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Marmon-Herrington

WORKSHOP MANUAL

REAR AXLES

RF17N/H R17N/H

MARMON-HERRINGTON ALL WHEEL DRIVE
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PREFACE

The present document gives directions to the trained personnel to repair the

RF17/R17 Rear Axles

Customary tools and devices, which are workshop standard, are assumed to be available.

Dissasembly and assembly of one version only is explained in this document. Differing working sequences of other possible versions can be recognized by the skilled professional. For such jobs see enclosed sectional and perspective views.

Damages caused by improperly or unprofessionally executed repair work throu untrained personnel and the resulting consequences are excluded from any contractual liability.

Use only Marmon-Herrington parts. Seal and bearings are proprietary throughout.

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GENERAL WORKING DIRECTIONS

Individuals repairing Marmon-Herrington equipment are responsible for all aspects of safety.

All safety regulations must be observed to avoid personal injury or property damage.

Proper mechanical training is required, and is the responsibility of the repair person or facility. Marmon-Hearington shall not be liable for personal injury or property damage resultant of inadequately trained personnel.

Always ensure a clean working environment. Parts and components must always be cleaned before assembly.

Always ensure that proper tools and equipment are available. Common hand and air tools are reffered to throughout this manual. Most special tools can be fabricated in the shop environment.

The condition of all parts must be checked prior to assembly. This includes wear items such as seals, bearings, o-rings, etc.

Observe all adjustment tolerances and torque requirements. Ensure that proper lubes and capacities are checked before operation.

Use original Marmon-Hearington parts only.

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FOREWORD

This manual has been prepared for owners and operators of vehicles equipped with Marmon-Herrington All-Wheel-Drive systems and components. For additional technical assistance, contact Marmon-Herrington Customer Service.

Please observe and follow all procedural and maintenance guidelines to ensure reliable operation and optimum service life. The Marmon-Herrington basic service schedule will integrate seamlessly with most preventative maintenance programs.

Marmon-Herrington shall not be liable for component failures or damages caused by operational abuse or neglect. Please review the Warranty Statement for a detailed explanation of coverage and claim reporting procedures.

We thank you for your investment in Marmon-Herrington equipment, and look forward to serving your needs in the tradition of engineering excellence.

GENERAL OPERATION STATEMENT

As close as engineers try to match gear ratios and tires for a given application, the reality is that there will always be some degree of ratio mis-match between front and rear axles. When a vehicle is operated on a hard, dry surface with the front axle engaged (AWD, 4X4, 6X6 modes), the tires are not able to slip and relieve the torsional forces being generated.

As such, Marmon-Herrington equipped vehicles are designed for **"as needed" AWD operation only,** in "off-raod" or poor traction conditions. They **are not** intended to be driven in AWD mode on hard, dry surfaces.

Note: Seek expert advice when considering tire size or gear ratios changes.

SHIFTING OF AXLE OR TRANSFER CASE

Marmon-Herrington Axles and Transfer Cases use no clutching or synchronization devices, and therefore should only be shifted when the vehicle is at a complete stop. This applies to front axle engagement, high and low ranges, and locking differentials. The only exceptions are those vehicles equipped with Marmon-Herrington's **Safety-Shift** system, which are calibrated to shift up to 5 mph.

"Shifting on the generally results in two types of damage. The is degradation of the engagement teeth due to relative rotation of the drive gears and shift collars. This type of damage can prevent the case from shifting normally, as the teeth become burred and cannot mesh.

The second condition occurs when a shift is actually completed at excessive speed. This results in extreme torque loading that is transmitted through the transfer case, drive shafts, and axles. The extent of possible damage increases proportionately with the vehicle speed.

SUMMARY

Before retreating from the subject of shifting, it must be reemphasized that **no transfer case, PTO, axle differential, or power divider should ever be shifted while the vehicle is in motion. The engagement of these components is intended for off-road only, in poor traction conditions.**

TORQUE

"Torque Shock" or "Torque Loading" is a damaging mode of failure that is easily avoidable. It generally occurs in situations wherein a vehicle is operating in an area of low traction at high RPM with the wheels spinning. When the tires make abrupt contact with a tractable surface, a violent shock-load is transmitted through the drive train. This can result in damages to axles, drive shafts, transfer cases and transmissions.

Simply engaging the front axle and operating in low range at lower speeds will allow the vehicle to proceed without imparting undue stress to the drive train.

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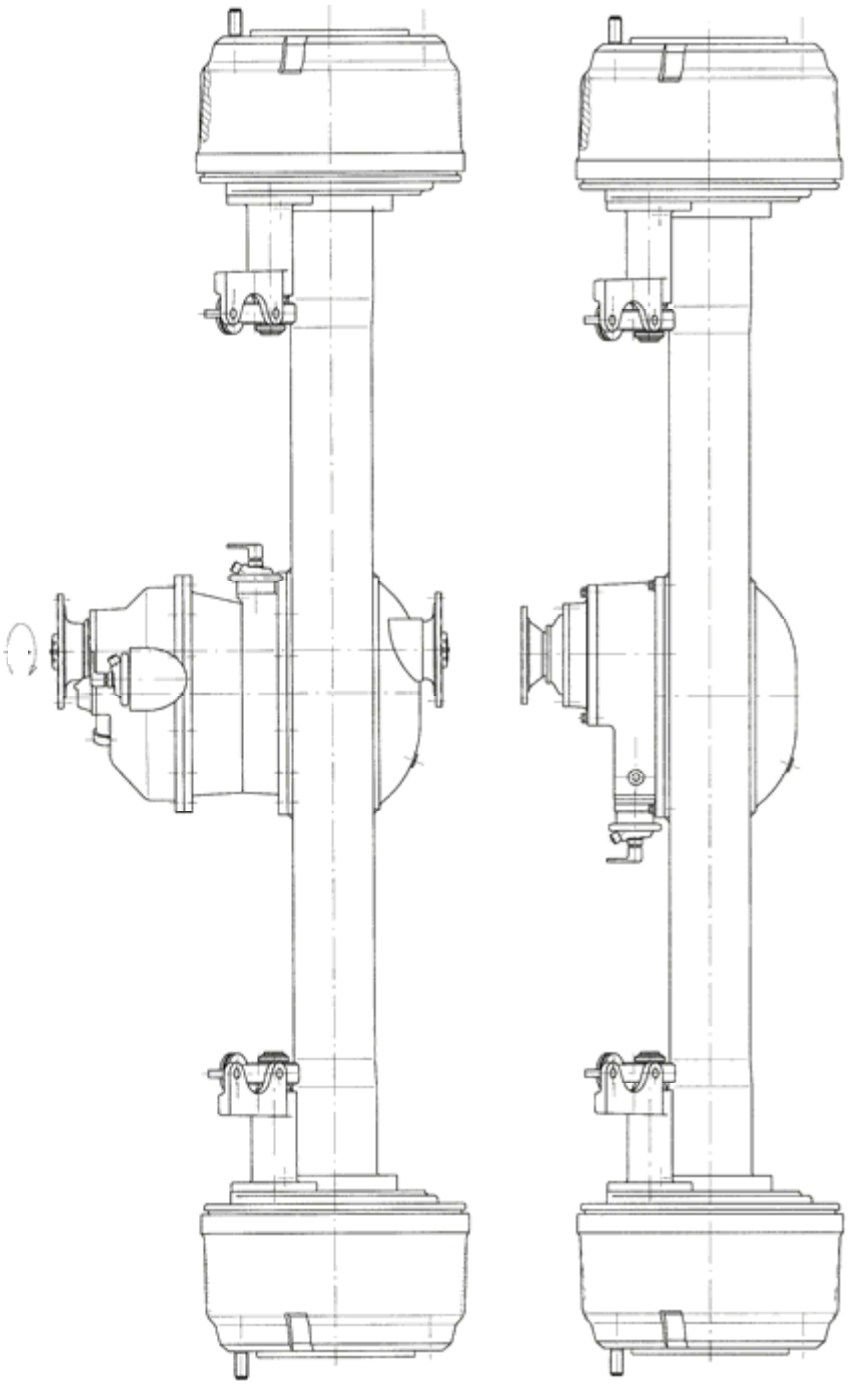
DRAWING OF THE AXLE

Forward direction



RF17/R17

Drawing number tandem axles	Type	Total ratio	Drive pinion hand of spiral
RF17	RF17	5,283	jobb / rechts / right
R17	R17	5,283	bal / links / left

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TECHNICAL DATA

DESIGNATION	UNITS	TYPE	
		RF17	R17
SYSTEM OF AXLE: The reduction of the axle is of a two-stage design. The reduction is accomplished by a pinion and drive gear in the carrier and by spur planetary gearing in the wheel hub.			
DIMENSIONS		mm	inches
Wheel track		2059	81.06
Overall width		2492	98.11
RATIOS			
Drive gear- / drive pinion tooth number		29/19	
Spur gear/Driven gear		23/23	
Planetary gear		64 / 26 +1 = 3,461	
Total ratio		5.283	

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DESIGNATION	UNITS	TYPE	
		RF17	R17
GENERAL DATA		Nm	SAE
Nominal axel load		7700	16,975
Max G.V.W.		22600	49,824
Permitted total rolling masse On highway operation		46000	101,412
Permitted input torque		15320	11,300
Max. output torque		30000	22,126
Max. output speed revolution		500	500
Max. engine performance		280	375
Axle mass without oil fill		720	628 / 1587/1385
Differential lock		Yes	
Inter axle differential lock		Yes	
Parts of the ABS		Can be installed	
Impulse generating ring		Can be installed	

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DESIGNATION	UNITS	TYPE		
		RF17/R17		
WHEEL HUB EXECUTION			**mm**	**in**
		Flange diameter	219.8	8.65
WHEEL BRAKE				
System: The wheel brake is of simplex system internally acting drum brake.			**Metric**	**SAE**
Brake drum diameter			420	16.535
Max. trued-up brake drum diameter			424	16.693
Brake lining width			180	7.09
Brake shoe clearance (at adjustment)			0.3 - 0.6	0.011-0.24
Max. radial play of the camshaft (camshaft bushing wearing)			0.4	0.015
Min. brake lining thickness measured at brake shoe center (marked by upper edge of recess on side of brake lining)			7	0.27
Max. camshaft torque/brake drum torque			**Nm** 1760/17072	**lbs** 1298/12591

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DESIGNATION	UNITS	TYPE	
		RF17/R17	
SLACK ADJUSTER System: MOM automatic slack adjuster		**mm**	**in**
Slack adjuster installation radius **"C"**		175	6.88
Distance of slack adjuster bushing bore center from seating plane of the chamber bracket **"A"**		83	
ANTIFRICTION BEARINGS			
In Wheel Hub			
Outer : taper roller bearing		30218 A MGM	
Inner : taper roller bearing		32218 A MGM	
In Wheel Hub planetary gear			
Cylindric roller bearing		K 30x42x30 MGM	
On drive pinion			
Outer : taper roller bearing		32312 B J2Q LC7 32312 CJR KOYO	
Inner : taper roller bearing		32314 B J2Q LC7 32314 CJR KOYO	

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DESIGNATION	UNITS	TYPE	
		RF17	R17
ANTIFRICTION BEARINGS			
On differential			
On flanged case half : taper roller bearing		32215 SKF; 32215 JR KOYO	
On half case : taper roller bearing		30215 SKF; 30215 JR KOYO	
On input shaft			
Outer : Taper roller bearing		32212 SKF 32212 CR KOYO	
Inner : Taper roller bearing		30214 X SKF 32012 JR KOYO	
On thru-drive shaft			
Deep-groove ball bearing		6210 RC3 KOYO	

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DESIGNATION	UNITS	TYPE	
		RF17	R17
SEALS			
In the wheel hub		1HH1 145x175x17.54-NB STEFA DENSO	
In camshaft bushing bracket		42x55x8 NB SEMPERFORM	
In differential		---	AS 75x95x10 NB SIMMERWERKE; A 75x95x10 NB SIMMERWERKE
In main differential			
Input shaft		A 75x95x10 NB SIMMERWERKE; AS 75x95x10 NB SIMMERWERKE	---
Through shaft		SIMMERWERKE ASL 65x90x10/12 NB; SIMMERWERKE A 65x90x10 NB	---

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TORQUE RATINGS

AIR INSTRUCTION".

DESIGNATION	SECTION/ FIG. ITEM No.	TYPE RF17/R17	
WHEEL HUB	**210/1**	**Nm**	**in**
Wheel nuts		As specified by the orderer	20 - 25
Wheel hub cover bolts	6	20 - 25	15 - 18
Brake drum mounting bolts	24	39 - 49	28 - 36
Planetary carrier mounting bolts	26	39 - 49	28 - 36
Spindle nut (inner) Per section 223	36	196	145
Spindle nut (outer)	34	450 - 490	330 - 360
Spindle to axle housing mounting bolts	41	360 - 380 Mounted with thread locker	265 - 280
Oil filling and level plugs		55 - 85	40 - 60
WHEEL HUB	**210/1**	**Nm**	**lbs**
Chamber bracket mounting hex. bolts	16	130 - 140 Mounted with thread locker	95 - 103
Dust shield mounting bolts	21	10 - 12	7 - 8.5
Hex. bolts mounting stop of the automatic slacker adjuster	29	20 - 25	15 - 18

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DESIGNATION	SECTION/ FIG. ITEM No.	TYPE	
		RF17	
WHEEL HUB	**310/1**	**Nm**	**lbs**
Differential carrier housing to axle causing mounting bolts	44	88 - 98 Mount with thread locker	65 - 72
Flanged castle nuts of companion flanges	1	850 - 1050	625 - 775
Drive gear to drive pinion castle nut	52	850 - 1050	625 - 775
Cover mounting bolts	6	59 - 78	43 - 57
Differential carrier housing II…III clamp bolts	14	88.3 - 98 Mount with thread locker	65 - 72
Differential carrier housing II…III clamp bolts	52	160 - 180	118 - 130
Toothed disc lock nut	57	37 Secured with thread	27
Oil pump cover I. mounting bolt	54	13	9.5
Clamp bolt of intermediate differential case halves	93	25 - 30 Mount with thread locker	18 - 22
Thru-drive shaft bearing cage castle nut	93	39 - 49 Mount with thread locker	28 - 36

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DESIGNATION	SECTION/ FIG. ITEM No.	TYPE RF17	
MAIN DIFFERENTIAL CARRIER HEAD	**310/1**	**Nm**	**lbs**
Oil pump mounting bolts	66	58.8 - 78.6	43 - 57
Input shaft cover mounting bolts bearing cage	6	58.8 - 78.6	43 - 57
Adjuster lock plate mounting bolts	22	15 - 20	11 - 15
Differential case halves clamp bolts	25	49 - 59	36 - 43
Driven pinion mounting bolts	39	120 - 135	88 - 99
DIFFERENTIAL LOCK	**310/1**	**Nm**	**lbs**
Actuating air chamber lock nut	16	29 - 39	21 - 28
Air chamber half nuts	---	2.5	2

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DESIGNATION	SECTION/ FIG. ITEM No.	TYPE	
		R17	
DIFFERENTIAL CARRIER HEAD	**310/1**	**Nm**	**lbs**
Differential carrier housing to axle housing mounting bolts	---	88 - 98 Mount with thread locker	65 - 72
Drive pinion castle nut	1	650 - 700	480 - 512
Differential carrier cover mounting bolts	6	20 - 30	65 - 72
Bearing cage mounting bolts	14	88 - 98 Mount with thread locker	15 - 22
Adjuster lock plate mounting bolts	22	15 - 20	11 - 15
Differential case halves clamp bolts	25	49 - 59	36 - 43
Ring gear mounting bolt	39	120 - 135	88 - 99
Bolts mounting the actuating air chamber lock	---	29 - 39	21 - 28
Nuts of clamps for diff. lock actuating air chamber	---	2.5	2

SECTION 207.

SECTION 207.

ADJUSTMENT DATA

DESIGNATION	UNITS	TYPE	
		RF17	R17
WHEEL HUB		mm	SAE
Axial play of the wheel hub bearings : (adjusted by the spindle nuts)		0.01 - 0.04	0.0004 - 0.0016
WHEEL BRAKE			
Shoe clearance (during adjustment)		0.3 - 0.6	0.012 - 0.024
Axial play of camshaft		0.1 - 0.5	0.0004 - 0.0017
DIFFERENTIAL CARRIER HEADS			
Drive pinion to drive gear backlash GLEASON-toothing (ground)		0.25 - 0.33	0.010 - 0.013
		Nm	**SAE** / **lbs**
Drive pinion rolling torque, after pre-loading the Bearings (the seal is not installed, adjustment by the distance rings)		2.5 - 3.5	2.2 - 2.7 / 2 - 2.6 1.6 - 2
Size of distance rings		- 34 distance rings from 13.89 to 14.715 mm in 0.025 mm steps.	

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DESIGNATION	UNITS	TYPE	
		RF17	R17
Theoretical distance between the drive pinion face and the drive gear centerline ("AXIS DISTANCE")	mm	88	
Shim thickness	mm	2.0; 0.25; 0.3; 0.5; 1.0	
Axial play of input shaft		0.1 - 0.15	
Shim thickness		2.0; 0.25; 0.3; 0.5; 1.0 1.5; 2.0	
DIFFERENTIAL LOCK			
Clearance between clutch gear and toothed hub (as engaged)	mm	0.5 - 2.0	

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PULLER AND PILOT BOLTS

PULLER AND PILOT BOLTS

SECTION	Stock No.:	Draw. NO.	DESCRIPTION	APPLICATION
213, 313	902390	M12X40 ISO 4017-10.9	Hex. full thrd. bolt, (4 off)	For brake drum
220	910186	M8X25 ISO 4017-10.9	Hex. full thrd. bolt, (2 off)	For planet carrier and flanged castle nut
282, 289, 312, 316	923737	M12X30 MSZ 2402-10.9	Std bolt, (2 off)	For installing differential carrier
283	987548	M8-10 ISO 4032	Hex. nut, (4 off)	For companion flange
288, 315		M12X1.5X80 ISO 8676-10.9	Hex. full thrd. bolt, (4 off)	For pulling on the driver gear
	939037	M12 MSZ 2201	Washer, (4 off)	
	365244	M12X1.5 ISO 8673-8	Hex. nut, (4 off)	
316	910339	M12X65 ISO 4017-10.9	Hex. full thrd. bolt, (2 off)	For removing the bearing cage

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SECTION 209.

GENERAL SERVICE INSTRUCTIONS

This section summarizes the service operations and adjustment data considered by us to be most important and which should thoroughly be observed and followed during assembling the axle.

WHEEL DRIVE AND THE WHEEL HUB

Assure 0.01 - 0.04 mm axial play for the wheel hub bearings after securing the spindle nut. For adjustment refer to Section 223.

Install ONLY identical code, same tolerance class bearings supplied in one package to one wheel hub planetary gear. Adjust the axial play of the axle-shaft t0.4 - 1.6 mm as measured between the sun gear and the friction disk. For adjustment shims of 0.25; 0.5 and 2.0 mm thickness are available. The adjustment is described in the Section 219.

WHEEL BRAKE

If the brake linings are worn to the permitted limit (max. 7.0 mm as indicated by upper edge of recess on side of the linings) replace the brake linings as

Check the brake shoe surface being in contact with the shoe anchor pin and the brake spanner rollers.

Adjust the shoe clearance (0.3 - 0.6 mm) by the brake lever.

After adjustment the brake lining may not interfere with the brake drum.

From among the sealing rings of the brake spanners that at the brake spanner head may not pass the surplus lubricant during greasing. The sealing ring at the brake spanner head protects the brake drum against the grease. Make sure to check if the sealing rings are pressed in proper position.
True up the brake drum ONLY to the permitted max. 424 mm diameter.

DIFFERENTIALS (MAIN DIFFERENTIAL - FORWARD-REAR AND DIFFERENTIAL CARRIER ASSEMBLY - REAR-REAR)

Install the taper roller bearings of the drive pinion with preload. Preload should provide that the bearings roll at the torque of 2.5 – 3.5 Nm at forward-rear carrier and at the torque of 2.2 – 2.7 Nm at rear-rear carrier. During inspection the seal ring (4 in 1 of Section 310) with the cover (5) are not installed in rear-rear carrier. For adjustment refer to Sections 290 and 317.

The gears of the cross differentials should be rotatable without jamming.

Install the taper roller bearings of the differentials free of clearance. After adjusting the proper contact pattern and the 0.25-0.33 mm backlash, tighten the bearing adjusters on both sides so that they could be by one of the tab lock plates (21). For inspection and adjustment refer to Section 287.

At the differential carrier assembly install the taper roller bearings 32212 and 32014 so, to obtain 0.1 to 0.15 mm axial play at the input shaft /68/. For adjustment refer to Section 293.
For adjustment of the inter-axle diff. lock actuating pneumatic chamber at the differential carrier assembly refer to Section 294.
For adjustment of the cross differential locks refer to the Section 318.

GENERAL INSTRUCTIONS

For purpose of labor safety during service operations performed on the axle removing the individual assembly units make sure to assure safe backing,
or suspension.

Install only clean and sound parts free of burr and knock-outs. Before installation wipe the mating surfaces of the parts clean and apply thin coat of oil.
For assembly operations use ONLY plastic or copper insert hammer.

Before installing the oil seals make sure to check if the sealing lip is
between the sealing lip and the dust protection edge.
Install the O-rings also with grease.

When installing the taper roller bearings take care of the pairing according to the original packing or to the

The following thread cementing, locking and surface sealing material are used at the axle, e.g.:

Thread adhesive:	LOCTITE 277
High-strenght	Omni FIT 1550 HENKEL
Thread locker:	LOCTITE 243
Medium-strenght	Omni FIT 230 M HENKEL
Surface sealant:	LOCTITE 515

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WHEEL DRIVE, WHEEL HUB

SECTIONAL VIEW OF THE WHEEL HUB

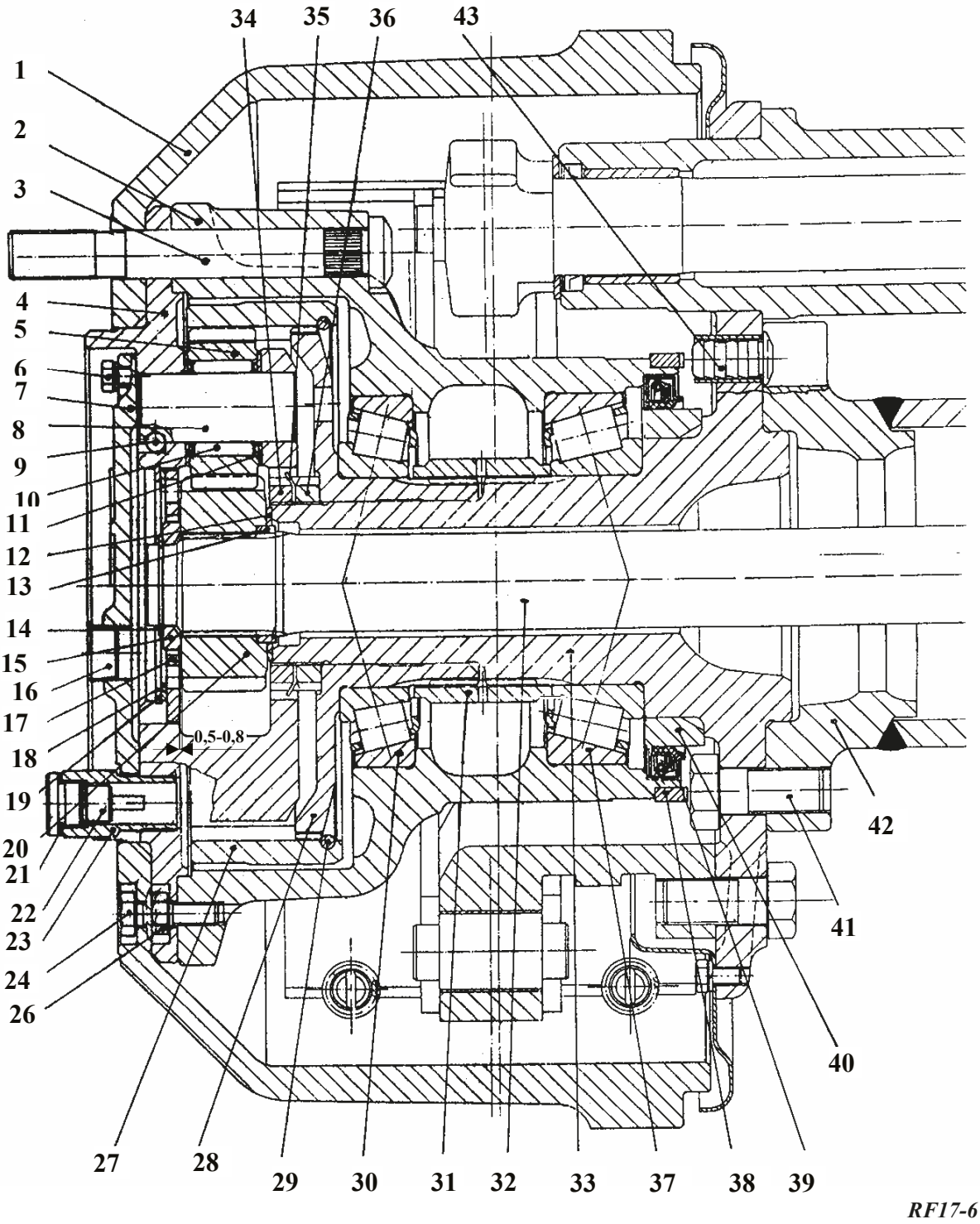

Fig. 1.: WHEEL DRIVE, WHEEL HUB SECTIONAL VIEW

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SECTION 211.

PARTS OF THE WHEEL DRIVE AND WHEEL HUB

1 – Brake drum
2 – Wheel hub
3 – Wheel bolt
4 – Pinion carrier
5 – Idler pinion
6 – Hex. bolt with lock washer
7 – End-cover
8 – Pinion pin
9 – Steel ball
10 – Cylindric roller bearing
11 – Distance plate
12 – Friction disk
13 – Distance ring
14 – Snap ring
15 – Distance ring

17 – Friction disk
18 – Shims
19 – Snap ring
20 – Sun gear
21 – Sealing ring
22 – Oil drain bore screw plug with magnetic insert
23 – Threaded stub
24 – Hex. bolt
–
26 – Hex. bolt
27 – Gear rim
28 – Rim hub
29 – Circlip
30 – Taper roller bearing
31 – Spacer sleeve (toothed)
32 – Axle shaft
33 – Spindle
34 – Outer shaft-end nut
35 – Lock plate
36 – Inner shaft-end nut
37 – Taper roller bearing
38 – Impulsering
39 – Sealing ring
40 – Shoulder ring
41 – Hex. bolt
42 – Axle housing
43 – Plastic Plug

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SECTION 212.

REMOVING AND REINSTALLING THE WHEEL DISK

REMOVING THE WHEEL DISK

With wheels in loaded condition loosen the wheel nuts, then jack up the axle, back out the wheel nuts and remove and the wheels.

REINSTALLING THE WHEEL DISKS

After positioning the wheel disk diagonally tighten to

SECTION 213.

REMOVING AND REINSTALLING THE BRAKE DRUM

REMOVING THE BRAKE DRUM

After removing the wheel disk back out the 4 off hex. bolts attaching the brake drum to the wheel hub, then by 2 off M12 bolts of at least 40 mm thread length driven into the threaded bores prepared for this purpose in the brake drum pull off and remove the brake drum.

REINSTALLING THE BRAKE DRUM

Position the brake drum on the wheel hub. Install the hex. bolts attaching the brake drum and tighten to the

SECTION 214.

REMOVING AND REINSTALLING THE END-COVER

REMOVING THE END-COVER

Drain the oil.

Remove the hex. bolts (6) attaching the end-cover (7) to the pinion carrier and separate the end-cover.

REINSTALLING THE END-COVER

As a described in the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to the seating of the end-cover (avoiding the bores from inside).

Aligning the bores and the oil drain bore position the end-cover to the pinion carrier and the secure by means of the hex. bolts with lock washer and tightened to 20 - 25 Nm torque.

SECTION 219.

REMOVING AND REINSTALLING THE AXLE SHAFT AND THE SUN GEAR, ADJUSTING THE AXLE SHAFT CLEARANCE

After removing the end-cover (7) by means of snap ring pliers remove the snap ring (19), then the shims (18) and the friction disk (17) from the pinion carrier.

By means of the tool Drw. No. **4927-00002** access behind the sun gear and pull out the axle shaft.

The sun gear (20) can be pulled from the axle-shaft (32) together with the distance and the friction disk (12) ring (13) after removing the snap ring (14) and the distance ring (15).

Reinstalling the sun gear in reverse order of removal. Make sure to check if the friction disk (12) is on the distance ring (13), as well as the chamfered side of outer distance ring (15) faces inward.

The axle shaft subassembled with sun gear can be reinstalled without aid.

After aligning the toothing of the planetary gears and the sun gear, as well as the splines of the differential gear, push the axle shaft subassembled with sun gear into the axle housing and the differential.

ADJUSTING THE AXLE SHAFT CLEARANCE

Insert the friction disk (17) into the installed planetary gear, then insert the snap ring (19). Pressing the friction disk to bottom out against the sun gear by means of feeler gage measure the distance between the friction disk and the snap ring.

From among the shims (18) select an amount of thickness less by 0.4 – 1.6 mm than the measured value.

By means of snap ring pliers remove the snap ring (19) again, then insert the selected shim pack and

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SECTION 220.

REMOVING AND REINSTALLING THE PLANET CARRIER, ADJUSTING THE AXLE SHAFT CLEARANCE

REMOVING THE PLANET CARRIER

Remove the hex. bolt (26) from of the pinion carrier (4). Following this for pulling the pinion carrier out of the wheel hub drive 2 off M8 bolts of at least 25 mm thread length into the threaded bore prepared for this purpose in the pinion carrier and pull the carrier out of the wheel hub.

REINSTALLING THE PLANET CARRIER

According to the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to seating of the pinion carrier avoiding the bore from inside.

Aligning the bores and the gear teeth insert the planetary gear into the wheel hub, making sure the matchmarks on the wheel hub and the pinion carrier align (oil drain).

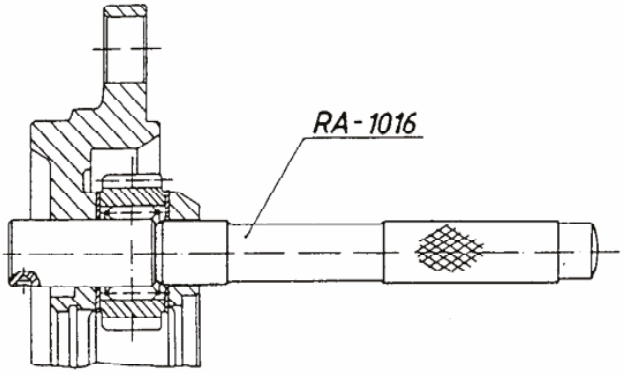
Secure the pinion carrier by means of hex.
bolts coated with thread locker and tightened to 39 - 49 Nm torque.

SECTION 221.

DISASSEMBLING AND REASSEMBLING THE PLANETARY GEAR

By means of the mandrel shows in the drive out the pinion pin toward direction of the detent ball (see Fig. 1.).

When driving in the pinion pins (8) make sure the seat machined for the detent ball in the pinion pin and the groove in the pinion carrier (4) align, to be able to insert the detent ball into the seat before completely
driving in the pinion pin.

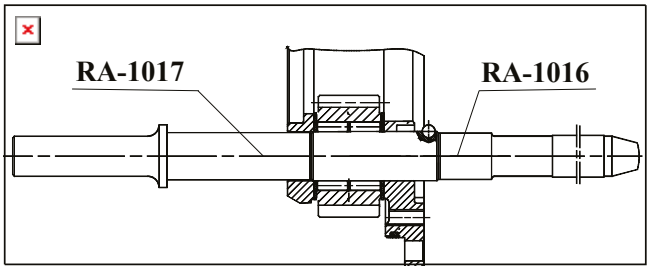


583.10-8

Fig. 1.: DRIVING OUT THE PINION PINS

Stack the sound or replaced parts one by one over the guide mandrel positioned thru the pinion carrier bore as shown in Fig. 2.

In case of replacing the cylindric roller bearings (10), make sure to install only identical tolerance class bearings supplied in one package and marked by the same color code into one wheel hub planetary gear.



583.10-9

Fig. 2.: DRIVING OUT THE PINION PINS

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SECTION 223.

REMOVING AND REINSTALLING THE WHEEL HUB

REMOVING THE WHEEL HUB

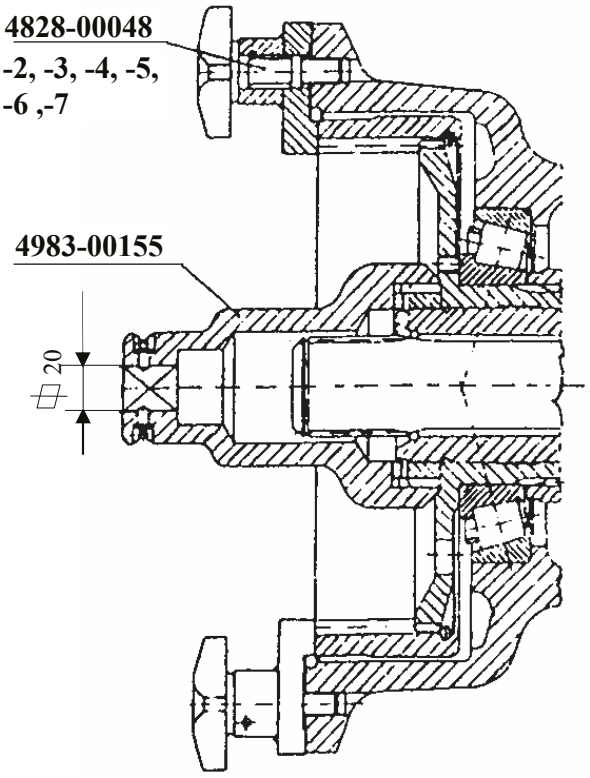
Before removing the spindle-end nuts safely suspend the wheel hub (2). Due to the thread-lock design of the spindle nuts, and the high torque value at which they are set, an impact wrench should be used to loosen the outer nut.

After removing the pinion carrier and the sun gear unsecure the shaft-end nuts.

With the clamping elements shown, clamp the wheel hub elements together and the shaft-end nuts can be removed by means of
the tools shown (see Fig. 1.).

Pull the wheel hub off steering knuckle. The wheel hub parts (inner part of the inner taper roller bearing (37) and toothed spacer sleeve (31) clamped together with the locking elements are removed from the knuckle by the seal ring (39) struck with surface sealant.

Application of the locking elements assures central positioning of the seal ring pressed in the wheel hub, when removing and reinstalling the assembled wheel hub.



839.89-10/1

Fig. 1.: ASSEMBLING THE SHAFT-END NUTS

INSTALLING THE WHEEL HUB

Reinstall the wheel hub preassembled and clamped together by means of the clamping elements, on the spindle according to section 224.

Adjust axial play of the wheel hub to 0.01 - 0.04 mm:

By means of the wrench Drw. No. 4983-00155 tighten the inner shaft-end nut (36) - while continually rotating and axially moving the wheel hub - so, the wheel hub shall turn hard. By this means proper connection of the bearings is assured.

Back out the shaft-end nut and tighten again to 196 Nm torque, then turn back by approx. 35°-45° position the lock plate and one of the slots of the shaft-end nut adjust to any tab of the lock plate, **but do not secure** yet. Install the outer shaft-end nut (34) up while rotating the wheel hub tighten to 450-490 Nm torque. This is a “wet” torque spec with lube applied to the thread.

By means of dial indicator check if the 0.01-0.04 mm axial play is obtained.

In case of improper bearing clearance repeat the adjustment by properly turning back the shaft-end nut and check procedures.

If the 0.01-0.04 mm axial play is adjusted secure the shaft-end nuts by the lock plate (33).

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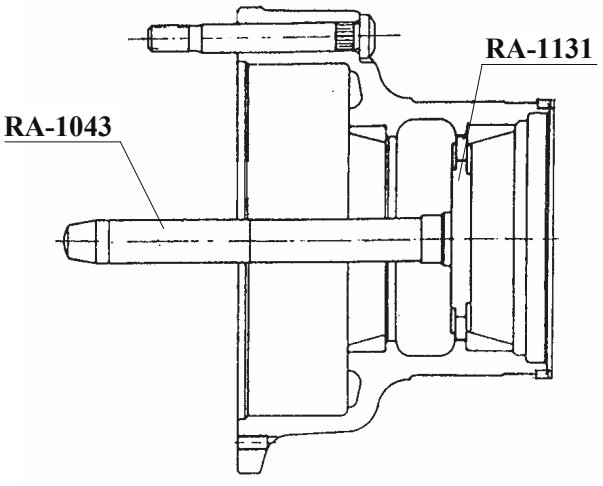
SECTION 224.

DISASSEMBLING AND REASSEMBLING THE WHEEL HUB

Attention!
At mounting of wheel hub the energizer ring is not replaced. At replacement of bearings and sealing rings take care to preserve the toothing of energizer ring in good state to a greater extent.

By means of a simple pry remove the sealing ring (39) from the removed wheel.
By means of the tools shown drive out the cups of the taper roller bearings (see Fig. 1.).

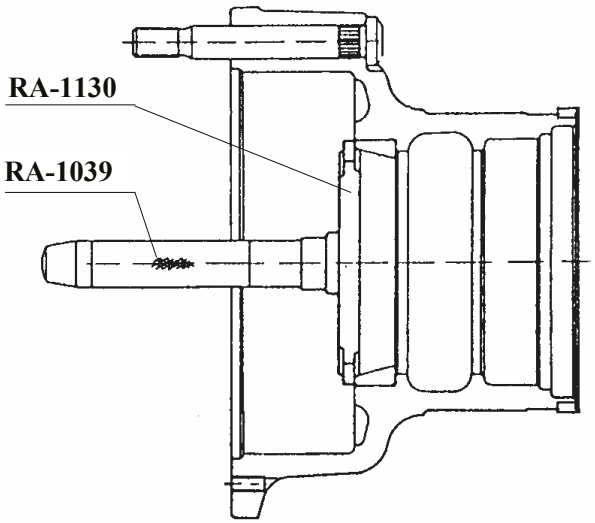


939.95-10

Fig. 1.: DRIVING OUT THE BEARING CUPS

REASSEMBLING THE WHEEL HUB

Drive in the cups of the outer taper roller bearings by means of the tool shown (Fig. 2.).



939.95-11

Fig. 2.: DRIVING IN THE TAPER ROLLER BEARING CUPS

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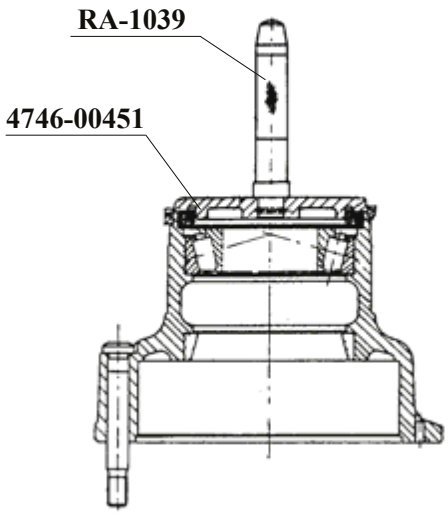
Seating of seal ring is to be lubricated with oil proof surface sealing material per “GENERAL SERVICE INSTRUCTIONS” and the seal ring .

Drive the sealing ring into the seat until the tool bottoms out (see Fig. 3.).

WARNING!

On the axles mountable with ABS toothed surfaces of the impulse ring shall be protected from shocking during installation of seal support and seal ring!



939.95-12/3

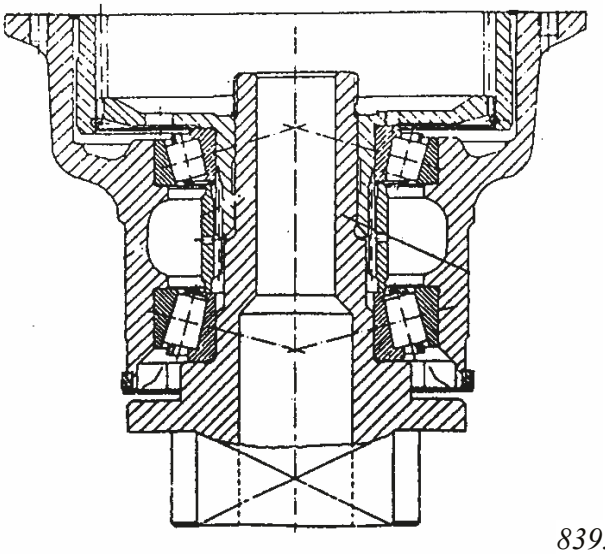
Fig. 3.: DRIVING IN THE SEALING RING

THE WHEEL HUB PREASSEMBLED

Preassembling is made on the master shaft shown in Fig. 4. Place on the master shaft the wheel hub assembled with taper roller bearing cups, the inner taper roller bearing cup and the sealing ring. Place in the engaged spacer sleeve (31).

Position on it the ring gear support (28) assembled with the taper roller bearing cup and ring gear, take care of bearing parts.

Clamp the installed parts together with the clamping elements shown in Fig. 1 of section 223.



839.95-22

Fig. 4.: THE WHEEL HUB PREASSEMBLED

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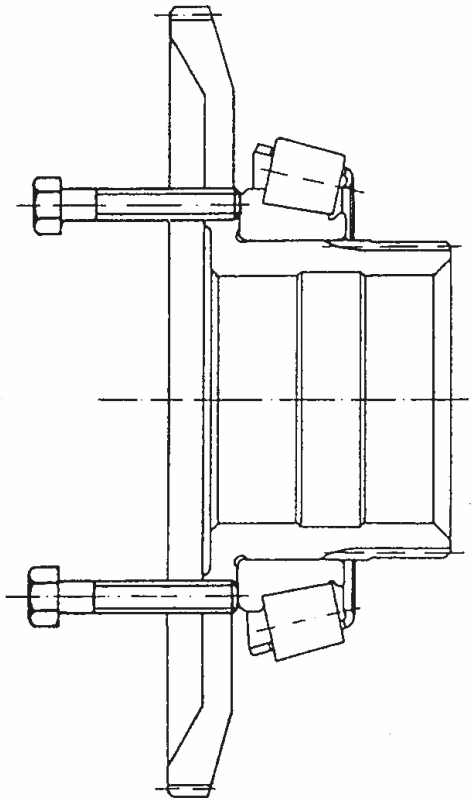
SECTION 225.

DISASSEMBLING AND REASSEMBLING THE RIM HUB

DISASSEMBLING THE RIM HUB

After removing the circlip (29) pull the gear rim (27) off the rim hub (28).

By 2 off M8 blts of at least 40 mm thread length driven into the thru bore in the ring gear support press off the taper roller bearing cup (Fig. 1.).



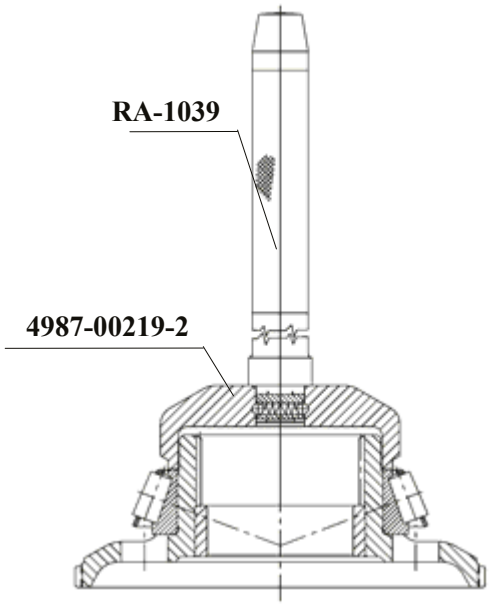
839.95-9

Fig. 1.: PRESSING OFF THE TAPER ROLLER BEARING CUP

REASSEMBLING THE RIM HUB

As shown in the drive the cone of the taper roller bearing to the rim hub (Fig. 2.).

Aligning the rim hub and the gear rim toothing push them completely together and install the circlip into its groove.



839.95-23

Fig. 2.: DRIVING THE TAPER ROLLER BEARING CONE TO THE RIM HUB

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SECTION 226.

REMOVING AND REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT ASSY.

REMOVING THE SPINDLE AND THE BRAKE SUPPORT ASSY.

After removing the wheel hub back out the hax. bolts (41) attaching the spindle (33) to of the axle housing (42) and pull the spindle out of the axle housing bore

REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT ASSY.

Aligning the bores push the spindle supplied together with the brake support into the axle housing bore. Secure the spindle by hex. bolts applied with thread locker and tighten the bolts to 360 - 380 Nm torque.

SECTION 229.

INSTALLATION INSTRUCTIONS FOR MOUNTING THE PARTS OF THE ANTIBLOCKING SYSTEM

This description contains the constructional elements of the antiblocking and anti-skid systems (ABS and ASR), that can be installed by the customer into the axle as well as the installation instructions.
In the „TECHNICAL DATA" manual items as (A, C) are necessary to mount the ABS and ASR items (1).

1. INSTALLABLE ELEMENTS OF THE ANTI-BLOCK AND ANTI-SKID SYSTEMS

1.1 Revolution sensor:
Robert Bosch GmbH A 335 545 231 or
KNORR-BREMSE ZB 9010-I/83315 or
WABCO 441 032 001 0 or
WABCO 441 032 808 0 or
WABCO 441 032 578 0

1.2 Spring bushing:
Robert Bosch GmbH C 335 002 431 A or
KNORR-BREMSE 4B 69698 or
WABCO 899 760 510 4 or
WABCO 899 759 815 4

NOTE: *Install speed sensor with the same type of springed bush only.*

A - Toothed impulse ring.

2. MOUNTING INSTRUCTIONS

Apply copper paste or silicon grease (e.g. Molykote FP186, NBU 30 PTM Univew N3) to the Ø18H11 bore of the speed sensor holder before installation of the springed bush, to prevent corrosion.

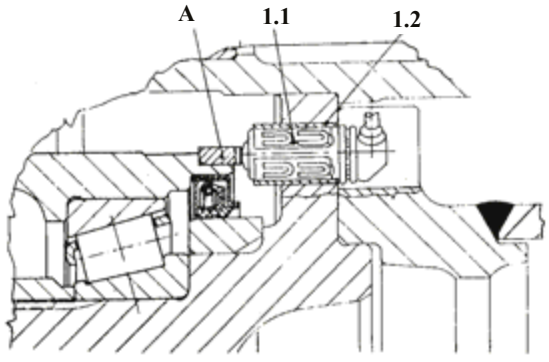
Push the springed bush into the Ø18H11 bore from the middle of axle to mate (12).

Insert speed sensor (1.1) into the spring bush, and push towards the inductor ring on the wheel hub. After dismounting wheel hub this adjustment must be made every time.

During operation the distance between the speed sensor and the inductor ring should be 0,8 mm max. Lead the wire of speed sensor from the axle brake system in such a way that the radius of the blended wire never less than a minimum of R50 mm and the wire at 50 mm intervals while inside the hot brake system .

Check the runout of toothed impulse inducing ring. Allowable runout of the ring teeth in the direction of the speed sensor is 0,2 mm max.

Note: Tachometer to be built in only with spring bushing of the same manufacturing. Besides BOSCH, KNORR and WABCO tachometer, a tachometer of other production, interchangeable with the above is allowed to be built in. If the impulse ring is changed, before pressing the new impulse ring is to be heated uniformly to 150°C and pushed up to stop on the wheel hub.



939.93-3

Fig. 1.: MOUNTING THE ANTI-LOCKING SYSTEM

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WHEEL BRAKE

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DRAWING OF THE FRONT WHEEL

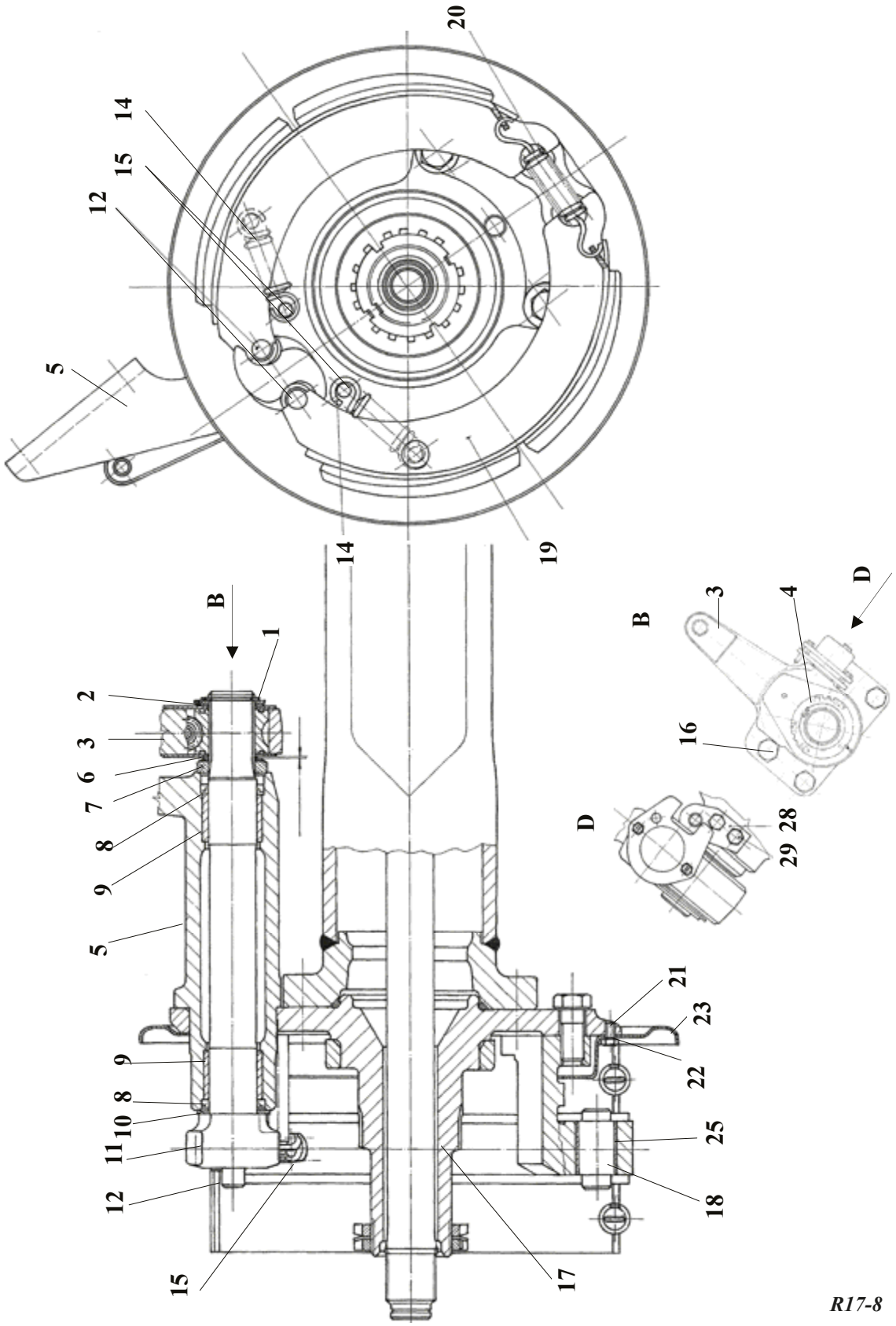

Fig. 1.: DRAWING OF THE FRONT WHEEL BRAKE

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PARTS OF THE WHEEL BRAKE

1 – Snap ring
2 – Spacer
3 – Brake lever
4 – Wear indicator disk
5 – Chamber bracket
6 – Shims
7 – Spacer
8 – Sealing ring
9 – Bearing bush
10 – Distance washer
11 – Brake spanner
12 – Brake shoe roller
–
14 – Brake shoe return spring, long
15 – Spring support pin
16 – Hex. bolt
17 – Spindle with brake support
18 – Brake shoe anchor pin
19 – Brake shoes
20 – Brake shoe return spring, short
21 – Hex. bolt
22 – Lock washer
23 – Brake cover plate
–
25 – Bushing
–
28 – Stop
29 – Hex. bolt with lock washer

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SECTION 262.

REMOVING AND REINSTALLING THE BRAKE SHOES REMOVING THE BRAKE SHOES

Remove the brake drum (1 in Fig. 1 of Section 210). Pry the brake shoes (19) away. Remove the brake shoe rollers (12).

Unhook the shoe return springs by means of the spring hooking device **4957-00489,** then remove the brake shoes.

BRAKE SHOE ROLLER AND ITS ASSEMBLING

At intervals described in the OPERATING AND MAINTENANCE INSTRUCTIONS drive out the brake shoe roller. Apply thin coat of the operating surface of the brake shoe roller and the groove with AGIP AUTOL TOP 2000 grease.

When the oil seal is to be replaced, after driving out the roller pin remove the worn oil seal.

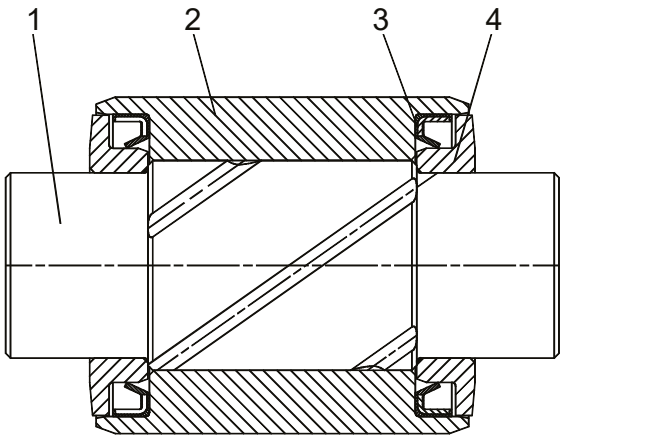

Fig. 1.: THE BRAKE SHOE ROLLER

By means of the tool shown drive in the new oil seal to bottom out (Fig. 2.).

Fill up the hole between the sealing lip of the oil seal and the spacer with the above mentioned grease, too.

Drive on the spacer with the spacer driver mandrel of the No. **8928-00058** set.

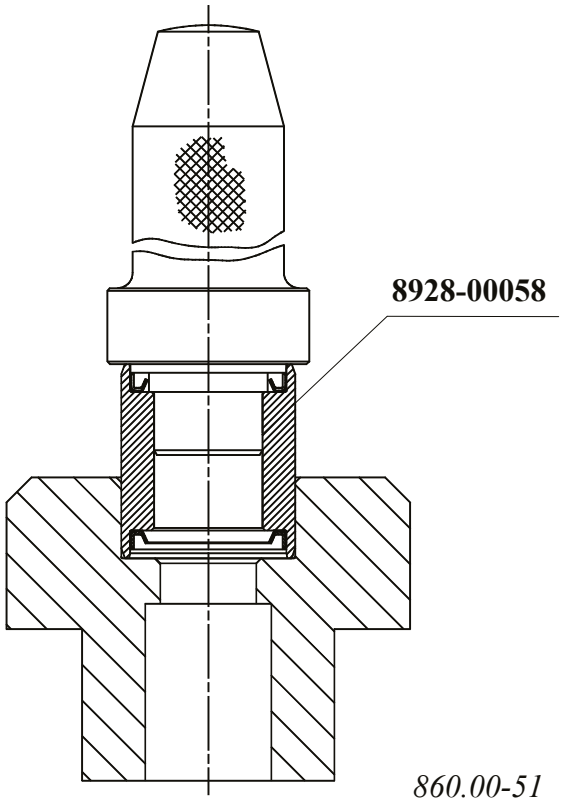

Fig. 2.: DRIVING IN THE OIL SEAL

REINSTALLING THE BRAKE SHOES

Position the brake shoes to the placed in shoe anchor pin (18) an the brake camshaft head. Hook the return springs (14 and 20) to the brake shoes. For hooking use the springs hooking device Drw. No. **4957-00489.**

Pull the rollers (12) over then pry the brake shoes away, then insert the roller pins so, they shall seat both in the brake shoe rib and in the brake spanner

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REPAIRING THE BRAKE SHOES AND THE BRAKE DRUM

Operate the axle with brake drum trued-up ONLY to the permitted max. diameter and brake linings worn to the permitted limit. Exceeding the above limits the brake spanner may turn over making the brake application impossible.

The permitted minimum thickness of the brake linings is indicated by upper edge of the recess in side of the linings. (As measured at the center of the brake shoe Vmin.= 7,0 mm).

Replace the brake linings if damaged or worn below the permitted limit . Replace the brake linings and true up the brake shoes only in pairs.

The working off is implemented with equipment drawing number 4399-03234. The device shall be mounted on the wheel hub. The of the device on the guiding (Ø282E8) after the clamping shall be checked then the device shall tightened by the wheel bolts.

The brake shoes equipped with nem linings should be in compliance with the dimension and technical requirements shown in Fig. 1.

The depth of cut can be adjusted base on the scale on the bolt of tool adjuster (1 pitch: 0.05 mm in radial direction). Every time, the device is permitted to be operated only by the crank rod. It is prohibited to turn on the drive!

CHECKING THE BRAKE DRUM

Check the inside surface of the brake drum.
If depth of the hair-cracks experienced on the brake drum surface does not exceed 1 mm the brake drum can be repaired by true-up.

The maximal brake drum diameter after true-up may be Ø 424 mm. Out of this diameter the brake drum should be replaced.

WARNING!
When trueing up the brake drum the brake shoes should be trued up taking the brake drum diameter into account.

E.g.: If diameter of the trued up brake drum is 422 mm, true up the brake shoe to R 210.6 - R 210.3 mm as shown in Fig. 1.

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SECTION 264.

REMOVING AND REINSTALLING THE ANCHOR BUSHING AND THE CHAMBER BRACKET, ASSEMBLING THE SPRING SUPPORT

REMOVING AND REINSTALLING THE ANCHOR BUSHING

If the anchor pin bushing (25) are to be replaced, drive out by means of No. 8839-00371 driver and drive in the tool shown (Figure 1.).

Note!
The bushing slots have to be located in the 90° zone.

In case of damage to the brake support the spindle assembly machined together with the brake support should be replaced as described in the Section 226.

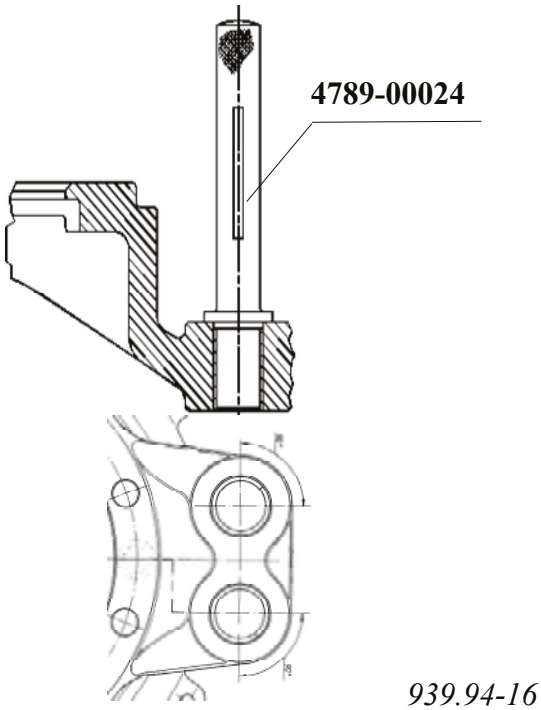

Fig. 1.: DRIVING THE BUSHINGS

ASSEMBLING THE SPRING SUPPORTING PINS

Install the spring support pins (15) with thread adhesive.

REMOVING AND REINSTALLING THE CHAMBER BRACKET

After removing the hex. bolts (16) pull the chamber bracket out of the brake support.

The relevant (RH-LH) camshaft support should be positioned into bore of the brake support and secure by hex bolts coated with thread locker. Tighten the bolts (16) to 130-140 Nm torque.

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REMOVING AND REINSTALLING THE BRAKE LEVER AND THE BRAKE SPANNER

REMOVING THE BRAKE SPANNER

Removal of the camshaft can be performed after removing the brake shoes.

Remove the snap ring (1), the spacer (2) and the wear indicator disk (4).

Pull the brake lever (3), the shims (6) and the spacer (7) off the brake spanner (11) end.

Pull the brake spanner out of the chamber bracket (5) and remove the distance washer (10) below the brake spanner head.

REINSTALLING THE BRAKE SPANNER

Position the distance washer (10) to the relevant brake spanner (RH - LH) to bottom out against the brake spanner head.

Apply grease to the brake spanner bushes and push the brake spanner subassembled with distance washer into the bushes (9) of the brake spanner support.

REINSTALLING AND ADJUSTING THE BRAKE LEVER

Stack the spacer (7), the required number shims (6) and the relevant brake lever (RH-LH) to the brake spanner.

Install the brake lever to the brake spanner so, the bore centre of the brake lever bush shall be in distance “A” in the “TECHNICAL DATA” from the upper plane of the diaphragm holder.
Position the spacer (2) and the wear indicator disk (4) to the end of the brake spanner.

After adjusting the above “A” dimension and the 0.1-0.5 mm shoe clearance adjust the wear indicator disk so, the cut-out marked “O” on the disk and the recess on the lever shall be in the nearest position to each other (see I. in Fig. 1. in section 268).

Position the snap ring (1) to the end of the brake spanner.

Check the axial clearance of the camshaft to be between 0,1 - 0,5 mm. If required perform readjustment by means of shims (6).

WARNING!
After installing the camshaft make sure it is installed properly (RH, LH). Actuating the slack adjuster brake shoe should open!

In case of new lining the brake lever recess and “O” mark of the wear indicator disk will nearly align (max. deviation is 9°).

With wear of the brake lining the brake diaphragm stroke length increase, which is automatically readjusted before exceeding the limit permitted by the diaphragm.

In case of new brake drum of Ø420 mm the mark “424” while at brake drum true-up to Ø424 mm the mark “424” of the disk may reach the recess on the brake lever. This indicates that the brake lining is worn to the permitted limit. In such a case replace the brake linings (see II. in Fig. 1. in section 268).

Attach the relevant brake lever stop (28) (RH-LH) to the diaphragm holder by 2 off M8x14 hex. bolts (29) with lock washer (30) for each. Tighten the hex. bolts to 20 - 25 Nm torque.

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SECTION 266.

REPAIRING THE BRAKE SPANNER BEARING SUPPORT

REMOVING THE BEARING BUSHES AND THE SEALING RINGS

By means of the tool shown pull the bearing bushes (9) out of the chamber bracket (5) See Fig. 1.

The bushes will push out the sealing rings (8) ahead.

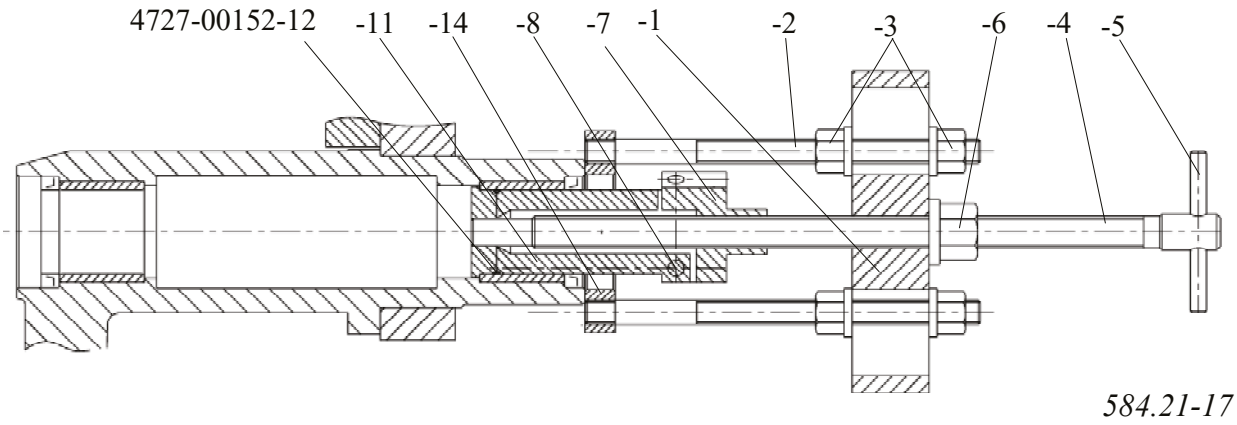

Fig. 1.: PULLING OUT THE BEARING BUSHES

REINSTALLING THE BEARING BUSHES

By means of the tools shown drive in the new bearing bushes until the tool bottoms out (Fig. 2.).

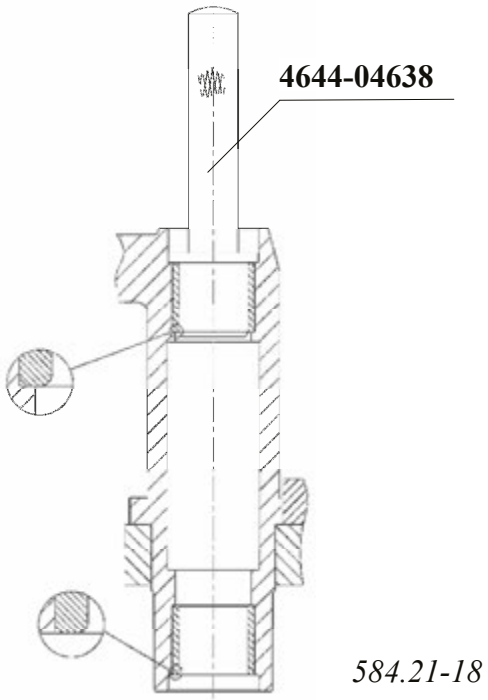

Fig. 2.: DRIVING IN THE BEARING BUSHES

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REINSTALLING THE BEARING BUSHES

When reinstalling the sealing rings make sure to check if the sealing lips of the rings both near the brake spanner head and on the brake lever side face toward the axle housing and the brake lever.

By this means leak-tighteness at the brake spanner head is assured.
During lubrication with grease the sealing ring near the brake lever should pass the surplus lubricant toward the brake lever.

By means of the tools shown press the sealing rings before the bushes (Fig. 3.).

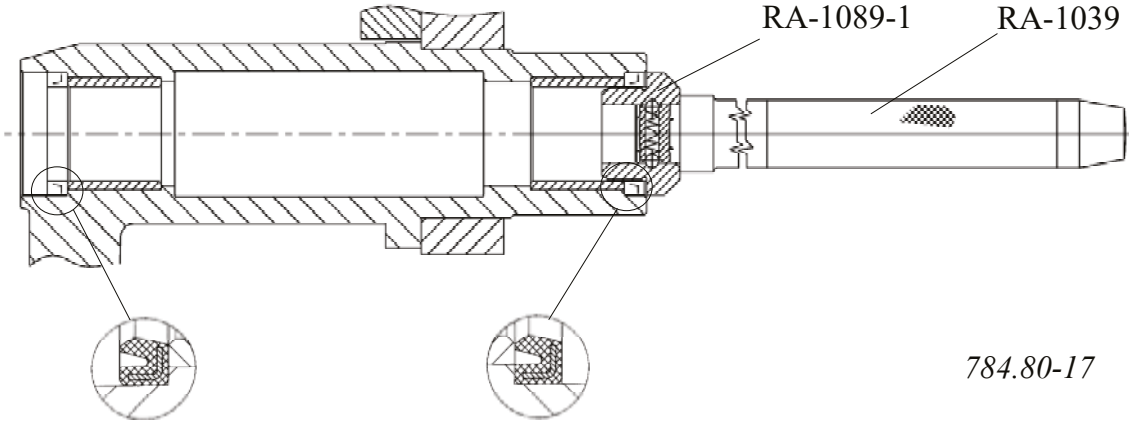

Fig. 3.: DRIVING IN THE SEALING RING

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SECTION 268.

AUTOMATIC SLACK ADJUSTER

The slack adjuster is automatically readjusted according to the brake lining wear.

In case of replacing the brake linings or after repairing the axle perform adjustment of the shoe clearance and the automatic slack adjuster as follows:

Items:
1 - Adjusting plate
2 - Setscrew (Hex. distance 13)
3 - Setscrew (Hex. distance 10)
4 - Protection
5 - Hex. adjusting ring (Hex. distance 32)
6 - Stop pin
7 - Plastic thread protector
8 - Toothed disk

I. Position of wear indicator disk a new brake lining.
II. Position of wear indicator disk at worn brake lining. Brake drum diameter: 420 mm.

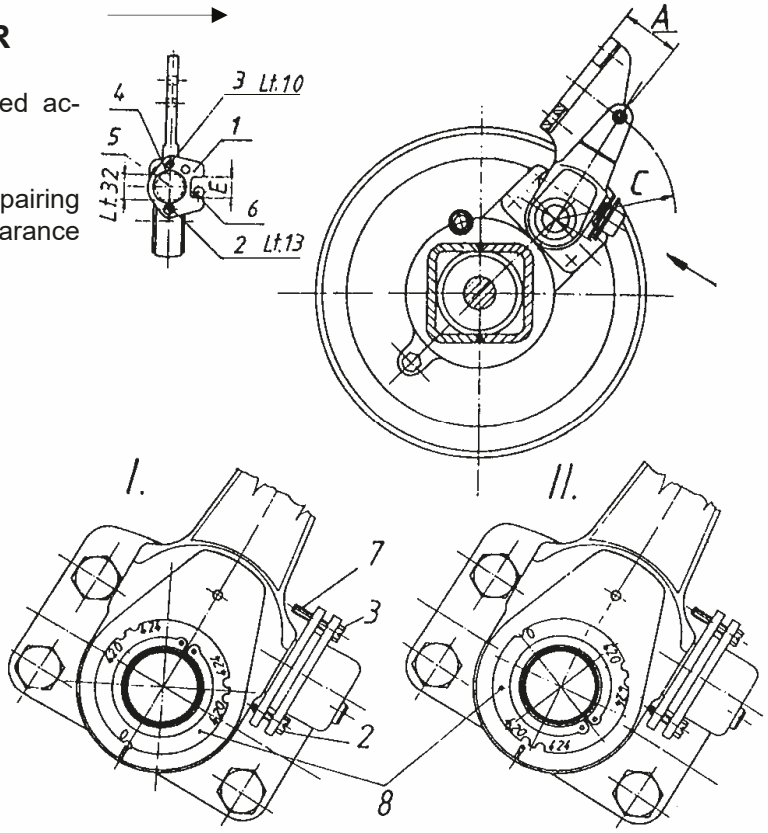

Fig. 1.: AUTOMATIC SLACK ADJUSTER

Adjustment data:

A= Distance between the chamber holder plane and the brake lever bore

C =Brake lever installation radius

For dimension A -C refer to “TECHNICAL DATA”.

Adjusting position of the brake lever and the shoe clearance:

- Remove setscrew (2, 3).
- Take care of the plastic thread protector (7).
- Remove the adjusting plate (1) and the plastic protection cap (4).
- By turning the hex. adjusting ring (5) to proper direction adjust the distance between the seating surface and the brake lever bore. (Start adjustment from a distance higher than If required, also adjust the push rod clevis.)
- After the above operation adjust the shoe clearance to 0.3 - 0.6 mm.

Adjusting and fixing the adjusting plate:

Secure the fork “E” of the adjusting plate (1) in bottom position relative to stop pin (6) as shown in Fig. 1.

Complete adjustment by reinstalling the plastic protection cap (4) and the adjusting plate (1) as well as installing and securing the setscrew (2, 3) and screwing on the plastic thread protector.

During plane of the adjusting plate should be perpendicular to the stop pin (6).

Before installation apply graphitic grease to serration of the brake lever.

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Main Differential (RF17)

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MAIN DIFFERENTIAL SECTIONAL VIEW

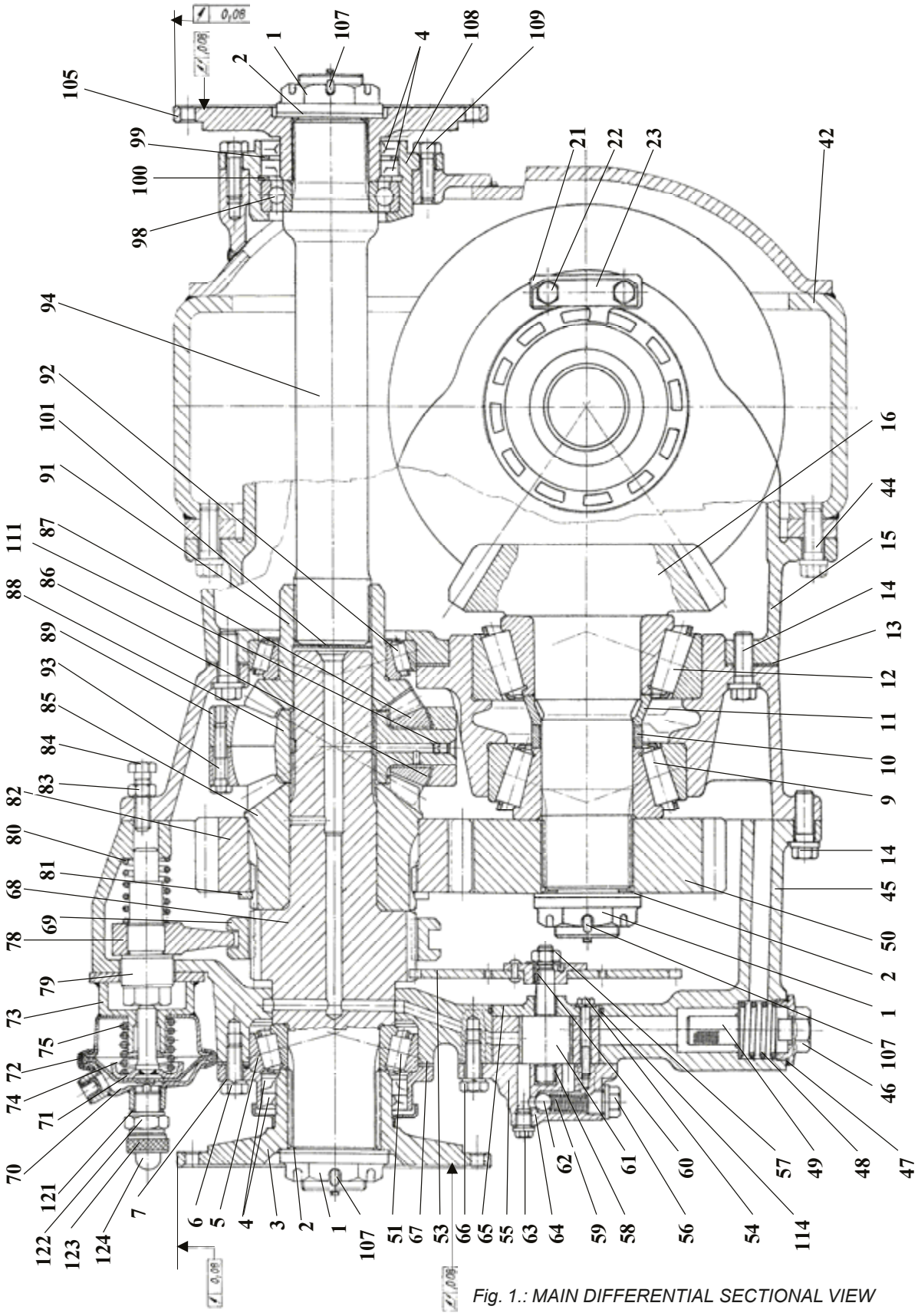

Fig. 1.: MAIN DIFFERENTIAL SECTIONAL VIEW

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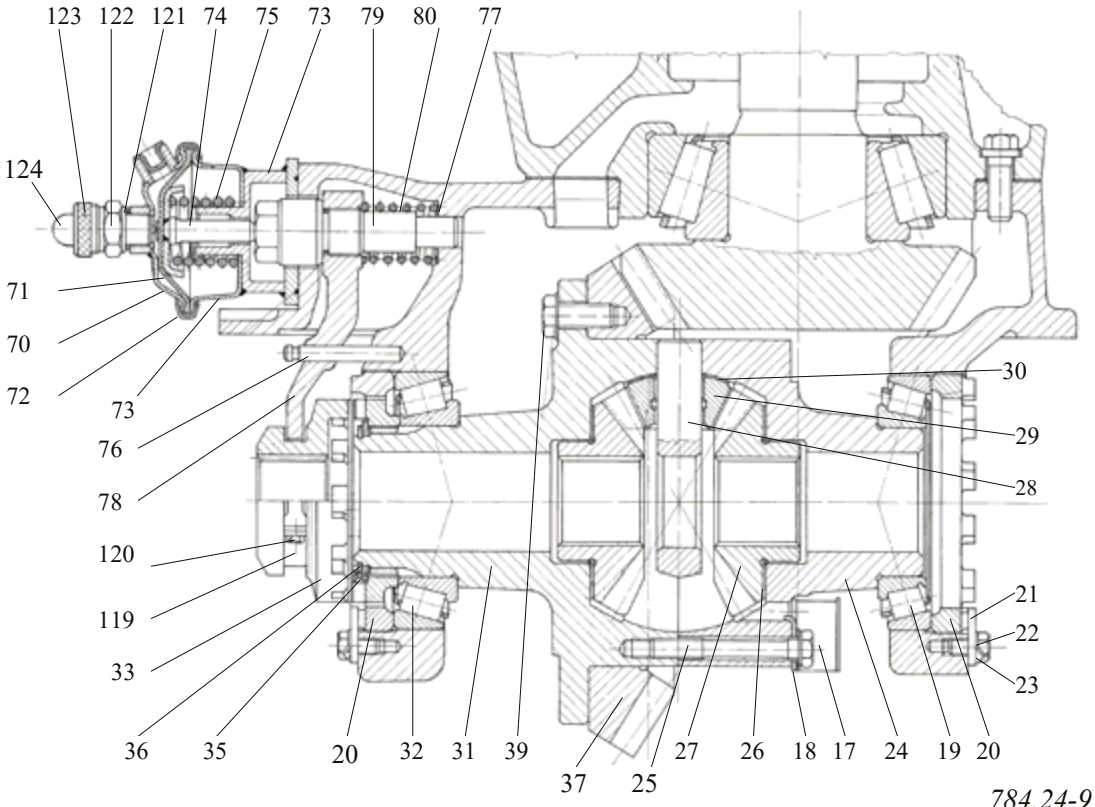

Fig. 1/A.: SECTIONAL VIEW OF THE CROSS DIFFERENTIAL IN THE MAIN DIFFERENTIAL

SECTION 281

PARTS OF THE DIFFERENTIAL

1 – Flanged castle nut
2 – Washer
3 –
4 – Sealing rings
5 – Cover
6 – Hex. bolt
7 – Lock washer
–
9 – Taper roller bearing (32312)
10 – Distance ring
11 – Distance sleeve
12 – Taper roller bearing (32314)
13 – Shims
14 –
15 – Differential carrier I.
16 – Drive pinion
17 –
18 – Washer
19 – Taper roller bearing (30215)
20 – Bearing adjuster
21 – Tab lock plate
22 – Hex. bolt
23 – Lock plate
24 – Differential case half
25 – Clamp bolt
26 – Spacer
27 – Differential gear
28 – Spider
29 – Differential pinion
30 – Shim
31 – Dif
32 – Taper roller bearing (32215)

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–
37 – Drive gear
–
39 –
–
42 – Axle housing
–
44 –
45 – Differential carrier II., III. assy.
46 – Drain screw plug with magnetic insert
47 – Sealing ring
48 – Spring
49 – .
50 – Driven gear
51 – Taper roller bearing (32212)
–
53 – Toothed disk
54 – Hex. bolt with lock washer
55 – Oil pump case
56 – Flanged screw plug with sealing ring
57 – Hex. nut with tab lock plate
58 – Bush
59 – Oil pressure control spring
60 – Woodruff key
61 – Oil pump drive gear
62 – Steel ball
63 – Flanged screw plug with sealing ring
64 – Oil pump cover II.
65 – Oil pump cover I.
66 – Hex. bolt with lock washer
67 – Shims
68 – Input shaft
69 – Toothed hub
70 – Pneumatic chamber cover
71 – Diaphragm
72 – Clamp
73 – Pneumatic chamber housing
74 – Spring retainer
75 – Spring
–
78 – Shift yoke
79 – Shift bar
80 – Spring
81 – Snap ring
82 – Pinion drive spur gear
83 – Lock nut
84 – Stop bolt
85 – Differential gear II.
86 – Spacer
87 – Differential pinion
88 – Sider
89 – Differential case
–
91 – Differential gear I.
92 – Taper roller bearing (32014)
93 – Hex. bolt
94 – Thru-drive shaft
–
98 – Deep-groove ball bearing (6210)
99 – Distance ring
100 – Snap ring
101 – Sealing plate
–
105 –
–
107 – Cotter pin
108 – Bearing cage
109 – Hex. bolt
–
111 – Grub screw
–
114 – O-ring
–
121 – Washer
122 – Reporting switch
123 – Connecting
124 – Rubber pipe

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SECTION 282.

REMOVING AND REINSTALLING THE MAIN DIFFERENTIAL

It is recommended to remove and reinstall the axle shaft with the differential lock in engaged position.

Before removing the main differential from the axle drain the oil.

Remove the hex. bolts (44) attaching the differential carrier assembly to the axle housing and by 2 off M12 bolts driven into the two threaded bores in the of the differential carrier pull the differential carrier assembly out of the axle housing.

REINSTALLING THE MAIN DIFFERENTIAL

At described in the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant (LOCTITE 515) to of the axle body and to connecting of the differential carrier I.

Install one M12 stud bolt to two opposite bores in the axle body, then the differential assembly into the axle housing and secure by hex. bolts (44) coated with thread locker.

Tighten the bolts diagonally to 100 - 110 Nm torque.

Install the axle-shafts.

SECTION 283.

REMOVING AND REINSTALLING THE COMPANION FLANGES AND THE COVER, REPLACING THE OIL SEALS IN THE COVER

REMOVING THE COMPANION FLANGE

By means of the tools shown (Fig. 1.) remove the

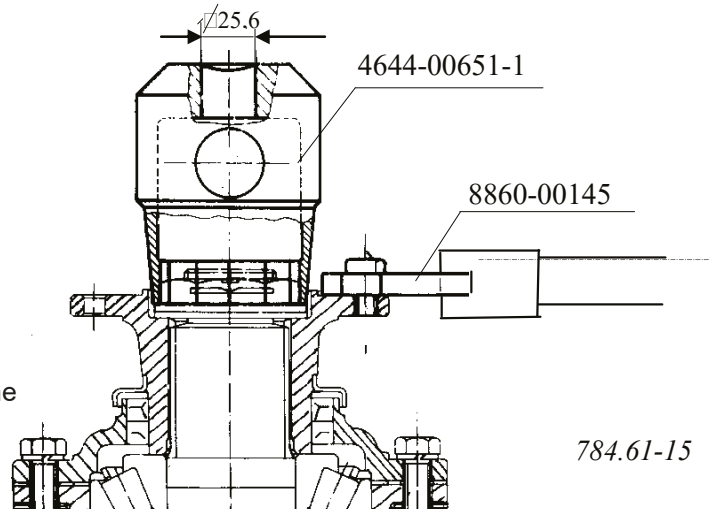

Fig. 1.: ASSEMBLING THE FLANGED CASTLE NUT

Pull off the companion by means of the dev assembled from the shown parts (Fig. 2.).

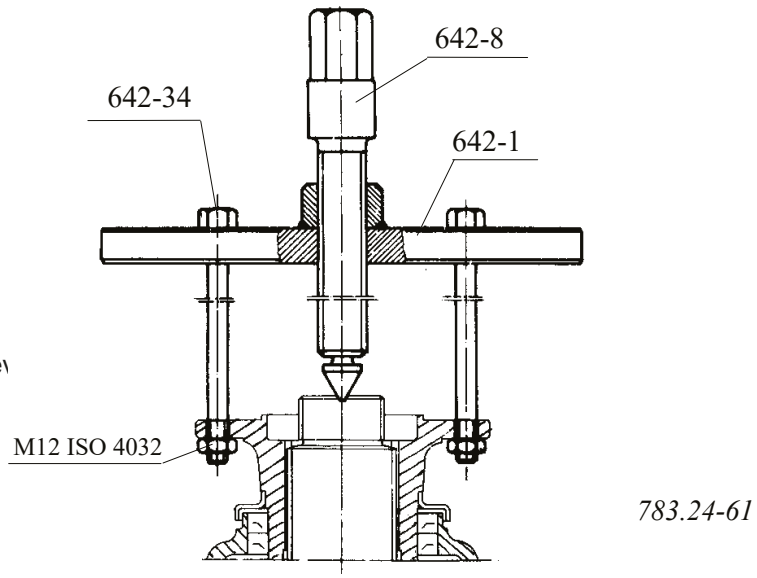

Fig. 2.: PULLING OFF THE COMPANION FLANGE

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REPLACING THE SEALING RINGS IN THE COVER

Back out the hex. bolts (6) and remove the cover (5) and the shims (67).

Remove the used sealing rings (4) from the cover, No. RA-0039 and RA-1241 of the tools

Drive in the new sealing rings (see Fig. 3. and 4.).

Apply grease to between the sealing lip and the dust protection edge of the outer sealing ring, while thin coat of grease (AMBLYGON TA 15/2) to the inner one.

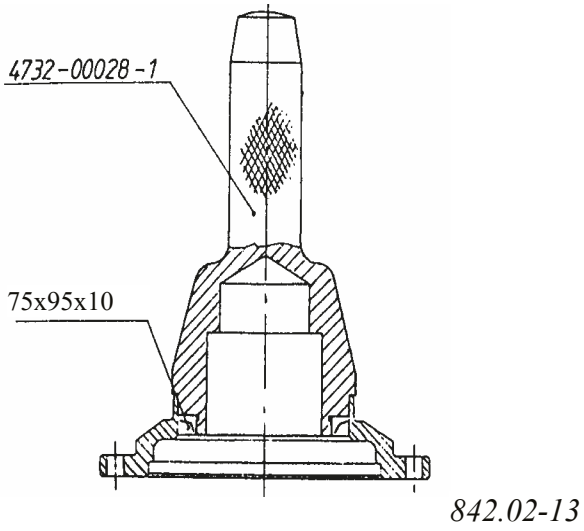

Fig. 3.: DRIVING IN THE INNER SEALING RING

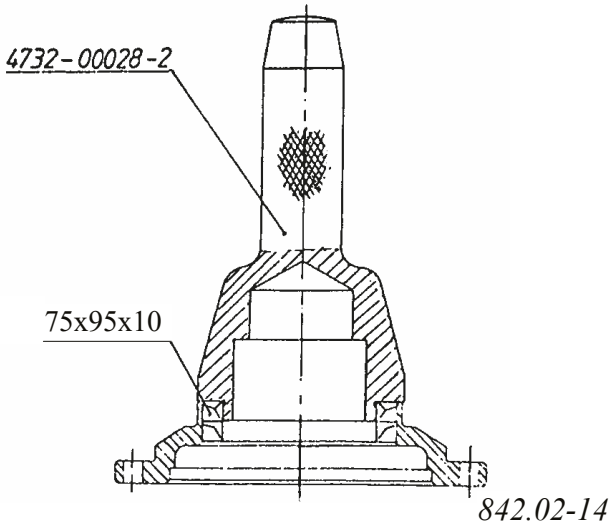

Fig. 4.: DRIVING IN THE OUTER SEALING RING

INSTALLING THE COVER

When installing the cover (5) adjust the axial play of the input shaft as described in the Section 293., then as described in the “GENERAL INSTRUCTIONS” apply oil-proof (LOCTITE 515) surface sealant to the protruding corner surface of the outer taper roller bearing on the input shaft.

Aligning the bores install the necessary shim pack (67) and the cover subassembled with sealing rings, Attach to the differential carrier III. by means of lock washer (7) and hex. bolts (6). Tighten the bolts to 59 - 78 Nm torque.

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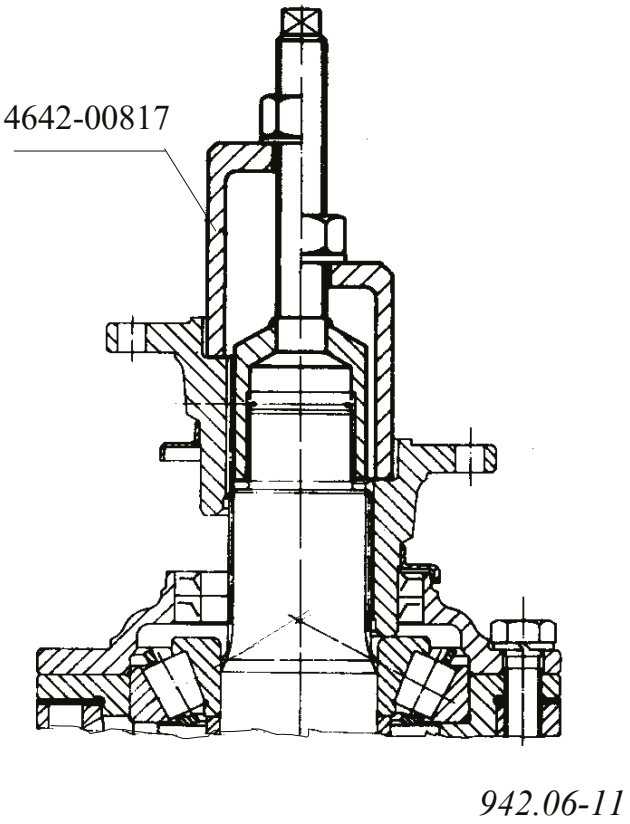

Fig. 5.: PRESSING ON THE COMPANION FLANGE

REINSTALLING THE COMPANION FLANGE

Fitting to splines of the input shaft drive (68) on the companion l. (3) until bottoms out, making sure not to damage the sealing rings. (Fig. 5.).

Install the washer (2) and the castle nut (1). By means of tools shown in Fig. 1. tighten the nut to 850 - 1050 Nm torque and secure with cotter (107).

Following this moving the input shaft (68) to axial direction measure the axial play by means of dial indicator equipped with magnetic stand. Turning the companion by pry perform measurement at three places in even pitch.

The axial play should be between 0.1-0.15 mm. Adjust this value, if required, by selecting the proper thickness shim pack (67).

Check the runout of the companion Allowable runout of the companion in radial and axial direction is 0.08 mm (Fig. 1. in section 280). When the adjustment is improper, then pull off the companion turn it by 15° and press on and check the runout again. Repeat the adjustment until obtaining the

After adjusting the proper axial play no jamming or uneven rotation is permitted.

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SECTION 284.

REMOVING AND REINSTALLING THE THRU-DRIVE SHAFT

REMOVING THE THRU-DRIVE SHAFT

As described in the Section 283. remove the castle nut (1) and the companion II. (105) the thru-drive shaft (94).

By means of a simple pry remove the sealing ring (4) and the distance ring (99).

Remove the inner sealing ring and the snap ring (100)

By means of the device shown remove the thru-drive shaft together with the deep-groove ball bearing (98). Secure the device to the thru-drive shaft by means of

If replacement of the deep-groove ball bearing (98) is required, pull off it with general puller.

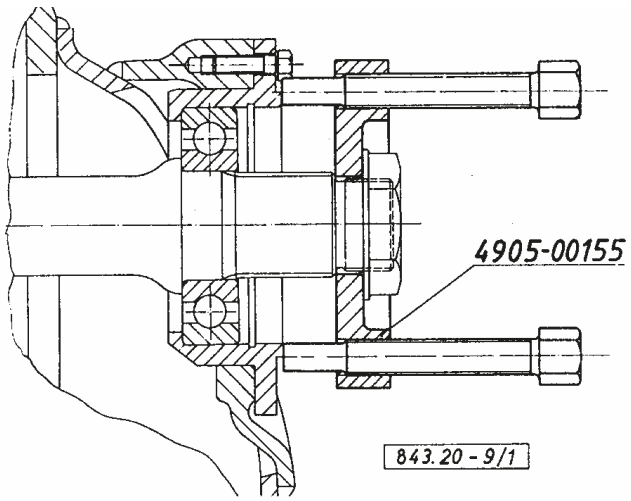

Fig. 1.: PULLING OUT THE THRU-DRIVE SHAFT

REMOVING AND REINSTALLING THE BEARING CAGE

After the hexagon head bolts (109) are backed out, remove the bearing cage (108) out of the axle housing.

Clean the connecting surfaces of the axle housing to the bearing cage.

As described in the “GENERAL INSTRUCTIONS” apply oil-proof (LOCTITE 515) surface sealant to the bearing cage face inside the bolt bores.

When reinstalling the bearing cage make sure to check if the oil plate faces downward. Secure the bearing cage by the hex. bolts applied with thread locker and tighten the bolts to 59 - 78 Nm torque.

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REINSTALLING THE THRU-DRIVE SHAFT

Heat up the deep-groove ball bearing to 80-100°C and by means of tool shown in Fig. 2. install to the thru-drive shaft to bottom out against the shoulder ring. Wait for the bearing cool down.

Position the subassembled thru-drive shaft to the axle housing, the aligning its splines to those of the differential gear I. (91) drive the deep-groove ball bearing together with the shaft to place until the bearing bottoms out against its seat. For driving in use the same tool as above (see Fig. 2.).

Position the snap ring (100). By the above tool drive in the inner sealing ring, position the distance ring (99) and also drive in the outer sealing ring by the drive sleeve shown in Fig. 2. to with outer edge of the bearing cage.

Apply grease to between the sealing lip and the dust protection edge of the outer sealing rings, and thin coat of grease the inner one.
(AMBLYGON TA 15/2)

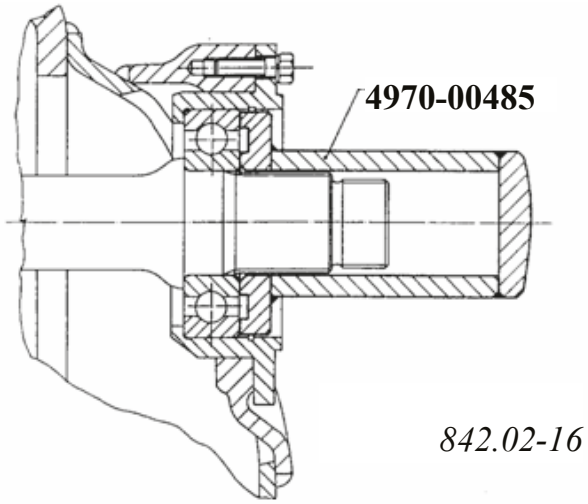

Fig. 2.: REINSTALLING THE THRU-DRIVE SHAFT

As described in the Section 283. install the companion II. (105) to the shaft end, position washer (2) and castle nut tightened to 850 - 1050 Nm torque and secure with cotter. Rotate the thru-drive shaft and check for even run, free of jamming and jerks.

SECTION 285.

REMOVING THE INPUT SHAFT AND DIFFERENTIAL CARRIER III.

After removing the companion I. (3) and the

outer of the differential carrier III. (45). Drive out the dowel pins and separate the differential carrier III. from the differential carrier II.

Match-mark the differential carriers II. and III. since they are matched parts. Withdraw the differential carrier III. (45) together with the input shaft (68) and the toothed hub (69).

Remove the differential side gear I. (91) assembled with the 32014 taper roller bearing (92) cone, then the differential (89) and remove the differential side gear II (85) mounted with the drive gear (82).

After backing out the 2 off M8x15 bolts remove the inter-axle differential lock actuating pneumatic chamber and unscrew the shift bar (79) from threaded bore of the shift yoke (78).

Pull the toothed hub (69) together with shift yoke (78) from the input shaft (68) and also remove the spring (80) set free.

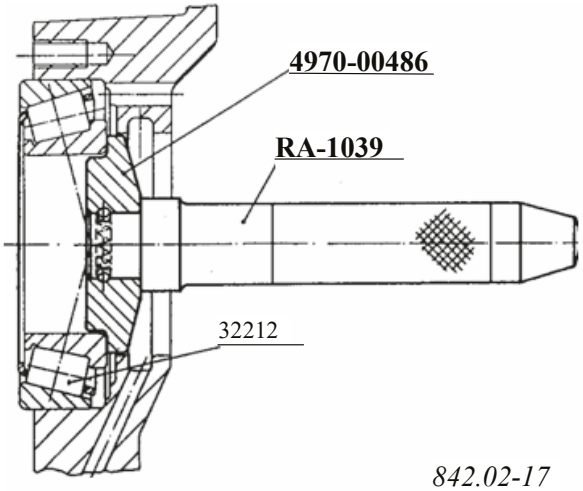

Fig. 1.: DRIVING OUT THE TAPER ROLLER BEARING

Properly backing up the differential carrier III. tap the input shaft out of the inner race of taper roller bearing (51).

From differential carrier III. remove the remained taper roller bearing by means of the tools shown (see Fig. 1.).

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REMOVING AND REINSTALLING THE CROSS DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTERN

Back out the hex. bolts (22) and remove the lock plates (23) and the tap lock plates (21).

By means of the tool shown remove the bearing adjusters (20) from the both sides (see Fig. 1.).

By means of the tool shown in Fig. 2. tap the differential toward the differential case half (31) so, the cup of the taper roller bearing (19) shall fall out.

Due to the taper roller bearing cones the differential can be removed only if disassembled.

Back out the bolts (25) clamping the differential case halves, then remove the separated case halves and the other parts from the carrier.

Drive the outer race of the other taper roller bearing out of the leg bore in the differential carrier by means of the tool shown in Fig. 3.

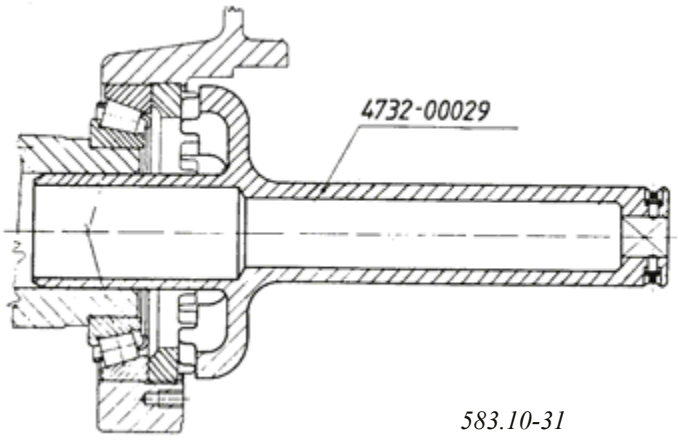

Fig. 1.: ASSEMBLING THE BEARING ADJUSTERS

REINSTALLING THE DIFFERENTIAL

Reinstall the differential only after installing the differential carrier II. and adjusting the axis distance (see Section 289.)!

Position the assembled differential into the differential carrier. Turn the differential carrier over so, the differ-

Position the cone of the taper roller bearing (19) to the differential case half (24) and by means of the tool shown drive on to bottom out (see Fig. 2.).

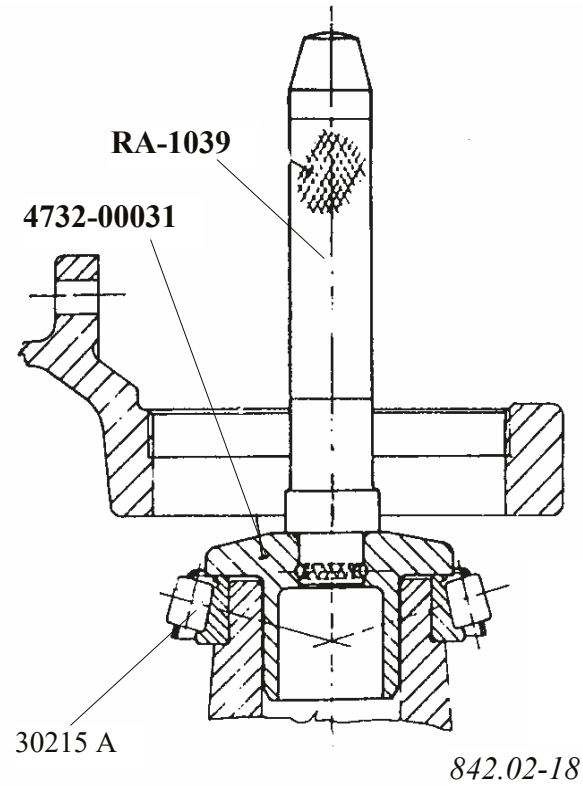

Fig. 2.: DRIVING ON THE TAPER ROLLER BEARING INNER RACE

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Position the taper roller bearing cup into the bearing bore in the differential carrier and drive in by means of the tool shown (see Fig. 3.).

Screw in the bearing adjuster (20).

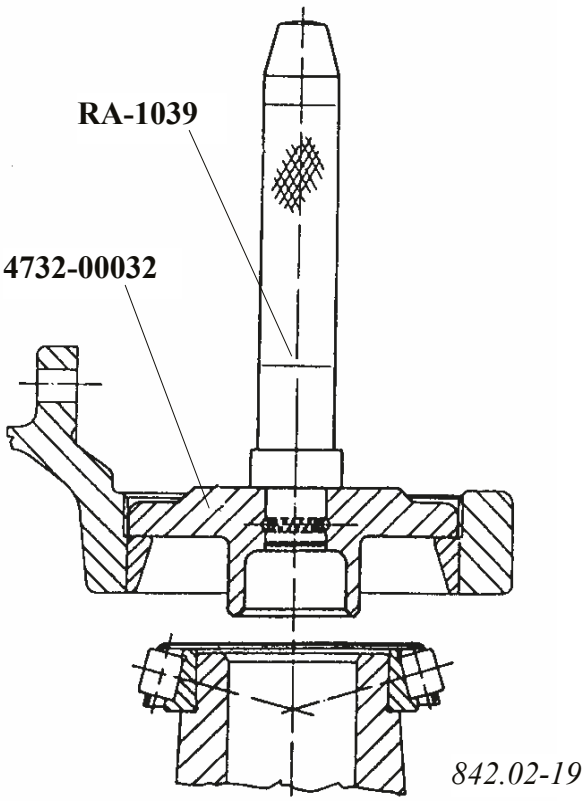

Fig. 3.: DRIVING IN THE TAPER ROLLER BEARING CUP

Turn the differential carrier over and drive the taper roller bearing cone and, then drive on the bearing cup by the same tool (Fig. 4.).

Screw in the bearing adjuster (20).

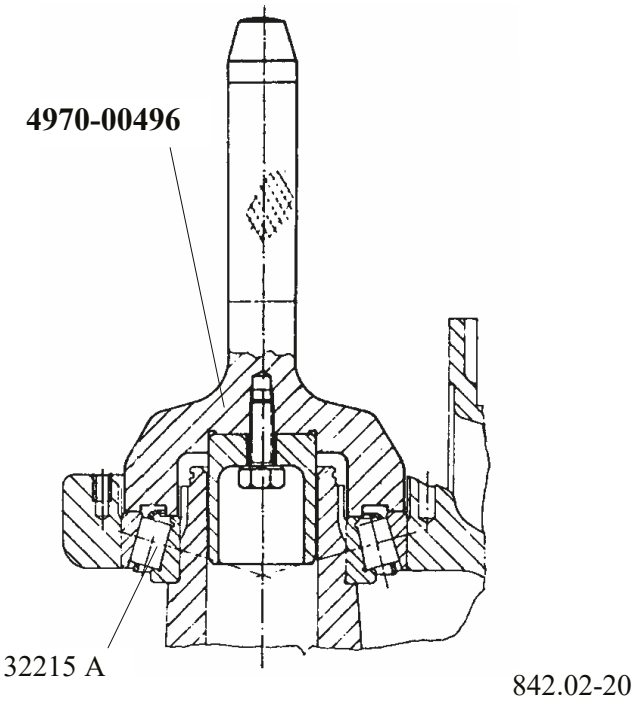

Fig. 4.: DRIVING THE TAPER ROLLER BEARING

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ADJUSTING THE BACKLASH AND THE BEARING PRELOAD

By means of the bearing adjuster adjust the drive pinion to gear backlash to 0.15-0.20 mm.

Locking the drive pinion measure the backlash at four places diagonally on the drive gear toothing, perpendicularly to the tooth surface by means of the backlash checking device No. 4750-00122 (Fig. 5.).

Maintaining the backlash install the differential taper roller bearing (19 and 32) with no clearance. Tighten the bearing adjuster (20) so, to obtain 0.000 mm axial play of the drive gear.

After adjusting the backlash and the bearing preload check the contact pattern as follows.

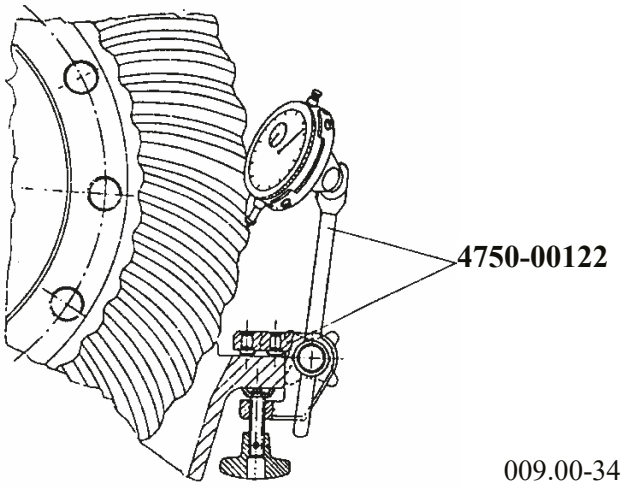

Fig. 5.: CHECKING THE BACKLASH

ADJUSTING THE CONTACT PATTERN

Apply indicator paint to 2 opposite teeth pairs of the drive gear.

Rotate the drive pinion to both directions for approx. 15 sec.., while braking the drive gear by a piece of wood.

During drive the rotation should be smooth and noiseless.

PROPER CONTACT PATTERN

If a contact pattern shown in detail 1 of Fig. 6. is obtained, the drive gear-pinion pair is installed properly.

Practically the perfect contact pattern shown in the cannot be obtained, but it is important that the pattern shall nowhere reach the edge of the tooth surface.

D = Large diameter
1 = Proper contact pattern
2 = Too deep contact
3 = Too high contact

In case of GLEASON toothing the contact pattern along the tooth is shifted toward the small diameter of the drive gear.

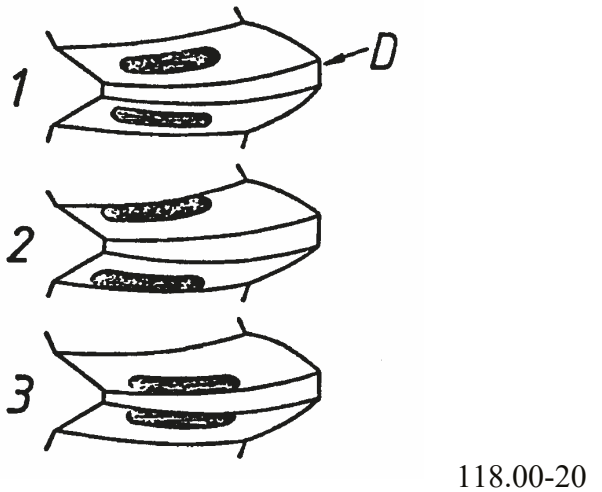

Fig. 6.: THE CONTACT PATTERN

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TOO DEEP CONTACT

If the contact pattern is shifted to the dedendum as shown in detail 2 of Fig. 6. increase the “AXIS DISTANCE” by increasing the thickness of the shim pack (13) and simultaneously reduce the increased backlash by shifting the drive gear so, to obtain the contact pattern shown in detail 1 of Fig. 6.

TOO HIGH CONTACT

If the contact pattern is shifted to the addendum as shown in detail 3 of Fig. 6. reduce the “AXIS DISTANCE” by reducing the thickness of the shim pack (13) and simultaneously increase the reduced backlash by shifting the drive gear so, to obtain the contact pattern shown in detail 1 of Fig. 6.

After each contact pattern adjustment measure the backlash and check if the bearing clearance is 0.00 mm. After adjusting the proper contact pattern and bearing clearance tighten further the bearing adjuster on both sides by 7.5°-15° to be able to secure them by one of the tap lock plates (21).

Secure the tap lock plates on both sides by means of the hex. bolts (22). Tighten the bolts to 15-20 Nm and secure by folding the corners of the lock plates (23) to

When the adjustment and the operation is proper, remove the differential carrier II. assembled with drive pinion and according to the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant (LOCTITE 515) to the inner then back the differential carrier II. and secure by hex. bolts (14) coated with thread locker. By means of wrench extension 4905-00022 diagonally tighten the bolts to 49-59 Nm torque.

SECTION 288.

DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL

Pull the inner of the taper roller bearings (19 and 32) from the removed differential (see Fig. 1.).

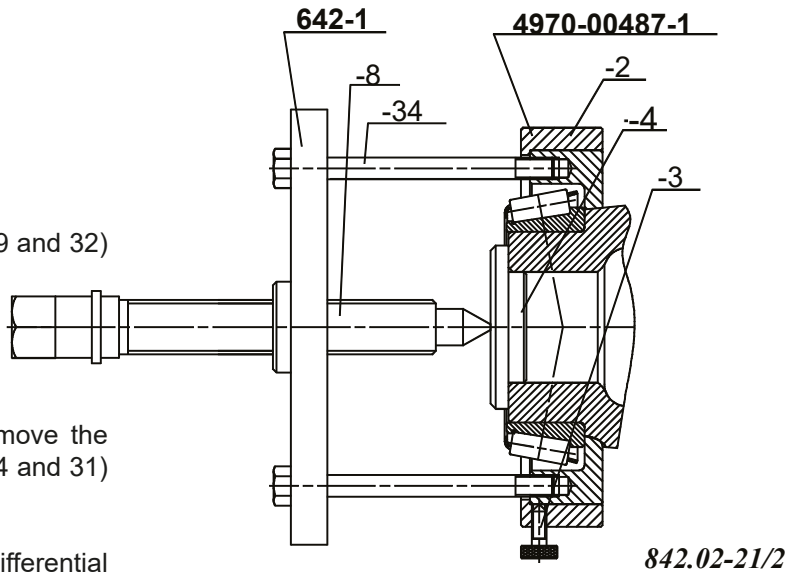

Fig. 1.: PULLING OFF THE TAPER ROLLER BEARINGS CONE

For disassembling the differential case remove the hex. bolts (25) clamping the case halves (24 and 31) together and separate the case halves.

Remove the spider (28) together with the differential pinions (29) and shims (30) as well as the differential gears (27) and the spacer (26).

Replace the drive gear only together with the matched drive pinion.

The match-marks are stamped to one face of the drive pinion and to one tooth end on the outer taper surface of the drive gear.

The match-marks indicate the number of the matched drive gear-pinion pair and the deviation - true to sense - from the theoretical “AXIS DISTANCE” measured between the drive pinion face and the drive gear centerline. For example: 1250, +0.04.

The differential case halves are matched pairs, thus install only match-marks differential case halves, according to the marks.

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REASSEMBLING THE DIFFERENTIAL

Pull the differential case half (31) over the lower service mandrel (see Fig. 2.). Insert the spacer (26) and the differential gear (27) as well as the spider (28) subassembled with shims (30) and differential pinions (29). Following this insert the other differential gear and the spacer.

According to the match-marks and aligning the bores the differential case halves together, then install the clamp bolts (25). By means of the upper service mandrel lock the differential and tighten the clamp bolts to 49 - 59 Nm. Fix the oil plate (17) by washer (18) to the differential. Remove the upper service mandrel and rotate the differential on the lower mandrel.

The differential roll evenly and smoothly without jamming and jerks.

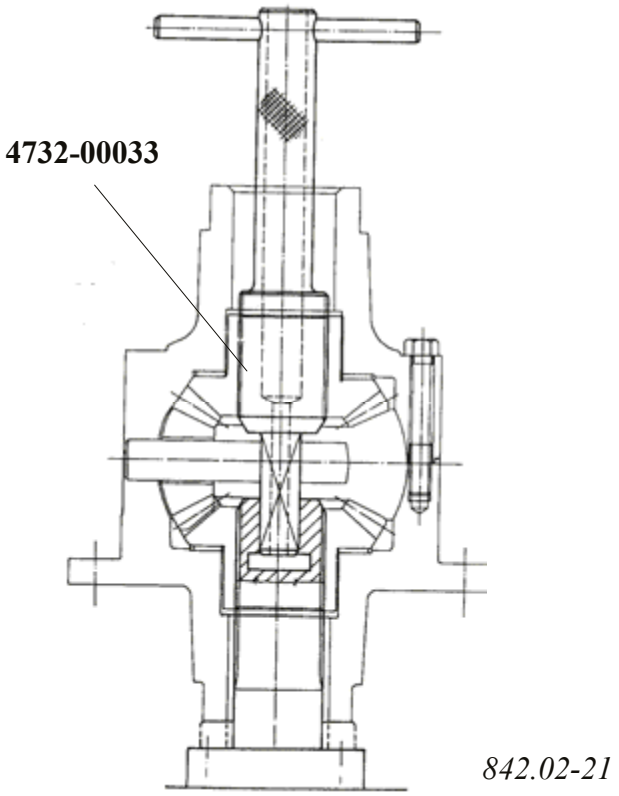

Fig. 2.: ASSEMBLING AND CHECKING THE DIFFERENTIAL

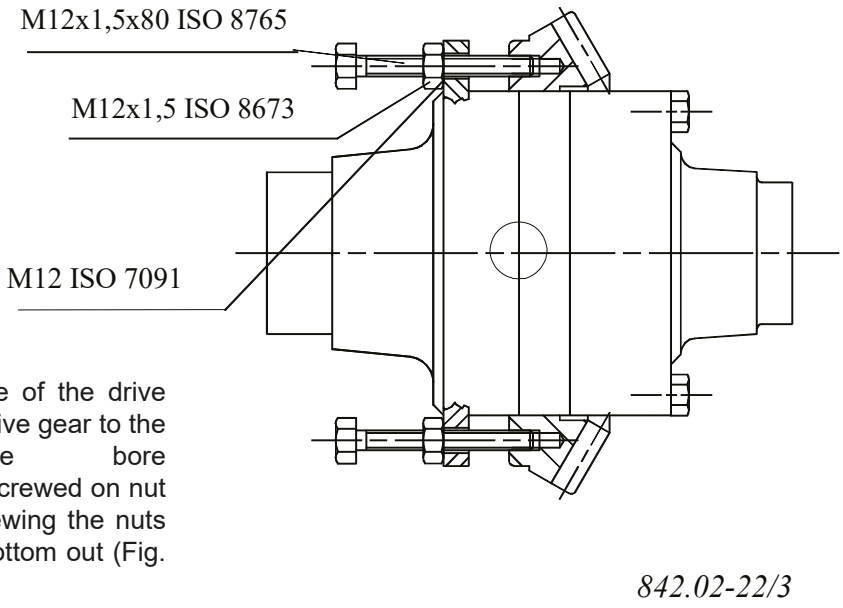

Fig. 3.: PULLING ON THE DRIVE GEARS

Apply thin coat of the mating surface of the drive gear. Aligning the bores position the drive gear to the differential case half. Thru the bore drive 4 off hex. bolts with completely screwed on nut into the drive gear and gradually screwing the nuts completely pull on the drive gear to bottom out (Fig. 3.).

Secure the drive gear by hex. self-lock bolts (at place of the puller bolts, as well) and tighten the bolts to 120 - 135 Nm torque.

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REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER II., ADJUSTING THE AXIS DISTANCE

If the drive pinion (16) or its bearings are to be replaced remove the differential carrier II. (45) from the differential carrier I. (15).

By means of the wrench extension **4905-00022** remove the hex. bolts (14) from the inner

Following this separate the differential carrier II. from the differential carrier I. and lift out together with the drive pinion and the driven gear (50). Remove the shims (13).

REINSTALLING THE DIFFERENTIAL CARRIER II. TO THE DIFFERENTIAL CARRIER I.

After reassembling the differential carrier II. and adjusting the bearing preload adjust the axis distance (after removing the differential).

ADJUSTING THE AXIS DISTANCE, REINSTALLING THE DIFFERENTIAL CARRIER II.

For purpose of piloting screw M12 stud bolts to two opposite bores in of the differential carrier I (15). Position the shims (13) necessary for adjusting the drive gear - pinion contact pattern over these stud bolts so, the extreme two ones shall be thicker. Use maximum 4 pcs from the shims.

Fit the differential carrier II. assembled with drive pinion into the Ø180 bore of the differential carrier I., then at two opposite bores provisionally secure by

On the relevant measuring pin of the accessory “A” belonging to the measuring device shown in Fig. 1. adjust the theoretical “AXIS DISTANCE” B=88.00 mm, by setting the dial indicator to zero.

Insert the measuring device set to B=88.00 mm to the differential carrier as shown in Fig. 1. and measure the “AXIS DISTANCE” deviation. Check if the reading is identical to the “AXIS DISTANCE” deviation stated on end of the drive pinion.

In case of odentity the adjustment is proper, other-

er shim pack (13). The permitted deviation is ±0.025 mm. E.g.: If axis distance stated on the drive pinion is +0.04, the value “B” to be adjusted is 88.04±0.025 mm.

Following this reinstall the differential into the differential carrier and adjust the contact pattern as described in the Section 287.

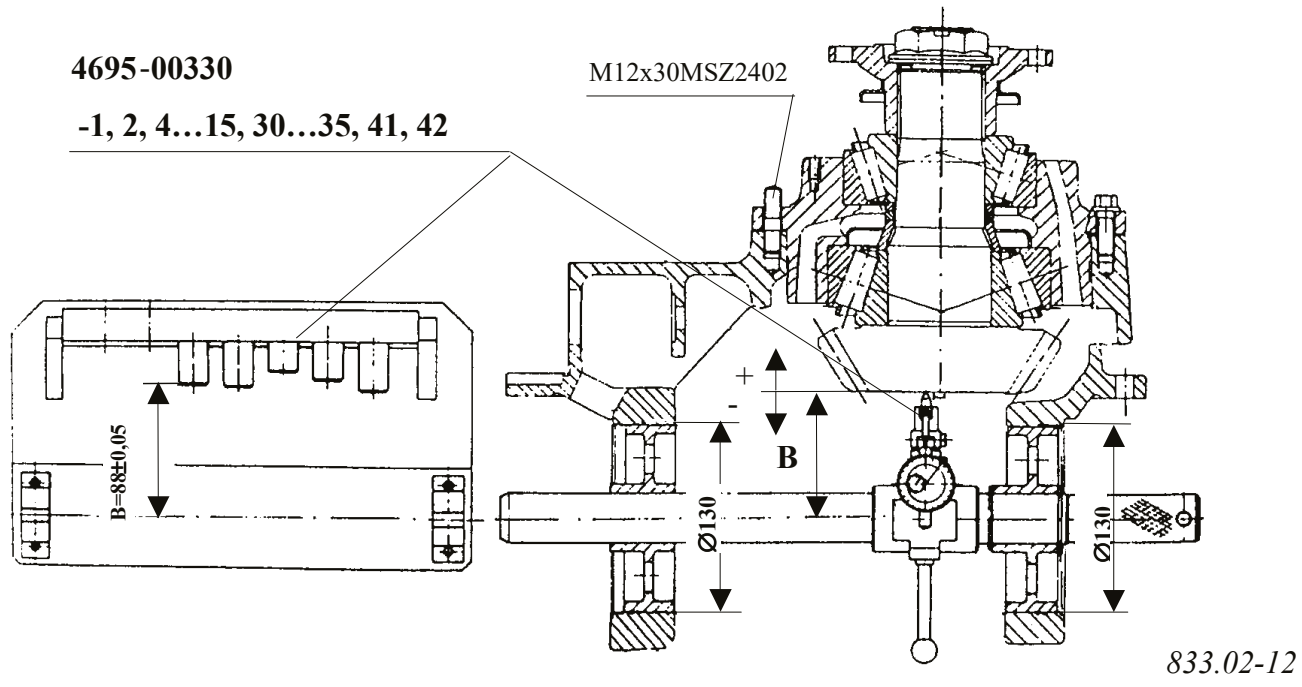

Fig. 1.: CALIBRATING THE AXIS DISTANCE

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SECTION 290.

DISASSEMBLING AND REINSTALLING THE DIFFERENTIAL CARRIER II.

DISASSEMBLING THE DIFFERENTIAL CARRIER II.

By means of the device shown drive the drive pinion out of the removed differential carrier II. (Fig. 1.).

When driving out the drive pinion the inner taper roller bearing cone remains on the pinion spindle.

Pull off the cone of the taper roller bearing by means of the device shown (Fig. 2.).

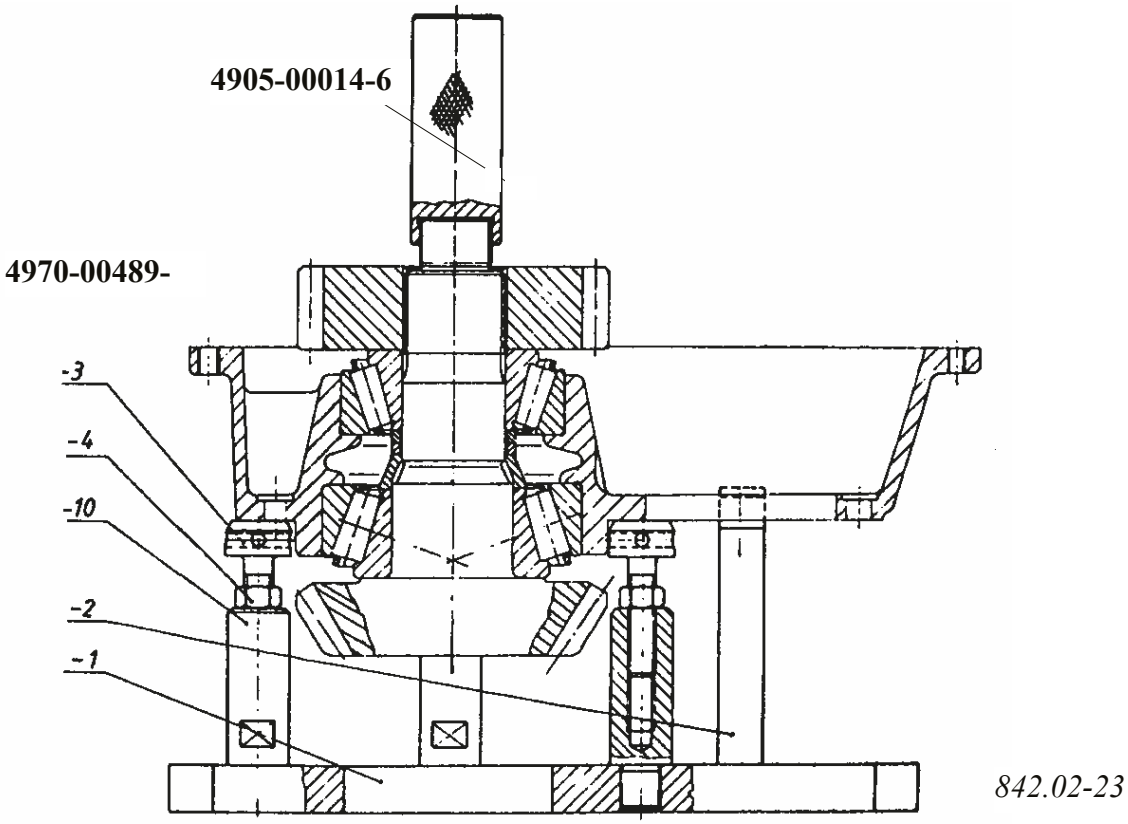

Fig. 1.: DRIVING OUT THE DRIVE PINION

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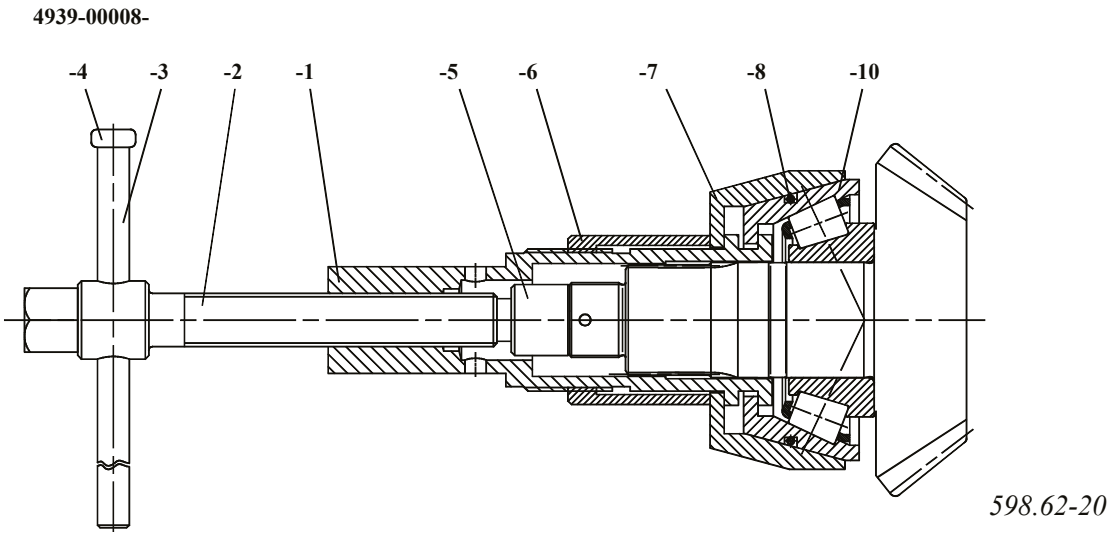

Fig. 2.: PULLING OFF THE TAPER ROLLER BEARING CONE

From the differential carrier II. press out the taper roller bearing cups 32312 (see Fig. 3.).

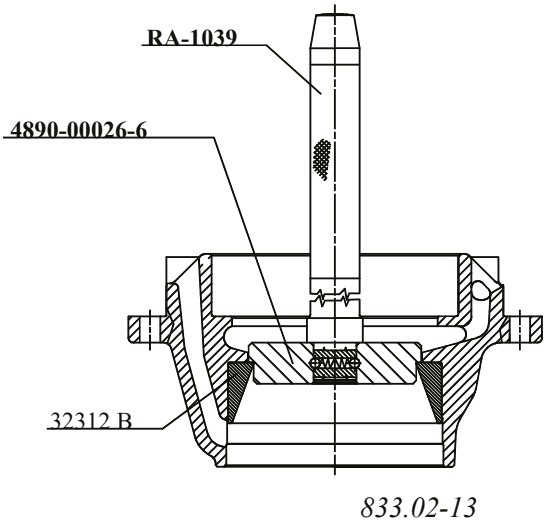

Fig. 3.: DRIVING OUT THE CUP OF THE INNER TAPER ROLLER BEARING

Turn the differential carrier II. over and press out the cup of the inner taper roller bearing 32314, too (see Fig. 4.).

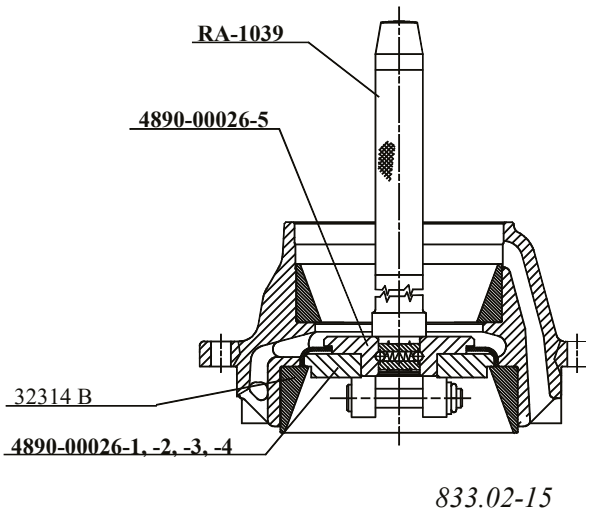

Fig. 4.: DRIVING OUT THE OUTER TAPPER ROLLER BEARING CUP

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REASSEMBLING THE DIFFERENTIAL CARRIER II.

Before reassembling carefully check the removal parts and replace if required.

Drive in the taper roller bearing (9, 12cups by means of the tools shown, bottom out (see Fig. 5.).

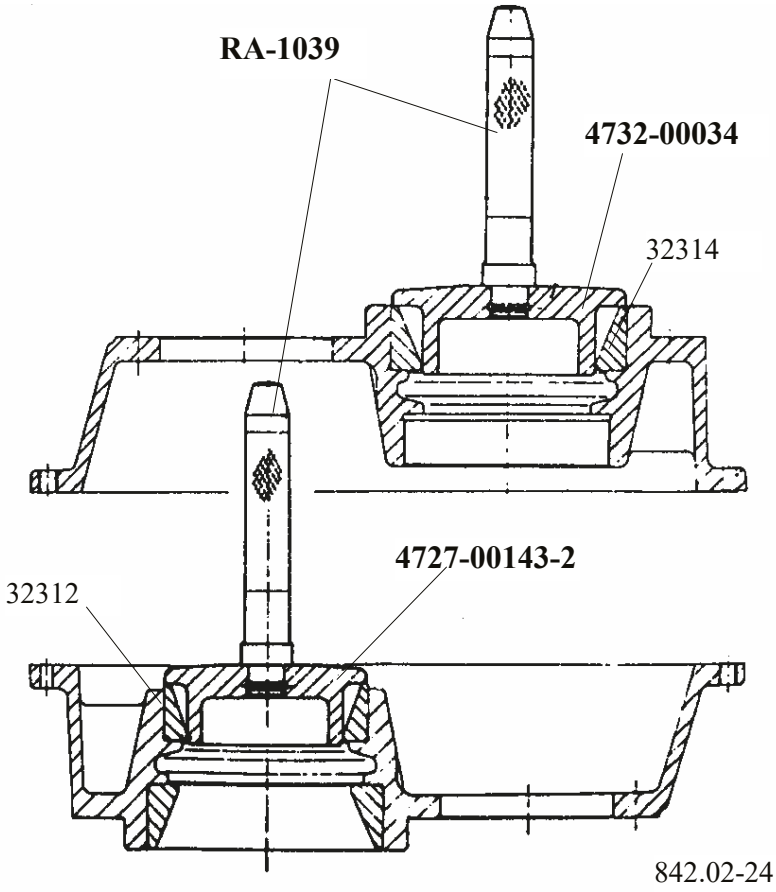

Fig. 5.: DRIVING THE TAPER ROLLER BEARING CUPS INTO THE DIFFERENTIAL CARRIER II.

After subassembled the differential carrier II. with the

preload.

The distance between the outer taper roller bearing cone and the distance sleeve may vary from 13.96 to 15.00 mm. For selecting the proper distance ring (10) this distance should be determined by measurement (X in Fig. 6.).

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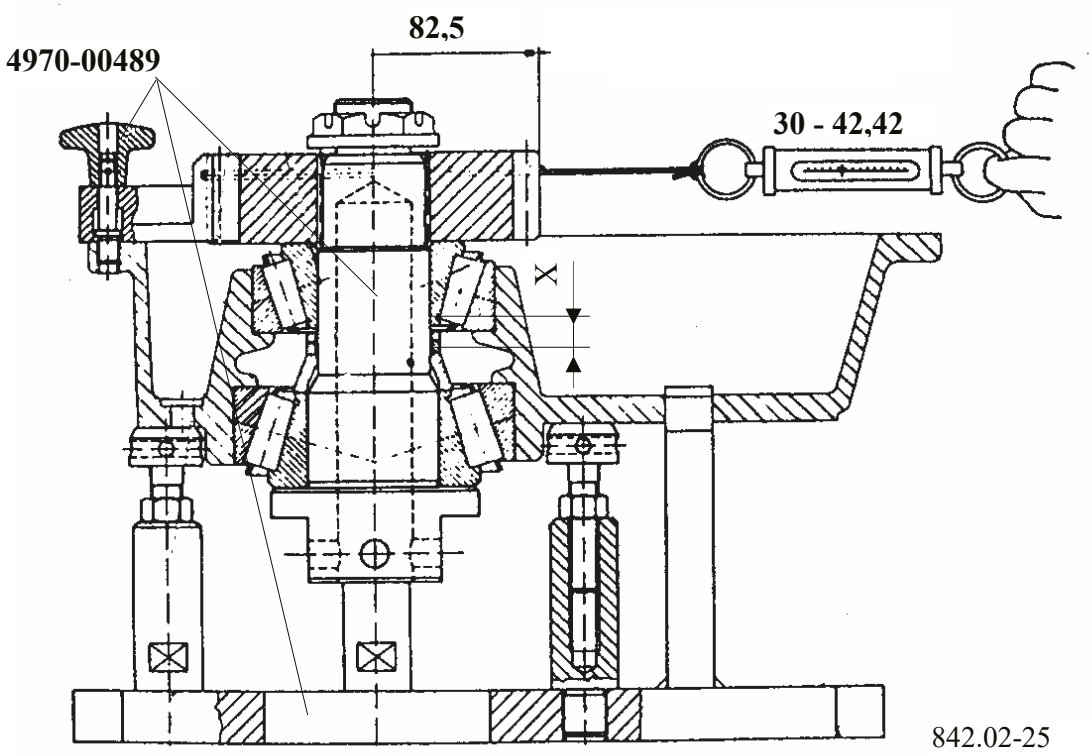

Fig. 6.: ADJUSTING THE BEARING PRELOAD

Position the inner taper roller bearing cone, the distance sleeve (11) and the distance ring (10) for the gap determined by measurement to the shown master shaft, then the subassembled differential carrier II., the outer taper roller bearing cone and the driven gear (50). Screw on the castle nut (1) (Fig. 5.).

Tighten the nut to 850 - 1050 Nm torque. Position the subassembled unit to the shown stand (Fig. 6.) and measure the rolling torque by means of attached with cord to mantle of the driven gear (50).

In case of new bearings installed the rolling torque at approx. 5 rpm should be 30.3 - 42.4 N with Ø165.5 mm driven gear which corresponds to 2.5 - 3.5 Nm rolling torque.

In case of reused bearings adjust the rolling to 1.25 - 1.75 Nm (i.e. to half to the rolling torque at new bearings).
In case of deviation from this value perform correction by changing the distance ring. If the rolling torque is higher than use higher distance ring pair, while at lower torque use lower one.

When the adjustment is proper relocate the parts from the adjusting device to the drive pinion. Make sure to install only the parts used for adjustment over to the drive pinion.

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REINSTALLING THE DRIVE PINION

By means of the tools shown drive the cone of the inner taper roller bearing (12) onto the drive pinion (Fig. 7.).

Position the distance sleeve (11), the previously selected distance ring (10), the differential carrier II. subassembled with bearing outer races, them by means of drive sleeve 4518-00022-4 drive on the cone of outer taper roller bearing to bottom out, taking care of proper connection of the taper roller bearings.

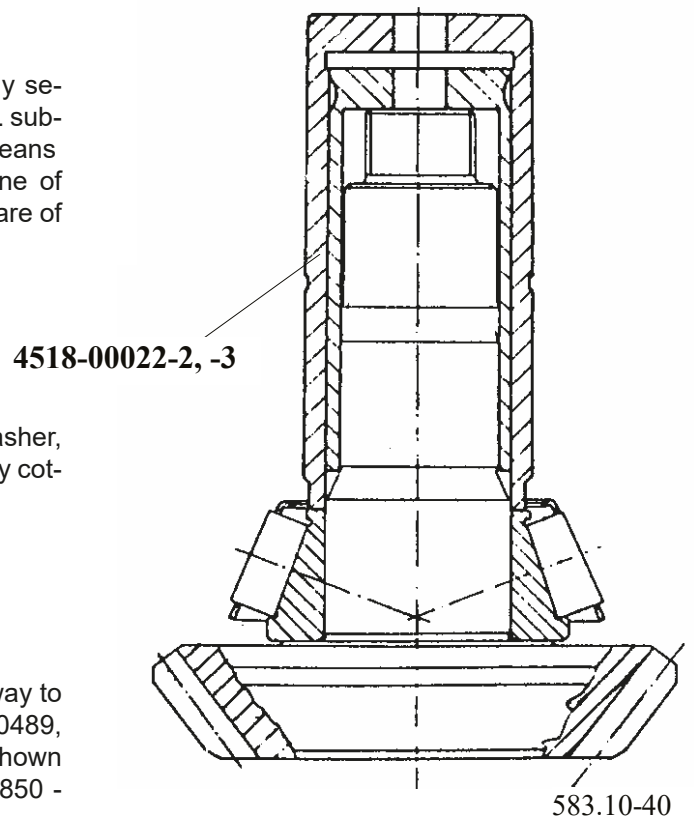

Fig. 7.: DRIVING ON THE INNER TAPER ROLLER BEARING CONE

Drive on the driven gear (50), position the washer, screw on the castle nut (1) and secure by cotter (2).

Position the drive pinion subassembled in this way to stand of the adjusting device Drw. No. 4970-00489, secure the driven gear by lock of the device as shown in Fig. 6. and tighten the castle nut to 850 - 1050 Nm torque.

Check the rolling torque as described earlier. If deviation is experienced repeat the adjustment until

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SECTION 292.

REINSTALLING THE INPUT SHAFT AND THE DIFFERENTIAL CARRIER III.

By means of the tools shown drive the taper roller bearing cup into its seat to bottom out (se Fig. 1.).

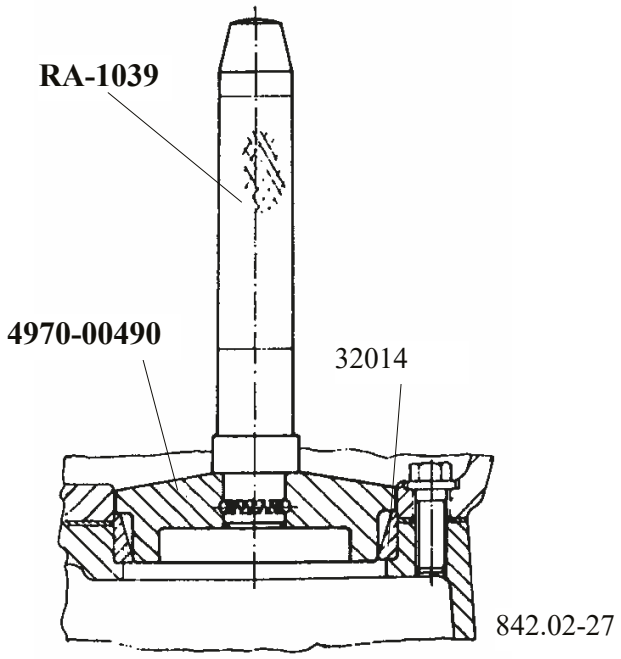

Fig. 1.: DRIVING IN THE TAPER ROLLER BEARING CUP

By means of the tool shown drive the cone of taper roller bearing 32014 onto the differential gear I. (91) to bottom out (see Fig. 2.).

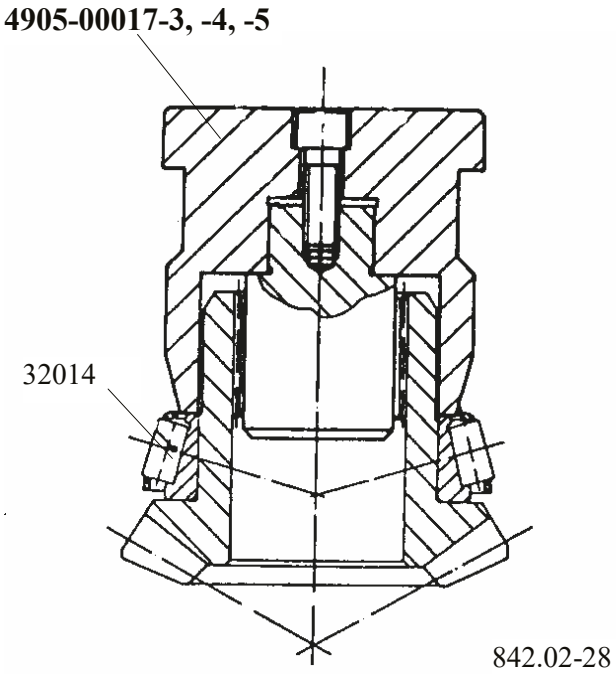

Fig. 2.: DRIVING ON THE TAPER ROLLER BEARING CONE

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By means of the tool shown drive the sealing plate to bottom out (see Fig. 3.).

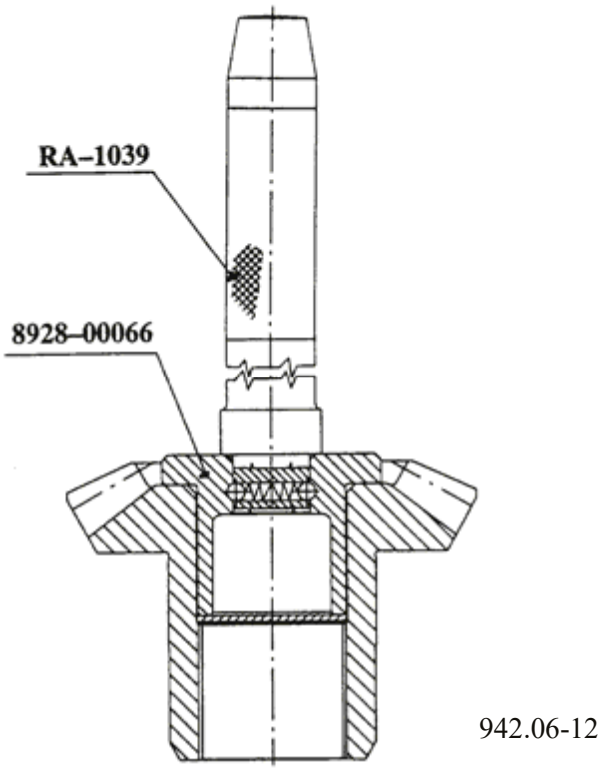

Fig. 3.: DRIVING OUT THE SEALING PLATE

By means of the press head shown drive the pinion drive spur gear onto the differential gear II. (85) to bottom out (see Fig. 4.).

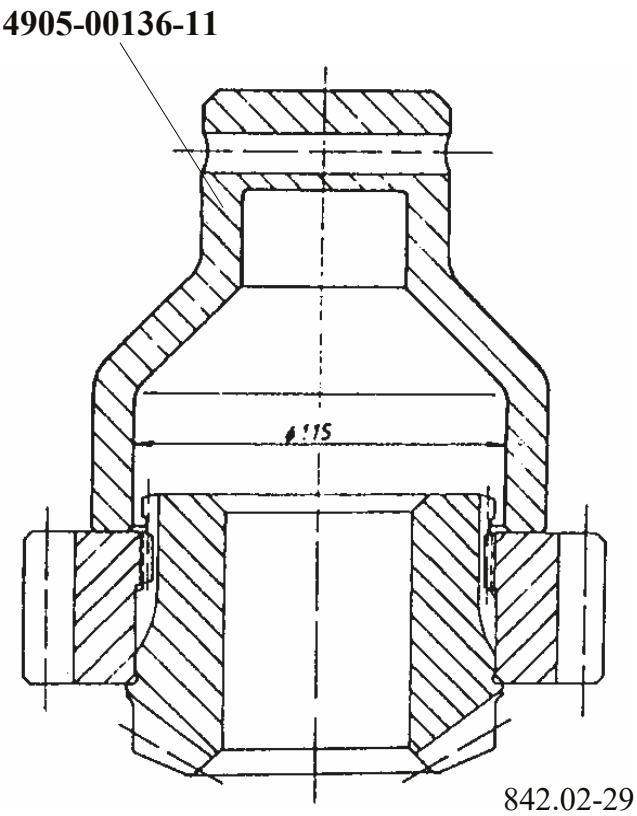

Fig. 4.: DRIVING THE PINION DRIVE SPUR GEAR ONTO THE DIFFERENTIAL GEAR II.

Secure the pinion drive spur gear in place by installing the snap ring (81) to its groove.

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SUBASSEMBLED THE INTER-AXLE DIFFERENTIAL CASE

Install the 4 off grub screw (111) with thread locker in the bore of the spider. Position the differential pinions (87) and the shims (86) to the spider (88) and insert this subassembled unit into the previously separated differential case (89).

Aligning the factory match-marks clamp the differential case halves together by means of hex. bolt (93) coated with thread locker. Diagonally tighten the clamp bolts to 25 - 30 Nm torque and rotating the drive pinion check if the assembly improper. During rotation on jamming may occur.

SUBASSEMBLING THE DIFFERENTIAL CARRIER III.

Fit the toothed hub (69) to splines of the input shaft (68). The toothed hub should slides freely when moving axially.

Put the input shaft together with toothed hub (69) sat to shift yoke (78) of the differential lock into the carrier bore so, the threaded bore of the shift yoke shall align with actuating bore of the differential lock.

Put the spring (80) near the shift yoke and thru the carrier bore screw the shift bar (79) into threaded bore in the shift yoke to bottom out secure the spring.

REINSTALLING THE OIL PUMP

Position the O-ring (114) into its seat. As described in the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant (LOCTITE 515) to seating surface of the oil pump cover I. (65) and to outer mantle of the cover II. (64). Fit the oil pump assembly into its bore and secure by means of hex. bolts with lock washer (66). Tighten the bolts to 59 - 78 Nm torque.

Install the toothed disk (53) with woodruff key (60) to input shaft of the oil pump and screw on the hex. nut with lock plate (57). Tighten the hex. nut to 37 Nm torque and secure by the tab lock plate.

REINSTALLING THE DIFFERENTIAL CARRIER III.

Secure the differential carrier so, the outer of the differential carrier II. shall face upward.

Install the differential gear (91) subassembled with bearing cone (as shown in Fig. 2.), the subassembled differential (89) to cup of the previously pressed in taper roller bearing 32014 (92), then the pinion drive spur gear subassembled as per Fig. 5.

As described in the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant (LOCTITE 515) to of the differential carrier.

After aligning the bores the subassembled carrier III. together with the input shaft (68) by means of dowel pin to the differential carrier II. and the connected parts and clamp the carrier halves together by means of hex. bolts (14) coated with thread locker and tightened to 88,3-108 Nm torque.

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INSTALLING THE OUTER TAPER ROLLING BEARING TO THE INPUT SHAFT

Heat up the cone of the outer taper roller bearing (51) to 80-100°C, then by means of tools shown drive onto the input shaft to bottom out against the shaft shoulder (see Fig. 5.).

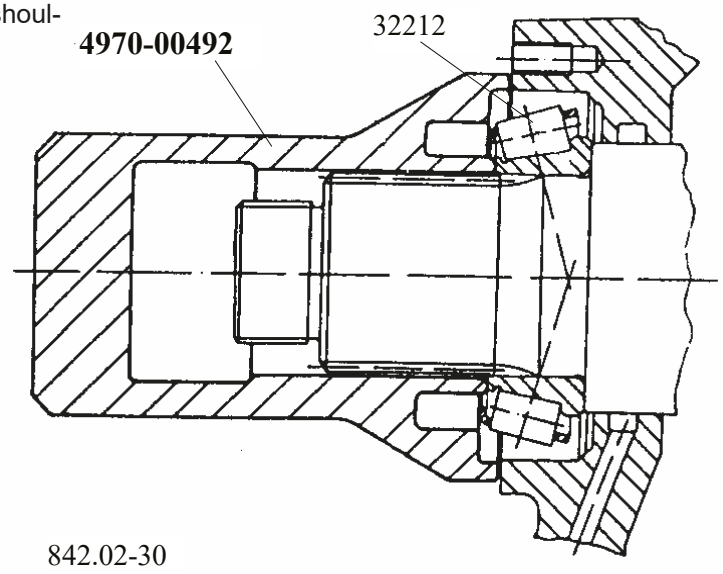

Fig. 4.: DRIVING ON THE OUTER TAPER ROLLER BEARING CONE

Fit the outer race of the previous bearing into the differential carrier III. and drive in by means of the same tool so, to to without jamming or excessive play when rotating (see Fig. 6.).

Following this, by moving in horizontal direction, check the differential lock shift bar (79) and shift yoke (78) for operating properly without jamming. If trouble is experienced eliminate before going on without assembly operations.

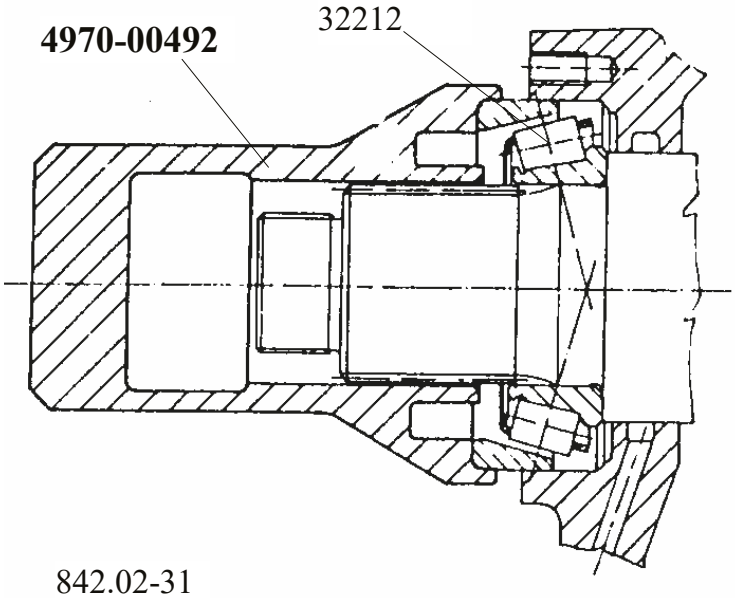

Fig. 6.: DRIVING IN THE OUTER TAPER ROLLER BEARING CUP

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ADJUSTING AND CHECKING THE AXIAL PLAY OF THE INPUT SHAFT

Fit the outer race of the taper roller bearing 32212 to the inner race, then rotating the input shaft check for running free of jamming.

Measure the height of the bearing outer race section protruding from the differential carrier III. and note the measured value.

Measure the height of the inner bearing seat in the cover (5) subassembled with sealing ring (4) and also note the result.

According to the measurement result select from the 7 different thickness shims (67) such an amount - but maximum 5 off - which assure 0.1-0.15 mm axial play.

As described in the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant to corner surface of the protruding bearing section, then install the previously selected shim pack and the cover (5) subassembled with sealing ring. Aligning the bores attach to the differential carrier III. (45) by means of lock washer (7) and hex. bolts (6). Tighten the bolts to 59 - 78 Nm torque diagonally.

CHECKING THE AXIAL PLAY

After installing the companion (see Section 283.) check the adjusted axial play by means of magnetic stand dial indicator while moving the input shaft to axial direction.

Perform measurement at three even pitch places by .

During check and axial play of 0.1-0.15 mm should be obtained. In case of deviation adjust the required value by means of shims (67).

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REPAIRING, REINSTALLING AND ADJUSTING THE INTER-AXLE DIFFERENTIAL LOCK

Remove the differential lock mechanism as d scribed in the Section 285.

REPAIRING THE PNEUMATIC CHAMBER

Remove the clamp (72) the housing (73) and the cover (70), then lift off the cover and the diapragm plate (71), as well. Pull the push rod - spring retainer (74) unit out of the housing, thus setting free the spring (75). Using sound or replaced parts perform reassembly in reverse order of disassembly

70 - Chamber cover

71 - Diaphragm

72 - Clamp

73 - Pneumatic chamber housing

74 - Spring retainer

75 – Spring

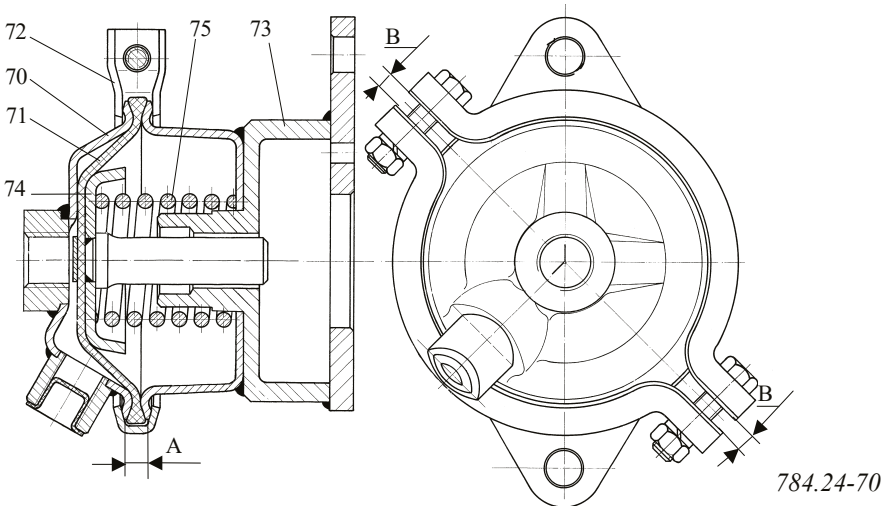

Fig. 1.: THE PNEUMATIC CHAMBER

ASSEMBLING INSTRUCTION FOR THE CLAMP

- The pneumatic chamber housing (73), the diaphragm (71) and the cover (70), to be axially compressed in a device. A=7.2-7.5 mm

- The clamp (72) halves to be radially compressed in a device so as both halves totally on the cover and housing. B=3.6-4.4mm.

- Nuts for the clamping bolts be tightened to 2.5 Nm torque the distance between the clamp ends-at both ends-be equal.

When checked with 10 bar (10 kp/cm2) trial pressure, no air leakage is permitted.

REINSTALLING THE ACTUATING PNEUMATIC CHAMBER

As described in the “GENERAL INSTRUCTIONS” apply oil-proof surface sealant to seating of the pneumatic chamber, then to the shift bar (79) and attach by 2 off M8x16 hex. bolts and lock washers. Tighten the bolts to 29-39 Nm torque.

Turn in the reporting switch (122) with the washer (121) and tighten it 50 - 80 Nm torque. Connect the air pipe and electrical connection.

Screw the lock nut (83) to the stop bolt (84) coated with thread locker to bottom out against the threaded end, then screw the stop bolt hand-tight into the housing bore.

ADJUSTING THE DIFFERENTIAL LOCK

Connect the air line and the electric wire.

Actuate the pneumatic chamber by means of 5 kp/cm2 (49 N/cm2) pressure air, after then turn the input (68) and thru-drive (94) shafts so, the clutch claws slide into one another. Following this carefully screw the stop bolt (84) coated with thread locker until bottoms out against the shift (79), then turn further by half turn and secure by lock nut (83) in this position.

After adjusting the stop bolt check the differential lock and the electric indicator for proper operation, by engaging and disengaging several times. Eliminate the trouble if experienced.

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DISASSEMBLING AND REASSEMBLING THE OIL PUMP

DISASSEMBLING THE OIL PUMP

Remove the hex. bolts with lock washer (54) clamping the oil pump covers (64 and 65) and the oil pump case (55), then remove the pump covers from the pump case.

After removing the cover pull the drive (61) and driven gears out of the oil pump case.

Tap or pull the used bushes (58) out of the covers.

After backing out the screw plug (56) the oil pressure control spring (59) and the steel ball (62) can be removed from the pump cover II.

REASSEMBLING THE OIL PUMP

Press the bushes into the covers the with the sides surface.

Tap the lock pin into both sides of the pump case. Insert the gear into relevant bores pump case, then the covers to the gears and the lock pins attach them to both sides of the pump case.

For reassembling the case and the cover use the matching sleeve Drw. No. **4905-00025.**

Make sure the gears are installed to the relevant bores.

From the oil pump cover I. side screw the hex. bolts with lock washer (54) thru the oil pump case (55) and tighten to 13 Nm torque.

Punch secure the lock pin on the oil pump cover I. (65) side against loosening.

Insert the steel ball (62) into the seat, position the oil pressure control spring (59) and secure by screw plug with sealing ring (56).

Install the other screw plug with sealing ring (63), as well.

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DIFFERENTIAL CARRIER ASSEMBLY

DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW

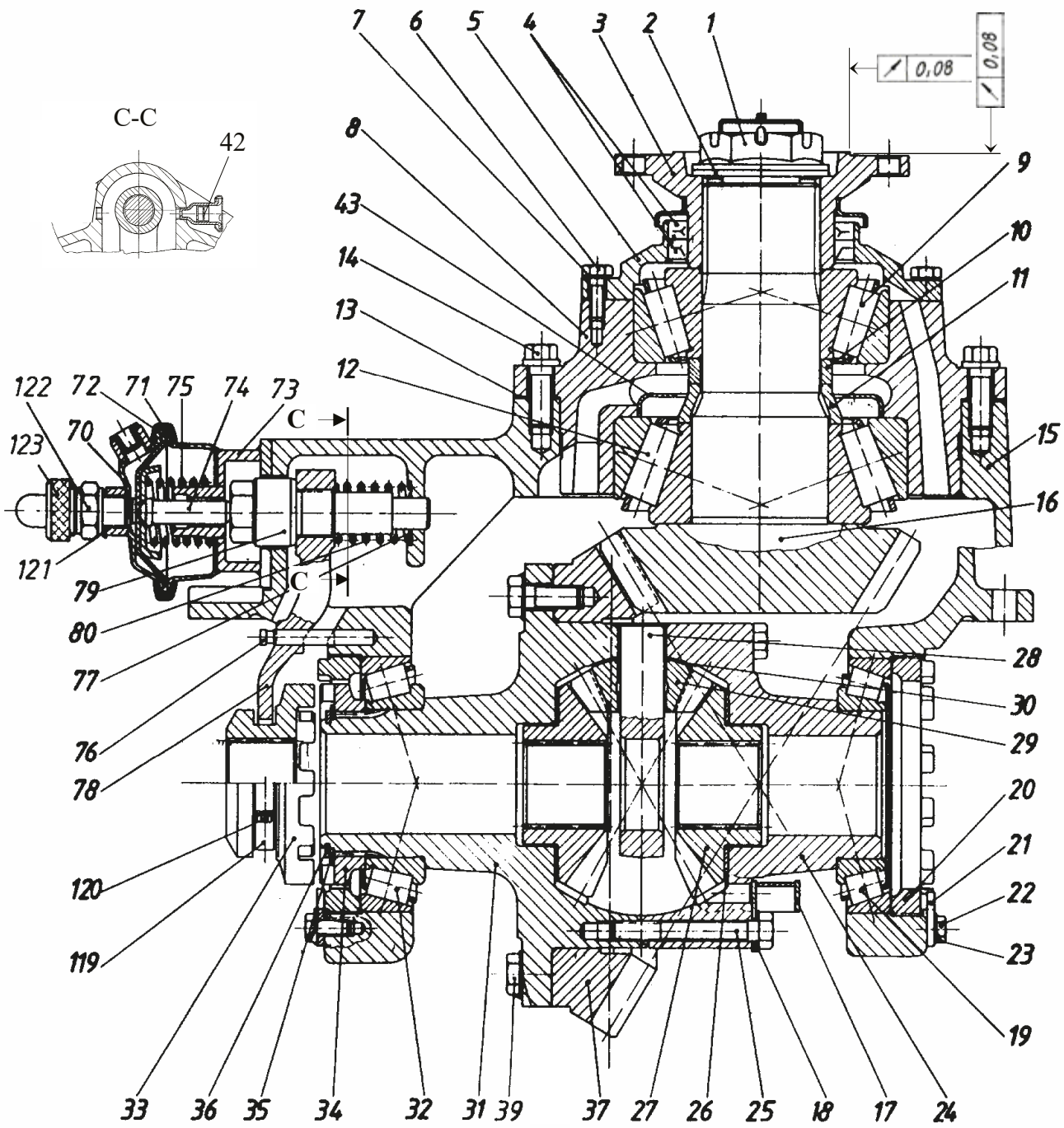

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Fig. 1.: DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW

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PARTS THE DIFFERENTIAL CARRIER ASSEMBLY

1 – Flanged castle nut with cotter pin
2 – Washer
3 –
4 – Sealing rings
5 – Cover
6 – Hex. bolt
7 – Lock washer
8 – Bearing cage
9 – Taper roller bearing
10 – Distance ring
11 – Distance sleeve
12 – Taper roller bearing
13 – Shims
14 –
15 – Differential carrier
16 – Drive pinion
17 –
18 – Washer
19 – Taper roller bearing
20 – Bearing adjuster
21 – Tab lock plate
22 – Hex. bolt
23 – Lock plate
24 – Differential case half
25 – Clamp bolt
26 – Spacer
27 – Differential gear
28 – Spider
29 – Differential pinion
30 – Shim
31 – Dif
32 – Taper roller bearing
33 – Toothed hub
34 – Differential lock clutch gear
35 – Backing ring
36 – Snap ring
37 – Drive gear
–
39 – Hex. bolt
–
42 – Vent valve
43 –
–
70 – Pneumatic chamber cover
71 – Diaphragm
72 – Clamp
73 – Pneumatic chamber housing
74 – Spring retainer
75 – Spring
76 – Pilot pin
77 – Washer
78 – Shift yoke
79 – Shift bar
80 – Spring
–
119 – Shackle
120 – Hex. bolt
121 – Washer
122 – Reporting switch
123 – Connecting

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SECTION 312.

REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY

Drain the oil from the axle before removing the differential carrier assembly.

Remove the axle shaft as described in Section 219.

Remove the hex. bolts attaching the differential carrier assembly to the axle and lift out the carrier.

REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY

As described in the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to of the axle body and to connecting of the differential carrier.

Install one M12 stud bolt to two opposite bores in the axle body, then the differential carrier assembly into the axle housing and secure by hex. bolts coated with thread locker.

Tighten the bolts diagonally to 88 - 98 Nm torque.

Reinstall the axle-shafts according to Section 219.

SECTION 313.

REMOVING AND REINSTALLING THE COMPANION FLANGE AND THE COVER, REPLACING THE OIL SEAL

REMOVING THE COMPANION FLANGE

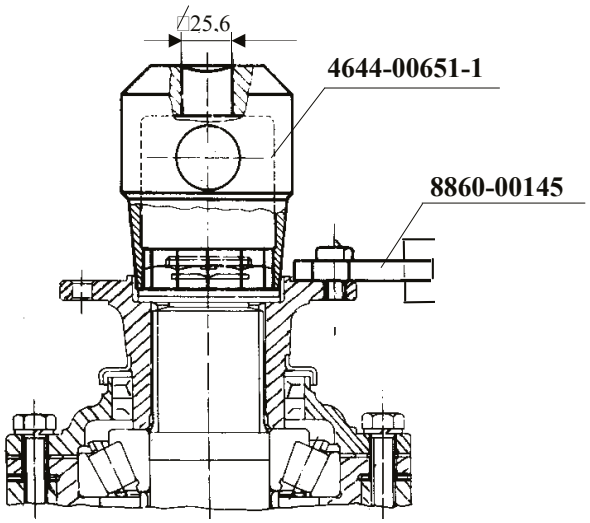

Fig. 1.: MOUNTING THE FLANGED CASTLE NUT

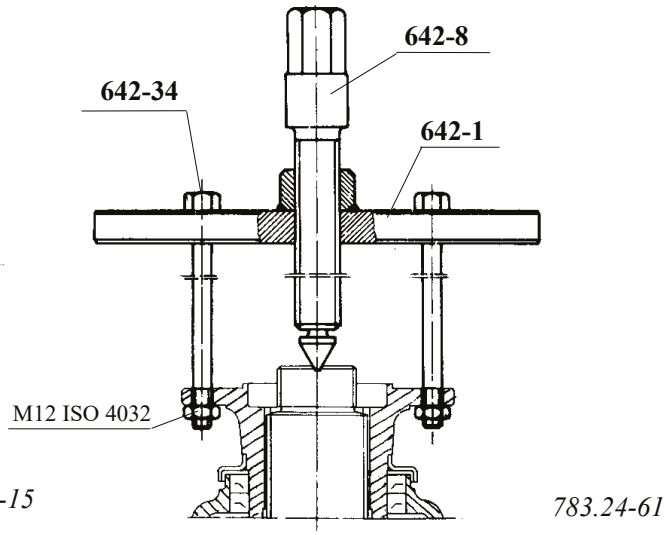

Fig. 2.: PULLING OF THE COMPANION FLANGE

After removing the cotter pin (Fig.

Pull of
means of the device assembled from
the shown parts (Fig. 2.).

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REPLACING THE OIL SEAL

Remove the cover (5).

Drive out the used sealing ring by means of the tools shown (Fig. 3.).

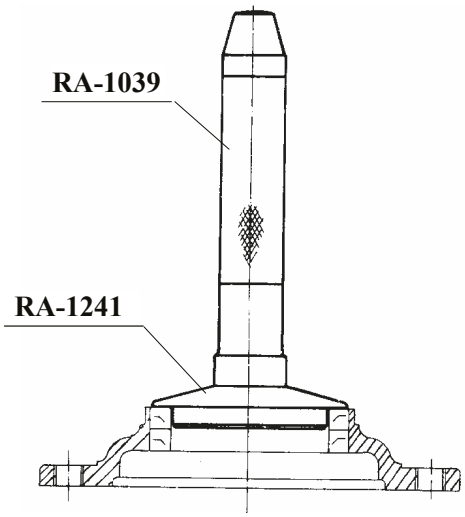

Fig. 3.: DRIVING OUT THE SEALING RING

Drive in the inner sealing ring (Fig. 4.)

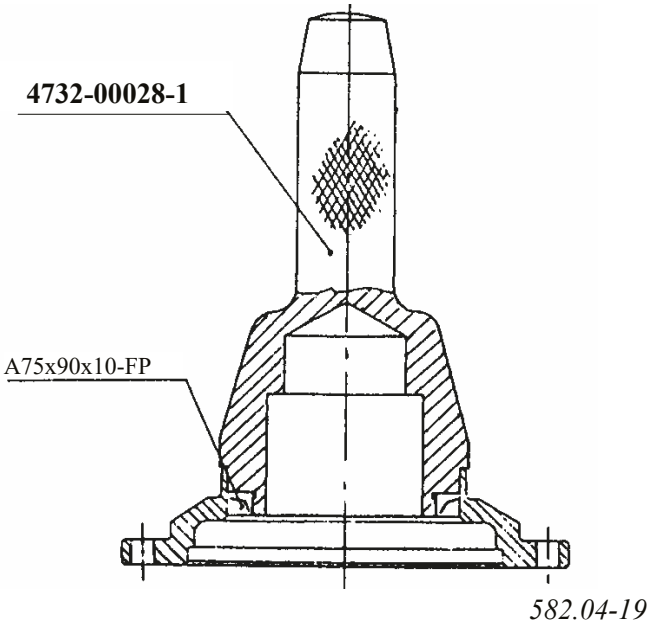

Fig. 4.: DRIVING IN THE INNER SEALING RING

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Drive in the outer sealing ring, as well, by means of the tool shown (Fig. 5.)

Apply grease to between the sealing lip and the dust protection edge of the outer sealing ring and apply thin coat grease to the inner one.

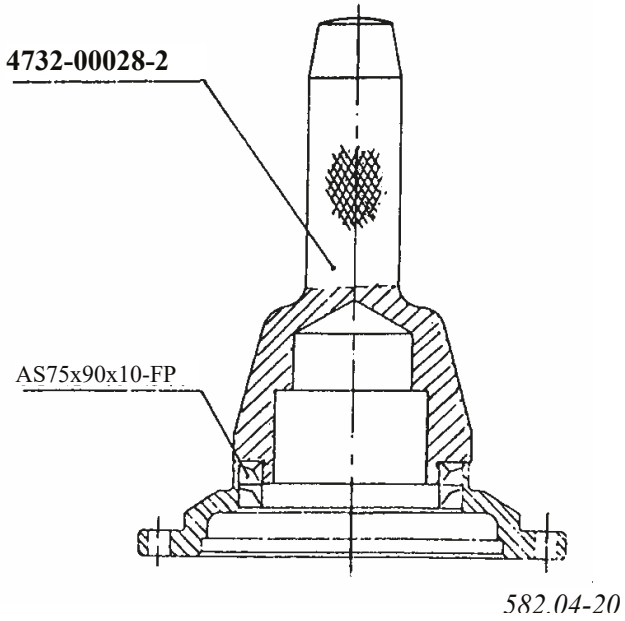

Fig. 5.: DRIVING IN THE OUTER SEALING RING

REINSTALLING THE COVER

As described in the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to inner of the cover (5) subassembled with sealing rings (4), then aligning the bores attach the cover to the bearing cage by means of the lock washer (7) and hex. bolts (6). Diagonally tighten the bolts to 20 - 30 Nm torque.

REINSTALLING THE COMPANION FLANGE

Press the companion (3) to the drive pinon splines to bottom out (Fig. 5.).

Install the washer (2), screw on castle nut (1) and tighten to 650 - 700 Nm torque and secure with cotter pin.

Check the runout of the companion Allowable runout of the companion in radial direction is 0,08 mm (Fig. 1. in section 310). When the adjustment is improper, then pull off the companion turn it by 15° and press on and check the runout again. Repeat the adjustment until obtaining the

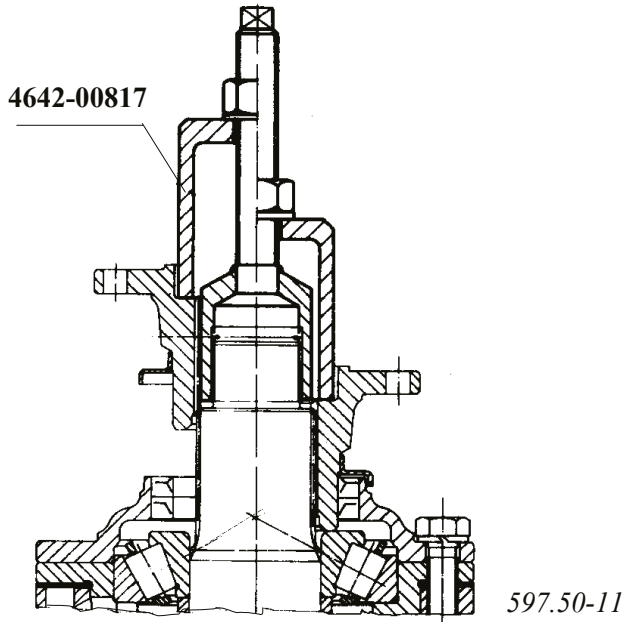

Fig. 6.: PRESSING ON THE COMPANION FLANGE

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REMOVING AND REINSTALLING THE DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTER

As described in the Section 318. remove the shift yoke (78) and the toothed hub (33).

Remove the snap ring (36) and the backing ring (35) and pull off the clutch gear (34).

Back out the hex. bolts (22) and remove the lock plates (23) and the tab lock plates (21).

By means of the tool shown remove the bearing adjusters (20) from the both sides (see Fig. 1.).

By means of the tool shown in Fig. 3. tap the differential toward the differential case half (31) so, the cup of the taper roller bearing (19) shall fall out.

The differential can be removed only if disassembled.

Back out the bolts (25) clamping the differential case halves, then remove the separated case halves and the other parts from the carrier.

Drive the outer race of the other taper roller bearing out of the leg bore in the differential carrier with tool **No.4732-00032** (see Fig. 3).

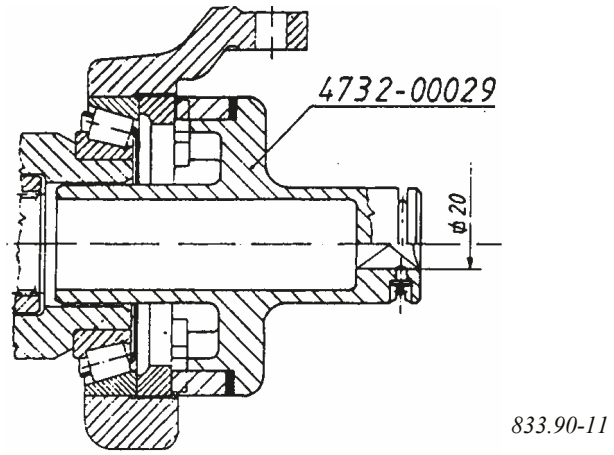

Fig. 1.: MOUNTING THE BEARING ADJUSTER

REINSTALLING THE DIFFERENTIAL

Reinstall the differential only after installing the bearing cage and adjusting the axis distance (see Section 316.)!

Position the assembled differential into the differential carrier. Turn the differential carrier over so, the differ-

Position the cone of the taper roller bearing (19) to the differential case half (24) and by means of the tool shown drive on to bottom out (see Fig. 2.).

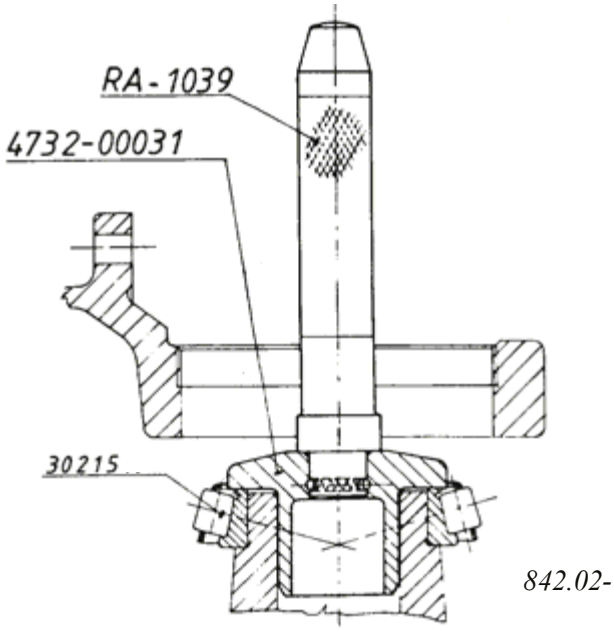

Fig. 2.: DRIVING ON THE TAPER ROLLER BEARING INNER RACE

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Position the taper roller bearing cup into the bearing bore in the differential carrier and drive in by means of the tool shown (see Fig. 3.).

Screw in the bearing adjuster (20).

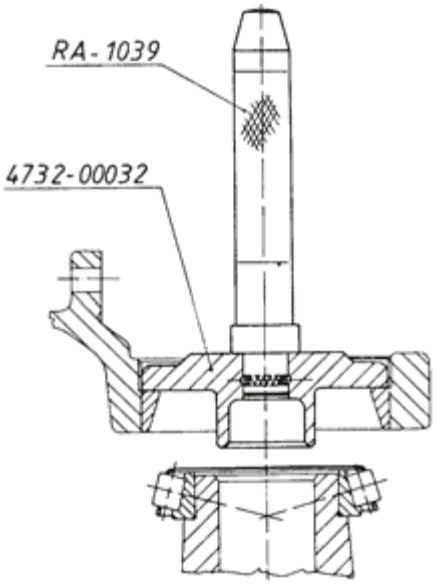

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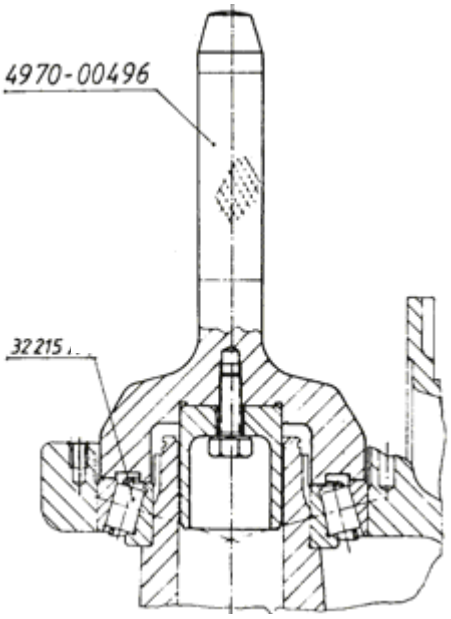
Fig. 3.: DRIVING ON THE TAPER ROLLER BEARING OUTER RACE

Turn the differential carrier over and drive the taper roller bearing cone and to the splinted shaft-end, then drive on the bearing cup by the same tool (Fig. 4.).

Screw in the bearing adjuster (20).

Install the oil plate (17) and the washer (18) to side the differential case (24) half.



842.02-20

Fig. 4.: DRIVING ON THE TAPER ROLLER BEARING INNER RACE

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ADJUSTING THE BACKLASH AND THE BEARING PRELOAD

By means of the bearing adjuster adjust the drive pinion to gear backlash at GLEASON toothing to 0.15 - 0.20 mm.

Locking the drive pinion measure the backlash at four places diagonally on the drive gear toothing, perpendicularly to the tooth surface by means of the backlash checking device (Fig. 5.).

Maintaining the backlash install the differential taper roller bearing (19 and 32) with no clearance. Tighten the bearing adjuster (20) so, to obtain 0.000 mm axial play of the drive gear.

Important: While setting the backlash of 0.000 mm, rotate the ring gear, hereby you can assure that taper rollers seat in the bearing. In stationary position some of the rollers may slightly diagonally wedge in. A bearing set this way will get loose during rotation.

After adjusting the backlash and the 0.000 mm bearing clearance check the contact pattern as follows.

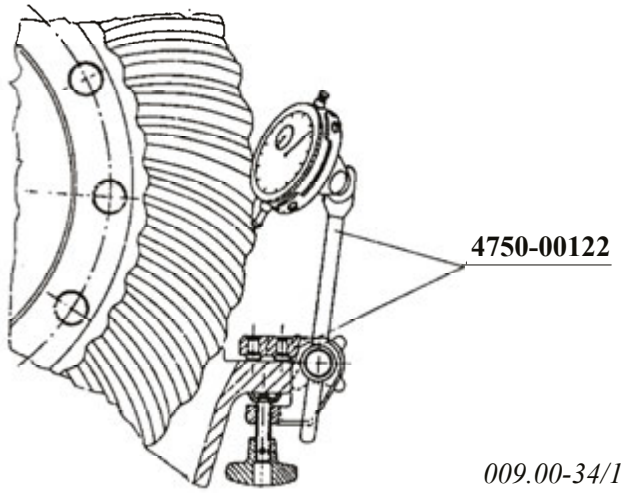

Fig. 2.: CHECKING THE BACKLASH

ADJUSTING THE CONTACT PATTERN

Apply indicator paint to opposite teeth pairs of the drive gear, at 4 places of 90° pitch and one tooth of the drive pinion

Rotate the drive pinion to both directions for approx. 15 sec., while braking the drive gear by a piece of wood.

PROPER CONTACT PATTERN

If a contact pattern shown in detail 1 of Fig. 6. is obtained, the drive gear-pinion pair is installed properly.

Practically the perfect contact pattern shown in the cannot be obtained, but it is important that the pattern shall nowhere reach the edge of the tooth surface.

D = Large diameter

1 = Proper contact pattern

2 = Too deep contact

3 = Too high contact

In case of GLEASON toothing the contact pattern along the tooth is shifted toward the small diameter of the drive gear.

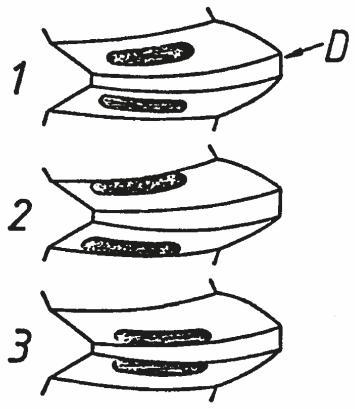

Fig. 6.: THE CONTACT PATTER

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TOO DEEP CONTACT

If the contact pattern is shifted to the dedendum as shown in detail 2 of Fig. 6. increase the “AXIS DISTANCE” by increasing the thickness of the shim pack (13) and simultaneously reduce the increased backlash by shifting the drive gear so, to obtain the contact pattern shown in detail 1 of Fig. 6.

TOO HIGH CONTACT

If the contact pattern is shifted to the addendum as shown in detail 3 of Fig. 6. reduce the “AXIS DISTANCE” by reducing the thickness of the shim pack (13) and simultaneously increase the reduced backlash by shifting the drive gear so, to obtain the contact pattern shown in detail 1 of Fig. 6.

After each contact pattern adjustment measure the backlash and check if the bearing clearance is 0.00 mm.

After adjusting the proper contact pattern and bearing clearance tighten further the bearing adjuster on both sides by 0.75 - 1.25 pitch (approx. 23°-37°) to be able to secure them by one of the tab lock plates (21).

Secure the tab lock plates on both sides by means of the hex. bolts (22). Tighten the bolts to 15 - 20 Nm and secure by folding the corners of the lock plates

When the adjustment and the operation is proper, remove the bearing cage assembled with drive pinion and according to the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to the inner then back the bearing cage and secure by hex. bolts (14) coated with thread locker. Diagonally tighten the bolts to 88 - 98 Nm torque.

Fit the differential lock clutch gear (34) to splines of the differential case, install the backing ring (35) and secure by snap ring (36).

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DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL

Pull the inner of the taper roller bearings (19 and 32) from the removed differential (see Fig. 1.).

For disassembling the differential case remove the hex. bolts (25) clamping the case halves (24 and 31) together and separate the case halves.

Remove the spider (28) together with the differential pinions (29) and shims (30) as well as the differential gears (27) and the spacer (26).

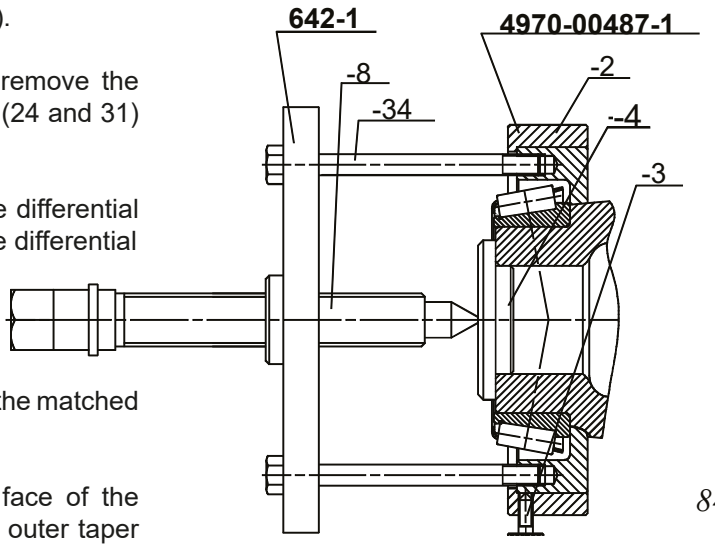

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Fig. 1.: PULLING OFF THE TAPER ROLLER BEARINGS CONE

Replace the drive gear only together with the matched drive pinion.

The match-marks are stamped to one face of the drive pinion and to one tooth end on the outer taper surface of the drive gear.

The match-marks indicate the number of the matched drive gear-pinion pair and the deviation - true to sense - from the theoretical “AXIS DISTANCE” measured between the drive pinion face and the drive gear centerline. For example: 1235, +0.04.

The differential case halves are matched pairs, thus install only match-marks differential case halves, according to the marks.

Pull the differential case half (31) over the lower service mandrel (see Fig. 2.). Insert the spacer (26) and the differential gear (27) as well as the spider (28) subassembled with shims (30) and differential pinions (29). Following this insert the other differential gear and the spacer.

According to the match-marks and aligning the bores the differential case halves together, then install the clamp bolts (25). By means of the upper service mandrel lock the differential and tighten the clamp bolts to 49 - 59 Nm. Remove the upper service mandrel and rotate the differential on the lower mandrel.

The differential roll evenly and smoothly without jamming and jerks.

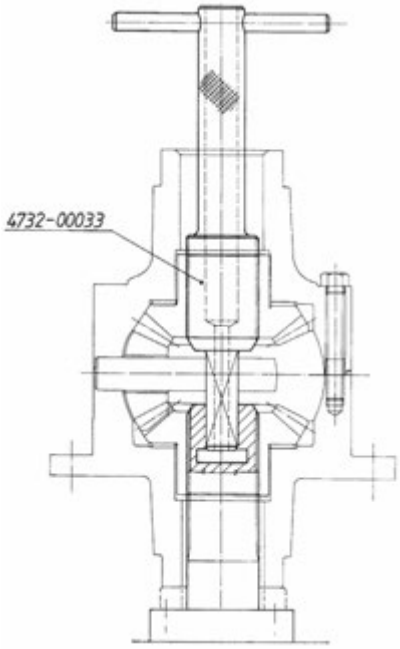

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Fig. 2.: MOUNTING AND CHECKING THE DIFFERENTIAL BOX

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Apply thin coat of the mating surface of the drive gear. Aligning the bores position the drive gear to the differential case half. Thru the bore drive 4 off hex. bolts with completely screwed on nut into the drive gear and gradually screwing the nuts completely pull on the drive gear to bottom out (Fig. 3.).

Secure the drive gear by self-lock bolts and tighten the bolts to 120 - 135 Nm torque.

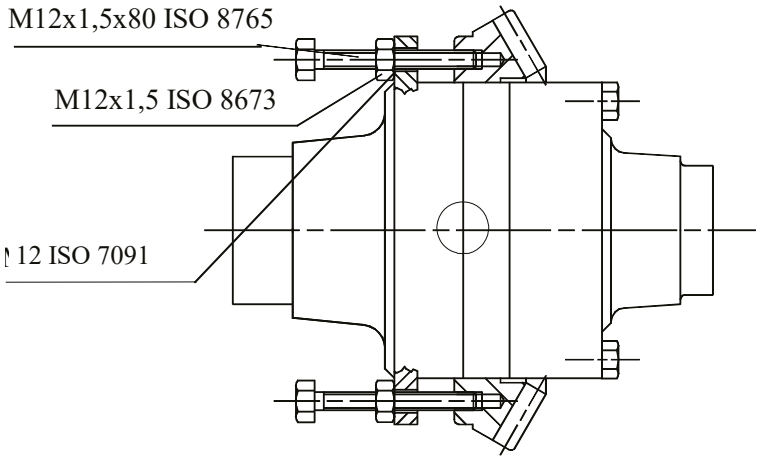

Fig. 3.: PULLING ON THE DRIVE GEARS *842.02-22/1*

SECTION 316.

REMOVING AND REINSTALLING THE BEARING CAGE, ADJUSTING THE AXIS DISTANCE

Remove the hex. bolts (14) attaching the bearing cage to the differential carrier.

By means of M12 bolts of at least 65 mm thread length driven into the two threaded bores in of the bearing cage out of the differential carrier and remove ferential carrier.

REINSTALLING THE BEARING CAGE TO THE DIFFERENTIAL CARRIER

After reassembling the bearing cage and adjusting the bearing preload adjust the axis distance (with differential removed from the carrier).

ADJUSTING THE AXIS DISTANCE

For purpose of piloting screw M12 guide stud bolts to two opposite bores in the differential carrier, position the shims (13) necessary for adjusting the drive pinion and gear contact pattern over these studs so, the extreme ones shall be the thicker. Aligning the bores push the bearing cage subassembled with drive pinion into the differential carrier (15) and provisionally secure by hex. bolts (14) driven into two opposite bores and tightened to 88 - 98 Nm torque.

On the relevant measuring pin of the accessory “A” belonging to the measuring device shown in Fig. 1. adjust the theoretical “AXIS DISTANCE” B=88.00 mm, by setting the dial indicator to zero.

Insert the measuring device set to B=88.00 mm to the differential carrier as shown in Fig. 1. and measure the “AXIS DISTANCE” deviation. Check if the reading is identical to the “AXIS DISTANCE” deviation stated on end of the drive pinion.

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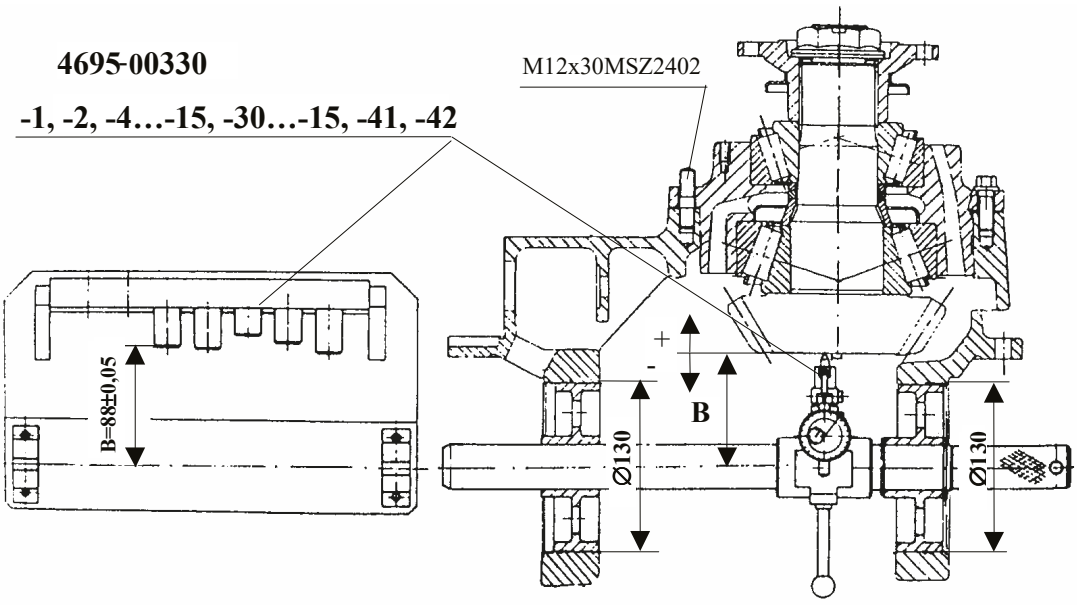

Fig. 1.: CALIBRATING THE AXIS DISTANCE

833.02-12

In case of identity the adjustment is proper, otherwise obtain the value by selecting the proper shim pack (13). The permitted deviation is ±0.025 mm. Eg.: If axis distance stated on the drive pinion is +0.04, the value “B” to be adjusted is 88.04±0.025 mm.

Following this reinstall the differential into the differential carrier and adjust the contact pattern as described in the Section 314.

REINSTALLING THE BEARING CAGE

In case of proper contact pattern adjustment and operation remove the bearing cage subassembled with drive pinion and according to the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to the inner then reinstall the bearing cage by means of
thread locker. Diagonally tighten the bolts to 88- 98 Nm torque.

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DISASSEMBLING AND REASSEMBLING THE BEARING CAGE

By means of the tools shown in the press the drive pinion (16) out of the bearing cage (8) (Fig. 1.).

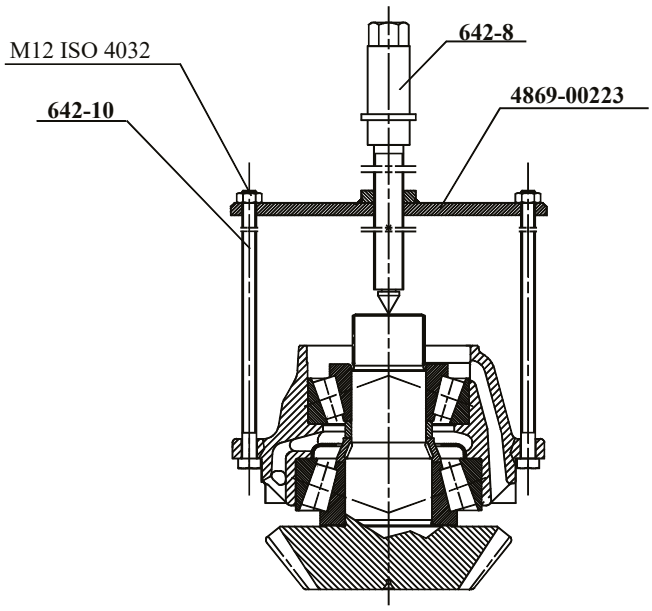

Fig. 1.: PRESSING OUT THE DRIVE PINION

Pull off the cone of the taper roller bearing by means of the device shown (see Fig. 2.).

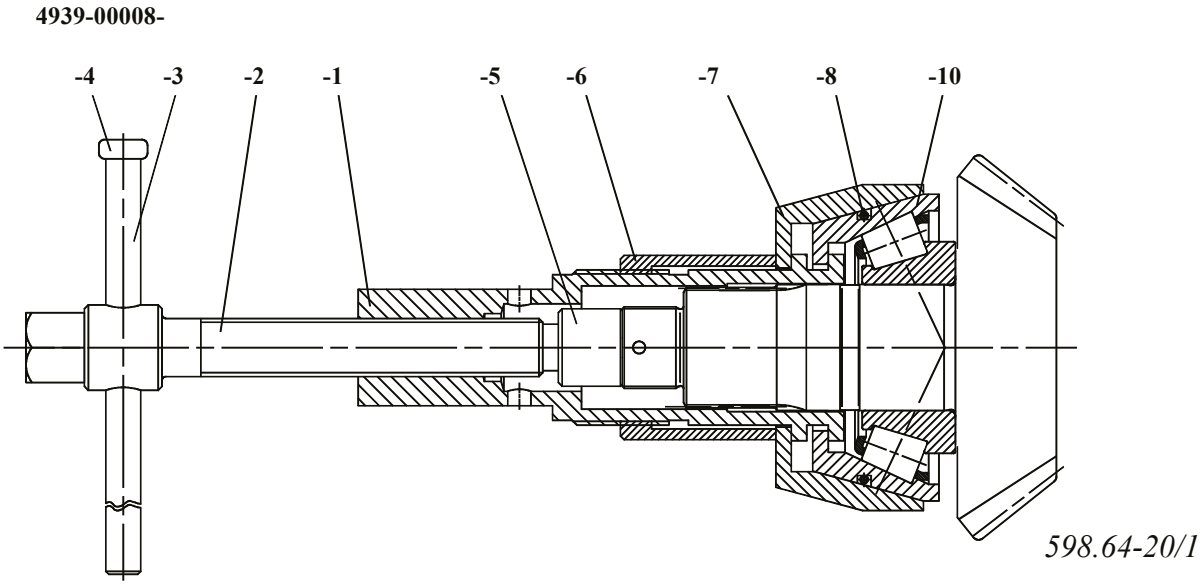

Fig. 2.: PRESSING OFF THE INNER TAPER ROLLER BEARING CONE

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Properly backing the bearing cage drive the cup of the taper roller bearing and the oil plate (43) out of the bearing cage (Fig. 3.).

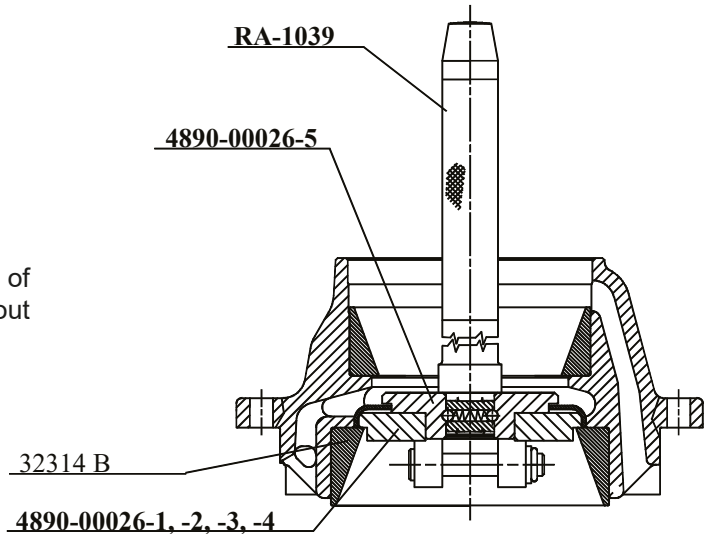

Fig. 3.: DRIVING OUT THE CUP OF THE INNER TAPER ROLLER BEARING

Turn the bearing cage over and drive out the cup of the outer taper roller bearing (Fig. 4.).

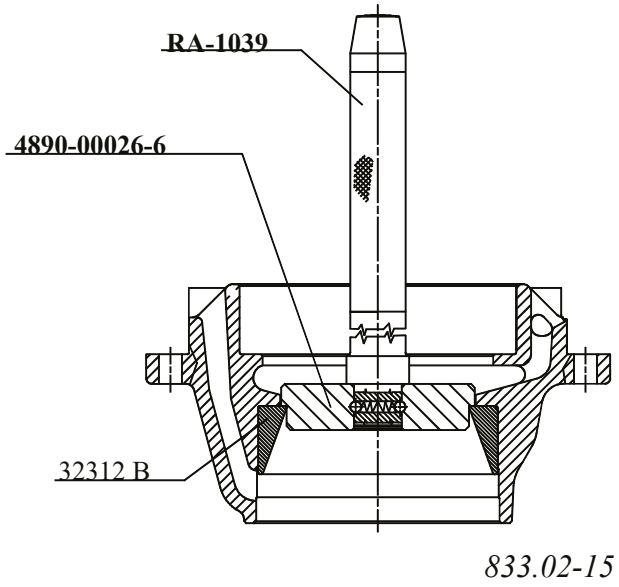

Fig. 4.: DRIVING OUT THE OUTER TAPER ROLLER BEARING CUP

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Position the oil the inner taper roller bearing (12) and by means of the tools shown drive into the bearing cage (Fig. 5.).

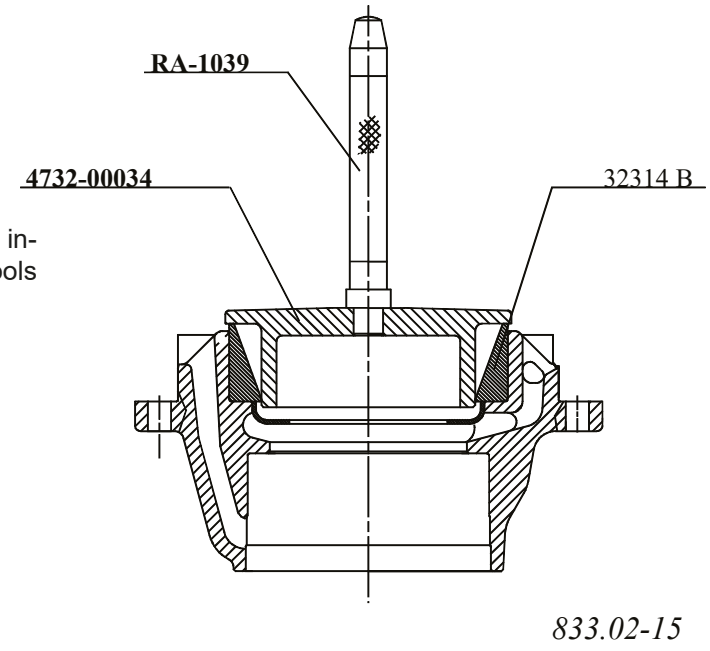

Fig. 5.: DRIVING IN THE CUP THE INNER TAPER ROLLER BEARING

By means of the tools shown drive in the cup of the outer taper roller bearing bottom out (see Fig. 6.).

After subassembling the bearing cage with taper roller bearing cups adjust the bearing preload.

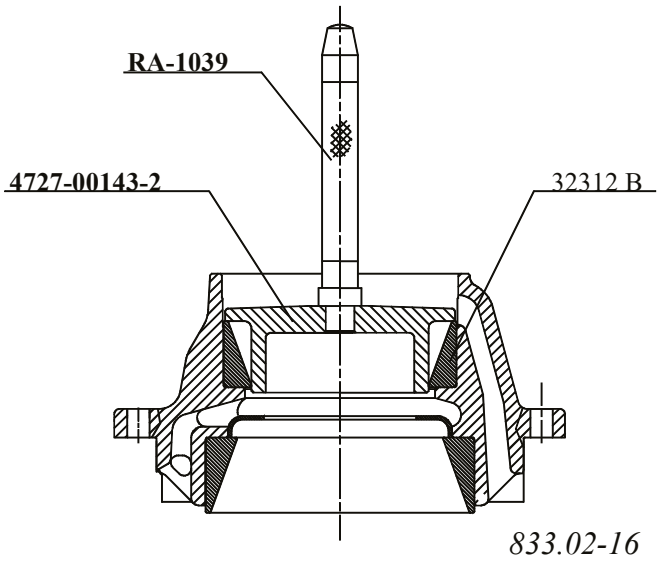

Fig. 6.: DRIVING IN THE CUP OF THE OUTER TAPER ROLLER BEARING

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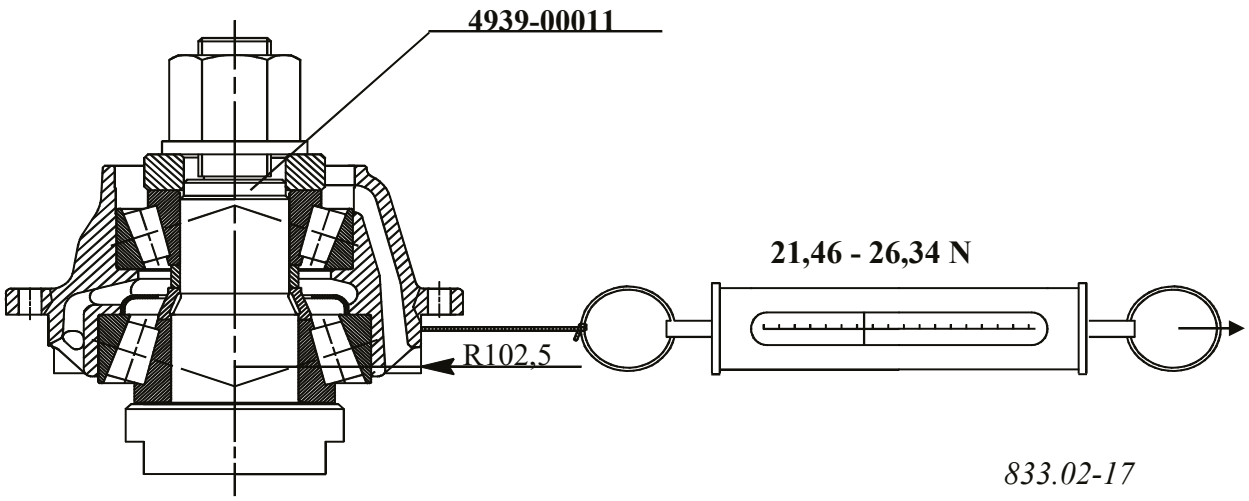

Fig. 7.: ADJUSTING THE BEARING PRELOAD

The distance between the outer taper roller bearing cone and the distance sleeve may vary between 13.89 and 14.715 mm. This distance should be determined by measurement for selecting the proper distance ring (10).

Stack the inner taper roller bearing cone, the distance sleeve (11) and the distance ring for the gap determined by measurement, then the subassembled bearing cage and the outer taper roller bearing cone on the shown master shaft.

Position the washer belonging to the master shaft to the bearing inner race, screw on the nut of the device and tighten to 650 - 700 Nm torque.

Attach approx. 2mtrs long cord to one bore in the bearing cage and wind the cord around the bearing cage. Attach to other end of the cord and measure the rolling torque.

With new bearing installed the force obtained from the at approx. 5 rpm should be 21.46 - 26.34 N, which corresponds to 2.2 - 2.7 Nm torque.

Installing reused bearings adjust the rolling torque to 1.1 - 1.35 Nm (approx. half to the new bearing).

In case of deviation perform correction by replacing the distance ring. With higher rolling torque use higher distance ring, while at lower torque use lower one. In case of proper adjustment relocate the parts from the master shaft to the drive pinion. Make sure to install only the parts used for the previous adjustment.

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By means of the tools shown drive the cone of the inner taper roller bearing (12) onto the drive pinion (Fig. 8.).

Position the distance sleeve (11), the previously selected distance ring (10) and the bearing cage subassembled with bearing cups to the drive pinion stem, them by means of press sleeve **4518-00022-4** drive on the outer taper roller bearing cone to bottom out while assuring proper connection of the bearings.

By means of tool according to Fig. 2. of Section 313. press the companion (3) to the drive pinion. Screw on the castle nut (1) and tighten to 650 - 700 Nm torque.

Check the rolling torque as described earlier. If deviation is experienced repeat the adjustment until obtain-

The oil seals (4) with the cover (5) are not installed during check.

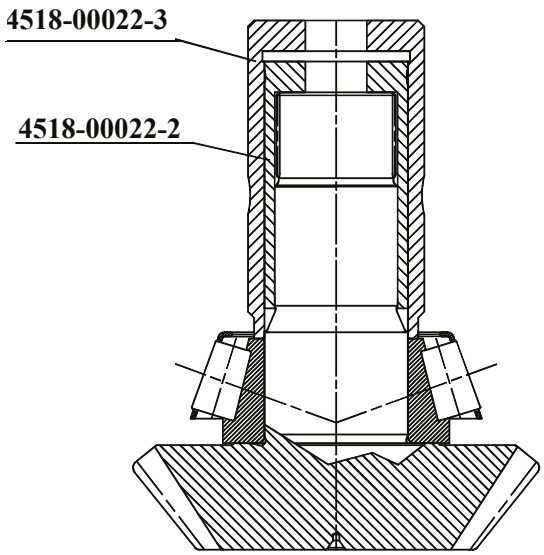

Fig. 8.: DRIVING ON THE INNER TAPER ROLLER BEARING CONE

SECTION 318.

REPAIRING, REINSTALLING, ADJUSTING THE DIFFERENTIAL LOCK

REMOVING THE DIFFERENTIAL LOCK

After detaching the pressure air connection and the electric wire remove the differential lock actuating pneumatic chamber by backing out the 2 off M8x16 bolts and unscrew the shift bar (79) from threaded bore of the shift yoke (78).

Pull the pilot pin (76) out of the differential carrier and remove the shift yoke (78) together with the toothed hub (33). Remove the spring (80) and stop washer (77), as well.

REPAIRING THE PNEUMATIC CHAMBER

Remove the clamp (72) clamping the housing (73) and the cover (70), then lift off the cover and the diapragm plate (71), as well. Pull the push rod - spring retainer unit out of the housing, thus setting free the spring (75).

Using sound or replaced parts perform reassembly in reverse order of disassembly.

ASSEMBLING INSTRUCTION FOR THE CLAMP

- The pneumatic chamber housing (73), the diaphragm (71) and the cover (70), to be axially compressed in a device. A=7.2-7.5 mm

- The clamp (72) halves to be radially compressed in a device so as both halves totally on the cover and housing. B=3.6-4.4mm

- Nuts for the clamping bolts be tightened to 2.5 Nm torque the distance between the clamp ends-at both ends-be equal.

When checked with 10 bar (10 kp/cm2) trial pressure, no air leakage is permitted.

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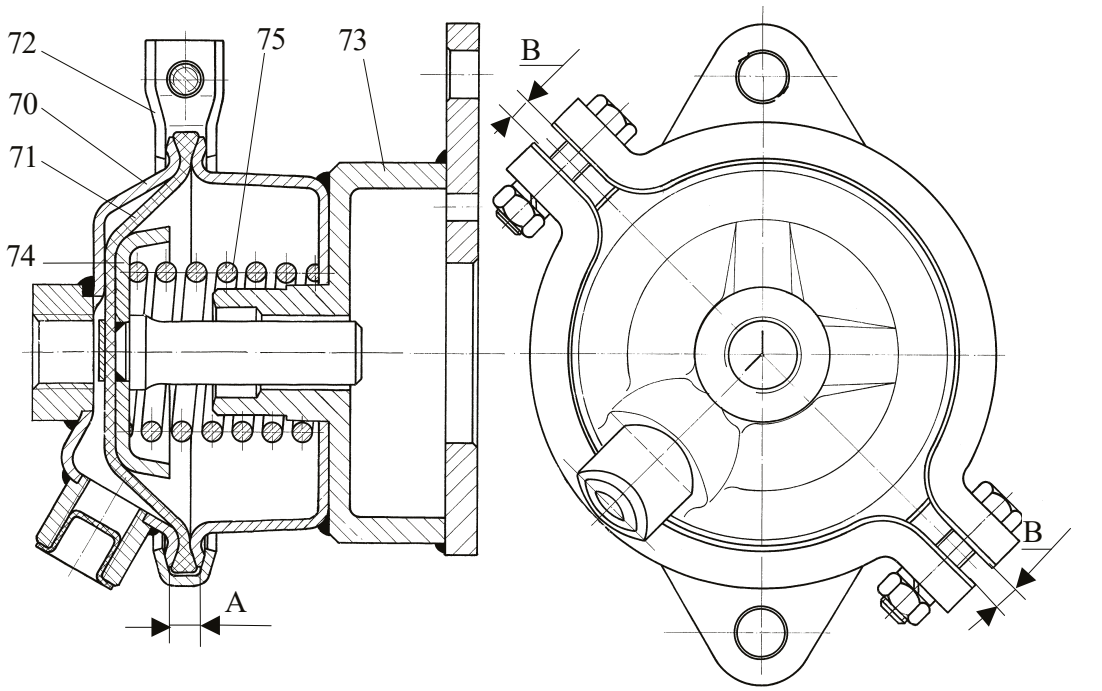

Fig. 1.: THE PNEUMATIC CHAMBER

REASSEMBLING THE DIFFERENTIAL LOCK

When reassembling the differential lock adjust the clearance between the clutch gear (34) and the toothed hub so, to obtain 0.5 - 2.00 mm clearance at engaged differential lock.

Section 310, Fig. 1. install the toothed hub with the shackle (119) and hex. bolts (120) to the shift yoke. Insert the shift yoke with the washers (77) without spring (80) into the differential carrier and screw in the shift bar (79).

Drive in the pilot pin (76). Push the shift bar in to bottom out and measure the clearance between the clutch gear (34) and the toothed hub (33). In case off 0.5 - 2.0 mm clearance the number of the stop insert (77) is otherwise adjust the required clearance by selecting the proper number stop inserts.

In case of proper clearance remove the shift yoke, then reinstall with the selected number stop inserts and the spring.

REINSTALLING THE PNEUMATIC CHAMBER

Install the actuating pneumatic chamber after assembling the differential carrier into the axle housing.
As described in the “GENERAL SERVICE INSTRUCTIONS” apply oil-proof surface sealant to seating of the pneumatic chamber, the to the shift bar (79) and attach to the housing by 2 off M8x16 bolts and lock washers. Tighten the bolts to 29 - 39 Nm torque.

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OIL FILL-UP, RUN, CHECK

According to the Operators Manual up the assembled axle with oil to lower edge of the bores in the end-cover of the wheel hubs, in the axle housing and the differentials.

Fill only completely clean oil fill-up into the axle.

After oil install the screw plugs and tighten to be leak-tight. Following this it is recommended to run the axle to both directions at varying speeds between 0 and 2200 rpm.

DURING RUNNING CHECK THE FOLLOWING:

THE AXLE FOR LEAKS:

No leaks are permitted.

THE AXLE FOR OPERATION:

No unusual noise or excessive friction may be experienced at the rotary mechanisms in the differentials and the wheel hubs. The meshing gears should roll on one freely without unusual noise.

THE BRAKE FOR OPERATION:

In normal position no friction may occur between the brake shoes and the brake drum, during brake application the brake spanner may not jam in the spanner bearing and upon releasing the brake the spanner should return to initial position.

THE AXLE FOR WARMING:

At the end of running the temperature of the wheel hub parts may not exceed approx. 60°C and at the input section approx. 80 C°

THE DIFFERENTIAL LOCK FOR OPERATION:

During run check by engaging and disengaging the differential lock, braking the wheel on one side and monitoring the pilot lamp.

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MARMON-HERRINGTON WARRANTY

This is to certify that we, Marmon-Herrington Company, Louisville, Kentucky, warrant each new chassis remanufactured, or assembly or part furnished for the remanufacture of a truck chassis against defects in material and workmanship under normal use and service. Marmon-Herrington's obligation under this warranty is limited to replacement of, at our factory, any part or parts thereof which shall, within one (1) year after delivery of such vehicle to the user after installation of the all-wheel drive conversion kit, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective.

Marmon-Herrington will warrant covered components against defects in material and workmanship under normal use and service for the period. This warranty includes all internal components with the following exceptions: Exceptions include, but are not limited to wear items such as brake linings and drums, oil seals and bearings, which will be covered for a period of 12 months or 12,000 miles, whichever

Failure to follow designated maintenance procedures and schedules, maintain required lubrication levels, or any form of operational abuse or misuse will void all warranty coverage expressed or implied.

Failure reporting and claims submission procedures are to be followed as outlines in the standard warranty guidelines.

Service parts are manufactured to the same standards as production installed parts. However, since the installation thereof, as well as the age and condition of the receiving vehicle are beyond the control of Marmon-Herrington, Service Parts are warranted for a period of ninety (90) days or thousand (5,000) miles whichever occurs. All other regular warranty conditions apply.

On vehicles operating OVERSEAS, the determination of defects will be made at Marmon-Herrington Company, Louisville, Kentucky, from complete information supplied in writing by overseas distributors or recognized acting distributors. Complete information is to mean: vehicle serial number, user's name, date of delivery, mileage at time of breakage, date of breakage, type of service, nature of break or fault, distributor's recommendation (for guidance only), and any other pertinent information. After determination of our obligation, any parts to be replaced will be shipped to distributor or acting distributor in accordance with his instructions.

The warranty is in lie of all other warranties expressed or implied and of all other obligations or liabilities incurred by Marmon-Herrington. Marmon-Herrington neither assumes nor authorizes any other person to assume any other liability in connection with this sale, including but not limited to indirect or consequential damages.

This warranty shall not apply to any vehicle which shall have been repaired or altered in any way so as in our judgement, to affect its stability or reliability, nor which has been subjected to misuse, negligence, or accident, nor which shall have been operated at a speed exceeding the factory rated speed or loaded beyond the factory rated load capacity or operated in violation of Marmon-Herrington's instructions.

Marmon-Herrington makes no warranty whatever on components of the original manufacturer's chassis not related to the work. Also, no warranty is made on tires, rims, ignitions, or other parts usually warranted separately by their respective manufacturers.

The manufacturers reserve the right to make changes in design, and changes or improvements upon their product, without notice, and without incurring any obligation to install such changes or improvements upon their products theretofore, manufactured. This warranty shall become effective only when the Warranty has been returned to Marmon-Herrington and validated by the same.

In the case of vehicles operating in extreme conditions such as corrosive material mines, deep-water zones or areas of hostile aggression, the following warranty limitations apply:

Marmon-Herrington shall not be responsible for damage caused by chemical corrosion, internal water damage due to total immersion, or explosive impact. These constitute severe duty and are not covered by Marmon-Herrington standard warranty.

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WARRANTY REPAIR AND CLAIM PROCEDURE

Initial Failure Reporting

1. Operator must call Marmon-Herrington Customer Service prior to performing any repairs and receive a Work Authorization Number to be eligible for reimbursement. The work authorization number does not guarantee payment but is an acknowledgement that the vehicle is within the warranty period in terms of date and mileage, and that a claim has been activated. It will be the responsibility of the operator to ensure that the repair facility is aware of and complies with the guidelines of this policy.
2. To expedite the authorization process, you will need the Sales Order Number or "S" number found on the front of this You will also need the Vehicle Number or the last six digits of the "VIN", the date the vehicle was placed in service, and the current mileage. Please note the following:
   - This Warranty Registration should have been submitted at the time of delivery. Of our records do not include a warranty registration, you must complete one before any authorization for repair can be issued. We will make them available by mail or fax upon request.
3. Marmon-Herrington will pre-approve .5 hours diagnosis/inspection time prior to your call for repair authorization. If the diagnosis/inspection complaint does not reveal a warrantable failure, or result in a warrantable repair, the customer will be responsible for all charges including diagnosis/inspection time.
4. The Operation Manual contains information covering proper equipment use and maintenance schedules. Operators must adhere to these guidelines to be eligible for reimbursement, and service records must be provided upon request.

Pre-Repair Requirements

1. Authorization for repairs will require a written estimate/repair order of costs after determination that a warrantable condition is found to exist.
2. Estimates must contain the following information:
   - A
   - The cost of disassembly, inspection and diagnosis of any portion of the vehicle to determine extent of repairs needed.
   - fect repairs must be listed.
   - Miscellaneous charges such as "shop supplies" must be Actual dollar amounts must be listed, as percentages will not be accepted.
   -
   - NOTE: If it becomes necessary to exceed the original estimate in terms of parts or labor, the repair facility must call Marmon-Herrington Customer Service for additional authorization.
3. Only the use of Marmon-Herrington supplied parts will constitute reimbursement unless prior approval has been obtained.

Parts Ordering

1. While Marmon-Herrington operates a full service Parts Department, replacement parts needed to effect Warranty repairs must be acquired through Customer Service to be eligible for reimbursement.

Post Repair requirements

1.
   - Customer's name, address, and phone number.
   - The V .
   - The Sales Order Number or "S" number, which the customer can provide or can be located on the ID tag, tot he transfer case or axle.
   - The Axle or Transfer case Model and Serial Number, also located in the ID tag.
   - Mileage IN / Mileage OUT
   - The Cause and Correction of the repair including detailed description of repairs and parts replaced.
   - The date the repair order was open and the date the repairs were completed.
   - The Work Authorization Number obtained from Customer Service.

Notes to Repair Facilities

1. Miscellaneous charges such as "shop supplies" must be listed as separate line items and shown on the invoice as stated in "Pre-Repair Requirements". Invoice for sublet repairs must be made available upon request.
2. All repairs must comply with any or all state and DOT requirements.
3. Downtime of vehicle and incurred costs associated due to the delay of parts shipments or any other condition beyond our control is not reimbursable and should not be listed on the invoice.
4. All failed parts that are required to be returned to Marmon-Herrington must be received before payment will be made. The Return Authorization will be sent with the replacement parts when shipped from Marmon-Herrington.
5. All claims must be submitted within 60 days of completion of repairs to be eligible for reimbursement.

For Work Authorization call: 800.227.0727 ext. 282
To Submit Claims by Fax: 502.253.0317
Submit Claims by Mail to: Marmon-Herrington Company
Customer Service Department
13001 Magisterial Drive
Louisville, KY 40223