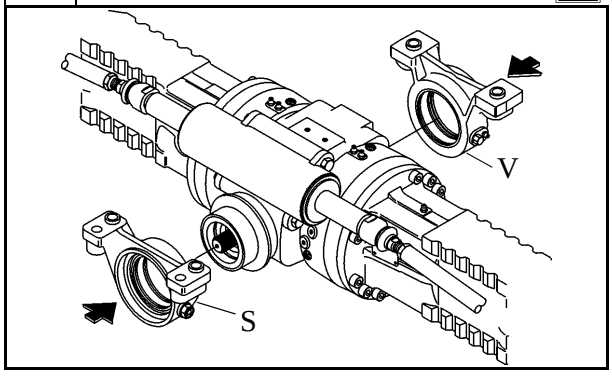
2



Solo se necessario montare le 2 nuove boccole di centraggio con un battitoio adatto.

Only if necessary fit 2 new centering bushes with a suitable driver.

3



Montare il supporto anteriore "**S**" e posteriore "**V**" sul corpo centrale facendo attenzione a non rovinare l'anello OR.

*Fit the front "**S**" and rear "**V**" supports to the central body taking care with the O-ring.*

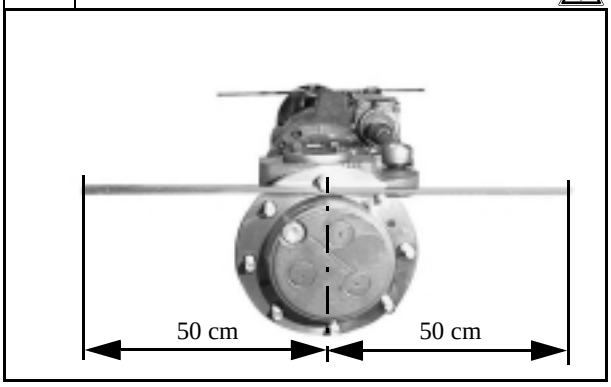
E.10 Registrazione convergenza

E.10 Toe-in adjustment

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

Some of the following pictures could not show exactly your axle, but the procedure is the same.

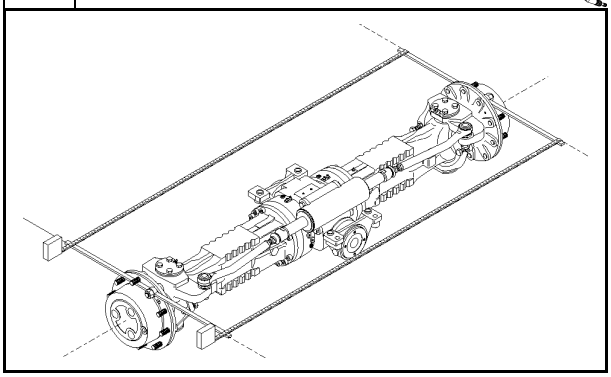
1



Montare 2 barre lineari uguali, lunghe 1 m, sui lati ruota, bloccandole con due dadi, sui prigionieri mozzo ruota.
Nota: Le due barre devono essere fissate alla loro mezzeria, in modo che siano perfettamente perpendicolari alla superficie di appoggio. Allineare al meglio le due barre.

Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.
***Note:** The two bars should be fixed on their middle so that they are perpendicular to the supporting surface. Align the two bars.*

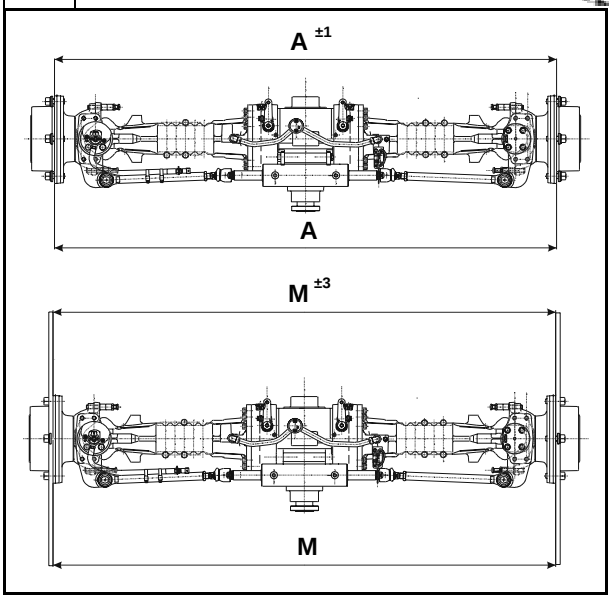
2



Rilevare con un metro a nastro, dai punti più estremi delle barre, la distanza millimetrica.
Nota: Prendere il valore minimo oscillando il punto di misurazione.

Measure the distance in mm. between the bar ends with a tapeline.
***Note:** Keep the minimum value, swinging the measurement point.*

3



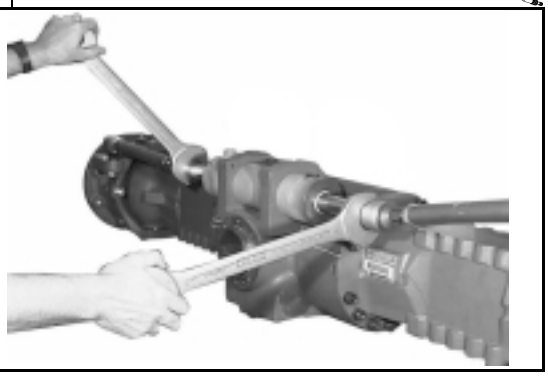
Verificare che la differenza tra le misurazioni alle estremità dei diametri dei mozzi ruota rientri nel campo di tolleranza richiesto (Vedi "convergenza" in Sez. B.4).
Il valore della convergenza nominale (**A**) è riferito al diametro esterno della flangia dei mozzi ruota, quindi il valore misurato (**M**) alle estremità delle barre deve essere rapportato alle loro proporzioni rispetto a tale diametro

converg. nominale (sez.B.4) = A $^{\pm 1}$ → converg. misurata = M $^{\pm 3}$

Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range (See "Toe-in" in sec. B.4).
*The nominal toe-in value (**A**) is referred to the external diameter of the wheel hubs flange, therefore the measured value (**M**) at the bars ends must be related to the ratio between lenght of the bar and flange diameter*

nominal toe-in (sec.B.4) = A $^{\pm 1}$ → measured toe-in = M $^{\pm 3}$

4



Nel caso che la convergenza non sia esatta agire con due chiavi sulle aste guida avvitando e svitando i due tiranti snodo equamente, in modo che alla fine rientri nella tolleranza prevista.

If toe-in is incorrect, operate with two wrenches on the guide rods screwing in and out the two joint tie rods equally till the toe-in is with in the requested tolerance.

5

Eseguita la regolazione, avvitare i dadi di bloccaggio delle aste guida alla coppia di serraggio prevista (sez. B8).

After adjusting, screw in the lock nuts of the guide rods to the requested torque (sec. B8).

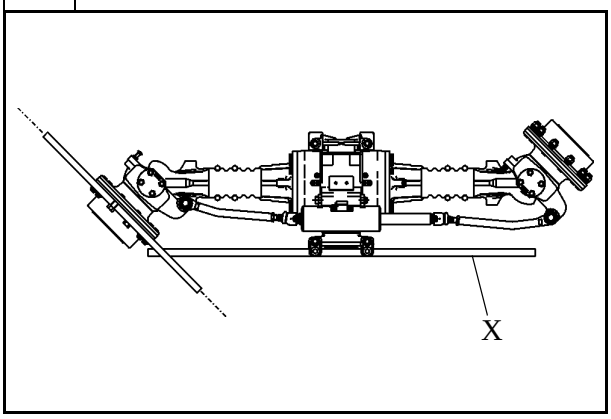
E.11 Registrazione angolo di sterzata

Alcune figure che seguono potrebbero non mostrare esattamente il vostro assale, ma la procedura rimane la stessa.

E.11 Steering angle adjustment

Some of the following pictures could not show exactly your axle, but the procedure is the same.

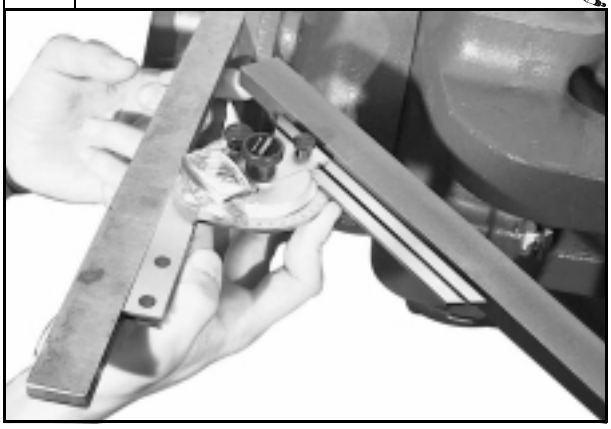
1



Utilizzare le stesse barre montate per la registrazione della convergenza ed una barra lunga, appoggiata perfettamente alla parte lavorata del corpo centrale (lato pignone), in modo che al massimo della sterzata le due barre formino un angolo acuto.

Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

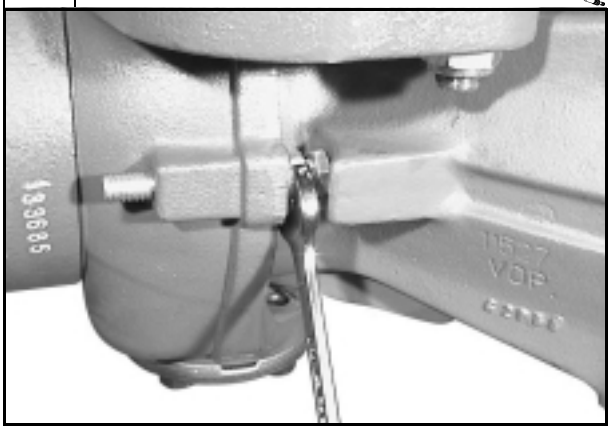
2



Regolare un goniometro all'angolo prescritto (Sez B.4) e posizionarlo sulla barra lunga.
Orientare un lato ruota fino a formare con le due barre l'angolo fissato dal goniometro.

Adjust a goniometer to the requested angle (Sec. B.4) and position it on the long bar.
Move a wheel side till it forms, with the two bars, the angle fixed by the goniometer.

3



Effettuare la regolazione del fermo meccanico di sterzata, avvitando o svitando le apposite viti (in figura), bloccandole poi con controdado alla coppia di serraggio prescritta (Sez. B.8).
Sterzare completamente dal lato opposto e ripetere le stesse operazioni.

Adjust the steering mechanical retainer, screwing in or out the special screws (see figure), locking them with a locknut to the requested torque (Sec. B.8).
Steer completely towards the other side and repeat the same operations.

E.12 Prove dopo montaggio

Passo 1
A motore spento, sollevare l'assale (**i**) della ruota motrice sino a che i pneumatici si siano staccati da terra.

Passo 2
Ingranare la marcia in modo che il pignone sia bloccato.

Passo 3
Con l'aiuto di un'altra persona collocata al lato opposto, iniziare la prova di montaggio ruotando per quanto possibile entrambe le ruote nel senso di marcia avanti. (Entrambe le ruote dovrebbero bloccarsi dopo poco)

Passo 4
Con il pignone sempre bloccato, liberare la ruota di destra e ruotare la ruota di sinistra nel senso (marcia avanti).
Se il montaggio è corretto si dovrà verificare che la ruota giri liberamente senza eccessivi sforzi, e la ruota di destra ruoti in senso opposto.
Ripetere l'operazione nel senso opposto (retro marcia).

SE UNA DELLE RUOTE NON GIRA LIBERAMENTE IN ENTRAMBE LE DIREZIONI ricontrollare passo passo il montaggio controllare anche che i freni non siano regolati scorrettamente agendo in modo improprio.

E.12 Testing after assembly

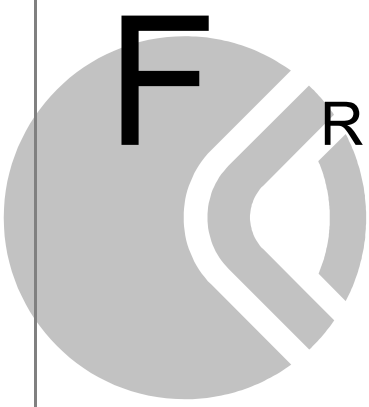
Step 1
*With engine off, lift the axle **(i)** so that the tyres get away from the ground.*

Step 2
Engage the gear so that the pinion gets blocked.

Step 3
With the help of another person standing on the opposite side, begin the assembly testing by rotating as much as possible both the wheels forward. (Both the wheels should get blocked after a while.)

Step 4
Keeping the pinion blocked, free the right wheel and rotate the left one in the line of march. Rotate the right wheels in the opposite direction.
The wheel will move freely without difficulty and the right wheel will move in the opposite direction if the assembly has been carried out correctly.
Repeat the same operation in the opposite direction (reverse gear).

IF ONE OF THE WHEELS DOES NOT ROTATE FREELY IN BOTH THE DIRECTIONS, then check step by step all assembly operations. Check and see that the brakes are regulated correctly and functioning properly.



F RICERCA GUASTI

F *TROUBLESHOOTING*

PROBLEMA	POSSIBILI CAUSE										
	1	2	3	4	5	6	7	8	9	10	11
- Vibrazioni delle ruote; resistenza del pneumatico anteriore; rottura del/i semiasse/i.	●	●	●		●						●
- Difficoltà nello sterzare; il veicolo tende ad andare dritto mentre è in curva.	●	●	●	●							●
- Non vi è azione del differenziale; inceppamento in curva.	●			●	●						●
- Rumore eccessivo nella trasmissione.	●	●	●	●	●		●		●		●
- Usura eccessiva del pneumatico.	●	●	●	●	●	●	●				●
- Rumore di attrito.	●			●	●			●	●	●	●
- In marcia avanti si avvertono vibrazioni, rumore intermittente.	●	●	●		●						●

PROBLEMS	POSSIBLE CAUSES										
	1	2	3	4	5	6	7	8	9	10	11
- Wheel vibration; front tyre resistance; halfshaft breakage.	●	●	●		●						●
- Steering is difficult; vehicle goes straight while its turning.	●	●	●	●							●
- No differential action; jamming while steering.	●			●	●						●
- No differential action; jamming while steering.	●	●	●	●	●		●		●		●
- Uneven wear of tyre.	●	●	●	●	●	●	●				●
- Friction noise.	●			●	●			●	●	●	●
- Vibration during forward drive, intermittent noise.	●	●	●		●						●

1 Installazione scorretta / assale difettoso

Correggere l'installazione oppure, se il differenziale non supera una delle fasi di prova, ripararlo o sostituirlo.

2 Sovraccarico e/o distribuzione scorretta del peso

Togliere il peso in eccesso e ridistribuire il carico, rispettando le istruzioni relative al veicolo.

9 Incorrect installation / defective axle

Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

10 Overloading/ incorrect weight distribution

Remove excessive weight and redistribute load, following instructions related to the vehicle.

3 Raggio di rotazione dei pneumatici diversi

Un pneumatico con raggio più piccolo provoca un parziale slittamento della ruota quando si applica energia. L'altro pneumatico con raggio maggiore dovrà sopportare tutto il lavoro. Sostituire il pneumatico o regolare la pressione di entrambi sino a che il raggio di rotazione sia uguale.

4 Semiasse rotto

E' sconsigliato usare un veicolo con un solo semiasse. E' possibile tuttavia spostare il veicolo a vuoto con il differenziale bloccato per pochi metri.

5 Semiasse piegato

Sostituire i semiassi.

6 Differenziale bloccato

Funzionamento anomalo del differenziale e/o rottura del dispositivo di comando del bloccaggio di comando. Verificare l'installazione, eventualmente smontare e verificare i componenti.
I veicoli impostati per angoli di sterzata ampi, possono procedere a scatti, avere difficoltà di sterzo e provocare un consumo del pneumatico nelle curve strette.
Ridurre l'angolo di sterzata minimo e decelerare quando il motore inizia a procedere a scatti.

7 Allineamento scorretto della ruota

Verificare l'integrità della struttura, e cuscinetti lato ruota.

8 Parti dell'assale consumate o difettose

Controllare le condizioni della corona dentata, dell'ingranaggio del pignone, dei cuscinetti, delle guarnizioni, ecc. Sostituire dove necessario.

9 Corpi estranei nella scatola dell'assale o montaggio scorretto di alcune sue parti

Controllare se vi sono corpi estranei. Controllare il montaggio delle parti dell'assale.

10 Regolazioni della coppia conica scorrette: parti di trasmissione consumate

(ingranaggi di trasmissione, giunti, ecc.). Sostituire o regolare secondo necessità.

11 Uso scorretto del prodotto

Rivedere le istruzioni rilasciate dal produttore del veicolo.

11 Different rotation radius of the tyres

If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied.The other tyre with bigger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyre.

12 Broken halfshaft

It is not advisable to operate the vehicle with a broken halfshaft. It is acceptable to move the vehicle (engine off unloaded) a few meters away only.

13 Bent halfshaft

Replace halfshaft.

14 Blocked differential

Abnormal functioning of the differential or breakage/ blockage of command device. Verify assembly and all components.
Vehicles with wide steering angle may proceed with kicks, have steering difficulty or cause pneumatic wearing at sharp turns. Reduce the steering angle to minimum and decelerate when the vehicle begins to kick.

15 Incorrect wheel adjustment

Verify group integrity and wheel side bearings.
Adjusting according.

16 Spoiled or worn out axle parts

Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.

17 Contamination in the axle box or incorrect assembly of parts

Look for foreign particles. Check assembly of the various parts of the axle.

18 Incorrect adjustment of bevel gear set: Parts of the transmission worn out.

(transmission gears, U joints, etc.)
Replace or adjust as required.

19 Incorrect use of the product

See the vehicle producer‘s instructions once again.

F.1 Controllo ed esame dei guasti

Questo capitolo offre una guida descrittiva ed esplicativa di problemi che si possono comunemente riscontrare sugli assali o di avarie che si possono verificare. La guida suggerisce anche le corrette procedure di riparazione.

Problema	Causa	Riparazione consigliata
Rottura verso l'estremità esterna del dente corona dentata	1. Carico dell'ingranaggio eccessivo rispetto a quello previsto 2. Regolazione ingranaggio scorretto (gioco eccessivo) 3. Dado del pignone allentato.	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente.
Rottura verso l'estremità interna del dente corona dentata	1. Urto da carico 2. Regolazione ingranaggio scorretto (gioco insufficiente) 3. Dado del pignone allentato	Sostituire corona dentata e pignone. Seguire attentamente le operazioni raccomandate di regolazione del gioco della corona dentata e del pignone e per la rilevazione dell'impronta del dente
Denti del pignone e della corona dentata erosi o rigati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Lubrificante errato o con additivi impoveriti 4. Cuscinetti del pignone consumati che provocano un gioco assiale del pignone e un contatto tra pignone e corona scorretto.	Sostituire corona dentata e pignone. Sostituire i cuscinetti del pignone facendo attenzione a sistemare correttamente la corona, il pignone e i precarichi dei cuscinetti. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti della corona e del pignone surriscaldati. Guardare se i denti dell'ingranaggio hanno perso la colorazione	1. Funzionamento prolungato a temperatura eccessiva. 2. Lubrificante scorretto 3. Livello dell'olio basso 4. Lubrificante sporco.	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire vino al giusto livello e sostituirlo agli intervalli raccomandati.
Denti del pignone di comando butterati	1. Uso estremamente intenso 2. Lubrificazione insufficiente	Sostituire corona dentata e pignone. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Corpo trave dell'assale piegato	1. Sovraccarico del veicolo 2. Veicolo incidentato 3. Urto da carico	Sostituire il corpo trave dell'assale
Cuscinetti consumati o butterati	1. Lubrificazione insufficiente 2. Lubrificante sporco 3. Uso estremamente intenso 4. Consumo normale 5. Dado del pignone allentato.	Sostituire i cuscinettii. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Le guarnizioni perdono olio	1. Funzionamento prolungato con temperatura dell'olio eccessiva. 2. Guarnizione dell'olio montata male 3. Bordo della guarnizione tagliata o intaccata 4. Lubrificante sporco	Sostituire la guarnizione e la superficie di accoppiamento se danneggiata. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Usura eccessiva della scanalatura della flangia di entrata.	1. Uso intenso 2. Dado del pignone allentato 3. Gioco assiale del pignone	Sostituire la flangia Controllare che la scanalatura del pignone non sia eccessivamente consumata Sostituire corona dentata e pignone, se necessario.

Problema	Causa	Riparazione consigliata
Rottura per fatica del dente dell'ingranaggio del pignone. Guardare se la linea di frattura ad onda è ben delineata (linea di arresto).	1. Uso intenso 2. Sovraccarico continuo	Sostituire corona dentata e pignone.
Rottura denti pignone e corona	Carico d'urto dei componenti del differenziale	Controllare e/o sostituire altri componenti differenziale.
Scanalature dell'ingranaggio planetario consumate (gioco eccessivo)	Uso intenso	Sostituire il gruppo ingranaggi differenziale. Sostituire il semiasse, se necessario.
Superfici della ralla di rasamento consumate o graffiate	1. Lubrificazione insufficiente 2. Lubrificazione scorretta 3. Lubrificante sporco	Sostituire tutte le ralle graffiate e quelle con uno spessore di 0,1mm inferiore a quello di rosette nuove. Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Diametro interno del cuscinetto a rulli conici del pignone consumato	1. Uso intenso 2. Gioco assiale del pignone eccessivo 3. Lubrificazione inadeguata 4. Lubrificante sporco	Sostituire il cuscinetto Controllare il gioco assiale del pignone Usare il lubrificante corretto, riempire fino al giusto livello e sostituirlo agli intervalli raccomandati.
Semiasse ritorto o rotto	Funzionamento intenso del veicolo, sovraccarico	Sostituire il semiasse
Semiasse spezzato presso la flangia ruota	1. Supporto della ruota allentato 2. Corpo trave piegato	Sostituire il semiasse Controllare la distorsione del corpo trave. Accertarsi che il sostegno della ruota non sia consumato o mal regolato.

F.1 Troubleshooting

This chapter is a descriptive and explanatory guide to common axle problems. This guide suggests the repair correct procedures to be followed.

Problem	*Cause*	*Action*
Ring gear tooth broken at the outer side	*1. Excessive gear load compared to the one foreseen* *2. Incorrect gear adjustment (excessive backlash)* *3. Pinion nut loosened*	*Replace bevel gear set* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash*
Ring gear tooth broken side	*1. Load bump* *2. Incorrect gear adjustment (insufficient backlash)* *3. Pinion nut loosened*	*Replace bevel gear set* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash.*
Pinion or ring gear teeth or worn	*1. Insufficient lubrication* *2. Contaminated oil* *3. Incorrect lubrication or depleted additives* *4. Worn out pinion bearings that cause an incorrect pinion axle backlash and wrong contact between pinion and ring.*	*Replace bevel gear set.* *Follow carefully the recommended operations for the adjustment of bevel gear set backlash.* *Use correct lubricants, fill up to the right levels and replace according to the recommended program.*
Overheated ring and pinion teeth. See if gear teeth have faded	*1. Prolong ed functioning at high temperatures* *2. Incorrect lubrication* *3. Low oil level* *4. Contaminated oil*	*Replace bevel gear set.* *Use proper lubrication, fill up to right level and replace at recommended program.*
Pinion teeth pitting	*1. Excessive use* *2. Insufficient lubrication*	*Replace bevel gear set.* *Use correct lubrication, fill up to the right level and substitute at recommended intervals*
Axle beam body bent	*1. Vehicle over loaded* *2. Vehicle's accident* *3. Load bump*	*Replace axle beam body*
Worn out or pitted bearings	*1. Insufficient lubrication* *2. Contaminated oil* *3. Excessive use* *4. Normal wear out* *5. Pinion nut loosened*	*Replace bearings.* *Use correct lubrication fill up, to the right level and replace at recommended intervals*
Oil leakage form gaskets and seals	*1. Prolonged functioning at high temperature of the oil* *2. Oil gasket assembled incorrectly* *3. Seal lip damaged* *4. Contaminated oil*	*Replace the gasket or seal and matching surface if damaged.* *Use correct lubrication and replace at recommended intervals.*
Excessive wearing out of input flange spline	*1. Exhaustive use* *2. Pinion nut loosened* *3. Pinion axle backlash*	*Replace the flange.* *Check that the pinion spline is not excessively worn out.* *Replace bevel gear set if required.*
Fatigue failure of pinion teeth *See if the fracture line is well defined (wave lines, beach lines)*	*1. Exhaustive use* *2. Continuos overload*	*Replace bevel gear set*
Pinion and ring teeth breakage	*1. Crash load of differential components*	*Check and/or replace other differential components.*

Problem	*Cause*	*Action*
Side gear spline worn out. *Replace all scratched washers (Excessive backlash)*	*Excessive use*	*Replace differential gear group.* *Replace halfshaft if required*
Thrust washer surface worn out or scratched.	*1. Insufficient lubrication* *2. Incorrect lubrication* *3. Contaminated oil*	*Use correct lubrication and fill up to right level.* *Replace at intervals recommended.* *Replace all scratched washers and those with 0,1mm thickness lower than the new ones.*
Inner diameter of tapered roller bearing worn out.	*1. Excessive use* *2. Excessive pinion axial backlash* *3. Insufficient lubrication* *4. Contaminated oil*	*Replace bearing.* *Check pinion axial backlash.* *Use proper lubrication, fill up to right level and replace at recommended intervals.*
Bent or broken halfshaft	*Vehicle intensively operated or overloaded*	*Replace*
Halfshaft broken at wheel side	*1. Wheel support loosened* *2. Beam body bent*	*Replace* *Check that wheel support is not worn out or wrongly adjusted.*

F.2 Diagnosi per problemi all'assale

Problema	Causa	Riparazione consigliata
Rumore durante la guida	1. Gioco tra corona dentata e pignone eccessivo 2. Pignone e corona dentata consumati 3. Cuscinetti del pignone consumati 4. Cuscinetti del pignone allentati 5. Gioco assiale del pignone eccessivo 6. Cuscinetti del differenziale consumati 7. Cuscinetti del differenziale allentati 8. Eccessiva scentratura della corona dentata 9. Livello lubrificante basso 10. Lubrificante di grado povero od errato 11. Semiasse piegato	1. Regolare 2. Sostituire 3. Sostituire 4. Regolare 5. Regolare 6. Sostituire 7. Regolare 8. Sostituire 9. Rabboccare 10. Sostituire 11. Sostituire
Rumore durante l'andatura in folle	1. I rumori provenienti dall'assale con il veicolo in movimento di solito si sentono durante l'andatura in folle anche se non molto forti 2. Errato gioco tra pignone e corona (il rumore che si sente decelerando sparisce all'aumentare della velocità). 3. Usura scanalatura pignone o flangia entrata	1. Regolare o sostituire (vedere sopra) 2. Regolare 3. Sostituire
Rumore intermittente	1. Corona dentata danneggiata 2. Bulloni della scatola del differenziale allentati	1. Sostituire coppia conica 2. Serrare a coppia
Rumore costante	1. Danni sui denti della corona dentata o del pignone 2. Cuscinetti usurati 3. Scanalature del pignone consumate 4. Semiasse piegato	1. Sostituire coppia conica 2. Sostituire 3. Sostituire 4. Sostituire
Rumore in curva	1. Satelliti planetari differenziale consumati 2. Scatola differenziale e/o perni del differenziale consumati 3. Ralle di rasamento del differenziale consumate 4. Scanalature del semiasse consumate	1. Sostituire 2. Sostituire 3. Sostituire 4. Sostituire

F.2 Axle problem and diagnosis

Problem	*Cause*	*Recommended repair*
Noise while driving	*1. Excessive backlash between pinion and ring gear* *2. Worn out pinion and gear ring* *3. Worn out pinion bearings* *4. Pinion bearings loosened* *5. Excessive axial pinion backlash* *6. Worn out differential bearings* *7. Differential bearings loosened* *8. Ring gear out of roundness* *9. Low lubricant level* *10. Poor or wrong lubricant* *11. Bent halfshaft*	*1. Adjust* *2. Replace* *3. Replace* *4. Adjust* *5. Adjust* *6. Replace* *7. Adjust* *8. Replace* *9. Oil level* *10. Replace* *11. Replace*
Noise while driving in neutral	*1. Noise coming from axle are usually heard when vehicle moves in neutral gear but are not loud.* *2. Incorrect backlash between pinion and ring (sound heard while decelerating disappears while increasing the speed)* *3. Pinion or input flange worn out*	*1. Replace or adjust (see above)* *2. Replace* *3. Adjust*
Intermittent noise	*1. Ring gear damaged* *2. Differential box bolts loosened*	*1. Replace bevel gear set* *2. Tighten to torque*
Constant noise	*1. Ring gear teeth or pinion damaged* *2. Worn out bearings* *3.Pinion spline worn out* *4. Bent halfshaft*	*1. Replace bevel gear set* *2. Replace* *3. Replace* *4. Replace*
Noise while seering	*1. Worn out differential gears* *2. Worn out differential box or spider* *3. Differential thrust washers worn out* *4. Half shaft spline worn out*	*1. Replace* *2. Replace* *3. Replace* *4. Replace*

G ATTREZZI SPECIALI

G *SPECIAL TOOLS*

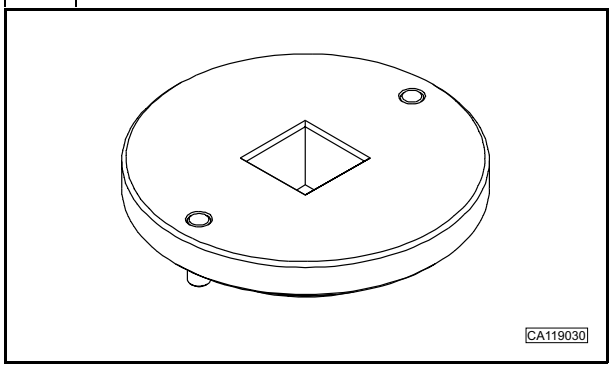
G.1 Attrezzature speciali

Battitoi e tamponi per il montaggio di tenute, cuscinetti e bronzine devono essere utilizzati con il manico intercambiabile CA119033; se ne raccomanda l'uso abbinato ad un'impugnatura di sicurezza per la protezione delle mani (da commercio).

G.1 Special tools

The special drifts/pad used to assembly the seals, bearings and bushes should always be used with the interchangeble handle CA119033; its use is recommended togheter with a suitable safety handle in order to protect the hands.

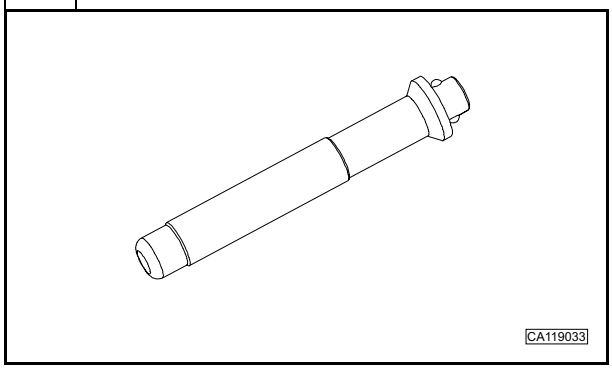
1



Chiave per ghiera
CA119030

Ring nut wrench
CA119030

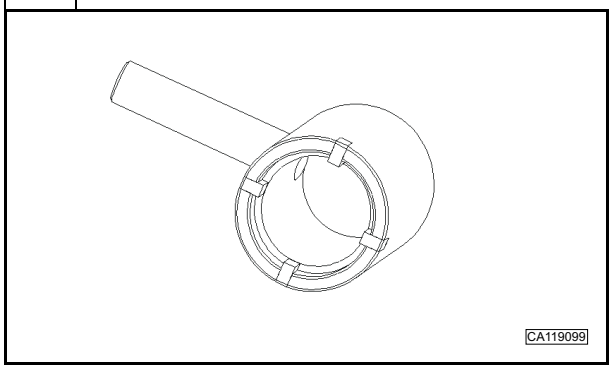
2



Manico intercambiabile
CA119033

Interchangeble handle
CA 119033

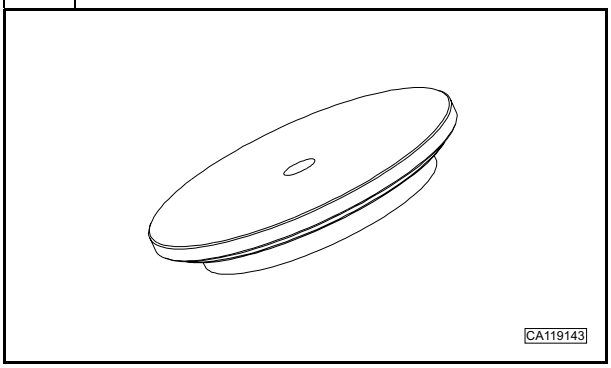
3



Chiave per ghiera pignone
CA119099

Pinion lock nut wrench
CA119099

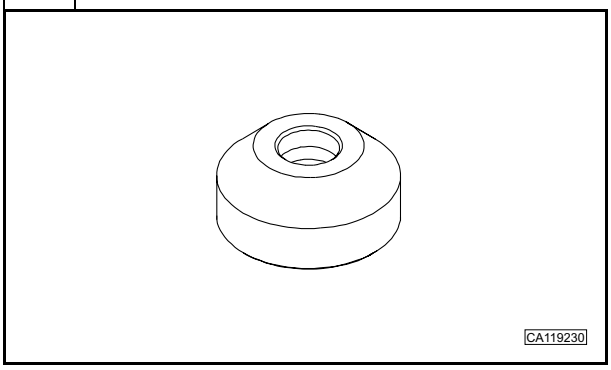
4



Battitoio anello di tenuta
CA119143

Oil seal driver
CA119143

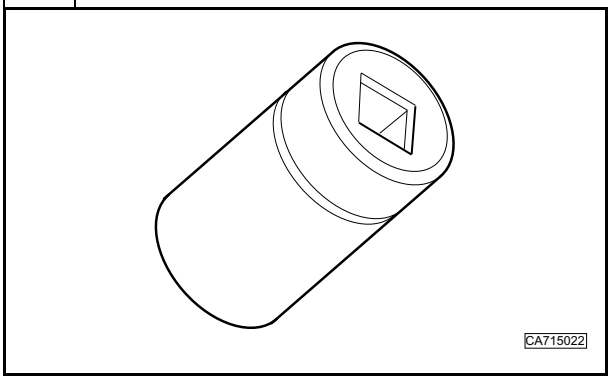
5



Battitoio per cuscinetto
CA119230

Driver for bearing
CA119230

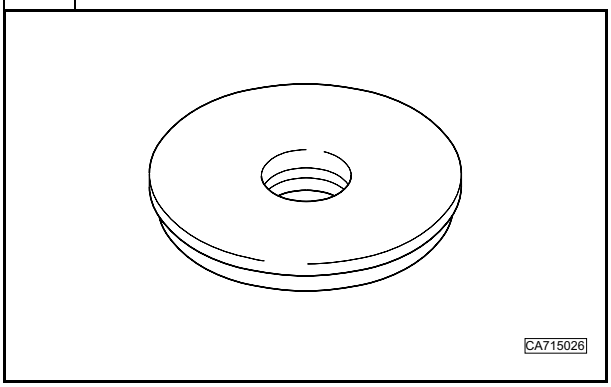
6



Chiave blocca codolo pignone
CA715022

Pinion shaft lock wrench
CA715022

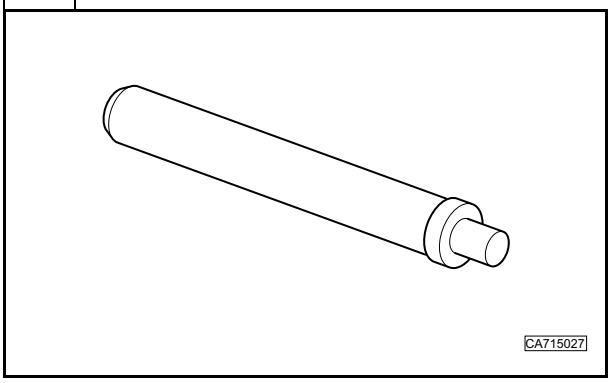
7



Battitoio cuscinetto anello interno
CA715026

Bearing cone driver
CA715026

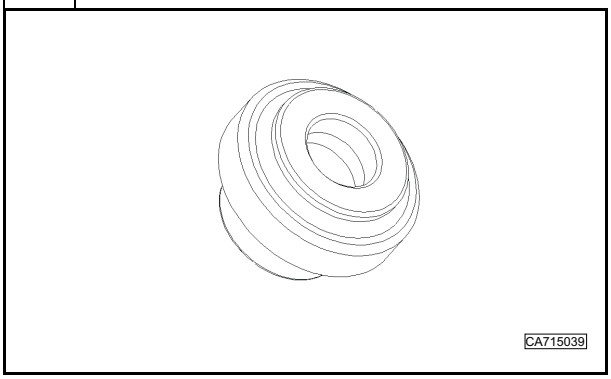
8



Battitoio per bussole
CA715027

Bush driver
CA715027

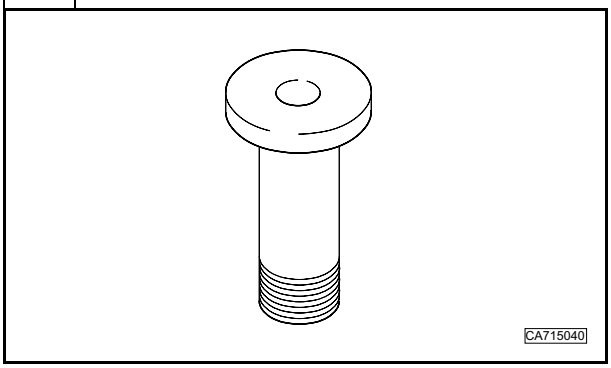
9



Battitoio per boccola
CA715039

Bush driver
CA715039

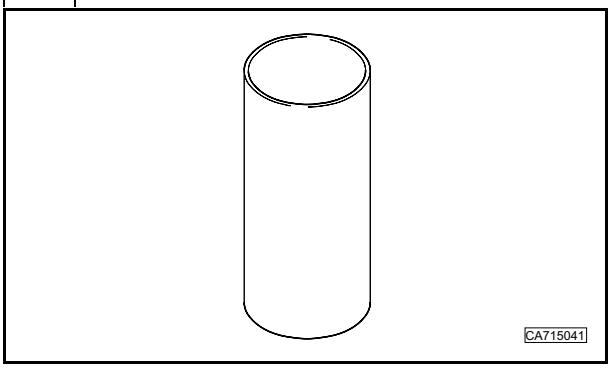
10



Falso pignone
CA715040

Dummy pinion
CA715040

11



Falsa scatola differenziale
CA715041

False differential box
CA715041

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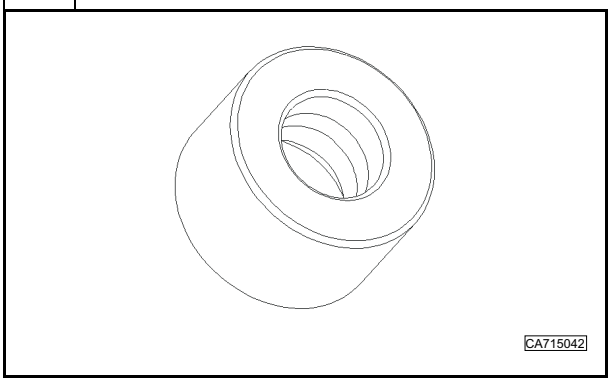

Battitoio per boccola snodo sferico
CA715042

Driver for king pin bush
CA715042

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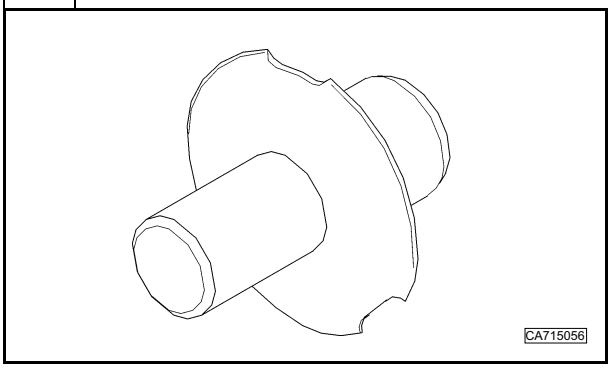

Tampone per cilindro freno
CA715056

Driver for oil seal
CA715056

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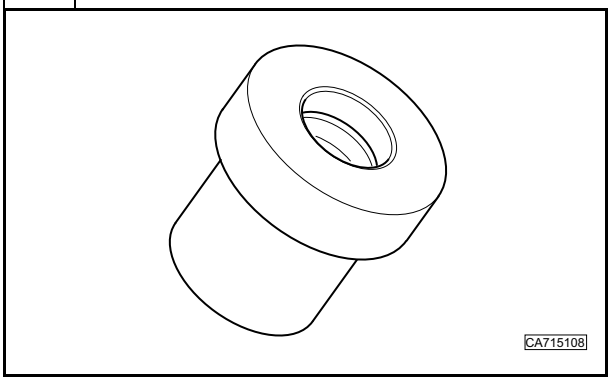

Battitoio bronzina
CA715108

Bush driver
CA715108

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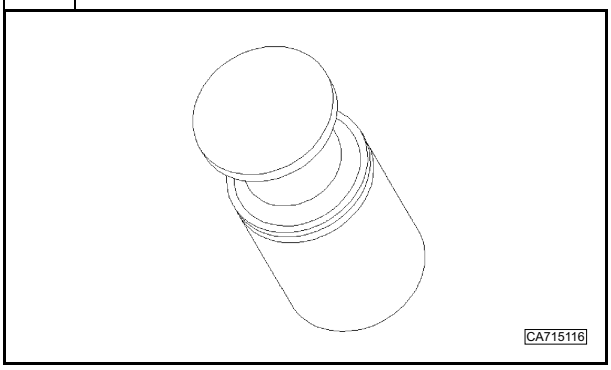

Prolunga per rivelazione precarico
CA715116

Extension for preload measurament
CA715116

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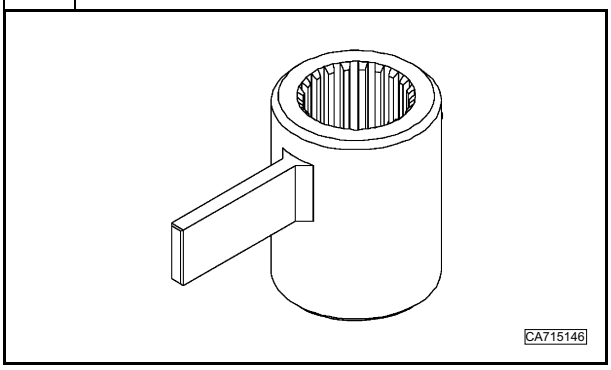
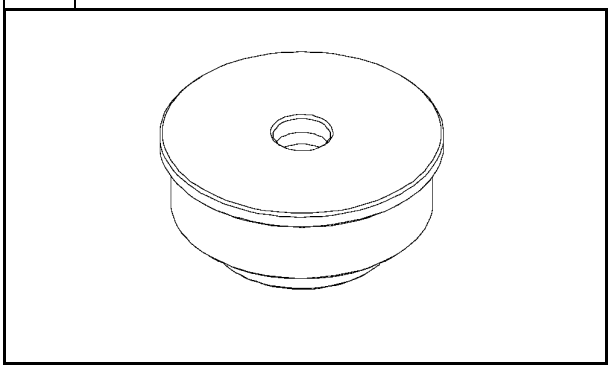


Attrezzatura per rilievo gioco
CA715146

Kit for backlash measurament
CA715146

17



Battitoio anello di tenuta
CA715043

Oil seal driver
CA715043

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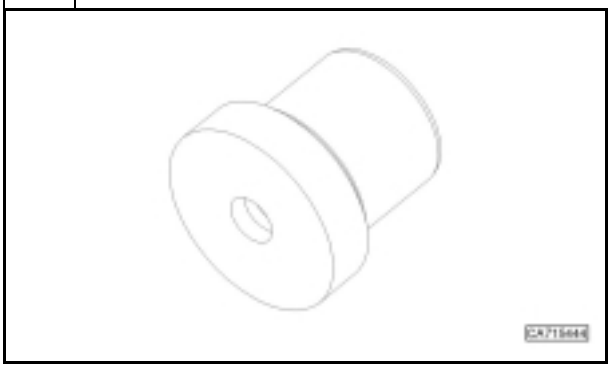

Battitoio bronzina
CA715444

Bush driver
CA715444

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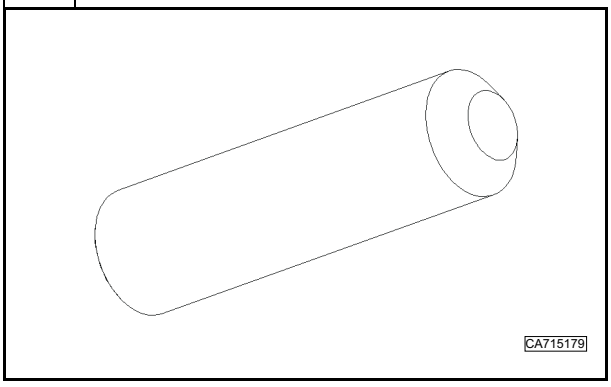
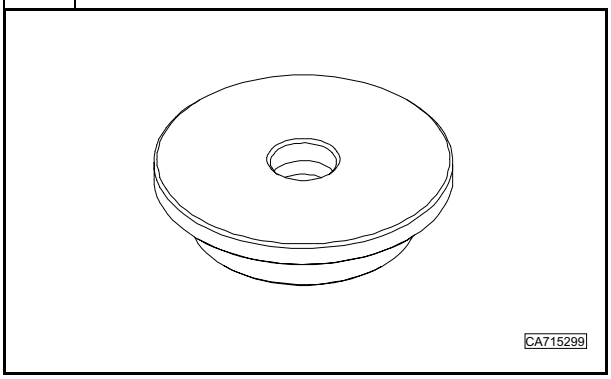


Battitoio cuscinetto anello interno
CA715179

Bearing cone driver
CA715179

20



Battitoio cuscinetto anello esterno
CA715299

Bearing cup driver
CA715299

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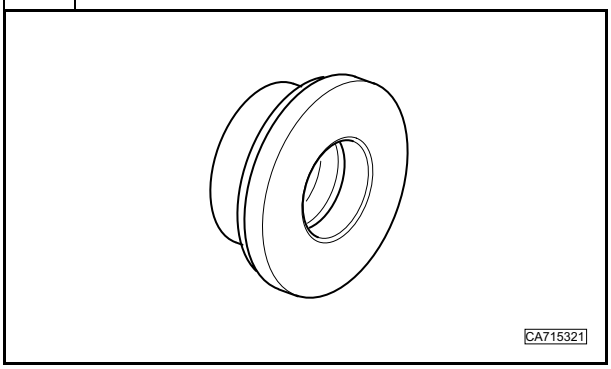
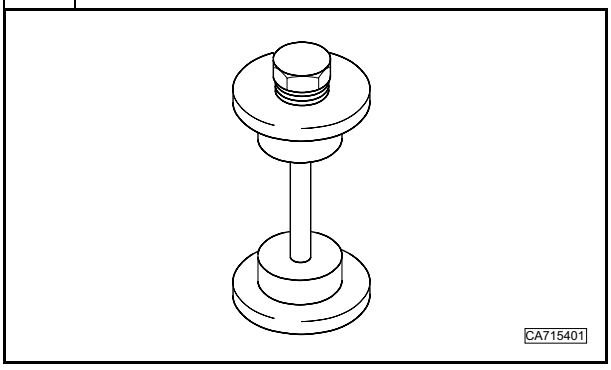


Battitoio per anelli di tenuta
CA715321

Driver for oil seal
CA715321

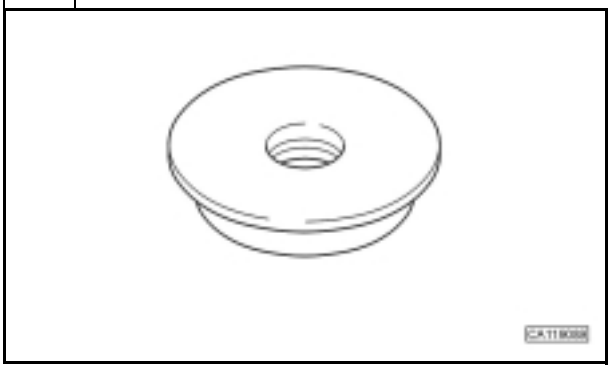
22



Kit inserimento piste cuscinetti
CA715401

Bearing races insertion kit
CA715401

23



Battitoio per anelli di tenuta
CA119089

Driver for oil seal
CA119089

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212
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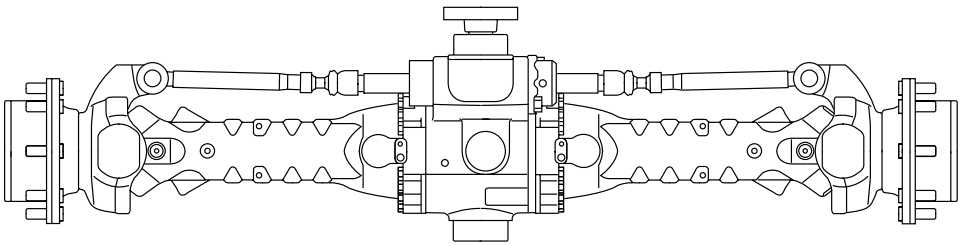
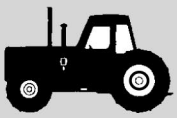
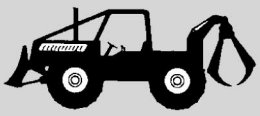
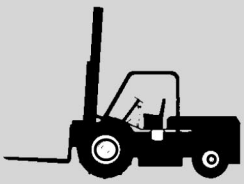
MO212S20









SPICER OFF-HIGHWAY PRODUCTS

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GB 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.

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.

CLASSIFICATION: This manual classifies units according to part numbers. For a correct interpretation, classification is indicated as follows:

▶▶[ ] = up to the part number

[ ]▶▶ = from the part number on

When no classification is given, disassembly and assembly operations are the same for all versions.

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 either from the vehicle manufacturer or directly from the Service Centers or Authorised Distributors of SPICER CLARK-HURTH.

ITA Il rendimento e la continuità degli organi meccanici dipendono oltre che da una costante e corretta manutenzione, anche dal tempestivo intervento, nell'eventualità di guasti o anomalie.
Nel proporre questo manuale si è considerata l'ipotesi di una revisione generale del gruppo ma è il meccanico a valutare la necessità di montare solo i singoli componenti nel caso di riparazione. Il manuale è una guida rapida e sicura che consente interventi precisi, tramite le fotografie ed i disegni prospettici che illustrano le varie fasi delle operazioni. Di seguito sono riportate tutte quelle informazioni ed avvertenze necessarie al corretto disassemblaggio, alle relative verifiche ed all'assemblaggio dei singoli componenti. Per la rimozione del ponte differenziale dal veicolo, è necessario consultare i manuali forniti dal costruttore del veicolo. Nel descrivere le operazioni seguenti, si presuppone che il ponte sia già stato rimosso dal veicolo.

IMPORTANTE: In tutte le operazioni, è consigliabile usare attrezzature idonee quali cavalletti o banchi di sostegno, martelli in plastica o rame, leve appropriate estrattori e chiavi specifiche, al fine di facilitare il lavoro salvaguardando nel contempo le superfici lavorate e la sicurezza degli operatori.
Prima di procedere al disassemblaggio delle parti e scaricare l'olio, è opportuno eseguire un'accurata pulizia del ponte, asportando incrostazioni ed accumuli di grasso.

PREMESSA: Tutti gli organi meccanici smontati, devono essere accuratamente puliti con prodotti appropriati, quindi ripristinati o sostituiti nel caso presentino danni, usura, incrinature, grippaggi, ecc. In particolare, verificare l'integrità di tutte quelle parti in movimento (cuscinetti, ingranaggi, coppia conica, alberi) e di tenuta (anelli OR, paraolio), soggette a maggiori sollecitazioni ed usura. È consigliabile, comunque, la sostituzione degli organi di tenuta ogni qualvolta si proceda alla revisione o riparazione dei componenti. Al momento del montaggio, gli anelli di tenuta devono essere lubrificati sui bordi di tenuta. Nel caso della coppia conica, la sostituzione di uno dei suoi ingranaggi comporta anche la sostituzione dell'altro. In fase di montaggio sono da rispettare scrupolosamente i giochi, i precarichi e le coppie prescritte.

VALIDITÀ: Il manuale fornisce le validità dei gruppi sotto forma di matricola. Al fine di una corretta interpretazione, le validità sono indicate come:

▶▶[ ] = fino alla matricola

[ ]▶▶ = dalla matricola

Se non sono indicate validità, le operazioni di smontaggio ed assemblaggio sono comuni a tutte le versioni.

MANUTENZIONE E RIPARAZIONE: Al fine di facilitare interventi sui gruppi ponte differenziali e cambi di velocità la SPICER CLARK-HURTH, ha ritenuto opportuno compilare queste istruzioni di manutenzione e riparazione. I disegni delle attrezzature specifiche eventualmente necessarie per l'esecuzione di interventi di manutenzione e riparazione possono essere acquistati direttamente presso il costruttore; i ricambi possono essere ordinati tramite il costruttore della macchina o direttamente presso la SPICER CLARK-HURTH.

D Die Leistung und Lebensdauer der mechanischen Teile hängt nicht nur von einer ständigen und richtig durchgeführten Wartung sondern auch von einem sofortigen Eingriff im Störungsfall ab. Um dieses Handbuch zu erstellen sind wir von einer allgemeinen Überprüfung der Einheit ausgegangen, doch entscheidet der Mechaniker ob die einzelnen Teile bei Reparaturen montiert werden müssen oder nicht. Das Handbuch ist schnell und einfach nachzuschlagen und ermöglicht es anhand der Abbildungen und der Zeichnungen, die die verschiedenen Vorgänge darstellen, gezielt einzugreifen. Nachstehend sind alle Informationen und Hinweise aufgeführt, die zur Zerlegung, Prüfung und Montage der Einzelteile nötig sind. Um die Differentialachse des Fahrzeugs abzumontieren, lesen Sie bitte die Anweisungen in den Handbüchern des Fahrzeugherstellers. Die nachstehenden Beschreibungen gehen davon aus, daß die Fahrzeugachse schon abmontiert worden ist.

WICHTIG: Um die Arbeit zu erleichtern und gleichzeitig die verarbeiteten Flächen zu schützen und die Sicherheit der Arbeiter zu gewährleisten, empfehlen wir geeignete Werkzeuge wie Böcke, Tisch, Gummi- oder Kupferhammer, geeignete Abzieher und Schlüssel zu verwenden.
Bevor mit der Zerlegung der Teile begonnen und das Öl abgelassen wird, muß die Achse sorgfältig gereinigt und Verkrustungen und Fettablagen abgetragen werden.

VORAUSSETZUNG: Alle abmontierten mechanischen Teile müssen sorgfältig mit geeigneten Reinigungsmitteln gereinigt oder, wenn beschädigt, verschleißt, gerissen, festgefressen usw. ausgewechselt werden. Insbesondere muß der einwandfreie Zustand aller beweglichen Teile (Lager, Zahnräder, Kegelradpaare, Wellen) und der Dichtungen (O-Ringe, Ölabdichtungen), die am meisten beansprucht werden und verschleißen, kontrolliert werden. Wir empfehlen auf jeden Fall die Abdichtungselemente immer auszuwechseln, wenn eine Überholung oder eine Reparatur der Teile vorgenommen wird. Bei

der Montage müssen die Ränder der Dichtringe geschmiert werden. Wenn beim Kegelradpaar ein Zahnrad ausgewechselt werden muß, muß auch das andere Zahnrad ausgewechselt werden. Bei der Montage müssen die vorgeschriebenen Spiele, Vorspannungen und Drehmomente strengstens eingehalten werden.

GÜLTIGKEIT: Das Handbuch gibt an zu welchen Kennummern die Einheiten gehören. Der Einfachheit halber sind die Angehörigkeiten folgendermaßen aufgeführt:

▶▶ _____ = bis Kennummer

_____ ▶▶ = ab Kennummer

Wenn keine Angehörigkeit angegeben ist, verstehen sich die Arbeiten zur Zerlegung und Montage für alle Ausführungen gültig.

SPEZIFISCHE WERKZEUGE UND ERSATZTEILE: die Zeichnungen der für Wartungsarbeiten erforderlichen spezifischen Werkzeuge, sind am Ende des Handbuchs aufgeführt; Ersatzteile können beim Fahrzeughersteller oder direkt bei der Kundendienststelle oder bei einem zugelassenen Händler der SPICER CLARK-HURTH bezogen werden.

ESP

El rendimiento y la duración de los órganos mecánicos depende, además que del constante y correcto mantenimiento, también de la intervención inmediata en caso de averías o anomalías.
Al proponer este manual, ha sido considerada la suposición de una revisión general del grupo, pero es el mecánico quien tiene que valorar la necesidad de montar cada uno de los componentes en caso de reparación. El manual es una guía rápida y segura que permite intervenciones precisas por medio de fotografías y de planos que muestran las distintas fases de las operaciones. A continuación figuran todas las informaciones y advertencias necesarias para ejecutar un montaje correcto, para las comprobaciones y el montaje de cada uno de los componentes. Para remover el puente diferencial del vehículo hay que consultar los manuales de los fabricantes del vehículo. En la descripción de las operaciones siguientes se supone que el puente ya ha sido sacado del vahículo.

IMPORTANTE: Para facilitar el trabajo salvaguardando al mismo tiempo las superficies mecanizadas y la seguridad de los operadores, se aconseja que se usen equipos y herramientas adecuados como caballetes y bancos de soporte, martillos de plástico o de cobre, palancas adecuadas, extractores y llaves específicas.
Antes de desmontar las partes y descargar el aceite, es conveniente que se haga una limpieza minuciosa del puente sacando las incrustaciones y acumulaciones de grasa.

INTRODUCCION: Todos los órganos mecánicos desmontados tienen que ser limpiados minuciosamente con productos adecuados y restaurados o sustituidos en el caso de que presenten daños, desgaste, rajaduras, agarrotamientos, etc. En particular, comprobar la integridad de todas las partes en movimiento (cojinetes, engranajes, par cónico, ejes) y de estanqueidad (anillos OR, detenedor de aceite) sujetas a mayores solicitaciones y desgaste.
Se aconseja, de todas formas, que se sustituyan los órganos de estanqueidad cada vez que se ejecute la revisión o reparación de los componentes.
Al volver a montar, los segmentos de compresión tienen que estar lubricados en los bordes de estanqueidad. En el caso del par cónico, la sustitución de uno de sus engranajes comporta también la sustitución del otro. Al montar hay que tener en cuenta escrupulosamente los juegos, las precargas y los pares descriptos.

VALIDEZ: El manual suministra la validez de los grupos en forma de matrícula. Para poder tener una interpretación correcta, la validez está indicada:

▶▶ _____ = hasta la matrícula

_____ ▶▶ = desde la matrícula en adelante

Si no ha sido indicada validez, las operación de desmontaje y montaje son comunes a todas las versiones.

HERRAMIENTAS ESPECIFICAS Y RECAMBIOS: Los planos de las herramientas especificas necesarias para la ejecución de las intervenciones de mantenimiento figuran al final del manual; los recambios se pueden pedir al fabricante de la máquina o directamente al Service Center o a Distribuidores autorizados de SPICER CLARK-HURTH.

F

Le rendement et la continuité des organes mécaniques dépendent, non seulement d'une maintenance correcte et constante, mais également de la rapidité d'intervention en cas de pannes ou d'anomalies. En vous proposant ce manuel, on envisage l'hypothèse d'une révision générale du groupe, mais c'est au mécanicien d'évaluer la nécessité de monter ou non chacun des composants en cas de réparation. Le manuel est un guide rapide et sûr consentant des interventions précises, au travers de photographies et de dessins prospectifs qui illustrent les différentes phases des opérations. Ensuite, sont reportées toutes les informations et précautions nécessaires pour un démontage correct et les vérifications et assemblage de chaque composant. En ce qui concerne le déplacement du pont d'étai du véhicule, il est nécessaire consulter les manuels fournis par le constructeur du véhicule. En décrivant les opérations suivantes, on présume que le pont ait déjà été enlevé du véhicule.

IMPORTANT: Pour faciliter le travail en sauvegardant en même temps les surfaces usinées et la sécurité des opérateurs, il est préconisé d'utiliser des installations appropriées telles que des étais ou banc de support, maillets en plastique ou cuivre, leviers appropriés, extracteurs et clés spécifiques.
Avant de procéder au démontage des parties et vidanger l'huile, il vaut mieux nettoyer soigneusement le pont, en enlevant incrustations et blocs de gras.

PRELIMINAIRE: Tous les organes mécaniques démontés doivent être soigneusement nettoyés à l'aide de produits appropriés et réparés ou remplacés dans le cas où ils seraient abîmés, usés, fêlés, grippés, etc. Vérifier, l'intégrité, en particulier, de toutes les parties en mouvement (paliers, engrenages, couple conique, arbres) et l'étanchéité des bagues (bagues OR, parahuile), qui sont sujettes à plus de sollicitations et à l'usure. Il est préconisé, de toute façon, de substituer les organes d'étanchéité, chaque fois que l'on effectue une révision ou une réparation des composants. Au moment du montage, les bagues d'étanchéité doivent être lubrifiées sur les bords étanches. Dans le cas du couple conique, la substitution de l'un de ses engrenages comporte également la substitution de l'autre. En phase de montage, il faut respecter scrupuleusement les jeux, les précharges et les couples prescrits.

VALIDITE: Le manuel fournit la validité des groupes sous forme de matricule. Pour une meilleure interprétation, les validités sont indiquées comme:

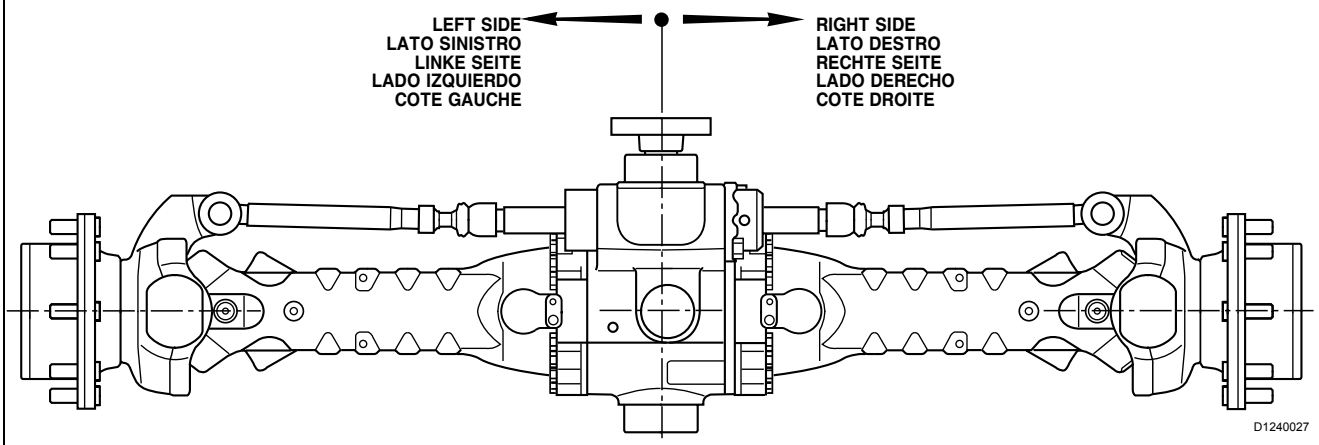
▶▶ _____ = jusqu'à l'immatriculation

_____ ▶▶ = à partir de l'immatriculation et après

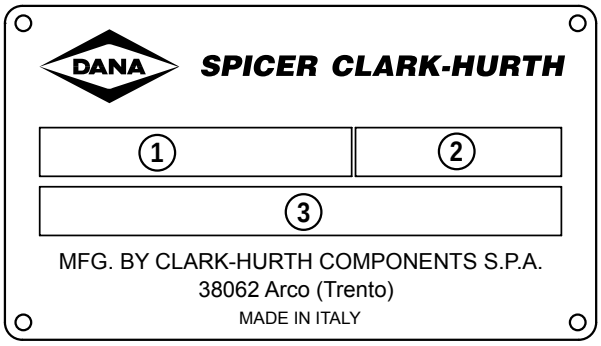
Si les validités ne sont pas indiquées, les opérations de démontage et d'assemblage sont pareilles dans toutes les versions.

INSTALLATIONS SPECIFIQUES ET PIECES DETACHEES: Les dessins des installations spécifiques nécessaires pour effectuer des interventions d'entretien sont reportées à la fin du manuel, les pièces détachées peuvent être commandées au constructeur de la machine ou directement aux Centres de Services, ou Distributeurs agréés de la Société SPICER CLARK-HURTH.

DEFINITION OF VIEWPOINTS - DEFINIZIONE VISTE - DEFINITION DER ANSICHTEN - DEFINICION VISTAS - DÉFINITION VUES



DATA PLATE - TARGA MATRICOLA - KENNUMMERNSCHILD - MATRICULA - PLAQUE D'IMMATRICULATION

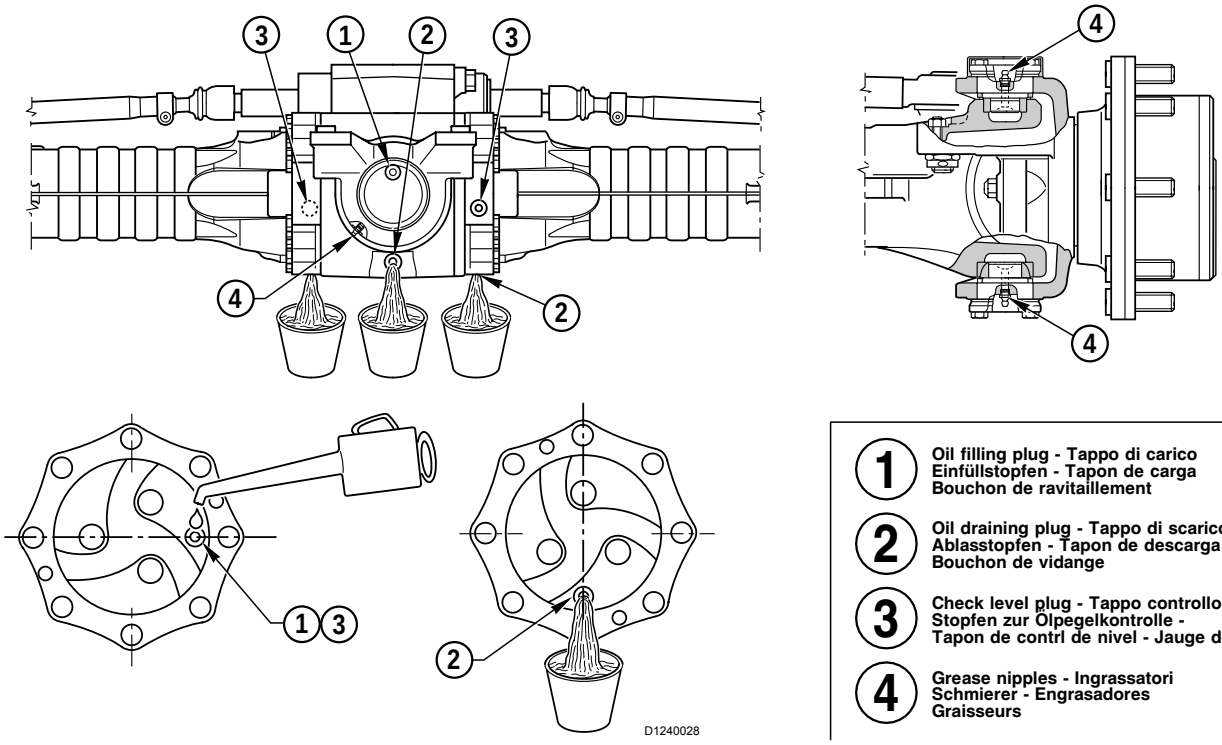


1 Type and model unit - modification index
Tipo e modello gruppo - indice di modifica
Typ und Modelleles Antriebes - Änderungsverzeichnis
Tipo y modelo grupo - indice de modificacion
Type et modéle de ensemble - tableau des modifications

2 Serial number
Numero di serie
Seriennummer
Número de serie
Numero de serie

3 Lubricant
Lubrificante
Schmieroel
Lubricante
Lubrificant

MAINTENANCE POINTS - PUNTI DI MANUTENZIONE - WARTUNGSSTELLEN - PUNTOS DE MANUTENCION - POINTS D'ENTRETIEN



1 Oil filling plug - Tappo di carico
Einfüllstopfen - Tapon de carga
Bouchon de ravitaillement

2 Oil draining plug - Tappo di scarico
Ablasstopfen - Tapon de descarga
Bouchon de vidange

3 Check level plug - Tappo controllo livello
Stopfen zur Ölpegelkontrolle -
Tapon de contrl de nivel - Jauge de niveau

4 Grease nipples - Ingrassatori
Schmierer - Engrasadores
Graisseurs

MAINTENANCE INTERVALS - INTERVALLI DI MANUTENZIONE - WARTUNGSINTERVALLE - INTERVALOS DE MANUTENCIÒN - INTERVALLE DE SERVICE

OPERATION - OPERAZIONE - ARBEITSVORGANG - OPERACION - OPERATION		FREQUENCY - PERIODICITÀ - ZEITABSTAND - FRECUENCIA - PERIODICITE	LUBRICANTS - LUBRIFICANTI - SCHMIERSTOFFE - LUBRICANTES - LUBRIFIANTS
• Check levels: • Controllo livelli: • Ölstandkontrolle: • Control niveles: • Contrôle niveaux:	Differential Differenziale Im differential Diferencial Differentiel	monthly mensile monatlich cada mes mensuel	• SAE85W90 (API GL4 - MIL L-2105) With additives for oil-bath brakes Con additivi per freni a bagno d'olio Mit Zusatzmittel für Bremsen in Ölbad Con aditivos para frenos de baño de aceite Avec adjuvants pour freins en bain d'huile • SAE85W90 (API GL5 - MIL 2105-B) With additives for oil-bath brakes, for units presenting hypoid crown wheel and pinion and /or self-locking differential gear Per esecuzioni con coppia conica ipoide e/o con differenziale autobloccante, con additivi per freni a bagno d'olio Bei Ausführungen mit Kegel- und Telleradpaar und/oder Selbstsperrdifferential, mit Zusatzmitteln für Bremsen in Ölbad Para ejecuciones con par cónico hipoide y/o con diferencial autobloqueante con aditivos para frenos de baño de aceite. Pour exécutions avec couple conique hypoïde et/ou différentiel autobloquant, avec adjuvants pour freins en bain d'huile
	Planetary reduction Riduzione epicicloidale Planetengetrieb Reducción epicicloidal Reduction epicycloidale	every 200 hours ogni 200 ore alle 200 Std. cada 200 horas toutes les 200 heures	
• Oil change: • Cambio olio: • Ölwechsel: • Cambio aceite: • Vidange huile:	Differential Differenziale Im differential Diferencial Differentiel	every 800 hours ✻ ogni 800 ore alle 800 Std. cada 800 horas toutes les 800 heures	
	Planetary reduction Riduzione epicicloidale Planetengetrieb Reducción epicicloidal Reduction epicycloidale	every 1000 hours ✻ ogni 1000 ore alle 1000 Std. cada 1000 horas toutes les 1000 heures	
	Self-locking differential gear Differenziale autobloccante Selbstsperrdifferential Diferencial autobloqueante Differentiel autobloquant	every 700 hours ✻ ❒ ogni 700 ore alle 700 Std. cada 700 horas toutes les 700 heures	

✻ Initially after 100 working hours - Inizialmente dopo 100 ore di lavoro - Erstmals nach 100 Betriebstunden - Al principio, después de 100 horas de trabajo - Initialement après 100 heures de travail

❒ When it starts sounding noisy - Anche ai primi cenni di rumorosità - Auch falls ungewöhnliche Geräusche zu bemerken sind - También al primer indicio de ruido - Même aux premiers signaux de bruit

OPERATION - OPERAZIONE - ARBEITSVORGANG - OPERACION - OPERATION	MEMBER - ORGANO - ELEMENT - ORGANO - ORGANE	CONDITIONS - CONDIZIONI - BEDINGUNG - CONDICIONES - CONDITIONS	FREQUENCY - PERIODICITÀ - ZEITABSTAND - FRECUENCIA - PERIODICITE	LUBRICANTS - LUBRIFICANTI - SCHMIERSTOFFE - LUBRICANTES - LUBRIFIANTS
Greasing Ingrassaggio Schmieren Engrase Graissage	Articulations Snodi Gelenk Rótula Articulations	Normal work Lavori normali Normale Arbeit Trabajos normales Tâches ordinaires	monthly mensile monatlich cada mes mensuel	MOLIKOTE
		Awkward work Lavori gravosi Schwere Arbeit Trabajos pesados Tâches extraordinaires	Weekly Settimanale Wöchentlich Semanal Hebdomadaire	

ADJUSTMENT AND CHECKS - REGISTRAZIONE E CONTROLLI - EINSTELLUNGEN UND KONTROLLEN - AJUSTE Y CONTROLES - REGLAGES ET CONTROLES

UNIT - GRUPPO - AGGREGAT - GRUPO - GROUPE	OPERATION - OPERAZIONE ARBEITSVORGANG - OPERACION - OPERATION	FREQUENCY - PERIODICITÀ - ZEITABSTAND - FRECUENCIA - PERIODICITE	SERVICE BRAKE CIRCUIT - CIRCUITO COMANDO FRENI - BREMSKREISLAUF - CIRCUITO MANDOS FRENOS - CIRCUIT DE COMMANDE DES FREINS
Negative brake Freno negativo Federspeicherbremse Freno negativo Frein négatif	Adjustment Registrazione Einstellen Ajuste Réglage	every 1000 hours ✻ ogni 1000 ore alle 1000 Std. cada 1000 horas toutes les 1000 hours	Only for mineral oil use e.g. ATF Dexron II. Make sure that master cylinder seals are suitable for mineral oil. Usare esclusivamente olio minerale ATF Dexron II. Accertarsi che le guarnizioni del cilindro master siano adatte a questo olio. Nur mineralisches Öl verwenden, z.B.: ATF Dexron II. Achtung: Dichtringe des Hauptbremszylinders müssen für dieses Öl geeignet sein. Usar exclusivamente aceite mineral ATF Dexron II. Asegurarse de que las juntas del cilindro principal son adecuadas para este aceite. Utiliser exclusivement huile minérale ATF Dexron II. Vérifier que les joints du maître-cylindre, soien compatibles avec cette huile.
Service brake Freni di servizio Hilfsbremse Frenos de ejercicio Freins de service	Adjustment Registrazione Einstellen Ajuste Réglage	every 500 hours ogni 500 ore alle 500 Std. cada 500 horas toutes les 500 hours	
Wheel nuts Dadi ruota Radmuttern Tuercas rueda Ecrous de roue	Tightening Serraggio - Festziehen Apriete Serrage	every 200 hours ogni 200 ore alle 200 Std. cada 200 horas toutes les 200 hours	

✻ Initially after 100 working hours - Inizialmente dopo 100 ore di lavoro - Erstmals nach 100 Betriebstunden - Al principio, después de 100 horas de trabajo - Initialement après 100 heures de travail

CONVERSION TABLES - TABELLE DI CONVERSIONE - UMRECHNUNGSTABELLEN
TABLAS DE CONVERSION - TABLEAUX DE CONVERSION

Units of pressure - Unità di pressione - Druckeinheiten
Unidad de presión - Unités de pression: 1 Atm ≅ 1 bar ≅ 10^5 P_A ≅ 14.4 P_{Si}

Units of weight - Unità di peso - Gewichtseinheiten
Unidad de peso - Unités de poids

	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

Units of torque - Unità di coppia - Drehmomenteinheiten
Unidad de par - Unités de couple

	Nm	daNm	kNm	kgm	lb-in
1Nm	1	0,1	0,001	0,102	8,854
1daNm	10	1	0,01	1,02	88,54
1kNm	1000	100	1	102	8854
1kgm	9,81	0,981	0,00981	1	86,8
1lb-in	0,1129	0,01129	0,0001129	0,01152	1

TIGHTENING TORQUES - COPPIE DI SERRAGGIO - ANZIEHDREHMOMENTE
PARES DE TORSION - COUPLES DE SERRAGE

Unit - Unità di misura - Meßeinheiten - Unidad de medida - Unités de mesure: Nm

SIZE OF BOLT MISURA VITE SCHRAUBENMASS TAMAÑO TORNILLO MESURE VIS		TYPE OF BOLT - TIPO VITE - GEWINDE - TIPO DE TORNILLO - TYPE DE VIS					
		8.8		10.9		12.9	
		Normali + Loctite 242	Loctite 270	Normali + Loctite 242	Loctite 270	Normali + Loctite 242	Loctite 270
COARSE PITCH - PASSO GROSSO - GROßER SCHRITT - PASO GRUESO - GROS PAS	M6 x 1	9,5-10,5	10,5-11,5	14,3-15,7	15,2-16,8	16,2-17,8	18,1-20,0
	M8 x 1,25	23,8-26,2	25,6-28,4	34,2-37,8	36,7-40,5	39,0-43,0	43,7-48,3
	M10 x 1,5	48-53	52-58	68-75	73-81	80-88	88-97
	M12 x 1,75	82-91	90-100	116-128	126-139	139-153	152-168
	M14 x 2	129-143	143-158	182-202	200-221	221-244	238-263
	M16 x 2	200-221	219-242	283-312	309-341	337-373	371-410
	M18 x 2,5	276-305	299-331	390-431	428-473	466-515	509-562
	M20 x 2,5	390-431	428-473	553-611	603-667	660-730	722-798
	M22 x 2,5	523-578	575-635	746-824	817-903	893-987	974-1076
	M24 x 3	675-746	732-809	950-1050	1040-1150	1140-1260	1240-1370
	M27 x 3	998-1103	1088-1202	1411-1559	1539-1701	1710-1890	1838-2032
	M30 x 3,5	1378-1523	1473-1628	1914-2115	2085-2305	2280-2520	2494-2757
FINE PITCH - PASSO FINE - KLEINER SCHRITT PASO FINO - PAS FIN	M8 x 1	25,7-28,3	27,5-30,5	36,2-39,8	40,0-44,0	42,8-47,2	47,5-52,5
	M10 x 1,25	49,4-54,6	55,2-61,0	71,5-78,5	78,0-86,0	86,0-94,0	93,0-103,0
	M12 x 1,25	90-100	98-109	128-142	139-154	152-168	166-184
	M12 x 1,5	86-95	94-104	120-132	133-147	143-158	159-175
	M14 x 1,5	143-158	157-173	200-222	219-242	238-263	261-289
	M16 x 1,5	214-236	233-257	302-334	333-368	361-399	394-436
	M18 x 1,5	312-345	342-378	442-489	485-536	527-583	580-641
	M20 x 1,5	437-483	475-525	613-677	674-745	736-814	808-893
	M22 x 1,5	581-642	637-704	822-908	903-998	998-1103	1078-1191
	M24 x 2	741-819	808-893	1045-1155	1140-1260	1235-1365	1363-1507
	M27 x 2	1083-1197	1178-1302	1520-1680	1672-1848	1834-2027	2000-2210
	M30 x 2	1511-1670	1648-1822	2138-2363	2332-2577	2565-2835	2788-3082

SCREW-LOCKING, SEALING AND LUBRICATING MATERIALS - MATERIALI PER BLOCCAGGIO VITI, TENUTA E LUBRIFICAZIONE - MATERIAL ZUR BLOCKIERUNG VON SCHRAUBEN UND FÜR DICHTUNGEN UND SCHMIERMITTEL - MATERIALES PARA EL BLOQUEO, ESTANQUEIDAD Y LUBRICACION - MATÉRIAUX POUR LE BLOCAGE VIS, ÉTANCHÉITÉ ET LUBRIFICATION

1 - Locking, sealing and lubricating materials referred to in this manual are the same used in the shop-floor.
I materiali per il bloccaggio, tenuta e lubrificazione specifica indicati nel manuale, sono quelli usati in fabbrica.
Die Materialien zur Blockierung von Schrauben, für Dichtungen und Schmiermittel, die im Handbuch aufgeführt sind, sind dieselben die auch vom Hersteller verwendet werden.
Los materiales para el bloqueo, estanqueidad y lubricación específica indicados en el manual, son los que se usan en la fábrica
Les matériaux de blocage, d'étanchéité et de lubrification spécifiés indiqués dans ce manuel sont ceux employés à l'usine.

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.
Di questi materiali, vengono riportate le applicazioni tipiche che li distinguono, in modo da poterli sostituire con prodotti similari commercializzati da altre marche e quindi con altre sigle.
Von diesen Materialien werden die typischen Anwendungen genannt, um sie mit ähnlichen Materialien zu ersetzen, die unter anderen Namen und Kennzeichnungen im Handel erhältlich sind.
De estos materiales damos las aplicaciones típicas que los distinguen, de manera que se puedan sustituir con productos similares comercializados por otras marcas y por tanto con otras siglas.
De ces matériaux ne sont reportées que les applications typiques qui les distinguent de telle sorte qu'ils puissent être substitués par des produits semblables se trouvant dans le commerce sous d'autres marques et par conséquent sous d'autres sigles.

DENOMINATION DENOMINAZIONE BEZEICHNUNG DENOMINACION DENOMINATION	**APPLICATION - APPLICAZIONE - ANWENDUNG - APLICACION - 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. • *Prodotto anaerobico adatto a prevenire l'allentamento di viti, dadi e tappi. Usato per la frenatura a media resistenza. Deve essere usato dopo aver asportato ogni traccia di lubrificante con l'attivatore specifico.* • Anaerobes Produkt, um das Lockern von Schrauben, Muttern und Stopfen zu verhindern. Für mittlere Widerstandskräfte geeignet. Darf erst aufgetragen werden, wenn die Flächen von Schmiermittel richtig sauber sind. Dazu das entsprechende Produkt verwenden. • *Producto anaeróbico apto para prevenir el aflojamiento de tornillos, tuerca y tapones. Usado para el frenado de media resistencia. Tiene que ser usado sólo después de haber quitado todo residuo de lubricante con el activador específico.* • Produit anaréobic servant à prévenir le relâchement des vis, écrous et bouchons. Utilisé pour le freinage demi résistant. Il doit être utilisé après avoir enlevé toute trace de lubrifiant à l'aide d'un activeur spécial.
Loctite 243	• The oleocompatible alternative to 242. Does not require the activation of lubricated surfaces. • *Prodotto alternativo al 242 che, essendo oleocompatibile, non richiede l'attivazione di superfici lubrificate.* • Alternatives Produkt zu Loctite 242. Da es ölkompatibel ist müssen die geschmierten Flächen nicht aktiviert werden. • *Producto alternativo al 242 que, siendo oleocompatible, no requiere la activación de superficies lubricadas.* • Produit en alternance avec le 242 lequel étant oléocompatible ne requiert aucune activation des surfaces lubrifiées.
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 approx. • *Prodotto anaerobico adatto per la frenatura ad altissima resistenza di viti e dadi. Deve essere usato dopo aver asportato ogni traccia di lubrificante con l'attivatore specifico. La rimozione delle parti, può richiedere un riscaldamento a circa 80°C.* • Anaerobes Produkt für hohe Widerstandskräfte für Schrauben und Muttern geeignet. Zuerst die Fläche sorgfältig aktivieren. Um die Flächen zu säubern, diese auf ca. 80°C erwärmen. • *Producto anaeróbico apto para el frenado de alta resistencia de tornillos y tuercas. tiene que ser usado después de haber quitado todo residuo de lubricante con el activador específico. La remoción de las partes, puede requerir un calentamiento a unos 80°C.* • Produit anaréobic apte au freinage à très haute résistance des vis et des écrous. Il doit être utilisé après avoir enlevé toute trace de lubrifiant à l'aide d'un activeur spécial.
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 max. diametrical clearance of 0.25 mm. • *Prodotto anaerobico adatto per la frenatura e sigillatura ad alta resistenza di parti filettate, bulloni e prigionieri di grandi dimensioni, protezione antimanomissione e sigillatura di tubazioni; può sigillare accoppiamenti con gioco diametrale massimo di 0,25 mm.* • Anaerobes Produkt zum Bremsen und Siegeln von großen Gewinden, Muttern und Stiftschrauben , sehr widerstandsfähig, verschleierungsbeständig, und zum Siegeln von Rohrleitungen geeignet; kann Kupplungen mit einer maximalen Lagerluft von 0,25 mm siegeln. • *Producto anaerobico apto para el frenado y selladura a alta resistencia de tornillos, tuercas y prisioneros de grandes dimensiones, protecion anti manomision y selladura de tubaciones ; puede sellar encolcados con juego diametral.* • Produit anaérobie adapté au freinage et au scellage à haute résistance des parties filetées, boulons et prisonniers de grandes dimensions, protection anti-altération et scellage de tuyauteries; il peut sceller des accouplements ayant un jeu diamétral maximal de 0,25 mm.

SCREW-LOCKING, SEALING AND LUBRICATING MATERIALS - MATERIALI PER BLOCCAGGIO VITI, TENUTA E LUBRIFICAZIONE - MATERIAL ZUR BLOCKIERUNG VON SCHRAUBEN UND FÜR DICHTUNGEN UND SCHMIERMITTEL - MATERIALES PARA EL BLOQUEO, ESTANQUEIDAD Y LUBRICACION - MATÉRIAUX POUR LE BLOCAGE VIS, ÉTANCHÉITÉ ET LUBRIFICATION

DENOMINATION DENOMINAZIONE BEZEICHNUNG DENOMINACION DENOMINATION	APPLICATION - APPLICAZIONE - ANWENDUNG - APLICACION - APPLICATION
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. • *Prodotto anaerobico adatto alla tenuta ermetica di fluidi tra assiemi flangiati e di viti a foro comunicante con i fluidi. Può sigillare giochi tra le flange fino a 0,2 mm.* • Anaerobes Produkt zur Abdichtung von Flüssigkeiten an Flanschen und Schrauben mit Löcher, die mit Flüssigkeiten in Kontakt stehen. Kann ein Spiel zwischen Flanschen bis 0,2 mm abdichten. • *Producto anaeróbico apto para le estanqueidad de fluidos entre grupos bridados y de tornillos de orificio comunicante con los fluidos. Puede sellar juegos entre las bridas hasta 0,2 mm.* • Produit anaréobic apte à la tenue étanche des fluides entre les pièces à brides et des vis à trou en contact avec les fluides. Il peut sceller un jeu parmi les flasques jusqu'à 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. • *Prodotto anaerobico sigillante rapido per la tenuta di filettature di raccordi conici o cilindrici fino a M80. Deve essere usato dopo aver asportato ogni traccia di lubrificante con l'attivatore specifico. Dopo la polimerizzazione presenta una moderata difficoltà di smontaggio per cui può richiedere, per i diametri maggiori, un riscaldamento.* • Anaerobes Produkt zum schnellen Siegeln und Abdichten von Kegel- oder Zylinderkupplungen bis M80. Darf erst aufgetragen werden, nachdem mit einem spezifischen Wirkstoff jede Spur von Schmiermittel abgetragen worden ist. Nach der Polymerisation könnte das Abmontieren etwas schwierig sein weshalb größere Durchmesser zuerst erhitzt werden müssen. • *Producto anaerobico sellante rapido para el estanqueido de tornillos de empalme conico o cilindrico hasta M80. Debe de ser utilisado despues de haber quitado cada mancha de lubrificante con activador especifico. Despues de la polimeracion presenta una moderada dificultà de desmontaje por lo tanto puede necesitar, para los diametros majores, un calientamiento.* • Produit anaérobie collage rapide assurant l'étanchéité des filetages des raccords coniques ou cylindriques jusqu'à M80. Il doit être utilisé après qu'on ait enlevé toute trace de lubrifiant à l'aide d'un activeur spécial. Une certaine difficulté de démontage se présente après la polymérisation, on peut donc avoir la nécessité de devoir chauffer préalablement pour de plus amples diamètres.
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. • *Adesivo anaerobico per l'incollaggio rapido ad alta resistenza di giunti cilindrici in metallo (mozzo su albero). Può incollare particolari con gioco tra 0,1 e 0, 25 mm.* • Anaerober Klebstoff für große Widerstandskräfte für Zylinderkupplungen aus Metall geeignet (Wellennaben). Kann Einzelteil mit einem Radialspiel zwischen 0,1 mm und 0,25 mm zusammenkleben. • *Adhesivo anaeróbico para el encolado rápido de alta resistencia de juntas cilíndricas de metal (cubo en el eje). Puede encolar piezas con juego entre 0,1 mm y 0,25 mm.* • Adhésif anaérobic servant à un collage rapide et hautement résistant des joints cylindriques en métal (moyeu sur l'arbre). Il peut servir à coller des pièces avec un jeu allant de 0,1 à 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. • *Adesivo anaerobico per l'incollaggio rapido a media resistenza di giunti cilindrici in metallo (mozzo su albero). Può incollare particolari con gioco radiale inferiore a 0,1 mm.* • Anaerober Klebstoff für mittlere Widerstandskräfte für Zylinderkupplungen aus Metall geeignet (Wellennaben). Kann Einzelteil mit einem Radialspiel von weniger als 0,1 mm zusammenkleben. • *Adhesivo anaeróbico para encolado rápido de media resistencia juntas cilíndricas de metal (cubo en el eje). Puede encolar piezas con juego radial inferior a 0,1 mm.* • Adhésif anaérobic servant à un collage rapide moyennement résistant des joints cylindriques en métal (moyeu sur l'arbre). Il peut servir à coller des pièces avec un jeu radial inférieur à 0,1 mm.
(AREXONS) Repositionable jointing compound for seals *Mastice per guarnizioni riposizionabile* Klebstoff für verstellbare Dichtungen *Pasta para juntas reposicionable* Mastic pour garnitures à remettre en place	• 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. • *Mastice sigillante per guarnizioni elastiche a base di solvente, essicante per evaporazione. Viene utilizzato per la tenuta sul diamentro esterno di anelli di tenuta per alberi rotanti con armatura metallica esterna.* • Klebstoff für Gummidichtung auf Lösemittelbasis, trocknet durch Verdampfung. Wird am äußeren Durchmesser von Dichtungsringe bei rotierenden Wellen mit Metallmantel verwendet. • *Pasta para juntas de sellado para juntas elásticas a base de disolvente, deshidratante por evaporación. Se utiliza para la estanqueidad en el diámetro externo de segmentos de compresión, para ejes giratorios con armadura metálica exterior.* • Mastic adhésif à base de solvants pour garnitures élastiques, séchant par évaporation. Il sert garder étanche le diamètre extérieur des bagues d'étanchéité des arbres rotatifs ayant une armature métallique externe.

SCREW-LOCKING, SEALING AND LUBRICATING MATERIALS - MATERIALI PER BLOCCAGGIO VITI, TENUTA E LUBRIFICAZIONE - MATERIAL ZUR BLOCKIERUNG VON SCHRAUBEN UND FÜR DICHTUNGEN UND SCHMIERMITTEL - MATERIALES PARA EL BLOQUEO, ESTANQUEIDAD Y LUBRICACION - MATÉRIAUX POUR LE BLOCAGE VIS, ÉTANCHÉITÉ ET LUBRIFICATION

DENOMINATION **DENOMINAZIONE** **BEZEICHNUNG** **DENOMINACION** **DENOMINATION**	**APPLICATION - APPLICAZIONE - ANWENDUNG - APLICACION - APPLICATION**
Silicone ***Silicone*** **Silikon** ***Silicona*** **Silicone**	• Semi-fluid adhesive material used for sealing and filling and to protect components from environmental and physical elements. Polymerises with non-corrosive dampness. • *Materiale adesivo semifluido usato per sigillatura, riempimenti e per la protezione di componenti dagli elementi ambientali e fisici. Polimerizza con umidità non corrosiva.* • Halbflüssiger Klebstoff zum Befestigen, Füllen und zum Schutz von Bestandteilen vor äußeren Einwirkungen. Polymerisiert durch nicht korrosive Feuchtigkeit • *Material adhesivo semifluido usado para el sellado, llenado y para la protección de componentes de elementos ambientales y físicos. Polimeriza con humedad no corrosiva.* • Produit adhésif semi-fluide utilisé pour le scellage, remplissage et protection des éléments ambiants et physiques. Polymérise à une humidité non corrosive.
(TECNO LUPE/101) Silicone-based grease *Grasso al silicone* Silikonfett *Grasa a la silicona* Graisse au silicone	• 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. • *Grasso sintetico con elevato grado di adesività, additivato con composti siliconici.* *Applicato su viti di registrazione a foro comunicante con fluidi di tipo oleoso.* *Usato quando si richiedono frequenti interventi di registrazione.* • Synthetisches Fett mit hoher Haftfestigkeit, mit silikonhaltigen Stoffen legiert. Wird auf Stellschrauben mit Loch, die mit ölhaltigen Flüssigkeiten in Kontakt stehen, angebracht. Wird verwendet, wenn die Schraub öfters eingestellt werden muß. • *Grasa sintética con elevado grado de adhesión, aditivada con componentes silicónicos.* *Aplicada en tornillos de ajuste de orificio comunicante con fluidos de tipo oleoso.* *Se usa cuando se requieren frecuentes intervenciones de ajuste.* • Graisse synthétique ayant un degré d'adhésivité élevé, adjuvé de composés au silicone. Appliqué sur les vis de réglage à trou communiquant avec des fluides du type huileux. Utilisé quand il y a besoin de réglages fréquents.
Molikote (DOW CORNING)	• 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. • *Composto lubrificante contenente bisolfuro di molibdeno, usato per la lubrificazione di perni snodo e per prevenire incollamenti ed ossidazioni di particolari non lubrificati in modo continuo.* • Schmierstoff mit Molybidändisulfid; wird zum Schmieren von Gelenkstiften und gegen Ankleben und Oxydation von nicht dauergeschmierten Einzelteilen verwendet. • *Compuesto lubricante que contiene bisulfuro de molibdeno, usado para la lubricación de rótulas y para prevenir encoladuras y oxidaciones de piezas no lubricadas de manera continua.* • Composé lubrifiant contenant du bisulfure de molybdène, utilisé pour lubrifier les axes d'articulation et prévenir collages et oxydations des pièces qui ne sont pas continuellement lubrifiées.
(Lithium-based) Grease ***Grasso (al Litio)*** **(Lithium) Fett** ***Grasa (al Litio)*** **Graisse (au Lithium)**	• Applied to bearings, sliding parts and used to lubricate seals or parts during assembly • *Applicato a cuscinetti, parti scorrevoli e per lubrificare guarnizioni o pezzi in fase di montaggio.* • Wird auf Lager, Gleitteilen aufgetragen und zum Schmieren von Dichtungen oder von Teilen bei der Montage verwendet. • *Aplicada a cojinetes, partes deslizables o para lubricar juntas o piezas en fase de montaje.* • Appliqué sur les paliers, parties coulissantes et pour lubrifier les garnitures ou pièces pendant la phase de montage.

NOTES ON SAFETY PRECAUTIONS - NOTE RIGUARDANTI LA SICUREZZA - BEMERKUNGEN ZUR SICHERHEIT - NORMAS CONCERNIENTES A LA SEGURIDAD - NOTES EN MATIERE DE SECURITE

GB

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

ITA

1 - Le operazioni descritte sono riferite all'assale bloccato su cavalletto ed alcuni particolari appoggiati su un banco di lavoro.
2 - Quando si asporta un braccio dell'assale, sistemare sotto l'altro braccio un cavalletto di sicurezza antiribaltamento.
3 - Se si opera su un'assale montato sulla macchina, assicurarsi di aver sistemato dei cavalletti di sostentamento e di aver immobilizzato longitudinalmente la macchina.
4 - Non permettere che persone estranee entrino nella zona di lavoro; delimitare questa zona, appendere dei cartelli di avviso di lavori in corso ed asportare le chiavi di avviamento della macchina.
5 - Usare solo ed esclusivamente attrezzi puliti e di buona qualità; scartare chiavi od attrezzi usurati o danneggiati, di bassa qualità od improvvisati. Assicurarsi che le chiavi dinamometriche siano state controllate e tarate.
6 - Durante le operazioni di riparazione, indossare sempre guanti e scarpe antiscivolo.
7 - Pulire immediatamente le zone eventualmente imbrattate d'olio.
8 - I lubrificanti, le guarnizioni, gli eventuali stracci di pulizia ed i solventi usati devono essere smaltiti come rifiuti speciali e comunque secondo le normative vigenti nel Paese ove vengono revisionati gli assali.
9 - Per la pulizia, usare solo solventi deboli escludendo categoricamente trielina, diluenti e solventi a base di toluolo, xilolo, ecc.; usare solo solventi leggeri quali cherosene, ragie minerali o solventi ecologici a base d'acqua.
10 - Per chiarezza di illustrazione ed esposizione, sulle figure di alcuni gruppi mancano dei particolari che, normalmente, possono essere lasciati montati. Rimuovere solo i particolari descritti.
11 - I termini DESTRA e SINISTRA usati nel manuale sono riferiti alla persona che guarda l'assale dal lato opposto alla presa di moto.
12 - Al termine delle riparazioni, per evitare dannose ossidazioni, ritoccare con cura le parti verniciate eventualmente danneggiate.

D

1 - Die beschriebenen Vorgänge werden an der Achse vorgenommen, wenn diese auf einem Bock blockiert ist. Zur Bearbeitung der Einzelteile, werden diese auf die Werkbank gelegt.
2 - Wenn eine Achse abgenommen wird, einen Sicherheitsbock unter den zweiten Arm legen.
3 - Werden Arbeiten an der Achse vorgenommen, wenn diese noch an der Maschine montiert ist, Böcke zur Halterung unter die Achse stellen und die Maschine der Länge nach blockieren.
4 - Es dürfen sich keine fremde Personen in der Nähe der Maschine während der Arbeiten aufhalten; diesen Bereich absperren und mit Schilder kennzeichnen, die auf die laufenden Arbeiten hinweisen. Zündschlüssel von der Maschine abnehmen.
5 - Nur saubere Werkzeuge guter Qualität verwenden; alte, beschädigte oder improvisierte Hilfsmittel nicht verwenden. Sicherstellen, daß die Dynamometer geprüft und geeicht worden sind.
6 - Bei Reparaturen, stets Handschuhe und rutschfeste Schuhe tragen.
7 - Mit Öl beschmutzte Stellen, sofort reinigen.
8 - Gebrauchte Schmiermittel, Dichtungen, Reinigungslappen und Lösemittel müssen als Sondermüll und auf jeden Fall laut den örtlich geltenden Vorschriften entsorgt werden.
9 - Zur Reinigung ausschließlich schwache Lösemittel wie Petroleum, Terpentin oder wasserhaltige Lösemittel verwenden. Auf keinen Fall Trichloräthylen, tuolol- oder xylolhlatige Lösemittel usw. verwenden.
10 - Um die Arbeitsvorgänge verständlich abzubilden, werden in einigen Fotos die Aggregate ohne Einzelteile gezeigt, die sonst bei der Arbeit nicht abmontiert werden müssen.
Nur die beschriebenen Teile abmontieren.
11 - Unter RECHTS und LINKS versteht man in diesem Handbuch die Seite einer Person, die zur Achse schaut und zwar dem Antrieb entgegengesetzt.
12 - Nach beendeten Arbeiten und um Rostbildungen zu vermeiden, die Teile an denen der Lack ggf. beschädigt worden ist, anstreichen.

ESP

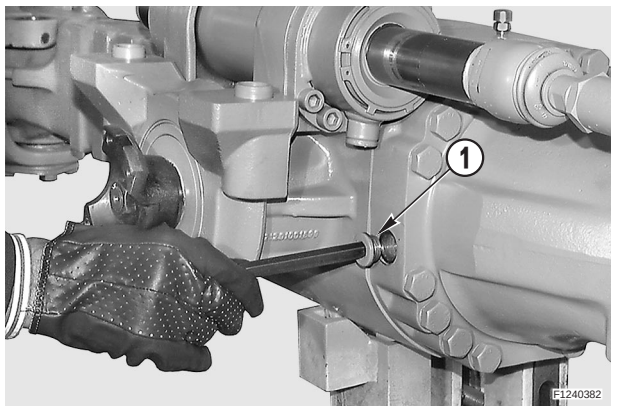
1 - Las operaciones descritas se refieren al eje bloqueado en un caballete y a algunas partes apoyadas en el banco de trabajo.
2 - Cuando se saca un brazo del eje, colocar debajo del otro un caballete de seguridad antivuelco.
3 - Si se trabaja con un eje montado en la máquina, asegurarse de haber colocado caballetes soporte y de haber inmovilizado longitudinalmente la máquina.
4 - No permitir que personas extrañas entren en la zona de trabajo; delimitar esta zona, colgar carteles de aviso de hombres trabajando y sacar las llaves de arranque de la máquina.
5 - Usar sólo y exclusivamente herramientas limpias y de buena cualidad; descartar llaves o herramientas gastadas o dañadas, de calidad mediocre o improvisadas. Asegurarse de que las llaves dinamométricas han sido controladas y calibradas.
6 - Durante las operaciones de reparación, llevar siempre guantes y calzado antideslizamiento.
7 - Limpiar inmediatamente las zonas que pudieran estar sucias de aceite.
8 - Los lubricantes, las juntas, los trapos para la limpieza y los disolventes usados hay que eliminarlos como desechos especiales y, de todas formas, de acuerdo con las normativas vigentes en el país en el que se revisan los ejes.
9 - Para limpiar, utilizar sólo disolventes débiles excluyendo en absoluto tricloroetileno, diluyentes y disolventes a base de toluol, silol, etc.; usar sólo disolventes ligeros como queroseno, aguarrás minerales o disolventes ecológicos a base de agua.
10 - Para que resulte clara la exposición y la ilustración, en las figuras de algunos grupos faltan algunas piezas que por lo general se pueden dejar montadas. Sacar sólo las partes descritas.
11 - Las palabras DERECHA E IZQUIERDA usadas en el manual se refieren a la persona que mira el eje del lado opuesto a la toma de movimiento.
12 - Al final de las reparaciones, para evitar oxidaciones, retocar cuidadosamente las partes pintadas que estuvieran dañadas.

F

1 - Les opérations décrites se rapportent à l'essieu bloqué sur chevalet et de quelques pièces posées sur un établi de travail.
2 - Quand on enlève un essieu monté sur la machine, ajuster sous l'autre bras un chevalet de sécurité contre tout basculement.
3 - Si on oeuvre sur un essieu monté sur la machine, s'assurer d'avoir aménagé des chevalets de soutien et d'avoir bloqué la machine en longueur.
4 - Ne jamais permettre à des étrangers de pénétrer dans la zone de travail; délimiter cette zone, mettre des pancartes de signalisation de travaux en cours et enlever les clés de contact de la machine.
5 - N'utiliser que des outils propres et de bonne qualité; éliminer clé ou autres outils usés, abîmés, de mauvaise qualité ou improvisés. Veiller à ce que les clés dynamométriques aient été contrôlées et calibrées.
6 - Pendant les opérations de réparation, endosser toujours gants et chaussures antidérapantes.
7 - Nettoyer tout de suite les éventuelles zones souillées d'huile.
8 - Les lubrifiants, les garnitures, les éventuels chiffons servant au nettoyage et les solvants utilisés devront être récoltés et traités comme rebut spécial conformément aux lois en vigueur dans le pays où les essieux sont en révision.
9 - Pour le nettoyage, n'utiliser que des solvants à base de toluol, xylol, etc.; n'utiliser que des solvants légers tels que kérosène, essences minérales, ou solvants écologiques à base d'eau.
10 - En ce qui concerne la clarté en matière d'illustration et exposition, sur les figures de certains groupes, il y a des pièces manquantes qui normalement peuvent rester montées.
Enlever uniquement les pièces décrites.
11 - Les termes DROITE et GAUCHE utilisés dans ce manuel se rapportent à la personne regardant l'essieu du côté opposé à celui de la prise de mouvement.
12 - A la fin des opérations, afin d'éviter un risque d'oxydation nuisible, retoucher soigneusement les parties vernies éventuellement abîmées.

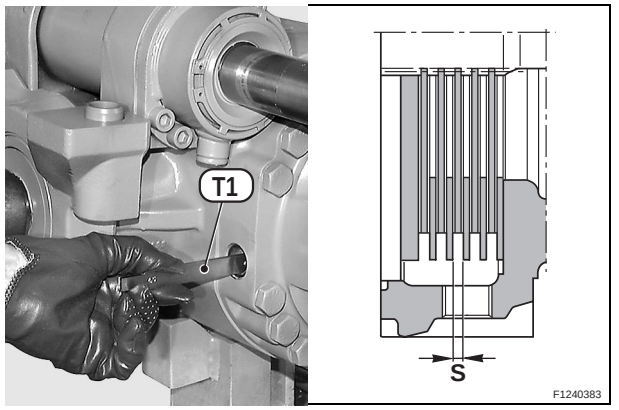
SYMBOLS - SIMBOLI - SYMBOLS
SIMBOLOS - SYMBOLES

	Disassembly of assembly groups Smontaggio di sottogruppi Zerlegen von Baugruppen Desmontaje de subgrupos Demontage des sous-groupes
	Reassemble to from assembly groups Montaggio di sottogruppi Zusasmmenbauen von Baugruppen Ensamblaje de subgrupos Montage des sous-groupes
	Remove obstruction parts Smontaggio di particolari ingombri Abbauen-Ausbauen Desmontaje de componentes abultados Demontage des pieces encombrante
	Reinstall-remount parts which had obstructed disassembly Montaggio di particolari ingombri Einbauen-Ausbauen Montaje de componentes abultados Montage des pieces encombrante
	Attention ! Important notice Attenzione, indicazione importante Achtung, wichtiger Hinweis ¡Cuidado ! Indicación importante Attention, indication importante
	Check - adjust e.g. torque, dimensions, pressures, etc. Controllare - regolare p.e. coppie, misure, pressioni ecc. Prüfen - Einstellen z.B. Momente, Maße, Drucke u.s.cs. Controlar y ajustar, por ej. pares, medidas, presiones, etc. Controler, regler p.e. couples, mesures, pressions ecc.
	T = Special tool P = page T = Attrezzature speciali P = Pagina T = Spezialwerkzeug P = Seite T = Herramientas especiales P = Página T = Outils P = Page
	Note direction of installation Rispettare direzione di montaggio Einbaurichtung beachten Respetar la dirección de ensamblaje Respecter direction de montage
	Visual inspection Esaminare con controllo visuale Kontrollieren -Prüfen Examinar mediante inspección visual Controler, examiner, controle visuel
	Possibly still serviceable, renew if necessary Eventualmente riutilizzare (sostituire se necessario) Bedingt weiderverwendbar Puede volver a utilizarse (reemplazar, si es preciso) Eventuellement a utiliser a noveau (remplacer si nécessaire)
	Renew at each reassembly Sostituire ad ogni montaggio Beim Zusammenbau immer erneuern Puede reemplazarse a cada ensamblaje Remplacer avec chaque montage
	Unlock - lock e.g. split pin, locking plate, etc. Togliere-mettere la sicura Entsichern-Sichern Quitar-colocar el seguro Enlever-mettre la securite
	Lock-adhere (liquid sealant) Mettere la sicura, incollare (mastice liquido) Sichern-Kleben (flüssige Dichtung) Colocar el seguro, pegar (mastique líquido) Mettre la securite, coller (mastic liquide)
	Guard against material damage, damage to parts Evitare danni materiali, danni a pezzi Materialschaden verhüten Evitar dañar los materials o las piezas Eviter dommages au materiaux, dommages au pieces
	Mark before disassembly, observe marks when reassembly Marchiare prima dello smontaggio (per il montaggio) Vor dem Ausbau markieren (für den Zusammenbau) Marcar antes de desmontar (para facilitar el ensamblaje) Marquer avant le demontage (pour le montage)
	Filling - topping up - refilling e.g. oil, cooling water, etc. Caricare - riempire (olio - lubrificante) Einfüllen - Auffüllen - Nachfüllen (Öl-Schmiermittel) Cargar - llenar (aceite lubricante) Charger - remplir (huile - lubrifiant)
	Drain off oil, lubricant Scaricare olio, lubrificante Öl, bzw. Schmiermittel Ablassen Descargar aceite lubricante Vidanger, lubrifiant
	Tighten Tendere Spannen Tensar Tendre
bar	Apply pressure into hydraulic circuit Inserire pressione nel circuito idraulico Leitung unter Druck setzen Introducir presión en el circuito hidráulico Inserer pression dans le circuit hydraulique
	To clean Pulire Reinigen Limpiar Nettoyer
	Lubricate - grease Lubrificare - ingrassare Schmieren - einfetten Lubrificar - Engrasar Lubrifier - Graisser



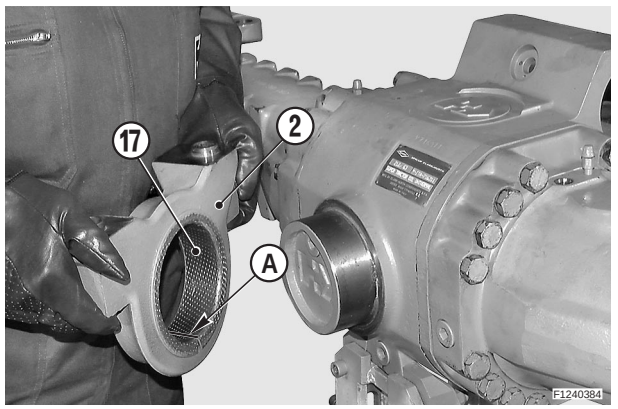
GB a

CAUTION! Perform all operations on both arms.
Remove the oil-level plug (1).



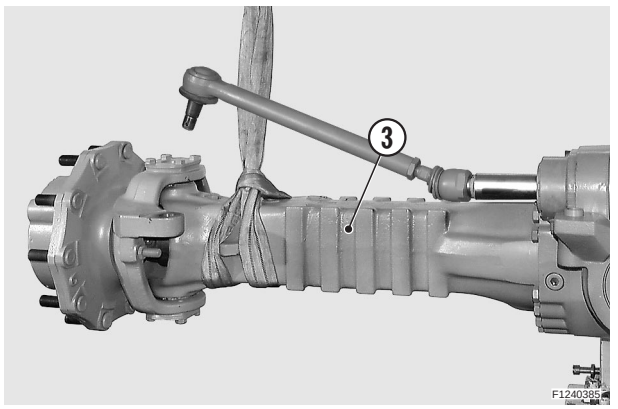
bar GB b

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.



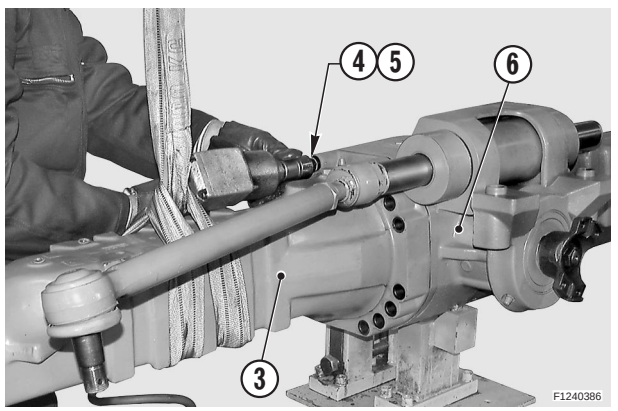
GB c

Remove the swinging support (2) on the side opposite the drive.
NOTE. If the bushing (17) is worn and needs replacing, note down the assembly side of the connection notch "**A**".



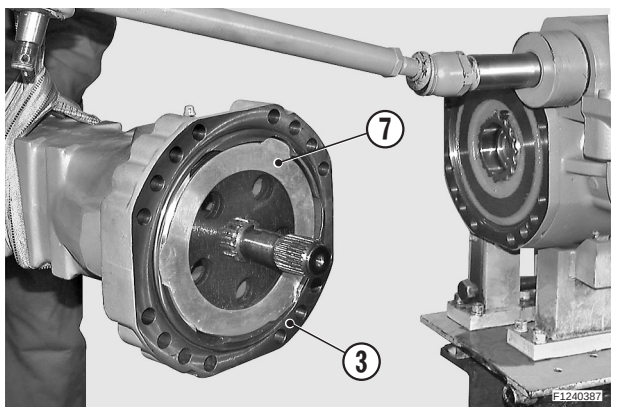
GB d

Disconnect the pins of the steering bars from the steering case (See «HOW TO REMOVE THE STEERING CYLINDER»).
Sling the arm (3) to be removed and put the rod under slight tension.



GB e

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



GB f

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

a

ITA **ATTENZIONE!** Eseguire tutte le operazioni per i due bracci.
Asportare il tappo (1) di livello olio.

D **ACHTUNG!** Alle Vorgänge für beide Arme durchführen.
Ölpegelstopfen (1) abnehmen.

ESP **CUIDADO!** Ejecutar todas las operaciones para los dos brazos.
Sacar el tapón (1) de carga de nivel aceite.

F **ATTENTION!** Effectuer toutes les opérations sur les 2 bras.
Enlever le bouchon de la jauge d'huile (1).

b

ITA Eseguire una frenata e, mantenendo la pressione, controllare con l'attrezzo **T1** lo spessore "**S**" tra i dischi.
"**S**" minimo: 4,5 mm
ATTENZIONE! Se necessario, sostituire i dischi freno ed intermedi di ambedue i lati.

D Die Bremse einmal betätigen und bei betätigter Bremse mit dem **T1** Werkzeug das Distanzstück "**S**" zwischen den Scheiben kontrollieren.
"**S**" mindestens: 4,5 mm
ACHTUNG! Wenn nötig, die Bremsscheiben und die mittleren Scheiben auf beiden Seiten auswechseln.

ESP Ejecutar un frenado y, manteniendo la presión, controlar con la herramienta **T1**, el espesor "**S**" entre los discos.
"**S**" mínimo: 4,5 mm
CUIDADO! Si fuera necesario, sustituir los discos del freno y los intermedios a ambos lados.

F Effectuer un freinage, puis en tenant sous pression, contrôler à l'aide de l'outil **T1** la cale "**S**" entre les disques.
"**S**" minimum: 4,5 mm.
ATTENTION! Si besoin, substituer les disques de freinage et les intermédiaires des deux côtés.

c

ITA Rimuovere il supporto oscillante (2) del lato opposto alla presa di moto.
NOTA. Se si deve sostituire la bronzina (17) perchè usurata, annotare il senso di montaggio del taglio di giunzione "**A**".

D Schwenkbare Halterung (2) an der der Zapfwelle entgegensetzten Seite abnehmen.
BEMERKUNG. Soll das Bronzelager (17) wegen Verschleiß ausgewechselt werden, Montagerichtung des Verbindungsschnitts "**A**" beachten.

ESP Remover el soporte oscilante (2) del lado opuesto a la toma de movimiento.
NOTA. Si hay que sustituir la chumacera (17) porque está gastada, anotar el sentido de montaje del corte de unión "**A**".

F Enlever le support oscillant (2) du côté opposé à celui de la prise de mouvement.
NOTE. Si on doit remplacer le coussinet (17) parce qu'il est usé, prendre note du sens de montage de l'entaille de jonction "**A**".

d

ITA Scollegare dalle scatole snodo i perni delle barre di sterzatura (Vedere «RIMOZIONE DEL CILINDRO DI STERZATURA»).
Imbragare il braccio (3) da asportare e mettere in leggera tensione la fune.

D Von den Gelenkgehäusen die Stifte der Lenkstangen abtrennen (Siehe «LENKZYLINDER ABMONTIEREN»).
Arm (3) anschlagen und das Seil spannen.

ESP Desconectar de los cárters de las rótulas los pernos de las barras de dirección (Véase «REMOCIÓN DEL CILINDRO DE DIRECCION»).
Eslingar el brazo (3) que hay que sacar y poner en tensión ligera el cable.

F Débrancher des boîtiers articulation les tourillons des barres de braquage (Voir «DEPOSE DU CYLINDRE DE BRAQUAGE»).
Elinguer le bras (3) à extraire et mettre légèrement en tension la corde.

e

ITA Allentare ed asportare le viti (4) e le rondelle (5) che fissano il braccio (3) al corpo centrale (6).

D Schrauben (4) mit den Unterlegscheiben (5) lockern und abschrauben, die den Arm (3) am zentralen Körper (6) befestigen.

ESP Aflojar y extraer los tornillos (4) y las arandelas (5) que fijan el brazo (3) al cuerpo central (6).

F Desserrer et enlever les vis (4), les rondelles (5) qui fixent le bras (3) au corps central (6).

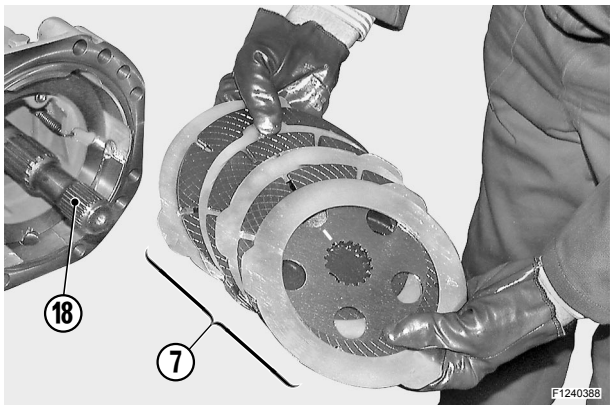
f

ITA Rimuovere il braccio (3) e con esso il pacco dei dischi di frenatura (7).
Posizionare il braccio su un banco di lavoro.

D Arm (3) samt Bremsscheiben (7) abnehmen.
Arm auf die Werkbank legen.

ESP Remover el brazo (3) y con el mismo el paquete de discos de frenado (7).
Posicionar el brazo en un banco de trabajo.

F Déposer le bras (3) et avec ce dernier le paquet de disques de freinage (7).
Placer le bras sur l'établi d'usinage.

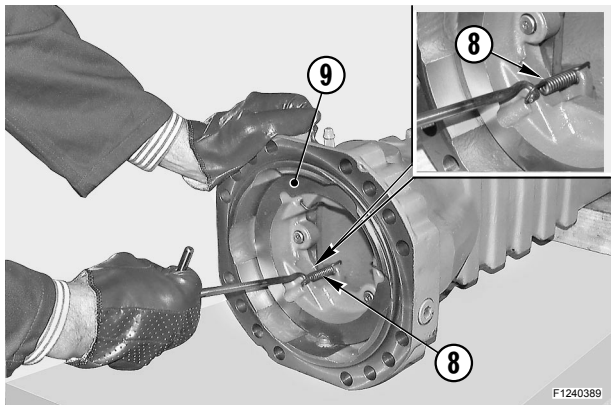


GB a

Remove the braking disks (7) and note down their order of assembly.

NOTE. 1 - If the disks do not need replacing, avoid switching their position.

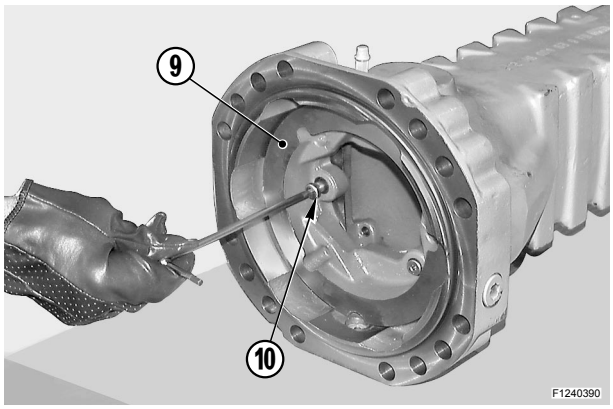
2 - Extract the u-joint (18).



GB b

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

NOTE. If the springs (8) are weak or deformed they must be replaced.

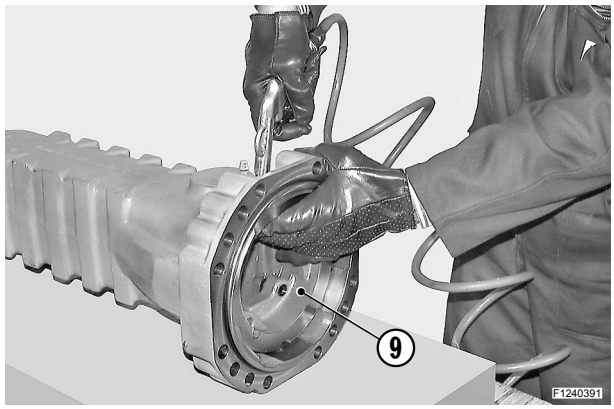


GB c

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

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

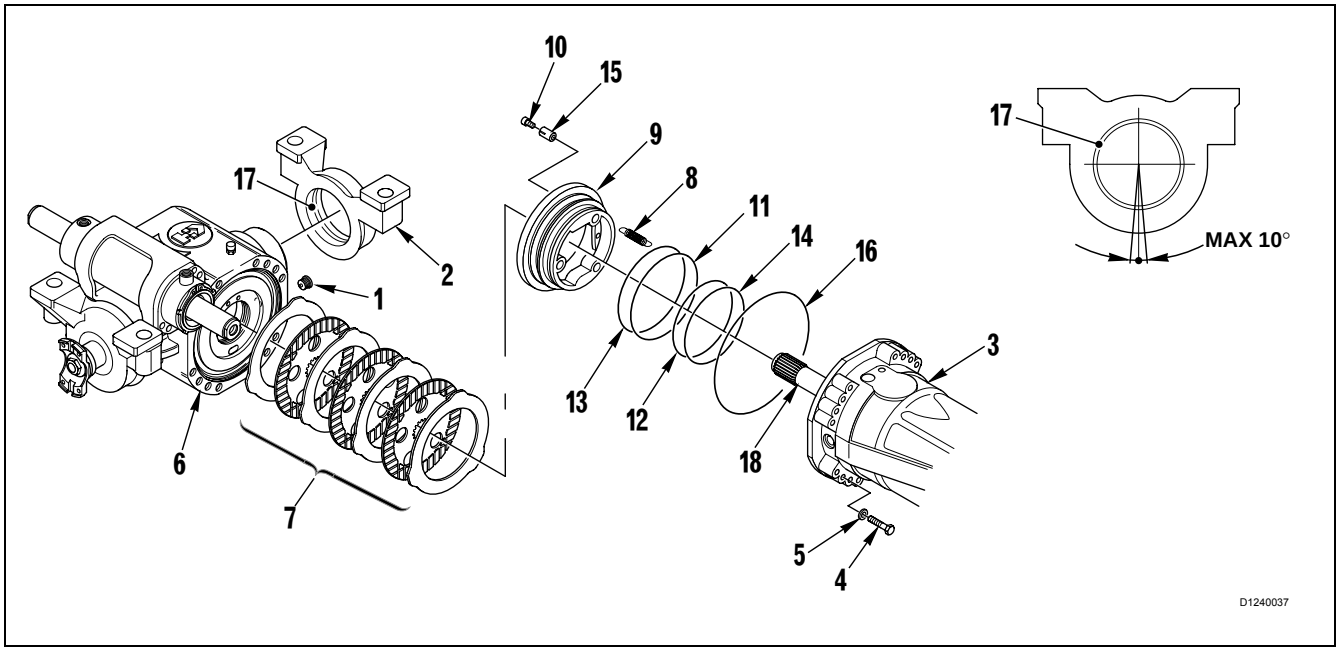
(See «HOW TO ASSEMBLE THE BRAKING UNITS»)



GB d

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.



a

ITA Rimuovere i dischi di frenatura (7) annotando l'ordine di montaggio.
NOTA. 1 - Se i dischi non vanno sostituiti, evitare lo scambio di posizione.
2 - Estrarre il doppio giunto cardanico (18).

D Bremsscheiben (7) abnehmen und auf die Reihenfolge der Montage achten.
BEMERKUNG. 1 - Sollen die Scheiben nicht ausgewechselt werden, diese in der richtigen Reihenfolge zur Seite legen.
2 - Doppelgelenkwelle (18) abnehmen.

ESP Remover los discos de frenado (7) anotando el orden de montaje.
NOTA. 1 - Si los discos no tienen que ser sustituidos, evitar el intercambio de posición.
2 - Extraer el semieje (18).

F Enlever les disques de freinage (7) en prenant note de l'ordre de montage.
NOTE. 1 - Si les disques ne sont pas à remplacer, éviter le changement de position.
2 - Extraire le joint de cardan double (18).

b

ITA Rimuovere le molle (8) di rientro del pistone (9).
NOTA. Se le molle (8) risultano snervate o deformate, devono essere sostituite.

D Rückzugsfedern (8) des Kolbens (9) abnehmen.
BEMERKUNG. Wenn die Federn (8) nachgesetzt oder verformt sind, diese auswechseln.

ESP Remover los muelles (8) de vuelta del pistón (9).
NOTA. Si los muelles (8) están desnervados o deformados, hay que sustituirlos.

F Enlever les ressorts (8) de rentrée du piston (9).
NOTE. Si les ressorts (8) sont énervés ou déformés, il faut les remplacer.

c

ITA Rimuovere le viti a perno (10) di guida del pistone (9).
ATTENZIONE! Se le viti devono essere sostituite, annotare la colorazione distintiva per i giochi freno (Vedere «ASSEMBLAGGIO GRUPPI DI FRENATURA»).

D Die Stiftschraube (10) zur Kolbenführung (9) entfernen.
ACHTUNG! Sollen die Schrauben ausgewechselt werden, auf die farbige Kennzeichnung für das Bremsenspiel achten (Siehe «ZUSAMMENBAU DER BREMSAGGREGATE»).

ESP Remover los pernos roscados (10) de guía del pistón (9).
CUIDADO! Si hay que sustituir los pernos, anotar el color distintivo para los juegos del freno (Véase «MONTAJE DE LOS GRUPOS DE FRENADO»).

F Enlever les vis goujon (10) de guidage du piston (9).
ATTENTION! Si les vis doivent être remplacées, prendre note de la couleur de distinction des jeux de frein (Voir «ASSEMBLAGE DU GROUPE DE FREINAGE»).

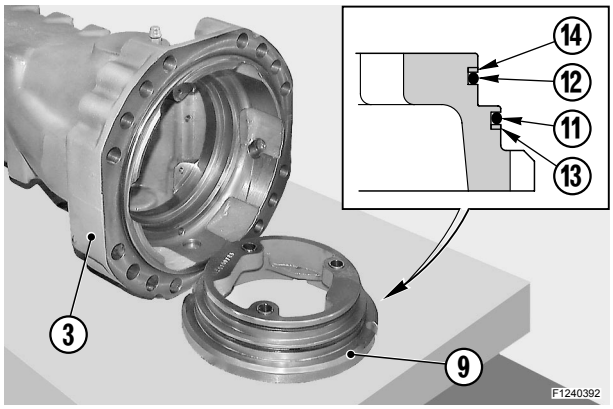
d

ITA Immettere lentamente aria compressa attraverso l'attacco del circuito frenante per estrarre il pistone completo.
ATTENZIONE! Trattenere il pistone che può essere espulso velocemente ed essere danneggiato.

D Langsam Druckluft in den Bremskreislauf blasen, um den kompletten Kolben herauszuziehen.
ACHTUNG! Den Kolben mit der Hand halten, um zu vermeiden daß er zu schnell herausgestoßen und beschädigt wird.

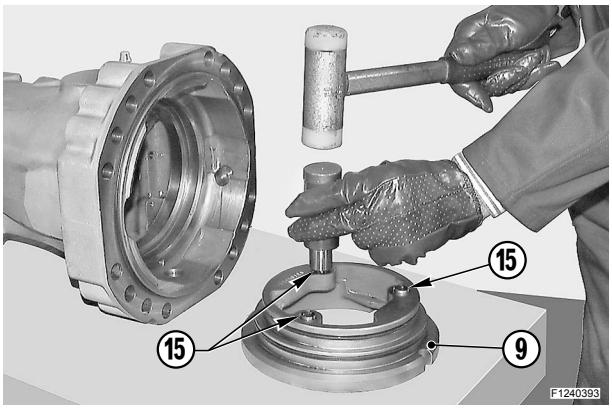
ESP Introducir lentamente aire comprimido a través de la unión del circuito frenante para extraer el pistón completo.
CUIDADO! Retener el pistón porque puede ser expulsado rápidamente y quedar dañado.

F Injecter tout doucement de l'air comprimé à travers le raccord du circuit freinant pour extraire le piston complet.
ATTENTION! Retenir le piston qui pourrait être éjecté fortement et s'abîmer.



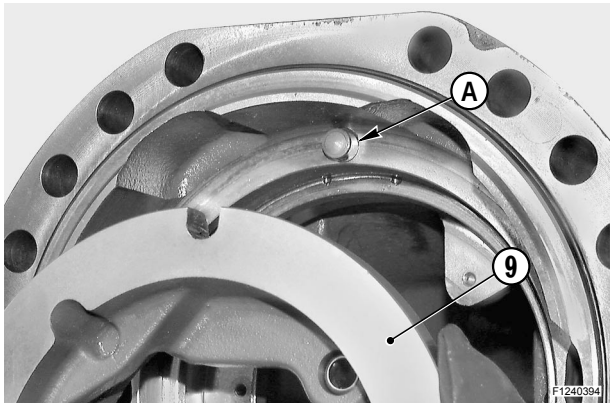
GB a

Accurately clean the piston (9) and the seats of slide and seal. 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).



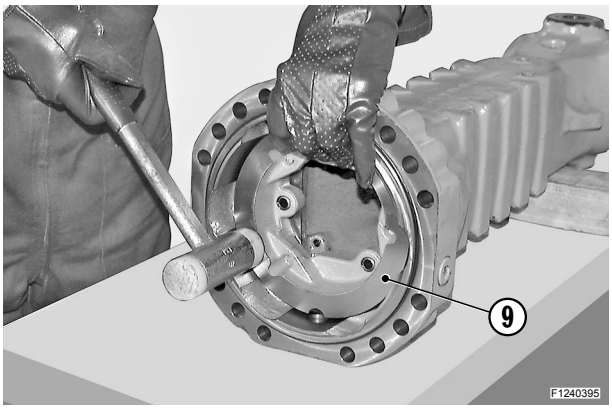
GB b

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



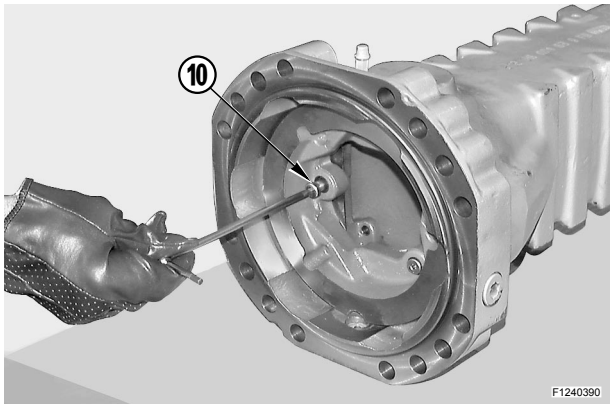
GB c

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.



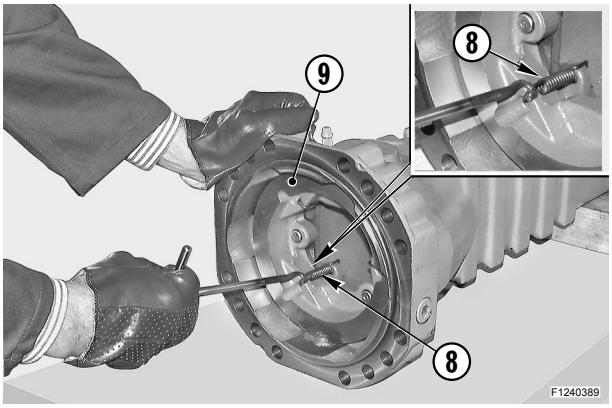
GB d

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



GB e

Fit the pin screws (10) making sure that they are all of the same colour. White: 1 mm gap
Yellow: 0.75 mm gap
Blue: 0.5 mm gap
Apply Loctite 270 to the thread.
Torque wrench setting: 5–7 Nm.



GB f

Fit the reversal springs (8) on the piston (9).
CAUTION! Pay due attention not to deform the connections of the springs.

a

ITA Pulire accuratamente il pistone (9) e le sedi di scorrimento e tenuta.
Sostituire le guarnizioni OR (11) e (12) e gli anelli antiestrusione (13) e (14), rispettando il senso di montaggio.
ATTENZIONE! Controllare attentamente il posizionamento degli anelli antiestrusione (13) e (14).

D Kolben (9) sowie Gleit- und Dichtungssitze sorgfältig reinigen.
O-Ringe (11) und (12) sowie die Halteringe (13) und (14) auswechseln; dabei auf die Reihenfolge der Montage achten.
ACHTUNG! Position der Halteringe (13) und (14) sorgfältig kontrollieren.

ESP Limpiar minuciosamente el pistón (9) y los alojamientos de deslizamiento y estanqueidad.
Sustituir las juntas OR (11) y (12) y los anillos antiextrusión (13) y (14) teniendo en cuenta el sentido de montaje.
CUIDADO! Controlar atentamente el posicionamiento de los anillos antiextrusión (13) y (14).

F Nettoyer soigneusement le piston (9), les logements de coulissement et d'étanchéité.
Remplacer les garnitures OR (11) et (12), les anneaux anti-extrusion (13) et (14) en respectant le sens du montage.
ATTENTION! Contrôler soigneusement la position des anneaux anti-extrusion (13) et (14).

b

ITA Inserire a filo del pistone (9) le molle (15) per l'autoregolazione della corsa.

D Den Kolben (9) und die Federn (15) zur Selbstregelung des Hubs genau einsetzen.

ESP Introducir a ras del pistón (9) los muelles (15) para la autorregulación de la carrera.

F Introduire, au fil du bord du piston (9) les ressorts (15) pour l'autorégulation de la course.

c

ITA Lubrificare le guarnizioni (11) e (12) e montare nel braccio (3) il pistone (9).
ATTENZIONE!: Controllare che la sede del pistone imbocchi la spina di arresto (**A**) interna al braccio.

D Dichtungen (11) und (12) schmieren und Arm (3) und Kolben (9) montieren.
ACHTUNG! Der Kolben muß den Anhaltestift (**A**) im Inneren des Arms aufnehmen.

ESP Lubricar las juntas (11) y (12) y montar en el brazo (3) el pistón (9).
CUIDADO! Controlar que el alojamiento del pistón encaje en la clavija de tope (**A**) dentro del brazo.

F Lubrifier les garnitures (11) et (12), puis monter dans le bras (3) le piston (9).
ATTENTION! Contrôler que le logement du piston s'emboîte bien avec la broche d'arrêt (**A**) à l'intérieur du bras.

d

ITA Aiutare l'inserimento del pistone (9) con leggeri colpi di mazzuolo in materiale plastico distribuiti lungo la circonferenza.

D Den Kolben (9) einsetzen; diesen dazu leicht mit einem Gummihammer entlang seiner Kreislinie schlagen.

ESP Facilitar la inserción del pistón (9) con ligeros golpes de martillo de material plástico distribuidos en toda la circunferencia.

F Accompagner l'introduction du piston (9) par de légers coups de maillet en matière plastique distribués tout le long de la circonférence.

e

ITA Montare le viti a perno (10) controllando che siano tutte dello stesso colore. Bianco: gioco 1 mm
Giallo: gioco 0,75 mm
Azzurro: gioco 0,5 mm.
Spalmare la filettatura con Loctite 270.
Coppia di serraggio: 5÷7 Nm

D Die Stiftschrauben (10) einsetzen. Diese müssen alle gleichfarbig sein. Weiß: Spiel 1 mm
Gelb: Spiel 0,75 mm
Hellblau: Spiel 0,5 mm.
Das Gewinde mit Loctite 270 schmieren.
Anzugsmoment: 5÷7 Nm.

ESP Montar los pernos roscados (10) controlando que sean todos del mismo color. Blanco: juego 1 mm
Amarillo: juego 0,75 mm
Azul: juego 0,5 mm.
Pasar en la rosca Loctite 270.
Par de torsión: 5÷7 Nm.

F Monter les vis à tourillon (10) en contrôlant si elles sont toutes de ma même couleur. Blanc: jeu 1 mm
Jaune: jeu 0,75 mm
Bleu ciel: jeu 0,5 mm.
Enduire le filetage de Loctite 270.
Couple de serrage: 5÷7 Nm.

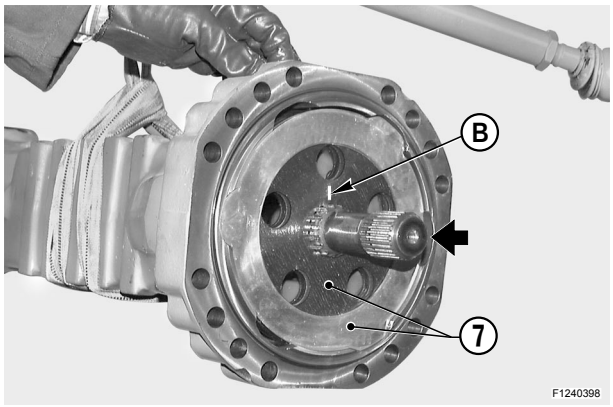
f

ITA Montare le molle (8) di ritorno del pistone (9).
ATTENZIONE! Usare molta cautela per non deformare gli attacchi delle molle.

D Die Rückzugsfedern (8) des Kolbens (9) montieren.
ACHTUNG! Sehr vorsichtig vorgehen, um die Federn am Anschluß nicht zu verformen.

ESP Montar los muelles (8) de retorno del pistón (9).
CUIDADO! Tener mucho cuidado a fin de no deformar las uniones de los muelles.

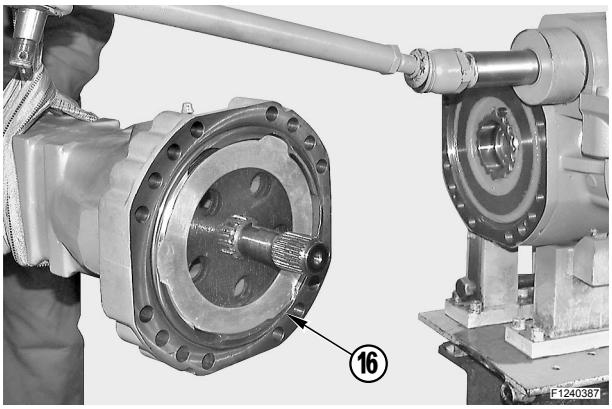
F Monter les ressorts (8) de retour du piston (9).
ATTENTION! Faire très attention à ne pas déformer les raccords des ressorts.



GB a

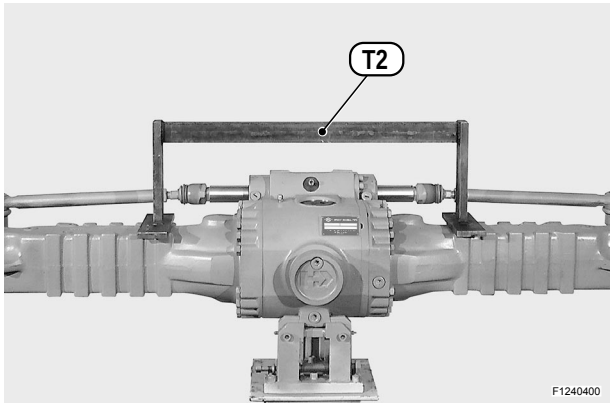
Slightly lubricate the braking disks (7) and fit them in the arm following the correct sequence; orient them so that the oil circulation holes and the marks "**B**" are perfectly lined up.

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



GB b

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



GB c

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

a

ITA Lubrificare leggermente i dischi di frenatura (7) e montarli nel braccio con la giusta sequenza, orientati in modo che i fori di circolazione dell'olio ed i contrassegni "**B**" siano perfettamente allineati.
NOTA. I dischi in acciaio devono essere montati lasciando libera la cava corrispondente al tappo livello olio.

D Die Bremsscheiben (7) leicht schmieren und in der richtigen Reihenfolge auf den Arm montieren. Dabei müssen sie so orientiert sein, daß Ölleitungslöcher genau mit den Kennzeichnungen "**B**" übereinstimmen.
BEMERKUNG. Bei der Montage der Stahlscheiben die dem Ölfüllstopfen entspricht, freilassen.

ESP Lubricar ligeramente los discos de frenado (7) y montarlos en el brazo con la secuencia exacta, orientados de manera que los orificios de circulación del aceite y las marcas "**B**" estén perfectamente alineados.
NOTA. Los discos en acero deben de ser asemblados dejando libre el nicho correspondiente a la tapa de nivel aceite.

F Lubrifier légèrement les disques de freinage (7), puis monter ceux-ci dans le bras à la juste séquence, orientés de telle sorte à ce que les trous de circulation de l'huile et ceux marqués "**B**" soient parfaitement alignés.
NOTE. Les disques en acier doivent être montés sans déranger la rainure du bouchon du niveau de l'huile.

c

ITA Controllare la planarità dei bracci con l'attrezzo **T2** e fissarli definitivamente con le viti (4) e le rondelle (5) con il metodo del serraggio incrociato.
Coppia di serraggio: 298 Nm

D Die Ebenheit der Arme mit dem Werkzeug **T2** kontrollieren und die Arme endgültig mit den Schrauben (4) und Unterlegscheiben (5) abwechselnd und gegenseitig festschrauben.
Anzugsmoments: 298 Nm

ESP Controlar la planaridad de los brazos utilizando la herramienta **T2** y fijarlos definitivamente con los tornillos (4) y las arandelas (5) con el método de torsión cruzado.
Par de torsión: 298 Nm

F Contrôler l'uniformité des bras à l'aide de l'outil **T2** puis fixer définitivement ces derniers avec les vis (4) et les rondelles (5) par le biais du mode de serrage croisé.
Couple de serrage: 298 Nm

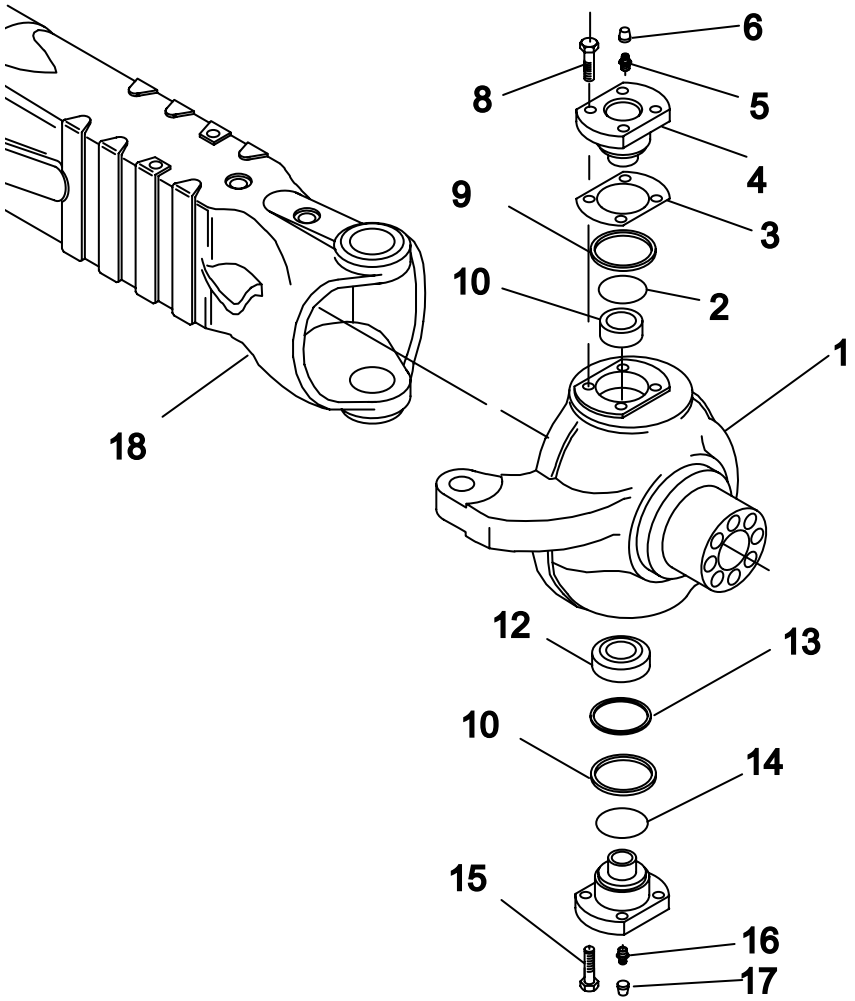
b

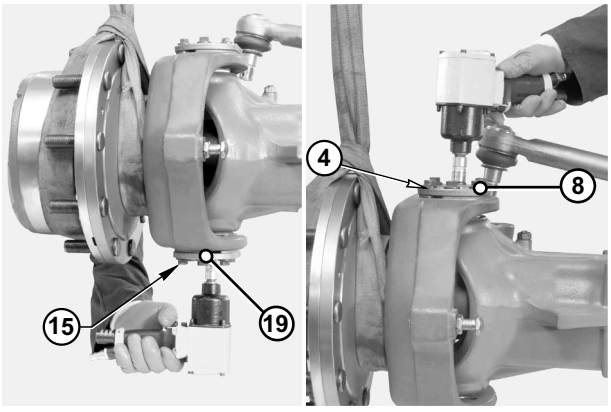
ITA Verificare l'integrità ed il posizionamento dell'anello di tenuta (16) del braccio; installare il braccio completo. Fissarlo in posizione con due viti (4) e rondelle (5) contrapposte.

D Kontrollieren ob der Kolbenring (16) unbeschädigt und auf den Arm richtig montiert ist; den kompletten Arm montieren.
In seiner Position mit zwei Schrauben (4) und den entgegengesetzten Unterlegscheiben (5) befestigen.

ESP Comprobar la integridad y el posicionamiento del segmento de compresión (16) del brazo; instalar el brazo completo.
Fijarlo en su posición con dos tornillos (4) y arandelas (5) contrapuestas.

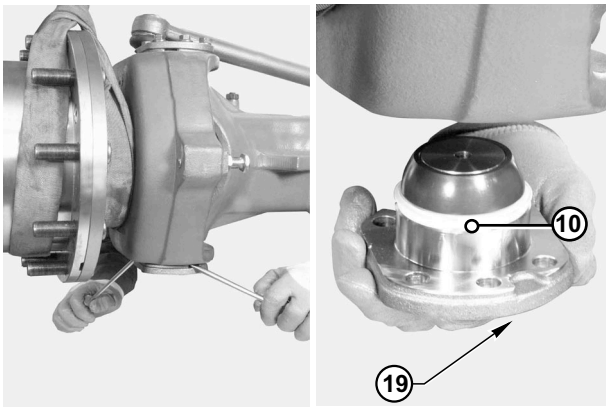
F Vérifier le bon état et la position de la bague d'étanchéité (16) du bras, installer le bras complet. Fixer celui-ci à sa place à l'aide des deux vis (4) et des rondelles (5) superposées.





GB e

Unloose and remove the fittin screws (15)(8) from the articulation pin (19)(4).



GB f

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

e

ITA Allentare ed asportare le viti di ritegno (15)(8)del perno snodo (19)(4).

D Schrauben (15)(8) des oberen Gelenkstiftes (19)(4) lockern und abschrauben.

ESP Aflojar y sacar los tornillos de retenciòn (15)(8)de la ròtula (19)(4).

F Desserrer et enlever les vis de fixation (15)(8) du tourillon d'articulation(19)(4).

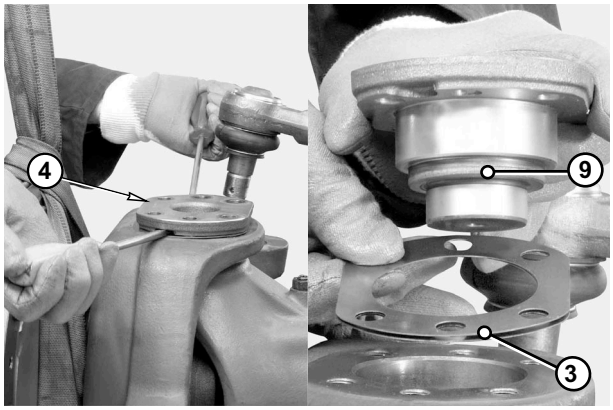
f

ITA Rimuovere il perno snodo inferiore (19) completo di anello di tenuta frontale (10).

D Unteren Gelenkstift (19) samt frontalem Kolbenring (10) abnehmen.

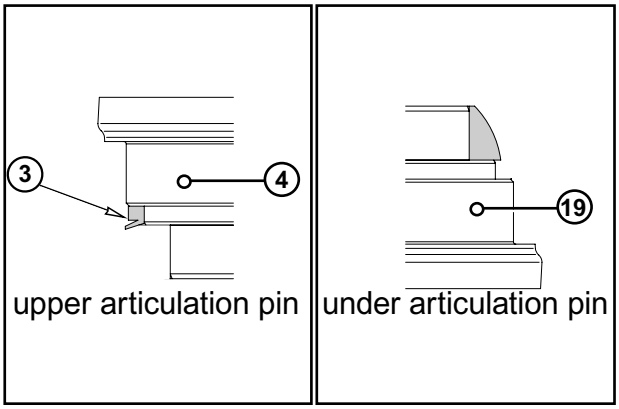
ESP Remover la ròtula inferior (19) completa de segmento de compresiòn frontal (9).

F Enlever le tourillon inférieur d'articulation (19) équipè de la bague d'ètanchéité frontale (9).

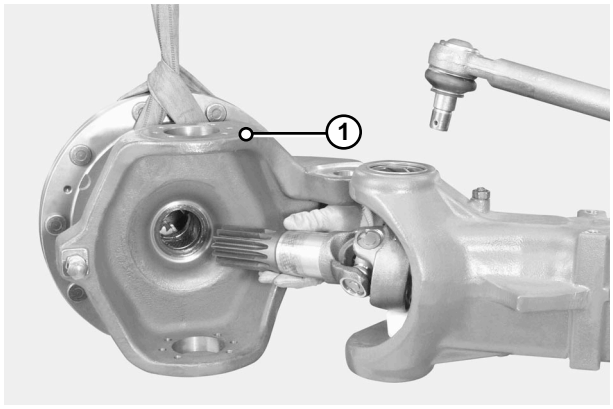


GB a

Using two levers, remove the top articulation pin (4) complete with front seal (9) and shims (3) .
Pay attention not to damage the surfaces.



GB b



GB c

Remove the complete steering case (1).

ITA Utilizzando due leve, rimuovere il perno snodo superiore (4) completo di guarnizione frontale (9) e spessori (3).
Prestare attenzione per non rovinare i piani.

D Mit Hilfe von zwei Hebeln, oberen Gelenkstift (4) samt frontalem Kolbenring (9) und Scheibe (3) abnehmen.
Achtung, die Fla chen nicht verkratzen.

a

ESP Utilizando dos palancas, remover la ròtula superior (4) completa de junta frontal (9) y espesores (3).
Tener cuidado a fin de no estropear las superficies.

F A l'aide de deux leviers, enlever le tourillon supérieur d'articulation (4) équipé de la garniture frontale (9) et cale (3).
Faire trés attention de ne pas abõmer les plateaux.

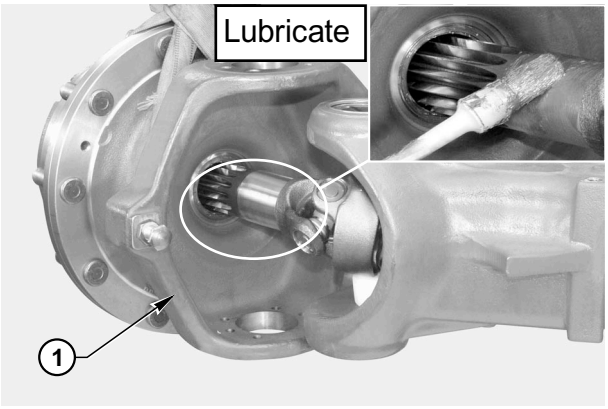
ITA Rimuovere il gruppo snodo completo (1).

D Komplettes Gelenkaggregat (1) abnehmen.

c

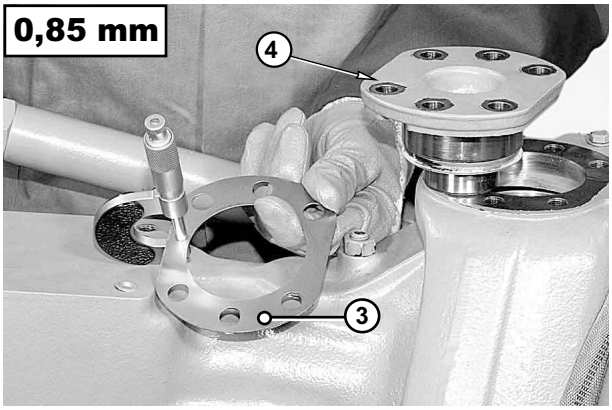
ESP Remover el grupo ròtula completo (1).

F Enlever le groupe d'articulation complet (1).



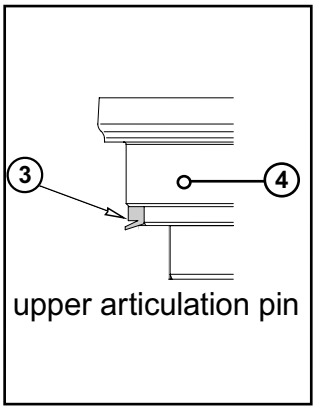
GB a

Lubricate the terminal of the u-joint and install the steering case (1).
Pay due attention not to damage the dust cover rings and the sealing rings.



GB b

Prepare a series of shims (3) of 0,85 mm. To be assembled under the upper pin (4).

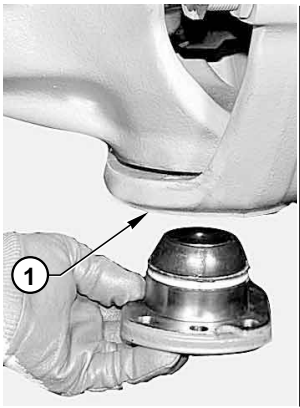


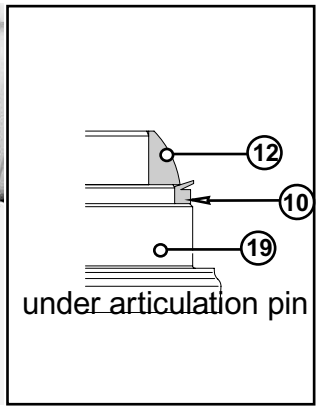
GB c

Fit a new seal (3) onto the top articulation pin (4). Lubricate and install the unit in the steering case. Position the screws (8) and tight wrench 140Nm.
Check the correct assembly side of the seal (3).

GB d

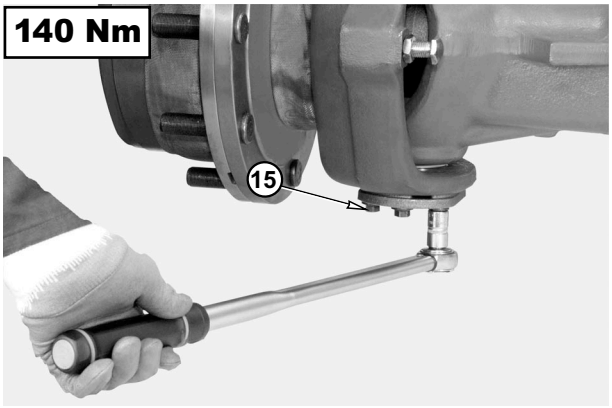
Lubricate and the unit in the steering case.





GB e

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



GB f

Tighten the new fittin screws (15) of top and bottom articulation pins in sequence using the cross tightening method.
Torque wrench setting: 140 Nm

a

ITA Lubrificare il terminale del doppio giunto cardanico (25) e montare il gruppo scatola snodo (1).
Prestare molta attenzione per non danneggiare gli anelli parapolvere e di tenuta.

D Das Endstuèck der Doppelgelenkwelle schmieren und das Gelenkgehaéuse-Aggregat (1) montieren.
Vorsicht: Staubschutzringe und Dichtungsringe nicht beschaédigen.

ESP Lubricar el terminal del semieje y montar el grupo caja de ròtula (1).
Tener mucho cuidado a fin de no danàr los segmentos de protecciòn.

F Lubrifier l'extrémité de joint de cardan double , puis monter le groupe du boõtier articulation (1).
Faire très attention à ne pas abòmer les bagues anti-poussiére et d'étanchéitè .

b

ITA Preparare una serie di spessori da 0,85 mm (3) da montare sotto il perno superiore (4).

D Eine Reihe von Unterlegscheiben 0,85 mm (3) zur Montage unter den oberen Bolzen (4) vorbereiten.

ESP Preparar una serie de espesores (3) de 0,85 mm para poner debajo del perno superior (4).

F Preparer un jeu de cales (3) 0,85 mm puor les monter sous le tourillon superieur (4).

c

ITA Montare sul perno (4) di fulcro snodo superiore una nuova guarnizione (3), lubrificare e montare il gruppo nella scatola snodo. Montare le viti (8) e serrarle a 140Nm.Controllare il senso di montaggio della guarnizione(3).

D Auf den Zentrierstift (4) des oberen Gelenks eine neue Dichtung 3) montieren, schmieren und das Aggregat in das Gelenkgehaèuse montieren. Die Schrauben (8) anbringen und zuschrauben 140Nm.

ESP Montar en el perno (4) de centro de la ròtula superior una junta nueva (3), lubricar y montar el grupo en la ròtula. Montar los tornillos (8) y apretarlos 140Nm.
Controlar el sentido de montaje de la guarniciòn.

F Monter sur le tourillon (4) du point d'appui articulation supèrieur, une garniture neuve (3), lubrifier et monter le groupe dans boõtier articulation. Monter les vis (8) et serrer 140Nm.
Contròler le sens de montage de la garniture.

d

ITA Lubrificare e montare il gruppo nella scatola snodo.

D Schmieren und das Aggregat in das Gelenkgeheause montieren.

ESP Lubricar y montar el grupo en la cja de la rotula.

F Lubrifier et monter le groupe dans boitier articulation.

e

ITA Montare il gruppo (19) nella scatola snodo (1). Montare le viti (15) e serrarle leggermente.
Controllare il senso di montaggio della guarnizione (10).

D Schmieren und das Aggregat (19)
in das Gelenkgehaéuse (1) montieren. Die Schrauben (15) anbringen und leicht zuschrauben.
Montagerichtung der Dichtungen (10) kontrollieren.

ESP Lubricar y montar el grupo (19) en la ròtula (1).
Montar los tornillos (15) y apretarlos ligeramente.
Controlar el sentido de montaje de la guarniciòn (10).

F Lubrifier et monter le groupe (19) dans boõtier articulation (1). Monter les vis (15) et serrer légérement.
Contròler le sens de montage de la garniture (10).

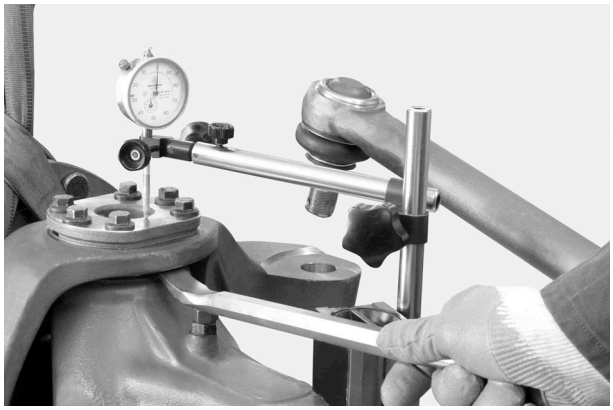
f

ITA Serrare in sequenza con il metodo incrociato, le nuove viti (15) di ritegno dei perni snodo inferiore e superiore.
Coppia di serraggio: 140 Nm

D Entgegengesetzt und abwechselnd die Schrauben (15) der unteren und oberen Gelenkstiften festschrauben.
Anzugsmoment: 140 Nm

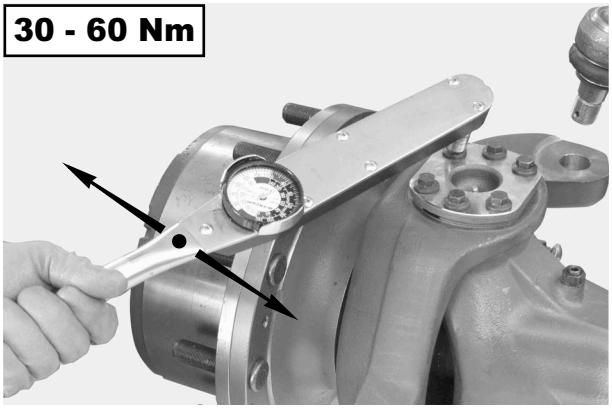
ESP Apretar en secuencia con el método cruzado, los tornillos (15) de retenciòn de las ròtulas inferior y superior.
Par de torsiòn: 140 Nm

F Serrer dans l'ordre, par le biais du mode croisè , les vis (15) de fixation des tourillons d'articulation inférieur et supérieur.
Couple de serrage: 140 Nm



GB a

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



GB b

Check the torque of the pins, which has to be between 30 and 60 Nm. If the preliminary measured value is too high, the shims have to be increased.

a

ITA Con l'aiuto di una leva verificare che il gioco verticale sia nullo.
Se non é nullo, rilevare il valore del gioco e ridurlo togliendo spessori

D Mit Hilfe eines Hebels auf vertikale Spielfreiheit überprüfen.
Falls es nicht Null ist, die Größe des Spiels messen und durch Entfernen von Unterlegscheiben reduzie-

ESP Haciendo palanca, verificar que no exista juego vertical. Si existiese reducir los espesores ya colocados.

F A l'aide d'un levier verifier que le jeu vertical soit nul.
Si est pas nul relever la valeur du jeu et reduire enmoinsavec les cales.

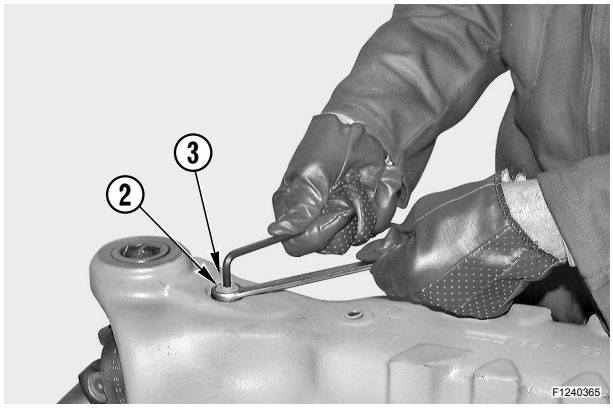
b

ITA Verificare la coppia di rotazione dei perni, 30-60 Nm.
Se è troppo alto è necessario aumentare gli spessori.

D Drehmoment zum Durchdrehen der Bolzen prüfen.
Es muß zwischen 30 und 60Nm betragen.
Falls es zunächst zu hoch ist, müssen die Unterlegscheiben verstärkt werden.

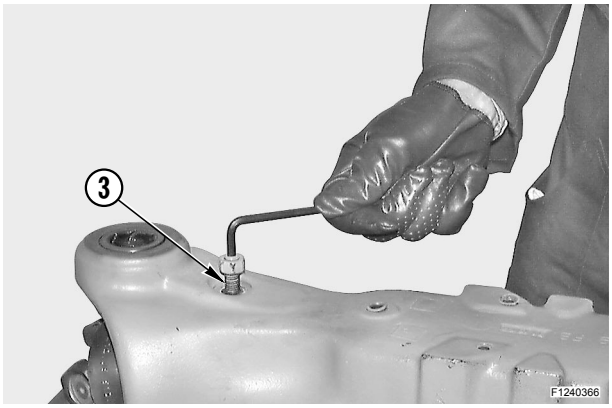
ESP Verificar el par de rotaciòn de los pernos que debe ser de 30 a 60 Nm . Si fuese demasiado alto aumentar los espesores.

F Verifier la couple de rotation des tourillons de 30 a 60 Nm.
Si le precharge misuree est trop haut, il faut augmenter les cales.



GB a

Unloose and remove the top and bottom check nuts (2) from the dowels (3).



GB b

Remove top and bottom check dowels (3) from the flange (5) or bush (13).

NOTES - NOTE - BEMERKUNG - NOTAS - NOTE

GB The u-joint can only be removed after extraction of the steering case has been performed (See: «REMOVING THE STEERING CASE»). Different procedures need to be followed depending on the kind of repair operation needed and the type of axle:

1 - Axle without parking brakes: compressed air (7 bar approx.) should be introduced in the braking circuit in order to hold the braking disks in position.

2 - Axle with negative brake: does not require any preparation as the disks are mechanically locked in position.

3 - Axle with mechanical brake: requires that the external control levers are put under tension in relation to each other.

4 - Disassembly to be carried out with the arm resting on the bench.

The explanations reported herewith refer to removal operations carried out on the bench; the different stages of u-joint removal also apply to all other solutions or versions.

ITA La rimozione del doppio giunto cardanico può essere eseguita solo dopo la rimozione della scatola snodo (Vedere «RIMOZIONE SCATOLA SNODO») ed in modo diversificato, in funzione del tipo di riparazione da eseguire e del tipo di assale:

1 - Assale senza freni di stazionamento: è necessario immettere aria compressa (circa 7 bar) nel circuito di frenatura per tenere in posizione i dischi freni.

2 - Assale con freno negativo: non richiede alcuna preparazione in quanto i dischi restano bloccati meccanicamente.

3 - Assale con freno a comando meccanico: richiede di mettere in tensione tra loro le leve esterne di comando.

4 - Smontaggio eseguito con il braccio appoggiato sul banco.

Le spiegazioni riportate si riferiscono alla rimozione eseguita al banco e le fasi sono comuni alle altre soluzioni o versioni.

D Die Doppelgelenkwelle können erst abmontiert werden, wenn das Gelenkgehäuse schon abgenommen worden ist (Siehe, «GELENKGEHÄUSE ABMONTIEREN»). Der Vorgang ist je nach benötigter Reparatur und je nach Achsentyp unterschiedlich:

1 - Achse ohne Feststellbremse: die Bremsanlage mit ca. 7 bar unter Druck setzen, um die Bremsscheiben in ihrer Position festzuhalten.

2 - Achse mit negativer Bremse: benötigt keinerlei Vorbereitung, da die Scheiben mechanisch blockiert bleiben.

3 - Achse mit mechanisch gesteuerten Bremsen: in diesem Fall müssen die äußeren Steuerhebel untereinander unter Spannung gesetzt werden.

4 - Zum Abmontieren, Arm auf die Werkbank legen.

Die Erläuterungen beziehen sich auf das Abmontieren an der Werkbank, wobei die Vorgänge für alle anderen Lösungen oder Ausführungen gleich sind.

ESP La remoción de los semiejes se puede ejecutar solamente después de la remoción del cárter de la rótula (Véase «REMOCION CAJA DE ROTULA») y de manera diversificada en función del tipo de reparación que hay que ejecutar y del tipo de eje:

1 - Eje sin frenos de estacionamiento: es necesario hacer entrar aire comprimido (aproximadamente 7 bares) en el circuito de frenado para mantener en posición los discos de los frenos.

2 - Eje con freno negativo: no requiere ninguna preparación puesto que los discos quedan bloqueados mecánicamente.

3 - Eje con freno de mando mecánico: requiere la puesta en tensión entre sí de las palancas exteriores de mando.

4 - Desmontaje ejecutado con el brazo apoyado en el banco.

Las explicaciones que aquí figuran se refieren a la remoción ejecutada en el banco y las fases son comunes para otras soluciones o versiones.

F La dépose de joint de cardan double ne peut être effectuée qu'après la dépose du boîtier articulation (Voir, DEPOSE DU BOITIER ARTICULATION), d'une façon diversifiée, en fonction du type de réparation à effectuer et du type d'essieu:

1 - Essieu sans freins de stationnement: il faut introduire de l'air comprimé (environ 7 bar) dans le circuit de freinage pour maintenir les disques de freinage en place.

2 - Essieu à frein négatif: ne requiert aucune préparation parce que les disques mécaniquement restent bloqués.

3 - Essieu à frein de commande mécanique: requiert de mettre sous tension des leviers externes de commande entre-eux.

4 - Démontage effectué et bras déposé sur l'établi.

Les explications reportées se réfèrent à la dépose effectuée sur l'établi, les phases sont les mêmes que pour les autres solutions ou versions.

a

ITA Allentare ed asportare i dadi superiori ed inferiori (2) di bloccaggio dei grani (3).

D Obere und untere Muttern (2) die die Stifte (3) blokkieren, abschrauben.

ESP Aflojar y sacar las tuercas superiores e inferiores (2) que bloquean las espigas (3).

F Desserrer puis enlever les écrous supérieurs et inférieurs (2) de blocage des grains (3).

b

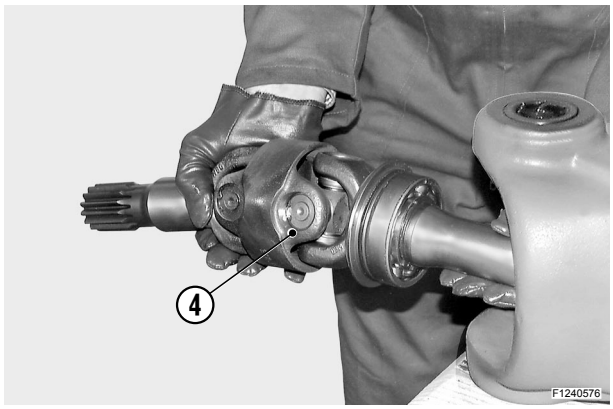
ITA Asportare i grani superiore ed inferiore (3) di ritegno flangia (5) o della bussola (13).

D Obere und untere Stifte (3), die den Flansch (5) oder die Buchse (13) halten, abnehmen.

ESP Sacar la espigas superior y la inferior (3) de retención de la brida (5) o del manguito (13).

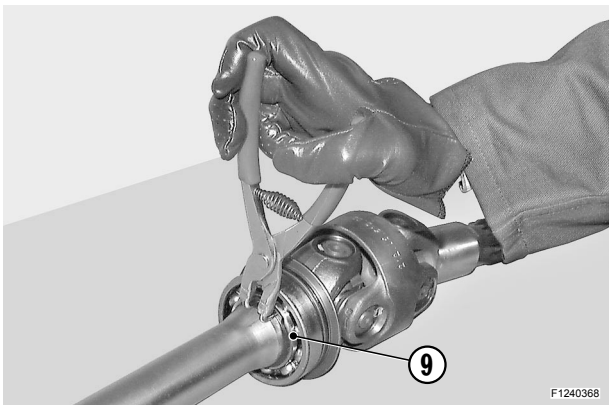
F Enlever les grains supérieurs et inférieurs (3) de fixation de la flasque (5) ou de la douille (13).

FLANGED VERSION - VERSIONE A FLANGIA - AUSFÜHRUNG MIT FLANSCH - VERSION A BRIDA - VERSION A FLASQUE



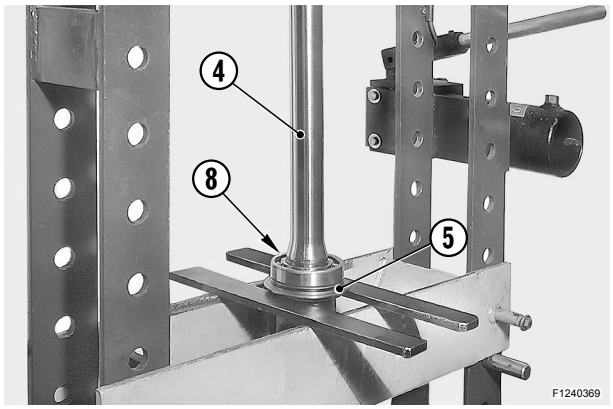
GB a

Remove the u-joint (4).
NOTE. To remove the u-joint use, if necessary, a plastic hammer or a lever.



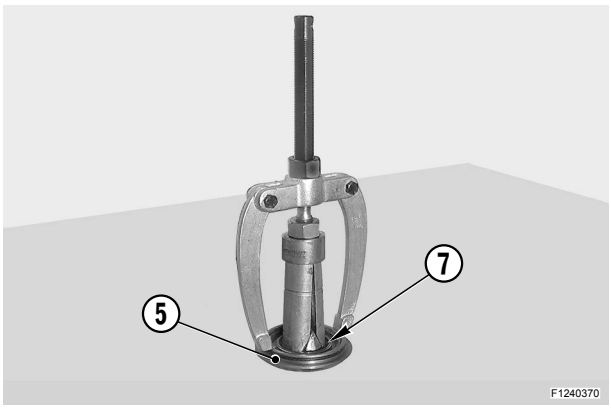
GB b

Remove the snap ring (9) from the bearing as well as the packing ring (5).



GB c

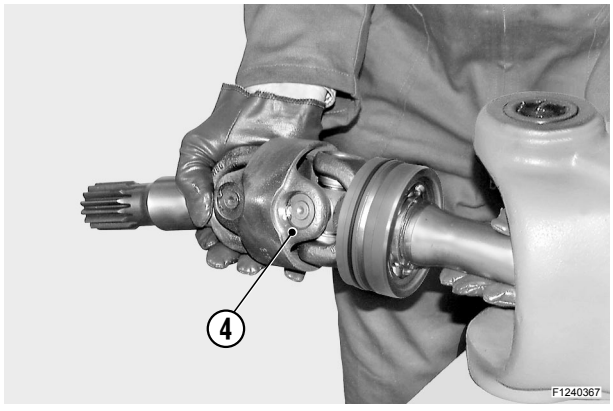
Position the entire u-joint (4) under a press and remove the bearing (8) and the ring (5) simultaneously.



GB d

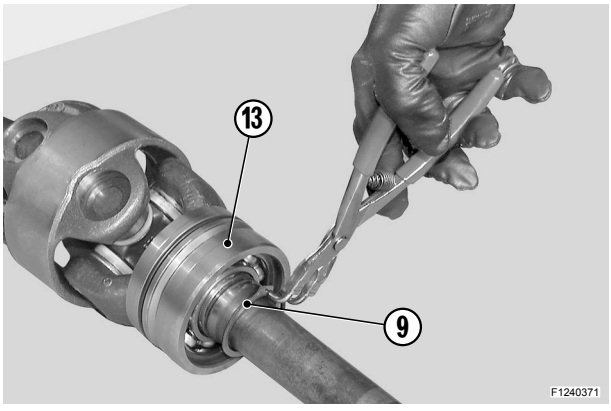
Extract the sealing ring of the shaft from the flange (5).
NOTE. Note down the assembly side of the ring.

COUPLING VERSION - VERSIONE A MANICOTTO - AUSFÜHRUNG MIT MUFFE - VERSION A MANGUITO - VERSION A MANCHON



GB e

Remove the entire u-joint (4).
NOTE. To remove the u-joint use, if necessary, a plastic hammer or a lever.



GB f

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

a

ITA Estrarre il doppio giunto cardanico (4) completo.
NOTA. Se necessario, per l'estrazione del doppio giunto cardanico usare un mazzuolo in materiale plastico od una leva.

D Komplette Doppelgelenkwelle (4) heraus ziehen.
BEMERKUNG. Wenn nötig, einen Gummihammer oder einen Hebel verwenden, um die Doppelgelenkwelle heraus zu ziehen.

ESP Extraer el semieje (4) completo.
NOTA. Si fuera necesario, para extraer el semieje, utilizar un martillo de material plástico o una palanca.

F Extraire le joint de cardan double (4) complet.
NOTE. Si besoin, pour l'extraction du joint de cardan double, utiliser un maillet en matière plastique ou un levier.

b

ITA Asportare l'anello di ritegno (9) del cuscinetto e dell'anello porta guarnizioni (5).

D Den Haltering (9) des Lagers und des Dichtungsrings (5) abnehmen.

ESP Sacar el anillo de retención (9) del cojinete y del anillo porta juntas (5).

F Enlever la bague de retenue (9) du palier, puis la bague porte-garniture (5).

c

ITA Sistemare il doppio giunto cardanico completo (4) sotto una pressa e rimuovere il cuscinetto (8) e contemporaneamente l'anello (5).

D Die komplette Doppelgelenkwelle (4) unter eine Presse setzen und gleichzeitig das Lager (8) und den Ring (5) abnehmen.

ESP Colocar el semieje completo (4) debajo de una prensa y remover el cojinete (8) y al mismo tiempo el anillo (5).

F Ajuster le joint de cardan double complet (4) sous une presse puis enlever le palier (8) et la bague (5) en même temps.

d

ITA Estrarre dalla flangia (5) l'anello di tenuta dell'albero.
NOTA. Annotare il senso di montaggio dell'anello.

D Vom Flansch (5) den Wellenkolbenring abnehmen.
BEMERKUNG. Auf die Montagerichtung des Ringes achten.

ESP Extraer de la brida (5) el segmento de compresión del eje.
NOTA. Anotar el sentido de montaje del anillo.

F Extraire de la flasque (5) la bague d'étanchéité de l'arbre.
NOTE. Prendre note du sens de montage de la bague.

e

ITA Estrarre il doppio giunto cardanico (4) completo.
NOTA. Se necessario, per l'estrazione del doppio giunto cardanico usare un mazzuolo in materiale plastico od una leva.

D Komplette Doppelgelenkwelle (4) heraus ziehen.
BEMERKUNG. Wenn nötig, einen Gummihammer oder einen Hebel verwenden, um die Doppelgelenkwelle heraus zu ziehen.

ESP Extraer el semieje (4) completo.
NOTA. Si fuera necesario, para extraer el semieje, utilizar un martillo de material plástico o una palanca.

F Extraire le joint de cardan double (4) complet.
NOTE. Si besoin, pour l'extraction du joint de cardan double, utiliser un maillet en matière plastique ou un levier.

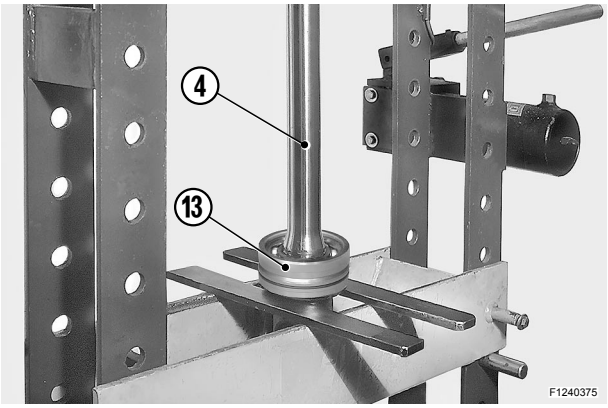
f

ITA Asportare l'anello elastico di ritegno (9) del gruppo bussola (13).

D Haltering (9) von der Buchse (13) abnehmen.

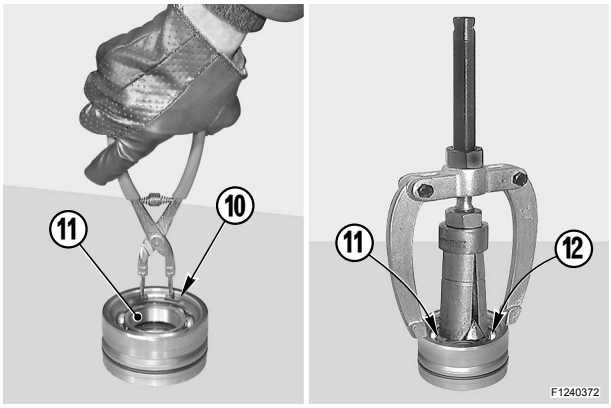
ESP Sacar el anillo elástico de retención (9) del grupo del manguito (13).

F Enlever l'anneau élastique de retenue (9) du groupe de douille (13).



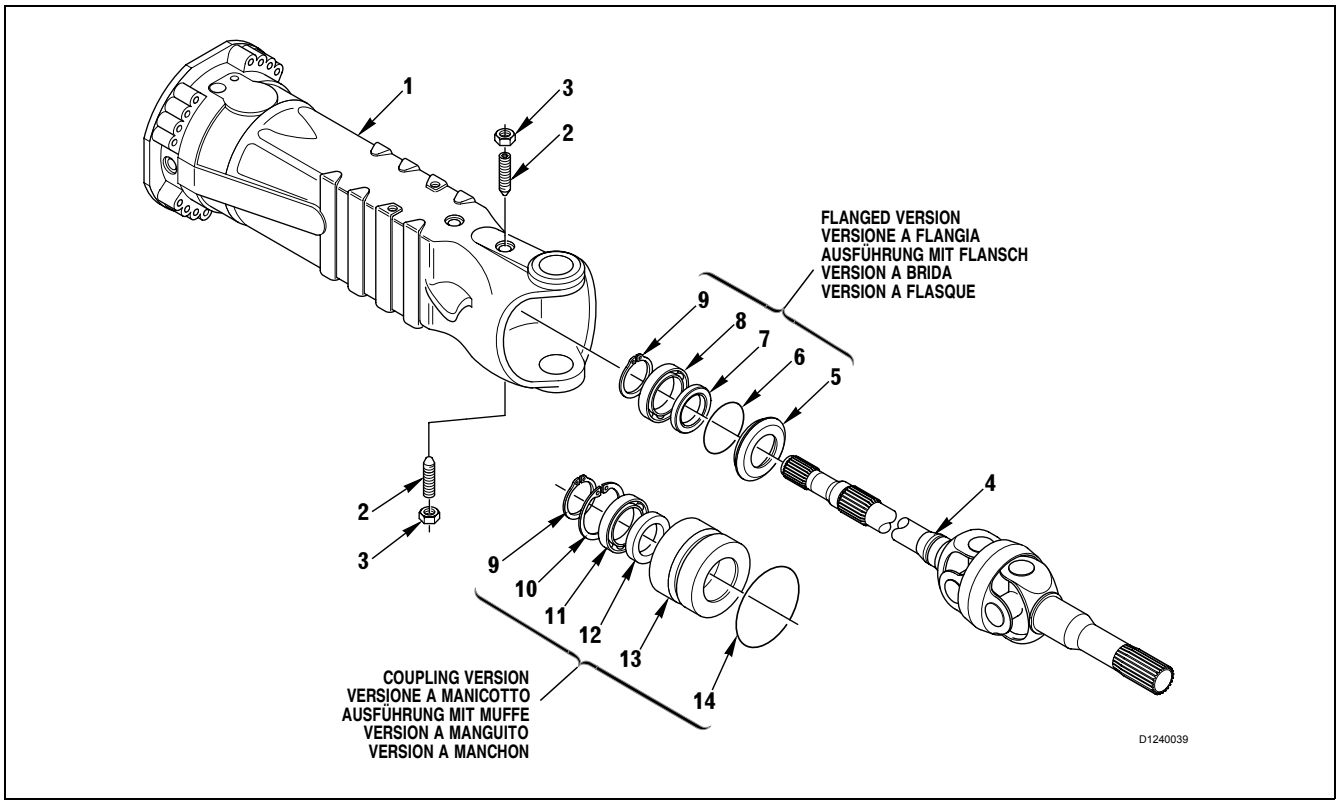
GB a

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



GB b

Remove the snap ring (10) from the bearing (11). Use a puller to remove the bearing (11), the sealing ring (12) and the O-ring (14).
NOTE. Note down the assembly side of the ring (12).



a

ITA Sistemare il doppio giunto cardanico completo (4) sotto una pressa e rimuovere la bussola (13) completa.

D Die komplette Doppelgelenkwelle (4) unter eine Presse setzen und die komplette Buchse (13) abnehmen.

ESP Colocar el semieje completo (4) debajo de una prensa y remover el manguito (13) completo.

F Ajuster le joint de cardan double complet (4) sous une presse, puis enlever la douille (13) complète.

b

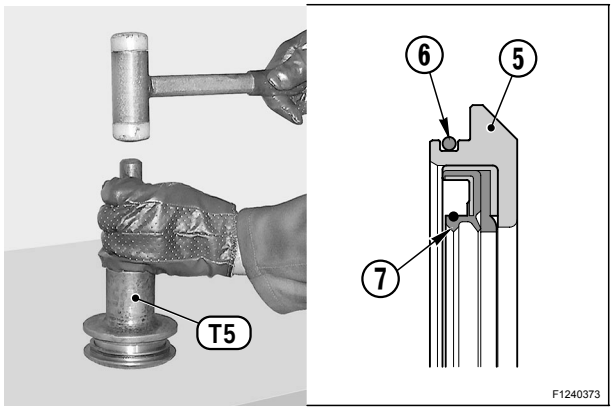
ITA Asportare l'anello elastico di ritegno (10) del cuscinetto (11).
Con un estrattore, rimuovere il cuscinetto (11) e l'anello di tenuta (12) e la guarnizione OR (14).
NOTA. Annotare il senso di montaggio dell'anello (12).

D Haltering (10) des Lagers (11) abnehmen.
Mit dem Abzieher, das Lager (11) und den Dichtring (12) sowie den O-Ring (14) abnehmen.
BEMERKUNG. Auf die Montagerichtung des Ringes (12) achten.

ESP Sacar el anillo de retención (10) del cojinete (11).
Utilizando un extractor, remover el cojinete (11) y el segmento de compresión (12) y la junta OR (14).
NOTA. Anotar el sentido de montaje del anillo (12).

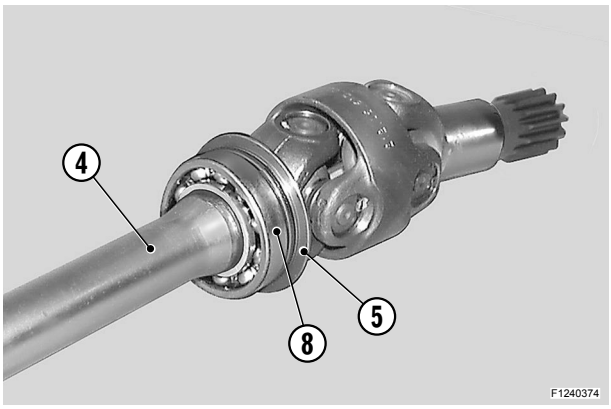
F Enlever l'anneau de retenue (10) du palier (11).
A l'aide d'un extracteur, enlever le palier (11) et la bague d'étanchéité (12) puis la garniture OR (14).
NOTE. Prendre note du sens de montage de la bague (12).

FLANGED VERSION - VERSIONE A FLANGIA - AUSFÜHRUNG MIT FLANSCH - VERSION A BRIDA - VERSION A FLASQUE



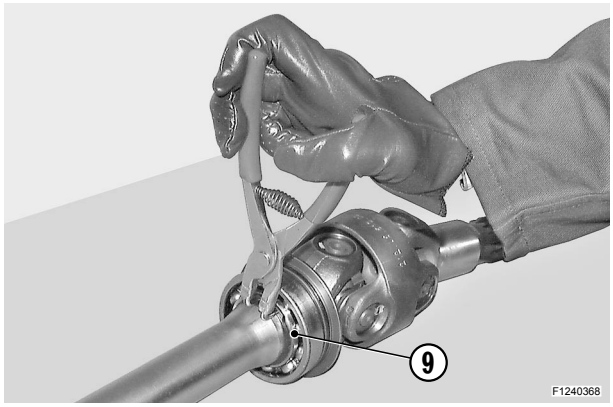
GB a

Insert the sealing ring (7) of the shaft in the flange (5), using tool **T5**.
NOTE. Carefully check the assembly side. Also replace the outer O-ring (6).



GB b

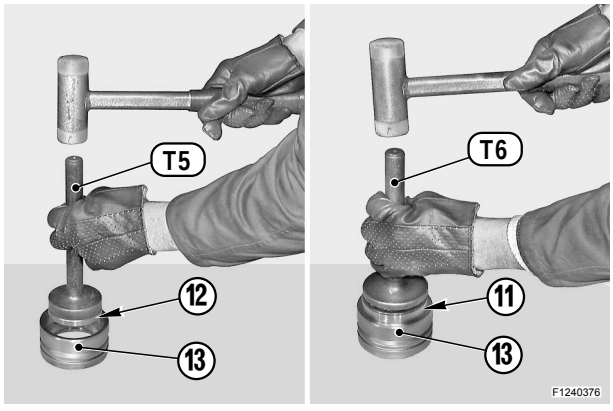
Fit the flange (5) onto the u-joint (4).
Heat the bearing (8) at an approx. temperature of 100° C, fit it on the u-joint and fasten.



GB c

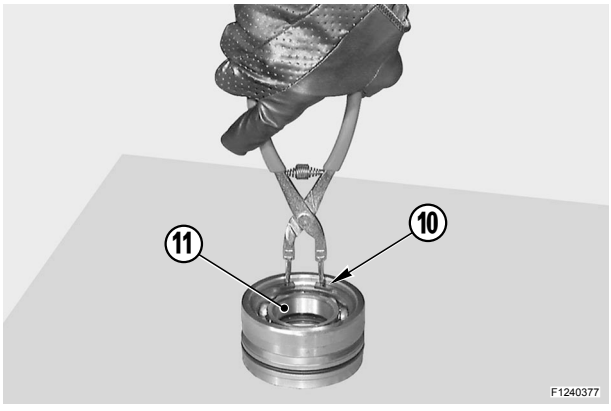
Fit the snap ring (9) on the bearing (8).

COUPLING VERSION - VERSIONE A MANICOTTO - AUSFÜHRUNG MIT MUFFE - VERSION A MANGUITO - VERSION A MANCHON



GB e

Using tools **T5** and **T6**, insert the sealing ring (12) and the bearing (11) in the bush (13).
NOTE. Carefully check the assembly side of the seal (12).



GB f

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

a

ITA Utilizzando l'attrezzo **T5** inserire nella flangia (5) l'anello di tenuta (7) dell'albero.
NOTA. Controllare attentamente il senso di montaggio. Sostituire anche l'anello OR esterno (6).

D Mit dem Werkzeug **T5**, den Kolbenring (7) in den Flansch (5) montieren.
BEMERKUNG. Montagerichtung sorgfältig kontrollieren. Den äußeren O-Ring (6) auswechseln.

ESP Utilizando la herramienta **T5** introducir en la brida (5) el segmento de compresión (7) del eje.
NOTA. Controlar atentamente el sentido de montaje. Sustituir también el anillo OR exterior (6).

F A l'aide d'un outil **T5** introduire dans la flasque (5) la bague d'étanchéité (7) de l'arbre.
NOTE. Contrôler soigneusement le sens de montage. Remplacer également la garniture OR (6).

b

ITA Infilare la flangia (5) sul doppio giunto cardanico (4). Scaldare il cuscinetto (8) a circa 100°C, infilarlo sul doppio giunto cardanico e mandarlo in battuta.

D Flansch (5) in die Doppelgelenkwelle (4) einsetzen. Lager (8) auf ca. 100°C erhitzen und auf die Doppelgelenkwelle setzen; bis zum Anschlag schieben.

ESP Introducir la brida (5) en el semieje (4).
Calentar el cojinete (8) a unos 100°C, introducirlo en el semieje hasta el tope.

F Enfiler la flasque (5) sur le joint de cardan double (4). Chauffer le palier (8) à environ 100°C, enfiler celui-ci sur le joint de cardan double et l'envoyer en butée.

c

ITA Montare l'anello elastico (9) di ritegno del cuscinetto (8).

D Haltering (9) auf das Lager (8) montieren.

ESP Montar el anillo elástico (9) de retención del cojinete (8).

F Monter l'anneau élastique (9) de retenue du palier (8).

e

ITA Utilizzando gli attrezzi **T5 e T6** inserire nella bussola (13) l'anello di tenuta (12) ed il cuscinetto (11).
NOTA. Controllare attentamente il senso di montaggio della guarnizione (12).

D Mit den Werkzeugen **T5** und **T6** den Haltering (12) und das Lager (11) in die Buchse (13) setzen.
BEMERKUNG. Montagerichtung der Dichtung (12) aufmerksam kontrollieren.

ESP Utilizando las herramientas **T5** y **T6**, introducir en el manguito (13) el segmento de compresión (12) y el cojinete (11).
NOTA. Controlar atentamente el sentido de montaje de la junta (12).

F A l'aide des outils **T5** et **T6** introduire dans la douille (13) la bague d'étanchéité (12) et le palier (11).
NOTE. Contrôler soigneusement le sens de montage de la garniture (12).

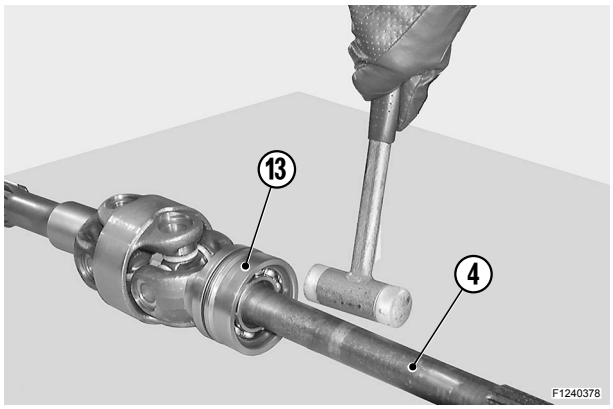
f

ITA Montare l'anello elastico (10) di ritegno del cuscinetto (11).

D Haltering (10) des Lagers (11) montieren.

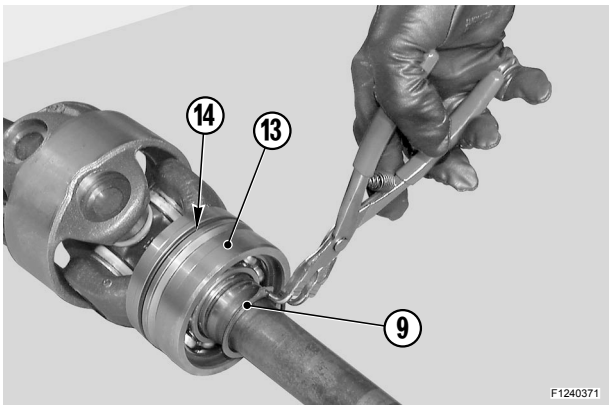
ESP Montar el anillo elástico (10) de retención del cojinete (11).

F Monter l'anneau élastique (10) de retenue du palier (11).



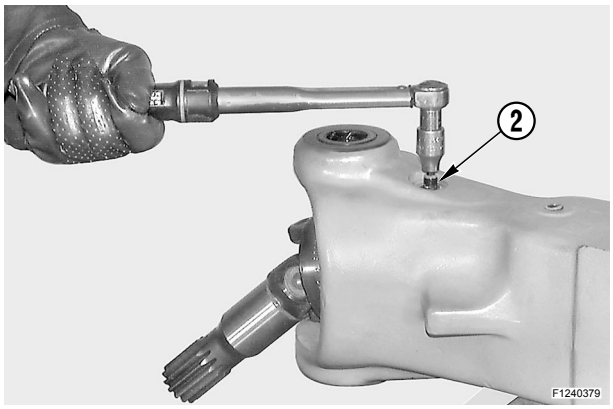
GB a

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



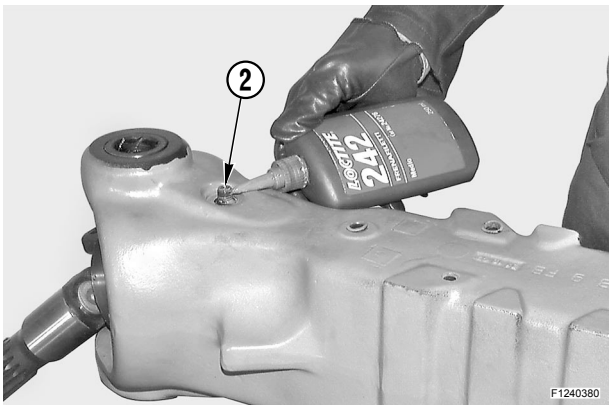
GB b

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



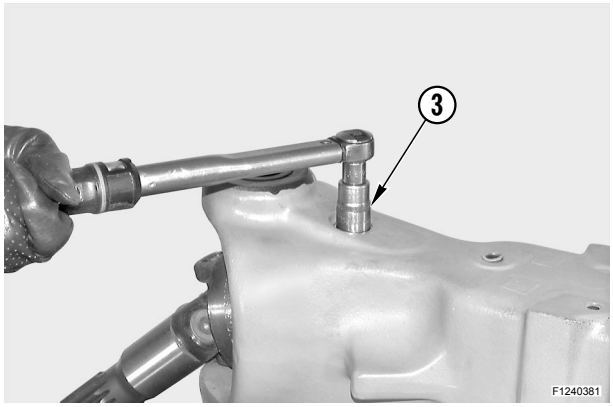
GB c

Insert the u-joint and tighten the top and bottom dowels (2).
Torque wrench setting: Max. 15 Nm.
NOTE. For u-joint coming with a bush, centre the point of the check dowels in the slot.



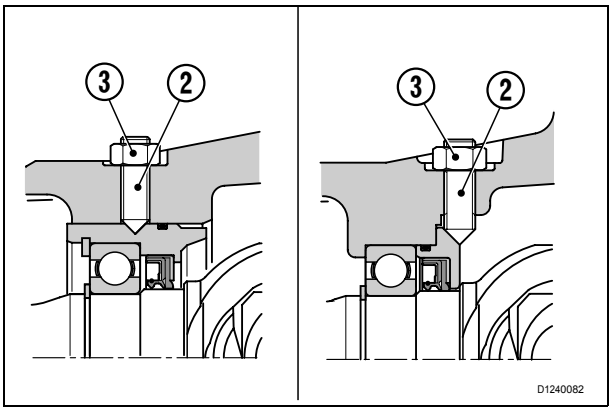
GB d

Apply Loctite 242 to the jutting parts of the dowels (2).



GB e

Screw the check nuts (3) of the dowels (2) and lock them using a dynamometric wrench.
Torque wrench setting: 122 Nm



a

ITA Scaldare in olio il cuscinetto a circa 100°C ed infilare sul doppio giunto cardanico (4) la bussola completa (13).

D Lager in Öl auf ca. 100°C erhitzen und auf die Doppelgelenkwelle (4) die komplette Buchse (13) schieben.

ESP Calentar en aceite el cojinete a unos 100°C e introducir en el semieje (4) el manguito completo (13).

F Chauffer dans l'huile à environ 100°C le palier puis enfiler sur le joint de cardan double (4) la douille complète (13).

b

ITA Montare l'anello di ritegno (9) del gruppo bussola (13); posizionare anche la guarnizione OR (14).

D Haltering (9) des Buchsenaggregats (13) montieren; O-Ring (14) ebenfalls montieren.

ESP Montar el anillo de retención (9) del grupo del manguito (13); posicionar también la junta OR (14).

F Monter l'anneau de retenue (9) du groupe douille (13): placer également la garniture OR (14).

c

ITA Infilare il doppio giunto cardanico e serrare i grani superiore ed inferiore (2).
Coppia di serraggio: Max. 15 Nm.
NOTA. Per il doppio giunto cardanico con bussola, centrare la punta dei grani di ritegno nella cava.

D Doppelgelenkwelle einsetzen und obere und untere Stifte (2) festschrauben.
Anzugsmoment: Max. 15 Nm
BEMERKUNG. Bei der Doppelgelenkwelle mit Buchse, Stiftspitze genau zentrieren.

ESP Introducir el semieje y apretar la espiga superior y la inferior (2).
Par de torsión: Máx. 15 Nm.
NOTA. Para el semieje con manguito, centrar la punta de las espigas de retención en la ranura.

F Enfiler le joint de cardan double et serrer les grains supérieurs et inférieurs (2).
Couple de serrage: Max. 15 Nm.
NOTE. Pour le joint de cardan double à douille, centrer la pointe des grains de fixation dans le creux.

d

ITA Spalmare con Loctite 242 le porzioni sporgenti dei grani (2).

D Mit Loctite 242 die herausragenden Stifte (2) schmieren.

ESP Pasar Loctite 242 en las partes salientes de las espigas (2).

F Enduire de Loctite 242 les parties saillantes des grains (2).

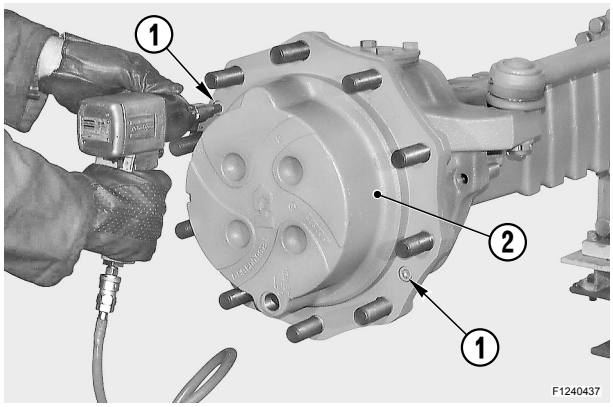
e

ITA Avvitare i dadi (3) di bloccaggio dei grani (2) e bloccarli con chiave dinamometrica.
Coppia di serraggio: 122 Nm

D Muttern (3) zur Befestigung der Stifte (2) zuschrauben und mit einem Momentenschlüssel blockieren.
Anzugsmoment: 122 Nm

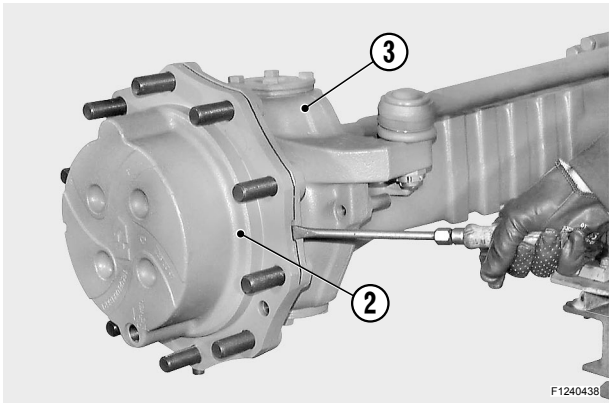
ESP Atornillar las tuercas (3) de bloqueo de las espigas (2) y bloquearlas con llave dinamométrica.
Par de torsión: 122 Nm

F Visser les écrous (3) de blocage des grains (2), puis bloquer à l'aide d'une clé dynamométrique.
Couple de serrage: 122 Nm



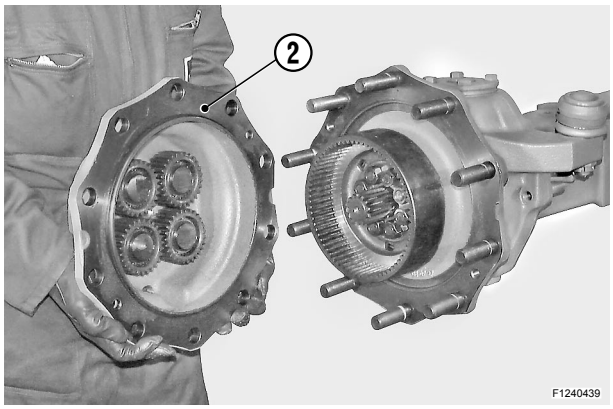
GB a

Disconnect the steering bars from the steering case (3).
For details, see «HOW TO REMOVE THE COMPLETE STEERING CASE».
Remove the securing screws (1) from the planetary carrier cover (2).



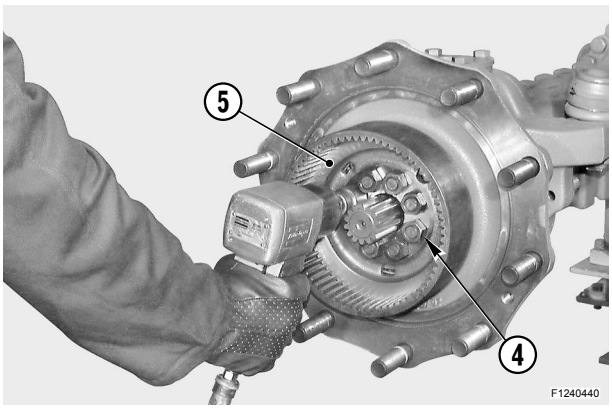
GB b

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



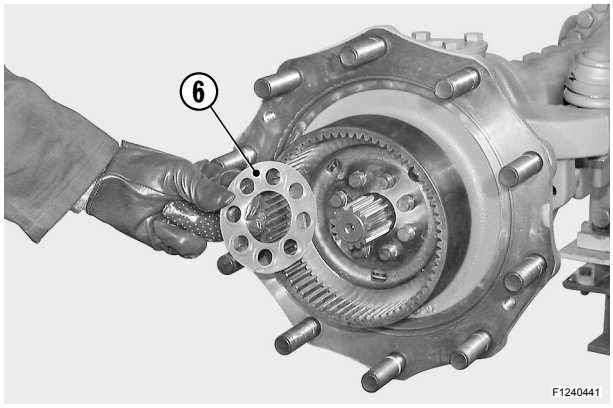
GB c

Remove the complete planetary carrier cover (2).



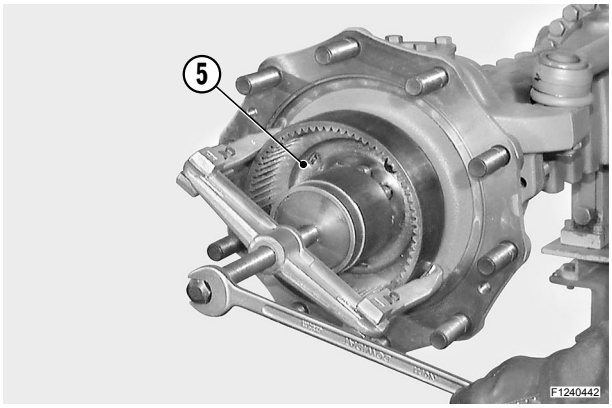
GB d

Unloose and remove the tightening nuts (4) from the crown flange (5).



GB e

Remove the safety flange (6).



GB f

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

a

ITA Scollegare dalla scatola snodo (3) le barre di sterzatura.
Per i dettagli, vedere «RIMOZIONE SCATOLA SNODO COMPLETA».
Asportare le viti (1) di fissaggio del coperchio portasatelliti (2).

D Gelenkgehäuse (3) von den Lenkstangen trennen.
Siehe «KOMPLETTES GELENKGEHÄUSE ABMONTIEREN».
Befestigungsschrauben (1) vom Planetenradhalterdeckel (2) abschrauben.

ESP Separar de la caja de rótula (3) las barras de dirección.
Para los detalles, véase «REMOCION CAJA DE ROTULA COMPLETA».
Sacar los tornillos (1) de fijación de la tapa portasatélites (2).

F Débrancher, du boîtier articulation (3), les barres de braquage.
Pour de plus amples détails, voir «DEPOSE DU BOITIER D'ARTICULATION COMPLET».
Enlever les vis de fixation (1) du couvercle porte-satellites (2).

b

ITA Utilizzando un cacciavite inserito alternativamente nelle cave predisposte, staccare il coperchio portasatelliti (2) dalla scatola snodo (3).

D Mit einem Schraubenzieher den Planetenradhalterdeckel (2) vom Gelenkgehäuse (3) trennen. Dazu den Schraubenzieher abwechselnd in die vorgesehenen Nuten stecken und anheben.

ESP Utilizando un destornillador introducido alternativamente en las ranuras predispuestas, desprender la tapa portasatélites (2) de la caja de la rótula (3).

F A l'aide d'un tournevis introduit au fur et à mesure dans les creux prédisposés, décrocher le couvercle porte-satellites (2) du boîtier articulation (3).

c

ITA Asportare il coperchio portasatelliti (2) completo.

D Kompletter Planetenradhalterdeckel (2) abnehmen.

ESP Sacar la tapa portasatélites (2) completa.

F Enlever le couvercle porte-satellites (2) complet.

d

ITA Allentare ed asportare i dadi (4) che fissano la flangia portacorona (5).

D Befestigungsmuttern (4) des Kranzhalterflansches (5) lockern.

ESP Aflojar y quitar las tuercas (4) que fijan la brida portacorona (5).

F Desserrer et enlever les écrous (4) de fixation de la flasque porte-couronne (5).

e

ITA Rimuovere la flangia di sicurezza (6).

D Sicherheitsflansch (6) abnehmen.

ESP Remover la brida de seguridad (6).

F Enlever la flasque de sécurité (6).

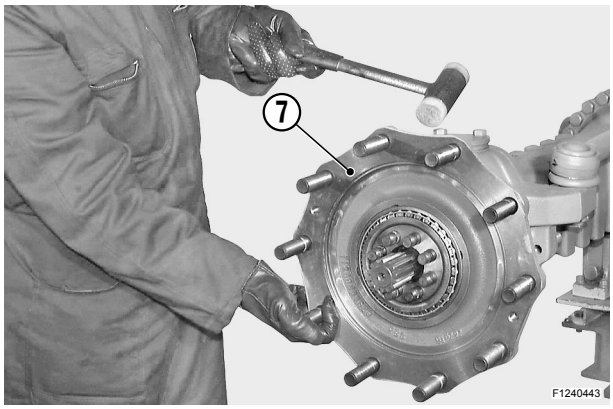
f

ITA Utilizzando un estrattore e, facendo reazione sui prigionieri, rimuovere la flangia portacorona (5) completa.

D Durch einen Abzieher über die Stiftschrauben, den kompletten Kranzhalterflansch (5) abnehmen.

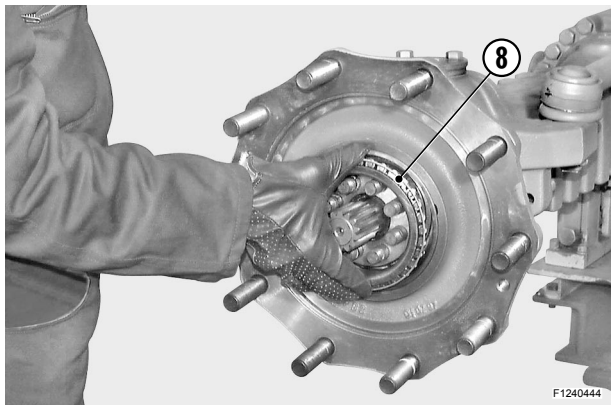
ESP Utilizando un extractor y apalancando los prisioneros, remover la brida portacorona (5) completa.

F En utilisant l'extracteur et en faisant réagir les prisonniers, enlever la flasque porte-couronne (5) complète.



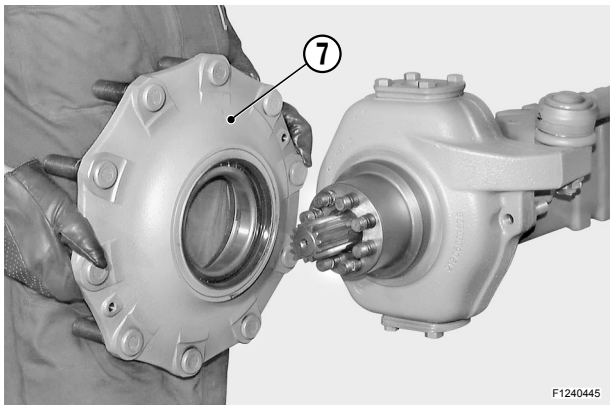
GB a

Partially extract the hub (7) using a plastic hammer.
NOTE. Alternately hammer on several equidistant points.



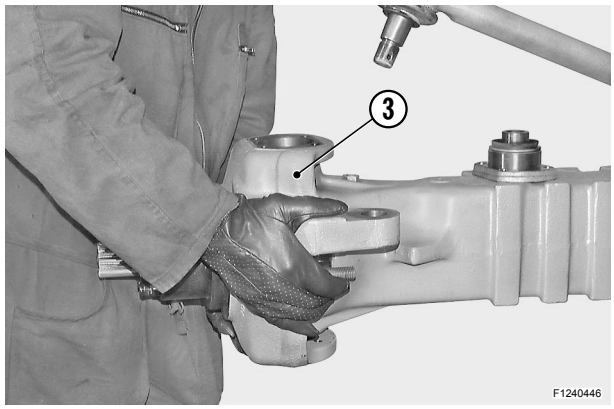
GB b

Remove the external bearing (8).



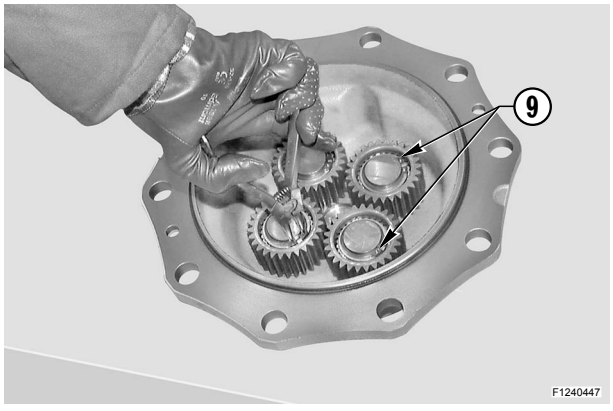
GB c

By hand remove the complete hub (7).



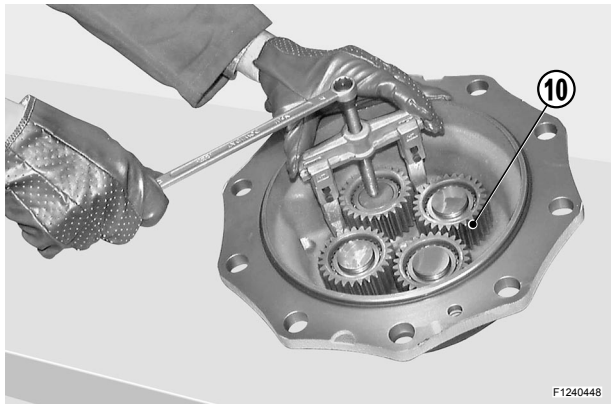
GB d

Remove the pins and remove the steering case (3).
For details, see «HOW TO REMOVE THE COMPLETE STEERING CASE»



GB e

Remove the snap rings (9).



GB f

With the help of a puller, remove the planet wheel gears (10).
NOTE. Note down the assembly side of planet wheels.

a

ITA Utilizzando un mazzuolo in materiale plastico, sfilare parzialmente il mozzo portaruota (7).
NOTA. Battere alternativamente in più punti equidistanti.

D Mit einem Gummihammer, die Radhalternabe (7) etwas heraus schieben.
BEMERKUNG. Abwechselnd an verschiedenen, gleich entfernten Stellen schlagen.

ESP Utilizando un martillo de material plástico, extraer parcialmente el cubo portarruedas (7).
NOTA. Golpear alternativamente en varios puntos equidistantes.

F A l'aide d'un maillet en matière plastique, extraire partiellement le moyeu porte-roue (7).
NOTE. Frapper sur plusieurs points à la même distance.

b

ITA Asportare il cuscinetto esterno (8).

D Äußeres (8) Lager abnehmen.

ESP Sacar el cojinete exterior (8).

F Enlever le palier externe (8).

c

ITA Sfilare il mozzo portaruota (7).

D Radhalternabe (7) herausziehen.

ESP Extraer el cubo portarruedas (7).

F Extraire le moyeu porte-roue (7).

d

ITA Asportare i perni e rimuovere la scatola snodo (3).
Per i dettagli di rimozione dei perni, vedere «RIMOZIONE SCATOLA SNODO COMPLETA».

D Stifte und Gelenkgehäuse (3) entfernen.
Siehe «KOMPLETTES GELENKGEHÄUSE ABMONTIEREN».

ESP Sacar los pernos y remover la caja de la rótula (3).
Para los detalles de remoción de los pernos, véase «REMOCION CAJA DE ROTULA COMPLETA».

F Enlever les tourillons, enlever le boîtier articulation (3).
Pour de plus amples détails, voir «DEPOSE DU BOITIER ARTICULATION COMPLET».

e

ITA Asportare gli anelli elastici (9).

D Die Kolbenringe (9) entfernen.

ESP Sacar los anillos elásticos (9).

F Enlever les anneaux élastiques (9).

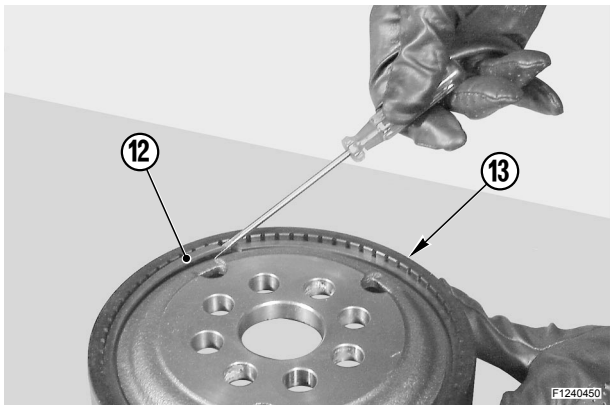
f

ITA Utilizzando un estrattore, asportare gli ingranaggi satelliti (10).
NOTA. Annotare il senso di montaggio dei satelliti.

D Mit einem Abzieher, die Planetenräder (10) heraus nehmen.
BEMERKUNG. Montagerichtung der Planetenräder beachten.

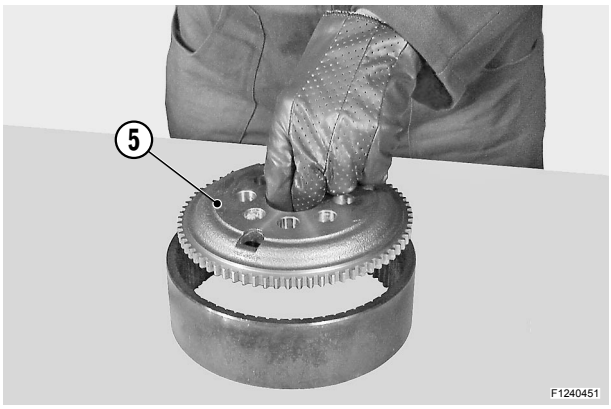
ESP Utilizando un extractor, sacar los engranajes satélites (10).
NOTA. Anotar el sentido de montaje de los satélites.

F A l'aide d'un extracteur, extraire les engrenages satellites (10).
NOTE. Prendre note du sens de montage des satellites.



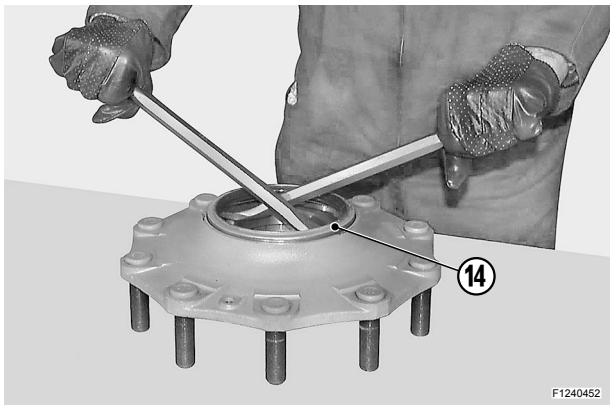
GB a

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



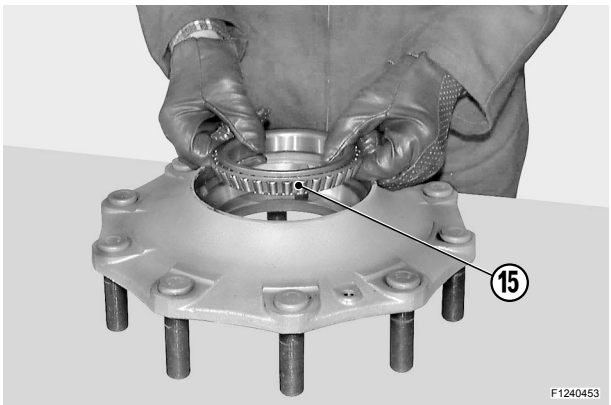
GB b

Remove the crown flange (5).



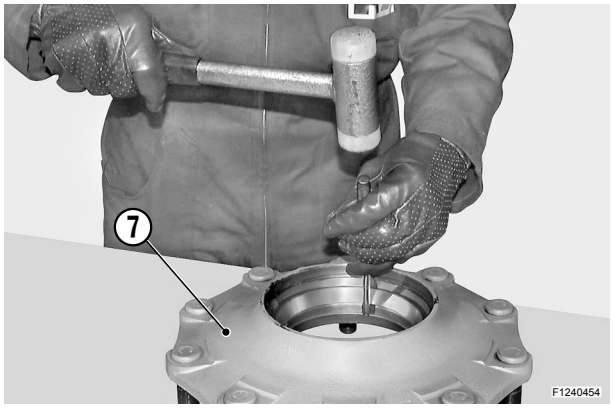
GB c

Remove the sealing ring from the hub (14).



GB d

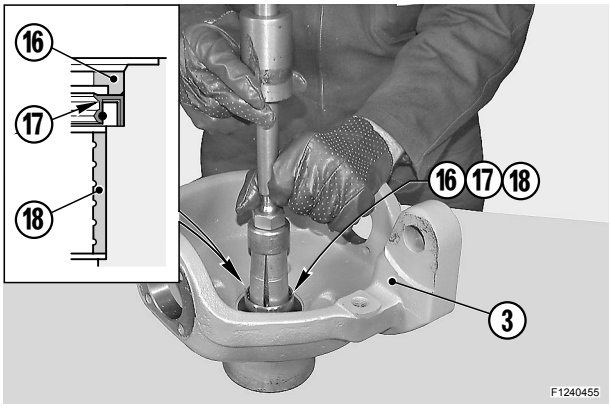
Remove the internal bearing (15).



GB e

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

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



GB f

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

NOTE. Note down the orientation of both centring ring (16) and sealing ring (17).

a

ITA Asportare l'anello elastico (12) di ritegno della corona (13).

D Den Kolbenring (12) vom Kranz (13) abnehmen.

ESP Sacar el anillo elástico (12) de retención de la corona (13).

F Enlever l'anneau élastique (12) de retenue de la couronne (13).

b

ITA Rimuovere la flangia portacorona (5).

D Kranzhalterflansch (5) abnehmen.

ESP Remover la brida portacorona (5).

F Déposer la flasque porte-couronne (5).

c

ITA Rimuovere dal mozzo portaruota (14) l'anello di tenuta.

D Von der Radhalternabe (14) den Kolbenring abnehmen.

ESP Remover del cubo portarruedas (14) el segmento de compresión.

F Enlever, du moyeu porte-roue (14), la bague d'étanchéité.

d

ITA Rimuovere il cuscinetto interno (15).

D Inneres Lager (15) abnehmen.

ESP Remover el cojinete interior (15).

F Enlever le palier interne (15).

e

ITA Rimuovere le ralle esterne dei cuscinetti (8) e (15) utilizzando un cacciaspine inserito nelle cave predisposte sul mozzo (7).

NOTA. Battere in modo alternato per evitare impuntamenti e deformazione delle ralle.

D Die äußeren Scheiben der Lager (8) und (15) mit einem Dübel durch die Nabenlöcher (7) herausschlagen.

BEMERKUNG. Abwechselnd herausschlagen, um Verformungen zu vermeiden.

ESP Remover las ranguas exteriores (8) y (15) de los cojinetes utilizando un extractor para clavijas insertado en las ranuras predispuestas en el cubo (7).

NOTA. Golpear de manera alternada para evitar daños y deformaciones de las ranguas.

F Enlever les crapaudines externes des paliers (8) et (15) à l'aide d'une chasse-goupilles placé dans les creux spécialement conçus à cet effet sur le moyeu (7).

NOTE. Taper d'une manière alternée afin d'éviter talonnage et déformation des crapaudines.

f

ITA Utilizzando un estrattore, asportare dalla scatola snodo (3), l'anello centratore (16), l'anello di tenuta (17) e la bronzina (18).

NOTA. Annotare gli orientamenti dell'anello centratore (16) e dell'anello di tenuta (17).

D Mit einem Abzieher das Gelenkgehäuse (3), den Zentrierring (16), den Kolbenring (17) und das Bronzelager (18) abnehmen.

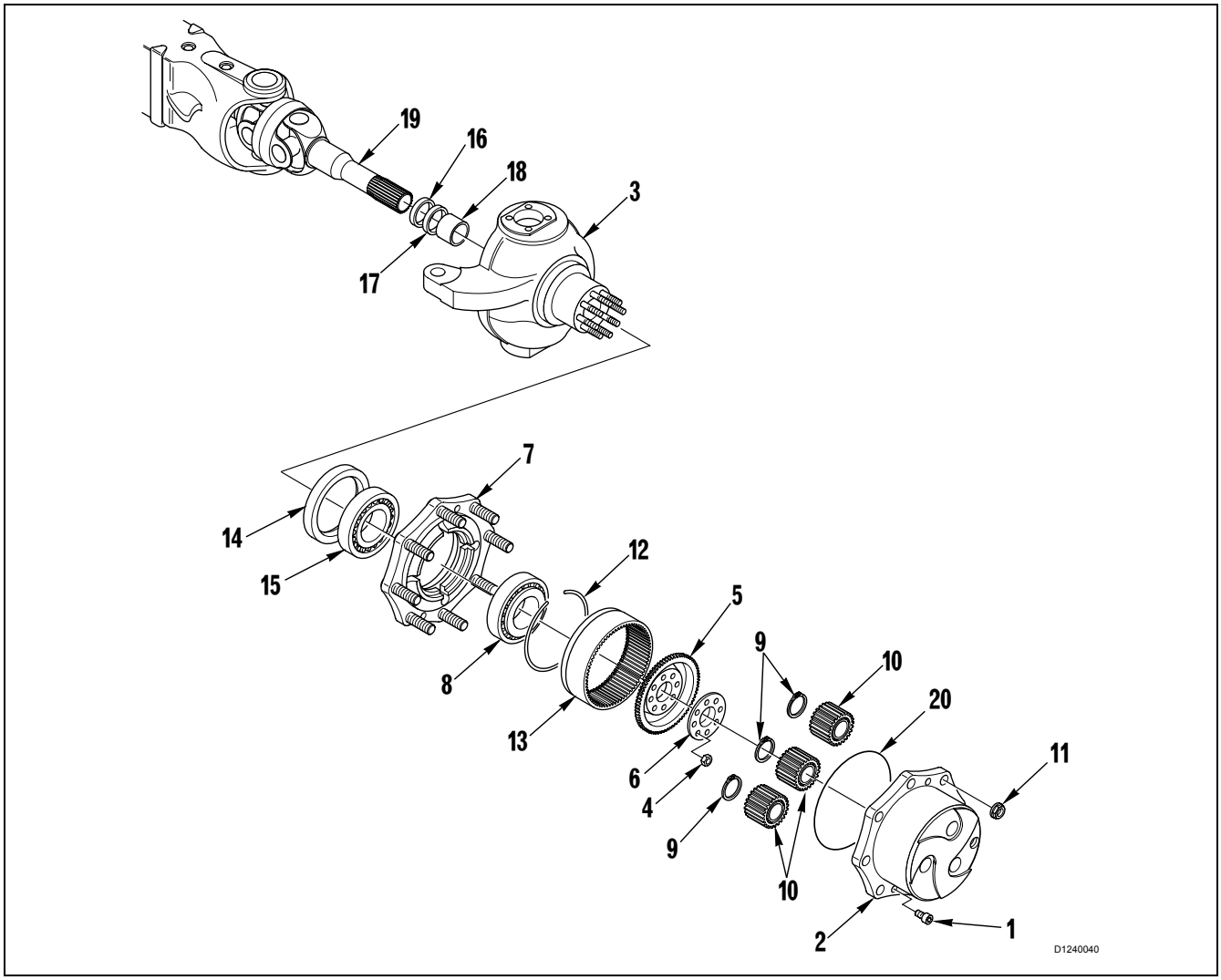
BEMERKUNG. Auf die Montagerichtung des Zentrierringes (16) und des Kolbenringes (17) achten.

ESP Utilizando un extractor, sacar de la caja de la rótula (3) el anillo de centraje (16), el segmento de compresión (17) y la chumacera (18).

NOTA. Anotar las orientaciones del anillo de centraje (16) y del segmento de compresión (17).

F A l'aide d'un extracteur, extraire le boîtier articulation (3), l'anneau de centrage (16), la bague d'étanchéité (17) et le coussinet (18).

NOTE. Prendre note du sens de l'anneau de centrage (16) et de la bague d'étanchéité (17).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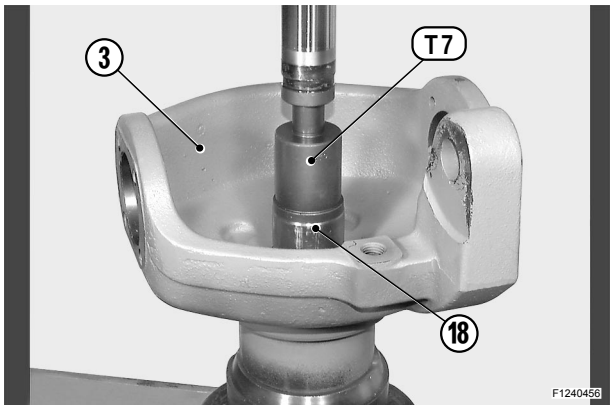
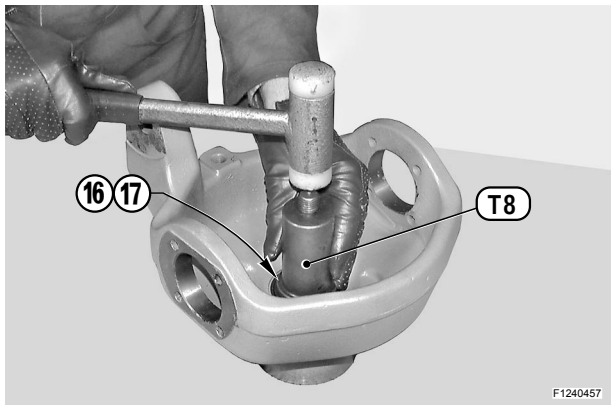


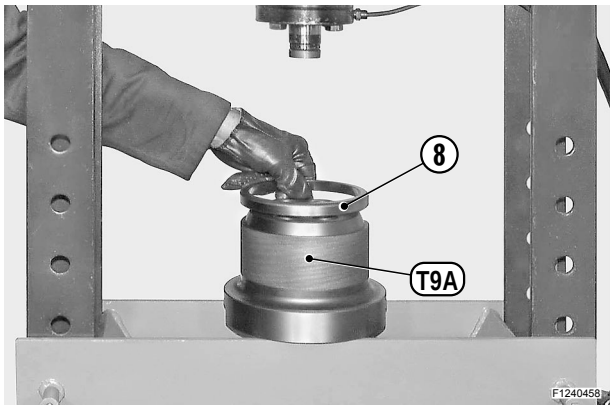
GB a

Lubricate the bushing (18) and the seat of the steering case (3). Install the bushing (18), using tool **T7**.



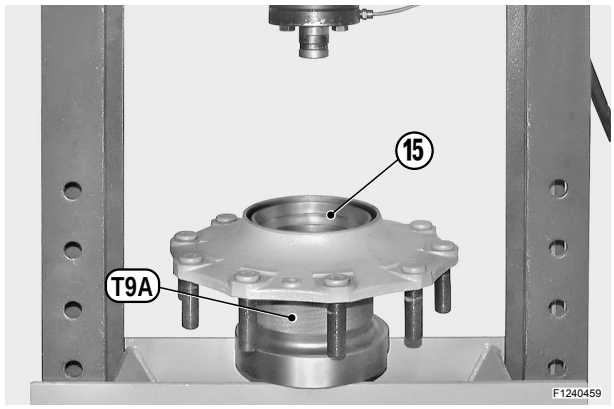
GB b

Lubricate the outer surface of the sealing ring (17) and centring ring (16); fit them into their seat using tool **T8**.



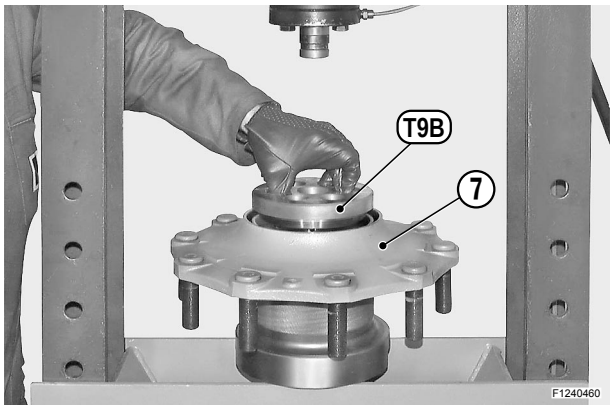
GB c

Position the lower part of tool **T9A** and the thrust block of the external bearing (8) under the press.



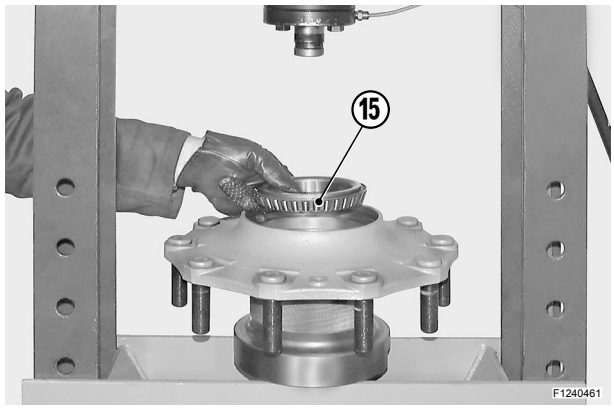
GB d

Lubricate the seats of the bearings and position the hub (7) on tool **T9A**; position the thrust block of the internal bearing (15).
NOTE. Check that the thrust block is correctly oriented.



GB e

Position the upper part of tool **T9B** and press the thrust blocks into the hub (7) all the way down.



GB f

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

a

ITA Lubrificare la bronzina (18) e la sede della scatola snodo (3).
Utilizzando l'attrezzo **T7** montare la bronzina (18).

D Das Bronzelager (18) und das Gelenkgehäuse (3) schmieren.
Mit einem Werkzeug **T7** das Bronzelager (18) montieren.

ESP Lubricar la chumacera (18) y el alojamiento de la caja de la rótula (3).
Montar la chumacera (18) utilizando la herramienta **T7**.

F Lubrifier le coussinet (18) et le logement du boîtier articulation (3).
A l'aide de l'outil **T7** monter le coussinet (18).

b

ITA Lubrificare la superficie esterna dell'anello di tenuta (17) e dell'anello centratore (16); montarli in sede utilizzando l'attrezzo **T8**.

D Die äußere Fläche des Kolbenringes (17) und des Zentrierringes (16) schmieren; die beiden Ringe mit einem Werkzeug **T8** montieren.

ESP Lubricar la superficie exterior del segmento de compresión (17) y del anillo de centraje (16); montarlos en un alojamiento utilizando la herramienta **T8**.

F Lubrifier la surface externe de la bague d'étanchéité (17), et de l'anneau de centrage (16), puis monter ceux-ci dans leur logement à l'aide de l'outil **T8**.

c

ITA Posizionare sotto la pressa la parte inferiore dell'attrezzo **T9A** e la ralla del cuscinetto esterno (8).

D Unter einer Presse den unteren Teil des Werkzeugs **T9A** und die Scheibe des äußeren Lagers (8) positionieren.

ESP Posicionar debajo de la prensa la parte inferior de la herramienta **T9A** y la rangua del cojinete exterior (8).

F Placer sous la presse la partie inférieure de l'outil **T9A** et la crapaudine du palier externe (8).

d

ITA Lubrificare le sedi dei cuscinetti e posizionare sull'attrezzo **T9A** il mozzo portaruota (7); posizionare la ralla del cuscinetto interno (15).
NOTA. Controllare l'orientamento della ralla.

D Die Lagersitze schmieren und am Werkzeug **T9A** die Radhalternabe (7) positionieren; die Scheibe des inneren Lagers (15) positionieren.
BEMERKUNG. Die Position der Scheibe beachten.

ESP Lubricar los alojamientos de los cojinetes y posicionar en la herramienta **T9A** el cubo portarruedas (7); posicionar la rangua del cojinete interior (15).
NOTA. Controlar la orientación de la rangua.

F Lubrifier le logement des paliers et placer sur l'outil **T9A** le moyeu porte-roue (7); placer la crapaudine du palier interne (15).
NOTE. Contrôler les sens de la crapaudine.

e

ITA Posizionare la parte superiore dell'attrezzo **T9B** e pressare a fondo le ralle nel mozzo portaruota (7).

D Das obere Teil des Werkzeugs **T9B** positionieren und die Scheiben in die Radhalternabe (7) fest eindrücken.

ESP Posicionar la parte superior de la herramienta **T9B** y presionar a fondo las ranguas en el cubo portarruedas (7).

F Placer la partie supérieure de l'outil **T9B**, puis presser à fond les crapaudines du moyeu porte-roue (7).

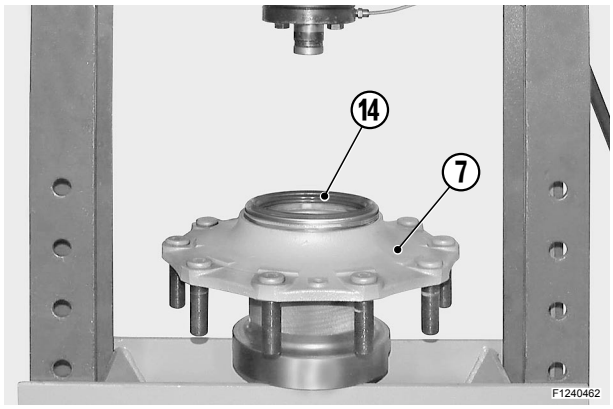
f

ITA Montare il cuscinetto (15) nella ralla interna.

D Lager (15) in die innere Scheibe montieren.

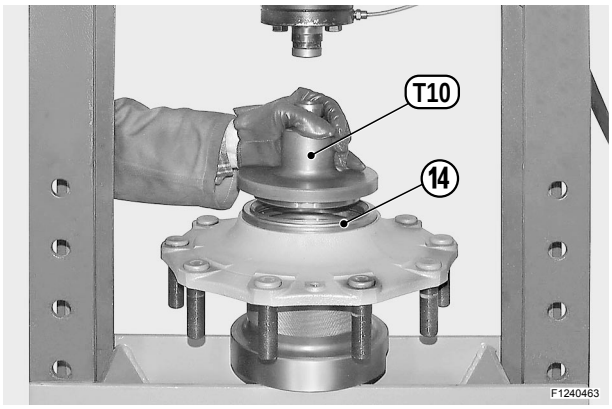
ESP Montar el cojinete (15) en la rangua interior.

F Monter le palier (15) dans la crapaudine interne.



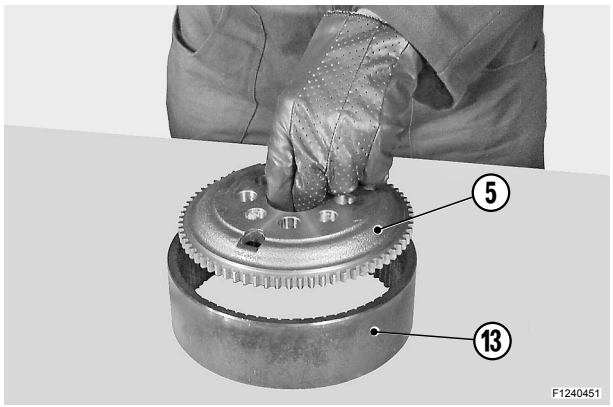
GB a

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.



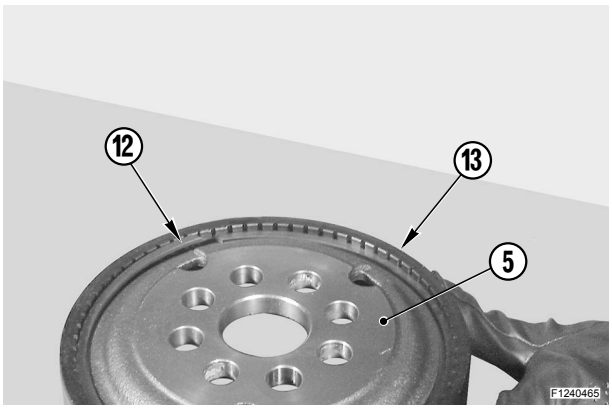
GB b

Position tool **T10** and press the sealing ring (14) into its seat.



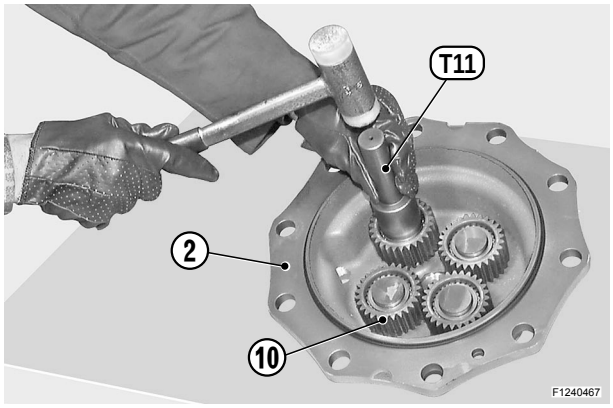
GB c

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



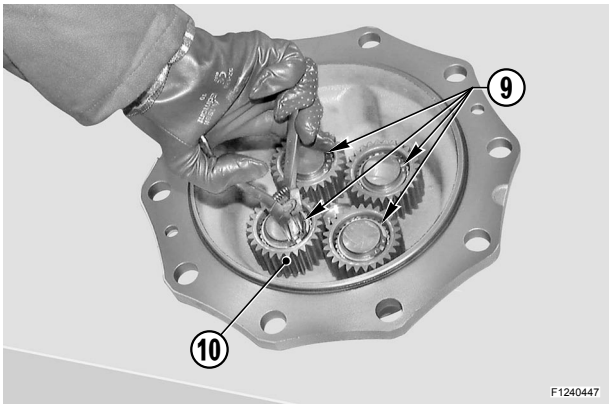
GB d

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)



GB e

With the help of tool **T11**, insert the planet wheel gears (10) into the cover (2).
Accurately check the orientation.



GB f

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

a

ITA Spalmare la superficie esterna dell'anello di tenuta (14) con mastice per guarnizioni riposizionabile.
Posizionare l'anello di tenuta (14) nel mozzo (7).
NOTA. Controllare l'orientamento dell'anello (14).

D Die äußere Fläche des Kolbenringes (14) mit Klebstoff für verstellbare Dichtungen schmieren.
Den Kolbenring (14) in die Nabe (7) montieren.
BEMERKUNG. Richtung des Ringes (14) beachten.

ESP Pasar sobre la superficie exterior del anillo de compresión (14) un pasta para juntas reposicionable.
Posicionar el segmento de compresión (14) en el cubo (7).
NOTA. Controlar la orientación del anillo (14).

F Enduire la surface externe de la bague d'étanchéité (14) avec mastic pour garnitures à remettre en place.
Placer la bague d'étanchéité (14) dans le moyeu (7).
NOTE. Contrôler le sens de la bague (14).

b

ITA Posizionare l'attrezzo **T10** e pressare in sede l'anello di tenuta (14).

D Das Werkzeug **T10** positionieren und den Kolbenring (14) in seinen Sitz pressen.

ESP Posicionar la herramienta **T10** y presionar en su alojamiento el segmento de compresión (14).

F Placer l'outil **T10** et presser dans son logement la bague d'étanchéité (14).

c

ITA Inserire la flangia (5) nella corona (13).

D Flansch (5) in den Kranz (13) montieren.

ESP Introducir la brida (5) en la corona (13).

F Introduire la flasque (5) dans la couronne (13).

d

ITA Inserire l'anello elastico (12) per fissare la posizione della flangia (5) nella corona (13).
NOTA. Controllare attentamente l'inserimento dell'anello (12) nella cava della corona (13).

D Den Kolbenring (12) einsetzen, um die Position des Flansches (5) im Kranz (13) zu sichern.
BEMERKUNG. Sorgfältig kontrollieren, ob der Ring (12) in der Nut des Kranzes (13) richtig eingesetzt ist.

ESP Introducir el anillo elástico (12) para fijar la posición de la brida (5) en la corona (13).
NOTA. Controlar atentamente la inserción del anillo (12) en la ranura de la corona (13).

F Introduire l'anneau élastique (12) pour fixer la position de la flasque (5) dans la couronne (13).
NOTE. Contrôler soigneusement l'introduction de la bague (12) dans le creux de la couronne (13).

e

ITA Utilizzando l'attrezzo **T11** inserire nel coperchio (2) gli ingranaggi satelliti (10).
Controllare attentamente l'orientamento.

D Mit dem Werkzeug **T11** in den Deckel (2) die Planetenräder (10) einsetzen.
Die Position sorgfältig kontrollieren.

ESP Utilizando la herramienta **T11** introducir en la tapa (2) los engranajes satélites (10).
Controlar atentamente la orientación.

F A l'aide de l'outil **T11** introduire dans le couvercle (2) les engrenages satellites (10).
Contrôler attentivement le sens.

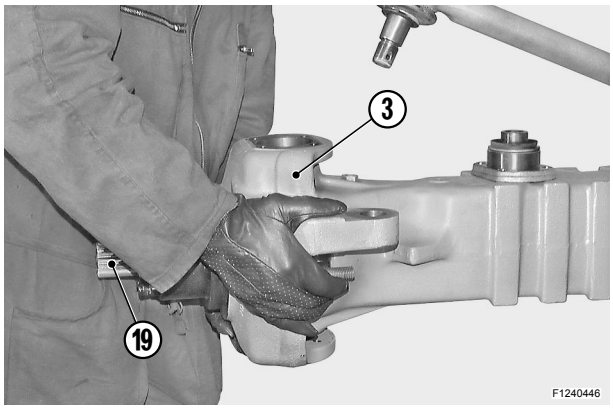
f

ITA Bloccare la posizione degli ingranaggi (10) montando gli anelli elastici di ritegno (9).

D Die Position der Räder (10) mit den Halteringen (9) blockieren.

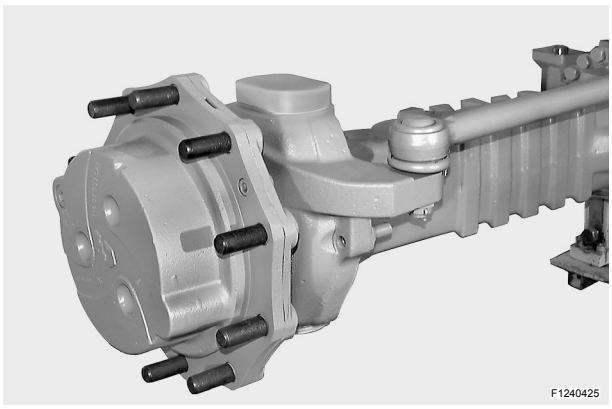
ESP Bloquear la posición de los engranajes (10) montando los anillos elásticos de retención (9).

F Bloquer la position des engrenages (10) en montant les anneaux élastiques de retenue (9).



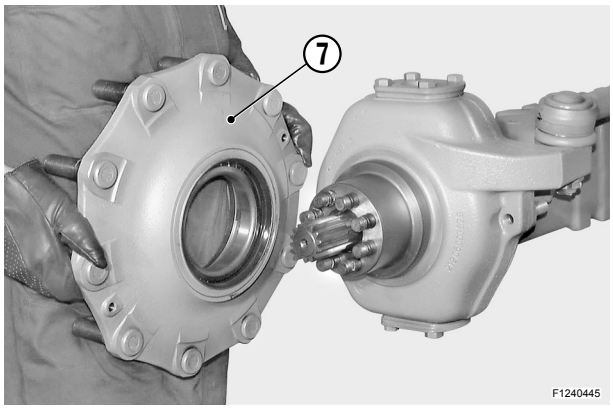
GB a

Fit the steering case (3) onto the U-joint (19) and install the articulation pins. For pin assembly details, see «HOW TO ASSEMBLE THE COMPLETE STEERING CASE».



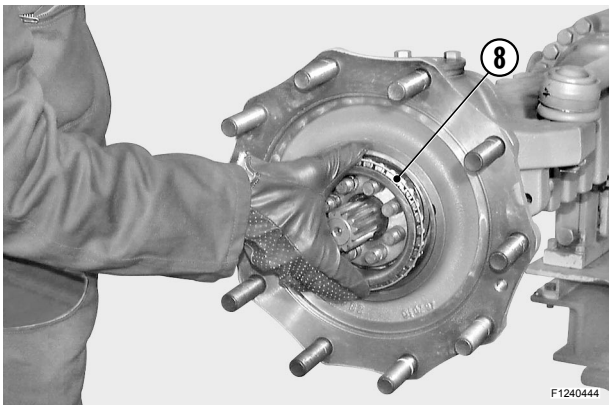
GB b

Connect the steering bars.
For details, see «HOW TO INSTALL THE COMPLETE STEERING CASE».



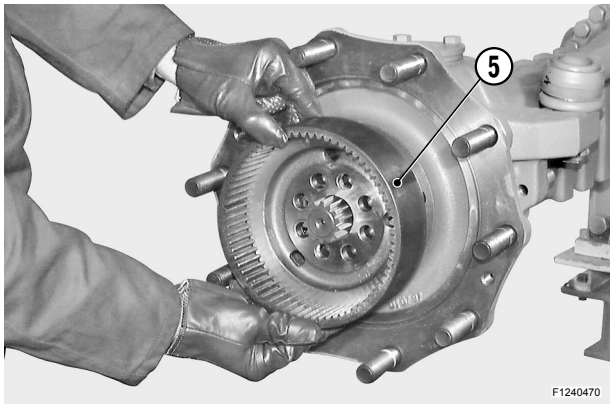
GB c

Install the hub (7).



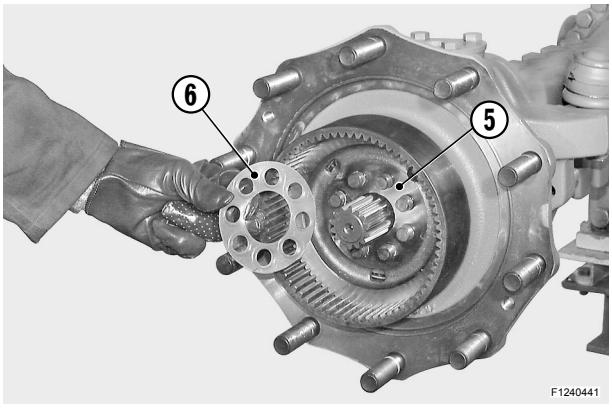
GB d

Install the external bearing (8).
NOTE. Using a plastic hammer, drive the bearing to the limit stop by lightly hammering around the edge.



GB e

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.



GB f

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

a

ITA Infilare la scatola snodo (3) sul doppio giunto (19) e montare i perni snodo.
Per i dettagli di montaggio dei perni snodo, vedere «ASSEMBLAGGIO SCATOLA SNODO COMPLETA».

D Gelenkgehäuse (3) auf die Doppelkupplung (19) setzen und die Gelenkstifte montieren.
Siehe zur Montage der Gelenkstifte «KOMPLETTES GELENKGEHÄUSE ZUSAMMENBAUEN».

ESP Introducir la caja de la rótula (3) en la junta doble (19) y montar las rótulas.
Para los detalles de montaje de las rótulas, véase «MONTAJE DE LA CAJA DE ROTULA COMPLETA».

F Introduire le boîtier articulation (3) sur le double joint (19), puis monter les tourillons d'articulation.
Pour de plus amples détails sur le montage des tourillons d'articulation, voir «ASSEMBLAGE DU BOITIER ARTICULATION COMPLET».

b

ITA Collegare le barre di sterzatura.
Per i dettagli, vedere «INSTALLAZIONE SCATOLA SNODO COMPLETA».

D Lenkstangen anschließen.
Siehe «KOMPLETTES GELENKGEHÄUSE INSTALLIEREN».

ESP Conectar las barras de dirección.
Para los detalles, véase «INSTALACION CAJA DE ROTULA COMPLETA».

F Relier les barres de braquage.
Pour de plus amples détails voir «INSTALLATION DU BOITIER ARTICULATION COMPLET».

c

ITA Montare il mozzo portaruota (7).

D Radhalternabe (7) montieren.

ESP Montar el cubo portarruedas (7).

F Monter le moyeu porte-roue (7).

d

ITA Montare il cuscinetto esterno (8).
NOTA. Mandare a fondo corsa il cuscinetto con leggeri colpi di mazzuolo distribuiti su tutta la circonferenza.

D Äußeres Lager (8) montieren.
BEMERKUNG. Das Lager bis zum Anschlag einsetzen; dazu einen Gummihammer verwenden und entlang der Kreislinie einschlagen.

ESP Montar el cojinete exterior (8).
NOTA. Llevar al fondo de carrera el cojinete con ligeros golpes de martillo distribuidos en toda la circunferencia.

F Monter le palier externe (8).
NOTE. Envoyer le palier en fin de course avec des petits coups de maillet distribués sur toute la circonférence.

e

ITA Montare la flangia portacorona (5) completa.
NOTA. Per mandare in battuta la flangia (5), usare un mazzuolo in materiale plastico battuto alternativamente in più punti equidistanti.

D Kompletter Kranzhlaterflansch (5) montieren.
BEMERKUNG. Um den Flansch (5) bis zum Anschlag einzusetzen, einen Gummihammer verwenden und abwechselnd an gleich entfernten Stellen einschlagen.

ESP Montar la brida portacorona (5).
NOTA. Para llevar a tope la brida (5) usar un martillo de material plástico golpeándolo alternativamente en varios puntos equidistantes.

F Monter la flasque porte-couronne (5) complète.
NOTE. Pour envoyer la flasque (5) en butée, utiliser un maillet en matière plastique en battant sur plusieurs points équidistants.

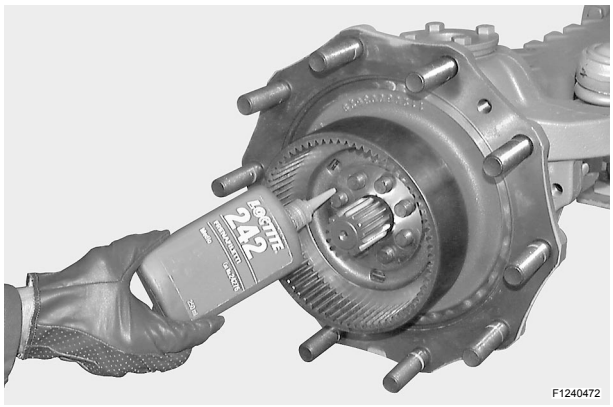
f

ITA Lubrificare con grasso Tecnolube Seal 101 la superficie della flangia di sicurezza (6) a contatto con la flangia portacorona (5).
Montare la flangia di sicurezza (6).

D Mit Fett Typ Tecnolube Seal 101 die Oberfläche des Sicherheitsflansch (6) schmieren, der am Kranzhalterflansch (5) anliegt.
Sicherheitsflansch (6) montieren.

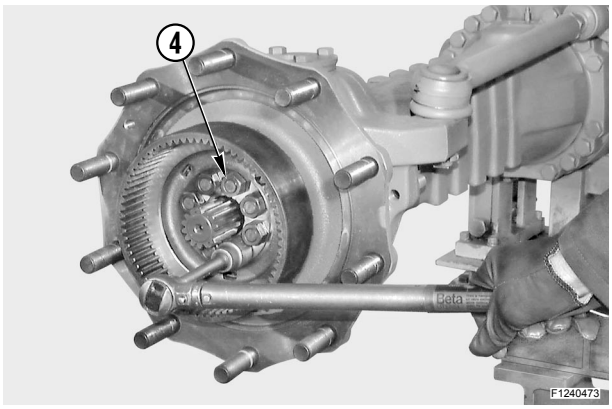
ESP Lubricar con grasa Tecnolube Seal 101 la superficie de la brida de seguridad (6) en contacto con la brida portacorona (5).
Montar la brida de seguridad (6).

F Lubrifier avec du gras Tecnolube Seal 101 la surface de la flasque de sécurité (6) en contact avec la flasque porte-couronne (5).
Monter la flasque de sécurité (6).



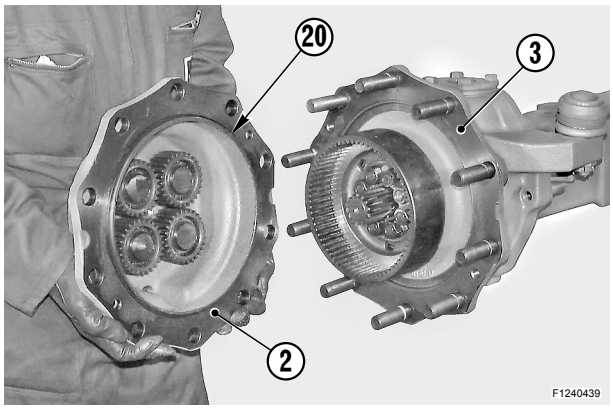
GB a

Apply Loctite 242 to the studs and fit in the nuts (4).



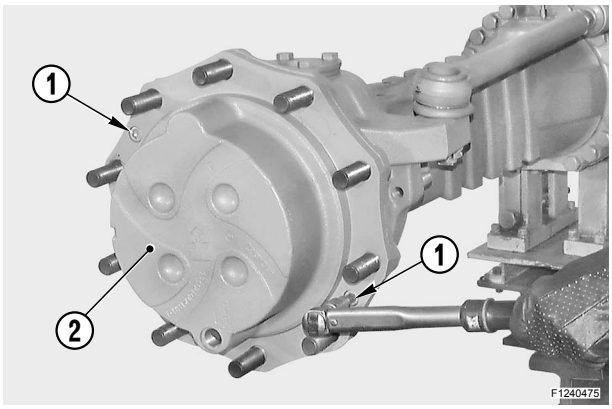
GB b

Cross tighten the nuts (4) in two stages.
Initial torque wrench setting: 120 Nm
Final torque wrench setting: 255–285 Nm



GB c

Fit the planetary carrier cover (2) onto the hub (3).
CAUTION! Check that the O-ring (20) is in good condition and in position.



GB d

Lock the planetary carrier cover (2) by tightening the screws (1).
Torque wrench setting for screws: 40–50 Nm

a

ITA Spalmare i prigionieri con Loctite 242 e montare i dadi (4).

D Die Stiftschrauben mit Loctite 242 schmieren und die Muttern (4) montieren.

ESP Pasar en los prisioneros Loctite 242 y montar las tuercas (4).

F Enduire les prisonniers avec du Loctite 242 puis monter les écrous (4).

b

ITA Serrare i dadi (4) in due tempi e con il metodo del serraggio incrociato.
Coppia di serraggio iniziale: 120 Nm
Coppia di serraggio finale 255÷285 Nm

D Die Mutter (4) abwechseln und entgegengesetzt festschrauben.
Anfänglicher Anzugsmoment: 120 Nm
Endgültiger Anzugsmoment: 255÷285 Nm

ESP Apretar las tuercas (4) en dos tiempos y siempre con el método de torsión cruzada.
Par de torsión inicial: 120 Nm
Par de torsión final 255÷285 Nm

F Serrer les écrous (4) en deux temps par le biais du mode de serrage croisé.
Couple de serrage initial: 120 Nm
Couple de serrage final: 255÷285 Nm

c

ITA Montare il coperchio portasatelliti (2) sul mozzo portaruota (3).
ATTENZIONE! Controllare lo stato e la posizione della guarnizione OR (20).

D Planetenradhalterdeckel (2) auf die Radhalternabe (3) montieren.
ACHTUNG! Den Zustand und die Position des O-Ringes (20) kontrollieren.

ESP Montar la tapa portasatélites (2) en el cubo portarruedas (3).
CUIDADO! Controlar el estado y la posición de la junta OR (20).

F Monter le couvercle porte-satellites (2) sur le moyeu porte-roue (3).
ATTENTION! Contrôler l'état et la position de la garniture OR (20).

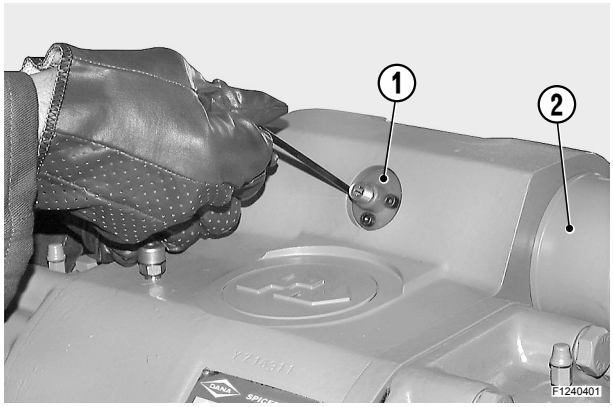
d

ITA Bloccare il coperchio portasatelliti (2) con le viti (1).
Coppia di serraggio viti: 40÷50 Nm

D Planetenhalterdeckel (2) mit den Schraube (1) festschrauben.
Anzugsmoment der Schrauben: 40÷50 Nm

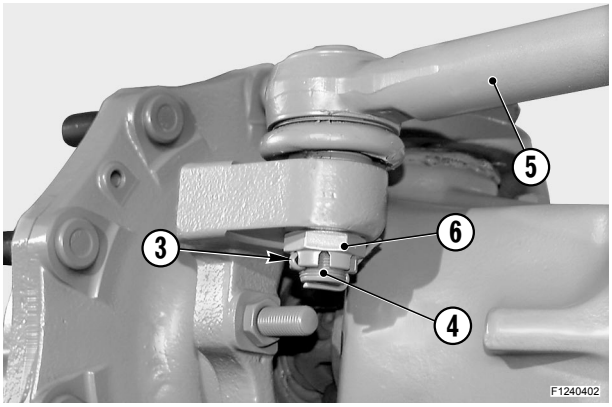
ESP Bloquear la tapa portasatélites (2) con los tornillos (1).
Par de torsión tornillos: 40÷50 Nm

F Bloquer le couvercle porte-satellites (2) avec les vis (1).
Couple de serrage vis: 40÷50 Nm



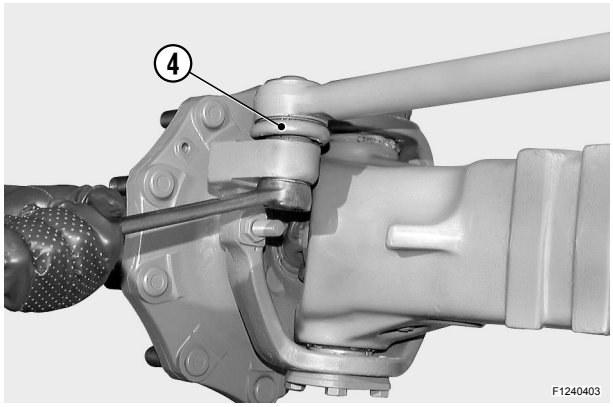
GB a

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



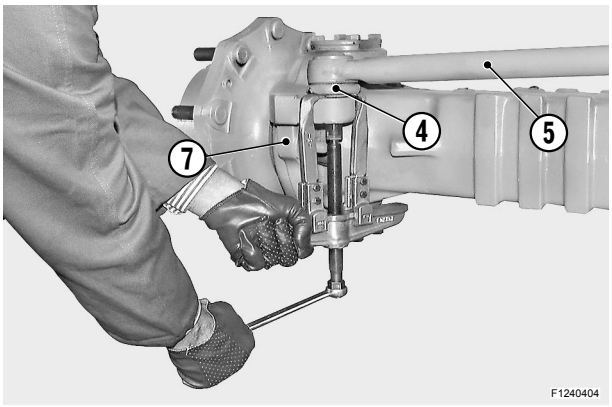
GB b

Remove the safety cotter pins (3) from the articulation pins (4) of the steering bars (5).
CAUTION! Dispose of used cotter pins.



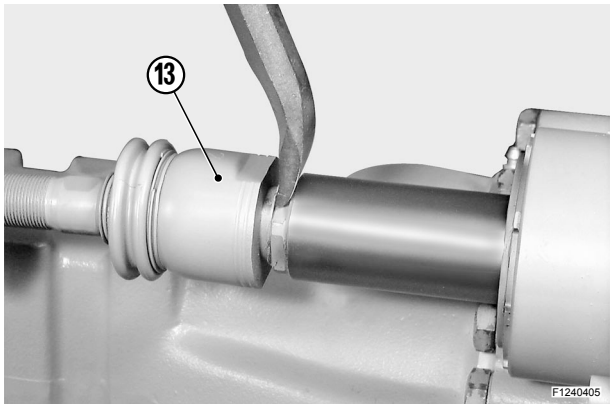
GB c

Remove the castellated nuts (6) that lock the articulation pins (4).



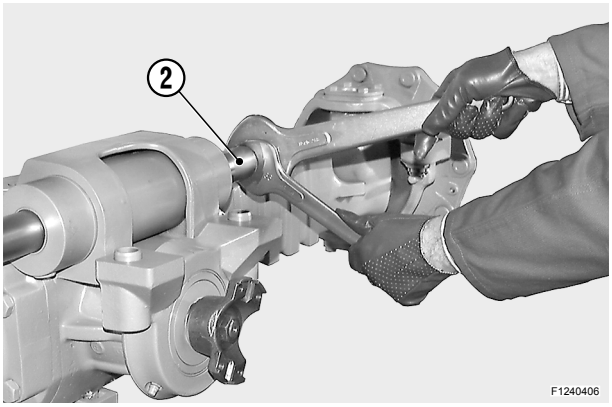
GB d

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



GB e

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



GB f

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

a

ITA Se è previsto rimuovere il sensore (1) di centraggio della corsa del pistone di sterzatura (2).

D Wenn vorgesehen, Sensor (1) zur Zentrierung des Hubs des Lenkkolbens (2) abnehmen.

ESP Si ha sido previsto, remover el sensor (1) de centraje de la carrera del pistón de dirección (2).

F Si prévu, enlever le capteur (1) de centrage de la course du piston de braquage (2).

b

ITA Asportare le copiglie (3) di sicurezza perni snodo (4) delle barre di sterzatura (5).
ATTENZIONE! Scartare le copiglie usate.

D Splint (3) der Gelenkstifte (4) der Lenkstangen (5) abnehmen.
ACHTUNG! Verbrauchte Splinte nicht verwenden.

ESP Sacar las clavijas (3) de seguridad de la rótulas (4) de las barras de dirección (5).
CUIDADO! Tirar las clavijas usadas.

F Enlever la goupille (3) de sûreté des tourillons d'articulation (4) des barres de braquage (5).
ATTENTION! Eliminer les goupilles usées.

c

ITA Rimuovere i dadi ad intaglio (6) di ritegno perni snodo (4).

D Kronenmutter (6) von den Gelenkstiften (4) abnehmen.

ESP Remover las tuercas ranuradas (6) de retención de las rótulas (4).

F Enlever les écrous cannelés (6) de fixation des tourillons d'articulation (4).

d

ITA Utilizzando un estrattore, scollegare i perni conici dello snodo sterzo (4) dalla scatola snodo (7).

D Mit einem Abzieher, die Kegelstifte des Gelenks (4) von dem Gelenkgehäuse (7) abnehmen.

ESP Utilizando un extractor, desconectar los pernos cónicos de la rótula de dirección (4) del cárter de la rótula (7).

F A l'aide d'un extracteur, débrancher les pivots coniques d'articulation de braquage (4) du boîtier articulation (7).

e

ITA Se il collegamento delle barre di sterzatura prevede il collare di sicurezza (13) rialzare la bordatura.

D Falls die Lenkstangen mit einem Sicherheitsbund (13) versehen sind, den Rand anheben.

ESP Si la conexión de las barras de dirección prevé el collarín de seguridad (13) elevar los rebordes.

F Si le raccordement des barres de braquage est équipé de collet de sécurité (13) rehausser la bordure.

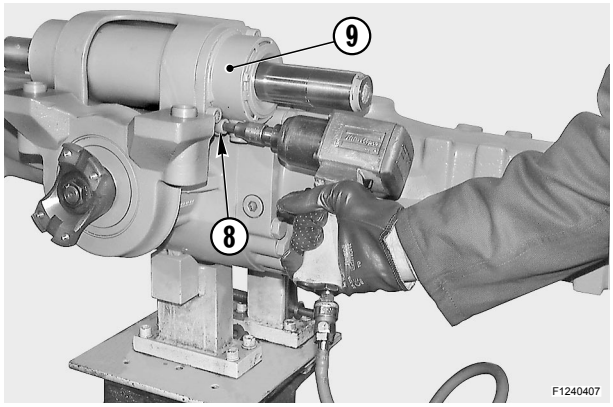
f

ITA Scollegare dal pistone (2) le barre di sterzatura destra e sinistra (5).

D Vom Kolben (2) die rechte und linke Lenkstange (5) abnehmen.

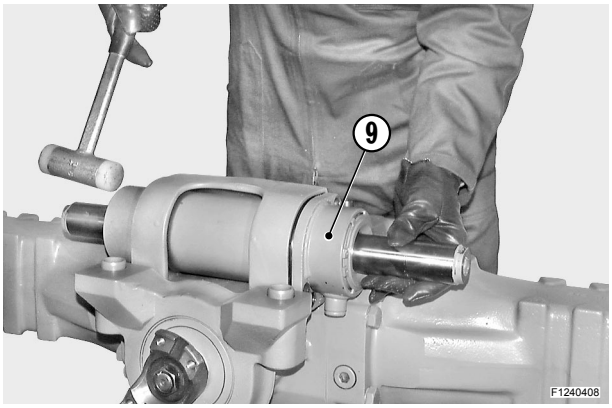
ESP Desconectar del pistón (2) las barras de dirección derecha e izquierda (5).

F Désassembler du piston (2) les barres de braquage droite et gauche (5).



GB a

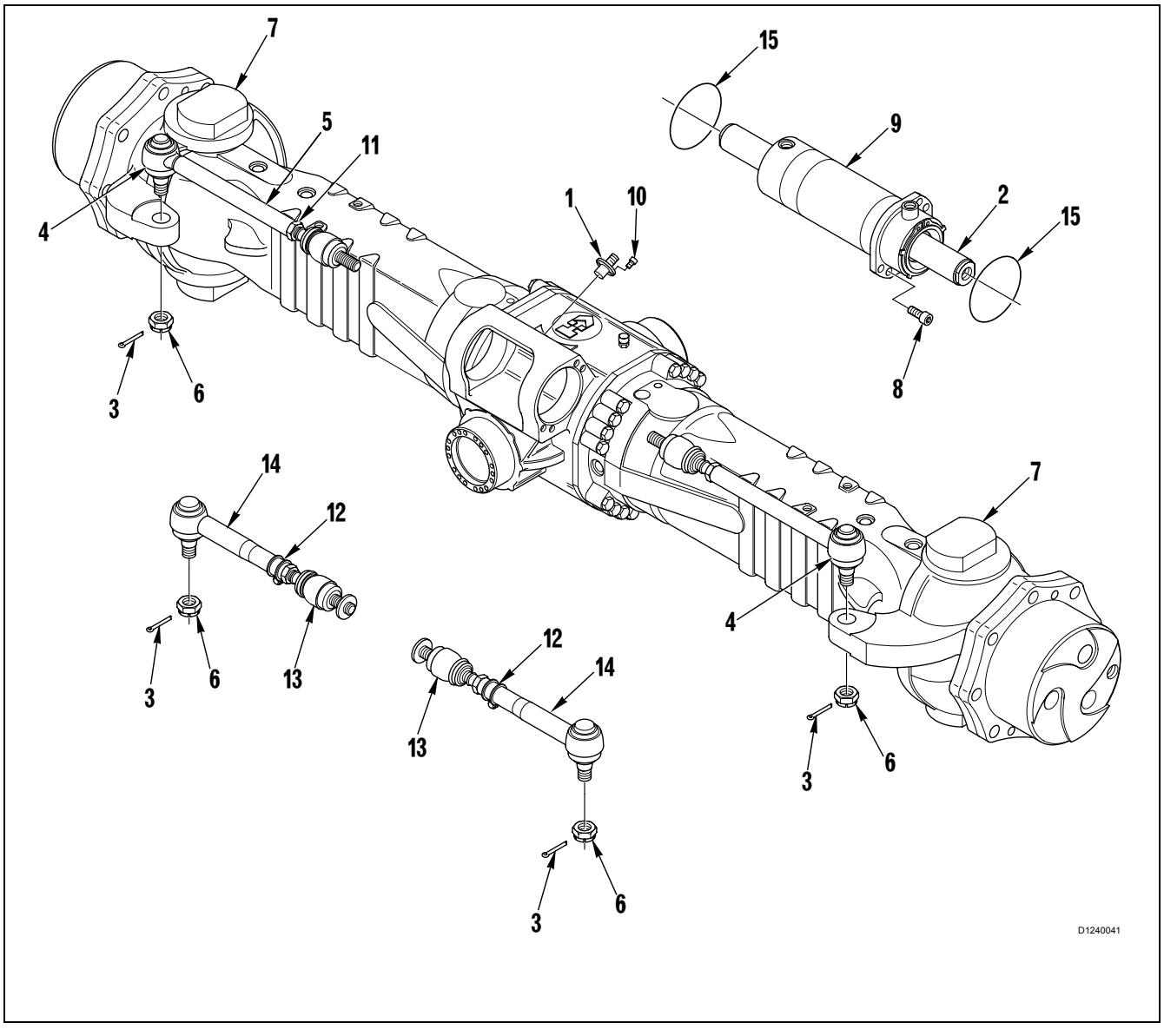
Remove the securing screws (8) from the steering cylinder (9).



GB b

Extract the cylinder (9) using a plastic hammer.

NOTE. For cylinder disassembly, refer to «HOW TO DISASSEMBLE THE STEERING CYLINDER».



a

ITA Asportare le viti (8) di fissaggio del cilindro di sterzatura (9).

D Die Befestigungsschrauben (8) des Lenkzylinders (9) abnehmen.

ESP Sacar los tornillos (8) que fijan el cilindro de dirección (9).

F Enlever les vis (8) de fixation du cylindre de braquage (9).

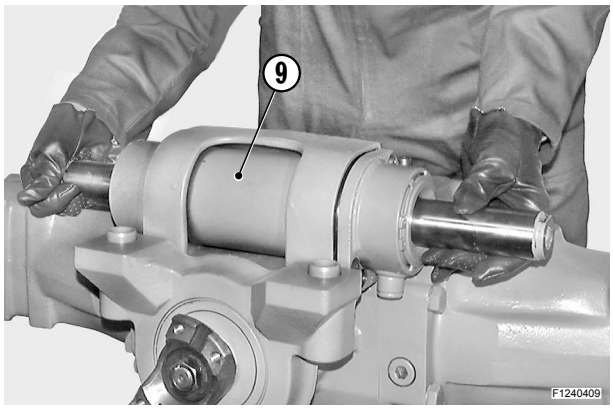
b

ITA Estrarre il cilindro (9) utilizzando un mazzuolo in materiale plastico.
NOTA. Per lo smontaggio del cilindro, vedere «SMONTAGGIO CILINDRO DI STERZATURA».

D Den Zylinder (9) mit einem Gummihammer herausschlagen.
BEMERKUNG. Um den Zylinder abzumontieren, siehe «LENKZYLINDER ABMONTIEREN».

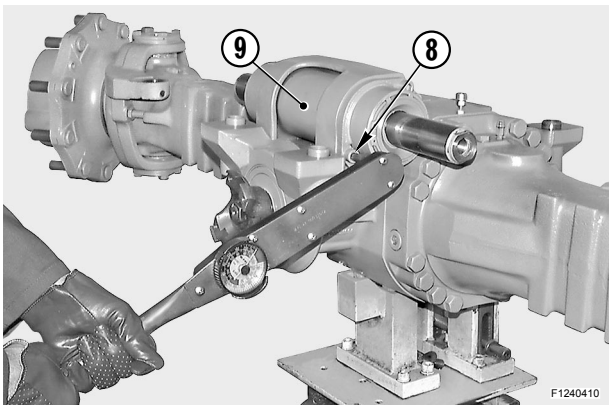
ESP Extraer el cilindro (9) utilizando un martillo de material plástico.
NOTA. Para desmontar el cilindro, véase «DESMONTAJE CILINDRO DE DIRECCIÓN».

F Extraire le cylindre (9) à l'aide d'un maillet en matière plastique.
NOTE. Pour démonter le cylindre, voir «DEMONTAGE DU CYLINDRE DE BRAQUAGE».



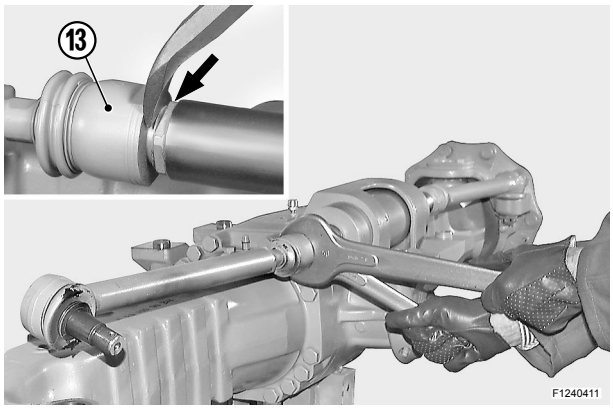
GB a

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.



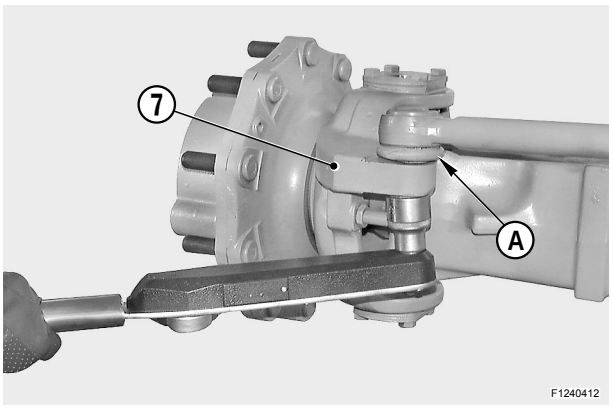
GB b

Lock the cylinder by cross- tightening the screws (8).
Torque wrench setting: 116–128 Nm



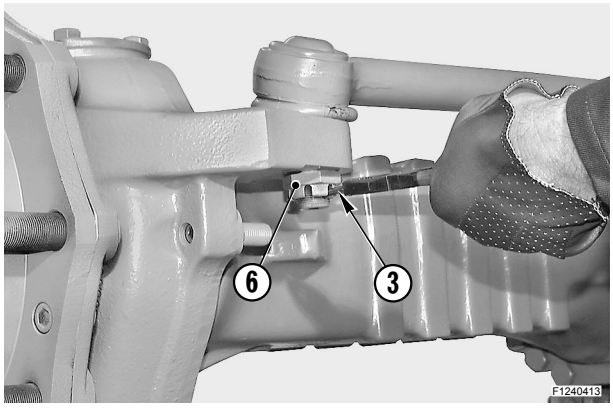
GB c

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



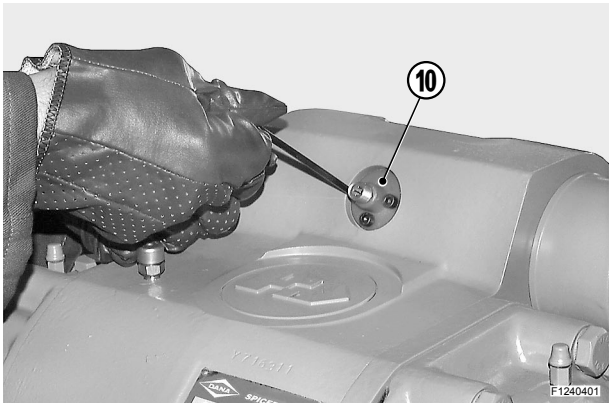
GB d

Insert the pins (4) in the steering case (7) and lock into position using a torque wrench setting of 260–290 Nm.
Find the position of the notching in relation to the hole of the cotter pins and tighten the nut (6) further.
CAUTION! Check that rubber guards (**A**) are intact.



GB e

Insert the cotter pins (3) and bend the safety stems.
CAUTION! Use new cotter pins.



GB f

Install the proximity (1) for checking piston centring - if applicable - and tighten the screws (10).
Torque wrench setting: 5–6 Nm

a

ITA Controllare lo stato delle guarnizioni OR (15) del corpo assale; lubrificare le sedi di tenuta delle guarnizioni (15) e montare in sede il cilindro di sterzatura (9).

D O-Ringe (15) des Achsenkörpers kontrollieren; die Sitze der Dichtungen (15) schmieren und den Lenkzylinder (9) in seinen Sitz montieren.

ESP Controlar el estado de las juntas OR (15) del cuerpo del eje; lubricar los alojamientos de estanqueidad de las juntas (15) y montar en el alojamiento el cilindro de dirección (9).

F Contrôler le bon état des garnitures OR (15) du corps d'essieu, lubrifier les logements d'étanchéité des garnitures (15), puis monter le logement du cylindre de braquage (9).

b

ITA Bloccare il cilindro con le viti (8) serrate con il metodo incrociato.
Coppia di serraggio: 116÷128 Nm

D Zylinder mit den Schrauben (8) blockieren; dabei die Schrauben entgegengesetzt und abwechselnd festschrauben.
Anzugsmoment 116÷128 Nm

ESP Bloquear el cilindro con los tornillos (8) apretados con el método cruzado.
Par de torsión: 116÷128 Nm

F Bloquer le cylindre à l'aide des vis (8) serrées par le biais du mode croisé.
Couple de serrage: 116÷128 Nm

c

ITA Spalmare la filettatura con Loctite 242 e collegare le barre di sterzatura avvitando nello stelo del pistone i terminali.
Coppia di serraggio: 240÷270 Nm
NOTA. Per la versione a manicotto, ribadire il bordo dello snodo (13) sui piani dello stelo del pistone.

D Das Gewinde mit Loctite 242 schmieren und die Lenkstangen verbinden; dabei die Endstücke auf den Kolbenschaft festschrauben.
Anzugsmoment: 240÷270 Nm
BEMERKUNG. Bei der Ausführung mit Muffe, den Gelenkrand (13) an den Kolbenschaftflächen bördeln.

ESP Pasar por la rosca Loctite 242 y conectar las barras de dirección atornillando en el vástago del pistón los terminales.
Par de torsión: 240÷270 Nm
NOTA. Para la versión de manguito, rebordear el borde de la rótula (13) en las superficies más importantes del vástago del pistón.

F Enduire le filetage avec du Loctite 242 et brancher la barre de braquage en vissant les embouts dans la tige du piston.
Couple de serrage: 240÷270 Nm
NOTE. Dans la version à manchon, river le bord de l'articulation (13) sur les plans clé de la tige du piston.

d

ITA Inserire nella scatola snodo (7) i perni (4) e bloccare la posizione serrandoli con una coppia di 260÷290 Nm. Ricercare la posizione dell'intaglio rispetto al foro delle copiglie serrando ulteriormente il dado (6).
ATTENZIONE! Controllare l'integrità delle protezioni in gomma (**A**).

D In das Gelenkgehäuse (7) die Stifte (4) einsetzen und mit einem Anzugsmoment von 260÷290 Nm festschrauben. Die Position des Schnitts zum Loch der Splinte suchen, und die Mutter (6) nochmals festziehen.
ACHTUNG! Kontrollieren ob die Gummiringe (**A**) in Ordnung sind.

ESP Introducir en el cárter de la rótula (7) los pernos (4) y bloquear la posición apretándolos con un par de 260÷290 Nm.
Buscar la posición de la ranura con respecto al orificio de las clavijas apretando aún la tuerca (6).
CUIDADO! Controlar la integridad de las protecciones de goma (**A**).

F Introduire dans le boîtier articulation (7) les tourillons (4), puis bloquer dans la position en serrant ceux-ci à un couple de 260÷290 Nm.
Chercher la position de l'entaille par rapport au trou de la goupille en serrant encore l'écrou (6).
ATTENTION! Contrôler le bon état des protections en caoutchouc (**A**).

e

ITA Inserire le copiglie (3) e piegare i gambi di sicurezza.
ATTENZIONE! Usare copiglie nuove.

D Die Splinte (3) einsetzen und die beiden Sicherheitsstifte knicken.
ACHTUNG! Neue Splinte verwenden.

ESP Introducir las clavijas (3) y doblar las patas de seguridad.
CUIDADO! Usar clavijas nuevas.

F Introduire les goupilles (3) et plier les tiges de sécurité.
ATTENTION! Utiliser des goupilles neuves.

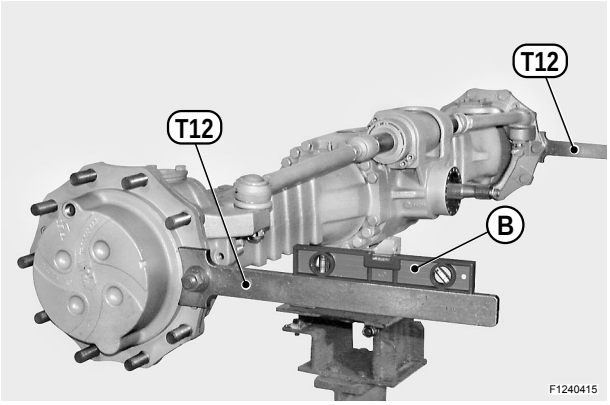
f

ITA Se è previsto, installare il sensore di prossimità (1) per il controllo della centratura del pistone e serrare le viti (10).
Coppia di serraggio: 5÷6 Nm

D Wenn vorgesehen, den Näherungsschalter (1) zur Kontrolle der Kolbenzentrierung installieren und mit den Schrauben (10) festschrauben.
Anzugsmoment: 5÷6 Nm

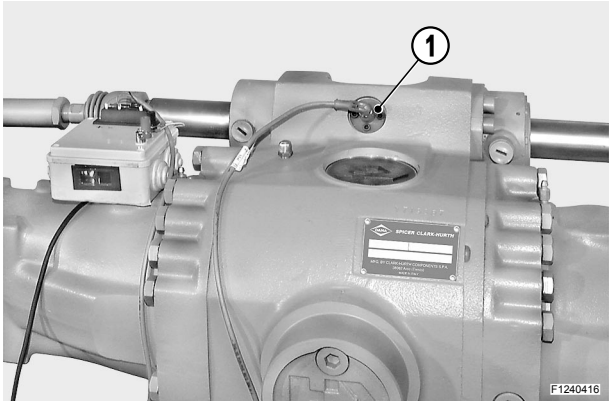
ESP Si ha sido previsto, instalar el sensor de proximidad (1) para el control del centraje del pistón y apretar los tornillos (10).
Par de torsión: 5÷6 Nm

F Si prévu, installer le capteur de proximité (1) de contrôle de centrage piston et serrer les vis (10).
Couple de serrage: 5÷6 Nm



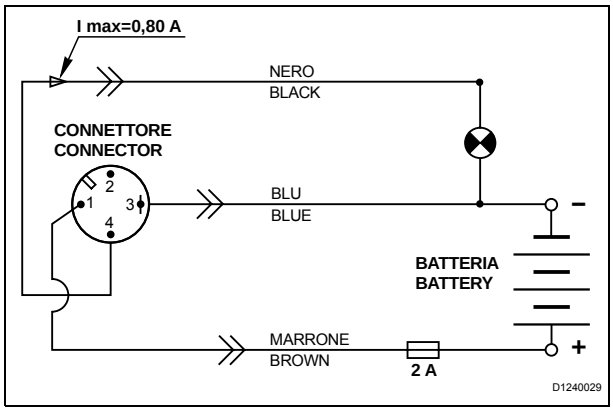
GB a

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



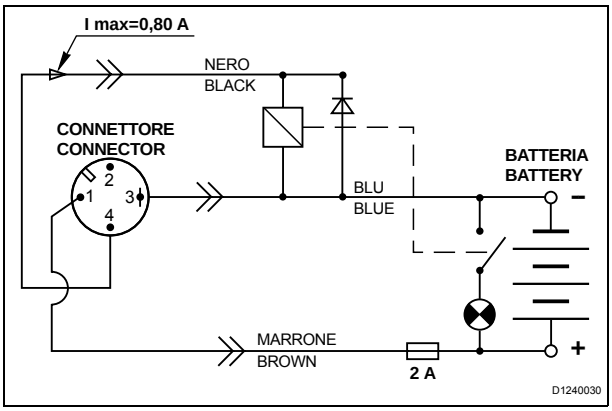
GB b

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



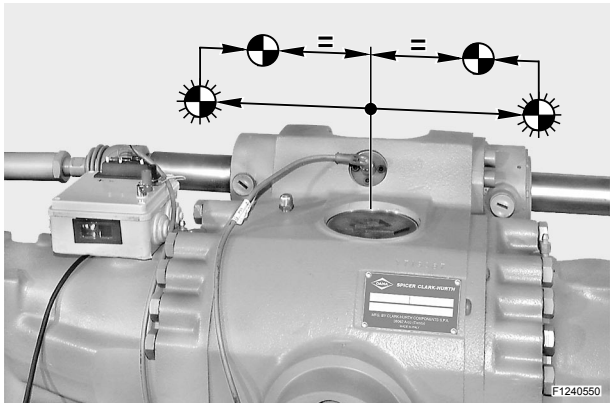
GB c

Sensor connection card, STANDARD version.



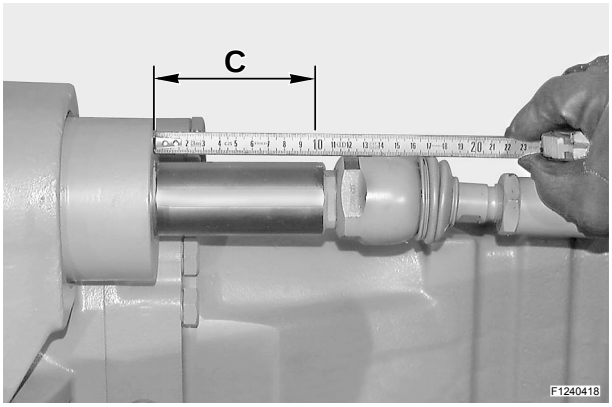
GB d

Sensor connection card, OPTIONAL version.



GB e

Centre the piston by slowly moving it first in one direction then in the other and 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.



GB f

Inspect jut "**C**" on one side of the piston and note down the size for checking later adjustments.

NOTE. If cylinders come without a sensor, the centring of the piston must be carried out on the basis of the maximum stroke.

a

ITA **ATTENZIONE!** Se previsto, eliminare l'azione del freno negativo.
Applicare sui mozzi portaruota gli attrezzi **T12** e bloccarli.
Controllare con una livella "**B**" che gli attrezzi siano perfettamente in piano e paralleli tra loro.

D **ACHTUNG!** Wenn vorgesehen, Wirkung der Negativbremse beseitigen.
An den Radhalternaben die **T12** Werkzeuge anbringen und blockieren.
Mit einer Libelle "**B**" kontrollieren, ob die Werkzeuge livelliert und parallel liegen.

ESP **CUIDADO!** Si ha sido previsto, eliminar la acción el freno negativo
Aplicar en los cubos portarruedas las herramientas **T12** y bloquearlas.
Controlar utilizando un nivel "**B**" que las herramientas estén perfectamente niveladas y paralelas entre sí.

F **ATTENTION!** Si prévu, éliminer l'action du frein négatif.
Appliquer sur les moyeux des roues les outils **T12** puis bloquer.
Contrôler à l'aide d'un niveau "**B**" que les outils soient parfaitement à plat et parallèles entre-eux.

b

ITA Collegare il sensore (1) al dispositivo di controllo secondo uno dei due schemi.

D Sensor (1) mit der Kontrollvorrichtung nach einem der beiden Pläne verbinden.

ESP Conectar el sensor (1) al dispositivo de control según uno de los dos esquemas.

F Connecter le capteur (1) au dispositif de contrôle à l'aide de l'un des deux schémas.

c

ITA Scheda collegamento sensore versione STANDARD.

D Verbindungskarte für Sensor STANDARD Ausführung.

ESP Tarjeta de conexión sensor versión ESTÁNDAR.

F Carte de connexion du capteur version STANDARD.

d

ITA Scheda collegamento sensore versione OPZIONALE.

D Verbindungskarte für Sensor OPTION Ausführung.

ESP Tarjeta de conexión sensor versión OPCIONAL.

F Carte de connexion du capteur version OPTIONNEL.

e

ITA Eseguire la centratura spostando lentamente il pistone prima in un senso e poi nell'altro, posizionandolo a metà della corsa determinata dalle accensioni e dallo spegnimento in fase di ritorno, della lampada di segnalazione del dispositivo di controllo.

D Die Zentrierung vornehmen, dabei den Kolben zuerst leicht in die eine, dann in die andere Richtung drehen und auf halbem Hubweg positionieren. Dieser halber Weg liegt zwischen dem Ein- und Ausschalten der Kontrolleuchte der Kontrollvorrichtung.

ESP Ejecutar el centraje desplazando lentamente el pistón primero en un sentido y después en el otro, posicionándolo a mitad de la carrera determinada por el encendido y el apagado en fase de retorno, de la lámpara de señalización del dispositivo de control.

F Effectuer le centrage en déplaçant lentement le piston d'abord dans un sens, puis dans l'autre, en le plaçant à mi-course qui est déterminée par la lampe-témoin qui s'allume et qui s'éteint pendant la phase de retour et qui se trouve sur le dispositif de contrôle.

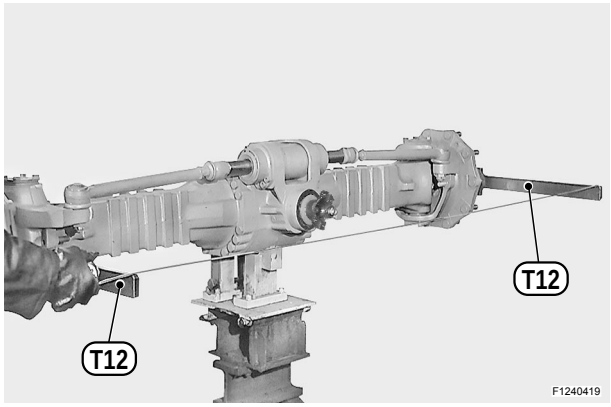
f

ITA Controllare la sporgenza "**C**" del pistone su un lato ed annotare la misura per il controllo delle regolazioni successive.
NOTA. Per i cilindri senza sensore, la centratura del pistone deve essere eseguita in base alla corsa massima.

D Den Vorsprung "**C**" des Kolbens an einer Seite kontrollieren und das Maß zur Kontrolle der nachfolgenden Einstellungen notieren.
BEMERKUNG. Für Zylinder ohne Sensor, erfolgt die Kolbenzentrierung aufgrund des maximalen Hubs.

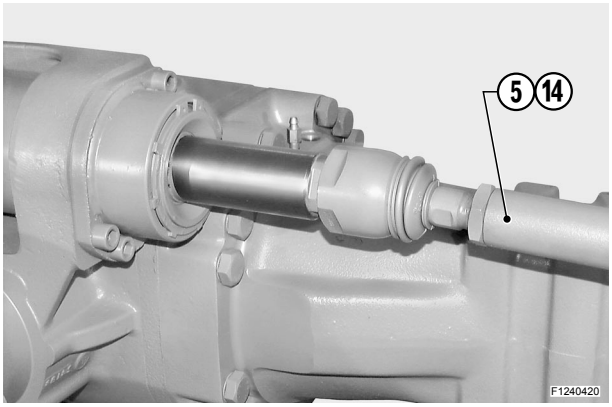
ESP Controlar la parte saliente de "**C**" del pistón en un lado y anotar la medida para el control de las regulaciones sucesivas.
NOTA. Para los cilindros sin sensor, el centraje del pistón tiene que ser ejecutado de acuerdo con la carrera máxima.

F Contrôler la saillie "**C**" d'un côté du piston et prendre note de la mesure pour contrôler les régulations suivantes.
NOTE. Pour les cylindres sans capteur, le centrage du piston doit être effectué en se basant sur la course maximale.



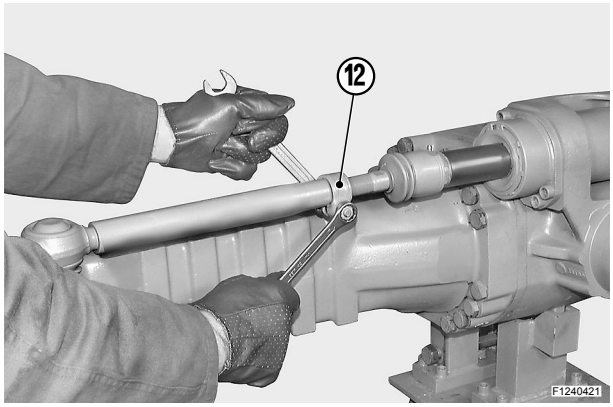
GB a

Without moving the piston, check front and rear size at the edge of tools **T12**.
Max. difference: 0.6–0.7 mm
NOTE. In order to check the rear size, rotate the bevel pinion and check that tools **T12** are flat.



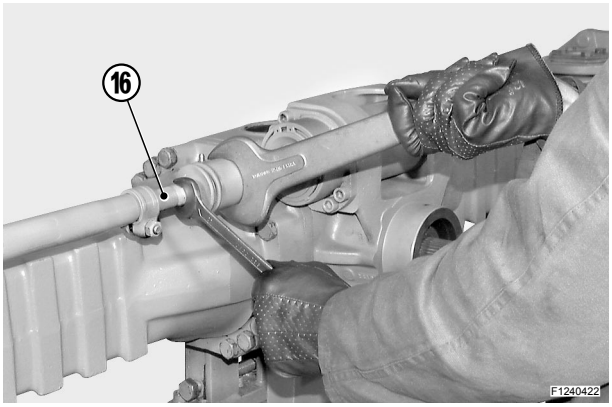
GB b

If necessary, adjust convergency without moving the centring 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.



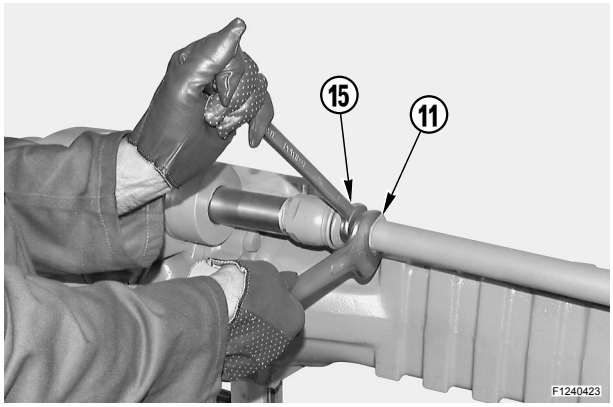
GB c

CONVERGENCY ADJUSTMENT ON UNITS WITH COLLAR
Unloose the nuts on the collars (12).



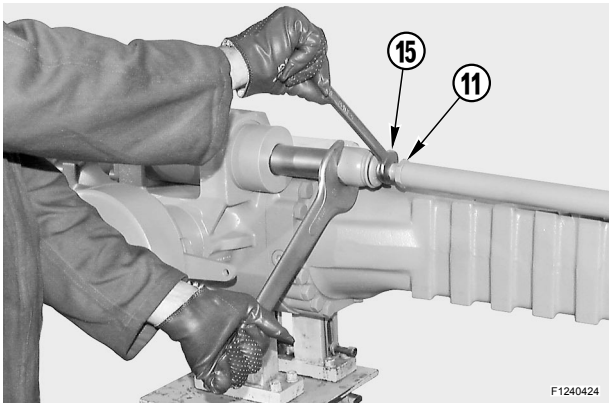
GB d

Rotate the ball-and-socket joints (16) until convergency has been obtained.
Check that articulations move easily and lock the collars (12).
Torque wrench setting for nuts: 42–52 Nm



GB e

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



GB f

Hold the articulations still and rotate the ball-and-socket joints (15).
Once the convergency has been adjusted, lock the nuts (11).
Torque wrench setting for nuts: 298–328 Nm

a

ITA Senza spostare il pistone controllare la misura anteriore e posteriore all'estremità degli attrezzi **T12**. Differenza max: 0,6÷0,7 mm

NOTA. Per controllare la misura posteriore, far ruotare il pignone conico e controllare planarità e parallelismo degli attrezzi **T12**.

D Ohne den Kolben zu verstellen, das vordere und hintere Maß am Endstück der Werkzeuge **T12** kontrollieren. Max. Unterschied: 0,6÷0,7 mm

BEMERKUNG. Um das hintere Maß zu kontrollieren, das Kegelrad drehen und kontrollieren ob die Werkzeuge **T12** eben und parallel liegen.

ESP Sin desplazar el pistón, controlar la medida anterior y posterior en los extremos de las herramientas **T12**. Diferencia máx.: 0,6÷0,7 mm

NOTA. Para controlar la medida posterior, hacer girar el piñón cónico y controlar la planaridad y el paralelismo de las herramientas **T12**.

F Sans déplacer le piston, contrôler les mesures avant et arrière de l'extrémité des outils **T12**. Différence max.: 0,6÷0,7 mm

NOTE. Pour contrôler la mesure arrière, faire tourner le pignon conique et contrôler l'uniformité et le parallélisme des outils **T12**.

b

ITA Se necessario, regolare la convergenza senza spostare la centratura del pistone, regolando la lunghezza delle barre di sterzatura (5) o (14).

NOTA. Mezzo giro di avvitamento restringe la misura anteriore di circa 3 mm ed allarga la posteriore di circa 3 mm.

D Wenn nötig, die Konvergenz einstellen, ohne die Kolbenzentrierung zu verstellen; dazu die Länge der Lenkstangen (5) oder (14) einstellen.

BEMERKUNG. Eine halbe Umdrehung verringert das Vordermaß um ca. 3 mm und erweitert das hintere Maß um ca. 3 mm.

ESP Si fuera necesario, regular la convergencia sin desplazar el centraje del pistón, regulando la longitud de las barras de dirección (5) o (14).

NOTA. Media vuelta de atornillado restringe la medida anterior en aproximadamente 3 mm y ensancha la posterior en aproximadamente 3 mm.

F Si besoin, régler la convergence sans déplacer le centrage du piston, en réglant la longueur des barres de braquage (5) ou (14).

NOTE. Un demi-tour de vis diminue la mesure avant d'environ 3 mm et élargit celle de derrière d'environ 3 mm.

c

ITA **REGOLAZIONE CONVERGENZA PER VERSIONI CON COLLARE**
Allentare i dadi dei collari (12).

D **KONVERGENZ BEI DEN AUSFÜHRUNGEN MIT BUND EINSTELLEN**
Die Bundmuttern (12) lockern.

ESP **REGULACIÓN CONVERGENCIA PARA VERSIONES CON COLLARÍN**
Aflojar las tuercas de los collarines (12).

F **REGLAGE DE CONVERGENCE DES VERSION A COLLIER DE SERRAGE**
Desserrer les écrous des colliers de serrage (12).

d

ITA Ruotare i perni sferici (16) fino ad ottenere la convergenza.
Controllare la libertà di movimento degli snodi e bloccare i collari (12).
Coppia di serraggio dadi: 42÷52 Nm

D Die kugeligen Stifte (16) drehen, bis die Konvergenz erreicht worden ist.
Die freie Bewegung der Gelenke überprüfen und mit den Bunden (12) blockieren.
Anzugsmoment der Muttern: 42÷52 Nm

ESP Girar los pernos esféricos (16) hasta obtener la convergencia.
Controlar la libertad de movimiento de las rótulas y bloquear los collarines (12).
Par de torsión de las tuercas: 42÷52 Nm

F Tourner les tourillons sphériques (16) jusqu'à obtenir la convergence.
Contrôler le libre mouvement des articulations et bloquer les colliers de serrage (12).
Couple de serrage des écrous: 42÷52 Nm

e

ITA **REGOLAZIONE CONVERGENZA PER VERSIONE ALTERNATIVA**
Allentare i dadi (11) ed avvitarli sui perni sferici (15).

D **KONVERGENZ BEI DEN ALTERNATIVEN AUSFÜHRUNGEN EINSTELLEN**
Die Muttern (11) lockern und auf die kugeligen Stifte (15) festschrauben.

ESP **REGULACIÓN CONVERGENCIA PARA VERSIÓN ALTERNATIVA**
Aflojar las tuercas (11) y atornillarlas en los pernos esféricos (15).

F **REGLAGE DE LA CONVERGENCE EN VERSION ALTERNATIVE**
Desserrer les écrous (11) puis visser les tourillons sphériques (15).

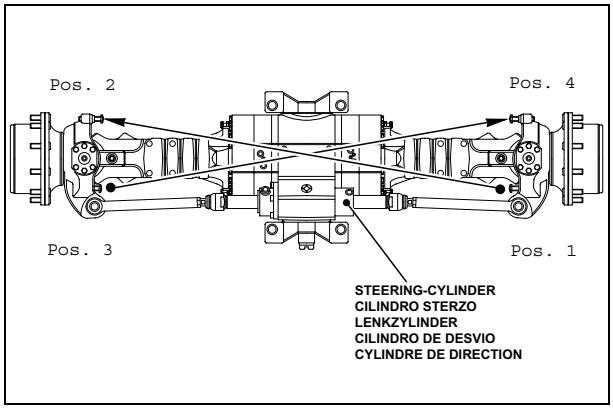
f

ITA Mantenendo fermi gli snodi, ruotare i perni sferici (15).
A convergenza regolata, bloccare i dadi (11).
Coppia di serraggio dadi: 298÷328 Nm

D Die Gelenke festhalten und die kugeligen Stifte (15) drehen.
Wenn die Konvergenz eingestellt ist, die Muttern (11) blockieren.
Anzugsmoment der Muttern: 298÷328 Nm

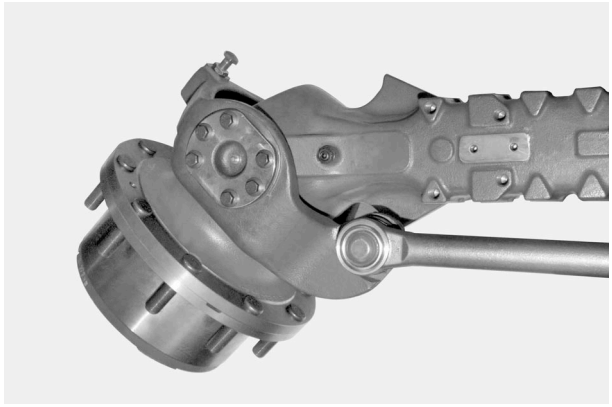
ESP Manteniendo firmes las rótulas, girar los pernos esféricos (15).
Una vez regulada la convergencia, bloquear las tuercas (11).
Par de torsión de las tuercas: 298÷328 Nm

F Tout en maintenant fermement les articulations, tourner les tourillons sphériques (15).
Lorsque la convergence est réglée, bloquer les écrous (11).
Couple de serrage des écrous: 298÷328 Nm



GB a

ADJUSTING THE STEERING ANGLE
NOTE. Perform the same operations on both sides (see diagram).
Loosen the nut of one of the adjusting srews on cylinder side.

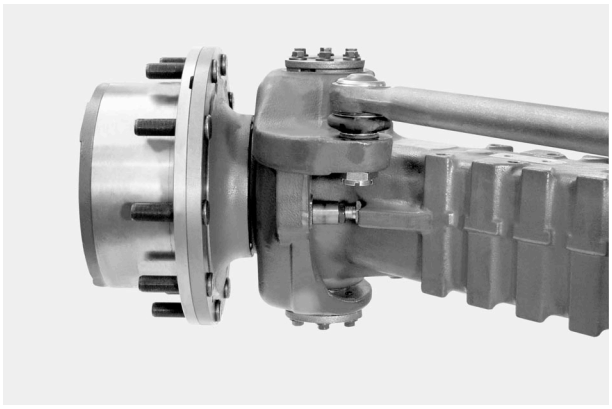


GB b

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

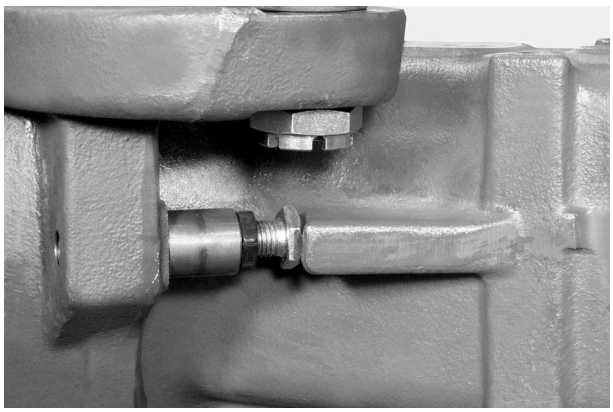
GB c

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



GB d

As you hold the adjusted screw in position against the arm stop, adjust the screw opposite, on non-cylinder side, until it leans against the arm stop.



GB e

IMPORTANT! The screws must lean against the respective arm stops all at the same time.

STEERING ANGLE ***ANGOLO DI STERZATURA*** **EINSHLAGWINKEL** ***ANGULACION DE DESVIO-ANGLE DE BRAQUAGE***		**40°**	**37°**	**36°**	**35°**	**30°**	**29°**
DISTANCE DISTANZA ABSTAND DISTANCIA DISTANCE	**'B' mm**	**30**	**37**	**39,4**	**41,8**	**53,3**	**38,2**

a

ITA REGISTRAZIONE ANGOLO DI STERZATURA
Eseguire le stesse operazioni per i due lati con la sequenza dello schena.
Allentare il dado di fissaggio “A” della vite di registrazione.

D EINSTELLUNG DES EINSCHLAGWINKELS BEMERKUNG.
Dieselben Vorgaenge fuer beide Seiten in derselben Reihenfolge des Schemas vornehmen. Die Mutter einer der beiden Stellschrauben an der Zylinderseite lockern.

ESP REGISTRACION ANGULACION DE DESVIO
NOTE. Efectuar las mismas operations para los dos lados con la sequencia del esquema.
Aflojar la tuerca de uno de los deux vis de reglage.

F REGLAGE ANGLE DE BRAQUAGE
NOTE. Exècuter les memes poperations des deux còtes dans la sequence du schema.
Desserrer l’ecrou d’une des deux vis dè reglage còté cylindre.

b

ITA Eseguire una sterzatura completa fino a far appoggiare la vite regolata (22) sull’arresto nel braccio (31).

D Die vollstaendige Lenkung durch fueren, bis die eingestellte Schraube an der Armsperre angliet.

ESP Efectuar un desvio completo hasta hacer apoyar los tornillos regulada sobre el paro del eje.

F Exècuter un braquage complet jusqu’àù la butee de la vis réglée sur l’arret du bras.

c

ITA Eseguire una sterzatura completa fino a far appoggiare la vite regolata (22) sull’arresto nel braccio (31).

D Die vollstaendige Lenkung durch fueren, bis die eingestellte Schraube an der Armsperre angliet.

ESP Efectuar un desvio completo hasta hacer apoyar los tornillos regulada sobre el paro del eje.

F Exècuter un braquage complet jusqu’àù la butee de la vis réglée sur l’arret du bras.

d

ITA Mantenendo la posizione di appoggio della vite regolata ,
registrare la vite contrapposto del lato oppsto cilindro fino al suo appoggio sull’arresto del braccio.

D In dieser Position der eingestellen Scraube, die entgegensetzte Schraube an der Zyliderseite einstellen, bis sie an der Armsperre anliegt.

ESP Manteniendo la posicion de apoyo del tornillo regulado; registrar el tornillo contrapuesto del lado opuesto cilindro hasta su apoye sobre el paro del eje.

F En conservant la position d’appui de la vis règlèe, régler la vis opposé du cylindre jusqu’àsa butee sur l’arrét du bras.

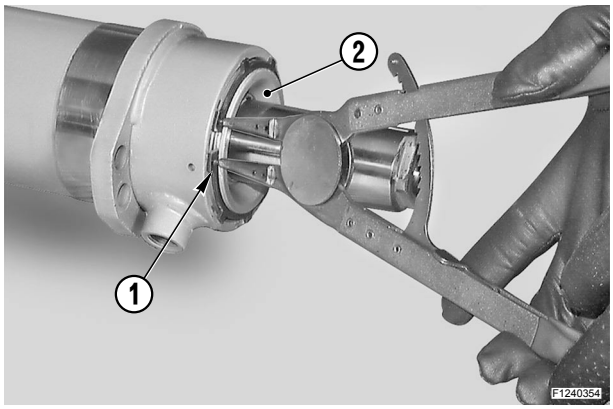
e

ITA IMPORTANTE! Le viti devono appoggiare contemporaneamente sui rispettivi arresti.

D WICHTIG! Die Schrauben un muessen gleichzeitig an den entsprechenden Sperren angliegen.

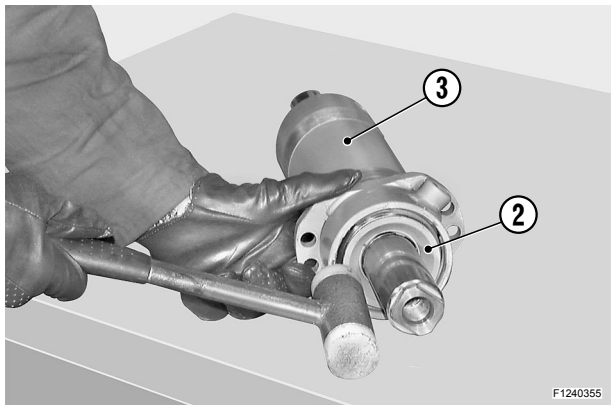
ESP IMPORTANTE! Los tornillos debe de apoyarse contemporaneamente sobre la respctivas paradas.

F IMPORTANT! Les vis doivent s’appuyer simultanement à leurs butées correspondantes.



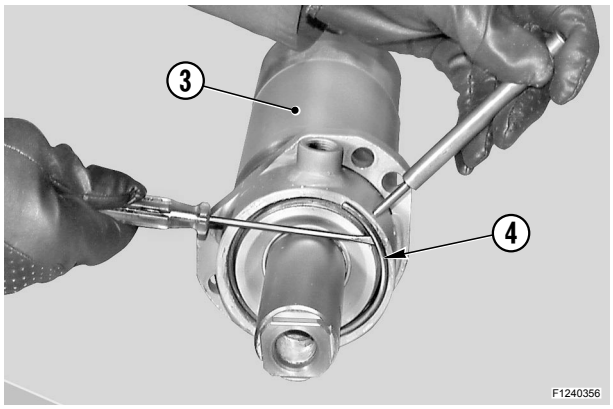
GB a

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



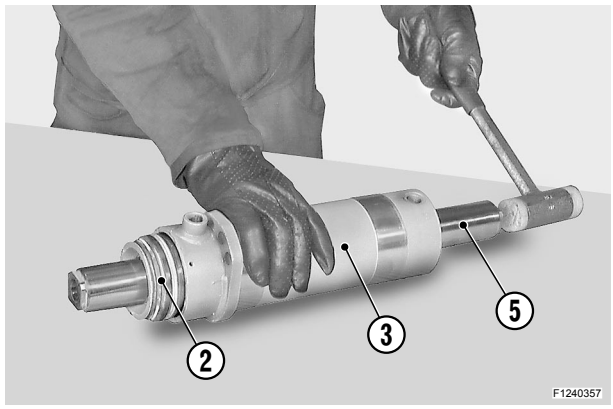
GB b

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.



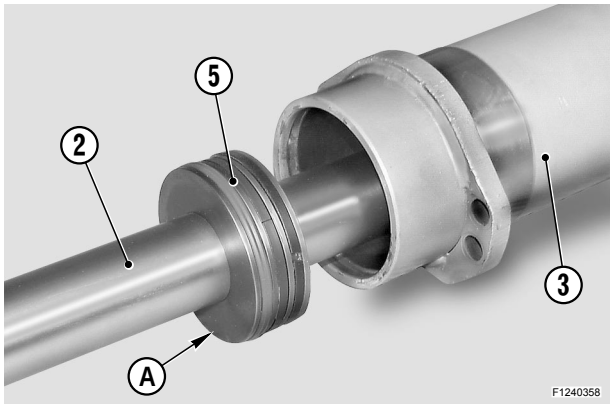
GB c

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.



GB d

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



GB e

Disassemble the cylinder unit (3) by extracting first the head (2), then the piston (5).
CAUTION! Note down the assembly side of the piston (5). The bevelled part "**A**" of the piston is oriented towards the head (2).

GB f

Remove all seals, anti-extrusion rings and scraper rings from head (2), cylinder (3) and piston (5).
NOTE. 1 - All seals must be replaced every time the unit is disassembled. 2 - Particular attention must be paid not to damage the seats of both seals and piston slide.

a

ITA Rimuovere l'anello elastico (1) di ritegno della testata (2).

D Kolbenring (1) vom Kopf (2) abnehmen.

ESP Remover el anillo elástico (1) de retención de la culata (2).

F Enlever l'anneau élastique (1) de retenue de la culasse (2).

b

ITA Con leggeri colpi di un mazzuolo in materiale plastico, spingere la testata (2) verso l'interno del cilindro (3).
NOTA. Inserire la testata fino a filo del cilindro.

D Mit einem Gummihammer den Kopf (2) leicht zum Zylinder (3) hin schlagen.
BEMERKUNG. Den Kopf bis an den Zylinderrand hinein schlagen.

ESP Con ligeros golpes de martillo de material plástico, empujar la culata (2) dentro del cilindro (3).
NOTA. Introducir la culata hasta que quede a ras del cilindro.

F Avec de légers coups de maillet en matière plastique, pousser la culasse (2) à l'intérieur du cylindre (3).
NOTE. Introduire la culasse jusqu'au bord du cylindre.

c

ITA Utilizzando un punteruolo, forzare l'anello di arresto (4) interno al cilindro (3) ed estrarlo utilizzando un cacciavite.

D Mit einem Dübel den Sprengring (4) in den Zylinder (3) ausdrücken und mit einem Schraubenzieher herausnehmen.

ESP Utilizando un punzón, forzar el anillo de tope (4) dentro del cilindro (3) y extraerlo utilizando un destornillador.

F A l'aide d'un pointeau forcer l'anneau de butée (4) à l'intérieur du cylindre (3), extraire ce dernier à l'aide d'un tournevis.

d

ITA Con un mazzuolo in materiale plastico, mandare in battuta il pistone (5) a ridosso della testata (2).
Proseguire fino all'espulsione della testata (2) dal cilindro (3).

D Mit einem Gummihammer den Kolben (5) bis zum Anschlag des Kopfes (2) bringen.
Weiter schlagen, bis der Kopf (2) aus dem Zylinder (3) geschlagen worden ist.

ESP Con un martillo de material plástico, mandar a tope el pistón (5) detrás de la culata (2).
Continuar hasta la expulsión de la culata (2) del cilindro (3).

F A l'aide d'un maillet en matière plastique, envoyer en butée le piston (5) à l'abri de la culasse (2).
Continuer jusqu'à l'éjection de la culasse (2) hors du cylindre (3).

e

ITA Scomporre il gruppo cilindro (3) estraendo nell'ordine la testata (2) ed il pistone (5).
ATTENZIONE! Annotare il senso di montaggio del pistone che ha la parte smussata "**A**" orientata verso la testata (2).

D Das Zylinderaggregat (3) zerlegen; dazu der Reihenfolge nach den Kopf (2) und den Kolben (5) abnehmen.
ACHTUNG! Montagerichtung des Kolbens beachten: das abgerundete Teil "**A**" muß zum Kopf (2) gerichtet sein.

ESP Descomponer el grupo cilindro (3) extrayendo en su orden la culata (2) y el pistón 5.
ATENCION! Anotar el sentido de montaje del piston que tiena la parte descantillada "**A**" orientada hacia culata (2).

F Décomposer le groupe cylindre (3) en extrayant dans l'ordre d'abord la culasse (2), puis le piston (5).
ATTENTION! Prendre note du sens de montage du piston, la partie arrondie "**A**" tournée vers la culasse (2).

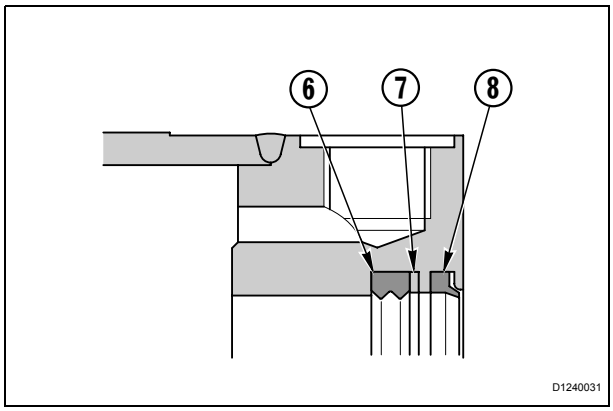
f

ITA Rimuovere dalla testata (2), dal cilindro (3) e dal pistone (5) tutte le guarnizioni, gli anelli antiestrusione e gli anelli raschiatori.
NOTA. 1 - Tutte le tenute devono essere sostituite ad ogni smontaggio. 2 - Prestare molta attenzione per non rovinare le sedi delle guarnizioni e dello scorrimento del pistone.

D Vom Kopf (2), vom Zylinder (3) und vom Kolben (5) alle Dichtungen, Halteringe und Abschaber wegnehmen.
BEMERKUNG. 1 - Alle Dichtungen müssen jedesmal gewechselt werden, wenn der Zylinder zerlegt wird. 2 - Sehr vorsichtig vorgehen, um die Dichtungs- und Kolbensitze nicht zu beschädigen.

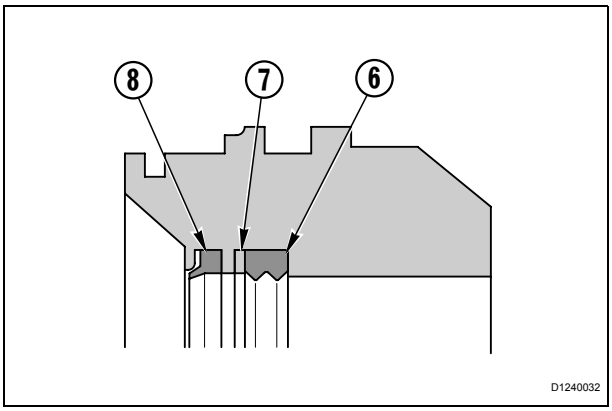
ESP Remover de la culata (2) del cilindro (3) y del pistón (5) todas las juntas, los anillos antiextrusión y los anillos raspadores.
NOTA. 1 - Todas las estanqueidades tienen que ser sustituidas a cada desmontaje. 2 - Tener mucho cuidado a fin de no dañar los alojamientos de las juntas y del deslizamiento del pistón.

F Enlever de la culasse (2), du cylindre (3) et du piston (5), toutes les garnitures, anneaux anti-extrusion et les anneaux racleurs.
NOTE. 1 - Toutes les étanchéités doivent être remplacées à chaque démontage. 2 - Faire très attention à ne pas abîmer les logements des garnitures et de coulissement du piston.



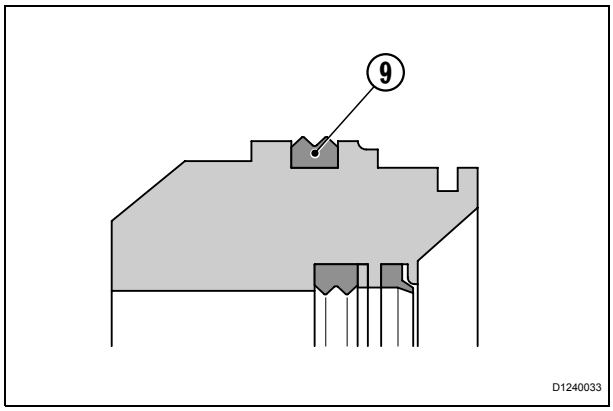
GB a

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.



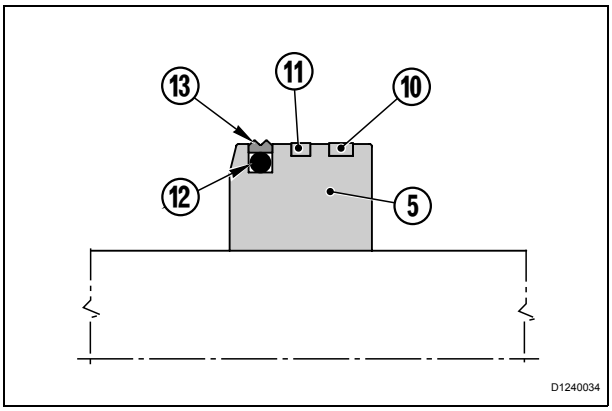
GB b

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.



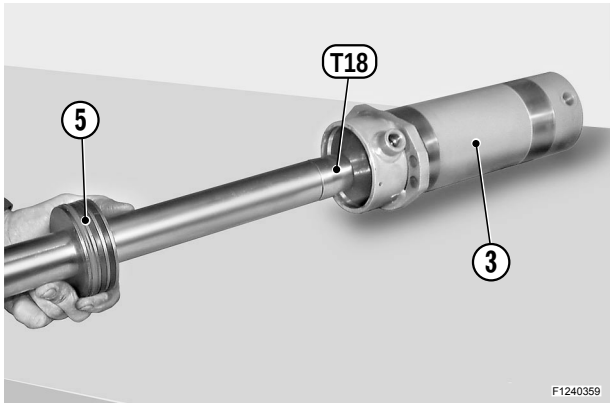
GB c

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.



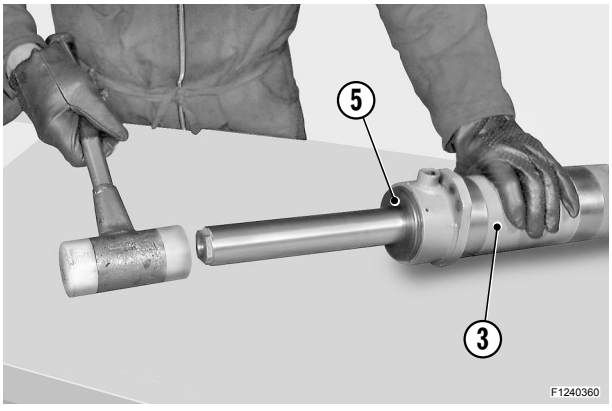
GB d

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



GB e

Apply tool **T18** to the shaft on the opposite side of the head (2) and centre it on the cylinder (3) so that it fits into the piston (5).
NOTE. Apply a little grease to seals and cylinder.



GB f

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

a

ITA Lubrificare con grasso ed installare nel cilindro (3) l'anello di tenuta (6) dello stelo, l'anello antiestrusione (7) e l'anello raschiatore (8).
ATTENZIONE! Controllare attentamente il posizionamento dell'anello antiestrusione (7).

D Mit Fett die Dichtung (6) des Schaftes, den Haltering (7) und den Abschaber (8) schmieren und in den Zylinder (3) montieren.
ACHTUNG! Sorgfältig die Position des Halterings (7) kontrollieren.

ESP Lubricar con grasa e instalar en el cilindro (3) el segmento de compresión (6) del vástago, el anillo antiextrusión (7) y el anillo raspador (8).
CUIDADO! Controlar atentamente el posicionamiento del anillo antiextrusión (7).

F Lubrifier avec du gras et installer dans le cylindre (3) la bague d'étanchéité (6) de la tige, l'anneau anti-extrusion (7) et l'anneau racleur (8).
ATTENTION! Contrôler attentivement le positionnement de l'anneau anti-extrusion (7).

b

ITA Lubrificare con grasso ed installare nella testata (2) l'anello di tenuta (6) dello stelo, l'anello antiestrusione (7) e l'anello raschiatore (8).
ATTENZIONE! Controllare attentamente il posizionamento dell'anello antiestrusione (7).

D Mit Fett die Dichtung (6) des Schaftes, den Haltering (7) und den Abschaber (8) schmieren und in den Kopf (2) montieren.
ACHTUNG! Sorgfältig die Position des Halterings (7) kontrollieren.

ESP Lubricar con grasa e instalar en la culata (2) el segmento de compresión (6), el anillo antiextrusión (7) y el anillo raspador (8).
CUIDADO! Controlar atentamente el posicionamiento del anillo antiextrusión (7).

F Lubrifier avec du gras et installer dans le cylindre (2) la bague d'étanchéité (6) de la tige, l'anneau anti-extrusion (7) et l'anneau racleur (8).
ATTENTION! Contrôler attentivement le positionnement de l'anneau anti-extrusion (7).

c

ITA Montare all'esterno della testata (2) la guarnizione (9).
ATTENZIONE!
1 - Per facilitare il montaggio, lubrificare con grasso la superficie esterna del pistone.
2 - Non arrotolare la guarnizione (9).

D Außen am Kopf (2) die Dichtung (9) montieren.
ACHTUNG!
1 - Um die Montage zu erleichtern, die äußere Kolbenfläche mit Fett schmieren.
2 - Die Dichtung (9) nicht wickeln.

ESP Montar fuera de la culata (2) la junta (9).
CUIDADO!
1 - Para facilitar el montaje, lubricar con grasa la superficie exterior del pistón.
2 - No enrollar la junta (9).

F Monter à l'extérieur de la culasse (2) la garniture (9).
ATTENTION!
1 - Pour rendre plus aisé le montage, lubrifier avec du gras la surface externe du piston.
2 - Ne pas enrouler les garnitures (9).

d

ITA Preparare il pistone (5) montando l'anello di guida (10), l'anello magnetico (11), l'OR (12) e la guarnizione (13).
ATTENZIONE! 1 - Per facilitare il montaggio, lubrificare con grasso.
2 - Se non è previsto il sensore di centratura, l'anello magnetico (11) è sostituito con un secondo anello di guida (10).

D Den Kolben (5) mit dem Führungsring (10), dem magnetischen Ring (11), den O-Ring (12) und der Dichtung (13) vorbereiten.
ACHTUNG! 1 - Um die Montage zu erleichtern, mit Fett schmieren.
2 - Wenn kein Zentrierungssensor vorgesehen ist, ist der magnetische Ring (11) mit einem zweiten Führungsring (10) ersetzt.

ESP Preparar el pistón (5) montando el anillo de guía (10), el anillo de imán (11), el OR (12) y la junta (13).
CUIDADO!1 - Para facilitar el montaje, lubricar con grasa.
2 - Si no ha sido previsto el sensor de centraje, el anillo de imán (11) es sustituido por un segundo anillo de guía (10).

F Préparer le piston (5) en montant l'anneau de guidage (10), l'anneau magnétique (11), la OR (12) et la garniture (13).
ATTENTION! 1 - Pour rendre plus aisé le montage, lubrifier avec du gras. 2 - Si le capteur de centrage n'est pas prévu, l'anneau magnétique (11) est remplacé par un second anneau de guidage (10).

e

ITA Applicare l'attrezzo **T18** sullo stelo lato opposto testata (2) e centrarlo nel cilindro (3) fino ad imboccare il pistone (5).
NOTA. Lubrificare leggermente con grasso le guarnizioni ed il cilindro.

D Das Werkzeug **T18** auf den Schaft an der dem Kopf (2) entgegengesetzten Seite anbringen und auf den Zylinder (3) zentrieren, bis es auf dem Kolben (5) sitzt.
BEMERKUNG. Die Dichtungen und den Zylinder leicht mit Fett schmieren.

ESP Aplicar la herramienta **T18** sobre el vastago lado opuesto culata (2) y centrarlo en el cilindro (3) hasta entrar en el piston. (5).
NOTA. Lubrificar ligermente con grasa las juntas y el cilindro.

F Appliquer l'outil **T18** sur la tige du côté opposé à la culasse (2) et centrer celui-ci dans le cylindre (3) jusqu'à engager le piston (5).
NOTE. Lubrifier légèrement les garnitures et le cylindre avec du gras.

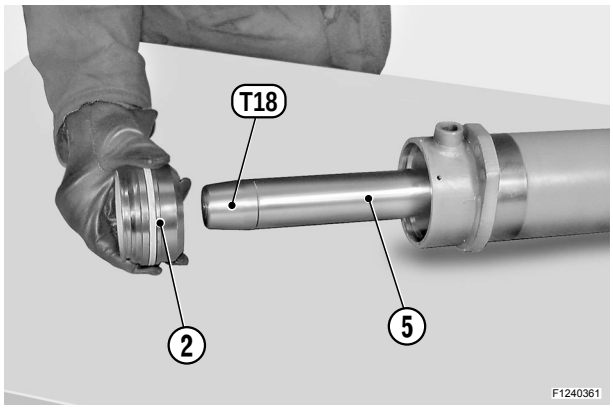
f

ITA Con un mazzuolo in materiale plastico, inserire il pistone (5) nel cilindro per circa 100 mm.

D Mit einem Gummihammer, den Kolben (5) in den Zylinder 100 mm lang schlagen.

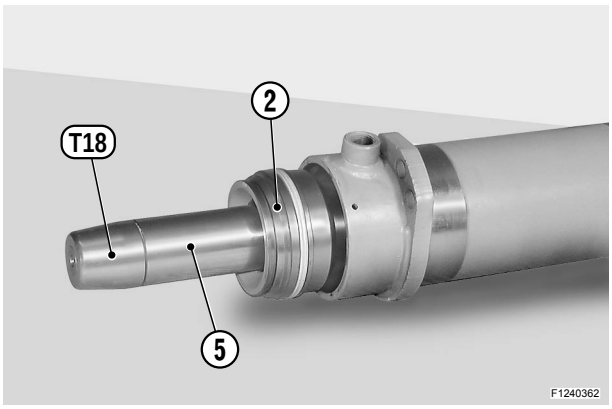
ESP Con un martillo de material plástico, introducir el pistón (5) en el cilindro unos 100 mm.

F A l'aide d'un maillet en matière plastique, introduire le piston (5) d'environ 100 mm dans le cylindre.



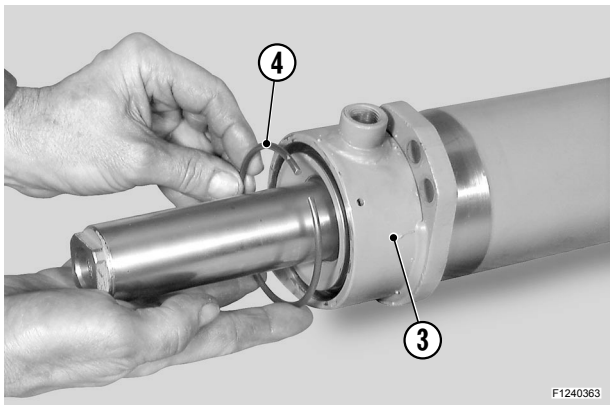
GB a

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



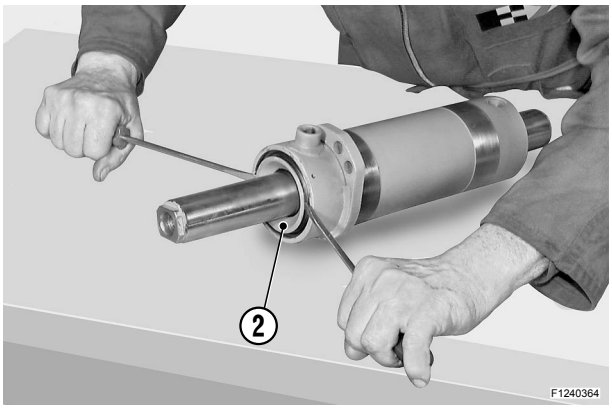
GB b

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.



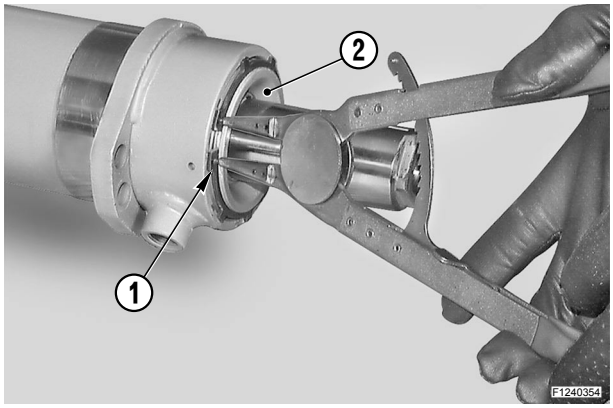
GB c

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



GB d

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



GB e

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.

a

ITA Rimuovere l'attrezzo **T18** ed applicarlo sul lato opposto del pistone (5).

D Werkzeug **T18** abnehmen und an der anderen Kolbenseite (5) anbringen.

ESP Remover la herramienta **T18** y aplicarla en el lado opuesto del pistón (5).

F Enlever l'outil **T18** et appliquer ce dernier sur le côté opposé du piston (5).

b

ITA Lubrificare con grasso le guarnizioni della testata (2), infilarla sul pistone e, con un mazzuolo in materiale plastico, inserirla nel cilindro (3).
NOTA. Inserire la testata fino a filo del cilindro.

D Die Dichtungen des Kopfes (2) mit Fett schmieren. Den Kopf auf den Kolben schieben und mit einem Gummihammer in den Zylinder (3) schlagen.
BEMERKUNG. Den Kopf bis zum Zylinderrand hinein schlagen.

ESP Lubricar con grasa las juntas de la culata (2), introducirla en el pistón y, utilizando un martillo de material plástico, introducirla en el cilindro (3).
NOTA. Introducir la culata hasta nivel del cilindro.

F Lubrifier avec du gras les garnitures de la culasse (2). Enfiler celle-ci sur le piston, et à l'aide d'un maillet en matière plastique, introduire dans le cylindre (3).
NOTE. Introduire la culasse jusqu'au bord du cylindre.

c

ITA Inserire l'anello di arresto (4) assicurandosi che si assesti nella sede del cilindro (3).

D Den Haltering (4) einsetzen und kontrollieren, ob er richtig im Sitz des Zylinders (3) sitzt.

ESP Introducir el anillo de tope (4) asegurándose de que se ajuste en el alojamiento del cilindro (3).

F Introduire l'anneau de butée (4) en s'assurant qu'il s'ajuste bien dans le logement du cylindre (3).

d

ITA Utilizzando due cacciaviti o leve, forzare la testata fino alla battuta sull'anello di arresto (4).

D Mit zwei Schraubenzieher oder Hebeln, den Kopf bis zum Anschlag des Sprengrings (4) schieben.

ESP Utilizando dos destornilladores o palancas, forzar la culata hasta el tope en el anillo de tope (4).

F A l'aide de deux tournevis ou leviers, envoyer en butée la tête sur l'anneau de butée (4).

e

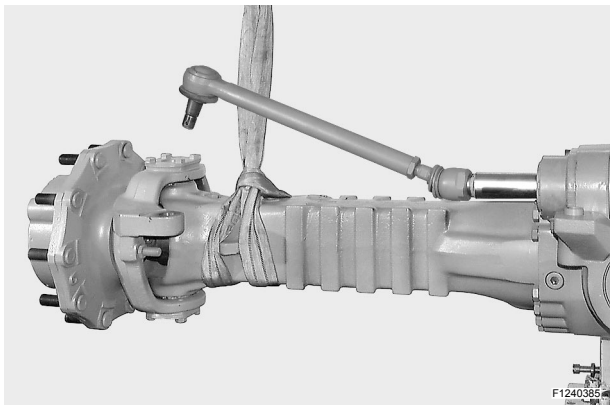
ITA Montare l'anello elastico (1) di ritegno della testata (2).
ATTENZIONE! Assicurarsi che l'anello elastico (1) sia impegnato a fondo nella sede.
Se necessario, forzarlo in sede con un punteruolo ed un martello.

D Den Kolbenring (1) des Kopfes (2) montieren.
ACHTUNG! Kontrollieren ob der Kolbenring (1) in seinem Sitz richtig sitzt.
Wenn nötig, in seinen Sitz mit einem Dübel und einen Hammer schlagen.

ESP Montar el anillo elástico (1) de retención de la culata (2).
CUIDADO! Asegurarse de que el anillo elástico (1) está colocado a fondo en la sede.
Si fuera necesario, forzarlo en el alojamiento utilizando un punzón y un martillo.

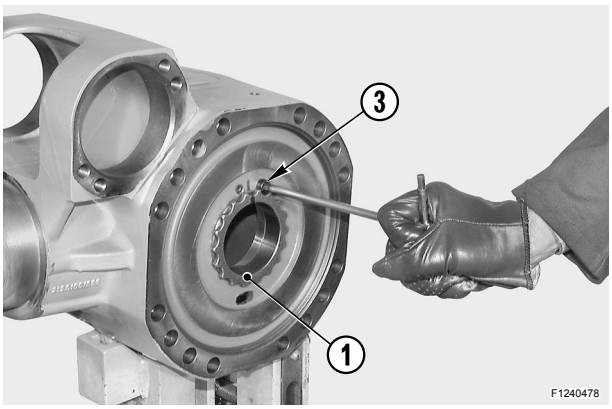
F Monter l'anneau élastique (1) de retenue de la culasse (2).
ATTENTION! S'assurer que l'anneau élastique (1) soit engagé à fond dans le logement.
Si besoin, forcer dans le logement à l'aide d'un poinçon et d'un marteau.

REMOVING - RIMOZIONE - ABMONTIEREN - REMOCION - DEPOSE



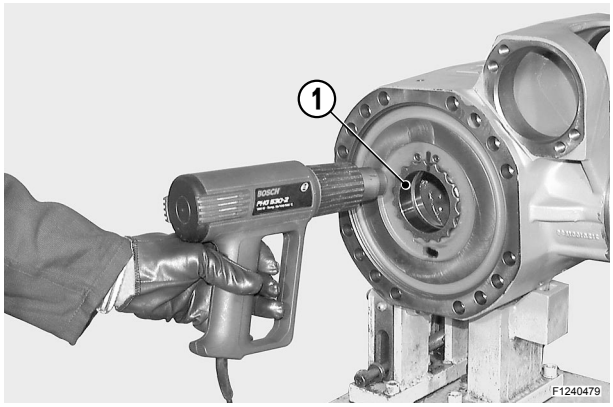
GB a

Remove the complete arms.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISKS».



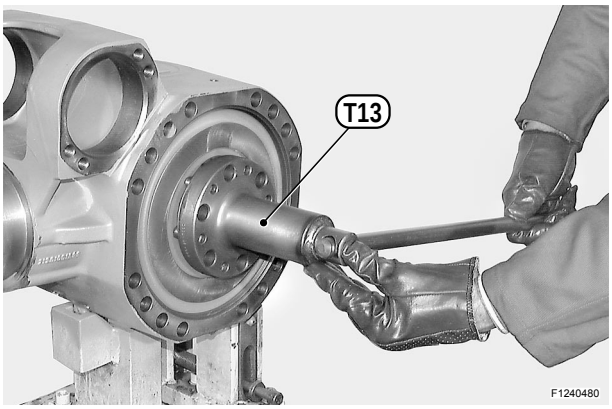
GB b

Mark the position of the ring nuts (1). Remove the fittin screws (3) from the ring nuts (1).



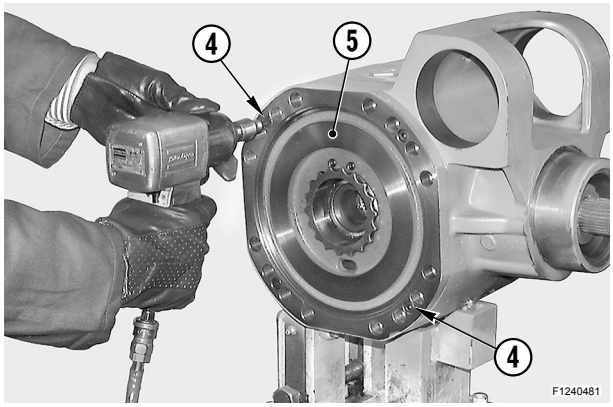
GB c

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



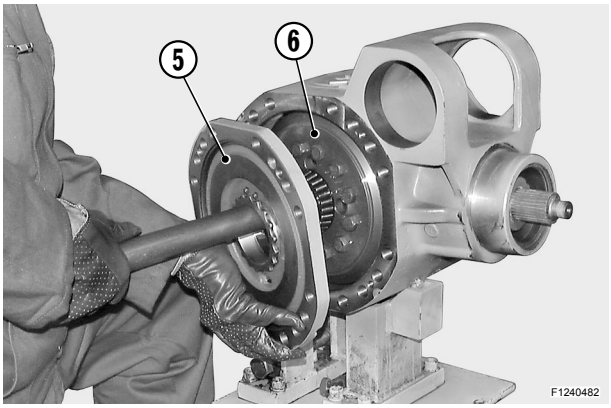
GB d

Apply tool **T13** and remove the ring nuts.
NOTE. Accurately clean the threaded portions on ring nuts of body and cover.



GB e

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



GB f

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

a

ITA Rimuovere i bracci completi.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO».

D Die kompletten Arme abmontieren.
Siehe «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN».

ESP Remover los brazos completos.
Para los detalles, véase «CONTROL DEL DESGASTE Y SUSTITUCION DE LOS DISCOS DEL FRENO».

F Déposer les bras complets.
Pour de plus amples détails voir «CONTROLE D'USURE ET SUBSTITUTION DES DISQUES DE FREINAGE».

b

ITA Contrassegnare la posizione delle ghiere (1).
Rimuovere le viti (3) di ritegno delle ghiere (1).

D Position der Nutmutter (1) markieren. Schrauben (3) der Nutmutter (1) abschrauben.

ESP Marcar la posición de las virolas (1).
Remover los tornillos (3) de retención de las virolas (1).

F Marquer la position des colliers de serrage (1). Enlever les vis (3) de fixation des colliers de serrage (1).

c

ITA Scaldare le ghiere (1) in modo uniforme fino ad una temperatura di circa 80°C.

D Nutmutter (1) gleichmäßig auf ca. 80°C erhitzen.

ESP Calentar las virolas (1) de manera uniforme hasta un temperatura de unos 80°C.

F Chauffer les colliers de serrage (1) de façon uniforme jusqu'à une température d'environ 80°C.

d

ITA Applicare l'attrezzo **T13** ed asportare le ghiere.
NOTA. Pulire accuratamente le filettature delle ghiere del corpo e del coperchio.

D Werkzeug **T13** anbringen und Nutmutter entfernen.
BEMERKUNG. Sorgfältig das Gewinde der Nutmutter, des Körpers und des Deckels reinigen.

ESP Aplicar la herramienta **T13** y sacar las virolas.
NOTA. limpiar con cuidado las roscas de las virolas del cuerpo y de la tapa.

F Appliquer l'outil **T13** et enlever les anneaux de fixation.
NOTE. Nettoyer soigneusement le filetage des anneaux de fixation, du corps et du couvercle.

e

ITA Asportare le viti (4) di ritegno del coperchio intermedio (5).

D Schrauben (4) des mittleren Deckels (5) abschrauben.

ESP Sacar los tornillos (4) de retención de la tapa intermedia (5).

F Enlever les vis (4) de fixation du couvercle intermédiaire (5).

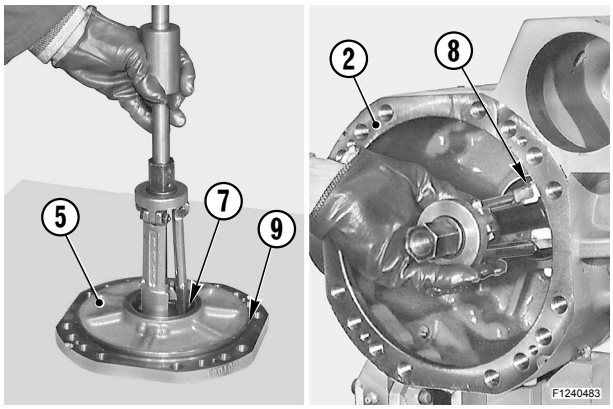
f

ITA Forzare con un cacciavite introdotto nei vani contrapposti e rimuovere il coperchio intermedio (5) ed il gruppo differenziale completo (6).
NOTA. Sostenere i pezzi con un'asta.

D Einen Schraubenzieher in die Hohlräume stecken und anheben, um den mittleren Deckel (5) und das komplette Differentialaggregat (6) zu entfernen.
BEMERKUNG. Die Teile mit einem Stab halten.

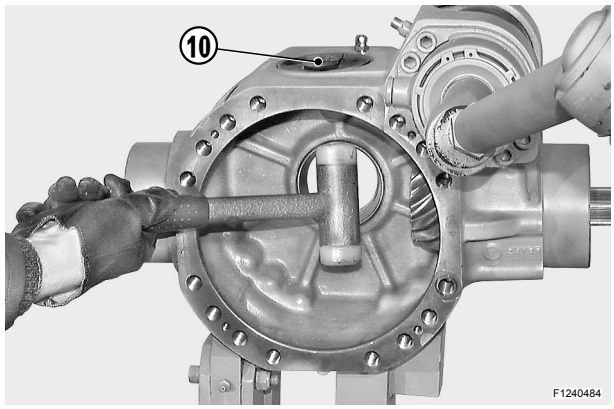
ESP Forzar utilizando un destornillador introducido en los compartimentos contrapuestos y remover la tapa intermedia (5) y el grupo diferencial completo (6).
NOTA. Sostener las piezas utilizando una varilla.

F Forcer à l'aide d'un tournevis, introduit dans les creux interposés, enlever le couvercle intermédiaire (5) et le groupe différentiel complet (6).
NOTE. Soutenir les pièces avec une tige.



GB a

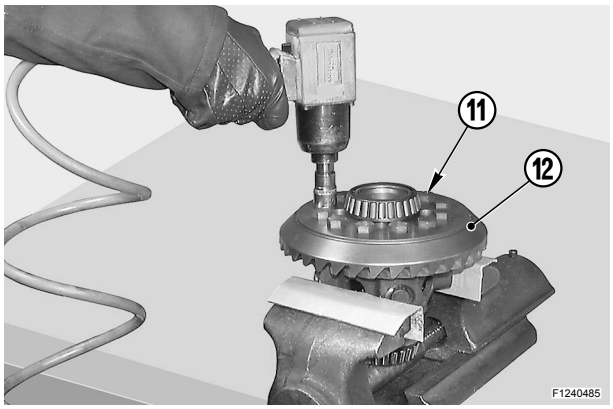
If the bearings need replacing, extract the external thrust blocks of the bearings (7) and (8) from middle cover (5) and central body (2).
NOTE. Accurately check the O-ring (9).



GB b

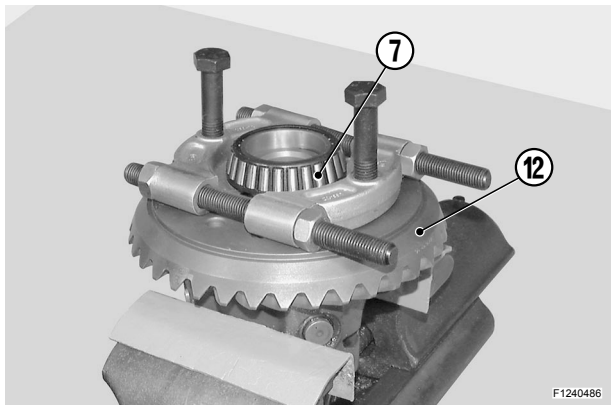
Remove the top plug (10).

DISASSEMBLING - SMONTAGGIO - ZERLEGEN - DESMONTAJE - DESASSEMBLAGE



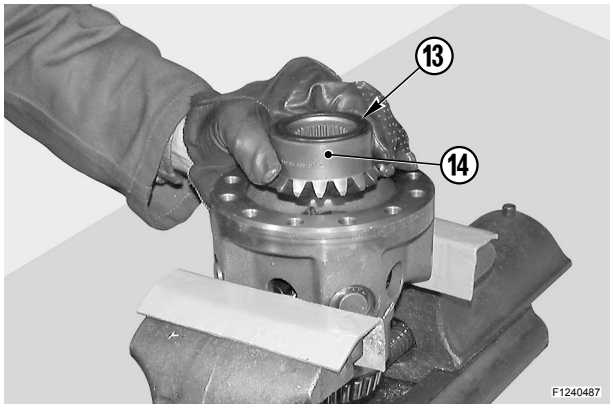
GB c

Remove the fittin screws (11) from the crown (12).



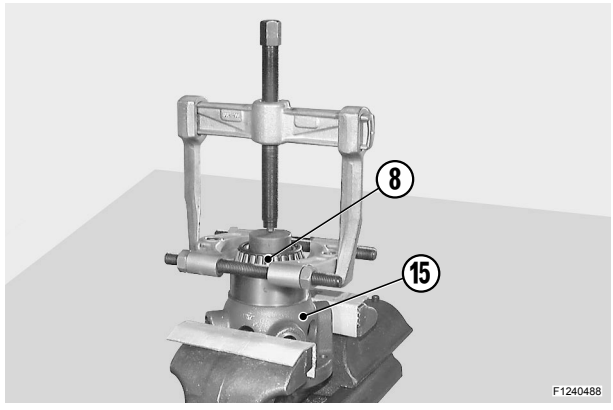
GB d

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



GB e

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



GB f

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

a

ITA Se si devono sostituire i cuscinetti, estrarre dal coperchio intermedio (5) e dal corpo centrale (2) le ralle esterne dei cuscinetti (7) e (8).
NOTA. Controllare attentamente l'anello OR (9).

D Wenn Lager ausgewechselt werden müssen, vom mittleren Deckel (5) und vom zentralen Körper (2) die äußeren Scheiben der Lager (7) und (8) entfernen.
BEMERKUNG. O-Ring (9) sorgfältig kontrollieren.

ESP Si hay que sustituir los cojinetes, extraer de la tapa intermedia (5) y del cuerpo central (2) las ranguas exteriores (7) y (8) de los cojinetes.
NOTA. Controlar atentamente el anillo OR (9).

F Si on doit remplacer les paliers, extraire du couvercle intermédiaire (5) et du corps central (2), les crapaudines externes des paliers (7) et (8).
NOTE. Contrôler attentivement la garniture OR (9).

b

ITA Rimuovere il tappo superiore (10).
NOTA. Il tappo deve essere sostituito ad ogni rimozione.

D Oberer Stopfen (10) entfernen.

ESP Remover el tapón superior (10).

F Enlever le bouchon supérieur (10).

c

ITA Rimuovere le viti (11) di ritegno della corona (12).

D Die Schrauben (11) des Kranzes (12) abschrauben.

ESP Remover los tornillos (11) de retención de la corona (12).

F Enlever les vis (11) de fixation de la couronne (12).

d

ITA Se si deve sostituire, estrarre il cuscinetto (7) e rimuovere la corona (12).

D Falls das Lager ausgewechselt werden muß, Lager (7) heraus nehmen und Kranz (12) entfernen.

ESP Si hay que sustituirlo, extraer el cojinete (7) y remover la corona (12).

F Extraire le palier (7) et déposer la couronne (12) en cas que le premier doit être remplacé.

e

ITA Rimuovere la rondella di rasamento (13) e l'ingranaggio planetario (14).

D Zwischenlegscheibe (13) und Planetenrad (14) entfernen.

ESP Remover la arandela de espesor (13) y el engranaje planetario (14).

F Enlever la rondelle de rasage (13) et l'engrenage planétaire (14).

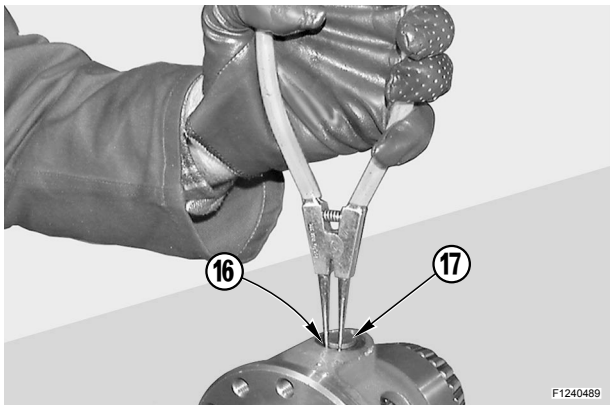
f

ITA Se si deve sostituire, estrarre il cuscinetto (8) dalla scatola differenziale (15).

D Wenn das Lager ausgewechselt werden muß, Lager (8) aus dem Differentialgehäuse (15) nehmen.

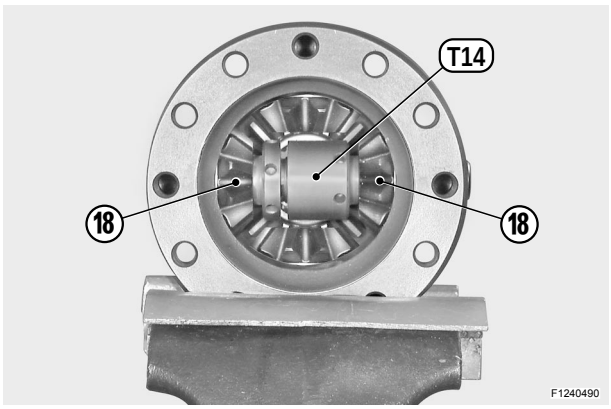
ESP Si hay que sustituirlo, extraer el cojinete (8) de la caja del diferencial (15).

F Extraire le palier (8) du boîtier différentiel (15) en cas que le premier doit être remplacé.



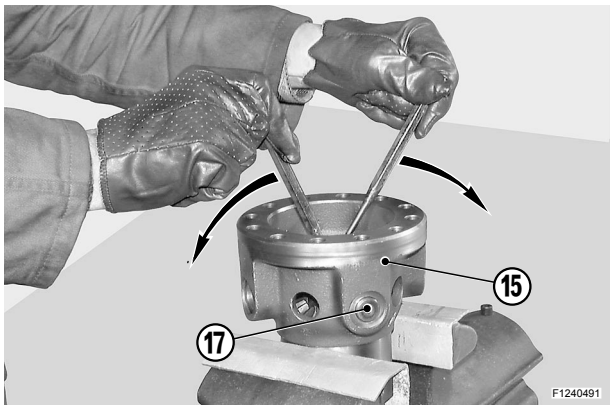
GB a

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



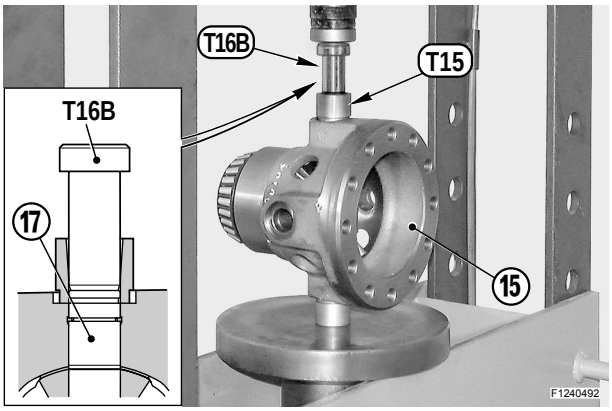
GB b

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



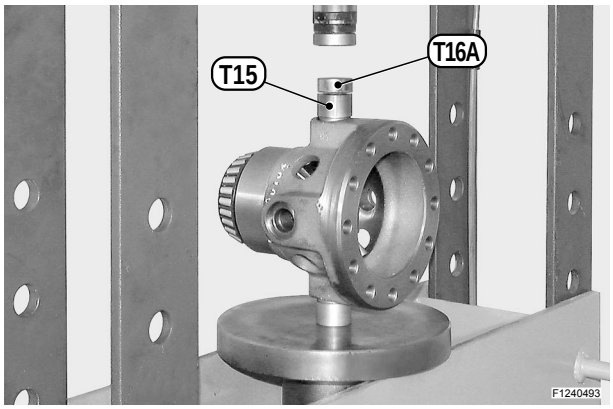
GB c

Force tool **T14** in-between the planet wheel gears (18) using two pin-drivers.
CAUTION! Make sure that tool **T14** is perfectly lined up with the pins (17) when locked.



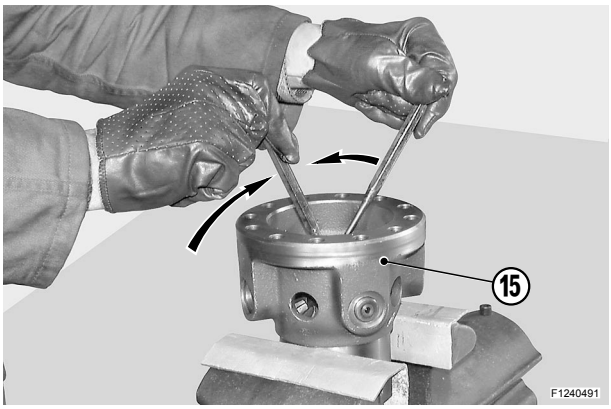
GB d

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



GB e

Remove gudgeon **T16A** and bush **T15**.
NOTE. In this condition the tool **T14** contains pin (17).



GB f

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

a

ITA Rimuovere gli anelli elastici (16) dai perni (17) degli ingranaggi satelliti (18).

D Kolbenringe (16) von den Stiften (17) der Plantenräder (18) entfernen.

ESP Remover los anillos elásticos (16) de los dos pernos (17) de los engranajes satélites (18).

F Enlever les anneaux élastiques (16) des tourillons (17) des engrenages satellites (18).

b

ITA Inserire tra gli ingranaggi satelliti (18) l'attrezzo **T14**.

D Zwischen den Planetenrädern (18) das Werkzeug **T14** einsetzen.

ESP Introducir entre los engranajes satélites (18) la herramienta **T14**.

F Introduire entre les engrenages satellites (18) l'outil **T14**.

c

ITA Operando con due cacciaspine, forzare l'attrezzo **T14** tra gli ingranaggi satelliti (18).
ATTENZIONE! Controllare attentamente che l'attrezzo **T14** rimanga allineato ai perni (17) quando è bloccato.

D Mit zwei Dübeln, das Werkzeug **T14** zwischen den Planetenrädern (18) fest einsetzen.
ACHTUNG: Sorgfältig darauf achten, daß das blokkierte Werkzeug **T14** mit den Stiften (17) fluchtgerecht ist.

ESP Trabajando con dos extractores de clavijas, forzar la herramienta **T14** entre los engranajes satélite (18).
CUIDADO! Controlar atentamente que la herramienta **T14** quede alineada con los pernos (17) cuando está bloqueada.

F En oeuvrant avec deux chasse-goupilles, forcer l'outil **T14** entre les engrenages satellites (18).
ATTENTION! Contrôler attentivement si l'outil **T14** reste aligné aux tourillons (17) quand il est bloqué.

d

ITA Sistemare il corpo differenziale (15) sotto una pressa, posizionare la boccola **T15** ed inserire lo spinotto **T16A**. Pressare lo spinotto **T16A** fino a fondo corsa.

D Das Differentialgehäuse (15) unter eine Presse legen und die Buchse **T15** positionieren; Bolzen **T16A** einsetzen. Drücken, bis der Bolzen **T16A**.

ESP Colocar la caja del diferencial (15) debajo de una prensa; posicionar el casquillo **T15** e introducir la cruceta **T16A**. Presionar la cruceta **T16A**.

F Ajuster le boîtier différentiel (15) sous la presse, placer la bague **T15** et introduire le goujon **T16A**.
Presser le goujon **T16A**.

e

ITA Asportare lo spinotto **T16A** e la bussola **T15**.
NOTA. In questa condizione, il perno (17) è contenuto nell'attrezzo **T14**.

D Bolzen **T16A** und die Buchse **T15** abnehmen.
BEMERKUNG. In diesem Zustand, ist der Stift (17) im Werkzeug **T14** enthalten.

ESP Sacar la cruceta **T16A** y el manguito **T15**.
NOTA. En esta condición el perno (17) se encuentra en la herramienta **T14**.

F Enlever le goujon **T16A** et la douille **T15**.
NOTE. Dans cette condition le tourillon (17) se trouve dans l'outil **T14**.

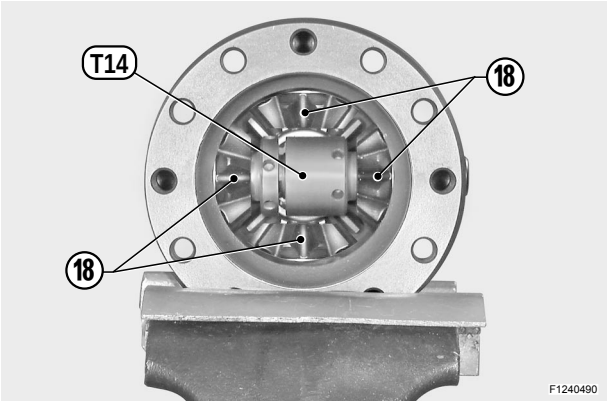
f

ITA Rimuovere l'attrezzo **T14** e con esso il perno (17) del satellite.

D Das Werkzeug **T14** und damit den Stift (17) des Planetenrades abnehmen.

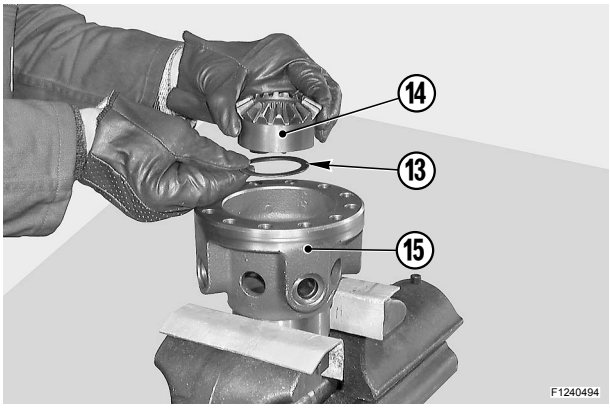
ESP Remover la herramienta **T14** y con ella el perno (17) del satélite.

F Enlever l'outil **T14** et, avec ce dernier, le tourillon (17) du satellite.



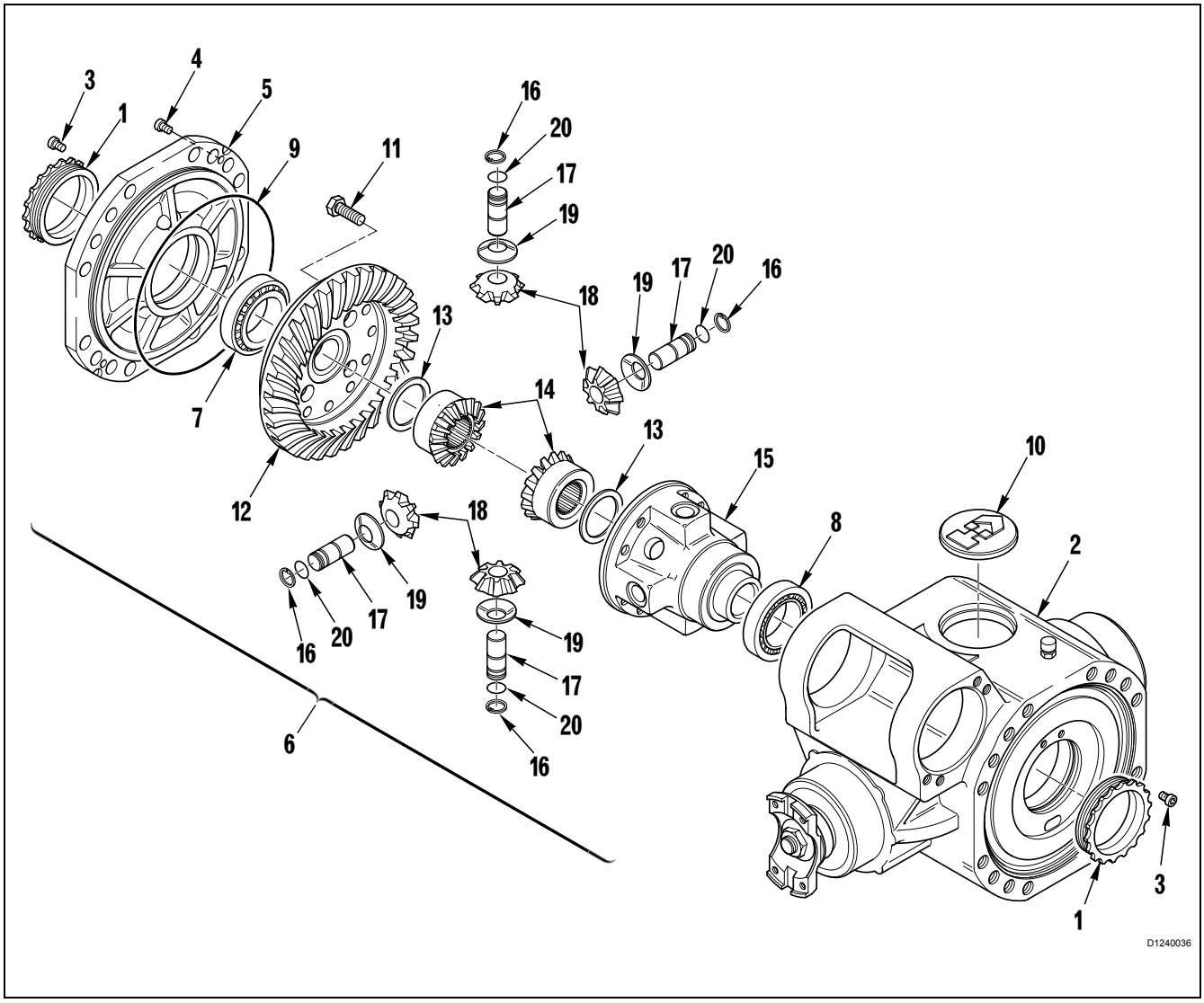
GB a

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



GB b

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



a

ITA Lasciando in posizione l'ingranaggio satellite che si è liberato, bloccare nuovamente l'attrezzo **T14**.
Ripetere le operazioni di estrazione del perno del secondo perno satellite (17).
Ripetere le operazioni per gli altri perni.

D Das nun freie Planetenrad in seiner Position lassen und das Werkzeug **T14** wieder blockieren.
Die Vorgänge für das Herausnehmen des Stiftes des 2. Planetenrades (17) wiederholen.
Die Vorgänge auch für die anderen Stifte wiederholen.

ESP Dejando en posición el engranaje satélite que ha quedado libre, bloquear otra vez la herramienta **T14**.
Repetir las operaciones de extracción del perno del segundo perno satélite (17).
Repetir las operaciones con los demás pernos.

F En maintenant la position de l'engrenage satellite dégagé, bloquer de nouveau l'outil **T14**.
Répéter les opérations d'extraction du tourillon du 2° satellite (17).
Répéter les opérations pour les autres tourillons.

b

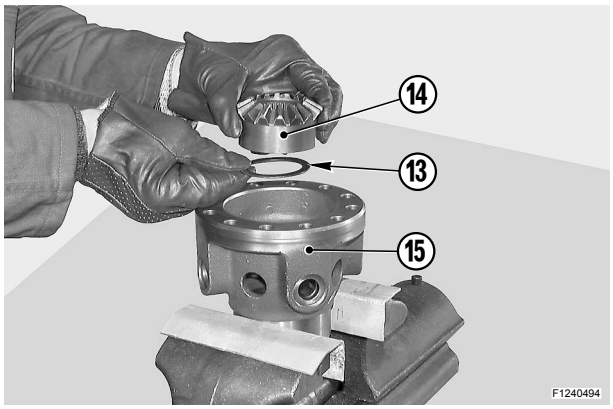
ITA Rimuovere l'attrezzo **T14** ed asportare dal corpo differenziale gli ultimi due ingranaggi satelliti (18), il 2° ingranaggio planetario (14) e la relativa rondella di rasamento (13).

D Werkzeug **T14** entfernen und vom Differentialgehäuse die letzten beiden Planetenräder (18), das 2. Differentialrad (14) und die Zwischenlegscheibe (13) abnehmen.

ESP Remover la herramienta **T14** y sacar de la caja del diferencial los últimos dos engranajes satélite (18), el 2° engranaje diferencial (14) y la arandela de espesor correspondiente (13).

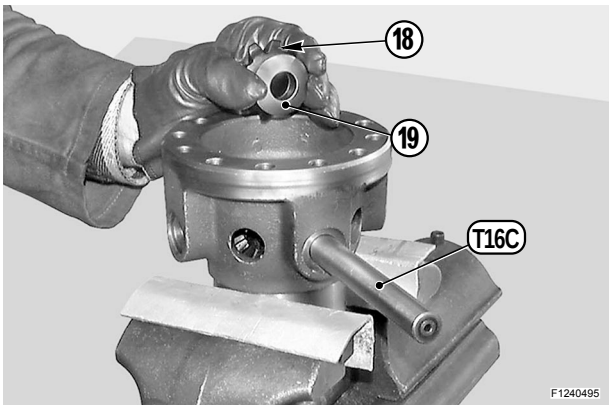
F Enlever l'outil **T14** et extraire du boîtier différentiel les deux derniers engrenages satellites (18), le 2° engrenage du différentiel (14) et la relative rondelle de rasage (13).

ASSEMBLING - ASSEMBLAGGIO - MONTIEREN - MONTAJE - MONTAGE



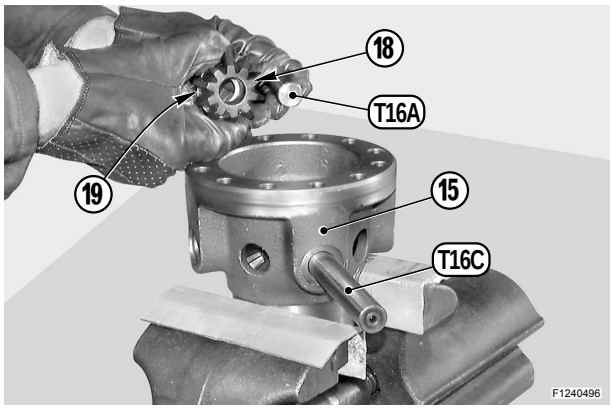
GB a

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



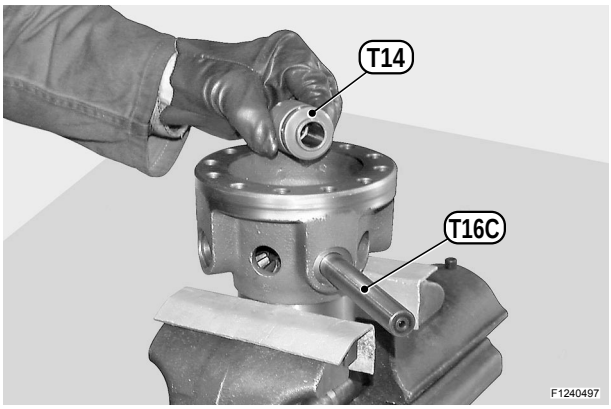
GB b

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



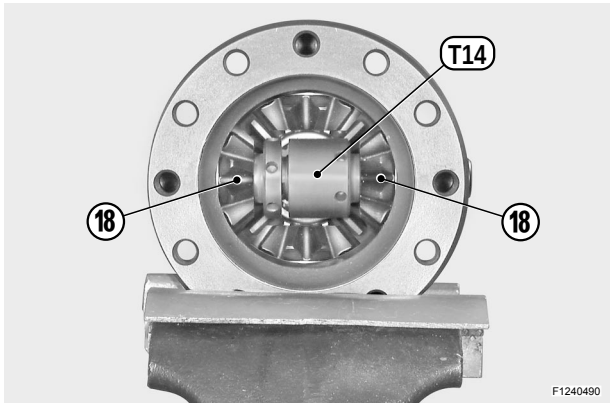
GB c

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



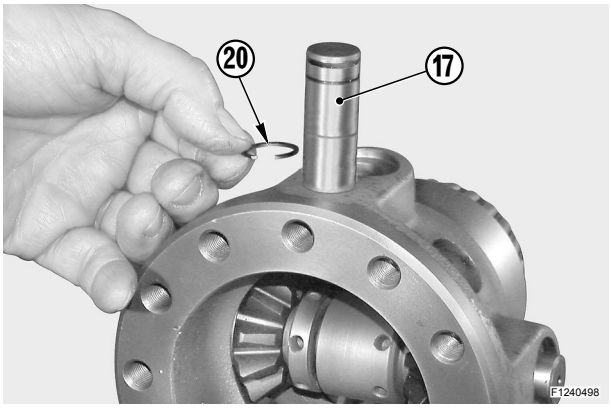
GB d

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



GB e

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



GB f

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

a

ITA Inserire nel corpo differenziale (15), la rondella di rasamento (13) e l'ingranaggio planetario (14).

D Das Differentialgehäuse (15), die Zwischenlegscheibe (13) und das Planetenrad (14) einsetzen.

ESP Introducir en la caja del diferencial (15) la arandela de espesor (13) y el engranaje planetario (14).

F Introduire, dans le boîtier du différentiel (15), la rondelle de rasage (13) et l'engrenage planétaire (14).

b

ITA Posizionare la rondella di rasamento (19), il primo ingranaggio satellite (18).
Tenerli in posizione con la barra **T16C**.

D Die Zwischenlegscheibe (19) und das erste Planetenrad (18) positionieren.
Mit dem Stab **T16C** diese in ihrer Position halten.

ESP Posicionar la arandela de espesor (19), el primer engranaje satélite (18).
Mantenerlos en posición por medio de la barra **T16C**.

F Placer la rondelle de rasage (19) et le premier engrenage satellite (18).
Maintenir ceux-ci en place à l'aide de la barre **T16C**.

c

ITA Utilizzando lo spinotto **T16A**, posizionare il secondo ingranaggio satellite (18) e la relativa rondella di rasamento (19).

D Mit dem Bolzen **T16A** das zweite Planetenrad (18) und die entsprechende Zwischenlegscheibe (19) positionieren.

ESP Utilizando la cruceta **T16A**, posicionar el segundo engranaje satélite (18) y la arandela de espesor correspondiente (19).

F A l'aide du goujon **T16A** placer le second engrenage satellite (18) et sa relative rondelle de rasage (19).

d

ITA Inserire tra i due ingranaggi satelliti (18) l'attrezzo **T14**.
Allineare tutto il gruppo inserendo a fondo la barra **T16C** fino ad espellere lo spinotto **T16A**.

D Zwischen den beiden Planetenräder (18) das Werkzeug **T14** einsetzen.
Das gesamte Aggregat fluchten; dazu den Stab **T16C** ganz einschieben bis die Bolzen **T16A** herausgestoßen worden sind.

ESP Introducir entre los dos engranajes satélite (18) la herramienta **T14**.
Alinear todo el grupo introduciendo a fondo la barra **T16C** hasta expulsar la cruceta **T16A**.

F Introduire entre les deux engrenages satellites (18) l'outil **T14**.
Aligner tout le groupe en insérant à fond la barre **T16C** jusqu'à éjecter le goujon **T16A**.

e

ITA Bloccare l'attrezzo **T14** a ridosso degli ingranaggi satelliti (18).
Dopo il bloccaggio, rimuovere la barra **T16C**.

D Werkzeug **T14** an den Planetenrädern (18) anliegend, blockieren.
Danach Stab **T16C** entfernen.

ESP Bloquear la herramienta **T14** detrás de los engranajes satélite (18).
Después de bloquearlos, remover la barra **T16C**.

F Bloquer l'outil **T14** à l'abri des engrenages satellites (18).
Après avoir bloqué, enlever la barre **T16C**.

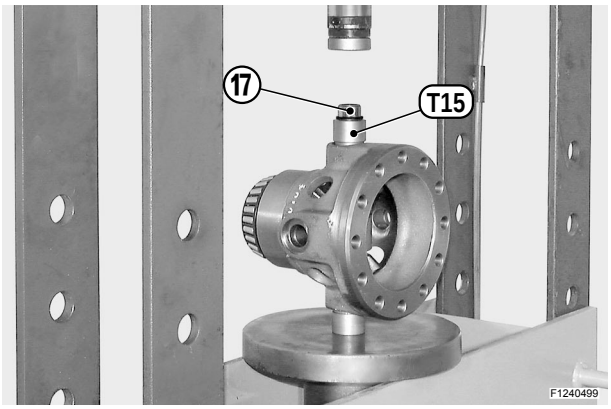
f

ITA Montare sui perni (17) gli anelli elastici (20).

D Auf die Stifte (17) die Kolbenringe (20) montieren.

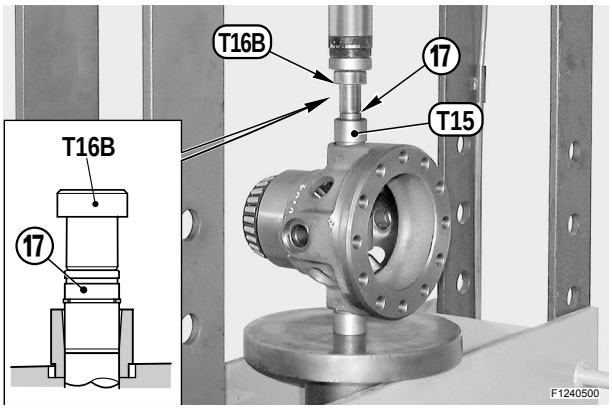
ESP Montar en los pernos (17) los anillos elásticos (20).

F Monter sur les tourillons (17) les anneaux élastiques (20).



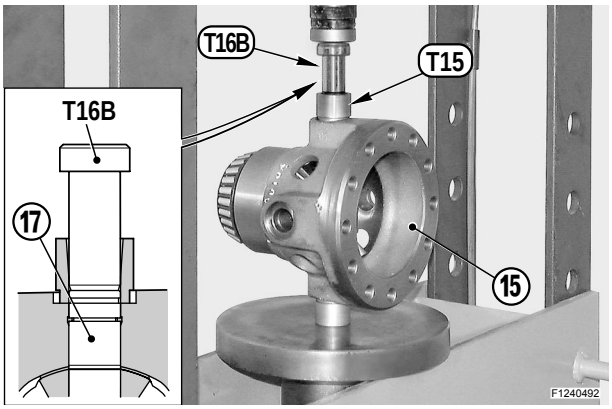
GB a

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



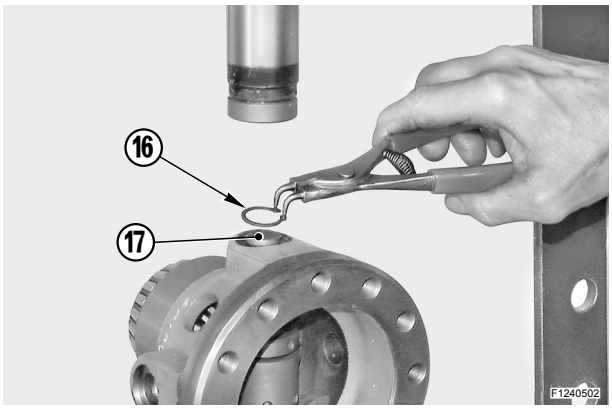
GB b

Put gudgeon **T16B** on top of the planet wheel pin (17).



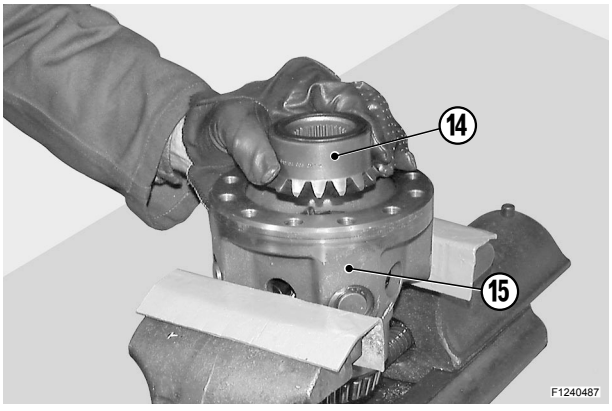
GB c

Press **T16B** pin all the way down.



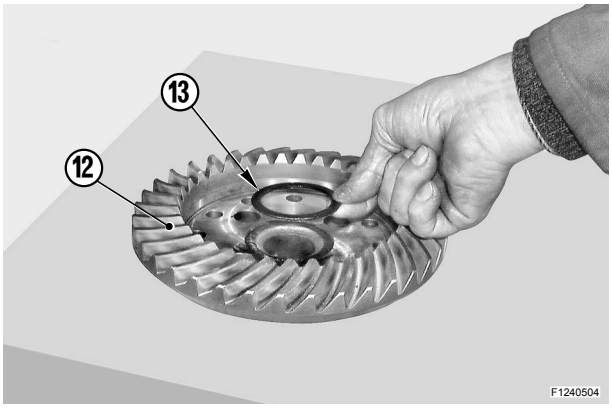
GB d

Remove gudgeon **T16B**, bush **T15** and fit the snap ring (16) on the pin (17).
CAUTION! Make sure that the snap ring centres the seat and that it rests on the surface of the differential carrier.
Repeat the operations on the other planet wheel pin or planet wheel axle.



GB e

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



GB f

Position the shim washer (13) on the crown (12).
NOTE. In order to hold the shim washer (13) in position, apply grease to it.

a

ITA Posizionare sotto la pressa il corpo differenziale (15), sistemare la boccola **T15** ed inserire il perno satellite (17).

D Unter der Presse das Differentialgehäuse (15) positionieren, die Buchse **T15** anbringen und den Planetenradstift (17) einsetzen.

ESP Posicionar debajo de la prensa la caja del diferencial (15), colocar el casquillo **T15** e introducir el engranaje satélite (17).

F Placer sous la presse le boîtier différentiel (15), ajuster la bague **T15** et introduire le tourillon satellite (17).

b

ITA Sovrapporre al perno satellite (17) lo spinotto **T16B**.

D Über den Planetenradstift (17) den Bolzen **T16B** anbringen.

ESP Superponer al perno satélite (17) la cruceta **T16B**.

F Juxtaposer sur le tourillon satellite (17) le goujon **T16B**.

c

ITA Pressare lo spinotto **T16B** a fondo.

D Den Stift **T16B** fest hinein drücken.

ESP Apretar la cruceta **T16B** a hondo.

F Presser à fond sur l'axe **T16B**.

d

ITA Rimuovere lo spinotto **T16B**, la boccola **T15** e montare sul perno (17) l'anello elastico (16).
ATTENZIONE! Assicurarsi che l'anello elastico centri la sede e che appoggi sul piano del corpo differenziale.
Ripetere le operazioni per l'altro perno satellite e per l'altro asse satelliti.

D Bolzen **T16B**, Buchse **T15** entfernen und auf den Stift (17) den Kolbenring (16) montieren.
ACHTUNG! Der Kolbenring muß im Sitz zentriert sein und an der Fläche des Differentialgehäuses anliegen.
Dieselben Vorgänge für den anderen Planetenradstift und die andere Planetenradachse wiederholen.

ESP Remover la cruceta **T16B**, el casquillo **T15** y montar en el perno (17) el anillo elástico (16).
CUIDADO! Asegurarse de que el anillo elástico esté centrado en el alojamiento y que esté apoyado en la superficie de la caja del diferencial. Repetir las operaciones en el otro perno satélite y en el otro eje satélite.

F Enlever le goujon **T16B** de la douille **T15** puis monter sur le tourillon (17) l'anneau élastique (16).
ATTENTION! S'assurer que l'anneau élastique est bien centré dans son logement et qu'il repose sur le plan du boîtier différentiel. Répéter ces mêmes opérations pour l'autre tourillon satellite et pour l'autre axe satellites.

e

ITA Posizionare il secondo ingranaggio planetario (14) nel corpo differenziale (15).

D Das zweite Planetenrad (14) im Differentialkörper (15) positionieren.

ESP Posicionar el segundo engranaje planetario (14) en el cuerpo del diferencial (15).

F Placer le second engrenage planétaire (14) dans le corps différentiel (15).

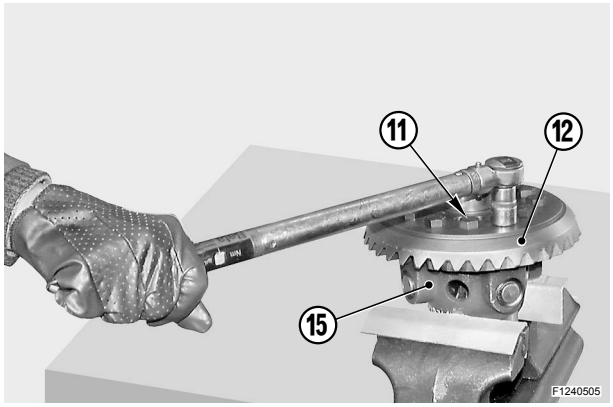
f

ITA Posizionare la rondella di rasamento (13) sulla corona (12).
NOTA. Per mantenere la posizione, spalmare la rondella di rasamento (13) con grasso.

D Zwischenlegscheibe (13) auf den Kranz (12) positionieren.
BEMERKUNG. Um die Position zu sichern, die Zwischenlegscheibe (13) mit Fett einschmieren.

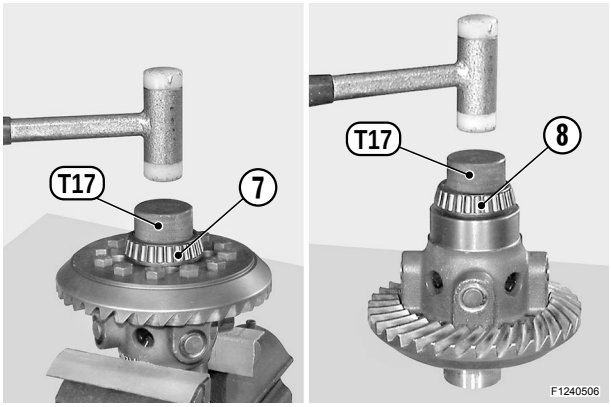
ESP Posicionar la arandela de espesor (13) en la corona (12).
NOTA. Para mantener la posición, pasar grasa en la arandela de espesor (13).

F Placer la rondelle de rasage (13) sur la couronne (12).
NOTE. Pour maintenir cette position, enduire la rondelle de rasage (13) avec du gras.



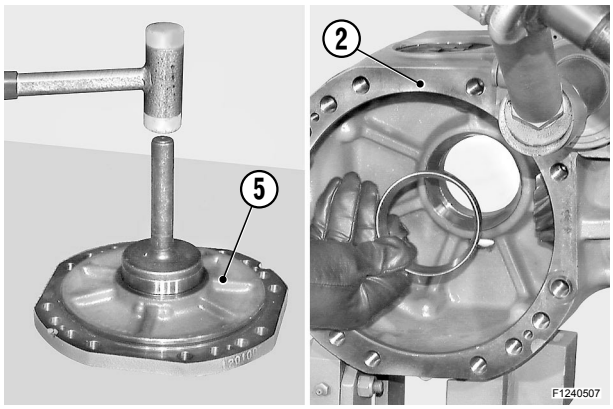
GB a

Position the crown (12) on the differential carrier (15) and lock it with screws (11) applied with Loctite 242.
Torque wrench setting for screws: 128–142 Nm
NOTE. Secure the screws using the cross-tightening method.



GB b

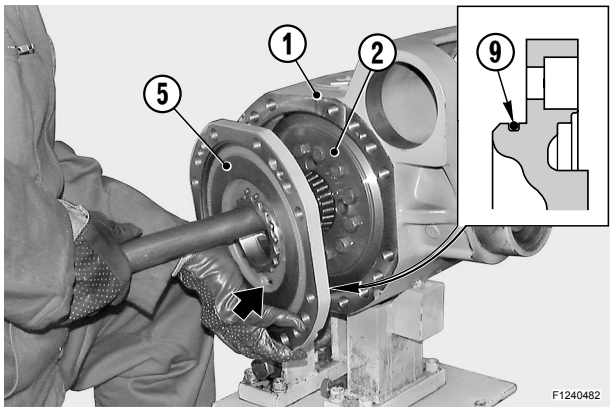
Install the bearings (7) and (8) using tool **T17**.



GB c

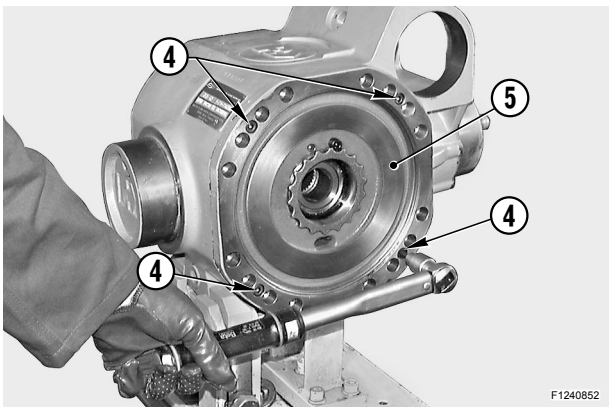
If the bearings are replaced, insert the external thrust blocks in the middle cover (5) and in the central body (2).

INSTALLING - INSTALLAZIONE - INSTALLIEREN - INSTALACION - INSTALLATION



GB e

Position the differential unit (6) 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 (9) and make sure that the cover is fitted with the oil discharge in the lower position.



GB f

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

a

ITA Posizionare la corona (12) sul corpo differenziale (15) e bloccarla con le viti (11) spalmate con Loctite 242. Coppia di serraggio viti: 128÷142 Nm

NOTA. Serrare le viti con il metodo del serraggio incrociato.

D Den Kranz (12) auf den Differentialkörper (15) positionieren und mit den Schrauben (11) blockieren. Anzugsmoment der Schrauben: 128÷142 Nm

BEMERKUNG. Die Schrauben abwechselnd und entgegengesetzt festschrauben.

ESP Posicionar la corona (12) en el cuerpo del diferencial (15) y bloquearla con los tornillos (11) pasarles Loctite 242.

Par de torsión: 128÷142 Nm

NOTA. Apretar los tornillos con el método de torsión cruzado.

F Placer la couronne (12) sur le corps du différentiel (15) puis bloquer avec les vis (11) enduites avec Loctite 242.

Couple de serrage des vis: 128÷142 Nm.

NOTE. Serrer les vis par le biais du mode de serrage croisé.

b

ITA Utilizzando l'attrezzo **T17**, montare i cuscinetti (7) e (8).

D Mit dem Werkzeug **T17** die Lager (7) und (8) montieren.

ESP Utilizando la herramienta **T17**, montar los cojinetes (7) y (8).

F A l'aide de l'outil **T17** monter les paliers (7) et (8).

c

ITA Se vengono sostituiti i cuscinetti, inserire nel coperchio intermedio (5) e nel corpo centrale (2) le ralle esterne.

D Falls die Lager ausgewechselt werden sollen, in den mittleren Deckel (5) und in den zentralen Körper (2) die äußeren Scheiben einsetzen.

ESP Si se sustituyen los cojinetes, introducir en la tapa intermedia (5) y en el cuerpo central (2) las ranguas exteriores.

F Si les paliers doivent être remplacés, introduire dans le couvercle intermédiaire (5) et, dans le corps central (2), les crapaudines externes.

e

ITA Utilizzando una barra, posizionare il gruppo differenziale (6) nel corpo centrale (2) e montare il coperchio intermedio (5).

NOTA. Controllare attentamente la condizione dell'anello OR (9) e che il coperchio venga montato con lo scarico olio nella posizione inferiore.

D Mit einem Stab das Differentialaggregat (6) in den zentralen Körper (2) positionieren und den mittleren Deckel (5) montieren.

BEMERKUNG. Sorgfältig den Zustand des O-Ringes (9) kontrollieren und sicherstellen, daß der Deckel mit dem Ölablaßstopfen nach unten gerichtet montiert wird.

ESP Utilizando una barra, posicionar el grupo diferencial (6) en el cuerpo central (2) y montar la tapa intermedia (5).

NOTA. Controlar atentamente las condiciònes del segmento OR (9) y que la tapa venga montada con el descarge aceite en la posiciòn inferior.

F A l'aide d'une barre, placer le groupe différentiel (6) dans le corps central (2) et monter le couvercle intermédiaire (5).

NOTE. Contrôler attentivement les conditions de l'anneau torique (9) te que le couvercle soit monté avec le bouchon de vidange pour l'huile dans la position inférieure.

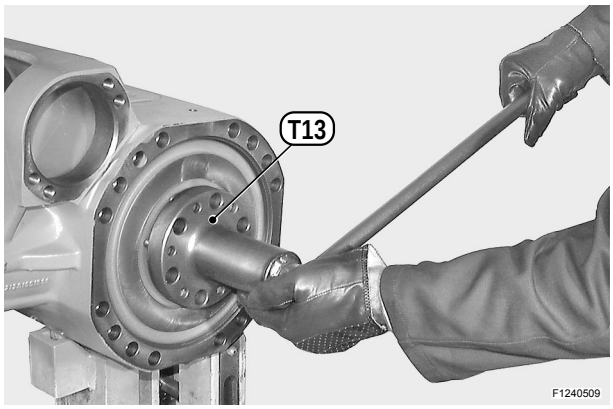
f

ITA Bloccare il coperchio intermedio (5) con le viti (4). Coppia di serraggio viti: 23,8÷26,2 Nm

D Mit den Schrauben (4) blockieren den mittleren Deckel (5). Anzugsmoment der Schrauben: 23,8÷26,2 Nm

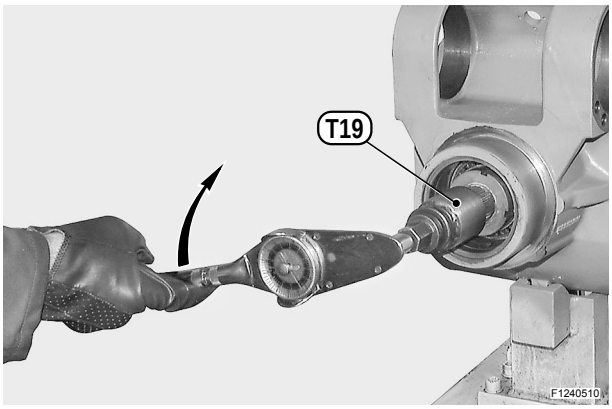
ESP Bloqueare la tapa intermedia (5) con los tornillos (4). Par de torsión tornillos: 23,8÷26,2 Nm

F Bloquer le couvercle intermédiaire (5) dernier avec les vis (4). Couple de serrage des vis: 23,8÷26,2 Nm



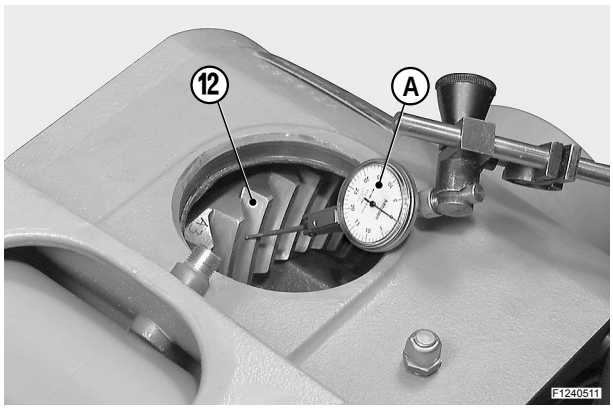
GB a

NOTE. If the ring nuts (1) are removed, spread them with Loctite 242.
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.



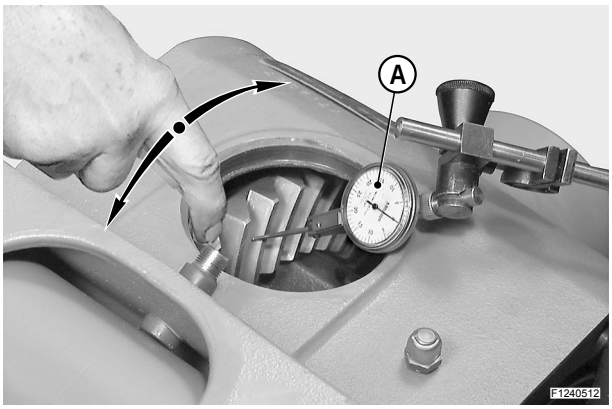
GB b

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 140÷210 Ncm.
CAUTION! If bearings are not new, check the static torque; if bearings are new, check the continuous torque.



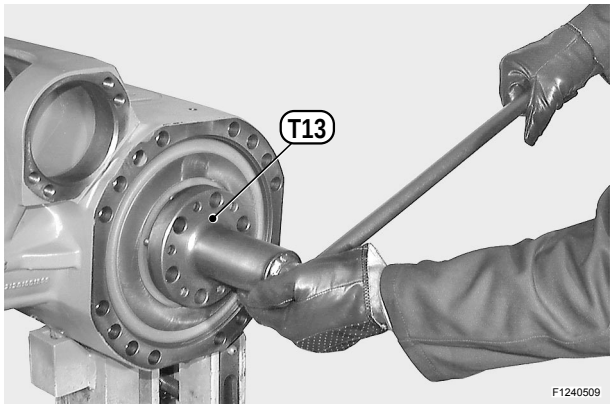
GB c

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



GB d

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



GB e

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

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

Difference between MIN and MAX clearance for whole circumference should not exceed 0.09 mm.
La differenza tra gioco MIN e MAX rilevata sull'intera circonferenza non deve superare il valore di 0,09 mm.
Der Unterschied zwischen dem MIN e MAX Spiel der gesamten Kreislinie darf den Wert von 0,09 mm nicht überschreiten.
La diferencia entre el juego Min y Max determinada sobre la entera circonferencia no debe de superar el valor de 0,09 mm.
La différence de jeu entre MIN et MAX relevée sur toute la circonférence ne doit pas aller au-delà de la valeur de 0,09 mm.

a

ITA **NOTA.** Se le ghiere (1) vengono rimosse, spalmarle con Loctite 242.
Serrare le ghiere dal lato corona fino ad azzerare i giochi tra pignone e corona e bloccarla; ritornare indietro di circa 1/4÷1/2 giro.

D **BEMERKUNG.** Wenn die Nutmuttern (1) ausgewechselt werden, diese mit Loctite 242 schmieren.
Nutmuttern an der Kranzseite fest ziehen bis kein Spiel mehr zwischen Rad und Kranz übrig bleibt ; danach um 1/4÷1/2 Umdrehung wieder aufschrauben.

ESP **NOTA.** Si se remueven las virolas (1) pasarles Loctite 242.
Apretar las virolas del lado corona hasta acerar los juegos entre el pinon y la corona y bloquearla, volver atras de 1/4÷1/2 giro approx.

F **NOTE.** Si les anneaux (1) sont enlevés, les enduire avec du Loctite 242.
Serrer les anneaux de fixation du côté couronne jusqu'à mettre à zéro les jeux entre pignon et couronne et bloquer: revenir en arrière d'environ 1/4÷1/2 tour.

b

ITA Precaricare i cuscinetti tramite la ghiera lato opposto corona per incrementare la coppia di rotazione pignone fino a 140÷210 Ncm.
ATTENZIONE! Con cuscinetti usati, controllare la coppia di spunto; con cuscinetti nuovi, controllare la coppia di rotazione continua.

D Lager durch die Nutmutter an der dem Kranz entgegengesetzten Seite vorladen, um das Gegenmoment des Rades auf 140÷210 Ncm zu bringen.
ACHTUNG! Bei verbrauchten Lagern, das Anlaufdrehmoment kontrollieren; bei neuen Lagern, das kontinuierliche Drehmoment kontrollieren.

ESP Precargar los cojinetes atraves la virola lado opuesto corona para incrementar el par de rotacion pinon hasta 140÷210 Ncm.
CUIDADO! Con cojinetes usados, controlar el par de inicio, con cojinetes nuevos, controlar el par de rotación continua.

F Précharger les paliers au moyen d'anneaux de fixation du côté opposé de la couronne pour augmenter le couple de rotation pignon jusqu'à 140÷210 Ncm.
ATTENTION! Avec les paliers usés, contrôler le couple de pointe; avec les paliers neufs, contrôler le couple de rotation continu.

c

ITA Posizionare, attraverso il foro per il tappo superiore (10), un comparatore a tasto orientabile "**A**".
Posizionarlo sul centro di un dente della corona (12), precaricarlo di circa 1 mm ed azzerarlo.

D Durch das Loch des oberen Stopfens (10) eine schwenkbare Meßuhr "**A**" in der Mitte eine Kranzzahnes (12) anbringen. Die Meßuhr auf 1 mm vorladen und auf Null stellen.

ESP Posicionar, a través del orificio para el tapón superior (10), un comparador de tecla orientable "**A**".
Posicionarlo en el centro de un diente de la corona (12), precargarlo de aproximadamente 1 mm y ponerlo a cero.

F Placer, par le trou du bouchon supérieur (10), un comparateur à touche orientable "**A**".
Placer ce dernier au centre d'une dent de la couronne (12), précharger d'environ 1 mm, puis le mettre à zéro.

d

ITA Muovere manualmente nei due sensi la corona (12) per controllare il gioco esistente tra pignone e corona.

D Den Kranz (12) von Hand in beide Richtungen bewegen und das Spiel zwischen Rad und Kranz prüfen.

ESP Mover manualmente en los dos sentidos la corona (12) para controlar el juego que hay entre el piñón y la corona.

F Déplacer la couronne (12) manuellement dans les deux sens pour contrôler le jeu existant entre pignon et couronne.

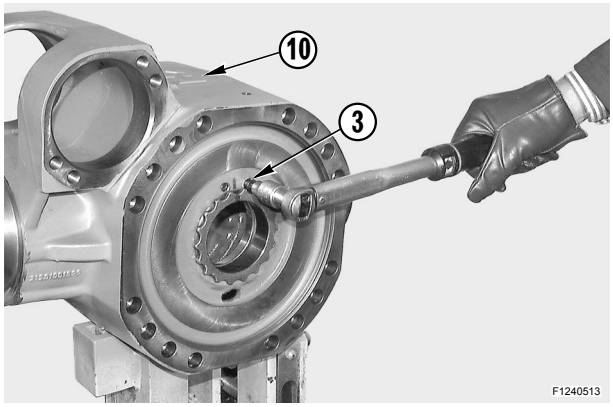
e

ITA Regolare il gioco tra pignone e corona allentando una ghiera (1) e serrando la ghiera opposta in egual misura.
Gioco normale: vedere tabella.

D Das Spiel zwischen Rad und Kranz einstellen; dazu eine Nutmutter (1) lockern und die entgegengesetzte Nutmutter auf dieselbe Weise zuschrauben.
Normales Spiel: siehe Tabelle.

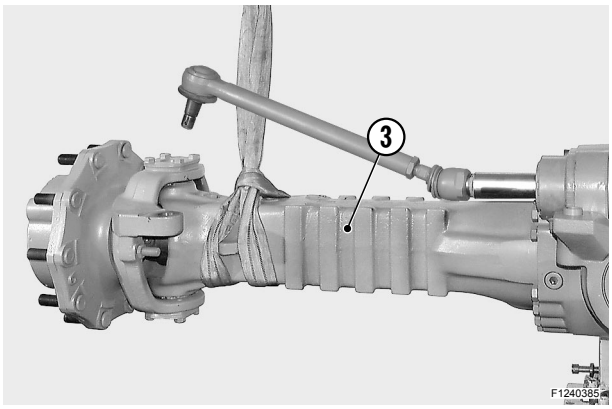
ESP Regular el juego entre el piñón y la corona aflojando una virola (1) y apretando la virola opuesta en la misma medida.
Juego normal: véase la tabla.

F Régler le jeu entre pignon et couronne en desserrant un collier de serrage (1) puis en serrant le collier de serrage opposé avec la même mesure de jeu.
Jeu normal: voir tableau.



GB a

Apply Loctite 242 to the screws (3), fit them into one of the two holes and tighten.
Torque wrench setting: 23.8–26.2 Nm
Fit the top plug (10) after applying repositionable jointing compound for seals to the rims.



GB b

Re-install the complete arms.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISKS».

a

ITA Spalmare le viti (3) con Loctite 242 ed avvitarle in uno dei due fori predisposti.
Coppia di serraggio: 23,8÷26,2 Nm
Montare il tappo superiore (10) dopo aver spalmato i bordi con mastice per guarnizioni riposizionabile.

D Die Schrauben (3) mit Loctite 242 schmieren und in eines der beiden vorgesehenen Löcher schrauben.
Anzugsmoment: 23,8÷26,2 Nm
Die Ränder des oberen Stopfens (10) mit Klebstoff für verstellbare Dichtungen schmieren und den Stopfen montieren.

ESP Pasar Loctite 242 en los tornillos (3) y atornillarlos en uno de los dos orificios predispuestos.
Par de torsión: 23,8÷26,2 Nm
Montar el tapón superior (10) después de repasar los bordes con pasta para juntas reposicionable.

F Enduire les vis (3) avec du Loctite 242, puis visser celles-ci dans l'un des deux trous prédisposés.
Couple de serrage: 23,8÷26,2 Nm
Monter le bouchon supérieur (10) après avoir enduit les bords avec mastic pour garnitures à remettre en place.

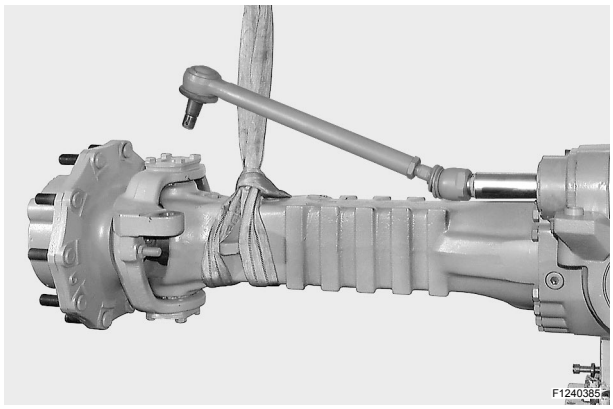
b

ITA Rimontare i bracci completi.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO».

D Die beiden kompletten Arme montieren.
Siehe «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN».

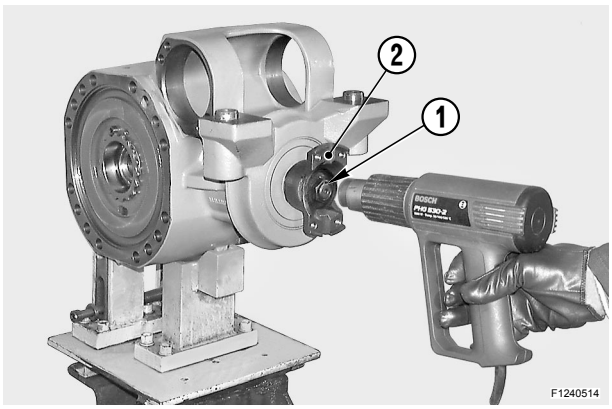
ESP Volver a montar los brazos completos.
Para los detalles, véase «CONTROL DEL DESGASTE Y SUSTITUCION DE LOS DISCOS DEL FRENO».

F Remonter les bras complets.
Pour de plus amples détails, voir «CONTROLE USURE ET SUBSTITUTION DES DISQUES DE FREINAGE».



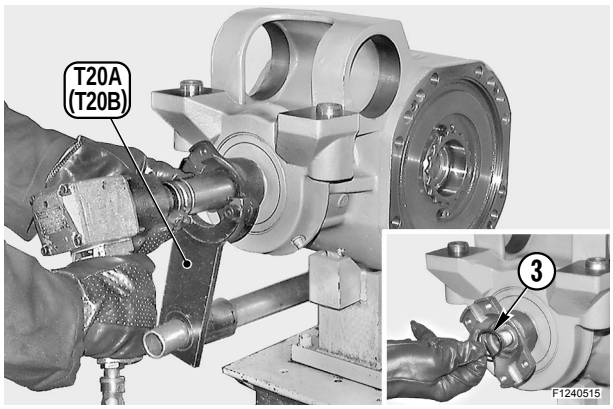
GB a

Remove the complete arms and the differential unit.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISKS» and «REMOVING THE DIFFERENTIAL UNIT».



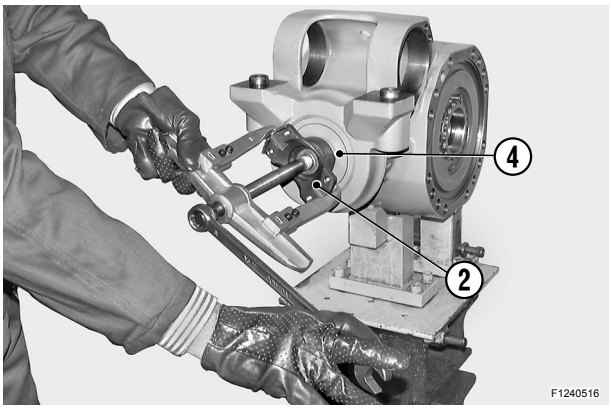
GB b

If disassembly is awkward, heat the check nut (1) of the flange (2) at 80°C.
NOTE. Heating is meant to unloose the setting of Loctite on the nut (1).



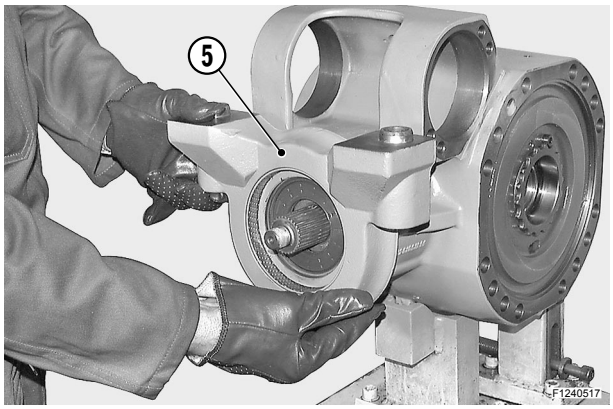
GB c

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



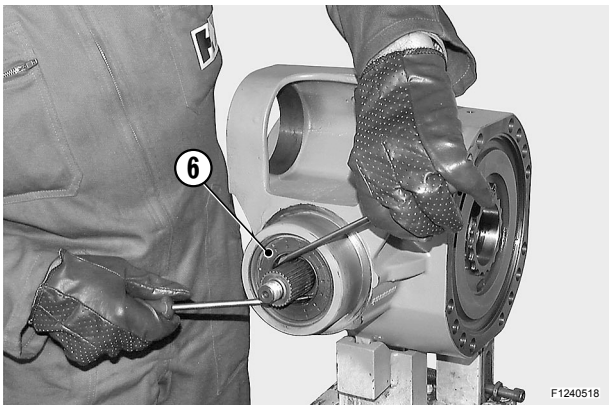
GB d

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



GB e

Remove the swinging support (5).



GB f

Remove the sealing ring (6).

a

ITA Rimuovere i bracci completi ed il differenziale.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO» e «RIMOZIONE GRUPPO DIFFERENZIALE».

D Komplette Arme und Differential abnehmen.
Siehe «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN» und «DIFFERENTIALAGGREGAT ABMONTIEREN».

ESP Remover los brazos completos y el diferencial.
Para los detalles véase «CONTROL DESGASTE Y SUSTITUCION DE LOS DISCOS DEL FRENO» y «REMOCION GRUPO DIFERENCIAL».

F Enlever complètement les bras complets et le différentiel.
Pour de plus amples détails, voir «CONTROLE USURE ET SUBSTITUTION DES DISQUES DE FREINAGE» et «DEPOSE DU GROUPE DIFFERENTIEL».

b

ITA Se lo smontaggio risulta faticoso, scaldare a circa 80°C il dado (1) di ritegno della flangia (2).
NOTA. Il riscaldamento ha lo scopo di allentare la presa del Loctite di bloccaggio del dado (1).

D Wenn das Abmontieren schwierig ist, die Mutter (1) zur Halterung des Flansches (2) auf ca. 80°C erwärmen.
BEMERKUNG. Durch das Erhitzen wird das Fett aufgeweicht, das die Mutter (1) blockiert.

ESP Si el desmontaje resulta difícil, calentar a unos 80°C la tuerca (1) de retención de la brida (2).
NOTA. El calentamiento tiene la finalidad de aflojar la adhesión del Loctite de bloqueo de la tuerca (1).

F Si démonter est difficile, chauffer l'écrou (1) de fixation de la flasque (2) à environ 80°C.
NOTE. Le chauffage à pour objet de ralentir la prise du Loctite de blocage de l'écrou (1).

c

ITA Applicare l'attrezzo **T20A** (oppure **T20B**) ed impegnarlo in modo da evitare la rotazione del pignone.
Allentare ed asportare il dado (1); asportare anche l'anello OR (3).

D Werkzeug **T20A** (**T20B**) so anbringen, daß das Rad nicht mehr drehen kann.
Mutter (1) lockern und abschrauben; O-Ring (3) ebenfalls abnehmen.

ESP Aplicar la herramienta **T20A** (**T20B**) y bloquearla a fin de evitar la rotación del piñón.
Aflojar y sacar la tuerca (1); sacar también el anillo OR (3).

F Appliquer l'outil **T20A** (ou **T20B**) engager ce dernier de manière à éviter la rotation du pignon.
Relâcher et enlever l'écrou (1) enlever également la garniture OR (3).

d

ITA Utilizzando un estrattore, rimuovere la flangia (2) completa della protezione (4).

D Mit einem Abzieher, Flansch (2) samt Schutzteil (4) abnehmen.

ESP Utilizando un extractor, remover la brida (2) completa con la protección (4).

F A l'aide d'un extracteur, enlever la flasque (2) complète de la protection (4).

e

ITA Rimuovere il supporto oscillante (5).

D Schwenkbare Halterung (5) entfernen.

ESP Remover el soporte oscilante (5).

F Enlever le support oscillant (5).

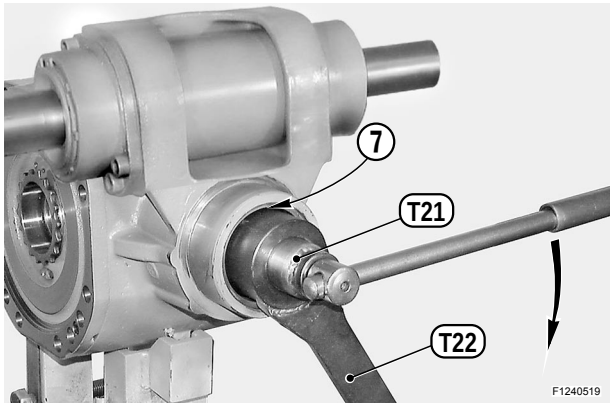
f

ITA Rimuovere l'anello di tenuta (6).

D Kolbenring (6) entfernen.

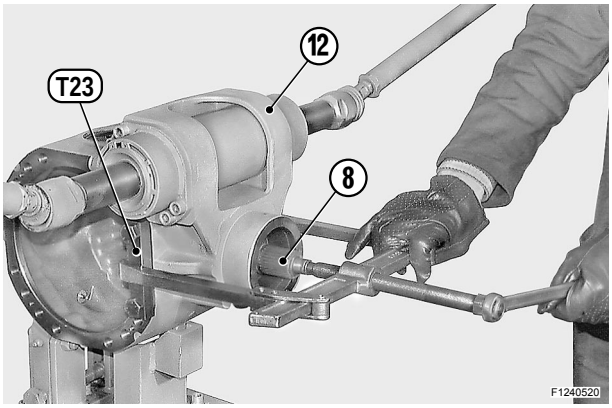
ESP Remover el segmento de compresión (6).

F Enlever la bague d'étanchéité (6).



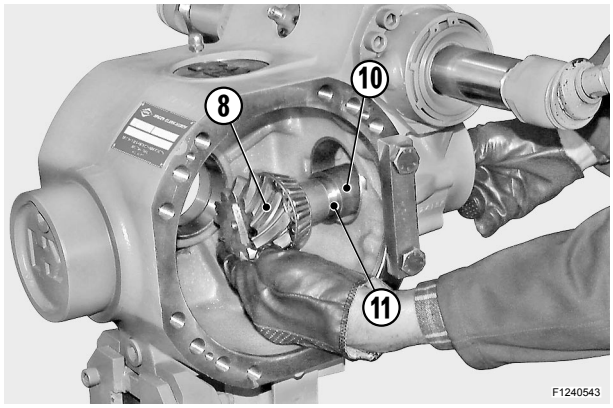
GB a

Position wrench **T22** onto the ring nut (7) and apply bar hold **T21** to the pinion (8).
Stop wrench **T22** and rotate the pinion so as to release and remove the ring nut (7).
NOTE. If disassembly proves awkward, weld the ring nut at approx. 80°C.



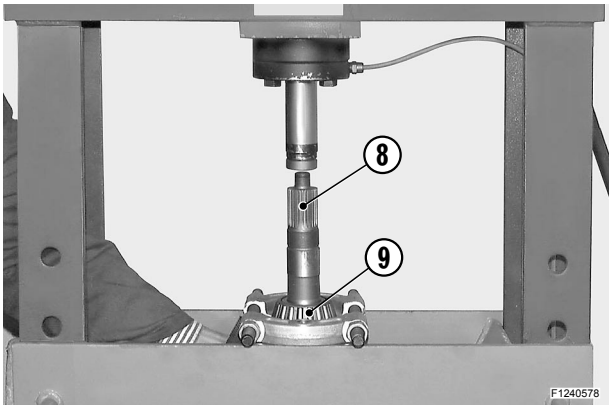
GB b

Apply blocks **T23** and, with the help of a puller, extract the pinion (8) complete with the internal bearing (9), the distance piece (10) and shims (11).
NOTE. The thrust blocks of the bearings remain in the central body (12).



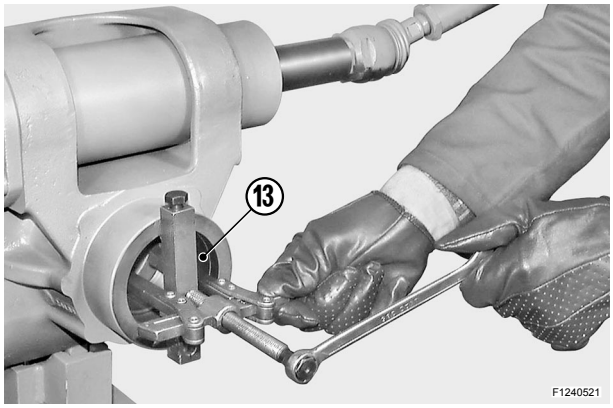
GB c

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



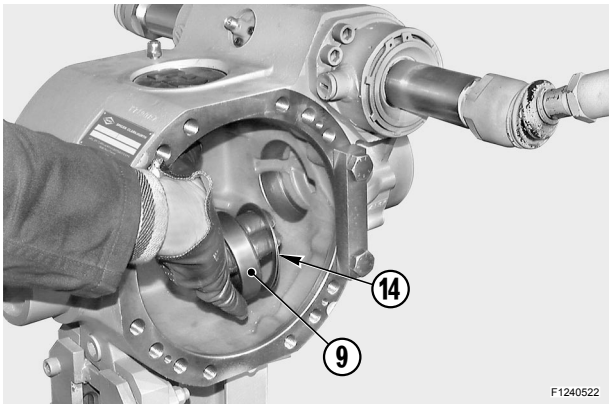
GB d

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



GB e

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



GB f

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

a

ITA Impegnare la chiave speciale **T22** sulla ghiera (7) ed applicare sul pignone (8) il codolo **T21**.
Fermare la chiave **T22** e ruotare il pignone per allentare ed asportare la ghiera (7).
NOTA. Se lo smontaggio risulta faticoso, scaldare la ghiera a circa 80 °C.

D Den speziellen Schlüssel **T22** in die Nutmutter (7) setzen und am Rad (8) den Schaft **T21** anbringen.
Schlüssel **T22** festhalten und das Rad drehen, um die Nutmutter (7) zu lockern und abzunehmen.
BEMERKUNG. Falls die Nutmutter zu fest sitzt, diese auf ca. 80°C erhitzen.

ESP Bloquear la llave especial **T22** en la virola (7) y aplicar en el piñón (8) el mango **T21**.
Bloquear la llave **T22** y girar el piñón para aflojar y extraer la virola (7).
NOTA. Si el desmontaje resulta difícil, calentar la virola a unos 80°C.

F Engager la clé spéciale **T22** sur le collier de serrage (7) et appliquer sur le pignon (8) le cône **T21**.
Bloquer la clé **T22**, tourner le pignon pour relâcher et enlever le collier de serrage (7).
NOTE. Si le désassemblage est rendu difficile, chauffer la bague à une chaleur de 80°C.

b

ITA Applicare i blocchi **T23** e con un estrattore, estrarre il pignone (8) completo del cuscinetto interno (9), del distanziale (10) e degli spessori (11).
NOTA. Le ralle dei cuscinetti rimangono nel corpo centrale (12).

D Die Blöcke **T23** anbringen und mit einem Abzieher das Rad (8) samt dem inneren Lager (9), Distanzstück (10) und der Scheiben (11) herausziehen.
BEMERKUNG. Die Lagerscheiben bleiben im zentralen Körper (12) sitzen.

ESP Aplicar los bloqueos **T23** y con un extractor, extraer el piñón (8) con su cojinete interior (9) del separador (10) y de los posibles espesores (11).
NOTA. Las ranguas de los cojinetes quedan en el cuerpo central (12).

F Appliquer les blocs **T23** et à l'aide d'un extracteur, extraire le pignon (8) complet du palier interne (9), du différentiel (10) et des éventuelles cales (11).
NOTE. Les crapaudines des paliers demeurent dans le corps central (12).

c

ITA Asportare il pignone (8), gli spessori (11) ed il distanziale (10).

D Rad (8), Unterlegscheibe (11) und Distanzstück (10) abnehmen.

ESP Sacar el piñón (8), los espesores (11) y el separador (10).

F Enlever le pignon (8), les cales (11) et l'entretoise (10).

d

ITA Utilizzando un estrattore ed una pressa, rimuovere dal pignone (8) il cuscinetto interno (9).

D Mit einem Abzieher und einer Presse, vom Rad (8) das innere Lager (9) abnehmen.

ESP Utilizando un extractor y una prensa, remover del piñón (8) el cojinete interior (9).

F A l'aide de l'extracteur et d'une presse, ôter du pignon (8) le palier interne (9).

e

ITA Rimuovere la ralla del cuscinetto esterno (13).

D Scheibe vom äußeren Lager (13) abnehmen.

ESP Remover la rangua del cojinete exterior (13).

F Enlever la crapaudine du palier externe (13).

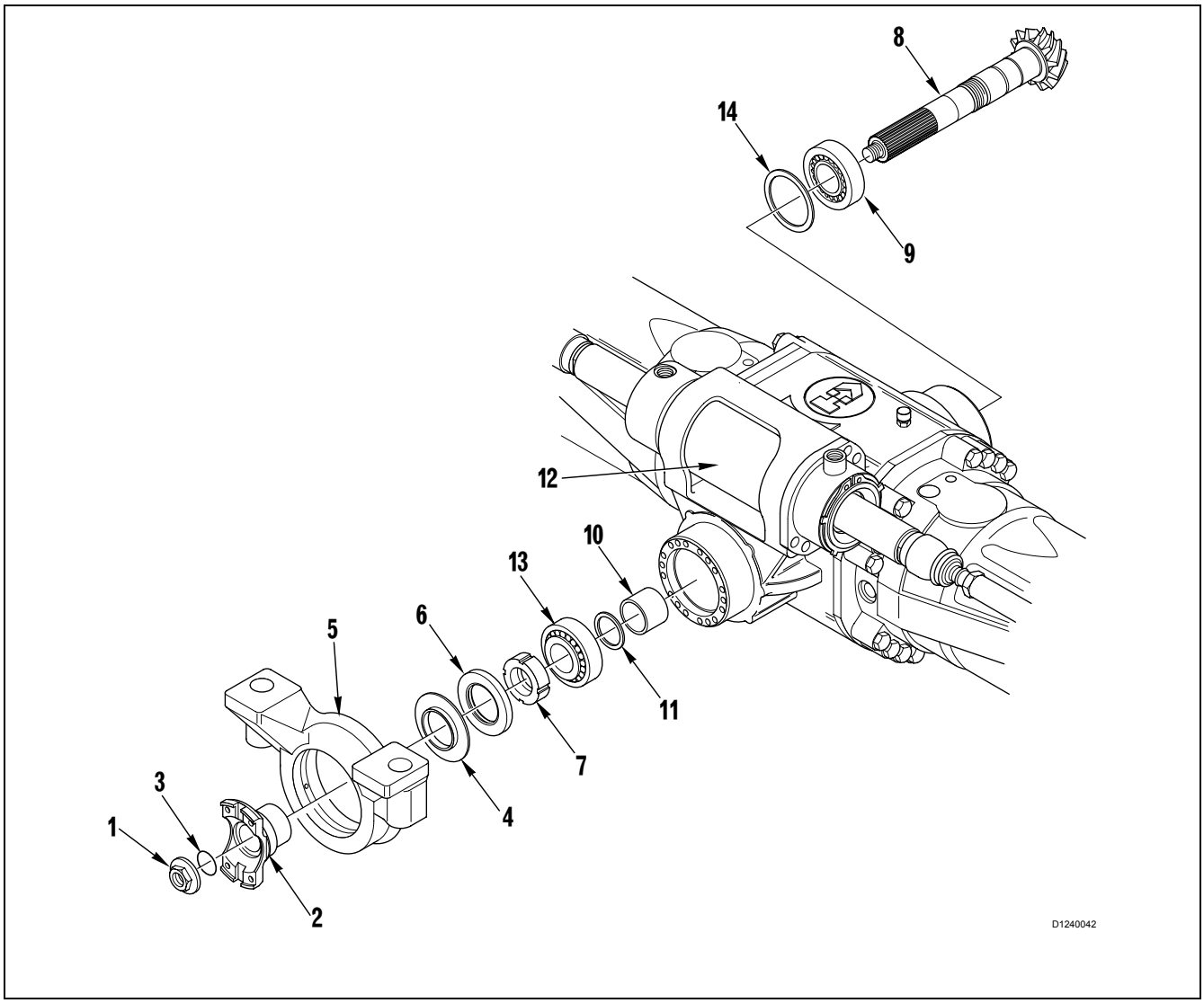
f

ITA Con un punzone inserito nelle cave predisposte, rimuovere la ralla del cuscinetto interno (9) e gli spessori di rasamento (14).

D Einen Dübel in die vorgesehenen Nuten stecken und die Scheibe des inneren Lagers (9) und die Zwischenlegscheiben (14) entfernen.

ESP Utilizando un punzón introducido en las ranuras predispuestas, remover la rangua del cojinete interior (9) y los espesores (14).

F A l'aide d'un poussoir introduit dans le creux prédisposé, enlever la crapaudine du palier interne (9) et les cales de rasage (14).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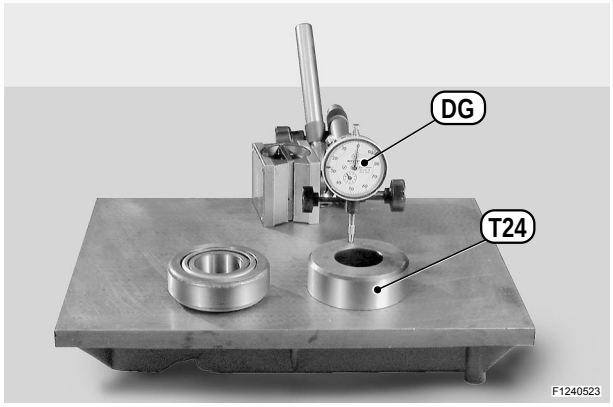
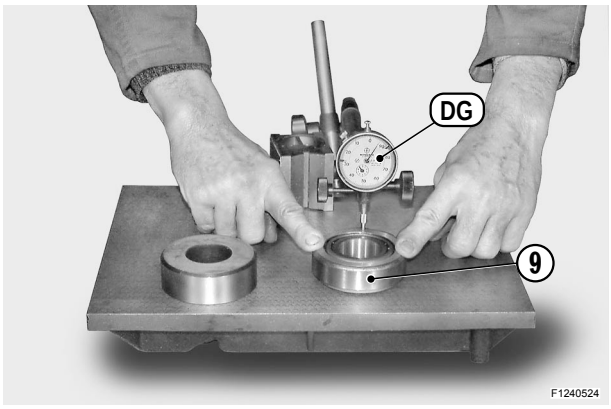


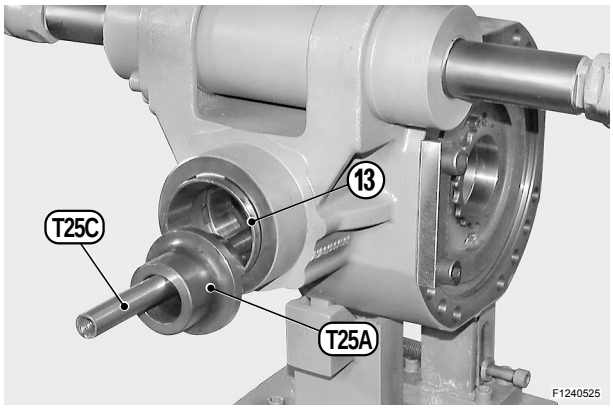
GB a

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



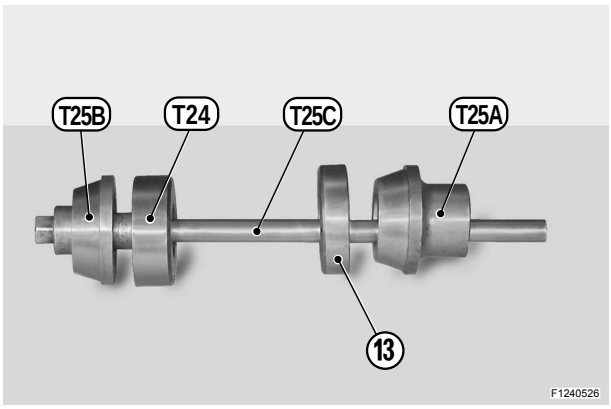
GB b

Bring the internal bearing (9), complete with its thrust block, under the comparator "**DG**".
Determine overall thickness "**D**" of the bearing checking the discrepancy between this size and the size of the measurement ring.
CAUTION! Press the thrust block in the centre and take several measurements while rotating the thrust block.



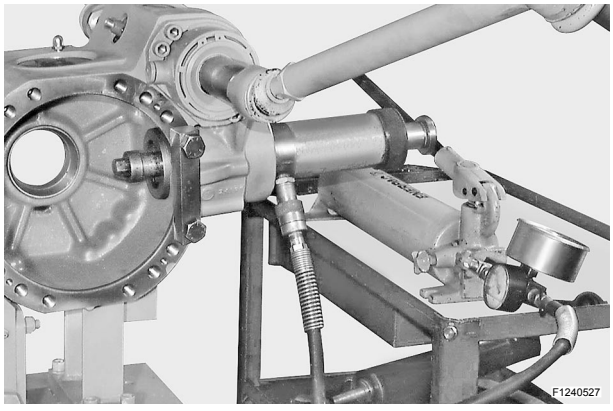
GB c

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



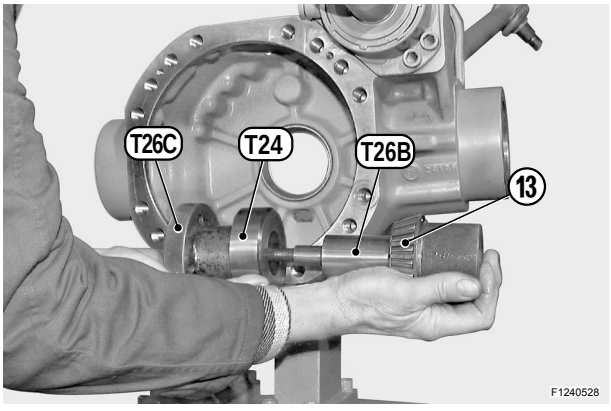
GB d

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



GB e

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.



GB f

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

a

ITA Utilizzando un piano di riscontro, azzerare sull'anello di misura **T24** (di spessore conosciuto pari a 30,2 mm) un comparatore centesimale "**DG**".
Precaricare il comparatore di circa 2 mm.

D Mit Hilfe eines Anschlags am Meßring **T24** (bekannte Stärke 30,2 mm) eine hundertteilige Meßuhr "**DG**" auf Null stellen.
Meßuhr auf 2 mm vorladen.

ESP Utilizando una superficie para la comparación, poner a cero en el anillo de medida **T24** (del que se conoce el espesor igual a 30,2 mm) un comparador centesimal "**DG**".
Precargar el comparador en 2 mm aproximadamente.

F A l'aide d'un plan de comparaison, mettre à zéro sur l'anneau de mesurage **T24** (d'une épaisseur connue égale à 30,2 mm), un comparateur centésimal "**DG**".
Précharger le comparateur d'environ 2 mm.

b

ITA Portare sotto il comparatore "**DG**" il cuscinetto interno (9) completo di ralla.
Determinare lo spessore totale "**D**" del cuscinetto controllando lo scostamento rispetto la misura dell'anello di misura.
ATTENZIONE! Premere la ralla in modo centrato ed eseguire più volte la misurazione ruotando la ralla.

D Unter die Meßuhr "**DG**" das innere Lager (9) samt Scheibe legen.
Gesamte Stärke "**D**" des Lagers messen und die Abweichung im Verhältnis zum Meßring kontrollieren.
ACHTUNG! Die Scheibe muß zentriert sein und den Meßvorgang mehrmals bei gedrehter Scheibe wiederholen.

ESP Poner debajo del comparador "**DG**" el cojinete interior (9) con la rangua.
Determinar el espesor total "**D**" del cojinete controlando la diferencia con respecto al tamaño del anillo de medida.
CUIDADO! Presionar la rangua de manera centrada y ejecutar varias veces la medida girando la rangua.

F Amener sous le comparateur "**DG**" le palier interne (9) équipé de crapaudine.
Définir l'épaisseur totale "**D**" du palier en contrôlant l'écart par rapport à celle mesurée par l'anneau de mesurage.
ATTENTION! Presser la crapaudine vers le centre, puis en effectuer plusieurs fois le mesurage en tournant la crapaudine.

c

ITA Inserire parzialmente nel corpo centrale (12) la ralla del cuscinetto esterno (13).

D Auf den zentralen Körper (12) die Scheibe des äußeren Lagers (13).

ESP Introducir parcialmente en el cuerpo central (12) la rangua el cojinete exterior (13).

F Introduire, partiellement dans le corps central (12), la crapaudine du palier externe (13).

d

ITA Montare il tirante **T25C**, l'anello di misura **T24**, ed infine l'attrezzo anteriore **T25A** di guida della ralla (13) del cuscinetto esterno.

D Die Spannstange **T25C**, den Meßring **T24**, und zuletzt das vordere Werkzeug **T25A** zur Führung der Scheibe (13) des äußeren Lagers montieren.

ESP Montar el tirante **T25C**, el anillo de medida **T24**, y por último la herramienta anterior **T25A** guía de la rangua (13) del cojinete exterior.

F Monter la tringle **T25C**, l'anneau de mesurage **T24**, et enfin l'outil antérieur **T25A** de guidage de la crapaudine (13) du palier externe.

e

ITA Collegare il tirante alla pressa e mandare in sede la ralla del cuscinetto esterno (13).
Scollegare la pressa e rimuovere il tirante.
NOTA. Prima di proseguire, assicurarsi dell'inserimento totale della ralla.

D Spannstange mit der Presse verbinden und die Scheibe in ihren Sitz im äußeren Lager (13) einsetzen.
Von der Presse abnehmen und Spannstange abnehmen.
BEMERKUNG. Sorgfältig kontrollieren, ob die Scheibe richtig eingesetzt worden ist.

ESP Conectar el tirante a la prensa y colocar en el alojamiento la rangua del cojinete exterior (13).
Sacar la prensa y remover el tirante.
NOTA. Antes de continuar, asegurarse de que la rangua está completamente insertada.

F Brancher la tringle à la presse, puis envoyer dans son logement la crapaudine du palier externe (13).
Débrancher la presse et enlever la tringle.
NOTE. Avant de continuer, s'assurer que la crapaudine est complètement insérée.

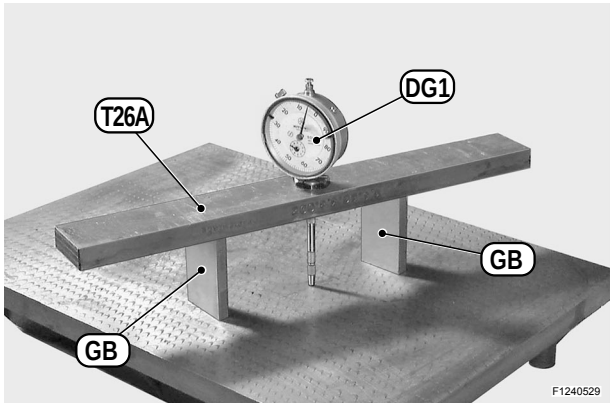
f

ITA Inserire l'attrezzo **T26B** completo di cuscinetto esterno (13) anello di misura **T24** e ghiera di altezza calibrata **T26C**.
Serrare a fondo manualmente.

D Werkzeug **T26B** mit dem äußeren Lager (13), Meßring **T24** und in der Höhe kalibrierte Nutmutter **T26C** einsetzen.
Von Hand festschrauben.

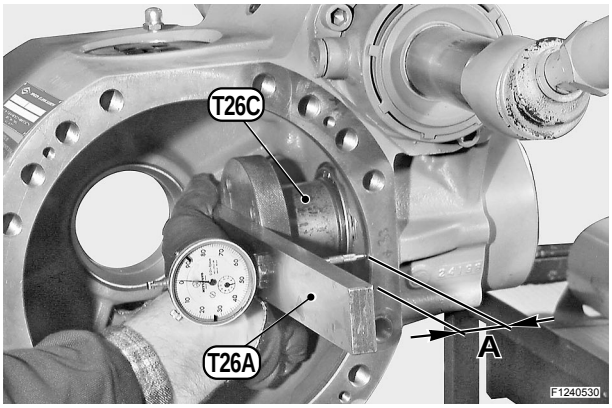
ESP Introducir la herramienta **T26B** con el cojinete exterior (13), el anillo de medida **T24** y la virola de altura calibrada **T26C**.
Apretar a fondo manualmente.

F Introduire l'outil **T26C** équipé du palier externe (13), l'anneau de mesurage **T24** et le collier de serrage de hauteur taraudé **T26C**.
Serrer à fond manuellement.



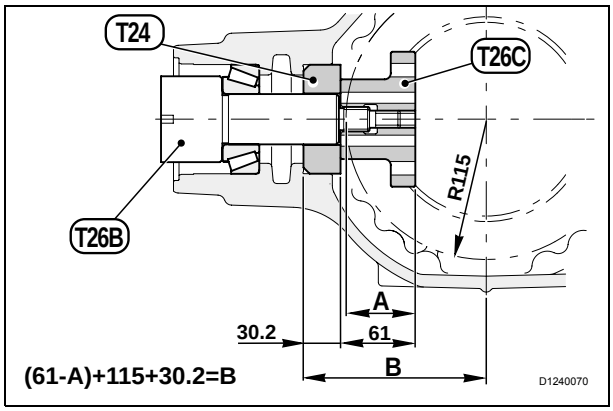
GB — a

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



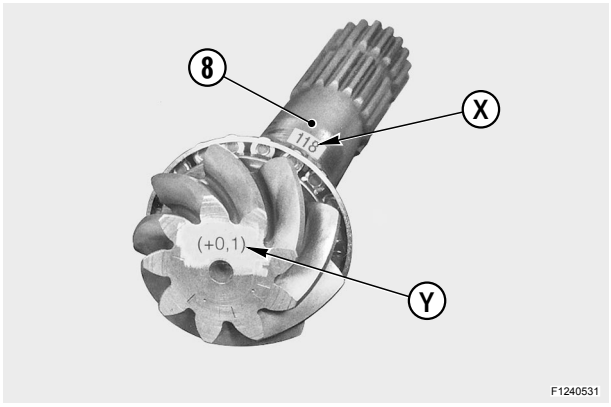
GB — b

Lay bar **T26A** on gauged nut **T26C** and take the size "**A**" at about 57 mm corresponding to the maximum diameter of arms centring.



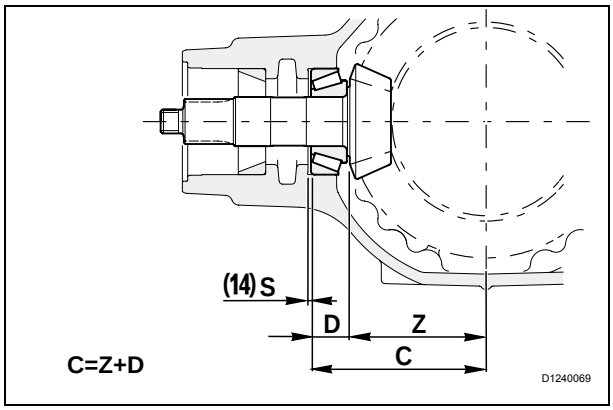
GB — c

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).



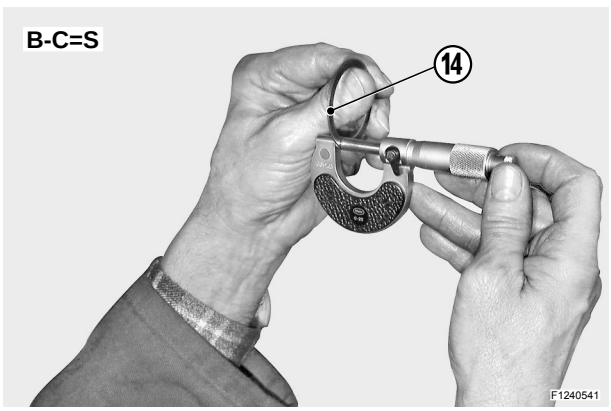
GB — d

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



GB — e

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).



GB — f

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).

a

ITA Montare un comparatore centesimale "**DG1**" con stelo prolungato, nella barra **T26A**; azzerare il comparatore quando la barra appoggia su due blocchetti "**GB**" calibrati da 57 mm.
Precaricare il comparatore di circa 2 mm ed azzerarlo.

D Die hundertteilige Meßuhr "**DG1**" mit dem Verlängerungsstift in den Stab **T26A** montieren; die Meßuhr auf Null stellen, nachdem der Stab auf zwei kalibrierte Blöcke "**GB**" zu 57 mm gelegt worden ist.
Meßuhr auf 2 mm vorladen und auf Null stellen.

ESP Montar un comparador centesimal "**DG1**" con vástago prolongado en la barra **T26A**; poner a cero el comparador cuando la barra está apoyada en dos bloques "**GB**" calibrados de 57 mm.
Precargar el comparador en 2 mm aproximadamente y ponerlo a cero.

F Monter un comparateur centésimal "**DG1**" muni de tige de prolongation dans la barre **T26A**; mettre le comparateur à zéro lorsque la barre posée sur les deux blocs calibrés "**GB**" est à 57 mm.
Précharger le comparateur à environ 2 mm et remettre à zéro.

b

ITA Appoggiare la barra **T26A** sulla ghiera calibrata **T26C** e rilevare la misura "**A**" circa 57mm in corrispondenza del diametro massimo della centratura dei bracci.

D Stab **T26A** auf die kalibrierte Nutmutter **T26C** legen und das Maß "**A**" bei ca. 57 mm am maximalen Durchmesser der Armzentrierung messen.

ESP Apoyar la barra **T26A** en la virola calibrada **T26C** y registrar la medida "**A**" unos 57 mm en correspondencia del diámetro máximo del centraje de los brazos.

F Poser la barre **T26A** sur le collier de serrage taraudé **T26C**, relever la mesure "**A**" à environ 57 mm en correspondance du diamètre de centrage maximal des bras.

c

ITA Eseguire il calcolo per ottenere la prima misura utile "**B**", per il calcolo degli spessori (14) da inserire sotto la ralla del cuscinetto interno (9).

D Das Maß "**B**" ausrechnen, das zur Ermittlung der Distanzstücke (14) dient, die unterhalb der Scheibe des inneren Lagers (9) eingesetzt werden sollen.

ESP Ejecutar el cálculo para obtener la primera medida útil "**B**" para el cálculo de los espesores (14) que hay que insertar debajo de la rangua del cojinete interior (9).

F Faire le calcul pour obtenir la première mesure utile "**B**" pour calculer les cales (14) à introduire au-dessous de la crapaudine du palier interne (9).

d

ITA Controllare la misura nominale (X) segnata sul pignone e sommare o sottrarre ad essa la variazione indicata: (Y) per ottenere la misurazione "**Z**".
Es: Z = 118 + 0,1 = 118,1
Z = 118 – 0,2 = 117,8

D Das Nennmaß (X), das am Rad markiert ist, kontrollieren und die Abweichung addieren oder abziehen. (Y) für das Maß "**Z**".
Beisp.: Z = 118 + 0,1 = 118,1
Z = 118 – 0,2 = 117,8

ESP Controlar la medida nominal (X) marcada en el piñón y sumarle o restarle la variación indicada (Y) para obtener la medida "**Z**".
Ej.: Z = 118 + 0,1 = 118,1
Z = 118 – 0,2 = 117,8

F Contrôler la mesure nominale (X) marquée sur le pignon et additionner ou soustraire à celle-ci la variation indiquée (Y) pour obtenir le mesurage "**Z**".
Exp. Z = 118 + 0,1 = 118,1
Z = 118 – 0,2 = 117,8

e

ITA Calcolare la seconda misura utile "**C**" per il calcolo dello spessore "**S**" da inserire sotto la ralla del cuscinetto interno (9).

D Das zweite Maß "**C**" für das Distanzstück "**S**" ausrechnen, das unter die Scheibe des inneren Lagers (9) eingesetzt werden soll.

ESP Calcular la segunda medida útil "**C**" para el cálculo del espesor "**S**" a insertar debajo de la rangua del cojinete interior (9).

F Calculer la seconde mesure utile "**C**" pour calculer la cale "**S**" à introduire au-dessous de la crapaudine du palier interne (9).

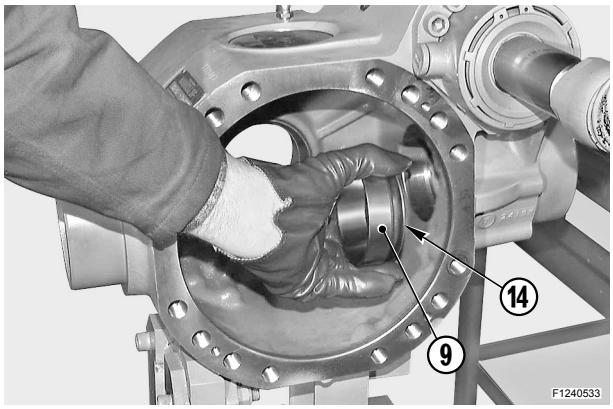
f

ITA Eseguire la differenza tra le misure "**B**" e "**C**" per stabilire la misura "**S**" dello spessore (14) da inserire sotto la ralla del cuscinetto interno (9).

D Den Unterschied zwischen Maß "**B**" und "**C**" ausrechnen, um das Distanzstück "**S**" (14) auszurechnen, das unter die Scheibe des inneren Lagers (9) eingesetzt werden soll.

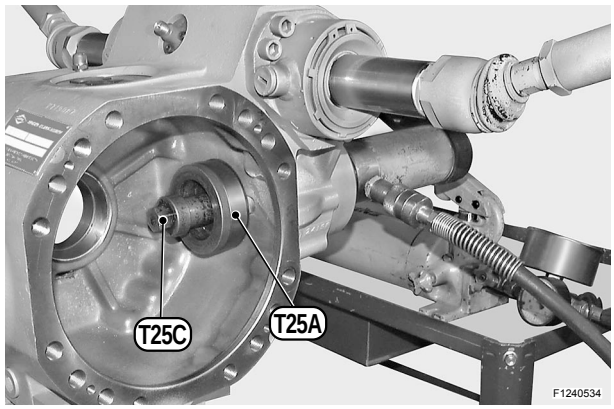
ESP Sacar la diferencia entre las medidas "**B**" y "**C**" para establecer la medida "**S**" del espesor (14) a insertar debajo de la rangua del cojinete interior (9).

F Effectuer la différence entre les mesures "**B**" et "**C**" pour établir la mesure "**S**" de la cale (14) à introduire au-dessous de la crapaudine du palier interne (9).



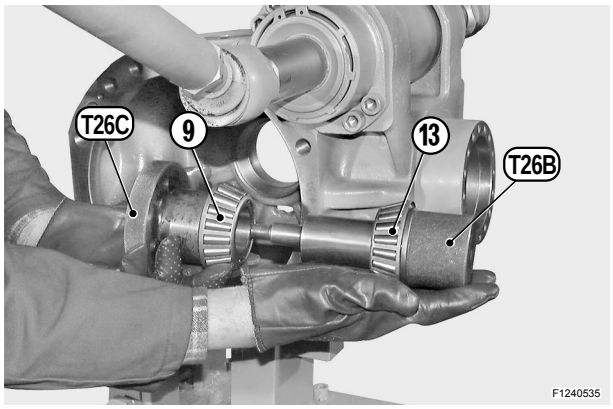
GB a

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.



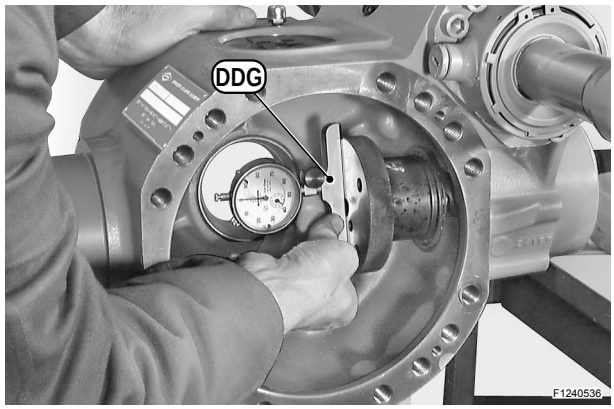
GB b

Position tool **T25A** and tension rod **T25C**.
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.



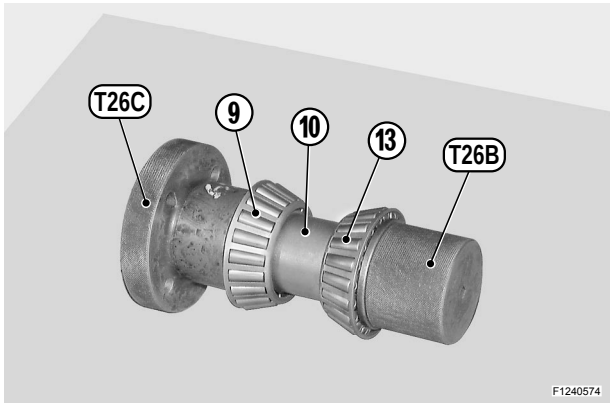
GB c

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



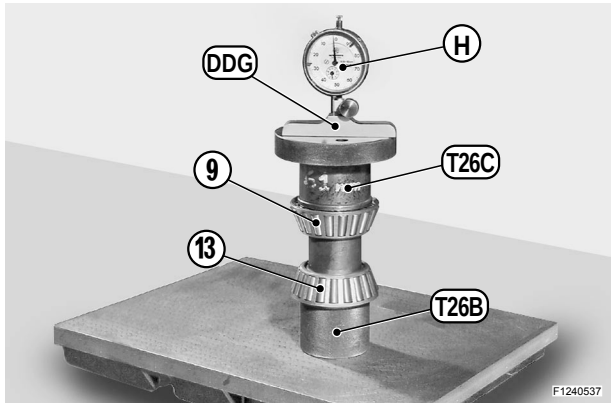
GB d

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



GB e

Remove the comparator and release tools and bearings from the central body.
Re-install all and insert the distance piece (10) between bearings (9) and (13); manually tighten the whole pack.



GB f

Insert depth comparator "**DDG**" into tool **T26B-T26C** and measure variation "**H**" in relation to the zero setting performed back at point d.

a

ITA Inserire nel corpo centrale lo spessore "**S**" (14) e la ralla del cuscinetto interno (9).
NOTA. Per tenere in posizione lo spessore "**S**" (14), spalmarlo leggermente con grasso.

D In den zentralen Körper das Distanzstück "**S**" (14) und die Scheibe des inneren Lagers (9) einsetzen.
BEMERKUNG. Um das Distanzstück "**S**" (14) in seiner Position festzuhalten, dieses leicht mit Fett schmieren.

ESP Introducir en el cuerpo central el espesor "**S**" (14) y la rangua del cojinete interior (9).
NOTA. Para mantener en su posición el espesor "**S**" (14), pasarle ligeramente un poco de grasa.

F Introduire dans le corps central la cale "**S**" (14) et la cale du palier interne (9).
NOTE. Enduire légèrement celle-ci de gras pour la maintenir dans sa position.

b

ITA Montare l'attrezzo **T25A** ed il tirante **T25C**.
Collegare il tirante alla pressa, mandare in battuta la ralla e quindi smontare gli attrezzi.
NOTA. Prima di proseguire, assicurarsi dell'inserimento totale della ralla.

D Werkzeug **T25A** und Spannstange **T25C** montieren. Spannstange mit der Presse verbinden und die Scheibe bis zum Anschlag einsetzen. Danach die Werkzeuge abmontieren.
BEMERKUNG. Sorgfältig kontrollieren ob die Scheibe richtig eingesetzt worden ist.

ESP Montar la herramienta **T25A** y el tirante **T25C**.
Conectar el tirante a la prensa, llevar a tope la rangua y luego desmontar las herramientas.
NOTA. Antes de continuar, asegurarse de que la rangua ha sido totalmente introducida.

F Monter l'outil **T25A** et la tringle **T25C**.
Relier la tringle à la presse, envoyer en butée la crapaudine, puis démonter les outils.
NOTE. Avant de continuer, s'assurer que la crapaudine est entièrement insérée.

c

ITA Inserire gli attrezzi **T26C** e **T26B** completi dei cuscinetti conici (9) e (13); serrare manualmente fino ad avere sicuramente una coppia di rotolamento.

D Die Werkzeuge **T26C** und **T26B** samt Kegellager (9) und (13) einsetzen; von Hand zudrehen bis ein Drehmoment erreicht worden ist.

ESP Introducir las herramientas **T26C** y **T26B** con sus cojinetes cónicos (9) y (13); apretar manualmente hasta obtener con seguridad un par de rodamiento.

F Introduire les outils **T26C** et **T26B** équipés des paliers coniques (9) et (13); serrer manuellement jusqu'à être sûr d'avoir un couple de roulement.

d

ITA Inserire in uno dei due fori laterali dell'attrezzo **T26C** lo stelo di un comparatore di profondità "**DDG**"; azzerare il comparatore con un precarico di circa 3 mm.

D In eines der beiden seitlichen Löcher des Werkzeugs **T26C** den Stift der Meßuhr "**DDG**" stecken; die Meßuhr auf 3 mm vorladen und auf Null stellen.

ESP Introducir en uno de los dos orificios laterales de la herramienta **T26C** el vástago de un comparador de profundidad "**DDG**"; poner a cero el comparador con una precarga de aproximadamente 3 mm.

F Introduire dans l'un des deux trous latéraux de l'outil **T26C**, la tige d'un comparateur de profondeur "**DDG**", mettre le comparateur à zéro avec une précharge d'environ 3 mm.

e

ITA Rimuovere il comparatore e smontare dal corpo centrale il gruppo attrezzi e cuscinetti.
Rimontare il tutto inserendo tra i cuscinetti (9) e (13) il distanziale (10); serrare manualmente l'intero pacco.

D Die Meßuhr abnehmen und vom zentralen Körper die Werkzeuge und Lager abmontieren.
Das ganze wieder montieren und dabei zwischen den Lagern (9) und (13) das Distanzstück (10) einsetzen; von Hand das Ganze festschrauben.

ESP Remover el comparador y desmontar del cuerpo central el grupo de las herramientas y cojinetes.
Volver a montar todo introduciendo entre los cojinetes (9) y (13) el separador (10); apretar manualmente todo el paquete.

F Enlever le comparateur et démonter du corps central le groupe outils et paliers.
Remonter le tout en insérant entre les paliers (9) et (13), l'entretoise (10); serrer tout le paquet à la main.

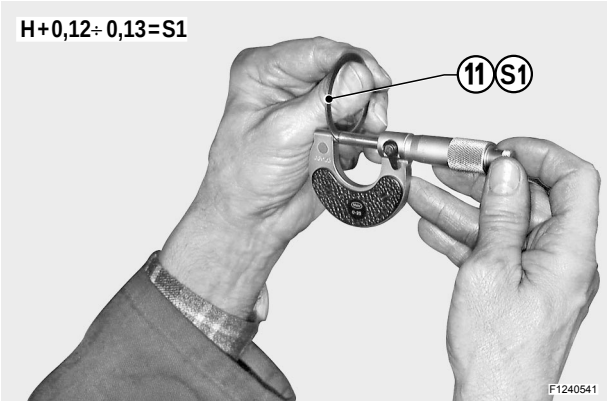
f

ITA Inserire nell'attrezzo **T26B-T26C** il comparatore di profondità "**DDG**" e rilevare lo scostamento "**H**" rispetto l'azzeramento eseguito al punto d.

D In das Werkzeug **T26B-T26C** die Meßuhr "**DDG**" für die Tiefe einsetzen und die Abweichung "**H**" im Verhältnis zur unter Punkt d vorgenommenen Nullstellung messen.

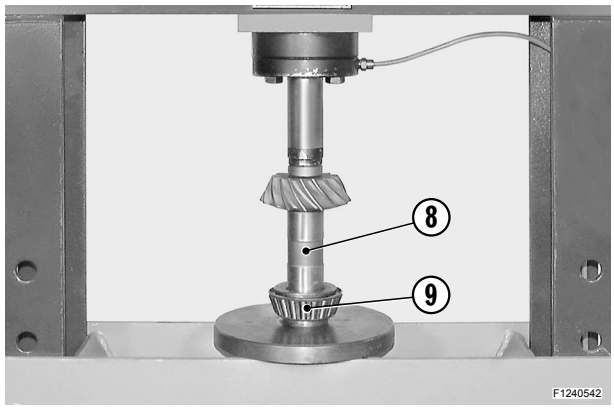
ESP Introducir en la herramienta **T26B-T26C** el comparador de profundidad "**DDG**" y relevar el alejamiento "**H**" respecto al aceramiento efectuado al punto d.

F Introduire l'outil **T26B-T26C** le comparateur de profondeur "**DDG**" et relever l'écart "**H**" par rapport à la mise à zéro effectué au point d.



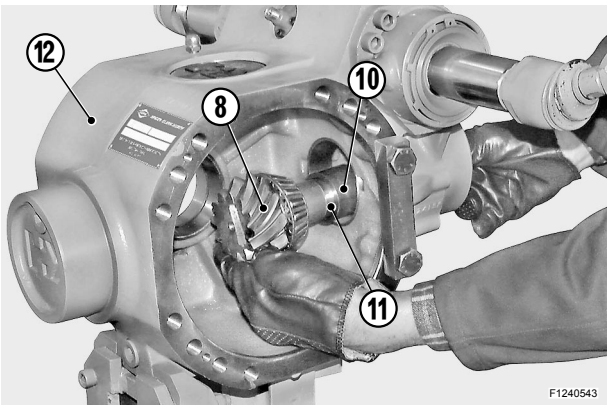
GB a

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



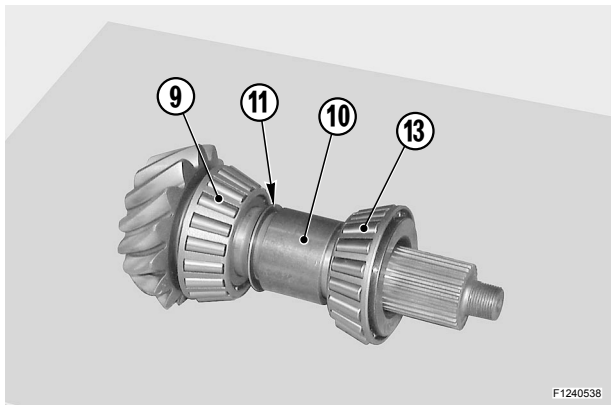
GB b

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



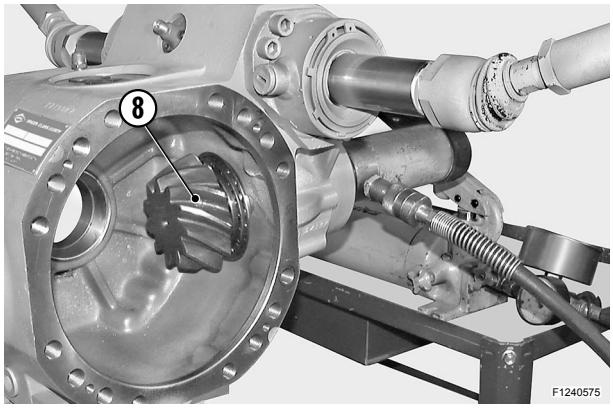
GB c

Fit the pinion (8), shim "**S1**" (11) and distance piece (10) in the main body (12).
NOTE. The finer shims must be placed in- between the thicker ones



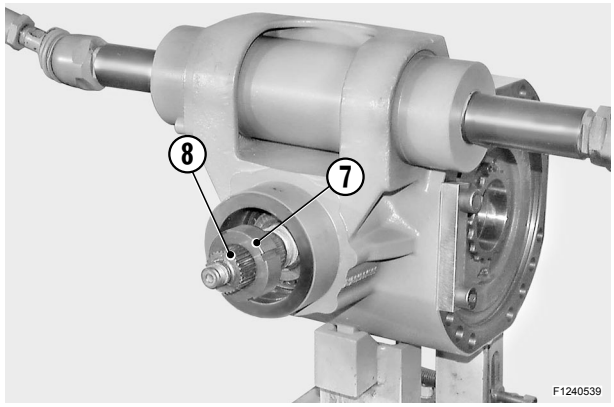
GB d

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



GB e

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



GB f

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

a

ITA Lo scostamento rilevato è da sommare ad una misura fissa di 0,12÷0,13 mm, per ottenere lo spessore "**S1**" (11) da inserire tra cuscinetto esterno (13) e distanziale (10) e quindi, determinare il precarico stabilito per i cuscinetti.

D Die ermittelte Abweichung wird dem festen Maß von 0,12÷0,13 mm hinzu gerechnet, um das Distanzstück "**S1**" (11) zu ermitteln, das zwischen dem äußeren Lager (13) und das Distanzstück (10) eingesetzt werden soll und folglich die benötigte Vorbelastung der Lager festzulegen.

ESP La separación registrada hay que sumarla a una medida fija de 0,12÷0,13 mm para obtener el espesor "**S1**" (11) que hay que introducir entre el cojinete exterior (13) y el separador (10) y luego, determinar la precarga establecida para los cojinetes.

F L'écart relevé est à additionner à une mesure fixe de 0,12÷0,13 mm pour obtenir la cale "**S1**" (11) à introduire entre le palier externe (13) et entretoise (10) et par conséquent déterminer la précharge préconisée pour les paliers.

b

ITA Posizionare il cuscinetto interno (9) e pignone (8) sotto una pressa; forzare sul pignone il cuscinetto.

D Das innere Lager (9) und das Rad (8) unter eine Presse setzen; auf das Rad das Lager drücken.

ESP Posicionar el cojinete interior (9) y el piñón (8) debajo de una prensa; forzar en el piñón el cojinete.

F Placer le palier interne (9) et le pignon (8) sous presse; forcer sur pignon et palier.

c

ITA Montare nel corpo centrale (12), il pignone (8), gli spessori "**S1**" (11) e il distanziale (10).
NOTA. Gli spessori più fini devono essere contenuti tra quelli più spessi.

D Zentralen Körper (12), Rad (8), Unterlegscheibe "**S1**" (11) und Distanzstück (10) montieren.
BEMERKUNG. Die dünneren Unterlegscheiben müssen zwischen den stärkeren gelegt werden.

ESP Montar en el cuerpo central (12) el piñón (8) los espesores "**S1**" (11) y el separador (10).
NOTA. Los espesores más delgados tienen que colocarse entre los más gruesos.

F Monter le corps central (12), le pignon (8), les cales "**S1**" (11) et l'entretoise (10).
NOTE. Les cales plus minces doivent être intercalées parmi les plus épaisses.

d

ITA Inserire nel corpo centrale il cuscinetto esterno (13) in modo da completare il pacco come composto in figura.

D In den zentralen Körper das äußere Lager (13) einsetzen wie in der Abbildung gezeigt.

ESP Introducir en el cuerpo central el cojinete exterior (13) de manera que el paquete quede completo como ha sido formado en la figura.

F Introduire dans le corps central, le palier externe (13), de manière à compléter le paquet comme composé sur la figure.

e

ITA Collegare il pignone (8) al tirante **T28A** e **T28B**; collegare il tirante **T28C** (Vedere attrezzature speciali) alla pressa e mandare in blocco.

D Ritzel (8) mit der Zugstange **T28A** und **T28B** verbinden; Zugstange **T28C** (siehe Spezialausrüstung) mit der Presse verbinden und blockieren.

ESP Conectar el pignon (8) al tirante **T28A** y **T28B**; conectar el tirante **T28C** (Vease herramientas especiales) a la prensa y bloquear.

F Brancher le pignon (8) à la tringle **T28A** et **T28B**; relier la tringle **T28C** (voir installations spéciales) à la presse puis envoyer en butée.

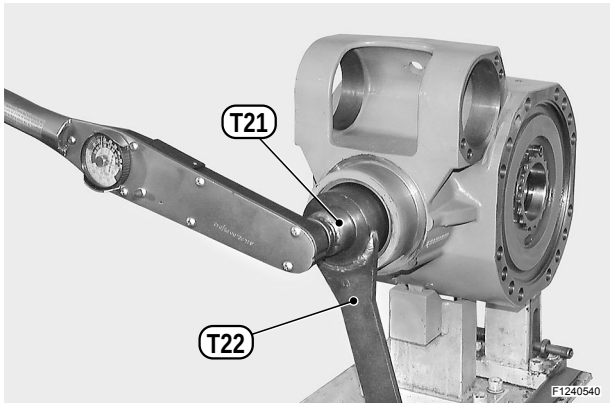
f

ITA Spalmare la filettatura della ghiera (7) con Loctite 242 ed avvitarla sul pignone (8).

D Das Gewinde der Nutmutter (7) mit Loctite 242 schmieren und auf das Rad (8) schrauben.

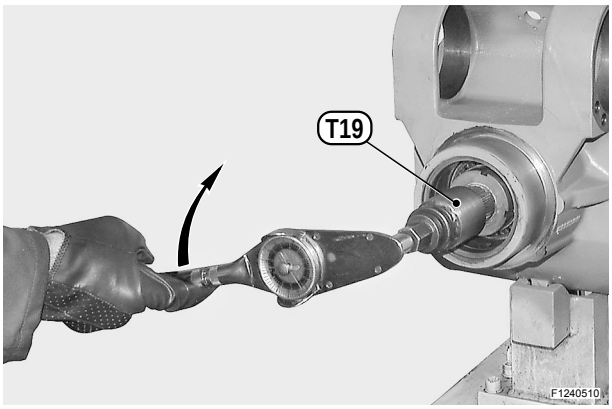
ESP Pasar sobre la rosca de la virola (7) Loctite 242 y atornillarla en el piñón (8).

F Enduire le filetage du collier de serrage (7) avec du Loctite 242, puis visser celui-ci sur le pignon (8).



GB a

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



GB b

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

CAUTION! If torque exceeds the maximum value, then the size of shim "**S1**" (11) between the bearing (13) and the distance piece (10) needs to be increased.
If torque does not reach the set value, increase the torque setting of the ring nut (7) in different stages to obtain a maximum value of 570 Nm.

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

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

a

ITA Impegnare la chiave speciale **T22** sulla ghiera (7) ed applicare il codolo **T21** sul pignone (8).
Fermare la chiave **T22** e ruotare il pignone con una chiave dinamometrica fino alla coppia minima richiesta di 500 Nm.

D Den speziellen Schlüssel **T22** auf die Nutmutter (7) setzen und den Schaft **T21** auf das Rad (8) montieren.
Den Schlüssel **T22** festhalten und das Rad mit einem Momentenschlüssel drehen bis das mindeste Anzugsmoment von 500 Nm erreicht worden ist.

ESP Colocar la llave especial **T22** en la virola (7) y aplicar el mango **T21** en el piñón (8).
Parar la llave **T22** y girar el piñón con una llave dinamométrica hasta el par mínimo requerido de 500 Nm.

F Engager la clé spéciale **T22** sur le collier (7) et appliquer la queue **T21** sur le pignon (8).
Bloquer la clé **T22**, tourner le pignon avec une clé dynamométrique jusqu'au couple minimum requis de 500 Nm.

b

ITA Applicare sul pignone (8) il codolo **T19** e con un torsiometro, controllare la coppia di rotazione del pignone.
Coppia di rotazione: 120÷170 Ncm

ATTENZIONE! Se la coppia supera il valore massimo bisogna aumentare lo spessore "**S1**" (11) tra cuscinetto (13) e distanziale (10).

Se la coppia di rotazione non raggiunge il valore stabilito, aumentare la coppia di serraggio della ghiera (7) in più tempi fino a raggiungere il valore massimo ammesso di 570 Nm.

ATTENZIONE! Se la coppia di rotazione non raggiunge il valore minimo, è necessario diminuire lo spessore "**S1**" (11).

ATTENZIONE! Al fine di poter calcolare gli incrementi o la diminuzione dello spessore "**S1**", è necessario considerare che la variazione dello spessore (11) di 0,01 mm, fa variare la coppia di rotazione del pignone (8) di 60 Ncm.

D Den Shaft **T19** montieren auf das Rad (8) und mit einem Drehungsmesser das Drehmoment des Rads kontrollieren.
Drehmoment: 120÷170 Ncm

ACHTUNG! Falls das Drehmoment größer als der maximale Wert sein sollte, muß ein größeres Distanzstück "**S1**" (11) zwischen Lager (13) und Distanzstück (10) eingesetzt werden.
Falls das Drehmoment den benötigten Wert nicht erreicht, muß das Drehmoment der Nutmutter (7) stufenweise erhöht werden, bis der maximal zugelassene Wert von 570 Nm erreicht worden ist.

ACHTUNG! Falls das Drehmoment den minimalen Wert nicht erreicht, muß das Distanzstück "**S1**" (11) kleiner gewählt werden.

ACHTUNG! Um die Erhöhungen oder Verringerungen des Distanzstücks "**S1**" ausrechnen zu können, muß beachtet werden, daß ein Unterschied von 0,01 mm des Distanzstücks (11), das Drehmoment des Rads (8) um 60 Ncm verändert.

ESP Aplicar el mango **T19** en el piñón (8) y con un torsiómetro, controlar el par de rotación del piñón.
Par de rotación: 120÷170 Ncm

CUIDADO! Si el par supera el valor máximo, hay que aumentar el espesor "**S1**" (11) entre el cojinete (13) y el separador (10).
Si el par de rotación no alcanza el valor establecido, aumentar el par de torsión de la virola (7) varias veces hasta alcanzar el valor máximo admitido de 570 Nm.

CUIDADO! Si el par de rotación no alcanza el valor mínimo, hay que disminuir el espesor "**S1**" (11).

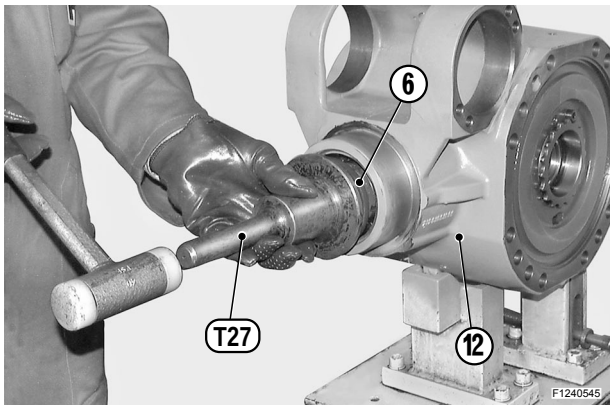
CUIDADO! A fin de poder calcular los incrementos o la disminución del espesor "**S1**", hay que considerar que el espesor (11) de 0,01 mm hace variar el par de rotación del piñón (8) en 60 Ncm.

F Appliquer la queue **T19** sur le pignon (8) et l'aide d'un torsiomètre, contrôler le couple de rotation du pignon.
Couple de rotation: 120÷170 Ncm

ATTENTION! Si le couple dépasse la valeur maximale, il faut augmenter la cale "**S1**" (11) entre palier (13) et entretoise (10).
Si le couple de rotation n'atteint pas la valeur établie, augmenter le couple de serrage du collier de serrage (7) en plusieurs fois jusqu'à atteindre la valeur maximale préconisée de 570 Nm.

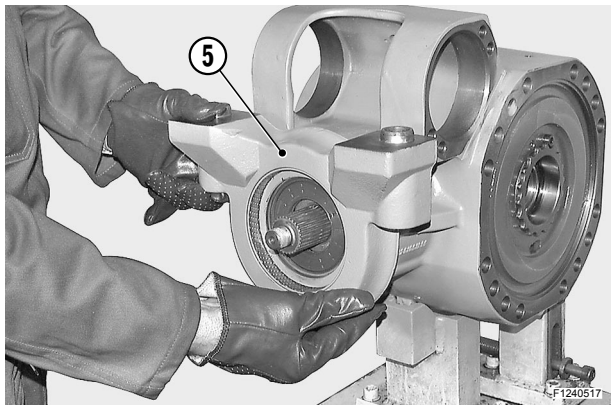
ATTENTION! Si le couple de rotation n'atteint pas la valeur minimale, il faut diminuer la cale "**S1**" (11).

ATTENTION! Pour pouvoir calculer l'incrémentation ou la diminution de la cale "**S1**", il faut tenir compte que la variation de la cale (11) de 0,01 mm, modifie le couple de rotation du pignon (8) de 60 Ncm.



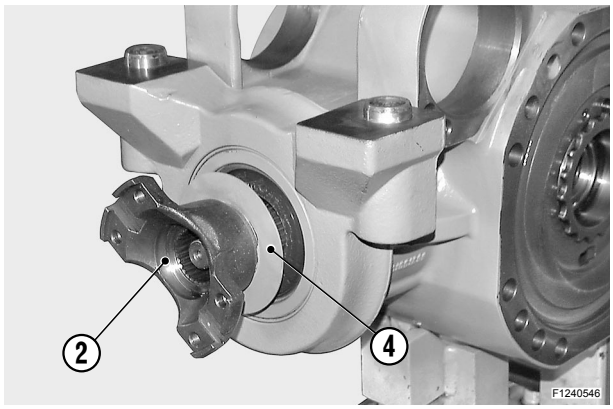
GB a

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



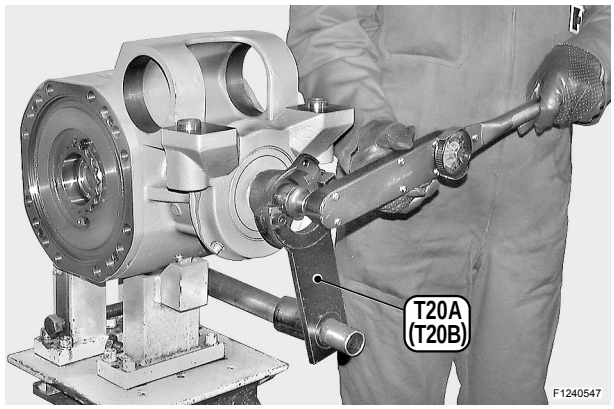
GB b

Install the swinging support (5).
NOTE. Check that it is properly oriented.



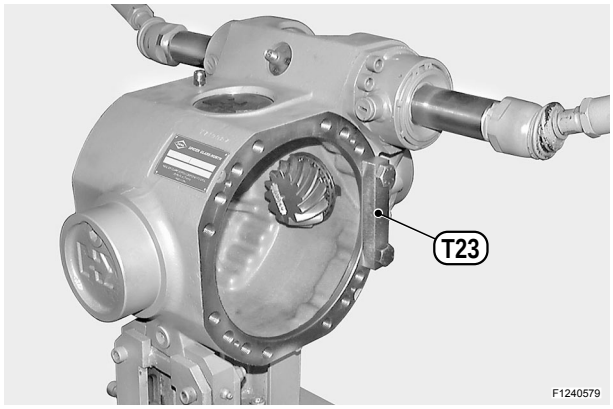
GB c

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



GB d

Apply Loctite 242 to the threaded part of the pinion (8).
Position tool **T20A** (or **T20B**) and fasten it in order to avoid rotation.
Insert O-ring (3) the nut (1) and tighten it using a dynamometric wrench.
Torque wrench setting: 280–310 Nm



GB e

Remove blocks **T23** (used for extracting the pinion) and re-install the arms.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISKS».

a

ITA Lubrificare la superficie esterna del nuovo anello di tenuta (6) e montarlo nel corpo centrale (12) utilizzando l'attrezzo **T27**.

D Die äußere Fläche des neuen Ringes (6) schmieren und den zentralen Körper (12) mit Hilfe des Werkzeugs **T27** montieren.

ESP Lubricar la superficie exterior del nuevo segmento de compresión (6) y montarlo en el cuerpo central (12) utilizando la herramienta **T27**.

F Lubrifier la surface externe de la bague d'étanchéité neuve (6), puis monter celle-ci dans le corps central (12) à l'aide de l'outil **T27**.

b

ITA Montare il supporto oscillante (5).
NOTA: Controllare attentamente l'orientamento.

D Die schwenkbare Halterung (5) montieren.
BEMERKUNG. Richtung sorgfältig kontrollieren.

ESP Montar el soporte oscilante (5).
NOTA. Controlar atentamente la orientación.

F Monter le support oscillant (5).
NOTE. Contrôler attentivement le sens.

c

ITA Montare la flangia (2) completa della protezione (4) e mandarla in battuta.
Se necessario, per il calettamento della flangia (2), usare un mazzuolo in materiale plastico.
NOTA. Controllare che la protezione (4) sia ben forzata sulla flangia e che non sia deformata.

D Flansch (2) samt Schutzteil (4) montieren und bis zum Anschlag bringen.
Wenn nötig, den Flansch (2) mit einem Gummihammer einschieben.
BEMERKUNG. Kontrollieren ob das Schutzteil (4) richtig auf dem Flansch sitzt und nicht verformt ist.

ESP Montar la brida (2) con su protección (4) y llevarla hasta el tope.
Si fuera necesario, para ensamblar de la brida (2) usar un martillo de material plástico.
NOTA. Controlar que la protección (4) está bien forzada en la brida y que no está deformada.

F Monter la flasque (2) équipée de protection (4), puis envoyer celle-ci en butée.
Si besoin, pour caler la flasque (2) utiliser un maillet en matière plastique.
NOTE. Veiller à ce que la protection (4) est bien forcée sur la flasque et qu'elle n'est pas déformée.

d

ITA Spalmare la porzione filettata del pignone (8) con Loctite 242.
Montare l'attrezzo **T20A** (oppure **T20B**) ed impegnarlo per evitare la rotazione. Montare l'anello OR (3) ed il dado (1); serrare con chiave dinamometrica.
Coppia di serraggio: 280÷310 Nm

D Das Gewinde des Rads (8) mit Loctite 242 schmieren.
Das Werkzeug **T20A** (**T20B**) montieren und blokkieren, damit es nicht drehen kann.
O-Ring (3) und Mutter (1) montieren und mit einem Momentenschlüssel festschrauben.
Anzugsmoment: 280÷310 Nm

ESP Pasar en la parte roscada del piñón (8) Loctite 242.
Montar la herramienta **T20A** (o **T20B**) y bloquearla para evitar la rotación.
Montar el anillo OR (3) y la tuerca (1) y apretarlos con llave dinamométrica.
Par de torsión: 280÷310 Nm

F Enduire la partie filetée du pignon (8) avec du Loctite 242. Monter et fixer l'outil **T20A** (ou **T20B**) pour éviter la rotation.
Monter le OR (3) et l'écrou (1), puis serrer à l'aide de la clé dynamométrique.
Couple de serrage: 280÷310 Nm

e

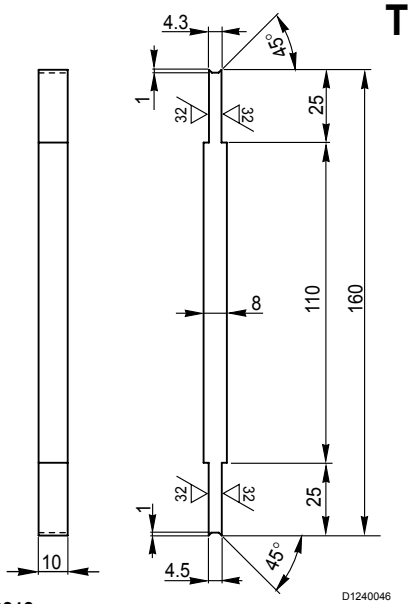
ITA Asportare i blocchi **T23** montati per l'estrazione del pignone e rimontare i bracci.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO».

D Blöcke **T23** abnehmen, die zum Herausnehmen des Rads montiert wurden und Arme wieder montieren.
Siehe «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN».

ESP Sacar los bloques **T23** montados para la extracción del piñón y volver a montar los brazos.
Para los detalles, véase «CONTROL DEL DESGASTE Y SUSTITUCION DE LOS DISCOS DEL FRENO».

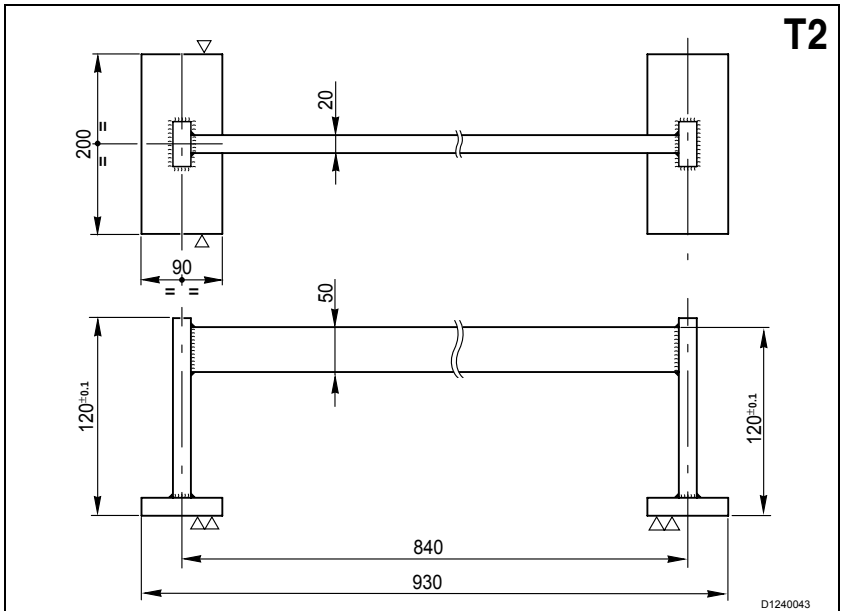
F Enlever les blocs **T23** montés pour l'extraction des pignons, puis remonter les bras.
Pour de plus amples détails, voir «CONTROLE DE L'USURE ET SUBSTITUTION DES FREINS».

T1



2313

T2



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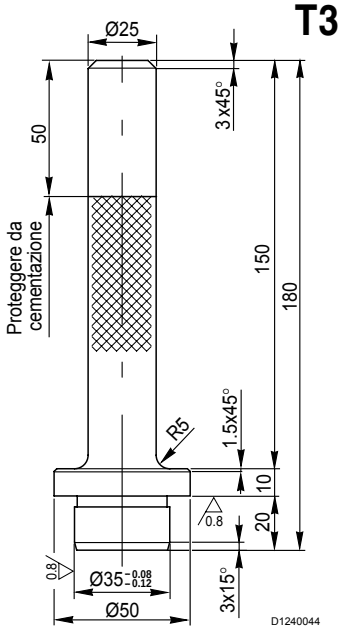
T3



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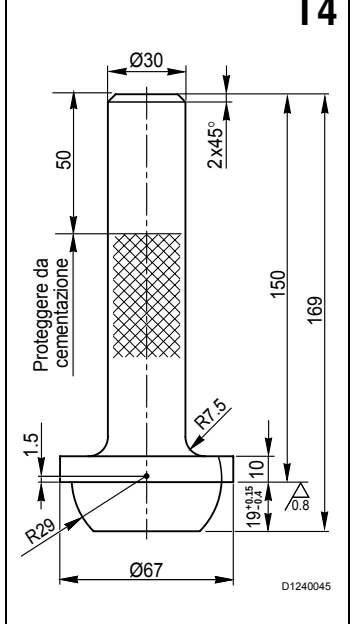
T4



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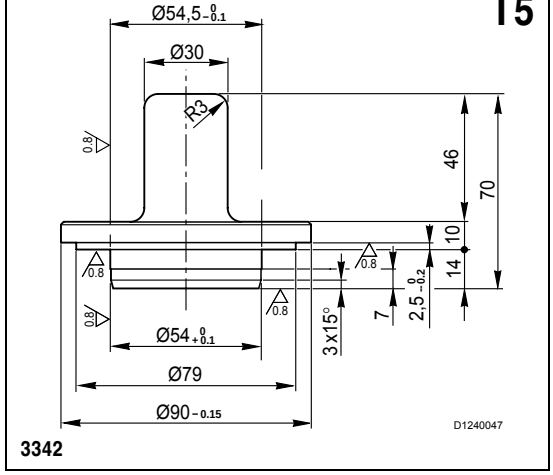
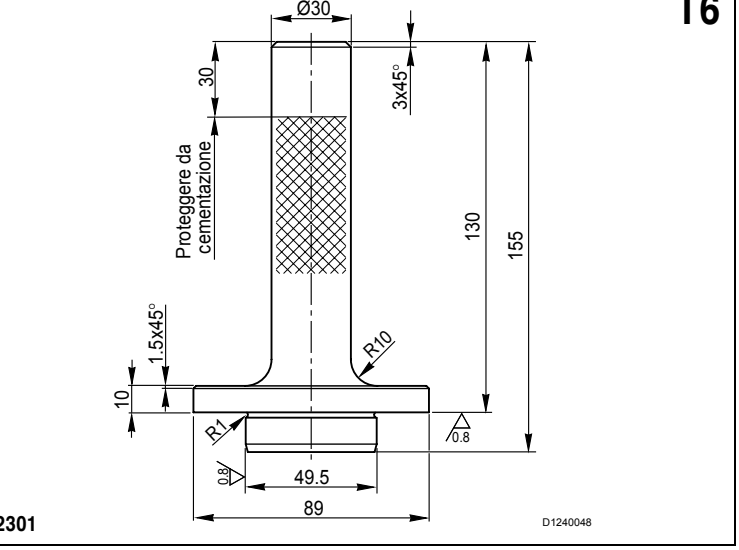
T5



3342

T6



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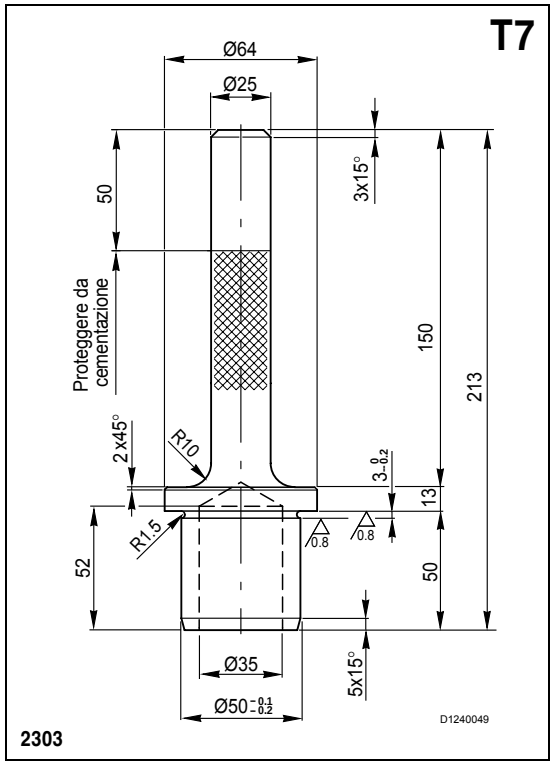
T7



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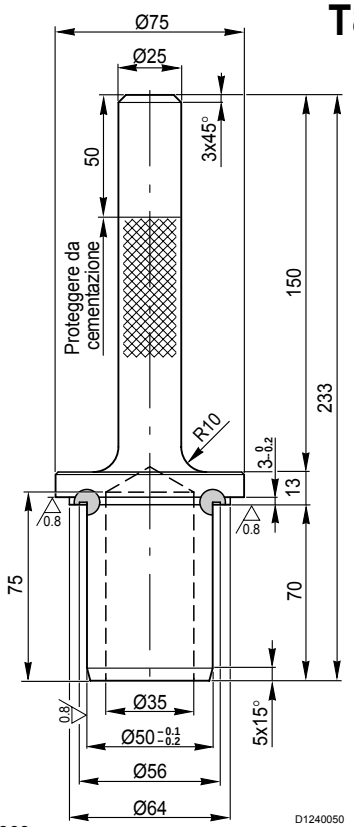

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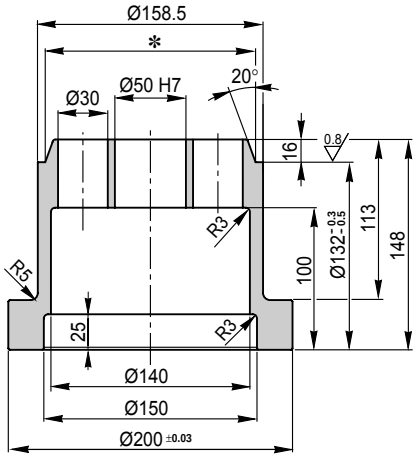
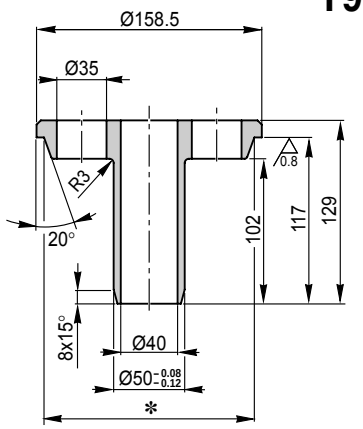
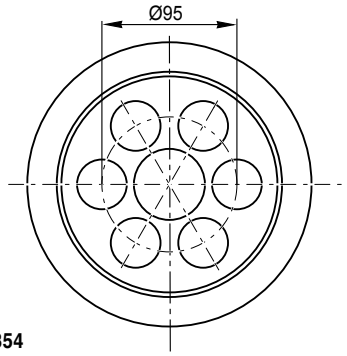
T9







*Ø148 For Timken thrust block
Per ralla TIMKEN
Für TIMKEN scheibe
Para rangua TIMKEN
Pour ralla TIMKEN

Ø150 For Koyo thrust block
Per ralla KOYO
Für KOYO scheibe
Para rangua KOYO
Pour ralla KOYO

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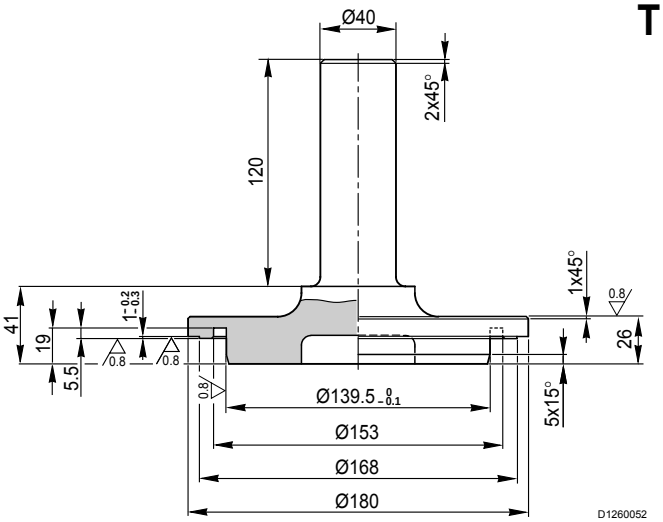
3354

T10



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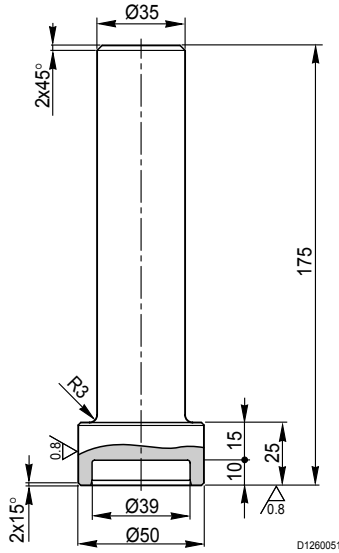

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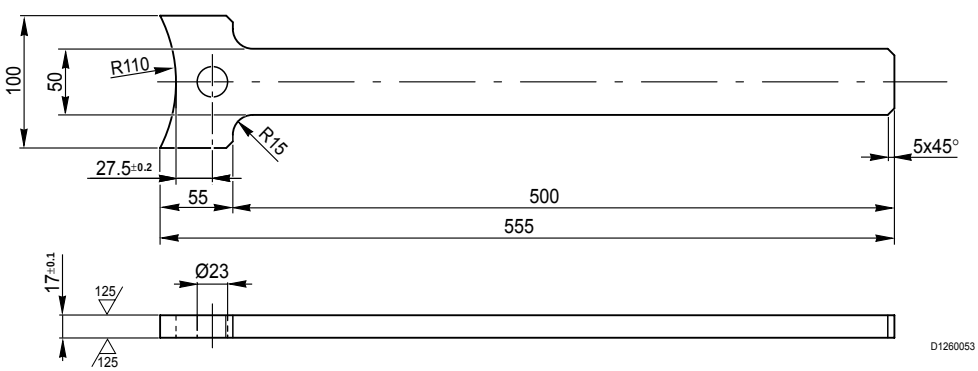

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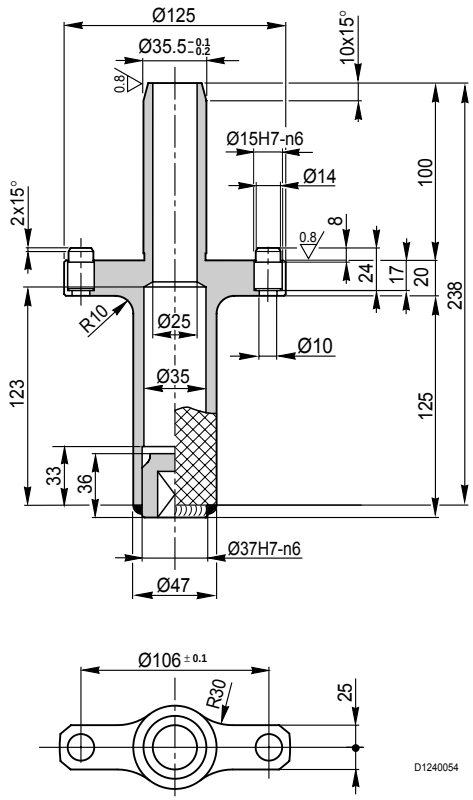

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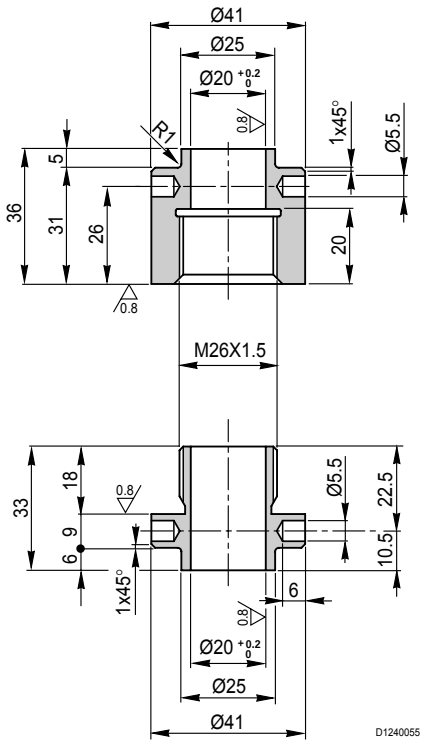

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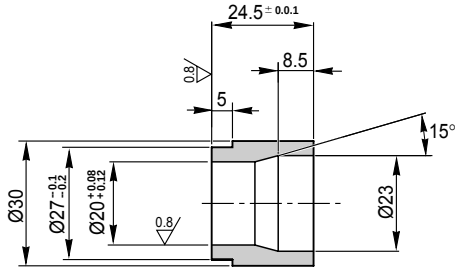

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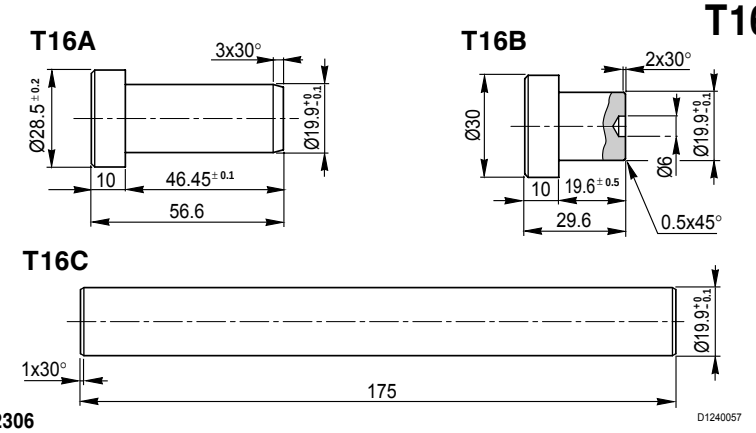

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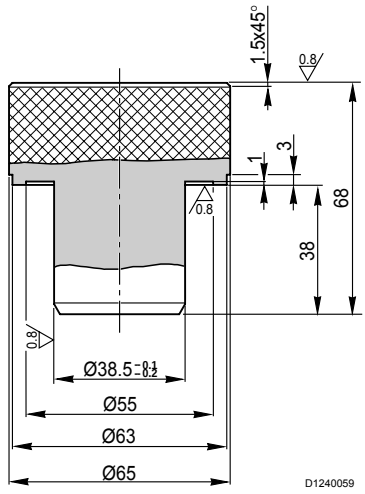

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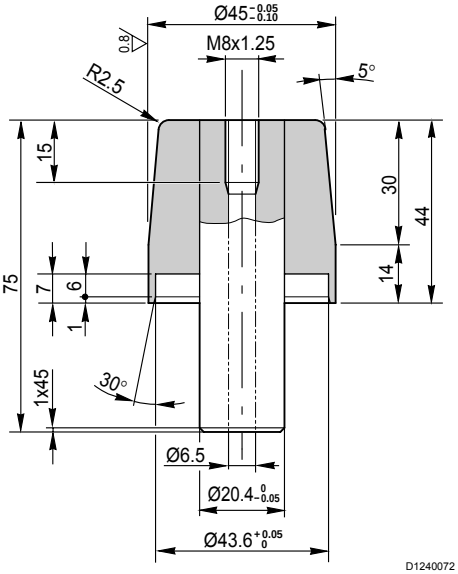
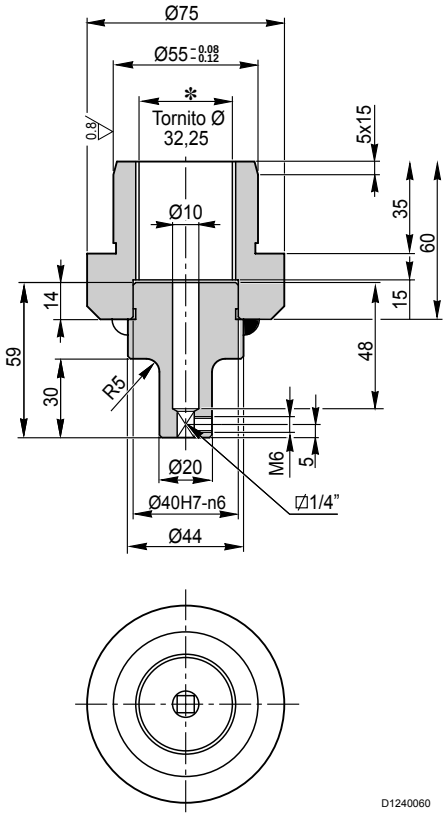


2724

T19

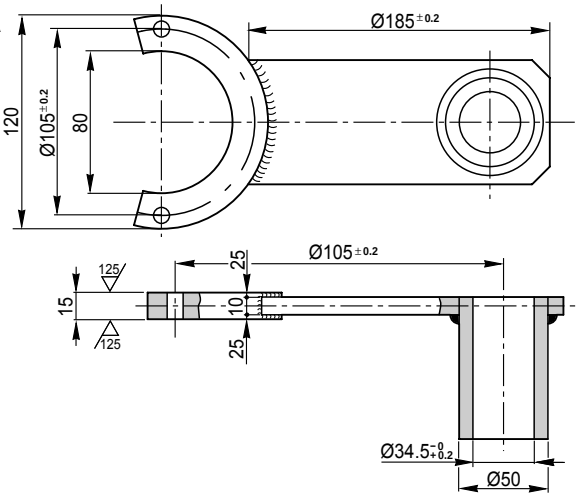
✻38x1.25x29 DIN 5480



3317/4

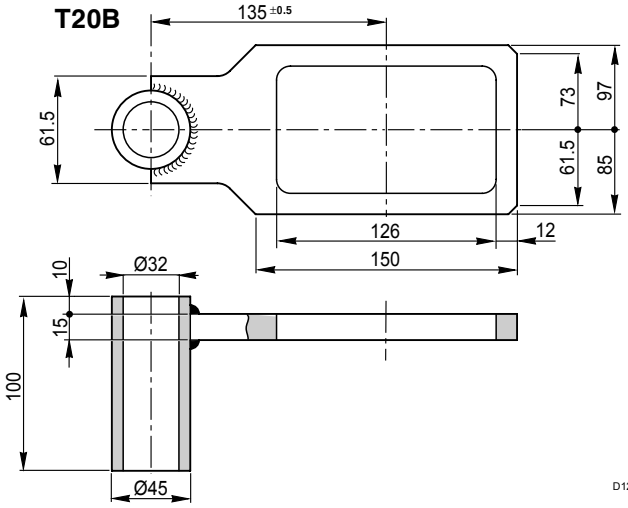
T20

T20A



2307

T20B



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T21

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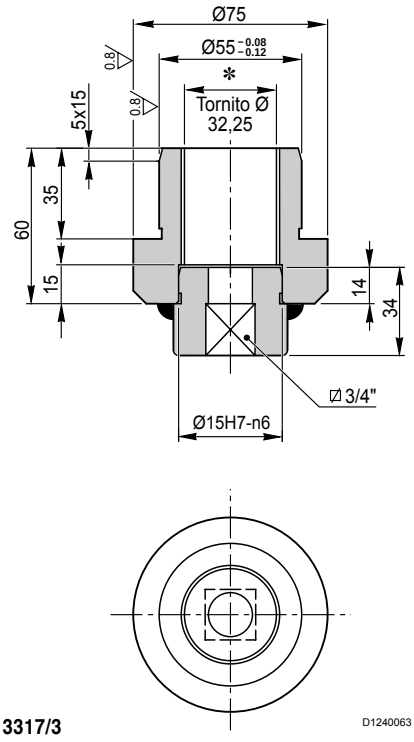

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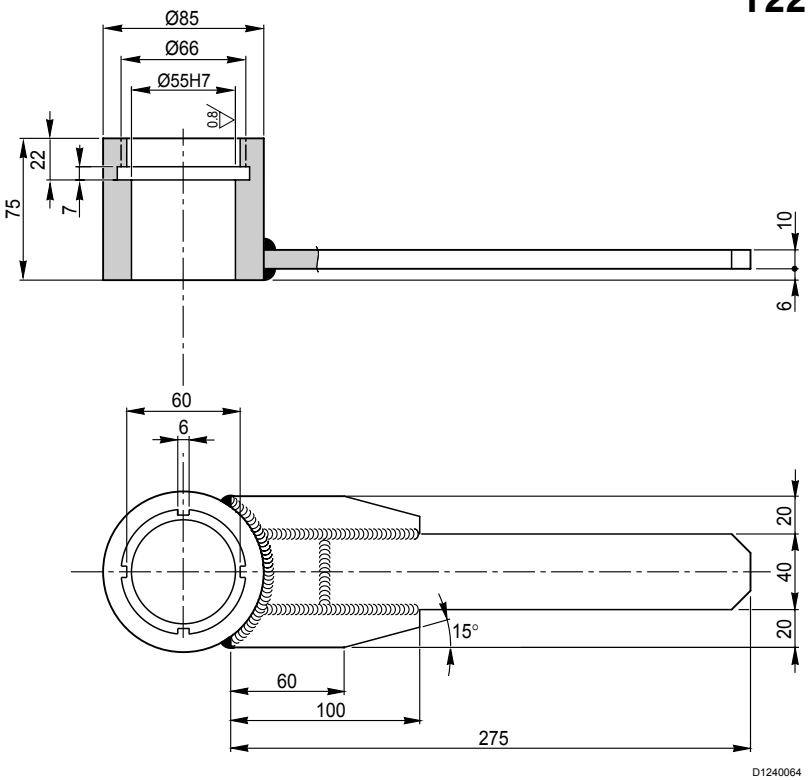
T22



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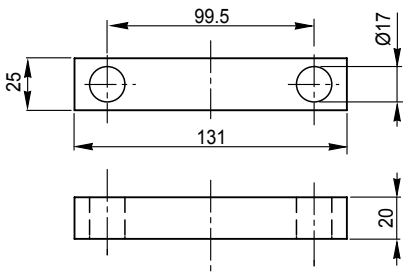
T23



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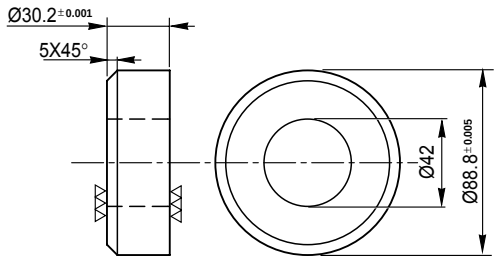

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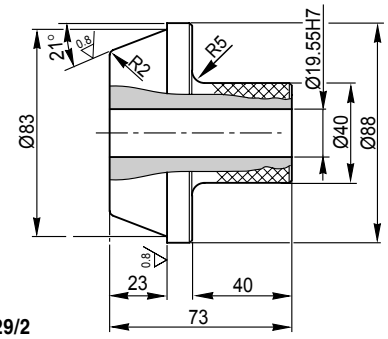
T25

T25A



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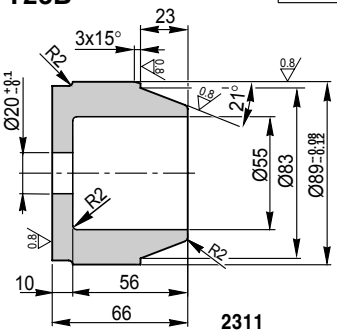
T25B



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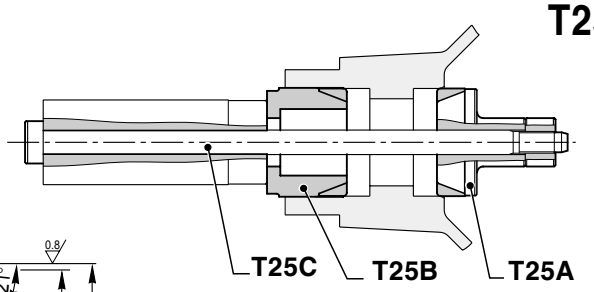

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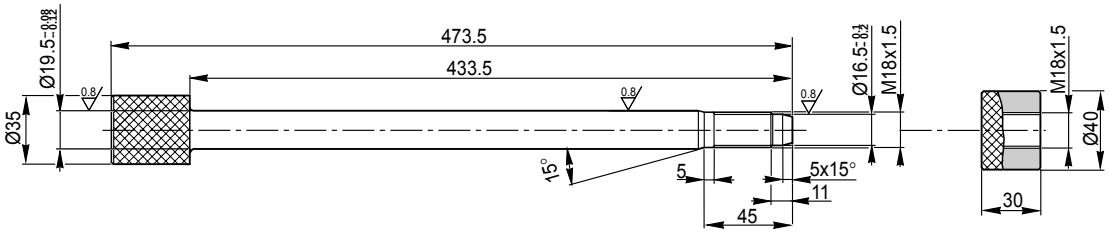

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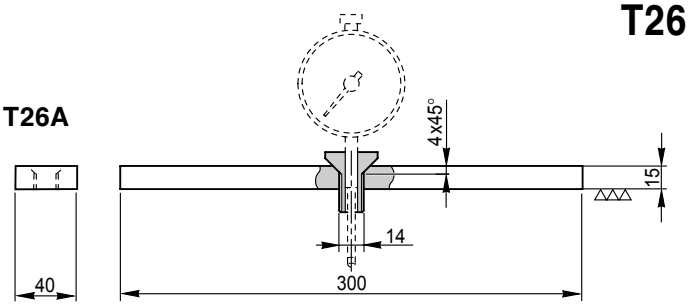
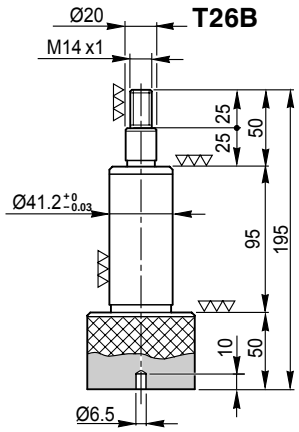
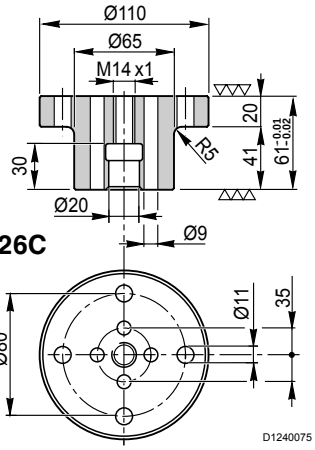
T26

T26A



T26B





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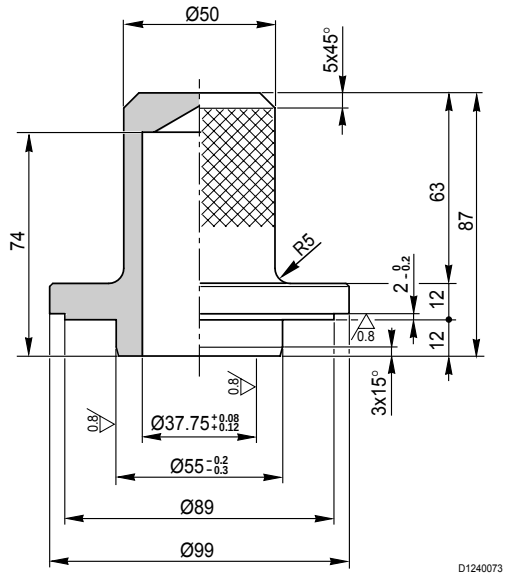

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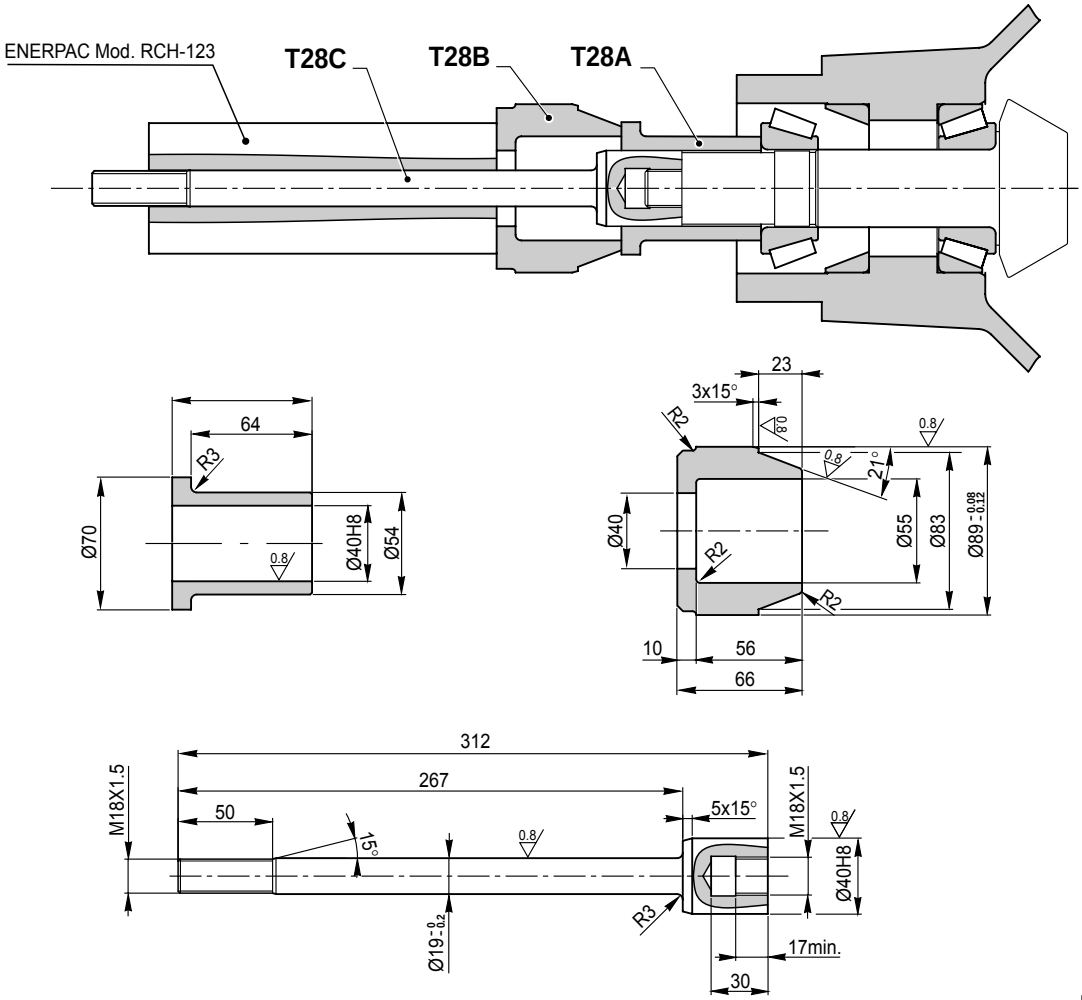
T28



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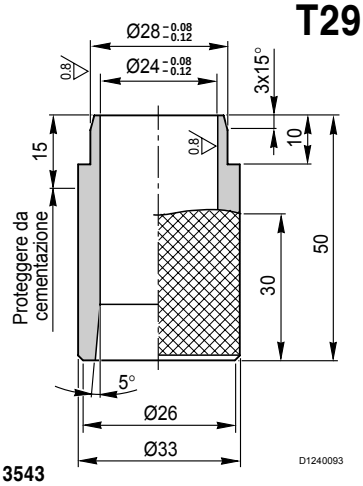
T29



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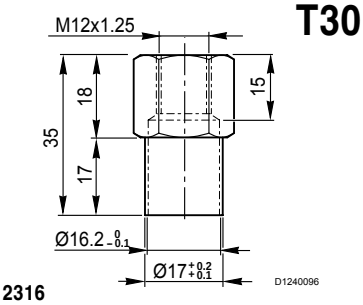

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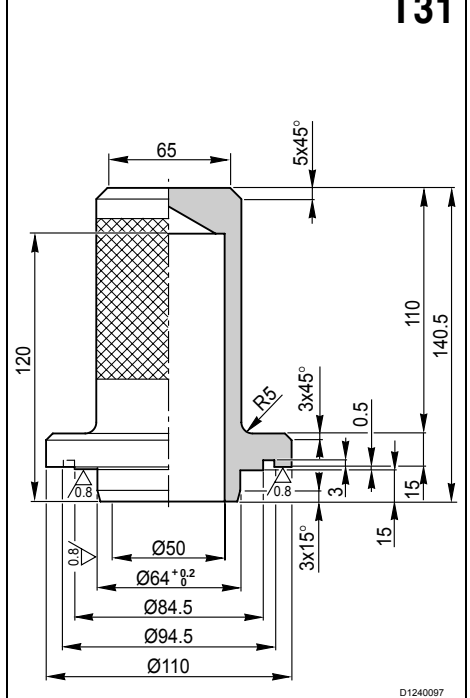
T31



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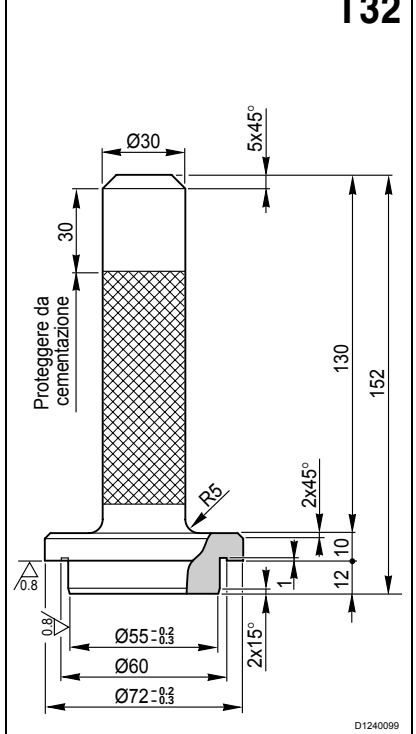
T32



2317

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Insufficient braking Frenatura insufficiente Ungenëgende Bremswirkung Frenado insuficiente Freinage insuffisant	1. Incorrect adjustment	Inspect disc thickness and if discs are usable readjust brakes to the specifications in the vehicle's manual.
	1. Incorretta registrazione	Controllare lo spessore dei dischi freno e, se i dischi freno possono essere riutilizzati, registrarli come da istruzioni del manuale del veicolo.
	1. Fehlerhafte Einstellung	Bremsscheibenstärke überprüfen, koennen die Bremscheiben noch verwendet werden, Spiel neu einstellen gemäß Anweisungen im Handbuch des Fahrzeuges.
	1. Ajuste incorrecto	Controlar el espesor de los discos del freno y, si los discos del freno pueden volver a utilizarse, ajustarlos de acuerdo con las instrucciones del manual del vehículo.
	1. Mauvais reglage	Inspecter l'épaisseur des disques frein et, si les disques frein sont en bon etat, regler selon les instructions du manuel du vehicule.
	2. Brake discs worn out	Inspect disc thickness and replace if necessary.
	2. Dischi freno usurati	Controllare lo spessore dei dischi freno e, se necessario, sostituirli.
	2. Bremsscheiben verschlissen	Bremsscheibenstärke überprüfen und falls erforderlich ersetzen.
	2. Discos del freno gastados	Controlar el espesor de los discos del freno y, si fuera necesario, sustituirlos.
	2. Disques frein usés	Inspecter l'épaisseur des disques frein et si nécessaire remplacer les disques.
	3. Incorrect brake fluid	Replace all seals in axle and master cylinder that have made contact with the incorrect fluid and all brake hoses. If incorrect fluid leaked into axle oil, seals and o-rings in axle must be replaced.
	3. Fluido non idoneo nel circuito	Sostituire tutti gli anelli di tenuta del ponte e del cilindro master che sono venuti a contatto con il fluido non idoneo nonché i tubi flessibili. Se il fluido non idoneo è entrato nel ponte e si è mescolato con il lubrificante devono essere sostituiti tutti gli anelli di tenuta ed gli O-rings.
	3. Ungeeignete Fluessigkeit in der Bremsanlage	Alle Dichtringe und Gummischläuche die mit der falschen Flüssigkeit in Kontakt gekommen sind, in der Achse und im Hauptbremszylinder ersetzen. Sollte diese Flüssigkeit auch in die Achse gelaugt sein, sind auch sämtliche O-Ringe und Dichtringe der Achse zu ersetzen.
	3. Fluido no adecuado para el circuito	Sustituir todos los segmentos de compresión del puente y del cilindro principal que han estado en contacto con el fluido no adecuado como así también los tubos flexibles. Si el fluido no adecuado ha entrado en el puente y se ha mezclado con el lubricante, hay que sustituir todos los segmentos de compresión y los O-Rings.
	3. Fluide inadéquat dans le circuit	Substituer tous les joints d'étencheité du pont et du maître-cylindre qui ont été en contact avec ce fluide mais aussi les tubes flexibles. Si le fluide incorrect est entré dans le pont et s'est melange avec le lubrifiant tous les joints d'étanchéité et o-ring doivent être changés.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Insufficient braking *Frenatura insufficiente* Ungenëgende Bremswirkung *Frenado insuficiente* Freinage insuffisant	4. Loss of brake fluid	Inspect for and repair any leaks in outside circuit or master cylinder. If caused by incorrect brake fluid see correction N. 3. If leak is to the outside replace the o-rings between the center and intermediate housings. If leak is to the inside replace above o-rings and brake piston o-rings.
	4. Perdita del fluido dal circuito freno	*Controllare e riparare tutte le perdite del circuito esterno o del circuito master.* *Se la causa è dovuta al fluido non idoneo vedere rimedio n. 3.* *Se la perdita è verso l'esterno del ponte sostituire gli O-ring tra la scatola centrale ed il coperchio intermedio.* *Se la perdita è verso l'interno del ponte, sostituire gli O-ring sopra menzionati e quelli del pistone freno.*
	4. Verlust von Bremsflüssigkeit	Äussere Bremsanlage und Hauptbremszylinder auf Ölverluste prüfen. Sollte der Verlust auf ungeeignete Bremsfluessigkeit zurückzuführen sein, siehe Abhilfe N.3. Sollte der Verlust nach aussen sein, die O-Ringe zwischen dem Achsmittengehäuse und den Zwischengehäuse ersetzen. Sollte der Verlust nach innen sein, oben genannte O-Ringe und jene der Bremskolben ersetzen.
	4. Pérdida del fluido del circuito del freno	*Controlar y reparar todas las pérdidas del circuito exterior o del cilindro principal.* *Si la causa se debe al fluido no idóneo, véase el remedio nº3.* *Si la pérdida es hacia fuera del puente, sustituir los O-Ring entre la caja central y la tapa intermedia.* *Si la pérdida es hacia el interior del puente, sustituir los O-Ring mencionados más arriba y los del pistón del freno.*
	4. Fluidé dans le circuit de freinage	Inspecter et réparer toutes les fuites du circuit externe ou du maître-cylindre. Si la cause est dûe à l'utilisation d'un fluide non indique voir remède N. 3. Si la fruite est vers l'exterieur du pont, substituer les o-rings entre le carter central et les carters intermediaires. Si la fruite est vers l'interieur du pont substituer les o-rings mentionnés ci-dessus et ceux des pistons frein.
	5. Overheated axle causing brake fluid to vaporize. (Brake return when axle cools)	See «overheating» problem.
	5. Surriscaldamento del ponte con vaporizzazione del fluido. *(I freni ritornano quando il ponte si raffredda)*	*Vedere problema: Surriscaldamento.*
	5. Verdunstung der Bremsflussigkeit wegen Überhitzung. (Im abgekühlten Zustand ist die Bremswirkung wieder hergestellt)	Siehe Problem: Überhitzung.
	5. Sobrecalentamiento del puente con vaporización del fluido. *(Los frenos vuelven a funcionar cuando se enfría el puente)*	*Véase el problema: Sobrecalentamiento.*
	5. Surchauffe du pont avec vaporisation du fluide. (Les freins fonctionnent à nouveau quand le fluide se refroidit).	Voir probleme: Surchauffe.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Soft brake pedal *Pedale del freno non risponde* Leichtes Bremspedal *El pedal del freno no funciona* Pedale du frein ne repond pas	6. Air in brake circuit *6. Aria nel circuito frenante* 6. Luft in der Bremsanlage *6. Aire en el circuito frenante* 6. Air dans le circuit	Bleed brakes as described in the vehicle's service manual. *Spurgare il circuito frenante come da istruzioni di spurgo del manuale del veicolo.* Bremsen entlüften gemäß Anweisungen im Handbuch des Failrzeuges. *Purgar el circuito frenante se acuerdo con las instrucciones de purga del manual del vehículo.* Purger le circuit de frein selon «instructions de purge» du manuel du véhicule.
Ineffective safety brake *Freno negativo inefficiente* Federspeicherbremse ohne Funktion. *Freno negativo ineficiente* Inefficacite du frein negatif	7. Incorrect adjustment *7. Registrazione incorretta* 7. Fehlerhafte Einstellung des Bremsscheibenspieles *7. Ajuste incorrecto* 7. Mauvais reglage	See correction N. 1. *Vedere rimedio N. 1.* Siehe Abhilfe N. 1. *Véase remedio N.1.* Voir remède N. 1.
	8. Brake disc worn out *8. Dischi freno usurati* 8. Bremslamellen verschlissen *8. Discos del freno gastados* 8. Usure disques frein	See correction N. 2. *Vedere rimedio N. 2.* Siehe Abhilfe N. 2. *Véase remedio N. 2.* Voir remède N. 2.
Overheating *Surriscaldamento* Überhitzung *Sobrecalentamiento* Surchauffe	9. Oil level wrong *9. Livello olio non corretto* 9. Niedriger Ölspiegel-Falscher Ölstand *9. Nivel de aceite no correcto* 9. Niveau d'huile pas incorrect	Drain, flush and refill oil to proper level. *Scaricare, eseguire un lavaggio e riempire d'olio fino a livello.* Öl ablassen, reinigen und richtigen Ölstand wieder herstellen. *Descargar, ejecutar un lavado y llenar con aceite hasta el nivel.* Vidanger, rincer et refaire le niveau d'huile.
	10. Too small of a brake gap *10. Poco gioco tra i dischi freno* 10. Zu wenig Spiel zwischen den Bremslamellen *10. Poco juego entre los discos del freno* 10. Peu de jeu entre les disques frein	Readjust brakes to the specifications in the vehicle's service manual. *Registrare il freno come istruzioni da manuale del veicolo.* Spiel gemäß Anweisungen im Handbuch des Fahrzeuges herstellen. *Ajustar el freno de acuerdo con las instrucciones del manual del vehículo* Regler le frein selon les instructions du manuel du véhicule.
	11. Park brake dragging *11. Freno di parcheggio in trazione* 11. Feststellbremse zieht *11. Freno de estacionamiento en tracción* 11. Frein de parc mal réglé	Unlock the brake and adjust the correct gap. *Sbloccare il freno ripristinando il gioco corretto.* Bremsen lösen und richtiges Lamellenspiel einstellen. *Desbloquear el freno restableciendo el juego correcto.* Débloquer le frein et régler le jeu.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Overheating *Surriscaldamento* Überhitzung *Sobrecalentamiento* Surchauffe	12. Incorrect brake fluid in system *12. Fluido non idoneo nel circuito* 12. Ungeeignete Flüssigkeit in der Bremsanlage *12. Fluido no adecuado en el circuito* 12. Fluide incorrect dans le circuit	See correction N. 3. *Vedere rimedio N. 3.* Siehe Abhilfe N. 3. *Véase remedio N. 3* Voir remède N. 3.
	13. No free-pedal at master cylinder *13. Non c'è corsa a vuoto sul cilindro master* 13. Kein Leerweg am Bremspedal *13. No hay carrera en vacío en el cilindro principal* 13. Pas de garde sur la pedale du maître-cylindre	Readjust brake pedal as described in the vehicle's service manual. *Registrare il pedale del freno come istruzioni da manuale del veicolo.* Bremspedal gemäß Anweisungen im Handbuch des Fahrzeuges einstellen. *Ajustar el pedal del freno de acuerdo con las instrucciones del manual del vehículo.* Régler la pedale du frein selon les instructions du manuel du véhicule.
	14. Restriction in brake lines *14. Restringimento sul circuito del freno* 14. Verengung in der Bremsanlage *14. Circuito del freno restringido* 14. Reglage sur circuit du frein	Inspect for and replace damage lines. *Controllare e riparare i condotti ammaccati o piegati.* Anlage überprüfen und verbeulte oder geknickte Leitungen ersetzen. *Controlar y reparar los conductos golpeados o plegados.* Inspecter et réparer les conduites endommagées.
	15. Restriction in return line of brake Servo system *15. Restringimento sul condotto di ritorno del sistema servo* 15. Verengung in der Rückflussleitung des Servobremssystems *15. Conducto de retorno del sistema servo restringido* 15. Etranglement sur la conduite de retour du servo-frein	Inspect for and replace damaged return line. Inspect for and remove any filter, tee'd in line or any other source of back pressure from the return line. *Controllare e riparare il condotto ammaccato o piegato.* *Controllare e sostituire tutti i filtri e raccordi sul circuito o qualsiasi altro ostacolo nel condotto di ritorno.* Anlage überprüfen und verbeulte oder geknickte Leitungen ersetzen. Alle Filter und Abzweigungen in der Anlage überprüfen, sämtliche Hindernisse für den freien Durchfluß entfernen. *Controlar y reparar el conducto golpeado o plegado.* *Controlar y sustituir todos los filtros y empalmes en el circuito o cualquier otro obstáculo en el conducto de retorno.* Inspecter et réparer la conduite endommagée. Inspecter et changer tous les filtres, raccords en «T» ou autre obstacle sur le circuit de retour.
	16. Incorrect lubricant *16. Lubrificante non idoneo* 16. Ungeeignetes Schmieroel *16. Lubricante no adecuado* 16. Lubrifiant incorrect	Change the retaining rings of the brake circuit and brake pump. *Sostituire gli anelli di tenuta del circuito freno e della pompa freno.* Die Abdichtungsringe des Bremskreislaufs der Bremspumpe ersetzen. *Sustituir los segmentos de compresión del circuito del freno y de la bomba del freno.* Replacer les anneaux d'étanchéité du circuit et de la pompe de frein.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Diff-lock inoperative *Il blocco differenziale non funziona* Differentialsperre ohne Wirkung *El bloque del diferencial no funciona* Mauvais fonctionnement du blocage du différentiel	17. If manual control, loose or misadjusted linkage *17. Se il comando è manuale: comando scollegato o registrato male* 17. Bei mechanisch betätigter Sperre, loser oder schlecht eingestellter Hebel *17. Si el mando es manual: mando desconectado o mal ajustado* 17. Si la commande est manuel: commande déconnectée ou mal réglée	Inspect and correct linkage and readjust as indicated in vehicle's service manual. *Controllare, riparare e registrare il comando indicato nel manuale del veicolo.* Hebel überprüfen und gemäß Anweisungen im Handbuch des Fahrzeuges einstellen. *Controlar, reparar y ajustar el mando indicado en el manual del vehículo.* Inspecter, réparer er régler la commande selon le manuel du véhicule.
	18. If hydraulic control, problems in the hydraulic or electrical circuits of the vehicle *18. Se il comando è idraulico: problemi nel circuito elettrico del veicolo* 18. Bei hydraulisch betätigter Sperre, Probleme in der hydraulischen oder elektrischen Anlage des Fahrzeuges *18. Si el mando es hidráulico: problemas en el circuito eléctrico del vehículo* 18. Si la commande est hydraulique: problème dans le circuit électrique dans le véhicule	Refer to the service manual for the vehicle. *Fare riferimento alle istruzioni nel manuale del veicolo.* Siehe Anweisungen im Handbuch des Fahrzeuges. *Consultar las instrucciones del manual del vehículo.* Voir instructions dans manuel du véhicule.
	19. If hydraulic control: problems in actuating cylinder (noteable through loss of hydraulic oil or increase of the oillevel in axle) *19. Se il comando è idraulico: problemi nell'attuatore (caratterizzati da perdite del fluido idraulico o da aumento del livello d'olio nel ponte)* 19. Bei hydraulisch betätigter Sperre, Ölverlust im Betätigungszylinder (erkentlich durch Verlust von hydraulisch Fluessigkeit oder Anstieg des Oelniveaus in der Achse) *19. Si el mando es hidráulico: problemas en el actuador (caracterizados por pérdidas del fluido hidráulico o por un aumento del nivel del aceite en el puente)* 19. Si la commande est hydraulique: problèmes dans le vérin (caracterisés par des fuites de fluide hydraulique ou augmentation du niveau d'huile dans le pont)	Rebuilt cylinder. *Controllare e riparare il cilindro.* Überprüfen und Zylinder reparieren. *Controlar y reparar el cilindro.* Inspecter et reparer le cylindre.
	20. If with lim. slip differential, worn discs *20. Se il differenziale è del tipo autobloccante, dischi usurati* 20. Wenn mit Selbstsperrdifferential, Scheiben verschlissen *20. Si el diferencial es del tipo autobloqueante: discos gastados* 20. Si avec différentiel à glissement limité, usure sur les disques	Replace discs. *Sostituire i dischi.* Scheiben ersetzen. *Sustituir los discos.* Remplacer les disques.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Oil coming out of breather *Olio fuoriesce dallo sfiato* Ölaustritt aus dem Entlüfter *El aceite sale del purgador* Huile sort du reniflard	21. Leak in internal brake system *21. Perdita di fluido idraulico dal sistema frenante* 21. Verlust von hydraulisch Flüssigkeit der Bremsanlage *21. Pérdida de fluido hidráulico del sistema frenante* 21. Fuite de fluide hydraulique du systeme de freinage	See correction N. 2 and 3. *Vedere rimedio N. 2 e 3.* Siehe Abhilfe N. 2 und 3. *Véanse remedios N. 2 y 3.* Voir remède N. 2 et 3.
	22. Leak in diff-lock actuating cylinder *22. Perdita d'olio idraulico dal circuito del blocco differenziale* 22. Verlust von Hydraulisch Flüssigkeit der hydraulisch Anlage der Differentialsperre *22. Pérdida de aceite hidráulico del circuito del bloque del diferencial* 22. Fuite d'huile hydraulique du circuit de blocage du différentiel	See correction N. 19. *Vedere rimedio N. 19.* Siehe Abhilfe N. 19. *Véase remedio N. 19.* Voir remède N. 19.
NoSpin indexing noise when driving straight **CAUTION! With NoSpin, fatigue damage can occur on the side with the larger tire.** *Il NoSpin è rumoroso viaggiando sul rettilineo* ***ATTENZIONE! Con il NoSpin possono verificarsi avarie da fatica sul lato con il pneumatico più grande.*** NoSpin macht Geräusche bei Geracheausfahrt **ACHTUNG! Mit NoSpin können auf der Seite mit dem grösseren Reifenradius Ermüdungsschäden auftreten.** *El NoSpin hace ruido andando en un rectilíneo* ***CUIDADO! con el No Spin se pueden producir averías por fatiga en un lado en el neumático más grande.*** Le No-Spin fait du bruit en roulant en ligne droite **ATTENTION! Avec le NoSpin, des ruptures de fatigue peuvent se produire du côté des pneumatiques les plus grands.**	23. Unequal tire pressure left anal right *23. Pressione disuguale nei pneumatici sui due lati* 23. Ungleichmässiger Reifendruck links und rechts *23. Presión desigual en los neumáticos a ambos lados* 23. Pressions différentes dans les pneumatiques sur les deux cotes du véhicule	Inflate tires to the recommended pressure in the service manual, or until the rolling radius is equal. *Gonfiare i pneumatici alla pressione raccomandata nel manuale o comunque fino ad ottenere un raggio statico uguale.* Reifen vorschriftsgemäß auf pumpen bis ein gleichgroßer statischer Halbmesser erreicht wird. *Hinchar los neumáticos a la presión recomendada en el manual o, de todas formas, hasta obtener un rayo estático igual.* Gonfler les pneumatiques selon la pression recommandée dans le manuel os jusq'à obtenir le même rayon sous charge.
	24. Different style, size or brand of tires between left and right hand side *24. Pneumatico di disegno, marca o costruttore diversi sui due lati* 24. Unterschiedliche Reifen, -größen - marken, links und rechts *24. Neumáticos de diseño, marca o fabricante distintos a los dos lados* 24. Pneumatiques de sculptures ou de constructeurs differents sur les deux côtes du vehicule	Change tires to make the rolling radius equal. Vary the tire pressure within the specifications until the rolling radius is equal. *Cambiare pneumatici o rendere i raggi statici dei pneumatici eguali.* *Variare la pressione dei pneumatici nei campi di tolleranza prescritti dai costruttori dei pneumatici stessi, fino ad ottenere un raggio statico uguale.* Reifen ersetzen sodaß ein gleich-großer Statischer Halbmesser erreicht wird. Reifendruck im Bereich der Vorschriften ändern bis ein gleichgroßer Halbmesser erreicht wird. *Cambiar los neumáticos o hacer que los rayos estáticos de los neumáticos sean iguales.* *Variar la presión de los neumáticos en los campos de tolerancia prescritos por los fabricantes de dichos neumáticos, hasta obtener un radio estático igual.ù* Changer les pneumatiques ou rendre les rayons sans charge des pneumatiques égaux. Modifier la pression des pneumatiques dans les tolérances prescrites par les constructeurs de ces memes pneumatiques, jusq'à obtenir un rayon sous charge identique.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Noise during coast and under power the same *Rumorosità uguale sia in tiro che in rilascio* Geräusch im Zug und im Schub gleich stark *Ruido igual tanto en tracción como en inercia* Bruit en traction ou en retenue	25. Wheel bearings damaged *25. Cuscinetti dei mozzi danneggiati* 25. Lager der Radnaben beschädigt *25. Cojinetes de los cubos dañados* 25. Roulements des moyeux endommagés	Replace and adjust. *Sostituire i particolari in avaria.* Beschädigte Teile gemäß Anweisungen. *Sustituir las piezas averiadas.* Remplacer les pièces endommagées.
Noise under power greater than during coast *Rumorosità più elevata in tiro piuttosto che in rilascio* Geräeusch stäerker im Zug als im Schub *Ruido más elevado en tracción que en inercia* Bruit pus éleve en traction qu'en retenue.	26. Low oil level *26. Livello olio basso* 26. Niedriger Ölstand *26. Nivel de aceite bajo* 26. Niveau d'huile insuffisant	Refill oil to proper level. *Ripristinare il livello olio.* Schmieröl nachfüllen bis richtiger Ölstand wieder hergestellt ist. *Restablecer el nivel del aceite.* Refaire le niveau d'huile.
	27. Incorrect lubricant *27. Olio non idoneo* 27. Ungeeignetes Schmieröl *27. Aceite no adecuado* 27. Huile incorrect	See correction N. 16. *Vedere rimedio N. 16.* Siehe Abhilfe N. 16. *Véase remedio N. 16.* Voir remède N. 16.
	28. Ring and pinion worn *28. Coppia conica usurata* 28. Kegel- und Tellerrad verschlissen *28. Par cónico gastado* 28. Usure du couple conique	Inspect through top cover. Replace and adjust. *Controllare attraverso il coperchio superiore. Sostituire la coppia conica.* Durch die obere Bohrung überprüfen. Kegel- und Tellerrad ersetzen. *Controlar a través de la tapa superior. Sustituir el par cónico.* Inspectioner au travers du couvercle superieur. Remplacer le couple conique.
	29. Worn ring and pinion bearings *29. Cuscinetti della coppia conica usurati* 29. Kegelrollenlager des Kegel- und Tellerradpaares verschlissen *29. Cojinetes del par cónico gastados* 29. Usure des roulements du couple conique	Replace and adjust. *Sostituire i particolari in avaria.* Beschädigte Teile ersetzen. *Sustituir las piezas averiadas.* Remplacer les pièces endommagées.
	30. Worn planetary gears or bearings *30. Planetari o cuscinetti dell'epicicloidale usurati* 30. Planetenräder oder Lager der Planetenabtriebe verschlissen *30. Planetarios y cojinetes del epicicloidal gastados* 30. Usure des planétaires ou roulement de l'épicycloïdale	Replace. *Sostituire i particolari in avaria.* Beschädigte Teile ersetzen. *Sustituir las piezas averiadas.* Remplacer les pièces endommagées.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
Noise during coast greater than under power *Rumorosità più elevata in rilascio piuttosto che in tiro* Geräeusch stäerker im Schub als im Zug *Ruido más elevado en inercia que en tracción* Bruit plus éleve en retenue qu'en traction	31. Loose pinion nut *31. Ghiera pignone allentata* 31. Wellenmutter des Kegelritzels lose *31. Virola del piñón floja* 31. Ecrou du pinion dévissé	Inspect ring, pinion and pinion bearings. If undamaged, retighten nut. *Controllare la coppia conica ed i rispettivi cuscinetti, se non fossero danneggiati serrare la ghiera.* Kegel- und Tellerrad und Lager überprüfen. Sollten diese nicht beschädigt sein, Wellenmutter anziehen. *Controlar el par cónico y los cojinetes correspondientes.* Inspecter le couple conique et les roulements et si rien n'est endommagé, resserrer l'ecrou.
	32. Only pinion bearing damaged *32. Solo un cuscinetto del pignone è danneggiato* 32. Nur eines der Lager des Kegelritzels ist beschädigt *32. Sólo un cojinete del piñón está dañado* 32. Seulement un roulement du pignon est endommagé	See correction N. 29. *Vedere rimedio N. 29.* Siehe Abhilfe N. 29. *Véase remedio N. 29.* Voir remède N. 29.
Noise during turn (without NoSpin) *Rumore sotto sterzo (senza NoSpin)* Geräusch während der Kurvenfahrt (ohne NoSpin) *Ruido en la dirección (sin NoSpin)* Bruit en braquage (sans NoSpin)	33. Worn spider and/or side gears *33. Satelliti e/o planetari del differenziale danneggiati* 33. Ausgleich kegelräder und/oder welleräder verschlissen *33. Satélites y/o planetarios del diferencial dañados* 33. Satellites et/ou planétaires du différentiel endommagées	Replace. *Sostituire i particolari danneggiati.* Beschädigte Teile ersetzen. *Sustituir las piezas dañadas.* Remplacer les pièces endommagées.
A «Stick slip» noise when going from forward to reverse *Un rumore tipo «Stick slip» si manifesta durante l'inversione di marcia* «Stick slip» -Geräusch bei Änderung der Fahrtrichtung *Un ruido tipo «Stick slip» se manifiesta al invertir la marcha* Un bruit type «Stick slip» se manifeste pendant l'inversion	34. Worn or damaged cardanshaft *34. Giunto cardanico danneggiato* 34. Kardanwelle beschädigt *34. Junta cardánica dañada* 34. Joint cardan endommagé	Inspect and replace as described in vehicle's service manual. *Controllare e sostituire il giunto come indicato nel manuale del veicolo.* Überprüfen und Kardanwelle gemäß. Anweisungen im Handbuch des Fahrzeuges ersetzen. *Controlar y sustituir la junta como se indica en el manual del vehículo.* Inspecter et remplacer le joint cardan selon les indications du manuel du véhicule.
	35. Loose wheel *35. Ruota allentata* 35. Rad lose *35. Rueda floja* 35. Roue dévissée	Inspect for wheel and wheel stud damage. Replace if needed and retorque lugnuts. *Ispezionare eventuali danni al disco ed alle colonnette del mozzo ruota, se necessario sostituire i particolari danneggiati e serrare i dadi alla coppia prescritta.* Eventuelle Schäden an der Felge und an den Radbolzen überprüfen. Falls erforderlich beschädigte Teile ersetzen und Radmuttern gemäß vorgeschriebenem Drehmoment anziehen. *Inspeccionar los posibles daños al disco y a las columnas del cubo de la rueda; si fuera necesario, sustituir las piezas dañadas y apretar las tuercas al par prescrito.* Inspecter les éventuels dommages au disque et aux goujons du moyeu de rue. Si nécessaire remplace les pieces endommagées et serrer les écrous au couple prescrit.

PROBLEM - PROBLEMA - PROBLEM - PROBLEMA - PROBLEME	CAUSE - CAUSE - URSACHE - CAUSAS - CAUSE	CORRECTION - RIMEDI - ABHILFE - REMEDIOS - REMEDE
A «Stick slip» noise when going from forward to reverse *Un rumore tipo «Stick slip» si manifesta durante l'inversione di marcia* «Stick slip» -Geräusch bei Änderung der Fahrtrichtung *Un ruido tipo «Stick slip» se manifiesta al invertir la marcha* Un bruit type «Stick slip» se manifeste pendant l'inversion	36. Articulation box joint and achsel shaft damaged *36. Giunti della scatola snodo, semiassi o snodi di sterzatura danneggiati* 36. Kupplung des Gelenkgehäuseg, Halbachse beschädigt *36. Juntas de la caja de la rótula, semieje o perno de dirección dañados* 36. Joint boîtier d'articulation, demi-essieu endommagé	Inspect and replace. *Ispezionare e sostituire i particolari danneggiati.* Überprüfen und beschädigte Teile ersetzen. *Inspeccionar y sustituir las piezas dañadas.* Inspecter et remplacer les pièces endommagées.
	37. Spider pins loose in diff-carrier *37. Satelliti liberi nella scatola differenziale* 37. Ausgleich kegelräder im Differential lose *37. Satélites libres en la caja del diferencial* 37. Satellites libres dans le carter central	Inspect through top cover. Replace. *Controllare attraverso il coperchio superiore, sostituire i particolari danneggiati.* Durch die obere Bohrung überprüfen. Beschädigte Teile ersetzen. *Inspectioner au travers du couvercle superieur.* Remplacer les pièces endommagées.
	38. Damaged or missing spider and/or side gear washers *38. Rondelle di rasamento del differenziale usurate* 38. Anlaufscheiben im Differential verschlissen *38. Arandelas de espesor del diferencial gastadas* 38. Usure des rondelles du différentiel	See correction N. 33. *Vedere rimedio N. 33.* Siehe Abhilfe N. 33. *Véase remedio N. 33.* Voir remède N. 33.

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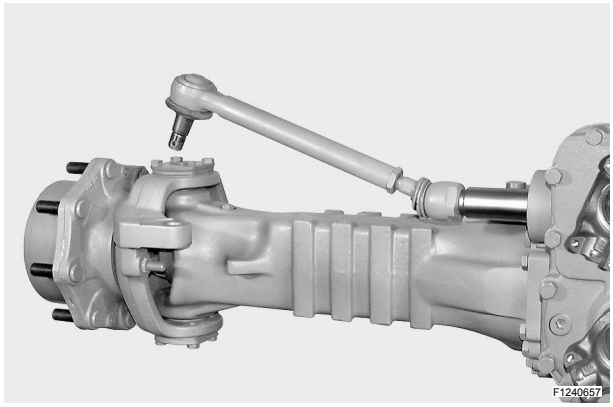
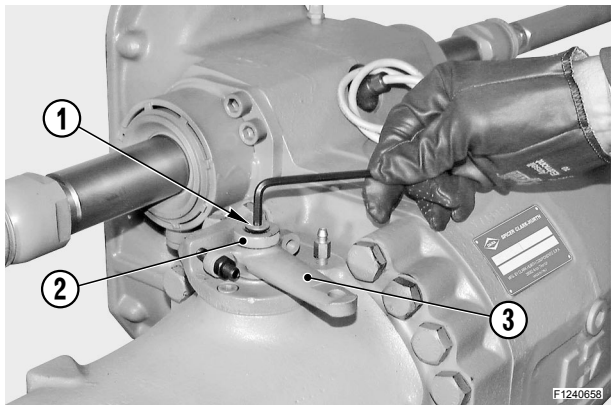


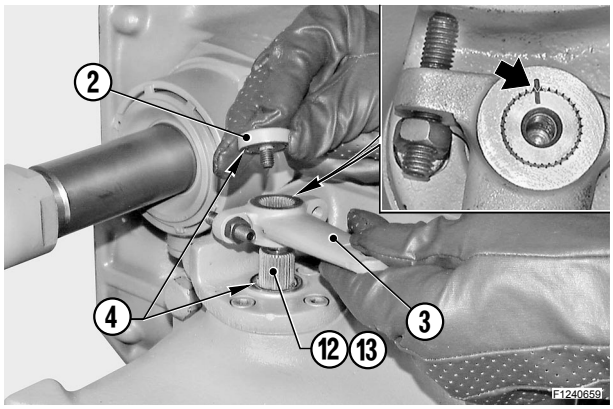
GB a

NOTE. The same disassembly procedure applies to both arms and may only be carried out when levers (3) are released.
Disconnect the tension bar from the steering case. For details, see «HOW TO REMOVE THE STEERING CYLINDER».



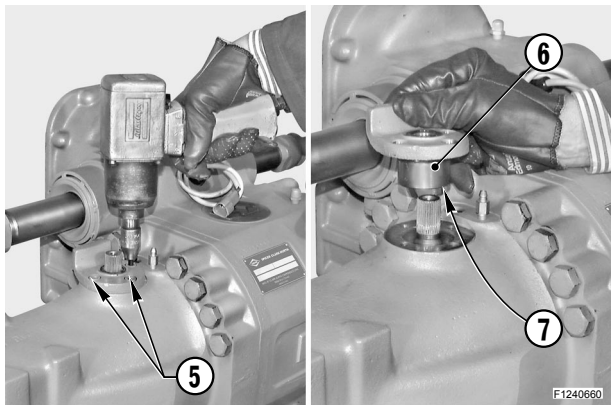
GB b

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



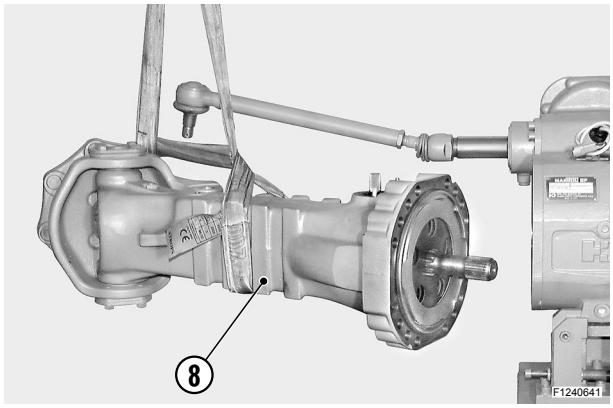
GB c

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



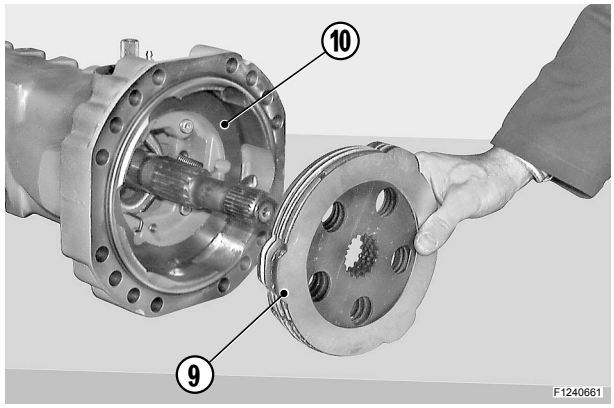
GB d

Draw out the screws (5) and remove bush (6) along with O-ring (7).



GB e

Connect the whole arm (8) to the hoist and put the rod under light tension.
Remove the whole arm; for details, see «CHECKING AND REPLACING THE BRAKING DISKS».



GB f

Remove the braking disks (9) and the whole piston (10).
For details, see «CHECKING AND REPLACING THE BRAKING DISKS».

a

ITA **NOTA.** Lo smontaggio è uguale per i due bracci e può essere eseguito solo a leve (3) libere.
Scollegare dalla scatola snodo il tirante di sterzatura.
Per i dettagli, vedere «RIMOZIONE CILINDRO DI STERZATURA».

D **BEMERKUNG.** Beide Arme werden auf dieselbe Weise abmontiert; dies kann jedoch nur erfolgen, wenn die Hebel (3) frei sind.
Spannstange vom Gelenkgehäuse abtrennen.
Weitere Einzelheiten im Paragraph «LENKZYLINDER ABMONTIEREN».

ESP **NOTA** El desmontaje es ugual por los dos brazos y puede ser efectuado solo a palancas (3) libres.
Desconectar del carter de las rotulas el tirante de direccion.
Para los detalles, vease «REMOCION CILINDRO DE DIRECCION».

F **NOTE.** Le démontage est pareil pour les deux bras et ne peut être effectué que lorsque les leviers (3) sont libres.
Débrancher de la boîte articulation la tringle de braquage.
Pour tout détail, voir «DEPOSE CYLINDRE DE BRAQUAGE».

b

ITA Asportare la vite (1) di bloccaggio della rondella (2) di ritegno della leva (3).

D Die Schraube (1) zur Befestigung der Unterlegscheibe (2) des Hebels (3) abschrauben.

ESP Sacar el tornillo (1) de bloqueo de la arandela (2) de retencion palanca (3).

F Enlever la vis (1) de blocage de la rondelle (2) de fixation du levier (3).

c

ITA Rimuovere la rondella (2), la leva (3) e le guarnizioni OR (4).
Contrassegnare le posizioni delle leve (3) rispetto le leve di spinta (12) e (13).

D Unterlegscheibe (2), Hebel (3) und O-Ringe (4) abnehmen.
Die Positionen der Hebel (3) im Verhältnis zu den Druckhebeln (12) und (13) kennzeichnen.

ESP Remover la arandela (2), la palanca (3) y las guarniciones OR (4).
Senalar las posiciònes de las palancas (3) respecto a las palancas de empuje (12)

F Enlever la rondelle (2), le levier (3) et les garnitures OR (4).
Marquer les positions des leviers (3) par rapport aux leviers (12) et (13).

d

ITA Asportare le viti (5) e rimuovere la boccola (6) completa di guarnizione OR (7).

D Schrauben (5) abschrauben und Buchse (6) samt O-Ring (7) abnehmen.

ESP Sacar los tornillos (5) y remover el casquillo (6) completo de guarniciones OR (7).

F Enlever les vis (5) et extraire la douille (6) équipée de garnitures OR (7).

e

ITA Agganciare il braccio completo (8) ad un mezzo di sollevamento e mettere il leggera tensione la fune.
Rimuovere il braccio completo; per i dettagli, vedere «CONTROLLO E SOSTITUZIONE DISCHI FRENI».

D Vollständigen Arm (8) mit einem Hebekarren anheben bis das Seil gespannt ist.
Vollständigen Arm abtrennen; weitere Einzelheiten im Paragraph «BREMSSCHEIBEN KONTROLLIEREN UND AUSWECHSELN».

ESP Enganchar el brazo completo (8) y un medio de levantamiento y poner en ligera tension el cable.
Remover el brazo completo; por los detalles, vease «CONTROL Y SUSTITUCION DISCOS FRENOS».

F Accrocher le bras complet (8) à un moyen de relevage et mettre la corde légèrement en tension.
Enlever le bras complet: pour tout détail, voir «CONTROLE ET SUBSTITUTION DES DISQUES FREINS».

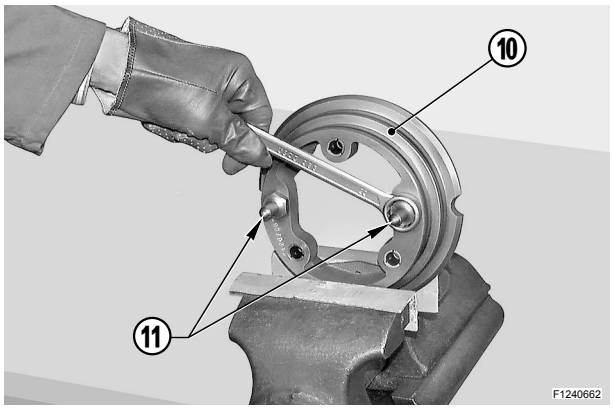
f

ITA Rimuovere i dischi freni (9) ed il pistone completo (10).
Per i dettagli, vedere «CONTROLLO E SOSTITUZIONE DISCHI FRENI».

D Bremsscheiben (9) und den ganzen Kolben (10) abnehmen. Weitere Einzelheiten im Paragraph «BREMSSCHEIBEN KONTROLLIEREN UND AUSWECHSELN».

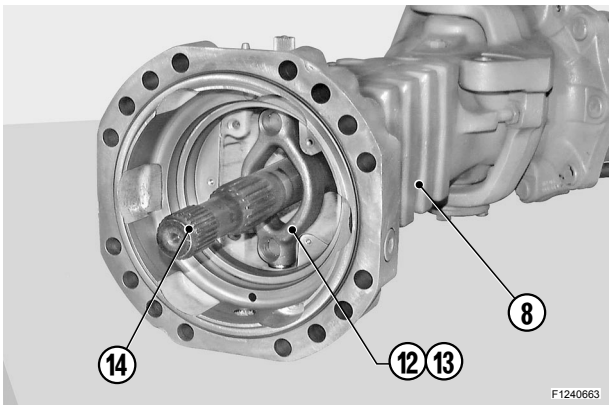
ESP Remover los discos frenos (9) y el piston completo (10).
Por los detalles, vease «CONTROL Y SUSTITUCION DISCOS FRENOS».

F Enlever les disques freins (9) et le piston complet (10).
Pour tout détail, voir «CONTROLE ET SUBSTITUTION DES DISQUES FREINS».



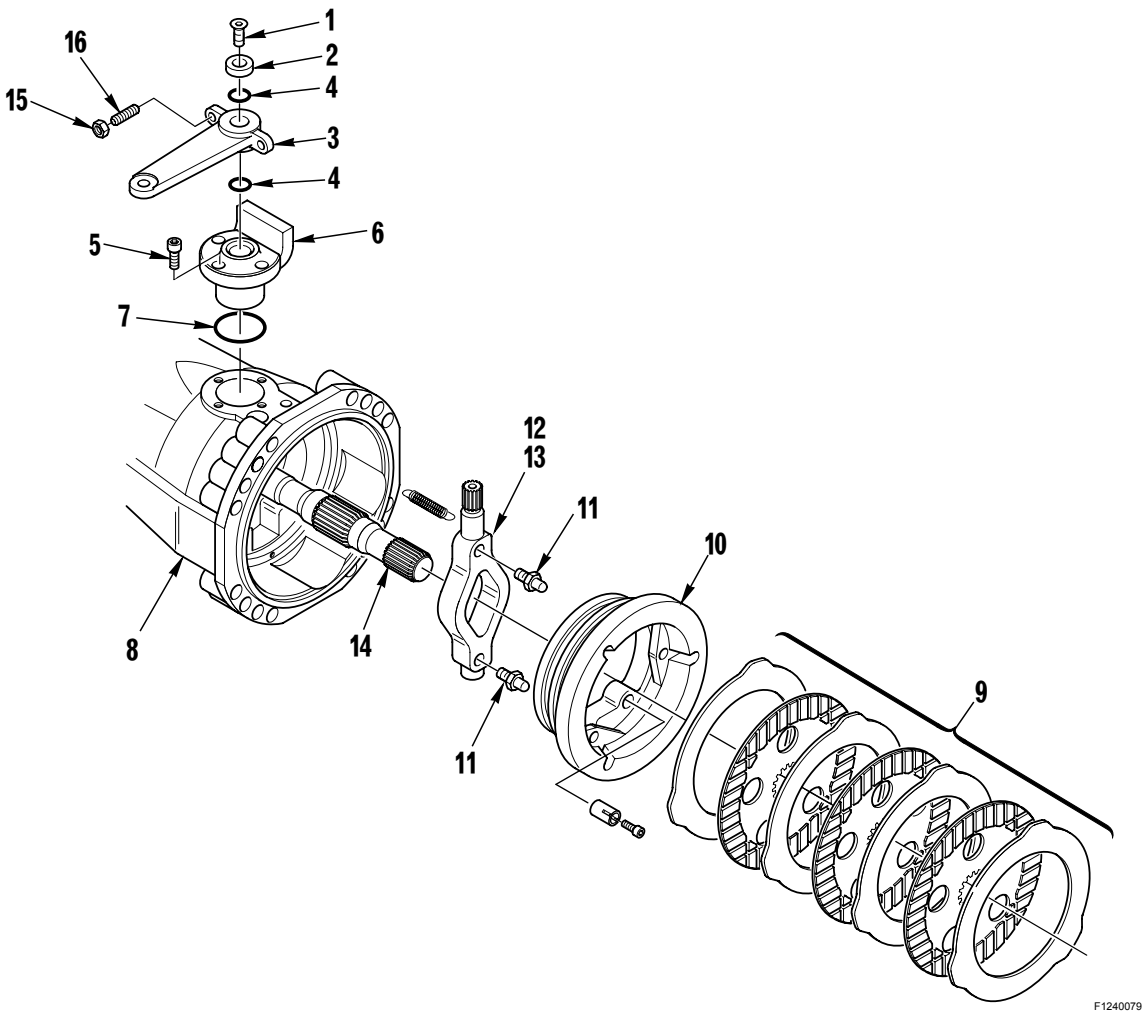
GB a

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



GB b

If thrust levers (12) and (13) need replacing, remove the U-joint (14) before removing the arms (8).
For details, see «HOW TO REMOVE THE U-JOINT».



a

ITA Se si devono sostituire i puntali (11), bloccare il pistone (10) in una morsa con ganasce in materiale tenero e rimuovere i puntali.

D Falls die Schafte (11) ausgewechselt werden sollen, Kolben (10) in einem Spannbackenpaar aus weichem Material blockieren und Schafte abnehmen.

ESP Si se deben cambiar las puntas (11), bloquear el piston (10) en un corchete con mordazas en material tierno y remover las puntas.

F Si l'on doit substituer les tiges (11), bloquer le piston (10) dans un étau à mâchoire en matériel tendre, puis enlever les tiges.

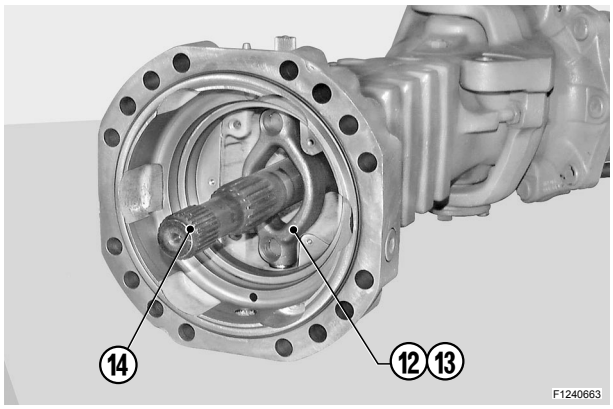
b

ITA Se si devono sostituire le leve di spinta (12) e (13), prima di rimuovere i bracci (8) rimuovere il giunto cardanico (14).
Per i dettagli, vedere «RIMOZIONE DEL DOPPIO GIUNTO CARDANICO».

D Falls die Druckhebel (12) und (13) ausgewechselt werden sollen, zuerst die Doppelgelenkwelle (14) und dann die Arme (8) abnehmen. Weitere Einzelheiten im Paragraph «DOPPELGELENKWELLE INSTALLIEREN».

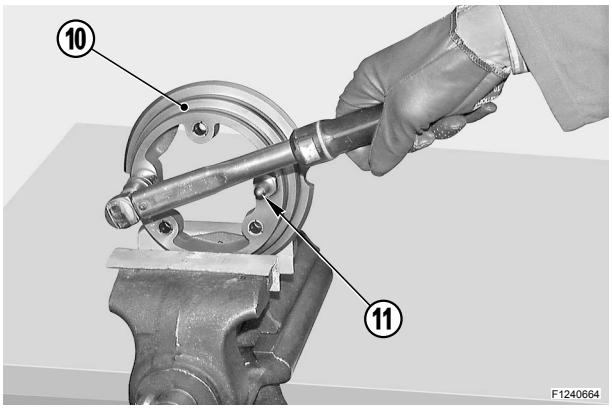
ESP Si se deben cambiar las palancas de empuje (12) y (13), antes de remover los brazos (8) remover los semiejes (14).
Por los detalles, vease «REMOCION DE LOS SEMIEJES».

F Si l'on doit substituer les leviers de poussée (12) et (13), avant d'enlever les bras (8) enlever le joint de cardan double (14).
Pour tout détail, voir «DEPOSE DE JOINT DE CARDAN DOUBLE».



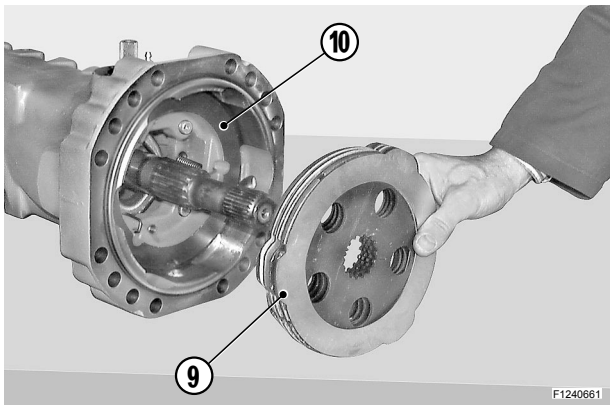
GB a

Install thrust levers (12) and (13), then install the U-joint (14). For details, see «HOW TO INSTALL THE U-JOINT».



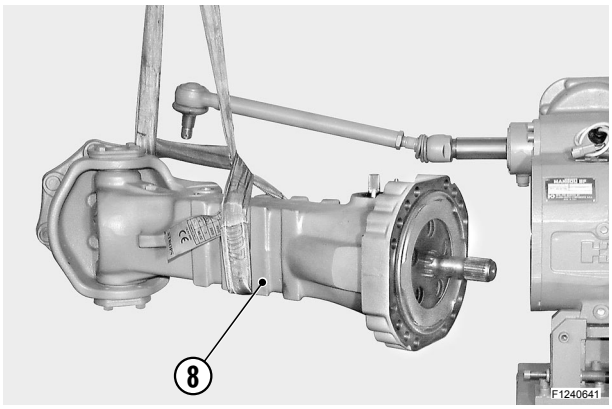
GB b

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.



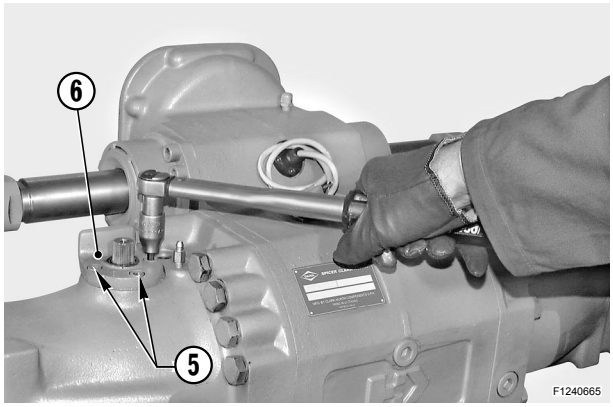
GB c

Re-install the piston (10) and the braking disks (9). For details, see «HOW TO ASSEMBLE THE BRAKING UNITS».



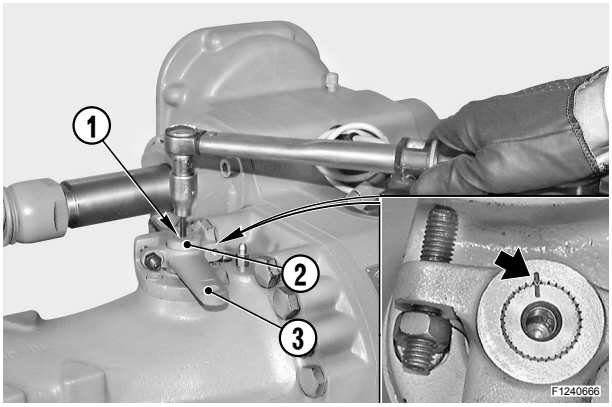
GB d

Install the arms (8) into the main body; check flatness and block arms following the appropriate procedures illustrated in section «HOW TO ASSEMBLE THE BRAKING UNITS».



GB e

Install the bush (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.



GB f

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.

CAUTION! Refer and keep to the positions marked during disassembly.

a

ITA Montare le leve di spinta (12) e (13) e successivamente il doppio giunto cardanico (14).
Per i dettagli di montaggio del doppio giunto cardanico, vedere «INSTALLAZIONE DEL DOPPIO GIUNTO CARDANICO».

D Druckhebel (12) und (13) montieren; danach Doppelgelenkwelle (14) montieren.
Weitere Einzelheiten im Paragraph «DOPPELGELENKWELLE INSTALLIEREN».

ESP Montar la palancas de empuje (12) y (13) y al final los semiejes (14).
Por los detalles de montaje de los semiejes, vease «INSTALACION DE LOS SEMIEJES».

F Monter les leviers de poussée (12) et (13) et ensuite le joint de cardan double (14).
Pour tout détail, voir «DEPOSE DE JOINT DE CARDAN DOUBLE».

b

ITA Spalmare la filettatura dei puntali (11) con Loctite 270 e montarli sul pistone (10).
Bloccarli con una coppia di serraggio di 30÷35 Nm.

D Schafte (11) mit Loctite 270 schmieren und auf den Kolben (10) montieren.
Anzugsmoment: 30÷35 Nm.

ESP Pasar la rosca de las puntales (11) con Loctite 270 y montarlas sobre los pistones (10).
Bloquearlos con un par de torsion de 30÷35 Nm.

F Enduire le filetage des tiges (11) avec du Loctite 270 puis les monter sur le piston (10).
Bloquer à un couple de serrage de 30÷35 Nm.

c

ITA Rimontare il pistone (10) ed i dischi freno (9).
Per i dettagli, vedere «ASSEMBLAGGIO DEI GRUPPI DI FRENATURA».

D Kolben (10) und Bremsscheiben (9) wieder montieren.
Weitere Einzelheiten im Paragraph «ZUSAMMENBAU DER BREMSAGGREGATE».

ESP Remontar los pistones (10) y los discos frenos (9).
Por los detalles, vease «ASEMBLAJE DE LOS GRUPOS DE FRENADURA».

F Remonter le piston (10) et les disques freins (9).
Pour tout détail, voir «ASSEMBLAGE DES GROUPES DE FREINAGE».

d

ITA Montare i bracci (8) sul corpo centrale; controllare il livellamento e quindi bloccarli con le modalità descritte per l'«ASSEMBLAGGIO DEI GRUPPI DI FRENATURA».

D Die Arme (8) auf den zentralen Körper montieren; danach abrichten und laut Anweisungen des Paragraphs «ZUSAMMENBAU DER BREMSAGGREGAT» blockieren.

ESP Montar los brazos (8) sobre el cuerpo central, controlar el nivelamiento y entonces bloquearlos con las modalidades descritas por «ASEMBLAJE DE LOS GRUPOS DE FRENADURA».

F Monter les bras (8) sur le corps central; contrôler le niveau, puis bloquer en suivant le mode décrit dans l'«ASSEMBLAGE DES GROUPES DE FREINAGE».

e

ITA Montare la boccola (6) completa di guarnizione OR (7) e bloccarla con le viti (5).
Serrare le viti con una coppia di 23,8÷26,2 Nm.

D Buchse (6) samt O-Ring (7) montieren und mit den Schrauben (5) festschrauben.
Anzugsmoment der Schrauben: 23,8÷26,2 Nm.

ESP Montar el casquillo (6) completa de guarnicion OR (7) y bloquearla con tornillos (5).
Apretar los tornillos con un par de 23,8÷26,2 Nm.

F Monter la douille (6) équipée de garniture OR (7) et bloquer cette dernière avec les vis (5).
Serrer les vis à un couple de serrage de 23,8÷26,2 Nm.

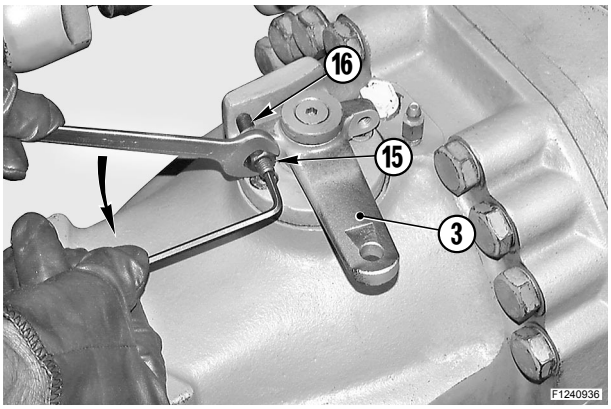
f

ITA Montare nell'ordine la guarnizione OR inferiore (4), la leva (3) e la rondella (2) completa della relativa guarnizione OR (4).
Bloccarla con la vite (1) serrata ad una coppia di 23,8÷26,2 Nm.
ATTENZIONE! Rispettare le posizioni contrassegnate in fase di smontaggio.

D Der Reihenfolge nach den unteren O-Ring (4), Hebel (3) und Unterlegscheibe (2) samt O-Ring (4) montieren.
Mit der Schraube (1) festschrauben. Anzugsmoment der Schraube: 23,8÷26,2 Nm.
ACHTUNG! Die beim Abmontieren markierten Positionen einhalten.

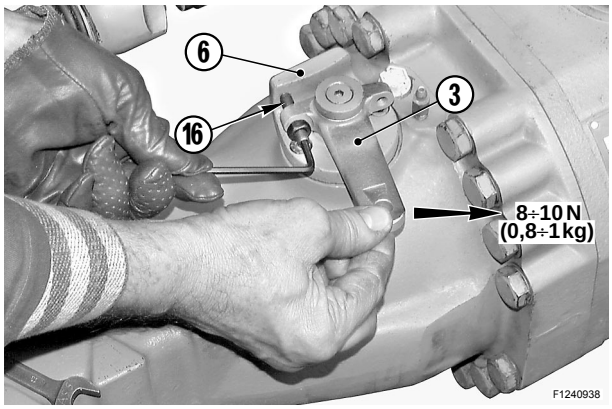
ESP Montar en el orden la guarnicion OR inferior (4), la palanca (3) y la arandela (2) completa de la relativa guarnicion OR (4).
Bloquearla con el tornillo (1) apretada a un par de 23,8÷26,2 Nm.
ATENCION! Respectar las posiciònes senaladas en fase de montaje.

F Monter dans l'ordre la garniture OR inférieure (4), le levier (3) et la rondelle (2) équipée de sa relative garniture OR (4).
Bloquer celle-ci avec la vis (1) serrer à un couple de 23,8÷26,2 Nm.
ATTENTION! Respecter les positions notées en phase de démontage.



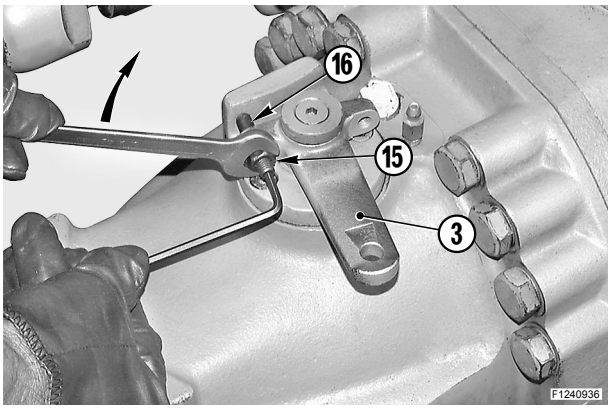
GB a

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



GB b

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 dowel (16) until it is caused to rest onto bush (6).



GB c

Lock dowel (16) in this position with nut (15).
Torque wrench setting: 20 – 25 Nm.
CAUTION! The idle stroke should be eliminated without preloading thrust levers (12) and (13).

GB d

CAUTION! After connecting the control cable, check that when brakes are released both dowels (16) do lean against bush (6).

a

ITA Collegare il circuito frenante ed inserire la massima pressione di lavoro per assestare i dischi.
Rilasciare la pressione, allentare il dado (15) e svitare di qualche giro il grano (16).

D Den Bremskreislauf anschließen und den maximale Arbeitsdruck einlassen, um die Scheiben zu setzen.
Den Druck ablassen, die Mutter (15) lockern und den Stift (16), um einige Umdrehungen aufschrauben.

ESP Conectar el circuito frenante y introducir la maxima presiòn de trabajo para ajustar los discos.
Soltar la presion, aflojar las tuercas (15) y destornillar de algun giro la espiga (16).

F Brancher le circuit freinant et insérer le maximum de pression d'usinage pour ajuster les disques.
Relâcher la pression, desserrer l'écrou (15) et dévisser le grain (16) de quelques tours.

b

ITA Applicare alla leva (3) una forza di 8÷10 N (0,8÷1 kg), diretta nel senso di frenatura per eliminare la corsa a vuoto.
Mantenendo la forza, avvitare il grano (16) fino all'appoggio sulla boccola (6).

D Auf den Hebel (3) eine Kraft von 8÷0 N (0,8÷1 kg) in die Bremsrichtung anbringen, um den leeren Lauf auszuschließen.
Bei angebrachter Kraft, Stift (16) aufschrauben, bis er an der Buchse (6) anliegt.

ESP Aplicar a la palanca (3) una fuerza de 8÷10 N (0,8÷1 kg), directa en el sentido de frenadura para eliminar la carrera a vacio.
Manteniendo la fuerza, atornillar la espiga (16) hasta el apoyo sobre el casquillo (6).

F Appliquer au levier (3) une contrainte de 8÷10 N (0,8÷1 kg), orientée dans le sens du freinage pour éliminer la course à vide.
En maintenant la contrainte, visser le grain (16) jusqu'à ce qu'il se pose sur le fourreau (6).

c

ITA Bloccare il grano (16) in questa posizione con il dado (15).
Coppia di serraggio: 20÷25 Nm.
ATTENZIONE! La corsa a vuoto va eliminata senza precaricare le leve di spinta (12) e (13).

D Stift (16) in dieser Position mit der Mutter (15) blokkieren.
Anzugsmoment: 20÷25 Nm.
ACHTUNG! Der leere Lauf muß beseitigt werden ohne die Druckhebel (12) und (13) vorzuladen.

ESP Bloquear la espiga (16) en esta colocacion con la tuerca (15).
Par de torsion: 20÷25 Nm.
ATENCION! La carrera a vacio debe de ser eliminada sin precargar las palancas de impulso (12) y (13).

F Bloquer le grain (16) dans cette position à l'aide de l'écrou (15).
Couple de serrage: 20÷25 Nm.
ATTENTION! La course à vide doit être éliminée sans précharger les leviers d'appui (12) et (13).

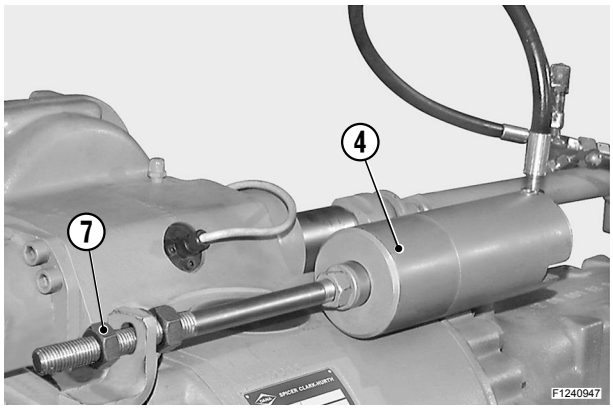
d

ITA **ATTENZIONE!** Dopo il collegamento del cavo di comando, controllare che in fase di rilascio dei freni, ambedue i grani (16) vadano in appoggio sulla boccola (6).

D **ACHTUNG!** Nach dem Anschluß des Steuerkabels, kontrollieren, ob beim Loslassen der Bremsen, beide Stifte (16) an der Buchse anliegen (6).

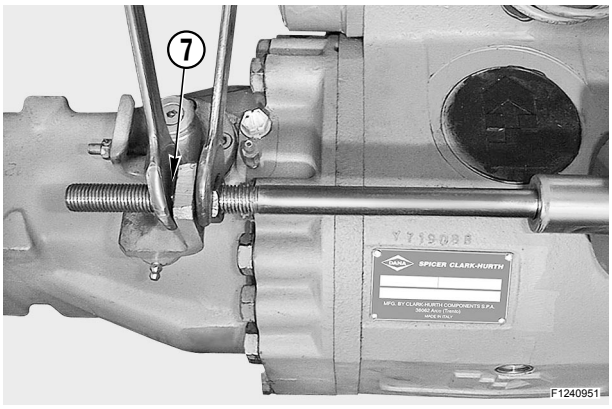
ESP **ATENCION!** Despues de la conexion del cable de mando, controlar que en fase de suelte de los frenos, las dos espigas (16) vayan en apoyo sobre el casquillo (6).

F **ATTENTION!** Après avoir branché le câble de commande, contrôler que pendant la phase de relâchement des freins, les deux grains (16) aillent se poser sur l'embout (6).



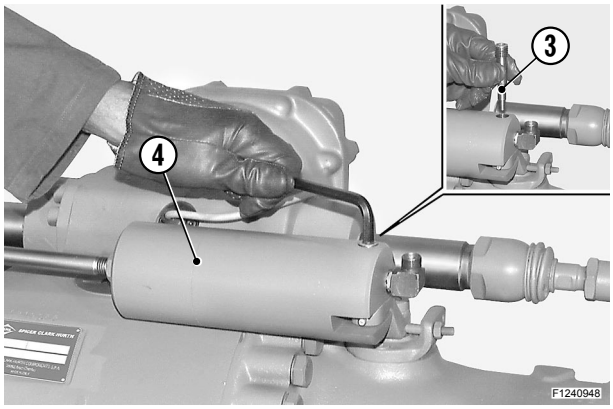
bar GB a

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.



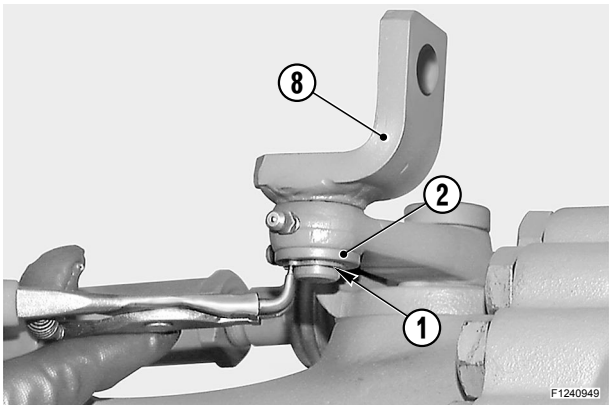
GB b

Loosen and remove the external nut (7).



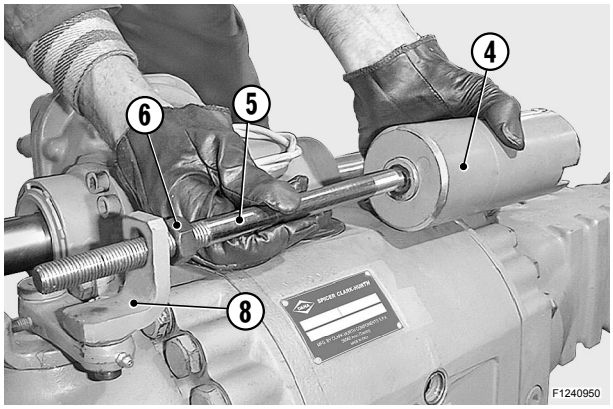
GB c

Release the pressure in the cylinder and disconnect the pressure delivery tube.
Remove the fulcrum pin (3) from the cylinder (4).



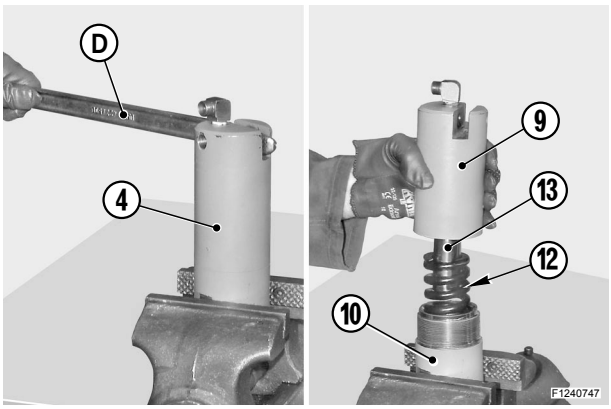
GB d

Remove the snap ring (1) that checks the support (8) and remove the distance piece (2).



GB e

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



GB f

Place cylinder (4) into a vice with the spring seat side (10) engaged in it and, using a bar "**D**", loosen and remove the cylinder unit (9) complete with piston (13) and spring (12).

a

ITA Immettere pressione nel cilindro (4) per sbloccare i freni.
NOTA. Se non è possibile utilizzare l'impianto idraulico macchina, utilizzare una pompa manuale esterna.

D Den Druck in den Zylinder (4) lassen, um die Bremsen frei zu machen.
BEMERKUNG: Falls die hydraulische Anlage der Maschine nicht verwendet werden kann, eine manuelle getrennte Pumpe verwenden.

ESP Meter presiòn en el cilindro (4) para bloquear los frenos.
NOTA. Si no es posible utilisar el equipo hydralico maquina, utilisar una pompa manual exterior.

F Envoyer de la pression dans le cylindre (4) pour débloquer les freins.
NOTE. Si utiliser l'installation hydraulique de la machine n'est pas possible, utiliser une pompe manuelle externe.

b

ITA Allentare ed asportare il dado esterno (7).

D Die äußere Mutter (7) abschrauben.

ESP Aflojar y sacar la tuerca esterna (7).

F Desserrer et enlever l'écrou externe (7).

c

ITA Rilasciare la pressione del cilindro e scollegare il tubo di mandata della pressione.
Rimuovere il perno di fulcro (3) del cilindro (4).

D Den Druck vom Zylinder ablassen und die Druckleitung abtrennen.
Den Zentrierstift (3) des Zylinders (4) abnehmen.

ESP Solter la presiòn del cilindro y desconectar el tubo de ida de la presiòn.
Remover la rotula (3) del cilindro (4).

F Relâcher la pression du cylindre et débrancher le tube de refoulement de pression. Enlever l'axe du point d'appui (3) du cylindre (4).

d

ITA Rimuovere l'anello elastico (1) di ritegno supporto (8) ed asportare il distanziale (2).

D Den Kolbenring (1) der Halterung (8) abnehmen und das Distanzstück (2) abnehmen.

ESP Remover el anillo elastico (1) de retencion suporte (8) y sacar el distancial (2).

F Enlever l'anneau à ressort (1) de retenue au support (8), puis enlever l'entretoise (2).

e

ITA Rimuovere il gruppo cilindro (4), completo di asta (5), dado interno (6) e supporto (8).

D Das Zylinderaggregat (4) samt Stab (5), innere Mutter (6) und Halterung (8) abnehmen.

ESP Remover el grupo cilindro (4), completo de varilla (5), tuerca interna (6) y suporte (8).

F Enlever le groupe cylindre (4), complet de tige (5), écrou interne (6) et support (8).

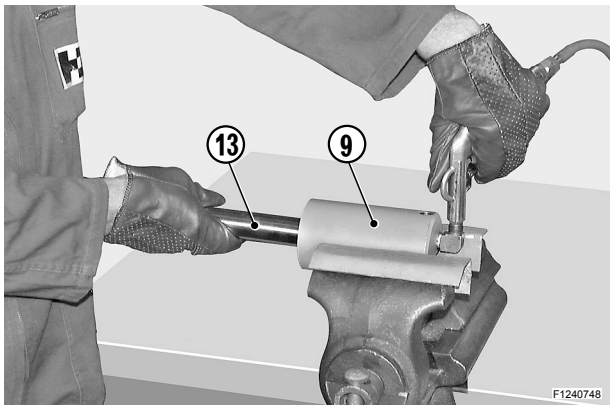
f

ITA Fissare il cilindro (4) in una morsa dal lato sede molla (10) e, utilizzando una barra "**D**", allentare ed asportare il corpo cilindro (9) completo di pistone (13) e la molla (12).

D Den Zylinder (4) in einem Spannstock an der Federseite (10) einklemmen und mit dem Stab "**D**" den Zylinderkörper (9) lockern und samt Kolben (13) und Feder (12) abnehmen.

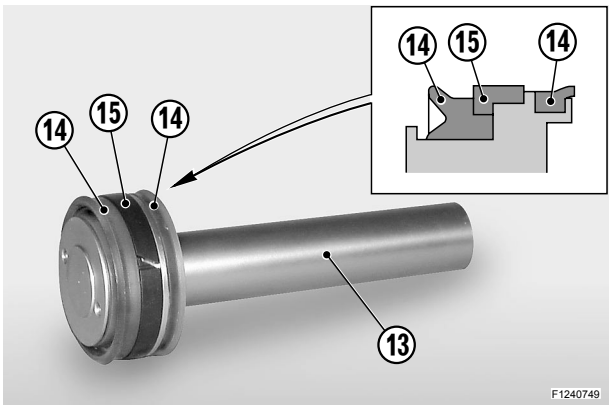
ESP Fijar el cilindro (4) en un corchete del lado muelle (10) y, utilizando un varilla "**D**", aflojar y sacar el cuerpo cilindro (9) completo de piston (13) y el muelle (12).

F Fixer le cylindre (4) dans un étau du côté du siège ressort (10), puis à l'aide dune barre "**D**", desserrer et enlever le corps cylindre (9) complet du piston (13) et du ressort (12).



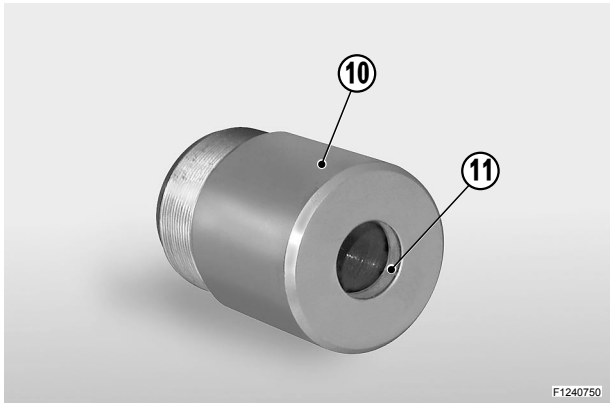
GB a

Gently introduce the union piece of the cylinder unit (9) so as to eject the piston (13).
CAUTION! Hold the piston as it may be forced out rapidly and be damaged.



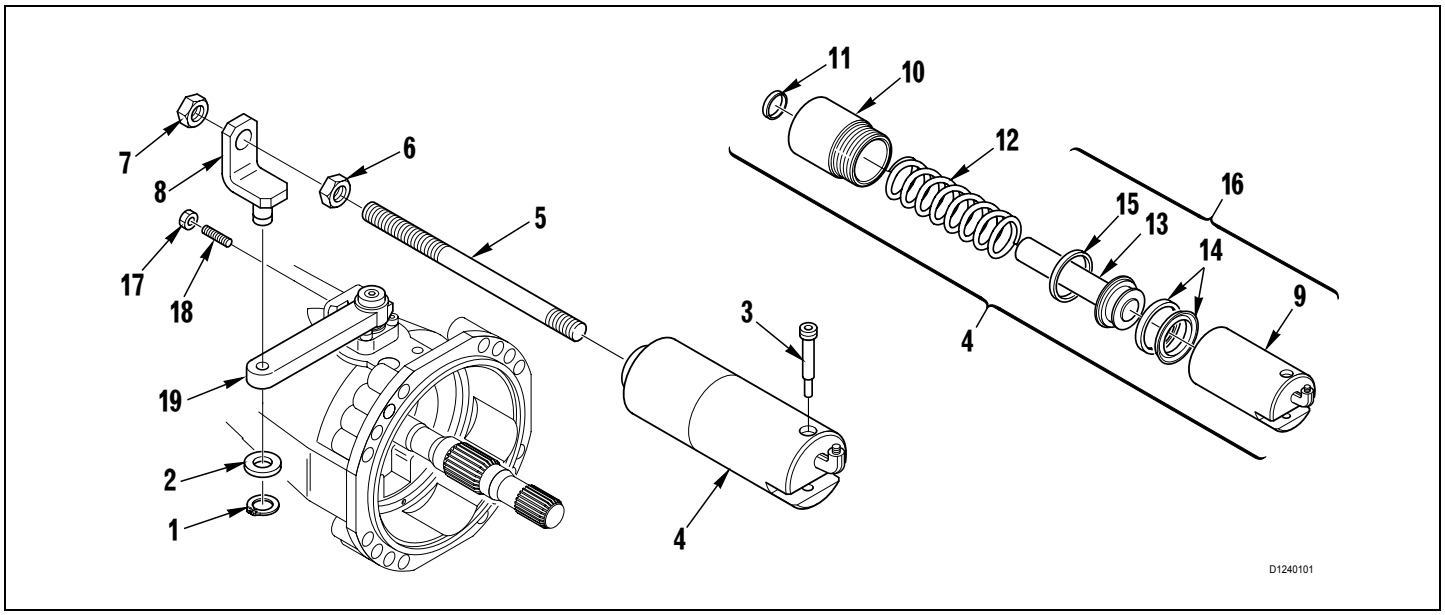
GB b

Remove seals (14) and guide ring (15) from the piston (13).
NOTE. Note down seals direction of assembly.



GB c

ONLY IF NECESSARY
Remove the guide ring (11) from the spring seat (10).
CAUTION! If the guide ring (11) is removed, it must be replaced.



a

ITA Immettere lentamente il raccordo del corpo cilindro (9) per espellere il pistone (13).
ATTENZIONE! Trattenere il pistone che può essere espulso velocemente ed essere danneggiato.

D Langsam das Anschlußstück des Zylinderkörpers (9) einsetzen, um den Kolben (13) auszustoßen.
ACHTUNG! Den Kolben halten, denn er könnte plötzlich herausspringen und beschädigt werden.

ESP Meter lentamente el empalme del cuerpo cilindro (9) para la expulsion del piston (13).
ATENCION! Tener el piston que puede ser expulso rapidamente y danarse.

F Introduire lentement le raccord du corps cylindre (9) et expulser le piston (13).
ATTENTION! Retenir le piston qui expulsé rapidement peut par conséquent s'endommager.

b

ITA Rimuovere dal pistone (13) le guarnizioni (14) e l'anello di guida (15).
NOTA. Annotare il senso di montaggio delle guarnizioni.

D Den Kolben (13), die Dichtungen (14) und den Führungsring (15) abnehmen.
BEMERKUNG. Montagerichtung der Dichtungen bemerken.

ESP Remover del piston (13) las guarniciones (14) y el anillo de guìa (15).
NOTA. Anotar el sentido de desmontaje de las guarniciones.

F Enlever du piston (13) les garnitures (14) et la bague de guidage (15).
NOTE. Prendre note du sens de montage des garnitures.

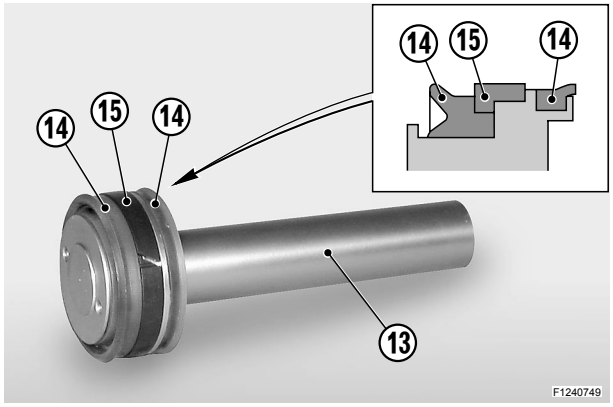
c

ITA **SOLO SE NECESSARIO**
Rimuovere dalla sede molla (10) l'anello di guida (11).
ATTENZIONE! Se l'anello di guida (11) viene smontato, deve essere sostituito.

D **NUR WENN NOTWENDIG**
Aus dem Federsitz (10) den Führungsring (11) nehmen.
ACHTUNG! Falls der Führungsring (11) abmontiert wird, muß er ausgewechselt werden.

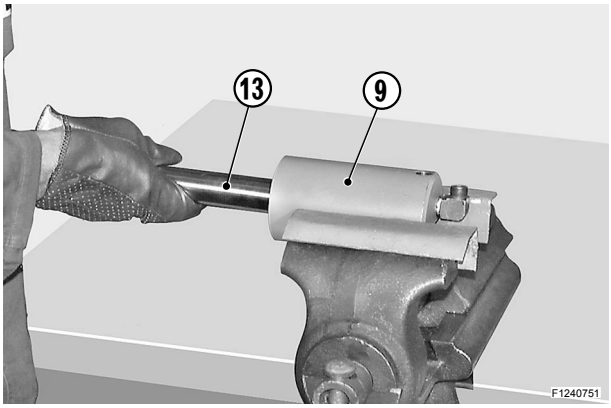
ESP **SOLO SI NECESARIO**
Remover de la sede muelle (10) el anillo de guìa (11).
ATENCION! Si el anillo de guìa (11) viene desmontado, debe de ser sobstituido.

F **SEUL SI BESOIN**
Enlever du siège ressort (10), la bague de guidage (11).
ATTENTION! Si la bague de guidage (11) est démontée, il faut la substituer.



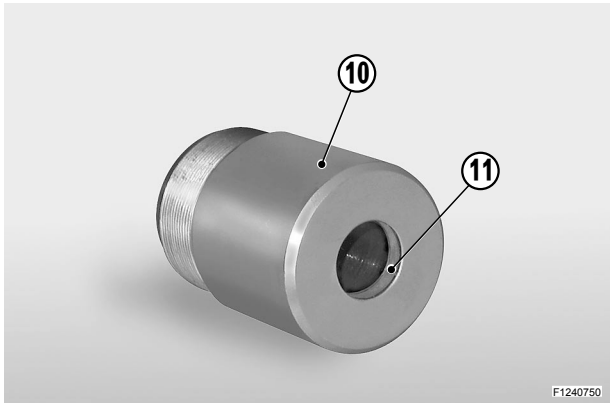
GB a

Install guide ring (15) and seals (14) onto the piston (13).
CAUTION! Carefully check seals assembly direction.



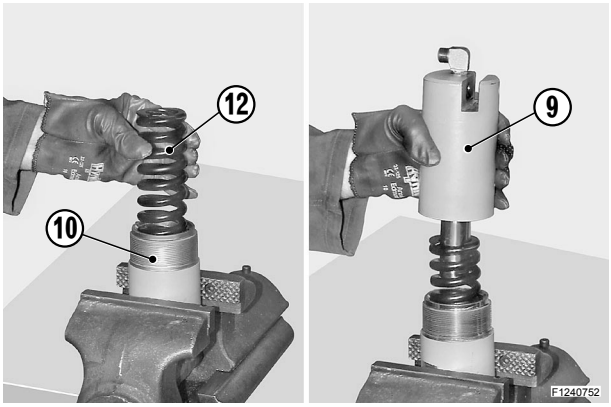
GB b

Lubricate the seals (14) and the inside of the cylinder (9); introduce the whole piston and move it to end of stroke.



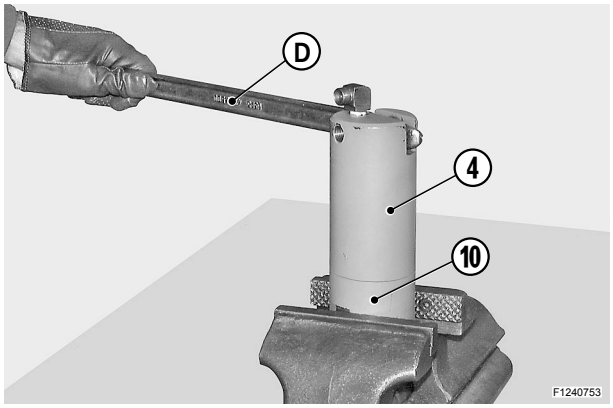
GB c

If guide ring has been removed, insert a new one (11) into the seat of the spring.
Lubricate the guide ring.



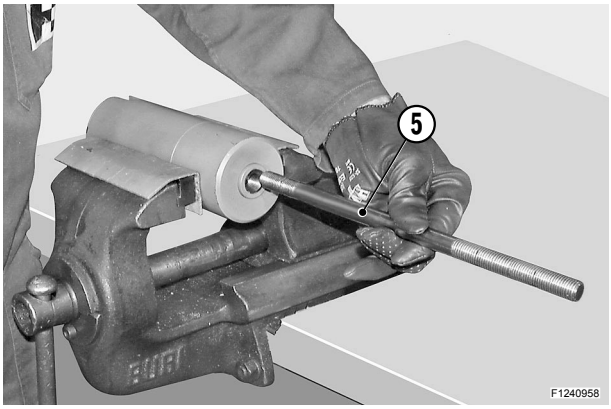
GB d

Position the spring seat (10) in a vice and insert spring (12).
Lubricate the thread. Assemble the whole cylinder (9).



GB e

Screw the cylinder (9) into the spring seat (10) and lock it using a bar "**D**".



GB f

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

a

ITA Montare sul pistone (13) l'anello di guida (15) e le guarnizioni (14).
ATTENZIONE! Controllare attentamente il senso di montaggio delle guarnizioni.

D Auf den Kolben (13) den Führungsring (15) und die Dichtungen (14) montieren.
ACHTUNG! Auf die Montagerichtung der Dichtungen sorgfältig achten.

ESP Montar sobre el piston (13) el anillo de guìa (15) y las guarniciones (14).
ATENCION! Controlar atentamente el sentido de montaje de las guarniciones.

F Monter sur le piston (13) la bague de guidage (15) et les garnitures (14).
ATTENTION! Contrôler attentivement le sens du montage des garnitures.

b

ITA Lubrificare le guarnizioni (14) e l'interno del cilindro (9); inserire il pistone completo e mandarlo a fine corsa.

D Dichtungen (14) und das Zylinderinnere (9) schmieren; den vollständigen Kolben einsetzen und bis zum Anschlag einschieben.

ESP Lubrificar las guarniciones (14) y el interno del cilindro (9); introducir el piston completo y mandarlo a final de carrera.

F Lubrifier les garnitures (14) à l'intérieur du cylindre (9); y introduire le piston complet et l'envoyer en fin de course.

c

ITA Se è stato smontato, inserire il nuovo anello di guida (11) nella sede molla (10).
Lubrificare l'anello di guida.

D Falls der Führungsring (11) abmontiert worden ist, diesen in den Federsitz (10) einsetzen.
Den Führungsring schmieren.

ESP Si ha sido desmontado, introducir el nuevo anillo de guìa (11) en la sede muelle (10).
Lubrificar el anillo de guìa.

F Si elle a été démontée, introduire la bague de guidage neuve (11) dans le siège ressort (10).
Lubrifier la bague de guidage.

d

ITA Posizionare la sede molla (10) in una morsa ed inserire la molla (12).
Lubrificare la filettatura. Montare il cilindro completo (9).

D Federsitz (10) in einen Spannbock einklemmen und die Feder (12) einsetzen.
Gewinde schmieren. Den vollständigen Zylinder (9) montieren.

ESP Colocar la sede muelle (10) en un corchete y introducir un muelle (12).
Lubrificar la rosca. Montar el cilindro completo (9).

F Placer le siège ressort (10) dans un étau et y introduire le ressort (12).
Lubrifier le filetage. Monter le cylindre complet (9).

e

ITA Avvitare il cilindro (9) nella sede molla (10) e bloccarlo utilizzando una barra "**D**".

D Den Zylinder (9) in den Sitze der Feder (10) schrauben und mit Hilfe des Stabs "**D**" blockieren.

ESP Atornillar el cilindro (9) en la sede muelle (10) y bloquearlo utilizando una varilla "**D**".

F Visser le cylindre (9) dans le siège ressort (10), puis bloquer celui-ci à l'aide d'une barre "**D**".

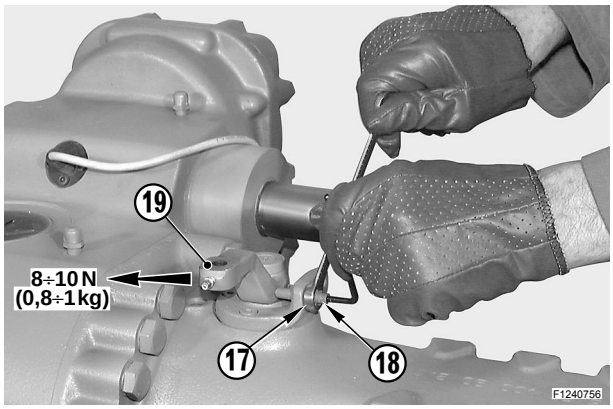
f

ITA Spalmare l'asta (5) con Loctite 270 ed avvitarla a fondo nel pistone (13).

D Den Stab (5) mit Loctite 270 schmieren und in den Kolben (13) festschrauben.

ESP Pasar la varilla (5) con Loctite 270 y aternillarla a fondo en el piston (13).

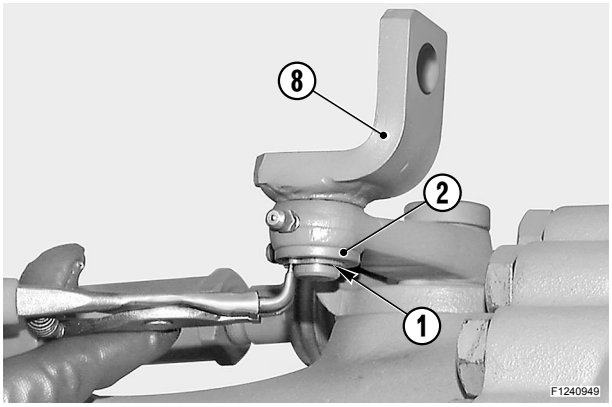
F Enduire la tige (5) avec du Loctite 270 et visser celle-ci à fond dans le piston (13).



GB a

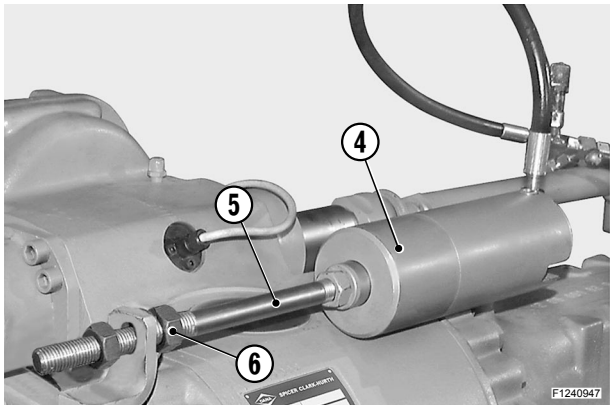
Loosen nuts (17) and set braking levers (19) clearances to zero by turning dowels (18); lock nuts (17) with a torque wrench setting of 20 – 25 Nm.

CAUTION! Clearances should be set to zero without causing any preloading.



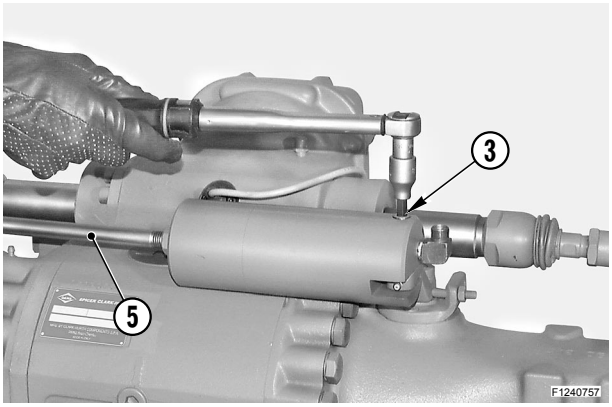
GB b

Install distance piece (2) and insert the pin of support (10) into the right-hand braking lever. Fit the second distance piece (2) and snap ring (1).



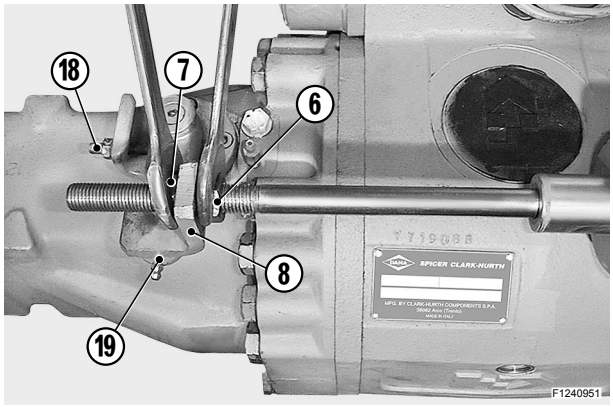
bar GB c

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



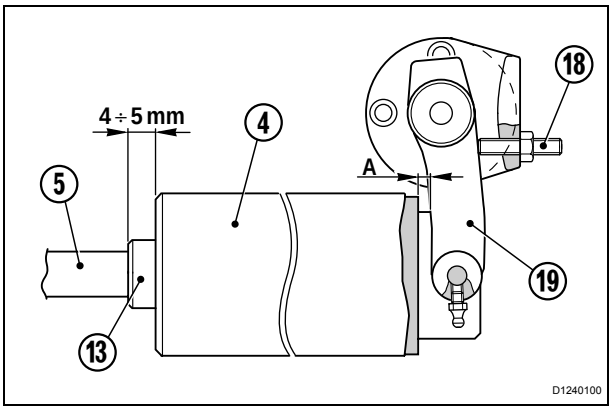
GB d

Centre the hole of fulcrum pin (3).
Apply Loctite 242 to the pin thread, screw and tighten pin with a dynamometric wrench set at 25 – 30 Nm.



GB e

Introduce pressure into the cylinder (4) and whilst 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.



GB f

Check that, when the brakes are released (pressure inserted), levers (19) do lean against the screws (18) without prestressing 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.

a

ITA Allentare i dadi (17) ed azzerare i giochi delle leve di frenatura (19) con i grani (18); bloccare i dadi (17) ad una coppia di 20÷25 Nm.
ATTENZIONE! I giochi devono risultare azzerati senza provocare precarico.

D Muttern (17) lockern und die Spiele der Bremshebel (19) mit den Stiften (18) zurückstellen; die Mutter (17) bei einem Anzugsmoment von 20÷25 Nm bockieren.
ACHTUNG! Die Spiele müssen zurückgestellt werden, ohne das Teil vorzuladen.

ESP Aflojar las tuercas (17) y poner a zero los juegos de las palancas de frenadura (19) con las espigas (18); bloquear las tuercas (17) a un par de 20÷25 Nm.
ATENCION! Los guegos deben de resultar a zero sin provocar precarga.

F Desserrer les écrous (17) et mettre à zéro les jeux des leviers de freinage (19) avec les grains (18); bloquer les écrous (17) à un couple de 20÷25 Nm.
ATTENTION! Les jeux doivent être mis à zéro sans provoquer de précharge.

b

ITA Montare il distanziale (2) ed infilare il perno del supporto (10) nella leva di frenatura destra. Montare il secondo distanziale (2) e l'anello elastico (1).

D Das Distanzstück (2) montieren und den Halterungsstift (10) in den rechten Bremshebel einsetzen. Das zweite Distanzstück (2) in den Kolbenring (1) montieren.

ESP Montar el distancial (2) y insertar el perno del suporte (10) en la palanca de frenadura derecha. Montar el segundo distancial (2) y el anillo elastico.

F Monter l'entretoise (2), puis introduire l'axe du support (10) dans le levier de freinage droit. Monter la deuxième entretoise (2) et l'anneau à ressort (1).

c

ITA Montare il cilindro (4) completo di asta (5) e del dado interno (6).

D Den Zylinder (4) samt Stab (5) und innere Mutter (6) montieren.

ESP Montar el cilindro (4) completo de varilla (5) y de la tuerca interna (6).

F Monter le cylindre (4) équipé de la tige (5) et de l'écrou interne (6).

d

ITA Centrare il foro del perno di fulcro (3).
Spalmare la filettatura del perno (3) con Loctite 242, avvitarlo e serrarlo con chiave dinamometrica tarata a 25÷30 Nm.

D Das Loch des Zentrierstiftes (3) zentrieren.
Das Stiftgewinde (3) mit Loctite 242 schmieren und mit einem Momentenschlüssel bei 25÷30 Nm fest ziehen.

ESP Centrar el agujero de la rotula del fulcro (3).
Pasar la rosca de la rotula (3) con Loctite 242, atornillarlo y apretarlo con llave dinamometrica tarada a 25÷30 Nm.

F Centrer le trou de l'axe du fourreau (3).
Enduire le filetage de l'axe (3) avec du Loctite 242, visser et serrer celui-ci à l'aide d'une clé dynamométrique calibrée à 25÷30 Nm.

e

ITA Immettere pressione nel cilindro (4) e, mantenendo entrambe le leve (19) appoggiate alle viti di registro (18), mandare in appoggio i dadi (6) e (7) sul supporto (8); bloccare i dadi con una coppia di 50÷60 Nm.

D Den Druck in den Zylinder (4) einlassen. Beide Hebel (19) an den Stellschrauben (18) anliegen lassen und die Muttern (6) und (7) bis zum Anschlag der Halterung (8) bringen; die Muttern mit einem Anzugsmoment von 50÷60 Nm fest ziehen.

ESP Meter presiòn en el cilindro 4)y, manteniendo las dos palancas (19) en apoyo a las tuercas de registro (18), mandasr en apoyo las tuercas (6) y (7) sobre el suporte (8); bloquear las tuercas con un par de 50÷60 Nm.

F Emettre de la pression dans le cylindre (4), puis en maintenant les deux leviers (19) posés sur les vis de réglage (18), envoyer les écrous (6) et (7) en appui sur le support (8); bloquer les écrous à un couple de 50÷60 Nm.

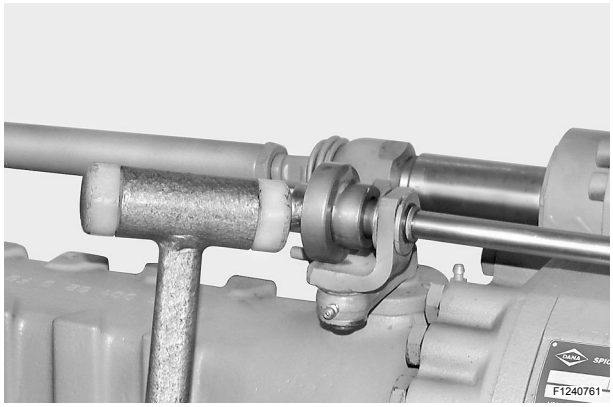
f

ITA Controllare che a freni sbloccati (pressione inserita), le leve (19) vadano in appoggio sulle viti (18) senza precaricarle e che tra cilindro (4) e leva (19) rimanga un gioco "**A**".
Controllare anche che a pressione rilasciata, il pistone (13) abbia una sporgenza di 4÷5 mm.

D Kontrollieren, ob bei freien Bremsen (eingelassener Druck), die Hebel (19) an den Schrauben (18) anliegen, ohne sie vorzuladen und ob zwischen Zylinder (4) und Hebel (19) ein Spiel "**A**" besteht.
Kontrollieren, ob bei abgelassenem Druck, der Kolben (13) um 4÷5 mm herausragt.

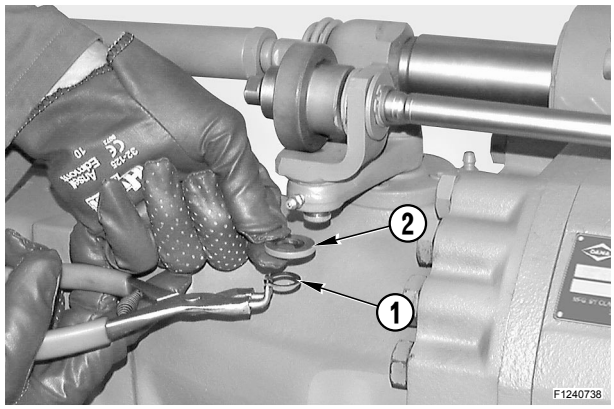
ESP Controlar que a frenos bloqueados (presiòn insertada), las palancas (19) vayan en apoyo sobre los tornillos (18) sin precargarlas y que entre el cilindro (4) y la palanca (19) haya un juego "**A**".
Controlar tambien que a presiòn soltada el piston (13) tenga una resalte de 4÷5 m/m.

F Contrôler que lorsque les freins sont débloqués (pression introduite), les leviers (19) aillent se poser sur les vis (18) sans précharger ces dernières, et qu'entre cylindre (4) et levier (19) il y ait un jeu "**A**".
Contrôler également que lorsque la pression est relâchée, le piston (13) ait une saillie de 4÷5 mm.



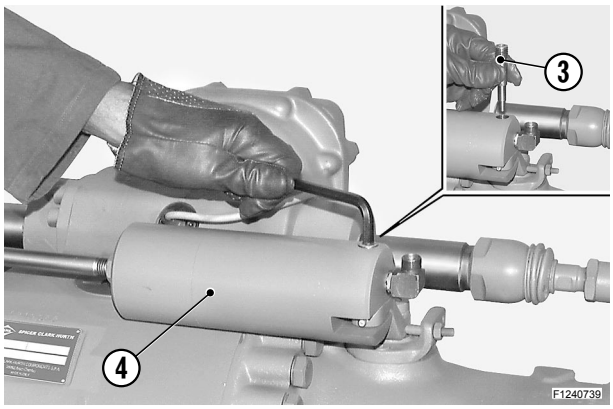
GB a

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



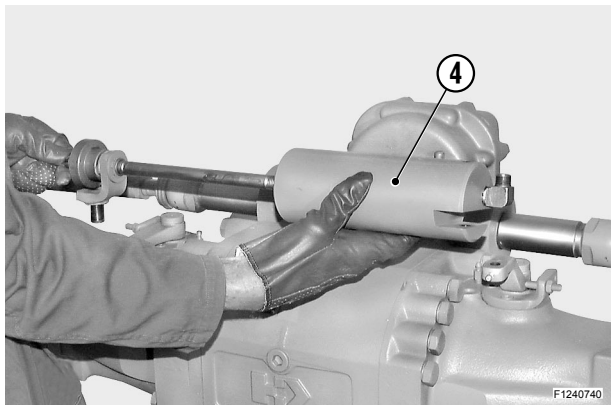
GB b

Remove snap ring (1) and extract distance piece (2).



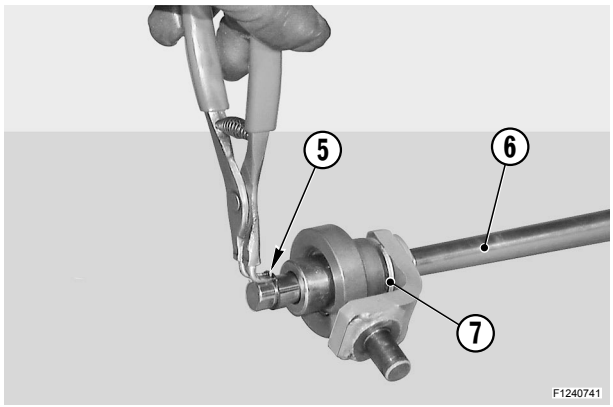
GB c

Remove the fulcrum pin (3) from the cylinder (4).



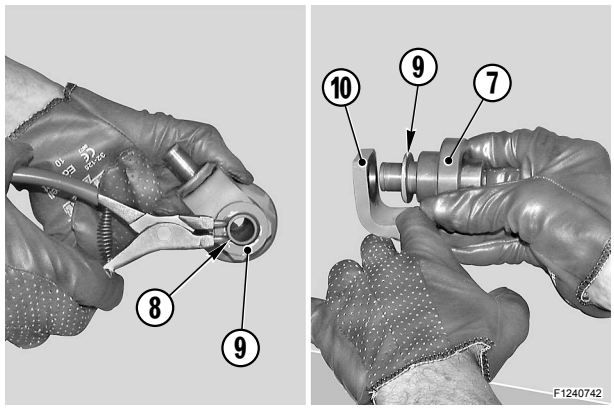
GB d

Remove the complete cylinder set (4).



GB e

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



GB f

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

a

ITA **ATTENZIONE!** Prima di intervenire nel gruppo, disattivare l'azione del cilindro con un leggero colpo di mazzuolo sull'anello esterno del gruppo di ritegno.

D **ACHTUNG!** Bevor am Aggregat gearbeitet wird, die Zylinderwirkung mit einem leichten Hammerschlag auf den äußeren Ring des Halteaggregats löschen.

ESP **ATENCION!** Antes de intervenir en el grupo, desconectar la acciòn del cilindro con un lijero golpe de martillo sobre el anillo esterior del grupo de retenciòn.

F **ATTENTION!** Avant d'intervenir dans le groupe, désactiver l'action du cylindre par un léger coup de maillet sur l'anneau externe du groupe de fixation.

b

ITA Rimuovere l'anello elastico (1) ed asportare il distanziale (2).

D Den Kolbenring (1) entfernen und das Distanzstück (2) abnehmen.

ESP Remover el anillo elastico (1) y sacar el distancial (2).

F Enlever l'anneau à ressort (1), puis enlever l'entretoise (2).

c

ITA Rimuovere il perno di fulcro (3) del cilindro (4).

D Den Zentrierstift (3) des Zylinders (4) abnehmen.

ESP Remover la rotula de fulcro (3) del cilindro (4).

F Enlever l'axe du fourreau (3) du cylindre (4).

d

ITA Asportare il gruppo cilindro completo (4).

D Gesamtes Zylinderaggregat (4) abnehmen.

ESP Sacar el grupo cilindro completo (4).

F Enlever le groupe cylindre complet (4).

e

ITA Rimuovere l'anello elastico (5) dallo stelo (6) e sfilare il gruppo di ritegno (7).

D Den Kolbenring (5) vom Schaft (6) abnehmen und das Halteaggregat (7) abziehen.

ESP Remover el anillo elastico (5) del vastago (6) y deshilar el grupo de retenciòn (7).

F Enlever l'anneau à ressort (5) de la tige (6) et extraire le groupe de retenue (7).

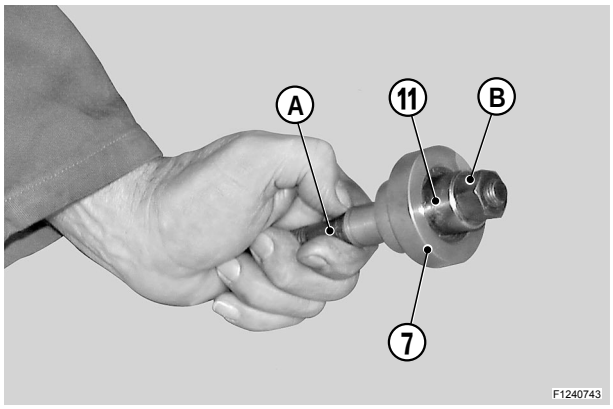
f

ITA Asportare l'anello elastico (8), la rondella (9) e separare dal gruppo di ritegno (7) il supporto (10) e la seconda rondella (9).

D Den Kolbenring (8), die Unterlegscheibe (9) abnehmen und das Halteaggregat (7) von der Halterung (10) und der Unterlegscheibe (9) trennen.

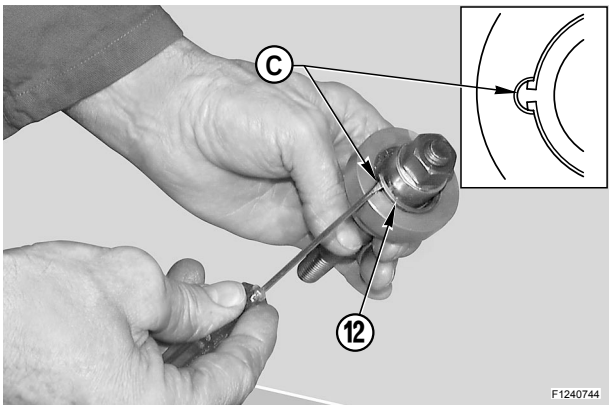
ESP Sacar el anillo elastico (8), la arandela (9) y separar del grupo de retenciòn (7) el suporte (10) y la segunda arandela (9).

F Enlever l'anneau à ressort (8), la rondelle (9) et séparer du groupe de retenue (7) le support (10) et la deuxième rondelle (9).



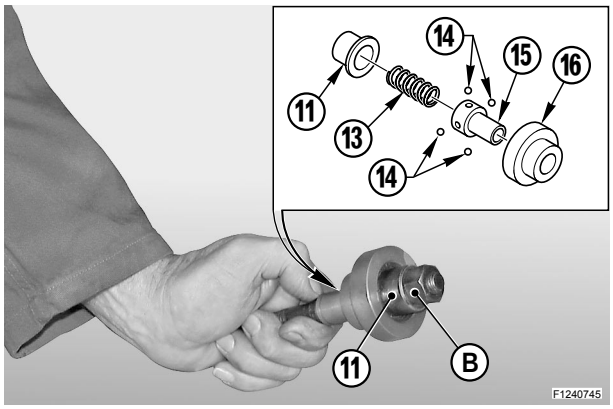
GB a

Introduce an 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 T.C.E.I. screw.



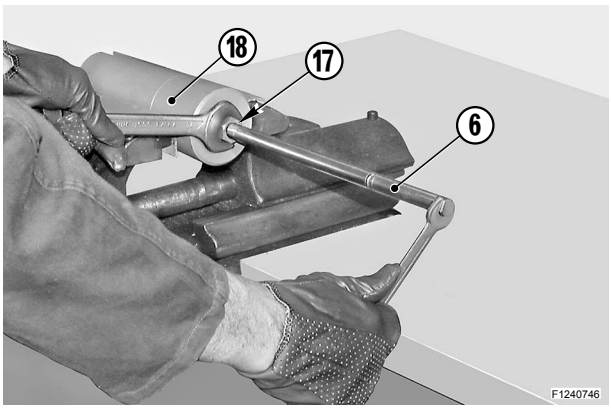
GB b

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



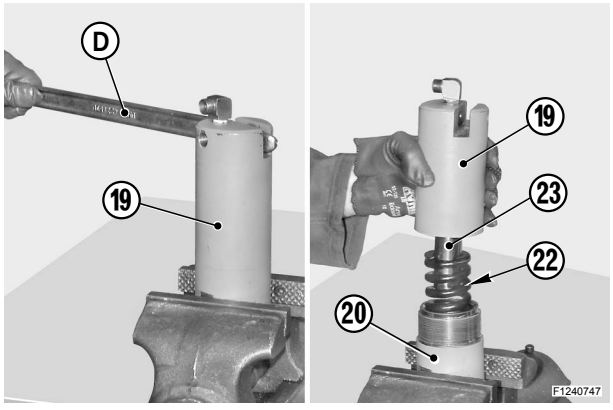
GB c

Slowly release nut "**B**" and disassemble the check unit.



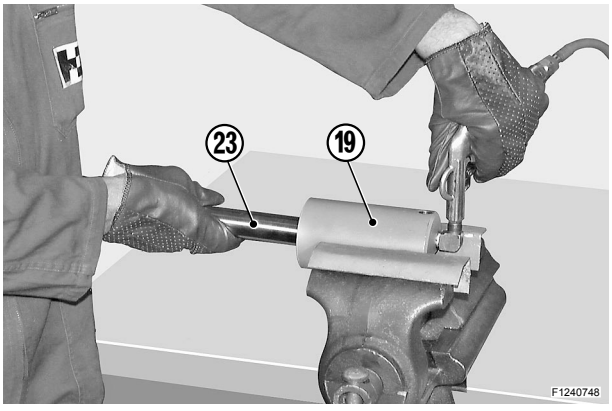
GB d

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



GB e

Place the cylinder in a vice with the spring seat (20) side engaged in it and, using a bar "**D**", loosen and remove the cylinder unit (19) complete with piston (23) and spring (22).



GB f

Slowly introduce air through the union piece of the cylinder unit (19) to expel the piston (23).
CAUTION! Hold the piston as it may be rapidly ejected and damaged.

a

ITA Inserire nel foro del gruppo di ritegno (7) una vite "**A**" da M14x100 ed avvitare un dado "**B**" fino a mandare a fondo corsa la sede molla (11).
NOTA. Usare una vite T.C.E.I.

D In das Loch des Halteaggregats (7) eine Schraube "**A**" M14x100 einsetzen und eine Mutter "**B**" bis zum Federsitz (11) einschrauben.
BEMERKUNG. Eine T.C.E.I. Schraube verwenden.

ESP Insertar en el agujero del grupo de retenciòn (7) un tornillo "**A**" de M14x100 y atornillar una tuerca "**B**" hasta mandar a fondo carrera el alojamiento muelle (11).
NOTA. Usar un tornillo T.C.E.I.

F Introduire dans le trou du groupe de fixation (7) une vis "**A**" de M 14 x 100 et visser un écrou "**B**" jusqu'à envoyer en fin de course le siège ressort (11).
NOTE. Utiliser une vis T.C.E.I.

b

ITA Far ruotare l'anello elastico (12) fino a portare le estremità in corrispondenza della nicchia "**C**".
Rimuovere l'anello elastico (12).

D Den Kolbenring (12) drehen, bis die Enden die Nische "**C**" erreichen.
Kolbenring (12) abnehmen.

ESP Hacer girar el anillo elastico (12) hasta llevar las extremidades en corrispondencia del nicho "**C**".
Remover el anillo elastico (12).

F Faire tourner l'anneau à ressort (12) jusqu'à en amener l'extrémité face à la niche "**C**".
Enlever l'anneau à ressort (12).

c

ITA Rilasciare lentamente il dado "**B**" e scomporre il gruppo di ritegno.

D Langsam die Mutter "**B**" abschrauben und das Halteaggregat auseinander nehmen.

ESP Dejar lentamente la turca "**B**" y descomponer el grupo de retenciòn.

F Desserrer lentement l'écrou "**B**" et désassembler le groupe de retenue.

d

ITA Allentare il dado (17) e rimuovere dal cilindro (18) lo stelo (6).

D Mutter (17) lockern und den Schaft (6) vom Zylinder (18) abnehmen.

ESP Aflojar la tuerca (17) y remover del cilindro (18) el vastago (6).

F Desserrer l'écrou (17), puis enlever le cylindre (18) la tige (6).

e

ITA Fissare il cilindro (18) in una morsa dal lato sede molla (20) e, utilizzando una barra "**D**", allentare ed asportare il corpo cilindro (19) completo di pistone (23) e la molla (22).

D Den Zylinder (18) in einem Spannbock an der Federseite (20) einklemmen und mit Hilfe des Stabs "**D**" den Zylinderkörper (19) lockern und samt Kolben (23) und Feder (22) abnehmen.

ESP Fijar el cilindro (18) en un corchete del lado de alojamiento de varilla "**D**", aflojar y sacar el cuerpo cilindro (19) completo de piston (23) y el muelle (22).

F Fixer le cylindre (18) dans un étau du côté du siège ressort (20), puis, à l'aide d'une barre "**D**", desserrer et enlever le corps cylindre (19) complet de piston (23), puis le ressort (22).

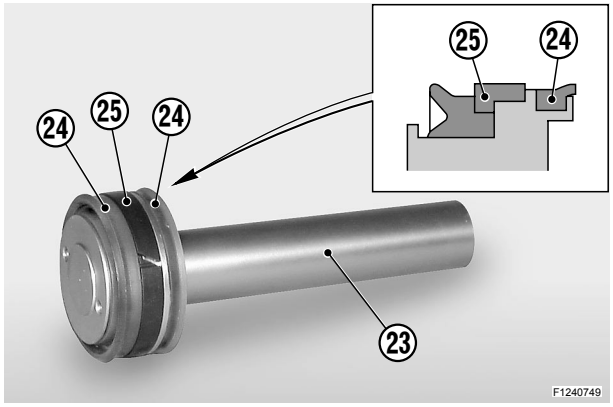
f

ITA Immettere lentamente aria attraverso il raccordo del corpo cilindro (19) per espellere il pistone (23).
ATTENZIONE! Trattenere il pistone che può essere espulso velocemente ed essere danneggiato.

D Langsam Luft durch das Anschlußstück des Zylinderkörpers (19) einlassen, um den Kolben (23) auszustoßen.
ACHTUNG! Den Kolben halten, denn er könnte plötzlich herausspringen und beschädigt werden.

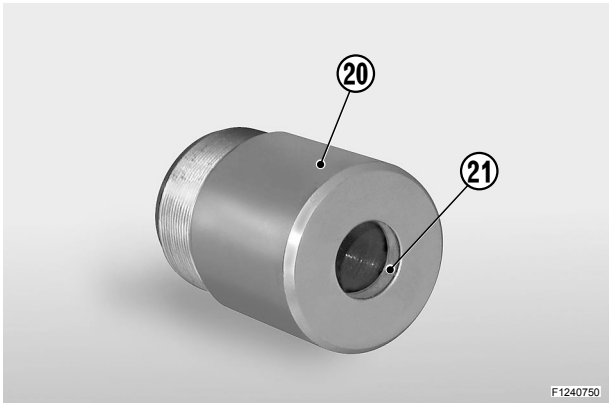
ESP Meter lentamente aire atraves del empalme del cuerpo cilindro (19) para expulsar el pistòn (23).
ATENCION! Tener el pistòn que puede ser expulso rapidamente y ser danado.

F Emettre lentement de l'air à travers le raccord du corps cylindre (19) et expulser le piston (23).
ATTENTION! Retenir le piston qui expulsé rapidement peut par conséquent s'endommager.



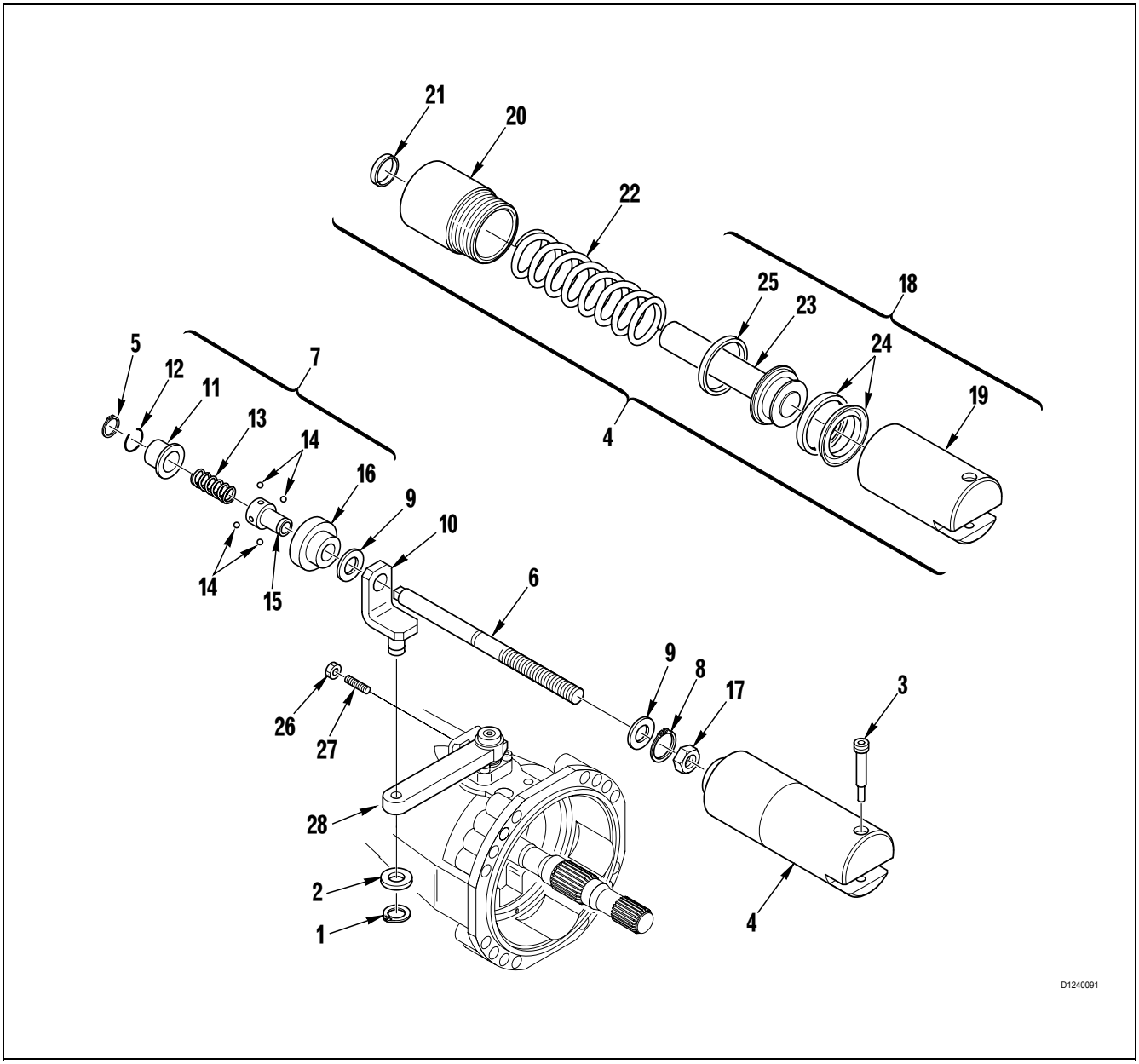
GB a

Remove seals (24) and guide ring (25) from the piston (23).
NOTE. Note down seals installation direction.



GB b

ONLY IF NECESSARY
Remove guide ring (21) from spring seat (20).
CAUTION! If guide ring (21) is taken out, it must be replaced.



a

ITA Rimuovere dal pistone (23) le guarnizioni (24) e l'anello di guida (25).
NOTA. Annotare il senso di montaggio delle guarnizioni.

D Den Kolben (23) und die Dichtungen (24) sowie den Führungsring (25) abnehmen.
BEMERKUNG. Montagerichtung der Dichtungen bemerken.

ESP Remover del pistòn (23) las guarniciones (24) y el anillo de guìa (25).
NOTA. Anotar el sentido de desmontaje de las guarniciones.

F Enlever le piston (23), les garnitures (24) et la bague de guidage (25).
NOTE. Noter le sens du montage des garnitures

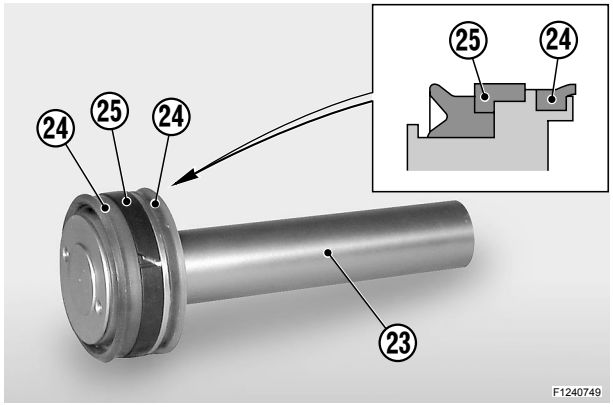
b

ITA **SOLO SE NECESSARIO**
Rimuovere dalla sede molla (20) l'anello di guida (21).
ATTENZIONE! Se l'anello di guida (21) viene smontato, deve essere sostituito.

D **NUR WENN NÖTIG**
Vom Federsitz (20) den Führungsring (21) abnehmen.
ACHTUNG! Wird der Führungsring (21) abmontiert, muß er ausgewechselt werden.

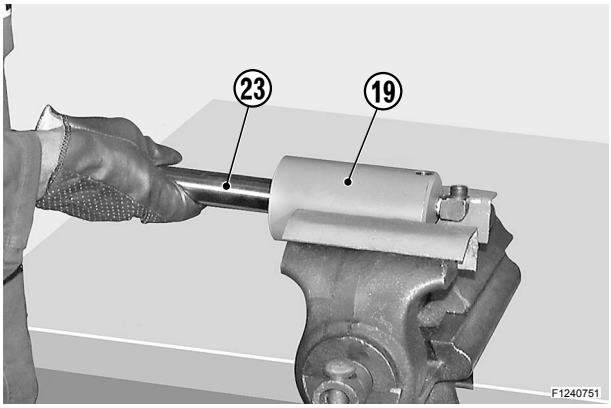
ESP **SOLO SI FUERA NECESARIO**
Remover del alojamiento muelle (20) el anillo de guìa (21).
ATENCION! Si el anillo de guìa (21) viene desmontado, debe de ser sobstituido.

F **SEULEMENT SI BESOIN**
Enlever du siège ressort (20) la bague de guidage (21).
ATTENTION! Une fois la bague de guidage (21) démontée, elle doit être substituée.



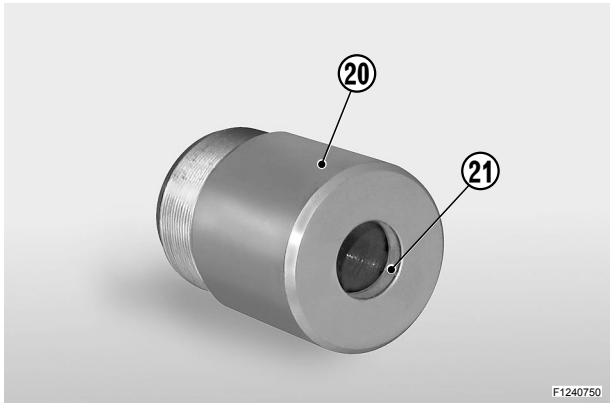
GB a

Fit guide ring (25) and seals (24) onto the piston (23).
CAUTION! Carefully check seals installation direction.



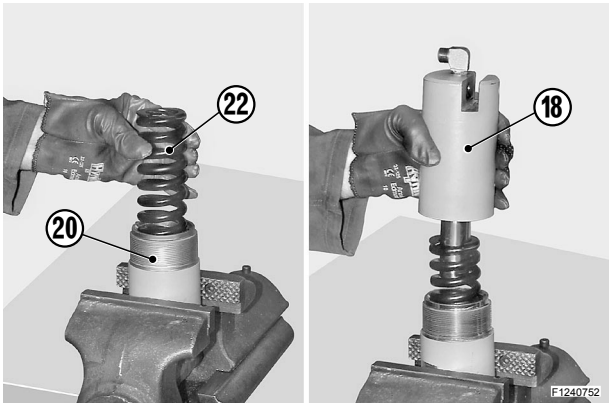
GB b

Lubricate seals (24) and the inside part of the cylinder (19); introduce the whole piston and move it to end of stroke.



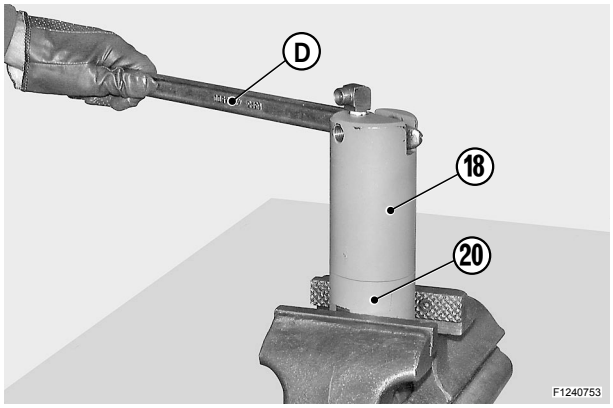
GB c

It the guide ring has been taken out, fit a new one (21) into the spring seat (20).
Lubricate the guide ring.



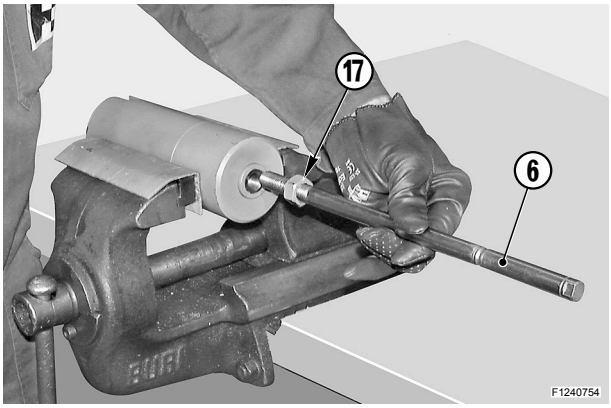
GB d

Position the spring seat (20) in a vice and insert spring (22).
Lubricate the thread. Install the whole cylinder (18).



GB e

Screw the cylinder (18) into the spring seat (20) and lock it using a bar "**D**".



GB f

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

a

ITA Montare sul pistone (23) l'anello di guida (25) e le guarnizioni (24).
ATTENZIONE! Controllare attentamente il senso di montaggio delle guarnizioni.

D Auf den Kolben (23) den Führungsring (25) und die Dichtungen (24) montieren.
ACHTUNG! Montagerichtung der Dichtungen sorgfältig kontrollieren.

ESP Montar sobre el piston (23) el anillo de guìa (25) y las guarniciones (24).
ATENCION! Controlar atentamente el sentido de montaje de las guarniciones.

F Monter sur le piston (23) la bague de guidage (25) et les garnitures (24).
ATTENTION! Contrôler attentivement le sens de montage des garnitures.

b

ITA Lubrificare le guarnizioni (24) e l'interno del cilindro (19); inserire il pistone completo e mandarlo a fine corsa.

D Dichtungen (24) und das Zylinderinnere (19) schmieren; den vollständigen Kolben einsetzen und bis zum Anschlag einschieben.

ESP Lubrificar las guarniciones (24) y el interno del cilindro (19); introducir el piston completo y mandarlo a final de carrera.

F Lubrifier les garnitures (24) et l'intérieur du cylindre (19); introduire le piston complet et envoyer celui-ci en fin de course.

c

ITA Se è stato smontato, inserire il nuovo anello di guida (21) nella sede molla (20).
Lubrificare l'anello di guida.

D Falls der Führungsring (21) abmontiert worden ist, diesen in den Federsitz (20) einsetzen.
Den Führungsring schmieren.

ESP Si ha sido desmontado, introducir un nuevo anillo de guìa (21) en el alojamiento muelle (20).
Lubrificar el anillo de guìa.

F Si elle a été démontée, introduire la bague de guidage neuve (21) dans le siège ressort (20).
Lubrifier la bague de guidage.

d

ITA Posizionare la sede molla (20) in una morsa ed inserire la molla (22).
Lubrificare la filettatura. Montare il cilindro completo (18).

D Federsitz (20) in einen Spannbock einklemmen und die Feder (22) einsetzen.
Gewinde schmieren. Den vollständigen Zylinder (18) montieren.

ESP Colocar el alojamiento muelle (20) en un corchete y introducir la muelle (22).
Lubrificar la rosca. Montar el cilindro completo (18).

F Placer le siège ressort (20) dans un étau et y introduire le ressort (22).
Lubrifier le filetage. Monter le cylindre (18) complet.

e

ITA Avvitare il cilindro (18) nella sede molla (20) e bloccarlo utilizzando una barra "**D**".

D Den Zylinder (18) in den Federsitz (20) montieren und mit Hilfe eines Stabs "**D**" blockieren.

ESP Atornillar el cilindro (18) en el alojamiento muelle (20) y bloquearlo utilizando una varilla "**D**".

F Visser le cylindre (18) dans le siège ressort (20) puis bloquer celui-ci à l'aide d'une barre "**D**".

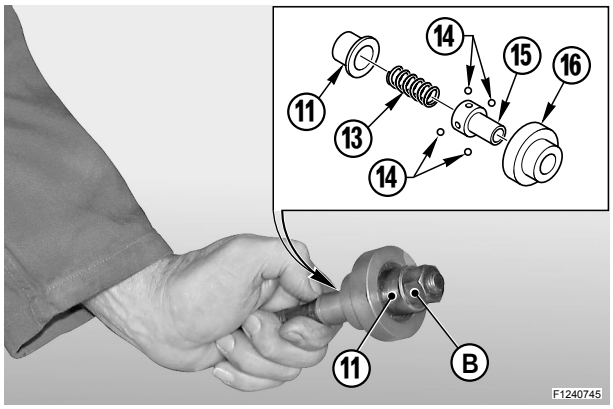
f

ITA Avvitare lo stelo (6) nel pistone senza bloccare il dado (17).

D Den Schaft (6) in den Kolben schrauben, ohne die Mutter (17) zu blockieren.

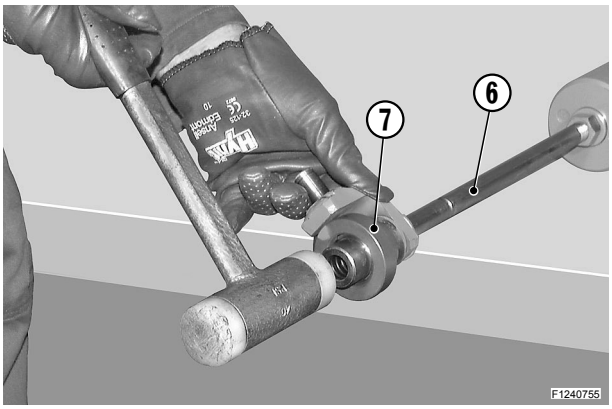
ESP Atornillar el vastago (6) en el piston sin bloquear la tuerca (17).

F Visser la tige (6) dans le piston sans bloquer l'écrou (17).



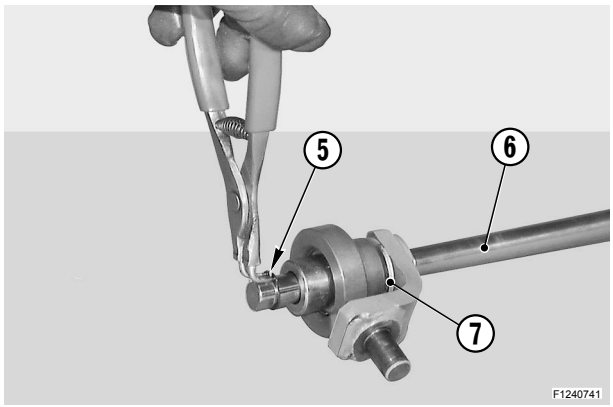
GB a

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



GB b

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

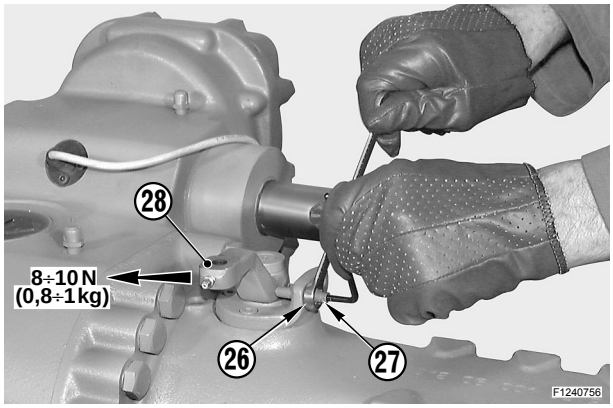


GB c

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

GB d

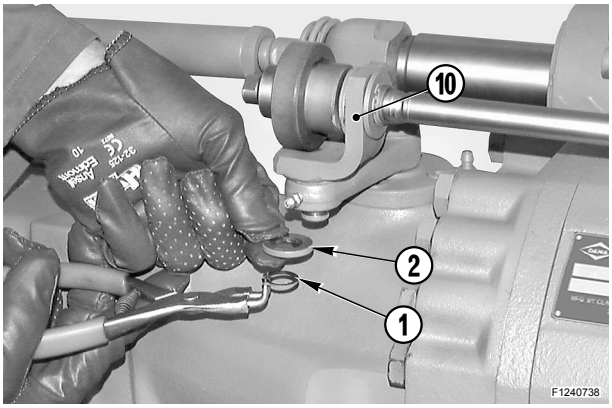
CAUTION! In case the braking disks have been replaced or if brake pistons have been removed: before adjusting the negative braking unit, apply the brakes several times at maximum pressure in order to set clearances.



GB e

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 dowels (27); lock nuts (26) to a torque wrench setting of 20 – 25 Nm.

CAUTION! The idle stroke should be eliminated without causing any preloading.



GB f

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

a

ITA Assemblare il gruppo di ritegno (7) seguendo la procedura di smontaggio in senso inverso.

D Halteaggregat (7) in umgekehrter Reihenfolge als beim Abmontieren, wieder zusammenbauen.

ESP Asemblar el grupo de retenciòn (7) siguiendo la procedura de desmontaje en sentido invertido.

F Assembler le groupe de retenue (7) en suivant la procédure du démontage mais dans le sens contraire.

b

ITA Utilizzando un mazzuolo in materiale plastico, montare il gruppo di ritegno (7) sullo stelo (6).

D Mit einem Gummihammer das Halteaggregat (7) auf den Schaft (6) montieren.

ESP Utilizando un martillo de plastica, montar el grupo de retenciòn (7) sobre el vastago (6).

F A l'aide d'un maillet en matière plastique, monter le groupe de retenue (7) sur la tige (6).

c

ITA Montare sullo stelo (6) l'anello elastico di sicurezza (5).

D Auf den Schaft (6) den Sicherheitskolbenring (5) montieren.

ESP Montar sobre vastago (6) el anillo elastico de seguridad (5).

F Monter sur la tige (6) l'anneau à ressort de sécurité (5).

d

ITA **ATTENZIONE!** Se sono stati sostituiti i dischi di frenatura o sono stati smontati i pistoni dei freni, prima di registrare il gruppo freno negativo eseguire più frenate alla massima pressione per assestare i giochi.

D **ACHTUNG!** Falls die Bremsscheiben ausgewechselt oder die Bremskolben abmontiert worden sind, mehrmals bei maximalen Druck bremsen, um das Spiel zu setzen, bevor das Bremsaggregat eingestellt wird.

ESP **ATENCION!** Si han sido sobstituidos los discos de frenadura o han sido desmontados los pistones de los frenos, antes de registrar el grupo freno negativo ejecutar mas frenadas a la maxima presiòn para asestar los juegos.

F **ATTENTION!** Si les disques de freinage ont été remplacés où que les pistons des freins ont été démontés, avant de régler le groupe frein négatif, effectuer quelques freinages au max. de la pression pour ajuster les jeux.

e

ITA Allentare i dadi (26) ed applicare alle leve (28) una forza di 8÷10 N (0,8÷1 kg) diretta nel senso di frenatura per eliminare i giochi utilizzando i grani (27); bloccare i dadi (26) ad una coppia di 20÷25 Nm.
ATTENZIONE! La corsa a vuoto deve essere eliminata senza provocare precarico.

D Muttern (26) lockern und an den Hebeln (28) eine Kraft von 8÷10 N (0,8÷1 kg) in die Bremsrichtung anbringen, um die Spiele der Stifte (27) zu beseitigen; die Muttern (26) bei einem Anzugsmoment von 20÷25 Nm blockieren.
ACHTUNG! Der leere Lauf muß beseitigt werden, ohne das Teil vorzuladen.

ESP Aflojar las tuercas (26) y aplicar a las palancas (28) una fuerza de 8÷10 N (0,8÷1 kg) directa en el sentido de frenadura para eliminar los juegos utilizando las espigas (27); bloquear las tuercas (26) a un par de 20÷25 Nm.
ATENCION! La carrera a vacio debe de ser eliminada sin provocar precarga.

F Desserrer les écrous (26), puis appliquer aux leviers (28) une contrainte de 8÷10 N (0,8÷1 kg) orientée dans le sens du freinage pour éliminer les jeux à l'aide des grains (27); bloquer les écrous (26) à un couple de 20÷25 Nm.
ATTENTION! La course à vide doit être éliminée sans provoquer de précharge.

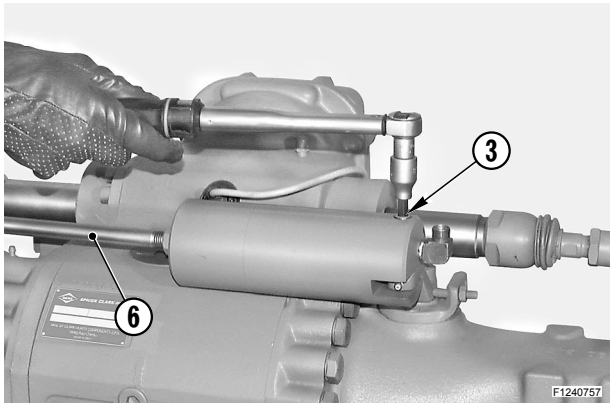
f

ITA Montare il distanziale (2) ed infilare il perno del supporto (10) nella leva di frenatura destra. Montare l'anello elastico (1).

D Das Distanzstück (2) montieren und den Stift der Halterung (10) in den rechten Bremshebel montieren. Den Kolbenring (1) montieren.

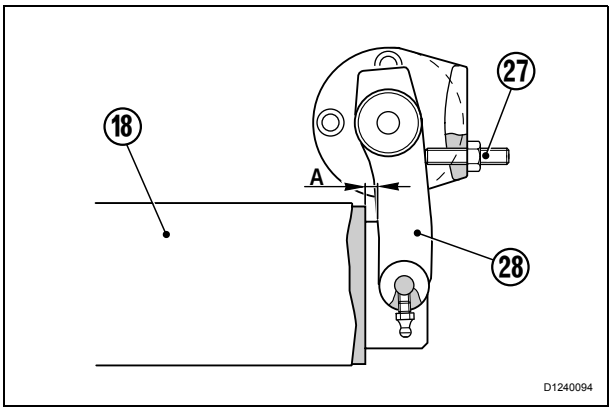
ESP Montar el distancial (2) y introducir la rotula del suporte (10) en la palanca de frenadura derecha. Montar el anillo elastico (1).

F Monter l'entretoise (2) et introduire l'axe du support (10) dans le levier de freinage droit. Monter l'anneau à ressort (1).



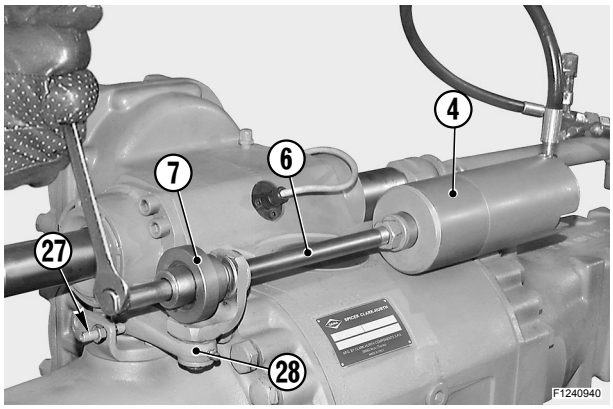
GB a

Rotate stem (6) to centre the hole of the fulcrum pin (3).
Apply Loctite 242 to the thread of the fulcrum pin (3), screw and tighten pin with a dynamometric wrench set to 25 – 30 Nm.



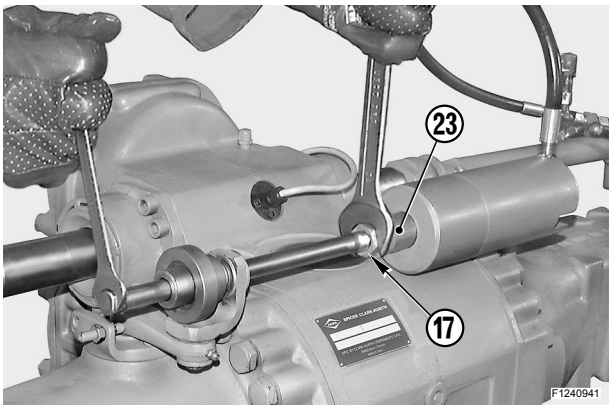
GB b

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



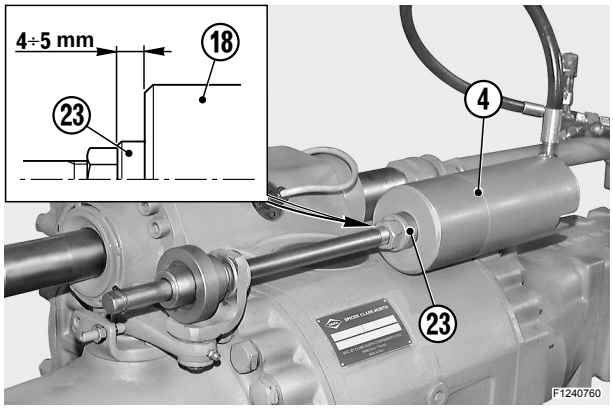
bar GB c

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



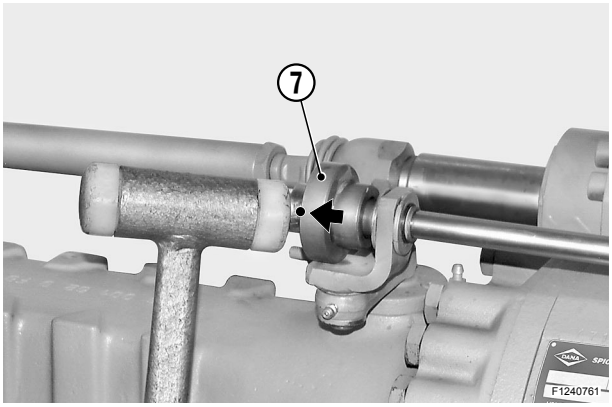
GB d

Lock nut (17) in position against the stem of the piston (23).
Torque wrench setting for the nut: max. 40 Nm.



GB e

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.



bar GB f

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

a

ITA Ruotare lo stelo (6) fino a centrare il foro del perno di fulcro (3).
Spalmare la filettatura del perno di fulcro (3) con Loctite 242, avvitarlo e serrarlo con chiave dinamometrica tarata a 25÷30 Nm.

D Den Schaft (6) drehen bis das Loch des Zentrierstifts (3) zentriert ist.
Das Gewinde des Zentrierstiftes (3) mit Loctite 242 schmieren und mit einem Momentenschlüssel bei 25÷30 Nm fest ziehen.

ESP Girar el vastago (6) hasta centrar el agujero de la rotula de fulcro (3).
Pasar la rosca de la rotula del fulcro (3) con Loctite 242, atornillarla y apretarla con llave dinamometrica tarata a 25÷30 Nm.

F Tourner la tige (6) jusqu'à centrer le trou de l'axe du fourreau (3).
Enduire le filetage de l'axe du fourreau (3) avec du Loctite 242, visser celui-ci à l'aide de la clé dynamométrique calibrée à 25÷30 Nm.

b

ITA Controllare che tra la leva (28) lato cilindro (in appoggio sul grano di registrazione) ed il cilindro (18) rimanga un gioco "**A**".
Se necessario, rimuovere la leva, ruotarla di un dente rispetto al profilo scanalato e ripetere l'eliminazione della corsa a vuoto.

D Kontrollieren, ob zwischen dem Hebel (28) an der Zylinderseite (am Stellstift anliegend) und dem Zylinder (18) ein Spiel "**A**" übrig bleibt.
Wenn nötig, den Hebel abnehmen, um einen Zahn drehen und den Vorgang wiederholen.

ESP Controlar que entre la palanca (28) lado cilindro (en apoyo sobre la espiga de registraciòn) y el cilindro (18) quede un juego "**A**".
Si necesario, remover la palanca, girar de un diente respecto al perfil rayado y repetir la eliminaciòn de la carrera a vacio.

F Contrôler qu'entre le levier (28) du côté cylindre (posé sur le grain de réglage) et le cylindre (18) il y ait un jeu "**A**".
Si besoin, enlever le levier, tourner celui-ci d'une dent par rapport au profil cannelé et éliminer de nouveau la course à vide.

c

ITA Inserire pressione nel cilindro (4) e, mantenendo le leve (28) appoggiate ai grani di registro (27), avvitare l'asta (6) fino ad agganciare lo sblocco rapido (7) nella cava.

D Druck in den Zylinder (4) einlassen. Die Hebel (28) am Stellstift (27) anliegen lassen und den Stab (6) festschrauben, bis er im der Schnellentsicherung (7) der Nut einrastet.

ESP Introducir presiòn en el cilindro (4) y, manteniendo las palancas (28) en apoyo a las espigas del registro (27), atornillar la varilla (6) hasta enganciar el bloqueo rapido (7) en el nicho.

F Introduire de la pression dans le cylindre (4), puis en maintenant le levier (28) posé sur les grains de réglage (27), visser la tige (6) jusqu'à accrocher le déblocage rapide (7) dans le creux.

d

ITA Bloccare il dado (17) contro lo stelo del pistone (23).
Coppia di serraggio dado: max. 40 Nm.

D Mutter (17) gegen den Kolbenschaft (23) blockieren.
Anzugsmoment für die Mutter: max. 40 Nm.

ESP Bloquear la tuerca (17) contra el vastago del piston (23).
Par de torsion tuerca: max. 40 Nm.

F Bloquer l'écrou (17) contre la tige du piston (23).
Couple de serrage écrou: max. 40 Nm.

e

ITA Rilasciare la pressione e controllare che il pistone (23) rientri fino ad avere una sporgenza di 4÷5 mm rispetto la testata del cilindro (4).

D Den Druck ablassen und kontrollieren, ob der Kolben (23) zurück fährt bis er um 4÷5 mm im Verhältnis zum Zylinderkopf (4) herausragt.

ESP Dejar la presiòn y controlar que el piston (23) vuelva hasta tener un resalte de 4÷5 mm respecto la culata del cilindro (4).

F Relâcher la pression et contrôler que le piston (23) rentre jusqu'à ce qu'il y ait une saillie de 4÷5 mm par rapport à la culasse du cylindre (4).

f

ITA Sbloccare il gruppo di ritegno (7) con un colpo di mazzuolo sull'anello esterno.
Inserire nuovamente pressione e controllare che a fine corsa del pistone avvenga l'aggancio del gruppo di ritegno (7) sull'asta (6).

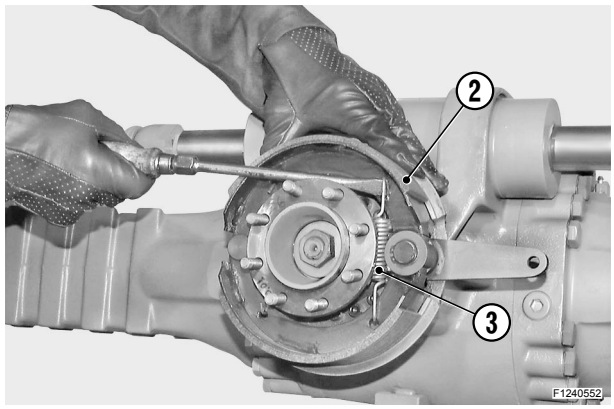
D Das Halteaggregat (7) mit einem Hammerschlag am äußeren Ring entsichern.
Nochmals Druck einlassen und kontrollieren, ob am Hubende des Kolbens das Halteaggregat (7) im Stab (6) einrastet.

ESP Sbloquear el grupo de retenciòn (7) con un golpe de martillo sobre el anillo elatico.
Introducir de nuevo presiòn y controlar que a final carrera del piston suceda el enganche del grupo de retenciòn (7) sobre la varilla (6).

F Débloquer le groupe de retenue (7) par un coup de maillet sur l'anneau externe.
Introduire de nouveau de la pression et contrôler qu'à la fin de course du groupe piston, il y ait un accrochage du groupe de retenue (7) sur la tige (6).

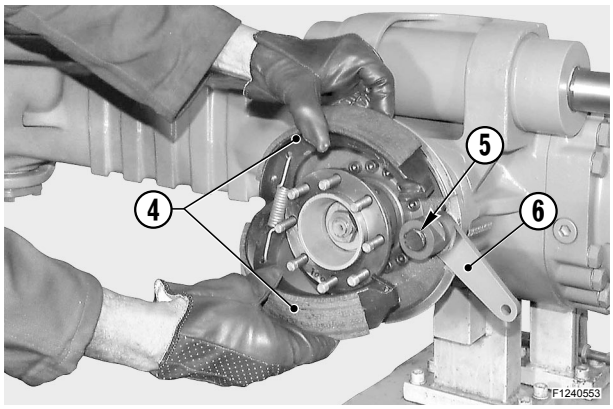
GB a

Pull out the drum (1) and remove dust from friction surfaces.
CAUTION! Use only brush-type vacuum cleaners.



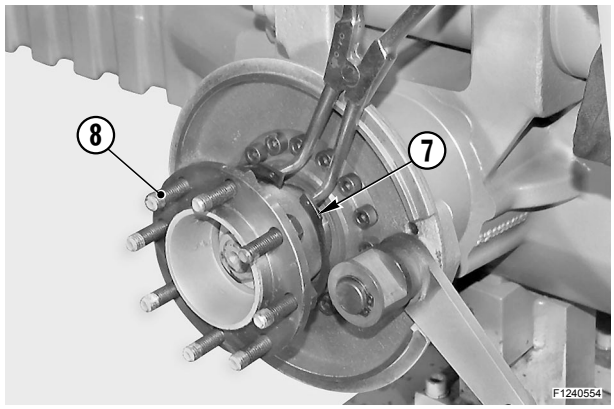
GB b

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



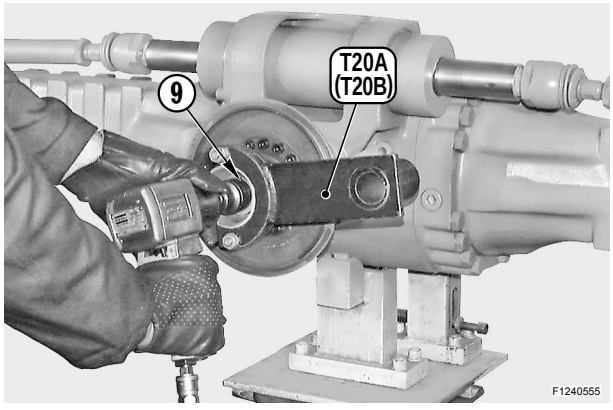
GB c

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



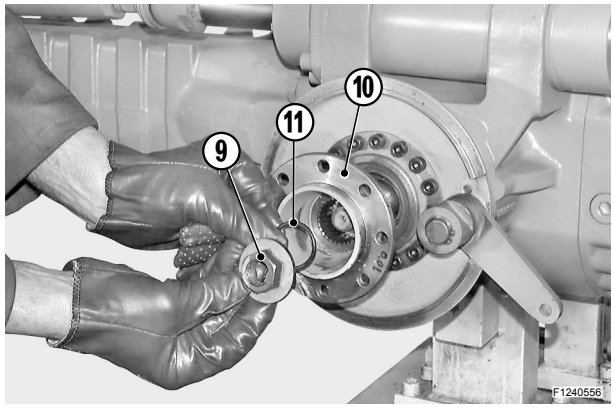
GB d

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



GB e

Fit tool **T20A** (**T20B**), engage the stop rod and loosen the check nut (9) of the flange (10).



GB f

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

a

ITA Rimuovere il tamburo (1) ed asportare la polvere delle guarnizioni di attrito.
ATTENZIONE! Usare solo aspirapolvere e pennello.

D Trommel (1) abnehmen und die Reibungsdichtungen vom Staub reinigen.
ACHTUNG! Nur mit einem Staubsauger und einem Pinsel.

ESP Remover el tambor (1) y sacar el polvo de las juntas de roce.
CUIDADO! Usar sólo aspirador y pincel.

F Déplacer le tambour (1) et enlever la poussière des garnitures de frottement.
ATTENTION! Utiliser seulement un aspirateur et un pinceau.

b

ITA Tenendo in posizione la ganascia superiore (2), sganciare la molla (3).

D Die obere Backe (2) festhalten und Feder (3) abnehmen.

ESP Manteniendo en posición la mordaza superior (2), desenganchar el muelle (3).

F En tenant bien en place la mâchoire supérieure (2) décrocher le ressort (3).

c

ITA Rimuovere il gruppo ganasce (4).
Se necessario, rimuovere l'anello elastico (5) e sfilare la leva (6).

D Backeneinheit (4) abnehmen. Wenn nötig Federring (5) abnehmen und Hebel (6) heraus ziehen.

ESP Remover el grupo mordazas (4).
Si fuera necesario, remover el anillo elástico (5) y sacar la palanca (6)

F Enlever le groupe mâchoire (4).
Si besoin, enlever l'anneau ressort (5) et extraire le levier (6).

d

ITA Rimuovere dalla sede l'anello elastico (7) di ritegno in posizione delle viti (8).
Asportare le viti (8).

D Federring (7) von den Schrauben (8) abnehmen. Schrauben (8) abschrauben.

ESP Remover de su alojamiento el anillo elástico (7) de retención en posición de los tornillos (8).
Sacar los tornillos (8).

F Extraire de son logement l'anneau à ressort (7) fixé sur les vis (8).
Enlever les vis (8).

e

ITA Montare l'attrezzo **T20A** (oppure **T20B**), impegnare l'asta di arresto ed allentare il dado (9) di ritegno della flangia (10).

D Werkzeug **T20A** (**T20B**) montieren und Sperrstab einsetzen; Mutter (9) zur Befestigung des Flansches (19) lockern.

ESP Montar la herramienta **T20A** (**T20B**), bloquear la varilla de tope y aflojar la tuerca (9) de retención de la brida (10).

F Monter l'outil **T20A** (**T20B**) engager la tige de butée et desserrer l'écrou (9) de fixation de la flasque (10).

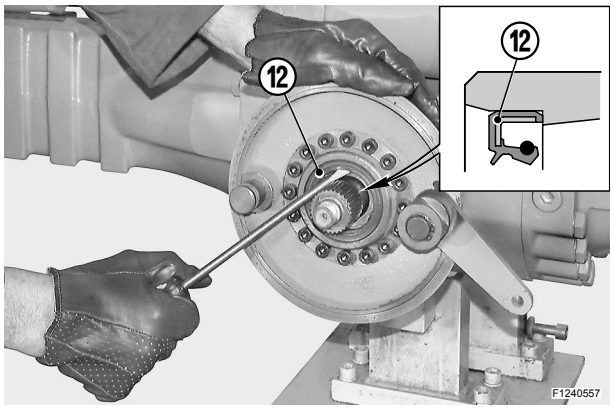
f

ITA Asportare nell'ordine, il dado (9), la guarnizione OR (11), la flangia (10) e l'anello di arresto (7).

D Der Reihe nach Mutter (9), O-Ring (11), Flansch (10) und Sperring (7) abnehmen.

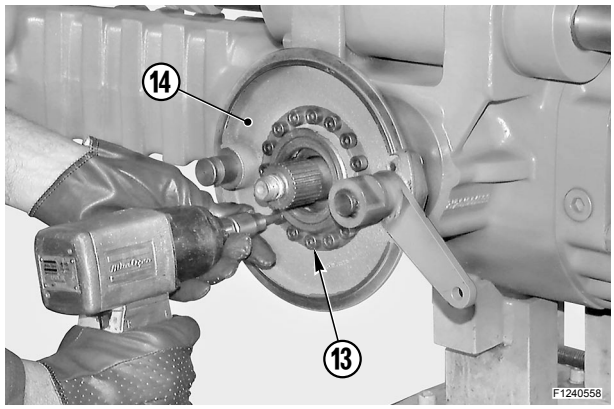
ESP Sacar en su orden, la tuerca (9), la junta OR (11), la brida (10) y el anillo de tope (7).

F Enlever dans l'ordre, l'écrou (9), la garniture OR (11), la flasque (10) et la bague de butée (7).



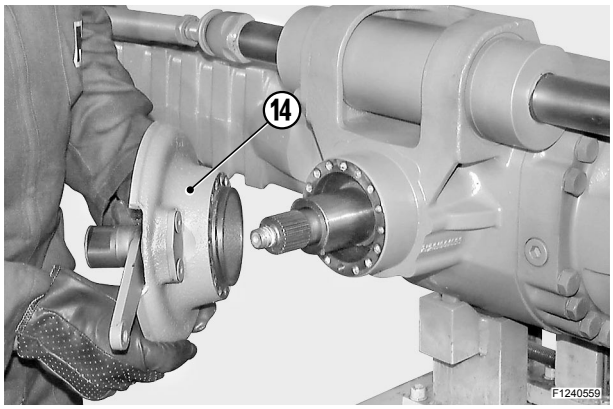
GB a

Remove the seal (12) and discard it.
NOTE. Note down assembly direction.



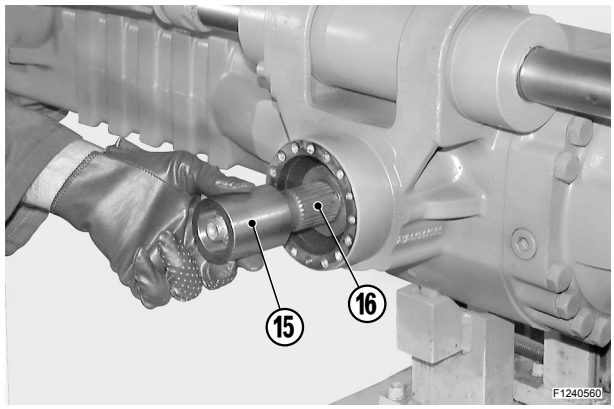
GB b

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



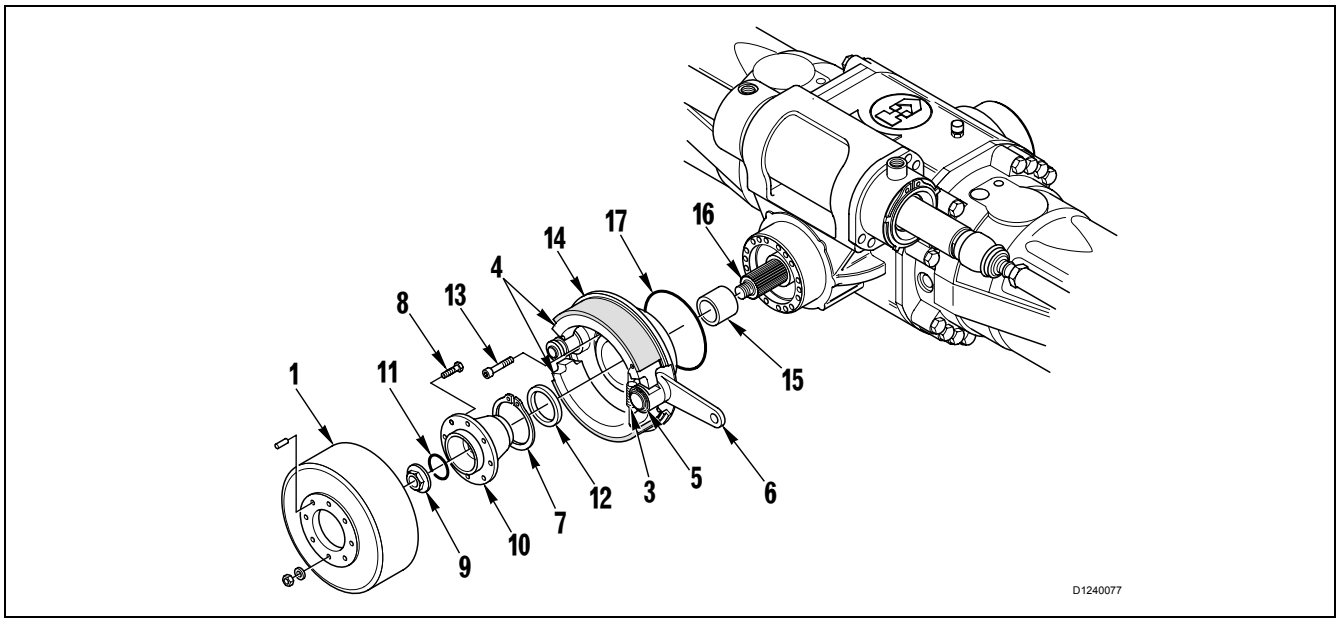
GB c

Remove brake support (14).



GB d

Remove the distance piece (15).
NOTE. If operations are to be carried out the bevel pinion, see the specific axle section.



a

ITA Rimuovere l'anello di tenuta (12) e scartarlo.
NOTA. Annotare il senso di montaggio.

D Dichtung (12) abnehmen und nicht mehr verwenden.
BEMERKUNG. Montagerichtung bemerken.

ESP Remover la junta (12) y descartarla.
NOTA. Anotar el sentido de montaje.

F Enlever la garniture (12) puis l'éliminer.
NOTE. Prendre note du sens du montage.

b

ITA Rimuovere le viti (13) di fissaggio del supporto freno (14).

D Schrauben (13) zur Befestigung der Bremsenhalterung (14) abschrauben.

ESP Remover los tornillos (13) de fijación del soporte del freno (14).

F Enlever les vis (13) de fixation du support du frein (14).

c

ITA Rimuovere il supporto freno (14).

D Bremsenhalterung (14) abnehmen.

ESP Remover el soporte del freno (14).

F Enlever le support du frein (14).

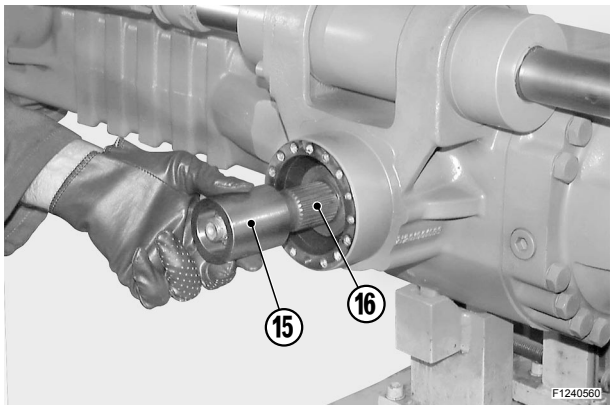
d

ITA Rimuovere il distanziale (15).
NOTA. Se si deve intervenire sul gruppo pignone conico, vedere il paragrafo specifico dell'assale.

D Distanzstück (15) abnehmen.
BEMERKUNG. Falls Eingriffe am Kegelrad nötig sind, siehe entsprechender Abschnitt betreffend Achsen.

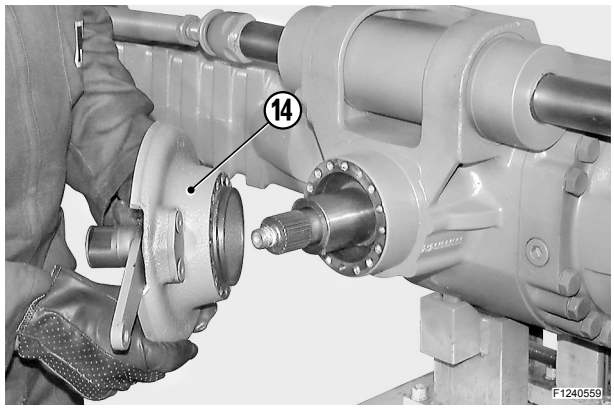
ESP Remover el separador (15).
NOTA. Si hay que intervenir en el grupo piñón cónico, véase el apartado específico del eje.

F Enlever l'entretoise (15).
NOTE. Si on doit intervenir sur le groupe pignon conique, voir le paragraphe concernant spécifiquement l'essieu.



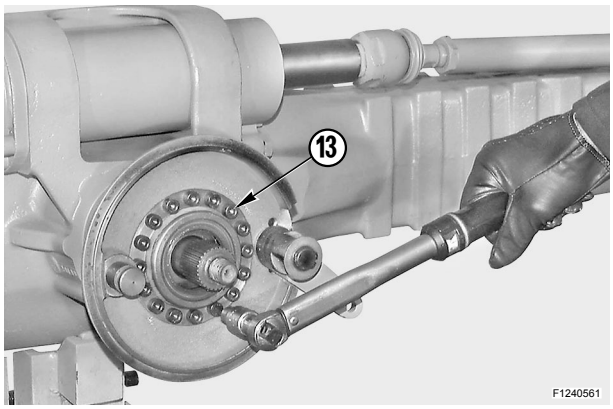
GB a

Fit the distance piece (15) onto the pinion (16).



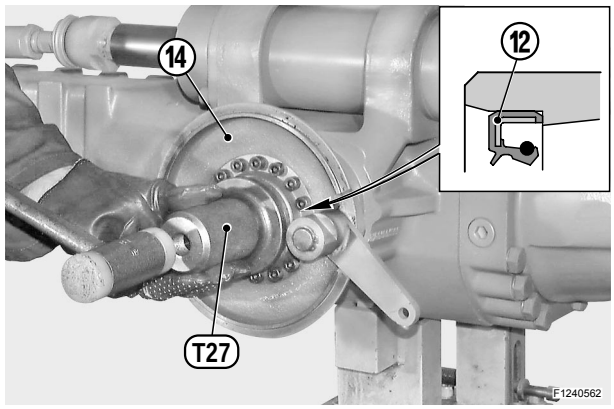
GB b

Lubricate the coupling surfaces and position brake support (14). Check that the O-ring (17) is intact.



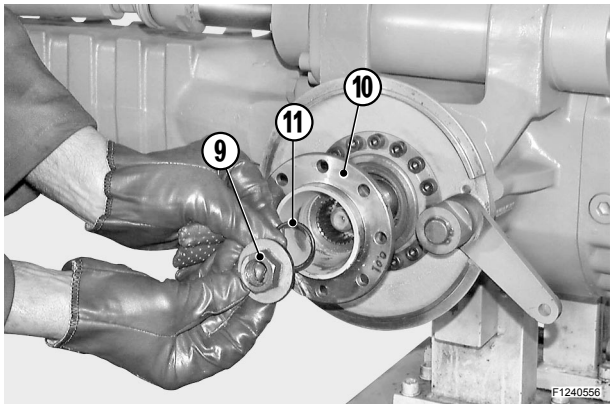
GB c

Apply Loctite 242 to the screws (13) and tighten using the criss-cross method. Torque wrench setting: 34.2 – 37.8 Nm



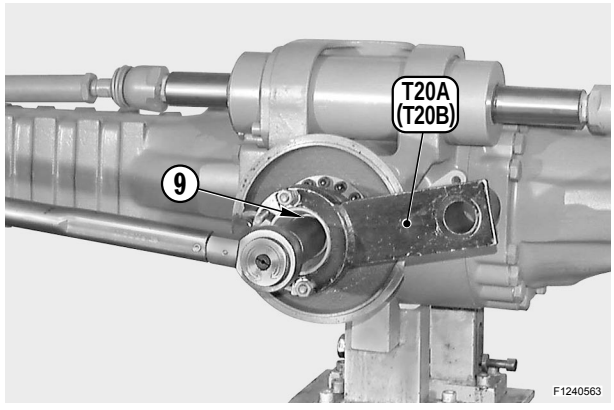
GB d

Lubricate the outer part of the seal (12) and insert it into the brake support (14) using tool **T27**.
NOTE. Carefully check assembly direction.



GB e

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



GB f

Fit tools **T20A** (or **T20B**), engage the stop rod and tighten the nut (9). Torque wrench setting: 280 – 310 Nm

a

ITA Montare sul pignone (16) il distanziale (15).

D Distanzstück (15) auf das Rad (16) montieren

ESP Montar en el piñón (16), el separador.

F Monter sur le pignon (16) l'entretoise (15).

b

ITA Lubrificare le superfici di accoppiamento e posizionare il supporto freno (14).
Controllare l'integrità della guarnizione OR (17).

D Kupplungsflächen schmieren und Bremsenhalterung (14) positionieren.
Zustand des O-Rings (17) kontrollieren.

ESP Lubricar las superficies de acoplamiento y posicionar el soporte del freno (14).
Controlar la integridad de la junta OR (17).

F Lubrifier les surfaces d'accouplement et mettre en place le support du frein (14).
Contrôler le bon état de la garniture OR (17).

c

ITA Spalmare le viti (13) con Loctite 242 ed avvitarle serrandole con il metodo incrociato.
Coppia di serraggio: 34,2÷37,8 Nm

D Schrauben (13) mit Loctite 242 schmieren und im Kreuz anziehen.
Anzugsmoment: 34,2÷37,8 Nm

ESP Pasar sobre los tornillos (13) Loctite 242 y atornillarlos apretándolos con el método cruzado.
Par de torsión: 34,2÷37,8 Nm.

F Enduire les vis (13) avec du Loctite 242, et les visser en les serrant avec la méthode croisée.
Couple de serrage: 34,2÷37,8 Nm

d

ITA Lubrificare l'esterno dell'anello di tenuta (12) ed inserirla nel supporto freno (14) con l'attrezzo **T27**.
NOTA. Controllare attentamente il senso di montaggio.

D Dichtung (12) außen schmieren und in die Bremsenhalterung (14) mit dem Werkzeug **T27** einsetzen.
BEMERKUNG. Montagerichtung prüfen.

ESP Lubricar la parte externa de la junta (12) e introducirla en el soporte del freno (14) con la herramienta **T27**.
NOTA. Controlar atentamente el sentido de montaje.

F Lubrifier la partie externe de la garniture (12) puis l'insérer dans le support du frein (14) à l'aide de l'outil **T27**.
NOTE. Contrôler soigneusement le sens du montage.

e

ITA Montare nell'ordine la flangia (10), la guarnizione OR (11) ed il dado (9).
Spalmare il filetto del pignone (16) con Loctite 242.

D Der Reihe nach Flansch (10), O-Ring (11) und Mutter (9) montieren.
Radgewinde (16) mit Loctite 242 schmieren.

ESP Montar en su orden la brida (10), la junta OR (11) y la tuerca (9).
Pasar en la rosca del piñón (16) Loctite 242.

F Monter dans l'ordre la flasque (10), la garniture OR (11) et l'écrou (9).
Enduire le filet du pignon (16) avec du Loctite 242.

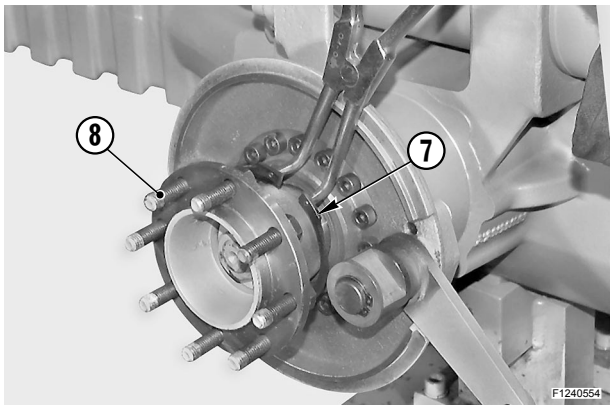
f

ITA Montare gli attrezzi **T20A** (oppure **T20B**), impegnare l'asta di arresto e serrare il dado (9).
Coppia di serraggio: 280÷310 Nm

D Werkzeug **T20A** (oder **T20B**) montieren, Sperrstab einsetzen und Mutter (9) anziehen.
Anzugsmoment: 280÷310 Nm

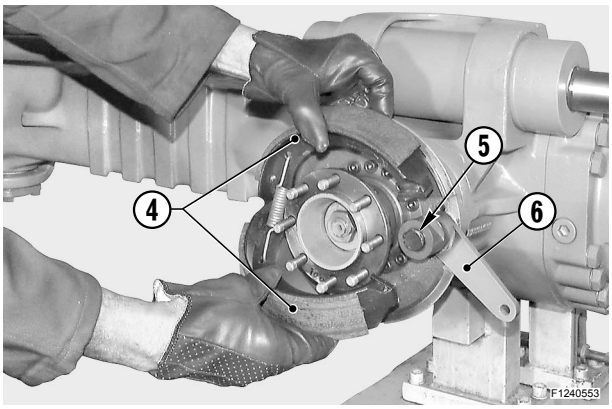
ESP Montar la herramienta **T20A** (o **T20B**), bloquear la varilla de tope y apretar la tuerca (9).
Par de torsión: 280÷310 Nm.

F Monter l'outil **T20A** (ou **T20B**), engager la tige de butée et serrer l'écrou (9).
Couple de serrage: 280÷310 Nm



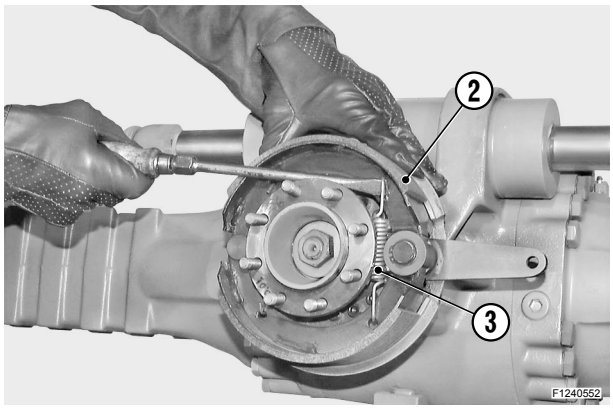
GB a

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.



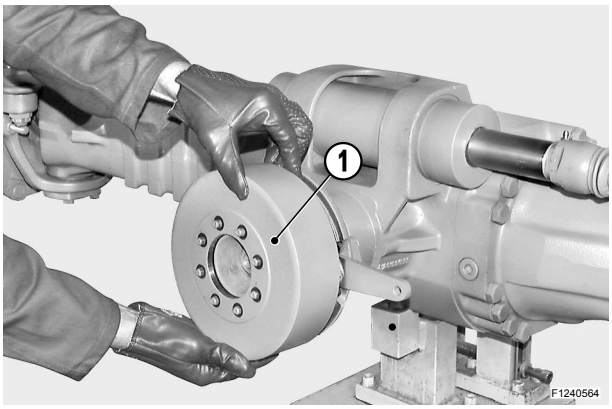
GB b

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



GB c

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



GB d

Fit the drum (1).
NOTE. Make sure that the friction surface of the drum carries no trace of grease and is perfectly clean.

a

ITA Inserire le viti (8) e mantenerle in posizione con l'anello elastico (7).
NOTA. Assicurarsi che l'anello elastico sia perfettamente in sede.

D Schraube (8) einsetzen und mit dem Federring (7) positionieren.
BEMERKUNG. Sicherstellen, daß der Federring richtig sitzt.

ESP Introducir los tornillos (8) y mantenerlos en posición por medio del anillo elástico(7).
NOTA. Asegurarse de que el anillo elástico se encuentra perfectamente en sede.

F Insérer les vis (8) et les tenir en place avec l'anneau ressort (7).
NOTE. S'assurer que l'anneau soit parfaitement dans son logement.

b

ITA Se è stata rimossa, montare la leva (6) e mantenerla in posizione con l'anello elastico (5).
Montare il gruppo ganasce (4).

D Falls der Hebel (6) abmontiert worden ist, diesen wieder montieren und mit dem Federring (5) positionieren.
Backeneinheit (4) montieren.

ESP Si ha sido quitada, montar la palanca (6) y mantenerla en posición con el anillo elástico (5).
Montar el grupo mordazas (4).

F Si enlevé, remonter le levier (6) et le tenir en place à l'aide de l'anneau ressort (5).
Monter le groupe mâchoires (4).

c

ITA Assicurarsi che le ganasce (4) centrino la cava del perno di fulcro ed appoggino sui piani della leva (6).
Aiutandosi con un cacciavite, impegnare la molla (3).

D Kontrollieren ob die Backen (4) in der Nut des Zentrierstiftes zentriert sind und auf die Flächen des Hebels (6) anliegen.
Mit Hilfe eines Schraubenziehers, Feder (3) einhaken.

ESP Asegurarse de que las mordazas (4) centren la ranura del perno de fulcro y apoyen sobre las superficies de la palanca (6).
Ayudándose con un destornillador, bloquear el muelle (3).

F S'assurer que les mâchoires (4) sont au centre du creux de l'axe du point d'appui et qu'elles reposent sur les surfaces du levier (6).
A l'aide d'un tournevis, engager le ressort (3).

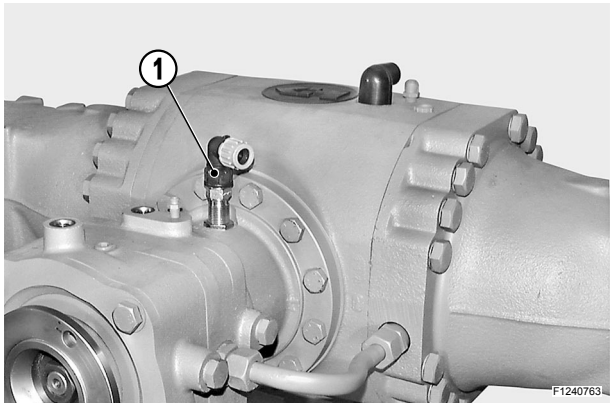
d

ITA Montare il tamburo (1).
NOTA. Assicurarsi che la superficie di attrito del tamburo sia perfettamente sgrassata e pulita.

D Trommel (1) montieren.
BEMERKUNG. Kontrollieren ob die Reibungsfläche der Trommel richtig entfettet und sauber ist.

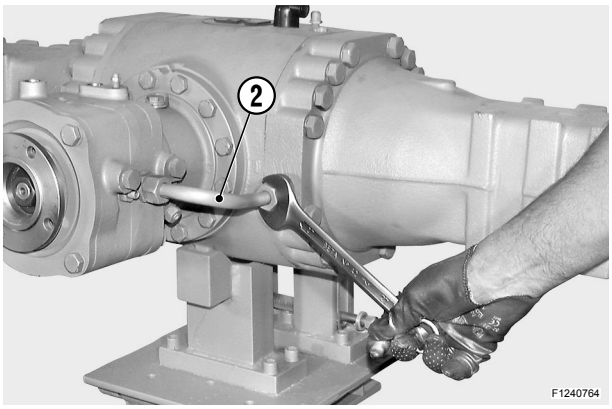
ESP Montar el tambor (1).
NOTA. Asegurarse de que la superficie de roce del tambor está perfectamente desengrasada y limpia.

F Monter le tambour (1).
NOTE. S'assurer que la surface de frottement du tambour est bien dégraissée et propre.



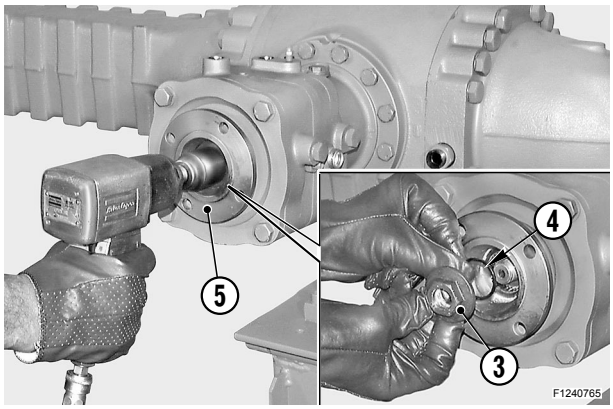
GB a

Remove movement sensor (1), if fitted.



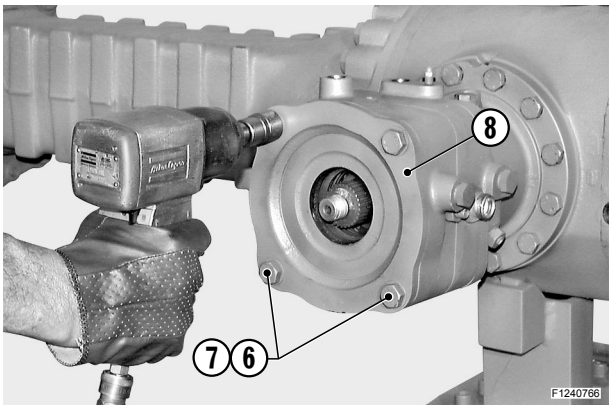
GB b

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



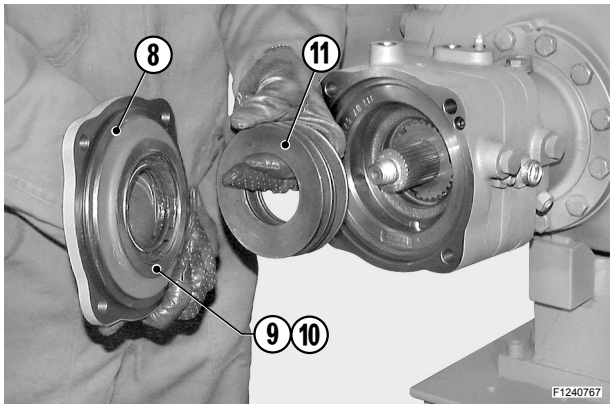
GB c

Remove nut (3), O-ring (4) and flange (5).
NOTE. If disassembly is awkward, heat nut (3) at about 80ÅC.



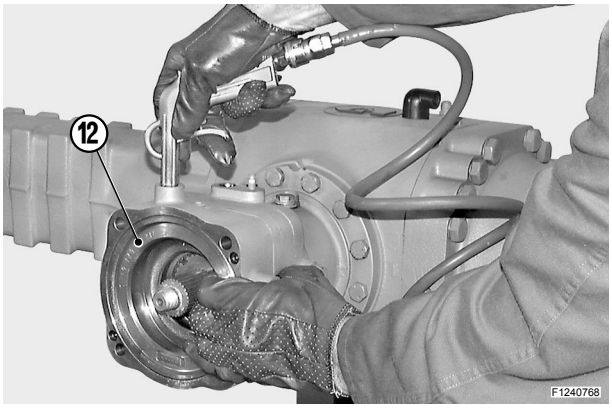
GB d

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



GB e

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).



bar GB f

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.

a

ITA Se è montato, rimuovere il sensore di movimento (1).

D Wenn montiert, den Bewegungsgeber (1) abnehmen.

ESP Si ha sido montado, remover el sensor de movimiento (1).

F S'il est monté, enlever le capteur de déplacement (1).

b

ITA Allentare i due dadi e rimuovere il tubo (2) della lubrificazione.

D Die beiden Muttern lockern und die Schmierleitung (2) abnehmen.

ESP Aflojar las dos tuercas y remover el tubo (2) de la lubrificaciòn.

F Dévisser le deux écrous et enlever le tuyau (2) pour la lubrification.

c

ITA Rimuovere il dado (3), la guarnizione OR (4) e la flangia (5).
NOTA. Se lo smontaggio risulta difficoltoso, scaldare il dado (3) a circa 80°C.

D Die Mutter (3), den O-Ring (4) und den Flansch (5) abnehmen.
BEMERKUNG. Falls das Abmontieren schwer sein sollte, die Mutter (3) bis auf ca. 80°C erwärmen.

ESP Remover la tuerca (3), la guarnicion OR (4) y la brida (5).
NOTA. Si el desmontaje resulta dificil, calentar la tuerca (3) a 80°C approx.

F Enlever l'écrou (3), la garniture OR (4) et la flasque (5).
NOTE. Si le démontage est difficile, chauffer l'écrou (3) à environ 80°C.

d

ITA Allentare in modo alternato ed incrociato le viti (6) fino ad annullare l'azione delle molle a tazza (11).
Rimuovere le viti (6) e le rondelle elastiche di ritegno coperchio (8).

D Abwechselnd und im Kreuz die Schrauben (6) lockern, bis die Wirkung der Tellerfeder (11) gleich Null ist.
Schrauben (6) und Federscheiben des Deckels (8) abnehmen.

ESP Aflojar de manera alterna y cruzada los tornillos (6) hasta anular la aciòn de los muelles a taza (11).
Remover los tornillos (6) y las arandelas elasticas de retenciòn tapa (8).

F Dévisser alternativement et de façon croisée les vis (6) jusqu'à annuler l'action des ressorts belleville (11).
Enlever les vis (6) et les rondelles à segment de fixation du couvercle (8).

e

ITA Asportare il coperchio (8), i rasamenti (9), l'anello di battuta (10) e le molle a tazza (11).
NOTA. Annotare il senso di montaggio dei rasamenti (9) e delle molle (11).

D Deckel (8), Scheiben (9), Anschlagring (10) und Tellerfedern (11) abnehmen.
BEMERKUNG. Montagerichtung der Scheiben (9) und der Federn (11) bemerken.

ESP Quitar la tapa (8), las raspaduras (9), el anillo de tope (10) y los muelles a taza (11).
NOTA. Anotar el sentido de las raspaduras (9) y de los muelles (11).

F Enlever le couvercle (8), les rasages (9), l'anneau de butée (10) et les ressorts belleville (11).
NOTE. Noter le sens de montage des rasages (9) et des ressorts (11).

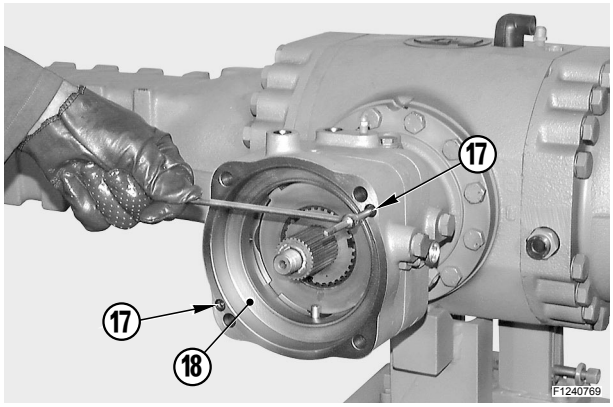
f

ITA Immettere lentamente aria compressa attraverso l'attacco per il freno negativo per estrarre il pistone (12).
ATTENZIONE! Trattenere il pistone (12) che può essere espulso velocemente ed essere danneggiato.

D Langsam Druckluft durch den Anschluß für die Negativbremse einlassen, um den Kolben (12) auszustoßen.
ACHTUNG! Den Kolben (12) halten, denn er könnte plötzlich herausspringen und beschädigt werden.

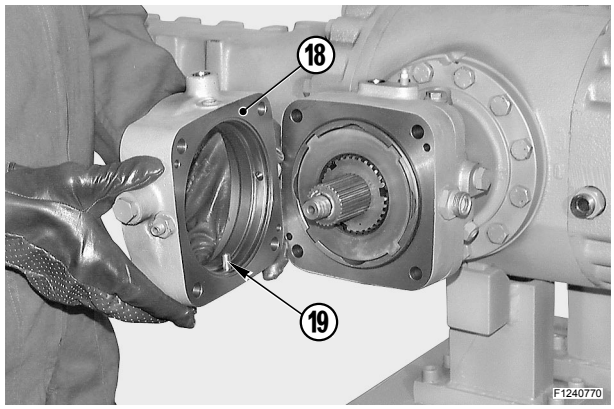
ESP Introducir lentamente aire comprimida atraves el ataque para el freno negativo para extraer el piston (12).
ATENCION! Tener el piston (12) que puede ser expulso rapidamente y ser danado.

F Emettre lentement de l'air comprimé à travers le point d'enclenchement du frein négatif pour en extraire le piston (12).
ATTENTION! Retenir le piston (12) qui être expulsé rapidement peut par conséquent s'endommager.



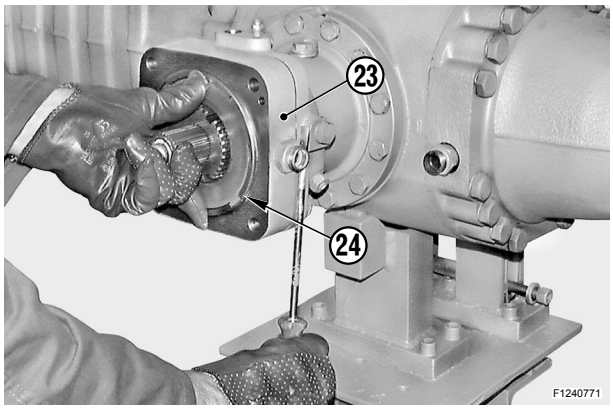
GB a

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



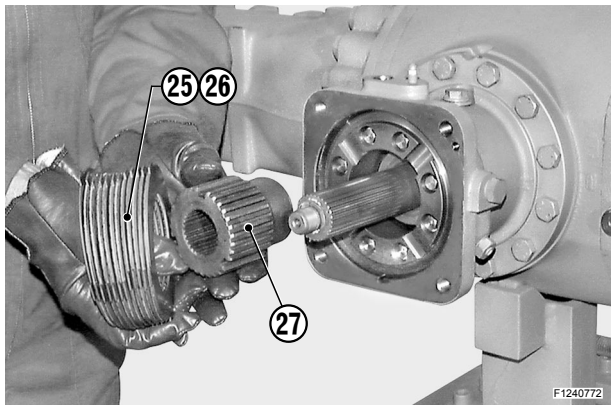
GB b

Remove cylinder (18) complete with guide pin (19) of piston (12).
NOTE. Take note of direction of assembly.



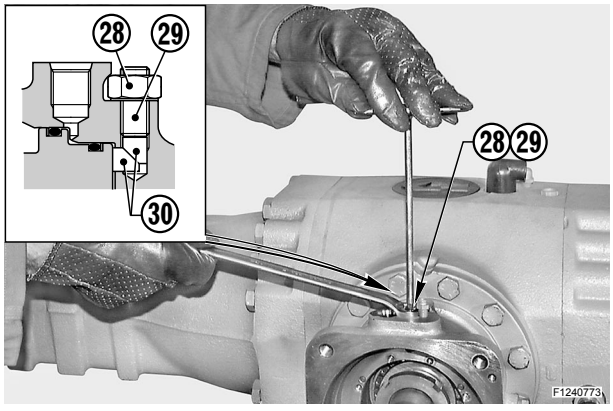
GB c

With the help of a lever, prize off the distance piece (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.



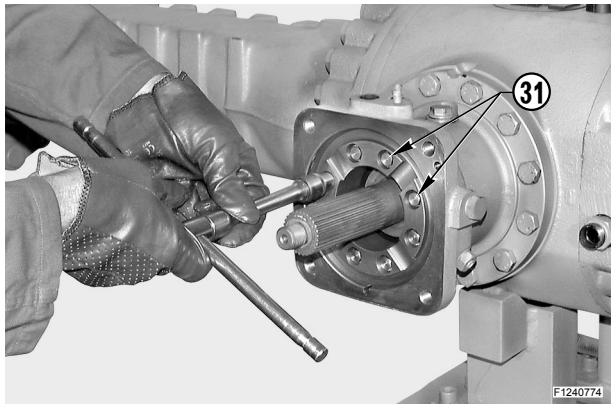
GB d

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



GB e

3-FUNCTION VERSION ONLY
Loosen nuts (28) (no. 3) and unscrew dowels (29) (no. 3) to retract the adjustment points (30).
NOTE. Loosen dowels (29) in an alternate manner until the piston comes to end of backstroke.
ONLY IF NECESSARY. Remove points (30).



GB f

3-FUNCTION VERSION ONLY
Loosen and remove the pin-type screws (31).
NOTE. Loosen screws (31) in an alternate and criss-cross manner.

a

ITA Rimuovere le viti (17) di ritegno del cilindro (18).

D Die Schrauben (17) zur Halterung des Zylinders (18) abnehmen.

ESP Sacar los tornillos (17) di retenciòn del cilindro (18).

F Enlever les vis (17) de fixation du cylindre (18).

b

ITA Rimuovere il cilindro (18) completo della spina (19) di guida del pistone (12).
NOTA. Annotare il senso di montaggio.

D Den Zylinder (18) samt Stift (19) zur Führung des Kolbens (12) abnehmen.
BEMERKUNG. Montagerichtung bemerken.

ESP Sacar el cilindro (18) completo de espina (19) de guìa del piston (12).
NOTA. Anotar el sentido de montaje.

F Enlever le cylindre (18) complet de broche (19) de guidage du piston (12).
NOTE. Prendre note du sens de montage.

c

ITA Forzando con una leva, rimuovere il distanziale (23) completo di OR (24).
NOTA. Pulire accuratamente la superficie di appoggio al mozzo di supporto pignone conico, controllare l'OR (24) e, se necessario, sostituirlo.

D Mit Hilfe eines Hebels, das Distanzstück (23) samt O-Ring (24) entfernen.
BEMERKUNG. Sorgfältig die Auflagefläche an der Nabe des kegeligen Kolbenhalters reinigen und O-Ring (24) kontrollieren. Wenn nötig, auswechseln.

ESP Haciendo fuerza con una palanca, sacar el distancial (23) completo de OR (24).
NOTA. Limpiar con atenciòn la superficie de apoyo al cubo de suporte pinon conico, controlar el OR (24) y, si necesario, sobstituirlo.

F En forçant sur le levier, enlever l'entretoise (23) complet de OR (24).
NOTE. Nettoyer soigneusement la surface d'appui du moyeu de support du pignon conique, contrôler la OR (24) et si besoin, la remplacer.

d

ITA Asportare i dischi di frizione (25), (26) ed il mozzo (27).

D Kupplungsscheiben (25), (26) und Nabe (27) abnehmen.

ESP Sacar los discos de friciòn (25), (26) y el cubo (27).

F Enlever les disques de friction (25), (26) et le moyeu (27).

e

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Allentare i dadi (28) (n° 3) e svitare i grani (29) (n° 3) per far rientrare i puntali di registro (30).
NOTA. Allentare i grani (29) in modo alternato fino a fine corsa di ritorno del pistone.
SOLO SE NECESSARIO. Asportare i puntali (30).

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Muttern (28) (3 St.) lockern und Stifte (29) (3 St.) abschrauben. Stellschäfte (30) zurück zu fahren.
BEMERKUNG. Stifte (29) abwechselnd bis zum Rücklaufende des Kolbens lockern.
NUR WENN NÖTIG. Schäfte (30) abnehmen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Aflojar los dados (28) (n°3) y destornillar las espigas (29) (n°3) para hacer entrar los puntales de registro (30).
NOTA. Aflojar las espigas (29) de manera alternada hasta final carrera de vuelta del piston.
SOLO SI NECESARIO. Sacar los puntales (30).

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Desserrer les écrous (28) (n°3) et dévisser les grains (29) (n°3) pour faire rentrer les tringles de réglage (30).
NOTE. Desserrer les grains (29) de façon alternée jusqu'au retour de fin de course du piston.
SEULEMENT SI BESOIN. Enlever les tringles (30).

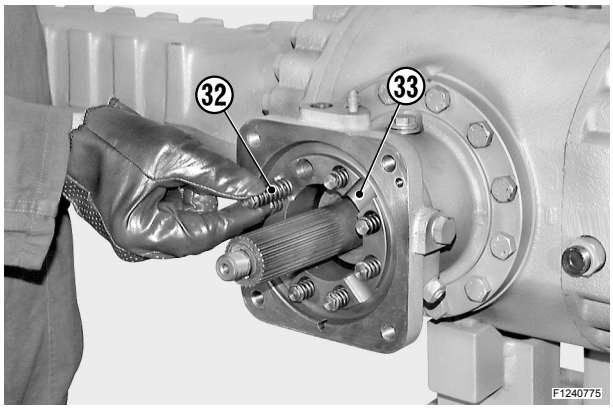
f

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Allentare ed asportare le viti a perno (31).
NOTA. Allentare le viti (31) in modo alternato ed incrociato.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Stiftschrauben (31) abschrauben.
BEMERKUNG. Schrauben (31) abwechselnd und im Kreuz abschrauben.

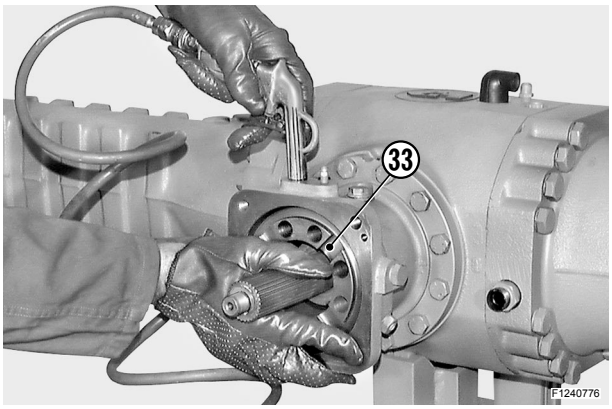
ESP **SOLO POR VERSION A 3 FUNCIONES**
Aflojar y sacar los tornillos a rotula (31).
NOTA. Aflojar los tornillos (31) de manera alternada y cruzada.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Desserrer et enlever les vis à cheville (31).
NOTE. Desserrer les vis (31) de façon alternée et croisée.



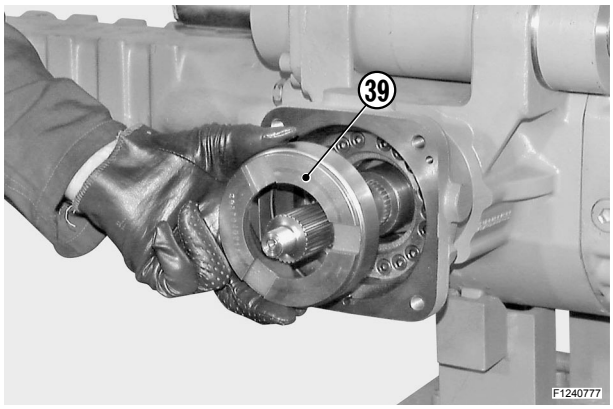
GB a

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



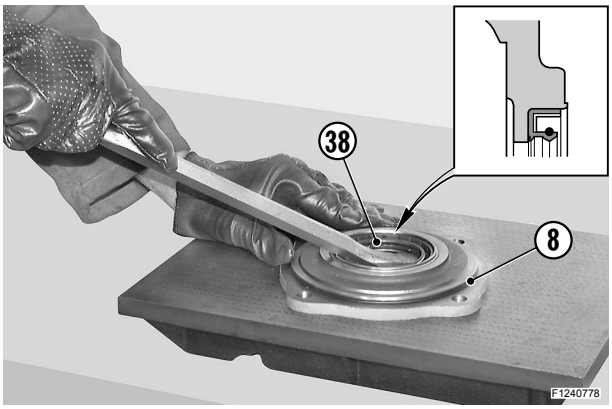
GB b

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.



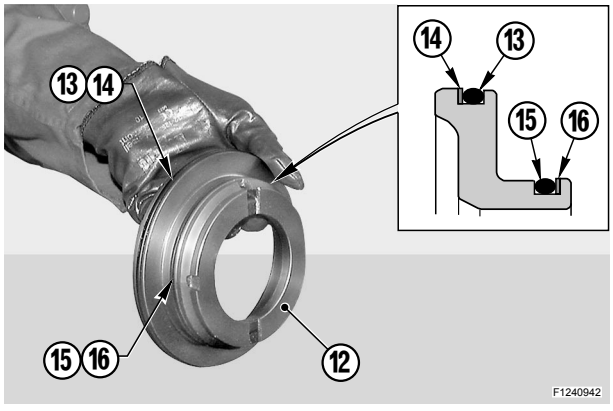
GB c

2-FUNCTION VERSION ONLY
Remove the distance piece (39).



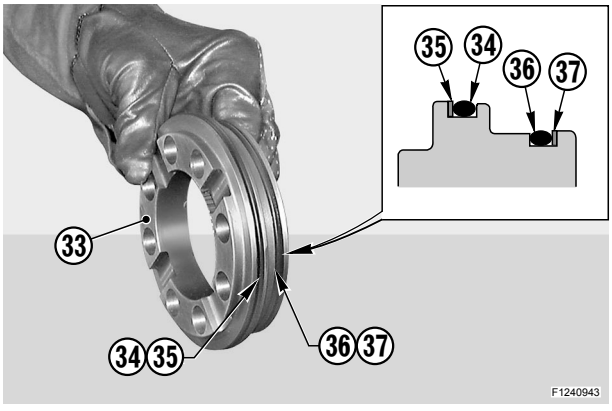
GB d

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.



GB e

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.



GB f

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

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Rimuovere le molle (32) di ritorno del pistone (33).

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Rückzugsfeder (32) des Kolbens (33) abnehmen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Sacar los muelles (32) de vuelta del piston (33).

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Enlever les ressorts (32) de retour du piston (33).

b

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Immettere lentamente aria compressa attraverso l'attacco del freno di servizio per estrarre il pistone (33).
ATTENZIONE! Trattenere il pistone (33) che può essere espulso velocemente ed essere danneggiato.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Langsam Druckluft durch den Anschluß der Hilfsbremse einlassen, um den Kolben (33) auszustoßen.
ACHTUNG! Den Kolben (33) halten, denn er könnte plötzlich herausgestoßen und beschädigt werden.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Introducir lentamente aire comprimida atraves el ataque del freno de servicio para sacar el piston (33).
ATENCION. Tener el piston (33) que puede ser expulso rapidamente y ser danado.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Emettre lentement de l'air comprimé à travers le point de montage du frein de service pour en extraire le piston (33).
ATTENTION! Retenir le piston (33) qui expulsé rapidement peut être par conséquent endommagé.

c

ITA **SOLO PER VERSIONE A 2 FUNZIONI**
Asportare il distanziale (39).

D **NUR FÜR AUSFÜHRUNG MIT 2 FUNKTIONEN**
Distanzstück (39) abnehmen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Sacar el distancial (39).

F **SEULEMENT DANS LES VERSIONS A 2 FONCTIONS.**
Enlever l'entretoise (39).

d

ITA Rimuovere dal coperchio (8) l'anello di tenuta (38).
NOTA. Annotare il senso di montaggio dell'anello (38) e sostituirlo ad ogni smontaggio.

D Vom Deckel (8) den Dichtring (38) abnehmen.
BEMERKUNG. Montagerichtung des Ringes (38) bemerken und beim Abmontieren jedesmal auswechseln.

ESP Remover de la tapa (8) el segmento de compresiòn (38).
NOTA. Anotar el sentido de montaje del segmento (38) y sobstituirlo cada desmontaje.

F Enlever du couvercle (8) la bague d'étanchéité (38).
NOTE. Prendre note du sens de montage de la bague (38), la remplacer à chaque démontage.

e

ITA Rimuovere dal pistone (12) gli anelli di tenuta (13) e (15) e gli anelli antiestrusione (14) e (16).
NOTA. Gli anelli di tenuta (13), (15) ed antiestrusione (14), (16) devono essere sostituiti ad ogni smontaggio.

D Vom Kolben (12) Dichtringe (13) und (15) sowie die Halteringe (14) und (16) abnehmen.
BEMERKUNG. Die Dichtringe (13), (15) und Halteringe (14). (16) müssen bei jedem Abmontieren ausgewechselt werden.

ESP Sacar el piston (12) los segmentos de compresion (13) y (15) y los segmentos anti-extrusiòn (14) y (16).
NOTA. Los segmentos de compresiòn (13) y (15) y anti-axtrusiòn (14), (16) deben de ser cambiados cada desmontaje.

F Enlever le piston (12) les bagues d'étanchéité (13) et (15) et les anneaux anti-extrusion (14), et (16).
NOTE. Les bagues d'étanchéité (13), (15) et anti-extrusion (14), (16) doivent être remplacées à chaque démontage.

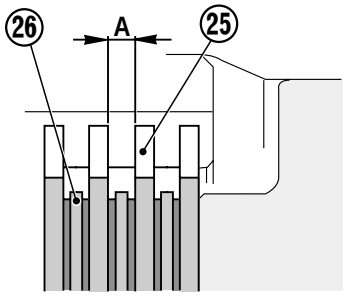
f

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Rimuovere dal pistone (33) gli anelli di tenuta (34) e (36) e gli anelli antiestrusione (35) e (37).
NOTA. Gli anelli di tenuta (34), (36) ed antiestrusione (35), (37) devono essere sostituiti ad ogni smontaggio.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Vom Kolben (33) die Dichtringe (34) und (36) sowie die Halteringe (35) und (37) abnehmen.
BEMERKUNG. Die Dichtringe (34), (36) und Halteringe (35), (37) jedesmal auswechseln, wenn sie abmontiert werden.

ESP **SOLO POR VERSION DE 3 FUNCIONES**
Remover del piston (33) los segmentos de compresiòn (34) y (36) y los segmentos anti-extrusiòn (35) y (37).
NOTA. Los segmentos de compresion (34), (36) y anti-extrusiòn (35), (37) deben de ser sobstituidos a cada desmontaje.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Enlever du piston (33) les bagues d'étanchéité (34) et (36) et les anneaux anti-extrusion (35) et (37).
NOTE. Les bagues d'étanchéité (34), (36) et anti-extrusion (35), (37) doivent être remplacées à chaque démontage.

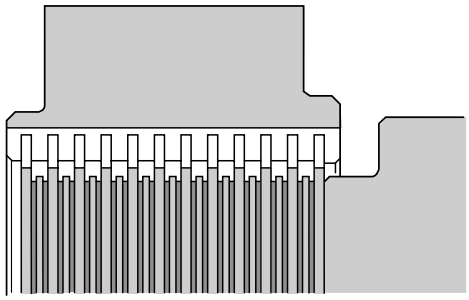


A minimo =1,36 mm

D1240083

GB a

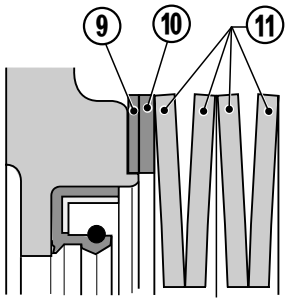
CAUTION! Always check the thickness of braking discs (26), even if the braking unit is being disassembled for other reasons than this.
If thickness "**A**" of one of the discs (26) is close to the minimum admissible size of 1.36 mm, replace the whole pack.



D1240095

GB b

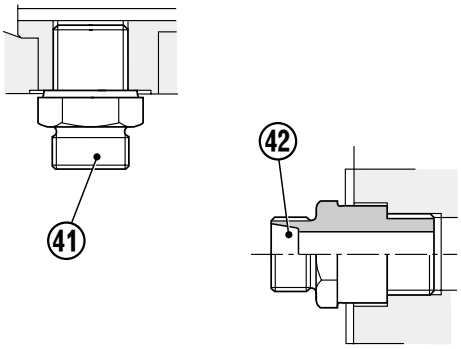
BRAKING DISCS PACK CONTENTS
The braking discs pack is comprised of: 11 braking discs and 12 steel counterdiscs.



D1240084

GB c

CAUTION! If the braking discs unit is replaced, shims (9) - which determine the preloading of Belleville washers (11) - must to be restored.



D1240085

GB d

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.

a

ITA **ATTENZIONE!** Anche se il gruppo freno viene smontato solo per motivi diversi, controllare lo spessore dei dischi di frenatura (26).
Se lo spessore "**A**" di un solo disco (26) si avvicina alla misura minima ammessa di 1,36 mm, sostituire l'intero pacco.

D **ACHTUNG!** Jedesmal wenn das Bremsaggregat aus irgend einem Grund abmontiert wird, die Stärke der Bremsscheiben (26) kontrollieren.
Falls die Stärke "**A**" auch nur einer Scheibe (26) dem Mindestmaß nah liegt, den ganzen Satz auswechseln.

ESP **ATENCION!** Tambien si el grupo freno viene desmontado solo por motivos diferentes, controlar el espesor de los discos de frenadura (26).
Si el espesor "**A**" de un solo disco (26) se acerca a la medida minima admetida de 1,36 mm, sobstituir el intero paquete.

F **ATTENTION!** Même si le groupe frein est démonté pour des raisons diverses, contrôler les cales des disques de freinage (26).
Si la cale "**A**" d'un seul disque (26) se rapproche de la mesure minimum consentie de 1,36 mm, substituer tout le paquet.

b

ITA **COMPOSIZIONE PACCO DISCHI DI FRENATURA**
Il pacco dei dischi di frenatura comprende: n° 11 dischi di frenatura e n° 12 controdischi in acciaio.

D **DER SATZ DER BREMSSCHEIBEN BESTEHT AUS**
11 Bremsscheiben und 12 Gegenscheiben aus Stahl.

ESP **COMPOSICION PAQUETE DISCOS DE FRENADURA**
El paquete de los discos de frenadura se compone de: n°11 discos de frenadura y n°12 contra-discos en acero.

F **COMPOSITION DU PAQUET DE DISQUES DE FREINAGE**
Le paquet de disques de freinage comprend: n° 11 disques de freinage et n° 12 contre-disques en acier.

c

ITA **ATTENZIONE!** Nel caso venga sostituito il gruppo dei dischi di frenatura, è necessario ripristinare gli spessori (9) determinanti il precarico delle molle a tazza (11).

D **ACHTUNG!** Falls das Bremscheibenaggregat ausgewechselt wird, die Distanzstück wieder (9) wieder einsetzen, die die Tellerfedern (11) vorladen.

ESP **ATENCION!** En el caso venga sobstituido el grupo de los discos de frenadura, es necesario restablecer los espesores (9) determinados la precarga de los muelles a taza (11).

F **ATTENTION!** Dans le cas où le groupe des disques de freinage est substitué, remettre les cales (9) qui déterminent la précharge des ressorts belleville (11).

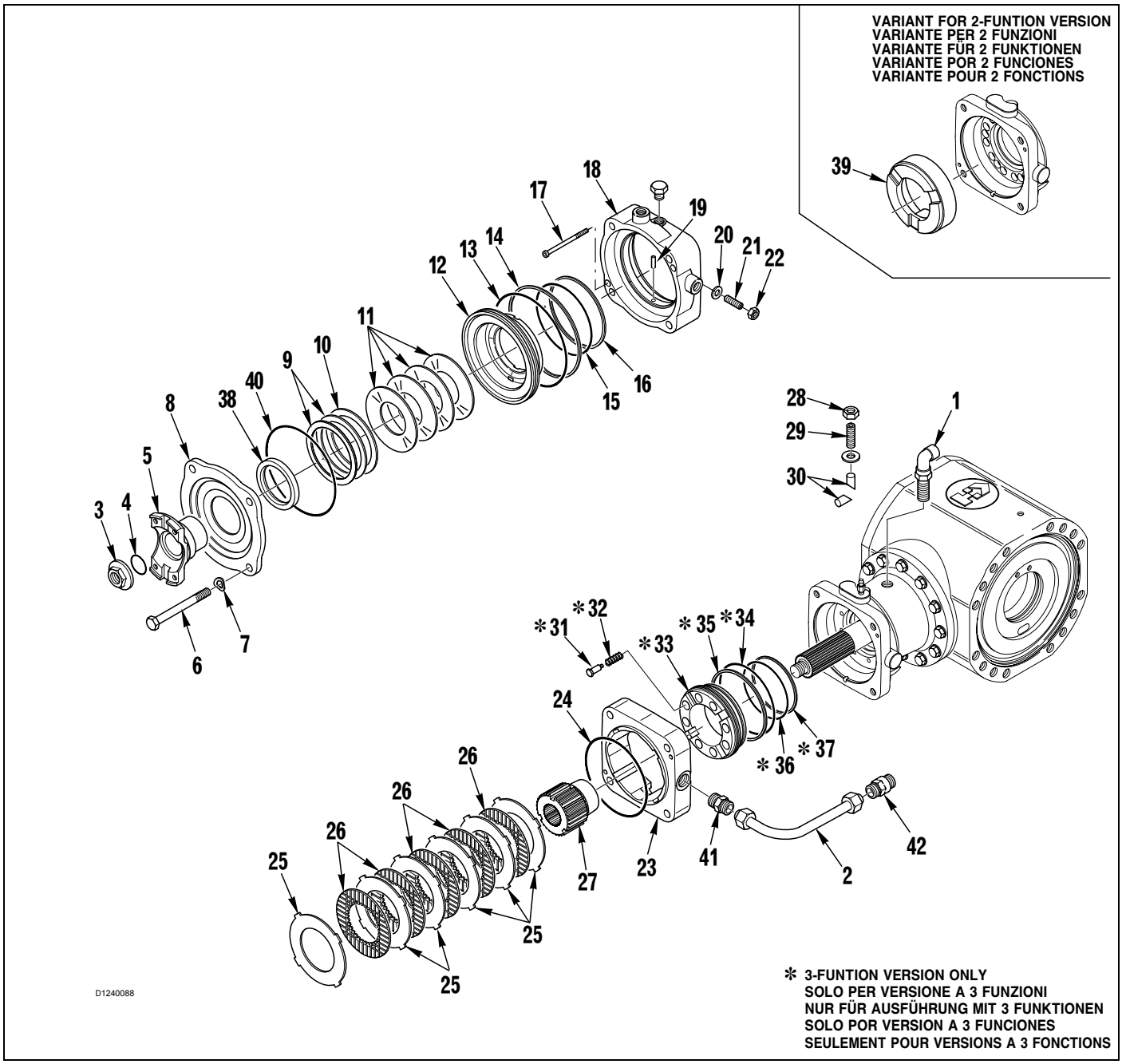
d

ITA **SOLO SE È NECESSARIA LA SOSTITUZIONE**
Rimuovere i raccordi (41), (42) di attacco del tubo di lubrificazione (2).
NOTA. In fase di montaggio, i raccordi (41), (42) devono essere spalmati con Loctite 577 e serrati con una coppia di 35÷50 Nm.

D **NUR WENN DAS AUSWECHSELN NÖTIG IST**
Anschlüsse (41), (42) der Schmierleitung (2) abnehmen.
BEMERKUNG. Bei der Montage, die Anschlüsse (41), (42) mit Loctite 577 schmieren und mit einem Anzugsmoment von 35÷50 Nm fest zeihen.

ESP **SOLO SI NECESARIA LA SOBSTITUCION**
Remover los empalmes (41), (42) de ataque del tubo de lubrificaciòn (2).
NOTA. En fase de montaje, los empalmes (41), (42) deben de ser pasados con Loctite 577 y cerrados con un par de 35÷50 Nm.

F **SEULEMENT QUAND LA SUBSTITUTION EST NECESSAIRE**
Enlever les raccords (41), (42) de branchement du tube de lubrification (2).
NOTE. En phase de montage, les raccords (41), (42) doivent être enduits avec du Loctite 577 et serrés à un couple de 35÷50 Nm.


VARIANT FOR 2-FUNTION VERSION
VARIANTE PER 2 FUNZIONI
VARIANTE FÜR 2 FUNKTIONEN
VARIANTE POR 2 FUNCIONES
VARIANTE POUR 2 FONCTIONS
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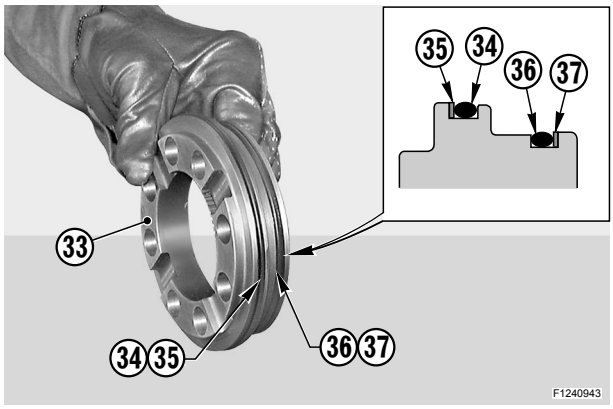
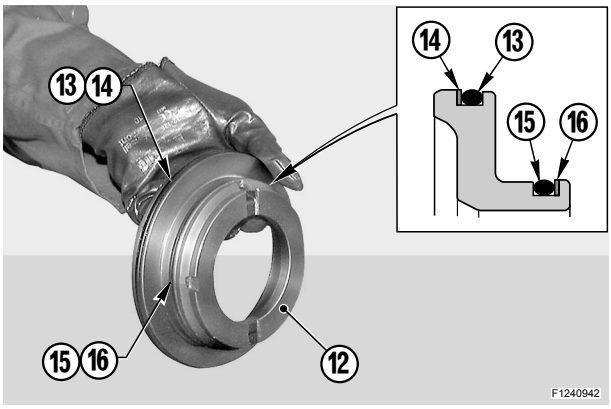
D1240088
* 3-FUNTION VERSION ONLY
SOLO PER VERSIONE A 3 FUNZIONI
NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN
SOLO POR VERSION A 3 FUNCIONES
SEULEMENT POUR VERSIONS A 3 FONCTIONS



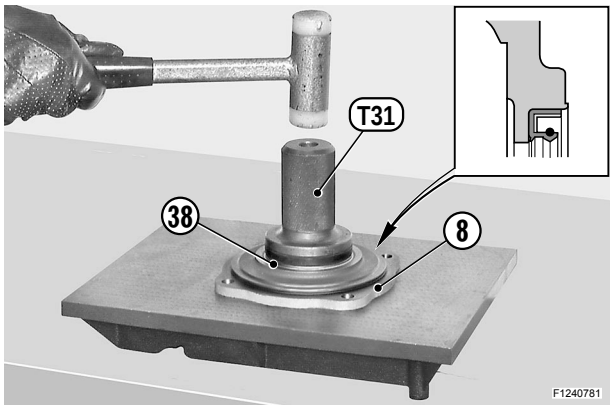
GB — a

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.



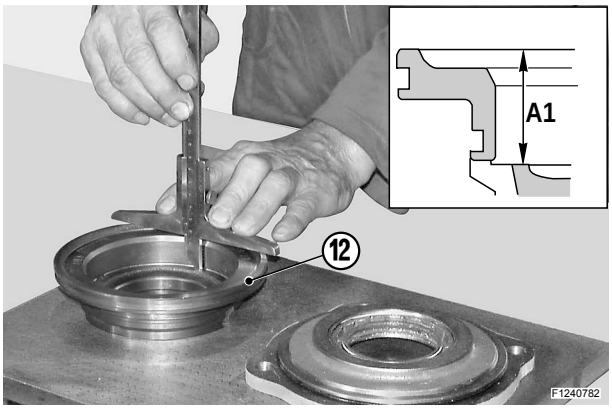
GB — b

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.



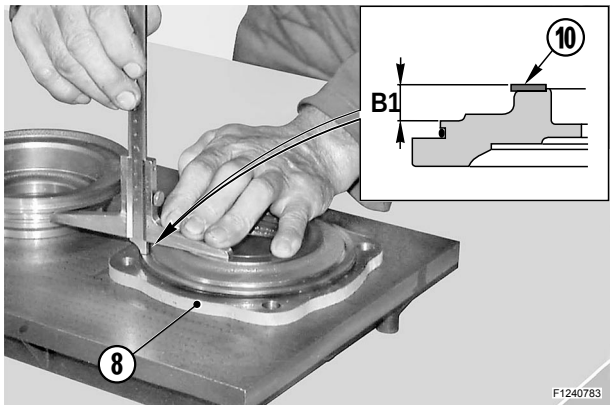
GB — c

Lubricate sealing ring (38) and, using tool T31, fit it into the cover (8).
NOTE. Carefully check the direction of ring (38).



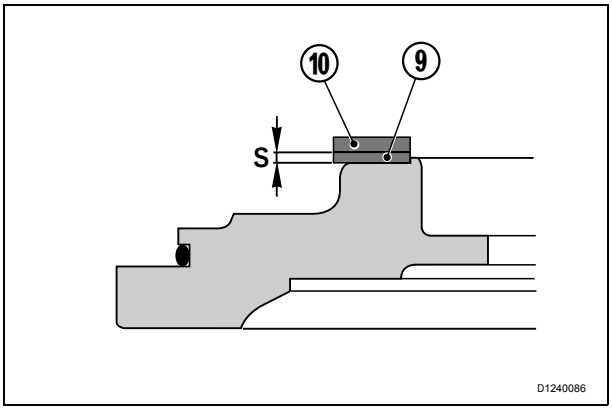
GB — d

3-FUNCTION VERSION ONLY
Measure size "**A1**" of piston (12) and note it down.



GB — e

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



GB — f

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.

a

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Montare sul pistone (33) del freno di servizio gli anelli di tenuta (34), (36) e gli anelli antiestrusione (35), (37).
NOTA. Controllare attentamente la posizione di montaggio degli anelli antiestrusione.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Auf den Kolben (33) der Hilfsbremse die Dichtringe (34), (36) und die Halteringe (35), (37) montieren.
BEMERKUNG. Sorgfältig die Montagerichtung der Halteringe prüfen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Montar sobre el piston (33) del freno de servicio los segmentos de compresion (34), (36) y los segmentos de anti-extrusion (35), (37).
NOTA. Controlar con cuidado la colocaciòn de montaje de los segmentos anti-extrusiòn.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Monter sur le piston (33) du frein de service les bagues d'étanchéité (34), (36) et les anneaux anti-extrusion (35), (37).
NOTE. Contrôler attentivement la position du montage des anneaux anti-extrusion.

b

ITA Montare sul pistone (12) del freno negativo gli anelli di tenuta (13), (15) e gli anelli antiestrusione (14), (16).
NOTA. Controllare attentamente la posizione di montaggio degli anelli antiestrusione.

D Auf den Kolben (12) der Negativbremse die Dichtringe (13), (15) und die Halteringe (14), (16) montieren.
BEMERKUNG. Sorgfältig die Montagerichtung der Halteringe prüfen.

ESP Monter sobre el piston (12) del freno negativo los segmentos de compresiòn (13), (15) y los segmentos anti-extrusion (14), (16).
NOTA. Controlar con cuidado la colocaciòn ce montaje de los segmentos anti-extrusion.

F Monter sur le piston (12) du frein négatif les bagues d'étanchéité (13), (15) et les anneaux anti-extrusion (14), (16).
NOTE. Contrôler attentivement la position du montage des anneaux anti-extrusion.

c

ITA Lubrificare l'anello di tenuta (38) e, utilizzando l'attrezzo **T31**, montarlo nel coperchio (8).
NOTA. Controllare attentamente l'orientamento dell'anello (38).

D Dichtring (38) schmieren und mit Hilfe des Werkzeugs T31 den Deckel (8) montieren.
BEMERKUNG. Sorgfältig die Montagerichtung des Ringes (38) prüfen.

ESP Lubrificar el segmento de compresiòn (38) y utilizando la herramienta **T31**, montarlo sobre la tapa (8).
NOTA. Controlar con cuidado la direcciòn del segmento (38).

F Lubrifier la bague d'étanchéité (38), puis à l'aide de l'outil **T31**, monter celle-ci dans le couvercle (8).
NOTE. Contrôler attentivement l'orientation de la bague (38).

d

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Rilevare la misura "**A**1" del pistone (12) e trascriverla.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Maß "**A**1" des Kolbens (12) messen und anmerken.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Relevar la medida "**A**1" del piston (12) y registrarla.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Relever la mesure "**A**1" du piston (12) et enregistrer cette dernière.

e

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Montare sul coperchio (8) l'anello di battuta (10) delle molle a tazza, rilevare la misura "**B1**" e trascriverla.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Auf den Deckel (8) den Anschlagring (10) der Tellerfedern montieren. Das Maß "**B1**" messen und anmerken.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Montar sobre la tapa (8) el segmento a tope (10) de los muelles a taza, relevar la medida "**B1**" y registrarla.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Monter sur le couvercle (8) l'anneau de butée (10) des ressorts Belleville, relever la mesure "**B1**" et enregistrer cette dernière.

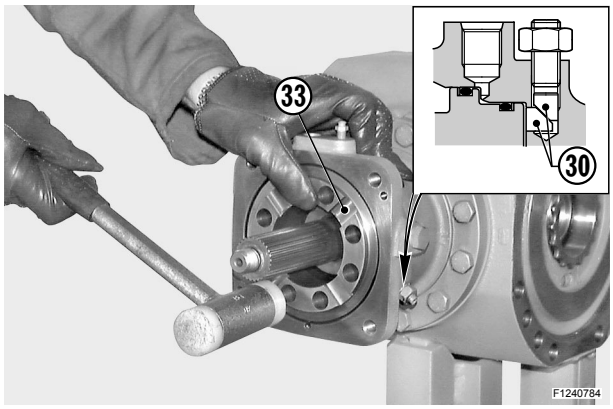
f

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Utilizzando le misure rilevate, determinare lo spessore "**S**" dei rasamenti (9) con il seguente calcolo:
S = (A1 + 1,5)–(B1 + 18,4) ove:
S = Spessori rasamenti - 1,5 mm = misura fissa del gioco dischi freno - 18,4 mm = misura fissa delle molle a tazza.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Anhand der ermittelten Maße die Stärke "**S**" der Scheiben (9) folgendermaßen ausrechnen:
S = (A1 + 1,5)–(B1 + 18,4) wo:
S = Scheibenstärke - 1,5 mm = feste Maß für das Spiel der Bremsscheiben - 18,4 mm = feste Maß für Tellerfedern.

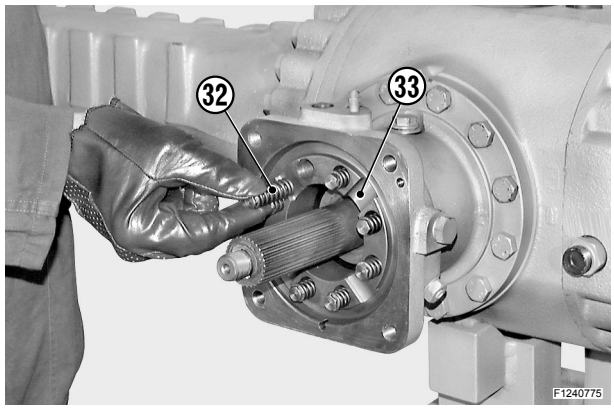
ESP **SOLO POR VERSION A 3 FUNCIONES**
Utilisando las medidas relevadas, determinar el espesor "**S**" de las raspaduras (9) con el siguiente calcolo:
S = (A1 + 1,5)–(B1 + 18,4) donde:
S = espesor raspaduras - 1,5 mm = medida fija del juego discos freno - 18,4 mm = medida fija de los muelles a taza.

F **SEULEMENT DANS LES VERSIONS A 2 FONCTIONS.**
A l'aide de la mesure relevée, définir la cale "**S**" des rasages (9) par le calcul suivant:
S = (A1 + 1,5)–(B1 + 18,4) ou:
S = Cales rasages - 1,5 mm = mesure fixe du jeu des disques frein - 18,4 mm = mesure fixe des ressorts Belleville.



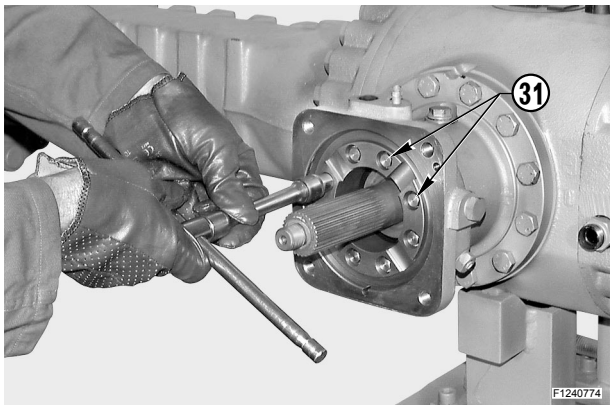
GB a

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.



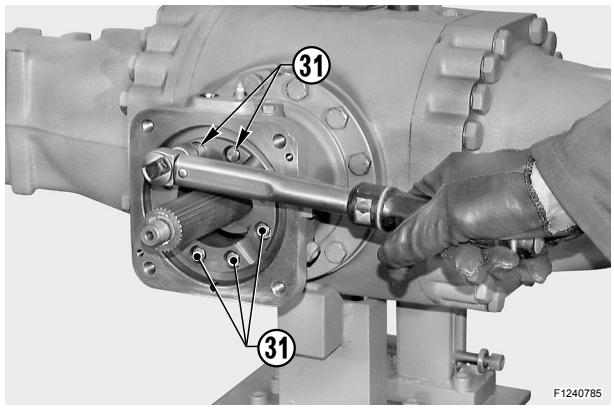
GB b

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



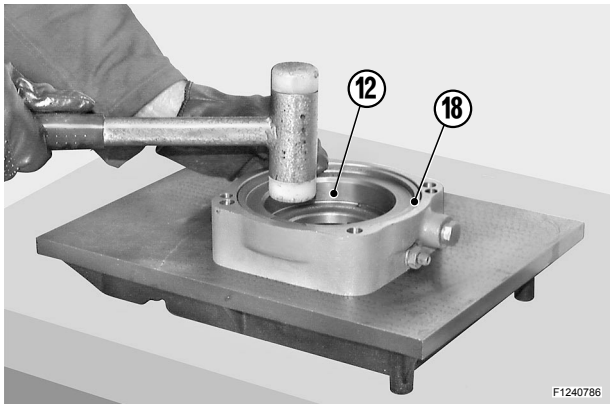
GB c

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 manner.



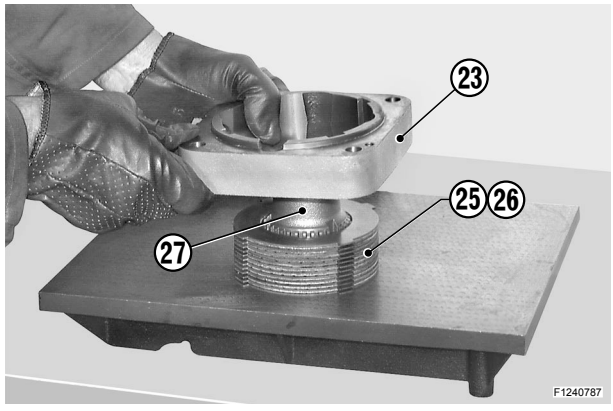
GB d

3-FUNCTION VERSION ONLY
Lock screws (31) in a criss-cross manner by using a dynamometric wrench set to a max. torque of 10 Nm.
CAUTION! Do not exceed the specified torque setting.



GB e

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.



GB f

Lightly lubricate the braking discs (25), (26) and fit them onto the hub (27).
Align discs (25) and fit the distance piece (23).
NOTE. The braking discs pack starts and ends with steel discs (25).

a

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Lubrificare le guarnizioni OR e montare il pistone (33) completo. Orientare il pistone con una leva e mandarlo a fondo corsa con un mazzuolo in materiale plastico.
ATTENZIONE! Controllare che i pioli di registro (30) siano inseriti a fondo e che scorrano tra loro.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
O-Ringe schmieren und den vollständigen Kolben (33) montieren. Den Kolben mit einem Hebel orientieren und bis zum Hubende mit einem Gummihammer schlagen.
ACHTUNG! Kontrollieren, ob die Regelungspole (30) bis zum Anschlag eingesetzt sind und verschiebt werden können.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Lubrificar las guarniciones OR y montar el piston (33) completo. Orientar el piston con una palanca y mandarlo a final carrera con un martillo en material plastico.
ATENCION! Controlar que las extremidades de registro (30) sean introducidas a fondo y que deslizen entre ellas.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Lubrifier les garnitures OR et monter le piston (33) complet. Orienter le piston à l'aide d'un levier puis l'envoyer en fin de course à l'aide d'un maillet en matière plastique.
ATTENTION! Contrôler, que les pôles de régistration (30) soient insérés à fond et qu'ils puissent glisser.

b

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Inserire le molle (32) di ritorno del pistone (33).

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Rückzugsfedern (32) in den Kolben (33) einsetzen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Introducir los muelles (32) de vuelta del piston (33).

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Introduire les ressorts (32) de retour du piston (33).

c

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Spalmare il filetto delle viti (31) con Loctite 242 ed avvitarle.
NOTA. Mandare in battuta le viti con una chiave normale con il metodo alternato ed incrociato.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Schraubengewinde (31) mit Loctite 242 schmieren und Schrauben fest schrauben.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Pasar la rosca de los tornillos (31) con Loctite 242 y atornillarlas.
NOTA. Mandar a tope los tornillos con una llave normal de manera alternada y cruzada.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Enduire le filet des vis (31) avec du Loctite 242, puis visser.
NOTE. Envoyer en butée les vis à l'aide d'une clé normale avec la méthode alternée, croisée.

d

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Bloccare le viti (31) in modo incrociato utilizzando una chiave dinamometrica tarata ad una coppia massima di 10 Nm.
ATTENZIONE! Non superare la coppia di serraggio indicata.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Die Schrauben (31) im Kreuz mit einem Momentenschlüssel und einem Anzugsmoment von 10 Nm fest schrauben.
ACHTUNG! Das angegebene Moment nicht überschreiten.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Bloquear los tornillos (31) de manera cruzada utilizando una llave dinamometrica tarada a un par maximo de 10 Nm.
ATENCION! No superar el par de torsion indicado.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Bloquer les vis (31) de manière croisée à l'aide d'une clé dynamométrique calibrée à un couple max. de 10 Nm.
ATTENTION! Ne jamais dépasser le couple de serrage indiqué.

e

ITA Lubrificare le guarnizioni (13), (15) e montare nel cilindro (18) il pistone (12) orientandolo sulla spina (19).
Per il montaggio, utilizzare un mazzuolo in materiale plastico e mandare il pistone (12) a fondo corsa.

D Dichtungen (13), (15) schmieren und in en Zylinder (18) den Kolben (12) montieren und auf den Stift (19) orientieren. Zur Montage einen Gummihammer verwenden, um den Kolben (12) bis zum Hubende zu schlagen.

ESP Lubrificar las guarniciònes (13), (15) y montar en el cilindro (18) el piston (12) dirijiendolo sobre la espina (19).
Para el montaje, utilizar un martillo en material plastico y mandar el piston (12) a final carrera.

F Lubrifier les garnitures (13), (15) puis monter dans cylindre (18) le piston (12) en l'orientant sur la broche (19).
Pour le montage, utiliser un maillet en matière plastique et envoyer le piston (12) en fin de course.

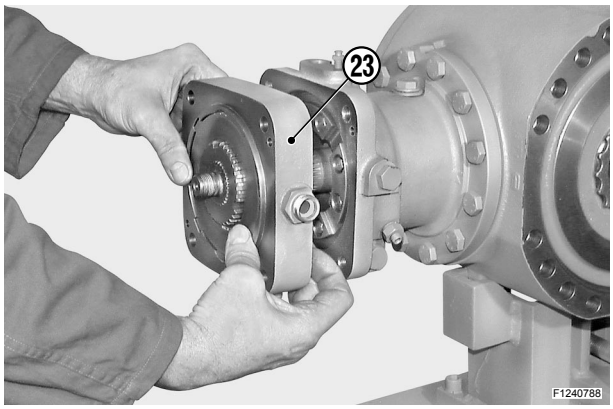
f

ITA Lubrificare leggermente i dischi di frenatura (25), (26) e montarli sul mozzo (27).
Allineare i dischi (25) e montare il distanziale (23).
NOTA. La composizione del pacco dei dischi di frenatura inizia e termina con i dischi di acciaio (25).

D Bremsscheiben (25), (26) leicht schmieren und auf die Nabe (27) montieren.
Scheiben (25) ausrichten und Distanzstück (23) montieren.
BEMERKUNG. Der Satz der Bremsscheiben beginnt und endet mit den Stahlscheiben (25).

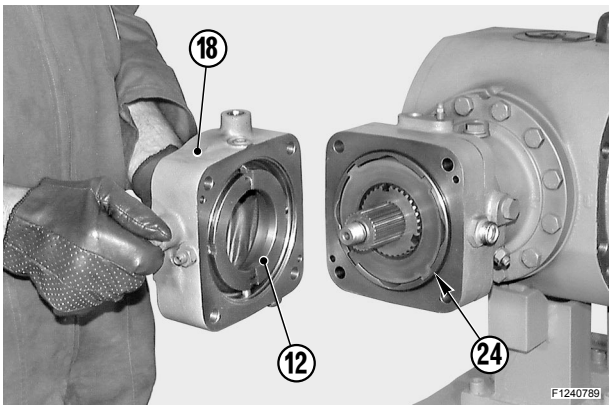
ESP Lubrificar ligermente los discos de frenadura (25), (26) y montarlos sobre el cubo (27).
Alinear los discos (25) y montar el distancial (23).
NOTA. La composiciòn del paquete de los discos de frenadura empieza y termina con los discos en acero (25).

F Lubrifier légèrement les disques de freinage (25), (26) et monter ceux-ci sur le moyeu (27).
Aligner les disques (25) et monter l'entretoise (23).
NOTE. La composition du paquet des disques de freinage commence et s'achève par des disques en acier (25).



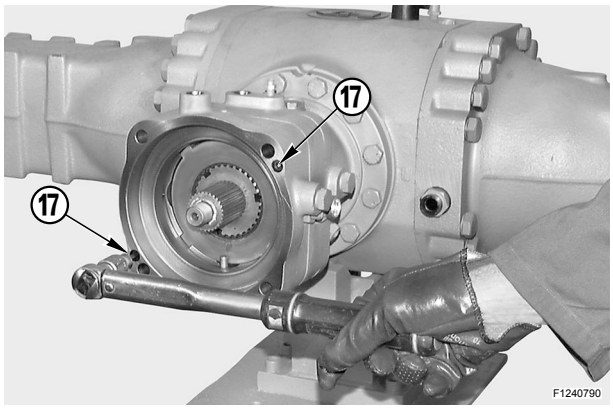
GB a

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



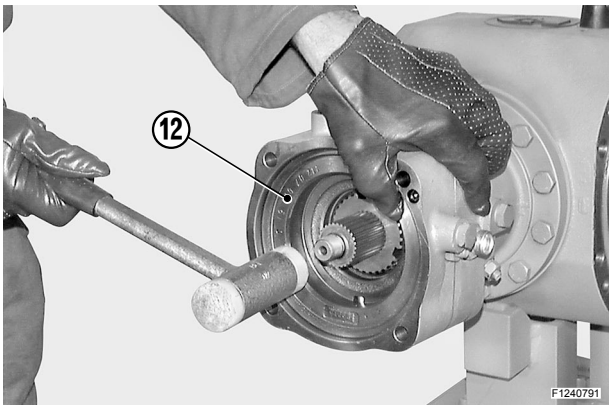
GB b

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



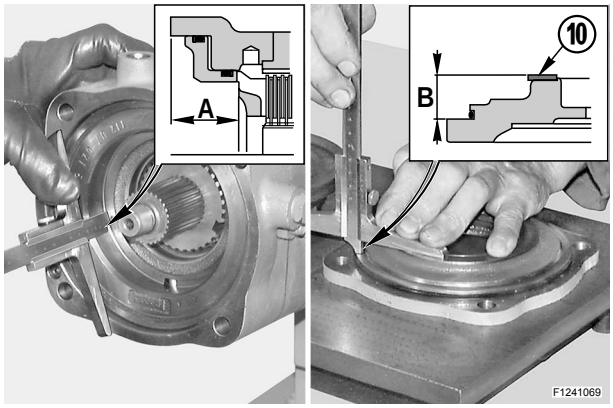
GB c

Introduce screws (17) and tighten in a criss-cross manner: use a torque wrench setting of 9.5 – 10.5 Nm.
NOTE. Before giving the final tightening, align the external surfaces of the components.



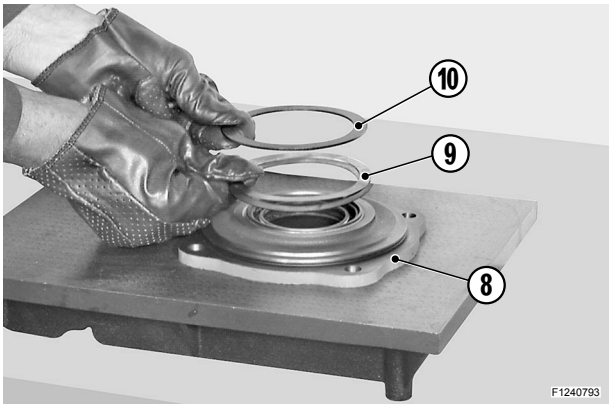
GB d

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



GB e

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



GB f

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.

a

ITA Spalmare il piano di appoggio del distanziale (23) con Loctite 510.
Montare sul pignone il gruppo dischi-mozzo-distanziale preparato nelle fasi precedenti e mandarlo in battuta.

D Die Auflagefläche des Distanzstückes (23) mit Loctite 510 schmieren.
Auf den Kolben das Aggregat Scheiben-Nabe-Distanzstück montieren, das zuvor vorbereitet wurden und bis zum Anschlag einsetzen.

ESP Pasar la superficie de apoyo del distancial (23) con Loctite 510.
Montar sobre el pinòn el grupo discos-cubo-distancial preparado en la fase precedente y mandarlo a tope.

F Enduire le plan d'appui de l'entretoise (23) avec du Loctite 510.
Monter sur le pignon le groupe disques-moyeu-entretoise préparé lors des phases précédentes et l'envoyer en butée.

b

ITA Lubrificare la guarnizione OR (24) e montare il cilindro (18) completo di pistone (12).

D O-Ring (24) schmieren und den Zylinder (18) samt Kolben (12) montieren.

ESP Lubrificar la guarnicion OR (24) y montar el cilindro (18) completo de piston (12).

F Lubrifier la garniture OR (24) et monter le cylindre (18) équipé du piston (12).

c

ITA Inserire le viti (17) ed avvitarle a fondo in modo incrociato; serrarle con una coppia di 9,5÷10,5 Nm.
NOTA. Prima del serraggio finale, allineare le superfici esterne dei componenti.

D Schrauben (17) einsetzen und bis zum Anschlag im Kreuz mit einem Anzugsmoment von 9,5÷10,5 Nm fest schrauben.
BEMERKUNG. Bevor die Teile endgültig festgezogen werden, die äußeren Flächen ausrichten.

ESP Introducir los tornillos (17) y atornillarlos a tope de manera cruzada; apretarlos con un par de 9,5÷10,5 Nm.
NOTA. Antes de apretarlos definitivamente, alinear las superficies exteriores de los componentes.

F Introduire les vis (17) et visser à fond de façon croisée; serrer celles-ci à un couple de 9,5÷10,5 Nm.
NOTE. Avant le serrage final, aligner les surfaces externes des composants.

d

ITA **SOLO PER VERSIONE A 2 FUNZIONI**
Utilizzando un mazzuolo in materiale plastico, mandare a fondo corsa il pistone (12).

D **NUR FÜR AUSFÜHRUNG MIT 2 FUNKTIONEN**
Mit einem Gummihammer den Kolben (12) bis zum Anschlag schlagen.

ESP **SOLO POR VERSION A 2 FUNCIONES**
Utilizando un martillo en material plastico, mandar a final carrera el piston (12).

F **SEULEMENT DANS LES VERSIONS A 2 FONCTIONS.**
A l'aide du maillet en matière plastique, envoyer le piston (12) en fin de course.

e

ITA **SOLO PER VERSIONE A 2 FUNZIONI**
Montare sul coperchio (8) l'anello di battuta (10) delle molle a tazza, rilevare la misura "**B**" e trascriverla.
Rilevare la misura "**A**" necessaria al calcolo dei rasamenti (9) con la formula: **S = A–(B + 18,4)** ove: S = Spessori rasamenti - 18,4 mm = misura fissa delle molle a tazza.

D **NUR FÜR AUSFÜHRUNG MIT 2 FUNKTIONEN**
Auf den Deckel (8) den Anschlagring (10) der Tellerfedern montieren. Das Maß "**B**" messen und anmerken.
Das Maß "**A**" messen, das zur Rechnung der Scheiben (9) mit nachstehender Formel nötig ist: **S = A–(B + 18,4)** wo:
S = Scheibenstärke - 18,4 mm = feste Maß für Tellerfedern.

ESP **SOLO POR VERSION A 2 FUNCIONES**
Montar sobre la tapa (8) el segmento a tope (10) de los muelles a taza, relevar la medida "**B**" y registrarla.
Relevar la medida "**A**" necesaria al calculo de las raspaduras (9) con la formula: **S = A–(B + 18,4)** donde: S = espesor raspaduras - 18,4 mm = medida fija de los muelles a taza.

F **SEULEMENT DANS LES VERSIONS A 2 FONCTIONS.**
Monter sur le couvercle (8) l'anneau de butée (10) des ressorts Belleville, relever la mesure "**B**" et enregistrer cette dernière. Relever la mesure "**A**" nécessaire pour calculer les rasages (9) avec la formule: **S = A–(B + 18,4)** ou: S = Cales rasages - 18,4 mm = mesure fixe des ressorts Belleville.

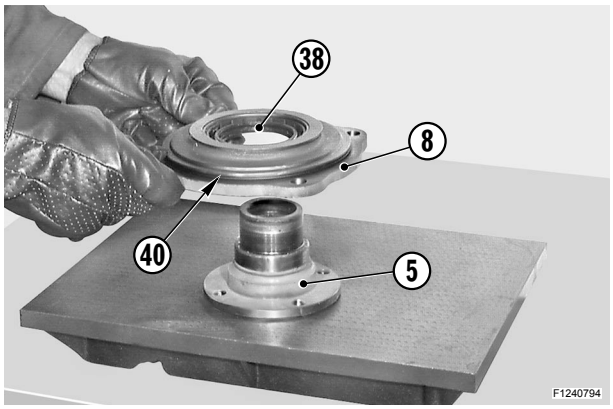
f

ITA Lubrificare leggermente gli spessori (9) calcolati e l'anello (10) di battuta delle molle a tazza.
Montare spessori ed anello sul coperchio (8).
NOTA. Posizionare lo spessore maggiore a ridosso del coperchio.

D Die Scheiben (9) und den Anschlagring (10) der Tellerfedern leicht schmieren.
Scheiben und Ring auf den Deckel (8) montieren.
BEMERKUNG. Die größere Scheibe sollte am Deckel anliegen.

ESP Lubrificar ligermente los espesores (9) calculados y el segmento (10) a tope de los muelles a taza.
Montar el espesor major detras de la tapa.
NOTA. Colocar el espesor major detras de la tapa.

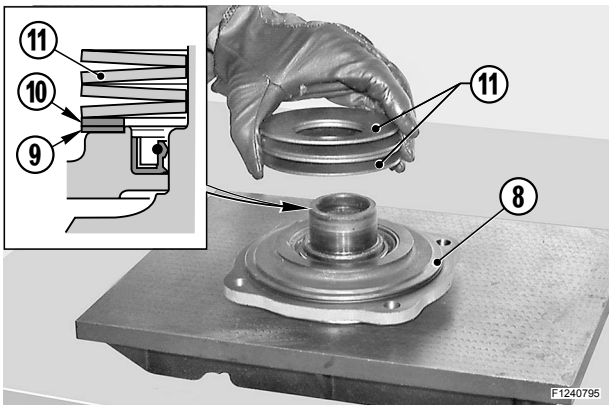
F Lubrifier légèrement les cales (9) calculées et l'anneau (10) de butée des ressorts belleville.
Monter cales et anneau sur le couvercle (8).
NOTE. Placer la cale la plus grande au-dessus du couvercle.



GB

a

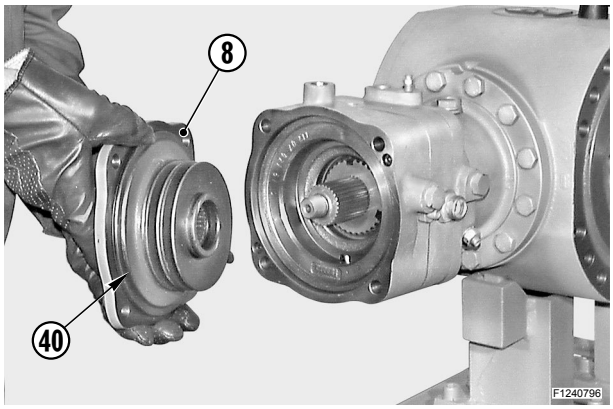
Check the state of the O-ring (40).
Lubricate sealing ring (38) and fit flange (5) into the cover (8).



GB

b

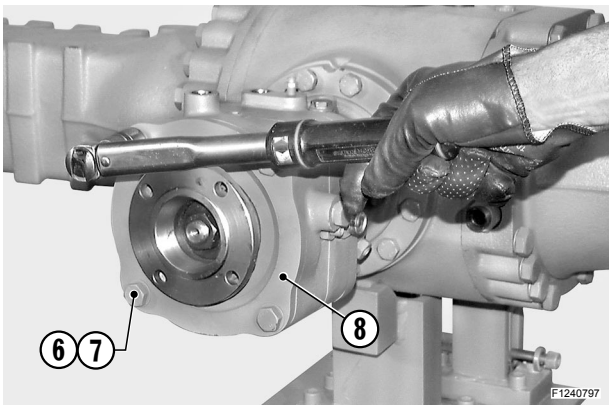
Fit the Belleville washers (11) onto the cover (8), thoroughly checking washers orientation.



GB

c

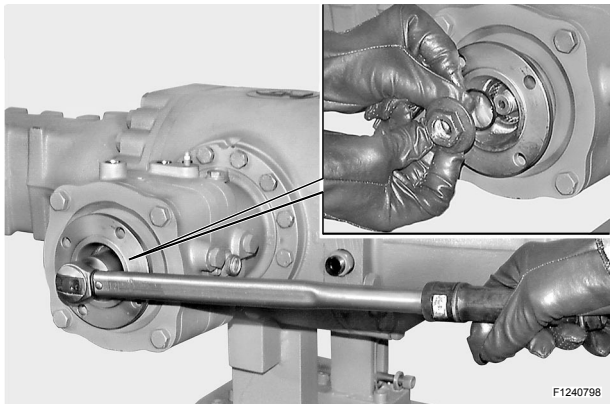
Lubricate the O-ring (40) and install the cover assembly (8).



GB

d

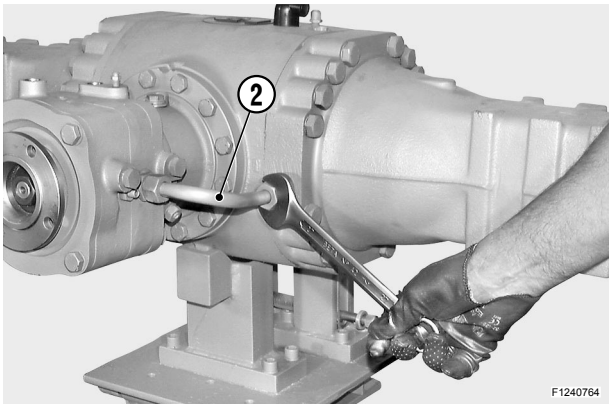
Fit screws (6) and washers (7); lock the cover with a torque wrench setting of 116 – 128 Nm.
NOTE. Tighten in an alternate and criss-cross manner.



GB

e

Apply Loctite 242 to the threaded portion of the pinion, fit O-ring (4) and nut (3); tighten the nut with a dynamometric wrench set to 280 – 310 Nm.
NOTE. Use tools **T21-T22**.



GB

f

Install the lubrication tube (2).

a

ITA Controllare lo stato dell'anello OR (40).
Lubrificare l'anello di tenuta (38) e montare la flangia (5) nel coperchio (8).

D Zustand des O-Rings (40) kontrollieren.
Dichtring (38) schmieren und Flansch (5) in den Dekkel (8) montieren.

ESP Controlar el estado del anillo OR (40).
Lubrificar el anillo de compresiòn (38) y montar la brida (5) sobre la tapa (8).

F Contrôler l'état de la garniture OR (40).
Lubrifier la bague d'étanchéité (38) et monter la flasque (5) dans le couvercle (8).

b

ITA Montare sul coperchio (8) le molle a tazza (11) controllandone attentamente l'orientamento.

D Auf den Deckel (8) die Tellerfeder (11) montieren und sorgfältig auf die Montagerichtung achten.

ESP Montar sobre la tapa (8) los muelles a taza (11) controlando con cuidado la direcciòn.

F Monter sur le couvercle (8) les ressorts belleville (11) en contrôlant attentivement leur orientation.

c

ITA Lubrificare l'anello OR (40) ed installare il gruppo coperchio (8).

D O-Ring (40) schmieren und Deckelaggregat (8) installieren.

ESP Lubrificar el anillo OR (40) y montar el grupo tapa (8).

F Lubrifier la garniture OR (40) et installer le groupe couvercle (8).

d

ITA Montare le viti (6) e le rondelle (7); bloccare il coperchio con una coppia di 116÷128 Nm.
NOTA. Eseguire il serraggio in modo alternato ed incrociato.

D Schrauben (6) und Unterlegscheiben (7) montieren; den Deckel mit einem Anzugsmoment von 116÷128 Nm blockieren.
BEMERKUNG. Schrauben abwechselnd und im Kreuz fest schrauben.

ESP Montar los tornillos (6) y las arandelas (7); bloquear la tapa con un par de 116÷128 Nm.
NOTA. Apretar de manera alternada y cruzada.

F Monter les vis (6) et les rondelles (7); bloquer le couvercle à un couple de 116÷128 Nm.
NOTE. Effectuer le serrage de façon alternée et croisée.

e

ITA Spalmare la porzione filettata del pignone con Loctite 242, montare l'anello OR (4) ed il dado (3); serrare il dado con chiave dinamometrica tarata a 280÷310 Nm.
NOTA. Utilizzare gli attrezzi **T21-T22**.

D Das Gewinde des Kolbens mit Loctite 242 schmieren und den O-Ring (4) und die Mutter (3) montieren; die Mutter mit einem Anzugsmoment von 280÷310 Nm fest schrauben.
BEMERKUNG. Werkzeuge **T21-T22** verwenden.

ESP Pasar la parte roscada del pinòn con Loctite 242, montar el segmento OR (4) y la tuerca (3); apretar la tuerca con llave dinamometrica tarada a 280÷310 Nm.
NOTA. Utilizar las herramientas **T21-T22**.

F Enduire la partie filetée du pignon avec du Loctite 242, monter la garniture OR (4) et l'écrou (3); serrer l'écrou à l'aide d'une clé dynamométrique calibrée à 280÷310 Nm.
NOTE. Utiliser les outils **T21-T22**.

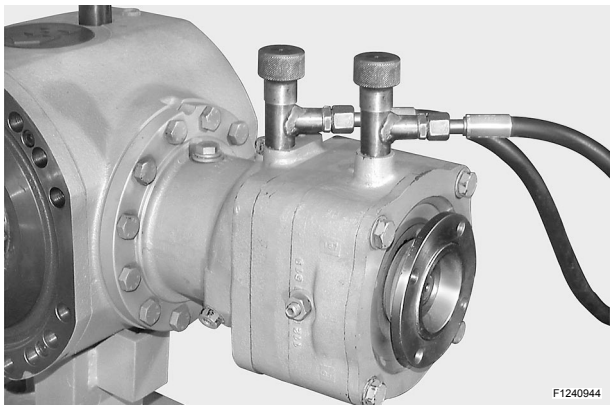
f

ITA Montare il tubo (2) della lubrificazione.

D Schmierleitung (2) montieren.

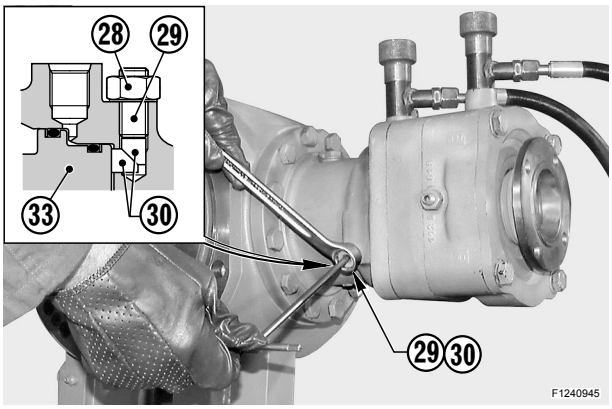
ESP Montar el tubo (2) de la lubrificaciòn

F Monter le tube (2) de lubrification.



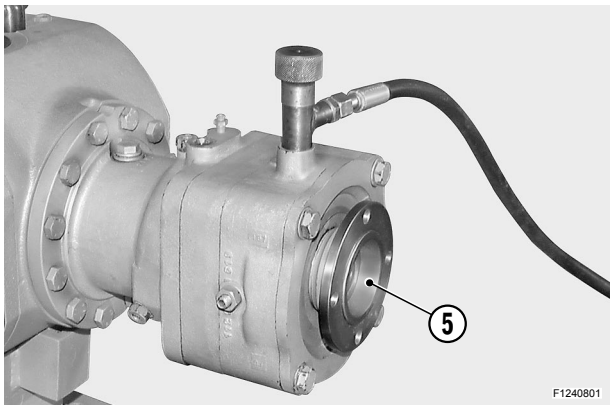
GB a

3-FUNCTION VERSION ONLY
Connet the service and negative brakes to an external pump; introduce pressure up to a value of 20 – 25 Nm.
NOTE. Check that pressure is kept stable for at least 5 minutes and make sure there are no leaks.



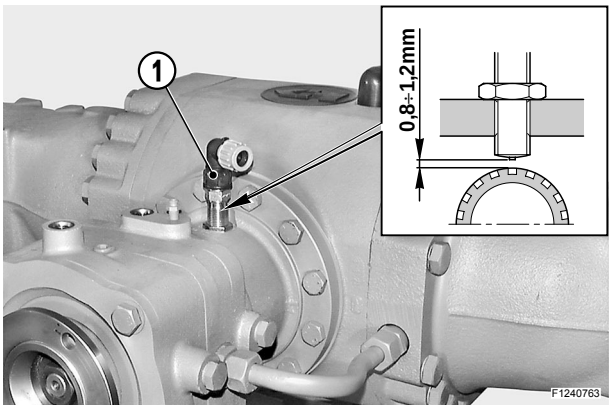
GB b

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



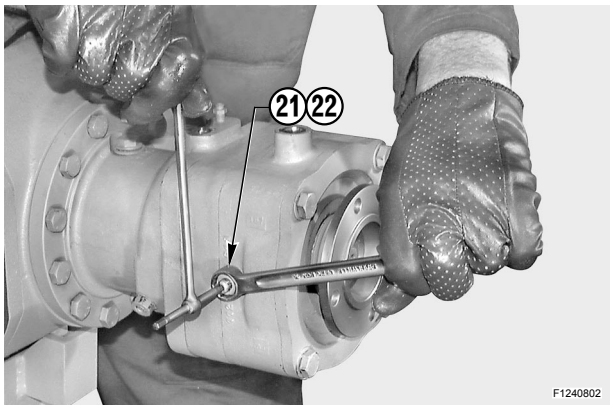
GB c

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



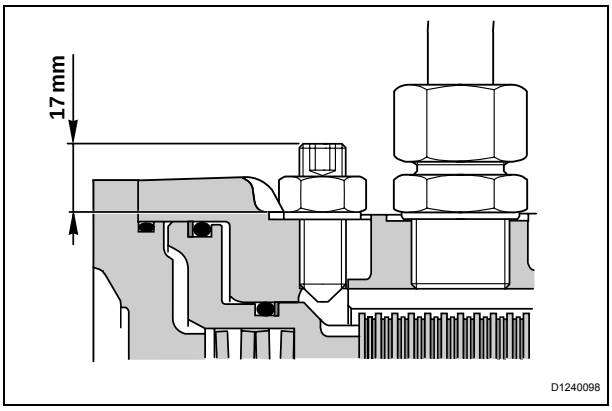
GB d

Fit the movement sensor (1) and screw it up to the limit stop. Unscrew sensor by 3/4 turn and lock into position with nut. Locking torque: MAX 30 Nm.
CAUTION! Do not exceed the specified torque setting.



GB e

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



GB f

When the emergency is over, loosen the dowels in an alternate manner until a 17 mm projection is obtained; lock into position with the nuts (22) tightened to15 Nm.

a

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Collegare i freni di servizio e negativo ad una pompa esterna; immettere pressione fino ad un valore di 20÷25 Nm.
NOTA. Controllare che la pressione rimanga stabile per almeno 5 minuti e quindi non vi siano perdite.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Die Hilfsbremse und Negativbremse an eine getrennte Pumpe schließen; Druck bis zu einem Wert von 20÷25 Nm einlassen.
BEMERKUNG. Kontrollieren, ob der Druck mindestens 5 Minuten lang stabil bleibt und nirgends austritt.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Conectar los frenos de servicio y negativo a una pompa externa; introducir hasta un valor de 20÷25 Nm.
NOTA. Controlar que la presion quede estabil por lo menos por 5 minutos y que no hayan perdidas.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Brancher les freins de service et négatif à une pompe externe; émettre de la pression jusqu'à une valeur de 20÷25 Nm.
NOTE. Contrôler que la pression soit stable pendant 5 minutes au moins et qu'il n'y ait pas de fuites.

b

ITA **SOLO PER VERSIONE A 3 FUNZIONI**
Avvitare i grani (29) fino all'appoggio dei pioli (30) sul pistone (33) e quindi svitarli di 1 giro per creare una corsa del pistone di 1,5 mm.
Bloccare la posizione dei grani (29) con i dadi (28) serrati a 15 Nm. Rilasciare la pressione.

D **NUR FÜR AUSFÜHRUNG MIT 3 FUNKTIONEN**
Stifte (29) bis zum Anschlag der Sprossen (30) am Kolben (33) schrauben und dann um 1 Umdrehung aufdrehen, um einen Hub von 1,5 mm herzustellen.
Die Position der Stifte (29) mit den Muttern (28) bei einem Anzugsmoment von 15 Nm blockieren. Druck ablassen.

ESP **SOLO POR VERSION A 3 FUNCIONES**
Atornillar las espigas (29) hasta el apoyo de las extremidades (30) sobre el piston (33) y ahora destornillarlos de 1 giro para averiguar una carrera del pistòn de 1,5 mm.
Bloquear la posiciòn de las espigas (29) con las tuercas (28) apretadas a 15 Nm. Dejar la presiòn.

F **SEULEMENT DANS LES VERSIONS A 3 FONCTIONS.**
Visser les grains (29) jusqu'à la dépose des chevilles (30) sur le piston (33), puis dévisser ceux-ci d'un tour pour créer une course du piston de 1,5 mm.
Bloquer la position des grains (29) avec les écrous (28) serrés à 15 Nm. Relâcher la pression.

c

ITA Controllare lo sblocco del freno negativo immettendo una pressione di 16÷35 bar e ruotando manualmente la flangia (5).
Rilasciare la pressione.

D Kontrollieren ob, beim einlassen von einem Druck von 16÷35 bar die Negativbremse entsichert und von Hand den Flansch (5) drehen.
Druck ablassen.

ESP Controlar el bloqueo del frenonegativo indroduciendo una presiòn de 16÷35 bar y ruotando manualmente la brida (5).
Dejar la presiòn.

F Contrôler le débrayage du frein négatif en émettant de la pression à 16÷35 bar et en tournant la flasque (5) manuellement.
Relâcher la pression.

d

ITA Montare il sensore di movimento (1) ed avvitarlo manualmente a fondo corsa. Svitarlo di 3/4 di giro e bloccare la posizione con il dado. Coppia di bloccaggio: MAX 30 Nm.
ATTENZIONE! Non superare la coppia indicata.

D Den Bewegungsgeber (1) montieren und von Hand bis zum Anschlag montieren. Dann um 3/4 Umdrehung aufdrehen und die Position mit der Mutter blockieren. Anzugsmoment: max. 30 Nm.
ACHTUNG! Das Anzugsmoment nicht überschreiten.

ESP Montar el sensor de movimiento (1) y atornillarlo manualmente a final carrera. Destornillarlo de 3/4 de vuelta y bloquear la posiciòn con la tuerca.
Par de bloqueo: Max 30 Nm.
ATENCION! No superar la mesura indicada.

F Monter le capteur de déplacement (1) et visser celui-ci à la main en fin de course. Dévisser encore celui-di de 3/4 de tour et bloquer sa position avec l'écrou. Couple de blocage: MAX. 30 Nm.
ATTENTION! Ne jamais dépasser le couple indiqué.

e

ITA **ATTEZIONE!** Per sbloccare il freno negativo in fase di emergenza (mancanza di pressione per avaria del veicolo), allentare i dadi (22) ed avvitare in modo progressivo alternato, i grani (21) fino ad avvertire un precarico; proseguire ulteriormente per 1,5 giri.

D **ACHTUNG!** Um die Negativbremse im Notfall zu entsichern (Druck bleibt wegen einer Störung am Fahrzeug aus), die Muttern (22) lockern und abwechseln die Stifte (21) fest schrauben bis sie vorgeladen sind; um weitere 1,5 Umdrehungen fest drehen.

ESP **ATENCION!** Para sbloquear el freno negativo en fase de emergencia (falta de presiòn por gaste del veiculo), aflojar las tuercas (22) y atornillar de manera progresiva alternada, las espigas (21) hasta averiguar una precarga, seguir ulteriormente por 1,5 giros.

F **ATTENTION!** Pour dégager le frein négatif en cas d'émergence (manque de pression en cas de panne du véhicule) desserrer les écrous (22) et visser de façon progressive alternée, les grains (21) jusqu'à avertir une précharge; faire encore 1,5 tour.

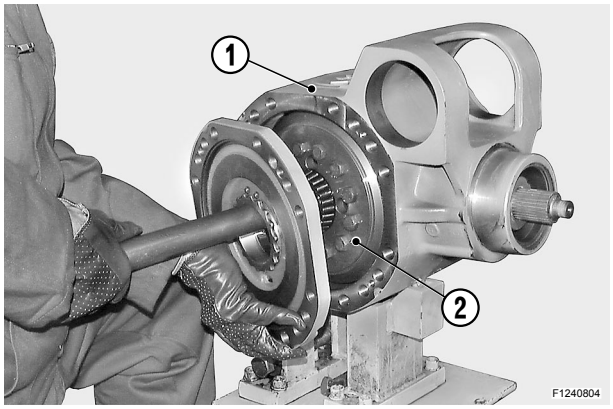
f

ITA Dopo l'emergenza svitare i grani in modo alternato fino ad ottenere una sporgenza di 17 mm; bloccare la posizione con i dadi (22) serrati a 15 Nm.

D Nach dem Notfall, die Stifte abwechselnd aufschrauben, bis ein Vorsprung von 17 mm erreicht wird; die Position mit den Muttern (22) bei einem Anzugsmoment von 15 Nm blockieren.

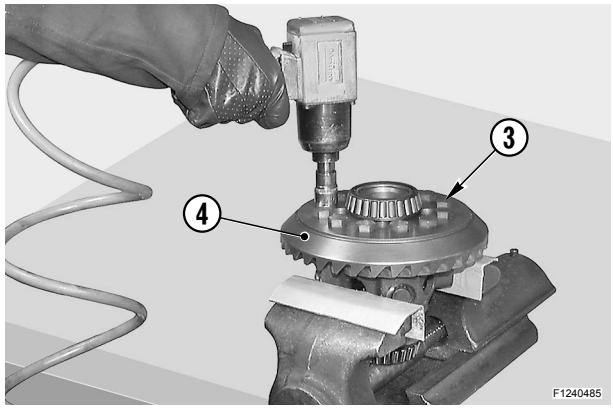
ESP Despues de una emergencia destornillar las espigas de manera alternada hasta obtener una parte saliente de 17 mm, bloquear la posiciòn con las tuercas (22) apretadas a 15 Nm.

F Après l'émergence dévisser les grains de façon alternée jusqu'à obtenir une saillie de 17 mm; bloquer la position à l'aide des écrous (22) serrés à 15 Nm.



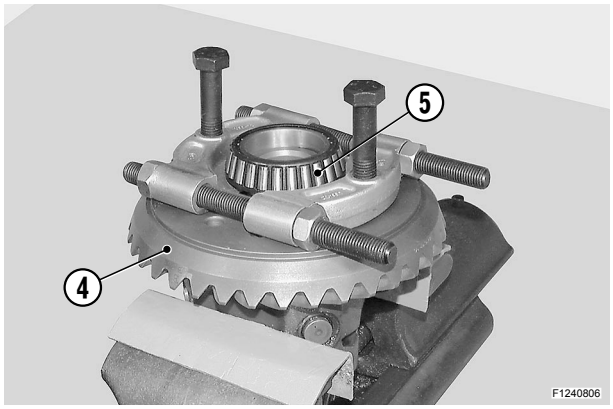
GB a

Remove the whole differential unit (2) from the central axle unit (1).
For details, see «REMOVING THE DIFFERENTIAL UNIT».



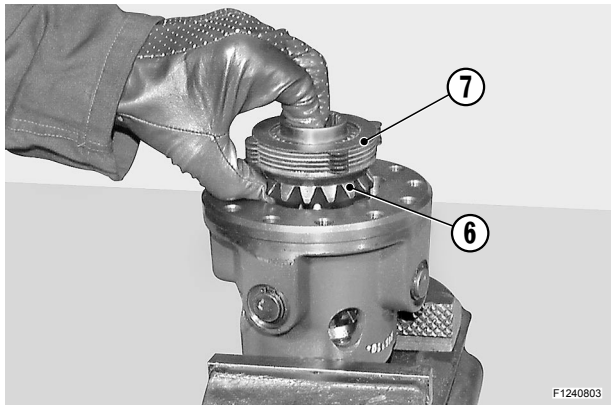
GB b

Remove the check screws (3) of the crown (4).
NOTE. Note down the position of the niches of the central hole in relation to the protrusions of the friction unit steel discs.



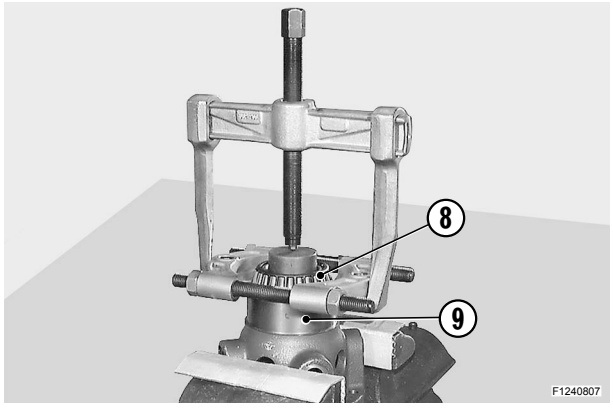
GB c

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



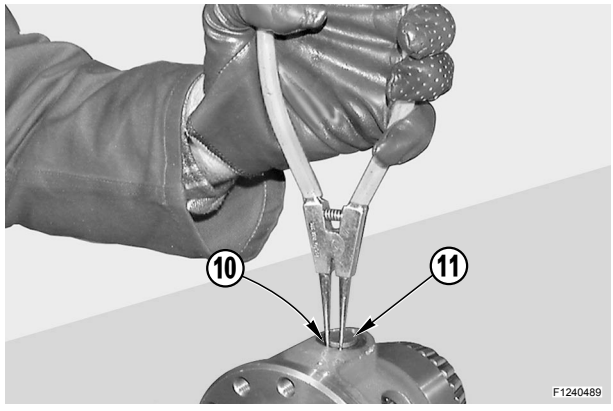
GB d

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



GB e

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



GB f

Remove the snap rings (10) from the pins (11) of the planet gears (12).

a

ITA Asportare dal corpo centrale assale (1) il gruppo differenziale (2) completo.
Per i dettagli, vedere «RIMOZIONE GRUPPO DIFFERENZIALE».

D Vom zentralen Achsenkörper (1) das vollständige Differentialaggregat (2) abnehmen.
Weitere Einzelheiten, siehe «DIFFERENTIALAGGREGAT ABNEHMEN».

ESP Sacar del cuerpo central axial (1) el grupo diferencial (2) completo.
Por los detalles, vease «REMOCION GRUPO DIFERENCIAL».

F Enlever le corps central essieu (1) le groupe différentiel (2) complet.
Pour tout détail, voir «DEPOSE DU GROUPE DIFFERENTIEL».

b

ITA Rimuovere le viti (3) di ritegno della corona (4).
NOTA. Annotare la posizione delle nicchie del foro centrale rispetto alle sporgenze dei dischi d'acciaio dei gruppi di frizione.

D Die Schrauben (3) zur Halterung des Kranzes (4) abnehmen.
BEMERKUNG. Die Position der Nischen des zentralen Lochs im Verhältnis zu den Stahlscheiben der Kupplungsaggregate anmerken.

ESP Remover los tornillos (3) de retenciòn de la corona (4).
NOTA. Anotar la colocaciòn de los nichos del agujero central respecto a las partes salientes de los discos de acero de los grupos de friciòn.

F Enlever les vis (3) de fixation de la couronne (4).
NOTE. Prendre note de la position des logements du trou central par rapport à la saillie des disques d'acier des groupes de friction.

c

ITA Se si deve sostituire, estrarre il cuscinetto (5); rimuovere la corona (4).

D Wenn es ausgewechselt werden muß, das Lager (5) heraus nehmen; Kranz (4) abnehmen.

ESP Si se debe de sobstituir, extraer el cojinete (5); remover la corona (4).

F Si on doit substituer, extraire le palier (5); enlever la couronne (4).

d

ITA Rimuovere l'ingranaggio planetario (6) ed il gruppo frizione (7) completo.

D Das Planetengetriebe (6) und das vollständige Kupplungsaggregat (7) abnehmen.

ESP Remover el engranaje planetario (6) y el grupo friciòn (7) completo.

F Enlever l'engrenage planétaire (6) et le groupe de friction (7) complet.

e

ITA Se si deve sostituire, estrarre il cuscinetto (8) dal corpo differenziale (9).

D Wenn es ausgewechselt werden muß, das Lager (8) vom Differentialkörper (9) heraus nehmen.

ESP Si se debe de sobstituir, extraer el cojinete (8) del cuerpo diferencial (9).

F Si on doit substituer, extraire le palier (8) du corps différentiel (9).

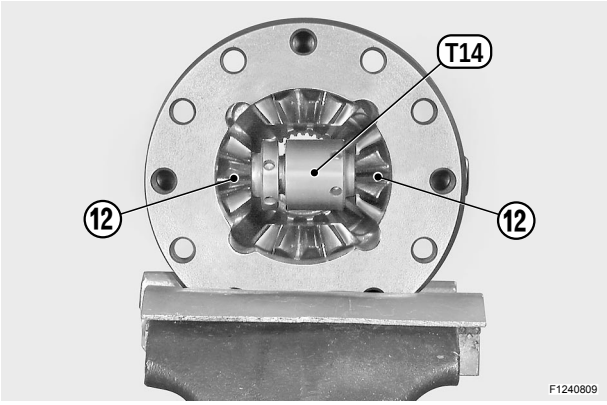
f

ITA Rimuovere gli anelli elastici (10) dai perni (11) degli ingranaggi satelliti (12).

D Die Kolbenringen (10) von den Stiften (11) der Planetengetriebe (12) abnehmen.

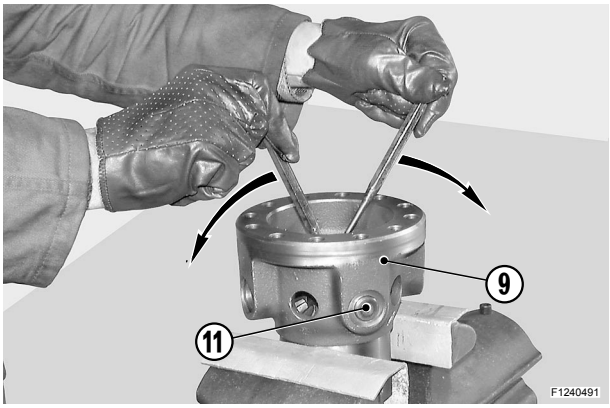
ESP Remover los segmentos elasticos (10) de los pernos (11) de los engranajes satelites (12).

F Enlever les anneaux à ressort (10) des axes (11) des engrenages satellites (12).



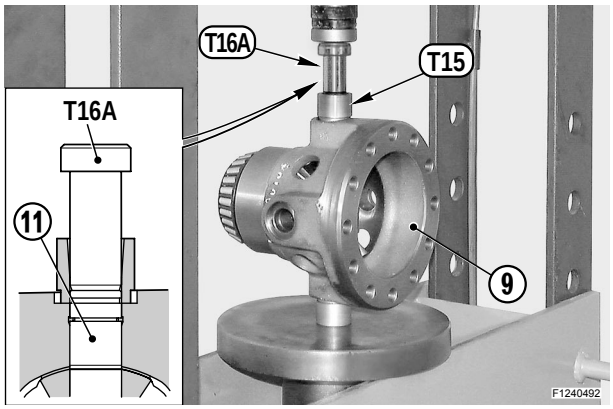
GB a

Introduce tool **T14** in-between the planet gears (12).



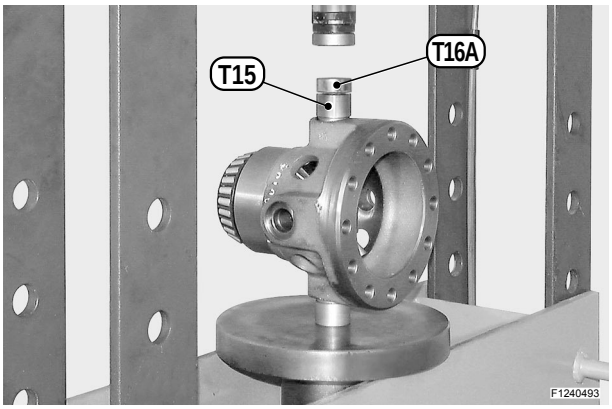
GB b

Using two pin-drivers, engage tool **T14** in between the planet gears (12).
CAUTION! Carefully check that tool **T14** keeps in an aligned position with the pins (11) when locked.



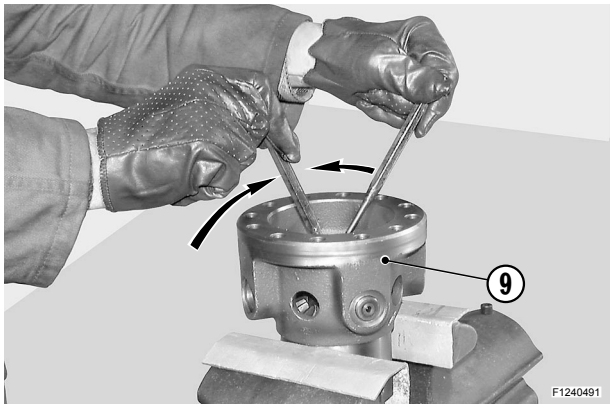
GB c

Place the differential unit (9) under a press, position bush **T15** and insert gudgeon **T16A**. Press gudgeon **T16A** to end of stroke.



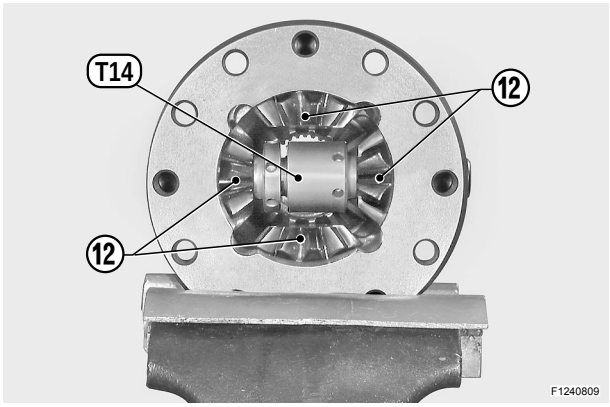
GB d

Remove gudgeon **T16A** and bush **T15**.
NOTE. In this state, the pin (11) is contained within tool **T14**.



GB e

Remove tool **T14** and planet pin (11) with it.



GB f

Leaving the released planet in its position, lock again tool **T14**. Repeat pin extraction operation on the second planet pin (11). Repeat the same operations on the remaining pins.

a

ITA Inserire tra gli ingranaggi satelliti (12) l'attrezzo **T14**.

D Zwischen den Planetengetriebe (12) das Werkzeug **T14** stecken.

ESP Introducir entre los engranajes satelites (12) la herramienta **T14**.

F Introduire entre les engrenages satellites (12) l'outil **T14**.

b

ITA Operando con due cacciaspine, forzare l'attrezzo **T14** tra gli ingranaggi satelliti (12).
ATTENZIONE! Controllare attentamente che l'attrezzo **T14** rimanga allineato ai perni (11) quando è bloccato.

D Mit zwei Dübeln das Werkzeug **T14** zwischen den Zahnrädern des Planetengetriebes (12) forcieren.
ACHTUNG! Sorgfältig kontrollieren, ob das Werkzeug **T14** mit den Stiften (11) ausgerichtet ist, nachdem es blockiert worden ist.

ESP Obrando con dos extractores de clivijas, hacer fuerza sobre la herramienta **T14** entre los engranajes satelites (12).
ATENCION! Controlar con cuidado que la herramienta **T14** quede en linea a los pernos (11) cuando esta bloqueado.

F En oeuvrant avec deux dispositifs arrache-broches, forcer l'outil **T14** entre les engrenages satellites (12).
ATTENTION! Contrôler attentivement que l'outil **T14** demeure aligné aux axes (11) quand il est bloqué.

c

ITA Sistemare il corpo differenziale (9) sotto una pressa, posizionare la boccola **T15** ed inserire lo spinotto **T16A**. Pressare lo spinotto **T16A** fino a fondo corsa.

D Den Differentialkörper (9) unter eine Presse legen, die Buchse **T15** positionieren und den Bolzen **T16A** einsetzen. Den Bolzen **T16A** bis zum Anschlag einpressen.

ESP Sistemar el cuerpo diferencial (9) bajo una presa, colocar el carquillo **T15** y introducir la cruceta **T16A**. Empujar la cruceta **T16A** a tope.

F Ajuster le corps différentiel (9) sous une presse, placer l'embout **T15** et introduire la cheville **T16A**. Presser la cheville **T16A** jusqu'en fin de course.

d

ITA Asportare lo spinotto **T16A** e la bussola **T15**.
NOTA. In questa condizione, il perno (11) è contenuto nell'attrezzo **T14**.

D Den Bolzen **T16A** und die Buchse **T15** abnehmen.
BEMERKUNG. In diesem Zustand befindet sich der Stift (11) im Werkzeug **T14**.

ESP Sacar la cruceta **T16A** y el manguito **T15**.
NOTA. En esta condicion, el perno (11) esta contenido en la herramineta **T14**.

F Enlever la cheville T16A et la bague T15.
NOTE. Dans ces conditions, l'axe (11) est contenu dans l'outil **T14**.

e

ITA Rimuovere l'attrezzo **T14** e con esso il perno (11) del satellite.

D Das Werkzeug **T14** und damit auch den Stift (11) des Planetengetriebes abnehmen.

ESP Remover la herramienta **T14** y con esta el perno (11) del satelite.

F Enlever l'outil **T14** et avec celui-ci l'axe (11) du satellite.

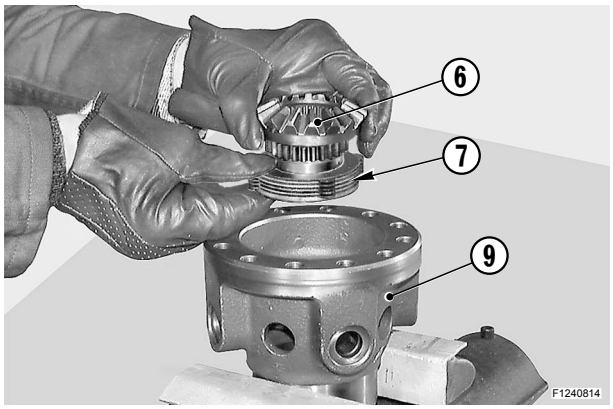
f

ITA Lasciando in posizione l'ingranaggio satellite che si è liberato, bloccare nuovamente l'attrezzo **T14**.
Ripetere le operazioni di estrazione del perno del secondo perno satellite (11).
Ripetere le operazioni per gli altri perni.

D Das Planetengetriebe, das sich freigesetzt hat, in seiner Position lassen, und Werkzeug **T14** wieder blockieren.
Die Vorgänge zum Abnehmen des zweiten Stiftes des Planetengetriebes (11) wiederholen.
Die Vorgänge für alle anderen Stifte wiederholen.

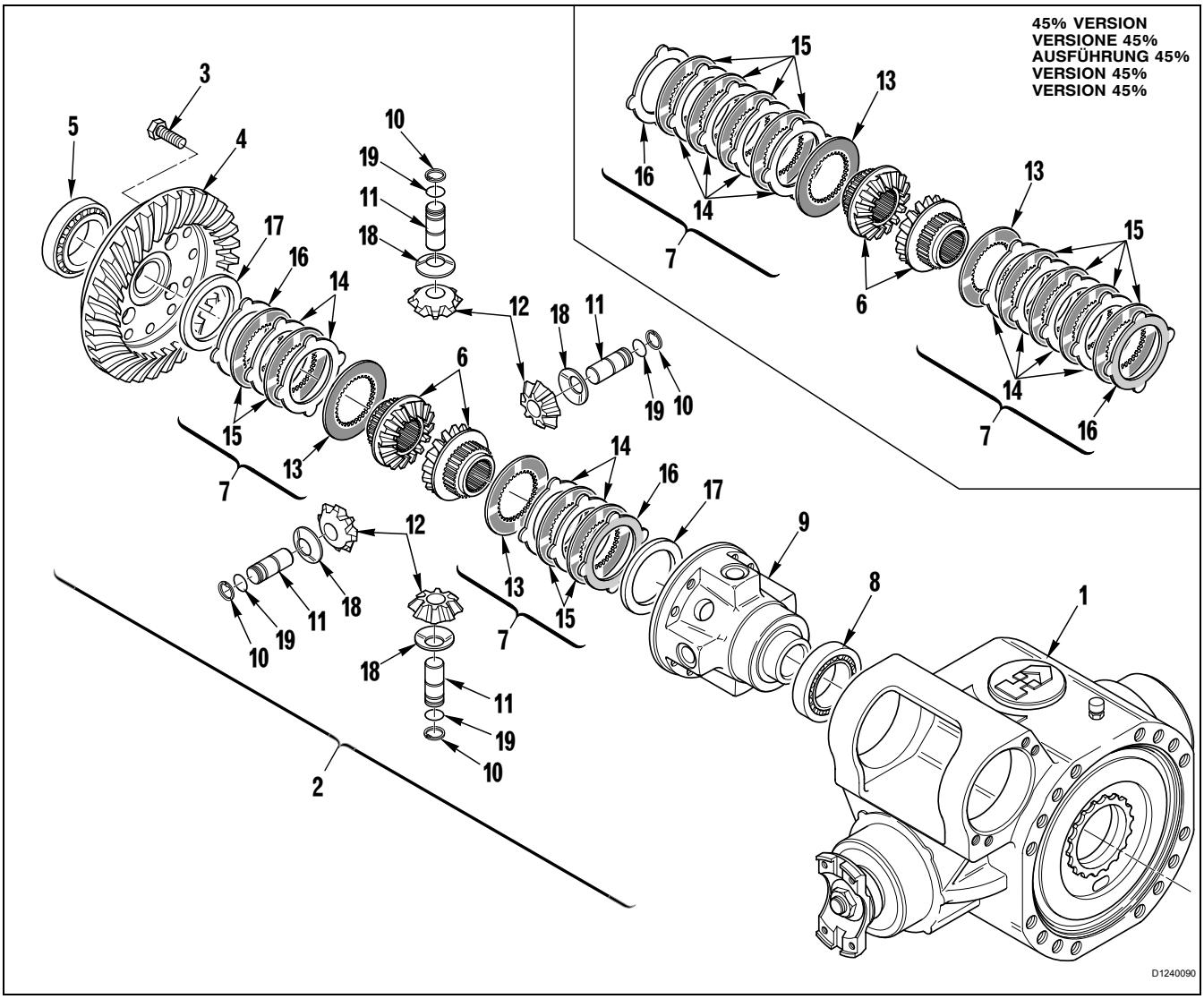
ESP Dejando en posiciòn el engranaje satelite que se ha librado, bloquear de nuevo la herramienta **T14**.
Repetir las operaciones de extraciòn del perno de segundo perno satelite (11).
Repetir las operaciònes para los otros pernos.

F En laissant dans sa position l'engrenage satellite qui s'est dégagé, bloquer de nouveau l'outil **T14**.
Répéter les opérations pour extraire l'axe du deuxième axe satellite (11).
Répéter les opérations pour les autres axes.



GB a

Remove tool **T14** and extract from the differential unit (9) the two final planet gears (12), the 2nd planet gear (6) and the whole friction assembly concerned (7).



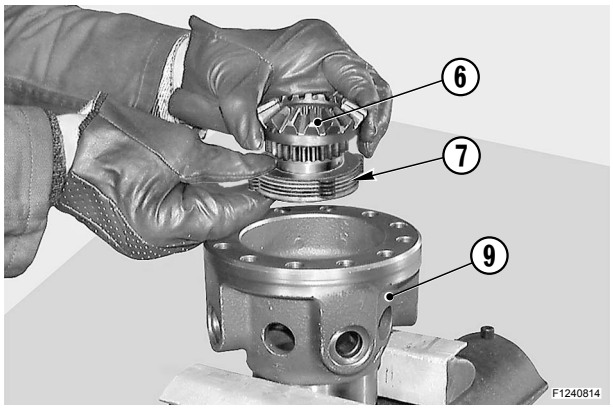
a

ITA Rimuovere l'attrezzo **T14** ed asportare dal corpo differenziale (9) gli ultimi due ingranaggi satelliti (12), il 2° ingranaggio planetario (6) ed il relativo gruppo di frizione (7) completo.

D Das Werkzeug **T14** abnehmen und vom Differentialkörper (9) die letzten beiden Zahnräder des Planetengetriebes (12), das 2. Planetengetriebe und das entsprechende Kupplungsaggregat (7) abnehmen.

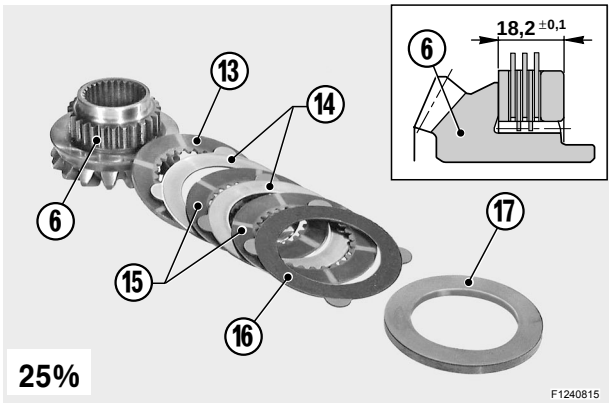
ESP Remover la herramienta **T14** y sacar del cuerpo diferencial (9) los ultimos dos engranajes satelites (12), el 2° engranaje planetario (6) y el relativo grupo de friciòn (7) completo.

F Enlever l'outil **T14** puis extraire du corps différentiel (9) les deux derniers engrenages satellites (12), le 2° engrenage planétaire (6) et le groupe de friction relatif (7) complet.



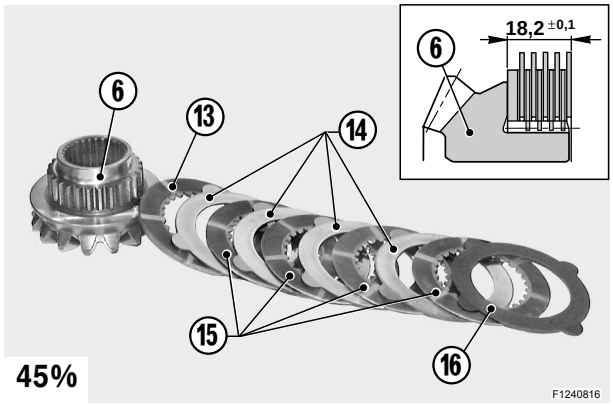
GB a

Place a friction unit (7) - suitable for the specific type of slipping - and planetary gear (6) into the differential unit (9).
The composition of the unit is illustrated in the points below.



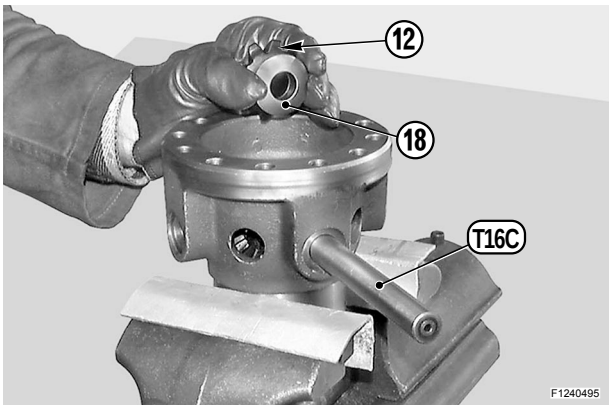
GB b

25% FRICTION UNIT COMPOSITION
Friction ring with increased shim (13), steel rings (14) and friction rings (15) alternated, end ring (16) and distance piece (17).
CAUTION! As to rings (13) and (16), the side without notches must face outwards.



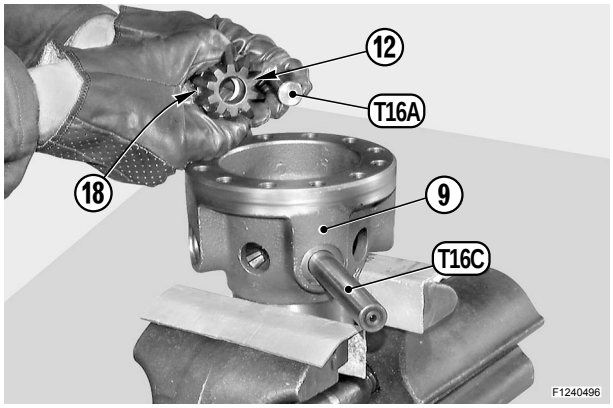
GB c

45% FRICTION UNIT COMPOSITION
Friction ring with increased shim (13), steel rings (14) and friction rings (15) alternated, end ring (16) and distance piece (17).
CAUTION! As to rings (13) and (16), the side without notches must face outwards.



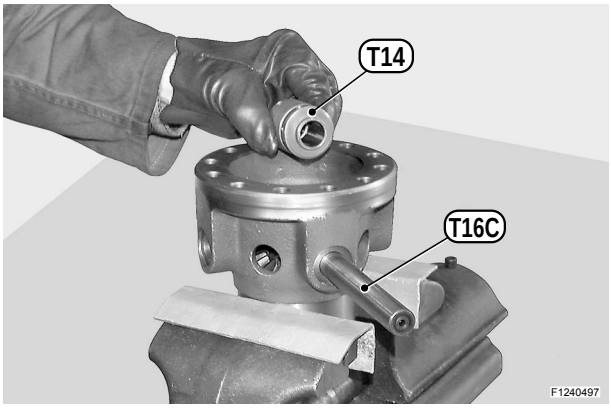
GB d

Position shim washer (18) and the first planet gear (12).
Hold them in position with bar **T16C**.



GB e

Using gudgeon **T16A**, position the second planet gear (12) and relative shim washer (18).



GB f

Insert tool **T14** in-between the two planet gears (12). Align the whole unit, pushing bar **T16C** in as far as it will go, until gudgeon **T16A** is expelled.

a

ITA Inserire nel corpo differenziale (9), il gruppo di frizione (7) specifico per il tipo di slittamento e l'ingranaggio planetario (6).
La composizione del gruppo di frizione è indicata in seguito.

D In den Differentialkörper (9) das für die Gleitungsart und das Planetengetriebe (6) geeignete Kupplungsaggregat (7) einsetzen.
Die Zusammensetzung des Kupplungsaggregats ist nachstehend beschrieben.

ESP Introducir en el cuerpo diferencial (9), el grupo de friciòn (7) especifico por el tipo de deslizamiento y el engranaje planetario (6).
La composiciòn del grupo de friciòn es indicada a seguir.

F Introduire dans le corps différentiel (9), le groupe de friction (7) spécifique pour le type de patinage et l'engrenage planétaire (6).
La composition du groupe de friction est indiquée ci-dessous.

b

ITA **COMPOSIZIONE GRUPPO DI FRIZIONE 25%**
Anello di frizione con spessore maggiorato (13), anelli d'acciaio (14) ed anelli di frizione (15) alternati, anello terminale (16), anello distanziatore (17).
ATTENZIONE! Gli anelli (13) e (16) devono avere la parte senza intagli rivolta verso l'esterno.

D **ZUSAMMENBAU DES KUPPLUNGSAGGREGATS 25%**
Kupplungsringe mit größerer Stärke (13), Stahlringe (14) und Kupplungsringe (15), Abschlußring (16), Distanzscheibe (17).
ACHTUNG! Die Ringe (13) und (16) müssen die glatte Seite nach außen gerichtet haben.

ESP **COMPOSICION GRUPO DE FRICION 25%**
Segmento de friciòn con espesor major (13), segmento de acero (14) y segmento de friciòn (15) alternados, segmento terminal(16), segmento distancial (17).
ATENCION! Los segmentos (13) y (16) deben de tener la parte sin ranaduras hacia el esterno.

F **COMPOSITION DU GROUPE DE FRICTION 25%**
Garniture de friction avec cale majorée (13), anneaux d'acier (14) et garniture de friction (15) alternés, anneau terminal (16), bague entretoise (17).
ATTENTION! Les garnitures (13) et (16) doivent avoir la partie sans entailles tournée vers l'extérieur.

c

ITA **COMPOSIZIONE GRUPPO DI FRIZIONE 45%**
Anello di frizione con spessore maggiorato (13), anelli d'acciaio (14) ed anelli di frizione (15) alternati, anello terminale (16).
ATTENZIONE! Gli anelli (13) e (16) devono avere la parte senza intagli rivolta verso l'esterno.

D **ZUSAMMENBAU DES KUPPLUNGSAGGREGATS 45%**
Kupplungsringe mit größerer Stärke (13), Stahlringe (14) und Kupplungsringe (15), Abschlußring (16).
ACHTUNG! Die Ringe (13) und (16) müssen die glatte Seite nach außen gerichtet haben.

ESP **COMPOSICION GRUPO DE FRICION 45%**
Segmento de friciòn con espesor major (13), segmento de acero (14) y anillo de friciòn (15) alternados, segmento terminal (16).
ATENCION! Los segmentos (13) y (16) deben tener la parte sin ranaduras hacia el esterno.

F **COMPOSITION DU GROUPE DE FRICTION 45%**
Garniture de la friction avec cale majorée (13), anneaux d'acier (14) et garniture de friction (15) alternés, anneau terminal (16).
ATTENTION! Les garnitures (13) et (16) doivent avoir la partie sans entailles tournée vers l'extérieur.

d

ITA Posizionare la rondella di rasamento (18), il primo ingranaggio satellite (12).
Tenerli in posizione con la barra **T16C**.

D Die Zwischenlegscheibe (18) und das erste Planetengetriebe (12) positionieren.
In dieser Position mit dem Stab **T16C** halten.

ESP Colocar la arandela de raspadura (18), el primer engranaje satelite (12).
Tenerlos en posiciòn con la barra **T16C**.

F Mettre la rondelle de rasage (18) en place, puis le premier engrenage satellite (12).
Maintenir ceux-ci en place avec la barre **T16C**.

e

ITA Utilizzando lo spinotto **T16A**, posizionare il secondo ingranaggio satellite (12) e la relativa rondella di rasamento (18).

D Mit einem Bolzen **T16A** das zweite Planetengetriebe (12) und die Zwischenlegscheibe (18) positionieren.

ESP Utilizando la cruceta **T16A**, colocar el segundo engranaje satelite (12) y la relativa arandela de raspadura (18).

F A l'aide de la cheville **T16C**, mettre en place le deuxième engrenage satellite (12) et sa rondelle de rasage (18).

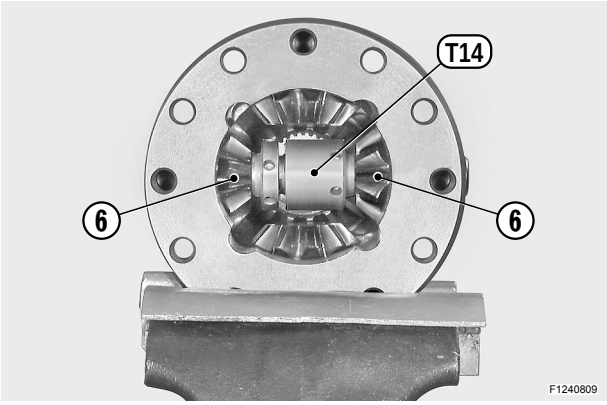
f

ITA Inserire tra i due ingranaggi satelliti (12) l'attrezzo **T14**.
Allineare tutto il gruppo inserendo a fondo la barra **T16C** fino ad espellere lo spinotto **T16A**.

D Die beiden Planetengetriebe (12) mit dem Werkzeug **T14** einsetzen. Das ganze Aggregat ausrichten indem der Stab **T16C** eingesetzt wird, bis der Bolzen **T16A** ausgestoßen wird.

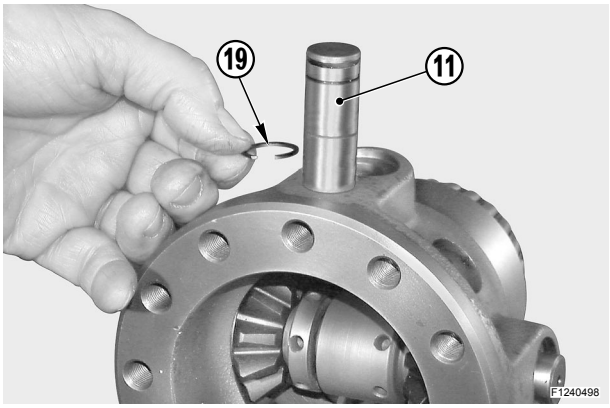
ESP Introducir entre los dos engranajes satelites (12) la herramienta **T14**.
Alinear todo el grupo introduciendo a tope la barra **T16C** hasta sacar la cruceta **T16A**.

F Introduire entre les deux engrenages satellites (12) l'outil **T14**.
Aligner tout le groupe en introduisant la barre **T16C** à fond jusqu'à expulser la cheville **T16A**.



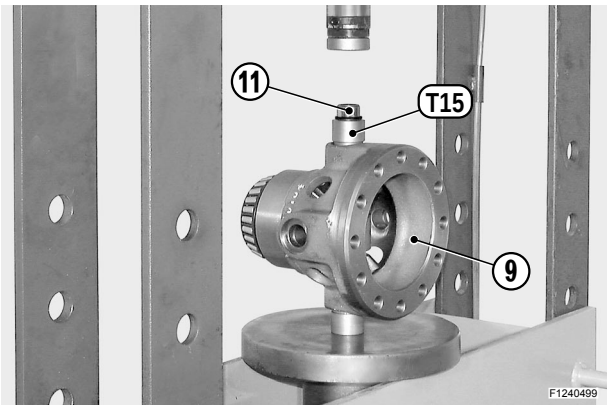
GB a

Lock tool **T14** behind the planet gears (12).
After locking the tool, remove bar **T16C**.



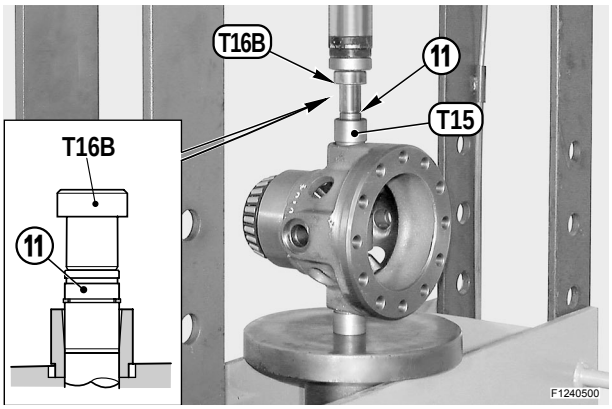
GB b

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



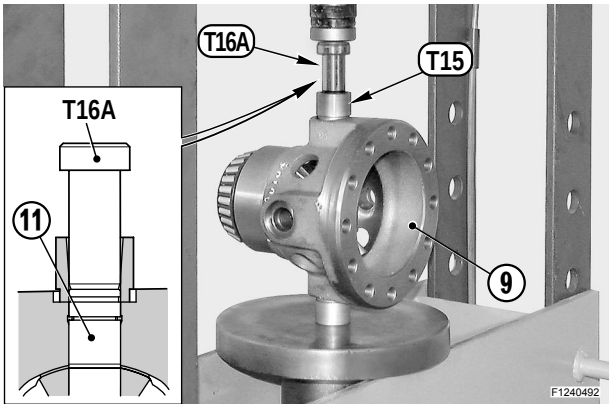
bar GB c

Position the differential unit (9) under the press, position bush **T15** and insert the planet pin (11).



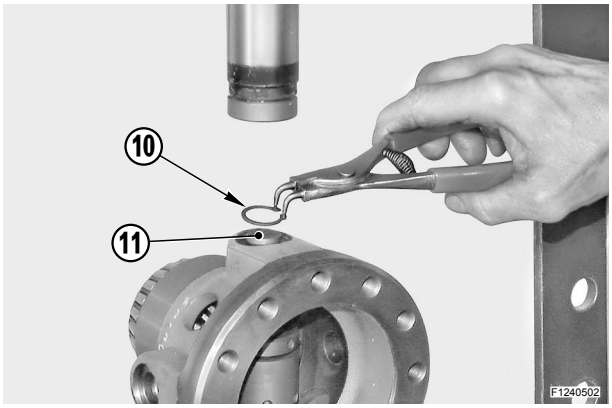
GB d

Place gudgeon **T16B** on top of the planet pin (11).



bar GB e

Press gudgeon **T16B** as far down as it will go.



GB f

Remove gudgeon **T16B**, bush **T15**, and fit the snap ring (10) onto the pin (11).

CAUTION! Make sure that the snap ring centers the seat and positions itself on the differential unit face.
Repeat the operations on the other planet pin and on the other planet unit.

a

ITA Bloccare l'attrezzo **T14** a ridosso degli ingranaggi satelliti (12).
Dopo il bloccaggio, rimuovere la barra **T16C**.

D Das Werkzeug **T14** am Anschlag der Planetengetriebe (12) blockieren.
Danach Stab **T16C** abnehmen.

ESP Bloquear la herramienta **T14** detras de los engranajes satelites (12).
Despues del bloqueo, remover la barra **T16C**.

F Bloquer l'outil **T14** au-dessus des engrenages satellites (12).
Après le blocage, enlever la barre **T16C**.

b

ITA Montare sui perni (11) gli anelli elastici (19).

D Auf die Stifte (11) die Kolbenringe (19) montieren.

ESP Montar sobre los pernos (11) los segmentos elasticos (19).

F Monter sur les axes (11) les anneaux à ressort (19).

c

ITA Posizionare sotto la pressa il corpo differenziale (9), sistemare la boccola **T15** ed inserire il perno satellite (11).

D Unter einer Presse den Differentialkörper (9) positionieren, die Buchse **T15** einlegen und den Planetenstift (11) einsetzen.

ESP Colocar bajo la prensa el cuerpo diferencial (9), colocar el casquillo **T15** y introducir el perno satelite (11).

F Placer le corps différentiel (9) sous la presse, ajuster l'embout **T15** et insérer l'axe satellite (11).

d

ITA Sovrapporre al perno satellite (11) lo spinotto **T16B**.

D Auf den Planetenstift (11) den Bolzen **T16B** legen.

ESP Sobreponer al perno satelite (11) la cruceta **T16B**.

F Poser sur l'axe satellite (11) la cheville **T16B**.

e

ITA Pressare lo spinotto **T16B** a fondo.

D Den Bolzen **T16B** fest einpressen.

ESP Apretar la cruceta **T16B** a tope.

F Presser la cheville **T16B** à fond.

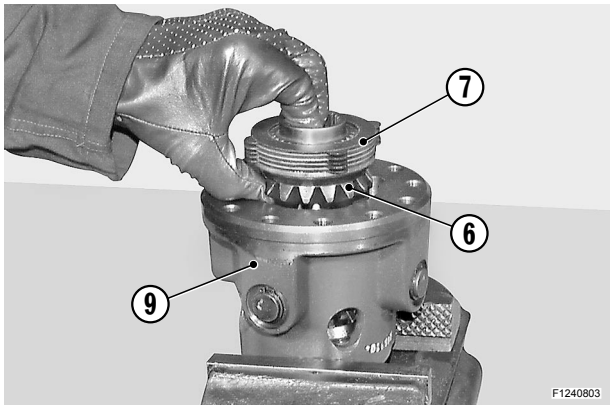
f

ITA Rimuovere lo spinotto **T16B**, la boccola **T15** e montare sul perno (11) l'anello elastico (10).
ATTENZIONE! Assicurarsi che l'anello elastico centri la sede e che appoggi sul piano del corpo differenziale.
Ripetere le operazioni per l'altro perno satellite e per l'altro asse satelliti.

D Den Bolzen T16B, die Buchse **T15** abnehmen und auf den Stift (11) den Kolbenring (10) montieren.
ACHTUNG! Kontrollieren, ob der Kolbenring im Sitz zentriert ist und auf der Fläche der Fläche des Differentialkörpers liegt.
Die Vorgänge für den anderen Planetenstift und die andere Planetenachse wiederholen.

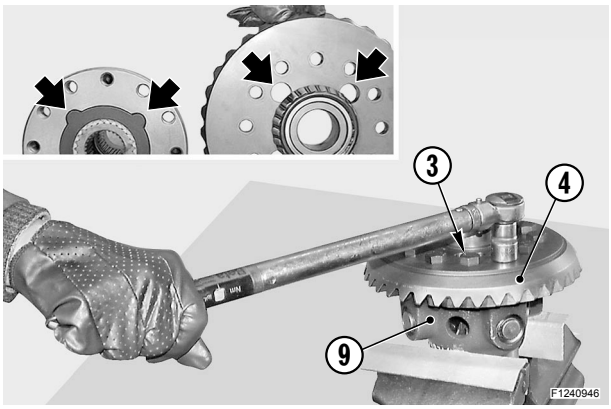
ESP Remover la cruceta **T16B**, el casquillo **T15** y montar sobre el perno (11) el segmento elastico (10).
ATENCION! Averiguar que el segmento elastico sea centrado en su alojamiento y que apoye sobre la superficie del cuerpo diferencial.
Repetir las operaciònes para el otro perno satelite y para el otro eje satelite.

F Enlever la cheville **T16B**, l'embout **T15** et monter sur l'axe (11) l'anneau à ressort (10).
ATTENTION! S'assurer que l'anneau à ressort soit bien centré sur le siège et posé sur la surface du corps différentiel.
Répéter les opérations pour l'autre axe satellite et l'autre essieu satellite.



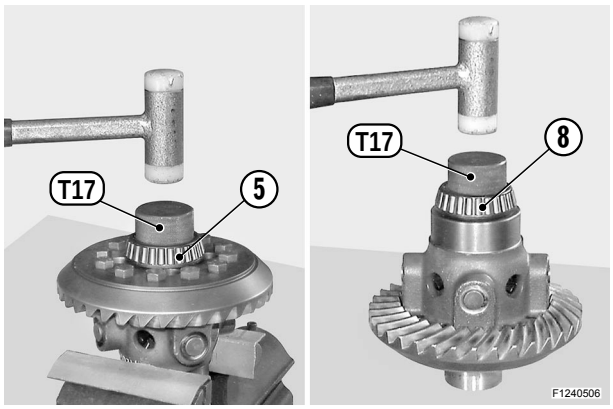
GB a

Check that planets have a light clearance in relation to the first planet gear.
Position the second planetary gear (6) and the second friction unit (7) into the differential unit (9).



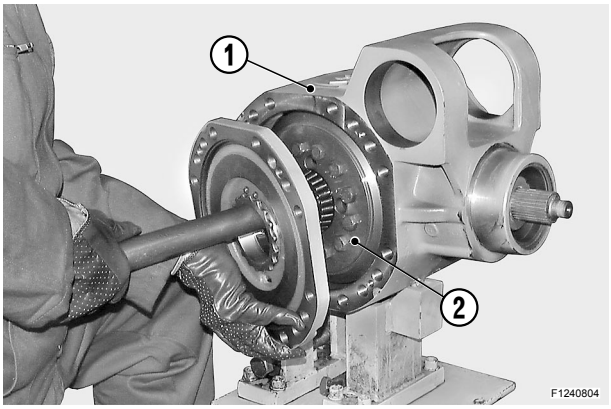
GB b

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.
Torque wrench setting for screws: 128 – 142 Nm.
NOTE. Tighten screws using the criss-cross method.



GB c

If bearings (5) and (8) have been removed, install them using tool **T17**.



GB d

Install the whole differential assembly (2) into the central body (1).
For details, see «INSTALLING THE DIFFERENTIAL UNIT».

a

ITA Controllare che i satelliti abbiano un leggero gioco rispetto il primo ingranaggio planetario.
Posizionare il secondo ingranaggio planetario (6) ed il secondo gruppo di frizione (7) nel corpo differenziale (9).

D Kontrollieren, ob die Planetengetriebe etwas Spiel im Verhältnis zum ersten Planetengetriebe haben.
Das zweite Planetengetriebe (6) und das zweite Kupplungsaggregat (7) in den Differentialkörper (9) einsetzen.

ESP Controlar que los satelites tengan un ligero juego respecto al primero engranaje planetario.
Colocar el segundo engranaje planetario (6) y el segundo grupo de friciòn (7) en el cuerpo diferencial (9).

F Contrôler que les satellites aient un peu de jeu par rapport au premier engrenage planétaire.
Mettre le deuxième engrenage planétaire (6) en place ainsi que le second groupe de friction (7) du corps différentiel (9).

b

ITA Allineare i fori di lubrificazione della corona (4) con le cave della scatola differenziale sulle sporgenze del gruppo di frenatura. Posizionare la corona (4) sul corpo differenziale (9) e bloccarla con le viti (3) spalmate con Loctite 242.
Coppia di serraggio viti: 128÷142 Nm
NOTA. Serrare le viti con il metodo del serraggio incrociato.

D Die Schmierlöcher des Kranzes (4) der Differentialschachtel mit den Vorsprüngen des Bremsaggregats ausrichten. Den Kranz (4) auf den Differentialkörper (9) positionieren und mit den Schrauben (3), die zuvor mit Loctite 242 geschmiert wurden, blockieren. Anzugsmoment der Schrauben: 128÷142 Nm.
BEMERKUNG. Sie Schrauben im Kreuz fest schrauben.

ESP Alinear los agujeros de lubrificar de la corona con los nichos de la caja diferencial (4) sobre las partes salientes del grupo de frenadura.
Colocar la corona (4) sobre el cuerpo diferencial (9) y bloquearla con los tornilloss: 128÷142 Nm.
NOTA. Apretar los tornillos de manera cruzada.

F Aligner les trous de lubrification de la couronne (4) avec les creux du carter différentiel sur les saillies du groupe de freinage. Placer la couronne (4) sur le corps différentiel (9) et bloquer celle-ci avec les vis (3) enduites de Loctite 242.
Couple de serrage des vis: 128÷142 Nm.
NOTE. Serrer les vis avec la méthode de serrage croisée.

c

ITA Se sono stati rimossi, montare i cuscinetti (5) e (8) utilizzando l'attrezzo **T17**.

D Falls sie abmontiert wurden, die Lager (5) und (8) mit dem Werkzeug **T17** montieren.

ESP Si han sido removidos, montar los cojinetes (5) y (8) utilizando la herramienta **T17**.

F S'ils ont été enlevés, remonter les paliers (5) et (8) à l'aide de l'outil **T17**.

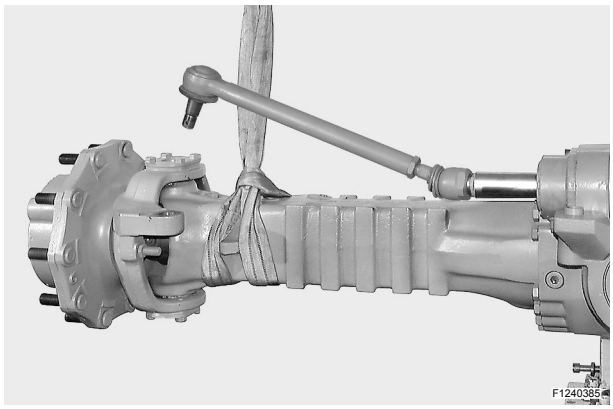
d

ITA Installare nel corpo centrale (1) il gruppo differenziale (2) completo.
Per i dettagli, vedere «INSTALLAZIONE GRUPPO DIFFERENZIALE».

D In den zentralen Körper (1) das vollständige Differentialaggregat (2) installieren.
Für weitere Einzelheiten, siehe «INSTALLATION DES DIFFERENTIALAGGREGATS».

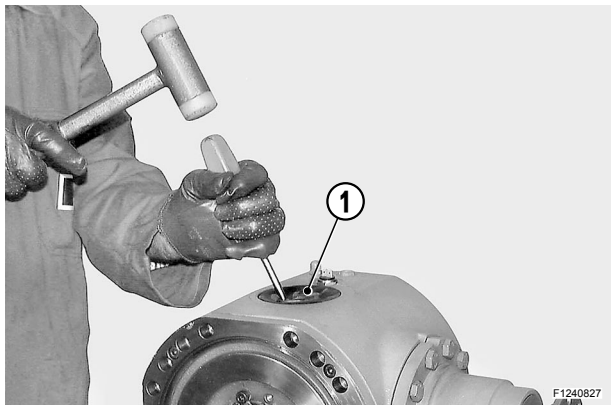
ESP Introducir en el cuerpo central (1) el grupo diferencial (2) completo.
Para los detalles, vease «INSTALACION GRUPO DIFERENCIAL»

F Installer dans le corps central (1) le groupe différentiel (2) complet.
Pour tout détail, voir «INSTALLATION DU GROUPE DIFFERENTIEL».



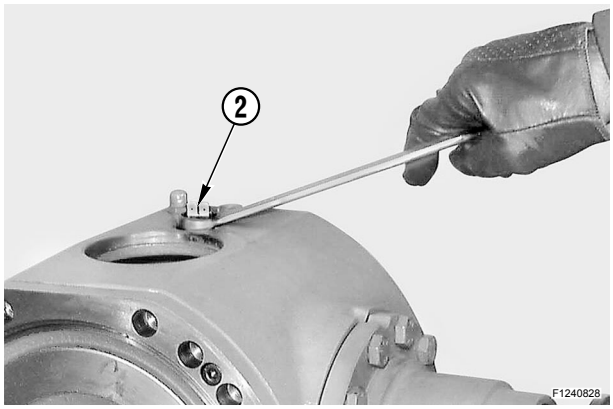
GB a

Remove the arms.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISCS».



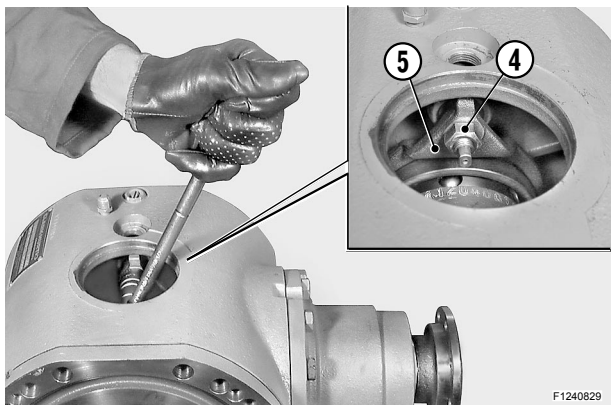
GB b

Remove the top cap (1).
NOTE. The cap must be replaced each time the unit is disassembled.



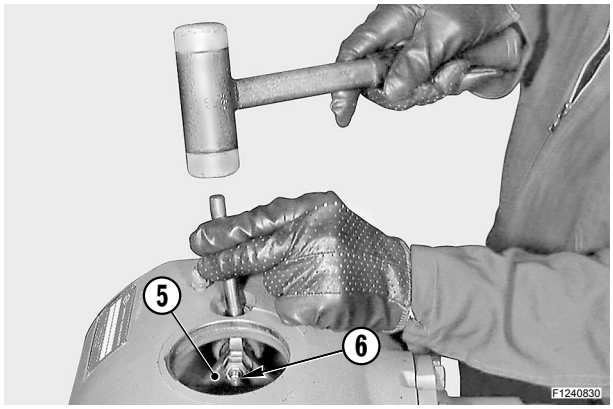
GB c

Remove the microswitch (2), signalling differential lock operation.
NOTE. Check the state of the O-ring (3).



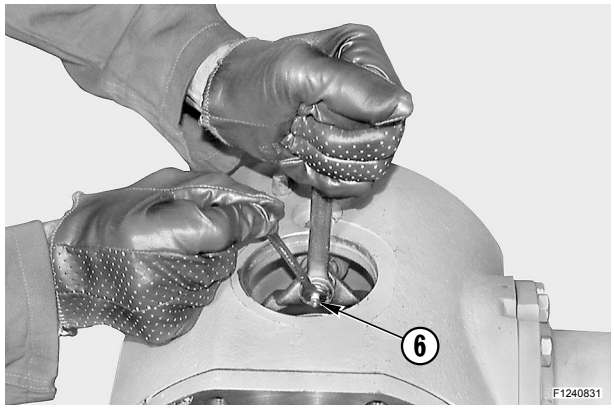
GB d

Loosen the lock nut (4) of fork (5) by about 2 turns.



GB e

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



GB f

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

a

ITA Asportare i bracci.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO».

D Die Arme abnehmen.
Für weitere Einzelheiten, siehe «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN».

ESP Sacar los brazos.
Para los detalles, vease «CONTROL DESGASTE Y SOBSTITUCION DISCOS FRENOS».

F Enlever les bras.
Pour tout détail, voir «CONTROLE DE L'USURE ET SUBSTITUTION DES DISQUES FREIN».

b

ITA Rimuovere il tappo superiore (1).
NOTA. Il tappo deve essere sostituito ad ogni smontaggio.

D Unterer Stopfen (1) abnehmen.
BEMERKUNG. Der Stopfen muß jedesmal ausgewechselt werden, wenn er abmontiert wird.

ESP Remover la tapa superior (1).
NOTA. La tapa debe de ser sobstituida a cada desmontaje.

F Enlever le bouchon supérieur (1).
NOTE. Le bouchon doit être remplacé à chaque démontage.

c

ITA Rimuovere il microinterruttore (2) di segnalazione inserimento bloccaggio differenziale.
NOTA. Controllare lo stato della guarnizione OR (3).

D Den Mikroschalter (2) abnehmen, der den Einsatz der Differentialblockierung meldet.
BEMERKUNG. Zustand des O-Rings (3) kontrollieren.

ESP Remover el microinterruptor (2) de senalaciòn introduciòn bloqueo diferencial.
NOTA. Controlar el estado de la guarniciòn OR (3).

F Enlever le microinterrupteur (2) qui signale l'insertion du blocage différentiel.
NOTE. Contrôler l'état des garnitures OR (3).

d

ITA Allentare il dado (4) di bloccaggio della forcella (5) di circa 2 giri.

D Mutter (4) zur Blockierung der Gabel (5) um ca. 2 Umdrehungen lockern.

ESP Aflojar la tuerca (4) de bloqueo de la horquilla (5) de 2 giros approx.

F Desserrer l'écrou (4) de blocage de la fourchette (5) d'environ 2 tours.

e

ITA Utilizzando un punzone metallico ed un mazzuolo, sbloccare la forcella (5) dal cono del pistone (6).

D Mit einem Metallstift und einem Hammer die Gabel (5) von dem Kolbentrichter (6) freisetzen.

ESP Utilizando un punzon metalico y un martillo, bloquear l'horquilla (5) del cono del pistòn (6).

F A l'aide d'un poussoir métallique et d'un maillet, débloquer la fourchette (5) du cône du piston (6).

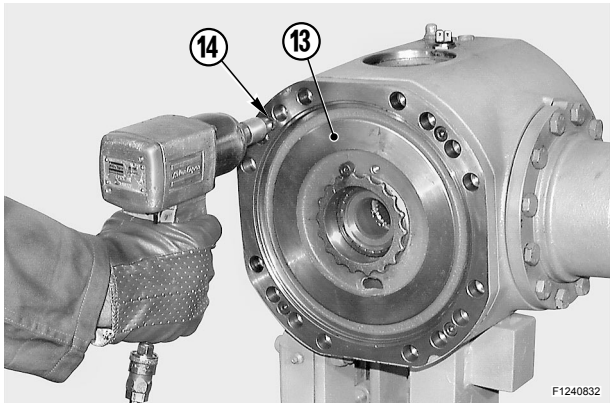
f

ITA Utilizzando due chiavi, bloccare il pistone (6) ed asportare il dado (4).

D Mit Hilfe von zwei Schlüsseln, den Kolben (6) blokkieren und die Mutter (4) abnehmen.

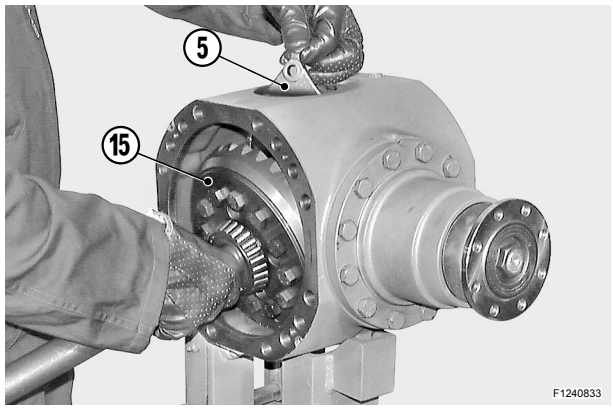
ESP Utilizando dos llaves, bloquear el pistòn (6) y sacar la tuerca (4).

F A l'aide de deux clés, bloquer le piston (6) et enlever l'écrou (4).



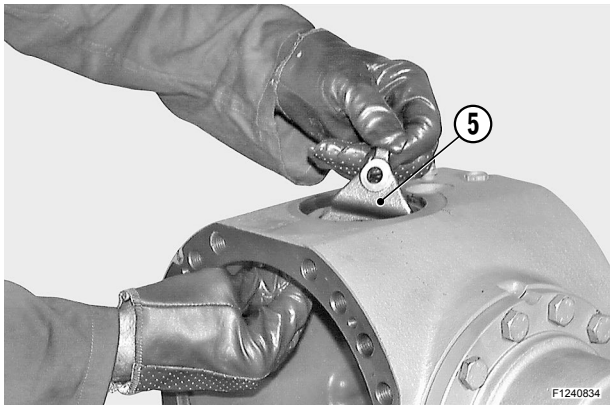
GB a

Remove screws (14) and remove the intermediate cover (13).
NOTE. Support the differential unit with a lever.



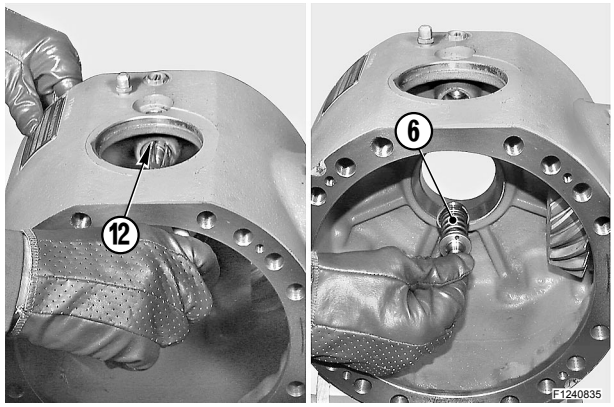
GB b

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



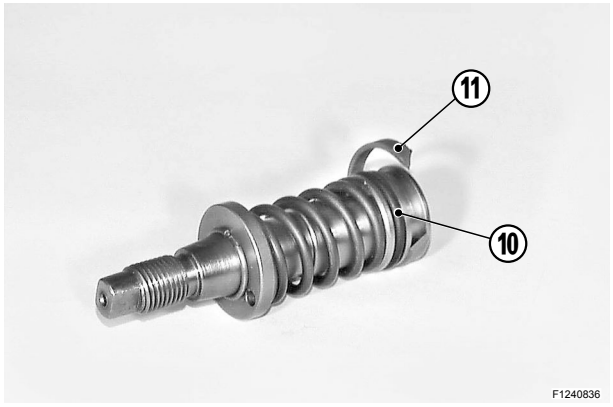
GB c

Extract fork (5).



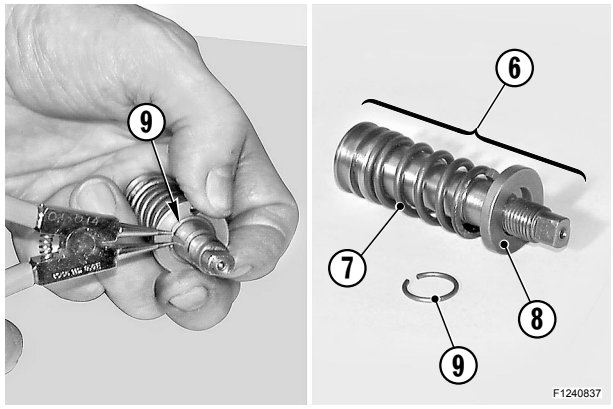
GB d

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



GB e

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.



GB f

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

a

ITA Rimuovere le viti (14) e rimuovere il coperchio intermedio (13).
NOTA. Sostenere il gruppo differenziale con una leva.

D Die Schrauben (14) abnehmen und den mittleren Dekkel (13) entfernen.
BEMERKUNG. Das Differentialaggregat mit einem Hebel stützen.

ESP Remover los tornillos (14) y remover la tapa intermedia (13).
NOTA. Sostener el grupo diferencial con una palanca.

F Enlever les vis (14) puis enlever le couvercle intermédiaire (13).
NOTE. Soutenir le groupe différentiel à l'aide d'un levier.

b

ITA Scollegare dal pistone (6) la forcella (5) e, tenendola sollevata, rimuovere il gruppo differenziale (15).

D Vom Kolben (6) die Gabel (5) abtrennen. Die anheben und des Differentialaggregat (15) entfernen.

ESP Desconectar del pistòn (6) la horquilla y, teniendola levantada, remover el grupo diferencial (15).

F Débrancher du piston (6) la fourchette (5) et en tenant cette dernière soulevée, enlever le groupe différentiel (15).

c

ITA Estrarre la forcella (5).

D Die Gabel (5) heraus nehmen.

ESP Extraer la harquilla (5).

F Extraire la fourchette (5).

d

ITA Rimuovere l'anello elastico (12) ed il pistone completo (6).

D Den Kolbenring (12) und den vollständigen Kolben (6) abnehmen.

ESP Remover el segmento elastico (12) y el pistòn completo (6).

F Enlever l'anneau à ressort (12) et le piston complet (6).

e

ITA Asportare l'anello di guida (11) e la guarnizione OR (10).
NOTA. L'anello di guida (11) e la guarnizione (10) devono essere sostituiti ad ogni smontaggio.

D Den Führungsring (11) und den O-Ring (10) abnehmen.
BEMERKUNG. Der Führungsring (11) und die Dichtung (10) müssen jedesmal ausgewechselt werden, wenn sie abmontiert werden.

ESP Sacar el segmento de guìa (11) y la guarniciòn OR (10).
NOTA. El segmento de guìa (11) y la guarniciòn (10) deben de ser sobstituidos a cada desmontaje.

F Enlever la bague de guidage (11) et la garniture OR (10).
NOTE. La bague de guidage (11) et la garniture (10) doivent être substituées à chaque démontage.

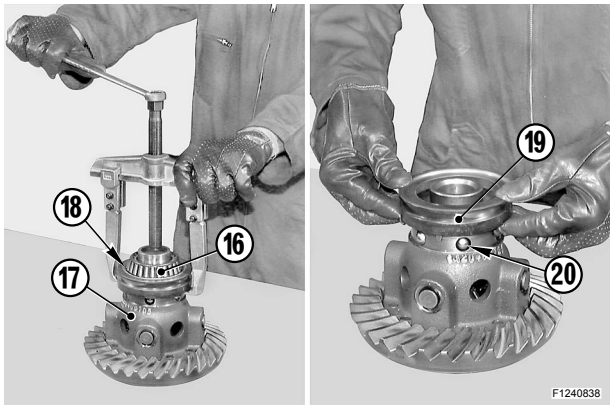
f

ITA Rimuovere l'anello elastico (9) e scomporre il gruppo pistone (6) in tutti i suoi componenti (7), (8).

D Den Kolbenring (9) abnehmen und das Kolbenaggregat (6) auseinander nehmen, um die Teile (7) und (8) frei zu setzen.

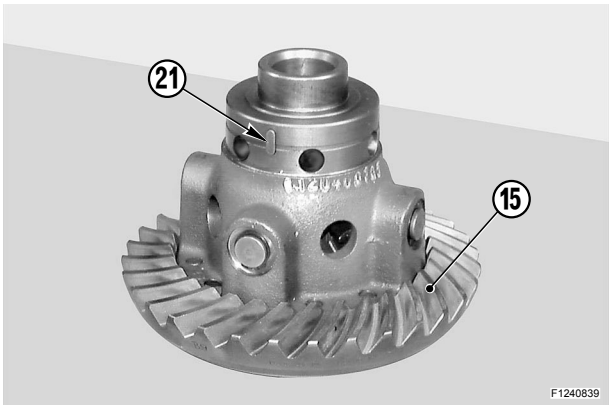
ESP Remover el segmento elastico (9) y descomponer el grupo pistòn (6) en todos sus componentes (7) y (8).

F Enlever l'anneau à ressort (9) et désassembler le groupe piston (6) de tous ses composants (7), (8).



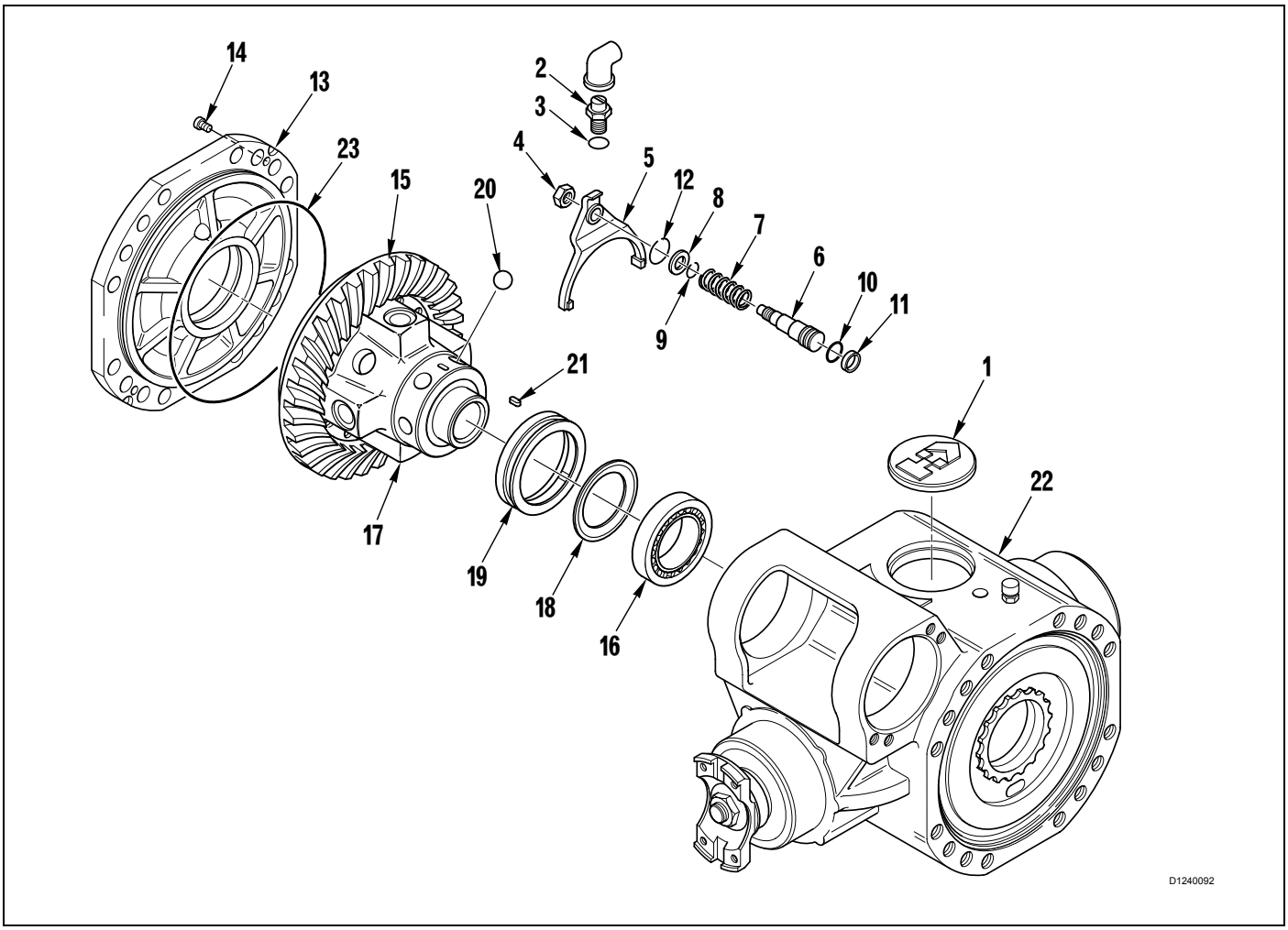
GB a

Remove bearing (16) from the differential carrier (17) as well as the stop ring (18), the coupling (19) and the spheres (20).
NOTE. Note down the direction of assembly of the stop ring (18).



GB b

ONLY IF NECESSARY
Remove the coupling guide key (21) and disassemble the differential unit (15).
(For details, see «HOW TO DISASSEMBLE THE DIFFERENTIAL UNIT».



a

ITA Rimuovere il cuscinetto (16) dalla scatola differenziale (17), l'anello di arresto (18), il manicotto (19) e le sfere (20).

NOTA. Annotare il senso di montaggio dell'anello di arresto (18).

D Lager (16) von der Differentialschachtel (17), den Sperring (18), die Hülse (19) und die Kugeln (20) entfernen.

BEMERKUNG. Montagerichtung des Sperrings (18) bemerken.

ESP Remover los cojinetes (16) de la caja diferencial (17), el segmento de paro (18) el manguito (19) y las espheras (20).

NOTA. Anotar el sentido de montaje del segmento de paro (18).

F Enlever le palier (16) du carter différentiel (17), la bague de butée (18), le manchon (19) et les sphères (20).

NOTE. Prendre note du sens de montage de la bague de butée (18).

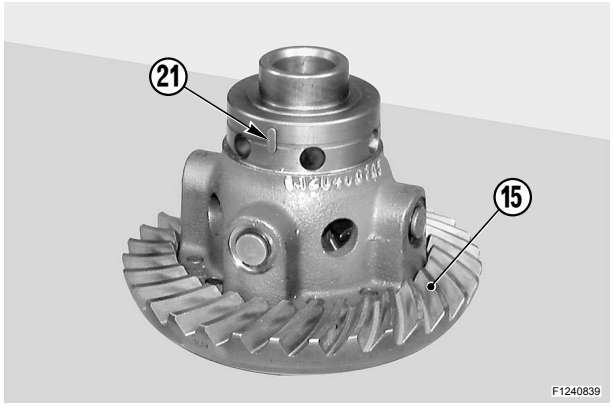
b

ITA **SOLO SE NECESSARIO**
Rimuovere la chiavetta (21) di guida del manicotto e smontare il gruppo differenziale (15).
(Per i dettagli, vedere «SMONTAGGIO GRUPPO DIFFERENZIALE»).

D **NUR FALLS NOTWENDIG**
Den Keil (21) zur Führung der Hülse entfernen und das Differentialaggregat (15) abmontieren.
(Für weitere Einzelheiten, siehe «DIFFERENTIALAGGREGAT ABMONTIEREN»).

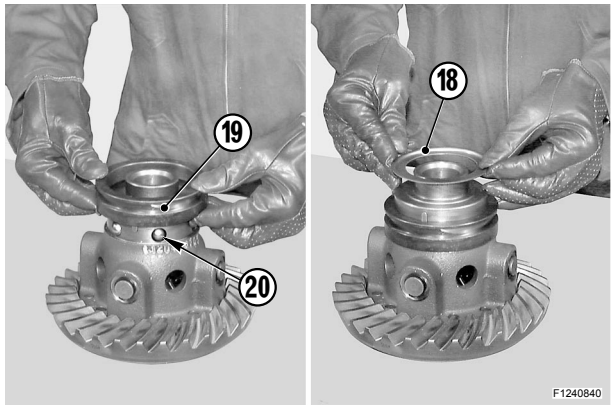
ESP **SOLO SI NECESARIO**
Remover la Laave (21) de guìa del manguito y desmontar el grupo diferencial (15).
Para los detalles, vease «DESMONTAJE GRUPO DIFERENCIAL».

F SEULEMENT SI BESOIN
Enlever la clavette (21) de guidage du manchon et démonter le groupe différentiel (15).
(Pour tout détail, voir «DÉMONTAAGE DU GROUPE DIFFERENTIEL».



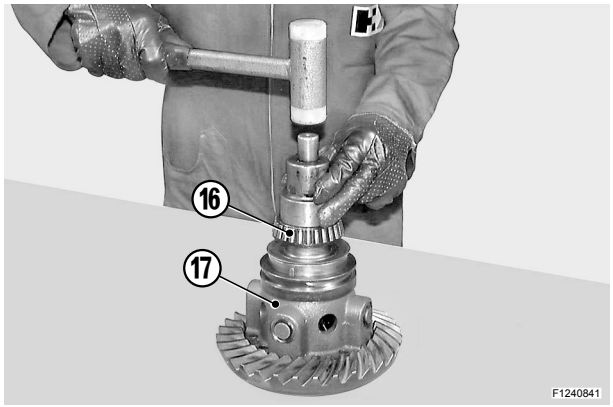
GB a

ONLY IF PREVIOUSLY DISASSEMBLED
Assemble the differential unit (15).
(For details, see «HOW TO ASSEMBLE THE DIFFERENTIAL UNIT»).
Position the guide key (21) of coupling (19).



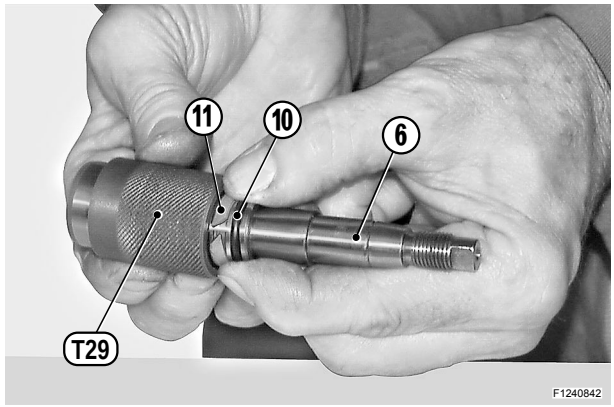
GB b

Install spheres (20), coupling (19) and stop ring (18).
NOTE. Pay great attention to ring orientation (18).



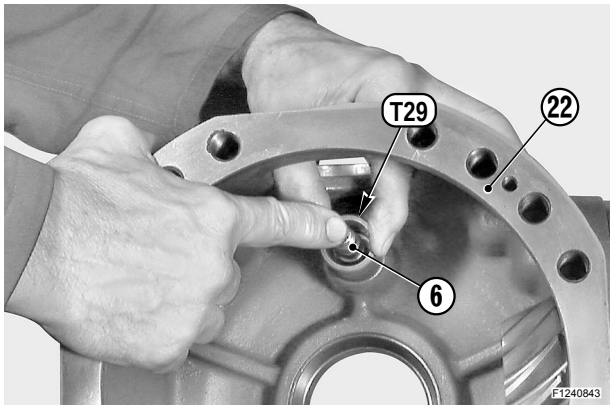
GB c

Fit bearing (16) onto the differential carrier (17).
NOTE. Make sure that the bearing is well set in the differential carrier.



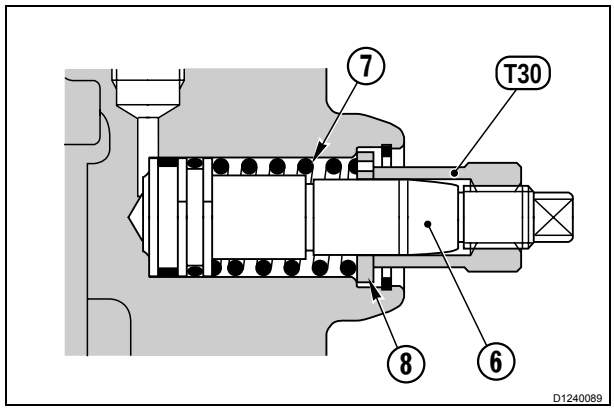
GB d

Fit O-ring (10) and guide ring (11) onto the piston (6). Lubricate seals and insert the assembly into tool **T29**.



GB e

Insert tool **T29** in the central unit (22) and push the piston (6) into the seat.
Remove tool **T29**.



GB f

Fit spring (7) and washer (8) on the piston (6) and install tool **T30**.

a

ITA **SOLO SE È STATO SMONTATO**
Assemblare il gruppo differenziale (15).
(Per i dettagli, vedere «ASSEMBLAGGIO GRUPPO DIFFERENZIALE»).
Posizionare la chiavetta (21) di guida del manicotto (19).

D **NUR WENN ES ABMONTIERT WURDE**
Differentialaggregat (15) zusammenbauen.
(Für weitere Einzelheiten, siehe «DIFFERENTIALAGGREGAT ZUSAMMENBAUEN»).
Den Keil (21) auf die Führung der Hülse (19) positionieren.

ESP **SOLO SI ESTA DESMONTADO**
Asemblar el grupo diferencial (15).
(Para los detalles, vease «ASEMBLAJE GRUPO DIFERENCIAL»).
Colocar la llave (21) de guìa del manguito (19).

F **SEULEMENT SI DEMONTE**
Assembler le groupe différentiel (15).
(Pour tout détail, voir «ASSEMBLAGE DU GROUPE DIFFERENTIEL»).
Mettre la clavette (21) de guidage du manchon (19) en place.

b

ITA Montare le sfere (20), il manicotto (19) e l'anello di arresto (18).
NOTA. Controllare attentamente l'orientamento dell'anello (18).

D Die Kugeln (20), die Hülse (19) und den Sperring (18) montieren.

ESP Montar las espheras (20), el manguito (19) y el segmento de paro (18).
NOTA. Controlar atentamente la direcciòn del segmento (18).

F Monter les sphères (20), le manchon (19) et l'anneau de butée (18).
NOTE. Contrôler attentivement l'orientation de l'anneau (18).

c

ITA Montare sulla scatola differenziale (17) il cuscinetto (16).
NOTA. Assicurarsi che il cuscinetto vada in sicura battuta sulla scatola differenziale.

D Auf die Diffenrentialschachtel (17) das Lager (16) montieren.
BEMERKUNG. Sicherstellen, daß das Lager richtig in der Differentialschachtel anschlägt.

ESP Montar sobre la caja diferencial (17) el cojinete (16).
NOTA. Asegurarse que el cojinete vaya seguramente a tope sobre la caja diferencial.

F Monter sur le carter du différentiel (17) le palier (16).
NOTE. S'assurer que le palier aille en butée sur le carter du différentiel.

d

ITA Montare sul pistone (6) l'anello OR (10) e l'anello di guida (11). Lubrificare le guarnizioni ed inserire il gruppo nell'attrezzo **T29**.

D Auf den Kolben (6) den O-Ring (10) und den Führungsring (11) montieren. Die Dichtungen Schmieren und das Aggregat in das Werkzeug **T29** setzen.

ESP Montar sobre el piston (6) el segmento OR (10) y el segmento de guìa (11). Lubrificar las guarniciònes y insertar el grupo en la herramienta **T29**.

F Monter sur le piston (6) la garniture OR (10) et la bague de guidage (11). Lubrifier les garnitures et introduire le groupe dans l'outil **T29**.

e

ITA Inserire l'attrezzo **T29** nel corpo centrale (22) e spingere il pistone (6) nella sede.
Rimuovere l'attrezzo **T29**.

D Das Werkzeug **T19** in den zentralen Körper (22) setzen und den Kolben (6) in den Sitz drücken.
Das Werkzeug **T29** entfernen.

ESP Introducir la herramienta **T29** en el cuerpo central (22) y empujar el pistòn (6) en su alojamiento.
Remover la herramienta **T29**.

F Introduire l'outil **T29** dans le corps central (22) et pousser le piston (6) dans son siège.
Enlever l'outil **T29**.

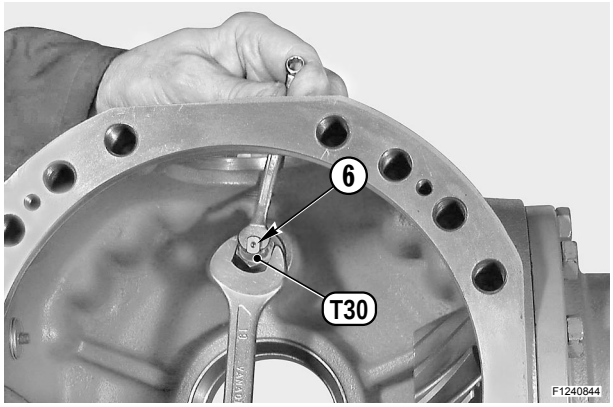
f

ITA Montare sul pistone (6) la molla (7) e la rondella (8) e montare l'attrezzo **T30**.

D Auf den Kolben (6) die Feder (7) und die Scheibe (8) montieren und das Werkzeug **T30** montieren.

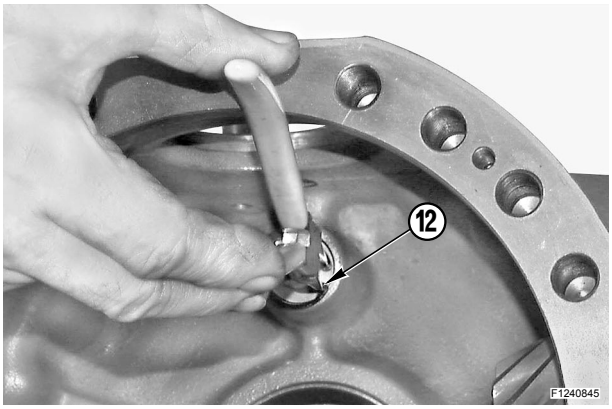
ESP Montar sobre el pistòn (6) el muelle (7) y la arandela (8) y montar la herramienta **T30**.

F Monter sur le piston (6) le ressort (7) et la rondelle (8) puis monter l'outil **T30**.



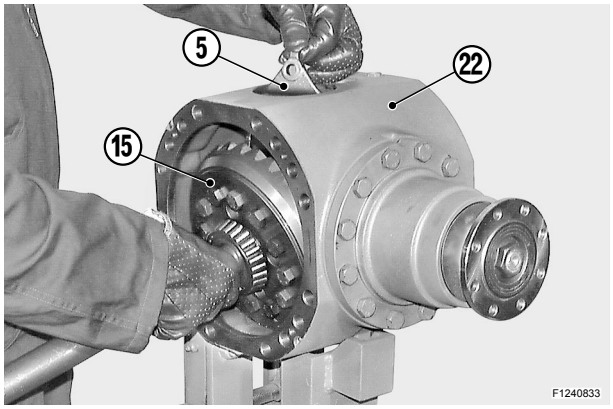
GB a

Screw tool **T30** on the thread of the piston (6) to compress spring (7) and vacate the seat for introducing the snap ring (12).



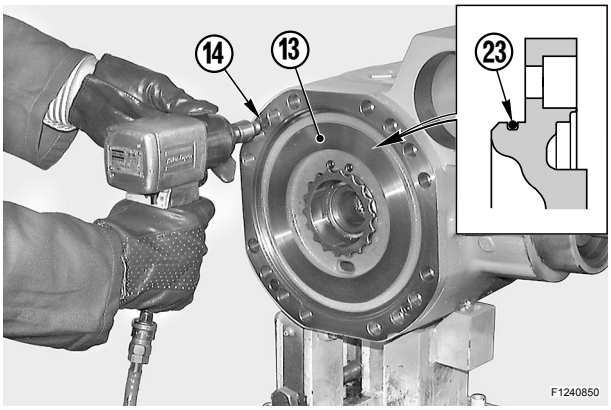
GB b

Fit the snap ring (12) of the unit.
Remove tool **T30** and fit the snap ring (9) of spring (7).



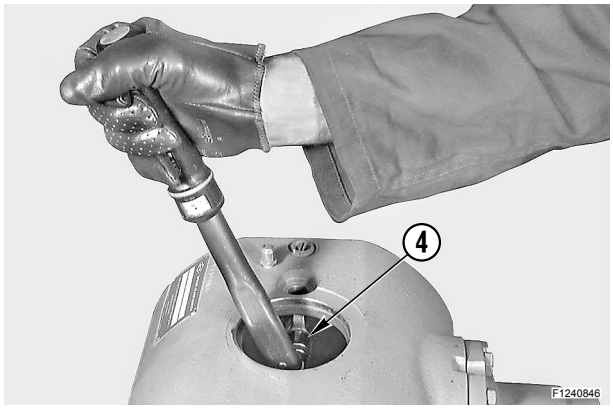
GB c

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



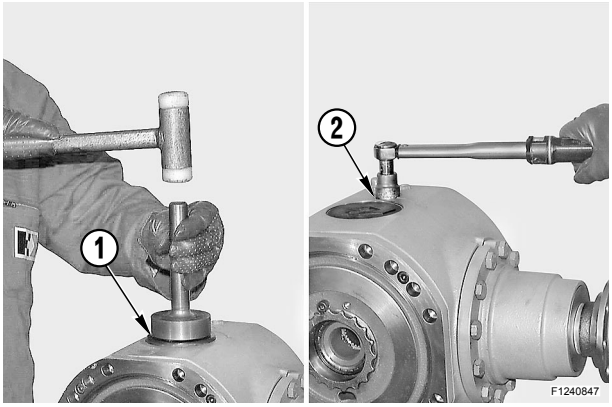
GB d

Fit the intermediate cover (13) and lock it with screws (14). Tighten screws using a torque wrench setting of 23.8 – 26.2 Nm.
NOTE. Carefully check the state of the O-ring (23).



GB e

Fit the lock nut (4) of the fork (5) and lock it with a dynamometric wrench set to a torque of 70 – 75 Nm.



GB f

Fit the microswitch (2) complete with O-ring; torque wrench setting: max. 30 Nm.
If necessary, adjust differential unit clearances. (see «DIFFERENTIAL UNIT ASSEMBLY»).
Fit the top cap (1) and the arms. (For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISKS»).

a

ITA Avvitare l'attrezzo **T30** sul filetto del pistone (6) per comprimere la molla (7) e liberare la sede per l'anello elastico (12).

D Das Werkzeug **T30** auf das Kolbengewinde (6) schrauben, um die Feder (7) zu komprimieren und den Sitz für den Kolbenring (12) freizusetzen.

ESP Atornillar la herramienta T30 sobre la rosca del pistòn (6) para comprimir el muelle (7) y dejar libre el alojamiento para el anillo elastico(12).

F Visser l'outil **T30** sur le filet du piston (6) pour comprimer le ressort (7) et dégager le siège pour l'anneau à ressort (12).

b

ITA Montare l'anello elastico (12) di ritegno del gruppo. Rimuovere l'attrezzo **T30** e montare l'anello elastico (9) di ritegno molla (7).

D Den Kolbenring (12) zur Halterung des Aggregats montieren.
Das Werkzeug **T30** abnehmen und den Kolbenring (9) zur Halterung der Feder (7) montieren.

ESP IMontar el segmento elastico (12) de compresiòn del grupo.
Removerla herramienta **T30** y montar el segmento elastico (9) de compresion muelle (7).

F Monter l'anneau à ressort (12) de retenue du groupe. Enlever l'outil **T30** et monter l'anneau à ressort (9) de retenue ressort (7).

c

ITA Inserire nel corpo centrale (22) la forcella (5) ed il gruppo differenziale (15).
Impegnare la forcella (5) nel manicotto (19) e sul pistone (6).

D In den zentralen Körper (22) die Gabel (5) und das Differentialaggregat (15) einsetzen.
Die Gabel (5) in der Hüllse (19) und auf den Kolben (6) einsetzen.

ESP ntroducir en el cuerpo (22) la horquilla (5) y el grupo diferencial (15).
Insertar la horquilla (5) en el manguito (19) y sobre el pistyòn (6).

F Introduire dans le corps central (22) la fourchette (5) et le groupe différentiel (15).
Engager la fourchette (5) dans le manchon (19) puis sur le piston (6).

d

ITA Montare il coperchio intermedio (13) e bloccarlo con le viti (14) serrate con una coppia di 23,8÷26,2 Nm.
NOTA. Controllare attentamente la condizione dell'anello OR (23).

D Den mittleren Deckel (13) montieren und mit den Schrauben (14) mit einem Anzugsmoment von 23,8÷26,2 Nm blockieren.
BEMERKUNG. Zustand des O-Ringes (23) sorgfältig kontrollieren.

ESP Montar la tapa intermedia (13) y bloquearla con tornillos (14) apretadas con un par de 23,8÷26,2 Nm.
NOTA. Controlar con cuidado la condiciòn del segmento OR (23).

F Monter le couvercle intermédiaire (13) et bloquer celui-ci avec les vis (14) serrées à un couple de 23,8÷26,2 Nm.
NOTE. Contrôler attentivement l'état de la garniture OR (23).

e

ITA Montare il dado (4) di ritegno forcella (5) e bloccarlo con una chiave dinamometrica tarata ad una coppia di 70÷75 Nm.

D Die Mutter (4) zur Halterung der Gabel (5) montieren und mit einem Momentenschlüssel und einem Anzugsmoment von 70÷75 Nm blockieren.

ESP Montar la tuerca (4) de compresiòn horquilla (5) y bloquearla con un llave dinamometrica tarada a un par de 70÷75 Nm.

F Monter l'écrou (4) de fixation fourchette (5) et bloquer celui-ci à l'aide d'une clé dynamométrique calibrée à un couple de 70÷75 Nm.

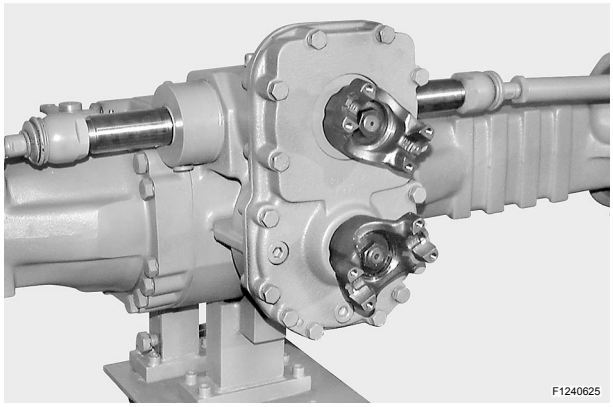
f

ITA Montare il microinterruttore (2) completo di guarnizione OR; coppia di serraggio: max. 30 Nm.
Se necessario, registrare i giochi differenziale. (Vedere «ASSEMBLAGGIO DIFFERENZIALE»).
Montare il tappo superiore (1) ed i bracci. (Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO»).

D Die Mikroschalter (2) samt O-Ring montieren. Anzugsmoment: max. 30 Nm.
Wenn nötig, die Differentialspiele einstellen (Siehe «DIFFERENTIAL ZUSAMMENBAUEN»). Den unteren Stopfen (1) und die Arme montieren. (Für weitere Einzelheiten, sieh «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN»).

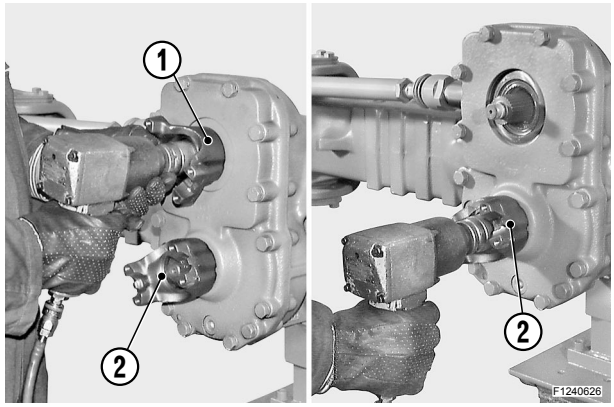
ESP Montar el microinterruptor (2) completo de guarniciòn OR; par de torsion: max. 30 Nm.
Si necesario, registrar los juegos diferenciales. (Vease «ASEMBLAJE DIFERENCIAL»):
Montar la tapa superior (1) y los ejes. (Para los detalles, vease «CONTROL DESGASTE Y SOBSTITUCION DISCOS FRENOS»).

F Monter le microinterrupteur (2) équipé de garniture OR; couple de serrage: max. 30 Nm.
Si besoin, régler les jeux du différentiel (Voir «ASSEMBLAGE DU DIFFERENTIEL»). Monter le bouchon supérieur (1) et les bras. (Pour tout détail, voir «CONTROLE DE L'USURE ET SUBSTITUTION DES DISQUES FREIN»).



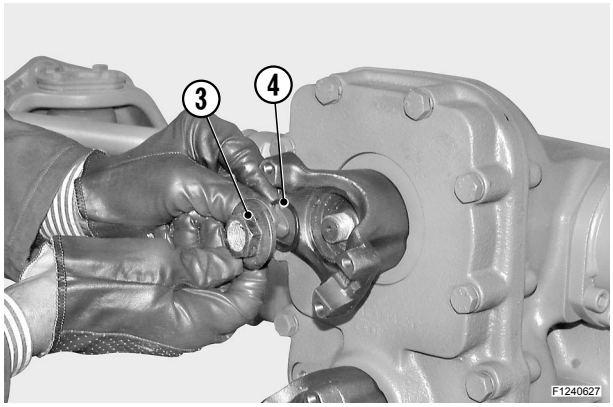
GB a

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



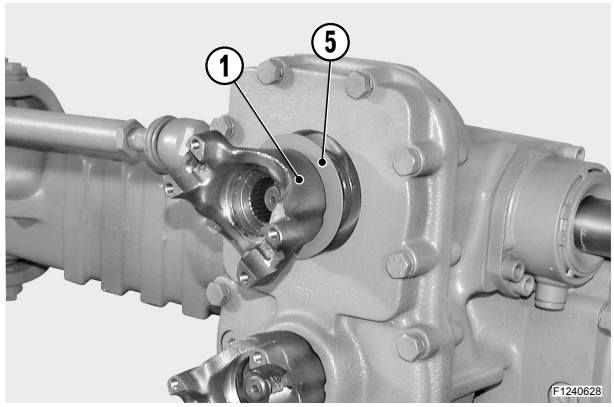
GB b

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



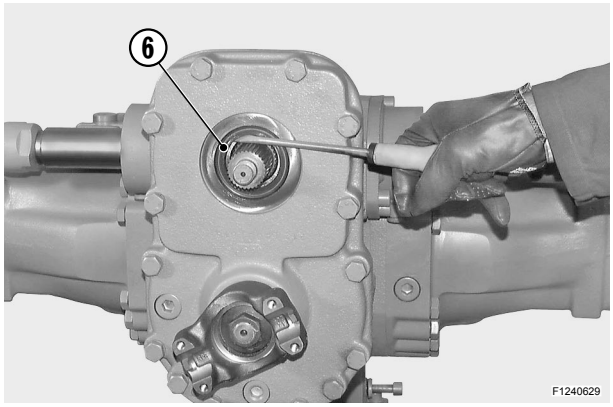
GB c

Draw out nuts (3) and O-rings (4).



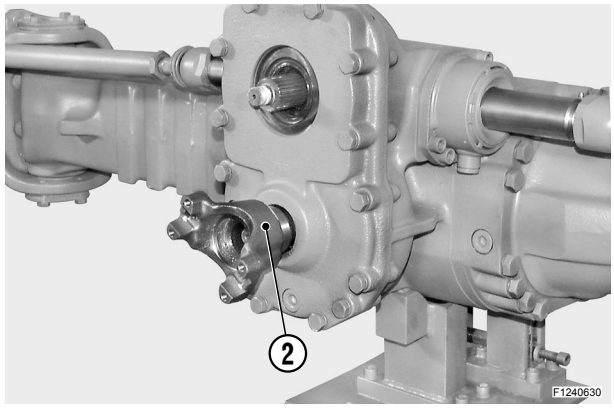
GB d

Remove the upper flange (2) together with dust ring (5).



GB e

Remove the snap ring (6) and discard it.



GB f

Remove the lower flange (2)

a

ITA La figura illustra l'assale con riduttore incorporato, con flange Mecchanic; lo smontaggio e l'assemblaggio sono uguali anche per le flange DIN.

D Die Abbildung zeigt die Achse mit eingebautem Reduzierer und Mecchanic Flanschen; das Abmontieren und Zusammenbauen erfolgt wie für die Flanschen DIN.

ESP La figura ilustra el eje con reductor encorporado, con bridas Mechanic; el desmontaje y el asemblaje son uguales tambien por las bridas DIN.

F La figure illustre l'essieu à réducteur incorporé, avec Flasque Mecchanic; le démontage et l'assemblage sont pareils même pour les flasques DIN.

b

ITA Allentare i dadi di ritegno delle flange superiore (1) ed inferiore (2).

D Befestigungsmuttern der oberen Flanschen (1) und der unteren Flanschen (2) lockern.

ESP Aflojar las tuercas de retencion de las bridas superior (1) y inferior (2).

F Desserrer les écrous de fixation des flasques supérieures (1) et inférieures (2).

c

ITA Asportare i dadi (3) e le guarnizioni OR (4).

D Muttern (3) abschrauben und O-Ringe (4) abnehmen.

ESP Sacar las tuercas (3) y las guarniciones OR (4).

F Enlever les écrous (3) et les garnitures OR (4).

d

ITA Rimuovere la flangia superiore (1) completa di anello parapolvere (5).

D Den oberen Flansch (1) samt Staubdichtungsring (5) abnehmen.

ESP Remover la brida superior (1) completa de segmento parapolvos (5).

F Enlever la flasque supérieure (1) équipée d'anneau anti-poussière (5).

e

ITA Rimuovere l'anello di tenuta (6) e scartarlo.

D Kolbenring (6) abnehmen und entsorgen.

ESP Remover el segmento de compresion (6) y descartarlo.

F Enlever la bague d'étanchéité (6) et la jeter.

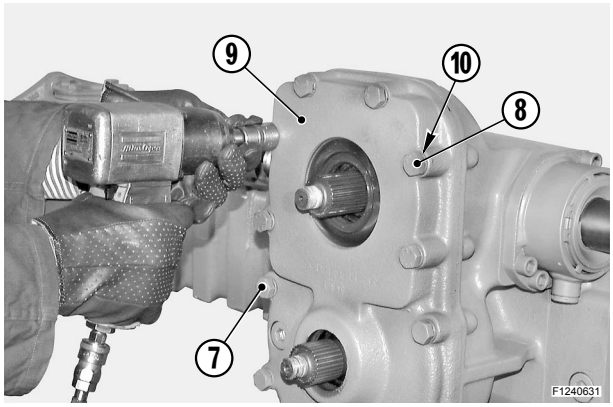
f

ITA Rimuovere la flangia inferiore (2).

D Unteren Flansch abnehmen (2).

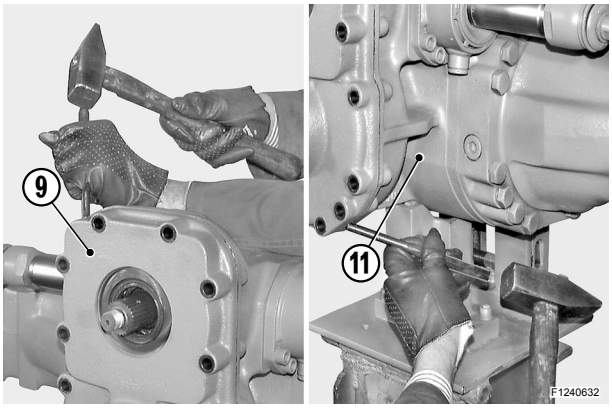
ESP Remover la brida inferior (2).

F Enlever la flasque inférieure (2).



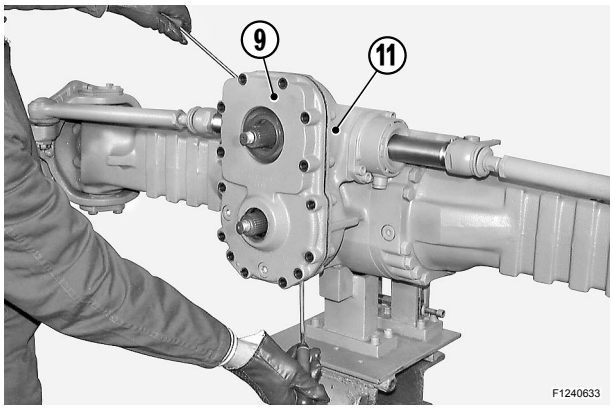
GB a

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



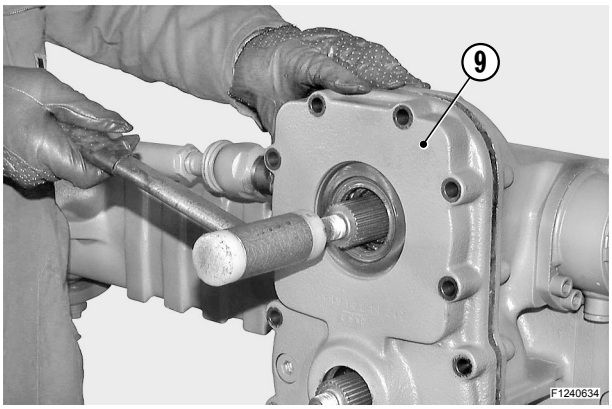
GB b

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).



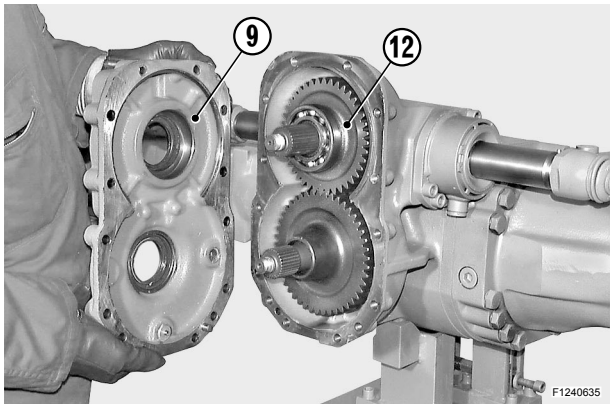
GB c

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



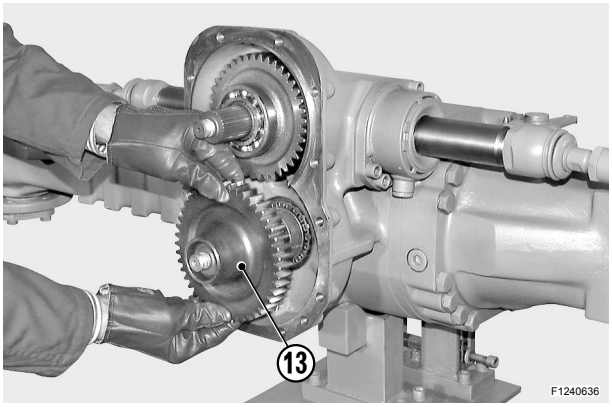
GB d

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



GB e

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



GB f

Remove lower gear (13).

a

ITA Rimuovere le viti (7), (8) di ritegno del coperchio (9) e le relative rondelle (10).

D Befestigungsschrauben (7) und (8) des Deckels (9) mit den Unterlegscheiben (10) abschrauben.

ESP Remover los tornillos (7), (8) de retencion de la tapa (9) y las relativas arandelas (10).

F Enlever les vis (7), (8) de fixation du couvercle (9) et ses relatives rondelles (10).

b

ITA Inserire alternativamente nelle cave predisposte uno spintore e, con leggeri colpi di martello, separare il coperchio (9) dal corpo riduttore (11).

D Abwechselnd, in die Nuten einen Stößel stecken und diesen mit einem Hammer leicht schlagen, bis sich der Deckel (9) vom Reduziererkörper (11) löst.

ESP Introducir alternativamente en los orificios propuestas un empuje y, con ligeros golpes de martillo, separar la tapa (9) del cuerpo reductor (11).

F Introduire alternativement dans les creux prédisposés un poussoir et, à l'aide de légers coups de maillet, séparer le couvercle (9) du corps réducteur (11).

c

ITA Inserire due leve nelle cave predisposte ed allontanare il coperchio (9) dal corpo riduttore (11).

D Zwei Hebel in die Nuten stecken und den Deckel (9) vom Reduziererkörper (11) abheben.

ESP Introducir dos palancas en los orificios propuestas un empuje y alejar la tapa (9) del cuerpo reductor (11).

F introduire deux leviers dans les creux prédisposés et éloigner le couvercle (9) du corps réducteur (11).

d

ITA Battere leggeri colpi con un mazzuolo per disimpegnare il coperchio (9) dall'ingranaggio superiore (12).

D Mit leichten Hammerschlägen, den Deckel (9) vom oberen Zahnrad (12) trennen.

ESP Golpear con ligeros golpes con un martillo para desconectar la tapa (9) del engranaje superior (12).

F Donner de légers coups de maillet pour dégager le couvercle (9) de l'engrenage supérieur (12).

e

ITA Asportare il coperchio (9) e rimuovere ogni traccia di sigillante.

D Deckel (9) abnehmen und Dichtungsmaße vollständig entfernen.

ESP Introducir la tapa (9) y remover cada mancha de cola.

F Enlever le couvercle (9) et nettoyer toute trace de colle.

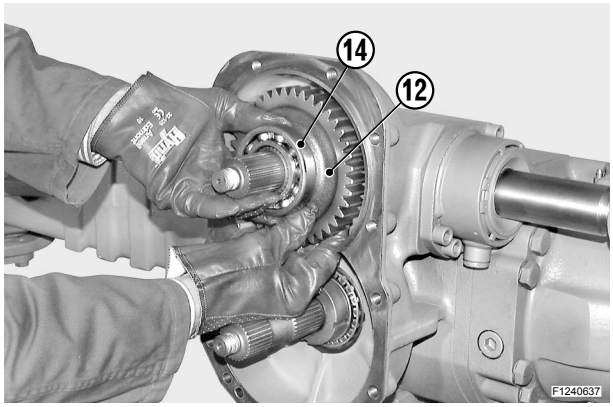
f

ITA Asportare l'ingranaggio inferiore (13).

D Das untere Zahnrad (13) entfernen.

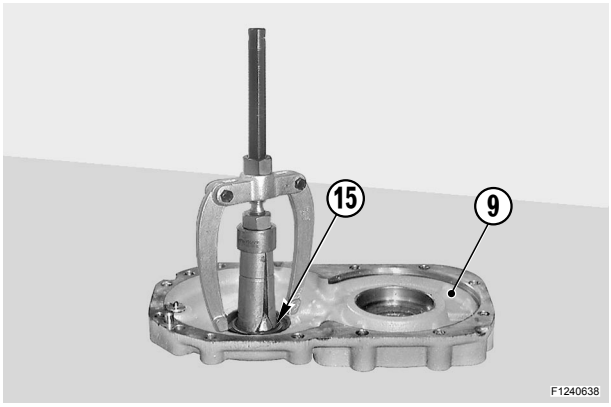
ESP Sacar el engranaje inferior (13).

F Enlever l'engrenage inférieur (13).



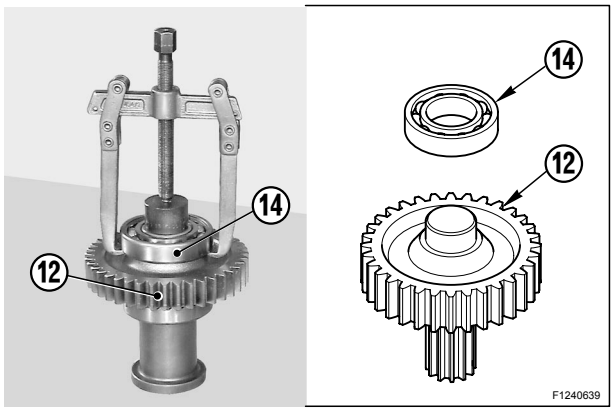
GB a

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



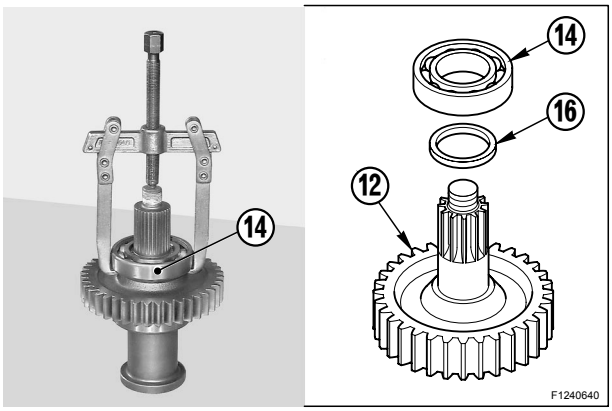
GB b

Using a puller, remove snap ring (15) from cover (9) and discard it.
NOTE. Note down direction of installation.



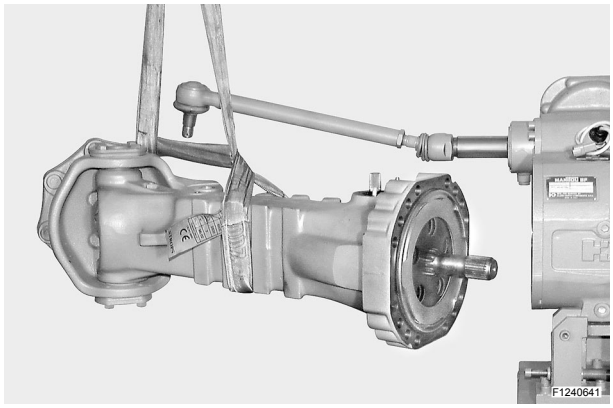
GB c

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



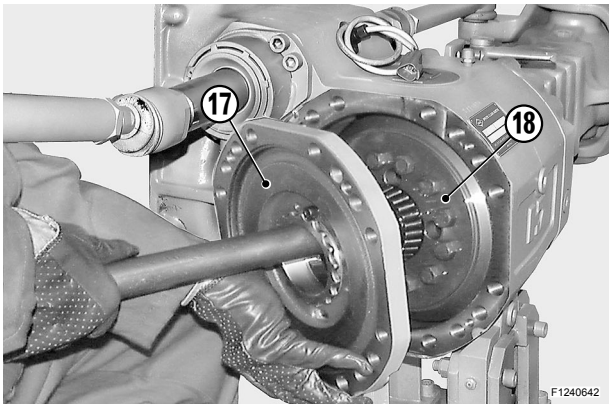
GB d

Remove outer bearing (14) and distance piece (16).



GB e

Disjoin from the steering case the steering bar located by the side of the intermediate cover (17).
Remove the complete arm.
For details, see «CHECKING WEAR AND REPLACING THE BRAKING DISCS».



GB f

Remove the intermediate cover (17) and the whole differential unit (18).
For details, see «HOW TO REMOVE THE DIFFERENTIAL UNIT».

a

ITA Rimuovere il gruppo ingranaggio superiore (12) completo di cuscinetti (14).

D Das obere Zahnradaggregat (12) samt Lager (14) entfernen.

ESP Remover el grupo engranaje superior (12) completo de cojinetes (14).

F Enlever le groupe engrenage supérieur (12) équipé des paliers (14).

b

ITA Utilizzando un estrattore, rimuovere dal coperchio (9) l'anello di tenuta (15) e scartarlo.
NOTA. Annotare il senso di montaggio.

D Mit einem Abzieher, vom Deckel (9) den Kolbenring (15) abnehmen und entsorgen.
BEMERKUNG. Auf die Montagerichtung achten.

ESP Utilizando un estractor, remover la tapa (9) el segmento de compresion (15) y descartarlo.
NOTA Anotar el sentido de montaje.

F A l'aide de l'extracteur, enlever le couvercle (9) la bague d'étanchéité (15) et l'éliminer.
NOTE. Prendre note du sens de montage.

c

ITA Rimuovere dal gruppo ingranaggio (12) il cuscinetto interno (14).

D Vom Zahnradaggregat (12) das innere Lager (14) abnehmen.

ESP Remover del grupo engranaje (12) el cojinete interior (14).

F Enlever le groupe engrenage (12) le palier interne (14).

d

ITA Rimuovere il cuscinetto esterno (14) ed il distanziale (16).

D Das äußere Lager (14) und das Distanzstück (16) entfernen.

ESP Remover el cojinete esterior (14) y el distancial (16).

F Enlever le palier (14) et l'entretoise (16).

e

ITA Scollegare dalla scatola snodo la barra di sterzatura del lato del coperchio intermedio (17).
Rimuovere il braccio completo.
Per i dettagli, vedere «CONTROLLO USURA E SOSTITUZIONE DISCHI FRENO».

D Vom Gelenkgehäuse die Lenkstange an der Seite des mittleren Deckels (17) abmontieren.
Den ganzen Arm abnehmen.
Weitere Einzelheiten im Paragraph «VERSCHLEISS KONTROLLIEREN UND BREMSSCHEIBEN AUSWECHSELN».

ESP Desconectar del carter de las rotulas la barra de direccion del lado de la tapa intermedia (17).
Remover el brazo completo.
Para los detalles, vease «CONTROL DESGASTE Y SUBSTITUCION DISCOS FRENO».

F Débrancher la boîte d'articulation de la barre de braquage du côté couvercle intermédiaire (17).
Enlever le bras complet.
Pour les détails, voir «CONTROLE USURE ET SUBSTITUTION DES DISQUES FREINS».

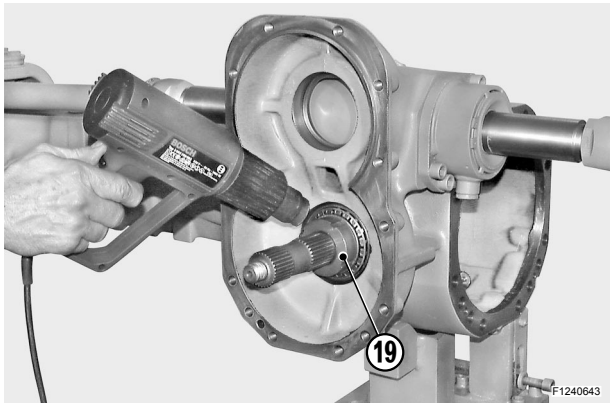
f

ITA Rimuovere il coperchio intermedio (17) ed il differenziale completo (18).
Per i dettagli, vedere «RIMOZIONE GRUPPO DIFFERENZIALE».

D Den mittleren Deckel (17) und das ganze Differential (18) abnehmen.
Weitere Einzelheiten im Paragraph «DIFFERENTIALAGGREGAT ABNEHMEN».

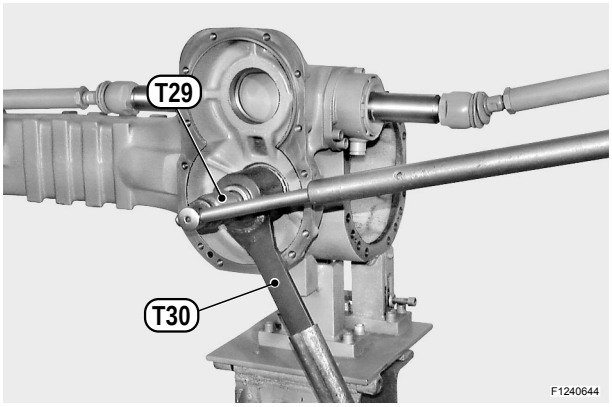
ESP Remover la tapa intermedia (17) y el diferencial completo (18).
Por los detalles, vease «REMOVER GRUPO DIFERENCIAL».

F Enlever le couvercle intermédiaire (17) et le différentiel complet (18).
Pour les détails, voir «DEPOSE DU GROUPE DIFFERENTIEL».



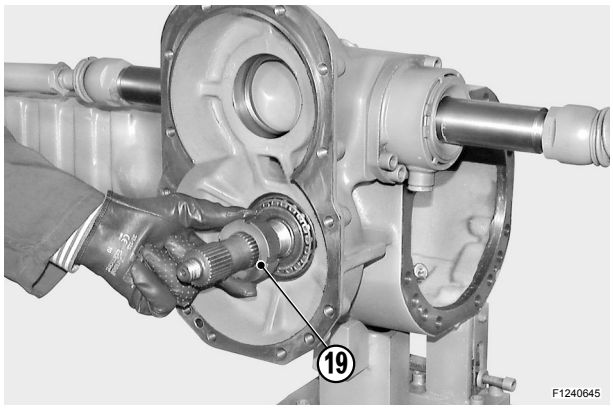
GB a

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



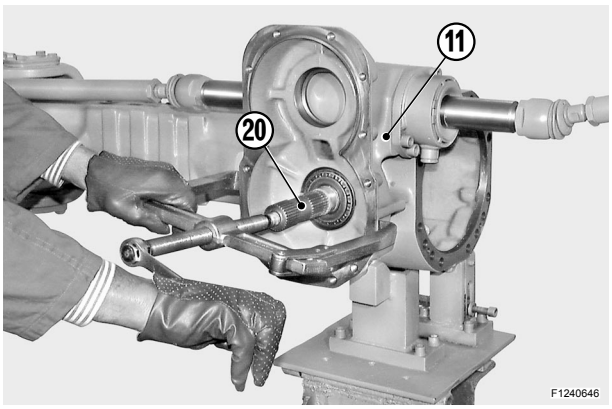
GB b

Engage special wrench **T30** on the ring nut (19) and apply bar-hold **T29** on the pinion (20).



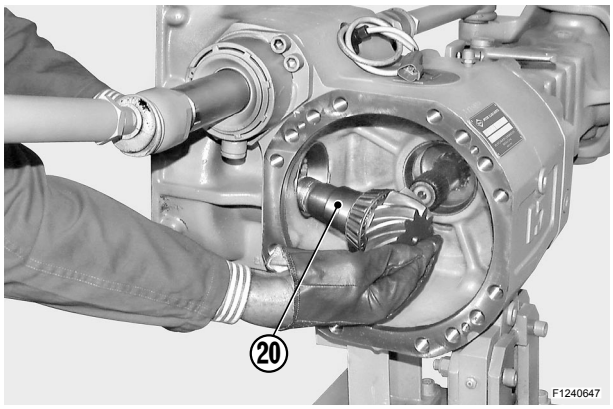
GB c

Remove ring nut (19)



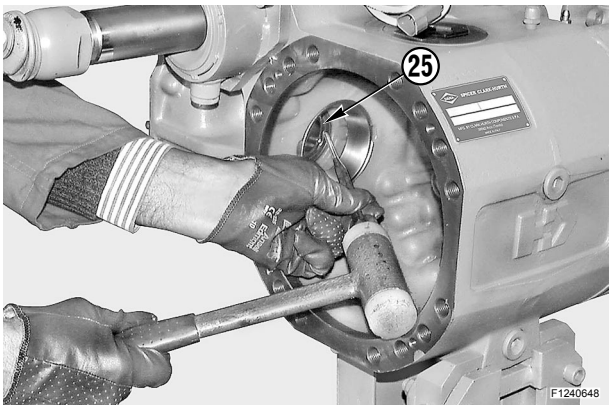
GB d

Using a puller, extract pinion (20) complete with inner bearing (21), distance piece (22) and distance washers.
NOTE. The thrust blocks of the bearings remain in the central body (11).



GB e

Remove the complete pinion (20).
NOTE. Carefully check and note direction of installation of distance piece.



GB f

Using a punch and a hammer, extract the snap ring (25).
NOTE. Note direction of installation of snap ring (24).

a

ITA Scaldare a circa 80°C la ghiera (19).

D Nutmutter (19) bis auf ca. 80°C erwärmen.

ESP Calentar hasta aproximadamente 80°C la virola (19).

F Chauffer l'anneau (19) à environ 80°C.

b

ITA Impegnare la chiave speciale **T30** sulla ghiera (19) ed applicare sul pignone (20) il codolo **T29**.
Fermare la chiave **T30** e ruotare il pignone (20) per allentare la ghiera (19).

D Spezialschlüssel **T30** in die Nutmutter (19) stecken und auf das Rad (20) den Schaft **T29** anbringen.
Den Schlüssel **T30** festhalten und das Rad (20) drehen, um die Nutmutter (19) zu lockern.

ESP Empenar la llave especial **T30** sobre la virola (19) y aplicar sobre el pinon (20) el mango **T29**.
Parar la llave **T30** y girar el pinon (20) para aflojar la virola (19).

F Engager la clé spéciale **T30** sur l'anneau de fixation (19) et appliquer sur le pignon (20) l'embout **T29**.
Arrêter la clé **T30** et tourner le pignon (20) pour desserrer l'anneau de fixation (19).

c

ITA Asportare la ghiera (19).

D Nutmutter (19) entfernen.

ESP Sacar la virola (19).

F Enlever l'anneau (19).

d

ITA Utilizzando un estrattore, estrarre il pignone (20) completo del cuscinetto interno (21), del distanziale (22) e degli spessori (23) e (24).
NOTA. Le ralle dei cuscinetti rimangono nel corpo centrale (11).

D Mit einem Abzieher, Rad (20) samt inneres Lager (21), Distanzstück (22) und Unterlegscheiben (23) und (24) herausnehmen.
BEMERKUNG. die Scheiben der Lager bleiben im Zentralkörper (11) sitzen.

ESP Utilizando un estractor, estraer el pinon (20) completo de cojinete interno (21), del distancial (22) y de los espesores (23) y (24).
NOTA. Las ranguas de los cojinetes quedan en el cuerpo central (11).

F A l'aide d'un extracteur extraire le pignon (20) équipé de palier interne (21), de l'entretoise (22) et des cales (23) et (24).
NOTE. Les crapaudines des paliers demeurent dans le corps central (11).

e

ITA Rimuovere il pignone completo (20).
NOTA. Controllare attentamente ed annotare il senso di montaggio del distanziale (22).

D Das gesamte Rad (20) abnehmen.
BEMERKUNG. Sorgfältig die Montagerichtung des Distanzstückes (22) kontrollieren.

ESP Remover el pinon completo (20).
NOTA. Controlar con cuidado y anotar el sentido de montaje del distancial (22).

F Enlever le pignon complet (20).
NOTE. Contrôler attentivement et prendre note du sens de montage de l'entretoise (22).

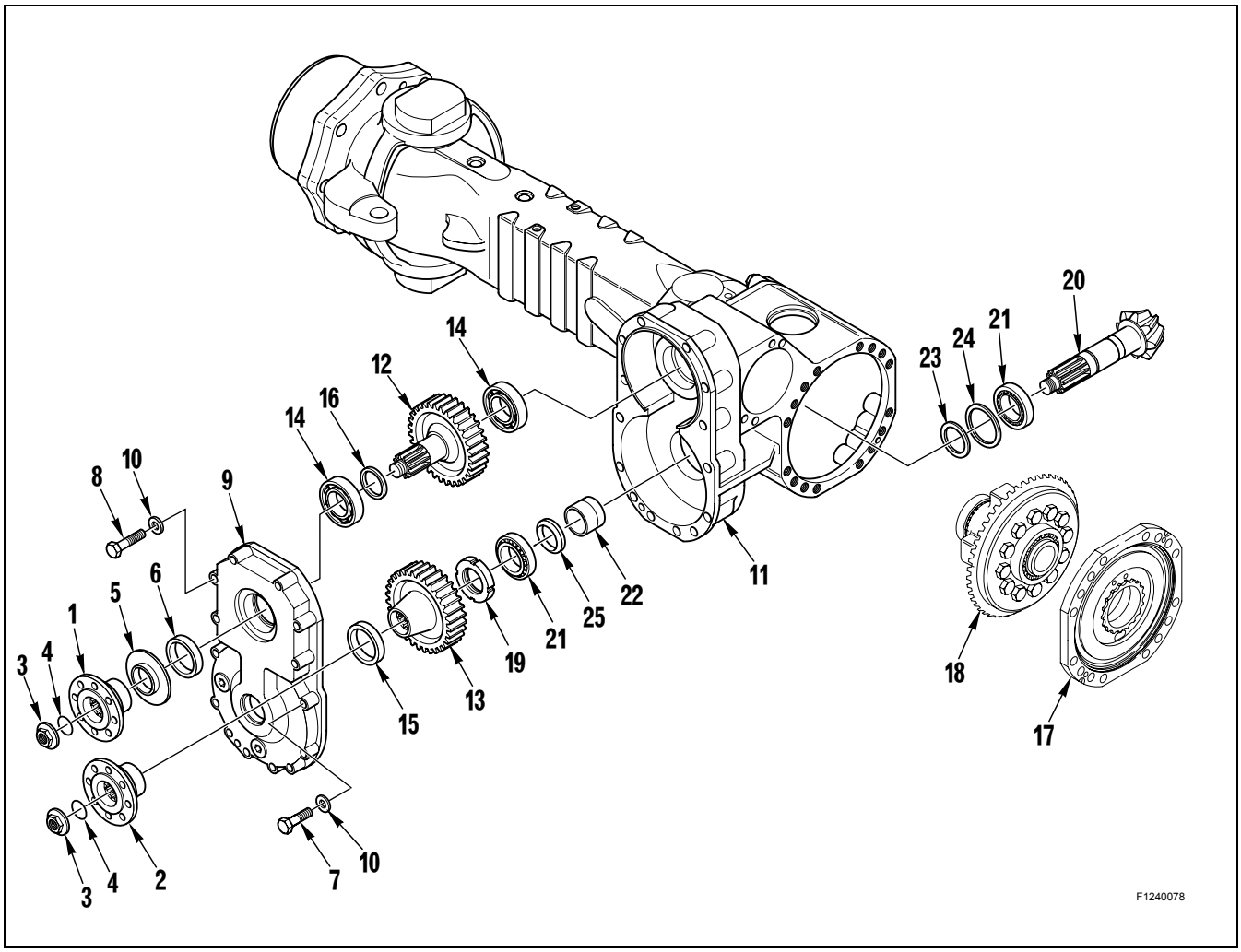
f

ITA Utilizzando uno spintore ed un mazzuolo, estrarre l'anello di tenuta (25).
NOTA. Annotare il senso di montaggio dell'anello di tenuta (24).

D Mit einem Stößel und einem Hammer, den Kolbenring (25) herausnehmen.
BEMERKUNG. Montagerichtung des Kolbenrings (24) beachten.

ESP Utilizando un empuje y un martillo, estaer el segmento de compresion (25).
NOTA. Anotar el sentido de montaje del segmento de compresion (24).

F A l'aide d'un poussoir et d'un maillet, extraire la bague d'étanchéité (25).
NOTE. Prendre note du sens du montage de la bague d'étanchéité (24).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GB **CAUTION!** 1 - If disassembly has been carried out only as a means to replace the snap ring (24), position the new ring and reassemble the unit by keeping to the torque wrench settings indicated in the following section and using the prescribed locking products.

2 - If disassembly is carried out in order to replace crown wheel and pinion, bearings, or planetary gear, break up distance washers and calculate clearances as indicated in the sections regarding removal, disassembly, assembly and installation of differential unit and bevel pinion.

ITA **ATTENZIONE!** 1 - Se lo smontaggio è stato eseguito solo per la sostituzione dell'anello di tenuta (24), procedere al posizionamento del nuovo anello e rimontare il gruppo rispettando le coppie di serraggio indicate nel paragrafo seguente ed utilizzando i prodotti di bloccaggio prescritti.

2 - Se lo smontaggio viene eseguito per la sostituzione della coppia conica, dei cuscinetti o degli ingranaggi satelliti, procedere alla scomposizione ed alla ricerca degli spessori e dei giochi come indicato nei paragrafi riguardanti la rimozione, lo smontaggio, l'assemblaggio e l'installazione del differenziale e del pignone conico.

D **ACHTUNG!** 1 - Falls die Teile nur abmontiert worden sind, um den Kolbenring (24) auszuwechseln, den neuen Kolbenring einsetzen und das Aggregat wieder zusammenbauen; dabei die im nachfolgenden Paragraph angegebene Anzugsmomente beachten und die vorgeschriebenen Befestigungsprodukte verwenden.

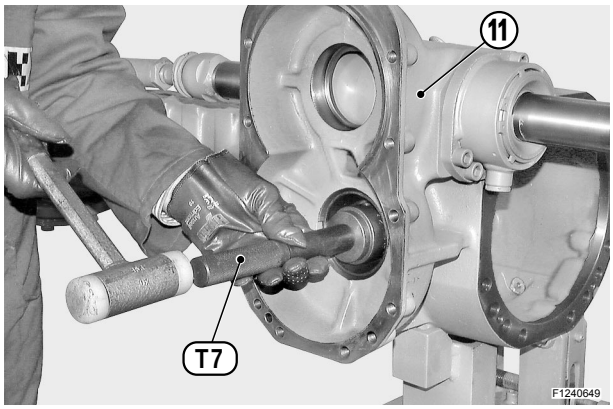
2 - Falls die Teile abmontiert worden sind, um den Kegelradtrieb, die Lager oder die Planetengetriebe auszuwechseln, die Unterlegscheiben auseinander nehmen und die Spiele beachten, die in den Paragraphen zum Entfernen, Abmontieren, Zusammenbau und zur Installation des Differentials und des Kegelrads angegeben sind.

ESP **CUIDADO!** 1 - Si el desmontaje ha sido efectuado solo por la sustitucion del segmento de compresion (24), remontar el grupo respectando los pares de torsion indicadas en el capitulo siguiente y utilizando los productos de bloque descritos.

2 - Si el desmontaje viene efectuado para la sustitucion del par conico, de los cojinetes o de los engranajes satelites, proceder a la descomposicion y a la busqueda de los espesores y de los juegos como indicados en los capitulos concernientes la remociòn, el desmontaje, el asemblaje y la instalacion del diferencial y del pinòn conico.

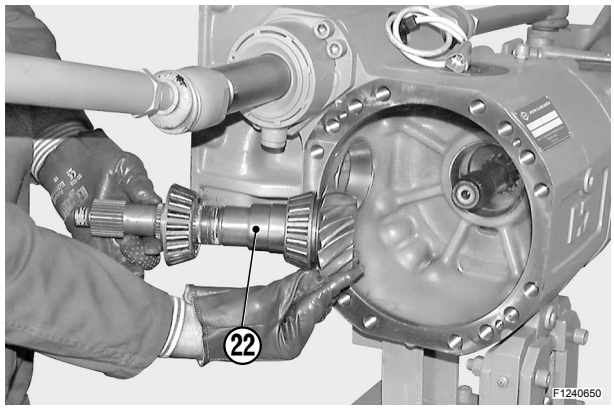
F **ATTENTION!** 1 - Si le démontage n'a eu lieu que pour la substitution de la bague d'étanchéité (24), positionner la bague d'étanchéité et remonter le groupe en respectant les couples de serrage indiqués dans le paragraphe suivant et en utilisant les produits de blocage préconisés.

2 - Si le démontage a lieu pour substituer le couple conique, les paliers ou les engrenages satellites, désassembler et rechercher les cales et les jeux comme indiqué dans les paragraphes ayant trait à la dépose, au démontage, à l'assemblage et à l'installation du différentiel et du pignon conique.



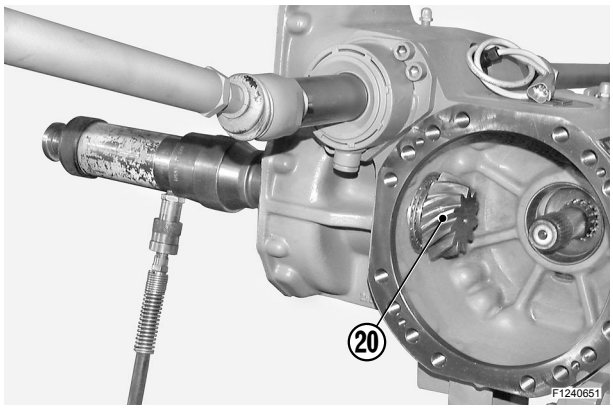
GB a

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 «HOW TO INSTALL AND ADJUST THE BEVEL PINION»).
Using tool **T7** insert the snap ring (25) previously lubricated with grease.



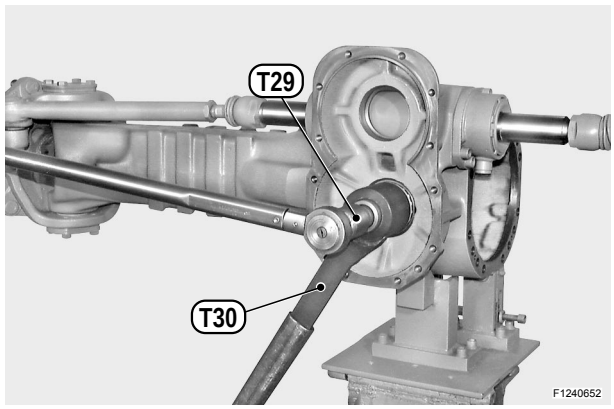
GB b

Assemble the pinion assembly as shown in the picture, checking that distance piece (22) is correctly oriented.
NOTE. Apply grease to the outer surface of the distance piece (22).



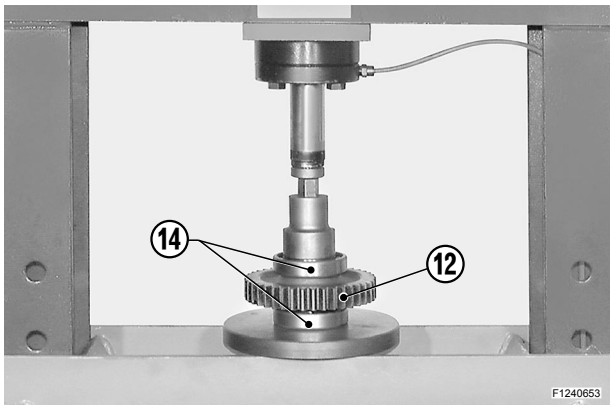
GB c

With tools **T28C**, **T28D** and **T28B** connected to a press, insert the complete pinion assembly (20).



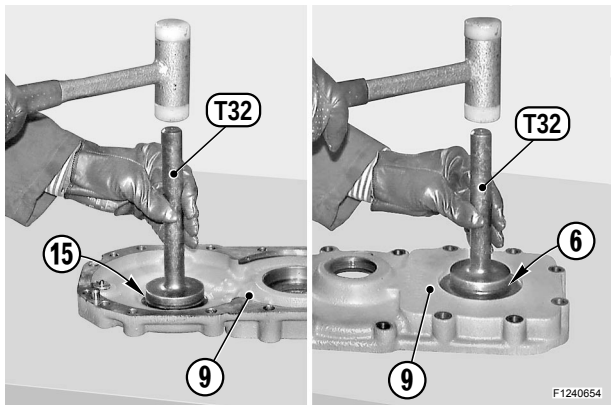
GB d

Apply Loctite 242 to the thread of the pinion and screw the ring nut (19). Engage special wrench **T30** on the ring nut and apply bar-hold **T29** to the pinion (20). Tighten the ring nut (19) following the appropriate procedure (See «HOW TO INSTALL AND ADJUST THE BEVEL PINION») and check that torque is 170 – 220Ncm.



GB e

Using a press, fit the bearings (14) and the distance piece (16) on the upper gear (12).
CAUTION! The distance piece (16) must be positioned between the outer bearing and the gear.



GB f

Grease snap rings (15) and (6); position the snap rings in the cover (9) using tool **T32**.

a

ITA Ricercare il valore degli spessori (23) e (24) ed inserire nel corpo riduttore (11) le ralle dei cuscinetti conici del pignone (Vedere «INSTALLAZIONE E REGISTRAZIONE PIGNONE CONICO»).
Utilizzando l'attrezzo **T7** inserire l'anello di tenuta (25) dopo averlo lubrificato con grasso.

D Die Größen der Unterlegscheiben (23) und (24) kontrollieren und in den Reduziererkörper (11) die Lagerscheiben des Rades einsetzen (Siehe «INSTALLATION UND EINSTELLUNG DES KEGELRADES»).
Mit Hilfe des Werkzeugs **T7** den zuvor eingefetteten Kolbenring (25) einsetzen.

ESP Buscar el valor de los espesores (23) y (24) y introducir en el cuerpo reductor (11) las ranguas de los cojinetes conicos del pinon (Vease «INSTALACION Y REGISTRACION PINON CONICO»).
Utilizando la herramienta **T7** introducir el segmento de compresion (25) despues de haberlo lubrificado con grasa.

F Chercher la valeur des cales (23) et (24), puis introduire dans le corps réducteur (11) les crapaudines des paliers coniques du pignon (voir «INSTALLATION ET REGLAGE DU PIGNON CONIQUE»).
A l'aide de l'outil **T7** introduire la bague d'étanchéité (25) après l'avoir lubrifiée avec du gras.

b

ITA Comporre il gruppo pignone come in figura, controllando che il distanziale (22) sia orientato correttamente.
NOTA. Lubrificare con grasso la superficie esterna del distanziale (22).

D Das Radaggregat wie in der Abbildung gezeigt zusammenbauen; dabei überprüfen ob das Distanzstück (22) auch richtig orientiert ist.
BEMERKUNG. Die äußere Fläche des Distanzstückes (22) mit Fett schmieren.

ESP Componer el grupo pinon como en figura, controlando que el distancial (22) sea orientado correctamente.
NOTA. Lubrificar con grasa la superficie exterior del distancial (22).

F Composer le groupe pignon comme sur la figure, contrôler si l'entretoise (22) est orientée correctement.
NOTE. Lubrifier avec du gras la surface externe de l'entretoise (22).

c

ITA Utilizzando gli attrezzi **T28C**, **T28D** e **T28B** collegati ad una pressa, inserire il gruppo pignone (20) completo.

D Mit Hilfe der an einer Presse angeschlossenen Werkzeuge **T28C**, **T28D** und **T28B**, das ganze Radaggregat (20) einsetzen.

ESP Utilizando las herramientas **T28C**, **T28D** y **T28B** conectar a un prensa, insertar el grupo pinon (20) completo.

F A l'aide des outils **T28C**, **T28D** et **T28B** reliés à une presse, introduire le groupe pignon (20) complet.

d

ITA Spalmare la filettatura del pignone con Loctite 242 ed avvitare la ghiera (19). Impegnare la chiave speciale **T30** sulla ghiera ed applicare il codolo **T29** sul pignone (20). Serrare la ghiera (19) con le modalità prescritte (Vedere «INSTALLAZIONE E REGISTRAZIONE PIGNONE CONICO») e controllare che la coppia di rotazione sia di 170÷220 Ncm.

D Radgewinde mit Loctite 242 schmieren und die Nutmutter (19) zuschrauben. Den Spezialschlüssel **T30** in die Nutmutter setzen und den Schaft **T29** auf das Rad (20) setzen. Nutmutter (19) laut Anweisungen fest ziehen (Siehe «INSTALLATION UND EINSTELLUNG DES KEGELRADES») und das Gegenmoment kontrollieren, das 170÷220 Ncm betragen muß.

ESP Pasar sobre la rosca del pinon Loctite 242 y entornillar la virola (19). Empenar la llave especial **T30** sobre la virola y aplicar el mango **T29** sobre el pinon (20). Apretar la virola (19) con las modalidades prescritas (Vease «INSTALACION Y REGISTRACION PINON CONICO») y controlar que el par de rotacion sea de 170÷220 Ncm.

F Enduire le filetage du pignon avec du Loctite 242 et visser l'anneau (19). Engager la clé spéciale **T30** sur l'anneau et appliquer l'embout **T29** sur le pignon (20). Serrer l'anneau (19) de la façon préconisée (voir «INSTALLATION ET REGLAGE DU PIGNON CONIQUE») et contrôler que le couple de rotation est de 170÷220 Ncm.

e

ITA Utilizzando una pressa, montare sull'ingranaggio superiore (12) i cuscinetti (14) ed il distanziale (16).
ATTENZIONE! Il distanziale (16) va posizionato tra il cuscinetto esterno e l'ingranaggio.

D Mit Hilfe einer Presse, die Lager (14) und das Distanzstück (16) auf das obere Zahnrad (12) montieren.
ACHTUNG! Das Distanzstück (16) muß zwischen dem äußeren Lager und das Zahnrad liegen.

ESP Utilizando una prensa, montar sobre el engranaje superior (12) los cojinetes (14) y el distancial (16).
CUIDADO. El distancial (16) viene colocado entre el cojinete exterior y el engranaje.

F A l'aide d'une presse, monter sur l'engrenage supérieur (12) les paliers (14) et l'entretoise (16).
ATTENTION! L'entretoise doit être placée entre le palier et l'engrenage.

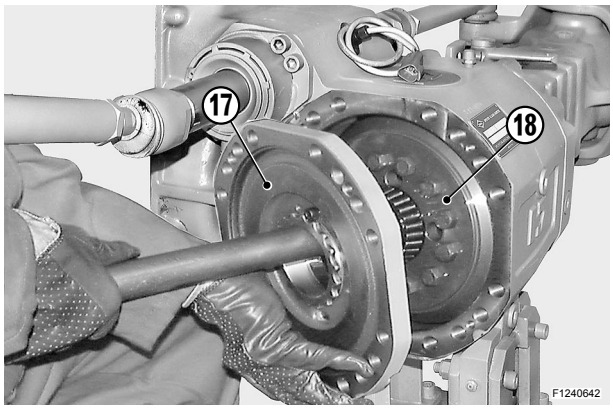
f

ITA Lubrificare con grasso gli anelli di tenuta (15) e (6); posizionarli nel coperchio (9) utilizzando l'attrezzo **T32**.

D Die Kolbenringe (15) und (6) mit Fett schmieren; diese mit dem Werkzeug **T32** auf den Deckel (9) positionieren.

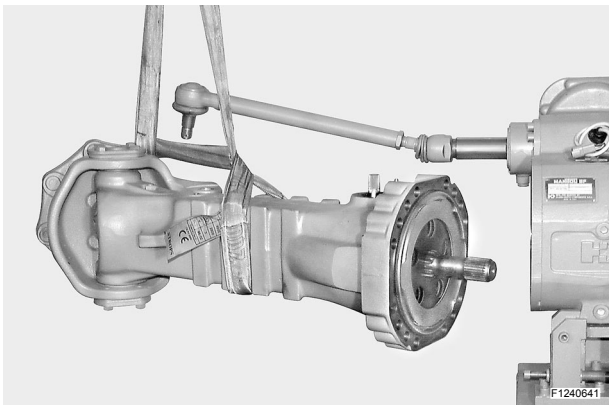
ESP Lubrificar con grasa los segmento de compresion (15) y (16); colocarlos en la tapa (9) utilizando la herramienta **T32**.

F Lubrifier avec du gras les bagues d'étanchéité (15) et (16): placer ces dernières dans le couvercle (9) à l'aide de l'outil **T32**.



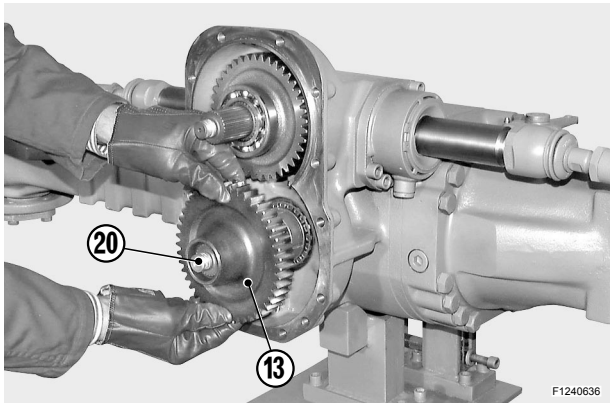
GB a

Re-install the differential unit (18) and the intermediate cover (17).
CAUTION! If the crown has been replaced, reinstate clearances.
For details, see «HOW TO ASSEMBLE AND ADJUST THE DIFFERENTIAL UNIT».



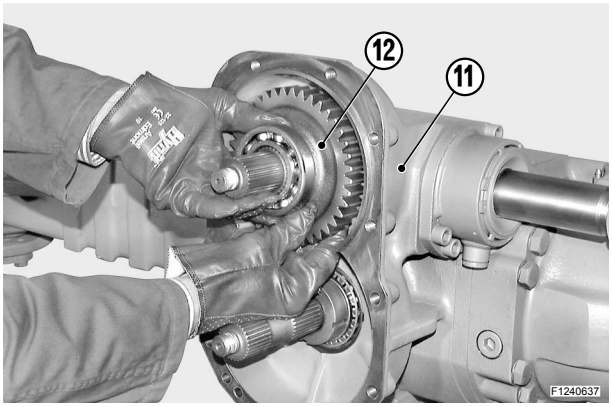
GB b

Re-install the complete arm checking flatness and blocking the arm by keeping to the appropriate procedures illustrated in section «HOW TO ASSEMBLE THE BRAKING UNITS».
Also connect the steering bar.



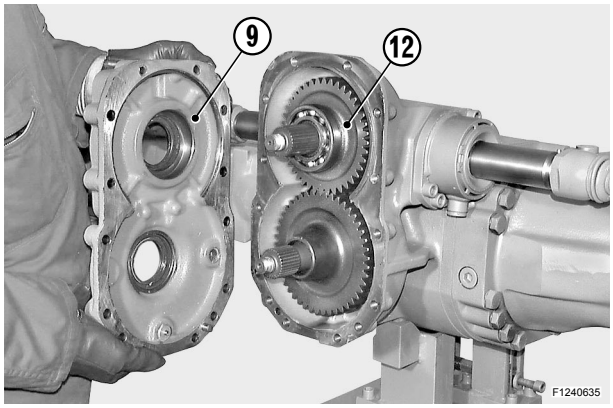
GB c

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



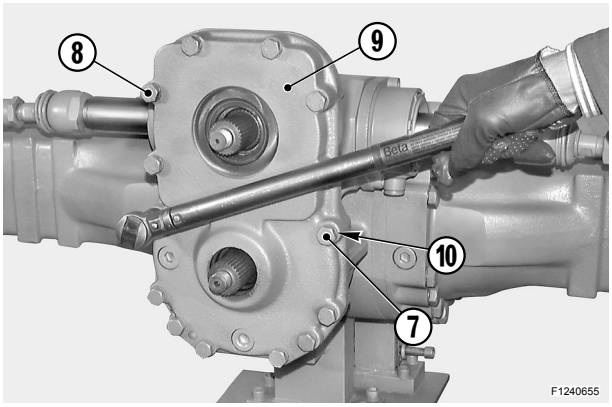
GB d

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



GB e

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



GB f

Block cover (9) with screws (7) and (8) and relative washers (10). Tighten using the criss-cross method.
Torque wrench setting: 82 – 91 Nm

a

ITA Rimontare il gruppo differenziale (18) ed il coperchio intermedio (17).
ATTENZIONE! Se è stata sostituita la corona, ristabilire i giochi.
Per i dettagli, vedere «ASSEMBLAGGIO ED INSTALLAZIONE GRUPPO DIFFERENZIALE».

D Das Differentialaggregat (18) und den mittleren Deckel (17) wieder montieren.
ACHTUNG! Falls der Kranz ausgewechselt worden ist, Spiele wieder herstellen.
Weitere Einzelheiten im Paragraph «ZUSAMMENBAU UND INSTALLATION DES DIFFERENTIALAGGREGATS».

ESP Remontar el grupo diferencial (18) y la tapa intermedia (17).
CUIDADO! Si ha sido cambiada la corona, restabilizar los juegos.
Para los detalles, vease «ASEMBLAJE Y INSTALACION GRUPO DIFERENCIAL».

F Remonter le groupe différentiel (18) et le couvercle intermédiaire (17).
ATTENTION! Si la couronne a été substituée, rétablir les jeux.
Pour tout détail, voir «ASSEMBLAGE ET INSTALLATION GROUPE DIFFERENTIEL».

b

ITA Rimontare il braccio completo, controllando la planarità e bloccandolo con le modalità indicate nel paragrafo «ASSEMBLAGGIO DEI GRUPPI DI FRENATURA».
Collegare anche la barra di sterzatura.

D Den gesamten Arm wieder montieren und Ebenheit laut Anweisungen des Paragraphs «ZUSAMMENBAU DER BREMSAGGREGATE» kontrollieren.
Lenkstange ebenfalls anschließen.

ESP Remontar el brazo completo, controlando la planaridad y bloqueando con las modalidades indicadas en al capitulo «ASEMBLAJE DE LOS GRUPOS DE FRENADURA».
Conectar tambien la barra de direccion.

F Remonter le bras complet, en contrôler l'uniformité et le bloquer suivant le mode indiqué au paragraphe «ASSEMBLAGE DES GROUPES DE FREINAGE».
Brancher également la barre de braquage.

c

ITA Montare sul pignone (20) l'ingranaggio inferiore (13).

D Das untere Zahnrad (13) auf das Rad (20) montieren.

ESP Montar sobre el pinon (20) el engranaje inferior (13).

F Monter sur le pignon (20) l'engrenage inférieur (13).

d

ITA Inserire nel corpo riduttore (11) il gruppo ingranaggio superiore (12).

D Das obere Zahnradaggregat (12) in den Reduziererkörper (11) einsetzen.

ESP Introducir en el cuerpo reductor (11) el grupo engranaje superior (12).

F Introduire dans le corps réducteur (11) le groupe engrenage supérieur (12).

e

ITA Spalmare la superficie di chiusura del corpo riduttore (11) con Loctite 510.
Lubrificare gli anelli di tenuta (6) e (15); montare il coperchio (9) assestandolo (se necessario) con leggeri colpi di un mazzuolo in materiale plastico.

D Die Schließfläche des Reduziererkörpers (11) mit Loctite 510 schmieren.
Kolbenringe (6) und (15) schmieren; Deckel (9) montieren und wenn nötig, mit einem Gummihammer leicht schlagen.

ESP Pasar la superficie de cierre del cuerpo reductor (11) con Loctite 510.
Lubrificar los segmentos de compresion (6) y (15); montar la tapa (9) arreglando (si necesario) con ligeros golpes de martillo en material plastico.

F Enduire la surface de fermeture du corps réducteur (11) avec du Loctite 510.

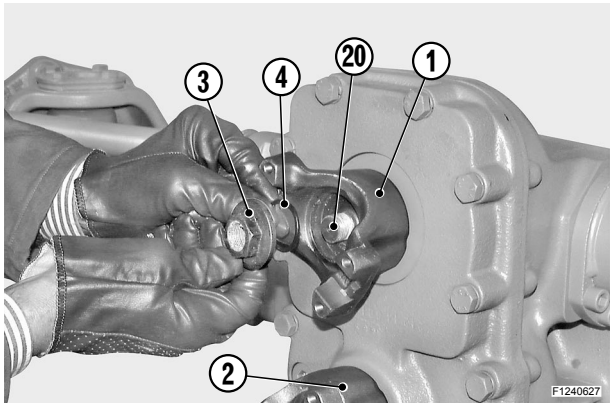
f

ITA Bloccare il coperchio (9) con le viti (7) e (8) e le relative rondelle (10) serrando con il metodo di serraggio incrociato.
Coppia di serraggio: 82÷91 Nm

D Deckel (9) mit den Schrauben (7) und (8) und den Unterlegscheiben (10) festschrauben; die Schrauben im Kreuz abwechselnd fest ziehen.
Anzugsmoment: 82÷91 Nm.

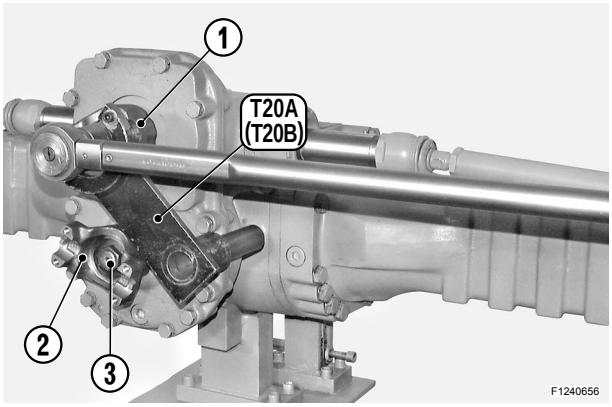
ESP Bloquear la tapa (9) con los tornillos (7) y (8) y las relativas arandelas (10) apretando con el metodo de torsion cruzado.
Par de torsion : 82÷91 Nm.

F Bloquer le couvercle (9) avec les vis (7) et (8) et leurs relatives rondelles (10) en serrant à l'aide du système de serrage croisé.
Couple de serrage: 82÷91 Nm.



GB a

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



GB b

Apply tool **T20A** (or **T20B**) to flanges (1) and (2) and tighten nuts (3) using a dynamometric wrench.
Torque wrench setting: 280 – 310 Nm

a

ITA Montare le flange superiore (1) ed inferiore (2).
Spalmare le filettature del pignone (20) e dell'ingranaggio superiore (12) con Loctite 242.
Montare gli anelli OR (4) ed i dadi (3).

D Obere (1) und untere Flanschen (2) montieren.
Radgewinde (20) und oberes Zahnrad (12) mit Loctite 242 schmieren.
O-Ringe (4) und Muttern (3) montieren.

ESP Montar las bridas superior (1) y inferior (2).
Pasar las roscas del pinon (20) y del engranaje superior (12) Loctite 242.
Montar los segmentos OR (4) y las tuercas (3).

F Monter les flasques supérieures (1) et inférieures (2).
Enduire les filetages du pignon (20) et de l'engrenage supérieur (12) avec du Loctite 242.
Monter les bagues OR (4) et les écrous (3).

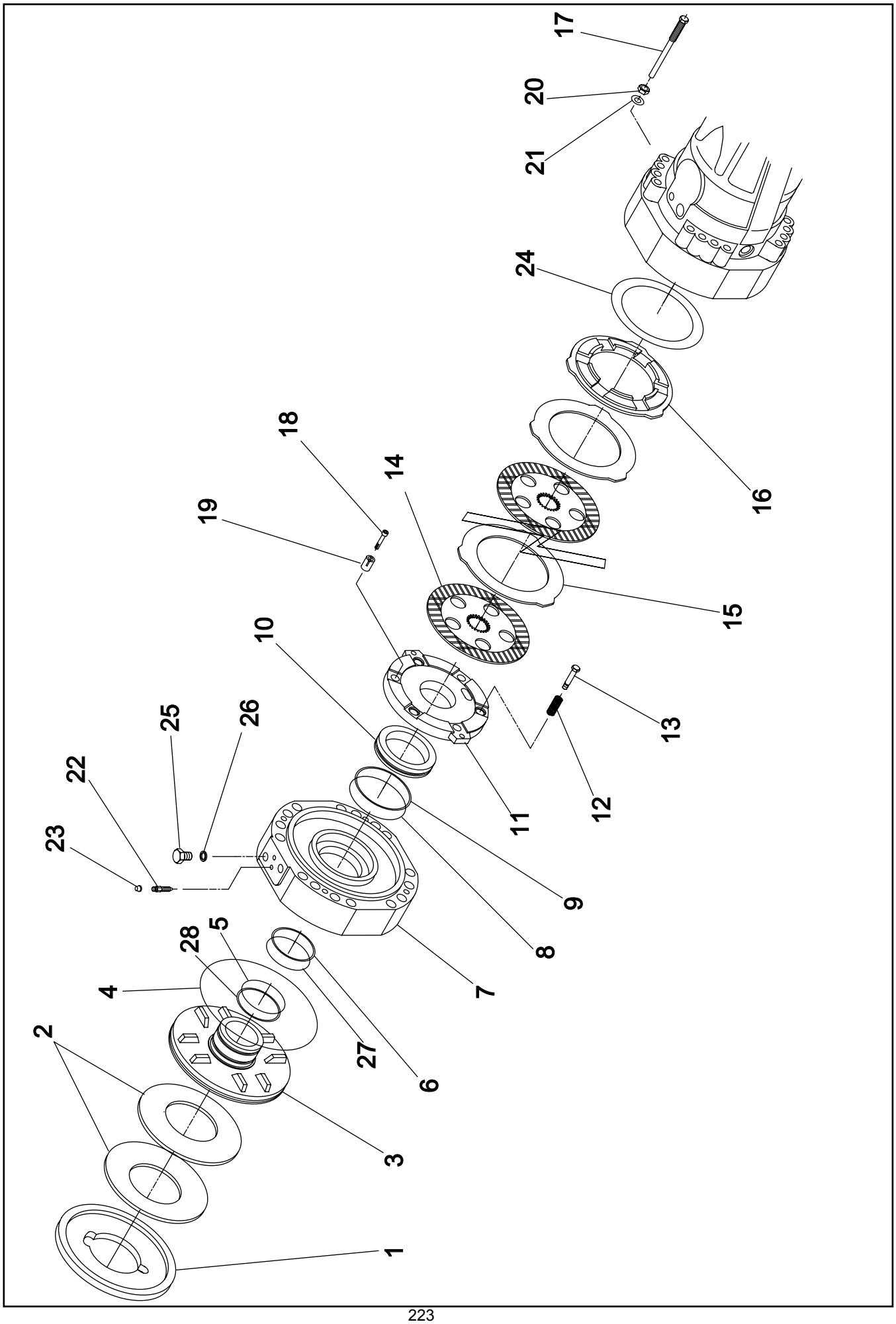
b

ITA Applicare alle flange (1) e (2) l'attrezzo **T20A** (oppure **T20B**) e serrare i dadi (3) con una chiave dinamometrica.
Coppia di serraggio: 280÷310 Nm

D An den Flanschen (1) und (2) das Werkzeug **T20A** (oder **T20B**) anbringen und Muttern (3) mit einem Momentenschlüssel fest ziehen.
Anzugsmoment: 280÷310 Nm.

ESP Aplicar a las bridas (1) y (2) la herramienta **T20A** (o **T20B**) y apretar las tuercas (3) con una llave dinamometrica.
Par de torsin : 280÷310 Nm.

F Appliquer aux flasques (1) et (2) l'outil **T20A** (ou **T20B**) et serrer les écrous (3) au moyen d'une clé dynamométrique.
Couple de serrage: 280÷310 Nm.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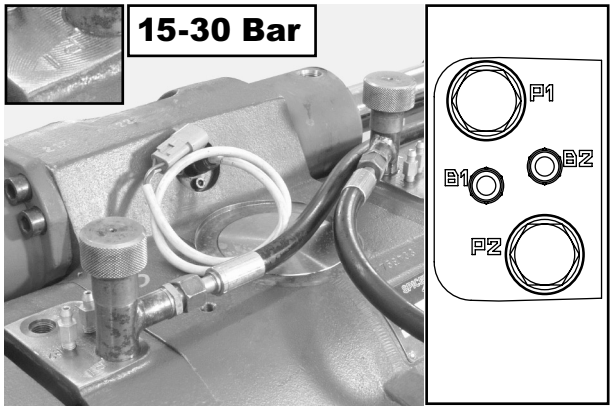
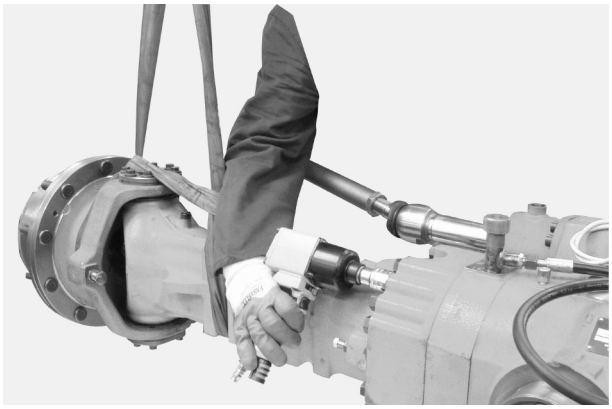


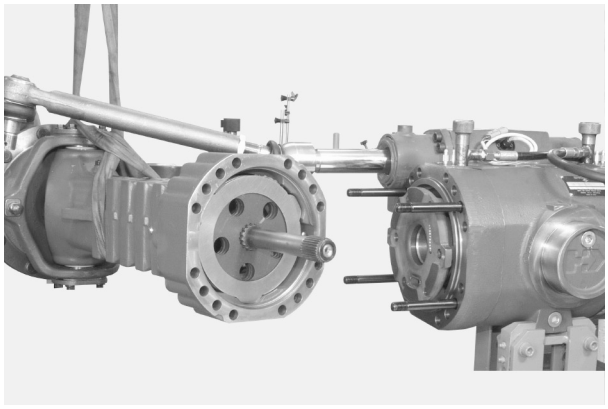
GB a

ADJUSTING THE BRAKES
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).



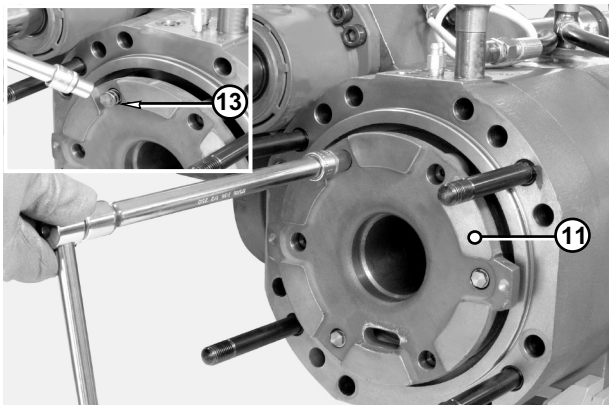
GB b

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



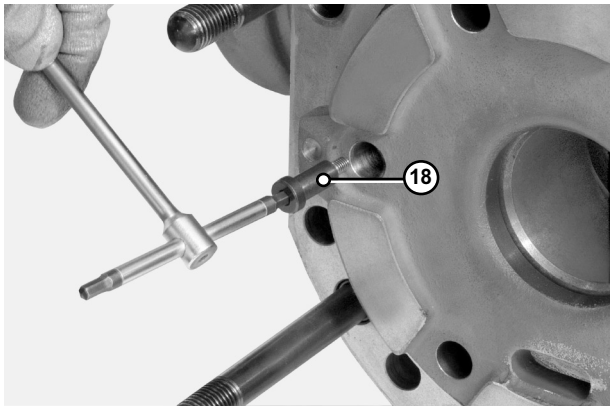
GB c

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



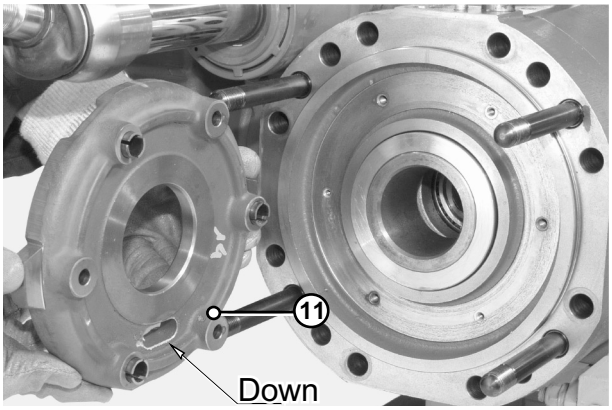
GB d

Remove the reversal springs (13) from the piston (11).



GB e

Remove the pin screws (18) guiding the piston (10).
CAUTION! If the screws are to be replaced, note down the different colours for the different brake gaps.



GB f

Note down their order of assembly and remove the counterwasher (11).

a

ITA REGISTRAZIONE FRENI
Collegare al raccordo “P1” del freno negativo una pompa esterna ed immettere una pressione di 15-30 bar per eliminare la pressione delle molle a tazza (2).

D BREMSEN EINSTELLEN
Anschluûstueck “P1” der Federspeicherbremse an eine aeuûere Pumpe anschlieûen und Druck bei 15-30 bar einlassen, um Tellerfedern (2) zu entlasten.

ESP REGISTRACION FRENOS
Conectar al empalme «P1» del freno negativo una pompa esterna y introducir una presion de 15-30 bar para eliminar la presion de los muelles a taza (2).

F REGLAGE DES FREINS
Brancher au raccord “P1” du frein négatif une pompe externe et envoyer une pression de 15-30 bar pour éliminer la pression des ressorts belleville (2).

b

ITA Imbragare il braccio da asportare e collegarlo ad un mezzo di sollevamento.
Allentare ed asportare le viti (17).

D Den abzunehmenden Arm anschlagen und an eine Hebezeug befestigen.
Schrauben (17) abschrauben.

ESP Atar el eje de sacar y conectarlo a un medio de levantamiento.
Aflojar y sacar los tornillos (17).

F Elinguer le bras a énlever et brancher celui-ci un moyen de relevage.
Desserrer et enlever les vis (17).

c

ITA Rimuovere il braccio completo di freni e semiassi; deporre il braccio in modo verticale.
Rilasciare la pressione.

D Remover el eje completo de frenos y semi-ejes; colocar el eje de manera vertical.
Druck ablassen.

ESP Enlever le bras complet de freins et demi-essieux; déposer le bras en vertical.Dejar la presion.

F Den Arm samt Bremsen und Halbachsen abnehmen; den Arm senkrecht ablegen.Libérer la pression.

d

ITA Rimuovere le molle (13) di rientro del pistone (11).

D Rückzugsfedern (13) des Kolbens (11) abnehmen.

ESP Remover los muelles (13) de vuelta del pistón (11).

F Enlever les ressorts (13) de rentrée du piston (11).

e

ITA Rimuovere le viti a perno (18) di guida del pistone (10).
ATTENZIONE! Se le viti devono essere sostituite, annotare la colorazione distintiva per i giochi freno

D Die Stiftschraube (18) zur Kolbenführung (10) entfernen.
ACHTUNG! Sollen die Schrauben ausgewechselt werden, auf die farbige Kennzeichnung für das Bremsenspiel achten

ESP Remover los pernos roscados (18) de guía del pistón(10).
CUIDADO! Si hay que sustituir los pernos, anotar el color distintivo para los juegos del freno

F Enlever les vis goujon (18) de guidage du piston(10).
ATTENTION! Si les vis doivent être remplacées, prendre note de la couleur de distinction des jeux

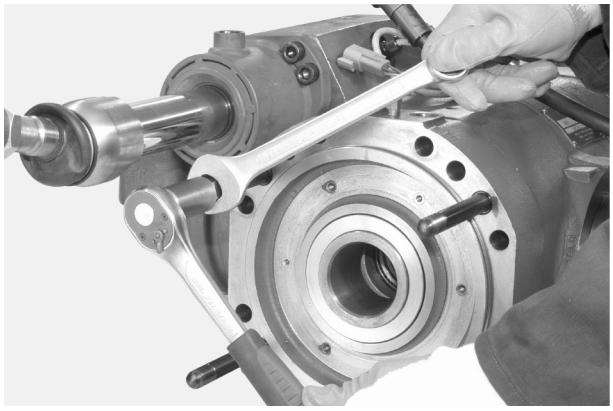
f

ITA Annotare l’ordine di montaggio e rimuovere il controdisco (11).

D Auf die Reihenfolge der Montage und achten Gegenscheibe (11) abnehmen .

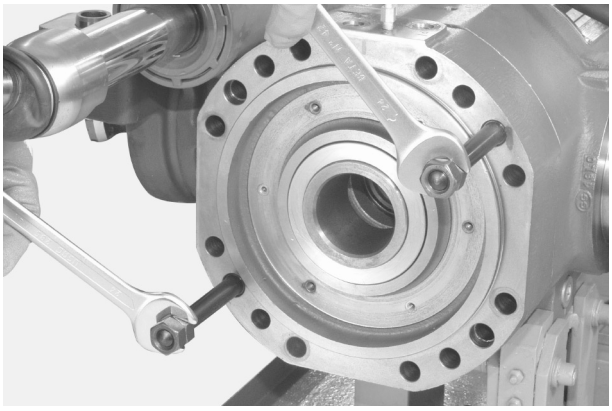
ESP Anotar el orden de montaje y remover los contradisco (11).

F Prenant note de l’ordre de montage, enlever les contre-disque (11).



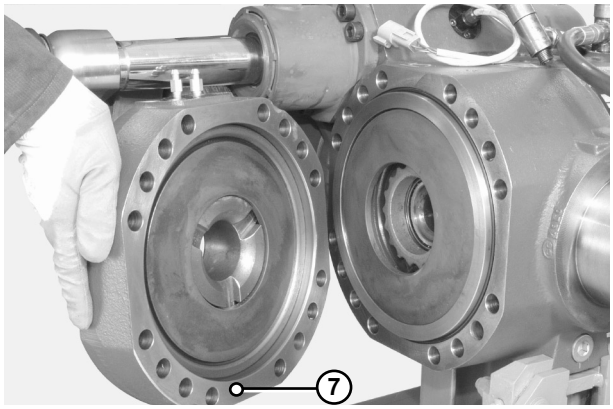
GB a

Loose the studs and remove two of them.



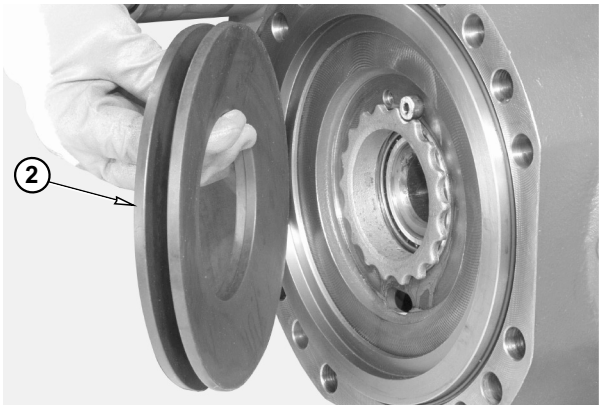
GB b

Remove the studs



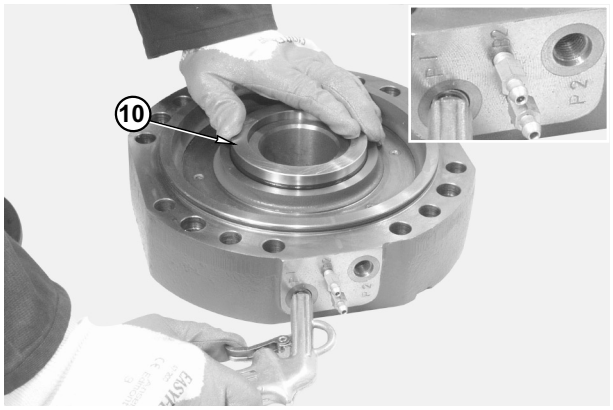
GB c

Move the cylinder (7) outwards while .



GB d

Remove the Belleville washers (2) and note down direction of assembly.



GB e

Slowly introduce low-pressure compressed air through the connection member for the service brake, in order to extract the piston (10).
CAUTION! Hold the piston (10) back, as it may be suddenly ejected and damaged.

GB f

NOTE. The O-rings must be replaced each time the unit is disassembled.

a

ITA Allentare i prigionieri ferma-coperchio e rimuoverne 2.

D Die Stiftschrauben lockern.
2 Stiftschrauben abnehmen.

ESP Aflojar los prisioneros.
Remover 2 prisioneros.

F Desserrer les prisonniers.
Enlever 2 prisonniers.

b

ITA Rimuovere i prigionieri.

D Stiftschrauben abnehmen.

ESP Remover prisioneros.

F Enlever prisonniers.

c

ITA Spostare verso l'esterno il cilindro (7).

D Den Zylinder (7) nach äußen verstellen.

ESP Desplazar hacia el esterior el cilindro (7).

F Dèplacer le cylindre (7) vers l 'extèrieur en soutenant le ressort belleville.

d

ITA Rimuovere le molle (2)ed annotare il senso di montaggio.

D Federn (2) a bnehmen und die Montagerichtung notieren.

ESP Remover los muelles (2) y anotar el sentido de montaje.

F Enlever le ressort (2) et prendre note du sens de son montage.

e

ITA Immettere lentamente aria compressa a bassa pressione attraverso l'attacco per il freno di servizio per estrarre il pistone (10).
ATTENZIONE! Trattenere il pistone (10) che può essere espulso velocemente ed essere
danneggiato.

D Langsam Druckluft bei Niederdruck durch den An schluû der Federspeicherbremse einlassen, um den Kölben (10) heraus zu drucken.
ACHTUNG! Den Kolben (10) halten, da er ploetzlich heraus springen und beschadigt werden koennte.

ESP Introducir lentamente aire comprimida a baja presiòn atraves el empalme por el freno negativo para sacar el piston (10).
ATENCION! Tener el piston (10) que puede ser expulso rapidamente y estropearse.

F Envoyer lentement de l'air comprimè a basse pression à travers le raccord du frein nègatif pour extraire le piston (10).
ATTENTION! Tenir le piston (10) qui pourrait è tre expulser rapidement et endommager.

f

ITA NOTA. Gli anelli OR devono essere sostituiti ad ogni smontaggio.

D BEMERKUNG. Die O-Ringe mue ssen jedesmal ausgewechselt werden, wenn das Teil zerlegt wird.

ESP NOTA. Los anillos OR deben de ser sobstituidos cada desmontaje.

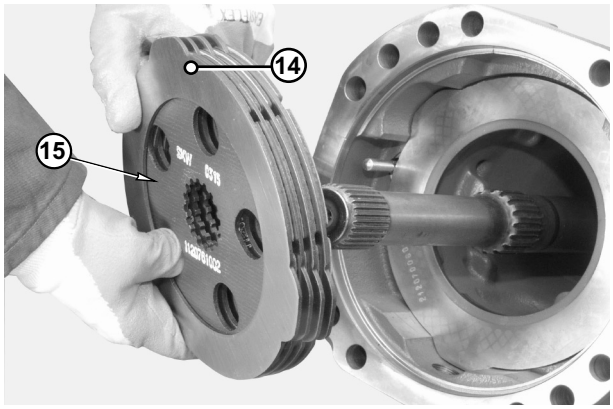
F REMARQUE. Les anneaux O'RING sont à substituer à chaque dè montage.

GB a

Note down their order of assembly and remove negative piston sign the position.

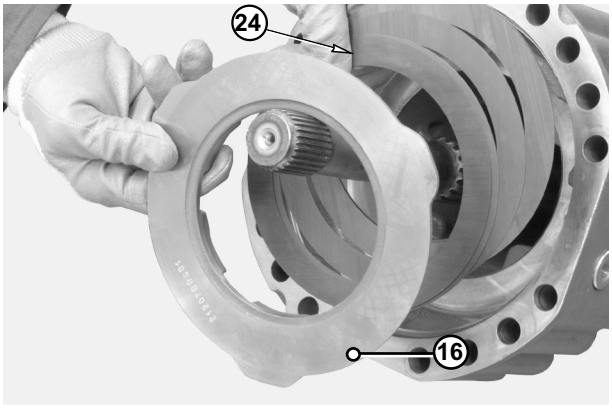
GB b

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 (3) back, as it may be suddenly ejected and damaged.



GB c

Remove braking discs (14) and (15), noting down direction of assembly.
NOTE. If disks are not to be replaced, avoid changing their position.



GB d

Remove braking discs (16) and shims (24) ,noting down direction of assembly.
NOTE. If disks are not to be replaced,avoid changing their position.

a

ITA Prima di rimuovere il pistone del freno negativo, segnare la posizione di montaggio.

D Auf die Bremse der Montage und achten Gegenscheibe (10) abnehmen .

ESP Anotar el orden de montaje y remover los freno (10).

F Prenant note de l 'ordre de montage, enlever les frein (10).

b

ITA Immettere lentamente aria compressa a bassa pressione attraverso l'attacco per il freno negativo per estrarre il pistone (3).
ATTENZIONE! Trattenere il pistone (3) che può essere espulso velocemente ed essere
danneggiato.

D Langsam Druckluft bei Niederdruck durch den An schluû der Federspeicherbremse einlassen, um den Kolben (3) heraus zu drucken.
ACHTUNG! Den Kolben (3) halten, da er ploetzlich heraus springen und beschadigt werden koennte.

ESP Introducir lentamente aire comprimida a baja presiòn atraves el empalme por el freno negativo para sacar el piston (3).
ATENCION! Tener el piston (3) que puede ser expulso rapidamente y estropearse.

F Envoyer lentement de l'air comprimè a basse pression à travers le raccord du frein nègatif pour extraire le piston (3).
ATTENTION! Tenir le piston (3) qui pourrait è tre expulser rapidement et endommager.

c

ITA Rimuovere i dischi di frenatura (14) e (15) annotando l'ordine di montaggio.
NOTA. Se i dischi non devono essere sostituiti, evitare lo scambio di posizione.

D Bremsscheiben (14) und (15) abnehmen und Montagerichtung notieren.
BEMERKUNG. Falls die Scheiben ausgewechselt werden mussen, ihre Position nicht verwechseln.

ESP Remover los discos de frenadura (14) y (15) anotando el orden de montaje.
NOTA. Si los discos no deben de ser sobstituidos, evitar el cambio de possiciòn.

F Enlever les disques de freinage (14) et (15) et prendre note de l'ordre du montage.
REMARQUE. Si les disques doivent étre substitués, éviter d'échanger leur position.

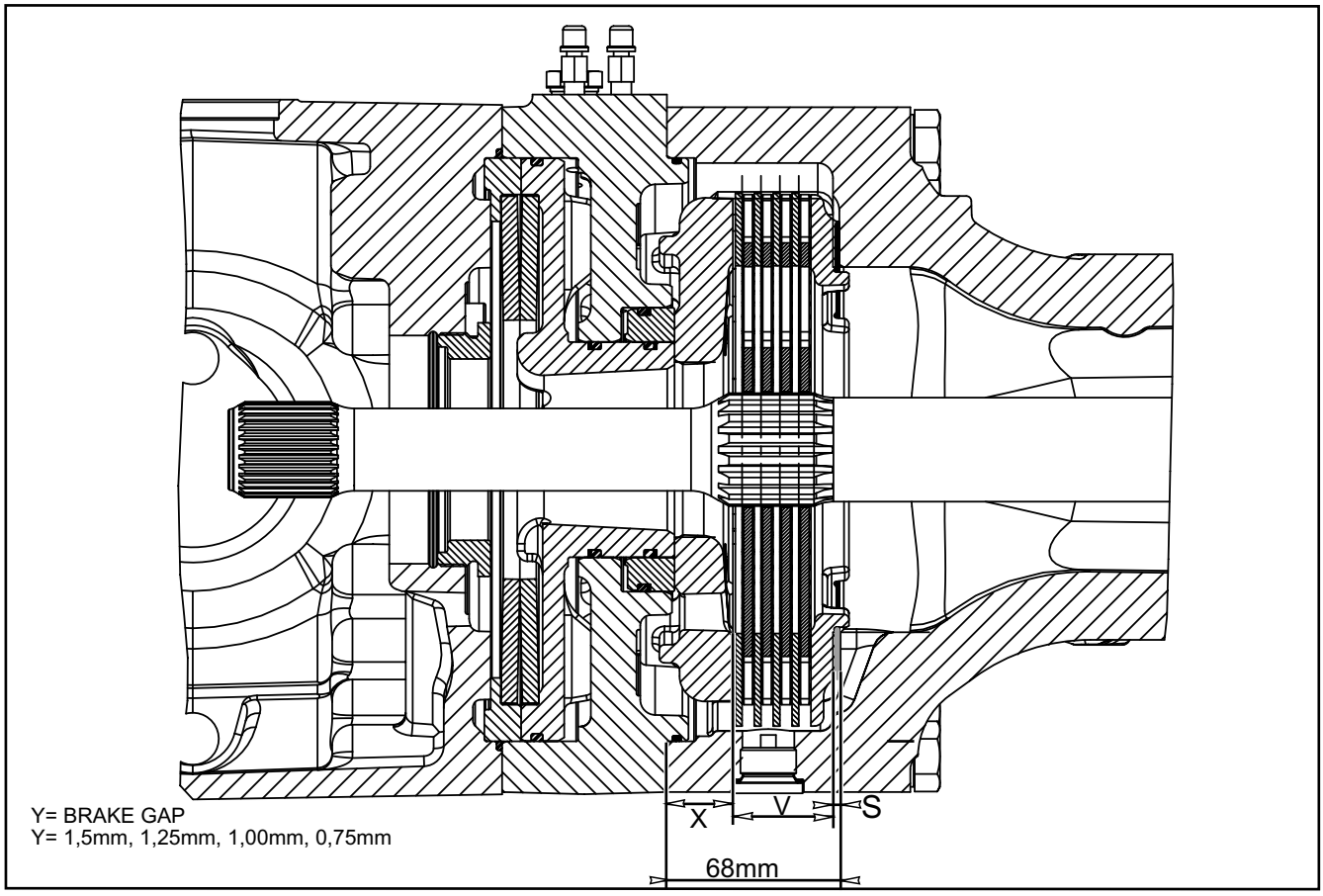
d

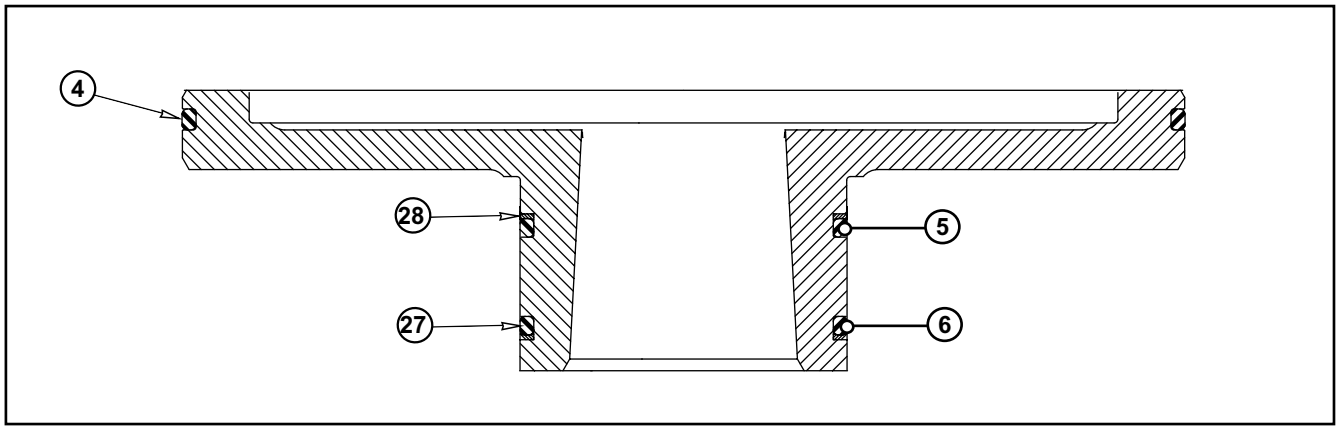
ITA Rimuovere i dischi di frenatura (16)e spessori (24) annotando l 'ordine di montaggio.
NOTA.Se i dischi non devono essere sostituiti, evitare lo scambio di posizione.

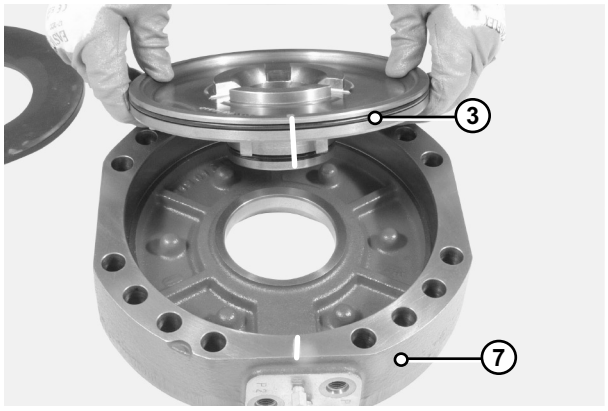
D Bremsscheiben (16)und Scheibe (24) abnehmen und Montagerichtung notieren.
BEMERKUNG.Falls die Scheiben ausgewechselt werden mussen,ihre Position nicht verwechseln.

ESP Remover los discos de frenadura (16) y espesores (24) anotando el orden de montaje.
NOTE.Si los discos no deben de ser sobstituidos,evitar el cambio de possiciòn.

F Enlever les disques de freinage (16)et cales (24) et prendre note de l 'ordre du montage.
REMARQUE.Si les disques doivent étre substitués,éviter d 'échanger leur position.

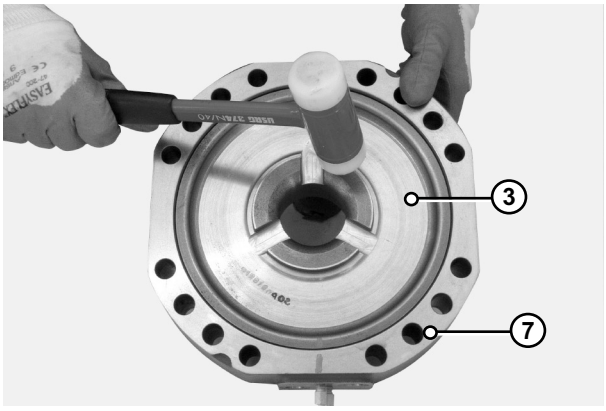






GB e

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).



GB f

Using a plastic hammer, ram the piston (3) into the cylinder (7).
NOTE. Lightly hammer all around the edge in an alternate sequence.

e

ITA Montare sul pistone (12) gli anelli OR (4)(28)(27)(5)(6).
Lubrificare il pistone e gli anelli OR e montare il gruppo nel cilindro (7).

D Auf den Kolben (12) die O-Ringe (4)(28)(27)(5)(6) montieren.
Den Kolben und die O-Ringe schmieren und das Aggregat in den Zylinder (7) montieren.

ESP Montar sobre el piston (3) los anillos OR(4)(28)(27)(5)(6).
Lubrificar el piston y los anillos OR y montar el grupo en los cilindros (7).

F Monter sur le piston (3), les anneaux O'RING (4)(28)(27)(5)(6).
Lubrifier le piston et les anneaux O'RING, puis monter le groupe dans le cylindre (7).

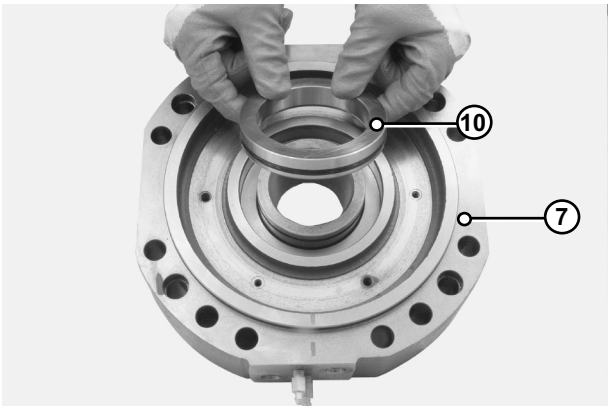
f

ITA Utilizzando un mazzuolo in materiale plastico, inserire a fondo il pistone (12) nel cilindro (10).
NOTA. Battere leggeri colpi distribuiti in modo alternato su tutta la circonferenza.

D Mit einem Gummihammer den Kolben (12) in den Zylinder (10) bis zum Anschlag einschlagen.
BEMERKUNG. Den Kolben abwechselnd rund um die gesamte Kreislinie leicht schlagen.

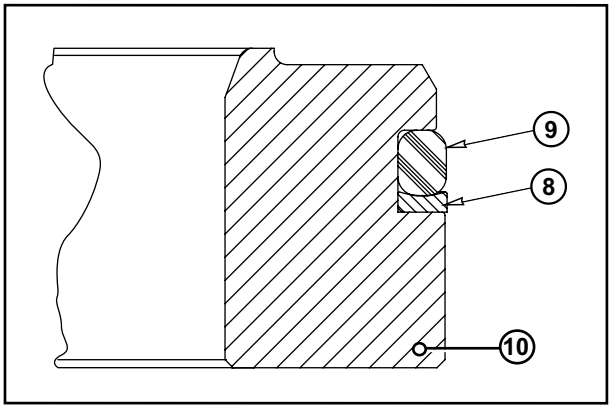
ESP Utilizando un martillo de materia plastica, introducir a fondo el piston (12) en el cilindro (10).
NOTA. Pegar ligeros golpes distribuidos de manera alternada sobre toda la circonferencia.

F A l'aide d'un maillet en matie Á re plastique, introduire le piston (12) aÁ fond dans le cylindre (10).
REMARQUE. Donner de le Â gers coups re Â guliers tout autour de la circonfeÂ rence.

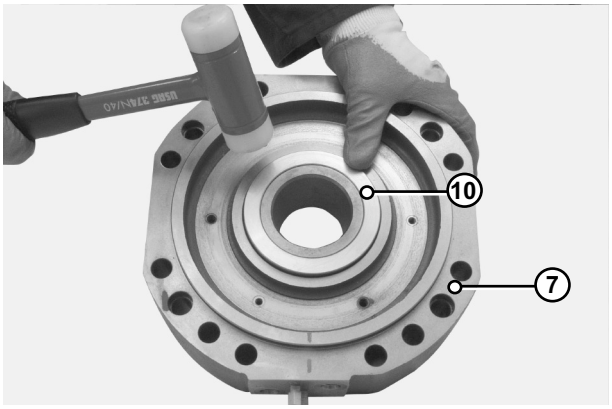


GB a

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).



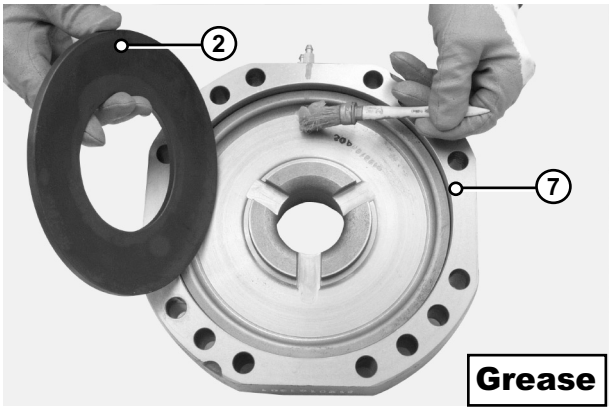
GB b



GB c

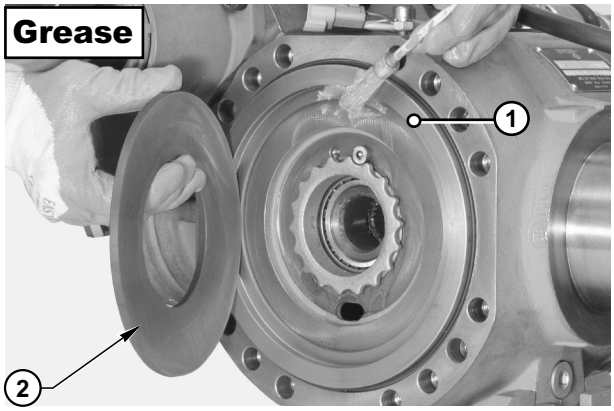
Using a plastic hammer, ram the piston (10) into the cylinder (7).
NOTE. Lightly hammer all around the edge in an alternate sequence.

GB d



GB e

Position the Belleville washers (2) and engage the cylinder (7).
NOTE. Check the sense of direction of washers (7) and relative centring.



GB f

Position the Belleville washers (2) and engage the cylinder (1).
NOTE.Check the sense of direction of washers (2) and relative centring.

a

ITA Montare sul pistone (10) gli anelli OR (9) e (8). Lubrificare il pistone e gli anelli OR e montare il gruppo nel cilindro (7).

D Auf den Kolben (10) die O-Ringe (9) und (8) montieren.
Den Kolben und die O-Ringe schmieren und das Aggregat in den Zylinder (7) montieren.

ESP Montar sobre el piston (10) los anillos OR (9) y (8). Lubrificar el piston y los anillos OR y montar el grupo en los cilindros (7).

F Monter sur le piston (10), les anneaux O'RING (9) et (8).
Lubrifier le piston et les anneaux O'RING, puis monter le groupe dans le cylindre (7).

c

ITA Utilizzando un mazzuolo in materiale plastico, inserire a fondo il pistone (10) nel cilindro (7).
NOTA. Battere leggeri colpi distribuiti in modo alternato su tutta la circonferenza.

D Mit einem Gummihammer den Kolben (10) in den Zylinder (7) bis zum Anschlag einschlagen.
BEMERKUNG. Den Kolben abwechselnd rund um die gesamte Kreislinie leicht schlagen.

ESP Utilizando un martillo de materia plastica, introducir a fondo el piston (10) en el cilindro (7).
NOTA. Pegar ligeros golpes distribuidos de manera alternada sobre toda la circonferencia.

F A l'aide d'un maillet en matiére plastique, introduire le piston (10) à fond dans le cylindre (7).
REMARQUE. Donner de légers coups règuliers tout autour de la circonférence.

e

ITA Posizionare le molle a tazza (2) e mandare in battuta il cilindro (7).
NOTA. Controllare il senso di orientamento delle molle a tazza (2) e la loro centratura.

D Tellerfedern (2) positionieren und den Zylinder (7) bis zum Anschlag einsetzen.
BEMERKUNG. Orientierung der Tellerfedern (2) und ihre Zentrierung kontrollieren.

ESP Colocar los muelles a taza (2) y mandar a tope el cilindro (7).
NOTA. Controlar el sentido de orientamiento de los muelles a taza (2) y su centraje.

F Positionner les ressorts belleville (2) et insérer à fond le cylindre (7).
REMARQUE. Contrôler l'orientation des ressorts belleville (5) et leur centrage.

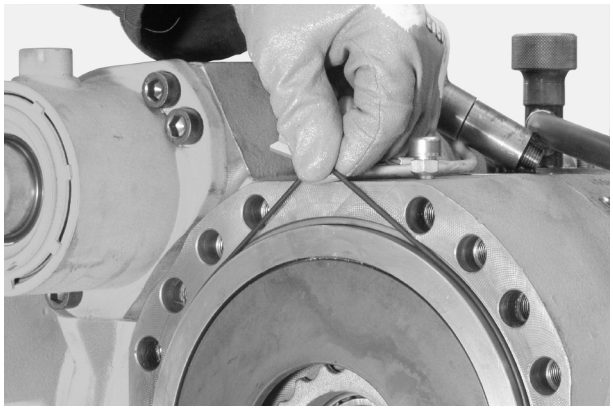
f

ITA Posizionare le molle a tazza (2)e mandare in battuta il cilindro (1).
NOTA.Controllare il senso di orientamento delle molle a tazza (2)e la loro centratura.

D Tellerfedern (2)positionieren und den Zylinder (1)bis zum Anschlag einsetzen.
BEMERKUNG.Orientierung der Tellerfedern (2) und ihre Zentrierung kontrollieren.

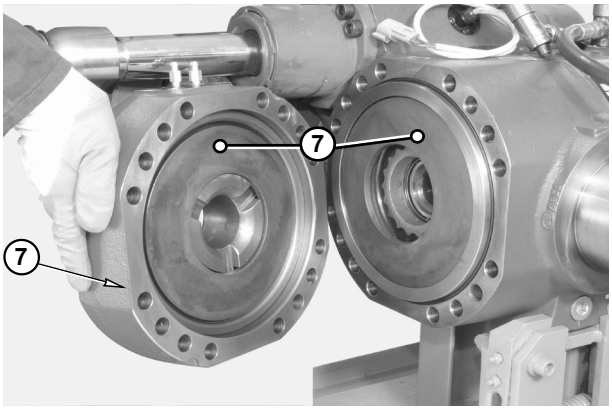
ESP Colocar los muelles a taza (2) y mandar a tope el cilindro (1).
NOTA.Controlar el sentido de orientamiento de los muelles a taza (2)y su centraje.

F Positionner les ressorts belleville (2) et insérer à fond le cylindre (1).
REMARQUE.Contrôler l 'orientation des ressorts belleville (2)et leur centrage.



GB a

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

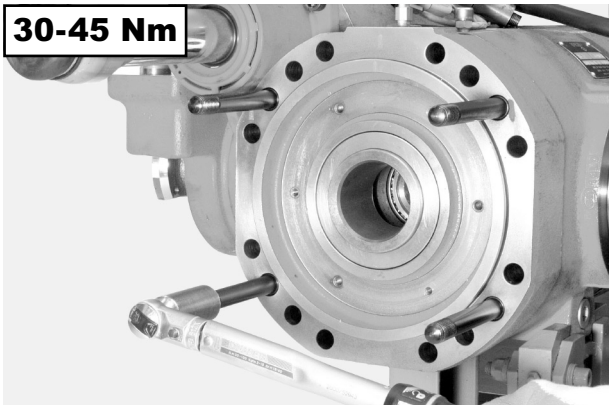


GB b

Position the Belleville washers (2) and engage the cylinder (7).
NOTE. Check the sense of direction of washers (2) and relative centring.

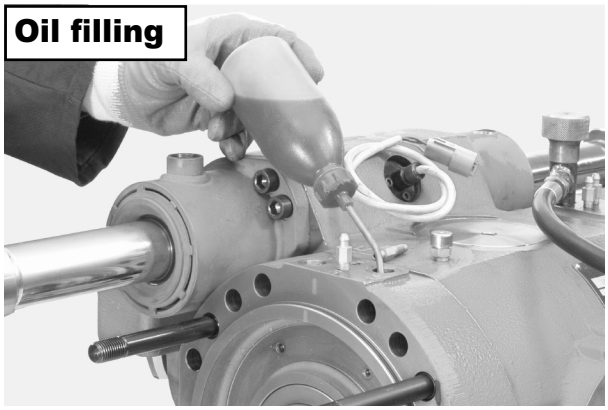
GB c

Lock the cylinder.

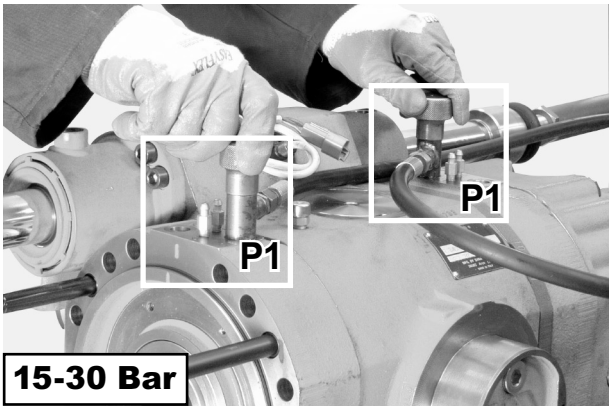


GB d

Tightening the studs with a dynamometric wrench set to a torque of 30 ± 45 Nm.



GB e



GB f

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

a

ITA Verificare l'integrità ed il posizionamento dell'anello OR.

D Zustand und die Position des O-Ringes kontrollieren;

ESP Averiguar la integridad y la colocaciòn del anillo OR.

F Vérifier le bon état et le positionnement de l'anneau O'RING.

b

ITA Posizionare le molle a tazza (2) e mandare in battuta il cilindro (7).
NOTA. Controllare il senso di orientamento delle molle a tazza (2) e la loro centratura.

D Tellerfedern (2) positionieren und den Zylinder (7) bis zum Anschlag einsetzen.
BEMERKUNG. Orientierung der Tellerfedern (2) und ihre Zentrierung kontrollieren.

ESP Colocar los muelles a taza (2) y mandar a tope el cilindro (7).
NOTA. Controlar el sentido de orientamiento de los muelles a taza (2) y su centraje.

F Positionner les ressorts belleville (2) et insérer à fond le cylindre (7).
REMARQUE. Contrôler l'orientation des ressorts belleville (2) et leur centrage.

c

ITA Bloccare il cilindro.

D Den Zylinder blockieren.

ESP Bloquear el cilindro.

F Bloquer le cylindre.

d

ITA Bloccare il cilindro con le viti serrate con chiave dinamometrica ad un coppia di 30-45 Nm.

D Den Zylinder mit den Schrauben mit einem Dynamometer und einem Anzugsmoment von 30-45 Nm blockieren.

ESP Bloquear el cilindro con los tornillos apretados con llave dinamometrica a un par de 30-45 Nm.

F Bloquer le cylindre avec les vis, serrer à l'aide de la clé dynamométrique à un couple de 30-45 Nm.

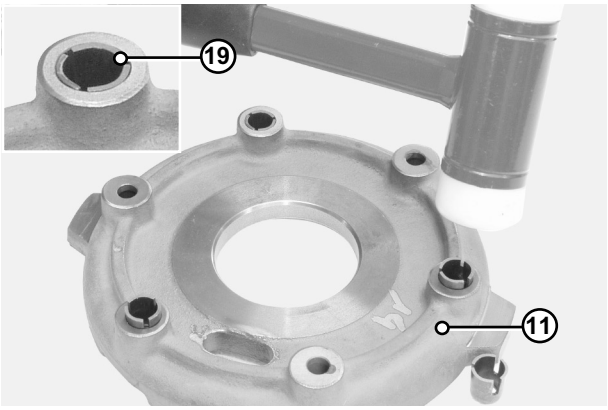
f

ITA Collegare al raccordo del freno negativo una pompa esterna ed immettere una pressione di 15-30 bar.

D An das Anschlüstück der Federspeicherbremse eine äußere Pumpe schlieün und Druck bei 15-30 bar einlassen.

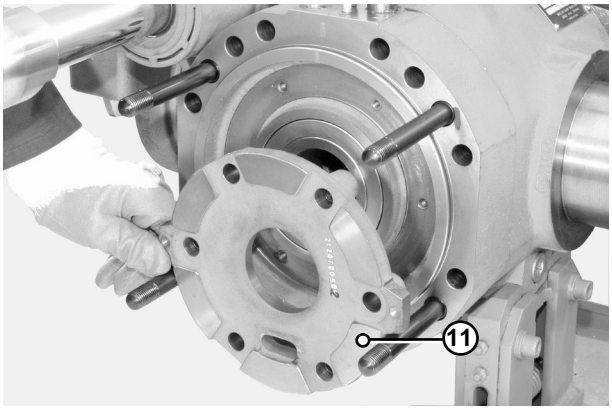
ESP Conectar al empalme del freno negativo una pompa externa y introducir presion de 15-30 bar.

F Brancher au raccord du frein négatif une pompe externe et envoyer une pression de 15-30 bar.



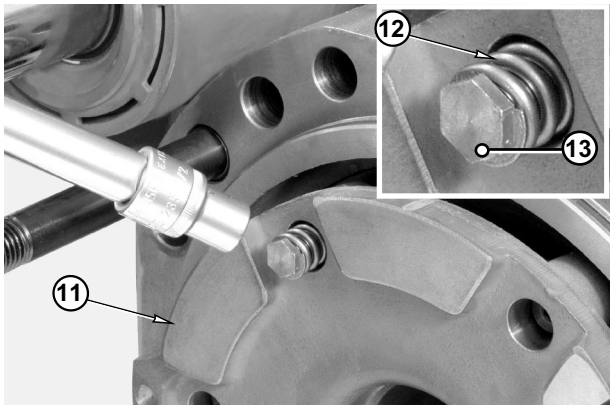
GB a

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



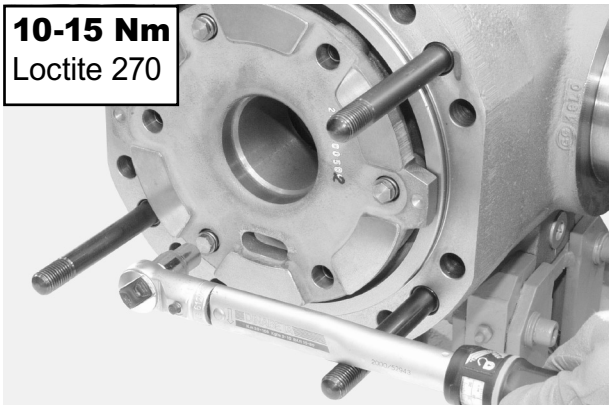
GB b

Insert the intermediate disk (11).



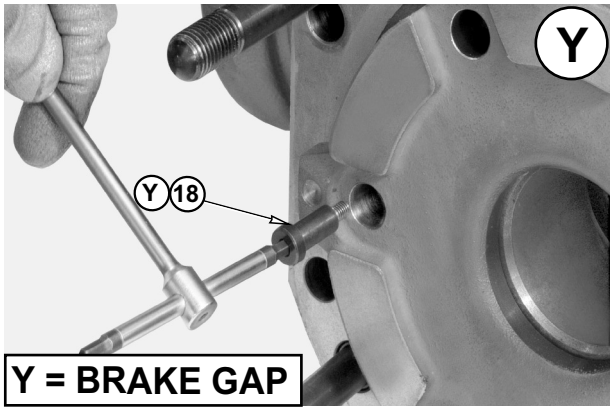
GB c

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



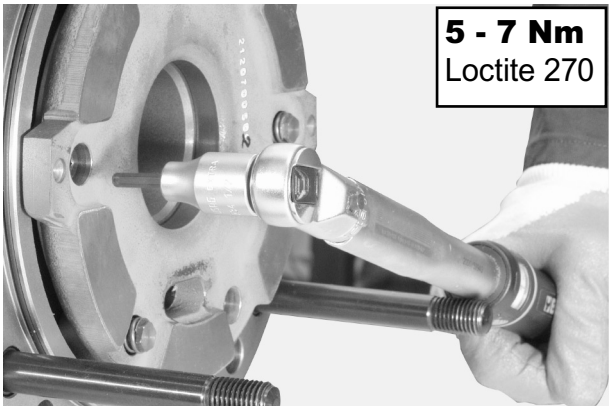
GB d

Apply LOCTITE 270 to the thread of the pistion adjustment nut.
Tighten with torque wrench setting of 10 - 15 Nm



GB e

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



GB f

Fit the pin screws making sure that they are all of the same colour.
Apply Loctite 270 to the thread.
Torque wrench setting: 5±7 Nm.

a

ITA Inserire a filo del pistone (11) le molle per l'autoregolazione della corsa (19).

D Den Kolben (11) und die Federn (19) zur Selbstregelung des Hubs genau einsetzen.

ESP Introducir a ras del pistòn (11) los muelles (195) para la autorregulaciòn de la carrera.

F Introduire, au fil du bord du piston (11) les ressorts (19) pour l'autorégulation de la course.

b

ITA Inserire il disco intermedio del pistone (11).

D Mittlere Scheibe montieren (11).

ESP Montar el disco intermedio (11).

F Monter le disque Intermédiaire (11).

c

ITA Montare le molle (12)(13) di ritorno del pistone(11).

D Die Rückzugsfedern (12)(13) des Kolbens (11) montieren.

ESP Montar los muelles (12)(13) de retorno del pistón (11).

F Monter les ressorts (12)(13) de retour du piston (11).

d

ITA Spalmare la filettatura con LOCTITE 242 sulla vite ritorno pistone. Serrare a coppia di serraggio 10-15Nm.

D Auf das Gewinde der Zylinder-Rückholmutter LOCTITE 270 auftragen.
Mit 10 - 15 Nm Anzugsmoment anziehen.

ESP Untar la rosca del tornillo de retorno del pistòn con LOCTITE 242 y apretar a par de torsion 10-15 Nm.

F Enduire le filetage avec Loctite 242 sûr la vis de retour piston. Serrer a couple 10-15 Nm.

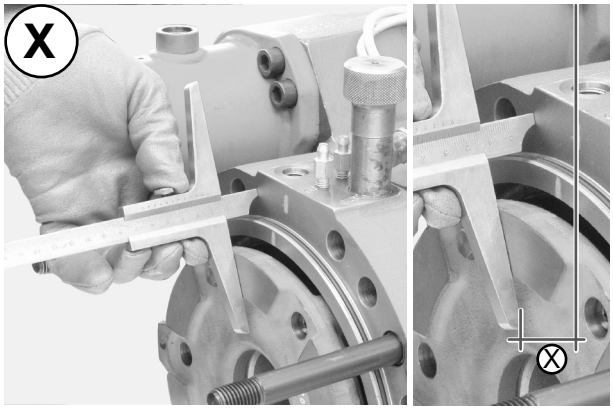
f

ITA Montare le viti a perno controllando che siano tutte dello stesso colore:
Spalmare la filettature con Loctite 270
Coppia di serraggio : 5:7

D Die Stiftschrauben einsetzen. Diese muèssen alle gleichfarbig sein.
Das Gewinde mit Loctite 270 schmieren.
Anzugsmoment: 7 Nm.

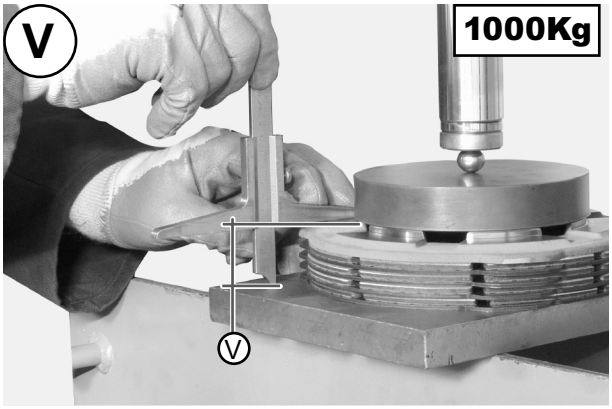
ESP Montar los pernos roscados controlando que sean todos del mismo color.
Pasar en la rosca Loctite 270.
Par de torsiòn: 7 Nm.

F Monter les vis àtourillon en contròlant si elles sont toutes de ma méme couleur.
Enduire le filetage de Loctite 270.
Couple de serrage: 7 Nm.



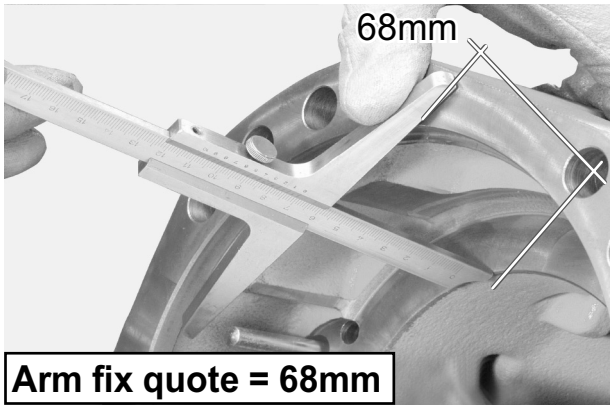
GB a

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



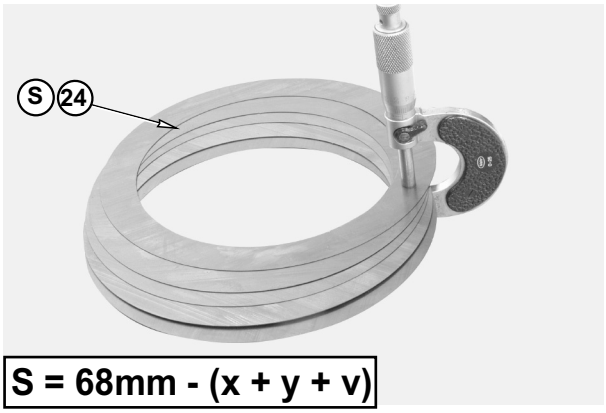
GB b

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



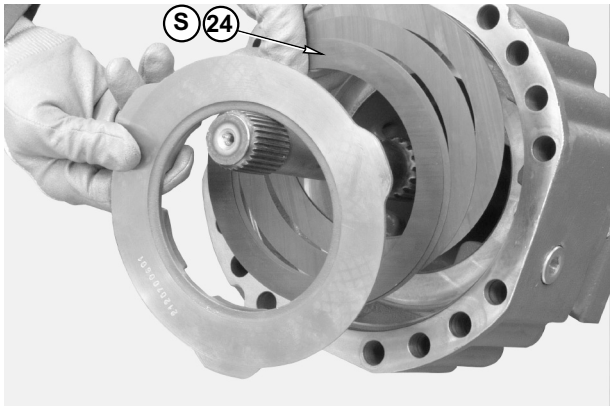
GB c

Arm fix quote = 68 mm



GB d

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



GB e

a

ITA Con pressione inserita 30bar rilevare la misura tra disco intermedio e coperchio.
ESEMPIO: 25,4mm

D Bei angelegtem Druck von 30 bar, das Maß von der Zwischenscheibe zur Deckelfläche ermitteln.

ESP Con la presion a 30 Bar medir la distancia enre el disco intermedio y la tapa.

F En donnant pressure de 30 Bar relever la mesure enre le flasque intermediaire et couvercle .
Example: 25,4mm

b

ITA Posizionare il pacco freni completo di distanziale sotto la pressa,
caricare con 1000Kg e rilevare la misura “V”.
ESEMPIO: V = 40mm

D Das Bremsscheibenpaket komplett mit Distanzstück unter eine Presse legen, mit 1000 kg belasten und das Maß “V” ermitteln.
EXAMPLE: V = 40mm

ESP Poner el paquete de frenos(discos) completo con el distancial. Debajo la prensa cargar con 1000Kg e medir la distanca V.
Ejemplo: V = 40mm

F Positionner le sabot des freins avèc la entretoise sous la presse.

c

ITA Quota fissa per il braccio = 68 mm

D Festes Maß = 68 mm

ESP Profundidad fija para el brazo = 68mm

F Mesure fix pou le bras: 68mm

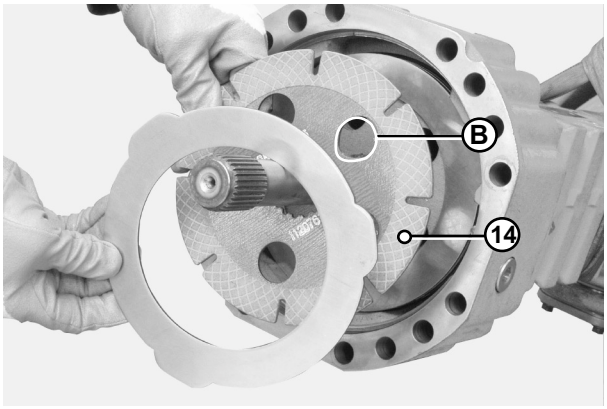
d

ITA **S = 68mm - (x + y + v)** = Spessori da inserire sotto il distanziale.

D **S = 68mm - (x + y + v)** = Maß der Zwischenlegs-cheiben, die unter die Distanzscheibe gelegt werden müssen.

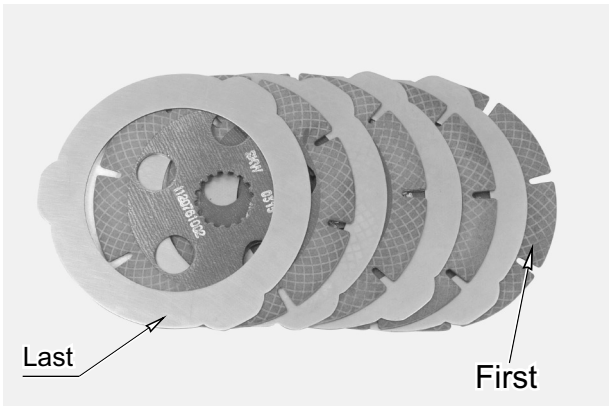
ESP **S = 68mm - (x + y + v)** = Espesores para poner debajo del distancial.

F **S = 68mm - (x + y + v)** = èpaisseurs de èposition sous la entretoise.

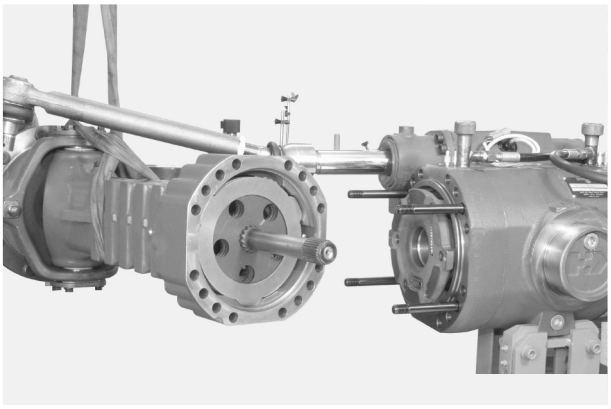


GB a

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 perfectly lined up.
NOTE. When installing the steel discs, the slot corresponding to the oil level cap should always be kept free.

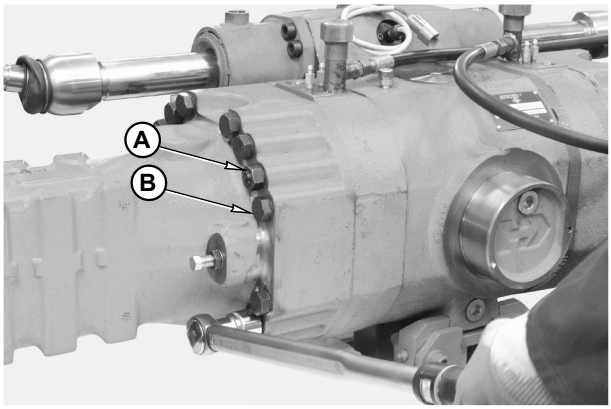


GB b



GB c

Check integrity and position of the arm’s O-ring; install the complete arm.
NOTE. To assist axle shaft centring, slightly move the wheel hub.



GB d

Torque wrench setting:
A = 200 Nm
B = 283 Nm.
NOTE.Tighten using the criss-cross method.

ITA Lubrificare leggermente i dischi di frenatura (14) e montarli nella corona
con la giusta sequenza, orientati in modo che i fori ovali ‘B’ siano perfettamente allineati.

D Die Bremsscheiben (14) leicht schmieren und in der richtigen Reihenfolge auf den Arm montieren. Dabei mùssen sie so orientiert sein, daû Oélleitungslòcher genau mit den Kennzeichnungen “B” ùbereinstimmen.
BEMERKUNG. Bei der Montage der Stahlscheiben die dem Oèl-fùllstopfen entspricht, freilassen.

a

ESP Lubricar ligeramente los discos de frenado (14) y montarlos en el brazo con la secuencia exacta, orientados de manera que los orificios de circulaciòn del aceite y las marcas “B” estèn perfectamente alineados.
NOTA. Los discos en acero deben de ser asemblados dejando libre el nicho correspondiente a la tapa de nivel aceite.

F Lubrifier lègèrement les disques de freinage (14), puis monter ceux-ci dans le bras àla juste séquence, orientés de telle sorte àce que les trous de circulation de l’huile et ceux marqués “B” soient parfaitement alignés.
NOTE. Les disques en acier doivent étre montés sans déranger la rainure du bouchon du niveau de l’huile.

ITA Verificare l’integrità ed il posizionamento dell’anello OR del braccio; installare il braccio completo.
NOTA. Per agevolare la centratura del semiasse, muovere lentamente il mozzo portaruota.

D Am Arm den Zustand und die Position des O-Ringes kontrollieren; den gesamten Arm installieren.
BEMERKUNG. Um die Halbachse leichter zentrieren zu können, die Radhalternabe etwas bewegen.

c

ESP Averiguar la integridad y la colocaciòn del anillo OR (23) del eje; colocar el eje completo.
NOTA. Para facilitar el centraje del semi-eje, mover lentamente el cubo porta-rueda.

F Vérifier le bon état et le positionnement de l’anneau O’RING du bras; installer le bras complet.
REMARQUE. Afin de rendre plus aisé le centrage du demi-essieu, bouger lentement le moyeu porte-roue.

ITA Coppia di serraggio:
A = 200 Nm
B = 283 Nm
NOTA. Serrare con il metodo incrociato.

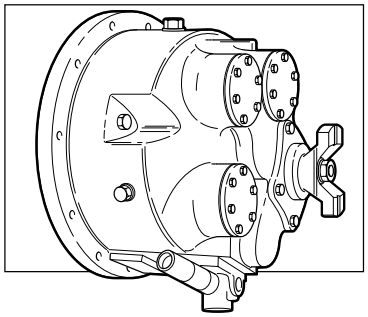
D Anzugsmoment:
A = 200 Nm
B = 283 Nm
BEMERKUNG.Im Kreuz fest drehen.

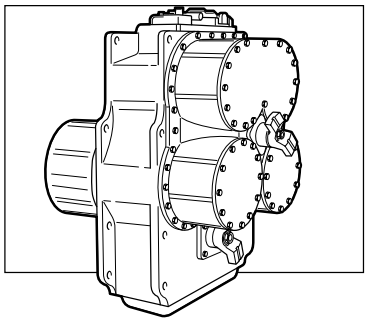
d

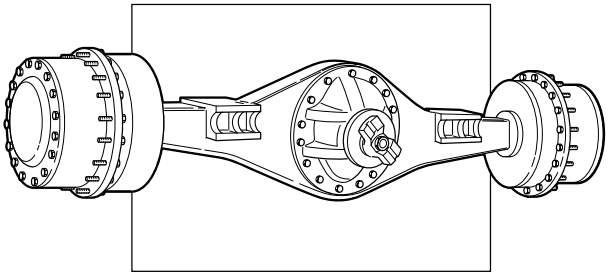
ESP Par de serraje:
A = 200 Nm
B = 283 Nm
NOTA.Apretar de manera cruzada.

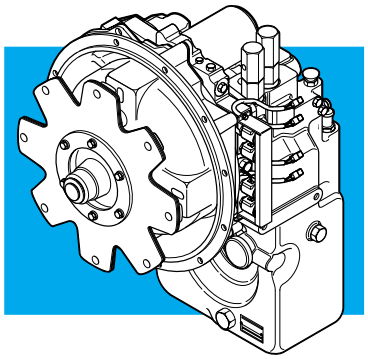
F Couple de serrage:
A = 200 Nm
B = 283 Nm
REMARQUE.Serrer avec la méhode croise.

Maintenance and Service Manual









T12000
Powershift Transmission

3, 4 & 6 SPEED INTERMEDIATE DROP

SPICER® OFF HIGHWAY-PRODUCTS™

People Finding A Better Way®

814967

TOWING OR PUSHING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

Note

IF THE TRANSMISSION HAS 4 WHEEL DRIVE, DISCONNECT BOTH FRONT AND REAR DRIVELINES. BECAUSE OF THE DESIGN OF THE HYDRAULIC SYSTEM, THE ENGINE CANNOT BE STARTED BY PUSHING OR TOWING.

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FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the ***SPICER OFF-HIGHWAY PRODUCTS*** product.

Extreme care has been exercised in the design, selection of materials, and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, its principle of operation, troubleshooting and adjustments, it is urged that the mechanic studies the instructions in this manual carefully and uses it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only ***SPICER OFF-HIGHWAY PRODUCTS*** approved parts as listed in the applicable parts manual should be used. Use of “will-fit” or non-approved parts may endanger proper operation and performance of the equipment. ***SPICER OFF-HIGHWAY PRODUCTS*** does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by ***SPICER OFF-HIGHWAY PRODUCTS*** .

IMPORTANT

ALWAYS FURNISH THE DISTRIBUTOR WITH THE SERIAL AND MODEL NUMBER WHEN ORDERING PARTS.

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1. SAFETY PRECAUTIONS

To reduce the chance of personal injury and/or property damage, the following instruction must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the machine. If replacement parts are required the part must be replaced by a spare part which has the same part number or with an equivalent part. Do not use a spare part of lesser quality.

The service procedures recommended in this manual are effective methods for performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a spare part, service procedure or tool, which is not recommended by ***SPICER OFF-HIGHWAY PRODUCTS***, must first determine that neither his safety nor the safe operation of the machine will be jeopardized by the spare part, service procedure or tool selected.

IMPORTANT

IT IS IMPORTANT TO NOTE THAT THIS MANUAL CONTAINS VARIOUS 'CAUTIONS' AND 'NOTICES' THAT MUST BE CAREFULLY OBSERVED IN ORDER TO REDUCE THE RISK OF PERSONAL INJURY DURING SERVICE OR REPAIR, OR THE POSSIBILITY THAT IMPROPER SERVICE OR REPAIR MAY DAMAGE THE UNIT OR RENDER IT UNSAFE. IT IS ALSO IMPORTANT TO UNDERSTAND THAT THESE 'CAUTIONS' AND 'NOTICES' ARE NOT EXHAUSTIVE, BECAUSE IT IS IMPOSSIBLE TO WARN ABOUT ALL THE POSSIBLE HAZARDOUS CONSEQUENCES THAT MIGHT RESULT FROM FAILURE TO FOLLOW THESE INSTRUCTIONS.

2. CLEANING, INSPECTION AND LEGEND SYMBOLS

2.1 CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION

CARE SHOULD BE EXERCISED TO AVOID SKIN RASHES, FIRE HAZARDS, AND INHALATION OF VAPOURS WHEN USING SOLVENT TYPE CLEANERS.

2.1.1 Bearings

Remove bearings from cleaning fluid and strike flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

2.1.2 Housings

Clean interior and exterior of housings, bearing caps, etc…, thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

CAUTION

CARE SHOULD BE EXERCISED TO AVOID INHALATION OF VAPOURS AND SKIN RASHES WHEN USING ALKALI CLEANERS.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal fillings, contaminated oil, or lapping compound.

2.2 INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

2.2.1 Bearings

Carefully inspect all rollers: cages and cups for wear, chipping, or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

2.2.2 Oil Seals, Gaskets, Etc.

Replacement of spring load oil seals, “O”-rings, metal sealing rings, gaskets, and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. When assembling new metal type sealing rings, these should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all “O”-rings and seals with recommended type Automatic Transmission Fluid before assembly.

2.2.3 Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

2.2.4 Housing, Covers, etc.

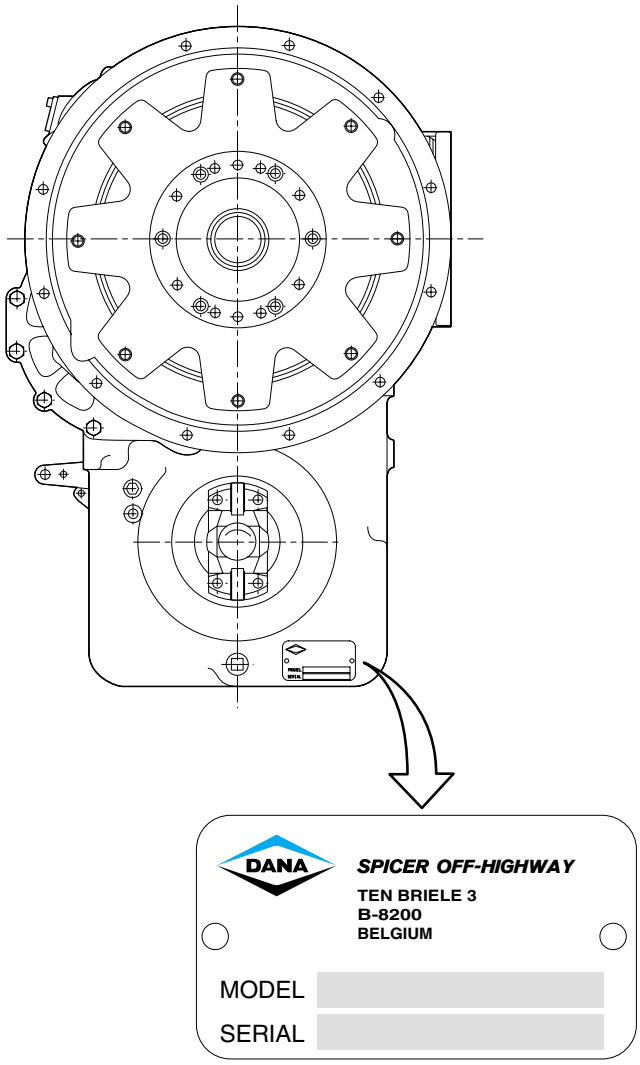
Inspect housings, covers and bearing caps to ensure that they are thoroughly clean and that mating surfaces, bearing bores, etc…, are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which would cause subsequent oil leaks or failures.

2.3 LEGEND SYMBOLS

	Smontaggio di sottogruppi Disassembly of assembly groups
	Montaggio di sottogruppi Reassemble to from assembly group
	Smontaggio di particollari ingombranti Remove obstruction parts
	Montaggio di particollari ingombranti Reinstall - remount parts which had obstructed disassembly
	Attenzione, indicazione importante Attention! important notice
	Controllare regolare p.e. coppie, misure, pressione etc. Check - adjust e.g. torque, dimensions, pressures etc.
	T = Attrezzature speciali P = Pagina T = Special tool P = Page
	Rispettare direzione di montaggio Note direction of installation
	Controllare esaminare controllo visuale Visual inspection
	Eventualimente riutilizzable (sostituire se necessario) Possibly still serviceable, renew if necessary

	Sostituire con ogni montaggio Renew at each reassembly
	Togliere - mettere la sicura Unlock - lock e.g. split pin, locking plate, etc.
	Mettere la sicura, incollare (mastice liquido) Lock - adhere (liquid sealant)
	Evitare danni ai materiali, danni ai pezzi Guard against material damage, damage to parts
	Marchiari prima dello smontaggio (per il montaggio) Mark before disassembly, observe marks when reasembl.
	Carricare riempire (olio - lubrificante) Filling - topping up - refilling e.g. oil, cooling water, etc.
	Scarricare olio, lubrificante Drain off oil, lubricant
	Tendere Tighten - clamp ; tightening a clamping device
	Insere pressione nel circuito idraulico Apply pressure into hydraulic circuit
	Pulire To clean

3. TECHNICAL SPECIFICATIONS



3.1 IDENTIFICATION OF THE UNIT

1. Model and type of the unit.

2. Serial number.

3.2 WEIGHT, DIMENSIONS, OIL CAPACITY

Weight (dry): ±174.6 kg (385 lb.)

	T-model	MT-model
Maximum length:	623.1 mm (24.53”)	712.5 mm (28.05”)
Maximum width:	477.0 mm (18.78”)	477.0 mm (18.78”)
Maximum height:	701.1 mm (27.60”)	701.1 mm (27.60”)

Oil capacity

±12.9 l (3.4 US Gallon) without cooler and hydraulic lines.

Consult operator’s manual on applicable machine for system capacity.

3.3 TIGHTENING TORQUES

3.3.1 Torque specifications for lubricated or plated screw threads

NOM. SIZE	GRADE 5			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
.2500	9 - 11	[12 - 15]	8 - 10	[11 - 14]
.3125	16 - 20	[22 - 27]	12 - 16	[16 - 22]
.3750	26 - 29	[35 - 39]	23 - 25	[31 - 34]
.4375	41 - 45	[56 - 61]	37 - 41	[50 - 56]
.5000	64 - 70	[87 - 95]	57 - 63	[77 - 85]
.5625	91 - 100	[123 - 136]	82 - 90	[111 - 122]
.6250	128 - 141	[174 - 191]	113 - 124	[153 - 168]
.7500	223 - 245	[302 - 332]	200 - 220	[271 - 298]

NOM. SIZE	GRADE 8			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
.2500	11 - 13	[15 - 18]	9 - 11	[12 - 15]
.3125	28 - 32	[38 - 43]	26 - 30	[35 - 41]
.3750	37 - 41	[50 - 56]	33 - 36	[45 - 49]
.4375	58 - 64	[79 - 87]	52 - 57	[71 - 77]
.5000	90 - 99	[122 - 134]	80 - 88	[108 - 119]
.5625	128 - 141	[174 - 191]	115 - 127	[156 - 172]
.6250	180 - 198	[224 - 268]	159 - 175	[216 - 237]
.7500	315 - 347	[427 - 470]	282 - 310	[382 - 420]

NOM. SIZE	GRADE 8.8 or 9.8		GRADE 10.9	
	COARSE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
M10	30 - 37	[40 - 50]	44 - 48	[60 - 65]
M12	50 - 55	[65 - 75]	74 - 81	[100 - 110]

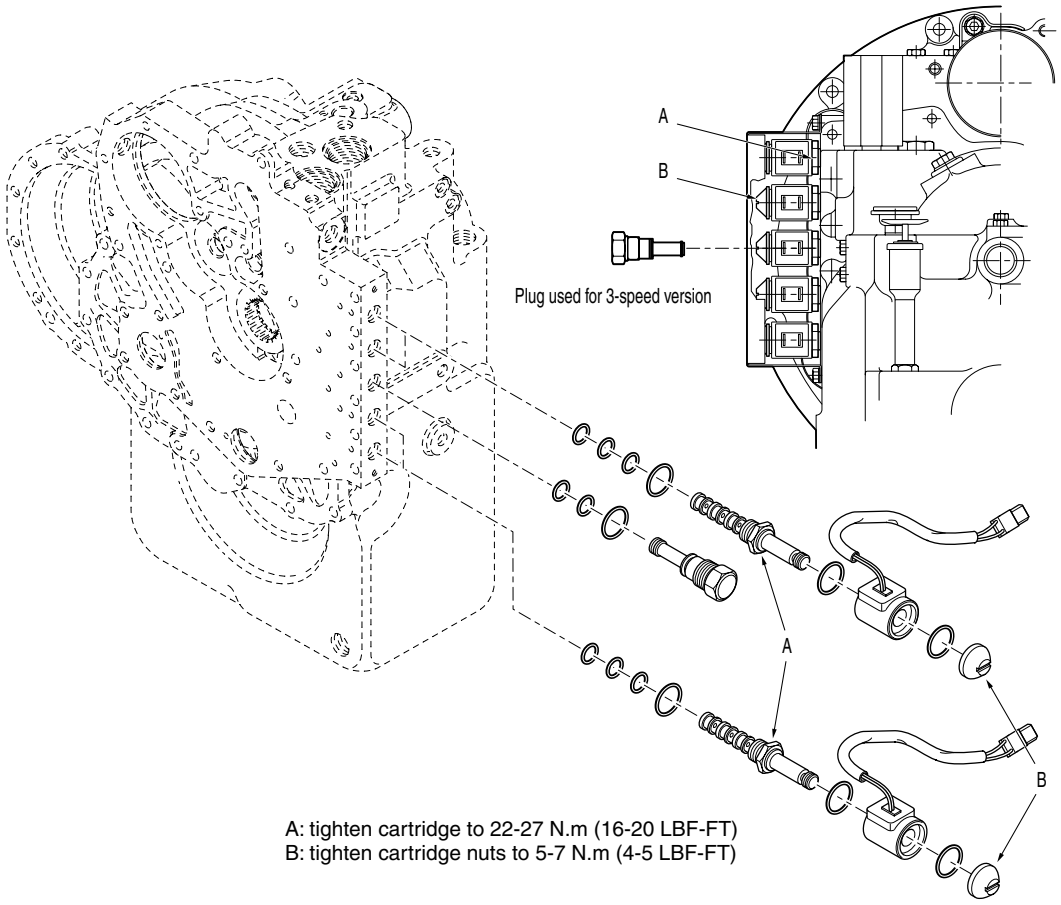
3.3.2 Pipe plug torque chart

THREAD NPTF	TORQUE	
	LBF - FT	[N.m]
1/16-27	5-7	[7-9]
1/8-27	7-10	[9-14]
1/4-18	15-20	[20-27]
3/8-18	25-30	[34-41]
1/2-14	30-35	[41-47]
3/4-10	40-45	[54-61]

3.3.3 Permanent metric plug torque chart

THREAD SIZE	TORQUE	
	LBF - FT	[N.m]
M18 x 1.5 6H	25-30	[34-41]
M18 x 1.5 6H	45-50	[61-68]

3.3.4 Coil and cartridge torque



A: tighten cartridge to 22-27 N.m (16-20 LBF-FT)
B: tighten cartridge nuts to 5-7 N.m (4-5 LBF-FT)

3.4 PRESSURE AND TEMPERATURE SPECIFICATIONS

- Normal operating temperature 70 - 120 °C (158 - 248 F) measured at temperature check port converter out (port 71 - **).
- Maximum allowed transmission temperature 120 °C (248 F).
- Transmission regulator pressure (*) - (neutral) - port 31 (**).
  - At 600 RPM min. 12.76 bar (185 PSI) minimum.
  - At 2000 RPM: 19.31 bar (280 PSI) maximum.

- Pump flow (*)
  - At 2000 RPM in neutral: 53 l/min. minimum (14 GPM).

- Clutch pressures (*)
  - 1st clutch: port 41 (**).
  - 2nd clutch: port 42 (**).
  - 3rd clutch: port 43 (**).
  - Forward High clutch: port 44 (**).
  - Forward clutch: port 45 (**).
  - Reverse clutch: port 46 (**).

  At 1800 RPM :
  - 16.5 - 19.3 bar (240 - 280 PSI) clutch activated.
  - 0 - 0.2 bar (0 - 3 PSI) clutch released.

- Filter bypass valve set at 2.1 - 3.5 bar (*) (30 - 50 PSI).
- Lube pressure (*) (port 33) 2.9 - 4.0 bar (42 - 58 PSI) at 49 l/min. (13 GPM) pump flow (±1850 RPM).
- Safety valve: cracking pressure (*) 8.27 - 10.20 bar (120 - 148 PSI), measured at port 32 with convertor out shut off.
- Transmission out pressure (*) (port 32) 2.9-6.41 bar (42-93 PSI) at 49 l/min, (13 GPM) pump flow (±1850 RPM), and max. 8.27 bar (120 PSI) at no load governed speed.

(*) All pressures and flows to be measured with oil temperature of 82-93 °C (180-200 F)

(**) Refer to section 7 “Troubleshooting” for check port identification.

3.5 ELECTRICAL SPECIFICATIONS

- Solenoid (forward, reverse, 1st, 2nd and splitter).

  Coil resistance:

  - 12V: 9.79 Ω ±0.5 Ω.
  - 24V: 39.3 Ω ±2 Ω.

- Speed sensor:
  - Type: magneto resistive sensor.
  - Sensing distance: 0 - 1.8 mm (0” - 0.07”).
  - Sensor signal: generates a square current with a fixed amplitude changing between 7 and 14 mA.

3.6 HYDRAULIC COOLER AND FILTER LINE SPECIFICATIONS

- Minimum 19 mm (.75”) internal diameter for lines and fittings.
- Suitable for operation from ambient to 120 °C (248 F) continuous operating temperature.
- Must withstand 20 bar (290 PSI) continuous pressure and with 40 bar (580 PSI) intermittent surges.
- Conform SAE J1019 and SAE J517, 100RI.

4. MAINTENANCE

4.1 OIL SPECIFICATION

4.1.1 Recommended lubricants

1.	Caterpillar	TO-4.
2.	John Deere	J20 C, D.
3.	Military	MIL-PRF-2104G.
4.	Allison	C-4.
5.	Dexron*	II Equivalent - See note below.

Note

DEXRON* II EQUIVALENT IS ACCEPTABLE; HOWEVER IT IS NOT COMPATIBLE WITH TORQUE CONVERTERS OR TRANSMISSIONS EQUIPPED WITH GRAPHITIC FRICTION MATERIAL CLUTCH PLATES.

Caution

DEXRON* III, ENGINE OIL OR GL-5 OILS ARE NOT RECOMMENDED.

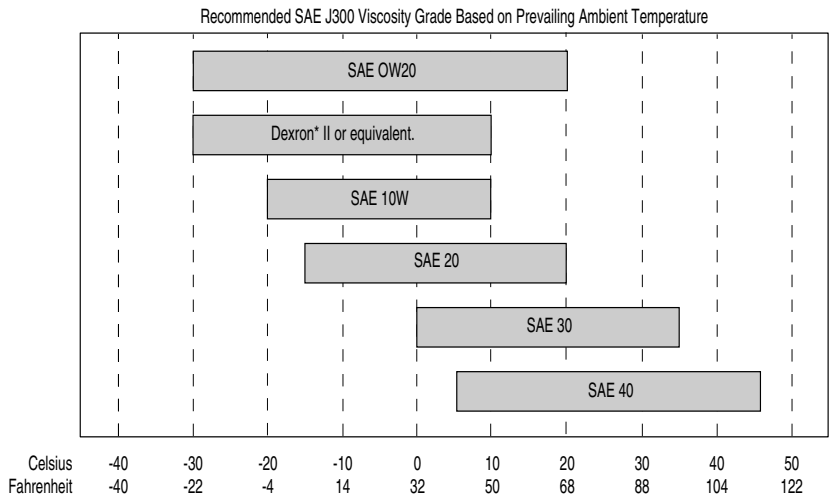
PREFERRED OIL VISCOSITY

It is recommended that the highest viscosity monograde lubricant available be used for the anticipated ambient temperature. Typically this will be a CAT TO-4 qualified lubricant. When large swings in ambient temperature are probable, J20 C, D multigrades are recommended. Multigrade lubricants should be applied at the lower viscosity rating for the prevailing ambient temperature, i.e. a 10W20 should be used where a 10W monograde is used. If a C-4 multigrade is used in stead of J20 lubricant it is recommended that the viscosity span no more than 10 points, i.e. 10W20.

Caution

SYNTHETIC LUBRICANTS ARE APPROVED IF QUALIFIED BY ONE OF THE ABOVE SPECIFICATIONS.
OIL VISCOSITY GUIDELINES APPLY, BUT SYNTHETIC MULTIGRADES MAY SPAN MORE THAN 10 POINTS.

FOR FIRE RESISTANT FLUID RECOMMENDATIONS PLEASE CONTACT ***SPICER OFF-HIGHWAY PRODUCTS***.



SUMP PREHEATERS

Preheat the transmission fluid to the minimum temperature for the oil viscosity used before engine start up.

NORMAL OIL CHANGE INTERVAL

Drain and refill system every 1000 hours for average environmental and duty cycle conditions. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgement must be used to determine the required change intervals for extreme conditions.

EXTENDED OIL CHANGE INTERVAL

Extended oil service life may result when using synthetic fluids. Appropriate change intervals should be determined for each transmission by measuring oil oxidation and wear metals, over time, to determine a baseline. Wear metal analysis can provide useful information but a transmission should not be removed from service based solely on this analysis.

FILTERS

Service oil filters element every 1000 hours under normal environmental and duty cycle conditions.

*Dexron is a registered trademark of GENERAL MOTORS CORPORATION.

4.2 MAINTENANCE INTERVALS

4.2.1 Daily

Check oil level daily with engine running at idle (600 RPM) and oil at 82 - 93 °C (180-200 F).

Maintain oil level at full mark.

4.2.2 Normal drain period

Normal drain period and oil filter element change are for average environment and duty cycle condition.

Severe or sustained high operating temperature or very dusty atmospheric conditions will cause accelerated deterioration and contamination.

For extreme conditions judgement must be used to determine the required change intervals.

Every 1000 hours

Change oil filter element.

Drain and refill system as follows (Drain with oil at 65 - 93 °C (150 - 200 F)):

1. Drain transmission.
2. Remove and discard filter. Install new filter.
3. Refill transmission to FULL mark.
4. Run engine at 500 - 600 RPM to prime convertor and lines.
5. Recheck level with engine running at 500 - 600 RPM and add oil to bring level to FULL mark. When oil temperature is hot 82.2 - 93.3 °C (180- 200 F) make final oil level check and adjust if necessary to bring oil level to FULL mark.

Note

IT IS RECOMMENDED THAT OIL FILTER BE CHANGED AFTER 100 HOURS OF OPERATION ON NEW, REBUILT OR REPAIRED UNIT.

4.3 SERVICING MACHINE AFTER COMPONENTS OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the driveline between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other. Therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered complete.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgement must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter element.
4. The oil cooler must be thoroughly cleaned. The cooler should be “back flushed” with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air, and steam cleaner for that purpose.

IMPORTANT

DO NOT USE FLUSHING COMPOUNDS FOR CLEANING PURPOSES.

5. Reassemble all components and use only type oil (See chapter 4.1.1 “Recommended lubricants”). Fill the transmission through filler opening until fluid comes up to FULL mark on transmission dipstick.

Note

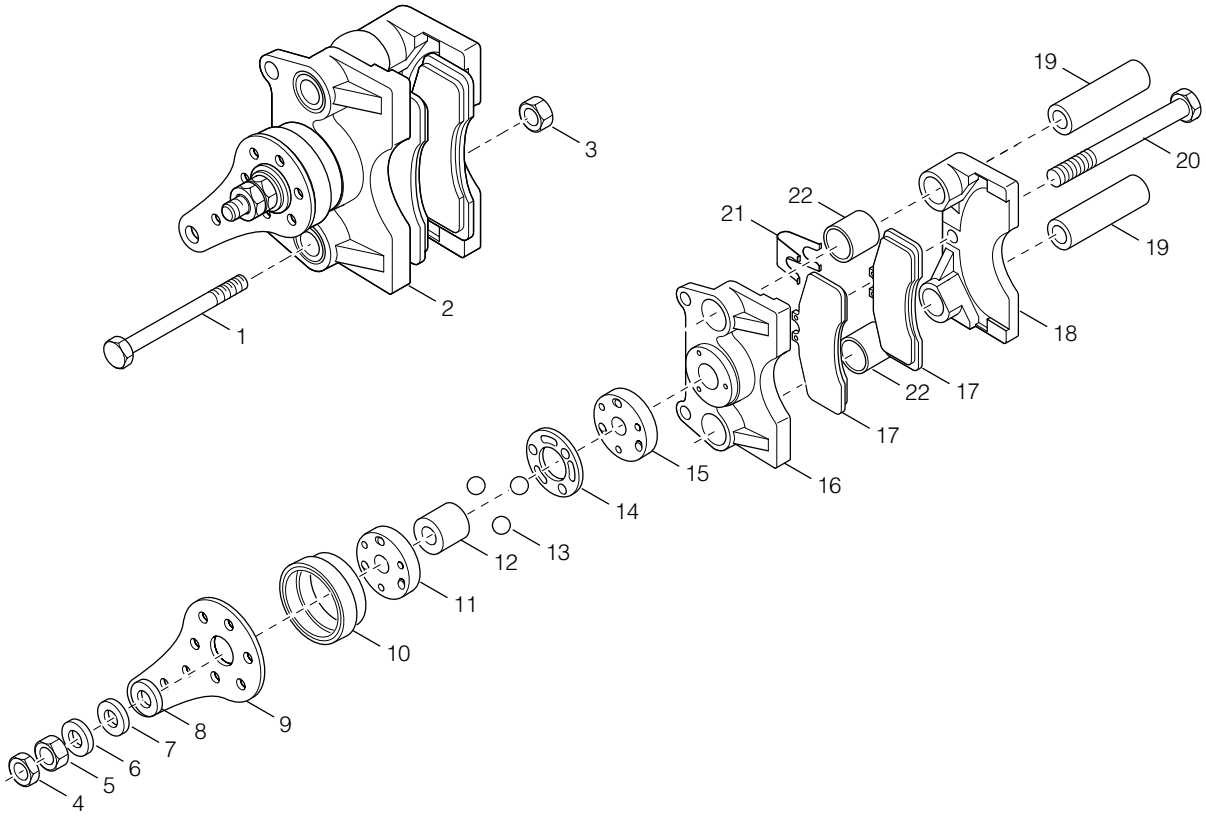
IF THE DIPSTICK IS NOT ACCESSIBLE OIL LEVEL CHECK PLUGS ARE PROVIDED.

- Remove check plug, fill until oil runs from oil hole. Relift filler and level plug.
- Run engine two minutes at 500 - 600 RPM to prime torque convertor and hydraulic lines.
- Recheck level of fluid in transmission with engine running at idle (500 - 600 RPM).
- Add quantity necessary to bring fluid level to FULL mark on dipstick or runs from oil level check plug hole.
- Install oil level plug of dipstick.
- Recheck with hot oil 82.2 - 93.3 °C (180 - 200 F).
- Adjust oil level to FULL mark on dipstick or runs freely from oil level plug.

6. Recheck all drain plugs, lines, connections, etc…., for leaks and tighten where necessary.

4.4 INSTRUCTIONS FOR LINING REPLACEMENT AND ADJUSTMENT OF PARKING BRAKE ASSEMBLY

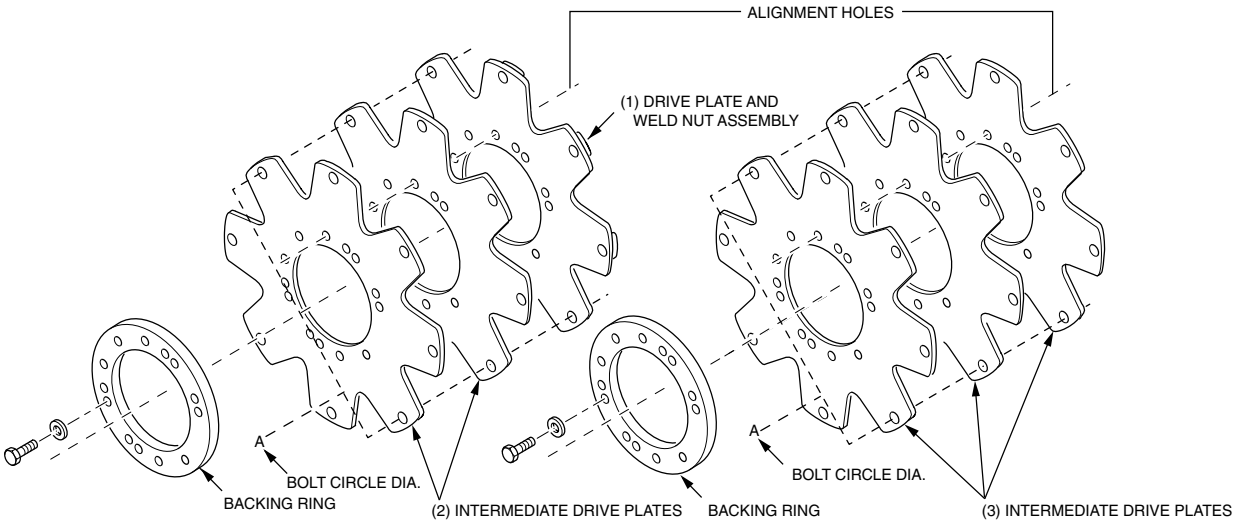
1. Loosen two adjustment locking nuts (4 & 5) enough to slide each torque plate (16 & 18) away from disc far enough to provide clearance to remove old carrier and lining assemblies and install new ones. (It may be necessary to remove one or both nuts).
2. Collapse lining retraction spring (21) and remove from brake head assembly.
3. Slide torque plates (16 & 18) away from disc, move carrier and lining assemblies (17) out of pockets, and remove from the brake head assembly from the side.
4. Install new carrier and lining assemblies (17) in each torque plate (16 & 18).
5. Install lining retention spring (21) into brake head assembly. Be sure spring's "feet" are positioned properly in holes in both lining carrier assemblies (17).
6. Tighten inner adjusting nut (5) until firm contact is made with the disc by the linings. Torque to (100 lbs.-inch) 11 N.m make certain lever is in proper operating position for application.
7. Back off inner adjusting nut 4 (5) to 5 flats and check that disc is free to move (total clearance 0.8 - 1.1 mm (0.031" - 0.043")).
8. Tighten outer locking nut (4) against inner adjusting nut to lock adjustment bolt in place. Torque to (45 to 55 lb.-ft.) 61 - 75 N.m.



5. INSTALLATION DETAILS

5.1 CONVERTER DRIVE COUPLING

Measure the “A” dimension (bolt circle diameter) and order drive plate kit listed below. Note three (3) kits have two (2) intermediate drive plates and one (1) drive plate and weld nut assembly. Three (3) kits with three intermediate drive plates.



“A” Dimension (Bolt circle diameter)

- 11.380” (288.900 mm) diameter
  Kit No. 802501.
- 13.125” (333.38 mm) diameter
  Kit No. 802424.
- 13.500” (342.90 mm) diameter
  Kit No. 802425.

Each kit will include the following parts:

- 2 Intermediate drive plates.
- 1 Drive plate and weld nut assembly.
- 1 Backing ring.
- 6 Mounting screws.
- 6 Lockwashers.
- 1 Instruction sheet.

“A” Dimension (Bolt circle diameter)

- 11.380” (288.900 mm) diameter
  Kit No. 802543.
- 13.125” (333.38 mm) diameter
  Kit No. 802426.
- 13.500” (342.90 mm) diameter
  Kit No. 802427.

Each kit will include the following parts:

- 3 Intermediate drive plates.
- 1 Backing ring.
- 6 Mounting screws.
- 6 Lockwashers.
- 1 Instruction sheet.

Note

To facilitate assembly, align small holes in drive plates - see illustration above - alignment holes.

Position drive plate and weld nut assembly on torque converter assembly with weld nuts toward converter. Align intermediate drive plates and backing plate with holes in torque converter assembly.

Note

Two dimples 180° apart in backing ring must be out toward engine flywheel (hollow side facing torque converter assembly). Install cap screws and lockwashers. Tighten cap screws torque 35 - 39 N.m. (26 - 29 lb. ft.).

5.2 TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel & housing for conformance to standard SAE No. 3 per SAE J927 and J1033 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play (Fig. 1).
3. Install two 63,50 mm (2.50") long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole (Fig. 2).

*4. Install a 101,60 mm (4.00") long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3.

5. Rotate the transmission torque converter to align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3. Locate transmission on flywheel housing.

   Aligning drive plate to flywheel and transmission to flywheel housing guide studs. Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

*6. Remove drive plate locating stud.

7. Install drive plate attaching screw and washer. Snug screw but **do not tighten**. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed. Torque each one 35 to 39 N.m. (26- 29ft.lbs.). This will require tightening each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened to specified torque.
8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within 0,025 mm (0.001") of the end play recorded in step No. 2.

* Does not apply to units having 3 intermediate drive plates. See Fig.4.

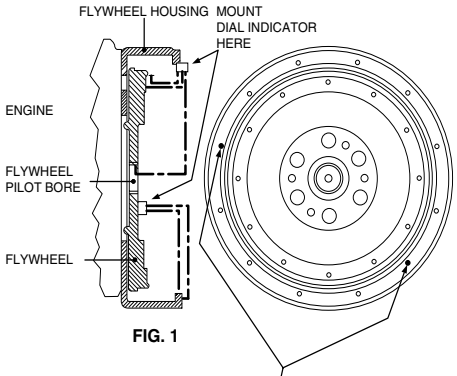


FIG. 1

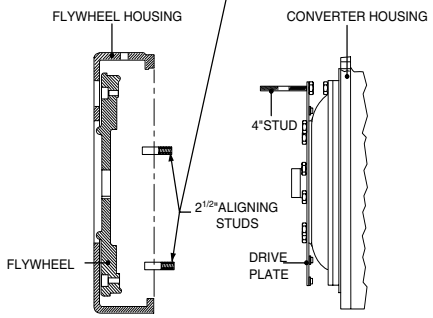


FIG. 2

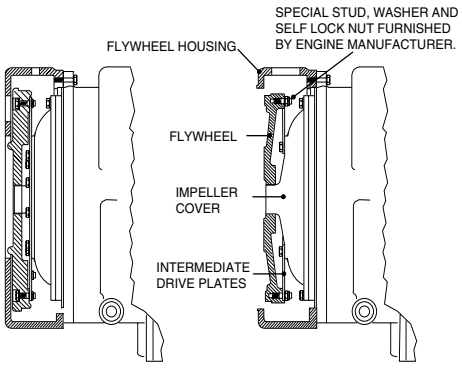


FIG. 3 FIG.4

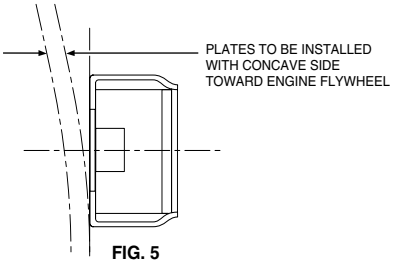
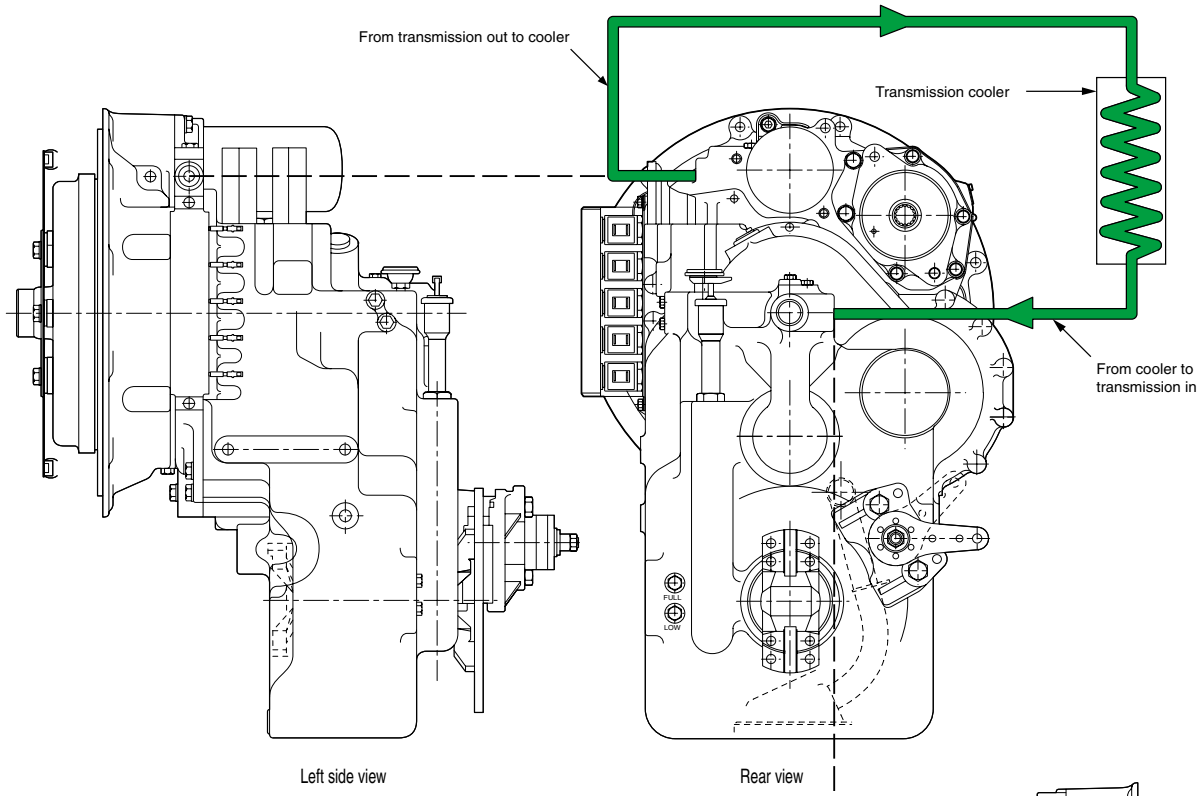


FIG. 5

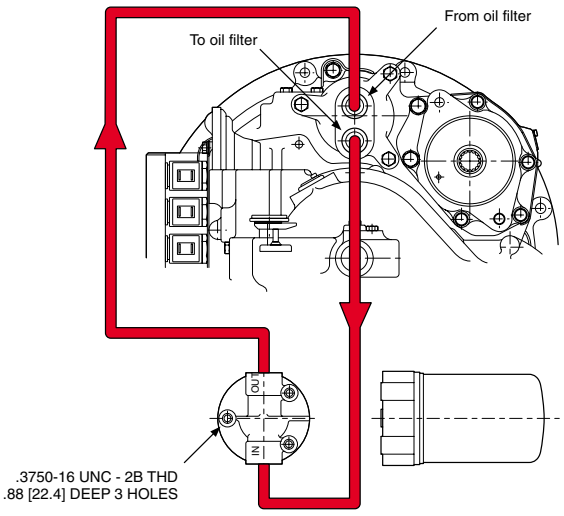
5.3 EXTERNAL PLUMBING



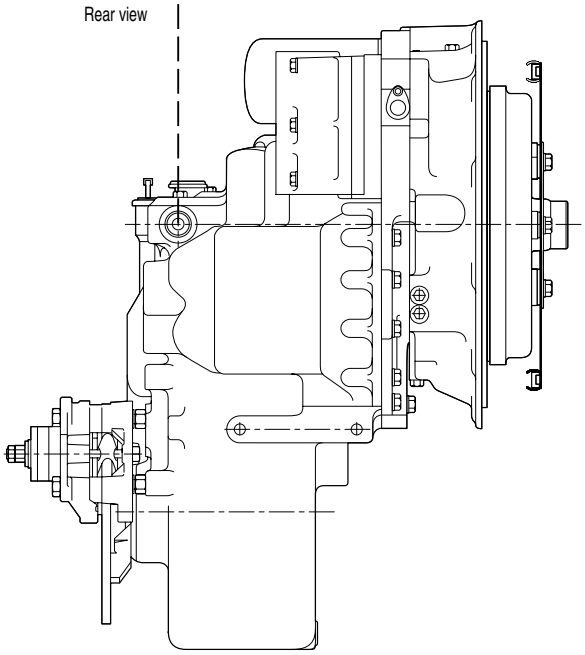
Left side view

Rear view

5.3.1 Optional remote filter



Optional remote filter

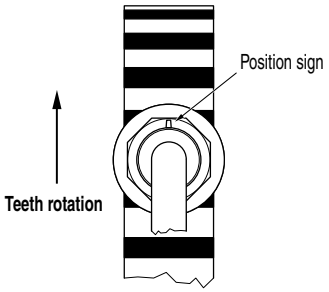


Right side view

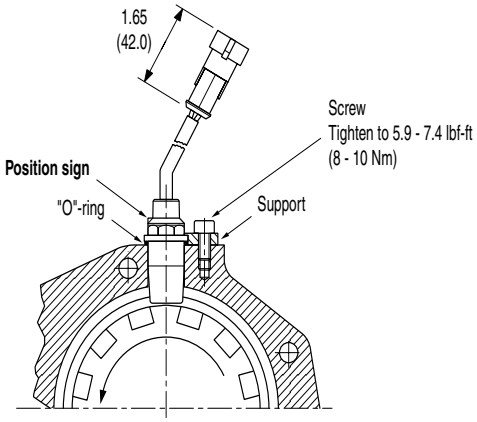
5.3.2 Cooler & filter lines specifications

- Minimum 19 mm (.75 inch) internal diameter for lines and fittings.
- Suitable for operation from ambient to 120 °C (248 F) continuous operating temperature.
- Must withstand 20 bar (290 psi) continuous pressure and with 40 bar (580 psi) intermittent surges.
- Conform SAE J1019 and SAE J517,100RI.

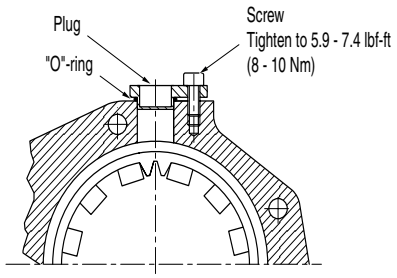
5.4 SPEED SENSOR INSTALLATION



On the sensor body there is a small plastic triangular position sign. Make sure the position sign on the sensor points as shown below in the direction of the movement of the gearteeth (Teeth rotation as shown).

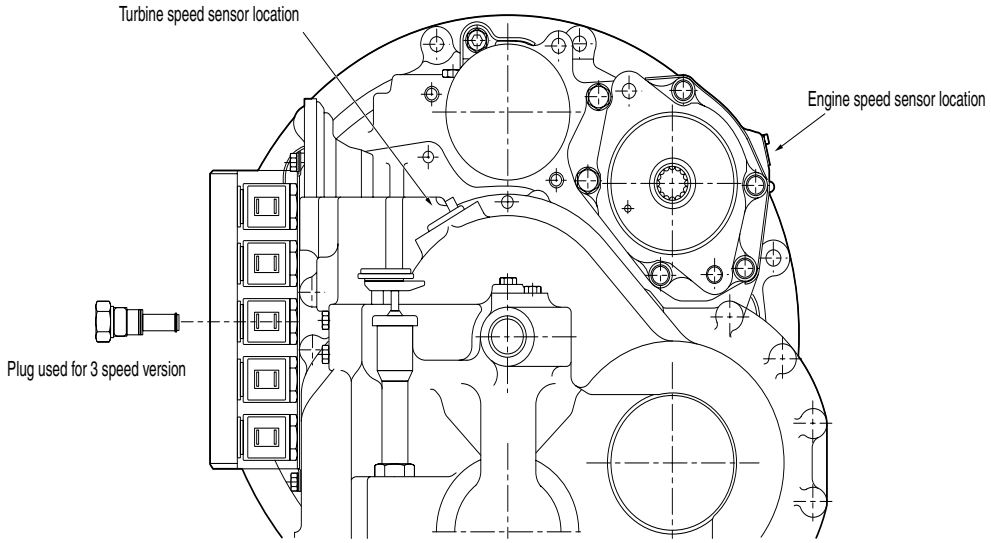


Sensor installed

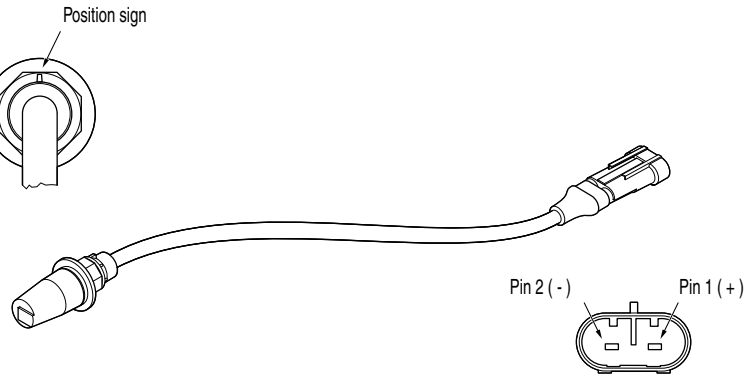


Hole plugged

Sensor position on transmission



5.4 SPEED SENSOR INSTALLATION (Continued)



The magneto resistive sensor generates a square wave current with a fixed amplitude changing between 7 mA and 14 mA.

The sensor has an integrated AMP superseal 2 pin connector.
The two pins are numbered 1 and 2.

Following table shows the relation between wire colour, pin number and connection.

COLOUR	PIN NUMBER	FUNCTION	CONNECTION
BROWN	1	Current input	Hot wire
BLUE	2	Current output	Ground wire

Note

THE SENSOR WIRES HAVE A POLARITY.

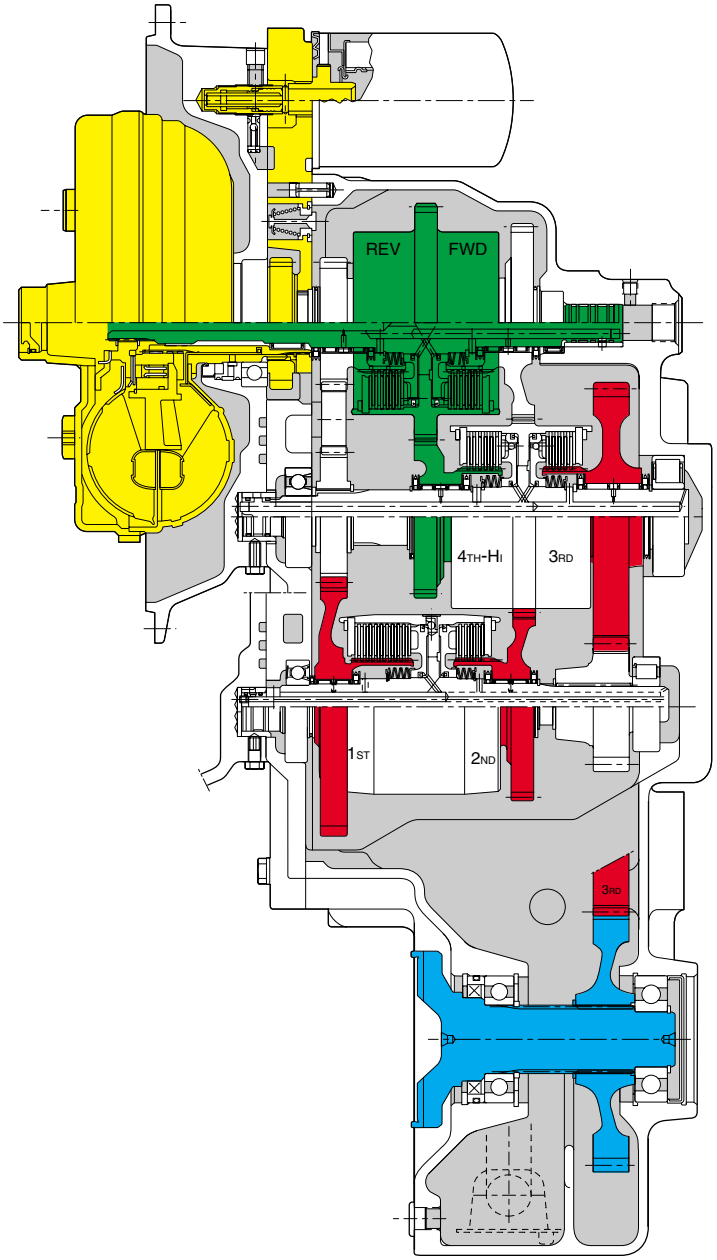
BE SURE TO CORRECTLY OBSERVE SENSOR POLARITIES, AS WRONG CONNECTIONS WILL DEACTIVATE THE SENSOR !

6. OPERATION OF THE TRANSMISSION

6.1 THE TRANSMISSION ASSEMBLY

Basically the transmission is composed of five main assemblies:

1. The converter, pump drive section and pressure regulating valve.
2. The input shaft and directional clutches.
3. The range clutches.
4. The output section.
5. The transmission solenoids.



6.1.1 The converter, pump drive section and pressure regulating valve

Engine power is transmitted from the engine flywheel to the impeller through the impeller cover.

This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump, that picks up fluid at its centre and discharges it at the outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the turbine shaft of the torque converter. This element receives fluid at its outer diameter and discharges it at its centre.

The reaction member of the torque converter is located between and at the centre of the inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element. This recirculation will make the converter to multiply torque.

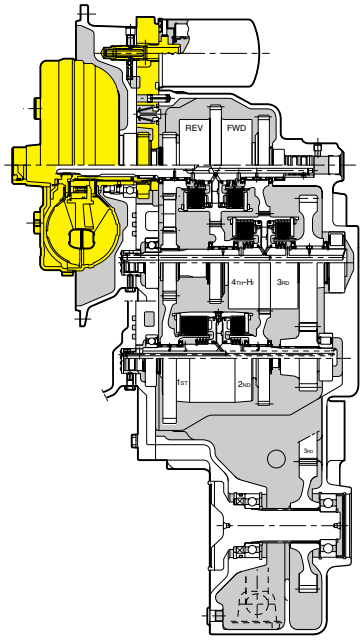
The torque multiplication is function of the blading (impeller, turbine and reaction member) and the converter output speed (turbine speed). The converter will multiply engine torque to its designed maximum multiplication ratio when the turbine shaft is at zero RPM (stall).

Therefore we can say that as the turbine shaft is decreasing in speed, the torque multiplication is increasing.

The hydraulic pump is connected with the pump drive gear. This pump drive gear is driven by the impeller hub gear. Since the impeller hub gear is connected with the impeller cover, the pump speed is in direct relation with the engine speed.

Note

THE PRESSURE REGULATOR VALVE IS MOUNTED BEHIND THE FILTER, IN THE FILTER ADAPTER HOUSING.



THE CONVERTER, PUMP DRIVE SECTION AND PRESSURE REGULATING VALVE

6.1.2 The input shaft and directional clutches

The turbine shaft driven from the turbine transmits power to the forward, 4th-High or reverse clutch.

These clutches consist of a drum with internal splines and a bore to receive a hydraulic actuated piston. The piston is oil tight by the use of sealing rings. The steel discs with external splines, and friction discs with internal splines, are alternated until the required total is achieved.

A back-up plate is then inserted and secured with a retainer ring. A hub with outer diameter splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, the solenoid will direct oil under pressure through tubes and passages to the selected clutch shafts.

Oil sealing rings are located on the clutch shafts. These rings direct the oil through a drilled passage in the shaft to the desired clutch.

Pressure of the oil forces the piston and discs against the back-up plate. The discs with splines on the outer diameter clamping against discs with teeth on the inner diameter enables the drum and hub to be locked together and allows them to drive as one unit.

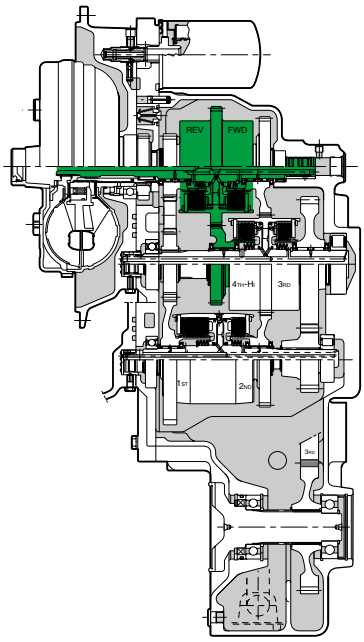
When the clutch is released, a return spring will push the piston back and oil will drain back via the solenoid, the bleed valve or holes in the clutch piston into the transmission sump.

These bleed valves will only allow quick escape of oil when the pressure to the piston is released.

The T12000 transmission, 3-speed version, has one reverse clutch and one forward clutch. This in combination with the 3 range clutches results in the transmission having 3 forward and 3 reverse speeds.

The T12000 transmission, 4- and 6-speed versions, have one reverse clutch and two forward clutches (forward and 4th-High). This in combination with the 3 range clutches results in the transmission having 4 forward (for the 4-speed) or 6 forward (for the 6-speed) and 3 reverse speeds.

The engagement of the directional clutches (forward and reverse) are modulated. This means that clutch pressure is built up gradually. This will enable the unit to make forward, reverse shifts while the vehicle is still moving and will allow smooth engagement of drive. The modulation is done hydraulically.



THE INPUT SHAFT AND DIRECTIONAL CLUTCHES

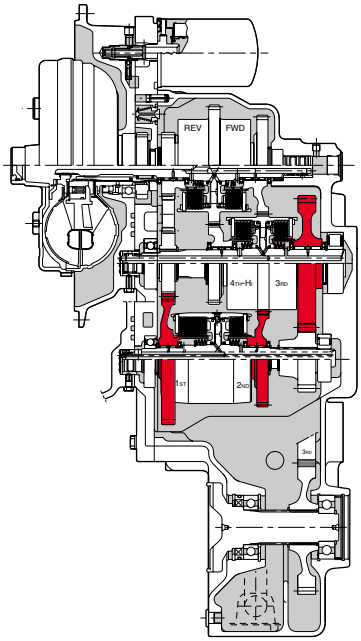
6.1.3 The range clutches

Once a directional clutch is engaged power is transmitted to the range clutches (1st, 2nd or 3rd).
Operation and actuation of the range clutches is similar to the directional clutches.
The engagement of the range clutches is not modulated.

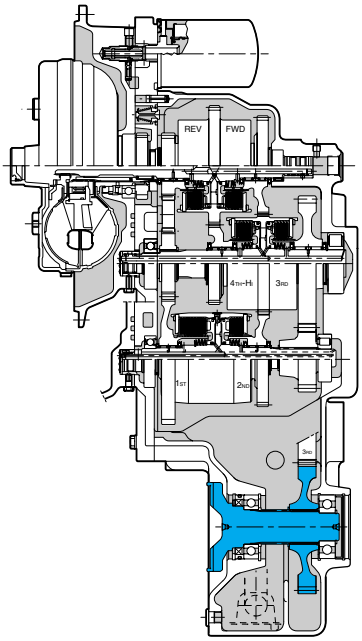
6.1.4 The output section

With a range clutch engaged, power is finally transmitted to the output shaft.
Output rotation is same as the engine rotation when the forward clutch is engaged.

A front axle disconnect is optional and is located on the output shaft. The drive to the front axle can be disconnected or connected by manual shifting.



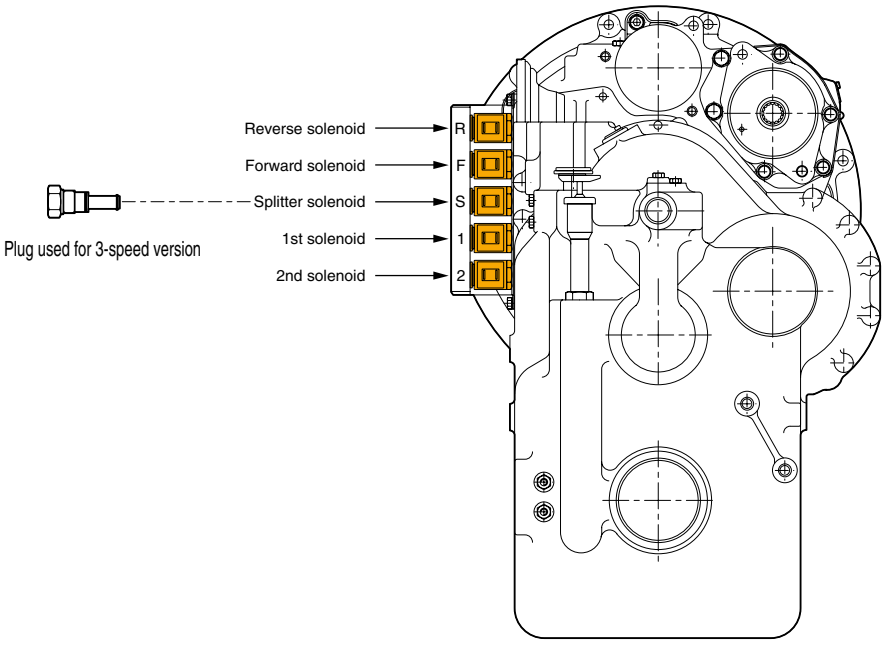
THE RANGE CLUTCHES



THE OUTPUT SECTION

6.1.5 The transmission controls (refer to hydraulic diagram)

The transmission is controlled by the direction and range solenoids. The solenoids are mounted on the left side of the transmission case. When the selected direction and range solenoids are energised, oil under pressure will flow through tubes and passages to the selected clutch shafts. Oil sealing rings are located on the clutch shafts. These rings direct oil under pressure through a drilled passage way in the shaft to the desired clutch.



Rear view

THE TRANSMISSION CONTROLS

6.2 ELECTRIC SOLENOID CONTROLS

6.2.1 3-Speed transmission

Transmission gear	Activated solenoids	Activated clutches
Forward 3	Forward	Forward, 3rd
Forward 2	Forward, 2nd	Forward, 2nd
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	-	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

Note

FOR THE 3-SPEED TRANSMISSION, THE SPLITTER SOLENOID DOES NOT EXSIST.

6.2.2 4-speed transmission

6.2.2.1 Standard 4-speed transmission (1, 3, 5, 6 ≈ 6-speed)

Transmission gear	Activated solenoids	Activated clutches
Forward 4	Forward, Splitter	4th-High, 3rd
Forward 3	Forward	Forward, 3rd
Forward 2	Forward, 2nd	Forward, 2nd
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	—	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

6.2.2.2 Alternative 4-speed transmission, model T12496 only (1, 3, 4, 5 ≈ 6-speed)

Transmission gear	Activated solenoids	Activated clutches
Forward 4	Forward	Forward, 3rd
Forward 3	Forward, Splitter, 2nd	4th-High, 2nd
Forward 2	Forward, 2nd	Forward, 2nd
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	—	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

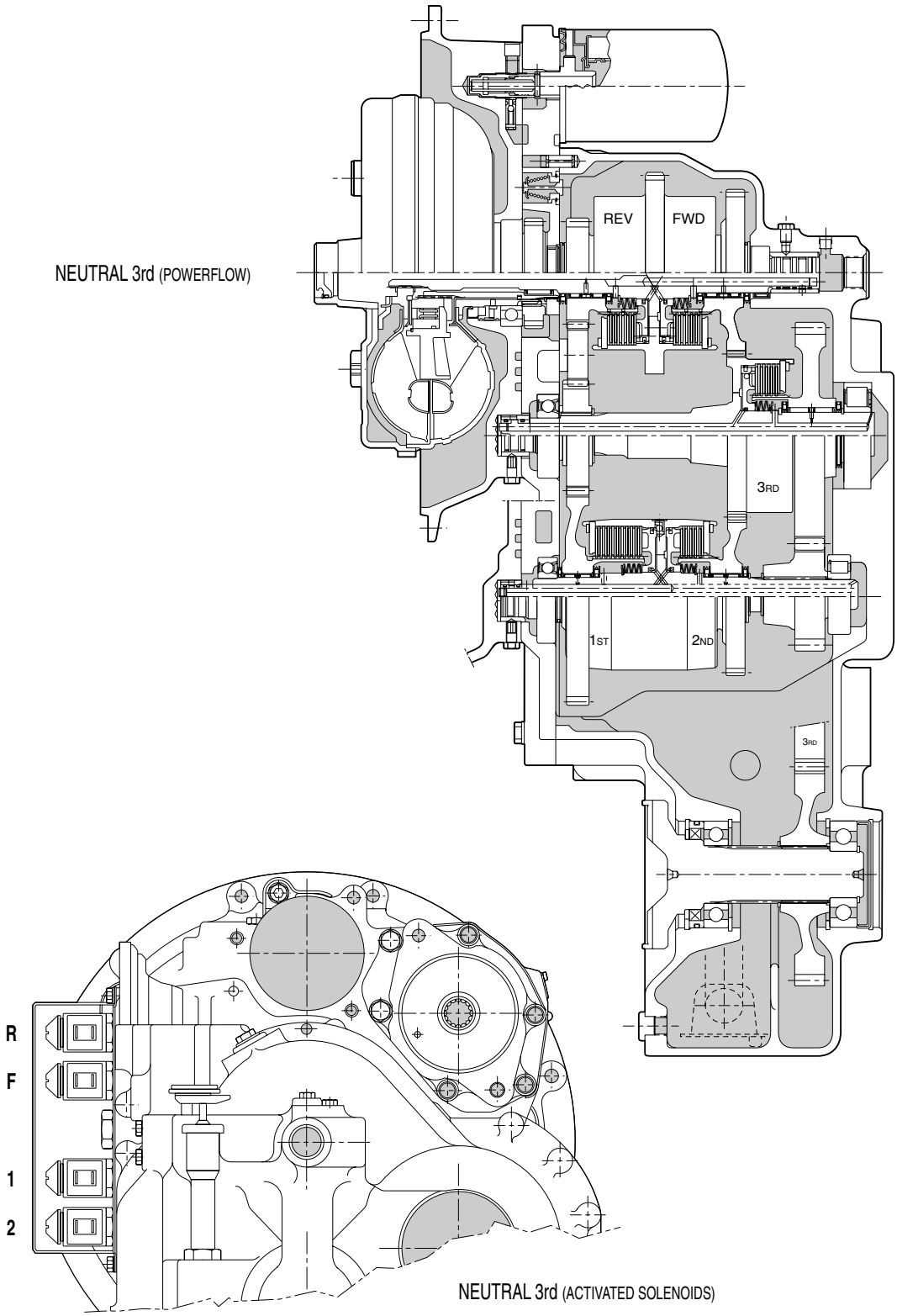
6.2.3 6-Speed transmission

Transmission gear	Activated solenoids	Activated clutches
Forward 6	Forward, Splitter	4th-High, 3rd
Forward 5	Forward	Forward, 3rd
Forward 4	Forward, Splitter, 2nd	4th-High, 2nd
Forward 3	Forward, 2nd	Forward, 2nd
Forward 2	Forward, Splitter, 1st, 2nd	4th-High, 1st
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	—	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

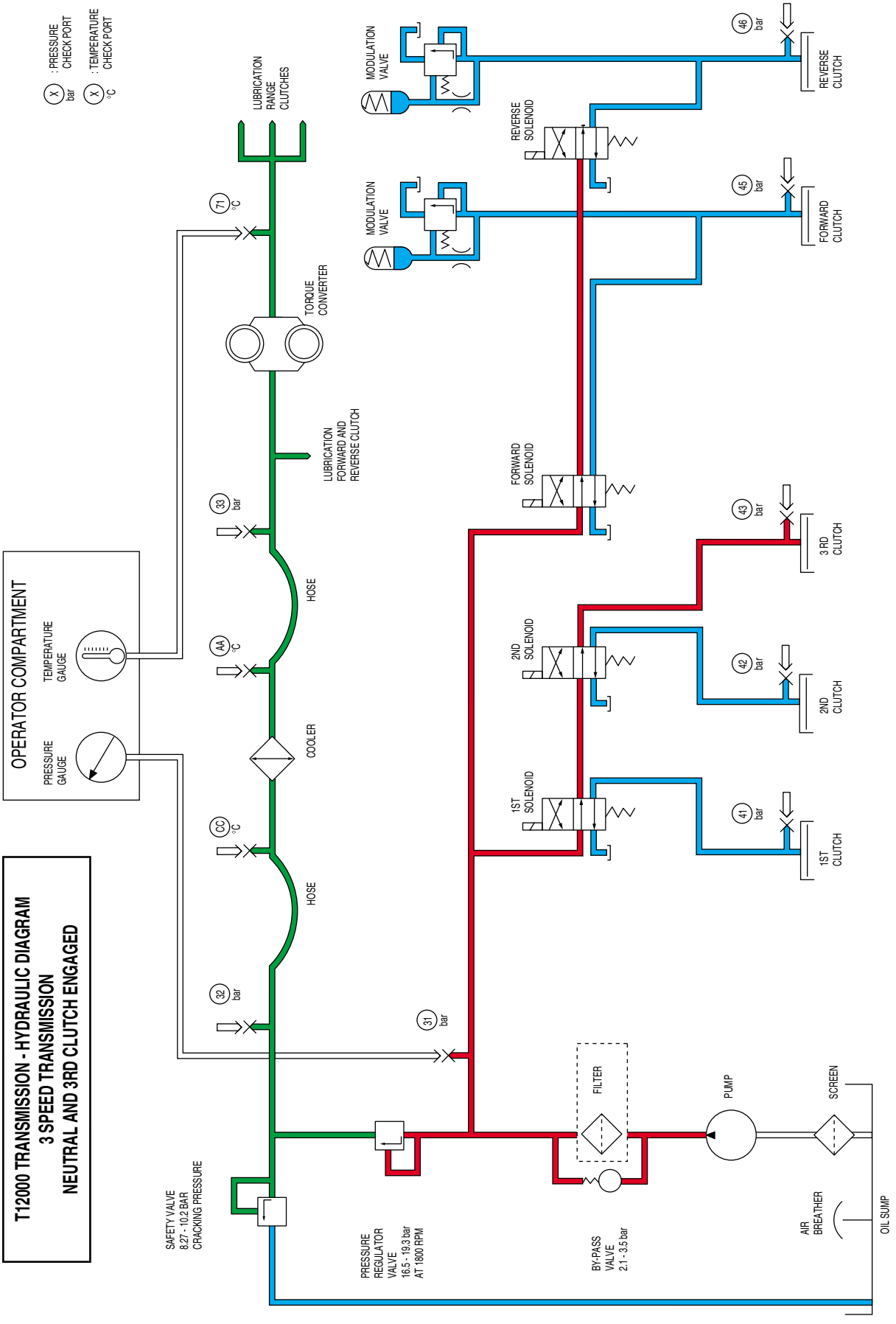
6.3 POWERFLOWS, ACTIVATED SOLENOIDS AND HYDRAULIC CIRCUIT

6.3.1 3-Speed transmission

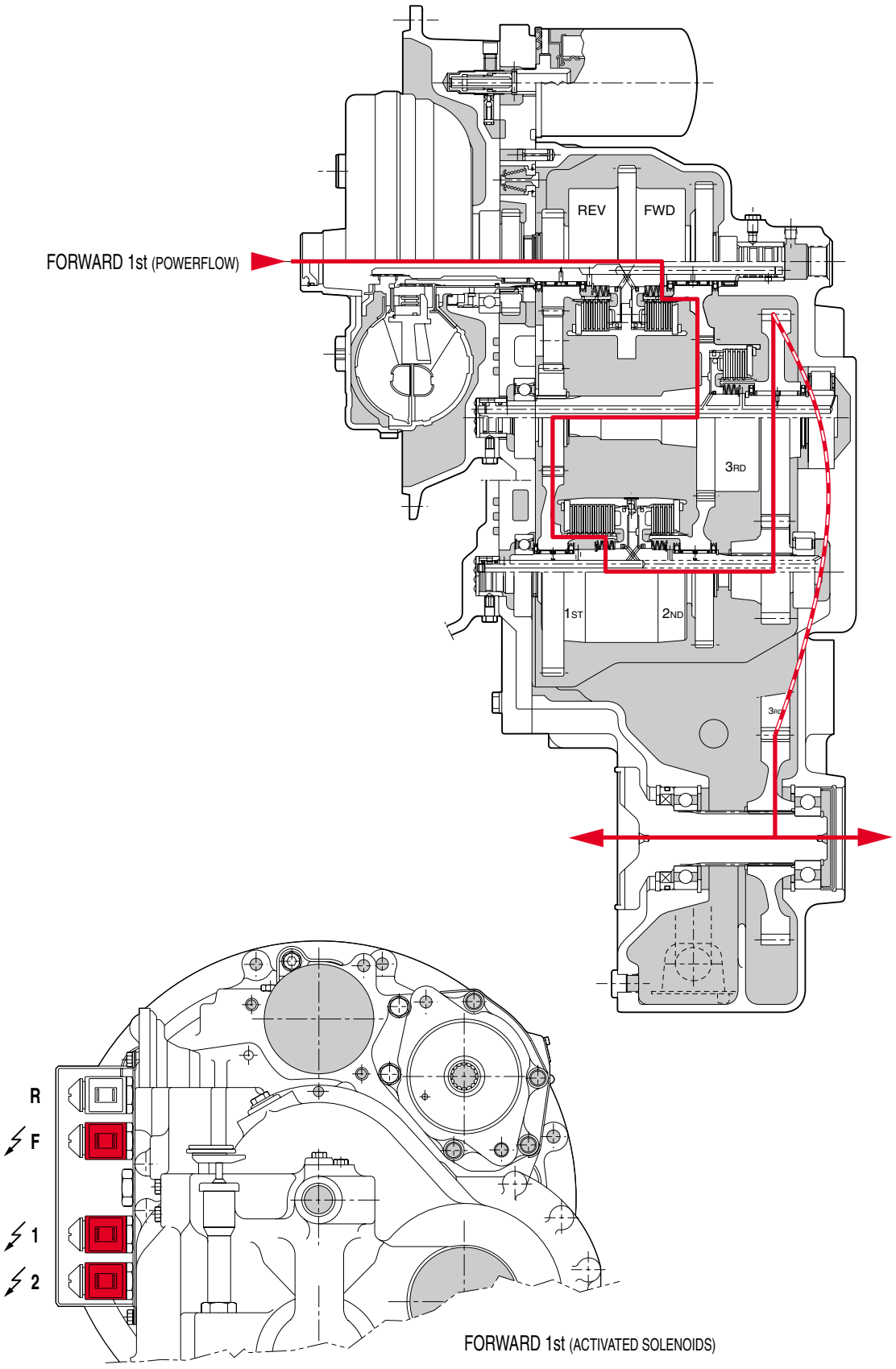
6.3.1.1 Neutral and 3rd clutch engaged



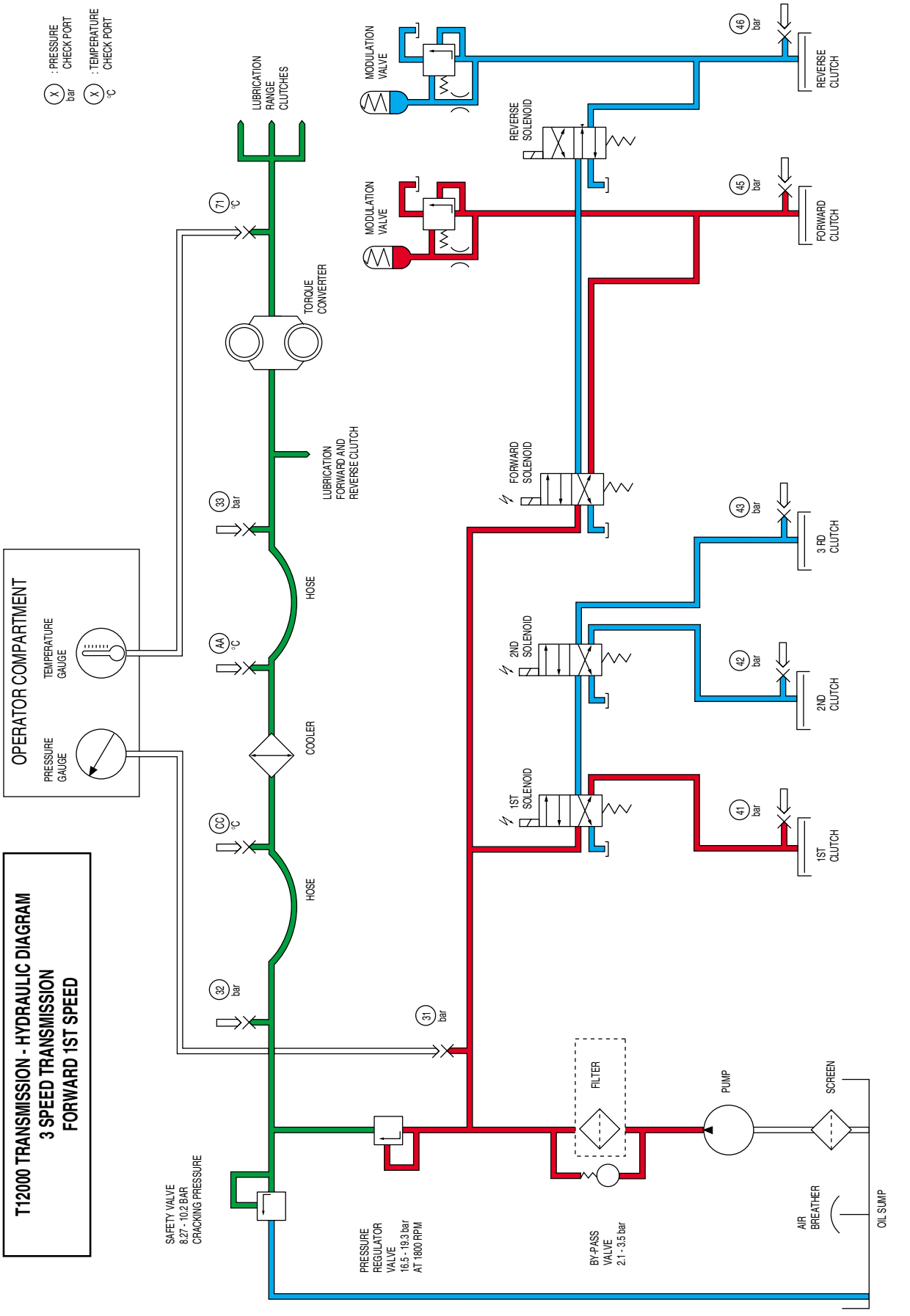
6.3.1.1 Neutral and 3rd clutch engaged (continued)



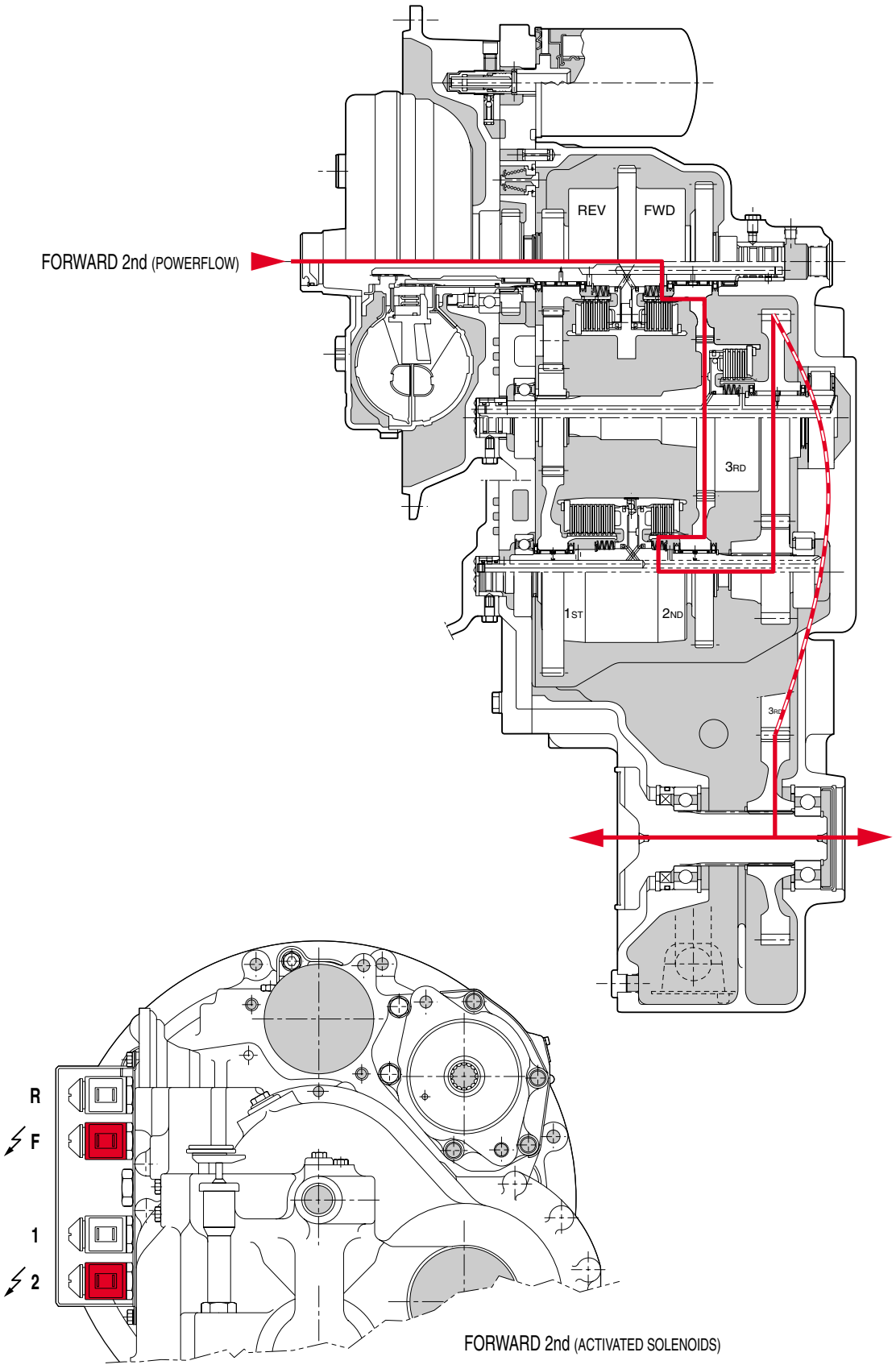
6.3.1.2 Forward 1st speed



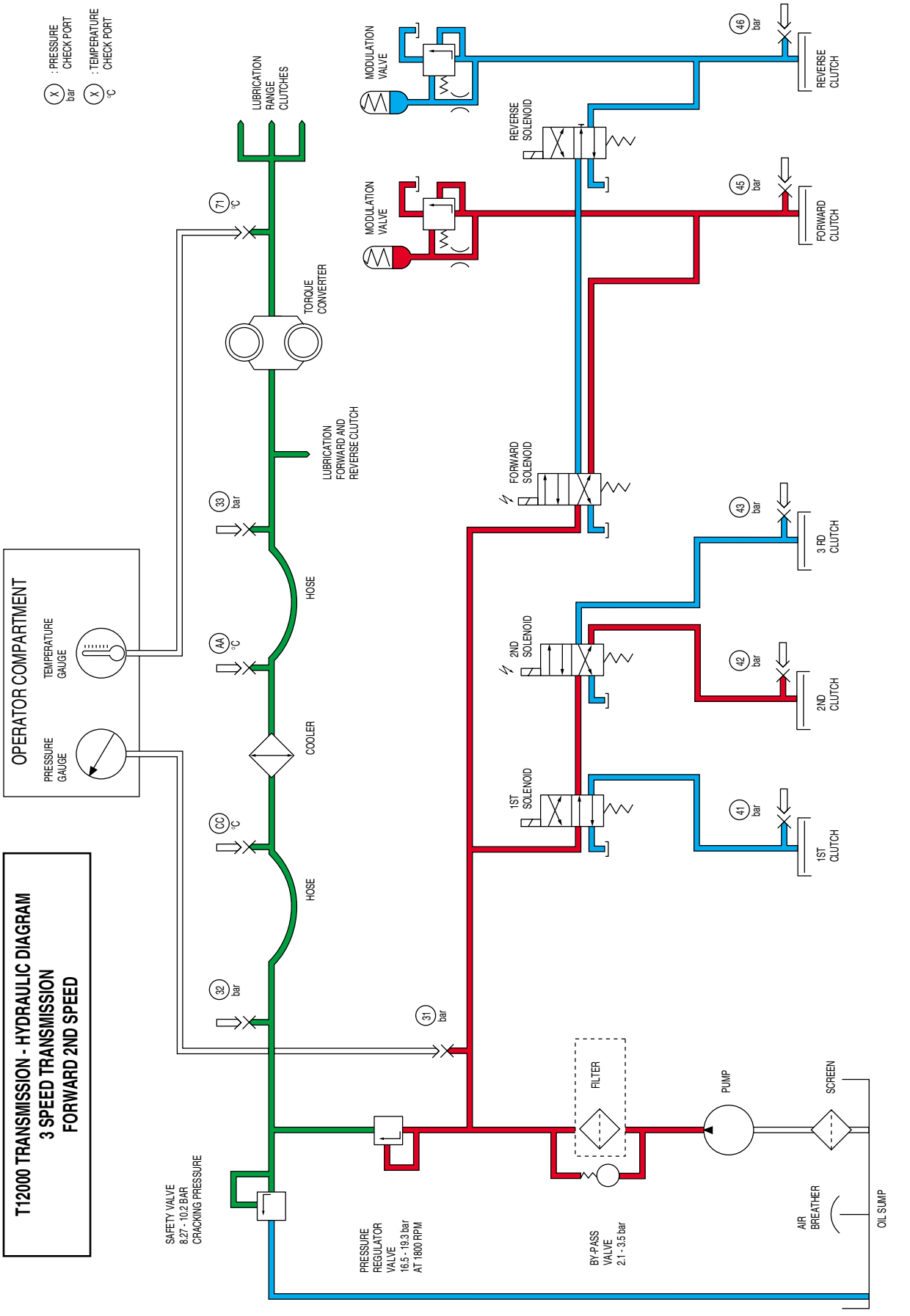
6.3.1.2 Forward 1st speed (continued)



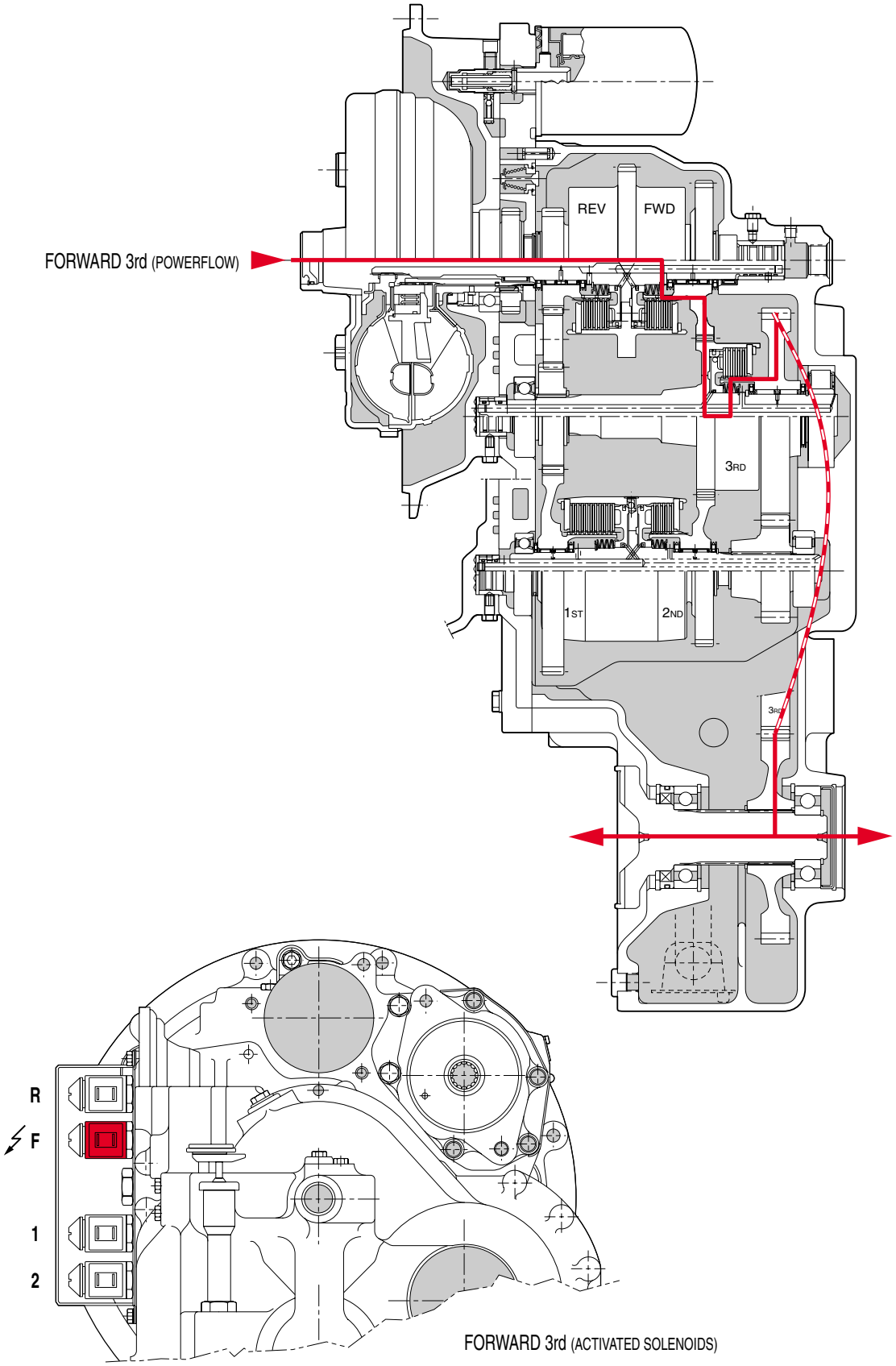
6.3.1.3 Forward 2nd speed



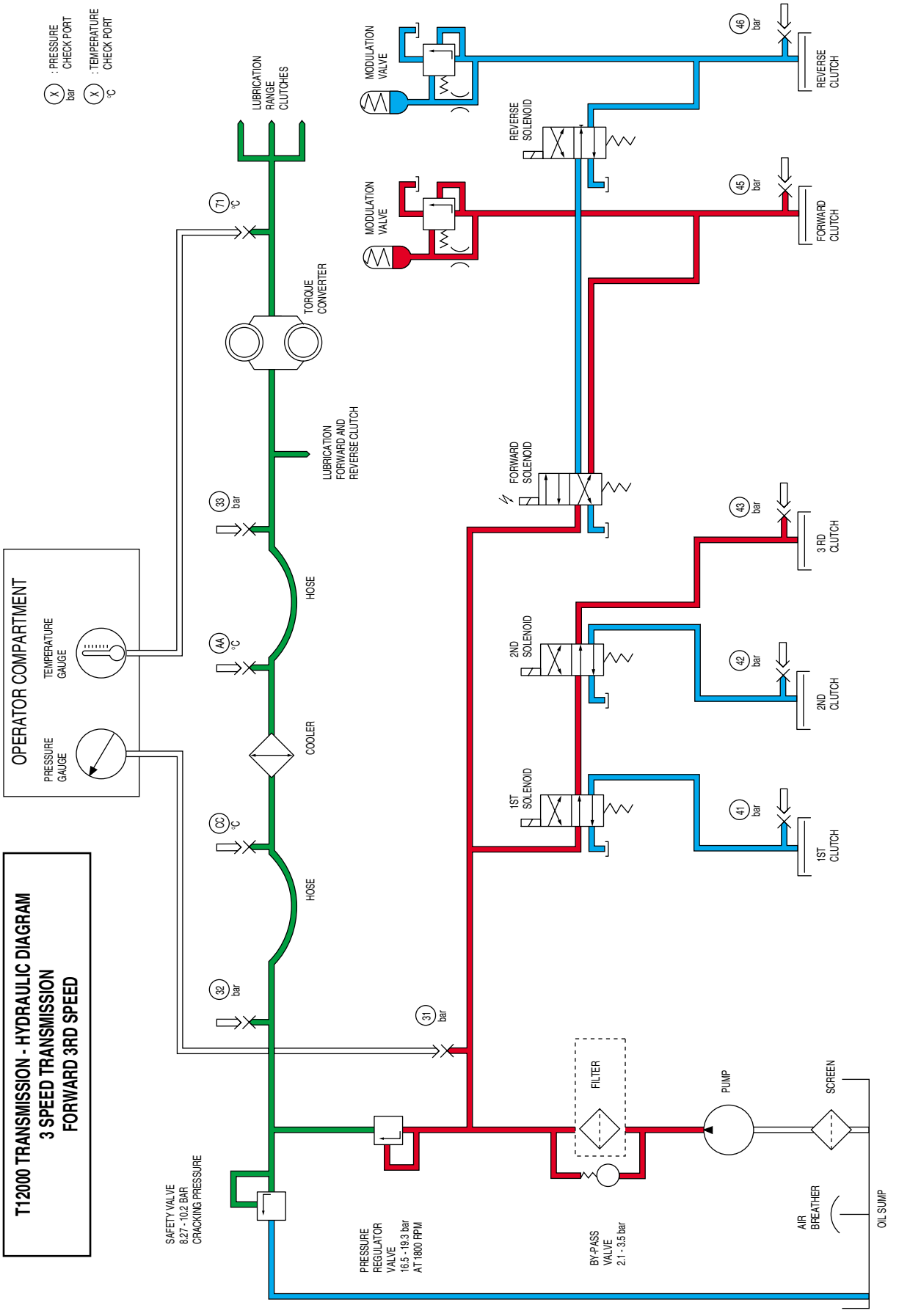
6.3.1.3 Forward 2nd speed (continued)



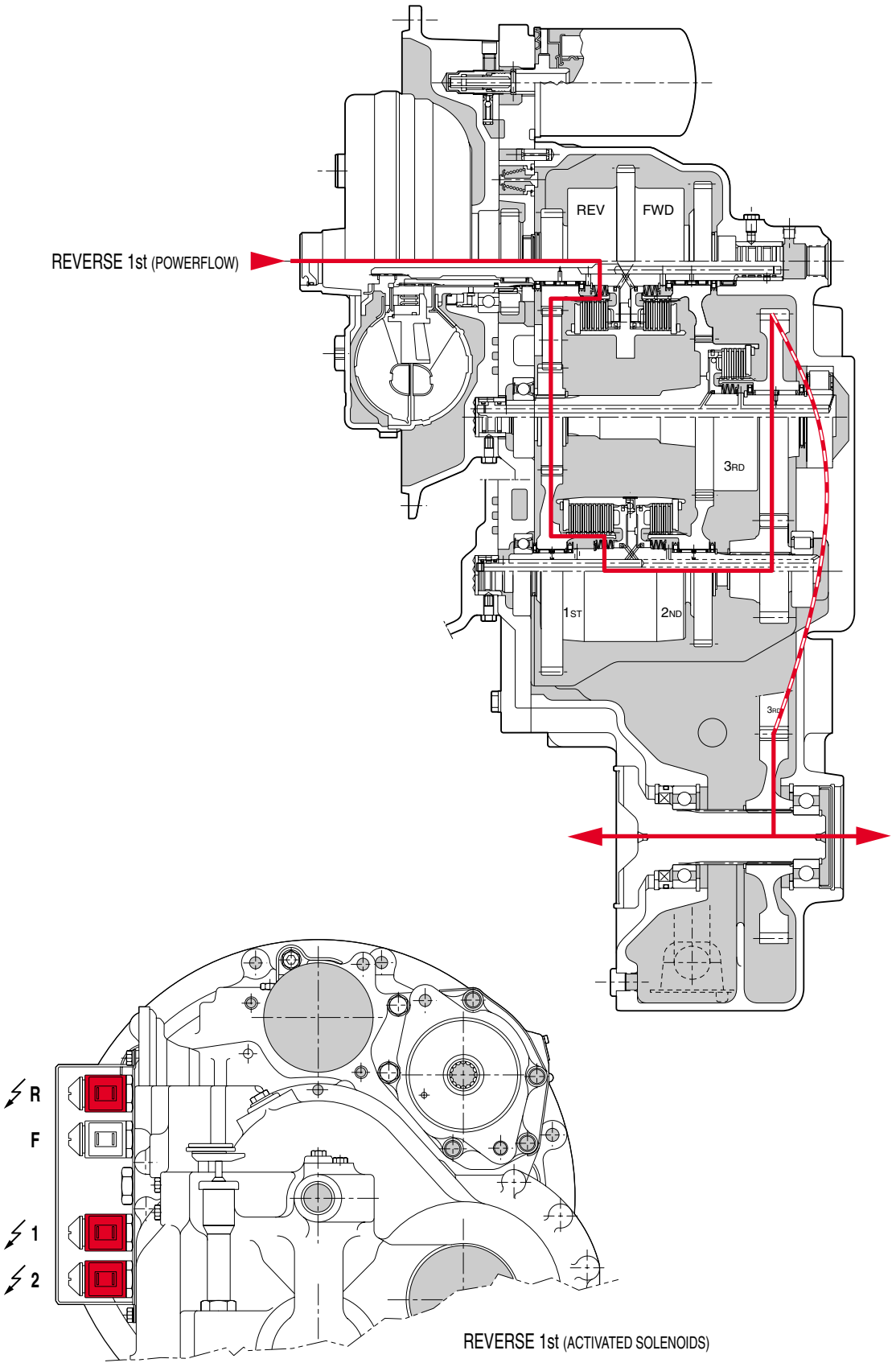
6.3.1.4 Forward 3rd speed



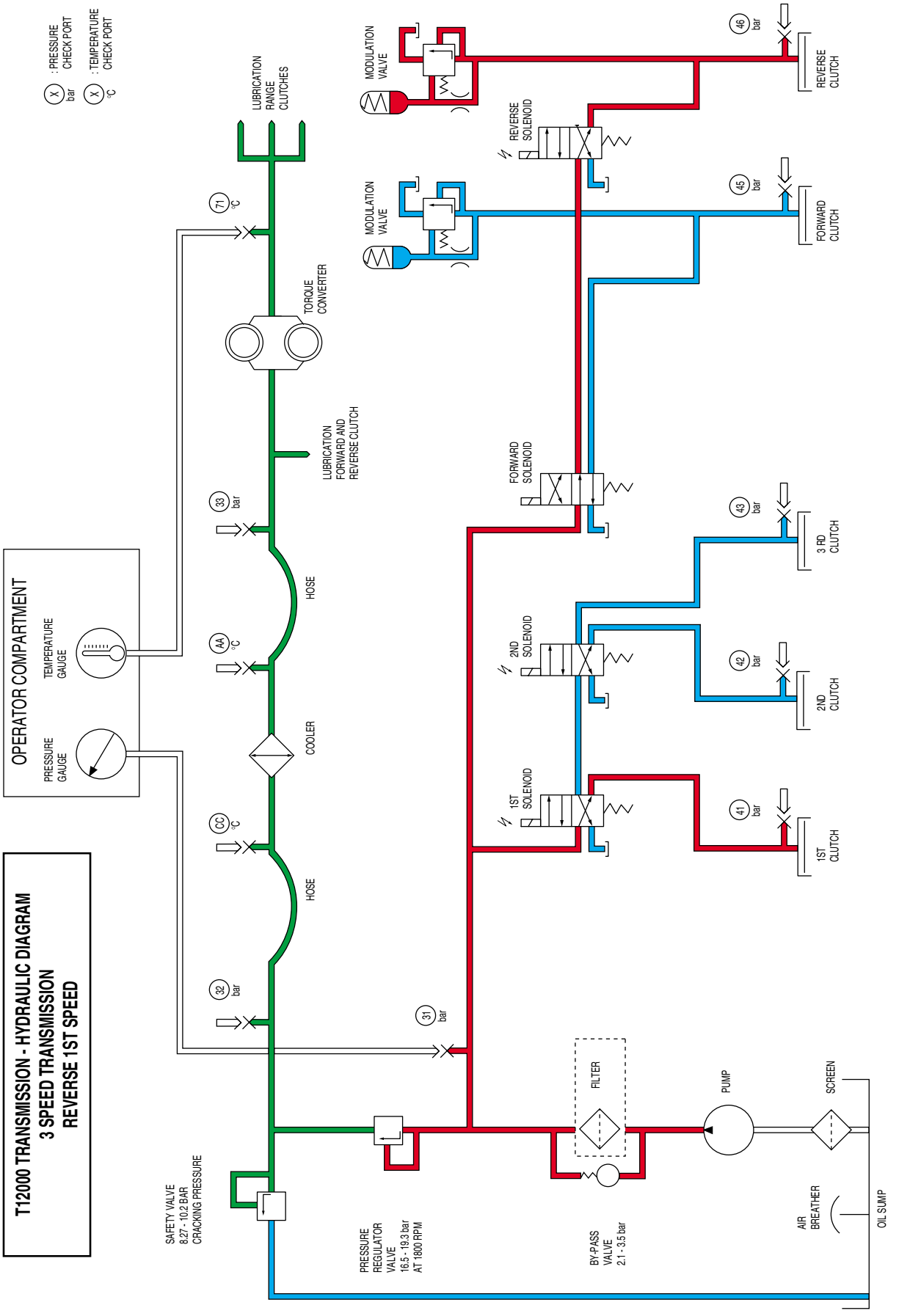
6.3.1.4 Forward 3rd speed (continued)



6.3.1.5 Reverse 1st speed



6.3.1.5 Reverse 1st speed (continued)

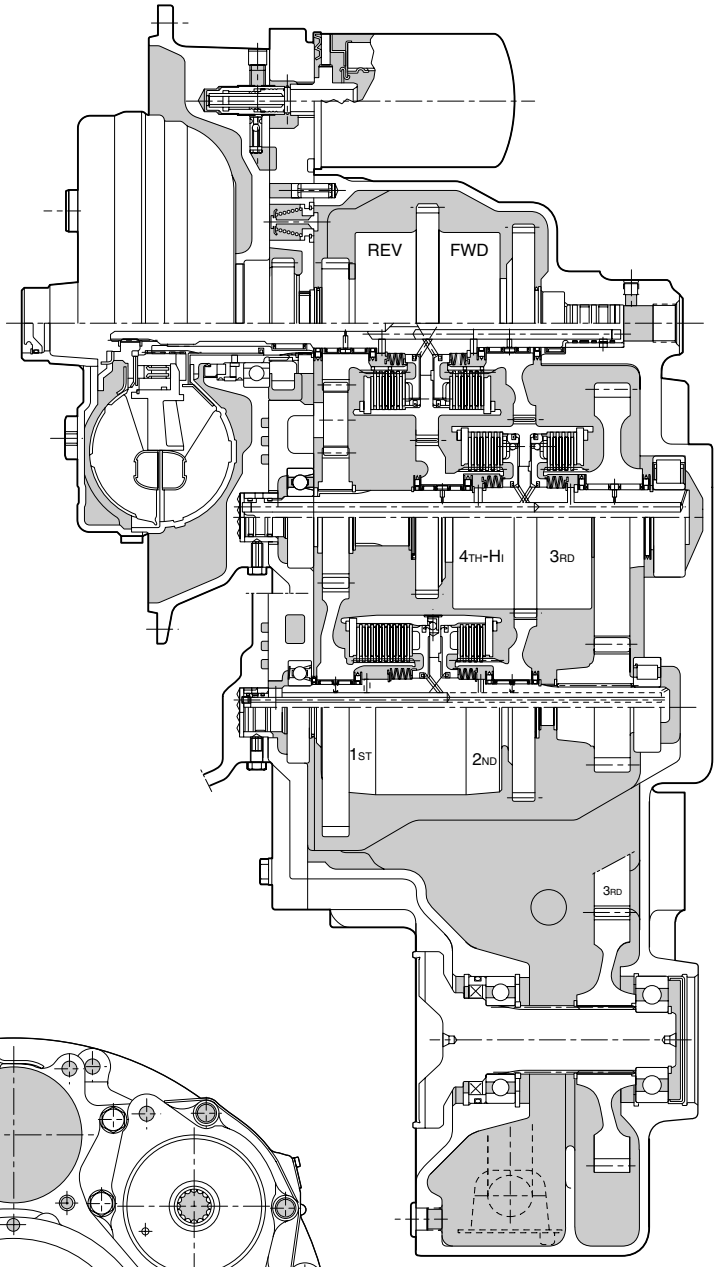


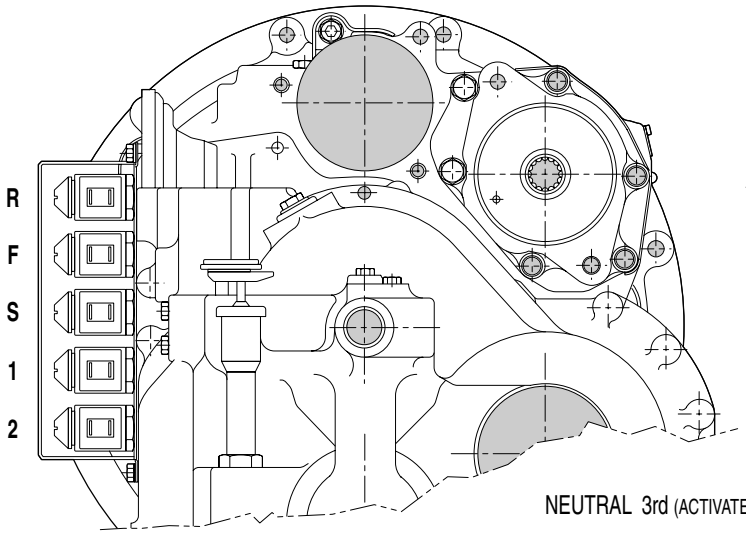
6.3.2 4-Speed transmission

6.3.2.1 Standard 4-speed transmission

6.3.2.1.1 Neutral and 3rd clutch engaged

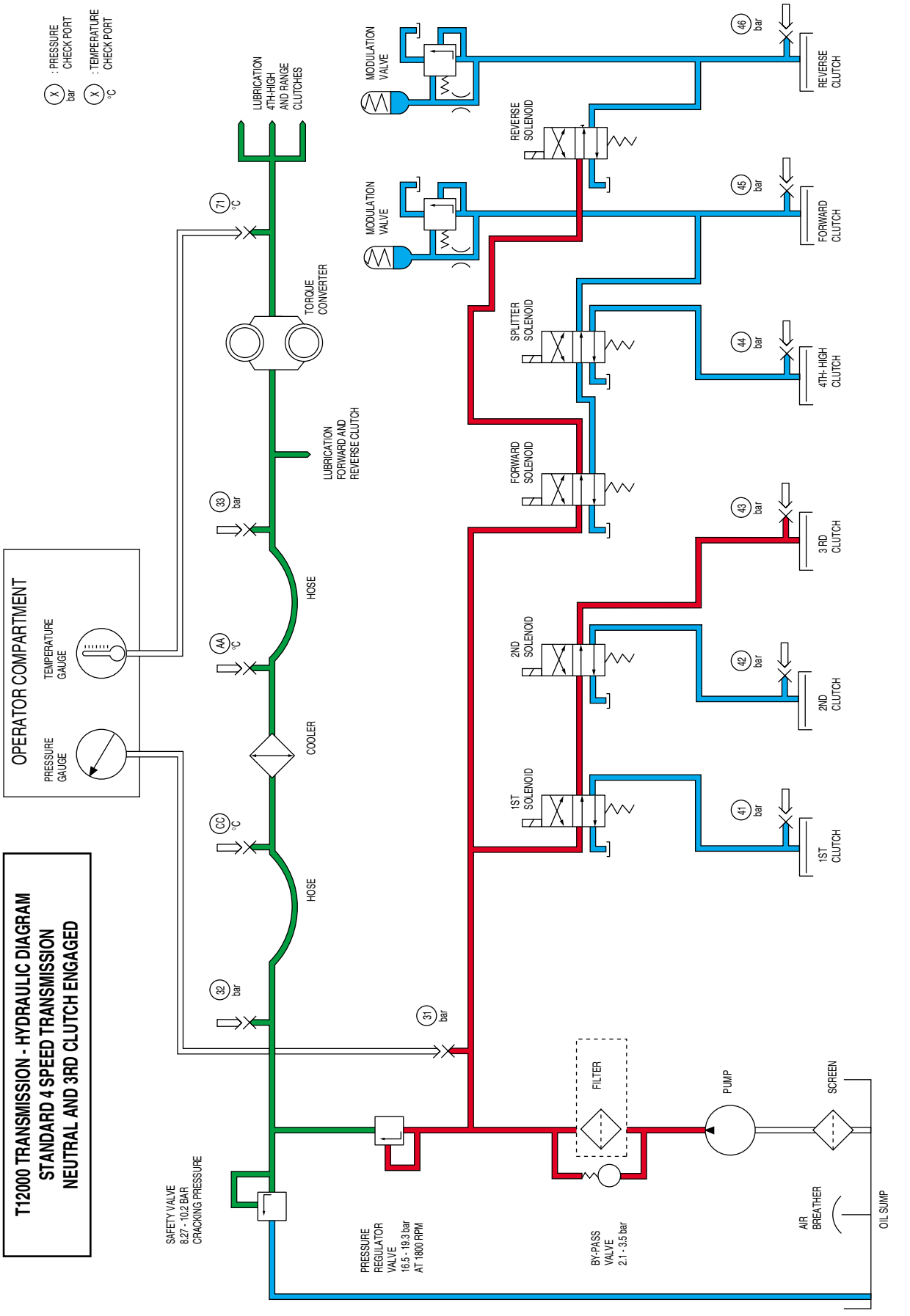
NEUTRAL 3rd (POWERFLOW)



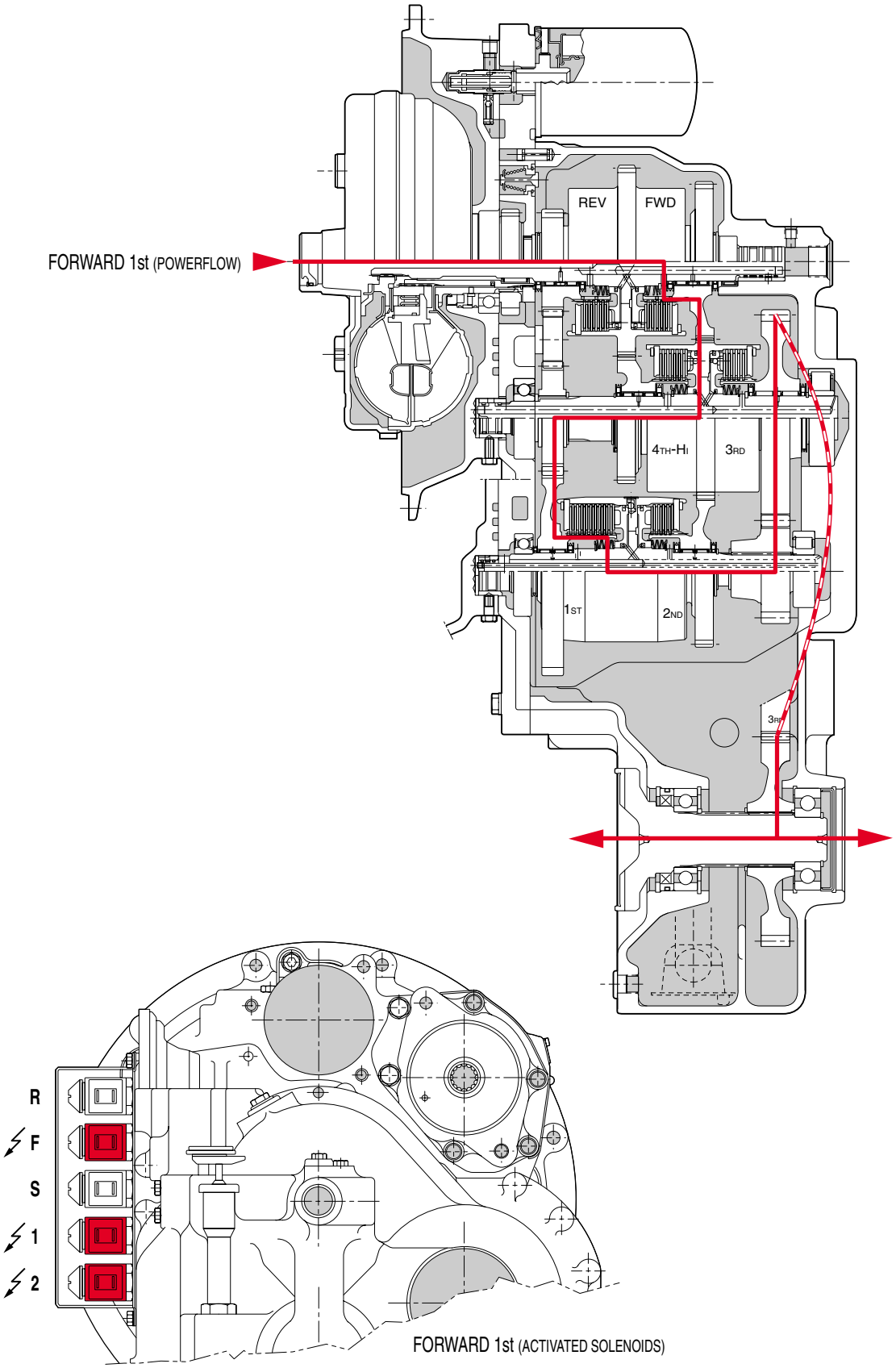


NEUTRAL 3rd (ACTIVATED SOLENOIDS)

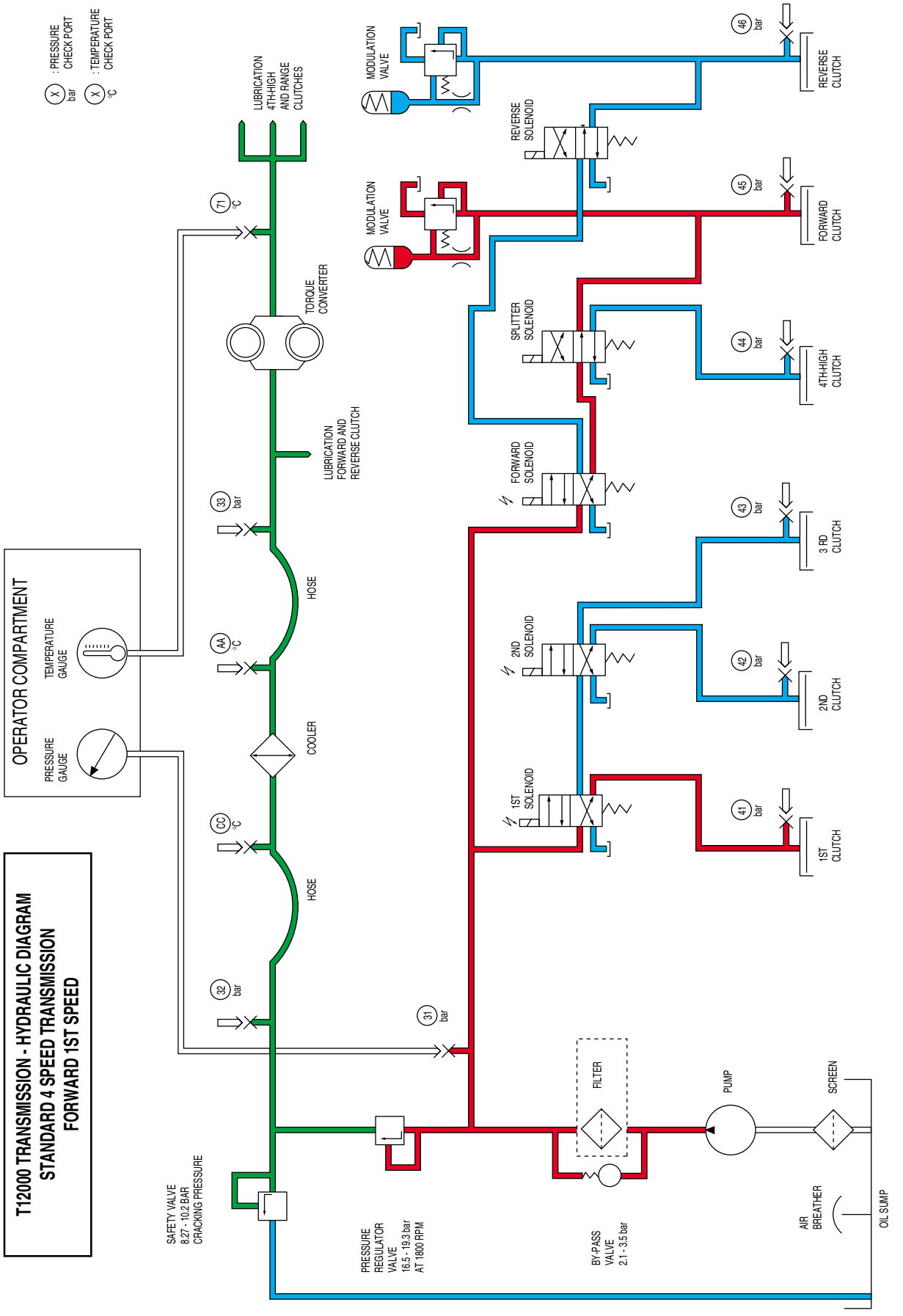
6.3.2.1.1 Neutral and 3rd clutch engaged (continued)



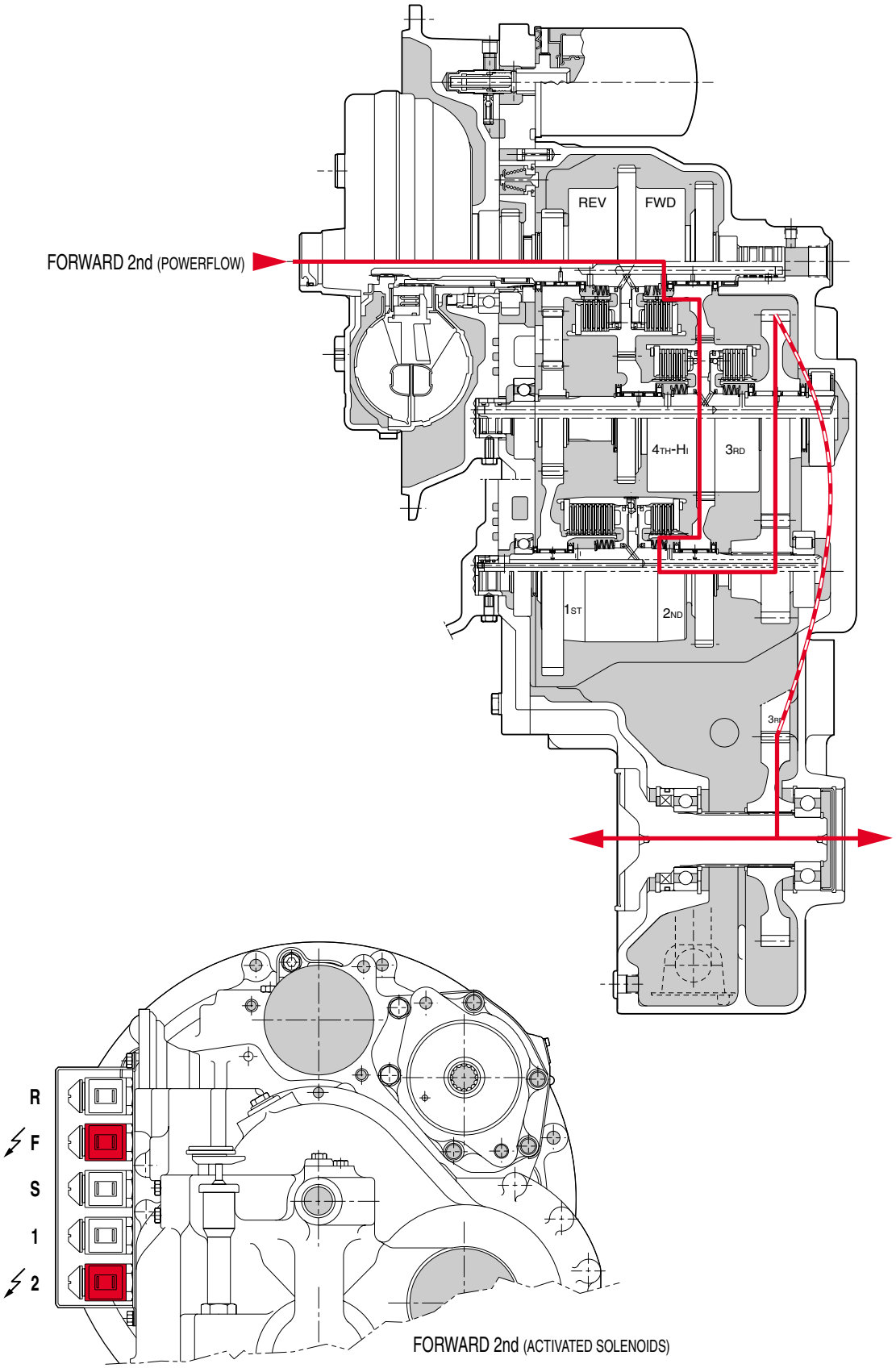
6.3.2.1.2 Forward 1st speed



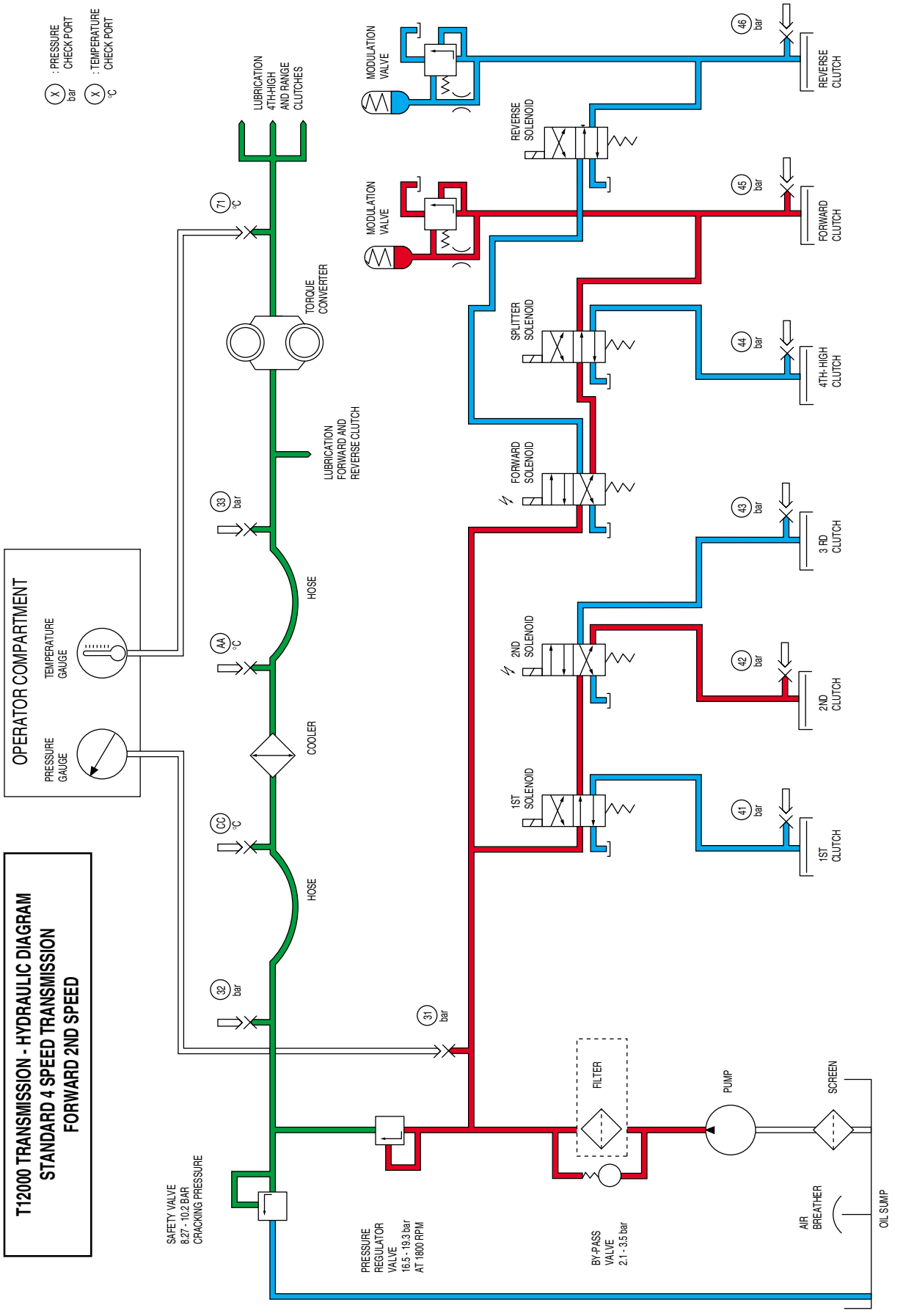
6.3.2.1.2 Forward 1st speed (continued)



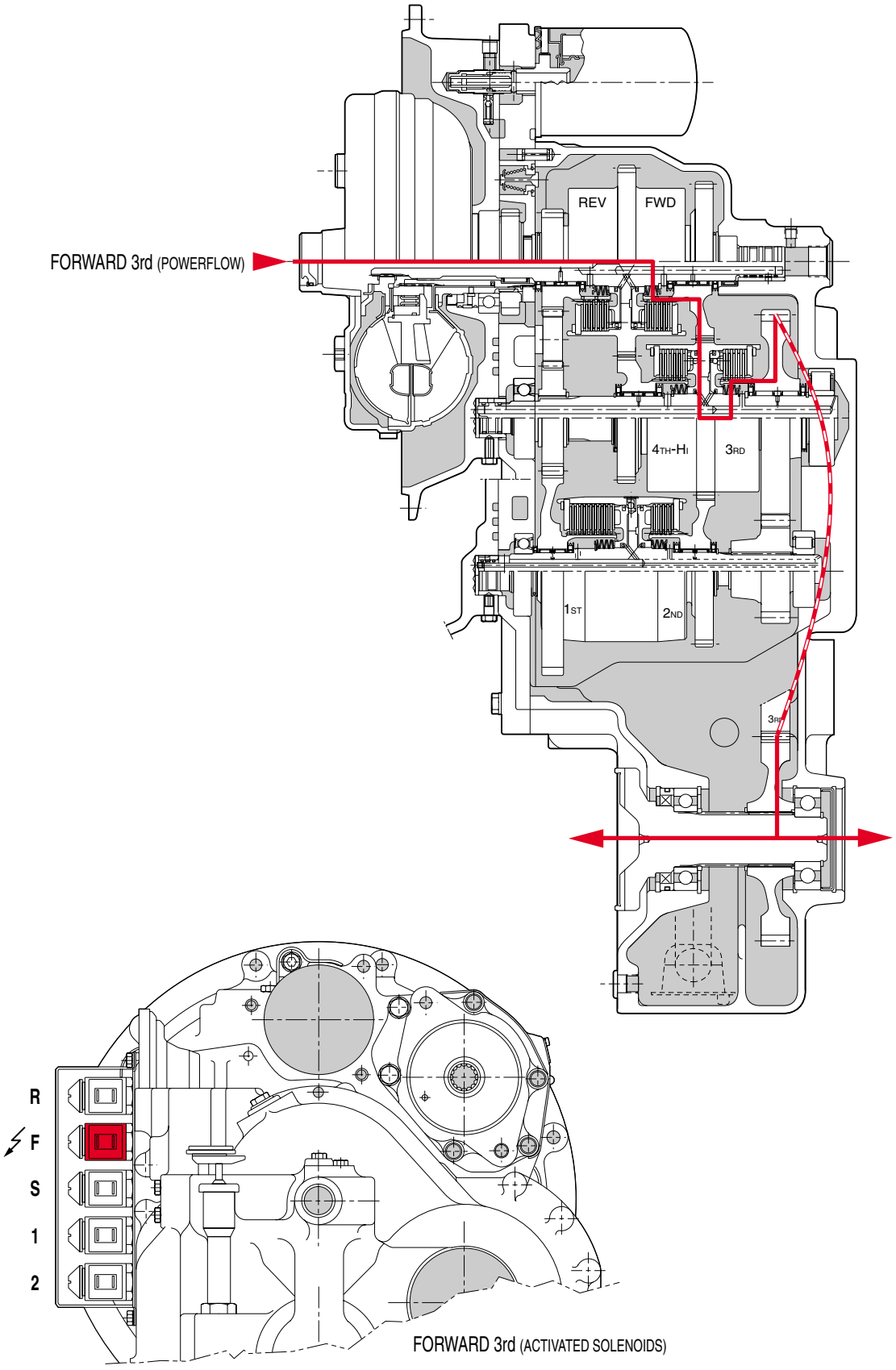
6.3.2.1.3 Forward 2nd speed



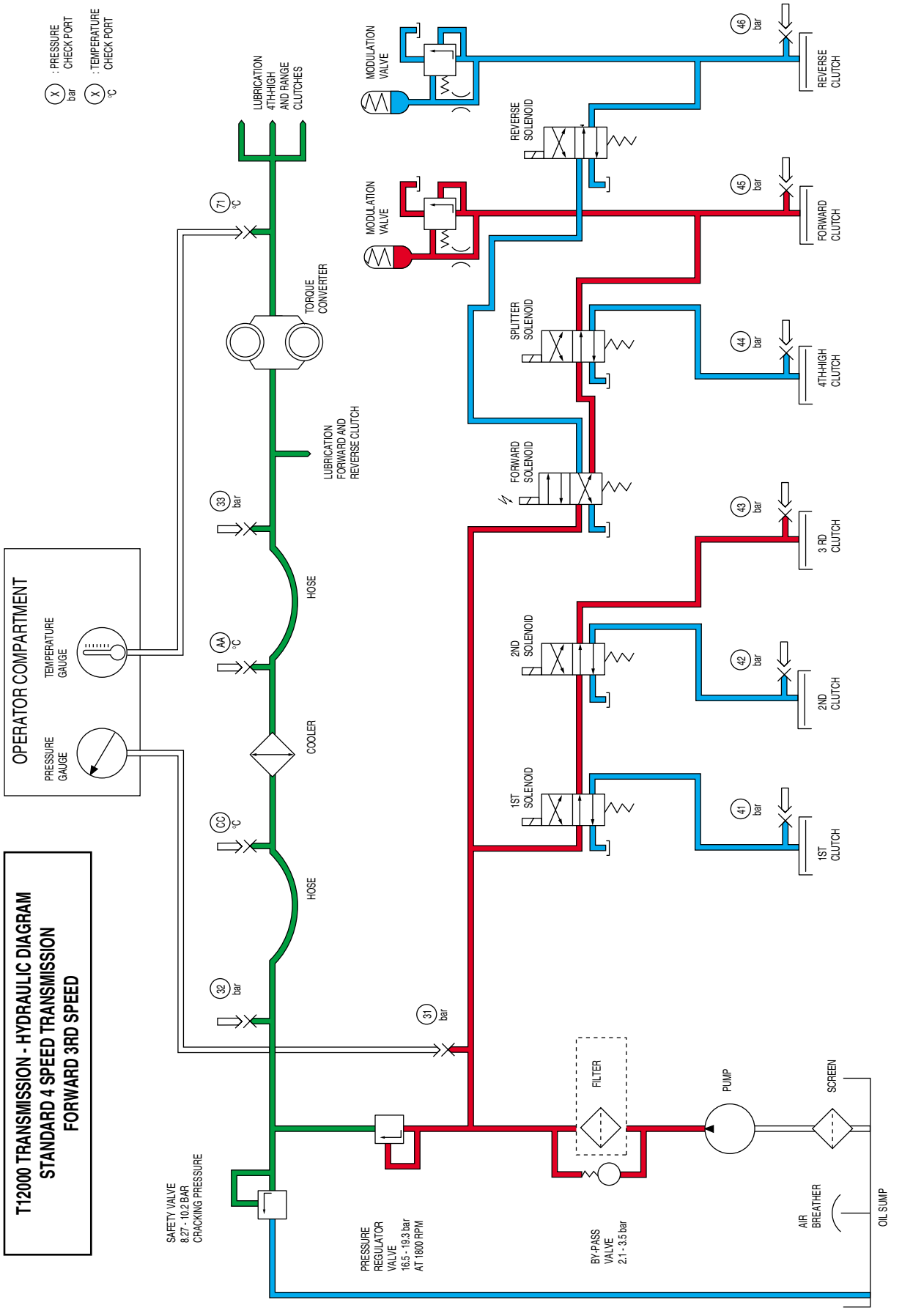
6.3.2.1.3 Forward 2nd speed (continued)



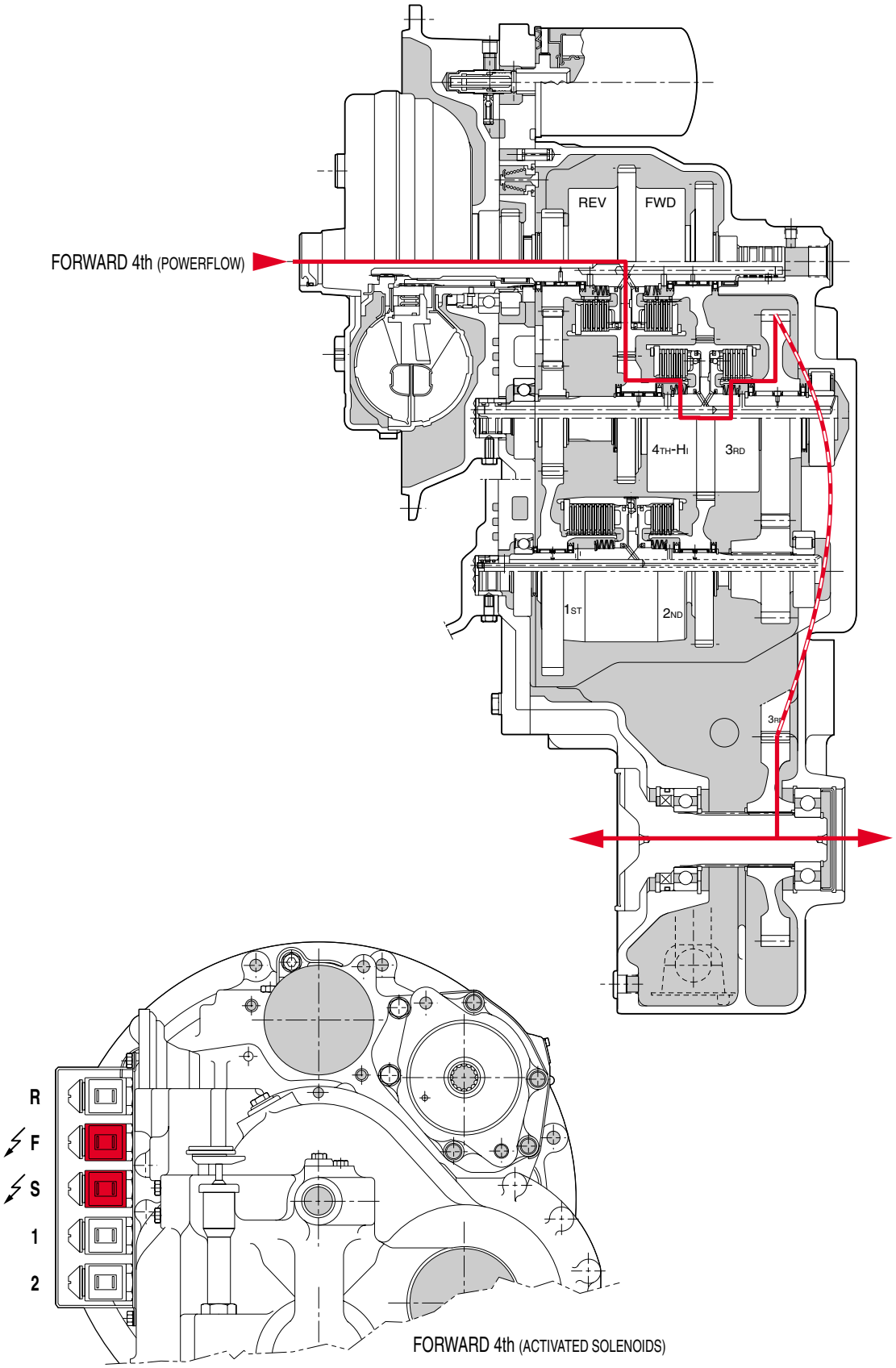
6.3.2.1.4 Forward 3rd speed



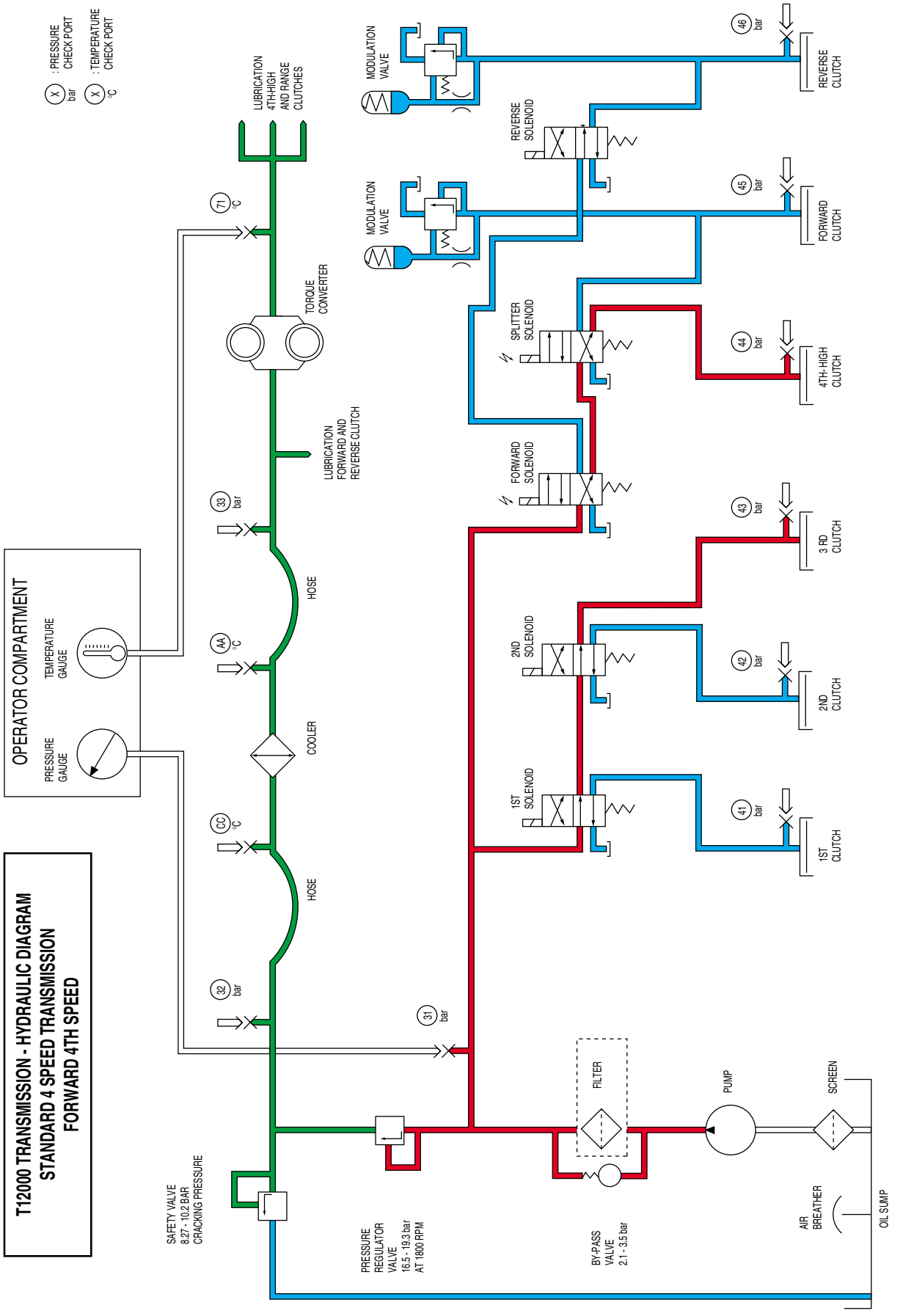
6.3.2.1.4 Forward 3rd speed (continued)



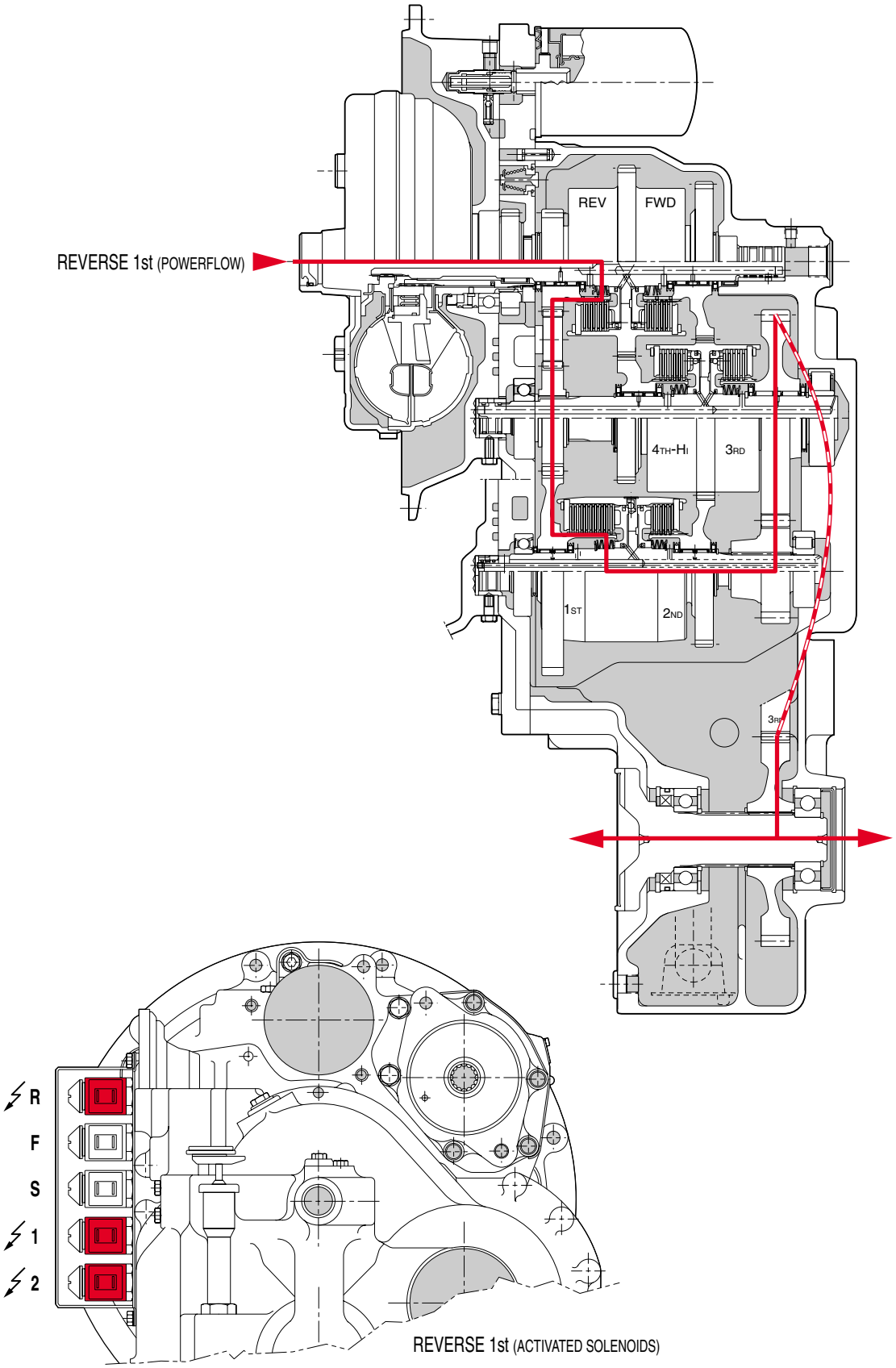
6.3.2.1.5 Forward 4th speed



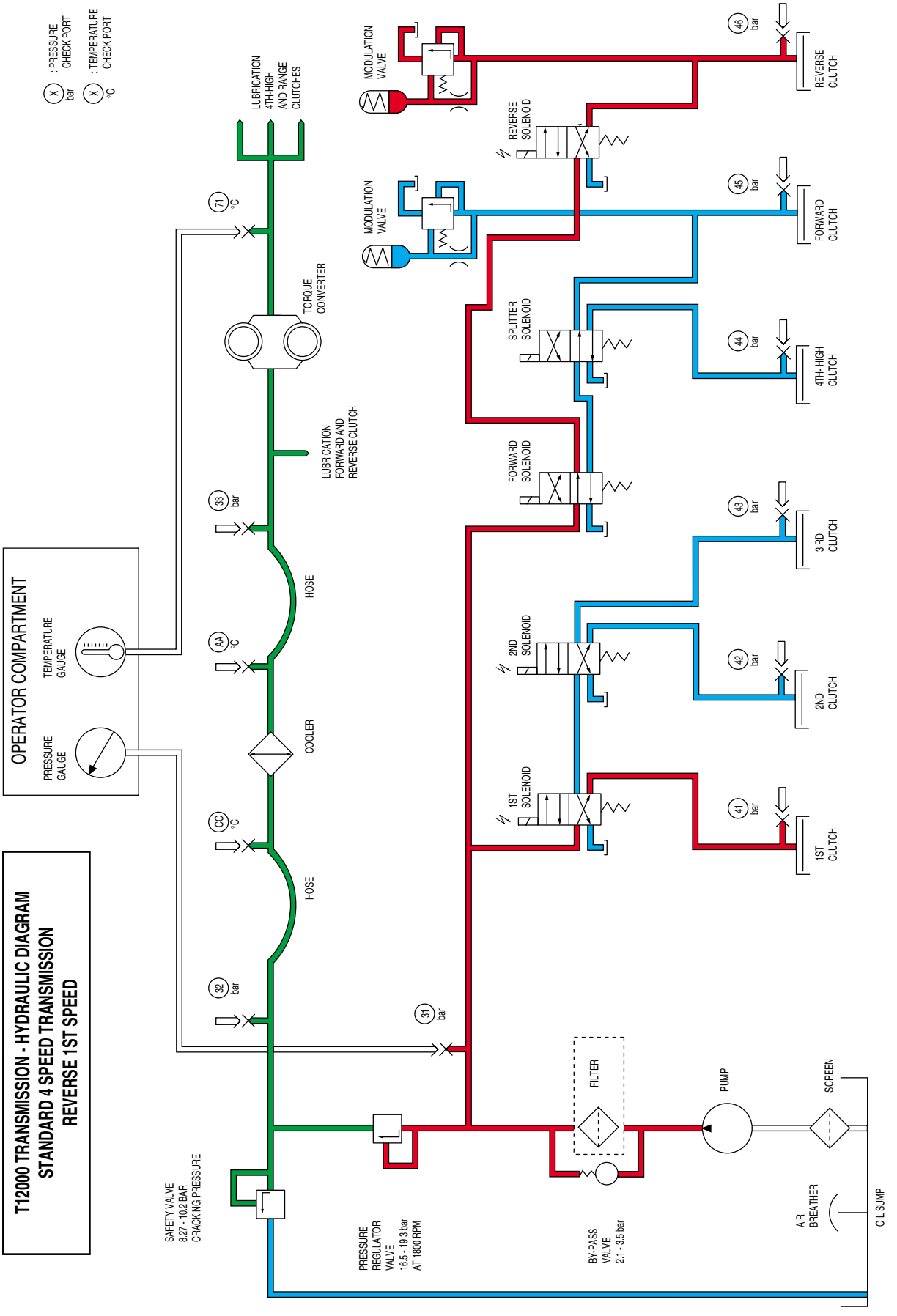
6.3.2.1.5 Forward 4th speed (continued)



6.3.2.1.6 Reverse 1st speed

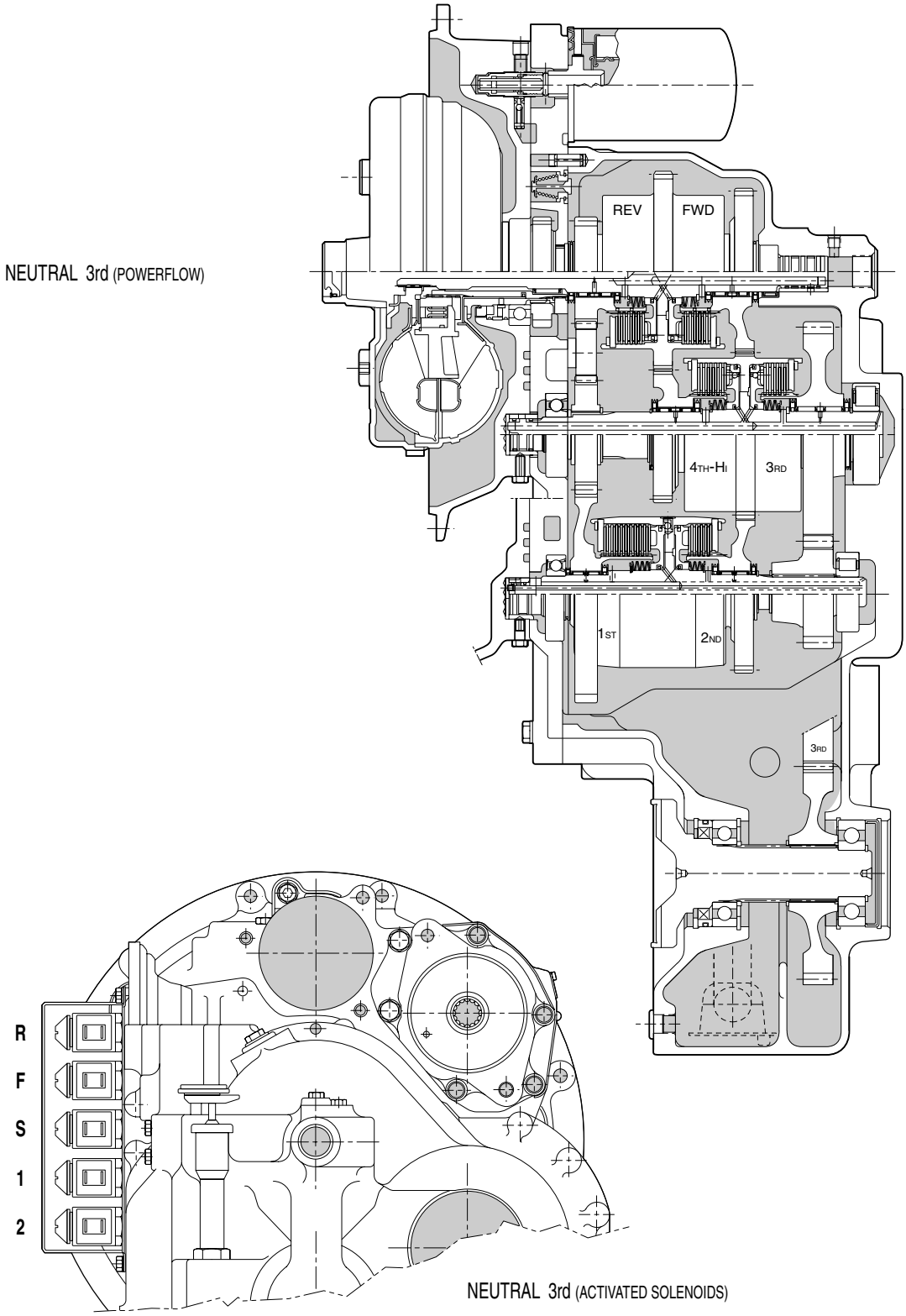


6.3.2.1.6 Reverse 1st speed (continued)

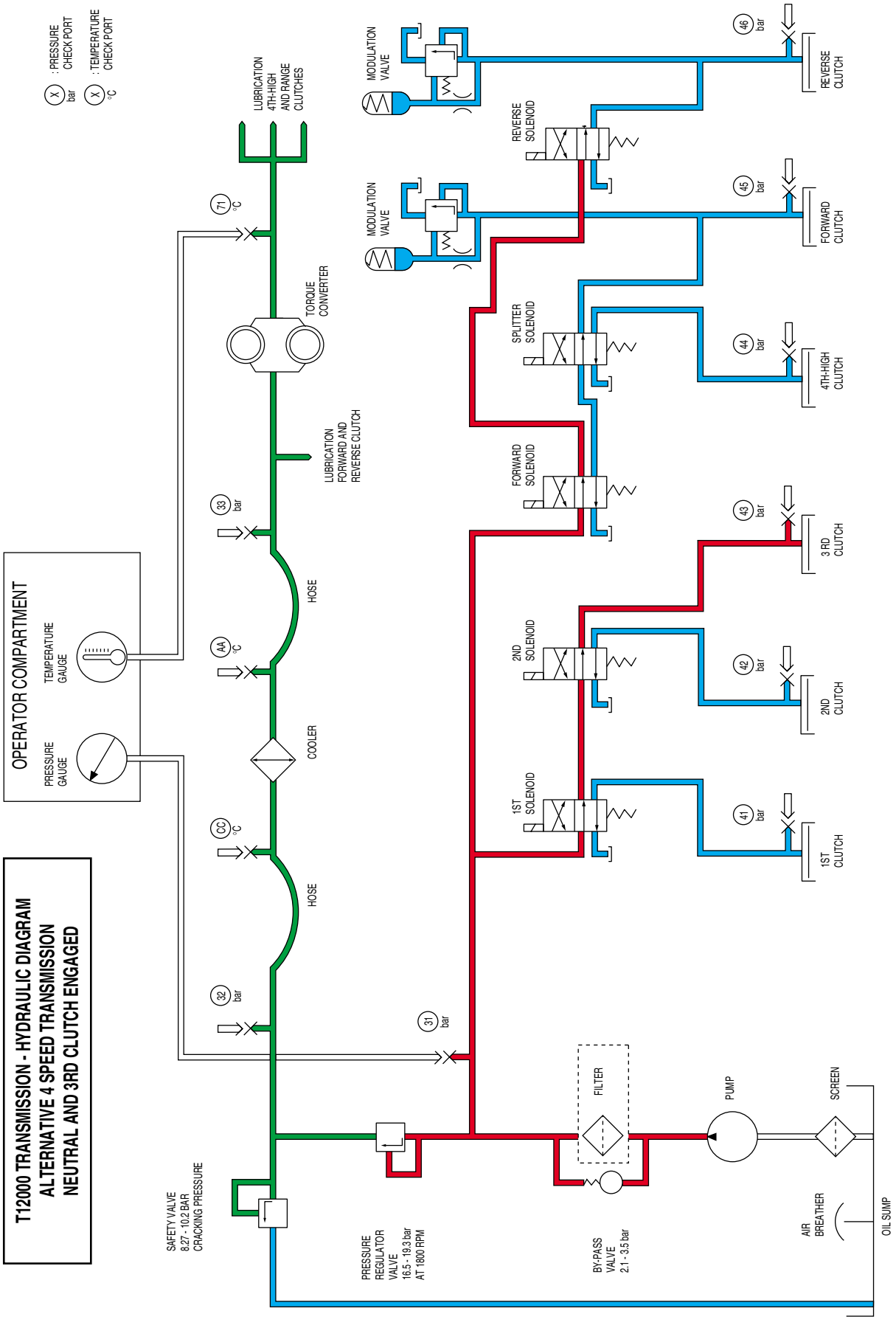


6.3.2.2 Alternative 4-speed transmission

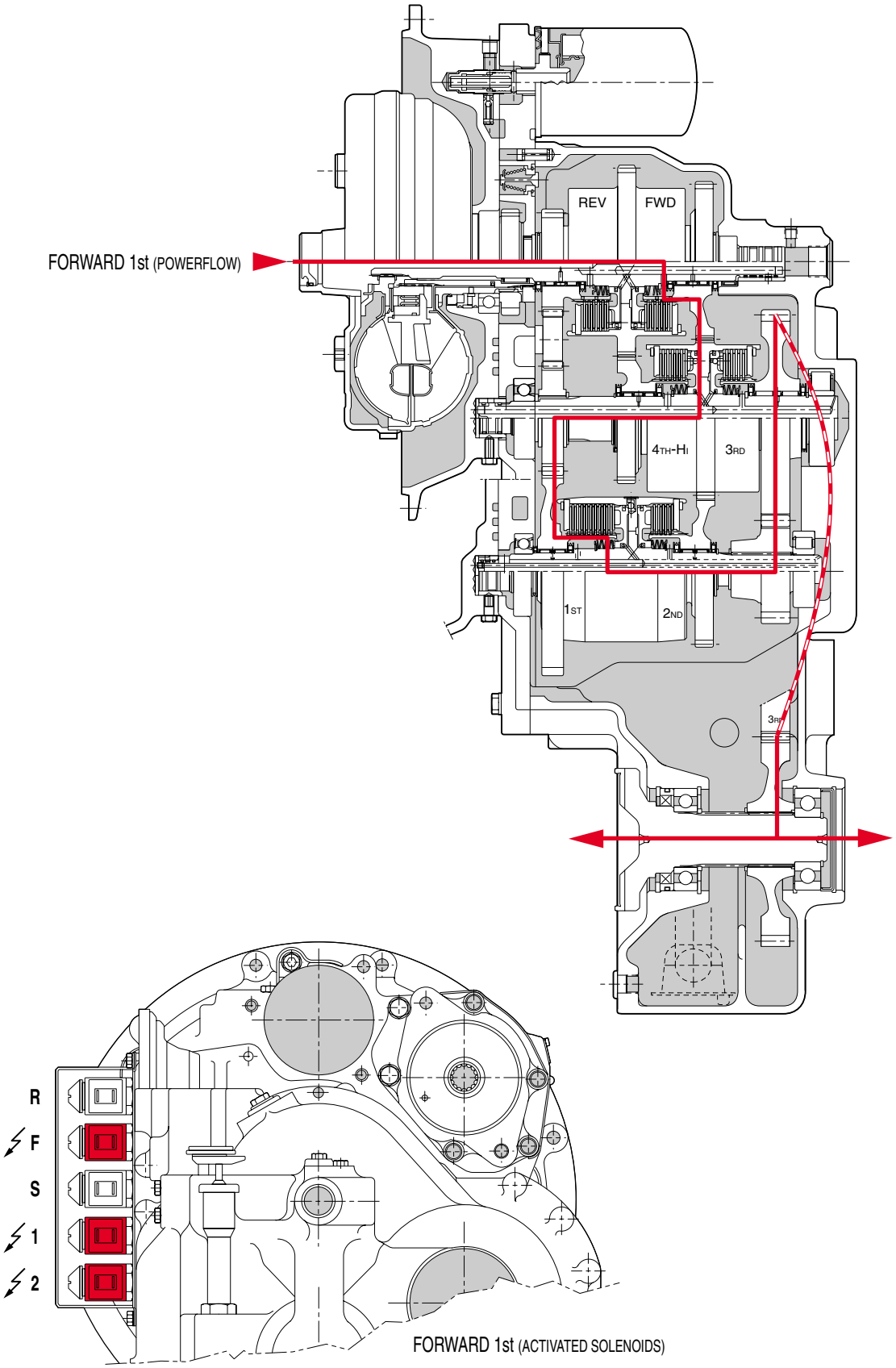
6.3.2.2.1 Neutral and 3rd clutch engaged



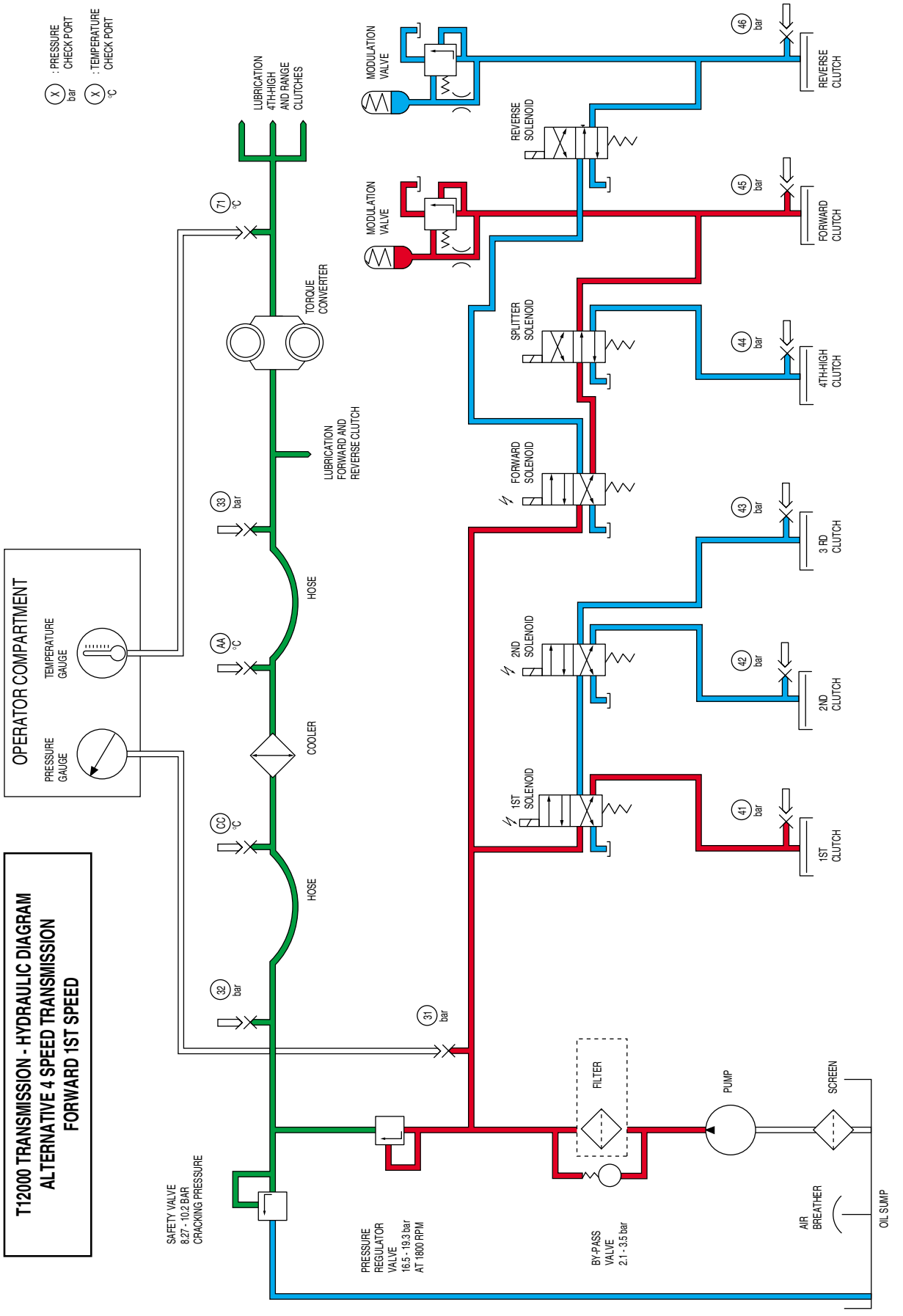
6.3.2.2.1 Neutral and 3rd clutch engaged (continued)



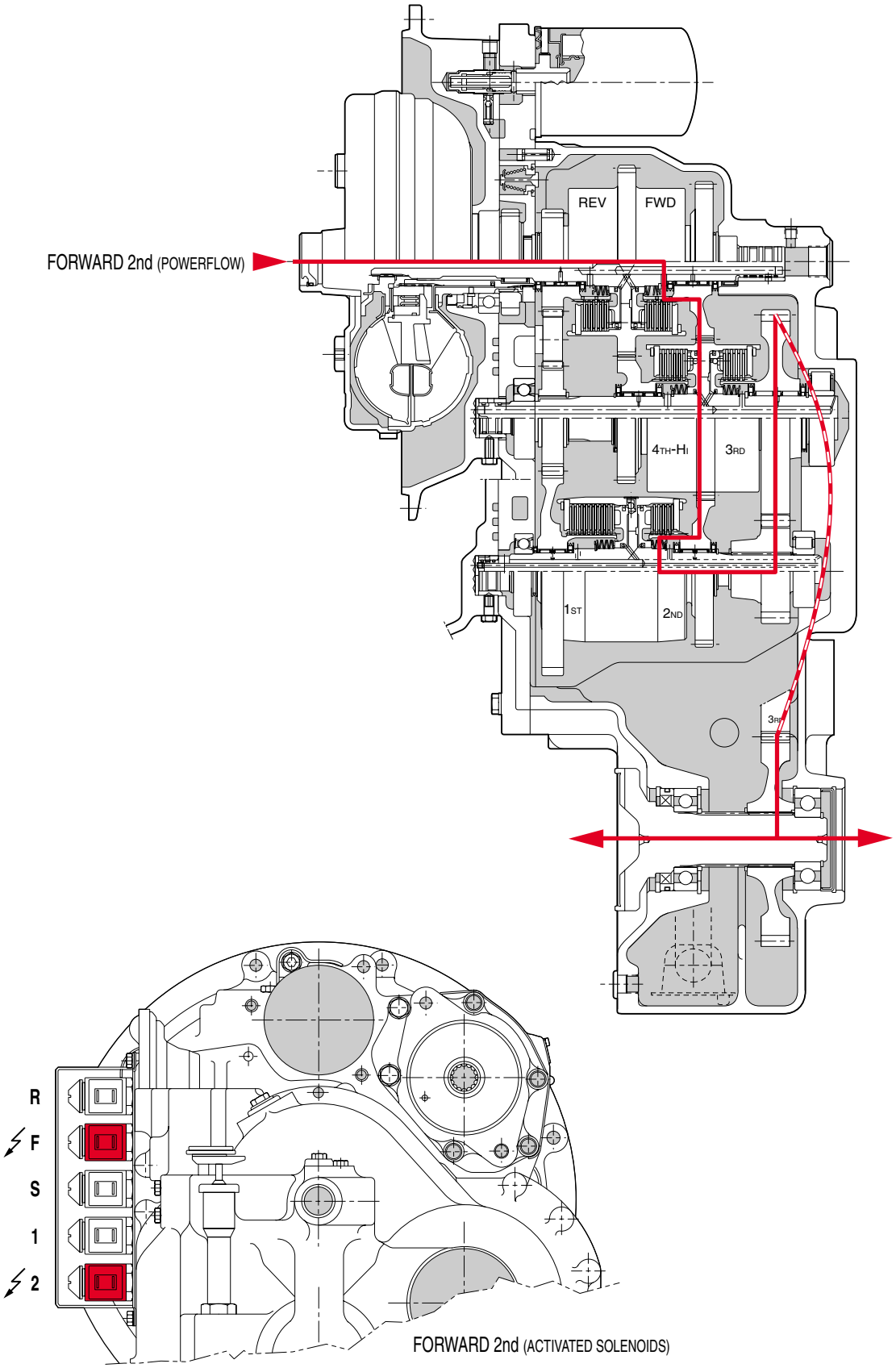
6.3.2.2.2 Forward 1st speed



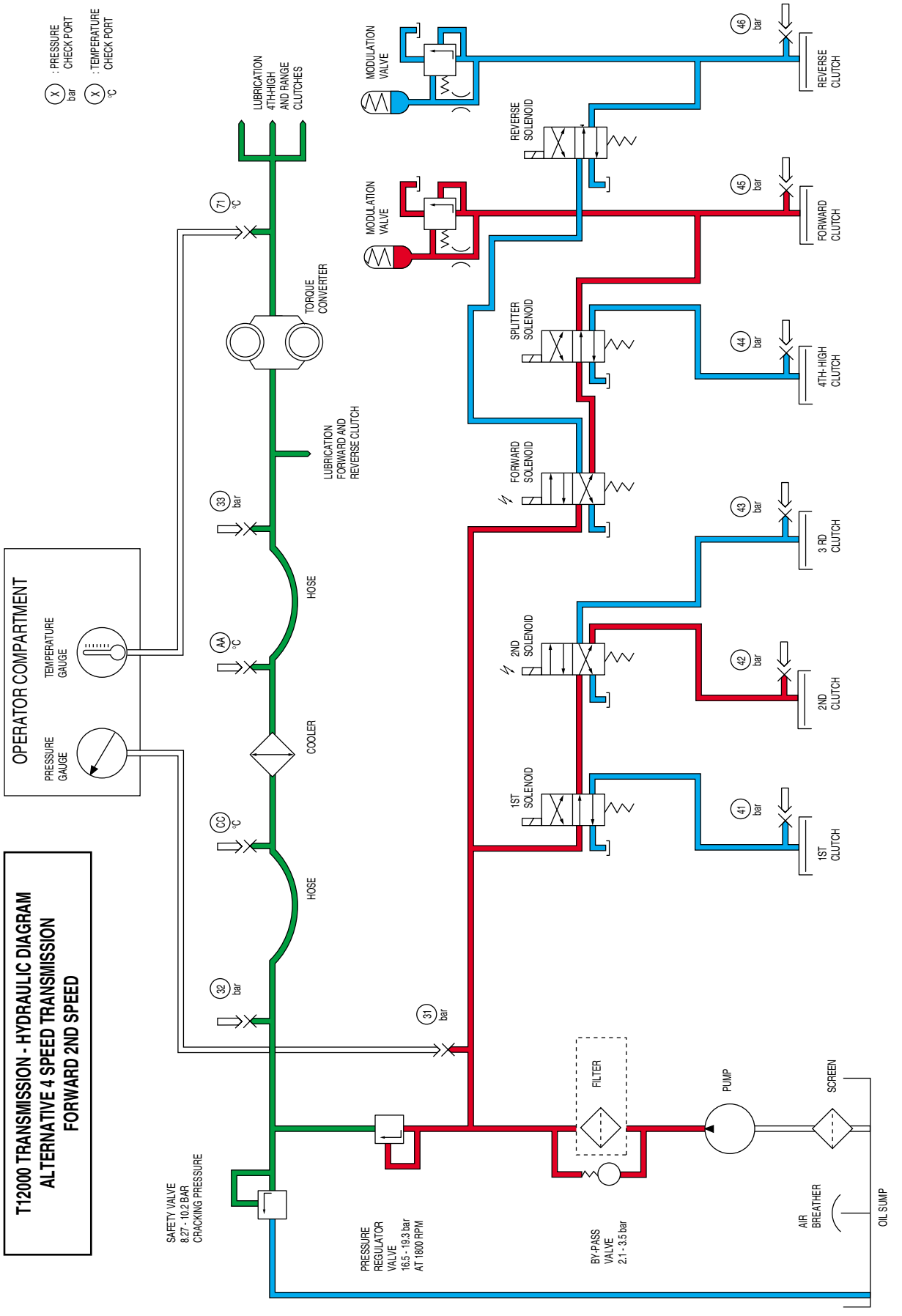
6.3.2.2.2 Forward 1st speed (continued)



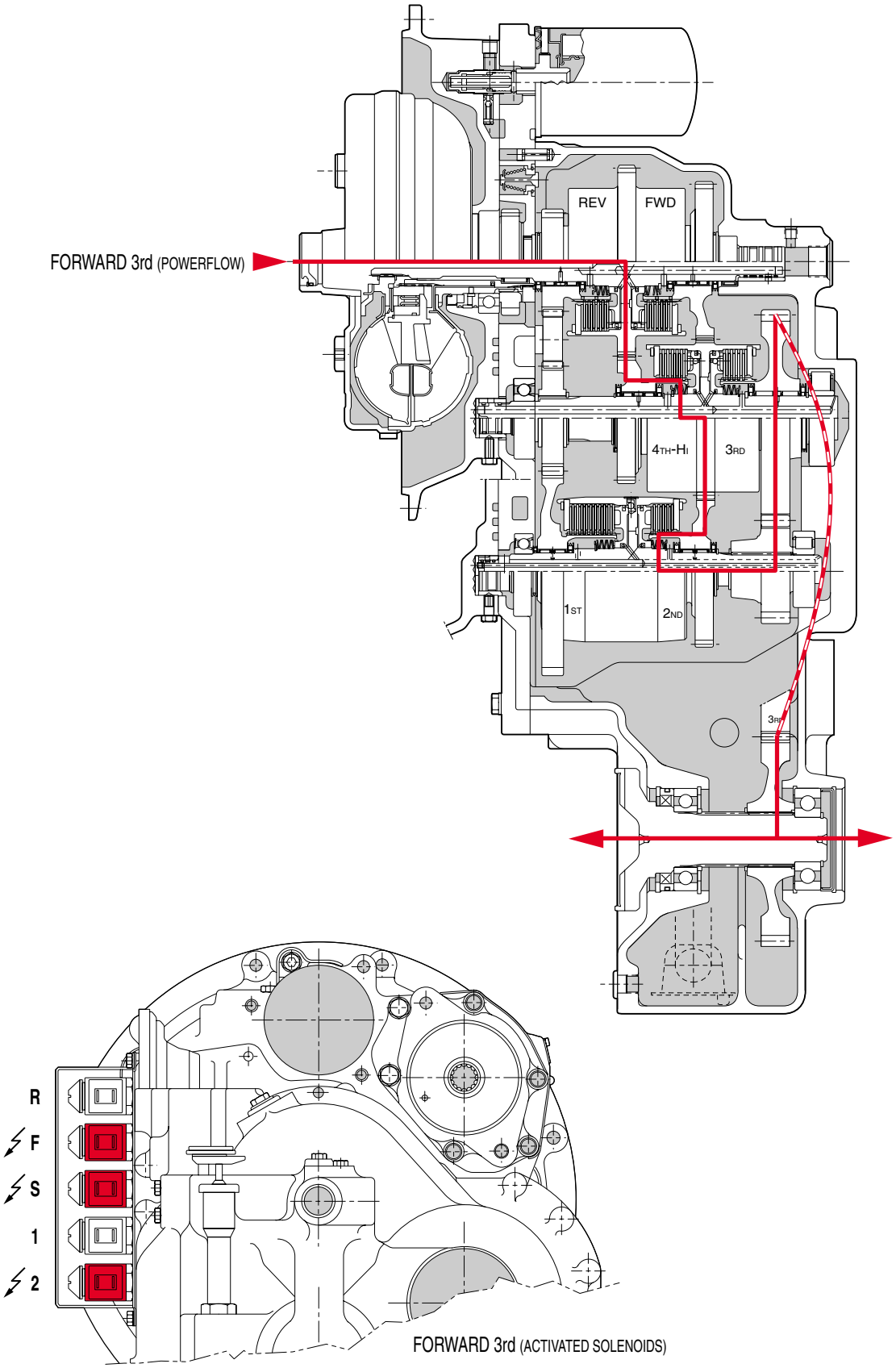
6.3.2.2.3 Forward 2nd speed



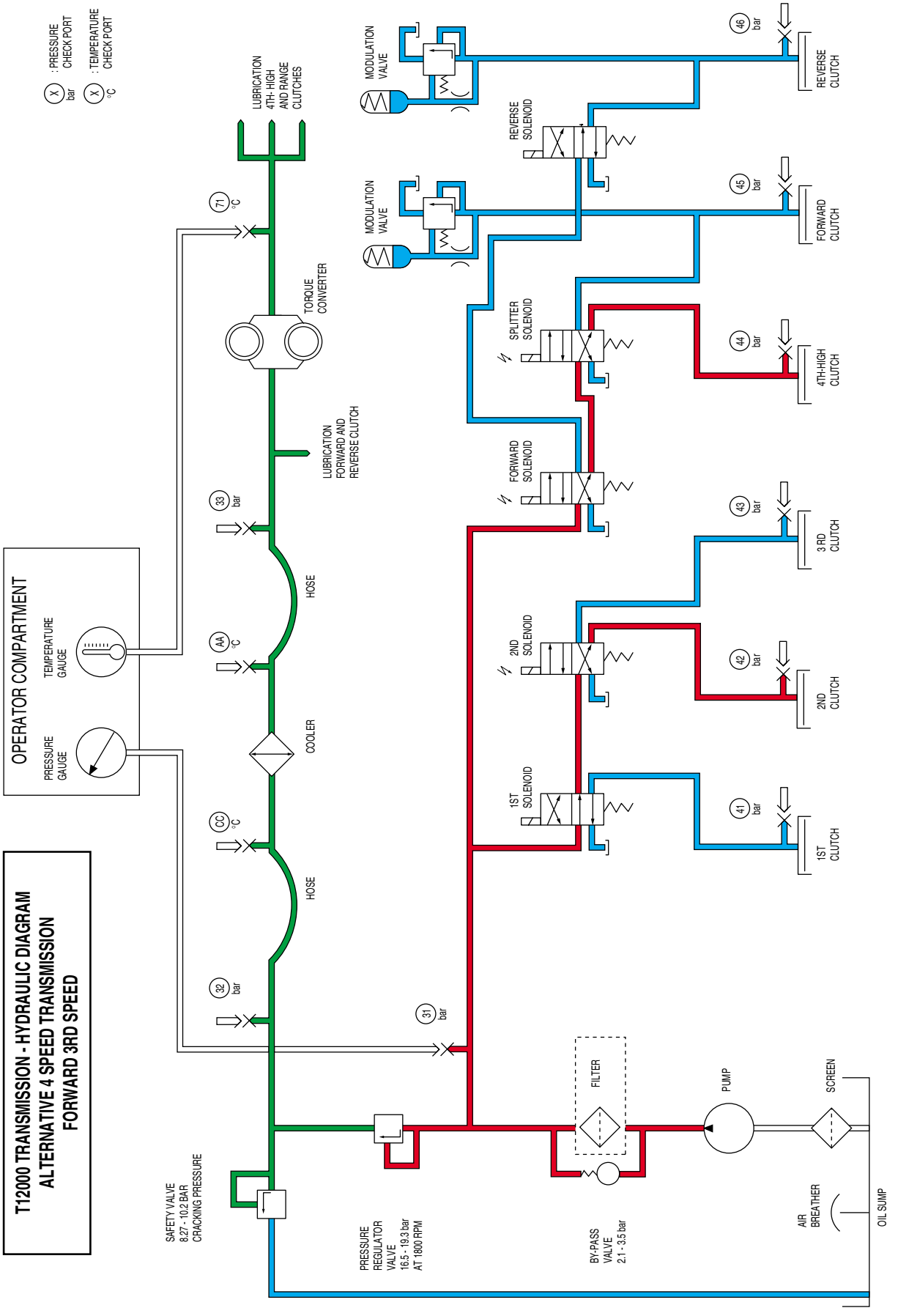
6.3.2.2.3 Forward 2nd speed (continued)



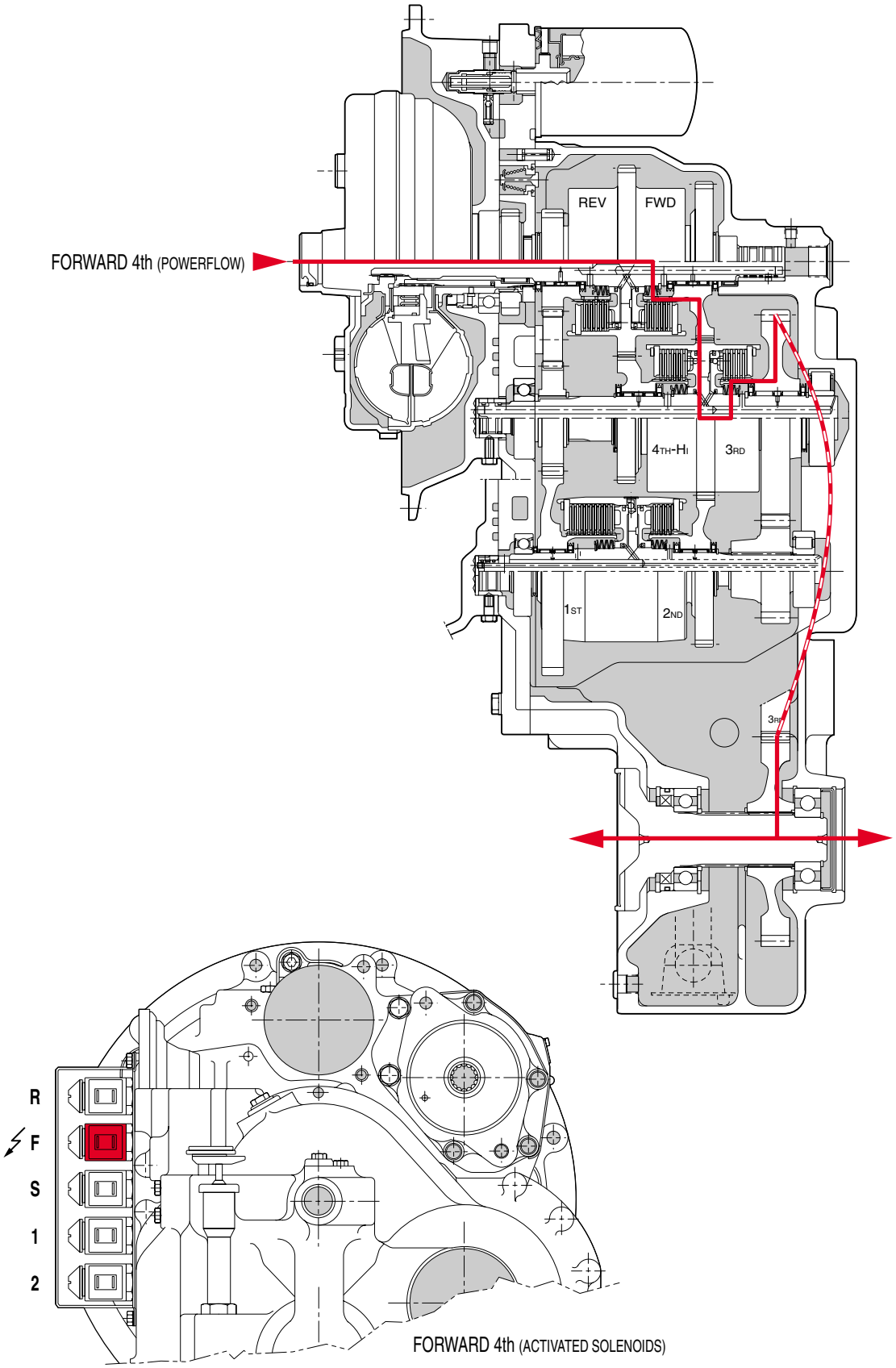
6.3.2.2.4 Forward 3rd speed



6.3.2.2.4 Forward 3rd speed (continued)



6.3.2.2.5 Forward 4th speed



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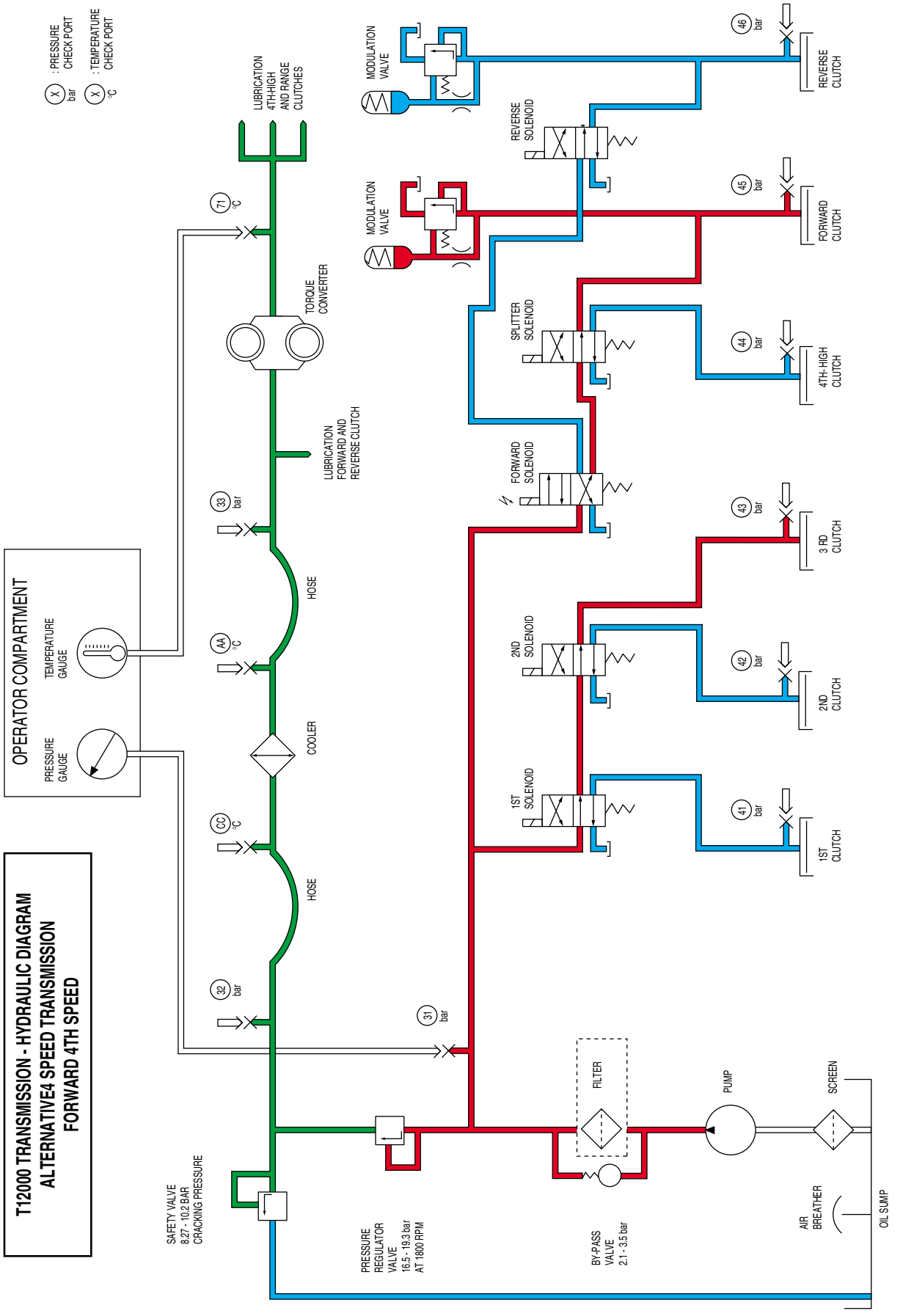
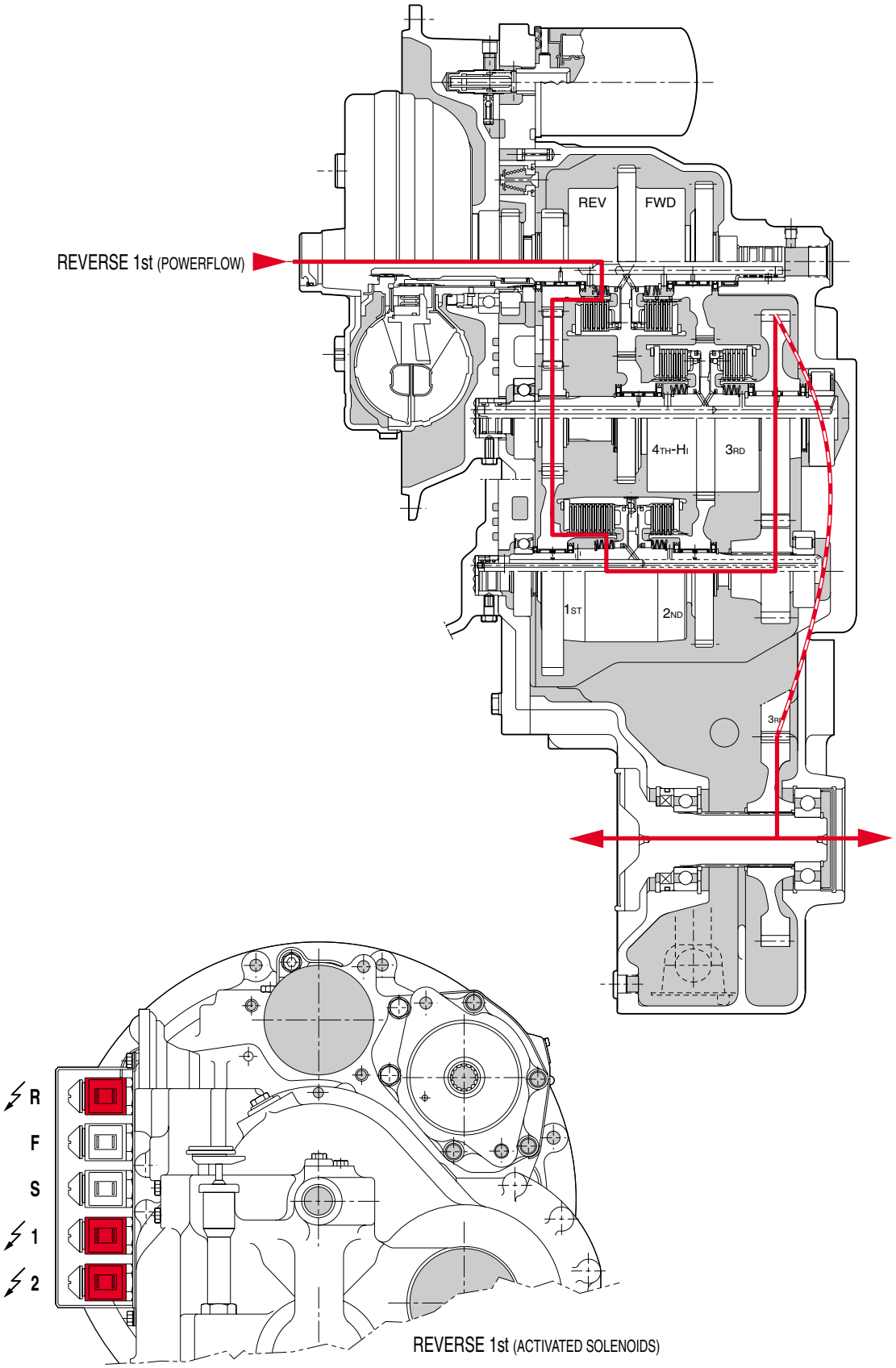


6.3.2.2.6 Reverse 1st speed



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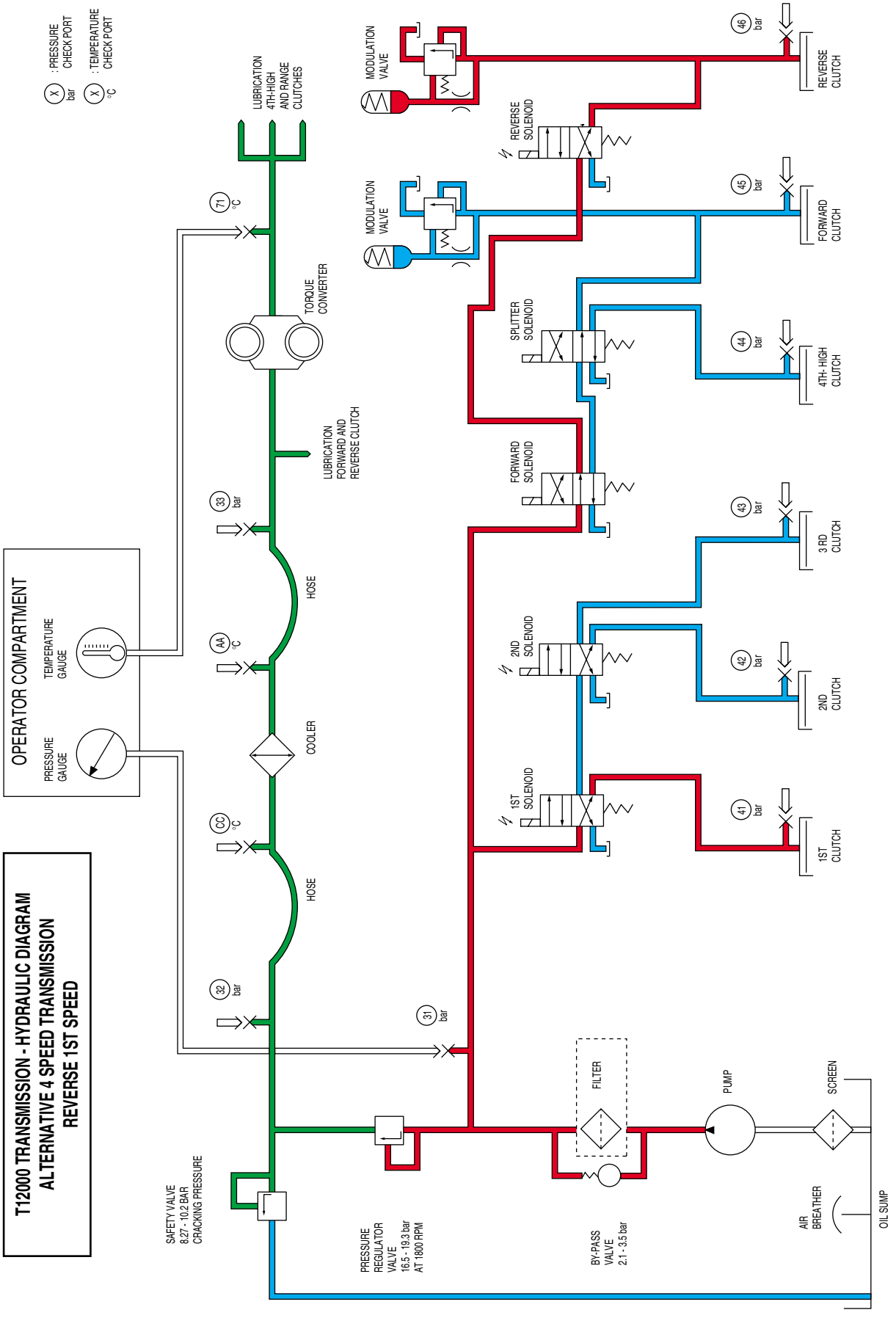
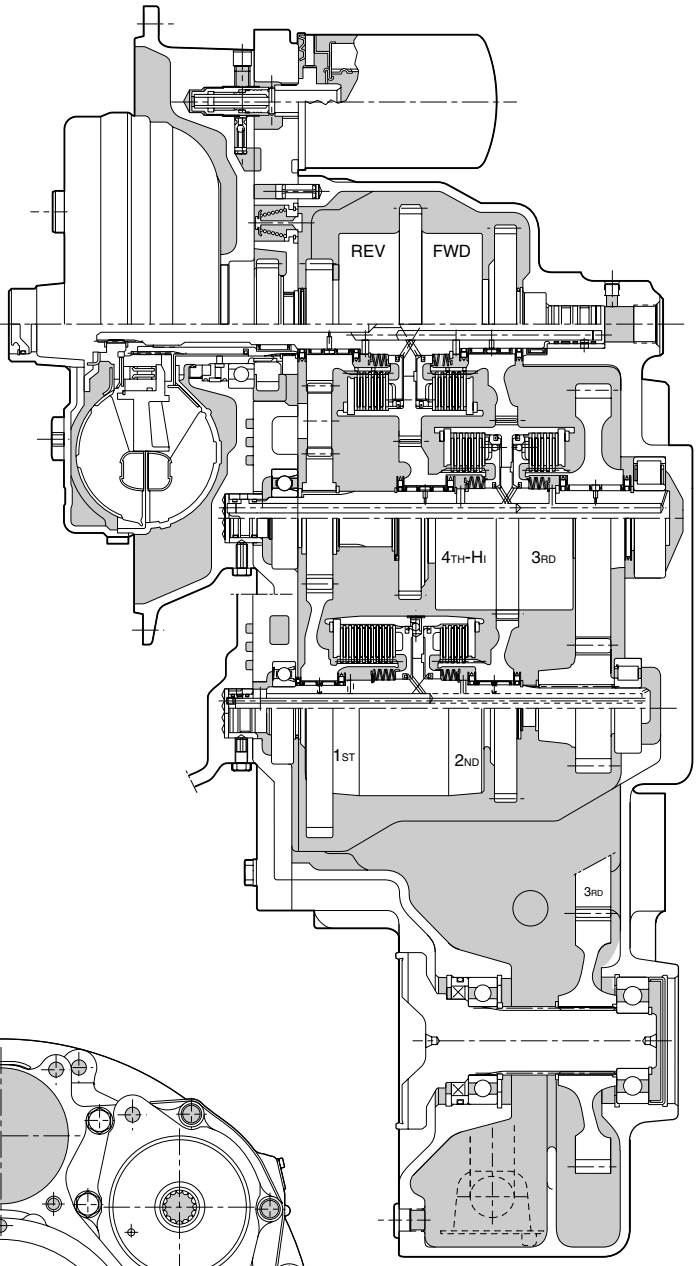
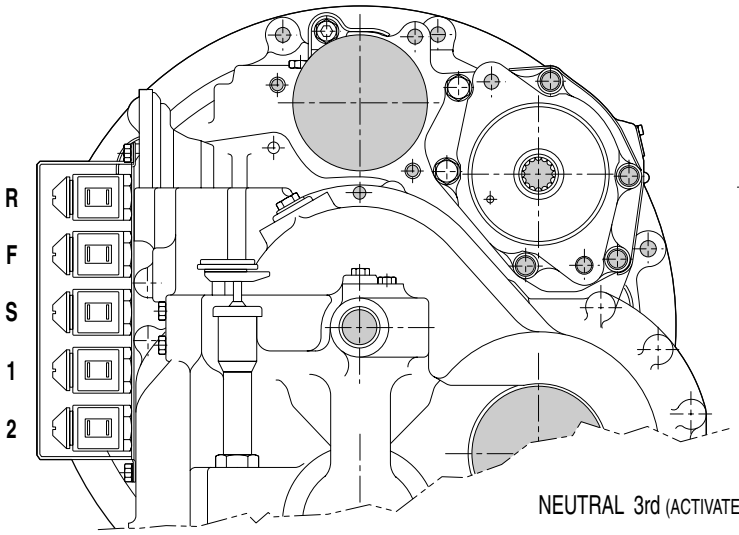


6.3.3 6-Speed transmission

6.3.3.1 Neutral and 3rd clutch engaged

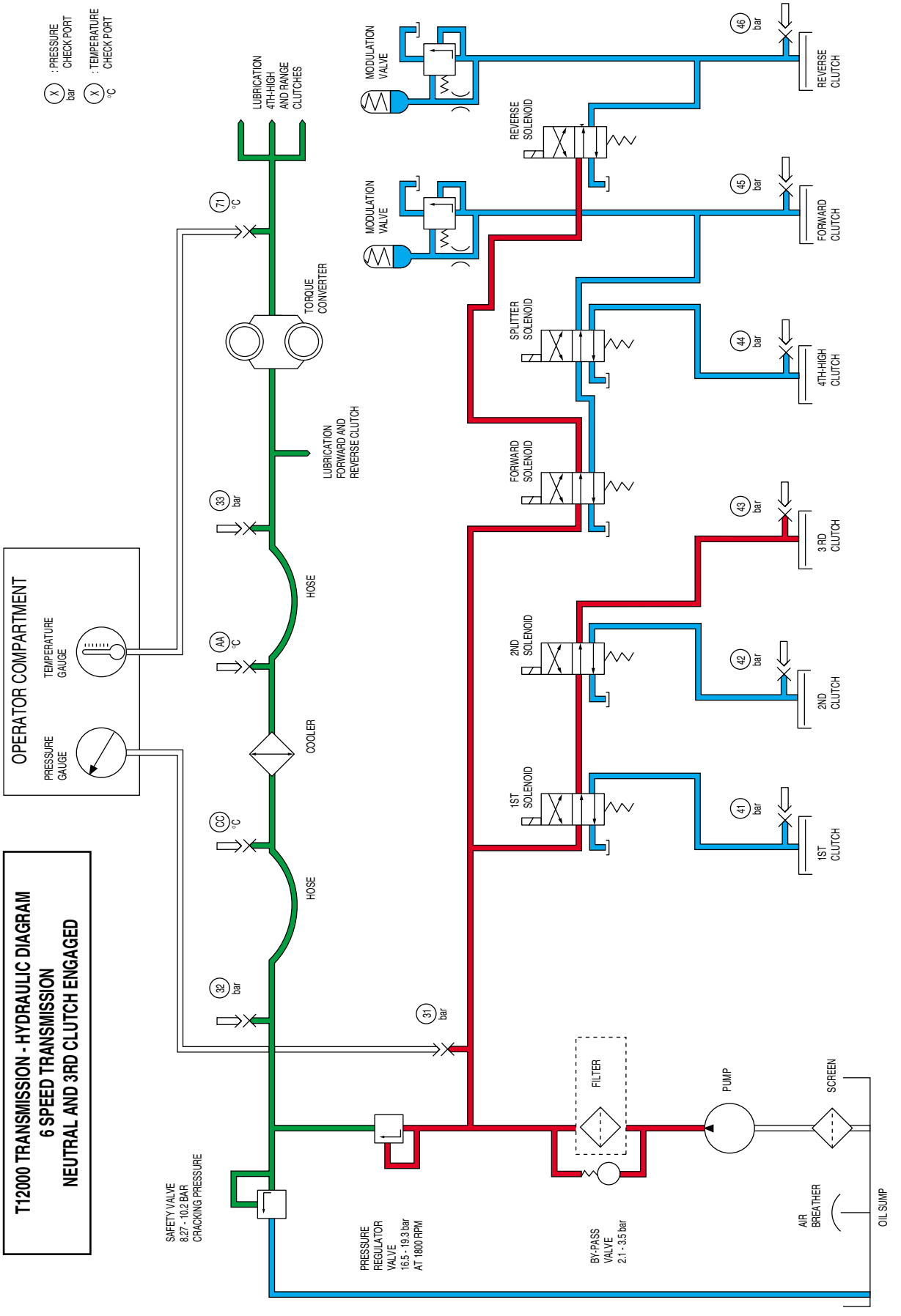
NEUTRAL 3rd (POWERFLOW)





NEUTRAL 3rd (ACTIVATED SOLENOIDS)

6.3.3.1 Neutral and 3rd clutch engaged (continued)



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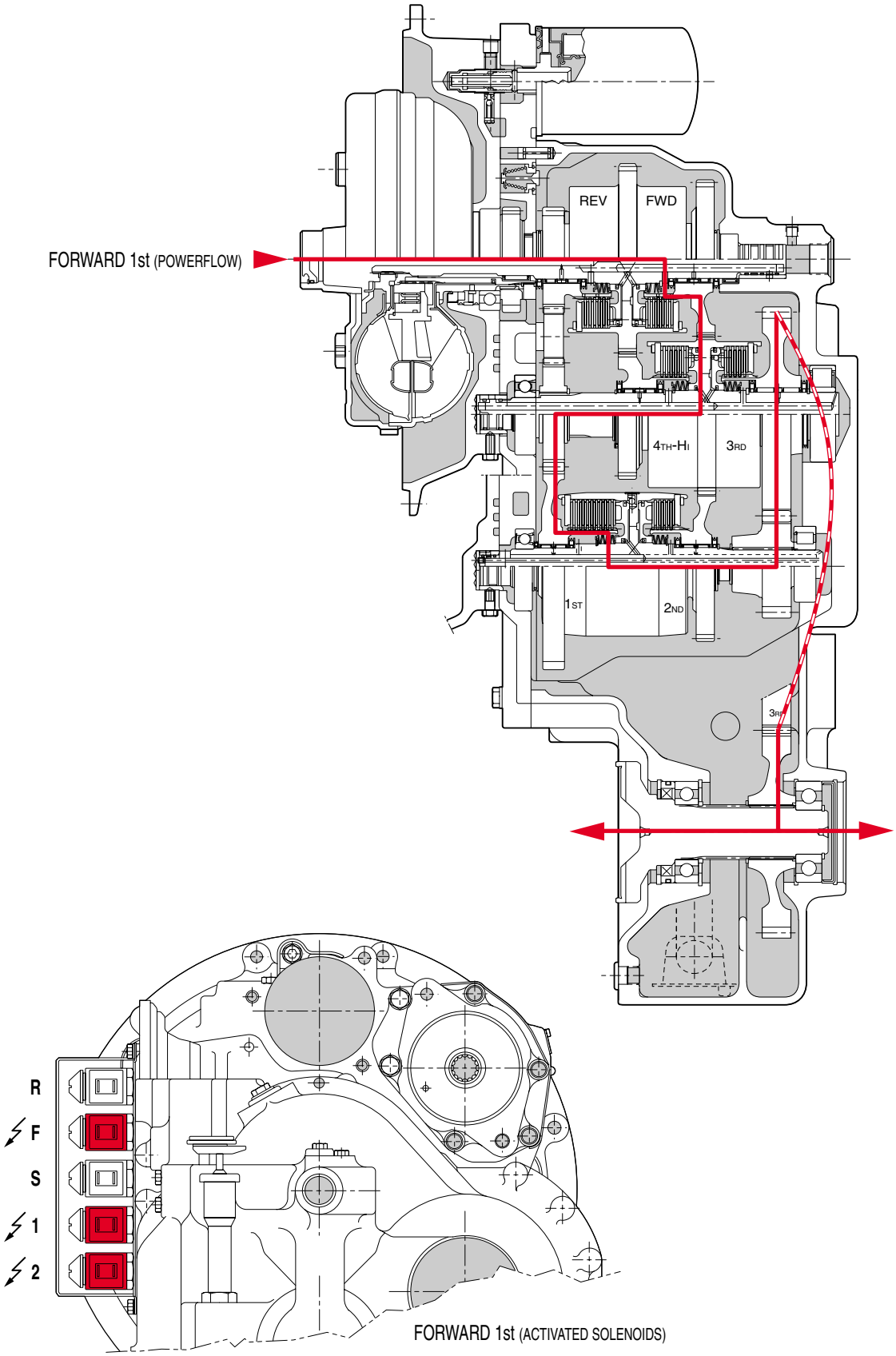

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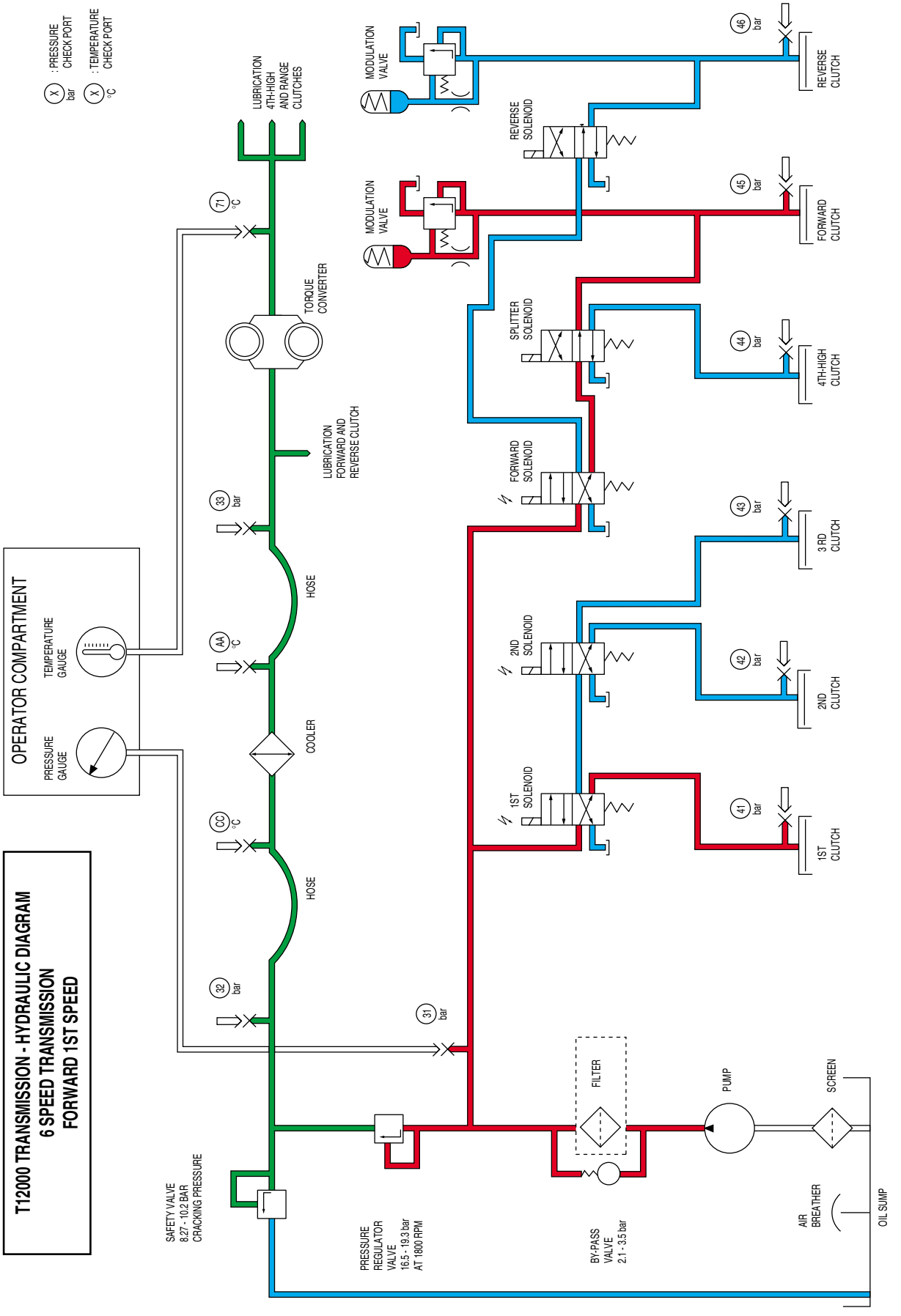
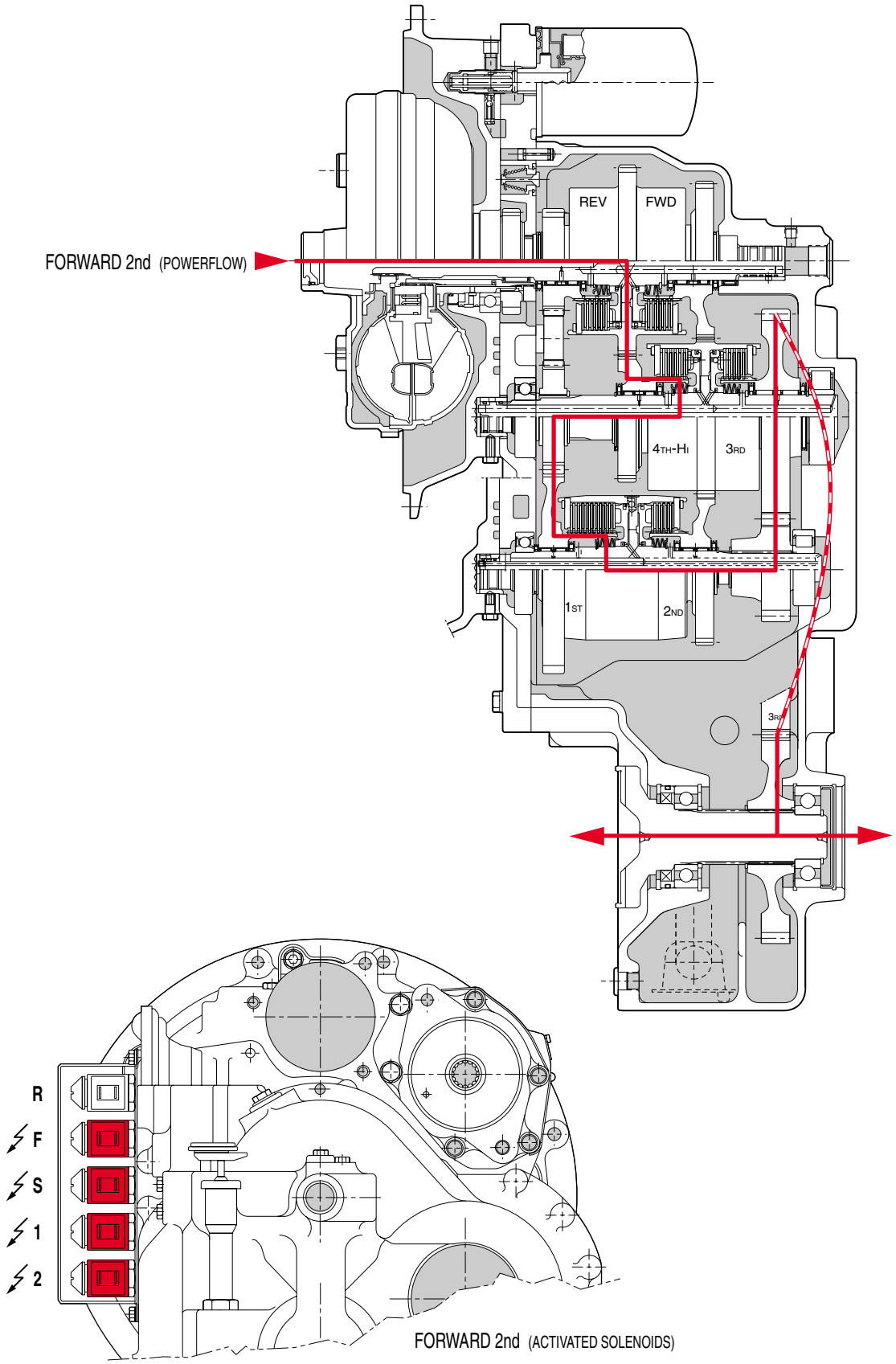


6.3.3.3 Forward 2nd speed



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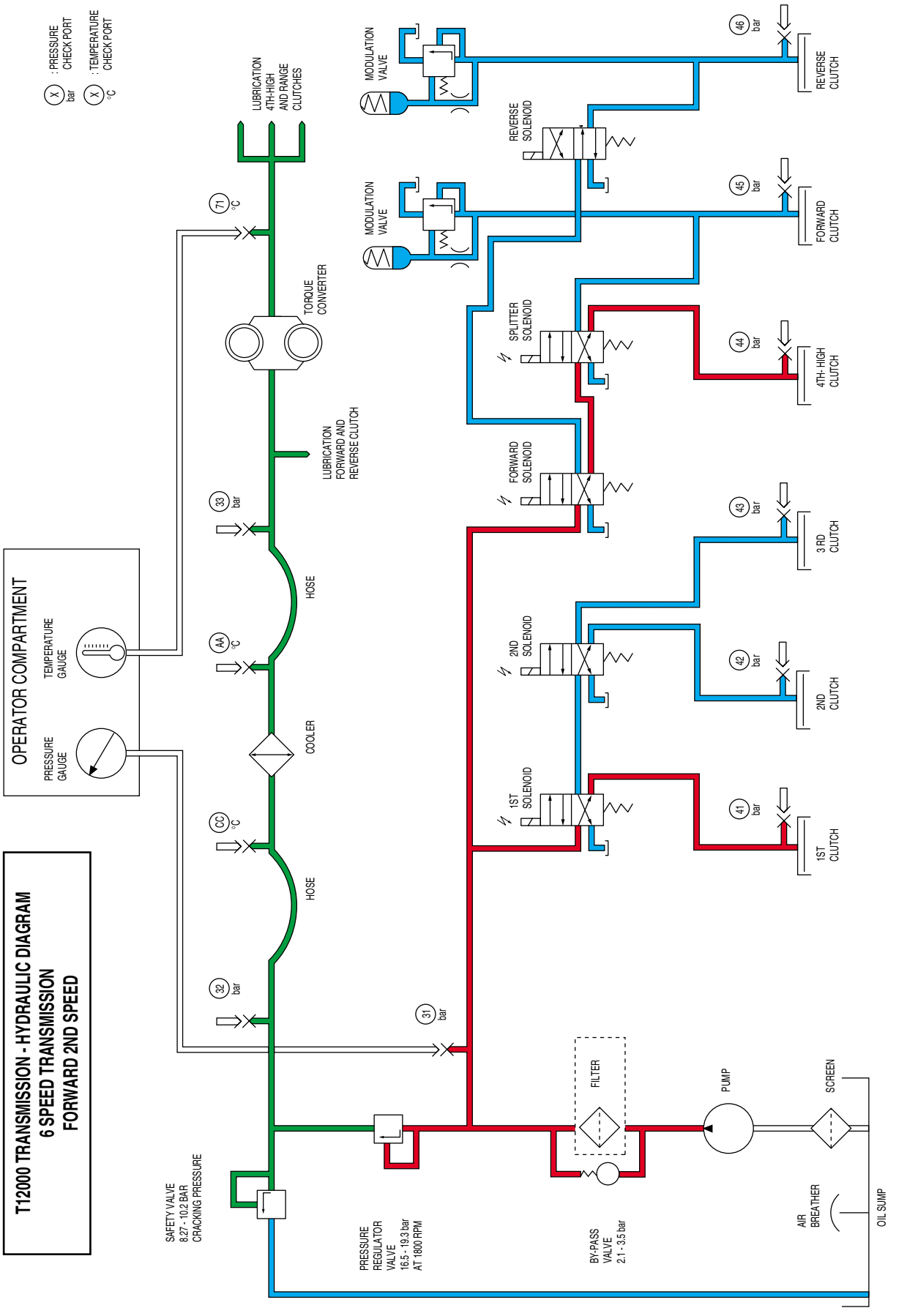

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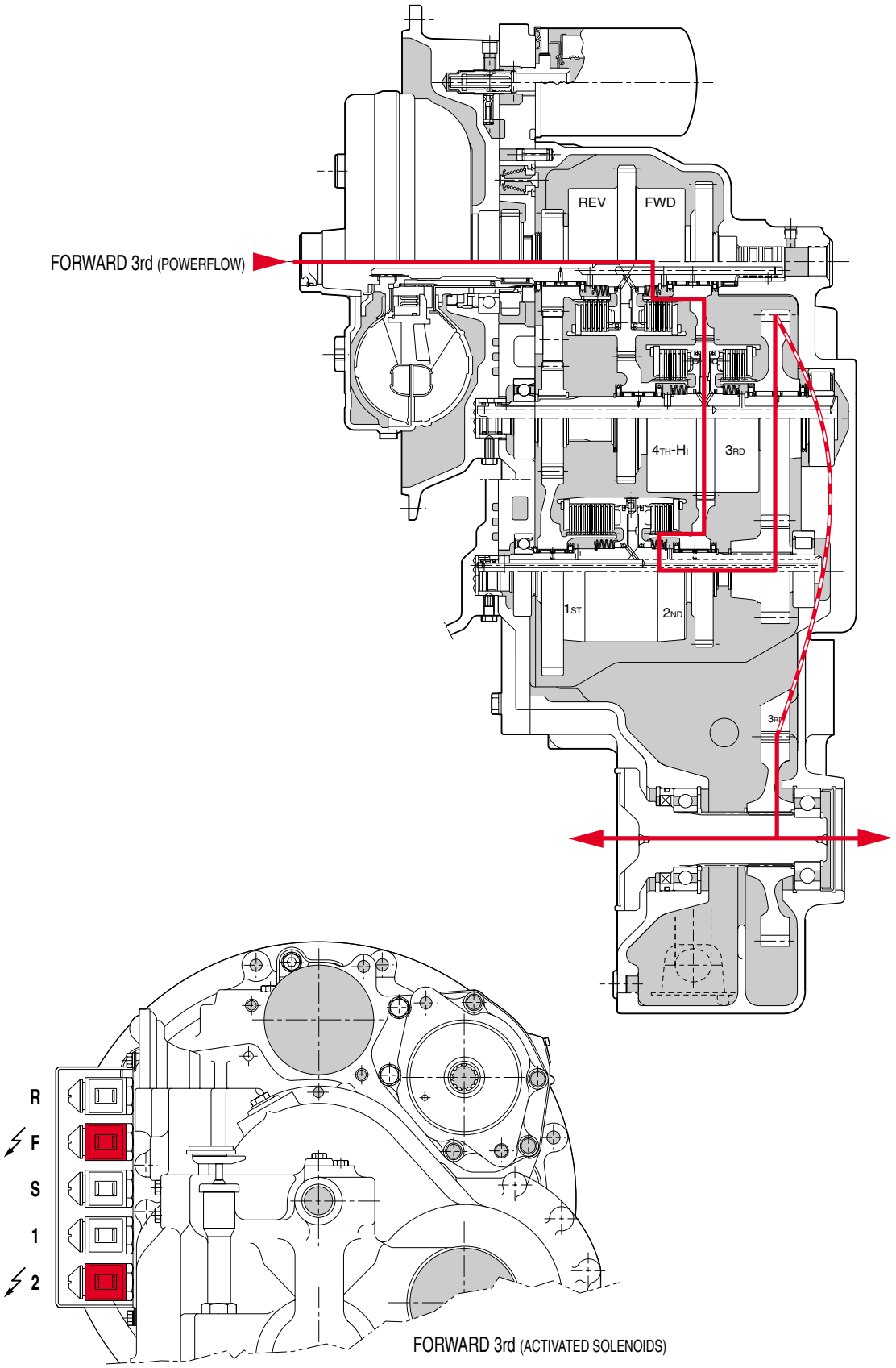

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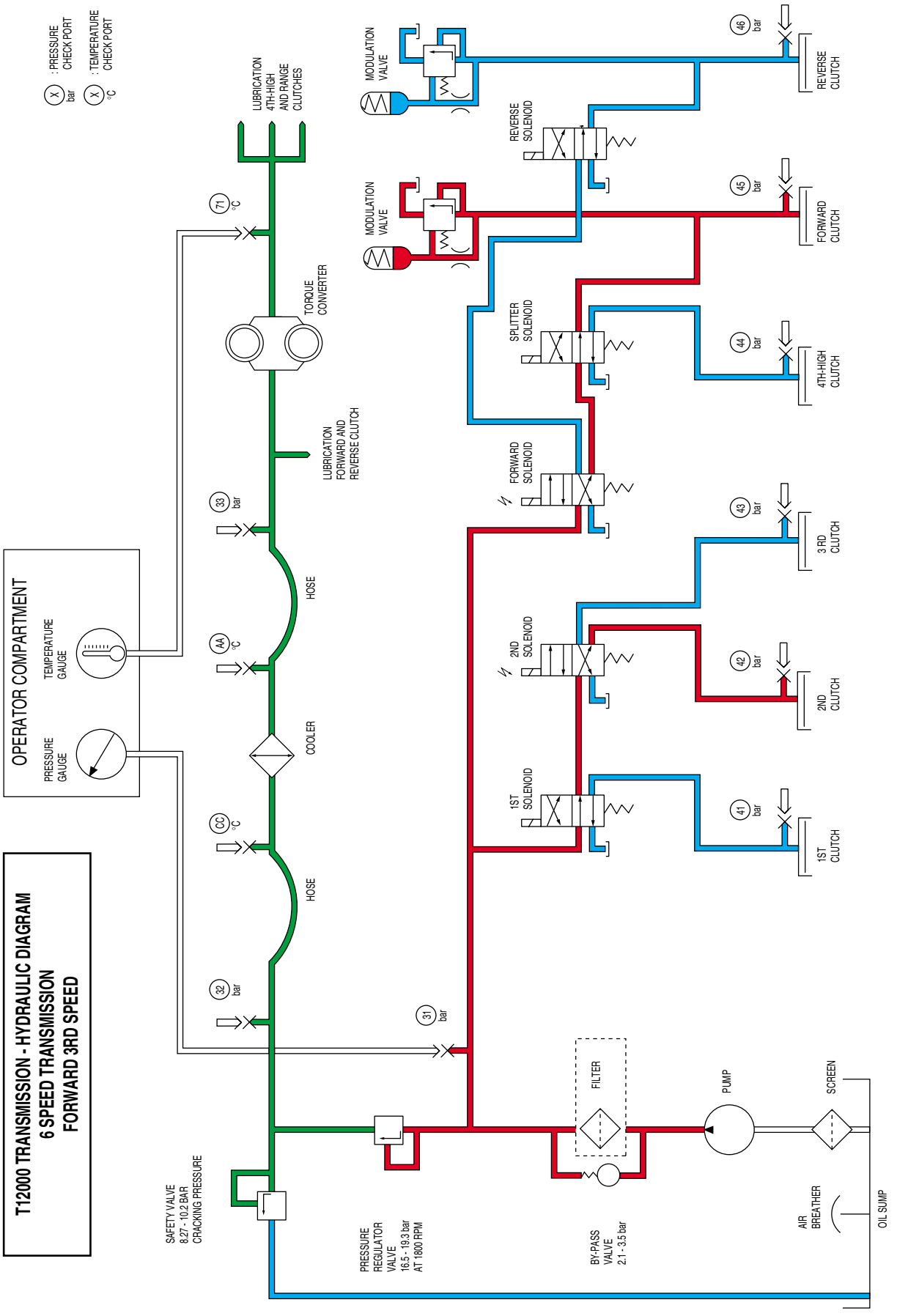
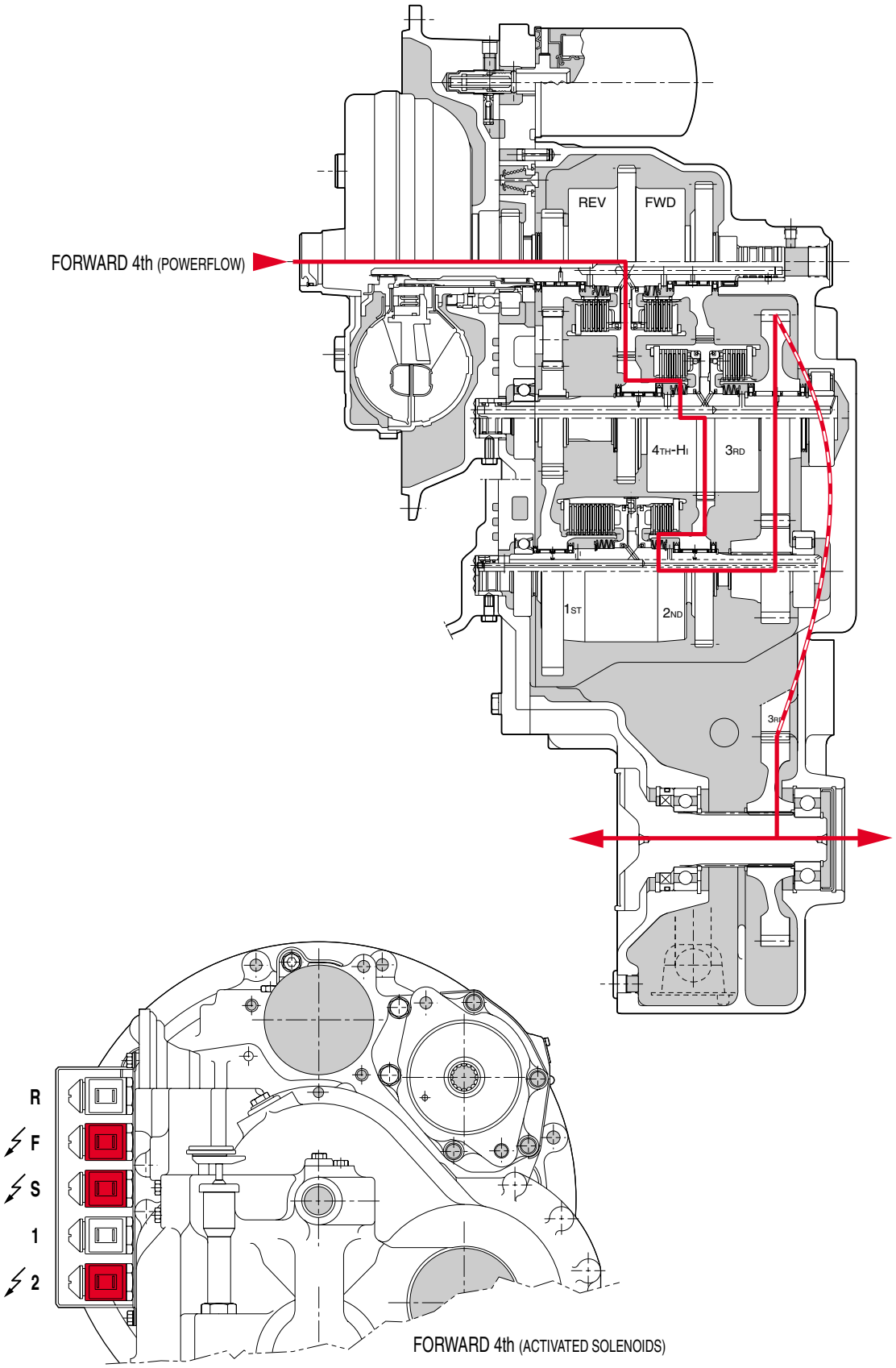


6.3.3.5 Forward 4th speed



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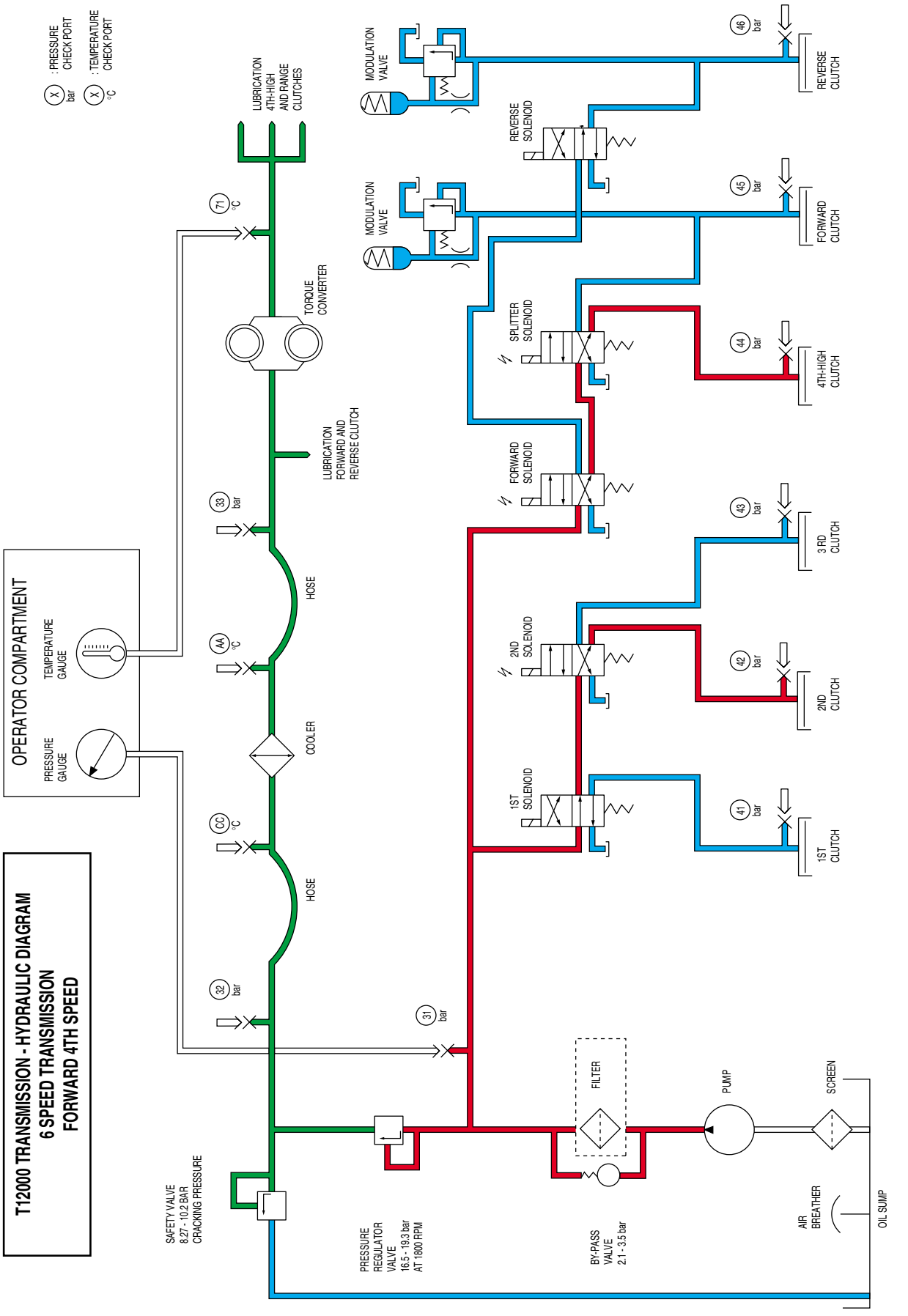
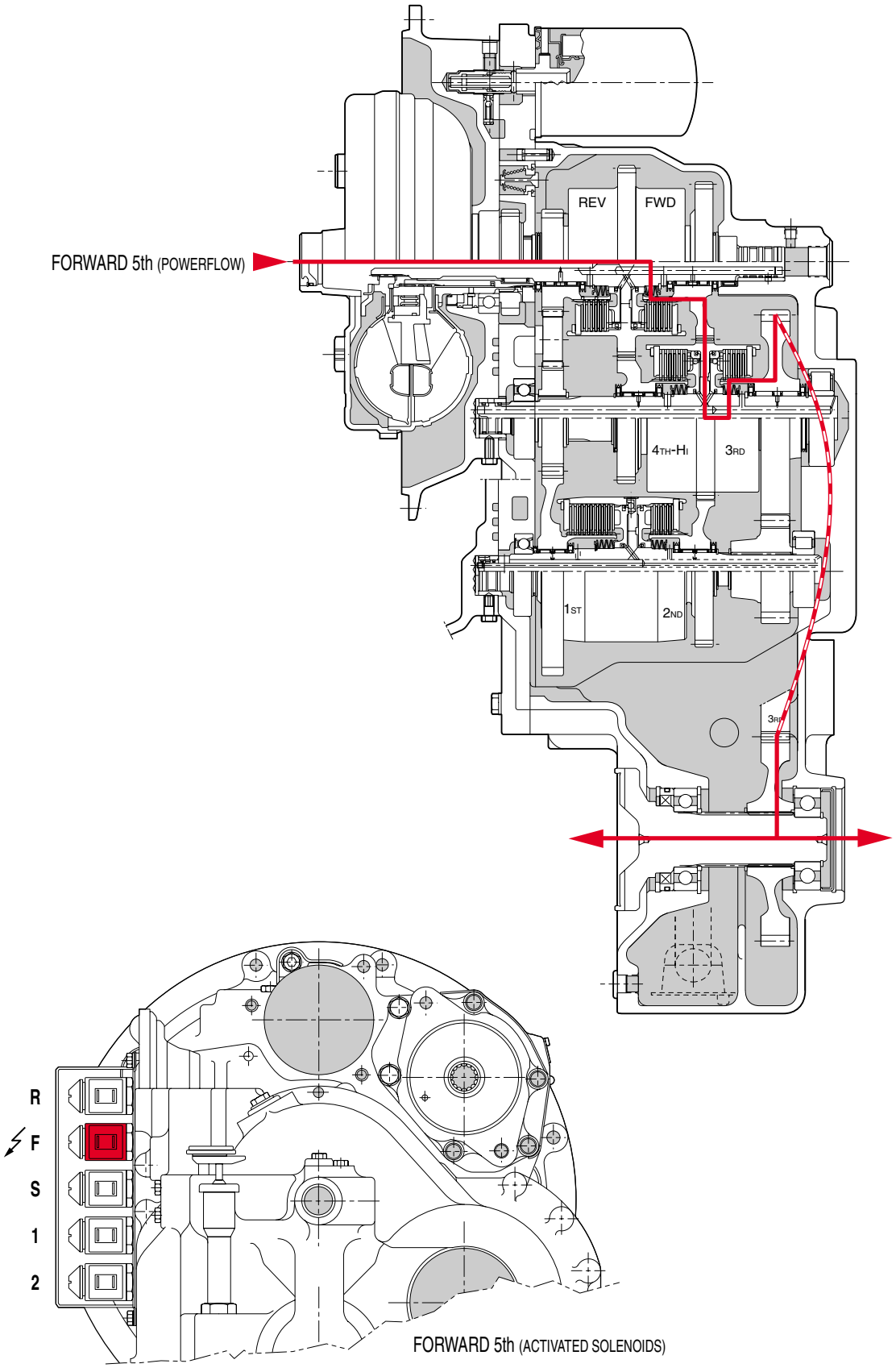


6.3.3.6 Forward 5th speed



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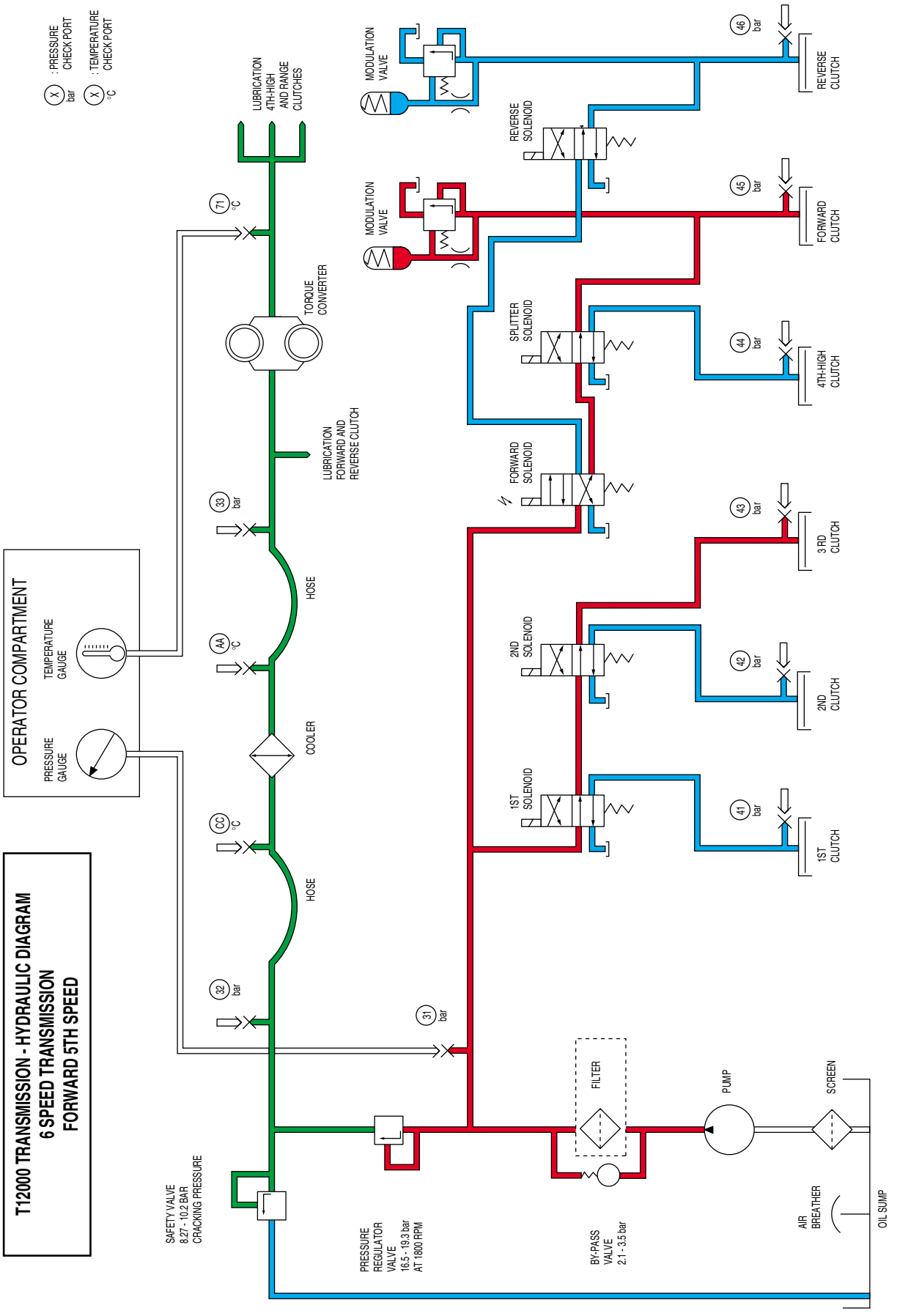
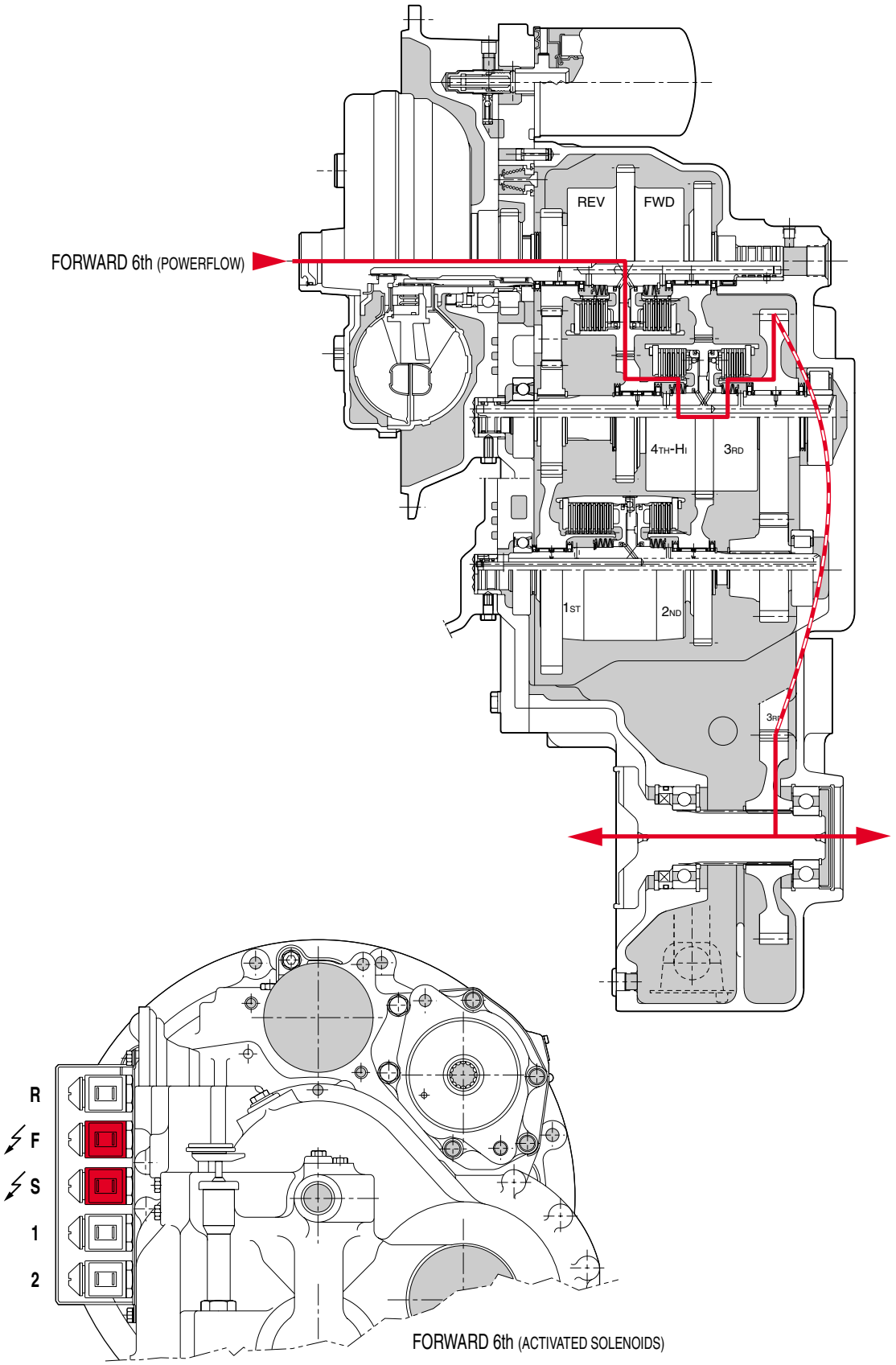


6.3.3.7 Forward 6th speed



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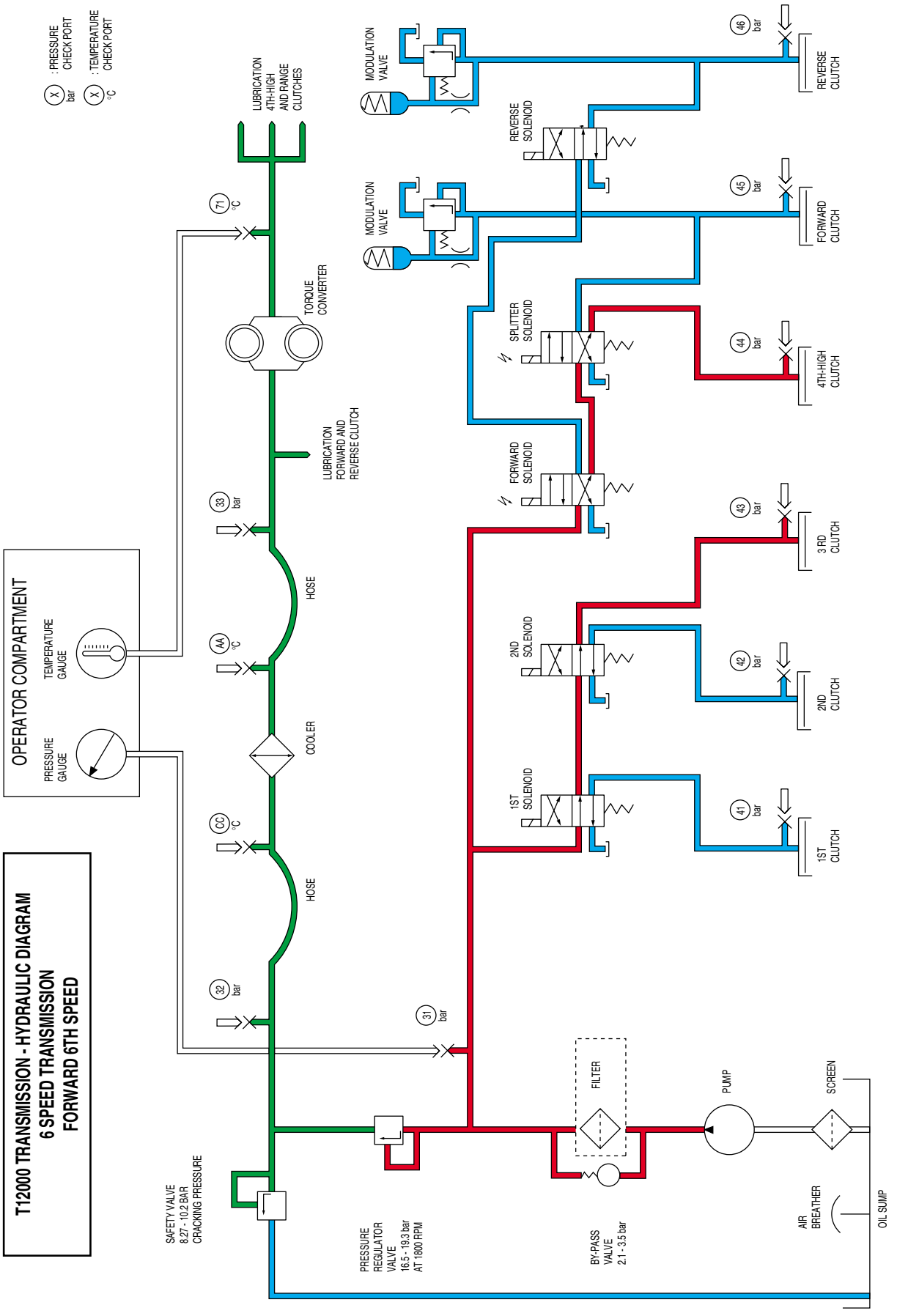
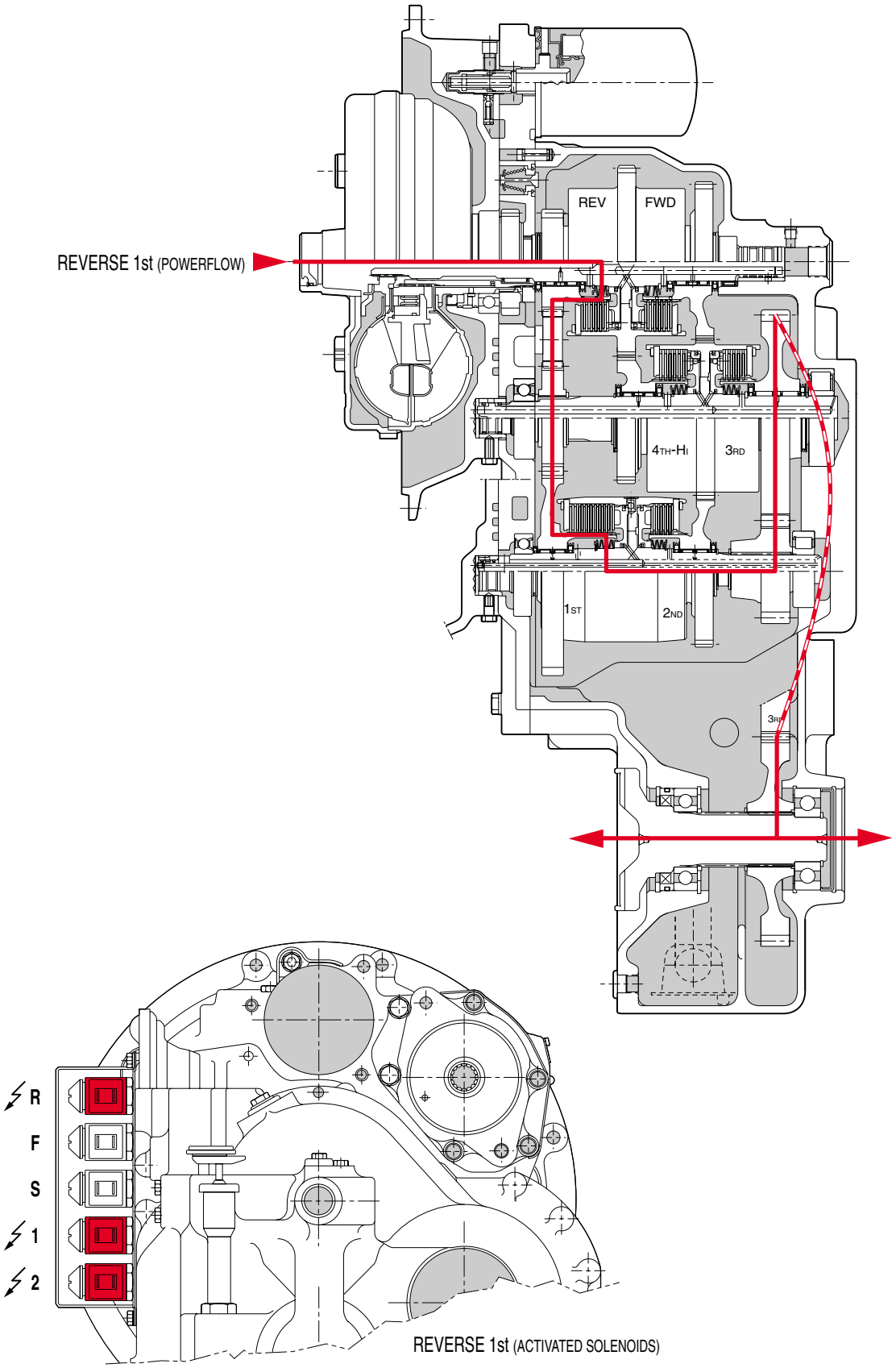
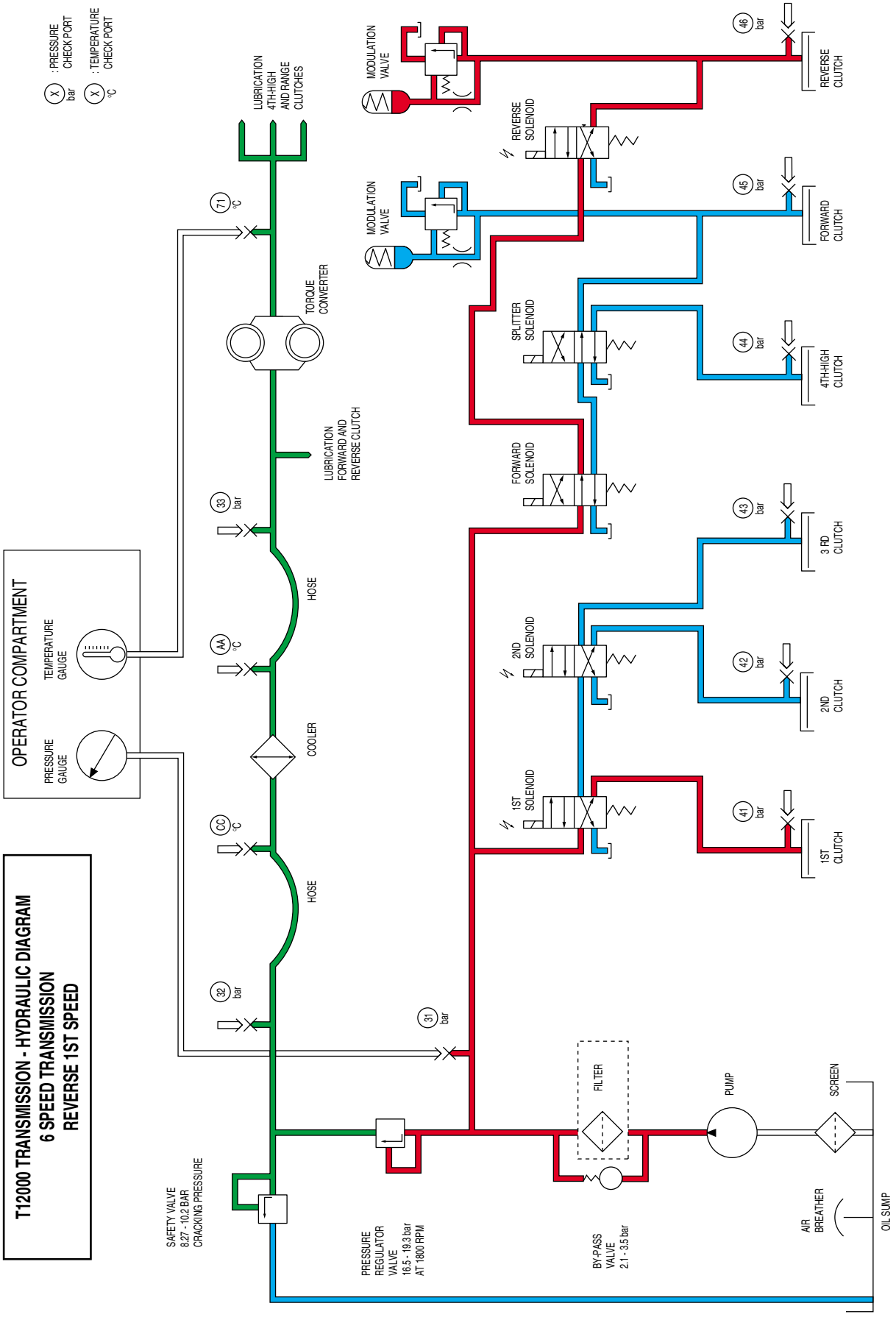


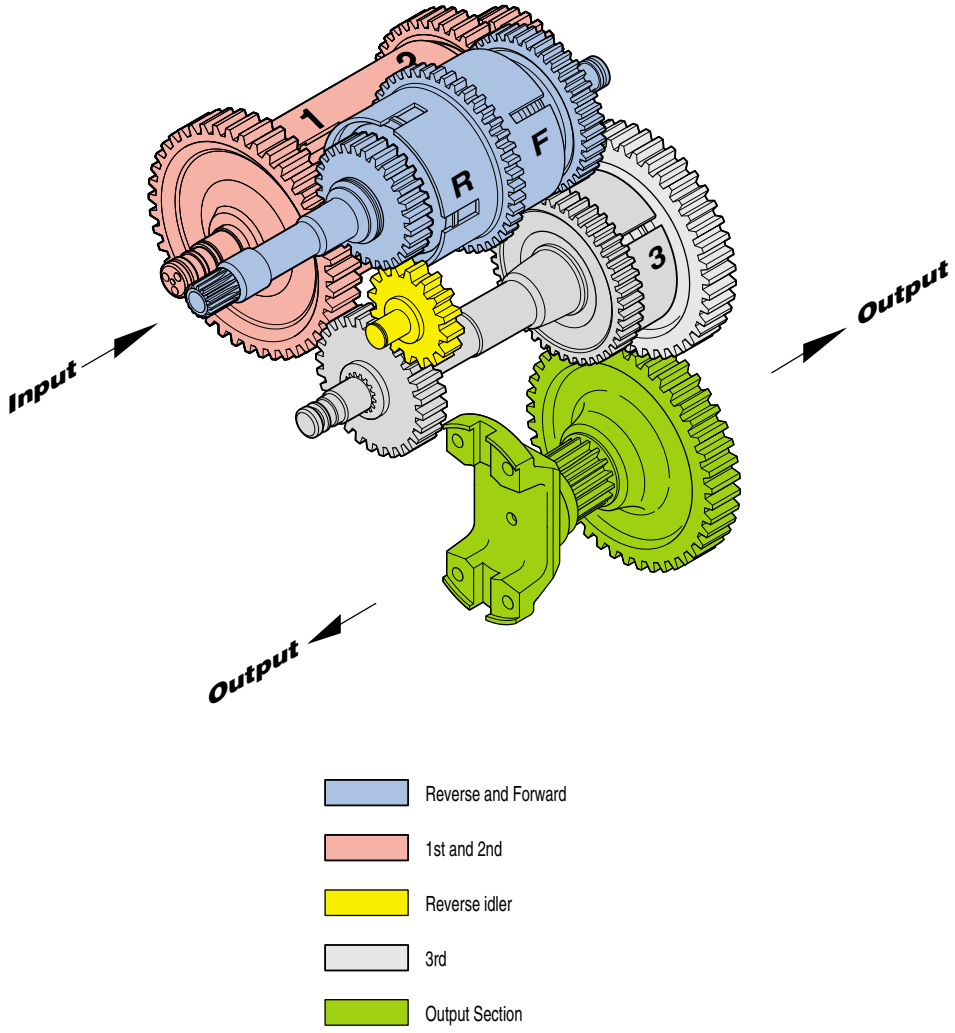
6.3.3.8 Reverse 1st speed



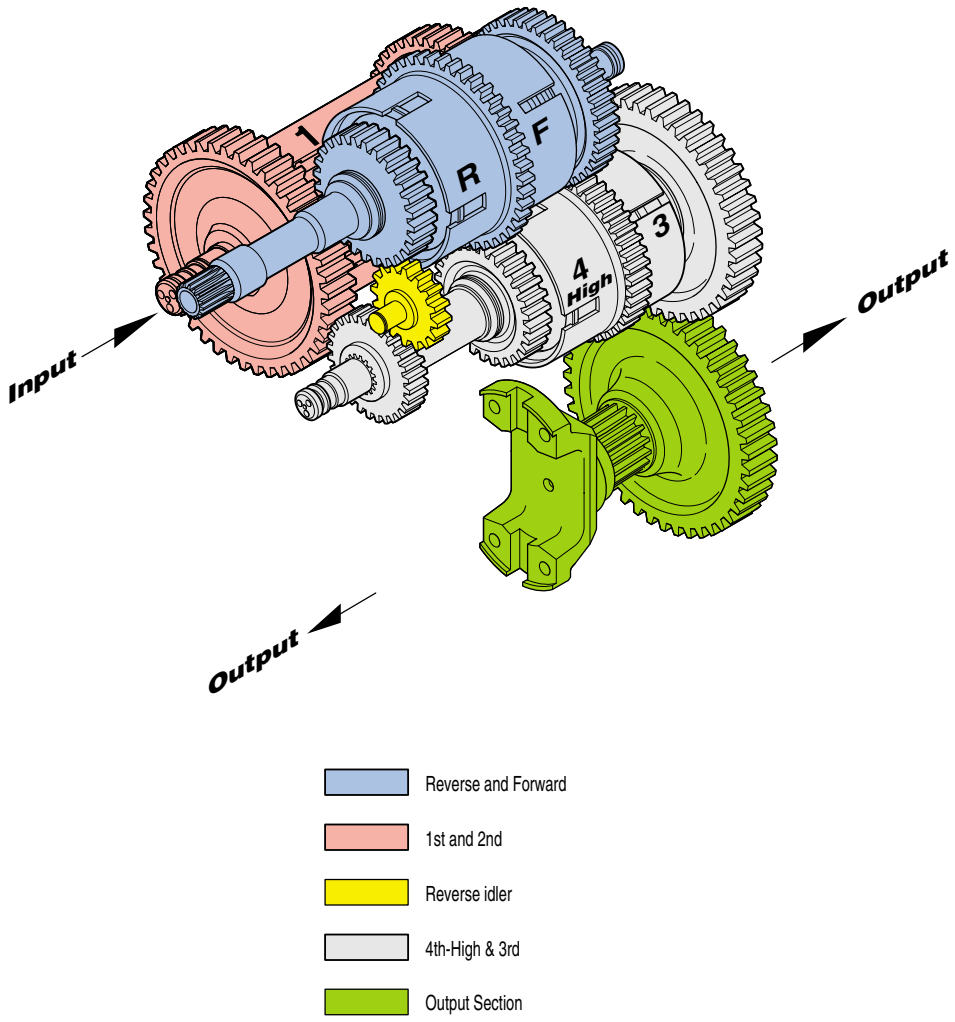
6.3.3.8 Reverse 1st speed (continued)



6.4 GEAR AND CLUTCH LAY-OUT (3-SPEED)



6.4 GEAR AND CLUTCH LAY-OUT (4-SPEED AND 6-SPEED)



7. TROUBLESHOOTING GUIDE FOR THE T12000 TRANSMISSION

The following information is presented as an aid to isolating and determining the specific problem area in a transmission that is not functioning correctly.

When troubleshooting a “transmission” problem, it should be kept in mind that the transmission is only the central unit of a group of related powertrain components. Proper operation of the transmission depends on the condition and correct functioning of the other components of the group. Therefore, to properly diagnose a suspected problem in the transmission, it is necessary to consider the transmission fluid, charging pump, torque converter, transmission assembly, oil cooler, filter, connecting lines, and controls, including the engine, as a complete system.

By analysing the principles of operation together with the information in this section, it should be possible to identify and correct any malfunction which may occur in the system.

7.1 T12000 TRANSMISSION

T12000 (power shift with torque converter transmission) troubles fall into three general categories:

1. Mechanical problems.

2. Hydraulic problems.

3. Electrical problems.

In addition to the mechanical and electrical components, all of which must be in the proper condition and functioning correctly, the correct functioning of the hydraulic circuit is most important. Transmission fluid is the “life blood” of the transmission. It must be supplied in an adequate quantity and delivered to the system at the correct pressures to ensure converter operation, to engage and hold the clutches from slipping, and to cool and lubricate the working components.

7.2 TROUBLESHOOTING PROCEDURES

7.2.1 Stall Test

A stall test to identifies transmission, converter, or engine problems.

Use following procedure:

1. Put the vehicle against a solid barrier, such as a wall, and/or apply the parking brake and block the wheels.
2. Put the directional control lever in FORWARD (or REVERSE, as applicable).
3. Select the highest speed.
   With the engine running, slowly increase engine speed to approximately one-half throttle and hold until transmission (converter outlet) oil temperature reaches the operating range.

CAUTION

DO NOT OPERATE THE CONVERTER AT STALL CONDITION LONGER THAN 30 SECONDS AT ONE TIME, SHIFT TO NEUTRAL FOR 15 SECONDS AND REPEAT THE PROCEDURE UNTIL DESIRED TEMPERATURE IS REACHED.
EXCESSIVE TEMPERATURE 120 °C (250 F) MAXIMUM WILL CAUSE DAMAGE TO TRANSMISSION CLUTCHES, FLUID, CONVERTER, AND SEALS.

7.2.2 Transmission pressure checks

Transmission problems can be isolated by the use of pressure tests. When the stall test indicates slipping clutches, then measure clutch pack pressure to determine if the slippage is due to low pressure or clutch plate friction material failure.

In addition, converter charging pressure and transmission lubrication pressure can also be measured.

7.2.3 Mechanical and electrical checks

Prior to checking any part of the system for hydraulic function (pressure testing), the following mechanical and electrical checks should be made:

- Check the parking brake and inching pedal for correct adjustment.
- Be sure all lever linkage is properly connected and adjusted in each segment and at all connecting points.
- The controls are actuated electrically. Check the wiring and electrical components.
- Be sure that all components of the cooling system are in good condition and operating correctly. The radiator must be clean to maintain the proper cooling and operating temperatures for the engine and transmission. Air clean the radiator, if necessary.
- The engine must be operating correctly. Be sure that it is correctly tuned and adjusted to the correct idle and maximum no-load governed speed specifications.

7.2.4 Hydraulic checks

Also, before checking the transmission clutches, torque converter, charging pump, and hydraulic circuit for pressure and rate of oil flow, it is important to make the following transmission fluid check:

Check oil level in the transmission. The transmission fluid must be at the correct (full level). All clutches and the converter and its fluid circuit lines must be fully charged (filled) at all times.

Note

THE TRANSMISSION FLUID MUST BE AT OPERATING TEMPERATURE OF 82 - 93 °C (180 - 200 F) TO OBTAIN CORRECT FLUID LEVEL AND PRESSURE READINGS.
DO NOT ATTEMPT TO MAKE THESE CHECKS WITH COLD OIL.

To raise the oil temperature to this specification it is necessary to either operate (work) the vehicle or run the engine with converter at “stall” (Refer to 7.2.1 “Stall test”).

CAUTION

BE CAREFUL THAT THE VEHICLE DOES NOT MOVE UNEXPECTEDLY WHEN OPERATING THE ENGINE AND CONVERTER AT STALL RPM.

7.3 TROUBLESHOOTING GUIDE

Refer to the following troubleshooting guide for the diagnosis of typical transmission troubles.

7.3.1 Low clutch pressure

CAUSE	REMEDY
1. Low oil level.	1. Fill to proper level.
2. Clutch pressure regulating valve stuck open.	2. Clean valve spool and housing.
3. Faulty charging pump.	3. Replace pump.
4. Broken or worn clutch shaft or piston sealing rings.	4. Replace sealing rings.
5. Clutch piston bleed valve stuck open.	5. Clean bleed valves thoroughly.

7.3.2 Low charging pump output

CAUSE	REMEDY
1. Low oil level.	1. Fill to proper level.
2. Suction screen plugged.	2. Clean suction pump.
3. Defective charging pump.	3. Replace pump.

7.3.3 Overheating

Cause	Remedy
1. Worn oil sealing rings.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn charging pump.	2. Replace charging pump.
3. Low oil level.	3. Fill to proper level.
4. Dirty oil cooler.	4. Clean cooler.
5. Restriction in cooler lines.	5. Change cooler lines.

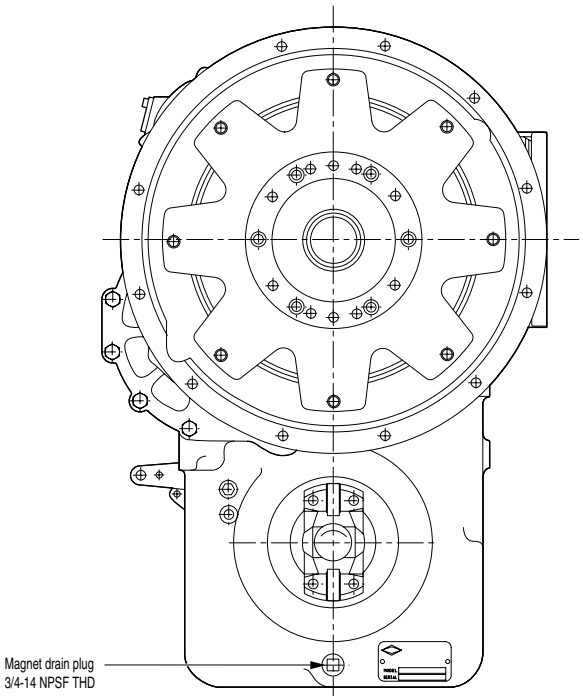
7.3.4 Noisy converter

Cause	Remedy
1. Worn charging pump.	1. Replace charging pump.
2. Worn or damaged bearings.	2. A complete disassembly will be necessary to determine which bearing is faulty.

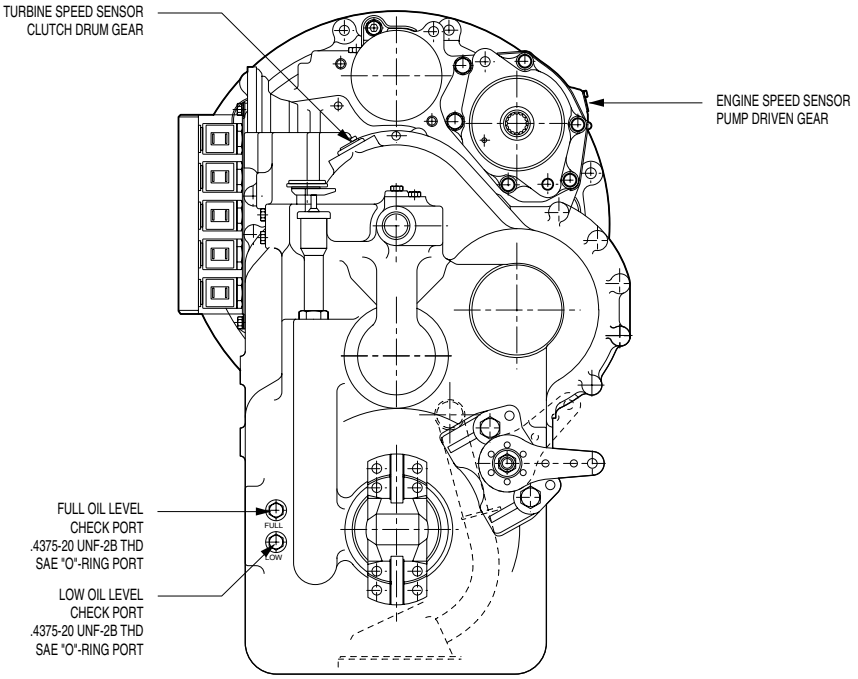
7.3.5 Lack of power

Cause	Remedy
1. Low engine RPM at converter stall.	1. Tune engine check governor.
2. See “Overheating” and make same checks.	2. Make corrections as explained in “Overheating”.

7.4 CHECK POINTS

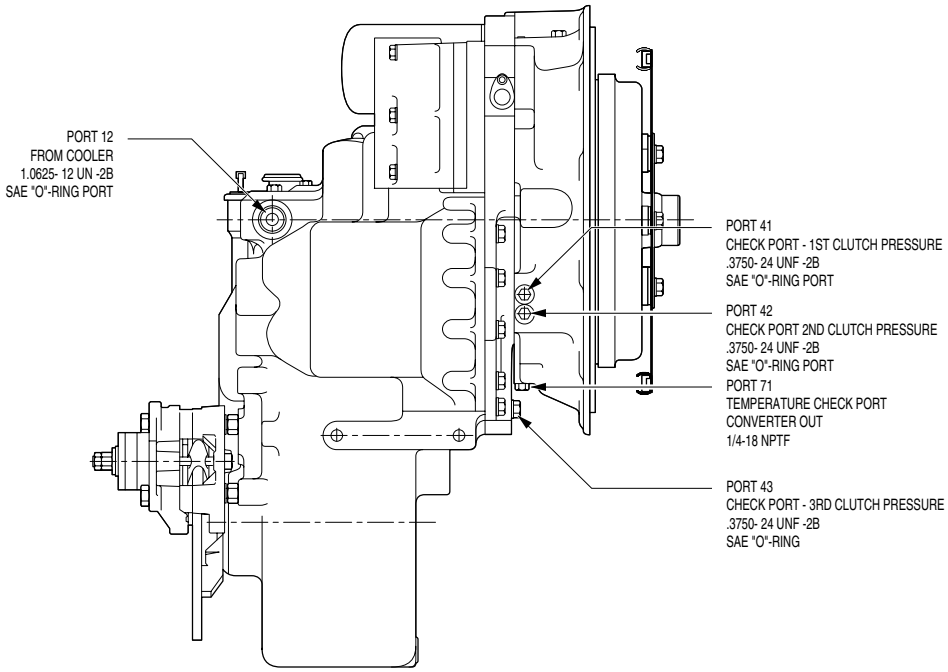


FRONT VIEW

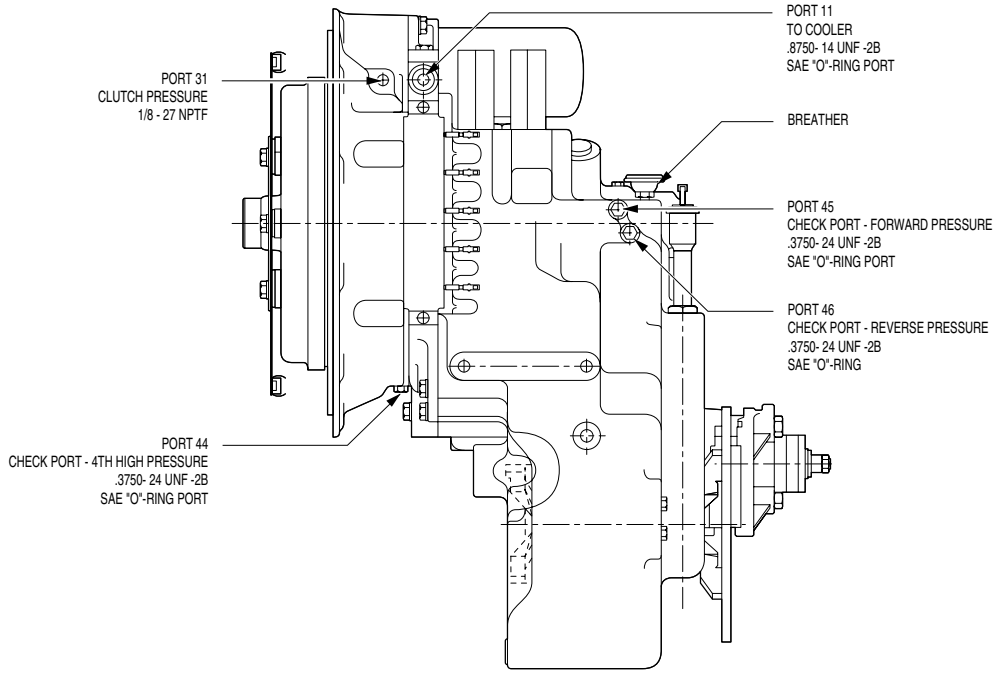


REAR VIEW

7.4 CHECK POINTS (CONTINUED)

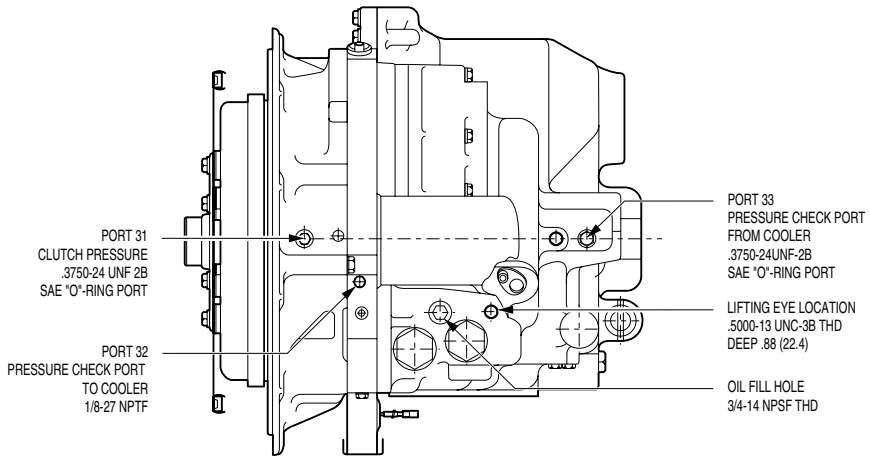


RIGHT SIDE VIEW



LEFT SIDE VIEW

7.4 CHECK POINTS (CONTINUED)



TOP VIEW

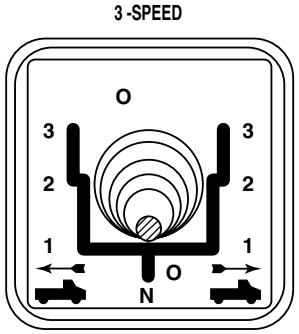
7.5 ELECTRICAL WIRING

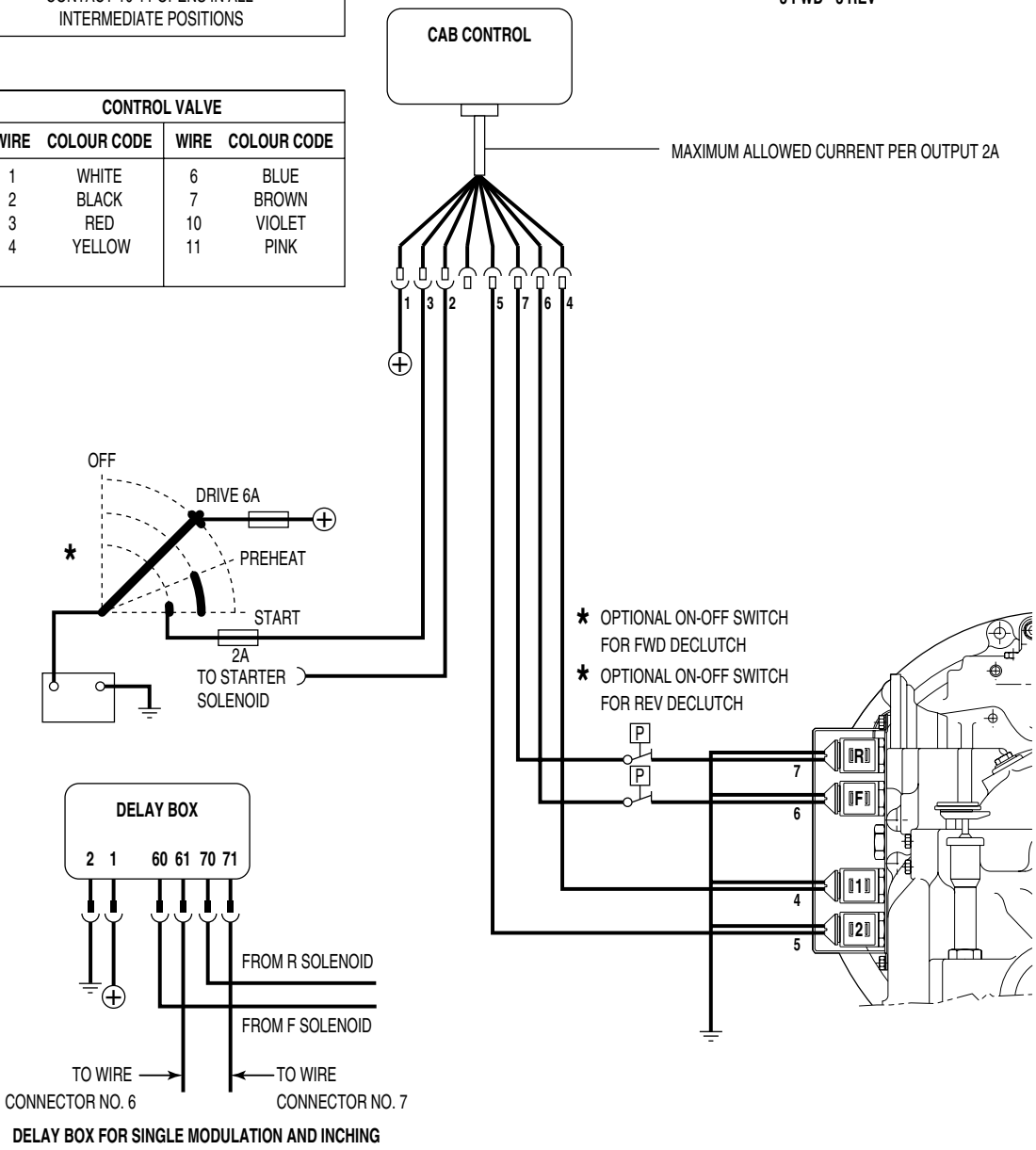
7.5.1 3-Speed transmission

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH ✱

CAB CONTROL	
CAB CONTROL POSITION	**CONTACTS CLOSED BETWEEN WIRES**
F3	1-6
F2	1-5 / 1-6
F1	1-4 / 1-5 / 1-6
N	2-3 / 1-4 / 1-5
R1	1-4 / 1-5 / 1-7
R2	1-5 / 1-7
R3	1-7
CONTACT 10-11 OPENS IN ALL INTERMEDIATE POSITIONS	

CONTROL VALVE			
WIRE	**COLOUR CODE**	**WIRE**	**COLOUR CODE**
1	WHITE	6	BLUE
2	BLACK	7	BROWN
3	RED	10	VIOLET
4	YELLOW	11	PINK





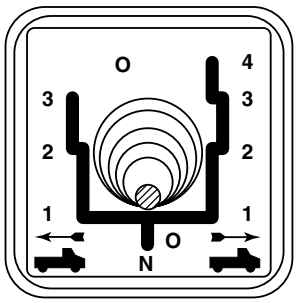
DELAY BOX FOR SINGLE MODULATION AND INCHING

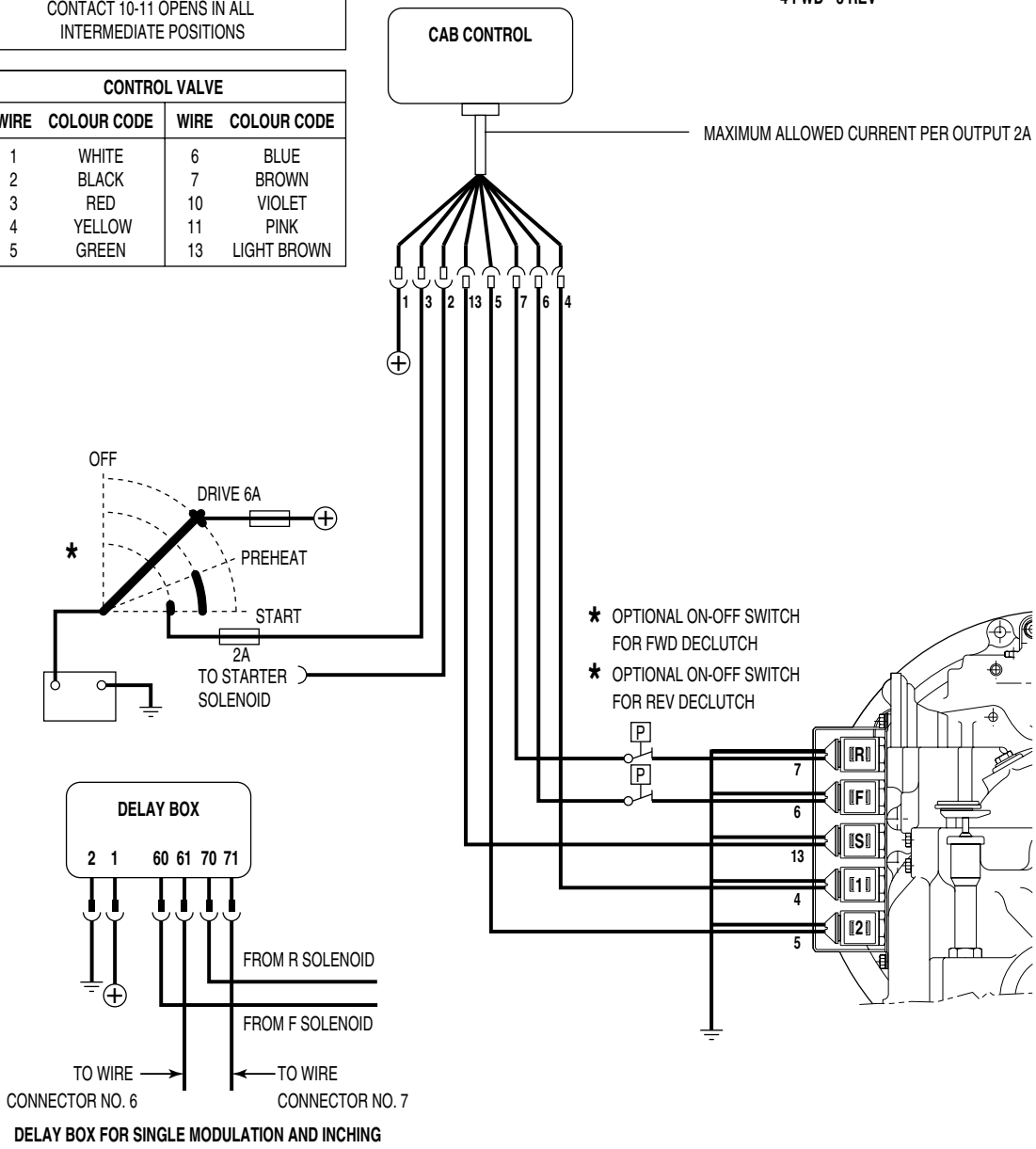
7.5.2 Standard 4-Speed transmission (1-3-5 ≈ 6 Speed)

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH ✱

CAB CONTROL	
CAB CONTROL POSITION	**CONTACTS CLOSED BETWEEN WIRES**
F4	1-6 / 1-13
F3	1-6
F2	1-5 / 1-6
F1	1-4 / 1-5 / 1-6
N	2-3 / 1-4 / 1-5
R1	1-4 / 1-5 / 1-7
R2	1-5 / 1-7
R3	1-7
CONTACT 10-11 OPENS IN ALL INTERMEDIATE POSITIONS	

CONTROL VALVE			
WIRE	**COLOUR CODE**	**WIRE**	**COLOUR CODE**
1	WHITE	6	BLUE
2	BLACK	7	BROWN
3	RED	10	VIOLET
4	YELLOW	11	PINK
5	GREEN	13	LIGHT BROWN





DELAY BOX FOR SINGLE MODULATION AND INCHING

7.5.3 Alternative 4-Speed transmission (1-3-4-5 ≈ 6 Speed)

Note

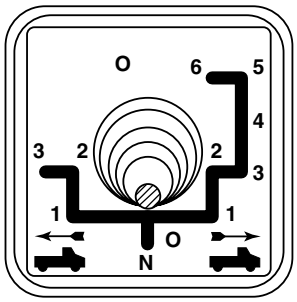
ALTERNATIVE 4-SPEED TRANSMISION IS ONLY AVAILABLE WITH EGS OR APC.
ELECTRIC SOLENOID CONTROL WIRING DIAGRAM FOR ALTERNATIVE 4-SPEED TRANSMISSION:
REFER TO WIRING DIAGRAM OF CORRESPONDING CONTROLLER.

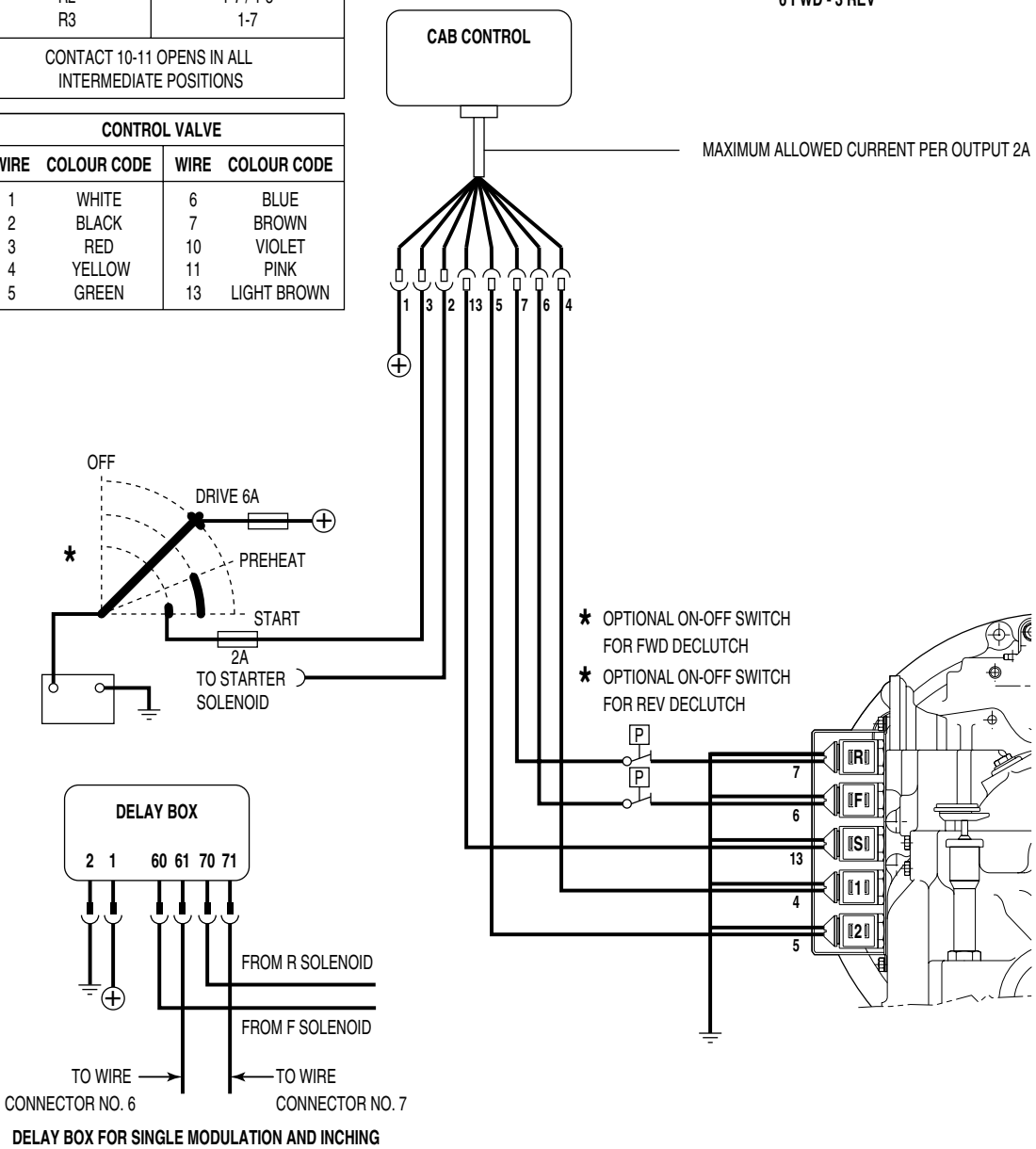
7.5.4 6-Speed transmission

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH ✱

CAB CONTROL	
CAB CONTROL POSITION	**CONTACTS CLOSED BETWEEN WIRES**
F6	1-6 / 1-13
F5	1-6
F4	1-6 / 1-5 / 1-13
F3	1-6 / 1-5
F2	1-6 / 1-5 / 1-4 / 1-13
F1	1-6 / 1-5 / 1-4
N	2-3 / 1-4 / 1-5
R1	1-7 / 10-5 / 1-4
R2	1-7 / 1-5
R3	1-7
CONTACT 10-11 OPENS IN ALL INTERMEDIATE POSITIONS	

CONTROL VALVE			
WIRE	**COLOUR CODE**	**WIRE**	**COLOUR CODE**
1	WHITE	6	BLUE
2	BLACK	7	BROWN
3	RED	10	VIOLET
4	YELLOW	11	PINK
5	GREEN	13	LIGHT BROWN





DELAY BOX FOR SINGLE MODULATION AND INCHING

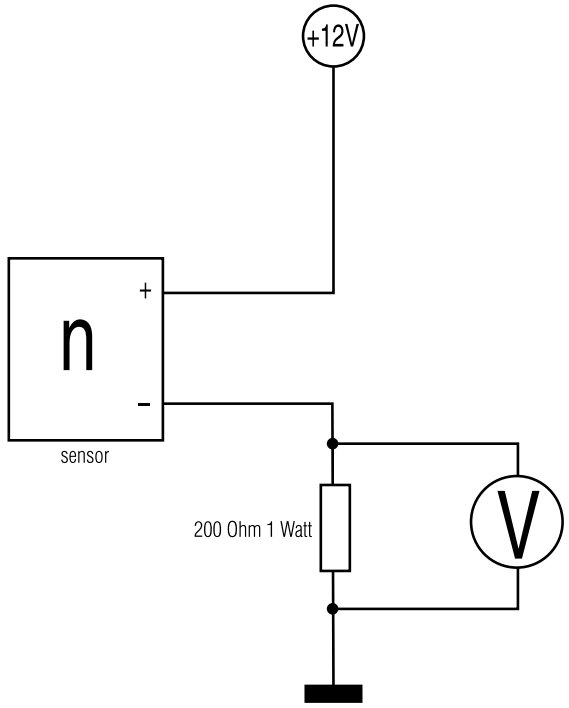
7.6 SPEED SENSOR - STATIC STANDALONE TEST

In order to be able to sense the currents, a series resistor of e.g. 200 Ohms must be used. This resistor is integrated in the controller, but when the sensor is to be tested, it must be connected externally.

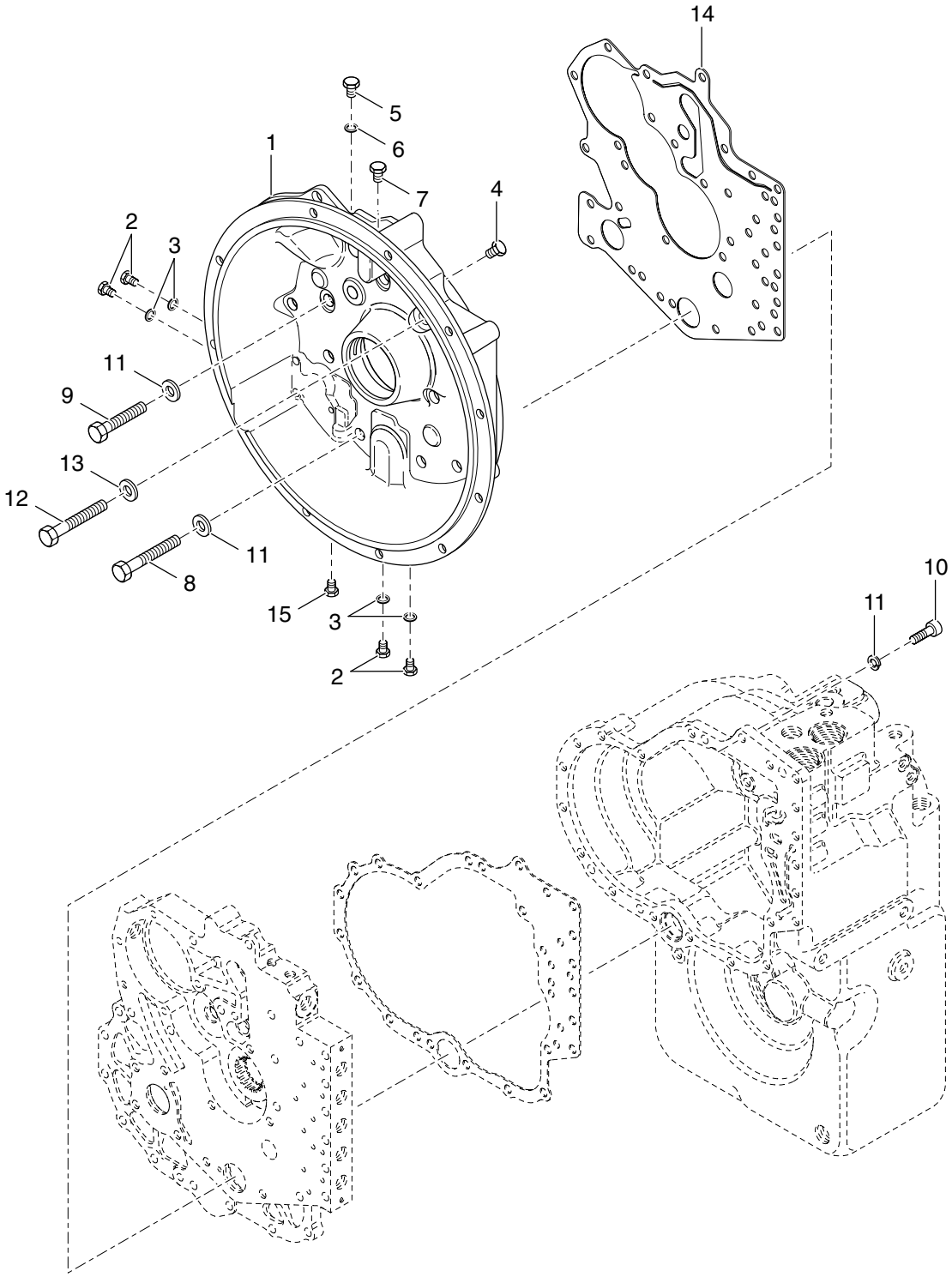
The idea is to connect the sensor to an external power source and measure the DC voltage across the series resistor.

The voltage reading should be either 1.2V-1.6V (for the 7mA ± 1mA current level) or 2.6-3.0V (for the 14mA ± 1mA current level)

If the teeth can be moved slowly, distinct toggling between the two levels should be noticed.



8. SECTIONAL VIEWS AND PARTS IDENTIFICATION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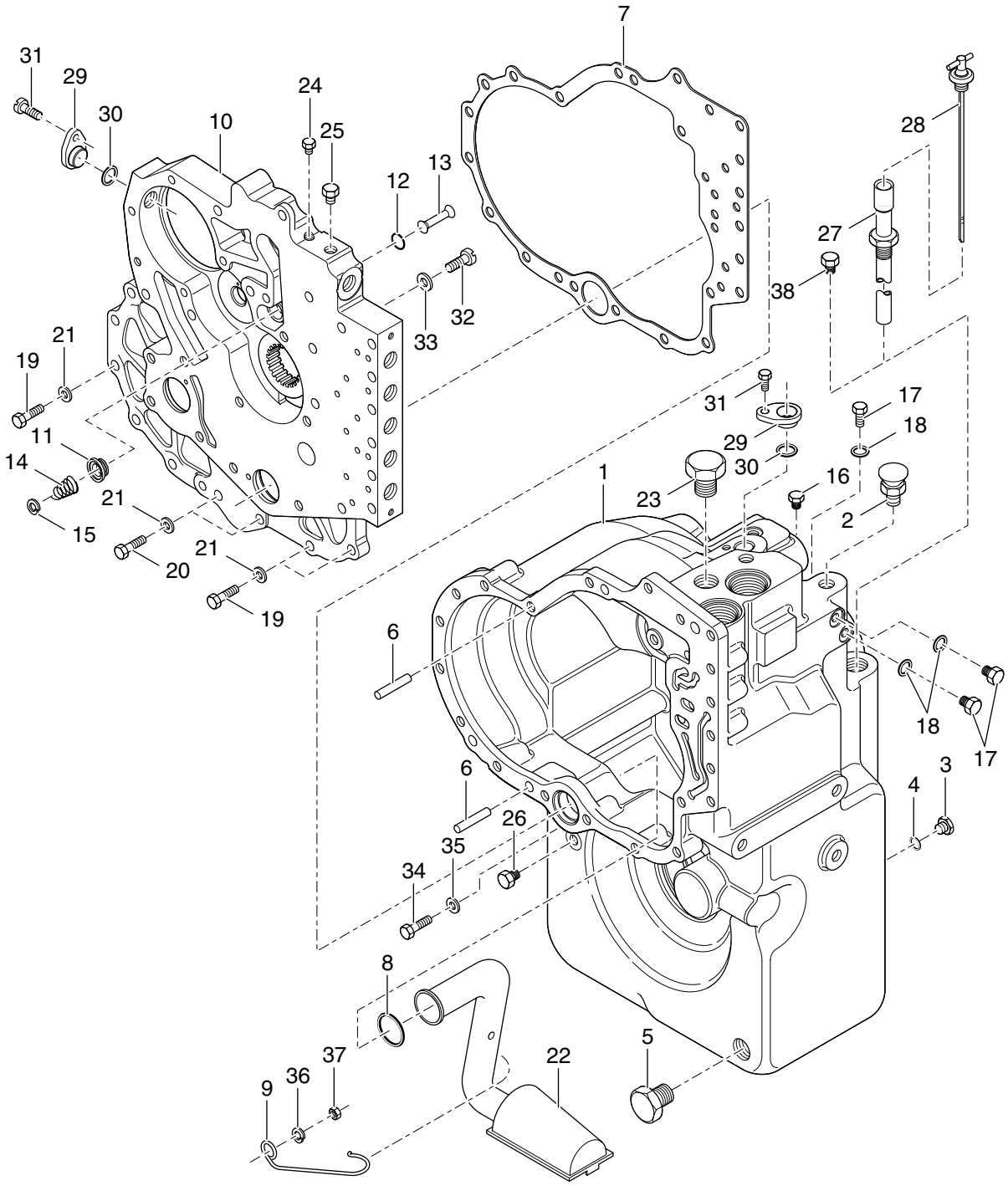
GROUP - CONVERTER HOUSING

Item	Description	Quantity
1	Housing - Converter	1
2	Plug	4
3	“O”-ring	4
4	Plug	1
5	Plug	1
6	“O”-ring	1
7	Plug	1
8	Screw - Converter housing to plate	6
9	Screw - Converter housing to plate	3
10	Screw - Converter housing to plate	1
11	Lockwasher - Converter housing to plate screw	10
12	Screw - Converter housing to transmission case	13
13	Lockwasher - Converter housing to transmission case screw	13
14	Gasket - Converter housing to plate	1
15	Plug	1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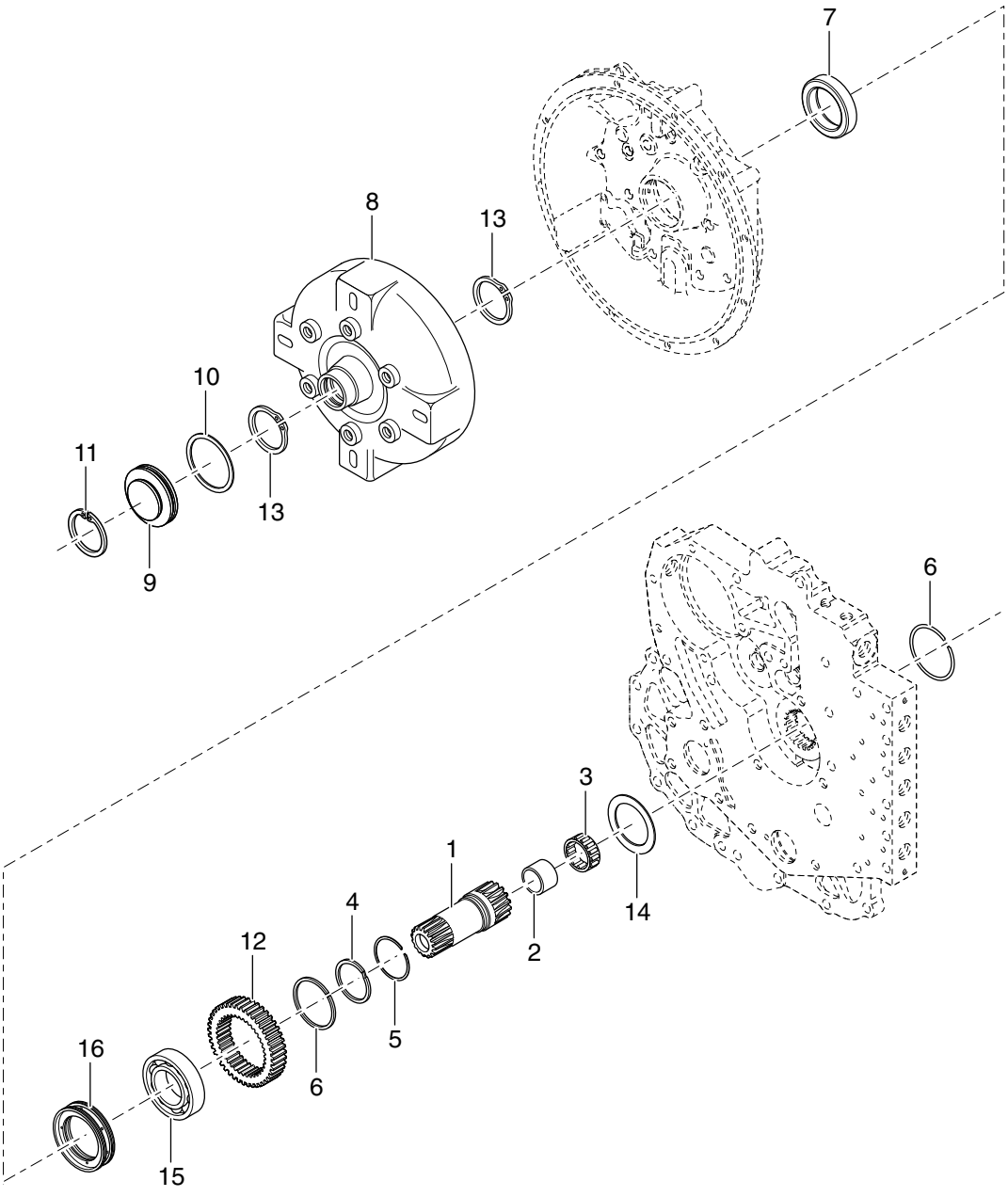
GROUP -TRANSMISSION CASE AND PLATE

Item	Description	Quantity
1	Case - Transmission	1
2	Breather - Air	1
3	Plug - Oil level	1
4	“O”-ring	1
5	Plug - Magnetic drain	1
6	Pin - Plate to transmission case dowel	2
7	Gasket - Plate to transmission case	1
8	Ring - Oil supply tube seal	1
9	Clip - Oil supply tube retainer	1
10	Spacer - Plate	1
11	Seat - Safety valve	1
12	Snap ring - Seat	1
13	Poppet - Converter safety valve	1
14	Spring - Converter safety valve	1
15	Washer - Poppet retaining	1
16	Plug	1
17	Plug	3
18	“O”-ring	3
19	Screw - Plate to transmission case	7
20	Screw - Plate to transmission case	2
21	Lockwasher - Plate to transmission case screw	9
22	Assembly - Tube & screen	1
23	Plug - Filler	1
24	Plug	1
25	Plug	1
26	Plug - Drain back port	1
27	Tube - Dipstick	1
28	Assembly - Dipstick	1
29	Plug - Speed sensor port	2
30	“O”-ring - Speed sensor	2
31	Screw - Speed sensor	2
32	Screw - Baffle hole	1
33	Washer - Baffle seal	1
34	Screw	1
35	Washer - Seal	1
36	Washer	1
37	Nut	1
38	Plug - Dipstick hole	1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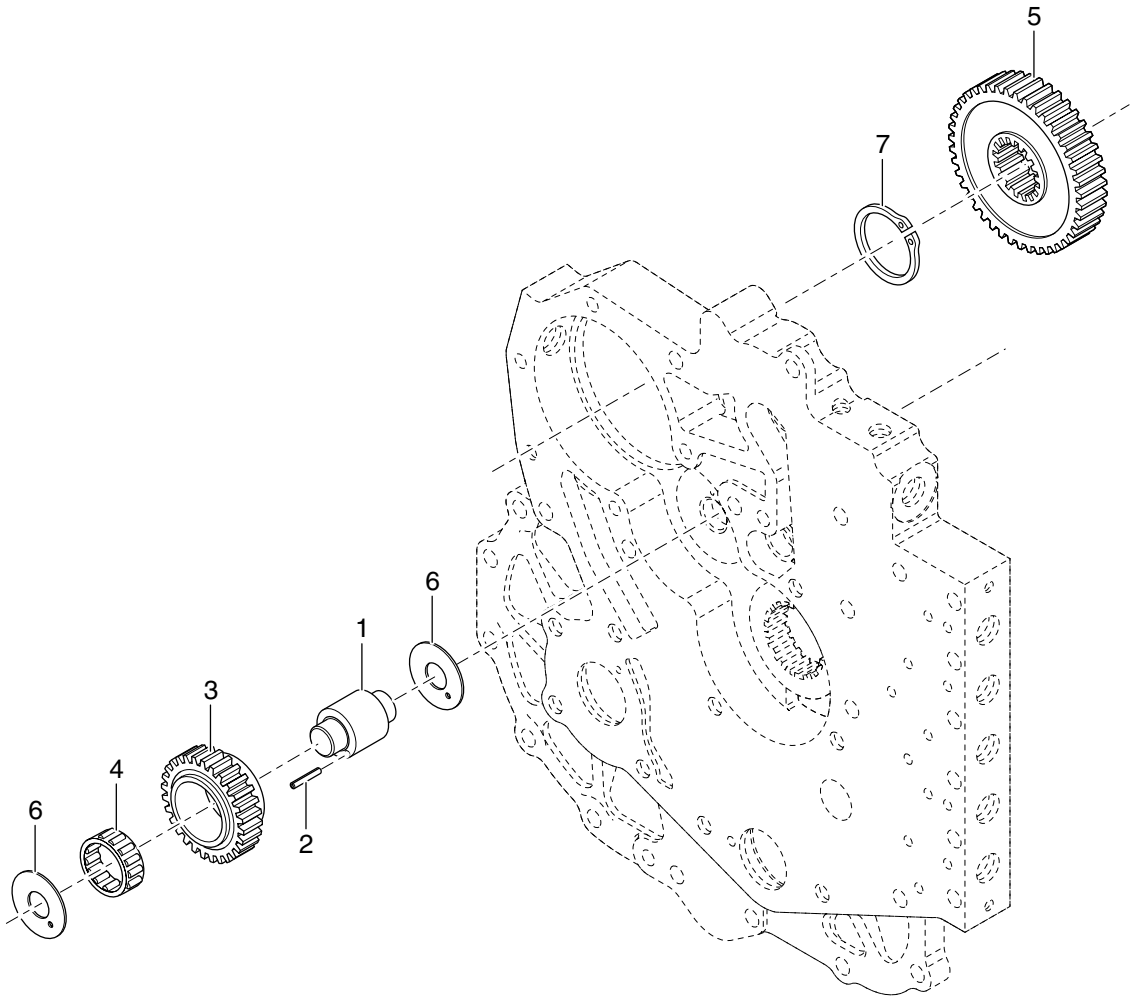
GROUP - TORQUE CONVERTER

Item	Description	Quantity
1	Stator support	1
2	Bushing	1
3	Bearing	1
4	Ring - Stator support piston	1
5	Expander - Stator support piston ring	1
6	Snap ring - Stator support	2
7	Seal - Converter housing oil	1
8	Assembly - Torque converter	1
9	Plug - Torque converter	1
10	“O”-ring - Torque converter plug	1
11	Snap ring - Torque converter plug	1
12	Gear - Impeller hub	1
13	Snap ring - Impeller hub	2
14	Washer - Impeller hub gear	1
15	Bearing - Torque converter	1
16	Ring - Oil distributor	1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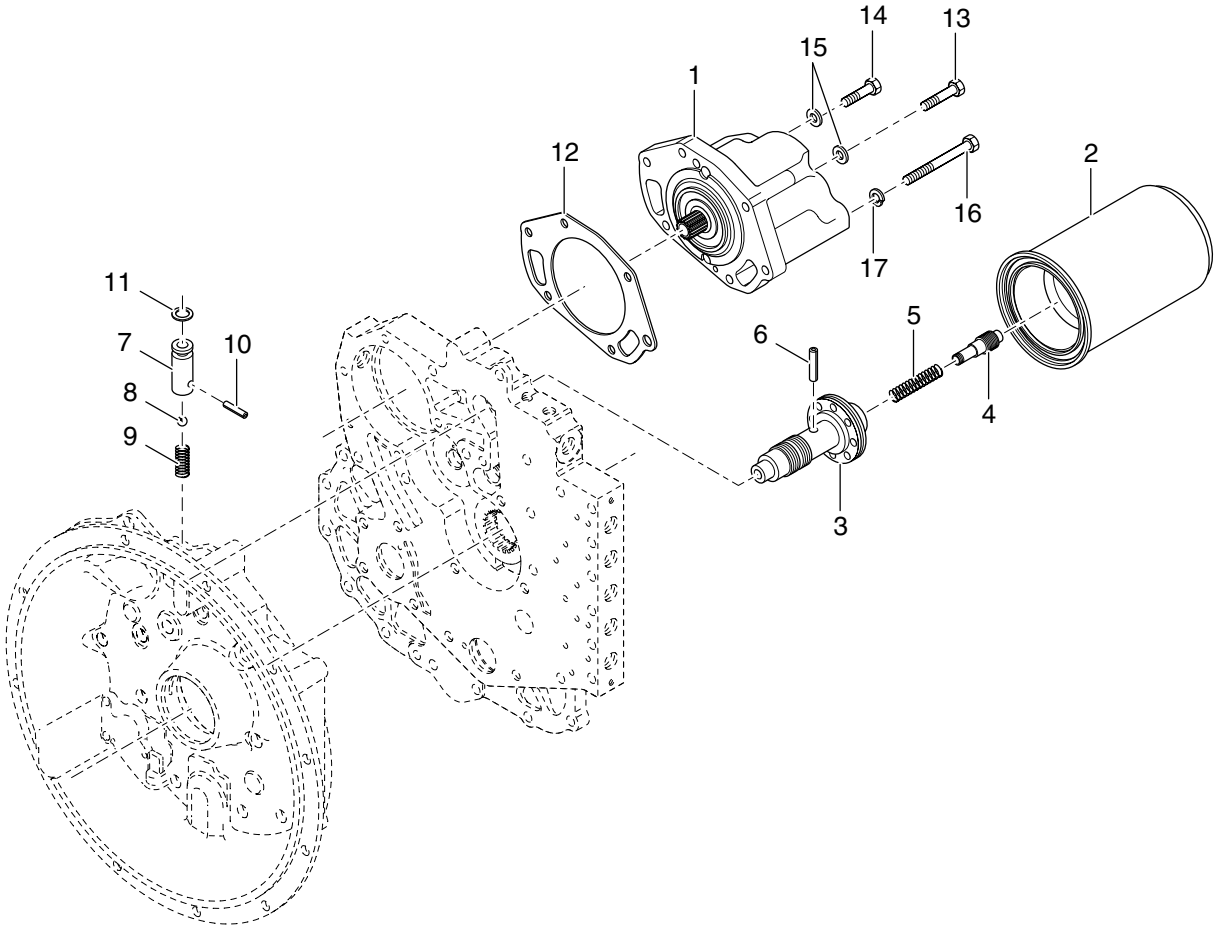
GROUP - PUMP DRIVE

Item	Description	Quantity
1	Shaft - Pump drive idler & pilot	1
2	Pin - Roll	1
3	Gear - Pump drive idler	1
4	Bearing - Idler gear	1
5	Gear - Pump drive	1
6	Washer - Pump drive idler thrust	2
7	Snap ring - Pump drive gear retaining	1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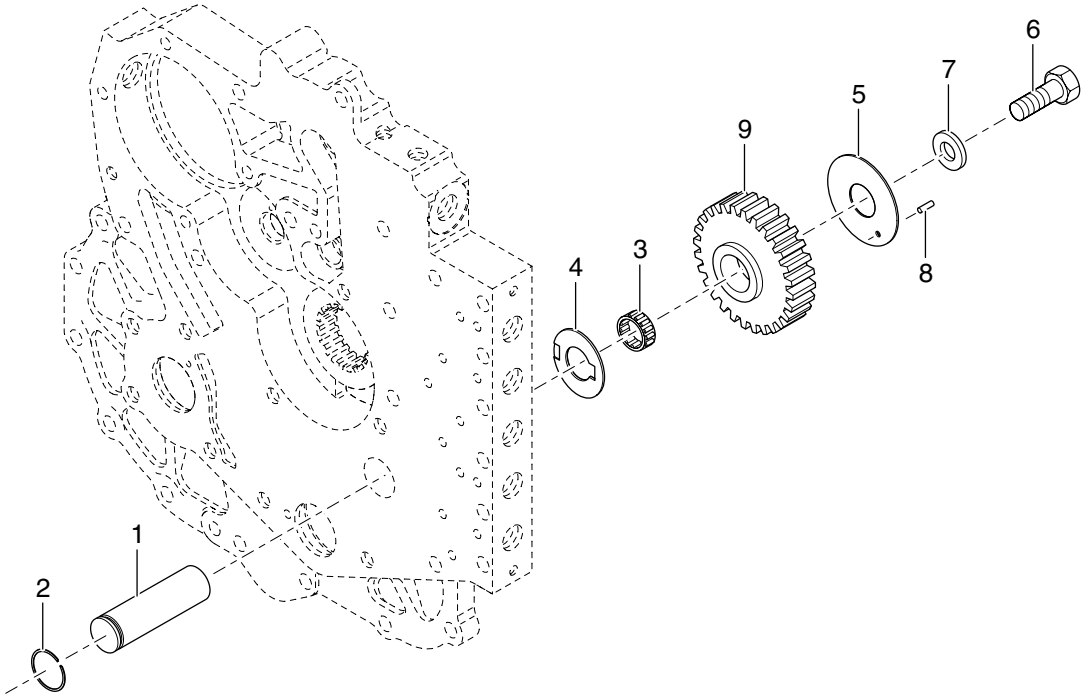
GROUP - CHARGING PUMP

Item	Description	Quantity
1	Assembly - Charge pump	1
2	Assembly - Hydraulic spin filter	1
3	Sleeve - Regulator valve	1
4	Piston - Regulator valve	1
5	Spring - Regulator valve	1
6	Pin	1
7	Body - Check valve	1
8	Ball	1
9	Spring - Check valve	1
10	Pin - Check valve	1
11	“O”-ring	1
12	Gasket - Charging pump	1
13	Screw - Pump mounting	4
14	Screw - Pump mounting	1
15	Lockwasher - Pump mounting screw	5
16	Screw - Pump mounting	1
17	Lockwasher - Pump mounting screw	1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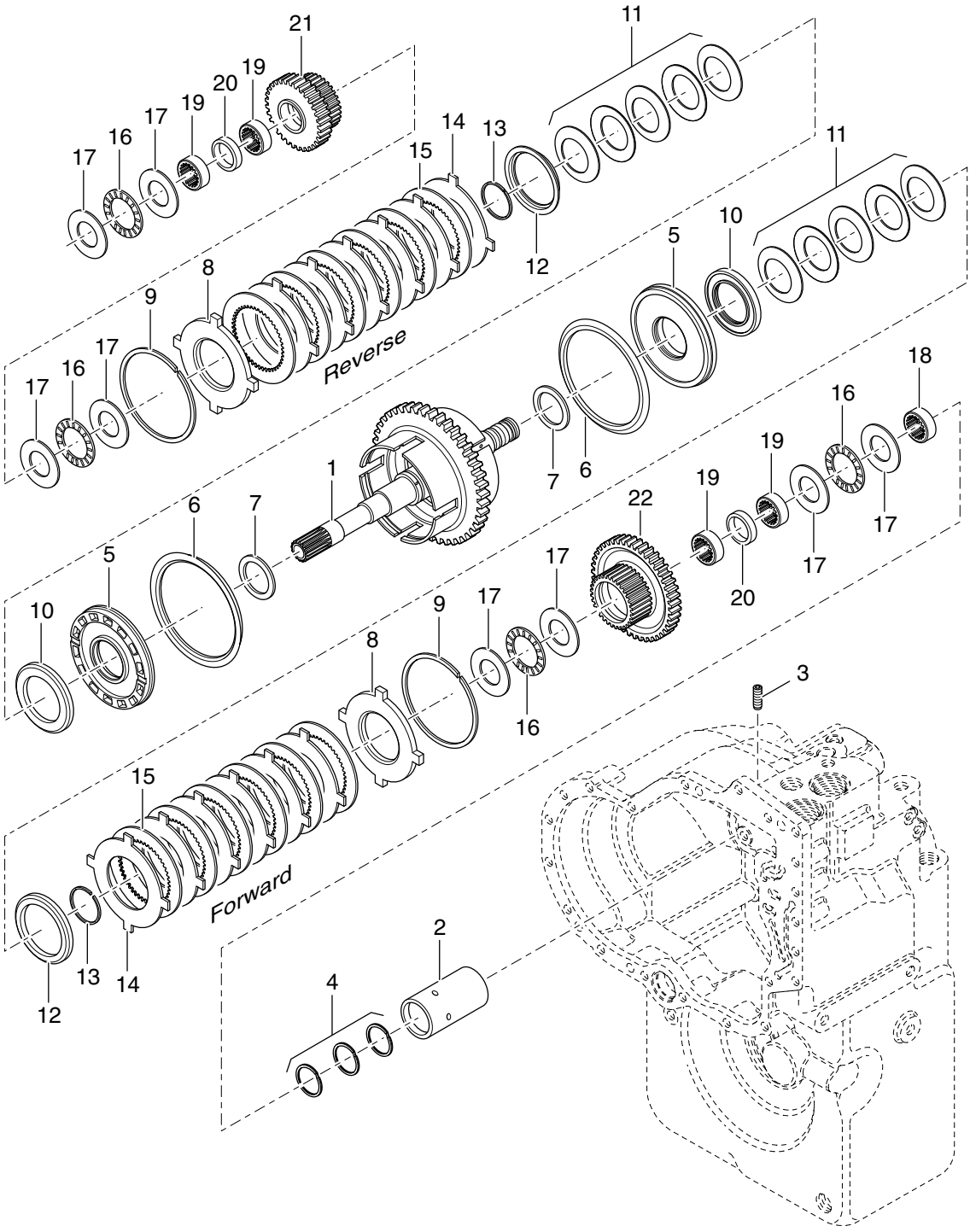
GROUP - REVERSE IDLER

Item	Description	Quantity
1	Shaft - Idler & pilot	1
2	Snap ring - Idler shaft	1
3	Bearing - Reverse idler gear	1
4	Washer - Thrust	1
5	Plate - End	1
6	Capscrew - Reverse idler end plate	1
7	Washer - End plate cap screw	1
8	Roll pin - End plate to shaft	1
9	Gear - Reverse idler	1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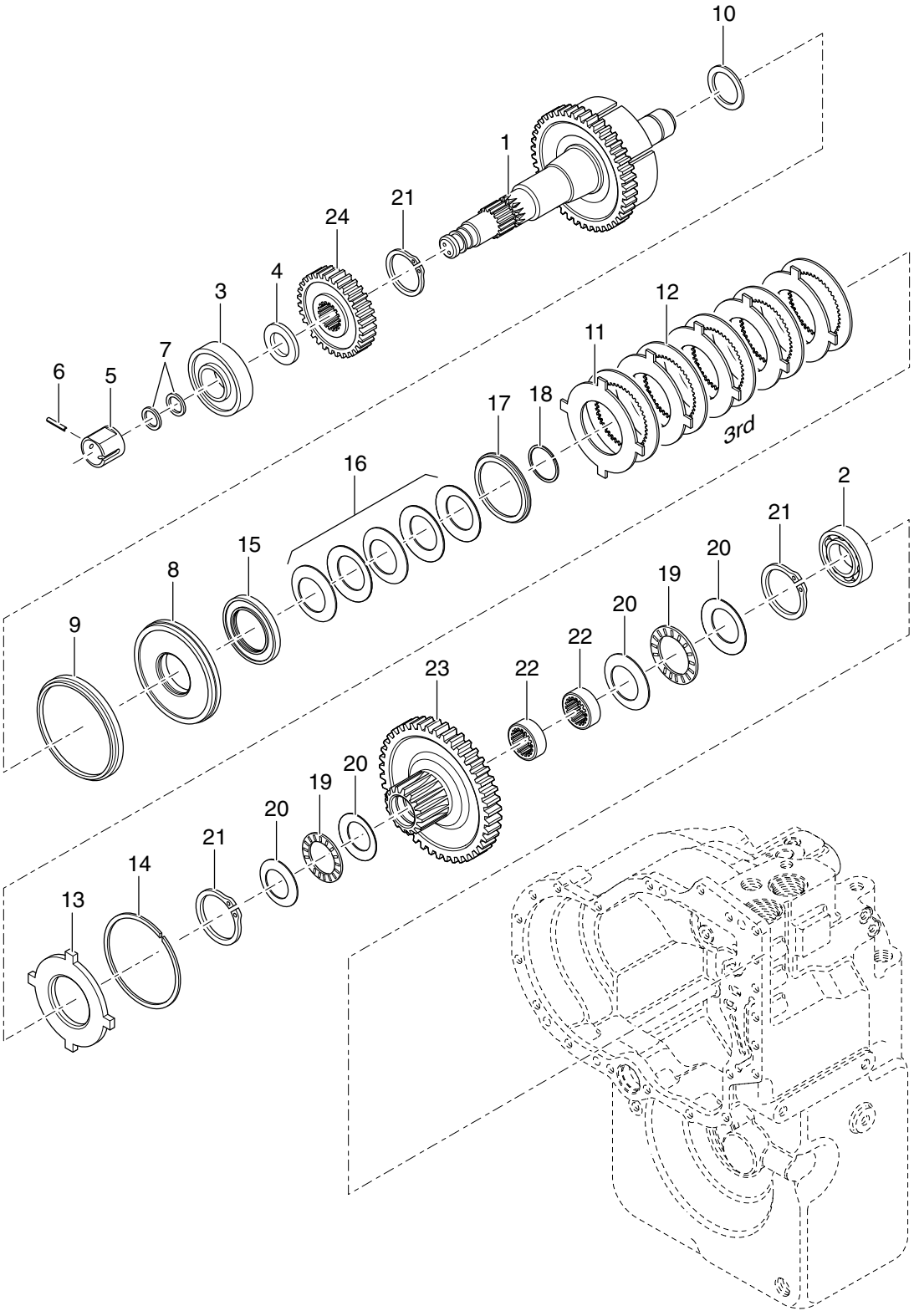
GROUP - FORWARD AND REVERSE SHAFT

Item	Description	Quantity
1	Assembly - Turbine shaft, drum & plug	1
2	Sleeve - Oil distributor	1
3	Screw - Retainer	1
4	Ring - Piston	3
5	Piston - Clutch	2
6	Seal - Clutch piston (Outer)	2
7	Seal - Clutch piston (Inner)	2
8	Plate - End	2
9	Snap ring - End plate	2
10	Plate - Clutch piston wear	2
11	Assembly - Disc spring	2
12	Retainer - Snap ring	2
13	Snap ring - retainer	2
14	Disc - Outer (6 forward - 6 reverse)	12
15	Disc - Inner (6 forward - 6 reverse)	12
16	Bearing - Clutch gear thrust	4
17	Washer - Clutch gear thrust	8
18	Bearing - Turbine shaft rear	1
19	Bearing	4
20	Spacer	2
21	Gear - Reverse clutch	1
22	Gear - Forward clutch	1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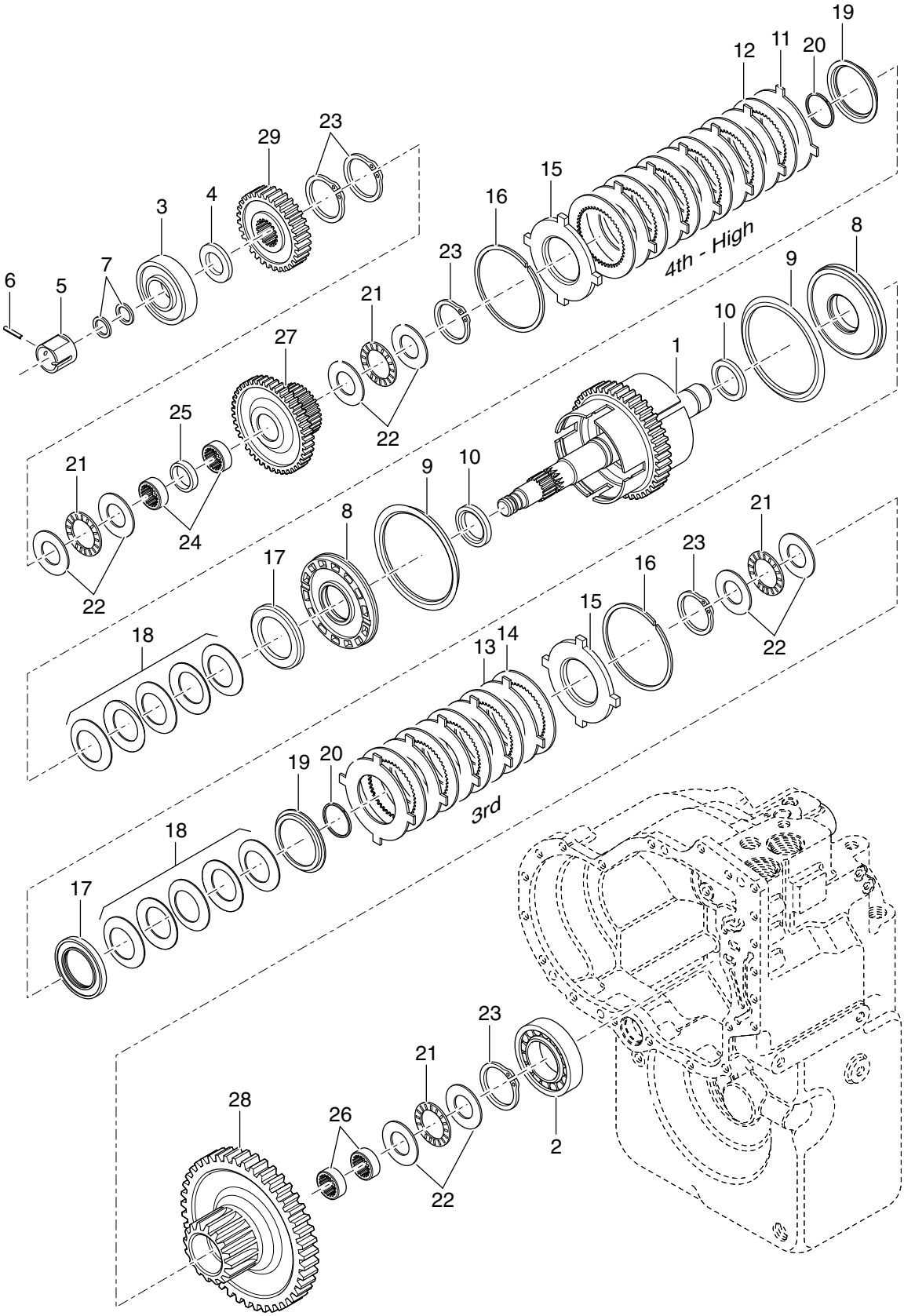
GROUP - 3RD SHAFT (FOR 3-SPEED TRANSMISSION ONLY)

Item	Description	Quantity
1	Assembly - 3rd shaft, drum and plug	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Washer - Bearing support	1
5	Sleeve - Oil distributor	1
6	Screw - Sleeve retaining	1
7	Ring - Piston	2
8	Clutch - Piston	1
9	Seal - Clutch piston (Outer)	1
10	Seal - Clutch piston (Inner)	1
11	Disc (Outer)	5
12	Disc (Inner)	5
13	Plate - End	1
14	Snap ring - end plate	1
15	Plate - Clutch piston wear	1
16	Assembly - disc spring	1
17	Retainer - Snap ring	1
18	Snap ring - Retainer	1
19	Bearing - Thrust needle roller	2
20	Washer - Clutch gear thrust	4
21	Snap ring - External	3
22	Bearing - 3rd clutch gear	2
23	Gear - 3rd clutch	1
24	Gear - First drive	1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3rd
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21
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26
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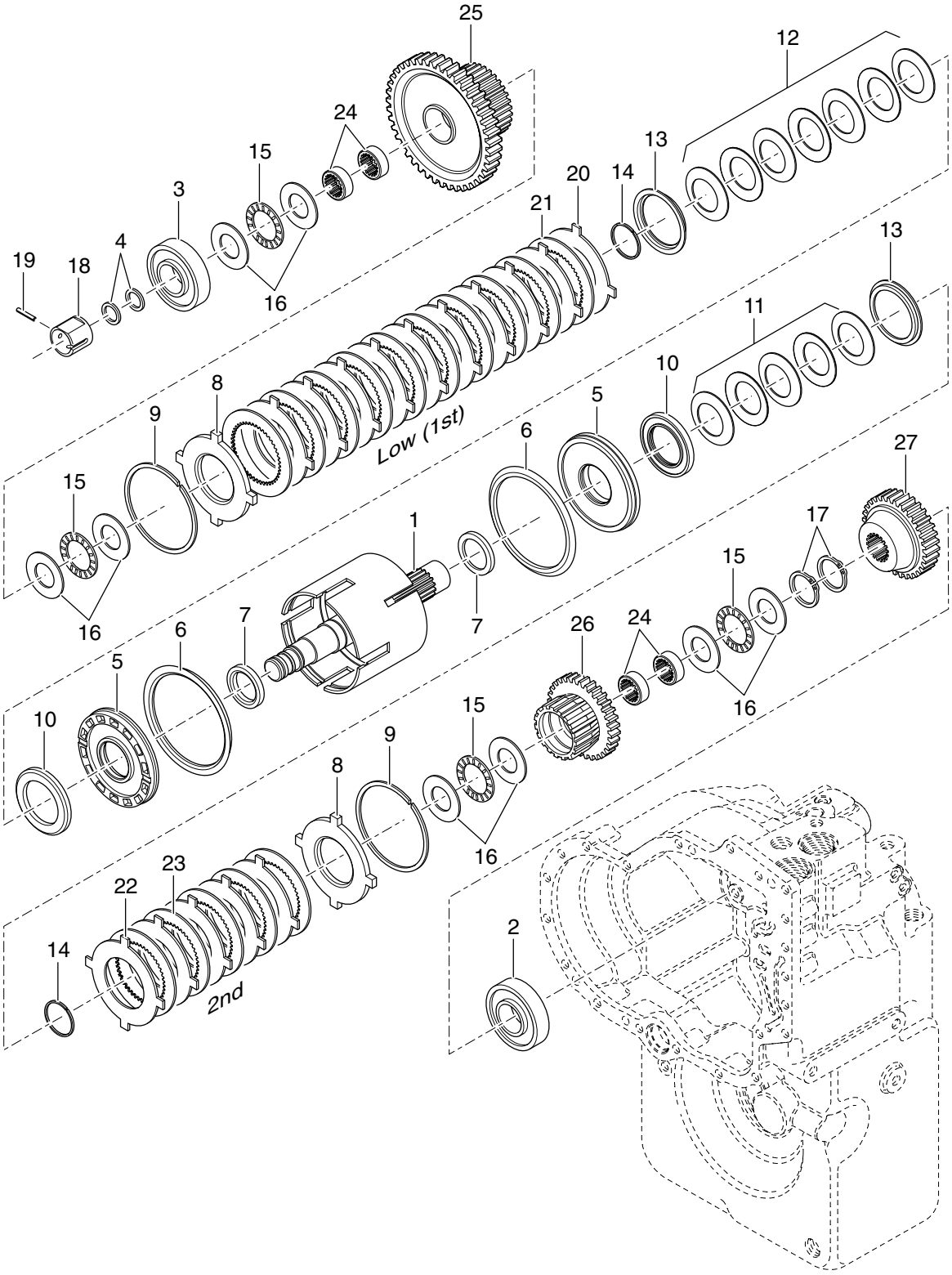
22

GROUP - HIGH (4TH) AND 3RD SHAFT

Item	Description	Quantity
1	Assembly - High and 3rd shaft, drum and plug	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Washer - Bearing support	1
5	Sleeve - Oil distributor	1
6	Screw - Sleeve retaining	1
7	Ring - Piston	2
8	Clutch - Piston	2
9	Seal - Clutch piston (Outer)	2
10	Seal - Clutch piston (Inner)	2
11	Disc (Outer) Hi	6
12	Disc (Inner) Hi	6
13	Disc (Outer) 3rd	5
14	Disc (Inner) 3rd	5
15	Plate - End	2
16	Snap ring - End plate	2
17	Plate - Clutch piston wear	2
18	Assembly - Disc spring	2
19	Retainer - Snap ring	2
20	Snap ring - Retainer	2
21	Bearing - thrust needle roller	4
22	Washer - Clutch gear thrust	8
23	Snap ring - Gear hub	5
24	Bearing - 4th clutch gear	2
25	Spacer	1
26	Bearing - 3rd clutch gear	2
27	Gear 4th clutch	1
28	Gear 3rd clutch	1
29	Gear - First drive	1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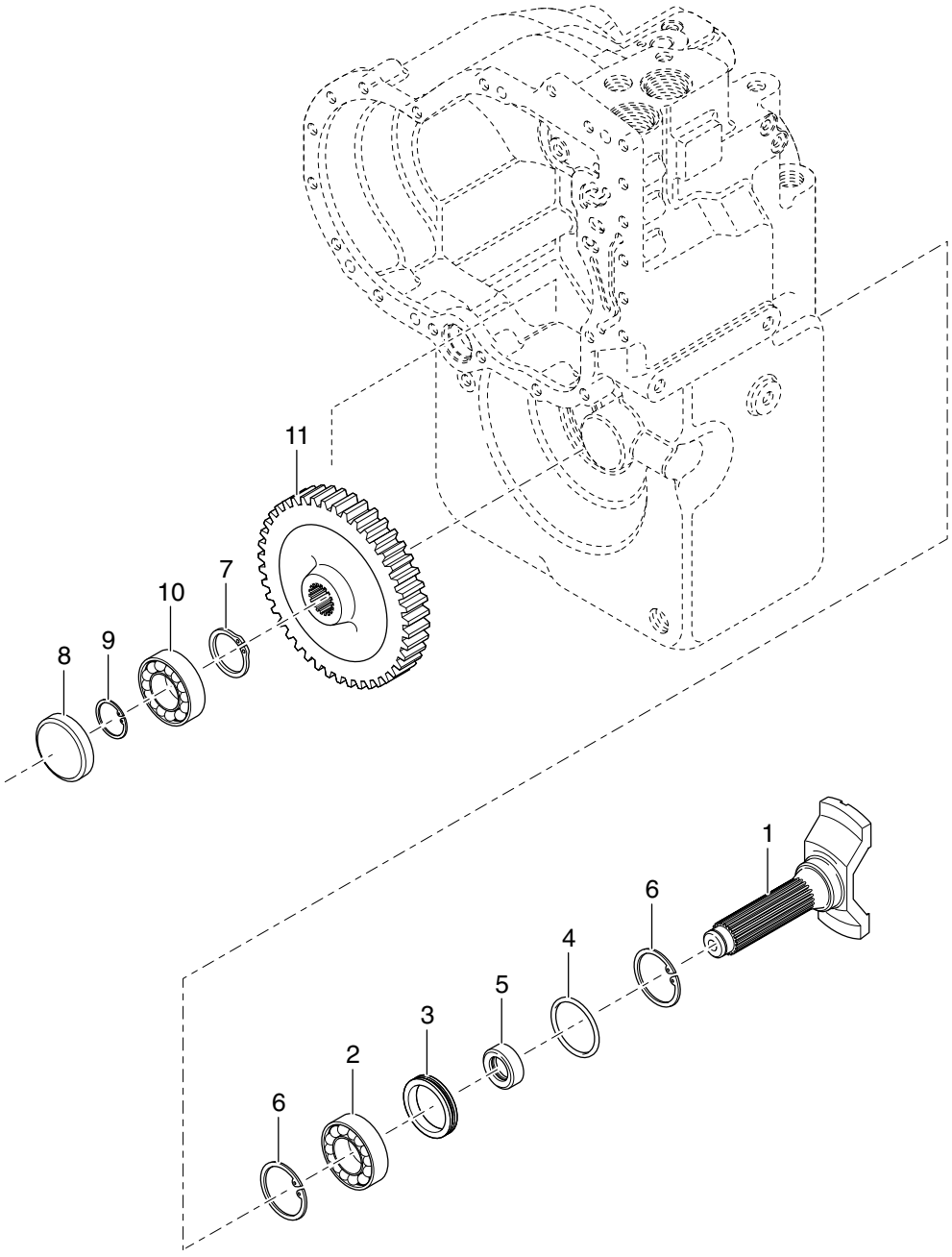
GROUP - 1ST AND 2ND SHAFT

Item	Description	Quantity
1	Assembly 1st and 2nd shaft, drum, plug and seat	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Ring - Piston	2
5	Piston - Clutch	2
6	Seal - Clutch piston (Outer)	2
7	Seal - Clutch piston (Inner)	2
8	Plate - End	2
9	Snap ring - End plate	2
10	Plate - Clutch piston wear	2
11	Assembly - Disc spring	1
12	Assembly - Disc spring	1
13	Retainer - Snap ring	2
14	Snap ring - Retainer	2
15	Bearing - Clutch gear thrust	4
16	Washer - Clutch gear thrust	8
17	Snap ring - 2nd clutch gear hub	2
18	Sleeve - Oil distributor	1
19	Screw - Sleeve retaining	1
20	Disc (Outer) 1st	10
21	Disc (Inner) 1st	10
22	Disc (Outer) 2nd	5
23	Disc (Inner) 2nd	5
24	Bearing	4
25	Gear - 1st clutch	1
26	Gear - 2nd clutch	1
27	Gear - 3rd driven	1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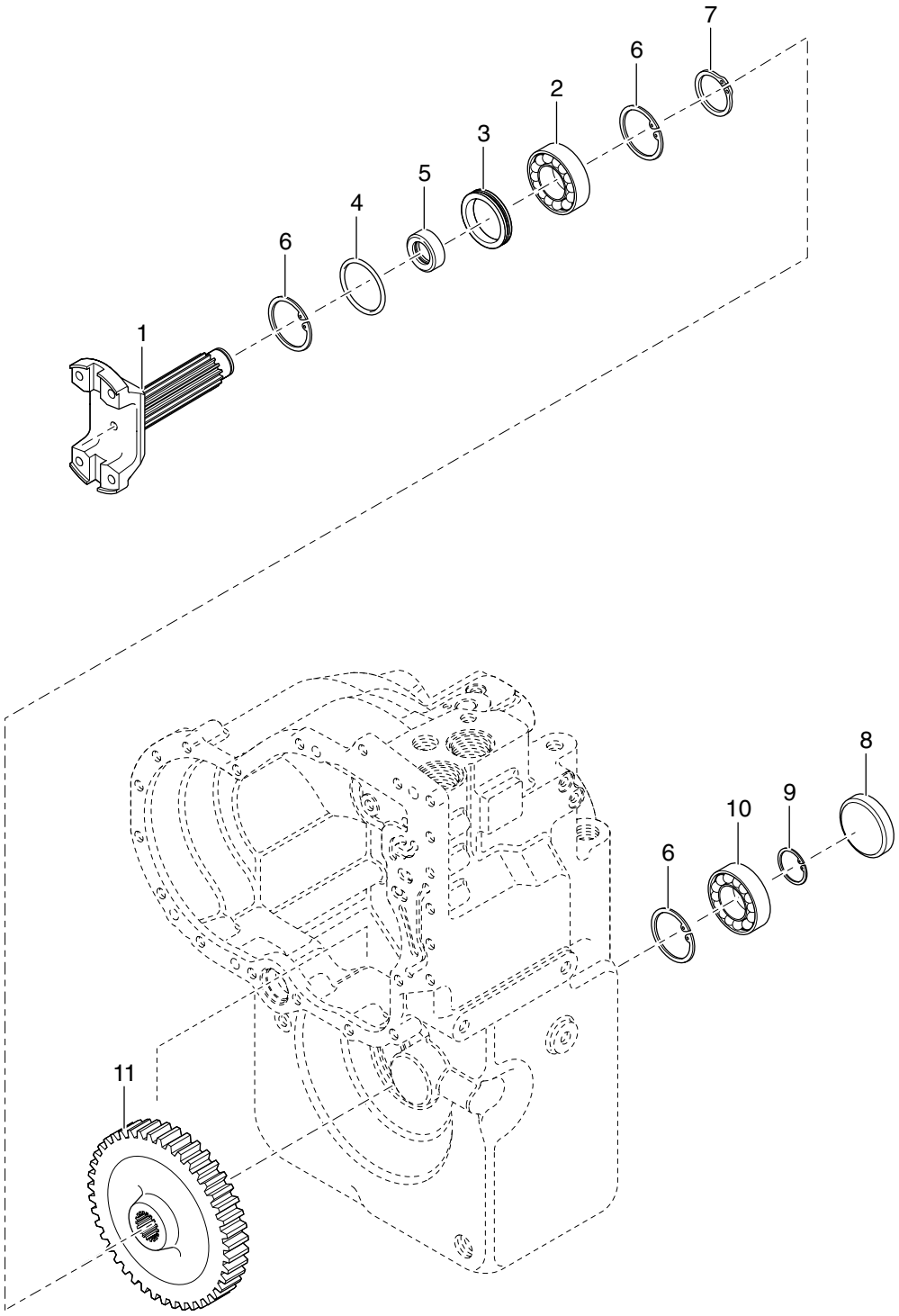
GROUP - OUTPUT SHAFT (REAR ONLY)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	1
3	Sleeve - Oil seal	1
4	“O”ring - Oil seal sleeve	1
5	Seal - Output shaft oil	1
6	Snap ring - Output shaft bearing	2
7	Snap ring - Gear & bearing retaining	1
8	Plug - End	1
9	Snap ring - Bearing retainer	1
10	Bearing - Output shaft	1
11	Gear - Output shaft	1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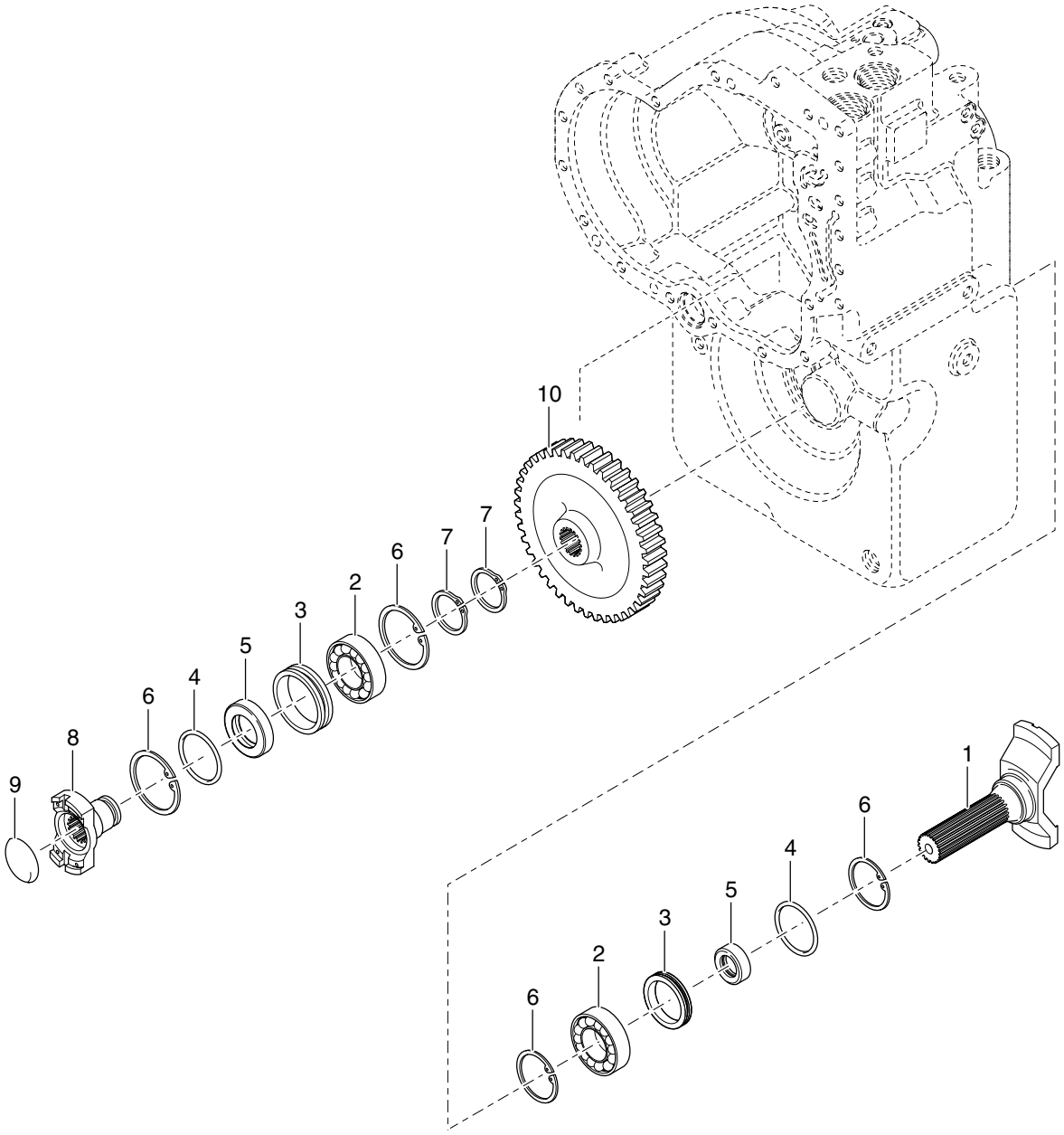
GROUP - OUTPUT SHAFT (FRONT ONLY)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	1
3	Sleeve - Oil seal	1
4	“O”ring - Oil seal sleeve	1
5	Seal - Output shaft bearing	1
6	Snap ring - Output shaft bearing	3
7	Snap ring - Gear & bearing retaining	1
8	Plug - End	1
9	Snap ring - Bearing retainer	1
10	Bearing - Output shaft	1
11	Gear - Output shaft	1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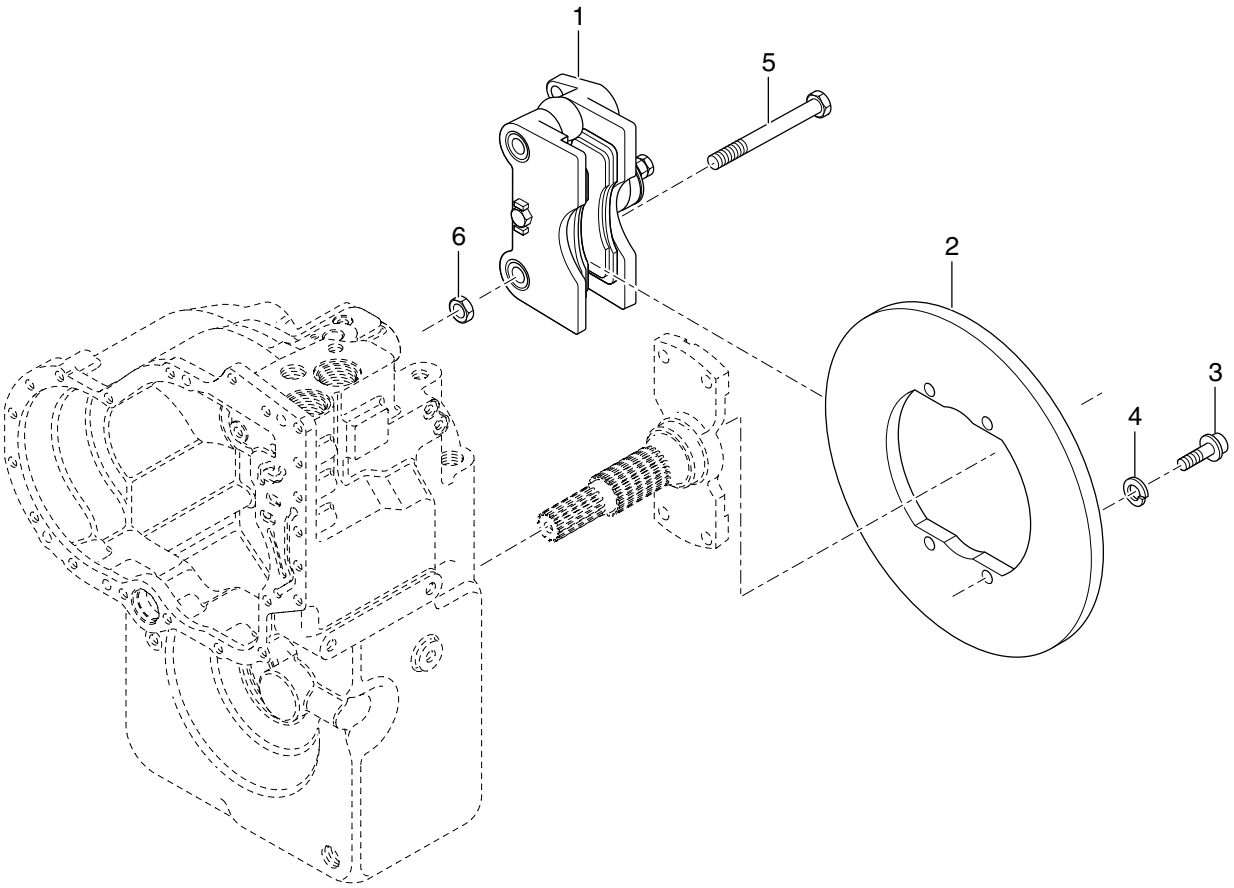
GROUP - OUTPUT SHAFT (FRONT & REAR)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	2
3	Sleeve - Oil seal	2
4	“O”-ring - Oil seal sleeve	2
5	Seal - Output shaft oil	2
6	Snap ring - Output shaft bearing	4
7	Snap ring - Gear & bearing retaining	2
8	Flange - Output	1
9	Plug - Flange	1
10	Gear - Output shaft	1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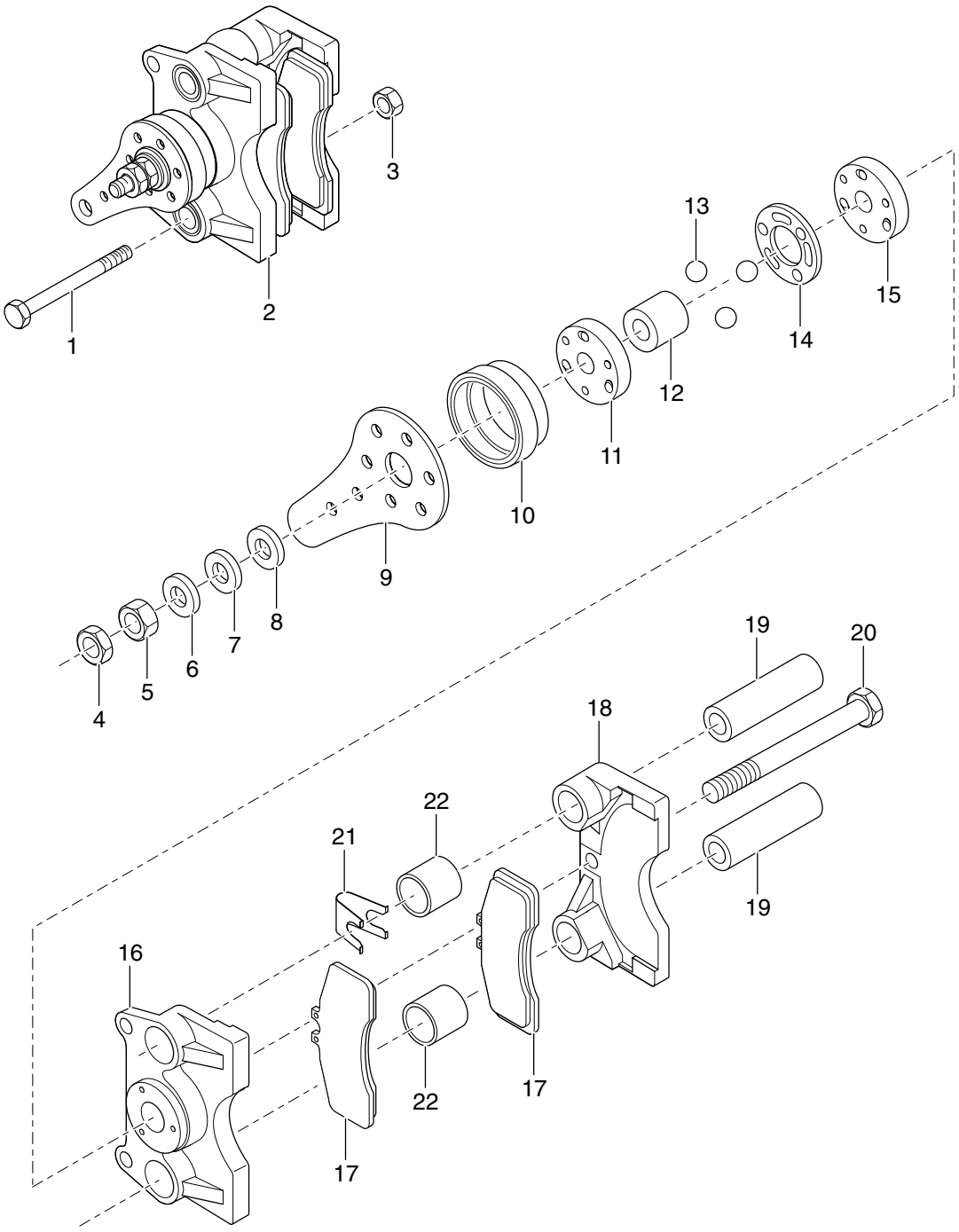
GROUP - DISK BRAKE

Item	Description	Quantity
1	Assembly - Caliper	1
2	Disc - Brake	1
3	Capscrew - Brake disc	4
4	Lockwasher	4
5	Capscrew - Caliper assembly mounting	2
6	Nut - Caliper assembly capscrew locking	2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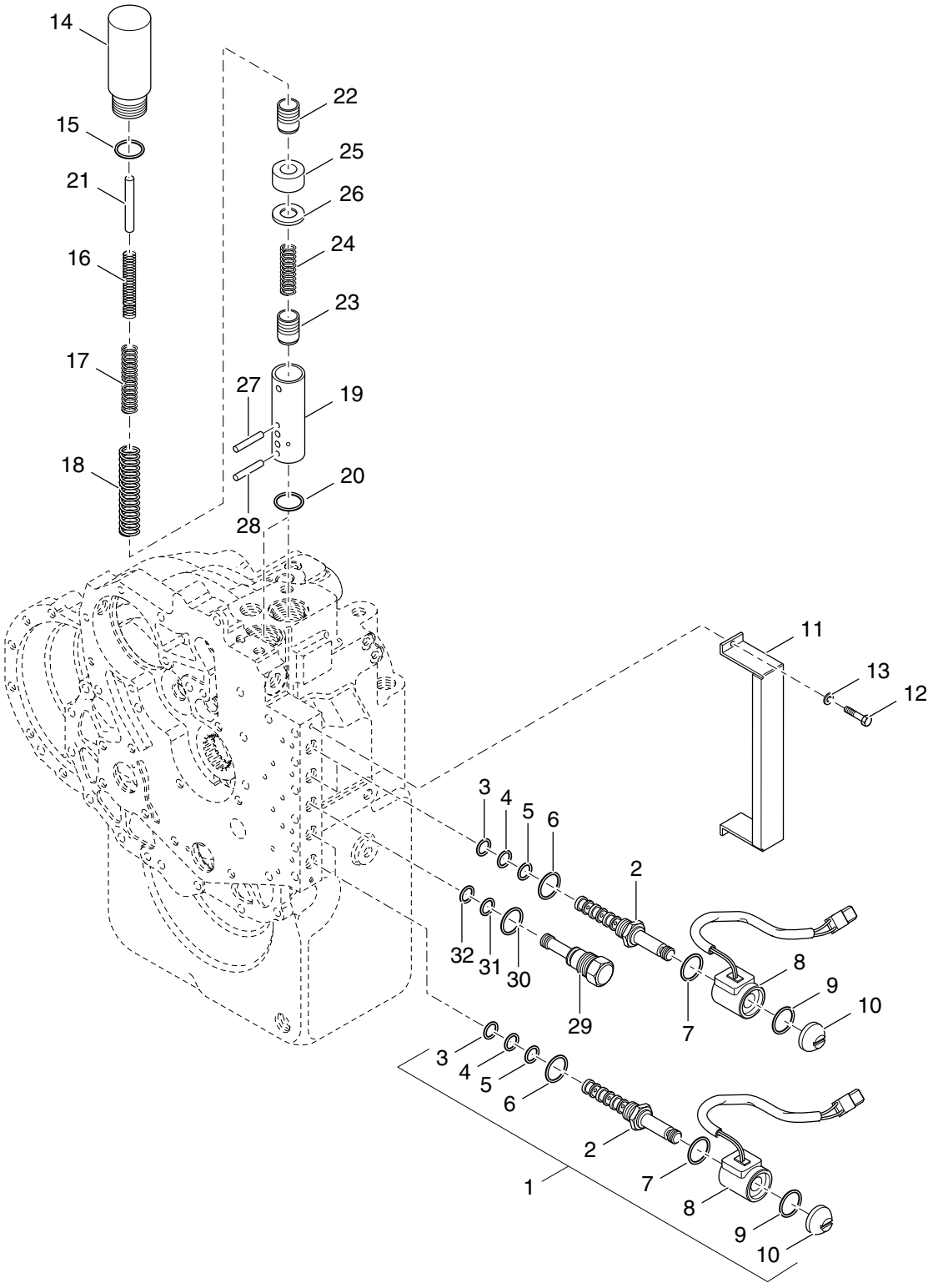
GROUP - CALIPER ASSEMBLY

Item	Description	Quantity
1	Screw - Brake mounting	2
2	Assembly - Caliper	1
3	Nut - Brake mounting screw	2
4	Nut - Jam adjustment	1
5	Nut - Adjustment	1
6	Washer - Hardened	1
7	Washer - Stainless steel	1
8	Washer - Thrust	1
9	Lever	1
10	Boot	1
11	Cam	1
12	Id seal	1
13	Ball bearing	3
14	Plastic retainer	1
15	Cam	1
16	Torque plate (Front)	1
17	Carrier and lining assembly	2
18	Torque plate (Rear)	1
19	Sleeve mounting	2
20	Bolt - Adjusting	1
21	Spring	1
22	Seal - Sleeve	2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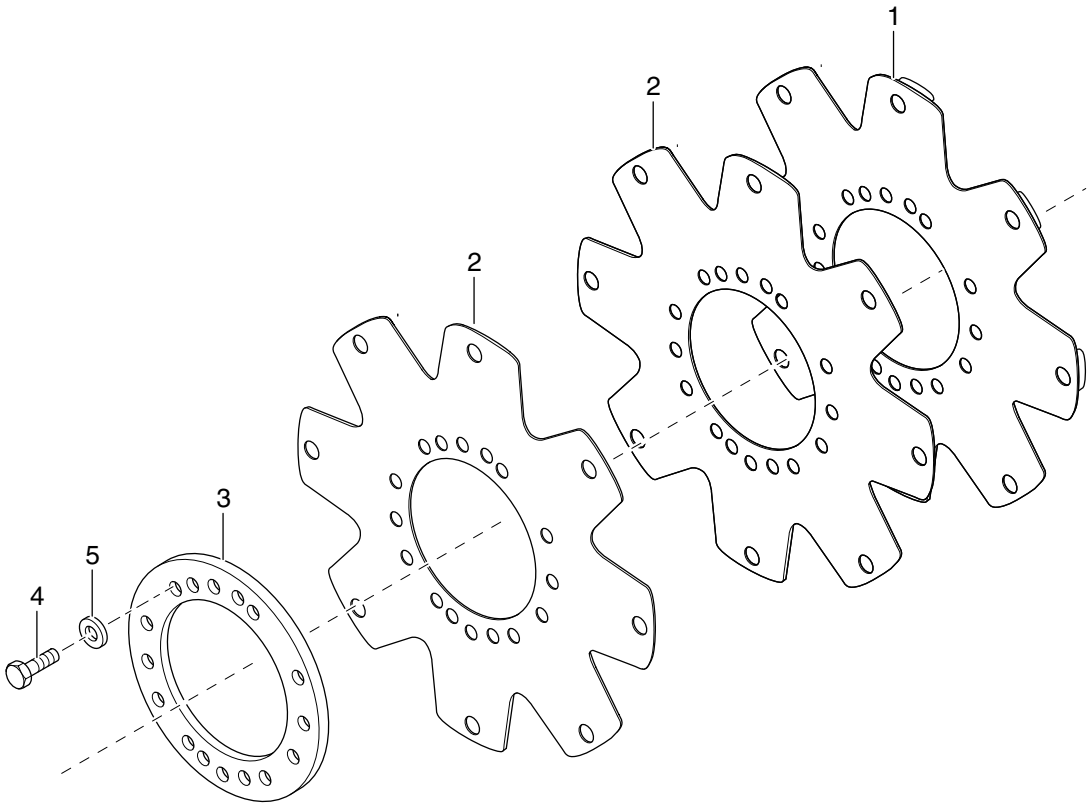
GROUP - ELECTRIC CONTROL

Item	Description	Quantity
1	Assembly - Solenoid cartridge	5*
2	Cartridge - Valve 4-way including items 3, 4, 5 and 6	5*
3	“O”-ring - Cartridge	5*
4	“O”-ring - Cartridge	5*
5	“O”-ring - Cartridge	5*
6	“O”-ring - Cartridge	5*
7	“O”-ring - Cartridge to coil	5*
8	Coil - Solenoid	5*
9	“O”-ring - Coil to nut	5*
10	Nut - Valve cartridge retainer	5*
11	Cover - Protective	1
12	Screw - Protective cover	2
13	Lockwasher - Protective cover screw	2
14	Housing - Modulation valve	2
15	“O”-ring - Modulation housing	2
16	Spring (Inner)	2
17	Spring (Middle)	2
18	Spring (Outer)	2
19	Sleeve - Modulation valve	2
20	“O”-Ring - Sleeve	2
21	Pin - Stop	2
22	Spool - Accumulator	2
23	Spool - Regulator	2
24	Spring - Modulation valve	2
25	Retainer - Spring	2
26	Spacer - Spring	2
27	Pin (Upper)	2
28	Pin (Lower)	2
29	Plug - Solenoid bore plug, used at forward high and low	1**
30	“O”-ring - Plug	1**
31	“O”-ring - Plug	1**
32	“O”-ring - Plug	1**

* - Quantity = 4, with 3-speed.
** - Used with 3-speed only.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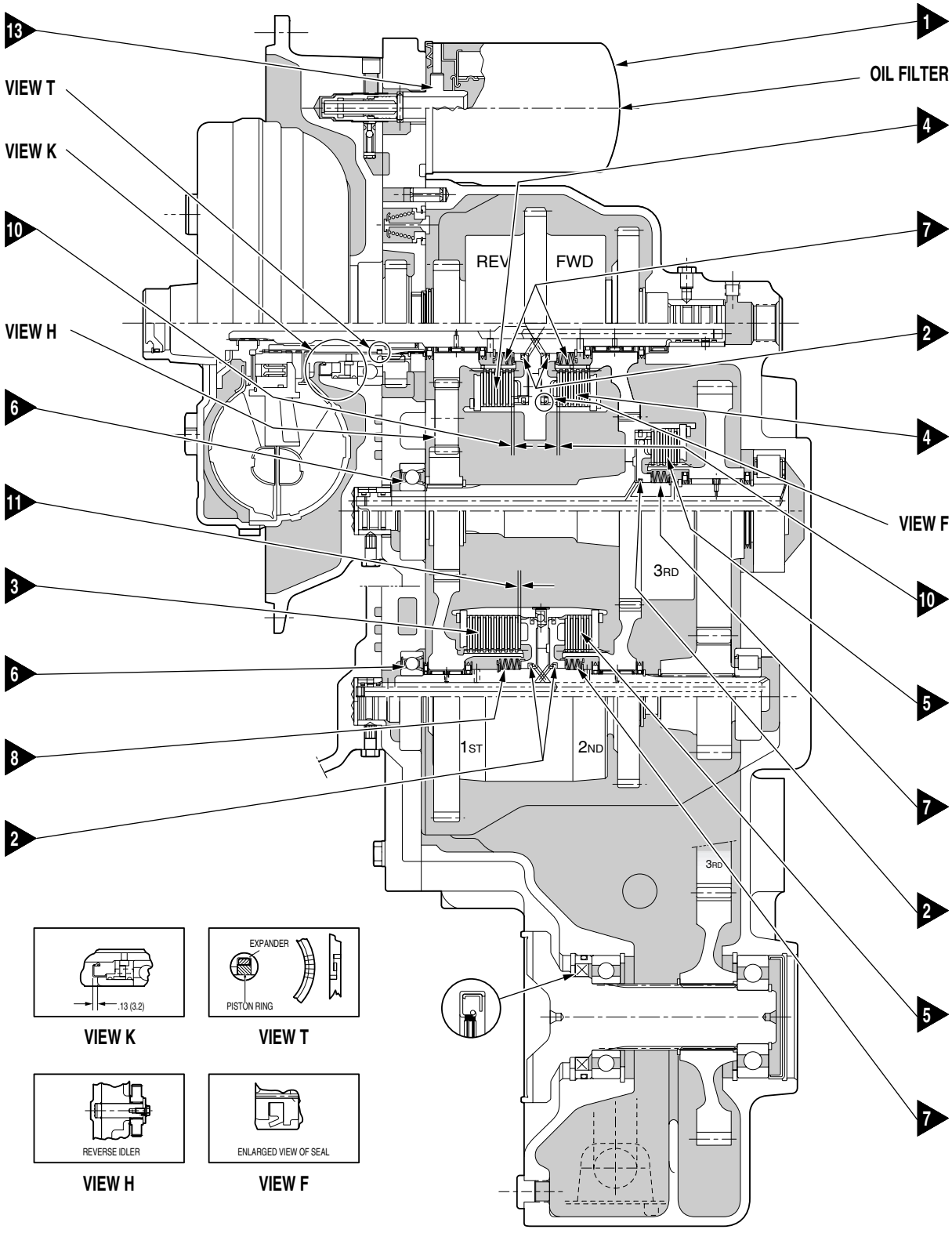
GROUP - DRIVE PLATE

Item	Description	Quantity
1	Assembly - Drive plate and (when used) weld nut	1
2	Plate - Drive	2
3	Ring - Drive plate backing	1
4	Screw - Drive plate mounting	6
5	Lockwasher - Drive plate mounting screw	6

9. ASSEMBLY INSTRUCTIONS

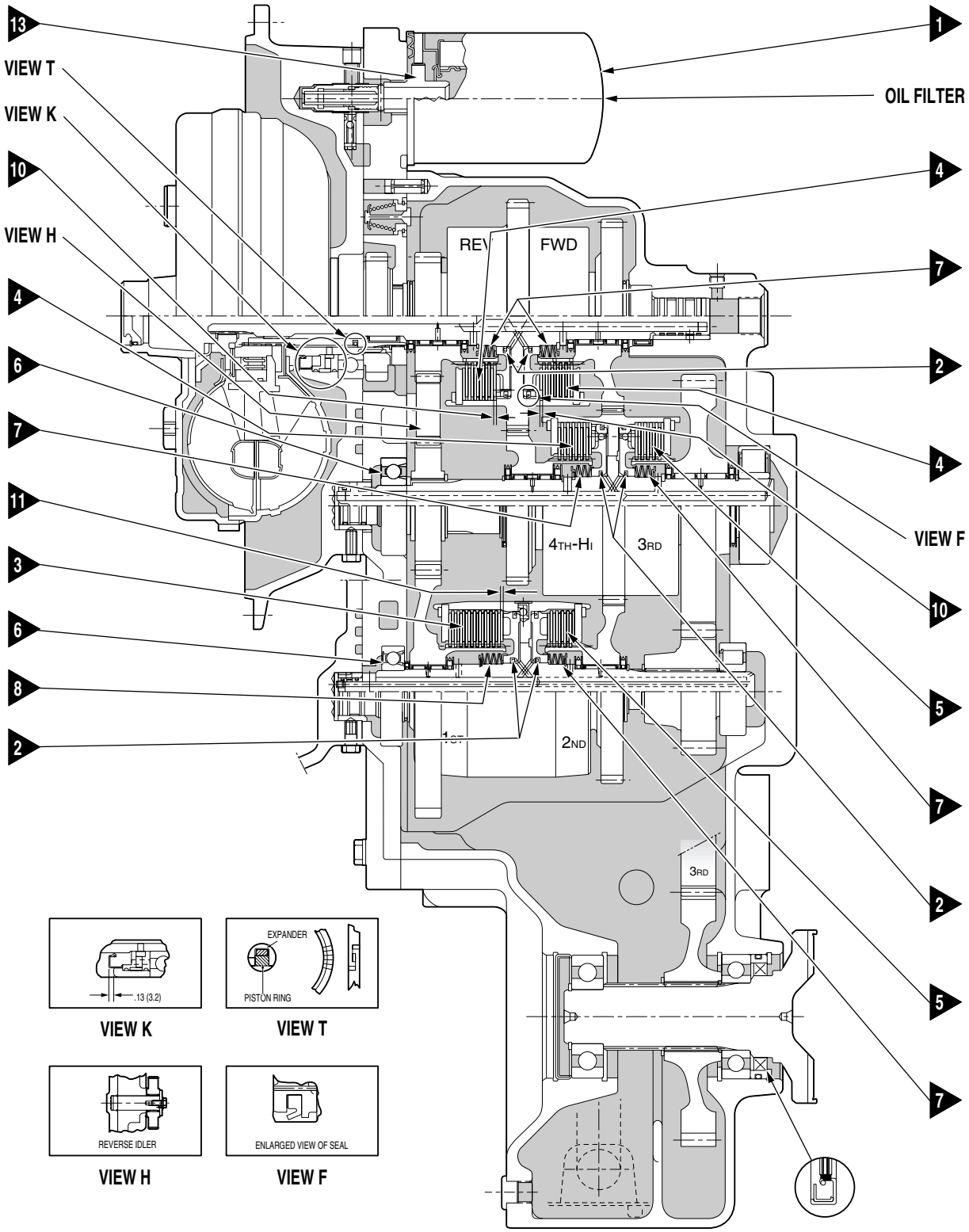
9. ASSEMBLY INSTRUCTIONS (CONTINUED)

3-Speed cross section

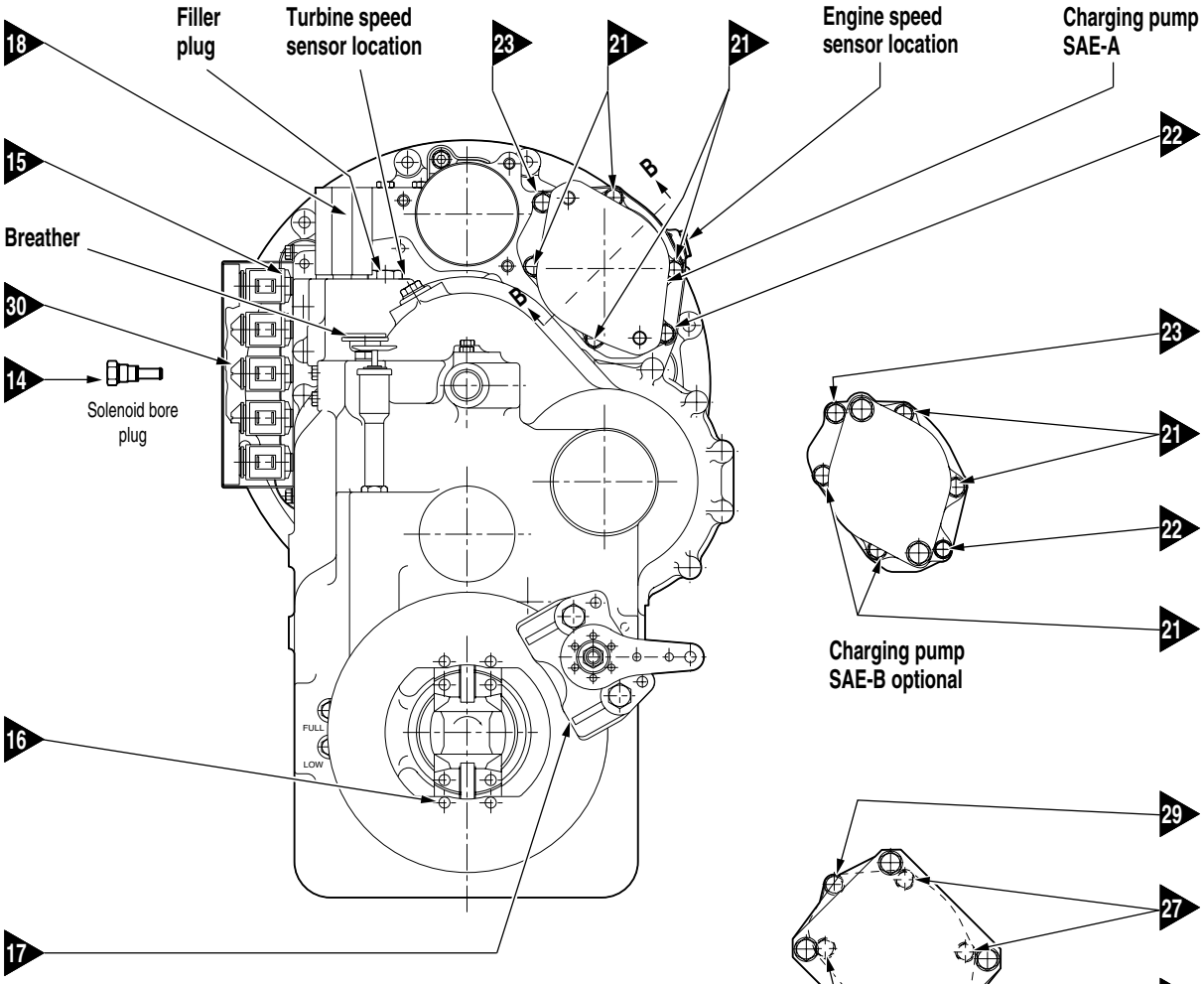


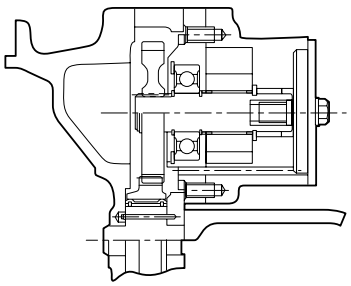
9. ASSEMBLY INSTRUCTIONS (CONTINUED)

4 and 6-speed cross section



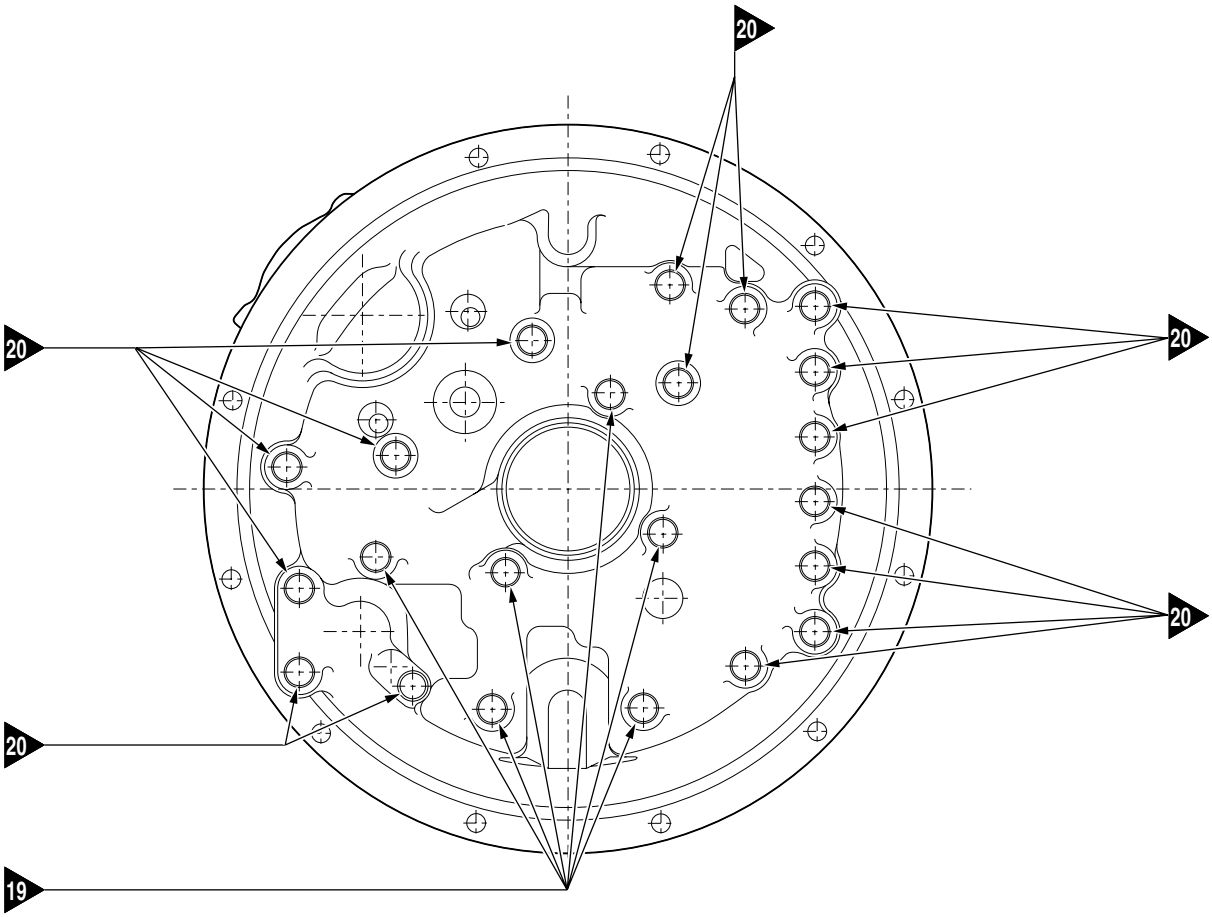
9. ASSEMBLY INSTRUCTIONS (CONTINUED)

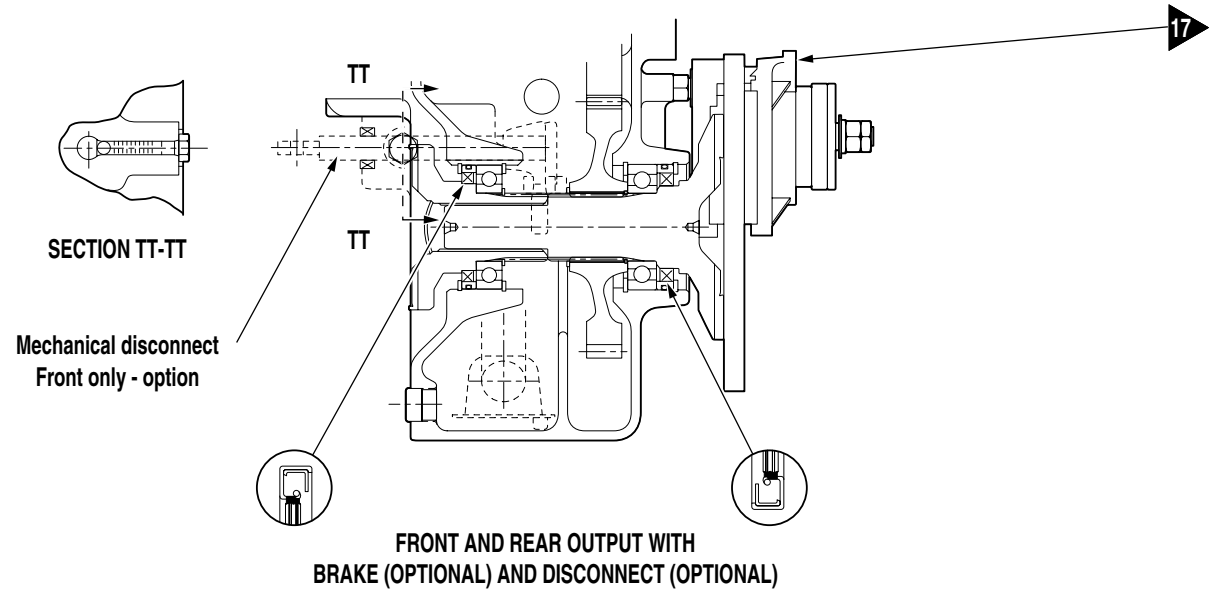




SECTION B-B

9. ASSEMBLY INSTRUCTIONS (CONTINUED)





FRONT AND REAR OUTPUT WITH BRAKE (OPTIONAL) AND DISCONNECT (OPTIONAL)

9. ASSEMBLY INSTRUCTIONS (CONTINUED)

Use Permatex and Loctite only where specified.

All lead in chamfers for oil seals, piston rings, and “O”-rings must be smooth and free from burrs. Inspect before assembly.

Lubricate all piston ring grooves and “O”-rings with oil before assembly.

Apply a thin coat of grease between seal lips on lip type seals prior to assembly.

Apply a thin coat of Permatex No. 2 or Loctite No. 641 to O.D. of all oil seals before assembly.

Apply a thin coat of Loctite No. 592 or 506 Dryseal to all pipe plugs.

After assembly of parts using Loctite or Permatex, there must not be any free or excess material which might enter the oil circuit.

1. Assemble oil filter and tighten to 20-25 lbf.ft [27-34 N.m].

2. Teflon seals must be sized prior to assembly.

3. 10 outer steel plates, 10 inner plates, alternately assemble, starting with outer steel plate.

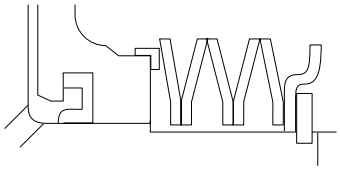
4. 6 outer steel plates, 6 inner plates, alternately assemble, starting with outer steel plate.

5. 5 outer steel plates, 5 inner plates, alternately assemble, starting with outer steel plate.

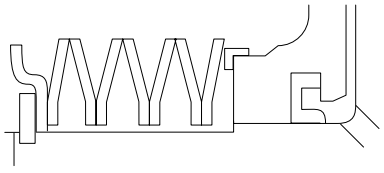
6. Shield bearing, assembly with shield as shown.

   Add a coating of Loctite 641 to outer diameter of bearings.

7. Fwd. ,Rev., 2nd and 3rd. clutch return disc springs. Concave side of first disc spring to be placed against clutch piston wear sleeve. Remaining four springs to be stacked alternately as shown.



8. Low clutch return disc springs concave side of first disc spring to be placed against clutch piston wear sleeve. Remaining six springs to be stacked alternately as shown.



10. Clearance between clutch piston and steel seperator plate to be .048-.108 [1.22-2.74]. If over .108 [2.74] clearance, add one steel outer disc under end plate.

9. ASSEMBLY INSTRUCTIONS (CONTINUED)

11 Clearance between clutch piston and steel separator plate to be .080-.135 [2.03-3.43]. If over .135 [3.43] clearance, add one steel outer disc under end plate.

13 Tighten regulator sleeve to 45-50 lbf.ft [61-68 N.m].

14 Use solenoid bore plug in middle position for 3-speed version only.

15 Solenoid cartridge to be assembled and tightened to 16-20 lbf.ft [22-27 N.m].

16 Apply Loctite No. 243 to thread of disc mounting screws.

17 See page 4-4 for brake information.

18 Tighten modulation valve and inching valve to 60-65 lbf.ft [81-88 N.m].

19 M10 x 1.17 - 1.20. [M10 x 30].

20 M10 x 2.32 - 2.4. [M10 x 60].

21 Use 5/16-18 x 5.00 screw.

22 Use 5/16-18 x 3.500 screw.

23 Use 3/8-16 x 5.00 screw.

24 Use 5/16-18 x 3.250 screw.

25 Use 5/16-18 x 2.00 screw.

26 Use 3/8-18 x 3.250 screw.

27 Use 5/16-24 nut.

28 Use 5/16-24 nut.

29 Use 3/8-24 nut.

30 Tighten all cartridge nuts to 4-5 lbf.ft [5-7 N.m].

10. Disassembly and reassembly of T12000 ID transmission

Figure 1
Side view of T12000 intermediate drop transmission.

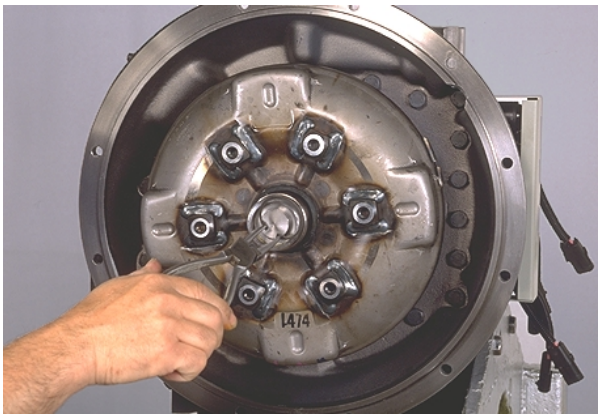


Figure 4
Remove torque converter plug retainer ring.

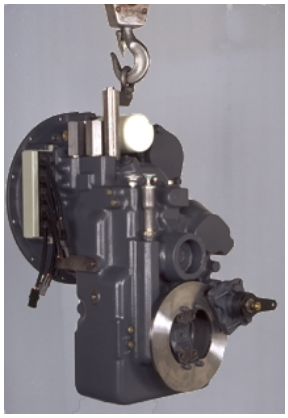


Figure 2
Rear view showing disc brake and electric control.

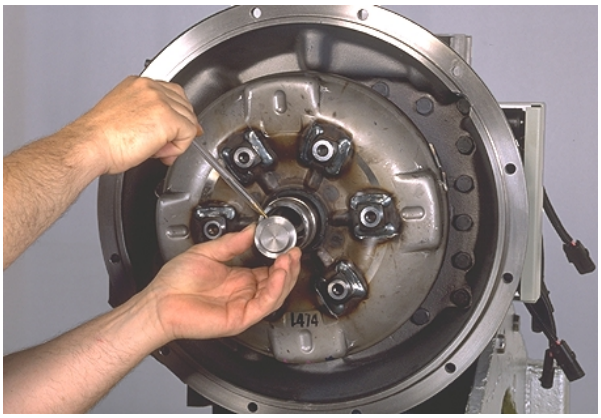


Figure 5
Remove plug and “O”-ring.

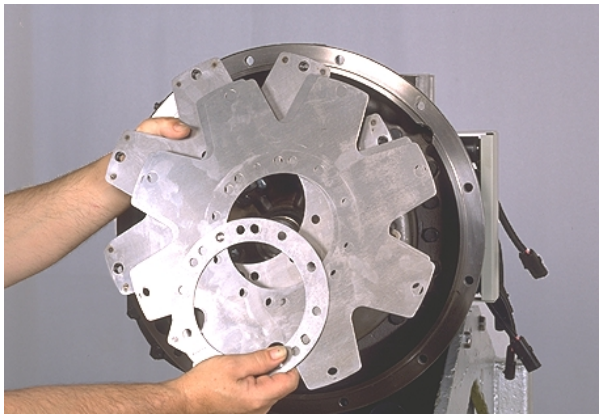


Figure 3
Remove drive plate attaching capscrews and washers. Remove drive plate and backing ring.

Figure 6
Remove torque converter to turbine shaft retainer ring.

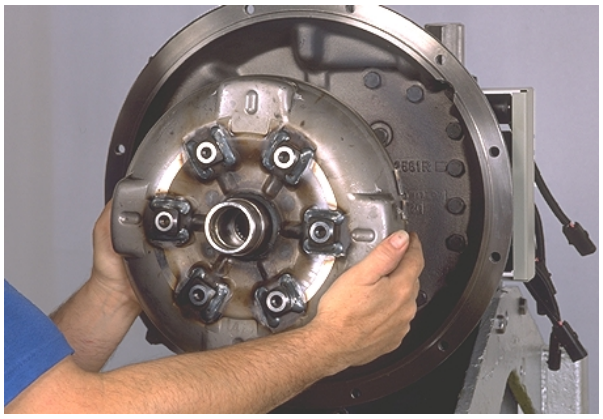


Figure 7
Remove torque converter assembly.

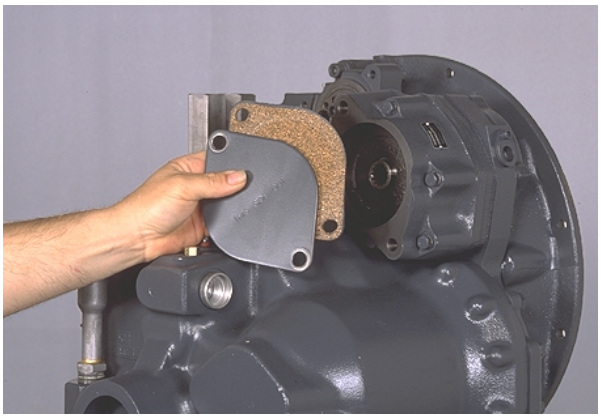


Figure 10
Remove charging pump permanent pump hole cover (not used when auxiliary pump is used).

Figure 8
Remove torque converter to shaft locating ring.

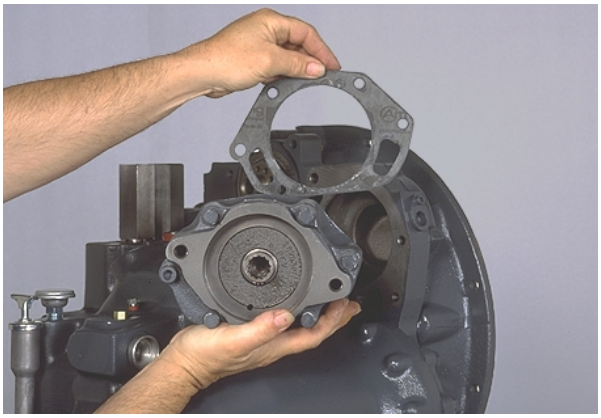


Figure 11
Remove pump mounting bolts and washers. Remove pump and gasket.

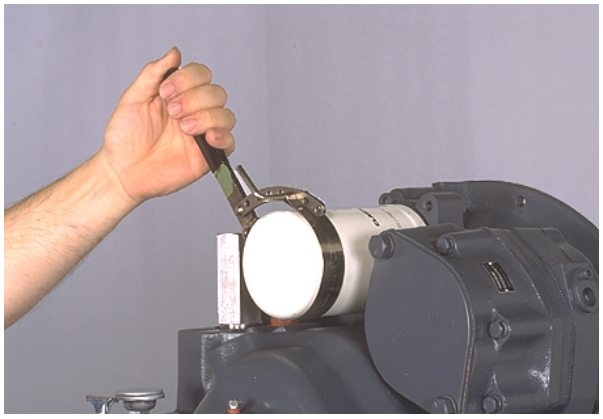


Figure 9
Remove filter assembly.

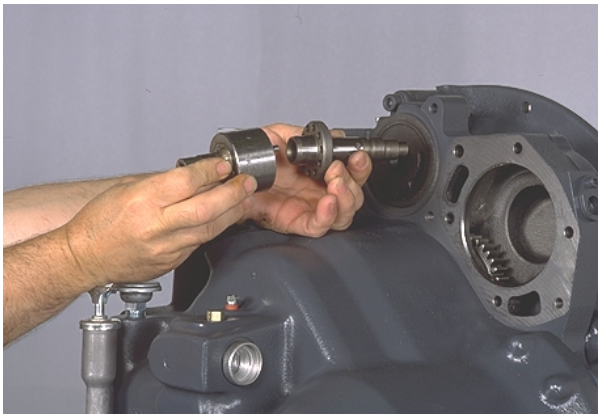


Figure 12
Remove pressure regulator and regulator sleeve.
NOTE: special tool can be fabricated. See Figure 427.

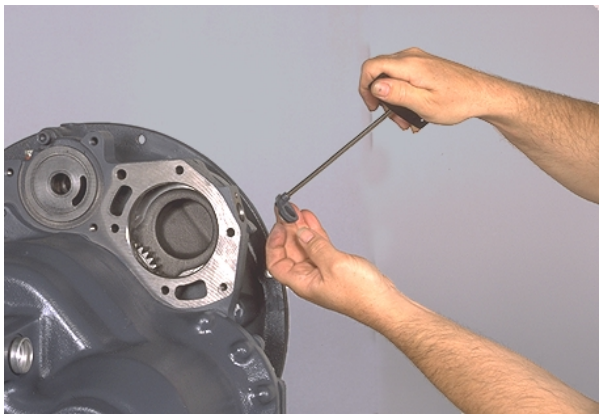


Figure 13
Remove sensor port plug and “O”-ring.

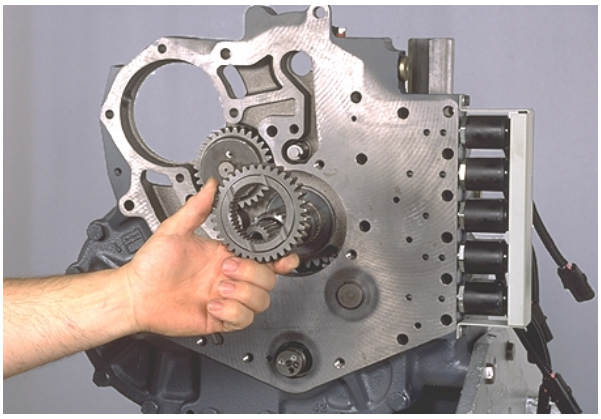


Figure 16
Remove impeller hub gear.

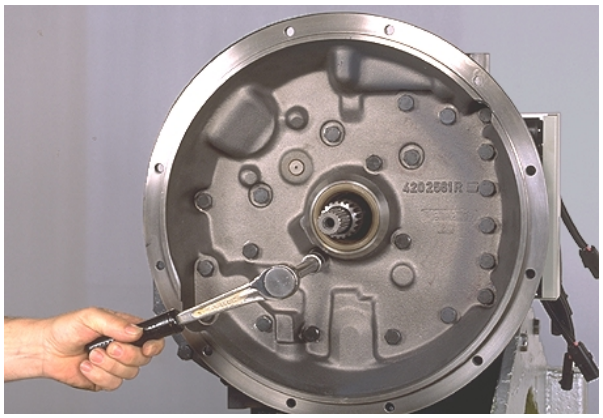


Figure 14
Remove converter housing to transmission case bolts and washers.

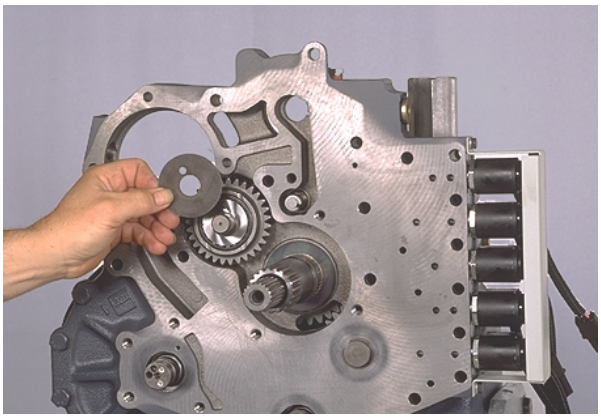


Figure 17
Remove pump drive idler gear washer.

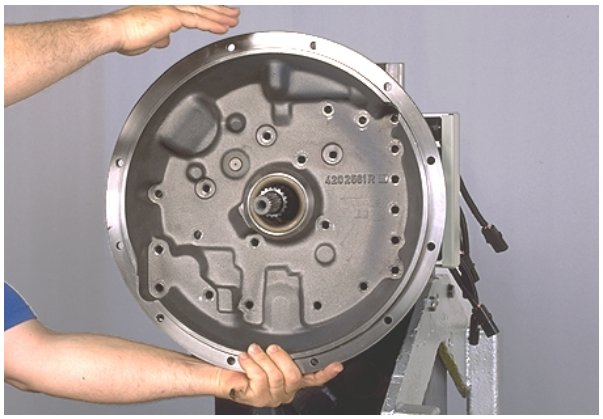


Figure 15
Remove converter housing and gasket.

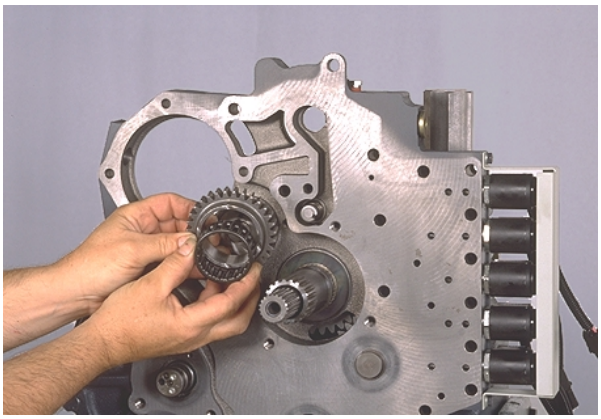


Figure 18
Remove pump drive gear and bearing.

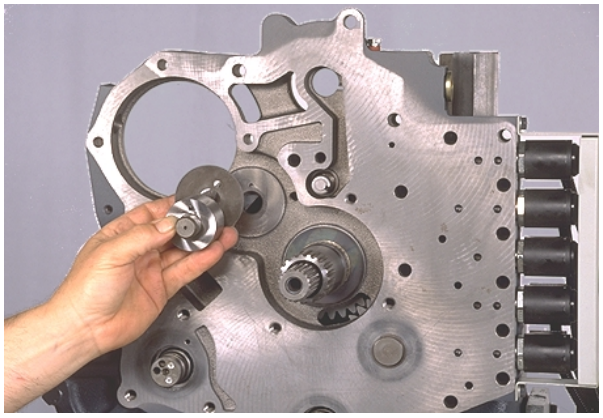


Figure 19
Remove pump drive idler shaft and washer.

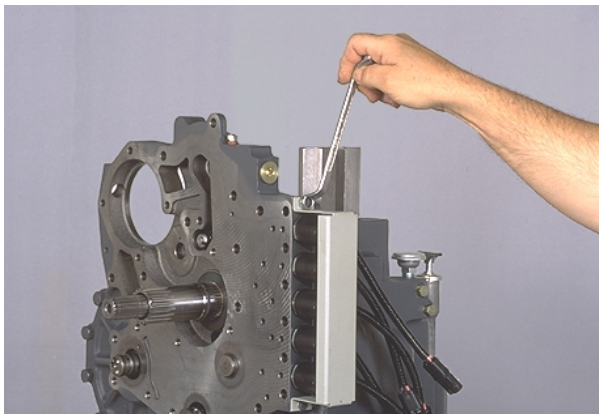


Figure 20
Remove solenoid protection cover screws.

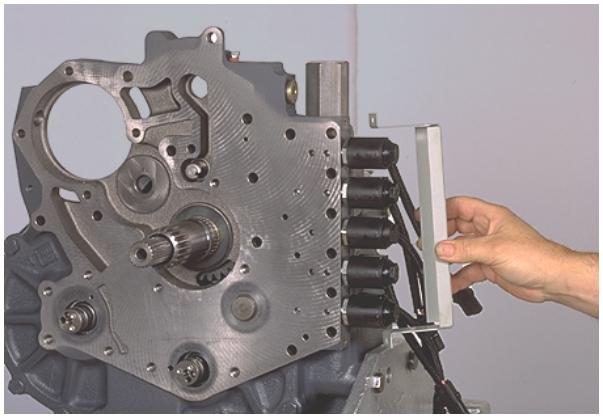


Figure 21
Remove solenoid protection cover .

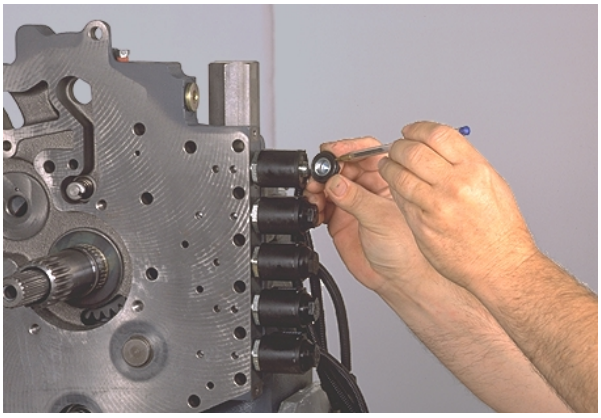


Figure 22
Remove solenoid valve cartridge retainer nut and “O”-ring.

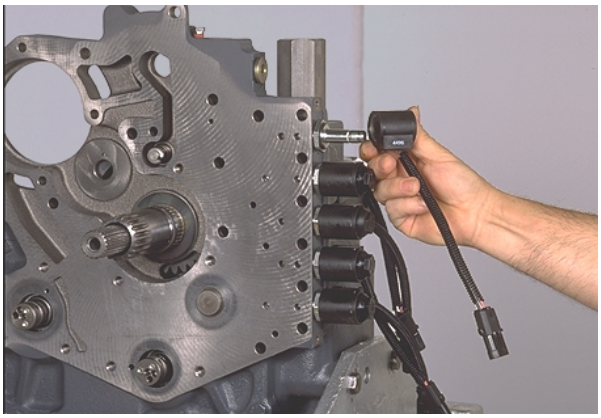


Figure 23
Remove solenoid coil and “O”-ring.

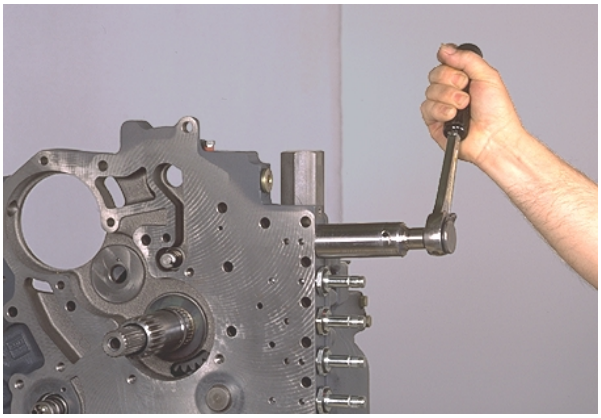


Figure 24
Remove valve cartridge and “O”-ring.

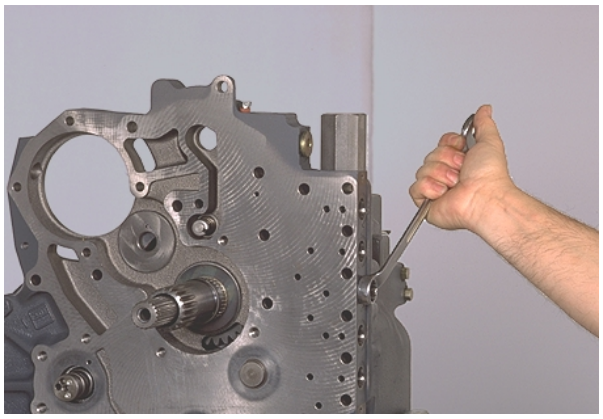


Figure 25

Repeat procedures figures 22 through 25 for remaining solenoid valves.
NOTE: A 3-speed will have a bore plug in the center box. Remove bore plug.

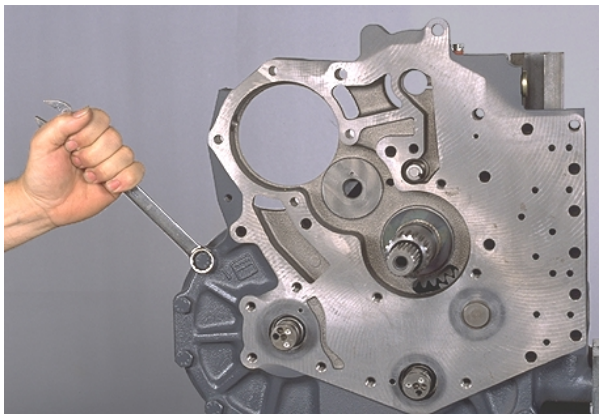


Figure 26

Remove spacer plate bolts and washers.

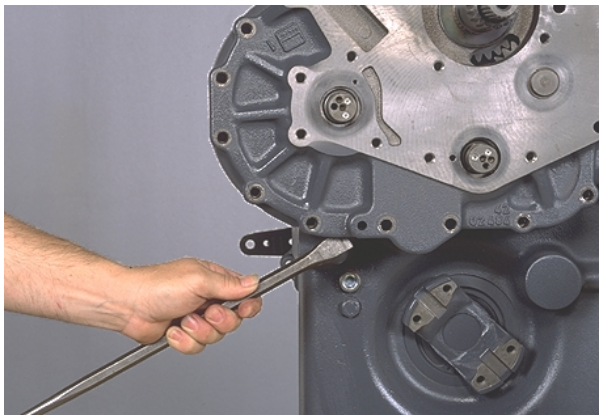


Figure 27

Pry spacer plate away from transmission case at dowel pin holes.

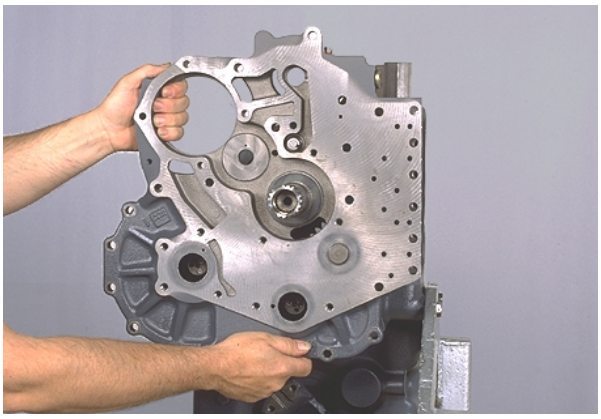


Figure 28

Remove spacer plate and gasket.

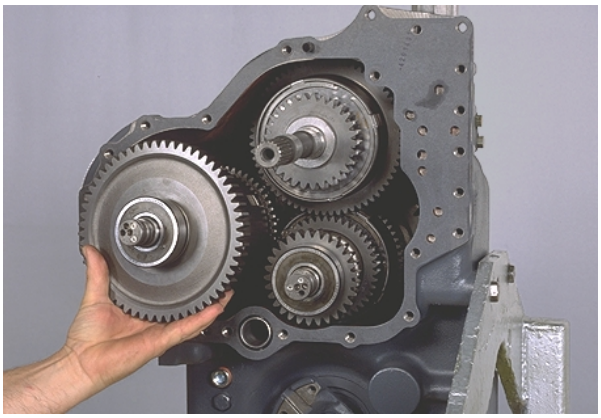


Figure 29

Remove 1st and 2nd clutch assembly.

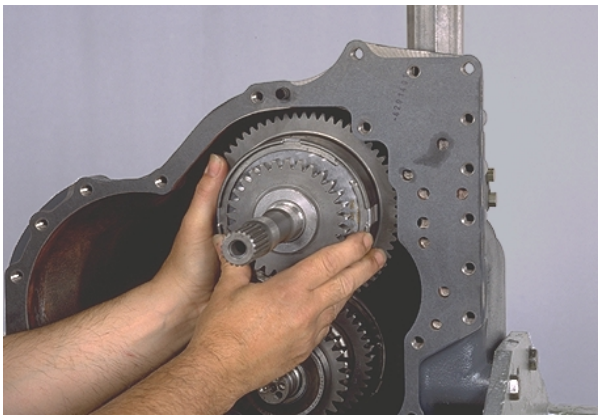


Figure 30

Remove forward and reverse clutch assembly.

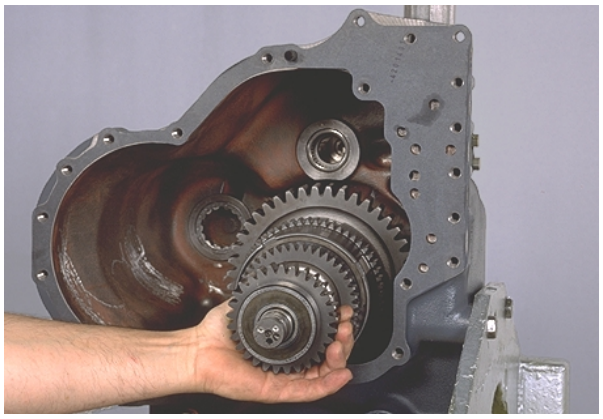


Figure 31

Remove high and 3rd clutch assembly.
NOTE: A 3-speed will only have 3rd clutch.

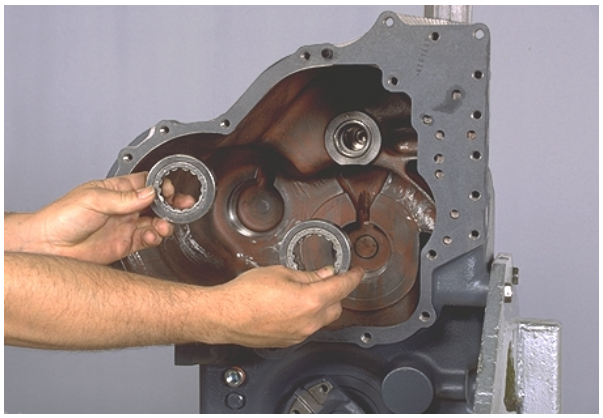


Figure 32

Remove clutch shaft rear bearing outer races.

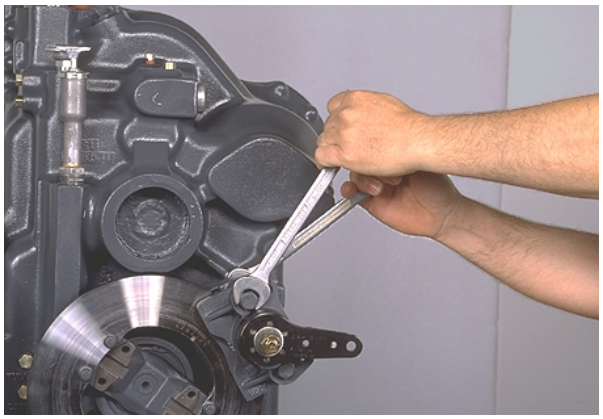


Figure 33

Remove brake disc assembly bolts from brake and housing.
NOTE: brake is an option and will not be on all units.

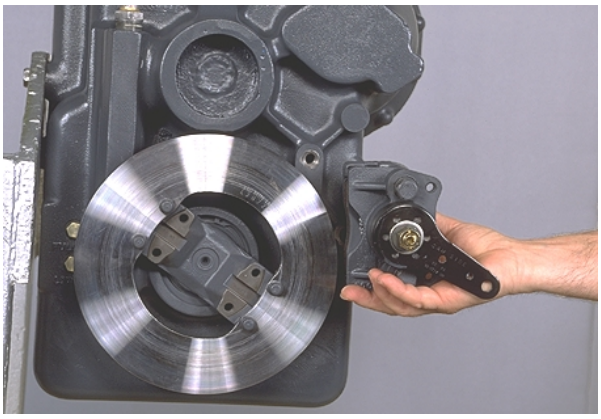


Figure 34

Remove brake caliper assembly.

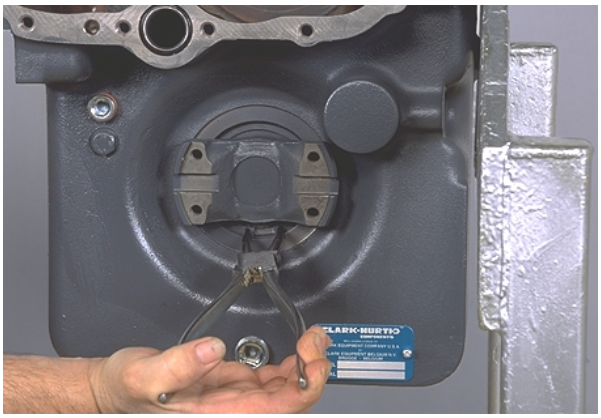


Figure 35

Turn front output flange as shown. Remove retainer ring from ring groove and pry output flange from housing.

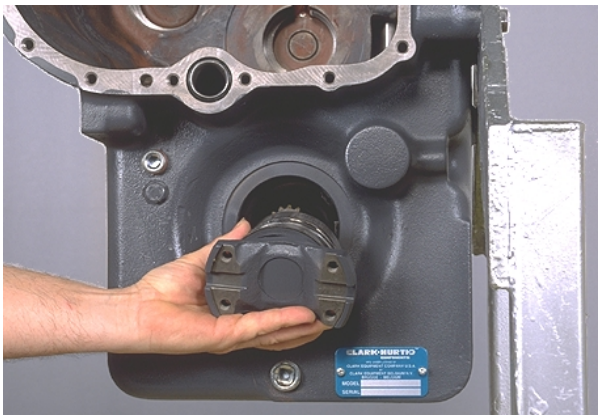


Figure 36

Output flange, oil seal sleeve and front bearing removed.

Figure 37
Remove bearing locating ring.

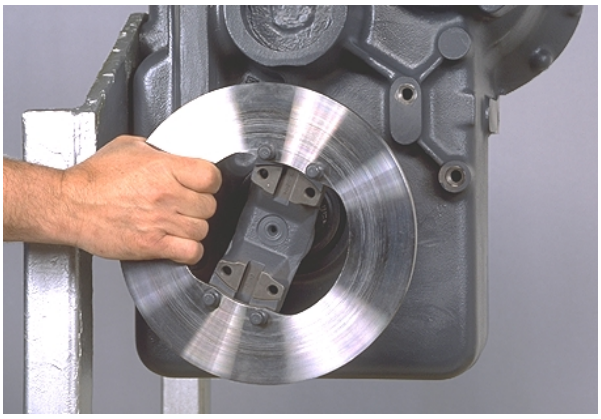


Figure 40
Flange removed.
NOTE: brake disc is optional and was removed with flange.

Figure 38
Remove output gear to shaft retainer ring.

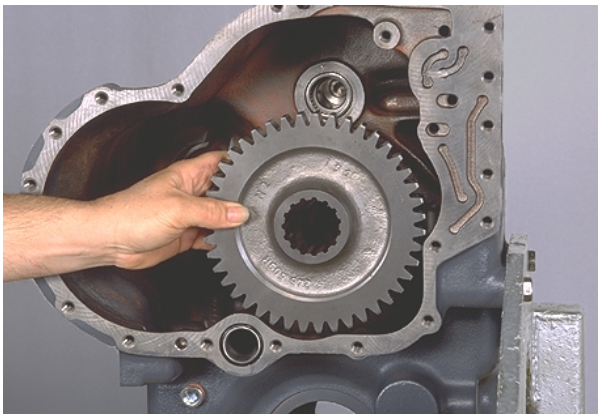


Figure 41
Remove output gear.

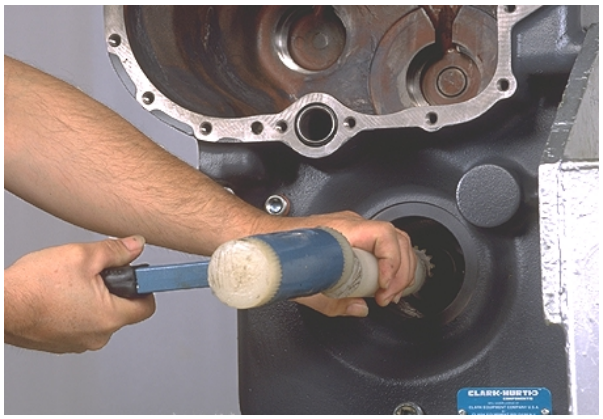


Figure 39
Tap output shaft and flange from housing.

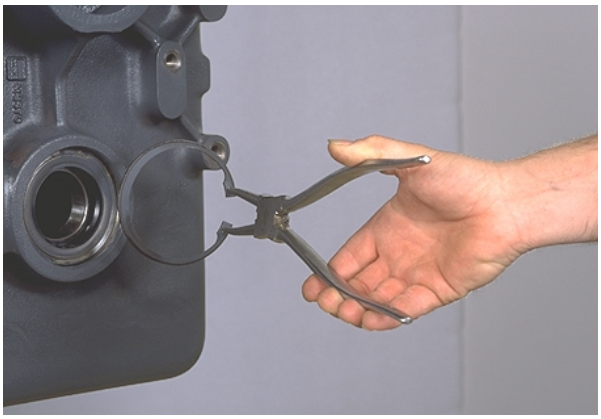


Figure 42
Remove flange oil seal sleeve retainer ring.

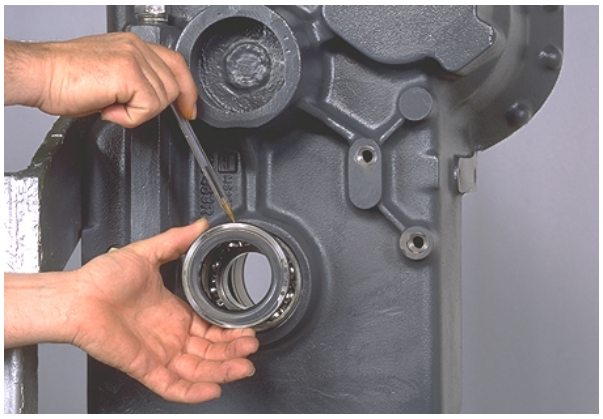


Figure 43
Remove sleeve and “O”-ring.

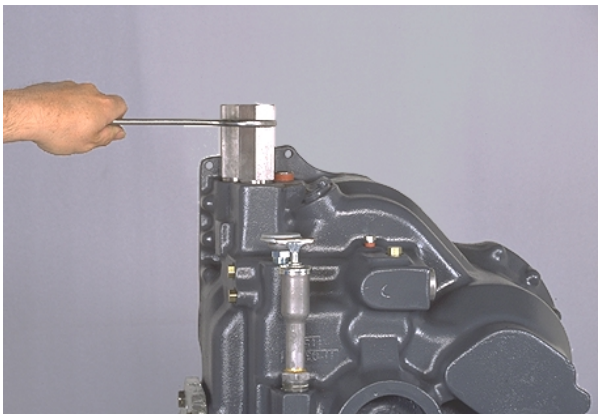


Figure 46
Remove modulator valve housing.
NOTE: for single modulation and hydraulic inching. See section 11.1.

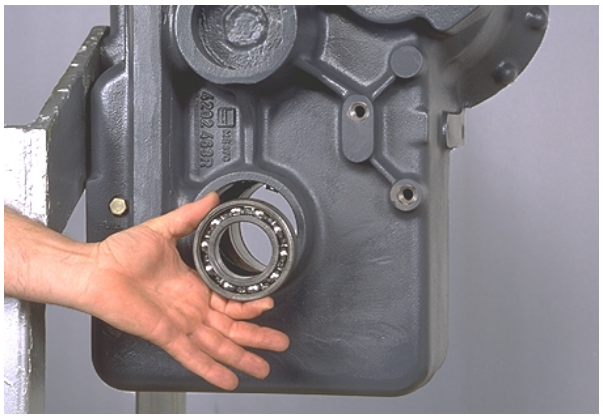


Figure 44
Remove output shaft rear bearing.

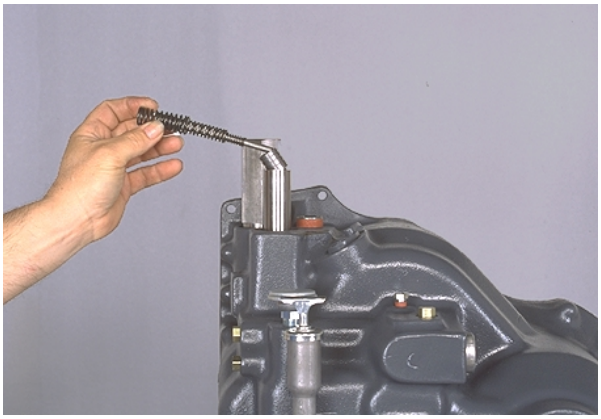


Figure 47
Remove inner, middle and outer springs.
Remove valve stop pin and accumulator spool.
Remove regulator spool and sleeve assembly.

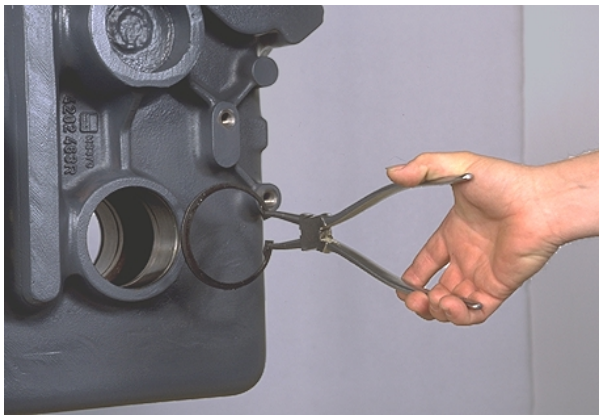


Figure 45
Remove bearing locating ring.

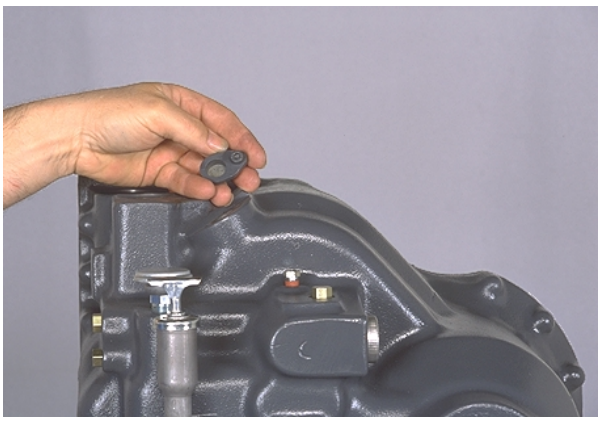


Figure 48
Remove sensor hole plug and “O”-ring.

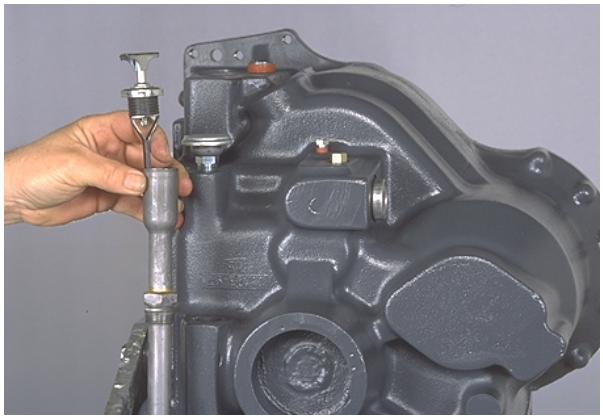


Figure 49
Remove dipstick and dipstick tube.

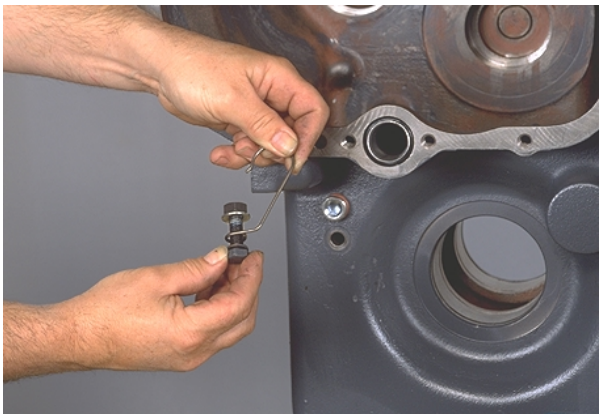


Figure 52
Tube retainer, screw, sealwasher, clip, washer and nut removed as shown.

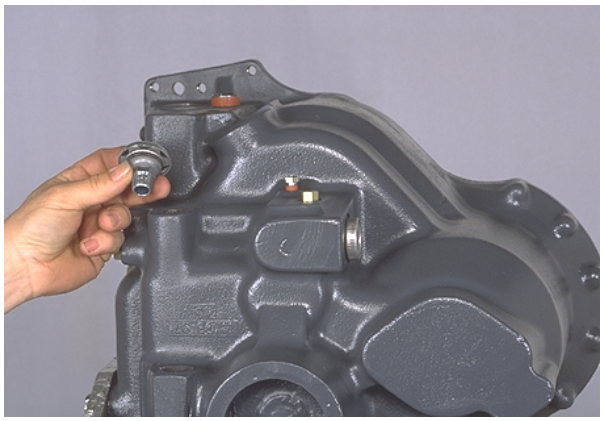


Figure 50
Remove air breather.

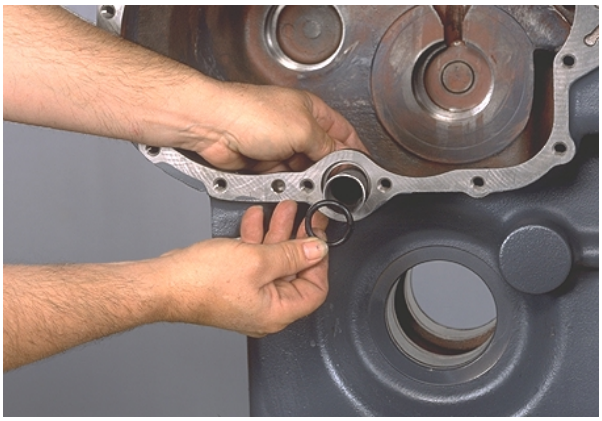


Figure 53
Remove supply tube “O”-ring.

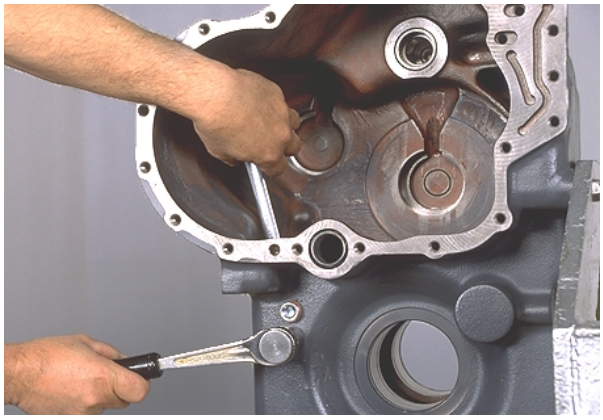


Figure 51
Remove supply tube retainer screw.

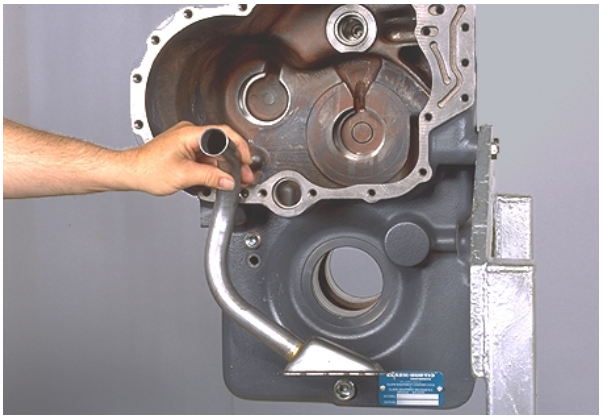


Figure 54
Remove supply tube and screen assembly.

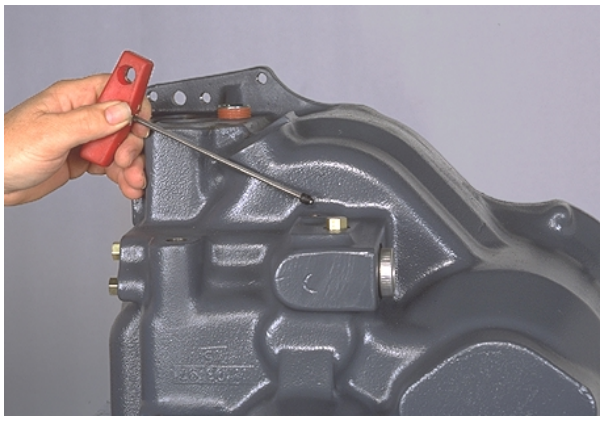


Figure 55

Remove oil sleeve distributor lock screw plug. Remove lock screw.

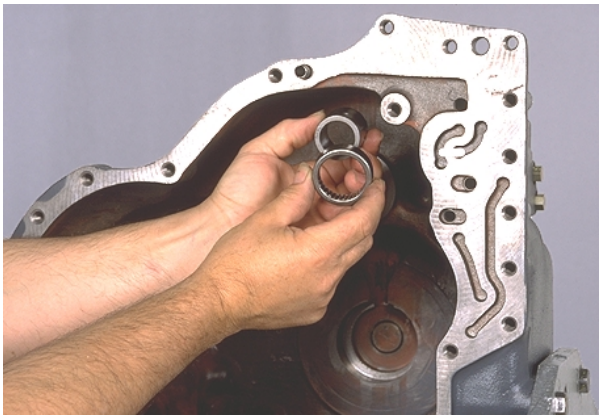


Figure 58

Pilot bearing and oil distributor sleeve removed.

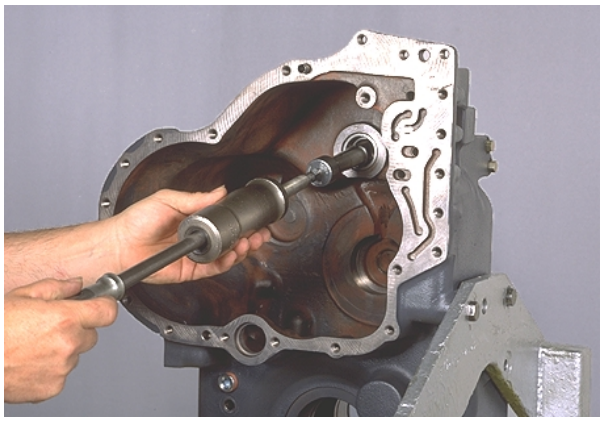


Figure 56

Use a hammer puller as shown to remove distributor sleeve.

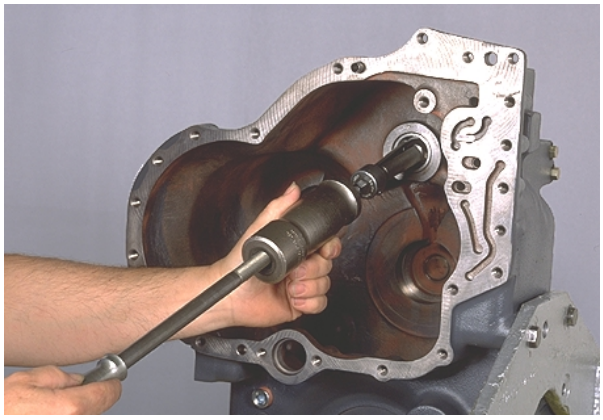


Figure 57

Sleeve being removed. Remove pilot bearing.

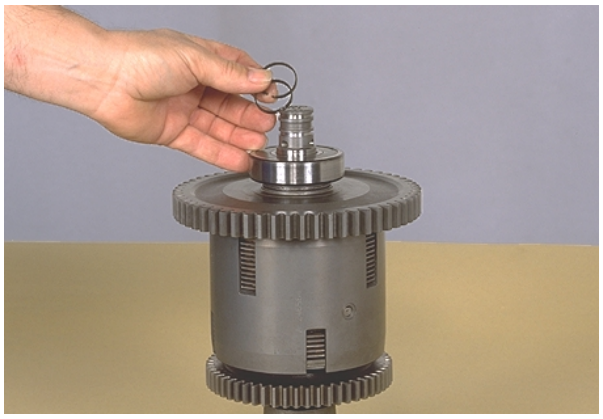


Figure 59
Remove clutch shaft oil sealing rings.

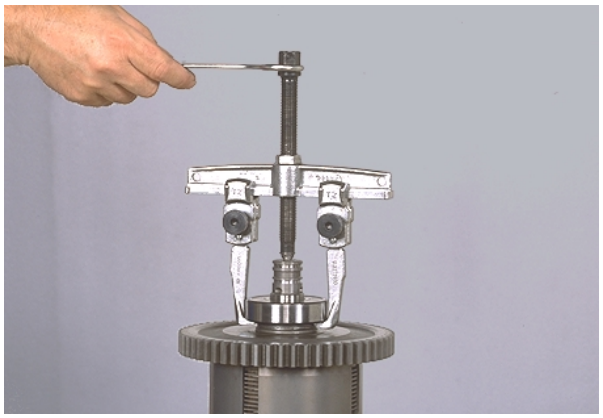


Figure 60
Remove front bearing.

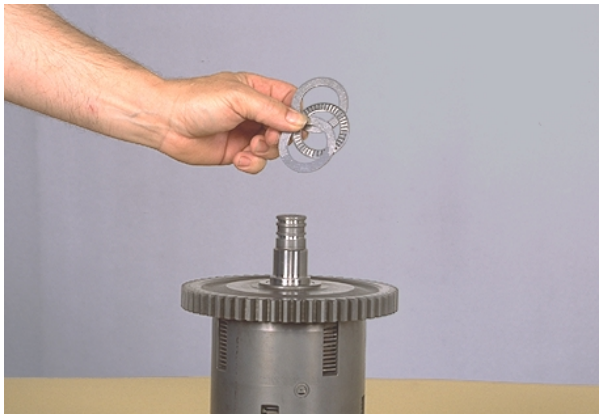


Figure 61
Remove outer thrust washer, bearing and inner thrust washer.

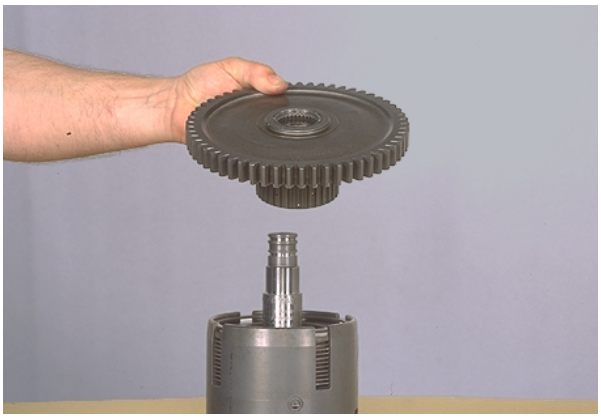


Figure 62
Remove clutch gear and disc hub.

Figure 63
Clutch gear and pilot bearings removed.

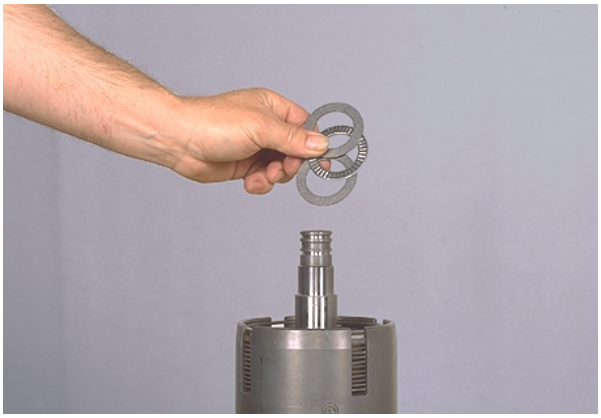


Figure 64
Remove outer thrust washer, thrust bearing and inner thrust washer.

Figure 65
Remove clutch disc end plate retainer ring.

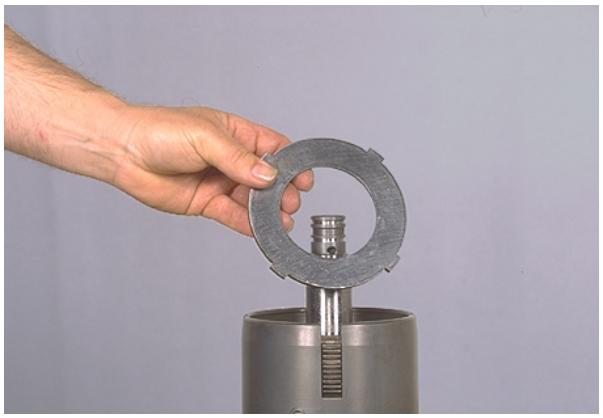


Figure 66
Remove clutch disc end plate.

Figure 67
Remove inner and outer clutch discs.

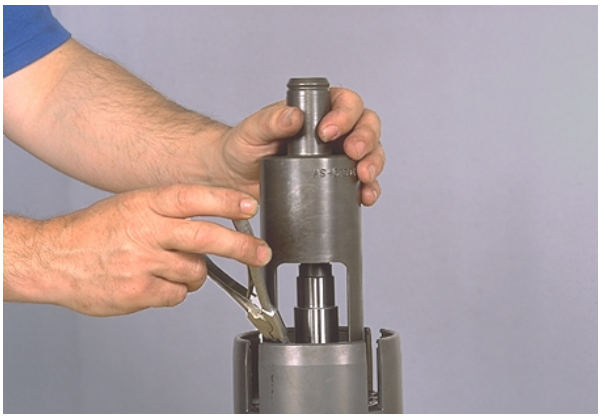


Figure 68
Compress disc springs and remove retainer ring.

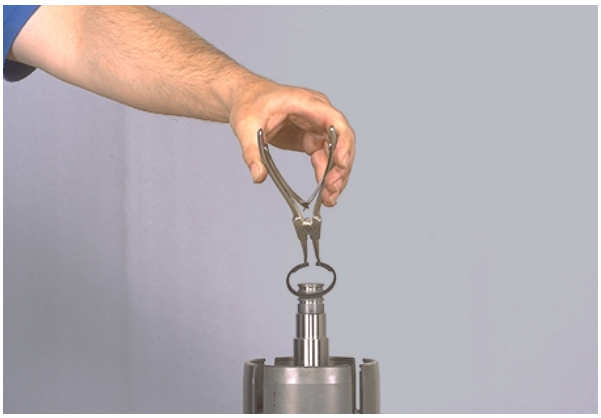


Figure 69
Remove retainer ring.

Figure 70
Remove retainer ring retainer.

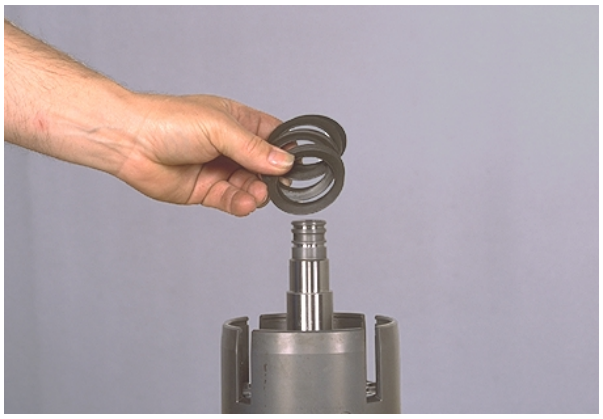


Figure 71

Remove disc spring.
NOTE: See page 10-85.

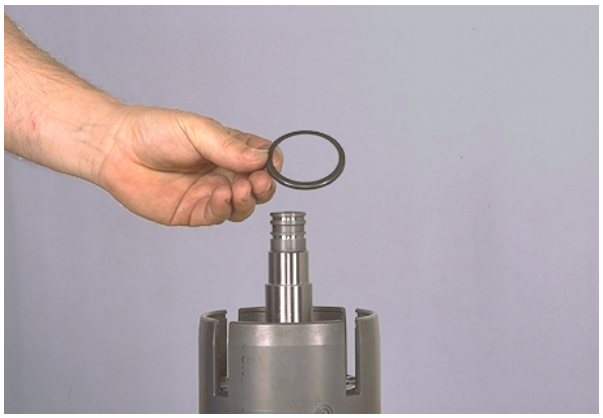


Figure 72

Remove clutch piston wear plate.

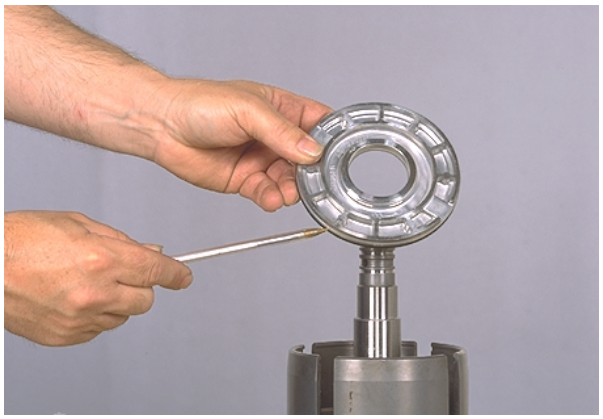


Figure 73

Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

Figure 74
Remove clutch shaft rear bearing outer race.

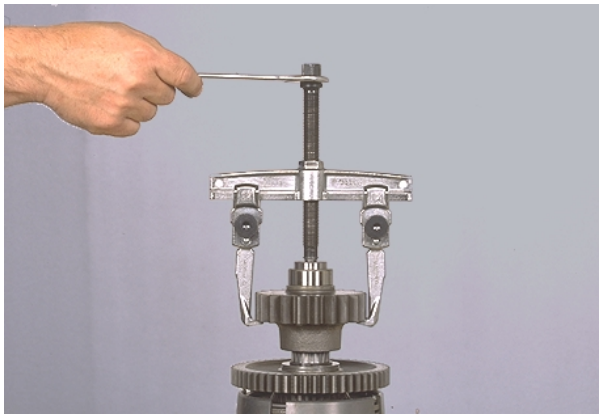


Figure 75
Using a gear puller as shown, remove gear and rear bearing inner race.

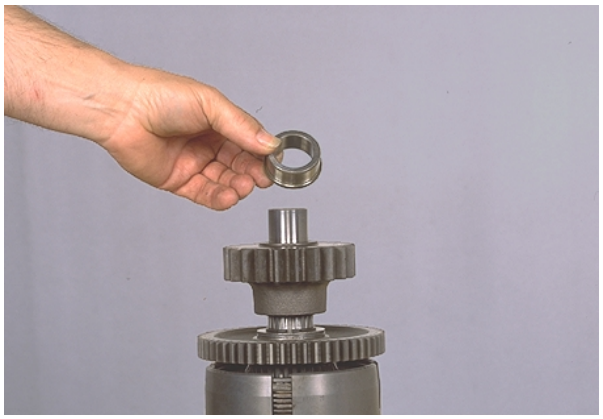


Figure 76
Remove inner race from shaft.

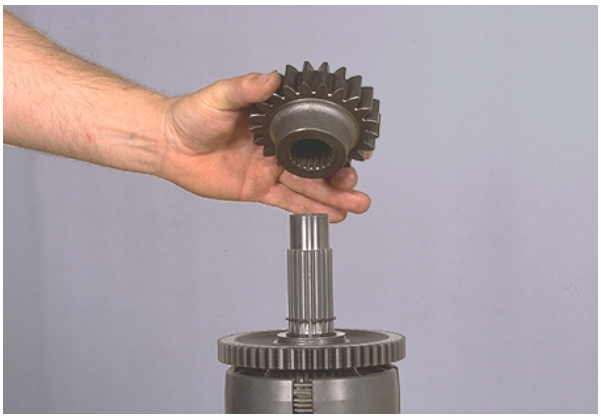


Figure 77
Remove gear from shaft.

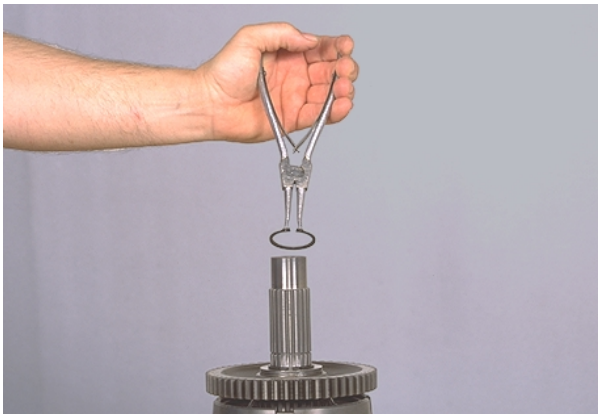


Figure 78
Remove gear locating ring from shaft.

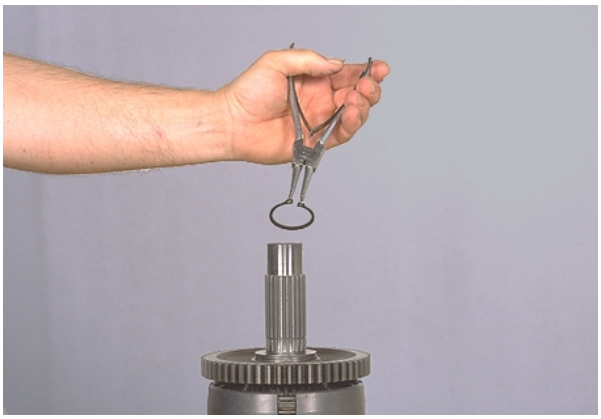


Figure 79
Remove thrust bearing and clutch gear retainer ring.

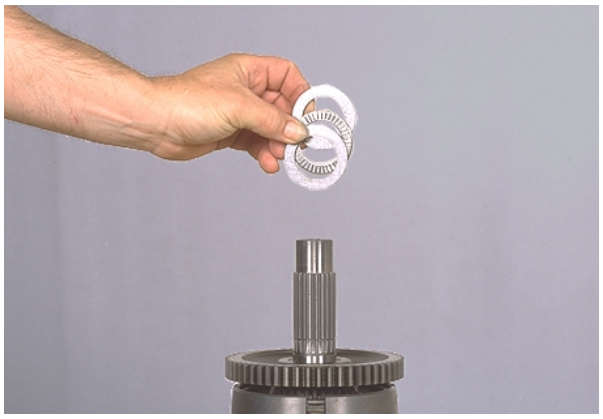


Figure 80

Remove outer thrust washer, thrust bearing and inner thrust washer.

Figure 81

Remove clutch gear and hub and gear bearings.

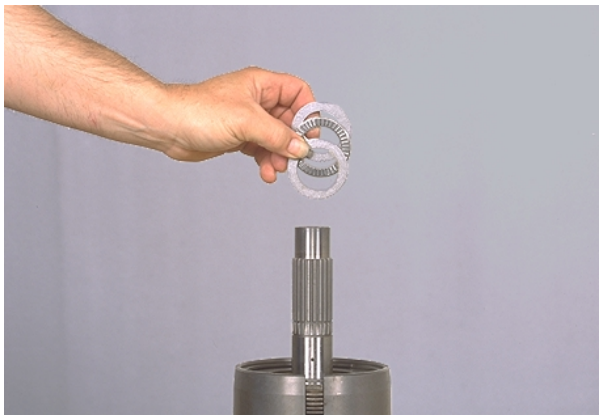


Figure 82

Remove outer thrust washer, thrust bearing and inner thrust washer.

Figure 83

Remove clutch disc and end plate retainer ring.

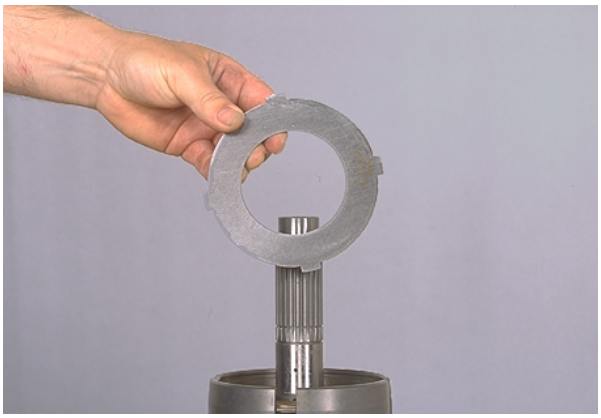


Figure 84

Remove end plate.

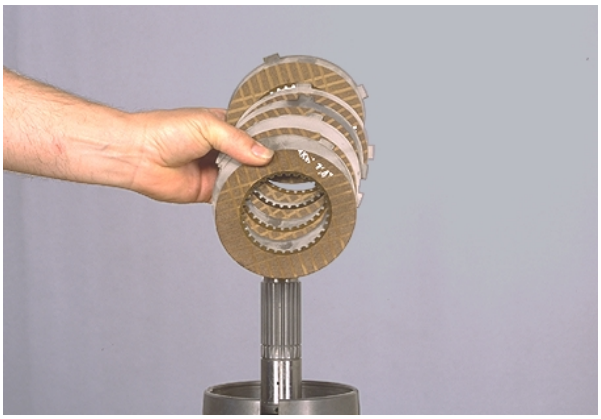


Figure 85

Remove inner and outer clutch discs.

Figure 86
Compress disc springs and remove retainer ring.

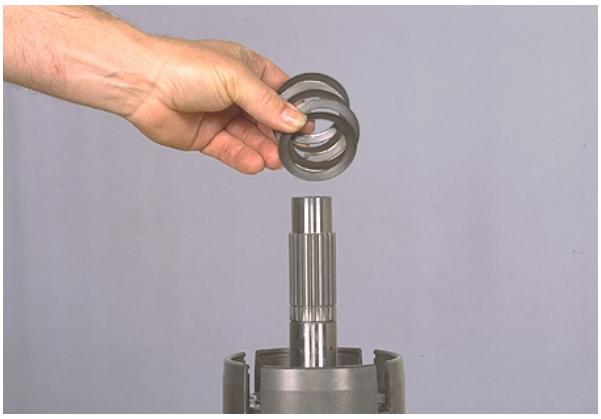


Figure 89
Remove disc springs.
NOTE: see page 10-85.

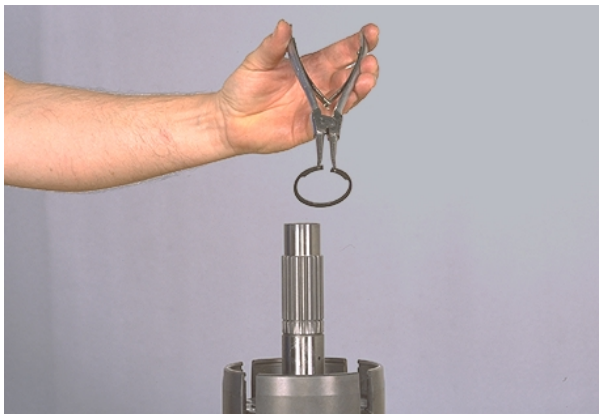


Figure 87
Remove retainer ring.

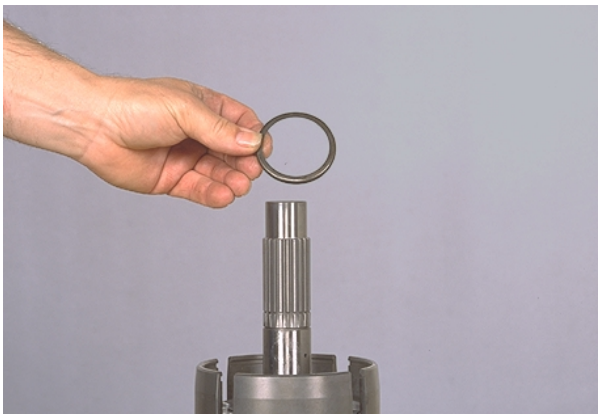


Figure 90
Remove clutch piston wear plate.

Figure 88
Remove retainer ring retainer.

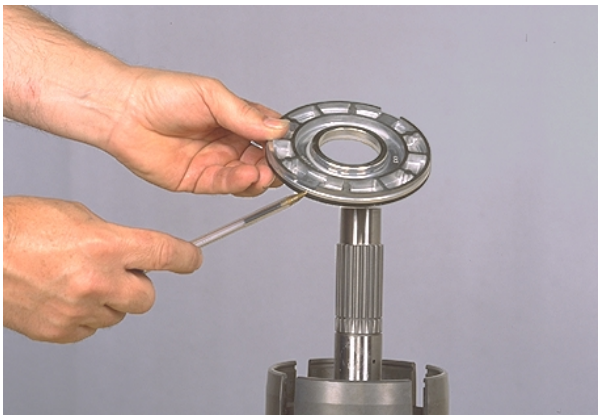


Figure 91
Remove clutch piston.

Figure 92

The two bleed valves in the clutch drum must be clean and free of any foreign material.
Refer to the “Cleaning and inspection” pages.
Install clutch piston outer seal ring.

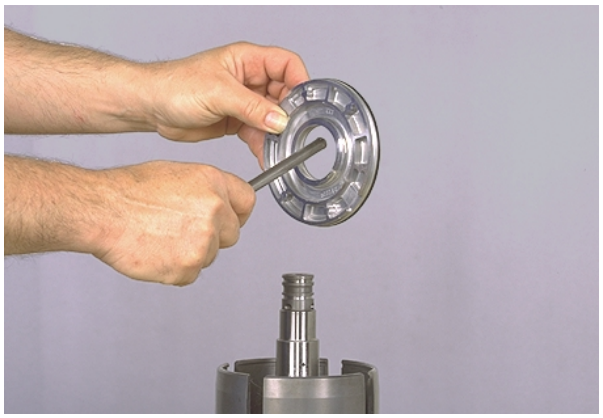


Figure 93

Install clutch piston inner seal ring.
NOTE: Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating piston while holding a round object against the new seal ring as shown. Rotate piston until seal ring is flush with outer diameter of piston.

Figure 94

Position piston in low clutch drum as shown. Use caution as not to damage inner and outer piston sealing rings.

Figure 95

Position clutch piston wear plate on piston.

Figure 96

Install piston return disc springs. First spring with large diameter of bevel toward wear plate.
Alternate seven (7) springs. **NOTE:** see page 10-85.

Figure 97

Position return spring retainer on clutch shaft.

Figure 98

Start ring on shaft with snap ring pliers.

Figure 99

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.

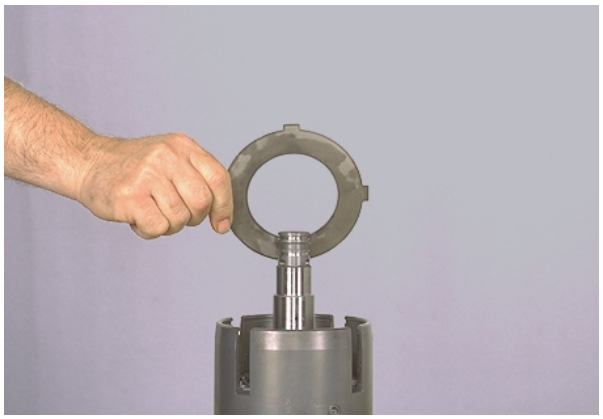


Figure 100

Install first steel outer clutch disc.

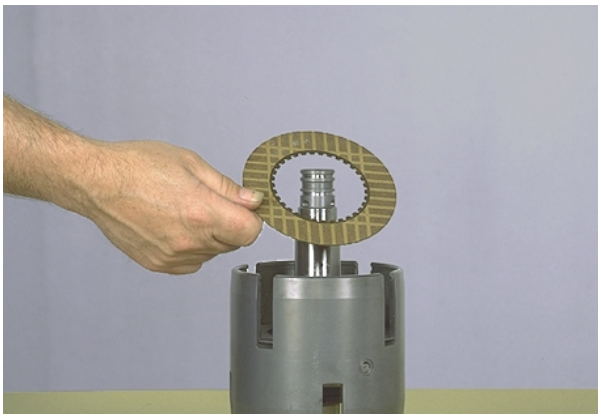


Figure 101

Install first friction (inner) clutch disc.
Alternate steel and friction until ten (10) steel and ten (10) friction discs are in position.

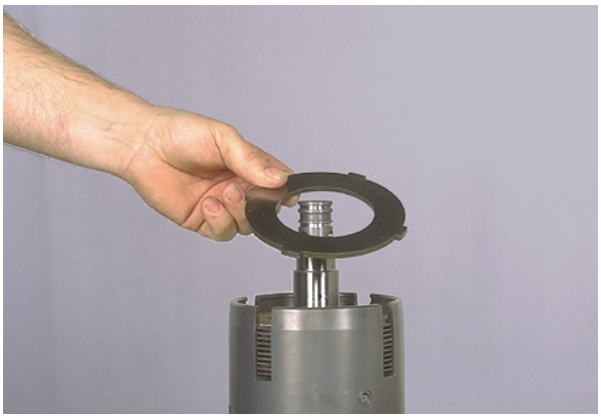


Figure 102

Install clutch disc end plate.

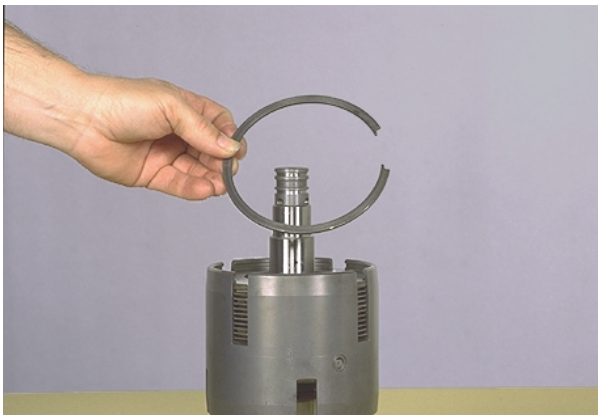


Figure 103

Install end plate retainer ring.

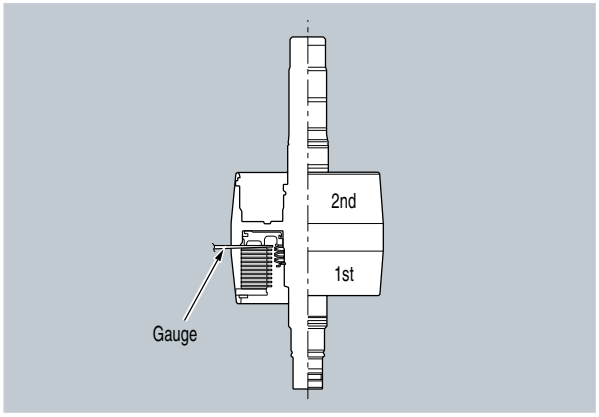


Figure 104

NOTE: Low (1st) clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .080-.135 [2.03-3.43]. If the clearance is greater than .135 [3.43], add one steel disc under the end plate.

Figure 105

Position thrust bearing inner washer on clutch shaft.

Figure 106

Position thrust bearing on clutch shaft against inner thrust bearing washer.

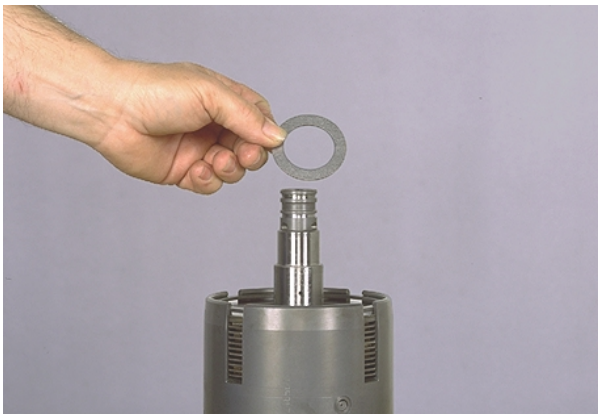


Figure 107

Install outer thrust bearing washer against bearing.

Figure 108

Press bearings in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides.

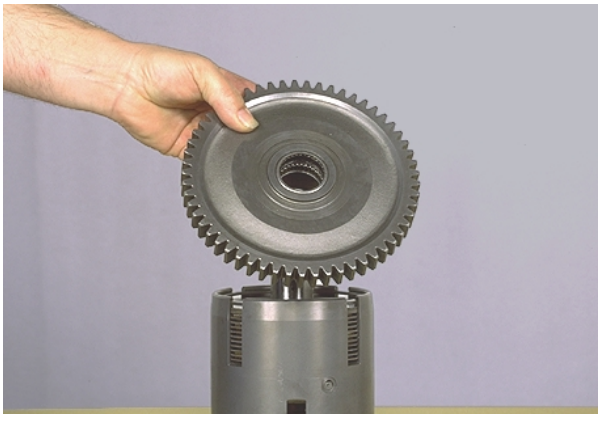


Figure 109

Install clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs.
Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

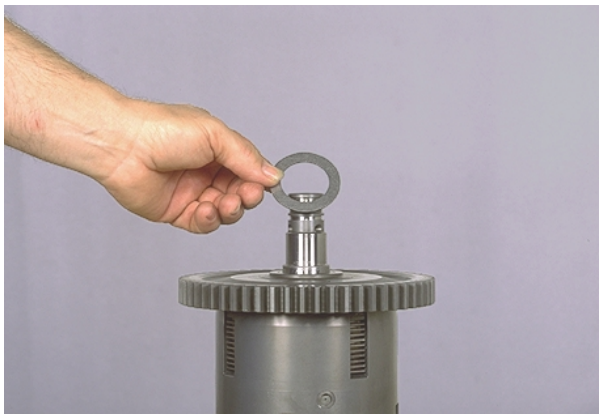


Figure 110
Position inner thrust washer on shaft.

Figure 113
Install clutch shaft front bearing.
NOTE: bearing has a shield in it.
This shield must be up.

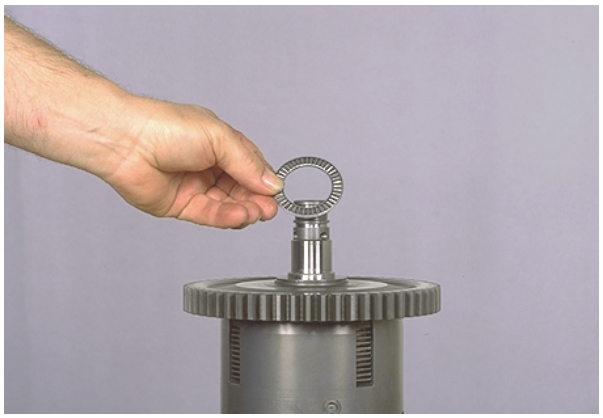


Figure 111
Position thrust bearing on shaft.

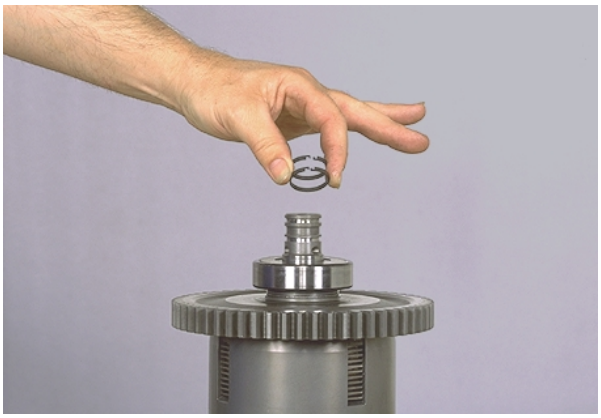


Figure 114
Install clutch shaft oil sealing rings.
Grease rings to facilitate reassembly into front housing.

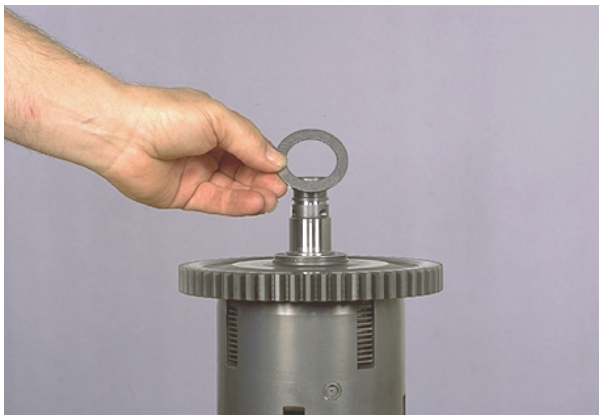


Figure 112
Position outer thrust washer on shaft.

Figure 115

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Refer to the cleaning and inspection pages.

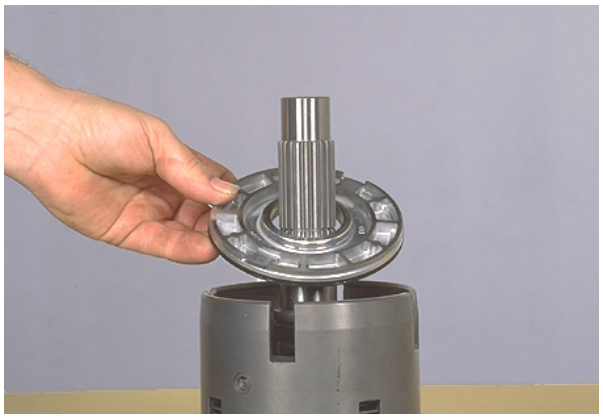


Figure 116

Position piston in clutch drum, using caution as not to damage piston sealing rings.

Figure 117

Install clutch piston wear plate.

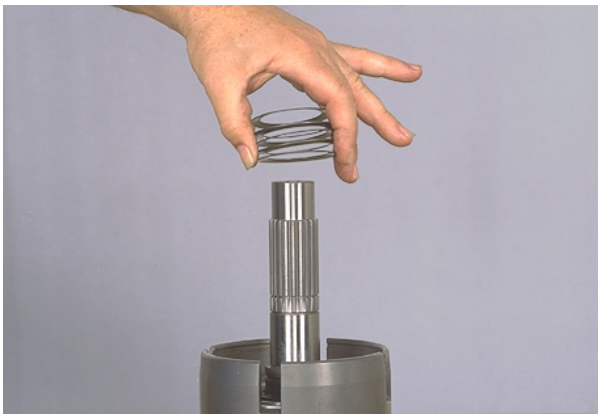


Figure 118

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate (5) springs. **NOTE:** see page 10-85.

Figure 119

Position return spring ring retainer on clutch shaft.

Figure 120

Start ring on shaft with snap ring pliers.

Figure 121

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a shaft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.

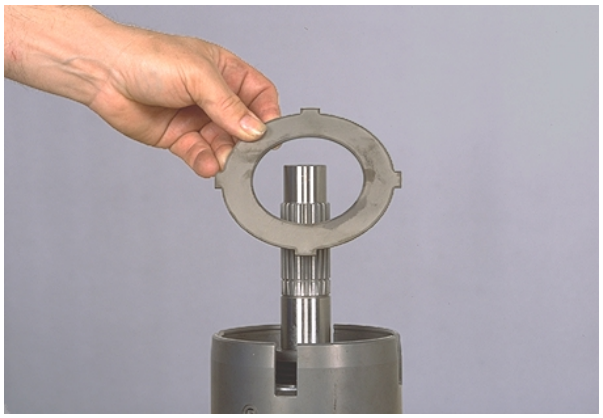


Figure 122

Install first steel (outer) clutch disc.

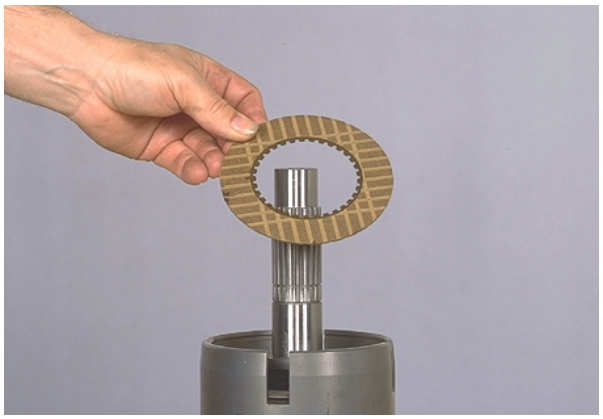


Figure 123

Install first friction (inner) clutch disc. Alternate steel and friction until five (5) steel and five (5) friction discs are in position.

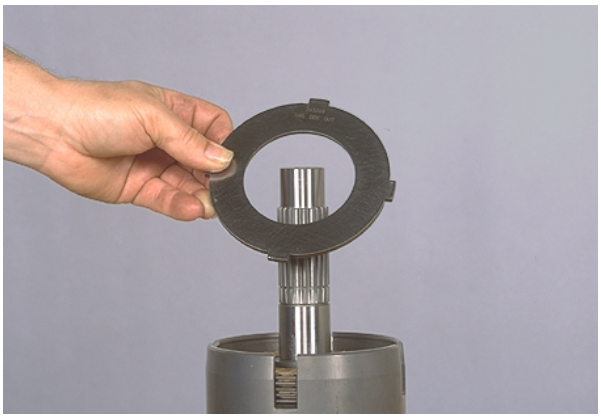


Figure 124

Install clutch disc end plate.

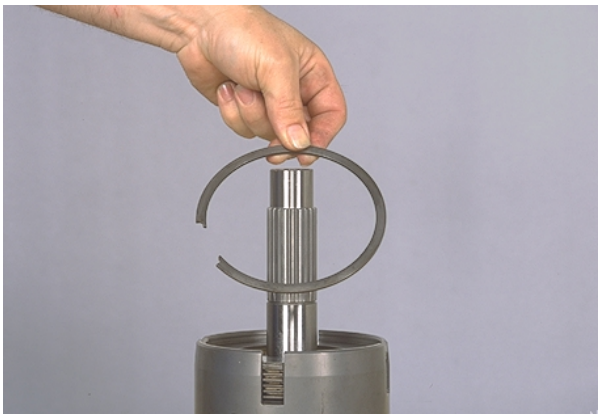


Figure 125

Install end plate retainer ring.

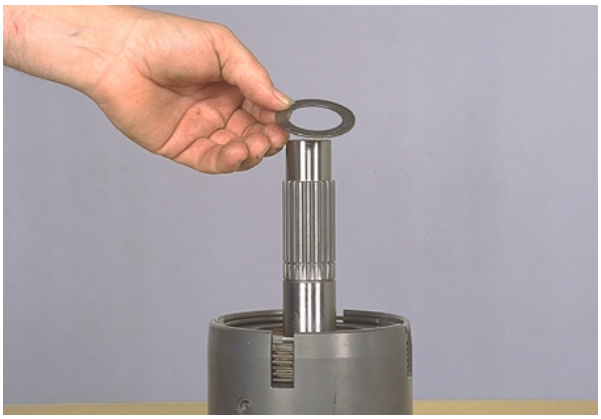


Figure 126

Position thrust bearing inner washer on clutch shaft.

Figure 127

Position thrust bearing on clutch shaft against inner thrust bearing washer.

Figure 130

Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

Figure 128

Install outer thrust bearing washer against thrust bearing.

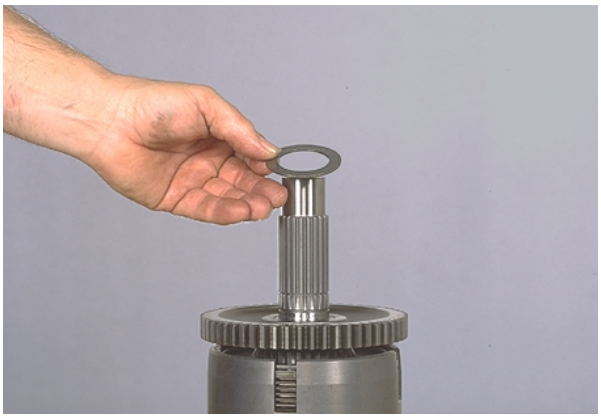


Figure 131

Position thrust bearing inner washer on clutch shaft.

Figure 129

Press needle bearings in clutch gear and disc hub, being certain bearings are pressed with face of gear on both sides.

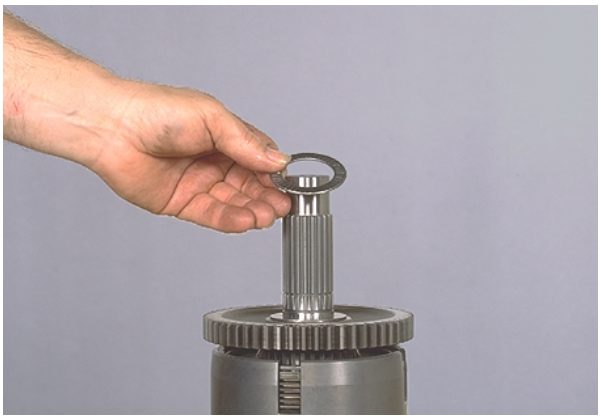


Figure 132

Position thrust bearing on clutch shaft against inner thrust bearing washer.

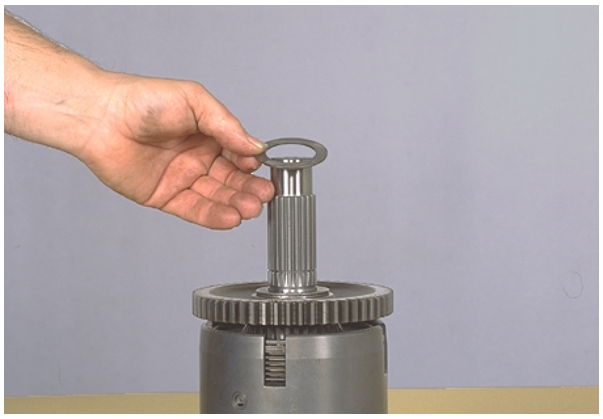


Figure 133
Install outer thrust bearing washer against bearing.

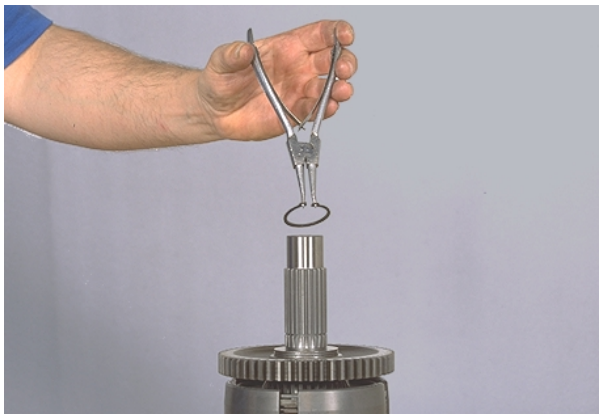


Figure 134
Install thrust washer retainer ring.

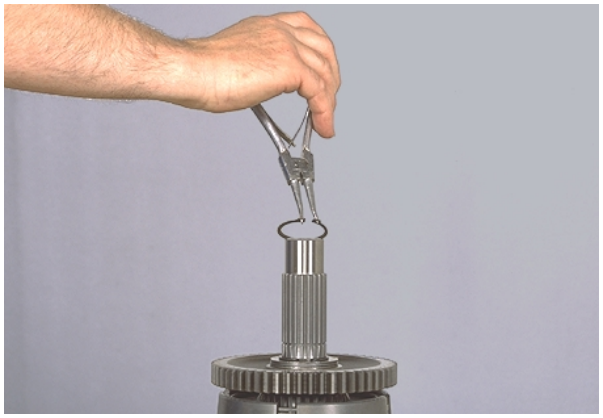


Figure 135
Install clutch shaft gear locating ring.

Figure 136
Install clutch shaft gear on clutch shaft with long hub of gear down.

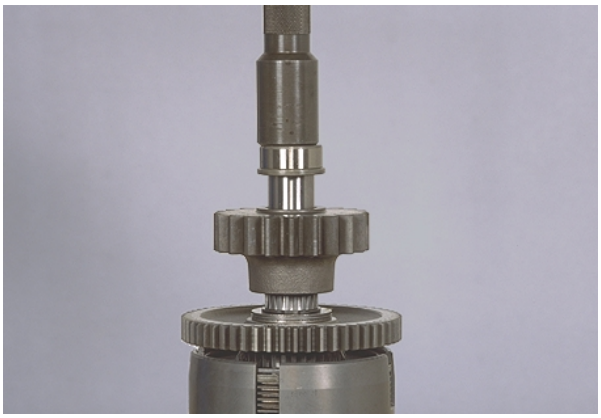


Figure 137
Install rear bearing inner race on clutch shaft with bearing race shoulder down.

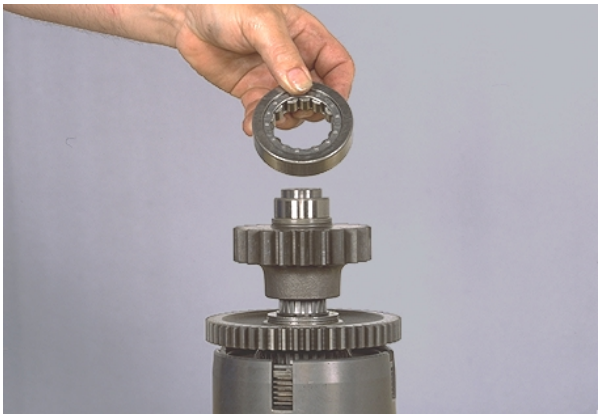


Figure 138
Position rear bearing on bearing race.

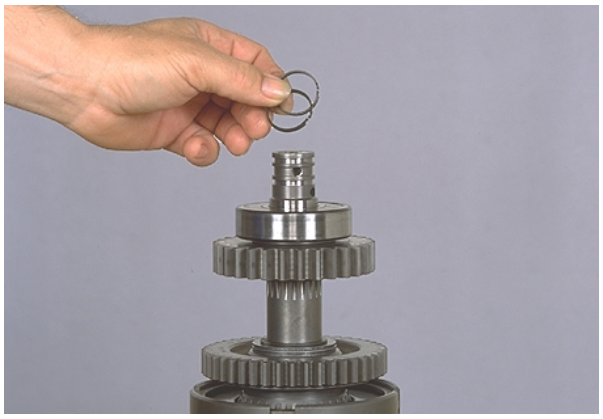


Figure 139

Remove clutch shaft oil sealing rings.
NOTE: The 4th clutch is only used on the 4 and 6 speed models.

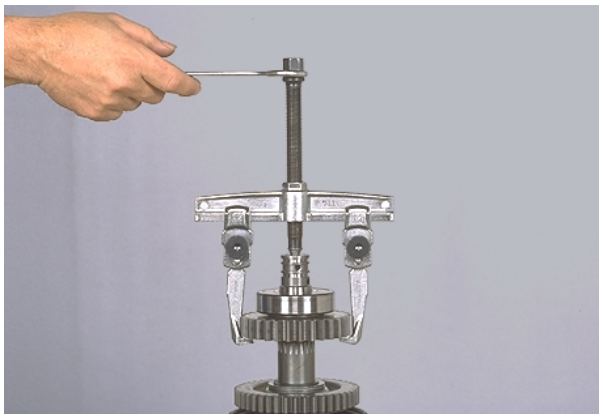


Figure 140

Using a gear puller as shown, remove first drive gear and front bearing.

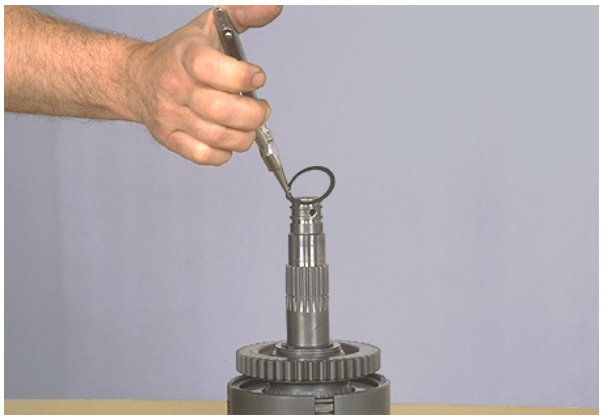


Figure 141

Remove first drive gear locating ring.
For 3-speed models, proceed to figure 155.

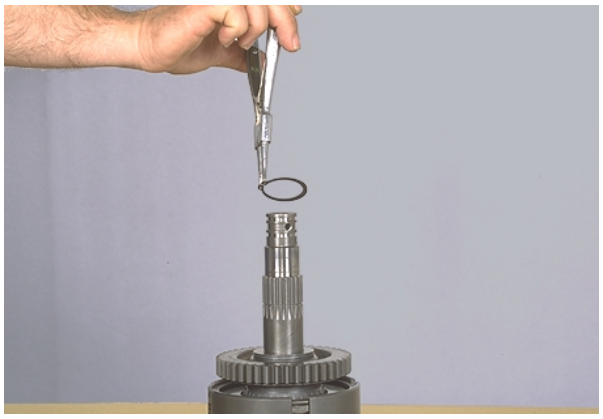


Figure 142
Remove outer thrust washer retainer ring.

Figure 145
Remove bearings and spacer from clutch gear.

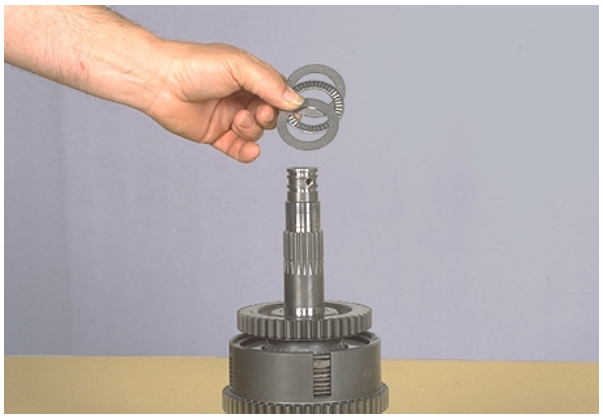


Figure 143
Remove outer washer, thrust bearing and inner thrust washer.

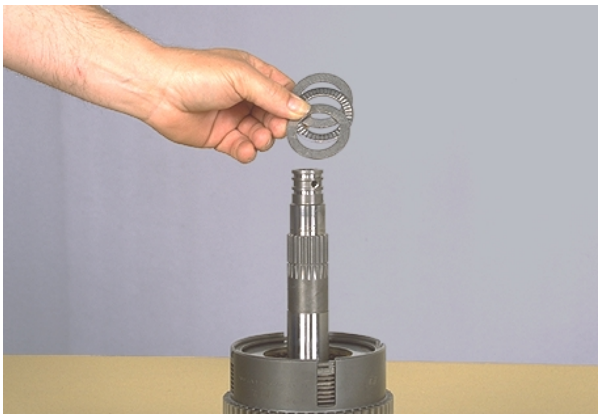


Figure 146
Remove outer thrust washer, thrust bearing and inner thrust washer.

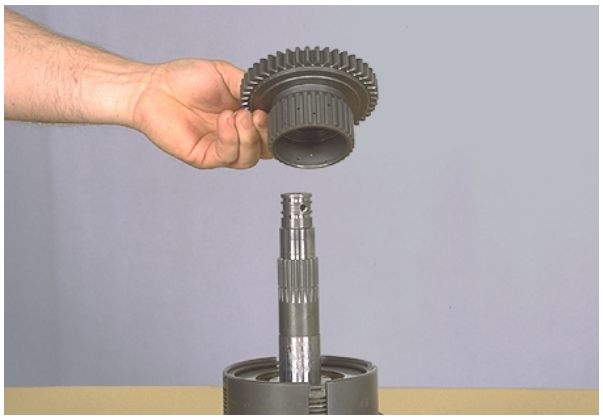


Figure 144
Remove clutch gear and disc hub.

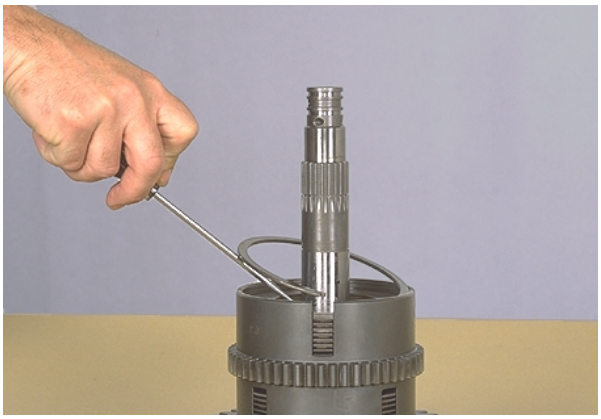


Figure 147
Remove end plate retainer ring.

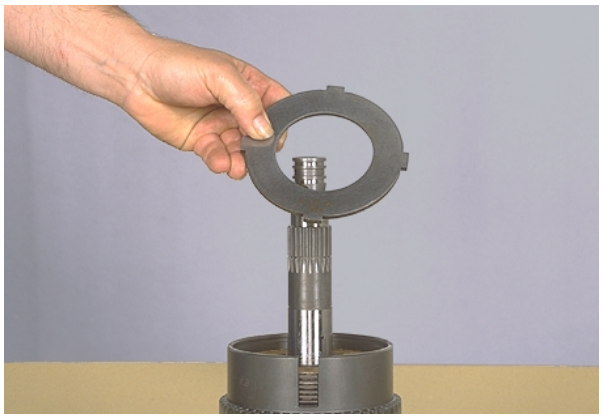


Figure 148
Remove end plate.

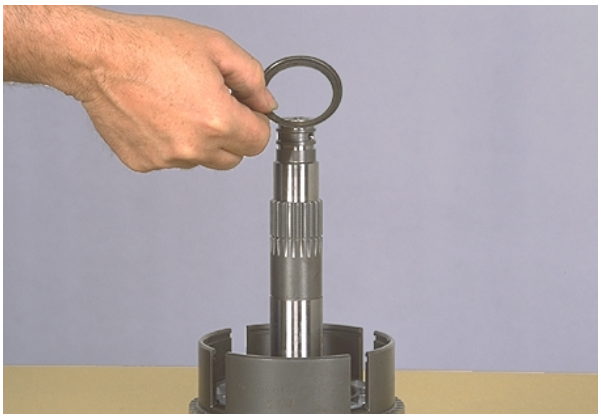


Figure 151
Remove retainer ring retainer.

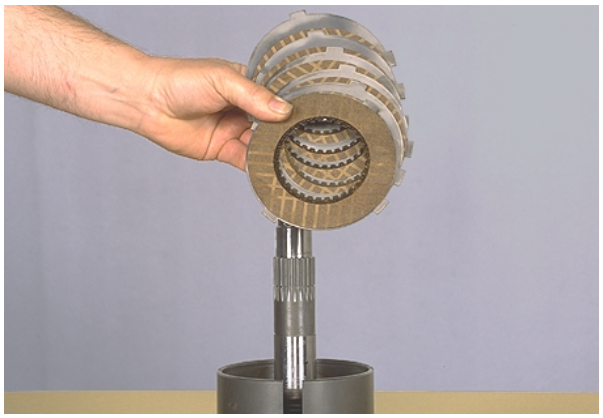


Figure 149
Remove clutch discs.

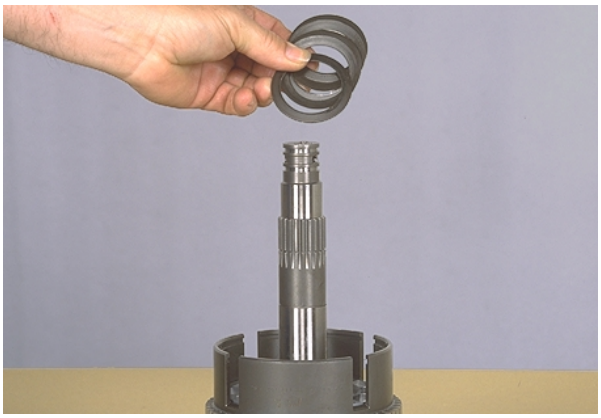


Figure 152
Remove disc springs.
NOTE: see page 10-85.

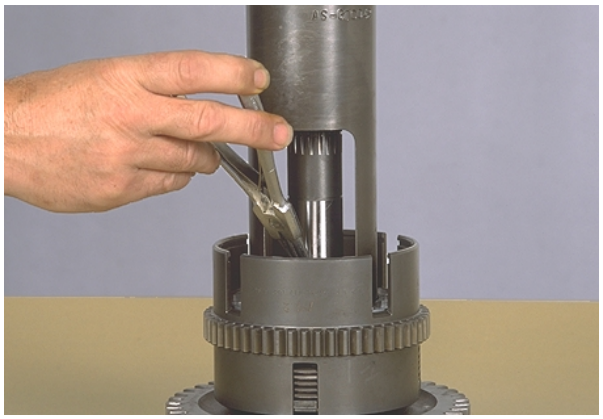


Figure 150
Compress disc springs and remove retainer ring.

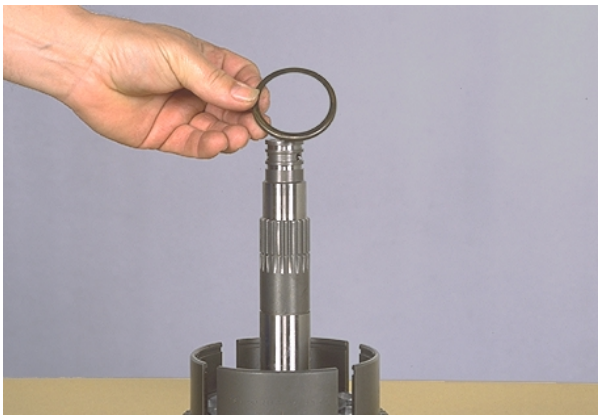


Figure 153
Remove clutch piston wear plate.

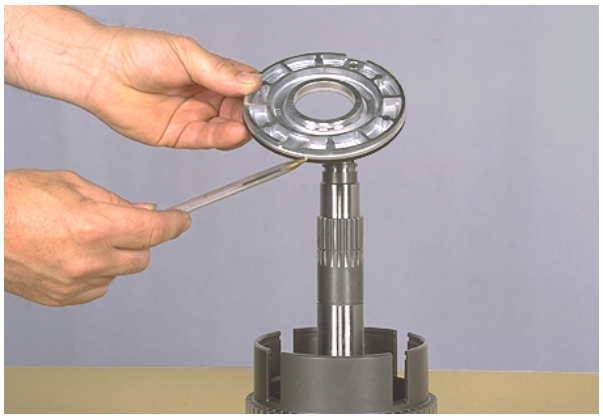


Figure 154
Remove clutch piston.

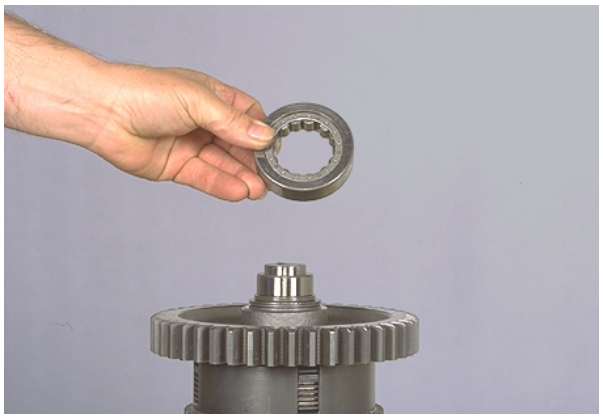


Figure 155
Remove clutch shaft rear bearing outer race.

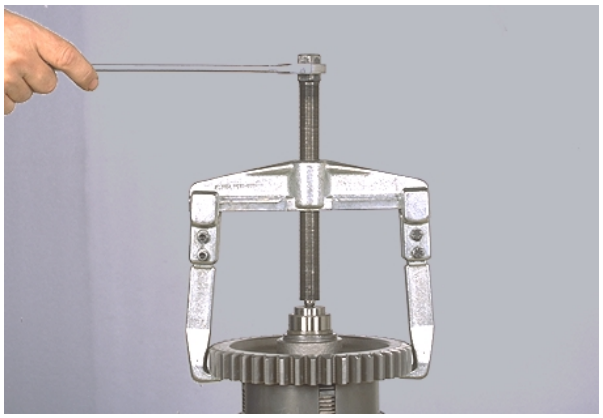


Figure 156
Use gear puller to remove clutch gear and bearing inner race.

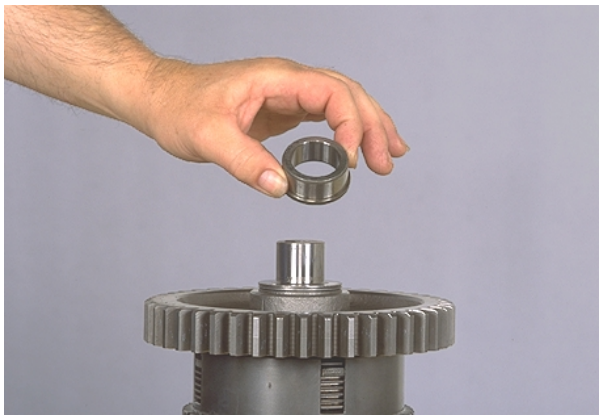


Figure 157
Remove clutch shaft rear bearing inner race.

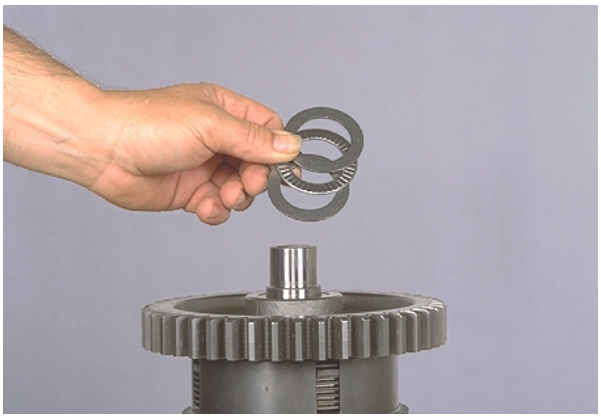


Figure 158
Remove outer thrust washer, thrust bearing and inner thrust washer.

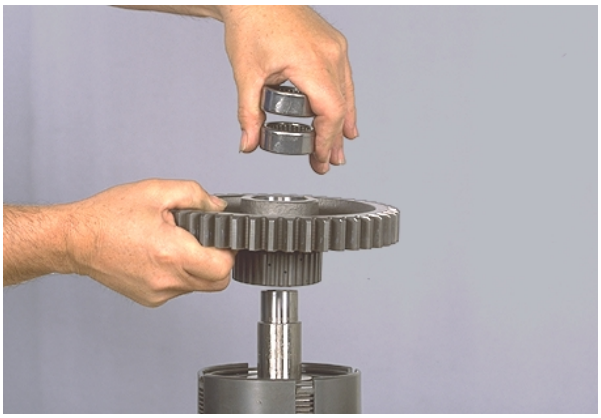


Figure 159
Remove clutch gear and hub and gear bearings.

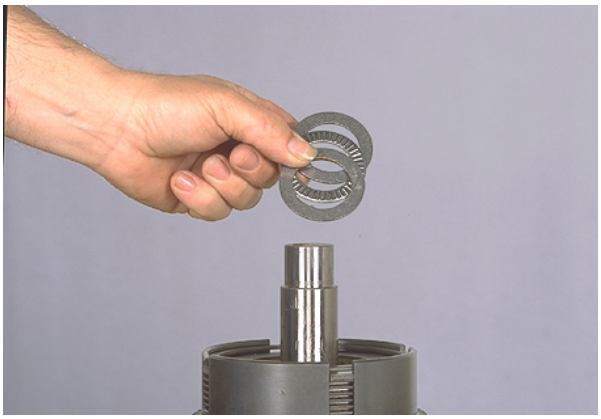


Figure 160
Remove outer thrust washer, thrust bearing and inner thrust washer.

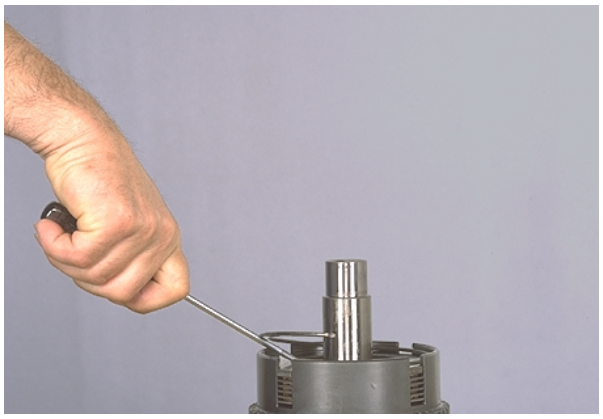


Figure 161
Remove end plate retainer ring.

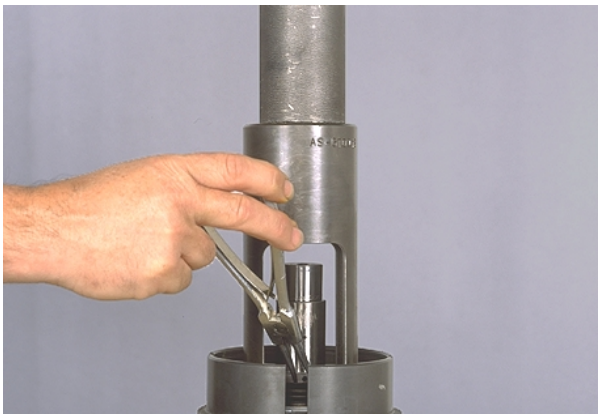


Figure 164
Compress disc springs and remove retainer ring.

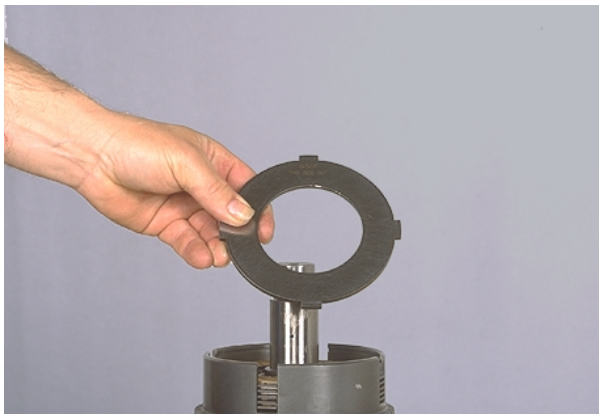


Figure 162
Remove end plate.

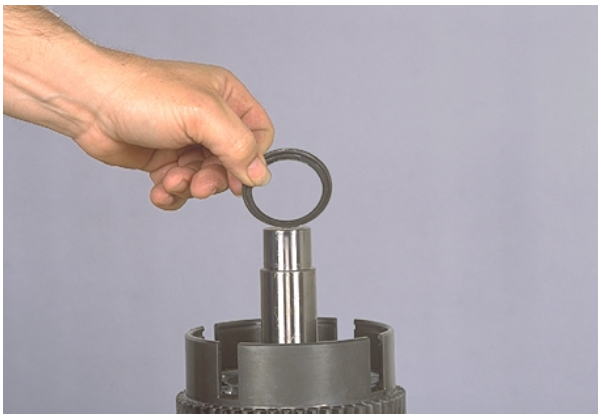


Figure 165
Remove retainer ring retainer.

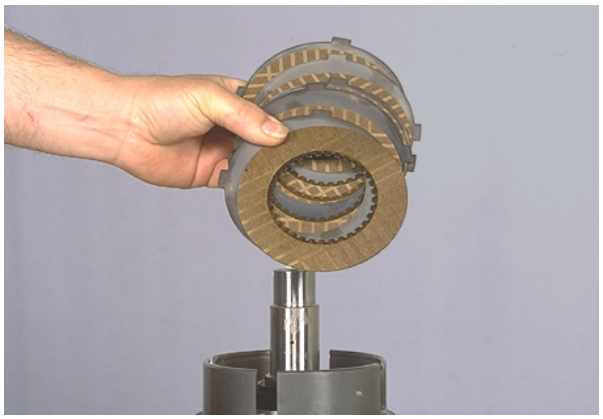


Figure 163
Remove clutch discs.

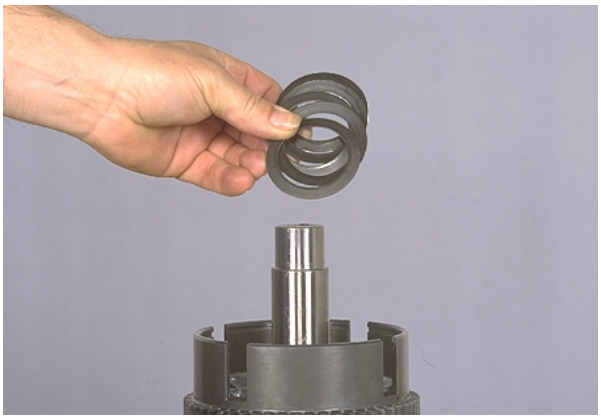


Figure 166
Remove disc springs.
NOTE: See page 10-85.

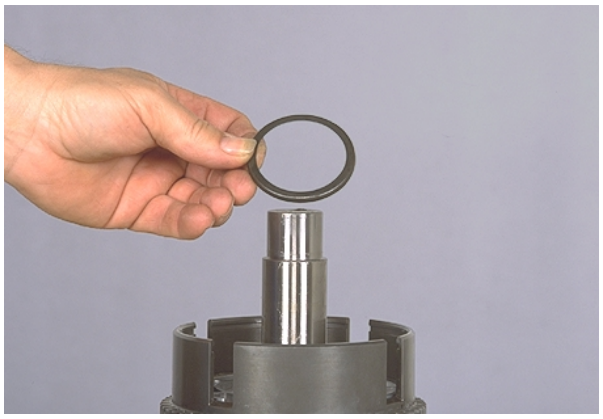


Figure 167
Remove clutch piston wear plate.

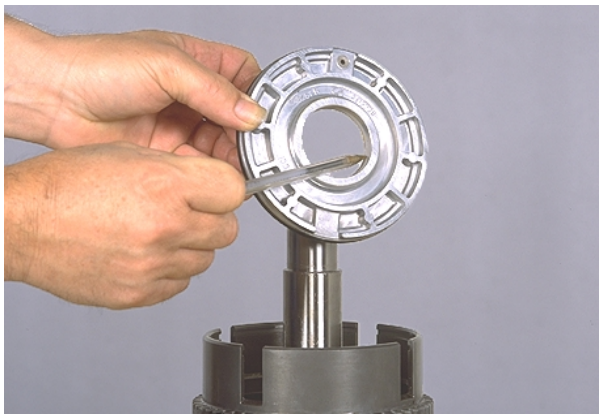


Figure 168
Remove clutch piston.

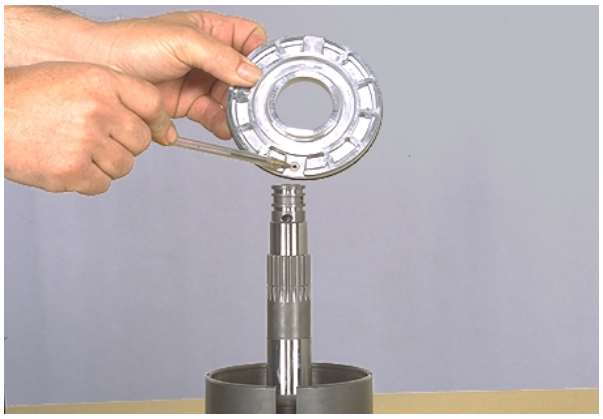


Figure 169

Clutch piston bleed ball must be clean and free of any foreign material. Refer to the cleaning and inspection page. For the 3-speed version, proceed to figure 189

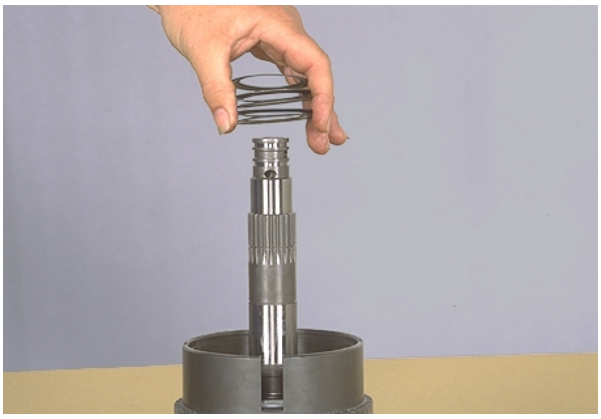


Figure 172

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.

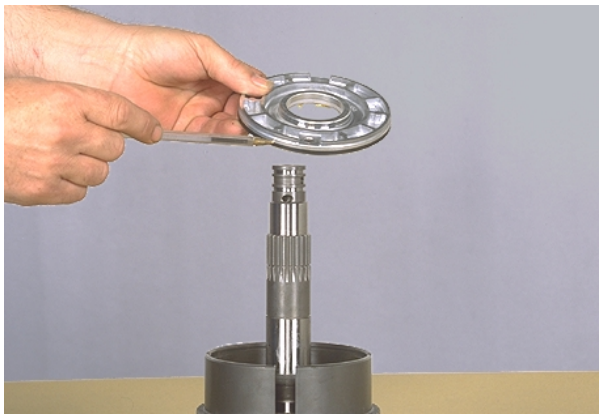


Figure 170

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

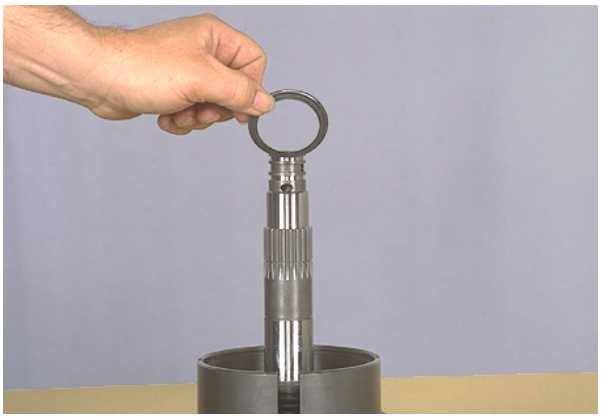


Figure 173

Position return spring ring retainer on clutch shaft.

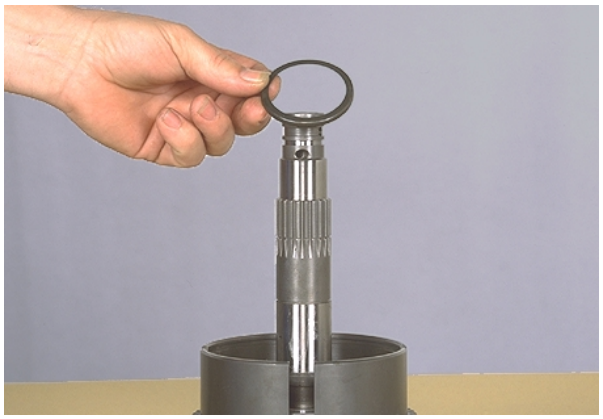


Figure 171

Install clutch piston wear plate.

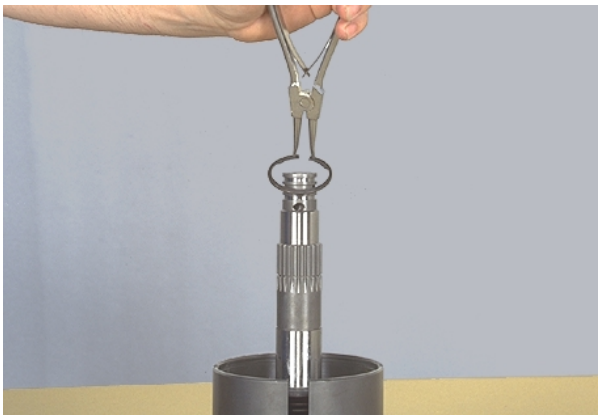


Figure 174

Start ring on shaft with snap ring pliers.

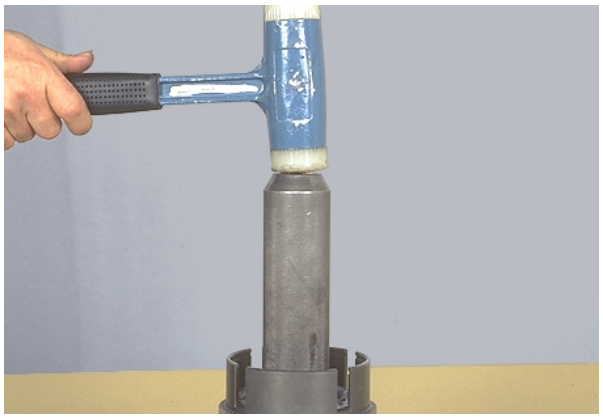


Figure 175

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring; be sure ring is in full position in groove.

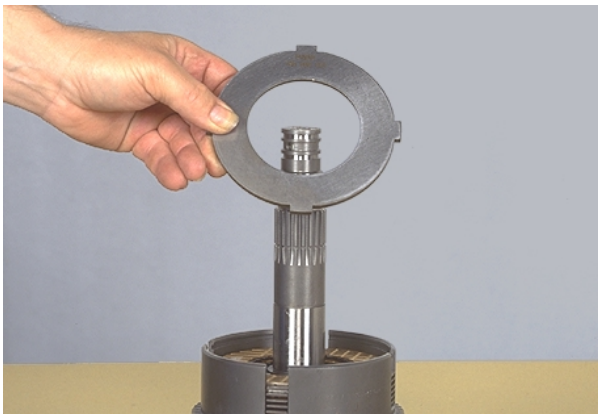


Figure 178

Install clutch disc end plate.

Figure 176

Install first steel (outer) clutch disc.

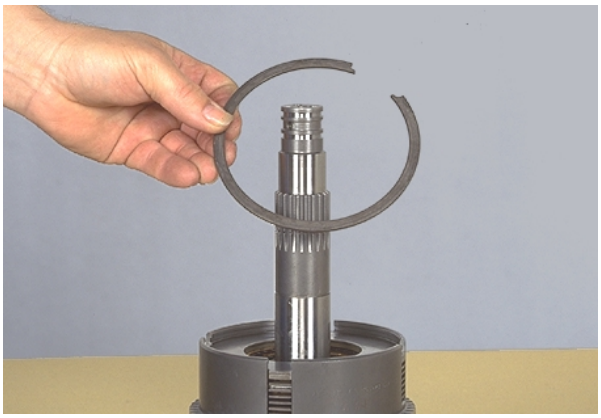


Figure 179

Install end plate retainer ring.

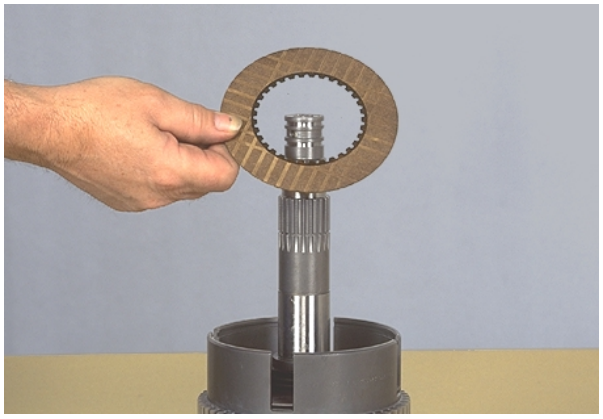


Figure 177

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

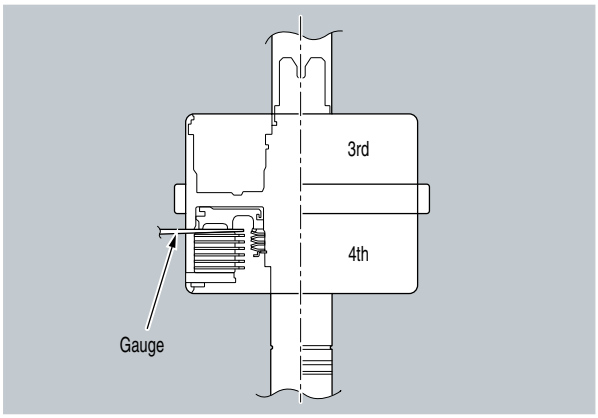


Figure 180

NOTE: 4th (high) clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .048-.108 [1,22-2,74]. If the clearance is greater than .108 [2,74), add one steel disc under the end plate.

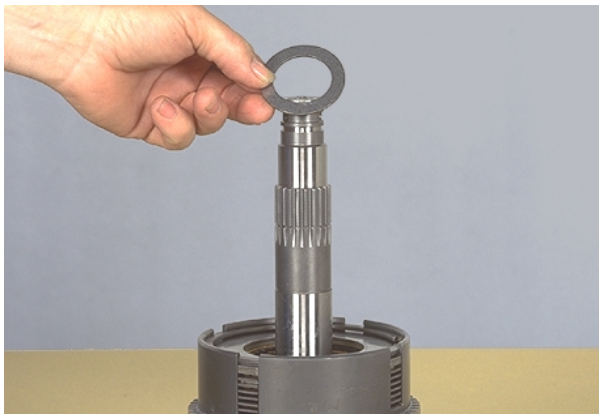


Figure 181

Position thrust bearing inner washer on clutch shaft.

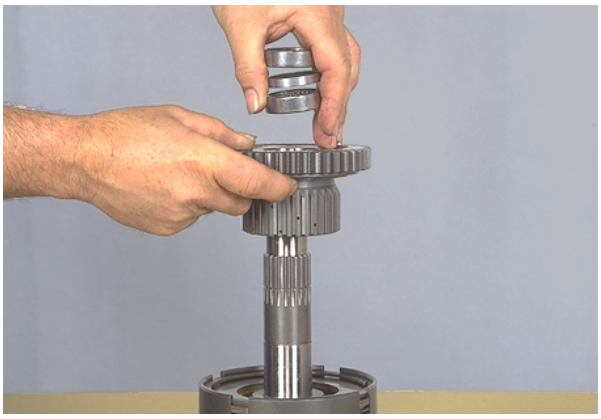


Figure 184

Press one bearing in clutch gear. Install bearing spacer next to bearing. Press second bearing in gear, being certain bearings are pressed flush with face of gears on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

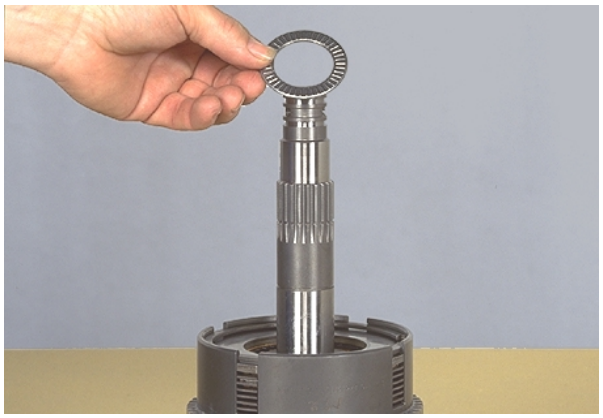


Figure 182

Position thrust bearing on clutch shaft against inner thrust bearing washer.

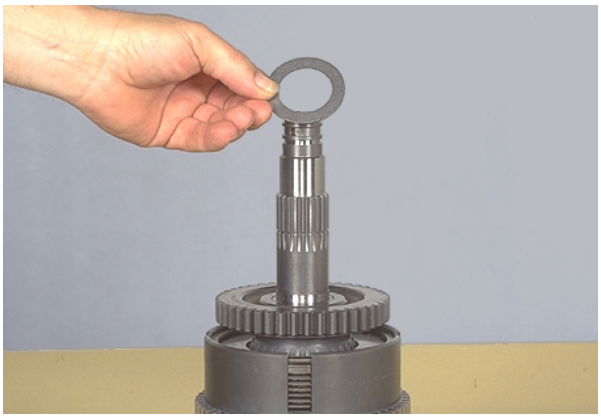


Figure 185

Position thrust washer on shaft.

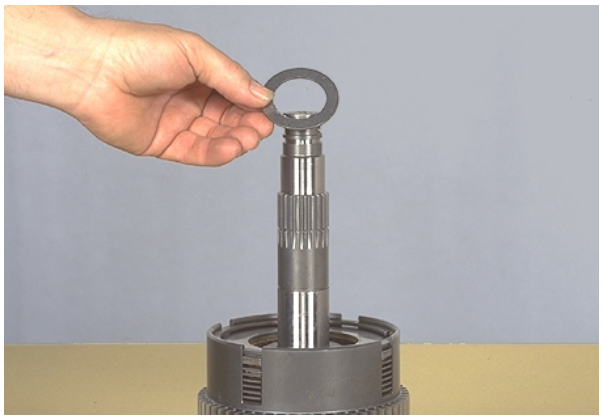


Figure 183

Install outer thrust bearing washer against bearing.

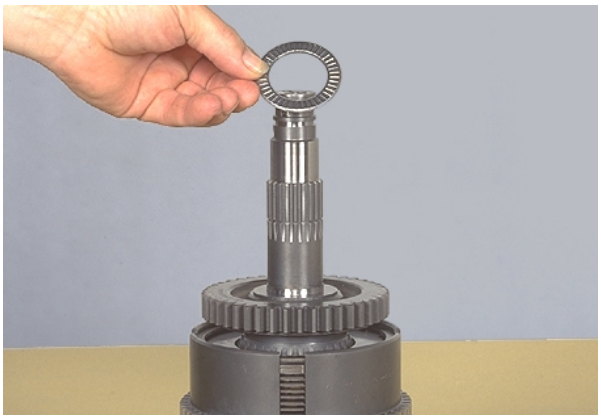


Figure 186

Position thrust bearing on shaft.

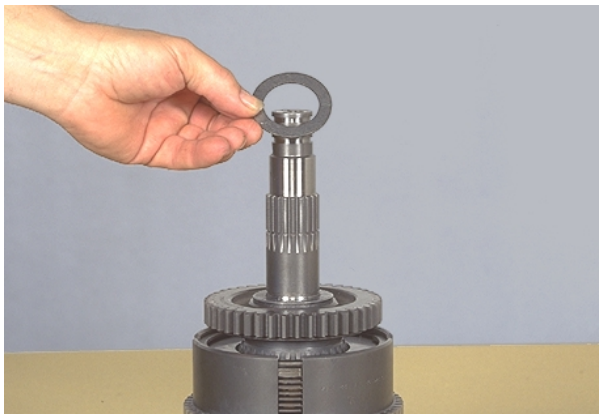


Figure 187
Position thrust washer on shaft.

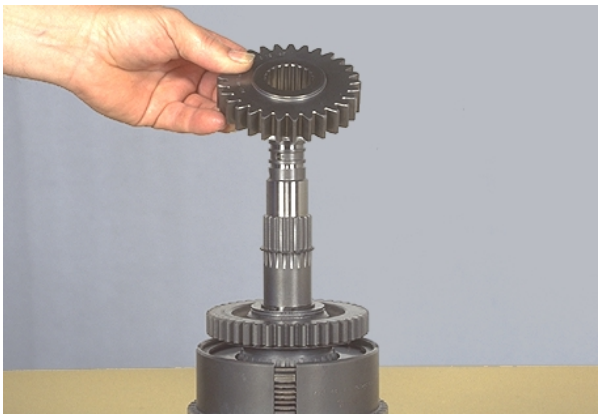


Figure 190
Position gear on clutch shaft.

Figure 188
Install thrust washer retainer ring
NOTE: 3-speed clutch drum not as shown.

Figure 191
Install clutch shaft front bearing. Note bearing has a shield in it. This shield must be up.

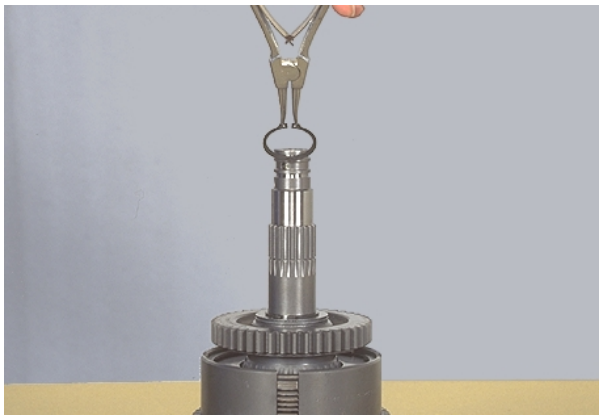


Figure 189
Install clutch shaft gear locating ring.

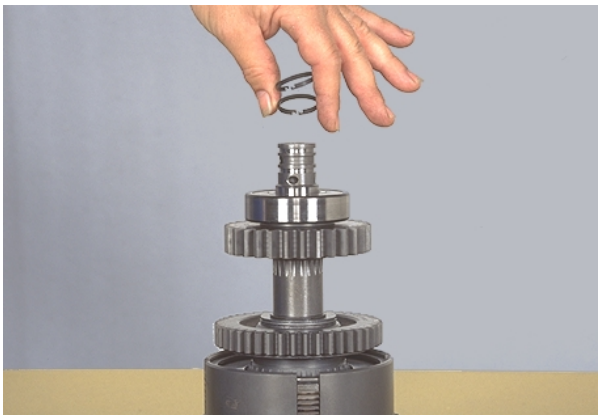


Figure 192
Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

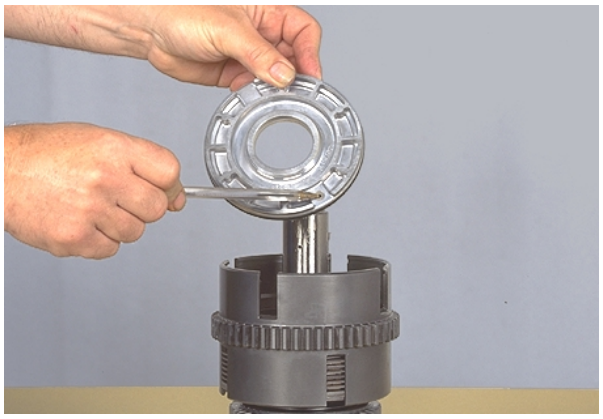


Figure 193

Clutch piston bleed ball must be clean and free of any foreign material. Refer to the cleaning and inspection pages.

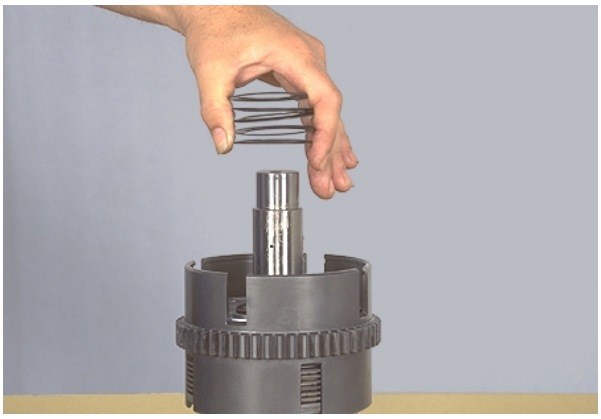


Figure 196

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.

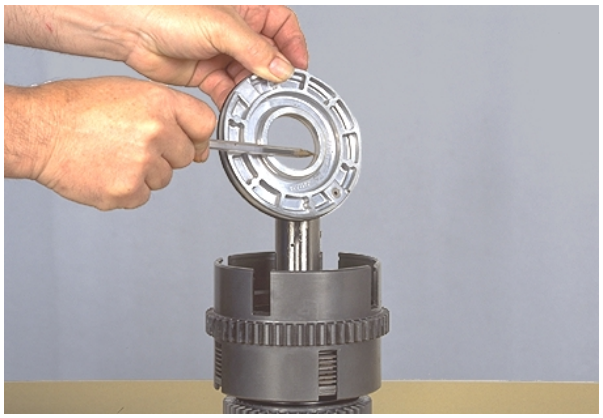


Figure 194

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

Figure 197

Position return spring ring retainer on clutch shaft.

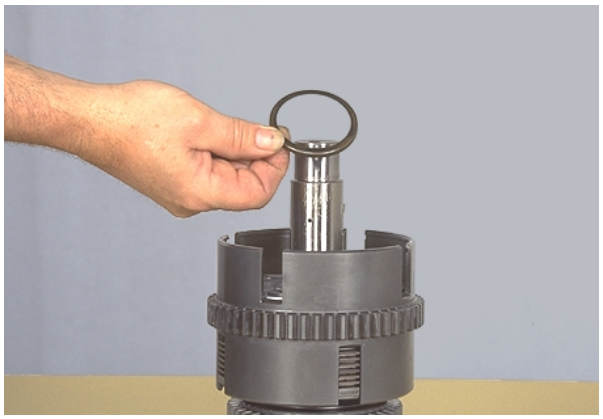


Figure 195

Install clutch piston wear plate.

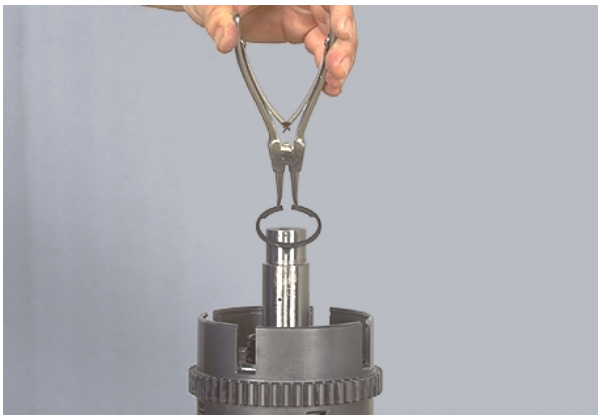


Figure 198

Start ring on shaft with snap ring pliers.

Figure 199

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and retainer ring; be sure ring is in full position in groove.

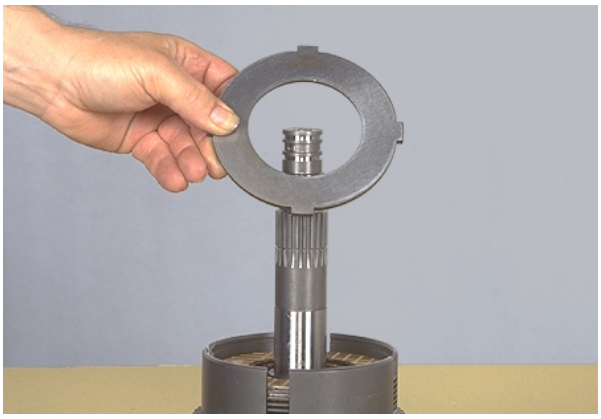


Figure 202

Install clutch disc end plate.

Figure 200

Install first steel (outer) clutch disc.

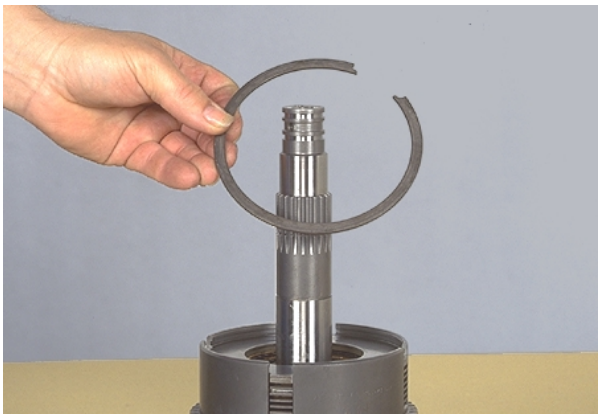


Figure 203

Install end plate retainer ring.

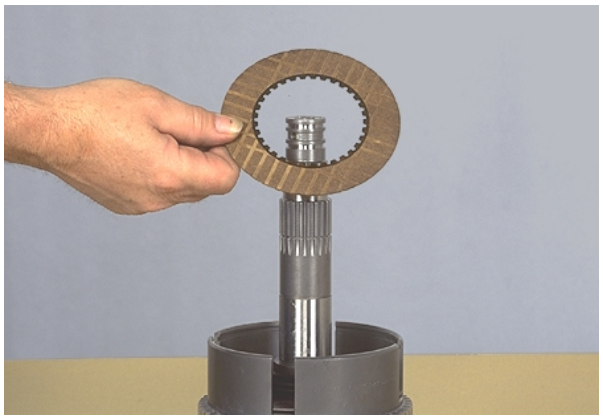


Figure 201

Install first friction (inner) clutch disc.
Alternate steel and friction until five (5) steel and five (5) friction discs are in position.

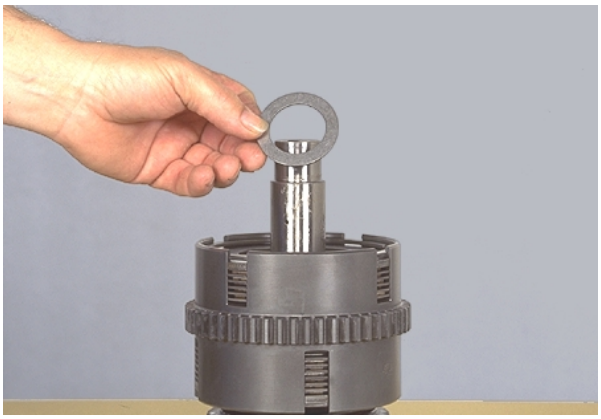


Figure 204

Position thrust bearing inner washer on clutch shaft.

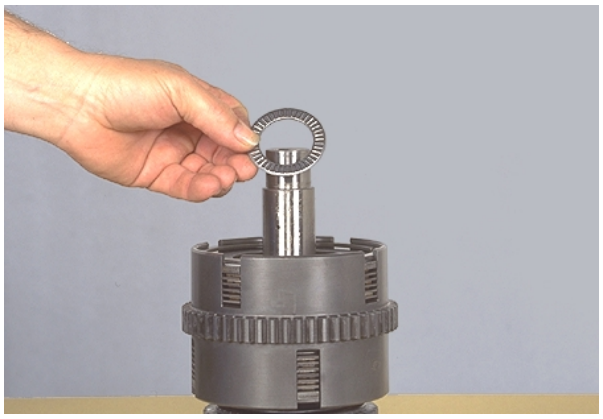


Figure 205

Position thrust bearing on clutch shaft against inner thrust bearing washer.

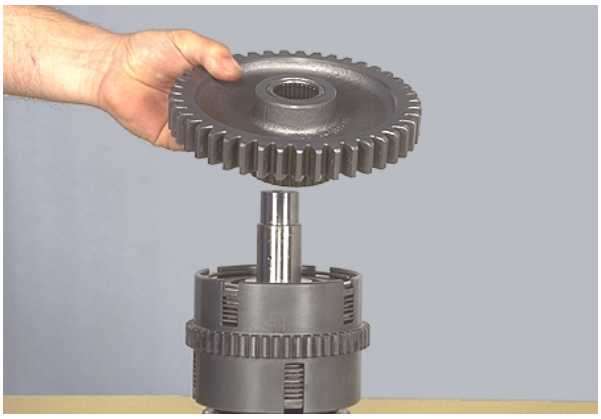


Figure 208

Install clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

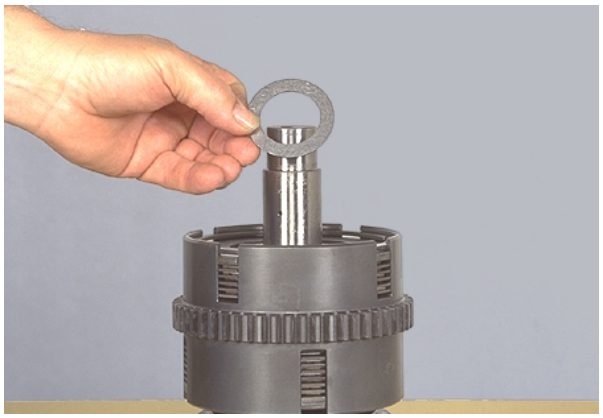


Figure 206

Install outer thrust bearing washer against thrust bearing.

Figure 209

Position thrust bearing inner washer on clutch shaft.

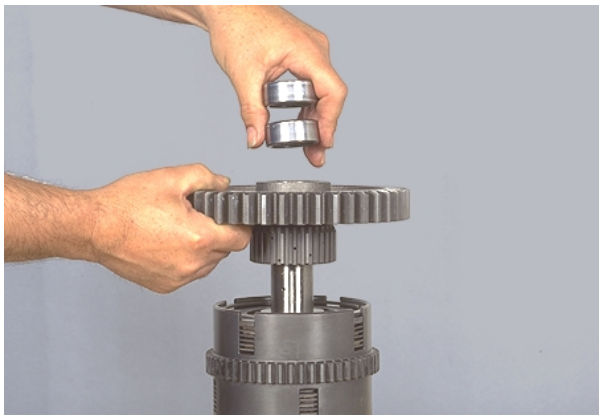


Figure 207

Press needle bearings in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides.

Figure 210

Position thrust bearing on clutch shaft against inner thrust bearing washer.

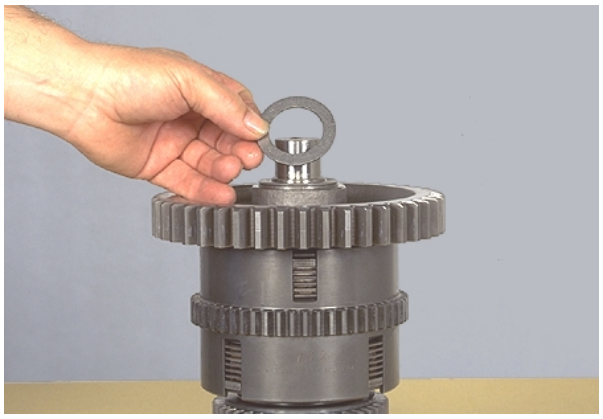


Figure 211

Install outer thrust bearing washer against thrust bearing.

Figure 212

Install clutch shaft rear bearing inner race.

Figure 213

Install clutch shaft rear bearing outer race.

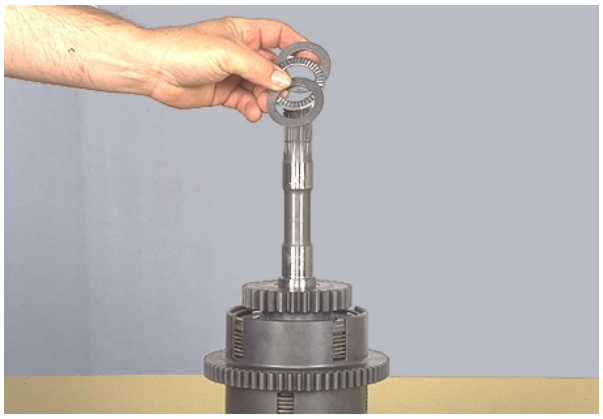


Figure 214

Remove outer thrust washer, thrust bearing and inner thrust washer. **Note**: a 3-speed transmission will not have external gear teeth on the forward and reverse clutch drum.

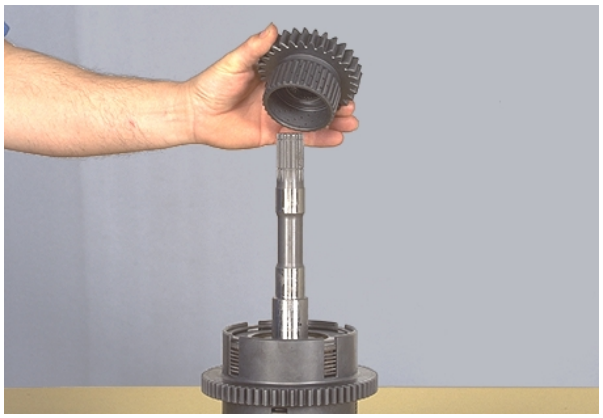


Figure 215

Remove clutch gear and disc hub.

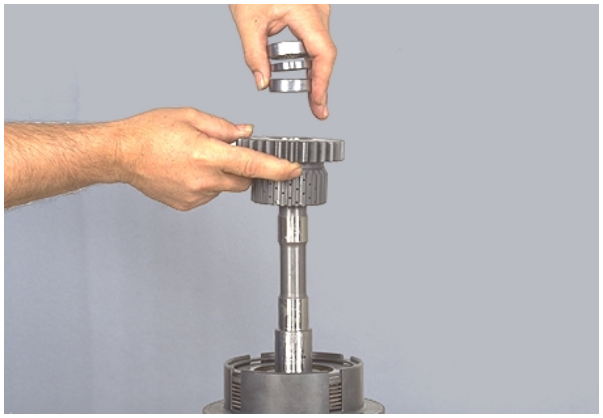


Figure 216

Remove bearings and spacer from clutch gear.

Figure 217

Remove outer thrust washer, thrust bearing and inner thrust washer.

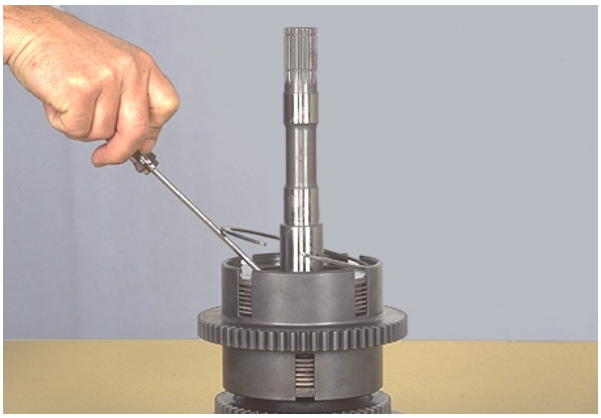


Figure 218

Remove end plate retainer ring.

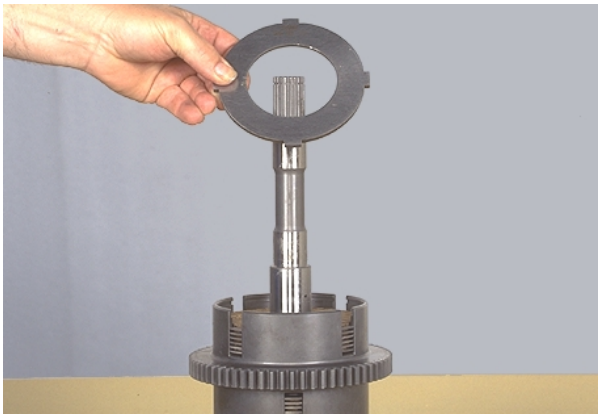


Figure 219

Remove end plate.

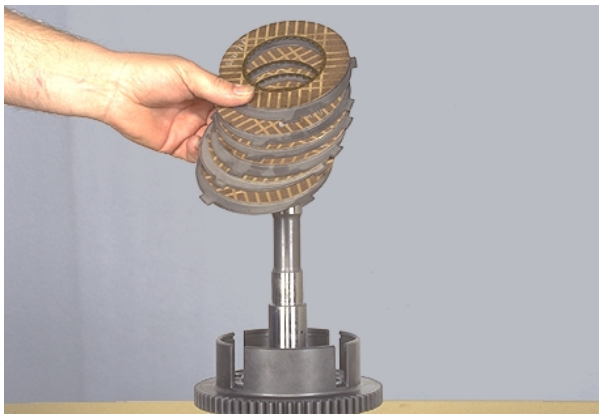


Figure 220
Remove clutch discs.

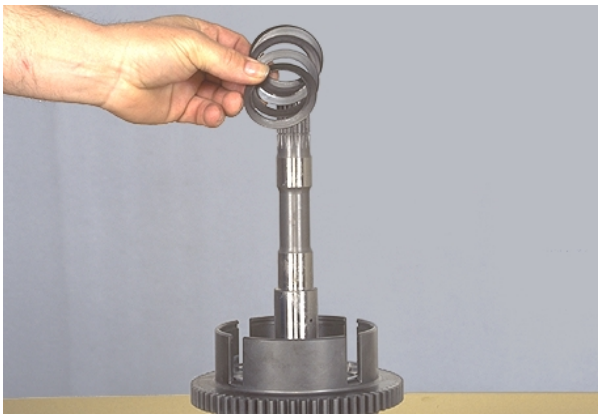


Figure 223
Remove disc springs.
NOTE: see page 10-85.

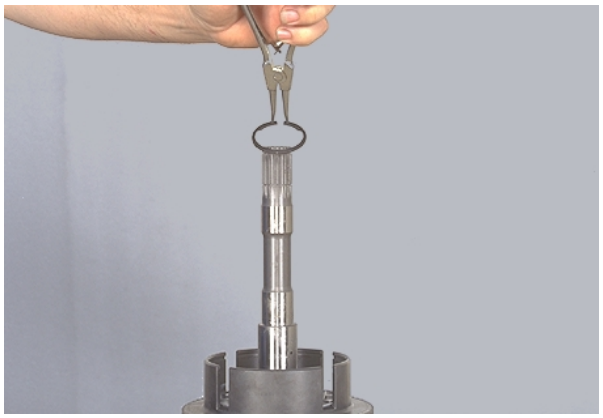


Figure 221
Compress disc springs and remove retainer ring.

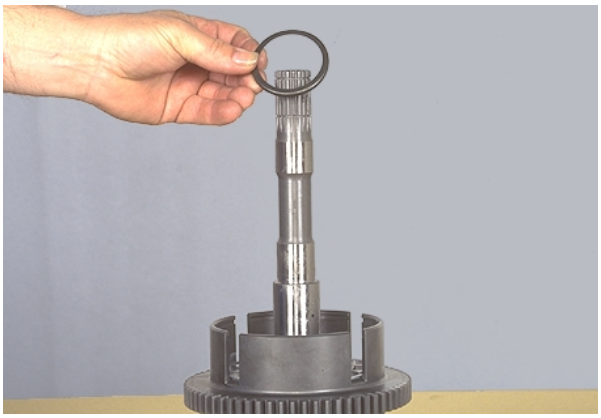


Figure 224
Remove clutch piston wear plate.

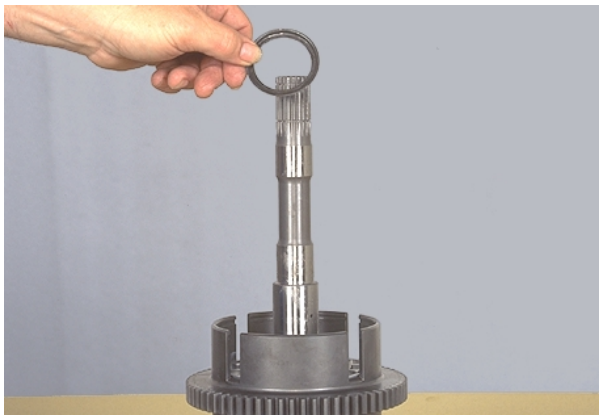


Figure 222
Remove retainer ring retainer.

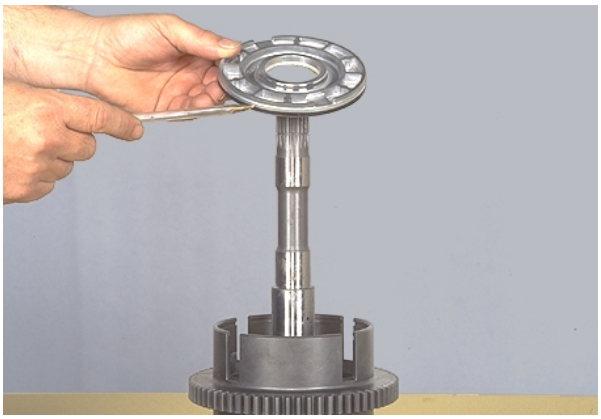


Figure 225
Remove clutch piston.

Figure 226
Remove clutch shaft oil sealing rings.

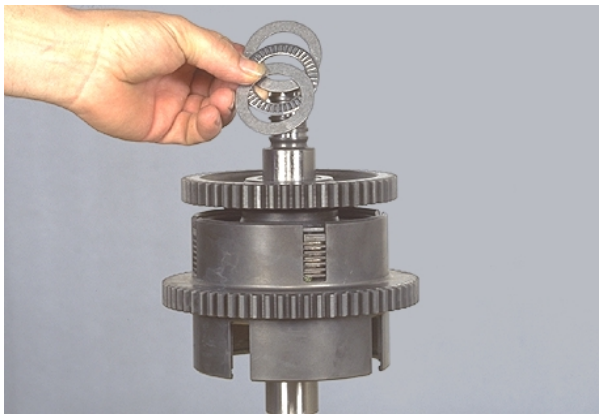


Figure 227
Remove outer thrust washer, thrust bearing and inner thrust washer.

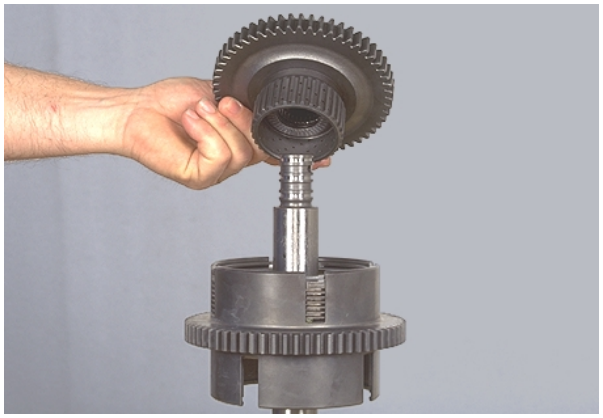


Figure 228
Remove clutch gear and disc hub.

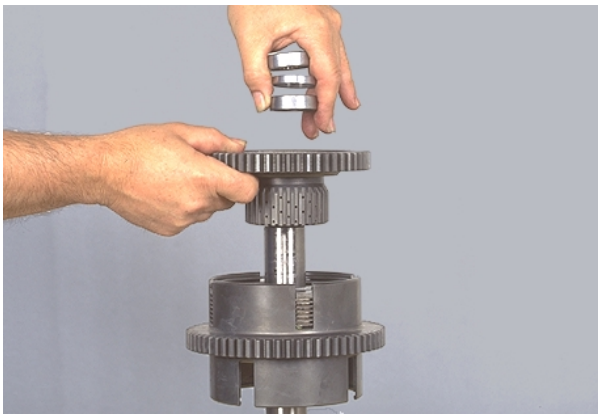


Figure 229
Remove bearings and spacer from clutch gear.

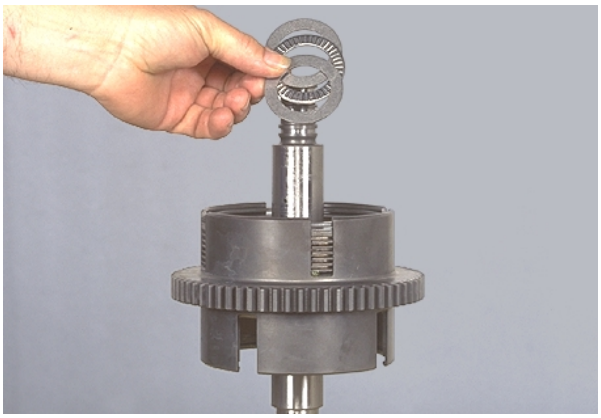


Figure 230
Remove outer thrust washer, thrust bearing and inner thrust washer.

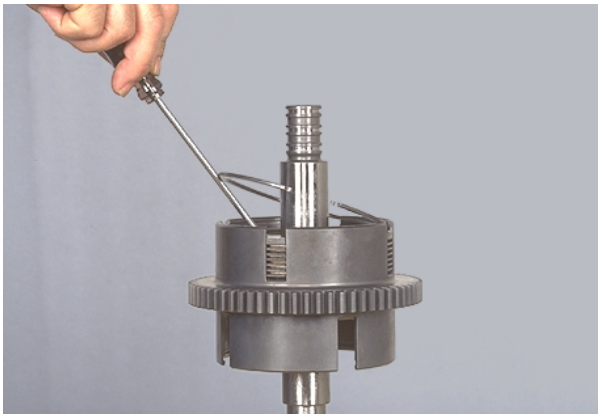


Figure 231
Remove end plate retainer ring.

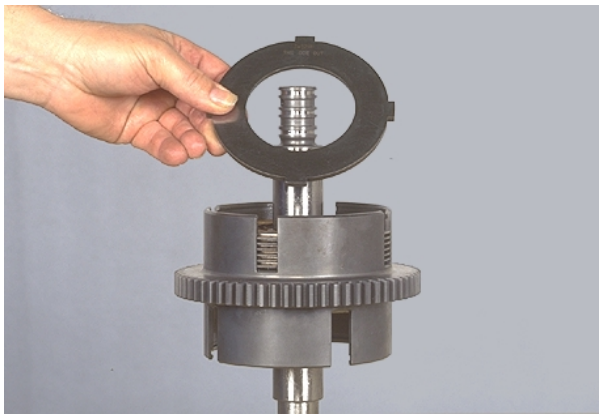


Figure 232
Remove end plate.

Figure 235
Remove retainer ring retainer.

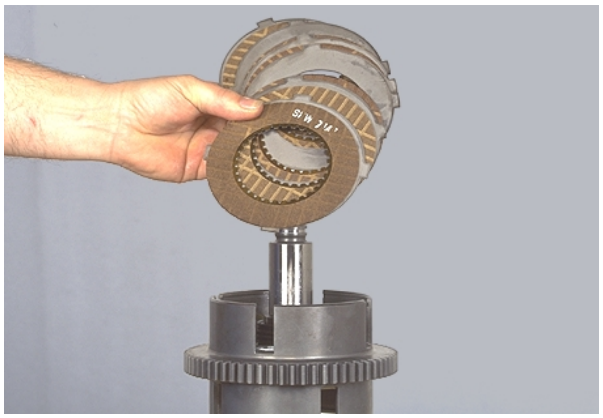


Figure 233
Remove clutch discs.

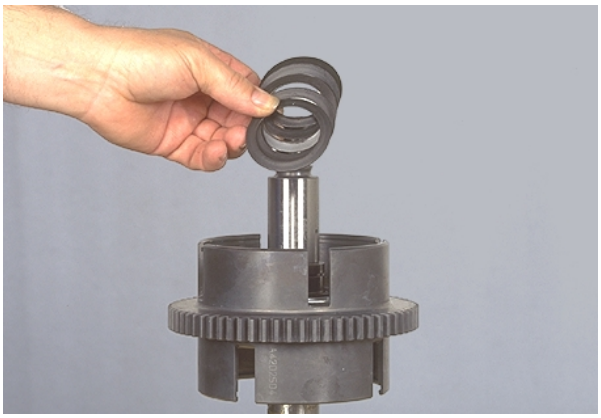


Figure 236
Remove disc springs.
NOTE: see page 10-85.

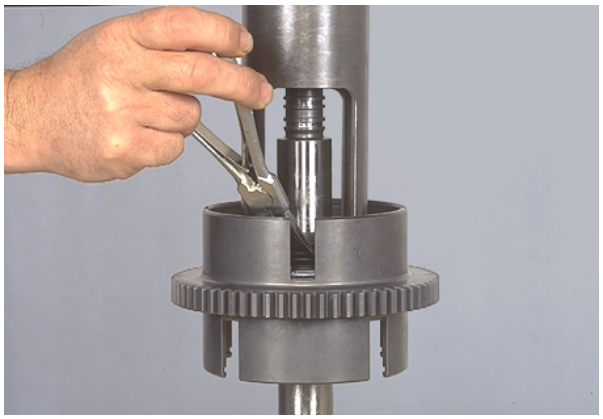


Figure 234
Compress disc springs and remove retainer ring.

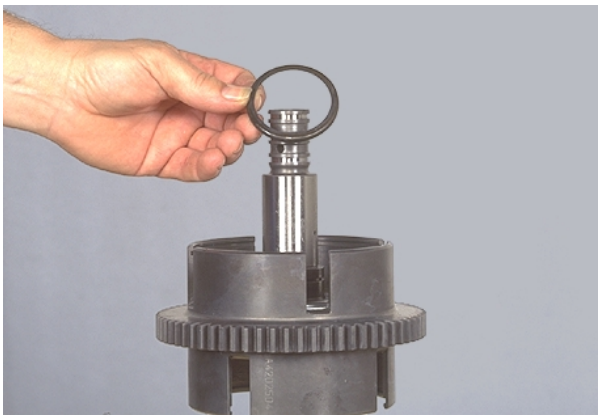


Figure 237
Remove clutch piston wear plate.

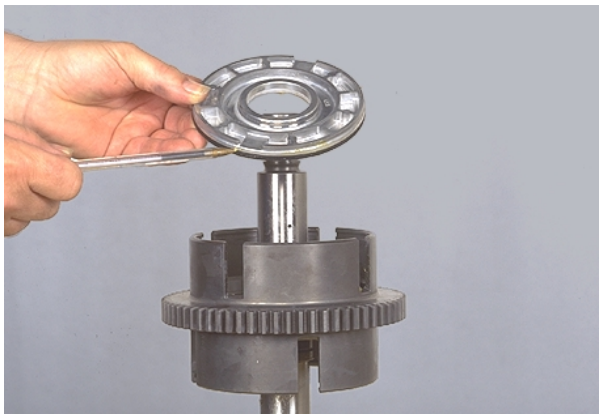


Figure 238
Remove clutch piston.

Figure 239

Clutch piston bleed orific must be clean free of any foreign material. Refer to the cleaning and inspection pages.

Figure 240

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

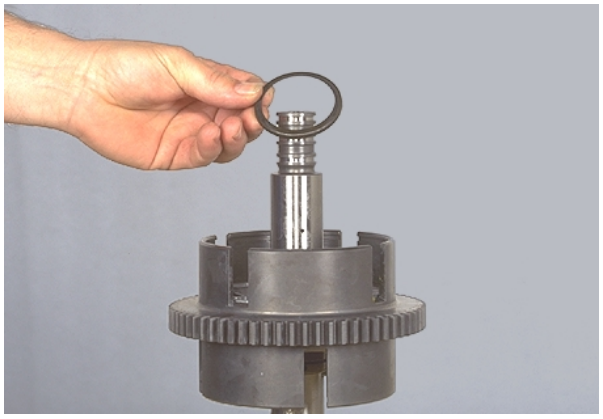


Figure 241

Install clutch piston wear plate.

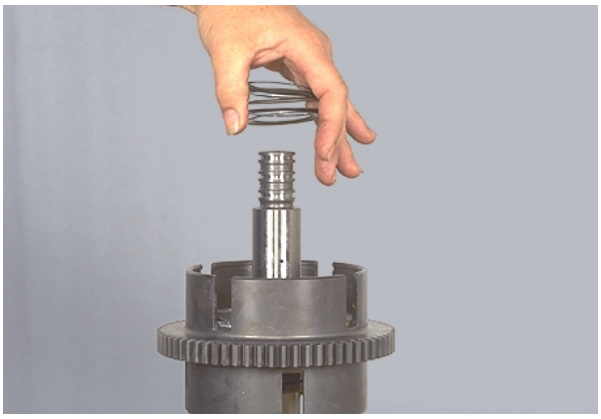


Figure 242

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.

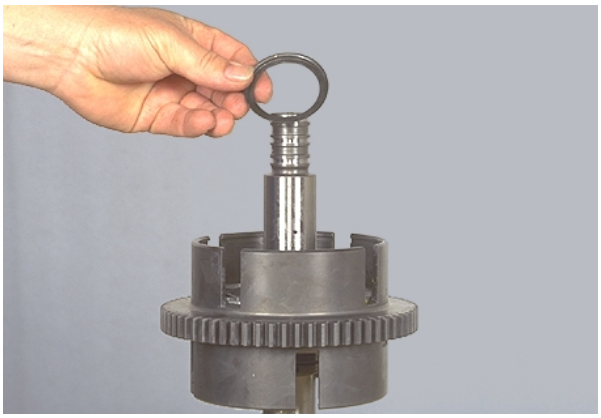


Figure 243

Position return spring ring retainer on clutch shaft.

Figure 244

Start ring on clutch with snap ring pliers.

Figure 245

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.

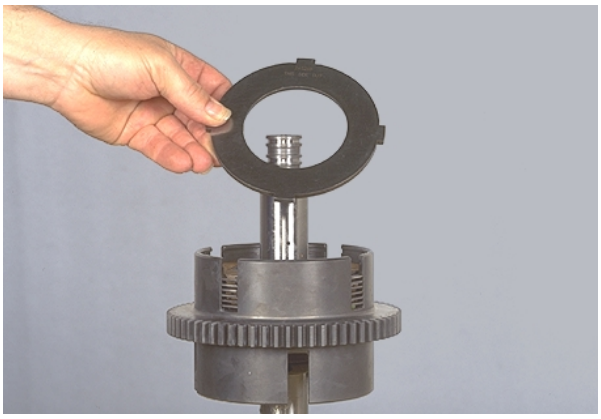


Figure 248

Install clutch disc end plate.

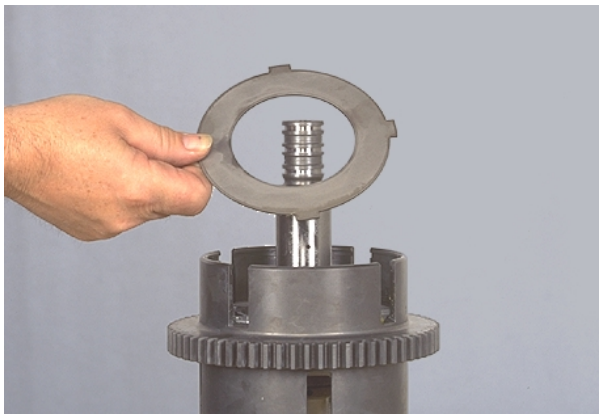


Figure 246

Install first steel (outer) clutch disc.

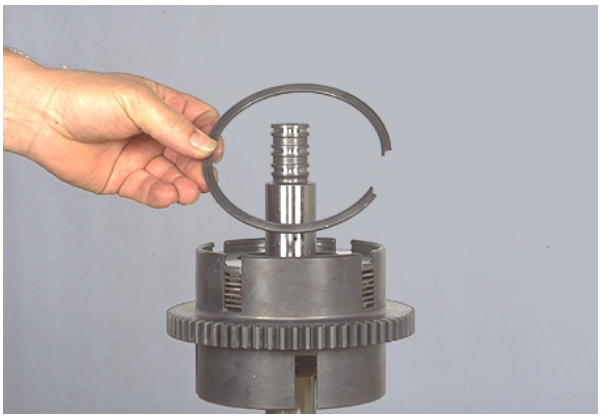


Figure 249

Install end plate retainer ring.

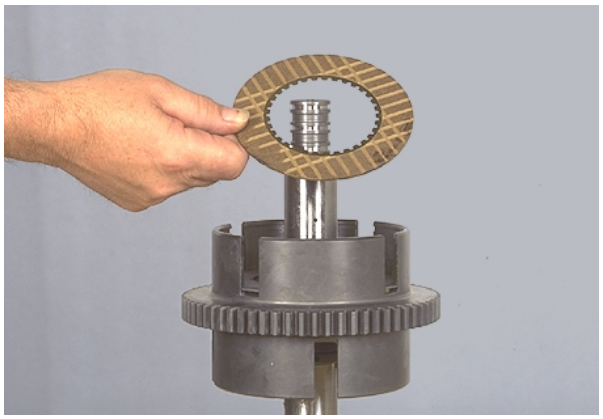


Figure 247

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

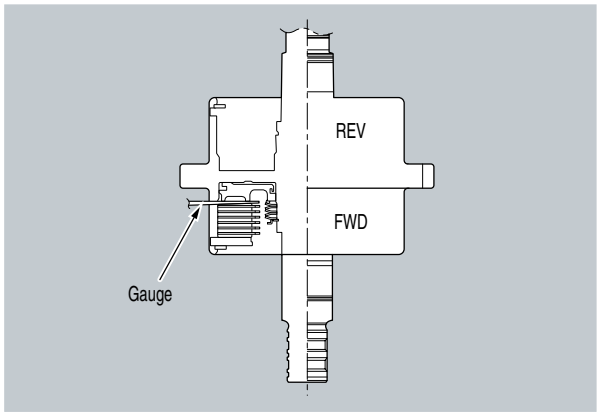


Figure 250

NOTE: forward clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum.
The required clearance is .048-.108 [1.22 - 2.74]. If the clearance is greater than .108 [2.74], add one steel disc under the end plate.

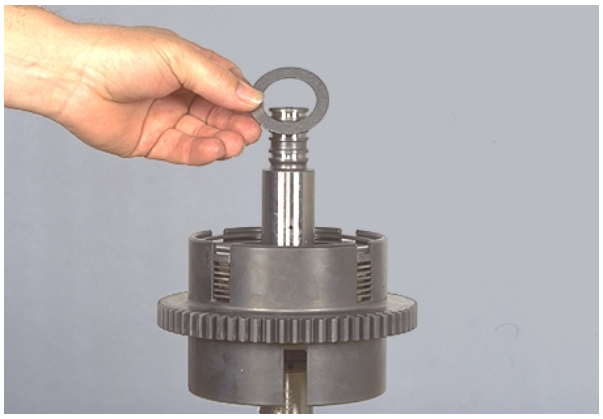


Figure 251

Position thrust bearing inner washer on clutch shaft.

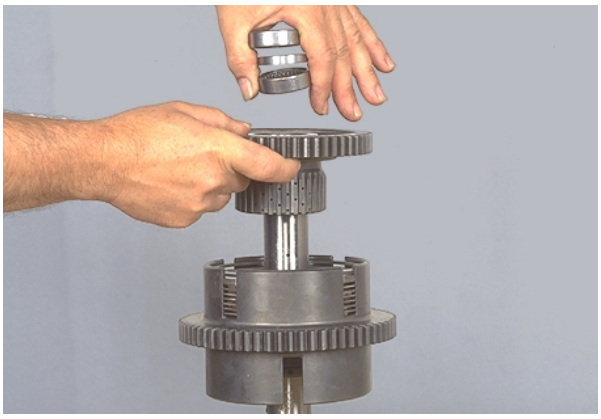


Figure 254

Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing, press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

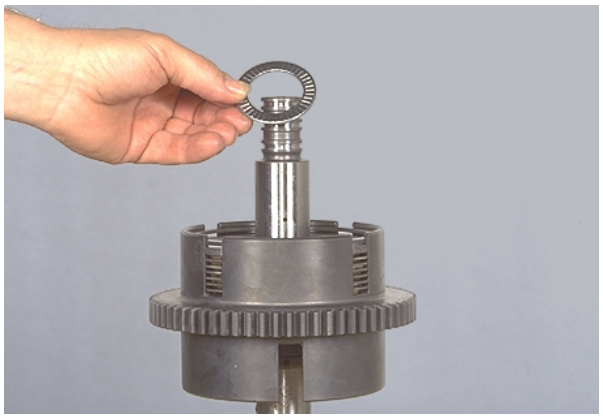


Figure 252

Position thrust bearing on clutch shaft against inner thrust bearing washer.

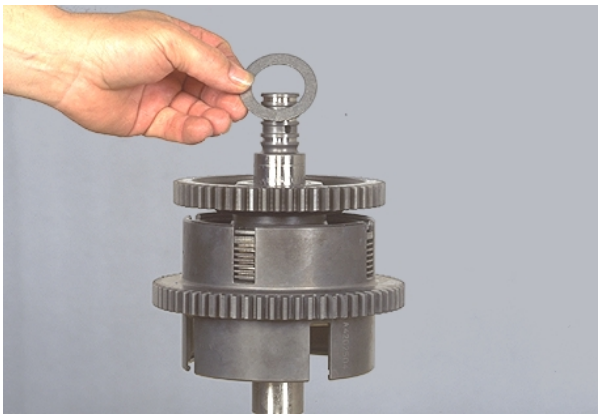


Figure 255

Position inner thrust washer on shaft.

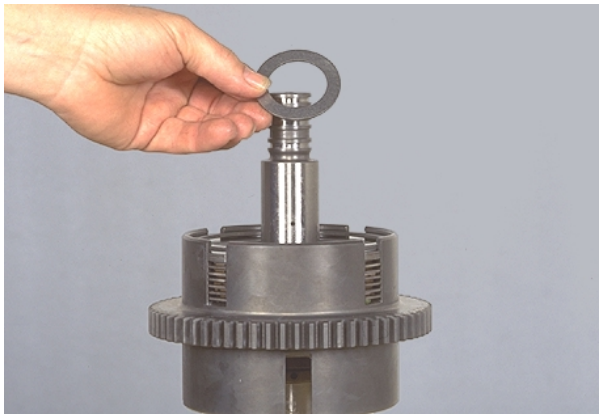


Figure 253

Install outer thrust bearing washer against thrust bearing.

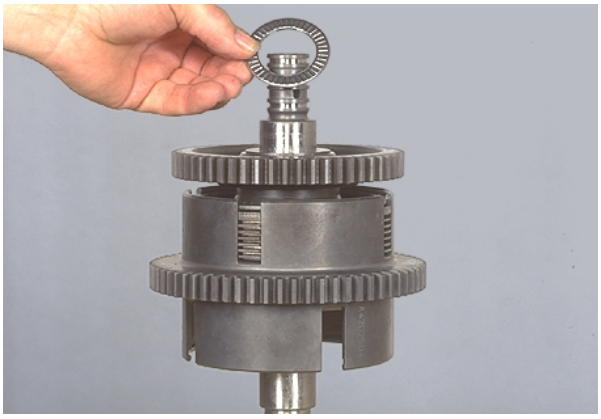


Figure 256

Position thrust bearing on shaft.

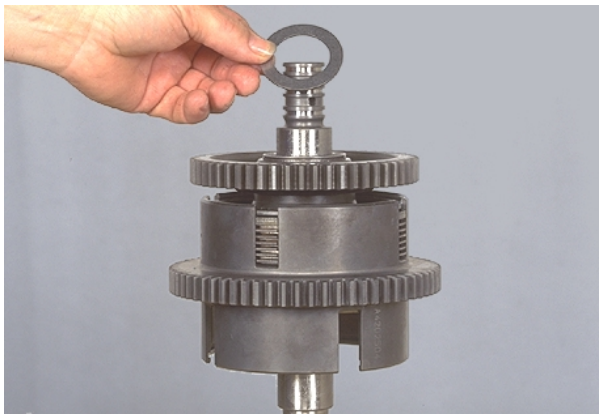


Figure 257

Position outer thrust washer on shaft.

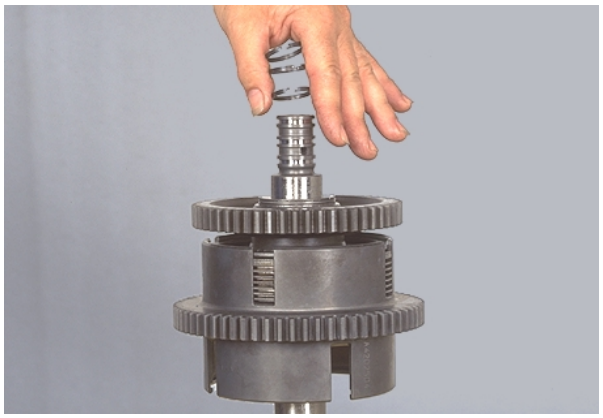


Figure 258

Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

Figure 259

Clutch piston bleed orifice must be clean and free of any foreign material. Refer to the cleaning and inspection pages.

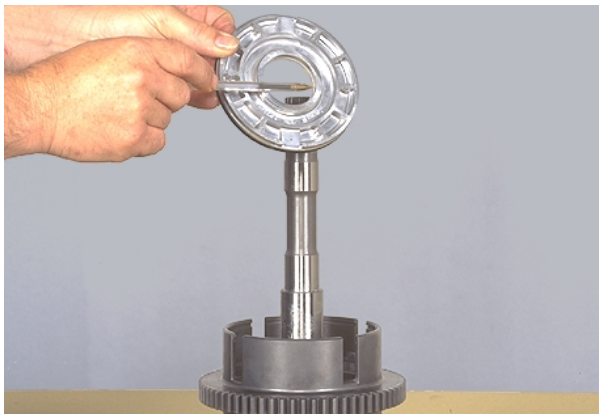


Figure 260

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

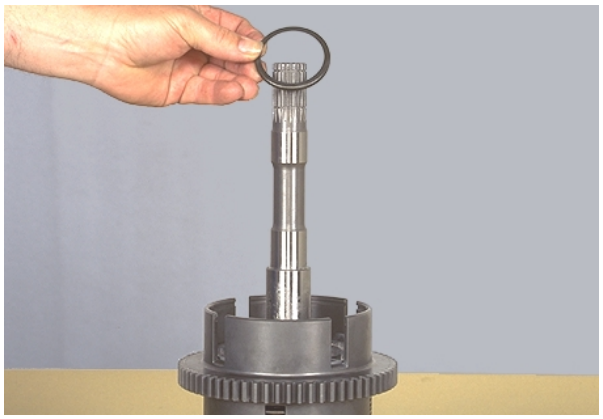


Figure 261

Install clutch piston wear plate.

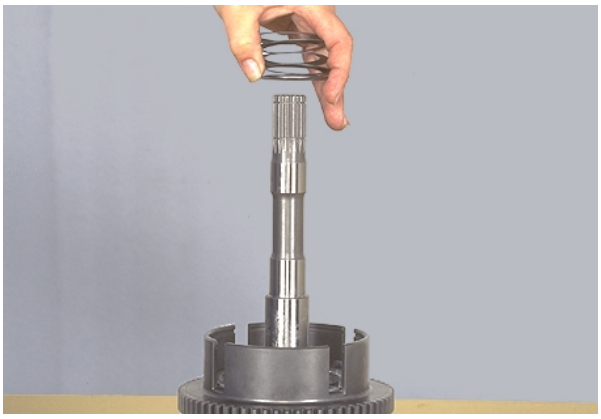


Figure 262

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.

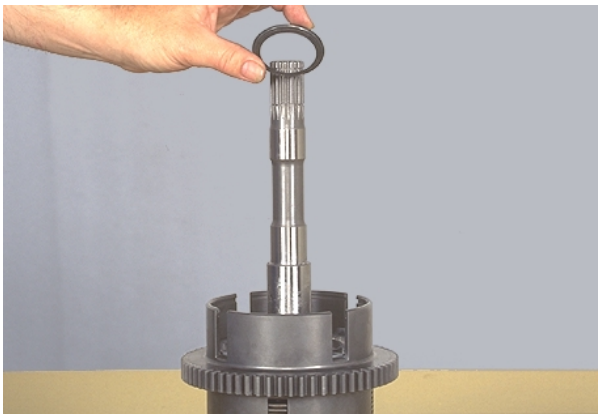


Figure 263

Position return spring ring retainer on clutch shaft.

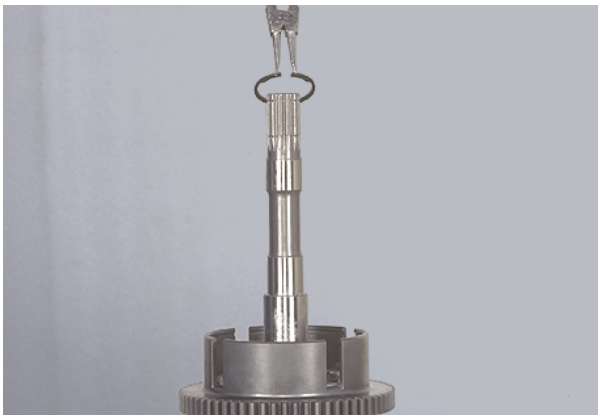


Figure 264

Start ring on shaft with snap ring pliers.

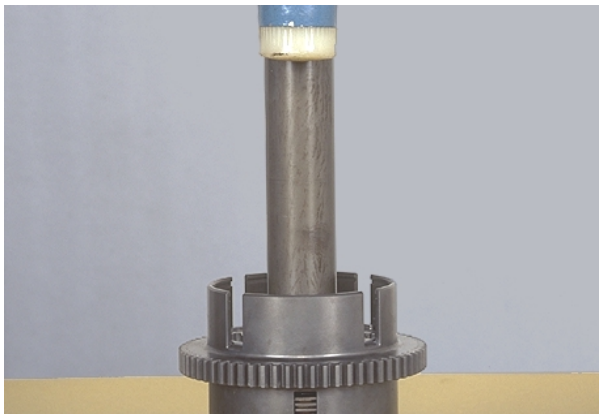


Figure 265

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.

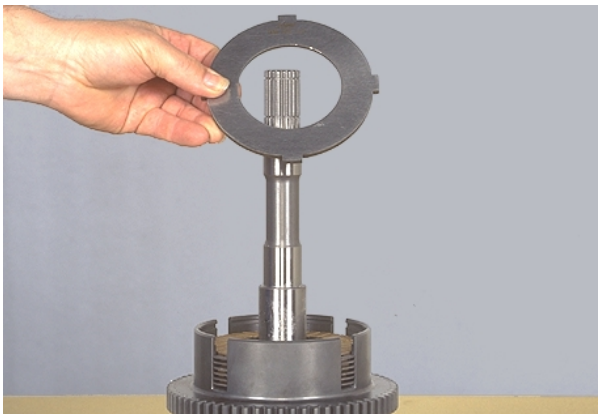


Figure 268

Install clutch disc end plate.

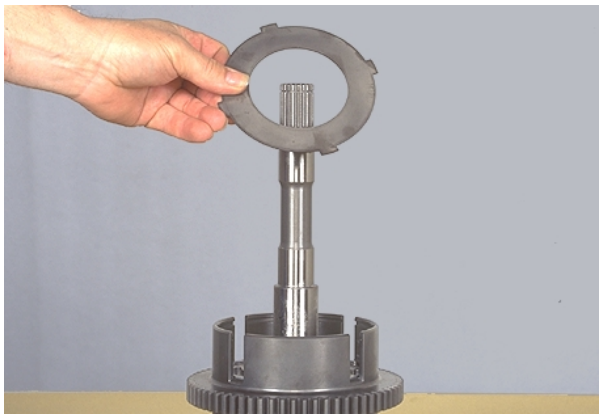


Figure 266

Install first steel (outer) clutch disc.

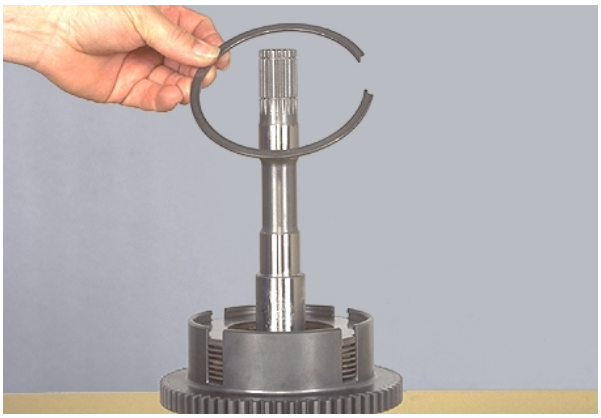


Figure 269

Install end plate retainer ring.

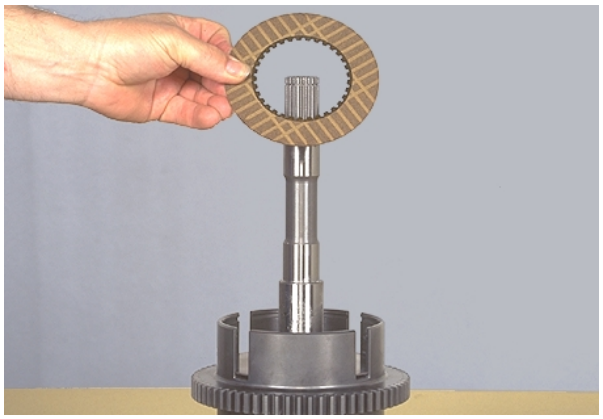


Figure 267

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

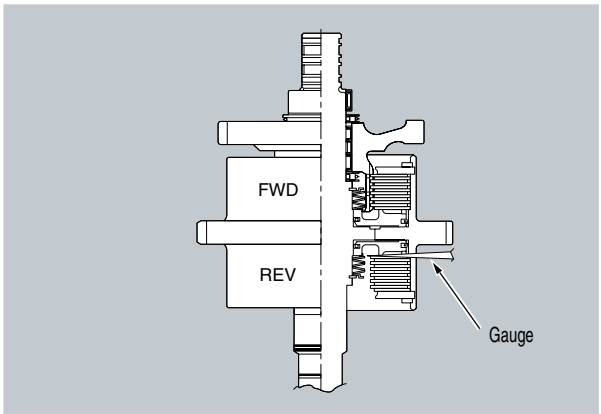


Figure 270

NOTE: reverse clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch disc on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .048-.108 [1,22-2,74]. If the clearance is greater than .108 [2,74] add one steel disc under the end plate.

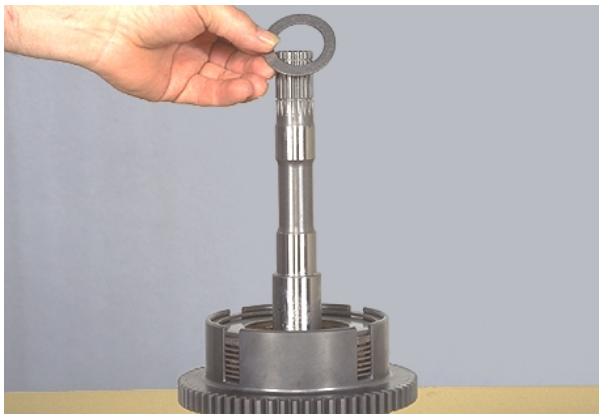


Figure 271

Position thrust bearing inner washer on clutch shaft.

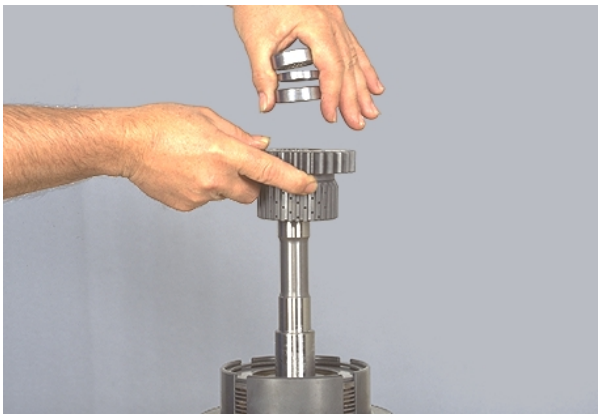


Figure 274

Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing. Press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

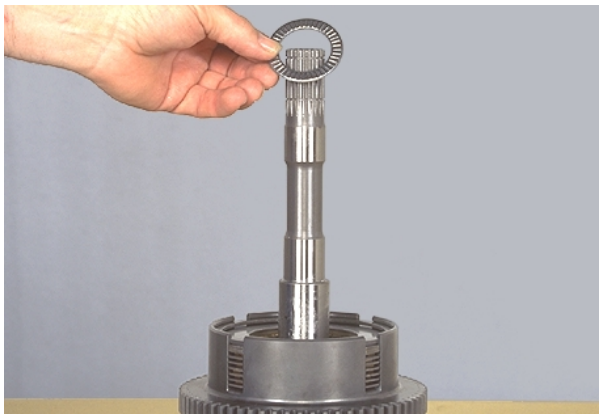


Figure 272

Position thrust bearing on clutch shaft against inner thrust bearing washer.

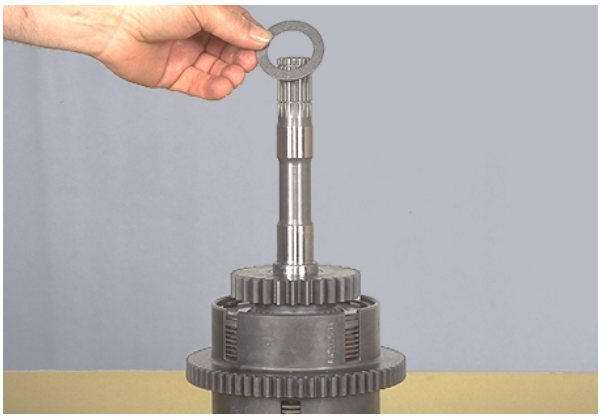


Figure 275

Position inner thrust washer on shaft.

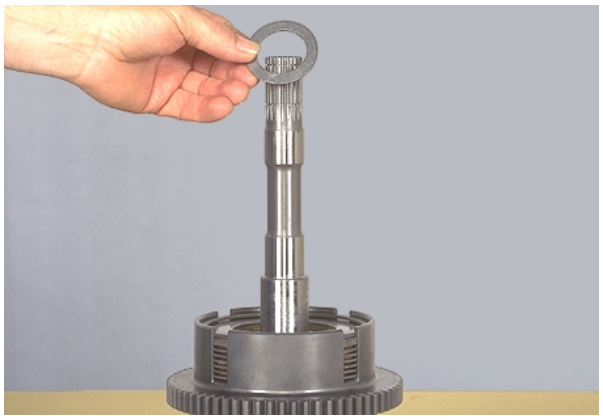


Figure 273

Install outer thrust bearing washer against bearing.

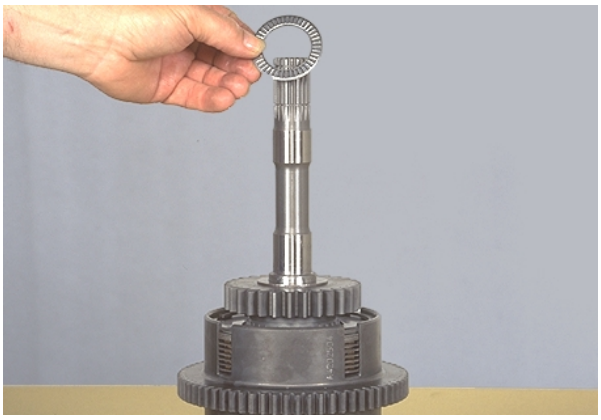


Figure 276

Position thrust bearing on shaft.

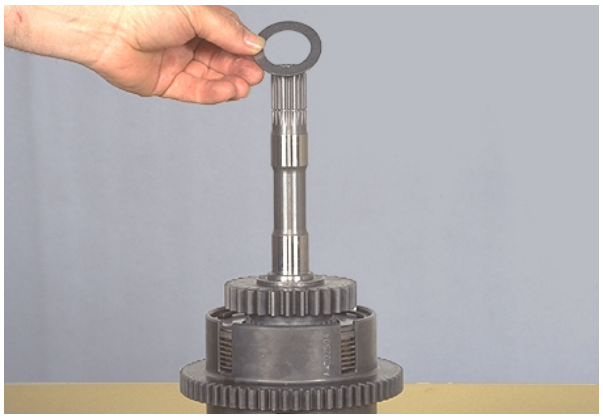


Figure 277
Position outer thrust washer on shaft.

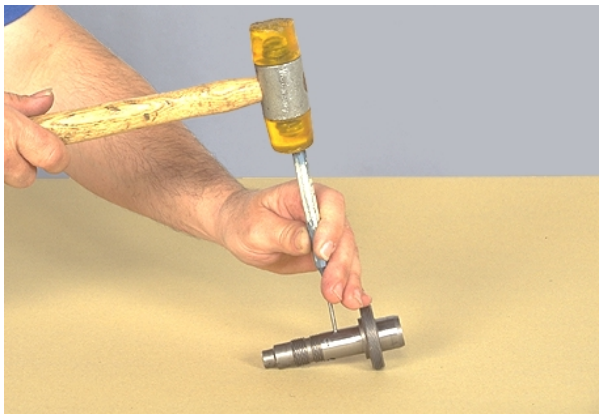


Figure 278

Tap pin from regulator valve sleeve. Use caution as valve spool is under spring pressure.

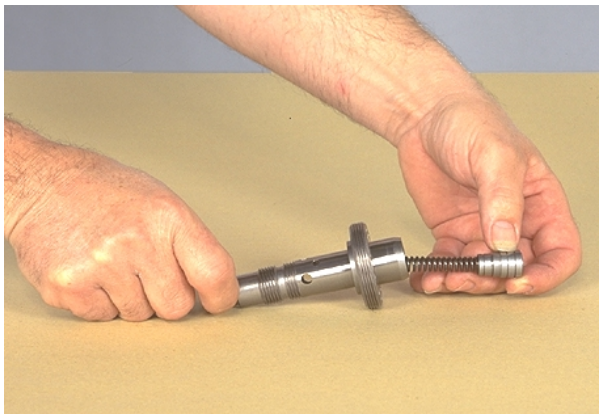


Figure 279

Remove regulator valve piston and pressure regulator valve spring.

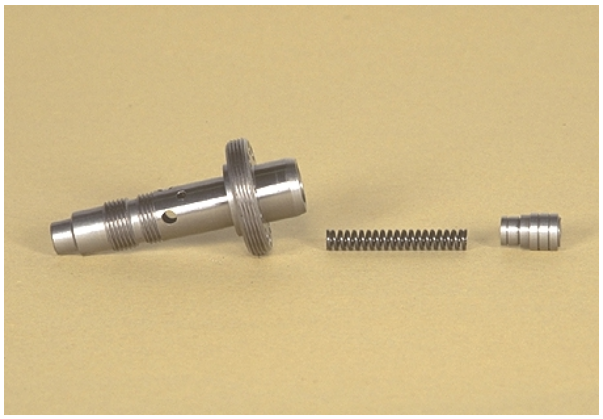


Figure 280

Spring and piston removed.

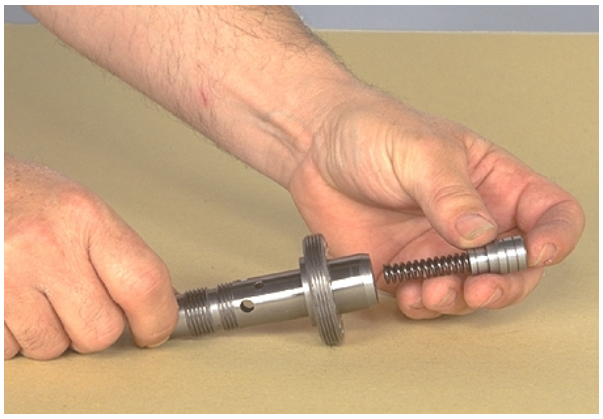


Figure 281

Position pressure regulator valve spring into regulator valve piston. Refer to the cleaning and inspection pages.

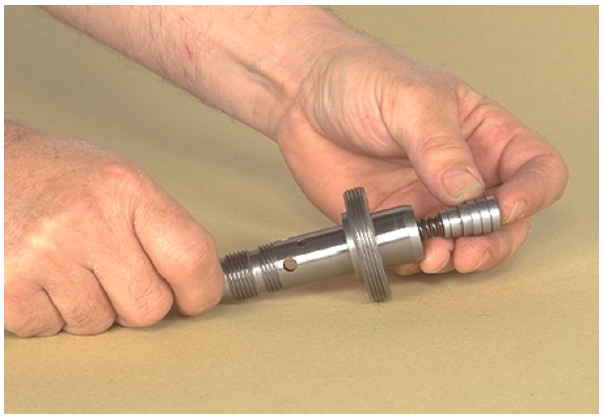


Figure 282

Install pressure regulator valve spring and regulator valve piston as an assembly into regulator valve sleeve.

Figure 283

Compress valve spring and valve and install pin into regulator valve sleeve.

Figure 284

Remove inner, middle and outer spring and stop pin from modulation housing sleeve. Reference figure 47.

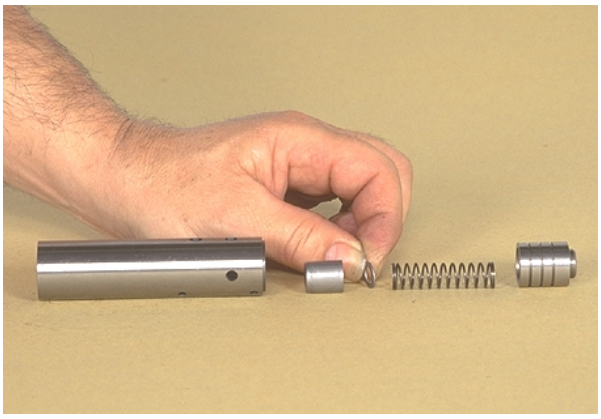


Figure 287

Remove regulator spool, spring, retainer spring and spacer spring from housing sleeve.

Figure 285

Remove accumulator spool. Reference figure 47.

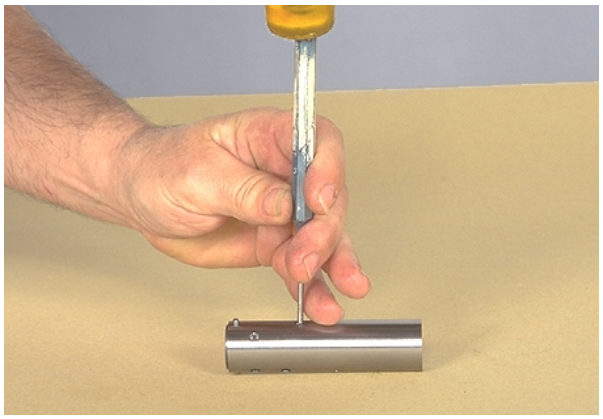


Figure 286

Remove cross pin from sleeve

NOTE: Some units will have two cross pins the same length. Some units will have two pins of different lengths. The longest pin goes in the bottom hole.

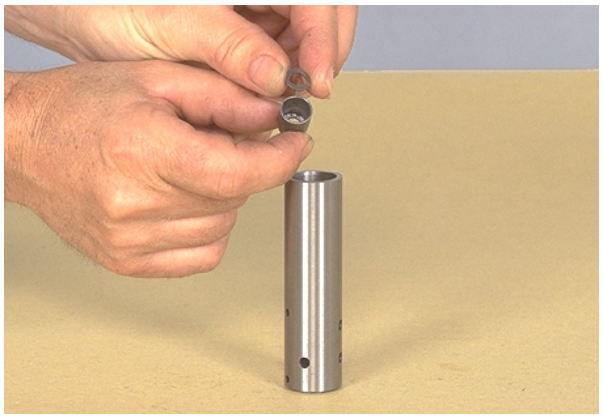


Figure 288

Install spring spacer in spring retainer.
Refer to the cleaning and inspection pages.

Figure 289

Install spring in spring retainer.

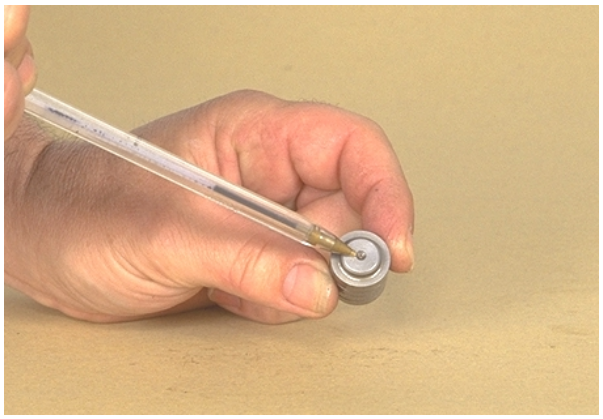


Figure 290

Check orifice in regulator spool to be free and clear of any foreign material.

Figure 291

Install spring retainer, spring and regulator valve in sleeve against inner cross pin.

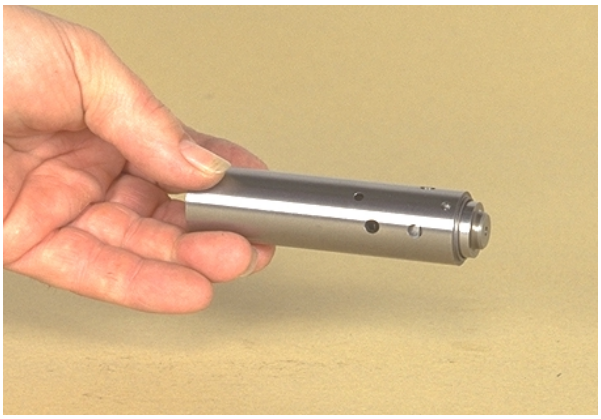


Figure 292

Compress regulator spool and spring in sleeve far enough to install cross pin.

Figure 293

Install cross pin.
NOTE: Some units will have two cross pins the same length. Some units will have two pins of different lengths. The longest pin goes in the bottom hole.

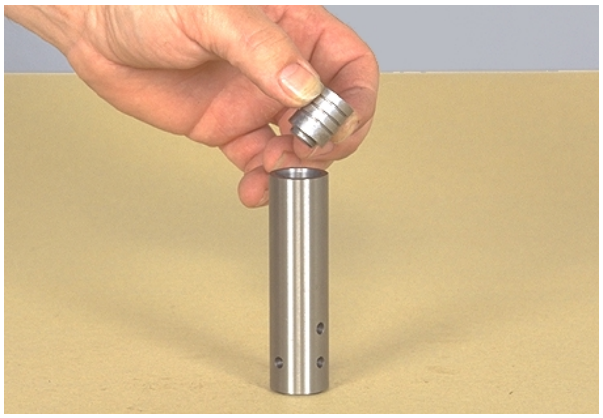


Figure 294
From opposite end, position accumulator spool in sleeve as shown.

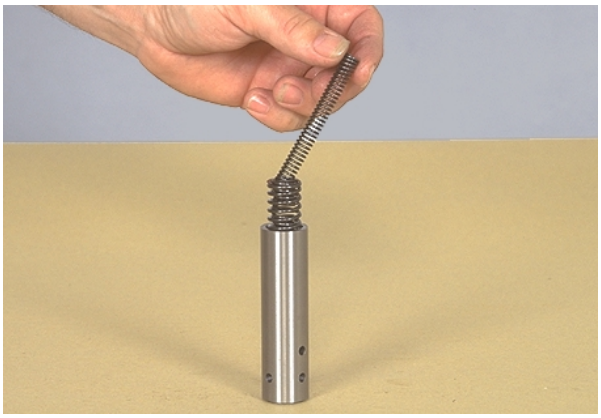


Figure 297
Install inner spring.

Figure 295
Install outer accumulator spring.

Figure 298
Install stop pin in inner spring.

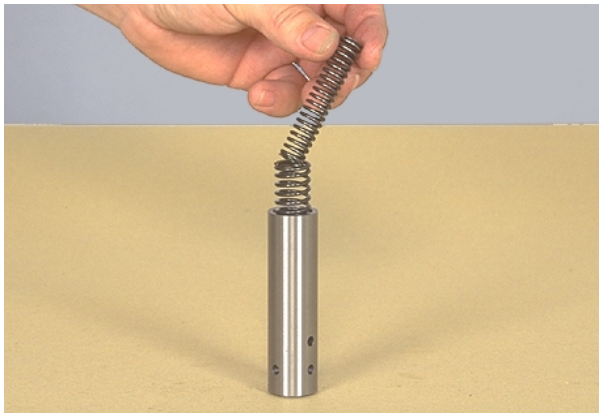


Figure 296
Install middle spring.

Figure 299
If charging pump or pump drive gear are to be replaced, remove retainer ring and drive gear.

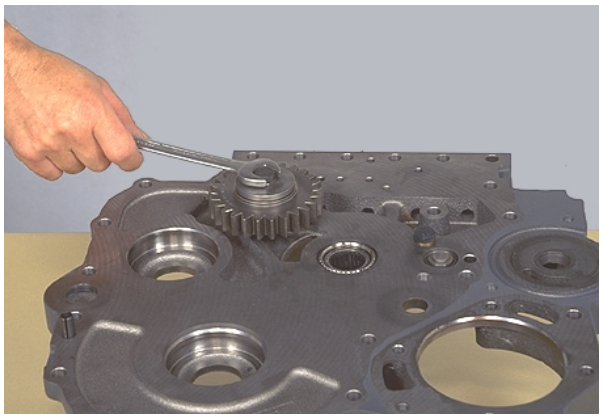


Figure 300
Remove reverse idler gear end plate capscrew and washer.

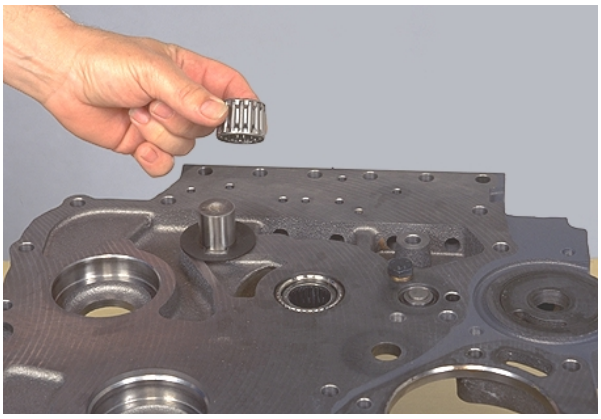


Figure 303
Remove reverse idler gear bearing.

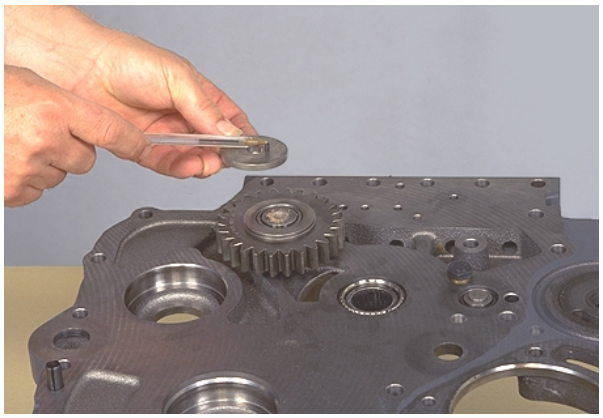


Figure 301
Remove end plate and dowel pin.

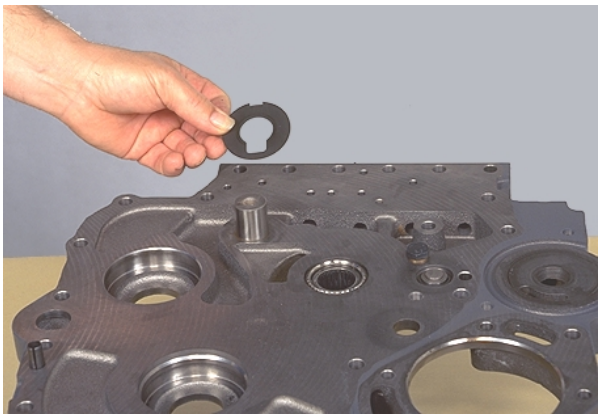


Figure 304
Remove idler gear tanged thrust washer.

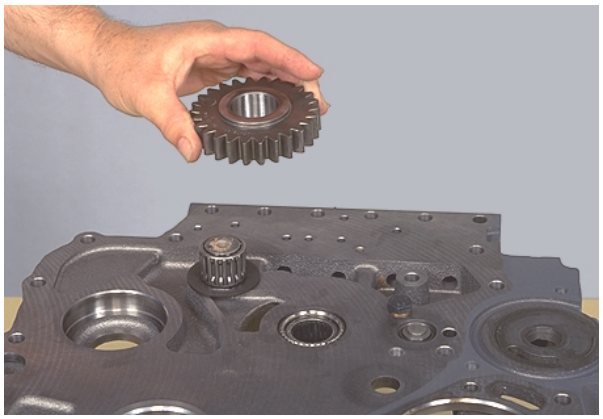


Figure 302
Remove reverse idler gear.

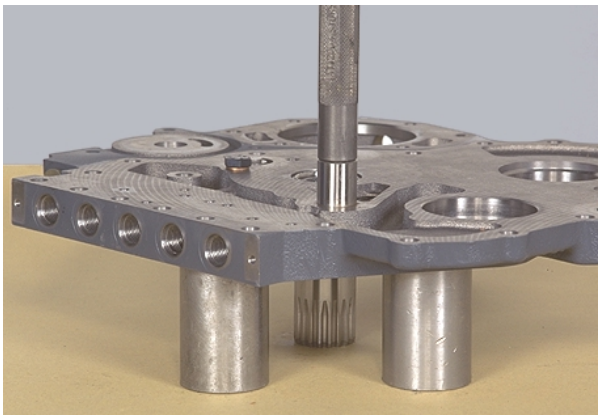


Figure 305
If reverse idler shaft is to be replaced, support spacer plate around idler shaft opening and press idler shaft from spacer.

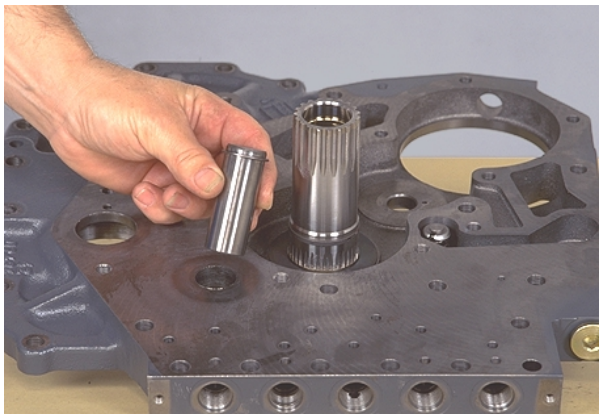


Figure 306
Idler shaft and locating ring removed.

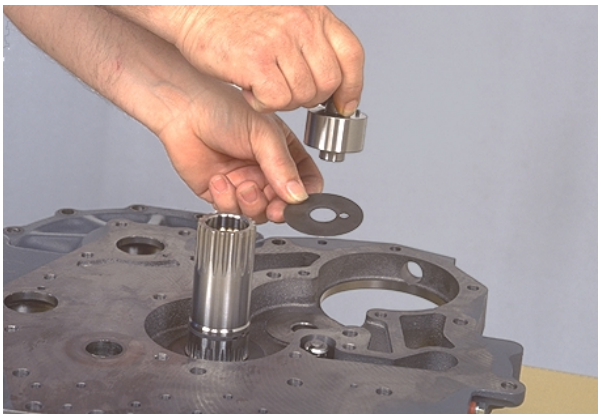


Figure 309
Remove pump drive idler shaft and thrust washer.

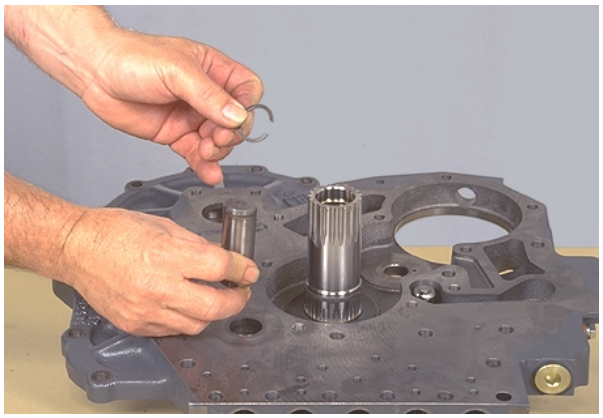


Figure 307
Remove locating ring from idler shaft.

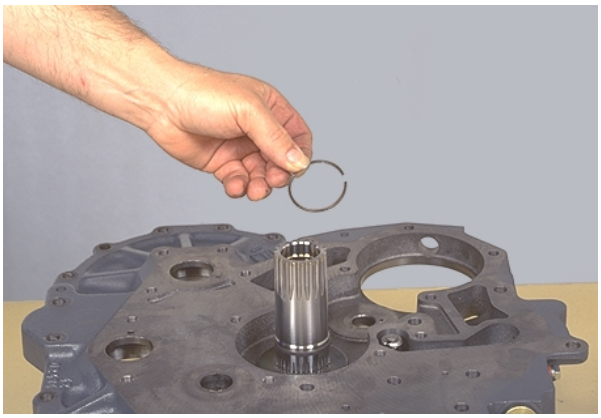


Figure 310
The stator support is held in place by two retaining rings. Remove converter end retainer ring from groove.

Figure 308
Tap pump drive idler shaft from spacer plate.

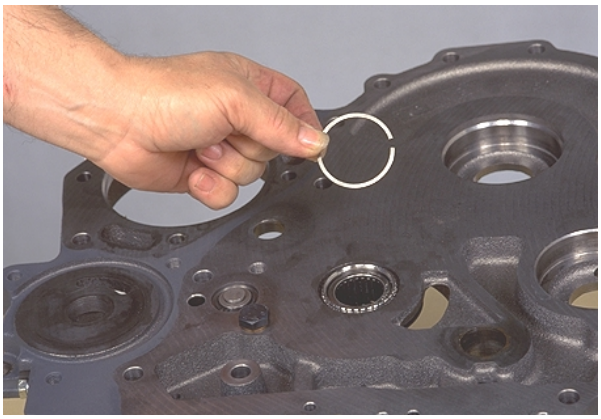


Figure 311
Push support towards transmission side far enough to expose retainer ring. Remove retainer ring.

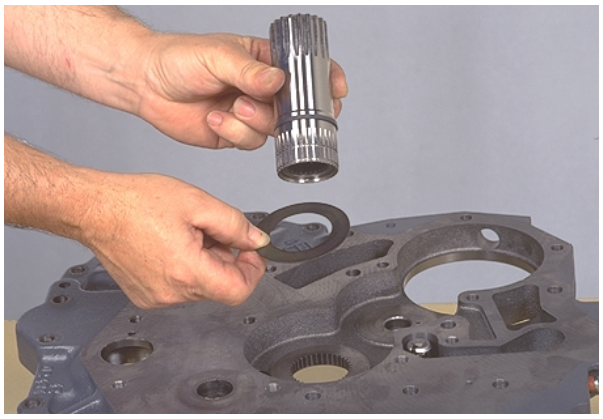


Figure 312

From converter end, remove stator support and thrust washer.

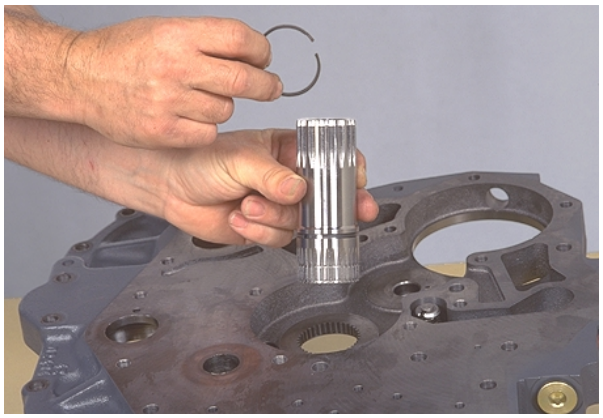


Figure 313

Remove stator support oil sealing ring.

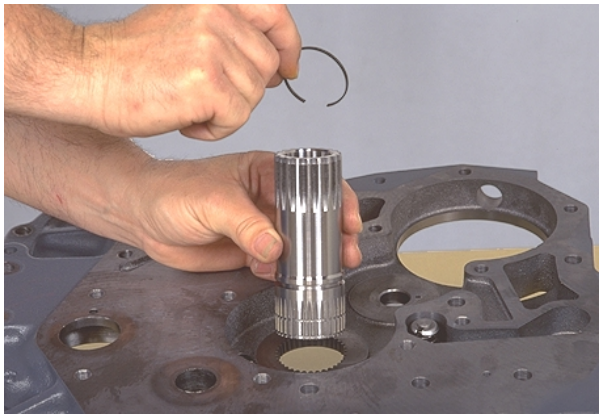


Figure 314

Remove sealing ring expander ring.

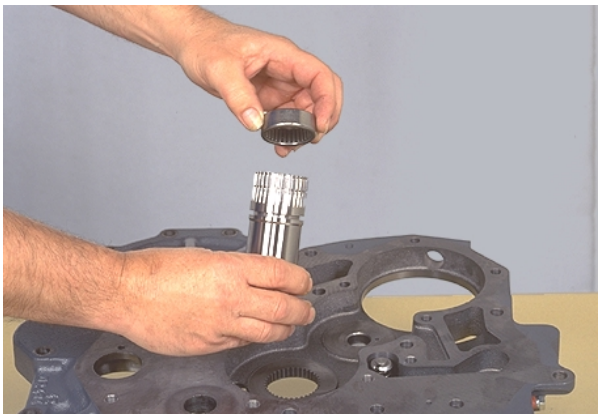


Figure 315

If support bushing or bearing is to be replaced, remove from stator support.

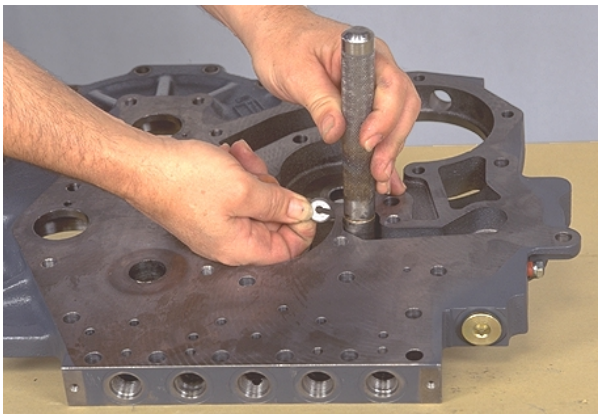


Figure 316

Compress converter safety valve spring and remove retaining washer.

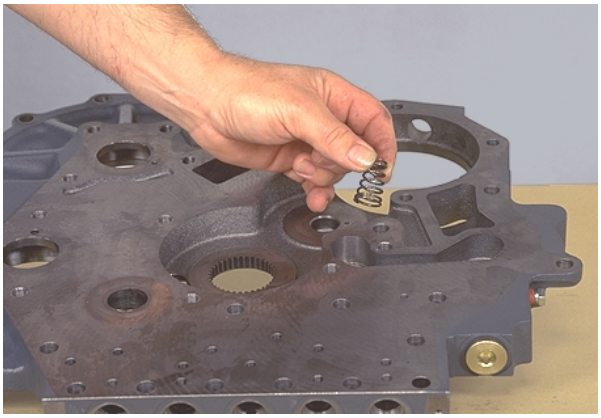


Figure 317

Remove safety valve spring.

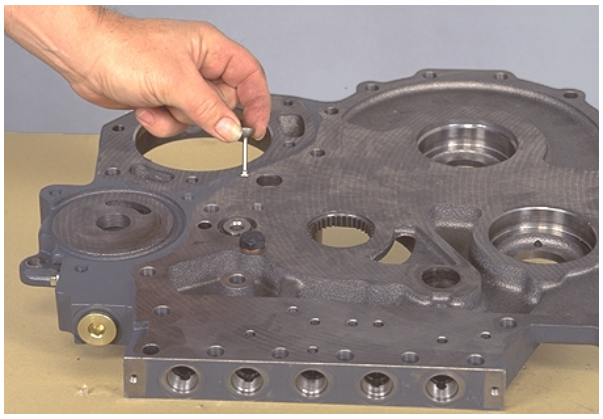


Figure 318

Turn spacer plate over and remove safety valve poppet.

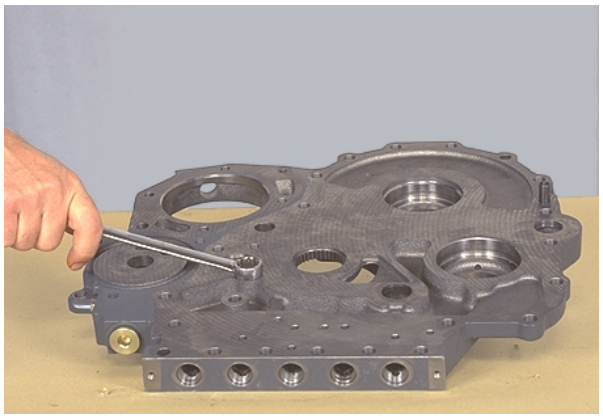


Figure 319

Remove plug and seal washer from spacer plate.

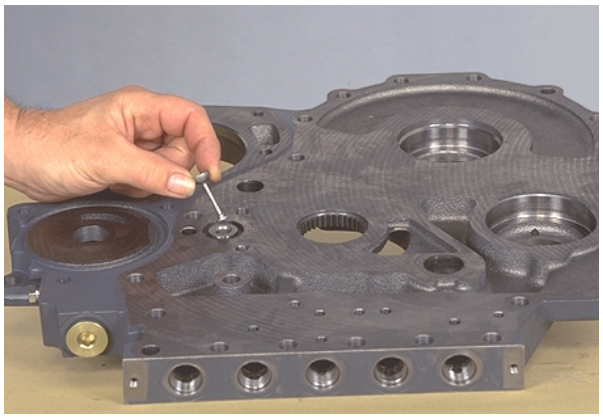


Figure 320

From transmission side of spacer plate, position converter safety valve poppet in bore in spacer. Refer to the cleaning and inspection pages.

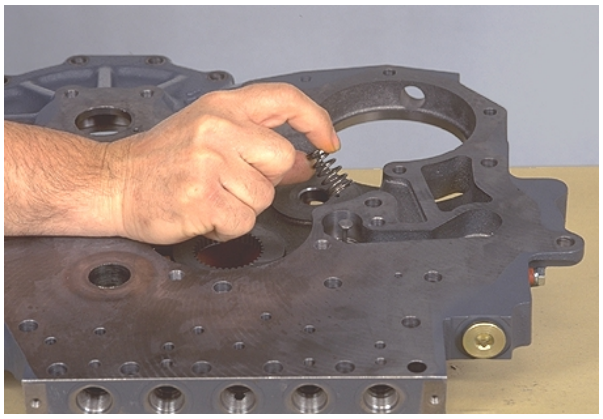


Figure 321

Turn spacer over and position safety valve spring on poppet.

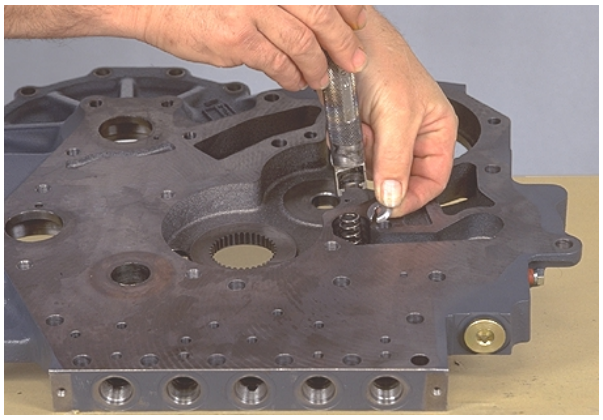


Figure 322

Compress spring and install poppet retaining washer. **NOTE:** end of spring must go in recessed side of washer.

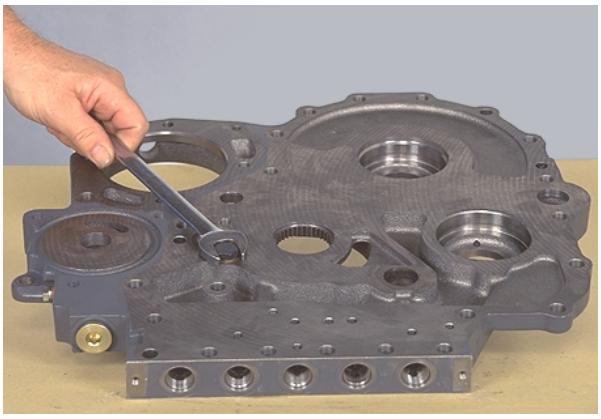


Figure 323

Install plug and seal washer.

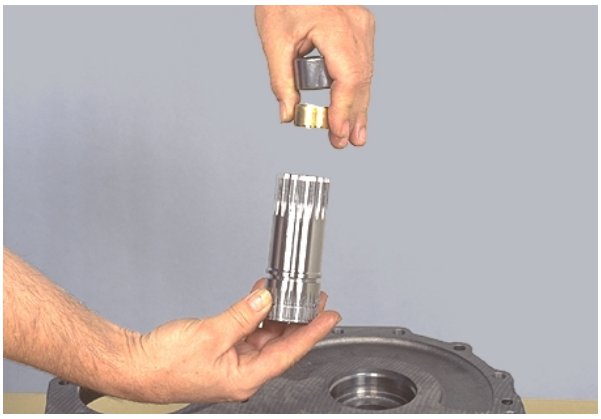


Figure 324

If stator support bushing was removed, install bushing in support. Install needle bearing in stator support.

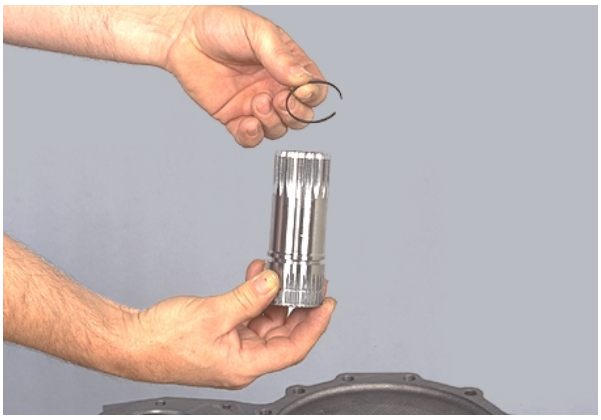


Figure 325

Install stator support oil sealing ring expander ring.

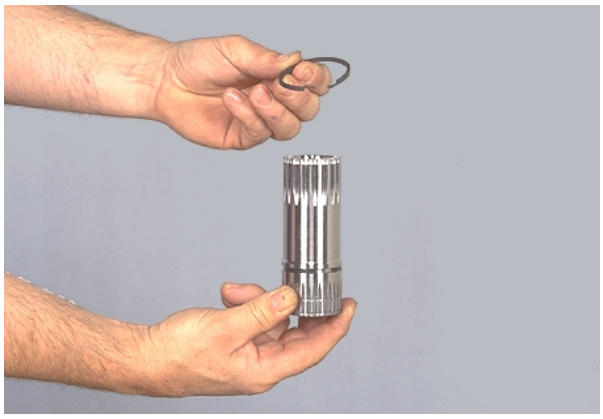


Figure 326

Install oil sealing ring on expander ring.
NOTE: Expander spring gap to be 180 degrees from sealing ring hook joint.

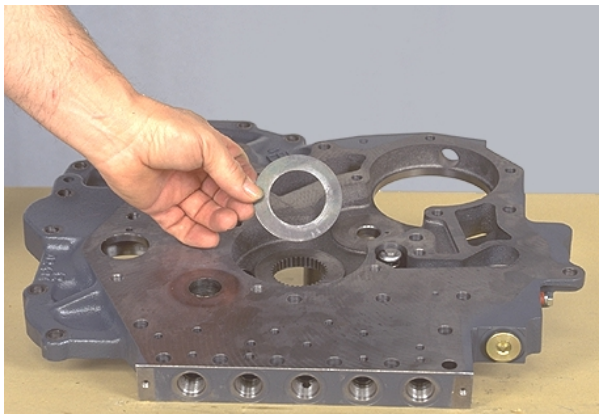


Figure 327

Position impeller hub gear washer on spacer plate.

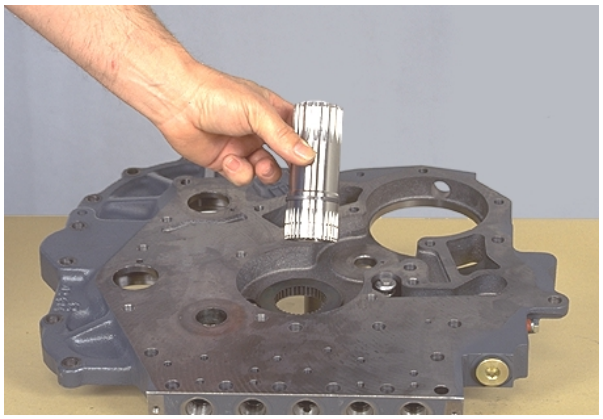


Figure 328

Install stator support through washer and spacer plate.

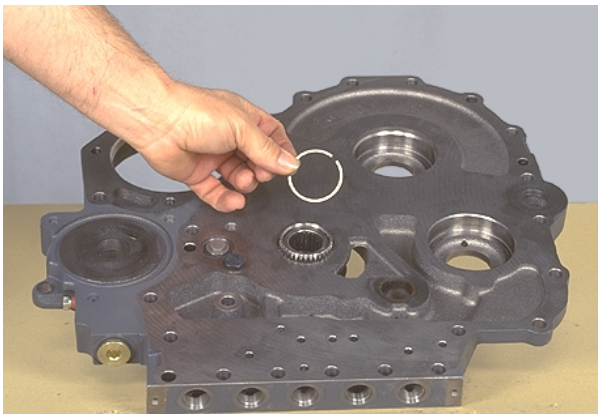


Figure 329

Install stator support locating ring.

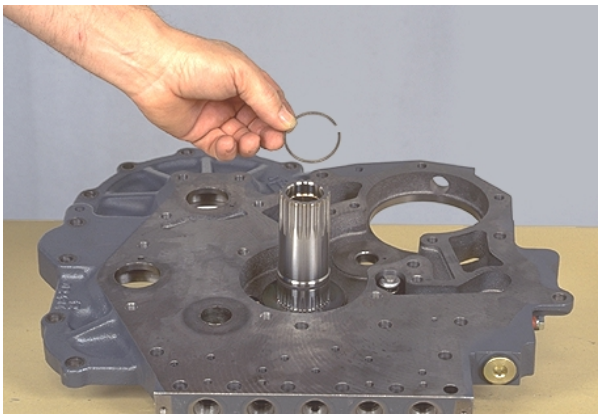


Figure 330

Push support back through spacer until locating ring shoulders in support bore.
Turn spacer plate over and install support retaining ring.

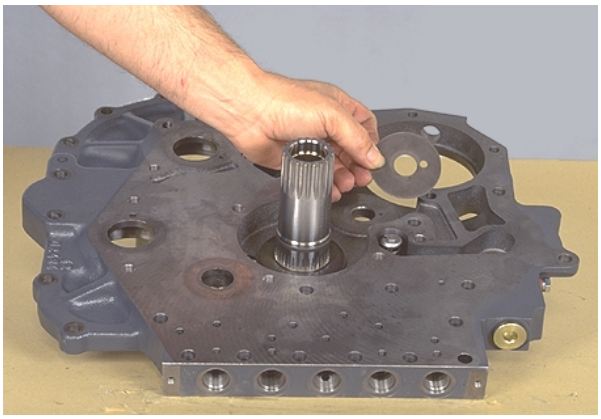


Figure 331

Position pump drive idler shaft washer on spacer plate.

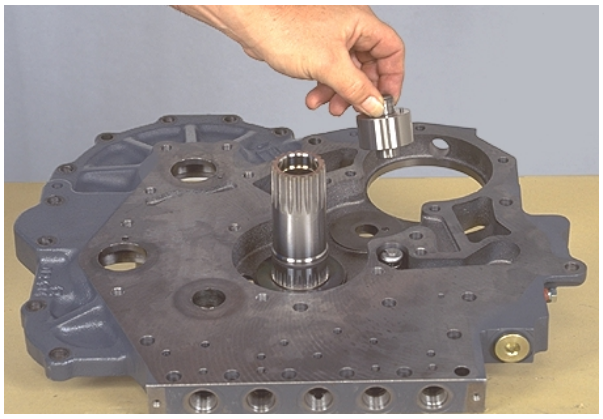


Figure 332

Position pump drive shaft through washer and into spacer plate. Align roll pin in spacer plate.

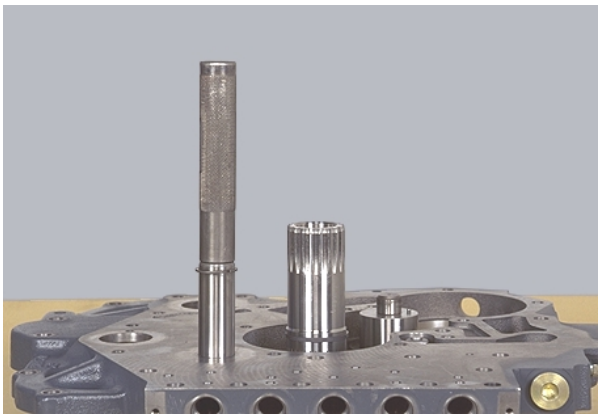


Figure 335

Support spacer plate and press reverse idler shaft into position and tight against locating ring.

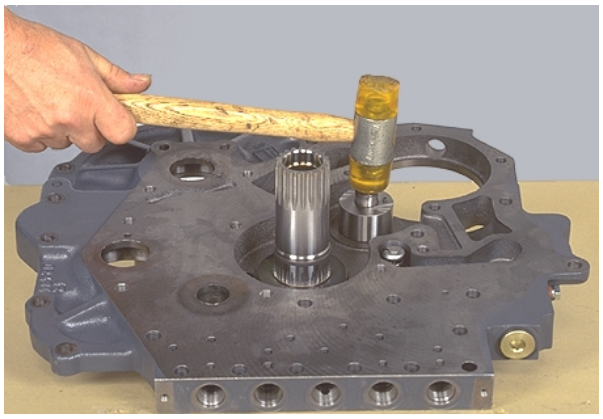


Figure 333

Tap shaft into place.

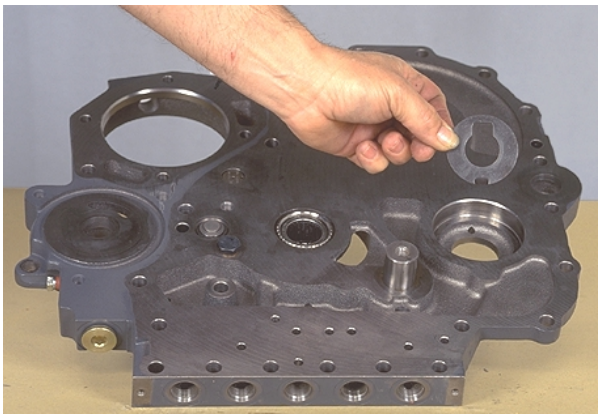


Figure 336

Turn spacer plate over and position tanged thrust washer on shaft, being certain tang in washer is in notch in spacer plate.

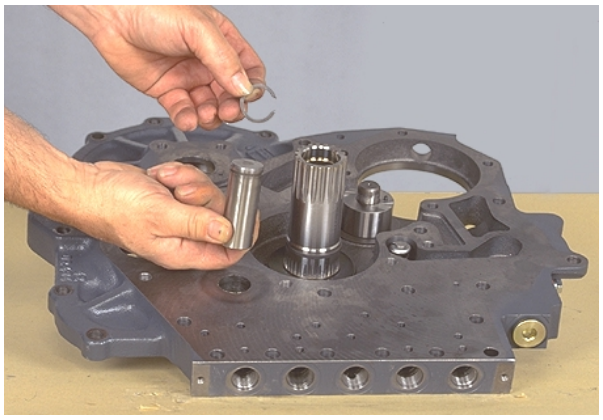


Figure 334

Install locating ring on reverse idler shaft.

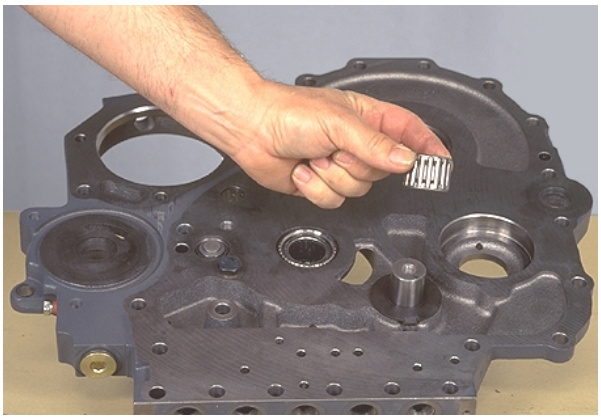


Figure 337

Position idler gear needle bearing on shaft. Lubricate bearing.

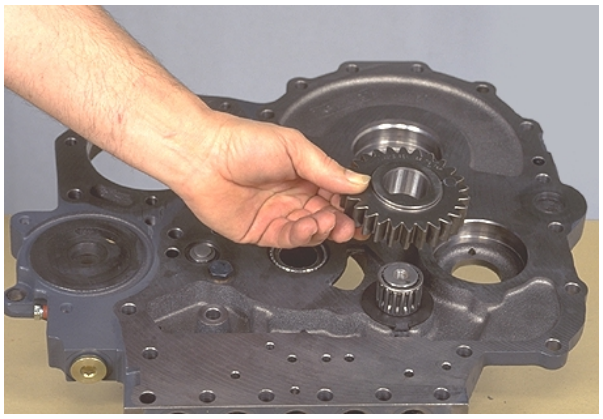


Figure 338

Position idler gear on bearing.

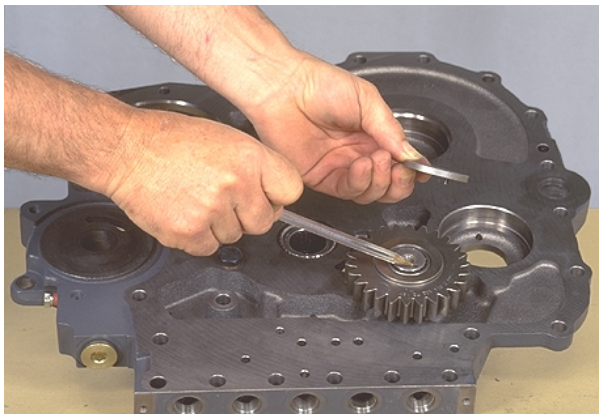


Figure 339

Position idler gear end plate and roll pin on idler shaft aligning roll pin with hole in idler shaft.

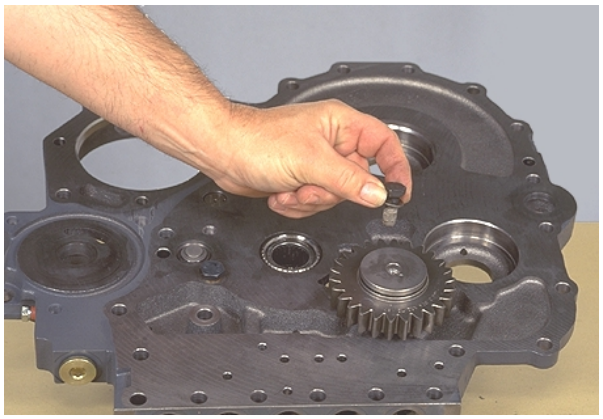


Figure 340

Install end plate capscrew and washer.

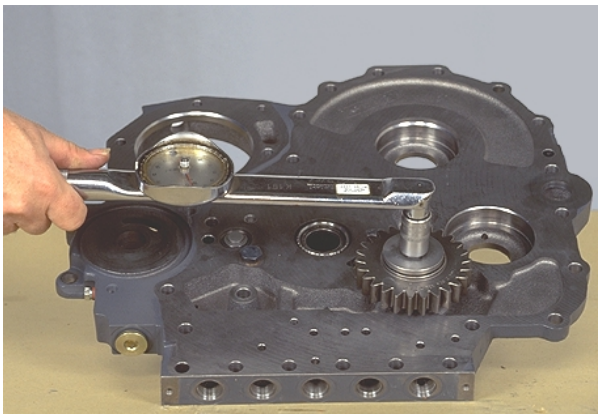


Figure 341

Tighten capscrew to specified torque (see torque chart).

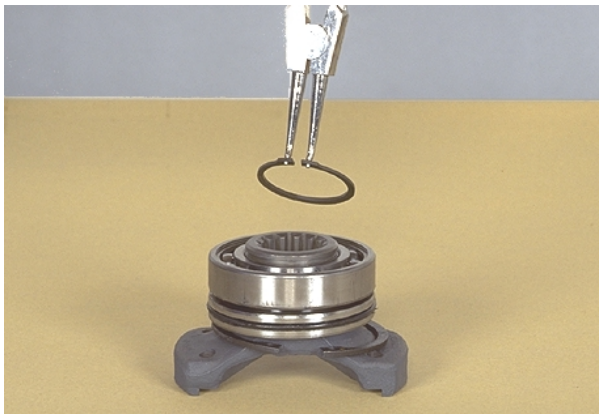


Figure 342

Remove flange to bearing retainer ring.
NOTE: do not remove expansion plug unless it is being replaced.

Figure 345

Oil seal sleeve and “O”-ring removed.

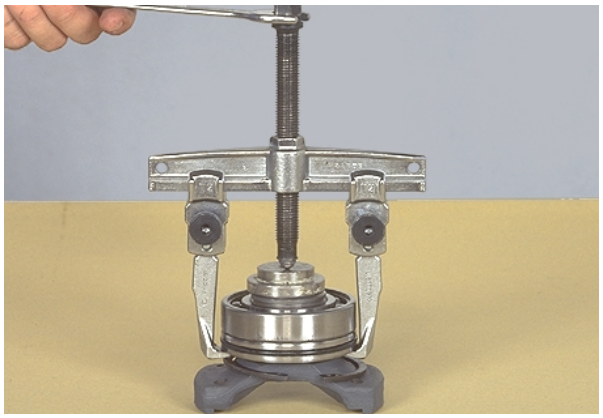


Figure 343

Using a bearing puller as shown, remove bearing.

Figure 346

Remove oil seal from sleeve.

Figure 344

Bearing removed.

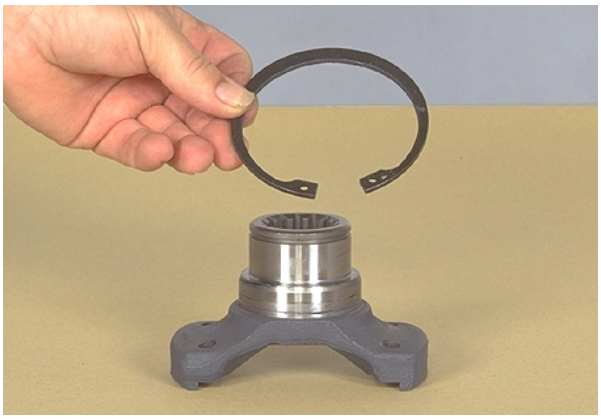


Figure 347

Remove oil seal retainer ring from output flange.

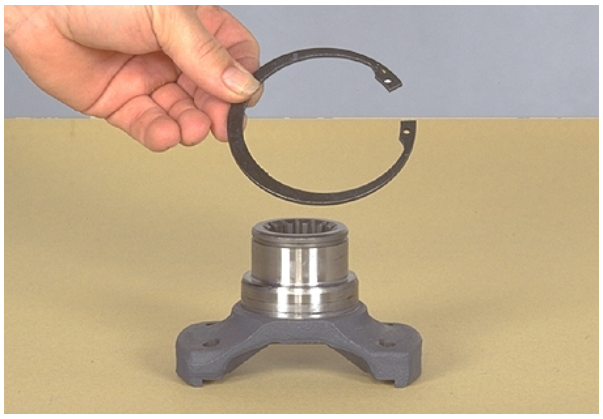


Figure 348

Position bearing retainer ring on output flange. Refer to the cleaning and inspection pages.

Figure 351

Press bearing on output flange.

Figure 349

Apply a very light coat of permatex #2 to the outer diameter of the output flange oil seal, press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve, and lip of seal must be in.

Figure 352

Install bearing to flange retainer ring.

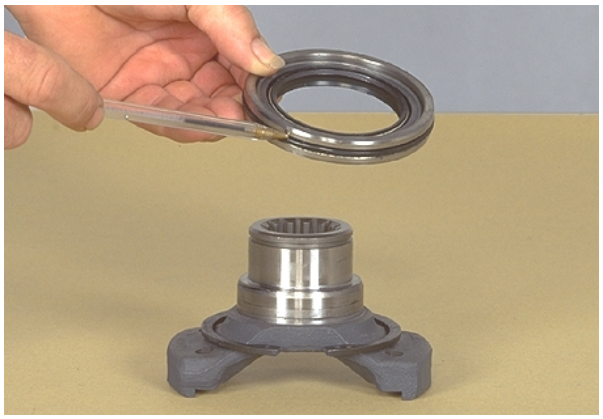


Figure 350

Install new “O”-ring on oil seal sleeve.
Position oil seal sleeve assembly on output flange.
NOTE: recessed position of oil seal and sleeve must be up, with lip of seal up. This leaves a space between oil seal and output bearing.

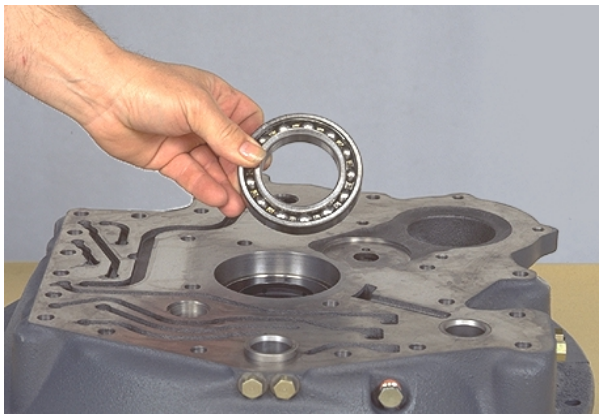


Figure 353
Remove torque converter bearing.

Figure 356
Remove converter housing plug (high and 3rd clutch shaft).

Figure 354
Remove oil distributor.

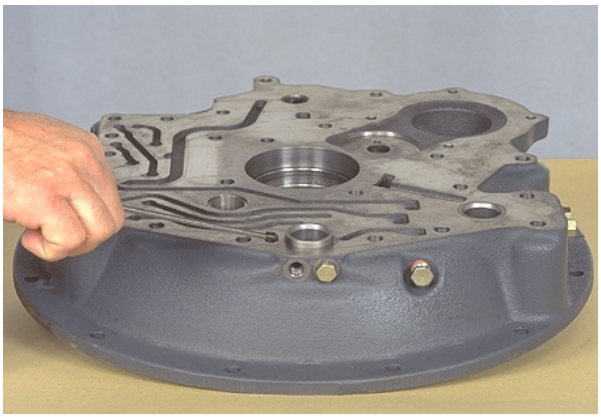


Figure 357
Remove oil distributor sleeve set screw.

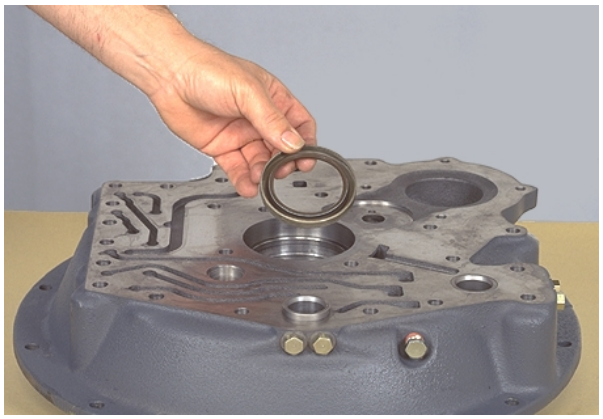


Figure 355
Remove converter oil seal.

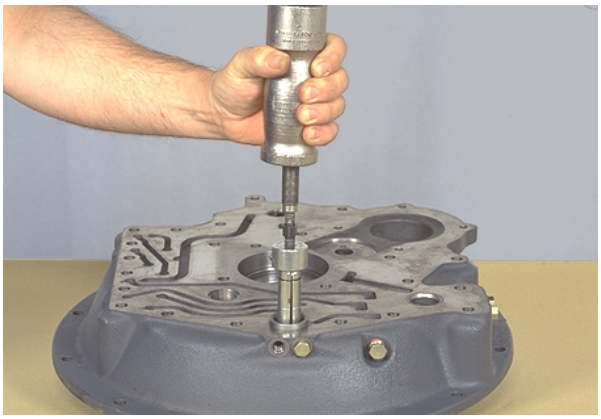


Figure 358
Using a hammer puller as shown, remove oil distributor sleeve (high and 3rd).

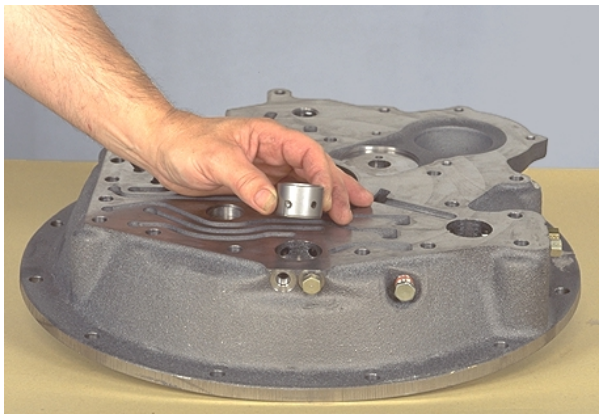


Figure 359
Sleeve removed.

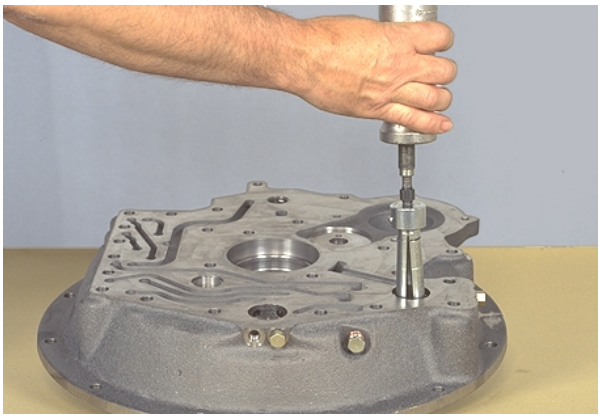


Figure 362
Using a hammer puller as shown, remove oil distributor sleeve (1st and 2nd).

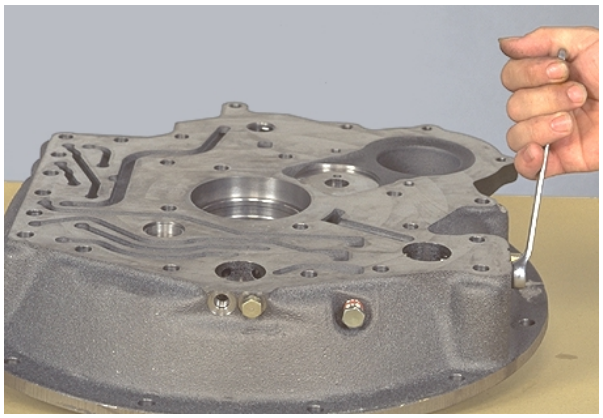


Figure 360
Remove converter housing plug (1st and 2nd clutch shaft).

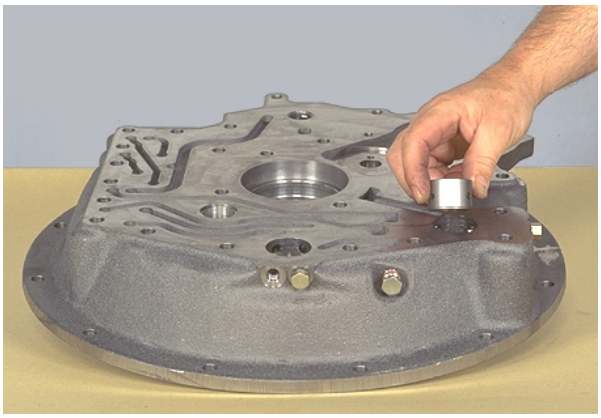


Figure 363
Sleeve removed.

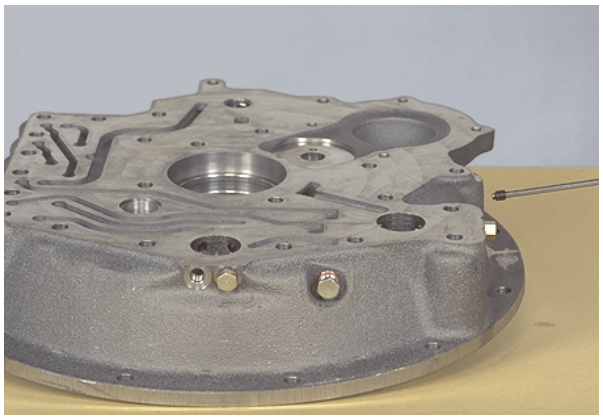


Figure 361
Remove oil distributor sleeve set screw.

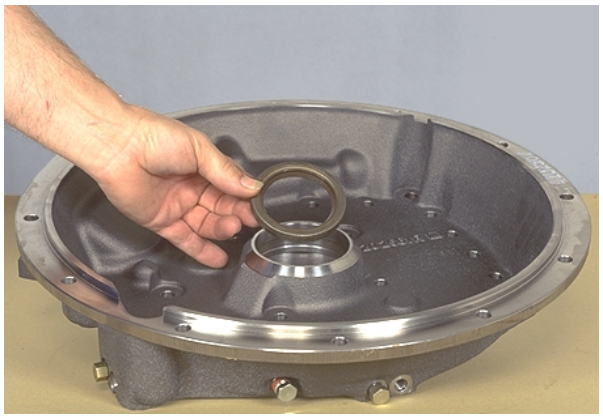


Figure 364

Apply a very light coat of Permatex #2 to the outer diameter of the converter housing oil seal. Press seal in housing with lip of seal in. Refer to the cleaning and inspection pages.

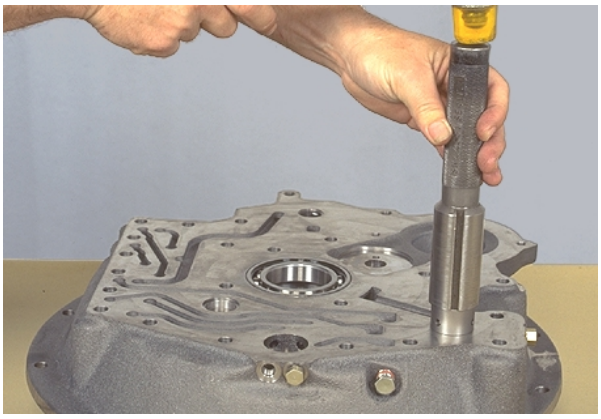


Figure 367

Install 1st and 2nd clutch shaft oil distributor sleeve in converter housing, with inside diameter chamfer up, and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.

Figure 365

Install oil distributor in converter housing with long hub towards oil seal.

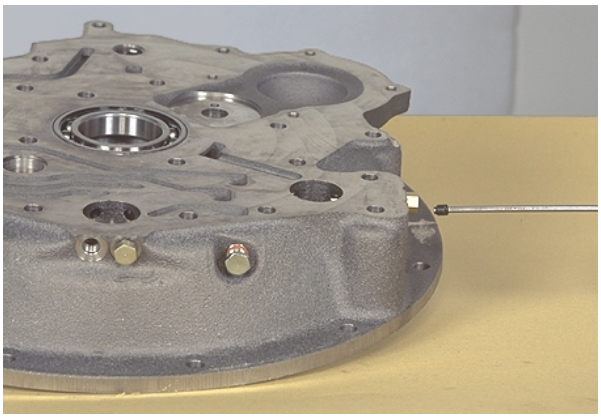


Figure 368

Apply Loctite #243 to threads of sleeve set screw (**NOTE:** this screw has a hole in it. Use caution as not to allow any loctite to plug hole). Install set screw in converter housing and in oil distributor.

Figure 366

Press converter bearing in housing against shoulder.

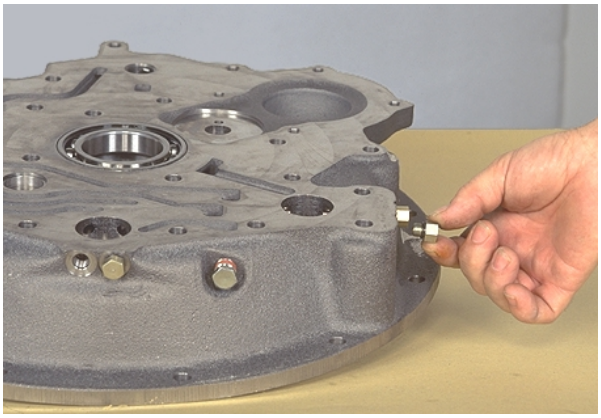


Figure 369

Install set screw plug.

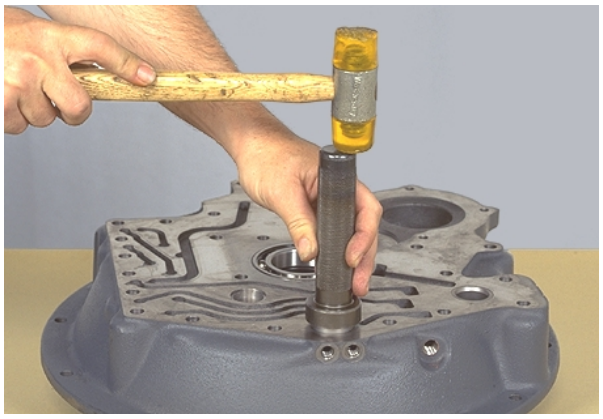


Figure 370

Install high-3rd clutch shaft oil distributor sleeve in converter housing with inside diameter chamfer up and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.

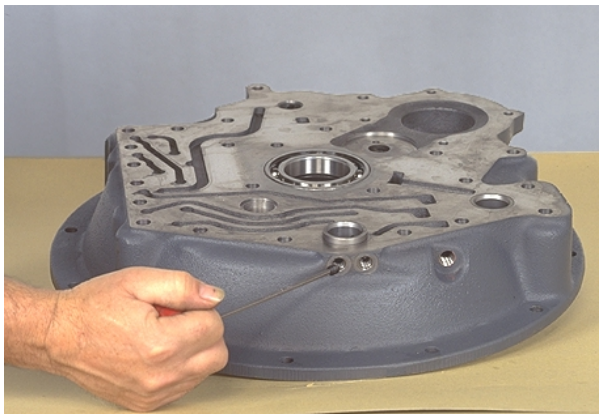


Figure 371

Apply loctite #243 to threads of sleeve set screw. (**NOTE:** this set screw has a hole in it. Use caution as not to allow any loctite to plug hole). Install set screw in converter housing and in oil distributor.

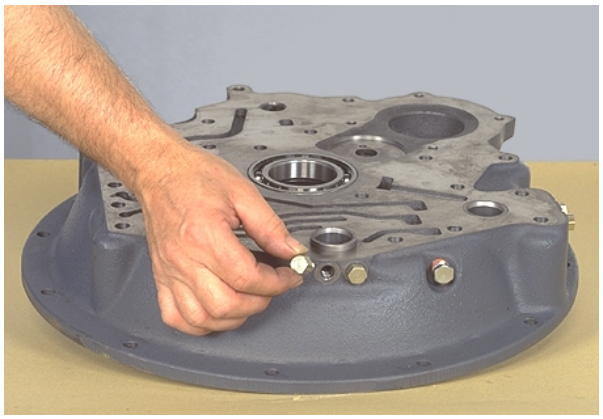


Figure 372

Install set screw plug.

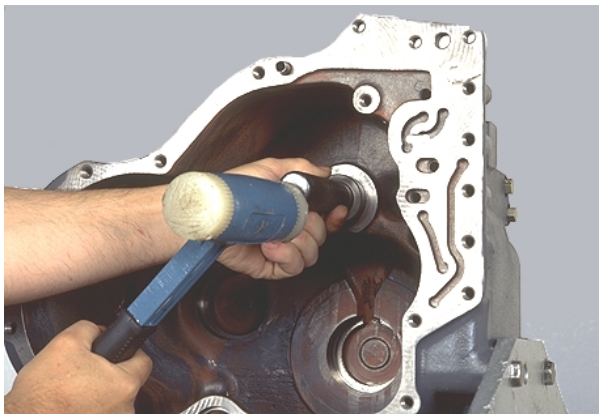


Figure 373

Install forward - reverse oil distributor sleeve in transmission case with inside diameter chamfer out (towards front of transmission) and the notch in the distributor aligned up withthe retaining set screw hole in the transmission case. Refer to the cleaning and inspection pages.

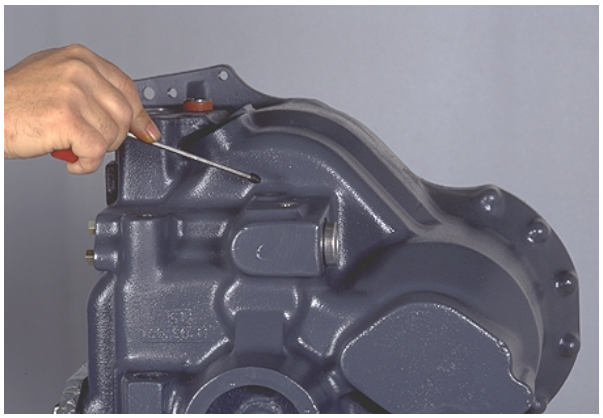


Figure 374

Apply Loctite #243 and install set screw in transmission case and in oil distributor sleeve.

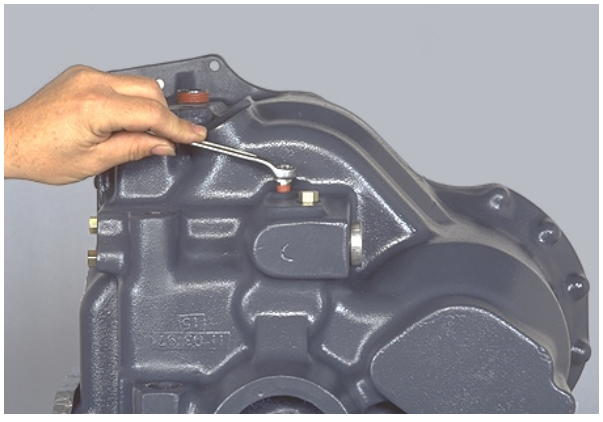


Figure 375

Install set screw plug.

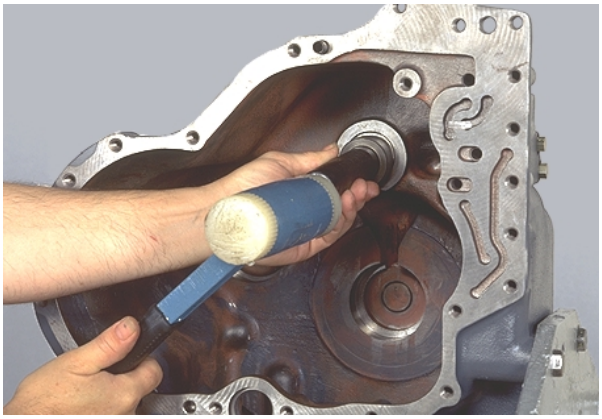


Figure 376

Install reverse and forward clutch shaft rear bearing in transmission case.

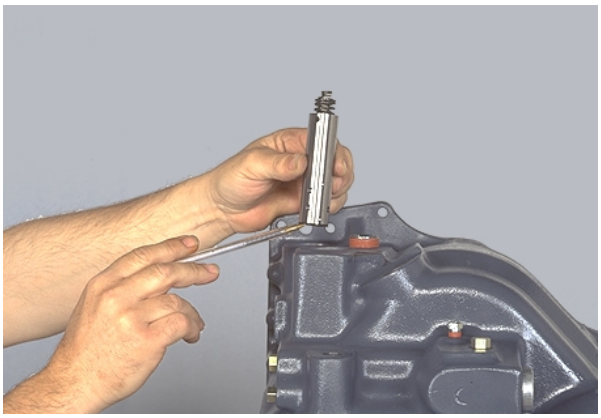


Figure 377

Position a new “O”-ring on lower end of the modulation valve sleeve and spring assembly.
Install “O”-ring on other valve sleeve.
NOTE: for single modulation and hydraulic inching see section 11.1.

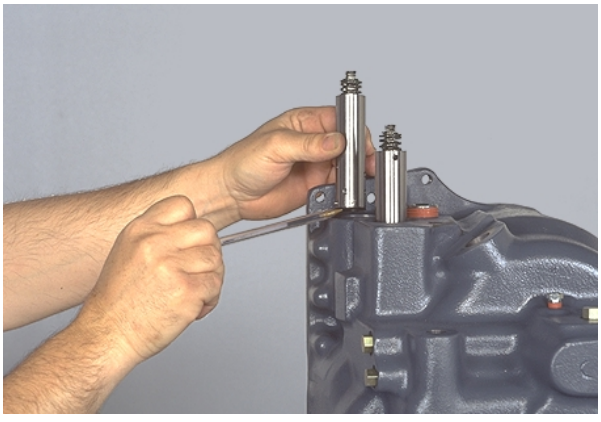


Figure 378

Install valve or valves in transmission case.

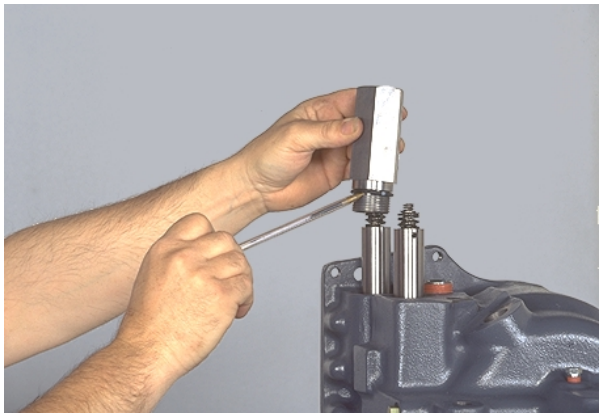


Figure 379

Position a new “O”-ring on modulator valve housing.

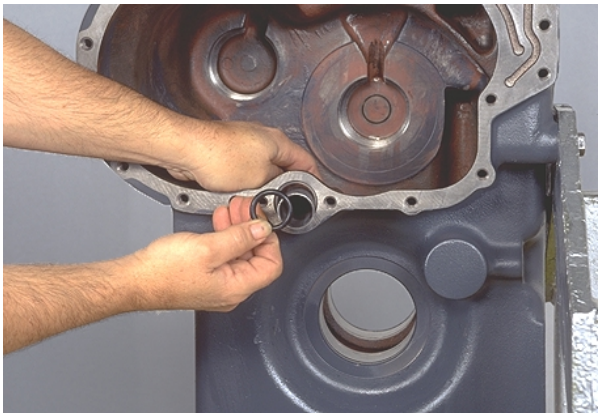


Figure 382

Push supply tube through opening in case and install “O”-ring.

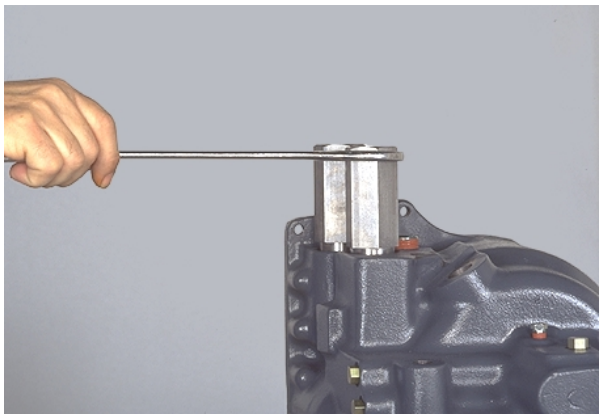


Figure 380

Install housing over sleeve and spring assembly and tighten to 60-65 LBF-FT [81-88 N.m].

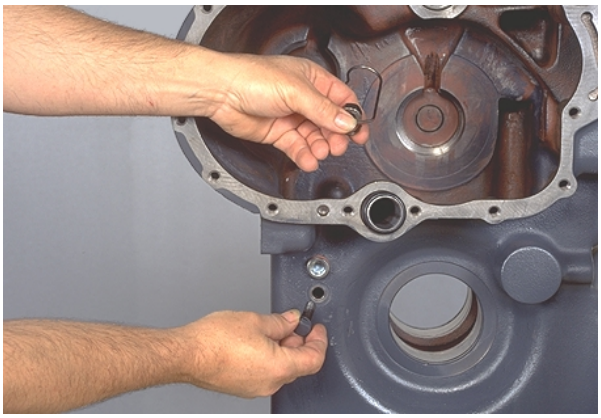


Figure 383

Install supply tube mounting screw, seal washer, clip, washer and nut. Tighten mounting screw securely (see figure 384).

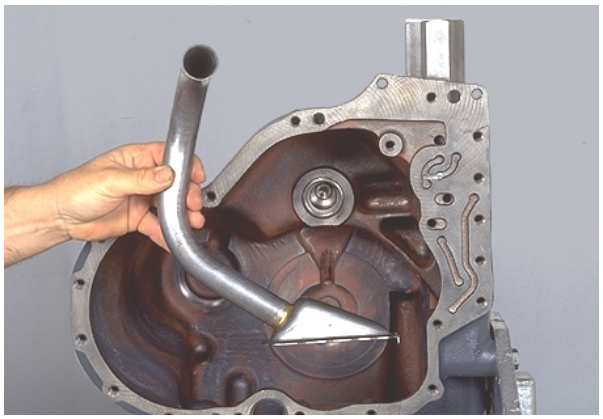


Figure 381

Position supply tube and screen assembly in transmission case sump.

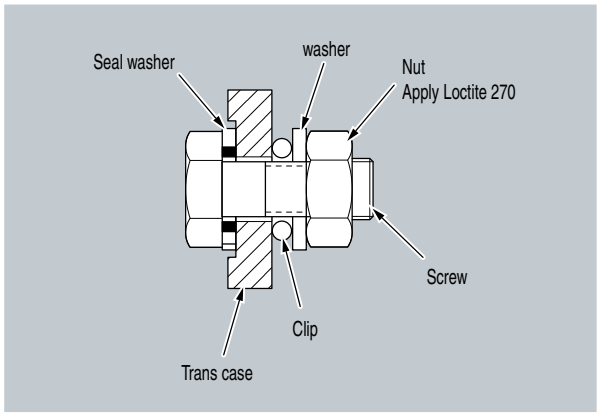


Figure 384

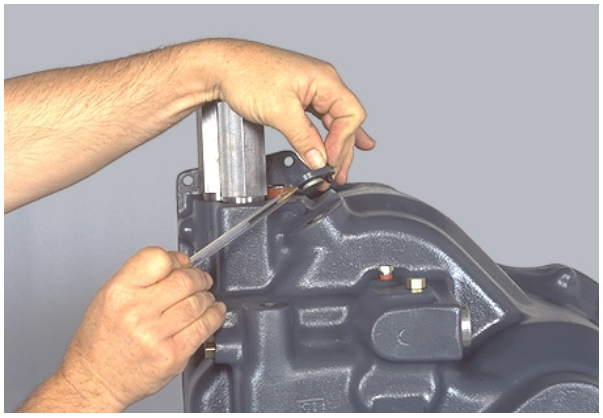


Figure 385
Install sensor hole plug and “O”-ring.

Figure 388
Install output shaft inner bearing locating ring in rear of transmission.

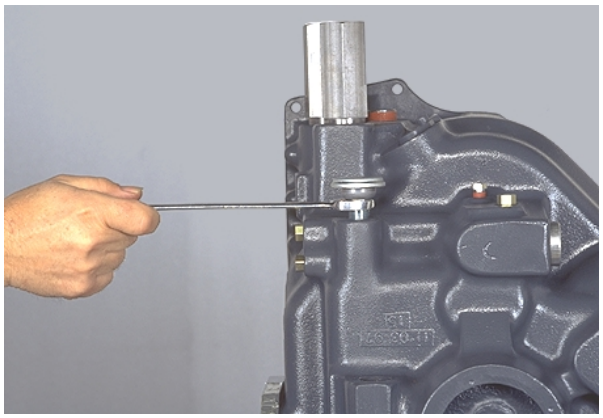


Figure 386
Install air breather.

Figure 389
Install rear bearing in case against locating ring.

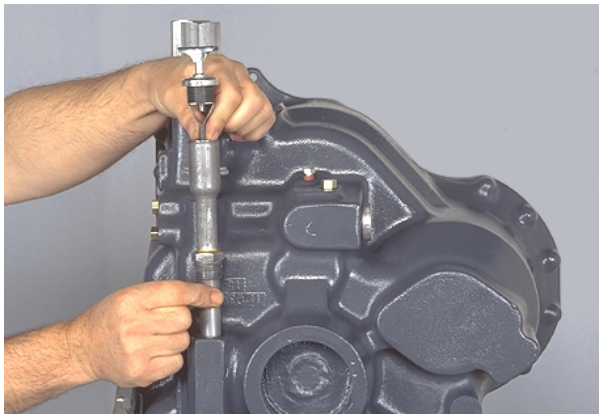


Figure 387
Install dipstick tube and dipstick.

Figure 390
Install new “O”-ring on rear oil seal sleeve.

Figure 391

Apply a very light coat of Permatex #2 to the outer diameter of the output flange oil seal, press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve and lip of seal must be in. Position oil seal sleeve in transmission case with recessed portion of oil seal towards output bearing. This leaves space between oil seal and output bearing.

Figure 392

Install oil seal sleeve retainer ring.

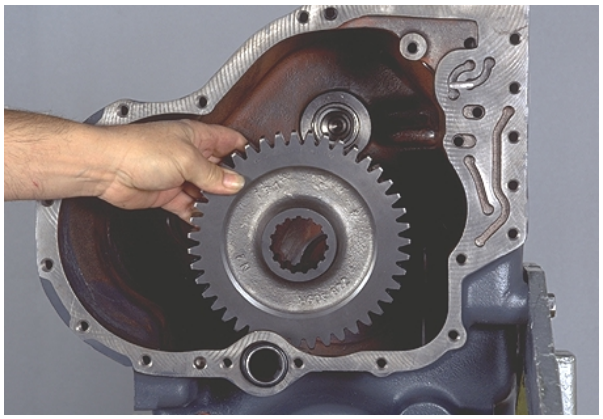


Figure 393

From front of transmission case, position output gear with long hub of gear towards front.

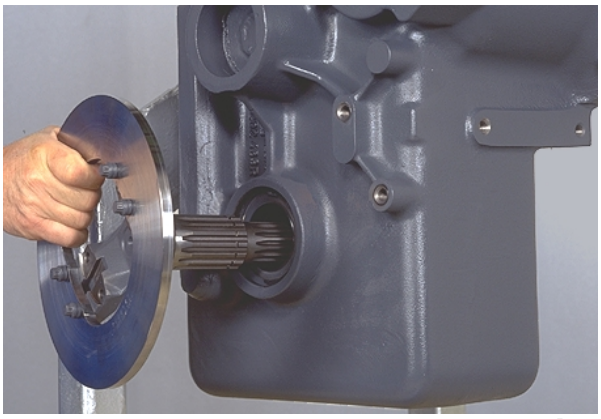


Figure 394

Install rear output flange and shaft through ouput oil seal. Align splines on shaft with splines on output gear. Install shaft through gear. Use caution as not to damage oil seal. Brake disc is an option and will not be on all units.

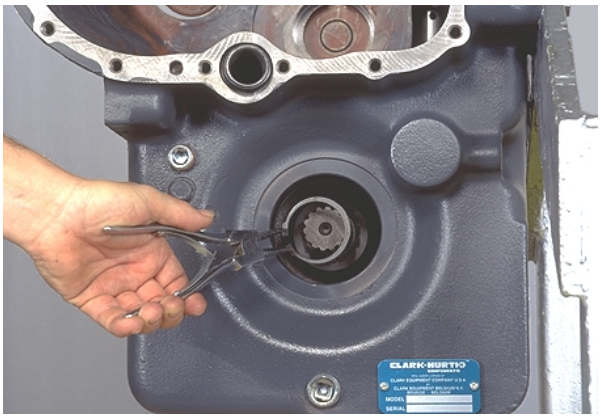


Figure 395

Install output shaft to output gear retainer ring.

Figure 396

Install front output shaft bearing locating ring.

Figure 397

Position front output flange and bearing assembly on output shaft. Using snap ring pliers as shown. Squeeze snap ring ends together and tap flange assembly into case until snap ring can seat in snap ring groove.

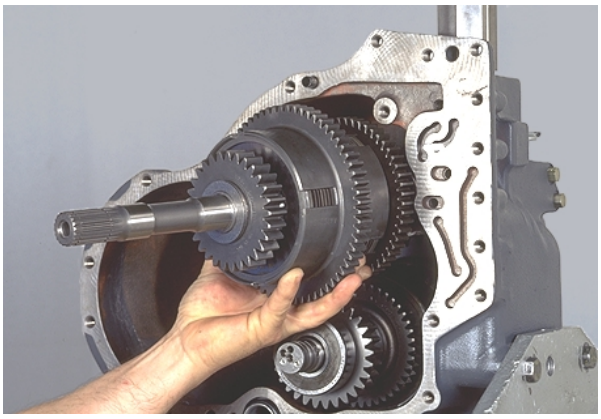


Figure 400

Install forward and reverse clutch assembly.

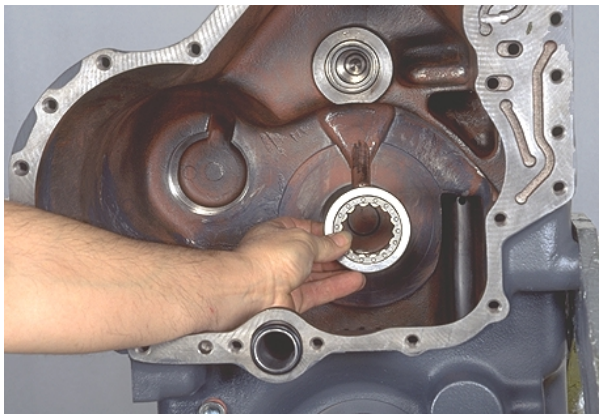


Figure 398

Install high and 3rd clutch shaft rear bearing outer race.

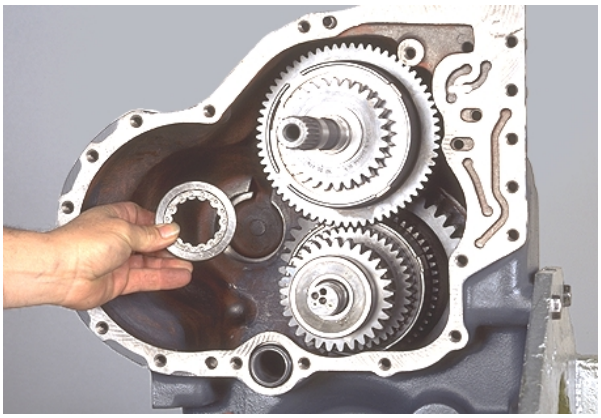


Figure 401

Install 1st and 2nd clutch shaft rear bearing outer race.

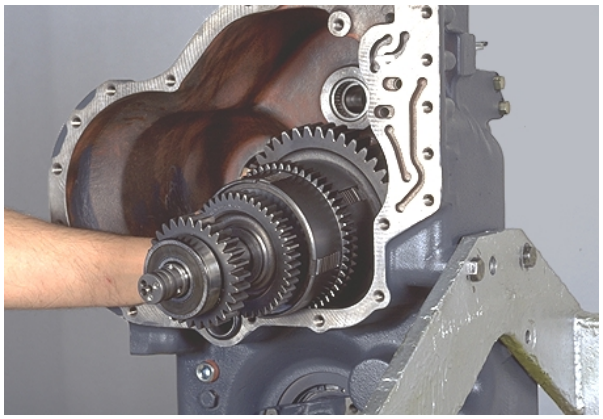


Figure 399

Install high and 3rd clutch assembly.

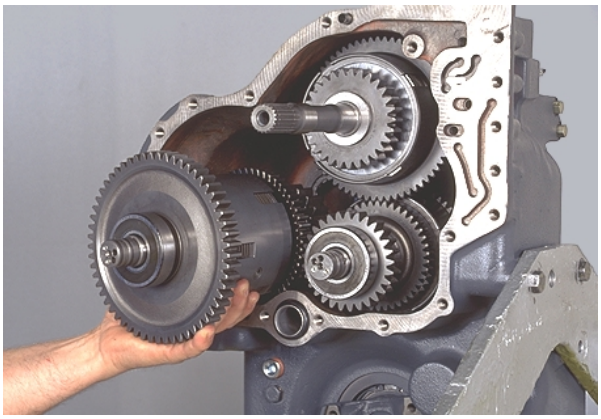


Figure 402

Install 1st and 2nd clutch assembly.

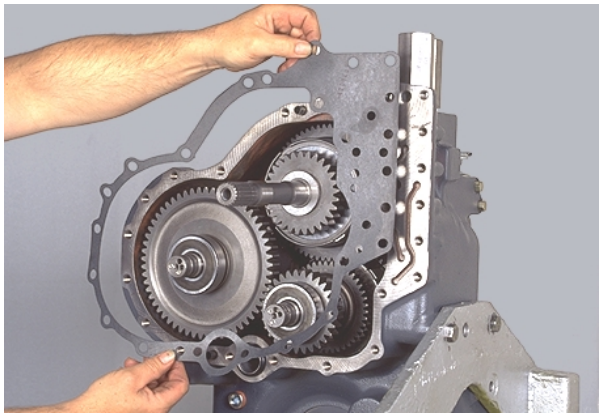


Figure 403

Position new transmission case to converter housing gasket on transmission case. A light coat of grease will hold gasket in position.

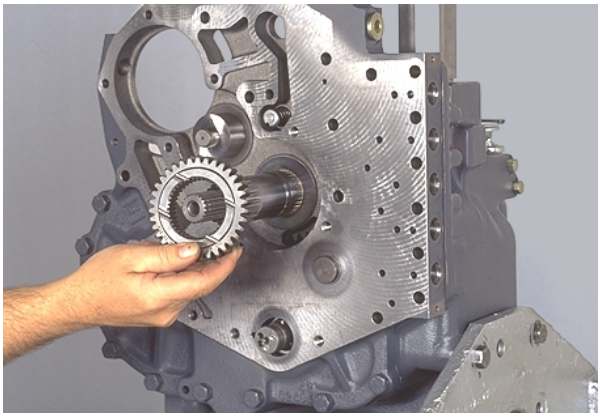


Figure 406

Position impeller hub gear on stator support.

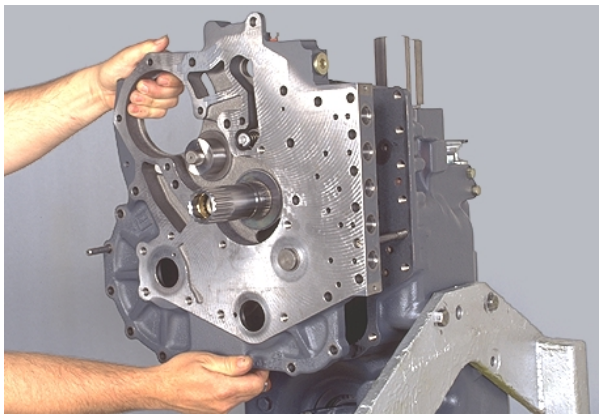


Figure 404

Install spacer plate assembly on transmission, aligning clutch shaft with openings in spacer plate.
Use caution as not to damage oil sealing rings.

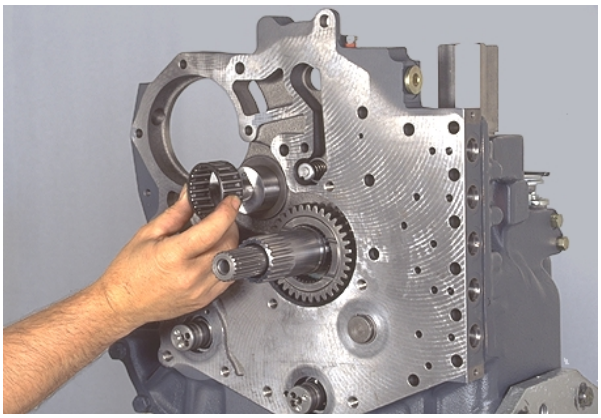


Figure 407

Install pump idler gear bearing on idler shaft.

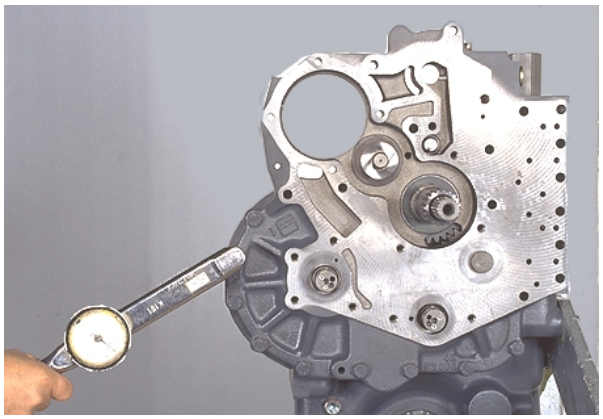


Figure 405

Spacer plate must be tight against transmission case.
Do not use bolts to pull spacer plate and case together.
Tap spacer plate into position at dowel pins.
Install spacer plate to transmission case capscrews.
Tighten capscrews to specified torque.

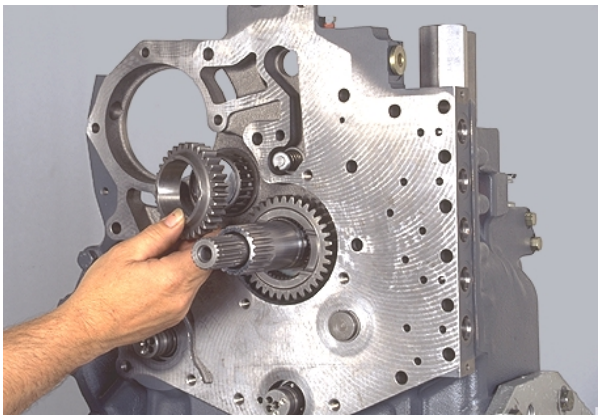


Figure 408

Install pump idler on bearing.

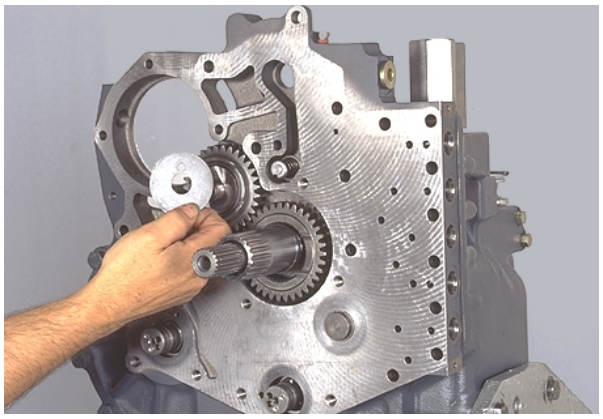


Figure 409

Install idler gear thrust washer, aligning hole with roll pin.

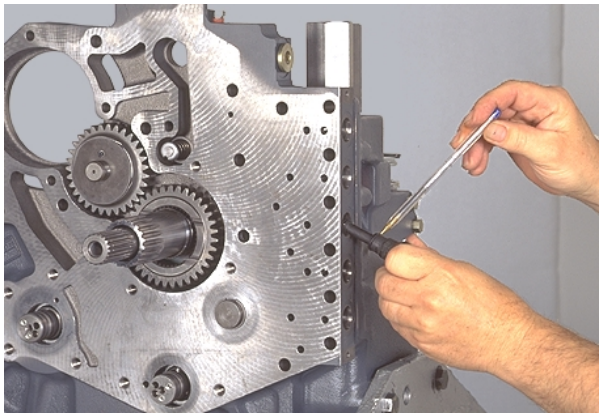


Figure 410

Install bore plug and “O”-rings in center hole on 3-speed transmissions only. Refer to the cleaning and inspection pages.

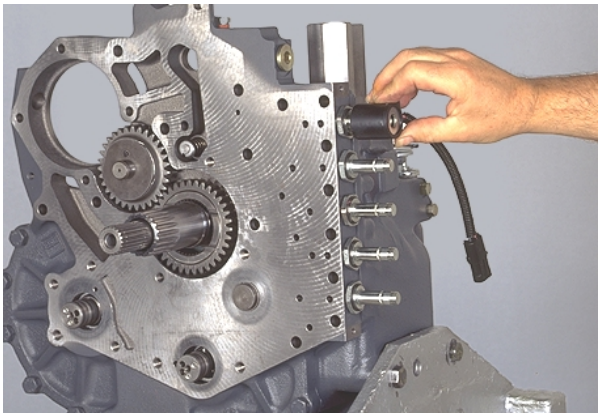


Figure 413

With cartridge to coil “O”-ring in place, position solenoid coil on cartridge.

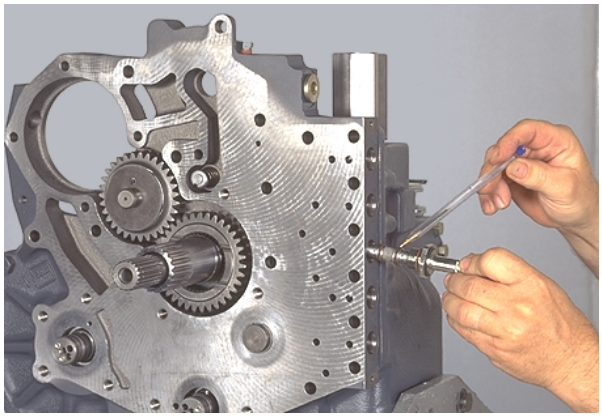


Figure 411

With “O”-rings in position, install solenoid cartridges.

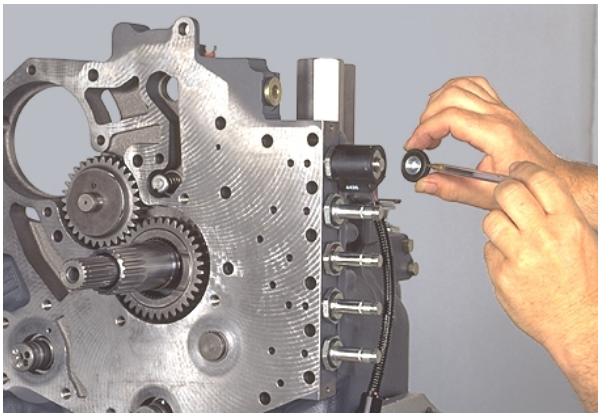


Figure 414

With new “O”-ring in position, install coil to cartridge nut. Tighten cartridge nut per assembly instruction drawing.

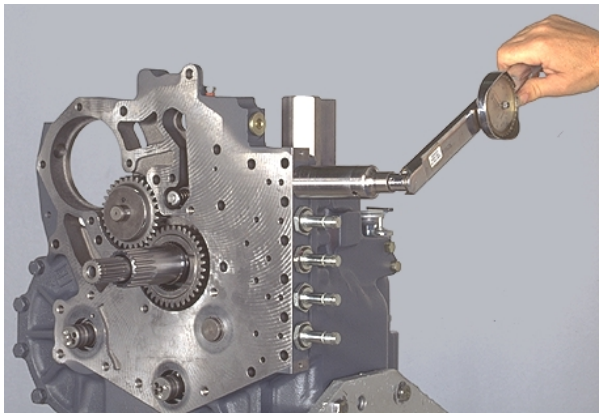


Figure 412

Tighten cartridges to specified torque. See assembly instruction drawing.

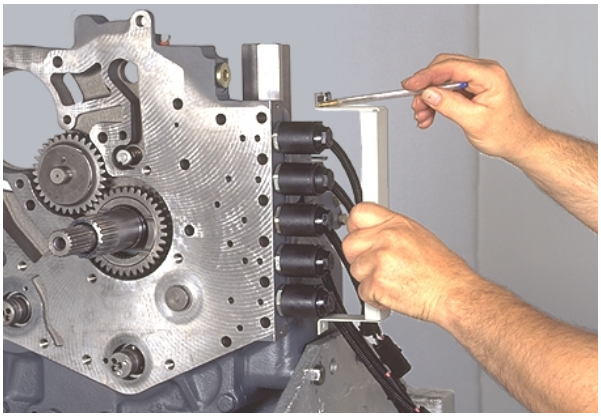


Figure 415

Install solenoid protection cover and mounting screws. Tighten screws to specified torque.

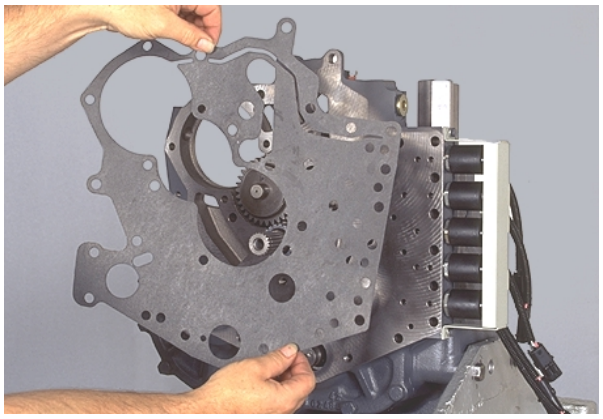


Figure 416

Position spacer to converter housing gasket on spacer. A light coat of grease will hold gasket in place.

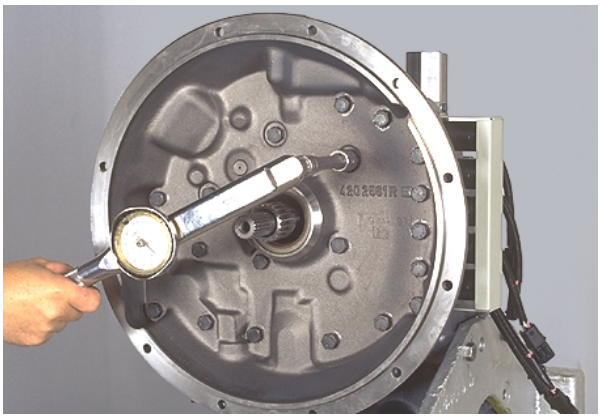


Figure 419

Tighten bolts to specified torque. See note in figure 417.

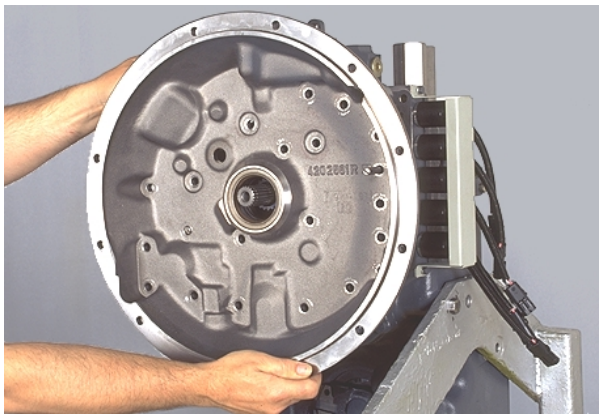


Figure 417

The use of aligning studs will facilitate converter housing to spacer installation. The transmission could be laid down to align the end of the clutch shafts into sealing ring sleeves in converter housing. Do not force this operation. Converter housing must be tight against transmission spacer.

NOTE: Do not use bolts to pull converter housing in place.

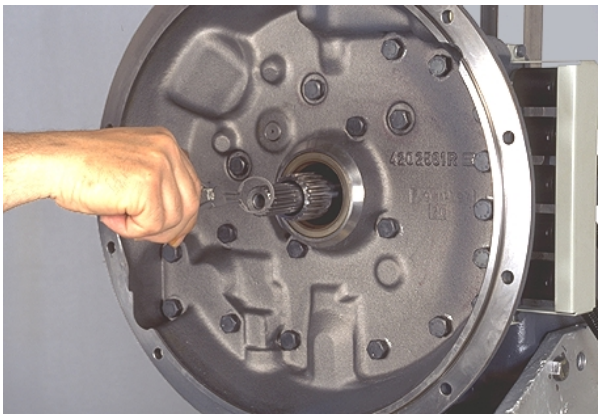


Figure 420

Install converter locating ring on turbine shaft.

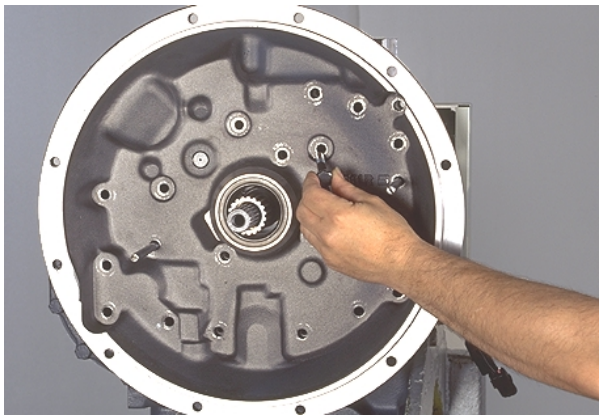


Figure 418

Install converter housing to transmission case screws and lockwashers.
See assembly instructions for proper screw location and installation.

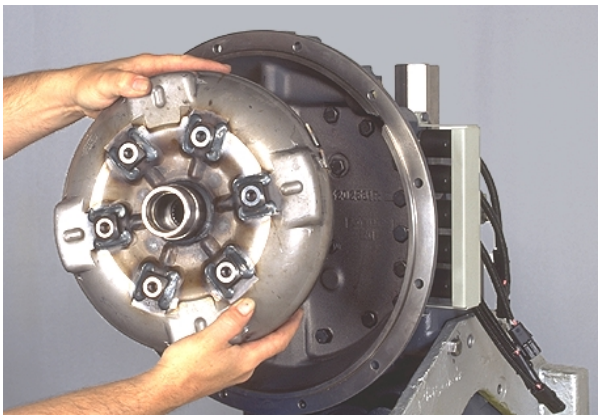


Figure 421

Position converter assembly on stator support and turbine shaft.

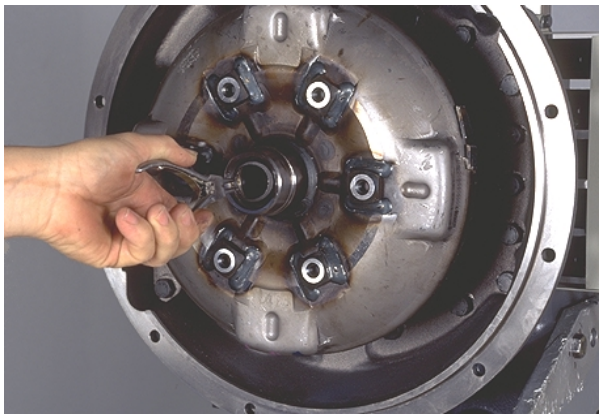


Figure 422
Install converter assembly retainer ring.

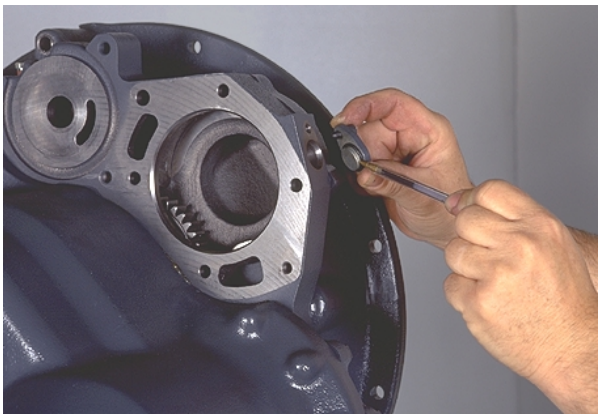


Figure 425
Install sensor hole plug end “O”-ring.

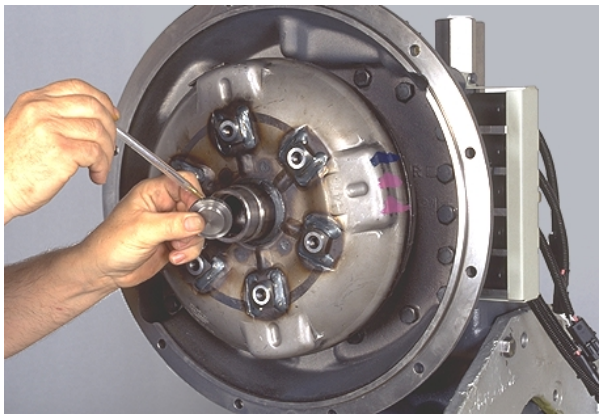


Figure 423
With new “O”-ring in place, install bore plug in converter assembly.

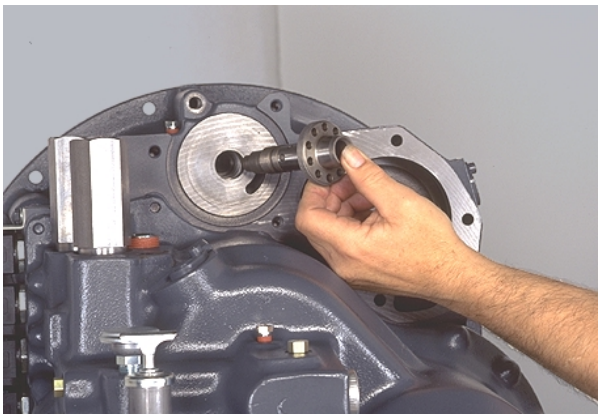


Figure 426
Install regulator sleeve assembly in converter housing.

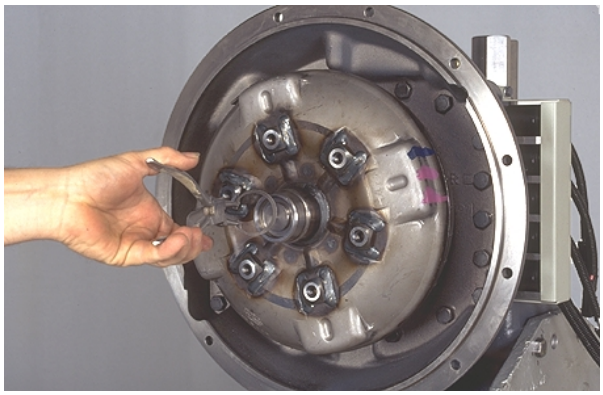


Figure 424
Install bore plug retainer ring.

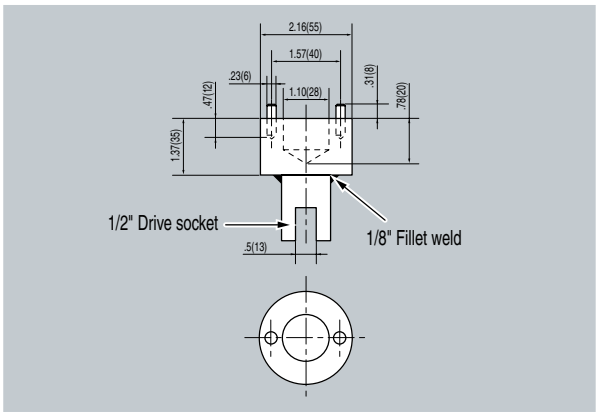


Figure 427
Using a special tool tighten sleeve to 45-50 lbf.ft [61.1-67.7 N.m].

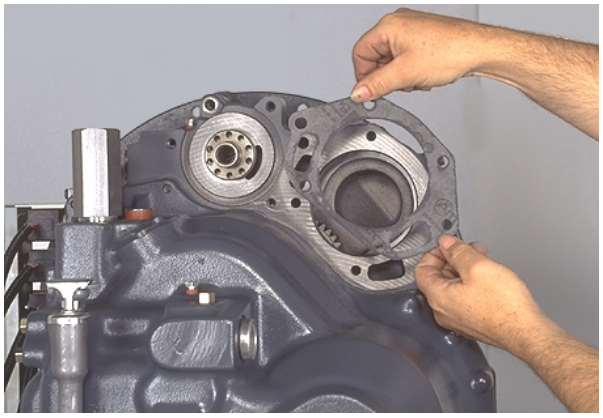


Figure 428

Position new charging pump to converter housing gasket.

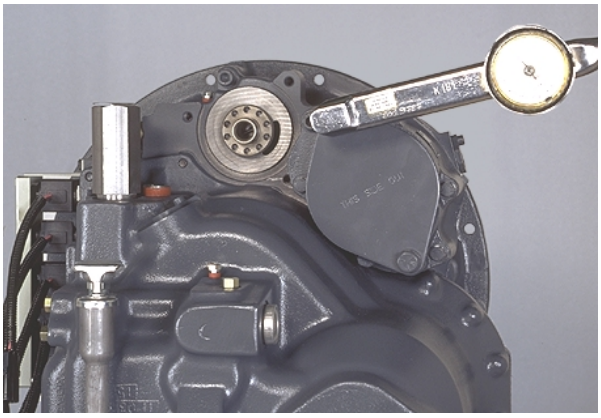


Figure 431

If auxiliary pump is used, it is not necessary to install the permanent pump hole cover. With new gasket in place, install pump hole cover on charging pump. Install bolts and washers and tighten to specified torque. See torque chart.

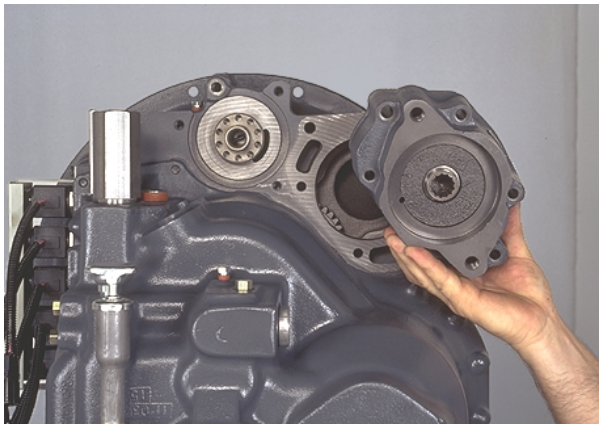


Figure 429

Install charging pump in converter housing.

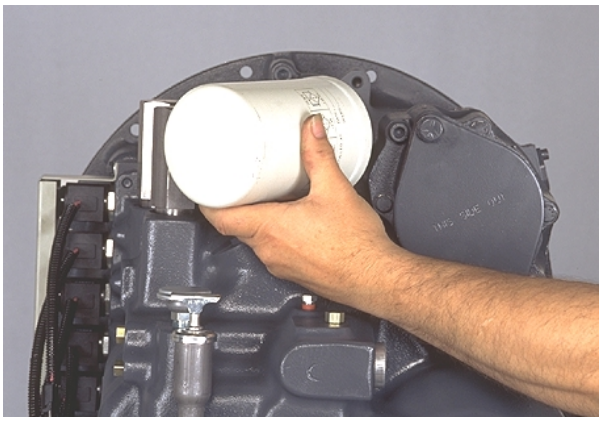


Figure 432

Install oil filter on regulating valve. Tighten filter to 20-25 lbf. ft [27-34 N.m]. If parking brake is not used proceed to figure 436.

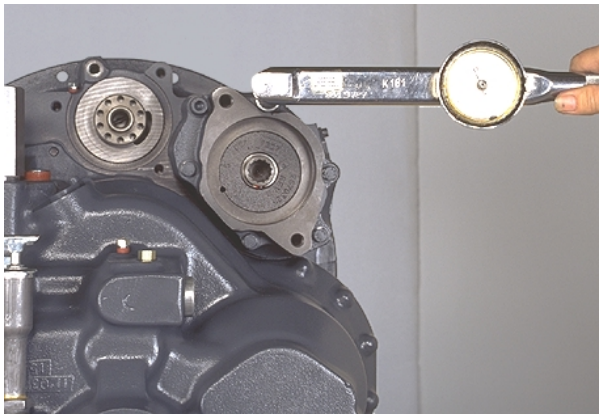


Figure 430

Install charging pump to converter housing bolts and washers and tighten to specified torque.
See torque chart.

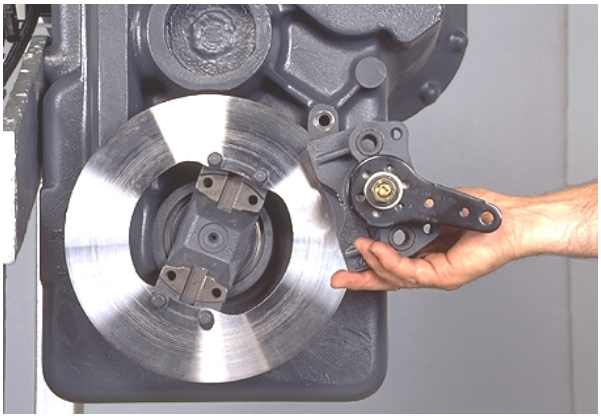


Figure 433

Position calliper brake assembly on brake disc.

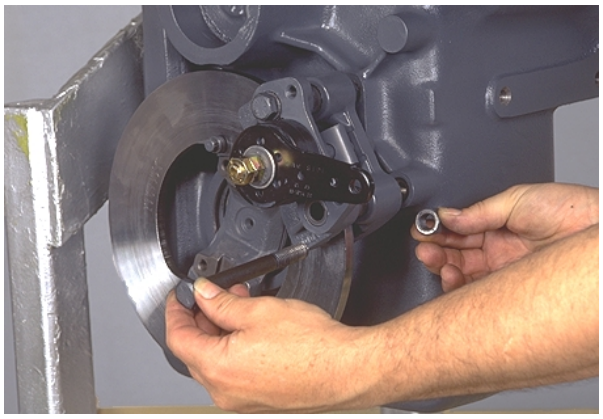


Figure 434

Install calliper brake mounting screw through brake assembly and through lock nut. Apply Loctite #262 to threads and install screw in transmission case.

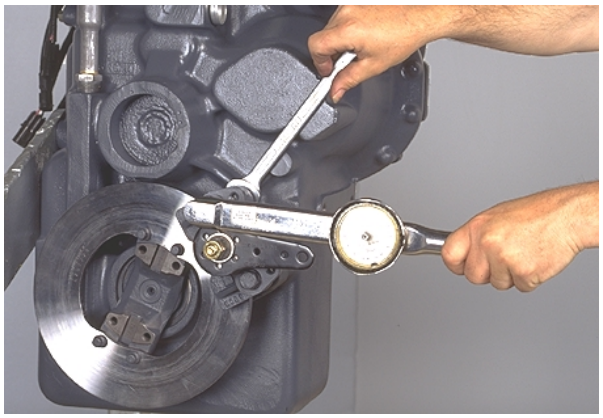


Figure 435

Mounting screws to be installed to allow free movement of calliper pads to disc. Tighten jam nut. See torque chart. See page 4-4 for brake information.

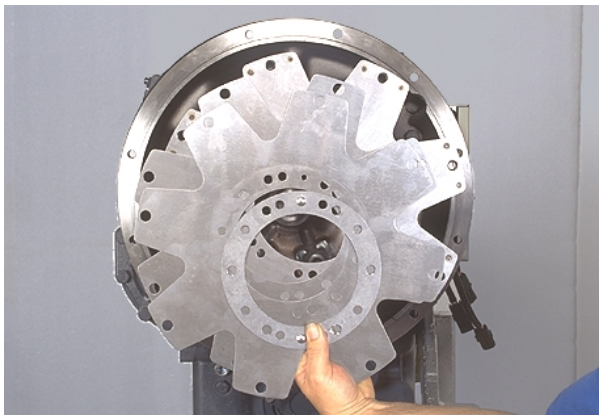


Figure 436

See special section on page 5-1 for drive plate installation.

NOTE: The disc springs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack. Service replacement assemblies are banded together and must be replaced as assembly.

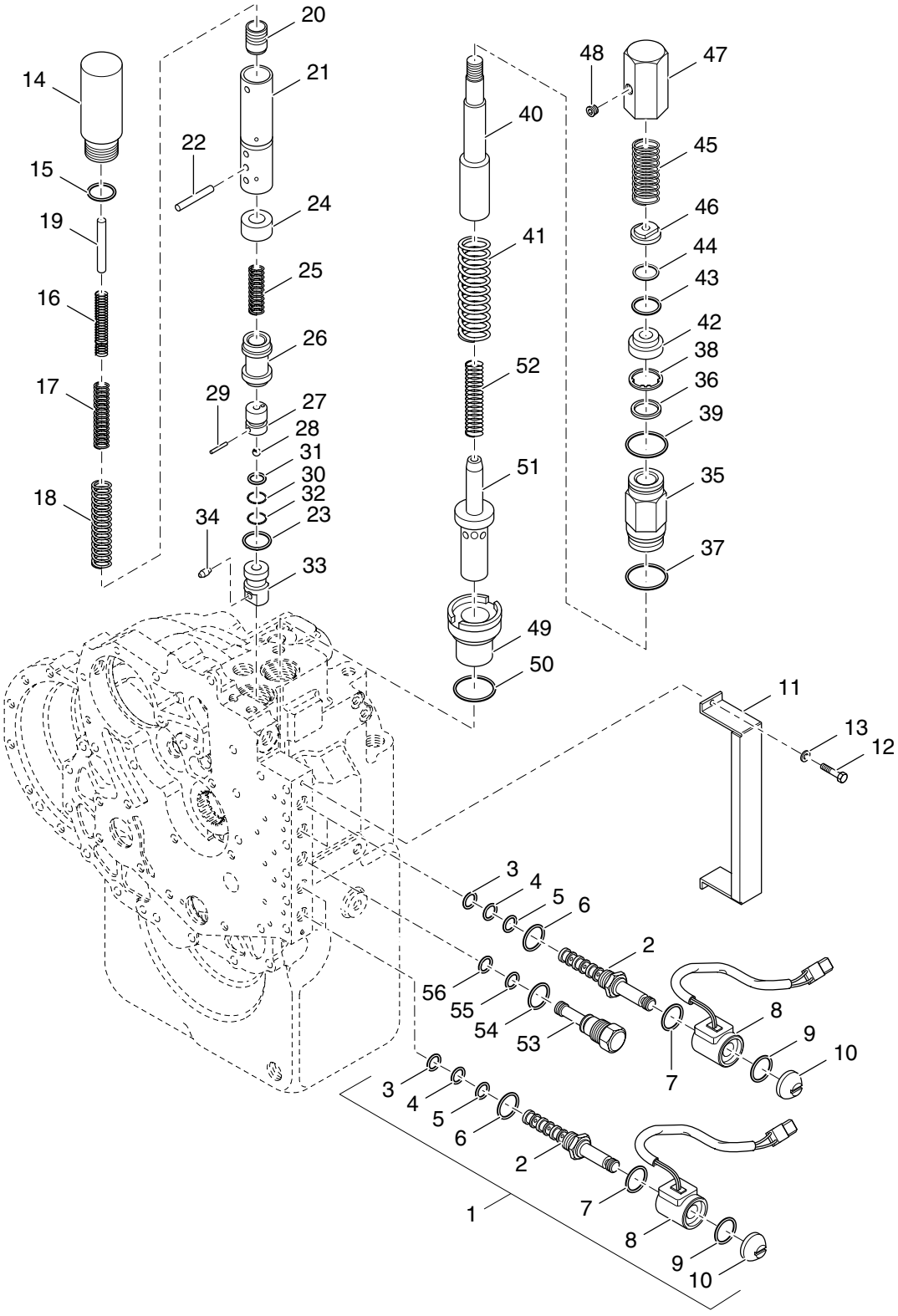
11. OPTIONS

11.1 ELECTRIC CONTROL-SINGLE MODULATION HYDRAULIC ACTUATED INCHING

The information contained herein must be used in conjunction with a T12000 ID section.

11.1.1 Sectional views and parts identification

Refer to following pages.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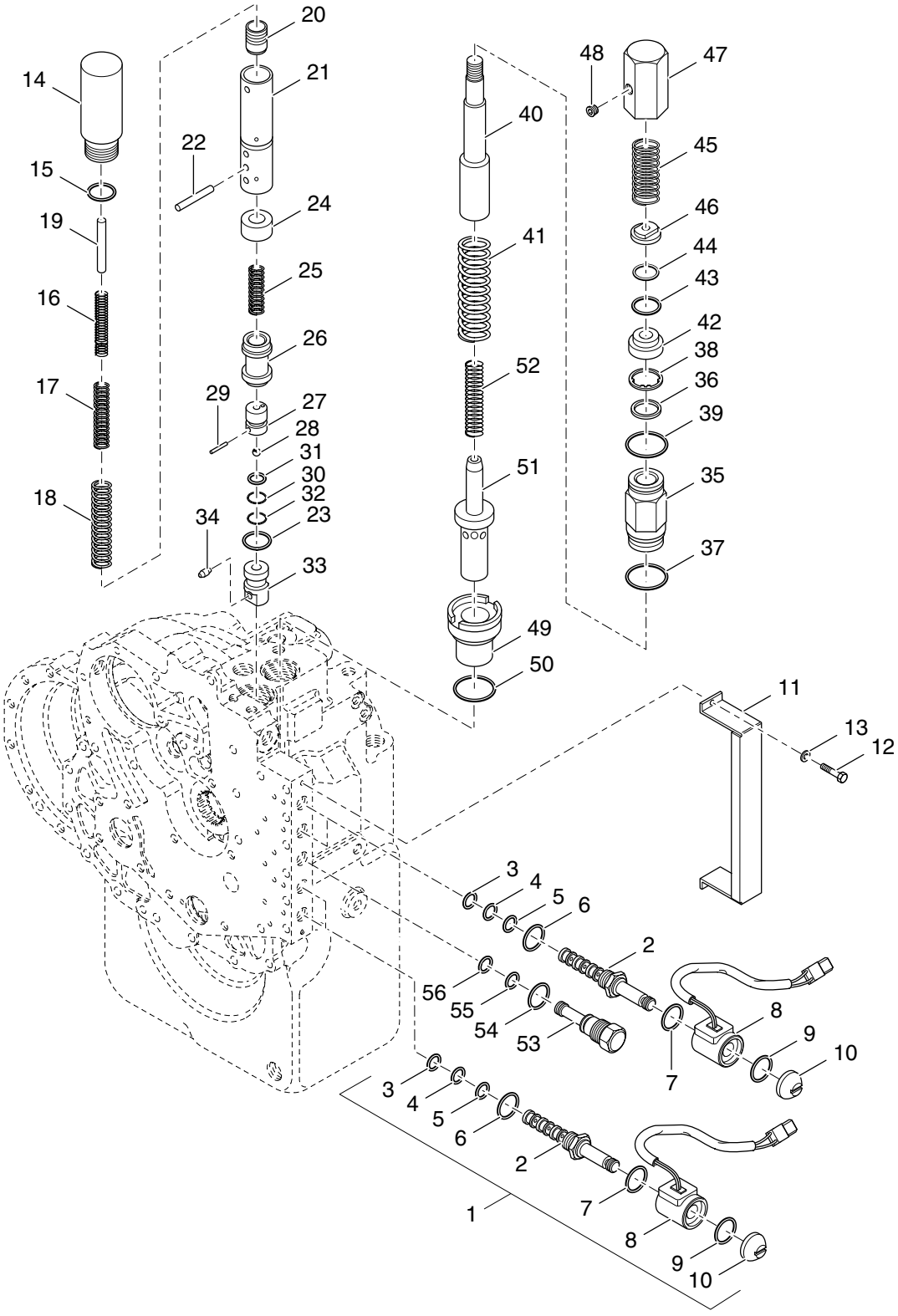
GROUP - ELECTRIC CONTROL- SINGLE MODULATION HYDRAULIC ACTUATED INCHING

Item	Description	Quantity
1	Assembly - Solenoid cartridge	5*
2	Cartridge - Valve 4-way including items 3, 4, 5 and 6	5*
3	“O”-ring - Cartridge	5*
4	“O”-ring - Cartridge	5*
5	“O”-ring - Cartridge	5*
6	“O”-ring - Cartridge	5*
7	“O”-ring - Cartridge to coil	5*
8	Coil-Solenoid	5*
9	“O”-ring-Coil to nut	5*
10	Nut - Valve cartridge retainer	5*
11	Cover - Protective	1
12	Screw - Protective cover	2
13	Lockwasher - Protective cover screw	2
14	Housing - Modulation valve	1
15	“O”-ring - Modulation housing	1
16	Spring (Inner)	1
17	Spring (Middle)	1
18	Spring (Outer)	1
19	Pin-Stop	1
20	Spool - Accumulator	1
21	Sleeve - Modulation housing	1
22	Pin - Modulation sleeve	1
23	“O”-ring - Modulation sleeve	1
24	Stop - Regulator spool	1
25	Spring - Regulator spool	1
26	Regulator - Spool	1
27	Sleeve - Regulator	1
28	Ball	1
29	Pin - Regulator spool sleeve	1
30	Snap ring	1
31	“O”-ring - Regulator spool sleeve	1
32	Snap ring	1
33	Sleeve - Shuttle	1
34	Spool - Shuttle	1
35	Body - Hydraulic inching	1
36	Seal - Hydraulic inching body	1
37	“O”-ring - Hydraulic inching body to case	1
38	Snap ring - Hydraulic inching body to cover	1
39	“O”-ring - Hydraulic inching body to cover	1
40	Rod - Hydraulic inching actuator	1
41	Spring - Inching return	1
42	Piston - Hydraulic inching (Lower)	1
43	Seal - Hydraulic inching piston	1
44	“O”-ring - Piston	1
45	Spring - Piston	1
46	Piston - Hydraulic inching (Upper)	1
47	Cover - Hydraulic inching	1
48	Plug - Hydraulic inching conver	3
49	Sleeve - Inching	1
50	“O”-ring - Inching sleeve	1

* quantity= 4, with 3-speed.
** used with 3-speed only.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Item	Description	Quantity
50	“O”-ring - Inching sleeve	1
51	Spool - Inching	1
52	Spring - Inching regulator	1
53	Plug - Solenoid bore plug, used at forward-High and Low	1**
54	“O”-ring - Plug	1**
55	“O”-ring - Plug	1**
56	“O”-ring - Plug	1**

* quantity= 4, with 3-speed.
** used with 3-speed only.

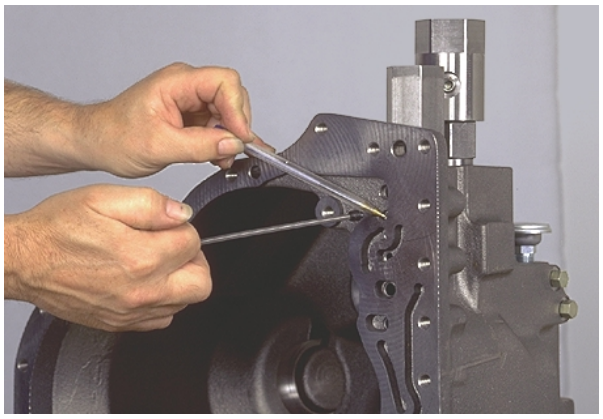


Figure 1
If inching is used install plug as shown.

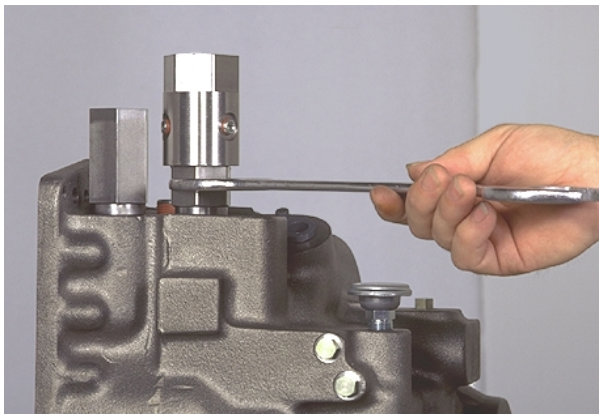


Figure 2
Remove hydraulic inching actuator.

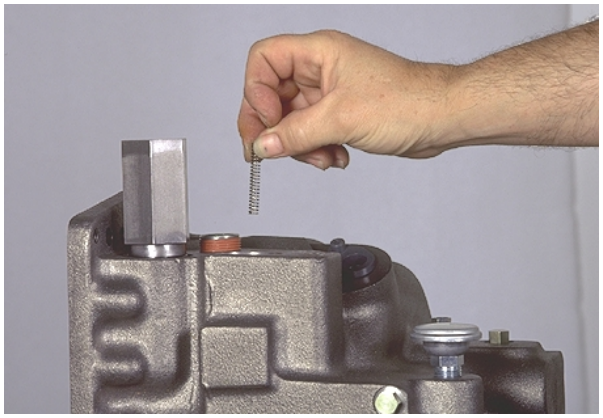


Figure 3
Remove inching regulator spring.

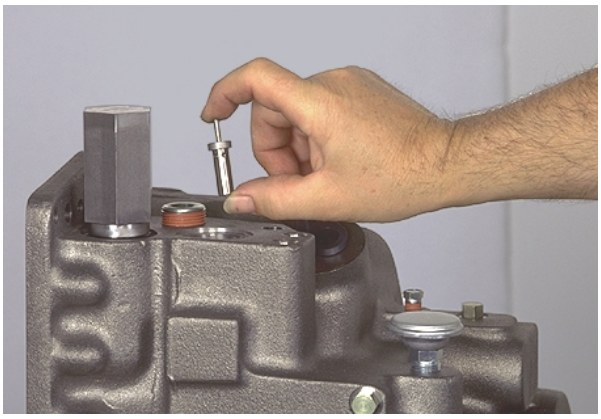


Figure 4
Remove inching spool.

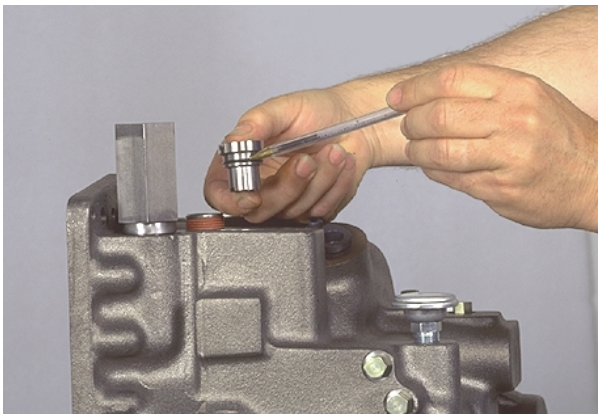


Figure 5
Remove inching sleeve and “O”-ring.

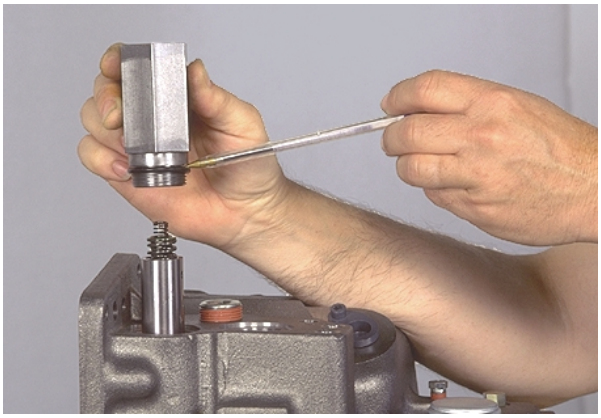


Figure 6
Remove modulator valve housing and “O”-ring.

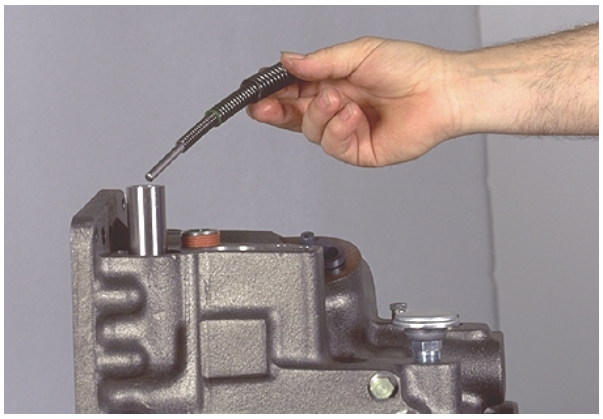


Figure 7

Remove modulator valve outer, middle, and inner springs and spring stop.

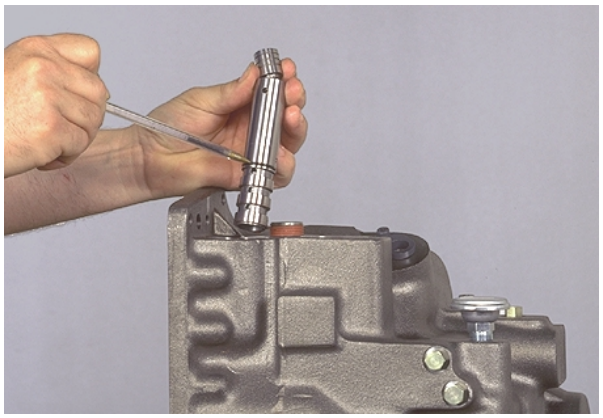


Figure 8

Remove modulation housing sleeve and accumulator spool.

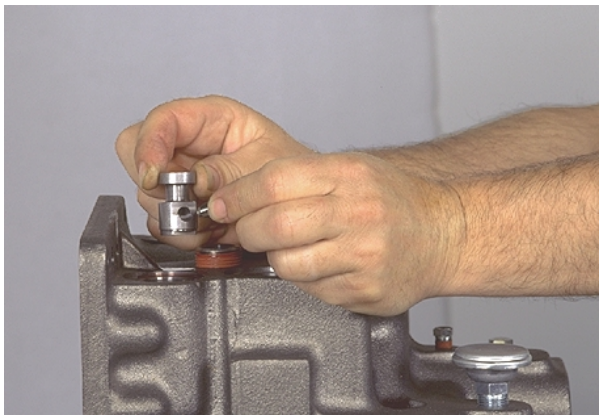


Figure 9

Remove shuttle sleeve and spool.

Figure 10
Remove modulator valve body “O”-ring.

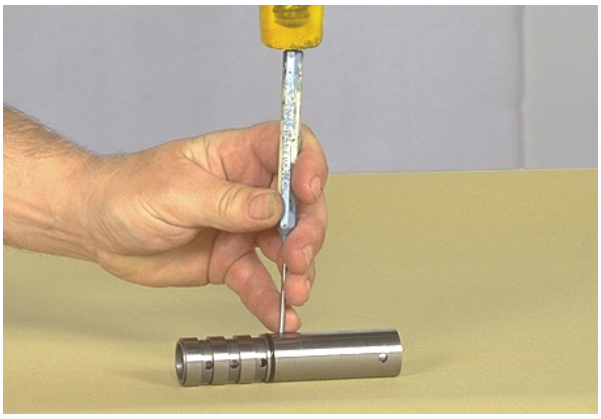


Figure 13
Remove modulator sleeve pin.

Figure 11
Remove modulator valve outer, middle and inner springs and spring stop ref. figure 7.

Figure 14
Remove regulator spool assembly retainer ring.

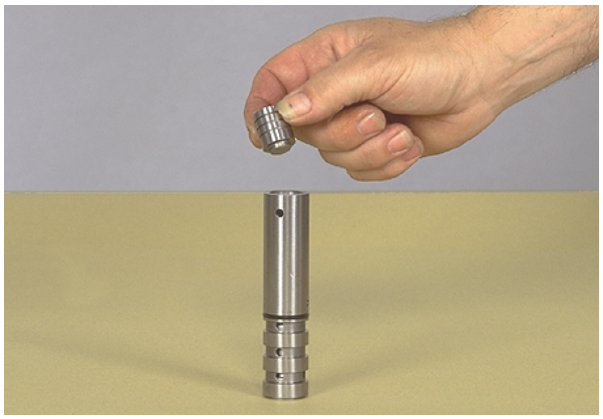


Figure 12
Remove accumulator spool. Ref. figure 8.

Figure 15
Remove regulator spool stop, spring and spring and sleeve assembly .

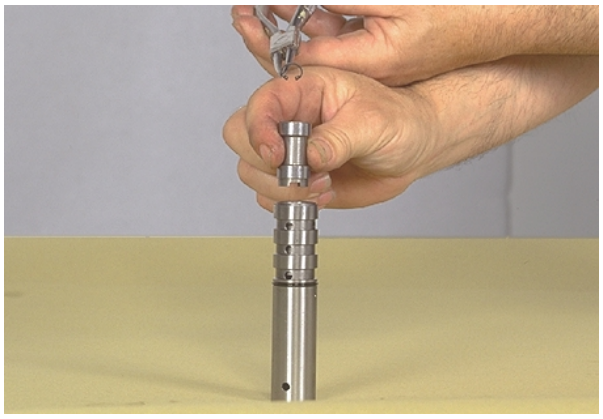


Figure 16
Remove regulator spool sleeve retainer ring.

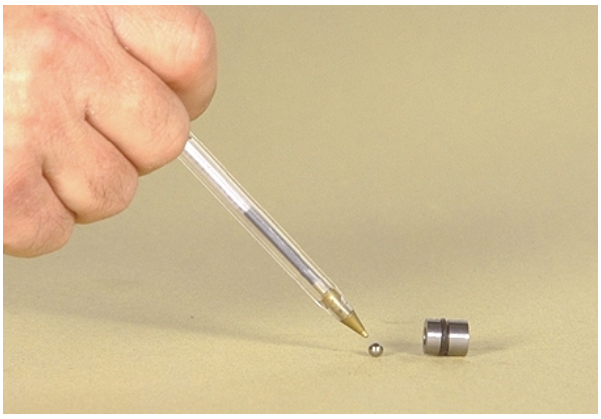


Figure 19
Remove check ball.

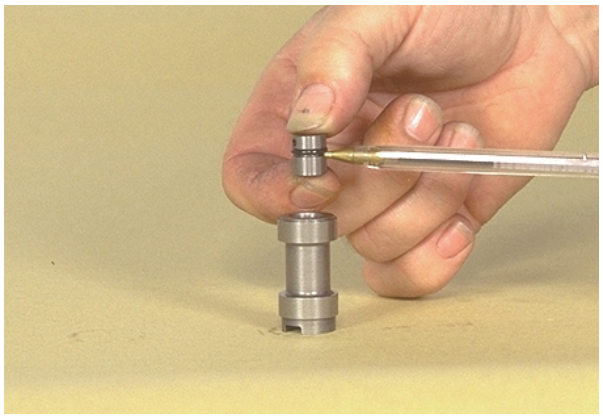


Figure 17
Remove regulator spool sleeve assembly.
Remove “O”-ring.

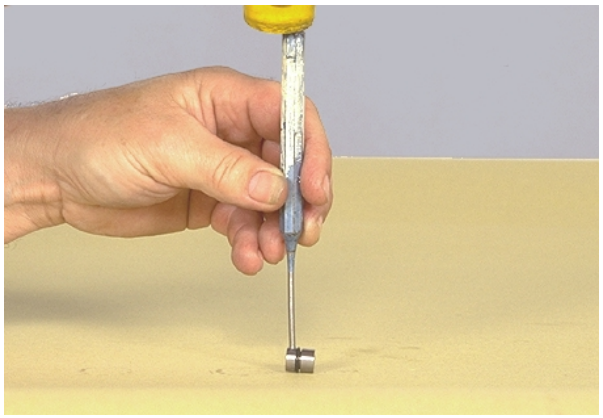


Figure 18
Remove sleeve check ball retainer pin.

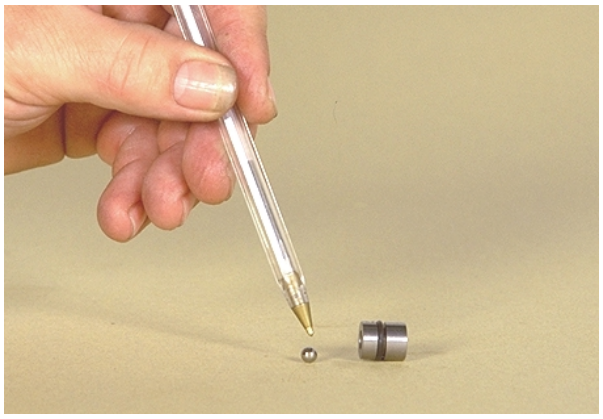


Figure 20

Install a new “O”-ring on regulator spool sleeve.
Position check ball in sleeve.
Refer to the cleaning and inspection pages.

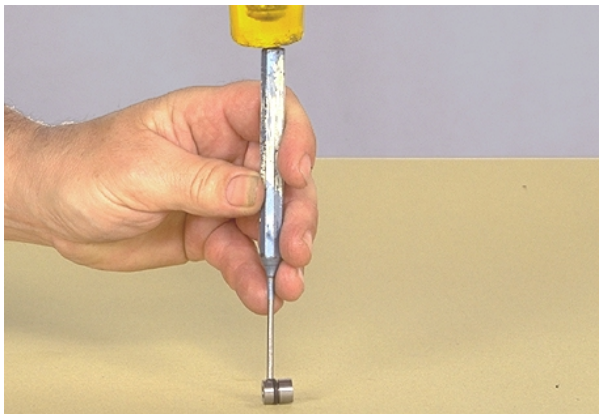


Figure 21

Install check ball retainer pin.

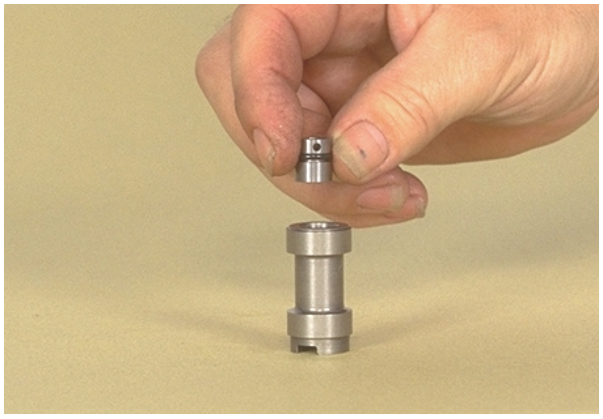


Figure 22

Position sleeve and ball assembly in regulator spool with check ball retainer pin up.

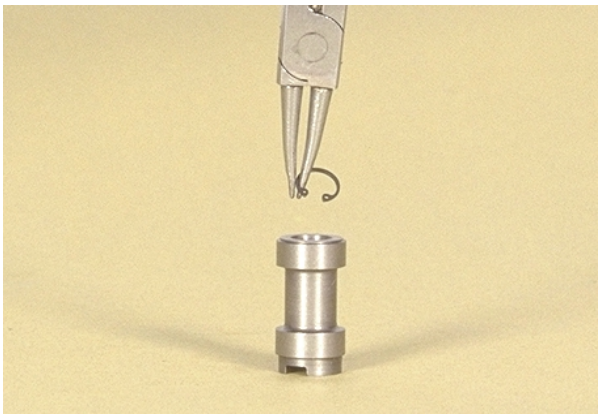


Figure 23

Install sleeve retainer ring.

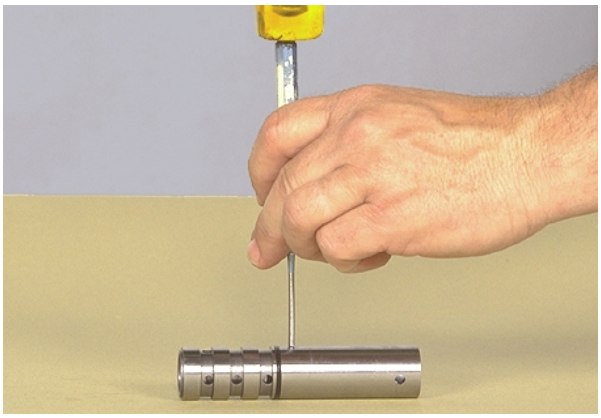


Figure 24

Install housing sleeve pin.

Figure 25

Install regulator spool stop, spring and regulator spool and sleeve assembly in housing sleeve.

Figure 26

Compress regulator spool spring and install retainer ring.

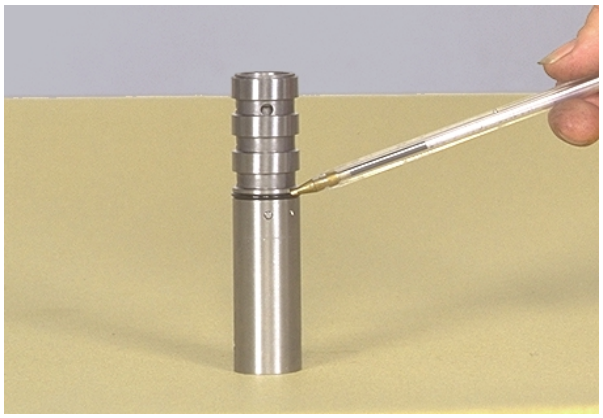


Figure 27

Position new “O”-ring on modulation sleeve.

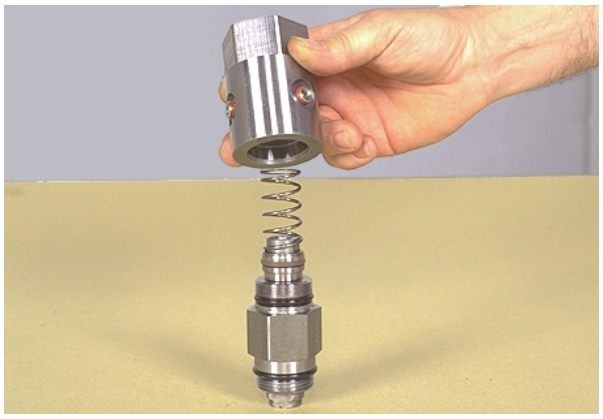


Figure 28
Remove hydraulic inching cover.

Figure 29
Remove inching return spring.

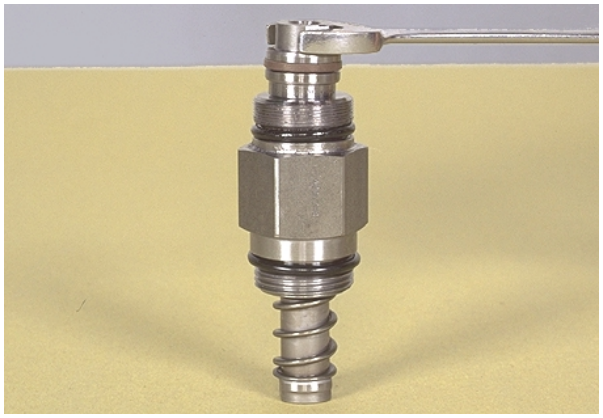


Figure 30
Remove hydraulic inching upper piston.

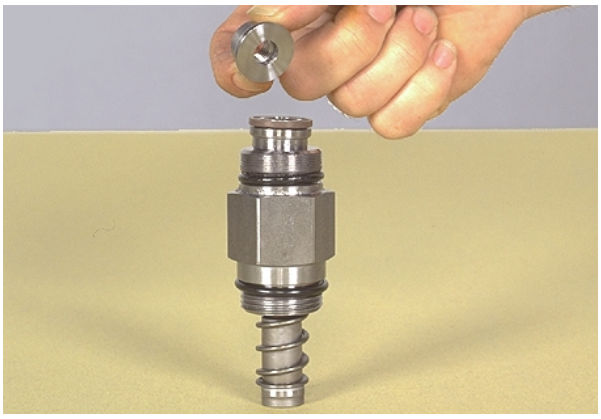


Figure 31
Inching upper piston removed.

Figure 32
Remove hydraulic piston seal.

Figure 33
Remove inching lower piston and “O”-ring.

Figure 34
Remove snap ring.

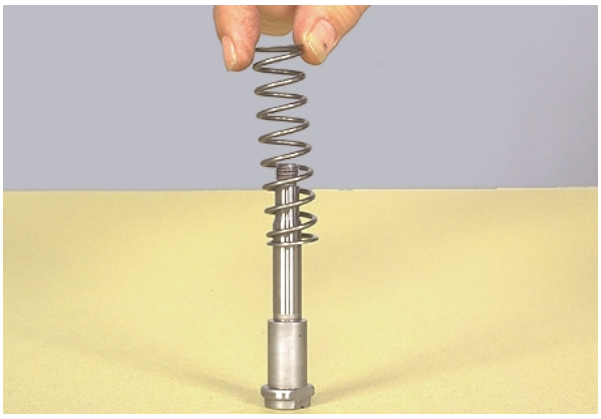


Figure 37
Remove inching return spring.

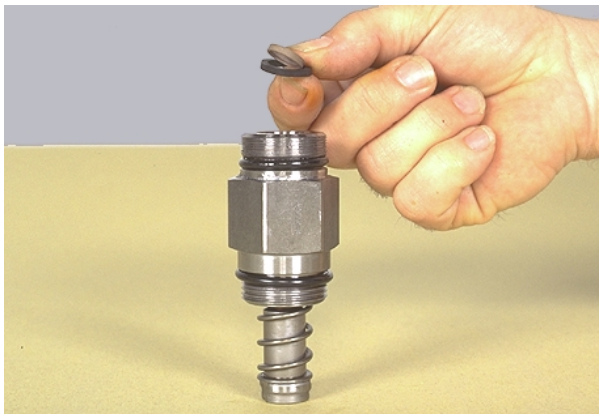


Figure 35
Remove hydraulic inching body seal.

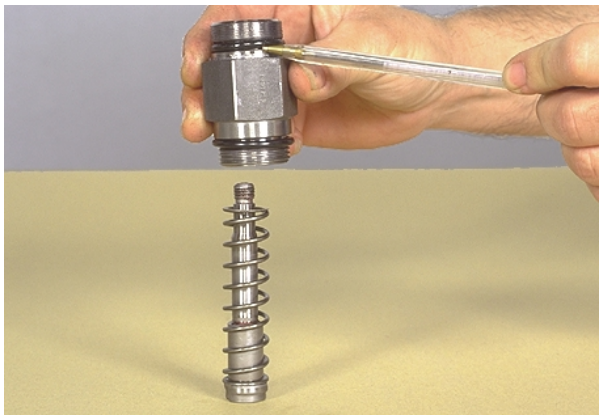


Figure 36
Remove hydraulic inching body and “O”-rings.

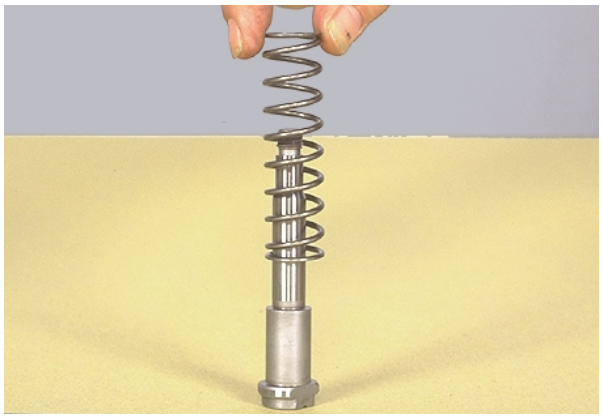


Figure 38

Install inching return spring.
Refer to the cleaning and inspection pages.

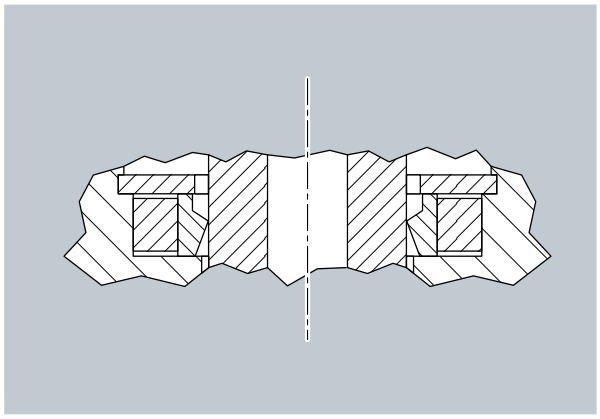


Figure 41

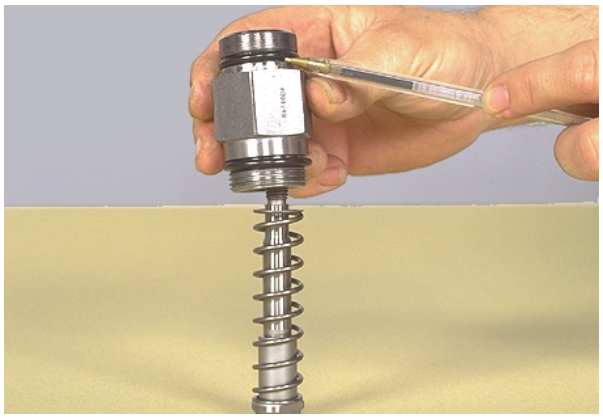


Figure 39

Install hydraulic inching body and “O”-rings.

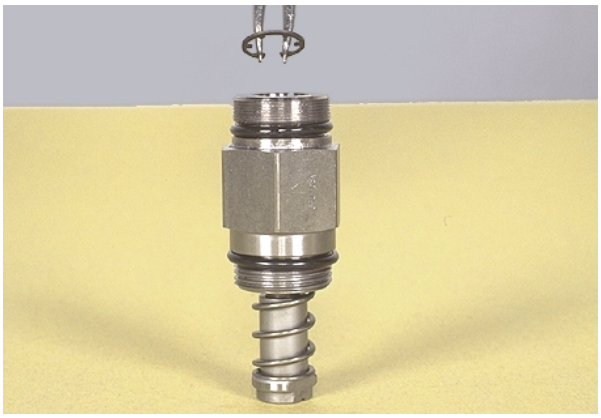


Figure 42

Install snap ring.

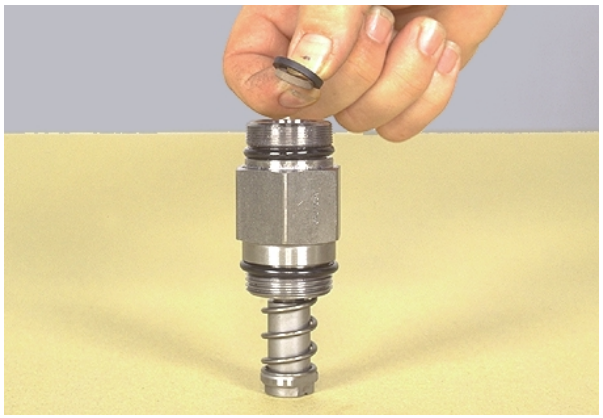


Figure 40

Install inching body seal. Be sure seal is mounted correctly. See figure 41.

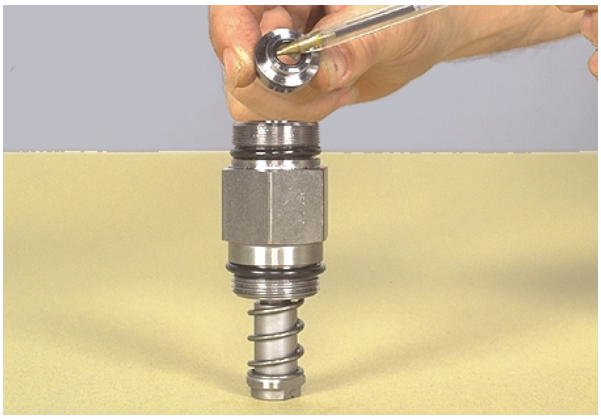


Figure 43

Install inching lower piston and “O”-ring.

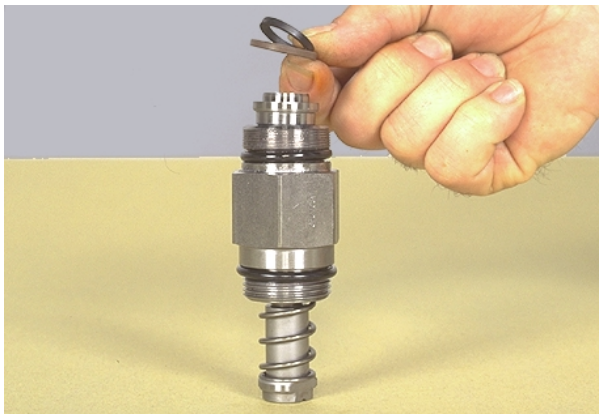


Figure 44
Install hydraulic piston seal.

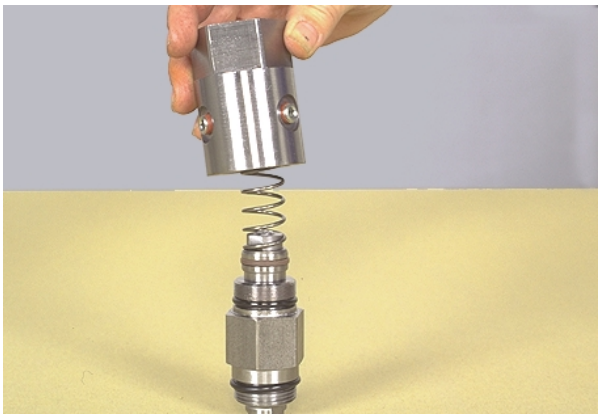


Figure 47
Install inching cover.

Figure 45
Apply Loctite nr. 243 to thread of inching actuator rod, install inching upper piston.

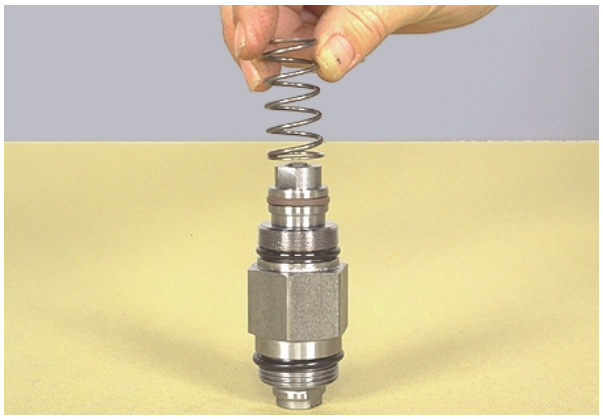


Figure 46
Install inching return spring.

Figure 48

Position shuttle spool in shuttle sleeve.
Install spool and sleeve in modulator valve bore.
Refer to the cleaning and inspection pages.

Figure 51

Install stop pin, inner, middle and outer springs in accumulator and housing sleeve.

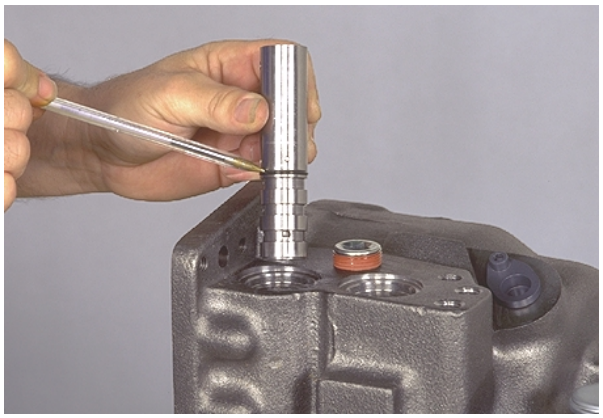


Figure 49

With new “O”-ring in position, install modulation housing sleeve assembly in bore.

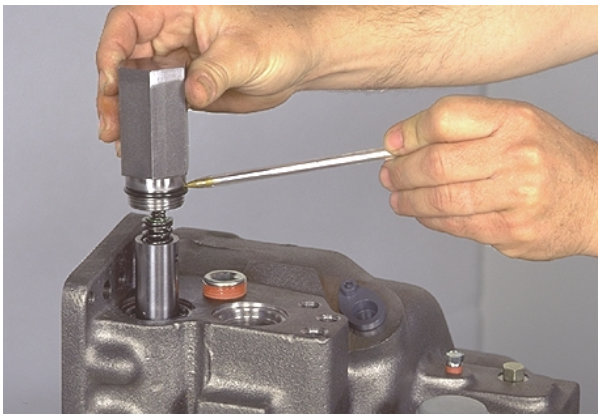


Figure 52

Position a new “O”-ring on modulator valve housing. Thread housing into valve bore.

Figure 50

Install accumulator spool in housing sleeve as shown.

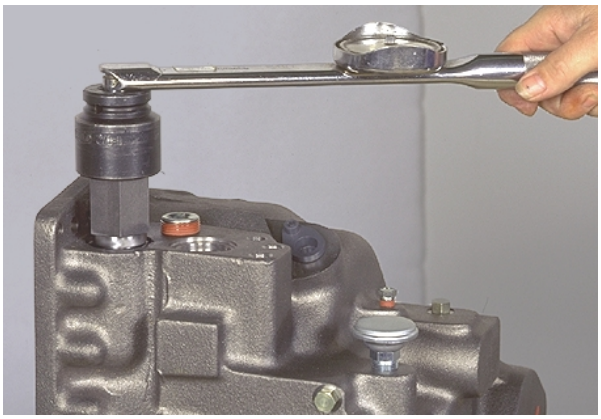


Figure 53

Tighten modulator valve housing to specified torque. See assembly instruction drawing. Ref. to figure 380.

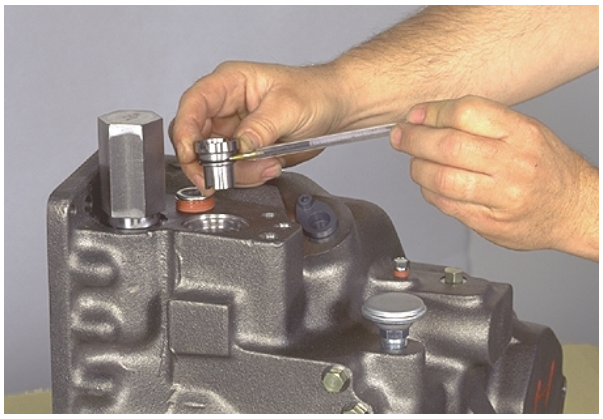


Figure 54
Install inching sleeve and “O”-ring.

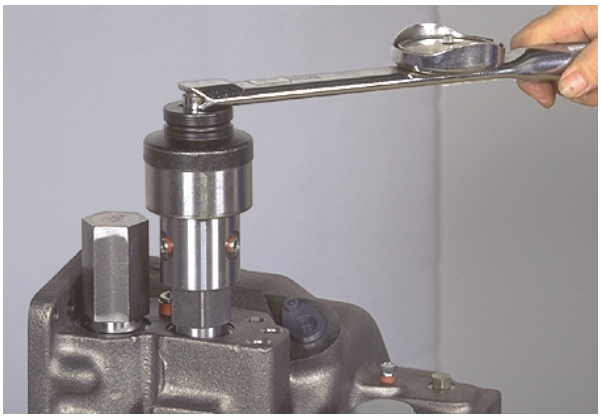


Figure 57
Tighten inching actuator to specified torque.
See assembly instruction drawing. Ref. to figure 380.

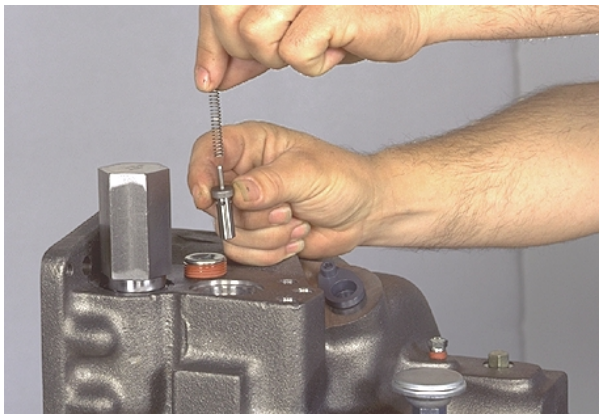


Figure 55
Install inching spool and regulator spring.

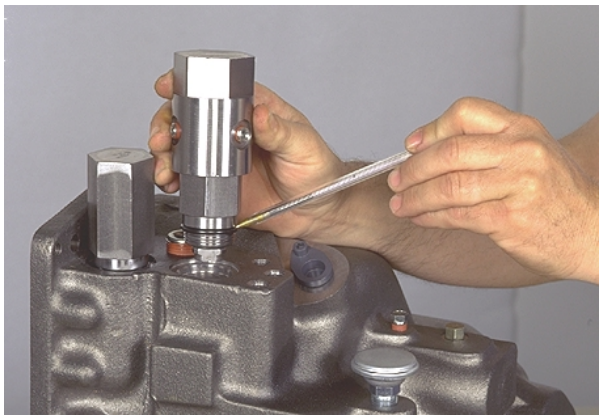


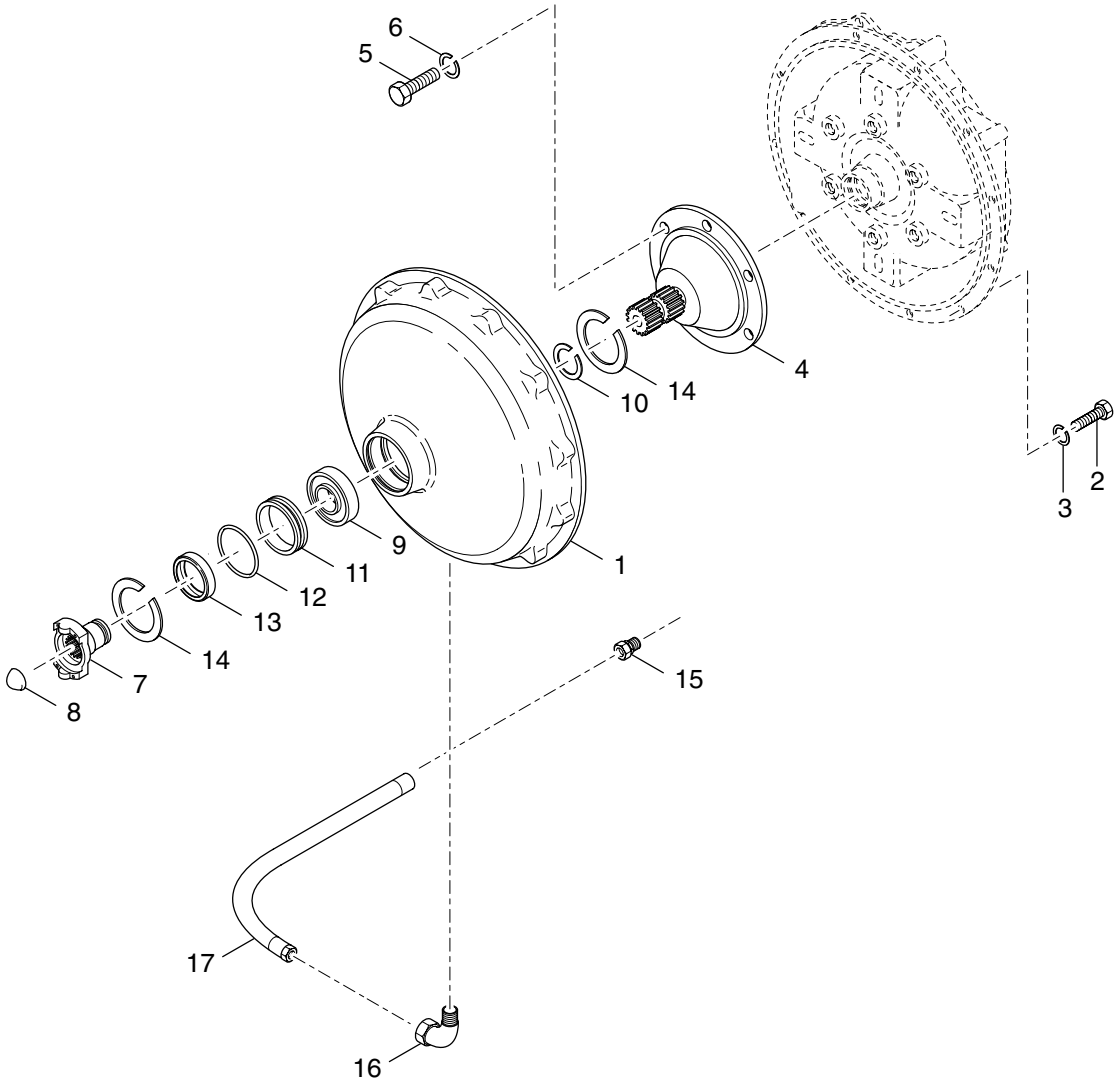
Figure 56
Install hydraulic inching actuator and “O”-ring.

11.2 MT SECTION

The information contained herein must be used in conjunction with a T12000 ID section. The MT model is the midship mounted T12000 series transmission with an integral convertor unit.

11.2.1 Sectional views and parts identification

11.2.2 Assembly instructions


6
5
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2
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11
12
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7
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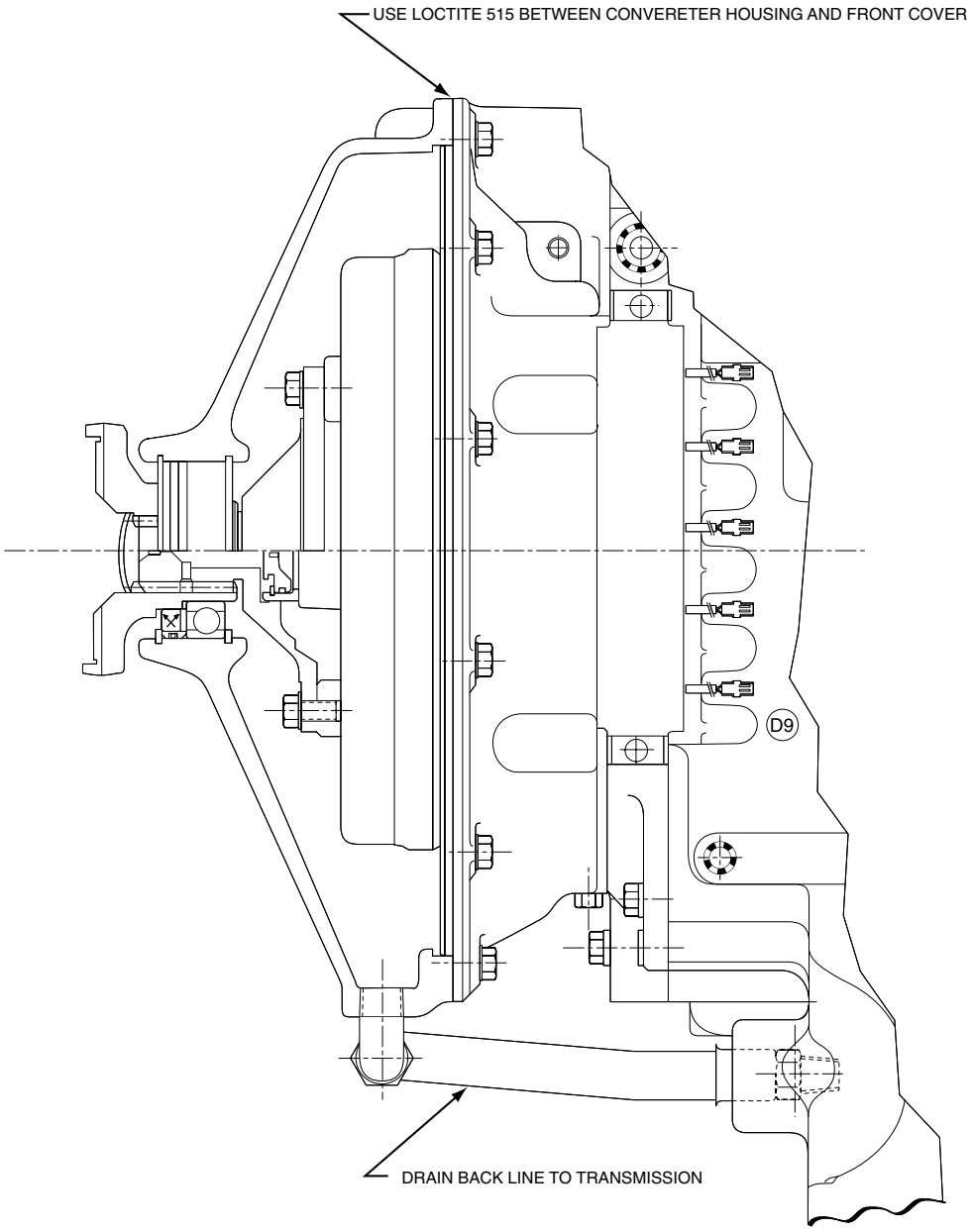
1
15
17
16

GROUP - FRONT COVER & INPUT DRIVE

Item	Description	Quantity
1	Cover - Front	1
2	Screw - Front cover to converter housing	12
3	Lockwasher - Front cover to converter housing	12
4	Shaft - Input Drive	1
5	Screw - Input drive shaft to torque converter	6
6	Lockwasher - Input drive shaft to torque converter	6
7	Flange - Input	1
8	Plug - Flange	1
9	Bearing - Input shaft	1
10	Snap ring - Flang retainer	1
11	Sleeve - Oil seal	1
12	“O”-ring - Oil seal sleeve	1
13	Seal - Input shaft oil	1
14	Snap ring - Input Shaft Bearing	2
15	Fitting	1
16	Fitting	1
17	Tube - Drain	1

11.2.2 MT cross section and assembly instructions



Brugge, Belgium

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USER FORK WEAR STANDARDS

Reprinted from ASME/ANSI B56. 1-1993

6.2.8 Inspection and Repair of Forks in Service on Fork Lift Trucks

(a) Forks in use shall be inspected at intervals of not more than 12 months (for single shift operations) or whenever any defect or permanent deformation is detected. Severe applications will require more frequent inspection.

(b) Individual Load Rating of Forks. When forks are used in pairs (the normal arrangement), the rated capacity of each fork shall be at least half of the manufacturer's rated capacity of the truck, and at the rated load center distance shown on the lift truck nameplate.

6.2.8.1 Inspection. Fork inspection shall be carried out carefully by trained personnel with the aim of detecting any damage, failure, deformation, etc., which might impair safe use. Any fork which shows such a defect shall be withdrawn from service, and shall not be returned to service unless it has been satisfactorily repaired in accordance with para. 6.2.8.2.

(a) Surface Cracks. The fork shall be thoroughly examined visually for cracks and if considered necessary, subjected to a non-destructive crack detection process, special attention being paid to the heel and welds attaching all mounting components to the fork blank. This inspection for cracks must also include any special mounting mechanisms of the fork blank to the fork carrier including bolt type mountings and forged upper mounting arrangements for hook or shaft type carriages. The forks shall not be returned to service if surface cracks are detected.

(b) Straightness of Blade and Shank. The straightness of the upper face of the blade and the front face of the shank shall be checked. If the deviation from straightness exceeds 0.5% of the length of the blade and/or the height of the shank, respectively, the fork shall not be returned to service until it has been repaired in accordance with para. 6.2.8.2.

(c) Fork Angle (Upper Face of Blade to Load Face of the Shank). Any fork that has a deviation of greater than 3 deg. from the original specification shall not be returned to service. The rejected fork shall be reset and tested in accordance with para. 6.2.8.2.

(d) Difference in Height of Fork Tips. The difference in height of one set of forks when mounted on the fork carrier shall be checked. If the difference in tip heights exceeds 3% of the length of the blade, the set of forks shall not be returned to service until repaired in accordance with para. 6.2.8.2.

(e) Positioning Lock (When Originally Provided). It shall be confirmed that the positioning lock is in good repair and correct working order. If any fault is found, the fork shall be withdrawn from service until satisfactory repairs has been effected.

(f) Wear.

(1) Fork Blade and Shank. The fork blade and shank shall be thoroughly checked for wear, special attention being paid to the vicinity of the heel. If the thickness is reduced to 90% of the original thickness, the fork shall not be returned to service.

(2) Fork Hooks (Where Originally Provided). The support face of the top hook and the retaining faces of both hooks shall be checked for wear, crushing, and other local deformations. If these are apparent to such an extent that the clearance between the fork and the fork carrier becomes excessive, the fork shall not be returned to service until repaired in accordance with para. 6.2.8.2.

(g) Legibility of Marking (When Originally Provided). If the fork marking in accordance with para. 7.25.2 is not clearly legible, it shall be renewed. Marking shall be renewed per instructions from original supplier.

6.2.8.2 Repair and Testing

(a) Repair. Only the manufacturer of the fork or an expert of equal competence shall decide if a fork may be repaired for continued use, and the repairs shall only be carried out by such parties. It is not recommended that surface cracks or wear be repaired by welding. When repairs necessitating resetting are required, the fork shall subsequently be subjected to an appropriate heat treatment, as necessary.

Courtesy of Kenhar Products Inc.

Kenhar

FORM #29903

Important rim and wheel safety precautions

NOTICE!

An inflated tire and rim can be very dangerous if misused or worn-out. Many accidents, some fatal, have resulted from improper handling and operation of truck rims and wheels. It is, therefore, of the utmost importance that the precautions outlined on this page be carefully followed by all persons servicing truck rims and wheels to avoid personal injuries and costly damage.

How to prevent rim accidents during tire mounting

Always inflate tire in safety cage or use a portable lock ring guard. This is a safeguard against improper assembly, inadvertently mismatched parts, and other assembly errors. Remember, an inflated tire contains potentially explosive energy that can blow improperly assembled rings loose. In emergency situations, where a safety cage or portable safety device is not available, use a clip-on type air chuck so that the operator can stand clear during tire inflation. **Important,** when clip-on air chuck is used, line pressure must be restricted to maximum inflation capacity of tire.

Use properly matched parts only. Rim base and rings must be matched according to size and type. This information is stamped on each Firestone part.

Replace damaged parts. Abuse during road operations or in mounting the tire can cause dents, cracks, or distortions which weaken the parts. Inspect for and replace damaged parts.

Periodically inspect and remove rust and other foreign matter. Accumulation of such material in the rim gutter can prevent the proper fitting of rings. Parts that are excessively corroded are weakened and should be replaced. Use of a rust preventative compound (not containing water) during mounting will minimize rusting.

Do not use over-size or over-inflated tires. Use only recommended size rims for tires and do not exceed maximum inflation pressure for the rim.

Follow manufacturer's recommended mounting procedures.

ADDED PRECAUTION: **Re-check assemblies just prior to inflation, particularly if they have been rolled across the floor or have received rough handling between mounting and inflation.**

During tire demounting

Completely deflate tire prior to demounting. The tire should be deflated prior to removal of the tire and rim assembly from the vehicle. Remove the valve core to insure complete deflation.

DO NOT STAND IN FRONT OF RIM/TIRE DURING DEFLATION.

Follow recommended demounting procedures.

Check for damaged or worn parts. Mark defective parts for destruction to preclude their future use.

During vehicle operation

Before putting new vehicles into service, clamps and wheel nuts should be checked for proper torque.

Do not overload rims or wheels. Insure that the combination of load and vehicle weight does not exceed the rated load of the rims or wheels used. Rims and wheels are designed to sustain their rated load using the maximum tire size recommended for that rim width by the Tire & Rim Association.

Inspect rims and wheels for damage during tire checks and at periodic maintenance intervals. Remove and replace defective parts.

Do not exceed maximum inflation pressures. This is determined by the size and ply rating of the tire, but is not to exceed the maximum inflation listed for the rim or wheel. It is also important to maintain uniform inflation in both tires of a dual assembly so that weight is equally sustained.

Do not run vehicle on one tire of dual assembly. When there is loss of air in a dual tire the carrying capability is reduced and the load must be sustained by the other tire and rim. Both tires should be inflated to balanced, recommended pressures before further operation.

Never re-inflate a tire that has been run flat or seriously underinflated without first breaking rim down and reassembling rim. It is especially important to make sure the lock ring is secure in the gutter and has not been damaged prior to re-inflation.

After first 50 to 100 miles of service re-check clamp and wheel nut torque. Loose wheel nuts can cause excessive wear around bolt holes, dangerous wheel vibration, and metal fatigue failure. Excessive torque is also dangerous in that it can cause stud or wheel breakage.

THE GRADALL COMPANY
406 Mill Ave., S.W. New Philadelphia, Ohio 44663

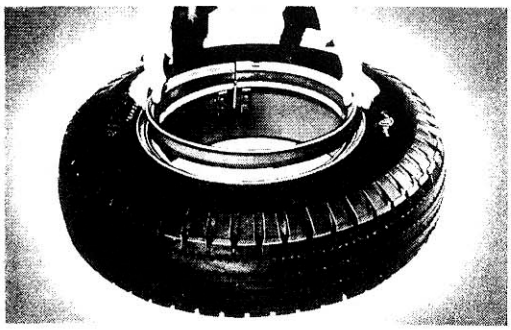
Form No. 0009

How to mount and demount ACCU-RIDE 5° Commander and 3-piece convertible rims

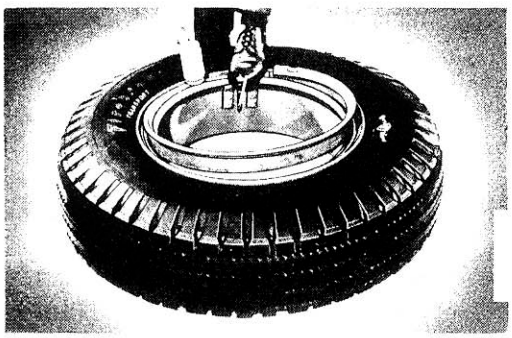
(Procedure applies to tires on both demountable rims and disc wheels)

Tools required: 1 rim mallet / 1 rim tool

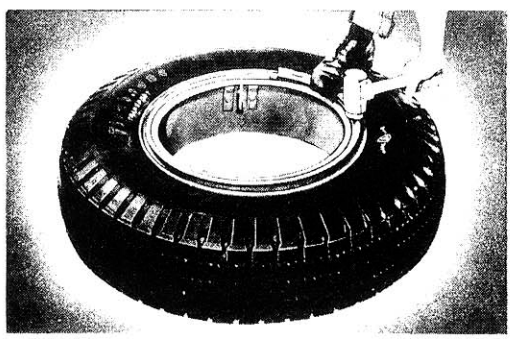
MOUNTING



After applying tire and tube in usual manner, place removable side ring (flange) on bead of tire. Then insert tapered toe of lock ring between side ring and rim base.

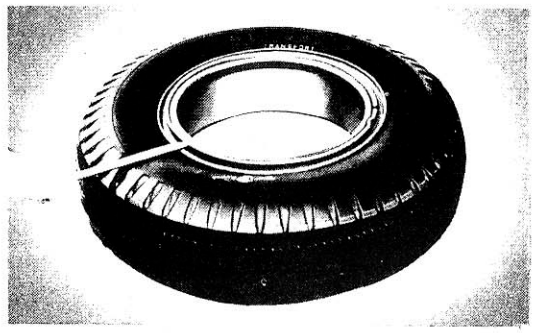


To fasten lock ring, hold with foot at one end of split and hammer end of ring into place with rim mallet.

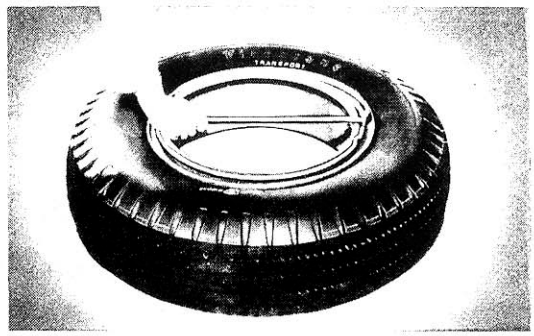


Continue progressively around the rim, holding ring with foot and hammering until entire ring is seated. Check seating of rings and inflate tire to recommended pressure.

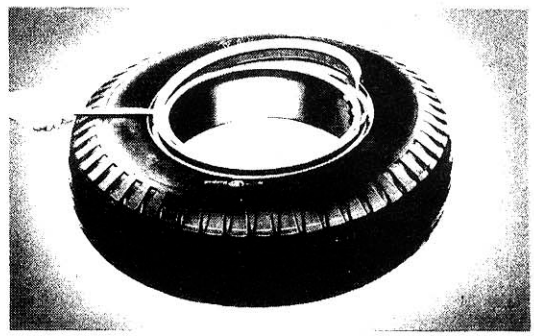
DEMOUNTING



Standing clear of rim, completely deflate tire by removing valve core or using deflator cap. Place tapered end of rim tool in depression in lock ring, or between rings, and press down on side ring to free bead. Continue downward pressure on side ring progressively around the tire until the bead is completely freed from the bead seat.



To disengage lock ring from the gutter, insert rim tool in removing notch, near split in the ring, and push downward. If desired, a second similar tool may be used to facilitate removal.



Insert the rim tool between the lock ring and side ring and press downward to pry ring up. Move progressively around the rim until lock ring is free, then lift off lock and side rings. Turn assembly over, unseat tire bead, stand tire up and remove rim base.

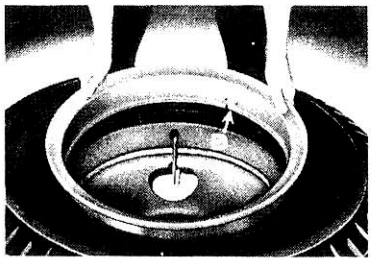
SAFETY PRECAUTIONS

1. **Use only parts free from damage or heavy rust.**
2. **Insure that lock ring is completely installed before inflating tire. Inflate tire in safety cage or use a lock ring guard. In emergency situations where a safety cage or portable safety device is not available, use clip-on type air chuck so that operator may stand clear during inflation.**
3. **Insure that tire is completely deflated prior to removal of rings.**
4. **Split lock rings used with continuous side rings must not butt.**
5. **Do not inflate a flat or seriously underinflated tire while tire is on vehicle. Remove and make sure all parts are serviceable and fully reassemble before reinflating tire.**

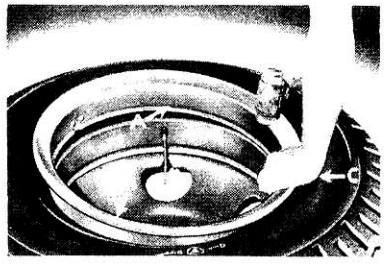
How to mount and demount ACCU-RIDE RH5° rims

Tools Required: 1 Rim Mallet
1 Rim Tool

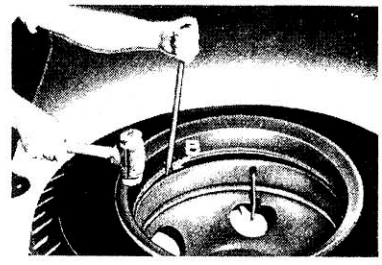
MOUNTING



Place disc portion of wheel on floor with rim gutter up. Apply tire with valve pointing in direction desired. Place side ring in position with operating notch located between two embossings (point B) approximately three inches from valve, on either side.

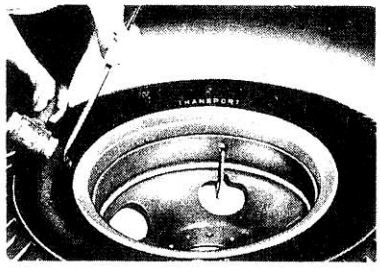


The two cutaway portions opposite each other in the inner diameter of the ring (points A) are placed so as to span the rim gutter. At point C, opposite valve, force half of ring into the gutter as far as possible using hand and rim mallet.

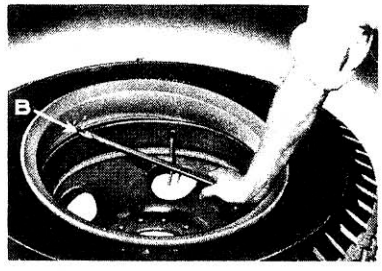


Insert straight end of rim tool in operating notch (point B), then pull in direction indicated by arrow. Retain pressure with tool and strike ring downward with mallet at point between tool slot and cutaway portion, thereby engaging ring over rim gutter at that point. Remove tool and strike additional blows progressively toward other cutaway portion until entire toe of ring has passed over the rim gutter. Check seating of ring as shown below and inflate tire to recommended pressure.

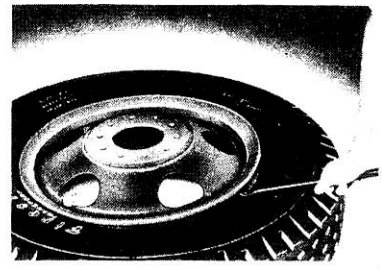
DEMOUNTING



CAUTION: Staying clear of rim, make certain tire is completely deflated. To loosen tire bead from side ring, drive curved bead-loosening end of above recommended rim tool, or a larger tire tool, between ring and bead. Pry downward on bead and repeat this operation around the ring until bead is loose.



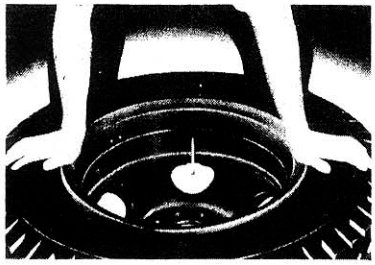
Remove ring by putting straight end of rim tool into notch in ring located between embossings (point B). Push ring downward at point opposite operating notch. Force tool handle downward as illustrated, causing ring to disengage from rim gutter. Continue operation, prying away from rim gutter with flat end of tool until free.



Turn assembly over and unseat tire bead from back flange in same manner as loosening bead from side ring in first step. Stand tire up and remove rim base.

NOTE: It is unnecessary to free the side ring from the tire bead if tire is to be removed for tube repair and immediately replaced. Simply loosen bead from back (permanent) flange as in third demounting step. Then turn the assembly over and remove ring, with tire attached, as in second demounting step.

IMPORTANT: RH-5° side rings are not interchangeable on other size RH-5° bases. Make certain side ring is right size for the rim base you are using.



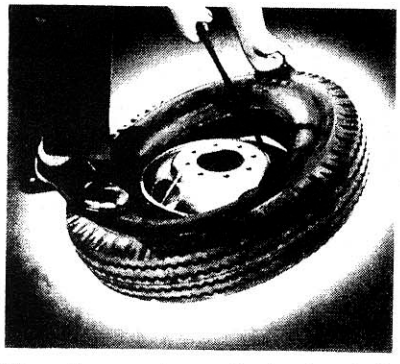
SAFETY PRECAUTIONS:

1. **Before inflating tire, be certain side ring has completely cleared the gutter of rim base. In this position, the side ring can be depressed by hand. This can be easily felt and seen. DO NOT INFLATE IF SIDE RING DOES NOT MOVE FREELY.**
2. **Inflate tire in safety cage or use a lock ring guard. In emergency situations where a safety cage or portable safety device is not available, use clip-on type air chuck so that operator may stand aside during inflation.**
3. **Use only parts free from damage or heavy rust, especially at the area of contact between the rim base and side ring.**
4. **Insure that tire is completely deflated prior to removal of side ring.**
5. **Do not inflate a flat or seriously underinflated tire while tire is on vehicle. Remove and make sure all parts are serviceable and fully reassemble before reinflating tire.**

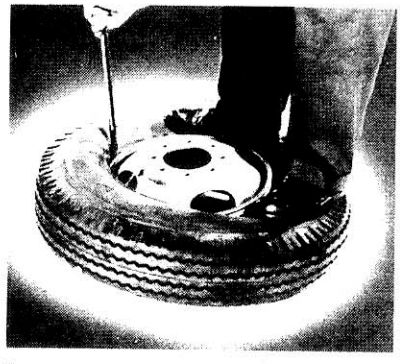
How to mount and demount ACCU-RIDE RHP rims

Tools required: 2 rim tools
1 rim mallet
1 tire tool (thin end)

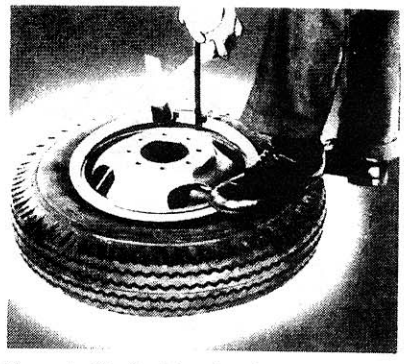
MOUNTING



Place tire on rim so that valve is in line with valve hole and insert valve through valve hole. Force first bead down into well of rim just to side of valve with foot. Mount first bead over rim gutter with rim tool progressing from each side of foot to point approximately opposite foot.

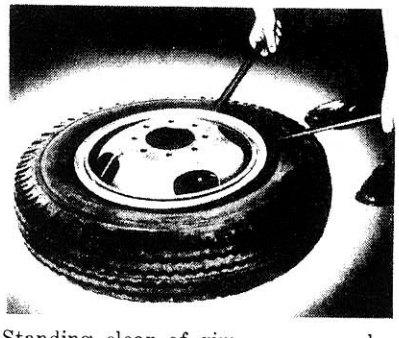


To apply second bead, start at point opposite valve and press bead toe over rim gutter and into rim well with foot pressure. Mount remainder of bead over rim gutter by means of thin tire tool, being careful not to pinch tube.

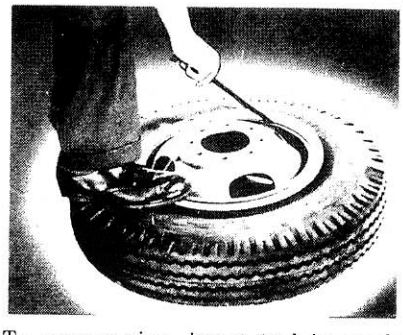


Place half of side ring in rim gutter with cutaway portions in position as shown. Insert thin end of rim tool or heavy screw driver and pull ring outward toward centered position. Strike with mallet, forcing rim into gutter.

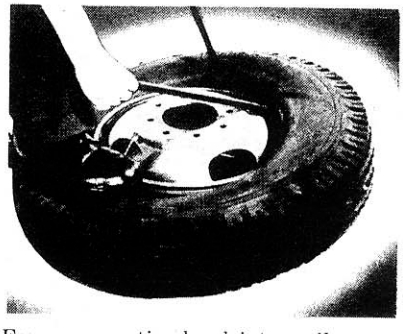
DEMOUNTING



Standing clear of rim, remove valve core to completely deflate tire. Place tire and wheel on floor with side ring up. To loosen first bead, drive hooked end of rim tool between tire and rim flange and press downward on bead. Progress around rim, using 2 tools, as shown.



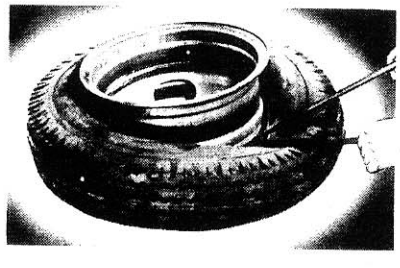
To remove ring, insert tool in notch and force ring opposite of notch into gutter, then pry off. Pry out and up on side ring, carefully but firmly. (Be careful not to bend side ring.)



Force upper tire bead into well opposite the valve slot and with tire tool pry opposite portion of bead over edge of rim.

Turn tire over and by means of rim tools, loosen bead on opposite bead seat. This can be further aided by using foot pressure.

Make sure one portion of second bead is still in the rim well, then pry opposite portion of bead over edge of rim. This will free the tire from the rim.



SAFETY PRECAUTIONS:

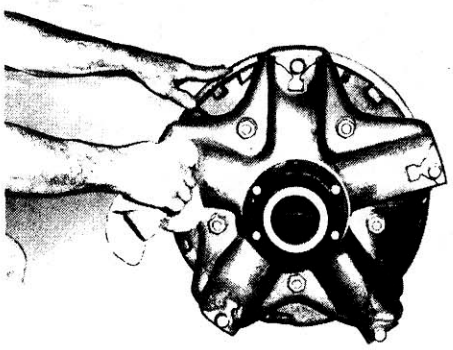
1. **Use only parts free from damage or heavy rust.**
2. **Insure that side ring is completely seated before inflating tire.**
3. **Inflate tire in safety cage or use a lock ring guard. In emergency situations where a safety cage or portable safety device is not available, use clip-on type air chuck so that operator may stand aside during inflation.**
4. **Insure that tire is completely deflated prior to removal of rings.**
5. **Do not mount 16.5 diameter tubeless tires on 16" diameter rims.**

How to properly install ACCU-RIDE rims and wheels

Proper installation of rims and wheels on a vehicle is essential to safe, economical, trouble-free service. Use only the specified sizes of studs, nuts and clamps.

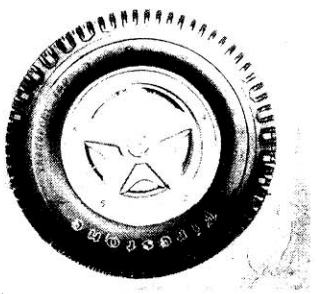
RECOMMENDED INSTALLATION PROCEDURE

DEMOUNTABLE RIMS



Make sure that all parts, including rims, rings, spacer bands and cast wheel studs are free from damage, dirt or rust. Replace any defective parts.

Place rims and spacer band on wheel. Secure clamps evenly in position and draw up nuts alternately in the sequence shown at right. Do **not** tighten them fully, however. This procedure will permit the inside rim to properly align itself on the 28° mounting bevel on the back of the cast wheel, thus avoiding damaging wheel wobble.



Then, tighten nuts fully, using same alternate sequence. Be sure to tighten these nuts **only** to the torque level recommended in the table below and to maintain them at that level through planned, periodic checks.

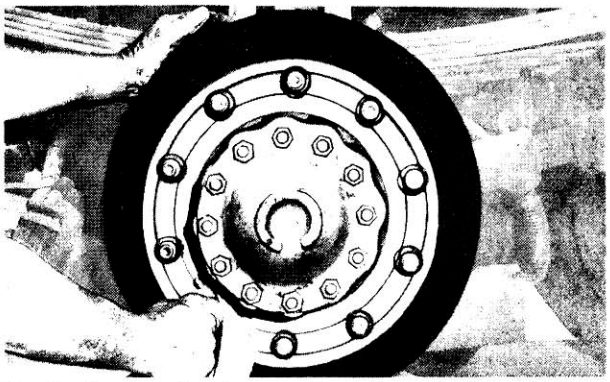
SPOKE WHEELS*	
Thread Size	Torque Ft.-Lbs. (Dry)
5/8 - 11	150 - 175
3/4 - 10	200 - 250
1 - 8	400 - 450
1 - 14	400 - 450

CAUTION: *Insufficient* mounting torque can cause rim slippage, resulting in broken valves, worn parts and damaged tires. *Excessive* mounting torque can cause damage by stripping studs, collapsing spacer bands or forcing rims into an out-of-round condition.

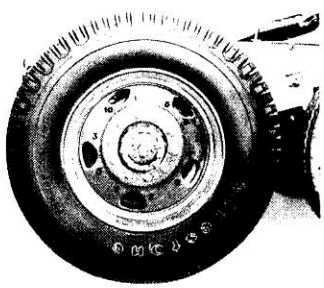
Wrenches for Demountable Rims and Disc Wheels: Double-end socket wrenches for rims and disc wheels normally are adequate to install and remove Accu-Ride rims and wheels, when used with a 3-foot bar. A 150-pound man, exerting his entire weight, 2.5 feet out on a bar, can apply 375 foot-pounds of torque to a wrench (150 x 2.5). Air wrenches, however, sometimes are used to save time and labor. The torque they deliver depends on the air line pressure from which they operate. Periodic checks by torque wrench, or other means, should be made to insure accuracy of these air wrenches.

***NOTE: After first 50 to 100 miles of service re-check clamp & wheel nut torque.**

DISC WHEELS



Check all parts for damage, including wheels and rings. Insure that studs, nuts and mounting faces of hub and wheels are clean and free from grease. Replace any defective parts.



Mount single wheel or inner dual wheel (also, outer dual wheel for hub - type mounting) over studs, being careful not to damage stud threads. Draw up nuts alternately in the sequence shown at left. Do **not** tighten them fully, however. This procedure will permit the uniform seating of nuts and insure the even, face-to-face contact of wheels and hub.

Tighten nuts fully, using the same alternate sequence. Mount the outer wheel (for double cap mounting) and repeat the entire procedure. In each case, be sure to tighten wheel nuts only to the torque level recommended in the table below and to maintain them at that level through planned, periodic checks.

Note: When inner cap nuts are re-tightened, be sure first to loosen outer cap nuts several turns; then, re-tighten them.

DISC WHEELS*		
Application	Thread Size	Torque Ft.-Lbs. (Dry)
Passenger Type Mtg.	7/16-20	80-90
	1/2-20	80-90
	9/16-18	110-120
	5/8-18	125-140
In-Out Coined Mtg.	9/16-18	175-200
	5/8-18	175-200
		1-pc. nut / 2-pc. nut
Piloted Mtg.	11/16-16	300-350 / 200-250
	3/4-16	450-500 / 300-350
	7/8-14	..... / 350-400
Ball Seat Mtg.	3/4-16	450-500
	1-1/8-16	450-500
Heavy Duty Ball Seat Mtg.	15/16-12	750-800
	1-5/16-12	750-800

CAUTION: *Insufficient* mounting torque can cause wheel shimmy, resulting in damage to parts and extreme tire tread wear. *Excessive* mounting torque can cause studs to break and discs to crack in the stud hole area.

Proper maintenance of ACCU-RIDE rims and wheels

Accu-Ride rims and wheels are thoroughly tested in Firestone laboratories, on Firestone test tracks and by both small and large fleets on the highways of America. All these tests, plus a rigid quality-control program, insure maximum performance of all Accu-Ride rims and wheels. In order, however, to maintain their built-in quality and to insure maximum service and safety a continuous maintenance program is advisable. Maintenance procedures should be carried out during all tire inspections and changes and at periodic maintenance intervals depending upon road and environmental conditions of operation.

RIM AND WHEEL MAINTENANCE DURING TIRE INSPECTIONS

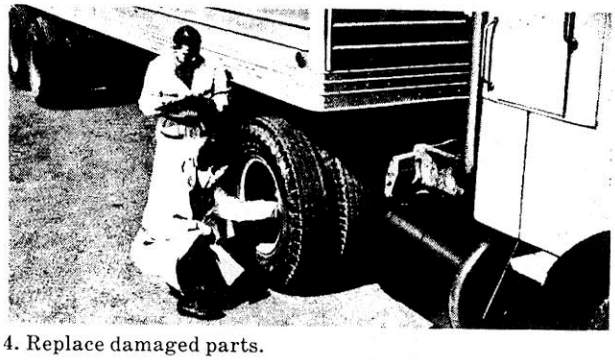
1. Check all metal surfaces thoroughly while making tire inspections, including areas between duals and on inboard side of wheel. Watch for:

excessive rust or corrosion build-up
cracks in metal
bent flanges, resulting from road obstructions
deep rim tool marks on rings or in gutter areas
loose, missing or damaged nuts or clamps
bent or stripped studs
damaged or missing rim drive plates
matched rim parts

2. Pull damaged rims or wheels.

CAUTION: Excessively corroded or cracked rims or rings can be dangerous. Deflate tires prior to the removal of rims or wheels from the vehicle.

3. Mark damaged or hazardous areas with chalk so that part will be removed from service.



4. Replace damaged parts.

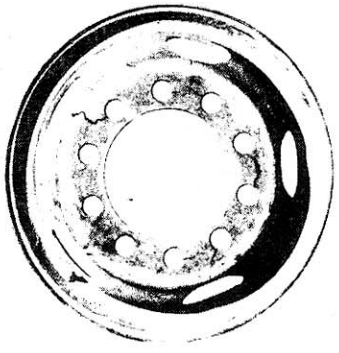
CAUTION: Insure that replacements are made with the proper sizes and types of rims and rings.

5. Inflate tires only to recommended air pressures.

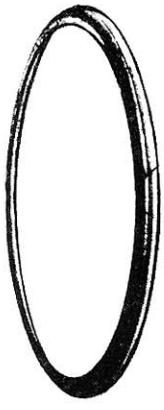
RIM AND WHEEL MAINTENANCE DURING TIRE CHANGES

1. Check all metal surfaces as in No. 1, above. A more thorough check may be made, however, after the tire has been demounted. Watch particularly for the damages illustrated below and refer to recommendations in this section of the catalog if corrective measures are required.

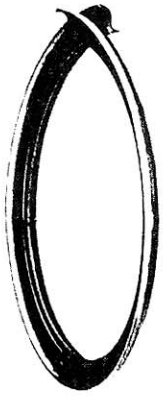
Cracks in the rim base, in the back flange and gutter areas. These are caused by deep rim tool marks, overloading and overinflating tires and using larger than recommended tire sizes.



Cracks in the wheel disc, between stud holes or hand holes. These are caused by loose wheel nuts, improper installation procedures and use of incorrect sizes or types of attaching parts.



Cracks through side ring, spreading laterally through the entire section. These are caused by improper mounting and demounting techniques, impact with road obstructions, and excessive clamping torques.



Sprung side ring, resulting from improper mounting procedures.

Erosion and chipping of bead seat of lock ring, resulting from excessive corrosion. This may occur with this part as well as others if protective measures described on following page are not taken.

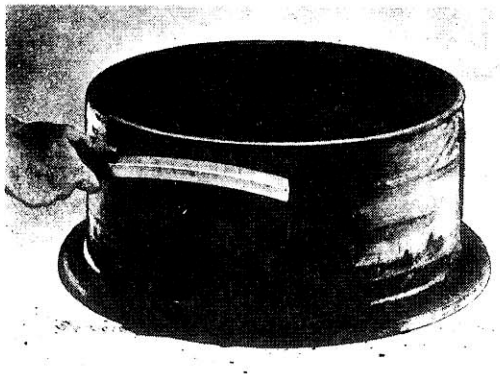
2. Replace damaged parts.

CAUTION: Insure that replacements are made with the proper sizes and types of rims and rings.

NOTE: Openings between ends of split side rings must not be less than 3/32" except where the ring design calls for an abutting condition, or more than 5/16" after ring is seated-in during operation. Split lock rings used with endless side rings must not butt.

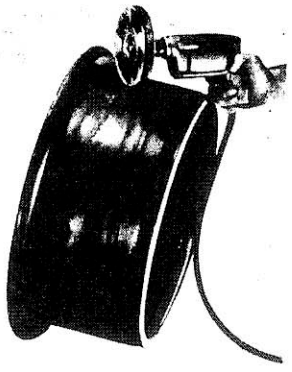
(Continued)

Proper maintenance of ACCU-RIDE rims and wheels
(continued)

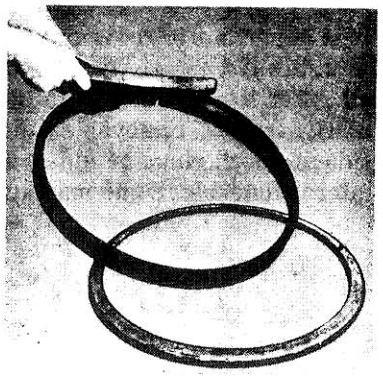


3. Thoroughly remove rust, dirt and other foreign materials from all surfaces. Hand or electric wire brushes, sand blasting or chemical baths may be used.

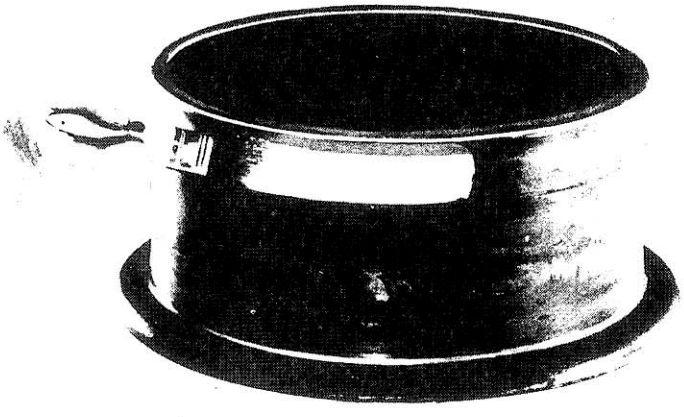
Gutter of rim base should be cleared of rust and other materials obstructing safe, positive seating of rings.



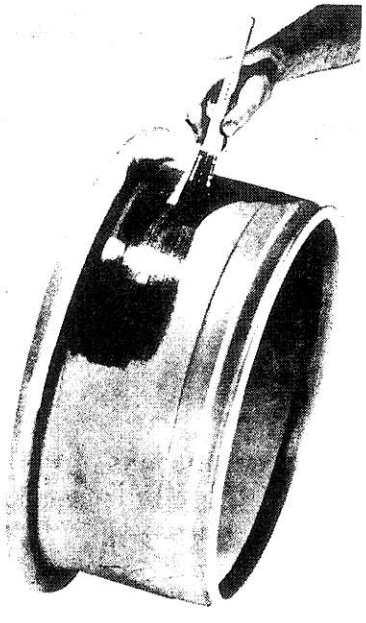
Bead seat areas of rim should be free of rust and rubber deposits. This is especially important for drop-center tubeless rims, because the 15° bead seat is the air-sealing element.



Rings should be cleaned with wire brush. Pay particular attention to seating surfaces and bead seat areas.



4. Paint rim by brush or spray with a fast-drying metal primer. Surfaces should be clean and dry prior to painting. Insure that bare metal areas on outside or tire side of rim are covered. This is especially important on drop-center tubeless rims, because warm and sometimes moist air is in constant contact with the metal surface on the tire side of the rim.

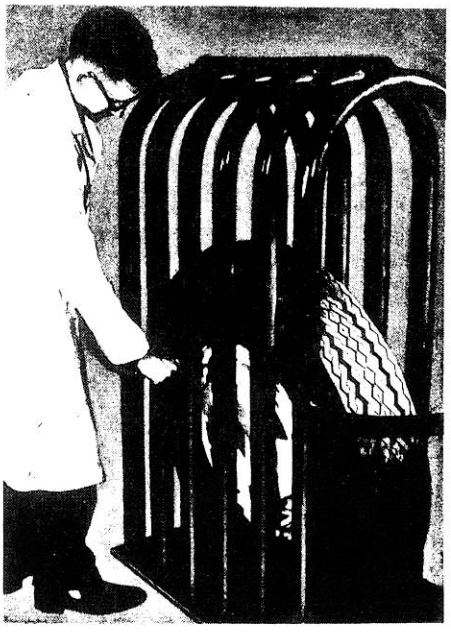


5. Lubricate tire side of rim base just prior to mounting tire. Avoid the use of any lubricant which contains water or solvent that is injurious to rubber. A combination lubricant and rust-preventive compound is preferable. This protective measure is of particular importance with drop-center tubeless rims as the air in the tire is contained by the tire-side rim surface.

6. Inflate tire only to recommended air pressure.

SAFETY PRECAUTIONS

1. **Insure that rings are properly seated, prior to inflation.**
2. **Use safety cage or lock ring guard. In emergency situations where a safety cage or portable safety device is not available, use clip-on type air chuck, so that operator may stand aside during inflation. When clip-on air chuck is used, pressure must be restricted to max. inflation capacity of tire or rim, whichever is lower.**
3. **Air tank should incorporate moisture trap when used with drop-center tubeless rims in order to reduce the moisture in contact with the metal rim surfaces.**



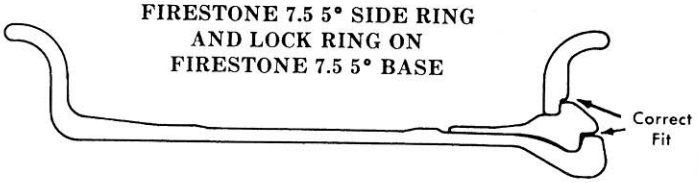
How to Insure Greater Safety and Service by Properly Matching Side and Lock Rings

It is important to recognize that the various types of highway rims produced by their manufacturers all differ to some degree in design. This is particularly true of removable rings and, as a result, side and lock rings of different rim types are not interchangeable. Some may appear to be, but they actually do not fit properly on the rim base. Serious accidents to personnel have resulted from the use of mismatched rings.

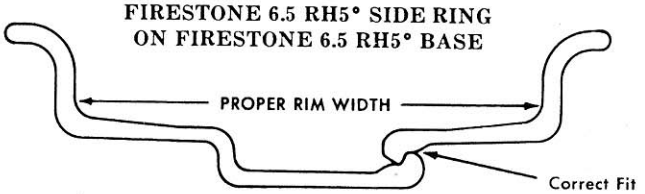
The drawings below illustrate a few of the potentially dangerous conditions which can result from the mismatching of rings and bases.

CORRECT

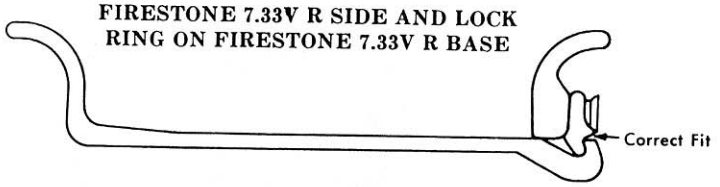
FIRESTONE 7.5 5° SIDE RING AND LOCK RING ON FIRESTONE 7.5 5° BASE



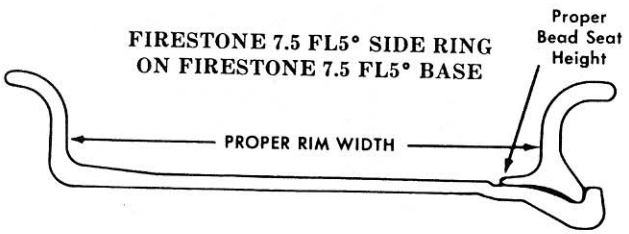
FIRESTONE 6.5 RH5° SIDE RING ON FIRESTONE 6.5 RH5° BASE



FIRESTONE 7.33V R SIDE AND LOCK RING ON FIRESTONE 7.33V R BASE

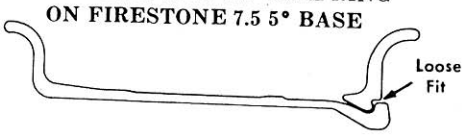


FIRESTONE 7.5 FL5° SIDE RING ON FIRESTONE 7.5 FL5° BASE

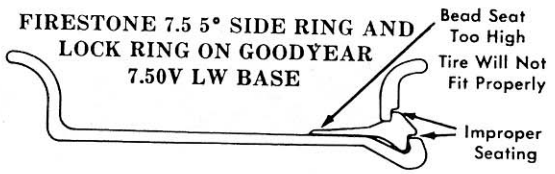


INCORRECT

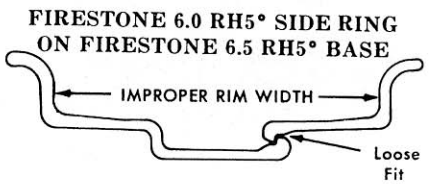
GOODYEAR 7.50V LW SIDE RING ON FIRESTONE 7.5 5° BASE



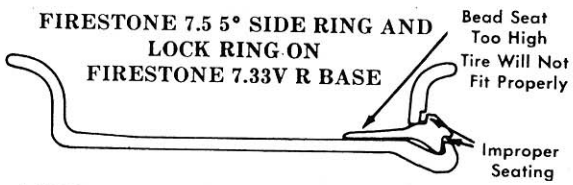
FIRESTONE 7.5 5° SIDE RING AND LOCK RING ON GOODYEAR 7.50V LW BASE



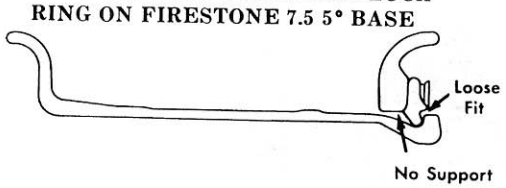
FIRESTONE 6.0 RH5° SIDE RING ON FIRESTONE 6.5 RH5° BASE



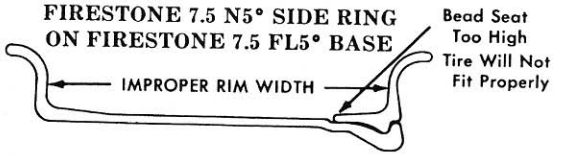
FIRESTONE 7.5 5° SIDE RING AND LOCK RING ON FIRESTONE 7.33V R BASE



FIRESTONE 7.33V R SIDE AND LOCK RING ON FIRESTONE 7.5 5° BASE

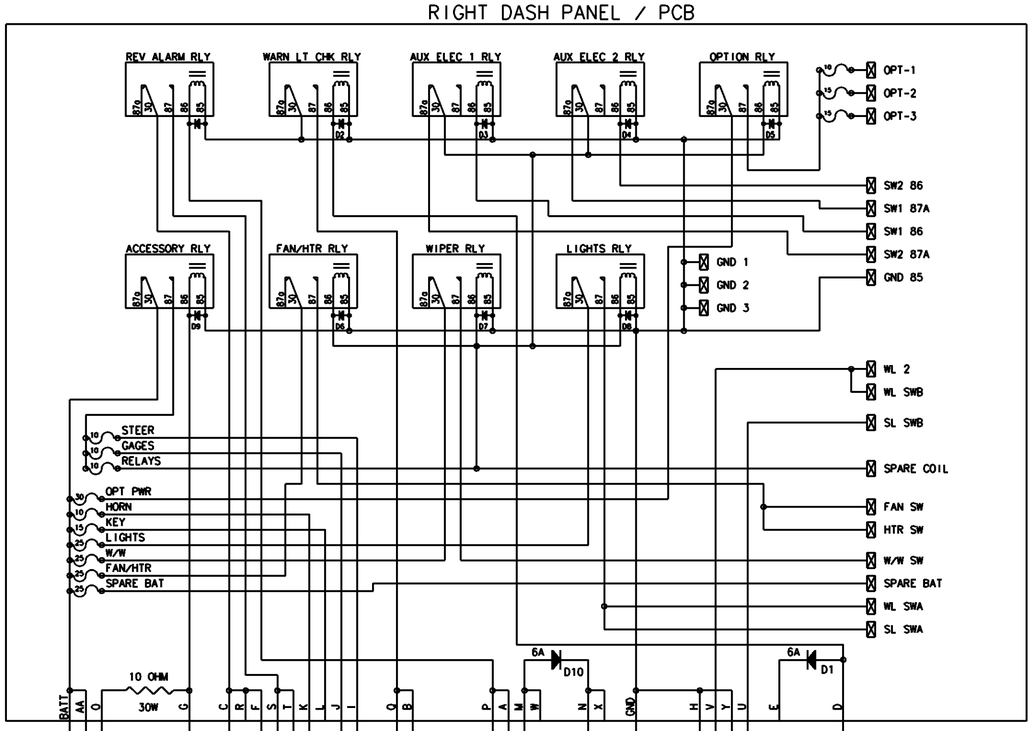


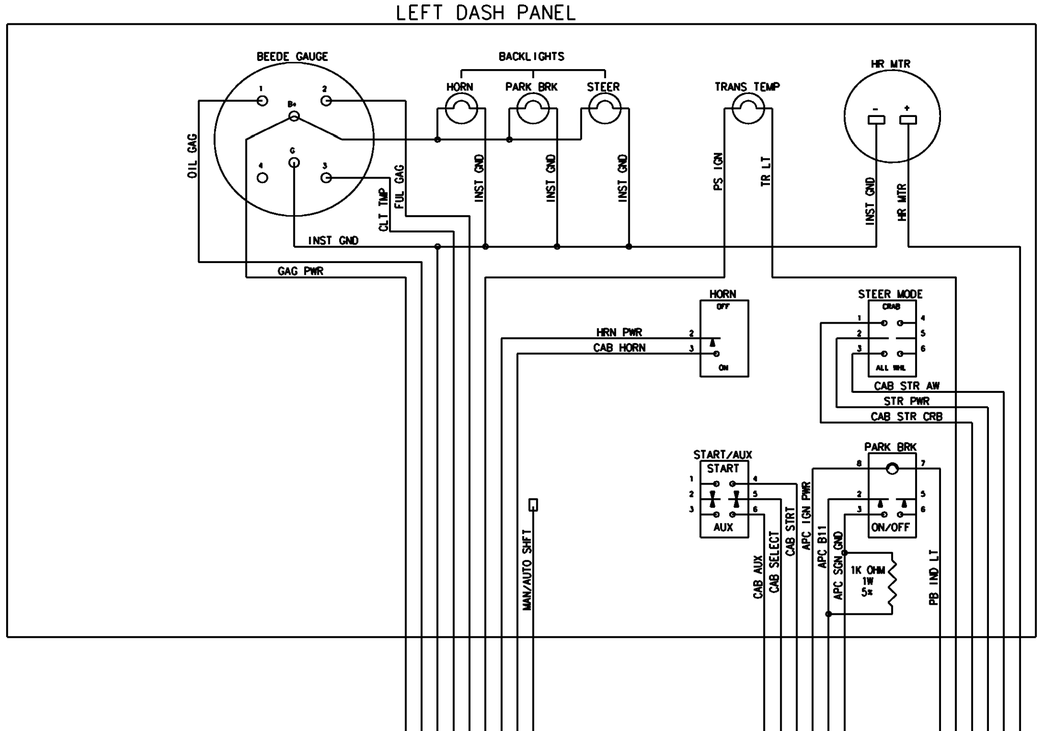
FIRESTONE 7.5 N5° SIDE RING ON FIRESTONE 7.5 FL5° BASE

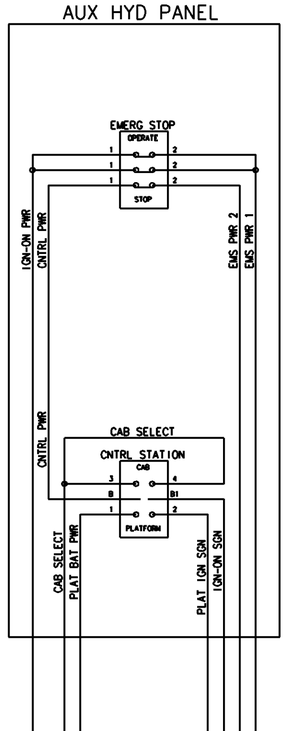


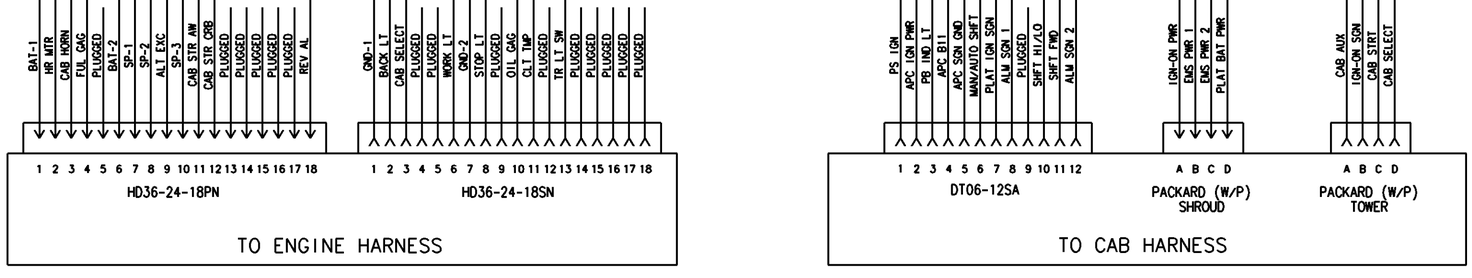
NOTE: When in doubt of component compatibility, refer to the U.S. Department of Transportation, National Highway Traffic Safety Administration's Multipiece Rim / Wheel Matching Chart. Chart is available from D.O.T. NHTSA Office of Defect Investigation, all rim and wheel distributors and all Firestone Sales Offices.

CARIBOU
DASH PANELS / PCB



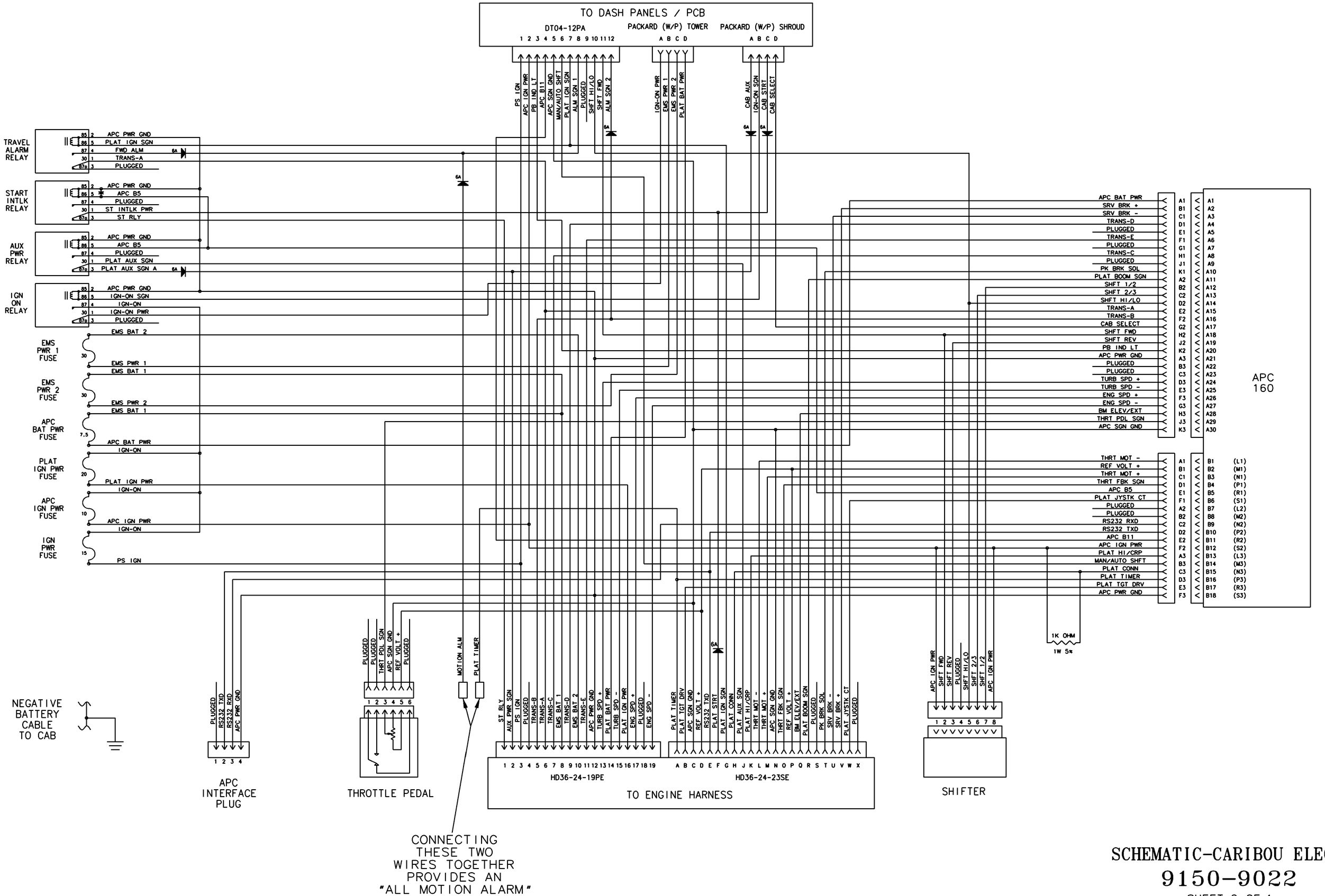






SCHEMATIC-CARIBOU ELEC
9150-9022

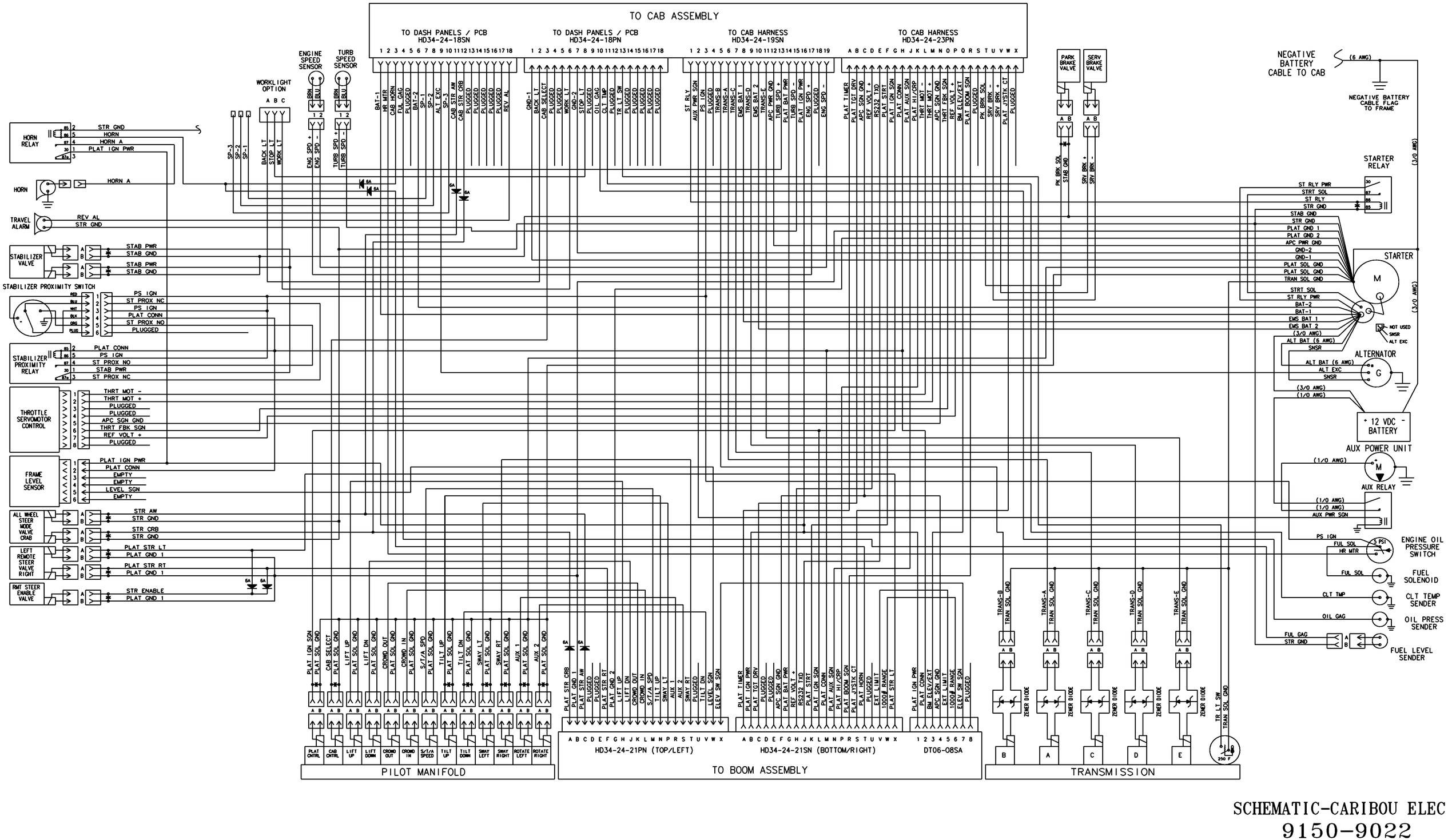
CARIBOU CAB



SCHEMATIC-CARIBOU ELEC.

9150-9022

CARIBOU ENGINE / CHASSIS

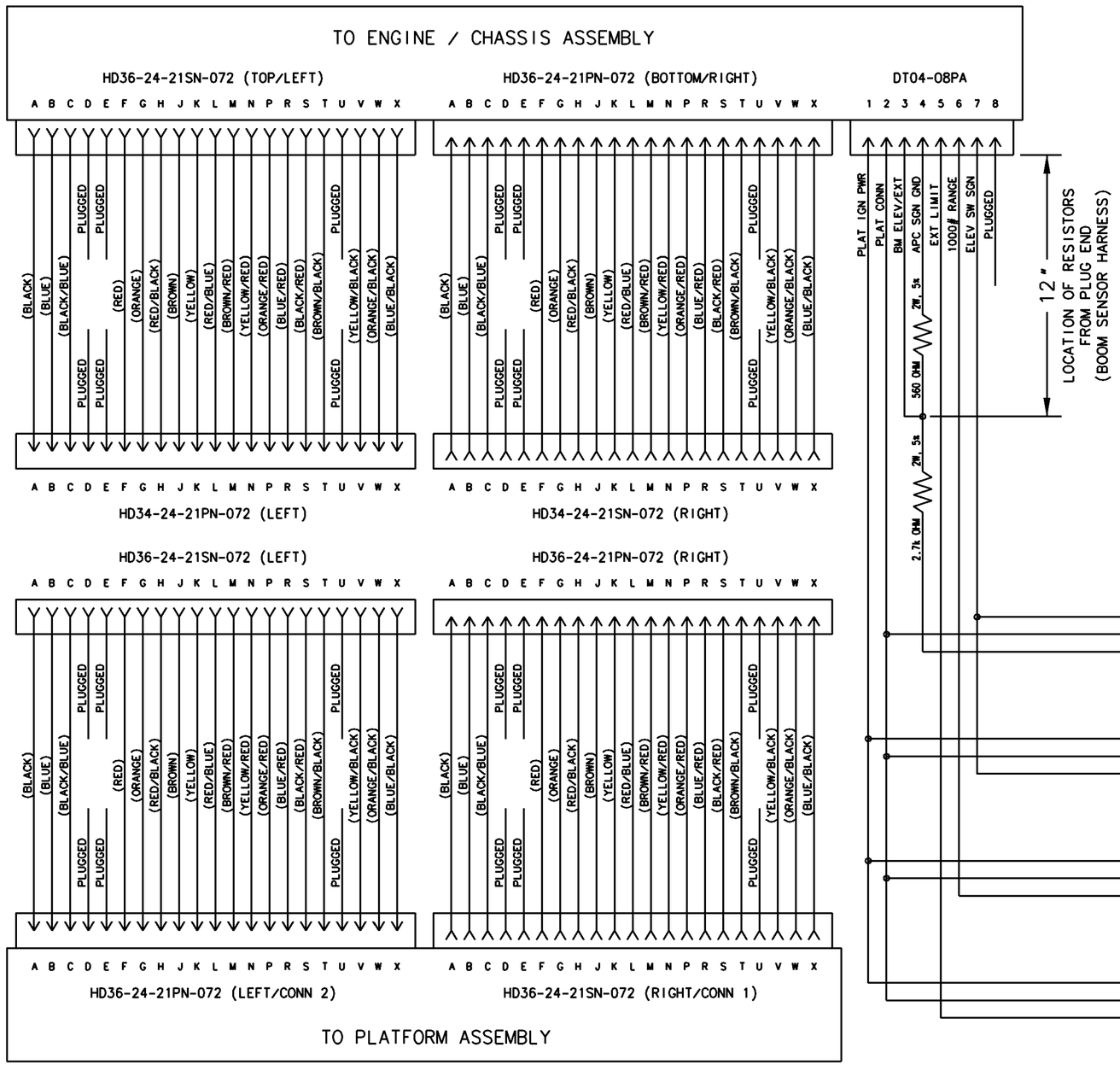


SCHEMATIC-CARIBOU ELEC.

9150-9022

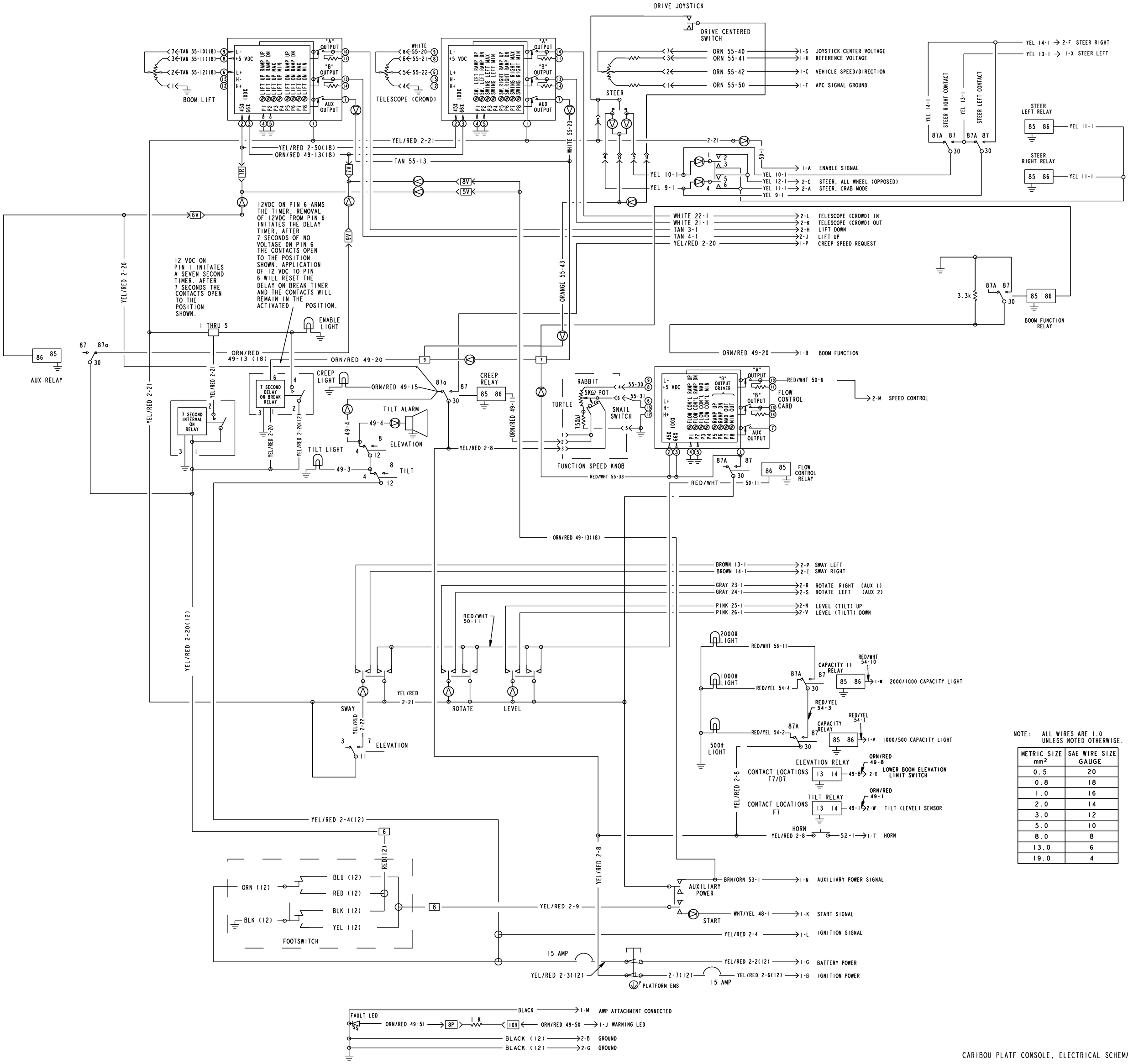
SHEET 3 OF 4

CARIBOU BOOM



SCHEMATIC-CARIBOU ELEC

9150-9022



NOTE: ALL WIRES ARE 1.0 UNLESS NOTED OTHERWISE.

METRIC SIZE mm²	SAE WIRE SIZE GAUGE
0.5	20
0.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8
13.0	6
19.0	4

CARIBOU PLATF CONSOLE, ELECTRICAL SCHEMATIC
1870140

Cyclopac® Service Procedures

Proper air cleaner servicing results in maximum engine protection against the ravages of dust. Proper servicing can also save time and money by maximizing filter life and dust cleaning efficiency.

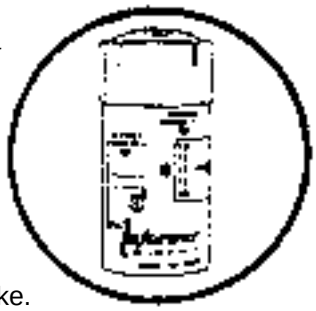
Two of the most common problems:

A) Over Servicing. New filter elements increase in dust cleaning efficiency as dust builds up on the media. Don't be fooled by filter appearance.... the filter should look dirty. By using proper filter measurement tools you will use the full life of the filter at maximum efficiency.

B) Improper Servicing. Your engine is vulnerable to abrasive dust contaminants during servicing. The most common cause of engine damage is careless servicing procedures. By following the steps shown, you can avoid unnecessary risk to the engine.

Measure Restriction

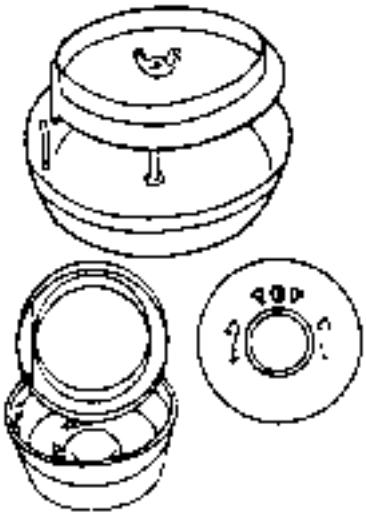
Measure the restriction of the air cleaner with a Donaldson restriction indicator, such as The Informer, a service gauge, or water manometer at the restriction tap provided in the air cleaner, the transfer pipe, or the blower intake.



One of two conditions will exist
(1) If the reading indicates the maximum restriction (per engine manufacturer's recommendations), change out the filter.
(2) If the reading shows below the maximum, the filter still has life left and should not be touched.

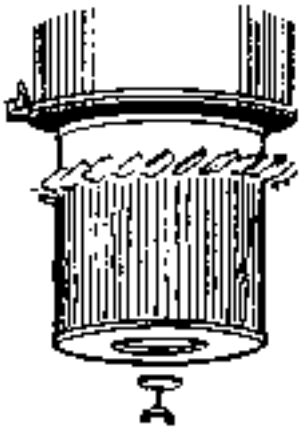
Empty the Dust Cup

Dust should not be allowed to build up closer than one inch from the baffle. On models equipped with a Donaldson Vacuator valve, dust cup service is cut to a minimum; all that is necessary is a quick check to see that the Vacuator valve is not inverted, damaged, or plugged.



Filter Servicing

When restriction indicates that filter servicing is required, loosen the wingnut and remove the primary filter. Before installing new filter, inspect the filter and gasket for shipping or storage damage. (See service tips on reverse side of this document.) Carefully install new element and wingnut.



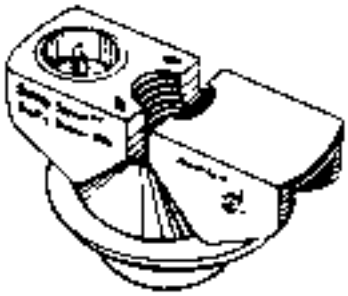
Always use authentic replacement Donaldson filters, which have been engineered to fit the air cleaner and engine intake system exactly.

Cover the Inlet

Don't leave the air inlet exposed! If the new filter won't be installed immediately, cover the opening to prevent stray contaminant from entering the induction system.

Safety Element Service

For Maximum engine protection and air cleaner service life, replace the safety filter **every third** primary filter change or cleaning, or as indicated by the Donaldson Safety Signal service indicator. Note that the safety element is not intended to be cleaned.



Reinstall the Dust Cup

Be sure the dust cup is sealed 360° around the air cleaner body. Reset the restriction indicator to green.

Check Connections

Ensure that all connections between the air cleaner and the engine are tight and leak-free.

Donaldson®

Air Filter Service Tips

7 Important Steps to Follow

(1) Remove the old element gently to prevent knocking dust off of it.

2) Always clean the inside of the housing carefully

3) Always clean the gasket sealing surfaces of the housing

4) Check for uneven dirt patterns in your old filter that indicate gasket leakage

5) Press your fresh gasket to see that it springs back

6) Make sure the gasket seats evenly

7) Ensure an airtight fit on all connections and ducts

T

The Important "Don't"

<u>Don't</u> remove filter for inspection.

Never rap a filter to clean it. Rapping only damages the filter.

<u>Never</u> judge the filter's life by looking at it. Measure how restricted its airflow is.

<u>Never</u> leave an air cleaner open longer than necessary.

<u>Don't</u> ignore a worn or damaged gasket in the housing....replace it!

Don't use a damaged or bunched filter.

Never use a warped cover on a housing.

Never substitute an incorrect filter model number.

Brochure No. F114004 (4/96) Replaces 1400-23

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