TM 09135C-OI

TEREXLIFT

SHOP MANUAL

Document 57.4400.8200 Edition 09/2005

Light Capability Rough Terrain Forklift (LCRTF)

TX 51-19MD

CONTRACT NO. SP050001D0044D.O.0024

PCN 500 091352 00

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DEALER'S OR ASSISTANCE STAMP

Shop Manual ***57.4400.8200***

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SECTION 1
INTRODUCTION

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1.0 INTRODUCTION

Owners, Users, and Operators:

Terex appreciates your choice of our machine for your application. Our number one priority is user safety, which is best achieved by our joint efforts. We feel that you make a major contribution to safety if you as the equipment users and operators:

1. **Comply** with OSHA, Federal, State, and Local Regulations.
2. **Read, Understand, and Follow** the instructions in this and other manuals supplied with this machine.
3. **Use Good, Safe Work Practices** in a common sense way.
4. **Only have trained operators** – directed by informed and knowledgeable supervision – running the machine.

NOTE: OSHA prohibits the alteration or modification of this machine without written manufacturers approval. Use only factory approved parts to service or repair this unit.

If there is anything in this manual that is not clear or which you believe should be added, please send your comments to Manager of Publication, Terex, 202 Raleigh Street, Wilmington, North Carolina 28412; or contact us by telephone at (910) 395-8500.

Thank you!

1.1 SYMBOLS

When using the machine, operators could face some situations requiring special care and particular knowledge.

When these situations involve the safety of operators or bystanders, the machine efficiency and proper utilization, this manual stresses these specific instructions by means of SPECIAL SYMBOLS. There are special (or safety) symbols in this manual, always combined with keywords, which class the situations according to their danger degree. The symbols are always followed by a text explaining the situation taken into account, the attention that must be paid to such situation, the method and the behavior, which should be adopted. When necessary, it stresses prohibitions or supplies instructions to prevent dangers. Sometimes, it can be followed by illustrations.
Listed below are special (or safety) symbols according to the relative seriousness of the hazard situation:

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

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

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

ATTENTION – Indicates a situation which, if not avoided, may result in property or equipment damage.

THIS SYMBOL MEANS YOUR SAFETY IS INVOLVED! READ, UNDERSTAND, AND FOLLOW ALL DANGER, WARNING, AND CAUTION DECALS ON YOUR MACHINE.

SECTION 2
SAFETY RULES

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2.0 SAFETY RULES

2.1 GENERAL

Most accidents, which occur while working, repairing or maintaining machines, are caused by not complying with the basic safety precautions. Therefore, it is necessary to pay attention to the potential hazards and the effects, which may come of operations carried out on the machine.

If you recognize hazardous situations, you can prevent accidents!

For instance, this handbook list special safety symbols to stress any potentially hazardous situation.

The instructions given in this manual are the ones established by Terex. They do not exclude other safe and most convenient ways for the machine installation, operation and maintenance which take into account the available spaces and means.

If in doubt, it is always better to ask! For this purpose, contact Terex the assistance service is at you disposal. Addresses, phone and fax numbers are given in the title page of this manual.

ATTENTION

Machine must be used, operatered and maintain in compliance with ASME B56.6 Standards.

2.2 OPERATORS MAINTENANCE STAFF RESPONSIBILITIES

The operators who use the machine regularly or occasionally (i.e. for transport reasons) shall have the following responsibilities:

- Make sure the machine is in proper order and all warning signals are functional before operating.
- Before and during any operation, operators shall never consume alcoholic beverages, medicines or other substances, which may alter their psychophysical conditions and, consequently, their working abilities.
- Never lift a load without a Rating Chart in the cab.
- Good eyesight, acute hearing, good coordination and ability to carry out all required operations in a safe way, according to the instructions of this manual.
- Ability to understand and apply the enforced rules, regulations and safety precautions.
  They shall be careful and sensible for their own as well as other's safety and shall desire to carry out the work correctly and in a responsible way.
- They shall keep calm and always be able to evaluate their own physical and mental conditions.
- Read and understand the operators' manual, its enclosed graphs and diagrams, the identification and hazard warning decals.
  The operator should be skilled and trained about the machine use.
- The operator might be required to have a license (or a driving license) when provided for by the laws enforced in the country where the machine works.

WARNING

From a technical point of view, the ordinary maintenance of the machine is not complex. And can be carried out by the machine operator provided that he has a basic knowledge of mechanics.

2.3 CLOTHING

Your clothing should be relatively close fitting. Loose jackets, shirt sleeves, rings, and other jewelry should be avoided because of the danger of catching them in moving parts or on controls.

2.4 PERSONAL EQUIPMENT

WARNING

Use only approved personal protective equipment in good condition.

Always wear required protective items such as hard hats, safety glasses, reflective clothing, safety shoes, and ear protection as required.

2.5 SAFETY PRECAUTIONS

JOB SITE

Always take into account the features of the job site where you are going in work:

- Always examine the working area and compare it with the machine dimensions in the different configurations.

DANGER

Pay the greatest attention to overhead electric lines. Always keep at a minimum a safe distance of at least 20 feet from the telescopic boom and the lifted load. Electrical Hazards!

- When assembling the machine or part of it on site, you need a well-equipped area of suitable dimensions. The surface shall be even, compact and stable.
- Look for the best route to the job site.
- When the machine is running, nobody can enter its working range.
- While working, keep the working area in order. Never leave objects scattered: They could hinder the machine movements and represent a danger for personnel.

2.6 GETTING READY TO WORK

Before any operation, the following precautions should be taken:

- First of all, make sure that all maintenance has been carried out with care according to the established schedule.
- Ensure you have enough fuel to avoid a sudden stop of the engine, especially during a crucial maneuver.
- Clean instruments, data plates, lights and the cab windshield thoroughly.
- Check the correct functioning of all the safety devices installed on the machine and in the job site.
- In case of troubles or difficulties, inform the supervisor at once. Never start working under unsafe conditions.

2.7 DURING WORK OR MAINTENANCE

During work, and especially maintenance, always pay attention:

- Do not pass or stop under raised loads or machine parts supported by hydraulic cylinders or ropes only.
- Keep the machine handholds and access steps always clean from oil, grease or dirt to prevent falls or slips.
- When entering/leaving the cab or other raised parts, always face the machine.
- Do not get into or off the machine while it is running.
- Do not leave the operators seat when the machine is running.
- Neither stop nor carry out repairs under or between the machine wheels when engine is running. When maintenance in this area is required, stop the engine.
- Do not carry out maintenance or repair works without a sufficient lighting.
- When using the machine lights, the beam should be oriented in order not to Blind the personnel at work.
- Before applying voltage to electric cables or components, check their connection and proper functioning.
- Do not carry out repairs on electric components with voltage over 48V.
- Do not connect wet plugs or sockets.
- Plates and hazard warning stickers shall never be removed, hidden or become unreadable.

- Except for maintenance purposes, do not remove safety devices, shields, protection cases, etc. Should their removal be necessary, stop the engine, remove them with the greatest care and always remember to refit them before starting the engine and using the machine again.
- Before any maintenance or repair work, stop the engine and disconnect the batteries.
- Do not lubricate, clean or adjust moving parts.
- Do not carry out operations manually when specific tools are provided for this purpose.
- Absolutely avoid the use of tools in bad conditions or in an improper way i.e. pliers instead of adjustable wrenches, etc.
- Before carrying out operations on hydraulic lines under pressure or disconnecting hydraulic components, ensure the relevant line has been previously depressurized and does not contain any hot fluid.

WARNING

Any repairs made on the hydraulic circuit must be carried out by authorized personnel. The hydraulic circuit of this machine is fitted with pressure accumulators. You and others could be seriously injured if accumulators are not completely depressurized. For this purpose, shut the engine down and step on the brake pedal 8-10 times. Operate the steering wheel and joystick several times until the wheels stop turning with the machine engine off.

- Neither smoke or open flames in areas subject to fire dangers and in presence of fuel, oil or batteries.
- Do not leave fuel cans or bottles in unsuitable places.
- Do not empty catalytic mufflers or tanks containing burning substances without taking the necessary measures.
- Carefully handle all flammable or dangerous substances.
- Do not tamper with fire-extinguishers or pressure accumulators: explosion hazard!
- After any maintenance or repair work, make sure that no tool, cloth or other object has been left within machine compartments, fitted with moving parts, or where suction and cooling air circulates.
- When working, do not have more than one person giving instructions to the operator. Instructions and signals must be given by one person only.
- Always follow the instructions given by the supervisor.
- Never distract the operator during working phases of a crucial maneuver.
- After working, never leave the machine under potentially dangerous conditions.
- **The relief valves are factory preset. Adjusting the relief valve in the field will void machine warranty. Valves must be set only by trained personnel.**

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SECTION 3
GENERAL INFORMATION AND SPECIFICATIONS

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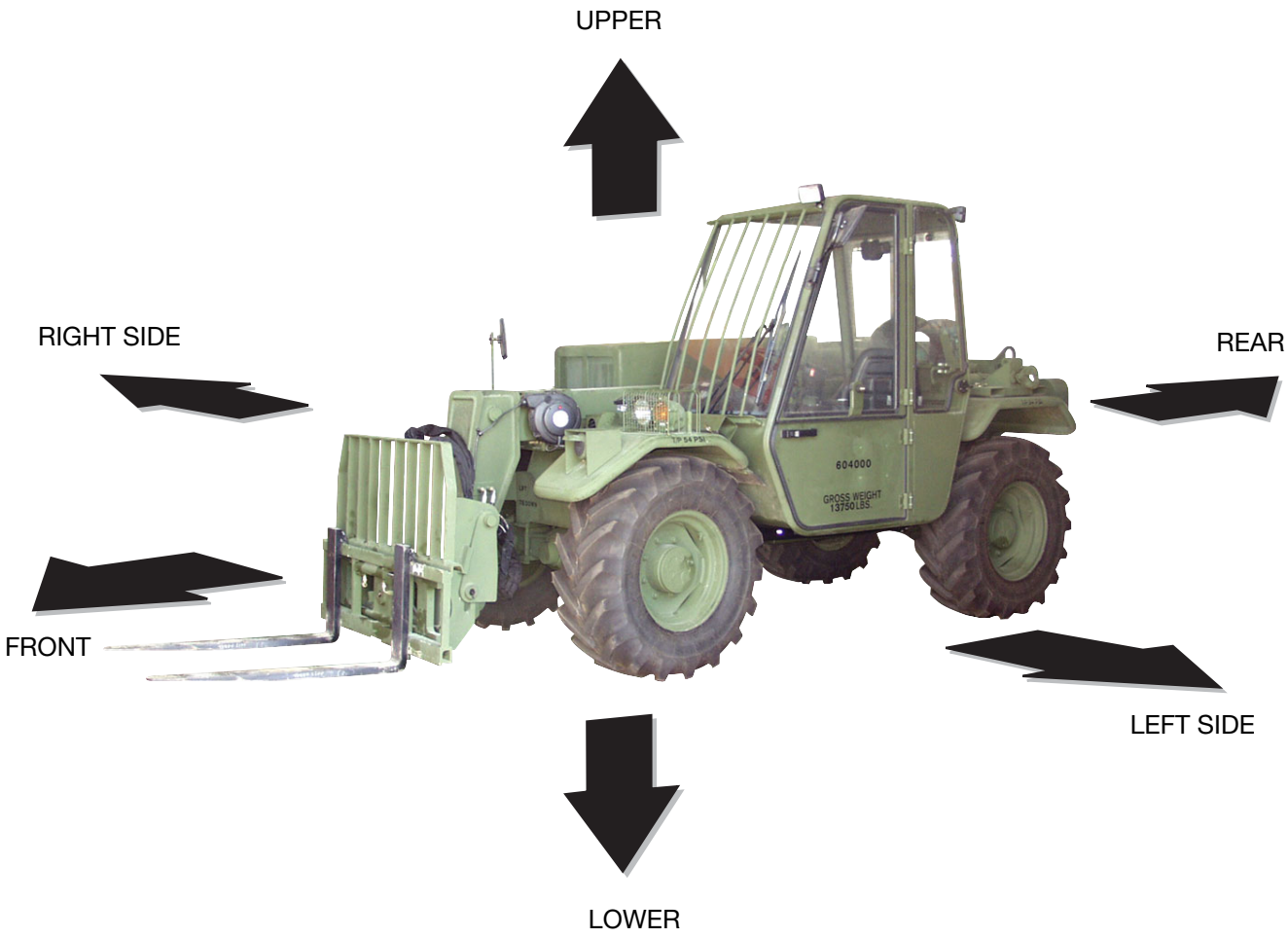
3.0 MACHINE REFERENCES

3.1 MACHINE POSITION

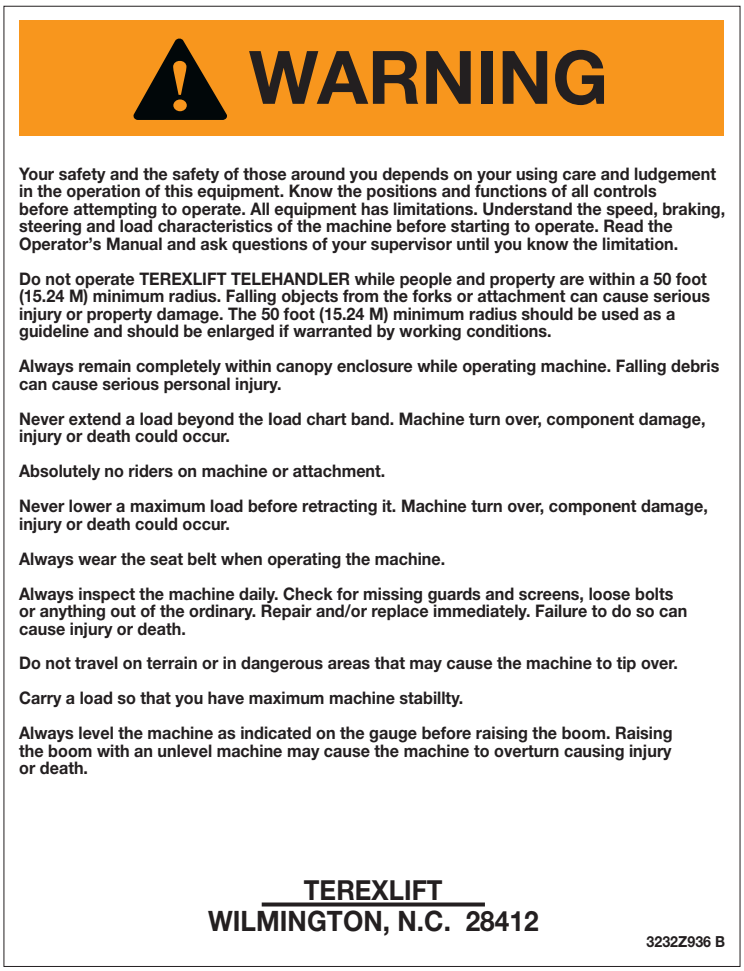
Any reference to the machine position will always be as if the operators is seating in the operator's seat, unless other wise specified.



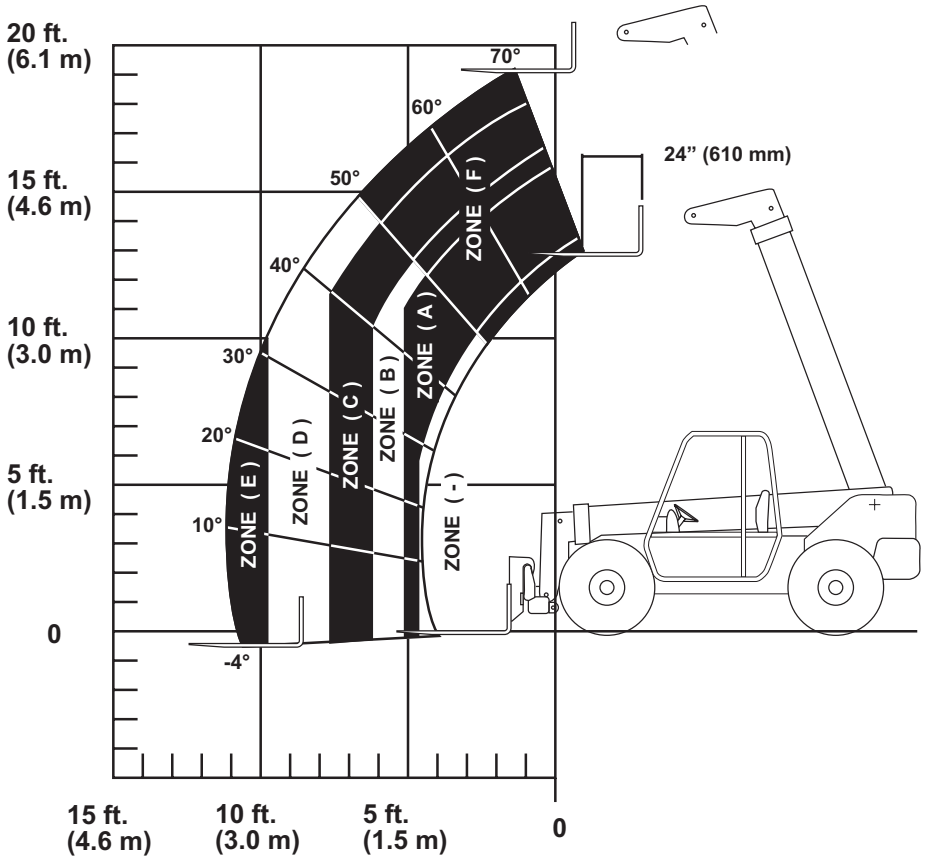
3.2 LABELS AND WARNING DECALS

The labels and warning decals normally applied on standard machines or which can be found when special attachments are coupled to the machine are shown below.

Read and understand all decals on this machine. Make sure they are easy to read. For this purpose, clean them or replace those that become unreadable (either graphic or text). To clean labels, use a soft cloth, water and soap.
Never use solvents, patrol, etc. When a label is applied on a part being replaced, make sure that the replaced part is already labeled as required or apply a new label.



TEREXLIFT TX51-19MD



RATED LIFT CAPACITIES ARE WITH:
MACHINE ON A FIRM LEVEL SURFACE WITH UNDAMAGED, PROPERLY INFLATED TIRES.

TIRE SIZE: 375 / 75 R20
TIRE PRESSURE: 54 psi
TIRE PRESSURE - SOFT GROUND: 26 psi

S/N

LOAD LIMITS / HORIZONTAL BOOM
LAST FULLY VISIBLE LETTER

(-)	RETRACTED =	5070 LBS	(2300 Kg)
(A)	LETTER VISIBLE =	4410 LBS	(2000 Kg)
(B)	LETTER VISIBLE =	3305 LBS	(1500 Kg)
(C)	LETTER VISIBLE =	2755 LBS	(1250 Kg)
(D)	LETTER VISIBLE =	2205 LBS	(1000 Kg)
(E)	LETTER VISIBLE =	1765 LBS	(800 Kg)
(F)	BOOM ANGLE +50° =	500 LBS	(225 Kg)

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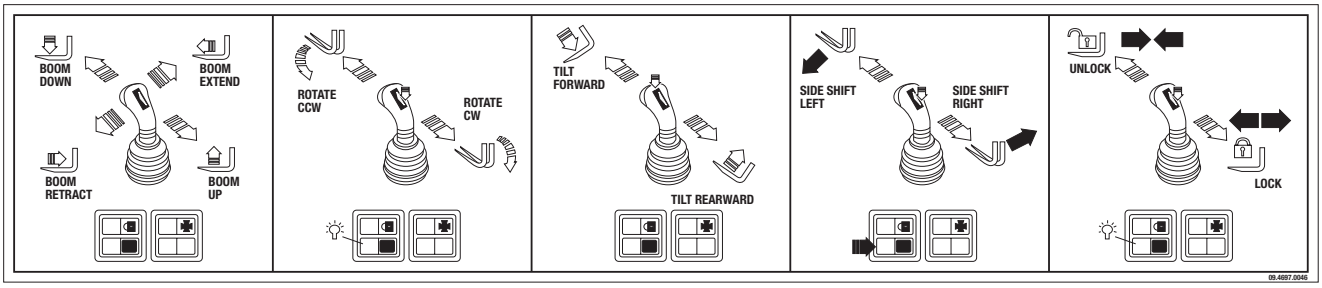


WARNING

USE THE SEALT BELT

ALWAYS ADJUST SEAT AND FASTEN SEAT BELT BEFORE STARTING ENGINE.

WARNING

Operation & Maintenance Manual

- Do not remove manual from machine.
- Replace manual if damaged.

MK181113

WARNING

BEFORE OPERATING

IMPROPER OPERATION OF THIS EQUIPMENT CAN CAUSE SEVERE INJURY OR DEATH.

READ AND UNDERSTAND THE OPERATOR'S MANUAL AND SAFETY INSTRUCTIONS BEFORE OPERATING OR SERVICING.

WARNING

PINCH POINT AREA

TO PREVENT INJURY KEEP CLEAR ANYTIME MACHINE IS RUNNING

WARNING

PARKING BRAKE

AN UNATTENDED MACHINE CAN MOVE OR ROLL.

SET PARKING BRAKE, LOWER CARRIAGE OR ATTACHMENT TO GROUND BEFORE LEAVING MACHINE.

FAILURE TO HEED COULD RESULT IN DEATH OR SERIOUS INJURY.

WARNING

NO RIDERS

DANGER

Keep clear of boom to prevent serious bodily injury.

MK 182121

DANGER

BATTERY COMPARTMENT

EXPLOSIVE GASES

CIGARETTES, FLAMES OR SPARKS COULD CAUSE BATTERY TO EXPLODE.

ALWAYS SHIELD EYES AND FACE FROM BATTERY.

POISON

CAUSES SEVERE BURNS

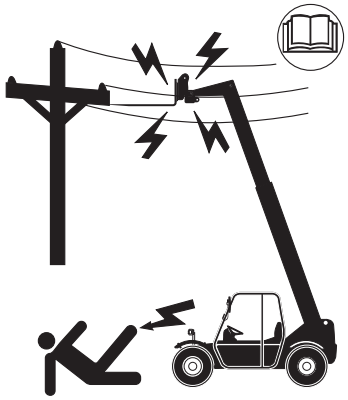
CONTAINS SULFURIC ACID. AVOID CONTACT WIYH SKIN, EYES OR CLOTHING.

CAUTION

NO STEP

12400-243

DANGER



DEATH OR INJURY CAN RESULT FROM CONTACTING ELECTRIC POWER LINES.

ALWAYS CONTACT THE ELECTRIC POWER LINES OWNER. THE ELECTRIC POWER SHALL BE DISCONNECTED OR THE POWER LINES MOVED OR INSULATED BEFORE MACHINE OPERATIONS BEGIN.

POWER LINE VOLTAGE	REQUIRED CLEARANCE
0 TO 50 KV	10 FT (3.00 M)
50 TO 200 KV	15 FT (4.60 M)
200 TO 350 KV	20 FT (6.10 M)
350 TO 500 KV	25 FT (7.62 M)
500 TO 750 KV	35 FT (10.67 M)
750 TO 1000 KV	45 FT (13.72 M)

CAUTION

DO NOT WASH OR PAINT INSIDE THIS ENCLOSURE

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3.3 EXPLANATION OF THE DIFFERENT SYMBOLS USED ON THE MACHINE

This paragraph illustrates those symbols, which are normally applied on the main control devices and instruments of a standard machine, and those, which can be applied on accessories or special attachments. They are mainly (ISO) standardized symbols, which are now part of the common life.

Symbol	Description	Symbol	Description	Symbol	Description
	Hazard indicator lights		Steering selection		Air filter clogged
	Windshield wiper		Brake pressure		Lift/Tie down
			Engine oil pressure		
	Windshield washer		Boom raising		Work - road setting
	Cab ventilation fan		Boom lowering		
			Boom extension		
	Diesel engine water temperature		Boom retraction		
	Fuel level		Attachment locking device		
	Fork rotating		Attachment releasing device		
	Turn signals		Fork pitching forward		
	Parking brake		Fork pitching back		
	Battery charge		Oil filter clogged		

3.4 MACHINE MODEL AND TYPE

Light Capability Rough Terrain Forklift (LCRTF), model TX-51-19MD

3.5 MANUFACTURER

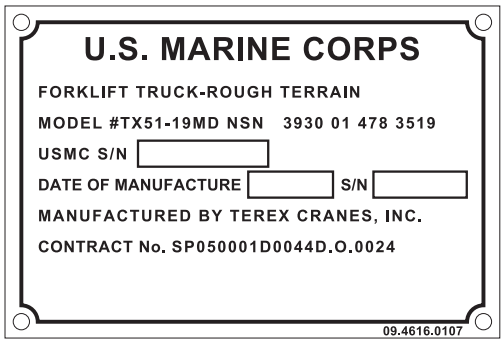
Terex
202 Raleigh Street
Wilmington, NC 28412
Phone: 910-395-8500 Fax: 910-395-8507

ATTENTION

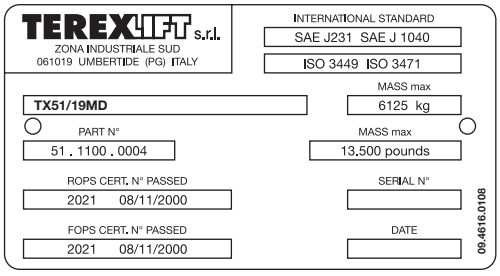
Check that the operator and maintenance manual refers to the delivered machine. When asking for information or technical assistance, always specify model, type and serial number of the machine.

3.6 MACHINE IDENTIFICATION

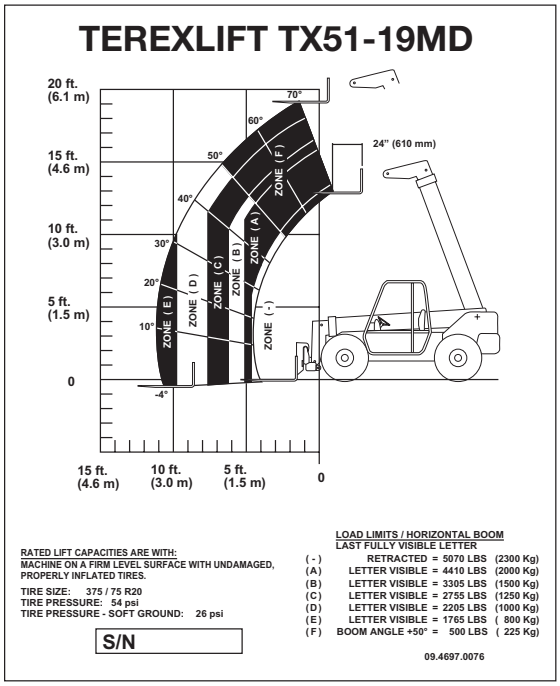
plates are applied on the machine.



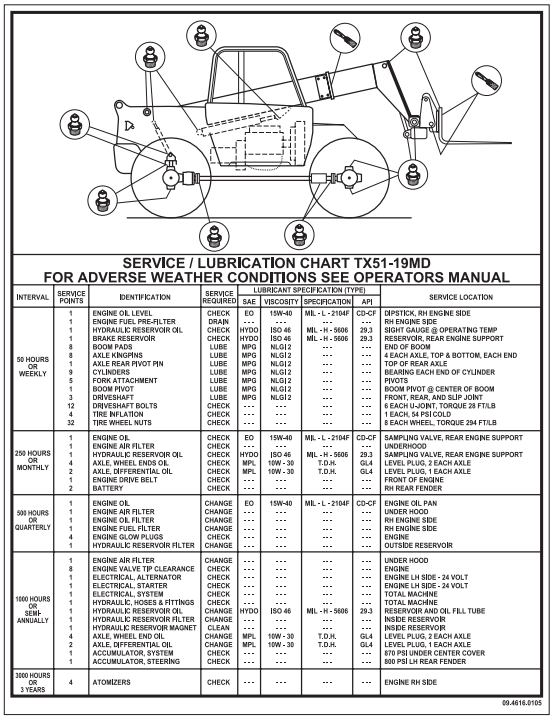
The ROPS / FOPS Cert. Plate is located inside the machine.



Machine Lifting Diagram is on the driver side, rear of machine, and left of the identification plate. This is to be used only as a reference. You should always use the current rating chart.



Service Lubrication Chart is located on the inside door of the operators cab. This should be used to locate all lubrication points and will tell you what type of lubrication is required.



3.7 CHASSIS SERIAL NUMBER

The chassis serial number is stamped on the front left part of the chassis side member.

3.8 IDENTIFICATION PLATES

The plates of the main components, which are not directly manufactured by Terex (engines, pump, etc.), are located where originally applied by the manufacturers.

3.9 ALLOWED USE

The machines have been designed and manufactured for lifting, handling. Any other use is considered contrary to that established and, therefore, improper. The compliance with and the strict respect of the operation, maintenance and repair conditions, indicated by the Manufacturer, represent and essential part of the allowed use. The use, maintenance and repair of the machine shall be carried out by skilled operators only who know well the special characteristics of the machine and the safety precautions to be taken.

The Manufacturer disclaims any responsibility for damage to persons or things arising from arbitrary modifications carried out on the machine.

3.10 IMPROPER USE

Improper use means a utilization of the machine following working criteria, which do not comply with the instructions of this manual, and in general, may result in risks for both operators and bystanders.

We list below some of the most frequent and hazardous situations of improper use:

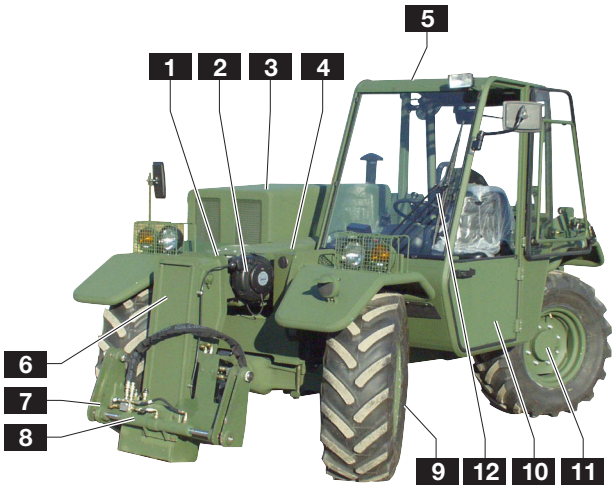
- Carrying passengers on the machine
- Not strictly complying with the operation and maintenance instructions of this manual.
- Working beyond the handler working limits
- Working on unstable edges of ditches
- Working on steep slopes
- Working in potentially explosive environments.

3.11 APPLICABLE STANDARDS

For ensuring the operator's safety, the following standards were followed during the risk analyze of the machine with telescopic boom:

DIRECTIVE	*TITLE*
89/392 CEE	Machine Directive
98/39 CEE	Steering Devices
86/295 CEE-91/368 CEE	ROPS – FOPS
86/296 CEE-91/368 CEE	Driving Place
88/465 CEE	Seats-Type-Approval
98/40 CEE	Rear view mirrors for agricultural machines
73/23 CEE-93/68 CEE	Low Voltage Directive
74/151 CEE	Tractors–Weight,Plate, etc.
79/532 CEE	Tractors – Lighting and signaling devices
80/720 CEE-97/54 CEE	Tractors–Working Ranges
89/391 CEE	Safety and Health of workers at work
89/336 CEE-92/31 CEE	Electromagnetic compatibility
96/627 CEE	Agricultural Tractors – Noise levels within the driving cab
STANDARD	***TITLE***
EN292-1/2	Machine Safety – Designing principles
EN294	Machine Safety – Safety distance
EN418	Machine Safety – Emergency stop
EN457	Machine Safety – Audible hazard signaling devices
EN563	Machine Safety - Surface temperature
EN574	Machine Safety – Control devices
EN811	Machine Safety – Safety distance
EN349	Machine Safety – Min. spaces
EN842	Machine Safety – Visible hazard signaling devices
EN982	Machine Safety – Hyd. systems
EN1032/5007/5008	Measurement of vibrations
EN1033/1037	Machine Safety – Prevention of accidental starting
EN1050	Machine Safety – Risk evaluation
EN1088	Machine Safety – Locking Devices
EN4871/ISO5131/7216	Acoustics
NC337-01/ISO5010	Steering devices
NC344-01/05/10	Braking devices
UNI EN 25353	Seat reference point
ISO 3767-1/2	Pictorial signs for the operator's controls
EN ISO 6682	Access to the operation controls
EN 22860/ISO 4252/4253	Minimum access dimensions
ASME B56.6	Stability Safety standard for rough terrain forklift trucks
SAE J1040,ISO 3471	ROPS – FOPS
SAE J231, ISO 3449	ROPS – FOPS

3.12 LIST OF THE MAIN COMPONENTS



1. 2nd Boom Section
2. Electrical Reel
3. Engine Hood
4. Boom Base Section
5. Driving Cab According to ROPS-FOPS Provisions
6. Boom Tip Section
7. Attachment Holding Frame
8. Attachment Locking Cylinder
9. Left Front Wheel Reduction Gear
10. Cab Door
11. Left Rear Wheel Reduction Wheel
12. Windshield Wipers

3.13 DESCRIPTION OF THE MAIN COMPONENTS

Transmission
Consists of a variable displacement hydraulic pump that drives a hydraulic motor located on the front axle. The pump only begins to drive the motor when the accelerator is depressed. The hydraulic motor adjusts to give maximum torque when under heavy loads, or maximum flow under light loads.

Steering Axles (front and rear) Differential Gears
The front axle (limited slip differential) drives the rear axle (locked differential) thru a drive shaft to provide 4 -wheel drive at all times.

Tires
The machine is equipped with tires suitable sized for the maximum load allowed on the machine. When replacement is necessary, they shall be replaced with new ones having the same dimensions and loading capacity.

Overload Warning System
The standard overload warning system installed on the vehicle enables the operator to work under the safest conditions. At the machine starting, the overload warning system carries out a diagnostics of all LED's then sets to the first green LED signaling the proper functioning of the instrument. Refer to 3B6 manual for more information.

Hydraulic Circuit
Consists of a gear pump connected to the engine which, through a steering valve, dispenses oil to the distributor for the following functions:

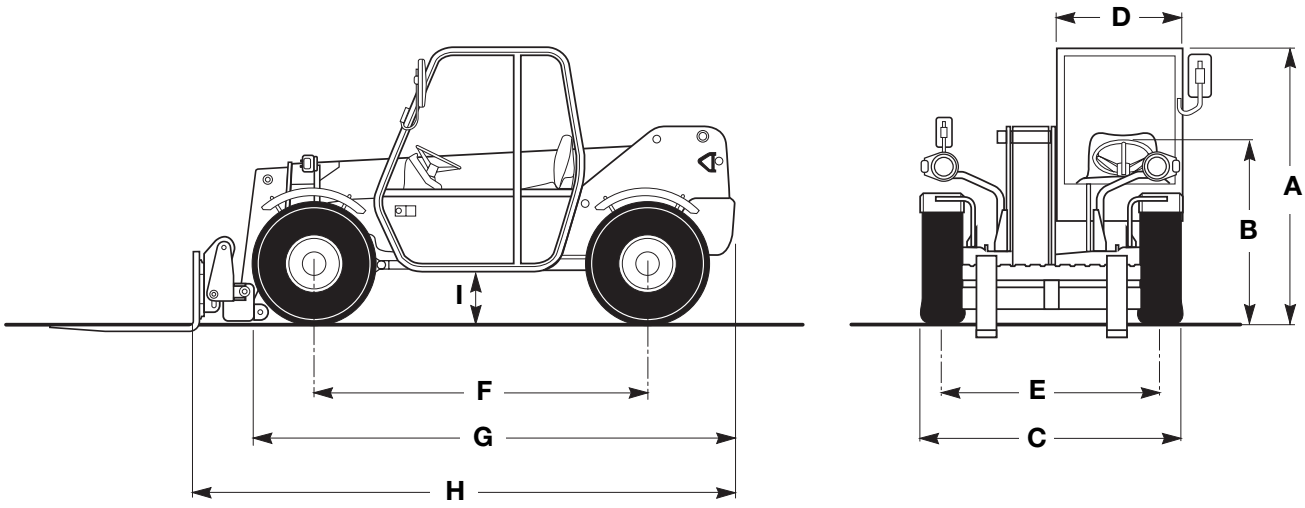
- Boom lifting / Lowering
- Telescopic Boom Sections Extension / Retraction
- Fork Rotation
- Fork Locking
- Fork Tilting
- Fork Side Shift
- Steering Valve
- Control Valve

Brake Circuit
Consists of an independent reservoir and circuit: The brake pedal operates a pump which pressurizes the wet disc brakes in the front axle.

3.14 OPTIONAL ACCESSORIES

The machine can be fitted with a wide range of optional accessories (Terex sales network). Check the accessories which can be fitted.

3.15 TECHNICAL DATA AND PERFORMANCE



		STANDARD	Metric
MAIN DIMENSIONS			
A Overheight	Ft. In.	7' 6"	
B Height Of Steering Wheel	Ft. In.	4' 11"	
C Overall Width	Ft. In.	6' 6”	
D Inside Cab Width	Ft. In.	3' 0"	
E Track	Ft. In.	4' 11"	
F Wheelbase	Ft. In.	7' 10"	
G Length At Front Wheels	Ft. In.	12' 6"	
H Length At Fork-Holder Plate	Ft. In.	14' 8"	
I Ground Clearance	Ft. In.	1' 4"	
• Outside Turn Radius	Ft. In.	26' 8"	
CHARACTERISTIC ANGLES			
• Angle Of Approach		90°	
• Departure Angle		70°	
WEIGHT			
• Weight In Running Order	Lb	13450	
SPEED			
• Working Speed (*)	Mph	5.0	
• Travel Speed (*)	Mph	20	
• Max. Slope With Full Load		45%	
(*) = either forward or reverse motion			
PAYLOAD AND REACH			
• Max. Lifting Height	Ft. In.	18' 9"	
• Reach At Max. Height	Ft. In.	14' 8"	
• Max. Reach Forward	Ft. In.	10' 9"	
• Implement Holding Plate Rotation		135°	
• Payload At Max. Height	Lb	500	
• Payload At Max. Reach	Lb	1765	
• Payload At 50° Boom Angle	Lb	2205	

DIESEL ENGINE		***Turbo***
• Make		DEUTZ
• Model / Type		BFM 2011
• Features:		Diesel
		4 Stroke
		Direct Injection
• Cylinders		2-3-4 Cylinders In Line
• Bore x Stroke	in (mm)	3.7 x 4.4 (94 x 112)
• Total Displacement	Cu. In. (cc)	189.65 (3108)
• Power At 2500 Rpm (ISO 3046 IFN)	Hp (kW)	81.6 (60)
ELECTRIC SYSTEM		
• Voltage	V	24
• Self – Regulated Alternator (On Diesel Engine)	V	24
• Battery	Ah	2x120
MACHINE NOISE LEVELS		
• Drive By @25 feet	dBa	68
• Static @25 feet	dBa	61
PRESSURE SETTING		
• Main Distributor Valve	psi	4100
• Propel Pump Valve	psi	6000
• Counterbalance Valve	psi	5100

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SECTION 4
CONTROLS AND INSTRUMENTS

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4.0 PREPARATION, INSPECTION AND ADJUSTMENTS

GENERAL
The following operating suggestions are offered as a reminder rather than as an attempt to instruct.

a. Always consult the rating chart in the cab for the maximum load, which may be lifted with the various combinations.
b. Before actually operating the machine each day, perform the pre-operation inspection check list (**Section 5**)
c. Clean the windows, headlights, and mirrors to ensure full vision. Also make sure the mirrors are properly adjusted to suit the needs of the operator.
d. Adjust the operator's seat to provide a comfortable and safe operating position.

DANGER

Overinflated or overheated tires can burst. A tire burst may result in serious injury; never use the machine if tires are worn, wrongly inflated or damaged.

e. Check the correct inflation of the tires (see chart below).

Dimensions		375/75 R20 x M27	
Load Index		155A	
Rim		11" x 20"	
Wheel Disc		8 holes DIN 70361	
Pressure	Bar	1.8 (soft)	3.7 (standard)
	PSI	26 (soft)	54 (standard)

f. Make sure that the tire plies are not cut or worn.

ATTENTION

Always use tires having the dimensions indicated in the vehicle registration document.

DANGER

A tire burst may result in serious injury; never use the machine if tires are worn, wrongly inflated or damaged.

4.1 ADJUSTING THE SEAT

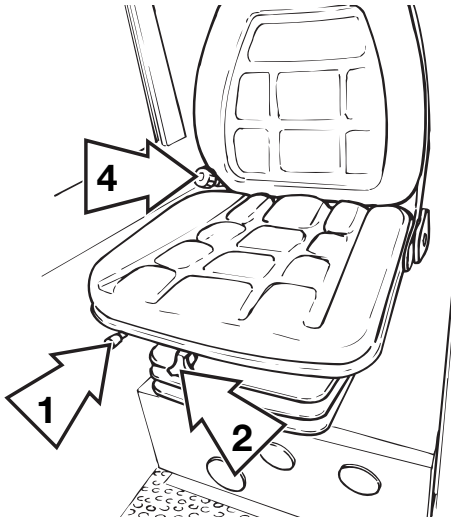
A correct adjustment of the seat ensures the operator a safe and comfortable driving. The operator's seat is fitted with devices, which allow for the adjustment of springing, back rest angle and distance from the controls.

Seat Distance From The Controls
The operator's seat is fitted with an adjusting device that allows sliding the same seat forward or back with respect to the steering column.

Springing Adjustment
Rotate knob (**2**) clockwise or counterclockwise until obtaining the required springing. Rotate clockwise to increase the seat springing or counterclockwise to reduce it.

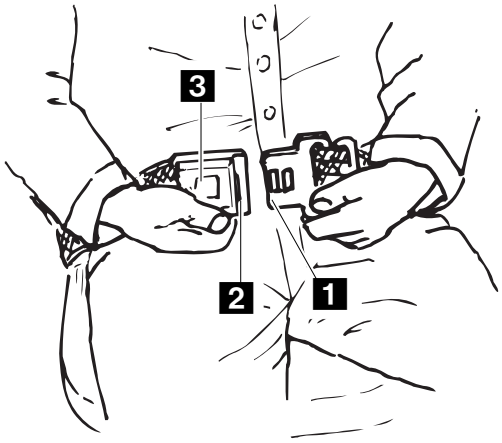
Height Adjustment
The seat height can be set to three different positions. To adjust, lift the seat until hearing he characteristic "clack" coupling sound. To lower the seat, raise to stroke end to unlock the mechanism, then release the seat; it automatically sets to the lowest position.

Back rest angle adjustment
The back rest can be adjusted by means of knob (**4**). Rotated clockwise, it increases the back rest angle; counterclockwise it reduces it.



4.2 FASTENING THE SEAT BELTS

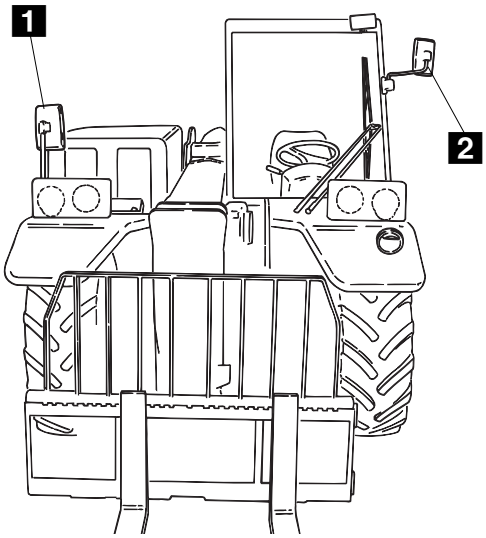
1. Sit correctly in the driving seat.
2. Check that belts are not tangled, then push tab (**1**) into buckle (**2**) until it latches.
3. To release the belt push button (**3**) and remove the tab from the buckle.
4. Adjust the belt across the hips and not on the stomach.
5. The two ends of the buckle can be adjusted separately, by holding the buckle in central position.



4.3 ADJUSTING THE REAR VIEW MIRRORS

The machine is fitted with two rear view mirror.

1. Right rear view mirror (**1**) is located on a special supporting bracket in an advanced position and allows checking the area behind the machine, on the right-hand side. To adjust its position, manually rotate the joint it is fitted with.
2. Left rear view mirror (**2**) is placed on the left upper post of the windshield and allows checking the area behind the machine, on the left hand side. To adjust its position, manually rotate the joint it is fitted with.



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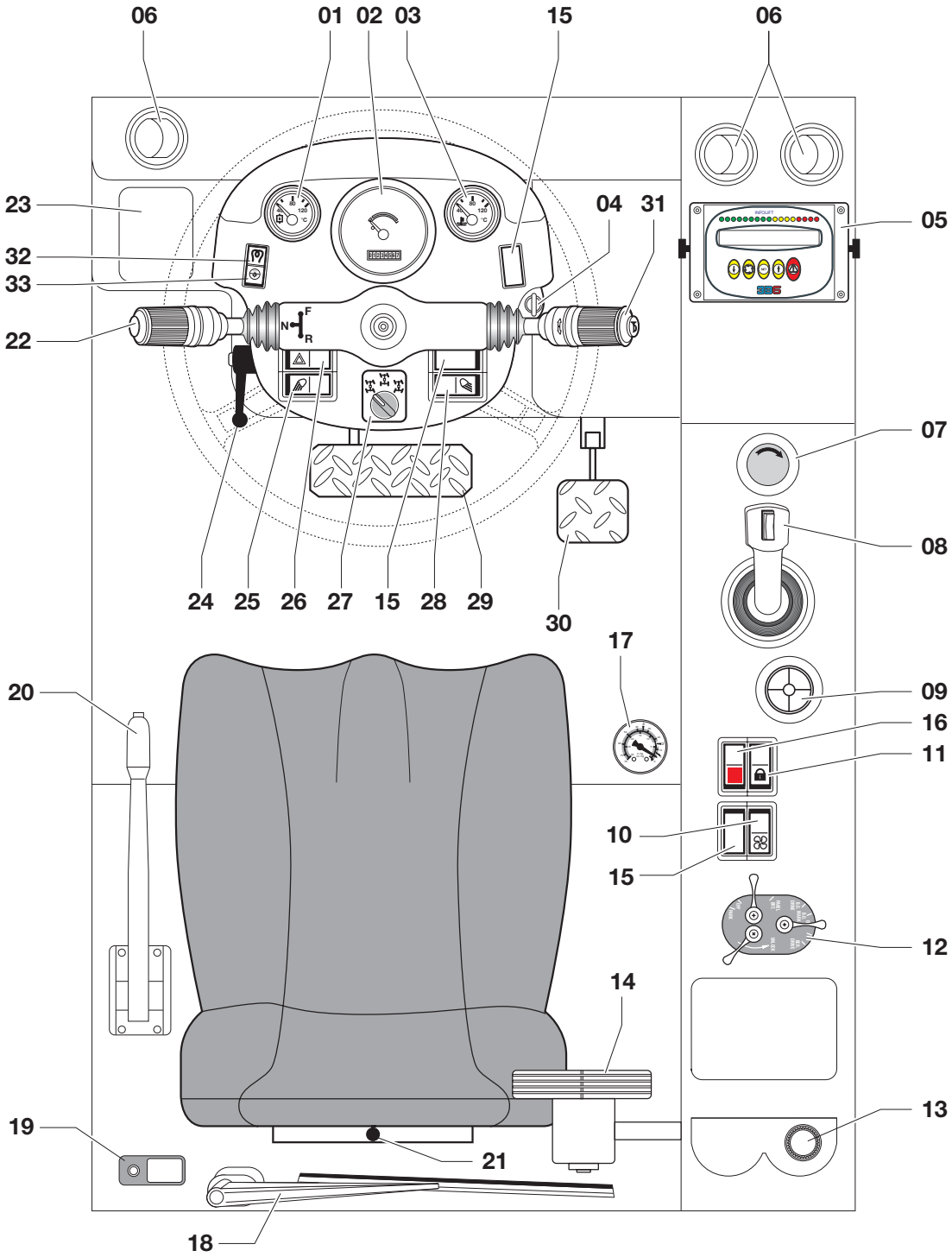
4.4 CONTROLS AND OPERATIONS

CONTROL IDENTIFICATION

The instruments and controls are shown below. The numbers on the illustration correspond to the numbers on the following list, which identifies the controls and describes their operations.

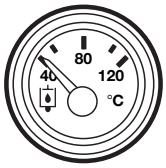


4.5 CONTROLS AND INSTRUMENTS

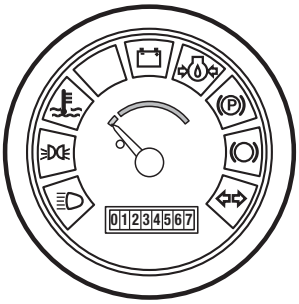
01. Hydraulic Oil Temperature Indicator
02. Gauge / Indicator Lights
03. Engine Coolant Temperature
04. Ignition Switch
05. Overload Warning System
06. Air Vents
07. Emergency Stop Button
08. Joystick Lever
09. Machine Level
10. Defroster Fan Switch
11. Work - Travel Switch
12. Blackout Lighting Control Switch
13. Windshield Water Reservoir
14. Cab Fan
15. Blank
16. Fork Side Shift / Rotating Switch
17. Filter Indicator
18. Rear Wiper
19. Dome Light
20. Parking Brake Lever
21. Seat Switch
22. Forward / Neutral / Reverse Speed Selection Lever
23. Fuse / Relay Panel
24. Steering Column Tilt Lever
25. Hazard Lights Switch
26. Front Work Light Switch
27. Steering Selection Switch
28. Rear Work Light
29. Brake Pedal
30. Accelerator Pedal
31. Turn Signals / Horn / Wiper / Windshield Washer Switch
32. Warning Lamp: Glow Plug
33. Warning Lamp: Clogged filter

4.6 CONTROL DESCRIPTION

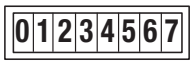
1. **Hydraulic Oil Temperature Indicator** – Indicates the oil temperature in the reservoir.



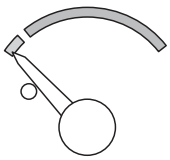
2. **Gauge / Indicator Lights:**



a. **Hourmeter** – This indicates the running time of the engine in hours.



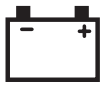
b. **Fuel Gauge** – Indicates the amount of fuel remaining in the fuel tank.



c. **Hazard Light** – Green indicator signaling when position lights are ON.

d. **Water Temperature Indicator** – Indicates when engine coolant is overheated.

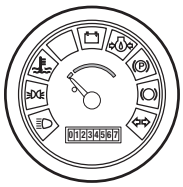
e. **Low Battery Charge** – Signals a low charge from the alternator.



f. **Low Engine Oil Pressure** – This indicator will light up when engine oil pressure is too low. Stop the engine.

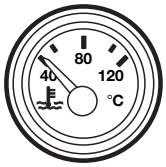
g. **Parking Brake Engaged** – Indicates the parking brake is engaged.

h. **Blank** – Not used



i. **Turn signal Indicator** – Green indicator signaling when turn signals are ON.

3. **Engine Coolant Temperature** –Indicates the engine coolant temperature.



ATTENTION

Engine cannot be started if the parking brake is not engaged, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

4. **Ignition Switch** - This switch is used to energize the electrical system of the machine and start the machine.

WARNING

Before using the machine, make sure that the first green LED of the overload warning system is ON.

The overload warning system must not be used to check the load to be lifted. During work if, several indicators light up, operate the levers more smoothly.

ATTENTION

This machine is equipped with overload warning system. When machine is out of balance and / or over capacity the overload warning system will shut down the Boom Down and Telescope Out functions. However Boom Up and Telescope In functions are still available to reposition load to a more stable area.

5. **Overload Warning System** – A LED warning display. The LED's switch on in sequence from the right to the left and indicate the gradual variation of the machine stability as follow:

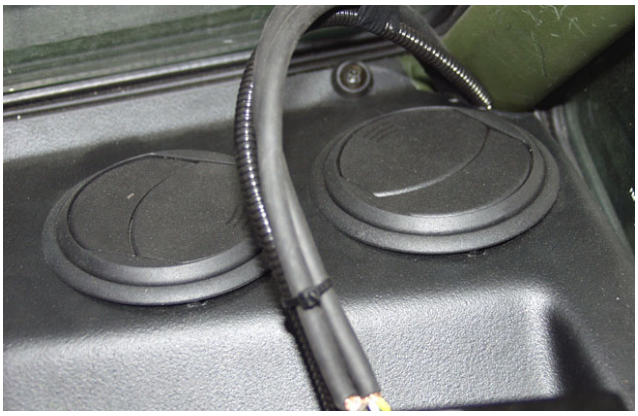
Green LED
- 0-89% of capacity
- normal operation

Yellow LED
- 90-100% capacity

Red LED
- hazardous overload; boom down, extend cut and allows only for the load return within safety limits.

At the machine starting, the overload warning system carries out a diagnostics of all LED's then sets to the first green LED signaling the proper functioning of the instrument.

6. **Air Vents** – Allows air flow in the cab. Rotate the vent to direct the air flow.

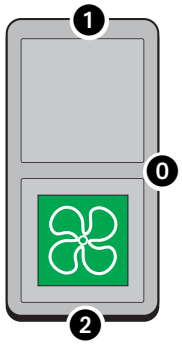


7. **Emergency Stop Button** – Any operated function can be stopped by pressing the emergency stop button. This button allows shutting the engine down. To reset, rotate the button clockwise.

8. **Joystick Lever** – Controls the Boom / Attachment function see section on control levers functions.

9. **Machine Level** – Use this device to ensure that the machine is level.

10. **Defroster Fan Switch** – Three-position switch that controls the speed of the fan.
Press switch up for low speed.
Press down for high speed.



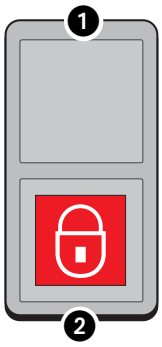
0 OFF
1 Low speed
2 High speed

WARNING

When traveling with or without a load, depress the Work - Travel Switch to lockout tilt, side shift, rotation functions on the attachment and to lockout crab and 4-wheel modes.

11. **Work - Travel Switch** – When traveling with or without a load this switch prevents operations of attachment functions and steering in crab and 4-wheel modes.

Two-position switch



1. Press the switch up to select the **Work Setting** and enable all attachment functions and all steering modes.
2. Press the switch down to select the **Travel Setting**. This disables all attachment functions, steering in crab and 4-wheel modes.

12. **Blackout Lighting Control Switch**

(**a**) Mechanical Lockout Lever

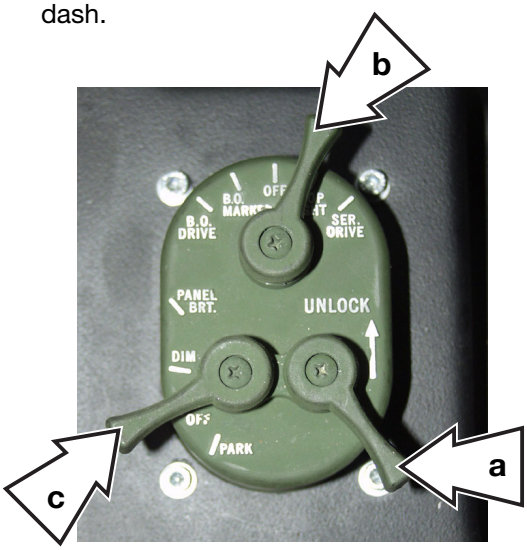
- Unlock switch by moving the lock CCW when operating the light and auxiliary switch or damage can occur to the switch mechanism.
- The Mechanical Lock prevents accidental switching in Blackout Modes.

(**b**) Lighting Control Lever

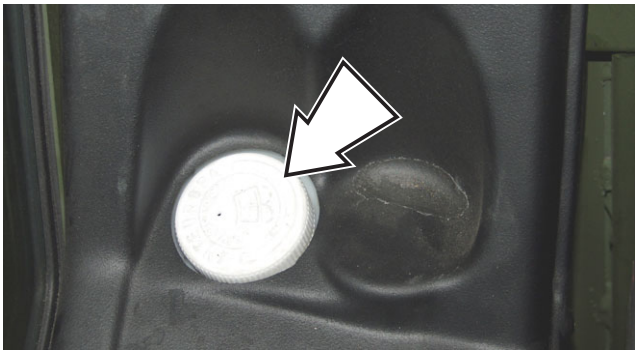
- BO Drive position – Operates the blackout headlight, blackout stoplight-taillights and all four blackout marker lights. All internal, external lights, horn and backup alarm are not operable when blackout lights are in operation. The Auxiliary Switch lever can operate indicator lights on the dash.
- BO Marker position – Operates the two front and two rear blackout markers. All internal and external lights, horn and the backup alarm are not operable when blackout markers are in operation. The Auxiliary Switch lever can operate indicator lights on the dash.
- Off position – All lights, backup alarm, horn, panel lights, blackout headlight, blackout stoplight taillights and all four blackout marker lights are inoperable.
- Stop Light position – Operates taillights, horn and the backup alarm. Blackout headlight, blackout stoplight-taillights and blackout markers are not operable.
- Ser. Drive position – All lights, taillights, horn and the backup alarm are operable. Blackout stoplight-taillights and blackout markers are not operable.
- Ser. Drive position – All lights, taillights, horn and the backup alarm are operable. Blackout headlight, blackout stoplight – taillights and blackout markers are not operable.

(**c**) Panel Light Control lever

- Panel Brt. position – Operates the bright indicator lights on the dash.
- Dim position - dims the indicator lights on the dash.
- Off position - indicator lights on the dash are inoperable.
- Park position - dims the indicator lights on the dash.

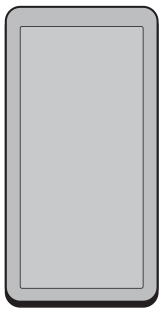


13. **Windshield Water Reservoir** – Holds the washer / water solution.

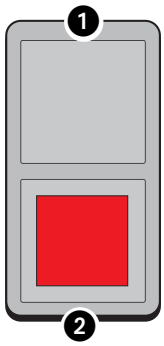


14. **Cab Fan** - To turn the fan on and off use the on / off switch bottom side of fan.

15. **Blank**



16. **Side Shift / Rotate Function Switch** – Works in conjunction with the rocker switch on the joystick control lever.



1. Side Shift.
2. Rotate Forks, Lock / Unlock Attachment.

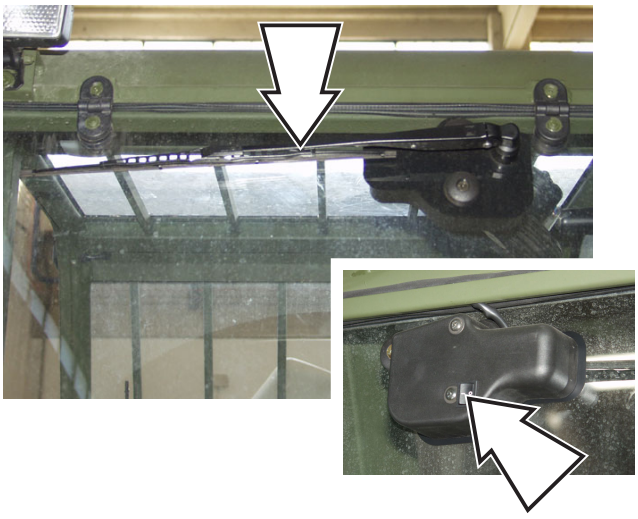
17. **Filter Indicator** - Indicates the degree of clogging so you will know when to change filter.

ATTENTION

Operating with indicator in red can damage the transmission pump and motor. You must change the filter. Do not wait until the filter change interval is reached.

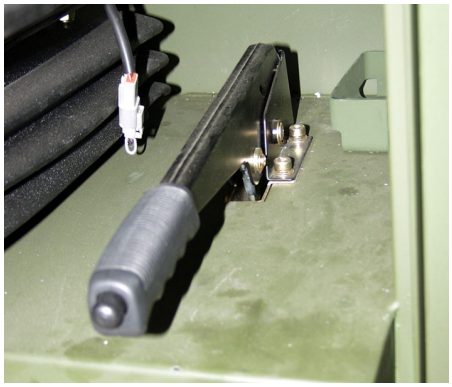
Green Area - 0-18 (PSI) is normal condition.
Yellow Area - 18-22 (PSI) Prepare to change filter
Red Area - 22-60 (PSI) Shut the machine down and change the filter.

18. **Rear Wiper** – To operate the rear wiper depress the rocker switch on the wiper motor box.



19. **Dome Light** - Three-position side switch.
Turn on / off to light the cab.
Center position: Off
Forward position: Dome Light
Rear Position: Spot / Map Light.

20. **Parking Brake Lever** – To engage the parking brake, pull the lever upward while holding the locking button pressed. Release the button when reaching the required braking tension. This brake when engaged, by means of a proximity switch, allows the machine to start and prevents transmission from going forward or reverse.



WARNING

Never use the parking brake to slow down the machine, unless in an emergency. This could cause damage to the parking brake.

ATTENTION

Engine cannot be started if the parking brake is not engaged, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

21. **Seat Switch** - Located on bottom of seat.
Enables the engine from starting unless operator is sitting in seat.

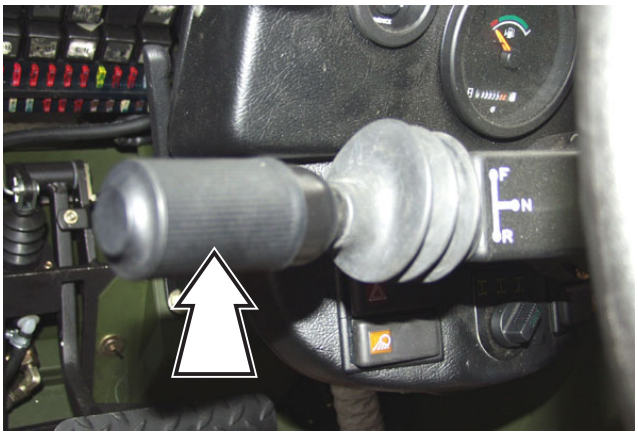
ATTENTION

Engine cannot be started if the parking brake is not engaged, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

22. **Forward / Neutral / Reverse Speed Selection Lever** – Three-position switch with locking in neutral position:

ATTENTION

Engine cannot be started if the parking brake is not engaged, operator completely sitting in seat and Forward/Neutral/Reverse lever in Neutral.

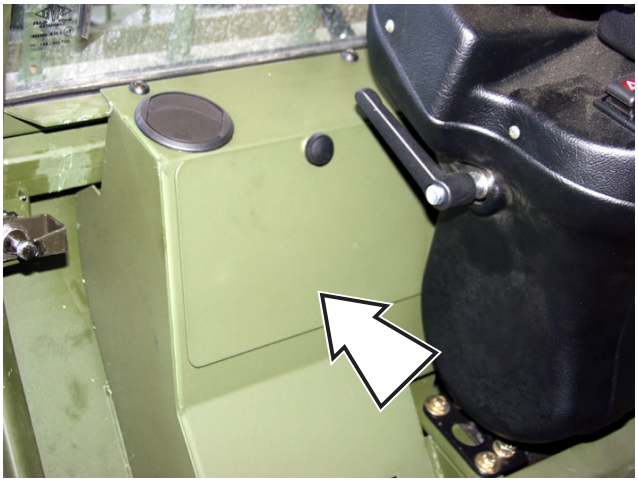


N Neutral position; drive not engaged.
F Raise and shift lever to pos. **F** to select forward.
R Raise and shift lever to pos. **R** to select reverse.

23. **Fuse / Relay Panel** – The electrical system is protected by fuses placed into the driving cab, on the left of steering column. Before replacing a blown fuse with a new one having the same amperage, find out why the fuse has blown.

ATTENTION

Do not use fuses having higher amperage than that recommended, since they can damage the electric system seriously.



If the fuse blows after a short time, look for the fault source by checking the electric system.

Always keep some spare fuses for an emergency.

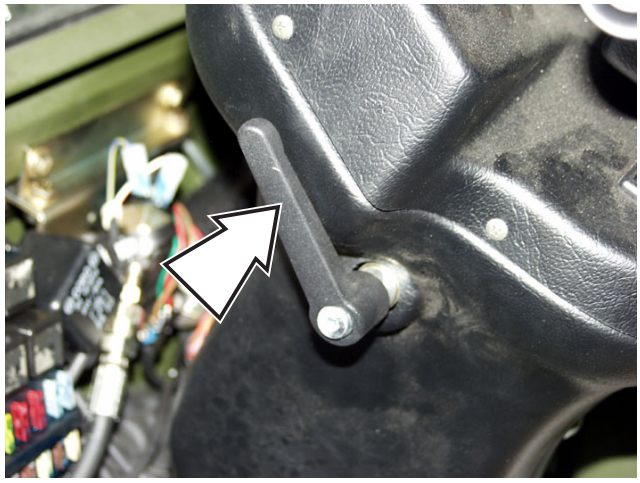
Never try to repair or short blown fuses.

Make sure the contacts of fuses and fuse sockets ensure a good electric connection and are not oxidized.

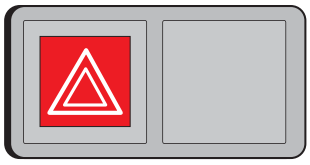
24. **Steering Column Tilt Lever** – Both the steering column and dashboard can be set to a different angle. Loosen the control lever and adjust column as required then retighten to lock the column in place.

WARNING

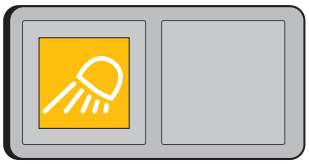
Before driving the machine, ensure the steering wheel is locked in place.



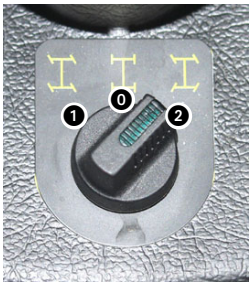
25. **Hazard Light Switch** – Fitted with on-off position, it switches on the hazard lights.



26. **Front Work Light Switch** - A spot light located on the front of the machine, used for night working.

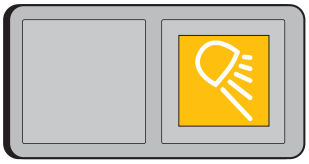


27. **Steering Selection Switch** – Three-position switch for selecting the steering mode, see Steering / Tire Alignment.



- 0 Two Wheel Steering
- 1 Crab Steering
- 2 Four Wheel Steering

28. **Rear Work Light** - A spot light located on the rear of the machine, used for night working



29. **Brake Pedal** – Gradually step on the brake pedal to decelerate and stop the machine. The brake operates on the front axle only.

30. **Accelerator Pedal** – Controls the engine rpm and the machine speed. It is fitted with an adjustable stop located behind the pedal in cab.

31. **Turn Signals / Horn / Wiper / Windshield Washer Switch**

a. **Turn Signals** – Set lever to pos. 1 to indicate a turn left or to pos. 2 to indicate a turn to the right.

b. **Windshield Wiper** – To operate the windshield wiper, rotate the lever tip to one of the four positions:

0	Wiper OFF
J	Timed wiper (if available)
1	Low Speed
2	High Speed

c. **Windshield Washer** – Push the second stage of the lever to spray windshield washer solution on the windshield.

d. **Horn Function** – By pressing the lever built-in button, horn will sound.

32. **Warning Lamp: Glow Plug** – Yellow light indicator which signal the preheating phase of the engine glow plugs.

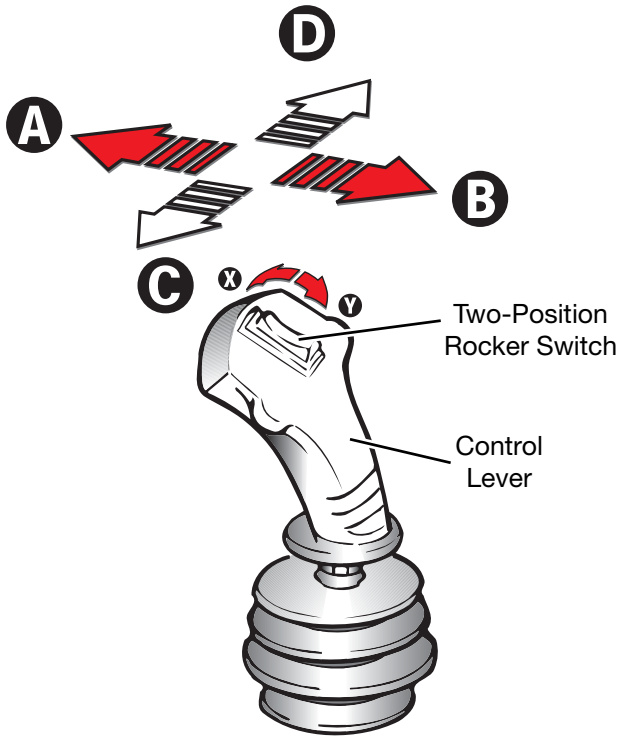
33. **Warning Lamp: Clogged filter** – Orange light indicator which signals when the air intake filter of the engine is getting soiled. Clean or replace the filter cartridge immediately.

4.7 CONTROL LEVER

Handlers are equipped with a piloted supplied service control lever. Only one function can be operated at a time.

The lever is equipped with a two-position button that returns to central position for the selection of the Fork Attachment functions: Side Shift, Rotate, Tilt and Disconnect Attachment.

Additionally, when operated in the four directions (right / left, forward / back) it allows for the control of the boom functions (up / down, retract / extend) and the Fork Attachment functions (forward / rearward tilting), (left/right side shift), Rotate clockwise / counter clockwise, connect / disconnect attachment.



WARNING

Smoothly move the control lever. The motion speed of the actuators depends on the lever position: a small motion results in a slow control movement of the actuators; vice versa, a full range motion of the lever corresponds to the max. speed of the actuator.

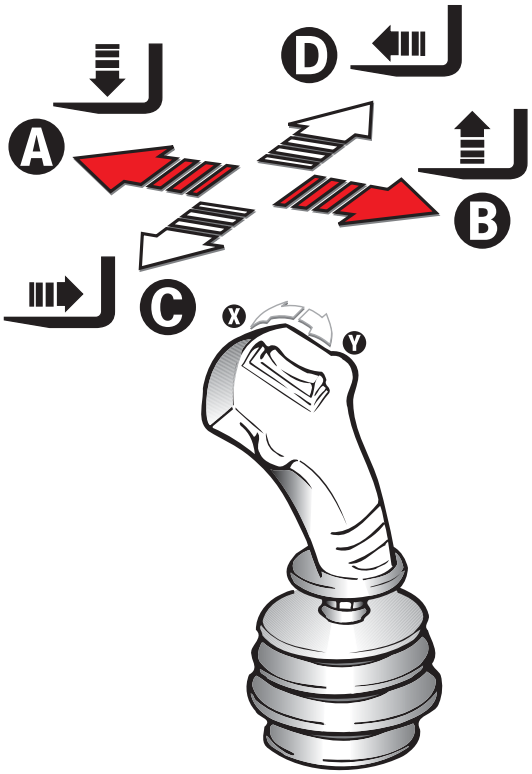
WARNING

Before operating the control lever, make sure that nobody is within the working range of the machine.

4.8 OPERATING THE CONTROL LEVER

The control lever is enabled to carry out the following functions:

- Boom hoist (Up / Down) is operated by moving the lever forward (Ⓐ) or rearward (Ⓑ).
- Boom Reach (Telescoping) is operated by moving the lever to the left (Ⓒ) or right (Ⓓ).
- Fork Tilting, Side Shifting or Rotating is operated by depressing the rocker switch and moving the control lever in the proper position.

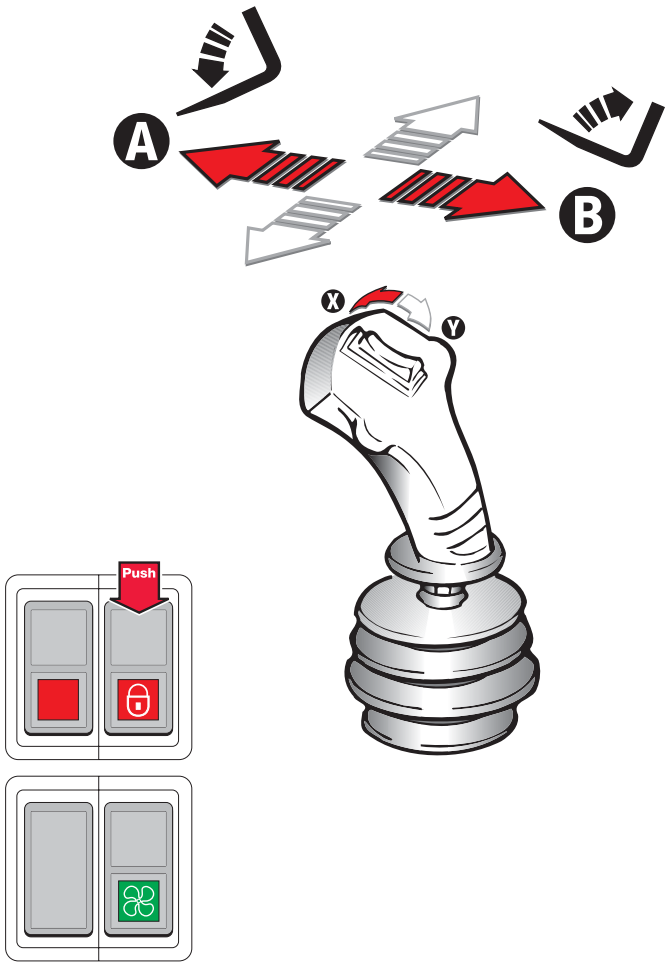


4.9 TILTING THE FORKS FORWARD AND REARWARD

WARNING

Before operating the boom, make sure that nobody is within the working range of the machine.

- Depress the rocker switch forward to tilt position (Ⓧ).
- Shift the lever forward to tilt the forks forward (Ⓐ).
- Shift the lever rearward to tilt the forks rearward (Ⓑ).

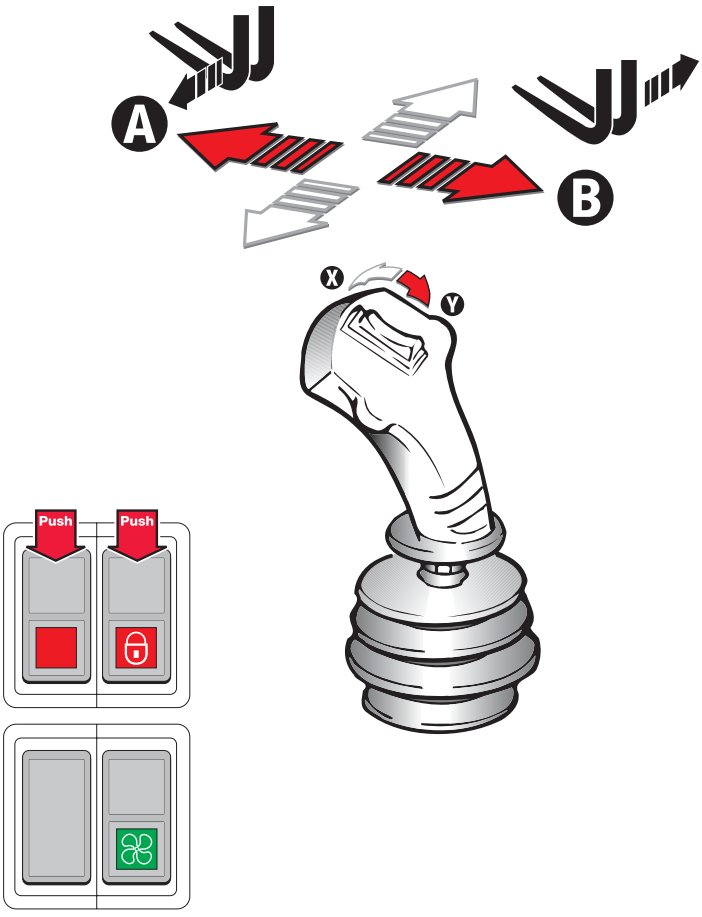


4.10 SIDE SHIFTING THE FORKS

WARNING

Before operating the Forks make sure that nobody is within the working range of the machine.

- Ensure the side shift / Rotate rocker switch is depressed in the Side Shift Position.
- Depress the rocker switch on the lever to the Side Shift Position (Ⓨ).
- To Side Shift the Forks left move the control lever forward (Ⓐ).
- To Side Shift the Forks right, move the control lever rearward (Ⓑ).

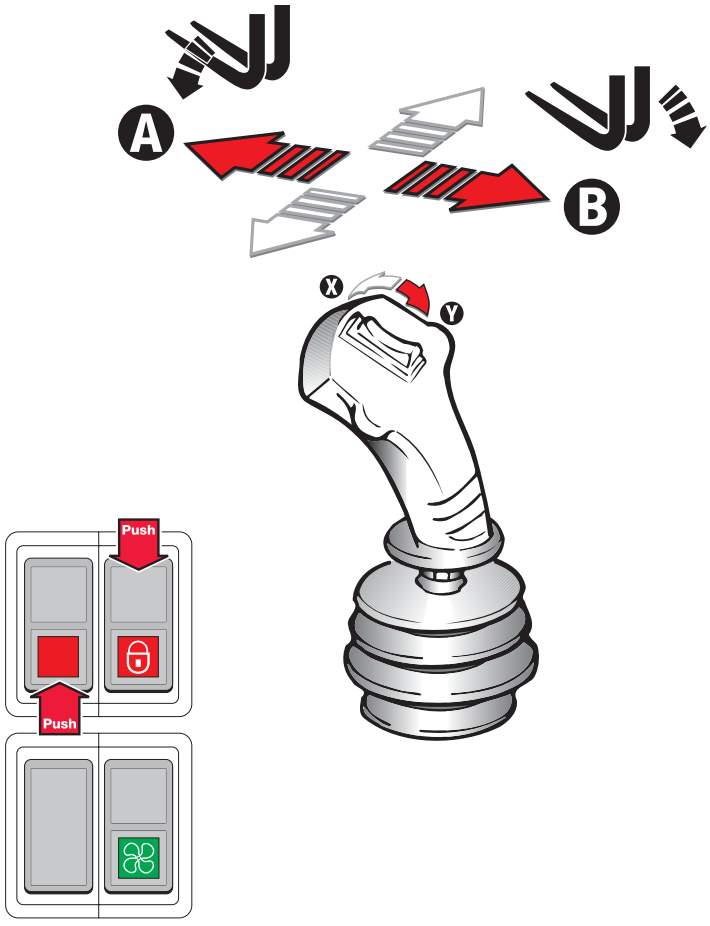


4.11 ROTATING THE FORKS

WARNING

Before operating the boom, make sure that nobody is within the working range of the machine.

- Ensure the side shift / rotate rocker switch is in the rotate position.
- Depress the rocker switch on the control lever to the rotate position (Ⓨ).
- To rotate the fork clockwise move the control lever rearward (Ⓑ).
- To rotate the forks counter clockwise move the control lever forward (Ⓐ).



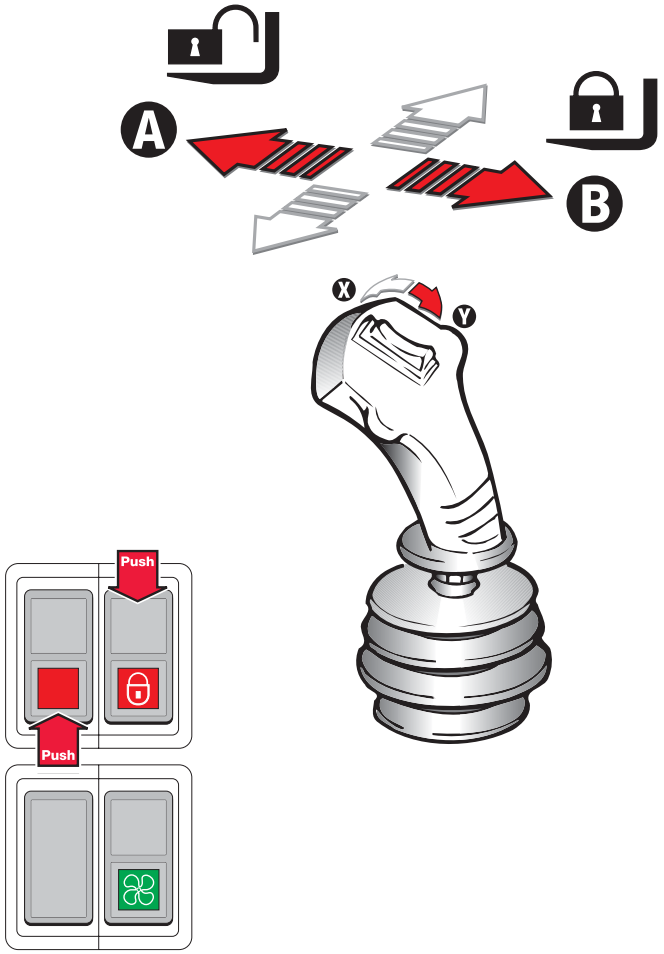
4.12 QUICK-COUPLING THE FORK ATTACHMENT

WARNING

Before operating the boom, make sure that nobody is within the working range of the machine.

To lock / unlock the attachment couplings, it is necessary to change the connection of the hydraulic lines to the control valve placed on the fork carriage carrier element.

- Disconnect both quick couplings controlling the fork rotation.
- Connect hoses to feed the locking cylinder.
- Depress the rocker switch on the control lever to the lock/unlock position (Ⓨ).
- To unlock the fork attachment move the lever forward (Ⓐ).
- To lock the fork attachment move the lever rearward (Ⓑ).



SECTION 5
PRE-OPERATION INSPECTION AND ADJUSTMENT

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5.0 PREOPERATION INSPECTION AND ADJUSTMENT

General
The following operating suggestions are offered as a reminder rather than as an attempt to instruct since a machine of this size must not be entrusted to anyone except a fully qualified operator.

1. Read and understand **section 4 'Controls and Instruments'** prior to starting this machine.
2. Always consult the rating chart in the cab for the maximum load which may be lifted.
3. Engine RPM's may need to be increased to smoothly function the hydraulic controls.

5.1 PREOPERATION INSPECTION AND CHECK LIST

Before starting the engine check the items below for safe conditions:

- Fluid Leaks
- All Windows Clean
- All lights Clean
- Tire and Wheels
- Guards in Place
- Operators Manual
- Rating Chart in Cab
- Boom Slide Pads
- Engine Air Cleaner
- Engine Oil Level
- Hydraulic Oil Level
- Brake Oil
- Engine Coolant Level
- Windshield Wiper Solvent

Before operating the machine verify the controls and functions listed below:

- Horn
- Gauges
- Brake Lights
- Reverse Lights
- Head Lights
- Turn Signal Lights
- Black Out Lights
- Wiper (Front and Rear)
- Park Brake
- Forward / Reverse
- Service Brake
- Accelerator
- Back Up Alarm
- Steering, All 3 Selections
- Wheel Alignment
- Boom Up/Down
- Boom Telescope Out/In
- Fork Tilt Up/Down
- Fork Side- Shift Left / Right
- Fork Rotate CW/CCW
- Attachment Lock Out

5.2 STARTING THE ENGINE

ATTENTION

Do not operate the starter motor for more than 20 seconds. If the engine fails to start within that time, wait a minute before trying again. If this precaution is not followed serious damage to the starter motor may result.

To start the engine proceed as follows:

1. Set the battery disconnect switch (located on the rear of the battery box) to the on position by turning the switch clockwise.

2. Apply the parking brake.
3. Place the gear lever in the NEUTRAL (**N**) position.
4. To start the engine, turn the ignition switch on and release when the engine starts. If the engine does not start within 20 seconds, release the switch lever and wait at least a minute before attempting again.

5. As soon as the engine starts reduce engine speed to idle. Wait some seconds before engaging a gear; this allows for a gradual warm up of the engine oil and a better lubrication.
6. Place the gear lever in the forward or reverse position.
7. Release the parking brake.
8. Slowly press the accelerator pedal to start moving.

5.3 JUMP-STARTING THE ENGINE

WARNING

When jump-starting the engine through the battery of another machine, make sure that the two vehicles cannot collide to prevent formation of sparks. Batteries give off a flammable gas and sparks may ignite it and cause an explosion.

Do not smoke when checking the electrolyte level.

Keep any metal object like buckles, watch straps, etc. clear of the battery positive (+) terminal. These elements can short between the terminal and nearby metal work and the operator can get burned.

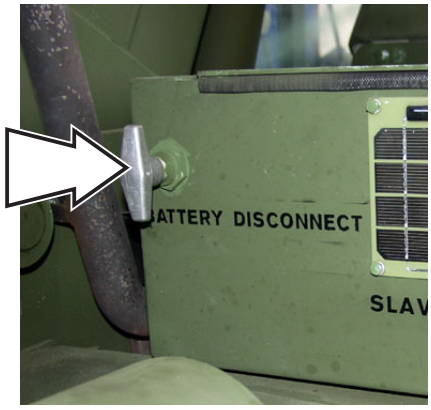
The booster supply must have the same rated voltage and output of the battery installed on the handler.

To jump-start the engine with Nato Slave Connection:

1. Set the gear switch to the neutral position, and engage the parking brake.
2. Remove cover from Nato Slave connection.
3. Install the slave connection support cable into the disabled unit.
4. Check that brakes on supporting machine are set.
5. Then install the supply end to the supporting machine. Start the supporting machine to supply maximum voltage to the disable system.
6. Only from the operator's seat of disabled unit, attempt to start the unit, using proper starting procedures, explained in **section 5.2 "Starting the Engine"**.
7. Upon the starting of disabled machine disconnect the slave cable from the supporting machine. Then from the machine that was disabled.
8. Reinstall weather cover on both units.

5.4 BATTERY DISCONNECT SWITCH

At the end or operation or during maintenance and repair work, especially while welding, set the battery disconnect switch (located on the rear of the battery box) to the off position by turning the switch counterclockwise.



5.5 STOPPING / PARKING MACHINE

CAUTION

Always face the machine when getting off the driving cab; make sure that your hands and shoe soles are clean and dry, and hold to the handholds to prevent falls and slips.

CAUTION

Always engage the parking brake when stopping the machine to prevent any accidental motion of the vehicle.

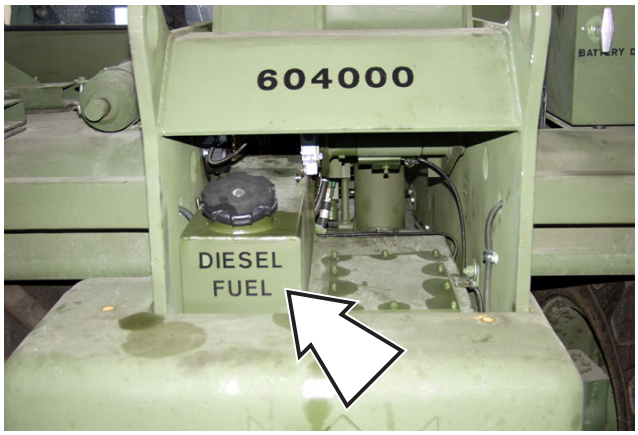
To stop and park the machine proceed as follows:

1. When possible, stop the machine on a dry, level and firm ground.
2. Bring the machine to a smooth stop by easing up the accelerator pedal and stepping down on the brake pedal.
3. When stopped engage the parking brake and ensure its indicator lights up.
4. Release the service brake pedal.
5. Rest the attachment coupled to the boom flat on the ground.
6. Get out the operators cab and close the cab door.
7. Set the battery cutout switch to OFF position.

5.6 REFUELING THE MACHINE

WARNING

1. Never fill fuel tank while engine is running.
2. No smoking or open flames
3. Avoid spillage.
4. Spilliage of oil or fuel shall be carefully washed away or completely evaporated.
5. Never operate machine with a leak in the fuel system. All make sure fuel cap is on fuel tank before starting machine.



To refuel the machine proceed as follows:

1. Turn off the machine.
2. Remove the diesel fuel cap from the fuel tank.
3. Fill fuel tank with diesel fuel only. Do not over fill tank.
4. Replace fuel tank cap and restart machine.

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SECTION 6
LUBRICATION

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6.0 LUBRICATION

GENERAL

This section covers the lubrication of this machine and includes lubrication charts for the purposed of showing the lubrication points. The various capacities of this machine, and listing the lubricant specifications, are included.

LUBRICATION

To ensure proper operation of this machine, all points requiring lubrication must be serviced with the correct lubricant at the proper time interval as shown on the lubricant chart. All normal wear points, which require lubrication, are shown in the lubrication charts. The possible exception, lubrication information concerning major purchased components, information concerning purchased components, see the manufacturer's manual.
If any conflict exists between the lubrication recommendations contained in this manual and the original manufacturer's service recommendations, the original manufacturer's recommendations take precedence. Points (levers, linkages, pins etc.) should be lubricated with an oil can once a week. Use a few drops of engine oil on each exposed pin or lever not equipped with grease fittings to prevent rust and to provide the limited lubrication required.

6.1 LUBRICANT SPECIFICATIONS

ATTENTION

The lubrication specifications that follow were in effect at the time this manual was printed. These specifications are periodically updated to include the most recent lubricants issued by lubricant manufacturers.

The following list defines three terms. Each one of the terms can be used to identify the type of lubricant needed to satisfy the lubricant specifications listed in the lubrication charts (see **chapter 6.3**)

1. Terex Specification Number. This number is used in the Material Specifications system to identify a specific type of lubricant.
2. Military Specification Number. This number is used in the military lubrication system to identify a specific type of lubricant. This lubricant identified by the specification number that is listed in the same row of the lubricant specification chart.

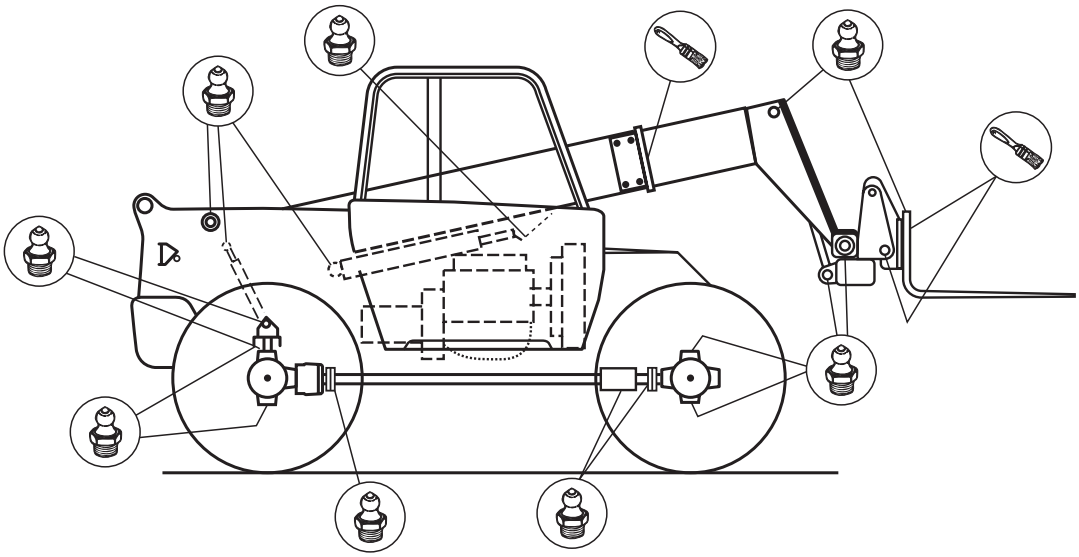
ATTENTION

The absence of an entry in the Military Specification Column of a lubricant specification chart does not mean that the recommended lubricant does not have an equivalent military specification. It may mean that the lubricant has not been tested by the military because it is a relatively new lubricant. For this reason, the lubricant may not be certified as meeting the standards of a particular military specification even though it may be perfectly capable of meeting the military standards.

3. Equivalent Lubricant. These are lubricants that presently meet the Terex standards. These lubricants are listed under the manufacturer's trade names. The absence of a lubricant from this list does not mean that Terex considers the lubricant unsuitable. It means that Terex has not yet tested the lubricant. The order in which the lubricants appear on any list does not signify any preference or superiority of any brand name. The listings are purely random and all products on the list are equally acceptable.
4. During extreme operating conditions below 32 degrees use lubricants listed in Lube and Fluid Chart (see **chapter 6.3**).

A. Grease:	NLGI #1 MIL-G-10942C MIL-G-3278A
B. Hydraulic Oil:	MIL-H24459 DIN 51524 DENISON HF-0 VICKERS M-2950-S GM LS-2 (ISO 32)
C. Engine Oil:	MIL-L-2104 F API CD-CE (SAE 5W-20)

6.2 LUBRICANT CHART



SERVICE / LUBRICATION CHART TX51-19MD
FOR ADVERSE WEATHER CONDITIONS SEE OPERATORS MANUAL

INTERVAL	SERVICE POINTS	IDENTIFICATION	SERVICE REQUIRED	LUBRICANT SPECIFICATION (TYPE)				SERVICE LOCATION
				SAE	VISCOSITY	SPECIFICATION	API	
50 HOURS OR WEEKLY	1	ENGINE OIL LEVEL	CHECK	EO	15W-40	MIL - L - 2104F	CD-CF	DIPSTICK, RH ENGINE SIDE
	1	ENGINE FUEL PRE-FILTER	DRAIN	---	---	---	---	RH ENGINE SIDE
	1	HYDRAULIC RESERVOIR OIL	CHECK	HYDO	ISO 46	MIL - H - 5606	29.3	SIGHT GAUGE @ OPERATING TEMP
	1	BRAKE RESERVOIR	CHECK	HYDO	ISO 46	MIL - H - 5606	29.3	RESERVOIR, REAR ENGINE SUPPORT
	8	BOOM PADS	LUBE	MPG	NLGI 2	---	---	END OF BOOM
	8	AXLE KINGPINS	LUBE	MPG	NLGI 2	---	---	4 EACH AXLE, TOP & BOTTOM, EACH END
	1	AXLE REAR PIVOT PIN	LUBE	MPG	NLGI 2	---	---	TOP OF REAR AXLE
	9	CYLINDERS	LUBE	MPG	NLGI 2	---	---	BEARING EACH END OF CYLINDER
	5	FORK ATTACHMENT	LUBE	MPG	NLGI 2	---	---	PIVOTS
	1	BOOM PIVOT	LUBE	MPG	NLGI 2	---	---	BOOM PIVOT @ CENTER OF BOOM
	3	DRIVESHAFT	LUBE	MPG	NLGI 2	---	---	FRONT, REAR, AND SLIP JOINT
	12	DRIVESHAFT BOLTS	CHECK	---	---	---	---	6 EACH U-JOINT, TORQUE 28 FT/LB
	4	TIRE INFLATION	CHECK	---	---	---	---	1 EACH, 54 PSI COLD
	32	TIRE WHEEL NUTS	CHECK	---	---	---	---	8 EACH WHEEL, TORQUE 294 FT/LB
250 HOURS OR MONTHLY	1	ENGINE OIL	CHECK	EO	15W-40	MIL - L - 2104F	CD-CF	SAMPLING VALVE, REAR ENGINE SUPPORT
	1	ENGINE AIR FILTER	CHECK	---	---	---	---	UNDERHOOD
	1	HYDRAULIC RESERVOIR OIL	CHECK	HYDO	ISO 46	MIL - H - 5606	29.3	SAMPLING VALVE, REAR ENGINE SUPPORT
	4	AXLE, WHEEL ENDS OIL	CHECK	MPL	10W - 30	T.D.H.	GL4	LEVEL PLUG, 2 EACH AXLE
	2	AXLE, DIFFERENTIAL OIL	CHECK	MPL	10W - 30	T.D.H.	GL4	LEVEL PLUG, 1 EACH AXLE
	1	ENGINE DRIVE BELT	CHECK	---	---	---	---	FRONT OF ENGINE
	2	BATTERY	CHECK	---	---	---	---	RH REAR FENDER
500 HOURS OR QUARTERLY	1	ENGINE OIL	CHANGE	EO	15W-40	MIL - L - 2104F	CD-CF	ENGINE OIL PAN
	1	ENGINE AIR FILTER	CHANGE	---	---	---	---	UNDER HOOD
	1	ENGINE OIL FILTER	CHANGE	---	---	---	---	RH ENGINE SIDE
	1	ENGINE FUEL FILTER	CHANGE	---	---	---	---	RH ENGINE SIDE
	4	ENGINE GLOW PLUGS	CHECK	---	---	---	---	ENGINE
	1	HYDRAULIC RESERVOIR FILTER	CHANGE	---	---	---	---	OUTSIDE RESERVOIR
1000 HOURS OR SEMI-ANNUALLY	1	ENGINE AIR FILTER	CHANGE	---	---	---	---	UNDER HOOD
	8	ENGINE VALVE TIP CLEARANCE	CHECK	---	---	---	---	ENGINE
	1	ELECTRICAL, ALTERNATOR	CHECK	---	---	---	---	ENGINE LH SIDE - 24 VOLT
	1	ELECTRICAL, STARTER	CHECK	---	---	---	---	ENGINE LH SIDE - 24 VOLT
	1	ELECTRICAL, SYSTEM	CHECK	---	---	---	---	TOTAL MACHINE
	1	HYDRAULIC, HOSES & FITTINGS	CHECK	---	---	---	---	TOTAL MACHINE
	1	HYDRAULIC RESERVOIR OIL	CHANGE	HYDO	ISO 46	MIL - H - 5606	29.3	RESERVOIR AND OIL FILL TUBE
	1	HYDRAULIC RESERVOIR FILTER	CHANGE	---	---	---	---	INSIDE RESERVOIR
	1	HYDRAULIC RESERVOIR MAGNET	CLEAN	---	---	---	---	INSIDE RESERVOIR
	4	AXLE, WHEEL END OIL	CHANGE	MPL	10W - 30	T.D.H.	GL4	LEVEL PLUG, 2 EACH AXLE
	2	AXLE, DIFFERENTIAL OIL	CHANGE	MPL	10W - 30	T.D.H.	GL4	LEVEL PLUG, 1 EACH AXLE
	1	ACCUMULATOR, SYSTEM	CHECK	---	---	---	---	870 PSI UNDER CENTER COVER
	1	ACCUMULATOR, STEERING	CHECK	---	---	---	---	800 PSI LH REAR FENDER
3000 HOURS OR 3 YEARS	4	ATOMIZERS	CHECK	---	---	---	---	ENGINE RH SIDE

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6.3 LUBE AND FLUID CAPACITY CHART

ABOWE 32 DEGREES F				
WHERE USED	**FLUID**	**CAPACITY**	**SPECIFICATION**	**VISCOSITY**
ENGINE	OIL	2.91+0.92 GALLONS	MIL-L 2104 F API CD-CE	SAE 15W-40
FRONT AXLE DIFFERENTIAL	GEAR OIL	6.6 QUARTS	ASTM D445 API GL-4	SAE 10W-30
REAR AXLE DIFFERENTIAL	GEAR OIL	5.5 QUARTS	ASTM D445 API GL-4	SAE 10W-30
FRONT WHEEL REDUCTION	GEAR OIL	1.8 QUARTS	ASTM D445 API GL-4	SAE 10W-30
REAR WHEEL REDUCTION	GEAR OIL	.7 QUARTS	ASTM D445 API GL-4	SAE 10W-30
HYDRAULIC RESERVOIR	Hydraulic Oil	18.5 GALLONS	MIL-H24459 DIN 51524 DENISON HF-0 VICKERS M-2950-S GM LS-2	ISO 46
BRAKE RESERVOIR	Hydraulic Oil	1 PINT	MIL-H24459 DIN 51524 DENISON HF-0 VICKERS M-2950-S GM LS-2	ISO 46
TELESCOPIC BOOM SECTIONS (SURFACES AT WEAR PAD CONTACT)	GREASE		NLGI #2	
CHASSIS & BOOM GREASE FITTINGS	GREASE		NLGI #2	

BELOWE 32 DEGREES F				
WHERE USED	**FLUID**	**CAPACITY**	**SPECIFICATION**	**VISCOSITY**
ENGINE (SEE DEUTZ FOR BELOW 10°F)	OIL	2.91+0.92 GALLONS	MIL-L 2104 F API CD-CE	SAE 5W-20
HYDRAULIC RESERVOIR	Hydraulic Oil	18.5 GALLONS	MIL-H24459 DIN 51524 DENISON HF-0 VICKERS M-2950-S GM LS-2	ISO 32
BRAKE RESERVOIR	Hydraulic Oil	1 PINT	MIL-H24459 DIN 51524 DENISON HF-0 VICKERS M-2950-S GM LS-2	ISO 32
TELESCOPIC BOOM SECTIONS (SURFACES AT WEAR PAD CONTACT)	GREASE		NLGI #1 MIL-G-10942C MIL-G-3278A	
CHASSIS & BOOM GREASE FITTINGS	GREASE		NLGI #1 MIL-G-10942C MIL-G-3278A	

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SECTION 7
PREVENTIVE MAINTENANCE

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7.0 PREVENTIVE MAINTENANCE

ATTENTION

The following suggested schedule check sheets are based on average operating conditions. The type of work being done, size of loads, and ground and weather conditions are all factors which must be considered when establishing a maintenance schedule for the machine. The suggested schedule basis is given for hours of operation and calendar intervals.

GENERAL

The actual operating environment of the machine governs the maintenance schedule. The suggested check sheets on the following pages indicate the areas of the machine to be checked and the intervals at which they should be checked.

Any changes in the established maintenance schedule should be preceded by a complete reanalysis of the machine operation. Carefully study previous maintenance sheets and records before making changes in, or extending, the check intervals.

The lubrication charts in **Section 3** provide general locations of the individual service points and list the type of lubricant, which should be used for each component. This machine has the engine mounted on the right side of the machine; all service location references will be made with this in mind.

The relief valves are factory preset. Adjusting the valve in the field will void machine warranty. Valves must be set only by trained personnel.

7.1 USING THE SUGGESTED SCHEDULE CHECK SHEETS

The maintenance schedule check sheets are designed as a preventative maintenance guide, until adequate experience is obtained to establish a schedule to meet a specific operating environment. Following the check sheets are detailed procedures, grouped in check intervals, describing the procedure that should be used to perform the check sheet operation. The check sheets can be reproduced by any printer to obtain additional copies. Maintenance personnel making each check should then indicate on the sheet that the required check has been completed, and the machine will be ready for additional service until the next check is due. Completed check sheets should be retained as a permanent part of the machine's maintenance records for future reference.

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7.2 'A' MAINTENANCE CHECKS – 50 HOURS OR WEEKLY SERVICES

Company Name _____

Company Address _____

_____

_____

Maintenance Person _____

Date Performed _____

Model Number _____ Serial Number _____

	MAINTENANCE POINT	PERFORMED BY
	Check Engine Oil Level	
	Drain Fuel Filter	
	Check Hydraulic Oil Level	
	Check Brake Reservoir	
	Lube Boom Pads	
	Lube Drive Shaft	
	Lube Axle King Pins	
	Lube Rear Axle Pivot	
	Lube Cylinder	
	Lube Fork Attachment	
	Lube Boom Pivot	
	Check Tire Inflation	
	Check Wheel Lug Nuts Torque	
	Check Drive Shaft Bolt Torque	

7.3 'B' MAINTENANCE CHECKS – 250 HOURS OR MONTHLY SERVICES

Company Name _____

Company Address _____

_____

_____

Maintenance Person _____

Date Performed _____

Model Number _____ Serial Number _____

	MAINTENANCE POINT	PERFORMED BY
	Check and Sample Engine Oil	
	Check Engine Air Filter	
	Check Drive Belt Condition	
	Check and Sample Hydraulic Oil	
	Check Wheel Ends	
	Check Differentials	
	Check Batteries	

7.4 'C' MAINTENANCE CHECKS – 500 HOURS OR QUARTERLY SERVICES

Company Name _____

Company Address _____

_____

_____

Maintenance Person _____

Date Performed _____

Model Number _____ Serial Number _____

	MAINTENANCE POINT	PERFORMED BY
	Change Engine Oil	
	Change Engine Air Filter (external cartridge)	
	Change Engine Oil Filter	
	Change Fuel Filter Element	
	Check Glow Plugs	
	Change Hydraulic Filter	

7.5 'D' MAINTENANCE CHECKS – 1000 HOURS OR SEMIANNUALLY SERVICES

Company Name _____

Company Address _____

_____

_____

Maintenance Person _____

Date Performed _____

Model Number _____ Serial Number _____

	MAINTENANCE POINT	PERFORMED BY
	Check Engine Valve Tip Clearance	
	Check Alternator	
	Check Starter	
	Check Electrical System	
	Check Hydraulic Hoses & Fittings	
	Change Hydraulic Reservoir Oil	
	Change Hydraulic Reservoir Filter	
	Clean Hydraulic Reservoir Magnet	
	Change Axle Wheel End Oil	
	Change Axle Differential Oil	
	Check System Accumulator	
	Check Steering Accumulator	
	Change Engine Air Filter (internal cartridge)	

7.6 'E' MAINTENANCE CHECKS – 3000 HOURS OR THREE YEARS SERVICES

Company Name _____

Company Address _____

_____

_____

Maintenance Person _____

Date Performed _____

Model Number _____ Serial Number _____

	MAINTENANCE POINT	PERFORMED BY
	Check Atomisers (Fuel Injector)	

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SECTION 8
50 HOURS OR WEEKLY MAINTENANCE

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8.0 50 HOURS OR WEEKLY MAINTENANCE

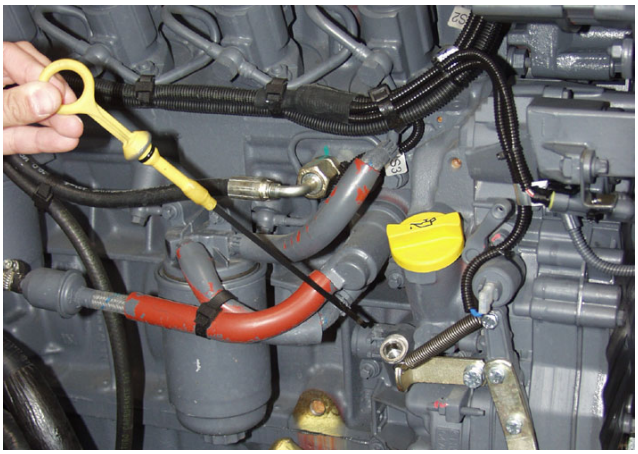
GENERAL
The lubrication charts in **Section 6** provide general locations of the individual service points and list the type of lubricant, which should be used for each component. Before proceeding with the 50 hours or weekly maintenance be sure you have completed the Pre-operation checklist.

8.1 CHECK ENGINE OIL

ATTENTION

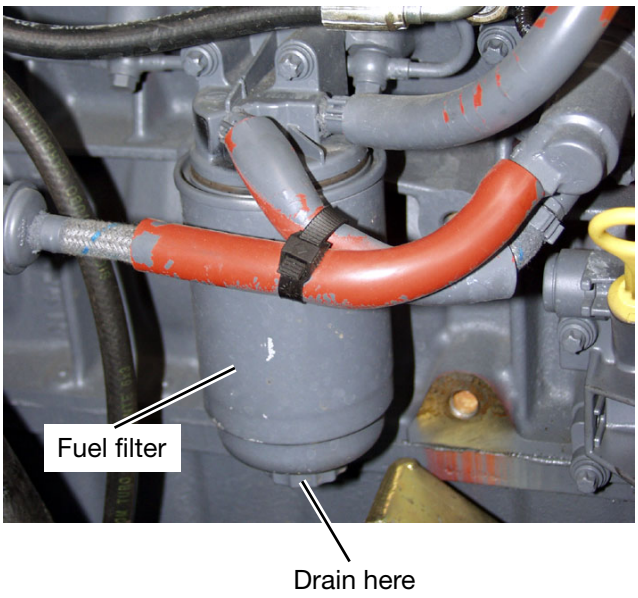
Never operate the engine with the oil, level below the low mark on the dipstick or above the high mark.

DEUTZ ENGINE
The engine oil dipstick is reached from the right side of machine at the lower left center of the engine. The oil level must be kept between the low and high marks on the dipstick. If the oil is below the low mark on the dipstick, add oil of the type specified, through the filler cap. Wait at least five minutes after shutting off the engine to check the oil level. This allows time for the oil to drain to the oil pan.



8.2 DRAIN ENGINE FUEL FILTER

The DEUTZ engine is equipped with a fuel filter located at the right side of engine. The fuel filter removes water from the fuel as the fuel passes through the filter. Place a container under the valve to collect the water. Drain the water by opening the valve on the bottom of the filter. Allow all water to drain, then close the drain valve securely.



8.3 CHECK HYDRAULIC RESERVOIR OIL

ATTENTION

Cleanliness is very important. Contamination can damage the hydraulic system.

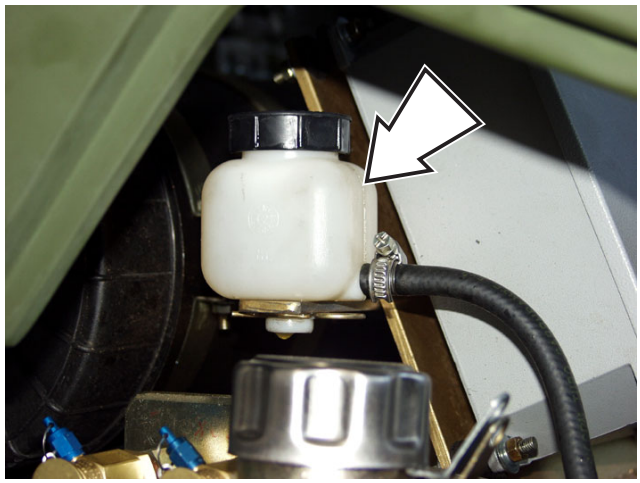
Check the hydraulic oil level with all cylinders fully retracted. If the oil level is low, clean around the fill tube cap before removing, then add specified oil to the fill tube as required, to bring the full level. The oil viscidity must match the climate. Do not mix brands of hydraulic oil.

8.4 CHECK BRAKE OIL RESERVOIR LEVEL

ATTENTION

Cleanliness is very important. Contamination can damage the hydraulic system.

The brake reservoir is located behind the engine, rear engine support. If the oil level is low, clean round the cap before removing, add hydraulic oil as required, to bring the oil to full level. Do not mix brands of hydraulic oil. **Do not use dot 3 brake fluid.**



8.5 LUBE BOOM PADS

The boom pads are located at the end of boom. Lubricate the boom pads by using a brush or roller to apply EP2 lubrication on all eight boom pads. Clean and lubricate all areas of the boom where the pads make contact.

8.6 LUBE DRIVE SHAFT

ATTENTION

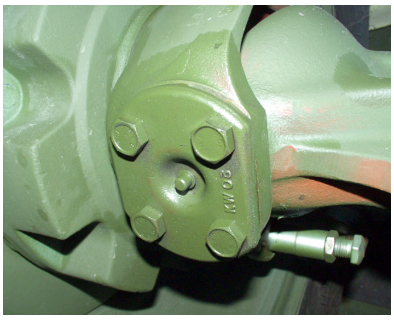
Clean all fitting before applying lubrication.

Lubricate the drive shaft by applying recommended lubrication to the grease fitting points.

8.7 LUBE AXLE KING PINS

Apply recommended lubrication to all eight king pins, located on top, bottom and each end of the axle.

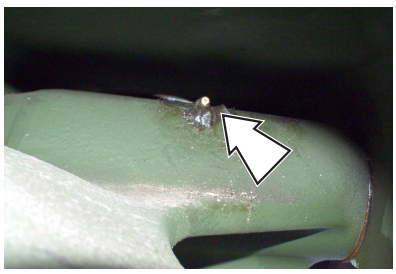
Bottom King Pin



Top King Pin

8.8 LUBE REAR AXLE PIVOT PIN

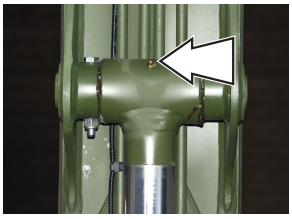
Apply recommended lubrication to the rear pivot pin, which is located top of rear axle.



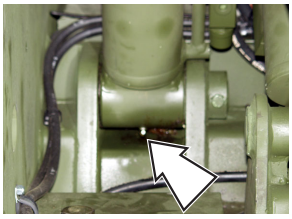
8.9 LUBE CYLINDERS

Raise the boom and clean all the grease fittings before applying EP2 lubrication. Lube all eight bearing, located on each end of cylinder.

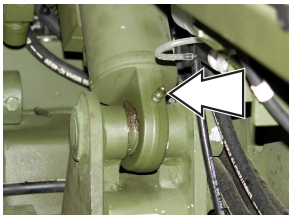
Top Boom Cylinder



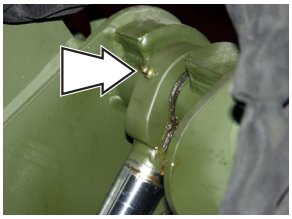
Bottom Boom Cylinder



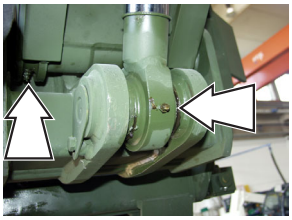
Top Slave Cylinder



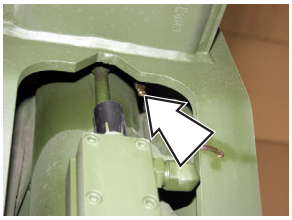
Bottom Slave Cylinder



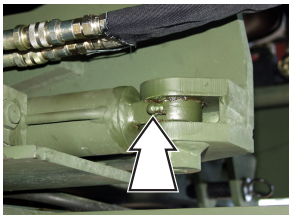
LH Fork Carrier
Bottom Tilt Cylinder



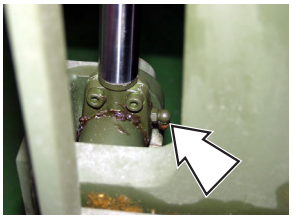
Top Tilt Cylinder



RH Fork Carrier
Cylinder

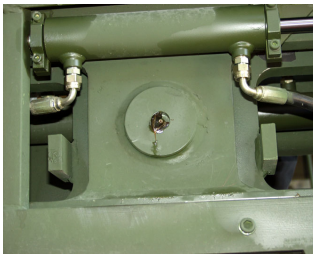


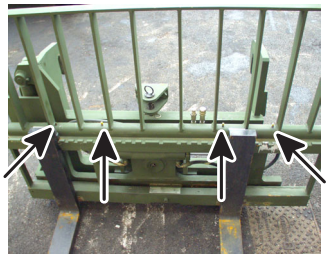
Bottom Rotation Cylinder



8.10 LUBE FORK ATTACHMENTS

Apply recommended lubrication to all three pivots. Lube bar and bushing.



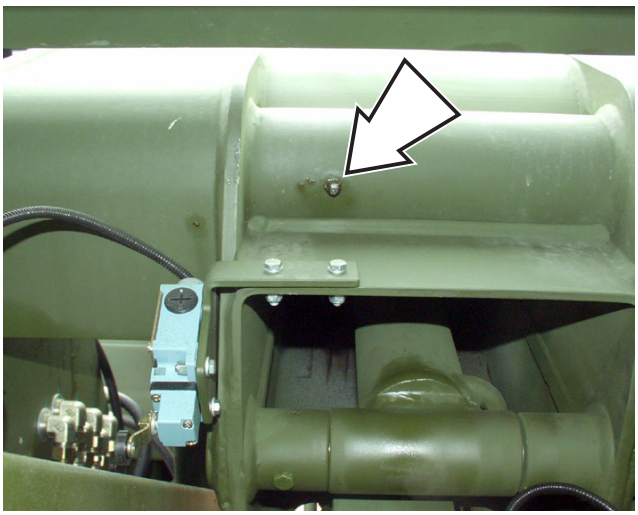


8.11 LUBE BOOM PIVOT

ATTENTION

If pin is pivot pin is removed, the complete cavity must be refilled with recommended lubrication.

Apply lubrication to boom pivot pin.



8.12 CHECK TIRE INFLATION

DANGER

Overinflated or over heated tires can burst. A tire burst may result in serious injury; never use the machine with worn, improperly inflated or damaged tires.

ATTENTION

Always use tires having the dimensions indicated in the vehicle registration document.

Dimensions	375/75 R20 x M27	
Load Index	155A	
Rim	11" x 20"	
Wheel Disc	8 holes DIN 70361	
Pressure Bar	1.8 (soft)	3.7 (Standard)
PSI	26 (soft)	54 (standard)

8.13 CHECK TIRE WHEEL NUTS

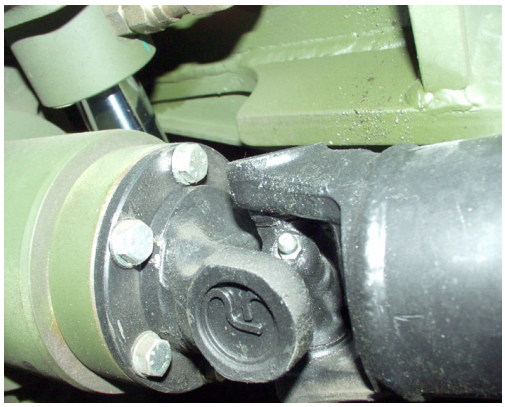
ATTENTION

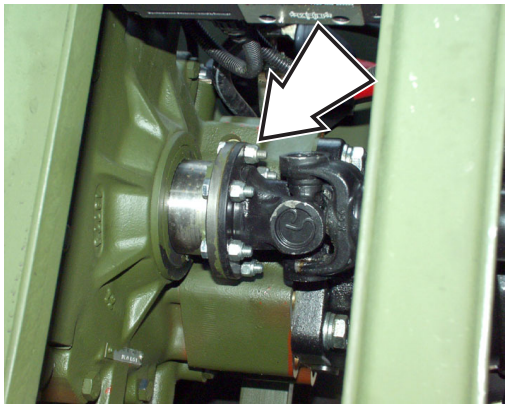
If wheel nuts loose torque often, check for damage of wheel.

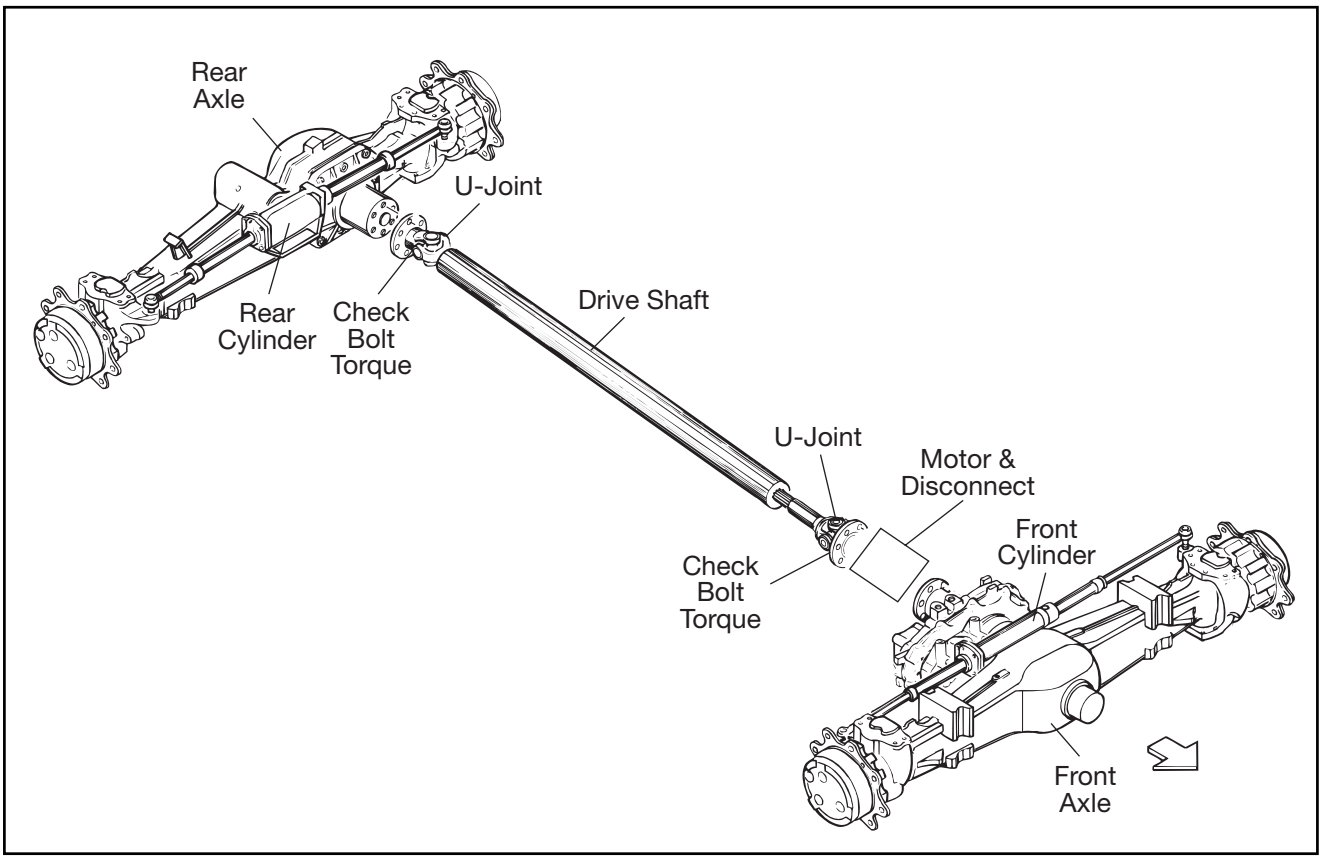
Check tire wheel nuts (8 per wheel – 32 places) to be sure they are secure. Tighten nuts as necessary by using a 33-MM socket and torque wrench. The nut torques should be 220 Ft Lbs. / 300 Nm.

8.14 CHECK DRIVE SHAFT BOLTS

Check drive shaft bolts (12 places) to be sure they are secure. Tighten bolts as necessary by using torque wrench. The bolt torques should be 27 Ft Lbs. / 36.6 Nm.







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SECTION 9
250 HOURS OR MONTHLY MAINTENANCE

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9.0 250 HOURS OR MONTHLY MAINTENANCE

GENERAL

The lubrication charts in **Section 6** provide general locations of the individual service points and list the type lubricant, which should be used for each component.

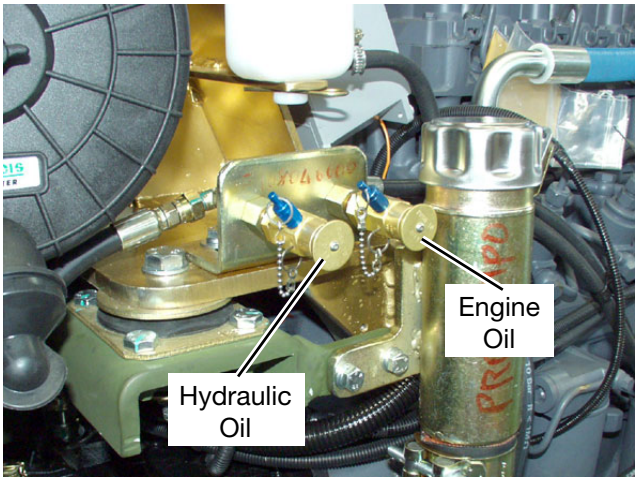
Before proceeding with 250 hours or Monthly Maintenance Checks, refer back to the pre-operation checklist and the 50 hours Maintenance.

9.1 ENGINE AND HYDRAULIC OIL SAMPLING

ATTENTION

Cleanliness is important to obtain an accurate sample.

The sampling valves are located near the rear engine support. When taking a sample, use proper containers. Clean the sampling valve and have the operator to start the engine. Remove the sampling valve cap and press front of valve to take a sample.



9.2 CHECK ENGINE AIR FILTER

ATTENTION

Environmental conditions have an important effect of the frequency at which the air filter needs service. If working in dusty area clean the filter and dust bowl daily. The filter element must be cleaned or renewed.

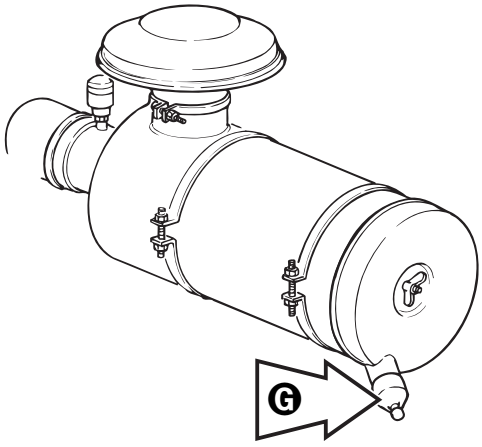
The air filter is located at the rear of the engine.

The engine air filter consists of an external cartridge and an internal cartridge. **The inner element should be replaced every two times the outer element is replaced.**

To clean or replace the external cartridge, follow the instructions in **chapter 10.3**.

ATTENTION

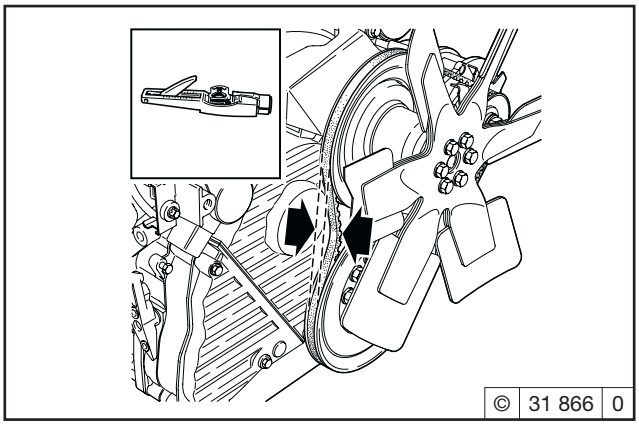
Daily remove any dust collected in the filter by pressing the rubber cap **G.**



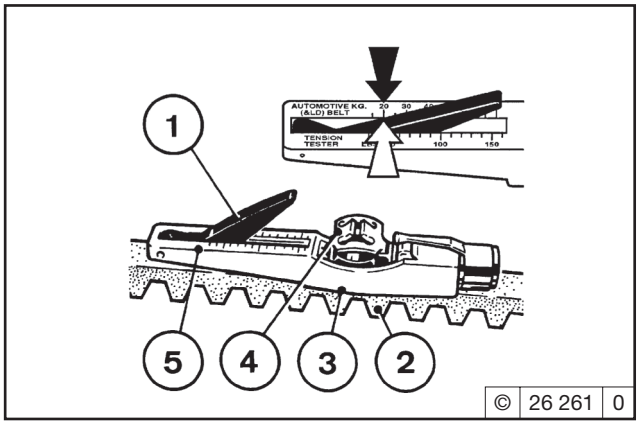
9.3 CHECK ENGINE DRIVE BELTS

ATTENTION

The alternator fitted to the 2011 engine is driven by a drive belt of a specific design. Use only a DEUTZ POWERPART drive belt. If this is not done, an early failure of the belt may occur.



- Visually inspect entire V-belt for damage.
- Replace damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.



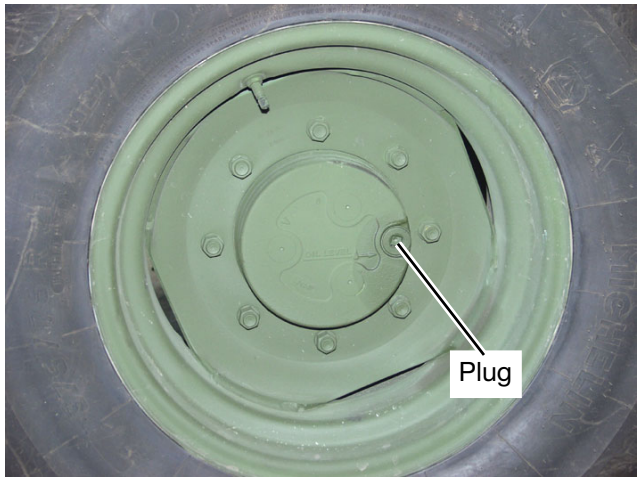
- To check tension of V-belt, use tension gauge.
  - Place indicator arm **1** into gauge.
  - Position guide **3** on V-belt **2**, midway between pulleys, with stop against edge of belt.
  - Push slowly on black pad 4 at right angles to V-belt **2** until spring is heard or felt to trigger.
  - Carefully remove gauge without altering position of indicator arm **1**.
  - Read off value where black indicator arm **1** intersects scale **5** (arrow). Adjustment values: 450 / 350 ±20 N.
  - If necessary, re-tension belt and measure again.

ATTENTION

Check, tension and change belts only with engine off. Refit belt guard, if provided.

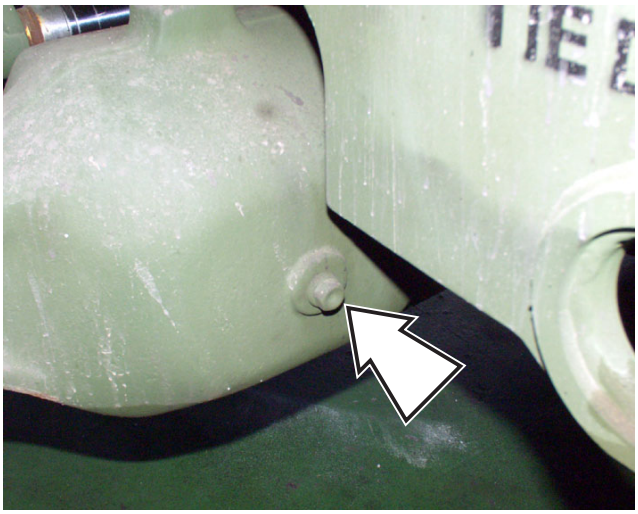
9.4 CHECK AXLE WHEEL ENDS OIL

Move machine to level ground. Rotate each wheel so oil level line is horizontal. Each axle hub has one plug level on the vertical center of axle. The oil should be at bottom of plug hole. Add recommended oil if necessary. See lubrication section for the type of oil.

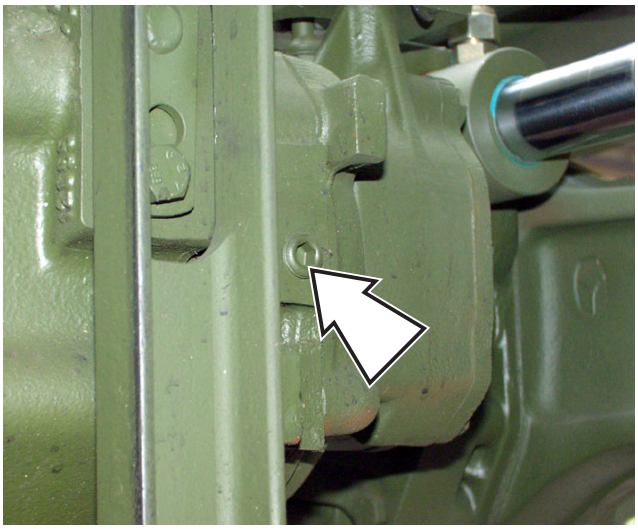


9.5 CHECK AXLE DIFFERENTIAL OIL

REAR DIFFERENTIAL – One plug located on rear of axle differential. The oil level should be level with plug hole. Add recommended oil if necessary. See lubrication section for the type of oil.



FRONT DIFFERENTIAL – One plug located on rear left side of axle beside differential. The oil level should be level with plug hole. Add recommended oil if necessary. See lubrication section for the type of oil.



9.6 CHECK BATTERY

WARNING

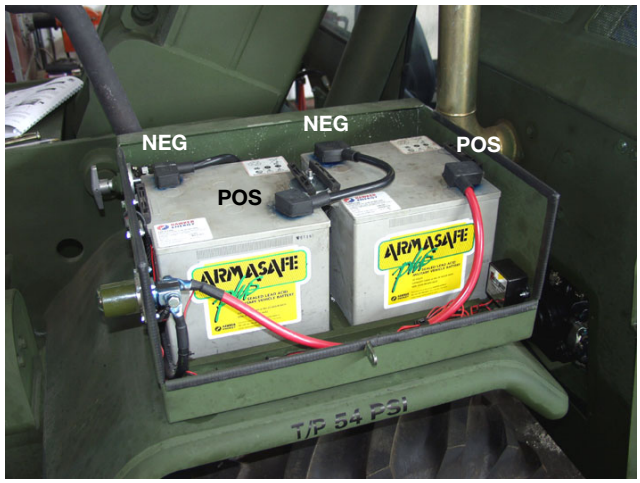
Battery Posts, terminals and related accessories contain lead and lead compounds, chemical known to the State of California to cause cancer and reproductive harm. Wash Hands after handling.

WARNING

Battery electrolyte contains sulfuric acid. It can burn you if it touches your skin and eyes. Always wear goggles and protective gloves, and handle the battery with caution to prevent spillage. Keep metal objects watchstraps, rings, and necklaces, clear of the battery leads, since they can short the terminals and burn you.

The battery is located on top rear of engine.

Check that the cable clips are well secured to the battery terminals. To tighten the clips, always use a wrench, never pliers. Protect the terminals by using Dielectric grease. Remove the battery and store it in a dry place, when the machine is not used for a long time. Before disconnecting the battery, set all switches in the cab to off. To disconnect the battery, disconnect negative (-) lead form the frame ground first. To connect the battery, connect the positive (+) lead first.



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SECTION 10
500 HOURS OR QUARTERLY MAINTENANCE

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10.0 500 HOURS OR QUARTERLY MAINTENANCE CHECKS

GENERAL

The lubrication charts in **Section 6** provide general locations of the individual service points and list the type lubricant, which should be used for each component.
Before proceeding with 500 hours or Quarterly Maintenance Checks, refer back to the pre-operation checklist and the 50, 250 hours Maintenance.

10.1 CHANGE ENGINE OIL

ATTENTION

Discard the used lubricating oil in a safe place and in accordance with local regulations.

CAUTION

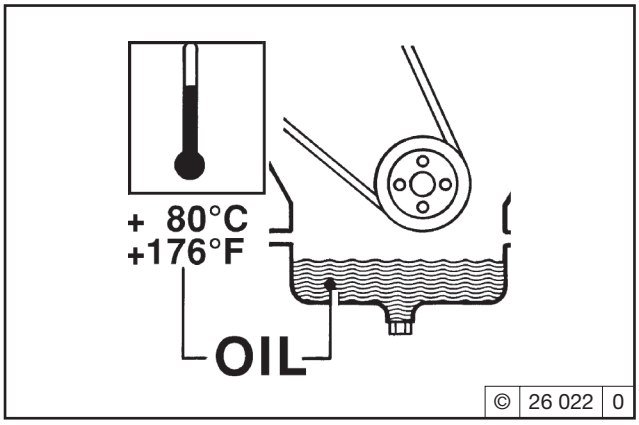
If the base of the sump is divided to fit over a transmission shaft, ensure that the drain plugs on both sides of the sump are removed. If they are not only some of the lubricating oil will be drained.

CAUTION

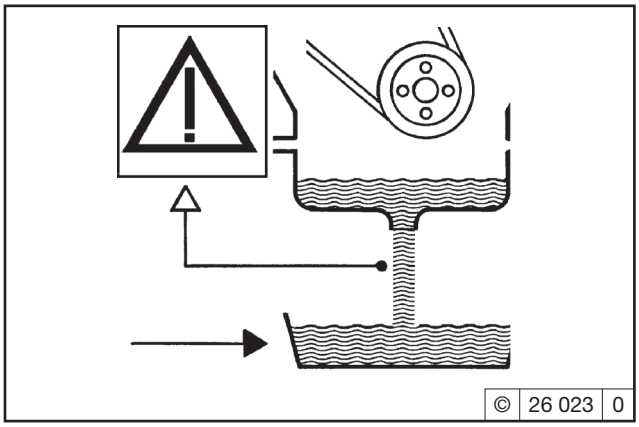
Do not exceed the correct level of lubricating oil in the sump. If there is too much lubricating oil, the excess must be drained to the correct level. An excess of lubricating oil could enter the breather valve. This could cause the engine speed to increase rapidly without control.

To change the engine oil, follow the instructions below:

- Allow engine to warm up.
- Ensure that engine or vehicle is level.
  - Lube oil temperature approx. 80°C.
- Switch off engine.



- Place oil tray under engine.
- Unscrew oil drain plug.
- Drain oil.
- Fit oil drain plug with new seal ring and tighten firmly (for torque, see Engine use and maintenance manual)
- Pour in lube oil (see **chapter 6.3**)
- Check oil level (see **chapter 8.1**).



CAUTION

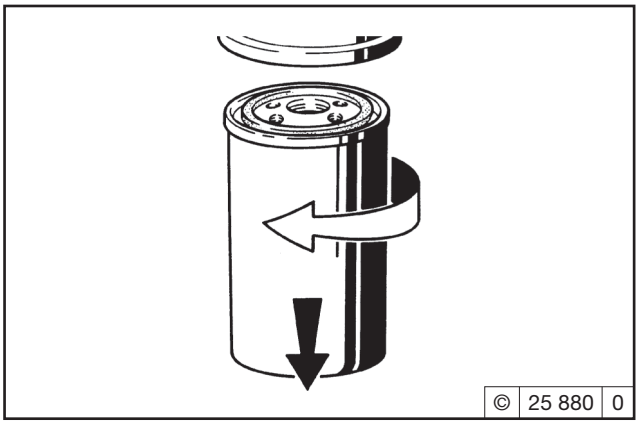
Caution when draining hot oil: Risk of scalding!
Do not let used oil run into the soil but collect it in a container!
Dispose of this in accordance with environmental regulations!

10.2 CHANGE ENGINE OIL FILTER

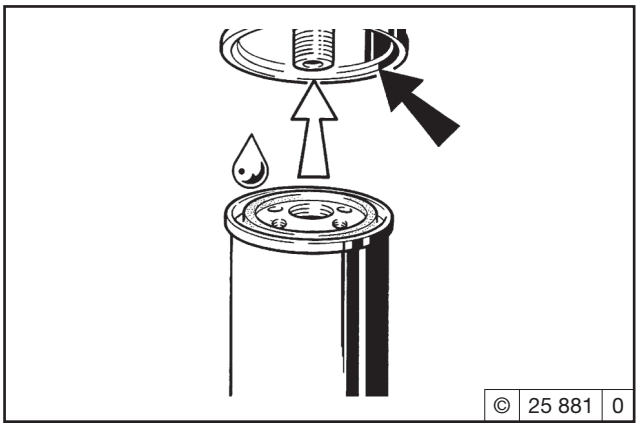
ATTENTION

Discard the used canister and lubricating oil in a safe place and in accordance with local regulation.

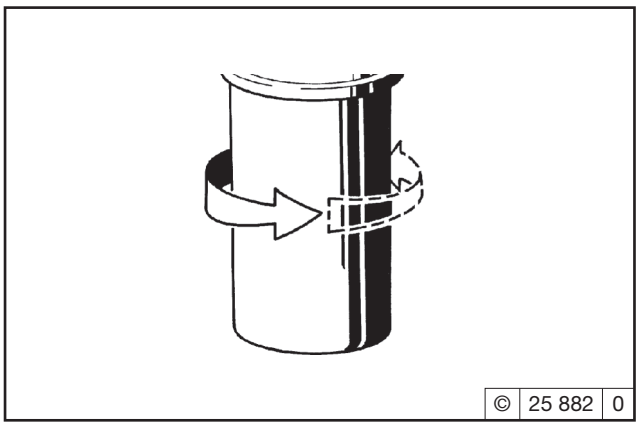
- Undo lube oil filter cartridge using commercial tool and spin off.
- Catch any escaping oil.



- Clean any dirt from filter carrier sealing surface.
- Lightly oil rubber gasket of new lube oil filter cartridge.
- Manually screw in new cartridge until gasket is flush.



- Tighten lube oil filter cartridge with another halfturn.
- Check oil level (see **chapter 8.1**).
- Check oil pressure.
- Check lube oil filter cartridge seal for leaks.



CAUTION

Caution is required in case of hot oil: Risk of scalding!

10.3 CHANGE ENGINE AIR FILTER (external cartridge)

ATTENTION

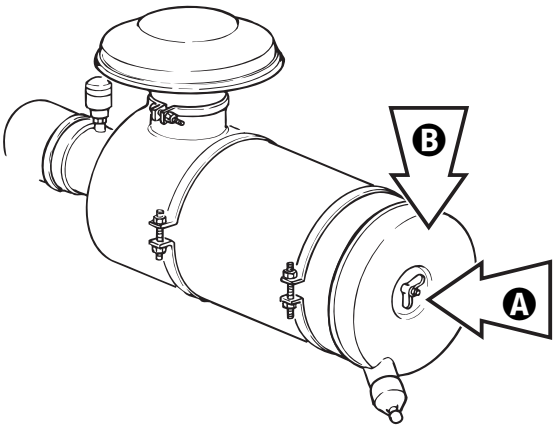
Environmental conditions have an important effect of the frequency at which the air filter needs service. If working in dusty area clean the filter and dust bowl daily. The filter element must be cleaned or renewed.

The air filter is located at the rear of the engine.

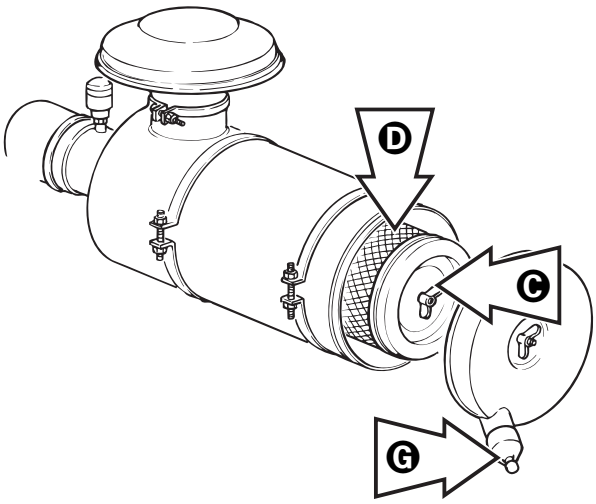
The engine air filter consists of an external cartridge and an internal cartridge. **The inner element should be replaced every two times the outer element is replaced.**

To clean or replace the external cartridge:

- Stop the engine and engage the parking brake.
- Unscrew wingnut **A** and remove cover **B**.



- Unscrew wingnut **C** and remove the outer element **D**.



- Clean the filter bowl.
- Dry clean the cartridge (max. pressure: 5 bar) and direct the air jet from inside to outside.
- Check for cracks in the filtering element by introducing a lamp inside.
- Smear the seal with grease, then refit the element.
- Tighten wingnut **C**, close cover **B** and tighten with wingnut **A**.

ATTENTION

Daily remove any dust collected in the filter by pressing the rubber cap **G.**

10.4 CHANGE ENGINE FUEL FILTER

The engine fuel filter is located on the right side of engine.

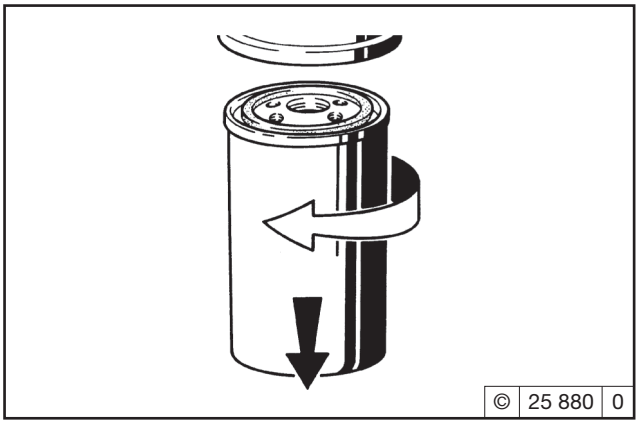
ATTENTION

Discard the used canister filter and fuel oil in a safe place and in accordance with local regulation.

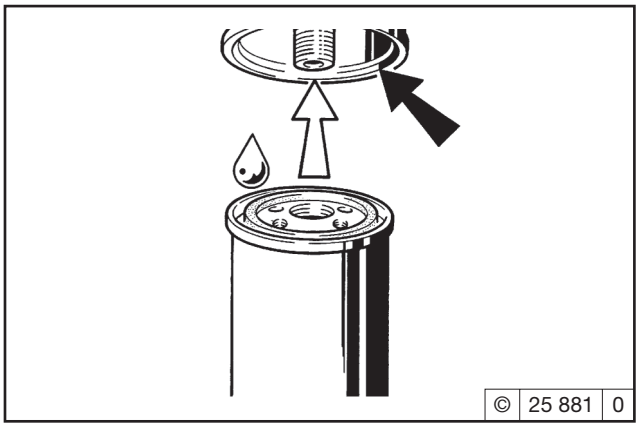
CAUTION

It is important that only genuine DEUTZ parts are used. The used of wrong parts could damage the fuel injection equipment.

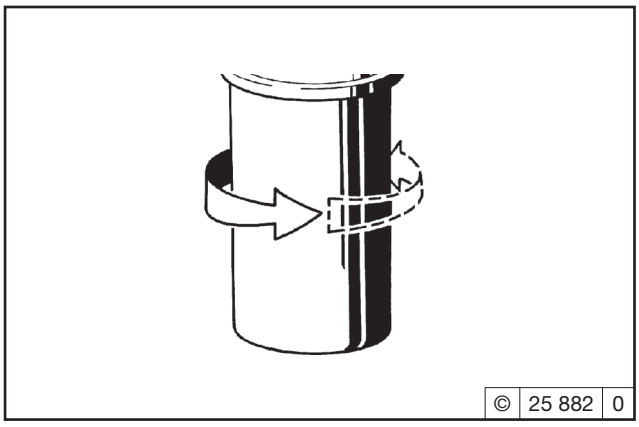
- Close fuel shut-off valve.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any escaping fuel.



- Clean any dirt from filter carrier sealing surface.
- Apply light film of oil or diesel fuel to rubber gasket of new fuel filter cartridge.
- Manually screw in new cartridge until gasket is flush.



- Tighten fuel filter cartridge with final half-turn.
- Open fuel shut-off valve.
- Check for leaks.



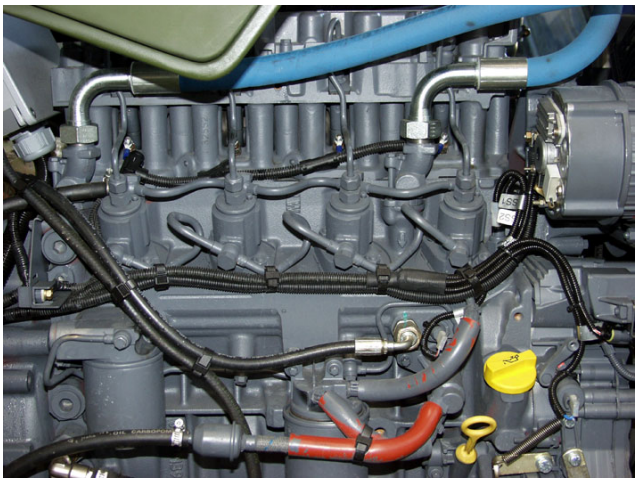
The fuel system does not need to be bled.

CAUTION

Keep naked flames away when working on the fuel system. Do not smoke!

10.5 CHECK ENGINE GLOW PLUGS

The engine glow plug is located outside the reservoir. Disconnect the glow plug connection. Apply one probe of a multimeter, which can check continuity to the terminal of the glow plug and apply the other probe to a suitable ground. If the continuity is correct the multimeter will give an audible signal. It there is no audible signal, change the glow plug. Repeat this check for all of the glow plugs.



10.6 CHANGE HYDRAULIC RESERVOIR FILTER

ATTENTION

The hydraulic oil-filtering element cannot be cleaned or washed and refitted. They must be replaced with new ones of the type recommended by manufacturer.

ATTENTION

Discard the used filter in a safe place and in accordance with local regulations.

Stop the machine on a level ground and engage the parking brake. Place a container of suitable size under the filter to collect any oil leaks, then close the valve. Using a strap wrench, remove the filter element. Change the filtering element, then before fitting a new one, thoroughly clean and grease both seat and gasket.

⚠ WARNING

Failing to open the valve all the way can cause damage to the transmission pump and motor. Do not start the engine with the valve closed.

Hand-tighten the filter, then reopen the valve. Check hydraulic oil level and add as necessary. Start the engine and inspect for any leaks.

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SECTION 11
1000 HOURS OR SEMIANNUALLY MAINTENANCE

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11.0 1000 HOURS OR SEMIANNUAL MAINTENANCE

GENERAL

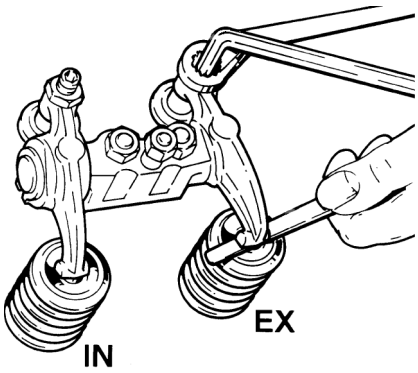
The lubrication charts in **Section 6** provide general locations of the individual service points and list the type lubricant, which should be used for each component. Before proceeding with 1000 hours or semiannual maintenance checks, refer back to the pre-operation checklist and the 50, 250 and 500 hours Maintenance.

11.1 CHECK ENGINE VALVE TIP CLEARANCE

CAUTION

If the cap nut is over tightened the stud and plate assembly for the rocker pedestal may be damage.

The valve tip clearance (8 places) is checked with a feeler gauge between the top of the valve stem and the rocker lever, with the engine cold. The correct clearance for both the inlet and the exhaust valves is:
Inlet: 0.3 mm (0.012 in)
Exhaust: 0.5 mm (0.02 in).
Refer to DEUTZ manual for procedures for setting valve tip clearances.

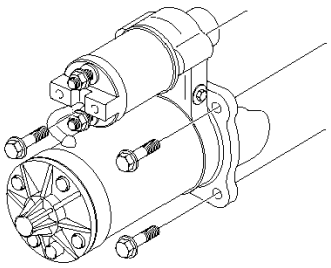


11.2 CHECK ELECTRICAL ALTERNATOR

With the engine off, check for side ply in the pulley. Start the engine. Make sure all accessories are off. Rev up the motor to a fast idle. Using a voltmeter set to the DC scale. Measure the voltage across the battery terminals - Red lead of the voltmeter on the positive terminal, black on the negative. The voltage should read around 26 volts. IF it reads less than 24 volts you may have a failed alternator. Turn on the defroster heater, headlights, work light, dome light and fan to draw power. Rev up the engine and watch the voltmeter. It should still be reading around 26 volts. If it reads lower than 25 volts the chances are the alternator is staring to fail. Check the field voltage at the alternator. Place ignition switch in the on position. Do not start engine. The brown / black wire on the alternator is the one that supplies the field. Check with a voltmeter to see if there is 24 volts at the field.

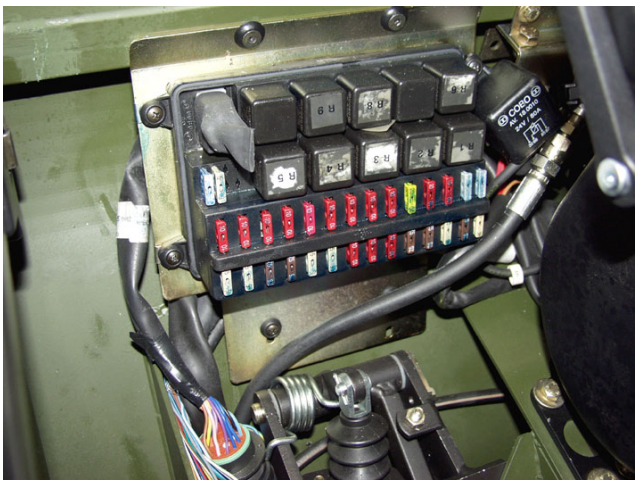
11.3 CHECK ELECTRICAL STARTER

Test the starter motor on the engine. Ensure that the battery is fully charged. Turn on the lights and operate the starter switch. Connect a voltmeter across the battery terminals and operate the starter switch. If the starter does not operate but the lights keep their power or there is no voltage drop across the battery, check the switch and all the connections and wires. Slow action of the starter can be caused by faulty wire connections. Failure to engage smoothly between the starter and the flywheel can be caused, on some types of starter motor, by dirt on the helical grooves of the starter motor drive, which can prevent free pinion movement. Clean the shaft thoroughly with cleaning fluid made especially for the purpose, and apply a small quantity of aero shell 6B or its equal. The starter is a specialist repair only.



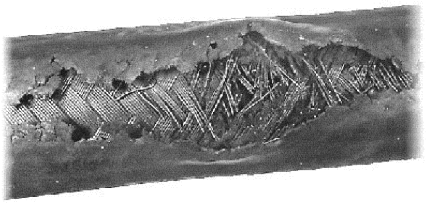
11.4 CHECK ELECTRICAL SYSTEM

Remove the fuse panel located on the left side of steering column. Inspect for corrosion. Check for damaged wires and faulty connections. Apply dielectric grease to connections. Spray waterproof / anticorrosion fluid to panel. Check the condition of all grounds. Pull solenoid caps and apply dielectric grease to connection. Check solenoid wire connections. Check wires to switches.



11.5 CHECK HYDRAULIC HOSES AND FITTING

Carefully inspect all hoses and fitting on the machine for leaks, and or damage. Leaks that cannot be stopped by tightening the connection should be removed and repaired. Make sure all fitting are tightened.



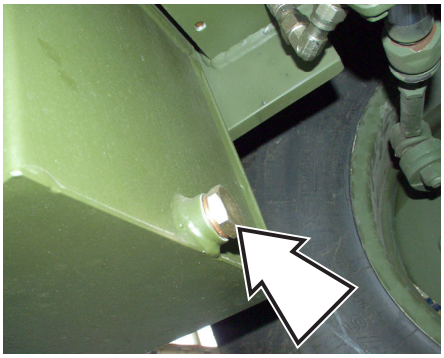
11.6 CHANGE HYDRAULIC RESERVOIR OIL FILTER, CLEANING HYDRAULIC MAGNET

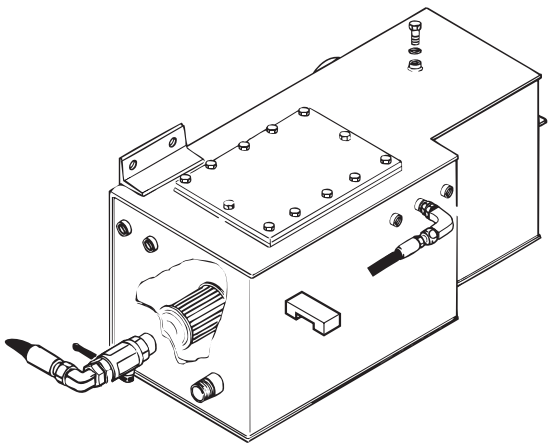
ATTENTION

When changing the oil, drain it when it is still hot and the polluting substances are in suspension.

To change the hydraulic reservoir oil procedures as follows:

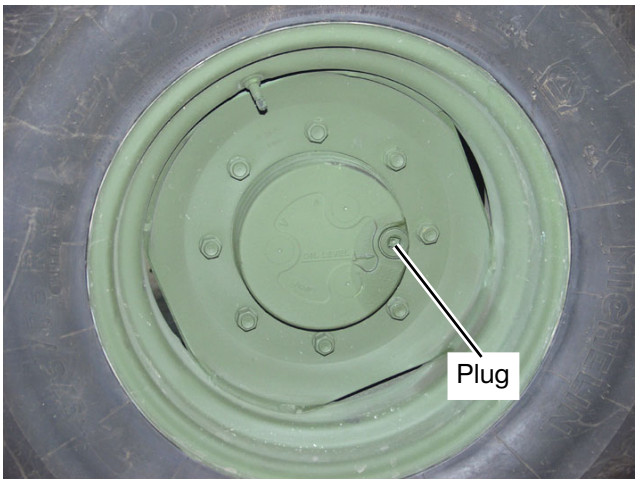
Stop the machine on level ground and engage the parking brake. Raise boom fully and support it.
Eliminate any residual pressure from the hydraulic circuit. Place a 25 gallon container or larger under the drain plug. Remove the drain plug and allow oil to flow out into the container. Remove the inspection cover from tank. Wash the tank thoroughly with solvent and a jet of compressed air. Remove old filter from inside reservoir and install new one. Remove magnet from bottom of reservoir, clean and replace it. Refit the oil drain plug and the inspection cover. Add new recommended oil, until it is present at the center of the sight glass.





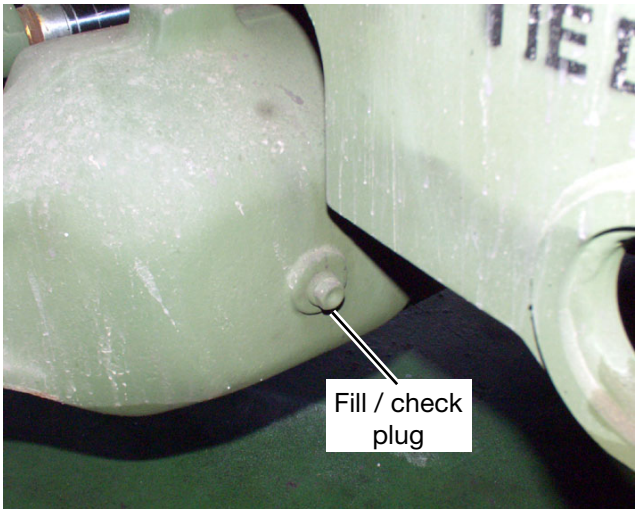
11.7 CHANGE AXLE WHEEL END OIL

To change the oil in the axle wheel ends, turn wheel so drain / fill plug is at the bottom of the axle. Place one gallon container under the drain / fill plug.
Remove plug and drain oil into container. When all fluid has drained rotate drain / fill plug to the horizontal center of the axle and add new recommended oil. Install and tighten plug. Repeat procedures for each wheel. Travel the machine for two minutes then recheck oil levels. Add more oil if necessary.

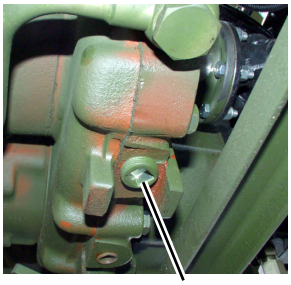


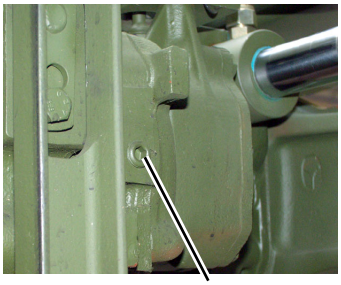
11.8 CHANGE AXLE DIFFERENTIAL OIL

The front and rear axle differentials use the same procedures. Place a two-gallon container under the drain plug. Loosen both drain plug and level plug and allow oil to flow out from the reduction gear. Refit and tighten drain plug. Add new recommented oil through plug until it is level with the hole. Refit and tighten level plug.



Rear Axle Differential



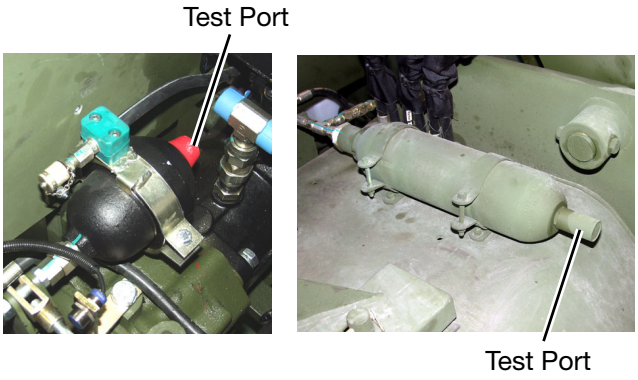


Front Axle Differential

11.9 CHECK ACCUMULATOR PRE-CHARGE PRESSURE

870 PSI (60 BAR) PRE-CHARGE

800 PSI (55 BAR) PRE-CHARGE



DANGER

Pressure is present in the steering safety hydraulic circuit even when the engine is off. When disassembling, disconnecting, or checking the precharge of the steering accumulator, rotate the steering wheel left or right with engine shut down until the steering wheel becomes hard to move. This procedure will eliminate the trapped pressure in the steering circuit.

Use the olaer pressure regulator and gauge assembly or equivalent to check the pre-charge pressure.

Remove the protective cap from the test port.
Install the pressure regulator and gauge assembly to the test port on the accumulator. Make sure the bleed valve is turned clockwise inward and verify pressure (870 PSI (60 BAR) for System Accumulator and 800 PSI (55 BAR) for Steering Accumulator). If pressure is low, check the charging valve for leaks using soapy water at the test port. Add additional dry nitrogen gas, if needed, by opening the nitrogen control valve. To release excess nitrogen gas pressure, open up bleeder valve located at bottom of pressure regulator until the correct pressure is achieved. Install the protective cap.

11.10 CHANGE ENGINE AIR FILTER (internal cartridge)

ATTENTION

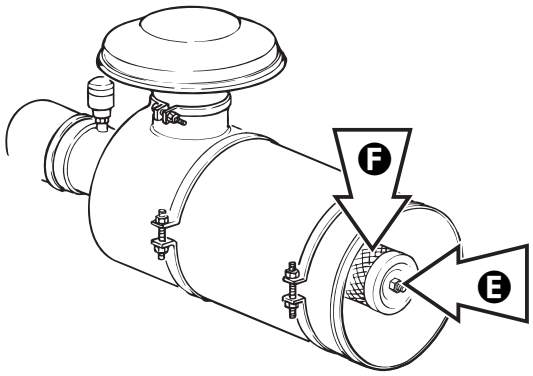
Environmental conditions have an important effect of the frequency at which the air filter needs service. If working in dusty area clean the filter and dust bowl daily. The filter element must be cleaned or renewed.

The air filter is located at the rear of the engine.

The engine air filter consists of an external cartridge and an internal cartridge. **The inner element should be replaced every two times the outer element is replaced.**
To replace the external cartridge, follow the instructions in **chapter 10.3**.

For the replacement of the internal cartridge:

- Stop the engine and engage the parking brake.
- Follow the instructions in **chapter 10.3** to remove the external cartridge.
- Undo the hexagonal nut **E** and pull off the internal cartridge **F**.



- Clean the filter bowl.
- Smear the seal with grease, then mount the new element and make sure it is correctly positioned.
- Re-tighten the hexagonal nut **E**.
- Refit the outer element and the cover (see **chapter 10.3**).

SECTION 12
3000 HOURS OR THREE YEARS MAINTENANCE

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12.0 3000 HOURS OR THREE YEARS

GENERAL

The lubrication charts in **Section 6** provide general locations of the individual service points and list the type lubricant, which should be used for each component. Before proceeding with 3000 Hours or Two Years, refer back to the pre-operation checklist and the 50, 250, 500 and 1000 Hours Maintenance.

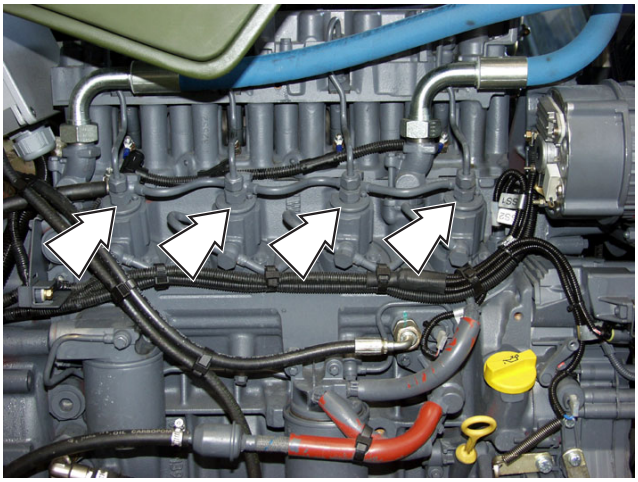
12.1 CHECK ATOMISERS (FUEL INJECTOR)

WARNING

If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.

Keep away from moving parts during engine operation. Some moving parts cannot be seen clearly while the engine runs.

The atomizer is located on the engine right side. An atomizer fault can cause an engine misfire. In order to find which atomizer is defective; operate the engine at a fast idle speed. Loosen and tighten the union nut of the high-pressure fuel pipe at each atomizer. When the union nut of the defection atomizer is loosened, it has little or no effect on the engine speed. To replace the atomizer refer to the DEUTZ manual.



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SECTION 13
ROUTINE MAINTENANCE

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13.0 ROUTINE MAINTENANCE

GENERAL

This section provides routine maintenance procedures. A through and regular maintenance keeps the machine in a safe and efficient working condition.
For this reason, it is advisable to wash, grease and service the machine properly. Always ensure all machine components are in good condition. Check for oil leaks and loosening guards, and make sure that the safety devices are efficient. In case of defects, find and rectify them before using the machine. For purchases components always refer to the vendor manuals.
Not-respecting the ordinary maintenance schedule of this manual automatically voids Terexlift warranty.
The relief valves are factory preset. Adjusting the valve in the field will void machine warranty. Valves must be set only by trained personnel.

13.1 REPLACING THE ATTACHMENTS

CAUTION

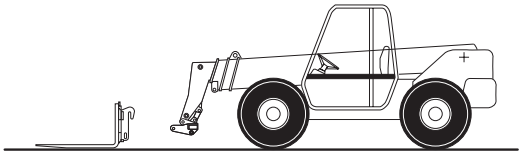
Use only attachments directly designed and manufactured by Terex for its handlers.

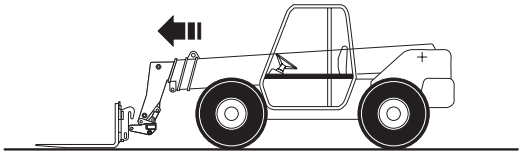
WARNING

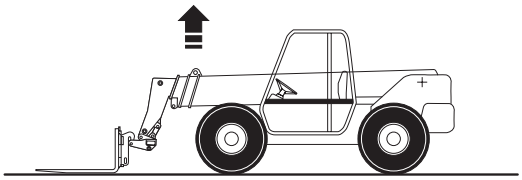
After substitution, visually check the attachment is correctly coupled to the boom, before operating the machine. A wrongly coupled attachment may cause injury to personnel or damage equipment.

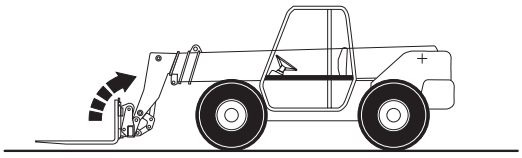
To change attachments, operator as follows:

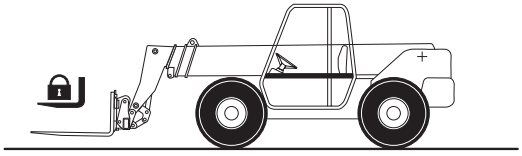
1. Disconnect the quick connectors from the fork rotate cylinder and connect them to the attachment lock / unlock cylinder. Then disconnect the quick connectors from the side shift cylinder.
2. Disconnecting the quick connectors of the attachment, and connect the hydraulic locking pipes of the attachment to couplings.
3. Operator the Joystick function to unlock attachment pins.
4. Rest the attachment flat on the ground.
5. Tilt the holding frame forward and retract the boom to release the attachment upper lock.
6. Move back with the machine (or with the boom) and drive to the new attachment going to be coupled.
7. Hold the frame tilted forward and hook the upper pins of the new attachment.
8. Retract and raise the attachment a few inches. Attachment will center automatically on the quick coupling frame.
9. Operate the joystick function to lock the attachment.
10. Couple the connectors of the attachment, to the quick couplings of the frame.









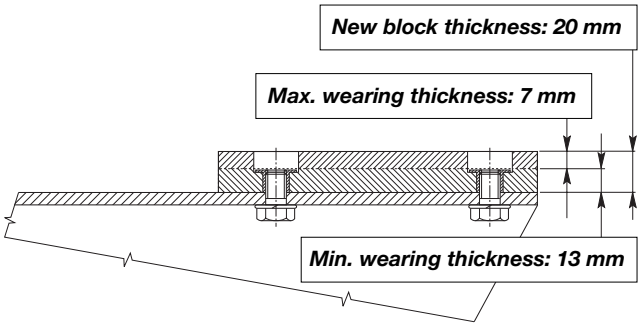


13.2 SLIDER PADS ADJUSTMENT

If the clearance between the boom sections are over (2mm), it is necessary to shim the Slider Pads of the boom sections. Usually, the Slider Pads that wear more rapidly are the lower Slider Pads of the fixed boom section and the upper Slider Pads of the moving boom section.

To adjust the Slider Pads follow the procedures listed below:

1. Fully retract the telescope section.
2. Rest the boom on a solid support.
3. With a thickness gauge, check the clearance of the Slider Pads. The tolerance after adjusting must be 1.0 mm to 1.5 mm.
4. Measure the thickness of the Slider Pads. The top and bottom Slider Pads of the base section and the top Slider Pads of the moving section must be at least 13 mm thick, all other Slider Pads must be 7 mm. If any of the pads are less then the above they will have to be replaced (see changing the Slider Pads).

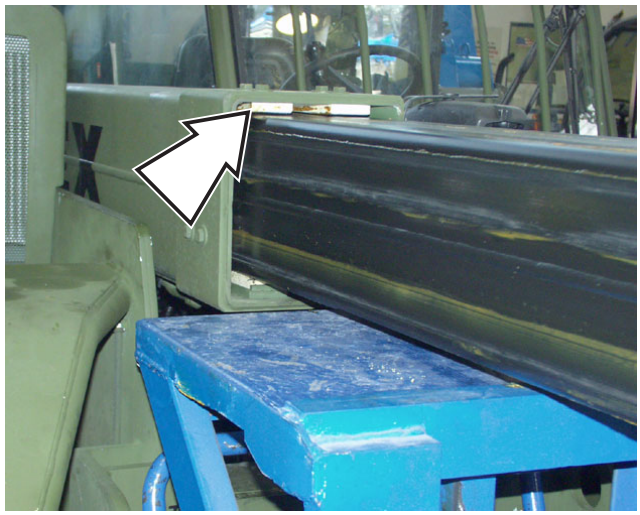


5. Remove the Slider Pads mounting screws and place shims between the boom section and the wear pad to obtain the 1.0 mm to 1.5 mm tolerance. Reinstall the mounting screws after applying a medium strength Locktite.
6. After shimming, fully extend the boom; clean the wear pad paths on the moveable boom section and grease with a thin coast of grease, (the recommended type of grease to use is Texclad 2 or any type of grease with a graphite additive).

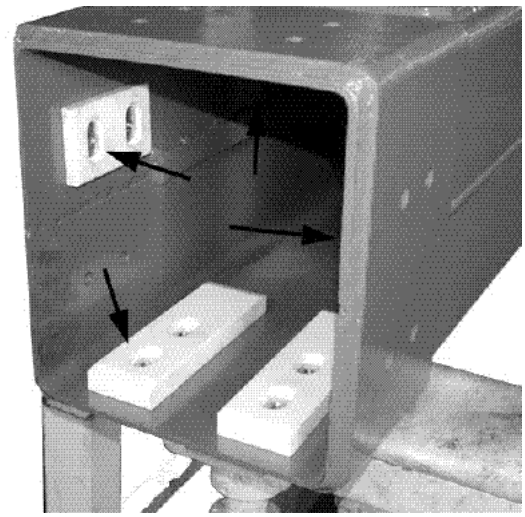
13.3 CHANGING SLIDER PADS

If the Slider Pads must be replaced, follow the procedures listed below:

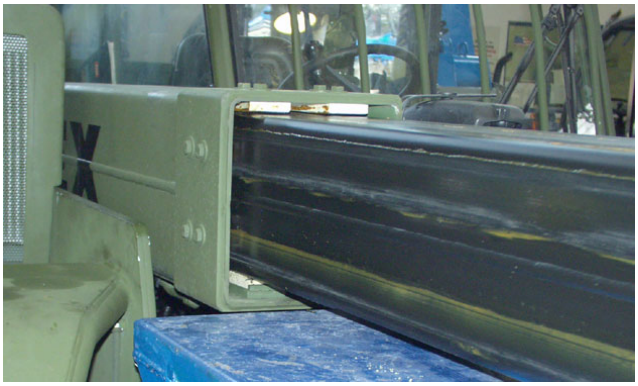
1. Put the boom in the horizontal position with the boom fully extended.



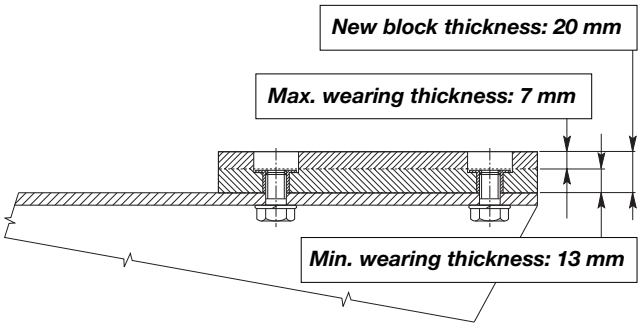
2. Support the moving section with a sling attached to a suitable lifting device. The moving section will have to be removed from the base section to access the rear Slider Pads on the moveable boom section. Before removing the moveable section several things must be done.
3. Support the moveable section so that the Slider Pads on the base section are free.
4. Remove the top, bottom and side Slider Pads from the base section. They are help in place by the external bolts.



5. Remove the telescope cylinder rod eye pin from the moveable section, this will allow the section to be pulled out of the base section far enough to access the Slider Pads on the rear of this section.
6. Only pull the section out as little as possible to access the Slider Pads. Be careful not to disturb the flexible hoses.

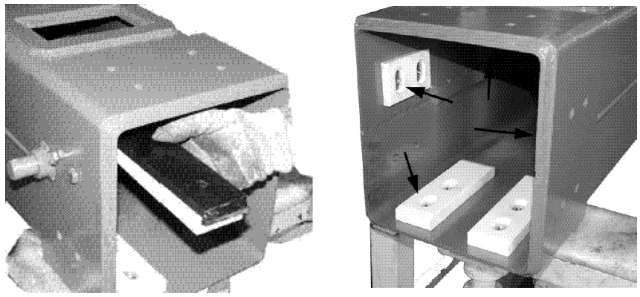


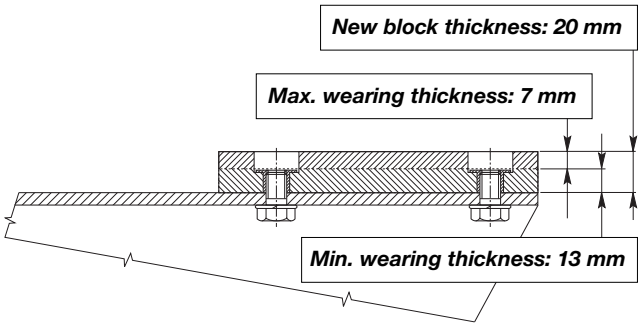
7. Remove the Slider Pads from the rear of the moveable boom section.
8. Measure the inside of the base section, top to bottom and side to side. Measure the outside of the moveable boom section in the same manner to determine if some shims will be required under the new Slider Pads. The final clearance must range from 1 to 1.5 mm.



9. Install the new Slider Pads and shims required determined from the above measurements.
   Apply a drop of medium strength Loctite on the bolt threads before installing.
10. Reinstall the moveable boom section being very careful with the flexible hoses.
11. Reinstall the telescope cylinder rod eye pin. To align the rod with the hole use a pointed bar to raise the telescope cylinder rod eye and insert the pin from the other side.

12. Install the Slider Pads on the top bottom and sides of the base section, again using shims as necessary and applying a drop of medium strength Loctite on the bolt threads. Maintain the 1 mm to 1.5 mm clearance.





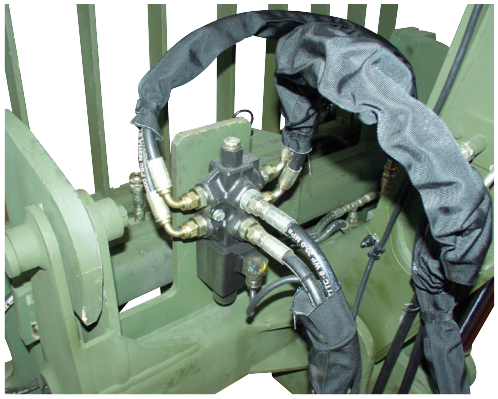
13. Clean the wear pad paths on the moveable boom section and grease with a thin coat of grease, (Texclad 2 or grease with graphite additive).

13.4 ATTACHMENT PLATE REMOVAL / INSTALLATION

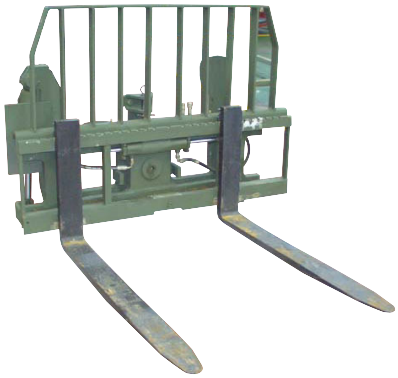
REMOVAL

Follow the procedures below for removing the attachment plate:

1. Disconnect the quick connectors feeding the attachment from the boom.



2. Release the attachment and rest it on a pallet to move it.



3. Using an adequate lifting device sling the attachment holding frame to support the frame weight.

4. Disconnect he quick connectors of the attachment locking cylinder.
5. Remove the bolt fixing the pin of the attachment rotation cylinder rod using a 17 mm wrench.

ATTENTION

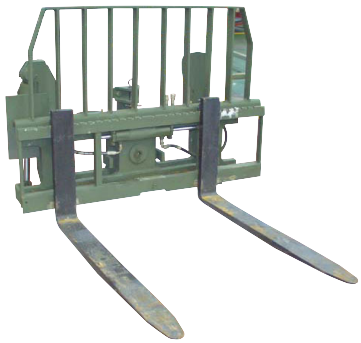
Do not use steel hammer or pinch bar. These items can cause damage to the machine parts.

6. Remove the pin. If necessary, strike the pin using piece of soft material.
7. Remove the screw fixing the hinging pin of the attachment holding frame with two 19 mm wrenches.

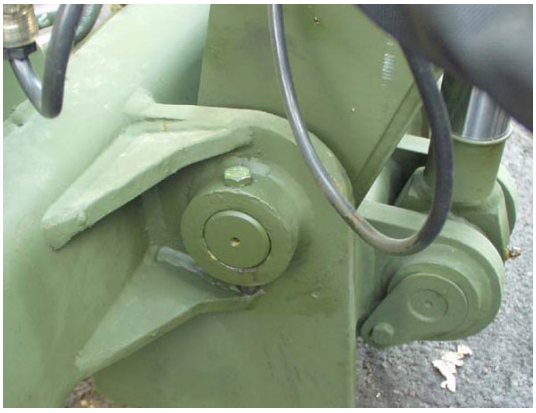
ATTACHMENT INSTALLATION

Follow the procedures below for installing the attachment plate:

1. Rest the attachment holding frame on a wooden pallet to handle it.



2. Apply lubrication prior to installing the hinging pins of the attachment holding frame.
3. Using two 19 mm wrench install the screw fixing the hinging pin of the attachment holding frame.



4. Apply lubrication prior to installing rotation cylinder rod pin.
5. Using a 17 mm wrench install the bolt fixing the pin of the attachment rotation cylinder rod.

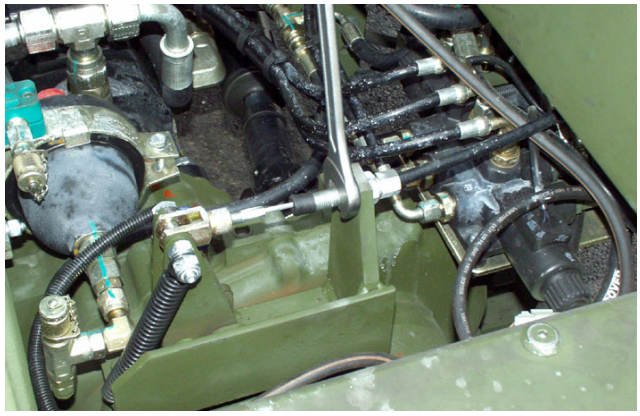
6. Connect the quick connectors of the attachment locking cylinder.
7. Using an adequate lifting device sling the attachment holding frame to support the frame weight.

8. Connect the quick connector feeding the attachment from the boom.

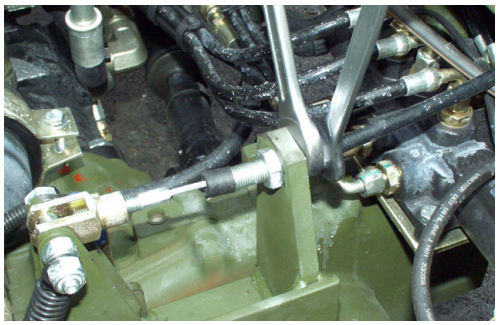
13.5 PARKING BRAKE ADJUSTMENT

Follow the procedures below for adjusting the parking brake:

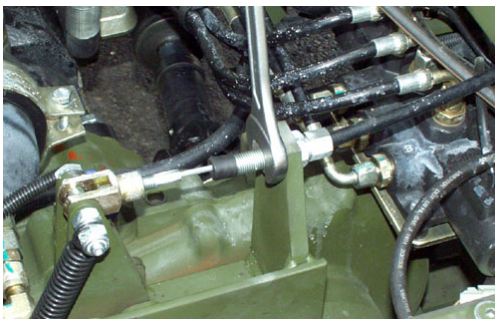
1. Position the machine on hard level surface.
2. Start machine and raise boom 45° with suitable supporting device support boom. Shut off the machine.
3. Using a 13 mm wrench remove bolts that are securing the upper protection plate and remove the plate.
4. Completely lower parking brake handle.
5. Using a 22 mm wrench loosen the front nut on securing bracket for the parking brake cable.



6. Use a 17 mm wrench to hold the sheath in position while using a 22 mm wrench rotate the nut clockwise to tighten the brake and counterclockwise to loosen the brake.



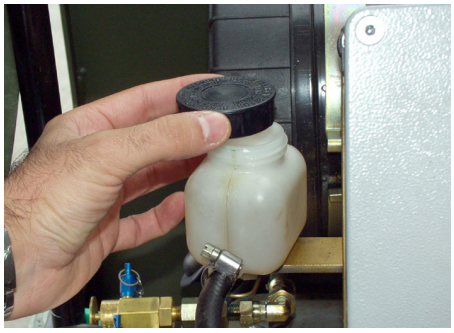
7. To ensure proper parking brake adjustment the parking brake handle in the operators cab should reach full resistance on the 5th or 6th detent click position on the hand brake lever.
8. Start the machine and test the brake.
9. When parking brake is adjusted use a 22 mm wrench and lock nut in position.



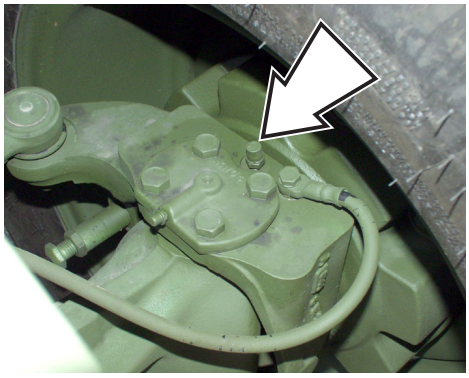
13.6 BLEEDING BRAKE SYSTEM

The proper removal of air from the brake system is very important. All too often, air has remained trapped in systems causing a spongy pedal and inadequate brakes. The air in the system will always seek the highest level. To properly bleed the system, do the following:

1. Fill the brake reservoir, located in the engine compartment with 10W hydraulic oil only.



2. Remove the protection cap from the brake bleeder vent.



3. For this operation, two operators are necessary, one in the operators cab and the other close to the brake bleeder line.
4. Depress brake pedal several times until it is no longer spongy, then while holding the brake down, use a 13 mm wrench and loosen the bleeder vent to allow air to escape.

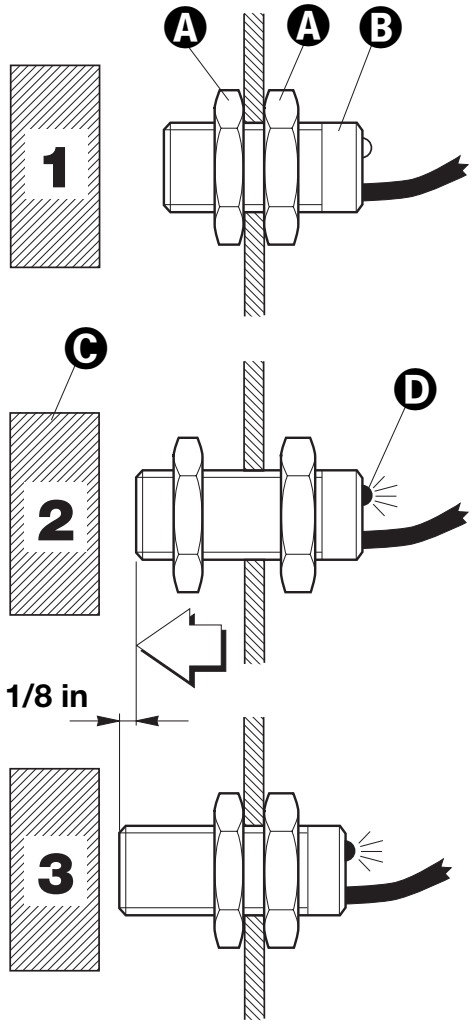
5. Retighten bleeder vent and allow pedal to return.
6. Repeat cycle until pedal is firm.
7. Protect the bleeder vent with the special cap.
8. Make several static brake applications and then repeat the cycle once more.
9. Check brake oil level. If necessary, add 10W Hydraulic oil only. (**Do not** use Brake fluid).

13.7 PROXIMITY SWITCH ADJUSTMENT

In case of a failure or complete malfunctioning of the proximity switches due to a loosening of their fixing ring nuts, re-adjust their position:

1. Loosen nuts (A) fixing the proximity switch (B).
2. Set the mobile part C of the machine, controlled by the proximity switch, as close as possible to it. Near the proximity switch to the component until the LED indicator D lights up.
3. Near the proximity switch by other 1/8". Tighten the proximity switch fitting nut at a torque of 15 Nm and the relevant lock nut.

The machine is equipped with a proximity switch on the parking brake. This switch prevents the machine starting when the parking brake is not engaged.



13.8 DRIVE SHAFT

This section contains instructions for removing and repairing these drive shafts.

DISASSEMBLY

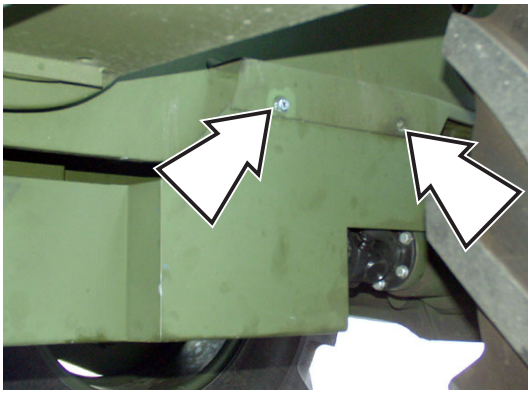
Periodic inspections of the drive shafts are recommended to check for proper lubrication, excessive wear, and any loose, missing or damaged components.

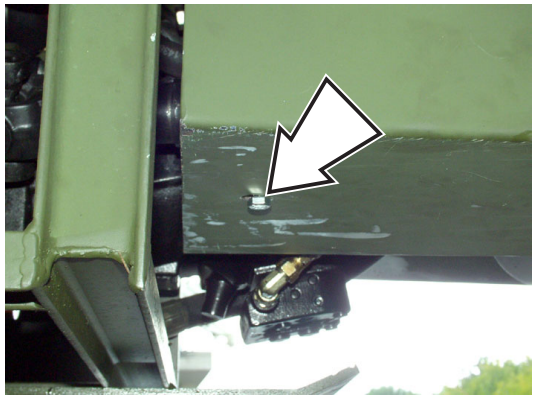
WARNING

Prior to removing the drive shaft, support the drive shaft to prevent it from dropping. Block the wheels to prevent the machine from rolling.

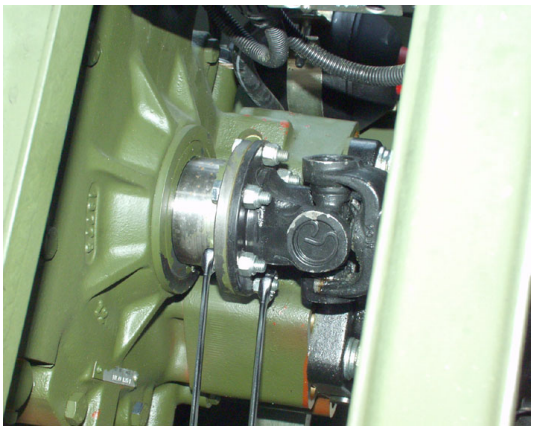
To remove the drive shaft follow the procedures listed below:

1. Position machine on a hard level surface.
2. Block all wheels to prevent machine from rolling.
3. Using a 13 mm wrench, remove the four bolts from the bottom protection cover.





4. Make a reference mark at the gear box and rear axle to ensure proper re-assembly. If part location is not marked you risk loosing the alignment location causing the drive shaft to become unbalance, which could cause damage to the machine.
5. Using two 13 mm wrenches remove the six bolts attaching the drive shaft to the gear box and the rear axle.



6. Remove the drive shaft.

ASSEMBLY

Periodic inspections of the drive shafts are recommended to check for proper lubrication, excessive wear, and any loose, missing or damaged components.

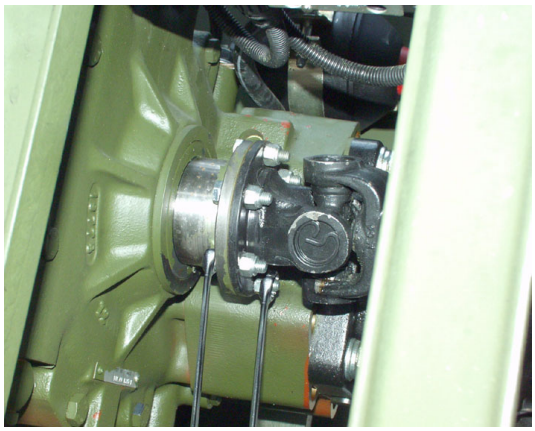
To remove the drive shaft follow the procedures listed below:

WARNING

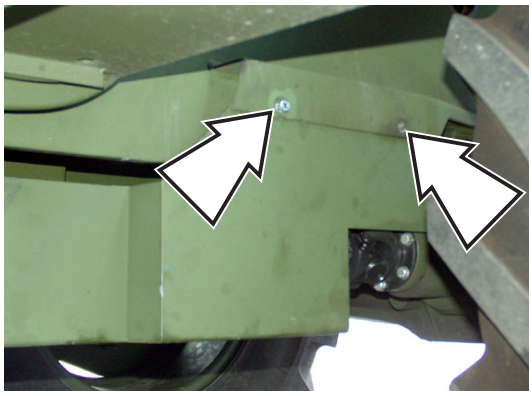
Prior to removing the drive shaft, support the drive shaft to prevent it from dropping. Block the wheels to prevent the machine from rolling.

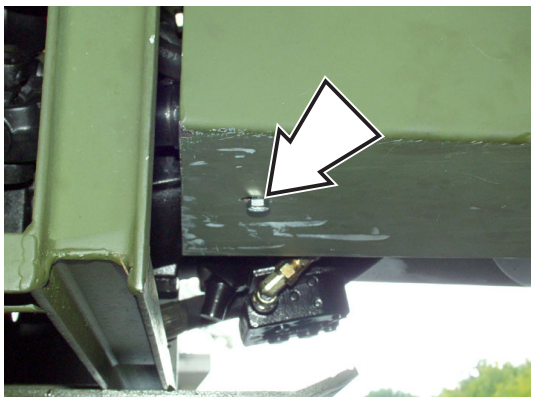
1. Position machine on a hard level surface.
2. Block all wheels to prevent machine from rolling.
3. Install the drive shaft.

4. Using two 13 mm wrenches install the six bolts attaching the drive shaft to the gear box and the rear axle. Make sure alignment is correct. If alignment is not correct you risk loosing the balancing of the drive shaft, which can cause damage to the machine.



5. Torque bolts to 20 ft lbs.
6. Using a 13 mm wrench install bottom protection cover.





13.9 FUEL TANK

DISASSEMBLY

Follow the procedures listed below for removing the fuel tank:

1. Position the machine on a hard level surface.

WARNING

The weight of the counterweight is approximately 2150 lbs. Use adequate lifting equipment to support the counterweight. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

2. Use an adequate lifting device to support the counterweight.
3. Remove the four bolts (two on the side and two on the back).
4. Lower the counterweight from the machine.
5. Carefully clean around the drain plug of the fuel tank.
6. Place a suitable container under fuel tank for draining fuel.
7. Remove fuel tank drain plug and fuller cap, allowing fuel to drain completely.
8. Use a screwdriver to loosen the hose clamps and disconnect the fuel supply and return lines.
9. Disconnect the electrical fuel gauge.
10. Use wood blocking to support the fuel tank.
11. Using a 13 mm and 19 mm wrench remove the three screws attaching fuel tank to the frame.
12. Lower and rest the fuel tank on the ground.

ASSEMBLY

Follow the procedures listed below for installing the fuel tank:

1. Install the three attaching screws to secure the fuel tank.
2. Connect the electrical fuel gauge.
3. Connect the fuel supply and return lines. Tighten the hose clamps.
4. Install the fuel tank drain plug.
5. Fill the tank and replace the fuel cap.

WARNING

The weight of the counterweight is approximately 2150 lbs. Use adequate lifting equipment to support the counterweight. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

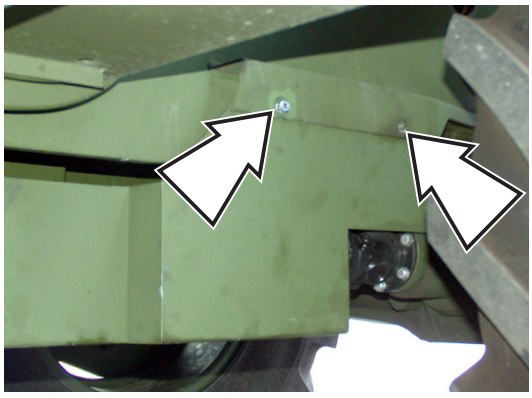
6. Use an adequate lifting device, install the counterweight.
7. Install the four bolts (two on the side and two on the back). Check for leaks.

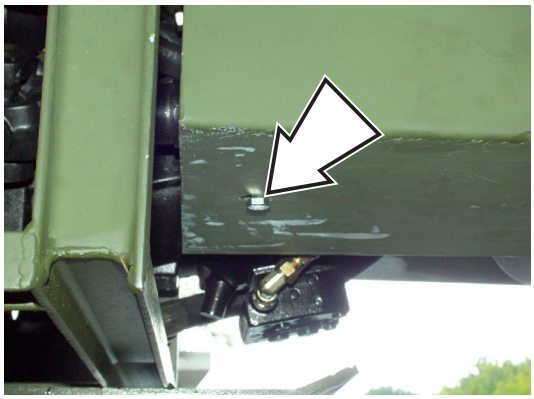
13.10 OIL TANK

DISASSEMBLY

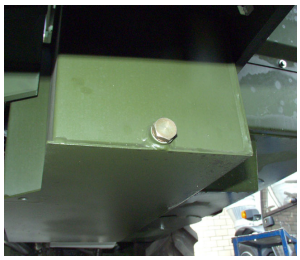
Follow the procedures listed below to disassembly the oil tank.

1. Remove the drive shaft protection cover by using a 13 mm wrench to loosen the four locking screws.

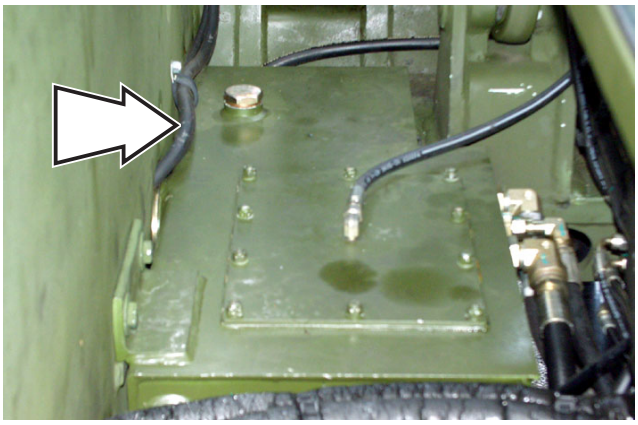




2. Carefully clean the area around the drain plug of the oil tank.

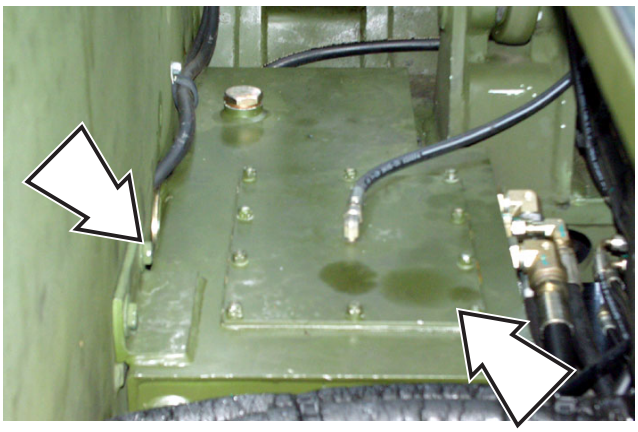


4. Place suitable container under oil tank drain plug.
3. Using a 32 mm wrench remove the drain plug and allow the oil to completely drain.
4. Close the oil valves.
5. Using a 32 mm and 36 mm wrench disconnect the valve.
6. Disconnect the three side flexible hoses by using a 22 mm – 27 mm and 32 mm wrench.



7. Disconnect the electrical wire from the sending unit.
8. Use a 38 mm and a 50 mm wrench to disconnect the flexible hoses under the valve.
9. Disconnect the hose clamp of the filler extension by using a 10 mm wrench.
10. Remove the tank vent line.
11. Place a pallet with shims under the tank to support its weight.

12. Remove the screws securing the tank on the machine by using a 17 mm and 19 mm wrench.

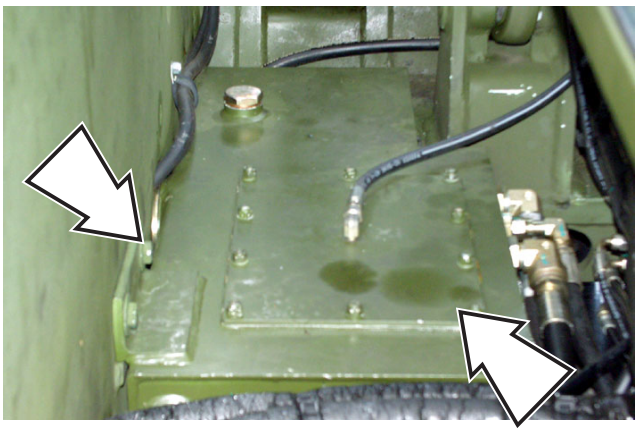


13. Lower and remove the tank from the machine.

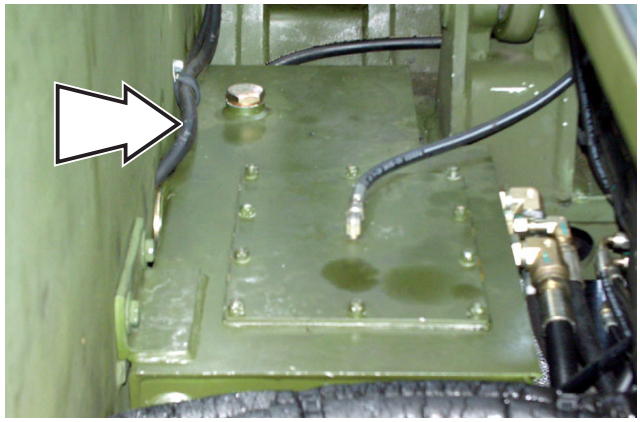
ASSEMBLY

Follow the procedures listed below to install the oil tank:

1. Install the oil tank by using a 17 mm and 19 mm wrench to secure the four screws that attach the oil tank to the machine.



2. Connect the tank vent lines.
3. Using a 10 mm wrench connect the hose clamp of the filler extension.
4. Connect the flexible hoses under the valve by using a 38 mm and 50 mm wrench.
5. Connect the electrical wire to the sending unit.
6. Connect the three side flexible hoses by using a 22 mm – 27 mm and 32 mm wrench.



7. Using a 32 mm and 367 mm wrench connect the valve.

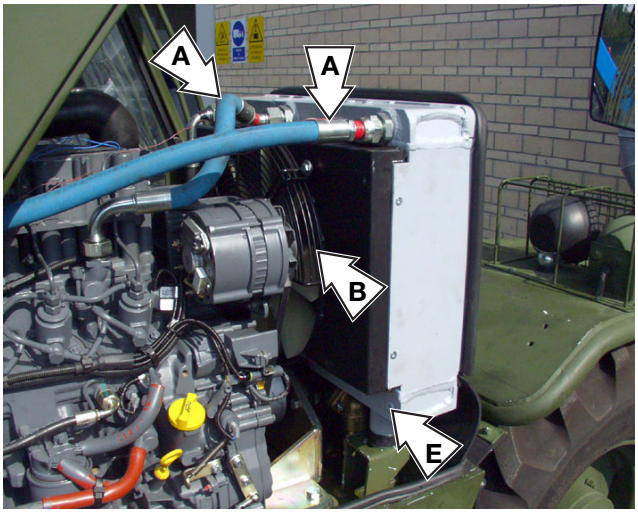
8. Fill the oil tank with oil and open the valves of the intake line before starting the machine.
9. Start the machine, after a few minutes, check the oil level and if necessary, add new oil.
10. Check for leaks.

13.11 RADIATOR

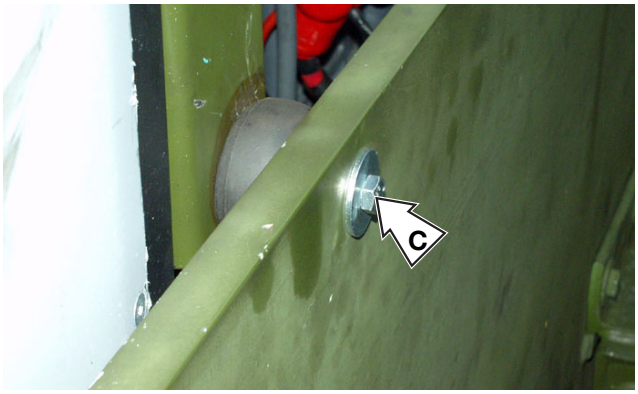
DISASSEMBLY

Follow the procedure listed below for removal of the radiator:

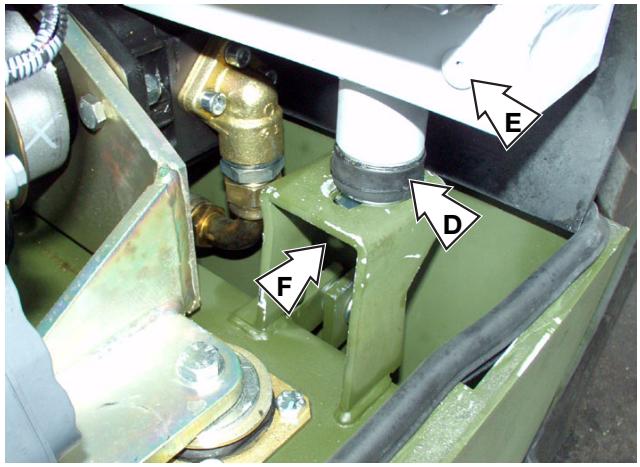
1. Stop the machine on a level ground and make sure the parking brake is engaged.
2. Place a container of suitable size under the drain plug.
3. Clean the area all around flexible hoses **A**. Disconnect the hoses with a 36mm wrench. Plug these hoses immediately to avoid that dust and impurities may enter the circuit.
4. Unscrew the oil drain plug **E** with a 6mm wrench and let the oil flow out into a collecting vessel.
5. Remove the protection grill of the radiator fan **B** using a 13mm wrench.



6. Unscrew the side fixing screw **C** of the radiator using a 13mm wrench.



7. Undo screws **F** fixing the two vibration-proof supports **D** using a 17mm wrench.

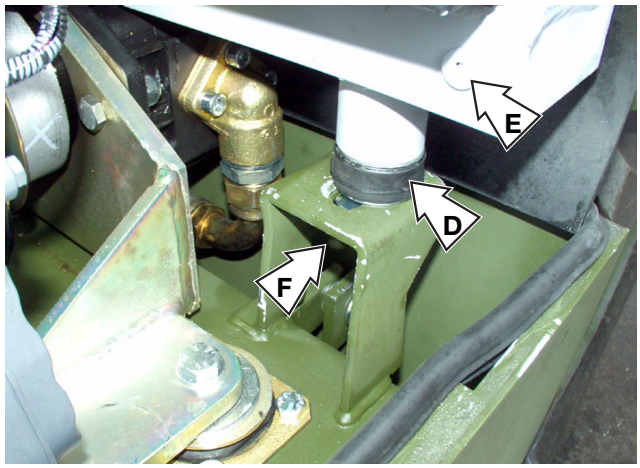


8. Remove the radiator from the machine using a suitable hoisting equipment.

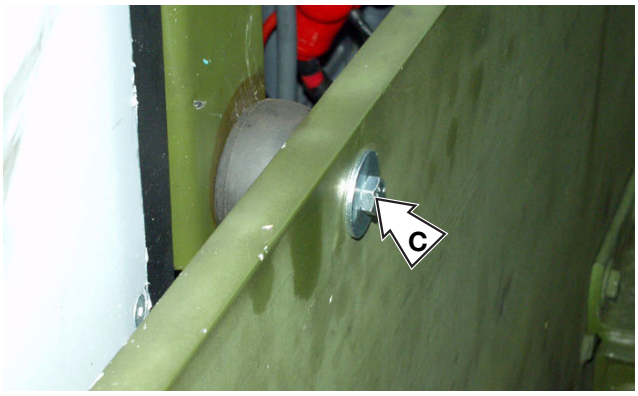
ASSEMBLY

Follow the procedure listed below to install the radiator:

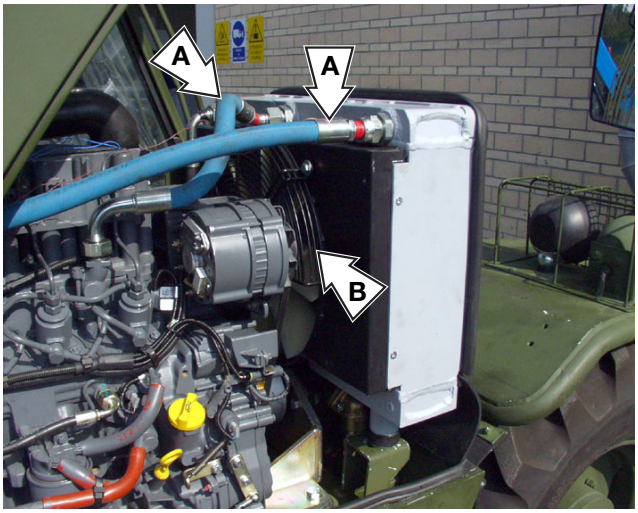
1. Place the radiator on to the machine using a suitable hoisting equipment.
2. Fit the two vibration-proof supports **D** to the frame by tightening screws **F** using a 17mm wrench.



3. Using a 13mm wrench, tighten the side fixing screw **C** of the radiator.



4. Mount the protection grill of the radiator fan **B** using a 13mm wrench.
5. Using a 36mm wrench, reconnect the flexible hoses **A** to the radiator



6. Tighten the oil drain plug **E** of the radiator.
7. Check the oil level and pour new oil, if necessary, until reaching the recommended level.
8. Start the engine, let it run for some minutes and check for oil leaks. Check again the engine oil level and add new oil up to the recommended level, if necessary.

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SECTION 14
HYDRAULIC BOOM

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

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14.0 BOOM INTRODUCTION

GENERAL

Section D covers the boom system components used on this machine with recommended inspection.
The boom system consists of a two section hydraulic boom with one telescope cylinder and valves for boom hoist, telescope functions and tilt cylinder.

14.1 BOOM REMOVAL / INSTALLATION

GENERAL

This section provides the necessary information to remove and install the boom assembly.

BOOM REMOVAL

The following instructions are general in nature.
Remove the boom as a complete unit, using these guidelines.

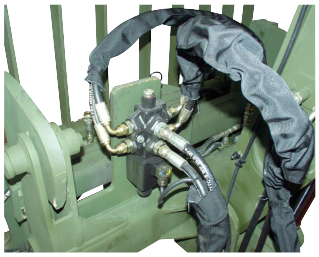
1. Position the machine on a hard level surface.

WARNING

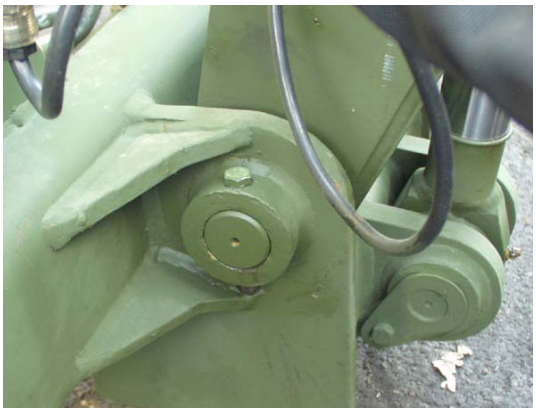
The weight of the boom assembly is approximately 1323 lbs. (600 kg). The weight of each boom hoist cylinder is approximately 135 lbs (72 kg). Use adequate lifting equipment to support the boom assembly and cylinders.
Failure to follow this warning could cause serious injury to personnel or damage to the machine.

2. Raise boom to the maxuim boom height.
3. Remove glass from boom side of cab.

4. Lower boom to a good working level.
5. To remove tool coupling, disconnect hydraulic hoses.



6. Use adequate lifting device to remove the tool coupling from machine.
7. Remove the pin holding coupling to boom mask and the pin attaching the tilt cylinder.

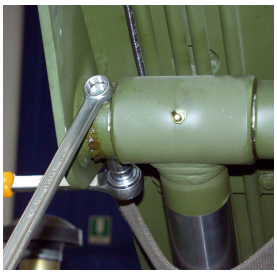


WARNING

Before removing the boom hoist cylinder rod pins, support the boom hoist cylinders using a suitable lifting device and blocking. This will prevent the cylinders from dropping when the rod pins are removed. If this precaution is not followed serious injury to personnel or damage to the machine may result.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8. Support the boom cylinders with an adequate lifting device and place blocking under the boom hoist cylinder.
9. Remove boom hoist cylinder pin.

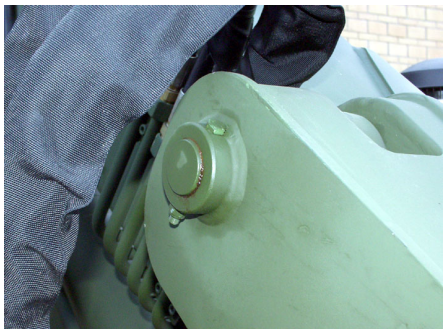


10. Support front and rear of boom assembly with an adequate lifting device.

ATTENTION

Use blocking to prevent damage to tubing when chains or sling are wrapped around boom.

11. Remove pin from small stabilizer cylinder.



12. Remove pivot pin from rear of boom.

13. Tag and disconnect hydraulic hoses.

WARNING

The weight of the boom assembly is approximately 1323 lbs (600 kg). The weight of each boom hoist cylinder is approximately 159 lbs (72 kg). Use adequate lifting equipment to support the boom assembly and cylinders. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

14. Position boom assembly on suitable support device near a strong anchor point. Support the boom with blocking to prevent damage to tubing.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

BOOM INSTALLATION

The following instruction are general in nature.
Install the boom as a complete unit using the following instructions as a guideline.

1. Position the machine on a hard level surface.

WARNING

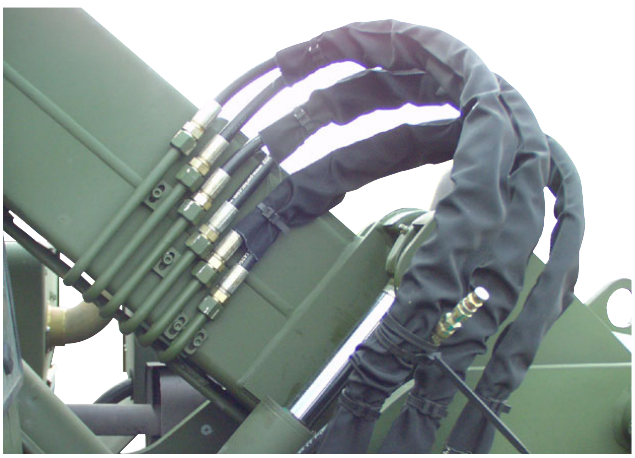
The weight of the boom assembly is approximately 1323 lbs (600 kg). The weight of each boom hoist cylinder is approximately 159 lbs (72 kg). Use adequate lifting equipment to support the boom assembly and cylinders.
Failure to follow this warning could cause serious injury to personnel or damage to the machine.

2. Use an adequate lifting device supporting the front and rear of boom assembly bring boom into position over machine at a 20° angle.

ATTENTION

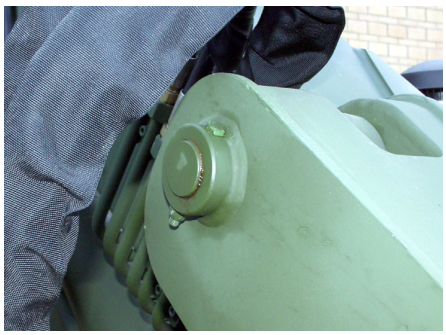
Use blocking to prevent damage to the tubing when chains or sling are wrapped around boom.

3. Connect all hydraulic hoses.

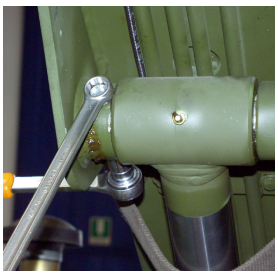


4. Lubricant all pin with ancanti-seize lubricant.
5. Insert pivot pin at the rear of boom.

6. Replace pin for small stabilizer cylinder.



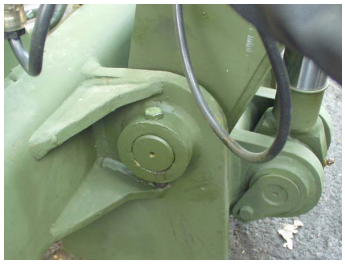
7. Insert boom hoist cylinder pin.



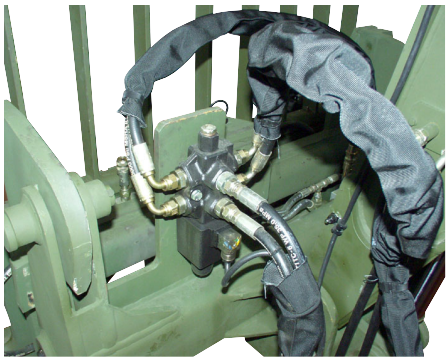
8. Using adequate lifting device to replace the tool coupling on the machine.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

9. Insert the pin holding coupling to the boom mask and the pin attaching the tilt cylinder.

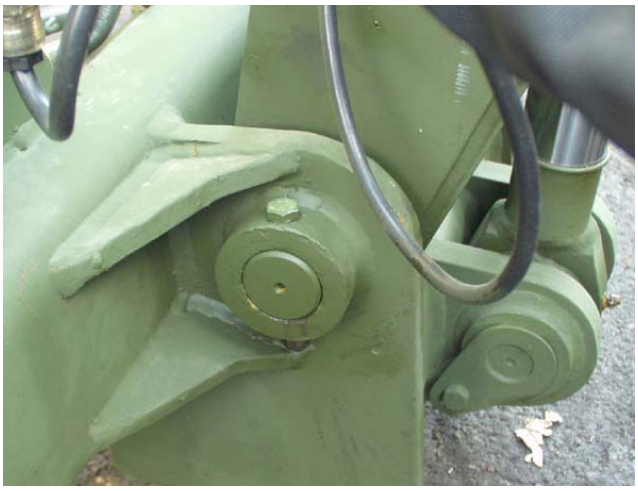
10. Reconnect the hydraulic hoses to the boom.



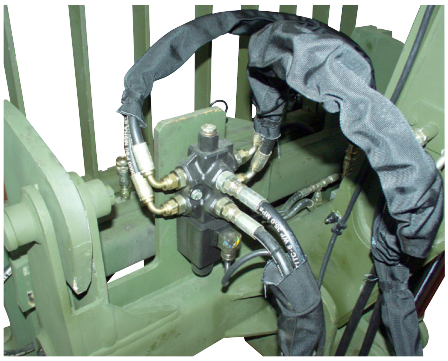
11. Start the engine and function boom to check for leaks.

14.2 TILT CYLINDER REPLACEMENT

1. Position the machine on a hard level surface.
2. Remove the pin holding coupling to boom mask and the pin attaching the tilt cylinder.

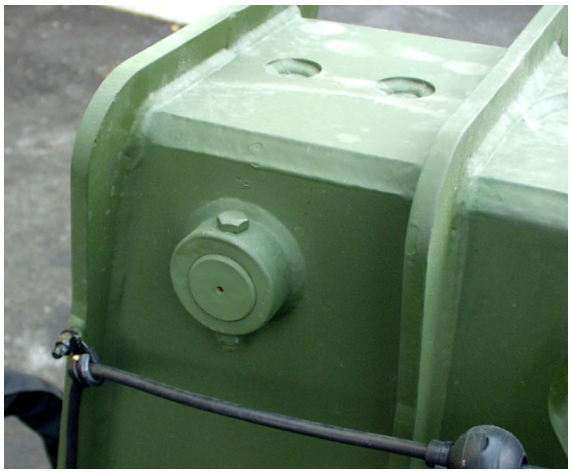


3. Unplug quick disconnect hoses.



4. Tag and remove hoses from holding valve.

5. Attach adequate lifting device, to tilt cylinder, carefully remove pin from top of boom head.



6. When removing tilt cylinder use caution not to damage holding valve.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

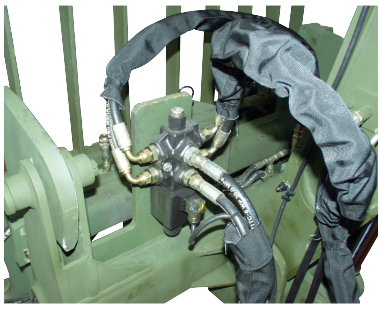
7. Remove the holding valve.

8. Using adequate lifting device lift new cylinder into place and reinsert pin.
9. Replace the holding valve.
10. Bring tool coupling in position on heads of boom.
11. Reinsert the pin holding coupling to boom mask and the pin attaching the tilt cylinder.
12. Connect hydraulic hoses. Start engine and check for leaks.

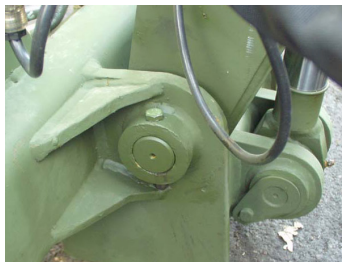
14.3 BOOM DISASSEMBLY

1. Position the machine on a hard level surface.
2. Position the boom assembly on suitable support device near a strong anchor point.
   Support boom with blocking to prevent damage to tubing.

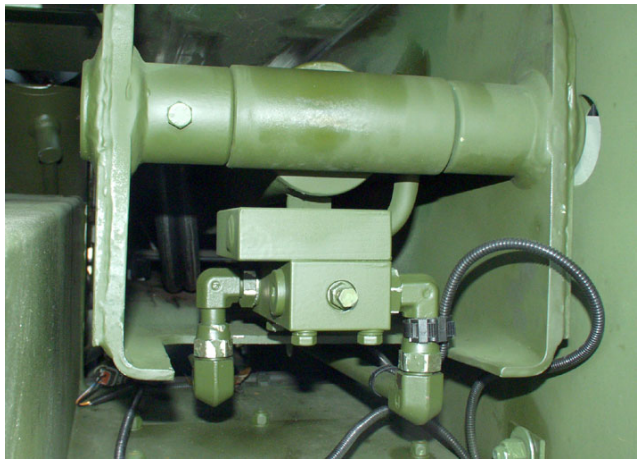
3. To remove tool coupling, disconnect hydraulic hoses.



4. Remove the pin holding coupling to boom mask and the pin attaching the tilt cylinder.



5. Use adequate lifting device to remove coupling from machine.
6. Remove the tilt cylinder.
7. Remove flow valve at back of boom.



8. Remove pin holding telescope cylinder at back of boom.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

9. Pull the inner section out approximately two feet.
10. Remove slider pad, and check for wear., note location of each pad.

ATTENTION

Bottom slider pad must be removed before pulling inner section completely out.

11. Pull inner section out enough to attach an adequate lifting device to support and prevent from falling.
12. Remove inner section and inspect inner slider pads.
13. Place inner section on a suitable support device.
14. Tag and remove all tubing and hydraulic hoses.

15. Remove snap ring, and drive out the pin attaching the telescope cylinder.

16. Carefully remove telescope cylinder from inner section.
17. Inspect all hydraulic hoses for damage and replace as required.

14.4 BOOM ASSEMBLY

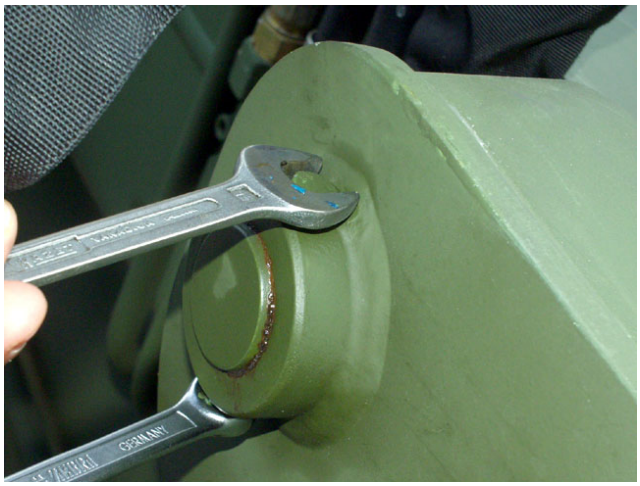
1. Position the machine on a hard level surface.
2. Lubricant all pin with ancanti-seize lubricant.
3. Insert the telescope cylinder pin and replace snap ring.
4. Position inner section in front of base section.
5. Connect all tubing and hydraulic hoses.
6. Push inner section approximately four feet in base section.
7. Install slider pads, then completely push inner section into base section.
8. Insert pin attaching the telescope cylinder to base section.
9. Reinstall flow valve.
10. Replace the tilt cylinder.
11. Use adequate lifting device to replace tool coupling to mask.
12. Replace the pin holding coupling to boom mask and the pin attaching the tilt cylinder.
13. Connect all hydraulic hoses.

14.5 COMPENSATION CYLINDER REMOVAL / INSTALLATION

REMOVAL

Follow the procedures below for removal of Compensation Cylinder:

1. Position the machine on a hard level surface.
2. Remove all attachments from attachment holding frame (refer to section 14.3 Attachment Removal).
3. Using two 13 mm wrenches remove retaining bolt from pivot pin.



ATTENTION

Do not use steel hammer or pinch bar. These items can cause damage to machine parts.

4. Remove pivot pin. If necessary use a lead or brass hammer strike the pivot pin. Do not use a steel hammer or pinch bar.

5. Raise the boom to the maximum height.
6. Place a container of suitable size under the hydraulic piping before disconnecting the hoses.
7. Using a 27mm wrench tag and disconnect the hydraulic hoses from the holding valves.
   Install covers and plugs on the lines and ports to prevent the entry of contaminants.
8. With suitable lifting device secure the rod end of the compensation cylinder.

9. Remove the retaining bolt from the lower pivot pin.
10. Remove the lower pivot pin.
11. Using suitable lifting device remove cylinder from the machine.

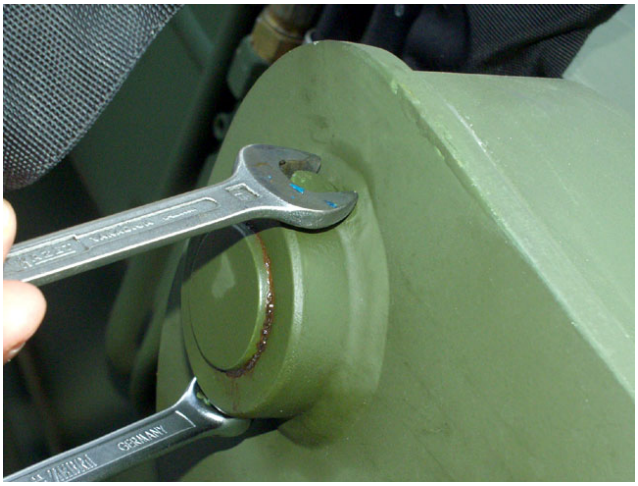
ASSEMBLY

1. Position the machine on a hard level surface.
2. Using suitable lifting device apply sling to the rod end of the cylinder.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

3. Install the compensation cylinder in machine.
4. Apply Anti-Seize to the lower pivot pin prior to installing.

5. Install the lower retaining bolt.



6. Using a 27 mm wrench install the hydraulic hoses to the holding valve.
7. Remove sling from compensation cylinder.
8. Install rod end of compensation cylinder to boom base.

9. Align and install upper pivot pin, making sure to apply Anti-Seize.

10. Install the retaining bolt.

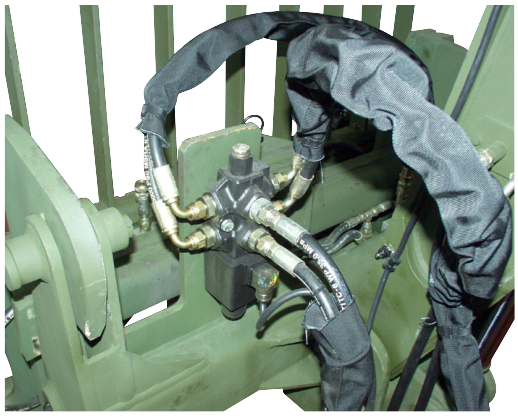
14.6 LOCKING CYLINDER REMOVAL / INSTALLATION

REMOVAL

Follow the procedures below for removal of Attachment Locking Cylinder:

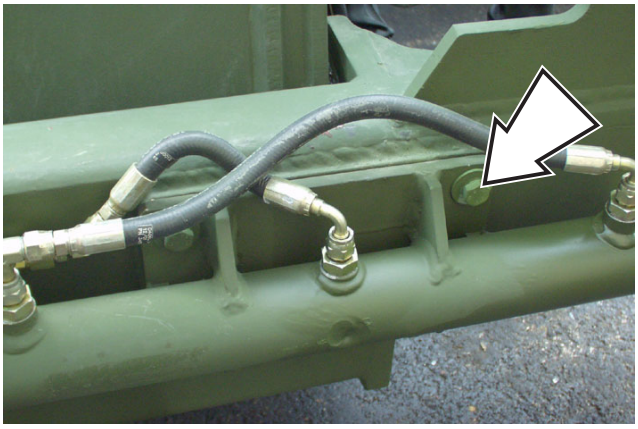
Always use adequate lifting device when lifting heavy parts from machine. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

1. Position the machine on a hard level surface.
2. Remove all attachments from attachment holding frame (refer to section 14.1 Replacing Attachments).
3. Disconnect the flexible hoses connected to the valve from the quick connectors on the holding frame.

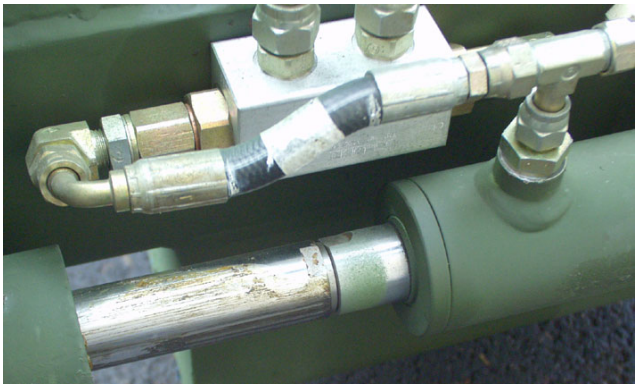


4. Using a 13 mm wrench, remove the two screws securing the valve to the attachment holding frame.

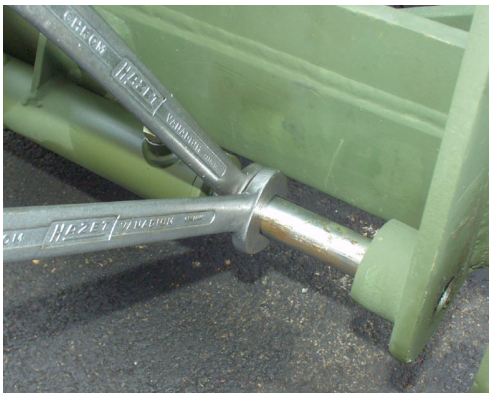
5. With a 17 mm wrench, loosen the four screws securing cylinder without removing them.



6. With a 2.5 mm wrench, remove the dowel securing the terminal pin from both sides of the cylinder.



7. Using two 27 mm wrenches, loosen and remove terminal pin.

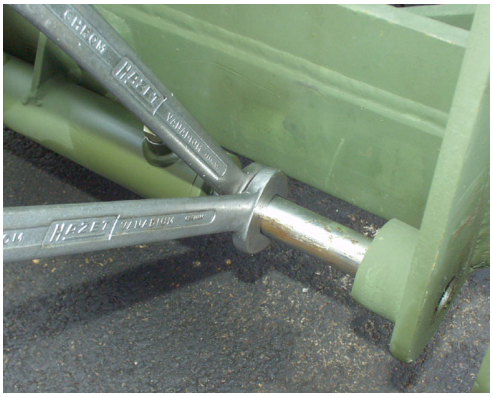


8. Remove the four screws, previously loosened, to set the cylinder free.
9. Use adequate lifting device to remove the cylinder from machine.
10. If necessary, position the cylinder on a stand and disconnect the piping with 19 mm and 23 mm wrenches.

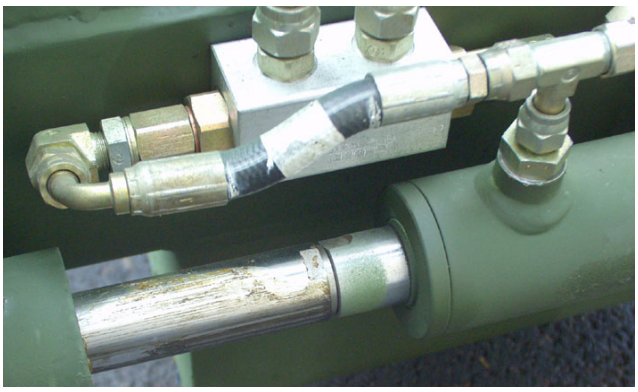
ASSEMBLY

Following the procedures below for installing the Attachment Locking Cylinder:

1. Using adequate lifting device, install the cylinder.
2. Apply Loctite 245 to the four screws to set the cylinder in place. Hand tighten screws.
3. Apply Loctite 245 to the terminal pins on the cylinder rod. Using two 27 mm wrenches, tighten the terminal pins in place.



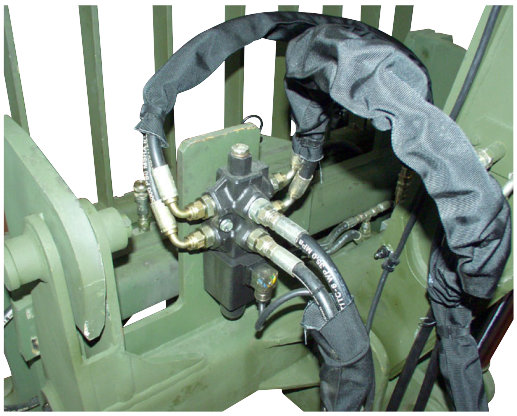
4. Using a 2.5 mm wrench, install the dowel securing the terminal pin from both sides of the cylinder.



5. Using a 13 mm wrench, install the two screws securing the valve to the attachment holding frame. Apply Loctite 245.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

6. Connect the flexible hoses to the valve from the quick connectors on the attachment holding frame.



7. Check for leaks.

14.7 BOOM HOIST CYLINDER

REMOVAL

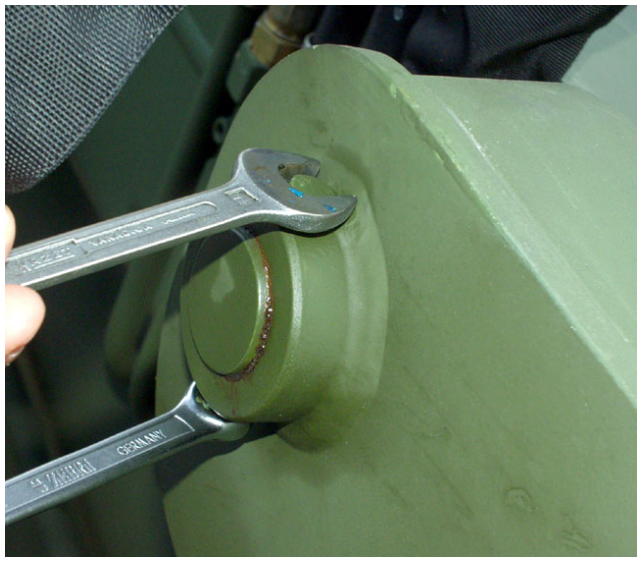
Follow the procedures below for removal of hoist cylinder:

1. Position the machine on a hard level surface.
2. Remove attachment from machine (refer to section 14.1- Replacing Attachments.

WARNING

The weight of the boom assembly is approximately 1600 lbs, weight of hoist cylinder is approximately 170 lbs. Use adequate lifting equipment to support the boom assembly and cylinders. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

3. Secure attachment holding frame with an adequate lifting device.
4. Raise the boom to the maximum height. The supporting lifting device must work together with the position of the hydraulic boom.
5. When the boom is completely over the operators cab, the chains of the supporting lifting device should be slightly tensioned, once chains are slightly tensioned, stop raising the boom.
6. Place a container of suitable size under the hydraulic piping before disconnecting the hoses.
7. Using a 27mm wrench tag and disconnect the hydraulic hoses from the boom hoist cylinder and the holding valves.
8. Install covers and plugs on the lines and ports to prevent the entry of dust and contaminants.
9. Using a 13 mm wrench, remove securing bolts from retaining pin of fork compensation cylinder.



DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

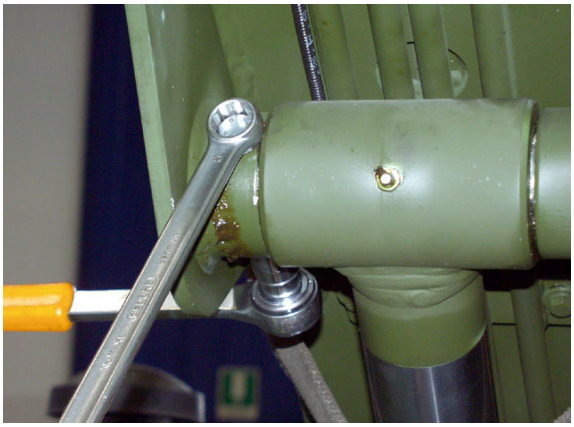
ATTENTION

Do not use steel hammer or pinch bar. These items can cause damage to the machine parts.

10. Remove upper compensation pin, if necessary use a lead or brass hammer strike the pin. Do not use a steel hammer or pinch bar.

11. Remove rod end of compensation cylinder from boom base.
12. Support the boom hoist cylinder with an adequate lifting device and place blocking under the cylinders.

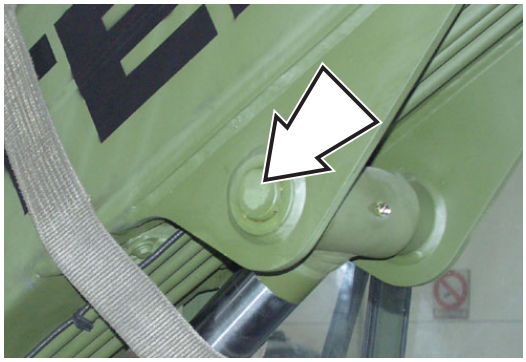
13. Using two 19 mm wrenches remove the retaining bolts, securing the rod pin to the boom.



ATTENTION

Do not use steel hammer or pinch bar. These items can cause damage to the machine parts.

15. Remove boom hoist rod end pin. If necessary use a lead or brass hammer to strike the pin. Do not use a steel hammer or pinch bar.



16. Place 4 x4 short timber on top of frame cross rail just in front of the hydraulic reservoir.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

17. Using adequate lifting device, lower boom onto the blocking.
18. Use two 19 mm wrenches and remove the retaining bolt from lower boom hoist cylinder.

ATTENTION

Do not use steel hammer or pinch bar. These items can cause damage to the machine parts.

19. Remove pivot pin from the cassis hole. If necessary strike the pivot pin by using a lead or brass hammer. Do not use steel hammer or pinch bar.
20. Lower the boom until the cylinder rests on the supporting blocking or stand.

21. Remove the sling securing the cylinder to the boom, then raise the boom until the boom hoist cylinder can be removed.
22. Using adequate lifting device remove the cylinder from the machine and support it on stands to prevent serious injury or damage to machine.

INSTALLATION

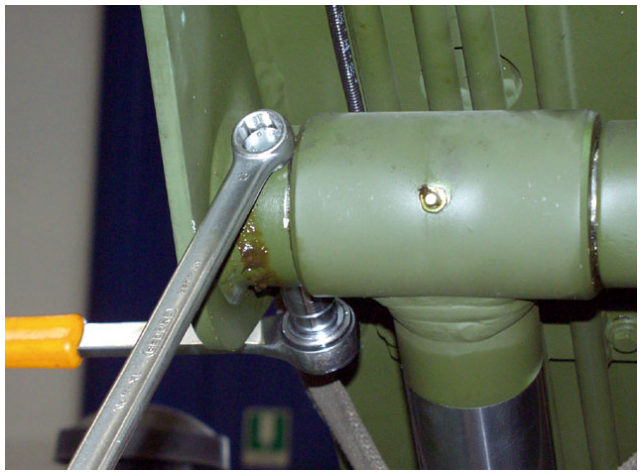
Follow the procedures list below to install the boom hoist cylinder.

1. Position the machine on a hard level surface.
2. Using adequate lifting device lift the boom hoist cylinder and place it in position.

WARNING

The weight of the boom assembly is approximately 1600 lbs; weight of hoist cylinder is approximately 170 lbs. Use adequate lifting equipment to support the boom assembly and cylinders. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

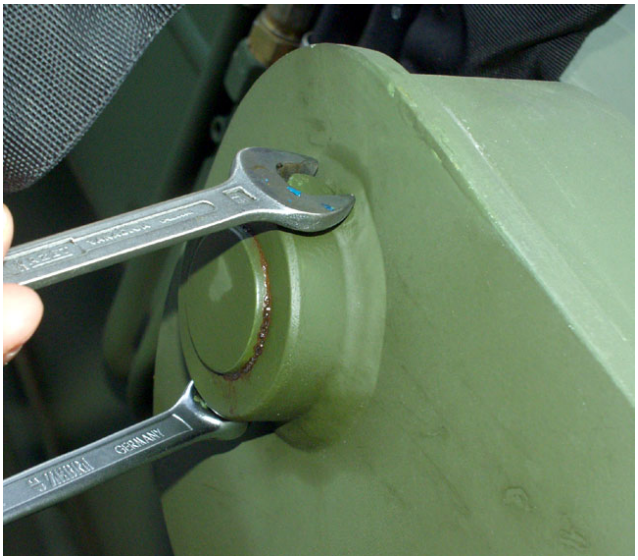
3. Apply antisize to the pivot pin and install pin through the cassis hole.
4. Using two 19 mm wrenches install the retaining bolt to the lower boom hoist cylinder.
5. Using adequate lifting device, lower the boom and install the rod end pin of boom hoist cylinder to boom base.
6. Install retaining bolt securing the rod pin to the boom.



7. Install compensation cylinder to boom base.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8. Using 13 mm wrench, install the securing bolts for the retaining pin of fork compensation cylinder.



9. Connect the hydraulic hoses to the boom hoist cylinder and the holding valves.
10. Start machine and extend boom hoist cylinder.
11. Check for leaks.

14.8 EXTEND CYLINDER REMOVAL / INSTALLATION

REMOVAL

Follow the procedures below for removal of extend cylinder:

1. Position the machine on a hard level surface.
2. Boom must be in the horizontal position with the boom slightly extended (approximately 2 feet).

WARNING

The weight of the boom assembly is approximately 1600 lbs, weight of extend cylinder is approximately 203 lbs. Use adequate lifting equipment to support the boom assembly and cylinders. Failure to follow this warning could cause serious injury to personnel or damage to the machine.

3. Remove the retaining bolt from the front movable section load pin.

ATTENTION

Do not use steel hammer or pinch bar. These items can cause damage to the machine parts.

4. Remove the load pin. If necessary using a lead or brass hammer strike the load pin. Do not use a steel hammer or pinch bar.
5. Place a container of suitable size under the hydraulic piping before disconnecting the hoses.
6. Using a 27mm wrench tag and disconnect the hydraulic hoses from the holding valves. Install covers and plugs on the lines and ports to prevent the entry of contaminants.
7. Remove the rear retaining bolt from back of the boom base.
8. Drive the rear telescope load pin from boom base.
9. Attach a suitable lifting device to secure the movable section.
10. With machine secure, remove and mark the location of the top and side slider pads.
11. Extend the cylinder from the base section and place a sling around the boom section, set the removed section on suitable stand.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

CLEANING AND INSPECTION

Perform the following steps before assembling the cylinder:

1. Discard all O-rings, seals, and packing. Have a complete supply of new sealing parts on hand.
2. Use a clean solvent to clean all parts that are going to be inspected and considered for reuse. Blow the parts dry.
3. Inspect all parts that are going to be reused. Any parts that show wear, distortion, or damage must be replaced.
4. Inspection the cylinder rod for dents or scratches, Fine scratches can be removed by using a hand held oil honing stone. The ridge around small dents can also be removed through the use of the honing stone. If the chrome finish on the rod is worn through by the use of the honing stone, the cylinder rod must be replaced.

INSTALLATION

To assemble the boom extend cylinder proceed as follows:

1. Position the machine on a hard level surface.
2. Install the telescope cylinder in the movable section.
3. Install until the rear telescope cylinder eye lines up, then install the boom base rear load pin.
4. Install the retaining bolt.
5. Install the slider pads.
6. Using a 27 mm wrench connect the hydraulic hoses to the holding valve.
7. Start the engine and check for leaks.
8. Retract and extend to remove any air buildup.
9. After running machine retract hydraulic boom. Lower forks to ground shut off the engine and check the hydraulic system.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

SECTION 15
CARRARO AXLES

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

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15.0 FRONT AXLE REMOVAL / INSTALLATION

GENERAL

This covers the removal and installation of the axles used on this machine. Additional information concerning the troubleshooting, service, maintenance, and repair of the axles, are covered in the Carraro Manuals, supplied by Carraro.

DESCRIPTION

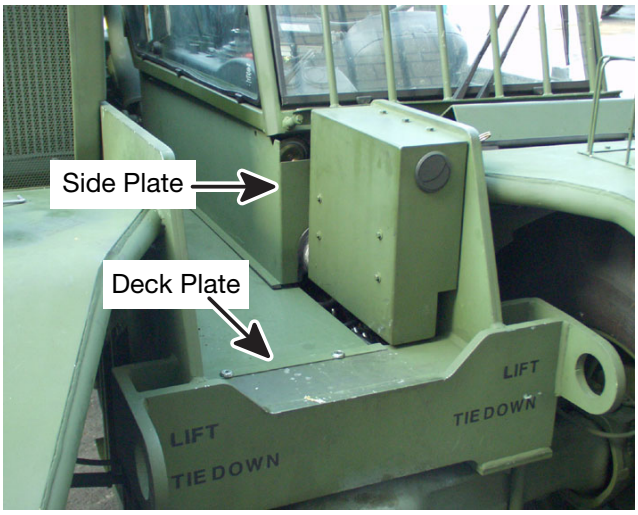
GENERAL

This machine is equipped with two drive steer axles which provide differential drive power transfer from the hydraulic drive motor to the machine wheels. The front axle is bolted directly to the carrier frame and is driven by a hydraulic drive motor. The rear axle is attached to the cassis by a pivoting pin.

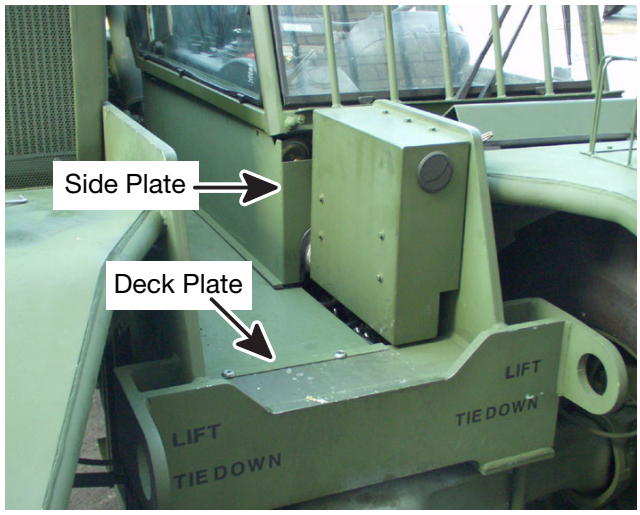
FRONT AXLE REMOVAL

To remove the front axle from the machine, proceed as follows

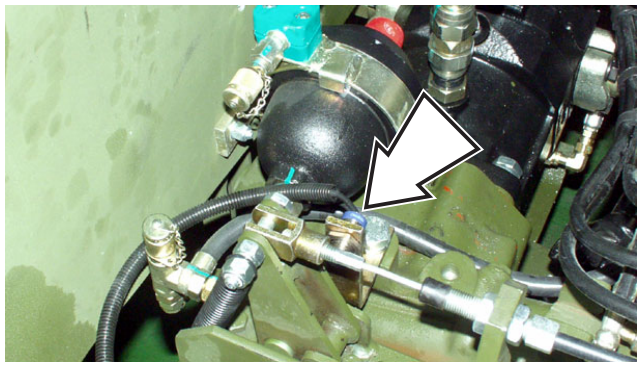
1. Remove all attachments such as fork or bucket.
2. Raise the boom to approximately 60°.
3. Remove the differential drain plug and drain the oil.
4. Raise the tires off the ground by using a lifting device. Lower the machine onto wooden blocking to support the chassis. Place additional support under the engine side of the chassis to prevent side tipping.
5. Remove the wheels.
6. Remove the side cover from cab.



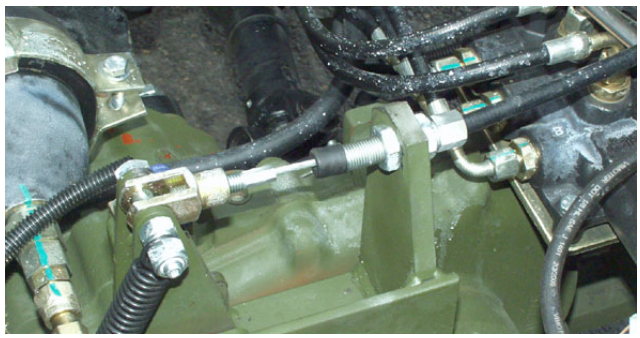
7. Remove the deck plate.



8. Remove the drive line.
9. Remove the handbrake proximity switch.

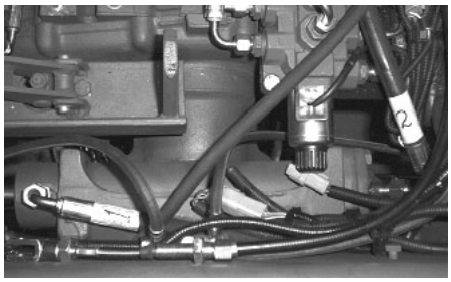


10. Disconnect the handbrake cable and spring.

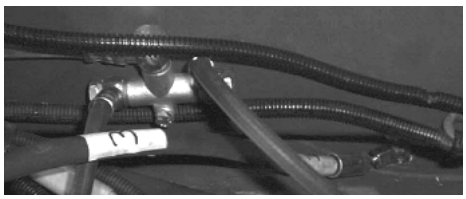


DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

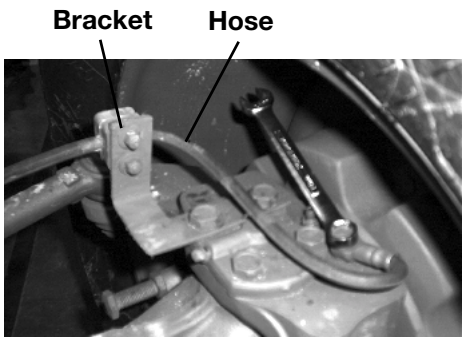
11. Tag and disconnect the hoses from the steering cylinder (#1 and #2). Place caps and covers on the hydraulic lines and cylinders to prevent hydraulic contamination.



12. Tag and disconnect the axle vent hose (#3).

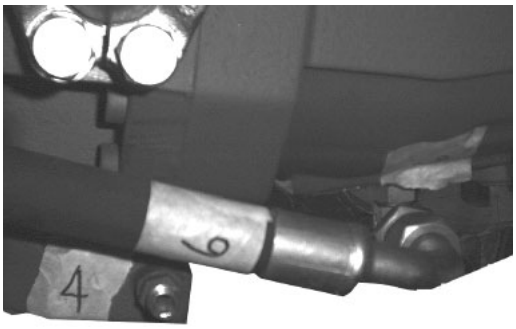


13. Tag and disconnect the brake supply lines bracket and hose from each side of axle.

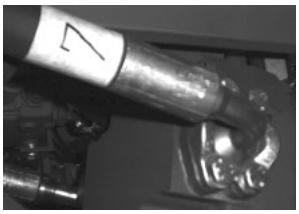


14. Tag and disconnect the small hose (#4 and #5) from the bottom sides of hydraulic drive motor.

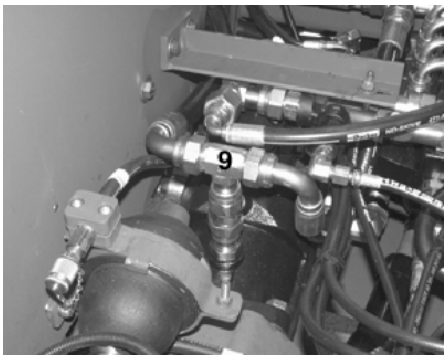
15. Tag and disconnect large hose (#6) from bottom of drive motor.



16. Tag and remove hoses (#7 and #8) from the upper rear section of drive motor. These hoses have o-ring seals which should be replaced.



17. Remove the check valve assembly (#9).

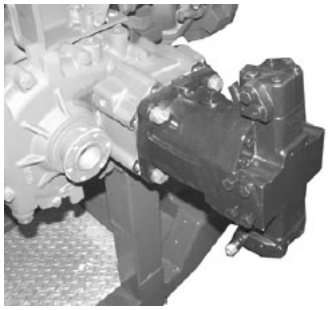


ATTENTION

Make a thorough visual inspection of the area around the axle to make sure that all hydraulic and electric lines are clear of the axle.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

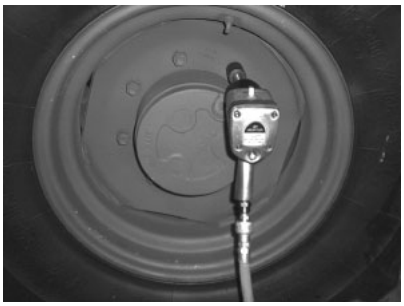
18. Place a suitable jack under the axle to prevent the axle from moving while the mounting hardware is being removed.
19. Remove the mounting bolts, which secure the axle to the frame.
20. Lift the axle using a suitable sling and lifting device, and move it to a suitable work area.
21. Remove the hydraulic drive motor from old axle and installation on new axle by using a medium strength threadlock to fasten the motor and torque at 151 foot pounds.



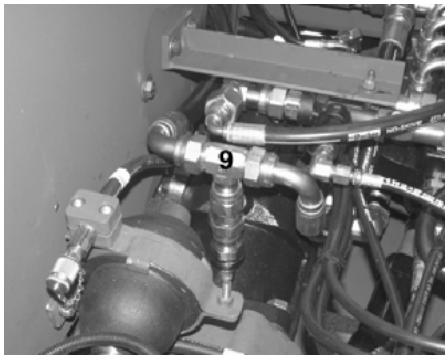
FRONT AXLE INSTALLATION

To installation the front axle on the machine, proceed as follows:

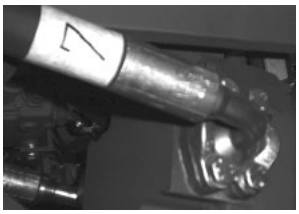
1. Position the axle below the machine. Jack the axle into position with the mounting holes aligned with the holes in the frame. Install the mounting bolts, and torque bolts at 510 foot-pounds.
2. Install the wheels and torque at 227 footpounds.



3. Install the driveline.
4. Install the check valve (#9).

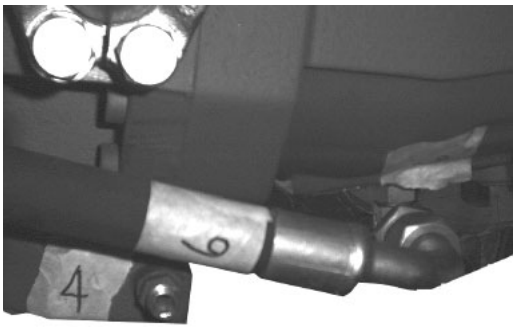


5. Install hoses (#7 and #8) on the upper section of drive motor. The hoses have o-ring seals, which should be replaced.



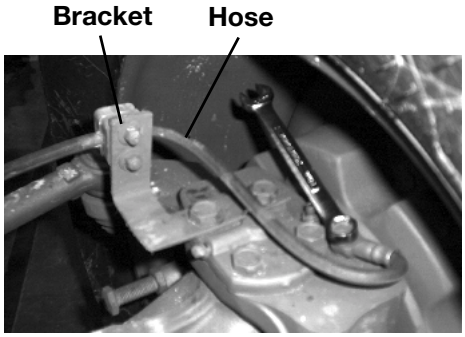
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

6. Connect large hose (#6) to bottom of drive motor.

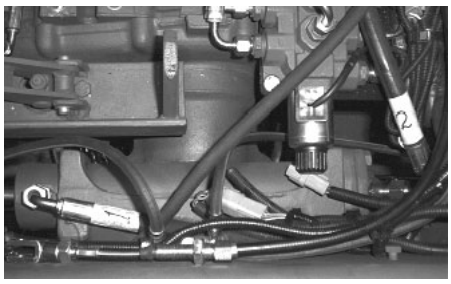


7. Connect the small hose (#4 and #5) to bottom sides of hydraulic drive motor.

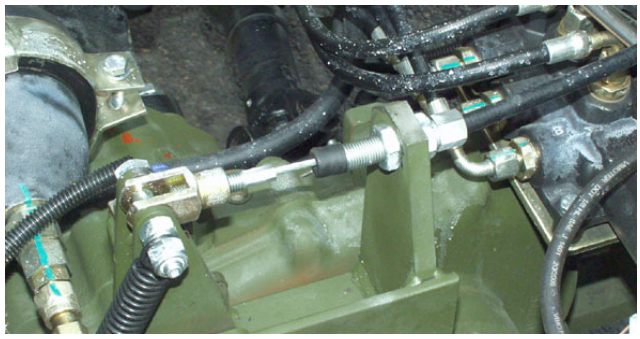
8. Connect the brake supply lines bracket and hoses to each side of the axle and adjust to proper brake settings.



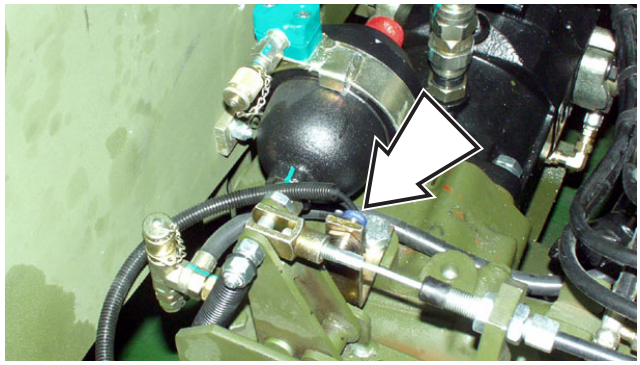
9. Reconnect any hydraulic and electric lines which may have been disconnected to remove the axle.
10. Bleed the brake line by pumping air out of the lines, starting with the right side of machine, then the left side. Repeat this procedure several times. This will force all air out of the brake lines.
11. Connect the axle vent hose.
12. Connect the hoses to the steering cylinder (#1 and #2).



13. Bleed the steering cylinder, by setting the four wheel steering to front steering and starting the engine. Turn the wheels all the way to the left and then all the way to the right.
    Repeat this procedures several times. This will force all air out of the steering cylinder.
14. Connect the hand brake cable and spring.



15. Plug in the hand brake proximity switch.



16. Stop the engine and check for leaks.
17. Check the steering stop bolts for proper adjustment.
18. Fill the wheel end planetaries and the differential to the proper oil level with the gear oil recommended in the lubricant section of this manual.
19. Install the deck plate and side cover.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

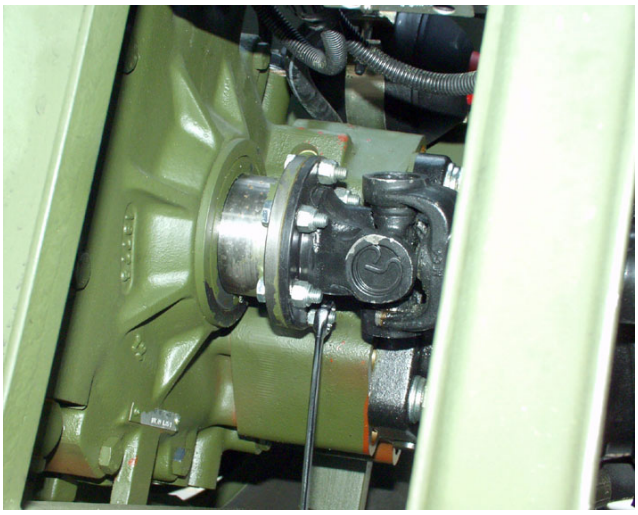
15.1 REAR AXLE REMOVAL / INSTALLATION

REMOVAL

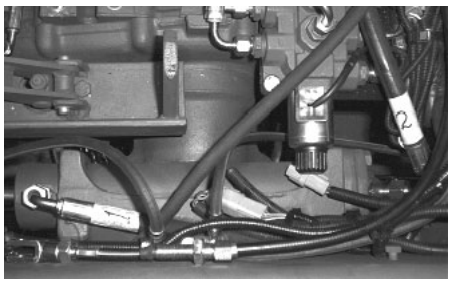
To remove the rear axle from the machine, proceed as follows:

1. Remove all attachments such as fork or bucket.
2. Remove the differential drain plug and drain the oil.
3. Raise the tires off the ground by using a lifting device. Lower the machine onto wooden blocking to support the chassis.

   Place additional support under the engine side of the chassis to prevent side tipping.
4. Remove the drive line extension and drive line.



5. Remove the rear wheels.
6. Tag and disconnect the hoses from the steering cylinder (#1 and #2). Place caps and covers on the hydraulic lines and cylinders to prevent hydraulic contamination.



7. Place a suitable jack under the axle to prevent the axle from moving while the mounting hardware is being removed.
8. Remove the load cell pin by using a slide hammer.

9. Slowly lower the axle approximately six inches and stop.
10. Tag and disconnect the axle vent hose.

ATTENTION

Make a thorough visual inspection of the area around the axle to make sure that all hydraulic and electric lines are clear of the axle.

11. Place a suitable jack under the axle to prevent the axle from moving while the mounting hardware is being removed.
12. Remove the mounting bolts/ pivoting pin, which secure the axle to the frame.
13. Lift the axle using a suitable sling and lifting device, and move it to a suitable work area.

REAR AXLE INSTALLATION

To install the rear axle on the machine, proceed as follows:

1. Raise axle approximately six inches to reconnect the vent hose.
2. Connect the axle vent hose.

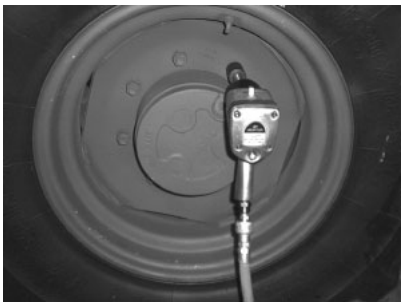
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

3. Slowly raise the axle until the load cell pinhole is perfectly aligned.

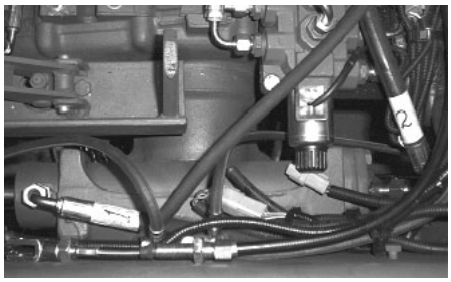
ATTENTION

When inserting the load cell pin, be careful not to damage the seals.

4. Carefully insert the load cell pin. Do not damage seals.
5. Insert the keeper bolt.
6. Install the wheels and torque at 227 footpounds.



7. Apply lubricant to all grease fittings on the axle.
8. Connect the hoses to the steering cylinder (#1 and #2).



9. Connect the drive line.
10. Reconnect any hydraulic and electric lines, which may have been disconnected to remove the axle.
11. Bleed the steering cylinder, by setting the four wheel steering to front steering and starting the engine. Turn the wheels all the way to the left and then all the way to the right.
    Repeat this procedures several times. This will force all air out of the steering cylinder.
12. Fill the wheel end planetaries and the differential to the proper oil level with the gear oil recommended in the lubricant section of this manual.
13. Stop the engine and check for leaks.
14. Check the steering stop bolts for proper adjustment.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Carraro Axles
REPAIR MANUAL

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

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DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

A GENERAL INFORMATION

A.1 Manual use

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 maintenance ensuring product integrity and expected life duration.
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 product 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 unit 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 machine.
Moreover, the attentive product inspection leads to a correct repair work estimation that could merely require dismounting only few components, and thus operating partially on the group.

A.2 Information property

CARRARO S.p.A. declares that the subject of this manual consists with the technical and safety specifications of the machine 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 machine or to a different use of them, which does not comply with what is provided for in this manual.

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DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

A.3 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 correct methods to working on the machine and its components, therefore they could not display exactly the same elements.

Definitions

Left side: it is the left side of the unit considering the vehicle running conditions.

Right side: it is the right side of the unit 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 injure the operator.

Measurements

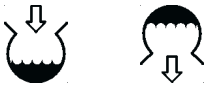
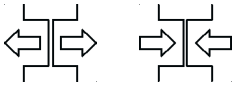
This manual indicates all measurements in International System (SI). Use the following conversion table to convert Imperial Measure.

Conversion table

S.I.		GB/USA SYSTEM	
1	(mm)	0.03937	(in)
10	(mm)	0.3937	(in)
25.4	(mm)	1	(in)
6.4516	(cm•)	1	(sq. in)
1	(m•)	1550	(sq. in)
16.378	(cm•)	1	(cu. in)
0.473	(dm•)	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/mm•)	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)

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Symbology

SYMBOLS	DESCRIPTION
	WARNING/DANGER
	REMOVE/INSTALL seals-gaskets-filters
	OIL FILLING OR OIL LEVEL/OIL DRAIN
	LUBRICATION/GREASING
	ADJUSTMENTS/MEASUREMENTS tightening torques-preloads-backlash
	SPECIAL TOOLS
	SEALING/LOCKING FLUIDS APPLICATION
	MARKING
	DISASSEMBLY/ASSEMBLY OF BULKY PARTS OR SUBASSEMBLIES
	WARNING: respect assembly orientation
	CLEANING CAREFULLY
	APPLY PRESSURIZED FLUID

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

A.4 General description

The machine 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 unit 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 working.
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 advise to replace tightening parts during every teardown or repair.
In case of replacement of one part of the bevel gear set this operation 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.

Some repairs are destructive for some axle components. Carefully reading and thorough understand of these instructions will avoid damage to other components unnecessarily.

A.5 Recommendations for repair 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 o-ring 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.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Oil drain

Before disassembly, oil should be drained out.

Warning: *Disposal of used oil must be done according to laws*

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.

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.

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.

Reassembly methods

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.

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 (Section C.4), keeping their level constant as indicated in this manual.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

B SAFETY INSTRUCTIONS

B.1 General safety recommendations

IMPORTANT:
Before proceeding with any operations please read this chapter very carefully.

Safety precautions:
Correct use and repair of Carraro products 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 advise 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.

B.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 on the machine.
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.

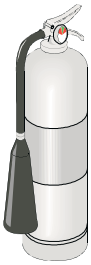
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

B.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. 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.
   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 machine.

  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.

  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.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

FRONT AXLE

Mod. 26.11+TB172

Rif. CA144609

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C GENERAL SPECIFICATIONS

C.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:

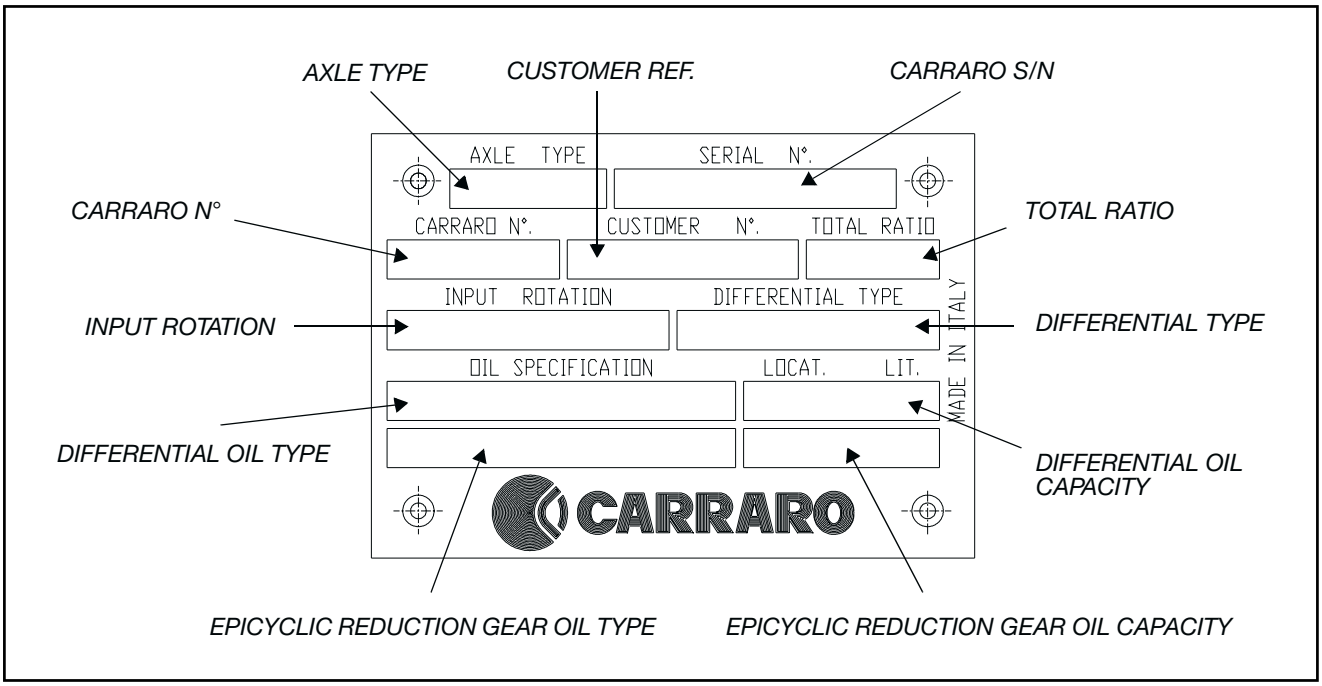
- increasing of tractive force, reducing the number of revolutions
- adjusting of inner wheels' speed with outer wheels' speed during steering.

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.

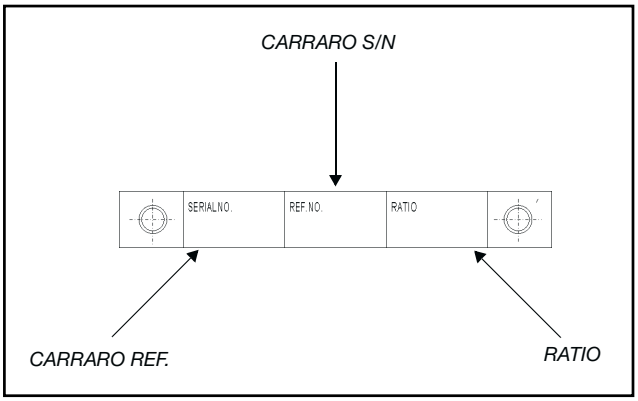
C.2 Product identification

Axle serial plate



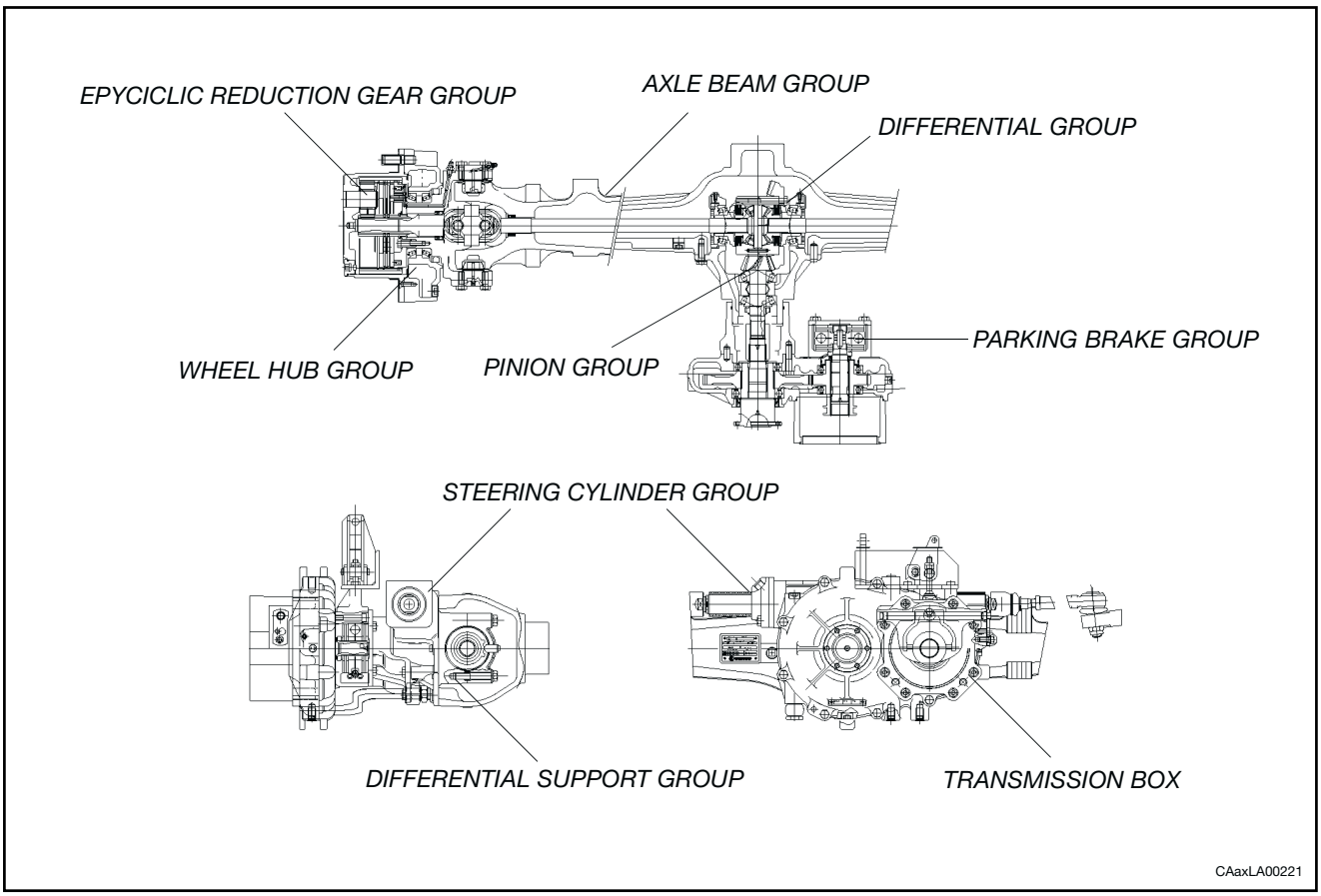
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Transmission serial plate



C.3 General description

The axle described in this manual designed and manufactured following the client requests, consists of a beam casing housing the differential and a wheel hub unit at each end.
The differential 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 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 by means of adjustable guide rods to correct the toe-in.
Furthermore the axle has a hydraulic braking system and a meccanical parking brake.
The frame is completed with a transmission/reduction box, which allows to control fully the motion parameters at the bevel gear input.



DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.4 Technical Features

MACHINE	**Front Axle**
CODE	**CA144609**
MODEL	**26.11+TB172**

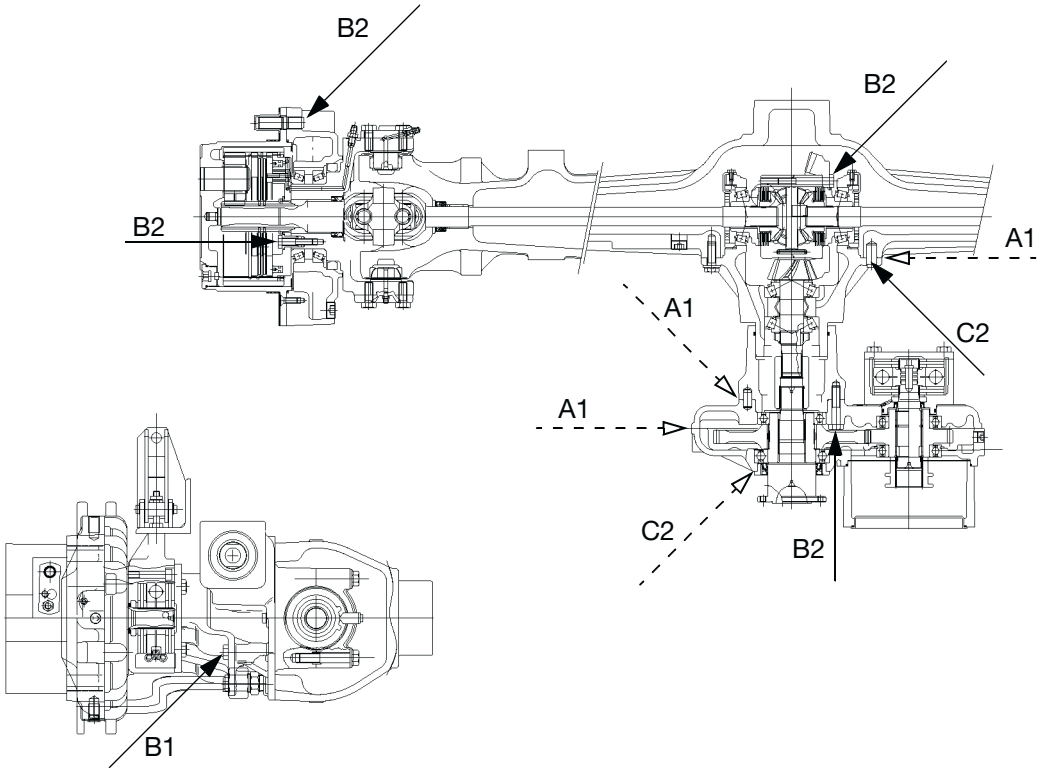
DIFFERENTIAL TYPE	
Open	○
Limited Slip	●
Limited Slip "Ball Type"	○
100% Mechanical lock, hydraulically controlled (positive or negative)	○
With multidisc clutch in oil bath hydraulically controlled	○
100% Mechanical, electromagnetically controlled	○
"No spin"	○

DESCRIPTION	**VALUES**
Bevel gear ratio	2.46 / 1
Epicyclic reduction gear ratio	6.00 / 1
Transfer Box ratio	1.85 / 1
Total ratio	27.33 / 1
Dry weight	341 Kg
Input rotation CLOCK WISE (C.W.) COUNTER CLOCK WISE (C.C.W.)	 ○ ●
Steering angle	36° $^{0}_{-0,2}$
Toe-in	A $^{0}_{-0,2}$
Bevel gear set backlash	0.16÷0.22 mm
Pinion bearings preloading (measured D=30.5 mm without seal)	P= 10.5÷15.7 daN
Pinion-ring gear bearing total preloading (measured D=30.5 mm without seal)	T= (P+3.9)÷(P+5.9) daN
Nominal differential disc thickness	1.6 mm
Nominal differential counterdisc thickness	1.5-2.8 mm
Maximum differential disc wearing	0.15 mm
Maximum differential counterdisc wearing	0.10 mm
Type of brake	Wet discs brake
Number of brake discs (each side)	2
Number of brake counterdiscs (each side)	3
Nominal brake disc thickness	4.75 ÷ 4.90 mm

DESCRIPTION	**VALUES**
Nominal brake counterdisc thickness	9.5/3/8 mm
Maximum brake disc wearing (each side)	0.25 mm
Maximum brake piston stroke	0.8 mm
Maximum operating pressure	68.9 bar
Max. wheels braking torque	11360 Nm
Oil specification IN PRESENCE OF DIFFERENTIAL LIMITED SLIP, USE RECOMMENDED OIL ENRICHED IN ADDITIVES Note: DO NOT USE SYNTHETIC OR VEGETABLE OIL WITHOUT CONSENT OF THE AXLE MANUFACTURER	SAE 80W to comply API GL4 respectively MIL-L-2105
Differential oil capacity	6 Liter
Epicyclic reduction gear oil capacity each side	1.6 Liter
Oil specification for brake actuation	MINERAL OIL
Oil displacement for brakes actuation	10 cc
Grease specification	TECNOLUBE SEAL POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2
Differential input flange	DIN1310
Hydraulic motor flange	DIN5480

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

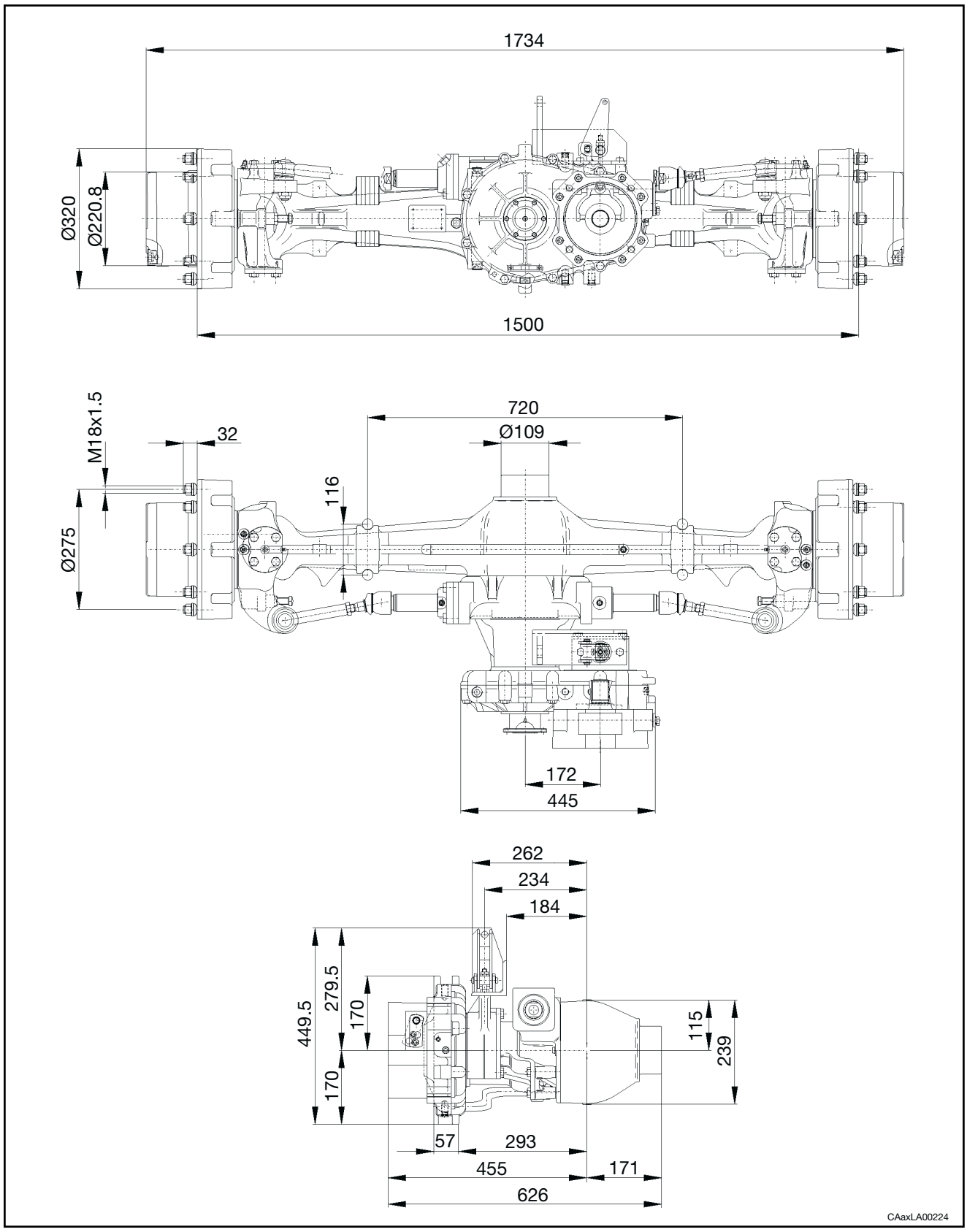
Sealing compounds and adhesives



A1 = LOCTITE® 510	●	**B2** = LOCTITE® 270	●
A2 = LOCTITE® 573	○	**C1** = LOCTITE® 405	○
A3 = LOCTITE® 518	○	**C2** = LOCTITE® 496	●
B1 = LOCTITE® 542	●	**C3** = LOCTITE® 638	○
⇦ - - - - -	Apply on the contact surfaces		
←	Apply on bolt screws / on pins		

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Overall dimensions (Millimeters)

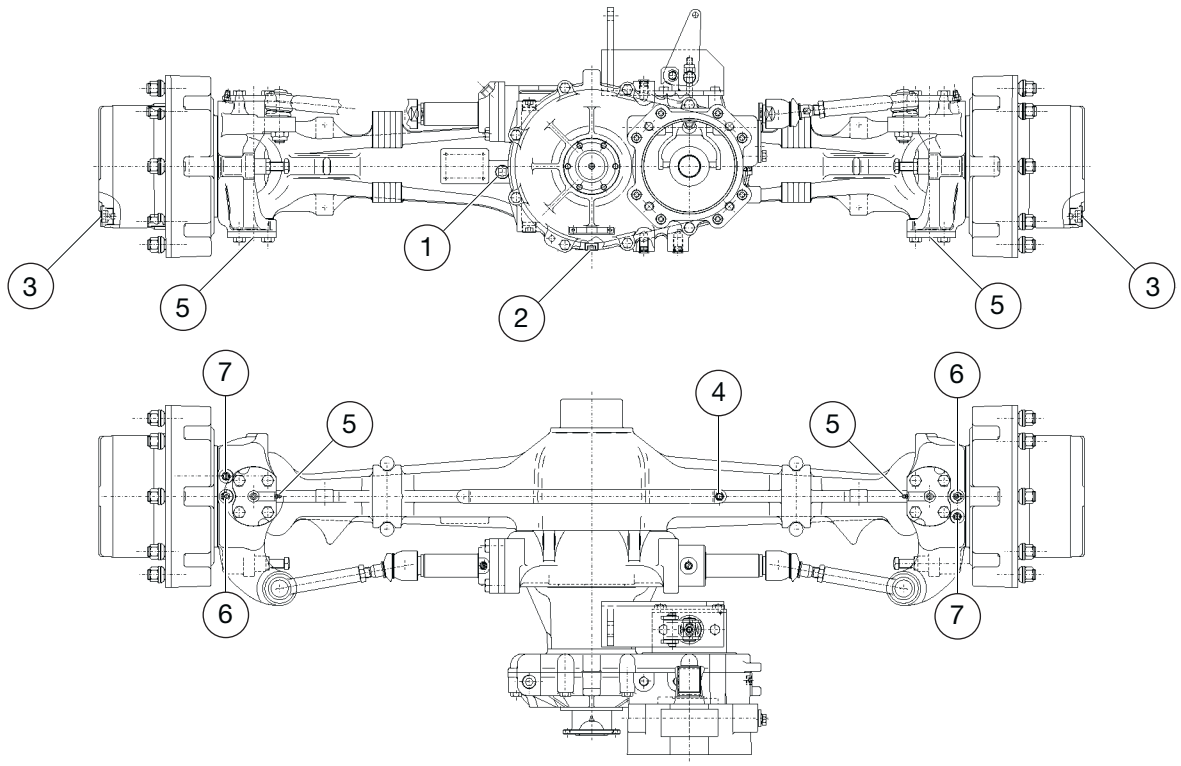


DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.5 Filling and checks

DESCRIPTION	POSITION
Oil filling and level plug	**1**
Oil drain plug	**2**
Level, filling and drain plug of epicyclic reduction gear oil	**3**
Oil breather	**4**
Greasing point	**5**
Oil bleed plug	**6**
Oil brake connection	**7**

Routine checks:
In the axle, lubricant should be flush with control plug (**1**), if not, make up level with the same oil.
See: section C.8
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.



DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.6 Service schedule

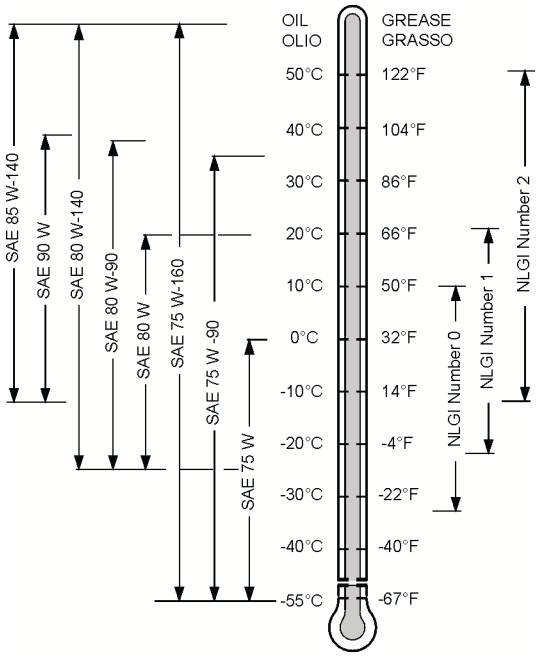
Operation	▲ First time	◆ Seasonally or every 1500 operating hours (1)
Axle oil change	150 - 200 hours ●	◆ ■
Lubrication works	▲ ■	◆ ■
Check and adjust oil level	50 - 100 hours ■	monthly ●
Clean magnetic oil plugs	150 - 200 hours ■	every oil change ●
Clean oil breather	▲ ■	monthly ●
Greasing	150 - 200 hours ●	weekly ●

remarks

- ● operation performed only by personnel authorized by the manufacturer
- ■ operation performed only by trained personnel

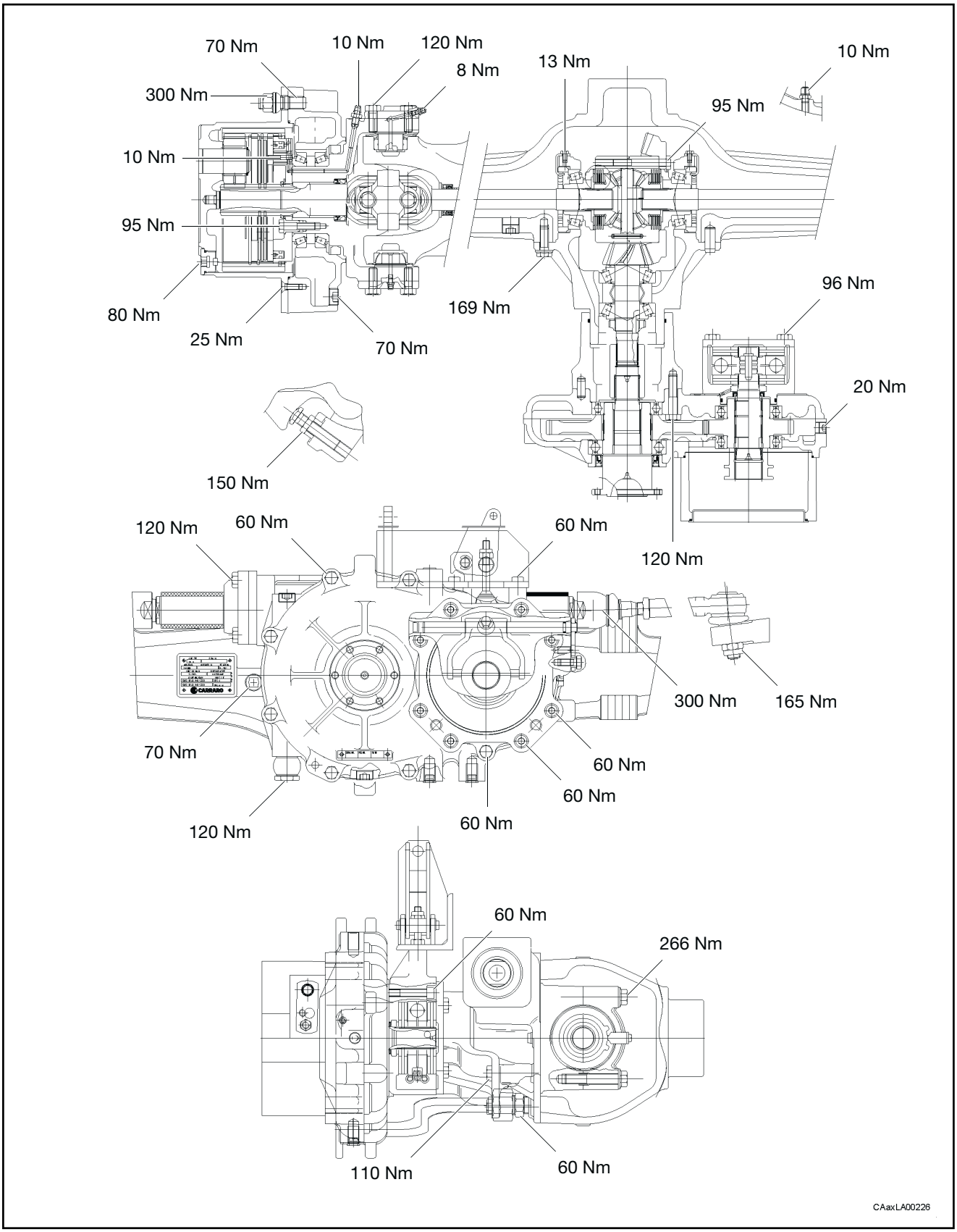
(1) which of both conditions comes first

Lubrication / greasing:
grades and application range



DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

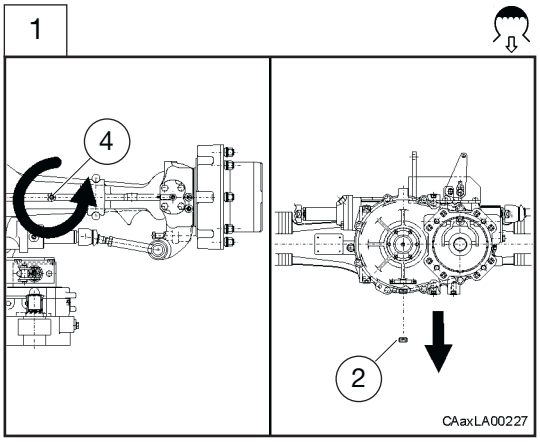
C.7 Tightening torques



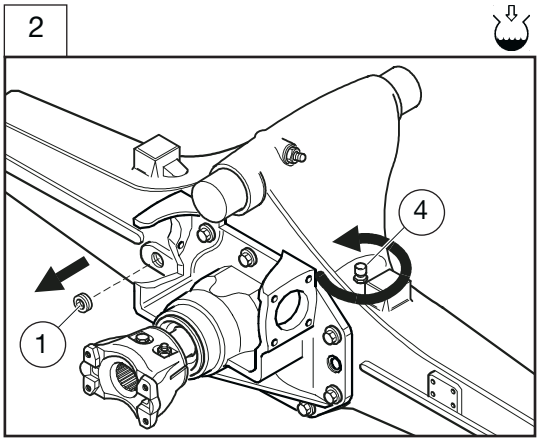
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.8 General checks

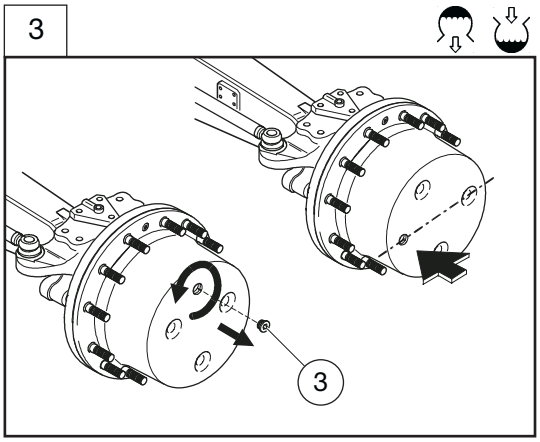
The disassembly/assembly instructions presume that the unit has been removed from the vehicle and positioned on a suitable workbench.
Some of the following pictures may not show exactly your axle, but the procedure is the same.



See: Section C.5
Before draining the oil, loosen the breather (**4**) to release possible internal pressure (Sec.C.5), then tighten the plug with a torque wrench to the prescribed torque (Sec.C.7).
Drain the oil from the appropriate plug (**2**).
Tighten the plug (**2**) to the prescribed torque (Sec.C.7).



Before draining the oil from the plug (**1**) (Sec.C.5), always loosen the breather (**4**) to release possible internal pressure.
Check oil level and top up if necessary.
Tighten the plug (**1**) to the prescribed torque (Sec.C.7).



Before draining the oil, position the wheel hub so that the filer cap is in the highest point, then loosen the plug (**3**) 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 (**3**) to the prescribed torque (Sec.C.7).

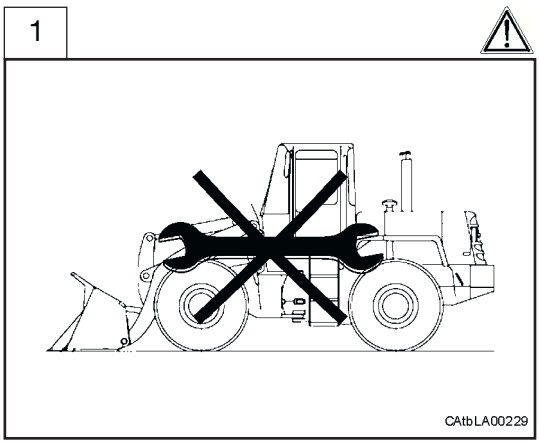
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D DISASSEMBLY OPERATIONS

D.1 Parking brake disassembly

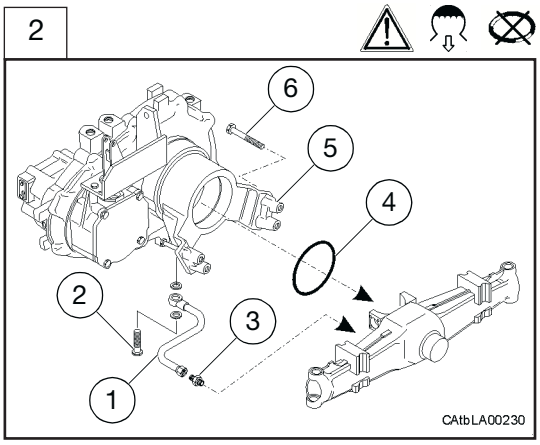
Some of the following pictures may not show exactly your axle, but the process is the same.

1



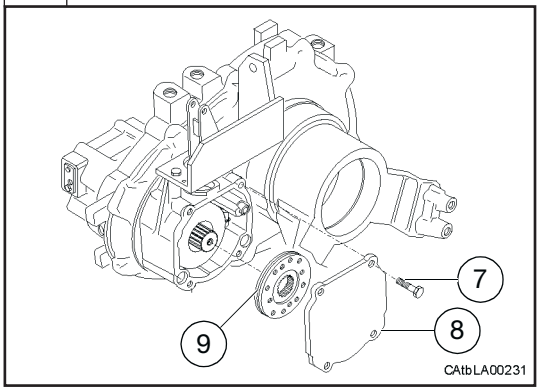
Warning: *execute disassembly operation only if the axle and related transmission group are removed from the vehicle and placed on a suitable workbench; if the group is on the vehicle, see the vehicle manufacturer instructions to disconnect brake control with totally safety.*

2



Before operating on the group, drain the oil.
See: section C.8.
Remove the oil recirculating pipe (**1**), unscrewing fastening parts (**2**) and (**3**).
Collect the drilled screw (**2**), the pipe (**3**), related washers and O-Rings.
Unscrew fastening screws (**6**) from the support (**5**) and disassembly transmission box from the group.

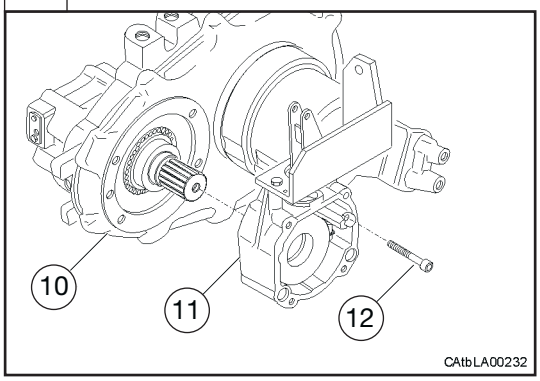
3



Unscrew the cover (**8**) fastening screws (**7**).
Remove the cover (**8**) and the brake disk (**9**).

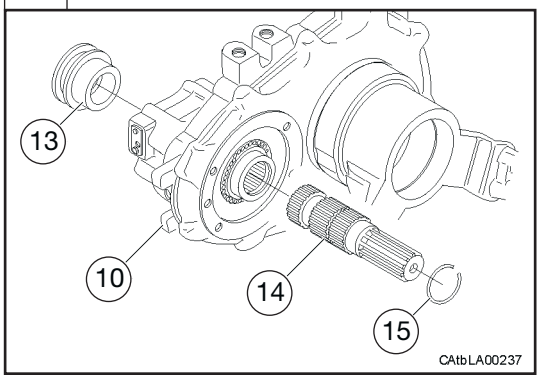
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



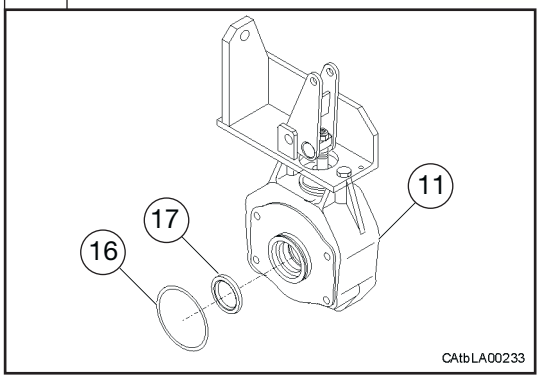
Unscrew the brake box (**11**) fastening screws (**12**).
Remove the brake box (**11**) from transmission box (**10**).

5



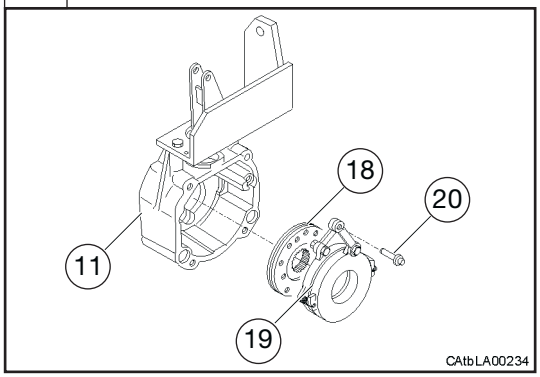
Extract the brake shaft (**14**) from transmission box (**10**).
Only if necessary, remove the lock ring (**15**) from shaft (**14**).
Collect the sleeve (**13**).

6



Remove the O-Ring (**16**) and the seal ring (**17**) from the parking brake box (**11**).

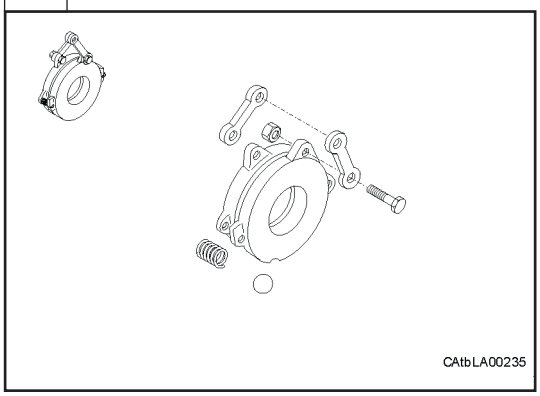
7



Extract the pin (**20**) and remove the actuator body (**19**) and the brake disk (**18**).

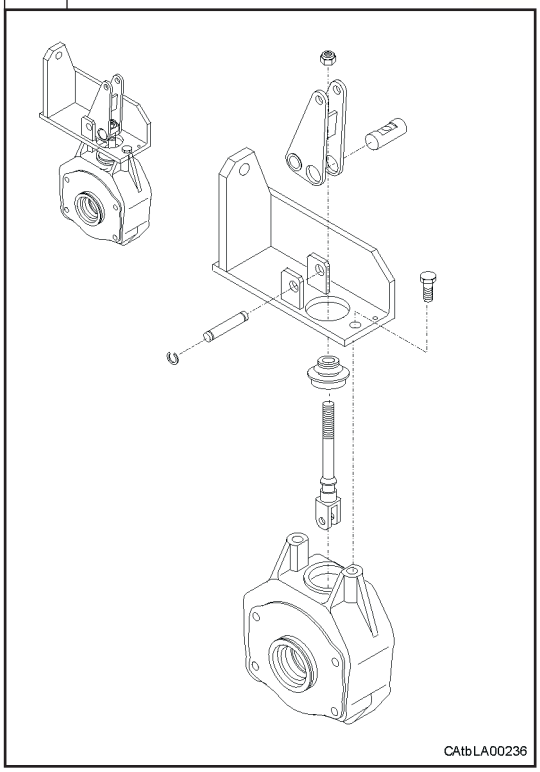
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



If necessary, disassembly actuator body as in figure.

9



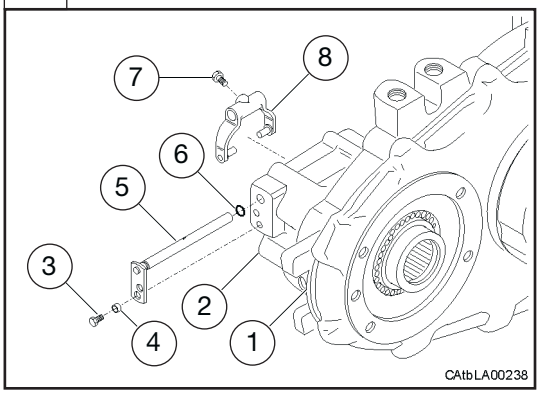
If necessary, disassembly control brake parts as in figure.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.2 Transmission box disassembly

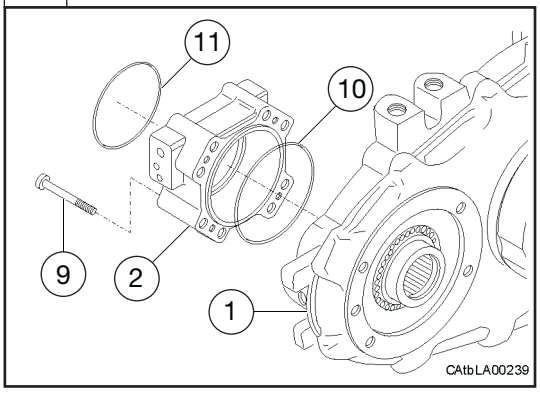
Some of the following pictures may not show exactly your axle, but the process is the same.

1



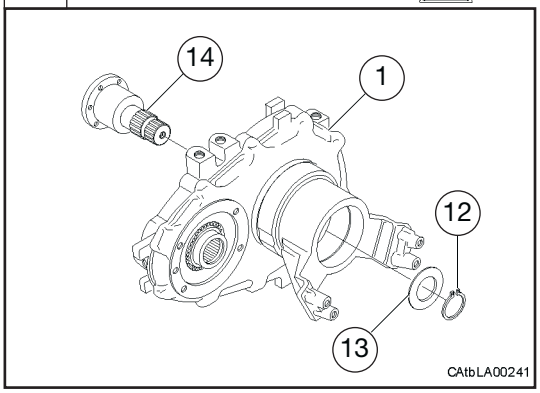
Position the transmission box (**1**) on a suitable workbench.
Remove the screw (**3**) and the bush (**4**) from the motor flange (**2**).
Loose the locking fork screw (**7**).
Extract the fork control shaft (**5**) from the motor flange (**2**) and collect the fork (**8**).

2



Unscrew fastening screws (**9**) and remove the motor flange (**2**).
Remove O-Rings (**10**) and (**11**) from motor flange (**2**)

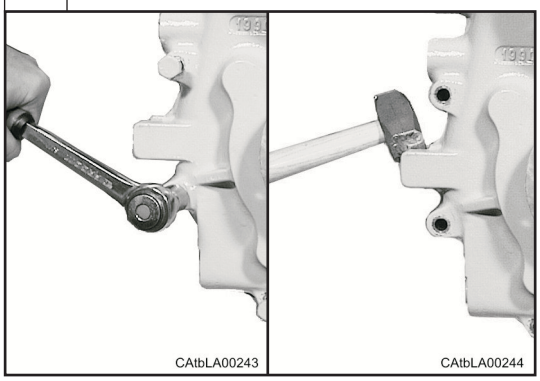
3



Remove the lock ring (**12**) and the washer (**13**) from the shaft (**14**).
Extract the shaft (**14**) from the transmission box (**1**).

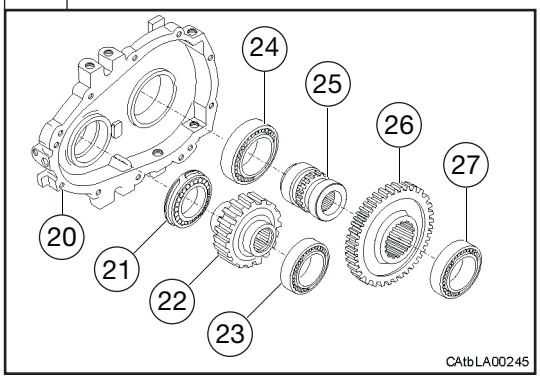
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



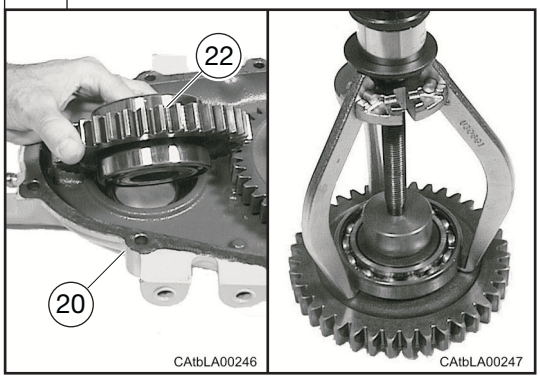
Remove fastening screws from the half box.
Separate half boxes by beating on the fitting parts with a hammer made of soft material.

5



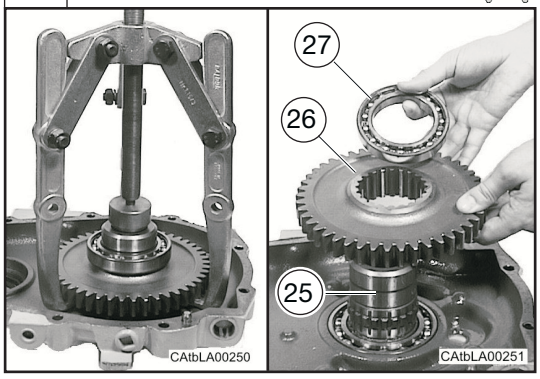
See: parts disassembly numbering.

6



Position the half box (**20**) on a workbench.
Collect the gear (**22**) with the bearings.
Take the bearings (**21**) and (**22**) out with a three-hold extractor.

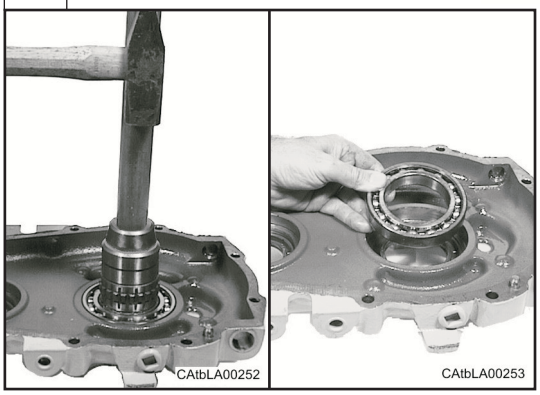
7



Take the gear (**26**) and the ball bearing (**27**) out of the shaft (**25**), using a special three-hold extractor clamping the gear.

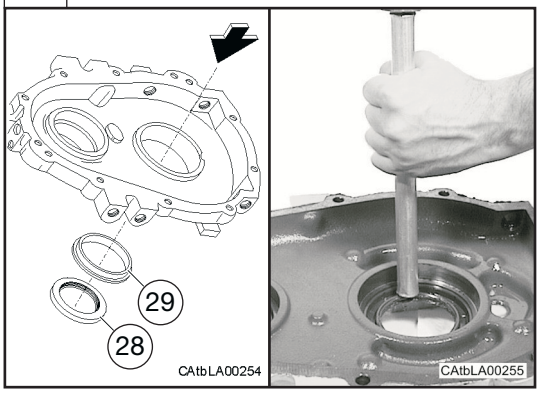
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



Remove the shaft (**25**) with a hammer and a pad.
Remove the bearing (**24**).

9

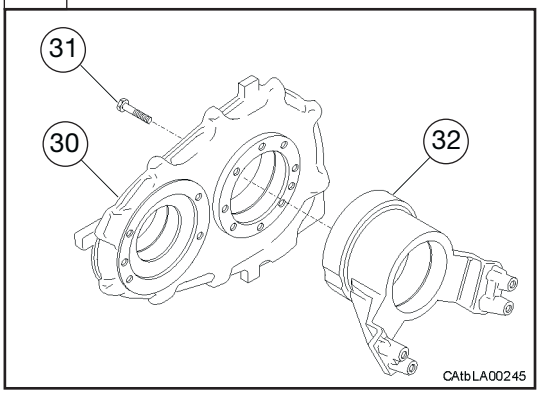


Remove the seal ring (**28**) from the half box (**20**) with a hammer and a drift.

Note: *this is a destructive operation for the seal ring.*

Only if necessary remove the bush (**29**).

10



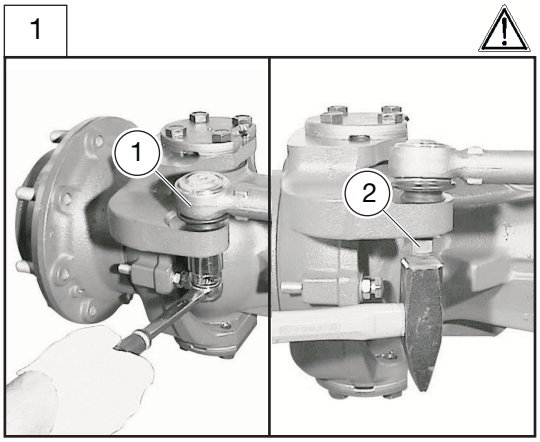
Remove the screws (**31**) and remove off the support (**32**) from the transmission half box (**30**).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.3 Steering cylinder group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

1

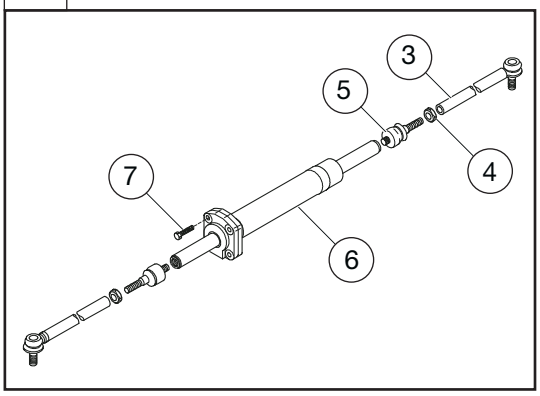


Unloose the guide rod (**1**) locknut (**2**) of some turns till it is over the end of the threaded pin.
Beat on the nut with a hammer in order to disjoin the guide rod from the swivel housing.

Warning: *do not beat on the end of the threaded pin.*

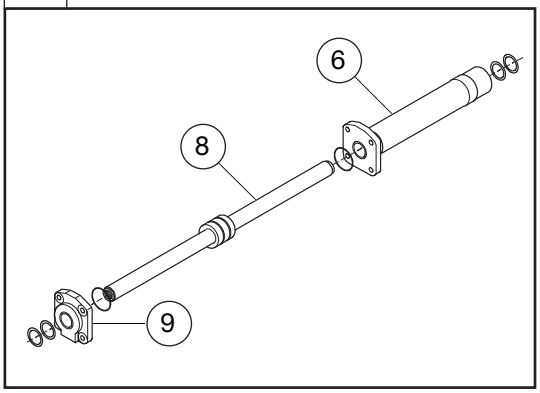
Note*: this is a destructive operation for the nut.*

2



Remove the guide rod link (**3**) by unloosing the nut (**4**) with a suitable wrench, then check its conditions.
Unscrew the fastening screws (**7**) of the cylinder, then take the cylinder (**6**) out of its housing and, if necessary, use a rubber hammer.
Remove only that parts that need to be overhauled and/or replaced.

3



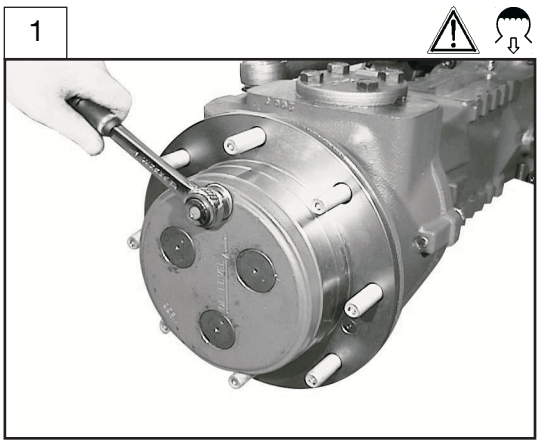
Detach the cylinder head (**9**) from the cylinder case (**6**).
Remove off the cylinder head and the rod (**8**) from the cylinder case.
Remove all the seals and O-Rings, both from the cylinder head and the rod.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.4 Epicyclic reduction gear disassembly

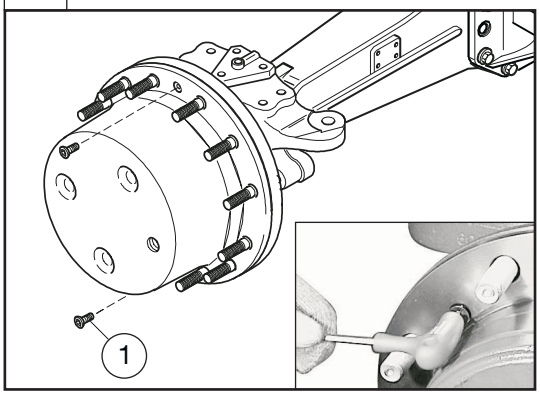
Some of the following pictures may not show exactly your axle, but the process is the same.

1



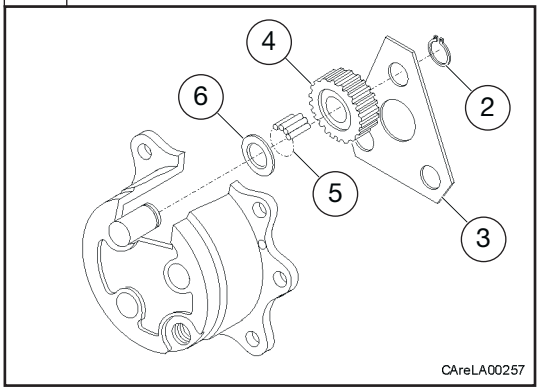
See: sections C.5 and C.8.
Before draining the oil, position the wheel hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, then remove it completely. Turn the wheel hub upsidedown till the hole is in the lowest point.
Drain the oil completely.

2



Unscrew and remove both fastening screws (**1**) of the planetary carrier with a wrench.
Remove the planetary carrier from the wheel hub and collect the relative O-Ring.
Position the planetary carrier on a workbench and check its wear conditions.

3



<u>To carry out any possible replacements of the planetary gears:</u>

- remove the Seeger rings (**2**) on every pin;
- remove the triangular plate (**3**);
- take the planetary gears (**4**) out of the pins;
- collect the roller bearings (**5**), checking their conditions;
- collect the washer (**6**).

Note: *with new planetary gears is advisable to assembly new roller bearings.*

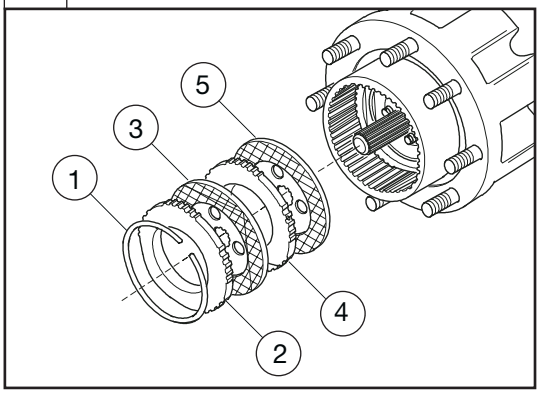
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.5 Wheel hub group disassembly

Before disassembling the wheel hub, 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.

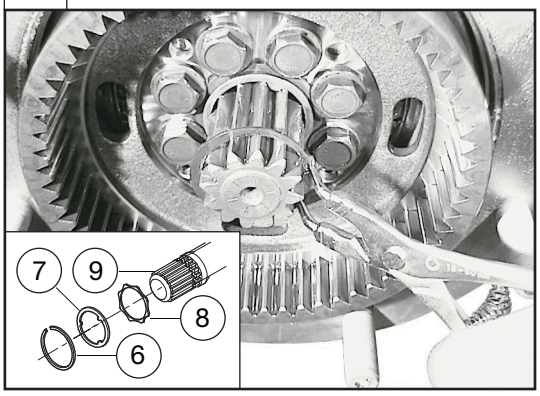
Some of the following pictures may not show exactly your axle, but the process is the same.

1



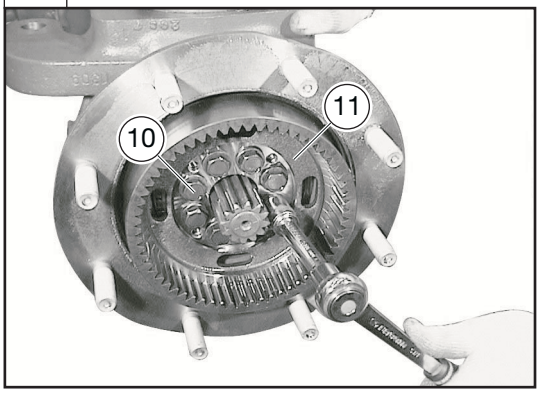
Remove the lock ring (**1**).
Take separator disks (**2**, **4**) and brake disks (**3**, **5**) out, as in figure.

2



Remove the lock ring (**6**) from the U-Joint shaft (**9**) using a suitable pliers.
Collect the U-Joint shaft washers (**7**, **8**).

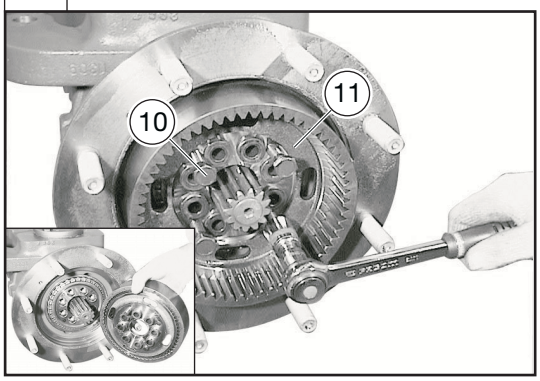
3



Unscrew and remove the fastening screws (**10**) from the wheel carrier group (**11**).

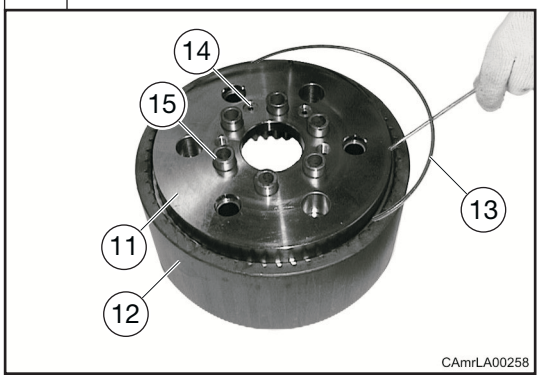
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



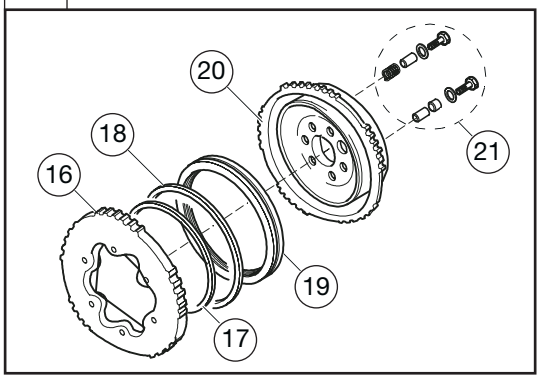
In order to remove the wheel carrier group from its housing, screw two of the just removed screws (**10**) in the threaded extraction holes.
Extract and remove the wheel carrier (**11**) together with the epicyclic ring gear (**12**).

5



Remove the steel lock ring (**13**) and disjoin the wheel carrier (**11**) from the epicyclic ring gear (**12**).
Remove the O-Rings (**14**).
Only if necessary, remove the centering bushes (**15**) from the wheel carrier with a hammer and the special tool CA715086.

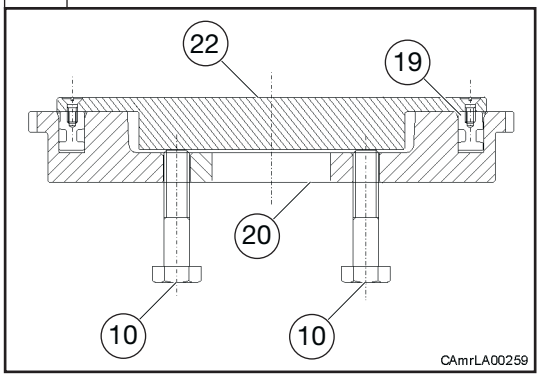
6



Unscrew the kit self-adjust fastening screws (**21**) to disassembly the separator disk (**16**) from the wheel carrier (**20**).

Note: *collect all the kit self-adjust parts.*

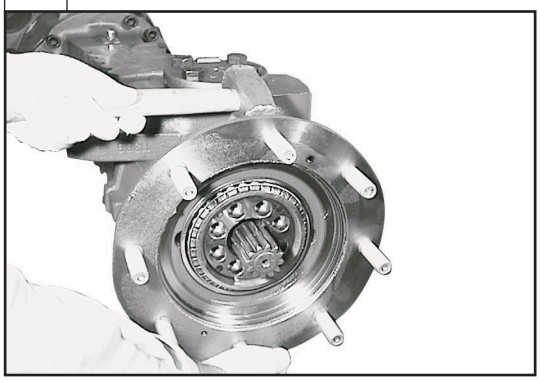
7



To remove the piston (**19**) assemble the special tool CA715492 (**22**) and two fastening screw (**10**) just used to remove the wheel carrier group (**20**), as in figure.
Screw the two bolts (**10**) to extract the piston (**19**).
Remove the QUAD-Rings (**17**, **18**) from the piston (**19**).
Check the wear conditions of the components.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

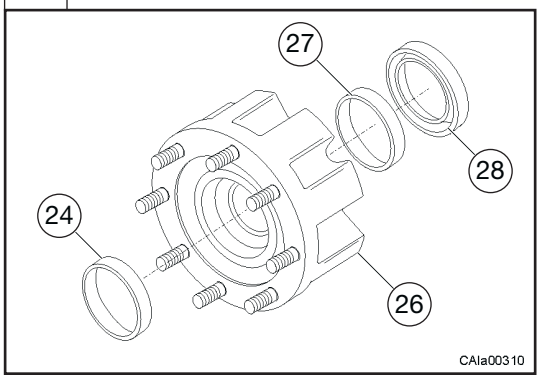
8



Remove the wheel hub, using levers and a hammer to facilitate the operation.

***Note**: collect the bearing cone.*

9

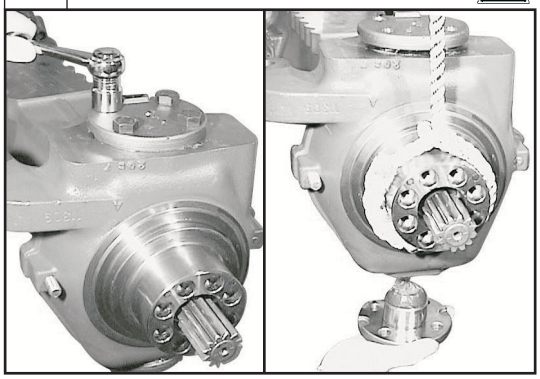


Position the wheel hub (**26**) on a flat surface and take the seal ring (**28**) out with a lever.

***Note**: this is a destructive operation for the seal ring.*

Take the bearing cups (**27**, **24**) out, using a hammer and a suitable drift or using a suitable extractor.

10



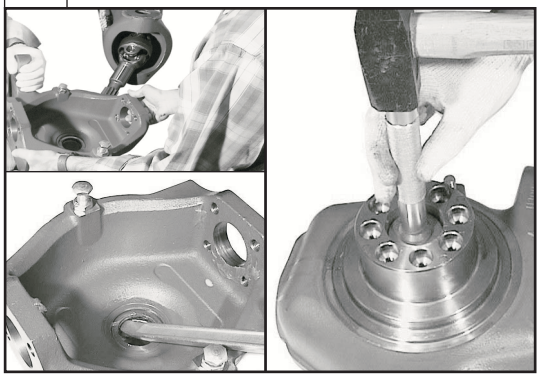
Remove the fastening screws from the upper and lower king pin.

***Danger:** 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.

***Note:** collect the belleville washers and the shim.*

11



Remove the swivel housing from the axle beam and from the short shaft of the U-Joint.
Position the swivel housing on a flat surface and take the seal ring out with a lever.

***Note**: this is a destructive operation for the seal ring.*

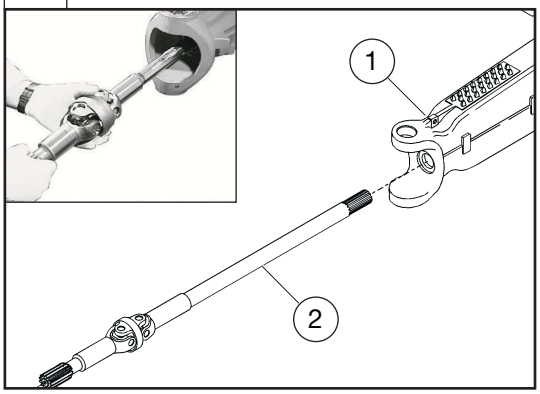
Turn the swivel housing and take the bush out, using a drift and a hammer.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.6 Axle beam group disassembly

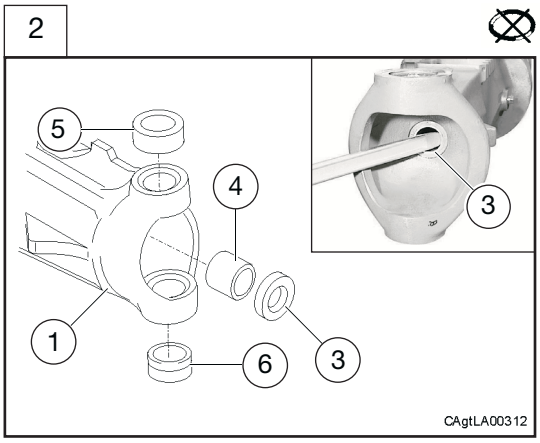
Some of the following pictures may not show exactly your axle, but the process is the same.

1



Remove the U-Joint (**2**) from the axle beam (**1**).

2



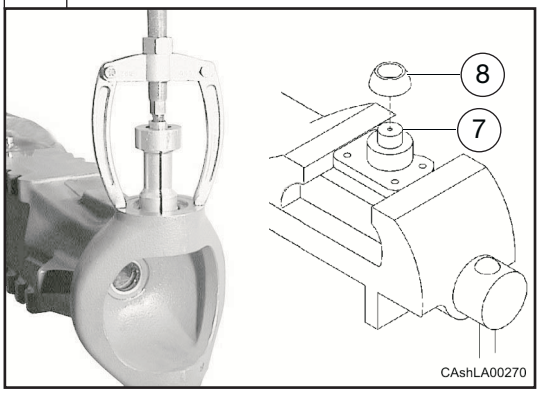
Take the seal ring (**3**) out of the axle beam (**1**) with a lever.

Note: *this is a destructive operation for the seal ring.*

Remove the bush (**4**) from the beam with a suitable extractor.

Note: *examine the bush before the removal and replace it only if the wear conditions require this.*

3



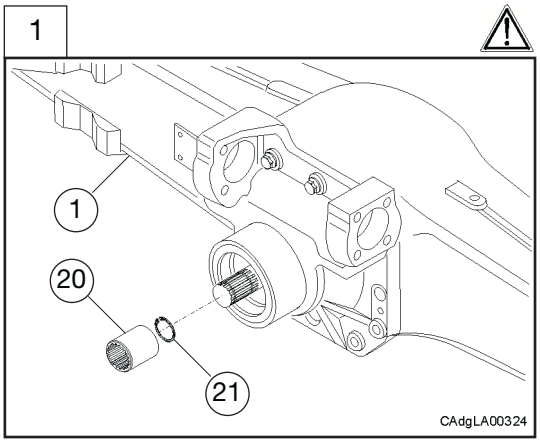
Take the upper (**5**) and lower (**6**, **8**)bushes out of the king pin housings (**7**) and out of king pin with a suitable extractor.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.7 Differential support group disassembly

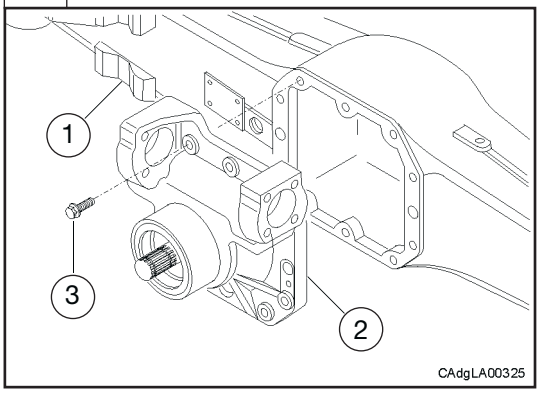
Some of the following pictures may not show exactly your axle, but the process is the same.

1



Remove the sleeve (**20**).
If necessary remove the lock ring (**21**) from the sleeve (**20**).

2

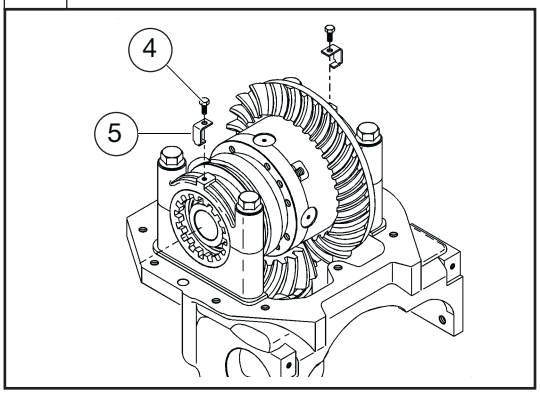


Loosen and remove the screws (**3**) on the differential support (**2**).
Remove the differential support (**2**) from the axle housing (**1**).

Warning: *support the differential support with a rope or other appropriate means.*

Note: *remember the fastening screws position.*

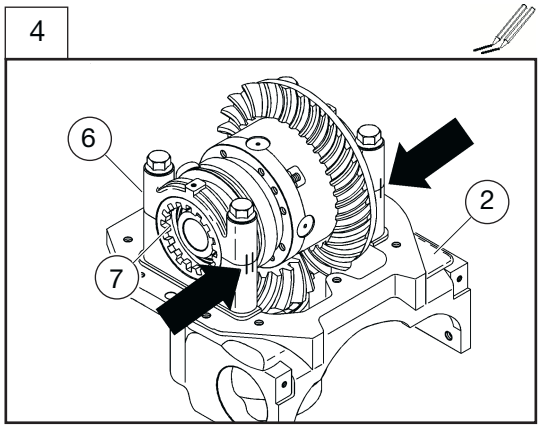
3



Loosen and remove the screws (**4**) to take out the two ring nut retainers (**5**).

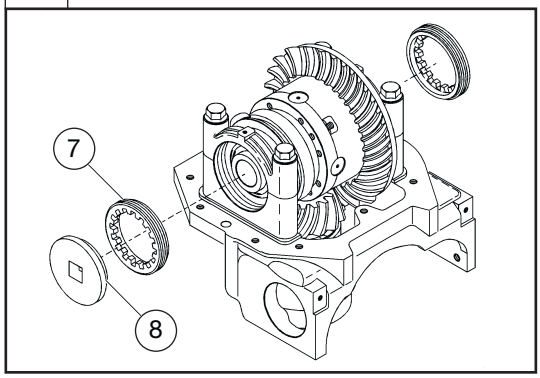
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



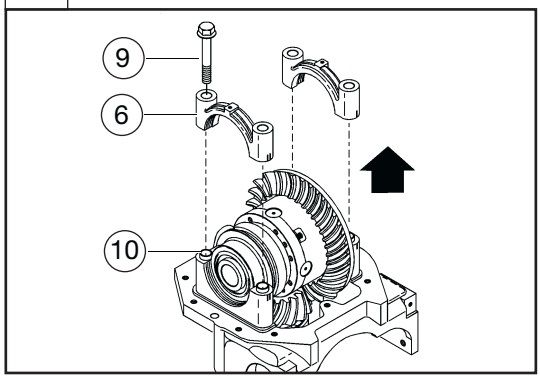
Before removing the bolts (**6**), mark both half-collars and the differential support with permanent reference marks to avoid inverting them during re-assembly. Mark the area between the ring nuts (**7**) and the differential support (**2**) as well.

5



Unscrew the adjuster ring nuts (**7**) using tools CA119030 (**8**) and a wrench.

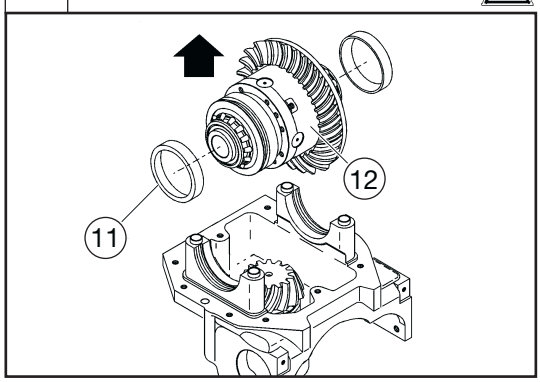
6



Remove the 4 screws (**9**) and remove both half-collars (**6**).

Note: *check that the bushes (**10**) remains in their housings.*

7



Take out the differential case (**12**).
Collect from ring gear side the cup bearings (**11**).

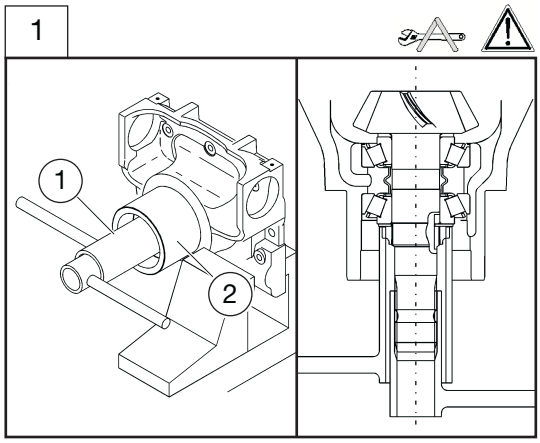
Warning: *don't mismatch the cup bearings if they are not to be replaced.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.8 Pinion group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

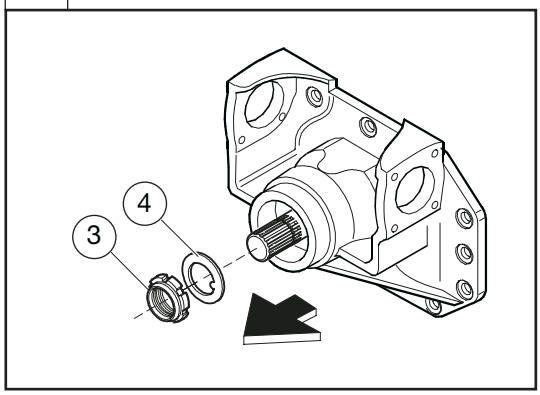
1



Fit the differential support (**2**) in a vise.
Unscrew the lock nut using special tools CA715080 and CA715081 (**1**).

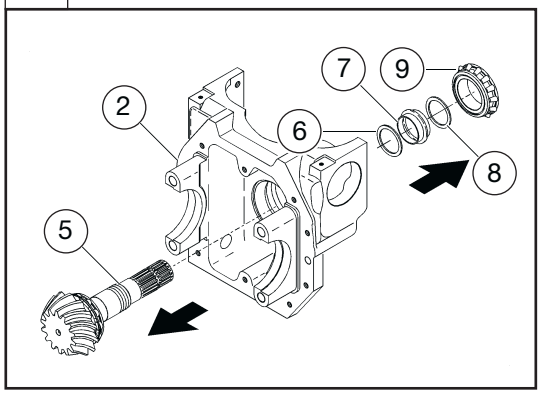
Note: *This operation will irretrievably damage the ring nut.*

2



Remove the ring nut (**3**) and collect its retaining washer (**4**).

3



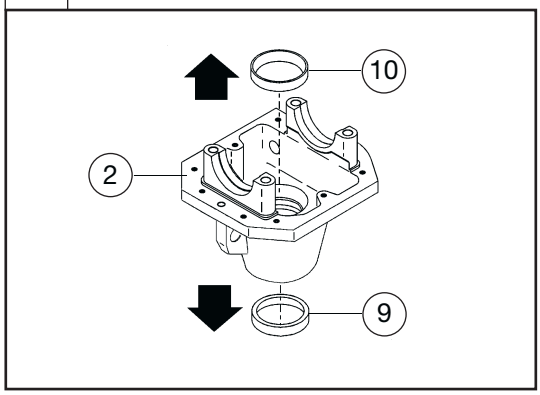
Tap the shaft with a soft hammer to remove the bevel pinion (**5**).

Warning: *take care not to drop the pinion.*

Collect the washers (**6**, **8**), the collapsible spacer (**7**) and the inner cone (**9**) of the tapered roller bearing.

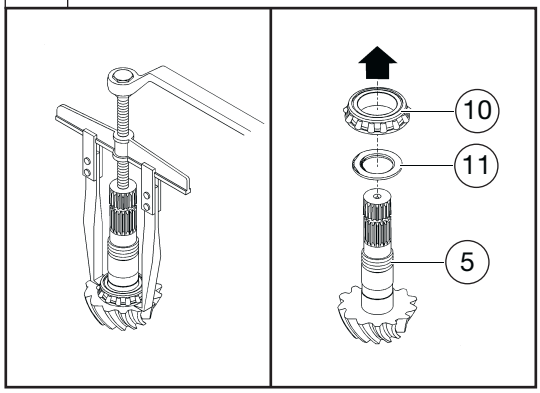
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



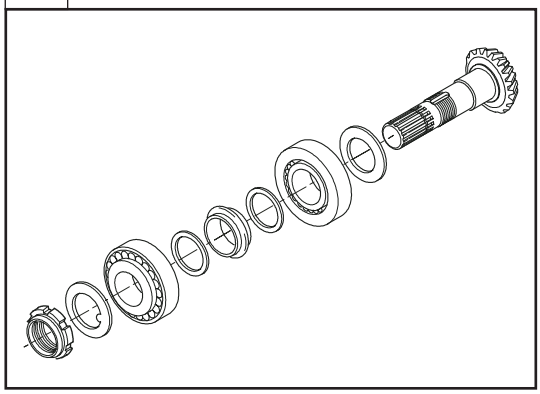
Place the differential support (**2**) on a flat surface as shown in the figure and remove the outer cups of the taper roller bearing (**10**, **9**) using a drift and a hammer.

5



To remove the inner cone of the tapered roller bearing (**10**) of the pinion (**5**), use a standard extractor.
Collect the underlying shim (**11**).

6



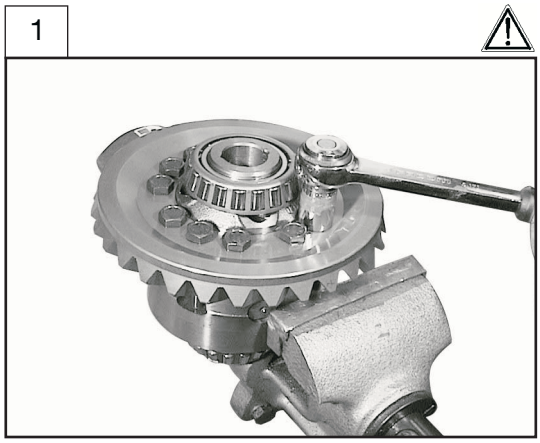
Check all pinion components condition.
The ring nut and the collapsible spacer must be replaced when reassembling the unit.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.9 Differential group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

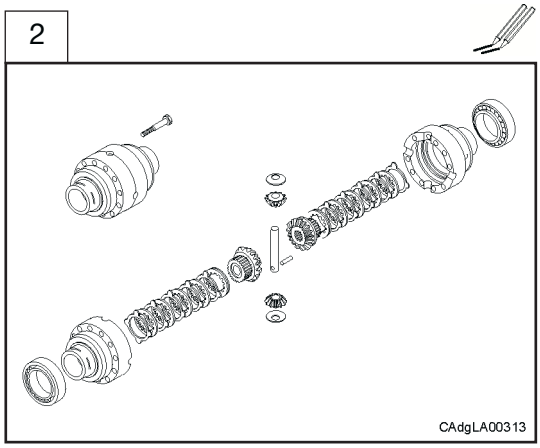
1



Collect the differential and close it in a clamp.
Unscrew the fastening screws and remove the bevel gear crown.

Warning: *this will make both differential half boxes free, so take care not to drop the internal components.*

2

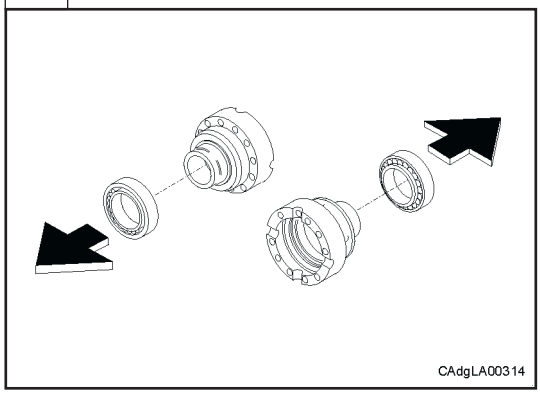


Disassemble the differential box in two half boxes complete with the relative components.

Note*: mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.*

Disassemble all the components.
Check the operating and wear conditions of the components.

3



Take the bearing out of the differential half box, using two levers or a three-hold extractor.

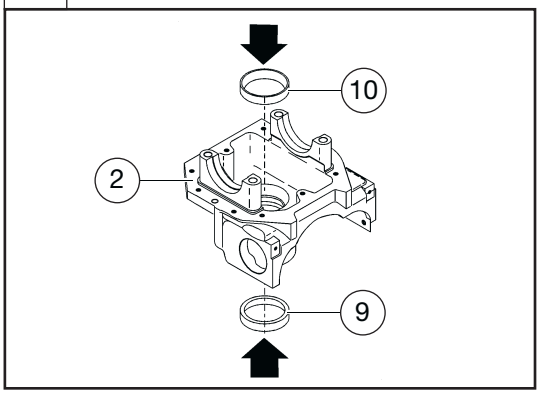
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E ASSEMBLY OPERATIONS

E.1 Pinion group assembly

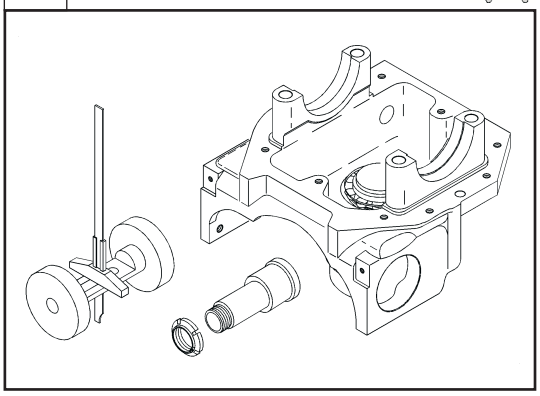
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



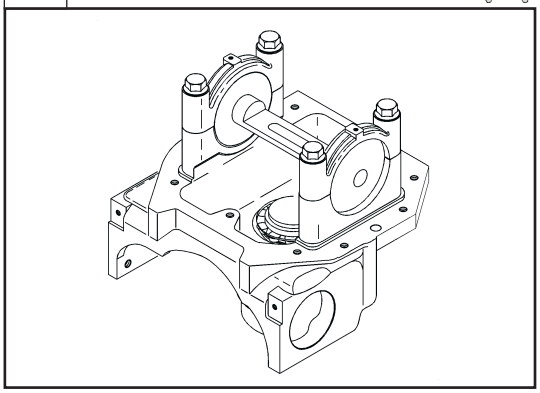
Place the differential support (**2**) on a workbench.
Fit the outer cups of the new bearings (**9**, **10**) using the special tool CA715083 and a hammer.

2



In order to measure the distance, use the kit consisting of the special tools called “false pinion” CA715450 and “false differential box” CA119205 e CA119206.

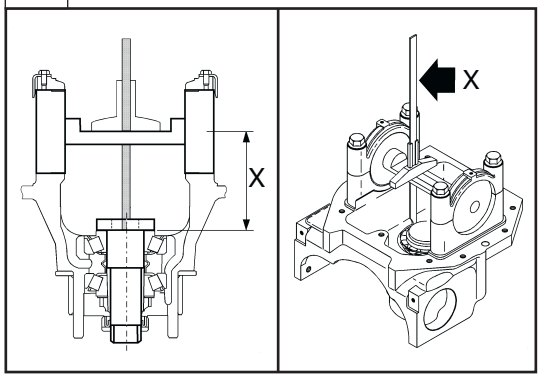
3



Insert the false pinion with CA715450, together with its bearings and its ring nut, in the just mounted housings for the bearings.
Tighten without exceeding, till the backlash is eliminated.
Install special tools CA119205 and CA119206 to the differential group supports and screw in the half collar bolts (see figure).

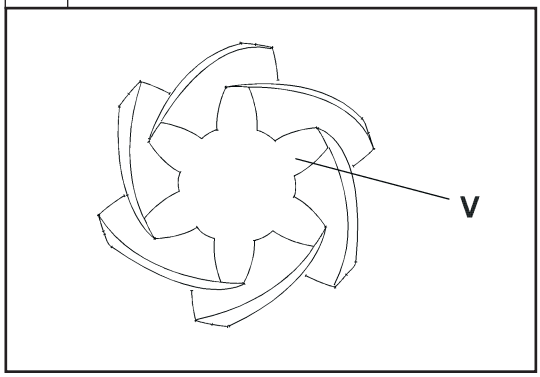
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



Assembly diagram of the tools CA119205 and CA119206 on the bearing differential support seats.
Use a depth gauge to measure distance "**X**" (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing).

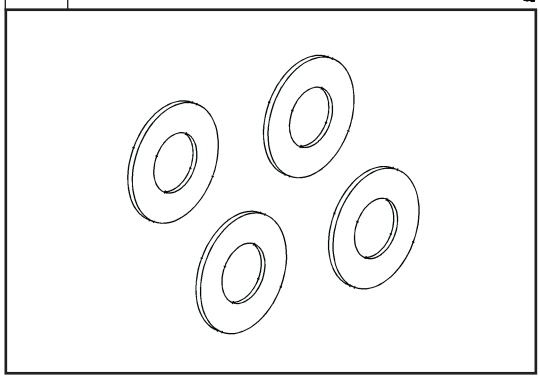
5



In order to determine the necessary thickness (**S**) between the pinion and the bearing, subtract the value (**V**), stamped on the pinion head (**V**=requested conical distance), from the measured value (**X**).

S=X-V

6

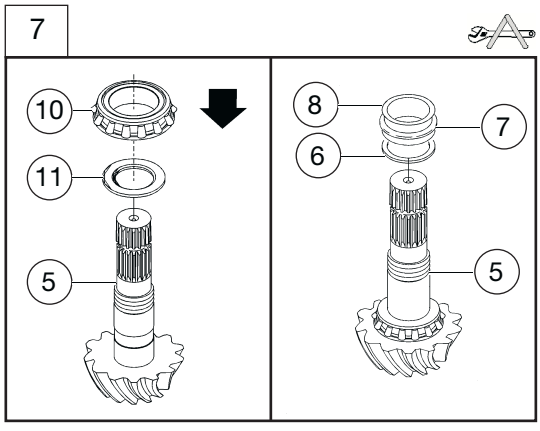


Select the thickness (**S**) from the range of available shims, and fit to shaft under the pinion head.

Note: *take care to assemble correctly.*

SHIM RANGE										
Thick.	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Q.ty	-	-	-	-	-	-	-	-	-	-

7

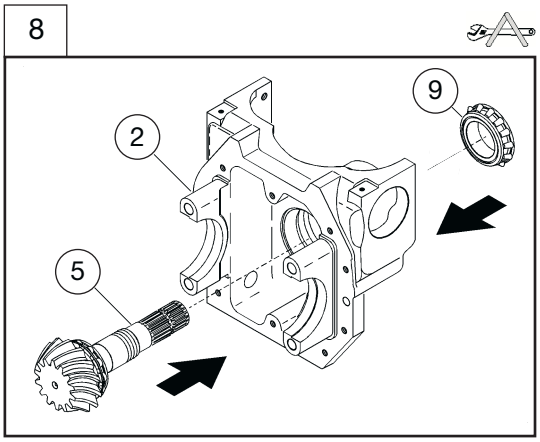


Once you have chosen and inserted the suitable shim (**11**) with the chamfer against the gear, force the bearing (**10**) into the pinion shaft (**5**) end with special tool CA715082 under a press, making sure that it is well set.
Insert the shims (**6**, **8**) and a new elastic spacer (**7**).

Note: *use always a new elastic spacer.*

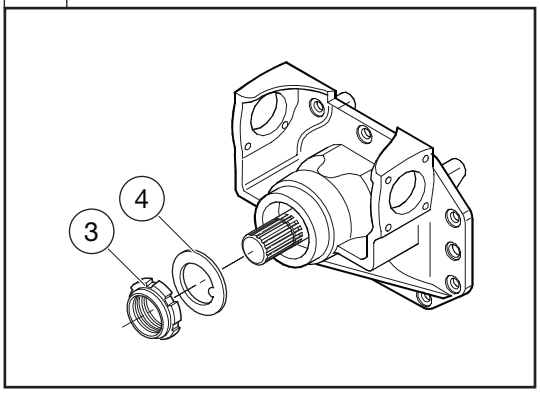
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



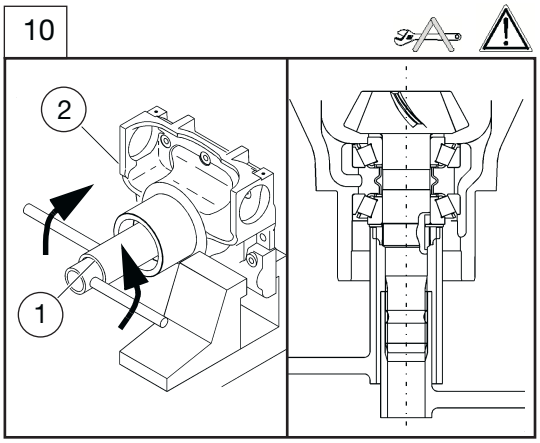
Insert the bevel pinion unit (**5**) into the differential support housing (**2**) and the second bearing cone (**9**) into the pinion end, as in figure.
In order to force the second bearing (**9**) into position, use the special tool CA715082 and a hammer.
It is advisable to offer resistance, for example with a sledge, to the beating force.

9



Insert a ring nut washer (**4**) and screw a new lock ring nut (**3**) on the pinion end.

10



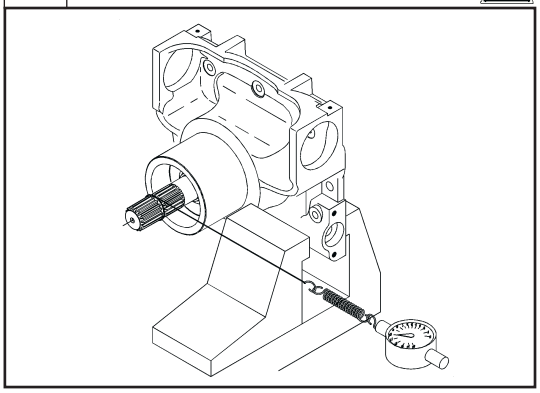
Screw the ring nut in, using the wrench for ring nut CA715080 and for pinion retainer CA715081.

Warning: *The torque setting is given by the preloading measurement on bearings. Tighten the ring nut gradually.*

Note: *if the tightening is excessive, the elastic spacer must be replaced and the procedure repeated. When you check the preloading, it is advisable to beat slightly both pinion ends with a soft hammer, so as to help setting the bearings.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

11

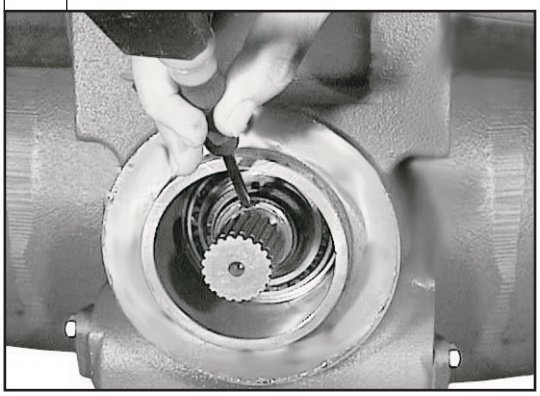


Carry out the preloading measurement (**P**) of the pinion taper roller bearings, using a dynamometer whose cord is wound on the end of pinion spline.
The adjustment is carried out by increasing the ring nut torque gradually, being careful not to exceed.

Warning: *all preloadings must be measured without the seal ring.*

P=10.5÷15.7 daN

12

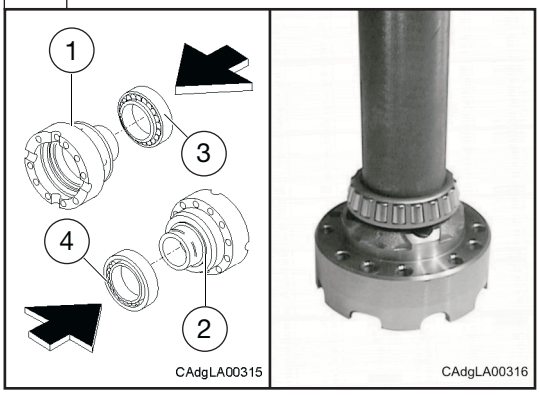


Once the requested preloading value is achieved, caulk the ring nut, using a hammer and a chisel.

E.2 Differential group assembly

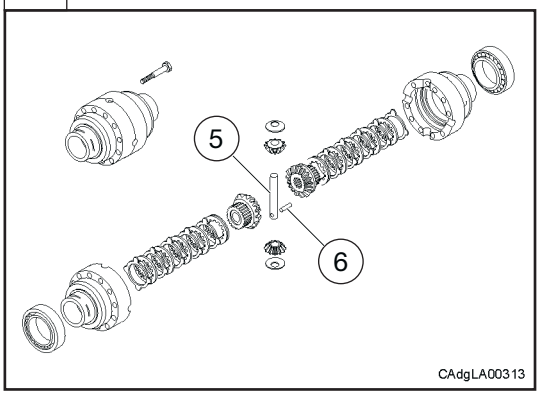
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



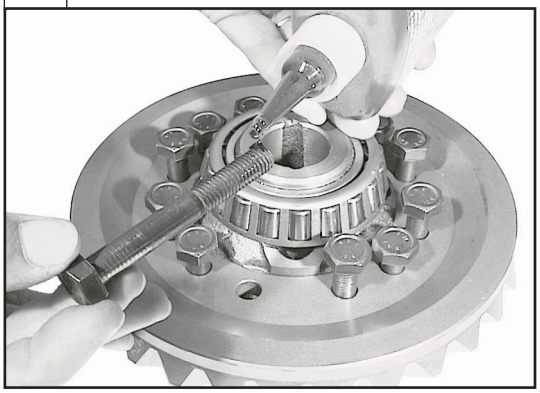
Assemble the cones of the new taper roller bearings (**3**, **4**) on the half boxes (**1**, **2**), using the special tool CA715093 and a hammer.

2



Position a half box on a workbench and assemble all inner components (discs and counterdiscs, thrust washers, sun gears, planetary gears, thrust washers, spider), as shown in figure.
Fix the pin (**5**) with the lock pin (**6**).
Join the two half boxes, aligning the reference marks made upon them.

3



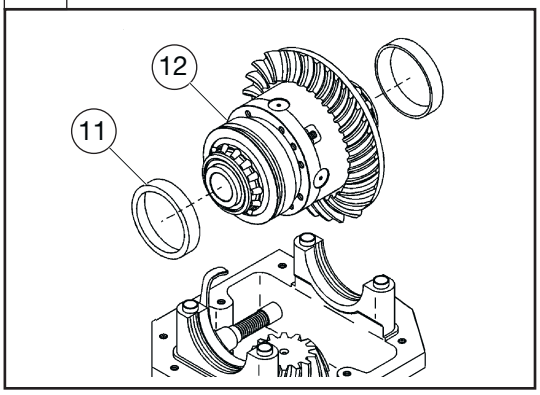
Position the bevel crown gear on the differential box.
Apply Loctite® 270 on screws thread.
Fix the whole tightening the screws to the requested torque (Sec. C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.3 Differential support group assembly

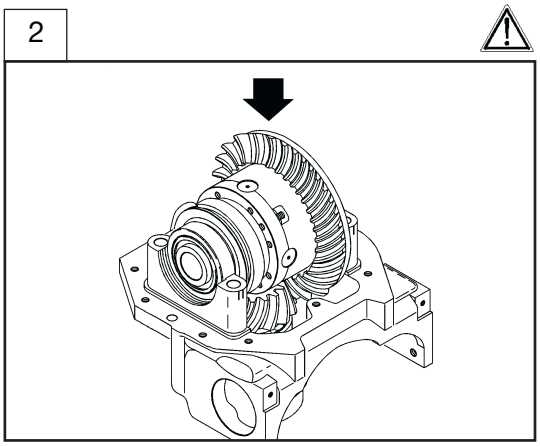
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



Assemble the outer cups (**11**) of the taper roller bearings on both differential box bearings (**12**).

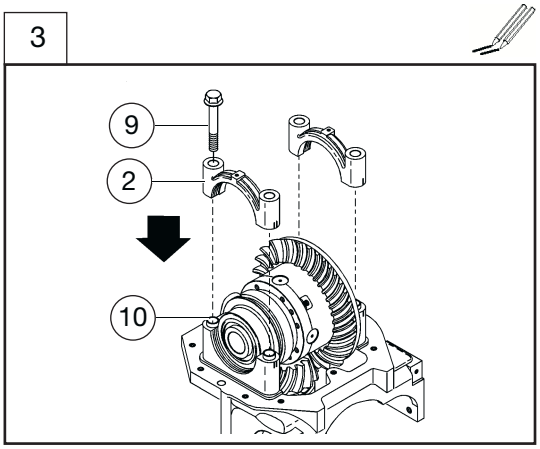
2



Position the complete differential box on the differential support.

Warning: *take care not to invert the outer cups of the taper roller bearings and check the right side of the bevel crown assembly.*

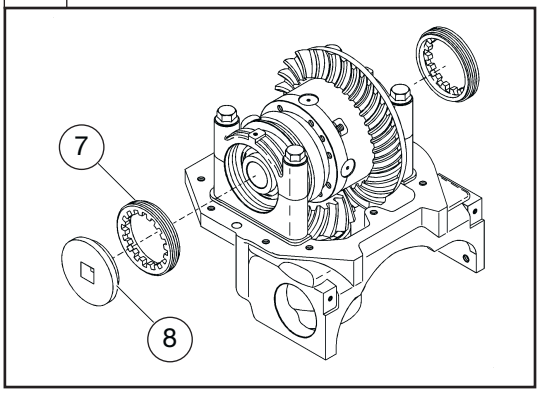
3



Move the differential group so to place the bevel crown gear on the pinion.
Check that all bushes (**10**) are in their housings and position both half collars (**2**) on their seats using the previously traced reference marks.
Lock both collars with their fastening bolts (**9**).

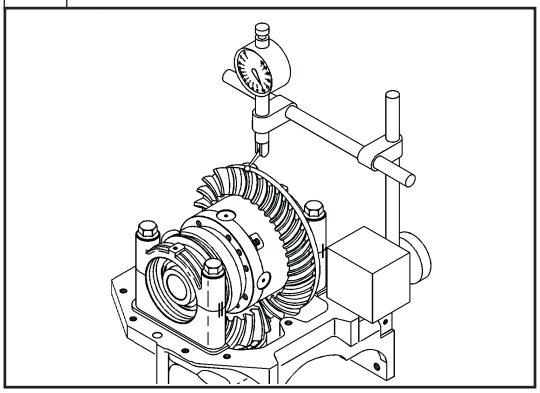
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



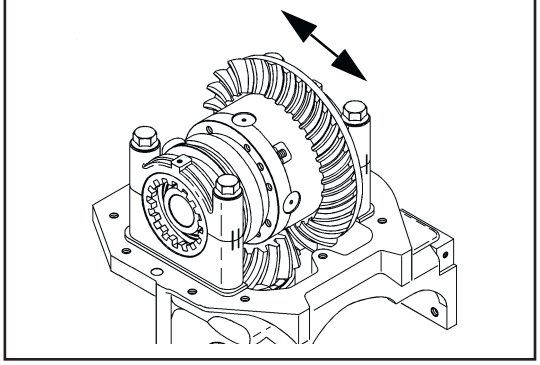
Assemble and tighten both adjustment ring nuts (**7**) in the differential support with special tools CA119030 (**8**), till the backlash is eliminated and the differential bearings are slightly preloaded.
Check that the differential bearings are well settled; if necessary, knock slightly with a soft hammer, in order to properly set the bearings in position.

5



Position a magnetic-base dial gauge on the differential support, so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.

6



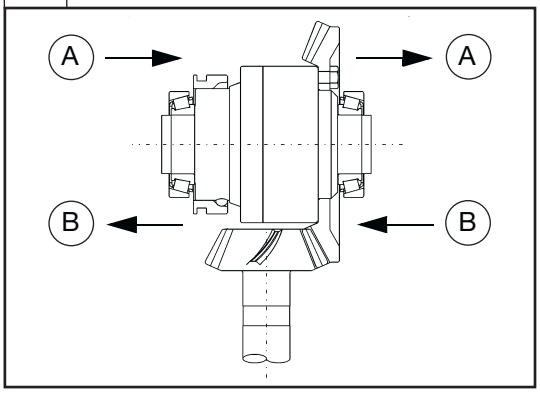
Lock the pinion and move the crown gear alternatively and note the pinion-ring gear backlash, measured with the comparator.
Repeat the operation on 2 or more points (teeth), rotating the crown gear, so that to obtain an average value.
Check if the measured backlash value is within the requested range:

0.16÷0.22 mm

Carry out the adjustment by operating on the 2 ring nuts with the appropriate tools CA119030.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

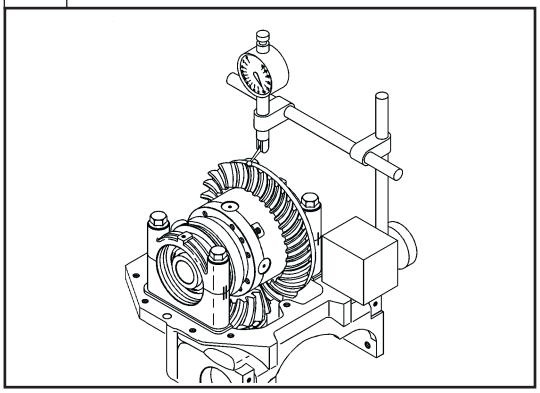
7



Adjust the ring nuts, remembering that:

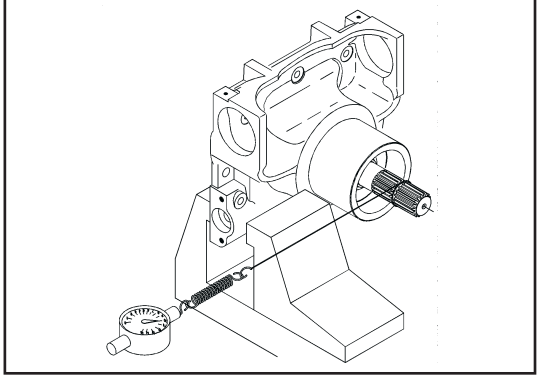
- if **the measured backlash is less** than the given tolerance range, unscrew the ring nut on the bevel crown gear side and screw in the opposite one by the same measure (**A**);
- if **the measured backlash is greater** than the given tolerance range, unscrew the ring nut on the side opposite to the bevel crown gear, and screw in the other one by the same measure (**B**).

8



Once the adjustment of the pinion-ring gear backlash has been carried out, 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.

9



Once the pinion-ring gear backlash has been established, measure the total preloading (**T**) of the bearings (pinion-crown bevel gear system), using a dynamometer whose cord is wound on the pinion splined end. The measured value should be within the following range:

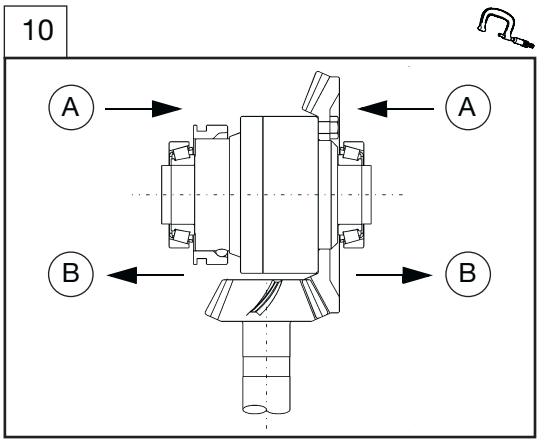
T=(P+3.9)÷(P+5.9) daN

where **P** is the effectively measured pinion preloading
See: sec. “Pinion assembly”.

Warning: *all preloadings must be measured without seal ring.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

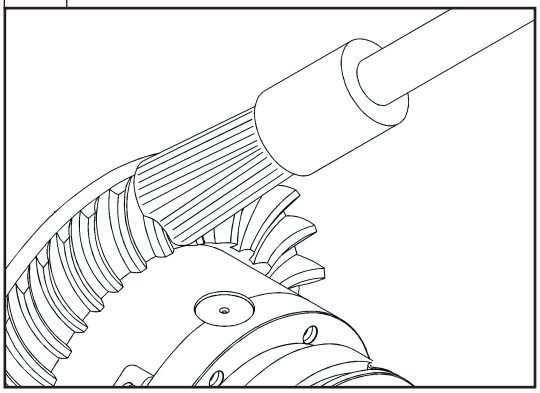
10



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:

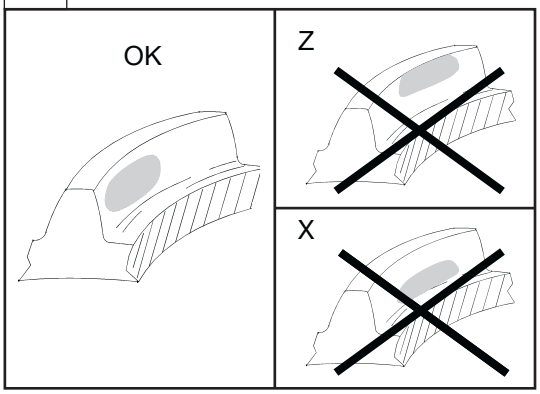
- if **the total preloading is less** than the given range, screw in both ring nuts by the same measure (**A**), keeping the pinion-ring gear backlash value unchanged;
- if **the total preloading is greater** than the given range, unscrew both ring nuts by the same measure (**B**), keeping the pinion-ring gear backlash value unchanged.

11



NOTE
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.

12



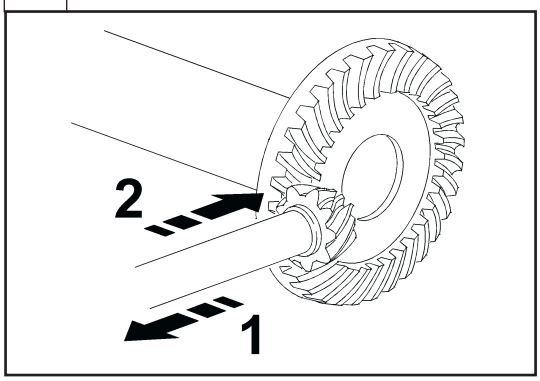
OK -> Correct contact
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

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.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

13

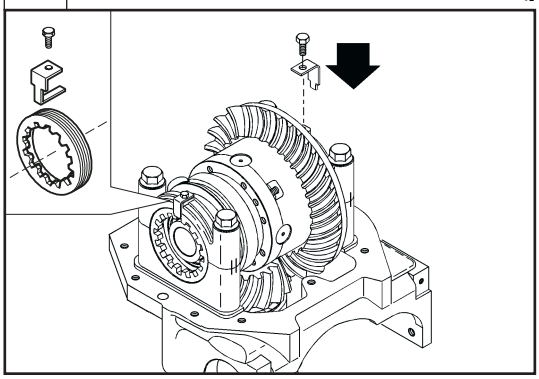


Movements to correct:

1 -> move the pinion for type X contact adjustment

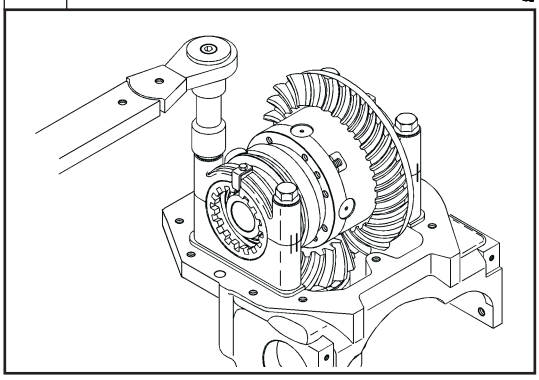
2 -> move the pinion for type Z contact adjustment.

14



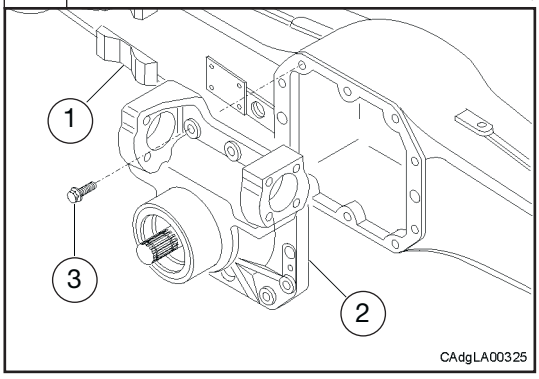
Once all the adjustment operations have been completed, fit the adjuster ring nut retainers and their respective screws, tightening them to the requested torque (Sect. C.7) with a dynamometric wrench.

15



Tighten the bolts of both half collars to the requested torque (Section C.7) with a dynamometric wrench.

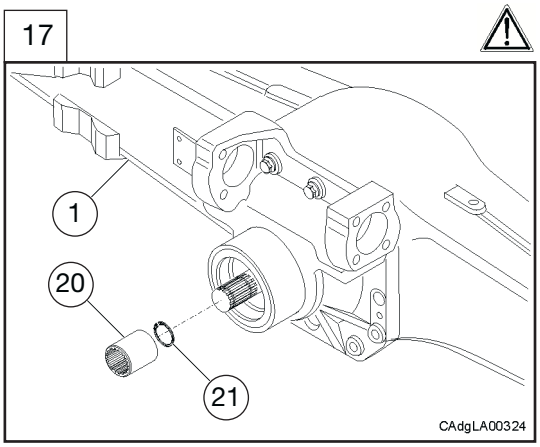
16



Before matching surfaces, make sure they are perfectly clean.
Degrease and clean them with appropriate detergents.
Spread a film of Loctite® 510 on the contact surface between the axle beam and the differential support.
Position the differential support (**2**) on the axle housing (**1**), and tighten the retaining screws (**3**) to the requested torque (Section C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

17

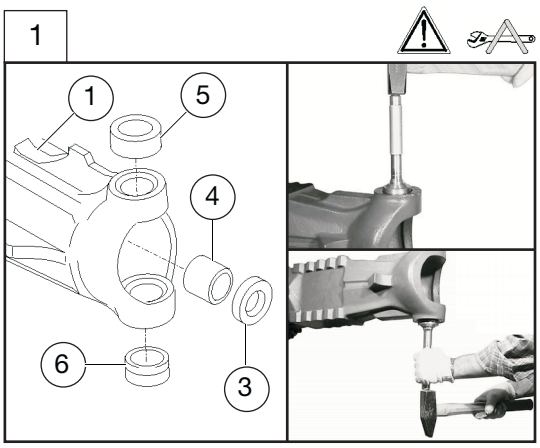


If necessary insert the lock ring (**21**) in the sleeve (**20**).
Assemble the sleeve (**20**).

E.4 Axle beam group assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

1

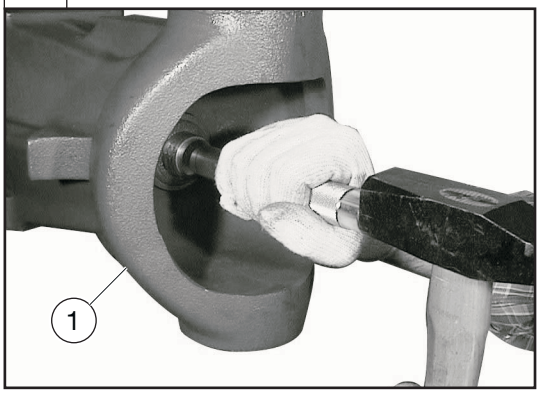


Assemble the upper king pin bush (**5**) on the axle beam (**1**) with the special tool CA119220 and a hammer.
Insert the cup (**6**) of the ball bearing on the lower part of the axle beam with the special tool CA715451 and a hammer

Note: *to make the assembly easier, it is advisable to cool the bush (**5**) and the cup (**6**) of the ball bearing at a temperature lower than 100°C.*

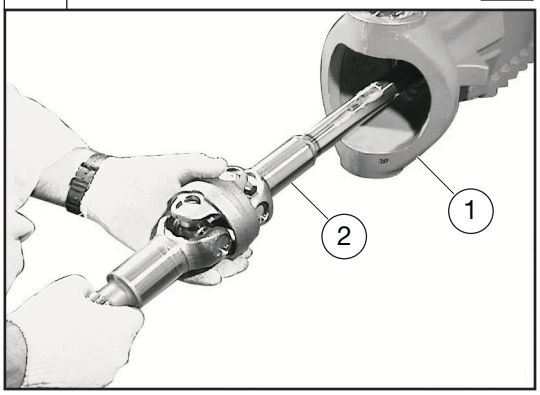
Warning: *wear safety gloves.*

2



Assemble the bush (**4**) on the axle beam (**1**) with the special tool CA715454 and a hammer.
Assemble the seal ring (**3**) on the beam with the special tool CA715453 and a hammer.
Fill 3/4 of the seal ring cavity with grease.

3



Lubricate the bush and the seal ring lip.
Insert the U-Joint (**2**) inside the axle beam (**1**).

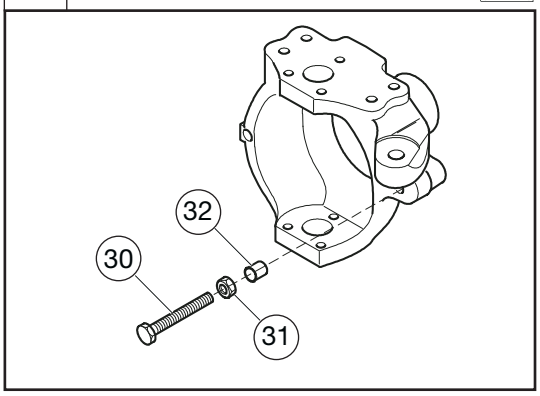
Warning: *be careful not to damage the seal.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.5 Wheel hub group assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

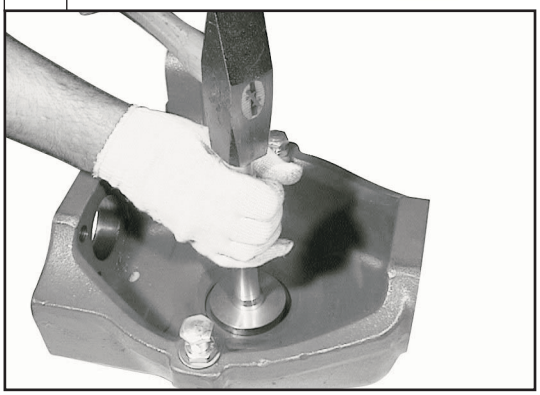
1



If it has been removed, reassemble the steering mechanical retainer composed by: screw (**30**), nut (**31**) and spacer (**32**).

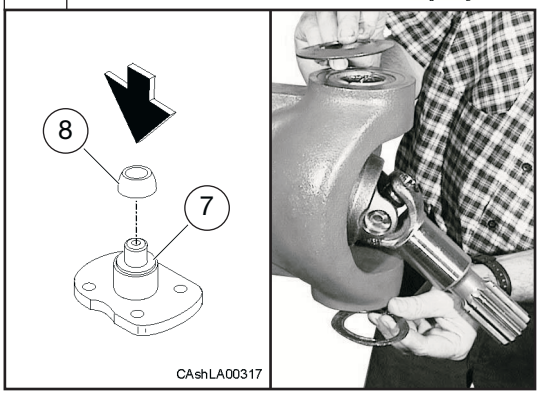
Warning: *insert the spacer bush (**32**) on the screw between the nut and the swivel housing (as in figure); the lack of the spacer (**32**) may produce the axle damage.*

2



Force the bush into the swivel housing with the special tool CA119097 and a hammer or a press.
Assemble the seal ring on the swivel housing with the special tool CA715360 and a hammer.
Fill 3/4 of the gasket cavity with grease.

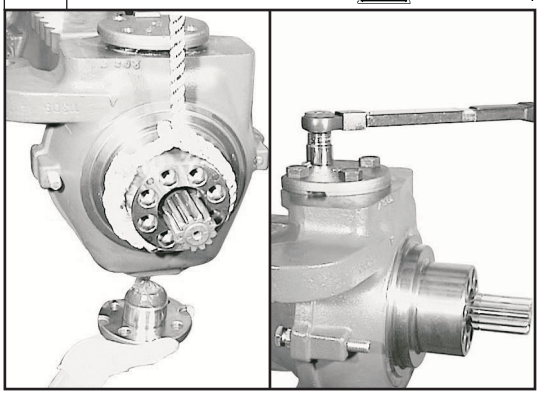
3



Position the lower king pin (**7**) on a workbench and assemble the cone (**8**) of the spherical joint with the special tool CA715451 under a press.
Grease well the king pin housings with specific grease (Sec.C.4).
Position the shim and the Belleville washers on the upper king pin housings.
Position the Belleville washers on the lower king pin housings.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4

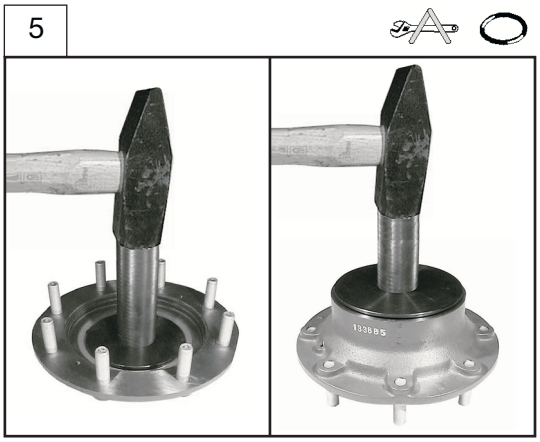


Danger: *secure the swivel housing group with a rope.*

Lubricate the seal ring lip and protect the splined end of the axle shaft by winding it with thin adhesive tape to avoid damage to the seal ring.
After assembly, remove completely the adhesive tape.
Assemble the swivel housing on the axle beam.
Assemble the two king pins, the upper and the lower, and tighten the retaining screws with dynamometric wrench to the requested torque (Sec.C.7).

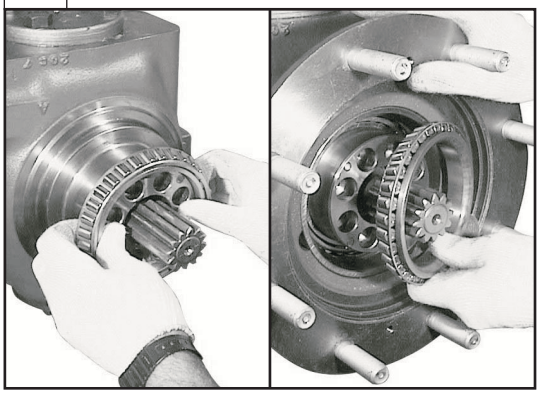
Note: *make sure that the Belleville washers remain in their position.*

5



Position the wheel hub on a workbench and force both cups of the taper roller bearings in position with the special tool CA715085 under a press or with a hammer.
Insert the seal ring into the wheel hub with the special tool CA715099 and a hammer.

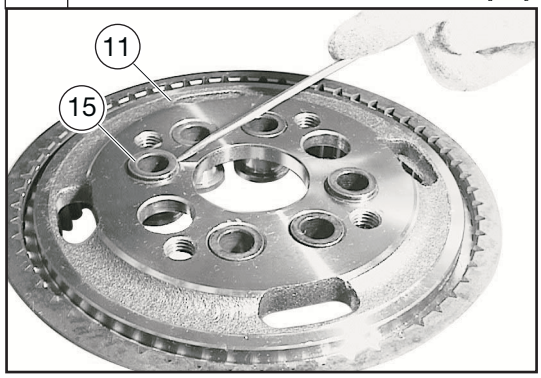
6



Assemble the cone of the taper roller bearing on the swivel housing end.
Assemble the wheel hub on the swivel housing and fit the other cone of the taper roller bearing in position.

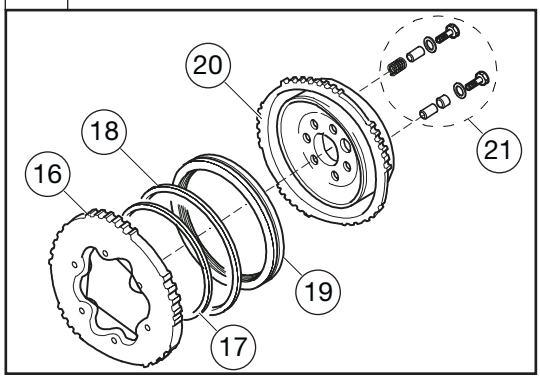
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

7



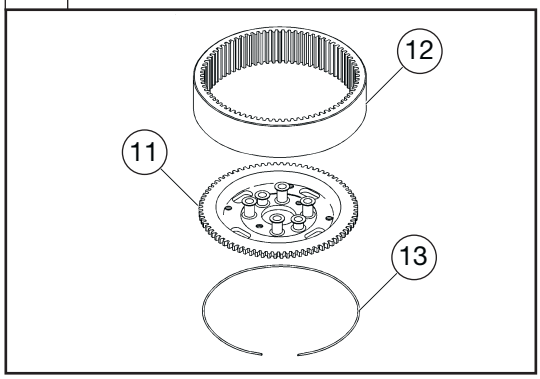
Position the wheel carrier (**11**) on a workbench and force the bushes (**15**) to the carrier surface level with the special tool CA715086.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

8



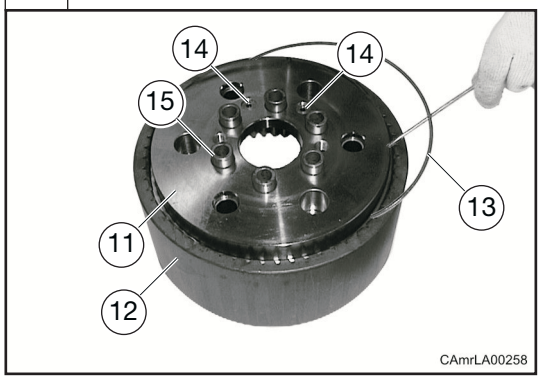
Assemble new QUAD-Rings (**17**, **18**) to the piston (**19**).
Insert the piston (**19**) in the wheel carrier (**20**).
Screw the kit self-adjust fastening screws (**21**) to assembly the separator disk (**16**) to the wheel carrier (**20**).

9



Assemble the wheel carrier (**11**) and epicyclic ring gear (**12**) group with the special locking ring (**13**).

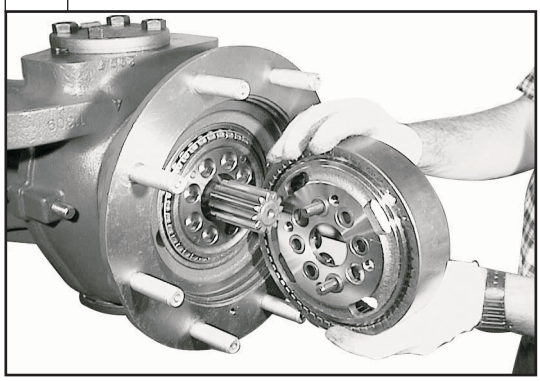
10



Insert two greased new O-Rings (**14**) in the wheel carrier (**11**).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

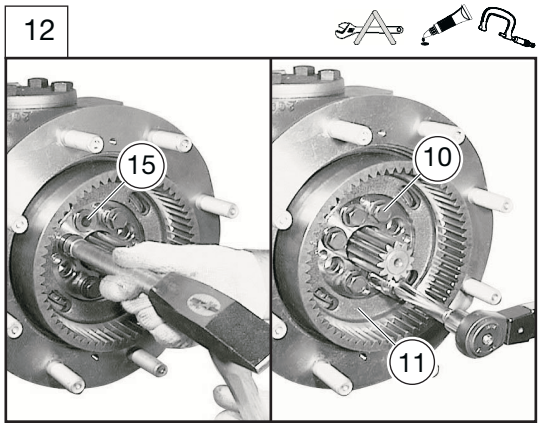
11



Note: *check O-Rings (**14**) position.*

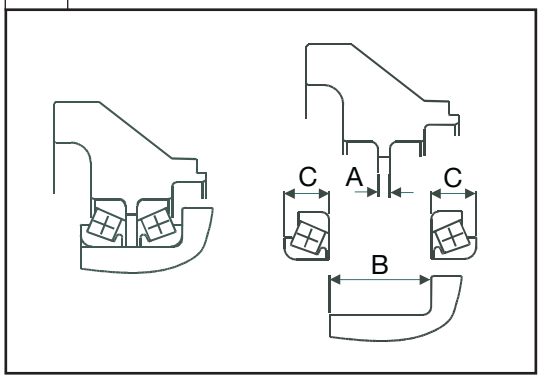
Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins and screw the relative screws in order to put in contact the ring bevel gear with the wheel hub.

12



Force all the hub dowel bushes (**15**) completely with the special tool CA715086 and a hammer.
Apply Loctite® 270 on fastening screws (**10**) thread.
Assemble the wheel carrier (**11**) fastening screws (**10**) and tighten to the requested torque (Sec. C.7).

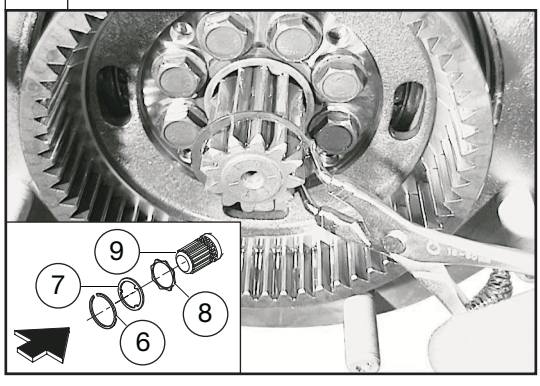
13



The special operation “Set Right” of the bearings does not require specific registrations of preloading or backlash. Anyway, before assembling new components check the indicated dimensions.

A= 11.975 ÷ 12.025
B= 52.229 ÷ 52.279
C= 20.000 ÷ 20.100

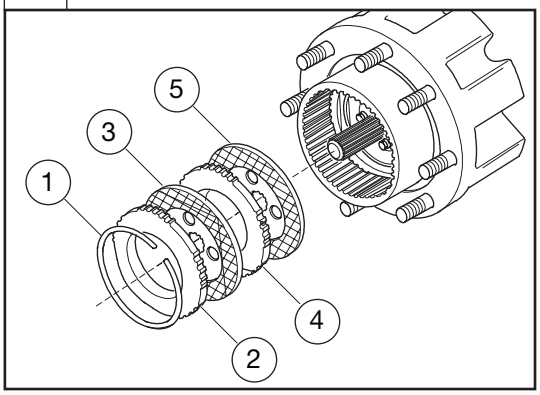
14



Slide the washers (**7**, **8**) into the U-Joint shaft (**9**) and lock it with the retaining ring (**6**), inserting it at the end of the splined hub and pushing it into its housing.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

15



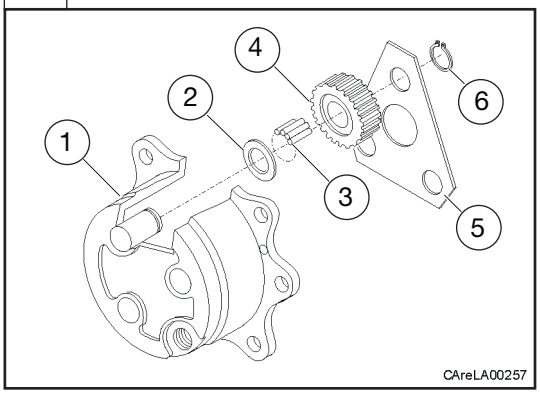
Insert separator disks (**2**, **4**) and brake disks (**3**, **5**), as in figure.
Lock the disks with the lock ring (**1**).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.6 Epicyclic reduction gear assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

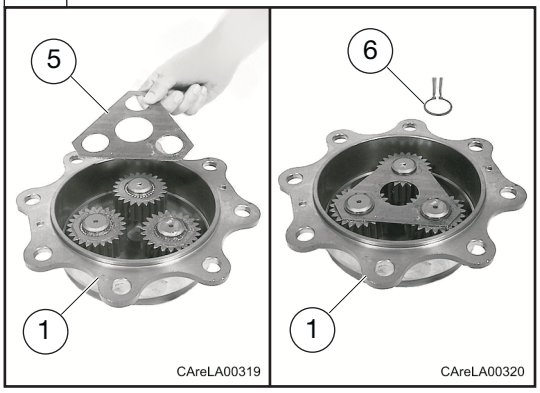
1



Collect all epicyclic reduction gear parts: the planetary carrier (**1**), the thrust washers (**2**), the roller bearings (**3**), the planetary gears (**4**), the triangular plate (**5**) and the Seeger rings (**6**) of every pin.

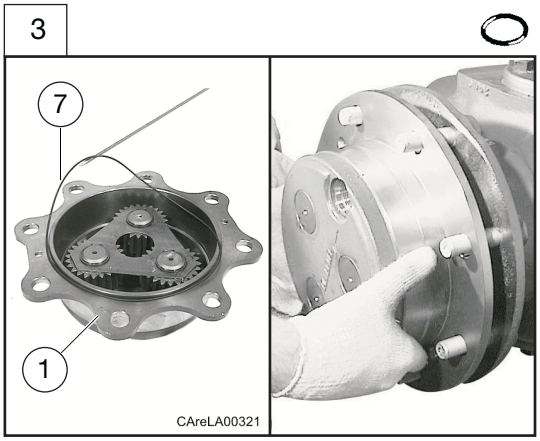
Note: *with new planetary gears is advisable to assembly new roller bearings.*

2



Position the planetary carrier on a workbench.
Insert the thrust washers (**2**) and the epicyclic gears (**4**) in the planetary carrier pins.
Insert the needles bearing (**3**) in the epicyclic gears (**4**).
Assemble the triangular plate (**5**) and the related Seeger rings (**6**).

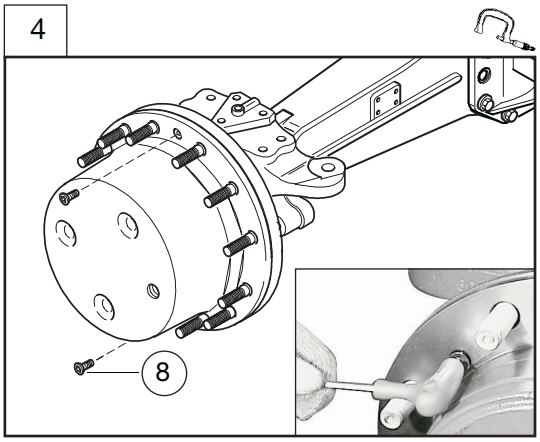
3



Assemble a new O-ring (**7**) on the planetary carrier (**1**).
Assemble the epicyclic reduction gear on the wheel hub.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



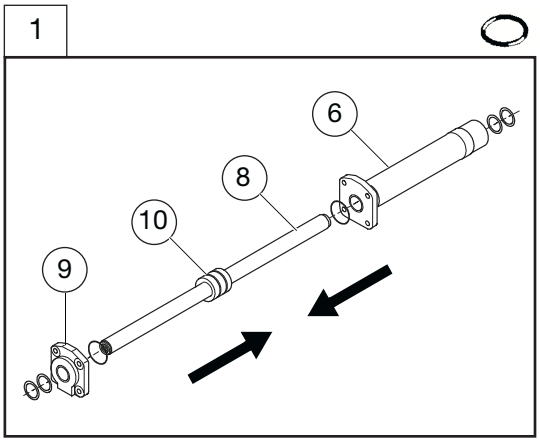
Tighten the fastening screws (**8**) with a dynamometric wrench to the requested torque (Sec. C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.7 Steering cylinders group assembly

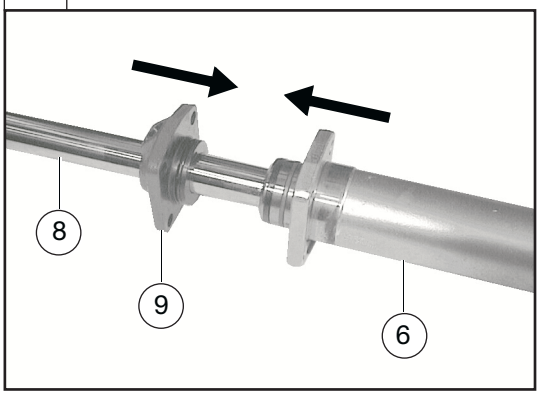
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



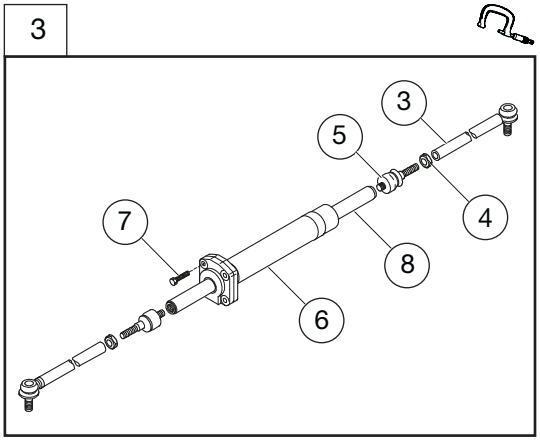
Assemble new seal rings: on the cylinder head (**9**), on the piston (**10**) and on the cylinder body (**6**).

2



Slide pre-assembled rod (**8**) into the cylinder body (**6**).

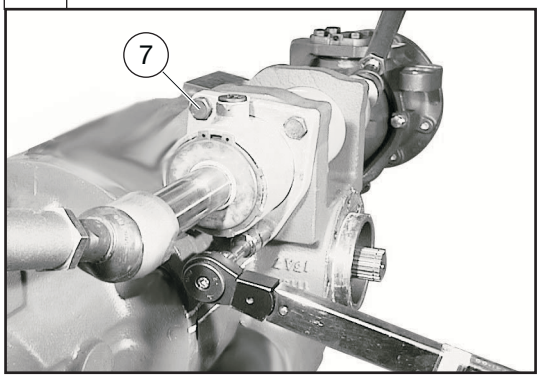
3



Fit the guide rods (**3**), the spherical joint (**5**) and the nut (**4**) to the ends of the cylinder rod (**8**) then tighten with dynamometric wrench to the requested torque (Sec. C.7).

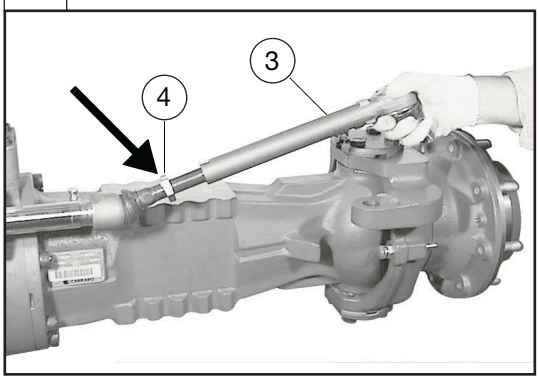
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



Install the steering cylinder on the central body, with guide rods already assembled on the stem.
Assemble and tighten the steering cylinder fastening screws with dynamometric wrench to the requested torque (Sec. C.7).

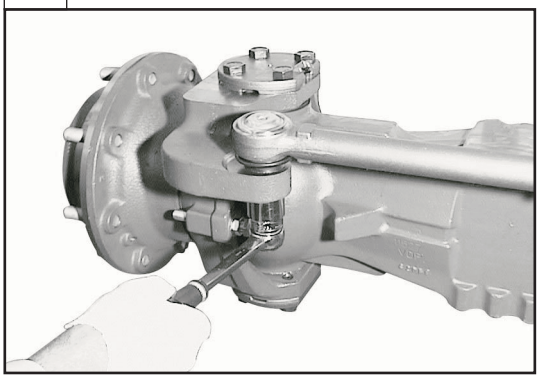
5



Align the swivel housings with the axle (parallel wheel hub).
Screw the guide rod (**3**) so that the ball joint can be inserted into the swivel housing arm.

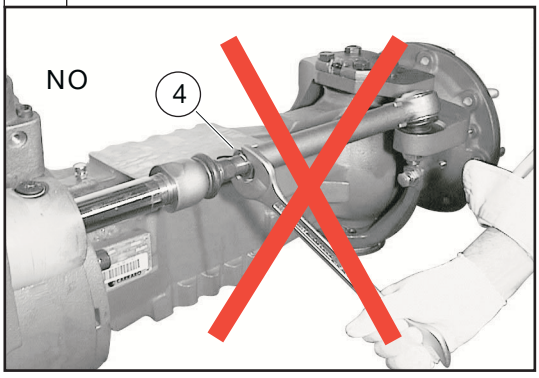
***Note**: it is important to unscrew the locking nut (**4**) to carry out this operation.*

6



Insert the ball joint into its own housing on the swivel housing.
Assemble and tighten the lock nut with dynamometric wrench to the requested torque (Sec. C.7).

7



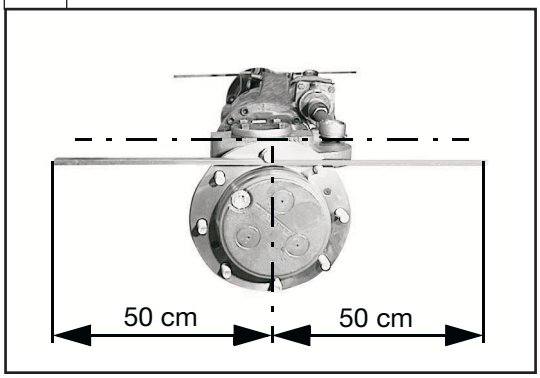
Screw in the lock nut of the guide rod only when the toe-in adjustment has been carried out.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.8 Toe-in adjustment

Some of the following pictures may not show exactly your axle, but the procedure is the same.

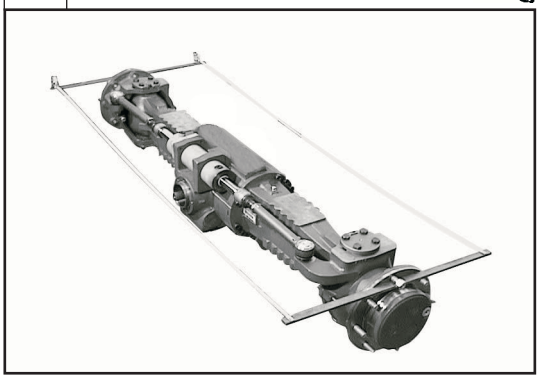
1



Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

***Warning**: The two bars should be fixed on their middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis. Align the two bars.*

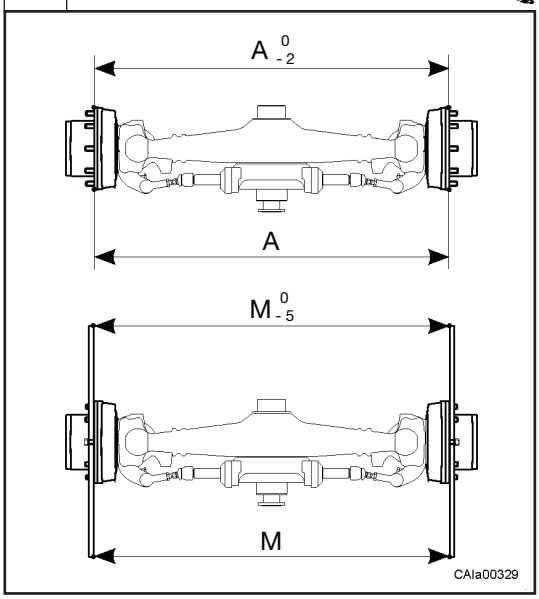
2



Measure the distance in mm (**M**) between the bars ends with a tapeline.

***Note:** Keep the minimum value, swinging the measurement point.*

3

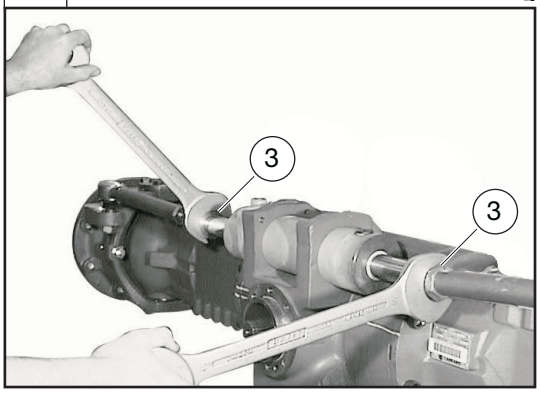


Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.
See: “Toe-in” in sec.C.4.
The nominal toe-in value (**A**) is referred to the external diameter of the wheel hubs flange, therefore the measured value (**M**) at the bars ends must be related to the ratio between length of the bar and flange diameter

nominal toe-in (sec.C.4) = A $^{0}_{-2}$ -> measured toe-in = M $^{0}_{-5}$

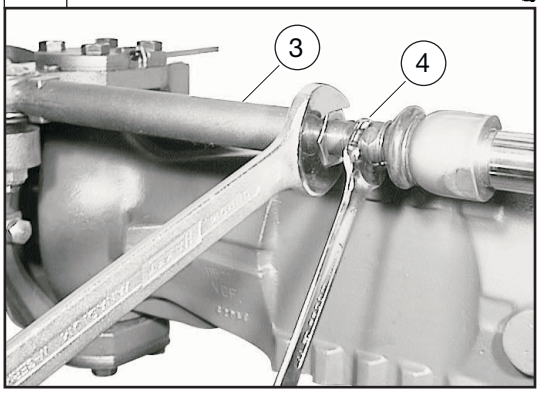
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



If toe-in is incorrect, operate with two wrenches on the guide rods (**3**) screwing in and out the two joint tie rods equally till the toe-in is within the requested tolerance.

5



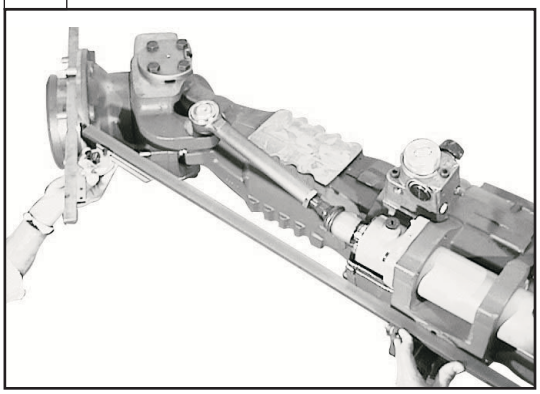
After adjusting, screw in the lock nuts (**4**) of the guide rods (**3**) to the requested tightening torque (Sec.C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.9 Steering angle adjustment

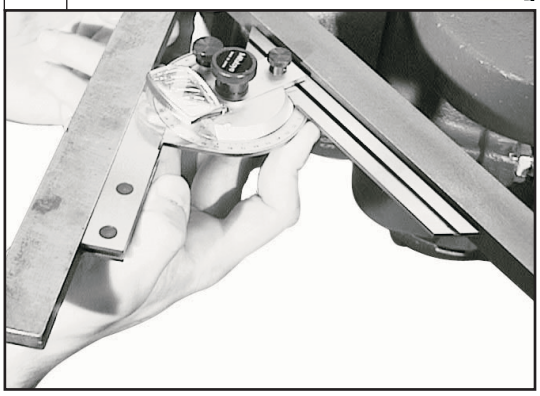
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



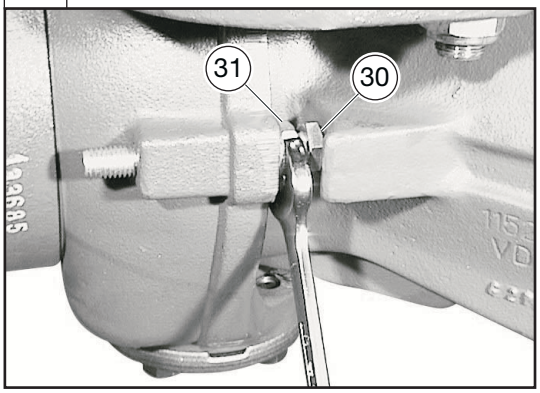
Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

2



Adjust a goniometer to the requested angle (Sec. C.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



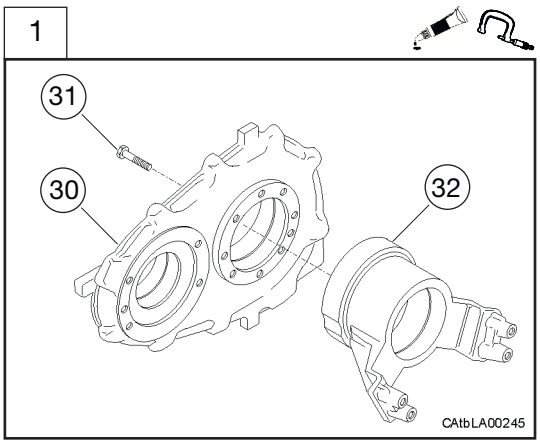
Adjust the steering mechanical retainer, screwing in or out the special screws (**30**), locking them with a locknut (**31**) to the requested tightening torque (Sec.C.7).
Steer completely towards the other side and repeat the same operations.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.10 Transmission box assembly

Some of the following pictures may not show exactly your axle, but the process is the same.

1

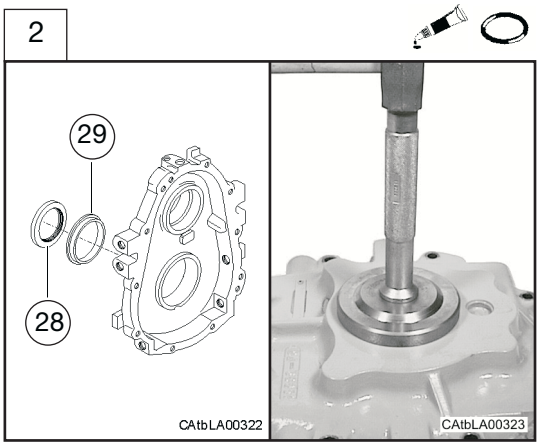


Assemble the support (**32**) to the transmission half box (**30**) with the fastening screws (**31**).

Note: *spread a film of Loctite® 270 on screws thread before assembly.*

Tightening the screws to the requested torque (Sec. C.7).

2

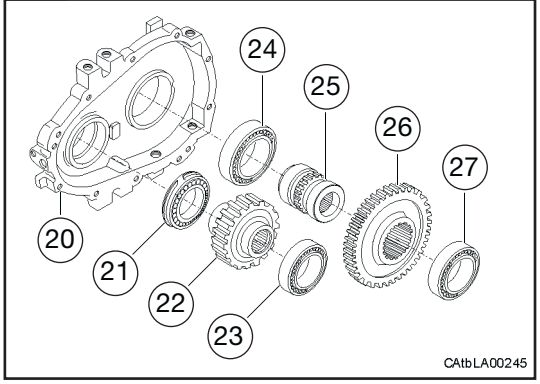


Position the second half box on a flat surface.
If necessary assembly the bush (**29**).

Note: *spread a film of Loctite® 496 on the bush (**29**) contact surface.*

Assemble the seal ring (**28**) using the special tool CA715298.

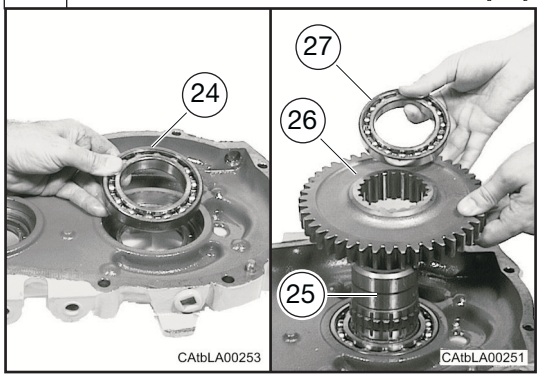
3



See: parts numbering.

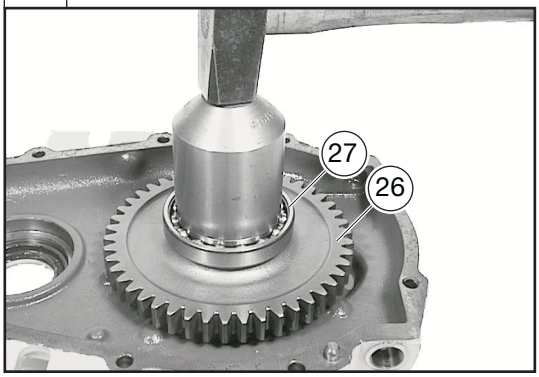
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



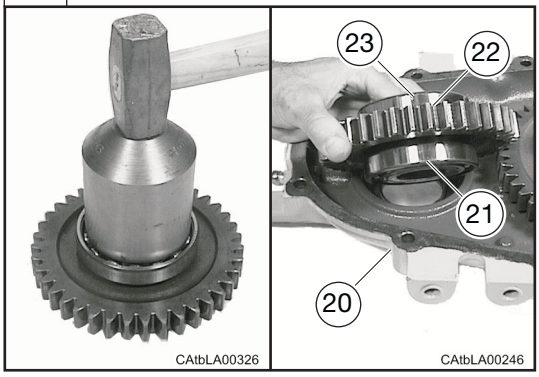
Assembly the bearing (**24**) and the shaft (**25**) to the half box.
Insert the gear (**26**) and the ball bearing (**27**) on the shaft (**25**).

5



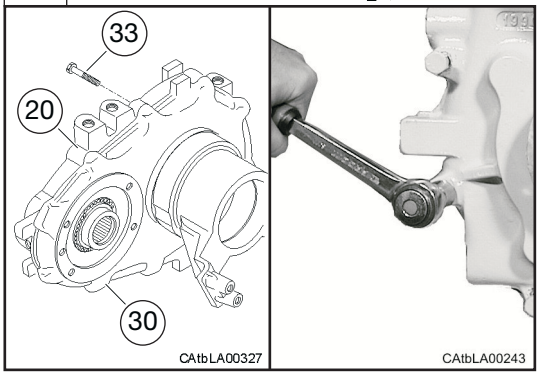
Fit the gear (**26**) and the bearing (**27**) using the special tool CA715445.

6



Position the gear (**22**) on a workbench.
Assemble the two bearings (**21**, **23**) to the gear (**22**) using the special tool CA715403.
Assemble the group gear-bearing-shaft to the half box, fitting it by mean of a hammer and a pad.

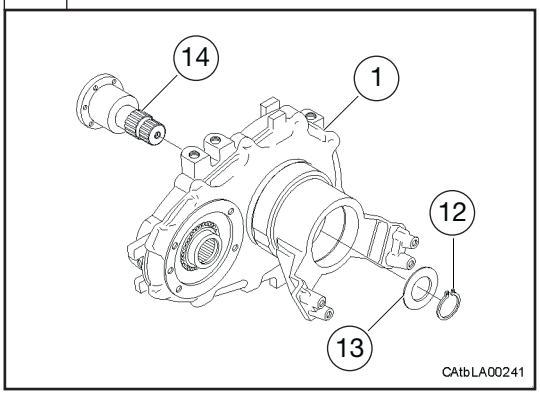
7



Cleaning well the contact surfaces and spread a film of Loctite® 510.
Assemble the half boxes (**20**, **30**) using a soft hammer to fit.
Tighten the fastening screws (**33**) with dynamometric wrench to the requested torque (Sec.C.7).

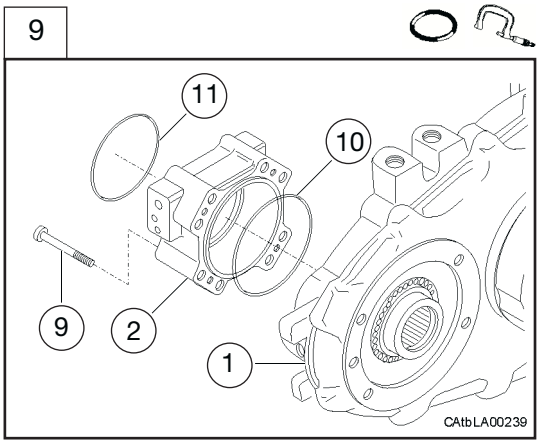
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



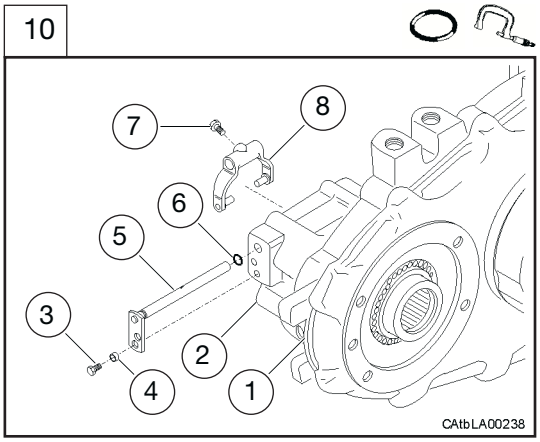
Insert the shaft (**14**) on the transmission box.
Assemble the lock ring (**12**) and the washer (**13**) on the shaft (**14**).

9



Insert new well lubricated O-Rings (**10**, **11**) in the motor flange (**2**).
Assemble the motor flange (**2**) with the fastening screws (**9**) to the requested torque (Sec.C.7)

10



Assemble a new well lubricated O-Ring (**6**).
Position the fork (**8**) in the motor flange (**2**).
Insert the fork control shaft (**5**) in the motor flange (**2**) and in the fork (**8**).

Note: *do not tighten the screw (**7**) before inserting the sleeve coupling.*

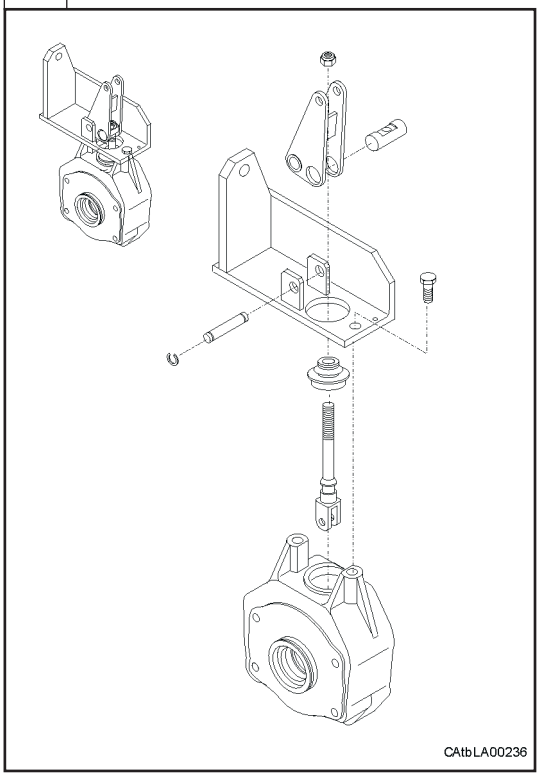
Assemble the screw (**3**) and the bush (**4**) in the motor flange (**2**).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.11 Parking brake assembly

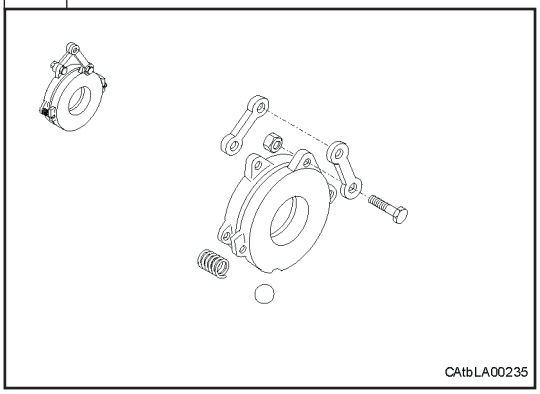
Some of the following pictures may not show exactly your axle, but the process is the same.

11



If necessary, assemble control brake parts as in figure.

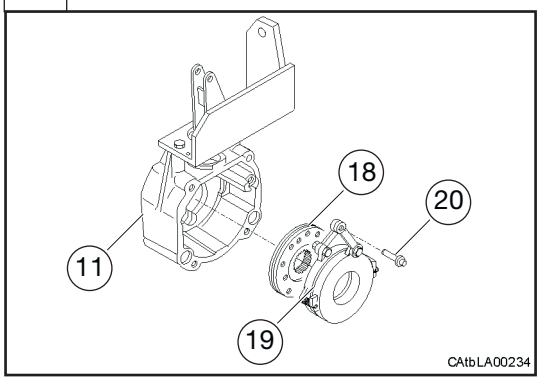
12



If necessary, assemble actuator body as in figure.

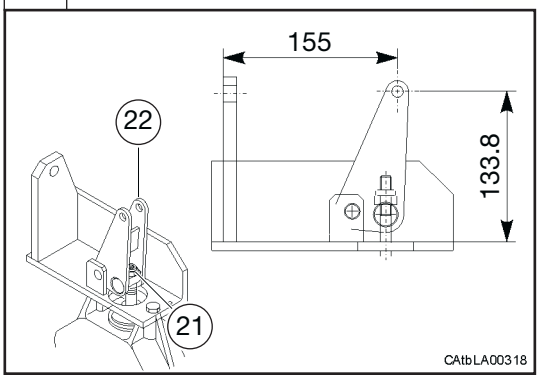
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

13



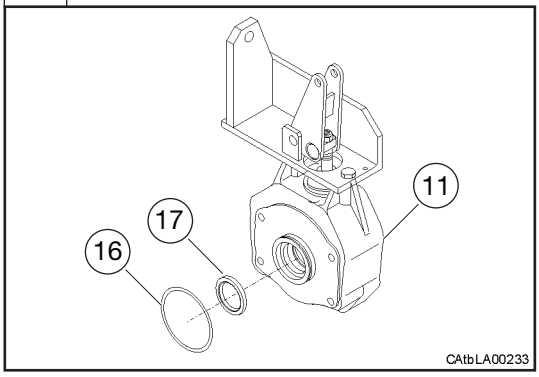
Insert the pin (**20**) to fit the actuator body (**19**) and the brake disk (**18**) in the brake box (**11**).

14



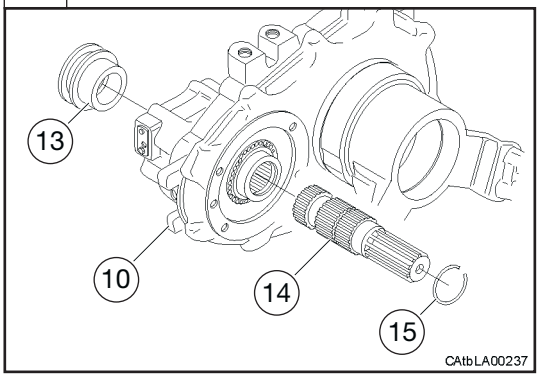
Adjust the nut (**21**) to position the brake lever (**22**) as in figure.

15



Assemble a new well lubricated O-Ring (**16**) and new seal ring (**17**), using the special tool CA119102, in the brake box (**11**).

16



Fit the lock ring (**15**) to the shaft (**14**).
Insert the brake shaft (**14**) in the transmission box (**10**).
Assemble the sleeve coupling (**13**) to the brake shaft (**14**) and to the fork.
Lock the fork with related lock screw.
See: sec.E.10.10, part.(**7**, **8**).

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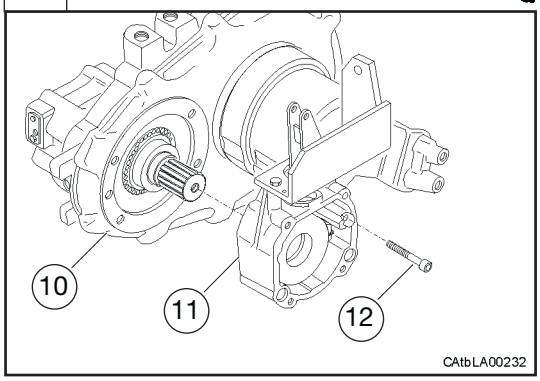
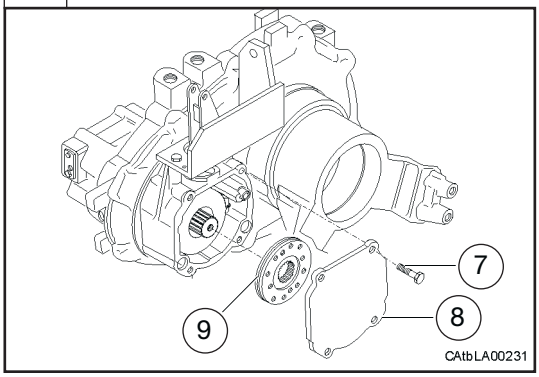
17



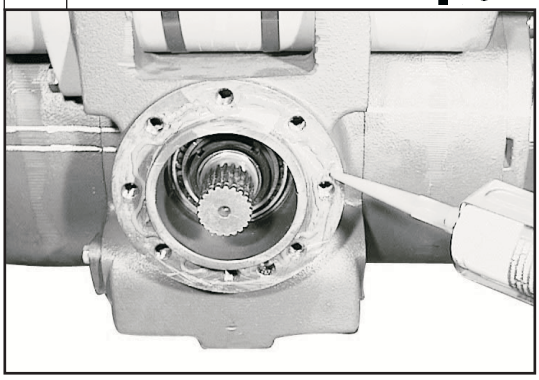
Assemble the brake box (**11**) to the transmission box (**10**).
Note: before assembly, insert transmission box fastening screws in the transmission box support.
Assemble the brake box (**11**) fastening screws (**12**) to the requested torque (Sec.C.7).

18



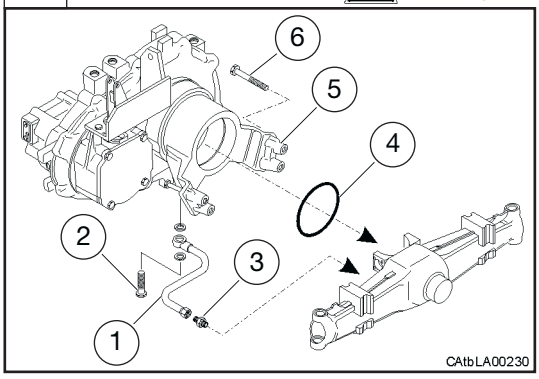
Assemble the brake disk (**9**) and the cover (**8**).
Assemble the cover (**8**) fastening screws (**7**) to the requested torque (Sec.C.7).

19



Cleaning well the support (**5**) contact surfaces and spread a film of Loctite® 510 as in figure.

20



Insert a new O-Ring (**4**) in the support (**5**).
Assemble the transmission box to the axle.

Warning: *do not damage the O-Ring (**4**) during assembly operation.*

Tighten the fastening screws (**6**) to the requested torque (Sec.C.7).

Note: *spread a film of Loctite® 270 on screws thread before assembly.*

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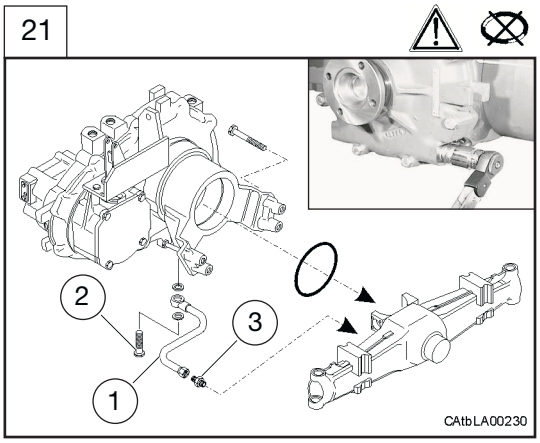
21



Restore the hydraulic connection between axle and transmission.
Assemble the oil recirculating pipe (**1**) and the relative fastening parts (**2**) and (**3**) then tighten them to the requested torque (Sec.C.7).

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 WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.
Check and see that the brakes are regulated correctly and functioning properly.

F TROUBLESHOOTING

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 Incorrect installation / defective axle
Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

2 Overloading / incorrect weight distribution
Remove excessive weight and redistribute load, following instructions related to the vehicle.

3 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.

4 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.

5 Bent halfshaft
Replace halfshaft.

6 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.

7 Incorrect wheel adjustment
Verify group integrity and wheel side bearings.
Adjusting according.

8 Spoiled or worn out axle parts
Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.

9 Contamination in the axle box or incorrect assembly of parts
Look for foreign particles. Check assembly of the various parts of the axle.

10 Incorrect adjustment of bevel gear set: Parts of the transmission worn out (transmission gears, U joints, etc.)
Replace or adjust as required.

11 Incorrect use of the product
See the vehicle producer‘s instructions once again.

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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.*

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Problem	Cause	Action
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.*
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 0,1 mm 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.*

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F.2 Axle problem and diagnosis

Problem	Cause	Action
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*

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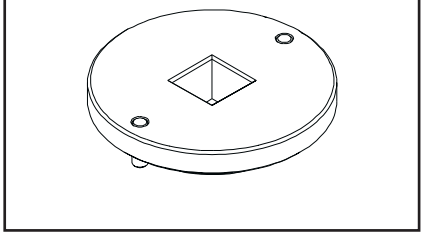
G SPECIAL TOOLS

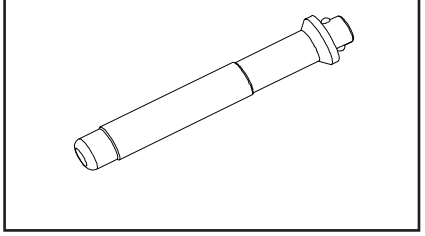
G.1 Special tools

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.

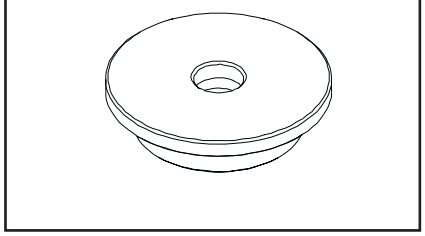
CA119030	Wrench



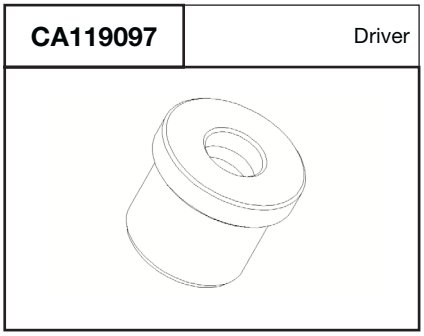
CA119033	Handle



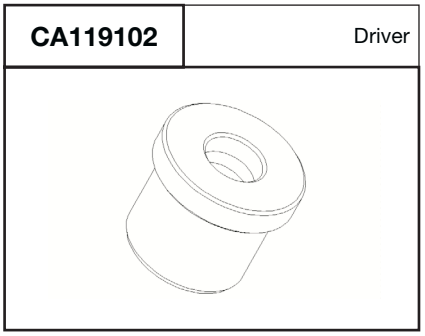
CA119068	Driver



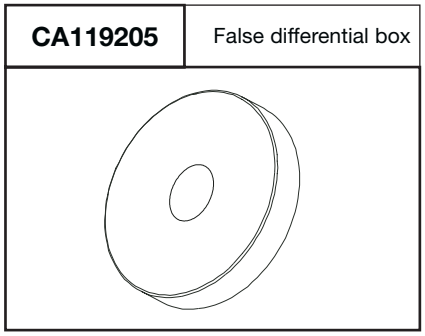
CA119097	Driver



CA119102	Driver



CA119205	False differential box



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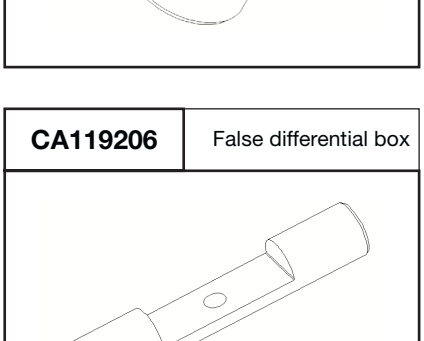
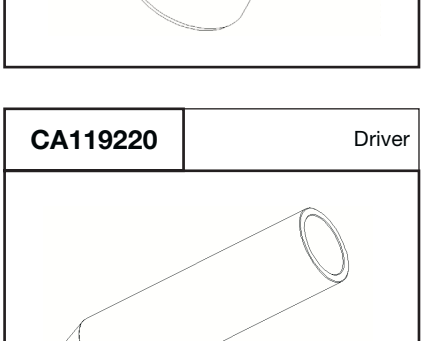
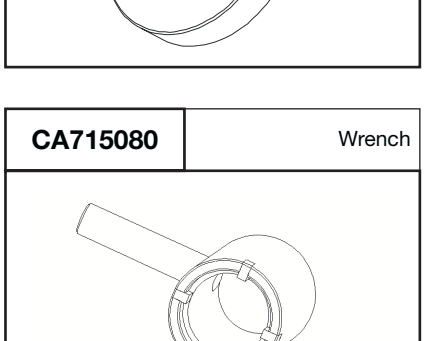


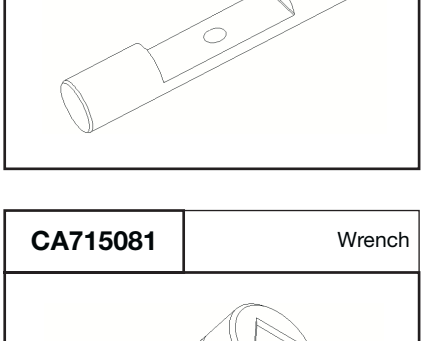
CA119220	Driver



CA715080	Wrench



CA715081	Wrench



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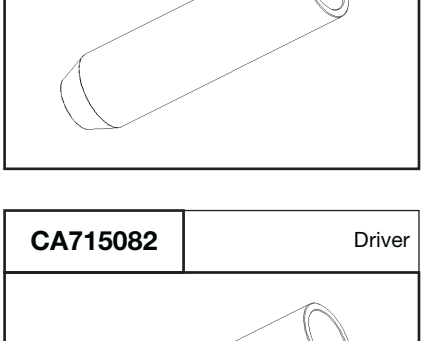

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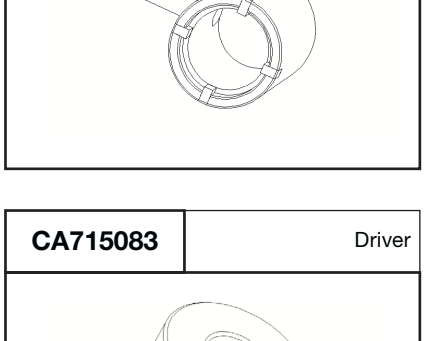

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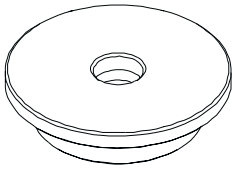
CA715085	Driver



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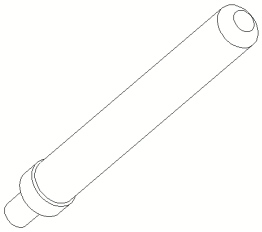
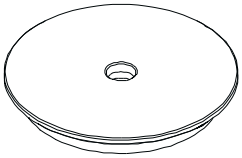
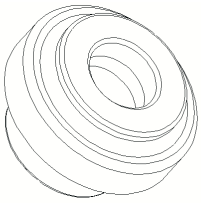


CA715099	Driver

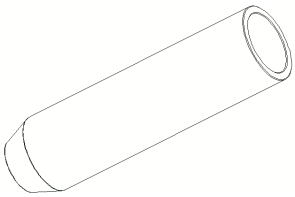


CA715298	Driver

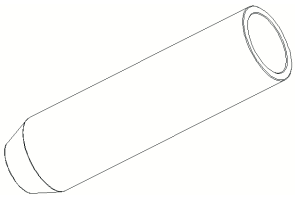
CA715360	Driver



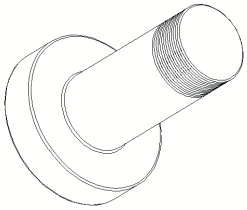
CA715403	Driver



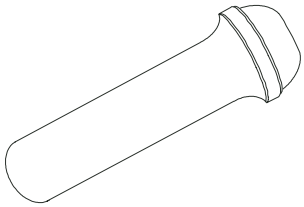
CA715445	Driver



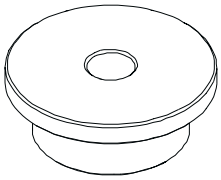
CA715450	False pinion



CA715451	Driver

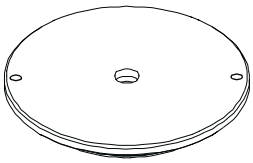


CA715453	Driver



CA715454	Driver

CA715492	Puller



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REAR AXLE

Mod. 26.11

Rif. CA144610

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C GENERAL SPECIFICATIONS

C.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:

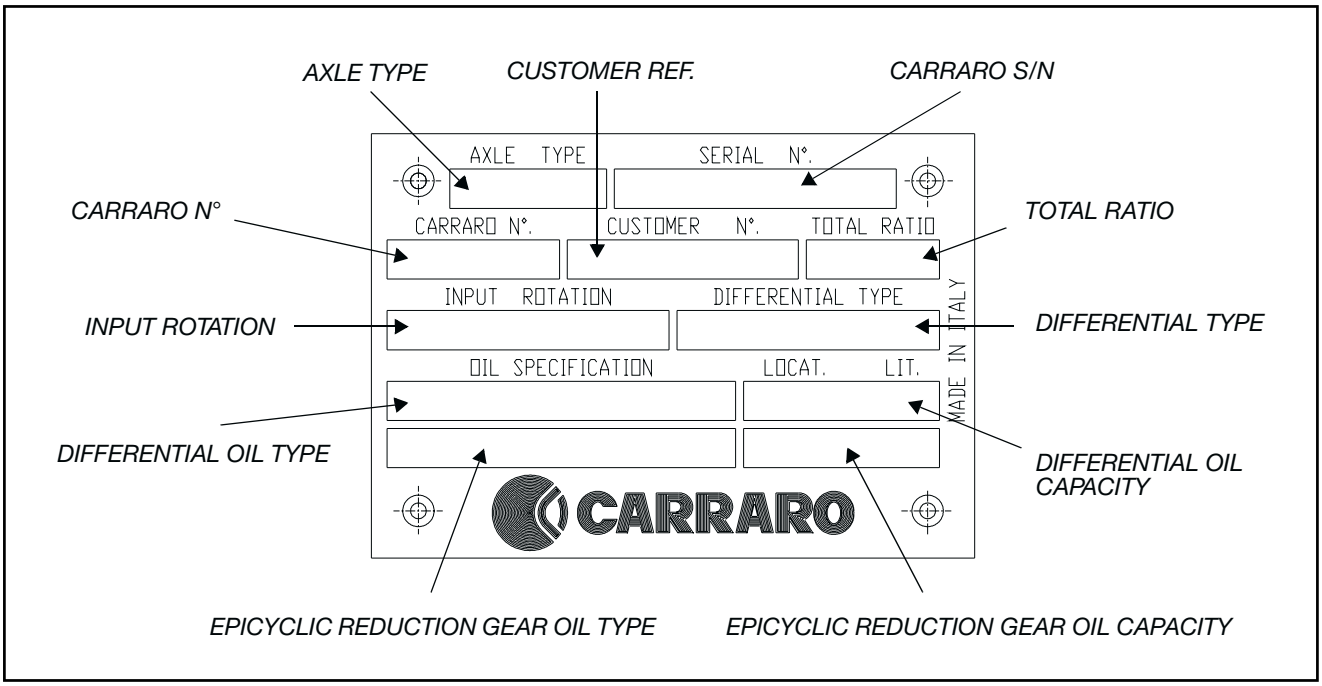
- increasing of tractive force, reducing the number of revolutions
- adjusting of inner wheels' speed with outer wheels' speed during steering.

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.

C.2 Product identification

Axle serial plate



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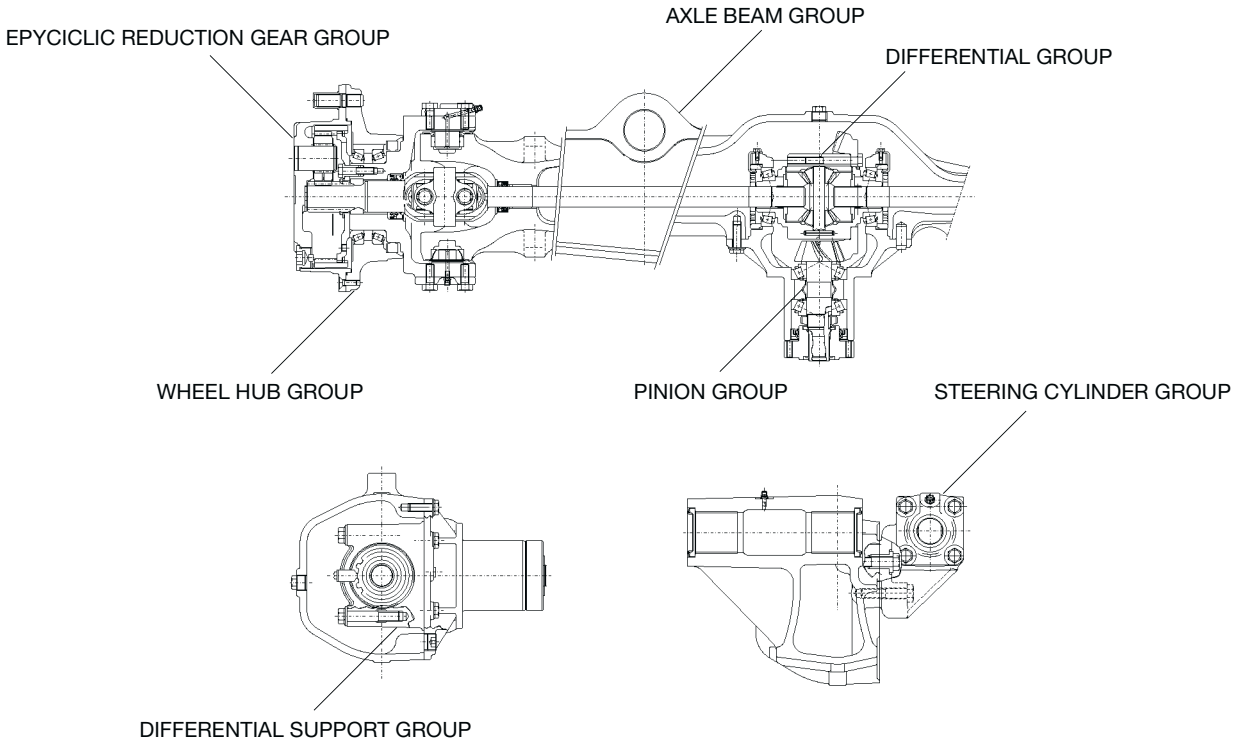
C.3 General description

The axle described in this manual designed and manufactured following the client requests, consists of a beam casing housing the differential and a wheel hub unit at each end.
The differential 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 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 by means of adjustable guide rods to correct the toe-in.



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C.4 Technical Features

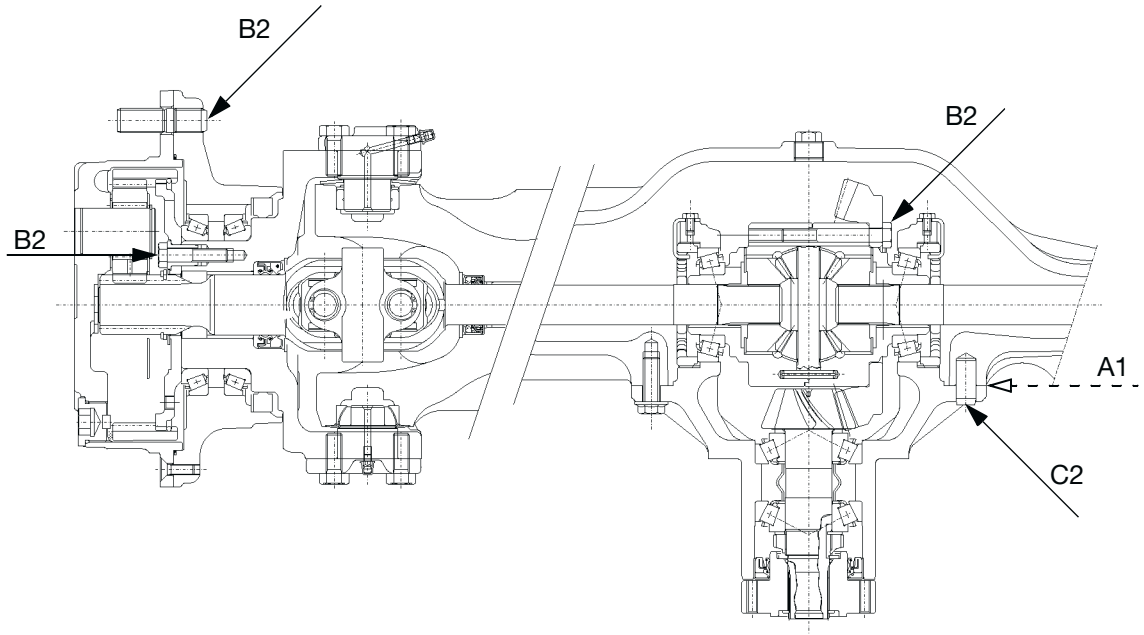
MACHINE	**Rear Axle**
CODE	**CA144610**
MODEL	**26.11**

DIFFERENTIAL TYPE	
Open	●
Limited Slip	○
Limited Slip “Ball Type”	○
100% Mechanical lock, hydraulically controlled (positive or negative)	○
With multidisc clutch in oil bath hydraulically controlled	○
100% Mechanical, electromagnetically controlled	○
“No spin”	○

DESCRIPTION	**VALUES**
Bevel gear ratio	2.46 / 1
Epicyclic reduction gear ratio	6.00 / 1
Total ratio	14.7 / 1
Dry weight	238 Kg
Input rotation CLOCK WISE (C.W.) COUNTER CLOCK WISE (C.C.W.)	 ● ○
Steering angle	$36^{\circ}\ {}^{0}_{-0.2}$
Toe-in	$A^{\pm 1}$
Bevel gear set backlash	0.16÷0.22 mm
Pinion bearings preloading (measured D=30.5 mm without seal)	P= 10.5÷15.7 daN
Total pinion-ring gear bearing preloading (measured D=30.5 mm without seal)	T= (P+4.2)÷(P+6.4) daN
Differential oil capacity	5 Liter
Epicyclic reduction gear oil capacity each side	0.6 Liter
Oil specification Note: DO NOT USE SYNTHETIC OR VEGETABLE OIL WITHOUT CONSENT OF THE AXLE MANUFACTURER	SAE 80W to comply API GL4 respectively MIL-L-2105
Grease specification	TECNOLUBE SEAL POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2
Differential input flange	DIN1310

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Sealing compounds and adhesives

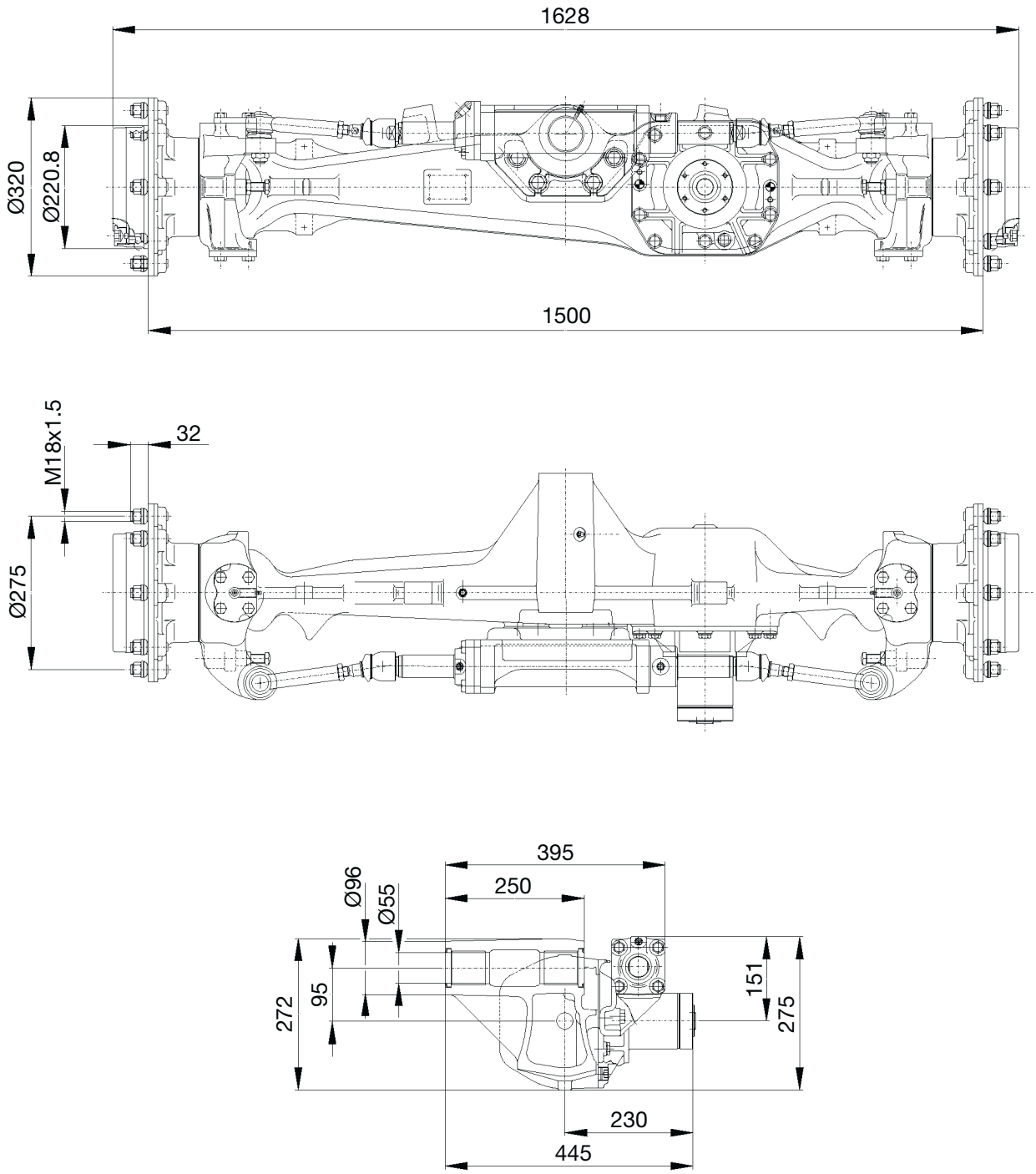


CAla00332

A1 = LOCTITE® 510	●	**B2** = LOCTITE® 270	●
A2 = LOCTITE® 573	○	**C1** = LOCTITE® 405	○
A3 = LOCTITE® 518	○	**C2** = LOCTITE® 496	●
B1 = LOCTITE® 542	○	**C3** = LOCTITE® 638	○
◁ - - - - -	Apply on the contact surfaces		
←	Apply on bolt screws / on pins		

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

Overall dimensions (Millimeters)

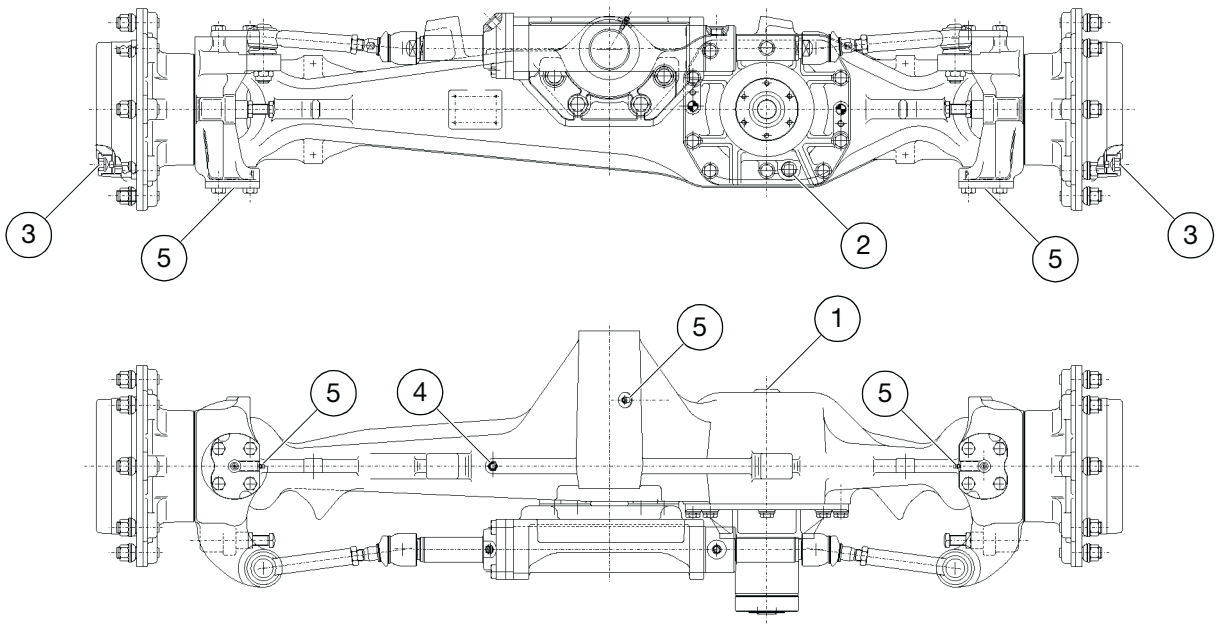


DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.5 Filling and checks

DESCRIPTION	POSITION
Oil filling and level plug	**1**
Oil drain plug	**2**
Level, filling and drain plug of epicyclic reduction gear oil	**3**
Oil breather	**4**
Greasing point	**5**

Routine checks:
In the axle, lubricant should be flush with control plug (**1**), if not, make up level with the same oil.
See: section C.8
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.



CAIa00334

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.6 Service schedule

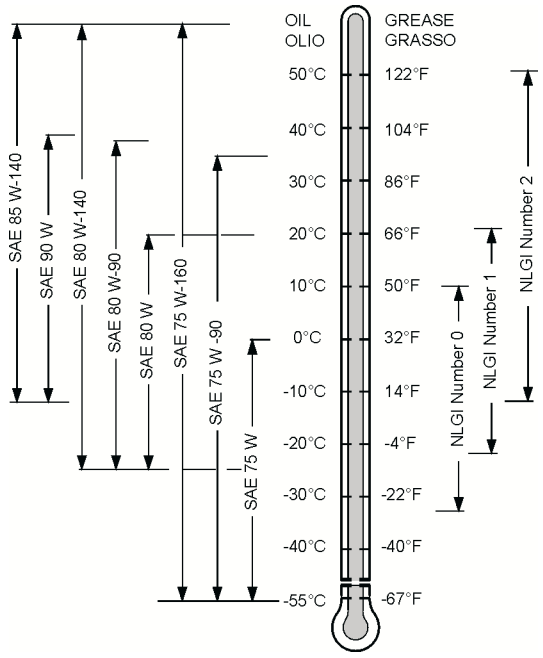
Operation	▲ First time	◆ Seasonally or every 1500 operating hours (1)
Axle oil change	150 - 200 hours ●	◆ ■
Lubrication works	▲ ■	◆ ■
Check and adjust oil level	50 - 100 hours ■	monthly ●
Clean magnetic oil plugs	150 - 200 hours ■	every oil change ●
Clean oil breather	▲ ■	monthly ●
Greasing	150 - 200 hours ●	weekly ●

remarks

- ● operation performed only by personnel authorized by the manufacturer
- ■ operation performed only by trained personnel

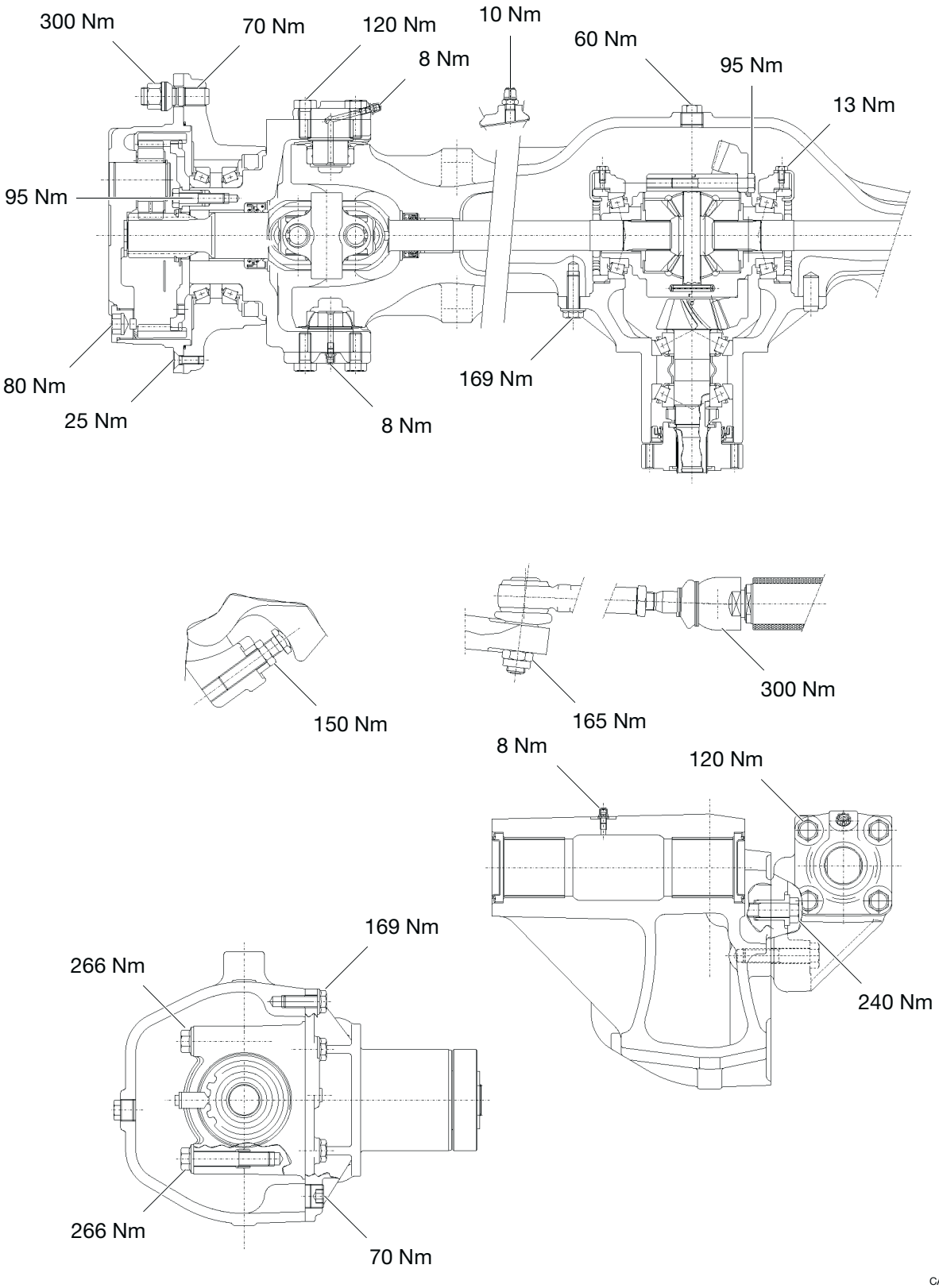
(1) which of both conditions comes first

Lubrication / greasing:
grades and application range



DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.7 Tightening torques



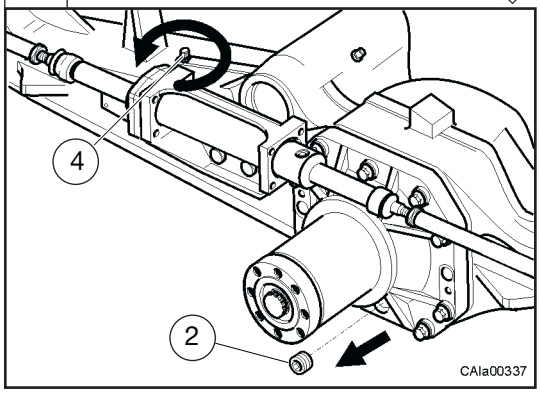
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

C.8 General checks

The disassembly/assembly instructions presume that the unit has been removed from the vehicle and positioned on a suitable workbench.

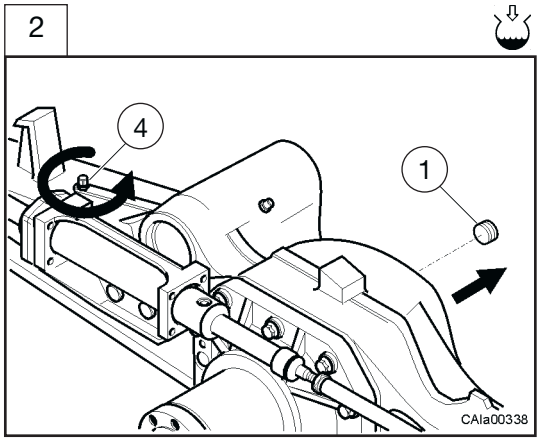
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



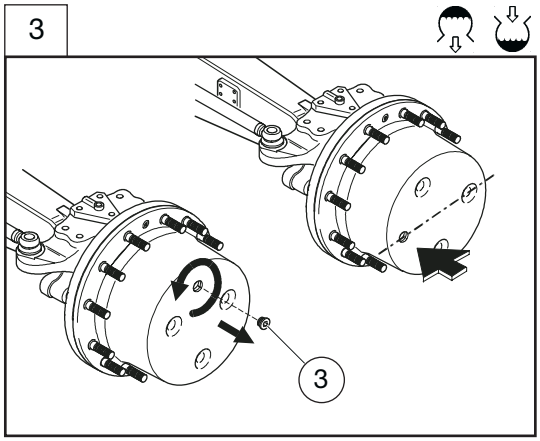
See: Section C.5
Before draining the oil, loosen the breather (**4**) to release possible internal pressure (Sec.C.5), then tighten the plug with a torque wrench to the prescribed torque (Sec.C.7).
Drain the oil from the appropriate plug (**2**).
Tighten the plug (**2**) to the prescribed torque (Sec.C.7).

2



Before draining the oil from the plug (**1**) (Sec.C.5), always loosen the breather (**4**) to release possible internal pressure.
Check oil level and top up if necessary.
Tighten the plug (**1**) to the prescribed torque (Sec.C.7).

3



Before draining the oil, position the wheel hub so that the filer cap is in the highest point, then loosen the plug (**3**) 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 (**3**) to the prescribed torque (Sec.C.7).

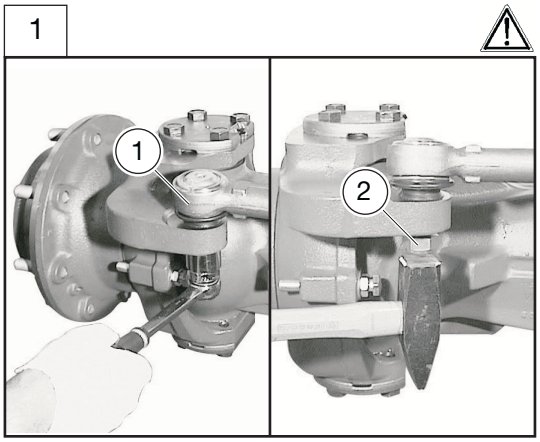
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D DISASSEMBLY OPERATIONS

D.1 Steering cylinder group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

1

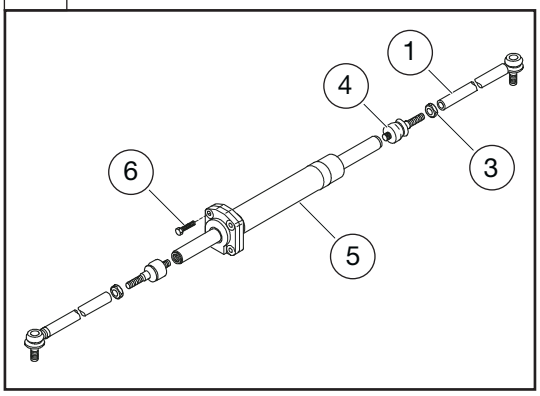


Unloose the guide rod (**1**) locknut (**2**) of some turns till it is over the end of the threaded pin.
Beat on the nut with a hammer in order to disjoin the guide rod from the swivel housing.

Warning: *do not beat on the end of the threaded pin.*

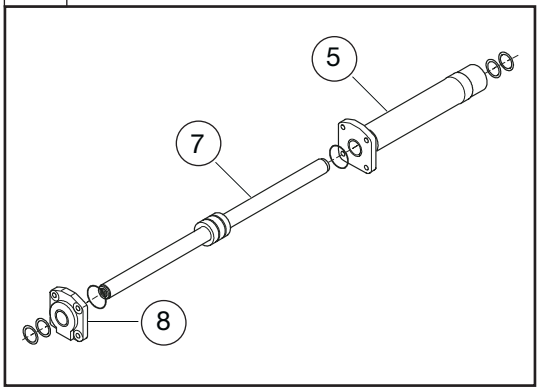
Note*: this is a destructive operation for the nut.*

2



Remove the guide rod link (**1**) by unloosing the nut (**3**) with a suitable wrench, then check its conditions.
Unscrew the fastening screws (**6**) of the cylinder, then take the cylinder (**5**) out of its housing and, if necessary, use a rubber hammer.
Remove only that parts that need to be overhauled and/or replaced.

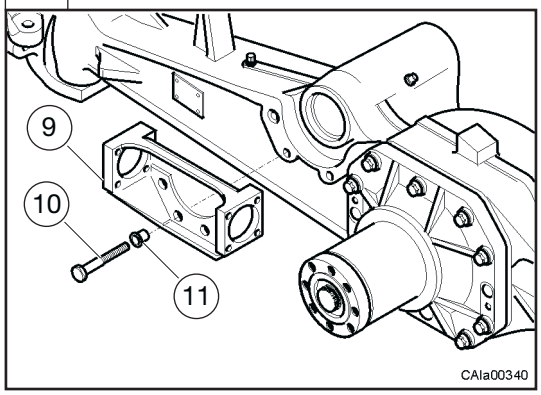
3



Separate the cylinder head (**8**) from the cylinder case (**5**).
Remove off the cylinder head and the rod (**7**) from the cylinder case.
Remove all the seals and O-Rings.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4

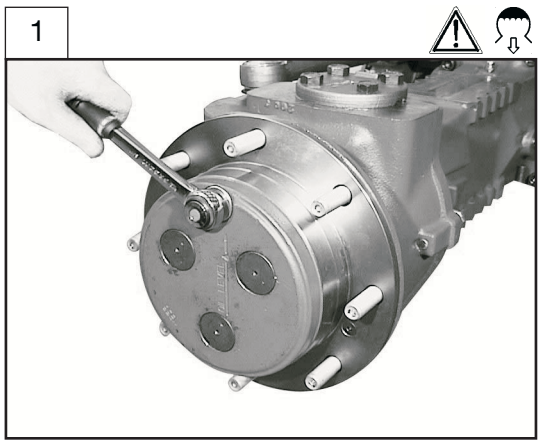


Remove the fastening screws (**10**) and collect the cylinder carrier (**9**).
If necessary remove the bushes (**11**).

D.2 Epicyclic reduction gear disassembly

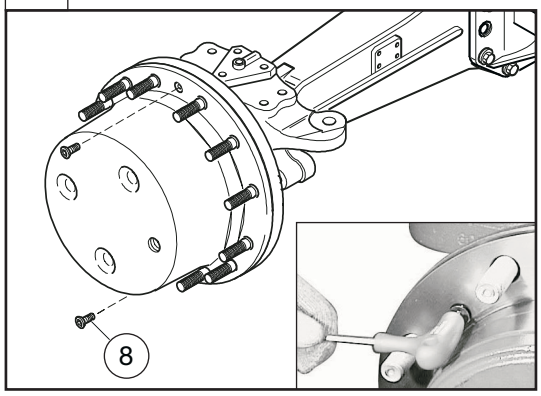
Some of the following pictures may not show exactly your axle, but the process is the same.

1



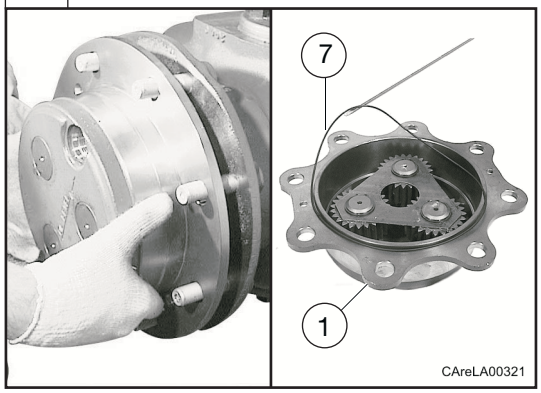
See: sections C.5 and C.8.
Before draining the oil, position the wheel hub with the plug on the upper part and loosen it of some turns in order to eliminate any possible inner pressure, then remove it completely. Turn the wheel hub upsidedown till the hole is in the lowest point.
Drain the oil completely.

2



Unscrew and remove both fastening screws (**8**) of the planetary carrier with a wrench.

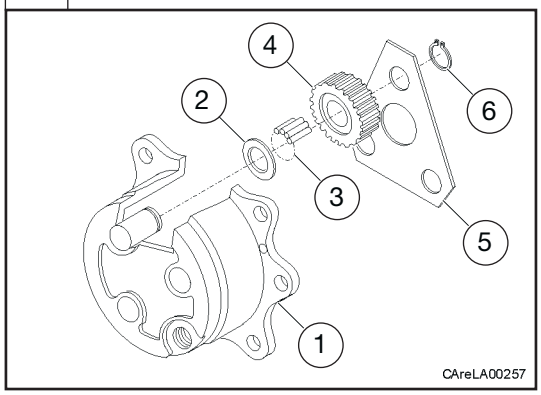
3



Remove the planetary carrier (**1**) from the wheel hub and collect the relative O-Ring (**7**).
Position the planetary carrier (**1**) on a workbench and check its wear conditions.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



To carry out any possible replacements of the planetary gears:

- remove the Seeger rings (**6**) on every pin;
- remove the triangular plate (**5**);
- take the planetary gears (**4**) out of the pins;
- collect the roller bearings (**3**), checking their conditions;
- collect the washer (**2**).

Note: *with new planetary gears is advisable to assembly new roller bearings.*

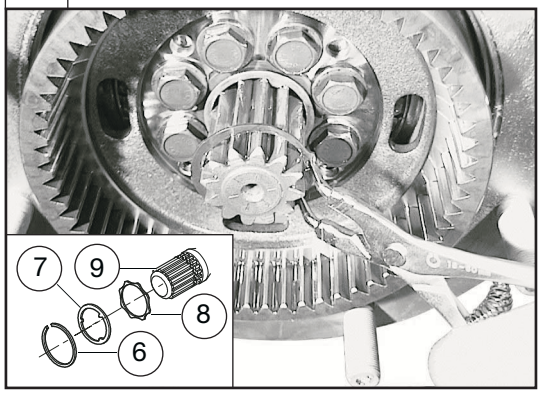
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.3 Wheel hub group disassembly

Before disassembling the wheel hub, 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.

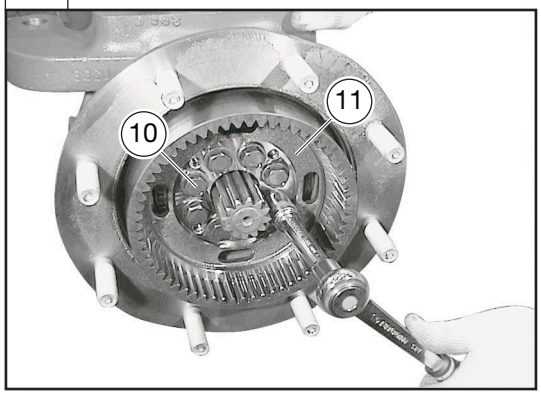
Some of the following pictures may not show exactly your axle, but the process is the same.

1



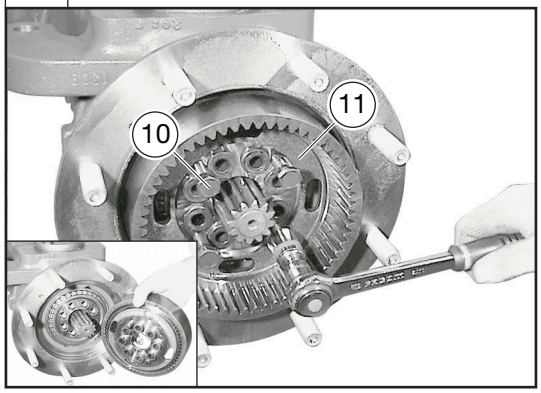
Remove the lock ring (**6**) from the U-Joint shaft (**9**) using a suitable pliers.
Collect the U-Joint shaft washers (**7**, **8**).

2



Unscrew and remove the fastening screws (**10**) from the wheel carrier group (**11**).

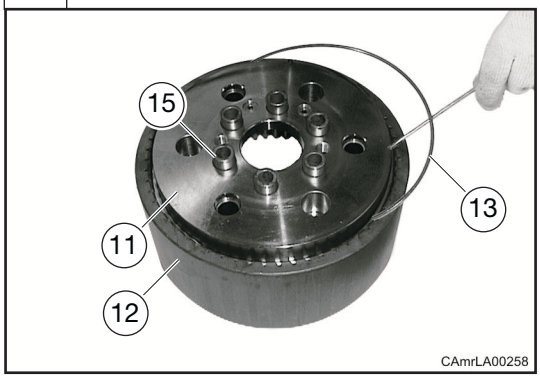
3



In order to remove the wheel carrier group from its housing, screw two of the just removed screws (**10**) in the threaded extraction holes.
Extract and remove the wheel carrier (**11**) together with the epicyclic ring gear (**12**).

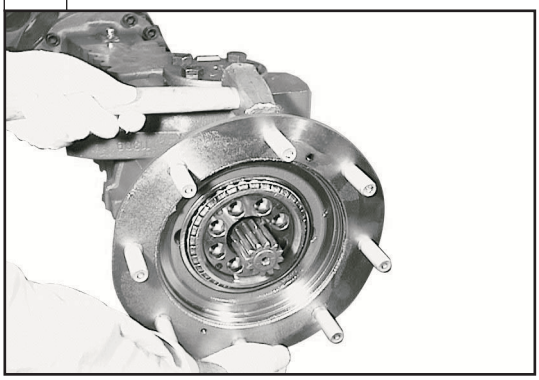
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



Remove the steel lock ring (**13**) and disjoin the wheel carrier (**11**) from the epicyclic ring gear (**12**).
Only if necessary, remove the centering bushes (**15**) from the wheel carrier with a hammer and the special tool CA715086.

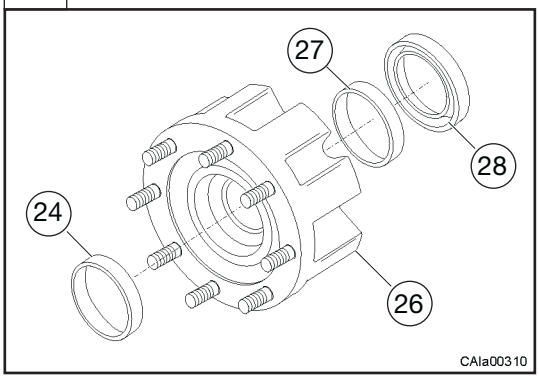
5



Remove the wheel hub, using levers and a hammer to facilitate the operation.

***Note**: collect the bearing cone.*

6

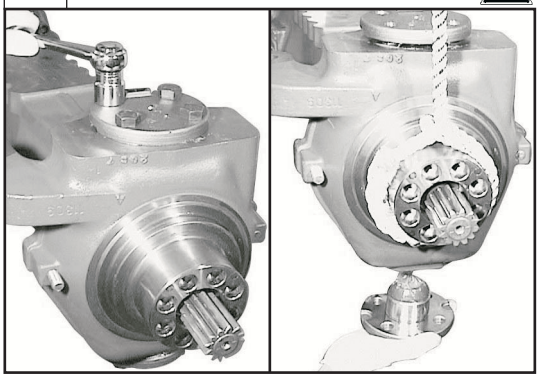


Position the wheel hub (**26**) on a flat surface and take the seal ring (**28**) out with a lever.

***Note**: this is a destructive operation for the seal ring.*

Take the bearing cups (**27**, **24**) out, using a hammer and a suitable drift or using a suitable extractor.

7



Remove the fastening screws from the upper and lower king pin.

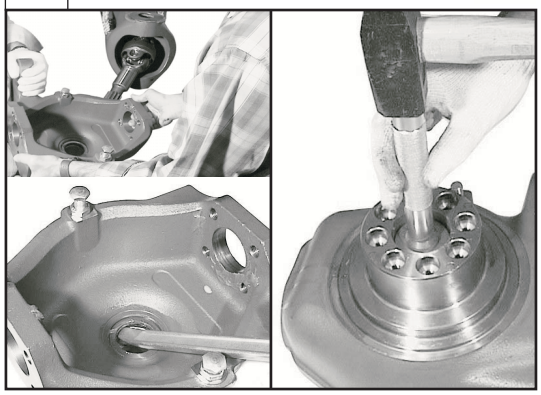
***Danger:** before removing the king pins, secure the swivel housing with a belt or a rope to a hoist or any other supporting device.*

Remove the king pins.

***Note:** collect the belleville washers and the shim.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



Remove the swivel housing from the axle beam and from the short shaft of the U-Joint.
Position the swivel housing on a flat surface and take the seal ring out with a lever.

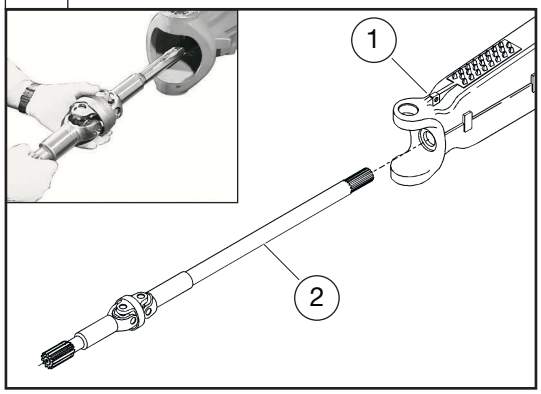
***Note**: this is a destructive operation for the seal ring.*

Turn the swivel housing and take the bush out, using a drift and a hammer.

D.4 Axle beam group disassembly

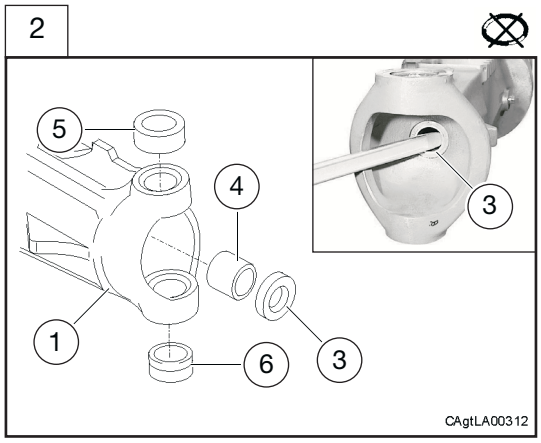
Some of the following pictures may not show exactly your axle, but the process is the same.

1



Remove the U-Joint (**2**) from the axle beam (**1**).

2



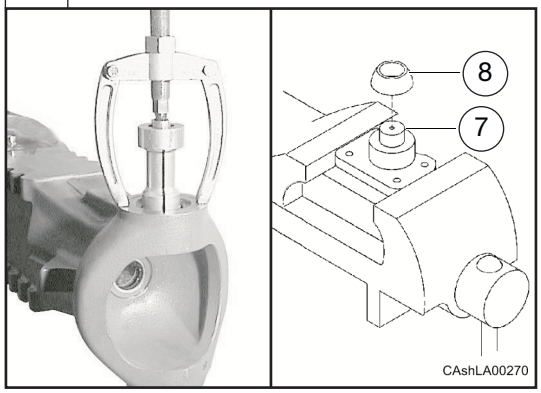
Take the seal ring (**3**) out of the axle beam (**1**) with a lever.

Note: *this is a destructive operation for the seal ring.*

Remove the bush (**4**) from the beam with a suitable extractor.

Note: *examine the bush before the removal and replace it only if the wear conditions require this.*

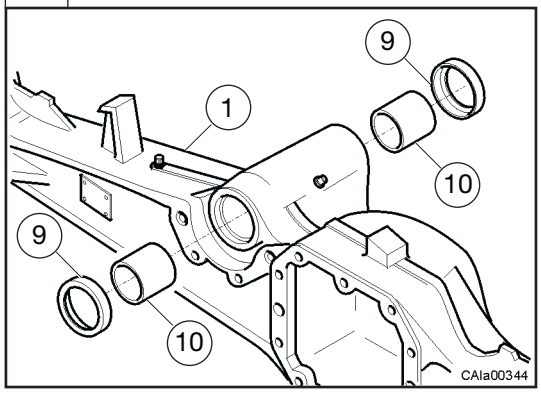
3



Take the upper (**5**) and lower (**6**, **8**)bushes out of the king pin housings (**7**) and out of king pin with a suitable extractor.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



Take the seal rings (**9**) out of the axle beam (**1**) with a lever.

Note: *this is a destructive operation for the seal rings.*

Remove the bush (**10**) from the beam with a suitable extractor.

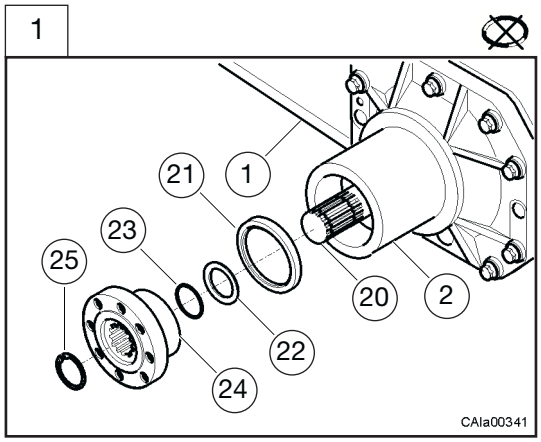
Note: *examine the bushes before the removal and replace only if the wear conditions require this.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.5 Differential support group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

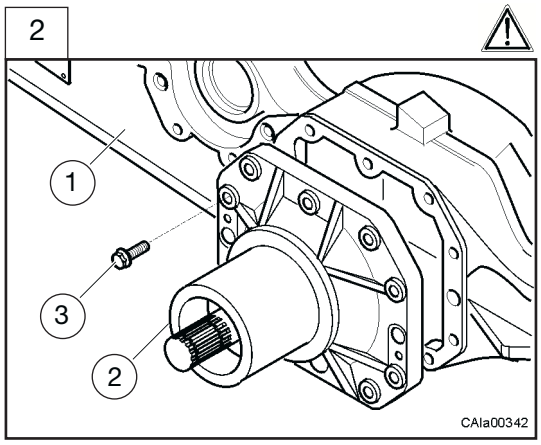
1



Remove the lock ring (**25**) from the pinion end.
Remove the flange (**24**).
Remove the O-Ring (**23**) and the washer (**22**).
Remove the seal ring (**21**) from the differential support (**2**).

Note: *this is a destructive operation for the seal ring.*

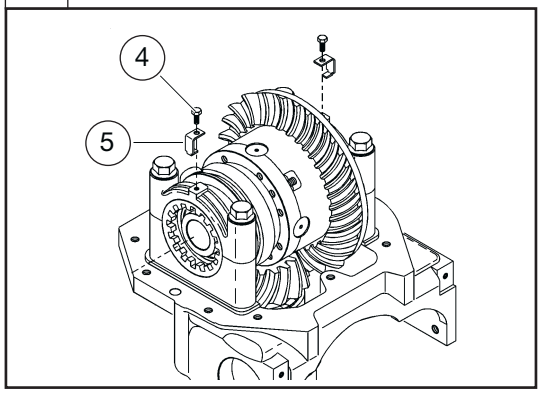
2



Loosen and remove the screws (**3**) on the differential support (**2**).
Remove the differential support (**2**) from the axle housing (**1**).

Warning: *support the differential support with a rope or other appropriate means.*

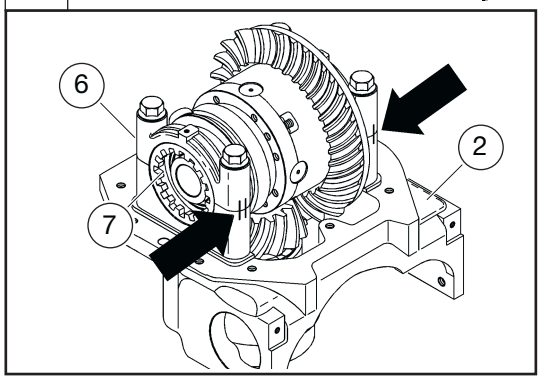
3



Loosen and remove the screws (**4**) to take out the two ring nut retainers (**5**).

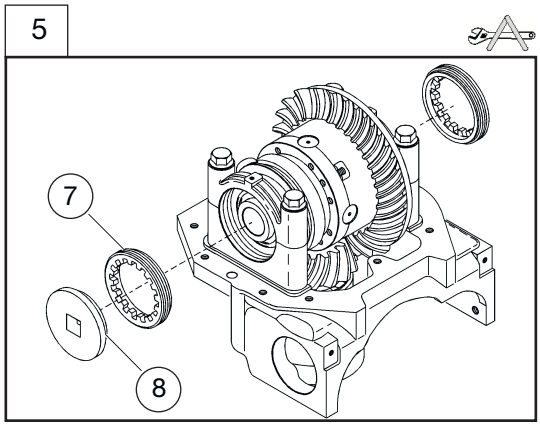
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



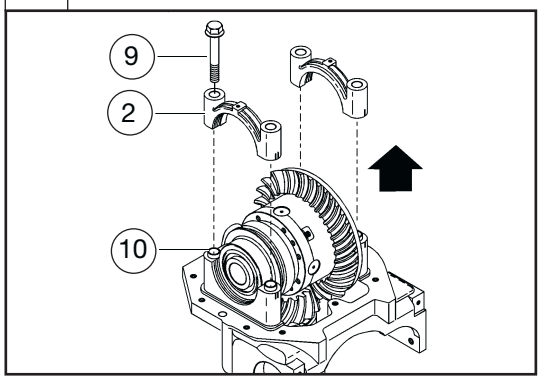
Before removing the bolts (**6**), mark both half-collars and the differential support with permanent reference marks to avoid inverting them during re-assembly. Mark the area between the ring nuts (**7**) and the differential support (**2**) as well.

5



Unscrew the adjuster ring nuts (**7**) using tools CA119030 (**8**) and a wrench.

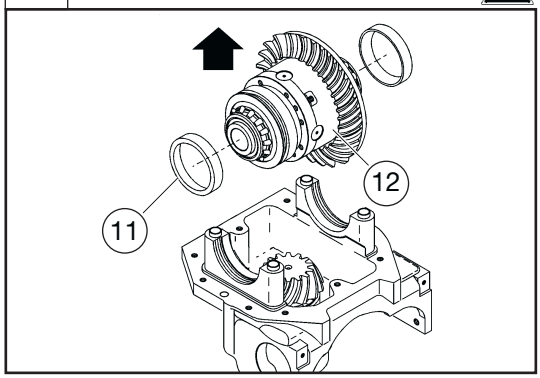
6



Remove the 4 screws (**9**) and remove both half-collars (**6**).

Note: *check that the bushes (**10**) remains in their housings.*

7



Take out the differential case (**12**).
Collect from ring gear side the cup bearings (**11**).

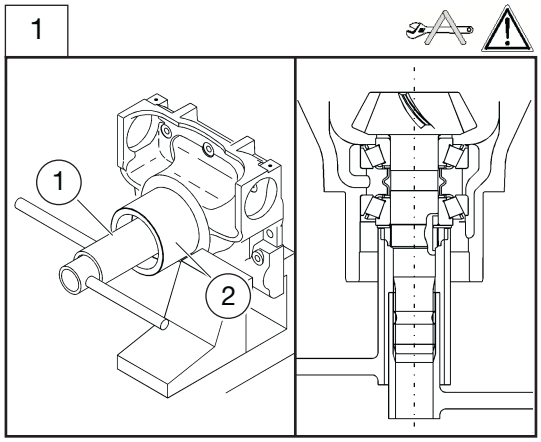
Warning: *don't mismatch the cup bearings if they are not to be replaced.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.6 Pinion group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

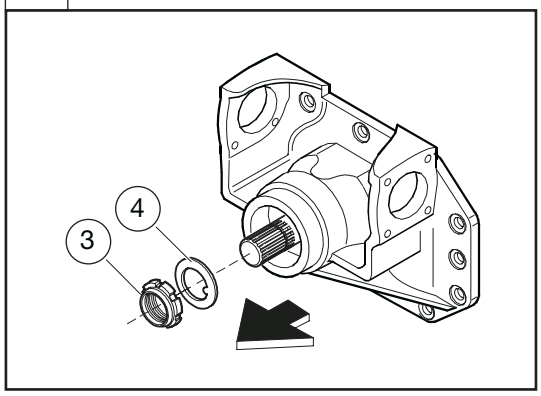
1



Fit the differential support (**2**) in a vise.
Unscrew the lock nut using special tools CA715080 and CA715081 (**1**).

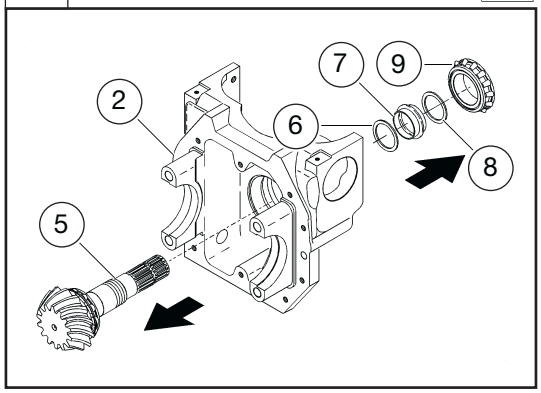
Note: *This operation will irretrievably damage the ring nut.*

2



Remove the ring nut (**3**) and collect its retaining washer (**4**).

3



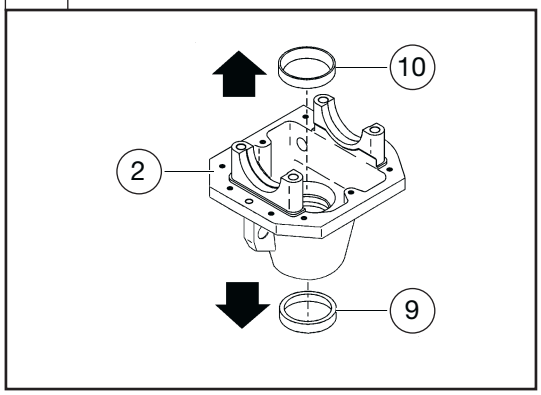
Tap the shaft with a soft hammer to remove the bevel pinion (**5**).

Warning: *take care not to drop the pinion.*

Collect the washers (**6**, **8**), the collapsible spacer (**7**) and the inner cone (**9**) of the tapered roller bearing.

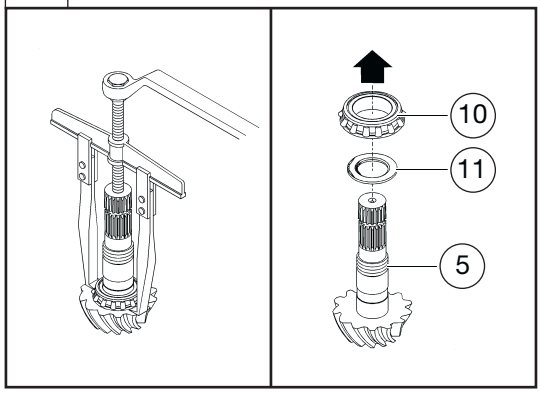
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



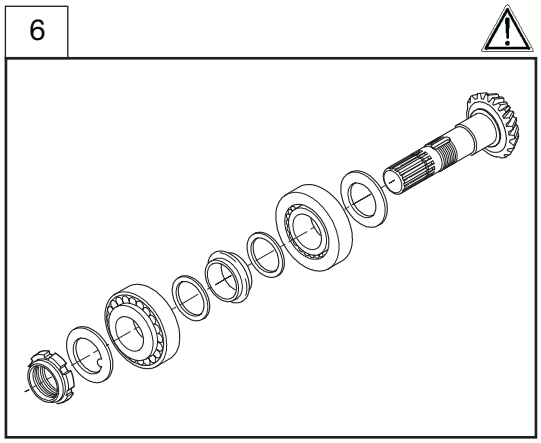
Place the differential support (**2**) on a flat surface as shown in the figure and remove the outer cups of the taper roller bearing (**10**, **9**) using a drift and a hammer.

5



To remove the inner cone of the tapered roller bearing (**10**) of the pinion (**5**), use a standard extractor.
Collect the underlying shim (**11**).

6



Check all pinion components condition.

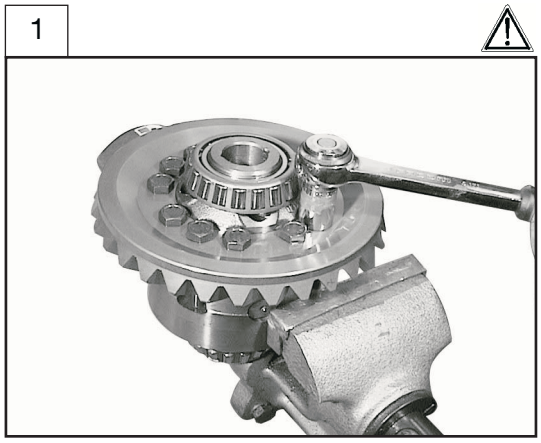
Note: *the ring nut and the collapsible spacer must be replaced when reassembling the unit.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

D.7 Differential group disassembly

Some of the following pictures may not show exactly your axle, but the process is the same.

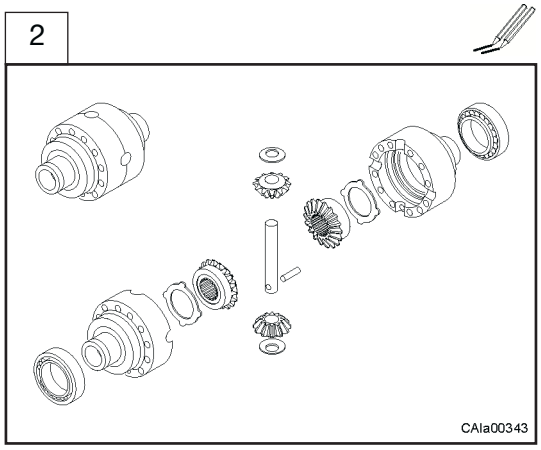
1



Collect the differential and close it in a clamp.
Unscrew the fastening screws and remove the bevel gear crown.

Warning: *this will make both differential half boxes free, so take care not to drop the internal components.*

2

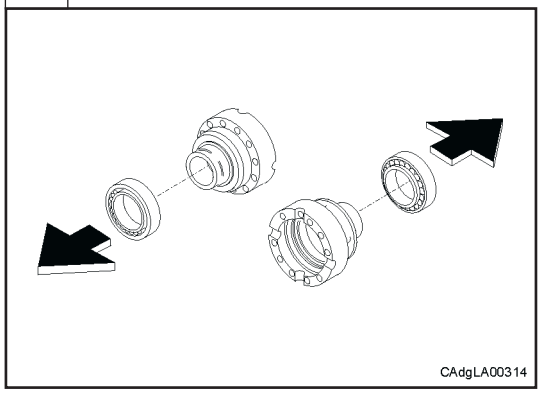


Disassemble the differential box in two half boxes complete with the relative components.

Note*: mark the two half boxes before disjoining them, in order to reassemble them in the same position as the one before disassembling.*

Disassemble all the components.
Check the operating and wear conditions of the components.

3



Take the bearing out of each differential half box, using two levers or a three-hold extractor.

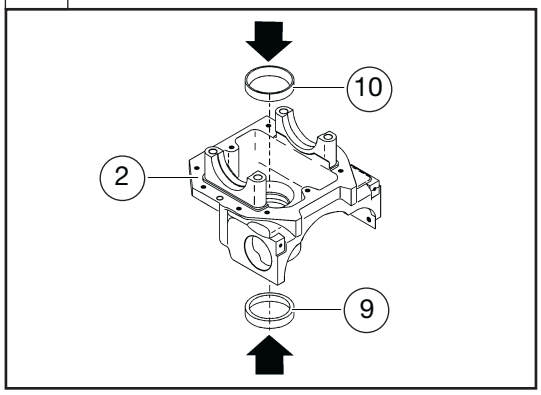
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E ASSEMBLY OPERATIONS

E.1 Pinion group assembly

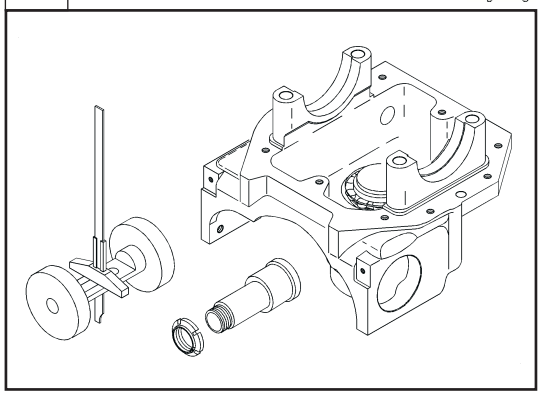
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



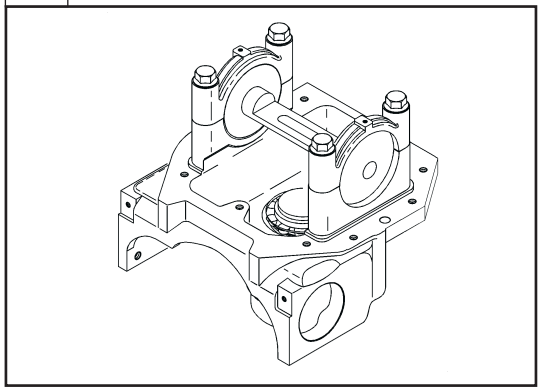
Place the differential support (**2**) on a workbench.
Fit the outer cups of the new bearings (**9**, **10**) using the special tool CA119068 and a hammer.

2



In order to measure the distance, use the kit consisting of the special tools called “false pinion” CA715450 and “false differential box” CA119205 e CA119206.

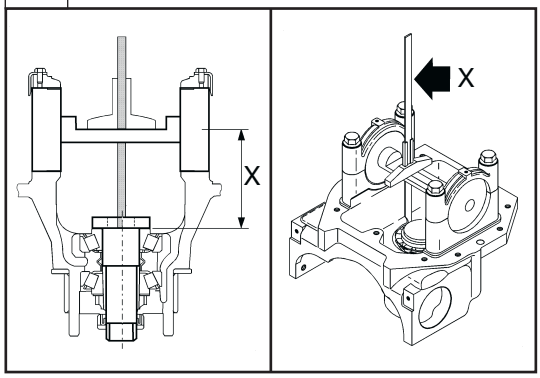
3



Insert the false pinion with CA715450, together with its bearings and its ring nut, in the just mounted housings for the bearings.
Tighten without exceeding, till the backlash is eliminated.
Install special tools CA119205 and CA119206 to the differential group supports and screw in the half collar bolts (see figure).

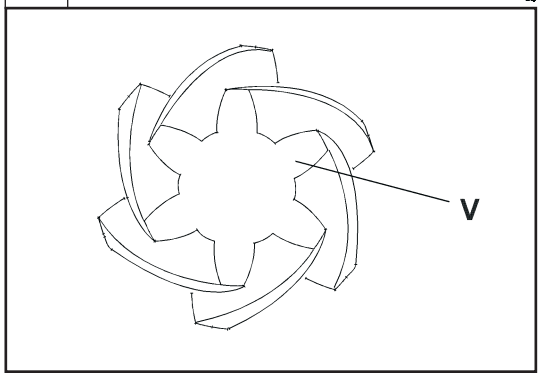
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



Assembly diagram of the tools CA119205 and CA119206 on the bearing differential support seats.
Use a depth gauge to measure distance "**X**" (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing).

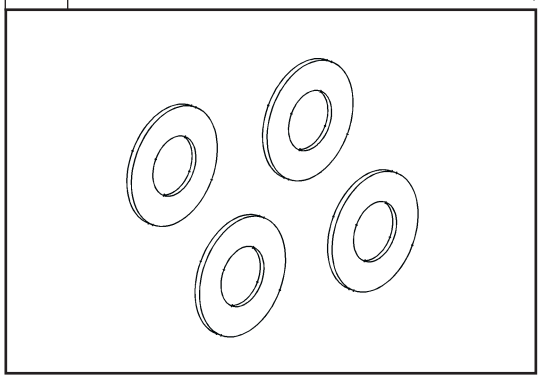
5



In order to determine the necessary thickness (**S**) between the pinion and the bearing, subtract the value (**V**), stamped on the pinion head (**V**=requested conical distance), from the measured value (**X**).

S=X-V

6

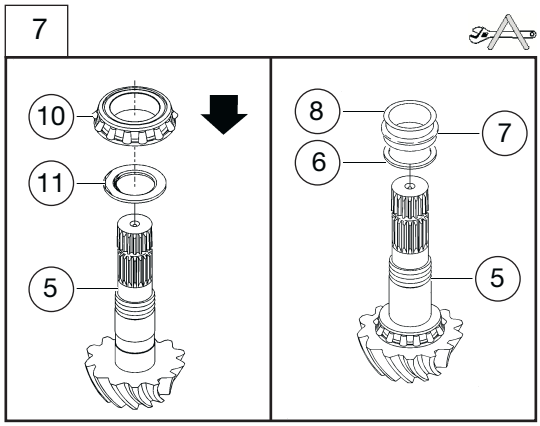


Select the thickness (**S**) from the range of available shims, and fit to shaft under the pinion head.

Note: *take care to assemble correctly.*

SHIM RANGE										
Thick.	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Q.ty	-	-	-	-	-	-	-	-	-	-

7

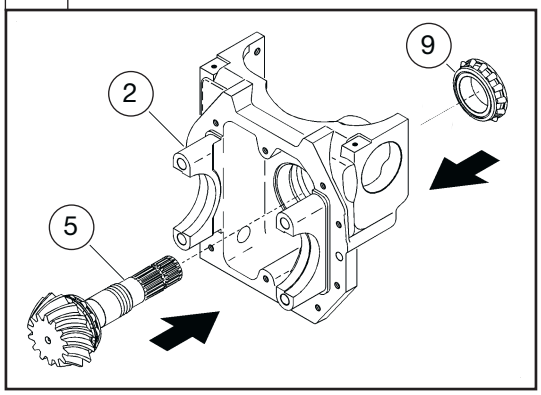


Once you have chosen and inserted the suitable shim (**11**) with the chamfer against the gear, force the bearing (**10**) into the pinion shaft (**5**) end with special tool CA715082 under a press, making sure that it is well set.
Insert the shims (**6**, **8**) and a new elastic spacer (**7**).

Note: *use always a new elastic spacer.*

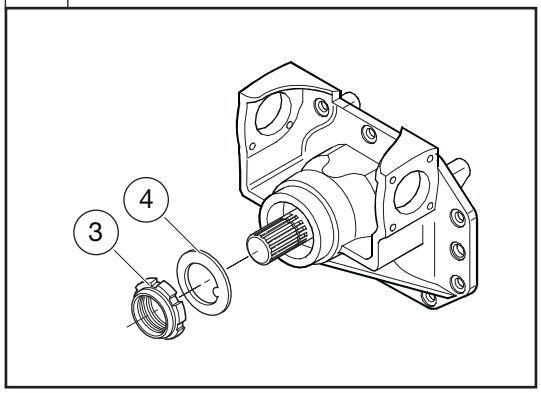
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



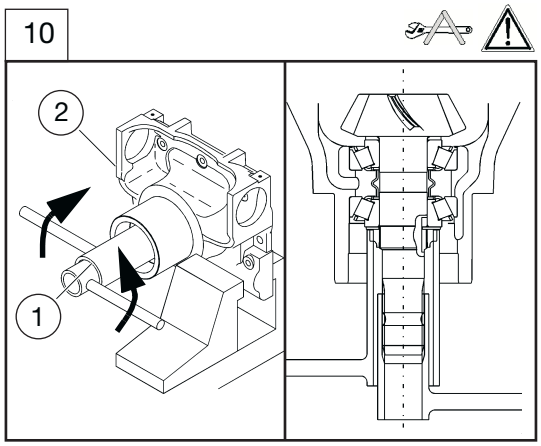
Insert the bevel pinion unit (**5**) into the differential support housing (**2**) and the second bearing cone (**9**) into the pinion end, as in figure.
In order to force the second bearing (**9**) into position, use the special tool CA715082 and a hammer.
It is advisable to offer resistance, for example with a sledge, to the beating force.

9



Insert a ring nut washer (**4**) and screw a new lock ring nut (**3**) on the pinion end.

10



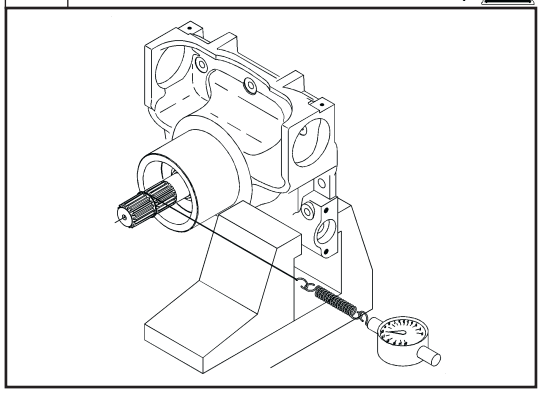
Screw the ring nut in, using the wrench for ring nut CA715080 and for pinion retainer CA715081.

Warning: *The torque setting is given by the preloading measurement on bearings. Tighten the ring nut gradually.*

Note: *if the tightening is excessive, the elastic spacer must be replaced and the procedure repeated. When you check the preloading, it is advisable to beat slightly both pinion ends with a soft hammer, so as to help setting the bearings.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

11

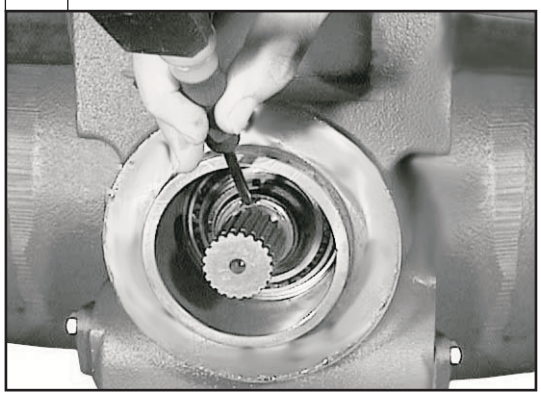


Carry out the preloading measurement (**P**) of the pinion taper roller bearings, using a dynamometer whose cord is wound on the end of pinion spline.
The adjustment is carried out by increasing the ring nut torque gradually, being careful not to exceed.

Warning: *all preloadings must be measured without the seal ring.*

P=10.5÷15.7 daN

12

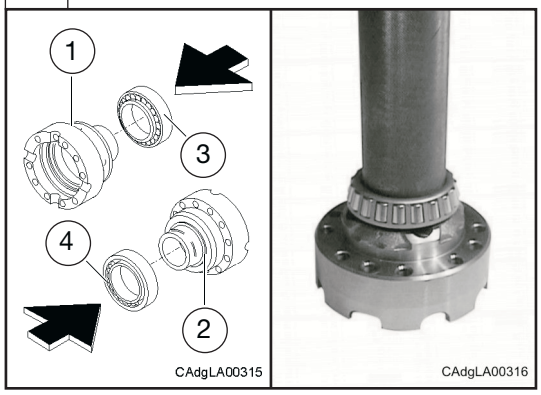


Once the requested preloading value is achieved, caulk the ring nut, using a hammer and a chisel.

E.2 Differential group assembly

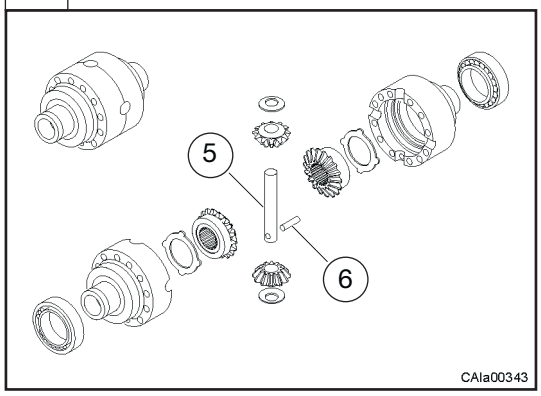
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



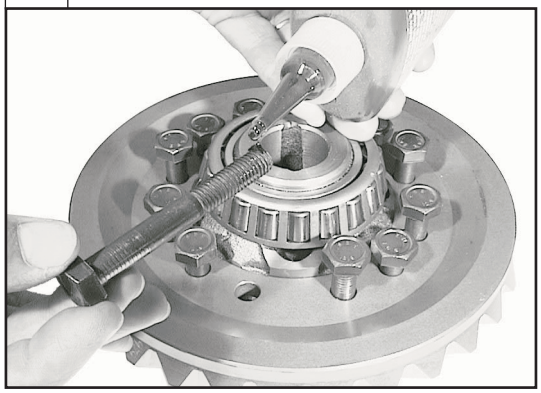
Assemble the cones of the new taper roller bearings (**3**, **4**) on the half boxes (**1**, **2**), using the special tool CA715093 and a hammer.

2



Position a half box on a workbench and assemble all inner components (thrust washers, sun gears, planetary gears, locking differential counterdisks, central pin), as shown in figure.
Fix the pin (**5**) with the lock pin (**6**).
Join the two half boxes, aligning the reference marks made upon them.

3



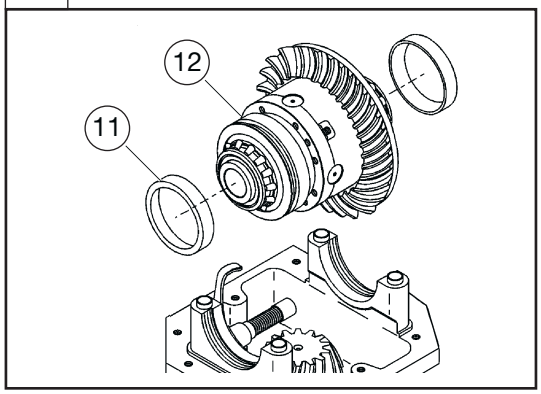
Position the bevel crown gear on the differential box.
Apply Loctite® 270 on screws thread.
Fix the whole tightening the screws to the requested torque (Sec. C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.3 Differential support group assembly

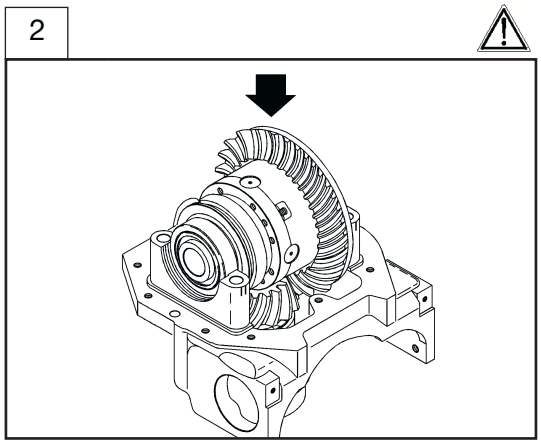
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



Assemble the outer cups (**11**) of the taper roller bearings on both differential box bearings (**12**).

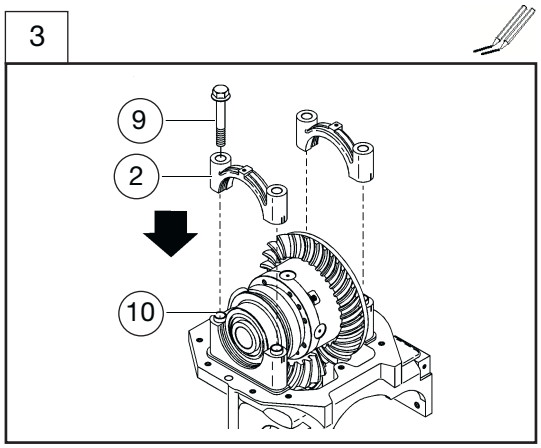
2



Position the complete differential box on the differential support.

Warning: *take care not to invert the outer cups of the taper roller bearings and check the right side of the bevel crown assembly.*

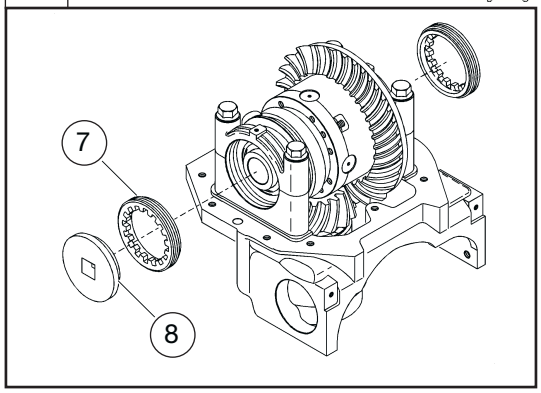
3



Move the differential group so to place the bevel crown gear on the pinion.
Check that all bushes (**10**) are in their housings and position both half collars (**2**) on their seats using the previously traced reference marks.
Lock both collars with their fastening bolts (**9**).

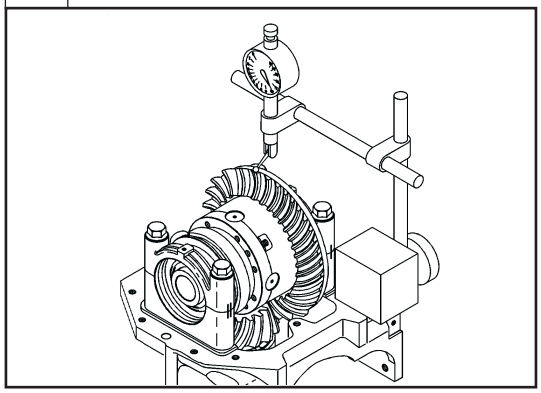
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



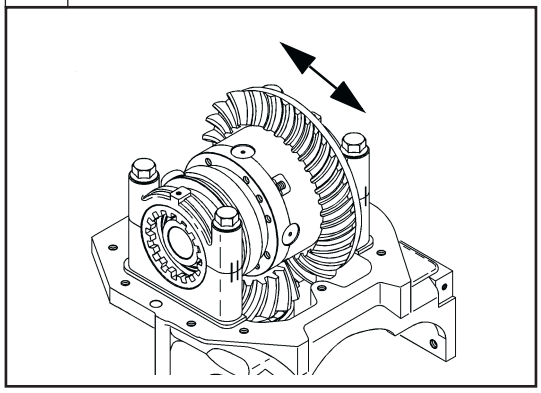
Assemble and tighten both adjustment ring nuts (**7**) in the differential support with special tools CA119030 (**8**), till the backlash is eliminated and the differential bearings are slightly preloaded.
Check that the differential bearings are well settled; if necessary, knock slightly with a soft hammer, in order to properly set the bearings in position.

5



Position a magnetic-base dial gauge on the differential support, so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.

6



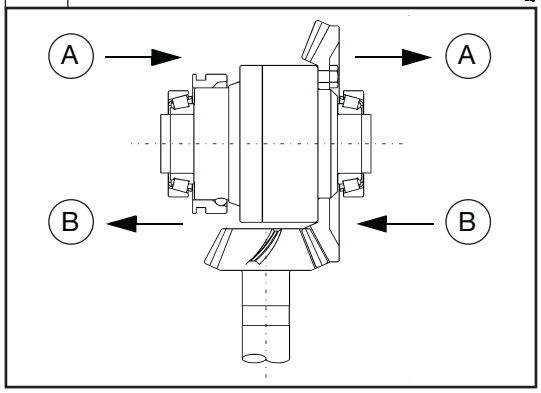
Lock the pinion and move the crown gear alternatively and note the pinion-ring gear backlash, measured with the comparator.
Repeat the operation on 2 or more points (teeth), rotating the crown gear, so that to obtain an average value.
Check if the measured backlash value is within the requested range:

0.16÷0.22 mm

Carry out the adjustment by operating on the 2 ring nuts with the appropriate tools CA119030.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

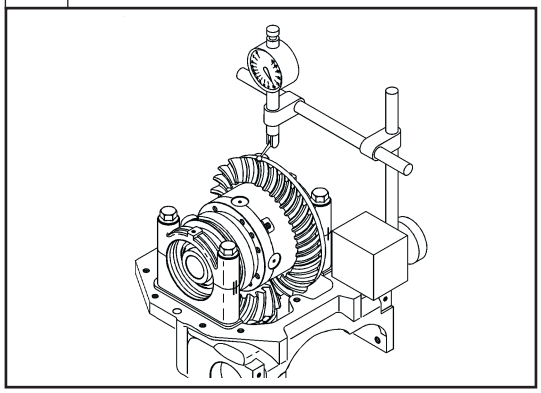
7



Adjust the ring nuts, remembering that:

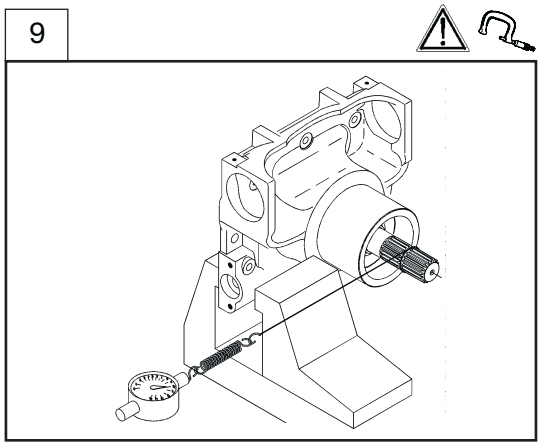
- if **the measured backlash is less** than the given tolerance range, unscrew the ring nut on the bevel crown gear side and screw in the opposite one by the same measure (**A**);
- if **the measured backlash is greater** than the given tolerance range, unscrew the ring nut on the side opposite to the bevel crown gear, and screw in the other one by the same measure (**B**).

8



Once the adjustment of the pinion-ring gear backlash has been carried out, 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.

9



Once the pinion-ring gear backlash has been established, measure the total preloading (**T**) of the bearings (pinion-crown bevel gear system), using a dynamometer whose cord is wound on the pinion splined end. The measured value should be within the following range:

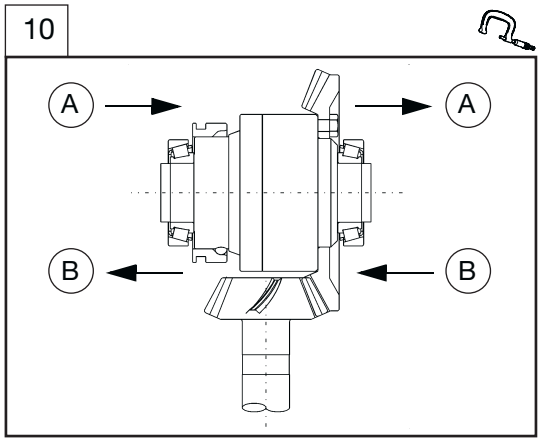
T=(P+4.2)÷(P+6.4) daN

where **P** is the effectively measured pinion preloading
See: sec. “Pinion assembly”.

Warning: *all preloadings must be measured without seal ring.*

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

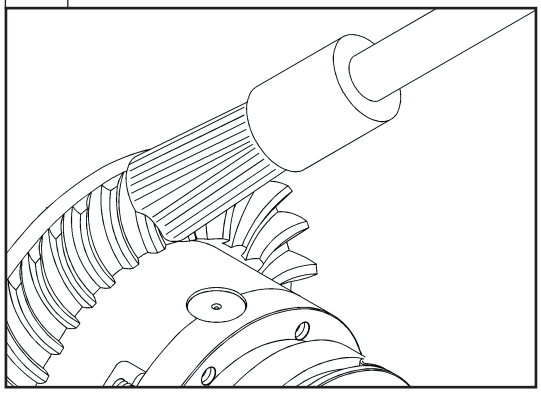
10



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:

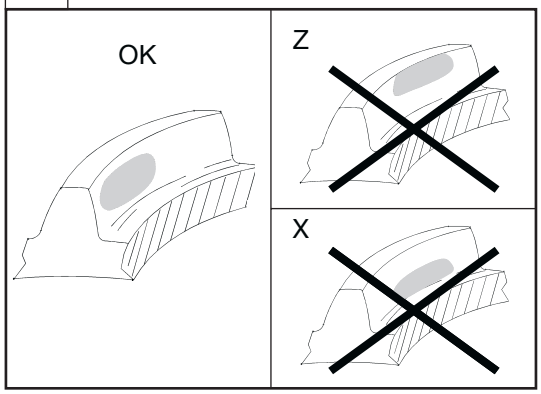
- if **the total preloading is less** than the given range, screw in both ring nuts by the same measure (**A**), keeping the pinion-ring gear backlash value unchanged;
- if **the total preloading is greater** than the given range, unscrew both ring nuts by the same measure (**B**), keeping the pinion-ring gear backlash value unchanged.

11



NOTE
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.

12



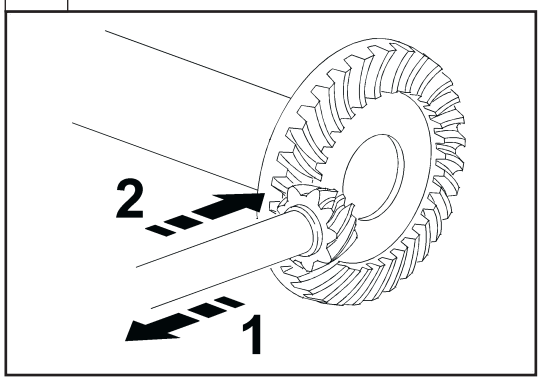
OK -> Correct contact
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

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.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

13

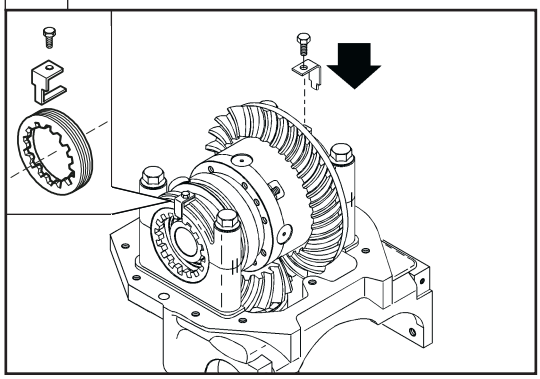


Movements to correct:

1 -> move the pinion for type X contact adjustment

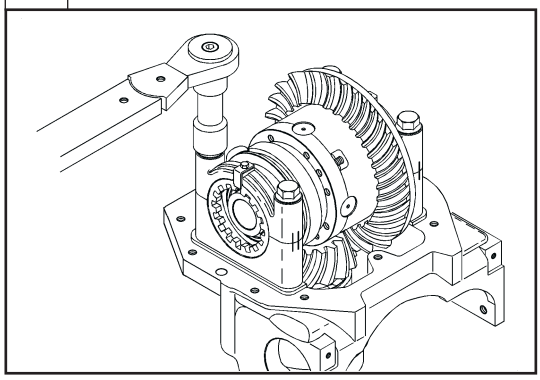
2 -> move the pinion for type Z contact adjustment.

14



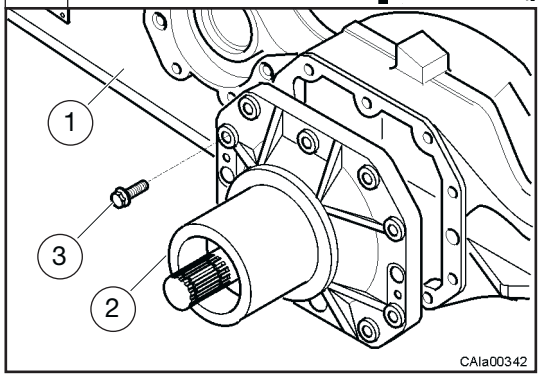
Once all the adjustment operations have been completed, fit the adjuster ring nut retainers and their respective screws, tightening them to the requested torque (Sect. C.7) with a dynamometric wrench.

15



Tighten the bolts of both half collars to the requested torque (Section C.7) with a dynamometric wrench.

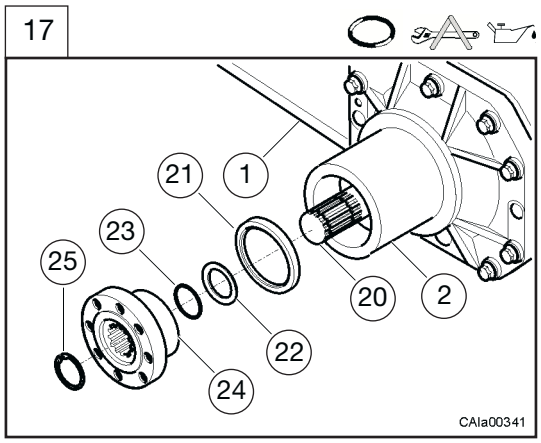
16



Before matching surfaces, make sure they are perfectly clean.
Degrease and clean them with appropriate detergents.
Spread a film of Loctite® 510 on the contact surface between the axle beam and the differential support.
Position the differential support (**2**) on the axle housing (**1**), and tighten the retaining screws (**3**) to the requested torque (Section C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

17



Assemble the seal ring (**21**) in the differential support (**2**) by mean of special tool CA715165.

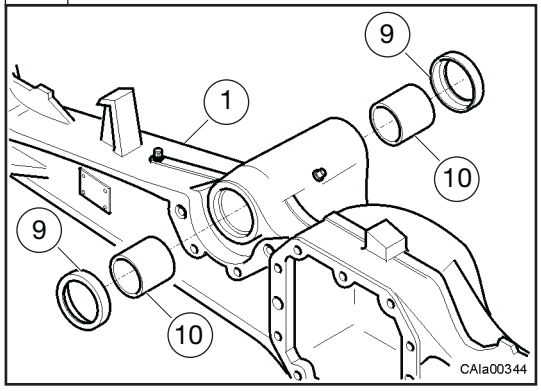
Note: *lubricate with grease the seal ring lip.*

See: sec.C.4.
Insert the washer (**22**) and the new O-Ring (**23**) on the pinion end (**20**).
Insert the flange (**24**).
Assemble the lock ring (**25**) to the pinion end (**20**).

E.4 Axle beam group assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

1

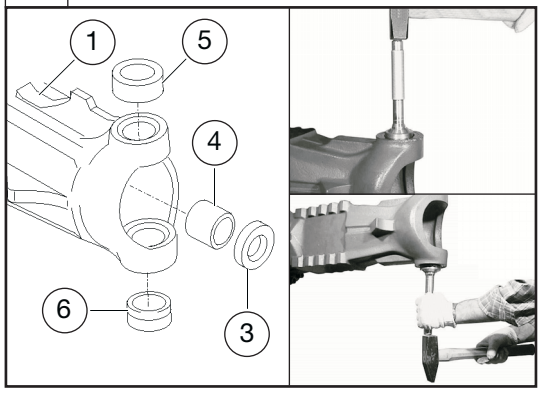


Insert the bushes (**10**) in the beam with the special tool CA119083.

Note: *to make the assembly easier it is advisable to cool the bushes (**10**) at a temperature lower than 100°C.*

Assemble the seal rings (**9**) to the axle beam (**1**) with the special tool CA715140.

2

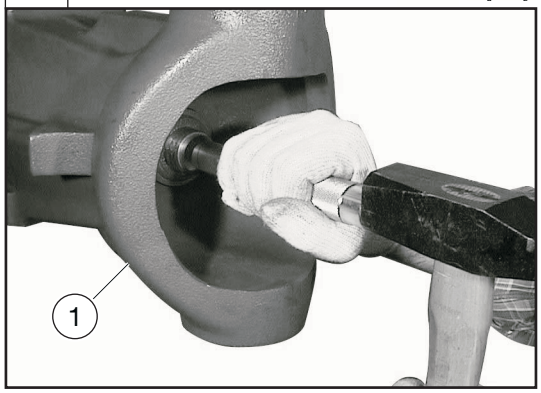


Assemble the upper king pin bush (**5**) on the axle beam (**1**) with the special tool CA119220 and a hammer.
Insert the cup (**6**) of the ball bearing on the lower part of the axle beam with the special tool CA715451 and a hammer

Note: *to make the assembly easier, it is advisable to cool the bush (**5**) and the cup (**6**) of the ball bearing at a temperature lower than 100°C.*

Warning: *wear safety gloves.*

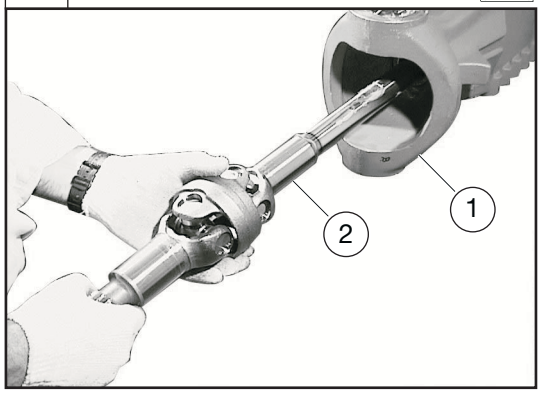
3



Assemble the bush (**4**) on the axle beam (**1**) with the special tool CA715454 and a hammer.
Assemble the seal ring (**3**) on the beam with the special tool CA715453 and a hammer.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



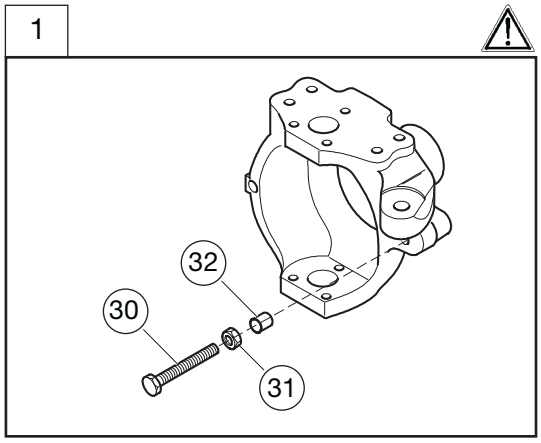
Lubricate with grease the seal ring lip and the bush.
Insert the U-Joint (**2**) inside the axle beam (**1**).

Warning: *be careful not to damage the seal.*

E.5 Wheel hub group assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

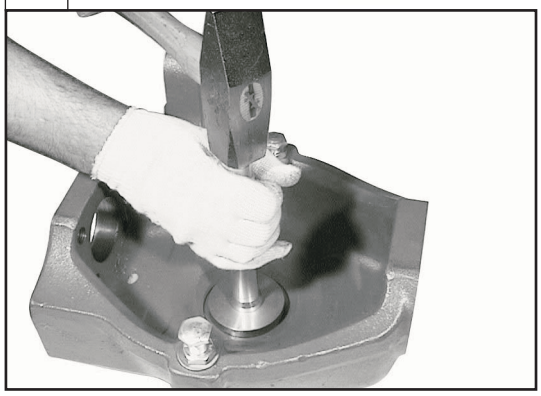
1



If it has been removed, reassemble the steering mechanical retainer composed by: screw (**30**), nut (**31**) and spacer (**32**).

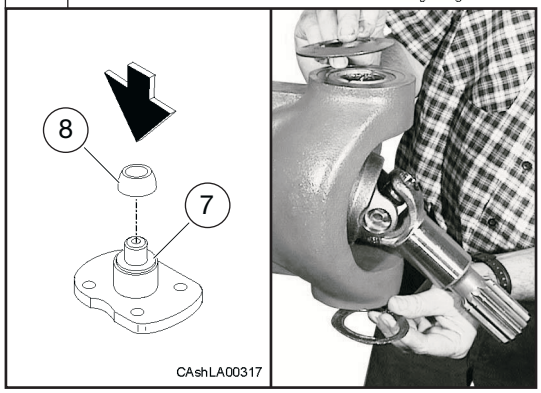
Warning: *insert the spacer bush (**32**) on the screw between the nut and the swivel housing (as in figure); the lack of the spacer (**32**) may produce the axle damage.*

2



Force the bush into the swivel housing with the special tool CA119097 and a hammer or a press.
Assemble the seal ring on the swivel housing with the special tool CA715360 and a hammer.
Fill of the gasket cavity with grease.
See: sec.C.4.

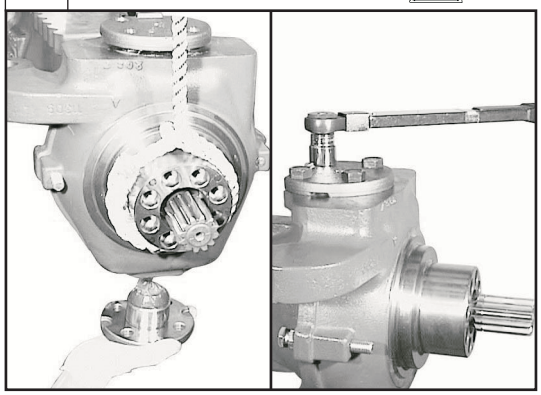
3



Position the lower king pin (**7**) on a workbench and assemble the cone (**8**) of the spherical joint with the special tool CA715451 under a press.
Grease well the king pin housings with grease.
See: sec.C.4.
Position the shim and the Belleville washers on the upper king pin housings.
Position the Belleville washers on the lower king pin housings.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4

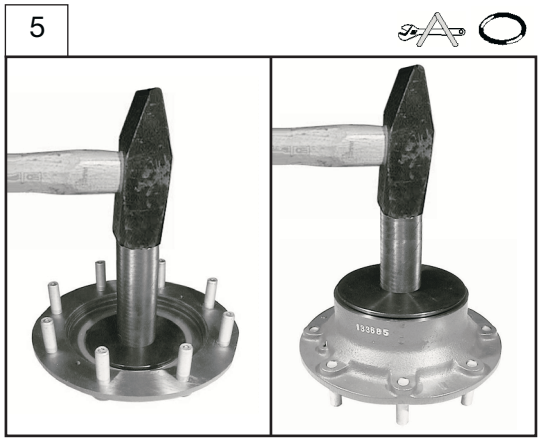


Danger: *secure the swivel housing group with a rope.*

Lubricate the seal ring lip and protect the splined end of the axle shaft by winding it with thin adhesive tape to avoid damage to the seal ring.
After assembly, remove completely the adhesive tape.
Assemble the swivel housing on the axle beam.
Assemble the two king pins, the upper and the lower, and tighten the retaining screws with dynamometric wrench to the requested torque (Sec.C.7).

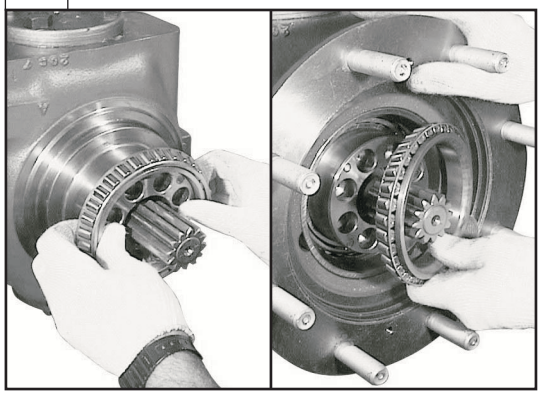
Note: *make sure that the Belleville washers remain in their position.*

5



Position the wheel hub on a workbench and force both cups of the taper roller bearings in position with the special tool CA715085 under a press or with a hammer.
Insert the seal ring into the wheel hub with the special tool CA715099 and a hammer.

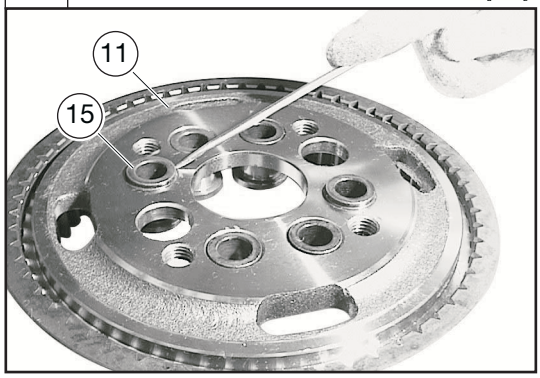
6



Assemble the cone of the taper roller bearing on the swivel housing end.
Assemble the wheel hub on the swivel housing and fit the other cone of the taper roller bearing in position.

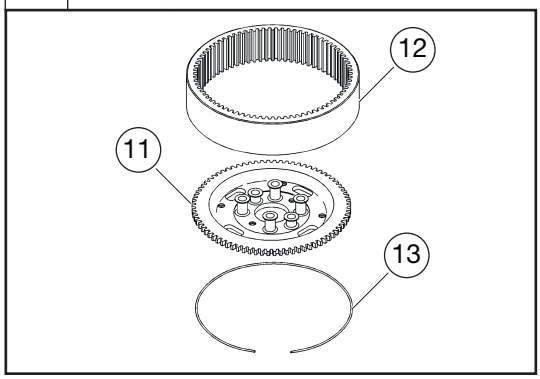
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

7



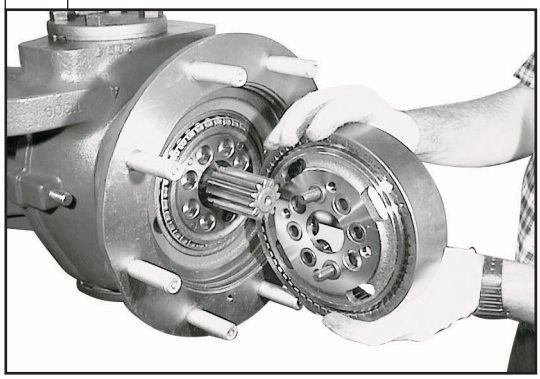
Position the wheel carrier (**11**) on a workbench and force the bushes (**15**) to the carrier surface level with the special tool CA715086.
At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

8



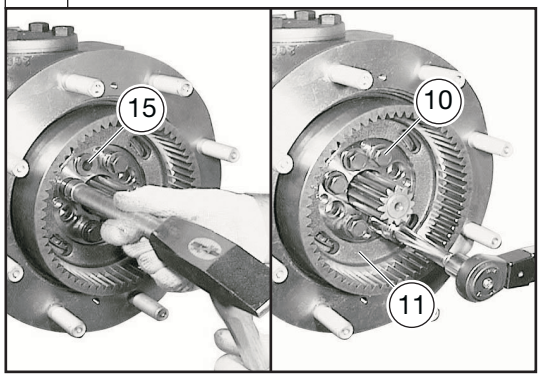
Assemble the wheel carrier (**11**) and epicyclic ring gear (**12**) group with the special locking ring (**13**).

9



Assemble the wheel carrier group on the wheel hub using the two projecting bushes as dowel pins and screw the relative screws in order to put in contact the ring bevel gear with the wheel hub.

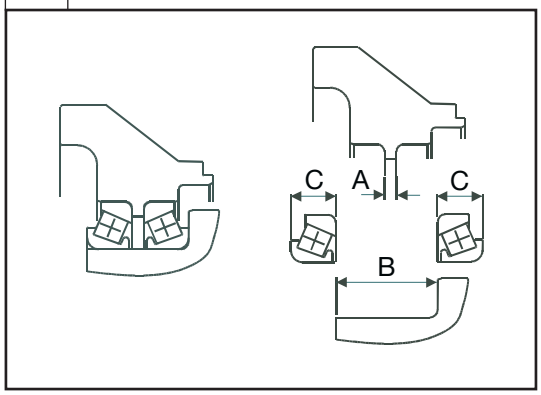
10



Force all the hub dowel bushes (**15**) completely with the special tool CA715086 and a hammer.
Apply Loctite® 270 on fastening screws (**10**) thread.
Assemble the wheel carrier (**11**) fastening screws (**10**) and tighten to the requested torque (Sec. C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

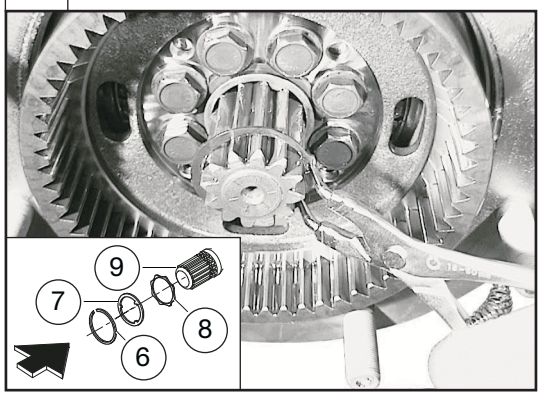
11



The special operation “Set Right” of the bearings does not require specific registrations of preloading or backlash. Anyway, before assembling new components check the indicated dimensions.

A= 11.975 ÷ 12.025
B= 52.229 ÷ 52.279
C= 20.000 ÷ 20.100

12



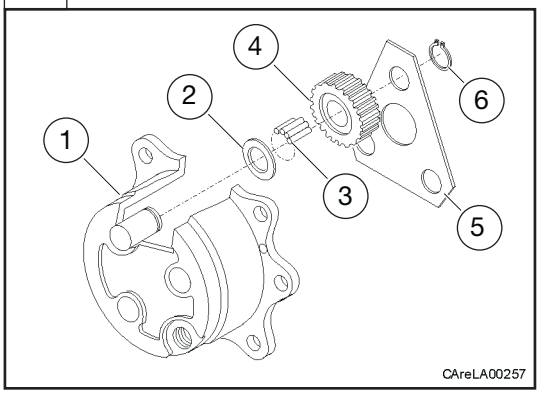
Slide the washers (**7**, **8**) into the U-Joint shaft (**9**) and lock it with the retaining ring (**6**), inserting it at the end of the splined hub and pushing it into its housing.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.6 Epicyclic reduction gear assembly

Some of the following pictures may not show exactly your axle, but the procedure is the same.

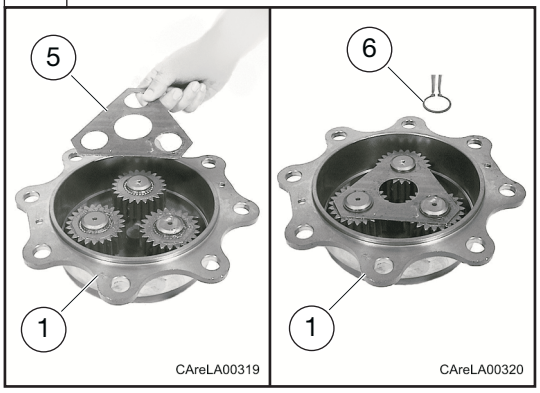
1



Collect all epicyclic reduction gear parts: the planetary carrier (**1**), the thrust washers (**2**), the roller bearings (**3**), the planetary gears (**4**), the triangular plate (**5**) and the Seeger rings (**6**) of every pin.

Note: *with new planetary gears is advisable to assembly new roller bearings.*

2

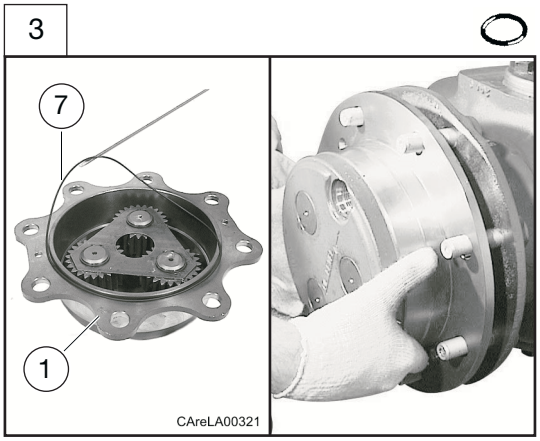


Position the planetary carrier on a workbench.
Insert the thrust washers (**2**) and the epicyclic gears (**4**) in the planetary carrier pins.
Insert the needles (**3**) in the epicyclic gears (**4**).

Note: *grease well the needles.*

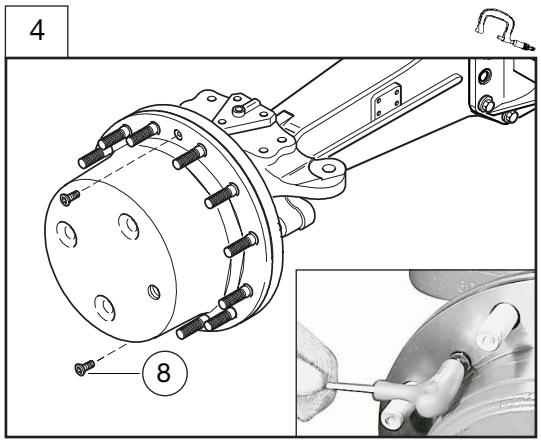
See: sec.C.4.
Assemble the triangular plate (**5**) and the related Seeger rings (**6**).

3



Assemble a new O-ring (**7**) on the planetary carrier (**1**).
Assemble the epicyclic reduction gear on the wheel hub.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

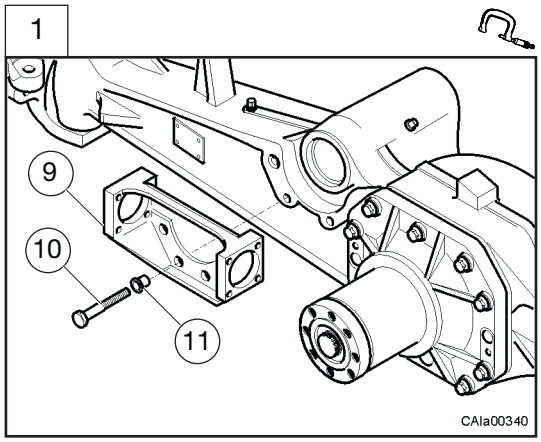


Tighten the fastening screws (**8**) with a dynamometric wrench to the requested torque (Sec. C.7).

E.7 Steering cylinders group assembly

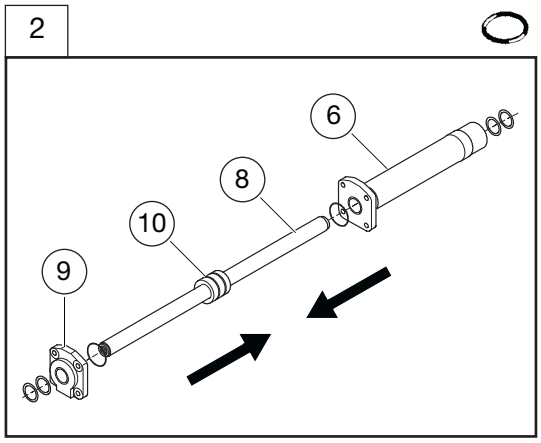
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



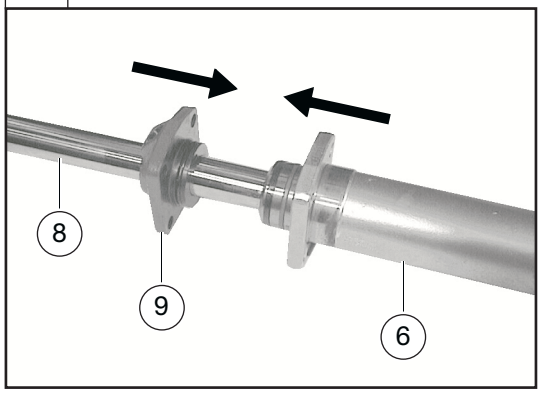
Insert the bushes (**11**) in the cylinder carrier (**9**).
Assemble the cylinder carrier (**9**) to the axle body with the fastening screws (**10**).
Tighten the fastening screws (**10**) to the requested torque (Sec. C.7).

2



Assemble new seal rings: on the cylinder head (**9**), on the piston (**10**) and on the cylinder body (**6**).

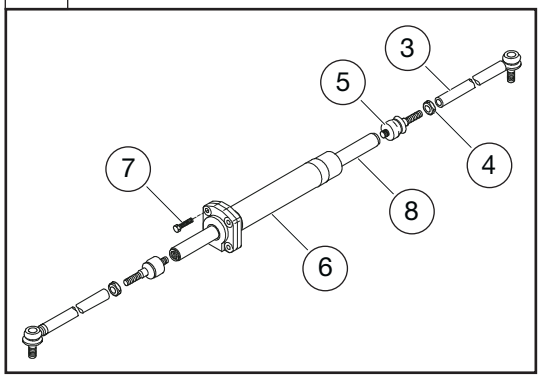
3



Slide pre-assembled rod (**8**) into the cylinder body (**6**).

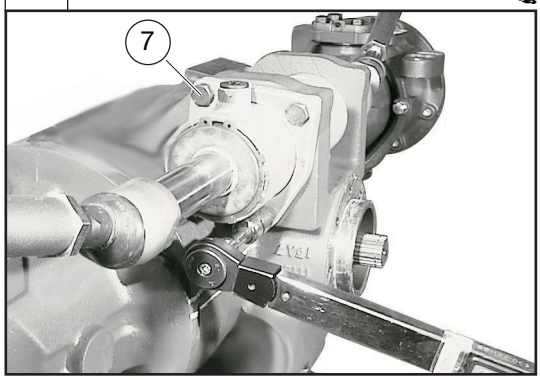
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



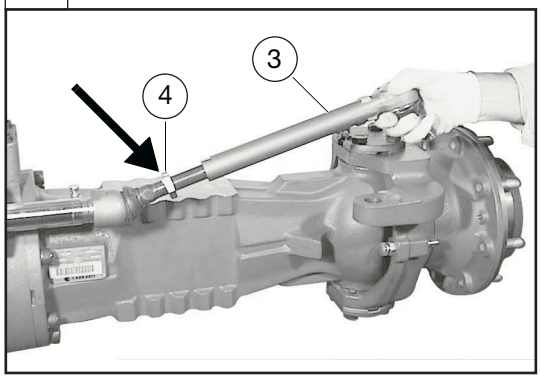
Fit the guide rods (**3**), the spherical joint (**5**) and the nut (**4**) to the ends of the cylinder rod (**8**) then tighten with dynamometric wrench to the requested torque (Sec. C.7).

5



Install the steering cylinder on the central body, with guide rods already assembled on the stem.
Assemble and tighten the steering cylinder fastening screws with dynamometric wrench to the requested torque (Sec. C.7).

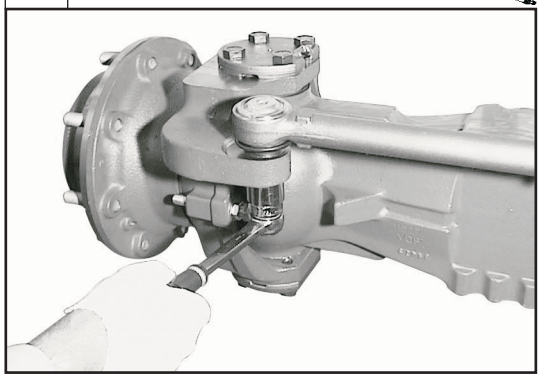
6



Align the swivel housings with the axle (parallel wheel hub). Screw the guide rod (**3**) so that the ball joint can be inserted into the swivel housing arm.

***Note**: it is important to unscrew the locking nut (**4**) to carry out this operation.*

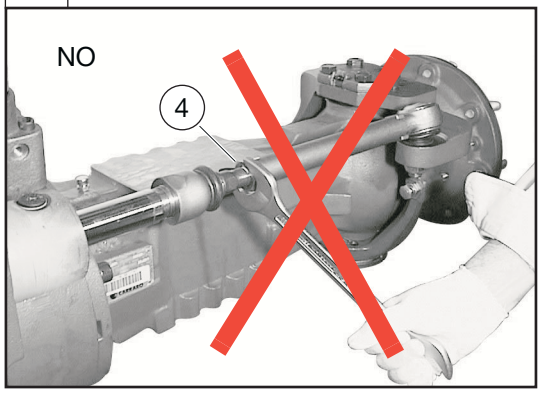
7



Insert the ball joint into its own housing on the swivel housing.
Assemble and tighten the lock nut with dynamometric wrench to the requested torque (Sec. C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

8



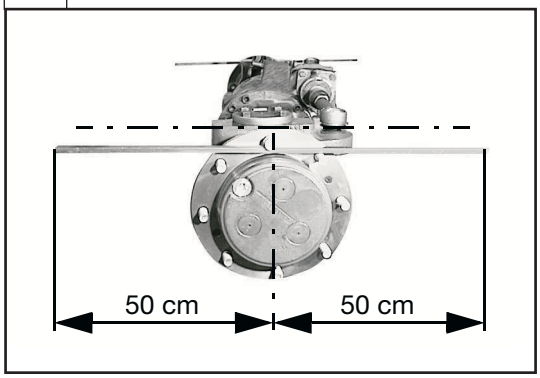
Screw in the lock nut (**4**) of the guide rod only when the toe-in adjustment has been carried out.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.8 Toe-in adjustment

Some of the following pictures may not show exactly your axle, but the procedure is the same.

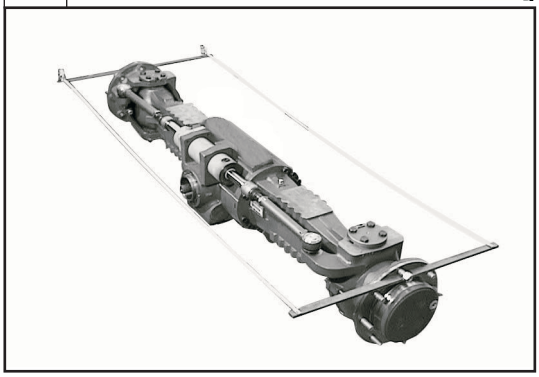
1



Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

***Warning**: The two bars should be fixed on their middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis. Align the two bars.*

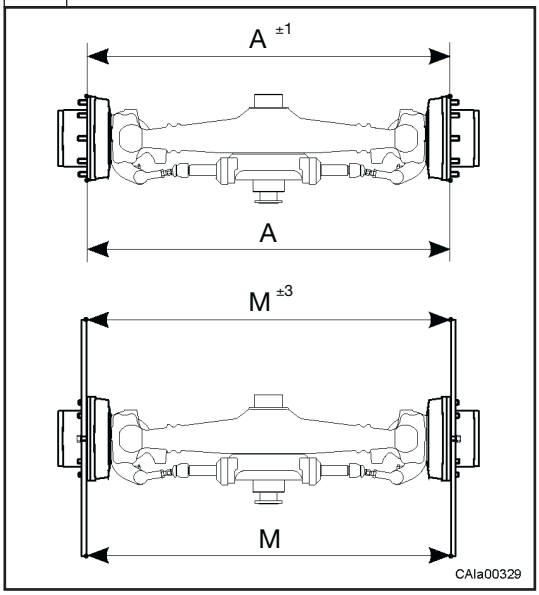
2



Measure the distance in mm (**M**) between the bars ends with a tapeline.

***Note:** Keep the minimum value, swinging the measurement point.*

3

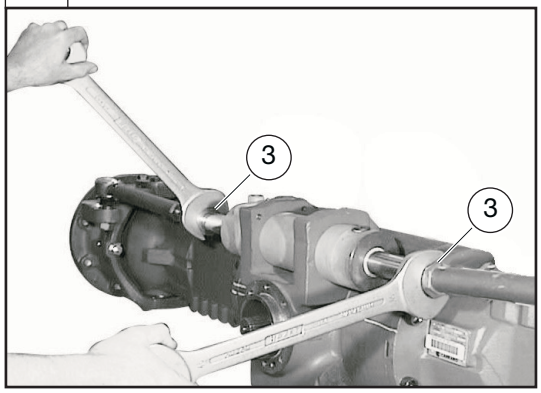


Check that the difference of the measurements between the wheel hubs diameters ends is within the requested tolerance range.
See: “Toe-in” in sec.C.4.
The nominal toe-in value (**A**) is referred to the external diameter of the wheel hubs flange, therefore the measured value (**M**) at the bars ends must be related to the ratio between length of the bar and flange diameter

nominal toe-in (sec.C.4) = $A^{\pm 1}$ -> measured toe-in = $M^{\pm 3}$

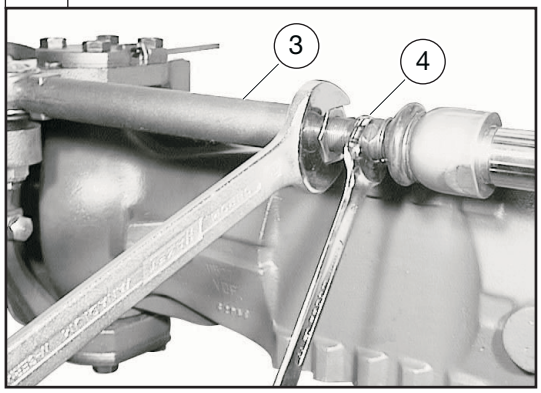
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

4



If toe-in is incorrect, operate with two wrenches on the guide rods (**3**) screwing in and out the two joint tie rods equally till the toe-in is within the requested tolerance.

5



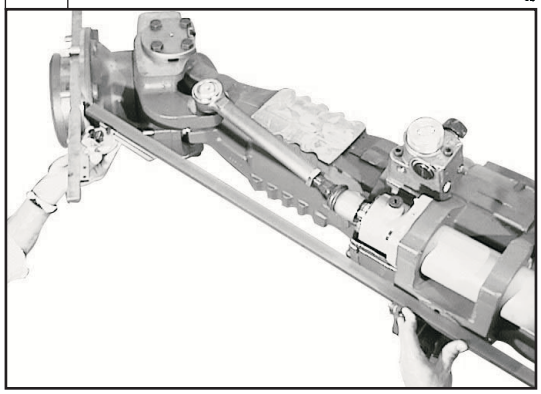
After adjusting, screw in the lock nuts (**4**) of the guide rods (**3**) to the requested tightening torque (Sec.C.7).

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.9 Steering angle adjustment

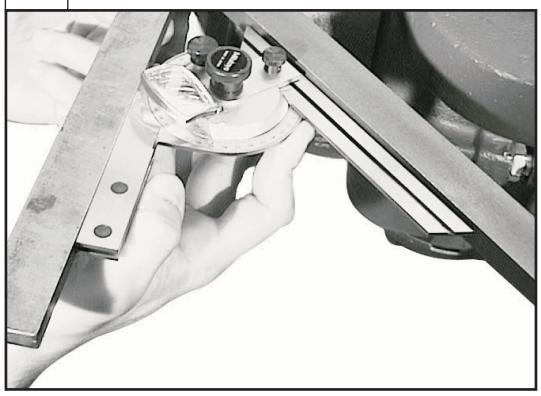
Some of the following pictures may not show exactly your axle, but the procedure is the same.

1



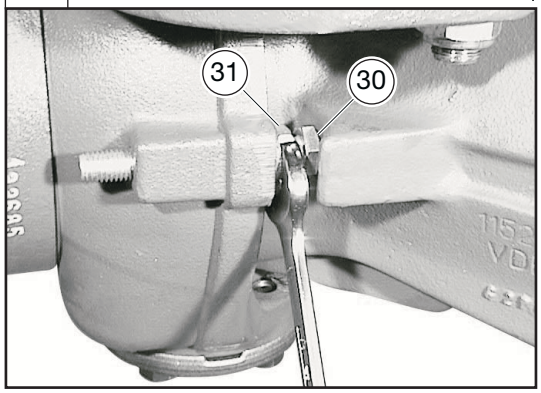
Use the same bars assembled for the toe-in adjustment and a long bar perfectly leaned over the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum steering.

2



Adjust a goniometer to the requested angle (Sec. C.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



Adjust the steering mechanical retainer, screwing in or out the special screws (**30**), locking them with a locknut (**31**) to the requested tightening torque (Sec.C.7).
Steer completely towards the other side and repeat the same operations.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

E.10 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 WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, then check step by step all assembly operations.
Check and see that the brakes are regulated correctly and functioning properly.

F TROUBLESHOOTING

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 Incorrect installation / defective axle
Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

2 Overloading / incorrect weight distribution
Remove excessive weight and redistribute load, following instructions related to the vehicle.

3 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.

4 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.

5 Bent halfshaft
Replace halfshaft.

6 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.

7 Incorrect wheel adjustment
Verify group integrity and wheel side bearings.
Adjusting according.

8 Spoiled or worn out axle parts
Check the condition of ring gear, pinion gear, bearings etc. Replace when ever necessary.

9 Contamination in the axle box or incorrect assembly of parts
Look for foreign particles. Check assembly of the various parts of the axle.

10 Incorrect adjustment of bevel gear set: Parts of the transmission worn out (transmission gears, U joints, etc.)
Replace or adjust as required.

11 Incorrect use of the product
See the vehicle producer‘s instructions once again.

DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

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.*

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Problem	Cause	Action
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.*
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 0,1 mm 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.*

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F.2 Axle problem and diagnosis

Problem	Cause	Action
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*

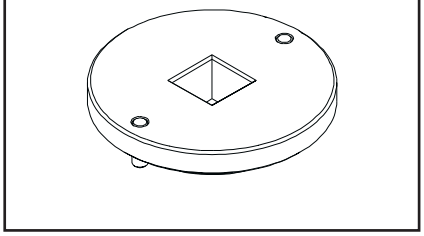
DO NOT DISASSEMBLE ANY COMPONENT (S) DURING WARRENTY PERIOD WITHOUT CONTACTING TEREXLIFT.

G SPECIAL TOOLS

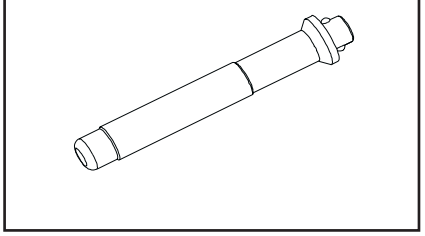
G.1 Special tools

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.

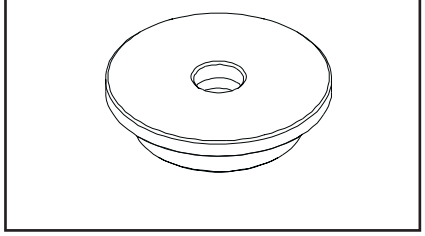
CA119030	Wrench



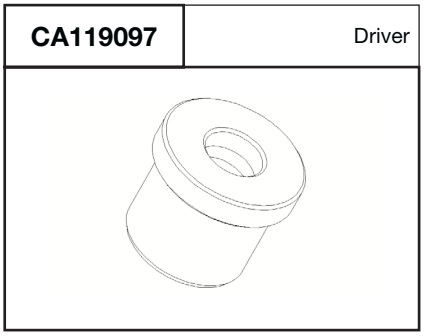
CA119033	Handle



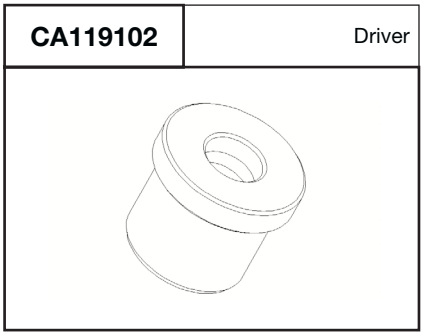
CA119068	Driver



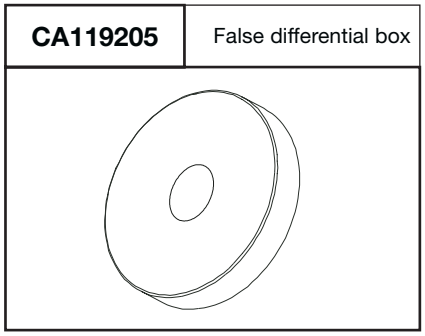
CA119097	Driver



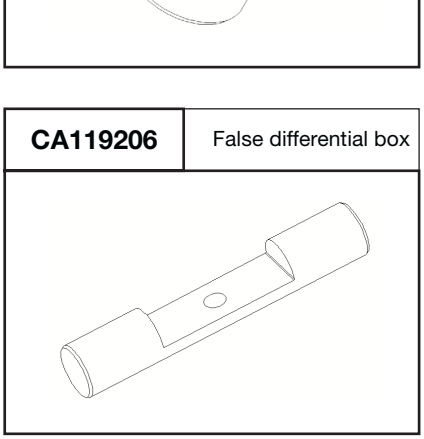
CA119102	Driver



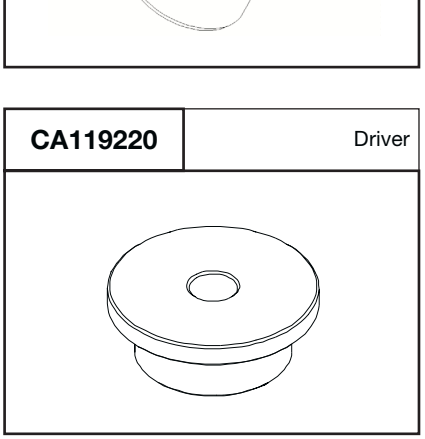
CA119205	False differential box



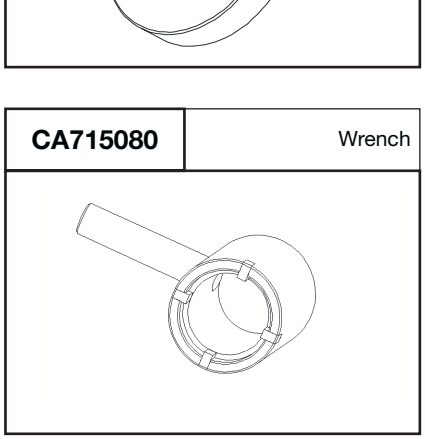
CA119206	False differential box



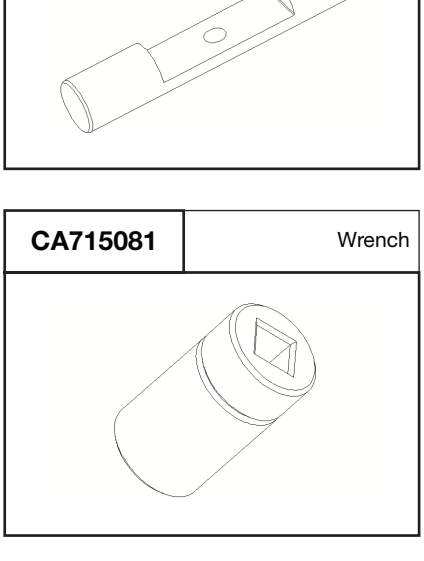
CA119220	Driver



CA715080	Wrench



CA715081	Wrench



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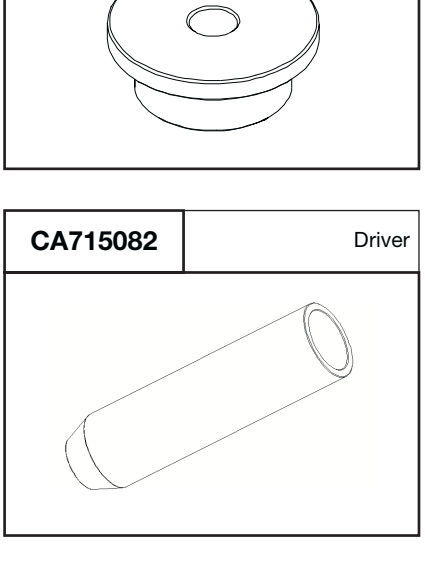

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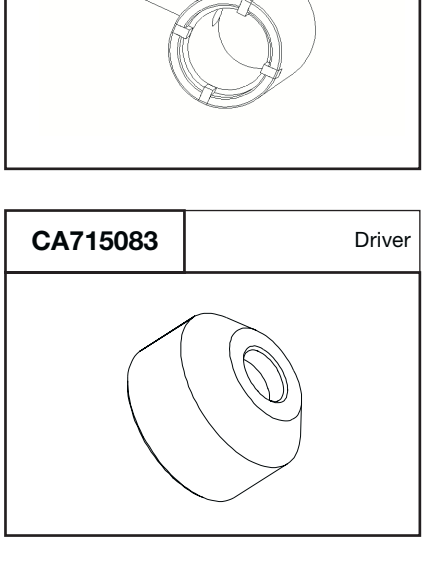

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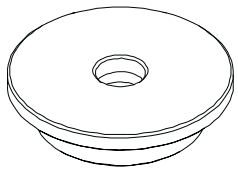
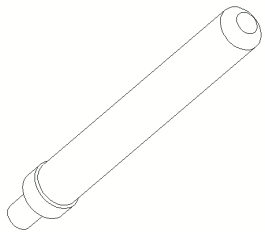
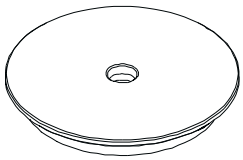
CA715085	Driver



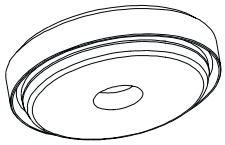
CA715086	Driver



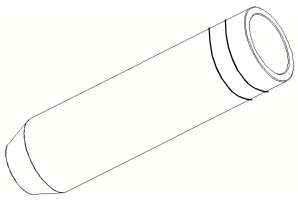
CA715099	Driver



CA715140	Driver

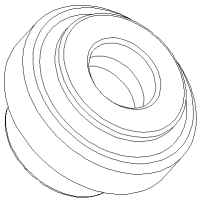


CA715165	Driver

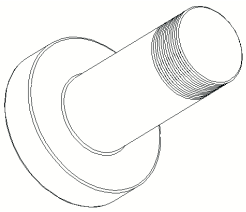


CA715298	Driver

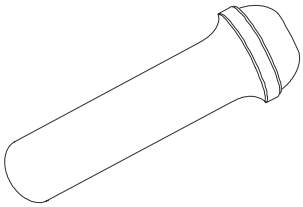
CA715360	Driver



CA715450	False pinion



CA715451	Driver



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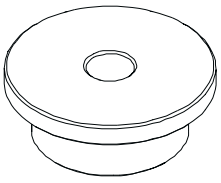

CA715454	Driver

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SECTION 16
TROUBLESHOOTING GUIDE

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16.0 TROUBLESHOOTING GUIDE

This section provides troubleshooting and schematic for the electrical and hydraulic system.
There are three troubleshooting charts one for General, Electrical and Hydraulic. These charts are of general nature, but should provide an intuitive feeling for a specific system. Knowing the system is the greatest aid to troubleshooting. Every component has a purpose in the system. The construction and operating characteristics of each one should be understood. Know the capabilities of the system. Each component in the system has a maximum rated speed, torque or pressure. Loading the system beyond the specification increases the possibility of failure. Know the correct operating pressures. Always set and check pressures with a gauge that is know to be accurate.

16.1 GENERAL TROUBLESHOOTING

FAULT	CAUSE	SOLUTION
The hydraulic oil Thermometer does not function	This is normal, when the outside temperature is low and / or the machine is used for short periods, since the hydraulic oil cannot warm up over 40-50°C The oil temperature bulb is damaged.	 Check and replace the bulb
High temperature of the Engine coolant	Water level in the overflow tank The temperature bulb is defective The dashboard manometer is defective	Check and, if necessary, refill Change bulb Change
Low hydraulic oil level	Oil Leaks	Refill
High hydraulic oil temperature	The radiator grill is dirty	Clean the grill regularly
Low engine performance	The air filter is dirty	Clean the air filter regularly
The steering column Response is slow or noisy	Joints are damaged The spiders of the driving shaft are damaged	Change the joints Change the spiders
The differential is noisy and its body temperature is high	No Oil Bearing are damaged	Check and refill Change the bearings as per HURTH instructions.
Oil leaks from axles and/or gearbox	Seals are worn	Change as per HURTH instructions

16.2 HYDRAULIC TROUBLESHOOTING

FAULT	CAUSE	SOLUTION
The machine drive is not enough. The machine will not move	The oil filter is clogged	Change the filter
	The max. pressure of the hydraulic system is not enough	Check the max. pressure
	The min. pressure of the hydraulic system is not enough	Check the min. pressure
	The drive pump and / or motor is damaged	Test the drive
	Low hydraulic level	Visually check the oil level; if necessary, add new oil
The boom does not move	The max. pressure of the hydraulic system is too low	Check the max. pressure
	The min. pressure is too low	Check the min. pressure
	The control lever is damaged	Check the lever; if necessary, replace it
	The distributor cursor is blocked	Check the cursor; if necessary, replace it
The boom jerks	The accumulator is damaged or empty	Check the accumulator; if necessary, replace it
No steering is possible with engine shut down	The one-way valve is dirty or damaged	Check the valves; if necessary replace them
Wheel misalignment	Internal cylinder blow-by	Check and change the seal
The steering column is hard (low force in the cylinders)	Low pressure	Check the pressure of the power steering circuit
	The cursor of load sensing valve 10 is blocked	Check the valve; if necessary, replace

16.2 HYDRAULIC TROUBLESHOOTING CONT'D

FAULT	CAUSE	SOLUTION
The service brake action is insufficient	No oil in the brake tank	Change the level; if necessary, refill. Check for oil leaks from the brake circuits
	The pump seals are worn	Dismount the pump and change the seals
	The brake discs are worn	Change the brake discs as per HURTH instructions
	Air in the circuit	Bleed system
With engine shut down: the lifting cylidner does not hold the boom in position, forks do not rotate, the boom section cannot be retracted	The block valves are damaged	Remove and clean the valves. if the trouble persists, change the valves
	The cylinder seals are worn	Remove the cylinders and change the seals
By lifting the boom, the machine does not sway the load	The seals of the sway cylinder are worn	Dismount the cylinder
	The shock-proof valves on the distributor are dirty or maladjusted	Remove the valves, dry-clean or change if damaged
	The one-way vavles on the sway cylinder are dirty or maladjusted	Remove teh valves, dry-clean or change if damaged
Forks cannot hold the load, the cylinder does not lock the load	The seals of the attachment rotation cylinder are worn	Dismount the cylinder
	The blocks valves are damaged	Remove and clean the valves. If the trouble persists, change the valves
By operating the control lever, no action is performed	The control lever is damaged	Check if the trouble depends upon an electric trouble. If trouble persists, change the lever
	The max. pressure valve of the distributor is damaged	Check the max. pressure value. Change the valve

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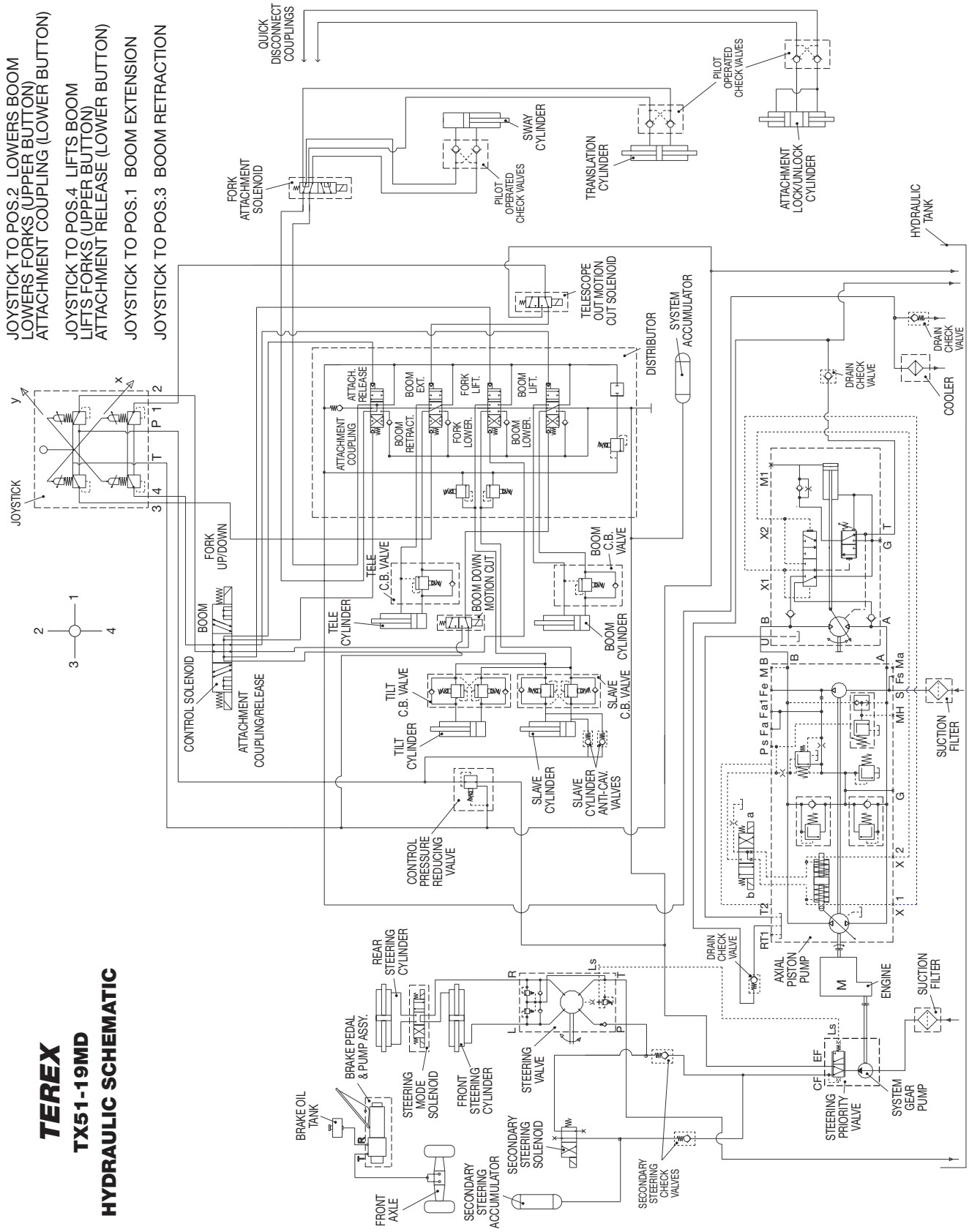
JOYSTICK TO POS.2 LOWERS BOOM
LOWERS FORKS (UPPER BUTTON)
ATTACHMENT COUPLING (LOWER BUTTON)
JOYSTICK TO POS.4 LIFTS BOOM
LIFTS FORKS (UPPER BUTTON)
ATTACHMENT RELEASE (LOWER BUTTON)
JOYSTICK TO POS.1 BOOM EXTENSION
JOYSTICK TO POS.3 BOOM RETRACTION
TEREX
TX51-19MD
HYDRAULIC SCHEMATIC
QUICK DISCONNECT COUPLINGS
FORK ATTACHMENT SOLENOID
SWAY CYLINDER
PILOT OPERATED CHECK VALVES
TRANSLATION CYLINDER
ATTACHMENT LOCK/UNLOCK CYLINDER
HYDRAULIC TANK
TELESCOPE OUT MOTION CUT SOLENOID
DISTRIBUTOR
SYSTEM ACCUMULATOR
DRAIN CHECK VALVE
COOLER
JOYSTICK
FORK UP/DOWN
BOOM
CONTROL SOLENOID
ATTACHMENT COUPLING/RELEASE
ATTACH. RELEASE
BOOM EXT.
FORK LIFT.
BOOM LIFT.
ATTACHMENT COUPLING
BOOM RETRACT.
FORK LOWER.
BOOM LOWER.
TELE C.B. VALVE
TELE CYLINDER
BOOM DOWN MOTION CUT
BOOM C.B. VALVE
BOOM CYLINDER
TILT C.B. VALVE
TILT CYLINDER
SLAVE C.B. VALVE
SLAVE CYLINDER
SLAVE CYLINDER ANTI-CAV. VALVES
CONTROL PRESSURE REDUCING VALVE
SUCTION FILTER
AXIAL PISTON PUMP
ENGINE
REAR STEERING CYLINDER
BRAKE PEDAL & PUMP ASSY.
STEERING MODE SOLENOID
FRONT STEERING CYLINDER
STEERING VALVE
BRAKE OIL TANK
SECONDARY STEERING SOLENOID
SECONDARY STEERING ACCUMULATOR
SECONDARY STEERING CHECK VALVES
FRONT AXLE
STEERING PRIORITY VALVE
SYSTEM GEAR PUMP

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16.3 ELECTRICAL TROUBLESHOOTING

FAULT	CAUSE	SOLUTION
The dashboard will not illuminate	The dashboard power supply fuse F3 is broken	Replace the fuse
	The battery is down	Check the battery condition
	The cutout switch is OFF	Turn it on
	The wire is broken or cable is disconnected	Check the line and reconnect any disconnected cable
The engine does not start. The starter does not run	The main fuse in the motor box is broken	Replace the fuse
	The power supply fuse F16 is broken	Replace the fuse
	The parking brake is not engaged	Engage the parking brake and ensure the relevant indicator on the dashboard lights up
	The emergency button is pressed down	Reset
	The parking brake proximity switch is defective	Check and adjust the distance
	The ignition switch is damaged	Change the switch
	R6 relay is damaged	Change
	The relay in the motor box is damaged	Change
	The cutout switch is OFF	Turn it on
	The battery is down	Recharge or change the battery
The engine does not start. The starter runs, but the engine does not start	No fuel	Refuel
	The fuel filter is clogged	See Perkins Operator's Manual
	The fuel hose is empty	Refuel, then see Perkins Operator's Manual
	The engine stop solenoid valve is locked	Check if power is supplied. Replace if damaged

16.3 ELECTRICAL TROUBLESHOOTING CONT'D

FAULT	CAUSE	SOLUTION
The machine does not move	The forward / reverse gear selector is in neutral	Set to correct position
	The parking brake is engaged	Release
	R2-R4-R5 relays are damaged	Check or change, if necessary
	No power to the solenoid valve	Check the line with a tester
	Fuses F23-F15 are broken	Change the fuses
	No current to relay R2-R4-R5 from the switch	Check the line with a tester; if necessary, change the relay
	No current to the solenoid 14-15	Check the line with a tester; if necessary, change the solenoid
No selection of the steering mode. Steering selector will not operate	Fuse F20 for the steering control is broken	Change the fuse
	The "ROAD/CABIN' switch is set to ROAD	Set to CABIN
	The switch is damaged	Change
	Coil 16/17 is shorted	Check with a tester; if necessary, change the coil or the solenoid vlave.
Low parking brake action	Insufficient cable tensioning	Check and adjust the brake cable tension
The boom does not lower, does not extend, does not tilt the attachment holding frame	Fuses F1-F15-F17 are broken	Change fuses
	The emergency stop button is pressed down	Reset
	Relays R1-R7 are damaged	Check with a tester; if necessary, replace
	The ARB control until is damaged and / or in alarm	Check the control unit
	The solenoid valve of 9-10 is shorted	Check with a tester; if necessary, replace

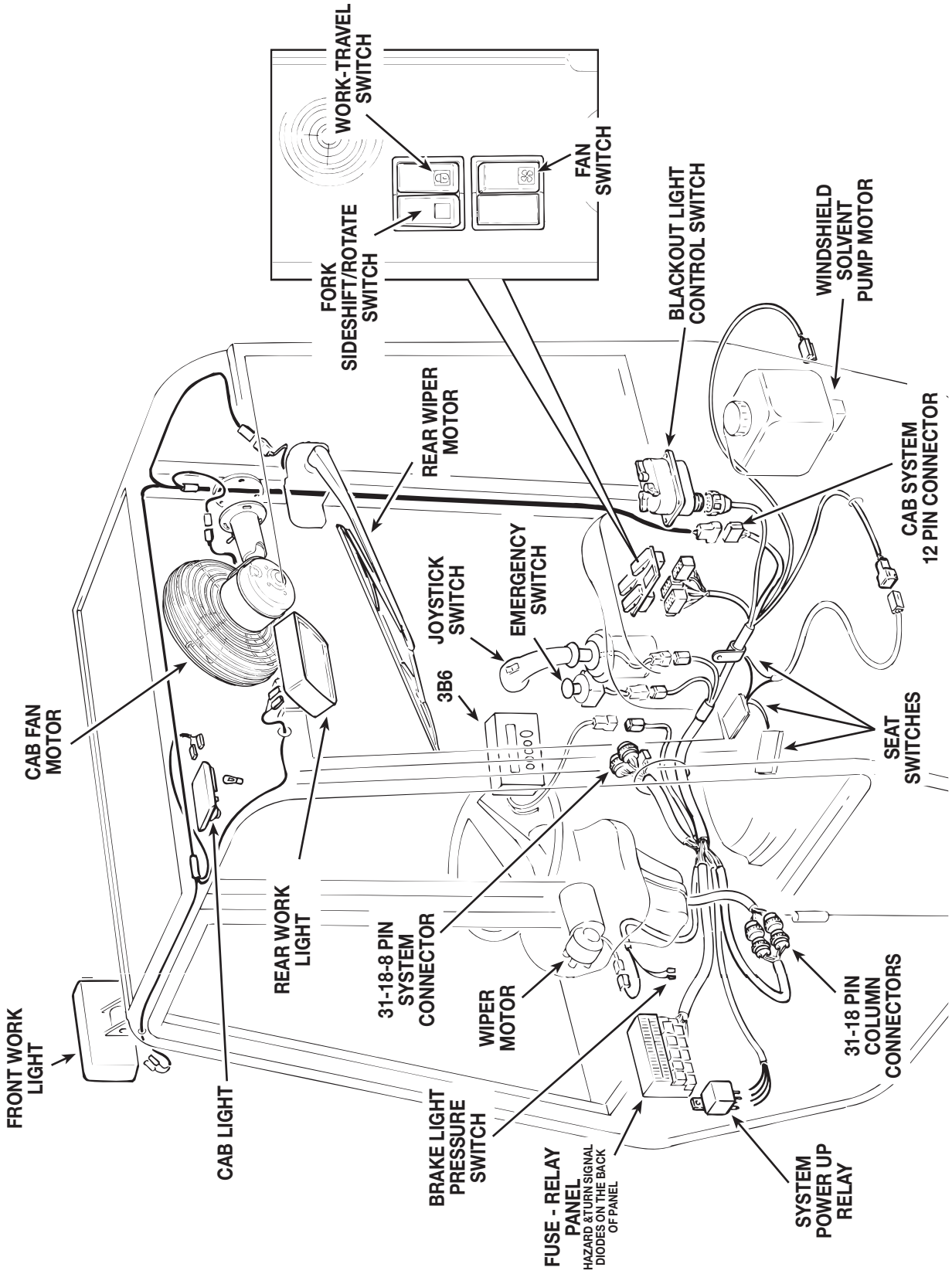
16.3 ELECTRICAL TROUBLESHOOTING CONT'D

FAULT	CAUSE	SOLUTION
The thermometer of the hydraulic oil does not function	The oil temperature bulb or instrument are damaged Fuse F16 is broken	Check and, in case, replace the bulb or instrument Replace the fuse
The parking brake indicator does not light up	Fuse is broken Relay R6 is damaged The parking brake sensor is damaged or maladjusted	Change fuse F16 Check and, in case, replace Check the sensor if damaged replace and adjust
By operating the control lever, no action is performed	Check if solenoid valve is 24V power supplied Check if the coil of solenoid valve is shorted Check if the cursor of solenoid valve is blocked Check if DFE distributor is 24V power supplied Check if the coil of DFE is shorted Check if the cursor of DFE is blocked The reel tracks are oxidixed due to humidity	Check with a tester Check with a tester; if in short, change the coil Check; if blocked, change the cursor of the solenoid valve Check with a tester Check with a tester; if in short, change the coil Check; if blocked, change the cursor or the solenoid vlave Disassembly the reel and clean the tracks. If the trouble persists due to excessive damage, change the reel.
The fuel gauge does not function	Fuse F16 is broken The fuel gauge is damaged The dashboard is instrument is damaged Harness is broken	Replace the fuse Change Change Check with a tester and restore

16.3 ELECTRICAL TROUBLESHOOTING CONT'D

FAULT	CAUSE	SOLUTION
The overload warning system is never in alarm or is in alarm when the unloaded machine is turned on	Check the IN/OUT tension of the loading cell The cell is damaged	Check Change if damaged
The light switch does not function	No 24V power The lever is damaged Fuse F19 is broken	Check with a tester and restore the circuit Change Replace the fuse
The front or rear windshield wiper does not function	No 24V power The motor is shorted The fuse is broken The lever is damaged	Check with a tester and restore the circuit Change the motor Change Fuse F18 Change
The heater does not function	No 24V power The heater motor 37 is shorted The fuse is broken The water cock is blocked or damaged The air conveying line are clogged or broken	Check with a tester and restore the circuit Change the motor Change the Fuse F22 Change Check and rectify the problem

CAB WIRING


WORK-TRAVEL SWITCH
FAN SWITCH
FORK SIDESHIFT/ROTATE SWITCH
BLACKOUT LIGHT CONTROL SWITCH
WINDSHIELD SOLVENT PUMP MOTOR
REAR WIPER MOTOR
CAB SYSTEM 12 PIN CONNECTOR
JOYSTICK SWITCH
EMERGENCY SWITCH
3B6
CAB FAN MOTOR
SEAT SWITCHES
REAR WORK LIGHT
31-18-8 PIN SYSTEM CONNECTOR
WIPER MOTOR
31-18 PIN COLUMN CONNECTORS
FRONT WORK LIGHT
CAB LIGHT
BRAKE LIGHT PRESSURE SWITCH
FUSE - RELAY PANEL
HAZARD &TURN SIGNAL DIODES ON THE BACK OF PANEL
SYSTEM POWER UP RELAY

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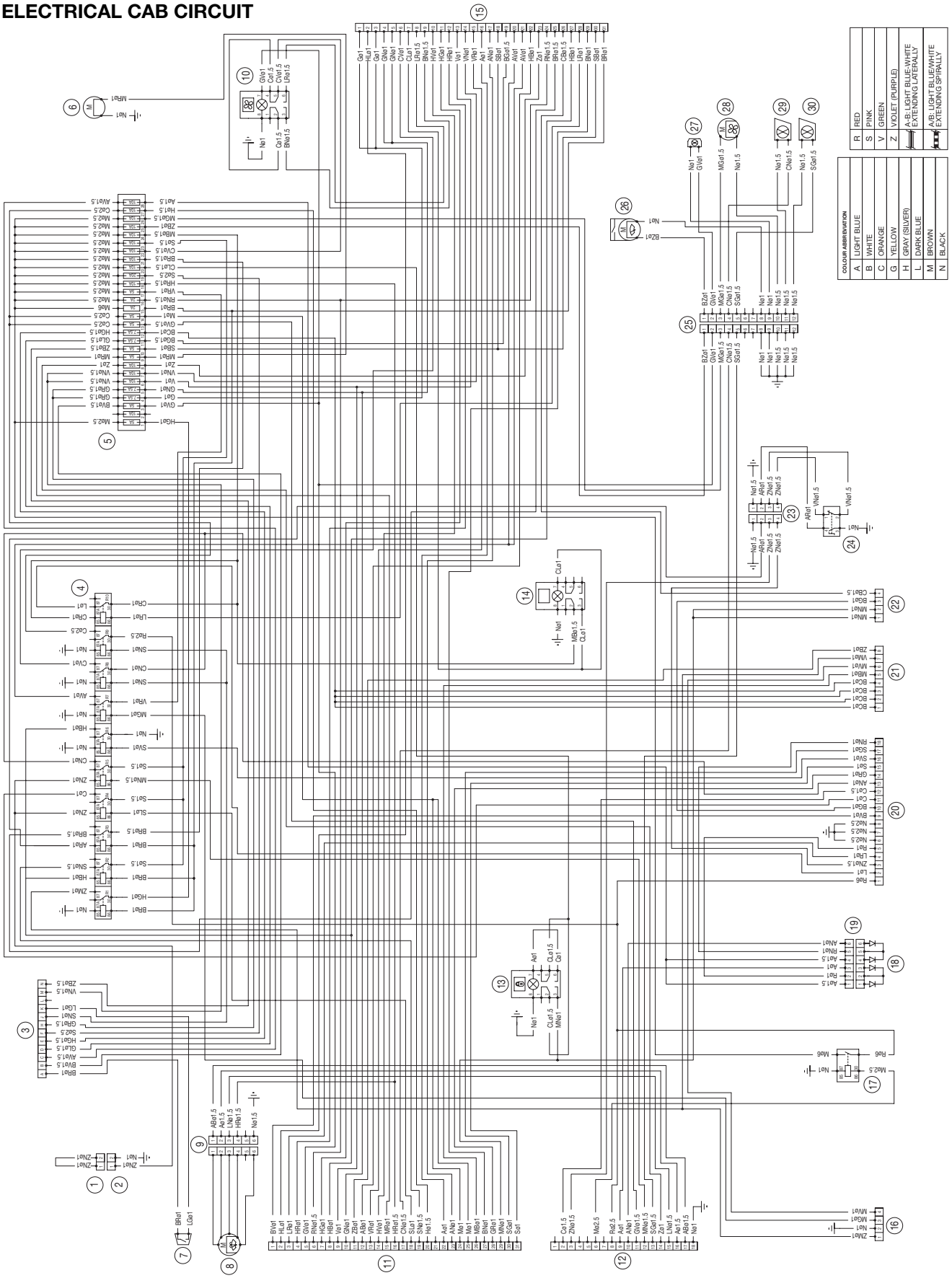
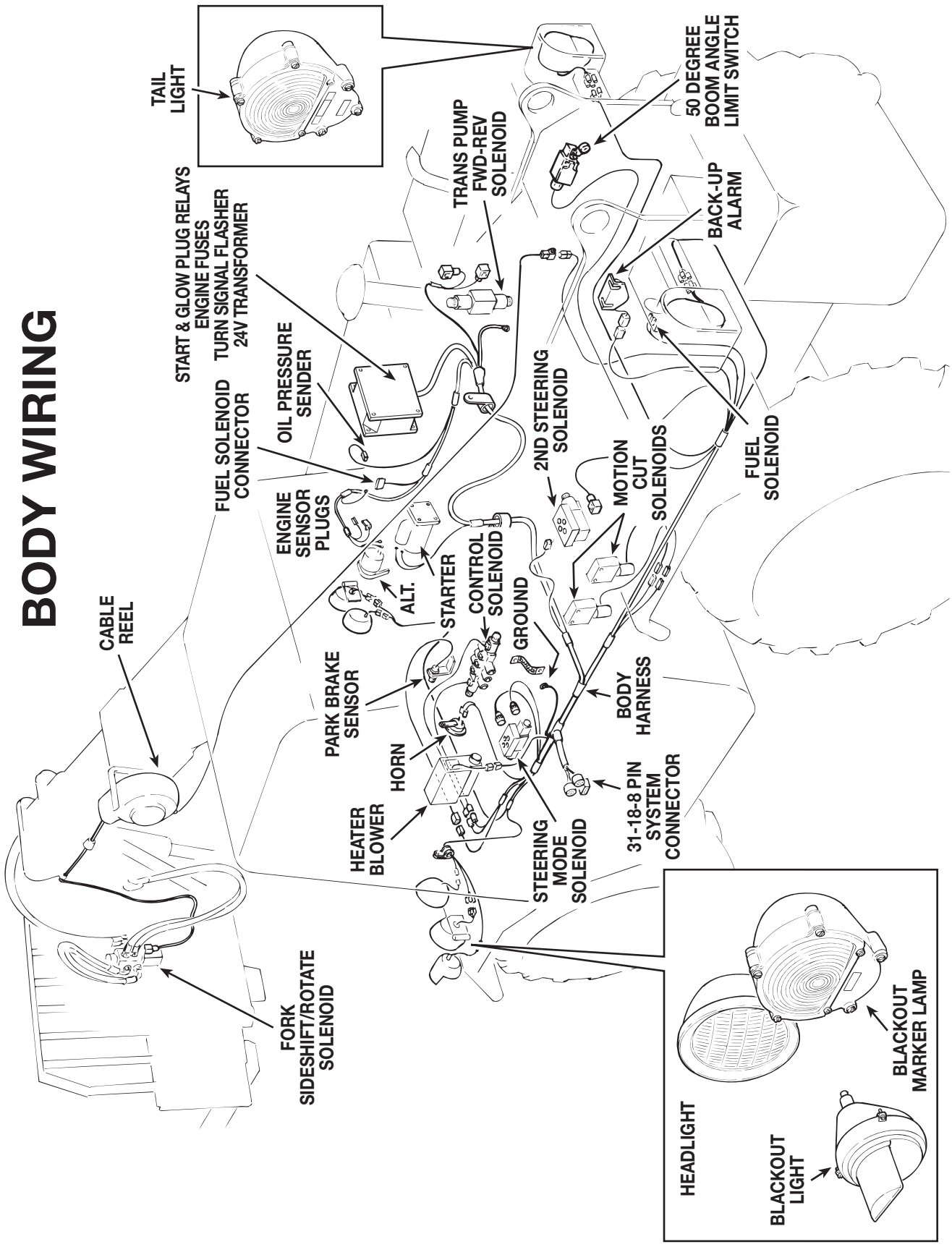
ELECTRICAL CAB CIRCUIT



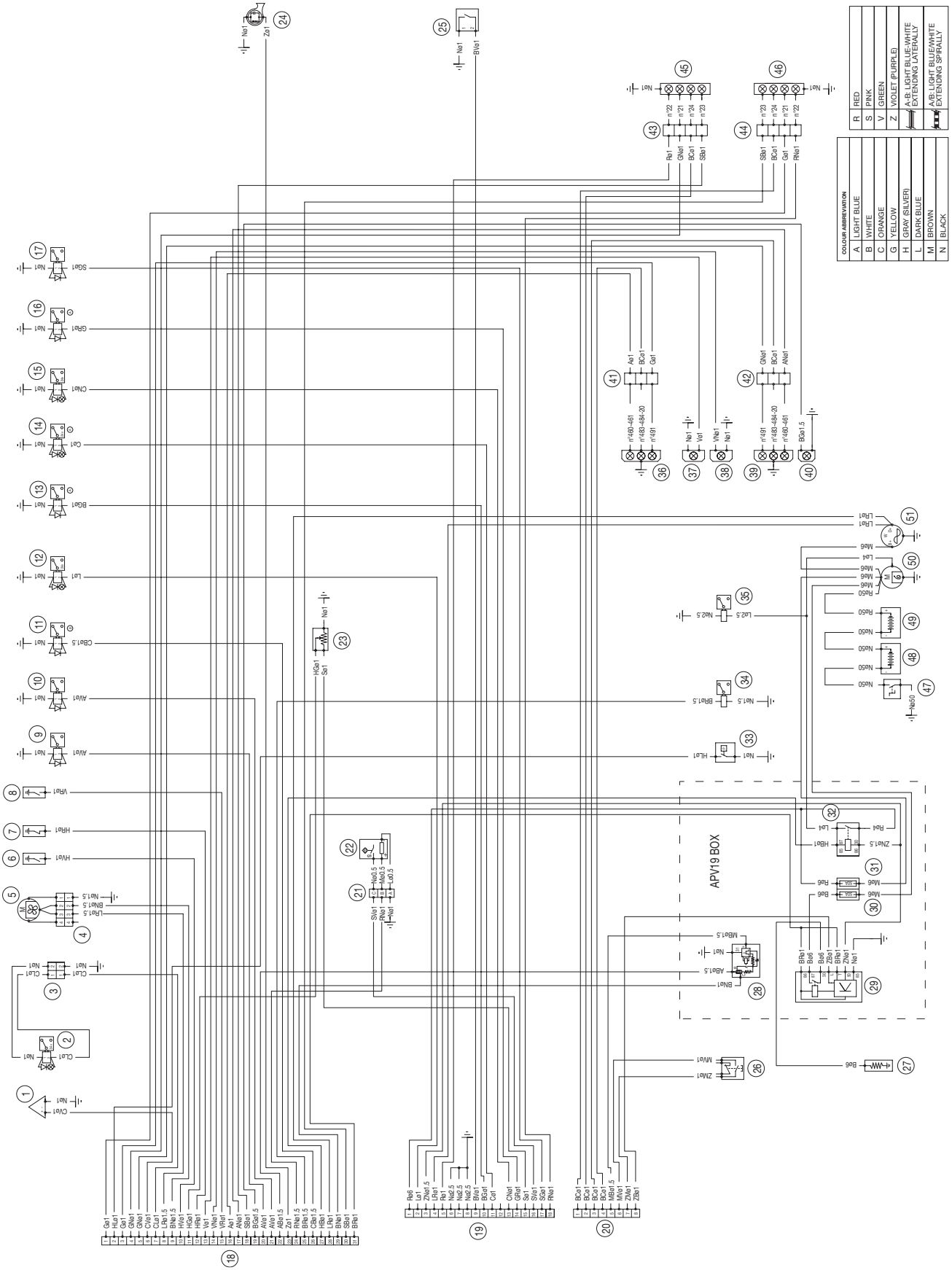
ELECTRICAL CAB CIRCUIT - description

Ref.	Description
1	SEAT MICROSWITCH BRIDGE
2	SEAT MICROSWITCH
3	LIGHTS CHANGE-OVER SWITCH CONNECTOR
4	FUSES AND RELAYS BOX (RELAY PANEL)
5	FUSES AND RELAYS BOX (FUSE PANEL)
6	WINDSCREEN WASHER KIT
7	HYDROSTOP
8	FRONT WINDSHIELD WASHER MOTOR
9	FRONT WINDSHIELD WASHER MOTOR CONNECTOR
10	HEATHER FAN SWITCH
11	31-POLE CONNECTOR – COLUMN LINE CONNECTION
12	18-POLE CONNECTOR – COLUMN LINE CONNECTION
13	WORK/TRAVEL SWITCH
14	FORK SIDE SHIFT/FORK ROTATE ROCKER SWITCH
15	31-POLE CONNECTOR – ENGINE LINE (X26. 3 s)
16	OVERLOAD WARNING SYSTEM CONTROL UNIT CONNECTOR
17	SYSTEM POWER UP RELAY
18	DIODE CONNECTOR
19	FUSES AND RELAYS BOX (DIODE BRIDGE)
20	18-POLE CONNECTOR – ENGINE LINE (X26.1s)
21	8-POLE CONNECTOR – ENGINE LINE (X26.2s)
22	JOISTICK CONNECTOR
23	EMERGENCY BUTTON SWITCH CONNECTOR
24	EMERGENCY BUTTON SWITCH
25	CAB SYSTEM 12 PIN CONNECTOR
26	REAR WINDSHIELD WIPER MOTOR
27	CAB CEILING MOTOR
28	CAB FAN MOTOR
29	REAR WORK LIGHT
30	FRONT WORK LIGHT

BODY WIRING


TAIL LIGHT
50 DEGREE BOOM ANGLE LIMIT SWITCH
TRANS PUMP FWD-REV SOLENOID
BACK-UP ALARM
START & GLOW PLUG RELAYS
ENGINE FUSES
TURN SIGNAL FLASHER
24V TRANSFORMER
OIL PRESSURE SENDER
FUEL SOLENOID CONNECTOR
2ND STEERING SOLENOID
MOTION CUT SOLENOIDS
FUEL SOLENOID
ENGINE SENSOR PLUGS
ALT.
STARTER
CONTROL SOLENOID
GROUND
CABLE REEL
PARK BRAKE SENSOR
BODY HARNESS
HORN
HEATER BLOWER
31-18-8 PIN SYSTEM CONNECTOR
STEERING MODE SOLENOID
FORK SIDESHIFT/ROTATE SOLENOID
HEADLIGHT
BLACKOUT MARKER LAMP
BLACKOUT LIGHT

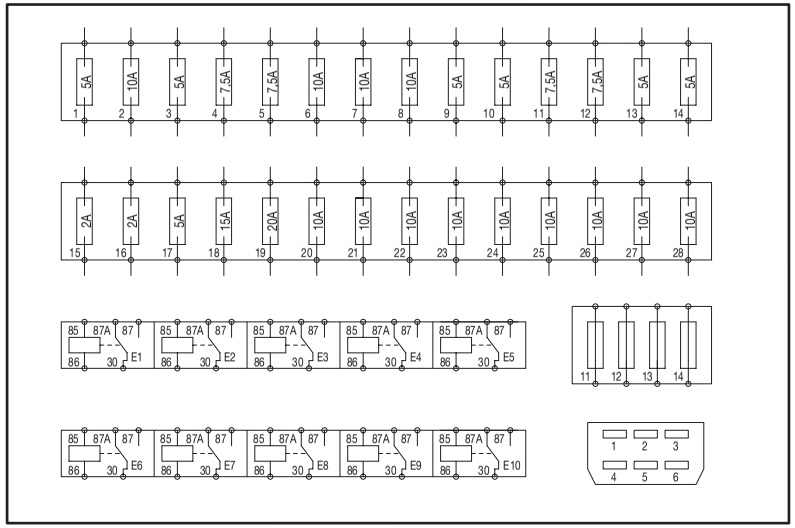
ELECTRICAL BODY CIRCUIT



ELECTRICAL BODY CIRCUIT - description

Ref.	Description
1	BACK-UP ALARM
2	ATTACHMENT COUPLING
3	SV CONNECTION – ATTACHMENT COUPLING
4	HEATING FAN MOTOR CONNECTOR
5	HEATING FAN MOTOR
6	WATER TEMPERATURE SENSOR
7	ENGINE OIL PRESSURE SENSOR
8	HYDRAULIC OIL TEMPERATURE SENSOR
9	DEADMAN SOLENOID VALVE
10	SOLENOID VALVE - OVERLOAD WARNING SYSTEM
11	SOLENOID VALVE - ATTACHMENT COUPLING
12	SOLENOID VALVE - T.U.V. NORMS
13	SOLENOID VALVE - ATTACHMENT RELEASE
14	SOLENOID VALVE - FORWARD SPEED
15	SOLENOID VALVE - REVERSE SPEED
16	SOLENOID VALVE - FOUR WHEEL STEER
17	SOLENOID VALVE - CRAB WHEEL STEER
18	CAB LINE CONNECTOR (X26.3p)
19	CAB LINE CONNECTOR (X26.1p)
20	CAB LINE CONNECTOR (X26.2p)
21	PARKING BRAKE SENSOR CONNECTOR
22	PARKING BRAKE SENSOR
23	FUEL FLOAT
24	HORN
25	ENGINE WATER TEMPERATURE SENSOR
26	BOOM ANGLE LESS THAN 50 DEGREES LIMIT SWITCH
27	PREHEATING GLOW PLUGS
28	TURN SIGNAL FLASHER
29	PREHEATING CONTROL UNIT
30	MAXI FUSE FOR GLOW PLUGS PROTECTION
31	SYSTEM PROTECTION MAXI-FUSE
32	START-UP RELAY
33	AIR FILTER PRESSURE SENSOR
34	SOLENOID VALVE - ENGINE STOP
35	DIESEL FUEL ENRICHER SV
36	POSITION LIGHT – TURN SIGNAL AND MILITARY RH BLACKOUT POSITION LIGHT
37	RIGHT HEADLIGHT
38	LEFT HEADLIGHT
39	POSITION LIGHT – TURN SIGNAL AND MILITARY LH BLACKOUT POSITION LIGHT
40	MILITARY BLACKOUT LOW BEAM
41	FRONT RH MILITARY LIGHT CONNECTOR
42	FRONT LH MILITARY LIGHT CONNECTOR
43	REAR RH MILITARY LIGHT CONNECTOR
44	REAR LH MILITARY LIGHT CONNECTOR
45	REAR RIGHT LIGHT
46	LEFT RIGHT LIGHT
47	BATTERY DISCONNECT SWITCH
48	12 V BATTERY
49	12 V BATTERY
50	STARTING MOTOR
51	ALTERNATOR

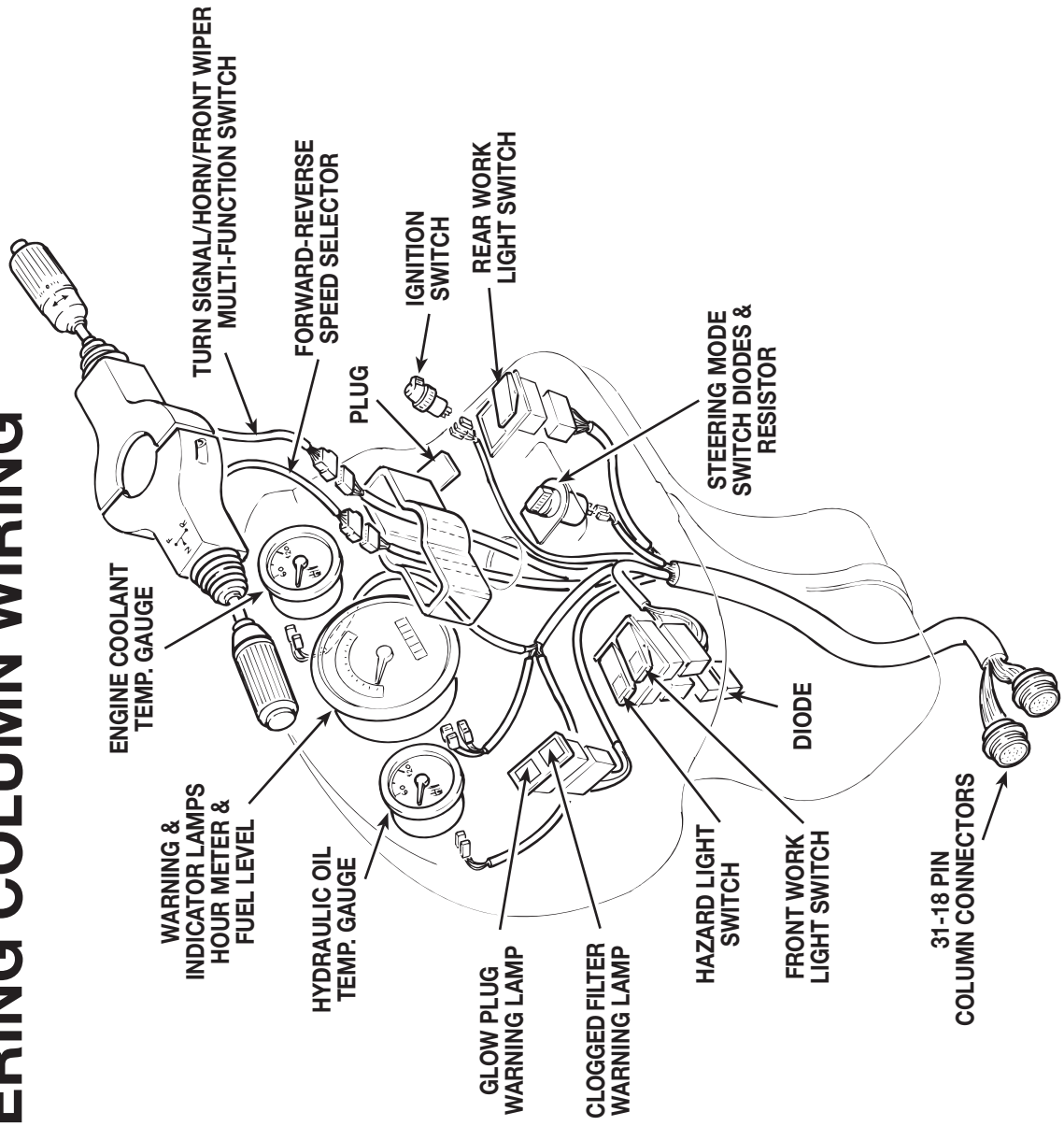
Fuses and Relays Table



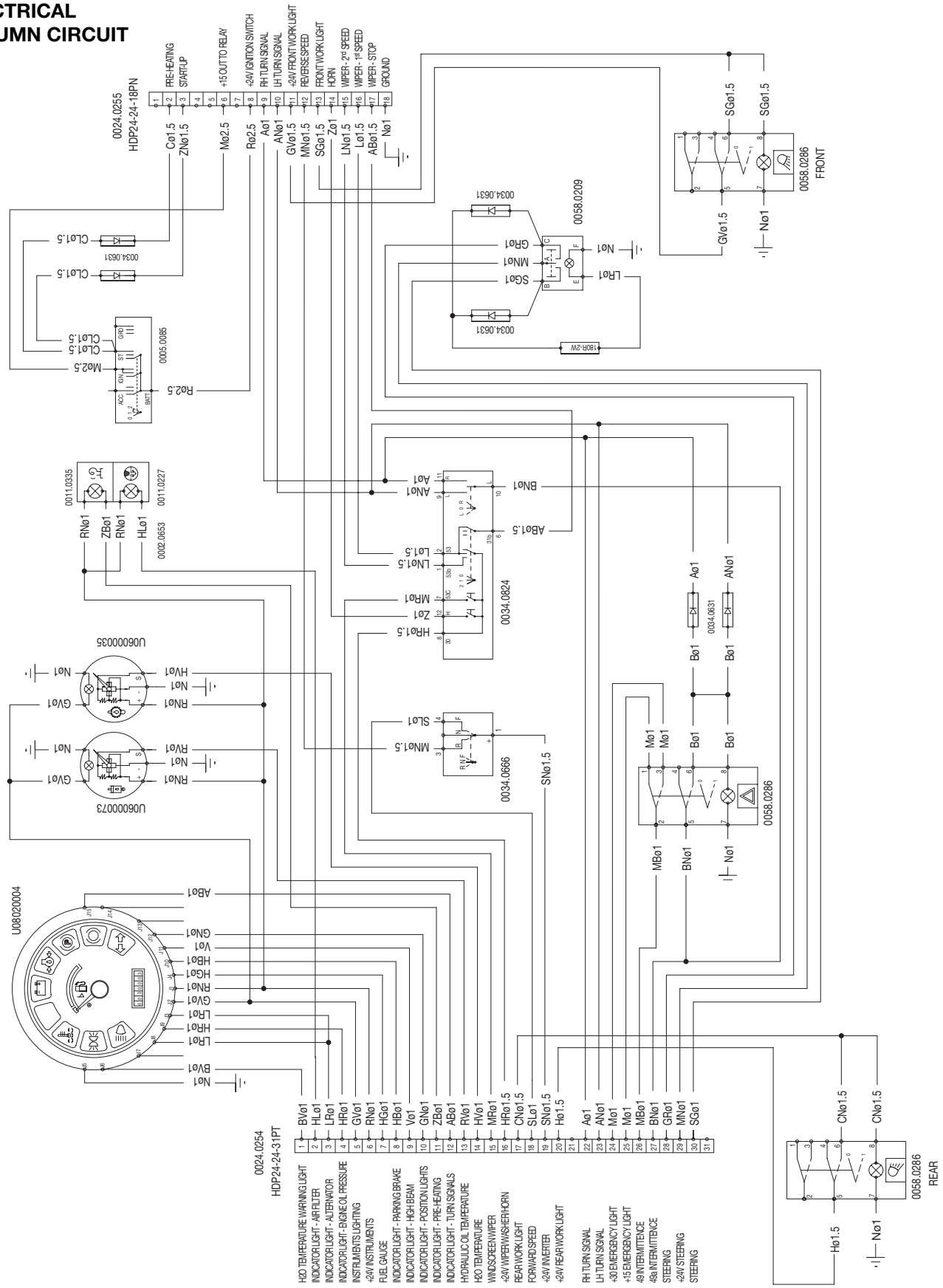
Ref.	FUSES
1	R1 RELAY POWER SUPPLY
2	OPTIONAL
3	HEATING FAN SWITCH LIGHTING, CAB CEILING LIGHT FIXITURE, WARNING LAMPS SET INSTRUMENT, HYDRAULIC OIL TEMPERATURE INDICATOR INSTRUMENT, FUEL INDICATOR INSTRUMENT
4	FRONT RIGHT/REAR LEFT POSITION LIGHTS, LICENSE PLATE LIGHTS
5	FRONT LEFT/REAR RIGHT POSITION LIGHTS, POSITION LIGHTS WARNING LAMPS
6	RIGHT HEADLIGHT, HEADLIGHTS WARNING LAMPS
7	LEFT HEADLIGHT
8	HORN
9	WINDSCREEN WASHER MOTOR
10	MARKED STOP LIGHT
11	MARKED MILITARY HEADLIGHT
12	MARKED POSITION LIGHTS
13	CAB FRONT WORK LIGHT SWITCH POWER SUPPLY
14	INDICATORS (+15) EMERGENCY SWITCH POWER SUPPLY
15	STOP SWITCH POWER SUPPLY, MILITARY LIGHTS SELECTORS CONNECTOR, R1-R2 RELAY EXCITATION, PRE-HEATING RELAY
16	PARKING BRAKE SENSOR POWER SUPPLY, WARNING LAMPS SET INSTRUMENT, HYDRAULIC OIL TEMPERATURE INDICATOR INSTRUMENT, FUEL INDICATOR INSTRUMENT
17	R7 RELAY POWER SUPPLY
18	FRONT WINDSCREEN WASHER MOTOR POWER SUPPLY, HORN-WINDSCREEN WASHER LEVER
19	MILITARY LIGHTS SELECTOR CONNECTOR POWER SUPPLY
20	ROAD SAFETY SWITCH POWER SUPPLY
21	R3 RELAY POWER SUPPLY
22	HEATING FAN SWITCH POWER SUPPLY
23	R2, R4, R5 RELAY POWER SUPPLY
24	ATTACHMENT COUPLING SWITCH POWER SUPPLY, R10 RELAY, R10 RELAY EXCITATION
25	REAR WINDSCREEN WASHER POWER SUPPLY
26	FAN MOTOR POWER SUPPLY
27	CAB REAR WORK LIGHT SWITCH POWER SUPPLY
28	LEFT-RIGHT BRAKE LIGHT

Ref.	RELAYS	
1	RELAY R1:	OVERLOAD WARNING SYSTEM CONTROL UNIT
2	RELAY R2:	SPEED SELECTOR POWER SUPPLY ENABLED
3	RELAY R3:	ENGINE STOP POWER SUPPLY ENABLED
4	RELAY R4:	TRANSMISSION FORWARD
5	RELAY R5:	TRANSMISSION REVERSE
6	RELAY R6:	PARKING BRAKE
7	RELAY R7:	DEADMAN, OVERLOAD WARNING SYSTEM
8	RELAY R8:	BACKUP HORN POWER SUPPLY ENABLED
9	RELAY R9:	FUSE N° 25, 26, 27 POWER SUPPLY CONSENT
10	RELAY R10:	T.U.V. NORMS

STEERING COLUMN WIRING



ELECTRICAL COLUMN CIRCUIT



SECTION 17
HYDRAULIC SYSTEM

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17.0 HYDRAULIC SYSTEM

GENERAL

This section provides troubleshooting, maintenance and service information for the pumps and valves and hydraulic system. A circuit description and hydraulic schematic are included to aid in troubleshooting the system.

17.1 HYDRAULIC DRIVE PUMP REMOVAL / INSTALLATION

REMOVAL

Follow the procedures below for removal of drive pump:

1. Remove the engine hood by opening and holding the hood in raised position. Use adequate lifting device to support the engine hood.
2. Remove the lock nut securing the shock absorbing gas springs by using two 13 mm wrenches.
3. Remove the four screws with lock nut and flat washer that secure the hood.
4. Remove the hood.
5. Place container of suitable size under the drive pump.
6. Using a 32 mm wrench disconnect the draining hoses.
7. Using an 18 mm wrench, disconnect the hydraulic supply hoses.
8. Using an 8 mm wrench, disconnect the two pressure hoses.
9. Close the oil tank valves.
10. Carefully clean the area around the piping prior to disconnecting the hoses.
11. Disconnect the intake hose with a 48 mm wrench.
12. Remove the two bolts locking the pump with a 14 mm wrench.
13. Use and adequate lifting device to support and pull the drive pump toward rear of machine.
14. Remove the drive pump from frame.

INSTALLATION

1. Using adequate lifting device support and install drive pump into the machine.
2. Using 14 mm wrench install the two bolts locking the pump in place.
3. Open the oil tank valves.
4. Using an 8 mm wrench, connect the two pressure hoses.
5. Use an 18 mm wrench and connect the hydraulic supply hoses.
6. Using a 32 mm wrench connect the draining hoses.
7. Fill the drive pump with the correct fluid.
8. Reinstall the engine hood.

17.2 CYLINDER HOLDING VALVE

REMOVAL

Follow the procedures below for removal of holding valve:

1. Position the machine on hard level surface.
2. Place a container of suitable size under the valve.
3. Prior to replacing any holding valves, make sure to relieve pressure from valves.
4. Use adequate lifting device to support the component.
5. Tag and disconnect hydraulic lines, releasing any residual pressure. Install covers and plugs on the lines and ports to prevent the entry of dust and contaminants.
6. Slowly remove the bolts securing the valve to the cylinder and bleed the cylinder.

INSTALLATION

1. Before reinstalling a holding valve special care must be taken to ensure all surfaces are clean.
2. Install new o-ring. You should never use old o-ring. O-ring must be replace with new o-rings.
3. Install holding valve and hand tighten the securing bolts.
4. Tighten the bolts in a cross tightening pattern.
5. Connect the hydraulic hoses in the correct locations.
6. Start machine and check for leaks.

17.3 HYDRAULIC MOTOR

REMOVAL

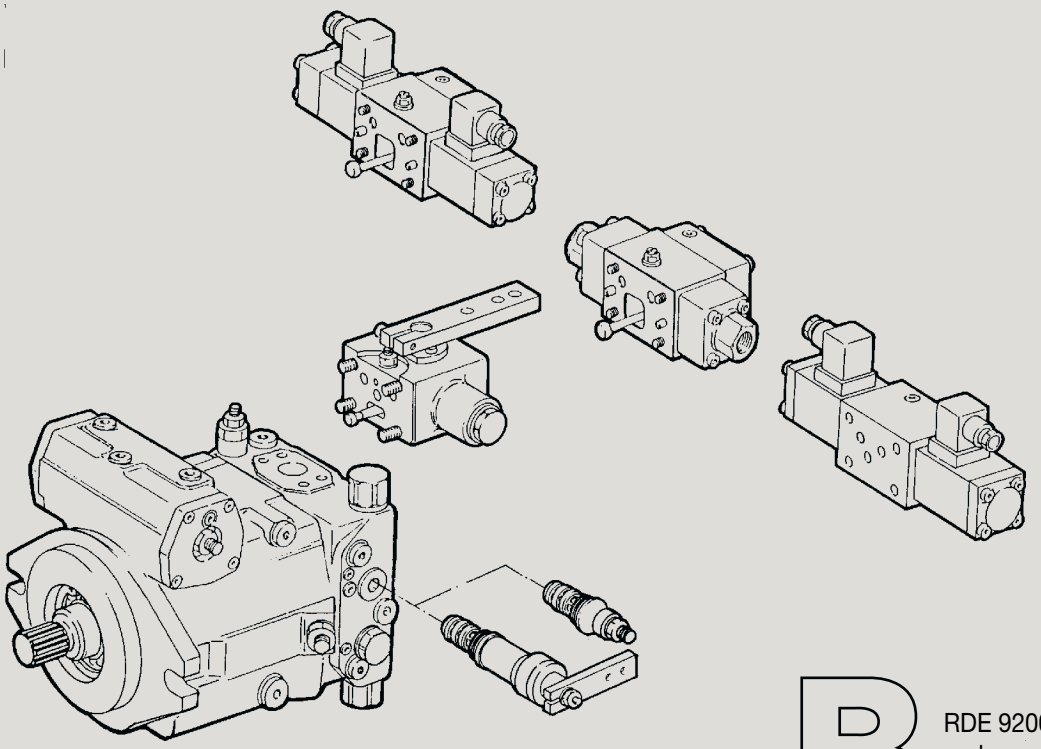
Follow the procedures below for removal of hydraulic motor:

1. Position the machine on hard level surface.
2. Remove the bottom protections cover and disconnect the drive shaft.
3. Disconnect the draining hose with a 32 mm wrench.
4. Using a 18 mm wrench disconnect the displacement change feeding hose.
5. Disconnect the two delivery hoses with an 8 mm wrench.
6. Remove the four locking screws of the motor with a 24 mm wrench.
7. Pull out the motor from the power divider secured to the front axle.
8. Protect the motor connecting compartment in a suitable way to prevent the entrance of impurities.

INSTALLATION

Follow the procedures below to installation the hydraulic motor:

1. Install the four locking screws of the motor.
2. Connect the two delivery hoses using an 8 mm wrench.
3. Connect the displacement change feeding hose.
4. Connect the draining hoses.
5. Install the bottom protection cover and connect the drive shaft.
6. Check for leaks.



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RDE 92003-01-R/05.99
replaces
RDE 92003-01-R/07.96

Repair instructions

Mod. A4VG 40 - 56 Series 32

NOTICE

Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing.

BRUENINGHAUS HYDROMATIK reserves the right to discontinue models or options at any time or to change specifications, materials, or design without notice and with-out incurring obligation.

Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options.

For the available combinations refer to the relevant data sheet for the basic unit and the desired option.

Adjustment and tests have to be carried out on the test bench under operating temperatures.

Protection of personnel and property has to be guaranteed by appropriate measures.

Expert knowledge, the precondition of any service work, can be obtained in our training courses.

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A4VG

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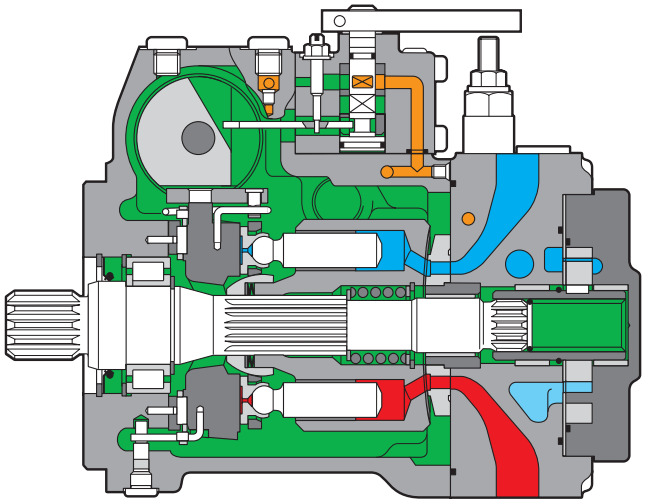
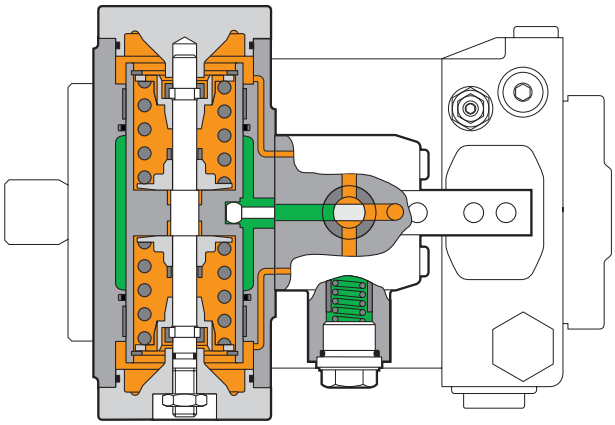
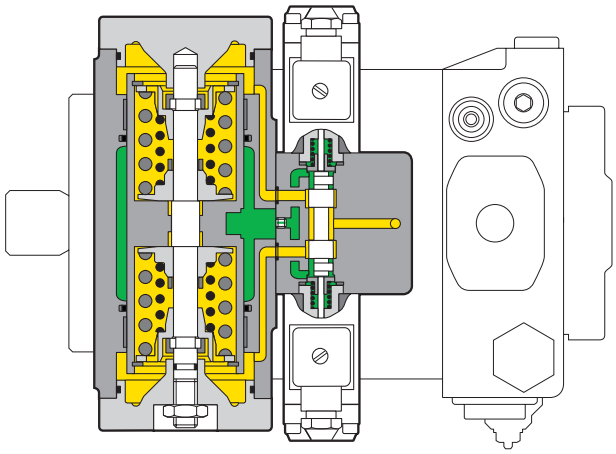


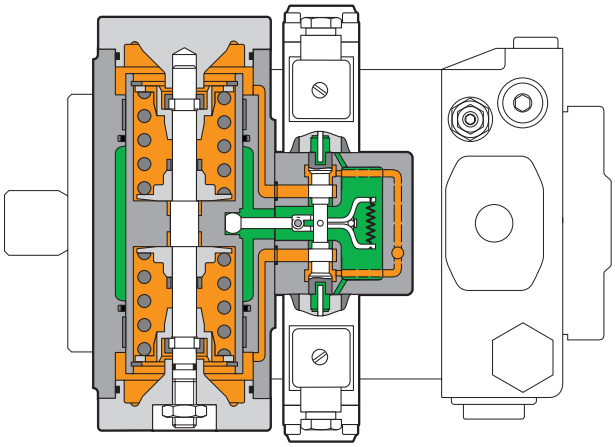
HWD



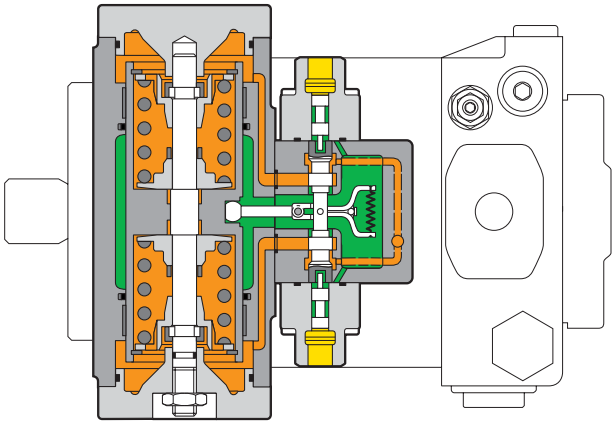
DAD



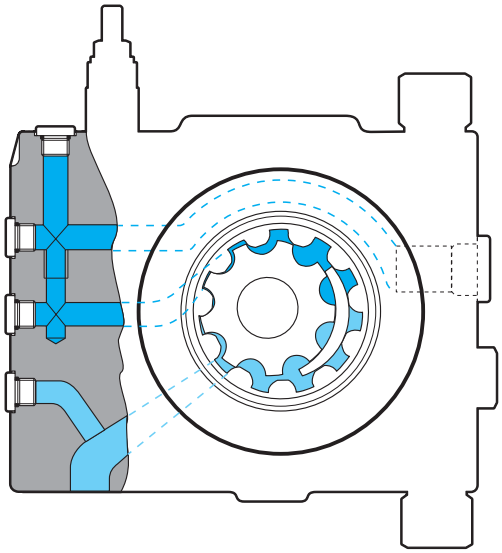
EPD

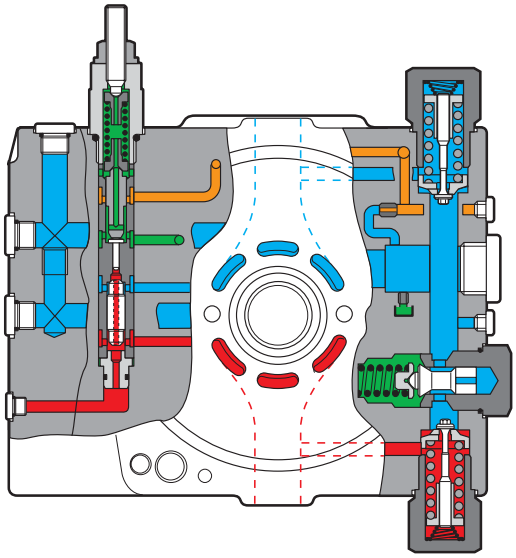


HDD

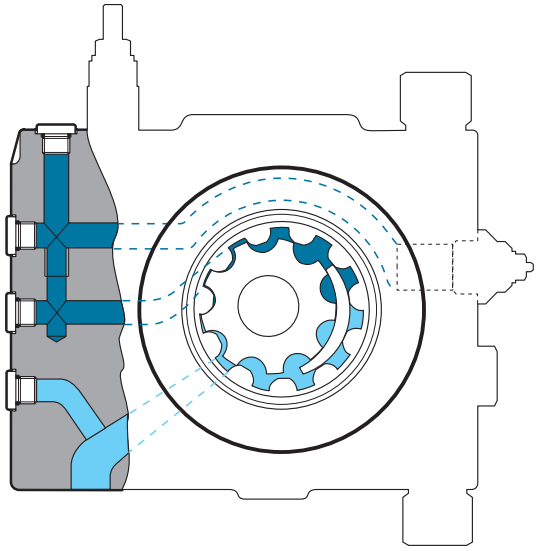


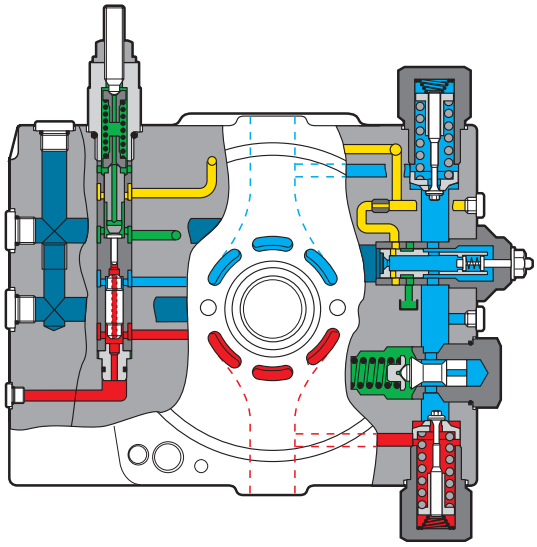
HWD / EPD / HDD

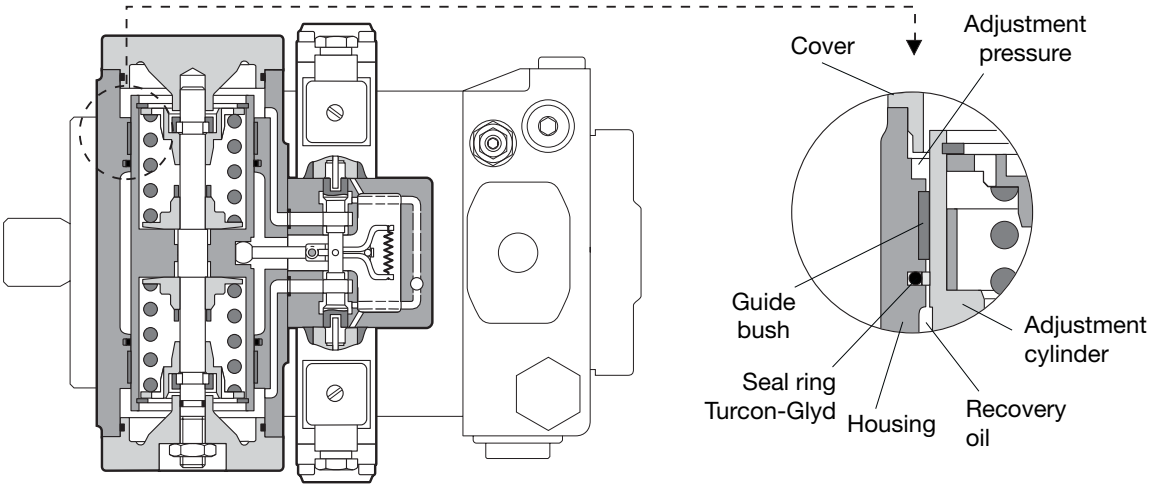




DAD



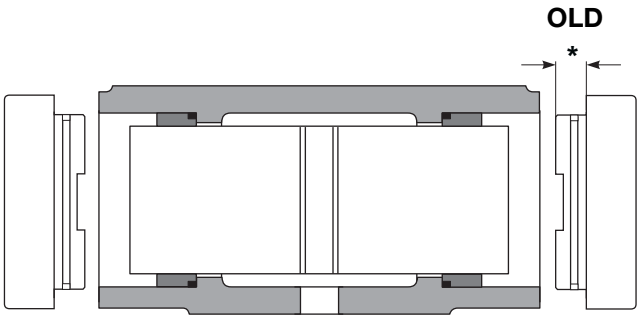




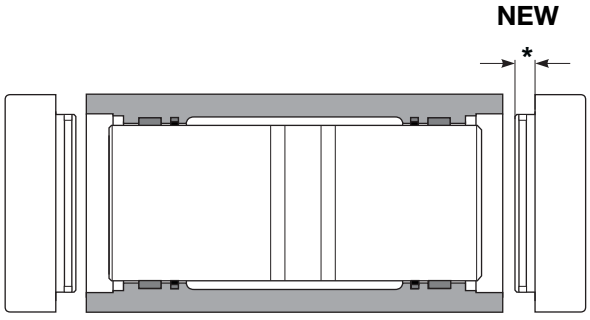
At present the change of the control into Turcon seal is made for A4VG.
The parts list of the complete unit will receive a new identification number.
Type reference and outside dimensions remain unchanged (pump housing will change at the area of the positioning piston. Positioning piston will change into chamfering design).

⚠ Do not use old positioning piston with Turcon seal (sharp edged - seal will be damaged)

Pump housing with bush

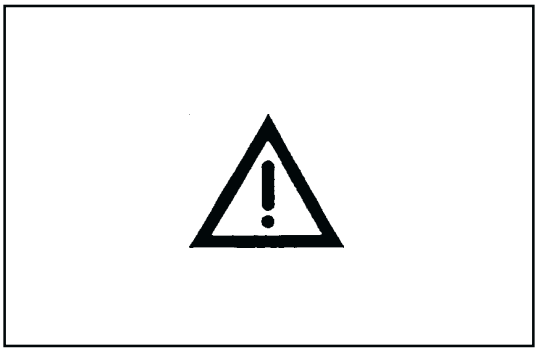


Pump housing with Turcon seal

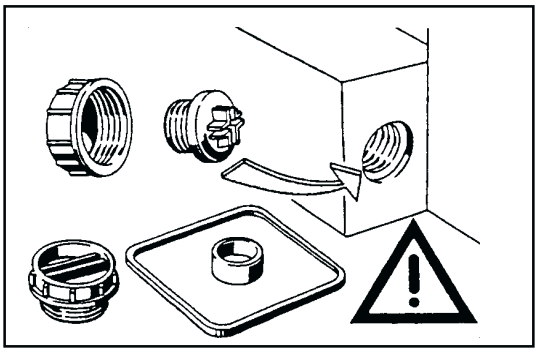


⚠ The change of the control into Turcon seal design improves in general the function (DA-behaviour, lower temperature-influence on control times).

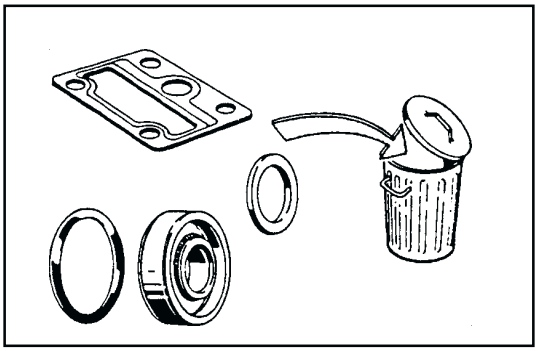
⚠ The control times will slightly change with the same throttle sections. Therefore our customers have to be informed about this change.



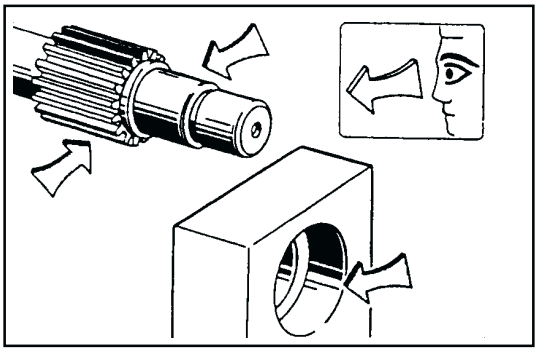
Attention!
Observe the following notices when carrying out repair work at hydraulic aggregates!



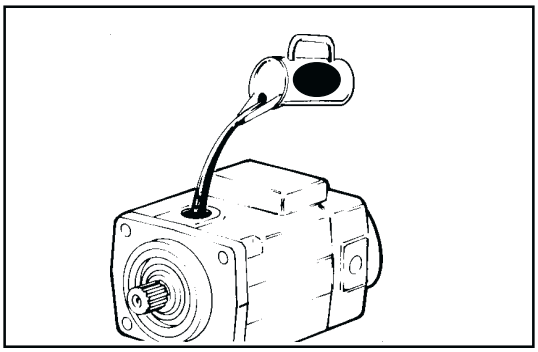
Close all ports of the hydraulic aggregates.



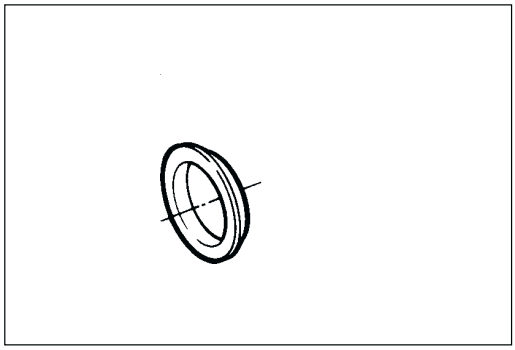
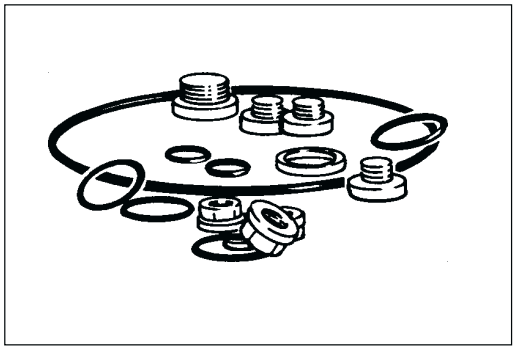
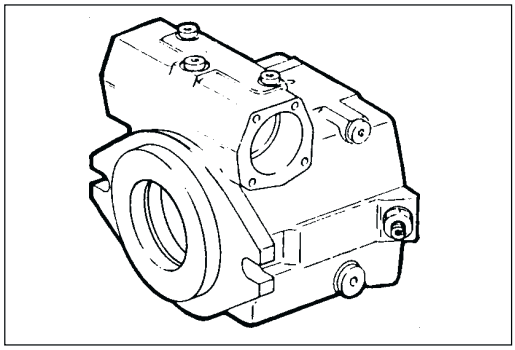
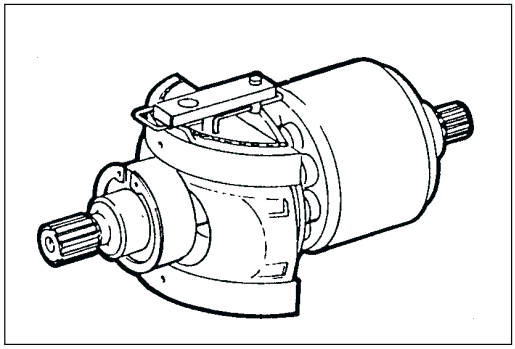
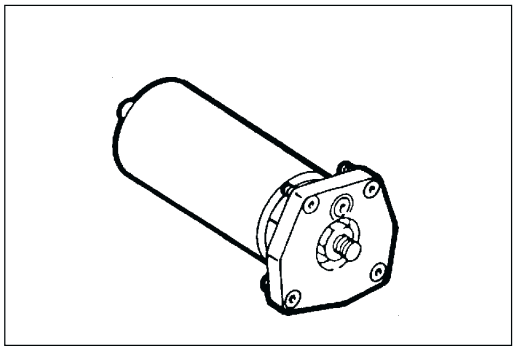
Replace all seals.
Use only original BRUENINGHAUS HYDROMATIK spare parts.

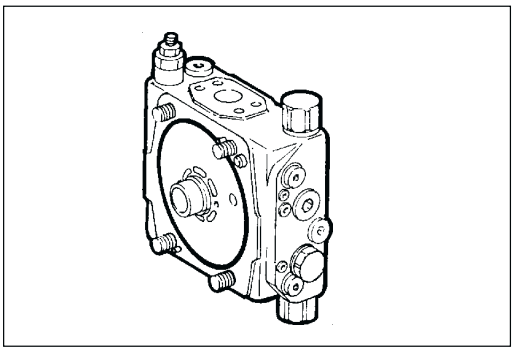


Check all seal and sliding surfaces for wear.
Attention: Rework of sealing area f. ex. with abrasive paper can damage surface.

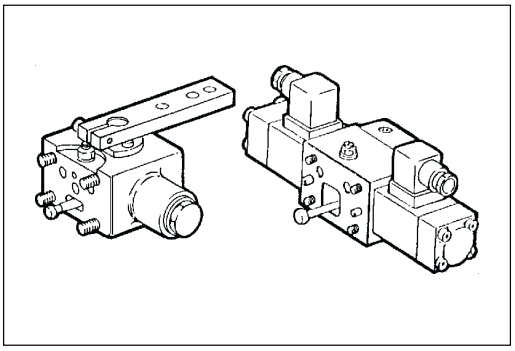


Fill up hydraulic aggregates with medium before start-up.

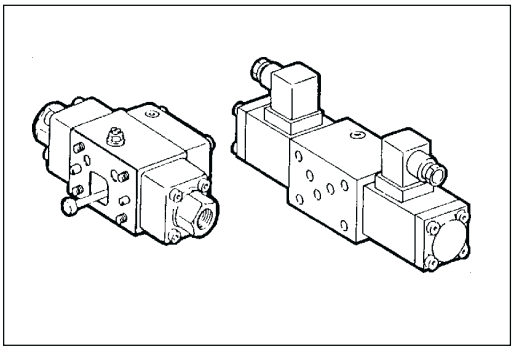
	1	Seal kit for drive shaft.
	2	External seal kit.
	3	Housing.
	4	Complete rotary group.
	5	Positioning piston.



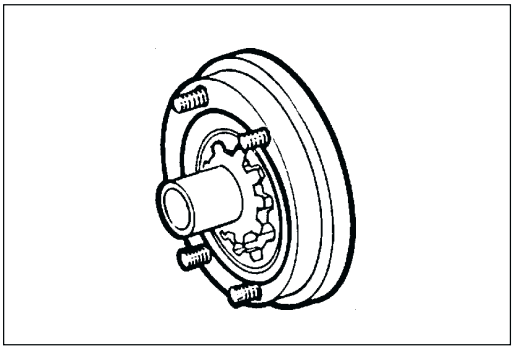
6 Port block.



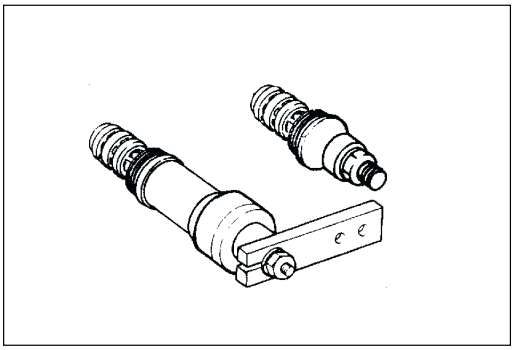
7 Control moduls **HW - EP.**



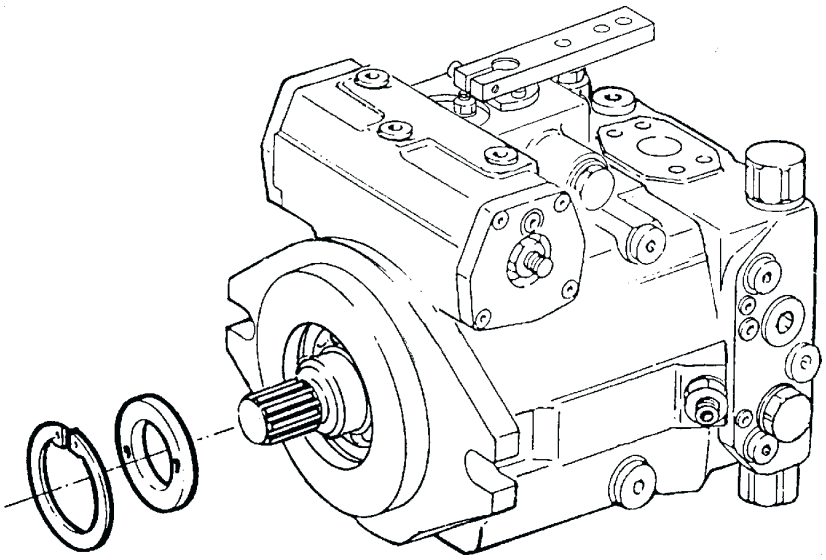
8 Control moduls **HD - DA.**



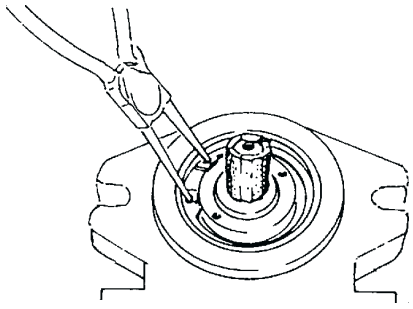
9 Boost pump.



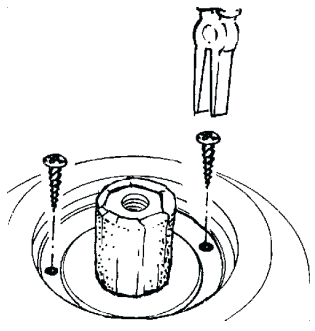
10 Control valve.



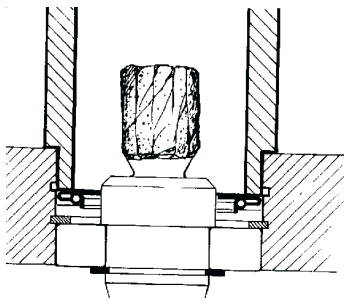
11



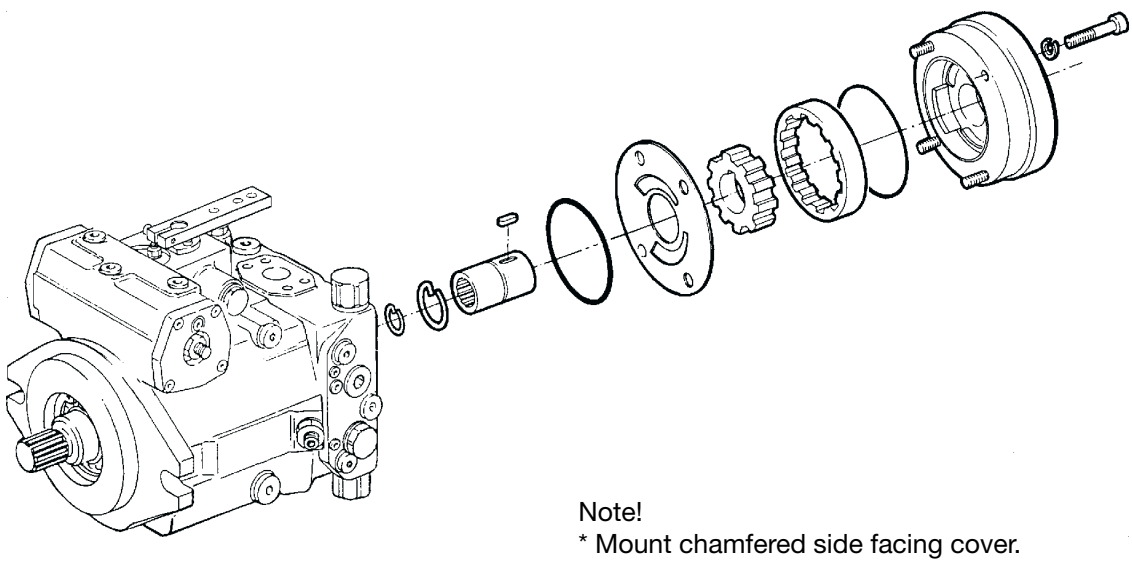
12 Protecting the drive shaft.
Remove retaining ring.



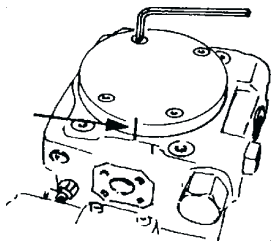
13 Screw in sheet metal screw into the holes fitted with rubber.
Pull out shaft seal with pliers.



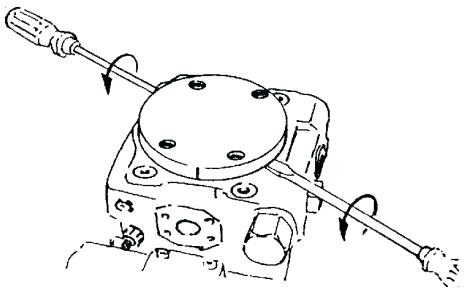
14 Press-in shaft seal with bush to stop.



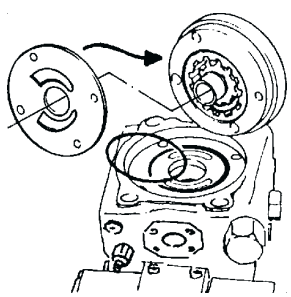
Note!
* Mount chamfered side facing cover. 15



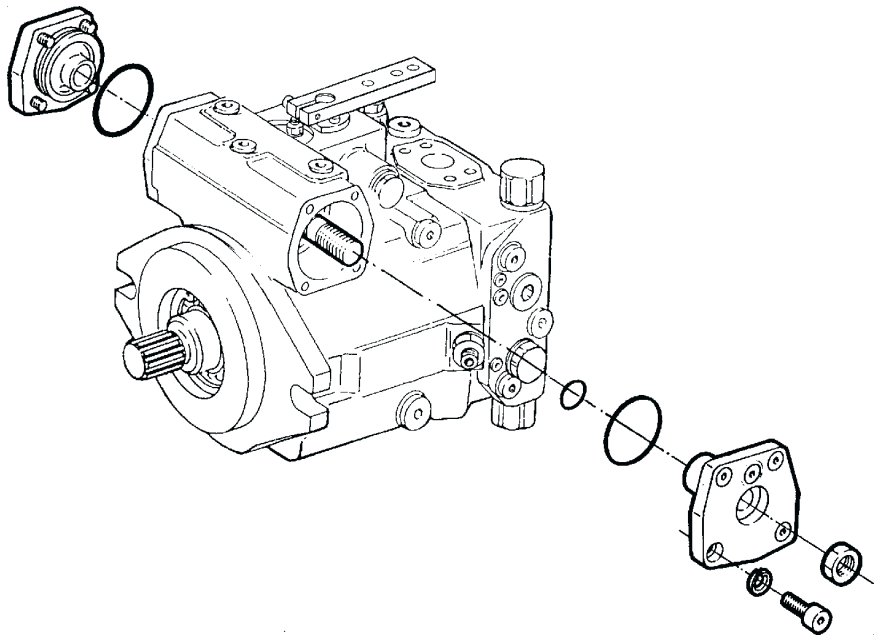
16 Mark position, remove fixing screws.



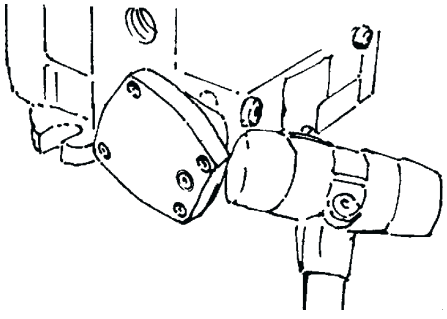
17 Pry-off cover.



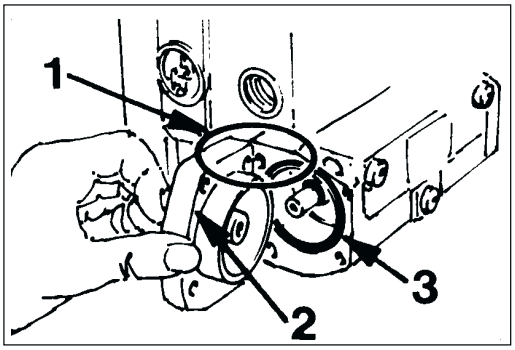
18 Inspect the parts of the boost pump and wear parts. Boost pump can only be interchanged completely.



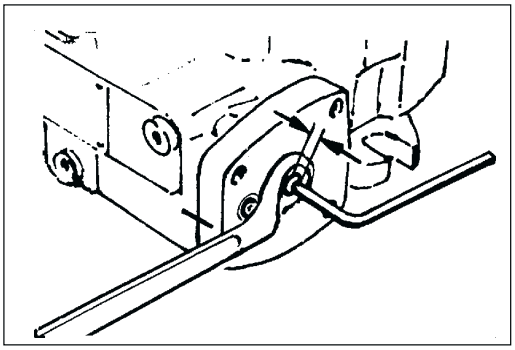
19



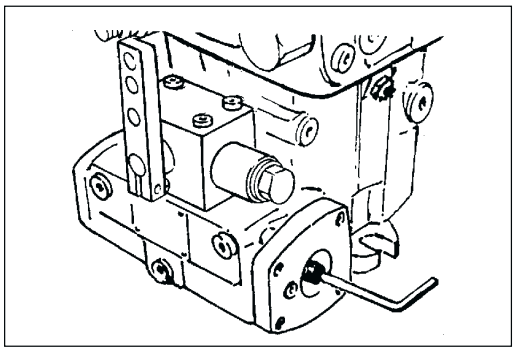
20 Loosen mounting screws.
Rotate cover and release by tapping gently with hammer.



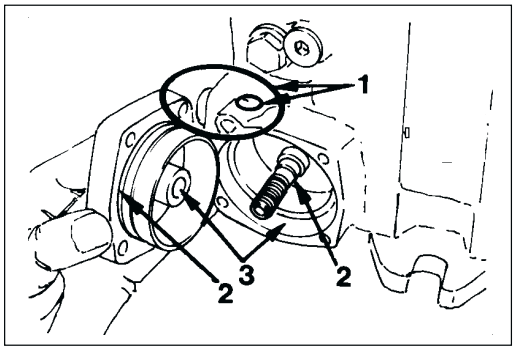
21 Check!
O-ring (1), groove (2), housing (3).



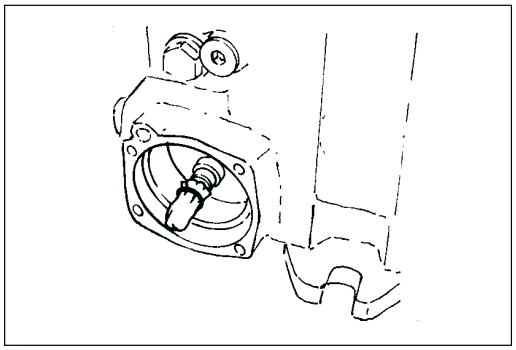
22 Remove locknut whilst holding setting screw.
Mark cover. Must be fixed, loosen counter nut.



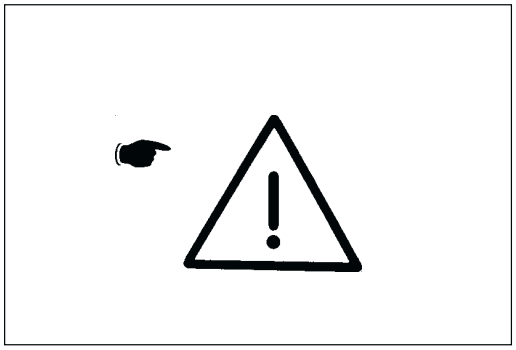
23 Pull cover off using zero position adjustment screw.



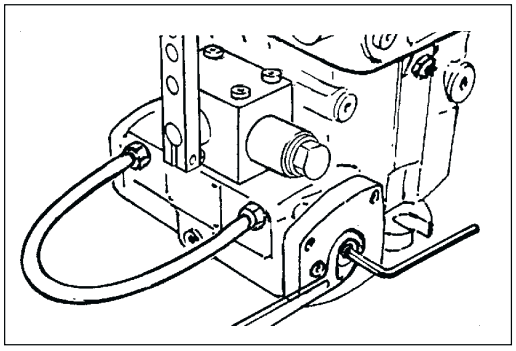
24 Check!
O-ring (19), groove (2), housing (3).



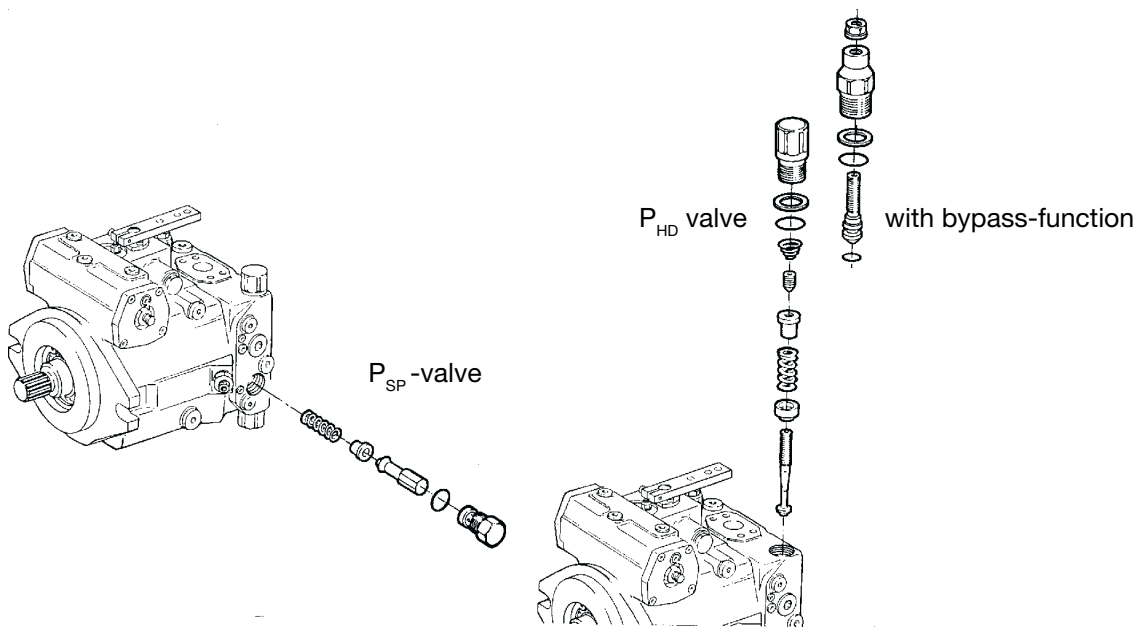
25 Cover threads, push on small O-ring.
Assemble in reversed order.



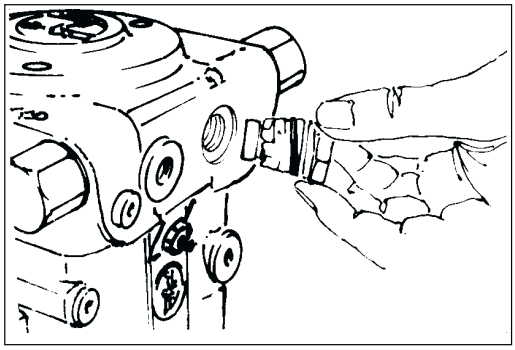
26 Attention!
Adjustment of the correct zero position to be carried out after installation into the machine or on the test bench.



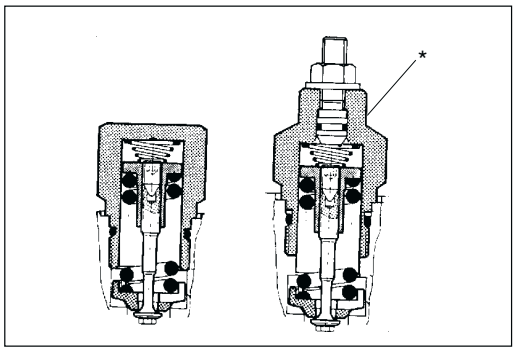
27 Reset mechanical zero position. To do this, connect X_1 to X_2 (size > 6).



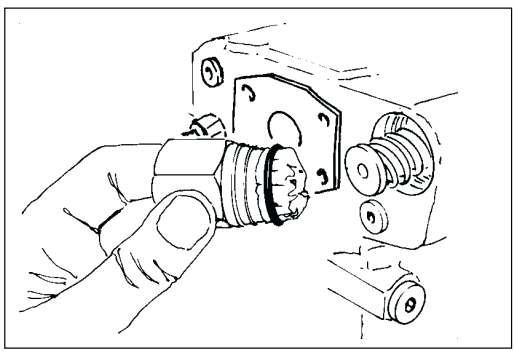
28



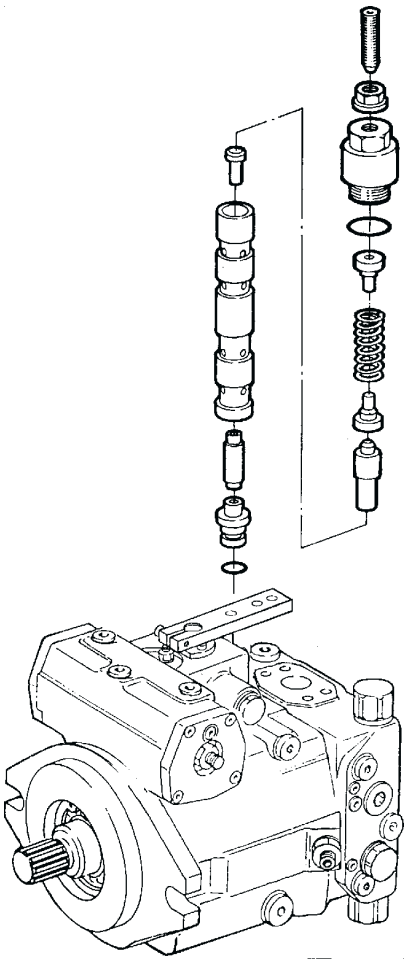
29 Cover threads before fitting new O-rings.
(Damage protection).



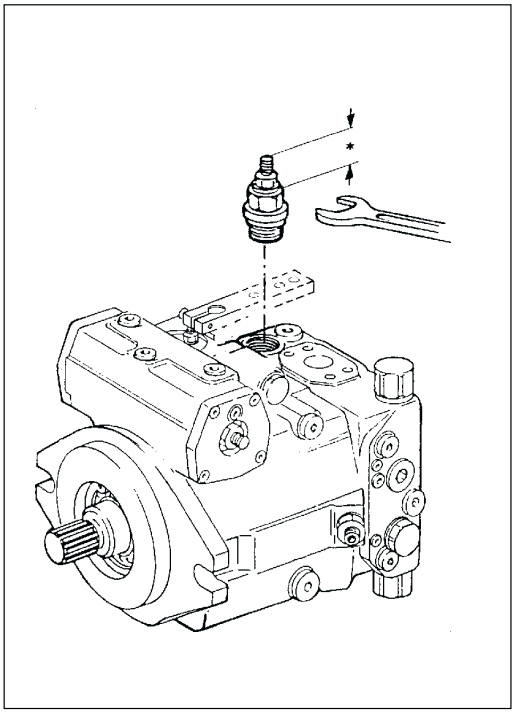
30 Remove valve poppet with spring.
* with bypass-function



31 Cover threads before fitting new O-rings.
(Damage protection).

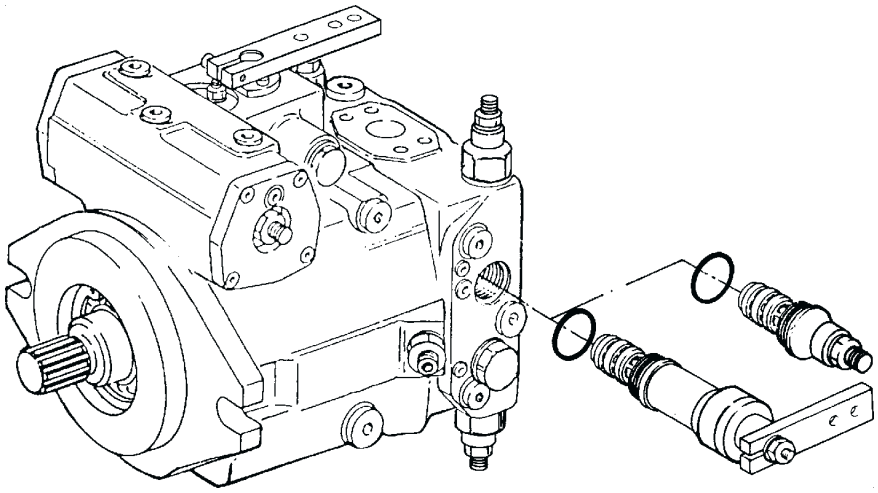


32

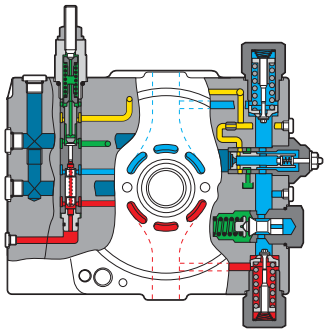


33 Change of the sealing nut.
Note setting measure (*).

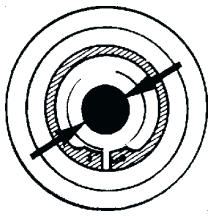
Attention!
After assembly check “valve setting”.



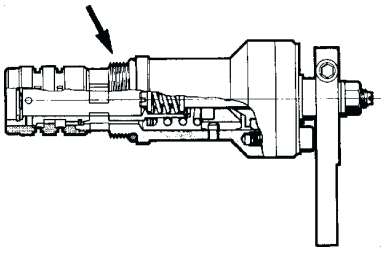
34



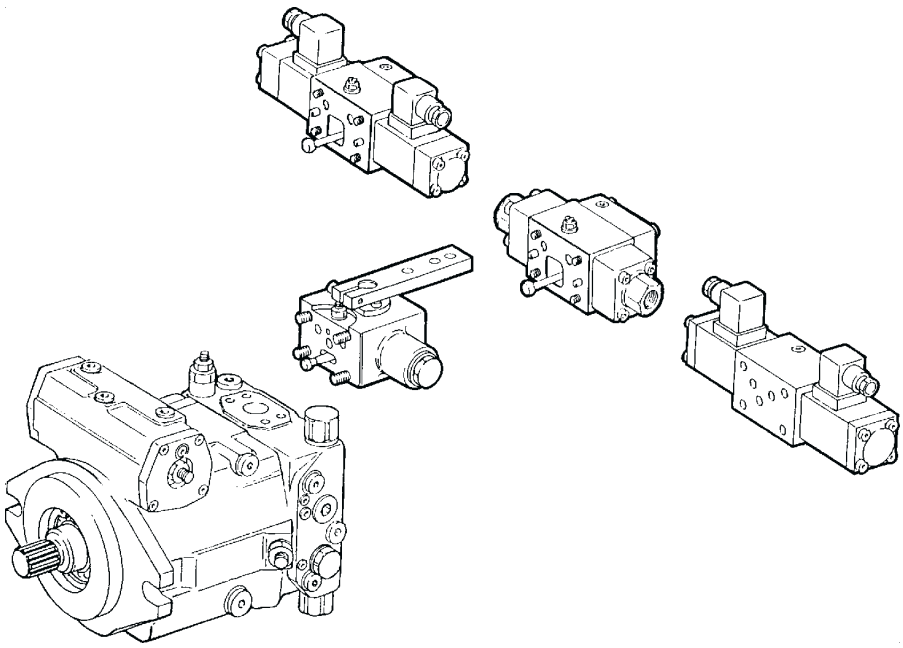
35 Remove control valve.



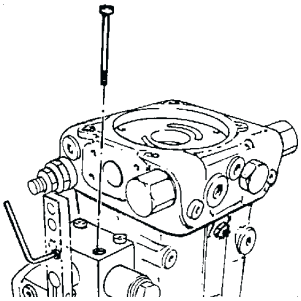
36 Do not damage throttle diameter.



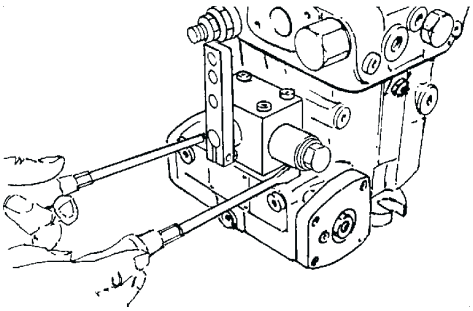
37 Before installing the new O-ring, tape the threads.



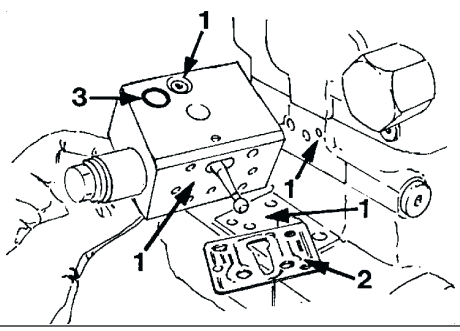
38



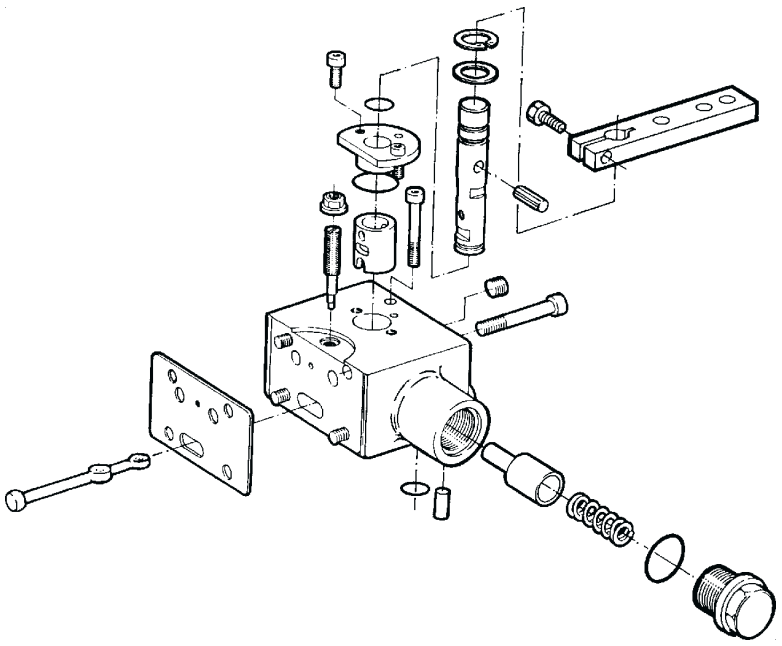
39 Remove fixing screws.



40 Pry-off the control module.

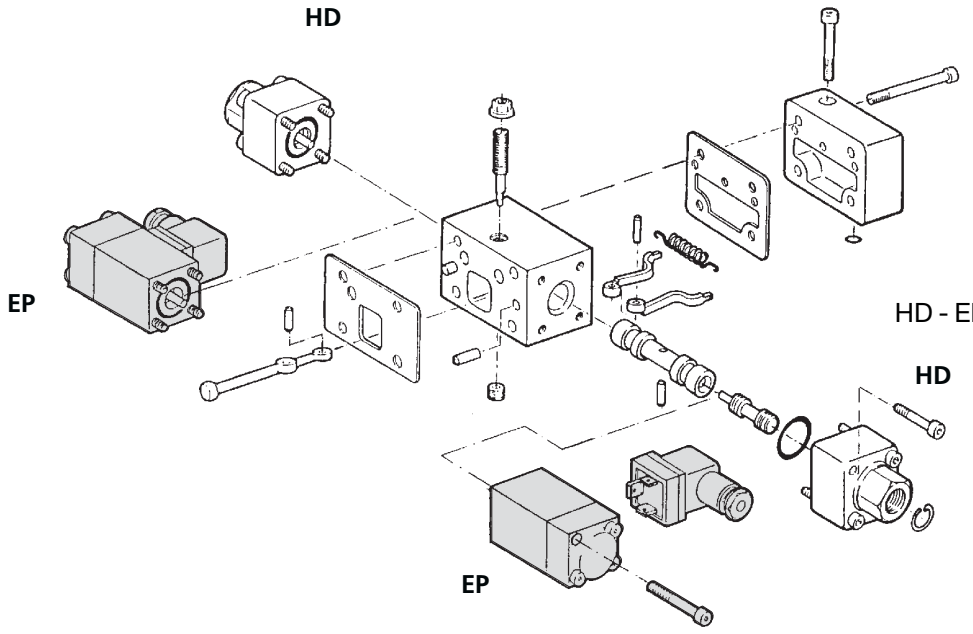


41 Check
Sealing surface (1), gasket (2), o-rings (3).



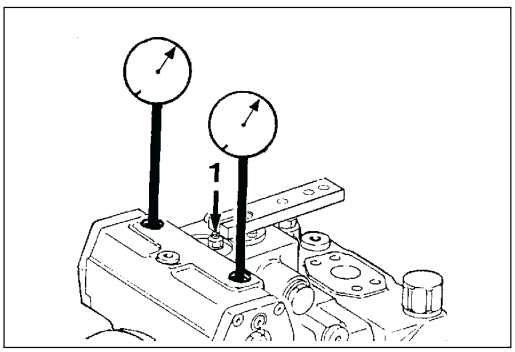
HW control module

42



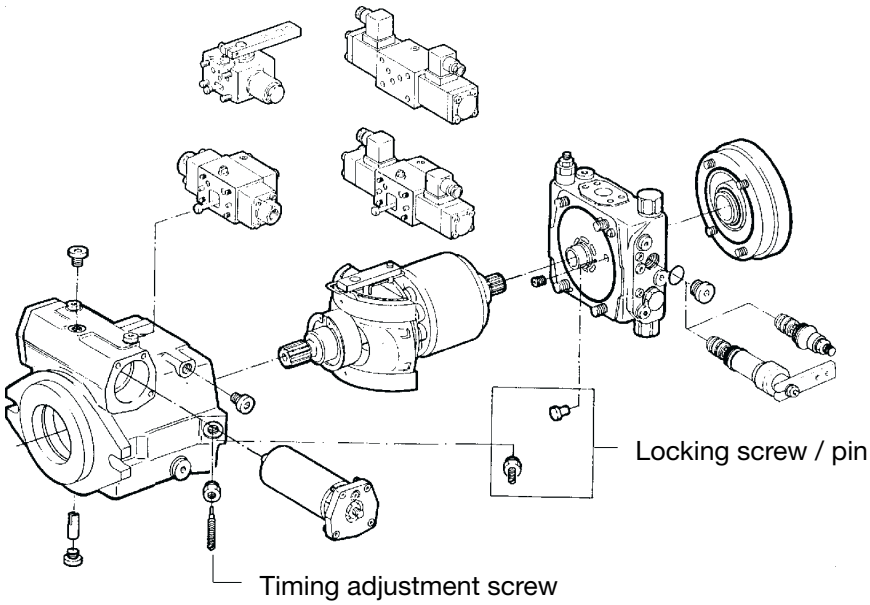
HD - EP control module

43

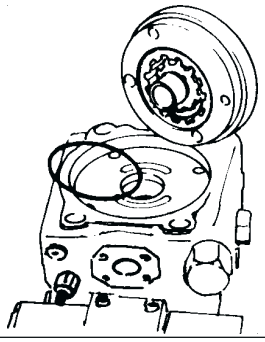


44

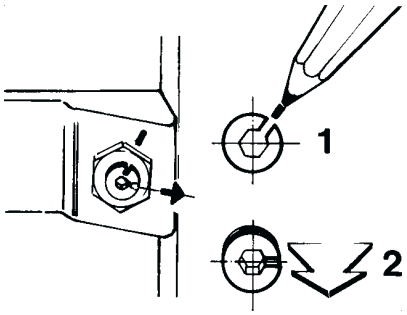
Reset hydraulic zero position (1).
Both gauges must indicate the same pressure.



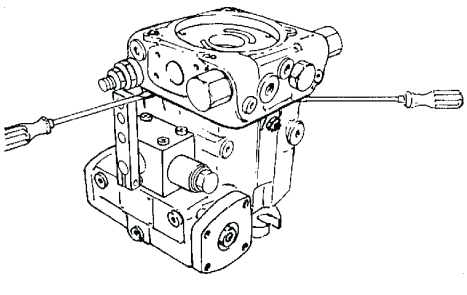
45



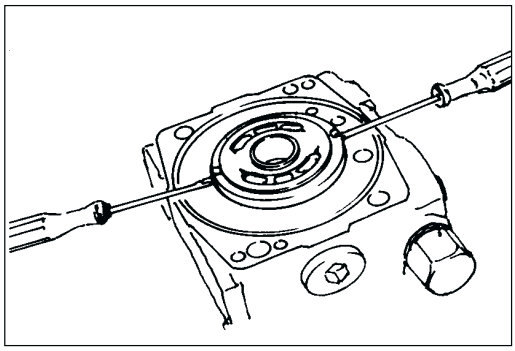
46 Mark position of the boost pump and the port plate.
Remove the boost pump.



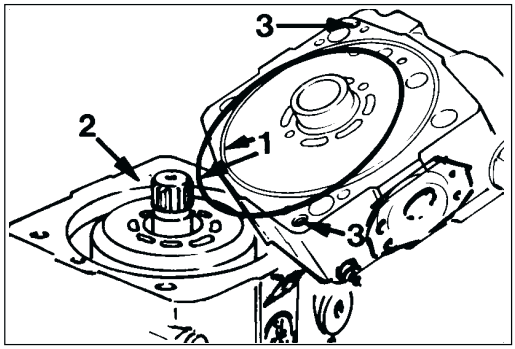
47 Mark the position of the indexing screw (1).
Set the indexing screw to disassembly position (2).



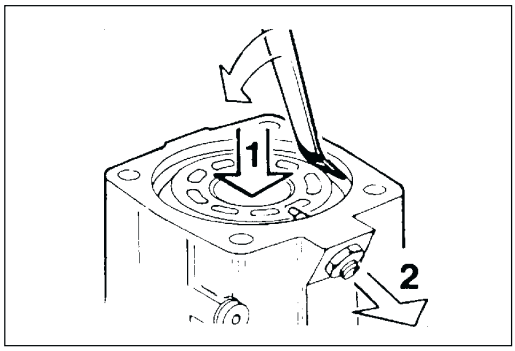
48 Release port plate fitting.
Take off port plate. If necessary, use screwdriver.
Attention! Sealing surface.



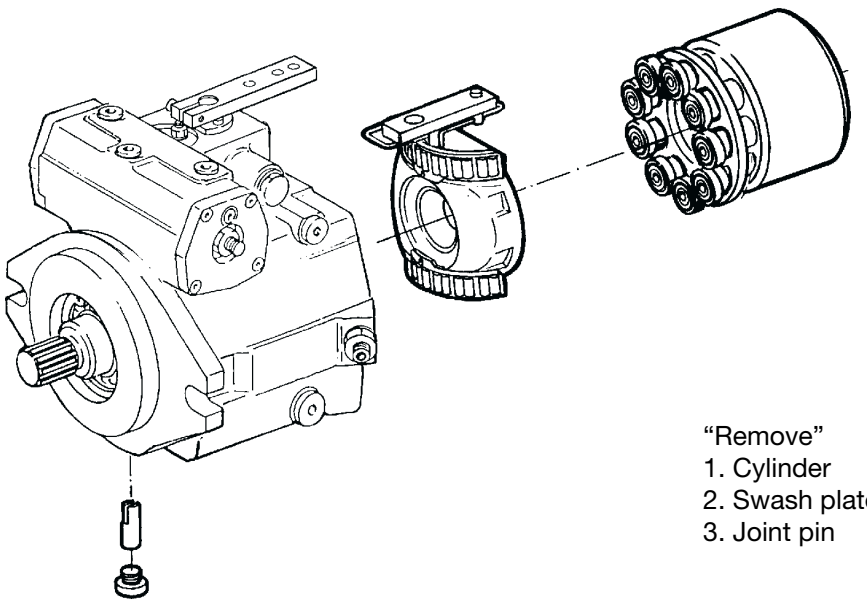
49 Lift off control plate.
Note position.



50 Check!
O-ring and groove (1), housing (2), Quad-ring and groove (3).

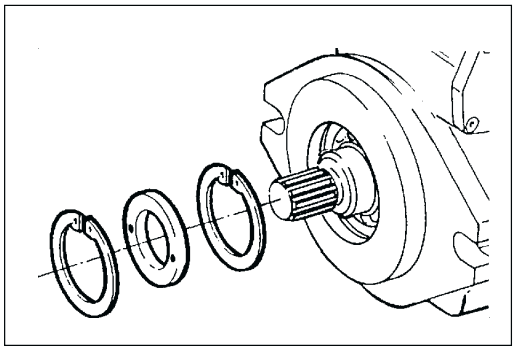


51 Press the cylinder to the bottom (1).
Remove fiming indexing screw (2).
Lift out rotary group (3).

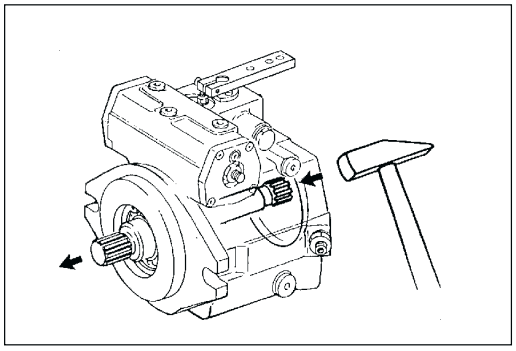


"Remove"
1. Cylinder
2. Swash plate
3. Joint pin

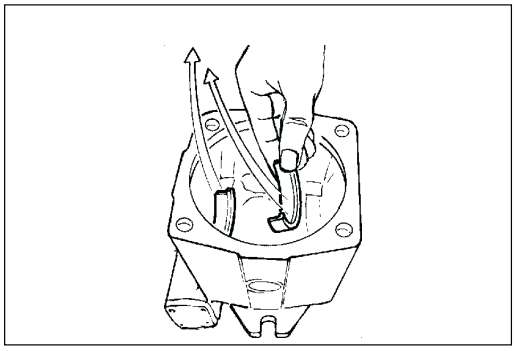
52



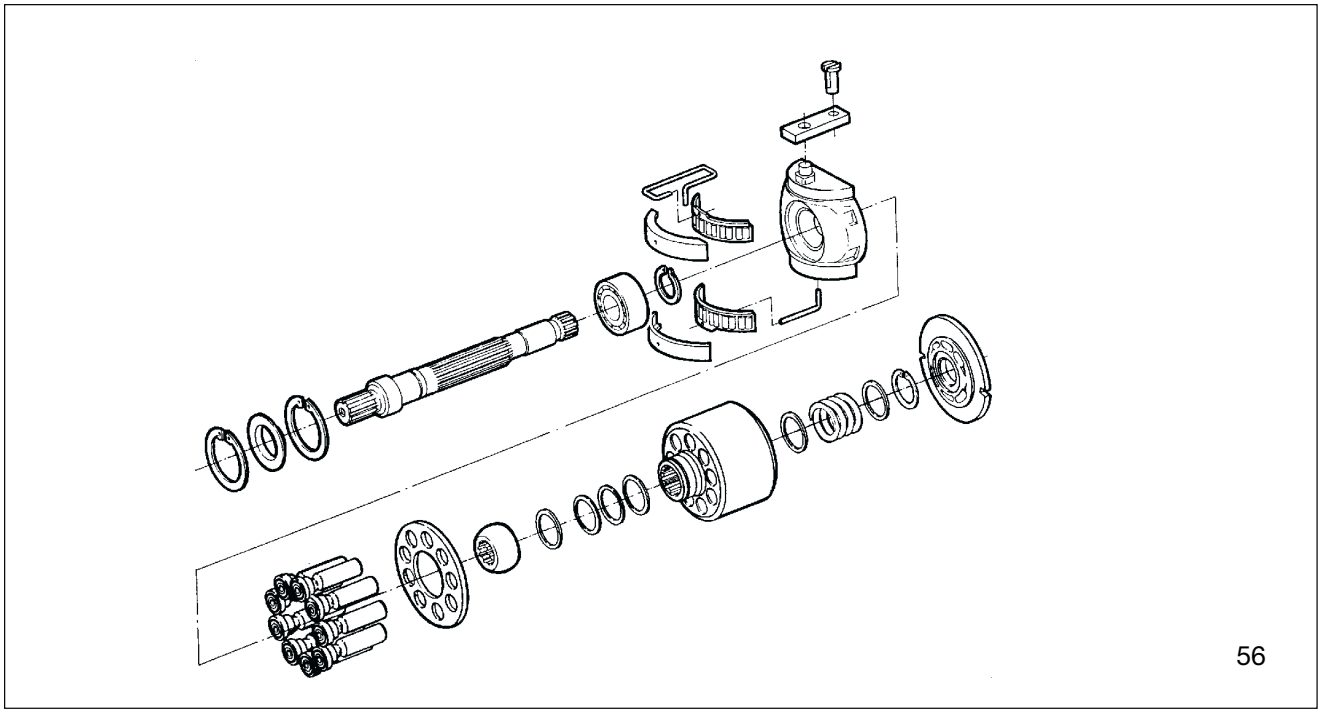
53 Remove retaining ring, radial seal ring.



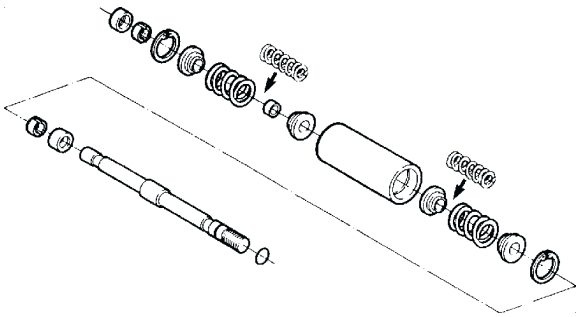
54 Remove drive shaft with slight hammer strokes.



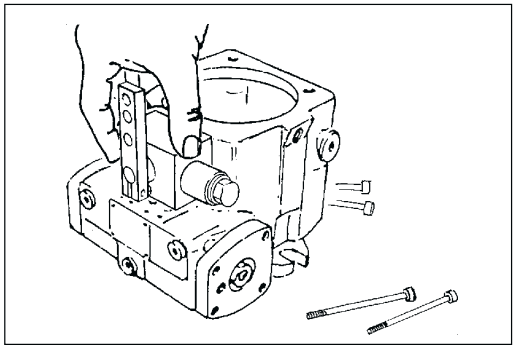
55 Remove bearing cups.



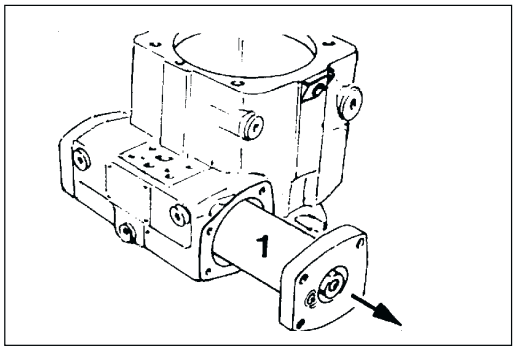
56



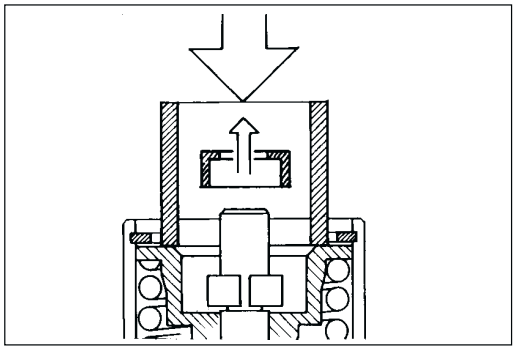
57



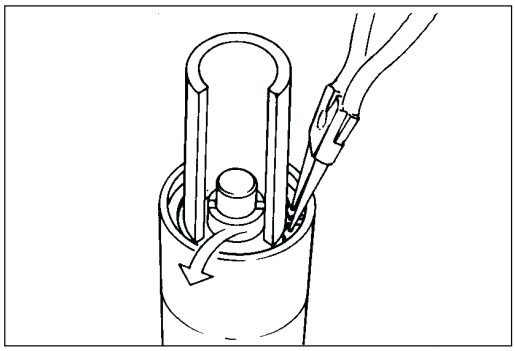
58 Remove control module.



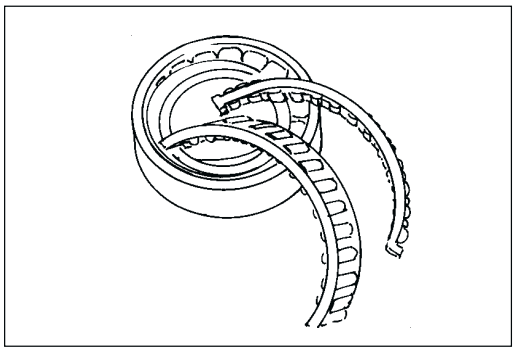
59 Pull out control piston (1).



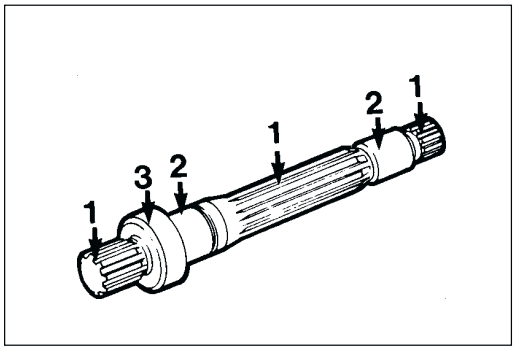
60 Mount fixture and tension spring.
Remove receiving ring.



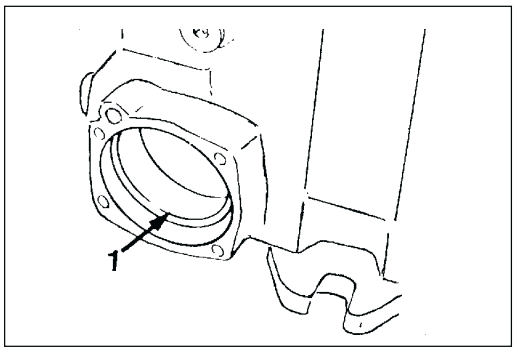
61 Take out rings.
Remove retaining ring.
Note! Parts are spring loaded.



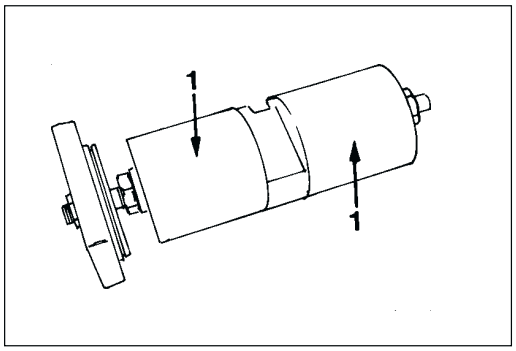
62 Replace all bearings.



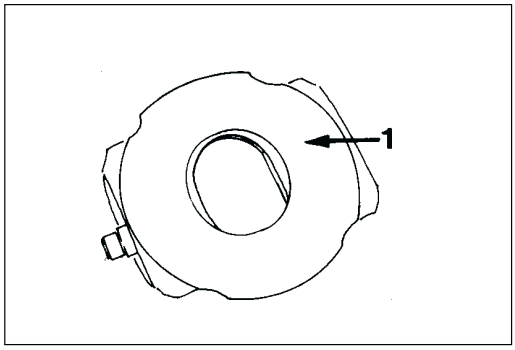
63 Check!
1. Splines for damage or fretting.
2. Running surfaces.
3. Groove cut by shaft seal.



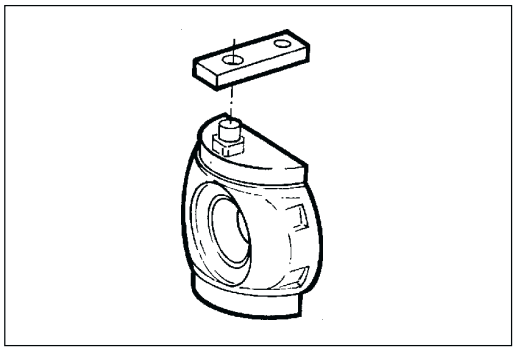
64 Check that the control piston guide bush (1) is free of grooves and has not worn out.



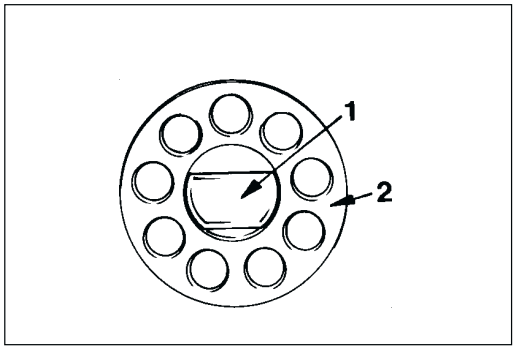
65 Check!
Control piston (1) is not scored.



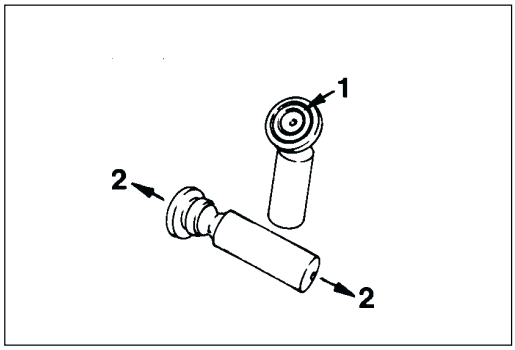
66 Check!
Sliding surface free of grooves.



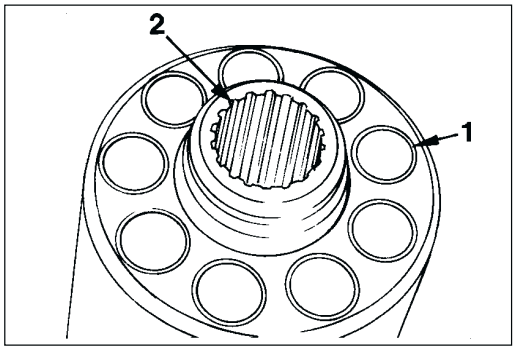
67 Check!
Make sure sliding ring/swivel pin are free of play.



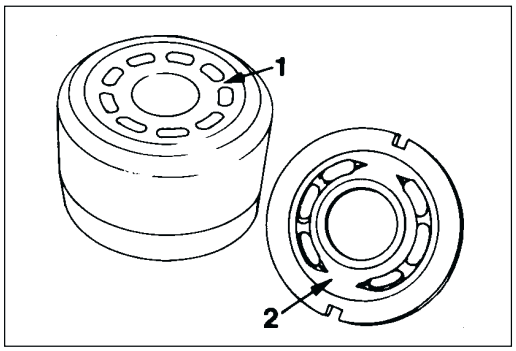
68 Check!
Check that return device is free of grooves (1) no wear in slipper pad area.



69 Check!
Check that there are no scratches or metal deposits on sliding surface (1), and there is no axial play (2), (otherwise: pistons must be replaced in sets).

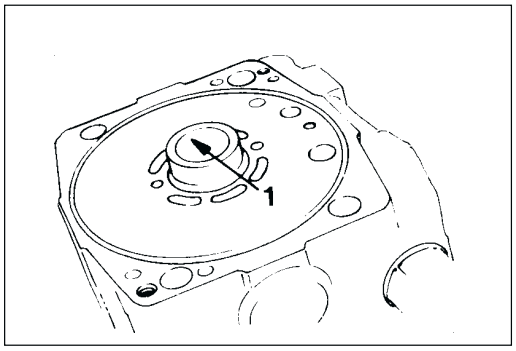


70 Check!
Cylinder bores (1), splines (2).



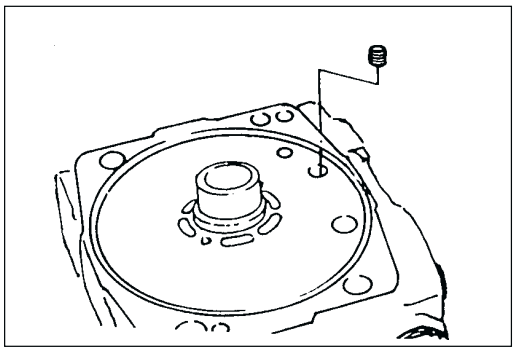
71

Check!
Cylinder gilding surface (1) free of scratches, no traces of wear and no embedded foreign particles. No scratches on the valve plate (2). (Replace ONLY in sets).



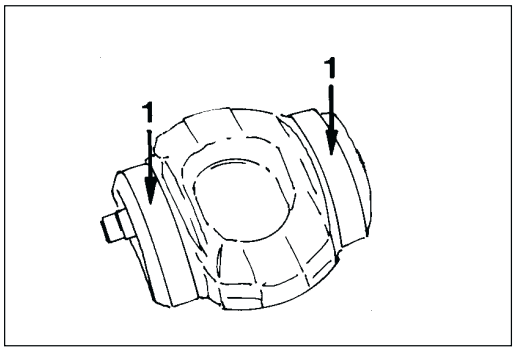
72

Check!
DU-bearing bush (1) is not worn out.



73

Information:
Boring for DA-control open.
Without DA-control closed.



74

Check!
Bearing surfaces (1).

Assemble housing - Turcon-Glyd-ring

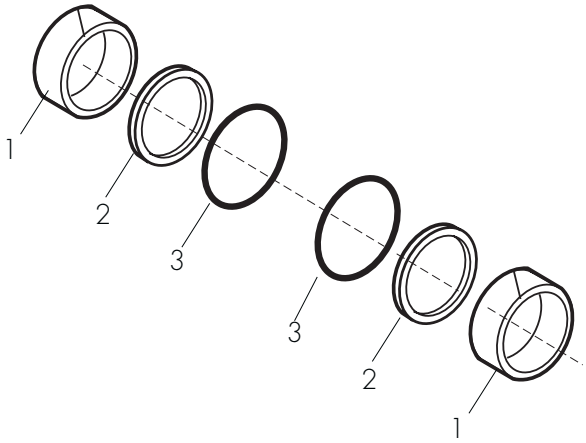
Auxiliary tools:

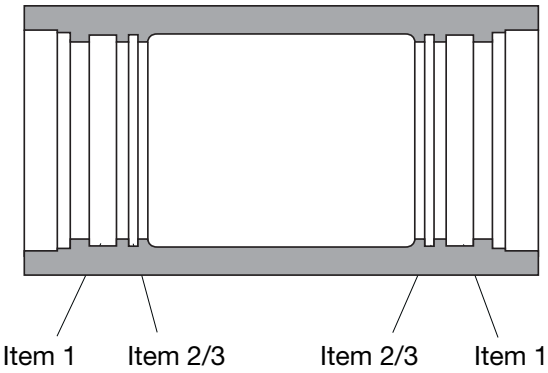
Assembly pliers: B+S x M22

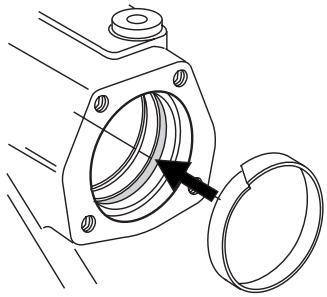
Guide thorn:

A4VG28	I: 277 4 347
A4VG40	I: 277 4 049
A4VG56	I: 277 4 050
A4VG71	I: 277 4 051
A4VG90	I: 277 4 052
A4VG125	I: 277 4 053
A4VG180	I: 277 4 054
A4VG250	I: 277 4 072

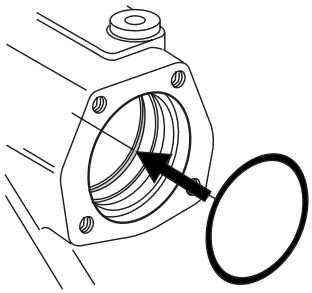
Assembly A4VG





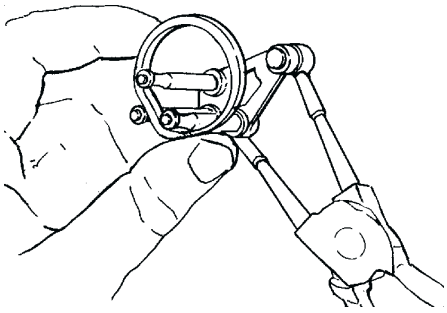


Item 1: Install barguide ring.

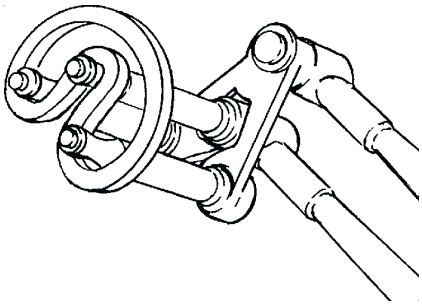


Item 3: Install O-ring.

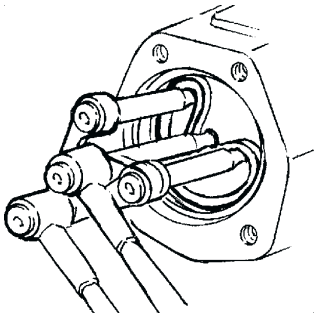
Assemble housing - Turcon-Glyd-ring



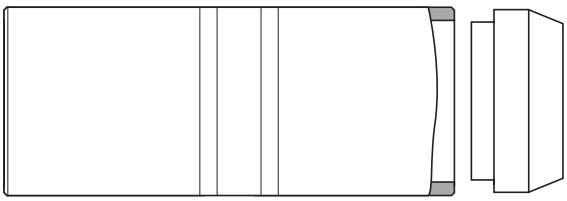
Fit the seal ring (Item 2) into the assembly tool.



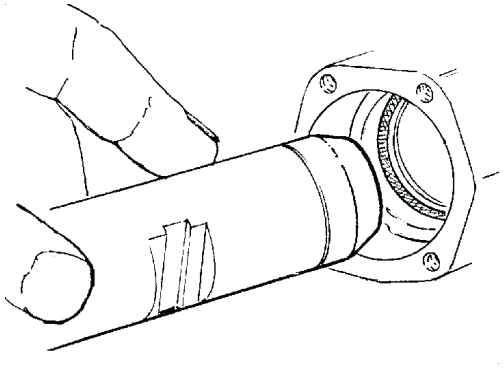
Press the seal ring into the kidney shape using the assembly tool. The deformation of the Turcon seal has to be done with care so as not to damage the sealing edges.



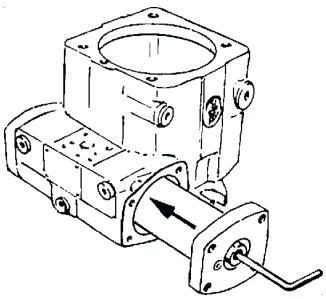
Position the seal ring into the housing and place it into the groove. Release the tension and withdraw the assembly tool. Check the position of the seal ring if necessary straighten using a finger.



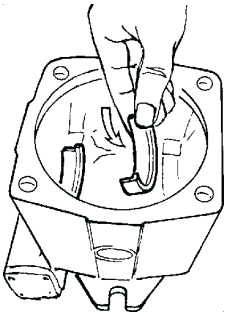
Insert guide thorn into the positioning piston.



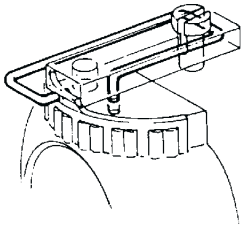
Grease slightly guide thorn.
Install positioning piston with guide thorn.



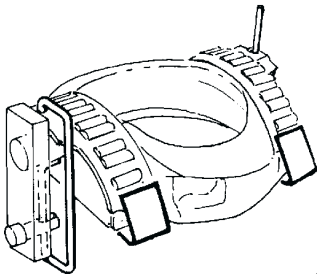
75 Insert positioning piston into the housing.
Instruction:
Oil positioning piston before assembly.

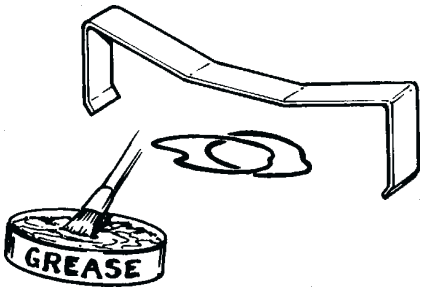


76 Insert bearing cup set.

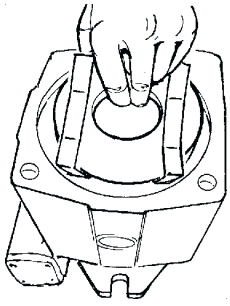


Assemble bearing, wire, gliding stone and articulating pin.
Assistance: Devices e.g. - Clamp / rubber rings / grease



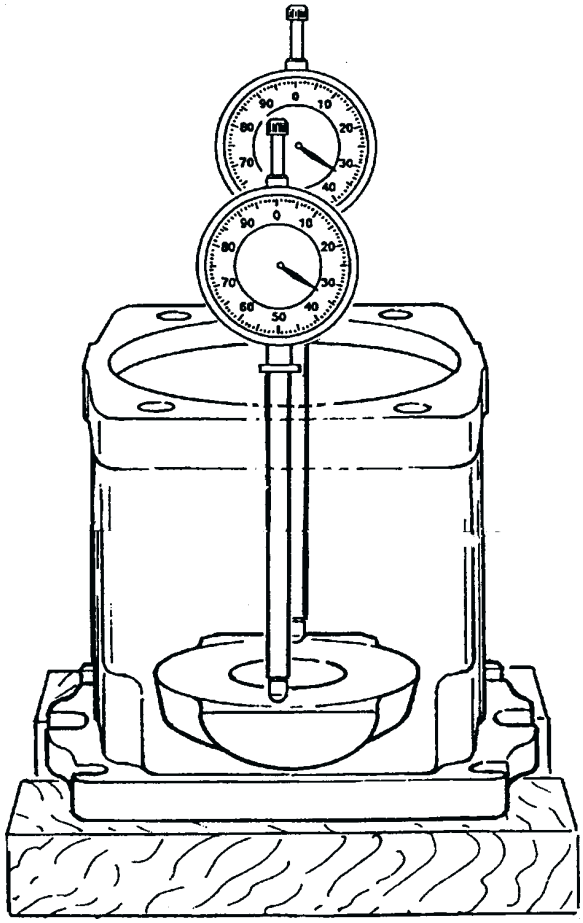


77



78 Insert completely swivel cradle into the housing.
Pay attention for correct seat of the swivel cradle in the housing.

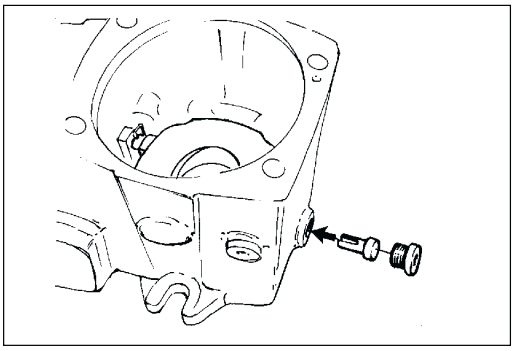
⚠ Remove auxiliary device.



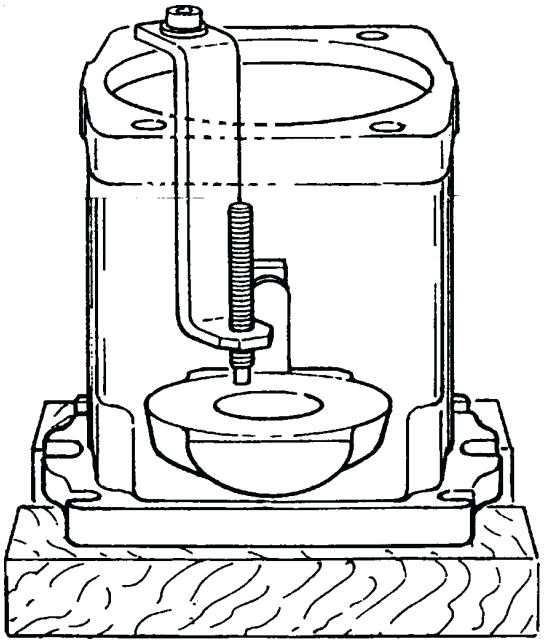
⚠ Check: Location of the swivel-bearing in the bearing.

Swivel the swivel bearing by using the control piston “it should move easily”.
Centralise by using a measuring device (dial gauge or depth measurement).
Check points 1 and 2 - they should have the same dimension.

79



80 Fit joint pin.

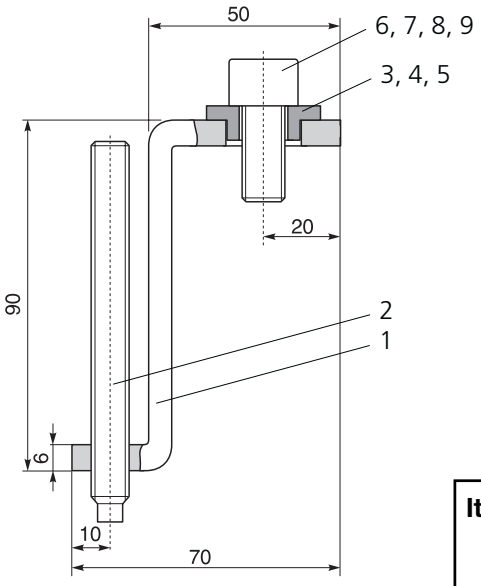


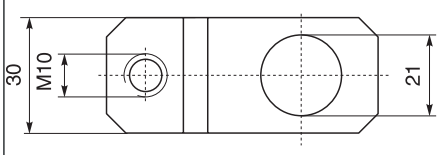
Fit holding device.
Hold swash plate in position utilising the set screw.

⚠ Do not use force.

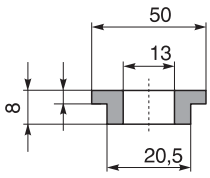
81

Holding device “swivel cradle” A4V

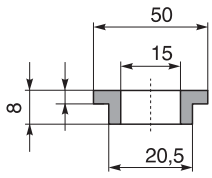




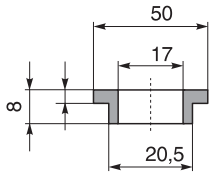
Part 3



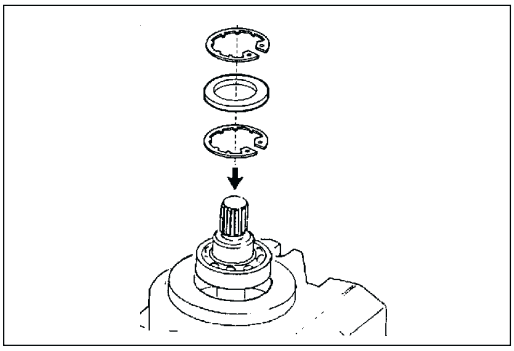
Part 4



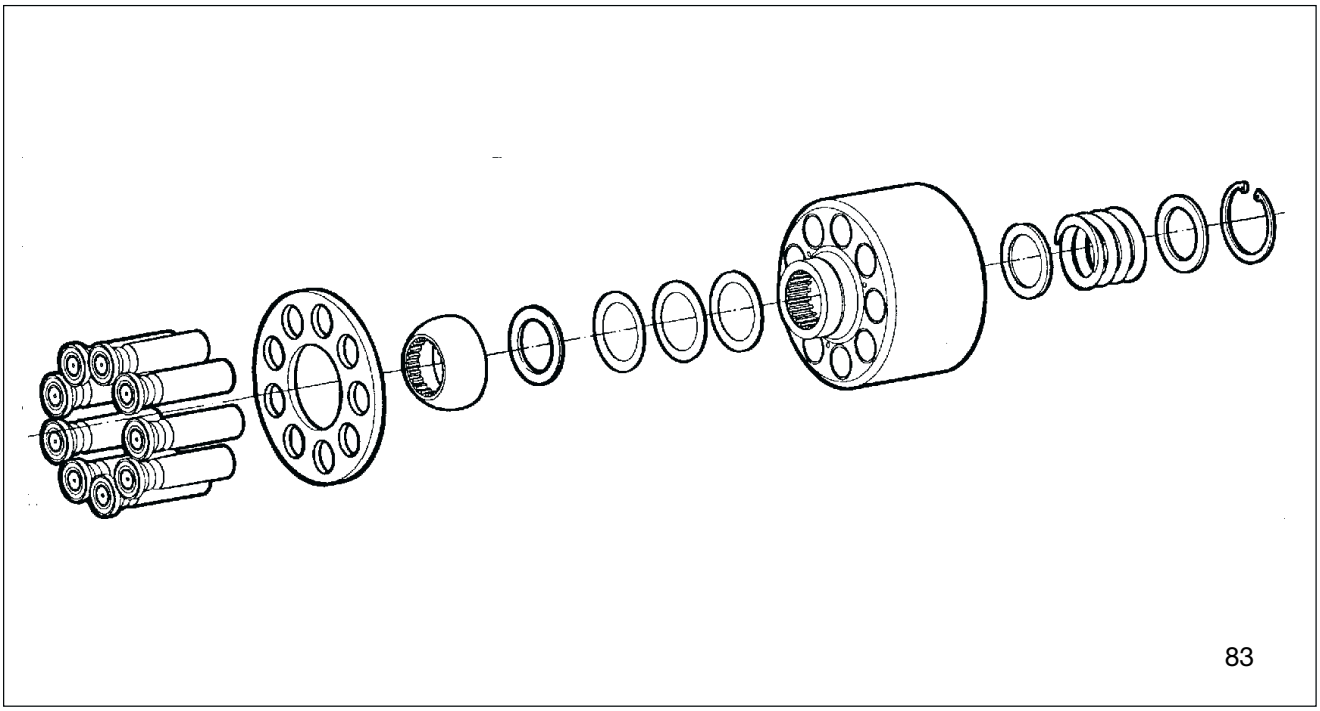
Part 5



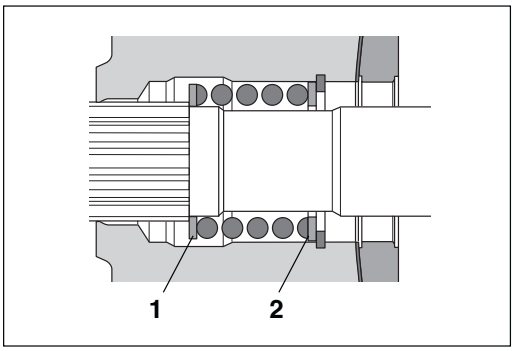
Item	Designation	Qty.
1	Angle	2
2	Threaded pin	2
3	Shim	2
4	Shim	2
5	Shim	2
6	Cyl. screw M12 x 25 DIN 912	2
7	Cyl. screw M14 x 25 DIN 912	2
8	Cyl. screw M16 x 30 DIN 912	2
9	Cyl. screw M20 x 35 DIN 912	2



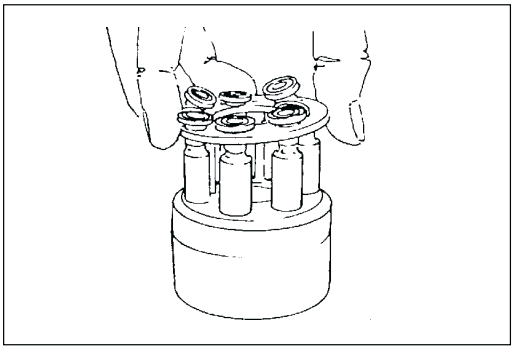
82 Assemble drive shaft with bearings and radial seal rings.



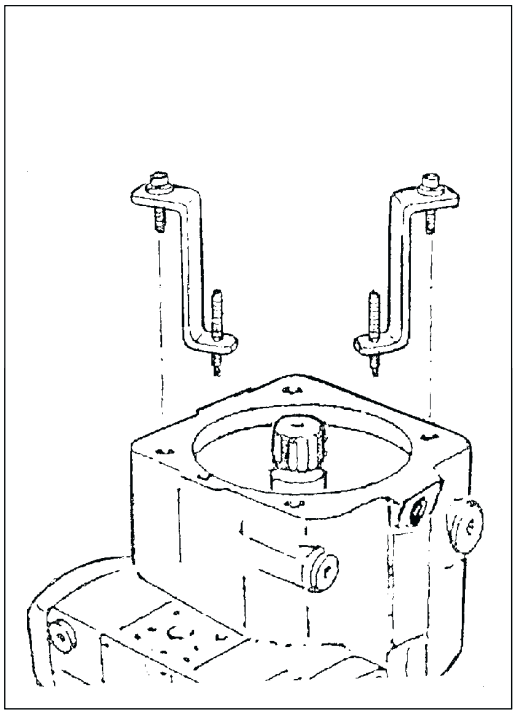
83



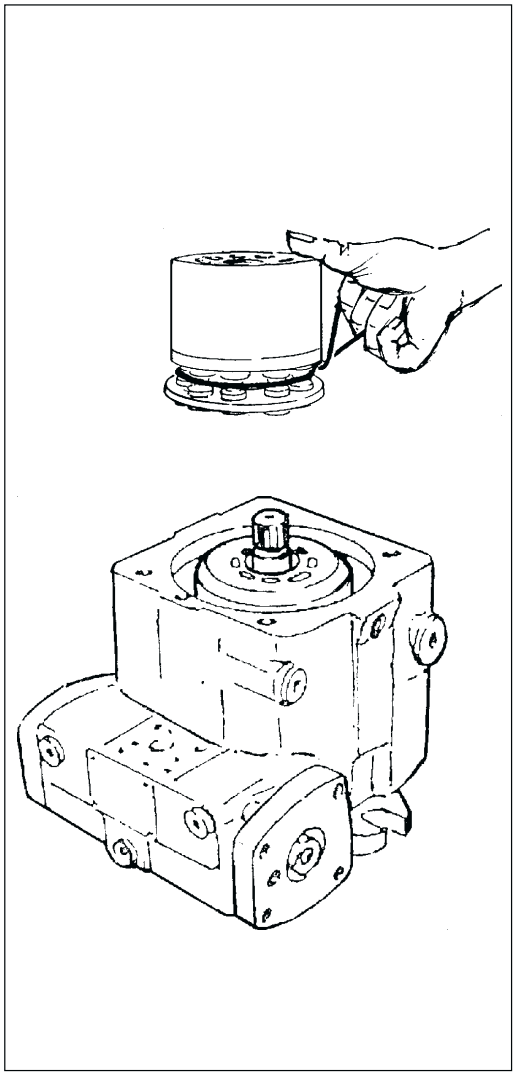
84 Disc 1, 2.



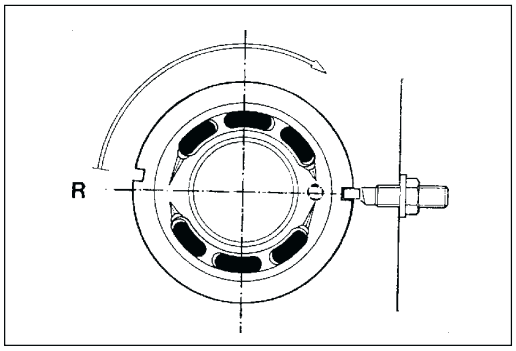
85 Assemble piston with retaining plate.
Note:
Oil piston and piston pad.



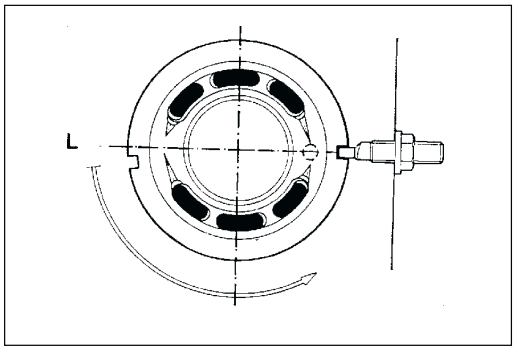
86 Remove holding device.
Fit cylinder complete with pistons and retaining device.



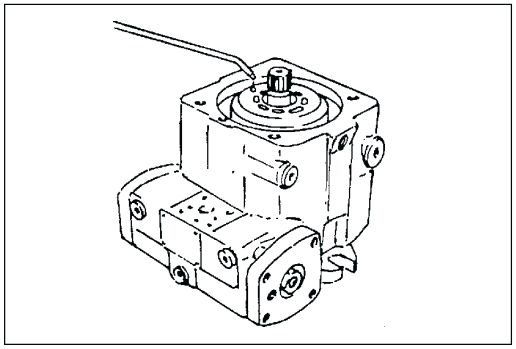
87 Assembly aid:
Hold the pistons by using an O-ring.



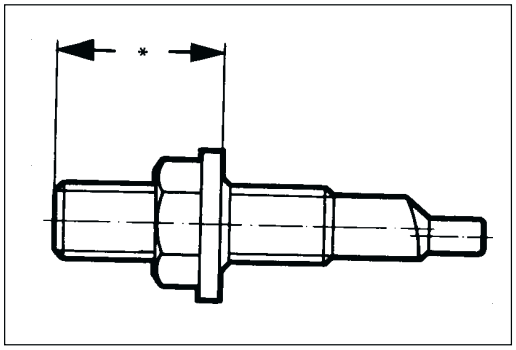
89 Control plate clockwise rotation - indexed in the direction of rotation.
Note! Noise grooves are machined - in based on direction of rotation.



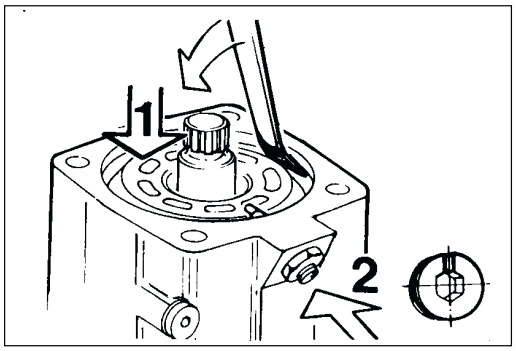
90 Control plate counter clockwise rotation - indexed in the direction of rotation.
Note! Noise grooves are machined - in based on direction of rotation.



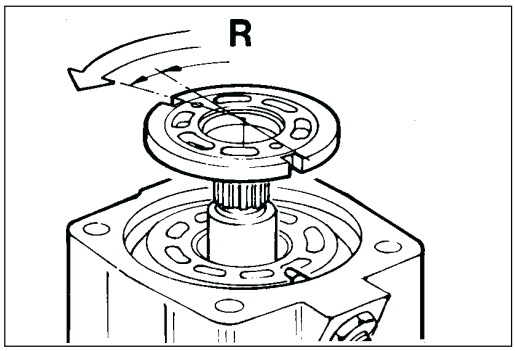
91 Oil the running surfaces of the cylinder barrel and the DU- bearing. Grease the O-rings and insert in grooves.



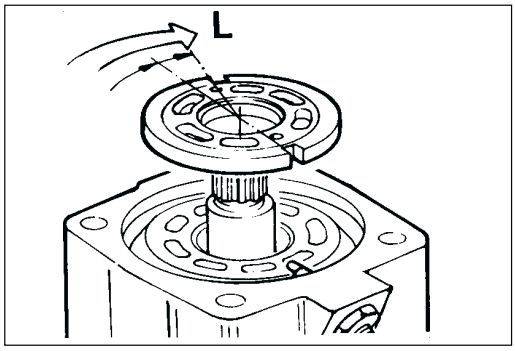
92 Basic setting - indexing screw
A4VG...40 * = 24 ± 0,75 mm.
A4VG...56 * = 21 ± 0,75 mm.



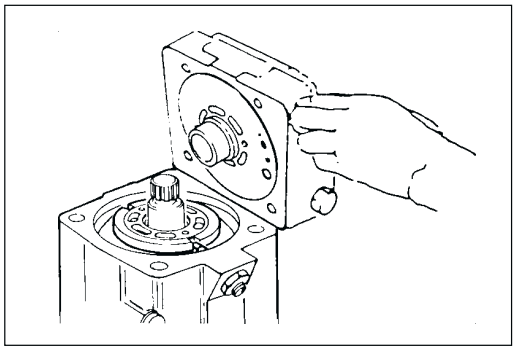
93 Press the cylinder to the bottom (1).
Screw in the indexing screw (2).
Groove in mounting position.



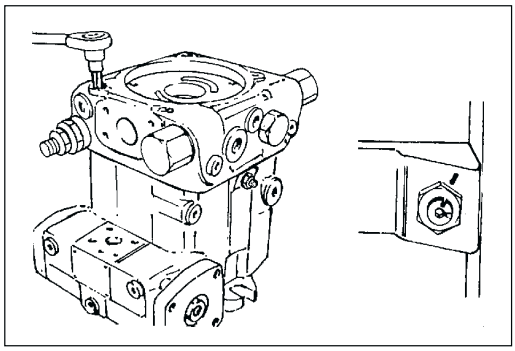
94 Insert the control plate - clockwise rotation.



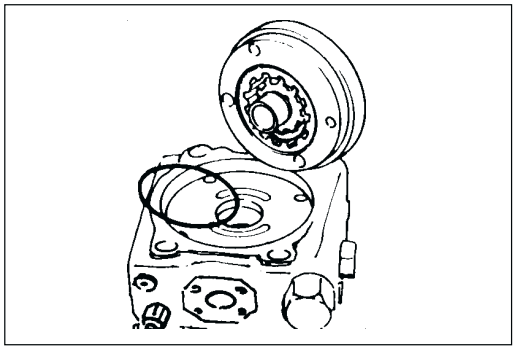
95 Insert the control plate - Counter- clockwise rotation.



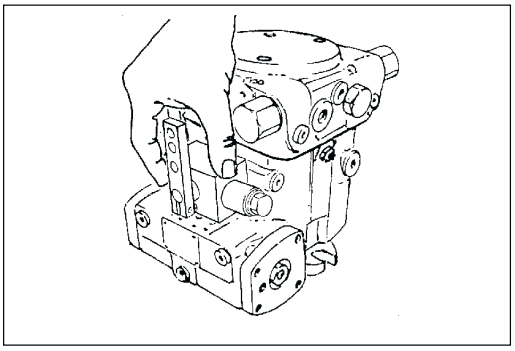
96 Place in correct position.
Note:
HW, HD, EP - Put control plate with greas to the port block.



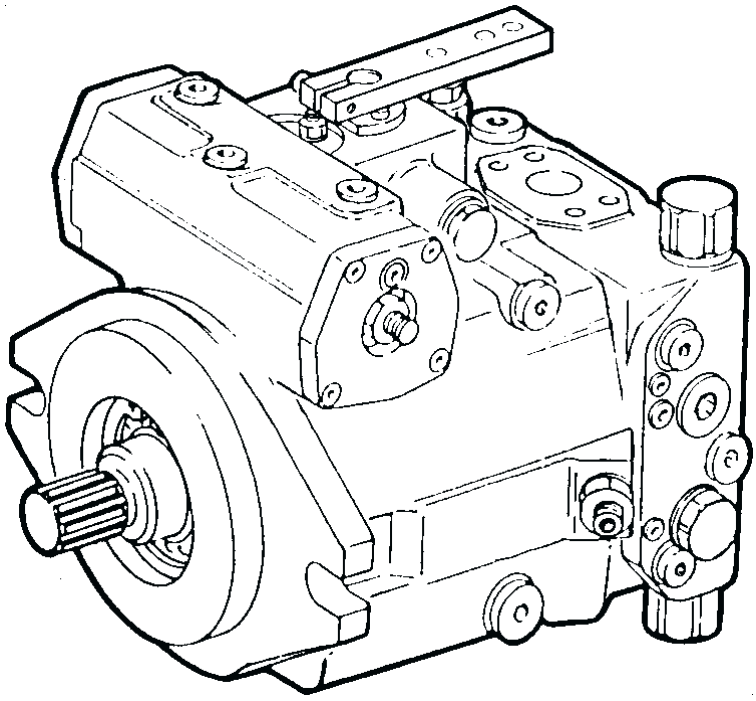
97 Tighten screws (Cross-corner).
Turn the indexing screw to marking.



98 Assemble boost pump.



99 Mount control module.



100

Tightening torques for shaft bolts (Metric ISO Standard Thread)

The values for tightening torques shown in the table are valid only for shaft bolts with metric ISO- standard threads and head support surface dimensions in accordance with DIN 912, DIN 931 and DIN 933. These values are also valid only for light or unoiled, untreated surface as well as for use only with torque-indicating wrenches and force limiting tools.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 3	1,3	2,0	2,3
M 4	3,1	4,5	5,3
M 5	6,1	8,9	10,4
M 6	10,4	15,5	18.0
M 8	25	37	43
M10	51	75	87
M12	87	130	150
M14	140	205	240
M16	215	310	370
M18	300	430	510
M 20	430	620	720
M 22	580	830	970
M 24	740	1060	1240
M 27	1100	1550	1850
M 30	1500	2100	2500

Tightening torques for seal-lock nuts (Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for seal-lock nuts of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 6	7,4	-	-
M 8	16,2	-	-
M10	29,5	-	-
M12	50,9	-	-
M14	81,1	-	-
M16	125,3	-	-

Tightening torques for locking screws VSTI (Metric ISO fine thread)

Thread size	Designation		Tightening torques (lb.ft)
M 8 x 1	VSTI 8 x 1	-ED/SA	= 4
M 10 x 1	VSTI 10 x1	-ED	= 7
M 12 x 1,5	VSTI 12 x 1,5	-ED	= 15
M 14 x 1,5	VSTI 14 x 1,5	-ED	= 22
M 16 x 1,5	VSTI 16 x 1,5	-ED/SA	= 22
M 18 x 1,5	VSTI 18 x 1,5	-ED/SA	= 29
M 20 x 1,5	VSTI 20 x 1,5	-ED/SA	= 37
M 22 x 1,5	VSTI 22 x 1,5	-ED	= 44
M 26 x 1,5	VSTI 16 x 1,5	-ED/SA	= 51
M 27 x 2	VSTI 27 x 2	-ED	= 66
M 30 x 1 ,5	VSTI 30 x 1,5	-ED/SA	= 74
M 33 x 2	VSTI 33 x 2	-ED/SA	= 88
M 42 x 2	VSTI 42 x 2	-ED/SA	= 147
M 48 x 2	VSTI 48 x 2	-ED	= 220

Tightening torques for cross-slotted lens head screws DIN 7985 (Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for cross-slotted lens head screws DIN 7985 of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 3	0,8	-	-
M 4	2,1	-	-
M 5	4,4	-	-
M 6	7,4	-	-
M 8	18,4	-	-
M10	36,1	-	-

General advice

- Make yourself familiar with the equipment of the machine.
- Only operate the machine if your are completely familiar with the operating and control elements as well as the functioning of the machine.
- Use your safety equipment like helmet, safety shoes and hearing protection.
- Make yourself familiar with your working field.
- Only operate the machine for its intended purpose.

Please observe the guidelines of the Professional Association and the machine manufacturer.

Before starting

- Observe the operating instructions before starting.
- Check the machine for obvious faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering thc driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

Start

- When starting all operating levers must be in "neutral position".
- Only start the machine from the driver's seat.
- Check the indicating instruments after start to assure that all functions are in order.
- Do not leave the machine unobserved when the motor is running.
- When starting with battery connection cables connect plus with plus and minus with minus. Always connect negative (-) cable last and disconnect negative cable first.

Attention

- Exhaust gas is dangerous. Assure sufficient fresh air when starting in closed rooms!

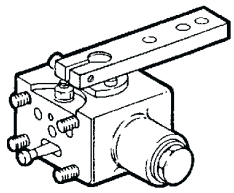
Hydraulic equipment

1. Hydraulic equipment is standing under high pressure.

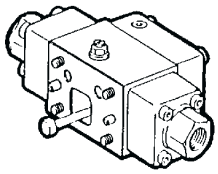
   ⚠ High pressure fluids (fuel, hydraulic oil) which escape under high pressure can penetrate the skin and cause heavy injuries. Therefore immediately consult a doctor as otherwise heavy infections can be caused.

2. When searching leakages use appropriate auxiliary devices because of the danger of accidents.
3. Before working at the hydraulic equipment, lower pressure to zero and lower working arms of the machine.
4. When working at the hydraulic equipment, absolutely stop motor and secure machine against rolling away (parking brake, shim)!
5. When connecting hydraulic cylinders and motor pay attention to correct connection of hydraulic flexible hoses.
6. In case of exchanging the ports, the functions are vice versa (f. ex. lift-up/lower) - danger of accidents!
7. Check hydraulic flexible hoses regularly and replace them in case of dammage or wear! The new hose pipes must comply with the technical requirements of the machine manufacturer!

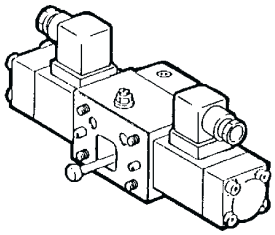
⚠ Orderly disposal or recycling of oil, fuel and filters!



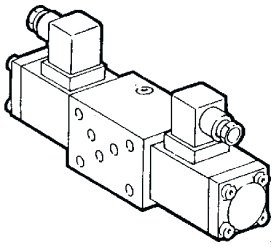
HW



HD



EP



DA

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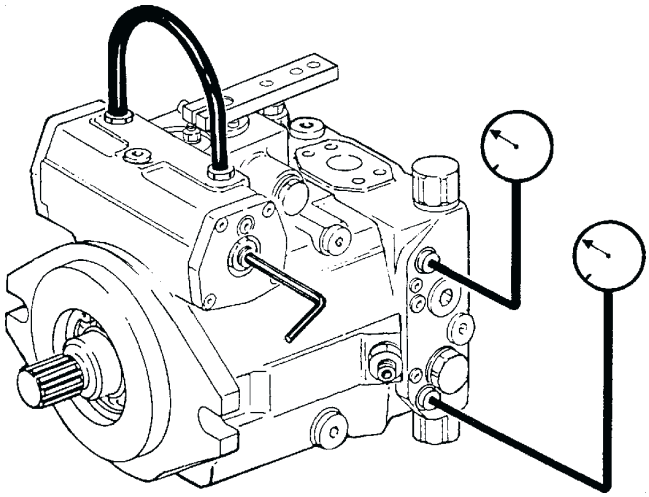

Attention!
Observe safety regulations!
Connect both control chambers with hose NW6.
Avoidance of rest signal from hydraulic zero position.
Connect manometer to M_A and M_B.
Adjust zero position so that at blocked drive both manometer indicate the same pressure valve.
Note:
Adjust death line of zero position.

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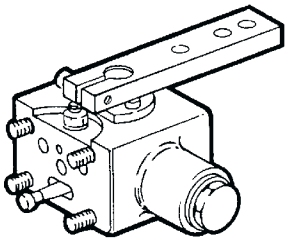
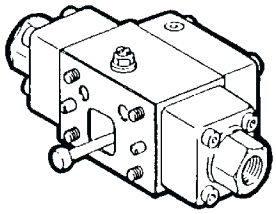
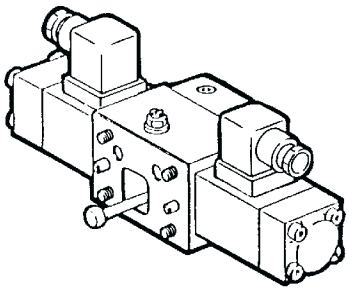


HW



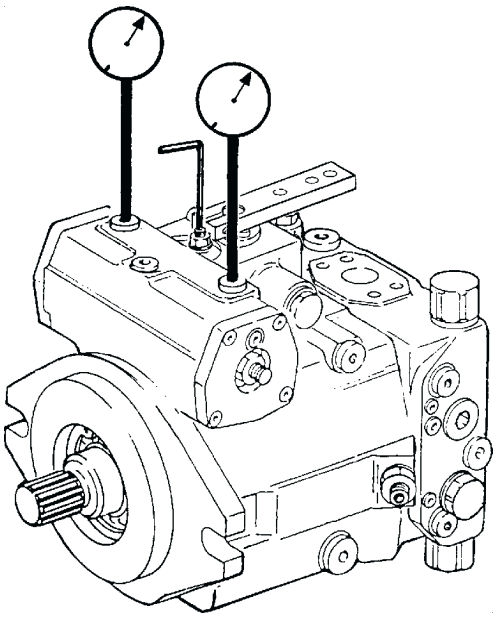
HD



EP

Attention!
Observe safety regulations!

103



Connect manometer to X_1 and X_2.
Adjust zero position so that at blocked drive both manometer indicate the same pressure value.
Note:
Eccentric adjusting
- Do not turn over ±90°.

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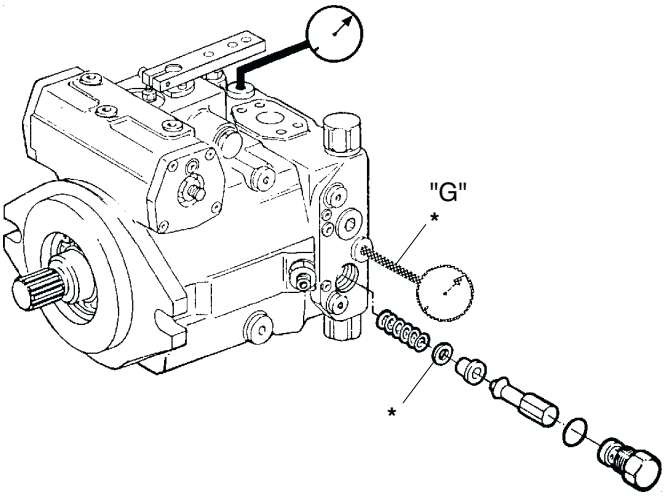

Attention!
Observe safety regulations!

Note:
Readjusting only at operating temperature.

Connect manometer to “G”.

Attention!
* Boost pressure setting!
Nominal pressure p_H- 18 bar
Peak pressure p_H- 40 bar
at max. speed.

Note:
Adjusting data according to order.

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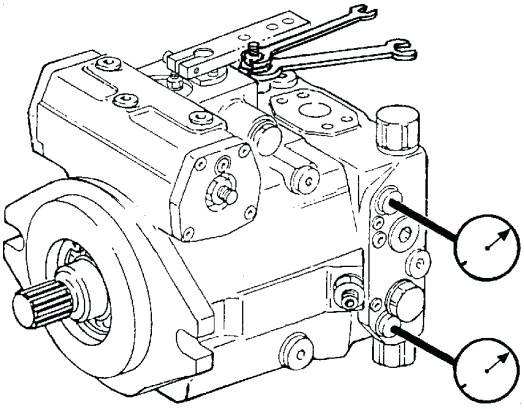
Pressure cut-off



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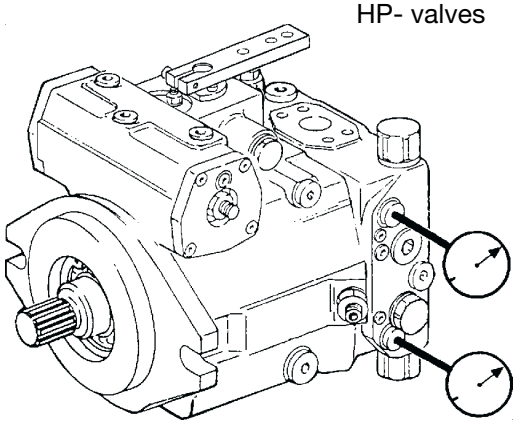
Attention!
Observe safety regulations.

HP valve without bypass-function

1. HP valves are always adjusted 10% higher than the pressure cut-off.
   If one setting value is changed, always check both values.
2. Readjusting only at operating temperature.

Connect manometer M_A and M_B.
Pressure cut-off: Note measure X setting screw! Turn setting screw on block.
HP valves: Operate valves with small pump flow volume.
Check setting value. (“temperature“ only for a short time).
Change “setting value“ - check.

HP- valves



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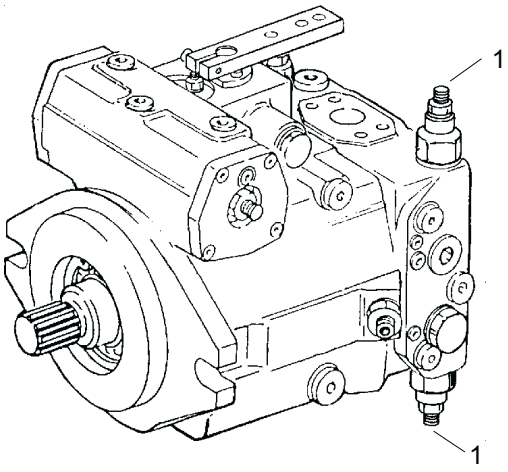
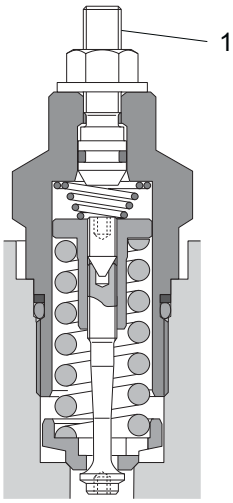
Pressure cut-off:
Turn back setting screw to measure (*).
Check pressure value and readjust.
Attention! Observe 10% pressure difference HP valves and pressure cut-off!





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Vehicle with hydrostatic transmission and gear shift without idling setting position (free wheeling).

Hydrostatic transmission / Bypass-switching

In this case the travel transmission is switched on to free wheeling. For this purpose the variable displacement pump has incorporated high pressure relief valves with bypass function.
The screw (item 1) is unscrewed to such an extent, that the valve cartridge is released and free oil circulation is possible.

⚠ Bypass: Screw in item1 up to planeness with nut.
Screw up nut again.

Towing speed

The max. towing speed of 2 km/h should not be exceeded.
- Higher admissible towing speeds depend on the available hydr. motor speed and engaged gear shift.

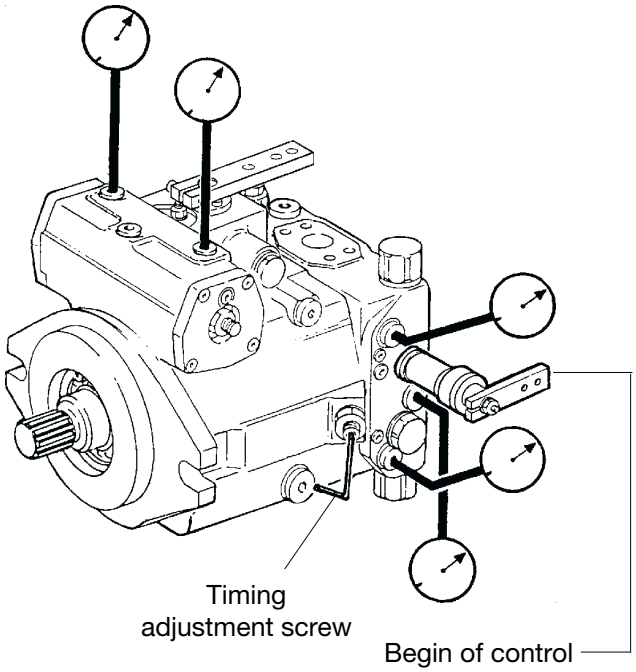
Towing distance

The towing distance should not exceed 1 km.
- If there is a lack of oil boosting, the hydraulic circuit will get empty.
  Take care of the heat development in the hydr. motor-rotary group.

Towing operation terminated

After termination of the towing operation turn item 1 back. The original pressure value setting of the high pressure relief valves will be avaiable again.

⚠ Valve function: Screw back item 1 up to stop.
Screw up the nut.



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Attention!
Observe safety regulations!

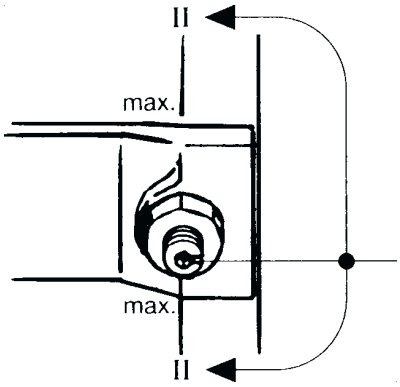
Check setting data.
Operating temperature should be kept largely constant during the check procedure.
Start prime mover, idle speed.

Block position
Drive direction switch - **"0"**.
Slowly increase motor speed up to the max. motor speed and thereby observe measuring instruments.

Boost pressure:
Idle speed of prime mover
Psp = approx. 15-20 bar
max. motor speed
Psp = ... bar*

Block position
Drive direction switch - **forward**
(Road gear and fully applied brake)

Check setting data pump A4VIDA
Begin of control:
HD 40-50 bar
Motor speed . . . . . rpm* Psp . . . . . bar*
HD . . . . . bar*
Readjusting - control start screw



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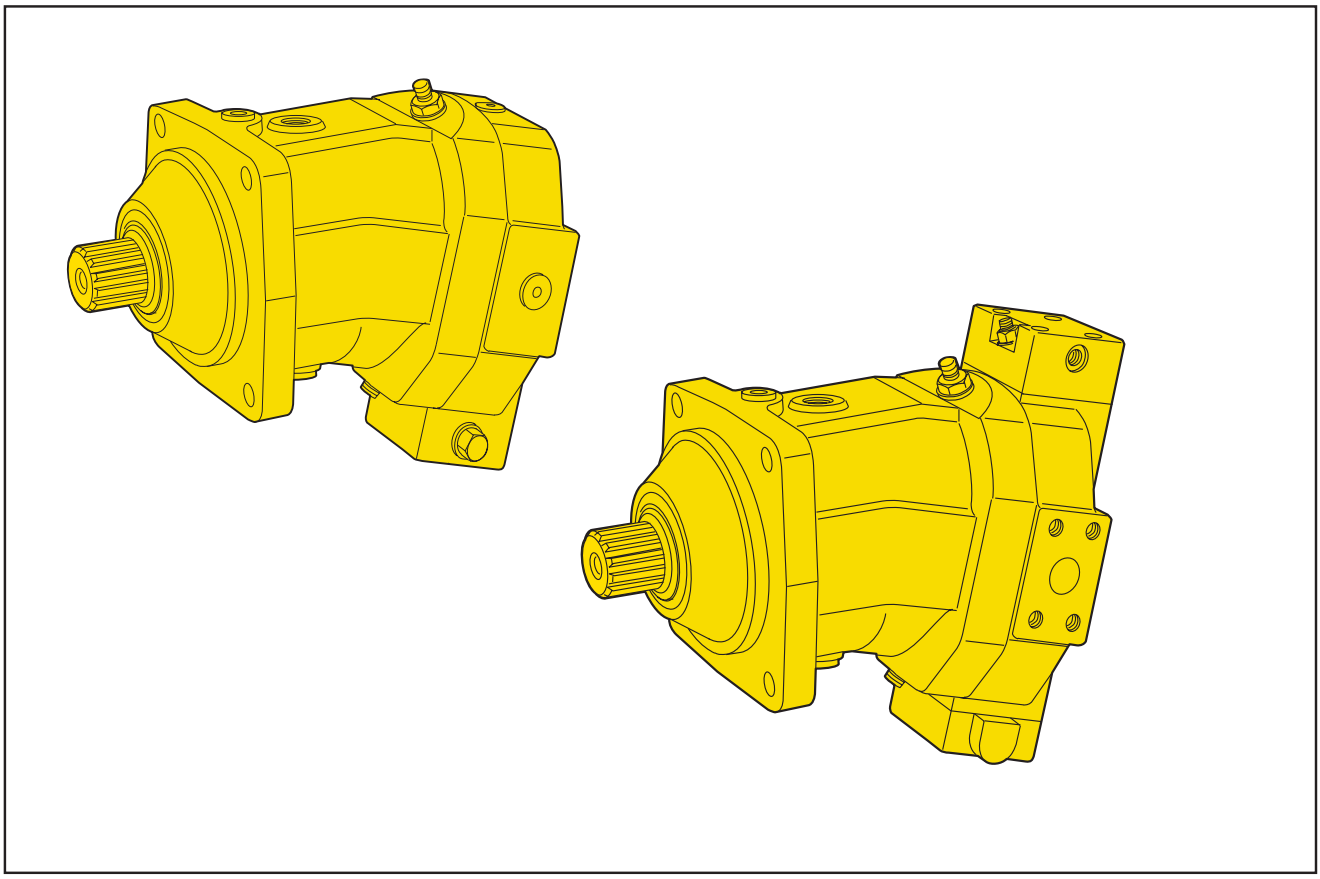
End of control
HD . . . . . bar
Motor speed . . . . . rpm* Psp . . . . . bar*
Readjusting timing adjustment screw

Note:
Eccentric adjusting - observe direction of rotation

* Setting data according to order!



Repair instructions

Mod. A6VM 28 ... 200 Series 63

RDE 91604-01-R/08.96

Type code A6V M _ _ / 6 3 W

Axial piston unit
Bent axis design, variable displacement — A6V

Mode of operation
Motor — M

Size
≅ Displacement $V_{g\,max}$ in cm³ — 28 55 80 107 140 160 200

Size 250 - 1000 see RE 91603

Control and regulating device					28	55	80	107	140	160	200	
Hydraulische Verstellung, steuerdruckabhängig	HD	1			●	●	●	●	●	●	●	HD1
	HD		2		●	●	●	●	●	●	●	HD2
	HD	1		D	●	●	●	●	●	●	●	HD1D
	HD		2	D	●	●	●	●	●	●	●	HD2D
Hydraulic two-position control	HZ1				●	-	-	-	●	●	●	HZ1
	HZ3				-	●	●	●	-	-	-	HZ2
Electrical control, with proportional solenoid	EP	1			●	●	●	●	●	●	●	EP1
	EP		2		●	●	●	●	●	●	●	EP2
	EP	1		D	●	●	●	●	●	●	●	EP1D
	EP		2	D	●	●	●	●	●	●	●	EP2D
Electr. two-position control, w. switching solenoid	EZ	1			●	-	-	-	●	●	●	EZ1
	EZ		2		●	-	-	-	●	●	●	EZ2
	EZ	3			-	●	●	●	-	-	-	EP3
	EZ		4		-	●	●	●	-	-	-	EP4
Automatic control, high pressure related	HA	1			●	❍	❍	❍	●	●	●	HA1
	HA		2		●	●	●	●	●	●	●	HA2
	HA	3			-	●	●	●	-	-	-	HA3
Hydraulic control, speed related												
p_{ST}/p_{HD}=5/100, hydraulic valve for travel direction					●	●	●	●	●	●	●	DA1
el. valve for travel direction (12 V) + el. Q_{max} switch (12 V)					●	●	●	●	●	●	●	DA2
el. valve for travel direction (24 V) + el. Q_{max} switch (24 V)					●	●	●	●	●	●	●	DA3
p_{ST}/p_{HD}=8/100, hydraulic valve for travel direction					●	●	●	●	●	●	●	DA4
el. valve for travel direction (12 V) + el. Q_{max} switch (12 V)					●	●	●	●	●	●	●	DA5
el. valve for travel direction (24 V) + el. Q_{max} switch (24 V)					●	●	●	●	●	●	●	DA6

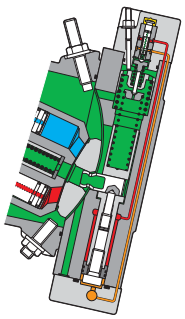
Pilot pressure increase Δ p = 10 bar
Pilot pressure increase Δ p = 25 bar
with constant pressure control

Control voltage 12 V
Control voltage 24 V
with constant pressure control

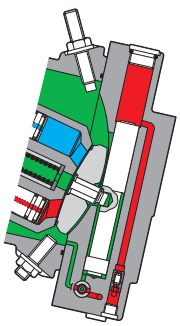
Model without pressure increase
Model with pressure increase Δ p = 100 bar

Override	HA1	HA2	HA3	
without override (no code)	●	●	●	
hydraulic override	●	●	●	T
electrical override, 12 V	●	●	●	U1
electrical override, 24 V	●	●	●	U2
el. override + el. valve for travel direction, 12 V	❍	❍	-	R1
el. override + el. valve for travel direction, 24 V	❍	❍	-	R2

Synchronizing piston



Differential piston



NOTICE

Specifications, descriptions and illustrative material shown herein were as accurate as known at the time this publication was approved for printing.
BRUENINGHAUS HYDROMATIK reserves the right to discontinue models or options at any time or to change specifications, materials, or design without notice and without incurring obligation.
Optional equipment and accessories may add cost to the basic unit, and some options are available only in combination with certain models or other options.
For the available combinations refer to the relevant data sheet for the basic unit and the desired option.
Adjustment and tests have to be carried out on the test bench under operating temperatures.
Protection of personnel and property has to be guaranteed by appropriate measures.
Expert knowledge, the precondition of any service work, can be obtained in our training courses.

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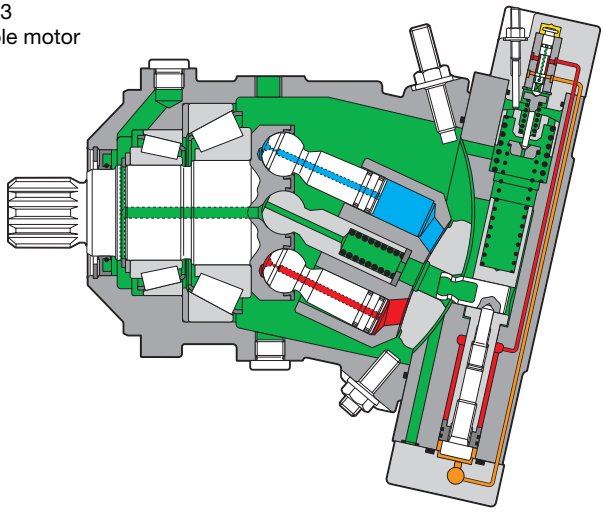
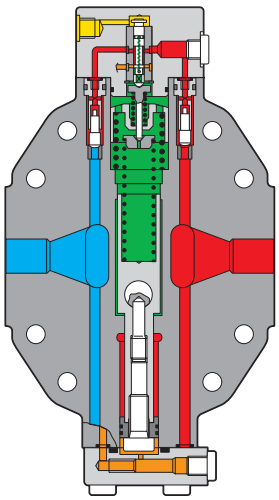
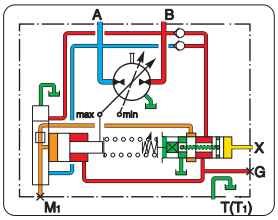
A6VM 28-200 HD./6

Index 3
Variable motor

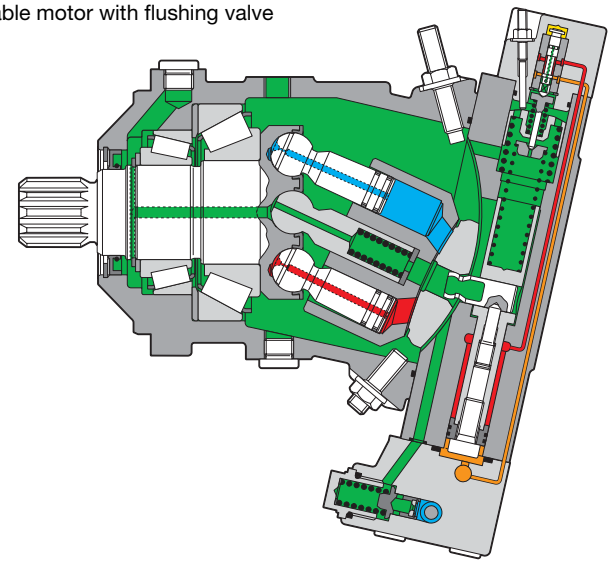


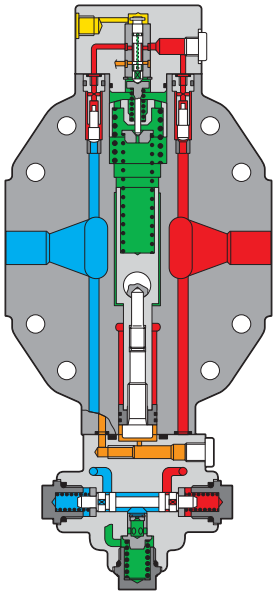


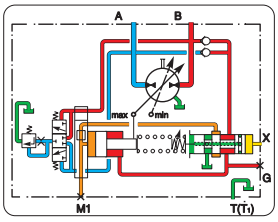


A6VM 28-200 HD./6

Index 3
Variable motor with flushing valve

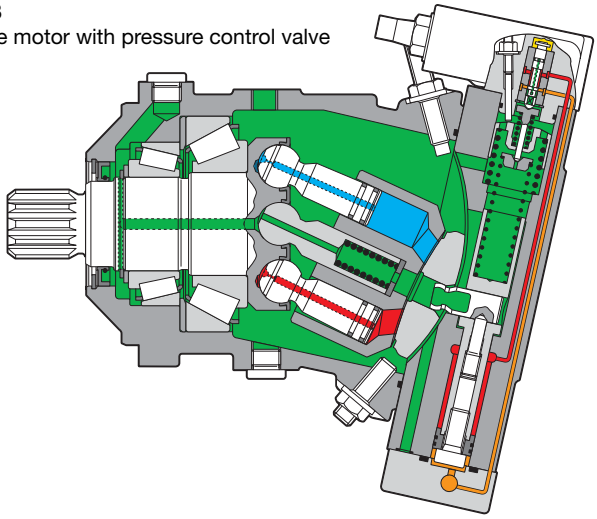


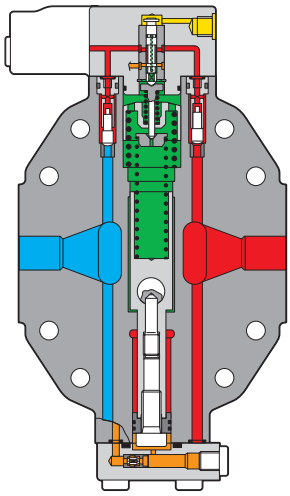


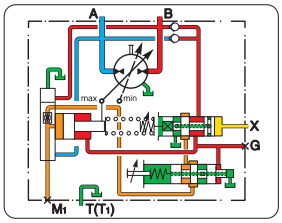


A6VM 28-200 HD1D/6

Index 3
Variable motor with pressure control valve

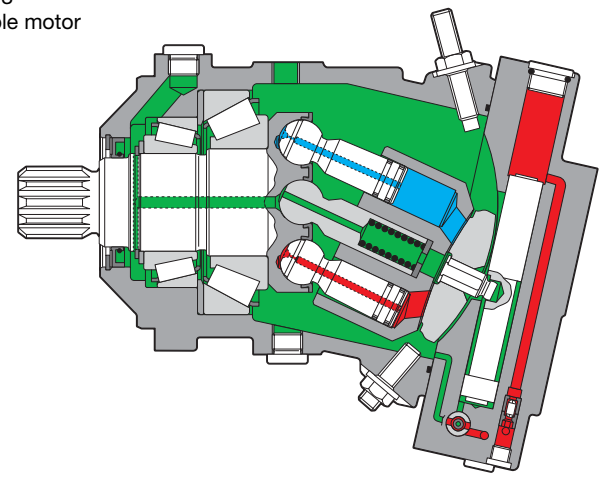


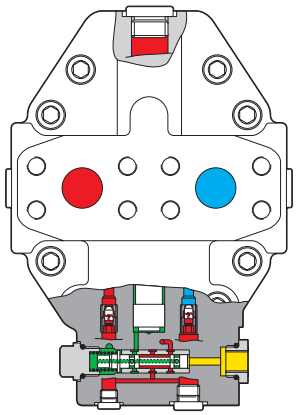


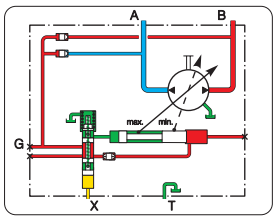


A6VM 55-107 HZ3/6

Index 3
Variable motor

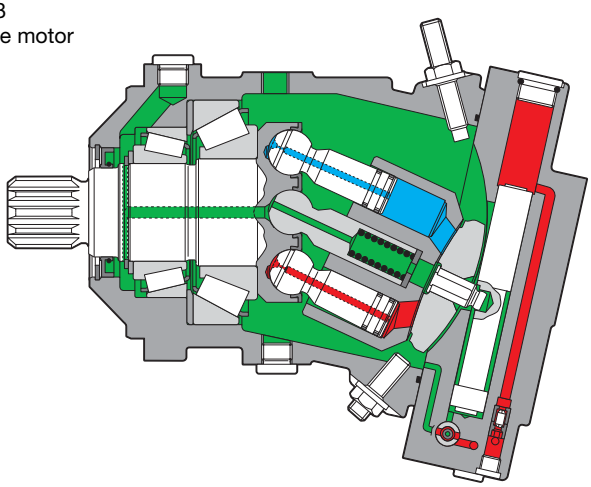


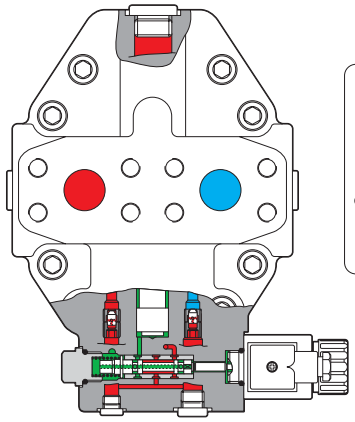


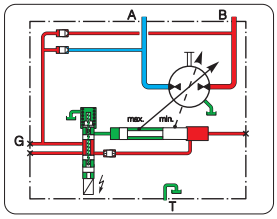


A6VM 55-107 EZ3/6

Index 3
Variable motor







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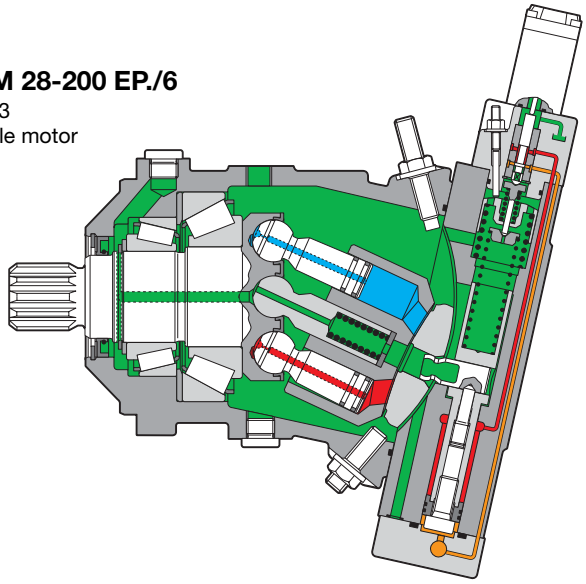
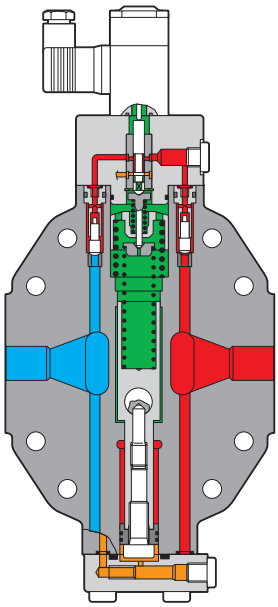
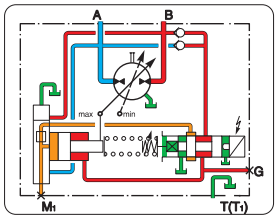
Index 3
Variable motor

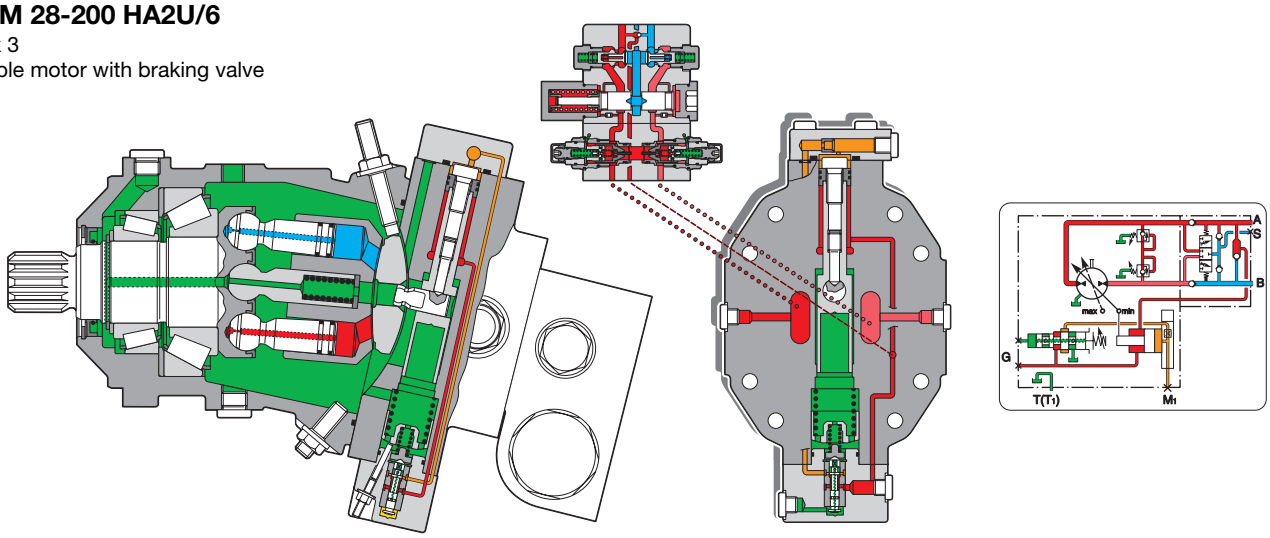






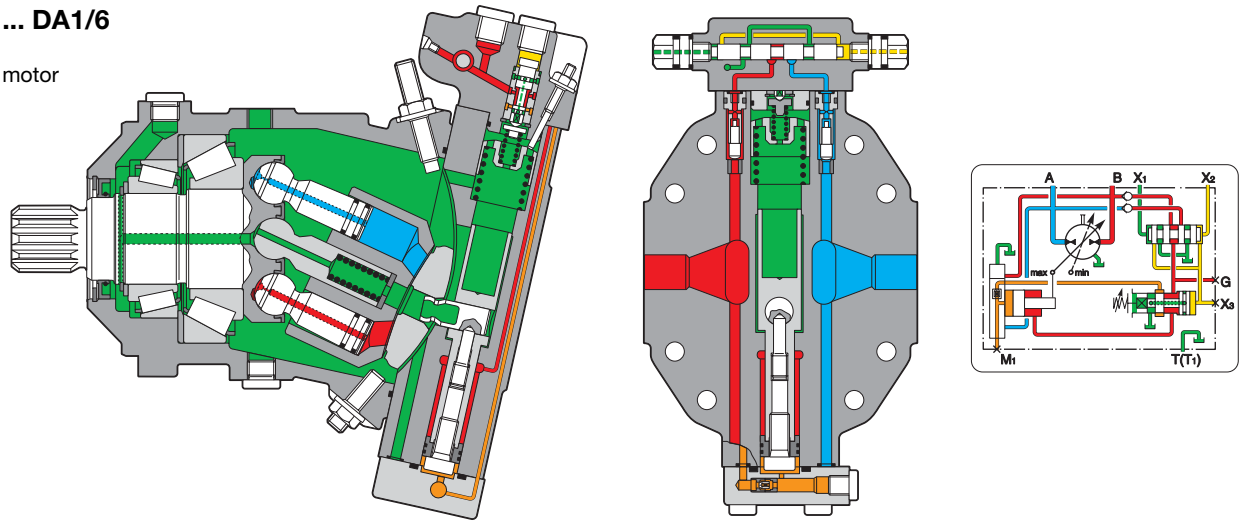
A6VM 28-200 HA2U/6

Index 3
Variable motor with braking valve



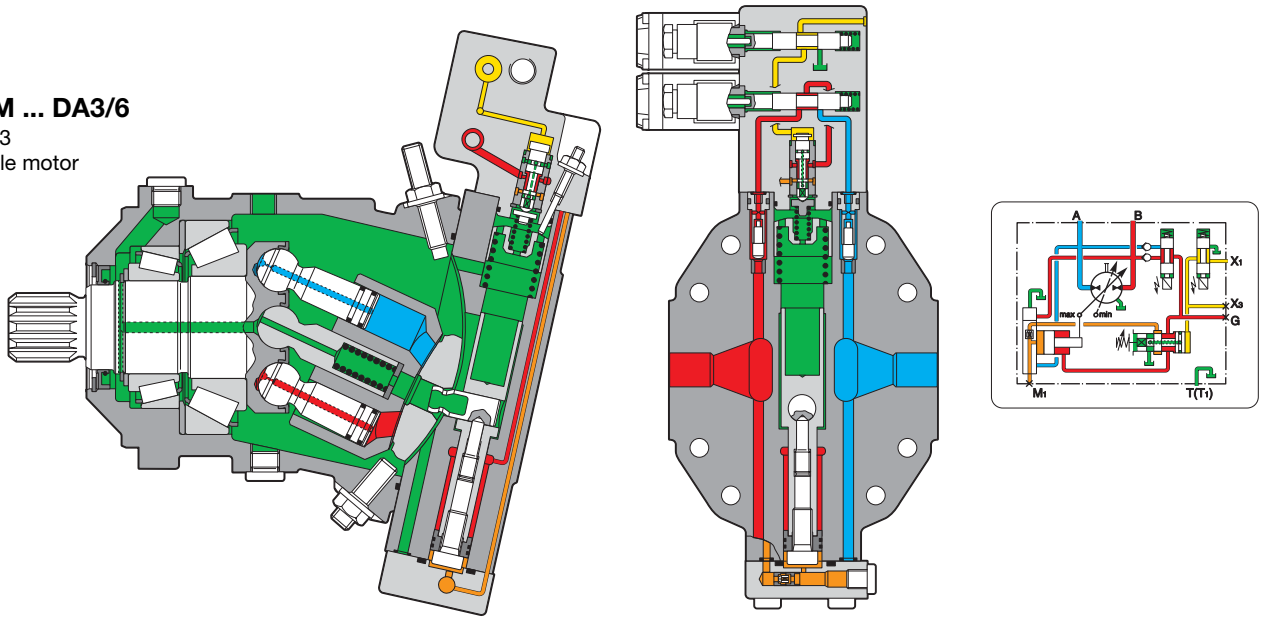
A6VM ... DA1/6

Index 3
Variable motor



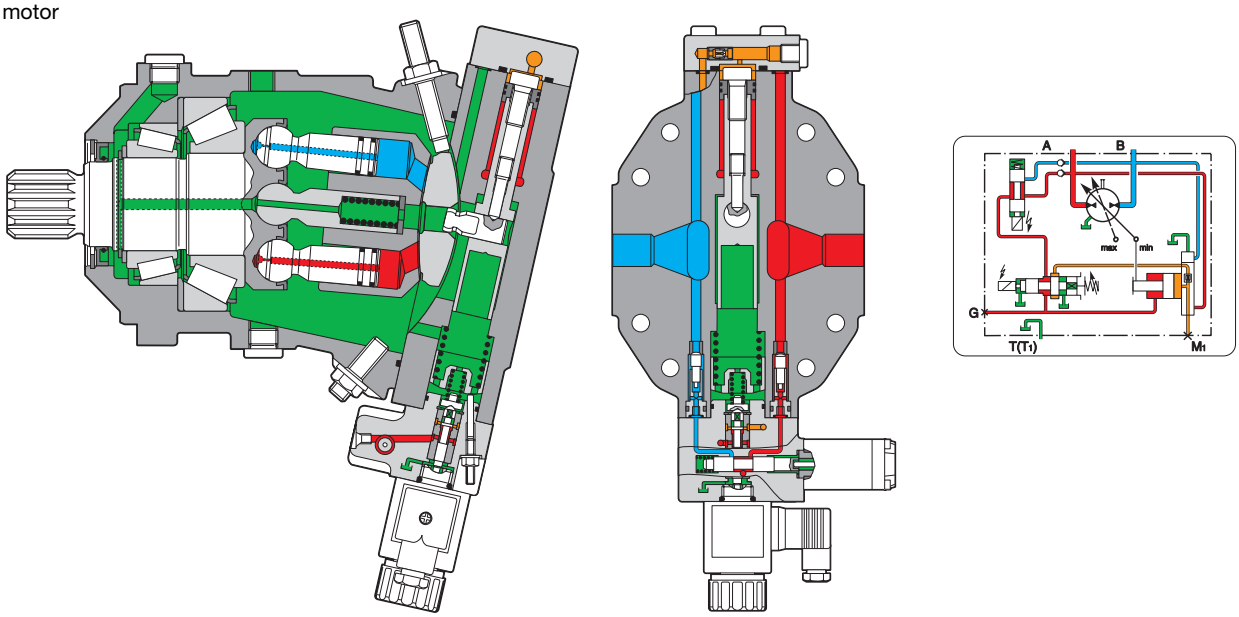
A6VM ... DA3/6

Index 3
Variable motor



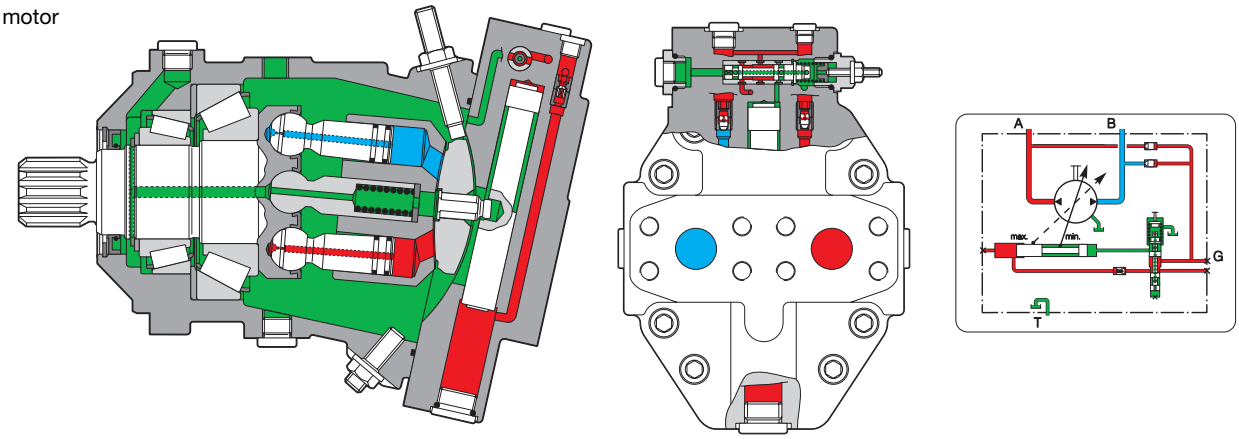
A6VM 28-200 HA2R/6

Index 3
Variable motor



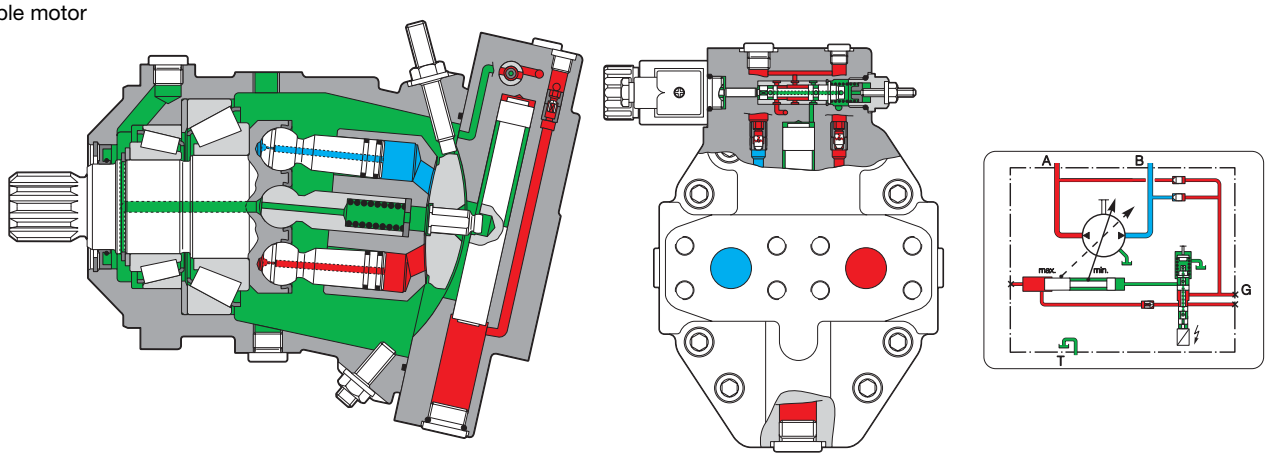
A6VM 55-107 HA3U/6

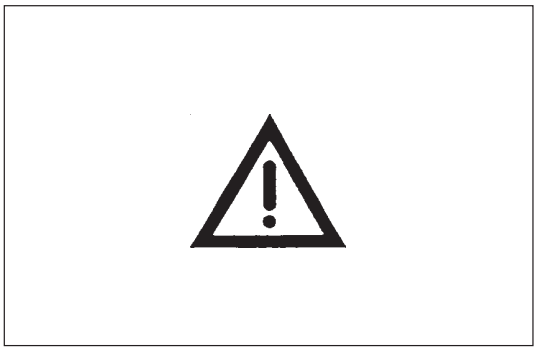
Index 3
Variable motor



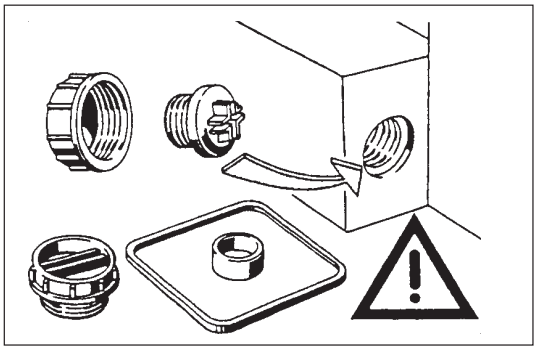
A6VM 55-107 HA3/6

Index 3
Variable motor

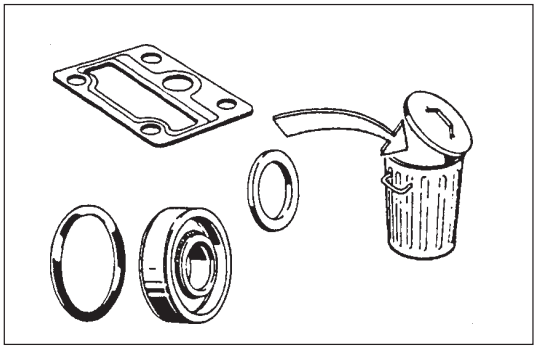




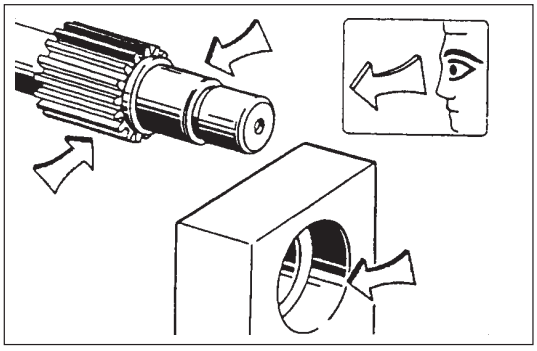
Attention!
Observe the following notices when carrying out repair work at hydraulic aggregates!



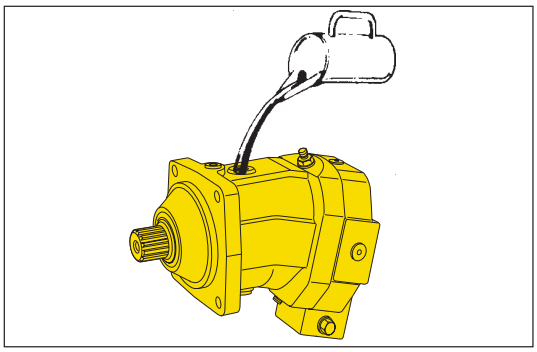
Close all ports of the hydraulic aggregates.



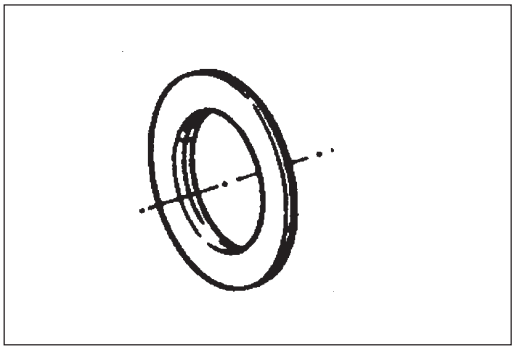
Replace all seals.
Use only original HYDROMATIK spare parts.



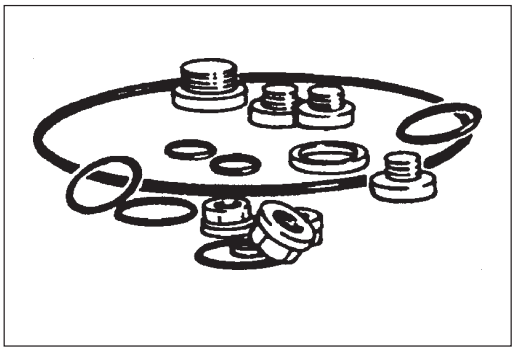
Check all seal and sliding surfaces for wear.
Attention: Rework of sealing area f. ex. with abrasive paper can damage surface.



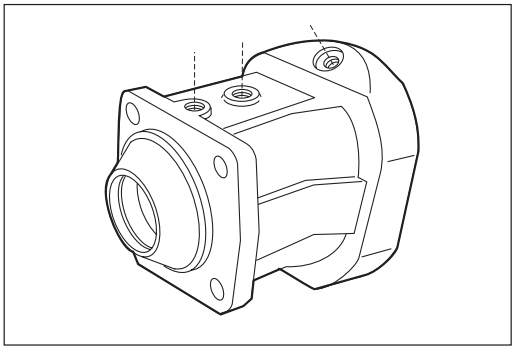
Fill up hydraulic aggregates with medium before start-up.



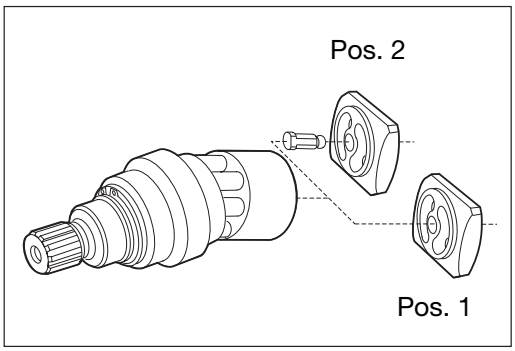
1 Seal kit for drive shaft.



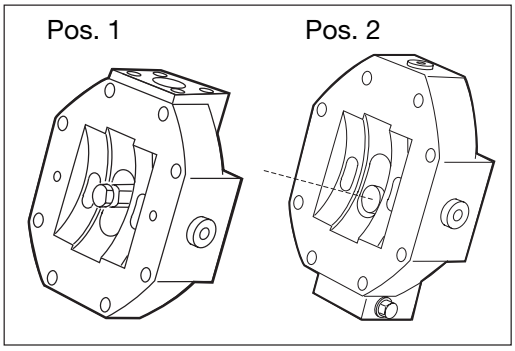
2 External seal kit.



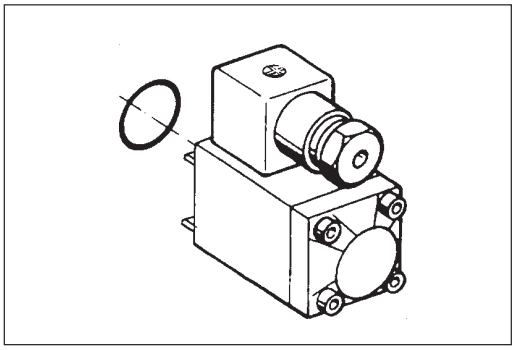
3 Housing.



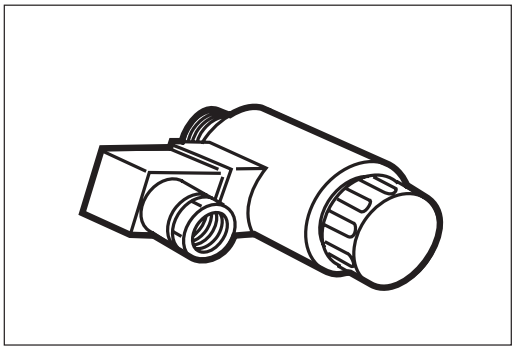
4 Complete rotary group
Note:
Pos. 1 - For port plate with differential piston
Pos. 2 - For port plate with synchronizing piston



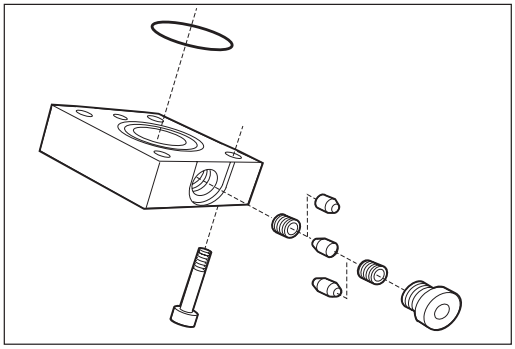
5 Port plate with control piston
Note:
Pos. 1 - For port plate with differential piston
Pos. 2 - For port plate with synchronizing piston



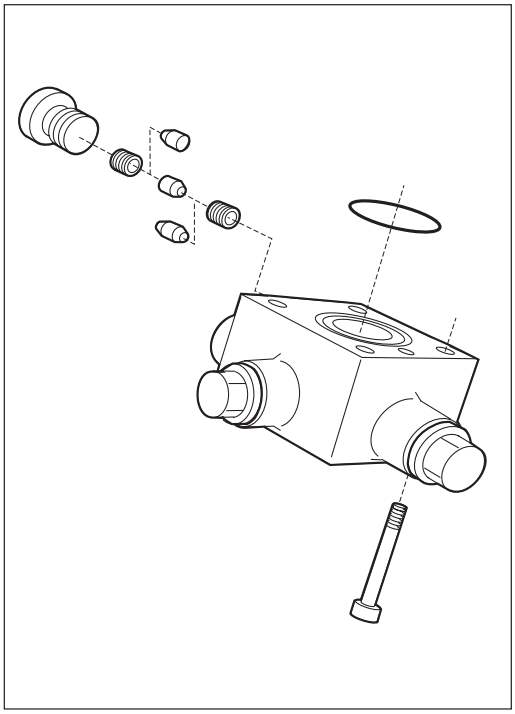
6 Proportional solenoid (EP).



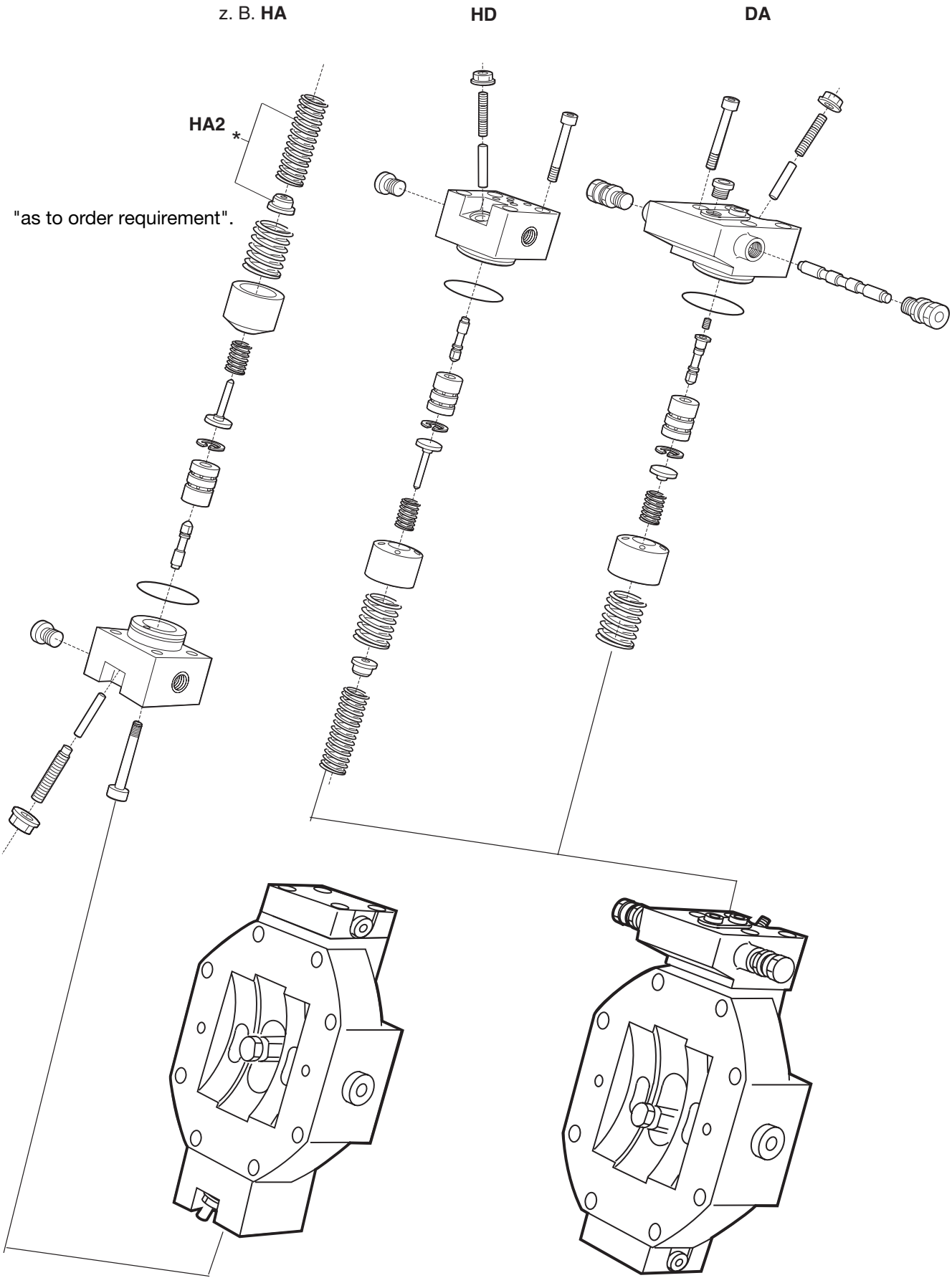
7 Solenoid.



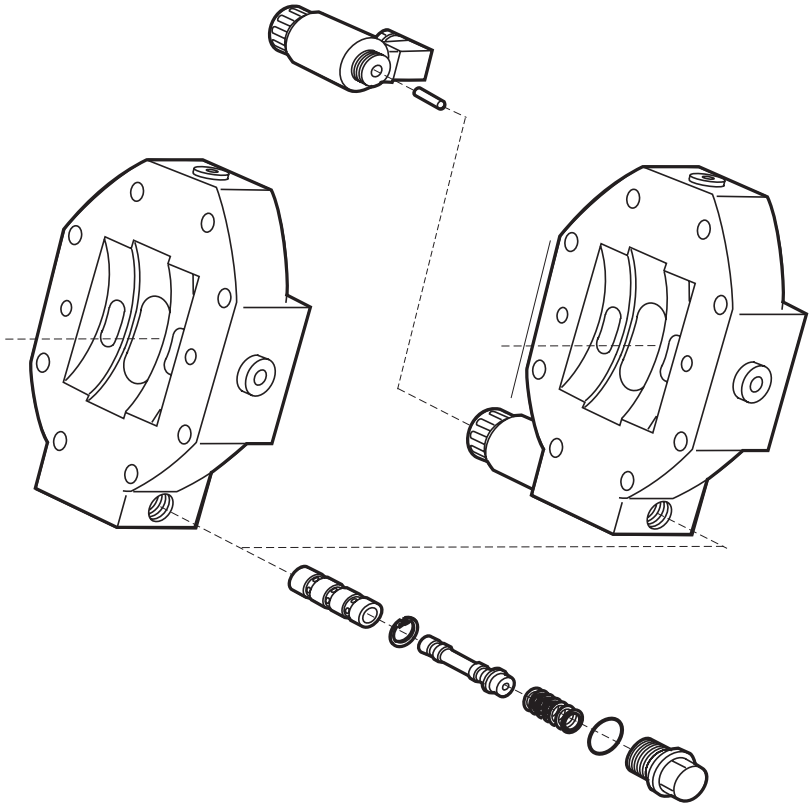
8 Cover with * throttle pin.
* Throttle pin “as to order requirement”.



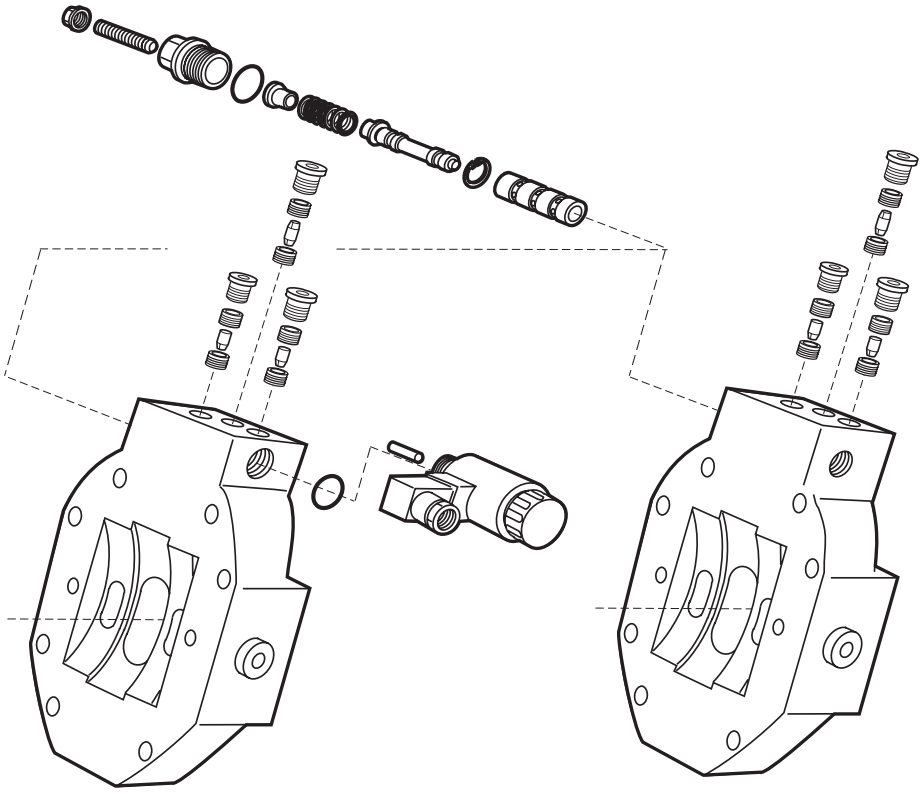
9 Cover with flushing and boost pressure valve and
* throttle pin.
* Throttle pin “as to order requirement”.

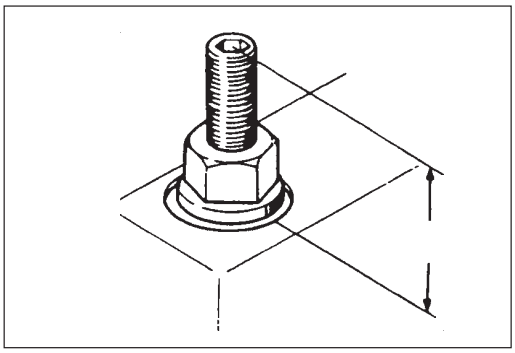

z. B. HA
HD
DA
HA2 *
"as to order requirement".

z. B. **HZ3 / EZ3**

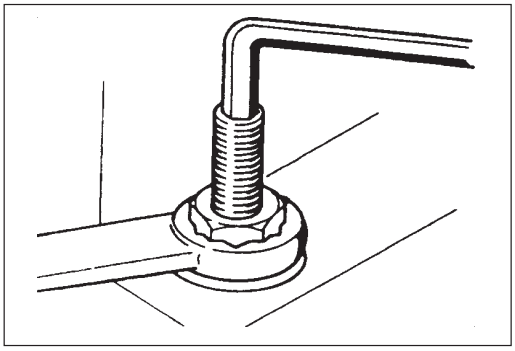


HA3 / HA3U

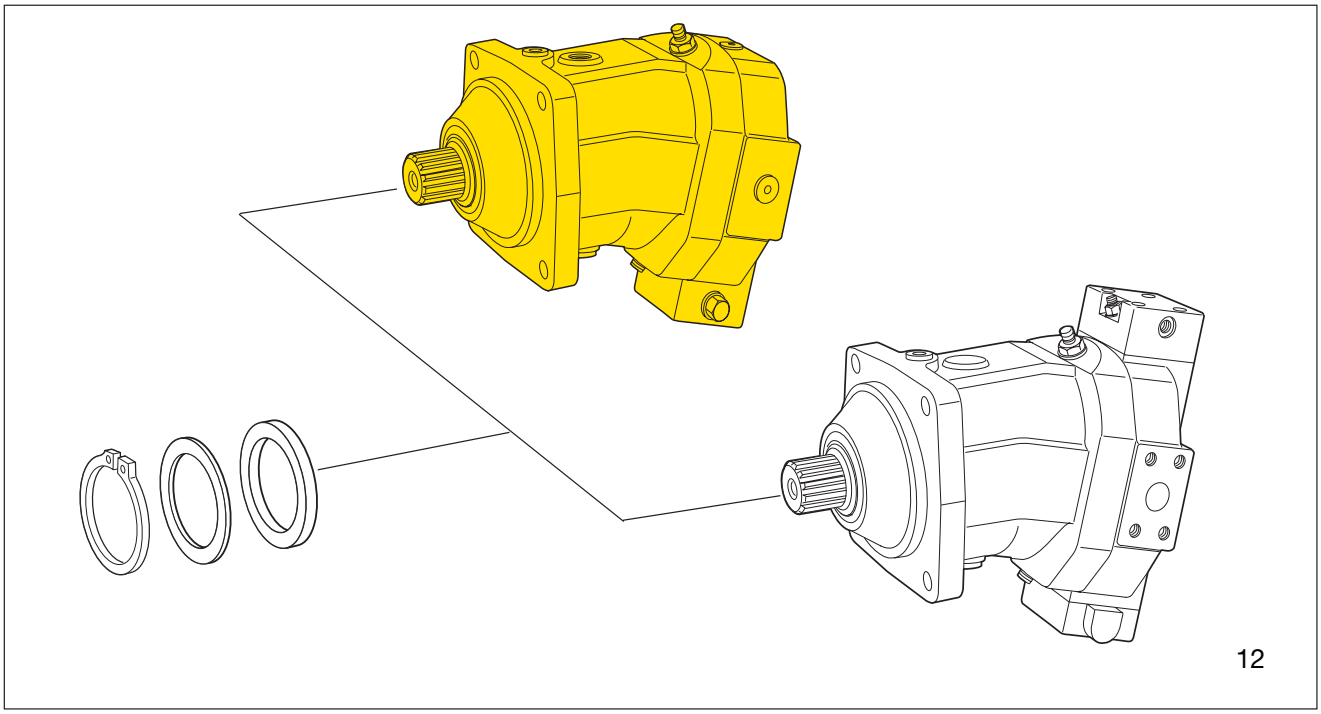


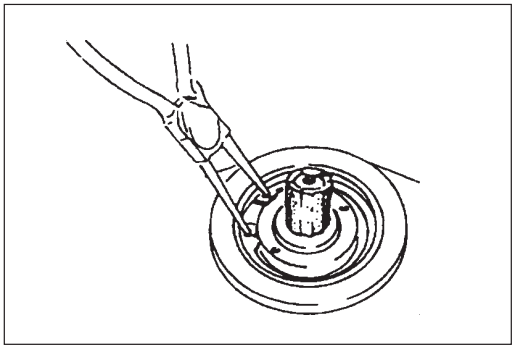


10 Replace seal nut.
First measure and record setting height.

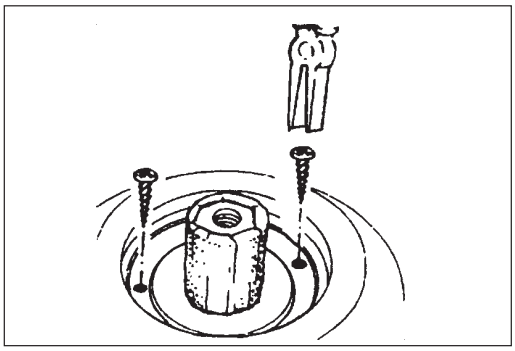


11 When tightening, counterhold setting screw, then check setting height.

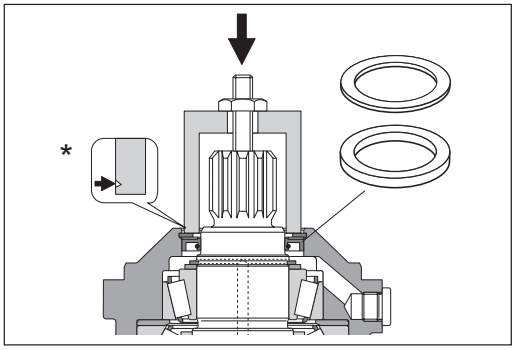




13 Protecting the drive shaft.
Remove retaining ring and shim.

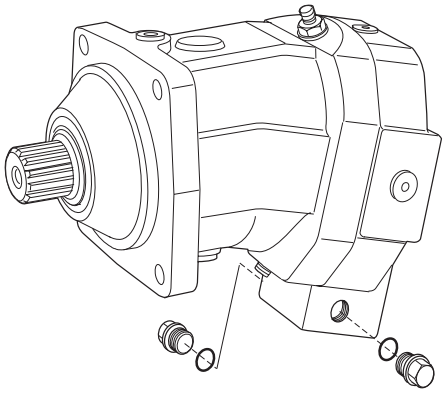


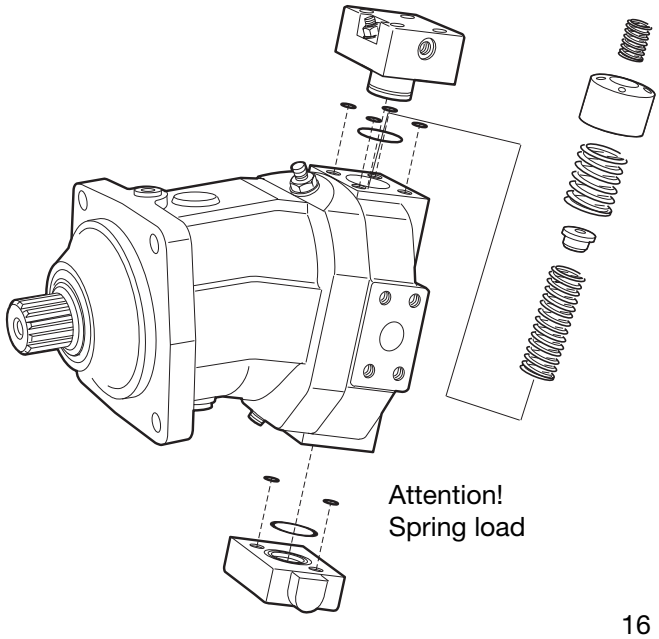
14 Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



15 Press in shaft seal ring and shim with bush to stop.

⚠ Take note of press-in depth!
Install mark for press-in depth of safety ring.





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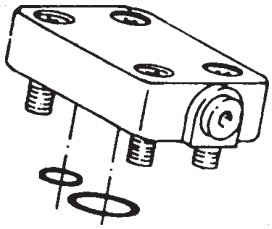
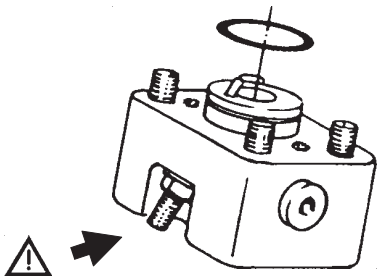
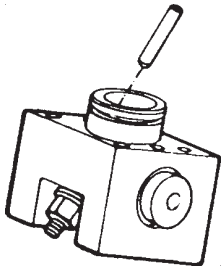


17 Inspect
Drilling in housing, O-ring, groove.

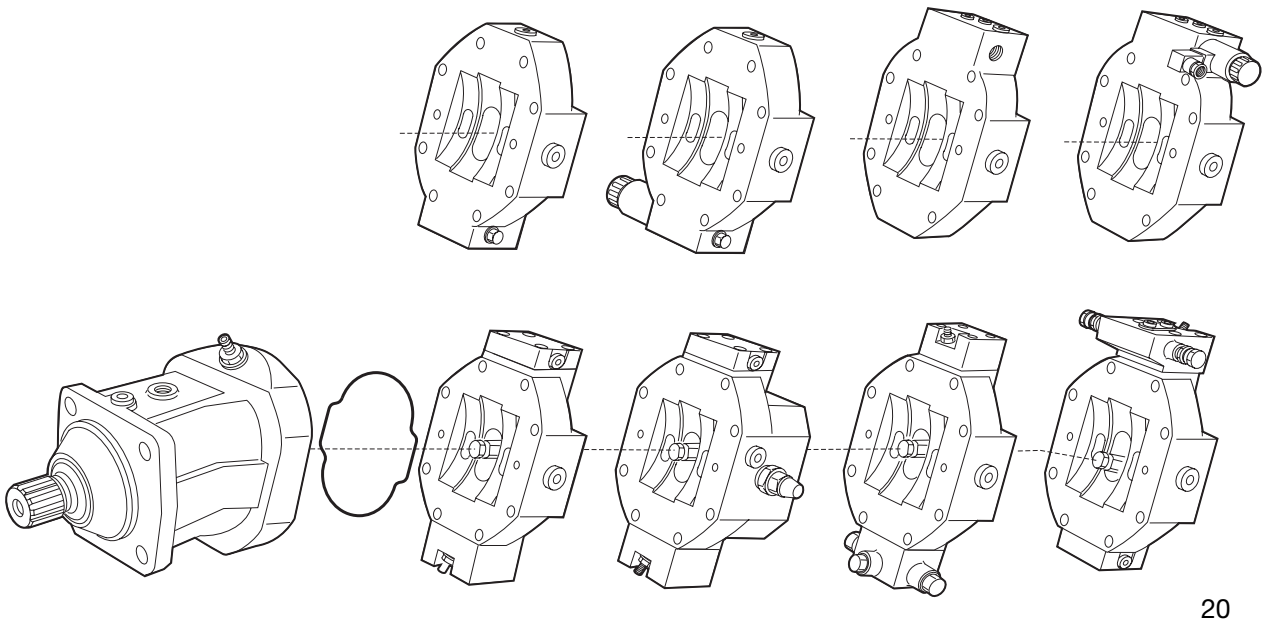


18 ⚠ Do not remove adjustment screw.

Inspect
O-ring, O-ring groove, housing.



19 Assembly aid
Insert pin with grease.



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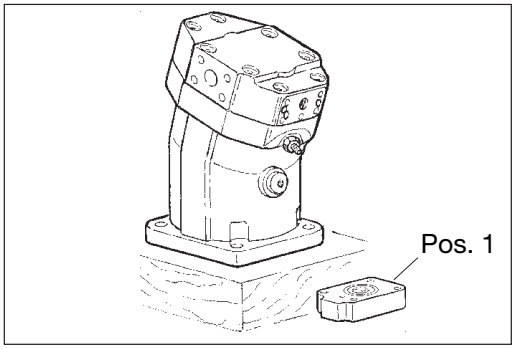

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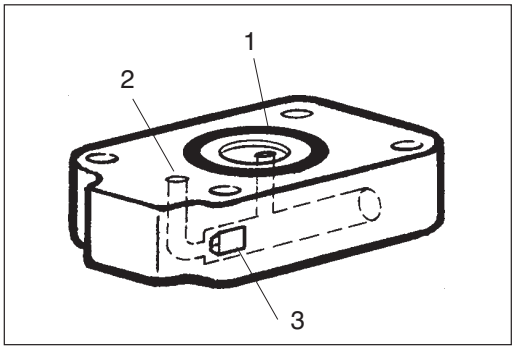
Example: A6VM ... HD control
Disassembly position:
Remove cover pos. 1



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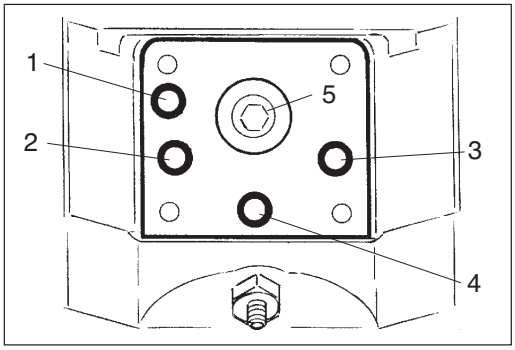
1. O-ring
2. Input flow of oil control
3. Throttle pin

⚠ Installation position differs according to the control components



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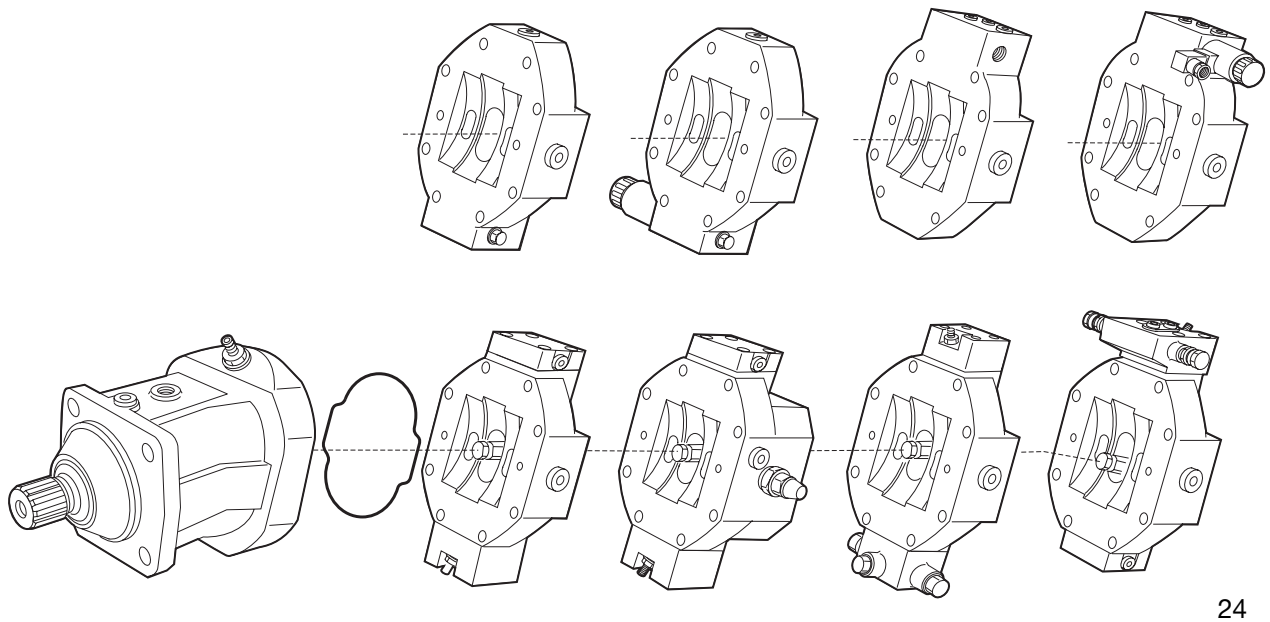
1. Input flow of oil control
2. High pressure/ low pressure
3. High pressure/ low pressure
4. Leckage oil
5. Control piston



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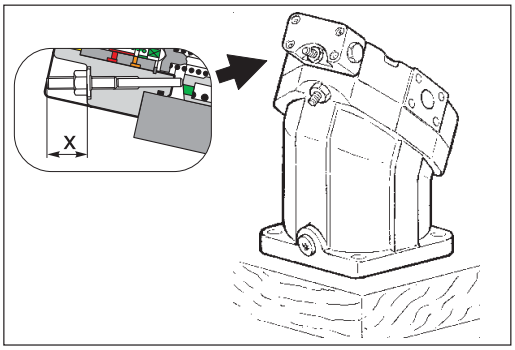

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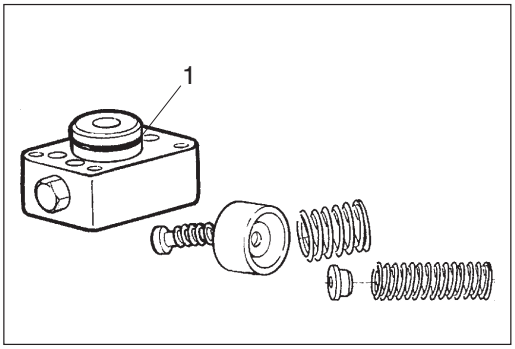
Example: A6VM... control - **differential piston**
Disassembly position: Remove cover pos. 2.

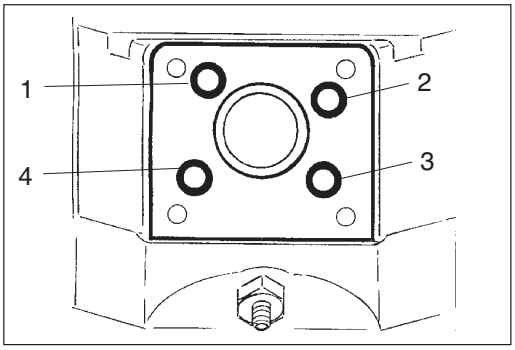
⚠ Attention! Spring load.

Dimension x: Note dimension (begin of regulation).



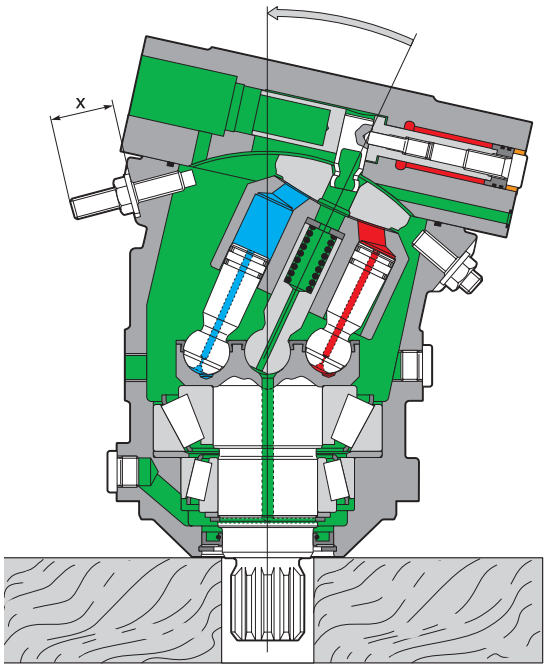
26

1. Check of O-ring



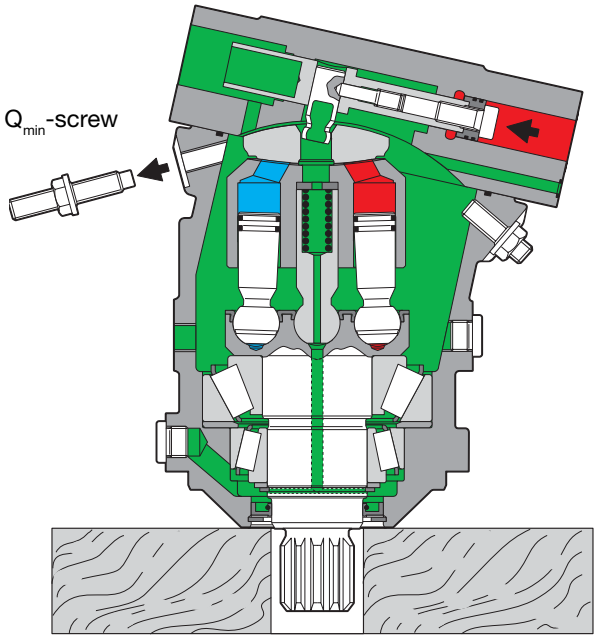
27

1. High pressure - small control piston side
2. Control pressure
3. High pressure - check valve
4. High pressure - check valve

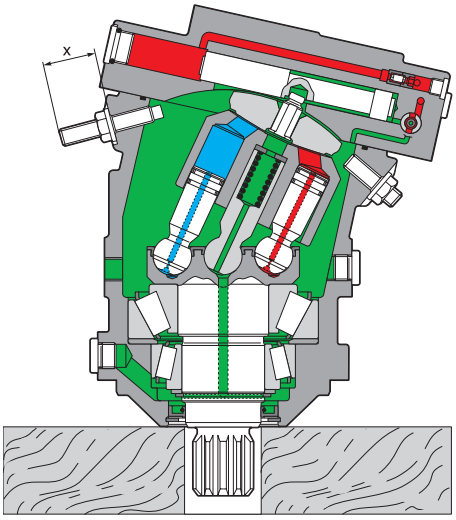


Diferential piston:
Note dimension x

⚠
For disassembly of the port plate, swivel always rotary group to zero position.
Piston rings to hang out of the cylinder boring.

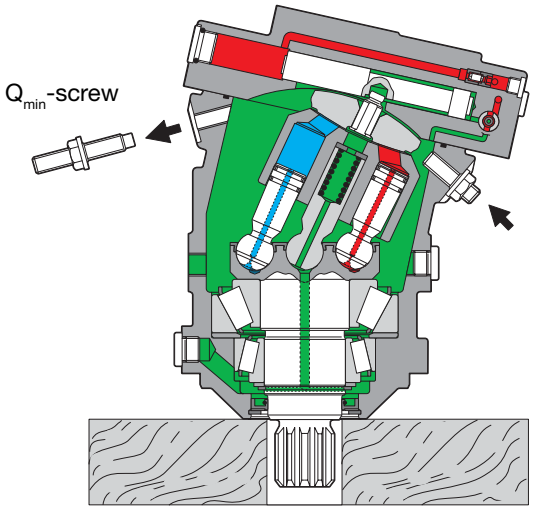


Remove Q_{min}-screw.
Swivel rotary group to 0°.

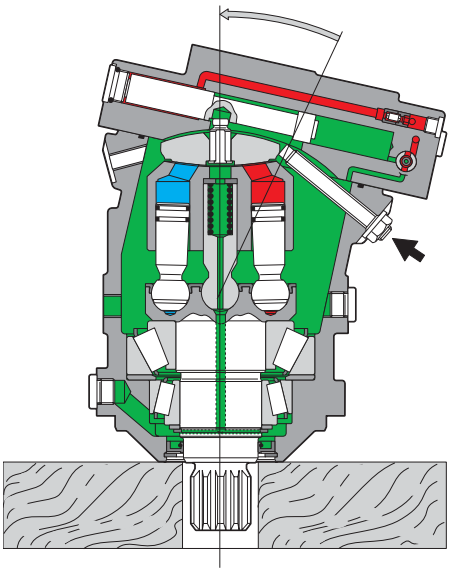


Synchronizing piston:
Note dimension x.

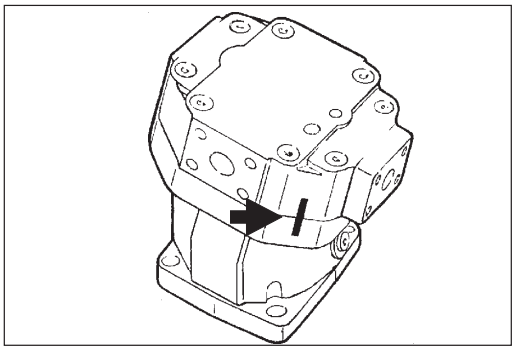
⚠
For disassembly of the port plate, swivel always rotary group to zero position.
Piston rings to hang out of the cylinder boring.



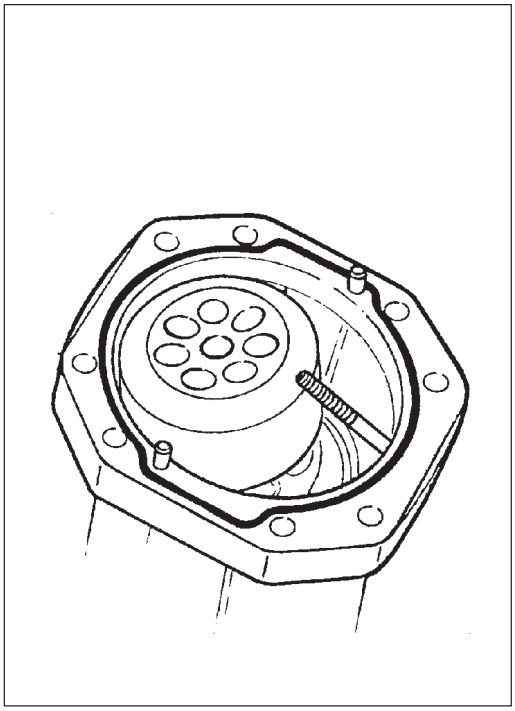
Remove Q_{min}-screw and plug.



Swivel rotary group to zero position with screw Q_{min}.



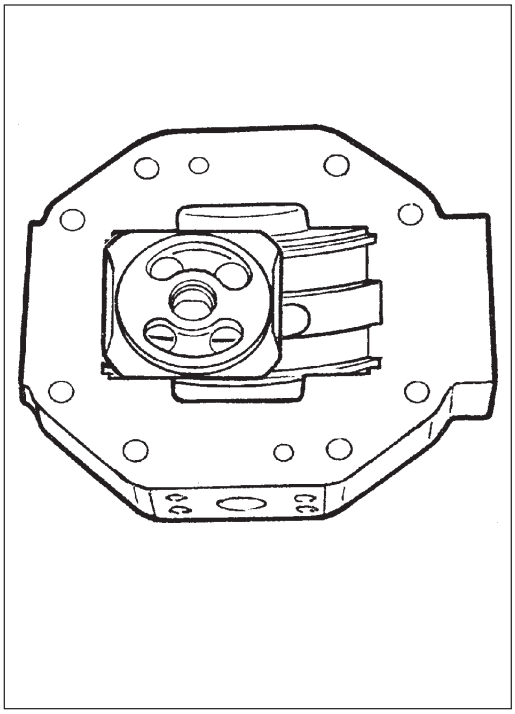
28 Port plate
Mark position. Loosen screws.
Removal



29 Check O-ring.

⚠ Stick new O-ring with some grease.

Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.

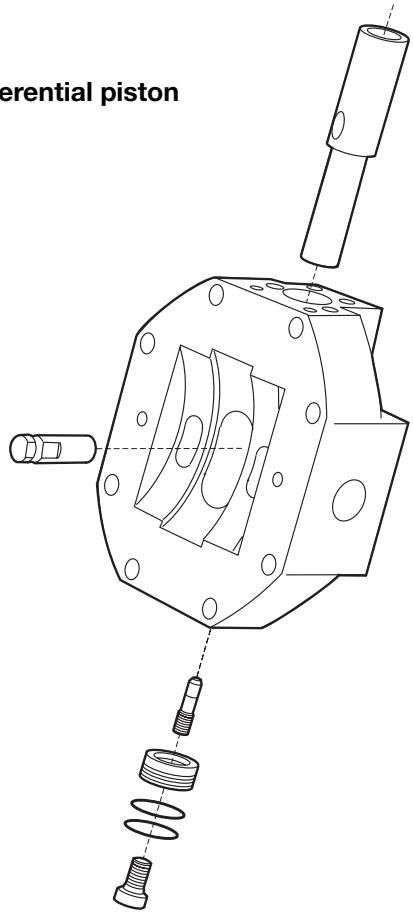


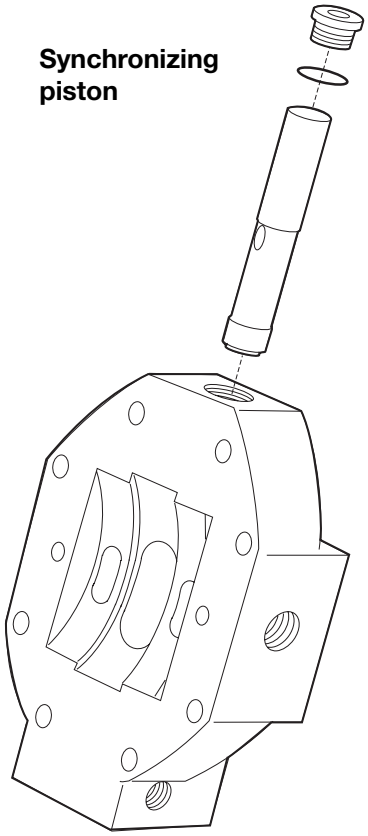
30

⚠ Stick control lens in sliding surface with grease.

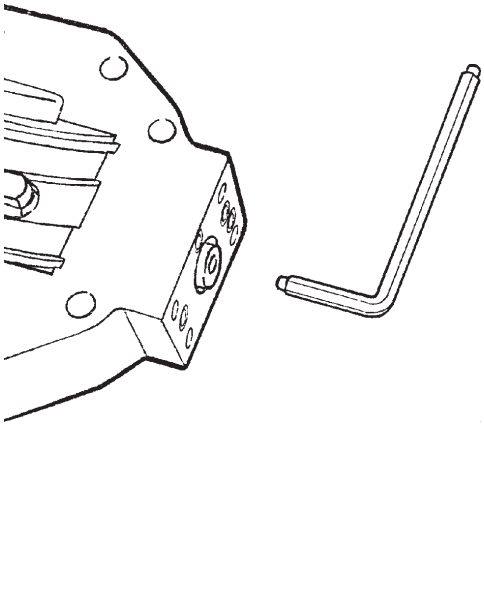
Assembly in reversal order.
Mount port plate.

⚠ Rotary group vertical.

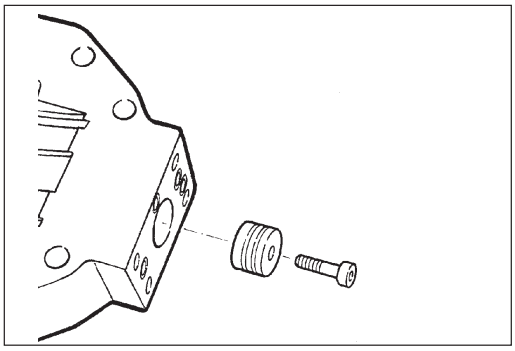




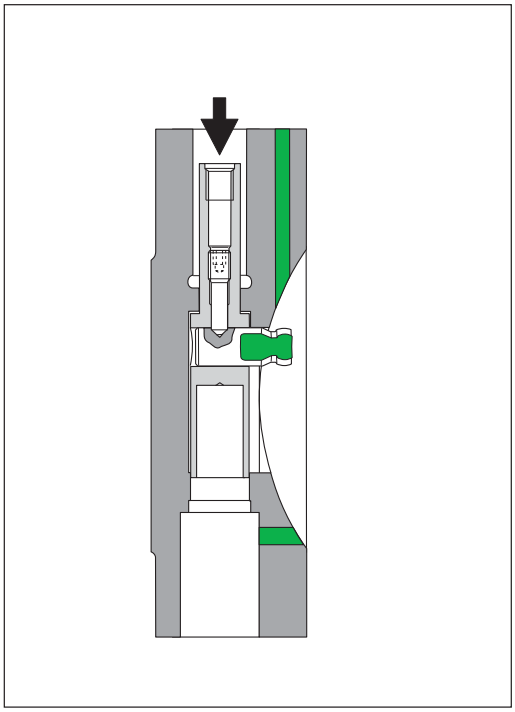
31



32 Loosen fixing screw.
Use only socket wrench.



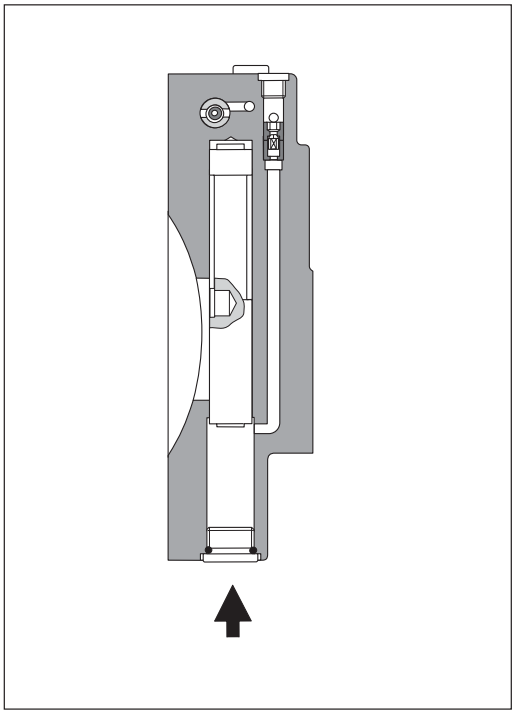
33 Remove piston with piston ring.



34 **Differential piston**

Warm up fixation screw for positioning plug via boring (screw glued - to turn out).

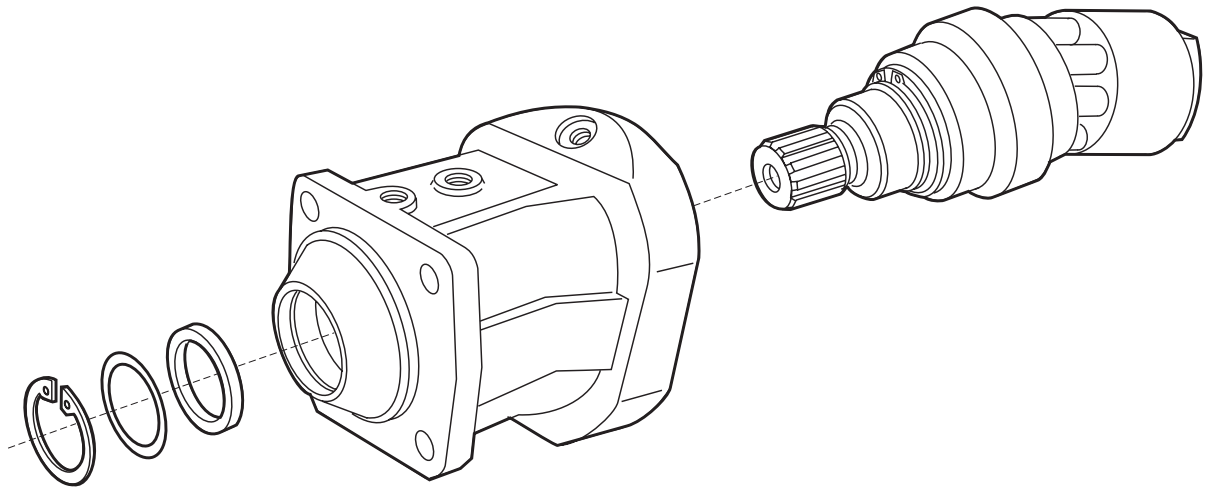
⚠ Use new screw.
Precote coating.
Note tightening torque!



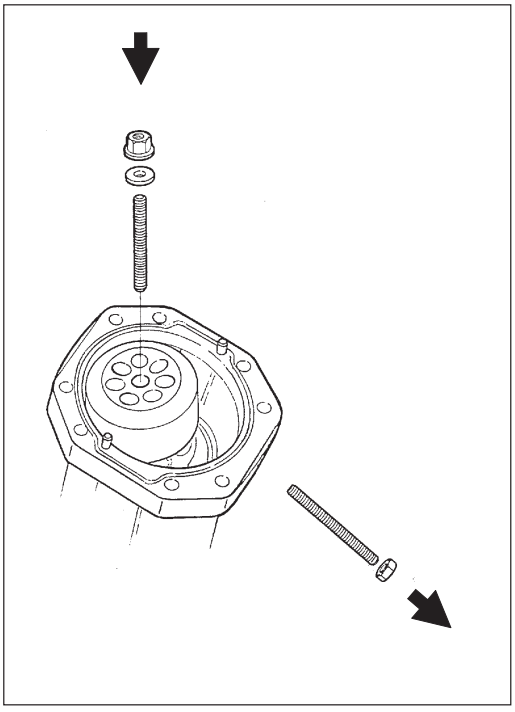
35 **Synchronizing piston**

Remove screw.
Remove piston.

⚠ Note installation position.



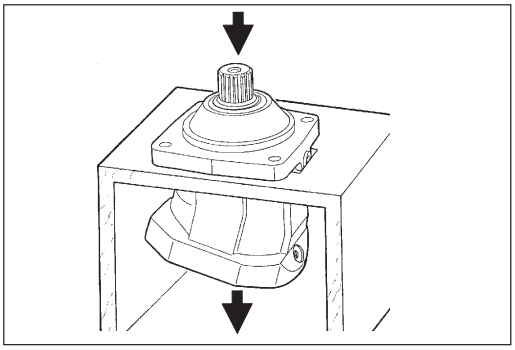
36



37

Screw in threaded pin into center pin.
Fix the cylinder with disc and locknut.
Remove Q_{max}-stop screw.

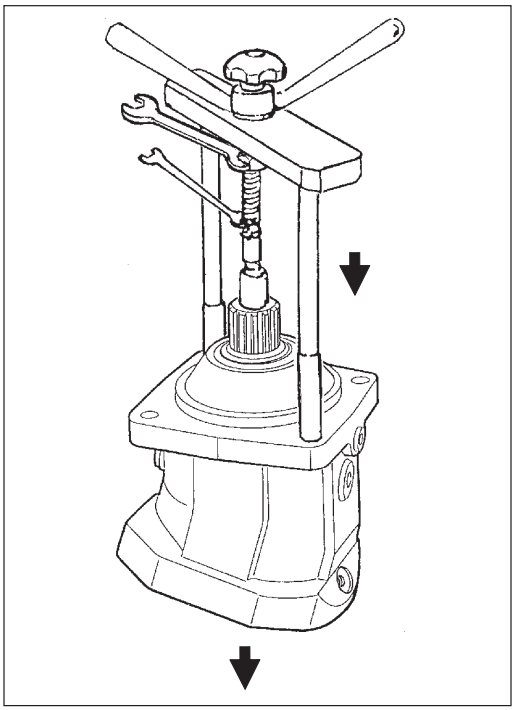
Size	
	28: M4 x 58 mm
	55: M5 x 71 mm
	80: M6 x 82 mm
	107: M6 x 92 mm
	140: M8 x 105 mm
	160: M8 x 105 mm
	200: M8 x 109 mm



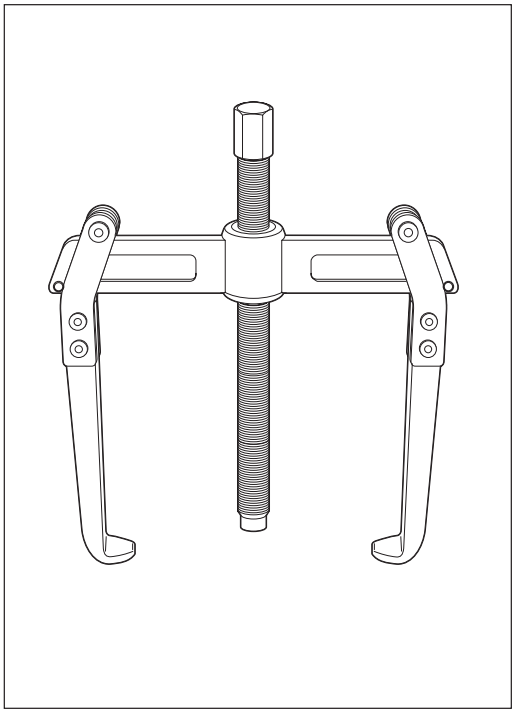
38

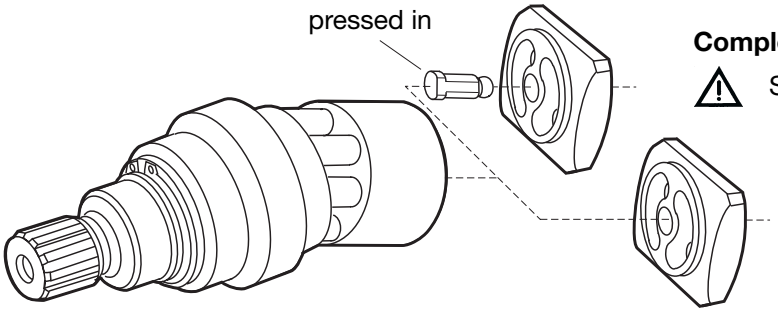
Press out rotary group!

⚠ If the bearings are used again do not hit on the drive shaft.



39 Or press-out with extraction device.

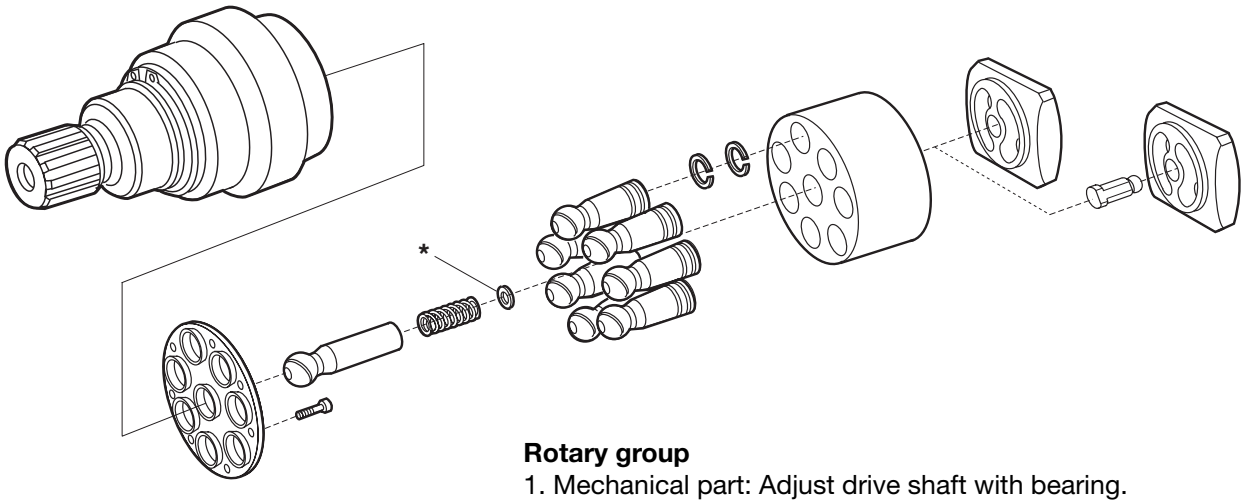




Complete rotary group

⚠ Setting of hydraulic part necessary.

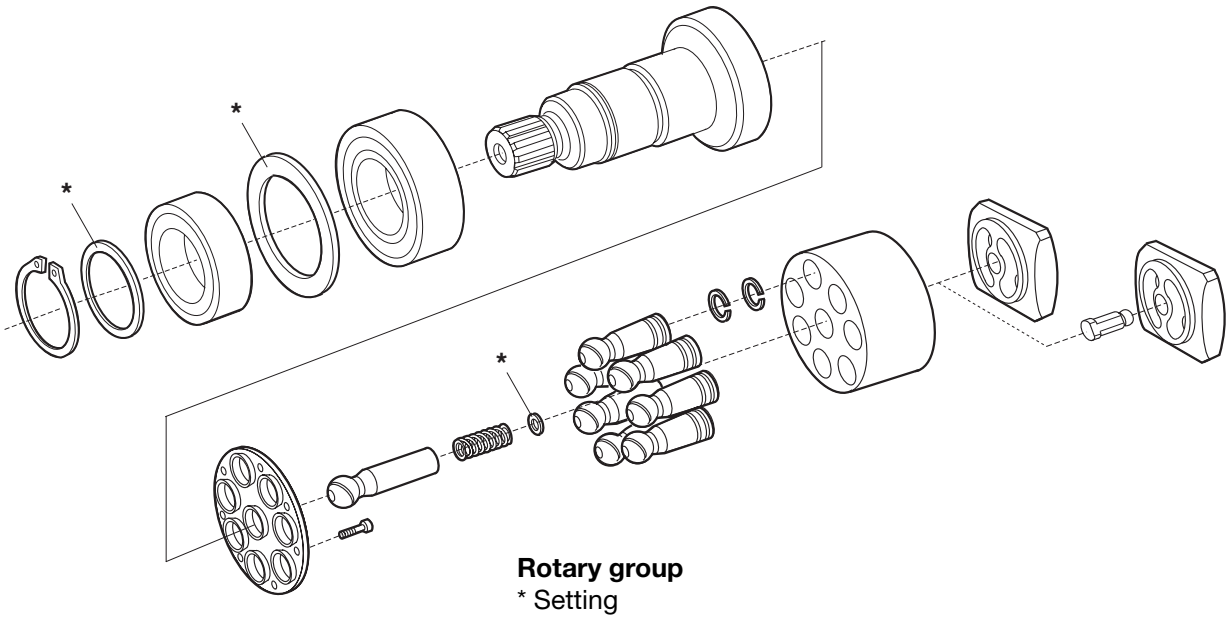
40



Rotary group

1. Mechanical part: Adjust drive shaft with bearing.
2. Hydraulic part: ⚠ Adjustment necessary

41

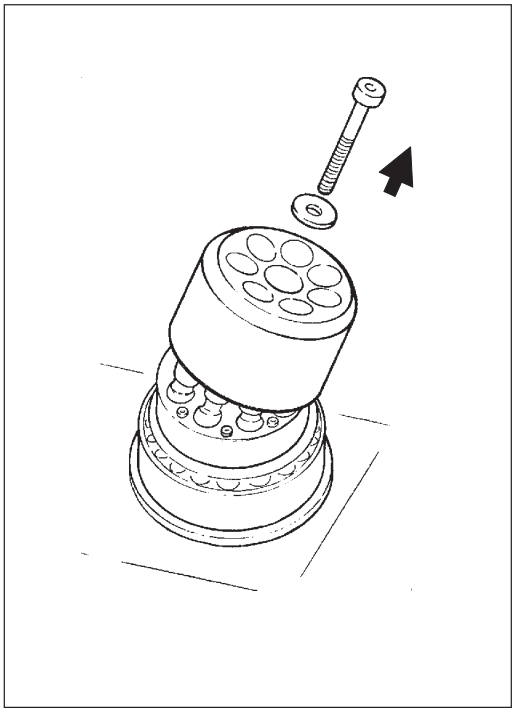


Rotary group

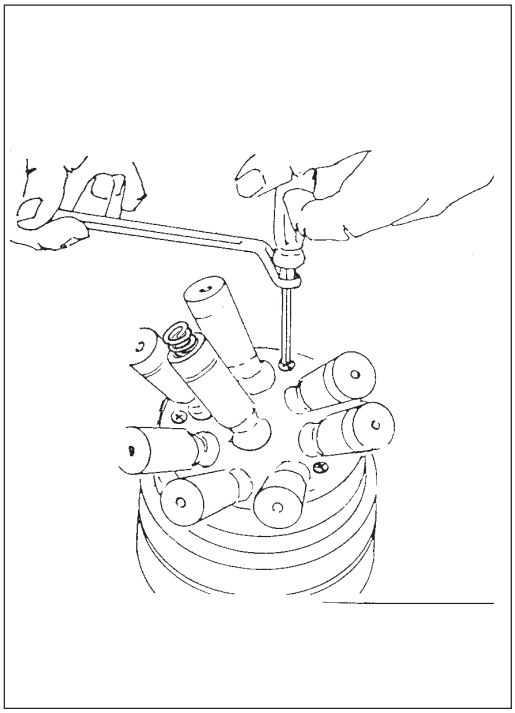
* Setting

Setting value, torque see service information.

42

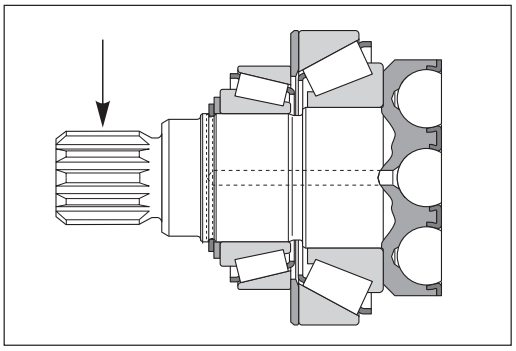


43 Remove fixing screw (cylinder).
Remove cylinder.

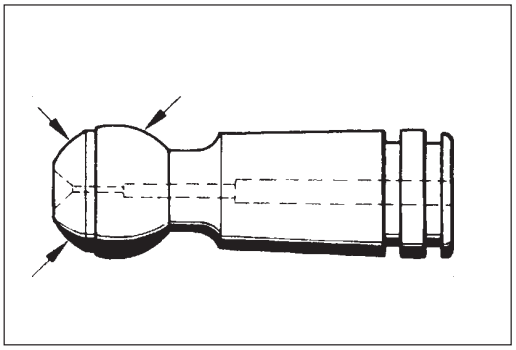


44 Disassemble retaining plate.

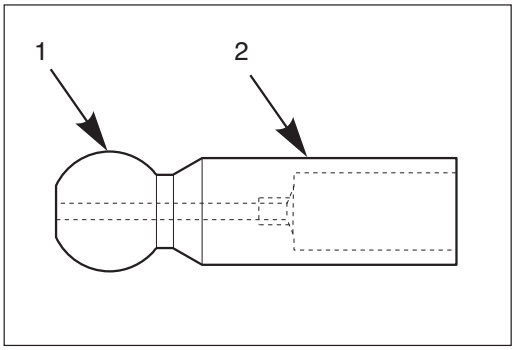
⚠ Screws are glued.
Use Torx-tools.



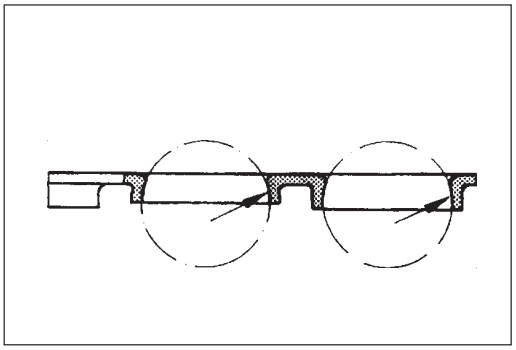
45 Free of corrosion, erosion or fretting; no damage to splines or keyways.



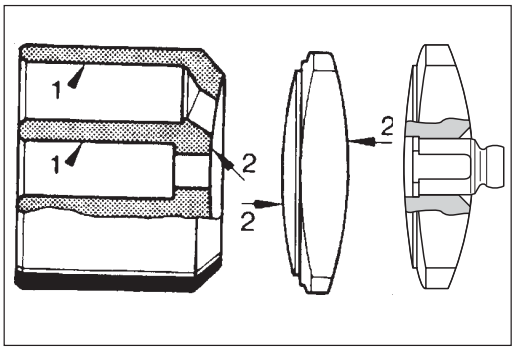
46 Pistons
No scoring and no pittings.



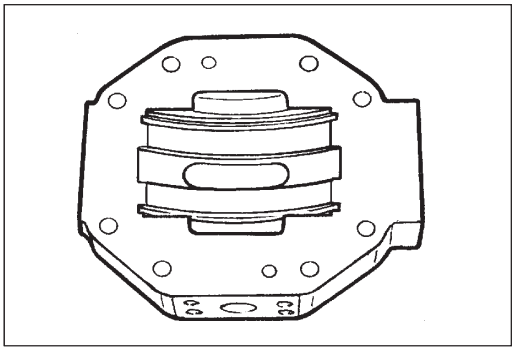
47 Center pin
No scoring and no pittings.



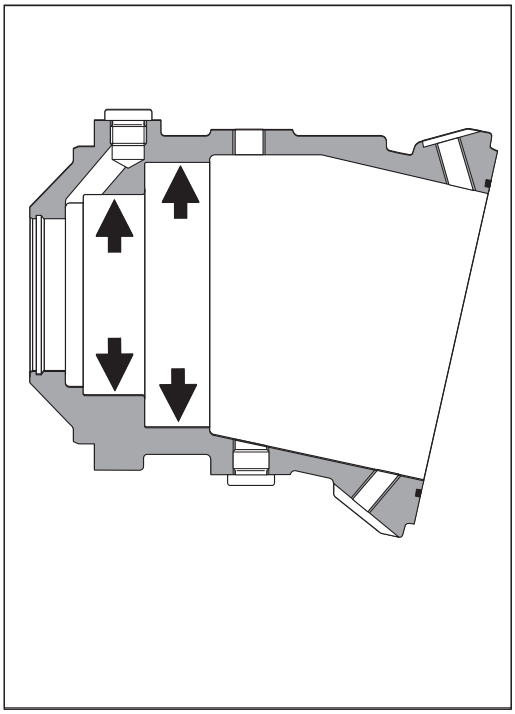
48 Retaining plate
No scoring and no evidence of wear



49 Cylinder block / control lens
1 Bores free of scoring, no evidence of wear.
2 Faces smooth and even, free of cracks and scoring.

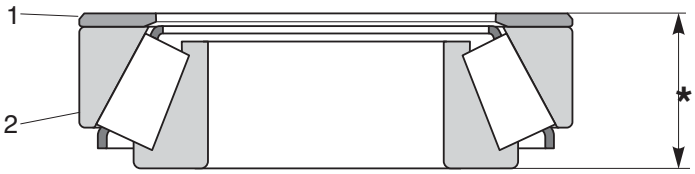


50 Control housing
Sliding surface and side guides free of scoring and no wear.

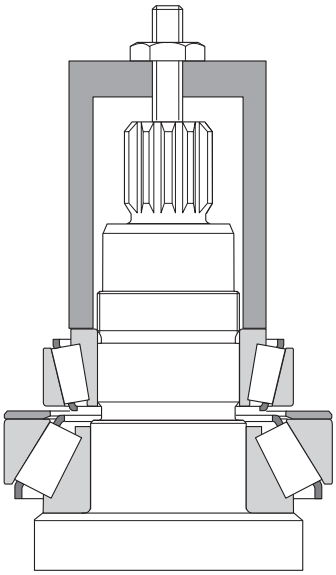


51 Visual check:
Bearing areas free of scoring and no evidence of wear.

Rotary group: mechanical part

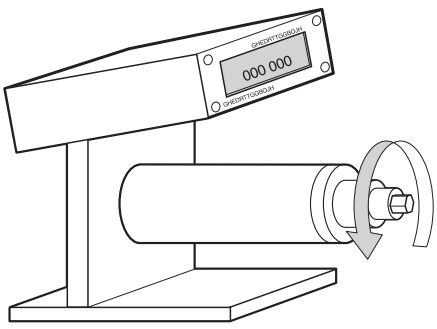


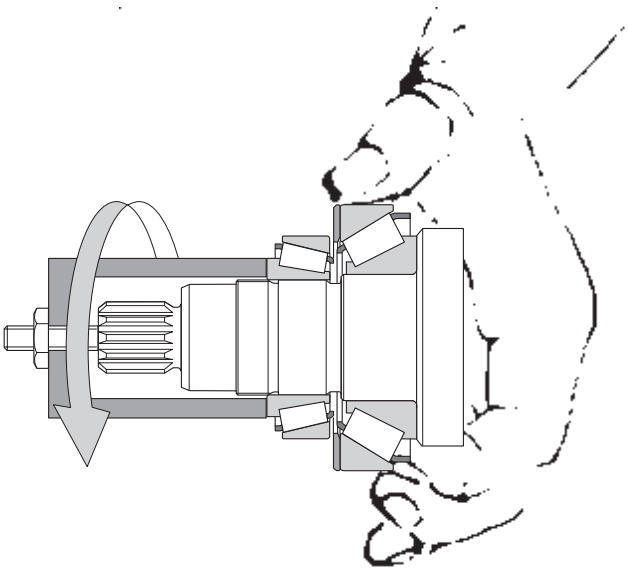
Adjustment dimension * and bearing torque see service information.



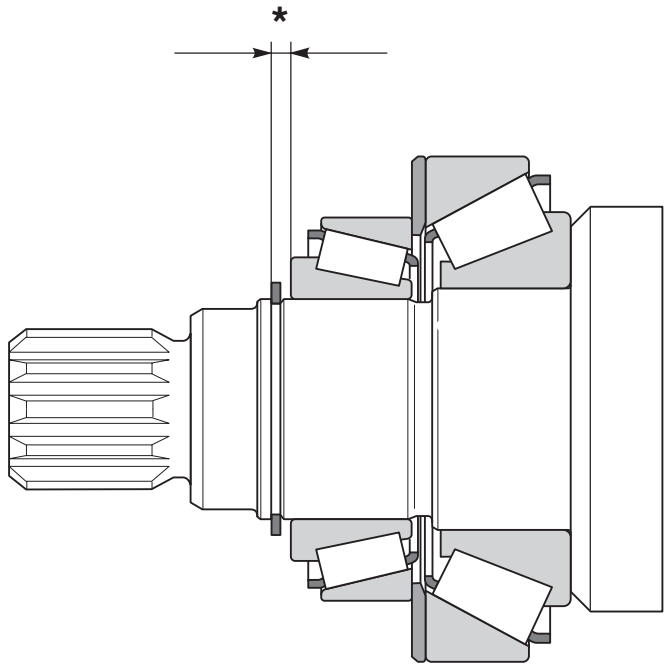
Press on bearing.
Do not exeed bearing torque during press-on.

Preload bearing with assembly sleeve and steady control of torque.

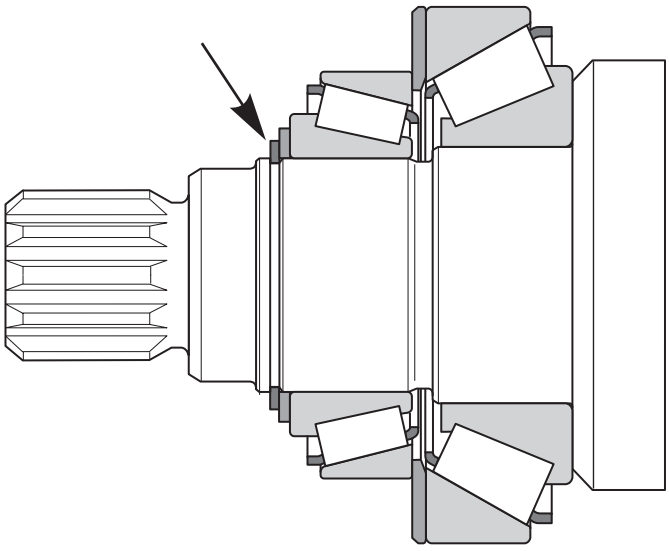




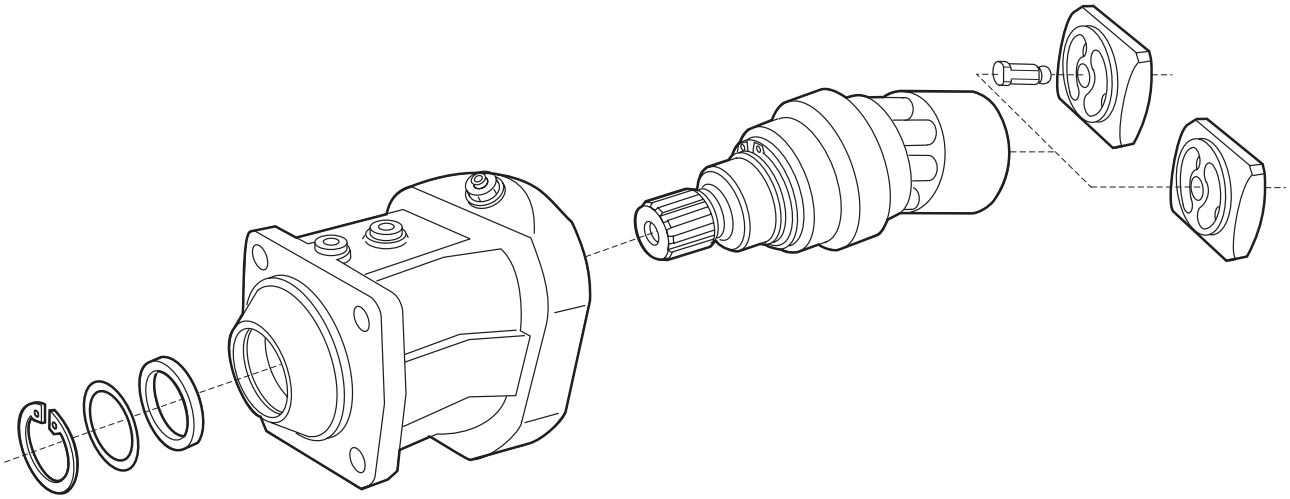
Rotary group: mechanical part



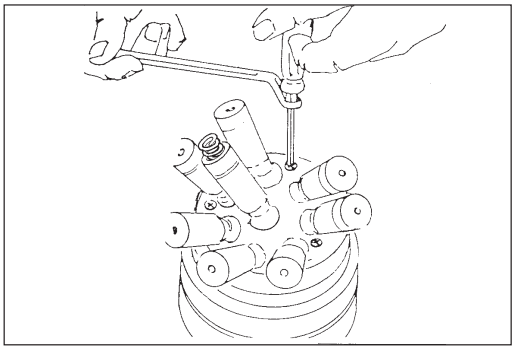
Assemble safety ring.
Determine dimension for adjustment disc with final dimensions (crossover).



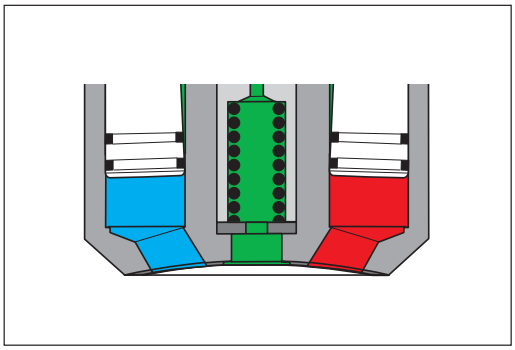
Install adjustment disc.
Assemble safety ring.
Drive shaft ready for assembly.



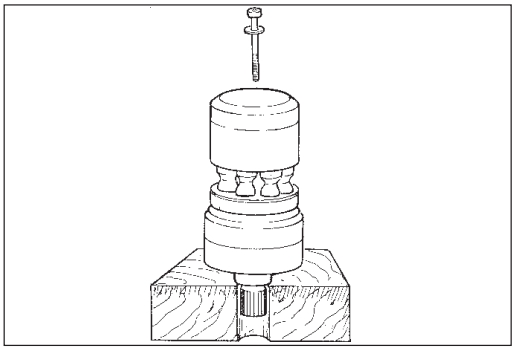
52



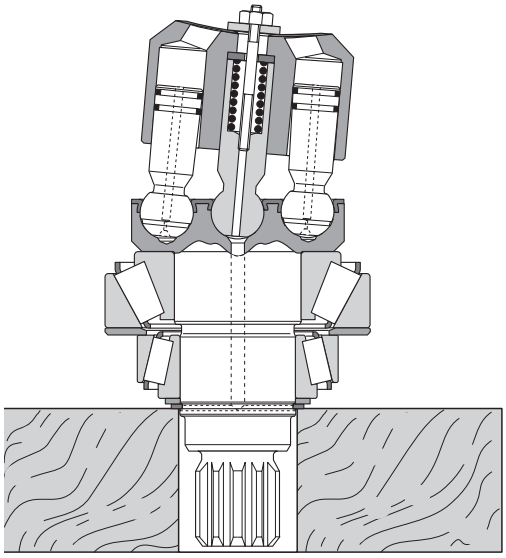
53 Insert retaining plate with piston and center pin.
Use screw with Precote-coating.



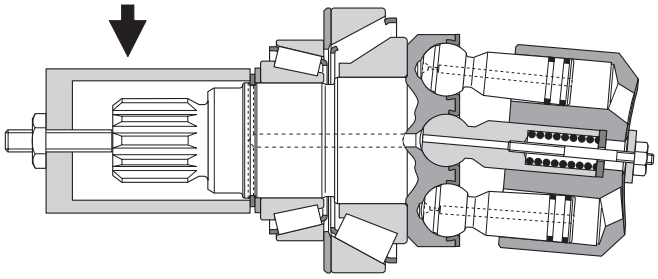
54 Make sure all parts are fitted in correctly.



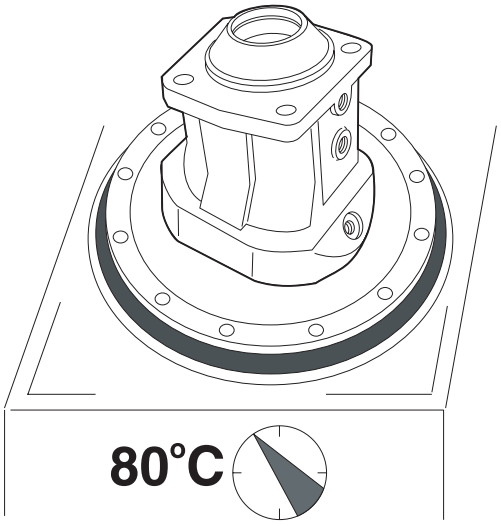
55 Swivel cylinder block to max. and fix the cylinder.



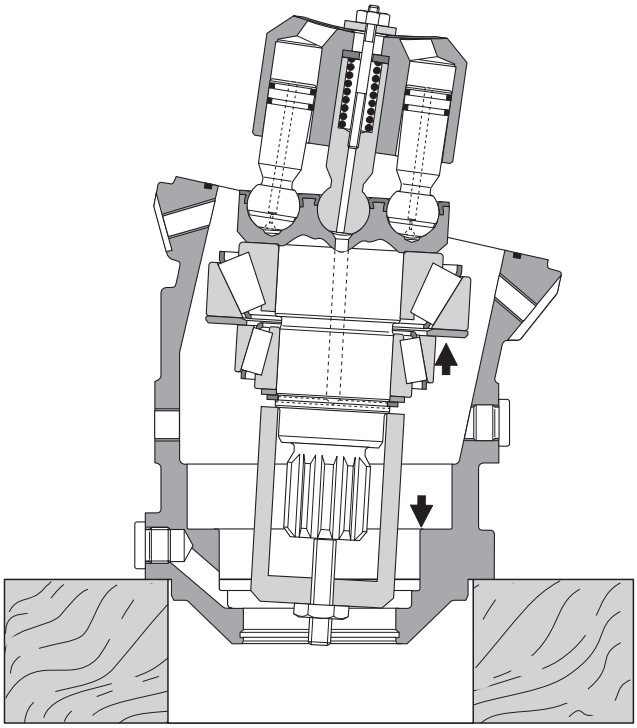
Rotary group completely assembled ready for assembly.



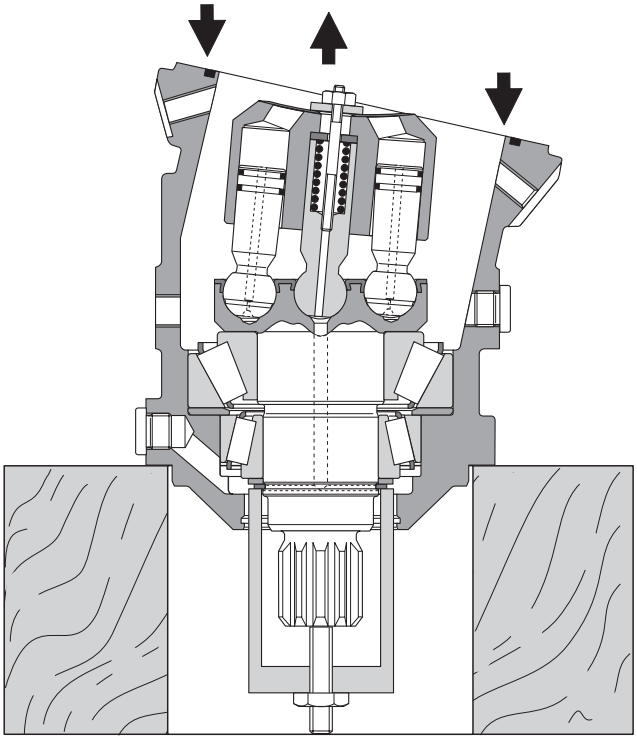
Place assembly sleeve.



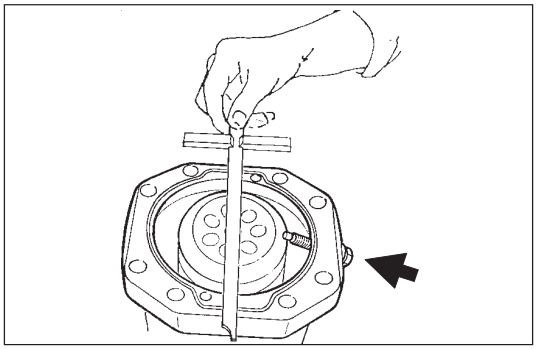
Warm up housing to 80°C.



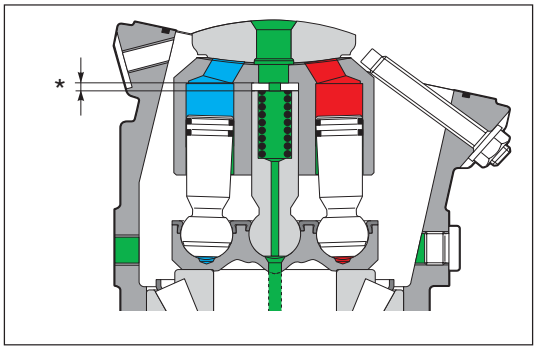
Insert rotary group into housing to seat position.



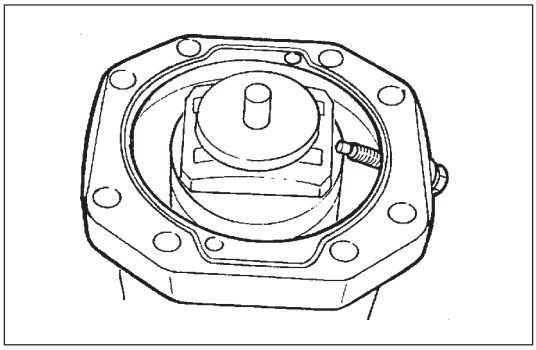
Fix zero position of cylinder with Q_{max}-screw.
1. Disassemble cylinder fixing screw.
2. Insert O-ring.



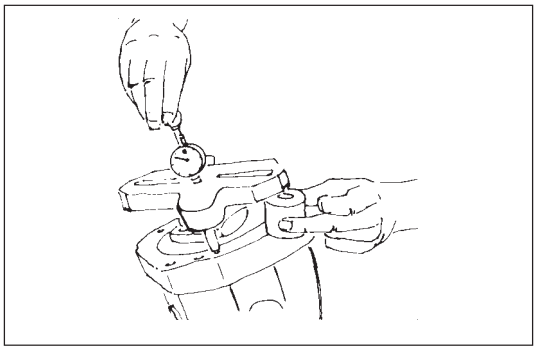
56 Determine cylinder swivel range to max. angle with screw.



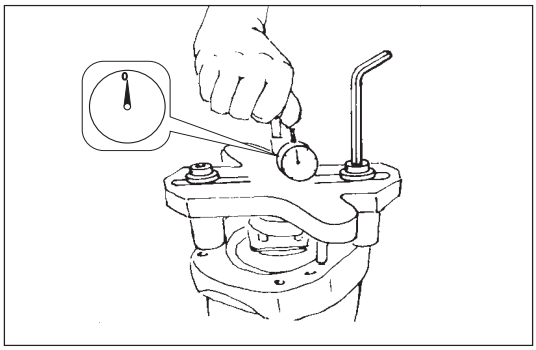
57 * Disc



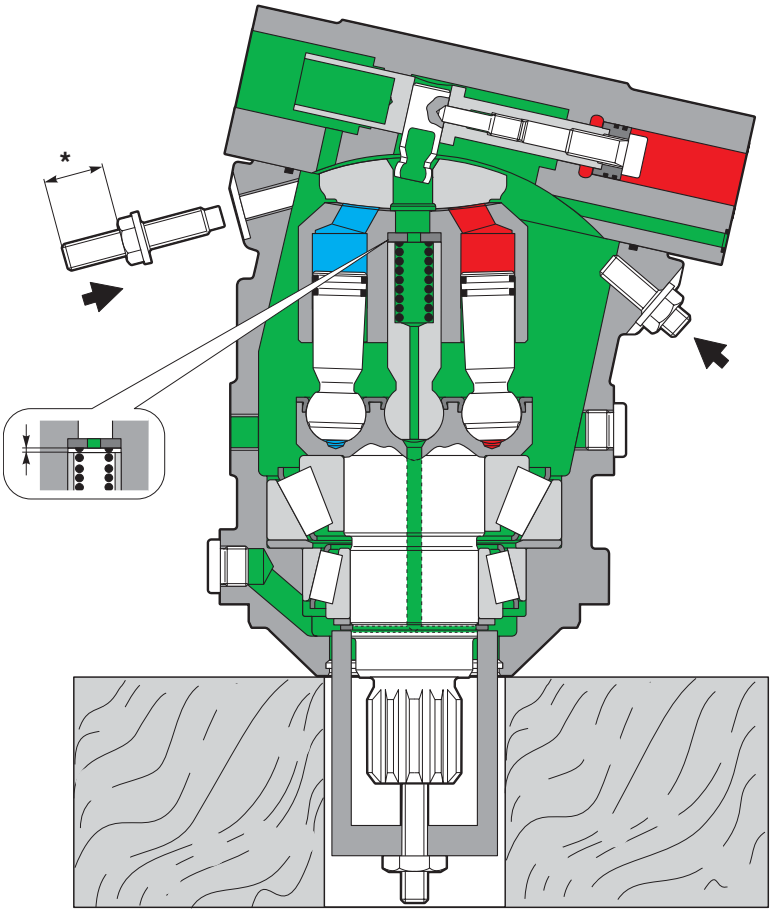
58 Place centering disc.



59 Mount measuring device.



60 Check dimension X.



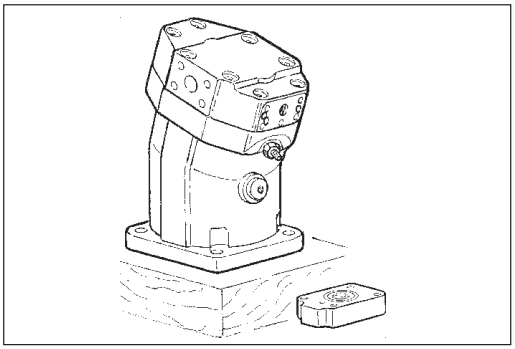
1. Assemble port plate with differential piston.

⚠ Take care of assembly design!

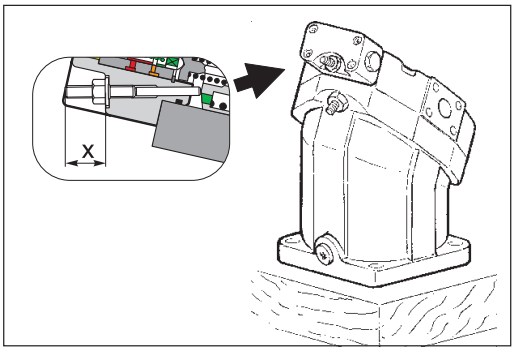
⚠ Tighten fixing screws with torque.

2. Swivel rotary group to “starting position”.
3. Set Q_{min}-screw to dimension*.
4. Assemble plug.
5. Remove assembly sleeve.

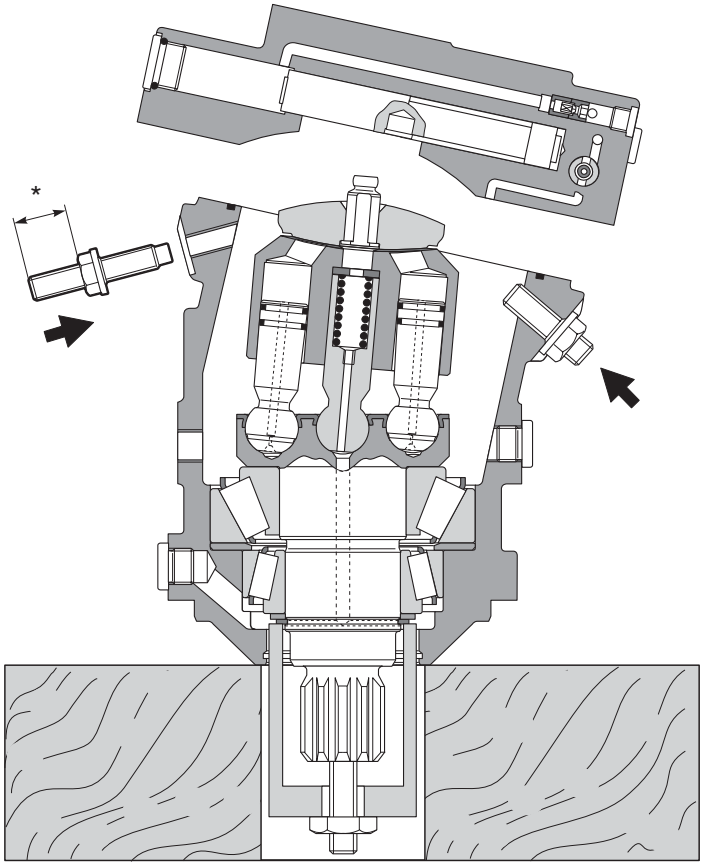
61



62 Assemble cover.



63 Assemble control components.



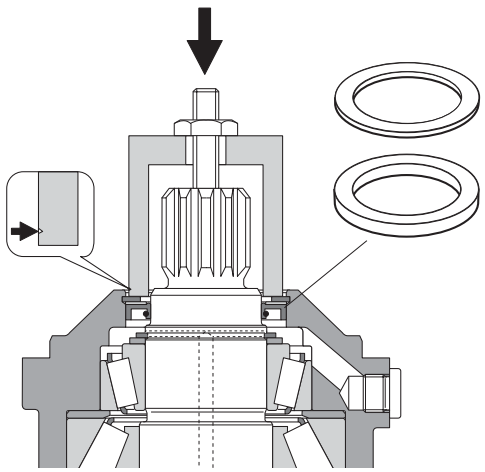
1. Assemble port plate with synchronizing piston.

⚠ Take care of assembly design!

⚠ Tighten fixing screws with torque.

2. Swivel rotary group to “starting position”.
3. Set Q_{min}-screw to dimension*.
4. Assemble plug.
5. Remove assembly sleeve.

64



65

Assemble shaft seal, disc and safety ring.
Press-in with assembly sleeve.

⚠ Take care of press-in depth.

Tightening torques for shaft bolts (Metric ISO Standard Thread)

The values for tightening torques shown in the table are valid only for shaft bolts with metric ISO-standard threads and head support surface dimensions in accordance with DIN 912, DIN 931 and DIN 933. These values are also valid only for light or unoiled, untreated surface as well as for use only with torque-indicating wrenches and force limiting tools.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 3	1,1	1,6	1,9
M 4	2,9	4,1	4,9
M 5	6	8,5	10
M 6	10	14	17
M 8	25	36	41
M10	49	69	83
M12	86	120	145
M14	135	190	230
M16	210	295	355
M18	290	405	485
M 20	410	580	690
M 22	550	780	930
M 24	710	1000	1200
M 27	1050	1500	1800
M 30	1450	2000	2400

Tightening torques for locking screws VSTI (Metric ISO fine thread)

Thread size	Designation		Tightening torques (lb.ft)
M 8 x 1	VSTI 8 x 1	-ED/SA	= 5
M 10 x 1	VSTI 10 x1	-ED	= 10
M 12 x 1,5	VSTI 12 x 1,5	-ED	= 20
M 14 x 1,5	VSTI 14 x 1,5	-ED	= 30
M 16 x 1,5	VSTI 16 x 1,5	-ED/SA	= 30
M 18 x 1,5	VSTI 18 x 1,5	-ED/SA	= 40
M 20 x 1,5	VSTI 20 x 1,5	-ED/SA	= 50
M 22 x 1,5	VSTI 22 x 1,5	-ED	= 60
M 26 x 1,5	VSTI 16 x 1,5	-ED/SA	= 70
M 27 x 2	VSTI 27 x 2	-ED	= 90
M 30 x 1 ,5	VSTI 30 x 1,5	-ED/SA	= 100
M 33 x 2	VSTI 33 x 2	-ED/SA	= 120
M 42 x 2	VSTI 42 x 2	-ED/SA	= 200
M 48 x 2	VSTI 48 x 2	-ED	= 300

Tightening torques for seal-lock nuts (Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for seal-lock nuts of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 6	10	-	-
M 8	22	-	-
M10	40	-	-
M12	69	-	-
M14	110	-	-
M16	170	-	-

Tightening torques for cross-slotted lens head screws DIN 7985 (Metric ISO-Standard Thread)

The values for tightening torques shown in the table are valid only for cross-slotted lens head screws DIN 7985 of the strength class 8.8 and with metric ISO-standard thread.

Thread size	Strength Classes		
	8.8	10.9	12.9
	Tightening Torque (lb.ft)		
M 3	1,1	-	-
M 4	2,9	-	-
M 5	6	-	-
M 6	10	-	-
M 8	25	-	-
M10	49	-	-

General advice

- Make yourself familiar with the equipment of the machine.
- Only operate the machine if your are completely familiar with the operating and control elements as well as the functioning of the machine.
- Use your safety equipment like helmet, safety shoes and hearing protection.
- Make yourself familiar with your working field.
- Only operate the machine for its intended purpose.

Please observe the guidelines of the Professional Association and the machine manufacturer.

Before starting

- Observe the operating instructions before starting.
- Check the machine for obvious faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering thc driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

Start

- When starting all operating levers must be in "neutral position".
- Only start the machine from the driver's seat
- Check the indicating instruments after start to assure that all functions are in order.
- Do not leave the machine unobserved when the motor is running.
- When starting with battery connection cables connect plus with plus and minus with minus. Always connect mass cable (minus) at last and cut off at first.

Attention

- Exhaust gas is dangerous. Assure sufficient fresh air when starting in closed rooms!

Hydraulic equipment

1. Hydraulic equipment is standing under high pressure.

⚠ High pressure fluids (fuel, hydraulic oil) which escape under high pressure can penetrate the skin and cause heavy injuries.
Therefore immediately consult a doctor as otherwise heavy infections can be caused.

2. When searching leakages use appropriate auxiliary devices because of the danger of accidents.
3. Before working at the hydraulic equipment, lower pressure to zero and lower working arms of the machine.
4. When working at the hydraulic equipment, absolutely stop motor and secure machine against rolling away (parking brake, shim)!
5. When connecting hydraulic cylinders and motor pay attention to correct connection of hydraulic flexible hoses.
6. In case of exchanging the ports, the tunctions are vice versa (f. ex. lift-up/lower) - danger of accidents!
7. Check hydraulic flexible hoses regularly and replace them in case of dammage or wear! The new hose pipes must comply with the technical requirements of the machine manufacturer!

⚠ Orderly disposal or recycling of oil, fuel and filters!

Note!
In order to supply proper spare parts, please provide following specifications when ordering spares:

Type Code
Type Number
Serial Number
Assembly Group
Item
Designation

In repairing the unit, we recommend the use of pre-assembled partially tested assembly groups.

HYDROMATIK GmbH

Glockeraustraße 2
D-89275 Elchingen
Postanschrift: Postfach 22 60, D-89012 Ulm
Telefon (0 73 08) 8 20
Telex 712538
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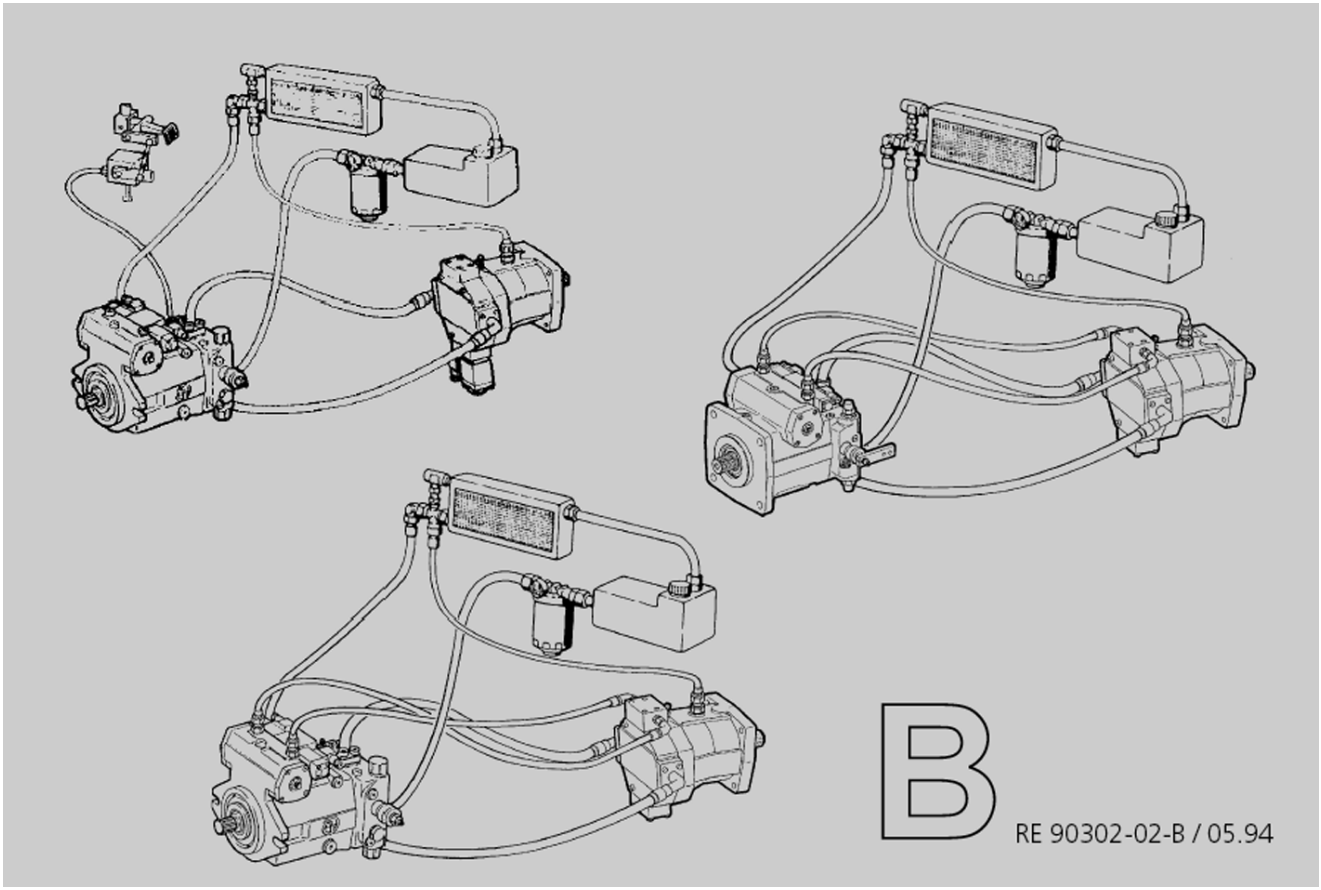
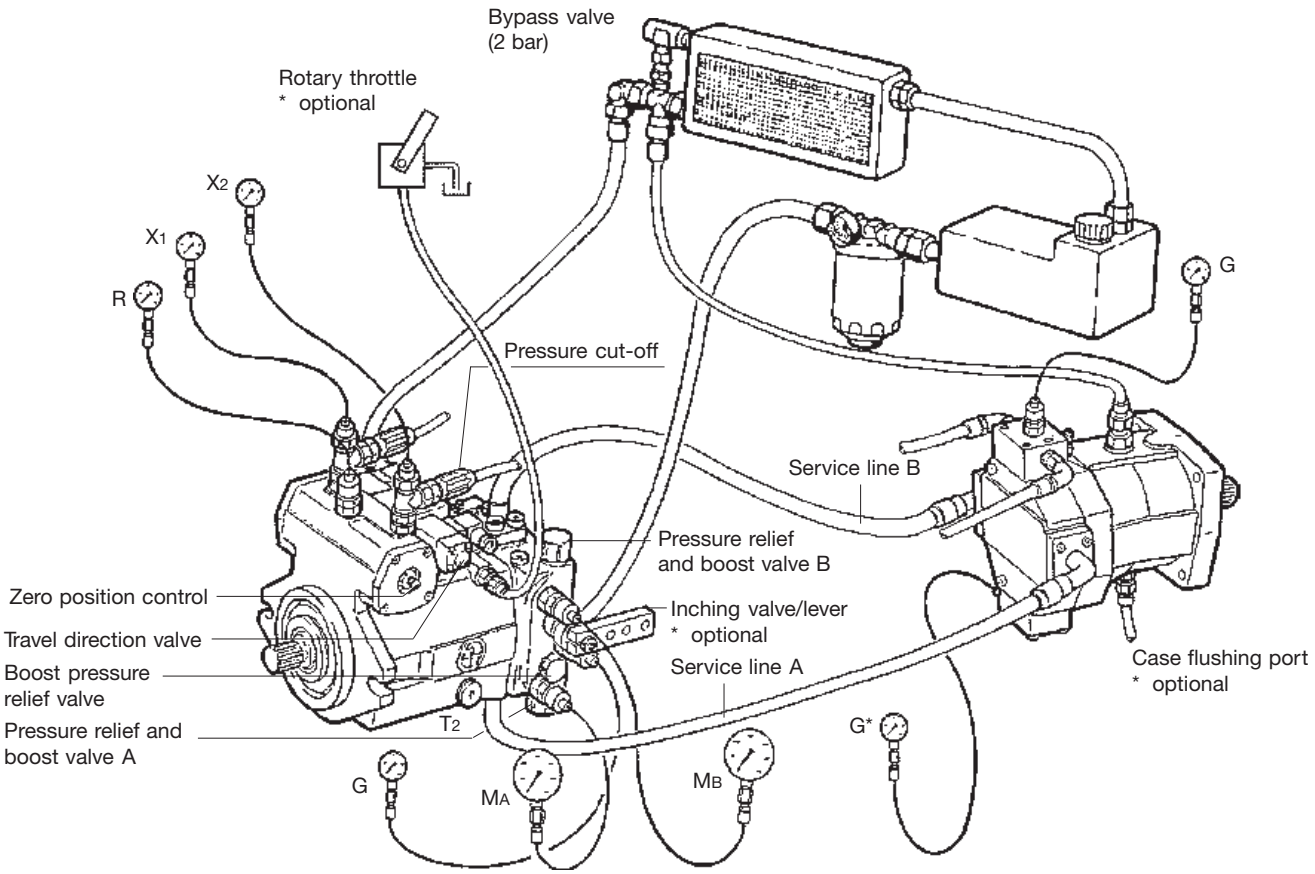


Operating Instruction

Fault finding A4VG…DA/A6VM…DA/A6VM…HA

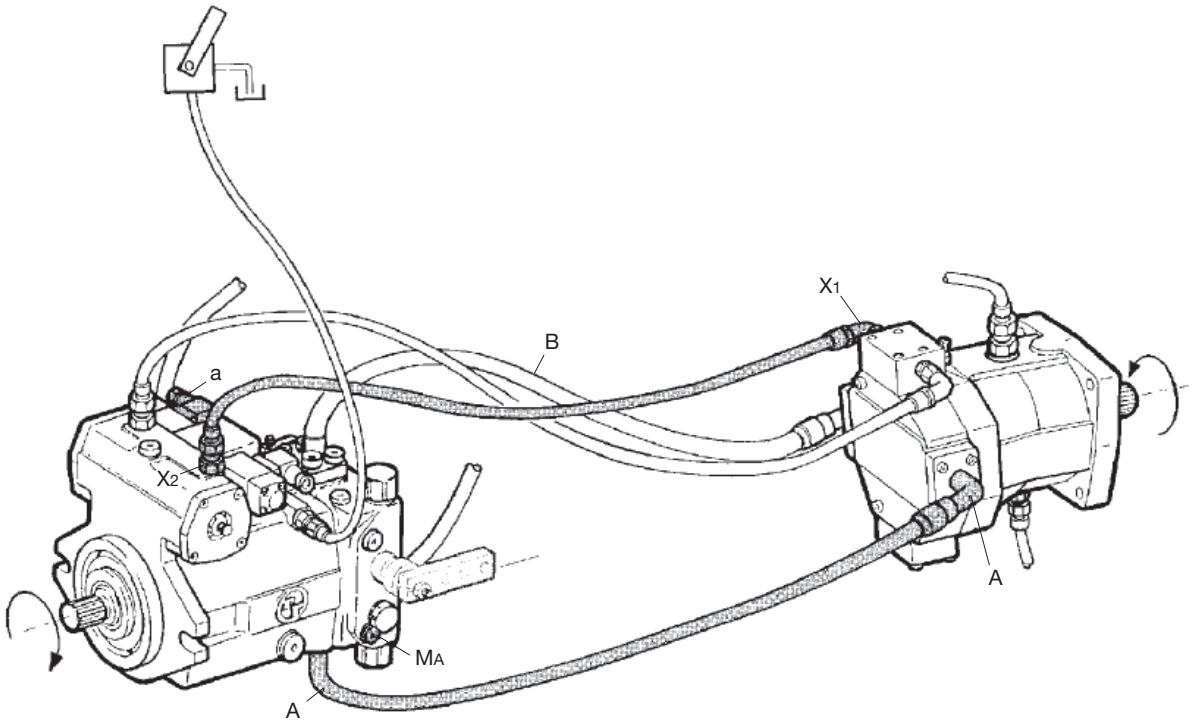


Installation

Orifice A4VG/DA		Size 40	Size 56
A, B	Service lines	SAE 3/4"	SAE 3/4"
G	Pressure connection for auxiliary circuits	M 12x1,5	M 14x1,5
$T_1(T_2)$	Oil infill and return	M 22x1,5	M 22x1,5
$T_1(T_2)$	Oil discharge	M 22x1,5	M 22x1,5
S	Suction port	M 33x2	M 33x2
M_A/M_B	Service line Measuring connections	M 12x1,5	M 12x1,5
R	Bleeding	M 12x1,5	M 12x1,5
X_1/X_2	Control pressure	M 12x1,5	M 12x1,5
P_S	Control pressure supply	M 14x1,5	M 14x1,5

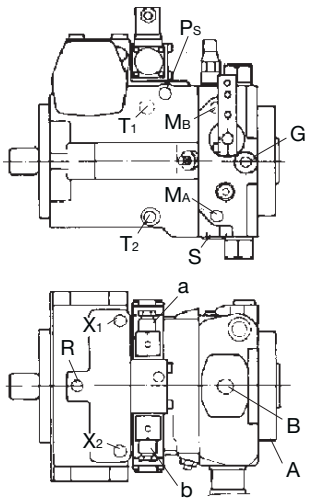
Orifice A6VG/DA		Size 55	Size 80	Size 107	Size 160	Size 200
A, B	Service lines	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
T_1	Case drain port	M 18x1,5	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
X_1/X_2	Pilot pressure ports	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^v	Operating pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^*	Control pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5

Measuring points A4Vg/DA - A6VM/DA		Pressure gauge (pressure range)
M_A	Service line A	600 bar
G_{A6VM}	Service line A/B	600 bar
M_B	Service line B	600 bar
G_{A4VG}	Boost pressure	40 bar
R	Housing pressure	10 bar
S	Negative suction pressure	1 bar (absolut)
X_1/X_2	Pilot pressure	40 bar
G*	Control pressure	600 bar



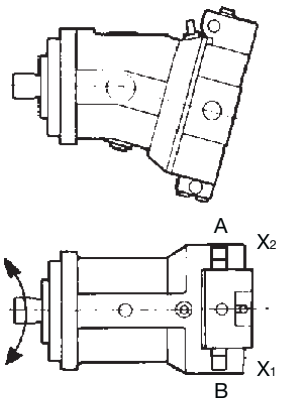
A4V/DA

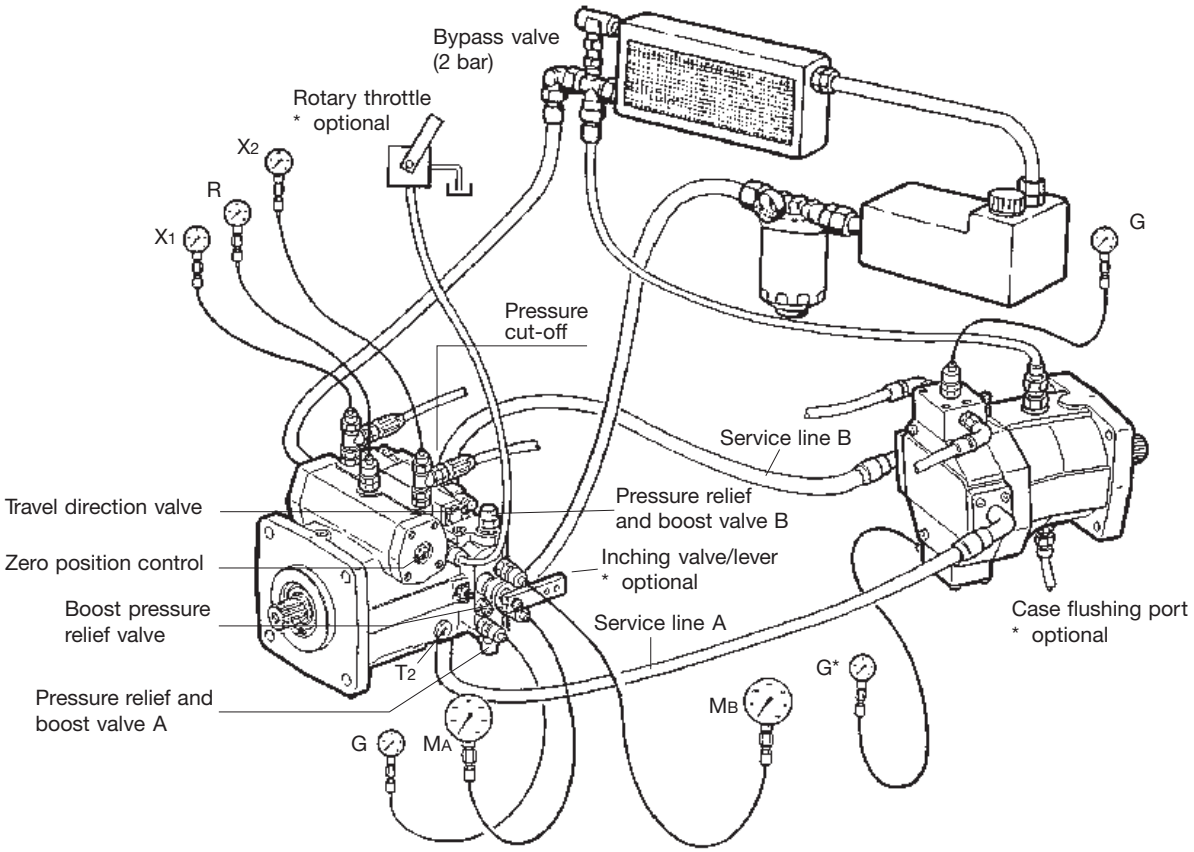
Direction of rotation	Clockwise		Anti-clockwise	
Solenoid operation	a	b	a	b
Control pressure in	X_2	X_1	X_2	X_1
Direction of through flow	B-A	A-B	A-B	B-A
Service pressure	M_A	M_B	M_B	M_A



A6VM/DA

Clockwise	Anti-clockwise
X_1	X_2
A - B	B - A



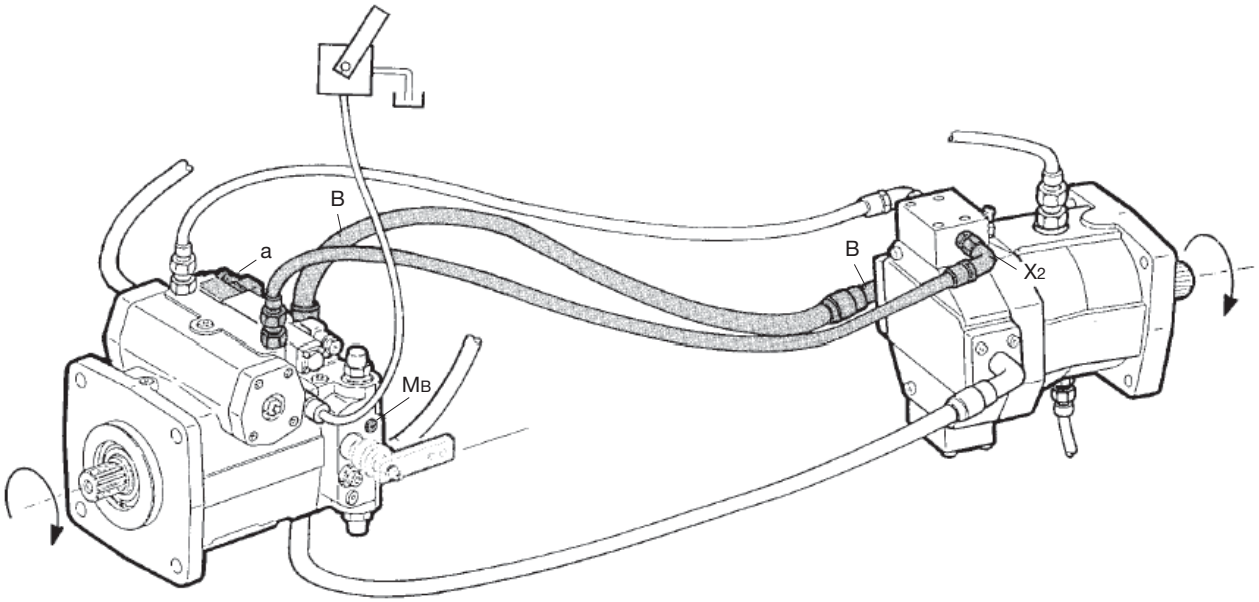


Installation

Orifice A4VG/DA		Size 71	Size 90	Size 125	Size 180
A, B	Service lines	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
G	Pressure connection for auxiliary circuits	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
$T_1(T_2)$	Oil infill and return	M 26x1,5	M 26x1,5	M 33x2	M 42x2
$T_1(T_2)$	Oil discharge	M 26x1,5	M 26x1,5	M 33x2	M 42x2
S	Suction port	M 42x2	M 42x2	M 48x2	M 48x2
M_A/M_B	Service line Measuring connections	M 12x1,5	M 12x1,5	M 12x1,5	M 12x1,5
R	Bleeding	M 12x1,5	M 16x1,5	M 16x1,5	M 16x1,5
X_1/X_2	Control pressure	M 12x1,5	M 16x1,5	M 16x1,5	M 16x1,5
P_S	Control pressure supply	M 14x1,5	M 18x1,5	M18x1,5	M 14x1,5

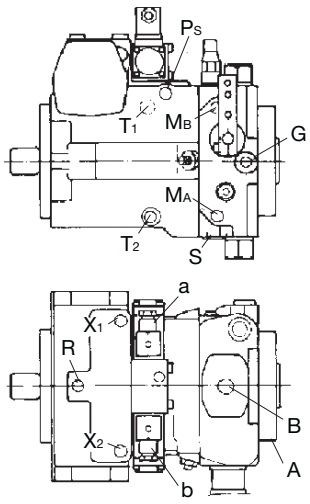
Orifice A6VG/DA		Size 55	Size 80	Size 107	Size 160	Size 200
A, B	Service lines	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
T_1	Case drain port	M 18x1,5	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
X_1/X_2	Pilot pressure ports	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^v	Operating pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^*	Control pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5

Measuring points A4Vg/DA - A6VM/DA		Pressure gauge (pressure range)
M_A	Service line A	600 bar
G_{A6VM}	Service line A/B	600 bar
M_B	Service line B	600 bar
G_{A4VG}	Boost pressure	40 bar
R	Housing pressure	10 bar
S	Negative suction pressure	1 bar (absolut)
X_1/X_2	Pilot pressure	40 bar
G*	Control pressure	600 bar



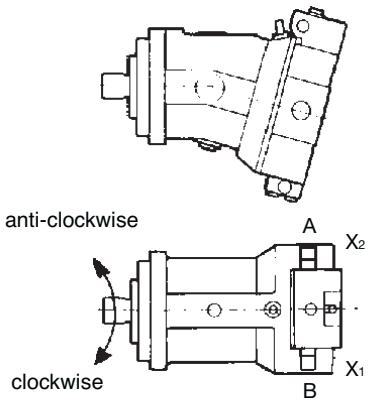
A4V/DA

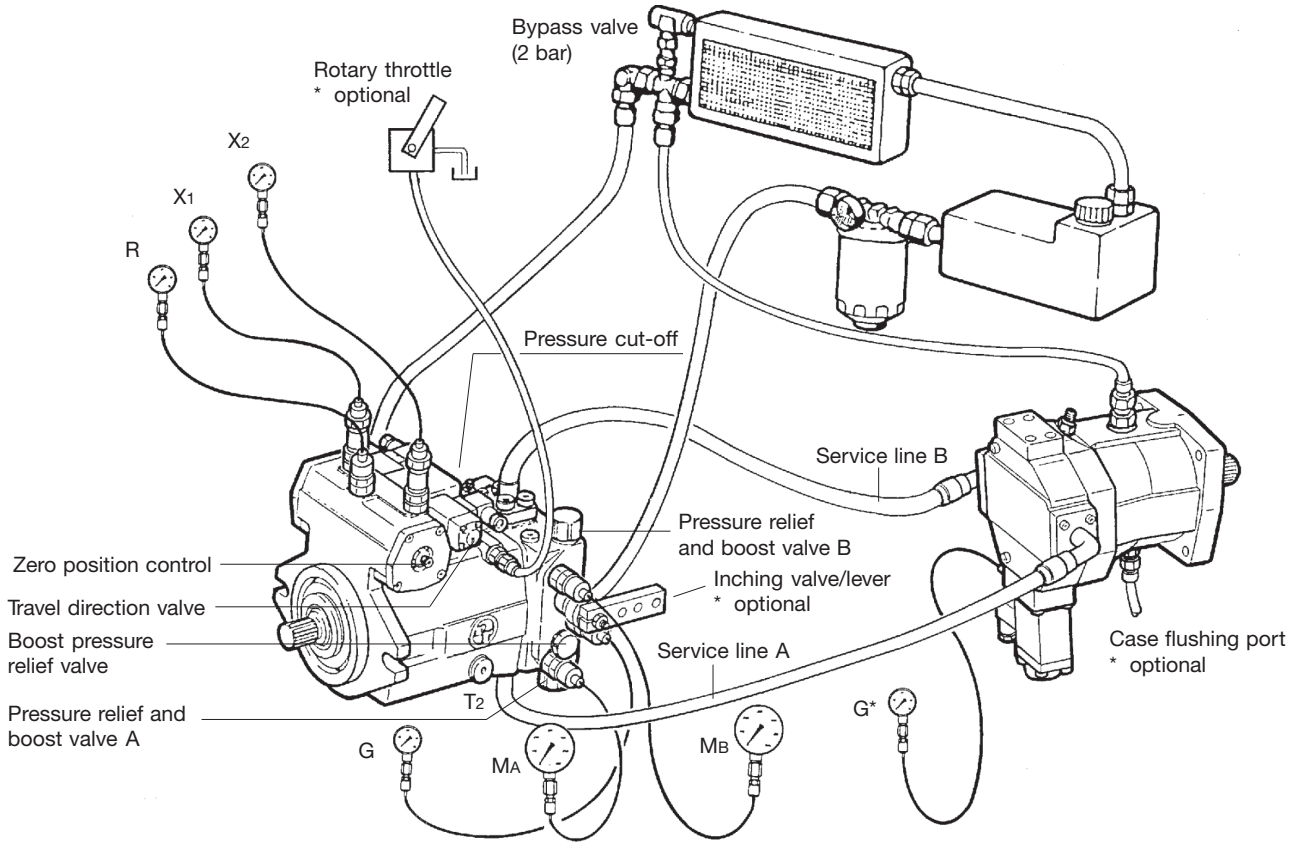
Direction of rotation	Clockwise		Anti-clockwise	
Solenoid operation	a	b	a	b
Control pressure in	X_2	X_1	X_2	X_1
Direction of through flow	A-B	B-A	B-A	A-B
Service pressure	M_B	M_A	M_A	M_B



A6VM/DA

Clockwise	Anti-clockwise
X_1	X_2
A - B	B - A



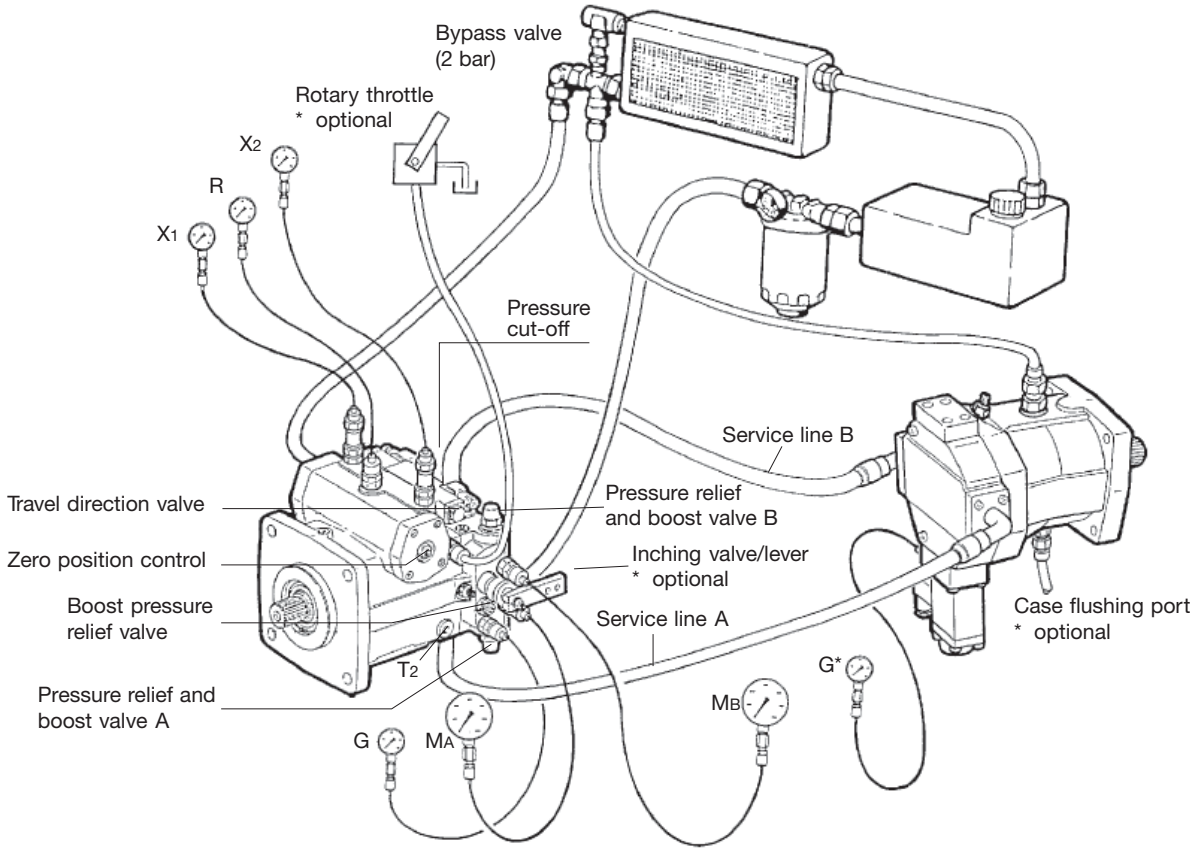


Installation

Orifice A4VG/DA		Size 40	Size 56
A, B	Service lines	SAE 3/4"	SAE 3/4"
G	Pressure connection for auxiliary circuits	M 12x1,5	M 14x1,5
$T_1(T_2)$	Oil infill and return	M 22x1,5	M 22x1,5
$T_1(T_2)$	Oil discharge	M 22x1,5	M 22x1,5
S	Suction port	M 33x2	M 33x2
M_A/M_B	Service line Measuring connections	M 12x1,5	M 12x1,5
R	Bleeding	M 12x1,5	M 12x1,5
X_1/X_2	Control pressure	M 12x1,5	M 12x1,5
P_S	Control pressure supply	M 14x1,5	M 14x1,5

Measuring points A4Vg/DA - A6VM/HA		Pressure gauge (pressure range)
M_A	Service line A	600 bar
G_{A6VM}	Service line A/B	600 bar
M_B	Service line B	600 bar
G_{A4VG}	Boost pressure	40 bar
R	Housing pressure	10 bar
S	Negative suction pressure	1 bar (absolut)
X_1/X_2	Pilot pressure	40 bar
G*	Control pressure	600 bar

Orifice A6VG/DA		Size 55	Size 80	Size 107	Size 160	Size 200
A, B	Service lines	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
T_1	Case drain port	M 18x1,5	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
X_1/X_2	Pilot pressure ports	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^V	Operating pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G*	Control pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5



Installation

Orifice A4VG/DA		Size 71	Size 90	Size 125	Size 180
A, B	Service lines	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
G	Pressure connection for auxiliary circuits	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
$T_1(T_2)$	Oil infill and return	M 26x1,5	M 26x1,5	M 33x2	M 42x2
$T_1(T_2)$	Oil discharge	M 26x1,5	M 26x1,5	M 33x2	M 42x2
S	Suction port	M 42x2	M 42x2	M 48x2	M 48x2
M_A/M_B	Service line Measuring connections	M 12x1,5	M 12x1,5	M 12x1,5	M 12x1,5
R	Bleeding	M 12x1,5	M 16x1,5	M 16x1,5	M 16x1,5
X_1/X_2	Control pressure	M 12x1,5	M 16x1,5	M 16x1,5	M 16x1,5
P_S	Control pressure supply	M 14x1,5	M 18x1,5	M18x1,5	M 14x1,5

Orifice A6VG/DA		Size 55	Size 80	Size 107	Size 160	Size 200
A, B	Service lines	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
T_1	Case drain port	M 18x1,5	M 18x1,5	M 18x1,5	M 22x1,5	M 22x1,5
X_1/X_2	Pilot pressure ports	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G^{v}	Operating pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5
G`	Control pressure	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5	M 14x1,5

Measuring points A4Vg/DA - A6VM/HA		Pressure gauge (pressure range)
M_A	Service line A	600 bar
G_{A6VM}	Service line A/B	600 bar
M_B	Service line B	600 bar
G_{A4VG}	Boost pressure	40 bar
R	Housing pressure	10 bar
S	Negative suction pressure	1 bar (absolut)
X_1/X_2	Pilot pressure	40 bar
G*	Control pressure	600 bar

Measuring equipment

The following pressure gauges (damped design) and measuring devices should be available:

2 pressure gauges up to 600 bar
HP measurements at measuring ports M_B / M_A / G_A / G*

2 pressure gauges up to 40 bar
Pilot pressure measurements at the measuring ports X_1/X_2 (control lines) and boost pressure measurements at measuring port G

1 pressure gauge up to 10 bar
Housing pressure measurements at port R of variable displacement pump and in oil motor drain line

1 vacuum pressure gauge up to 1 bar absolute
Measurement in suction line of oil motor

1 thermometer up to 100°C

1 tachometer up to 3000 rpm
Prime mover speed measurement

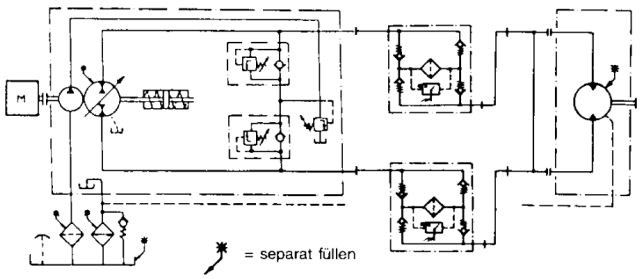
1 volt- and ammeter
Measuring range I = 1.5 A
U up to 30 volts

For checking solenoids

Safety Notes RDE 90 301 - 01

Flushing

During commissioning of the installation we recommend a flushing run for the filtering of the main circuit.
If a flushing run is carried out, this must be undertaken under zero load prior to the actual function test and under normal circumstances should last an hour.
With the installation ready for operation two HP super-fine filters, mounted as shown in service lines A and B between the variable displacement pump and the oil motor, will ensure that a flushing run can be carried out in both directions without additional assembly work.
At the same time this ensures that the pump and motor are protected before the first run takes place.
The pore size of the fiushing filter should correspond to that of the hydraulic installation. It should, however, have a beta value of at least $ß_{30}$ = 100. The flushing filters should be fitted with a clogging indicator instead of a bypass valve.



Commissioning

Prior to start

Has the tank been cleaned and flushed?

Have the lines been cleaned, are pipes free of tension and hoses correctly mounted?

Are all lines connected correctly as shown in the circuit diagram?

Fittings and flanges properly screwed up?

Are coupling or drive elements between prime mover and pump or motor and gearbox correctly mounted and aligned?

Does the direction of rotation of the prime mover agree with the direction of rotation of the pump?

Is the filter correctly mounted in the direction of flow?

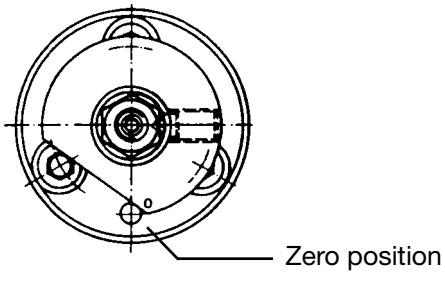
Connect measuring devices for test measurements during commissioning.

Fill oil tank with the prescribed fluid to maximum oil level mark.

Important: Depending on the installation position of the pump fill the housing via return line port T_1/ T_2 and motor housing via drain port T up to overflow. If, due to particular installation conditions, the suction line has not been filled prior to start, this mustbe filled separately.

Please note: Control device for variable displacement pump should be set to zero (solenoids de-energised).

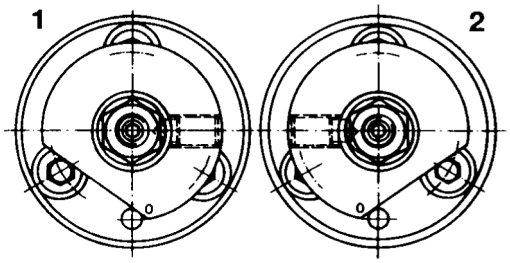
Please check mechanical actuation of speed control at prime mover and, if necessary, set so that, with the gas pedal fully operated, the speed control lever touches the full load stop.
Check direction of operation of the inch control valve.
Check whether control valve is at zero position.



Check direction of inch for reduced speed.

Note: The stop at the control valve may be turned through 180°, thus permitting a choice to be made between clockwise or anti-clockwise inch direction.

Mounting 1 Mounting 2



Depress inch pedal fully, check whether positioning distance is adequate. The angle of rotation of the control lever is 70°.

Please note: The mechanical; stop at the inch pedal must be set so that, when the pedal is fully depressed, the stop ring at the control valve does not touch the stop pin.

Start - First Run

Rotate the prime mover by means of the starter motor until the oil flows out of gauge port "G" of A6VM/DA without bubbles.

Start prime mover in the normal way, checking boost pressure at gauge port "G" of A4V/DA.

Do not drive the vehicle yet!

NB: Continually check the oil level in the tank. If necessary add more oil.
Foaming indicates leakage in the suction line.

Please note: An oiltight suction line is not necessarily airtight.

During the start-up phase pressure oscillations may occur at the boost pressure gauge. At idle speed the boost pressure must find its level at a constant 15-20 bar.

Turn off prime mover. Connect the electrical control and check the functioning of the solenoids.

Check oil level in the tank.

Start prime mover.

Check function under no load.

Check the measuring devices.

Keep installation running until it is warmed up to 50-60° (measured in the circuit).

Pay attention to any noises.

Once the operating temperature is reached switch off the prime mover.

Check setting data

The operating temperature should be kept at a predominantly constant level

Lock out inch pedal rods

Start drive motor, idle speed

Blocked state: switch for travel direction at "0"
Increase motor speed slowly up to max. motor speed, at the same time checking measuring devices

Boost pressure: Motor at idle speed
Psp = ca. 15-20 bar
Max. motor speed
Psp = ... bar*

Housing pressure: R = min. ..... bar
= max. ..... bar

Suction pressure: (Test port at suction filter)
= min. ..... bar*
= max. ..... bar*

Boost pressure: **Travel direction switch in forward position**
(In "road" gear, fully braked)
Check setting data for A4V/DA pump

Start of control

HP 40-50 bar - motor speed ..... rpm. Psp ..... bar*
HP ..... bar - motor speed ..... rpm. Psp ..... bar*

Checking pressure cut-off valve HP ..... bar*

⚠ Should be 30-40 bar below setting of safety valve

Checking safety relief valve HP ..... bar*

⚠ Block pressure cut off valve

⚠ Operate safety valves for very short period only (risk of overheating)

Turn off prime mover

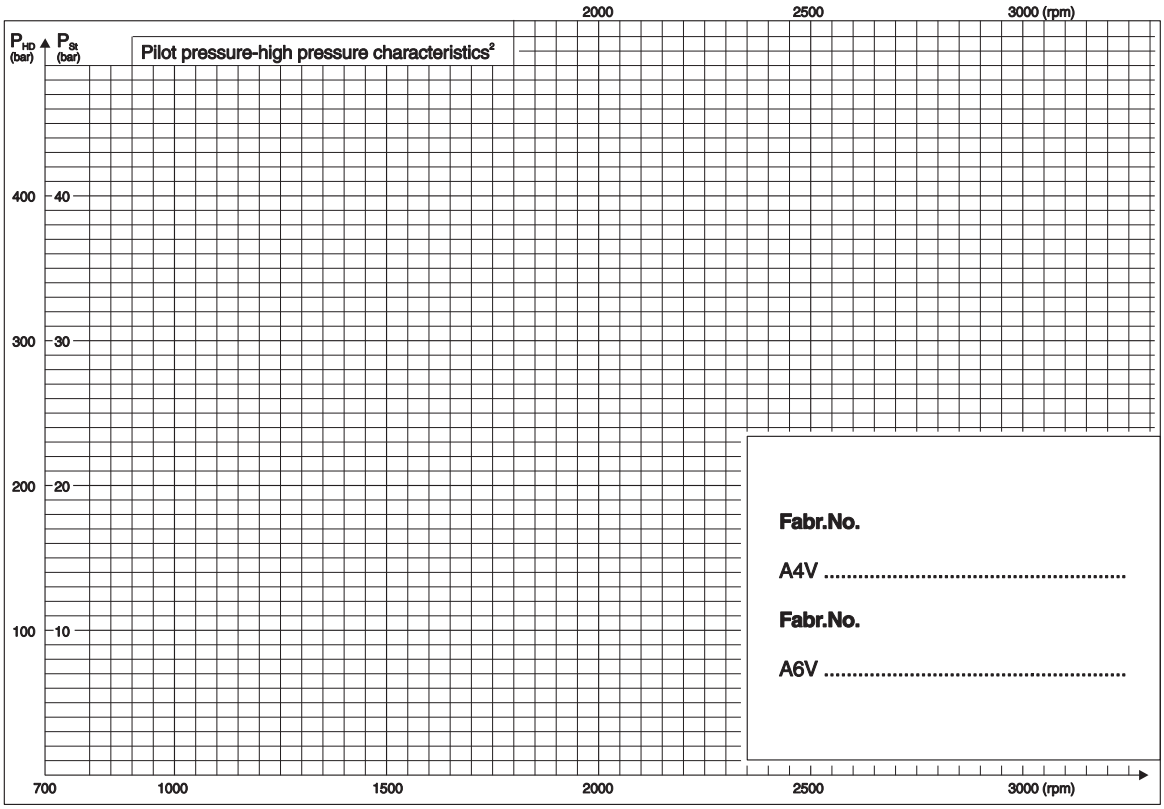
Engage inch pedal rods
Check: Repeat checking of start and end of control and set the inch pedal rods so that , from an engine speed of ..... ±100 rpm, the setting lever on the control valve moves to provide a constant high pressure of HP - 20 bar* until the maximum motor speed is reached.

⚠ This high pressure level must be 30-40 bar lower than the safety valve setting.

Leak test
Stop prime mover.
Tighten all fittings, flanges, plugs, even if they are already tight.

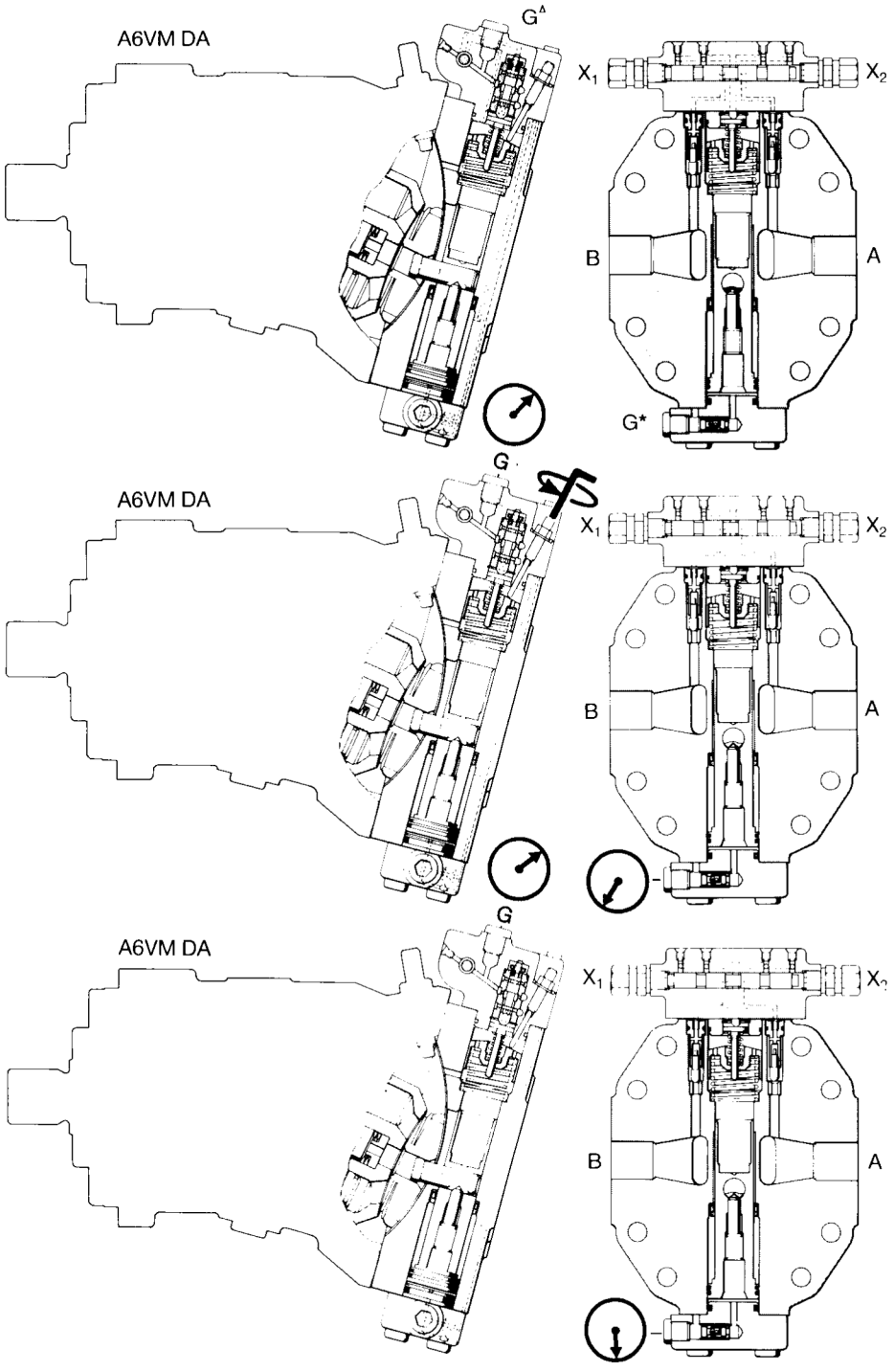
Nachziehen nur bei druckloser Anlage

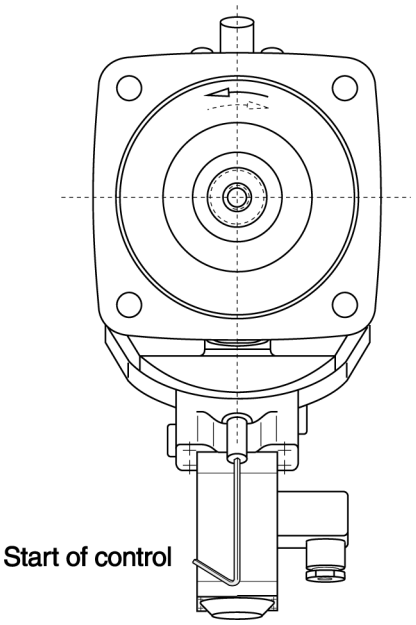
* For supplementary information see order confirmation.



Set values		Command values
Diesel engine speed		
1. Min. idle speed	(n-min)	
2. Nom. speed	(n-last)	
3. Min. speed	(n-max)	
Pump speed		
1.	(n-min)	
2.	(n-min)	
3.	(n-min)	
Oil temperature		
Tank		
Return line in front of cooler	L	
Boost pressure	(P_{SP})	
At nominal speed	(n-last)	
Suction pressure	(P_S)	
Housing pressure	(R)	
Pressure cut-off	(P_{HD})A	
	(P_{HD})B	
Start -up values		
Diesel engine speed	(N)	
High pressure	(P_{HD})	
Pilot pressure	(P_{ST})	
Blockkurve		
a) High pressure	= 50 bar	
Engine speed		
Boost pressure		
Pilot pressure		
b) High pressure	= 200 bar	
Engine speed		
Boost pressure		
Pilot pressure		
c) High pressure	= P_{HD} = Max	
Engine speed		
Boost pressure		
Pilot pressure		

Set values		Actual values
Diesel engine speed		
1. Min. idle speed	(n-min)	
2. Nom. speed	(n-last)	
3. Min. speed	(n-max)	
Pump speed		
1.	(n-min)	
2.	(n-min)	
3.	(n-min)	
Oil temperature		
Tank		
Return line in front of cooler	L	
Boost pressure	(P_{SP})	
At nominal speed	(n-last)	
Suction pressure	(P_S)	
Housing pressure	(R)	
Pressure cut-off	(P_{HD})A	
	(P_{HD})B	
Start -up values		
Diesel engine speed	(N)	
High pressure	(P_{HD})	
Pilot pressure	(P_{ST})	
Blockkurve		
a) High pressure	= 50 bar	
Engine speed		
Boost pressure		
Pilot pressure		
b) High pressure	= 200 bar	
Engine speed		
Boost pressure		
Pilot pressure		
c) High pressure	= P_{HD} = Max	
Engine speed		
Boost pressure		
Pilot pressure		


A6VM DA
G*
X1
X2
B
A
G*
A6VM DA
G
X1
X2
B
A
A6VM DA
X1
B
A



Checking settings (start of control)

Notes on setting

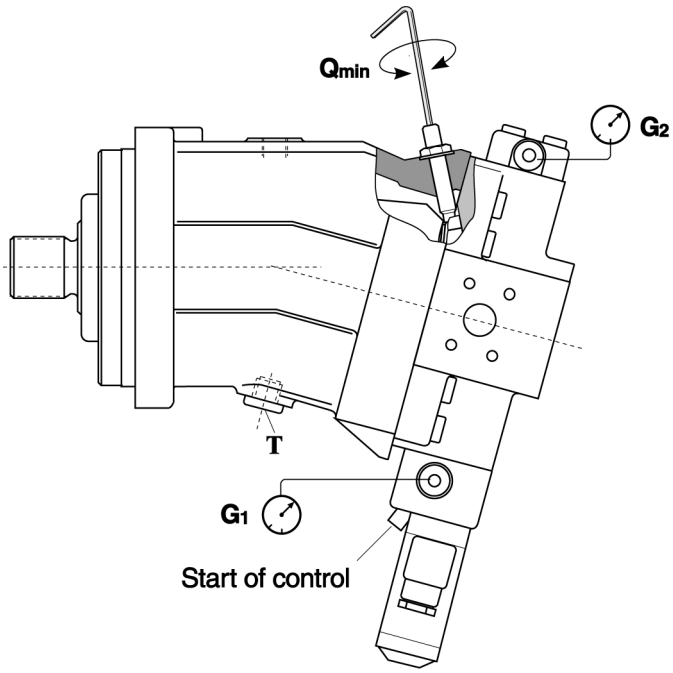
Observe safety regulations!
All settings to conform to works order
Blocked state ("road" gear and fully braked)
Pressure gauge to be connected at 400 bar to G_1 and G_2

Start of control: (see works order)
Pressure gauge at G1 = operating pressure
Pressure gauge at G2 = set pressure

Example:
Start of control 200 bar
Increase operating pressure slowly until pressure gauge G_1 reaches 200 bar
At the operating pressure, reading pressure gauge G_2, approx. 1/3 of operating pressure should be present i.e. a set pressure of approx. 70 bar.
"This is start of control"

Set pressure adjustment at the setscrew - start of control

Note:
Rotate in clockwise direction - start of control falls

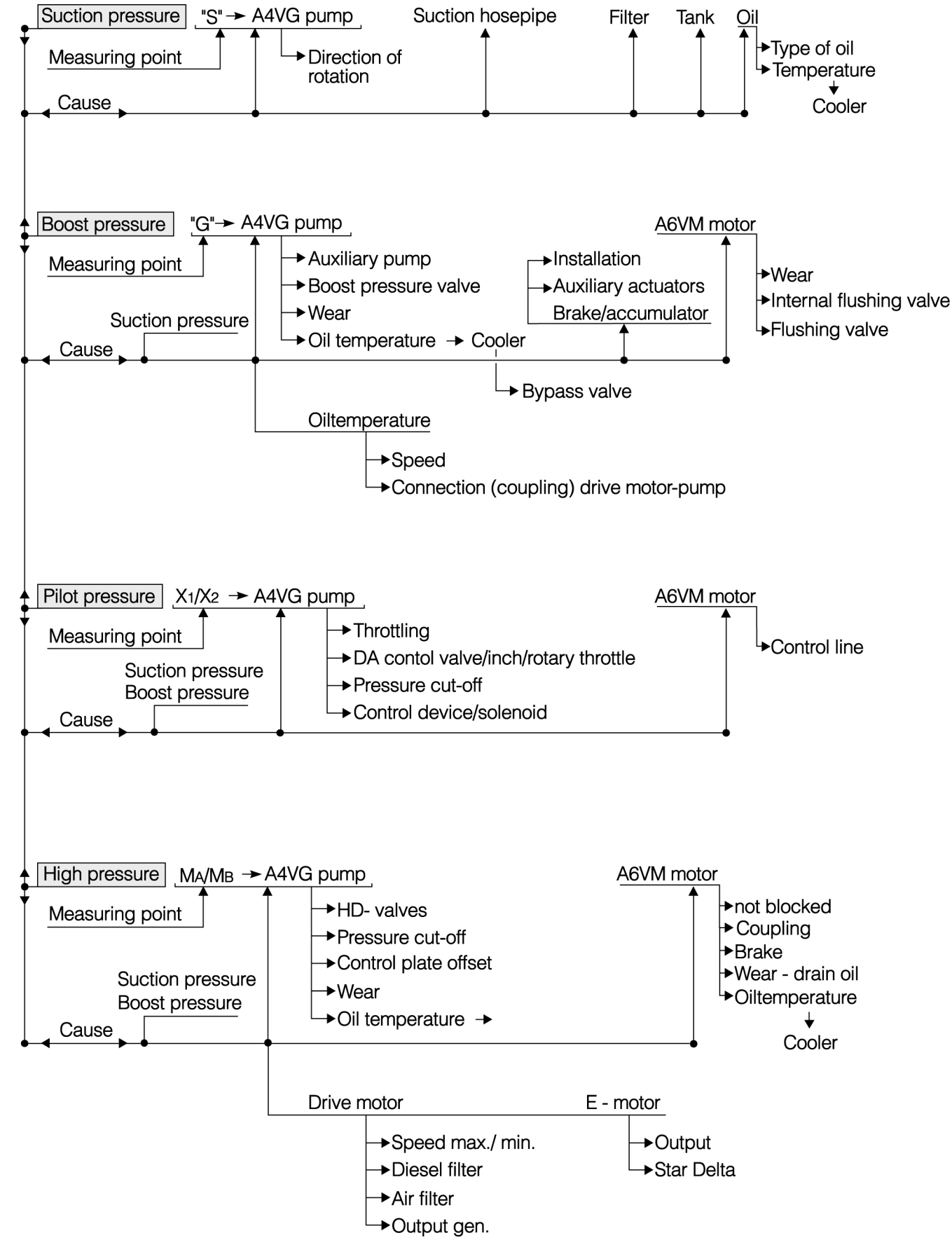


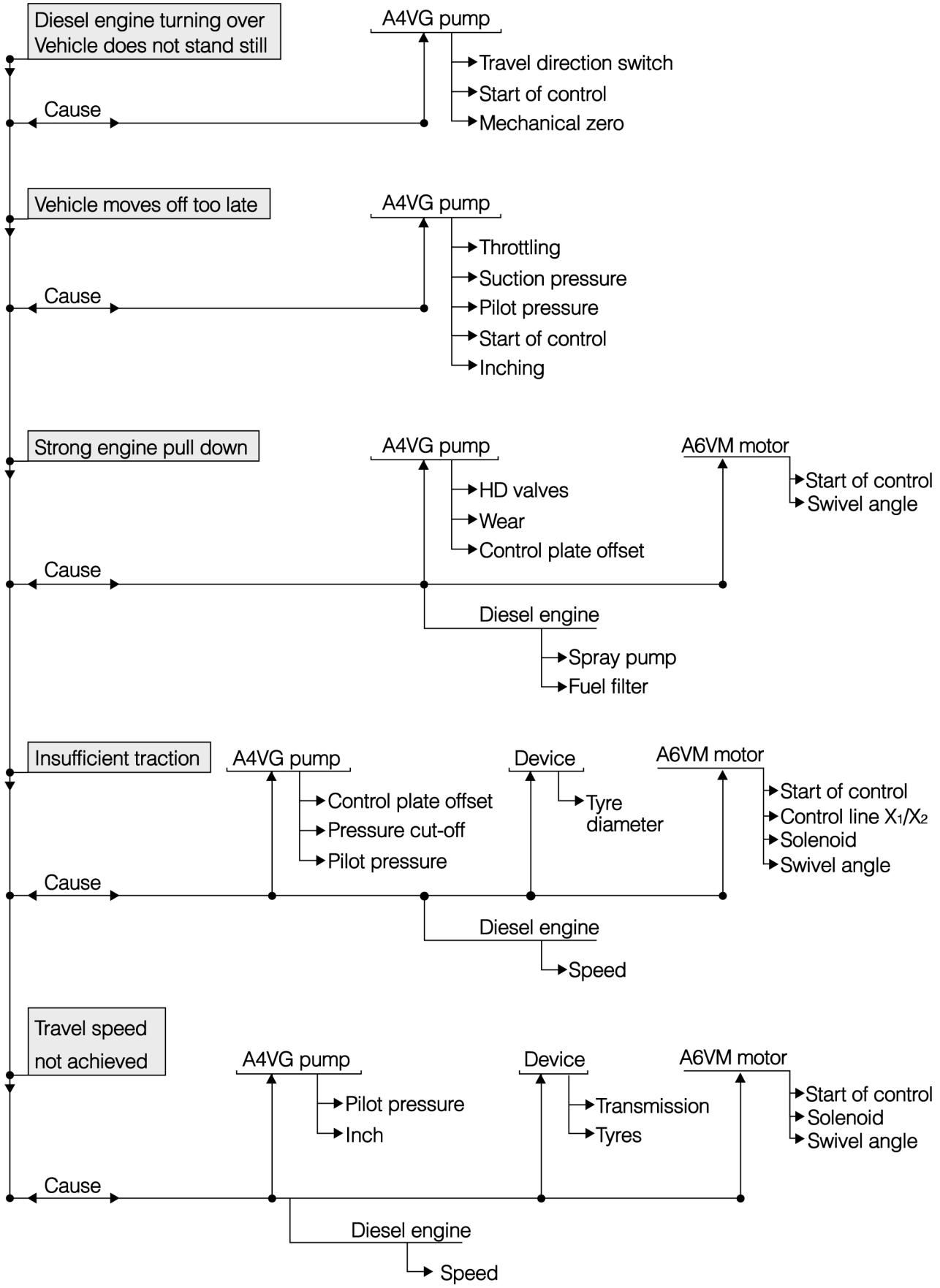
In installations with two or more motors e.g. tracked vehicles the following setting may also be used:
Destroy safety cap at Q_{min} stop
Loosen lock nut
Do not permit setting screw Q_{min} to turn
Connect operating pressure gauge to G_1

Example:
Increase operating pressure slowly until pressure gauge at G_1 shows 200 bar
Check: Q_{min} setscrew is "secure" (control lens is pressed against setting screw).
After 200 bar operating pressure the screw becomes loose (control lens oscillates in Q_{max} direction)
"This is the start of control"

NB
Do not alter set value Q_{min} screw
Note:
Adjustment at start of control setting screw

Note:
After checking or setting operations start of control adjustment screws and adjustment screw Q_{min} should be fitted with new safety caps.
Original HYDROMATIK caps yellow - equipment manufacturers caps are orange


Suction pressure
"S" → A4VG pump
Suction hosepipe
Filter
Tank
Oil
Measuring point
Direction of rotation
Type of oil
Temperature
Cooler
Cause
Boost pressure
"G" → A4VG pump
A6VM motor
Measuring point
Auxiliary pump
Boost pressure valve
Wear
Oil temperature → Cooler
Installation
Auxiliary actuators
Brake/accumulator
Wear
Internal flushing valve
Flushing valve
Suction pressure
Cause
Bypass valve
Oiltemperature
Speed
Connection (coupling) drive motor-pump
Pilot pressure
X1/X2 → A4VG pump
A6VM motor
Measuring point
Throttling
DA contol valve/inch/rotary throttle
Pressure cut-off
Control device/solenoid
Control line
Suction pressure
Boost pressure
Cause
High pressure
MA/MB → A4VG pump
A6VM motor
Measuring point
HD- valves
Pressure cut-off
Control plate offset
Wear
Oil temperature →
not blocked
Coupling
Brake
Wear - drain oil
Oiltemperature
Cooler
Suction pressure
Boost pressure
Cause
Drive motor
E - motor
Speed max./ min.
Diesel filter
Air filter
Output gen.
Output
Star Delta


Diesel engine turning over
Vehicle does not stand still
A4VG pump
Travel direction switch
Start of control
Mechanical zero
Cause
Vehicle moves off too late
A4VG pump
Throttling
Suction pressure
Pilot pressure
Start of control
Inching
Cause
Strong engine pull down
A4VG pump
A6VM motor
HD valves
Wear
Control plate offset
Start of control
Swivel angle
Cause
Diesel engine
Spray pump
Fuel filter
Insufficient traction
A4VG pump
Device
A6VM motor
Control plate offset
Pressure cut-off
Pilot pressure
Tyre diameter
Start of control
Control line X1/X2
Solenoid
Swivel angle
Cause
Diesel engine
Speed
Travel speed not achieved
A4VG pump
Device
A6VM motor
Pilot pressure
Inch
Transmission
Tyres
Start of control
Solenoid
Swivel angle
Cause
Diesel engine
Speed

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SECTION 18
ENGINE

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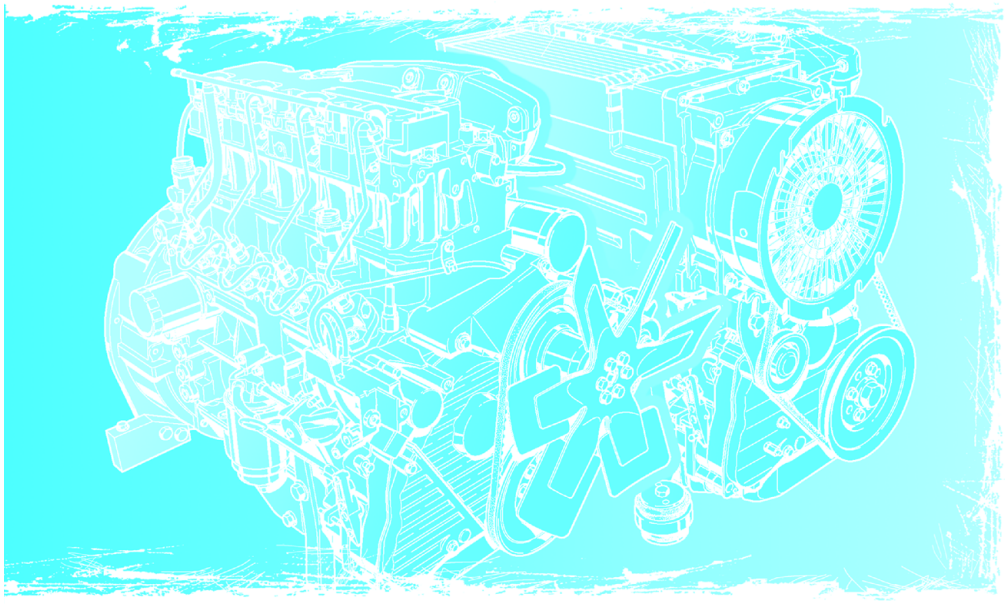

Operation Manual
2011

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- Please read and observe the information given in this Operation Manual. This will enable you to avoid accidents, preserve the manufacturer's warranty and maintain the engine in peak operating condition.
- This engine has been built exclusively for the application specified in the scope of supply - as described by the equipment manufacturer - and is to be used only for the intended purpose. Any use exceeding that scope is considered to be contrary to the intended purpose. The manufacturer will not assume responsibility for any damage resulting therefrom. The risks involved are to be borne solely by the user.
- Use in accordance with the intended purpose also implies compliance with the conditions laid down by the manufacturer for operation, maintenance and servicing. The engine should only be operated by personnel trained in its use and the hazards involved.
- The relevant accident prevention guidelines and other generally accepted safety and industrial medicine regulations must be observed.
- Unauthorised engine modifications will invalidate any liability claims against the manufacturer for resultant damage.
  Manipulations of the injection and regulating system may also influence the performance of the engine, and its emissions. Adherence to legislation on pollution cannot be guaranteed under such conditions.
- Do not change, convert or adjust the cooling air intake area to the blower.

  The manufacturer shall not be held responsible for any damage which results from such work.
- When carrying out maintenance/repair operations on the engine, the use of DEUTZ original parts is prescribed.
  These are specially designed for your engine and guarantee perfect operation.
  Non-compliance results in the expiry of the warranty!

Operation Manual 2011

Engine Serial Number: | | | | | | | |

Please enter the engine serial number here. This number should be quoted when inquiring about Customer Service, Repairs or Spare Parts (see Section 2.1).

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Foreword

Dear Customer,
Liquid-cooled Deutz engines are designed for a large number of applications. Consequently, a wide range of variants is offered to meet the requirements of specific cases.

Your engine is appropriately equipped for the installation concerned, which means that not all of the components described in this Operation Manual are necessarily fitted to your engine.

We have endeavoured to highlight any differences so that you will be able to locate the operating and maintenance instructions relevant to your engine quickly and easily.

Please read this Manual before starting your engine, and always observe the operating and maintenance instructions.

We are available to help with any additional inquiries

Sincerely,

DEUTZ AG

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2.1 Model
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4.1.2 Viscosity
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8.1 Preservation
8.1.1 Preserving Engine
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9.1 Engine Specifications and Settings
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9.3 Tools

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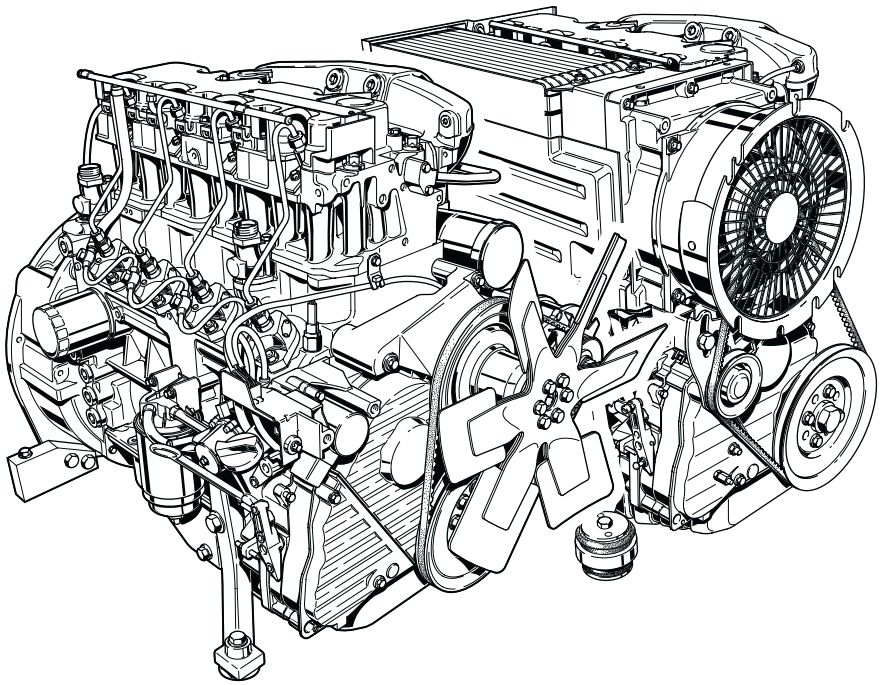


1. General

DEUTZ Engines
are the product of many years of research and development. The resulting know-how, coupled with stringent quality standards, guarantee their long service life, high reliability and low fuel consumption.
It goes without saying that the highest standards for environmental protection are also met.

Beware of Running Engine
Shut the engine down before carrying out maintenance or repair work. Ensure that the engine cannot be accidentally started - accidents may otherwise occur.
When the work is complete, be sure to refit any panels and guards that have been removed.
Observe industrial safety regulations when running the engine in an enclosed space or underground.
Work clothing must be tight-fitting when working on the running engine.
Never fill the fuel tank while the engine is running.

Service and Maintenance
will ensure that the engine continues to meet your requirements. Recommended service intervals must be observed and maintenance work carried out conscientiously. Special care should be taken under abnormally demanding operating conditions.

Safety

This symbol is used in the case of all safety instructions. Failure to comply with these instructions places the health and life of the affected persons in immediate danger. Please follow them carefully.
The attention of operating personnel should be drawn to these safety instructions. General safety and accident prevention regulations laid down by law must also be observed.

Service
Please contact one of our authorised service representatives in the event of breakdowns or for spare parts inquiries. Our trained specialists will carry out repairs quickly and professionally, using only genuine spare parts.

Asbestos

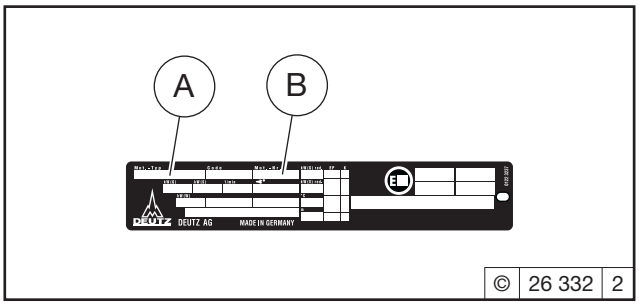
DEUTZ engine components are asbestos-free.

2. Engine Description

2.1 Model
2.2 Engine Illustrations
2.3 Lube Oil Circuit Schematic
2.4 Fuel System Schematic

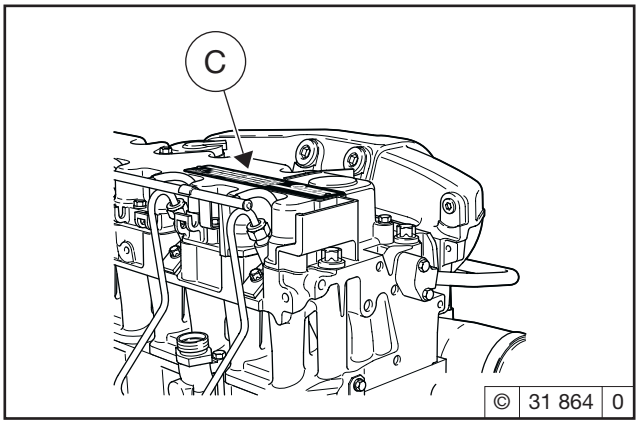
2.1 Model

2.1.1 Rating Plate



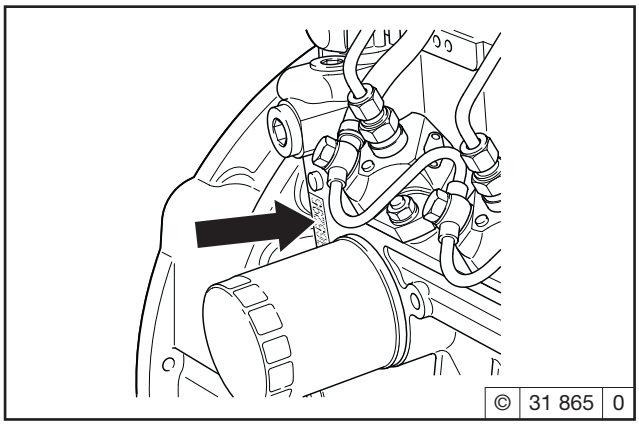
The model **A**, the engine serial number **B** and the performance data are stamped on the rating plate.
The model and engine serial number must be given when ordering parts.

2.1.2 Position of the Rating Plate



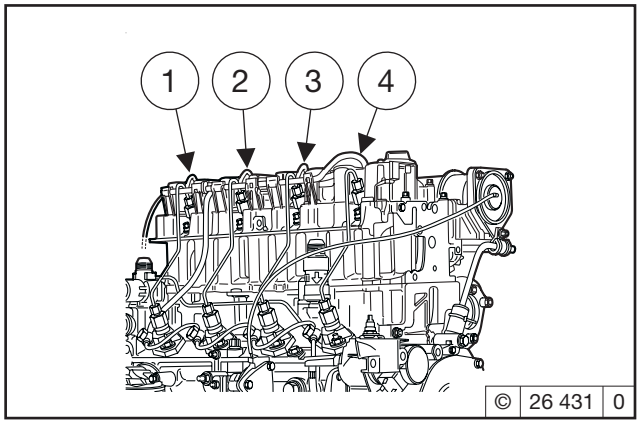
The rating plate **C** is attached to the valve cover.

2.1.3 Engine Serial Number



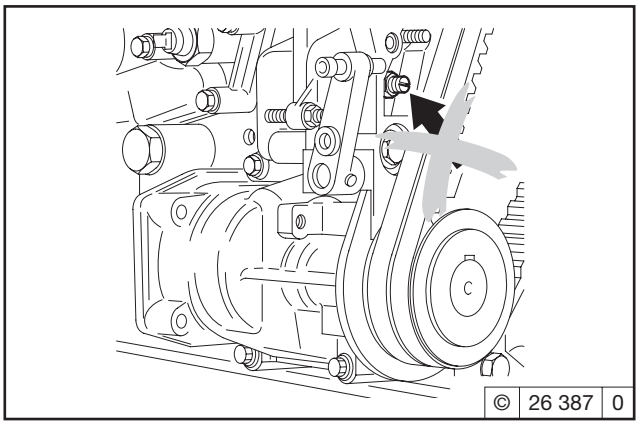
The engine serial number **B** is stamped on the crankcase **D** as well as the rating plate.

2.1.4 Cylinder Numbering



Cylinders are numbered consecutively, beginning at the flywheel.

2.1.5 Fuel Delivery Lock



The manufacturer shall not be held liable for damages resulting from adjustments made to the regulator by the operator.
The lock screws are protected in order to prevent this:

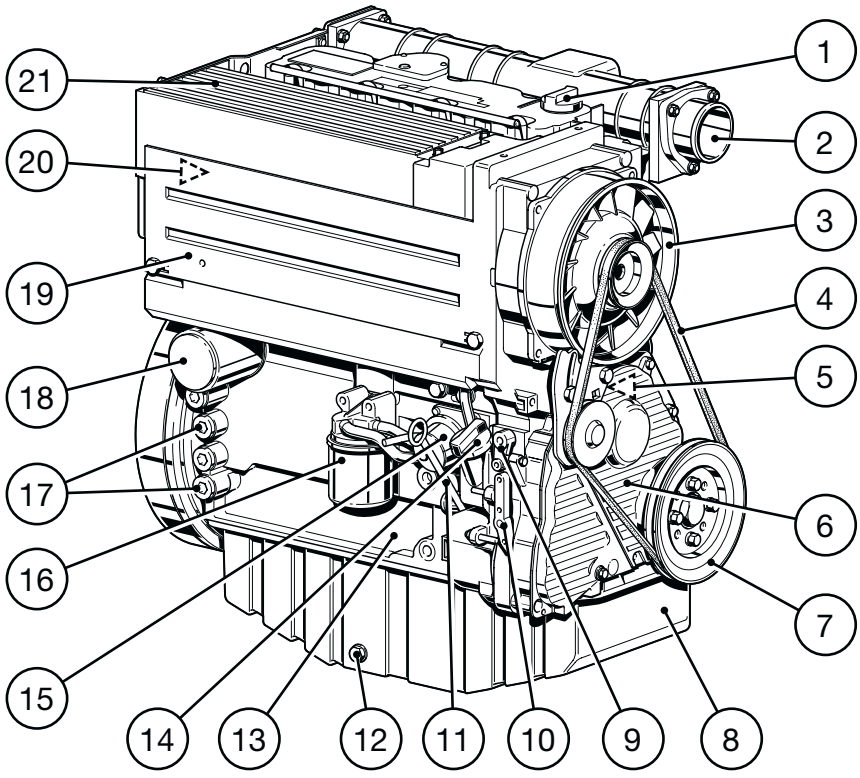
1. with locking paint on model: with torque balancer
2. with plastic protective cap on model: without torque balancer.

Adjustments to the regulator are to be carried out only by authorised DEUTZ SERVICE specialists.

2.2 Engine Illustration

2.2.1 Operation Side FL 2011

1 Oil filler neck (valve-gear housing cover)
2 Charge-air line / air-intake line
3 Fan with integrated generator
4 Narrow V-belt
5 Tractive electromagnet
6 Wheel-house cover
7 V-belt pulley on crankshaft
8 Oil pan
9 Shut-off lever
10 Speed control lever
11 Oil dipstick
12 Oil drain plug
13 Crankcase
14 Oil fill point (on side of crankcase)
15 Fuel pump
16 Easy-change fuel filter
17 Connecting facility for oil heater
18 Lube oil replacement filter
19 Removable coolant intake hood
20 Injection pumps
21 Oil cooler



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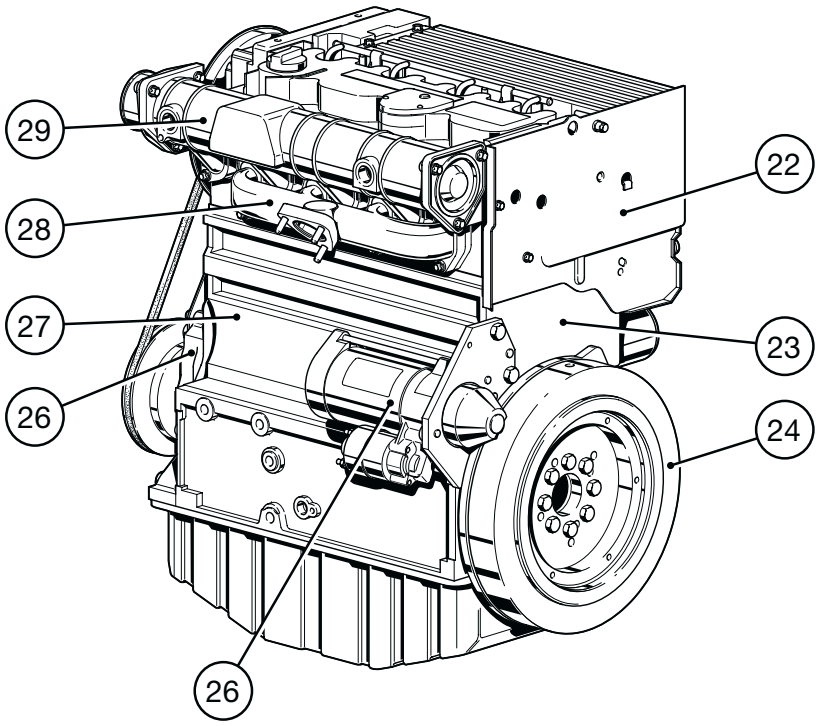
2.2.2 Exhaust Side
FL 2011

22 Date plate
23 Optional attachment of an SAE housing
24 Flywheel with ring gear
25 Starter
26 Front cover
27 Crankcase
28 Exhaust manifold
29 Air intake pipe



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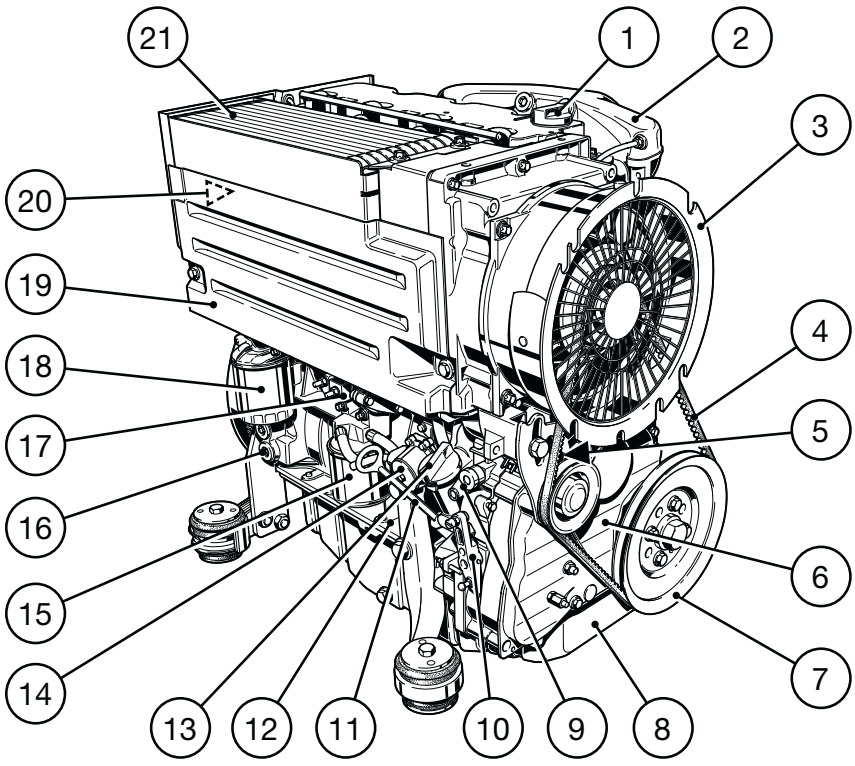
2.2.3 Operation Side
Example: BF4L 2011

1 Oil filler neck (valve-gear housing cover)
2 Charge-air line / air-intake line
3 Fan with integrated generator
4 Narrow V-belt
5 Tractive electromagnet
6 Wheel-house cover
7 V-belt pulley on crankshaft
8 Oil pan
9 Shut-off lever
10 Speed control lever
11 Oil dipstick
12 Crankcase
13 Oil fill point (on side of crankcase)
14 Fuel pump
15 Easy-change fuel filter
16 Connecting facility for oil heater
17 Charge-pressure-dependent full-load stop (CPD)
18 Lube oil replacement filter
19 Removable coolant intake hood
20 Injection pumps
21 Oil cooler



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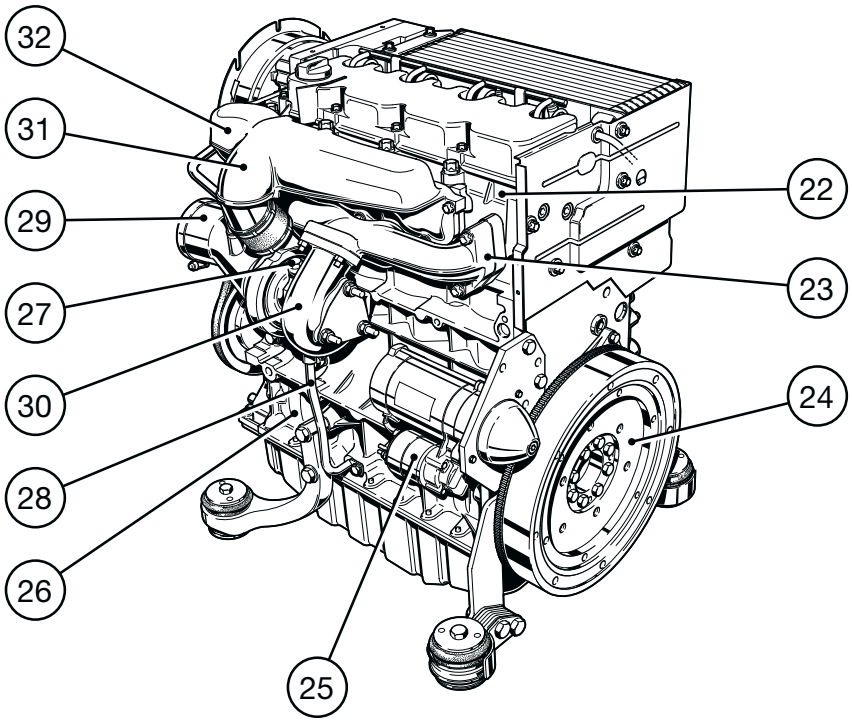
2.2.4 Exhaust Side
Example: BF4L 2011

22 Cylinder head
23 Exhaust manifold line
24 Flywheel with ring gear
25 Starter
26 Crankcase
27 Lube oil feed line to turbocharger
28 Lube oil return line from turbocharger
29 Induction pipe
30 Turbocharger (TC)
31 Intake manifold
32 Charge-air line



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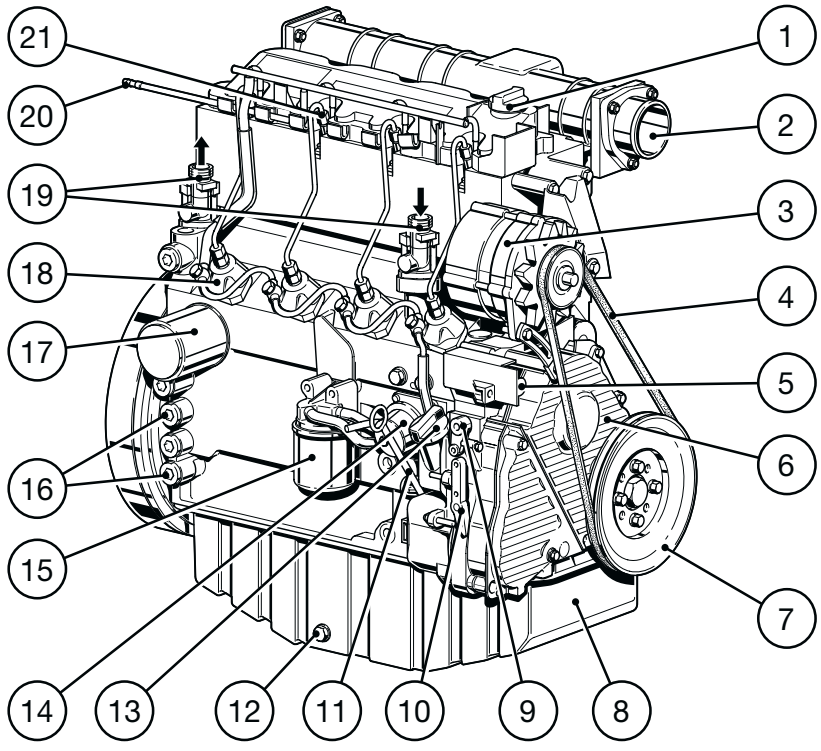
2.2.5 Operation Side FM 2011

1 Oil filler neck (valve-gear housing cover)
2 Charge-air line / air-intake line
3 Alternator
4 Narrow V-belt
5 Tractive electromagnet
6 Timing belt cover
7 V-belt pulley on crankshaft
8 Oil pan
9 Shut-off lever
10 Speed control lever
11 Oil dipstick
12 Oil drain plug
13 Oil fill point (on side of crankcase)
12 Crankcase
14 Fuel pump
15 Easy-change fuel filter
16 Connecting facility for oil heater
17 Lube oil replacement filter
18 Injection pump(s)
19 Oil cooler connection
20 Fuel leakage line
21 Injection valve(s)



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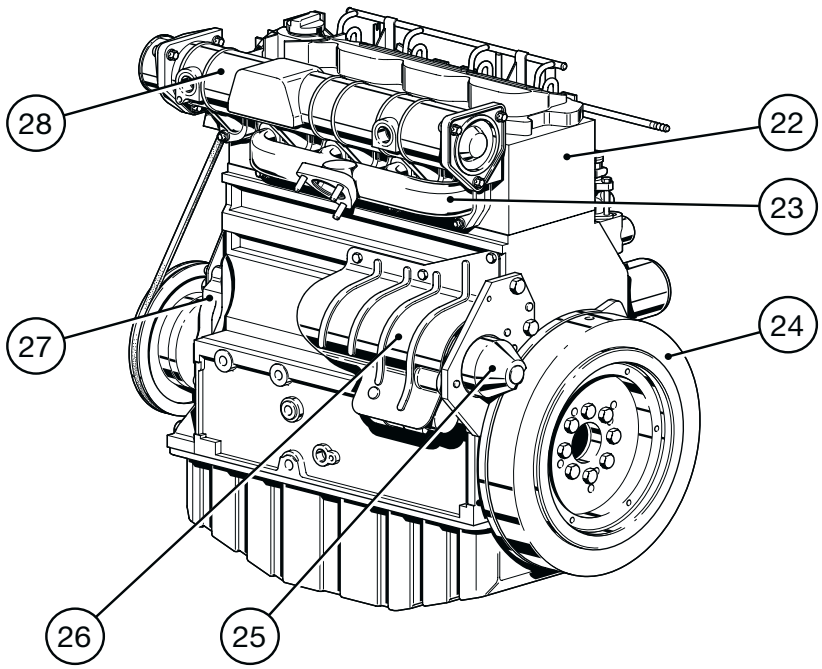
2.2.6 Exhaust Side FM 2011

22 Cylinder head
23 Exhaust manifold
24 Flywheel with ring gear
25 Starter
26 Starter guard (optional)
27 Crankcase
28 Air intake pipe



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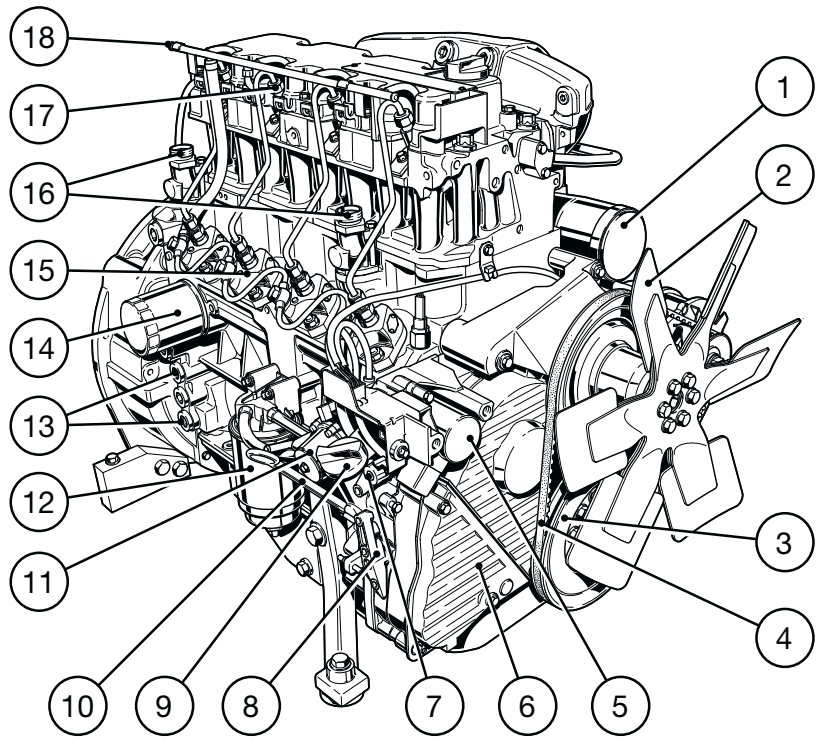
2.2.7 Operation Side BFM 2011

1 Air-intake pipe
2 Fan wheel
3 V-belt pulley on crankshaft
4 Narrow V-belt
5 Tractive electromagnet
6 Timing belt cover
7 Shut-off lever
8 Speed control lever
9 Oil fill point (on side of crankcase)
10 Oil dipstick
11 Fuel pump
12 Easy-change fuel filter
13 Connecting facility for oil heater
14 Lube oil replacement filter
15 Injection pump(s)
16 Oil cooler connection
17 Injection valve(s)
18 Fuel leakage line



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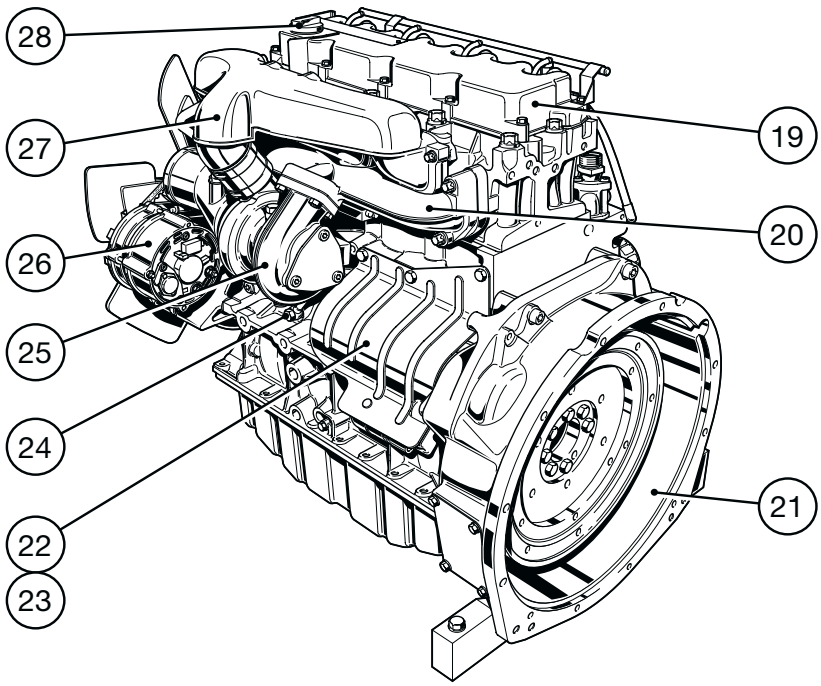
2.2.8 Exhaust Side
BFM 2011

19 Crankcase ventilation (optional)
20 Cylinder head cover
21 Exhaust manifold
22 SAE housing
23 Starter
24 Crankcase
25 Turbocharger
26 Generator with cover
27 Charge-air line
28 Oil filler neck



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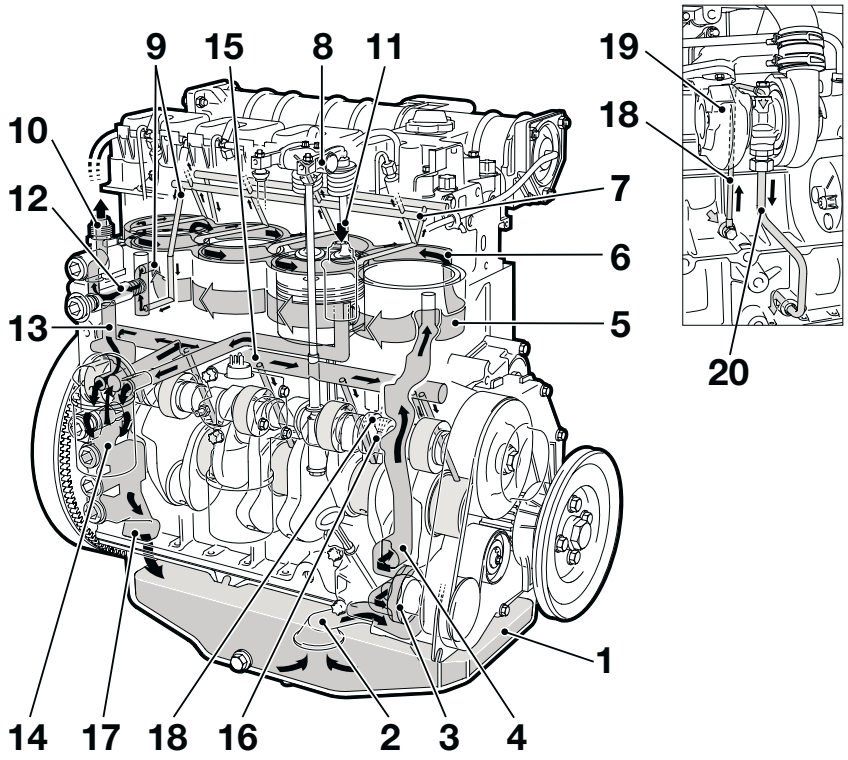
2.3 Oil Circuit

2.3.1 Lube Oil Circuit Schematic

1 Oil pan
2 Oil-intake pipe
3 Oil pump
4 Main oil duct
5 Oil-cooled cylinders
6 Cylinder head cooling neck
7 Oil duct for rocker arm lubrication
8 Rocker arm
9 Oil manifold for the thermostat
10 Intake to external engine oil cooler
11 Return from external engine oil cooler
12 Thermostat housing with slide thermostat
13 Oil duct to oil filter
14 Oil filter
15 Oil duct to cam, con-rod and crankshaft bear ings
16 Spray nozzle for piston cooling
17 Oil return via crankcase to oil pan
18 Lube oil intake to turbocharger
19 Turbocharger
20 Return from turbocharger to oil pan



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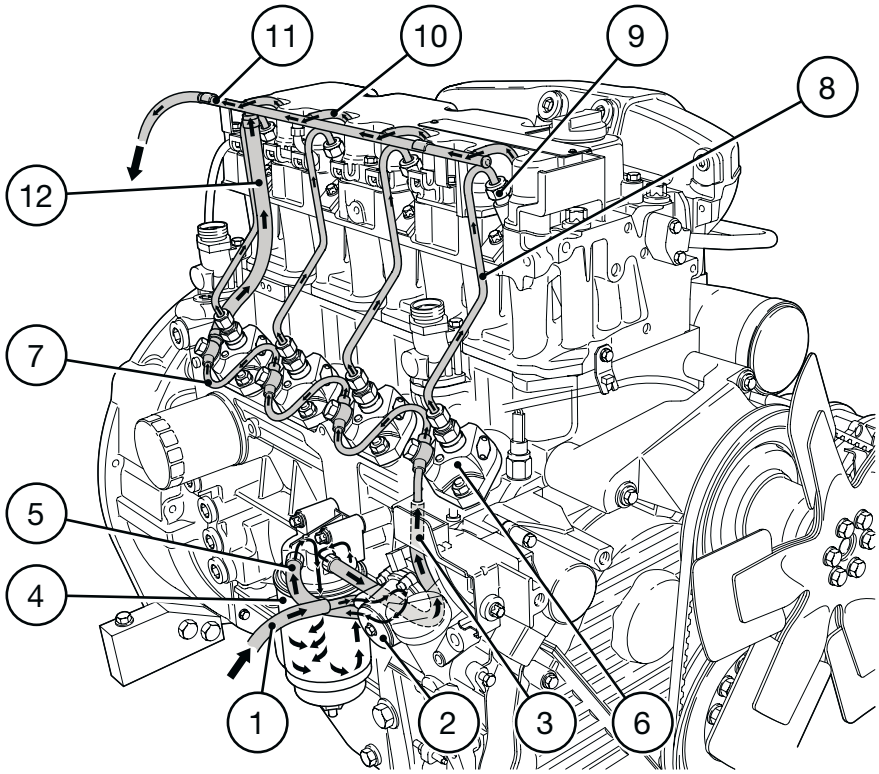
2.4 Fuel System Schematic

2.4.1 Fuel System

1 Fuel line from tank to fuel pump
2 Fuel pump
3 Fuel line from fuel pump to easy-change fuel filter
4 Easy-change fuel filter
5 Fuel line from filter to injection pump
6 Injection pump
7 Fuel distributor line
8 Injection line
9 Injection valves
10 Fuel leakage line
11 Fuel overflow pipe
12 Fuel return line to tank

The installation of a fuel pre-filter/hand pump between the fuel tank and the engine is prescribed to protect the engines against dirt in the fuel.



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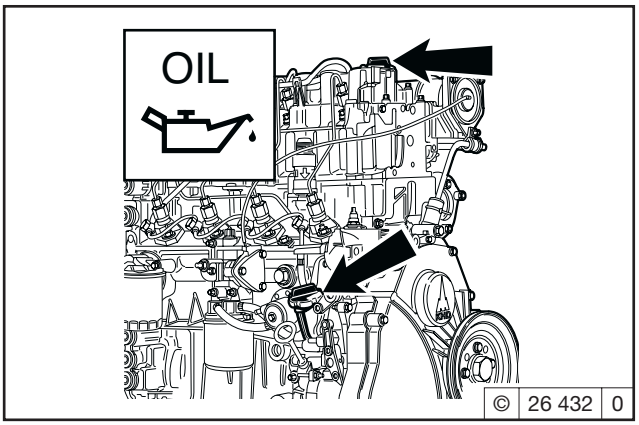
3. Engine Operation

3.1 Commissioning
3.2 Starting
3.3 Monitoring Operation
3.4 Shutting Off
3.5 Operating Conditions

3.1 Commissioning

3.1.1 Adding Engine Oil



As a rule, engines are delivered without oil.
Pour lube oil into the oil filler neck (arrow).
For oil grade and viscosity, see 4.1.

3.1.1.1 Initial Engine Oil Fill-Up for B/FL 2011

- Fill oil into oil pan up to **"Max."** mark on engine dipstick (for oil quantity see 9.1).
- Start engine and allow to run at low idling speed for approx. 2 mins.
- Switch off engine.
- Check oil level, if necessary, top up oil to **"Max."** mark.

3.1.1.2 Initial Engine Oil Fill-Up B/FM 2011

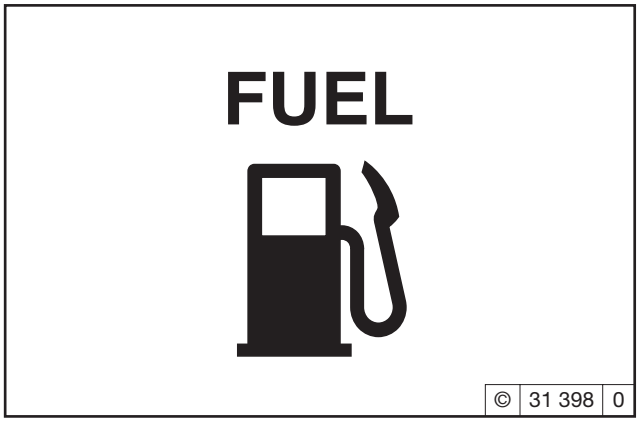
- Fill oil into oil pan up to **"Min."** mark on engine dipstick.
- In addition, top up oil quantity of supply hoses and of external oil cooler (according to manufacturer's specifications).
- Allow engine to run warm until thermostat opens (at approx. 95°C).
- Allow engine to run for approx. 2 mins.
- Switch off engine.
- Check oil level, and if necessary, top up oil to **"Max."** mark.

If the person operating the engine does not run up the engine until the thermostat opens, the oil level may lie above the **"Max."** mark on the engine dipstick when delivered. The level can then only be assessed after the engine has been run up.

3.1.1.3 Initial Engine Oil Fill-Up B/FM 2011 Genset Engine

- Fil oil into oil pan up to **"Max."** mark on engine dipstick (for oil quantity see 9.1).
- Start engine and allow to run at low idling speed for approx. 2 mins.
- Switch off engine.
- Check oil level and fill up with oil up to upper **"Max."** mark.

3.1.2 Adding Fuel



Use only commercial-grade diesel fuel. For fuel grade, see 4.2. Use summer or winter-grade fuel, depending on the ambient temperature.

Never fill the tank while the engine is running.
Ensure cleanliness!
Do not spill fuel!

3.1.3 Other Preparations

- Check battery and cable connectors, see 6.7.1.
- Transport hooks
  Remove if fitted (see 6.7.3)
- Trial run
  After engine has been prepared, let it run for about 10 minutes without being loaded.

  During and after trial run
  - Check engine for leaks.

  After engine has been turned off
  - Check oil level, see 6.1.2.
    Top up with oil, if necessary, see 3.1.1.
  - Retension V-belt, see 6.5).

3.1.4 Additional Maintenance Work

When commissioning new and reconditioned engines, the following additional maintenance work must be carried out:

- Change lube oil, see 6.1.1. + 6.1.2.
- Change oil filter cartridge, see 6.1.3.
- Change fuel filter cartridge, see 6.2.1.
- Check V-belts and retension as necessary, see 6.5.
- Check engine for leaks
- Check engine mounts, retighten if necessary, see 9.2.
- Check valve clearance, adjust if necessary, see 5.1. + 6.6.1.

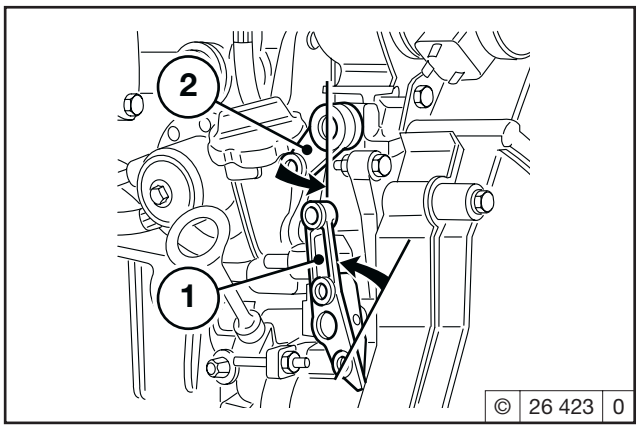
3.2 Starting

3.2.1 Electric starting

Before starting, make sure that nobody is standing in the immediate vicinity of the engine or driven machine.
After repair work:
Check that all guards have been replaced and that all tools have been removed from the engine.
When starting with glow plugs, do not use any other starter substance (e.g. injection with start pilot).
Risk of accident!
Caution: If the speed regulator has been removed, the engine must not be tested under any circumstances.

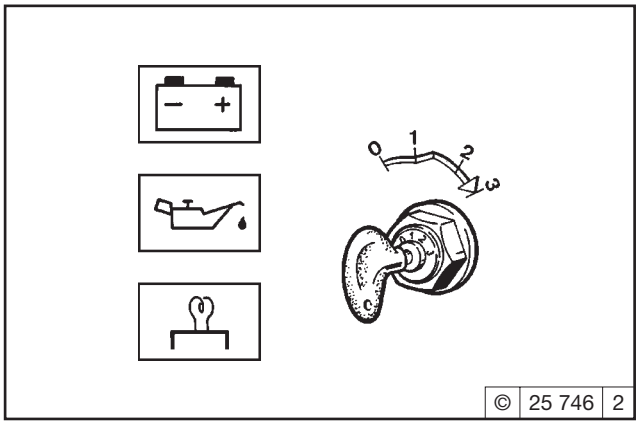
Disconnect the battery!

Do not actuate the starter for more than 20 seconds.
If the engine does not catch, wait a minute then try again.
If the engine does not catch after two attempts, refer to the Fault Table (see 7.1).



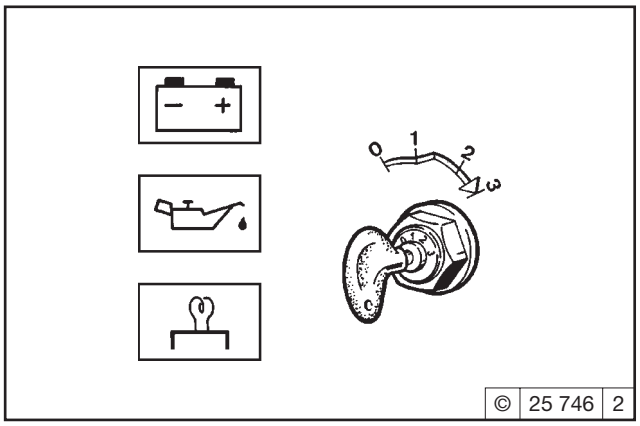
- Where possible, disengage clutch to separate engine from any driven parts.
- Move speed control lever 1 into idle position.
- Move shut-off handle 2 into operating position.

Without cold start assistance



- Insert key
  - Position 0 = no operating voltage
- Turn key clockwise
  - Position 1 = operating voltage
  - Pilot lights come on
- Push key in and turn further clockwise against spring pressure.
  - Position 2 = no function
  - Position 3 = start
- Release key as soon as engine fires
  - Pilot lights go out.

With cold start assistance - Glow plug



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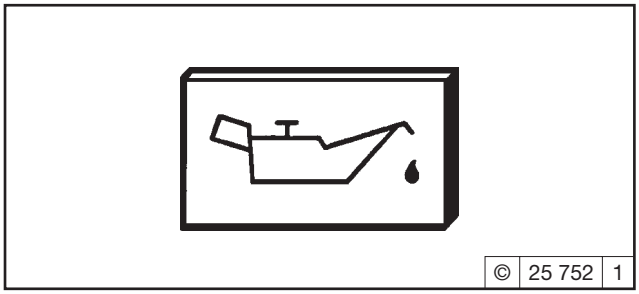
- Insert key
  - Position 0 = no operating voltage
- Turn key clockwise
  - Position 1 = operating voltage
  - Pilot lights come on
- Push key in and turn further clockwise against spring pressure.
  - Position 2 = preheat, hold for approx. 1 minute.
  - Preheat lamp comes on
  - Position 3 = start
- Release key as soon as engine fires
  - Pilot lights go out

3.3 Monitoring Operation

3.3.1 Engine Oil Pressure

Oil Pressure Pilot Light



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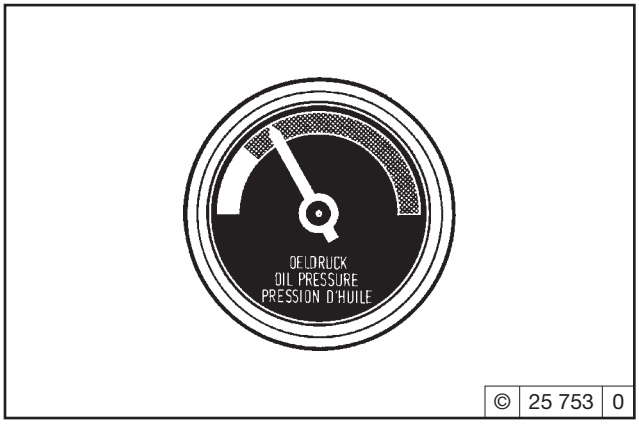
- Oil pressure pilot light comes on with operating voltage on and engine off.
- Oil pressure pilot light should go out when engine is running.

Oil Pressure Indicator



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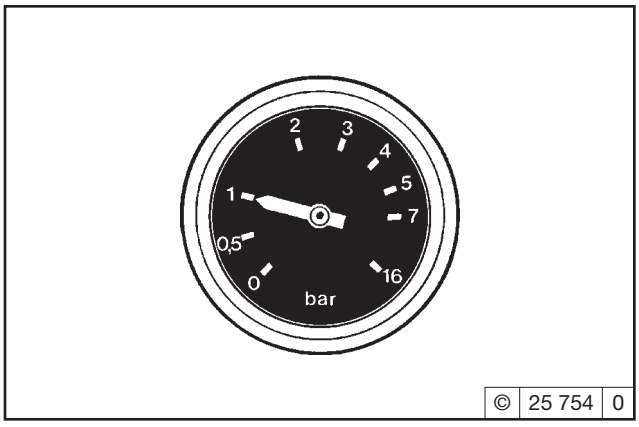
- Pointer must remain in green sector over entire operating range.

Oil Pressure Gauge



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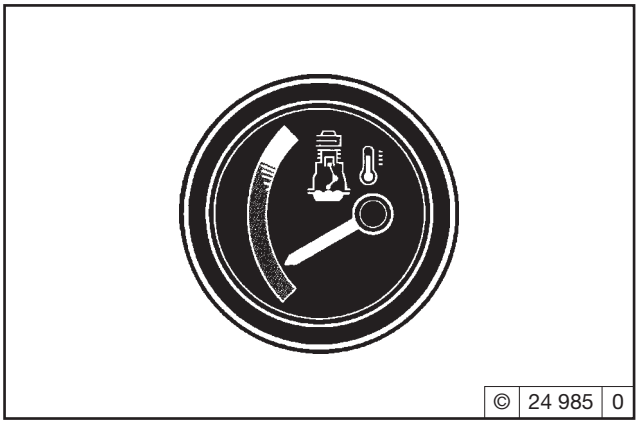
- Pointer must indicate minimum oil pressure (see 9.1).

3.3.2 Engine Temperature

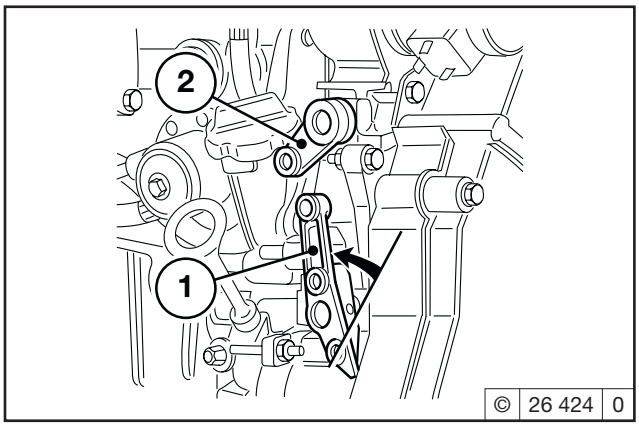
Engine Temperature Gauge



- Engine temperature gauge pointer should remain in green sector most of time. It should rarely enter yellow-green sector. If pointer enters orange sector, engine is overheating. Turn off and establish cause from Fault Table (see 7.1).

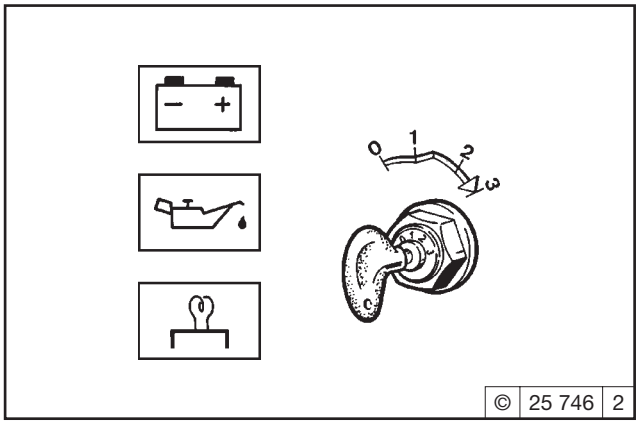
3.4 Shutting Off

3.4.1 Mechanical Shut-Off



- Move speed adjustment lever 1 to low idle.
- Move shut-off lever 2 until engine comes to a stop. Charge pilot light and oil pressure pilot light will come on when engine stops.
- Turn key anticlockwise (to position 0) and remove. Pilot lights will go out.

3.4.2 Electric Shut-Off (Ignition Key)



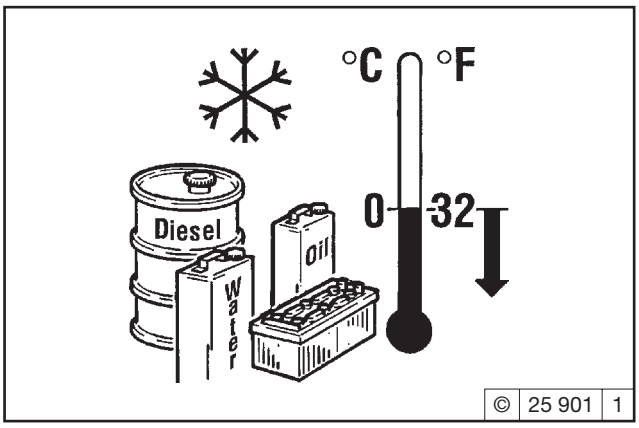
- Turn key anticlockwise (to position 0) and remove. Pilot lights will go out.

If possible, do not suddenly switch off engine when under full load.

3.5 Operating Conditions

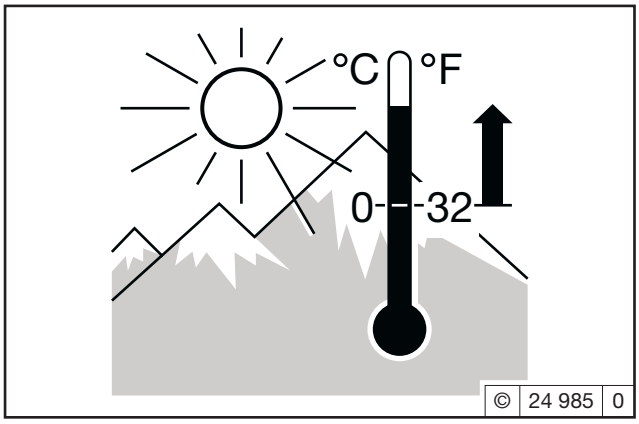
3.5.1 Winter Operation

- Lube Oil Viscosity
  - Select oil viscosity (SAE grade) according to ambient temperature before starting engine, see 4.1.2.
  - Increase oil change frequency when operating below -10°C, see 6.1.1.
- Diesel Fuel
  - Use winter-grade diesel fuel for operation be low 0°C, see 4.2.2.
- Additional Maintenance Work
  - Drain sludge from fuel tank once a week (undo sludge drain screw).
  - If necessary, allow oil in oil bath air cleaner and engine oil to settle at ambient temperature.
  - Below -20°C, after removing starter if necessary, smear ring gear on flywheel via pinion bore from time to time with cold-resistant grease. (e.g. Bosch grease FT 1 V 31).
- Cold Start Assistance
  - At temperatures near or below freezing point, use glow plugs if necessary, see 3.2.1. This not only lowers starting limit temperature, but provides easier starting at temperatures normally not requiring a starting aid.
- Battery
  - Efficient cold starting requires that battery is well-charged, see 6.7.1.
  - Starting limit temperatures can be lowered by 4-5°C by heating battery up to about +20°C. (To do so, remove battery and store in warm place).



3.5.2 High Ambient Temperature, High Altitude

- Air density decreases as altitude or ambient temperature increases. As a result of this, the engine's maximum output, quality of exhaust gas, temperature level and, in extreme cases, starting behaviour, are impaired. Engine can be used at altitudes up to 1000 m and temperatures up to 30°C for mobile operations. If the engine is to operate under more severe conditions (at higher altitudes or temperatures), it will be necessary to reduce the injected fuel quantity and thus engine power.
- If you have any doubts about engine operation under these or similar conditions, ask your engine or equipment supplier whether the engine has been derated in the interests of reliability, service life and exhaust gas quality (smoke). Otherwise contact DEUTZ SERVICE.



4. Operating media

4.1 Lube Oil
4.2 Fuel

4.1 Lube Oil

4.1.1 Quality

Lube oils are differentiated according to their performance and quality class. In common use are specifications named after the **API** (American Petroleum Institute) and **ACEA** European Engine Oil Sequences.

Approved API Oils:
Minimum: CF-4

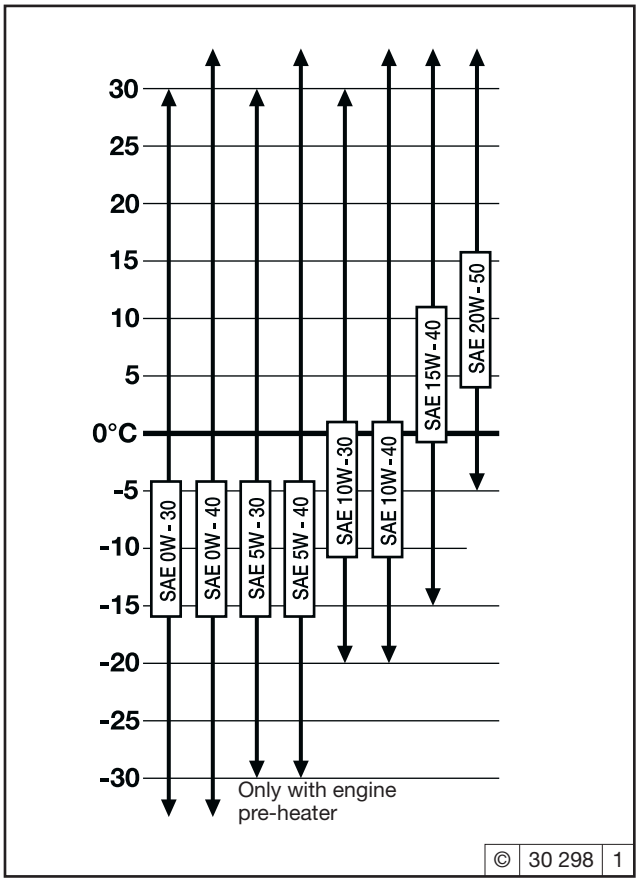
Approved ACEA Oils:
Minimum: E1-96

---

* Oil change intervals, see 6.1.1
Oil capacities, see 9.1

4.1.2 Viscosity

As the viscosity of the lube oil is dependent on temperature, the choice of SAE grade should be governed by the ambient temperature prevailing at the engine operating site. Optimum operating behaviour will be attained if you take the accompanying oil viscosity diagram as a guide.
Should the temperature fall temporarily below the limits of SAE grade selected, cold starting may be affected but the engine will not be damaged. In order to keep wear to a minimum, do not exceed application limits for extended periods of time.
Oil changes dictated by the seasons can be avoided by using multi-grade lube oils. Multi-grade oils, particularly light-flowing oils, also reduce fuel consumption.



4.2 Fuel

4.2.1 Quality

Use commercially available diesel fuel with less than 0.5% sulphur content. If the sulphur content is higher, oil change intervals should be reduced (see 6.1.1).

The following fuel specifications / standards are approved:

- DIN EN 590
- BS 2869
- ASTM D 975-96; 1-D and 2-D
- NATO Code F-54 / F-34 / F-44 and XF 63

Exhaust emission values which may be determined in the case of type approval tests always refer to the reference fuel prescribed by the authorities for the type approval test.

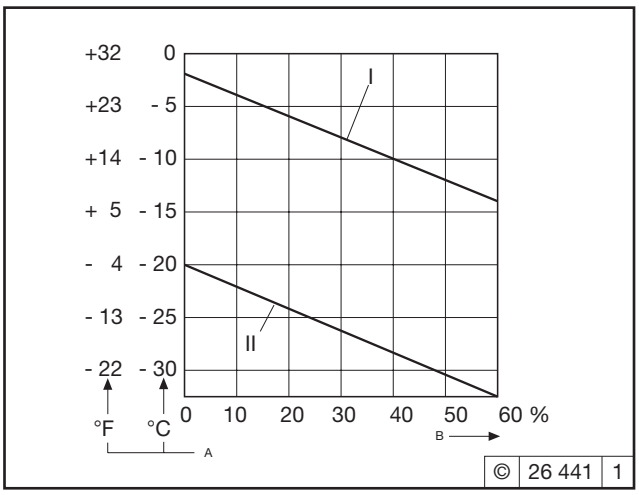
4.2.2 Winter-Grade Fuel

Waxing may occur at low temperatures, clogging the fuel system and reducing engine efficiency. If the ambient temperature is less than 0°C, wintergrade fuel (suitable down to -15°C) should be used.
(This fuel is usually available from filling stations well in advance of the cold months). Diesel fuel containing additives (Super diesel) is often on sale as well, for use down to -20°C.

- At temperatures below -15°C to -20°C, kerosene should be added to the diesel fuel. The relevant percentages are given in the adjacent diagram.

If summer-grade diesel fuel must be used at temperatures below 0°C, up to 60% kerosene can be added (see diagram).
In most cases, adequate resistance to cold can also be obtained by adding a flow improver (additive).
Please inquire at DEUTZ SERVICE.

Diesel fuels must never be mixed with petrol (Normal and Super grades)!



Legend:	
I	Summer-grade diesel fuel
II	Winter-grade diesel fuel
A	Ambient temperature
B	Percentage of kerosene added

Mix in tank only! Fill with the appropriate amount of kerosene first, then add the diesel fuel.

5. Service

5.1 Service Plan
5.2 Scheduled Maintenance Plan
5.3 Maintenance Chart
5.4 Maintenance Work Completed

5.1 Service Plan

Deutz maintenance and service schedule = E check = ● adjust = ❍
clean = ▲ replace = ■

⇩ prior to or during 1st trial run, check 2x daily during the breaking-in phase or when commissioning new and overhauled engines

⇩ every 10 operating hours or daily

Industrial engines

The specified engine maintenance intervals are permissible recommended maximums. Depending on usage, reduced maintenance intervals may be necessary (comply with the unit manufacturer's operating instructions).

Maintenance must only be carried out by authorised service personnel

in operating hours (OH) every											
E10	E20	E25	E30	E40	E50	E60	E70	Years		Operation	Section
		500	1000	3000	5000	6000	12000	1	2		
●	●									Top lube oil up if necessary	6.1.2/3.1.4
			■							FL 2011 lube oil, see TC 0199-99-3002	6.1.1/ 6.1.2
		■								BFL 2011 lube oil, see TC 0199-99-3002	6.1.1/ 6.1.2
	●		▲				■			Oil bath (lube oil quality, see TC 0199-99-3002 / Dry type filter	6.4
			■							Oil filter cartridge FL 2011	6.1.3
		■								Oil filter cartridge BFL 2011	6.1.3
			■							Fuel filter cartridge	
			▲							Change fuel pump/strainer if necessary	6.2.2
			●						■	Flexible fuel leakage lines, see TC 0138-21-9300	6.2.1/ 6.2.3
				●			■			Injection valve	#
●			▲							Fuel pre-cleaner	4.2
			●						■	Intake air cleaner (if available, maintain according to maintenance indicator)	6.4.3 /6.4.4
		●								Battery and cable connectors	6.7.1
●									■	Engine monitoring system, warning system	3.3 #
❍			❍							Valve clearance	6.1.1 #
			❍						■	V-belt	6.5 #
				●						Crankcase pressure vent valve	#
				■						Timing belt, extreme-duty, see adjacent table	#
					■					Timing belt, heavy-duty, see adjacent table	#
						■				Timing belt, light-duty, see adjacent table	#
●										Check engine for leaks (visual inspection)	-
			●				■			Basic overhaul	9.2
							■			Engine mount (replace if damaged)	#

Deutz maintenance and service schedule = E check = ● adjust = ❍ clean = ▲ replace = ■											Additions and modifications for engines with EPA approval
⇩ prior to or during 1st trial run, check 2x daily during the breaking-in phase or when commissioning new and overhauled engines											The specified engine maintenance intervals are permissible recommended maximums. Depending on usage, reduced maintenance intervals may be necessary (comply with the unit manufacturer's operating instructions).
	⇩ every 10 operating hours or daily										# Maintenance must only be carried out by authorised service personnel
		in operating hours (OH) every						Years			
E10	E20	E25	E30	E40	E50	E60	E70			Operation	Section
		250	500	1000	3000	6000	12000	1	2		
●	●		■							FL 2011 lube oil, see TC 0199-99-3002	6.1.1/ 6.1.2
		■								BFL 2011 lube oil, see TC 0199-99-3002	6.1.1/ 6.1.2
				●		■				Injection valve	#
				●					●	Crankcase pressure vent valve	#

Timing belt change intervals Guideline values in OH	Engine application Example:	Engine/ application/operating parameters Example:
6000 or max. 5 years	Generating sets 1500/1800 rpm; pump units, low speed; platform lifts; refrigeration units etc.	low speed; moderate ambient temperature; low dust exposure
5000 or max. 5 years	compressors; rollers; forklift trucks; welding units; small dumpers; ski-steer loaders etc.	wheel loaders;medium to high variable speed; high ambient temperature; moderate dust exposure
3000 or max. 5 years	agricultural machinery; ski-steer loaders; wheel loaders; drilling equipment; trench-cutting machines; joint cutters; bulldozers etc.	high speed; impact loads; extreme ambient temperature; high dust exposure

5.2.1 Scheduled Maintenance Plan

Intervals at/after	Deutz maintenance and service schedule	Operation	Carried out by:
50 OH	E 10	After commissioning and E 50-E 70	Authorised specialists
Daily	E 20	Daily check	Operator
250 OH	E 25	Inspection	Authorised specialists
500 OH	E 30	Extended inspection	Authorised specialists
1000 OH	E 40	Interim overhaul	Authorised specialists
3000 OH	E 50	Extended interim overhaul	Authorised specialists
6 000 OH	E 60	Partial overhaul	Authorised specialists
12 000 OH	E 70	Basic overhaul	Authorised specialists

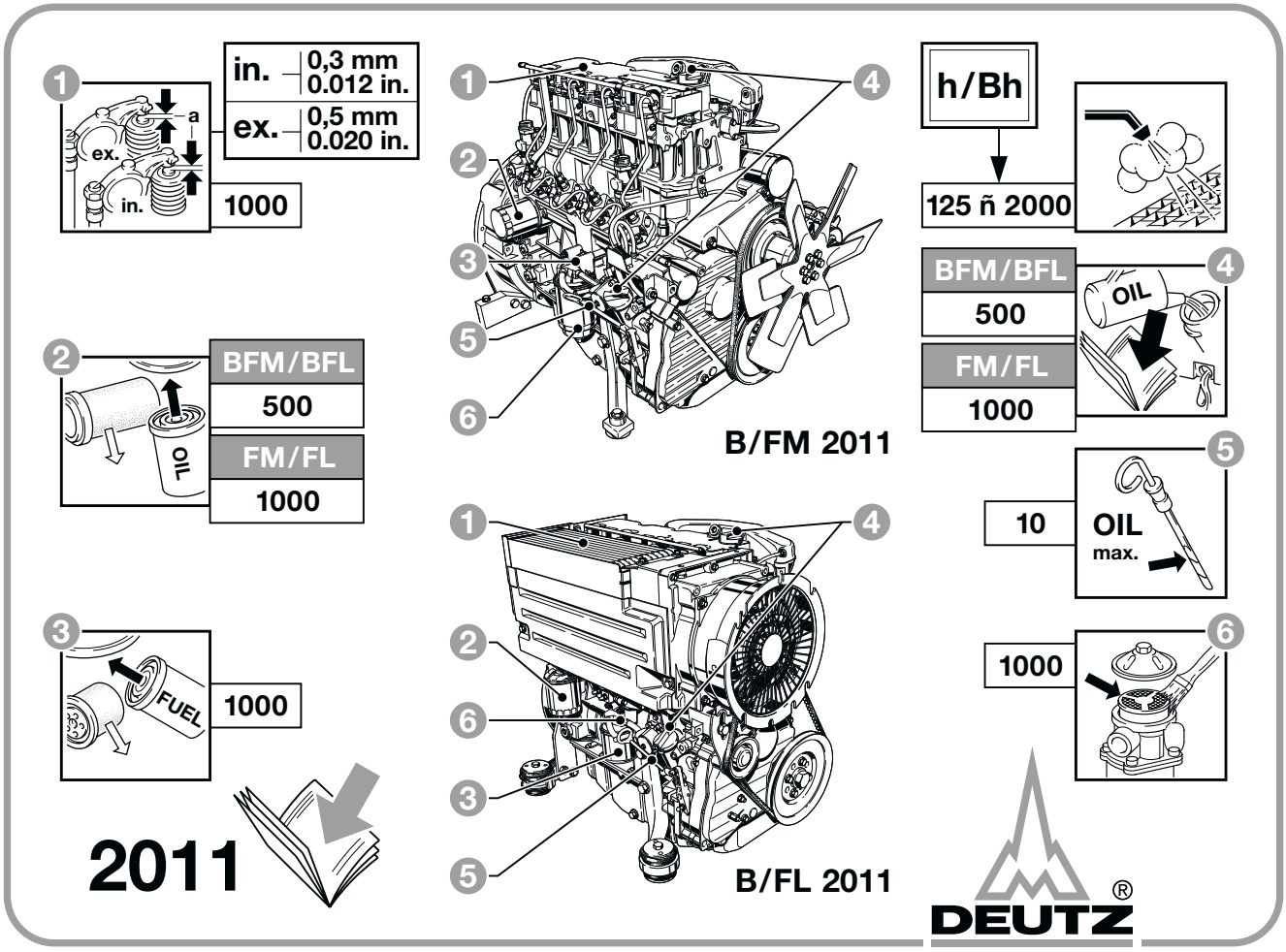
5.3 Maintenance Chart

The maintenance chart shown here is supplied as a self-adhesive label with each engine. It should be affixed where it can be seen clearly on the engine or driven equipment.

Check that this is the case.

If necessary, ask your engine or equipment supplier for a fresh supply of labels.

Routine work should be carried out according to the schedule in 5.1.



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Stop the engine before carrying out any maintenance work.

5.4 Maintenance Work Completed

Op. hours	Date	Signature/stamp
50-150*		
-		
125		
250		
375		
500		
625		
750		
875		
1000		
1125		
1250		
1375		
1500		
1625		
1750		
1875		
2000		
2115		
2250		
2375		
2500		
2625		
2750		
2875		
3000		
3125		
3250		
3375		
3500		
3625		
3750		
3875		
4000		
4125		
4250		
4375		
4500		
4625		
4750		
4875		
5000		

Op. hours	Date	Signature/stamp
5125		
5250		
5375		
5500		
5625		
5750		
5875		
6000		
6125		
6250		
6375		
6500		
6625		
6750		
6875		
7000		
7125		
7250		
7375		
7500		
7625		
7750		
7825		
8000		
8125		
8250		
8375		
8500		
8625		
8750		

* Following commissioning of new and overhauled engines.
Duly completed maintenance jobs can be recorded and signed off in the above chart.

6. Service and Maintenance

6.1 Lubrication System
6.2 Fuel System
6.3 Cooling system
6.4 Combustion Air Filter
6.5 Belt Drives
6.6 Adjustments
6.7 Accessories
6.8 Engine Cleaning

6.1 Lubrication System

6.1.1 Oil Change Intervals

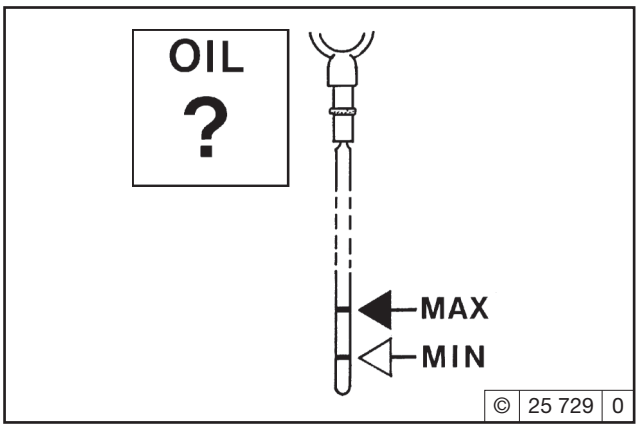
- Oil change intervals are dependent on engine application and quality of lube oil.
- If engine runs fewer hours during year than stated in table, oil should be changed at least **once a year**.
- Table refers to following conditions:
  - sulphur content max. 0.5% by weight for diesel fuel
  - continuous ambient temperature to -10°C (+14°F).
- If sulphur content is > 0.5 to 1% or continuous ambient temperature below -10°C (+14°F), intervals between oil changes should be halved.
- In case of fuels containing more than 1% sulphur, contact **your service representative**.

Engines for installation			Lube oil change intervals in OH		
			Naturally aspirated engines	Turbocharged engines	
Lube quality	API-specification		CF-4/ CG-4 / CH-4	CF-4	CG-4 / CH-4
	ACEA-specification		E1-E3/96+ E4-98	E1-E2/96	E3-96+ E4-98
Normal duty oil, e.g.: road vehicles, cranes, construction machinery, ships, generating sets, pumps, rail vehicles.			1000	250	500
Heavy duty for oil, e.g.: combine harvesters, emergency pumps, underground mining units, sweeping machines, winter maintenance equipment, emergency generators.			500	125	250
Vehicle engines			Lube oil change intervals in km		
			Naturally aspirated engines	Turbocharged engines	
Lube oil quality	API specification		CF-4/ CG-4 / CH-4	CF-4	CG-4 / CH-4
	ACEA specification		E1-E3/96+ E4-98	E1-E2/96	E3-96+ E4-98
Service group	Annual usage km	Average driving speed approx. km/h			
I	< 30 000	20	20 000	5 000	10 000
II	30 000 – 100 000	40	40 000	10 000	20 000
III	> 100 000	60	60 000	15 000	30 000

Change oil with engine off but still warm (lube oil temperature approx. 80°C).

6.1.2 Check Oil Level / Change Engine Oil

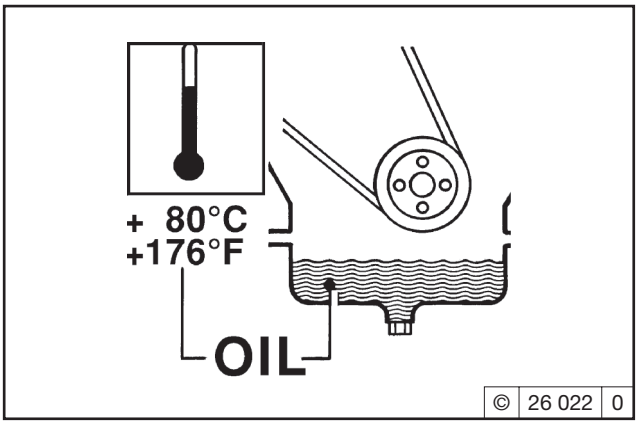
6.1.2.1 Check Oil Level



- Switch engine off before checking oil level.
- Ensure that engine or vehicle is level.
- Remove oil dipstick.
- Wipe dipstick with non-fibrous, clean cloth.
- Insert it to stop and remove again.
- Check oil level, and if necessary, top up to **"MAX"** mark.
  - If oil level is only just above **"MIN"** mark, more oil must be added.

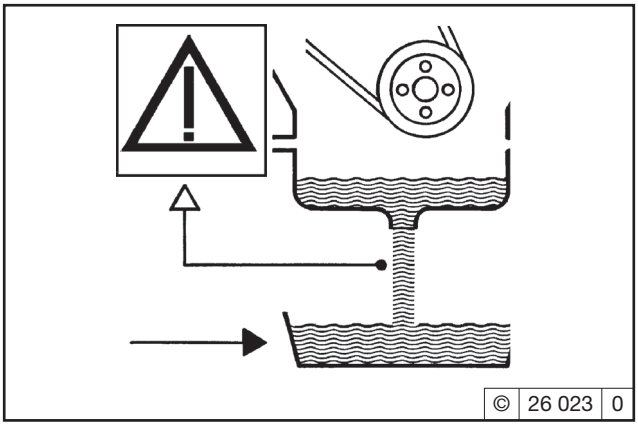
The level must not fall below the **"MIN"** mark.

6.1.2.2 Change Engine Oil



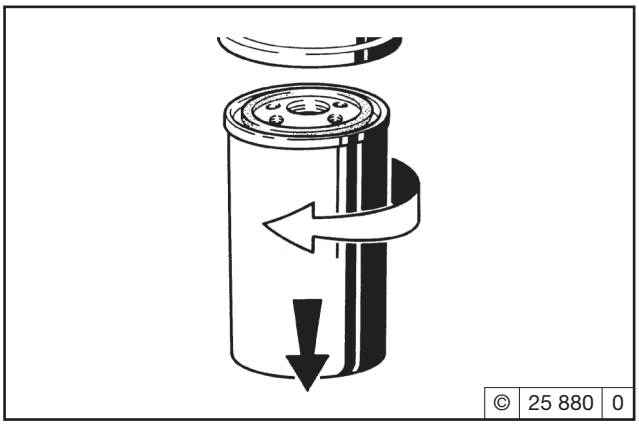
- Allow engine to warm up.
- Ensure that engine or vehicle is level.
  - Lube oil temperature approx. 80°C.
- Switch off engine.

Caution when draining hot oil: Risk of scalding!
Do not let used oil run into the soil but collect it in a container!
Dispose of this in accordance with environmental regulations!



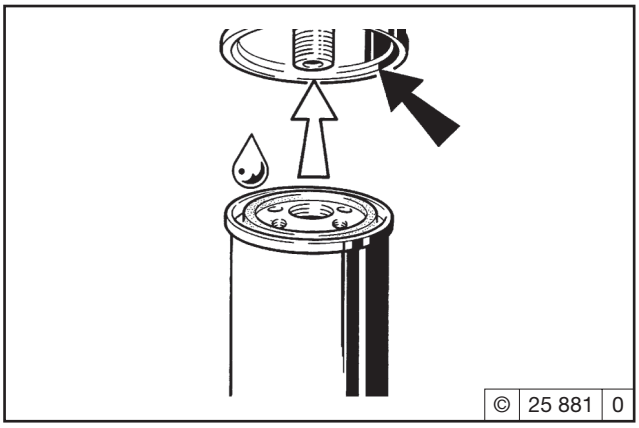
- Place oil tray under engine.
- Unscrew oil drain plug.
- Drain oil.
- Fit oil drain plug with new seal ring and tighten firmly (for torque, see 9.2)
- Pour in lube oil
  - For grade / viscosity, see 4.1
  - For quantity, see 9.1
- Check oil level, see 6.1.2.1.

6.1.3 Changing Oil Filter

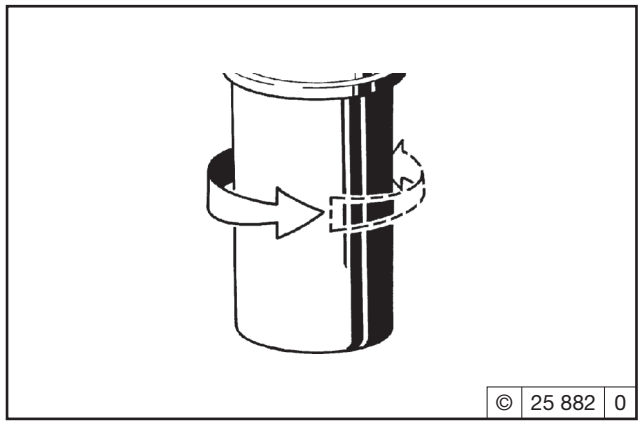


- Undo lube oil filter cartridge using commercial tool and spin off.
- Catch any escaping oil.

Caution is required in case of hot oil: Risk of scalding!

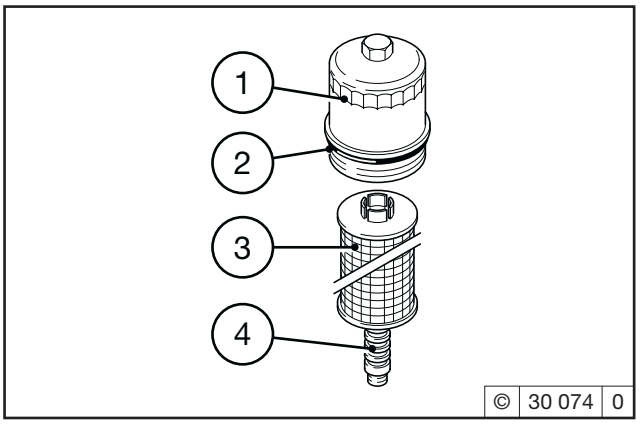


- Clean any dirt from filter carrier sealing surface.
- Lightly oil rubber gasket of new lube oil filter cartridge.
- Manually screw in new cartridge until gasket is flush.



- Tighten lube oil filter cartridge with another halfturn.
- Check oil level, see 6.1.2.
- Check oil pressure, see 3.3.1.
- Check lube oil filter cartridge seal for leaks.

6.1.4 Clean / Replace Oil Filter (Cup)

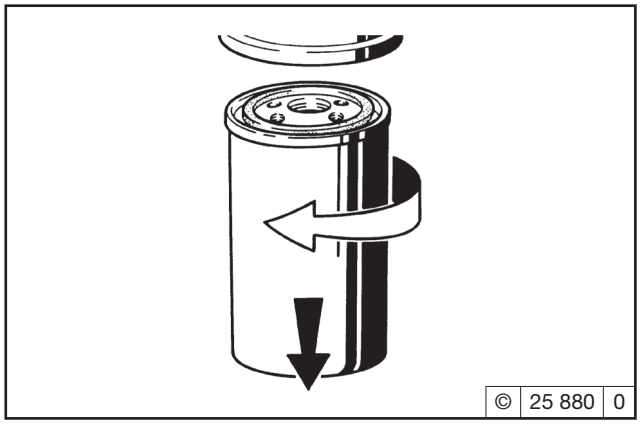


- Switch off engine.
- Loosen lube oil filter cover 1 and unscrew in anticlockwise direction.
- Carefully loosen paper filter cartridge 3 upwards from guide 4.
- Catch any escaping oil.
- Replace paper filter cartridge 3.
- Clean any dirt from sealing surface of filter carrier and lube oil filter cover 1 and from guide 4.
- Replace and lightly oil rubber gasket 2.
- Carefully insert new paper filter cartridge 3 into guide 4.
- Tighten lube oil filter cover 1 in clockwise direction (25 Nm).
- Start engine.
- Check oil level, see 6.1.2.
- Check oil pressure, see 3.3.1.
- Check lube oil filter attachment for leaks.

Caution is required in case of hot oil: Risk of scalding!

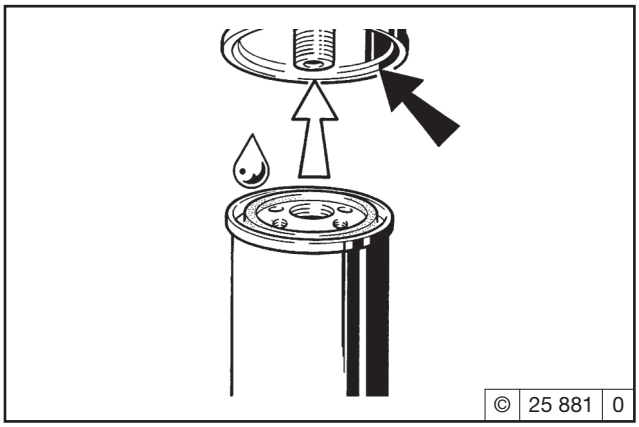
6.2 Fuel System

6.2.1 Replace Fuel Filter

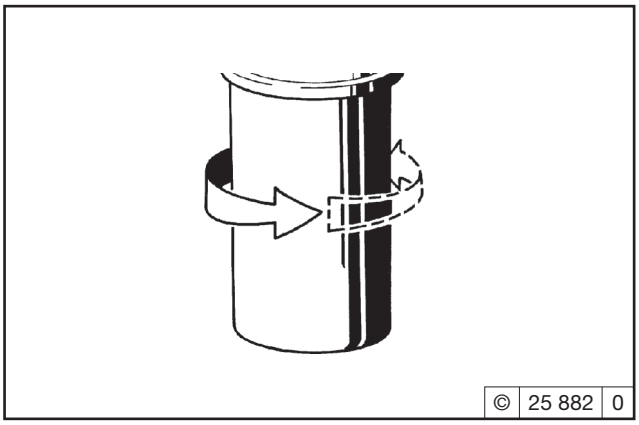


- Close fuel shut-off valve.
- Undo fuel filter cartridge with commercial tool and spin off.
- Catch any escaping fuel.

Keep naked flames away when working on the fuel system. Do not smoke!



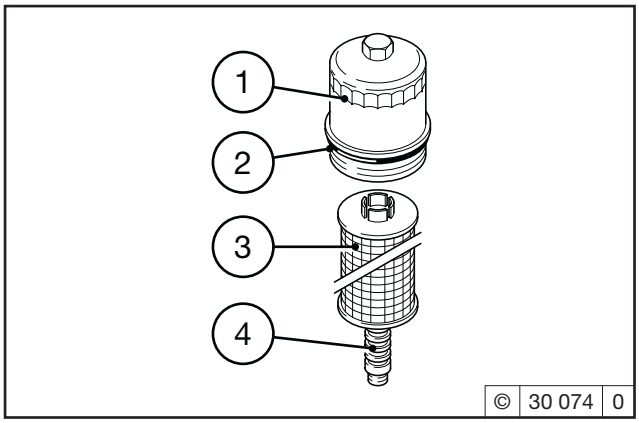
- Clean any dirt from filter carrier sealing surface.
- Apply light film of oil or diesel fuel to rubber gasket of new fuel filter cartridge.
- Manually screw in new cartridge until gasket is flush.



- Tighten fuel filter cartridge with final half-turn.
- Open fuel shut-off valve.
- Check for leaks.

The fuel system does not need to be bled.

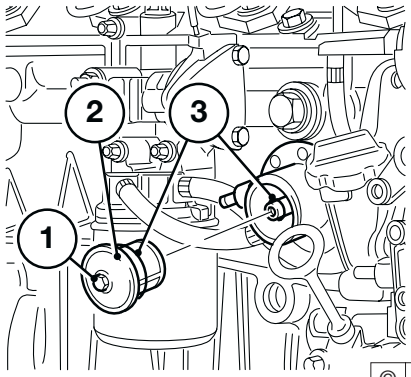
6.2.2 Clean / Replace Fuel Filter (Cup)



- Switch off engine.
- Loosen fuel oil filter cover 1 and unscrew in anticlockwise direction.
- Carefully loosen paper filter cartridge 3 upwards from guide 4.
- Catch any escaping fuel.
- Replace paper filter cartridge 3.
- Clean any dirt from sealing surface of filter carrier and fuel filter cover 1 and from guide 4.
- Replace and lightly oil rubber gasket 2.
- Carefully insert new paper filter cartridge 3 into guide 4.
- Tighten fuel filter cover 1 in clockwise direction (25 Nm).
- Start engine.
- Check fuel filter attachment for leaks.

Keep naked flames away when working on the fuel system. Do not smoke!

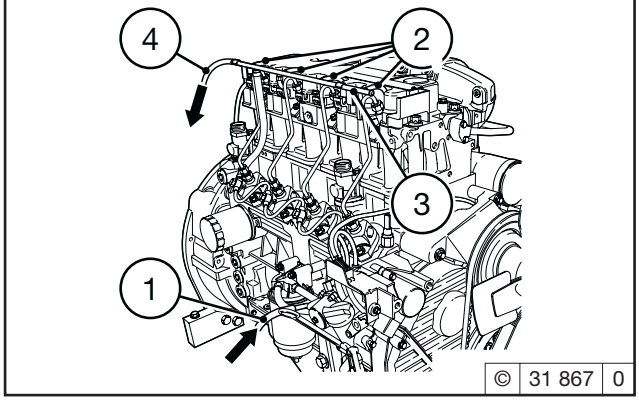
6.2.3 Clean Strainer of Fuel Filter



- Close fuel shut-off valve.
- Loosen and unscrew hexagonal nut 1.
- Remove fuel strainer cover 2 (cover and strainer, one unit).
- Clean fuel strainer 2 with diesel fuel. Replace if necessary.
- Place seal 3 in position.
- Mount fuel strainer cover 2.
- Tighten hexagonal screw 1.
- Check for leaks.

Keep naked flames away when working on the fuel system. Do not smoke!

6.2.4 Change Fuel Leakage Line



- Close fuel shut-off valve.
- Disconnect rubber hoses 3 from injection valves.
- Disconnect rubber hose 1 from fuel tank.
- Disconnect rubber hoses 4, 3 and 1 from unions 2 and dispose of in an environmentally friendly manner.
- Connect new rubber hoses 4, 3 and 1 to unions 2.
- Connect rubber hoses 3 to injection valves.
- Connect rubber hose 1 to fuel tank.
- Open fuel shut-off valve.
- Check for leaks after start-up.

6.3 Cooling System

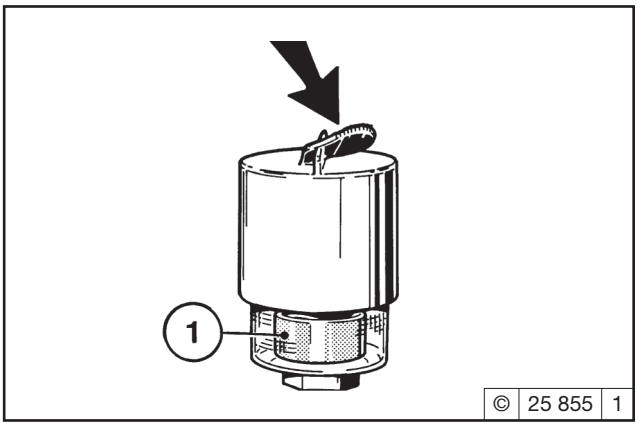
6.3.1 Cleaning Intervals

- Amount of contamination in cooling system depends on engine application.
- Oil and fuel residues on engine increase risk of contamination. Therefore pay special attention to leaks if engine is used in dusty environments.
- Serious contamination can occur, for example:
  - on construction sites where there is a high level of air-borne dust.
  - in harvesting applications where there are high concentrations of chaff and chopped straw in vicinity of machine.
- Because applications vary, cleaning intervals have to be determined from case to case. Cleaning intervals given in table on right can be used as a guide.

Checking or cleaning intervals Guideline values OH	Engine application
2000	Ships, generating sets in enclosed areas, pumps.
1000	Vehicles on paved roads
500	Tractors, fork-lift trucks, mobile generating sets
250	Vehicles on construction sites and unpaved roads, construction machines, compressors, underground mining units
125	Agricultural machines, tractors in harvesting applications

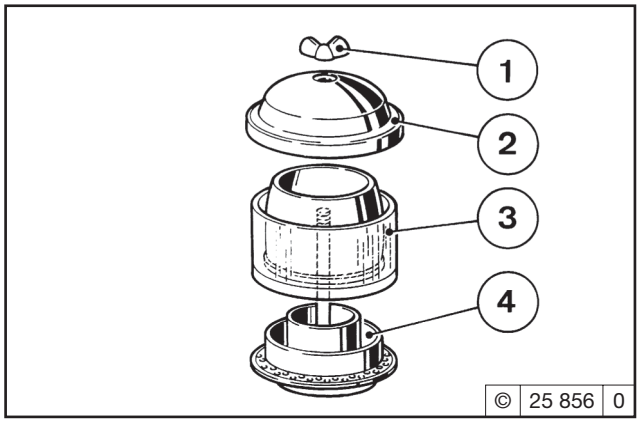
6.4 Combustion Air Filter

6.4.1 Cleaning Intervals



- Amount of dirt in air cleaner depends on amount of dust in air and size of air cleaner used. If high level of dust is anticipated, cyclone-type precleaner can be fitted to air cleaner.
- Cleaning intervals will have to be determined from case to case.
- If dry type air filters are used, cleaning should only be carried out according to service indicator or service switch.
- Air cleaner servicing is needed when:
  - **Service indicator**
    red signal 1 is fully visible when engine is off.
  - **Service switch**
    yellow pilot light comes on when engine is running.
- pressing button on service indicator. Service indicator is now ready for operation again.

6.4.2 Emptying Cyclone-Type Precleaner

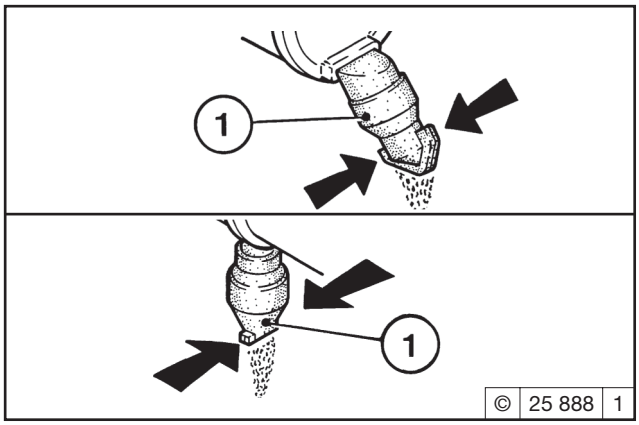


- Undo wing nut 1 and remove cover 2.
- Remove collector bowl 3 from lower section 4 and empty. Clean leaves, straw and other foreign matter from lower section of pre-cleaner.
- Reposition collector bowl 3 onto lower section 4, fasten cover 2 in place by tightening wing nut 1.

Never fill collector bowl with oil. Replace collector bowl if damaged.

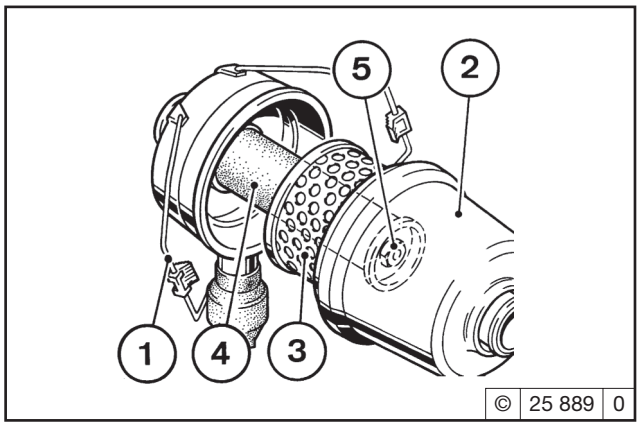
6.4.3 Dry Type Air Cleaner

Discharge Valve



- Empty dust discharge valve 1 by pressing apart lips of discharge slot as indicated by arrows.
- Clean discharge slot from time to time.
- Remove any caked dirt by pressing together upper section of valve.

Filter Cartridges

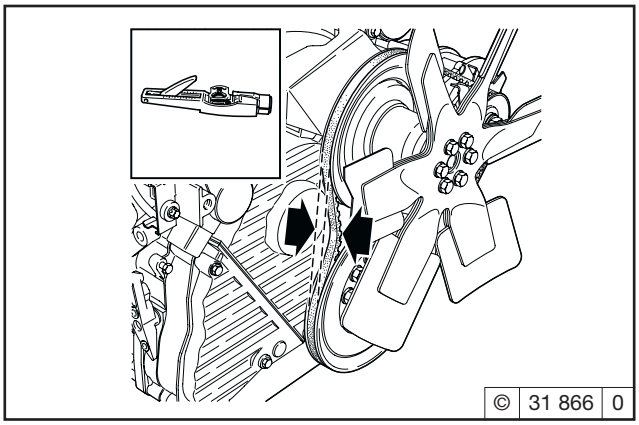


- Undo clip fasteners 1.
- Take off hood 2 and remove cartridge 3.
- Clean cartridge, replace at least once a year.
- Clean cartridge 3.
  Using dry compressed air (max. 5 bar), blow out from inside to outside (or in difficult cases, tap out, taking care not to damage cartridge, or wash according to manufacturer's instructions).
- Gaskets on filter cartridge can become damaged through regular removal and replacement. Check paper filter (light showing through) and gaskets for damage.
  Replace if necessary.
- After five cleaner services or after two years at latest, replace safety cartridge 4 (never clean).
  To do so:
  - Undo hex nut 5 and remove cartridge 4.
  - Install new cartridge, fit and tighten hex nut.
- Install cartridge 3, replace hood 2 and do up clip fasteners 1.

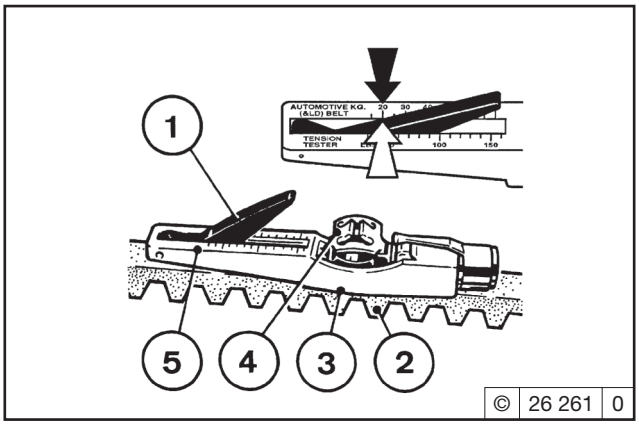
Never clean filter cartridge with petrol or hot fluids.

6.5 Belt Drives

6.5.1 Check V-belt



- Visually inspect entire V-belt for damage.
- Replace damaged V-belts.
- After installing new belts, run engine for 15 minutes, then check belt tension.
- To check tension of V-belt, use tension gauge (see 9.3).
  - Place indicator arm 1 into gauge.
  - Position guide 3 on V-belt 2, midway between pulleys, with stop against edge of belt.
  - Push slowly on black pad 4 at right angles to Vbelt 2 until spring is heard or felt to trigger.

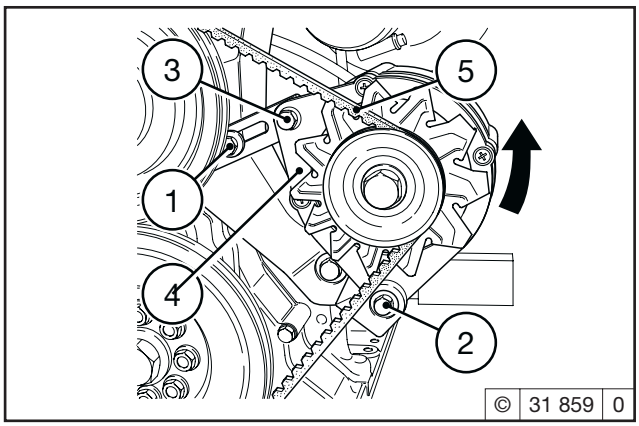


  - Carefully remove gauge without altering position of indicator arm 1.
  - Read off value where black indicator arm 1 intersects scale 5 (arrow). For settings, see 9.1.
  - If necessary, retension belt and measure again.

Check, tension and change belts only with engine off. Refit belt guard, if provided.

After installing new belts, run engine for 15 minutes, then check belt tension.

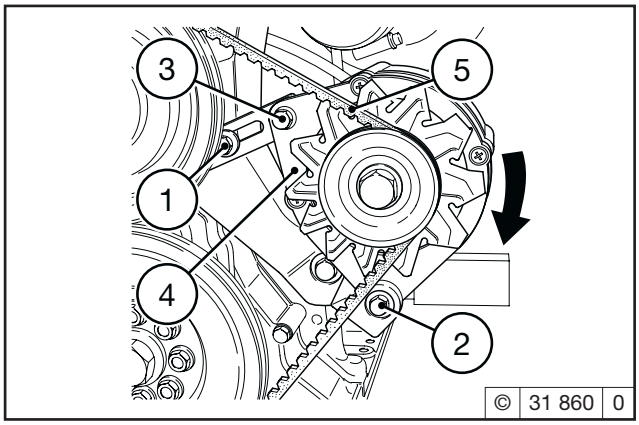
6.5.2 Tensioning Alternator Belts



- Slacken off bolts 1, 2 and 3.
- Adjust alternator 4 in direction of arrow by turning bolt 3 until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.

Check, tension and change belts only with engine off. Refit belt guard, if provided.

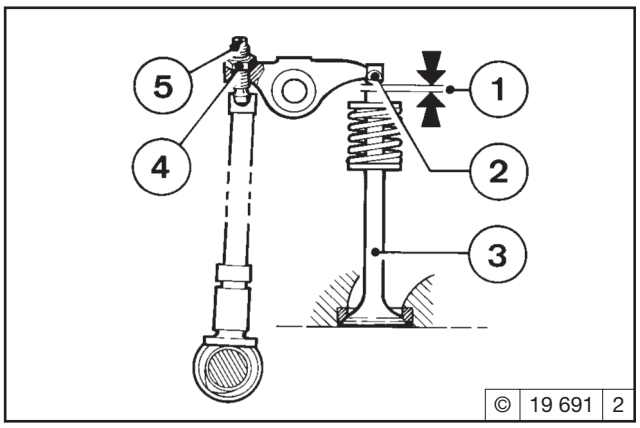
6.5.3 Changing Alternator Belts



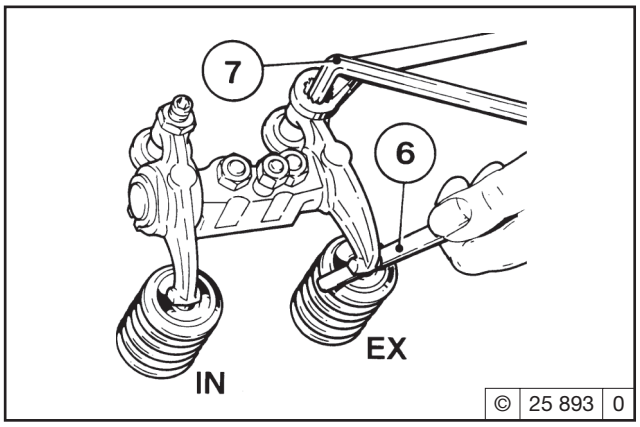
- Slacken off bolts 1, 2 and 3.
- Adjust alternator 4 in direction of arrow by turning bolt 3.
- Remove and replace belt.
- Adjust alternator 4 against direction of arrow by turning bolt 3, until correct belt tension is achieved.
- Retighten bolts 1, 2 and 3.

6.6 Adjustments

6.6.1 Check Valve Clearance, adjust if necessary

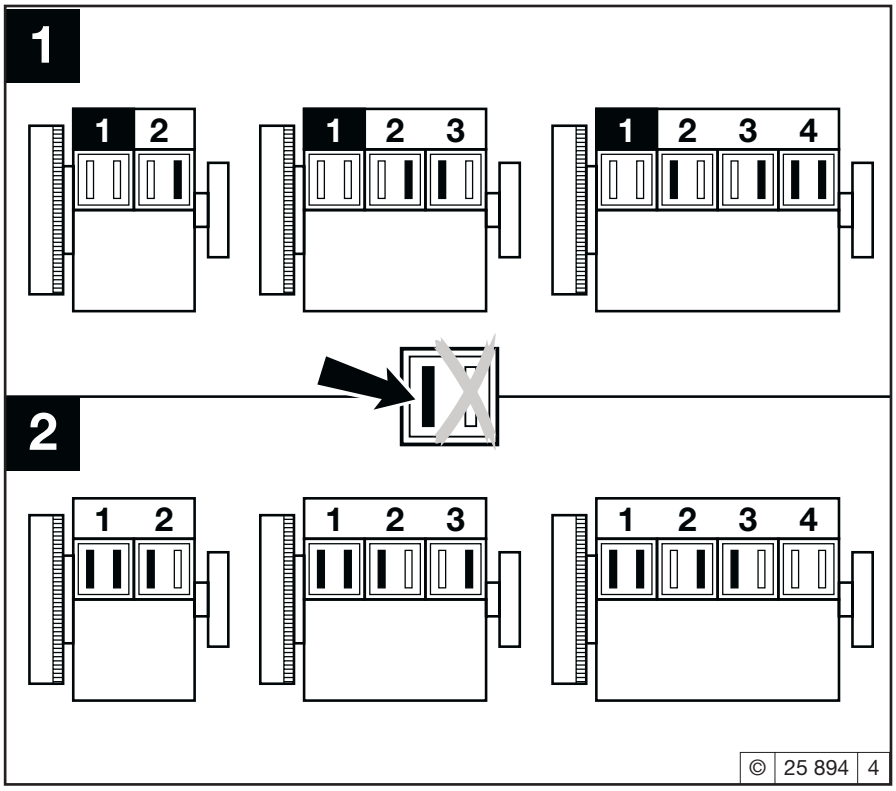


- Remove cylinder head cover.
- Position crankshaft as per schematic, see 6.6.1.1.
- Before adjusting valve clearance, allow engine to cool down for at least 30 minutes. Oil temperature should be below 80°C.
- Check valve clearance 1 between rocker arm / tappet contact face 2 and valve stem 3 with feeler gauge 6 (there should be only slight resistance when feeler blade is inserted).
  For permissible valve clearance, see 9.1.



- Adjust valve clearance if necessary:
  - Release locknut 4.
  - Use Allan key 7 to turn setscrew 5 so that correct clearance is attained after locknut 4 has been tightened.
- Check and adjust valve clearance on all cylinders.
- Reinstall cylinder head cover, with new gasket if necessary.

6.6.1.1 Valve Clearance Adjustments Schematic



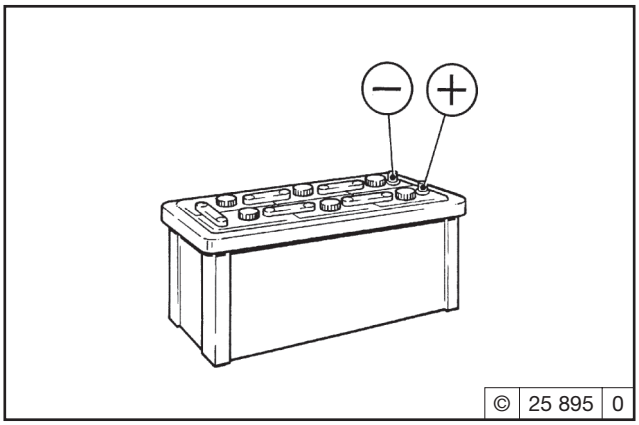
- **Crankshaft Position 1:**
  Turn crankshaft until both valves in cylinder 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valves **marked in black** on schematic. Mark respective rocker arm with chalk to show that adjustment has been carried out.

- **Crankshaft Position 2:**
  Turn crankshaft one full revolution (360°).
  Adjust clearance of valves **marked in black** on schematic.

6.7 Accessories

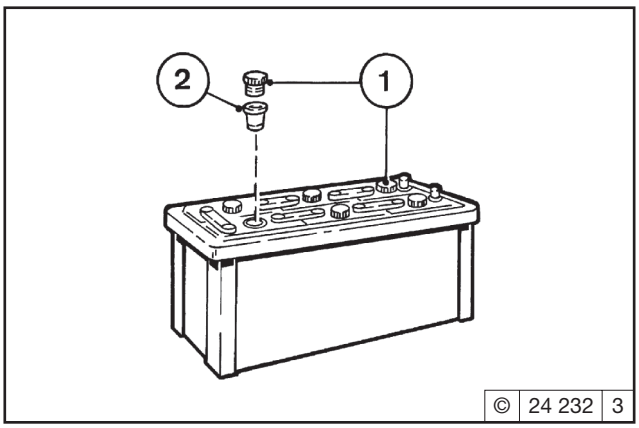
6.7.1 Battery

6.7.1.1 Check Battery and Cable Connectors



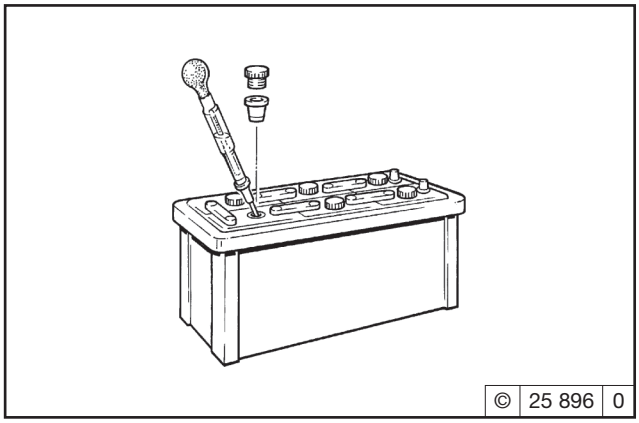
- Keep battery clean and dry.
- Undo dirty clamps.
- Clean terminal posts (+ and -) and clamps of battery, and grease with acid-free and acidresistant grease.
- When reassembling, ensure that clamps make good contact. Tighten clamp bolts hand-tight.

6.7.1.2 Check Electrolyte Level



- Remove sealing caps 1.
- If testers 2 are present:
  Electrolyte level should reach base of these.
- Without testers:
  Electrolyte level should be 10-15 mm above top of plates.
- If necessary, top up with distilled water.
- Screw sealing caps back in.

6.7.1.3 Check Electrolyte Density



- Measure electrolyte density of individual cells with commercial hydrometer.

  Hydrometer reading (see table on following page) indicates battery's state of charge. During measurement, temperature of electrolyte should preferably be +20°C.

Electrolyte density				
in [**kg/l**]		in [°**Bé** (Baumé scale)*]		**Charge status**
Normal	**Tropical**	**Normal**	**Tropical**	
1.28	1.23	32	27	well charged
1.20	1.12	24	16	semi-charged, re-charge
1.12	1.08	16	11	discharged, immediately charge

* Measurement of electrolyte density in °Bé (Baumé scale) is out of date and rarely used today.

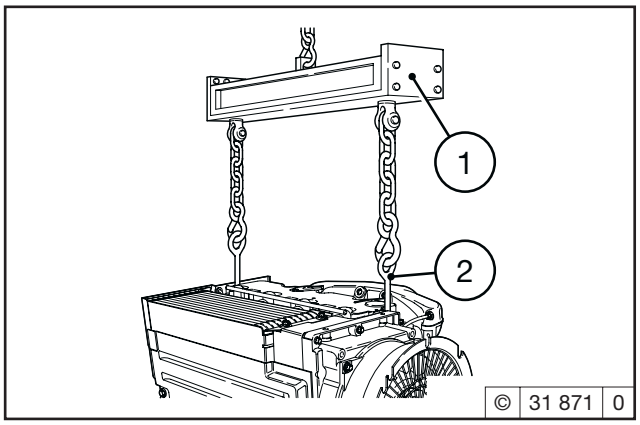
The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery!
Do not allow battery acid to come into contact with skin or clothing!
Wear protective goggles!
Do not rest tools on the battery!

6.7.2 Rotary Current Alternator

Notes on the three-phase system:

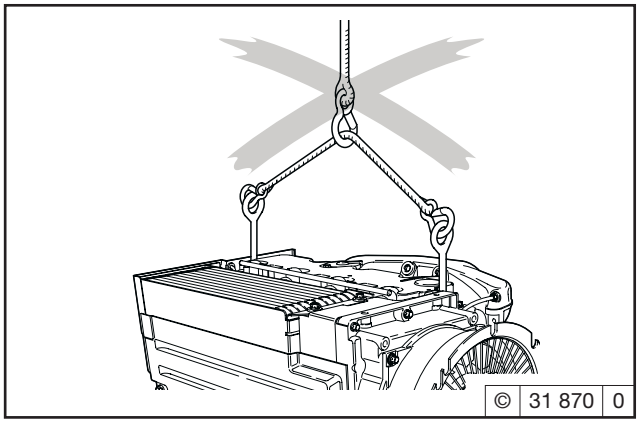
- Never disconnect cables between battery, alternator and regulator while engine is running.
- If, however, it is necessary to start and operate engine without battery, disconnect regulator from alternator before starting.
- Be sure not to confuse battery terminals.
- Replace defective charge pilot lamp bulb immediately.
- When washing engine, cover up alternator and regulator.
- Touching lead against frame to check whether it is live must not, under any circumstances, be carried out with three-phase electrical systems.
- In case of electric welding, connect ground terminal on welder directly to piece being welded.

6.7.3 Transportation Shackles



- Always use proper lifting tackle 1 when transporting engine.
- After transportation and before commissioning of engine: remove attachment eyes 2.

Use only correct lifting gear.



6.8 Engine Cleaning

6.8.1 Engine Cleaning

Preperation

- Switch off engine.
- Remove engine covers and cooling air hood. Replace them after cleaning and before test run.
- Cover electrical / electronic components and connections (e.g. alternator, starter, governor, solenoid).

Using compressed air

- Blow air through engine, taking particular care not to damage cooler and cooling fins (begin to blow through air from exhaust side).
  Remove dirt which has blown into interior space.

Using cold-cleaning compound

- Spray engine with commercial cold-cleaning compound and allow to react for approx. 10 mins.
- Spray-clean engine with strong water jet, repeat if necessary.
- Allow engine to run warm so that remaining water evaporates.

Using high-pressure device

- Clean engine with steam jet (max. spray pressure of 60 bar, max. steam temperature of 90°C).
- Allow engine to run warm so that remaining water evaporates.

Clean the engine only when the engine is switched off.

7. Faults, Causes and Remedies

7.1 Fault Table

- Faults are often caused by engine not being properly operated or maintained.
- Each time fault occurs, check whether all operating and servicing regulations have been complied with.
- Corresponding fault table can be found on adjacent page.
- If you cannot ascertain cause of a fault or cannot rectify fault, please contact DEUTZ SERVICE.

Faults										Measures	
Engine does not start or is difficult to start										Check	Ch
	Engine starts, but runs irregularly or fails									Adjust	A
		Engine becomes excessively hot. Temperature warning system responds								Replace	Rp
			Engine output is deficient							Clean	Cl
				Engine does not run on all cylinders						Top up	T
					Engine oil pressure is non-existent or excessively low					Reduce	Rd
						Engine oil consumption excessive					
							Engine smokes - blue				
								- white			
									- black		
										Cause	**Section**	
●										Not declutched (where possible)	Engine Operation	**Ch**
●								●		Below starting limit temperature		**Ch**
		●			●					Oil level too low		**T**
		●	●			●	●			Oil level too high		**Ch**
					●	●	●			Excessive inclination of engine		**Rd**
●					●					Incorrect lube oil SAE class or quality	Operating media	**Rp**
●	●		●					●		Fuel quality not as per operating manual		**Rp**
		●	●						●	Air cleaner clogged / turbocharger defective	Combustion air	**Ch / Rp**
		●	●						●	Air cleaner service switch / indicator defective		**Ch / Rp**
									●	CPD * defective		**Ch**
			●						●	Charge air line leaking		**Ch**
		●								Oil cooler panels clogged		**Ch / Cl**
		●								Cooling fan defective, split or loose V-belt	Cooling system	**Ch / Rp**
		●								Cooling air temperature rise / heating short circuit		**Ch**
		●								Resistance in cooling system too great / through-flow quantity too small		**Ch**
●										Battery defective or discharged	Electrics	**Ch / T**
●										Electric cable connections to starter electrical system loose or oxidised		**Ch**
●										Starter defective or pinion does not engage		**Ch**
●										Solenoid defective (release switch)		**Ch**
●	●		●					●	●	Incorrect valve clearance	Engine	**A**
	●		●	●						Injection line leaks		**Ch**
●	●	●	●	●				●	●	Injection valve defective		**Ch / Rp**

* **CPD** = Charge pressure-dependent full-load stop

8. Engine Preservation

8.1 Preservation

If the engine is to remain idle for an extended period of time, it is necessary to take protective measures to prevent rusting. The preservative measures described here will protect the engine for up to 6 months.
The procedure will have to be reversed before the engine is recommissioned.

- Anti-corrosion oils to specification:
  MIL-L-21260B
  TL 9150-037/2
  Nato Code C 640 / 642
- Anti-corrosion media for exterior protection only to specification:
  Nato Code C 632
- Recommended cleaning agent to remove preservatives:
  Petroleum benzine
  (hazardous materials class A3)

8.1.1 Preserving Engine

- Clean engine using high-pressure equipment (or with cold-cleansing agent in emergency).
- Run engine until warm, then turn off.
- Drain engine oil (see 6.1.2) and fill with anticorrosion oil.
- If necessary, clean oil bath cleaner (see 6.4.3) and fill with anti-corrosion oil.
- Drain fuel tank.
- Make up a mixture of 90% diesel fuel and 10% anti-corrosion oil, and refill fuel tank.
- Allow engine to run for approx. 10 mins.
- Switch off engine.
- Turn engine over manually several times to preserve cylinders and combustion chamber.
- Remove V-belts and store in wrapped condition.
- Spray grooves on V-belt pulleys with anti-corrosion spray.
- Close intake ports and exhaust ports.

8.1.2 Removing Engine Preservatives

- Remove anti-corrosion agent from grooves in V-belt pulleys.
- Install V-belt, retension after brief operation if necessary, see 6.5.
- Remove covers from intake port and exhaust port.
- Commission engine, see also 5.1, note 2.

9. Technical Specification

9.1 Engine Specifications and Settings
9.2 Torque Wrench Settings
9.3 Tools

9.1 Engine Specifications and Settings

Model		F2L 2011	F3L 2011	F4L 2011
Number of cylinders		2	3	4
Cylinder arrangement			vertical in line	
Bore	[mm]		94	
Stroke	[mm]		112	
Total displacement	[cm^3]	1554	2331	3108
Compression ratio	[ε]		19	
Working cycle			4-stroke diesel engine	
Combustion system			Naturally aspirated engine with direct injection	
Direction of rotation			On left when looking at flywheel	
Weight incl. integral cooling system to DIN 70020-A				
(without starter, with alternator)	approx. [kg]	175	217	256
Engine output	[kW (hp)]		1)	
Speed	[rpm]		1)	
Lubrication			Pressure lubrication	
SAE oil			20 W 20	
Maximum oil temperature in oil pan	[°C]		130	
Min. oil pressure in warm condition, oil temperature 110°C				
at: 900 rpm (low idling speed)	[bar]		1.4 3)	
1800 rpm	[bar]		2.2 3)	
max. 2800 rpm	[bar]		3 3)	
Oil change quantity (oil pan) approx.	[l]	6 2)	5.5 2)	10 2)
Oil change quantity with filter (standard 0.5 l)	approx. (l)	6.5 2)	6 2)	10.5 2)
Valve clearance with cold engine				
(Engine cooling time at least 30 min.: oil temperature should be below 80°C	[mm]		Inlet 0.3 +0.1 / Exhaust 0.5 +0.1	
Start of feed	[°crankshaft BTDC]		1)	
Injector opening pressure: vehicle/unit	[bar]		210 +8	
Firing order of engine		1 - 2	1 - 2 - 3	1 - 3 - 4 - 2
V-belt tension: pretension / retension (after engine has been running under load for 15 mins)	[N]		450 / 350 ±20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1.
2) Approx. values can vary depending on sump and/or cooler design (external cooling system). **Upper oil dipstick mark is always authoritative.**
3) Values for engines without engine oil heating.

Model

		BF3L 2011	BF4L 2011
Number of cylinders		3	4
Cylinder arrangement		vertical in line	
Bore	[mm]	94	
Stroke	[mm]	112	
Total displacement	[cm^3]	2331	3108
Compression ratio	[ε]	17.5	
Working cycle / Combustion system		Four-stroke diesel with turbocharging and direct fuel injection	
Direction of rotation		On left when looking at flywheel	
Weight without cooling system			
Weight without starter, with alternator as per DIN 70020-A approx.	approx. [kg]	222	257
Engine output	[kW (hp)]	1)	
Speed	[rpm]	1)	
Lubrication		Pressure lubrication	
SAE oil		20 W 20	
Maximum oil temperature in oil pan	[°C]	130	
at: 900 rpm (low idling speed)	[bar]	1.4 3)	
1800 rpm	[bar]	2.2 3)	
max. 2800 rpm	[bar]	3 3)	
Oil change quantity (oil pan without cooling system) ca.	[l]	7.5	10 2)
Oil change quantity with filter (standard 0.5 l)	approx. (l)	8	10.5 2)
Valve clearance with cold engine			
(Engine cooling time at least 30 min.: oil temperature should be below 80°C	[mm]	Inlet 0.3 $^{+0.1}$ / Exhaust 0.5 $^{+0.1}$	
Injector opening pressure: vehicle/unit	[bar]	210 $^{+8}$	
Start of feed	[°crankshaft BTDC]	1)	
Firing order of engine		1 - 2 - 3	1 - 3 - 4 - 2
V-belt tension: pretension / retension (after engine has been running under load for 15 mins)	[N]	450 / 350 ±20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1.
2) Approx. values can vary depending on sump and/or cooler design (external cooling system). **Upper oil dipstick mark is always authoritative.**
3) Values for engines without engine oil heating.

Model

		F2M 2011	F3M 2011	F4M 2011
Number of cylinders		2	3	4
Cylinder arrangement			vertical in line	
Bore	[mm]		94	
Stroke	[mm]		112	
Total displacement	[cm^3]	1554	2331	3108
Compression ratio	[ε]		19	
Working cycle			4-stroke diesel engine	
Combustion system			Naturally aspirated engine with direct injection	
Direction of rotation			On left when looking at flywheel	
Weight without cooling system			Refer to head-office	
(without starter, with alternator) approx.	approx. [kg]	169	210	248
Engine output	[kW (hp)]		1)	
Speed	[rpm]		1)	
Lubrication			Pressure lubrication	
SAE oil			20 W 20	
Maximum oil temperature in oil pan	[°C]		130	
Min. oil pressure in warm condition, oil temperature 110°C				
at: 900 rpm (low idling speed)	[bar]		1.4 3)	
1800 rpm	[bar]		2.2 3)	
max. 2800 rpm	[bar]		3 3)	
Engine with Thermostat				
Oil change quantity without external cooler (see 3.1.1.2)/without filter approx.	[l]	5.5 2)		10 2)
Oil change quantity without external cooler (see 3.1.1.2) + filter replacement (standard 0.5 litre) approx		6 2)		10.5 2)
Genset Engine without Thermostat:				
Oil change quantity including external cooler (see 3.1.1.3)/without filter approx.	[l]	8.5 2)		13 2)
Oil change quantity including cooler (see 3.1.1.3) + filter replacement (standard 0.5 litre) approx.		9 2)		13.5 2)
Valve clearance with cold engine				
(Engine cooling time at least 30 min.: oil temperature should be below 80°C	[mm]		Inlet 0.3 +0.1 / Exhaust 0.5 +0.1	
Start of feed	[°crankshaft BTDC]		1)	
Injector opening pressure: vehicle/unit	[bar]		210 +8	
Firing order of engine		1 - 2	1 - 2 - 3	1 - 3 - 4 - 2
V-belt tension: pretension / retension (after engine has been running under load for 15 mins)	[N]		450 / 350 ±20	

1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1.
2) Approx. values can vary depending on sump and/or cooler design (external cooling system). **Upper oil dipstick mark is always authoritative.**
3) Values for engines without engine oil heating.

Model

		BF3M 2011	BF4M 2011
Number of cylinders		3	4
Cylinder arrangement		vertical in line	
Bore	[mm]	94	
Stroke	[mm]	112	
Total displacement	[cm^3]	2331	3108
Compression ratio	[ε]	17.5	
Working cycle		4-stroke diesel engine	
Combustion system		Turbocharging and direct injection	
Direction of rotation		On left when looking at flywheel	
Weight without cooling system		Refer to head-office	
(without starter, with alternator) approx.	approx. [kg]	215	250
Engine output	[kW (hp)]	1)	
Speed	[rpm]	1)	
Lubrication		Pressure lubrication	
SAE oil		20 W 20	
Maximum oil temperature in oil pan	[°C]	130	
Min. oil pressure in warm condition, oil temperature 110°C			
at: 900 rpm (low idling speed)	[bar]	1.4 3)	
1800 rpm	[bar]	2.2 3)	
max. 2800 rpm	[bar]	3 3)	
Engine with Thermostat			
Oil change quantity without external cooler (see 3.1.1.2)/without filter approx.	[l]	7.5 2)	10 2)
Oil change quantity without external cooler (see 3.1.1.2) + filter replacement (standard 0.5 litre) approx		8 2)	10.5 2)
Genset Engine without Thermostat:			
Oil change quantity including external cooler (see 3.1.1.3)/without filter approx.	[l]	11 2)	13.5 2)
Oil change quantity including cooler (see 3.1.1.3) + filter replacement (standard 0.5 litre) approx.		11.5 2)	14 2)
Valve clearance with cold engine			
(Engine cooling time at least 30 min.: oil temperature should be below 80°C	[mm]	Inlet 0.3 +0.1 / Exhaust 0.5 +0.1	
Start of feed	[°crankshaft BTDC]	1)	
Injector opening pressure: vehicle/unit	[bar]	210 +8	
Firing order of engine		1 - 2 - 3	1 - 3 - 4 - 2
V-belt tension: pretension / retension (after engine has been running under load for 15 mins)	[N]	450 / 350 ±20	

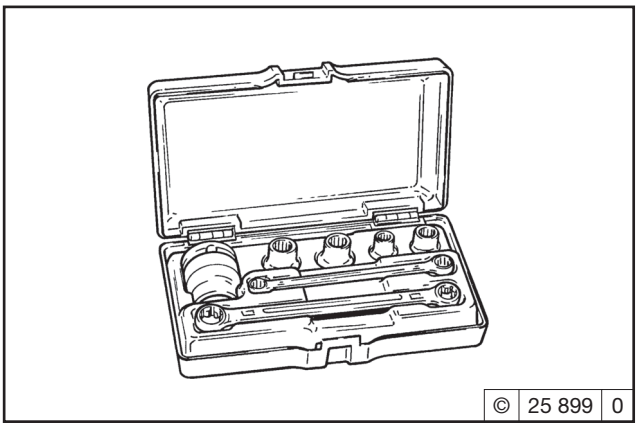
1) Engine power, speed, start of delivery are stamped on engine rating plate, see also 2.1.
2) Approx. values can vary depending on sump and/or cooler design (external cooling system). **Upper oil dipstick mark is always authoritative.**
3) Values for engines without engine oil heating.

9.2 Torque Wrench Settings

Installation location	Pre-tension [Nm]			Re-tension [Nm]				Total	Comments
	1st stage	2nd stage	3rd stage	1st stage	2nd stage	3rd stage	4th stage	[Nm]	
Cylinder head cover								8.5	
Cylinder head cover								8.5	
Rocker arm adjustment screw								21	
Intake manifold								8.5	
Foot Rigid suspension	30			45					
Foot Elastic suspension								106	
Air intake pipe								21	
Exhaust manifold								22	
Oil drain plug								55	
Oil pan (sheet metal)								21	
Oil pan (cast)								31	
Injection line attachment								30	
Injection valve attachment								21	TORX
Lube oil filter cartridge								27	on engine or separate
Threaded pipe union								4	

9.3 Tools

TORX



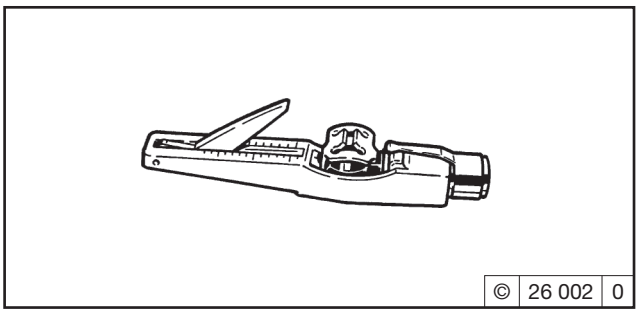
A TORX BN. 8189 screw set is used with engines in the 1011 series.
This system was chosen because of the many advantages it offers:

- Outstanding accessibility to bolts.
- High load transfer when loosening and tightening.
- Almost impossible for socket to slide off or break, thereby practically ruling out risk of injury.

TORX tools can be ordered from:

FA.WILBÄR
Postfach 14 05 80
D-42826 Remscheid

V-belt tension gauge



The V-belt tension gauge can be obtained under order number **8115** from:

FA.WILBÄR
Postfach 14 05 80
D-42826 Remscheid

10. Service

Knowing it's DEUTZ

DEUTZ has always stood for excellence in motor construction, pioneering many developments in the industry. As an independent motor manufacturer, we offer — worldwide — a comprehensive range of diesel and gas motors spanning from 4kW to 7,400kW. Our products are perfectly tailored to meet our customers' individual requirements.

Over 1.4 million DEUTZ motors do their job reliably all over the world. We are determined to preserve the high standard of performance and dependability of our motors, thus keeping our customers satisfied at all times. Therefore we are represented worldwide through a network of highly competent service partners who will meet the needs of our customers, wherever they are.

This is why DEUTZ is not only the name for motors which pack a lot of inventive genius. DEUTZ also means reliable service and comprehensive support to enhance your motor's performance.

This index Sales & Service offers you an overview of the DEUTZ partners in your vicinity, including the products for which they are responsible and the range of services provided. But even when no direct product responsibility is mentioned, your DEUTZ partner will be happy to help you with expert advice.

The Index is constantly updated. Please ask your DEUTZ service partner for the latest edition.

DEUTZ AG - at your service.

Obtainable from the local service Partner reponsible for you or from:

DEUTZ AG

Deutz-Mülheimer Str. 147-149
D-51057 Köln

Phone: 0049-221-822-0
Telefax: 0049-221-822-5304
Telex: 8812-0 khd d
http://www.deutz.de

Order-No.: 0297 7444

Order-No.: 0297 7445 (CD-ROM)

SECTION 19
TABLES AND ENCLOSURES

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19.0 TORQUE WRENCH SETTINGS

D x p	Torque wrench setting (Nm)			
	4.8	**8.8**	**10.9**	**12.9**
M 4 x 0,7	1.2	2.3	3.2	3.9
M 5 x 0,8	2.3	4.5	6.3	7.5
M 6 x 1	3.9	7.7	10.8	12.10
M 8 x 1,25	9.1	18.2	25.6	30.7
M 8 x 1	9.6	19.2	26.8	32.4
M 10 x 1,5	18.6	36.10	54.10	62.5
M 10 x 1,25	19.4	38.7	54.4	65.3
M 12 x 1,75	31.3	62.6	87.8	105.6
M 12 x 1,25	**33.5**	**66.9**	**93.8**	**112.10**
M 14 x 2	49.8	99.7	140.3	168.3
M 14 x 1,5	52.9	105.6	149.1	178.6
M 16 x 2	75.3	151.3	212.6	255.4
M 16 x 1.5	78.10	157.10	222.9	267.2
M 18 x 2,5	104.8	208.9	293.8	352.8
M 18 x 1,5	113.7	227.3	320.3	383.8
M 20 x 2,5	147.6	295.2	414.8	497.4
M 20 x 1,5	159.4	318.1	447.10	537.3
M 22 x 2,5	196.3	392.7	552.1	661.10
M 22 x 1,5	211.1	421.4	592.7	711.5
M 24 x 3	254.6	509.10	716.6	863.5
M 24 x 2	269.4	539.5	760.2	907.8
M 27 x 3	372.7	745.4	1047.10	1254.6
M 27 x 2	394.1	789.7	1107	1328.4
M 30 x 3,5	506.3	1011.1	1424.4	1704.8
M 30 x 2	544.7	1092.3	1535.1	1837.7

ATTENTION

Sensor maximum driving torque: 15 Nm.

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19.1 PRESSURE SETTING

Transmission

Min. 725 PSI - 1100 RPM
Max. 6230 PSI - 2500 RPM

Distributor Valve
3500 PSI

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19.2 SPECIAL TOOL LIST

SPECIAL TOOLS LIST

TX51-19MD Light Capability Rough Terrain Forklift
Contract M67854-00-C-3014

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
Hydraulic Cylinders - USAG					
Cylinder disassembly & assembly	USAG 282T SN/50/80 Wrench / 4.5mm Dia. Pin				
Cylinder disassembly & assembly	USAG 281C/215 Wrench / 6mm Dia. Pins				

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
Fork Carriage Assembly - Terex Corporation					
Rotation nut on fork carriage	Fork Rotation nut wrench	3221N8			

SPECIAL TOOLS LIST

TX51-19MD Light Capability Rough Terrain Forklift
Contract M67854-00-C-3014

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
Diesel Engine - DEUTZ Engine Company					
Crankshaft & Flywheel	Drive Handle		21825639	MS.550	Churchill/Kent Moore
Crankshaft & Flywheel	Front crank seal replacer		21825577	PD.170	Churchill/Kent Moore
Crankshaft & Flywheel	Rear oil seal replacer Tool (use with 21825639)		27610021	PD.255	Churchill/Kent Moore
Crankshaft & Flywheel	Front crank seal replacer		21825577	PD.170	Churchill/Kent Moore
Crankshaft & Flywheel	Adapter, main tool to crankshaft nose (use with 21825577)		27610026	PD.259	Churchill/Kent Moore
Crankshaft & Flywheel	Adapter for front oil seal (use with 21825577)		27610027	PD.260	Churchill/Kent Moore
Cylinder Block & Crankcase	Rubber strip seal installer		27610013		
Cylinder Head	Adapter for valve spring compressor (used with 21825666)				
Fuel System	Kit, governor arm lock, Clamp Tool		27610018	PD.254	Churchill/Kent Moore
Fuel System	Rack position Tool (use with 27610018)		27610089		
Timing Tools	Idler gear hub replacer (use with 21825639)		27610022	PD.256	Churchill/Kent Moore
Timing Tools	Adapter, Remover Idler gear hub (use with 21825589)		27610025	PD.258	Churchill/Kent Moore

SPECIAL TOOLS LIST

TX51-19MD Light Capability Rough Terrain Forklift
Contract M67854-00-C-3014

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
Front & Rear Axles - Carraro **Front & Rear Axle**					
Differential support cups bearing	Differential support cups bearing driver - 27349		119068		
Front Axle Only					
	Carraro Part # tool is used with				
false pinion	false pinion-124897		715450		
bushing for conic distance measurement	bushing for conic distance measurement		119205		
shaft	shaft		119206		
pinion bearing	Driver for pinion bearing-27349		715082		
ring nut	ring nut wrench-118445		715080		
locking pinion	locking pinion wrench-126441		715081		
differential housing bearing	driver for differential housing bearing-27308		715083		
ring nut	ring nut wrench-107400		119030		
axle beam bushing	driver for axle beam bushing-124615		119220		
battitoio per rotula sferica su trave assale	battitoio per rotula sferica su trave assale- 27692		715451		
spheric bearing	driver for spheric bearing-118504		715454		
bushing	driver for bushing-126398		715453		

SPECIAL TOOLS LIST

TX51-19MD Light Capability Rough Terrain Forklift
Contract M67854-00-C-3014

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
oil seal	driver for oil seal-125390		119097		
swivel housing bushing	driver for swivel housing bushing-127684		715166		
swivel housing oil seal	driver for swivel housing oil seal-134293		715085		
wheel hub oil seal	driver for wheel hub oil seal-139279		715099		
wheel hub oil sea	driver for wheel hub oil seal-127994		715086		
brake housing ring	driver for brake housing ring-25144		119102		
bearings	driver for bearings-25741/ 25820		715403		
transmission housing bearing	driver for transmission housing bearing- 25742		715028		
transmission housing bearing	driver for transmission housing bearing- 25743		715445		
oil seal	driver for oil seal-141045		715298		
	interchangeable handler		119033		
Rear Axle Only					
false pinion	false pinion-126441		715450		
conic distance measurement	bushing for conic distance measurement		119205		
shaft	shaft		119206		
pinion bearing	driver for pinion bearing-27349		715082		

SPECIAL TOOLS LIST

TX51-19MD Light Capability Rough Terrain Forklift
Contract M67854-00-C-3014

Where Used & OEM Name	Tool Description	Terex Tool Part Nbr.	OEM Tool Part Nbr.	Other Supplier	
				Tool Part Nbr.	Name
ring nut	ring nut wrench-118445		715080		
locking pinion	locking pinion wrench-126441		715081		
differential housing bearing	driver for differential housing bearing-27308		715083		
ring nut	ring nut wrench-118445		119030		
oil seal	driver for oil seal-139420		715165		
bushing	driver for bushing-124615		119220		
spheric bearing	driver for spheric bearing-27692		715451		
bushing	driver for bushing-118504		715454		
oil seal	driver for oil seal-126398		715453		
swivel housing bushing	driver for swivel housing bushing-125390		119097		
swivel housing oil seal	driver for swivel housing oil seal-127684		715166		
wheel hub bearings	driver for wheel hub bearings-118378		715085		
wheel hub oil seal	driver for wheel hub oil seal-139279		715099		
wheel hub oil seal	driver for wheel hub oil seal-127994		715086		
pivot oil seal	driver for pivot oil seal-25124		715140		
pivot bushing	driver for pivot bushing-119926		119083		
	interchangeable handler		119033		

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SECTION 20
3B6 Technologies LMI System

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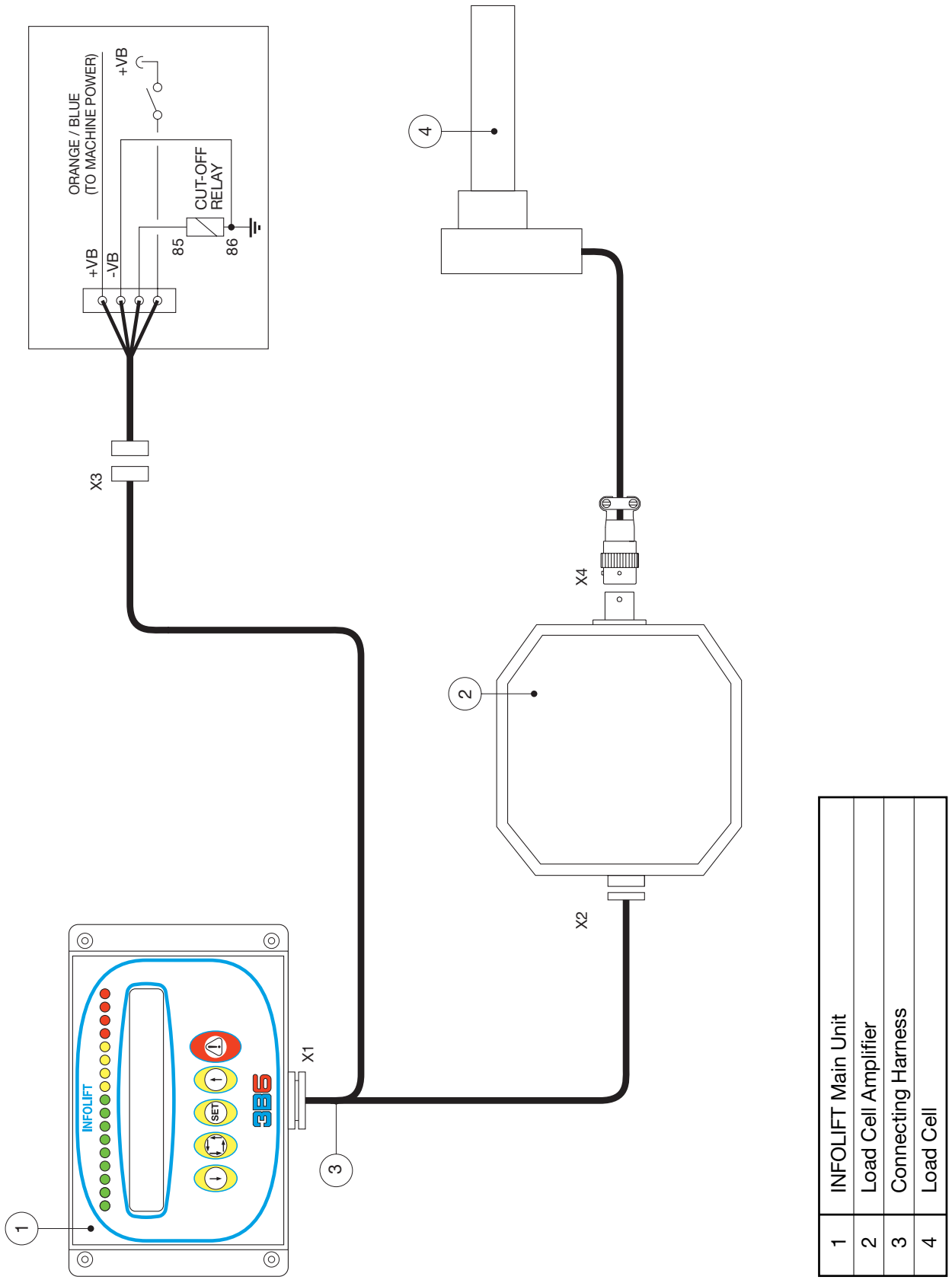
3B6 LOAD MOMENT INDICATOR (LMI)
TX 51-19MD USMC TELEHANDLER

USER AND ACCURACY VERIFICATION MANUAL

CE

Complies to the MACHINES DIRECTIVE Standards: EN60204-1, EN954, EN12077-2
EMC according to the " Heavy Industrial Environment" category: EN50081-2, EN50082-2

20.1 SYSTEM LAY-OUT AND CONNECTIONS



1	INFOLIFT Main Unit
2	Load Cell Amplifier
3	Connecting Harness
4	Load Cell

20.2 COMPONENTS LOCATION ON THE MACHINE

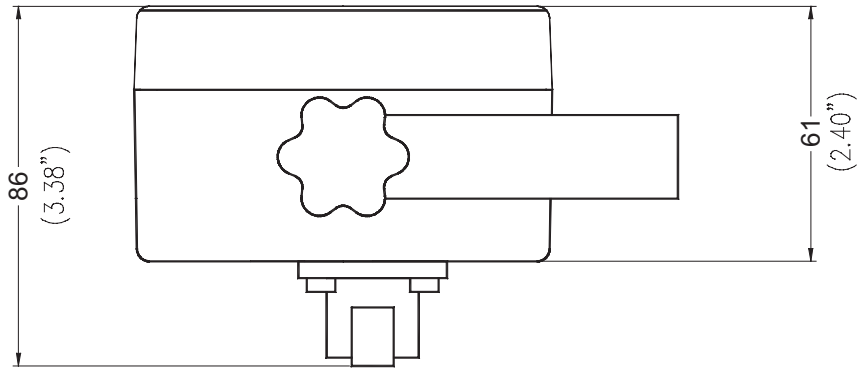
20.3 INFOLIFT MAIN UNIT: CHARACTERISTICS

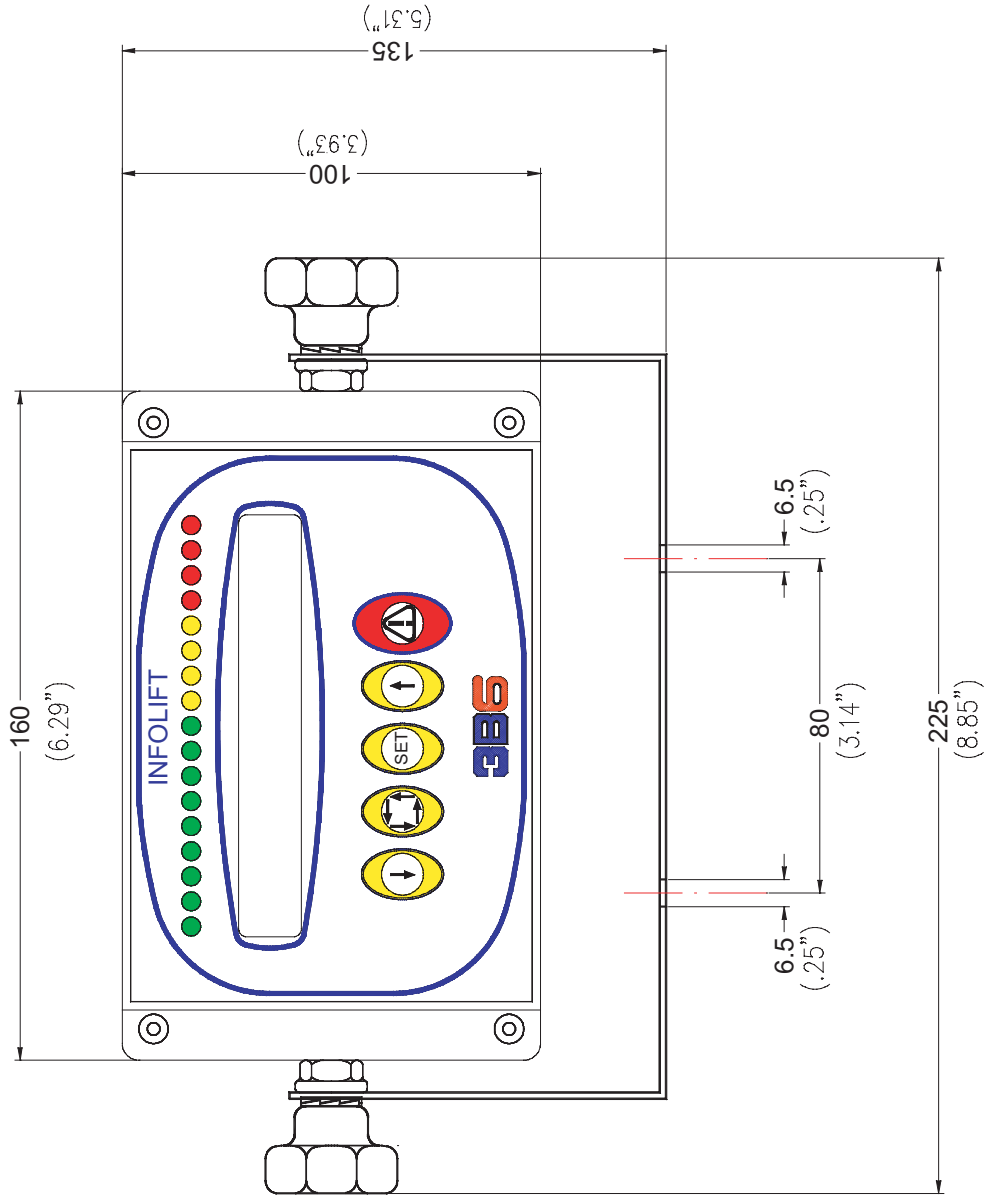
This compact size unit has been designed for Boom data displaying and Programmable lifting limits control. Limit detection cause the activation of an audible alarm as well as the warning relay switch-off.
A separate circuit is also included for hoist limit switch function.

- LCD alphanumerical back-lit display, 16 characters, 9.6mm (.37”) height.
- Limit load percentage 20 LED’s bar (extended version)
- 4 push buttons, for limit setting, buzzer enable/ disable, test activation and set-up functions
- Red alarm lamp
- Power supply: 10 to 30 V, protected against short circuits and polarity reverse.
- 2 digital inputs to select limits sets.
- 2 output relays, for shut-Off (alarm) relay, and auxiliary (warning) relay.
- Extensions: 2 Analog Inputs, 4 Digital Inputs, Can Bus Interface.
- Full EMC “Heavy Duty” compliance
- Environmental: suitable to work in Harsh Environments.
- Proofing: IP 65; PCB’s coated with thermoplastic varnish
- Dimension: 160 x 100 x 60 mm (6.29” x 3.93” x 2.36”) housing
- System supervision:

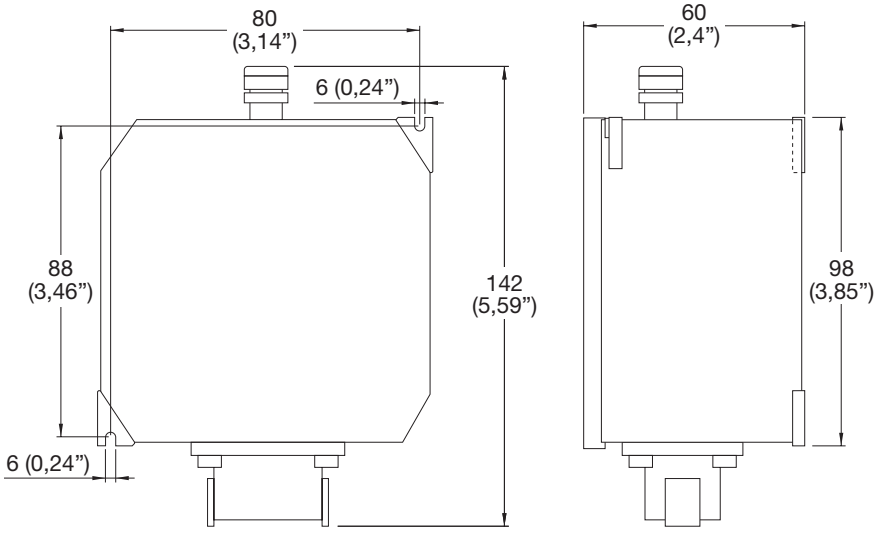
  FLASH ROM and EEPROM power on test, supply voltage, sensor integrity, relay status checks, dynamic “Emergency” Output.

20.4 INFOLIFT MAIN UNIT: DIMENSIONS





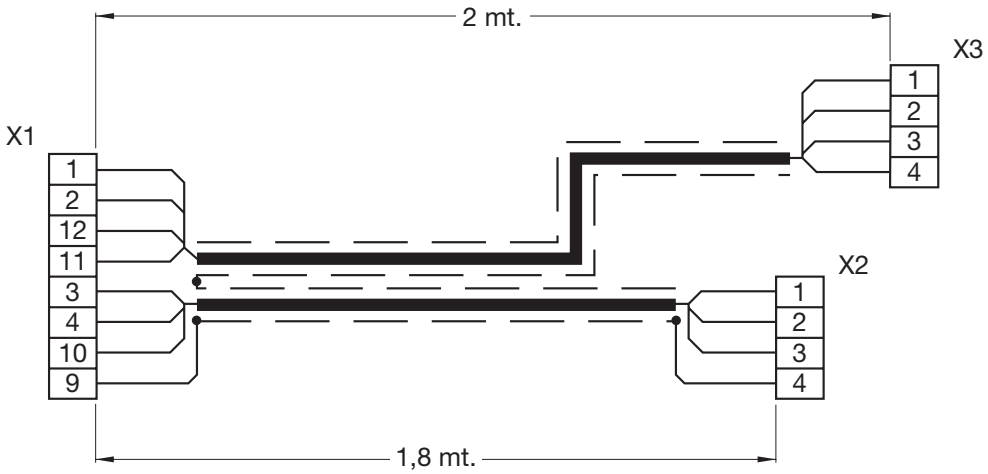
20.5 LOAD CELL AMPLIFIER : DIMENSIONS, CHARACTERISTICS, CABLE



CHARACTERISTICS

- Power Supply: 10-30 Vdc (from battery)
- Working Temperature: -20 ÷ +70°C (-4°F÷158°F)
- Input Voltage: 0 ÷ 20mV
- Output Voltage: 0,5 ÷ 4,5V
- Proofing: IP 65

CABLE



CONN. X1		
PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	GREEN	CUT-OFF
3	BROWN	+VB
4	GREEN	AIN1
9	YELL/GREEN	SHLD
10	WHITE	AGND
11	YELLOW	INP1
12	WHITE	-VB

CONN. X2		
PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	WHITE	AGND
3	GREEN	AIN1
4	YELL/GREEN	SHLD

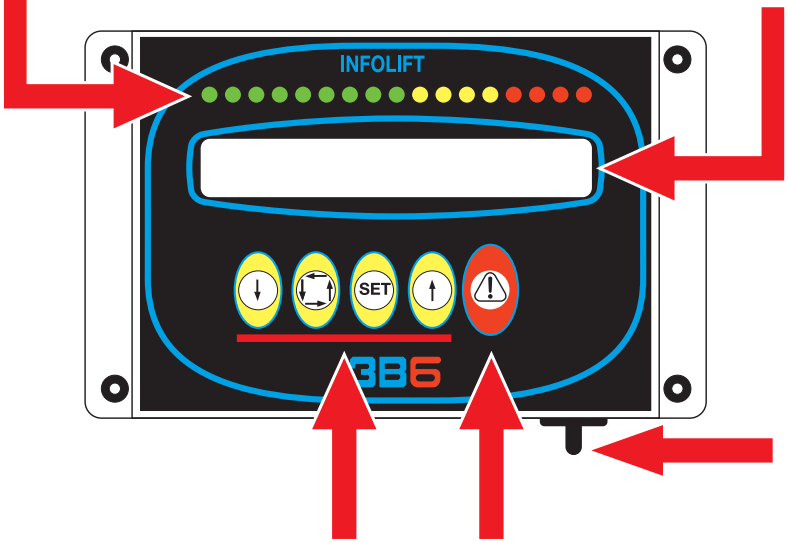
CONN. X3		
PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	WHITE	-VB
3	GREEN	CUT-OFF
4	YELLOW	INP1

20.6 CONTROL PANEL DESCRIPTION

Green/Amber/Red Leds bar to show current load percentage (SWL) (Safety/ Alarm/Shut down)
Load percentage Led Activated Conditions

- 0% < 90 % Green Normal Operating area
- 90% to 100% Yellow Pre-warning area
- > 100 % Red Overload area

16 character alphanumeric display for working messages and accuracy verification menu.
The list of all messages is shown in following pages.



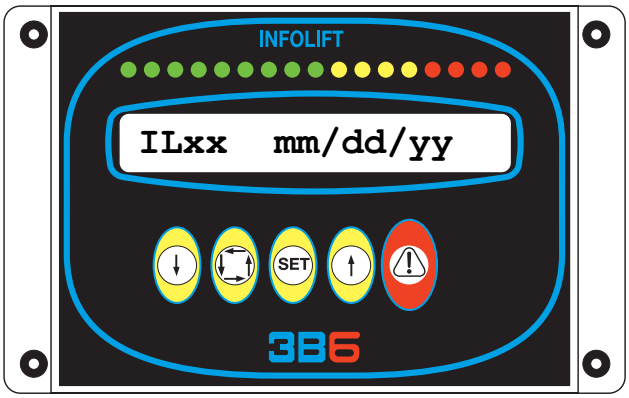
Dimmer

4 Set-up Pushbuttons
(not used in normal working condition)

Alarm red lamp and red pushbutton.
Blinking if alarms are detected.
Press and hold the red button to override the shut-off output.

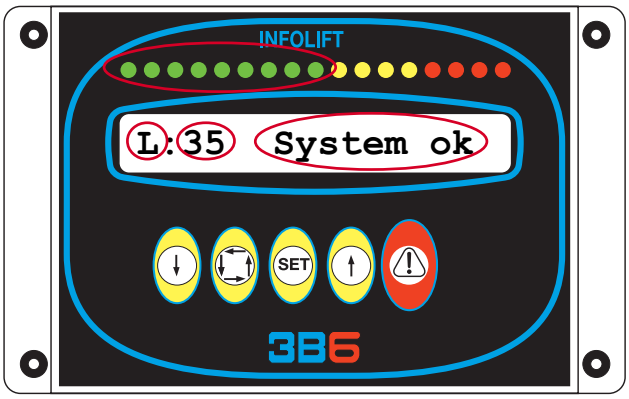
20.7 DISPLAY INFORMATION: WORKING MESSAGES

The following table shows the messages list in operative conditions.



This page appears for a few seconds during the **POWER-ON SEQUENCE** and shows **software version and date of issue.**

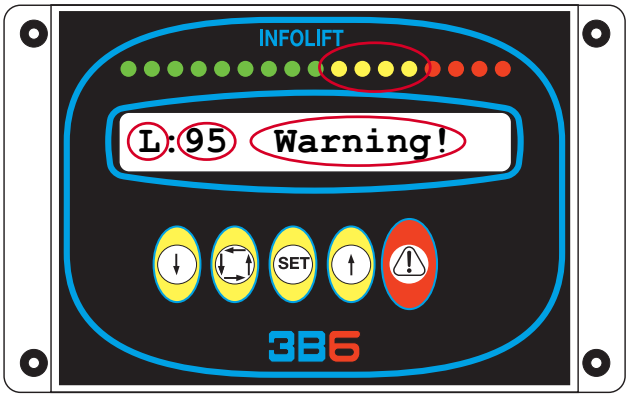
Meanwhile system is performing a self-test check.



System works properly in **SAFE WORKING CONDITION**
Load percentage is less than 90 %.

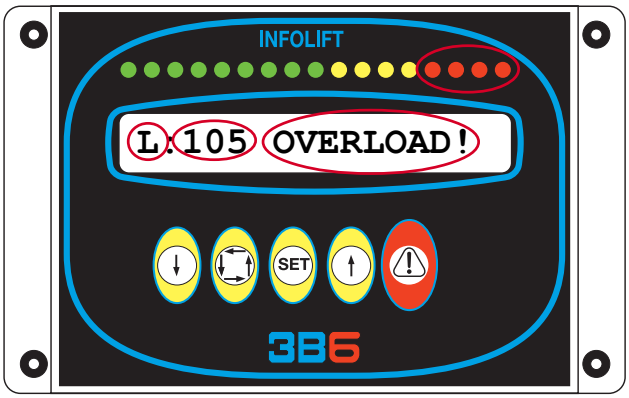
Green leds are ON and Buzzer is OFF.

The "**L: xx**" on the left **is the current load percentage.**



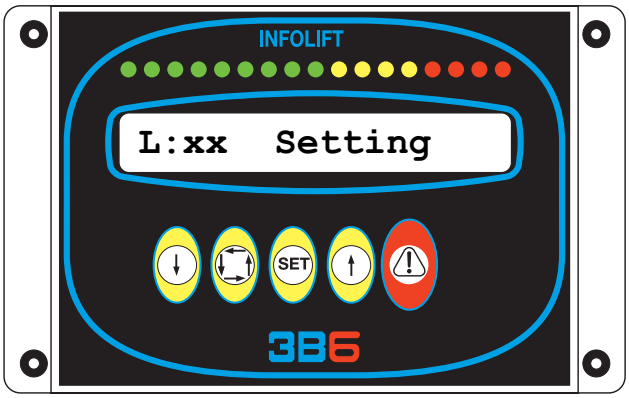
System works in the **PRE-WARNING** condition
Load percentage is from 90 % and 100%.

Yellow leds are ON and Buzzer is beeping.

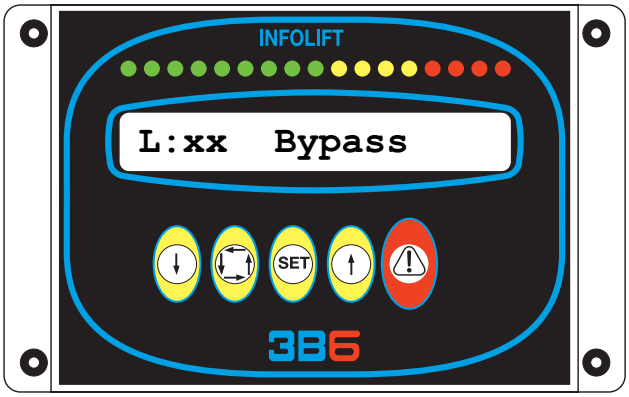


System is in overload **SHUT-OFF** condition
Load percentage is greater than 100 %.

Red leds are ON and Buzzer beeps continuously.

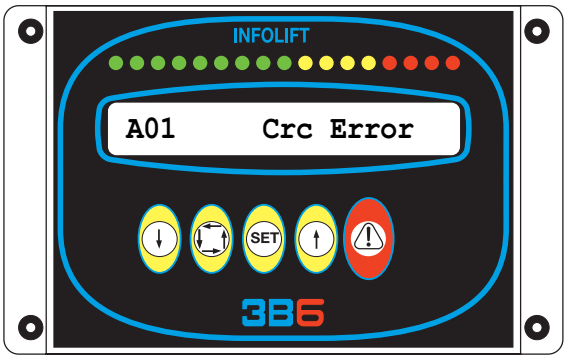


System is in SETTING MODE
because is has not been calibrated yet or the password has been activated.



SHUT-OFF OVERRIDE function is activated
i.e. because alarm button is depressed.

20.8 DISPLAY INFORMATION: DIAGNOSTICS MESSAGES

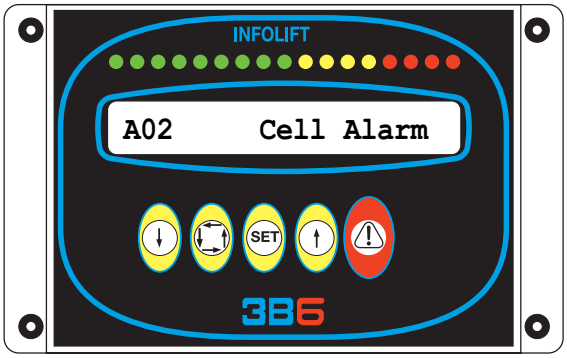


A01 Crc Error message is shown when

a corrupted value has been detected in the internal memory.

Shut-Off Output is OFF.
(to override shut-off, refer to page 479)

ACTION : - Recalibrated the system, see page 482
- Replace INFOLIFT panel.

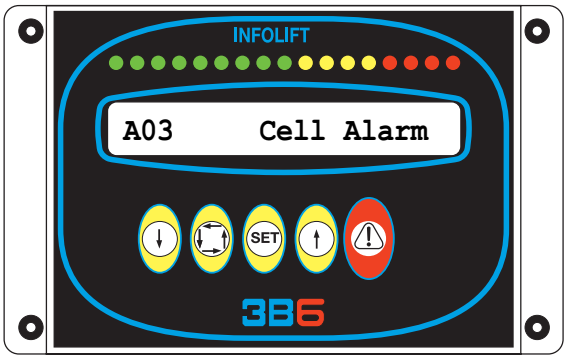


A02 Cell Alarm message is shown when

the value read from the load cell is less than the minimum allowed.

Shut-Off Output is OFF.
(to override shut-off, refer to page 479)

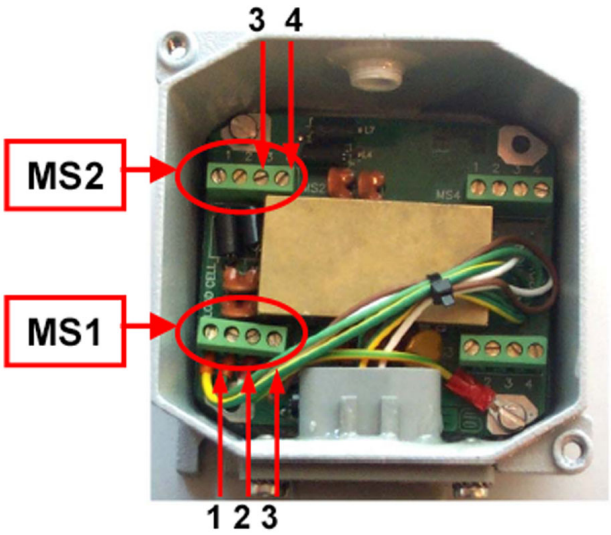
ACTION : SEE PAGE 477



A03 Cell Alarm message is shown when

the value read from the load cell is greater than the maximum allowed.

Shut-Off Output is OFF.
(to override shut-off, refer to page 479)



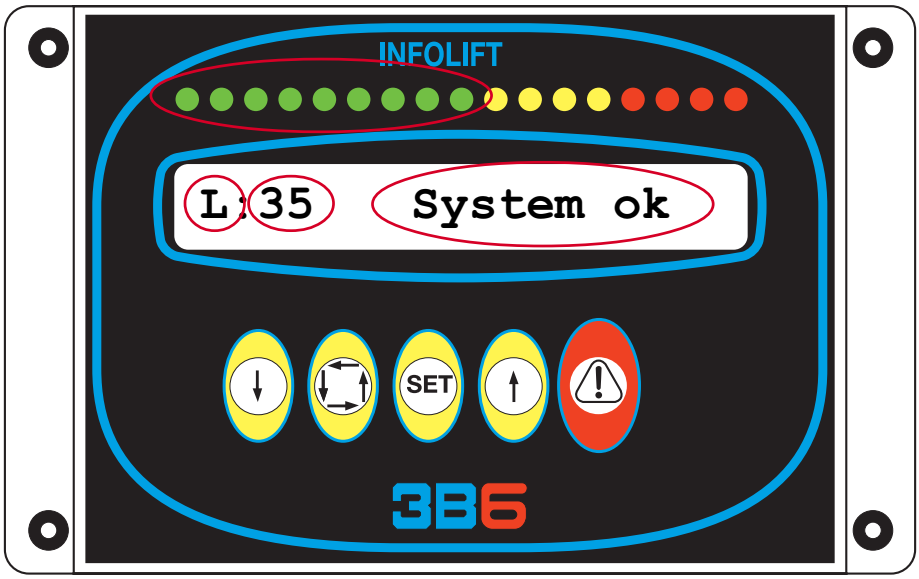
ACTION:

- Check the cables integrity between INFOLIFT / Amplifier and Amplifier/ Load Cell
- Check the proper supply voltage on Amplifier board (MS1 Terminal) between 3 (+VB = BATTERY +) and 2 (GND)
- Check Load Cell supply voltage on Amplifier board (MS2 Terminal) between 3 (+V=8Vdc) and 4 (0Vdc)
- Check the load signal on amplifier board (MS1 Terminal) between 1(signal) and 2 (0V); signal must stay in the range of 0,5Vdc (no load) and 4,5Vdc(Max load).

20.9 STANDARD OPERATING MODE

NORMAL/SAFE WORKING LOAD (Less than 90% Load applied)

Once power is applied to the machine the system will automatically start up and indicate on the display the percentage of load applied to the machine. The display will indicate:



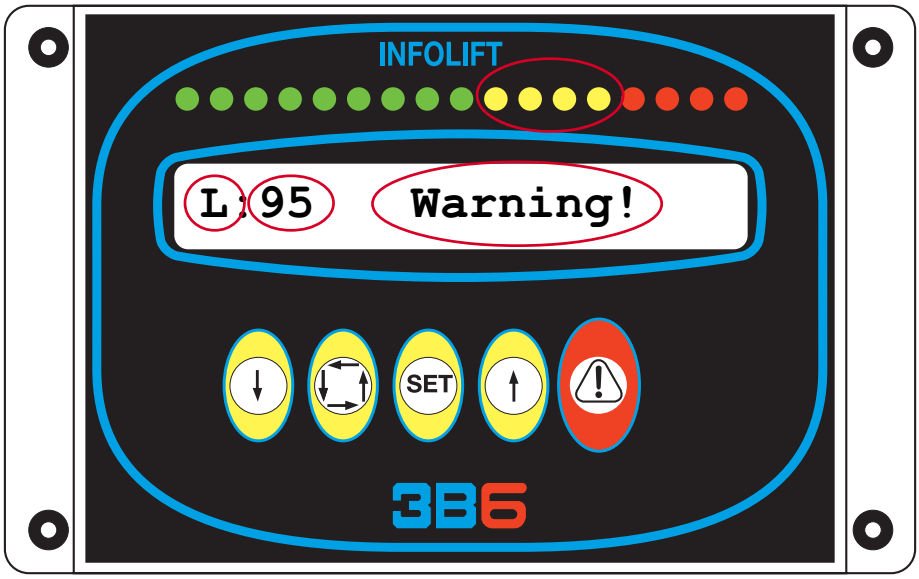
L = represents the load,
35 = represents the percentage of load the machine has applied
System Ok = represents working in a normal load condition

The number 35 can be 0 to 89 (percentage to 90%) which means the system is working in a normal operating mode.

The LED bar graph will display in the green area of the LED's.

PRE-WARNING WORKING LOAD (90 to 100% Load applied)

The display will indicate:



L = represents the load,
95 = represents the percentage of load the machine has applied
Warning = represents working in the pre-warning condition

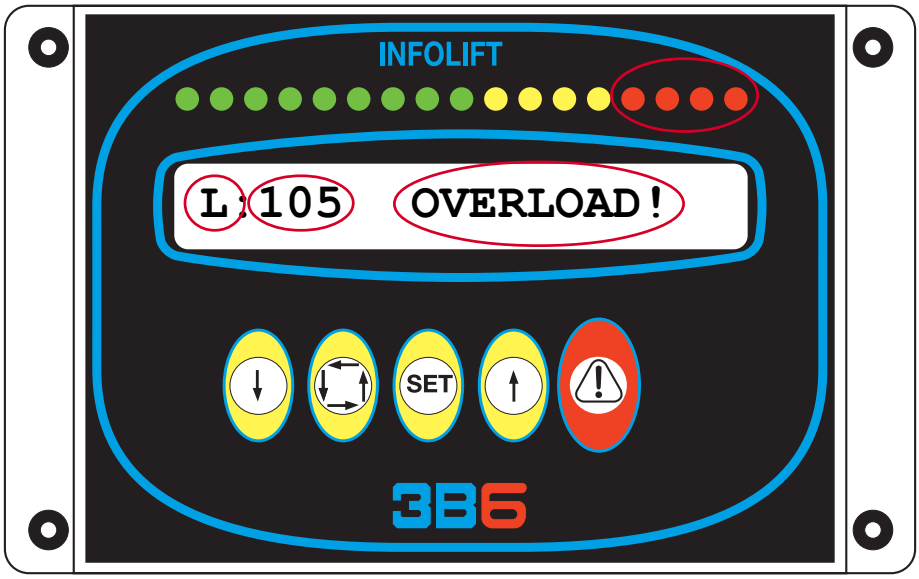
The system display will indicate Represents the Load percentage is from 90 % to 100% and the system is working in the pre-warning condition.
The number 95 can be 90 to 100, which means the system is working in a pre-warning load condition.

Caution shall be exercised in this condition!

The LED bar graph will display in the Yellow area of the LED's and the buzzer will be beeping.

OVERLOAD WORKING LOAD (Greater than 100% Load applied)

The display will indicate:



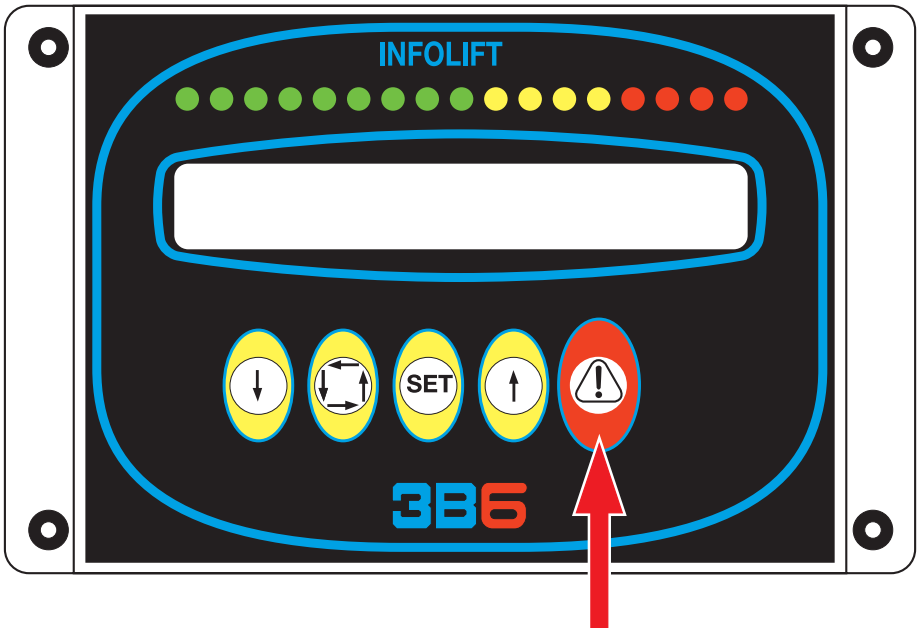
L = represents the load,
100 = represents the percentage of load the machine has applied
Overload = represents working in a overload condition

Represents the load percentage is greater than 100 percent and the system is in an overload condition.
The number 105 can be greater than 100, which means the system is working in a overload condition.
The shut-off function will engage and the boom up and boom extend function will disengage.

CAUTION shall be exercised in this condition!

The LED bar graph will display in the Red are of the LED's and flashing, the buzzer will beeps continuously and the shutoff functions will be engaged.

BYPASS PUSHBUTTON (Red pushbutton on the display front)



This pushbutton can be depressed and held to override the shutoff functions.

Caution shall be excerised when using this overide feature!

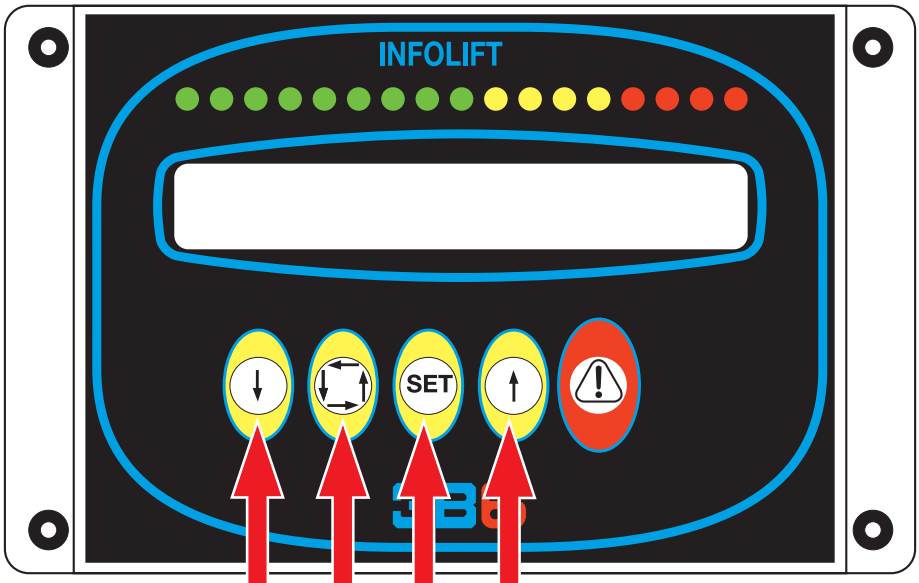
Once the pushbutton is released the shut-off function will disengage or it will automatically reset once the load applied is less than 100%.

Meanwhile displaying and warning functions are active.

20.10 ACCURACY VERIFICATION

PUSHBUTTONS FUNCTIONS

Display pushbutton functions in the accuracy verification mode.



DOWN ARROW or MINUS pushbutton.
Used to decrease or scroll down.
In selection pages, it opens the previous page.
In setting pages, it decreases selected value.

UP ARROW or PLUS pushbutton.
Used to increase or scroll up.
In selection pages, it opens the following page.
In setting pages, it increases selected value.

SET or ENTER pushbutton.
Activates the command or page currently being viewed.

INDEX or ESCAPE pushbutton.
Can be described as an “escape route,”
I.e. it exits from the current page, and goes back to the previously viewed one, or to the home page.
In data setting pages, it moves the cursor line over the various digits and selects them.

PROCEDURE

To enter re-accuracy verification procedure and parameters setting password is required (see page 484) accuracy verification is very easy and can be done on-site directly from the INFOLIFT display panel.
This describes the accuracy verification procedures for a new machine.

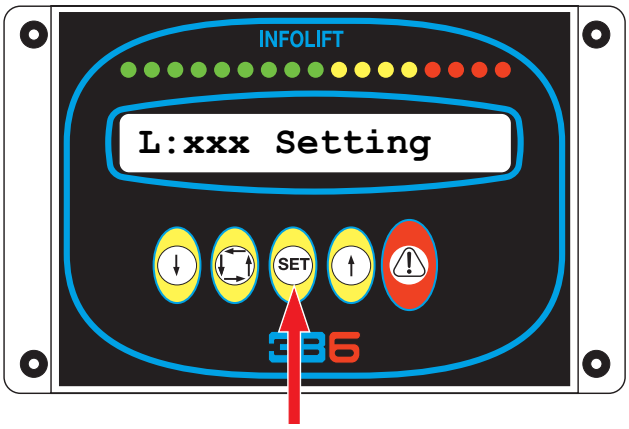
Weights required:

- 1650 lb / 750 kg weight
- 5100 lb / 2313 kg weight

Steps for accuracy verification mode are as follows:

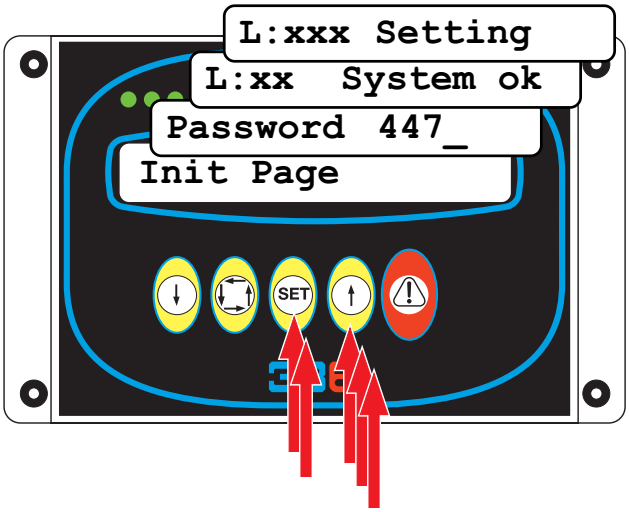
1. Enter into accuracy verification mode.
2. Empty moment accuracy verification.
3. Loaded moment accuracy verification.
4. Test of the system.

20.11 ACCURACY VERIFICATION MODE



First time accuracy verification of the system

If the system has never been calibrated, once the power is applied to the unit the display will indicate L: XXX Setting.
Press the “UP ARROW”

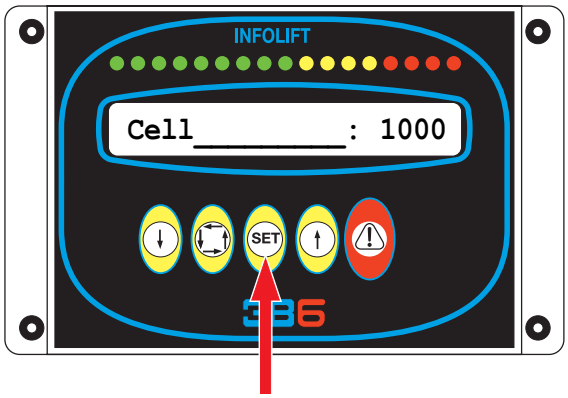


Re-accuracy verification of the system

If the system has been calibrated and you are repeating the accuracy verification you will need to do the following;
Turn the power on to the unit, when the display indicates “init Page”, press the set pushbutton.
The display will change and indicate “Password 447_”.
The last digit will be blinking, using the “UP ARROW” pushbutton scroll to “**XXXX**”(*) and push the “SET” pushbutton.
The display will now indicate “L: XX System Ok”.
Press the up arrow to scroll to the accuracy verification start up.
The display should indicate “L: XXX Setting”, you are now in the accuracy verification mode and ready for accuracy verification.
Press the “UP ARROW”.

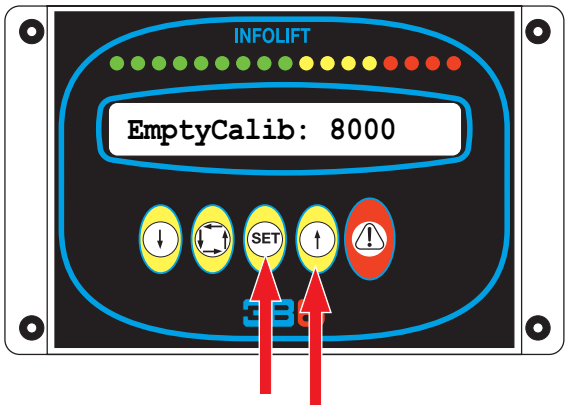
(*) = Selected Password

Display indicates:



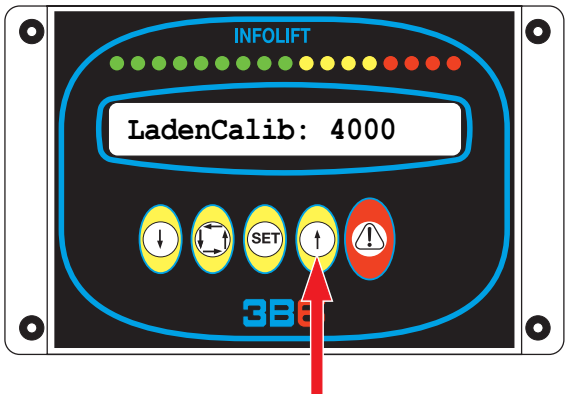
Load cell reading page:
This page indicates the load cell output signal without being filtered.
Check the values to be within the range of 100-500 and also if the value changes moving the boom (the value should decrease when extending the boom with a load applied. If the value increases or is between 50-60, check the load cell wiring.
Correct the wiring by switching the yellow and green wires from the load cell wiring in the amplifier box on terminal MS2.
If the load cell reading is correct push the “SET” pushbutton to scroll into the empty accuracy verification page.

Display indicates:



Empty accuracy verification page*:* no load on the forks
Fully retract the boom and raise the boom to the maximum angle.
The numerical value to the right of the “EmptyCalib” indicates the load cell output signal being filtered, the range number should be from 0 to 10000.
Fully retract the boom and raise the boom to the maximum angle.
In this condition the moment should be at the lowest and the load cell should indicate the highest value.
Press the “SET” pushbutton to save the system empty accuracy verification, now press the “UP ARROW” to scroll to the Laden accuracy verification page.

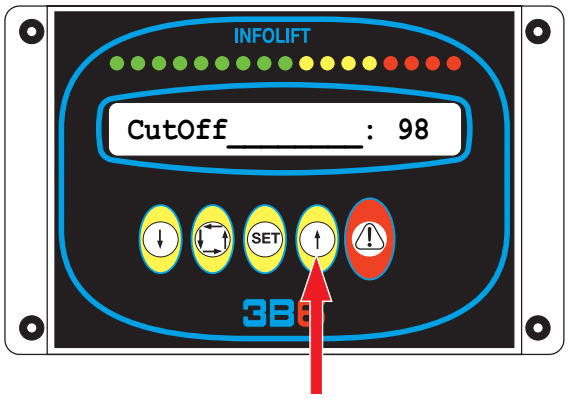
Display indicates:



Laden accuracy verification page: Load on forks.
Lift the 1650 lb/ 750 kg weight, set the boom angle to 0 degrees and fully extend the boom.
The numerical value to the right of the “LadenCalib” indicates the load cell output being filtered, the range number should be from 0-10000.
In this condition the moment should be at the maximum and the load cell should indicate the minimum value.
The accuracy verification is know complete.
Check the accuracy verification by lifting the 5100 lb / 2313 kg weight.
Press the “UP ARROW”.

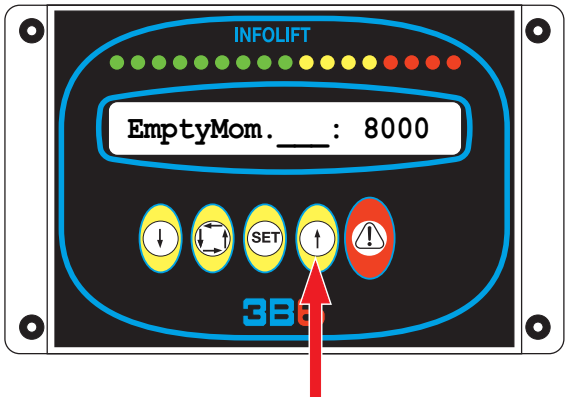
NOTE: Pressing the “UP ARROW” will allow you to scroll to other pages within the system.

Display indicates:



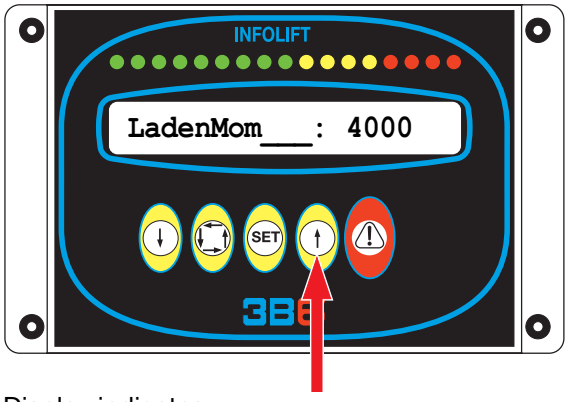
CutOff Percentage page:
This page indicates the percentage of the maximum moment when the shut off is enabled.
The displayed number indicates the load percentage to activate the shutoff of the value you set in the Laden accuracy verification.
Press the “UP ARROW”.

Display indicates:



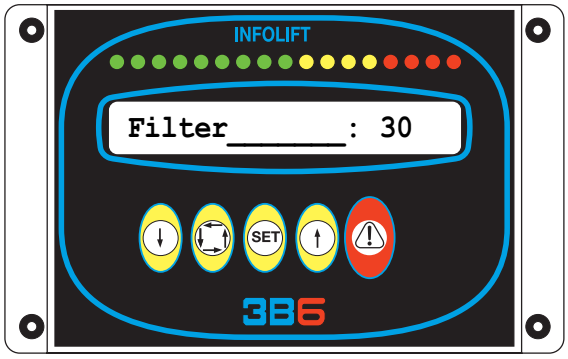
Empty Moment Value page:
This page indicates the value set in the Empty accuracy verification.
Press the “UP ARROW”.

Display indicates:



Laden Moment Value page:
This page indicates the value set in the Laden accuracy verification.
Press the “UP ARROW”.

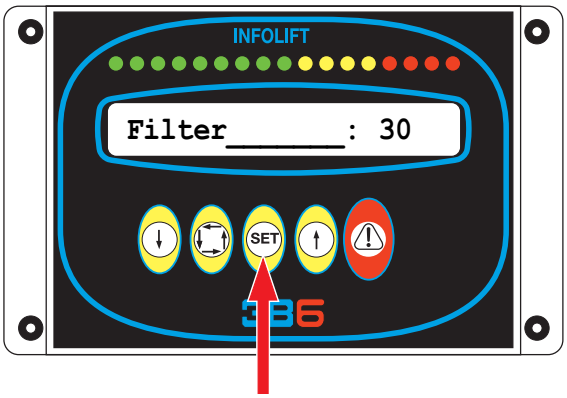
Display indicates:



This page indicates the **filter value** used by the load cell reading.
The range is 0-30, the default is set to 30 (maximum filter is 30).

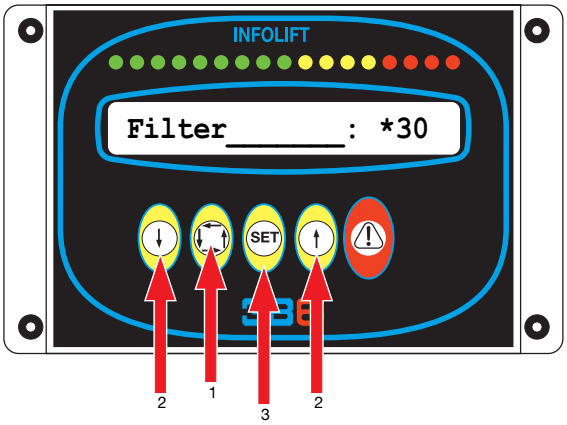
20.12 HOW TO SET A NUMERIC VALUE

Setting a numeric value is one of the most frequently-used operations, to be done as follows:



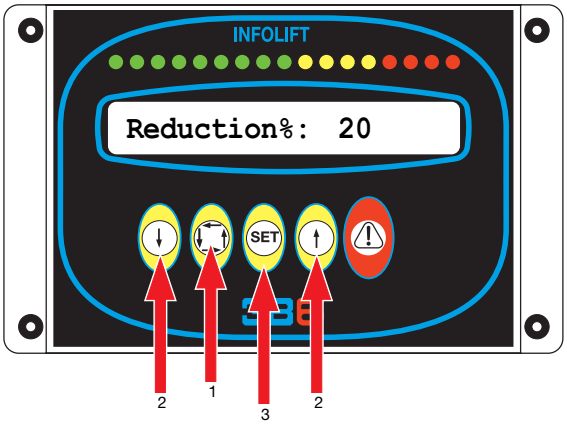
The first thing to do is to enter the page with the value to be set.
Press «SET» to open the page of the value you wish to set.

Display indicates:



The asterisk means that the digit blinks.
Use «INDEX» to move the blink position along the digits of the number.
Use “UP ARROW” or “DOWN ARROW” to increase or decrease blinking digit.
When desired value is shown, press «SET», and you will go back to the previous display mode.
Note:
In this page «INDEX» does not get the ESCAPE function.
So, if you want to go back to the HOME page, you must remember to use «SET» to set the value first.

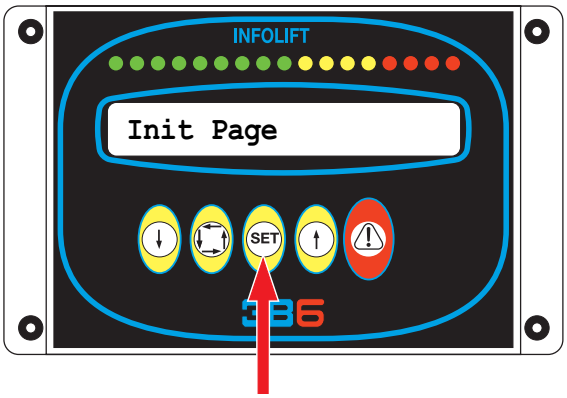
Display indicates:



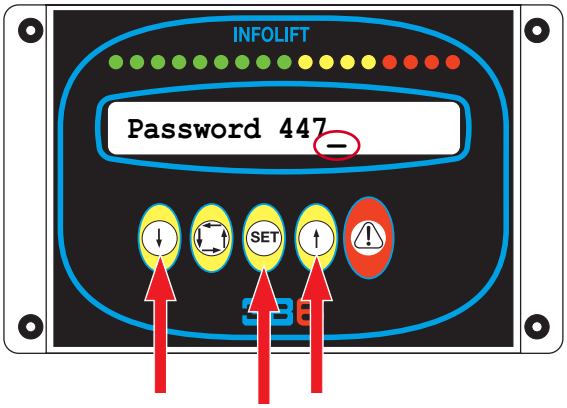
This parameter indicates the value of the maximum load reduction when the boom angle is higher than 50 degrees.
The range is 0 to 100, the default is set to 20.
Use «INDEX» to move the blink position along the digits of the number.
Use “UP ARROW” or “DOWN ARROW” to increase or decrease blinking digit.
When desired value is shown, press «SET», and you will go back to the previous display mode.
Note:
In this page «INDEX» does not get the ESCAPE function.
So, if you want to go back to the HOME page, you must remember to use «SET» to set the value first.

20.13 HOW TO SET THE PASSWORD

The password is required to enable a new accuracy verification if the system is already calibrated.
The procedure is the following:

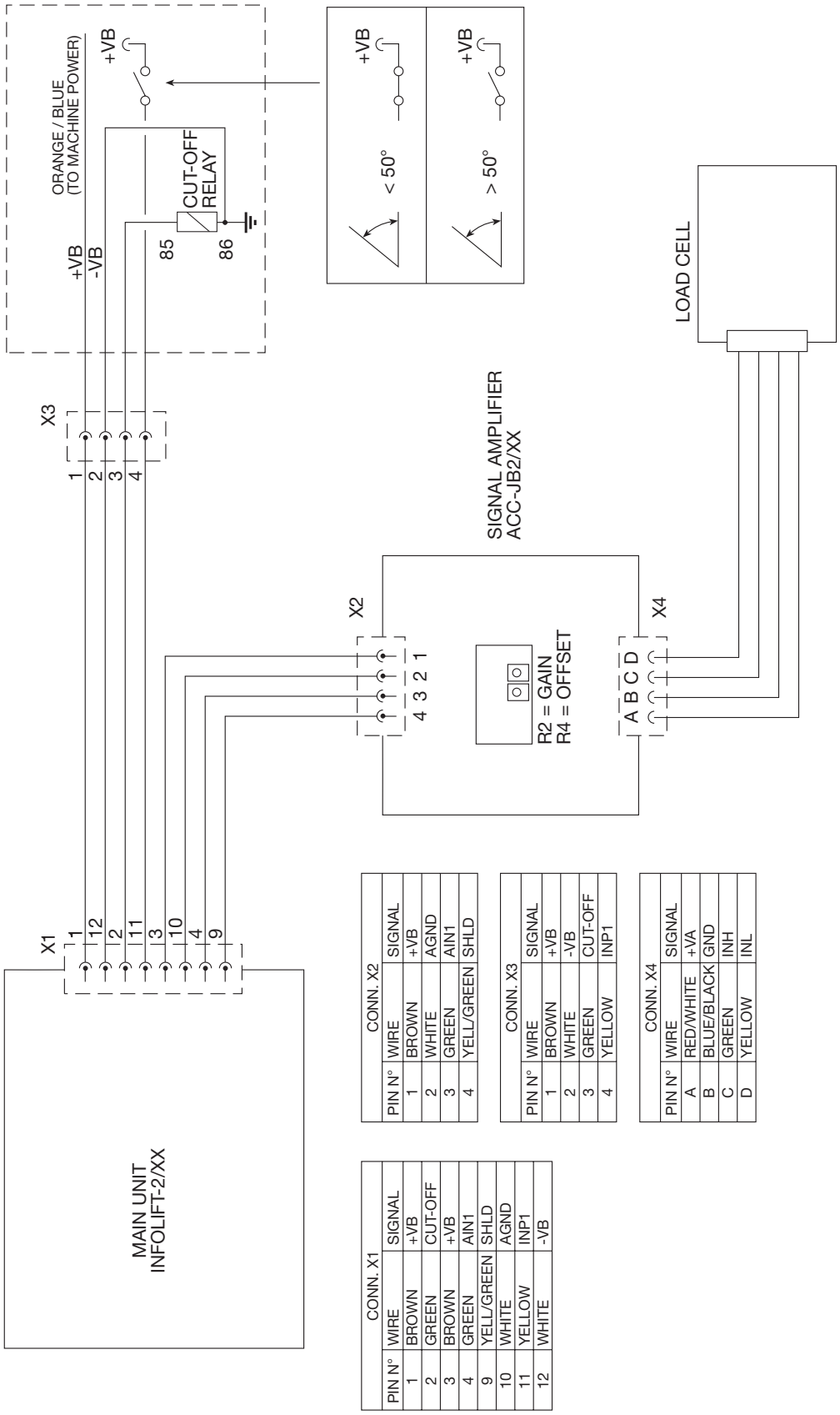


Switch on the power and push SET key when “init Page” is shown.



The last digit is blinked.
With Plus and Minus key change the number to the correct password value (XXXX).
Then Hit SET to confirm and go in “OPERATOR” page.
Now by “UP ARROW” is possible to scroll into accuracy verification menu.

20.14 EXTERNAL WIRING



CONN. X1

PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	GREEN	CUT-OFF
3	BROWN	+VB
4	GREEN	AIN1
9	YELL/GREEN	SHLD
10	WHITE	AGND
11	YELLOW	INP1
12	WHITE	-VB

CONN. X2

PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	WHITE	AGND
3	GREEN	AIN1
4	YELL/GREEN	SHLD

CONN. X3

PIN N°	WIRE	SIGNAL
1	BROWN	+VB
2	WHITE	-VB
3	GREEN	CUT-OFF
4	YELLOW	INP1

CONN. X4

PIN N°	WIRE	SIGNAL
A	RED/WHITE	+VA
B	BLUE/BLACK	GND
C	GREEN	INH
D	YELLOW	INL

20.15 SPARE PARTS LIST

DESCRIPTION	CODE
MAIN UNIT	INFOLIFT-2/xx
LOAD CELL AMPLIFIER	ACC-JB2/xx
CONNECTING HARNESS	CV1 ILFST1/xx

20.16 WARNINGS

What should be known before starting the machine?
All the recommendations and rules from the Manufacturer to work wisely and consciously in any time and situation.

WARNINGS

- The LMI is an electronic device with the aim to help the operator in the current use of the machine, warning him by means of visual and audible signals while approaching dangerous conditions.
- However this device can't replace the operator, good experience in the safe use of the machine.
- The responsibility of the operations in safe conditions of the machine is the operator concern as well as the accomplishment of all prescribed safety rules
- The Operator must be able to detect if the data given by the LMI are correct and correspond to actual working conditions.
- He must be able to utilize the data given by the LMI in order to operate in safe conditions at any time.
- The LMI is an electronic device including several sensing components, therefore it can be subject to failures or defects.
- The operator must recognize these events and he must take action (to proceed to repair if possible or to call TEREX Assistance).
- Before starting the operations with the machine, the user must fully read this manual and follow the instructions at any time.
- The LMI is supplied with a key for shut-down function by-passing.
- In normal working operations, this key must be positioned not to by-pass shut-down.
  It's forbidden to use the key to lift loads exceeding the loads values allowed by the Manufacturer.
- The key can be used only when an emergency/ malfunctioning occurs or a situation justifying its use.
- Only Authorised Personnel is allowed to the use of the key; they are also responsible for it.
- The LMI has a powerful FAIL-SAFE autodiagnosis program suitable to verify its good operations and the one of its transducers.
  In case a trouble has been detected, the LMI puts itself in a safe state by stopping the manoeuvres (please see the AUTODIAGNOSTIC chapter).
- In spite of this, the Operator, before starting the operation with the machine, must take care that the LMI is working correctly.
  To do this, he must verify the validity of the displayed values by doing some tests. He must verify that there are not messages or alarm indications; he must verify the correct operation of the manoeuvre stopping functions. The operator is responsible for the correct setting of the machine load table and therefore for the right LMI set.
- When switching-on the machine the last selected Table is kept valid, to allow Operator check.
  About this, please follow the instructions given in the ATTACHMENTS SELECTION chapter. An incorrect setting of the tables, can cause an incorrect LMI operation and therefore can provoke a dangerous situation for the machine.
- Operating conditions usually change when:
  Further attachments are fitted or removed (jib, winch, basket, forks) and relevant Table selecting mode is set on the control panel.
  Outriggers Extension / Withdrawn, Turret Front/360° rotation , On Wheels/Outriggers, Operating Modes are set in automatic way by micro-switches.
  Generally, it's compulsory to follow the Manufacturer instructions and procedures at any time.