

**Brought to you by Pro Gear &  
Transmission.**

**For parts or service call:**

**877-776-4600  
407-872-1901**



**[www.globaldifferentialsupply.com](http://www.globaldifferentialsupply.com)**

**906 W. Gore St. Orlando, FL 32805  
[parts@eprogear.com](mailto:parts@eprogear.com)**



**WORKSHOP MANUAL  
R/RF22 TANDUM  
REAR AXLES**

**MARMON-HERRINGTON ALL-WHEEL DRIVE**

13001 Magisterial Drive • Louisville, KY 40223

(502) 253-0277 • (800) 227-0727 • Fax (502) 253-0317

E-mail: [info@marmon-herrington.com](mailto:info@marmon-herrington.com)

# TABLE OF CONTENTS

	SECTION	PAGE
FORWORD .....	203	4
DRAWING OF THE AXLE .....	204	5
TECHNICAL DATA .....	205	6
TYPES .....		6
WHEEL HUB .....		9
WHEEL BRAKE .....		9
SLACK ADJUSTER .....		9
ROLLING BEARINGS .....		10
SEALS .....		10
TORQUE RATINGS .....	206	11
WHEEL HUB .....		11
WHEEL BRAKE .....		11
DIFFERENTIAL CARRIER HEADS .....		11
DIFFERENTIAL LOCK .....		12
ADJUSTMENT DATA .....	207	13
WHEEL HUB .....		13
WHEEL BRAKE .....		22
DIFFERENTIAL CARRIER HEAD .....		13
DIFFERENTIAL LOCK .....		13
GENERAL SERVICE INSTRUCTIONS .....	209	14
WHEEL HUB .....		14
WHEEL BRAKE .....		14
DIFFERENTIALS .....		14
GENERAL INSTRUCTIONS .....		14
WHEEL HUB .....		15
WHEEL HUB SECTIONAL VIEW .....	210	15
PARTS OF WHEEL HUB .....	211	16
REMOVING AND REINSTALLING THE WHEELS .....	212	16
REMOVING AND REINSTALLING THE BRAKE DRUM .....	213	16
REMOVING AND REINSTALLING THE END COVER .....	214	16
REMOVING AND REINSTALLING THE AXLE SHAFT AND THE SUN GEAR, ADJUSTING THE AXLE SHAFT CLEARANCE .....	219	16
REMOVING AND REINSTALLING THE PLANET CARRIER .....	220	17
DISASSEMBLING AND REASSEMBLING THE PLANET CARRIER .....	221	17
REMOVING AND REINSTALLING THE WHEEL HUB .....	223	18
DISASSEMBLING AND REASSEMBLING THE WHEEL HUB .....	224	20
DISASSEMBLING AND REASSEMBLING THE RIM HUB .....	225	21
REMOVING AND REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT ASSY. ....	226	21
INSTALLATION INSTRUCTIONS FOR PARTS OF ANTI-LOCKING SYSTEM .....	229	22
WHEEL BRAKE		
DRAWING OF THE WHEEL BRAKE .....	260	23
PARTS OF THE WHEEL BRAKE .....	261	23
REMOVING AND REINSTALLING THE BRAKE SHOES .....	262	24
REPAIRING THE BRAKE SHOES AND THE BRAKE DRUM .....	263	24
REMOVING AND REINSTALLING THE BRAKE SUPPORT AND THE BRAKE CHAMBER HOLDER .....	264	26
REMOVING AND INSTALLATION OF THE BRAKE LEVER AND THE BRAKE SPANNER .....	265	26
REPAIRING THE BRAKE SPANNER BEARING SUPPORT .....	266	27
AUTOMATIC SLACK ADJUSTER .....	268	28
MAIN DIFFERENTIAL (FORWARD-REAR AXLE) MAIN DIFFERENTIAL SECTIONAL VIEW .....	280	29
PARTS OF MAIN DIFFERENTIAL .....	281	30
REMOVING AND REINSTALLING THE MAIN DIFFERENTIAL .....	282	31
REMOVING AND REINSTALLING THE COMPANION FLANGES AND THE COVER, REPLACING THE OIL SEALS IN THE COVER .....	283	31
REMOVING AND REINSTALLING THE THRU-DRIVE SHAFT .....	284	33
REMOVING THE INPUT SHAFT AND DIFFERENTIAL CARRIER III .....	285	34
REMOVING AND REINSTALLING THE CROSS DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTERN .....	287	34
DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL .....	288	37



	SECTION	PAGE
REMOVING AND REINSTALLING THE DIFFERENTIAL		
CARRIER II, ADJUSTING THE AXIS DISTANCE .....	289	38
DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL CARRIER II .....	290	39
REINSTALLING THE INPUT SHAFT AND THE DIFFERENTIAL CARRIER III .....	292	41
ADJUSTING AND CHECKING THE AXIAL PLAY OF THE INPUT SHAFT .....	293	43
REPAIRING, REINSTALLING AND ADJUSTING THE INTER-AXLE DIFFERENTIAL LOCK .....	294	44
DISASSEMBLING AND REASSEMBLING THE OIL PUMP .....	295	44
DIFFERENTIAL CARRIER ASSEMBLY (REAR-REAR AXLE)		
DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW .....	310	45
PARTS OF THE DIFFERENTIAL CARRIER ASSEMBLY .....	311	46
REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY .....	312	46
REMOVING AND REINSTALLING THE COMPANION FLANGE AND THE COVER,		
REPLACING THE OIL SEAL .....	313	47
REMOVING AND REINSTALLING, DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL,		
ADJUSTING THE BACKLASH AND THE CONTACT PATTERN .....	314	47
REMOVING AND REINSTALLING THE BEARING CAGE, ADJUSTING THE AXIS DISTANCE .....	316	48
DISASSEMBLING AND REASSEMBLING THE BEARING CAGE .....	317	49
REPAIRING, REINSTALLING THE CROSS DIFFERENTIAL LOCKS		
(AT FORWARD-REAR AND REAR-REAR AXLES) .....	318	51
OIL FILL-UP, RUN, CHECK .....	395	52



## SECTION 203

### FOREWORD

This publication “REPAIR INSTRUCTIONS” was prepared for workshops and contains all the necessary assembly instructions as well as data to be checked and adjusted during repair, with the knowledge of which repair and adjustment of the MARMON-HERRINGTON RF22/R22 Series type tandem axles can properly be performed.

The “REPAIR INSTRUCTIONS” contain sections divided into the technical data and the service instructions of the axle. The sections of the service instructions contain the disassembly and reassembly operations of the individual assembly unit, stating the special tools to be used.

The serial numbers of the figures are started from the beginning in each section. The item numbers of the figures for an assembly unit are referred to in each section dealing with the assembly procedures.

For service operations it is recommended to use the tools shown in the figures in order to assure proper assembly of the individual units. The figures show each essential service operation stating the designation of the tool and its service position. The tools are partly available from commerce and partly can be fabricated in the workshop according to the tool blueprint ordered on basis of tool list supplemented to the “REPAIR INSTRUCTIONS”.

The manufacturer shall not be liable for warranty claims on damages resulting from negligence of the general service practice required for normal service operations but not contained in this Manual.

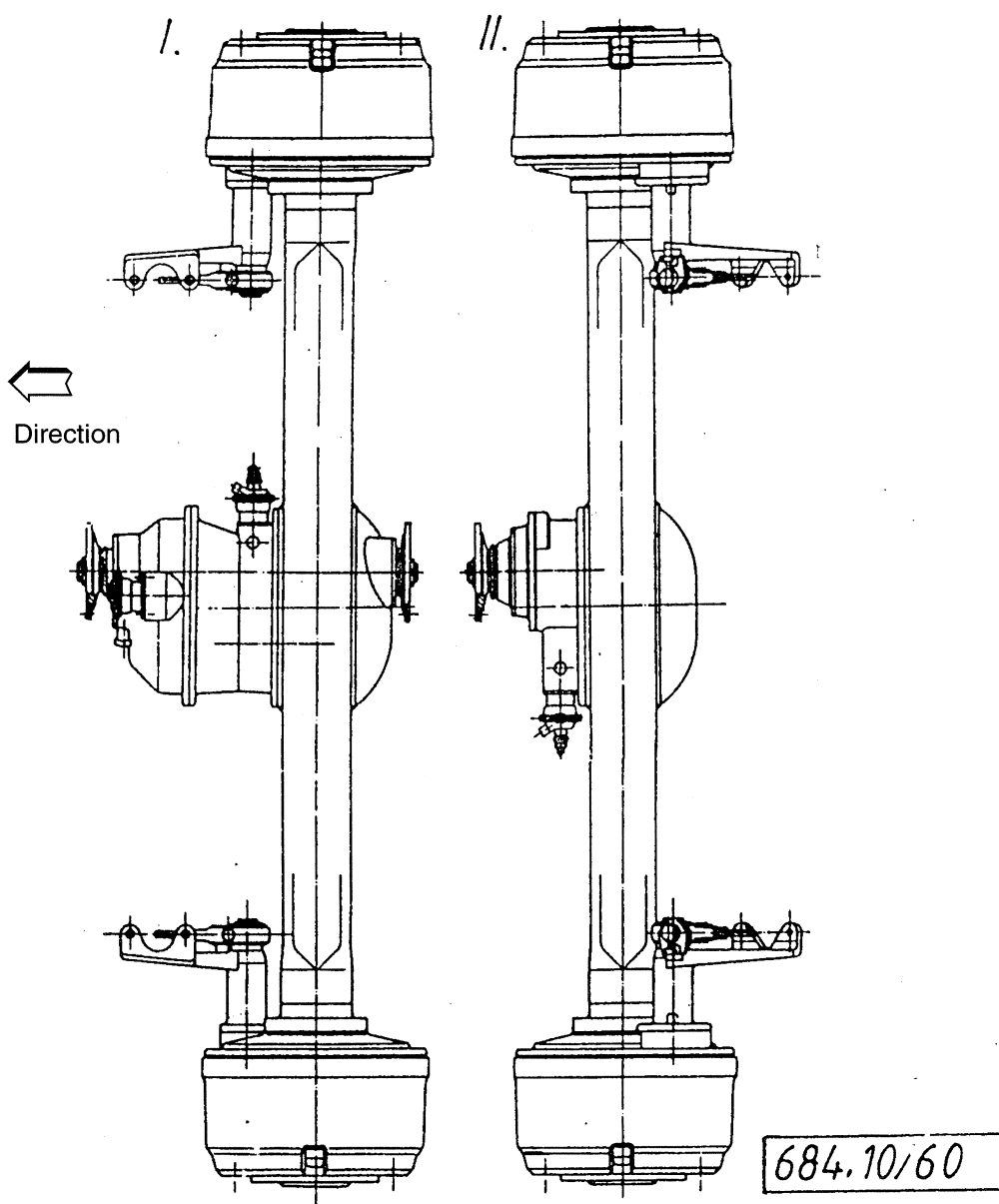
For replacing assembly units or individual parts use **ONLY genuine M-H made products.**

#### RIGHTS FOR ALTERATIONS RESERVED!

MARMON-HERRINGTON COMPANY  
13001 MAGISTERIAL DRIVE  
LOUISVILLE, KY 40245  
TEL.: 502-253-0277 FAX: 502-253-0317



## DRAWINGS OF THE AXLES



Drawing number of tandem axles Tandem (forward-rear axle)	Type	Total Ratio	Driven pinion hand of spiral
684.10-3300-00	RF22	4.563	R
684.11-3300-00	RF22	4.919	R
684.30-3300-00	RF22 WT	4.563	R
684.31-3300-00	RF22 WT	4.919	R
684.60-3300-00	R22	4.563	L
684.61-3300-00	R22	4.919	L
684.80-3300-00	R22 WT	4.563	L
684.81-3300-00	R22 WT	4.919	L



**SECTION 205**  
**TECHNICAL DATA**

DESIGNATION	UNITS	TYPE			
		RF22	RF22	RF22WT	RF22WT
SYSTEM OF THE AXLES:					
The reduction of the axle is of two-stage design. The reduction is accomplished by a pinion and ring gear pair in the carrier head assembly and by spur planetary gearing in the wheel hub.					
DIMENSIONS:					
WHEEL TRACK	mm	2092		2313	
OVERALL WIDTH	mm	2516		2737	
SPRING CLEARANCE DISTANCE	mm				
RATIOS:					
Drive gear/drive pinion tooth number		29/19	27/19	29/19	27/19
Spur gear/Driven gear			22/19		
Planetary gear			64/26 + 1 = 3.461		
Total ratio		4.563	4.919	4.563	4.919



## TECHNICAL DATA

DESIGNATION	UNITS	TYPE			
		R22	R22	R22WT	R22WT
SYSTEM OF THE AXLES:					
The reduction of the axle is of two-stage design. The reduction is accomplished by a pinion and ring gear pair in the carrier head assembly and by spur planetary gearing in the wheel hub.					
DIMENSIONS:					
WHEEL TRACK	mm	2092		2313	
OVERALL WIDTH	mm	2516		2737	
SPRING CLEARANCE DISTANCE	mm				
RATIOS:					
Drive gear/drive pinion tooth number		29/19	27/19	29/19	27/19
Spur gear/Driven gear		22/19			
Planetary gear		64/26 + 1 = 3.461			
Total ratio		4.563	4.919	4.563	4.919





## TECHNICAL DATA

DESIGNATION	UNITS	TYPE			
		RF22/R22	RF22/R22	RF22WT/R22WT	RF22WT/R22WT
<b>GENERAL DATA:</b>					
Nominal axle load	kg	10000			
Permitted total rolling mass:					
In on highway mode	kg	46000			
In domping mode	kg	30000			
Permitted imput torqe	Nm	6440	6200	6440	6200
Max. input speed RPM	1/sec	50			
Axle mass without oil fill	kg	716/640.5	716/640.5	728/649	728/649
Inter axle differential lock		Available			
Differential lock		Available			
ABS system		Available			



## TECHNICAL DATA

DESIGNATION	UNITS	TYPE	
		RF22/22WT	R22/22WT
WHEEL HUB EXECUTION			
Hub centering for installing wheel disc	mm	Flange diameter: 270 Wheel nut hex. distance	
WHEEL BRAKE:			
SYSTEM: The wheel brake is of simplex system internally acting drum brake			
Brake drum diameter	mm	(16.5") 420	
Max. trued-up brake drum diameter	mm	424	
Brake lining width	mm	(7") 180	
Brake shoe clearance (at adjustment)	mm	0.1 – 0.6	
Min. brake lining thickness measured at brake shoe center (marked by upper edge of recess on side of brake lining)	mm	7.0	
Max. camshaft torque and brake drum torque pertaining ( $\mu = 0.35$ )	Nm	1760/19200	
SLACK ADJUSTER		Automatic slack adjuster	
Slack adjuster installation radius "C"	mm	175	
Distance between the bore center of the brake lever bushing and the seating plane of the chamber holder "A"	mm	83	



## TECHNICAL DATA

DESIGNATION	UNITS	TYPE	
		RF22/22WT	R22/22WT
ROLLING BEARINGS:			
In wheel hub:			
Outer: Taper roller bearing		TIMKEN JM 822049 cup	TIMKEN JM 822010 cone
Inner: Taper roller bearing		TIMKEN 48393 cup	TIMKEN 48320 cone
On drive pinion:			
Outer: Taper roller bearing		32312 BX7JU MGM	
Inner: Taper roller bearing		32314 BX7JU MGM	
On differential:			
On flanged case halves: Taper roller bearing		32215 A MGM	
On flanged case: Taper roller bearing		30215 A MGM	
In wheel hub planetary gear:			
Cylindric roller bearing		K -30x42x30 MGM	
On input shaft			
Outer: Taper roller bearing		32212 MGM/SKF/FAG	—
Inner: Taper roller bearing		32014 X MGM/SKF/FAG	—
On thru-drive shaft:			
Deep-groove ball bearing		6210 MGM/SKF/FAG	—
OIL SEALS:			
In wheel hub:		1 HHI-178x205x17 STEFA	
In differential carrier:		A75x95x10 NB SIMMERWERKE	
Through shaft		ASL 65x90x10/12 NB SIMMERWERKE	
In camshaft bushing bracket		AS 42x55x8 NB AFIT SIMMERWERKE	



## TORQUE RATINGS

DESIGNATION	ITEM No.	TYPE	
		RF22/22WT	R22/22WT
<b>NOTE:</b> Nm to ftlb = Nm ÷ 1.3558 (Ex. 600 Nm ÷ 1.3558 = 443 ftlb)			
The serial numbers are the item numbers of the figures in the REPAIR INSTRUCTIONS			
WHEEL HUB:	210/1	Nm	
Wheel nuts:		As specified by the orderer	
Wheel hub cover	12	39-40 Mount with thread locker	
Oil filling and level plug	31,32	55 - 83	
Planetary carrier counting bolts	33	39 - 49 Mount with thread locker	
Spindle nut (outer)	34	450 - 490	
Spindle nut (inner)	36	196	
Brake drum mounting bolts	39	39 - 49	
Spindle mounting bolts	53	360 - 380 Mount with thread locker	
WHEEL BRAKE:	260/1	Nm	
Chamber bracket capscrews	5	130 - 140 Mount with thread locker	
Dust shield mounting hex. bolts	24	10 - 12	
Hex. bolts mounting stop of the automatic slack adjuster	29	20 - 25	
DIFFERENTIAL CARRIER HEADS:	310/1	Nm	
Differential carrier housing to axle causing mounting bolts	—	88 - 98 Mount with thread locker	
Self-lock nuts of companion flanges	1	540 - 590	
Drive gear to drive pinion castle nut	52	540 - 590	—
Cover mounting bolts	6	58.8 – 78.4	—
Differential carrier housing I...II...III clamp bolts	44	88; 3 - 98 Mount with thread locker	—
Toothed disk lock nut	57	37 Mount with thread locker	—
Oil pump mounting bolts	66	58.8 – 78.6	—
Clamp bolts of intermediate differential case halves	93	25 - 30 Mount with thread locker	—
Thru-drive shaft bearing cage castle nut	109	39 - 49 Mount with thread locker	—



## TORQUE RATINGS

DESIGNATION	ITEM No.	TYPE	
		RF22/22WT	R22/22WT
The serial numbers are the item numbers of the figures in the REPAIR INSTRUCTIONS			
Differential carrier cover mounting bolts bearing cage	310/1/6	—	20 - 30
Bearing cage mounting bolts	310/1/14	—	88 - 98 Mount with thread locker
Adjuster lock plate mounting bolts	22		15 - 20
Differential case halves clamp bolts	25		49 - 59
Drive pinion mounting self-lock nuts	39		98 - 118
DIFFERENTIAL LOCK	310/1		Nm
Actuating air chamber lock nut	—		29 - 39
Air chamber half nuts	—		2.5



**ADJUSTMENT DATA**

DESIGNATION	UNITS	TYPE	
		RF22/22WT	R22/22WT
<b>NOTE:</b> mm to inch = mm ÷ 25.4 (Ex. 0.15 mm ÷ 25.4 = .006 inch)			
WHEEL HUB:			
Axial play of wheel hub bearings (adjustment by the spindle nut)	mm	0.01 – 0.04	
WHEEL BRAKE:			
Drive pinion to drive gear backlash (during adjustment)	mm	0.1 – 0.6	
Axial play of camshaft	mm	0.1 – 0.5	
DIFFERENTIAL CARRIER HEAD			
Drive pinion to drive gear backlash	mm	0.25 – 0.33 GLEASON	
Drive pinion rolling torque, after preloading the bearings (the seal is not installed, adjustment by the distance rings or distance washers)	Nm	1.0 – 1.7	
Size of distance rings	mm	34 distance rings from 13.890 to 14.715 mm in 0.025 mm steps	
Theoretical distance between the drive pinion face and the drive gear centerline (AXIS DISTANCE")	mm	88.00	
Shim thicknesses	mm	0.20; 0.25; 0.30; 0.50; 1.0	
Axial play of input shaft	mm	0.05 – 0.25 With max. 5 shim	—
Shim thicknesses	mm	0.20; 0.25; 0.30; 0.50; 1.0; 1.5; 2.0	—
DIFFERENTIAL LOCK	310/1	Nm	
Backlash between clutch gear and toothedhub, when closed	mm	0.5 – 2.0	



## GENERAL SERVICE INSTRUCTIONS

**This section contains the assembly operations and adjustment data considered by us to be most important and which during service of the axle should thoroughly be observed and followed.**

### WHEEL DRIVE, WHEEL HUB

Assure **0.01 - 0.04 mm** axial play for the wheel hub bearings after securing the castle nut. For adjustment refer to the 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 to **1 - 1.5 mm** as measured between the bull 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 the upper edge of the recess on side of the brake lining**) replace the brake linings according to the instructions.

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

Adjust the specified shoe clearance (**0.1 - 0.6 mm**) by the brake lever. For adjustment refer to Section **265**.

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

The brake spanner head may not pass over the surplus lubricant during greasing. The sealing ring at the brake spanner head protects the brake drum against the grease. **Make sure to install the sealing ring in proper position.**

True the brake drum **ONLY** to the permitted maximum diameter.

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

Install the taper roller bearings of the drive pinion with preload. Assure such a preload, the bearings shall roll-down on **1.0 - 1.7 Nm** torque. During check at the main differential the sealing ring (**4**) in **Fig. 1 of Section 310** with the cover (**5**) is not installed. For adjustment refer to the Section **290 and 317**.

The gears of the cross differentials should rotate freely without jamming.

Install the taper roller bearings of the cross differentials without clearance. After adjusting the proper contact pattern and the specified **0.25 - 0.33 mm** backlash tighten further the bearing adjusters on both sides by approx.

**0.75 - 1.25** of pitch (approx. **23° - 37°**) to be able to secure them by one of the tab lock plates (**21**). For adjustment and check refer to the Section **287**.

At the differential carrier assembly install the taper roller bearings **32212** and **32014** so, to obtain **0.05 to 0.25 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, fixing or suspension.**

Install only clean and sound parts free of burr and dents. Before installation wipe the mating surfaces of the parts clean and apply thin coat of oil.

For assembly operations use **ONLY** plastic or lead-insert hammer.

Before installing the oil seals make sure to check if the sealing lip is sound and apply specified grease 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 manufacturer's specification.

**THE FOLLOWING THREAD ADHESIVE, LOCKING AND SURFACE SEALING MATERIAL ARE USED AT THE AXLE ASSEMBLY:**

Thread adhesive:	LOCTITE 277
Thread locker:	LOCTITE 243
Surface Sealant:	LOCTITE 518

Clean and degrease the surfaces before applying the thread adhesive and thread locker.

Before installation apply the thread adhesive and thread locker concentrically to approx. **4-5** threads on the threaded surface of the bolt.

Clean and degrease the surfaces before applying the air-curing sealant. Apply a continuous strip of min. **3 mm** diameter to the specified surface. The time between applying the sealant and assembling the parts together may not exceed **10 mins**.

**Instead of the above adhesive locking and sealing material other equivalent grade ones may also be used.**



## WHEEL HUB

## WHEEL HUB SECTIONAL VIEW

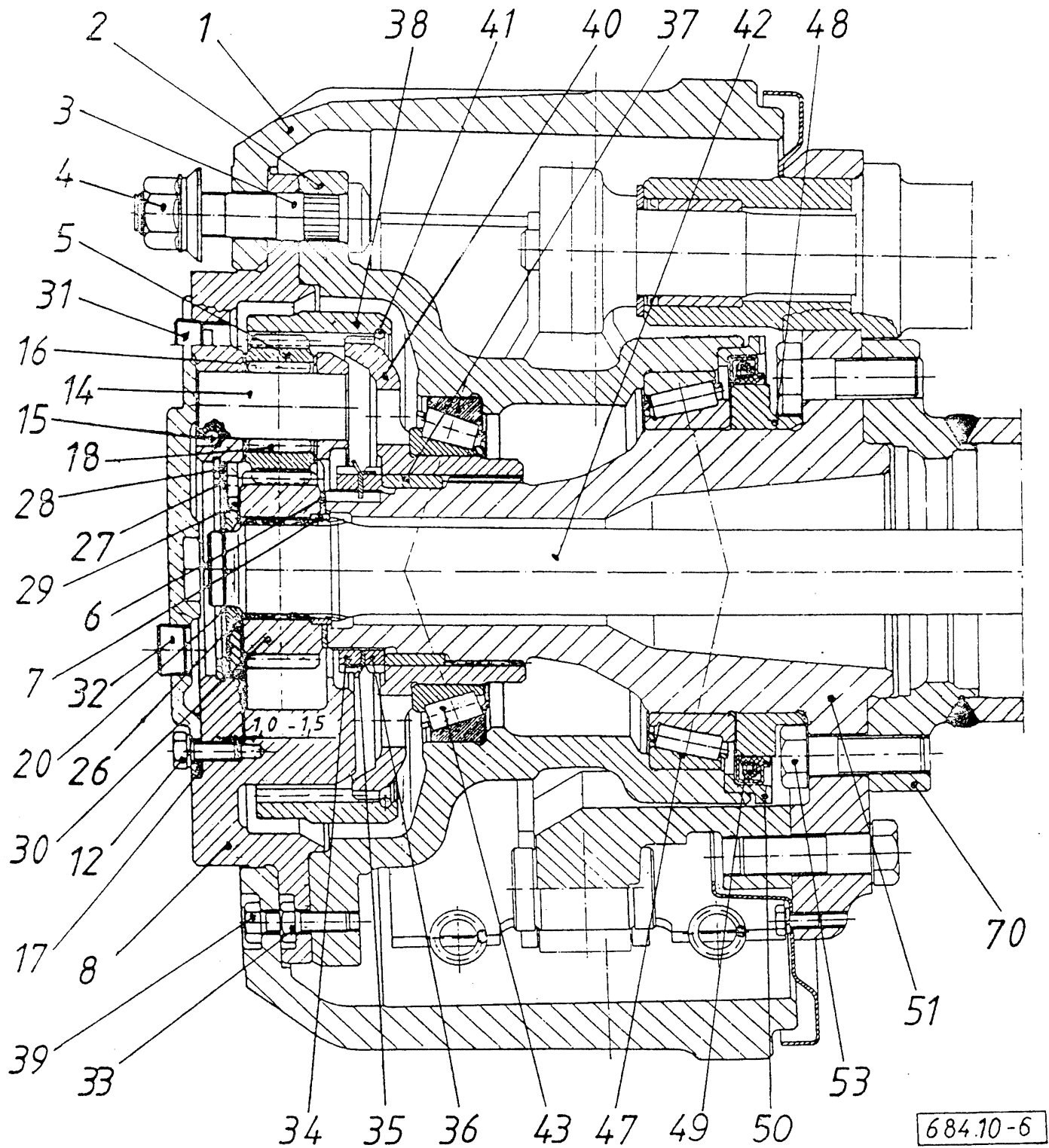


Fig. 1.: WHEEL HUB SECTIONAL VIEW





## SECTION 211

### PARTS OF THE WHEEL DRIVE, WHEEL HUB

- 1 — Brake drum
- 2 — Wheel hub
- 3 — Wheel bolt
- 4 — Wheel nut
- 5 — Idler pinion
- 6 — Friction disk
- 7 — Distance ring
- 8 — Pinion carrier
- 
- 12 — Hex. bolt
- 
- 14 — Pinion pin
- 15 — Steel ball
- 16 — Distance plate
- 17 — End-cover
- 18 — Cylindric roller bearing
- 
- 20 — Snap ring
- 
- 26 — Distance ring
- 27 — Shims
- 28 — Snap ring
- 29 — Friction disk
- 30 — Bull gear
- 31 — Oil drain bore screw plug with magnetic insert
- 32 — Oil filler bore screw plug
- 33 — Hex. bolt
- 34 — Outer shaft-end nut
- 35 — Lock plate
- 36 — Inner shaft-end nut
- 37 — Centering ring
- 38 — Gear rim
- 39 — Hex. bolt
- 40 — Rim hub
- 41 — Circlip
- 42 — Axle-shaft
- 43 — Taper roller bearing
- 
- 47 — Taper roller bearing
- 48 — Shoulder ring
- 49 — Sealing ring
- 50 — Oil seal support and pulse generating ring
- 51 — Spindle
- 
- 53 — Hex. bolt
- 
- 70 — Axle housing

## 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 the wheels.

## REINSTALLING THE WHEEL DISK

After positioning the wheel disk, diagonally tighten the wheel nuts as specified.

## SECTION 213

### REMOVING AND REINSTALLING THE BRAKE DRUM

#### REMOVING THE BRAKE DRUM

After removing the wheel disk back out the hex. bolts attaching the brake drum to the wheel hub, then by **(2) M12 bolts** of at least **40 mm** thread length driven into the threaded bores pull out the brake drum and remove.

#### REINSTALLING THE BRAKE DRUM

Position the brake drum on the wheel hub. Install the hex. bolts attaching the brake drum and tighten to the specified **39 - 49 Nm** torque.

## SECTION 214

### REMOVING AND REINSTALLING THE END-COVER

#### REMOVING THE END-COVER

Drain the oil.

Remove the hex. bolts **(12)** attaching the end-cover **(17)** to the pinion carrier and separate the end-cover.

#### REINSTALLING THE END-COVER

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-resistant surface sealant to the seating flange of the end-cover (avoiding the bores from the 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 coated with thread locker and tightened to **39 - 49 Nm** torque.

## SECTION 219

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

After removing the end-cover **(17)** by means of snap ring pliers remove the snap ring **(28)** from the pinion carrier, then remove the shims **(27)** and the friction disk **(29)**.

Access behind the sun gear and pull out the axle shaft.

The sun gear **(30)** can be pulled from the axle shaft **(42)** together with the distance ring **(7)** and the friction disk **(6)**



after removing the snap ring (20) and the distance ring (26).

Perform reinstallation in reverse order of removal. Take care the friction disk (6) shall be on the distance ring (7) and the chamfered side of the distance ring (26) shall face inward.

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

After aligning the teeth 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 (29) into the installed planetary gear, then insert the snap ring (28). Pressing the friction disk to bottom out against the bull gear (30) by means of feeler gage measure the distance between the friction disk and the snap ring.

From among the shims (27) select an amount **1.0 - 1.5 mm** less than the thickness of the measured value.

By means of snap pliers remove the snap ring (28) again, then insert the selected shim pack and finally install the snap ring.

## SECTION 220

### REMOVING AND REINSTALLING THE PLANET CARRIER

#### REMOVING THE PLANET CARRIER

Remove the hex. bolt (33) from flange of the pinion carrier (8). 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 flange 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 flange 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 match-marks on the wheel hub and the pinion carrier align (oil drain).

Secure the pinion carrier by means of hex. flanged 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 shown in the figure drive out the pinion pin toward direction of the detent ball (15) (See Fig. 1.).

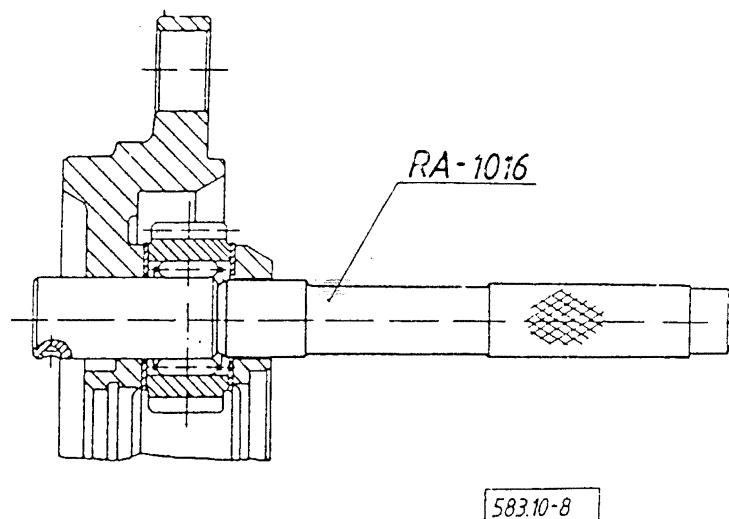


Fig. 1.: DRIVING OUT THE PINION PINS

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

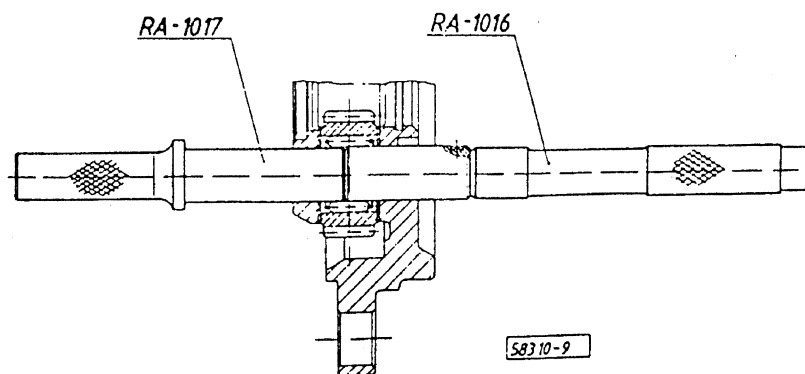


Fig. 2.: DRIVING IN THE PINION PINS

When driving in the pinion pins (14) make sure the seat machined for the detent ball in the pinion pin and the groove in the pinion carrier (8) align, to be able to insert the detent ball into the seat before completely driving in the pinion pin.

In case of replacing the cylindric roller bearings (18), 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.

Drive in the pinion pins by means of the mandrels shown (see Fig. 2.).



## REMOVING AND REINSTALLING THE WHEEL HUB

### REMOVING THE WHEEL HUB

After removing the pinion carrier and the axle unsecure the shaft-end nuts **(34 and 36)** and remove by the tools shown in **Fig. 1**.

Slightly pull the safety suspended wheel hub forward, thus the rim hub **(40)** assembled with gear rim can be pulled off together with the outer taper roller bearing cone **(43)**.

If unable to pull off the rim hub, by means of tools, it can be removed by turning the bolts into the **(2) M10** bores in the rim hub and properly backing the puller bolt.

Pull off the wheel hub from the spindle.

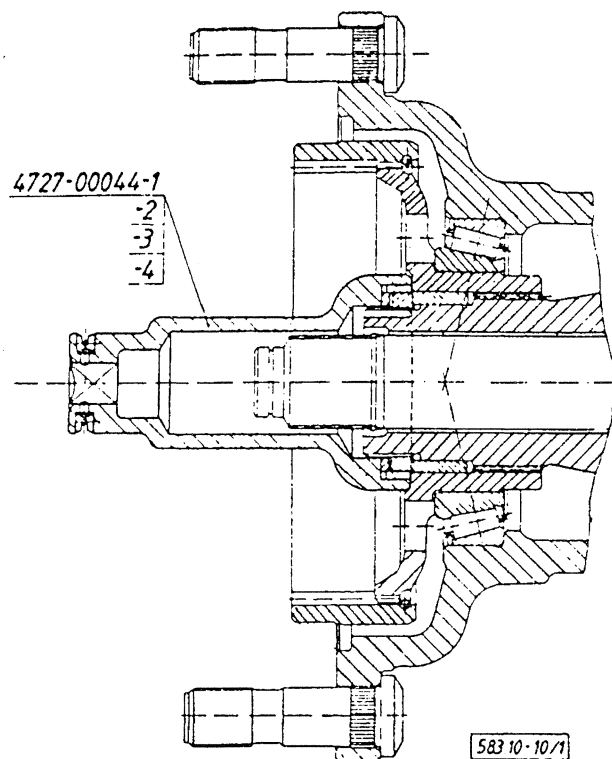


Fig. 1.: ASSEMBLING THE SHAFT-END NUTS

By means of the tools shown pull off the taper roller bearing cone (see Fig. 2.).

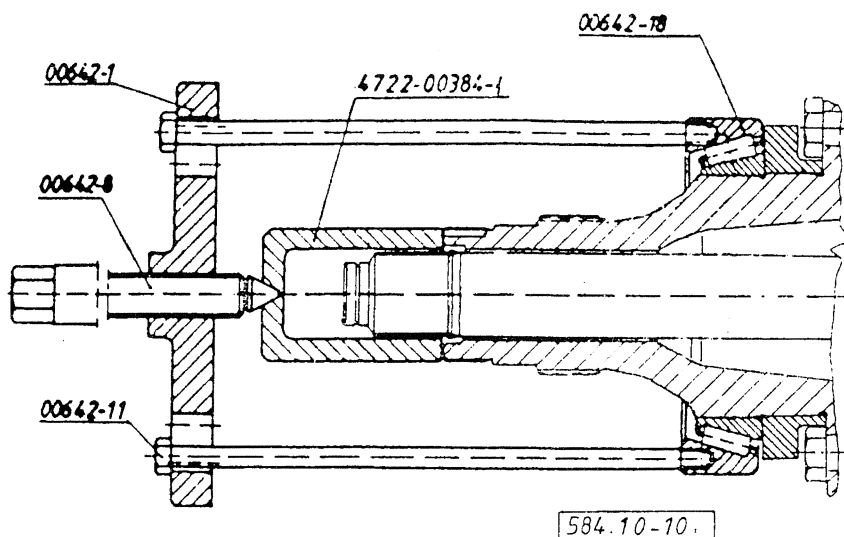


Fig. 2.: PULLING OFF THE INNER TAPER ROLLER BEARING



If the shoulder ring is to be replaced pull it off by means of the puller shown in **Fig. 3**.

### INSTALLING THE SHOULDER RING

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-proof surface sealant to the place of the shoulder ring on the spindle.

By means of the tools shown drive on the shoulder ring to bottom out (**Fig. 4.**).

After driving on the shoulder ring drive on the inner taper roller bearing cone to bottom out against the shoulder of the steering knuckle (see **Fig. 5.**).

### REINSTALLING THE WHEEL HUB

Safely suspend to hoist position the wheel hub subassembled with sealing ring (**49**) and cups of the taper roller bearings (**43 and 47**) to the steering knuckle and push on to bottom out making sure not to damage the sealing lips of the sealing rings.

Position the rim hub (**40**) subassembled with the outer taper roller bearing cone and with gear rim (**38**) into the wheel hub and aligning the splines drive on to bottom out, making sure the taper roller bearing seats properly.

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

By means of the wrench 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, install the outer shaft-end nut and tighten to **588 - 637 Nm** torque.

By means of dial indicator check if the specified **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 (**35**).

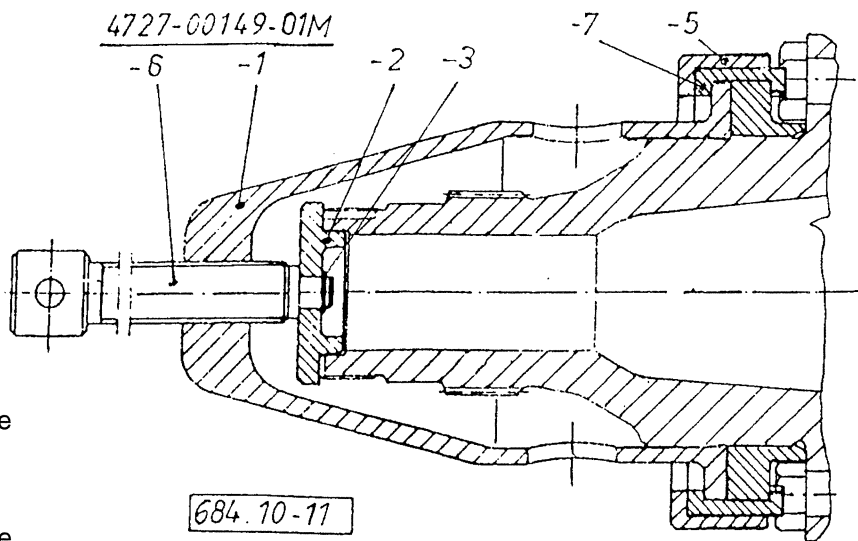


Fig. 3.: PULLING OFF THE SHOULDER RING

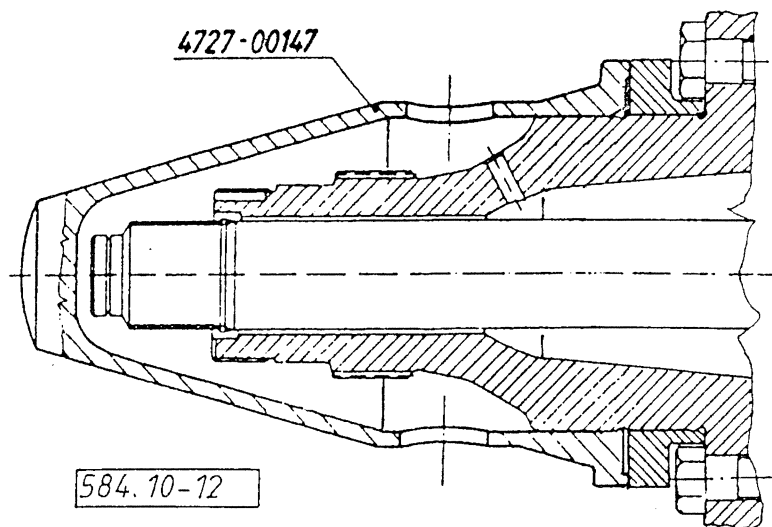


Fig. 4.: DRIVING ON THE SHOULDER RING

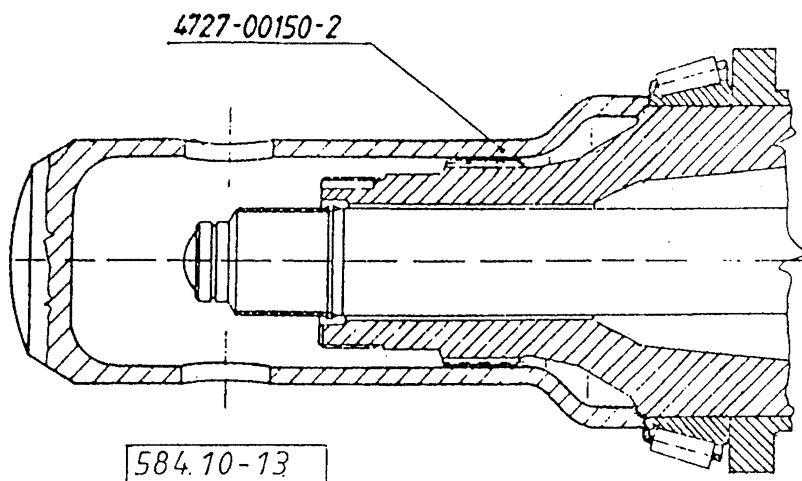


Fig. 5.: DRIVING THE INNER TAPER ROLLER BEARING CONE



## SECTION 224

# DISASSEMBLING AND REASSEMBLING THE WHEEL HUB

(Replacing the bearing cups and the sealing ring.)

By means of a simple pry remove the sealing ring (49) from the removed wheel hub.

By means of the tools shown drive out the cups of the taper roller bearings. (See Fig. 1.).

## REASSEMBLING THE WHEEL HUB

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

Turn the wheel hub over and also drive in the cup of the inner taper roller bearing (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!

According to "GENERAL SERVICE INSTRUCTIONS" apply oil-proof sealant to the impulse ring seat.

If the impulse ring is changed, before pressing the new impulse ring is to be cooled uniformly in dry ice and pushed in to stop on the wheel hub.

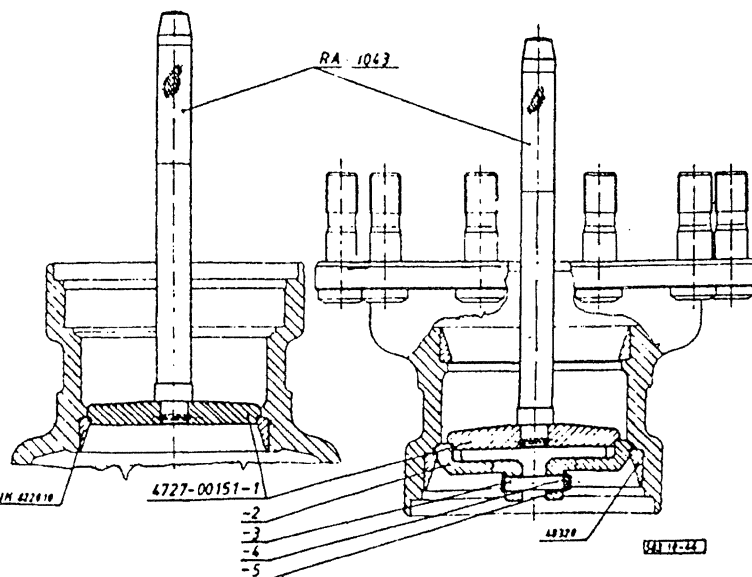


Fig. 1.: DRIVING OUT THE TAPER ROLLER BEARING CUPS

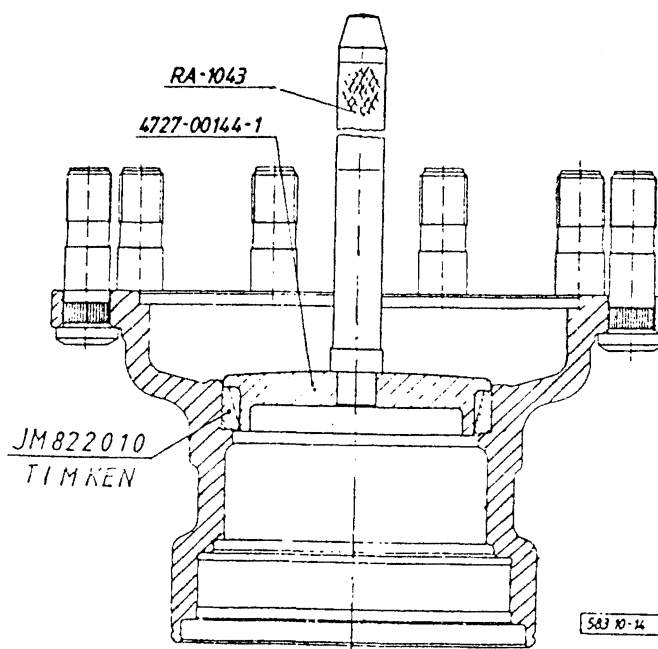
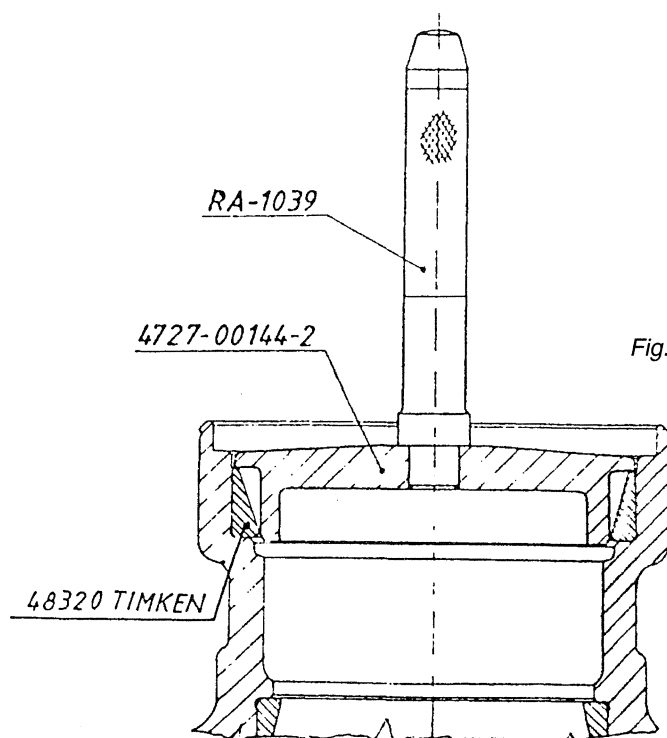


Fig. 2.: DRIVING IN THE OUTER TAPER ROLLER BEARING CUP



583.10-15

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

### TOOTHING CAN GET DAMAGED!

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. 4.).

Fill **AMBLYGON TA 15/2** grease between the sealing lip and the dust protection edge.

## SECTION 225

### DISASSEMBLING AND REASSEMBLING THE RIM HUB

#### DISASSEMBLING THE RIM HUB

After removing the circlip (41) pull the gear rim (38) off the rim hub (40).

Do not remove the centering ring (37) from the rim hub, these may be replaced only together.

#### REASSEMBLING THE RIM HUB

As shown in the figure drive the cone of the taper roller bearing to the rim hub supplied together with centering ring (37) (see Fig. 1.).

Aligning the rim hub and the gear rim (38) toothing push them completely together and install the circlip (41) into its groove.

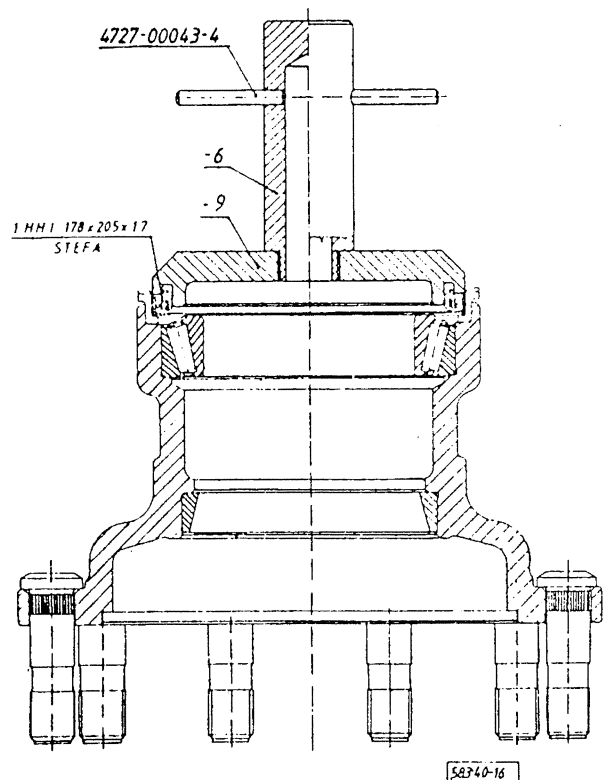


Fig. 4.: DRIVING IN THE SEALING RING

## 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 hex. bolt (53) attaching the spindle (51) to the flange of the axle housing (70) and pull the spindle out of the axle housing bore.

#### REINSTALLING THE SPINDLE AND THE BRAKE SUPPORT ASSY.

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-proof surface sealant to the seating flange of the axle housing (avoiding the bores from inside) and pull over the spindle. 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.

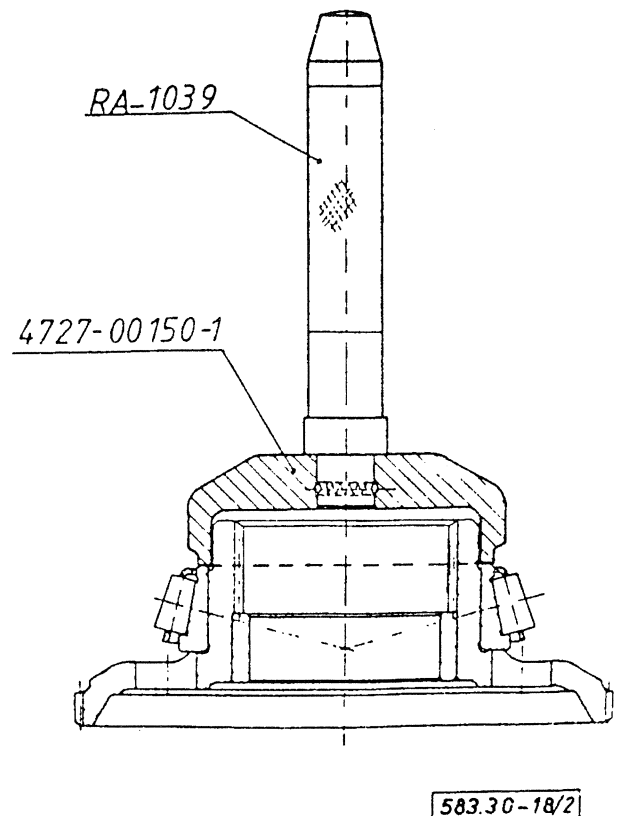


Fig. 1.: DRIVING THE TAPER ROLLER BEARING CONE TO THE RIM HUB



## SECTION 229

# INSTALLATION INSTRUCTIONS FOR PARTS OF ANTILOCKING SYSTEM

This section contains the constructional elements of the antilocking and anti-skid systems (ABS and ASR) that can be installed by the customer the axle as well as the installation instructions.

The axle contains the items **(A,C)** necessary at the installation of the anti-lock and anti-skid systems **(1)**.

## 1. INSTALLABLE ELEMENTS OF THE ANTI-LOCK AND ANTI-SKID SYSTEMS

1.1 Revolution sensor: A 335545231 Robert Bosch GmbH

or ZB 9010-I/83315 KNORR-BREMSE

or WABCO 441 032 001 0

1.2 Spring bushing: C 335 002-431 A Robert Bosch GmbH

or 4B 69698 KNORR-BREMSE

or WABCO 899 760 510 4

**Note:** The revolution sensor and the spring bushing must be of the same make.

## 2. INSTALLATION INSTRUCTION

### A. TOOTHED PULSE GENERATING RING

Before installing the spring bushing coat the **18H9** bore of the revolution sensor holder with copper paste or silicone grease (e.g. Molykote FP 186, Unirew N3) in order to prevent corrosion.

Insert the spring bushing from the middle of axle into the **18H9 bore** until stop **(1.2)**.

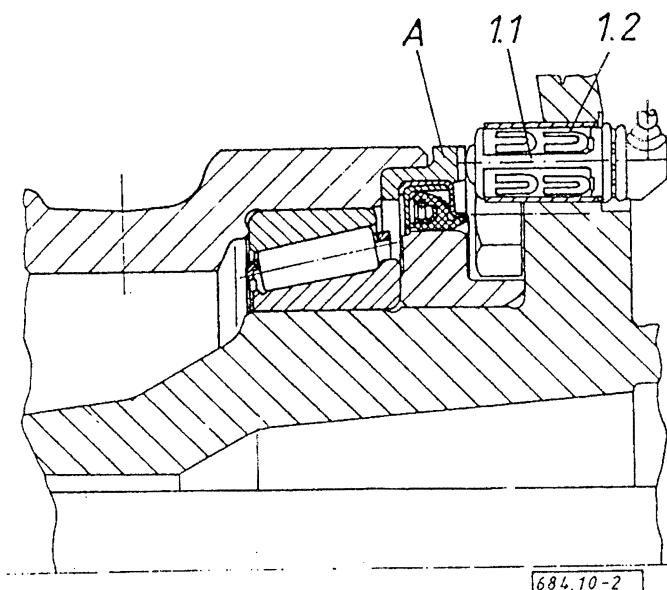
Put the revolution sensor **(1.1)** into the spring bushing and push it until it reaches the generator ring and the wheel hub. This setting has to be performed every time the hub will be disassembled.

During operation maximum clearance between the revolution sensor and the generator ring may be **0.8 mm**.

When leading the wire of the revolution sensor out of the axle brake mechanism be sure not to bend it with a radius less than **R50 mm**. Fasten the wire at distances of **50 mm** exposed to heat load inside the brake mechanism.

Check the runout of the toothed pulse generating ring on the wheel hub. Maximum permissible runout of toothing in direction of revolution sensor shaft is **0.2 mm**.

**NOTE:** Tachometer to be built in only with spring bushing of the same manufacturing. Besides BOSCH and



KNORR 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 cooled uniformly in dry ice and pushed up to stop on the wheel hub.

**SENSOR TEETH CAN NOT GET DAMAGED!**



# WHEEL BRAKE

SECTION 260

## DRAWING OF THE WHEEL BRAKE

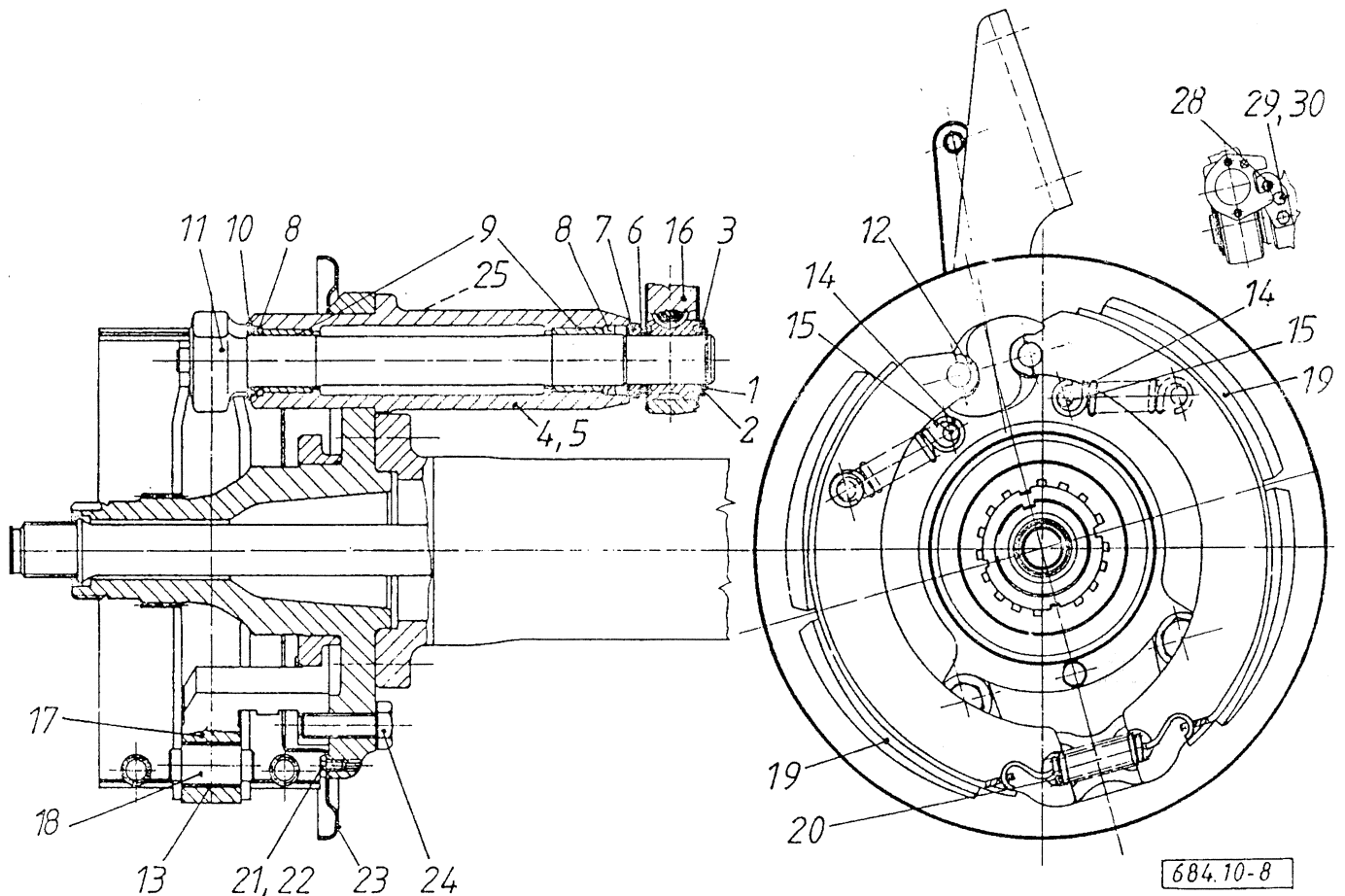


Fig. 1.: DRAWING OF THE WHEEL BRAKE

SECTION 261

## PARTS OF THE DRUM WHEEL BRAKE

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| 1 — Snap ring                       | 16 — Brake lever                     |
| 2 — Wear indicator disk             | 17 — Brake support                   |
| 3 — Spacer                          | 18 — Brake shoe anchor pin           |
| 4 — Diaphragm                       | 19 — Brake shoes                     |
| 5 — Hex. flanged bolt               | 20 — Brake shoe return spring, short |
| 6 — Shims                           | 21 — Hex. bolt                       |
| 7 — Spacer                          | 22 — Lock washer                     |
| 8 — Sealing ring                    | 23 — Brake cover plate               |
| 9 — Bearing bush                    | 24 — Hex. bolt                       |
| 10 — Distance washer                | 25 — Ball grease fitting             |
| 11 — Brake spanner                  | 26 — Brake lever return spring       |
| 12 — Roller                         | —                                    |
| 13 — Bushing                        | 28 — Stop                            |
| 14 — Brake shoe return spring, long | 29 — Hex. bolt                       |
| 15 — Spring support pin             | 30 — Washer                          |





## 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 in Fig. 1. of Section 240) away. Remove the rollers (12).

Unhook the shoe return springs by means of a spring hooking device, then remove the brake shoes.

## REINSTALLING THE BRAKE SHOES

Position the brake shoes to be placed in shoe anchor pin (18) and the brake camshaft head. Hook the return springs (14 and 20) to the brake shoes. For hooking use the spring hooking device.

Pry the brake shoes away, then insert the rollers (12) so, they shall seat both in the brake shoe rib and in the brake spanner involute profile.

## SECTION 263

# REPAIRING THE BRAKE SHOES AND THE BRAKE DRUM

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

The permitted minimum brake lining thickness is indicated by the upper edge of the recess in the brake lining side. (This value is  $v_{min} = 7.0 \text{ mm}$  as measured at center of the brake shoe)

Replace the brake linings if damaged or worn below the permitted limit

Replace the brake lining and true-up of the brake shoes only in pairs.

The working off is implemented with equipment mounted to the wheel-hub.

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

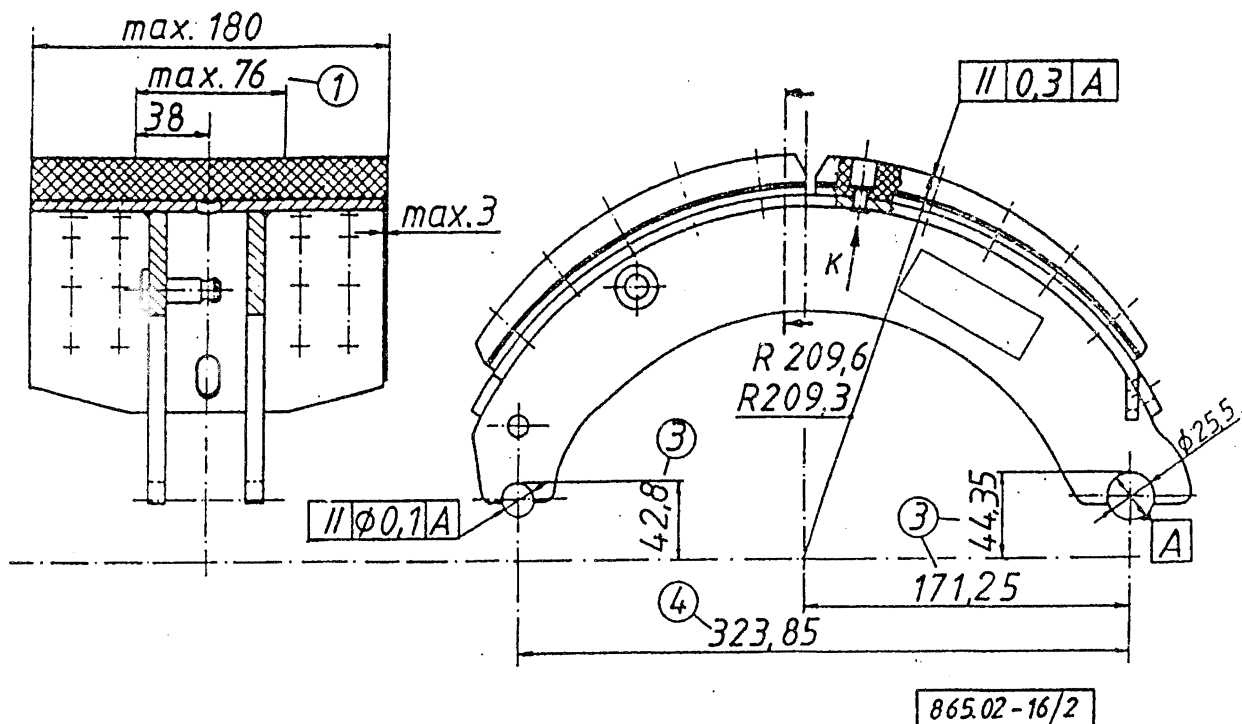


Fig. 1.: DATA FOR TRUEING UP THE BRAKE SHOES EQUIPPED WITH NEW LININGS

1 — Zed-area, max. 76

3 — Basis

4 — Controlling - dimension



For riveting use ONLY the rivets corresponding to **Fig. 2**

#### TECHNICAL REQUIREMENTS:

- 1 — Material: C10 MSZ 231
- 2 — Copper plated
- 3 — Tolerance of the untolerated dimensions is  $\pm 0.254$
- 4 — Tolerance of the untolerated angles is  $\pm 1^\circ$

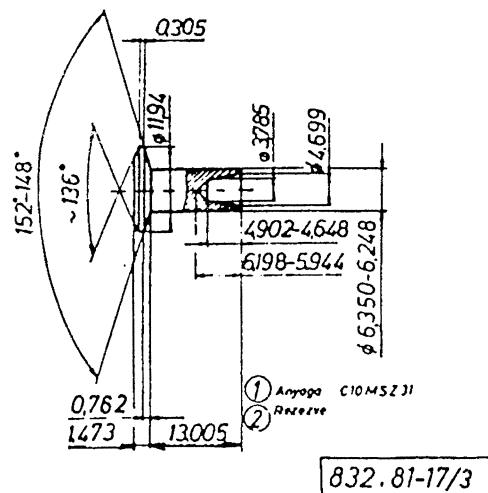


Fig. 2.: DIMENSIONS OF THE RIVETS

For riveting use the device equipped with tool developed according to **Fig. 3**.

- 1 — Rivet set, upper
- 2 — Rivet set, lower
- 3 — Globe R 2.4 mm

Perform riveting in sequence shown in **Fig. 4**.

- 1 — Center of the brake shoe
- 2 — Brake spanner end of the brake shoe

The brake lining should seat so, the feeler gage of **0.15 mm** thickness could not be inserted between the lining and the brake shoe along the full length except the Zed-area (see **Fig. 1.**).

At both linings check the lining surface for parallel to the dimension "A" by setting the dimension "A" to the shown position using a  $\phi 25.5$  mm pin (see **Fig. 1.**).

Upset rivet must withstand 1200 LBS proof load in direction of arrow -K- at rivet base.

Each lining may have 2 rivets with flanges cracked in Vee-shape, provided the test load was endured.

#### 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 maximum brake drum diameter after true-up dia. brake drums is  $\phi 424$  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 **R210,6 - R210,3 mm** as shown in **Fig. 1**.

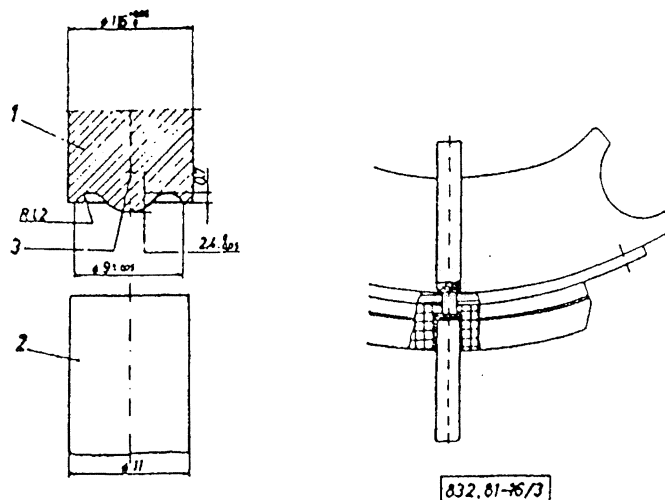


Fig. 3.: RIVETING TOOLS

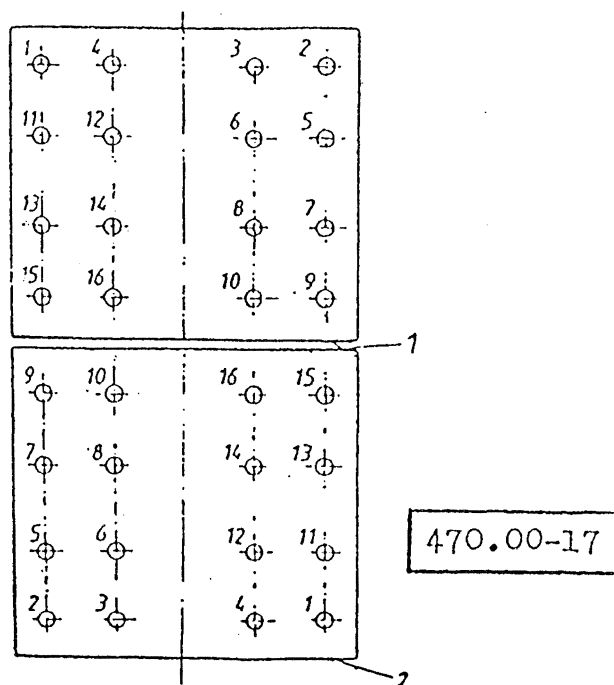


Fig. 4.: RIVETING SEQUENCE



## SECTION 264

### REMOVING AND REINSTALLING THE BRAKE SUPPORT AND THE BRAKE CHAMBER HOLDER, ASSEMBLING THE SPRING SUPPORTING PIN

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

If the anchor pin bushing (13) are to be replaced, use the tool shown (**Fig. 1**).

#### ASSEMBLING THE SPRING SUPPORTING

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

#### REMOVING THE BRAKE CHAMBER HOLDER

After removing the hex. flanged bolts (5) the brake chamber support can be pulled out of the spindle.

#### REINSTALLING THE BRAKE CHAMBER SUPPORT

The relevant (RH-LH) brake chamber support should be positioned into the bore of the spindle and secure by hex. flanged bolts coated with thread locker and tightened to **130 - 140 Nm** torque.

Install the brake cover plates by means of hex. bolts and lock washer. Tighten the hex. bolts to **10 - 12 Nm** torque.

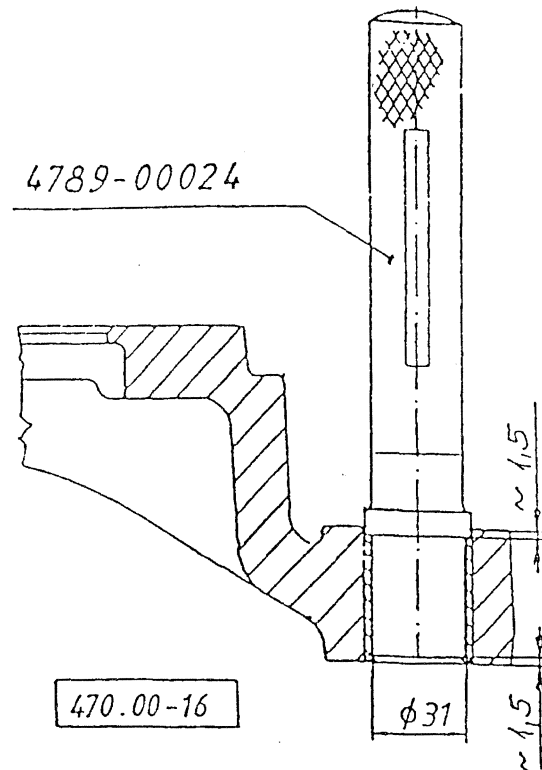


Fig. 1.: PRESSING THE BUSHING IN AND OUT

## SECTION 265

### 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 (3) and the wear indicator disk (2).

Pull the brake lever (16), the shims (6) and the spacer (7) off the brake spanner (11) end.

Pull the brake spanner out of the brake spanner support (4) 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 center of the brake lever bush shall be in distance "A" in the **"TECHNICAL DATA"** from the upper plane of the diaphragm holder.

Position the wear indicator disk (2) to the end of the brake spanner. After adjusting the above "A" dimension and the **0.1 - 0.6 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.

Position the spacer ring (3) and 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 the brake shoes should open!

In case of a new lining the notch of the slack adjuster and division "O" of the toothed disk nearly coincide (max. deviation 9°).

With wear of the brake linings the notch marked "420" belonging to the new brake drum gets nearer to the slack adjuster notch.



In case of a  $\varnothing 420$  mm new brake drum, mark "420" of the toothed disk in case of a brake drum trued up to  $\varnothing 424$  mm, mark "424" of the same max. reach the notch of the slack adjuster. This indicates that the brake lining got worn to the limit. In this case replace the brake linings.

At types equipped with automatic slack adjuster, attach the relevant brake lever stop (28) (RH-LH) to the brake chamber holder by 2 M8x14 hex. bolts (29) with lock washer (30) for each. Tighten the hex. bolts to 20 - 25 Nm torque.

## SECTION 266

# REPAIRING THE BRAKE SPANNER BEARING SUPPORT

## REMOVING AND REINSTALLING THE BEARING BUSHINGS AND THE SEALING RINGS

By means of the tool shown pull the bearing bushings (9) out of the brake chamber holder (4). See Fig. 1.

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

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

## REINSTALLING THE BEARING BUSHINGS

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 center and the brake lever.

By this means leak-tightness at the brake spanner head is assured.

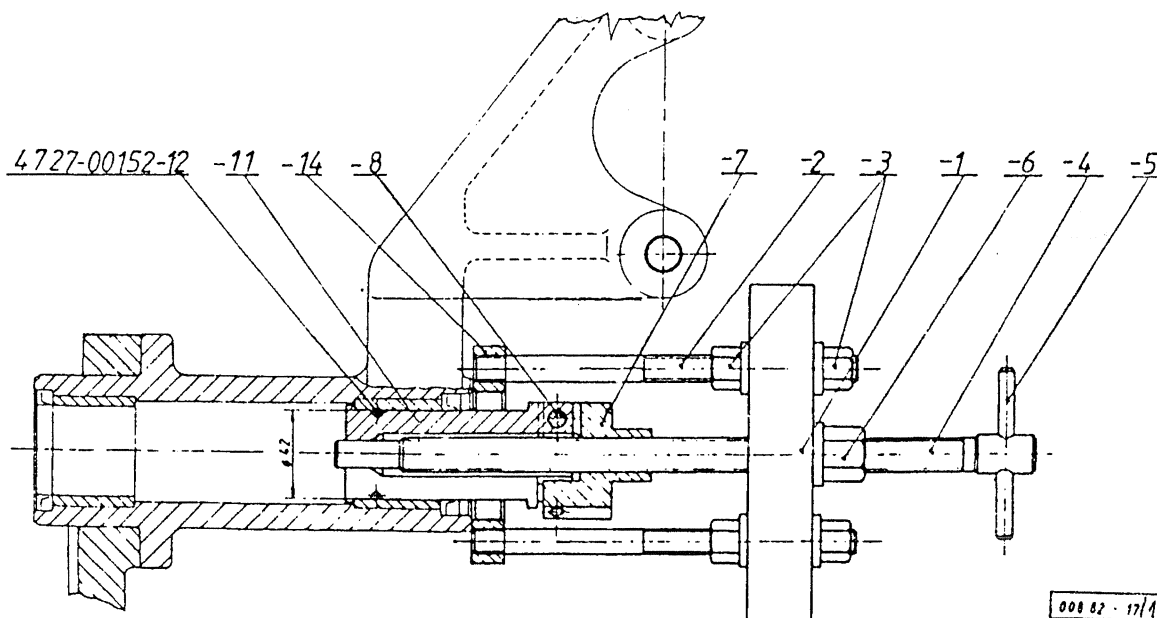


Fig. 1.: PULLING OUT THE BEARING BUSHINGS

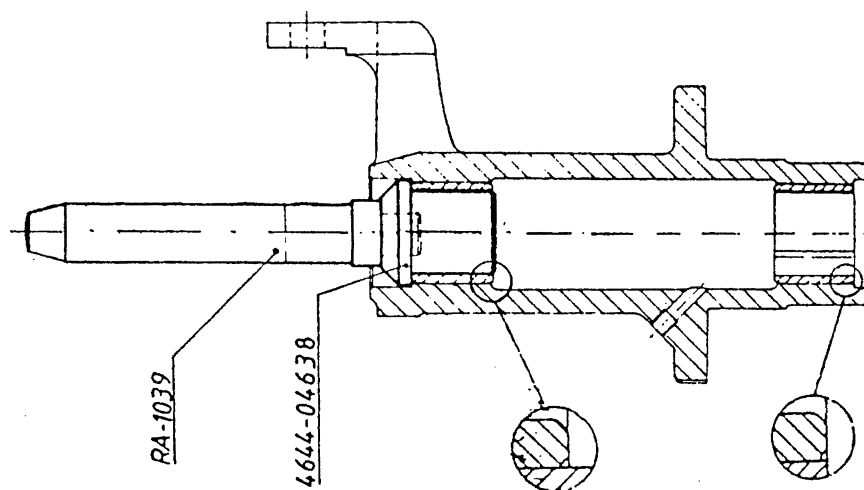


Fig. 2.: DRIVING IN THE BEARING BUSHINGS



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 bushings (**Fig. 3.**).

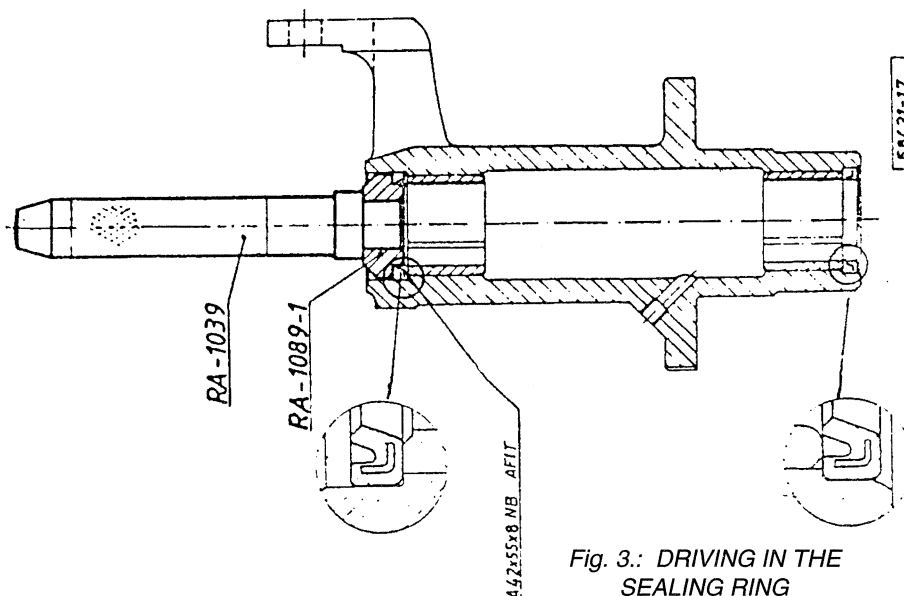


Fig. 3.: DRIVING IN THE SEALING RING

## SECTION 268

### AUTOMATIC SLACK ADJUSTER

The brake lever requires no maintenance, since it is automatically readjusted according to the brake lining wear.

the axle perform adjustment of the shoe clearance and the automatic brake lever as follows:

In case of replacing the brake linings of after repairing

#### ITEMS:

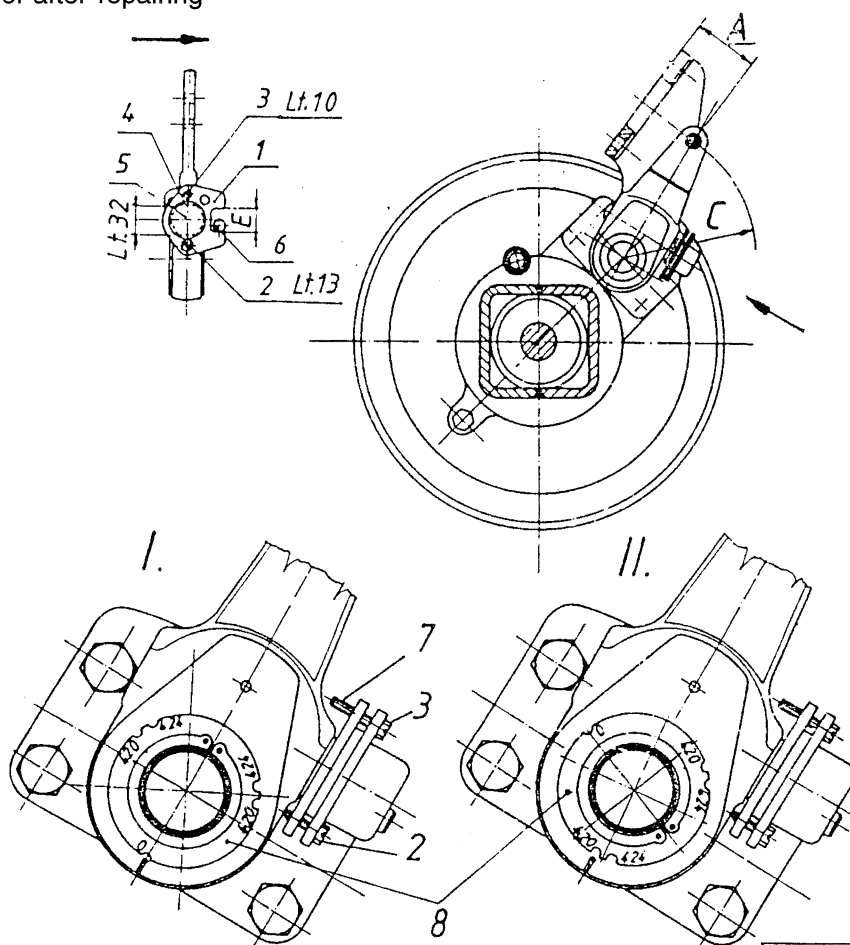
- 1 — Adjusting plate
  - 2 — Setscrew (hex. distance 13)
  - 3 — Setscrew (hex. distance 10)
  - 4 — Plastic protection cup
  - 5 — Hex. adjusting ring (hex. distance 32)
  - 6 — Stop pin
  - 7 — Plastic thread protector
  - 8 — Toothed disk
- I. Position of wear indicator disk a new brake lining
  - II. Position of wear indicator disk at worn brake lining. Brake drum diameter: **420 mm.**

#### ADJUSTMENT DATA:

A = Distance between the plane of the chamber bracket and the bore center of the brake lever

C = Brake lever radius

For dimensions A, C refer to “**TECHNICAL DATA**”.



### A./ ADJUSTING POSITION OF THE BRAKE LEVER AND THE SHOE CLEARANCE:

- Remove setscrews (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 specified distance between the seating surface and the brake lever bore. (Start adjustment from a distance higher than specified.  
If required, also adjust the push rod clevis.)
- After the above operation adjust the shoe clearance to 0.3 - 0.6 mm.

### B./ ADJUSTING AND FIXING THE ADJUSTING PLATE:

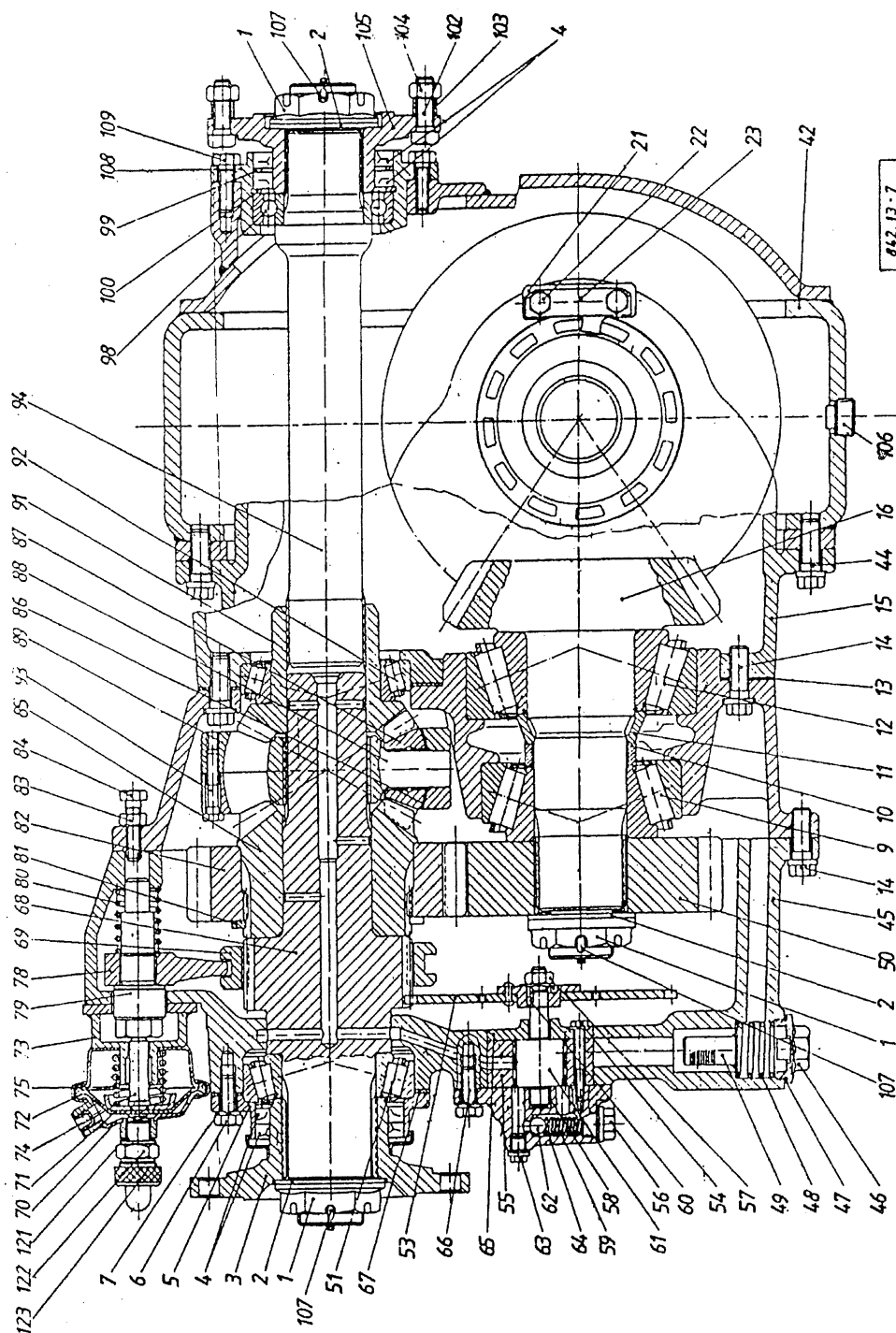
- Secure the stop fork "E" of the adjusting plate (1) in bottom position relative to stop pin (6) as shown in Fig. 1.
- Complete adjustment by reinstalling the plastic protection cap (4) and the adjusting plate (1) as well as installing and securing the setscrews (2, 3) and screwing on the plastic thread protector (7).
- During fixing plane of the adjusting plate should be perpendicular to the stop pin (6).
- Before installation apply graphitic grease to serration of the brake lever.

## MAIN DIFFERENTIAL (FORWARD-REAR AXLE)

SECTION 280

### MAIN DIFFERENTIAL SECTIONAL VIEW

Fig. 1.: MAIN DIFFERENTIAL  
SECTIONAL VIEW



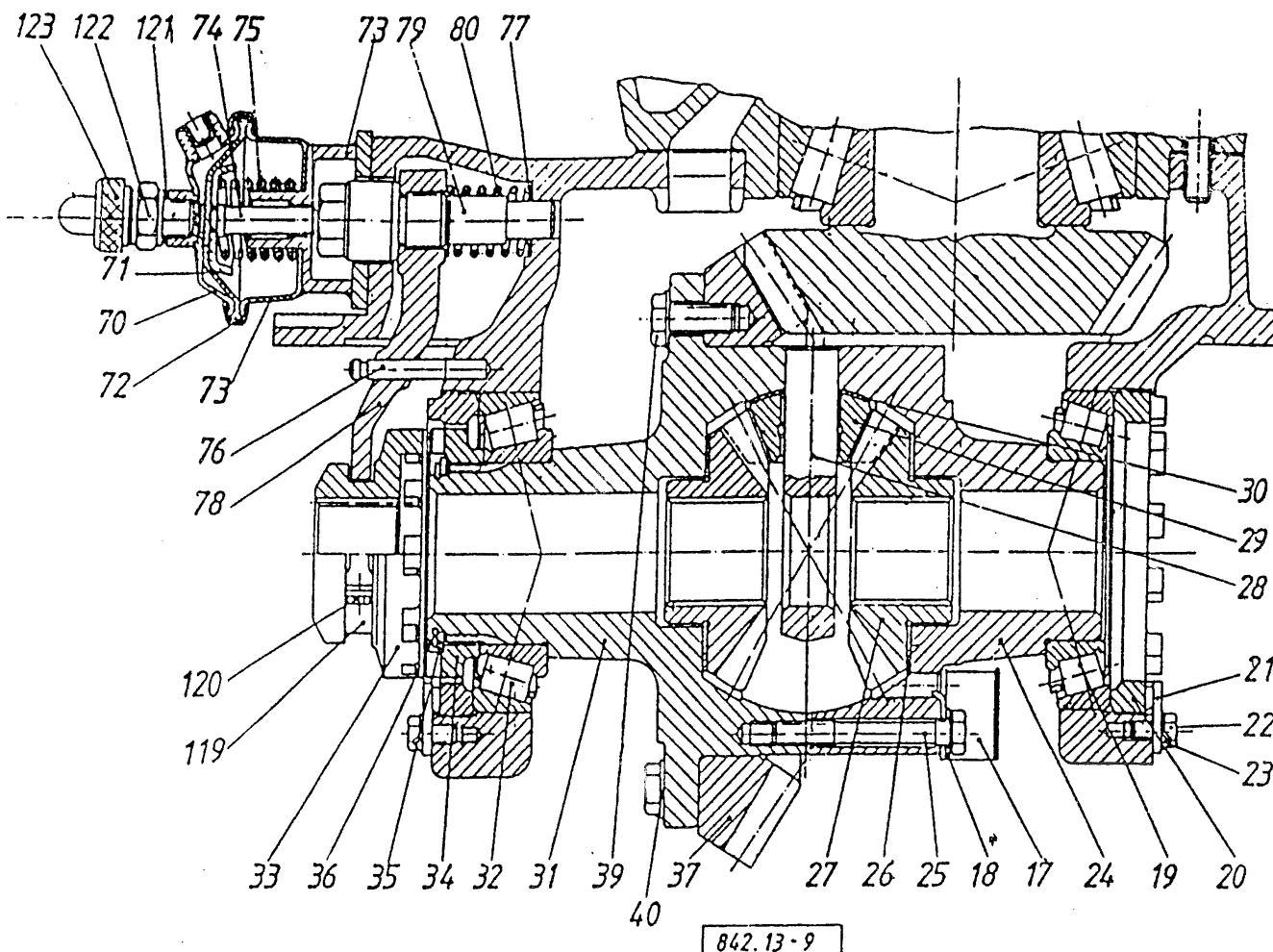


Fig. 1/A.: SECTIONAL VIEW OF THE CROSS DIFFERENTIAL IN THE MAIN DIFFERENTIAL

# SECTION 281

## PARTS OF THE MAIN DIFFERENTIAL

- |   |  |   |
|---|--|---|
| 1 — Flanged castle nut                        | 39 — Hex. Bolt                             | 77 — Stop insert                                |
| 2 — Washer                                    | 40 — Lock plate                            | 78 — Shift yoke                                 |
| 3 — Companion flange I.                       | —  | 79 — Shift bar                                  |
| 4 — Sealing rings                             | 42 — Axle housing                          | 80 — Spring                                     |
| 5 — Cover                                     | —  | 81 — Snap ring                                  |
| 6 — Hex. bolt                                 | 44 — Hex. flanged bolt                     | 82 — Pinion drive spur gear                     |
| 7 — Lock washer                               | 45 — Differential carrier II., III. assy.  | 83 — Lock nut                                   |
| —   | 46 — Drain screw plug with magnetic insert | 84 — Stop bolt                                  |
| 9 — Taper roller bearing (32312 B X7 JU MGM)  | 47 — Sealing ring                          | 85 — Differential gear II.                      |
| 10 — Distance ring                            | 48 — Spring                                | 86 — Spacer                                     |
| 11 — Distance sleeve                          | 49 — Oil filter                            | 87 — Differential pinion                        |
| 12 — Taper roller bearing (32314 B X7 JU MGM) | 50 — Driven gear                           | 88 — Sider                                      |
| 13 — Shims                                    | 51 — Taper roller bearing (2212)           | 89 — Differential case                          |
| 14 — Hex. flanged bolt                        | —  | —   |
| 15 — Differential carrier I.                  | 53 — Toothed disk                          | 91 — Differential gear I.                       |
| 16 — Drive pinion                             | 54 — Hex. bolt with lock washer            | 92 — Taper roller bearing (32014 X)             |
| 17 — Oil baffle plate                         | 55 — Oil pump case                         | 93 — Hex. bolt                                  |
| 18 — Washer                                   | 56 — Flanged screw plug with sealing ring  | 94 — Thru-drive shaft                           |
| 19 — Taper roller bearing (30215 A MGM)       | 57 — Hex. nut with tab lock plate          | —   |
| 20 — Bearing adjuster                         | 58 — Bushing                               | 98 — Deep-groove ball bearing (6210)            |
| 21 — Tab lock plate                           | 59 — Oil pressure control spring           | 99 — Distance ring                              |
| 22 — Hex. bolt                                | 60 — Woodruff key                          | 100 — Snap ring                                 |
| 23 — Lock plate                               | 61 — Oil pump drive gear                   | —   |
| 24 — Differential case half                   | 62 — Steel ball                            | 102 — Hex. bolt                                 |
| 25 — Clamp bolt                               | 63 — Flanged screw plug with sealing ring  | 103 — Spacer                                    |
| 26 — Spacer                                   | 64 — Oil pump cover II.                    | 104 — Hex. nut                                  |
| 27 — Differential gear                        | 65 — Oil pump cover I.                     | 105 — Companion flange II.                      |
| 28 — Spider                                   | 66 — Hex. bolt with lock washer            | 106 — Oil drain screw plug with magnetic insert |
| 29 — Differential pinion                      | 67 — Shims                                 | 107 — Cotter                                    |
| 30 — Shim                                     | 68 — Input shaft                           | 108 — Bearing cage                              |
| 31 — Differential case half (flanged)         | 69 — Toothed hub                           | 109 — Hex. bolt                                 |
| 32 — Taper roller bearing (32215 A MGM)       | 70 — Pneumatic chamber cover               | —   |
| 33 — Toothed hub                              | 71 — Diaphragm                             | 119 — Shackle                                   |
| 34 — Differential lock clutch gear            | 72 — Clamp                                 | 120 — Hex. bolt                                 |
| 35 — Backing ring                             | 73 — Pneumatic chamber housing             | 121 — Washer                                    |
| 36 — Snap ring                                | 74 — Spring retainer                       | 122 — Reporting switch                          |
| 37 — Drive gear                               | 75 — Spring                                | 123 — Connecting                                |
| —   | 76 — Pilot pin                             | —   |



## SECTION 282

### REMOVING AND REINSTALLING THE MAIN DIFFERENTIAL

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

Remove the axle shaft as described in **Section 219**.

Remove the hex. flanged bolts (44) attaching the main differential to the axle and remove the differential.

#### REINSTALLING THE MAIN DIFFERENTIAL

As described in the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to flange of the

axle body and to connecting flange of the differential carrier I.

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

Tighten the bolts diagonally to **88 - 98 Nm** torque.

Install the axle shafts as described in **Section 219**.

## 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 flanged castle nut (1).

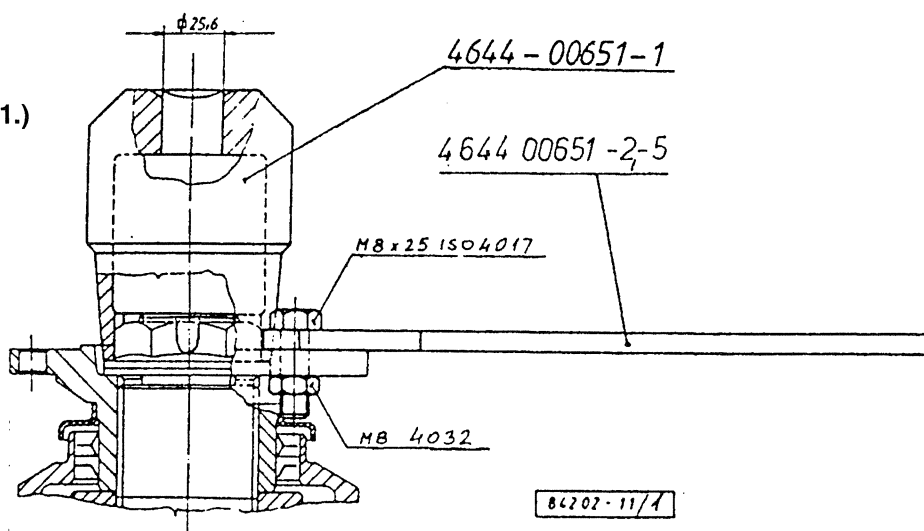
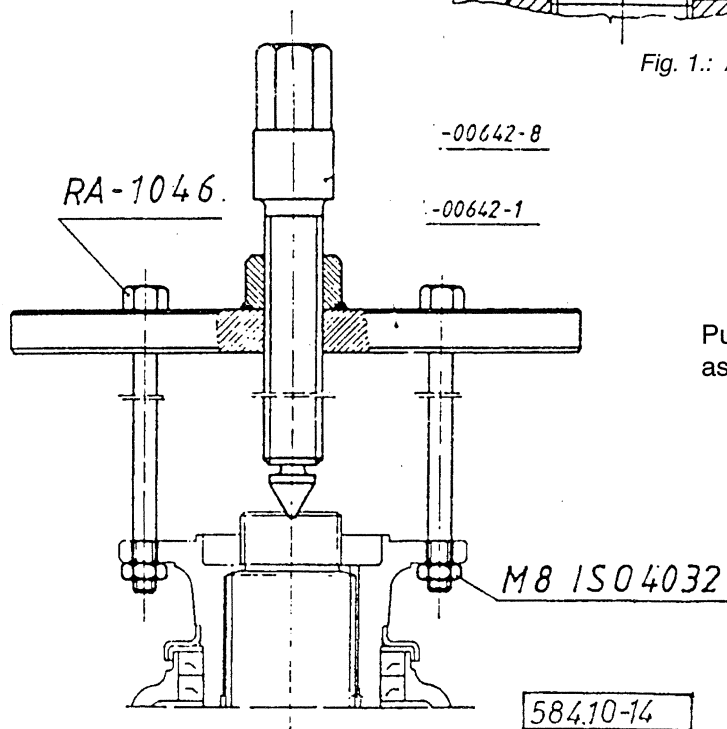


Fig. 1.: ASSEMBLING THE FLANGED CASTLE NUT



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

Fig. 2.: PULLING OFF THE COMPANION FLANGE





## REPLACING THE SEALING RINGS IN THE COVER

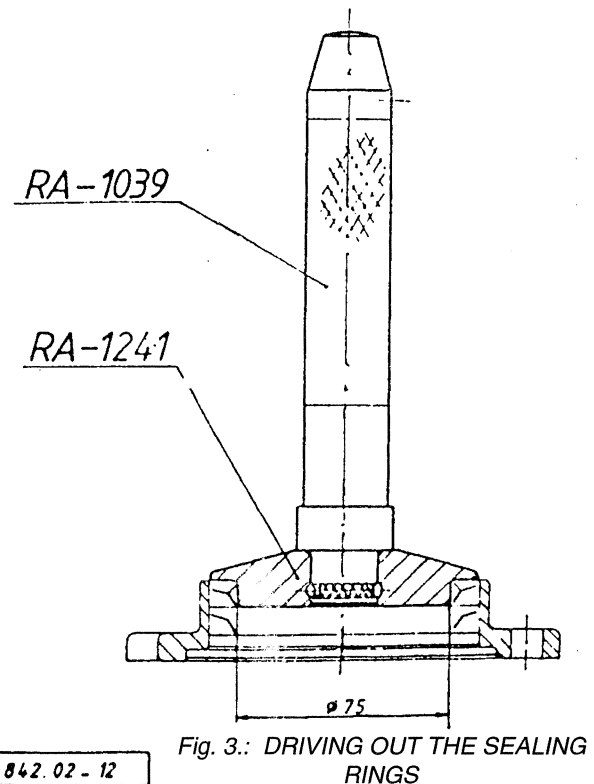
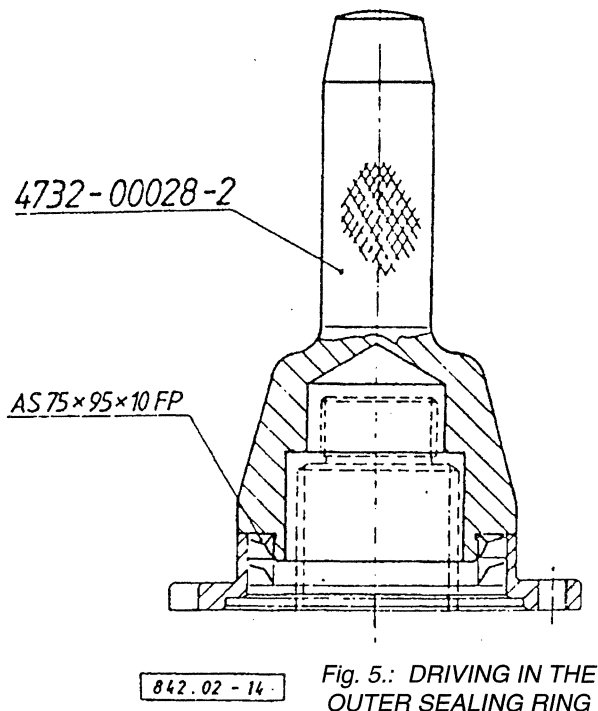
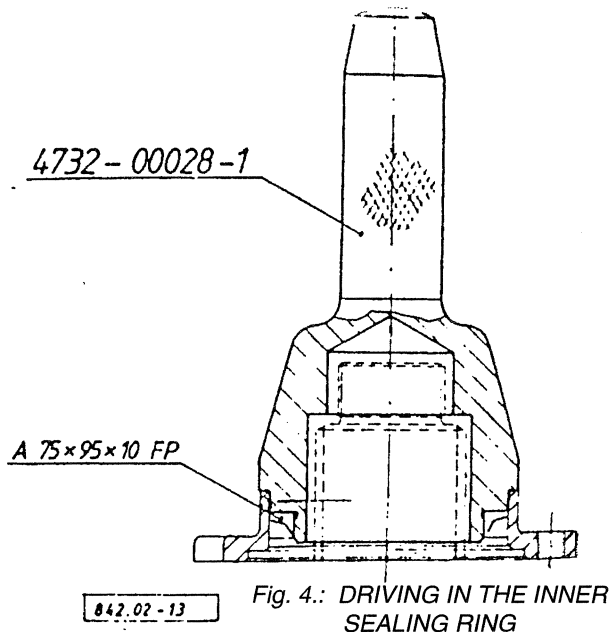
Back out the hex. bolts (6) and remove the cover (5) and the shims (67).

By means of the tools shown remove the used sealing rings (4) from the cover (Fig. 3.).

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

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

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



## INSTALLING THE COVER

When installing the cover adjust the axial play of the input shaft as described in **Section 293.**, then as described in the **"GENERAL SERVICE INSTRUCTIONS"** apply oil-proof 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 **58.8 - 78.4 Nm** torque.

## INSTALLING THE COMPANION FLANGE

Fitting to splines of the input shaft drive on the companion flange I. (3) by tool (as per Fig. 2. Section 313) until bottoms out, making sure not to damage the sealing rings. Install the washer (2) and the flanged castle nut (1). By means of tools shown in Fig. 1. tighten the nut to **540 - 590 Nm** torque and secure with cotter (107).

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

The axial play should be between **0.05 - 0.25 mm**. Adjust this value, if required, by selecting the proper thickness shim pack (67).

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



## REMOVING AND REINSTALLING THE THRU-DRIVE SHAFT

### REMOVING THE THRU-DRIVE SHAFT

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

By means of a simple pry remove the sealing rings (4). Remove 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 the flanged castle nut (1) as shown in **Fig. 1**.

If replacement of the deep-groove ball bearing (98) is required, properly back-up the bearing and tap the thru-drive shaft out of the bearing.

### REMOVING AND REINSTALLING THE BEARING CAGE

After backing out the hex. bolts (109) the bearing cage (108) can be removed from the axle housing.

As described in the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to the bearing cage face inside the bolt bores.

When reinstalling the bearing cage make sure to check if the oil baffle plate flange faces downward. Secure the bearing cage by the hex. bolts applied with thread locker and tighten the bolts to **39 - 49 Nm** torque.

### 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.

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**).

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 flush with outer edge of the bearing cage.

Apply specified grease between the sealing lip and the dust protection edge of the outer sealing rings, and thin coat of grease to the inner one.

As described in the **Section 283** install the companion flange II. (105) to the shaft end, position the washer and secure by flanged castle nut tightened to **540 - 590 Nm** torque and secure with cotter. Rotate the thru-drive shaft and check for even run, free of jamming and jerks.

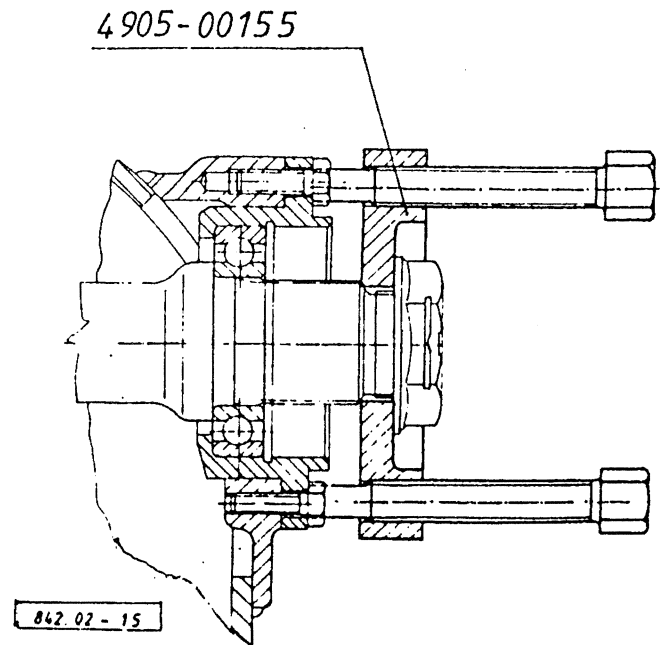


Fig. 1.: PULLING OUT THE THRU-DRIVE SHAFT

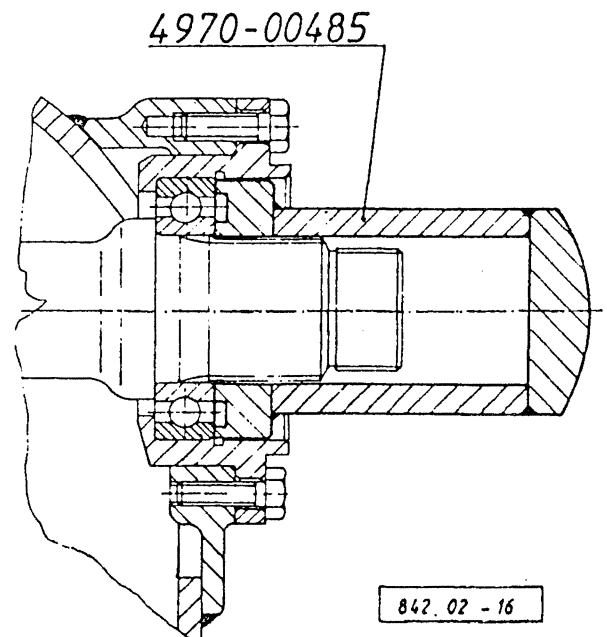


Fig. 2.: REINSTALLING THE THRU-DRIVE SHAFT



## SECTION 285

### REMOVING THE INPUT SHAFT AND DIFFERENTIAL CARRIER III.

After removing the companion flange I (3) and the cover (5) remove the hex. flanged bolts (14) from the outer flange 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 gear II (85) assembled with pinion drive spur gear (82), the differential and the differential gear I (91) assembled with inner race of the taper roller bearing 32014 X (92).

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

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.)

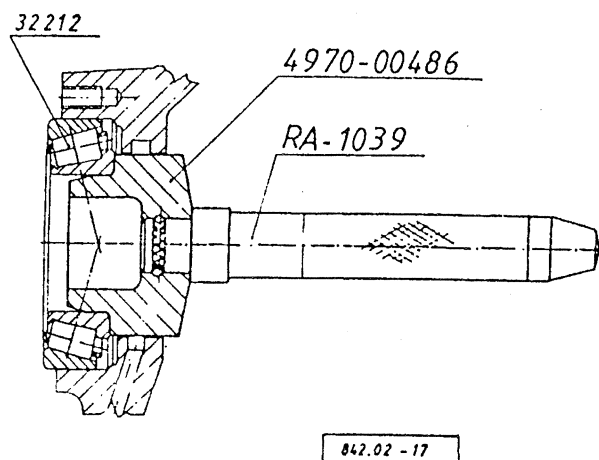


Fig. 1.: DRIVING OUT THE TAPER ROLLER BEARING

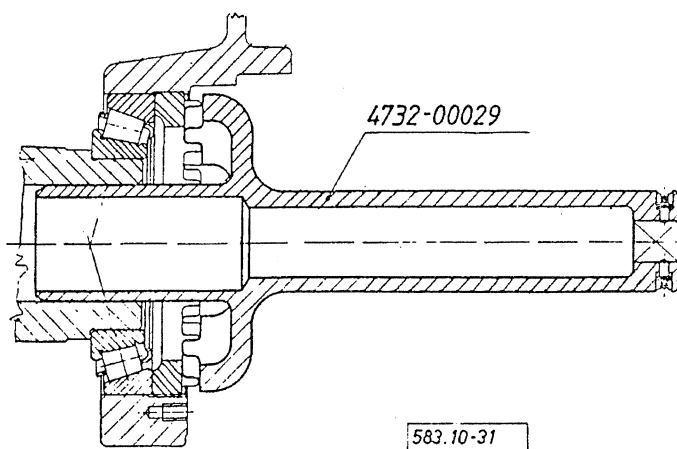


Fig. 1.: REMOVING THE BEARING ADJUSTERS

## SECTION 287

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

As described in 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 both sides (see Fig. 1.).

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

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

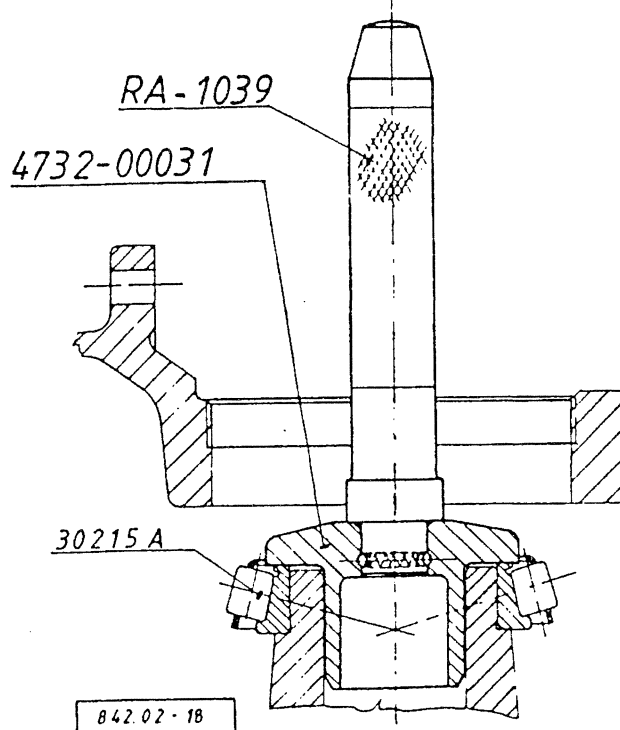


Fig. 2.: DRIVING ON THE TAPER ROLLER BEARING INNER RACE



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**.

### 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 differential shall be supported by its flanged case half.

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**).

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**).

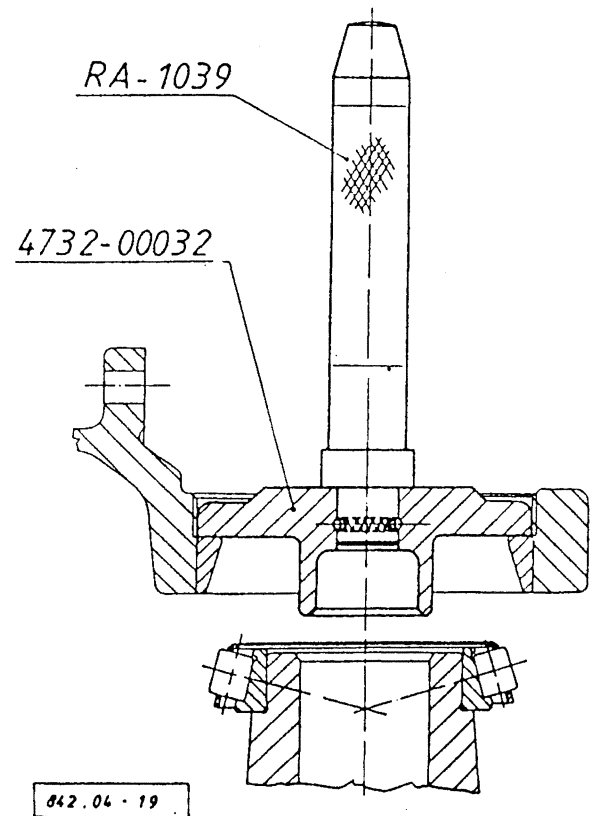


Fig. 3.: DRIVING IN THE TAPER ROLLER BEARING CUP

Screw in the bearing adjuster (20).

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

Screw in the bearing adjuster (20).

### ADJUSTING THE BACKLASH AND THE BEARING PRELOAD

By means of the bearing adjusters adjust the drive pinion to gear backlash of GLEASON toothing to **0.25 - 0.33 mm**.

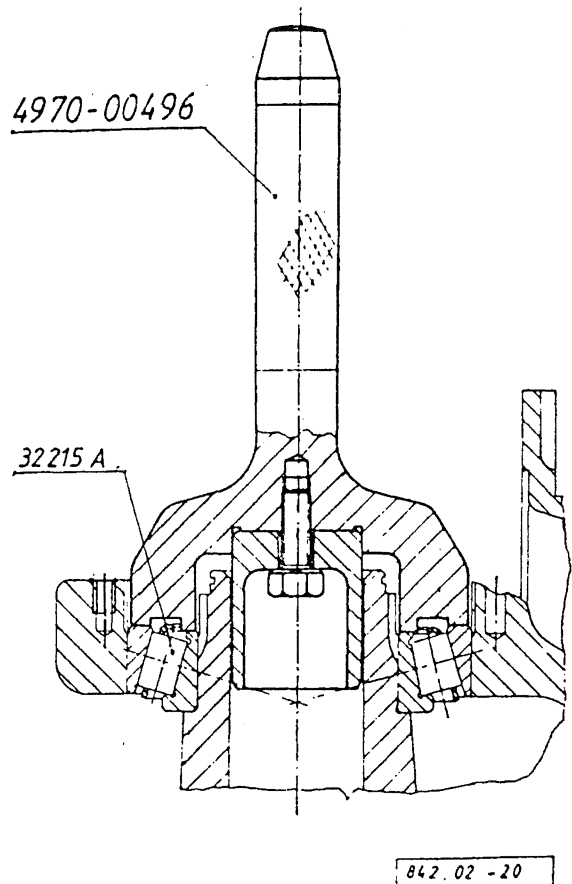


Fig. 4.: DRIVING THE TAPER ROLLER BEARING TO THE SPLINED SHAFT-END



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.

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

### 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.

### 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 figure 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.

### 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**).

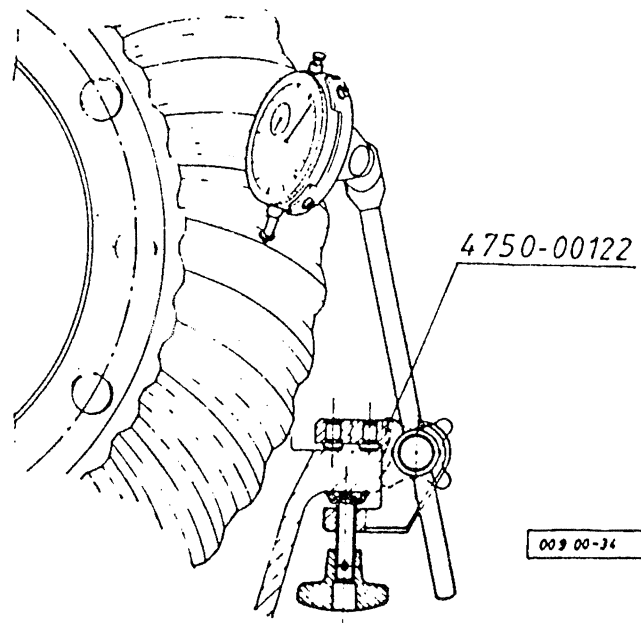


Fig. 5.: CHECKING THE BACKLASH

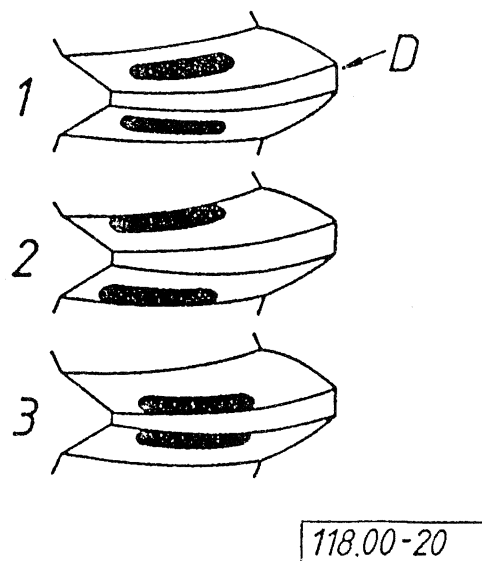


Fig. 6.: THE CONTACT PATTERN

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 (**23**) to flats of the bolts.

When the adjustment and the operation is proper, remove bearing cage assembled with drive pinion and according to the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to the inner flange, then fit back the differential carrier II and secure by hex. flanged bolts (**14**) coated with thread locker. Diagonally tighten the bolts to **88 - 108 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**).



## DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL

Pull the inner race 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).

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

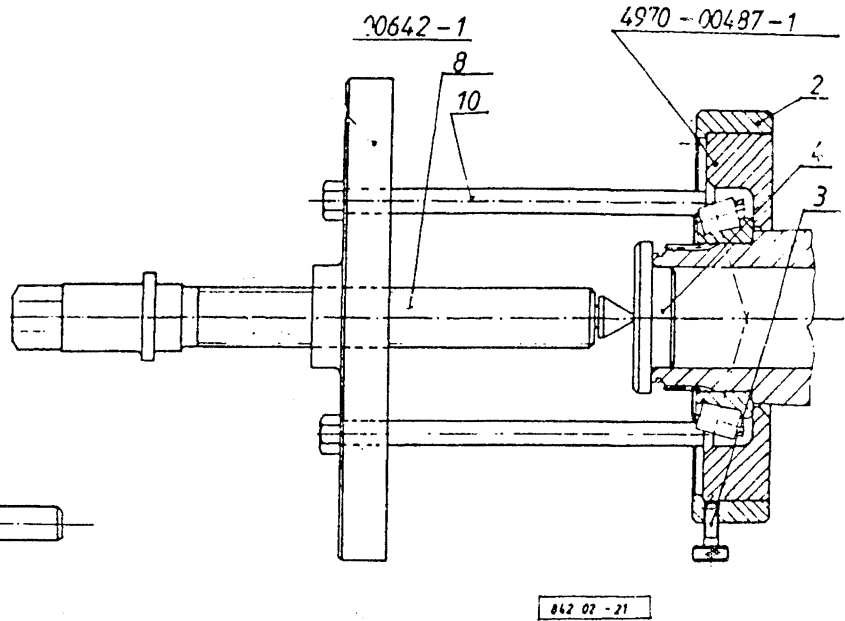


Fig. 1.: PULLING OFF THE TAPER ROLLER BEARING CONES

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

The match-marks indicate the identification 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 match pairs, thus assemble only match-marked case halves according to the marks.

Pull the flanged 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 fit 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 should roll evenly and smoothly without jamming and jerks.

Apply thin coat of oil to the mating surface of the drive gear. Aligning the bores position the drive gear to the flanged differential case half. Thru the flange bore drive 4 hex. bolts with completely screwed on nut into the drive

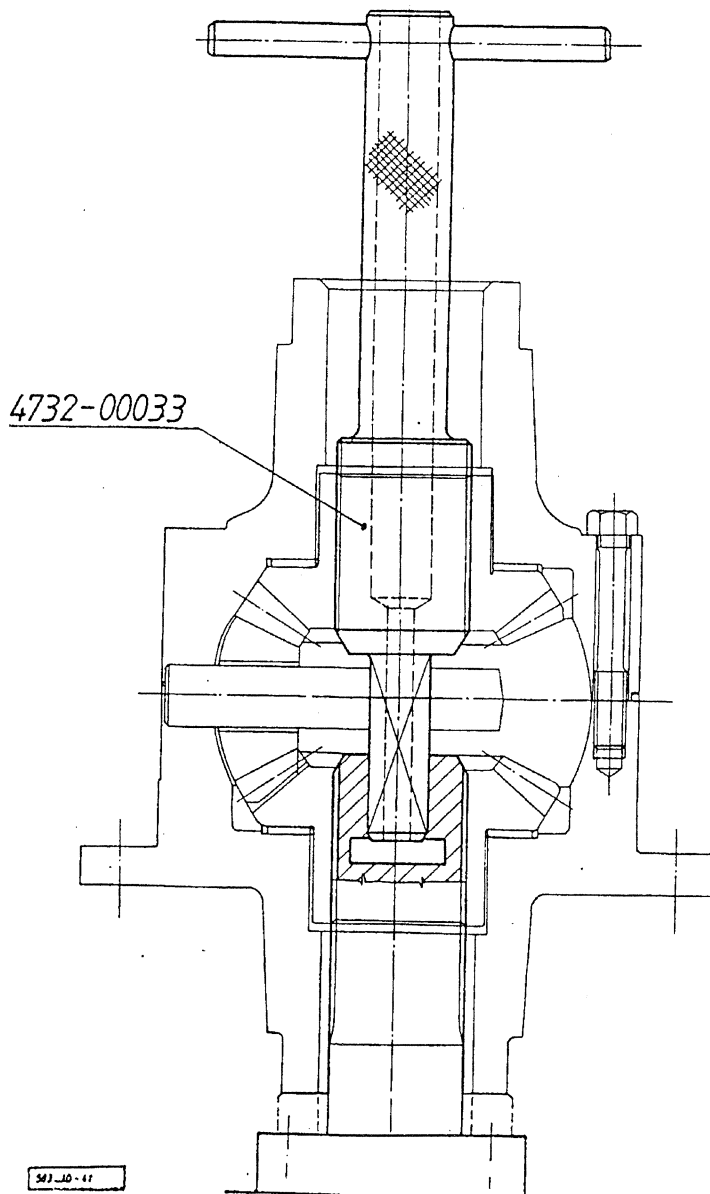


Fig. 2.: ASSEMBLING AND CHECKING THE DIFFERENTIAL



gear and gradually screwing the nuts completely pull on the drive gear to bottom out (**Fig. 3.**).

Secure the drive gear by means of hex. bolts and lock plates (at place of the puller bolts, as well) applied with thread locker and tighten the bolts to **98 - 118 Nm** torque and secure with lock plates (**40**) too.

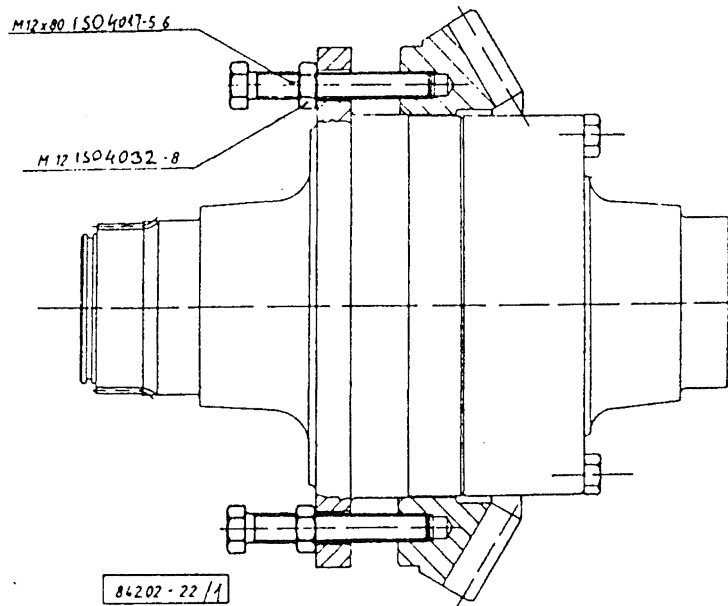


Fig. 3.: PULLING ON THE DRIVE GEAR

## SECTION 289

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

If the drive pinion (**169**) or its bearings are to be replaced remove the differential carrier II from the differential carrier I (**15**).

By means of the wrench extension remove the hex. flanged bolts (**14**) from the inner flange.

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 specified 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 the flange 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 the 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 hex. flanged bolts tightened to **88 - 108 Nm** torque.

According to **Fig. 1. of Section 316** install the axis distance adjusting device. Set the dial indicator on the accessory of the device at **88 mm** data to zero, then measure the axis distance and check if it is identical to that written into end of the drive pinion. In case of identity the adjustment is proper, otherwise perform correction by replacing the shims (**13**) to obtain the given value.

Permitted deviation is  $\pm 0.025$  mm.

For measuring the axis distance refer to **Fig. 1. of Section 316**.

After adjusting the axis distance reinstall the differential and adjust the contact pattern according to the **Section 287**.



## 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 (see Fig. 1.).

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

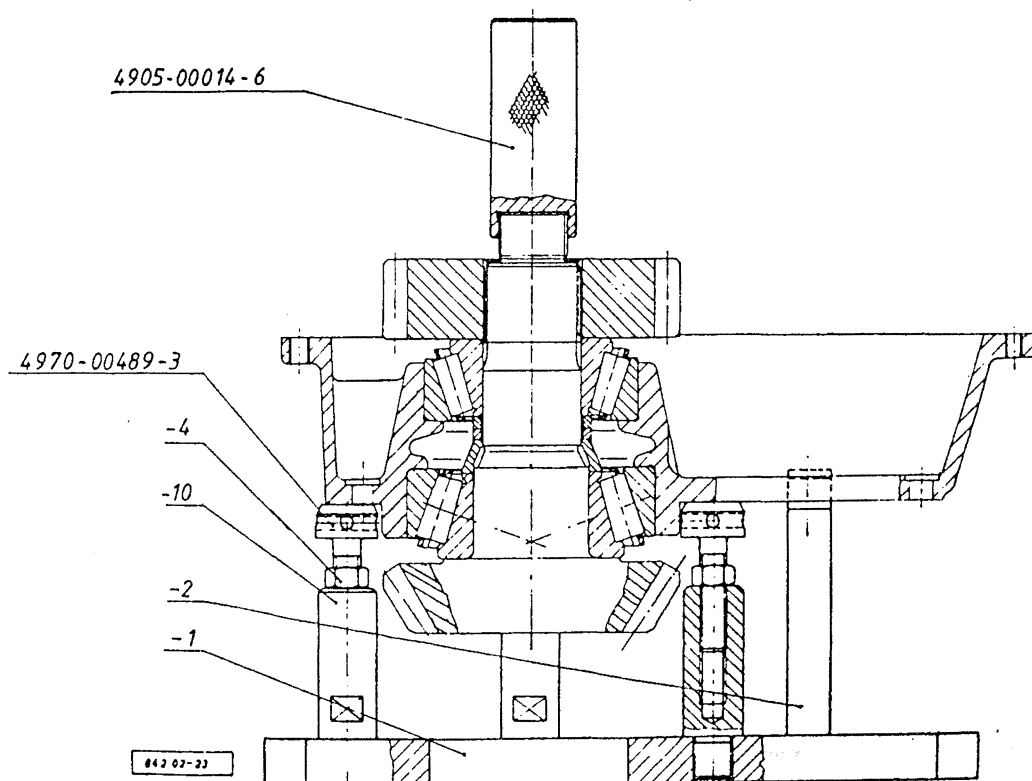


Fig. 1.: DRIVING OUT THE DRIVE PINION

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

From the differential carrier II press out the taper roller bearing cups (as shown in Fig. 2. and 3. of Section 317).

### REASSEMBLING THE DIFFERENTIAL CARRIER II

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

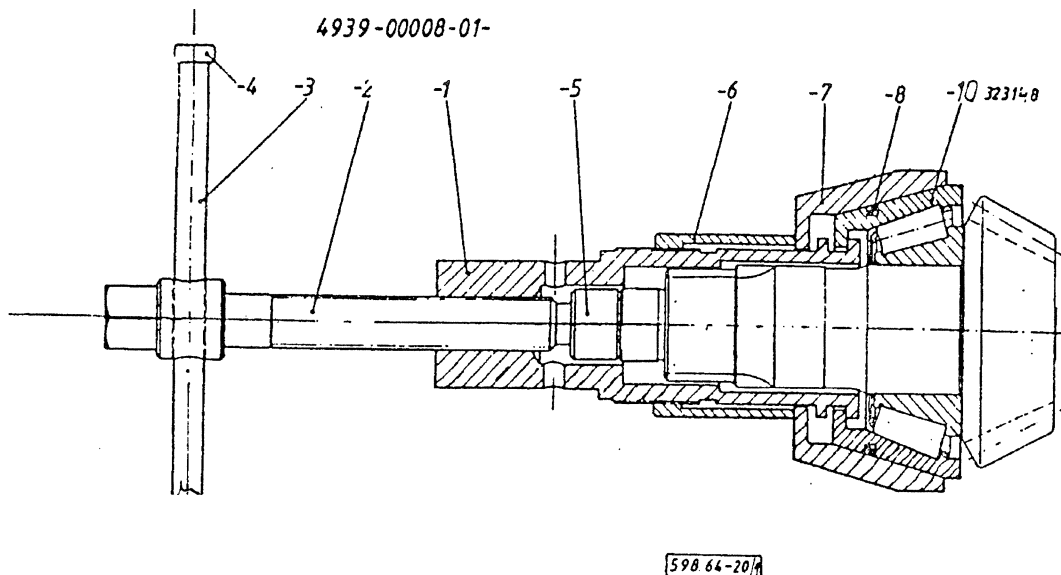


Fig. 2.: PULLING OFF THE TAPER ROLLER BEARING CONE





Drive in the taper roller bearing cups by means of the tools shown, bottom out (see Fig. 3.).

After subassembling the differential carrier II with the taper roller bearing cups adjust the specified bearing preload.

The distance between the outer taper roller bearing cone and the distance sleeve may vary between **13.890 to 14.715 mm**. For selecting the proper distance ring (10) this distance should be determined by measurement (X in Fig. 4.).

Position the inner taper roller bearing cone, the distance sleeve (11) and distance ring for filling 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). Position the washer (2) and screw on the flanged castle nut (1) (Fig. 4.).

Tighten the nut to **540 - 590 Nm** torque and position the subassembled unit to the shown stand (Fig. 4.) and measure the rolling torque by means of fish-scale attached with cord to mantle of the driven gear (50).

In case of new bearings installed the rolling torque at approx. **50 rpm** should be **10.8 - 18.5 N** with **Ø180 mm** driven gear, while **11.5 - 19.6 N** with that of **Ø170**, which corresponds to **1.0 - 1.7 Nm** rolling torque.

In case of reused bearings adjust the rolling torque to **0.5 - 0.85 Nm** (i.e. to half of the rolling torque at new bearings).

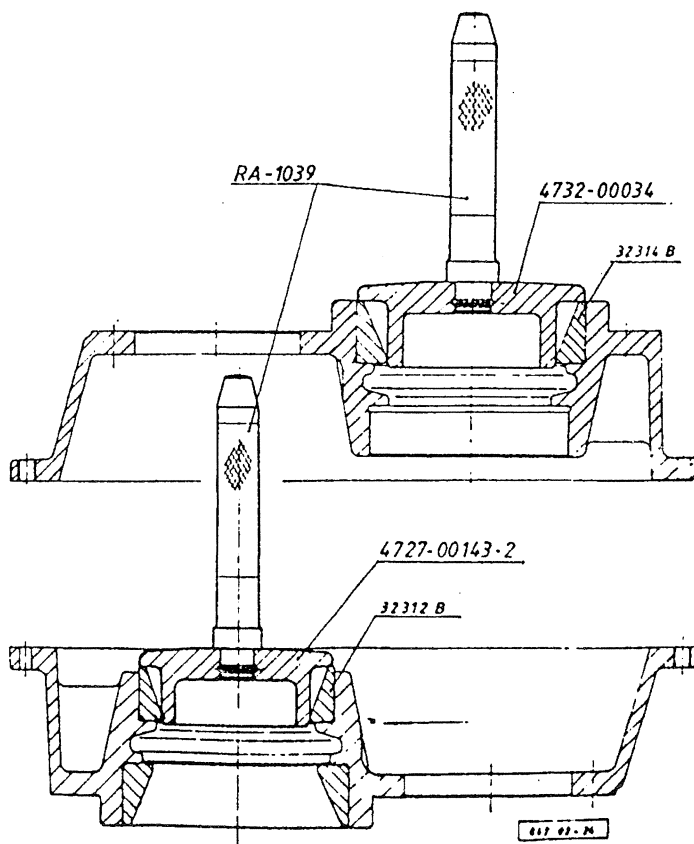


Fig. 3.: DRIVING THE TAPER ROLLER BEARING CUPS INTO THE DIFFERENTIAL CARRIER II

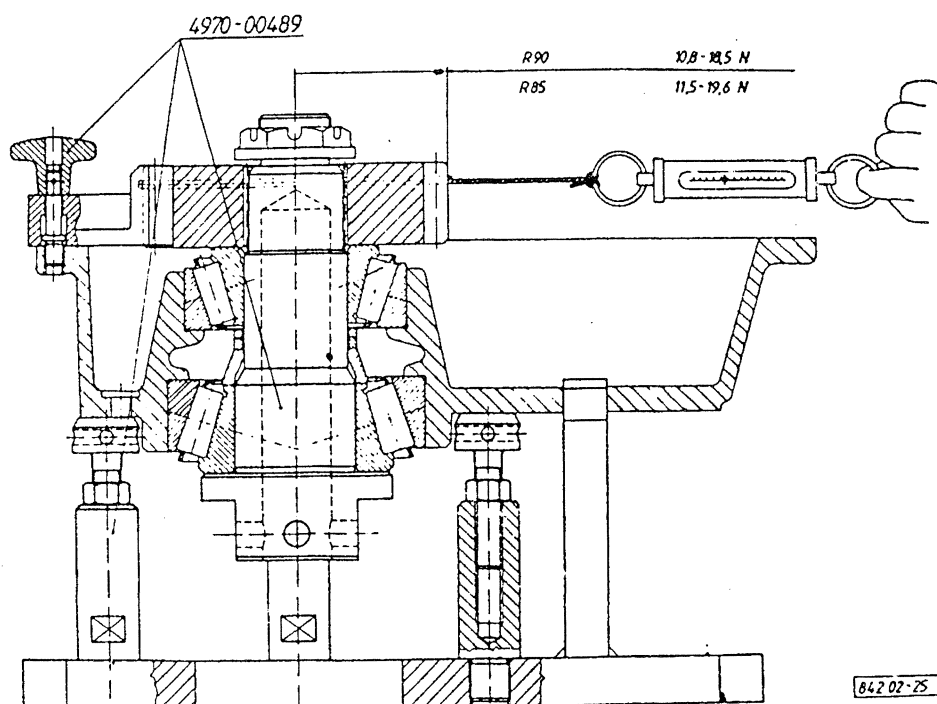


Fig. 4.: ADJUSTING THE BEARING PRELOAD



In case of deviation from this value perform correction by replacing the distance ring. If the rolling torque is higher than specified use higher distance ring, while at lower torque use lower one.

When the adjustment is proper adjustment 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.

### REINSTALLING THE DRIVE PINION

By means of the tools shown drive the inner taper roller bearing cone onto the drive pinion to bottom out (**see Fig. 7. of Section 317**).

Position the distance sleeve (11), the previously selected distance ring (10) the differential carrier II subassembled

with bearing outer races, then by means of drive sleeve drive on the cone of outer taper roller bearing to bottom out taking care of proper connection of the taper roller bearings.

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

Position the drive pinion subassembled in this way to stand of the adjusting device, secure the driven gear by lock of the device shown in **Fig. 4.** and tighten the self-lock nut to **540 - 590 Nm** torque.

Measure the rolling torque by fish-scale as described above and if required perform correction until the specified value is obtained.

## SECTION 292

### REINSTALLING THE INPUT SHAFT AND THE DIFFERENTIAL CARRIER III

If the inner taper roller bearing of the input shaft is to be replaced also, drive its cup out of the differential carrier I by means of the tools shown (**see Fig. 1.** ).

By means of the tools shown drive the taper roller bearing cup into its seat to bottom out (**see Fig. 2.**).

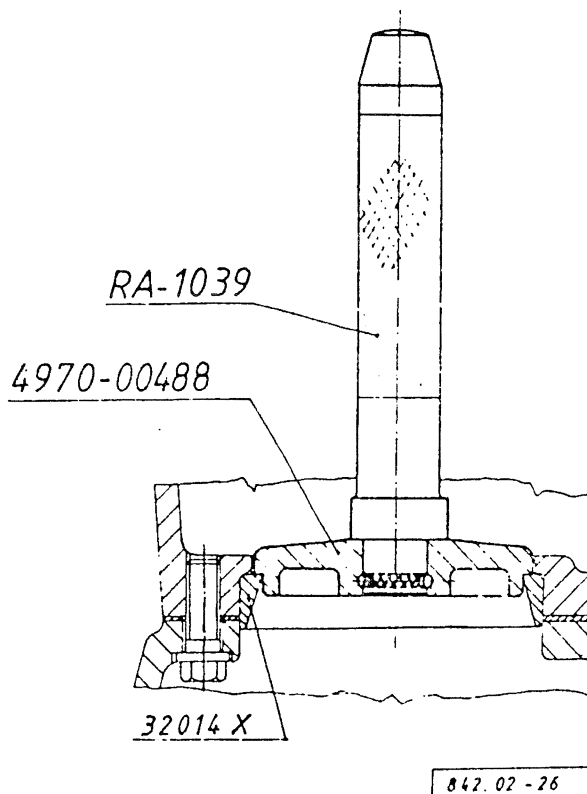


Fig. 1.: DRIVING OUT THE TAPER ROLLER BEARING CUP

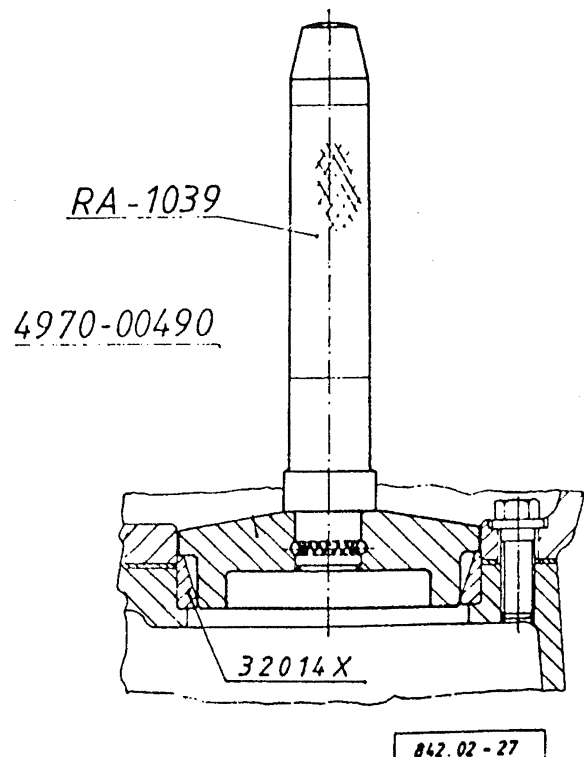


Fig. 2.: DRIVING IN THE TAPER ROLLER BEARING CUP



By means of the tools shown drive the cone of taper roller bearing **32014 X** onto the differential gear I (**91**) to bottom out (see Fig. 3.).

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.).

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

### SUBASSEMBLING THE INTER-AXLE DIFFERENTIAL CASE

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 is proper. 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 slide 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

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-proof surface sealant 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 **58.8 - 78.6 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 flange of the differential carrier II shall face upward.

Install the differential gear subassembled with bearing cone (as shown in Fig. 3.), the subassembled differential to cup of the previously pressed in taper roller bearing **32014 X** (**92**), then the pinion drive spur gear subassembled as per Fig. 4.

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-proof surface sealant to flange of the differential carrier.

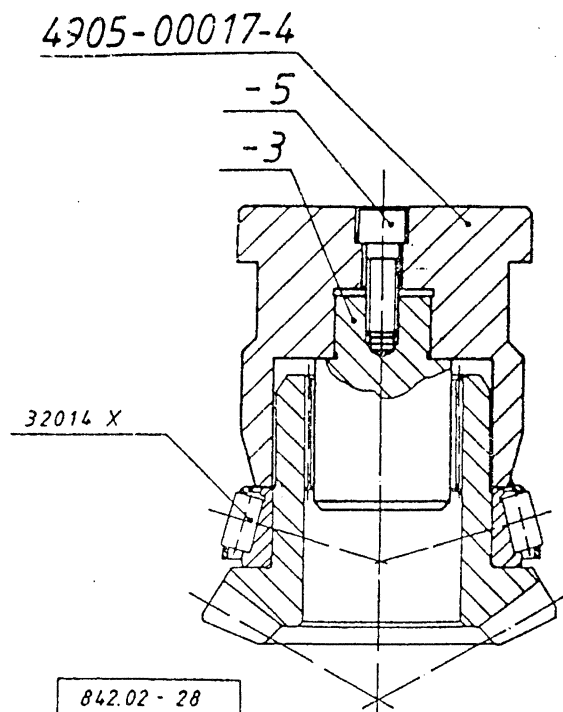


Fig. 3.: DRIVING ON THE TAPER ROLLER BEARING CONE

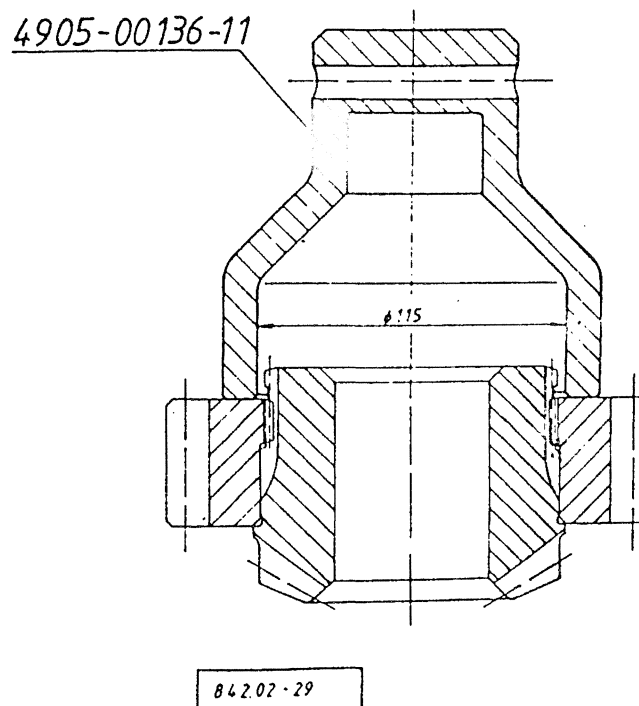


Fig. 4.: DRIVING THE PINION DRIVE SPUR GEAR ONTO THE DIFFERENTIAL GEAR II

After aligning the bores fit the subassembled carrier III together with the input shaft by means of dowel pin to the differential carrier II and the connected parts and clamp the carrier halves together by means of hex. flanged bolts (**14**) coated with thread locker and tightened to **88 - 98 Nm** torque.



## INSTALLING THE OUTER TAPER ROLLING BEARING TO THE INPUT SHAFT

Heat up the cone of the outer taper roller bearing 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.).

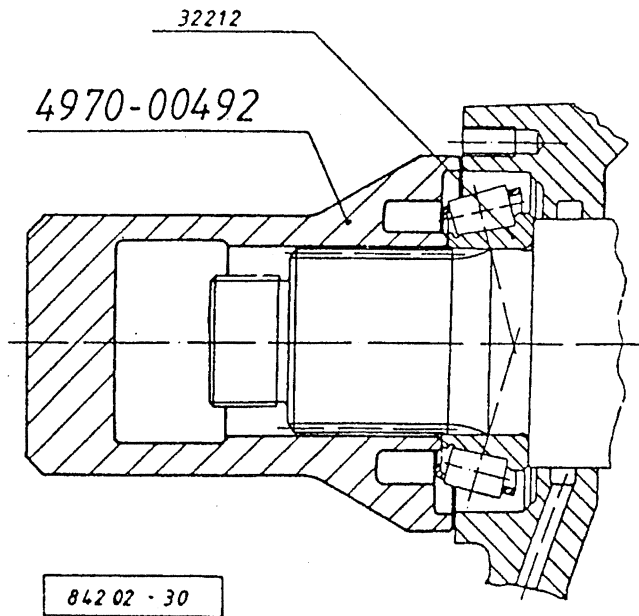


Fig. 5.: DRIVING ON THE OUTER TAPER ROLLER BEARING CONE

Fit the outer race of the previous bearing into the differential carrier III and drive in by means of the same tool so, to fit 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.

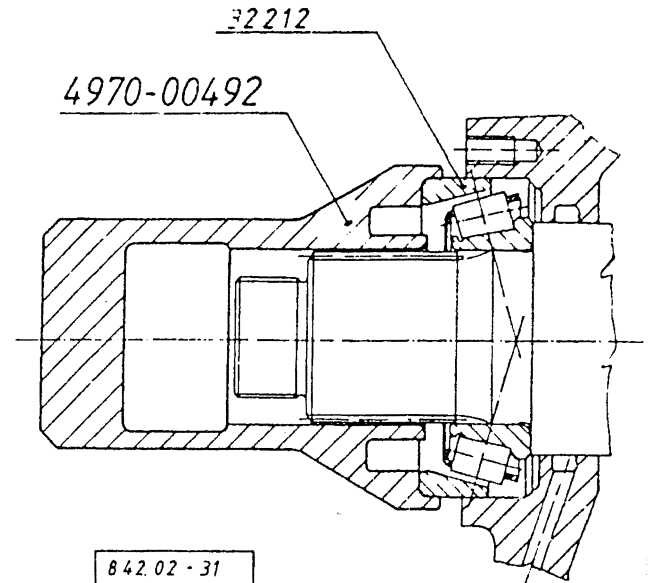


Fig. 6.: DRIVING IN THE OUTER TAPER ROLLER BEARING CUP

## SECTION 293

### ADJUSTING AND CHECKING THE AXIAL PLAY OF THE INPUT SHAFT

Fit the outer race of the taper roller bearing 32213 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 (maximum 5) which assure 0.05 - 0.25 mm axial play.

As described in the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to corner surface of the protruding bearing section, then install the previ-

ously 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 flange (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 turning the companion flange with pry.

During check and axial play of 0.05 - 0.25 mm should be obtained. In case of deviation adjust the required value by means of shims (67).



## SECTION 294

### REPAIRING, REINSTALLING AND ADJUSTING THE INTER-AXLE DIFFERENTIAL LOCK

Remove the differential lock mechanism as described in the **Section 285**.

Perform repair of the pneumatic chamber as described in the **Section 318**.

#### REINSTALLING THE ACTUATING PNEUMATIC CHAMBER

As described in the “**GENERAL SERVICE INSTRUCTIONS**” apply oil-proof surface sealant to seating flange of the pneumatic chamber, then fit to the shift bar **(79)** and attach to the housing by **2 M8x15** hex. bolts and lock washers. Tighten the bolts to **29 - 39 Nm** torque.

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 electric wire.

Acuate the pneumatic chamber with 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.

## SECTION 295

### 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 bushings out of the covers.

After backing out the flanged 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 to flush with the sides surface.

Tap the lock pin into both sides of the pump case.

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

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.

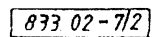
Punch secure the lock pin on the oil pump cover I **(65)** side against loosening.

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

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



### DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW



**Fig. 1.: DIFFERENTIAL CARRIER ASSEMBLY SECTIONAL VIEW**



## SECTION 311

### PARTS OF THE DIFFERENTIAL CARRIER ASSEMBLY

1 — Flanged castlenut	31 — Differential case half (with flange)
2 — Washer	32 — Taper roller bearing (32215 A MGM)
3 — Companion flange l.	33 — Toothed hub
4 — Sealing rings	34 — Differential lock clutch gear
5 — Cover	35 — Backing ring
6 — Hex. bolt	36 — Snap ring
7 — Lock washer	37 — Drive gear
8 — Bearing cage	—
9 — Taper roller bearing (32312 B X7 JU MGM)	39 — Hex. bolt
10 — Distance ring	40 — Lock plate
11 — Distance sleeve	43 — Oil baffle plate
12 — Taper roller bearing (32314 B X7 JU MGM)	—
13 — Shims	70 — Pneumatic chamber cover
14 — Hex. flanged bolt	71 — Diaphragm
15 — Differential carrier l.	72 — Clamp
16 — Drive pinion	73 — Pneumatic chamber housing
17 — Oil baffle plate	74 — Spring retainer
18 — Washer	75 — Spring
19 — Taper roller bearing (30215 A MGM)	76 — Pilot pin
20 — Bearing adjuster	77 — Stop insert
21 — Tab lock plate	78 — Shift yoke
22 — Hex. bolt	79 — Shift bar
23 — Lock plate	80 — Spring
24 — Differential case half	—
25 — Clamp bolt	119 — Shackle
26 — Spacer	120 — Hex. bolt
27 — Differential gear	121 — Washer
28 — Spider	122 — Reporting switch
29 — Differential pinion	123 — Connecting
30 — Shim	

## SECTION 312

### REMOVING AND REINSTALLING THE DIFFERENTIAL CARRIER ASSEMBLY

Before removing the differential carrier assembly from the axle drain the oil.

Remove the axle shaft as described in **Section 219**.

Remove the hex. flanged 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 the flange of

the axle body and to connecting flange of the differential carrier l.

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

Tighten the bolts diagonally to **88 - 98 Nm** torque.

Reinstall the axle shafts according to **Section 219**.



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

### REMOVING THE COMPANION FLANGE

Remove the flanged castle nut (1), then pull off the companion flange (Fig. 1. and 2. of Section 283).

### REPLACING THE OIL SEAL

Remove the cover (5).

Drive out the used seal by means of the tools shown (see Fig. 1.).

Drive the new sealing rings into the cover to flush with the side surface as shown in Fig. 4. and 5. of Section 283.

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

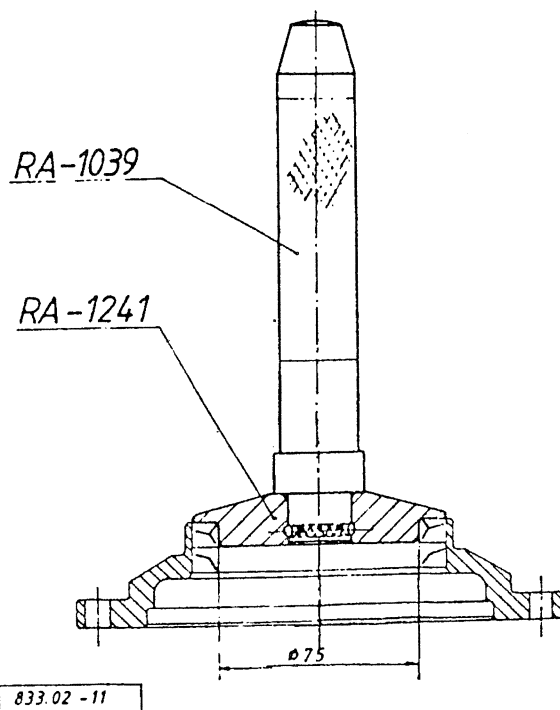


Fig. 1.: DRIVING OUT THE SEALING RINGS

### REINSTALLING THE COVER

As described in the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to inner flange 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

By means of the tool shown press the companion flange (3) to the drive pinion splines to bottom out (Fig.2.).

Install the washer (2), screw on flanged castle nut and tighten to 540 - 590 Nm torque.

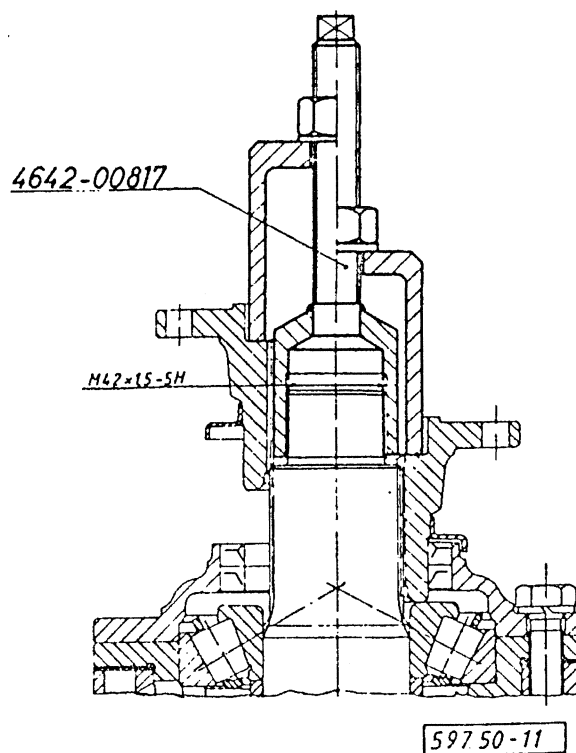


Fig. 2.: PRESSING ON THE COMPANION FLANGE

## REMOVING AND REINSTALLING, DISASSEMBLING AND REASSEMBLING THE DIFFERENTIAL, ADJUSTING THE BACKLASH AND THE CONTACT PATTERN

Refer to Section 287 and 288 "MAIN DIFFERENTIAL (FORWARD-REAR AXLE)".





## REMOVING AND REINSTALLING THE BEARING CAGE, ADJUSTING THE AXIS DISTANCE

Removing the hex. flanged 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 flange of the bearing cage out of the differential carrier and remove the shims from flange of the differential carrier.

### REINSTALLING THE BEARING CAGE TO THE DIFFERENTIAL CARRIER

After reassembling the bearing cage and adjusting the specified 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 into two opposite bores in the differential carrier, position 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. flanged bolts (14) driven into two opposite bores and tightened to 88 - 98 Nm torque.

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

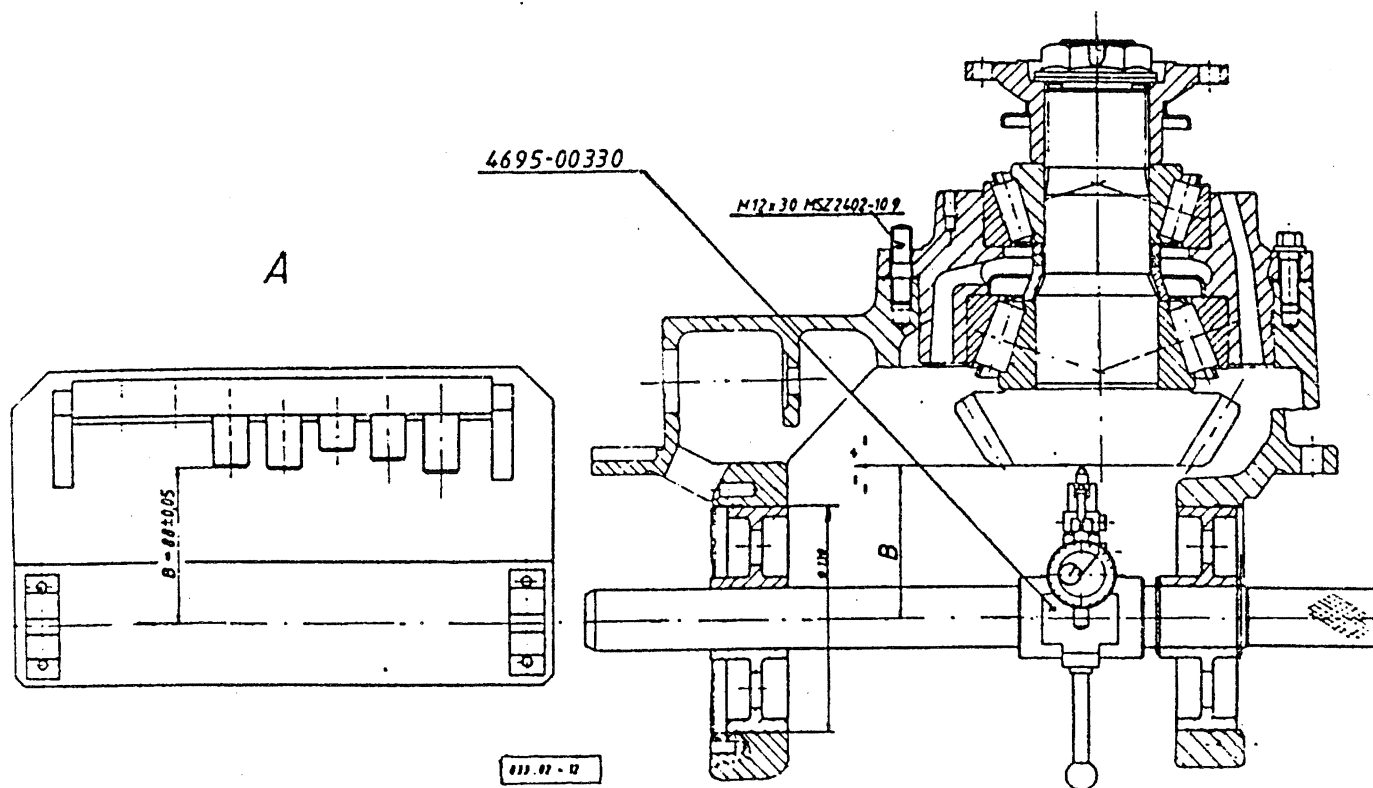


Fig. 1.: CALIBRATING THE AXIS DISTANCE

Insert the measuring device set to **B = 88.00 mm** into 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 identical deviations the adjustment is proper, otherwise obtain the specified value by selecting the proper shim pack (13). The permitted deviation is  $\pm 0.025$  mm.

E.g.: If the axis distance stated on the drive pinion is **+ 0.04**, the value "B" to be adjusted is **88.04  $\pm$  0.025 mm**.

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

### REINSTALLING THE BEARING CASE

In case of proper contact pattern adjustment and operation, remove the bearing cage assembled with drive pinion and according to the "GENERAL SERVICE INSTRUCTIONS" apply oil-proof surface sealant to the inner flange, then reinstall the bearing cage by means of hex. flanged bolts (14) coated with thread locker. Diagonally tighten the bolts to 88 - 98 Nm torque.



## SECTION 317

# DISASSEMBLING AND REASSEMBLING THE BEARING CAGE

By means of the device arranged from parts shown in the figure press the drive pinion (16) out of the removed bearing cage (8) (see Fig. 1.).

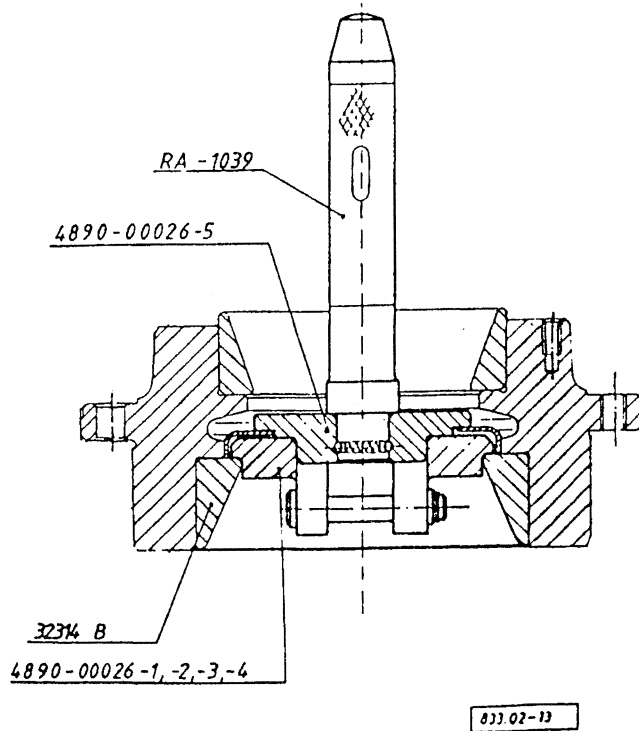


Fig. 1.: PRESSING OUT THE DRIVE PINION

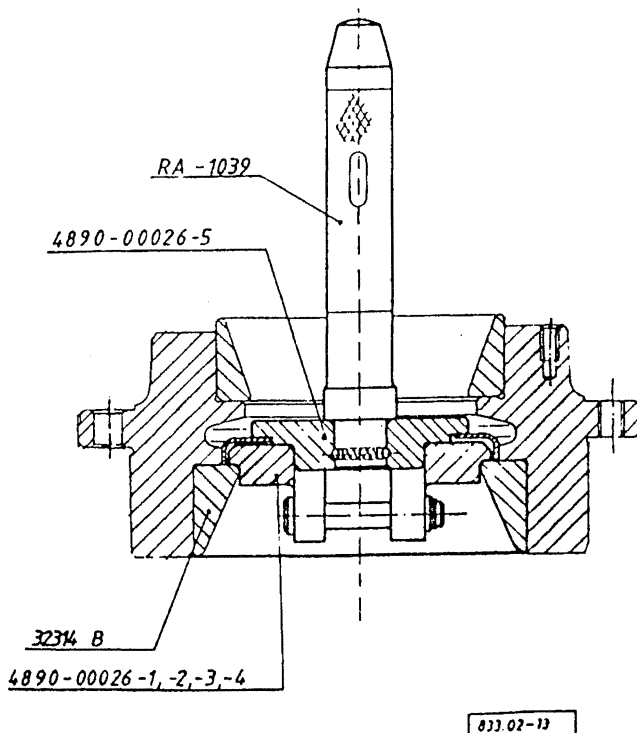


Fig. 2.: DRIVING OUT THE CUP OF THE INNER TAPER ROLLER BEARING

The drive pinion can also be removed by means of press, provided the flange of the bearing cage is properly backed up.

When pressing out the drive pinion (16) the inner race of the inner taper roller bearing cone remains on the pinion. Pull off the inner taper roller bearing cone (Fig. 2. of Section 290)

Properly backing the bearing cage drive the cup of the taper roller bearing out of the bearing cage by means of the tools shown (see Fig. 2.)

Turn the bearing cage over and by means of tools shown drive out the cup of the outer taper roller bearing (see Fig. 3.)

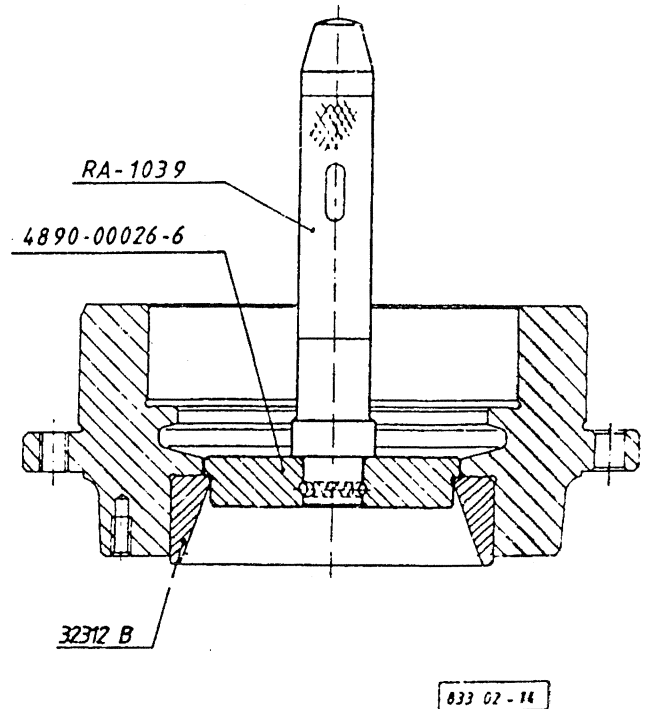


Fig. 3.: DRIVING OUT THE OUTER TAPER ROLLER BEARING CUP



Position the oil baffle plate (43) and the cup of the inner taper roller bearing (12) and by means of the tools shown drive into the bearing cage (Fig. 4.).

Turn the bearing cage over and by means of the tools shown drive in the cup of the outer taper roller bearing bottom out (see Fig. 5.).

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

The distance between the outer taper roller bearing cone and the distance sleeve may vary between **18.89 and 14.715 mm**. This distance should be determined by measurement for selecting the proper distance ring (10). (Dimension X in Fig. 6.).

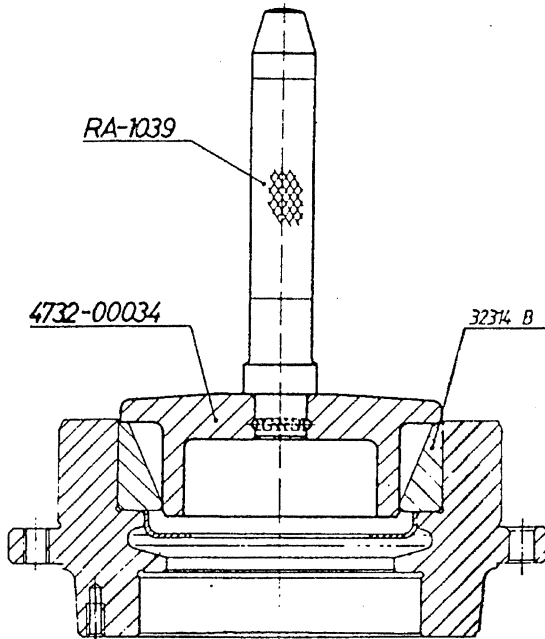


Fig. 4.: DRIVING IN THE CUP OF THE OUTER TAPER ROLLER BEARING

833 02 -15

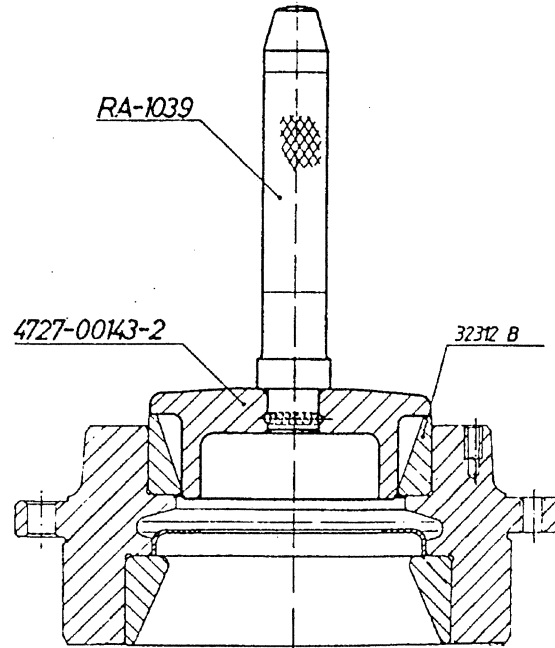


Fig. 5.: DRIVING IN THE CUP OF THE OUTER TAPER ROLLER BEARING

833 02 -16

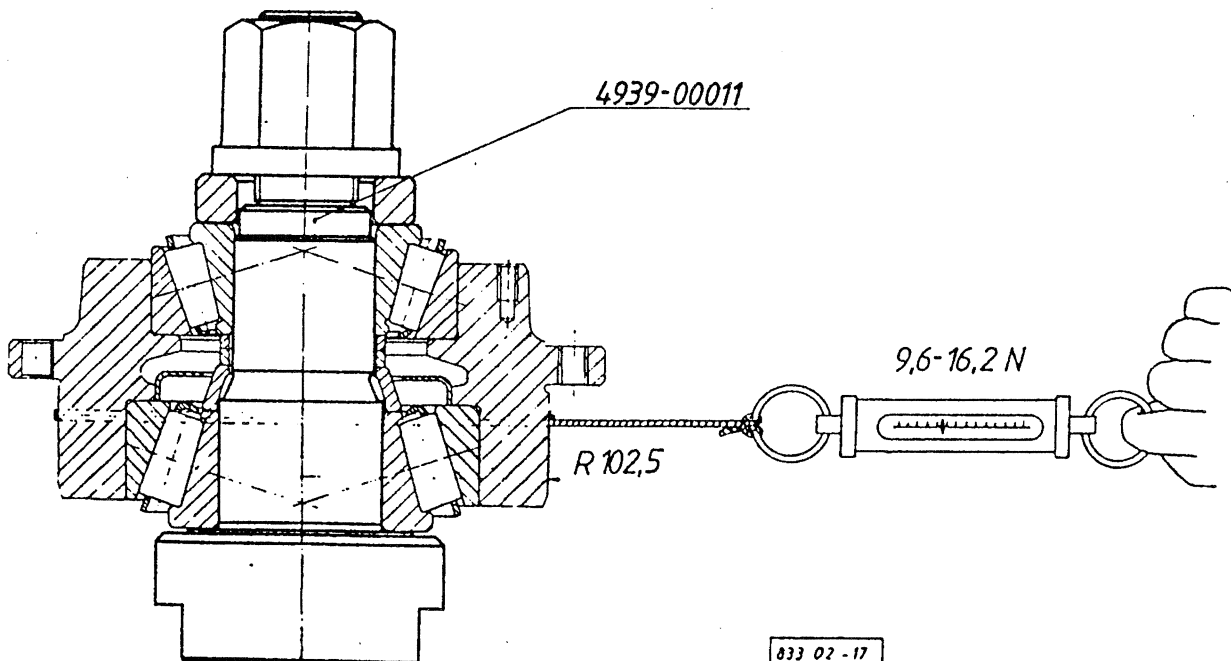


Fig. 6.: ADJUSTING THE BEARING PRELOAD

833 02 -17



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

Position the washer belonging to the master shaft to the bearing inner race, screw on the flanged nut of the device and tighten to **540 - 590 Nm** torque.

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

With new bearing installed the force obtained from the fish-scale at approx. **50 rpm** should be **9.6 - 16.2 N**, which corresponds to **1.0 - 1.7 Nm** torque.

Installing reused bearings adjust the rolling torque to **0.5 - 0.85 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.

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

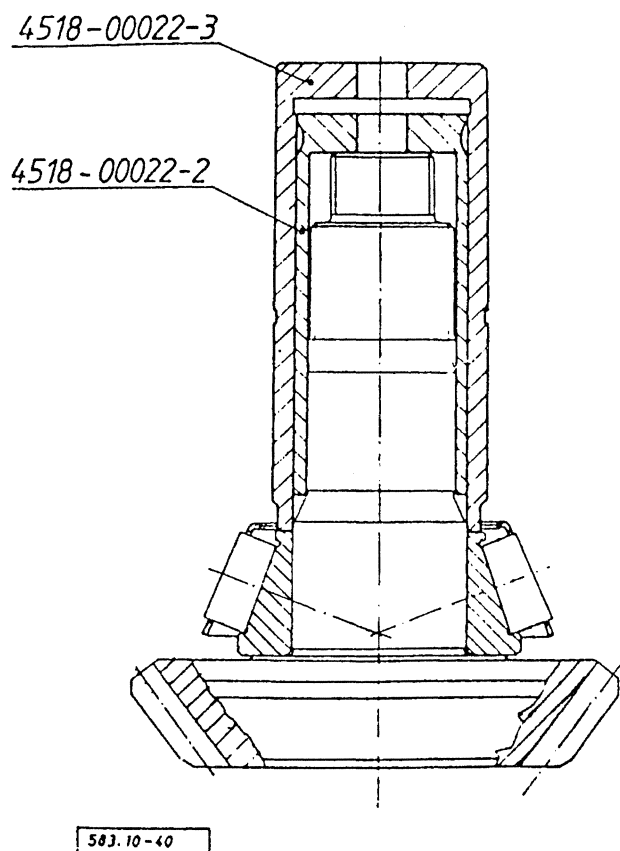


Fig. 7.: DRIVING ON THE INNER TAPER ROLLER BEARING CONE



Position the distance sleeve (11), the previously selected distance ring (10) and the bearing cage subassembled with bearing cups to the drive pinion stem, then by means of press sleeve 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 flange (3) to the drive pinion. Screw on the flanged castle nut (1) and tighten to **540 - 590 Nm** torque.

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

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

## SECTION 318

# REPAIRING, REINSTALLING, ADJUSTING THE CROSS DIFFERENTIAL LOCKS (AT FORWARD-REAR AND REAR-REAR AXLES)

## 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 **M8x15** 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 inserts (77), as well.

## REPAIRING THE PNEUMATIC CHAMBER

Remove the clamp (72) the housing (73) and the cover (70), then lift off the cover and the diaphragm 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 (Fig. 1.).

— The clamp (72) halves to be radically compressed in a device so as both halves totally fit on the cover and housing.

B=3.6 - 4.4 mm (Fig. 1.).

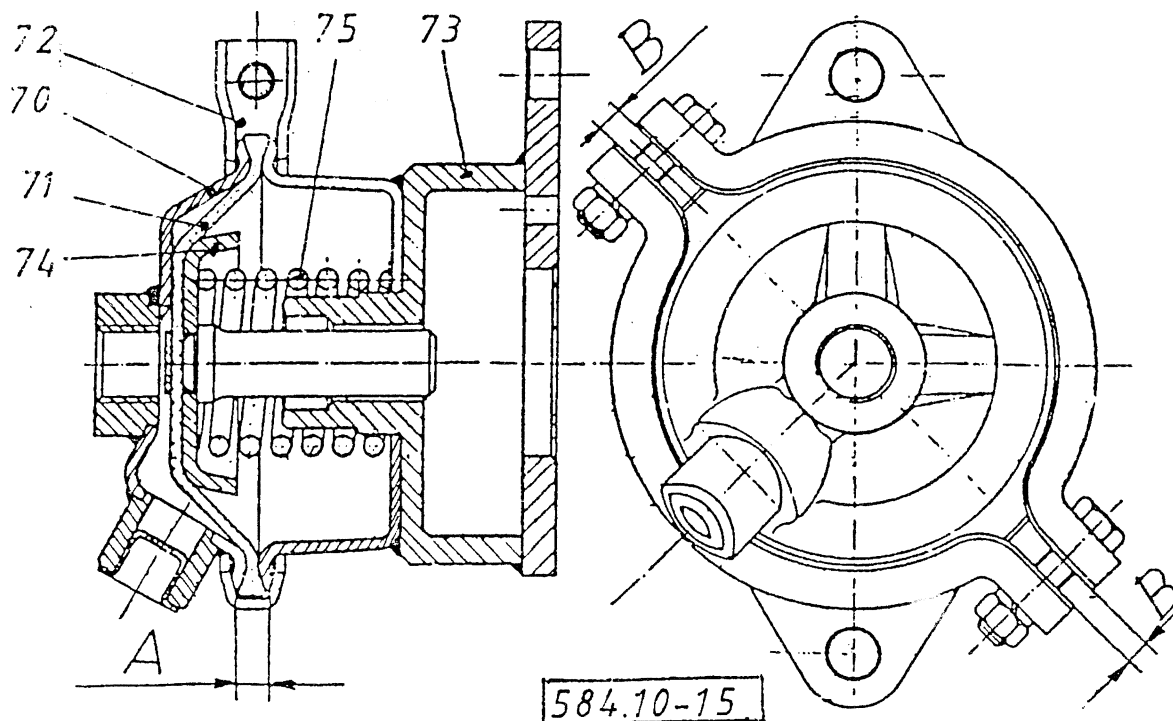


Fig. 1.: THE PNEUMATIC CHAMBER

— 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 trial pressure, no air leakage is permitted.

#### 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.

Install the toothed hub to the shift yoke with shackle (119) and hex. bolts (120). Position the shift yoke into the differential carrier with the stop inserts (77) and without spring (80), then screw in the shift bar (79).

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

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

#### REINSTALLING THE PNEUMATIC CHAMBER

Reinstall 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 the seating flange of the pneumatic chamber, then fit to the shift bar

(79) and attach to the housing by 2 **M8x15** hex. bolts and lock washers. Tighten the bolts to 29 - 39 Nm torque.

#### SECTION 395

### OIL FILL-UP, RUN, CHECK

According to the Operator's Manual fill up the finish assembled axle with oil to lower edge of the filler 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 fill-up 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 RUN 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 mechanism in the differential and the wheel hubs. The meshing gears should roll on one another smoothly 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 maximum 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.

**THE OIL PUMP OF THE DIFFERENTIAL CARRIER ASSEMBLY FOR PROPER DELIVERY:**

Check delivery by loosening the **M10** screw plug **(63)** on side of the oil pump.





13001 Magisterial Drive • Louisville, KY 40223  
(502) 253-0277 • (800) 227-0727 • Fax (502) 253-0317  
E-mail: [info@marmon-herrington.com](mailto:info@marmon-herrington.com)

JW06/99



# Marmon-Herrington *Literature Order Form*

Credit Card Orders Or Current Customers' Purchase Orders May Be Faxed — 502/253-0317

Sales Literature – No Charge	Part	Quantity	Parts Manuals:	Part	Price	Quantity	Extended Cost:
MVG 750 Transfer Case	TCSL001		MVG 750 Transfer Case	TCPM001	6.00		
MVG 1200 Transfer Case	TCSL002		MVG 1200 Transfer Case	TCPM002	6.00		
MVG 2000 Transfer Case	TCSL003		MVG 2000 Transfer Case	TCPM003	6.00		
MT 8 Axle	AXSL001		MT 8 Axle	AXPM001	6.00		
MT 10 Axle	AXSL002		MT 10 Axle	AXPM002	6.00		
MT 11 Axle	AXSL003		MT 11 Axle	AXPM003	6.00		
MT 14 Axle	AXSL004		MT 14 Axle	AXPM004	6.00		
MT 17 Axle	AXSL005		MT 17 Axle	AXPM005	6.00		
MT 22 Axle	AXSL006		MT 22 Axle	AXPM006	6.00		
MT 23 Axle	AXSL007		MT 23 Axle	AXPM007	6.00		
Driver Controlled Locking Differential	AXSL008		R/RF 22 Axle	AXPM008	6.00		
4 Page Brochure	PRBR001		<b>Repair Manuals:</b>				
<b>Total Sales Literature</b>			MVG 750 Transfer Case	TCRM001	10.00		
			MVG 1200 Transfer Case	TCRM002	10.00		
			MVG 2000 Transfer Case	TCRM003	10.00		
			MT10/MT11 Axles	ARM001	10.00		
			MT14/MT17 Axles	ARM002	10.00		
			MT22/MT23 Axles	ARM003	10.00		
			R/RF 22 Axle	ARM004	10.00		
			<b>Operators Manuals:</b>				
			Transfer Cases	OMTC-1	10.00		
			General	OMG-2	10.00		

## Method of Payment

- [ ] Check Enclosed
- [ ] Purchase Order/P.O. # \_\_\_\_\_  
(only w/current M-H Account)
- [ ] Mastercard/VISA – Card # \_\_\_\_\_  
Exp. Date \_\_\_\_\_

Authorized Card User's Signature: \_\_\_\_\_

<b>Sub Total:</b>		
<b>Total Quantity Sales Literature:</b>		No Charge
<b>KY Sales Tax:</b>		
<b>Shipping:</b> (included)		No Charge
<b>TOTAL Due:</b>		

## Ship Order to the following address

Company: _____	Telephone Number: _____
Name: _____	Fax Number: _____
Address: _____	Zip Code: _____
City/State: _____	Postal Code: _____
Country: _____	