

BEML - TATRA 815

26RR36 22 255 6x6.1R/50T, 51T

Workshop manual

Part 4 – AUXILIARY GEARBOX

Publication numer: 03-0254-ENG/00





4 AUXILIARY GEARBOX

4.1 Description and Main Technical Specifications

VEHICLE WITH WINCH

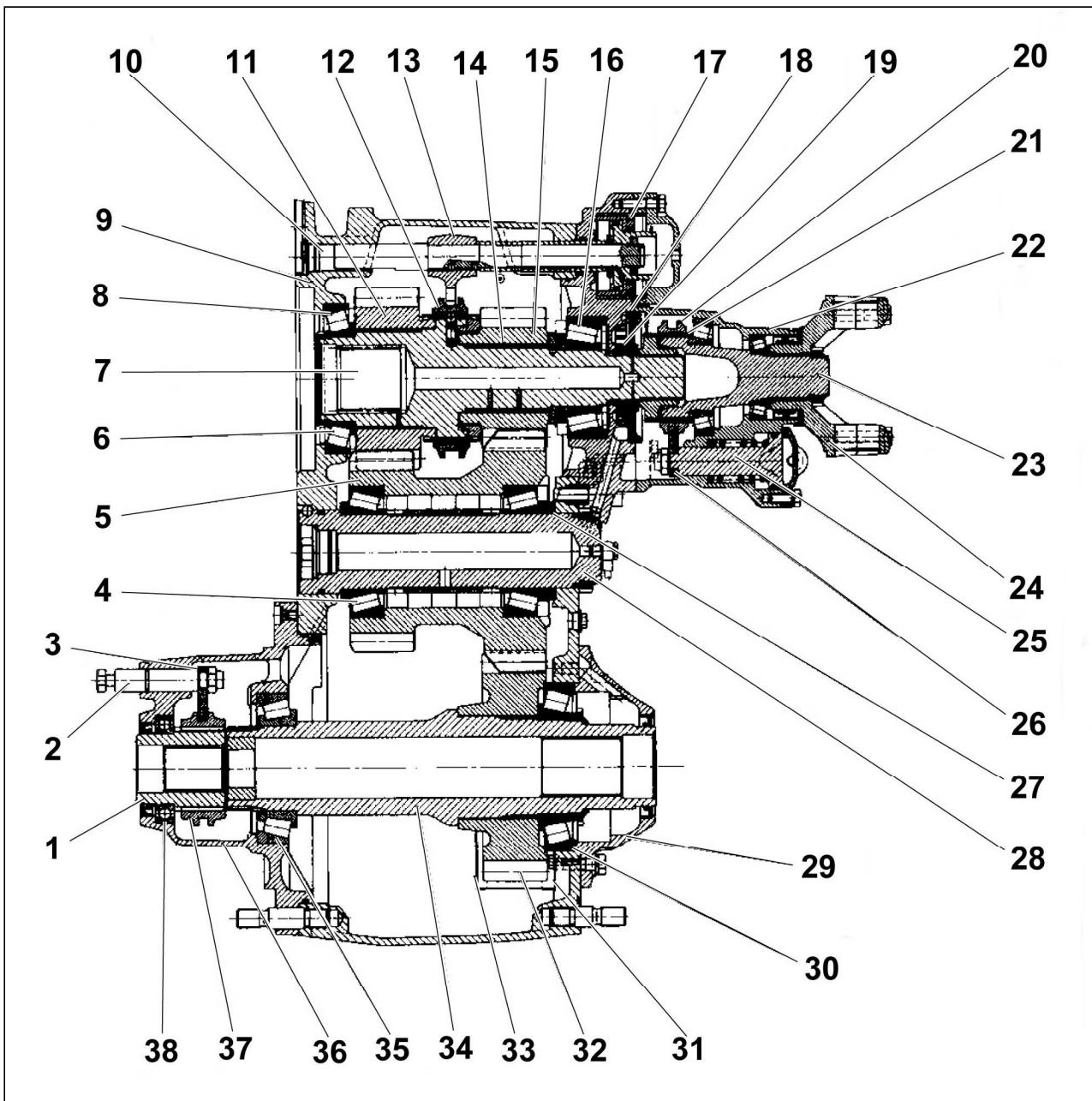
The vehicles BEML - TATRA **T 815 - 26RR36 22 255 6x6.1R/50T** use the mechanical (speed-reducing) two-speed auxiliary gearbox, in which the "H" gear ("hare" - step-up gear) or the "T" gear ("turtle" - step-down gear) can be shifted. The type designation of the auxiliary gearbox is BEML - TATRA H6 1.1/1.8.

The torque is transmitted from the gearbox via the driven shaft, whose involute splining is slid into the internal involute splining of the driving shaft **7**, which is carried on tapered roller bearings **6** and **16**. On this shaft, on needle bearings **11** there is a big driving gear **8** and on needle bearings **14** there is a driving gear **15** c/w connecting gearing, which is slid onto the involute splining. The coupling sleeve **12** fits on the involute splining of the driving shaft. Balls c/w springs lock the sleeve position. Teeth of these gears are in mesh with teeth of the intermediate gear **5**, which is carried on tapered roller bearings **4** and **27** on the intermediate gear pin **28**. Via the teeth, the torque is transmitted to the lower gear **32**, which is pressed on the involute splining of the lower shaft **34** and this fits on tapered roller bearings **30** and **35**. Out of the lower shaft the torque is transferred via the involute splining towards a couple of rear axles. To the front axle, it is connected via the internal involute splining of the carrier **1**, which is carried on the ball bearing **38** in the complete front drive shift mechanism cover **36**. The front drive shift-coupling sleeve **37** allows the front drive engagement via the shifter fork **3**, which fits on the guide pin **2**. After you push the rocker switch on the instrument panel, the front drive is shifted electro-pneumatically together with the inter-axle differential lock. After the electro-pneumatic valve is activated, the air is drawn from the vehicle pneumatic system towards shift cylinders of the front drive and inter-axle differential lock.

Arranged like this, the torque transmission from the gearbox level into a level of propeller shafts situated in the extended ladder-type frame is secured.



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Legend: 1 - carrier, 2 – shifter rod, 3 – shifter fork, 4,27 – tapered roller bearings, 5 – intermediate gear, 6 – tapered roller bearings, 7 – driving shaft, 8 – big driving gear, 9 – auxiliary gearbox housing, 10 – shifter rod, 11 – needle bearings, 12 – coupling sleeve, 13 - fork, 14 –needle bearings, 15 – driving gear, 17 - piston, 18 – external gear, 19 – internal gear, 20 – coupling, 21 – coupling sleeve, 22 – PTO housing, 23 – PTO driving shaft, 24 – carrier, 25 – piston, 26 – fork, 28 – intermediate gear pin, 29 – rear cover, 33, 35 – tapered roller bearings, 31 – complete partitions, RH, 32 – lower gear, 33 – complete partitions, LH, 34 – lower shaft, 36 – front drive shift mechanism cover, 37 – shifter sleeve, 38 – ball bearing

Fig. 4.1 Auxiliary gearbox cross-section (with winch drive)

It allows to engage the front drive, if need be, the operating conditions dependent, with the rear axles being driven permanently.

The on-road gear speed ("hare") and the off-road gear speed ("turtle") are shifted electro-pneumatically



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using the switch on the instrument panel. The both gear and neutral position may be shifted at standstill. One of the gear must be engaged before moving the vehicle. After the electro-pneumatic valve is activated, the air is drawn from the vehicle pneumatic system into the shift cylinder on the piston 17, which displaces the shifter rod 10 c/w fork 13 and shifter sleeve 12 into one of the pre-selected positions. To shift to a pre-selected gear, the vehicle must be at standstill and secured with the parking brake only. In the basic position of the shift switch, the on-road gear speed ("hare") is shifted in the auxiliary gearbox. To shift into a gear with the running engine, you must depress the clutch pedal. To shift into a gear with the engine not running, the ignition key must be in the position "I".

The winch drive is also shifted electro-pneumatically by the switch on the instrument panel. The winch is driven from the driving shaft 7 by the short propeller shaft.

The auxiliary gearbox housing 9 is a part of the central member frame and it is attached to it via stud bolts by nuts.

The auxiliary gearbox has the own oil filling.

There are two kinds of the lubrication.

The pressure-type lubrication. The oil is sucked by the internal gear 19, which is movably carried on the involute splining of the input shaft 7, and is in constant mesh with the external gear 18, which is rotary-mounted in the rear cover with the suction pipe through the filter screen beneath the plug c/w magnet. The oil is drawn from the oil pump to the splash pipe onto the input shaft and through another pipe via the grease neck into the intermediate gear pin and subsequently, into tapered roller bearings.

The oil-splash system from the partition, LH 33 and RH 31, which form the pan. The oil is taken by teeth of the lower gear 32 and splashed on the intermediate gear teeth 5 and further on, on the drive gear 8. The oil level is checked after removal of the plug from the checking hole. The oil level must reach to the lower edge of the hole.

The air pressure in the auxiliary gearbox is balanced with the ambient air via the vent hole.

VEHICLE WITHOUT WINCH

The vehicles BEML -TATRA T 815 - 26RR36 22 255 6x6.1R/51T use the mechanical (speed-reducing) two-speed auxiliary gearbox, in which the "H" gear ("hare" - step-up gear) or the "T" gear ("turtle" - step-down gear) can be shifted. The type designation of the auxiliary gearbox is BEML - TATRA H6 1.1/1.8.

The torque is transmitted from the gearbox via the driven shaft, whose involute splining is slid into the internal involute splining of the driving shaft 7, which is carried on tapered roller bearings 6 and 16. On this shaft, on needle bearings 11 there is a big driving gear 8 and on needle bearings 14 there is a driving gear 15 c/w connecting gearing, which is slid onto the involute splining. The coupling sleeve 12 fits on the involute splining of the driving shaft. Balls c/w springs lock the sleeve position. Teeth of these gears are in mesh with teeth of the intermediate gear 5, which is carried on tapered roller bearings 4 and 21 on the intermediate gear pin 22. Via the teeth, the torque is transmitted to the lower gear 26, which is pressed on the involute splining of the lower shaft 28 and this fits on tapered roller bearings 24 and 29. Out of the lower shaft the torque is transferred via the involute splining towards a couple of rear axles. To the front axle, it is connected via the internal involute splining of the carrier 1, which is carried on the ball bearing 32 in the complete front drive shift mechanism cover 30. The front drive shift-coupling sleeve 31 allows the front drive engagement via the shifter fork 3, which fits on the guide pin 2. After you push the rocker switch on the instrument panel, the front drive is shifted electro-pneumatically together with the inter-axle differential lock. After the electro-pneumatic valve is activated, the air is drawn from the vehicle pneumatic system towards shift cylinders of the front drive and inter-axle differential lock.

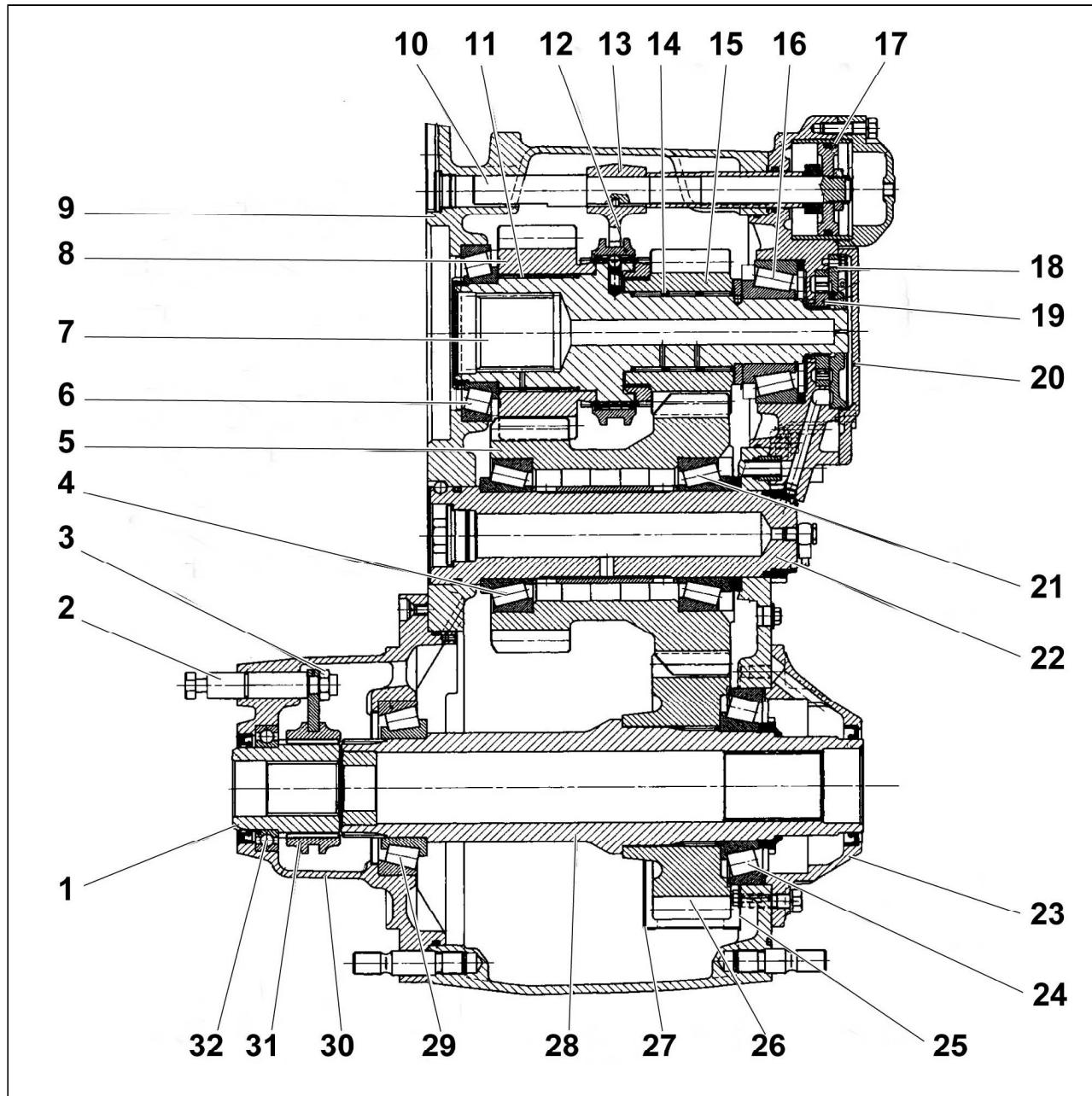
Arranged like this, the torque transmission from the gearbox level into a level of propeller shafts situated in



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the extended ladder-type frame is secured.



Legend: 1 - carrier, 2 – shifter rod, 3 – shifter fork, 4,27 – tapered roller bearings, 5 – intermediate gear, 6, 16 – tapered roller bearings, 7 – driving shaft, 8 – big driving gear, 9 – auxiliary gearbox housing, 10 – shifter rod, 11 – needle bearings, 12 – coupling sleeve, 13 - fork, 14 –needle bearings, 15 – driving gear, 17 - piston, 18 – external gear, 19 – internal gear, 20 – rear cover, 22 – intermediate gear pin, 23 – rear cover, 24, 29 – tapered roller bearings, 25 – complete partitions, RH, 26 – lower gear, 27 – complete partitions, LH, 28 – lower shaft, 30 – front drive shift mechanism cover, 31 – shifter sleeve, 32 – ball bearing

Fig. 4.2 Auxiliary gearbox cross-section (without winch drive)

It allows to engage the front drive, if need be, the operating conditions dependent, with the rear axles being driven permanently.



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The on-road gear speed ("hare") and the off-road gear speed ("turtle") are shifted electro-pneumatically using the switch on the instrument panel. The both gear and neutral position may be shifted at standstill. One of the gear must be engaged before moving the vehicle. After the electro-pneumatic valve is activated, the air is drawn from the vehicle pneumatic system into the shift cylinder on the piston 17, which displaces the shifter rod 10 c/w fork 13 and shifter sleeve 12 into one of the pre-selected positions. To shift to a pre-selected gear, the vehicle must be at standstill and secured with the parking brake only. In the basic position of the shift switch, the on-road gear speed ("hare") is shifted in the auxiliary gearbox. To shift into a gear with the running engine, you must depress the clutch pedal. To shift into a gear with the engine not running, the ignition key must be in the position "I".

The auxiliary gearbox housing 9 is a part of the central member frame and it is attached to it via stud bolts by nuts.

The auxiliary gearbox has the own oil filling.

There are two kinds of the lubrication.

The **pressure-type lubrication**. The oil is sucked by the internal gear 19, which is movably carried on the involute splining of the input shaft 7, and is in constant mesh with the external gear 18, which is rotary-mounted in the rear cover with the suction pipe through the filter screen beneath the plug c/w magnet. The oil is drawn from the oil pump to the splash pipe onto the input shaft and through another pipe via the grease neck into the intermediate gear pin and subsequently, into tapered roller bearings.

The **oil-splash system** from the partition, LH 27 and RH 25, which form the pan. The oil is taken by teeth of the lower gear 26 and splashed on the intermediate gear teeth 5 and further on, on the drive gear 8. The oil level is checked after removal of the plug from the checking hole. The oil level must reach to the lower edge of the hole.

The air pressure in the auxiliary gearbox is balanced with the ambient air via the vent hole.

Main Technical Specifications

Tab. 4.1 Technical specifications of the auxiliary gearbox

Data	Unit	Value
Number of stages		two
Transmission ratios		1.6 / 2.6
Auxiliary gearbox weight (w/o oil filling)	kg	300



4.2 Faults Causes and Troubleshooting

Fault	Cause	Remedy	Mentioned in:
The turtle (T) speed or the hare (H) speed cannot be shifted	Faulty electro-valve	Replace the electro-valve	
	The air leaks from the shift cylinder, shaped ring is leaky	Replace the shaped ring	(See Subchapter 4.5.2)
	Piston seizure in the shift cylinder, non-alignment between the piston and a hole in the cylinder liner, the piston is loose	Replace the piston and shift cylinder	(See Subchapter 4.5.2)
The turtle (T) speed or the hare (H) speed cannot be shifted	Wear of the shifter fork segment	Dismount the auxiliary gearbox, replace the shifter fork and worn parts	(See Subchapter 4.5.7)
	Wear of the shifter sleeve connecting gearing and/or guide slot	Dismount the auxiliary gearbox, replace the shifter sleeve and worn parts	(See Subchapter 4.5.7)
The turtle speed (T) or the hare speed (H) are slipping out	Battering of the driving shaft connecting gearing, wear of connecting gearings of the big driving gear, driving gear and coupling sleeve	Dismount the auxiliary gearbox, replace the driving shaft of the big gear and the driving gear, coupling sleeve and worn parts	(See Subchapter 4.5.7)
The rear cover in the space of the auxiliary gearbox pump outer and inner gears heats excessively	Seizure of the pump outer and inner gears in location	Replacement of the rear cover of the pump outer and inner gears and damaged parts	(See Subchapter 4.5.5)
The pump does not secure a sufficient lubrication	Wear of the pump outer and inner gears teeth, its location in the rear cover and loss of the pressure	Replacement of damaged parts	(See Subchapter 4.5.5)
	Loose connection of the suction pipe in its location in the complete housing	Repair of the suction pipe mounting	(See Subchapter 4.5.6)
Gearing is noisy (worn/damaged gearing)	Wear of the big drive gear and the drive gear teeth	Replacement of the big drive gear, drive gear and worn parts	(See Subchapter 4.5.7)
Tapered roller bearings of the input shaft are noisy and heat excessively	Wear of tapered roller bearings elements	Replacement of tapered roller bearings and worn parts	(See Subchapter 4.5.7)
Excessive noise of intermediate gear and lower gear set	Wear of the intermediate gear and lower gear teeth	Replacement of the lower gear and worn parts	(See Subchapter 4.5.7)



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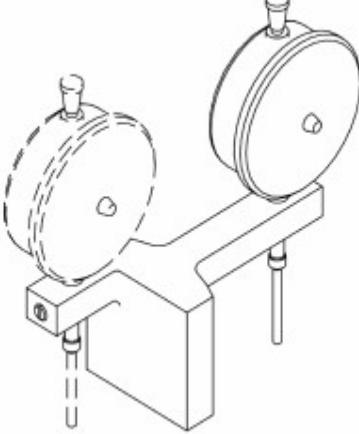
Fault	Cause	Remedy	Mentioned in:
Tapered roller bearings of the intermediate gear and complete lower shaft are noisy and heat excessively	Wear of tapered roller bearings elements	Replacement of tapered roller bearings and worn parts	(See Subchapter 4.5.7)
The front drive cannot be engaged	Faulty electro-valve	Replace the electro-valve	
	Piston seizure in the shift cylinder	Replace and repair the shift cylinder	(See Subchapter 4.5.2)
	Worn involute splining of the coupling sleeve, shifter fork segment, loose screw connection of the fork pin nut	Replacement of the coupling sleeve, shifter fork, fork guide pin nut and worn parts	(See Subchapter 4.5.7)
Damaged or loose suction pipe	The suction pipe has loosened from a hole in the complete housing, the discharge pipe has been damaged due to the gearing resulting from its loose connection	Attachment and locking the suction pipe into the hole, replacement of the damaged discharge pipe	(See Subchapter 4.5.7)
Leakage, which cannot be repaired without removal	Damaged (cracked) non-repairable outside complete housing jacket	Replacement of the complete housing c/w bolts	(See Subchapter 4.5.7)
Tapered roller bearings of PTO are noisy and heat excessively	Wear of tapered roller bearings elements	Replacement of tapered roller bearings and worn parts	(See Subchapter 4.5.8)
The winch drive cannot be shifted	Wear of the shifter sleeve	Replacement of the sleeve	(See Subchapter 4.5.8)

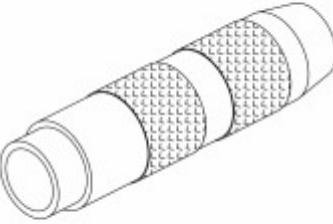


4.3 List of Special Tools

Tab. 4.2 Specials tools for removing and instalation procedures of the axiliary gearbox

<p>Name: Suspension eye for pulling of gearbox Tool number: 2 010 420 154</p>	
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<p>Name: Set up gauge (together with dial gauge) Tool number: MMU 1740.1</p>	
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<p>Name: Driver of L-H and S-Q gear-shift bar distance tube Tool number: PRL 0501</p>	
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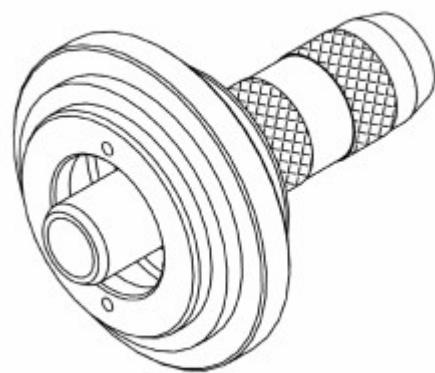


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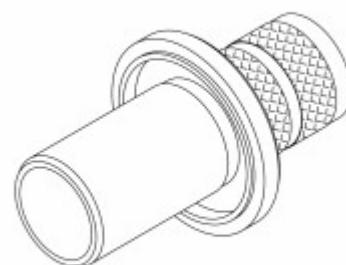
Name: Driver of shaft seals 85x110x12, 85x100x7

Tool number: PRL 0700.1



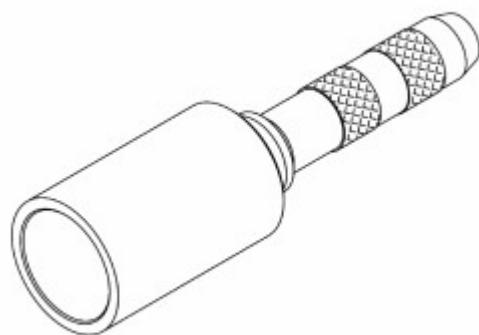
Name: Driver of outer races of bearings 32313, 33216

Tool number: PRL 0704



Name: Driver of inner race of bearing 32312

Tool number: PRL 0732.1



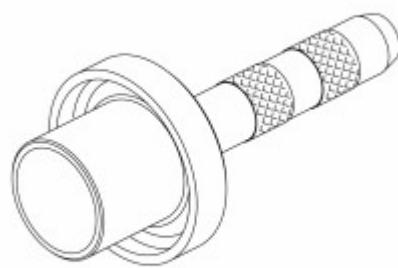


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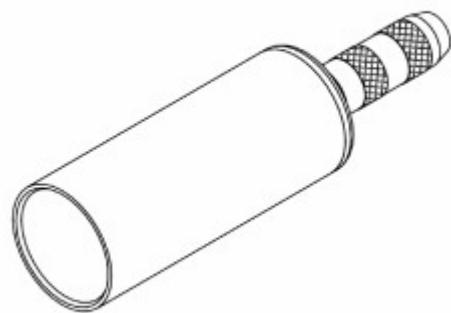
Name: Driver of inner races of bearings 32018, 30218

Tool number: PRL 0733



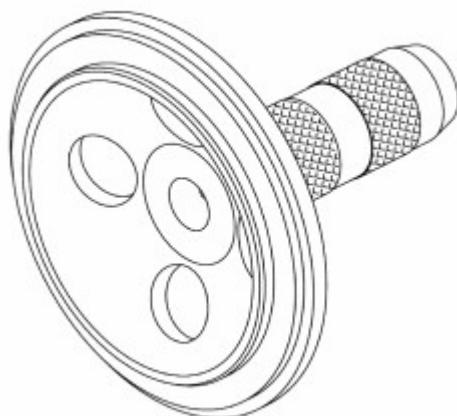
Name: Driver of inner races of bearings 30220, 33220

Tool number: PRL 0737.1



Name: Driver of 30220 bearing outer race

Tool number: PRL 0749



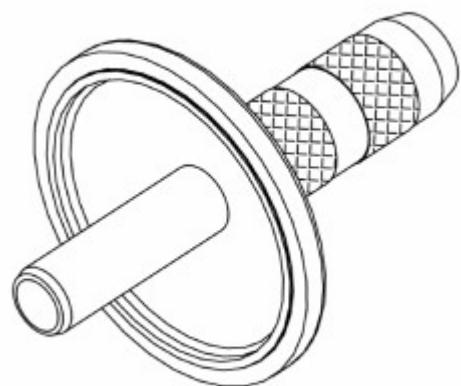


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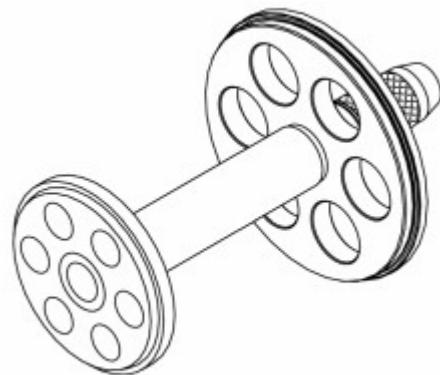
Name: Front drive housing driver

Tool number: PRL 0753



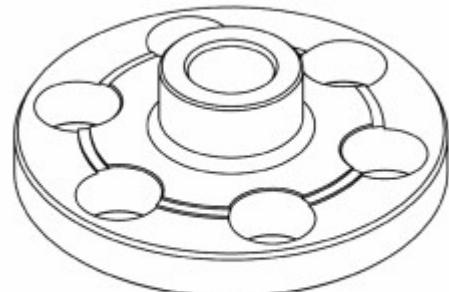
Name: Driver of outer race of bearing 30218

Tool number: PRL 0838



Name: Stand for driver PRL-0700.1

Tool number: PRL 0920



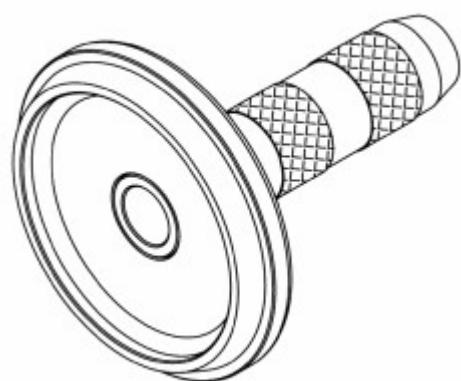


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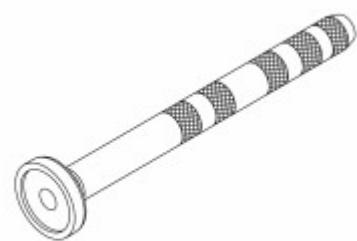
Name: Driver to press outer race of bearing 32312

Tool number: PRL 1330



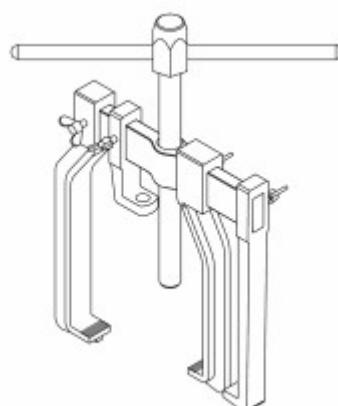
Name: Idle gear pin extractor

Tool number: PRL 1361



Name: Universal puller

Tool number: PRM 0777



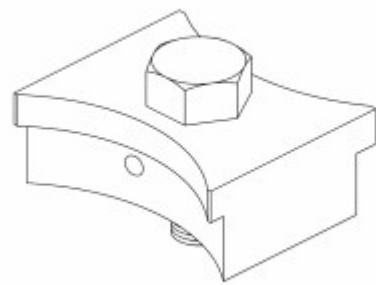


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Name: Fixing tool of gear shifting cylinder liner

Tool number: PRM 2439.1



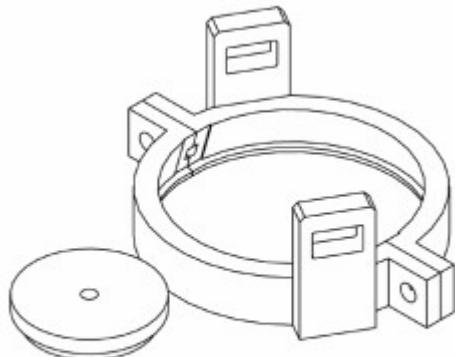
Name: Assembly trolley of auxiliary gearbox

Tool number: PRM 2531



Name: Puller of inner race of bearing 30220

Tool number: PRM 2760



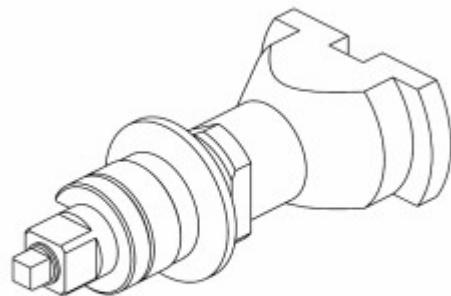


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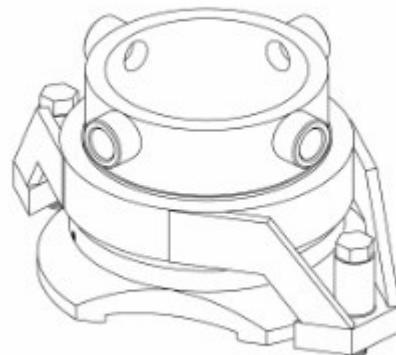
Name: Tool to set up clearance of PTO bearings

Tool number: PRM 2901



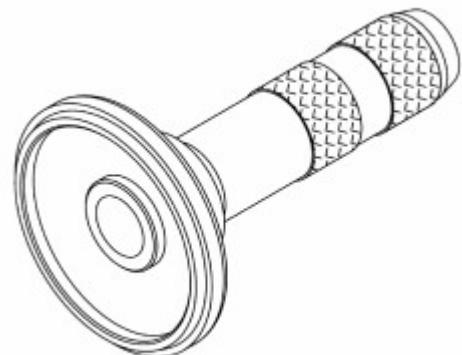
Name: Tool to set up clearance of driven shaft bearings

Tool number: PRM 2906.1



Name: Driver of outer race of bearing 30214

Tool number: PRM 3112



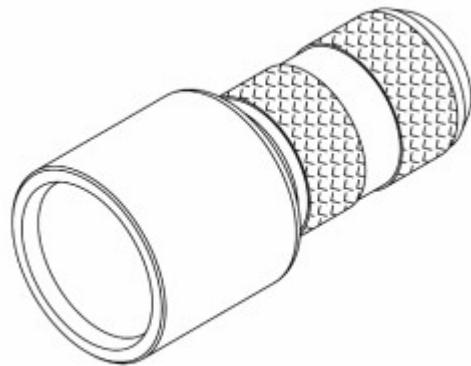


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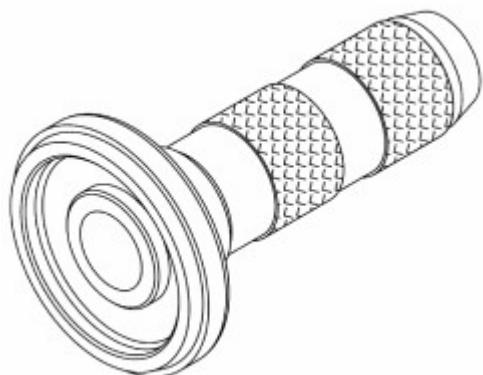
Name: Driver of inner race of bearings 30214 and 61914

Tool number: PRM 3113.1



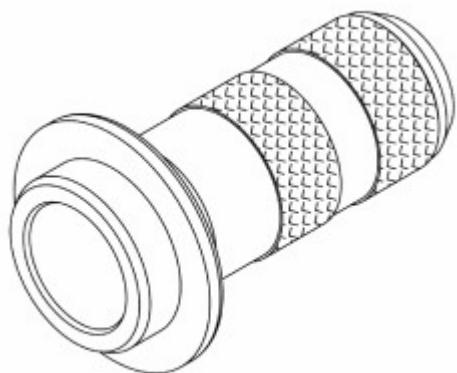
Name: Driver of outer race of bearing 30210

Tool number: PRM 3115



Name: Driver of inner race of bearing 30210 and shaft seal 70x90x13

Tool number: PRM 3116



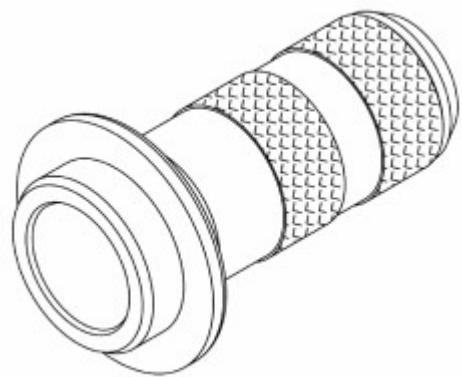


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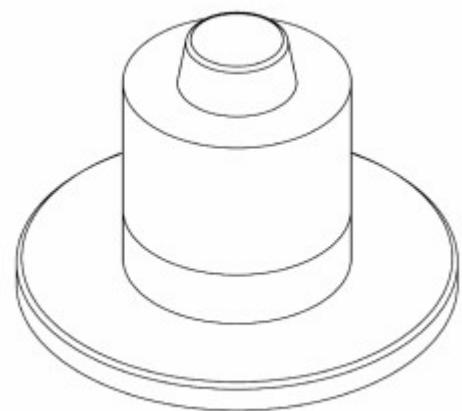
Name: Driver of shaft seal 70x90x13

Tool number: PRM 3117



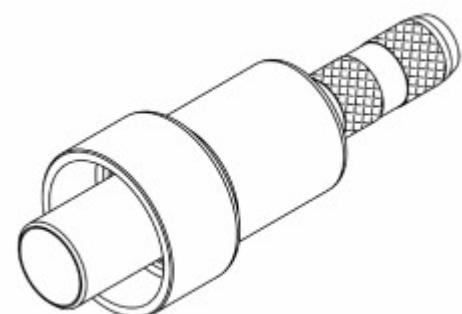
Name: Stand for drivers PRM-3117, PRM-3116 and PRM-3112

Tool number: PRM 3126



Name: Driver of inner ring of bearing 32218

Tool number: PRM 3166.1



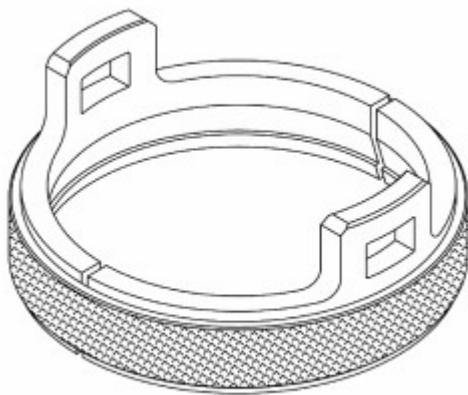


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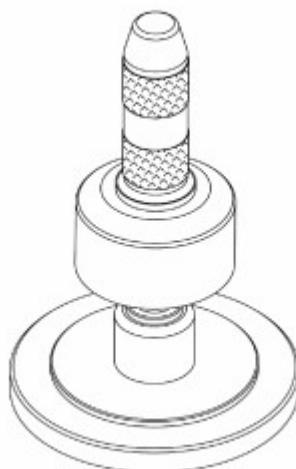
Name: Puller of inner ring of bearing 32218

Tool number: PRM 3167



Name: Driver of shaft seals 72x100x13, 75x100x13 and bearing 6015

Tool number: PRM 3168.1



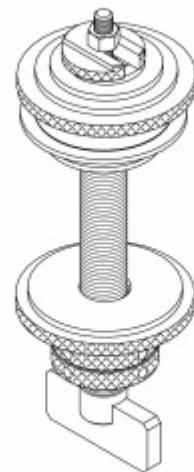


04 Auxiliary Gearbox



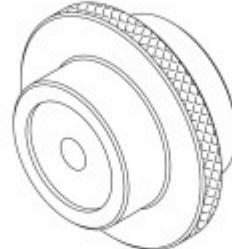
Name: Universal tool to measure clearance of tapered roller bearings

Tool number: PRM 3206



Name: Puller support of bearings

Tool number: PRM 3260.1



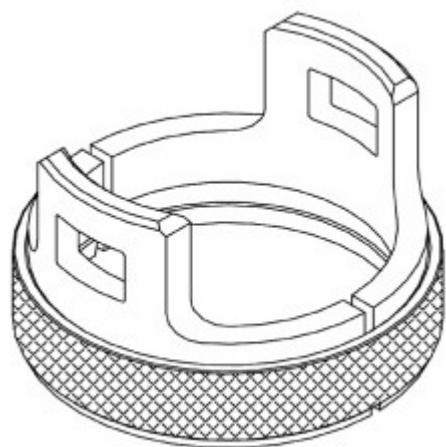


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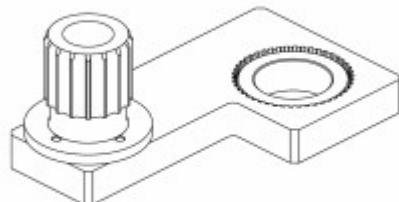
Name: Puller of inner race of bearing 32312

Tool number: PRM 3261



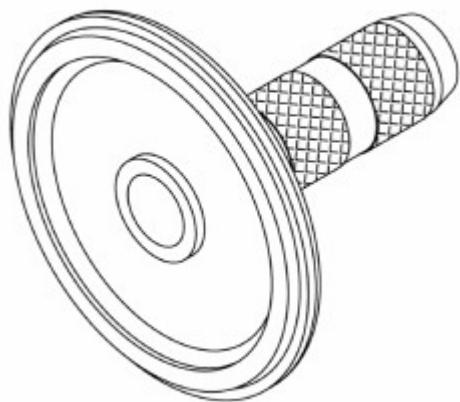
Name: Assembly stand of auxiliary gearbox shafts

Tool number: PRM 3262



Name: Driver of outer race of bearing 32218

Tool number: PRM 3269



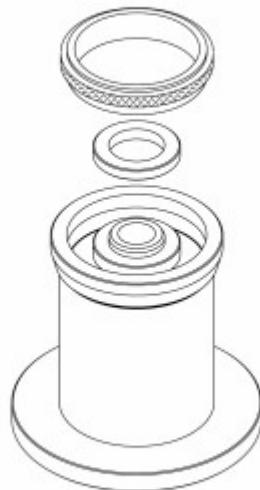


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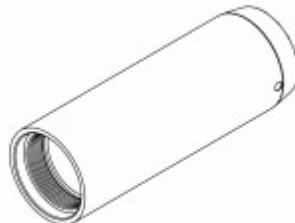
Name: Stand for driver PRL-0756, PRL-0753

Tool number: PRM 3270



Name: Guide mandrel for installing idle gear pin

Tool number: PRM 3292





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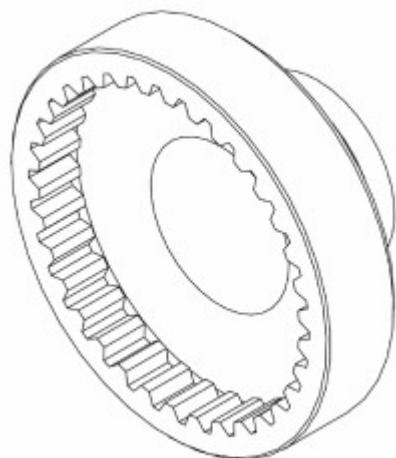
Name: Universal extractor

Tool number: PRM 3322



Name: Reduction part for stand PRM-3262

Tool number: PRM 3352





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Name: Universal extractor

Tool number: PRM 3353



Name: Universal puller

Tool number: PRM 3354



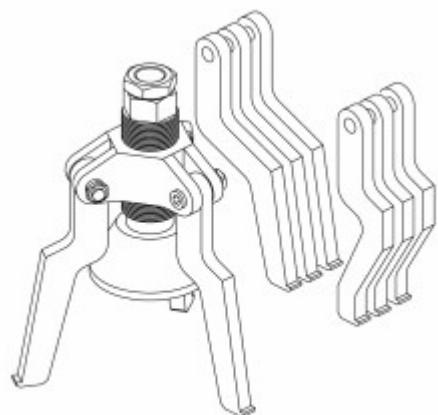


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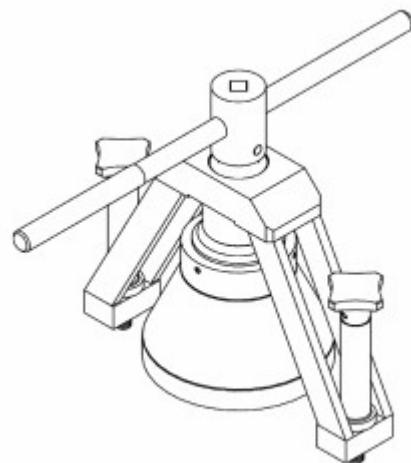
Name: Universal puller

Tool number: PRM 3355



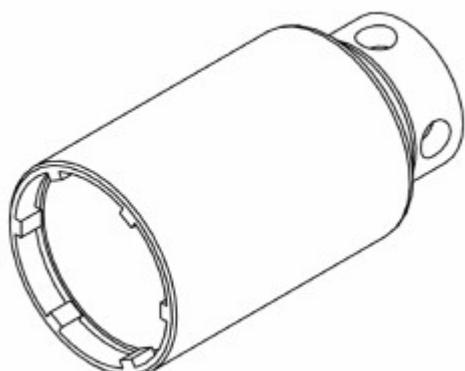
Name: Tool to set up clearance of drive shaft bearings

Tool number: PRM 3875



Name: Wrench for nuts 442 0 5257 136 4, 442 4 5257 172 4, 442 0 5257 070 4, 442 0 5257 097 4

Tool number: URN 0204.2



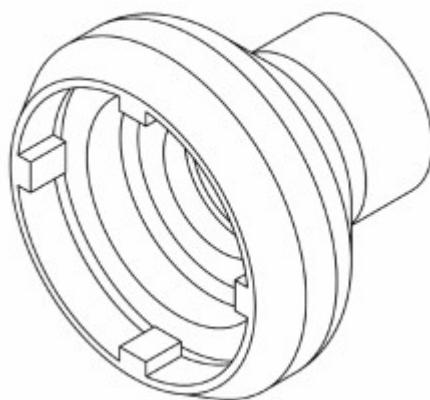


04 Auxiliary Gearbox



Name: Wrench for nut 442 0 5257 075 4

Tool number: URN 0356



Name:

Wrench for nuts 442 0 5257 142 4, 442 0 5257 155 4

Tool number: URN 1302



Name: Wrench for nut 442 0 5278 025 4

Tool number: URN 1333





4.4 Survey of Torque Specifications

Tab. 4.3 Survey of screw connections torque specifications

Data	Unit	Value
Oil drain and inspection plugs		200 ± 20
Shifter rod nut		160 ± 10
Cylinder cover bolts		32 - 46
Nut fixing the piston to the shifter rod		160 ± 10
Rear cover bolts		56 - 80
Oil pipe hollow screws		40 ± 4
Pump cover bolts		6,7 - 9,5
Rear cover bolts		32 - 46
Nuts 442 0 5257 173 4	Nm	400 ± 40
Nuts 442 0 5257 174 4		400 ± 40
Upper cover bolts M12		80 ± 10
Upper cover bolts M16		190 ± 20
Fastening nut to the front backbone tube		420 ± 40
Nuts 442 5257 172 4		400 ± 40
Fork pin nut		110 ± 10
Oil sight gauge		60 ± 10
Intermediate gear pin plug		300 ± 30
Partition bolts		16 - 23
Nuts 442 5278 025 4		400 ± 40



4.5 Working Procedures

4.5.1 Oil Change in the Auxiliary Gearbox

a) Reason for the Oil Change

1. Regular oil changes according to the TDS (BEML - TATRA Drain Specification) after three years of the operation at the latest.

b) Technical Conditions

1. Clean the filter screen during the oil change.
2. The filter screen must not be damaged.
3. Clean metal chips and residues from the drain plug magnet.
4. Replace the sealing ring during the installation of the plug c/w magnet.
5. Fill it with oil according to the manufacturer's specification.
6. No oil is allowed to leak beneath plugs of the inspection and drain holes after the oil change.

c) Oil Change Procedure

1. Place the oil pan below the auxiliary gearbox housing to catch the oil, which spills out, and dismount the plug **3** on the left-hand side at bottom of the auxiliary gearbox housing and drain the oil into a prepared pan.
2. Remove the filter screen **5**, rinse it out in the kerosene and use the brush to remove the dirt.
3. Thoroughly clean the bearing surface of the drain plug on the auxiliary gearbox housing.
4. Clean metal residues and chips from the magnet of the plug **3**.
5. Make sure that the suction pipe **6** is not partially moved out of its position in the hole of the auxiliary gearbox housing.
6. Slide the filter **5** into a hole on the auxiliary gearbox housing so that it rests against the suction pipe.
7. Fit a new sealing ring on the plug **3** and mount it into a screw hole.
8. Dismount the plug **2** from the filler and inspection hole and top up the oil into the gearbox housing up to the lower edge of the inspection and filler hole, fit a new sealing ring **1** on the plug and reinstall it.
9. Tighten plugs **2** and **3** to the torque specification of **200 ± 20 Nm**.
10. Make a test run with the vehicle and check the plugs for leaks.

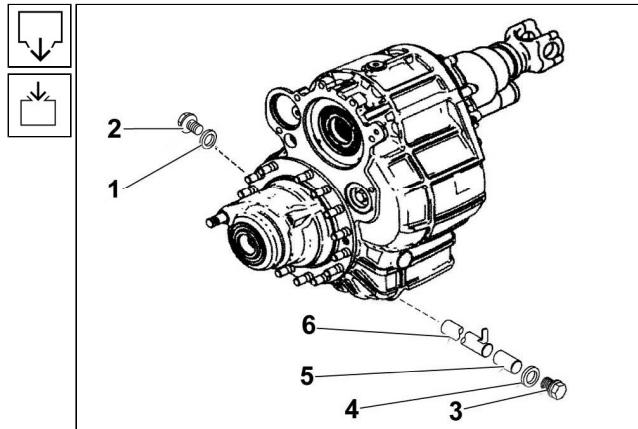


Fig. 4.3 Oil drain and inspection plugs on the auxiliary gearbox



04 Auxiliary Gearbox

4.5.2 Adjustment of On-road ("Hare") and Off-road ("Turtle") Gear Speeds in Auxiliary Gearbox without the Winch Power Take-off Drive

a) Reasons for the Adjustment

1. Some gear speed cannot be shifted.
2. Air leakage from the shift cylinder.
3. Piston seizure in the shift cylinder.

b) Technical Conditions

1. Replace shaped rings and washers with new ones.
2. Set the piston stops so that the clearance of **0.2 - 0.5 mm** occurs between the shifter sleeve and shifter fork during the gear shifting.
3. Both piston and cylinder must have no signs of corrosion and rubbed surfaces.
4. Use the tool **PRM 2439.1** for the adjustment.

c) Adjustment Procedure

1. Shift to the "turtle" gear or to the "hare" gear and shut the engine off.
2. Dismount union nuts from air pressure manifolds leading to the cylinder cover and shift cylinder.
3. Unscrew bolts **7** from the cylinder cover; withdraw the cover **6** and shaped sealing ring **13**.
4. Use the tool **PRM 2439.1** to lock the cylinder **12** against move-out and apply the transmission oil to the cylinder interior.
5. Convey the compressed air from the external source to move the piston **5** towards the cylinder margin. Unlock and dismount the nut **9** of the shifter rod **10**.
6. Convey the compressed air to press the piston **5** out of the shifter rod **10** and pull it out of the cylinder **12**.
7. Remove both washers **3**, **4** and spacer washers **1**, **8** at a time.

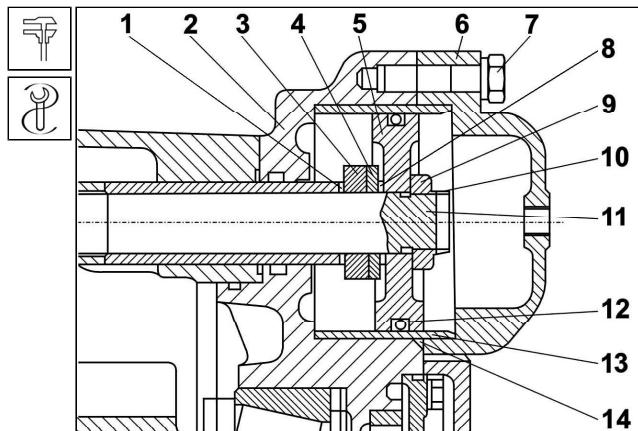


Fig. 4.4 Auxiliary gearbox shift cylinder

CAUTION:

Pay an extreme attention during application of the compressed air used to move the piston out of the cylinder and bear in mind that the piston might "shoot out".



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8. Tap the bush 2 in position and measure up the bush 2 countersinking depth of "x" of the shifter rod 3 into the rear cover 1. Calculate the thickness "z" of spacer washers out of the formula:
$$z = x - y,$$
in which y is the axial clearance, i.e. **0.2 - 0.5 mm.**
9. Fit spacer washers 1 onto the piston rod (shifter rod) 10 (See Fig. 4.4).
10. Fit the shaped ring 11 onto the piston 5 and apply the continuous layer of the plastic lubricant to the piston c/w ring.
11. Mount washers 3, 4 and fit the piston 5 on the shifter rod 10 and tighten the nut 9 to **160 ± 10 Nm.**

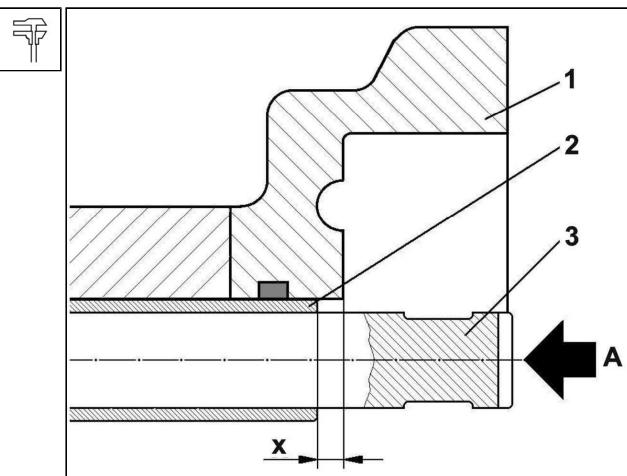


Fig. 4.5 Shifter rod bush

Note:

Do not lock the nut!

12. Measure up how much the cylinder overhangs from the rear cover – the dimension **B** - as shown in the figure of the shift cylinder piston adjustment.
13. Use the compressed air to displace the piston into a position of the "hare" gear speed shifting and measure up the countersinking depth **C** of the piston into cylinder and calculate the distance **A** between the piston face and the front surface of the rear cover as follows:
$$A = B - C.$$
14. Measure up the depth of a hole for the piston stop in the shift cylinder cover – the dimension **D** - and calculate the distance **X₁** between the piston face and the shift cylinder stop area using the formula:
$$X_1 = D - A.$$
15. Calculate the thickness of spacer washers **Z₁**:
$$Z_1 = X_1 + Y \quad (Y = 0.2 - 0.5 \text{ mm}).$$
16. Dismount the nut 9 (See Fig. 4.4) and move the piston 5 out of the cylinder. Fit spacer washers 2 (See Fig. 4.6) of the thickness **Z₁** between the piston 1 and washer 3.
17. Reinstall the piston into the cylinder and tighten the nut to the shifter rod to **160 ± 10 Nm.** Lock the nut in both grooves with a tool of the minimum radius of **2.5 mm.**
18. Dismount the tool **PRM 2439.1** from the cylinder. Slide the shaped sealing ring on the cylinder.
19. Apply a layer of the sealant to the perfectly clean bearing surface of the cylinder cover and bolts to attach the cylinder cover to the rear cover and tighten to **32 - 46 Nm.**
20. Convey the compressed air from the external source to check the cylinder for leaks and check the

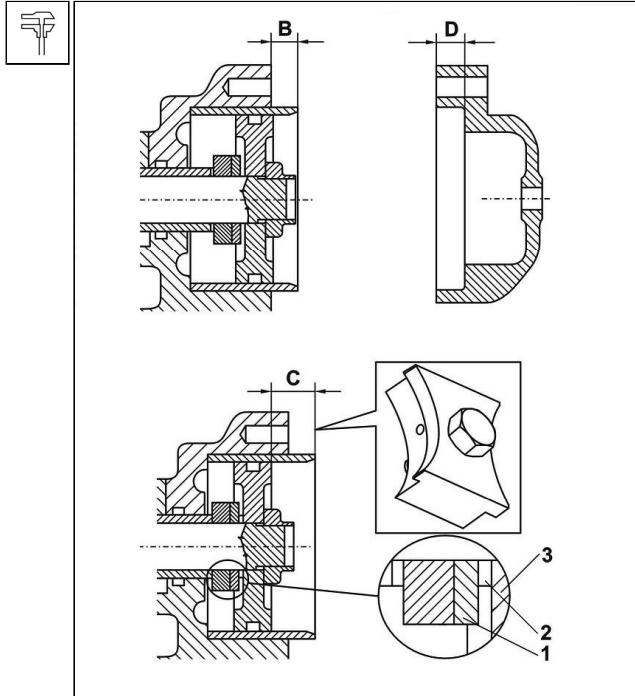


Fig. 4.6 Shift cylinder piston adjustment



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"turtle" and "hare" gear speeds shifting mechanism for function.

21. Mount union nuts of air pressure manifolds to the cylinder cover and to the rear cover.
22. Start the engine, pressurize the pneumatic system and use the soap water to check the connections for leaks.
23. Make a test run with the vehicle and check the "turtle" and "hare" gear speeds shifting for function.



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4.5.3 Adjustment of On-road ("Hare") and Off-road ("Turtle") Gear Speeds in Auxiliary Gearbox with the Winch Power Take-off Drive

a) Reasons for Adjustment

1. Some gear speed cannot be shifted.
2. Air leakage from the shift cylinder.
3. Piston seizure in the shift cylinder.

b) Technical Conditions

1. Replace shaped rings and washers with new ones.
2. Adjust piston stops so that the clearance between the shift sleeve and shifter fork is **0.2 - 0.5 mm** when the gear is shifted.
3. Both piston and cylinder must have no signs of corrosion or rubbed areas.
4. Use the tool **PRM 2439.1** for adjustment.

c) Adjustment Procedure

1. Shift in neutral and stop the engine.
2. Unscrew union nuts of air pressure manifold to cylinder cover and shift cylinder.
3. Unscrew bolts **7** from cylinder cover **6**, withdraw cover **6** and shaped sealing ring **13**.
4. Use the tool **PRM 2439.1** to secure the cylinder **12** against sliding-out and smear the inner space of cylinder with transmission oil.
5. Convey the compressed air from the external source to move the piston **5** together with floating piston **8** towards the edge of cylinder **12**. Unlock and unscrew nut **9** of the shift bar **1**.

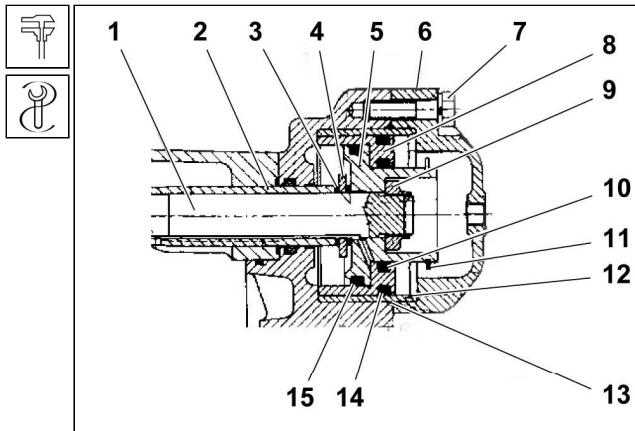


Fig. 4.7 Auxiliary gearbox shift cylinder

6. Use a tool to lock the floating piston **8** towards piston **5**.
7. Apply the compressed air to press the piston **5** c/w floating piston **8** out of the shift bar **1** and move it out of cylinder **12**.
8. Simultaneously take out washer **4**, and spacer washers **3**.
9. Withdraw lock ring **11** from piston **5**.
10. Dismantle the assembly of piston **5** and floating piston **8**. Remove outer ring **15** from piston **5** and outer ring **14** and inner ring **10** from floating piston **8**.
11. Unscrew the tool **PRM 2439.1** from cylinder.

CAUTION:

Pay an extreme attention when applying the compressed air during pushing the piston out of cylinder and do not allow the piston to shoot out.



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12. Oil the cylinder **12** (See Fig. 4.7) and secure with the tool **PRM 2439.1**.
13. Use the driver to knock the bush **2** (See Fig. 4.8) (being滑ed on the shift bar **1**) in position as far as it goes what means that the shift sleeve comes to bear against major drive gear - the high gear will be shifted.
14. Measure the countersinking depth "x" of the bush **2** of shift bar **3** into rear cover **1**. Calculate the thickness of spacer washers "z" out of formula:
$$z = x - y$$
where **y** is the axial clearance, i.e. **0.2 - 0.5 mm**.
15. Fit washers **3** and **4** on the piston rod (shift bar) **1** (See Fig. 4.7).
16. Fit ring **12** on piston **5**, fit inner ring **10** and outer ring **14** on floating piston **8** and smear them with grease.
17. Slide the assembly of pistons into cylinder **12** and tighten nut **9**.
18. Use a tool to secure the floating piston **8** to piston **5**.

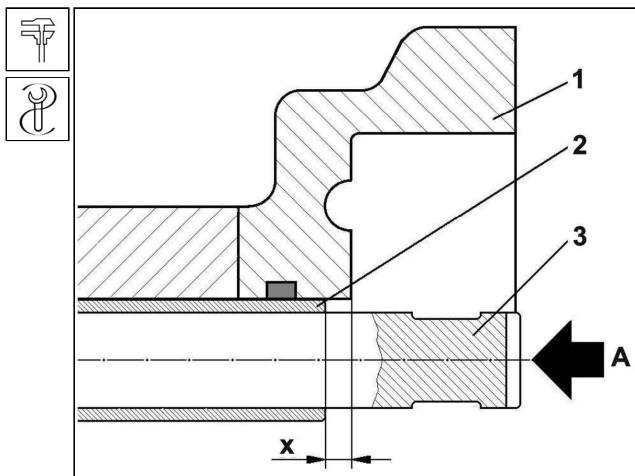


Fig. 4.8 Shift bar bush

19. Mount the pneumatic manifold and shift down to position of the low gear (the shift sleeve comes to bears against the drive gear).
20. With no air pressure in the system, measure the distance **A** between the rear face of floating piston **2** and rear surface of the rear cover **1**.
21. Measure the depth of the stop surface **B** from the face in the cylinder cover **7**.
22. Unscrew nut **5**, remove the assembly of pistons and insert a necessary number of washers **4** so that the dimension **A** exceeds by **0.2 to 0.5 mm** the dimension **B**.
23. Install the assembly of pistons into cylinder and screw the nut **5**. Tighten the nut to **160 ± 10 Nm**, lock the nut in grooves with a punch - radius R of the tool should be **2.5 mm** as a minimum.
24. Dismount the locking tools.
25. Slide the lock ring **3** into piston groove **6**.
26. Fit ring **13** on cylinder **12** (See Fig. 4.7) from outside.
27. Apply a layer of sealant to the contact surface (first clean it thoroughly) of the cylinder cover **6** and use bolts **7** c/w spring washers to attach the cylinder cover **6** to the rear cover. Tighten bolts **7** to **32 - 46 Nm**.

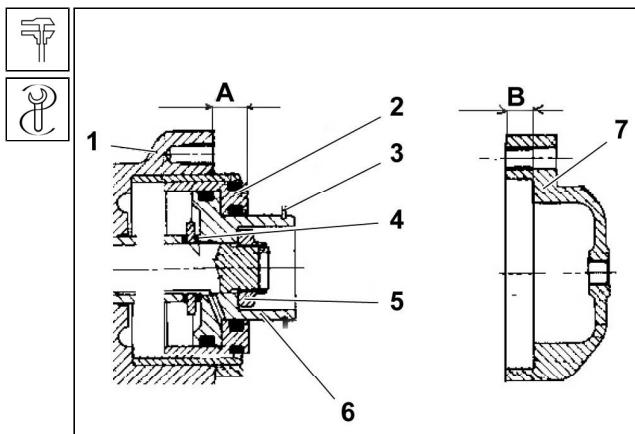


Fig. 4.9 Adjustment of shift cylinder pistons



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28. Apply the compressed air from the external source to check the cylinder for leaks and check whether the neutral, low and high gears are easy to be shifted.
29. Mount union nuts of the pressure air manifold to the cylinder cover and rear cover.
30. Start the engine, pressurize the pneumatic system and apply soap and water to check the connections for leaks.
31. Road test the vehicle and check the gear shifting of L/H gears.



4.5.4 Removal and Installation of the Tachograph Sensor

a) Reasons for Removal and Installation

1. Inspection or replacement of the speedometer sensor.
2. Disassembly or replacement of the auxiliary gearbox.

b) Technical Conditions

1. The distance between the sensor and the intermediate gear face makes **$1.5 + 0.3$ mm**.
2. Replace the damaged parts with new ones.
3. Apply the adhesive **LOCTITE** to the thread.
4. Seal up the speedometer cable union nut after inspection.

c) Removal Procedure

1. Unseal the union nut **2** of the sensor cable outlet on the auxiliary gearbox and remove it.
2. Unscrew the inductive sensor **1** from the auxiliary gearbox housing, remove and keep spacer washers **3** in a safe place.

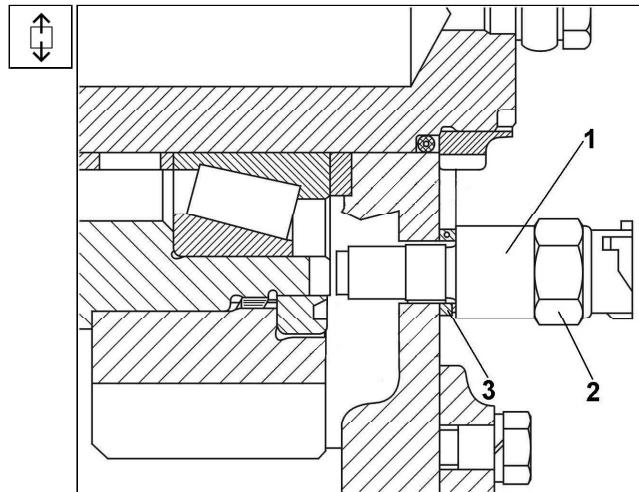


Fig. 4.10 Removal of the speedometer sensor

d) Installation Procedure

1. Measure up the distance of "x" between the body-bearing surface and the sensor face during installation of a new sensor **1**.
2. Measure up the distance of "y" between the face of the auxiliary gearbox housing and the face of the intermediate gear.
3. Calculate the thickness "T" of the spacer washer **3**:

$$T = Y - [X + (1.5 + 0.3)] \text{ mm}$$

4. Fit the spacer washer **3** and apply the adhesive **LOCTITE** to the sensor thread.
5. Mount the inductive sensor **1** and tighten to **$40 + 10$ Nm**.



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6. Mount the union nut **2** of the cable outlet.
7. Make a test run with the vehicle to check the speedometer signal.

Note:

Only the authorized service station may seal up the speedometer.

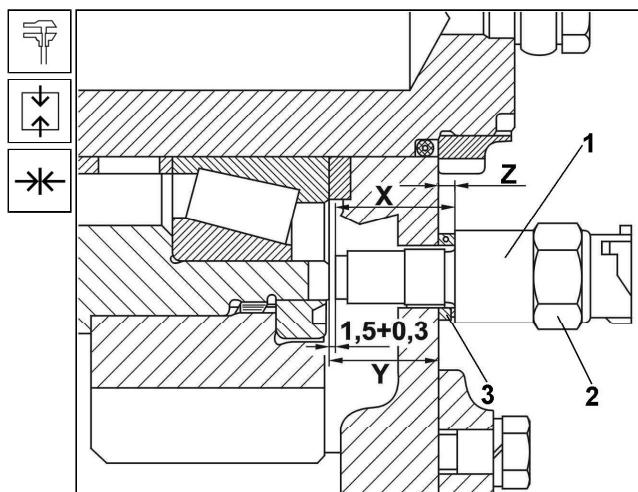


Fig. 4.11 Speedometer sensor installation



4.5.5 Removal and Installation of the Oil Pump Gears and Rear Cover

a) Reasons for Removal and Installation

1. The auxiliary gearbox heats excessively.
2. The pump does not provide a sufficient lubrication.
3. The tapered roller bearings of the input shaft are noisy and heat excessively (increased axial clearance).

b) Technical Conditions

1. Replace shaped seals, shaft seals and lock washers with new ones.
2. Replace the worn parts with new ones.
3. The bearing surfaces of covers must be cleaned thoroughly and coated with the sealant.
4. No oil is allowed to leak from connections and covers.

c) Removal Procedure

1. Detach the air inlet manifold from the winch drive engaging mechanism - **it applies to the truck's version fitted with a winch.**
2. Dismount four bolts **4** c/w spring washers from coupling plate **6**. Withdraw two yokes **3**, tilt the winch drive **5** aside and fix it - **it applies to the truck's version fitted with a winch.**
3. Unscrew six bolts **2** c/w spring washers, and withdraw the complete winch PTO housing **1** - **it applies to the truck's version fitted with a winch.**

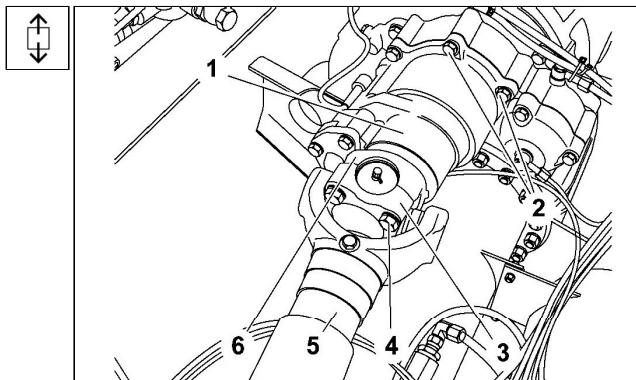


Fig. 4.12 Complete winch PTO housing - removal



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4. Remove outer lock ring **3** . Withdraw the coupling sleeve **1** from the drive shaft **2** -it applies to the truck's version fitted with a winch.

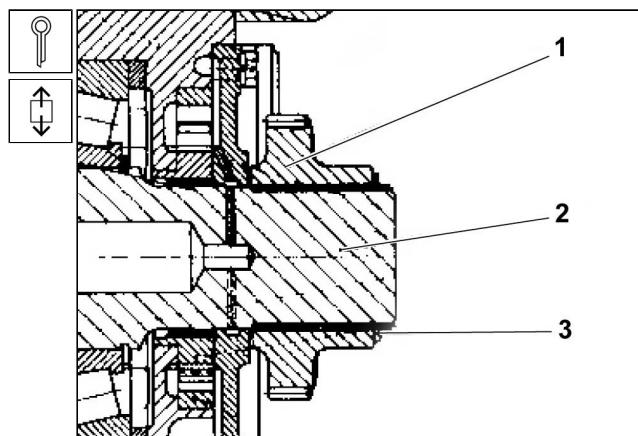


Fig. 4.13 Coupling sleeve - removal

5. Dismount bolts **3** fixing the rear cover (pump housing) **1** to the rear cover **2** ; withdraw the rear cover it applies to the truck's version without a winch.

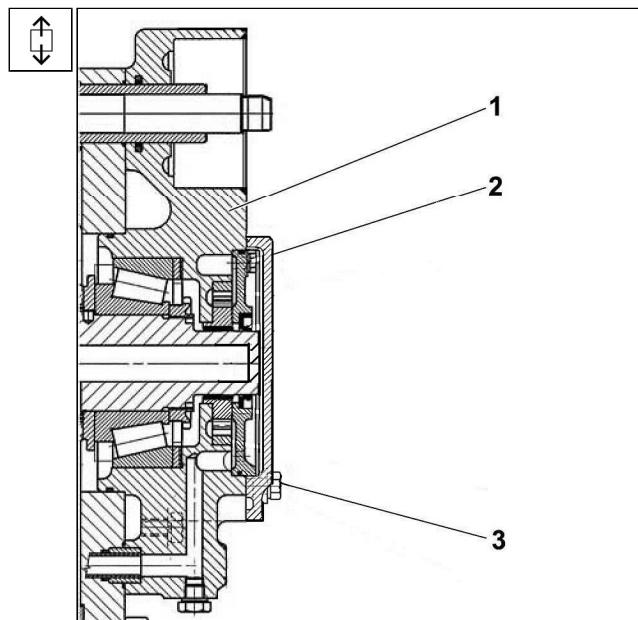


Fig. 4.14 Removal of the rear cover



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6. Dismount the bolts **2** and remove the pump cover **3** c/w shaped ring **7**.
7. Check the shaft seal **4** whether it is in a good condition. Remove the external gear **6** and the internal gear **5** of the rear cover **1** (pump housing) from the driving shaft involute splining.
8. Inspect the wear of teeth sides of the outer gear **6** and the inner gear **5**. If the wear (battering) is small, carry out the inspection of the radial clearance in location of the outer gear on the rear cover **1**.

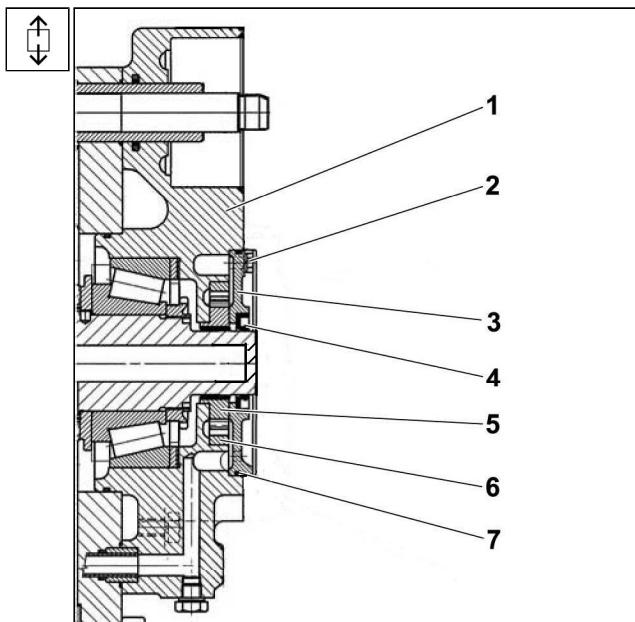


Fig. 4.15 Removal of pump gears

9. Dismount hollow screws **1** and **3** c/w sealing rings from the oil manifold **2** of the rear cover **5** and intermediate gear pin.
10. Dismount bolts **4** from connections of the rear cover **5** and auxiliary gearbox housing **6**.
11. Use the pry-bar to withdraw the rear cover **5** from location in the auxiliary gearbox housing **6**.

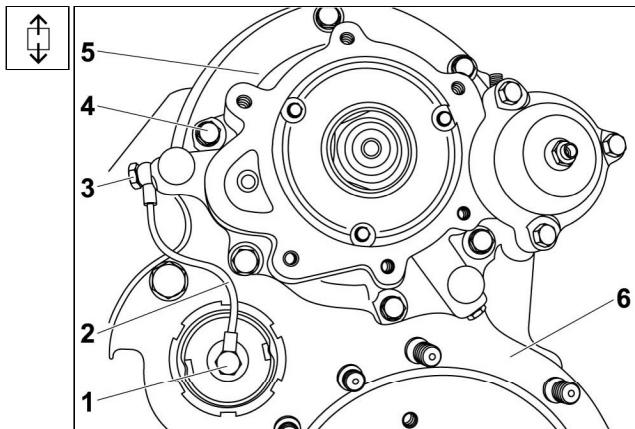


Fig. 4.16 Removal of the rear cover

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d) Installation Procedure

1. Place the washer **3** into the rear cover **2** on the bearing surface and lock it with a dowel **4**.
2. Use the setting tool **1** to measure the distance from the cover face to the washer-bearing surface and put down the value.

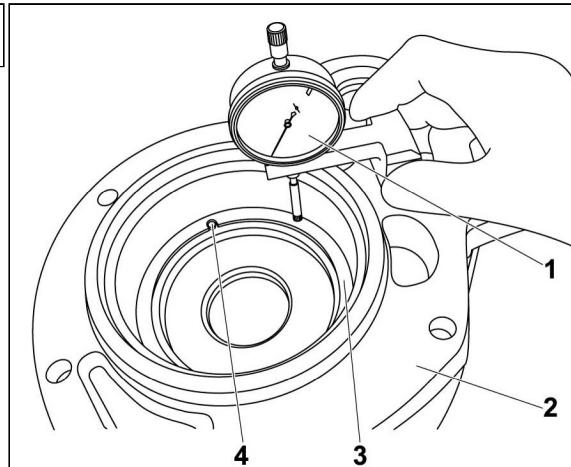


Fig. 4.17 Measurement of the distance from the rear cover face

3. Use the setting tool **1** to measure the distance from the face of the tapered roller bearing 32312 to the bearing surface of the housing and put down the value.
4. Calculate the thickness of washers using the formula:

$$A = (B - C) - D \text{ where:}$$

A is thickness of washers in mm

B is the measured value in the rear cover

C is the measured value from the face of the tapered roller bearing 32312 to the housing bearing surface

D is the specified axial clearance of tapered roller bearings, i.e. **0.05 - 0.15 mm**

5. Place spacer washers of the required thickness below the washer **3** (See Fig. 4.17) and press the bearing outer ring in position.

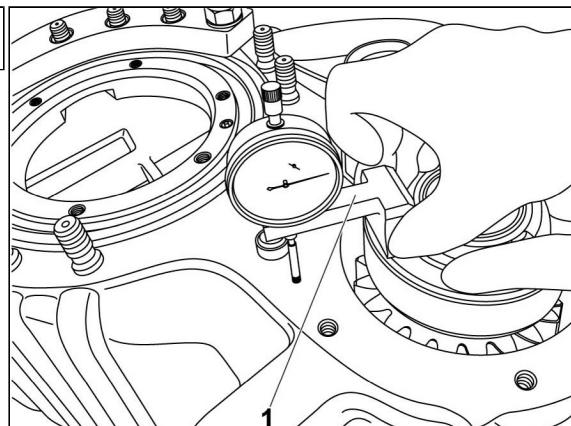


Fig. 4.18 Measurement of the distance from the bearing to the housing face



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6. Apply a layer of the sealant to the bearing surface of the rear cover 5 including bolt holes, fit the rear cover 5 into location in the auxiliary gearbox housing 6 and use the copper driver to press it in position.
7. Mount bolts 4 and tighten to **56 - 80 Nm**.
8. Install the pipe 2 and mount hollow screws 1 and 3 including seals.
9. Tighten hollow screws 1 and 3 to **40 ± 4 Nm**.

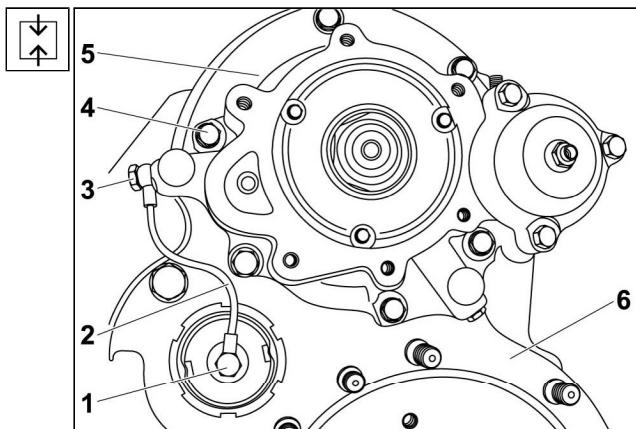


Fig. 4.19 Installation of the rear cover

10. While swiveling the inner involute splining of the input shaft 3, gently press the tapered roller bearing 32312 through the input shaft face.
11. Adjust the magnetic stand c/w dial indicator 2 in position and use the bar 1 to pry against the external gearing face and check the specified axial clearance of tapered roller bearings, i.e. **0.05 - 0.15 mm** as shown in the Fig. Carry out this procedure twice in succession.

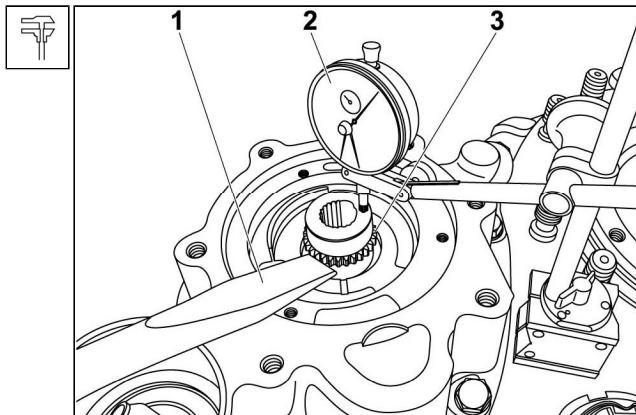


Fig. 4.20 Inspection of the input shaft axial clearance

12. If the measured clearance meets the specified one, place the outer gear 6 and the inner gear 5 of the pump into the cover and thoroughly smear with the transmission oil. The inner gear 5 of the pump must be slid onto the involute splining.
13. Press the shaft seal 4 into the pump cover 3, fit the shaped ring 7 into a slot and smear it with the plastic lubricant. Apply a layer of the sealant to the perfectly clean bearing surface of the pump cover 3 and use bolts 2 to attach the cover 3 to the rear cover 1 (pump housing) and tighten to **6.7 - 9.5 Nm**.

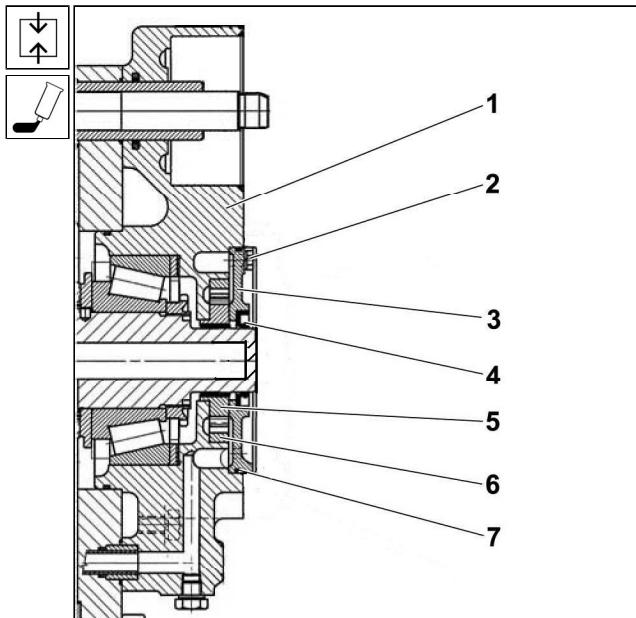


Fig. 4.21 Installation of pump gears



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14. Apply a layer of the sealant to the perfectly clean bearing surface of the rear cover 1 and use bolts 3 to attach the cover 2 to the rear cover 1 (pump housing) and tighten to 32 - 46 Nm it applies to the truck's version without a winch..

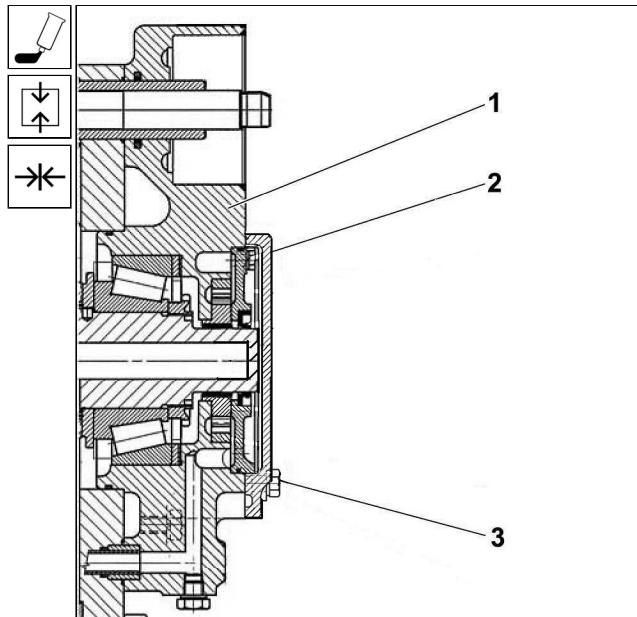


Fig. 4.22 Installation of the rear cover

15. Press the coupling sleeve 1 on grooves of the drive shaft 2 and secure with outer lock ring 3 - it applies to the truck's version fitted with a winch.

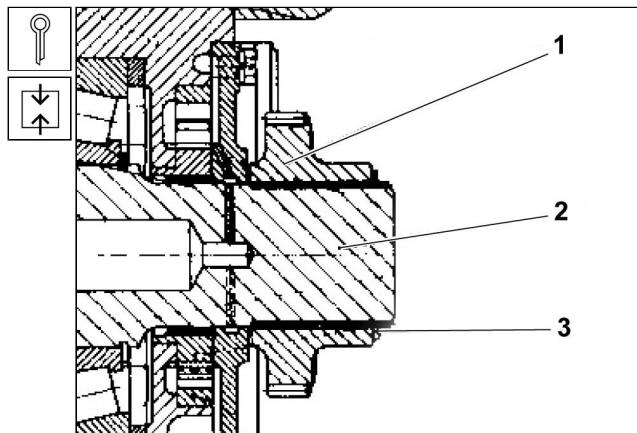


Fig. 4.23 Coupling sleeve - installation



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16. Apply a layer of sealant to the contact surface of the complete winch PTO housing 1 (first clean it thoroughly) and use bolts 2 c/w spring washers to attach the complete housing 1 and tighten the bolts with the **tightening torque of 32 - 46 Nm** to the rear cover (pump housing) - **it applies to the truck's version fitted with a winch**.
17. Slide the winch drive 2 into coupling plate 4 - **it applies to the truck's version fitted with a winch**.
18. Fit two yokes 3 and attach using bolts 1 - **it applies to the truck's version fitted with a winch**.
19. Connect the air inlet manifold to the winch drive engaging mechanism - **it applies to the truck's version fitted with a winch**.

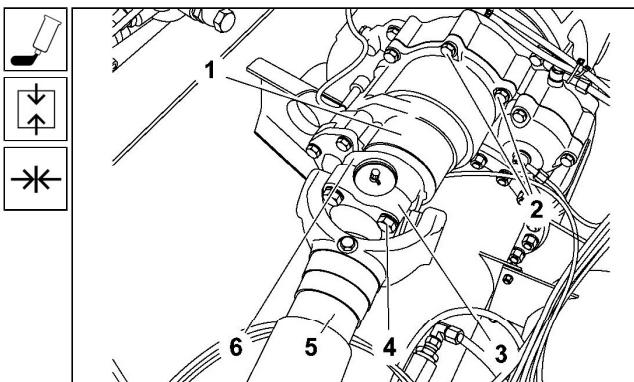


Fig. 4.24 Complete winch PTO housing - installation

e) Inspection of the Oil Pressure

1. Slacken the hollow screw 2 and connections of the complete connecting lubrication pipe 1 of the intermediate gear pin on the rear cover 3.
2. Start the engine and make about a 500 m test run at the engine speed of **1,400 rpm**. Make sure that the oil drips from below the hollow screw. If the oil drips, the pump is functional. Clean the auxiliary gearbox housing from oil.
3. Check the oil level and if need be, top up the oil into the auxiliary gearbox. Tighten the hollow screw 2 to **40 ± 4 Nm**.

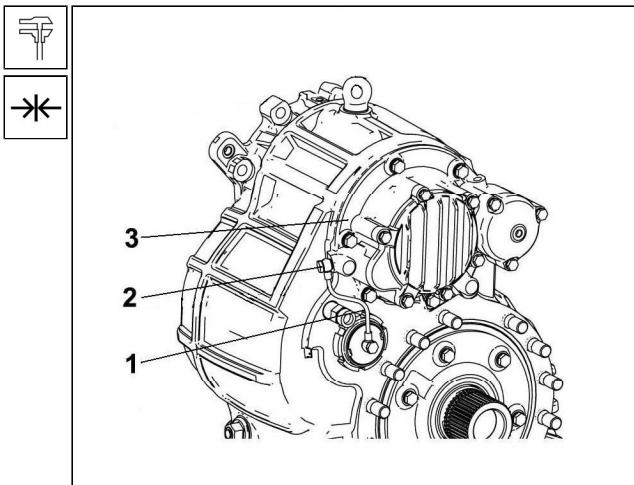


Fig. 4.25 Inspection of the oil pressure



4.5.6 Removal and Installation of the Auxiliary Gearbox

a) Reasons for Removal and Installation

1. The gear slips out - low ("turtle") and high ("hare") gears cannot be shifted.
2. Excessive noise of the intermediate gear and lower gear assembly (the gearing has been worn/damaged).
3. The tapered roller bearings of the intermediate gear and complete lower shaft are too noisy and heat excessively.
4. Leakage, which cannot be corrected without removal.
5. Damage, loosened intake pipe.
6. The front drive cannot be engaged, and the shift cylinder is functioning.

b) Technical Conditions

1. Replace the shaped sealing rings between backbone tubes, and auxiliary gearbox and gearbox with new ones.
2. Replace spring washers with new ones.
3. Smear the shaft splining with paste **Servo grease 'MP'**.
4. Apply sealant to threads of fastening bolts of the front drive shift control cylinder before installation.
5. Use the soap and water to check the air manifolds for leaks.
6. Use a special tool – hanger (lifting eye) **2 010 420 154** for removal and installation of the auxiliary gearbox.
7. Release the air from the pneumatic system.

c) Removal Procedure

1. Dismount the cargo platform.
2. Detach the bleeding manifold **5** from the auxiliary gearbox.
3. Loosen all clamps and clips of air manifolds and electric cables.
4. Dismount the gearbox according to the procedure (See Part 3).
5. Detach air manifolds **8** and **9** from the shift control cylinder.
6. Drain oil from auxiliary gearbox according to the procedure (See Subchapter 4.5.1).
7. Dismount plug **6** c/w sealing ring from auxiliary gearbox **7**. Mount the lifting eye instead of the plug **6** and hang the auxiliary gearbox **7** on the lifting device.
8. Unscrew four bolts **1** from the coupling plate **4**. Withdraw 2 pcs of yokes **3**, tilt off the winch drive **2** and fix it - **it applies to the truck's version fitted with a winch**

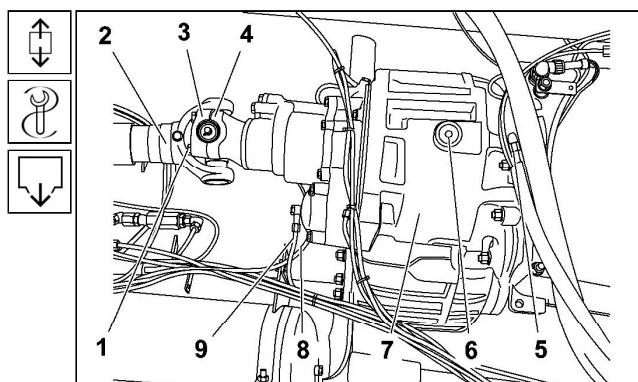


Fig. 4.26 Auxiliary gearbox - removal 1



04 Auxiliary Gearbox



9. Detach the air inlet manifold from the winch drive engaging mechanism - **it applies to the truck's version fitted with a winch.**
10. Unseal and unscrew the union nut of the cable outlet from sensor on the auxiliary gearbox (See Subchapter 4.5.4).

Note:

Mark the yokes 3 and mount them in the original place.

11. Dismount the torsion bars 4 of the front axle suspension according to the procedure (See Part 8).
12. Dismount couple of rear axles c/w rear backbone tube 7 and cross girder 6 according to the procedure (See Part 7).
13. Fit the vehicle frame on stands.
14. Remove the shift control cylinder 1 of the front axle drive (See Part 6).
15. Support the front backbone tube 2.
16. Unscrew nuts 3 fixing the auxiliary gearbox 5 to the front backbone tube 2.
17. Use the lifting device to move the auxiliary gearbox 5 out of the front backbone tube 2 rearwards in the vehicle centerline and remove from vehicle.
18. Place the auxiliary gearbox 5 into a pallet.
19. Check faces of backbone tubes flanges, correct possible damage and clean them. Remove shaped rings.

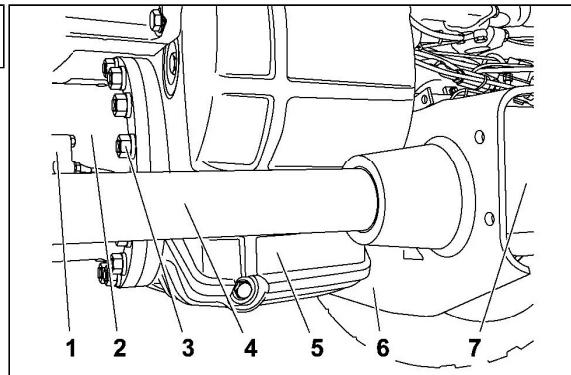


Fig. 4.27 Auxiliary gearbox - removal 2

d) Installation Procedure

1. Insert shaped rings into a face recess of the rear backbone tube and onto front part of the auxiliary gearbox front drive shift cover flange in places of connection with backbone tube flanges.
2. Smear the shaped rings with sealant to protect them against releasing.
3. Hang the auxiliary gearbox 5 on the lifting eye on crane, lower it down and slide into the front backbone tube 2 in the vehicle longitudinal centerline so that the propeller shaft will engage into coupling plate of the front drive.
4. Attach the auxiliary gearbox 5 to the front backbone tube 2 and tighten nuts 3 to the specified torque of **420 ± 40 Nm**.
5. Install the cross girder 6 and rear backbone tube 7 c/w couple of rear axles according to

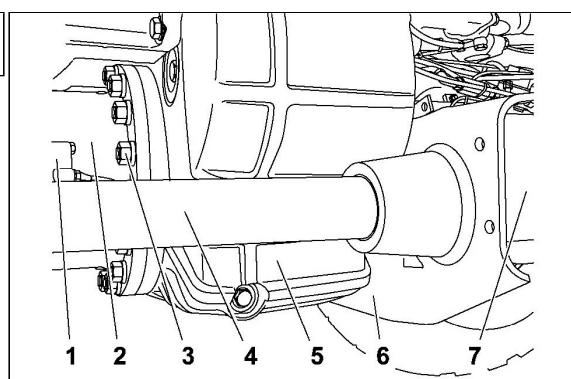


Fig. 4.28 Auxiliary gearbox - installation 1



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the procedure ((See Part 7).

6. Install the torsion bars 4 of the front axle suspension according to the procedure (See Part 8)).
7. Install the front drive shift control cylinder 1 on the front backbone tube according to the procedure (See Part 6).
8. Remove stands from beneath the vehicle frame and front backbone tube 2.
9. Slide the winch drive 2 into coupling plate 4 - **it applies to the truck's version fitted with a winch .**
10. Fit 2 pcs of yokes 3 and mount bolts 1 - **it applies to the truck's version fitted with a winch .**

Note:

Mount the marked yokes 3 in original place.

11. Dismount the lifting eye from auxiliary gearbox 7 and mount plug 6 together with new sealing ring.
12. Attach the air manifolds 8 and 9 to the shift cylinder (do not confuse the air manifolds).
13. Connect air manifolds to the winch drive engaging mechanism - **it applies to the truck's version fitted with a winch .**
14. Mount the gearbox according to the procedure (See Part 3).
15. Mount and seal the union nut of the sensor cable outlet on the auxiliary gearbox (See Subchapter 4.5.4).
16. Attach the bleeding hose 5 of the auxiliary gearbox.
17. Fix all clamps and clips of air manifolds and electric cables.
18. Fill the auxiliary gearbox with oil according to the procedure (See Subchapter 4.5.1).
19. Install the cargo platform.
20. Start the engine and use soap and water to check the air manifolds and connections for leaks.
21. Road test the vehicle.
22. Check the oil level after a road test.

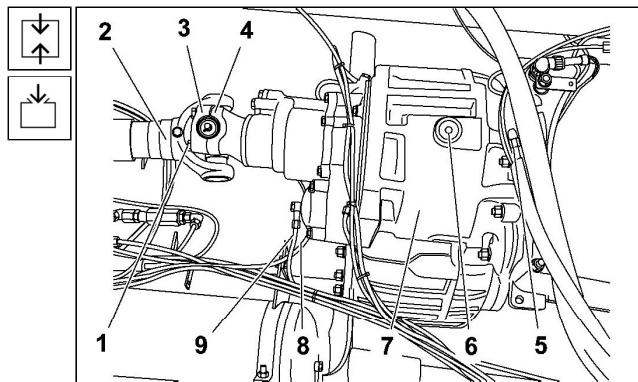


Fig. 4.29 Auxiliary gearbox - installation 2



04 Auxiliary Gearbox

4.5.7 Disassembly and Assembly of the Auxiliary Gearbox

a) Reasons for Disassembly and Assembly

1. The gear is slipping out – “turtle” and “hare” (T/H) gear speeds cannot be shifted.
2. Gears teeth have been damaged or cracked.
3. The auxiliary gearbox is too noisy.
4. The front drive cannot be engaged, while the air shift mechanism and the shift cylinder are in a good condition.
5. The auxiliary gearbox heats excessively.
6. Damage and replacement of the defective parts.
7. The auxiliary gearbox is leaky and it is not possible to replace the seals without its removal from the vehicle.

b) Technical Conditions

1. Replace all roller bearings with new ones when the general overhaul is performed. Otherwise, they need to be replaced only when the rolling races or rolling elements have been worn excessively. All rolling elements must roll in races uniformly without jerking. The contact zone must be situated in two thirds of the raceway width (it must not come to the center). No pitting or sunken raceways are allowed to occur on rolling elements and in the contact zone on raceways of the inner or the outer rings.
2. Teeth sides must not show any wear in the contact zone, i.e. no sunken place towards the non-functional surface of teeth, pitting (crumbled pieces of material) in the contact zone, mainly at teeth foot, are permissible.
3. The rolling races in gear holes and on the driving and driven shafts must have no signs of rolling races depressed area (increased radial clearance - noisiness) or material pitting for rollers.
4. Replace all shaped rings, shaft seals, lock rings and washers with new ones.
5. Dip shaft seals in the specified transmission oil for 30 minutes; fill one third of the edge circumference with the specified plastic lubricant AK 2 and press under a uniform pressure.
6. Clean and degrease bearing surfaces of cover, gearbox housing and screw threads before application of the **Ø 3-mm** layer of the sealant. The sealant should be applied to one bearing surface, apply the sealant round holes in the space between the hole and the housing cavity and allow the sealant to dry out for 5 minutes at least before the sealing surfaces are connected.
7. When needle bearings INA are replaced, mount bearings of one classification group to one location. Smear the location on the shaft with the specified oil before the installation.
8. Discard faulty or excessively worn parts.
9. Clean (wash) the parts before installation; check the functional surfaces (damage, completeness of the machining); correct the possible damage using the suitable tool if possible.
10. When more auxiliary gearboxes are repaired at a time, do not confuse the individual parts (housing cover), in which the bearing orifices are machined in a screwed condition. The parts numbering is situated on the housing face.
11. Press the specified inner rings of bearings and gears in a preheated condition (**100°C**).
12. Keep the minimum prescribed axial clearance of **0.25 mm** for rotary-mounted gears.
13. Keep the specified torque specifications for screw connections according to a survey of torque specifications.
14. Keep the specified axial clearances for bearings, input shaft, lower shaft and the intermediate gear.



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15. Use the specified tools for removal and installation.

c) Disassembly Procedure

1. Dismount the winch power take-off drive according to the procedure (See Subchapter 4.5.5) - it applies to the truck's version fitted with a winch.
2. Unscrew hollow screws **1** and **3** c/w sealing rings and withdraw the connecting pipe **2**.
3. Displace the auxiliary gearbox and use nuts to attach it to mounting of the assembly truck **PRM2531**.

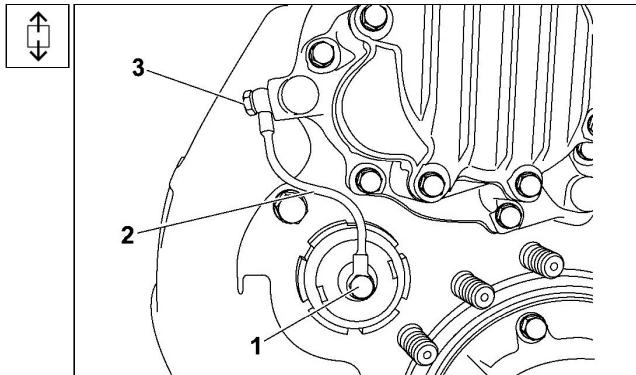


Fig. 4.30 Connecting pipe - removal

4. Swivel the auxiliary gearbox in the assembling truck **PRM 2531**.
5. Dismount two conical head screws M8 **2**.
6. Use the suitable tool to pry out the complete front drive shift mechanism cover **3** (see the arrow) from location in the housing **1**, withdraw it and place it aside.

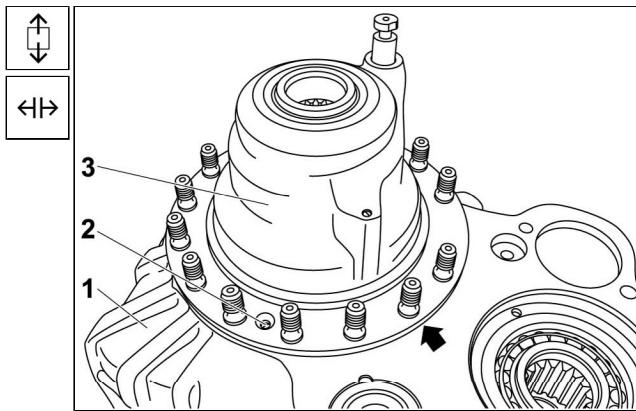


Fig. 4.31 Removal of the front drive shift mechanism cover

7. Bend off per two lock pieces on the partition, LH **1**.
8. Partially swivel the partition, LH **1** to move it out of location in the complete partition, RH and remove the partition.

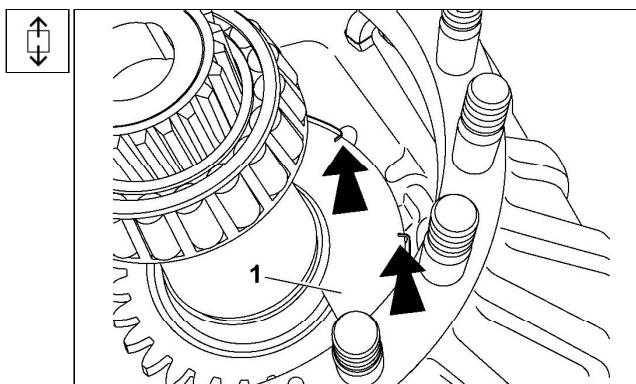


Fig. 4.32 Removal of the partition, LH



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9. Use the suitable tool **3** to remove the lower shaft **2** from location in the housing **1**.

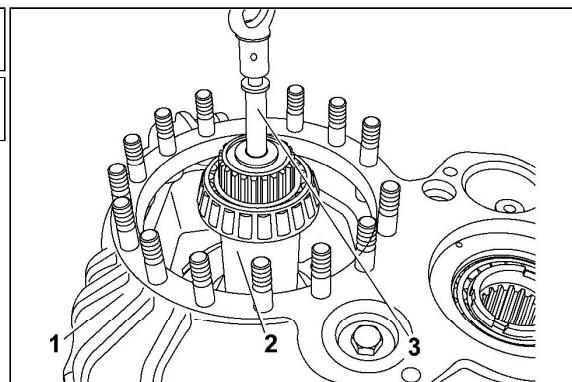
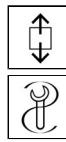


Fig. 4.33 Removal of the lower shaft from location

10. Unlock and unscrew bolts **4**.
11. Withdraw the lock metal sheet **3** and partition, RH **1** from the auxiliary gearbox housing **5**.

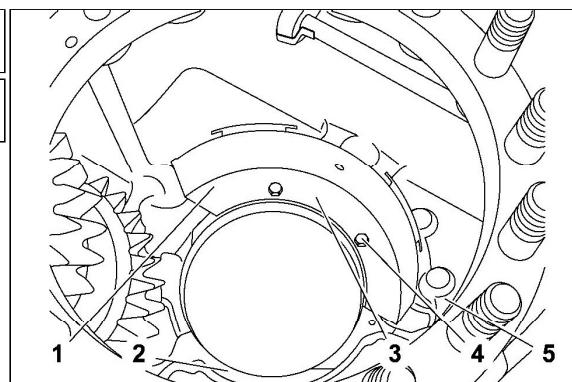
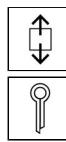


Fig. 4.34 Partition, RH - removal

12. Swivel the auxiliary gearbox in the assembling truck **PRM 2531**.
13. Dismount fastening bolts **2** fixing the rear cover **3** to the housing **1**, use the suitable tool to pry the rear cover **3** out of location in the housing **1** and place the cover aside.
14. Press out the outer ring of conel bearing **2** from the hole in the case **5** (See Fig. 4.34).

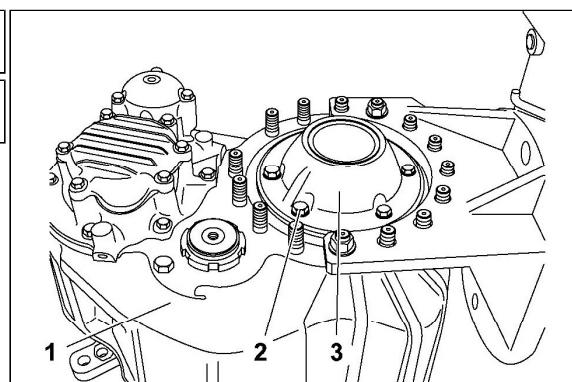
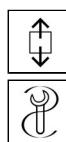


Fig. 4.35 Removal of the rear cover



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15. Unlock the nut **1** from two grooves and use the tool **URN 1333** to dismount the nut.
16. Remove the shaped ring **2** from location in the housing slot **3**.

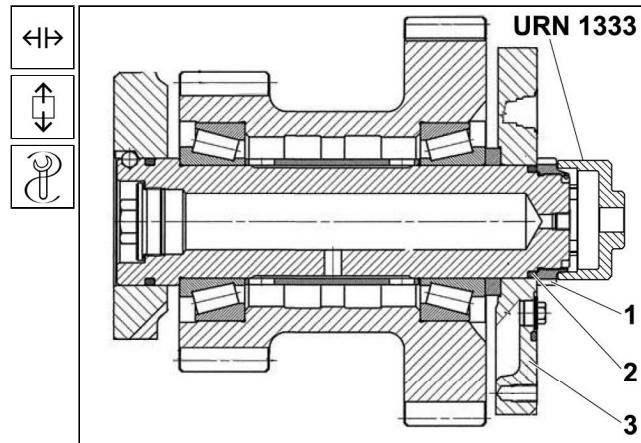


Fig. 4.36 Nut removal using the tool URN 1333

17. Press out the pin **5** of the intermediate gear using the tool **PRL 1361** from location in the housing **6**. While pressing it out, it is necessary to catch the ball **1** and pin **5** of the intermediate gear to protect them from falling-out (to avoid their damage).
18. Install the metal sheet washer **9** (the metal sheet should be 2 to 3 mm thick), intermediate gear **7** c/w tapered roller bearings **8**, spacer tube **2** and spacer washers **3** into the housing and move it to the washer **9**. Remove this set from the housing **6** and place it aside.
19. Remove the shim **4** from the housing recess **6**.
20. Dismount T/H shift piston of the auxiliary gearbox in accordance with the procedure (See Subchapter 4.5.2) - **it applies to the truck's version without a winch**.
21. Dismount the piston and floating piston of L/H auxiliary gears shifting according to the procedure (See Subchapter 4.5.3) - **it applies to the truck's version fitted with a winch**.
22. Remove the plug **2** from the housing **3**.
23. Use the suitable tool **1** to press the shifter rod **7** out of location in the housing **3** in the shifter fork **5** and remove the fork from slot in the coupling sleeve.
24. Remove the tube **6** from the shifter rod **7** and move the shifter rod **7** c/w bush **6** out of location in the housing **3**.

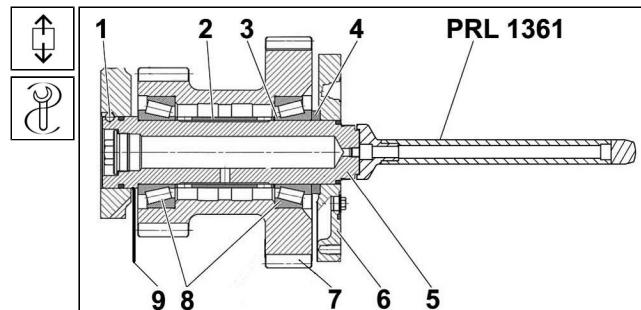


Fig. 4.37 Pressing-out of the intermediate gear pin

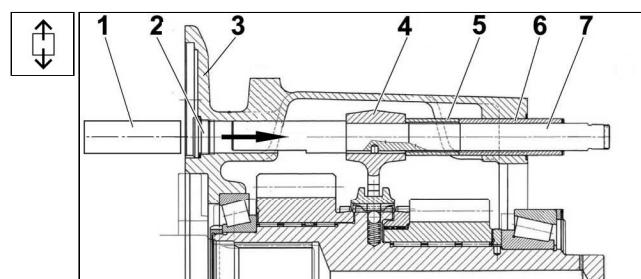


Fig. 4.38 Removal of the shifter fork and shifter rod



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25. Dismount the rear cover in accordance with the procedure (See Subchapter 4.5.5) - it applies to the truck's version without a winch.
26. Dismount the rear cover (pump housing) of the auxiliary gearbox in accordance with the procedure (See Subchapter 4.5.5).
27. Use the suitable tool to remove the driving shaft 3 from the housing 1.
28. Use the suitable (soft) tool to press the outer bearing ring 2 out of the housing 1.
29. Use the universal puller **PRM 3355** and universal extractor **prm 3353** press the outer roller 4 of the bearing 32 312 from the rear cover.

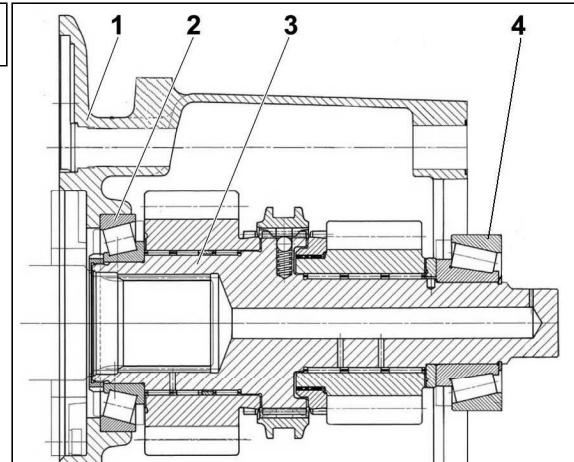


Fig. 4.39 Removal of the driving shaft from the housing

30. Attach the front drive shift mechanism cover 1 into a clamping device and use the universal puller **PRM 3355** c/w universal extractor **PRM 3353** to press the bearing outer ring 3 out c/w circular partition 2.

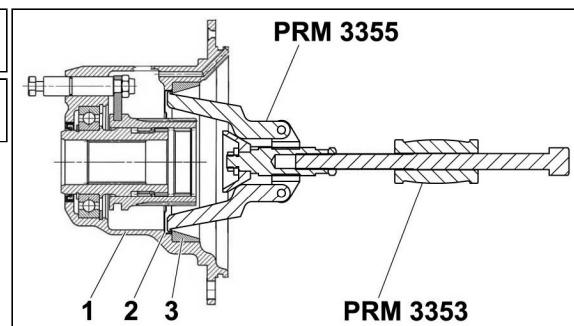


Fig. 4.40 Removal of the front drive shift mechanism cover - 1

31. Clamp the front drive shift mechanism cover 5 while catching its flange into a vice jaws c/w inserts, unlock and unscrew the nut 4 from the screw connection, move the fork pin 2 out of location of the shifter fork 3 and the front drive shift mechanism cover 5.
32. Move the shifter fork 3 c/w segment out of the groove in the coupling sleeve 6 and withdraw the coupling sleeve 6 from the involute splining of the front drive carrier 1.

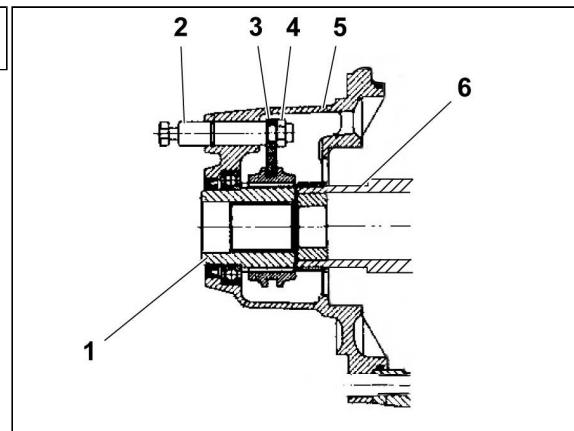


Fig. 4.41 Removal of the front drive shift mechanism cover - 2



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33. Use the extractor to press out the ball bearing **1** c/w front drive carrier **2** from the front drive shift mechanism cover **3**.

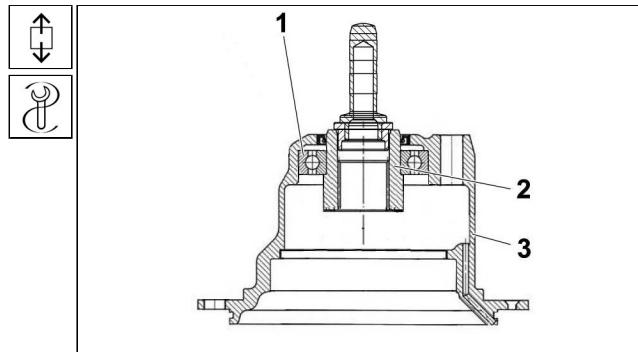


Fig. 4.42 Removal of the front drive shift mechanism cover - 3

34. Place the complete front drive shift mechanism cover **1** on a bench, use the pry bar to remove the shaft seal **2** from the front drive shift mechanism cover **1**.

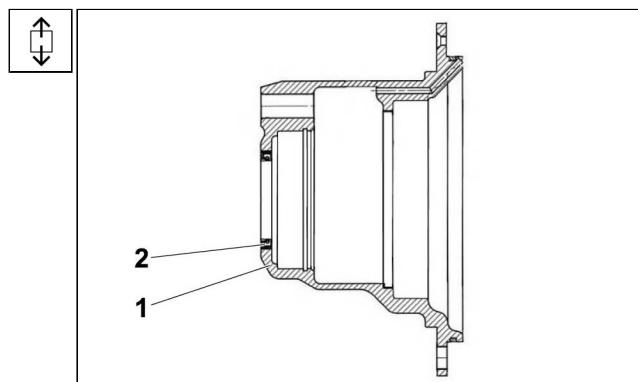


Fig. 4.43 Removal of the front drive shift mechanism - 4

35. Fit the lower shaft **1** into a stand. Unlock the nut safety piece **3** and use the wrench **URN 0204.2** to dismount the nut **2**.

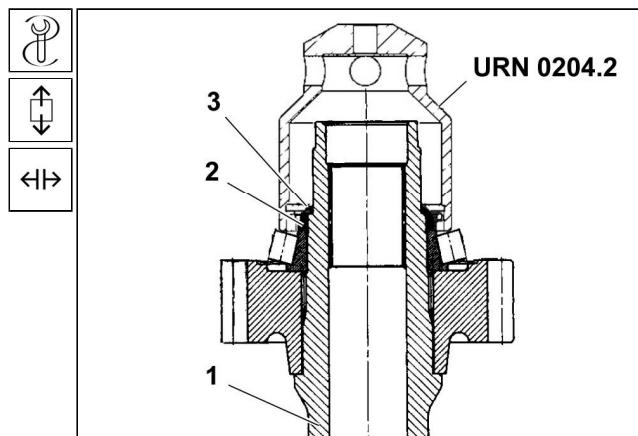


Fig. 4.44 Removal of the nut



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36. Use the universal puller **PRM 0777**, the bearing inner ring puller **PRM 2760** and support plate **PRM 3260.1** to withdraw the inner ring of the tapered roller bearing **1** from location of the lower shaft **2**.

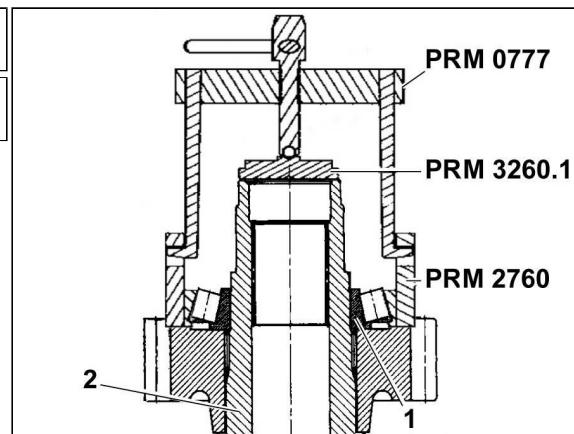
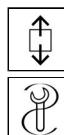


Fig. 4.45 Withdrawal of the tapered roller bearing inner ring

37. Place the lower shaft **1** facing with the lower gear rim **2** into a suitable tool (place common support plates under the lower gear **2**) and press out the lower gear **2**.

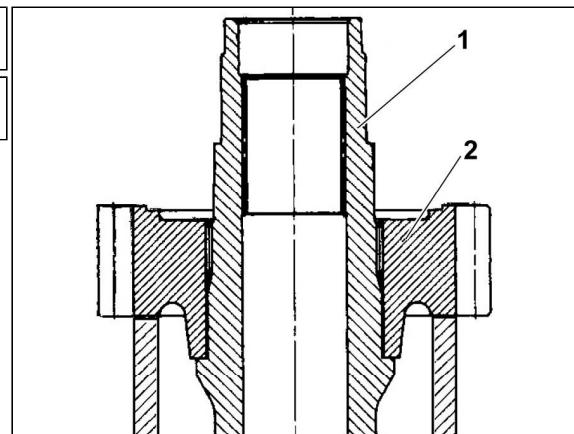
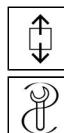


Fig. 4.46 Pressing-out of the lower gear

38. Use the universal puller **PRM 0777**, the bearing inner ring puller **PRM 3167** and support plate **PRM 3260.1** to remove the tapered roller bearing inner ring **1** from location of the lower shaft **2**.

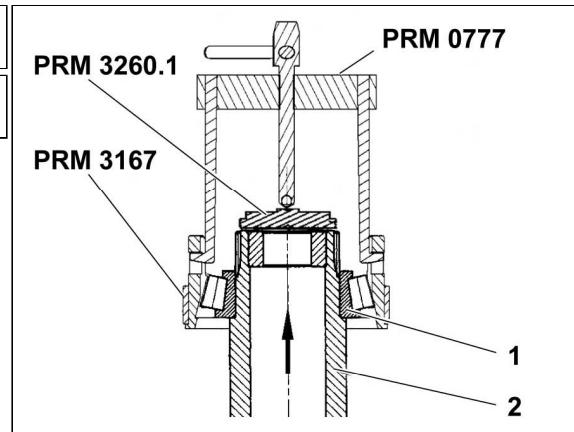


Fig. 4.47 Pressing-out of the bearing inner ring



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39. Place the intermediate gear **2** on a bench and use the universal puller **PRM 3355** and universal extractor **PRM 3353** to press out tapered roller bearings outer rings **1** and **3**.

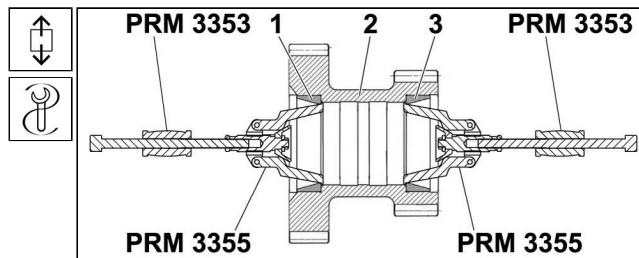


Fig. 4.48 Removal of bearing outer rings

40. Place the input shaft **1** into a shafts stand **PRM 3262** c/w reducing piece for driven shafts **PRM 3352**.

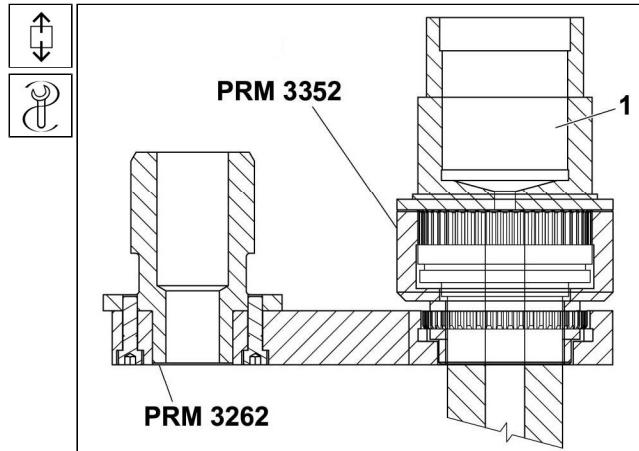


Fig. 4.49 Placing of the input shaft into a tool - 2

41. Unlock the nut safety piece and use the wrench **URN 1302** to dismount the nut **1** - bear in mind that it has the LH thread.

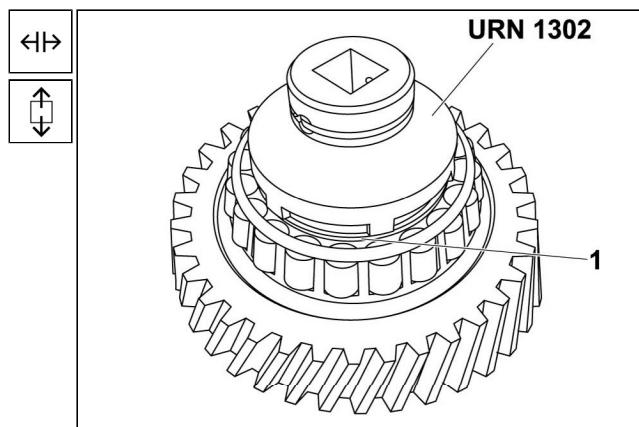


Fig. 4.50 Removal of the nut - 2



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42. Place the support **PRM 3260.1** into a shaft hole and use the universal puller **PRM 0777** to withdraw the tapered roller bearing **1** while catching the rear face of the gear **2**. As soon as the bearing is loose, slacken the puller and withdraw it c/w support lens.
43. Withdraw the driving gear **2** from the rolling mounting on the shaft **3**.

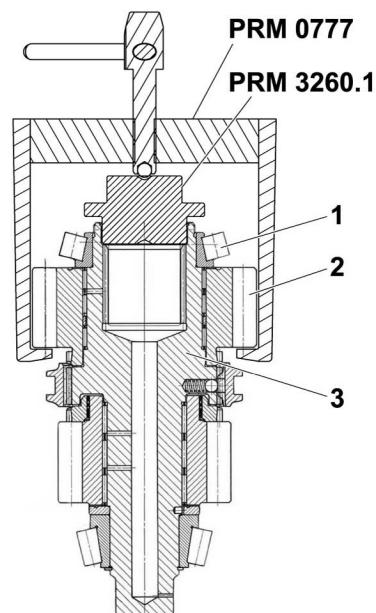
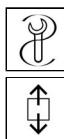


Fig. 4.51 Removal of the bearing and the big drive gear

44. Remove 3 pcs of bearing **4** and ring **5** from the rolling mounting of the shaft **1**.
45. Carefully withdraw the shifter sleeve **6** to prevent the shooting-out of balls **2**. Remove springs **3**.

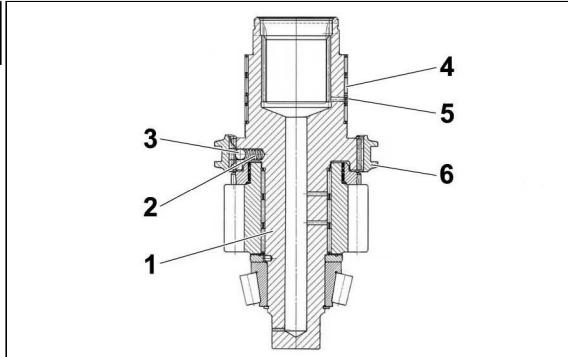


Fig. 4.52 Removal of shifter sleeve

46. Turn the input shaft **1** upside down and move it with its inner splining into a shafts stand **PRM 3262**.
47. Remove the lock ring **3** from recess in the shaft **1**.
48. Fit the tool **PRM 3261** on the rear face of the drive gear **2** and use the universal puller **PRM 0777** to withdraw the tapered roller bearing **4** while catching its rear face. As soon as the bearing is loose, slacken the puller and remove it.
49. Manually withdraw the bearing **4** from location.

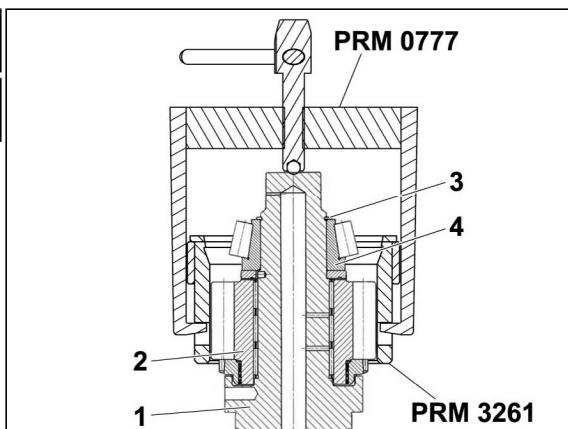
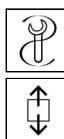


Fig. 4.53 Removal of the bearing



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50. Withdraw the shim **3** and pull out the roller 6x6 **4**.
51. Withdraw the driving gear **2** c/w connecting gearing **6** from location.
52. Remove 3 pcs of bearing **5** from the rolling mounting of the shaft **1**.

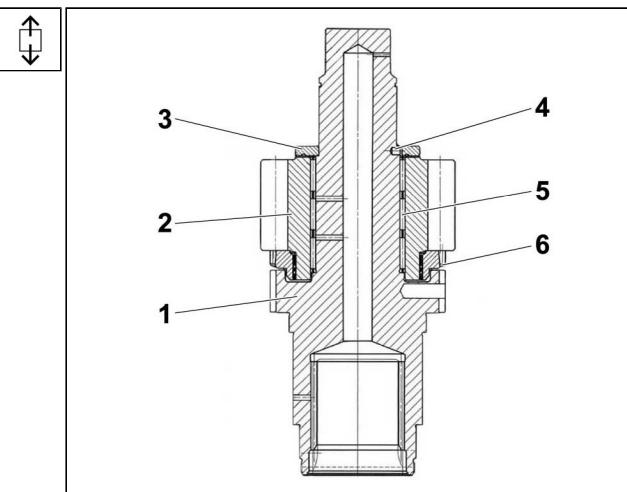


Fig. 4.54 Removal of the driving gear

50. Use the compressed air to check the suction pipe **2** (See Fig. 4.80) and discharge pipes **2** and **3** (See Fig. 4.81) for a good passage and check the suction pipe locking for condition **3** (See Fig. 4.79).
51. If the housing is replaced, dismount the suction pipe, discharge pipes and the complete partition, RH.
52. Check the parts for condition, discard the defective ones, replace them with new ones and clean the other parts.



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d) Assembly Procedure

1. Heat the bearing inner ring **1** to about **100° C** and use the tool **PRM 3166.1** to press it on the lower shaft **2**.
2. Turn the lower shaft.

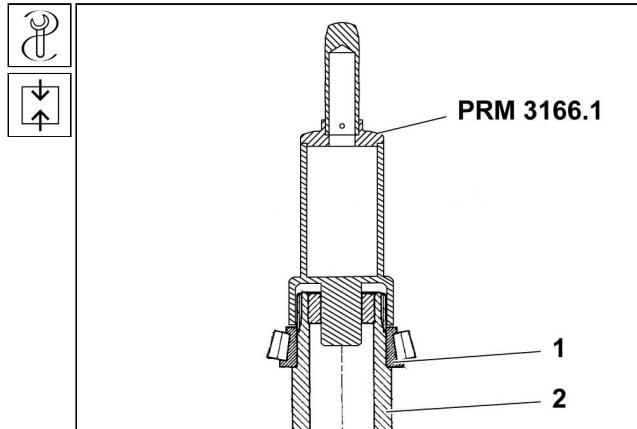


Fig. 4.55 Pressing-in of the bearing inner ring

3. Heat the lower gear **2** to about **100° C** and press it on the involute splining of the shaft **1**.

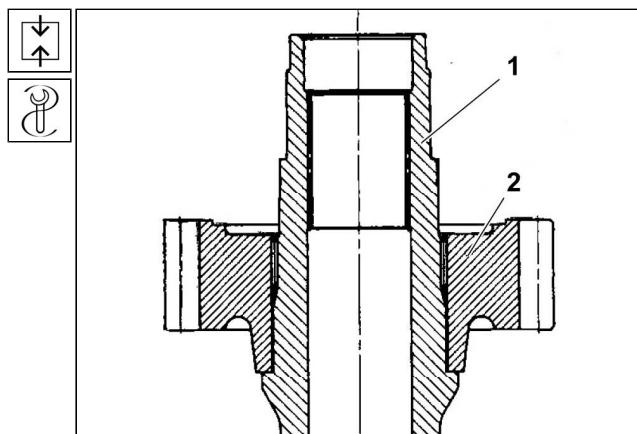


Fig. 4.56 Pressing-in of the lower gear

4. Heat the bearing inner ring of the bearing **1** to about **100° C** and use the tool **PRL 0737.1** to press it on the lower shaft **2**.

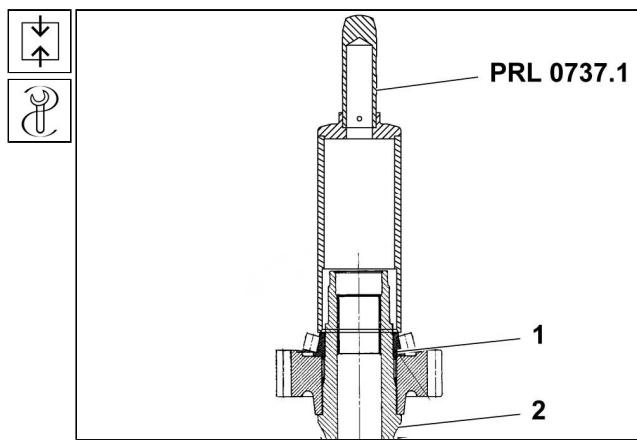


Fig. 4.57 Pressing-in of the bearing inner ring



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5. Use the wrench **URN 0204.2** to mount the nut **2** to the lower shaft **1**.
6. Tighten the nut **2** to **400 ± 40 Nm** and lock the safety piece **3** using the tool with **R 2.5 mm**.

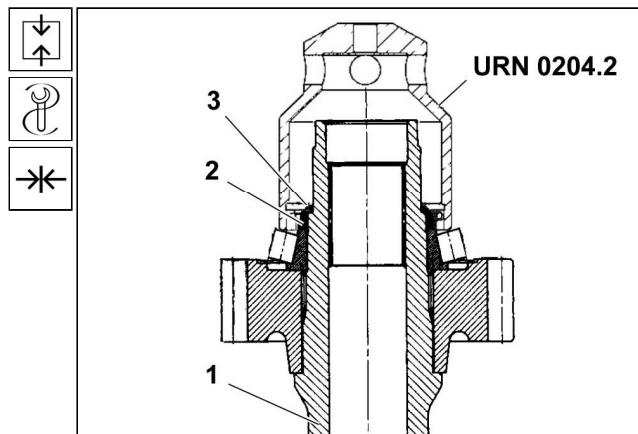


Fig. 4.58 Nut mounting

7. Place the input shaft **1** into a shafts stand **PRM 3262** c/w reducing piece for driven shafts **PRM 3352**.

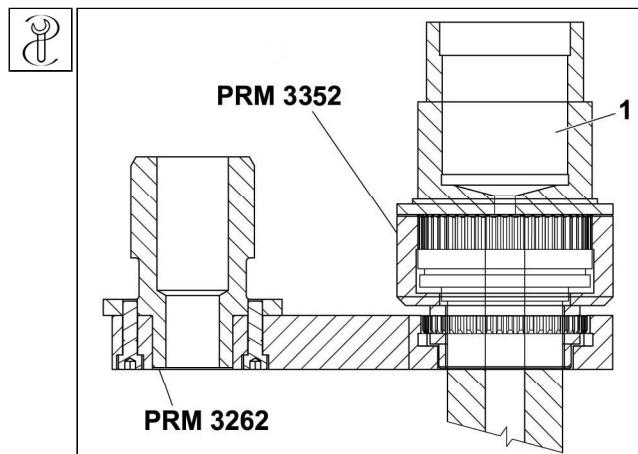


Fig. 4.59 Placing of the input shaft into a tool - 2

8. Slide needle bearing **2**, ring **3** (it must be on the place of the lubrication inlet) and two needle bearings on the rolling mounting of the shaft **1** and oil them.
9. Slide the big driving gear **4** on the rolling mounting.

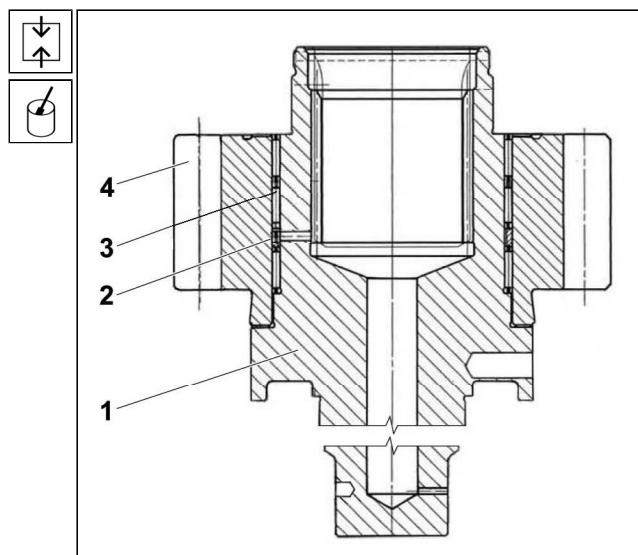


Fig. 4.60 Installation of the big driving gear



04 Auxiliary Gearbox



10. Heat the inner ring of the tapered roller bearing 30218 **2** to **100°C** and press it on the shaft **1** using the bearing inner rings puller **PRL 0733**.

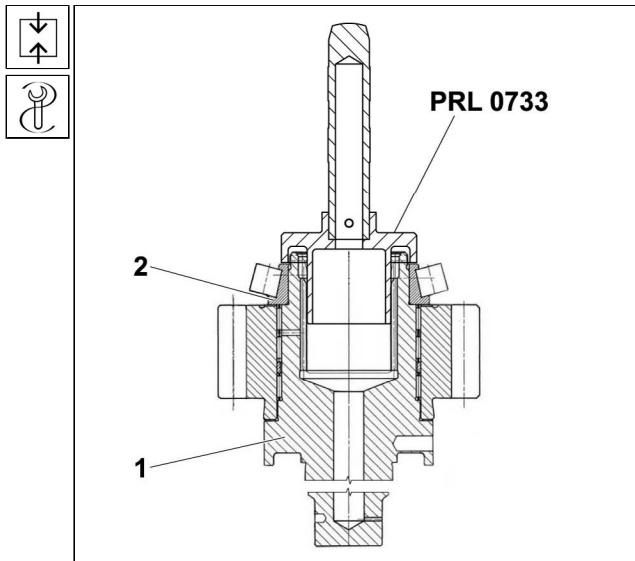


Fig. 4.61 Installation of the bearing

11. Smear the nut **1** with oil, mount and tighten to **400 ± 40 Nm** using a wrench **URN 1302** .
12. Cut through the nut in two spots against sense of turning to lock it - bear in mind that it has the LH thread.

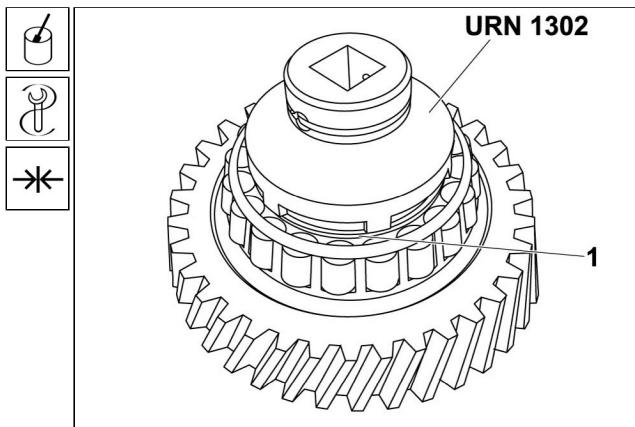


Fig. 4.62 Nut mounting

13. Turn the driving shaft upside down and slide it with internal splining into a shafts stand **PRM 3262**.
14. Fit springs **5** into two holes in the shaft **1** and use the grease to stick the balls **4**.
15. Position the slots in the shifter sleeve **3** and slide the sleeve on the involute splining of the shaft **1**.
16. Use the suitable tool to compress the balls **4** and arrest the sleeve in position.
17. Check the shifting of the sleeve **3** onto the connecting gearing of the big driven gear **2**.

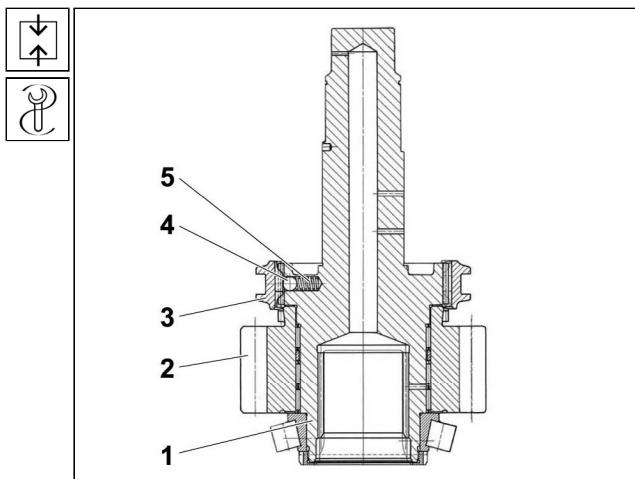


Fig. 4.63 Installation of the shifter sleeve



04 Auxiliary Gearbox



18. Slide bearings **2** on the rolling mounting of the shaft **1**. Smear the bearings with oil.
19. Slide the connecting gearing **6** on the connecting gearing of the driving gear **5**.
20. Mount the driving gear c/w connecting gearing **5** onto the rolling mounting.
21. Tap the dowel **3** into a hole in the shaft **1** and fit the shim **4**.

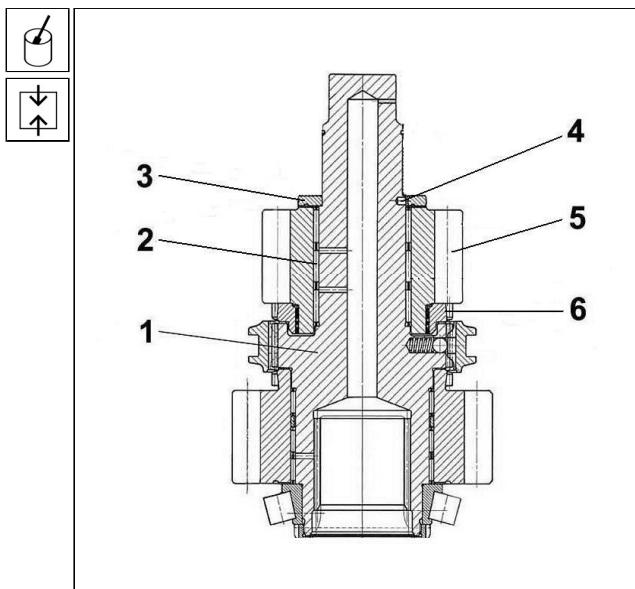


Fig. 4.64 Installation of the driving gear

22. Heat the tapered roller bearing **2** to the temperature of about **100°C** and use the driver **PRL 0732.1** to press the inner bearing ring in position. Insert the retaining ring **3** into a recess of the shaft **1**.

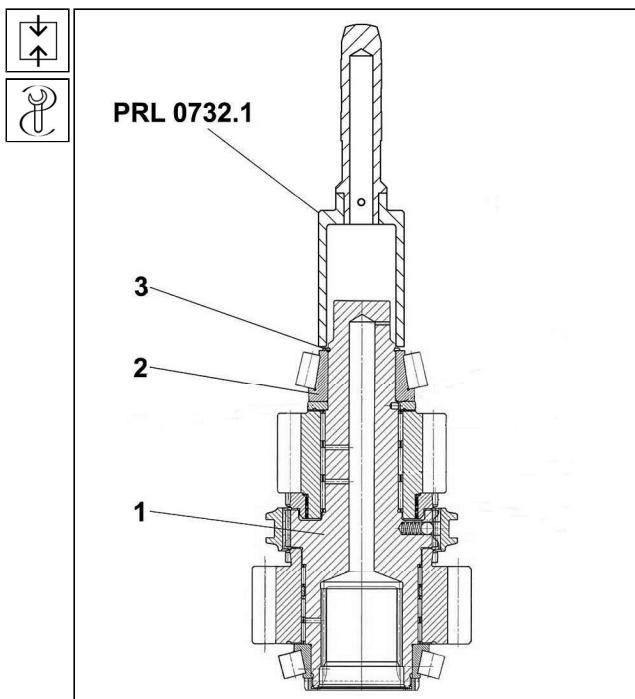


Fig. 4.65 Installation of the tapered roller bearing



04 Auxiliary Gearbox



23. Intermediate gear – keep the below-mentioned procedure during replacement of tapered roller bearings:

- Unwrap the bearings, wash them in the technical petrol to clean them from the preserving agent and dry them out. If the tool **PRM 3206** is not available, place the bearing with its inner ring on the grinded support plate and fit the outer ring by swiveling on rolling elements.
- Manually apply the uniform pressure to push the outer ring **2** on tapered rollers and use the depth gauge **1** to measure the distance of "x" in three points along the circumference from the outer ring face to the support plate. Put down the measured value. Carry out the same at the other bearing.

24. Use the tool **PRL 0704** to press the outer rings of tapered roller bearings **1** and **3** into location of the intermediate gear **2**.

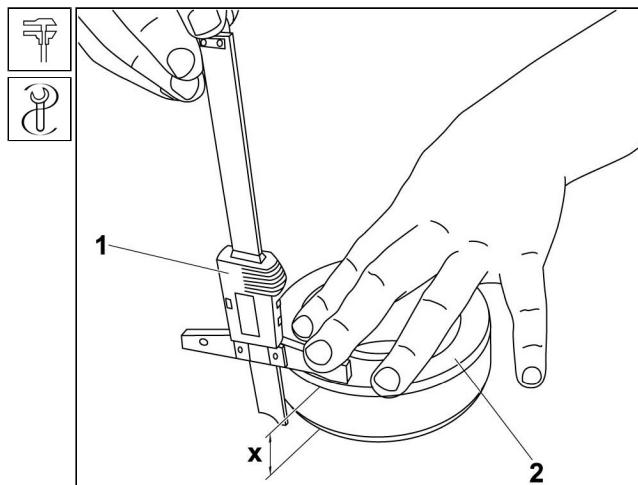


Fig. 4.66 Measurement of the bearing height -
1

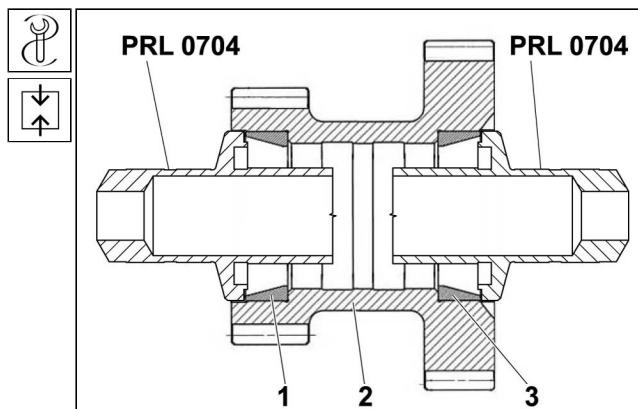


Fig. 4.67 Pressing-in of tapered roller bearings
outer rings



04 Auxiliary Gearbox



25. If the tool **PRM 3206** is available, clamp it into a vice. Otherwise, proceed as per point 42.
26. Fit the bearing inner ring **2** on the mandrel **1**.
27. Place the intermediate gear **9** with raceway of the bearing outer ring **2** on tapered rollers of the inner ring.
28. Fit spacer **8** and the 3 mm thick washers **3** on the bearing surface of the bearing inner ring.
29. Fit the bearing inner ring **4** with rollers on the raceway of the bearing outer ring. Place the bushing **5** c/w washer and mount the nut **6**.
30. While swiveling the intermediate gear **9**, tighten the nut **6** using the torque wrench to **20 - 30 Nm**.
31. Place the magnetic stand c/w dial indicator **7** on the suitable support plate. Situate the indicator pointer to face of the intermediate gear **9**.

32. Use the suitable pry bar resting against the face of the lower gearing rim to push the intermediate gear **9** upwards.
33. Read the value of the axial clearance **Y** on the dial indicator.
34. Calculate the thickness of spacer washers **X** in mm according to the formula **X = Y - (0.2 - 0.3)**, where **0.2 - 0.3 mm** is the specified clearance.
35. Dismount the nut **6**; withdraw bushing **5** and bearing inner ring **4**.
36. Use the caliper rule to measure spacer washers **3**, prepare the thickness of **X**, fit on the spacer **8** and center it.
37. Fit the bearing inner ring **4** with tapered rollers on the raceway of the bearing outer ring. Fit bushing **5** c/w washer and mount the nut **6**.
38. While swiveling the intermediate gear **9**, tighten the nut **6** using the torque wrench to **20 - 30 Nm**.
39. Repeat the measurement as per points 32 and 33.
40. If the measured value does not meet the specified one, repeat the adjustment.
41. If the measured value meets the specified axial clearance, repeat the inspection once more so that you turn the intermediate gear round slightly and fit tapered rollers in raceways and carry out the inspection as per points 32 and 33. Proceed as per point 59.

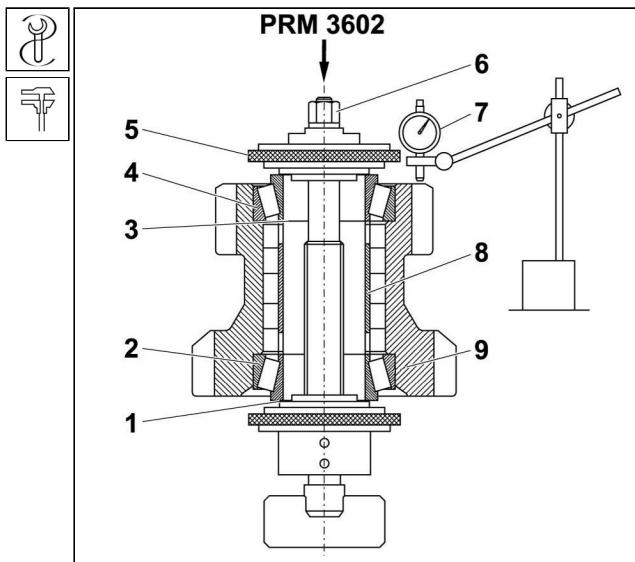


Fig. 4.68 Measurement of tapered roller bearings clearances



04 Auxiliary Gearbox



If the tool PRM 3206 is not available:

42. Fit the inner ring of the tapered roller bearing **2** into the intermediate gear **1** from the side of the bigger head diameter.
43. Place the intermediate gear c/w bearing on the grinded support plate **4**, fit the inner ring of tapered roller bearing **3** and while swiveling, fit tapered rollers in position and manually push the face circumference while applying the uniform force of **30 N**.
44. Measure the distance of "Y" and put down the measured value.
45. Measure the length "Z" of the spacer tube and put down the measured value.
46. Calculate:
 $T = Y - [(X_1 + X_2) + Z]$

T = calculated (measured) value of the gap between the spacer tube and face of the bearing inner ring

A = specified axial clearance between

tapered roller bearings of **0.2 - 0.3 mm**

S = thickness of spacer washers $S = T + A$

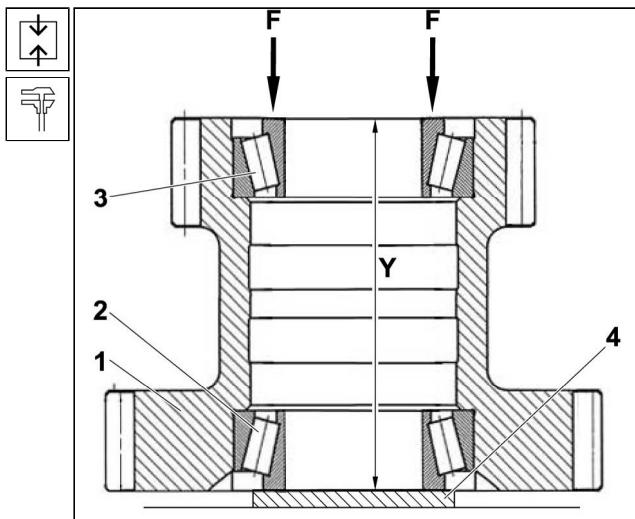


Fig. 4.69 Measurement of the Y distance

47. Select the spacer washers and verify the thickness of **S** using the micrometer or the caliper rule.
48. Bind up the washers together and prepare them together with intermediate gear and spacer tube for assembly.
49. Intermediate gear – when leaving the initial tapered roller bearings in position, the axial clearance is checked as follows:
 - Fit the inner ring of the tapered roller bearing **2** into the intermediate gear **1** from the side of the bigger head diameter, place the intermediate gear c/w bearing on the grinded support plate **4**, fit the inner ring of the tapered roller bearing **3** and while swiveling, fit the tapered rollers in position and manually push the face circumference while applying the uniform force of **30 N**.
 - Use the depth gauge to measure the distance of "y" in 3 points along the circumference from the face of the outer ring towards the support plate. Put down the measured value.

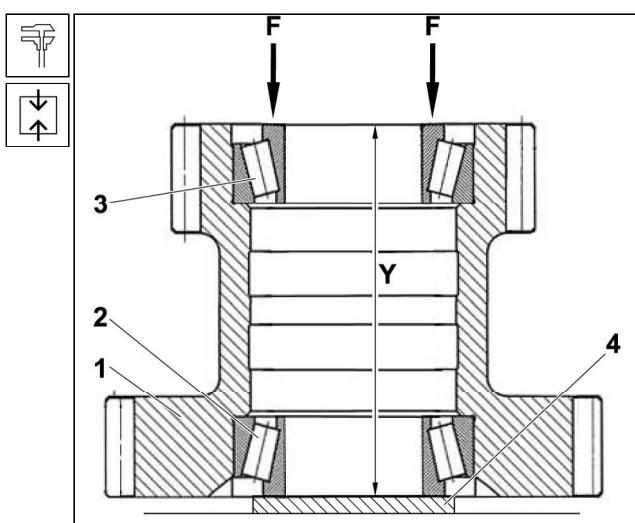


Fig. 4.70 Measurement of the Y distance



04 Auxiliary Gearbox



50. Place the end gauge on the face of the bearing inner ring 1, fit the tapered roller bearing inner ring 2 and while swiveling, fit the tapered rollers in position and manually push the face circumference while applying the uniform force.
51. Use the depth gauge to measure the distance of " v_1 " in 3 points along the circumference from the face of the bearing outer ring towards the support plate. Put down the measured value.

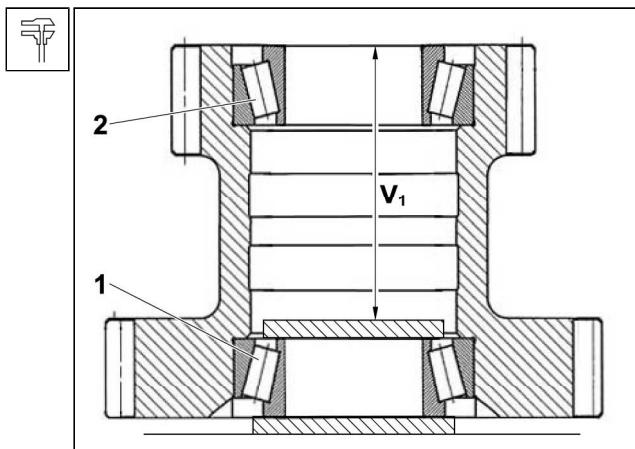


Fig. 4.71 Measurement of the bearing height - 2

52. Turn up the intermediate gear 2 with a smaller head diameter together with tapered roller bearing 1 on the grinded support plate 5 and while swiveling it, fit it in position and place the end gauge on the face of the bearing inner ring, fit the tapered roller bearing inner ring 3 in position and while swiveling, fit tapered roller bearings in position and manually push the face circumference while applying the uniform force.
53. Use the depth gauge to measure the distance of " v_2 " in 3 points along the circumference from the face of the bearing outer ring towards the support plate 4. Put down the measured value.

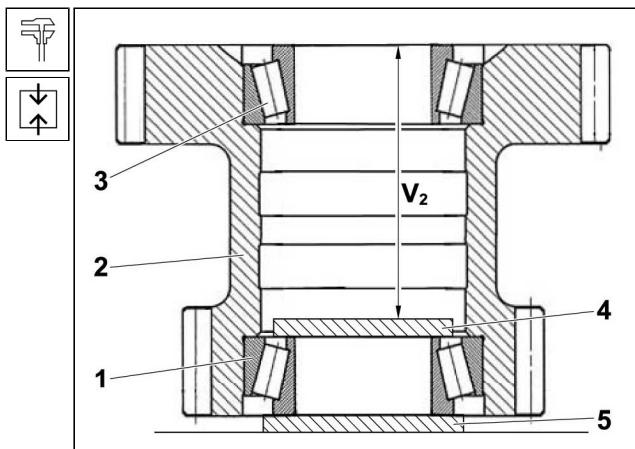


Fig. 4.72 Measurement of the bearing height - 3

54. Measure the length of the spacer tube "Z" and put down the measured value.
55. Measure the thickness of spacer washers "S" using the micrometer or the caliper rule.
56. Measure the thickness of "U" of the support plate 4 (end gauge) (See Fig. 4.72) using the micrometer or the caliper rule.
57. Carry out the calculation as follows:
Height of bearings: X_1 and X_2

$$X_1 = Y - (V_1 + U)$$

$$X_2 = Y - (V_2 + U)$$

$$T = Y - [(X_1 + X_2) + Z]$$

The axial clearance of tapered roller bearings – calculate A_1

$$A_1 = T + S$$

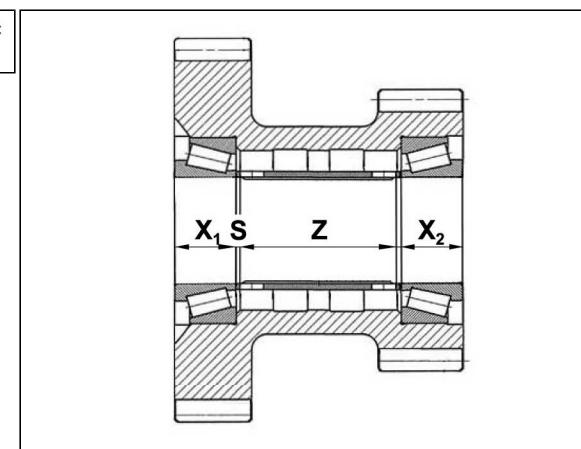


Fig. 4.73 Set of bearings, spacer tube and washers



04 Auxiliary Gearbox

58. In case that the calculated axial clearance does not meet the specified value of **0.2 - 0.3 mm**, add or remove spacer washers to obtain the thickness, which guarantees the specified axial clearance.
59. Insert the centering piece **2** and bush **3** into the plate **1** of the tool **PRM 3168.1**. Fit coupling plate **7** on bush **3** and use the driver **4** c/w pin **5** and handle **6** to press the bearing **8** heated to about **100 °C**.

Note:

Items **1** through **6** are a part of the tool **PRM 3168.1**.

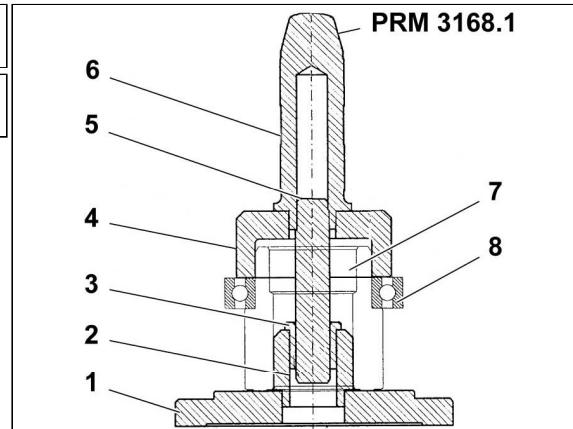


Fig. 4.74 Pressing the ball bearing

60. Insert the bush **1** into tool **PRM 3270**. Place the cover **6** on tool **PRM 3270** and use the driver **2** c/w pin **3** and handle **4** to press the shaft seal **5**.

Note:

Items **1** through **4** are a part of the tool **PRM 3168.1**.

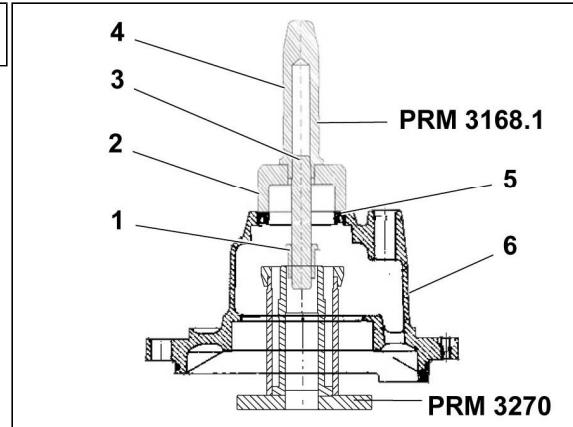


Fig. 4.75 Pressing the shaft seal

61. Place the front drive carrier c/w radial bearing **1** into a stand **PRM 3270**.
62. Position the front drive shift mechanism cover **2** and use the tool **PRL 0753** to press it on.

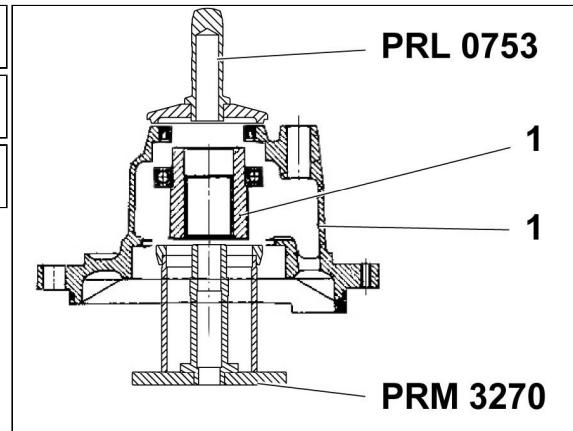


Fig. 4.76 Pressing-in of the front drive carrier into the front drive shift mechanism cover



04 Auxiliary Gearbox



63. Clamp the front drive shift mechanism cover **5** while catching its flange into jaws and inserts of the clamping device.
64. Fit a new shaped ring **2** into a recess of the fork pin **1** and oil it.
65. Fit the sliding sleeve **6** on the involute splining of the front drive carrier **7**.
66. Insert the shifter fork segment **3** into a groove of the sliding sleeve **6**.
67. Install the fork pin **1** into a hole of the front drive shift mechanism cover **5** and slide it into a hole of the sliding sleeve **6** at the same time.
68. Mount the nut **4** on the fork pin screw connection **1**, tighten to **110 ± 10 Nm** and lock the nut with a punch in the groove – the radius of the tool should be **2.5 mm** as a minimum.
69. Place the front drive shift mechanism cover **4** onto a support plate (it must not rest against the fork pin).
70. Use the tool **PRM 3269** to press the circular partition **3** and the bearing outer ring **1** (congeal the bearing outer ring before installation).
71. Fit a new shaped ring into a slot **2** of the front drive shift mechanism cover **4** and smear it with oil.

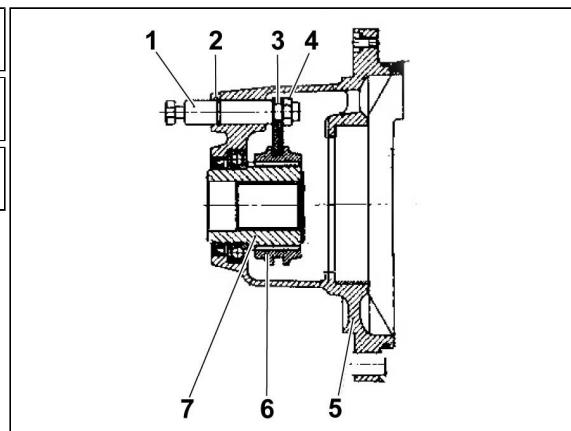
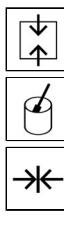


Fig. 4.77 Installation of the guide pin c/w fork and coupling sleeve

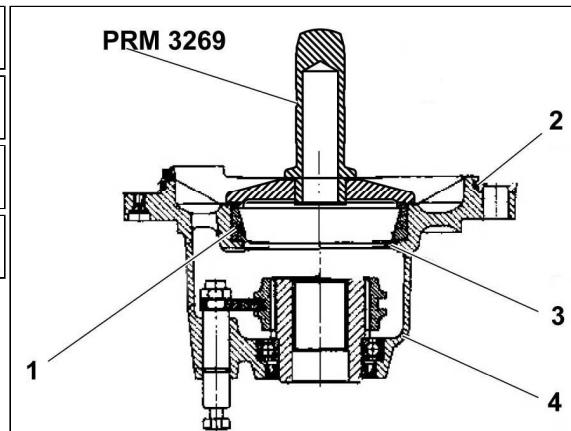
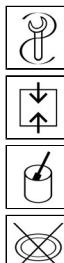


Fig. 4.78 Pressing-in of the circular partition and bearing outer ring

72. Place the suction pipe **2** into the housing **1**, slide the shaped ring **3**, press the centering ring **4** and bend it off in two points per $\alpha^\circ = 180$ using the tool with the minimum radius of R **2.5 mm**.

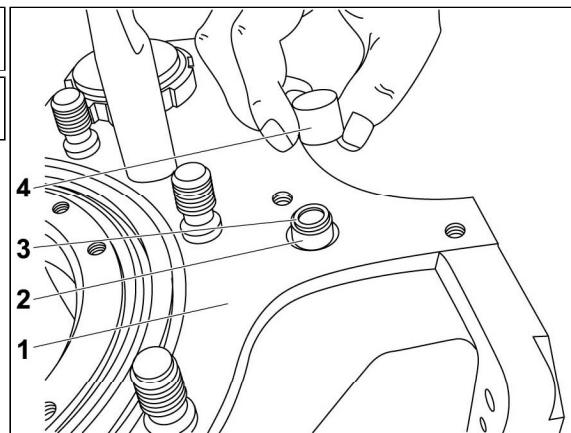


Fig. 4.79 Installation of the suction pipe



04 Auxiliary Gearbox



73. Install the complete suction pipe **2** (protruding 5 mm outwards) into a hole (during assembly of a new housing) at bottom of the housing and lock it with a welded metal sheet piece **3** by its bending over the lug.
74. Fit the complete strainer **4** and mount the plug c/w magnet and a new sealing ring.
75. Tighten the plug to **200 ± 20 Nm**.

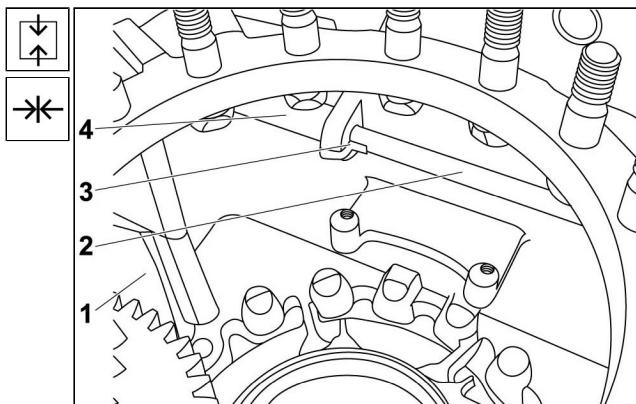


Fig. 4.80 Installation of the suction pipe - 1

76. Install the front discharge pipe **1** and the rear discharge pipe **2** (when a new housing is mounted).
77. Place the auxiliary gearbox housing **3** into the assembling truck **PRM 2531** and attach into the assembling stand using stud bolts.

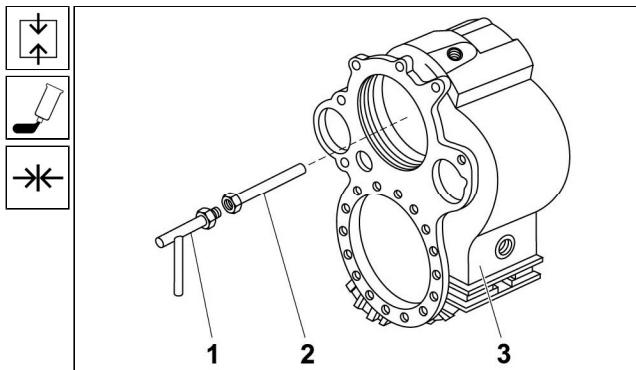


Fig. 4.81 Installation of the discharge pipe

78. Use the tool **PRL 0838** to press the outer ring of the tapered roller bearing **2** into a hole in the housing **1**.
79. Smear the outer ring **2** with oil and use the suitable tool to install the complete driving shaft **3** into location in the housing **1**.
80. Use the tool **PRL 1330** to press the outer ring of the tapered roller bearing **4** into the rear cover.

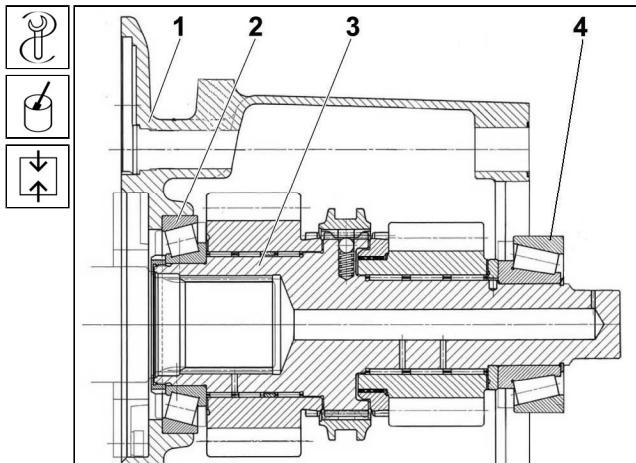


Fig. 4.82 Mounting of the input shaft in the housing



04 Auxiliary Gearbox



81. Press the roller **4** into the shifter rod **2** and slide the shifter rod **2** into a hole in the housing **1**.
82. Fit the shifter fork **3** into a slot of the coupling sleeve **5**, slightly swivel it and slide the shifter rod **2** as far as it goes.
83. Slide the pipe **6** from the opposite side and use the driver **PRL 0501** to press the bush **7** into a hole in the housing **1**.
84. Fit the shaped ring **2** on the plug **1**, screw the plug and tighten to **140 ± 14 Nm**.

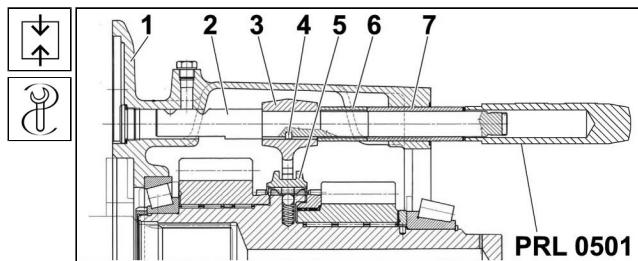


Fig. 4.83 Installation of the shifter fork

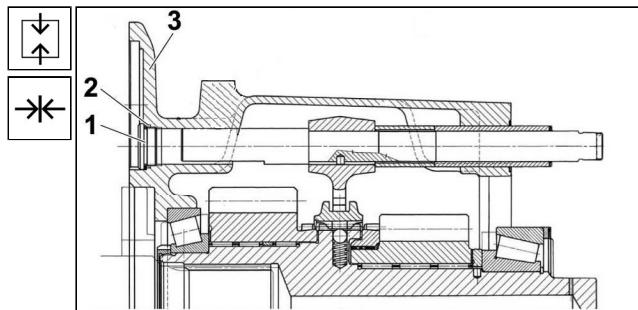


Fig. 4.84 Installation of the arrestment

85. Finish the assembly according to procedures (See Subchapter 4.5.5)
86. Finish the assembly according to procedures (See Subchapter 4.5.2) - **it applies to the truck's version without a winch.**
87. Finish the assembly according to procedures (See Subchapter 4.5.3) - **it applies to the truck's version fitted with a winch.**

88. Mount the tool **PRM 3292** on the intermediate gear pin **3**, place a new shaped ring **2** into a recess and install the plug **1** (on a new pin only) c/w new sealing ring. Smear the shaped ring **2** with oil.

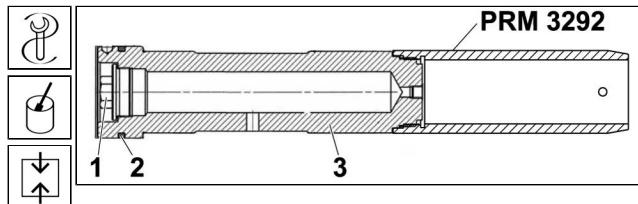


Fig. 4.85 Intermediate gear pin



04 Auxiliary Gearbox



89. Install the shim **5** into a recess in the housing.
90. Place the intermediate gear **8** c/w installed tapered roller bearing **7** on the metal sheet support plate **6**.
91. Use the plastic lubricant to stick spacer washers **4** to the face of the bearing inner ring **7** and center them.
92. Fit the pacer tube **3** on washers and center it.
93. Install the bearing inner ring **2** and slide this set on the shim **5** so that they are concentric and pull out the metal sheet support plate **6**.
94. Install the assembling mandrel of the intermediate gear pin **PRM 3292** c/w intermediate gear pin (See Fig. 4.85) into a hole in bearings so that the spacer washers are not taken down.

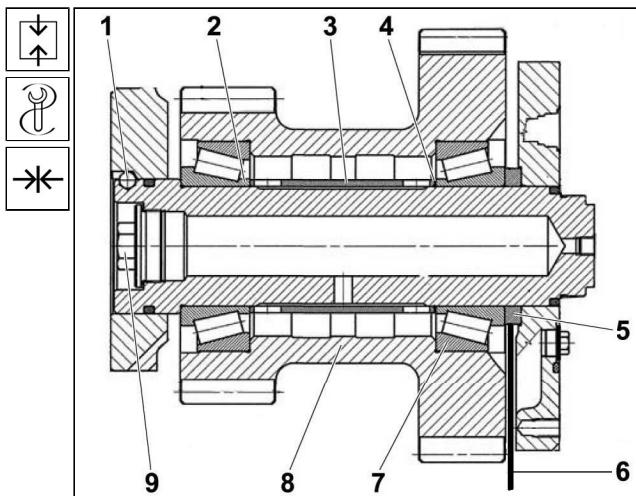


Fig. 4.86 Installation of the intermediate gear

95. Position the pin with a hole for the ball **1** to the cutout in the housing and press it in.
96. Use the driver with help of the hammer to push the pin in position.
97. Dismount the assembling mandrel of the intermediate gear pin **PRM 3292**.
98. Tighten the plug **9** to **300 ± 30 Nm**.

99. Install the complete right-hand partition **1** into the auxiliary gearbox housing **5**, place the lock metal sheet **3**, mount screws M8 **4**, tighten to **16 - 23 Nm** and secure it with a lock metal sheet.
100. Use the tool **PRL 0749** to press the tapered roller bearing outer ring **2** into a hole in the housing **5**.

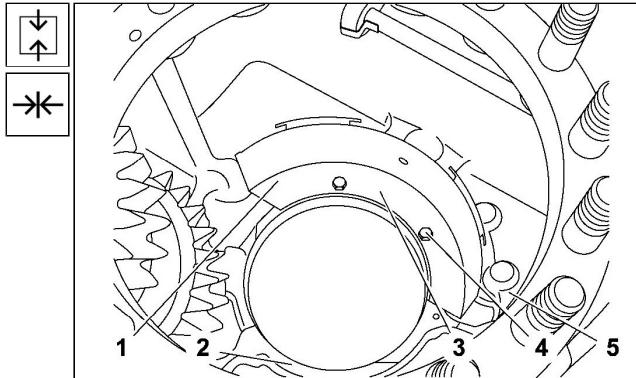


Fig. 4.87 Installation of the RH partition



04 Auxiliary Gearbox



101. Swivel the auxiliary gearbox housing in the assembling truck. Use two bolts **2** to attach the rear cover **2** to the housing to adjust the lower shaft in position.
102. Swivel the auxiliary gearbox housing in the assembling truck.

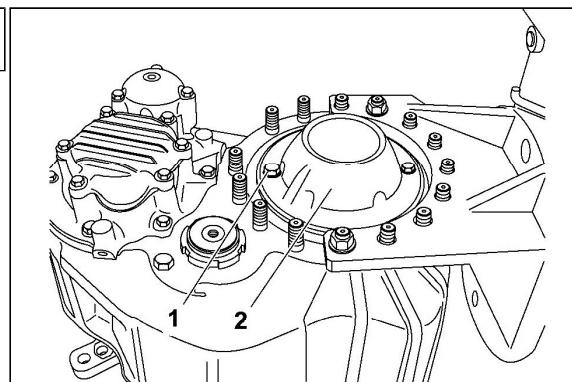


Fig. 4.88 Installation of the rear cover

103. Use the suitable tool **3** to install the lower shaft **2** into the housing **1**.

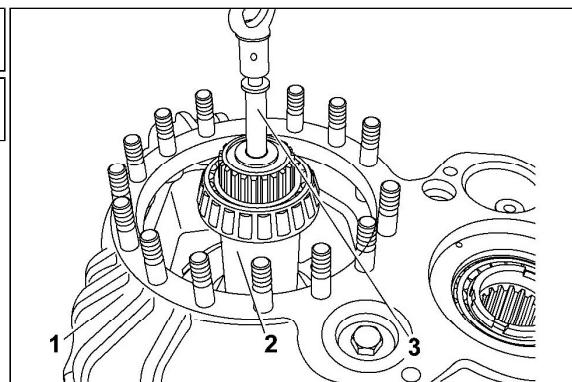


Fig. 4.89 Installation of the lower shaft in location

104. Slide the left-hand partition **1** into location of the right-hand partition and bend off three lugs to lock it.

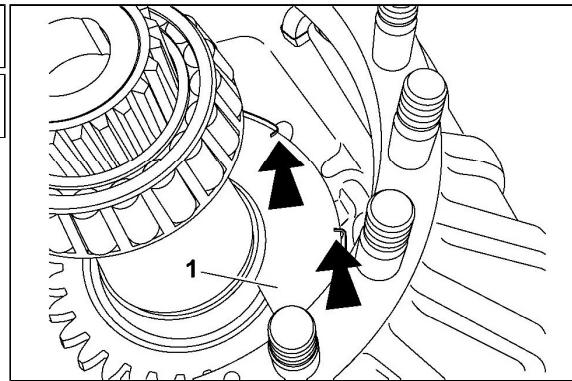


Fig. 4.90 Installation of the partition, LH



04 Auxiliary Gearbox



105. Slide the front drive shift mechanism cover **3** with the involute splining of the front carrier into the involute splining of the lower shaft and subsequently, into location in the housing.
106. Use two countersunk bolts **2** to attach it to the auxiliary gearbox housing **1**.
107. Shift the fork pin **4** to check the engagement of the front drive.
108. Swivel the housing in the clamping device and lock it.

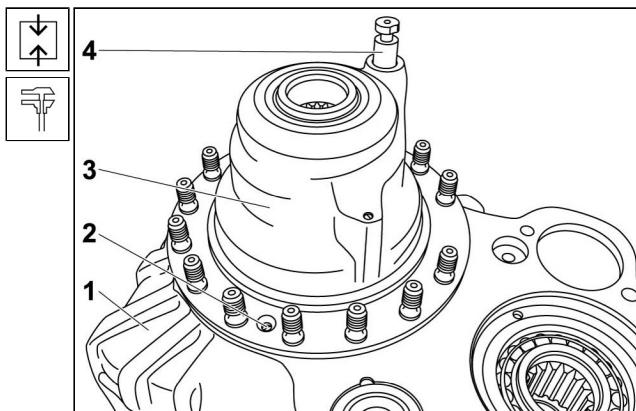


Fig. 4.91 Installation of the front drive shift mechanism cover

109. Fit the shaped ring into a recess in location of the intermediate gear pin and use the tool **URN 1333** to mount the nut (see the arrow).
110. Tighten the nut to **400 ± 40 Nm** and lock it in two grooves using the tool with the radius of **R 2.5 mm**.

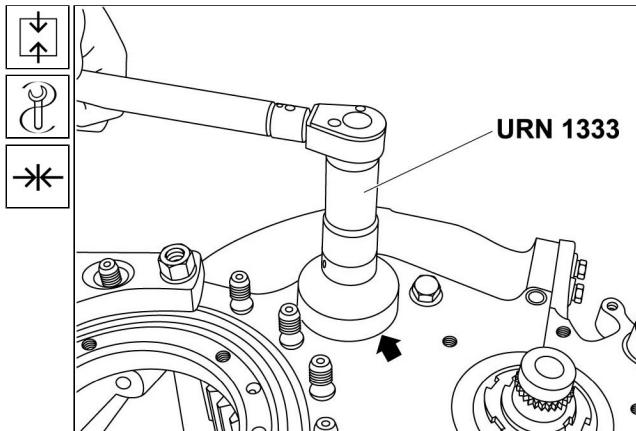


Fig. 4.92 Mounting of the nut

111. Unscrew two bolts **1** and remove the rear cover **2** from location on the auxiliary gearbox housing.

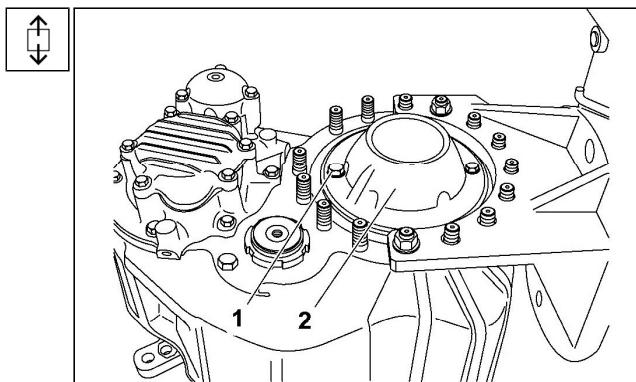


Fig. 4.93 Removal of rear cover - 1



04 Auxiliary Gearbox

112. Attach the tool **PRM 2906.1** to the housing **1**.
113. Adjust the zero clearance while swiveling the shaft **3** continuously.
114. Use the universal setting gauge c/w dial indicator **MMU 1740.1** to measure the distance from face of the outer ring **2** to the bearing surface of the housing **1** and put down the value.

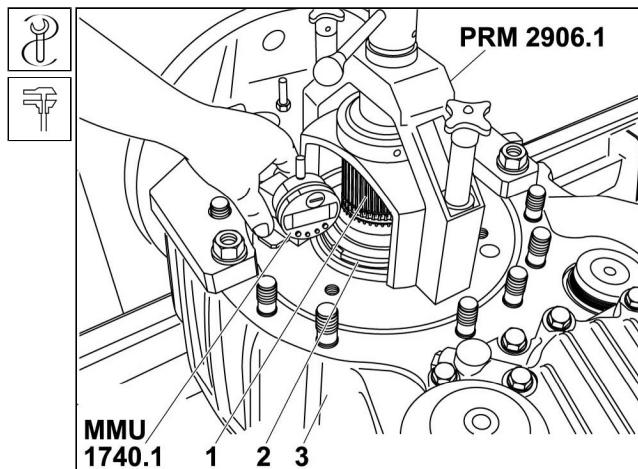


Fig. 4.94 Adjustment – measurement of the distance

115. Use the universal setting gauge c/w dial indicator **MMU 1740.1** to measure the distance from the bearing surface of the rear cover **1** to the face of the bearing surface for the bearing outer ring. Put down the measured value.

Calculation of the axial clearance:
The specified axial clearance of $x = 0.3 - 0.4$ mm.

The measured value from the face of the bearing outer ring to the bearing surface of the housing = y

The measured value from the bearing surface of the rear cover to the face of the bearing surface for the bearing outer ring = z

The calculated value = s

The thickness of washers = t

$$s = z - y$$

$$t = s - x$$

Note:

Use the micrometer or the caliper rule to check the thickness at selected spacer washers.

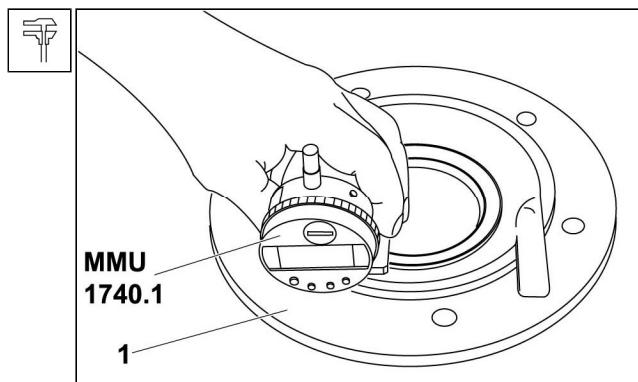


Fig. 4.95 Measurement of the distance in the rear cover



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116. Place the rear cover into a stand **PRL 0920** and use the tool **PRL 0700.1** to press the shaft seal **2** into the rear cover **1**.
117. Apply the $\varnothing 3$ mm layer of the sealant to the bearing surface.

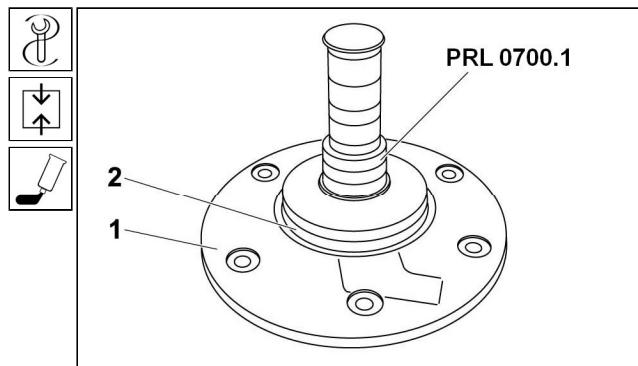


Fig. 4.96 Pressing-in of the shaft seal

118. Install spacer washers **1** onto the bearing surface of the bearing outer ring **2**.

Note:

Place the thickest spacer washer to the bearing face.

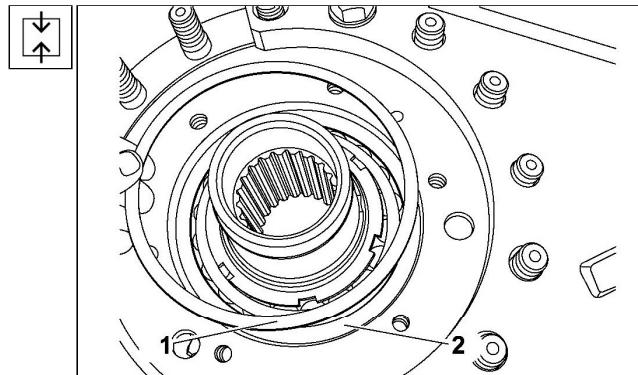


Fig. 4.97 Installation of spacer washers

119. Slide the rear cover **3** into location of the lower shaft **4** and housing **1**.
120. Tighten bolts **2** to **56 - 80 Nm**.

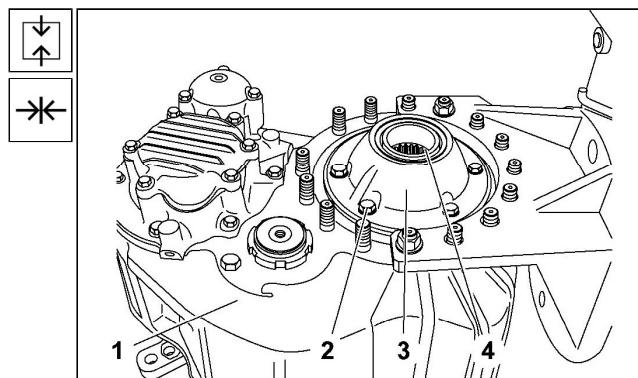


Fig. 4.98 Installation of the rear cover - 2



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121. Swivel the shaft **3**, fit tapered rollers and use the mallet to gently press them through the shaft face in position.
122. Attach the magnetic stand **4** c/w dial indicator **1** to the bearing surface of the auxiliary gearbox housing **2** so that the dial indicator pointer touches the face of the lower shaft **3**.
123. Use the suitable pry bar to partially move out the lower shaft **3** upwards while catching its keyway. Read the measured value on the dial indicator **1**. Repeat twice this operation.
124. If the measured value of the axial clearance meets the specified one, manually mount the plug into a filler hole.
125. If the measured value of the axial clearance does not meet the specified one, it is necessary to remove the rear cover and add or take out spacer washers to obtain a correct thickness.
128. Mount two hollow screws **1** and **3** c/w seals into the connecting pipe **2**; mount it into the rear cover (pump house) and into the intermediate gear pin.
129. Tighten hollow screws **1** and **3** to 40 ± 4 Nm.
130. Remove the auxiliary gearbox housing from the assembling truck **PRM 2531**.

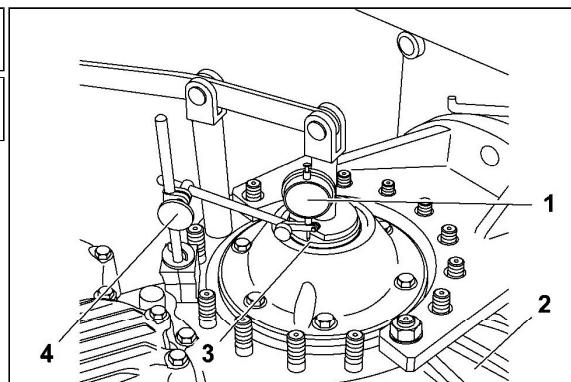


Fig. 4.99 Inspection of the lower shaft axial clearance

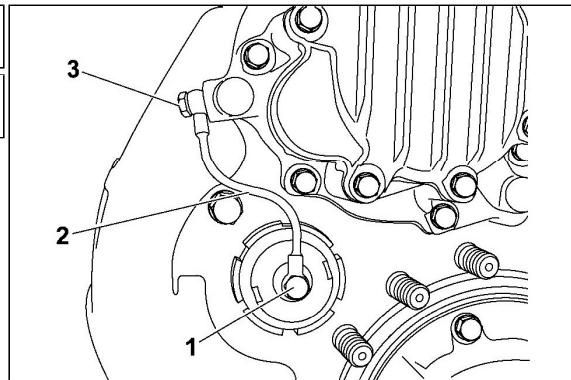


Fig. 4.100 Installation of the connecting pipe



4.5.8 Disassembly and Assembly of the Complete Winch PTO Housing

a) Reasons for Replacement

1. The tapered roller bearings of the drive shaft are noisy and heat extremely (increased axial clearance).
2. The shift sleeve of the winch PTO cannot be engaged / disengaged.
3. The air leaks from the winch PTO housing.
4. Broken winch PTO housing.

b) Technical Conditions

1. Remove rests of sealant from contact surfaces of PTO housing and degrease it.

c) Disassembly Procedure

1. Unscrew nut **15**, withdraw the coupling sleeve **13** and sliding fork **14**.
2. Unscrew three bolts **10** c/w spring washers from the shift cylinder cover **9**.
3. Withdraw the shift cylinder cover **9**, and remove ring **11**, piston **8** and spring **12**.
4. Use the nut wrench **URN 0356** to unlock and unscrew the slotted nut **6** and withdraw the coupling plate **5**.
5. Press the drive shaft **7** out of housing **16**.
6. Pull 2 pcs of shaft seals **4** from housing.
7. Use the universal puller **PRM 3355** and universal extractor **PRM 3353** to press out the outer ring of bearing **1** and circular partition **2**.
8. Use the universal puller **PRM 3354** and universal extractor **PRM 3322** to press out the outer ring of bearing **3**.
9. Withdraw inner rings of bearings **1** and **3** from the drive shaft **7**.

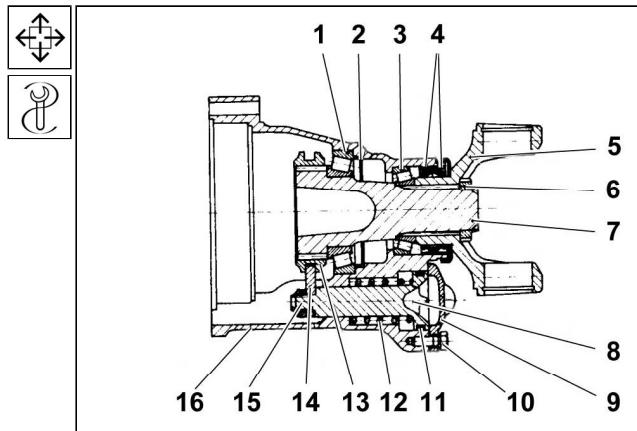


Fig. 4.101 Disassembly of the winch power take-off drive housing



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d) Assembly Procedure

1. Insert the sheet partition **3** into the PTO housing **1** and use the driver **PRM 3112** and stand **PRM 3126** to press the outer ring of bearing **2**.
2. Turn the PTO housing **1** upside down and use the driver **PRM 3115** to press the outer ring of bearing **4**.

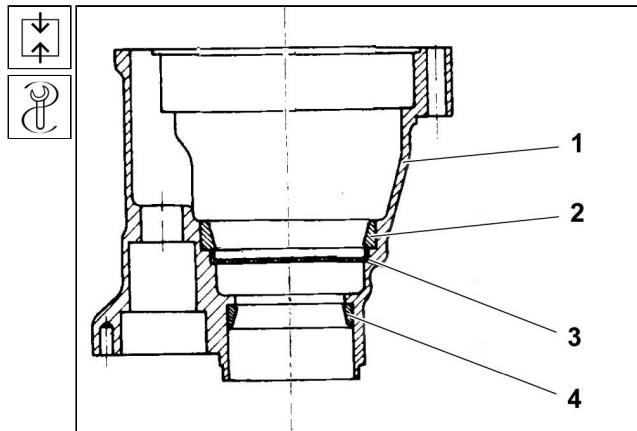


Fig. 4.102 Pressing in the tapered roller bearings

3. Use the driver **PRM 3113.1** to press the inner ring of bearing **4** heated to about **100 °C** on the drive shaft **1**.
4. Fit the shaft **1** into housing **5** and support so that it comes to bear against the stand **6** - **PRM 3126**.
5. Fit one or two spacer washers **3** from the splined end of the shaft **1** and use the driver **PRM 3116** to press the inner ring of bearing **2**.

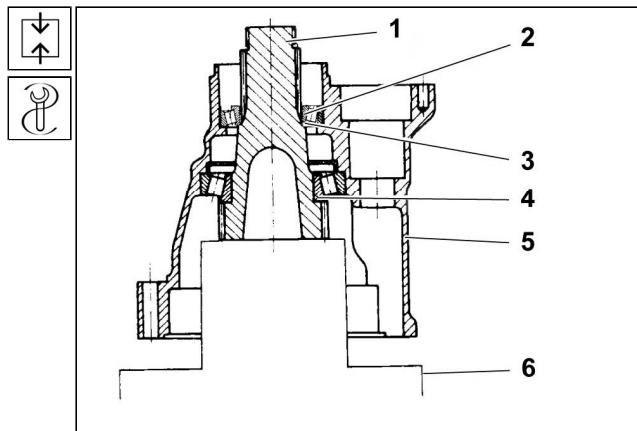


Fig. 4.103 Location of shaft

6. Fit coupling plate **5** (or suitable spacer) and tighten the slotted nut **6**.
7. If you feel a flexible resistance during the tightening-up, it means that the clearance is small (bearings rollers came to bear against bearings rings) and it is necessary to add spacer washers **2** under the inner ring of bearing **3**. The axial clearance of tapered roller bearings should be within the range of **0.05 to 0.15 mm**.
8. Withdraw the housing c/w shaft from stand **PRM 3126** and place on even surface in the vertical position. Use a dial indicator **7** to measure up the axial clearance. While measuring, turn the pin round and move it vertically.
9. If the clearance is not within the tolerance of **0.05 to 0.15 mm**, insert / remove

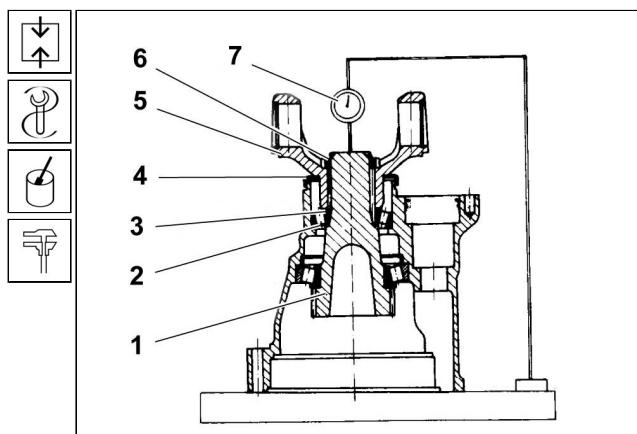


Fig. 4.104 Setting the shaft - 1



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a necessary number of spacer washers **2**.

10. Unscrew the slotted nut **6** and withdraw the coupling plate **5** (spacer).
11. Insert stand **PRM 3126** under the shaft **1**, use the driver **PRM 3117** to press two shaft seals **4** and fill the space between these seals with the plastic lubricant **AK2**.
12. Smear the tapered roller bearings with grease from both sides during the final assembly.
13. Carefully fit the coupling plate **5**, mount the slotted nut **6** and use the wrench **URN 0356** to tighten it to **400 ± 40 Nm**.
14. Secure the nut **6** in both grooves with a punch - the tool radius should be **2.5 mm** as a minimum.
15. Check the shaft whether it rotates smoothly.

Note :

The bearings clearance can be also set using an adjusting tool **PRM 2901**.

16. Fit the spring **4** into a hole for location of the piston and insert the piston **8** c/w sealing ring **5**.
17. Fit the sliding fork **2** on the coupling sleeve **3** and mount together so that the inner teeth of the sleeve **3** would mesh into teeth of the drive shaft **9** and a hole on the fork fits onto pin of the piston **8**.
18. Screw and tap the nut **1** to lock it.
19. Fit the gasket and use bolts **6** to mount the shift cylinder cover **7**.

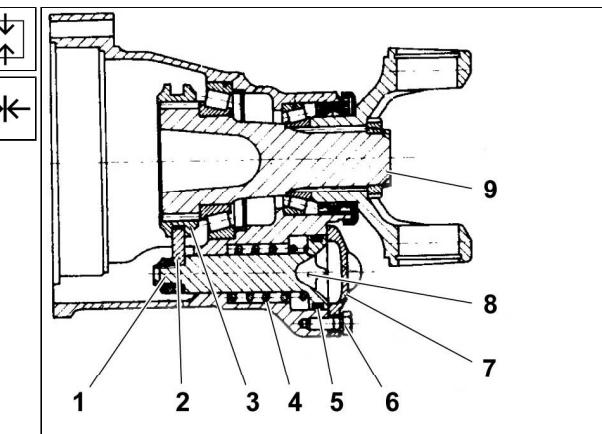


Fig. 4.105 Shift cylinder - installation

