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AXLE DRIVE - AXLE JOURNAL - PNEUMATIC GEARSHIFT ASSEMBLY Assy
group 090

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1 Works at mounted assemblies

1.1 Measure axle base model 716

Tools:

track and axle base measuring
gauge

905.3.42.301
standard

NOTE: Perfect wheel bearings and steering bolts are a precondition for measuring.

- 1 Jack up vehicle front and rear with suitable support benches under cross members (1).
- 2 Unscrew all wheels.

NOTE: Rear wheels must be lifted off from centering (2/1) at the brake disk in order not to distort the splash guard (2/2).

- 3 Clean contact surfaces as well as centering collar of disk wheels at the brake disks carefully and fasten measuring flanges (3) with 3 wheel screws each (spheric collar screws).

NOTE: Care for plane and centric position of measuring flanges.

- 4 Set brake disk of front wheel drive in true alignment to brake disk of rear wheel drive using a ruler (4). A uniform light slit indicates true alignment of the front brake disk to the rear one.

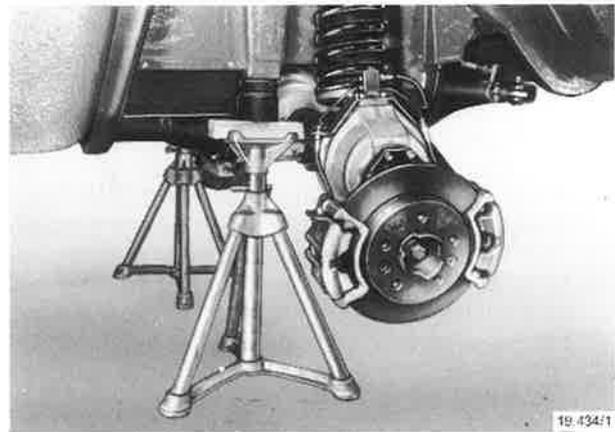


Fig. 1

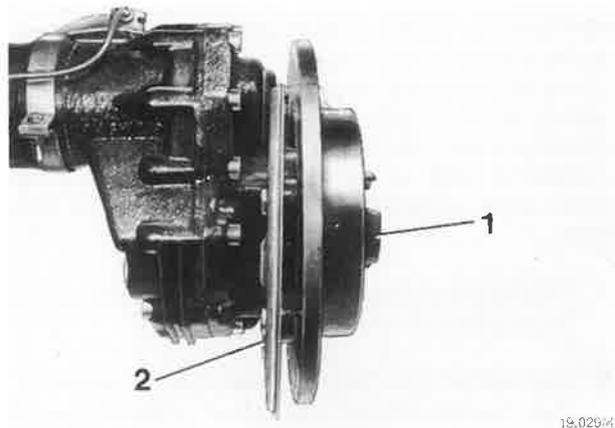


Fig. 2

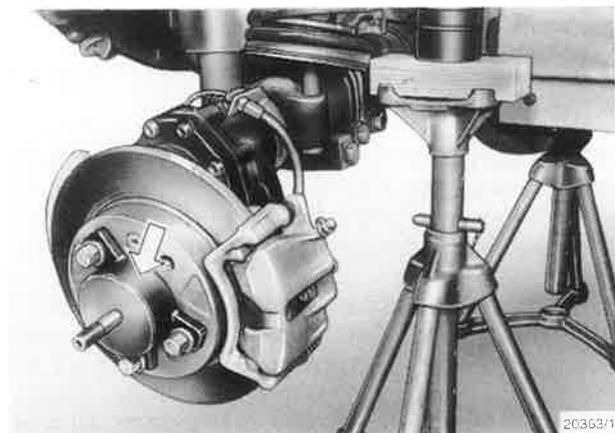


Fig. 3

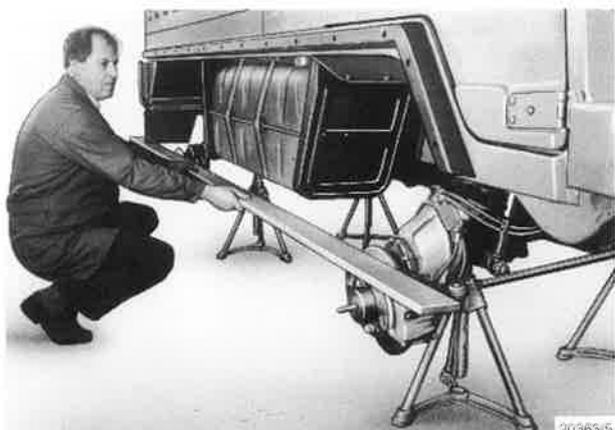


Fig. 4

- 5 Extract adjustable gauge rods one after another that measuring pins can be inserted completely into measuring flanges. Tighten clamping screws (5/1). Leave clamping screw (5/2) of smallest rod loosened.
- 6 Read off axle base and note down (5/3). Twist measuring flanges by 180° while clamping screw (5/2) of gauge rod remains loose and read off axle base again from scale and note down. The real axle base results from the mean value of the two measurements. Figure out axle base of the opposite side conforming to steps 3-6. The wheel base difference between left and right vehicle side must not exceed 2mm. Standard value of axle base at extended half-axes: 2407 ± 1 mm.

NOTE: If the standard values are remaining under or above the permissible tolerances, further measurements are required in order to find out and consequently eliminate the damaged half-axle. Differing axle bases might be also due to a damaged supporting tube as well as worn out bores of the wheel drive centering bolts can also affect the axle base.

- 7 Determine position of rear axle housing by applying a gradient water level (6).
- 8 Fit measuring flanges (7/1) and gauge beams (7/2) at the rear axle left and right. Adjust both gauge beams in same position as rear axle housing using gradient water level. Bores (7/3) for inserting centering pins must point to the same direction.
- 9 Insert gauge rod into gauge beams and read off value (8).

NOTE: Counterbalance 30 mm axle offset through adding a distance piece at the side of the measuring scale. When inserting gauge rod take care not to change gauge beams position (wrong measurement!).

- 10 Twist gauge beam by 180° and adjust in position of axle housing again by applying a gradient water level. Insert gauge beam and read off value. The difference of the measured values before and behind the axle must not exceed 2 mm.

NOTE: If parallelity of rear wheel flanges is within permissible tolerance, and if differing values have resulted from the comparative axle base measurement, now based on the two measurements the damaged left or right front half-axle can be eliminated.

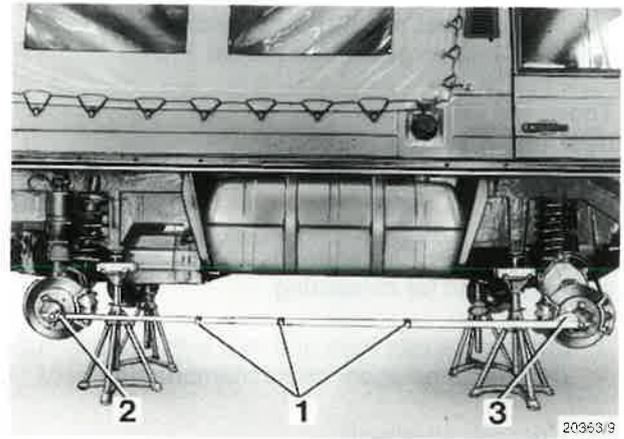


Fig. 5

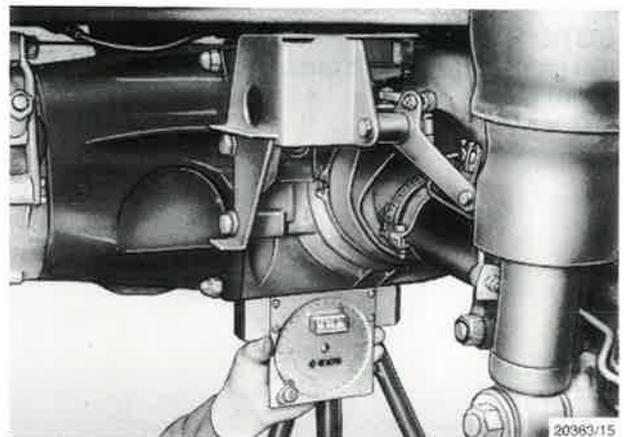


Fig. 6

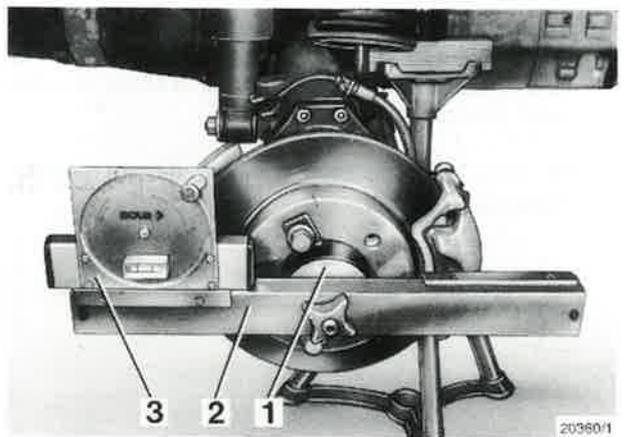


Fig. 7

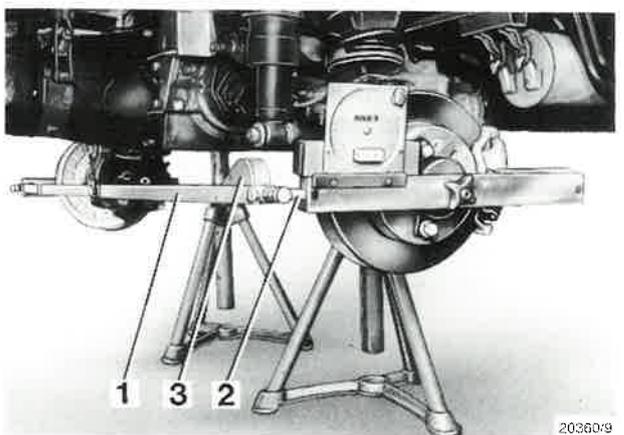


Fig. 8

1.2 Measure axle base model 718

Tools:
 track and axle base measuring gauge
 ruler 4m standard

NOTE: Perfect wheel bearings and steering bolts are a precondition for measuring.

- 1 Jack up vehicle front and rear with suitable support benches under cross members (1).
- 2 Unscrew all wheels.

NOTE: Rear wheels must be lifted off from centering (2/1) at the brake disk in order not to distort the splash guard (2/2).

- 3 Clean contact surfaces as well as centering collar of disk wheels at the brake disks carefully and fasten measuring flanges (3) with 3 wheel screws each (spherical collar screws) first of all to one side of the two rear axles.

NOTE: Care for plane and centric position of measuring flanges.

- 4 Extract adjustable gauge rods one after another that measuring pins can be inserted completely into measuring flanges. Tighten clamping screws (4/1). Leave clamping screw (4/2) of smallest rod loosened.
- 5 Read off axle base and note down (4/3). Twist measuring flanges by 180° while clamping screw (4/2) of gauge rod remains loose and read off axle base again from scale and note down. The real axle base results from the mean value of the two measurements.
- 6 Transfer measuring flange from second rear axle to front axle. Also on this occasion care for plane and centric position of measuring flange.

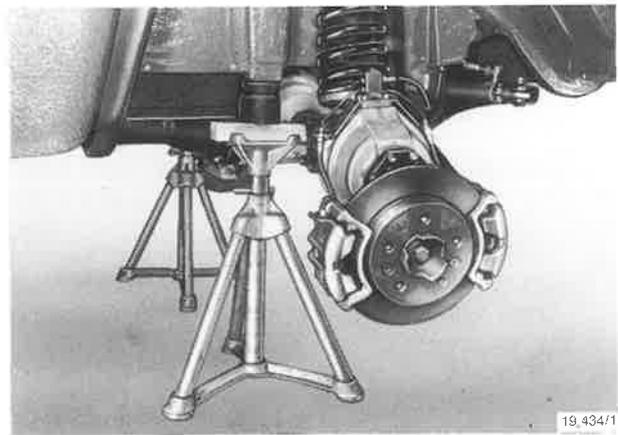


Fig. 1

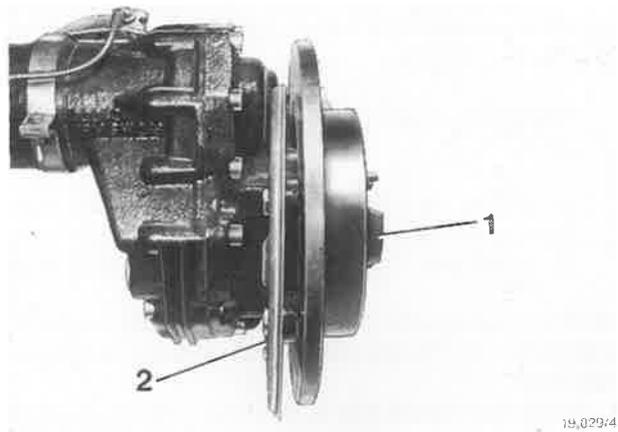


Fig. 2

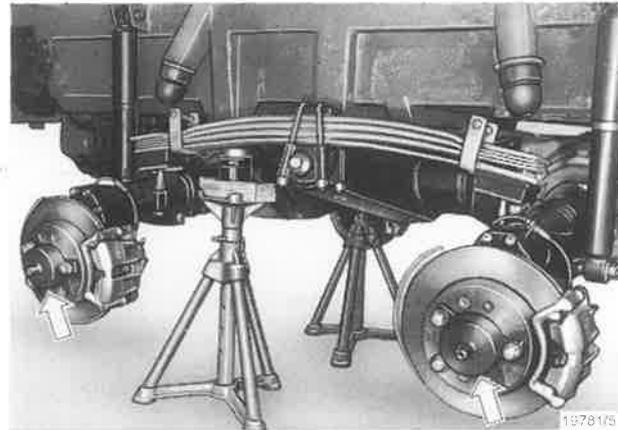


Abb. 3

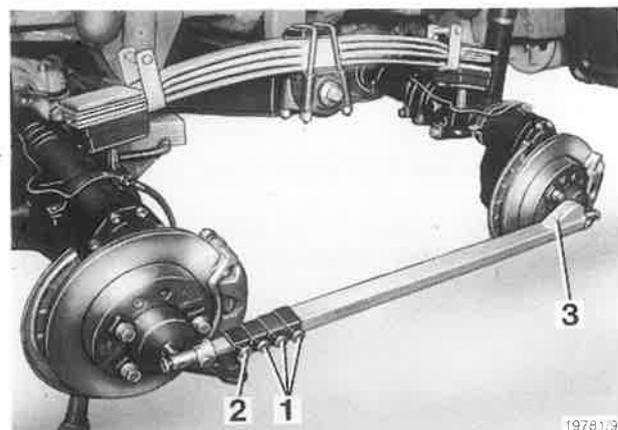


Abb. 4

- 7 Set brake disk of front wheel drive in true alignment to brake disk of rear wheel drives using a ruler (5). A uniform light slit indicates true alignment of the front brake disk to the rears.
- 8 Measure and note down axle base - front axle - first rear axle as described in steps 4 and 5 (6).
- 9 Transfer measuring flange from first to second rear axle and measure and note down axle base - front axle - second rear axle, as described in steps 4 and 5.
- 10 Determine axle bases of the opposite side, as described in steps 3 to 9.

The wheel base difference between left and right vehicle side must not exceed 2 mm in neither of the 3 axle bases.

Standard values of axle bases at extended half-axes:

front axle - first rear axle	= 2207±1mm
front axle - second rear axle	= 3187±1mm
first rear axle - second rear axle	= 980±1mm

NOTE: If the standard values are remaining under or above the permissible tolerances, replace damaged half-axle.

Differing axle bases might be also due to a damaged supporting tube as well as worn out bores of the wheel drive centering bolts can also affect the axle base.



Fig. 5

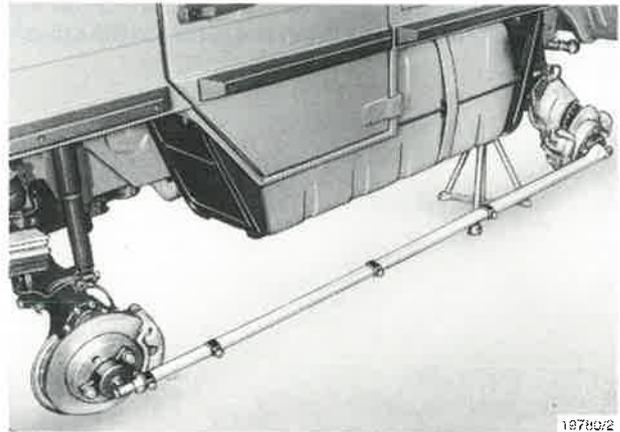


Fig. 6

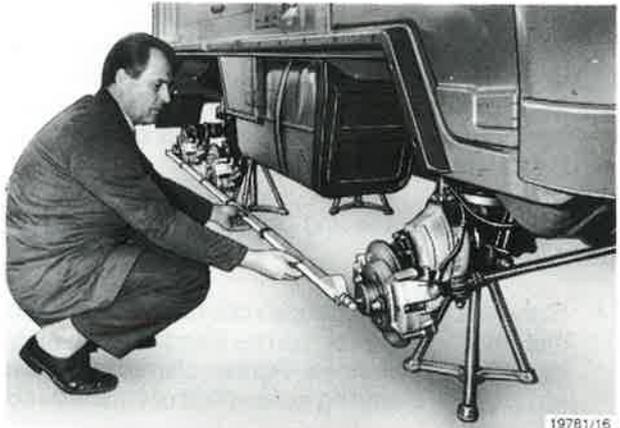


Fig. 7

1.3 Change axle rubber bellow

Includes :

Changing, removing and fitting front wheel drive , see group 091/section 1.7

Changing, removing and fitting rear wheel drive model 716, see group 093/section 1.5

Changing, removing and fitting rear wheel drive model 718, see group 093/section 1.6

Removing:

- 1 Remove respective wheel drive.

NOTE: When removing rear wheel drives, loosen brake hose only from inner brake hose bracket (1/1).

- 2 Mark position of brake hose bracket (1/1) on half-axle. Loosen retaining screw and remove bracket.

NOTE: This step is only necessary when changing rear axle bellows.

- 3 Loosen fastening straps (1/2 and 1/3) and remove together with rubber bellow.

Checking:

- 4 Check stop ring (2/1) and axle drive housing (2/2) for damage. Clean dirty ball cup (2/3) and check for traces of wear.

Fitting:

- 5 Grease ball cup (2/3) with Alfalub LGEM2
- 6 Slip on bellow. Mount fastening straps pointing backwards in driving direction and screw heads pointing downwards, hereby observing that the bellow's end is in line with cylindrical neck of half-axle (3).
- 7 Advance brake hose bracket - only at rear half-axes - closely to the cylindrical neck for the bellow and to the mark made during dismounting (1/1) - to reach tension-free movability of the brake hose even in case of swiveling of the axle - and tighten in this position.
- 8 Fit axle drive.

1.4 Change, remove and fit axle drive Front or rear axle

Includes:

Changing, removing and fitting front axle, see group 092/section 1.13

Stripping/assembling front axle, see group 091/section 2.1

Changing, removing and fitting rear axle model 716, see group 093/section 1.12

Stripping/assembling rear axle model 716, see group 093/section 2.1

Changing, removing and fitting first rear axle model 718, see group 093/section 1.13

Stripping/assembling first rear axle model 718, see group 093/section 2.2

Changing, removing and fitting second rear axle model 718, see group 093/section 1.14

Stripping/assembling second rear axle model 718, see 2.3

NOTE: According to axle drive designation as front or rear axle, screw along the brake power control support (front axle model 716) or the brake hose bracket (rear axles model 718) resp. at left side front (1/2) - pinion with connection toothing (1/1) pointing backwards. For this purpose loosen both cheese head screws and mount bracket. Tighten cheese head screws to 85 Nm.

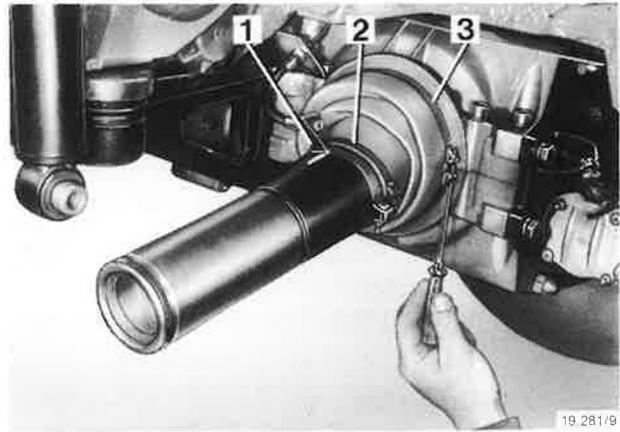


Fig. 1

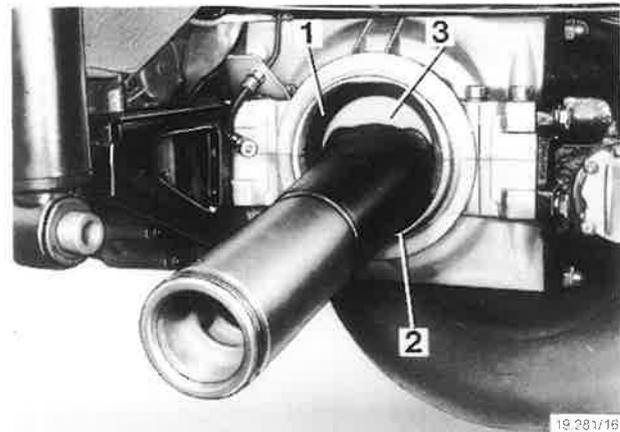


Fig. 2

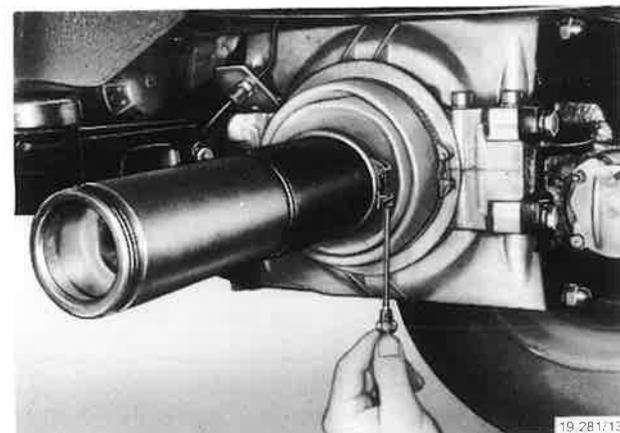


Fig. 3

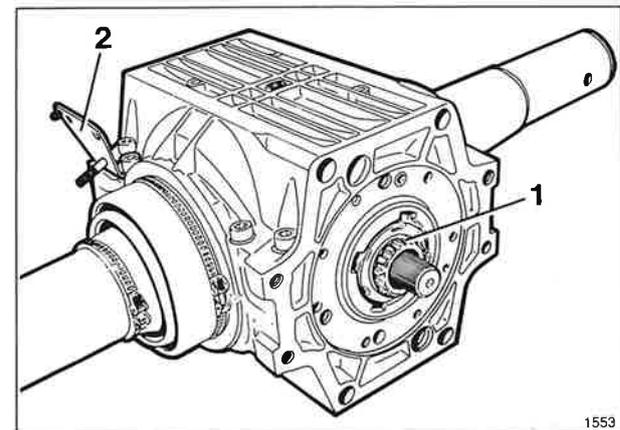


Fig. 1

1.5 Works at pneumatic gearshift assembly for all-wheel drive and lock(s)
Functional characteristics see group 190 ...

1.5.1 Check pneumatic function of gearshift assembly of rear differential lock(s)

Includes:

Checking vacuum unit for operational performance, see group 130/section 1.3

Changing, removing and fitting central covering, see group 171

Tools:

hand vacuum pump MITYVAC 905.3.12.111.0

WARNING: Don't let engine run in closed rooms without ventilation.

Shift driving switch into position "2" and actuate toggle switch

Solenoid valve (2/C) switches on audibly	Solenoid valve (2/C) does not switch on
--	---

see electrical fault finding scheme see group 190

Lift rear axle and check function of lock. In case of model 718 check both axles.

Differential lock not engaged	Differential lock engaged - control does not light up, see electrical fault finding scheme, see group 190
-------------------------------	---

NOTE: From here onwards uniform testing procedure of pneumatic unit for front and rear differential lock(s) as well as all-wheel gearshift operation, i.e. the described checks have to be carried out at the respective pneumatic gearshift assembly or unit.

Pull off tube or molded hose resp.(3/1) from pneumatic gearshift assembly (3/2) and connect vacuum pump (3/3) special tool pos. no. 905.3.12.111.0 to molded hose.

Shift selector lever into position "P", start engine and let it idle at higher revs. After abt. 10 seconds a vacuum of 700 - 800 mbar must have been established.

Stop engine and turn driving switch to "0"- position.

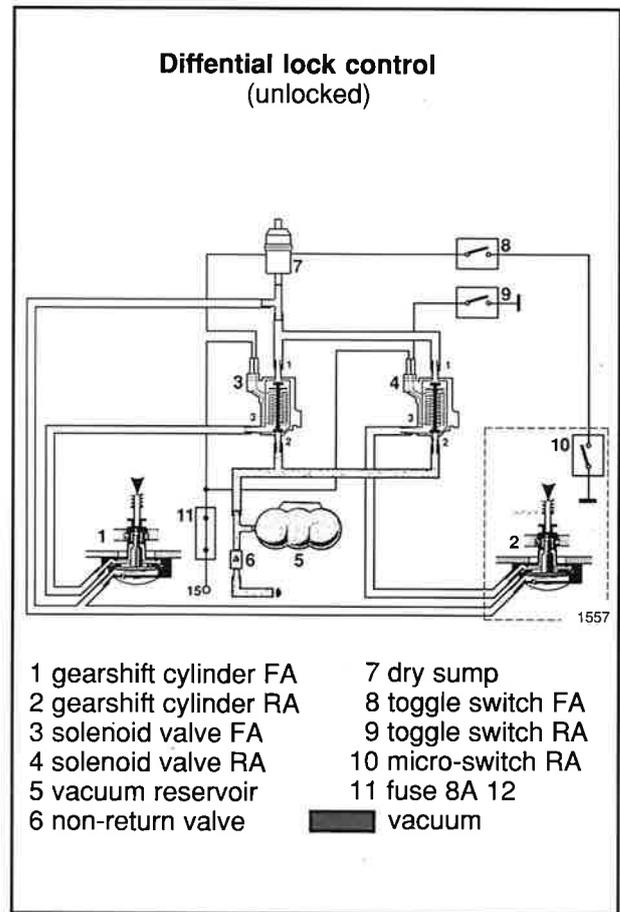


Fig. 1

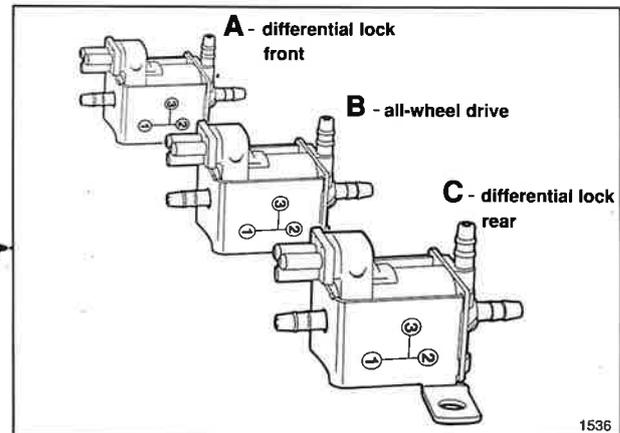


Fig. 2

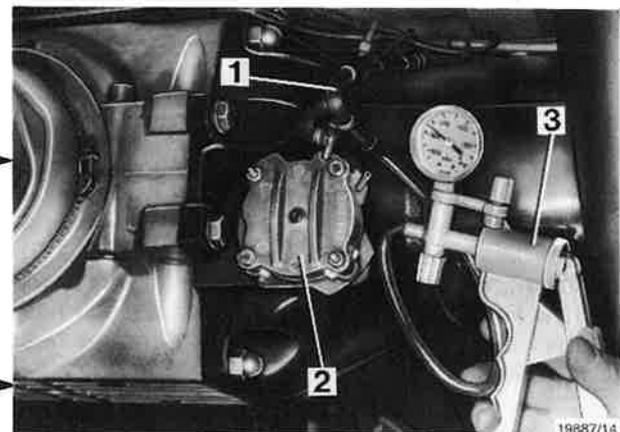


Fig. 3

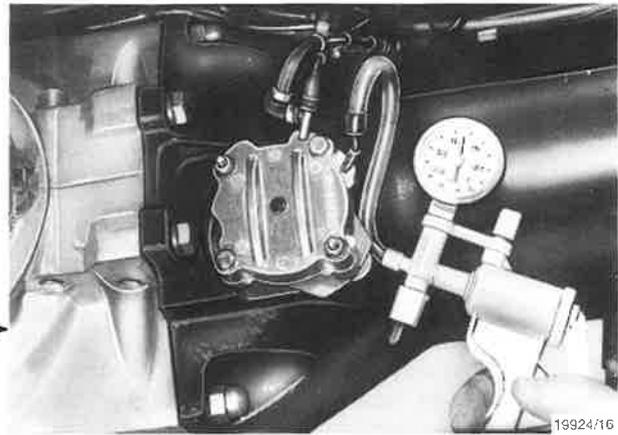
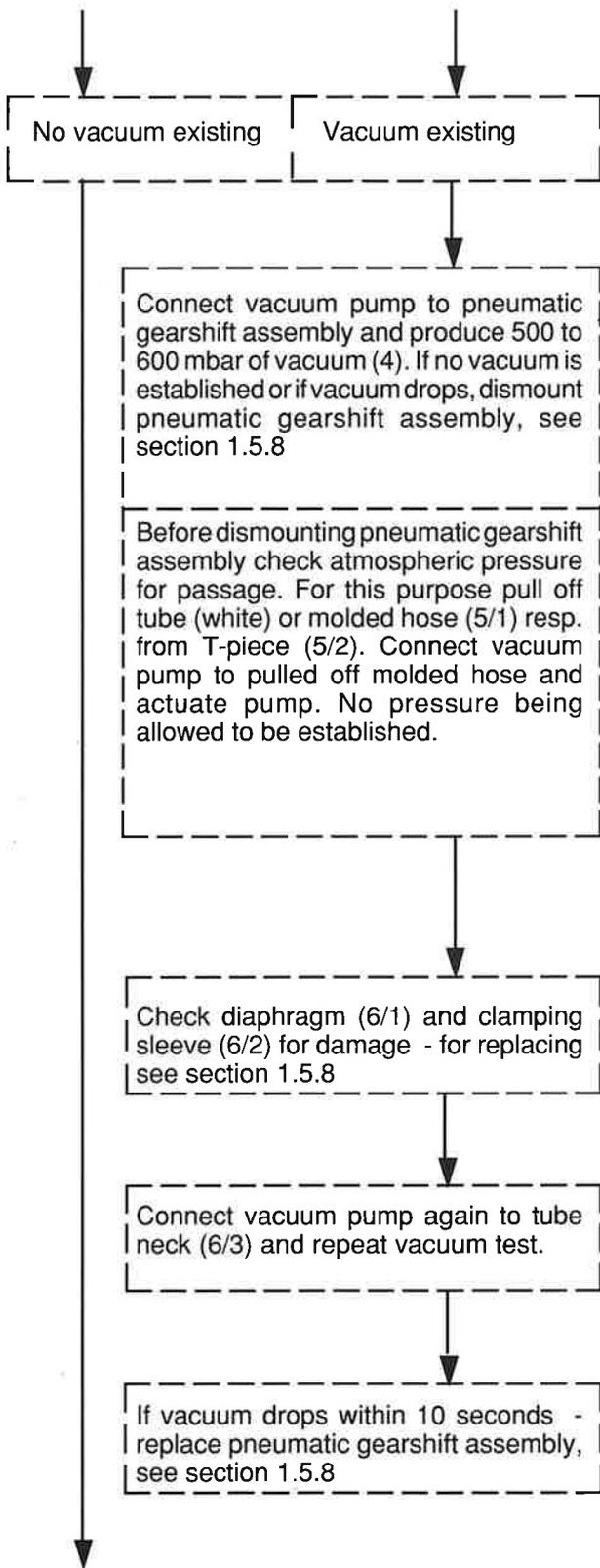


Fig. 4

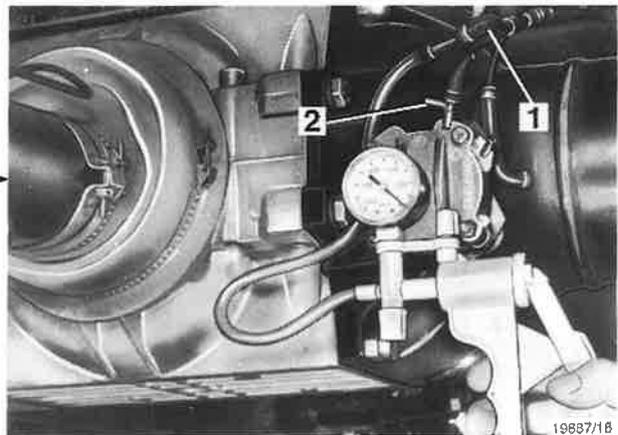


Fig. 5

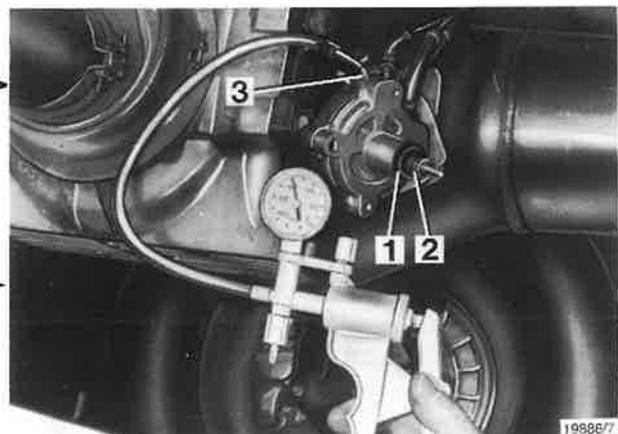


Fig. 6

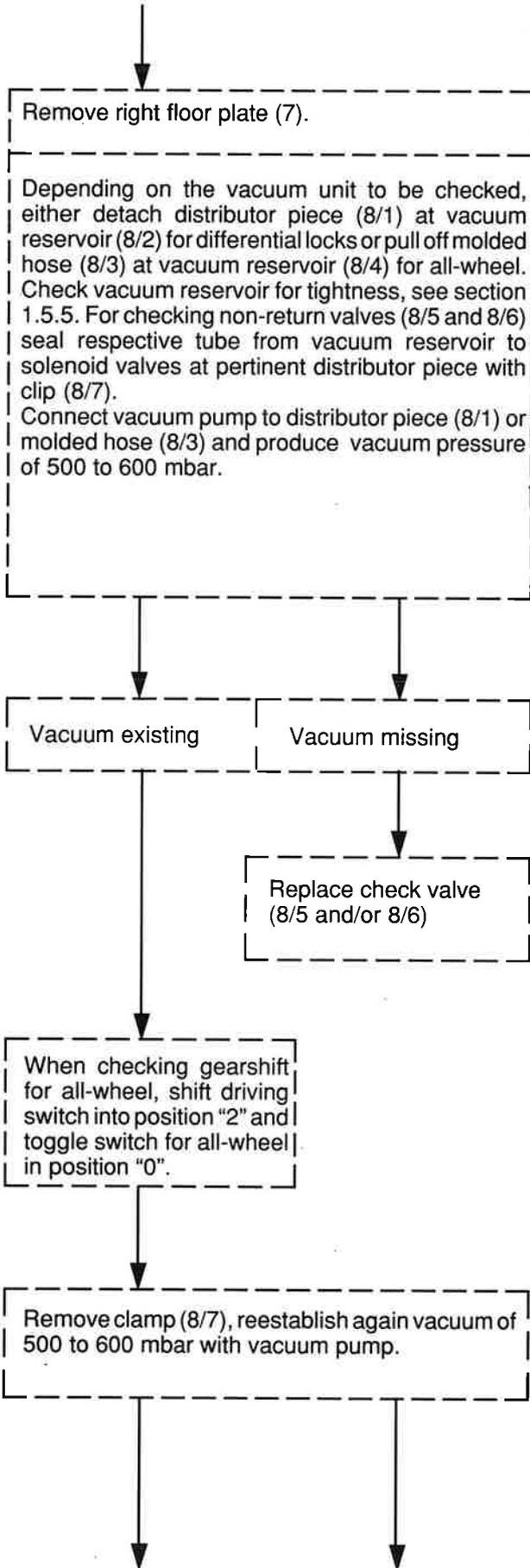


Fig. 7

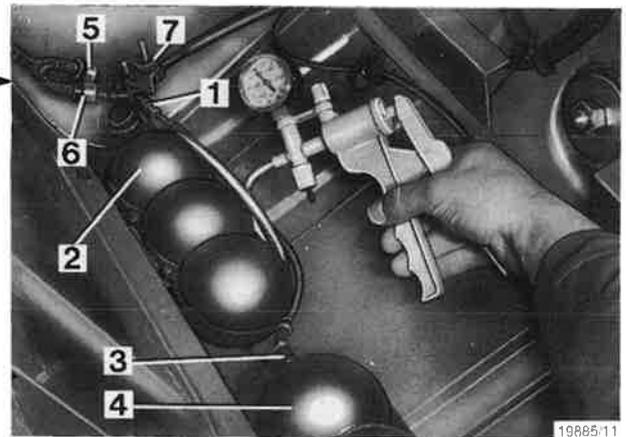


Fig. 8

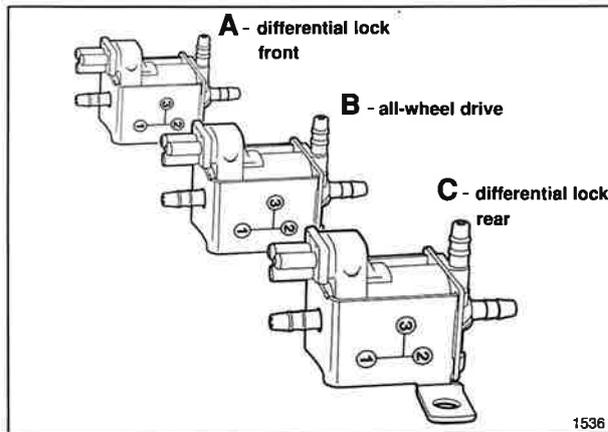
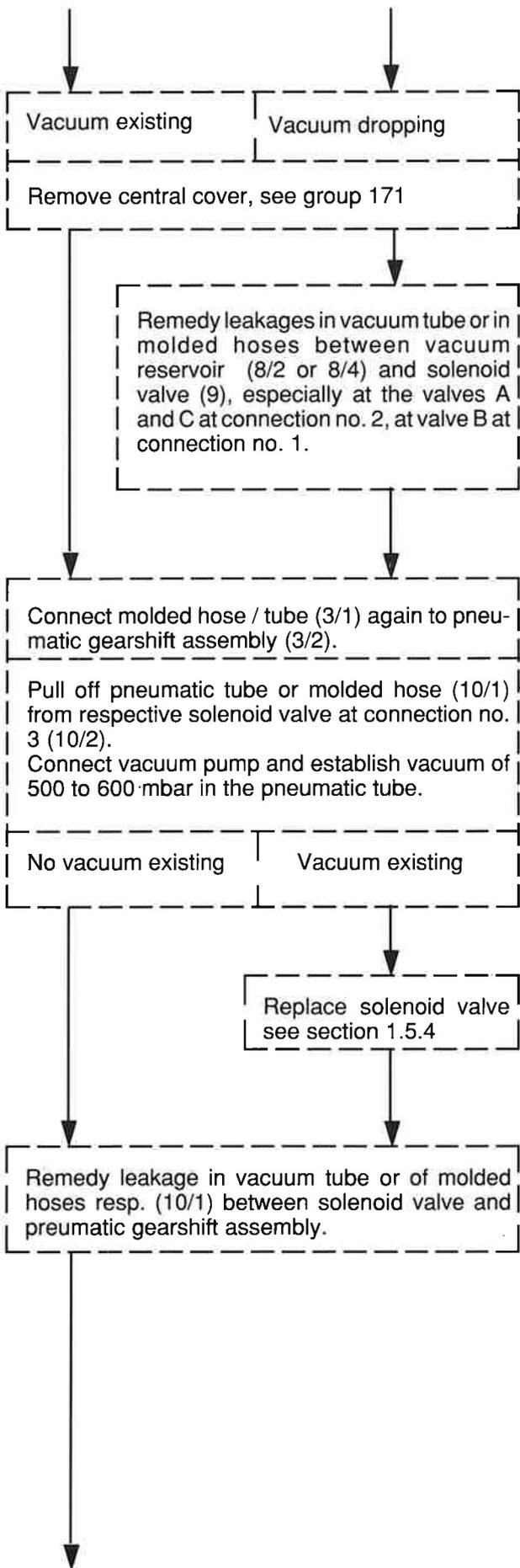


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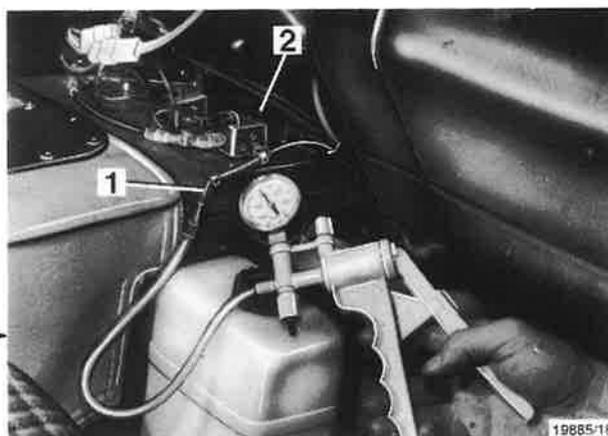


Abb. 10

1.5.2 Check pneumatic function of front differential lock gearshift assembly

Includes:

Checking vacuum unit for operational performance, see group 130

Changing, removing and fitting central covering, see group 171

Tools:

hand vacuum pump MITYVAC 905.3.12.111.0

WARNING: Don't let engine run in closed rooms without ventilation.

NOTE: The front differential lock (1/8) will not be actuated by switching unless the rear differential lock (1/9) has been engaged before (micro-switch 1/10 being closed). The spot and control lamp resp. incorporated in the switches lights up brighter as soon as gear shifting in axle drive or axle journal has been made.

Switch driving switch into position "2" and switch on rear differential lock. Control lamp in toggle switch must light up bright. If necessary check function of rear lock.

Actuate toggle switch for front differential lock.

Solenoid valve (2/A) switches audibly

Solenoid switch (2/A) does not switch

see electrical fault finding scheme, see group 190

Lift front axle and check function of lock

Differential lock is not engaged

Differential lock being engaged - control lamp does not light up, see electrical fault finding scheme see group 190

to be continued, see dotted rectangles section 1.5.1.

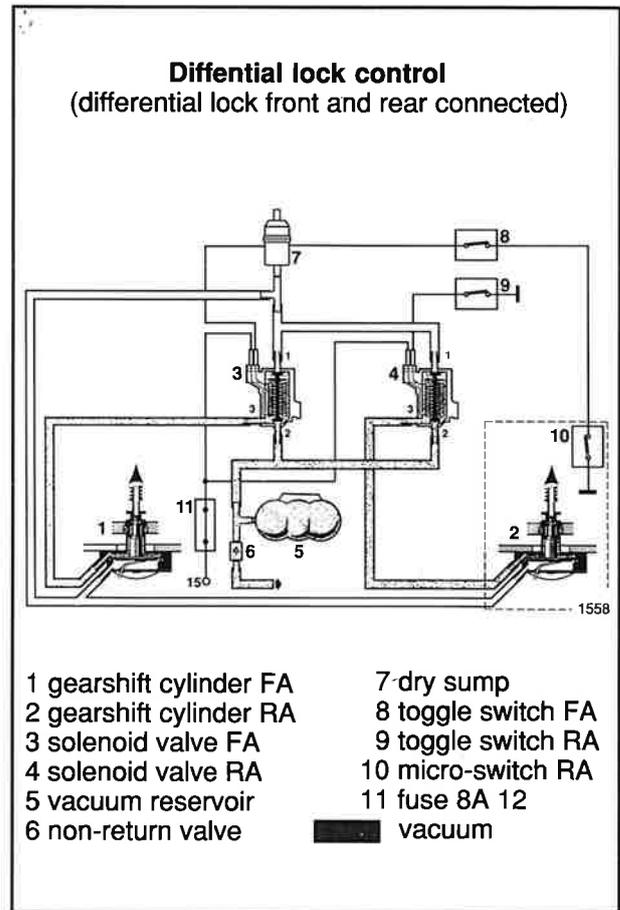


Fig. 1

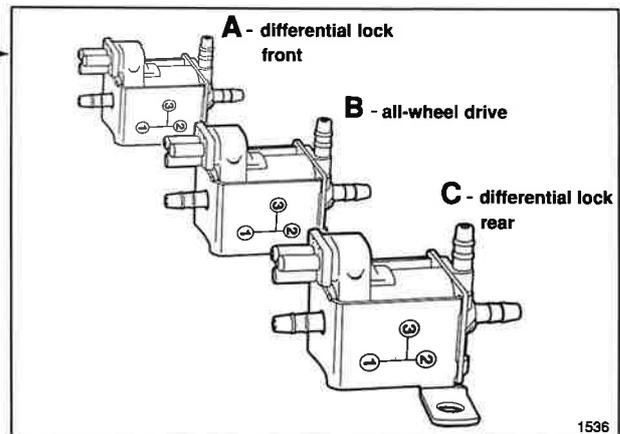


Fig. 2

1.5.3 Check pneumatic function of all-wheel gearshift assembly

Includes:

Checking vacuum unit for functioning see group 130
 Changing, removing and fitting central covering see group 171

Tools:

hand vacuum pump MITYVAC 905.3.12.111.0

WARNING: Don't let engine run in closed rooms without ventilation.

Shift into on-road gear of auxiliary gearbox, shift selector lever for automatic gearbox into position "N". Switch driving switch into position "2" and actuate toggle switch/all-wheel.

Solenoid valve (2/B) switches audibly	Solenoid valve (2/B) does not switch
---------------------------------------	--------------------------------------

see electrical fault finding scheme, see group 190

Lift rear axle (wheels having no ground contact) and check all-wheel drive connection of cardan shaft to auxiliary gearbox. Observe that shaft cannot be turned.

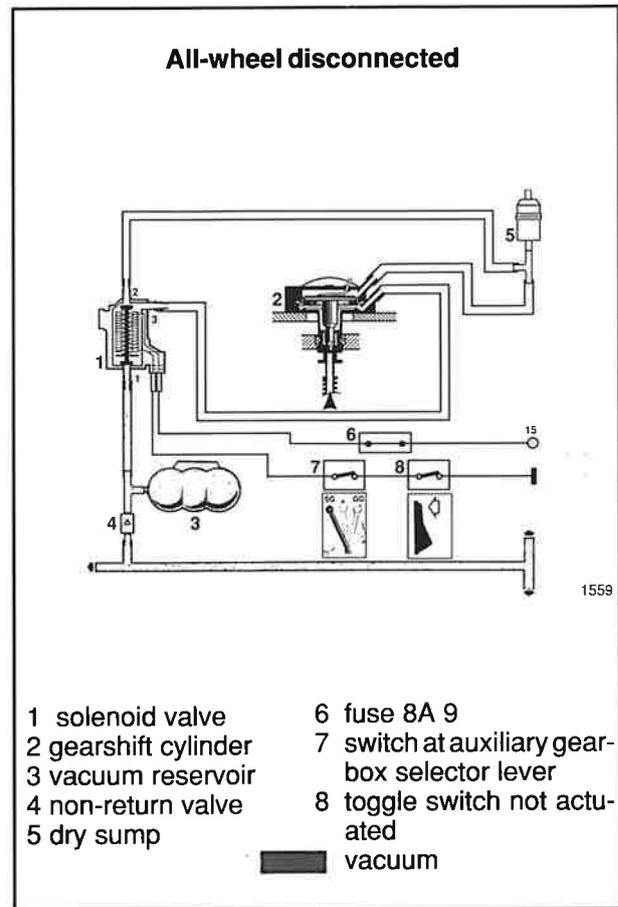


Fig. 1

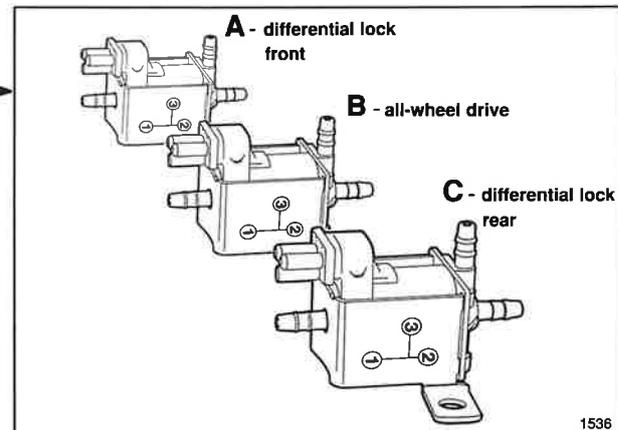


Fig. 2

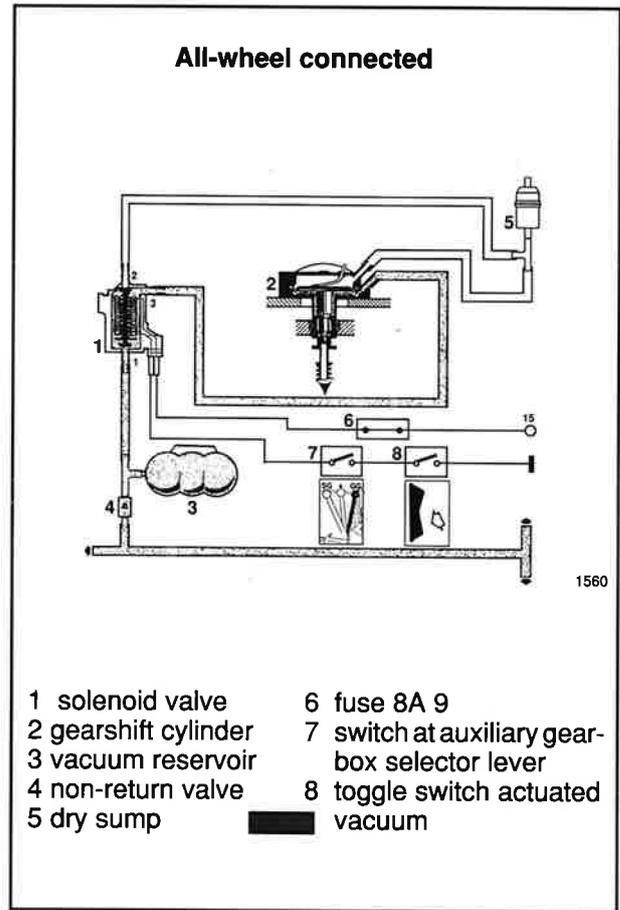
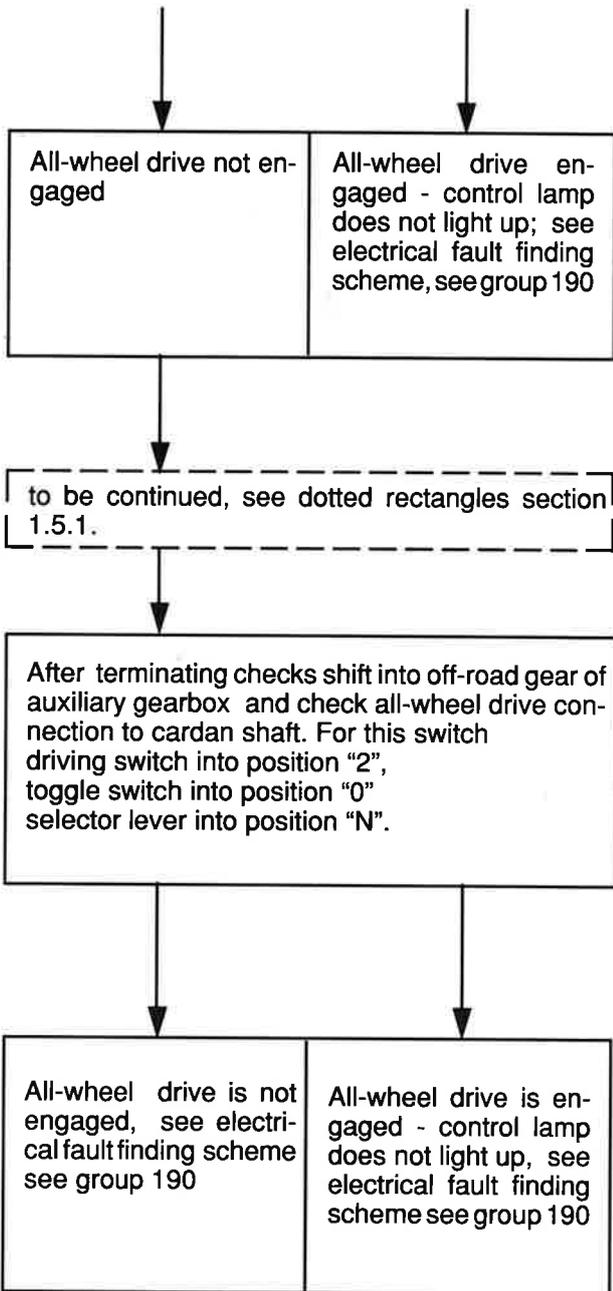


Fig. 3

1.5.4 Check, change solenoid valves for all-wheel and differential lock(s)

Includes:

Changing, removing and fitting central covering of instrument panel see group 171

Tools:

hand vacuum pump MITYVAC 905.3.12.111.0

NOTE: To effect electro-pneumatic shifting of all-wheel drive and of differential locks 3 identical solenoid valves (1) are used which are arranged at the air duct below the central covering of the instrument panel. In the right housing frame the connection marks of the hydraulic pipes are engraved (2). According to function the checking procedure of the individual solenoid valves is also different. Check refers to both opening range and tightness of the valve.

Check rear lock solenoid valve(1/C).

- 1 Remove central covering see group 171

- 2 Pull off pneumatic tube at connection no. 2 (2/2). Connect vacuum pump and produce vacuum of 500 to 600 mbar. If vacuum drops, replace solenoid valve.

- 3 Pull off pneumatic tube (with atmospheric pressure) at connection no. 1 and connect vacuum pump.

- 4 Turn driving switch into position "2" and switch on rear lock. Solenoid valve must switch audibly. If this is not the case, see electrical fault finding scheme group 190. Actuate vacuum pump until vacuum has reached 500 - 600 mbar (3). If vacuum drops, replace solenoid valve.

- 5 Reconnect pulled off pneumatic tube and mount central covering.

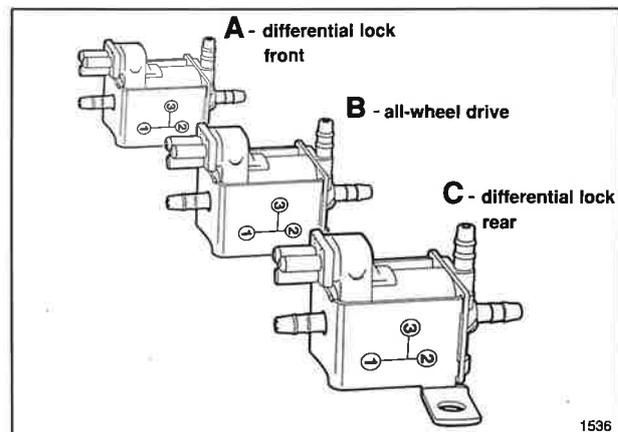


Fig. 1

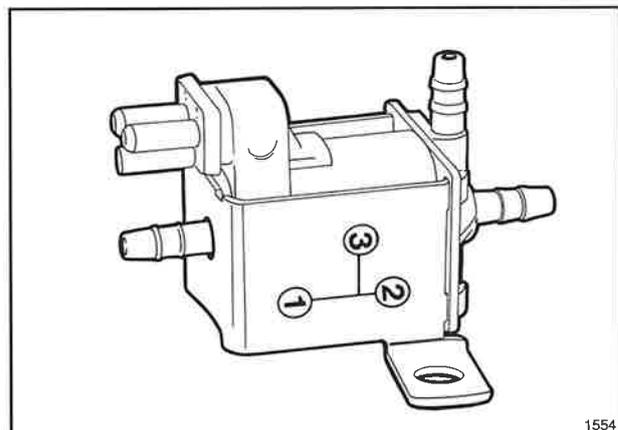


Fig.. 2

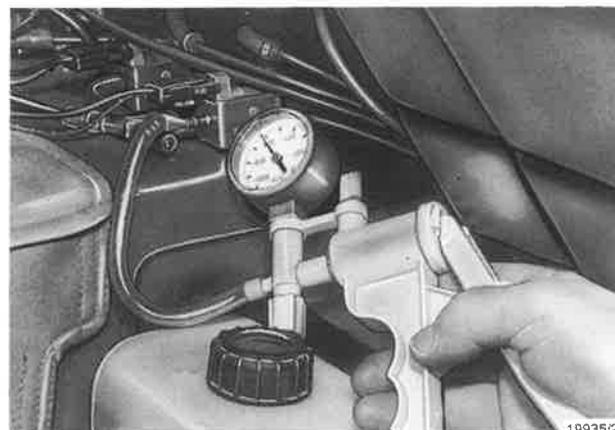


Fig. 3

Check front lock solenoid valve (1/A)

- 1 Carry out steps 1 to 3 as described for checking rear lock solenoid valve.
- 2 Turn driving switch into position "2" and switch on rear lock. The control lamp in toggle switch must light up bright. If this is not the case start engine and let it run for 10 to 20 seconds or start fault finding, see section 1.5.1.
- 3 Switch on front lock. The solenoid valve must switch audibly, if this is not the case see electrical fault finding scheme group 190... Actuate vacuum pump until vacuum reaches 500 - 600 mbar. If vacuum drops replace solenoid valve.
- 4 Reconnect pulled-off pneumatic tubes and mount central covering.

Check all-wheel solenoid valve (1/B)

- 1 Carry out steps 1 to 3 as described for checking rear lock solenoid valve.
- 2 Shift into on-road gear of auxiliary gearbox.
- 3 Turn driving switch into position "2" and actuate vacuum pump until vacuum has reached 500 - 600 mbar. If vacuum drops replace solenoid valve.
- 4 Reconnect pulled-off pneumatic tubes and mount central covering.

Change solenoid valves

- 1 Remove central covering see group 171
- 2 Pull off electrical plug (4/1).
- 3 Pull off pneumatic tubes and molded parts (4/2, 4/3 and 4/4).
- 4 Loosen both nuts (4/5), remove washer and solenoid valve.
- 5 Fitting is made in reverse sequence. Mount clamping ring (4/6) at connection no. 3 in same position as shown in fig. 4.
- 6 Fit central covering see group 171.

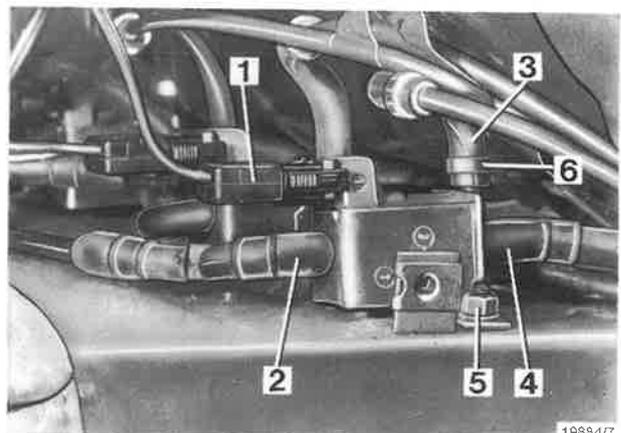


Fig. 4

1.5.5 Check, change vacuum reservoir for all-wheel and differential locks

Tools:
hand vacuum pump MITYVAC 905.3.12.111.0

- 1 Remove right floor plate (1).

- 2 Pull off distributor piece (2/1) and tube (2/2) resp. at the vacuum reservoir to be checked (2/3 for differential locks, 2/4 for all-wheel).

- 3 Connect vacuum pump to reservoir and produce vacuum of 500 - 600 mbar. If vacuum drops replace reservoir (2/5).

- 4 Fit distributor piece and tube resp. with sliding spray.



Fig. 1

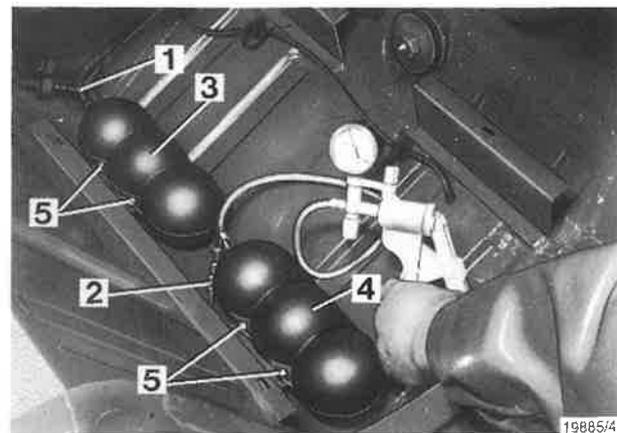


Fig. 2

1.5.6 Check, change non-return valves for all-wheel and differential locks

Tools:
hand vacuum pump MITYVAC 905.3.12.111.0

- 1 Remove right floor plate (1).

- 2 Depending on the vacuum unit to be checked pull off either distributor piece (2/1) at vacuum reservoir (2/2) for differential locks or molded hose (2/3) at vacuum reservoir (2/4) for all-wheel drive. For checking non-return valves (2/5 and 2/6) seal respective tubing from vacuum reservoir to solenoid valves at the pertinent distributor piece with a clamp (2/7). Connect hand pump to distributor piece (2/1) or molded hose (2/3) and produce vacuum of 500 - 600 mbar. Actuate brake pedal for abt. 5 - 10 times. The existing vacuum must not drop. If vacuum drops replace non-return valve.

- 3 When fitting new non-return valves observe correct air passage and blocking direction. Air must be flowing into engine direction (vacuum pump), while valve must close when this occurs in contrary direction (vacuum reservoir), make blow-through test. Fit distributor pieces and tube with sliding spray.



Fig. 1

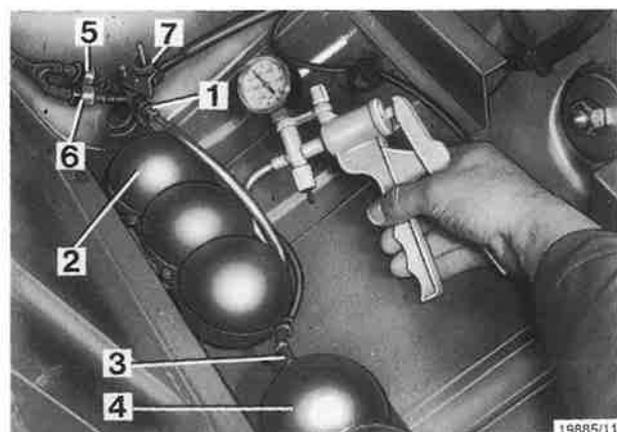


Fig. 2

1.5.7 Change molded hoses and distributor pieces as well as tubes for all-wheel and differential locks.

NOTE: Molded rubber hoses and distributor pieces are used to connect tubings (plastic) to solenoid valves, pneumatic gearshift assemblies and non-return valves or to convey atmospheric pressure as well as vacuum. Tight seat of molded hoses is provided by clamping sleeves which are slipped on at the ends. When exchanging a tube check also the pertinent molded hoses and/or distributor pieces and renew if necessary.

Leakages or deformations of white (atmospheric pressure) or black (vacuum) tubings can be remedied by cutting out and fitting in of a new tube applying one or more hose pieces pos. no. S001-116 997 0482 and two clamping sleeves each, pos. no. S001-345.1.22.138.1.

Basically take care to blow through each repaired or changed tube with filtered compressed air before being connected. Mount or insert resp. molded hoses, distributor pieces and tubings with sliding spray.

Change pneumatic gearshift tubings

Includes:

Changing, removing and fitting central covering of instrument panel, see group 171

- 1 Pull off respective tube or molded hose (1/3 vacuum tube black, 1/4 atmospheric pressure tube white) from necks of pneumatic gearshift assembly to front or rear differential lock(s) or to all-wheel drive gearshift.

NOTE: For security reasons the vacuum tube for all-wheel drive gearshift consists of steel in the exhaust end pipe area.

- 2 Loosen all cable clips (1/1) along the Bougier hose until entering into the right foot pan. In case of model 716 remove additionally pipe clip at the upper side of the front axle housing.
- 3 Remove central covering of instrument panel, see group 171.
- 4 Pull out suction pipe from windshield washer unit, unstrap unit and place on floor plate.
- 5 Mark vacuum tubes (black) and molded hoses resp. at connection no. 3 of the respective solenoid valve (2).

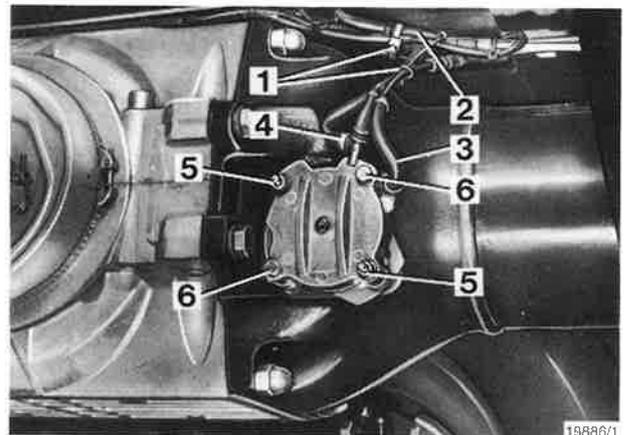


Fig. 1

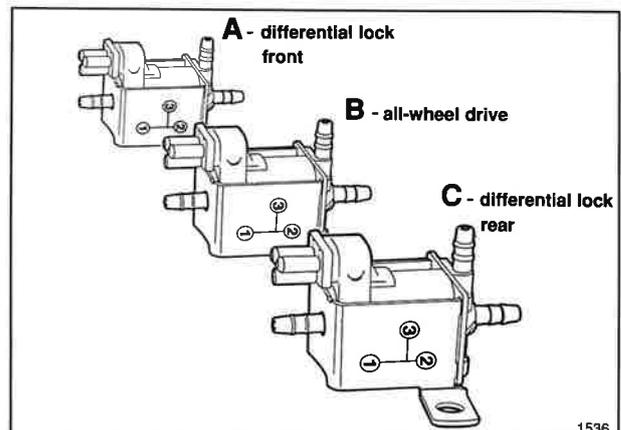


Fig. 2

- 6 Pull off marked vacuum tubes and molded hoses resp. from connection no. 3 of solenoid valves (3/1 - front lock, 3/2 - all-wheel, 3/3 - rear lock).

NOTE: As the three vacuum tubes as well as the atmospheric pressure tube are located in a Bougier hose from about the solenoid valves until the front axle housing area, for facilitating mounting it is necessary, also when exchanging only one tube, to detach all tubes being located in the Bougier hose.

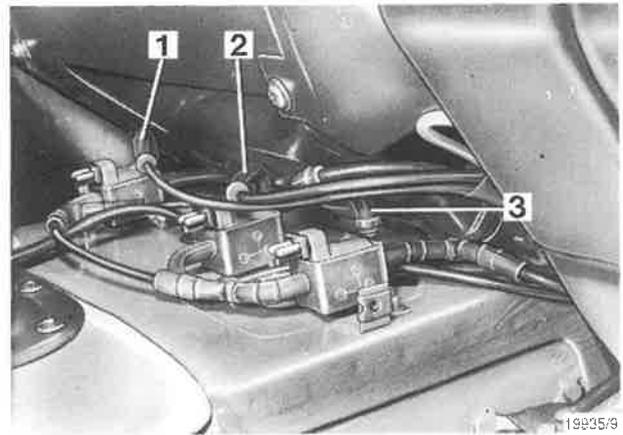


Fig. 3

- 7 Pull off atmospheric pressure tube (white) at distributor piece (4/1) from dryer and loosen cable clip (4/2) at heat exchanger.
- 8 Pull off molded hose from vacuum tube to be changed.
- 9 According to accessibility pull out respective vacuum tube or atmospheric pressure tube to front or rear from the Bougier hose.

NOTE: In case of tight sticking tubes pull Bougier hose out of foot pan, if necessary including the rubber grommet, and loosen tubes by rolling and kneading.

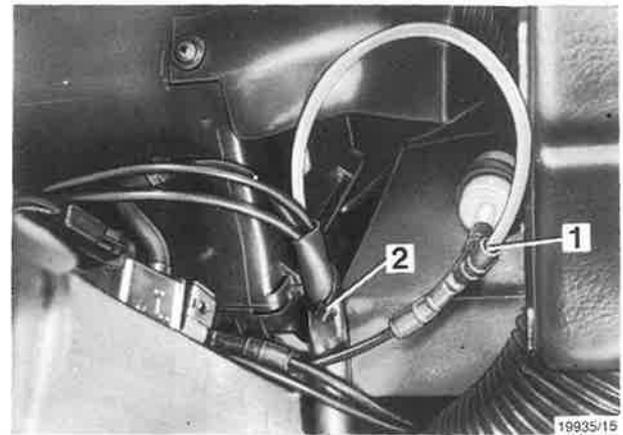


Fig. 4

- 10 Fitting is made in reverse sequence.

- care for chafe-free position of tubes. Attach cable clips in distances of 10 - 15 cm or as required.
- care for tight seat of clamping sleeves.

Change vacuum tube (black) from vacuum hose junction to non-return valves

- 1 Pull off vacuum tube or hose piece at the vacuum hose junction under the left foot pan (5).
- 2 Loosen cable clip from brake tube or at the underside of the right foot pan resp. and near the tube passage.
- 3 Remove right floor plate (6).

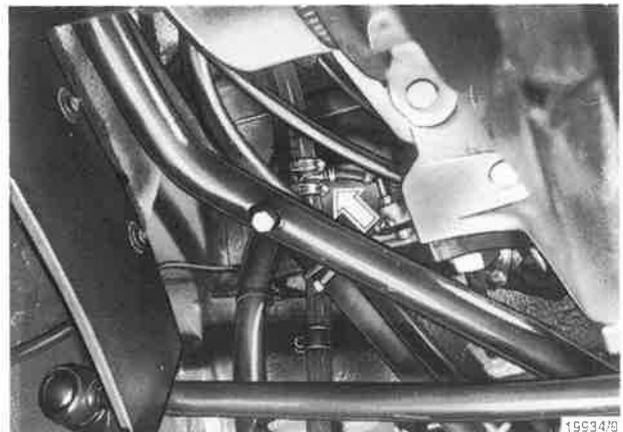


Fig. 5



Fig. 6

- 4 Open loosable cable clip (7/1) and remove vacuum tube (7/2) from distributor piece of non-return valves.
- 5 Pull out vacuum tube with insulating hose from penetration or rubber grommet (7/3) in the foot pan.
- 6 Change vacuum tube, insert into insulating hose and mount in reverse sequence. Care for tight seat of clamping sleeves.

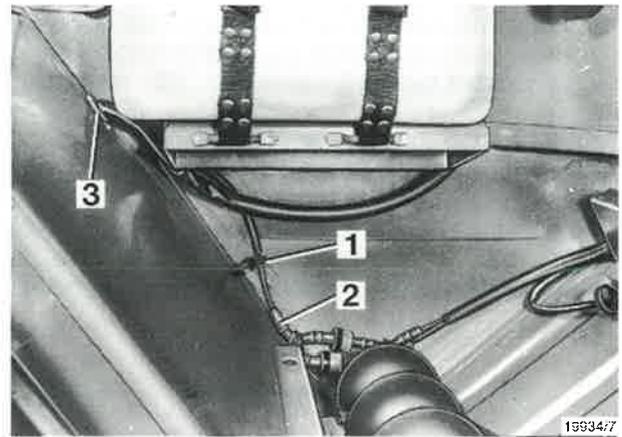


Fig. 7

Change vacuum tubes from non-return valves and vacuum reservoirs resp. to solenoid valves

Includes:

Changing, removing and fitting central covering of instrument panel see group 171

- 1 Remove right floor plate (6)
- 2 Pull off vacuum tubes (8/1 to front and rear differential locks gearshift control, 8/2 to all-wheel drive gearshift control) at the distributor pieces of non-return valves.
- 3 Loosen loosable (8/3) or also throw-away cable clips resp. along the front wall.
- 4 Remove central covering see group 171
- 5 Pull off vacuum tube and distributor piece resp. to rear differential lock (9/C) as well as connection tube to front differential lock (9/A) from connection no. 2 each. Pull off vacuum tube to all-wheel gearshift assembly (9/B) from connection no. 1.
- 6 Change vacuum tube(s), insert into insulating hose and mount in reverse sequence. Care for tight seat of clamping sleeves.

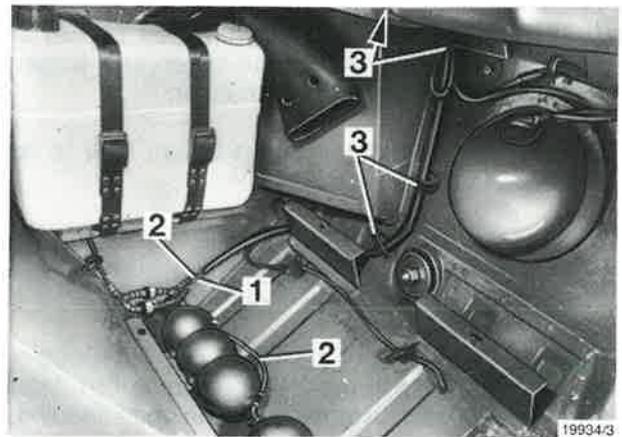


Fig. 8

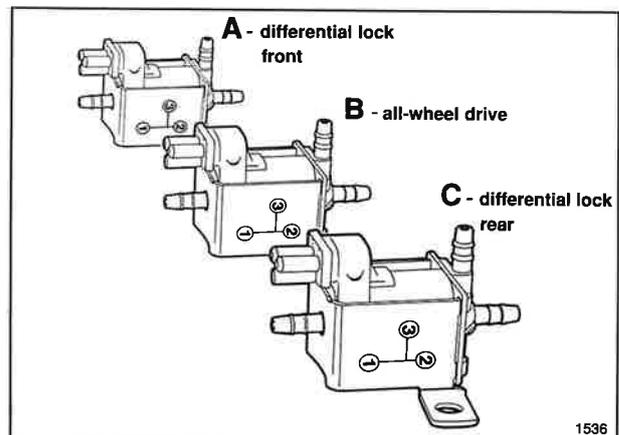


Fig. 9

Change atmospheric pressure tube from dryer to solenoid valves

Includes:

Changing, removing and fitting central covering of instrument panel see group 171

- 1 Remove central covering see group 171
- 2 Pull off tube from dryer (10/T) to solenoid valve "C" as well as connection tube to solenoid valve "A" at connection no. 1 and connection tube to solenoid valve "B" at connection no. 2 (11).

NOTE: For connecting and extending the tube a distributor piece each is used at dryer and solenoid valves "A" and "C". At the solenoid valve "B" the tube is mounted by means of a molded hose with clamping sleeve.

- 3 Fitting is made in reverse sequence.
- Care for tight seat of clamping sleeve.

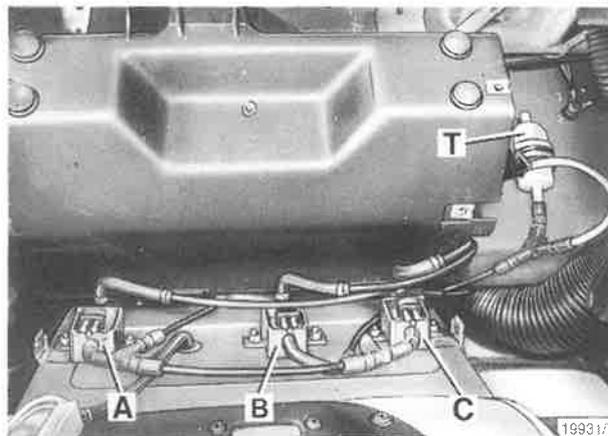


Fig. 10

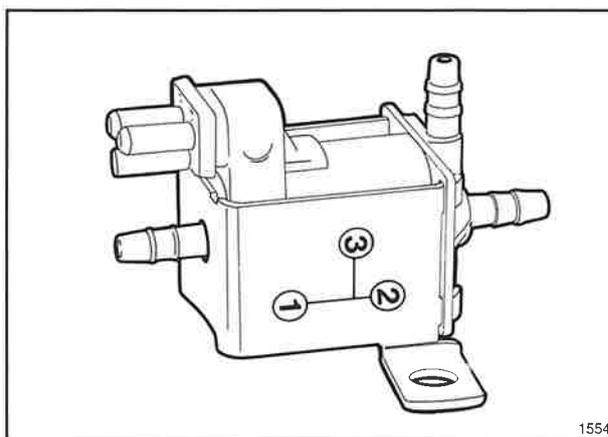


Fig. 11

1.5.8 Check, change pneumatic gearshift assemblies

Tools:

hand vacuum pump MITYVAC 905.3.12.111.0

NOTE: For gearshifting of differential locks and of all-wheel drive identical pneumatic gearshift assemblies are used, with same features regarding checking and changing.

Checking in mounted position

Pull off pneumatic tube and molded hose resp. from vacuum connection and connect vacuum pump (1). Actuate pump until vacuum has reached 500 - 600 mbar. If vacuum cannot be produced or is dropping resp., dismount pneumatic gearshift assembly and continue checking.

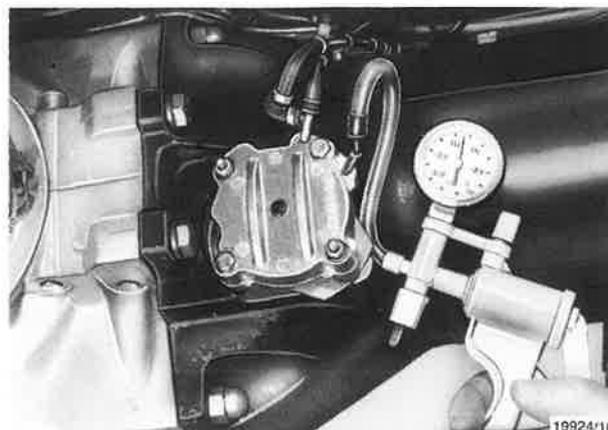


Fig. 1

Dismount pneumatic gearshift assembly

Cut through cable clip (2/1) and separate electrical plug connection (2/2). Mark vacuum tube and molded part (2/3) resp. or circlip and pull off together with atmospheric pressure tube or molded part (2/4) resp. from the connection pieces. Loosen hexagon nuts (2/5), remove washers and pneumatic gearshift assembly.

NOTE: The two hexagon screws connect the housing parts of the pneumatic gearshift assembly and must not be loosened.

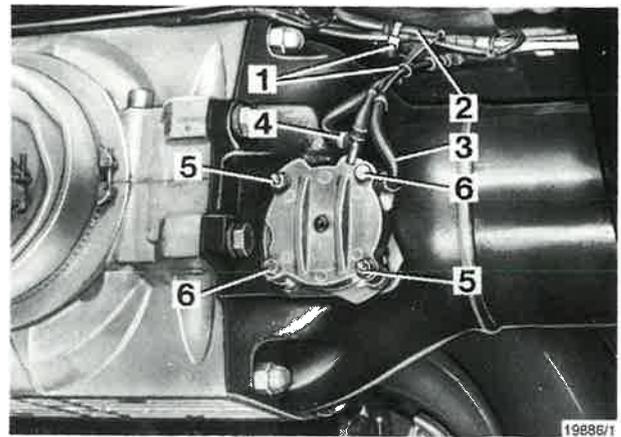


Fig. 2

Checking dismantled pneumatic gearshift assembly

Check diaphragm (3/1) and clamping sleeve (3/2) for intact state. Replace damaged or porous sealings and repeat check as carried out in mounted condition (3/3). In case no vacuum can be produced or vacuum is dropping resp., renew complete pneumatic gearshift assembly.

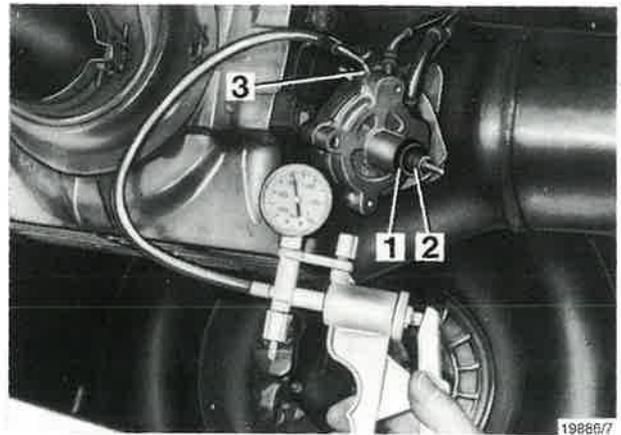


Fig. 3

Fit pneumatic gearshift assembly

Check stop position of V-ring (4/1) facing bush (4/2) in axle journal. Check diaphragm (4/3) and clamping sleeve (4/4) for intact state and correct seat. Centrally mount pneumatic gearshift assembly with new gasket having been smeared on both sides with sealant Loctite 574; use existing space for stud bolts (4/5) in a way that diaphragm (4/3) is in even position inside the bush (4/2) in axle journal. Mount pneumatic tubes and cable clips and also electrical plug resp. acc. to fig. 2.

NOTE: Do not exchange pneumatic tubes. Observe marks made during removing. Take care that a tight seat is achieved with clamping sleeves.

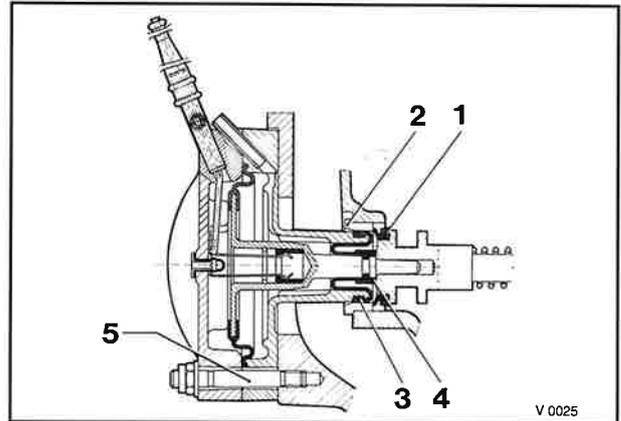


Fig. 4

2 Works at dismantled assemblies

2.1 Strip/assemble axle drive

Includes:

Changing, removing and fitting as well as stripping and assembling front axle see group 091

Changing, removing and fitting as well as stripping and assembling rear axles see group 093

Tools:

dial gauge holder	905.0.32.103.0
mounting carriage	905.3.31.001.0
hook	905.3.31.104.0
axle mounting trestle	905.3.31.403.0
measuring rings	905.3.32.401.0
press-on tool for ball bearing	905.3.33.401.1
press-off sleeve for pinion and bearing	905.3.33.407.2
press-in device	905.3.33.405.0
puller stopper	905.3.34.402.1
extractor	905.3.34.404.0
socket for set collar	905.3.35.402.1
socket for crown nut	905.3.35.403.1
retainer	905.3.36.401.2
locking key	905.3.36.404.2
rest Kukko no. 22-2	905.0.14.001.0
extractor Kukko no. 21-7	905.0.14.011.0
puller Kukko no. 18-1	905.0.14.020.0
separating device Kukko no 17-1	905.0.14.021.0
double-arm puller Kukko no. 20-10	905.0.14.022.0
puller hook extended Kukko no. 1-190-P	905.0.14.023.0
torque spanner 1/2" 25-130 Nm	standard
torque spanner 3/4" 75-400 Nm	standard
magnetic support	standard
dial gauge 1/100	standard

Stripping:

- 1 Replace screw plug in axle housing upper part by eye screw (1/1) pos. no. 710.1.32.386.1, hook in hook special tool pos. no. 905.3.31.104.1 into eye screw and place axle with crane into mounting carriage special tool pos. no. 905.3.31.001.0 or axle mounting trestle special tool pos. no. 905.3.31.403.0 resp.. Position half-axes (1/2) horizontally and support. Strap down axle housing with quick straps (1/3).
- 2 Remove axle bellows (1/4).

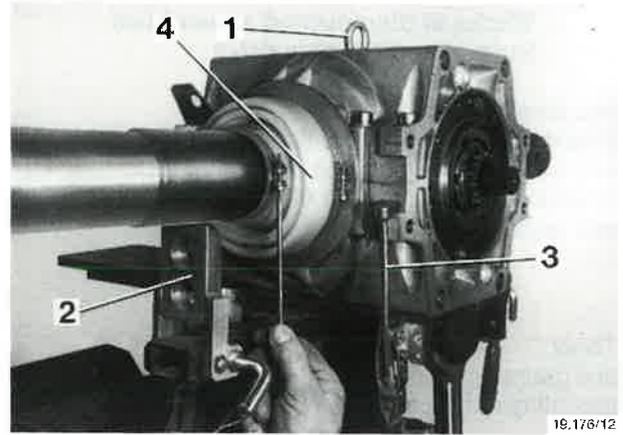


Fig. 1

- 3 Release front circlip and remove (2).

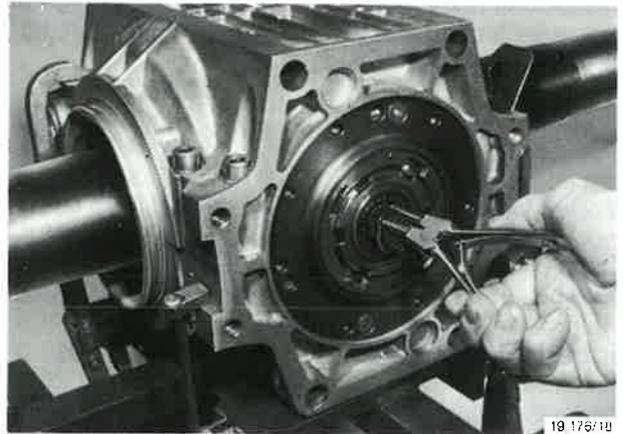


Fig. 2

- 4 Loosen countersunk screws of both bearing flanges (3).

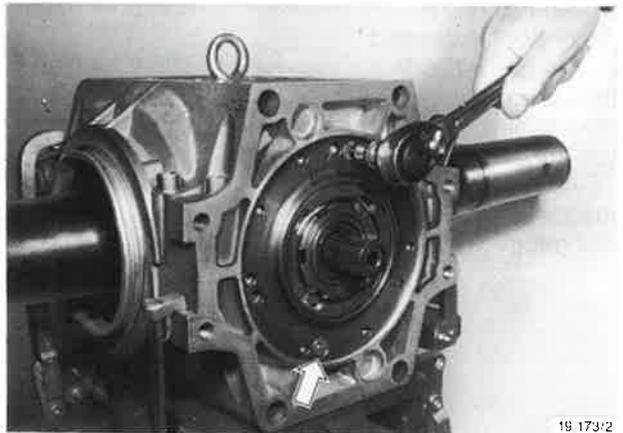


Fig. 3

- 5 Loosen housing cylinder bolts crosswise from outside to inside (4/1 and 4/2).

NOTE: If axle drive is used as rear axle, a brake hose bracket is screwed together on to the front left (4/3).

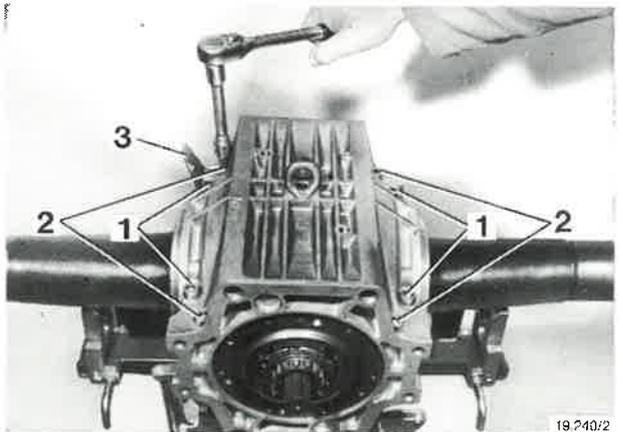


Fig. 4

- 6 Loosen housing upper part by slight taps with a plastic hammer and remove (5).

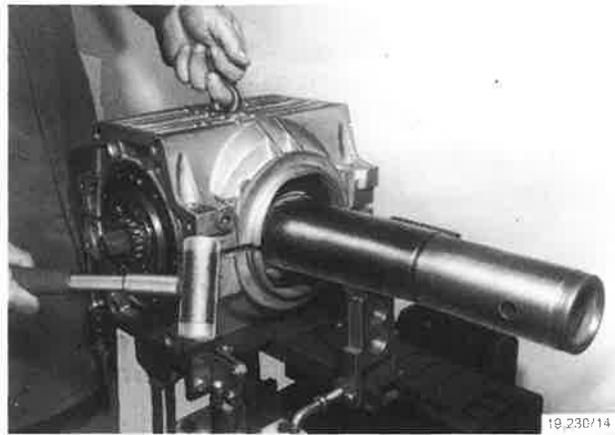


Fig. 5

- 7 Remove bearing flanges (6).

NOTE: Before removing one bearing flange, pull the other one out only as far as necessary so that the half-axes still remain centered.

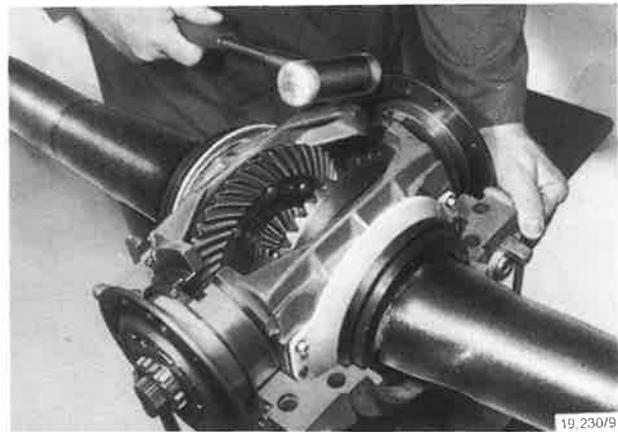


Fig. 6

- 8 Swivel half-axes downwards and remove complete differential gear unit (7).

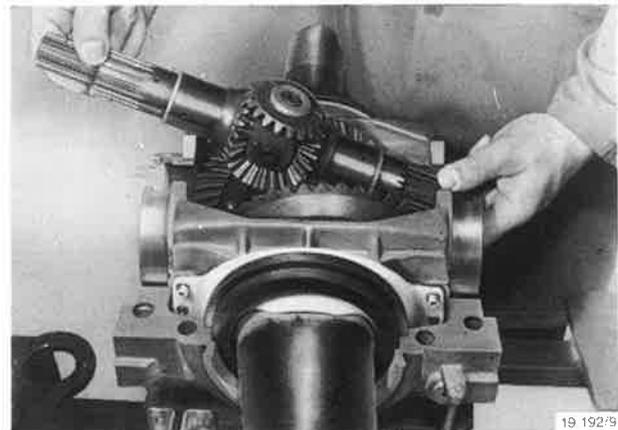


Fig. 7

- 9 Lift out half-axes (8).

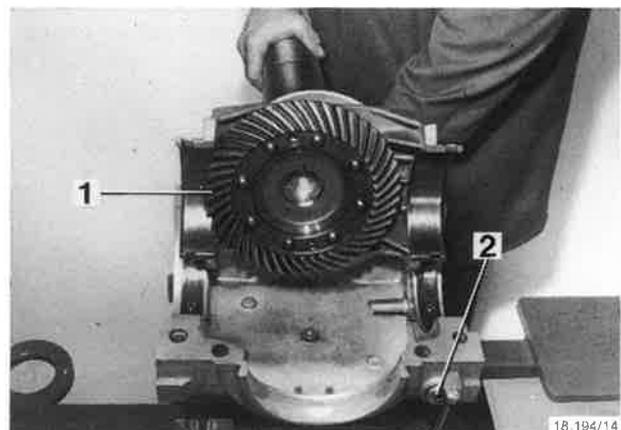


Fig. 8

- 10 Remove thrust washers (9/1) and bearing shells (9/2) only in case of wear and just like the oil catch (9/3) only when changing the axle drive housing.

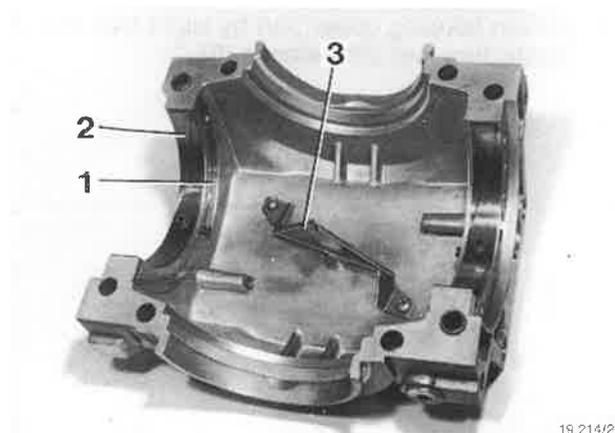


Fig. 9

Assembling:

- 11 Clamp housing lower part into mounting trestle. Insert thrust washers (10/1) with oil groove pointing to half-axle and drive in dowel pin until stop. Insert bearing shells (10/2) and drive in dowel pin also until stop.

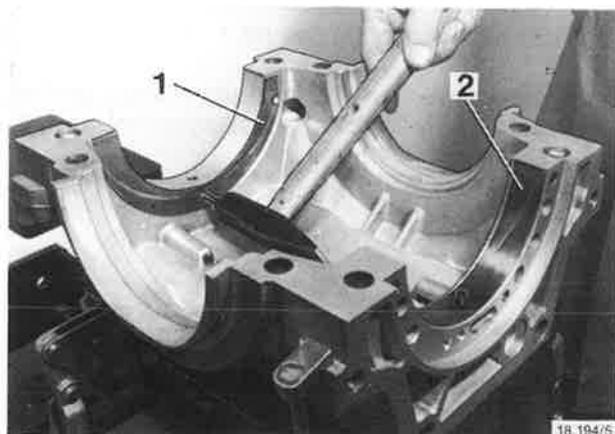


Fig. 10

- 12 Check ball cup (11/1) and seal ring (11/2) for traces of wear and cracks. Grease interspace of sealing lips with Alfabub LGEM2 and put on facing ball cup.

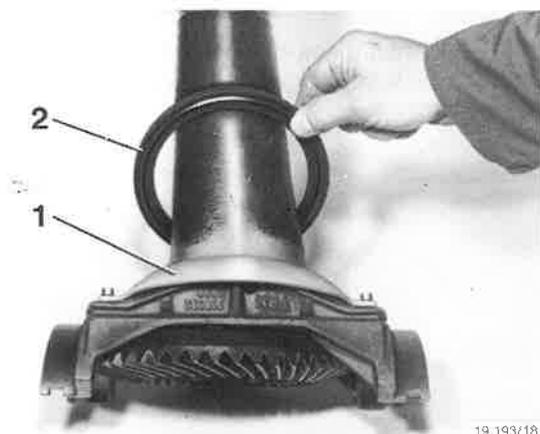


Fig. 11

- 13 Check stop ring for reusability and put on to seal ring (12).



Fig. 12

- 14 Insert left half-axle (13/1) - crown wheel with left-hand twist - pointing to rear pinion (with connection tootinging), right half-axle - crown wheel with right-hand twist - pointing to front pinion (without connection tootinging).

NOTE: When inserting half-axes into housing observe that oil control screw (13/2) is situated right in driving direction.

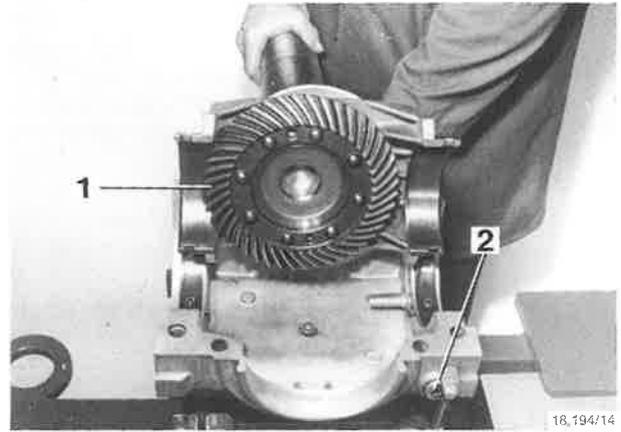


Fig. 13

- 15 Swivel both half-axes downwards. Care for correct position of seal and stop rings (14).

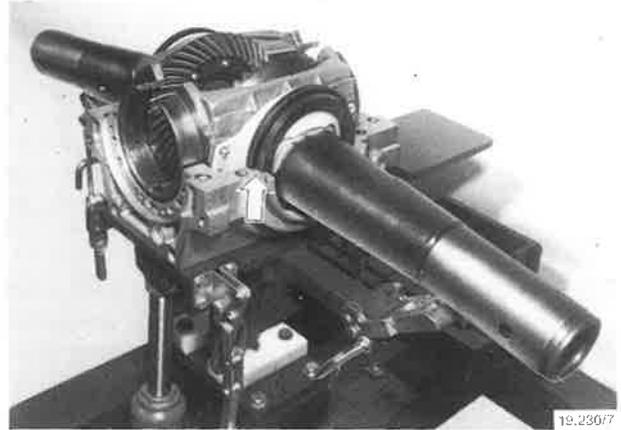


Fig. 14

- 16 Insert premounted differential gear unit with adjusting shims as seen in fig. 15. Recess for snap ring pointing forwards.

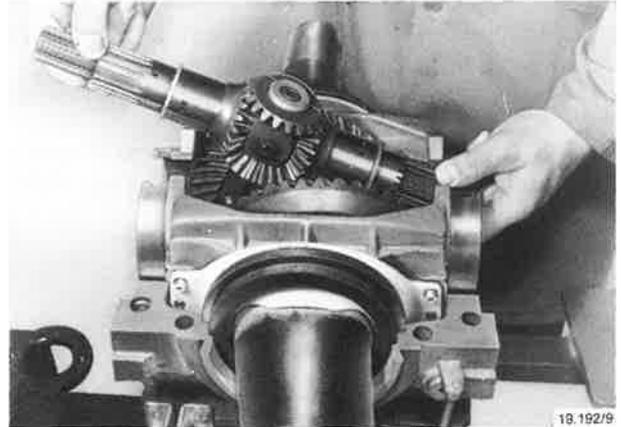


Fig. 15

- 17 Place half-axes in horizontal position and spread apart with 2 hardwood wedges (self-produced acc. to measures from fig. 16). Insert bearing flanges - oil pocket (16/1) pointing upwards - with pinion onto differential bevel gears and between the half-axes resp. in a way that marking on crown wheel (16/2) lines up with that on pinion.

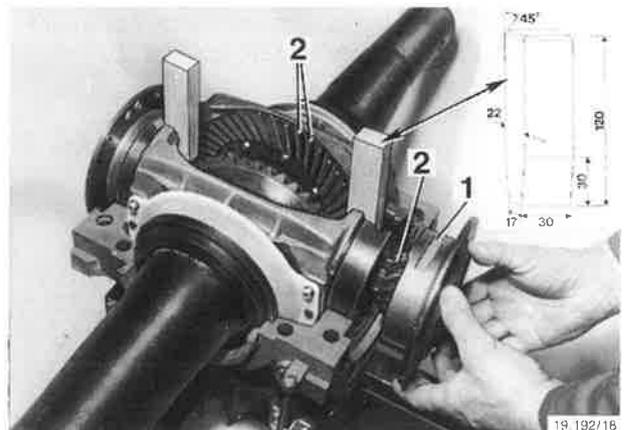


Fig. 16

- 18 Fasten bearing flanges provisionally with 2 screws in housing lower part (17). Fasten dial gauge holder special tool pos. no. 905.0.32.103.0 with dial gauge 1/100 to bearing flange and check axle play through moving the differential shaft to and fro.

Max. permissible play = 0.05 - 0.10 mm
Determine adjusting shim see section 2.2.4

- 19 Check tooth flank backlash between crown wheel and pinion see section 2.2.5.

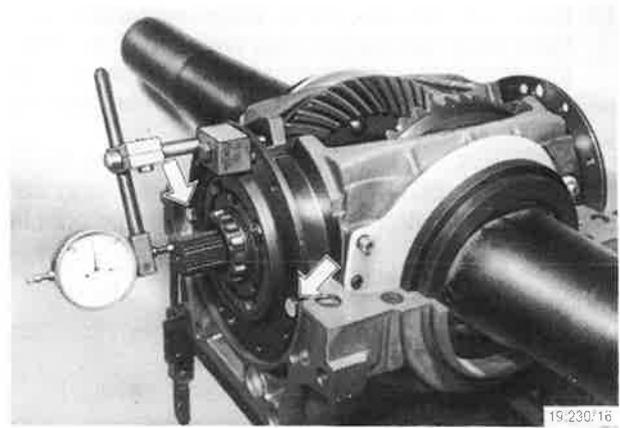


Fig. 17

- 20 Set back both bearing flanges (18/1) by abt. 2 mm from housing. The bores in the flanges must be in true alignment with the threads.

- 21 Smear sealing surface of upper housing half with Loctite 574. In this context care for existence of the diagonally arranged centering sleeves in upper or lower part of housing.

- 22 Put on housing upper part, oil filler screw must be on right side in driving direction. For complete assembling of both housing halves press stop ring (18/3) at the upper side a bit inside.

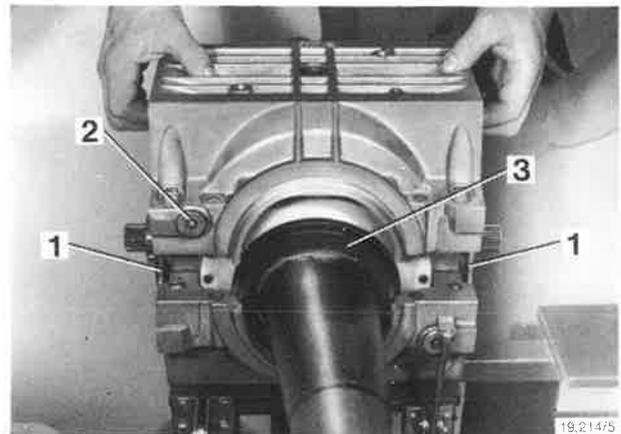


Fig. 18

- 23 Pretighten the inner housing screws (19/1) first and then the outer ones (19/2) crosswise and tighten to 85 Nm.

NOTE: If axle drive is used as rear axle screw together brake hose bracket (19/3) without washer at the front side left.

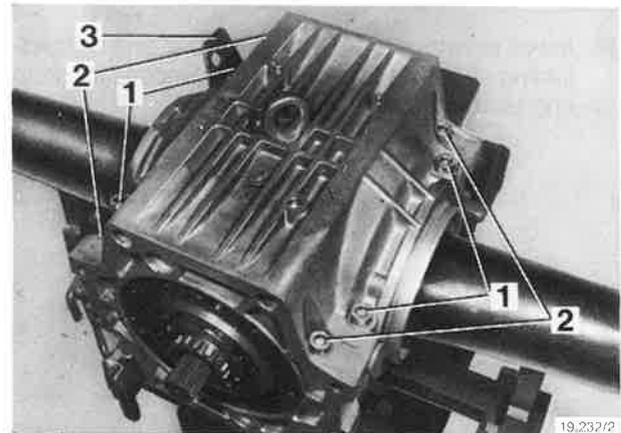


Fig. 19

- 24 Drive bearing flanges with soft metal hammer to stop and mount countersunk screws (20).

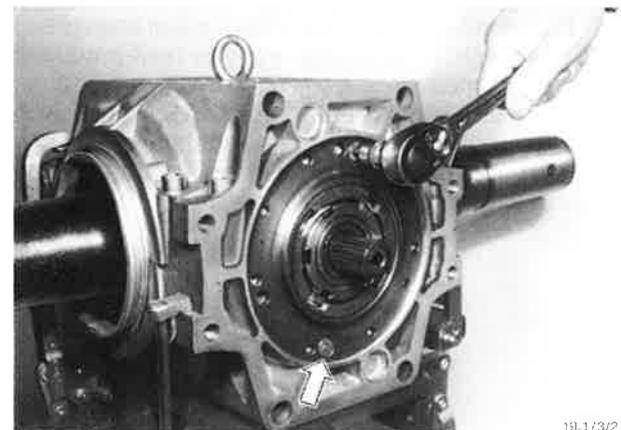


Fig. 20

25 Insert circlip (21).

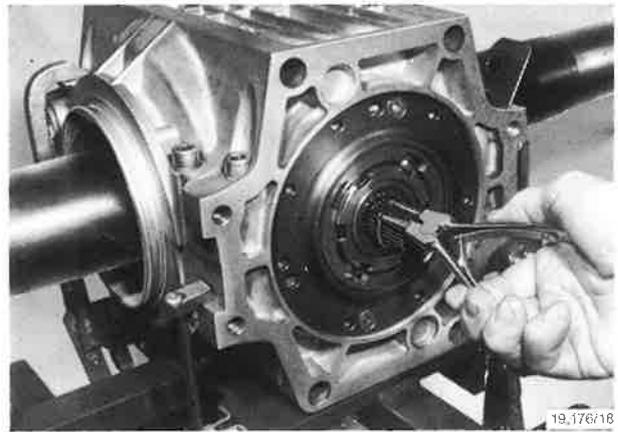


Fig. 21

26 Slip on rubber bellows (22/4). Mount fastening strap locks pointing backwards in driving direction and screw heads pointing downwards, the bellow's end being in same level as the cylindrical neck of half-axe (22).

27 Lift axle drive with crane from mounting trestle. Replace eye screw (22/1) by fastening screw.

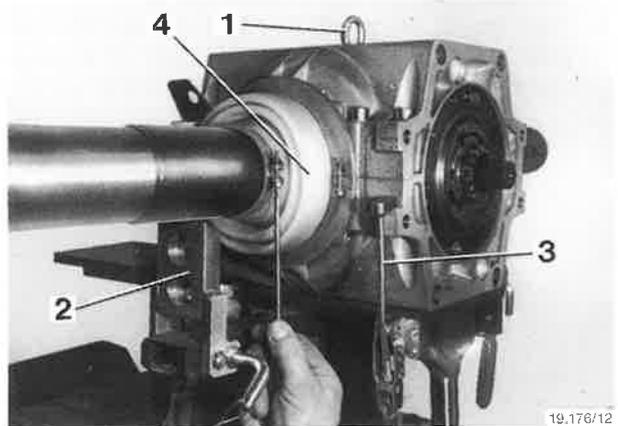


Fig. 22

2.2 Works at axle drive components

2.2.1 Strip/assemble pinion

Stripping:

- 1 Put bearing flange with pinion rear side on a heating plate and heat up to 110 °C.
- 2 Clamp retainer (1/1) special tool pos. no. 905.3.36.401.2 into vise and put on heated-up bearing flange.
- 3 Loosen crown nut using socket (1/2) special tool pos. no. 905.3.35.403.1 .

NOTE: Pinion **front** (without connection tothing) = **lefthand thread**
Pinion **rear** (with connection tothing) = **righthand thread**

- 4 Loosen set collar using socket (2) special tool pos. no. 905.3.35.402.1.

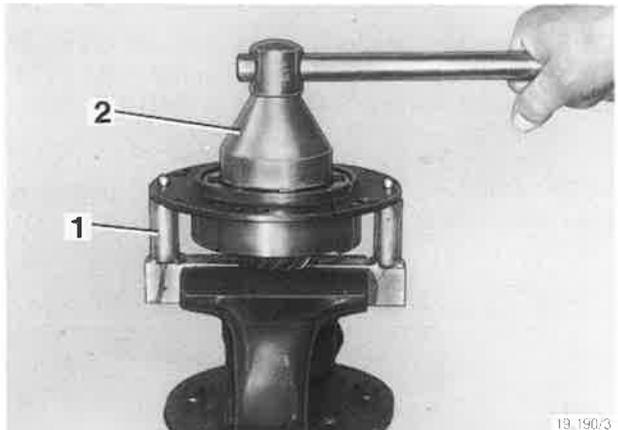


Fig. 1

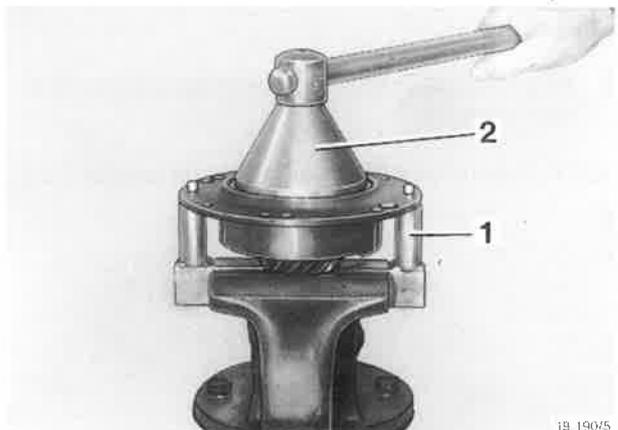


Fig. 2

- 5 Press out pinion with press-off sleeve (3/1) special tool pos. no. 905.3.33.407.2 under piercing press.

NOTE: Mark divided inside bearing raceway (3/2) to respective side of bearing.

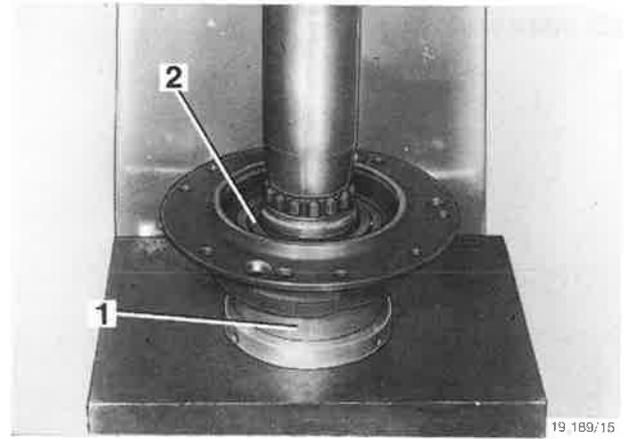


Fig. 3

- 6 Turn round press-off sleeve (4/1) special tool pos. no. 905.3.33.407.2 and press off second inside bearing raceway (4/2) from pinion.

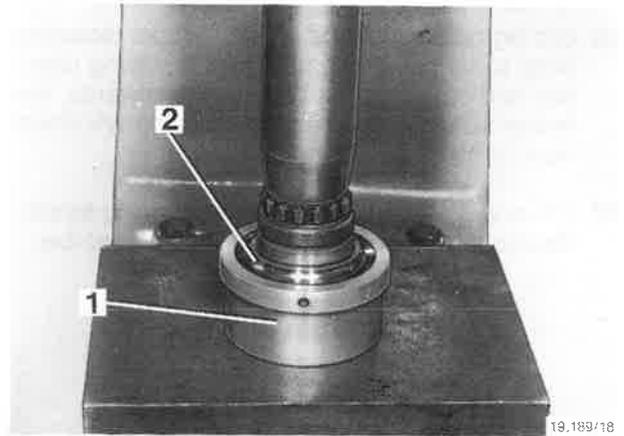


Fig. 4

- 7 Press out four-point bearing also with press-off sleeve (5/1) special tool pos. no. 905.3.33.407.2 and suitable intermediate piece (5/2) from bearing flange.

NOTE: Combine four-point bearing and adjusting shim and mark to bearing flange and pinion.

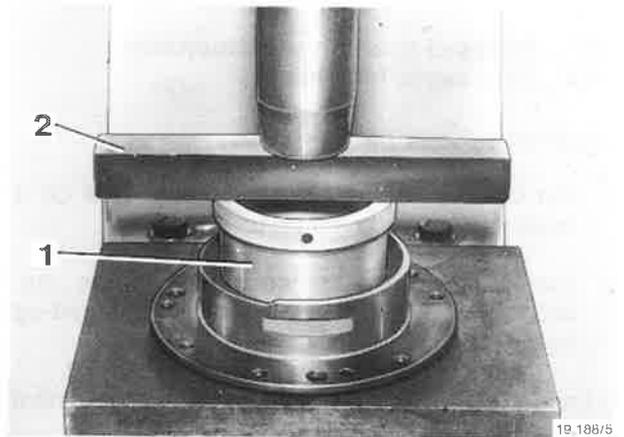


Fig. 5

Assembling:

- 8 Insert adjusting shim with chamfer first into bearing flange (6).

NOTE: Determine adjustment shim see section 2.2.5.



Fig. 6

- 9 Press in four-point bearing (7/2) with press-off sleeve special tool pos. no. 905.3.33.407.2 into bearing flange.

Key for fig. 7:

- 1 = set collar
- 2 = four-point bearing
- 3 = crown nut
- 4 = pinion front
- 5 = adjusting shim
- 6 = pinion rear
- 7 = bearing flange

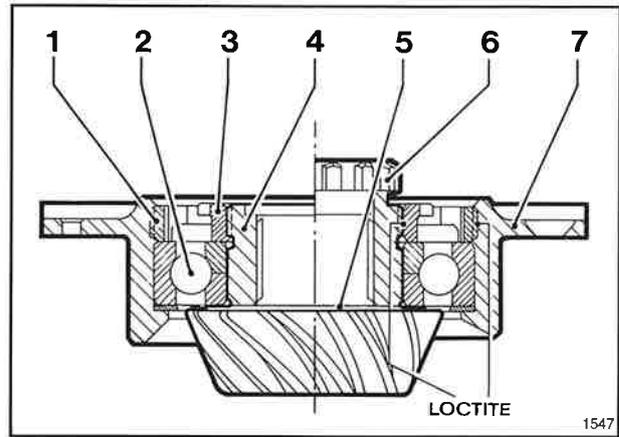


Fig. 7

- 10 Put both inside bearing raceways (8/1) with bearing flange (8/2) onto pinion and press on with press-on tool (8/3) special tool pos. no. 905.3.33.401.1.

NOTE: Observe markings made before dismantling.

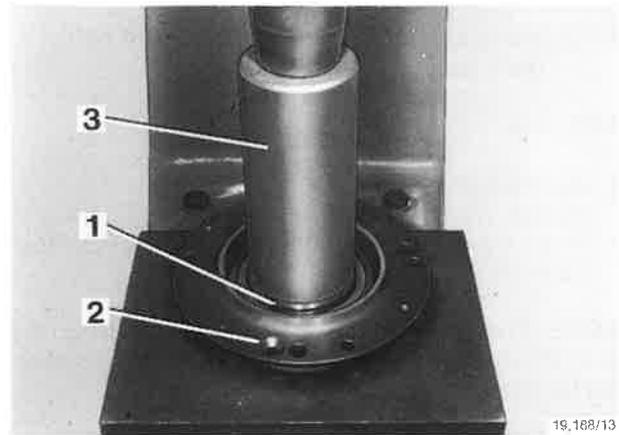


Fig. 8

- 11 Insert pinion with bearing flange into retainer (9/1) special tool pos. no. 905.3.36.401.2. Smear thread of set collar (9/2) and of crown nut (9/3) with Loctite 242 and screw in crown nut collar facing upwards.

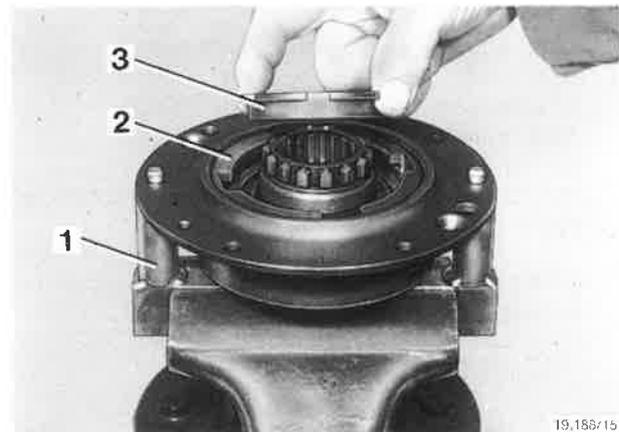


Fig. 9

- 12 Tighten set collar with socket special tool pos. no. 905.3.35.402.1 to 250-300 Nm (10).

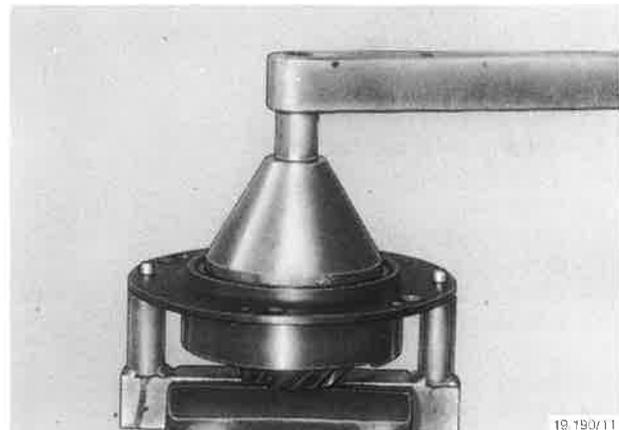


Fig. 10

13 Tighten crown nut with socket special tool pos. no. 905.3.35.403.1 to 250 - 300 Nm (11).

NOTE: Check pinion bearing after tightening for easy running.

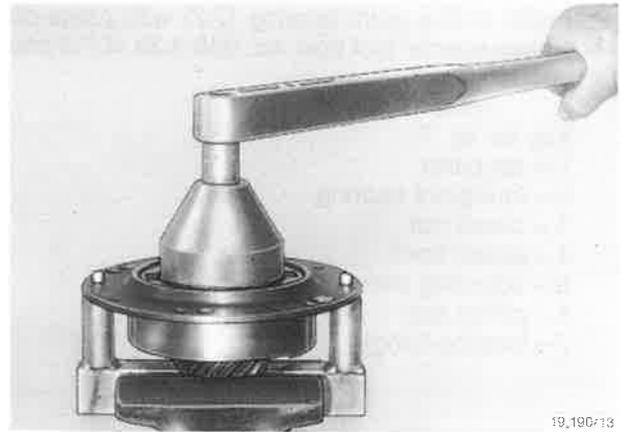


Fig. 11

2.2.2 Strip/assemble crown wheel and half-axle resp.

Stripping:

- 1 Checking:
Clean crown wheel on front face (1/1) and put half-axle onto press-off sleeve (1/2) special tool pos. no. 905.3.33.407.2.

NOTE: The ground rest (1/1) for the measuring ring or in the present case for the press-off sleeve must not be damaged (faulty measurement).

Arrange dial gauge with magnetic support above the centering screw bore and check concentric running (2).
Max. admissible eccentricity = 1 mm

Check centering screw bore for ovality.
Max. admissible ovality = 0.5 mm

In case of excess of admissible tolerances replace half-axes.

- 2 Insert half-axle into supporting ring at mounting carriage.

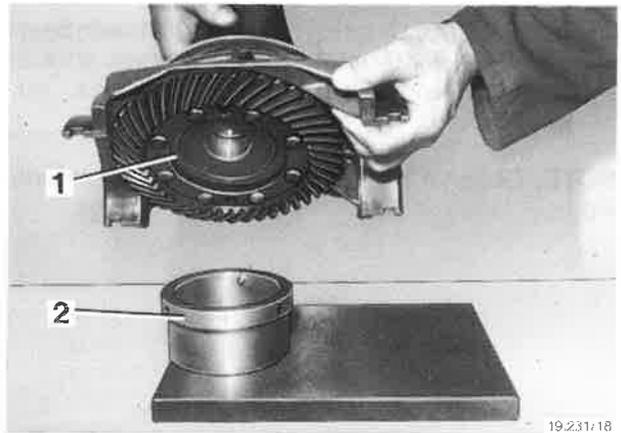


Fig. 1

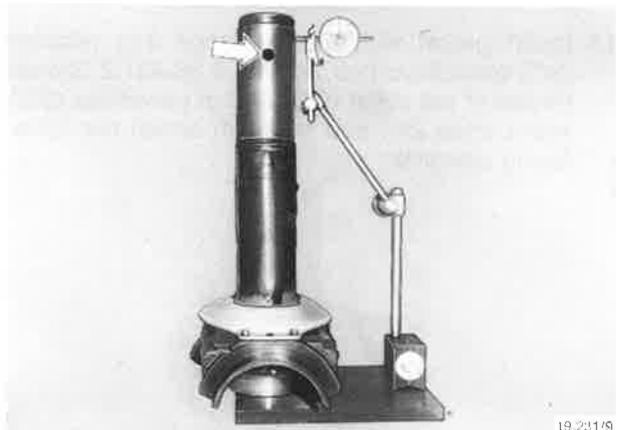


Fig. 2

Key for fig. 3:

- 1 = crown wheel
- 2 = half-axle
- 3 = deep groove ball bearing
- 4 = adjusting shim
- 5 = snap ring
- 6 = rotary shaft seal ring
- 7 = dowel pin
- 8 = cheese head screw with serrated lock washer
- 9 = ball shell
- 10 = O-ring
- 11 = circlip
- 12 = needle bearing

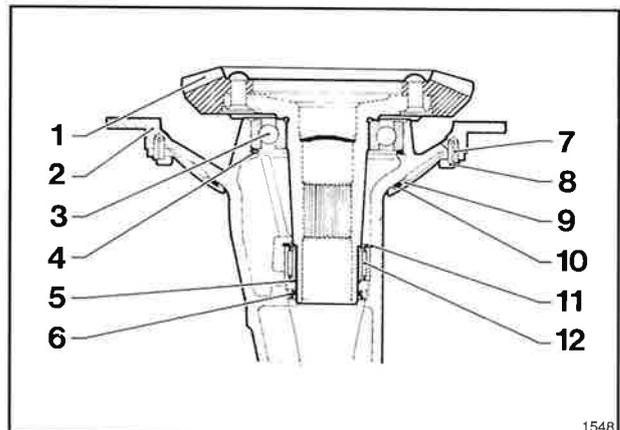


Fig. 3

- 3 Turn crown wheel with press-off threads into position acc. to fig. 4. Screw in two M 10 x 50 screws (with continuous thread) and push crown wheel by alternating screwing in of screws out from bearing in half-axle. Remove adjusting shim (3/4).

NOTE: Mark adjusting shim and crown wheel as against the respective half-axle. In case the deep groove ball bearing (3/3) does not remain on the crown wheel during dismounting of the crown wheel but remains in the half-axle, pull out bearing with extractor Kukko no. 21-7 special tool pos. no. 905.0.14.011.0 and rest Kukko no. 22-2 special tool pos. no. 905.0.14.001.0.

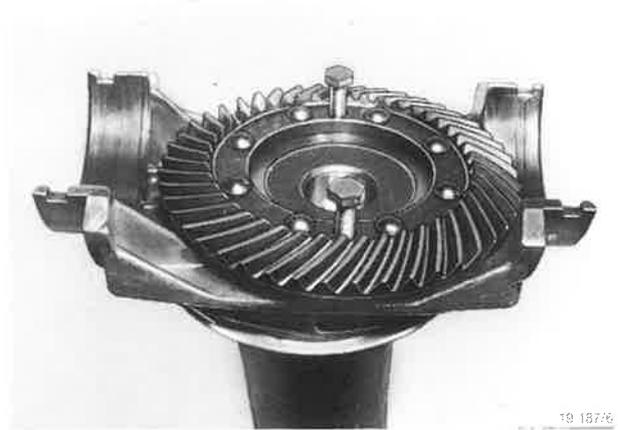


Fig. 4

- 4 Compress circlip and remove (5).

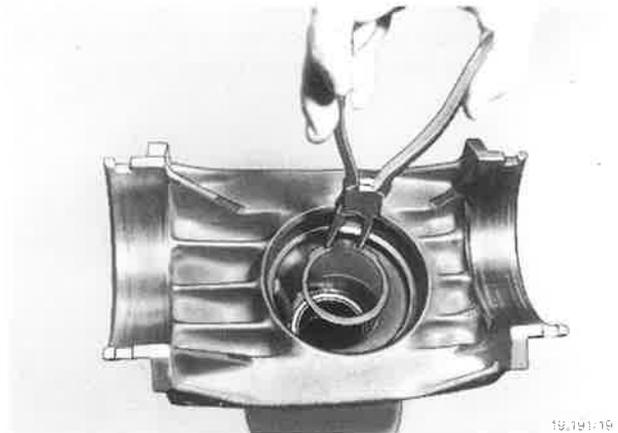


Fig. 5

- 5 Pull out needle bearing with extractor (6/1) Kukko no. 21-7 special tool pos. no. 905.0.14.011.0 and rest Kukko (6/2) no. 22-2 special tool pos. no. 905.0.14.001.0.
- 6 Drive out rotary shaft seal ring (3/6) starting from half-axle end using a suitable tube.

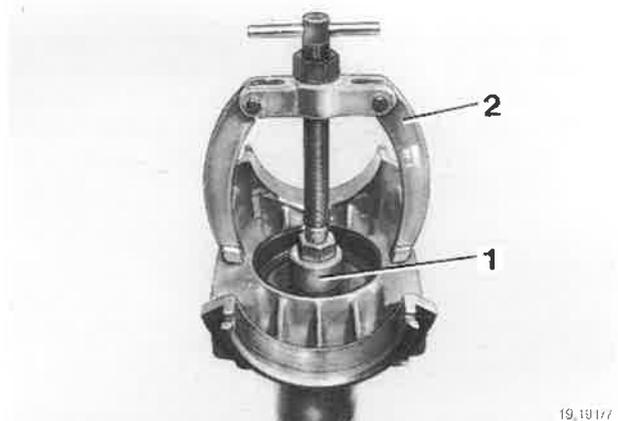


Fig. 6

- 7 Screw off ball cup and remove with O-ring (7).

NOTE: For lifting ball cup, apply screwdriver close to dowel pin.

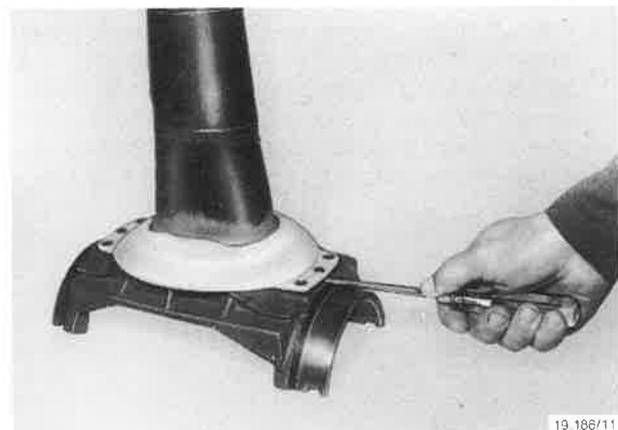


Fig. 7

8 Compress snap ring and remove (8).



19.186/19

Fig. 8

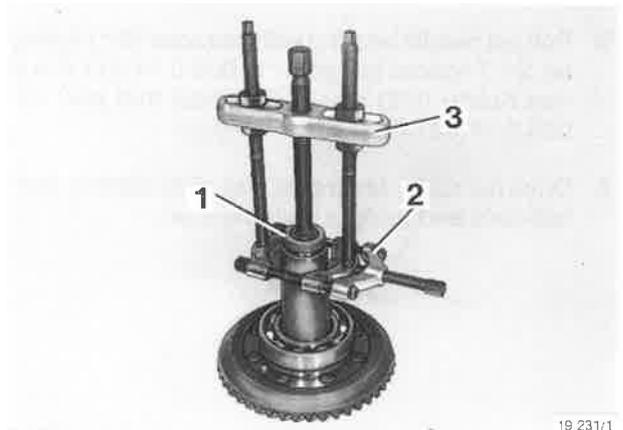
9 Lift off needle cage inner raceway carefully with a chisel for abt. 2 mm from crown wheel (9).



18.194/1

Fig. 9

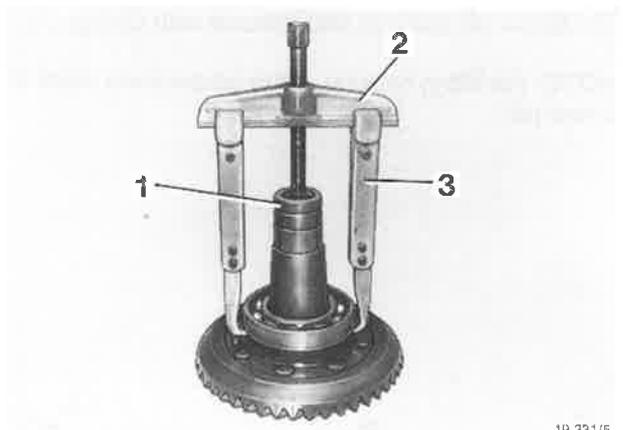
10 Pull off inner raceway with stopper (10/1) special tool pos. no. 905.3.34.402.1 in combination with separating device (10/2) Kukko no. 17-1 special tool pos. no. 905.0.14.021.0 and puller Kukko (10/3) no. 18-1 special tool pos. no. 905.0.14.020.0.



19.231/1

Fig. 10

11 Pull off deep groove ball bearing from crown wheel with stopper (11/1) special tool pos. no. 905.3.34.402.1, double arm puller (11/2) Kukko no. 20-10 special tool pos. no. 905.0.14.022.0 and extended puller hook (11/3) Kukko no. 1-190-P special tool pos. no. 905.0.14.023.0.

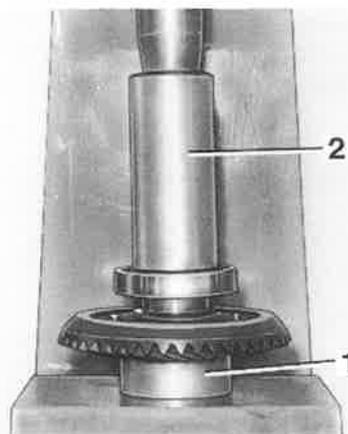


19.231/5

Fig. 11

Assembling:

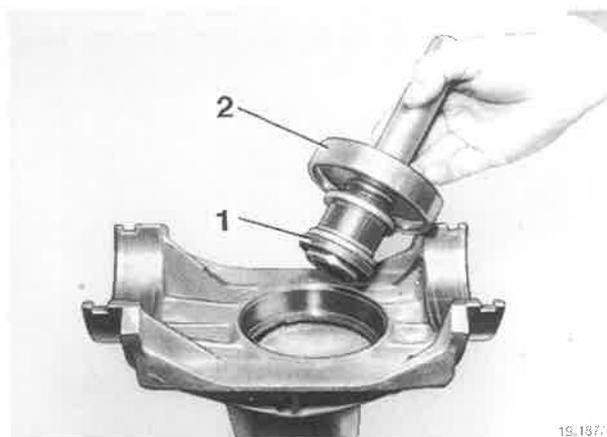
- 12 For even rest place crown wheel onto special tool pos. no. 905.3.33.407.2 (12/1) and press on deep groove ball bearing with press-on tool (12/2) special tool pos. no. 905.3.33.401.1 until stop.
- 13 Heat up needle bearing inner raceway to abt. 80°C and slip on at crown wheel flange. If necessary, drive with suitable drift punch until stop. Insert snap ring (8).



19.169/9

Fig. 12

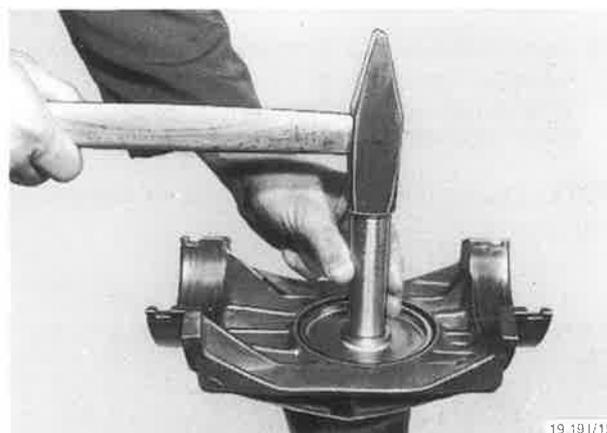
- 14 Press in shaft seal rotary ring (13/1) with press-in device (13/2) special tool pos. no. 905.3.33.405.0 and sealing lip (3/6) pointing to crown wheel.



19.167/2

Fig. 13

- 15 Place needle bearing into half-axle, drive in until stop with press-in device special tool pos. no. 905.3.33.405.0 (14) and mount circlip (5).



19.191/15

Fig. 14

- 16 Smear O-ring surface to inner ball cup with Loctite 574 and insert O-ring (15).



19.191/4

Fig. 15

- 17 Drive in dowel pins (16/1). Smear O-ring surface to half-axle also with Loctite 574 (16/2) and mount ball cup.



Fig. 16

- 18 Insert adjusting shim (17) into bearing bore, outside chamfer first.



Fig. 17

- 19 Insert half-axle into supporting ring at mounting carriage and drive in crown wheel and deep groove ball bearing resp. with a soft metal drift punch until stop (18).

NOTE: Do not damage ground rest for measuring ring.

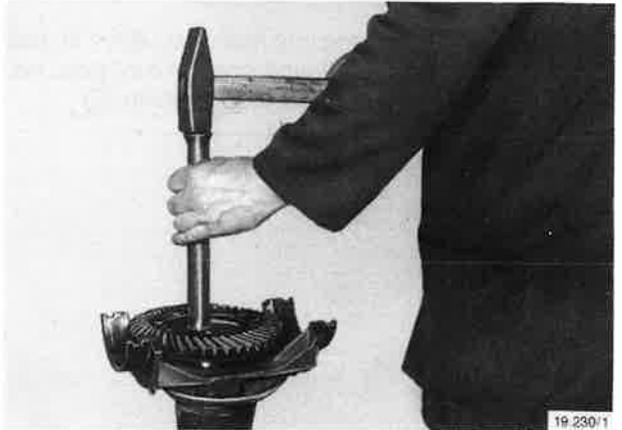


Fig. 18

2.2.3 Strip/assemble differential gear unit

Stripping:

NOTE: In case of reuse of the parts care for marking them towards each other first.

- 1 Remove differential bevel gears (1/8) and adjusting shims (1/9 and 1/10).

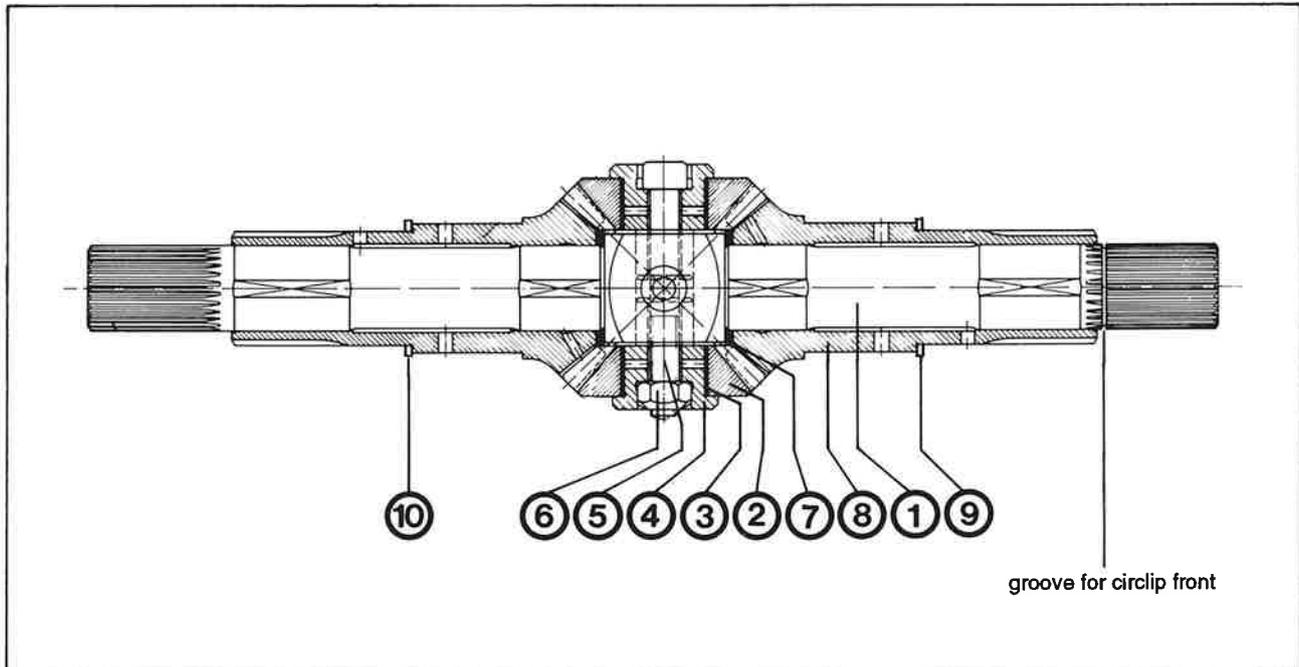


Fig. 1

Key for fig. 1:

- | | |
|--|---|
| <ol style="list-style-type: none"> 1 - differential shaft 2 - differential planetary wheel 3 - bush 4 - differential bolt 5 - cheese head screw | <ol style="list-style-type: none"> 6 - securing nut 7 - adjusting shim 8 - differential bevel gear 9 - adjusting shim 10 - adjusting shim (standard shim 3 mm) |
|--|---|

- 2 Loosen cheese head screw (1/5) and remove with securing nut (1/6).
- 3 Pull out both differential bolts (1/4) including bush (1/3) and planetary wheel (1/2) with extractor (2) special tool pos. no. 905.3.34.404.0.
- 4 Clean all parts and compare with table 1 values before reuse.

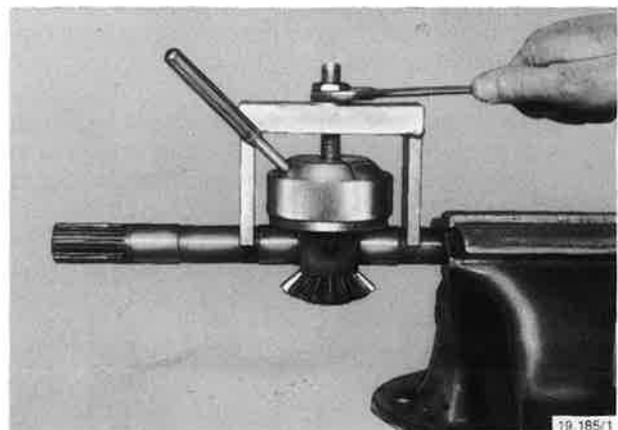


Fig. 2

Table 1: Dimensions and wear limits

Differential shaft outer Ø mm	Differential pinion inner Ø mm	Differential bolt outer Ø mm	Differential planetary wheel inner Ø mm	Bush for differential planetary wheel		Mounting play mm	Wear limit (clearance) mm	Tooth flank backlash mm
29.914 - 29.935	30.000 - 30.021					0.065 - 0.107	0.20	0.13 - 0.30
		27.914 - 27.930	30.000 - 30.021	29.950 - 29.990	27.970 - 27.990	0.050 - 0.147	0.50	

Assembling:

NOTE: In case of reuse of old parts take care of markings of parts which have run towards each other. Always change differential bevel gears and differential planetary wheels together. Differential planetary wheels are available in pairs in order to reach homogeneous mesh.

- 5 Press in differential bolts with planetary wheel and floating bush (1/3) into differential shaft (3) so that lubricating bores of differential bolts are in parallel position to longitudinal axis of differential shaft, see fig. 4.

NOTE: When pressing in the differential bolts lift planetary wheel and bush - as seen in fig. 3 - in order not to damage bush in case the differential bolt has been positioned canted.

- 6 Screw differential bolt together with new cheese head screw and new securing nut and tighten to 50 Nm. Mark position of cheese head screw to differential bolt and turn on by $60^\circ \pm 5^\circ$ (4).

NOTE: Use cheese head screw and securing nut only once.

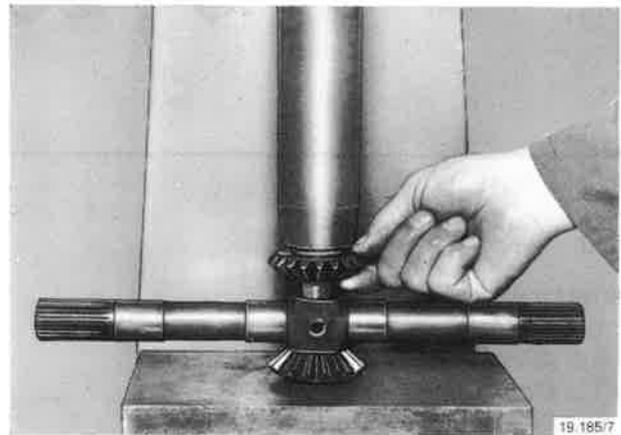


Fig. 3

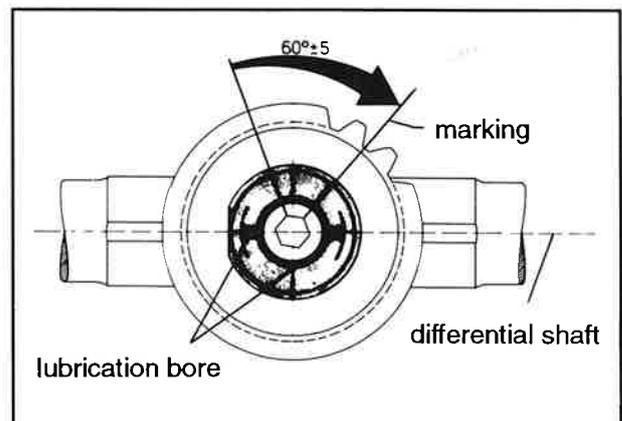


Fig. 4

2.2.4 Measuring differential gear unit

Adjust backlash:

- 1 Slip any adjusting shim (1/7) to differential shaft and put on differential bevel gear.
- 2 Clamp differential shaft between two soft vise chops (differential shaft resting on differential bevel gear which again is resting on the vise chops and by this is blocked against twisting). Arrange magnetic support and dial gauge 1/100 and measure backlash. When measuring pull differential planetary wheel outwards and determine value in this position (5).

Admissible backlash = 0.13 - 0.30 mm.

Measure and adjust resp. for both differential bevel gears. Available thicknesses of adjusting shims: 2.75;2.85;2.95;3.05;3.10 mm.

NOTE: Differential planetary wheels are always available in pairs in order to reach equivalent mesh. Therefore care for symmetrical backlash through adjusting shims in the region between 0.13 - 0.30 mm. After adjusting do not change differential bevel gears or shims.

Adjust axial play:

- 1 Slip on adjusting shim (standard shim 3mm) to rear differential bevel gear (1/10).
- 2 Determine front adjustment shim (1/9). Thickness of adjusting shim results from the difference housing length (6) less both pinion heights to bearing flange (7) as well as from the length measured along the two differential bevel gears including the standard shim's 3 mm (8). Also, 0.05 - 0.10 mm must be added for axial play of the complete differential gear unit.

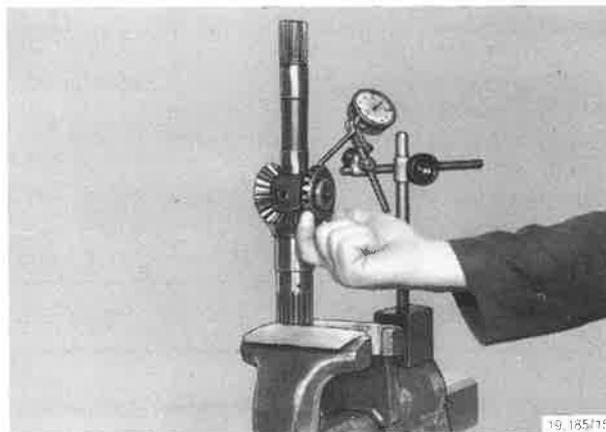


Fig. 5

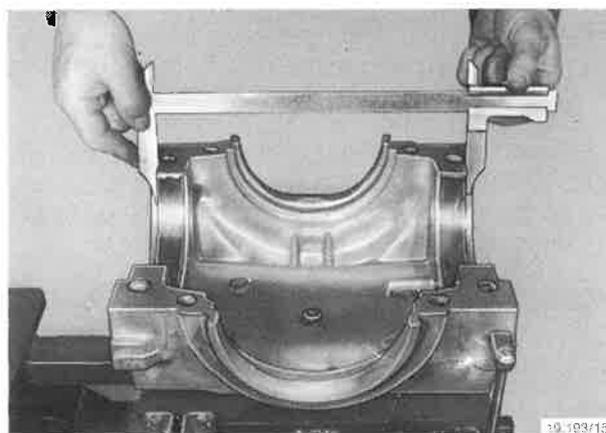


Fig. 6



Fig. 7

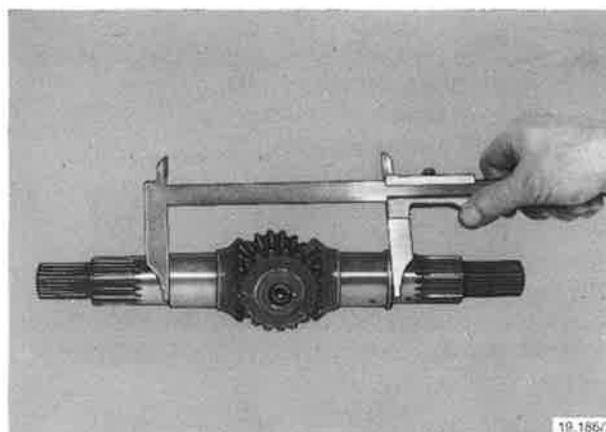


Fig. 8

Example:

Housing length	290.00 mm
Height of pinion rear	- 54.20 mm
Height of pinion front	- 54.15 mm
Length diff.bevel wheels with stand.shim	-178.70 mm
Axial play complete differential gear unit	- 0.05 mm -287.10 mm

Adjusting shim thickness 2.90 mm

Adjusting shims are available in thicknesses between 0.60 - 0.80 and 2.60 - 3.15 mm in 0.05 mm intervals.

- Place determined adjusting shim to the front and slip both bearing flanges onto differential bevel gears. Insert into lower axle housing half and tighten provisionally. When tightening the bearing flanges press them downwards. Fasten dial gauge support special tool pos. no. 905.0.32.103.0 with dial gauge 1/100 to bearing flange and check determined play by moving the differential shaft to and fro.

NOTE: Pinion adjustment must be made before.

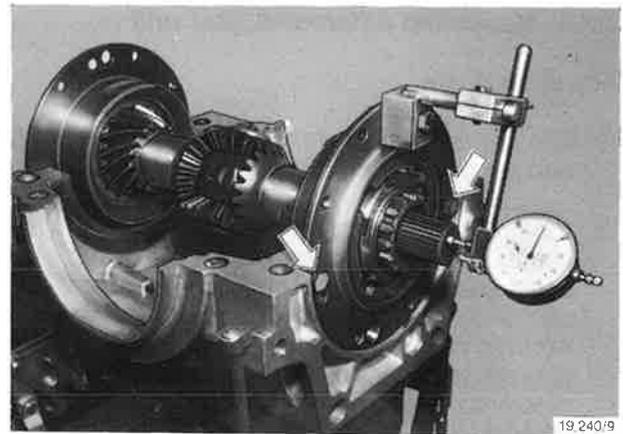


Fig. 9

2.2.5 Adjust pinion and crown wheel

NOTE: Pinion and crown wheel are only available in pairs. Smoothest possible running in combination with optimum meshing behaviour can be reached by shifting the wheels towards each other on testing machines. Determine deviations from theoretical specified distances and write them down to pinion or crown wheel resp. Also mark teeth of pinion and crown wheel being in mesh during determining the deviations. Therefore observe deviations and markings when mounting the bevel gears. Write down deviations under consideration of tolerance deviations in hundredths of millimeters with + or - signs (1).

Key for fig. 1:

- T = distance pinion axis - rear side crown wheel
- t = written down deviation of "T"
- R = distance crown wheel axis - pinion
- r = written down deviation of "R"
- Z = marking teeth
- P = pair number

Adjusting pinion:

To determine the required adjusting shim, two different methods can be chosen which are described in fig. 1, 2 and 3.

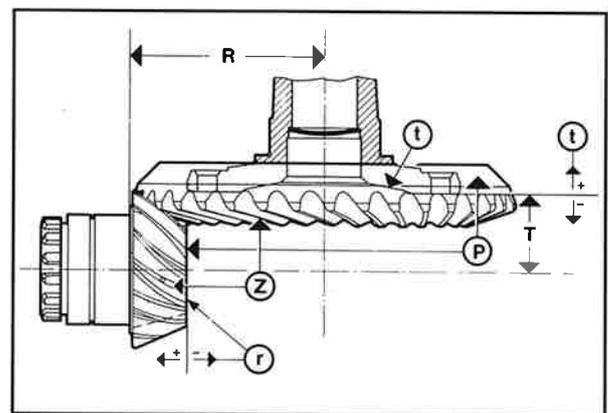


Fig.1

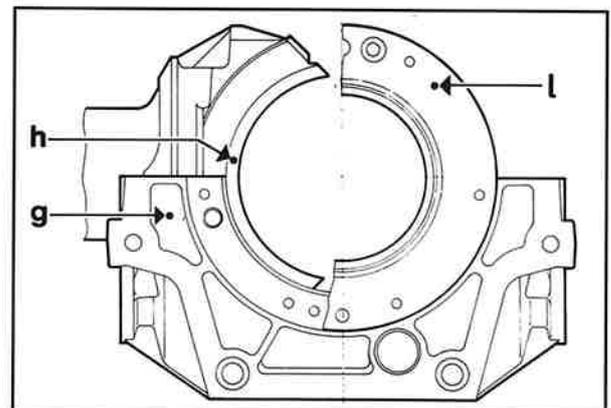
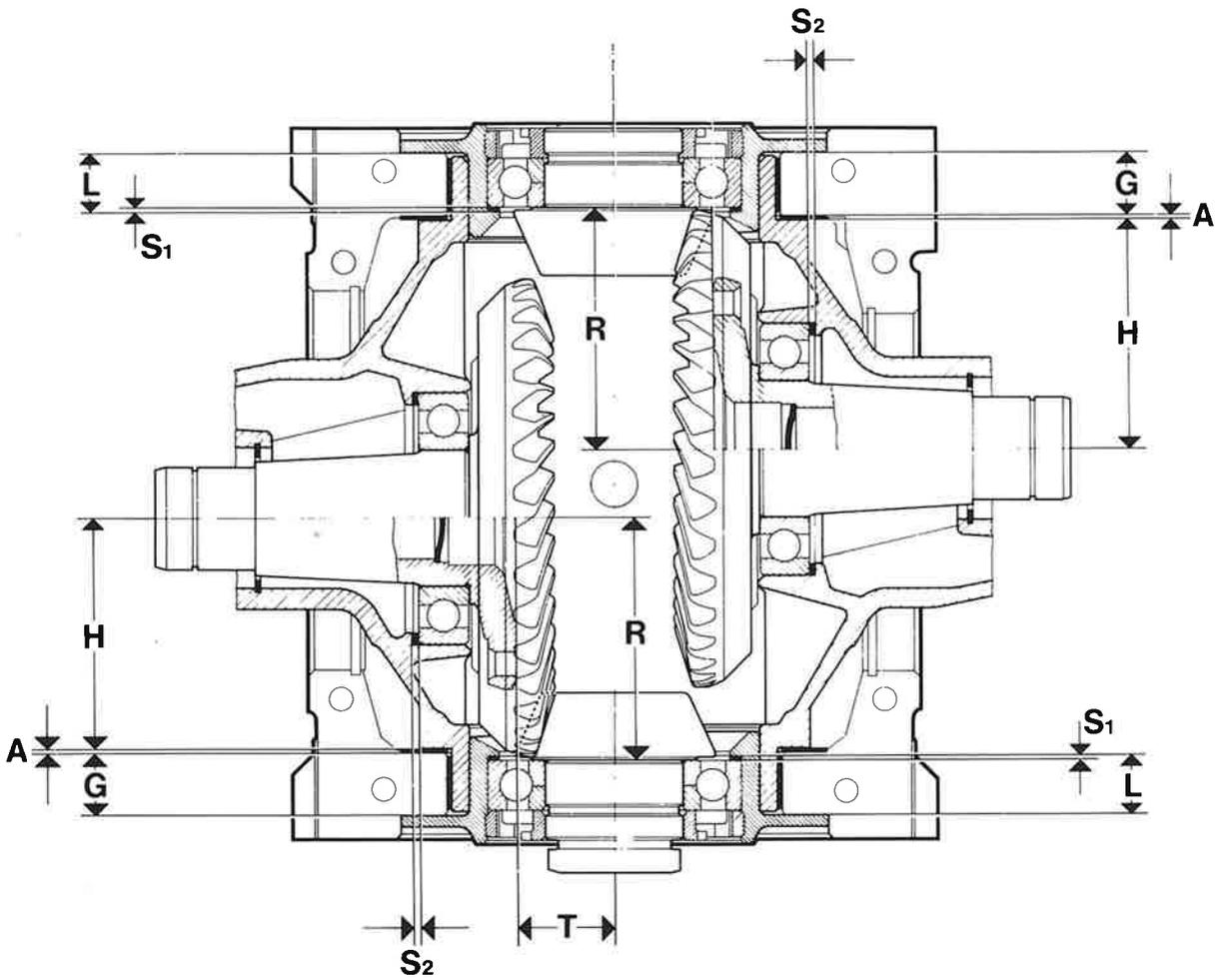


Abb. 2



short sign	denomination	specified value
G	housing length, bearing flange - thrust washer	27.50
H	distance crown wheel axis - half-axle bearing	101.00
A	thrust washer	1.50
L	bearing flange, rest housing - adjusting shim	26.00
R	distance crown wheel axis - rear side pinion	106.00
T	distance pinion axis - rear side crown wheel	44.00
S1	adjusting shim - pinion	2.00
S2	adjusting shim - crown wheel	2.00

Method 1:

Adjusting shim thickness is resulting from the below distances: housing thickness "G" with deviation "g" as well as thrust washer "A" and half-axle "H" with deviation "h", less bearing flange "L" with deviation "l". The calculated intermediate value will then be deducted from the height of the pinion or from the theoretical bevel height "R" with deviation "r", which now leads to the adjusting shim thickness "S₁".

short sign	denomination	specified value	deviation		actual size
G	housing length bearing flange - thrust washer	27.50	+	0.03	27.53
			-		
A	thrust washer	1.50			1.50
H	crown wheel axis - half-axle rest	101.00	+		100.96
			-	0.04	
total measurements G, A, H incl. deviations					129,99
less					-
L	bearing flange, rest housing - adjusting shim	26.00	+	0.05	26.05
			-		
subtotal					103.94
R	crown wheel axis - rear side pinion	106.00	+		105.90
			-	0.10	
less determined subtotal					-
					1.96
round-off					+
					-
thickness of adjusting shim S ₁					1.95

Method 2:

Adjusting shim thickness is resulting from the following deviations: deviation of housing "g", of half-axle "h", of bearing flange "l" and of pinion "r", which are then added to/deducted from the theoretical thickness of 2 mm (\pm).

NOTE: Adjusting shims are available in thicknesses from 1.60 - 2.80 mm in 0.05 intervals being rounded off adequately.

short sign	read-off sign with deviation	sign (\pm)	resulting for calculation		
			+	-	
g	- 0.03	is reversed		0.03	
h	- 0.04	is reversed	0.04		
l	+ 0.05	remains	0.05		
r	- 0.10	remains		0.10	
total of deviations			0.09	0.13	
difference from total of deviations				- 0.04	
theoretical shim thickness					2.00
differenc from total of deviations					- 0.04
determined shim					1.96
rounding-off					- 0.01
thickness of adjusting shim S1					1.95

Change adjusting shim

Removing:

- 1 Place bearing flange with pinion rear side onto a heating plate and heat up to abt. 110°C.
- 2 Clamp retainer (4/1) special tool pos. no. 905.3.36.401.2 into vise and put on heated-up bearing flange.
- 3 Loosen set collar with socket (4/2) special tool pos. no. 905.3.35.402.1.
- 4 Arrange bearing flange, outer side on suitable rest (prisms e.g.), under a piercing press and press out pinion with adjusting shim, four-point bearing and crown nut (5).

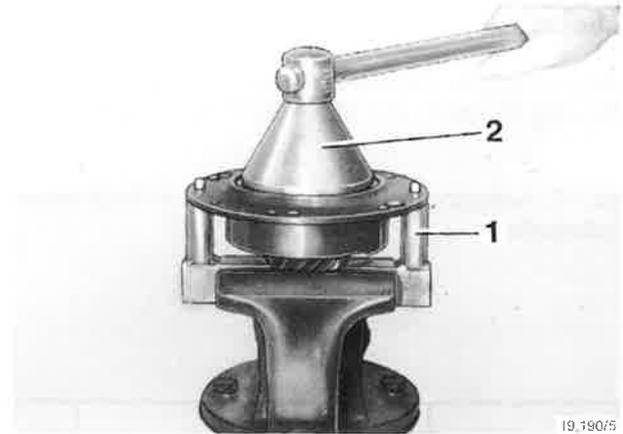


Fig. 4

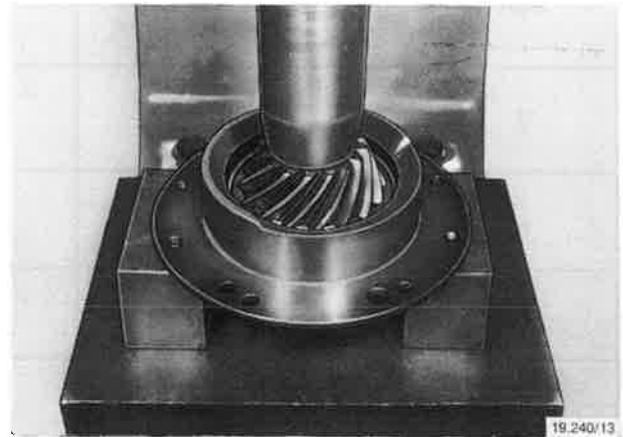


Fig. 5

Fitting:

- 5 Insert adjusting shim (6) into bearing flange, outside chamfer first.
- 6 Press in pinion or four-point bearing into bearing flange (7).
- 7 Insert bearing flange into retainer special tool pos. no. 905.3.36.401.2.
- 8 Smear set collar thread evenly with Loctite 242 and screw in, collar facing upwards.



Fig. 6



Fig. 7

- 9 Tighten set collar with socket special tool pos. no. 905.3.35.402.1 to 250 - 300 Nm (8).

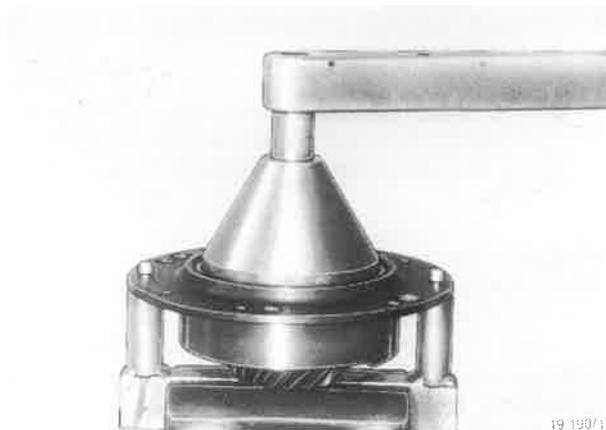


Fig. 8

Adjust crown wheel

Thickness of adjusting shim is determined with measuring rings special tool pos. no. 905.3.32.401.0. In case of non-availability of measuring rings, correct adjusting shims can also be determined through the adjustment/backlash method.

- 1 Put crown wheel with pressed on bearing onto measuring ring/measuring plate special tool pos. no. 905.3.32.401.0 (9).

NOTE: Crown wheel flange must not be damaged at front side (faulty measurement).



Fig. 9

- 2 Put on second measuring ring to bearing and put on half-axle (10).



Fig. 10

- 3 Arrange magnetic support with dial gauge 1/100 and extended feeler pin on the measuring plate and identify highest point of half-axle rest. Set dial gauge to zero in found position (11). Also check second side, in case of a difference set dial gauge to mean value.

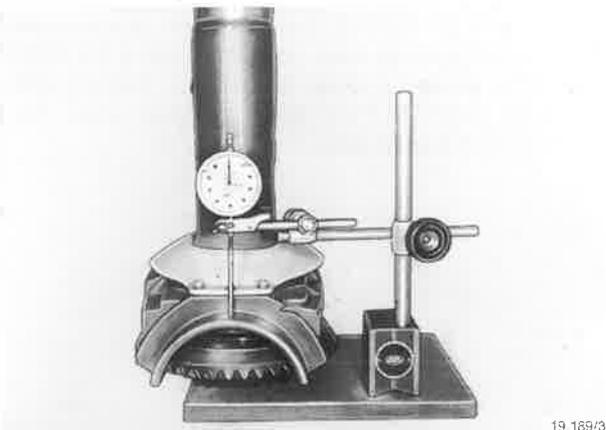


Fig. 11

- 4 Remove half-axle and crown wheel, but do not disarrange dial gauge.
- 5 Set up one of the measuring rings at front face and read off difference plus + or minus - between half-axle and measuring rings from the dial gauge (12).
- 6 Add or deduct the found value from the theoretical adjusting shim of 2 mm being already considered in the measuring rings. Then deviation of crown wheel "t" (1 and 3) is either added or deducted, observing that + or - being reversed, finally leading to the thickness of the required shim "S2", rounding-off also being considered. Adjusting shims are available in thicknesses from 1.60 - 2.80 mm in intervals of 0.05 mm being rounded off correspondingly.

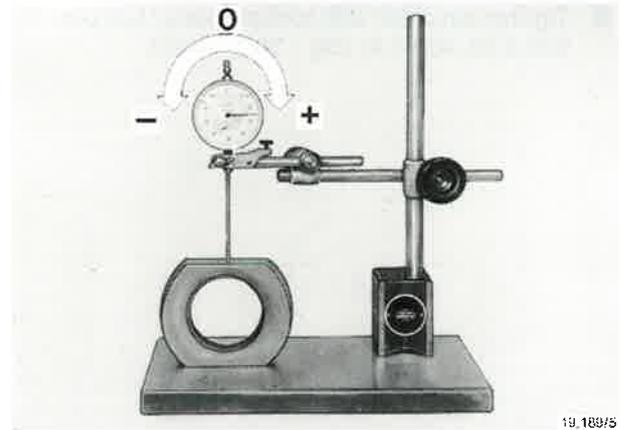


Fig. 12

theoretical shim thickness		2.00
difference half-axle measuring ring		+ 0.23 - 0.23
deviation "t"	sign (±)	2.23
- 0.10	is reversed	+ 0.10 - 0.10
round-off		2.33 0.02
thickness of adjusting shim S2		2.35

Calculation example

Change adjusting shim

Removing:

- 7 Turn crown wheel with press-off threads into position seen in fig. 13. Screw in two screws M 10 x 50 (with continuous thread) and press crown wheel by alternating screwing in screws out from rest in half-axle and remove adjustment shim (14) .

NOTE: In case that deep groove ball bearing does not remain on the crown wheel during dismounting of the crown wheel but in the half-axle, pull out bearing with extractor Kukko no. 21-7 special tool pos. no. 905.0.14.011.0 and rest Kukko no. 22-2 special tool pos. no. 905.0.14.001.0. For even rest, place crown wheel onto special tool pos. no. 905.3.33.407.2 (15/1) and press on deep groove ball bearing with press-on tool (15/2) special tool pos. no. 905.3.33.401.1 until stop.



Fig. 13

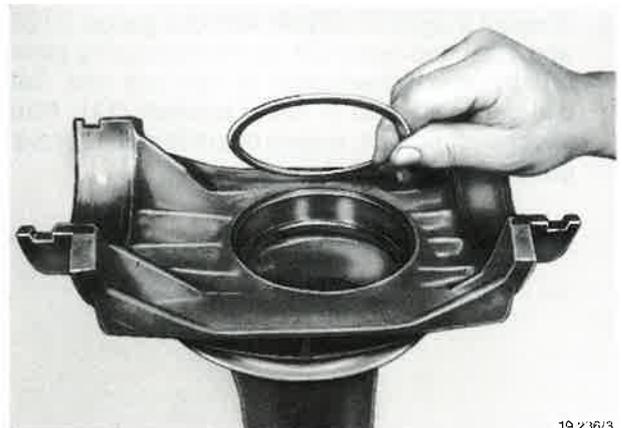


Fig. 14

Fitting:

- 8 Insert adjusting shim (14) into bearing bore, outside chamfer first.
- 9 Insert half-axle into supporting ring at mounting carriage and drive in crown wheel or deep groove ball bearing resp. until stop using a soft metal drift punch (16).

NOTE: Do not damage ground rest for measuring ring.

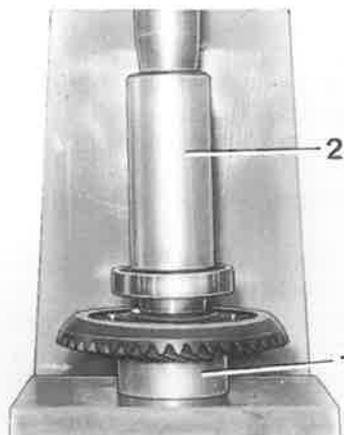


Fig. 15

Check adjusting of pinion and crown wheel

Check correctness of adjusting by controlling the backlash

Check backlash

- 1 Insert half-axes (without sealing and stop rubber), differential gear unit and bearing flange into housing lower part, see section 2.1
- 2 In order to center half-axes and pinion flanges correctly, attach housing upper part and tighten with 4 screws to 50 - 60 Nm. Fix bearing flanges with 2 opposite screws (17/1). Then remove housing upper part.
- 3 Check axial play of half-axle to be measured with feeler gauge (17/2).

Max. admissible play 0.5 mm.

If admissible play is exceeded, replace thrust washers left- and right-hand and prepare again axle drive to be measured as described in step 1 and 2.

- 4 Eliminate axial play of half-axle to be measured by inserting of evenly thick feeler gauge plates (17/2).
- 5 Insert locking key (17/3) special tool pos. no. 905.3.36.404.2 at crown nut and arrest pinion by turning on.

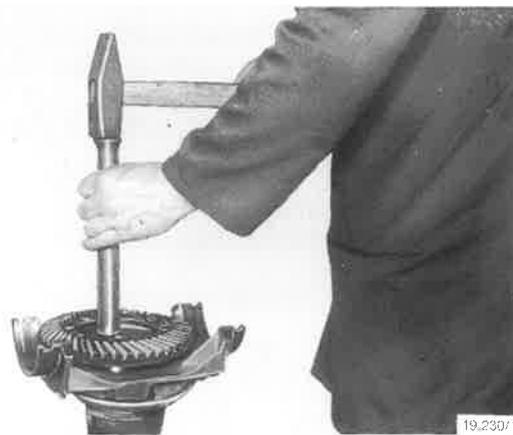


Fig. 16

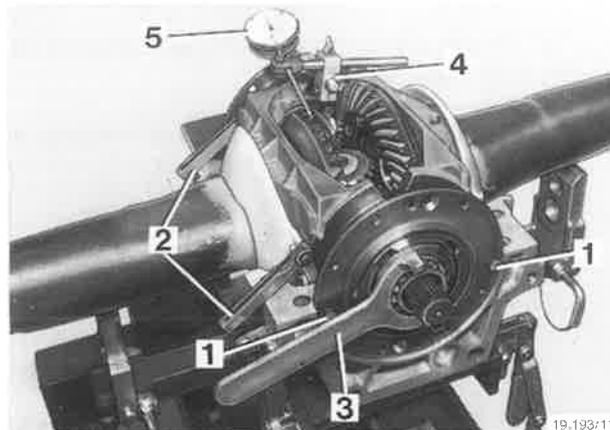


Fig. 17

- 6 Screw on dial gauge support (17/4) special tool pos. no. 905.0.32.103.0 with dial gauge 1/100 and extended feeler pin to bearing flange. Adjust dial gauge (17/5) to zero and determine backlash by moving crown wheel to and fro.

Max. admissible play 0.15 - 0.20 mm.

Repeat this check after loosening the locking key and turning on the crown wheel by 90° each until the initial point. In case admissible play is too high or too low (crown wheel run-out e.g.) make new adjustment of pinion and also of crown wheel.

Check meshing performance

- 1 Check meshing performance after having checked backlash. In order to make the meshing performance better perceptible, smear 5 - 6 teeth of crown wheel with a thin layer of a flake lead - gasoline mixture.
- 2 Move crown wheel into both directions to make the meshing performance well visible.

Correct meshing depth of pinion is seen in fig. 18.

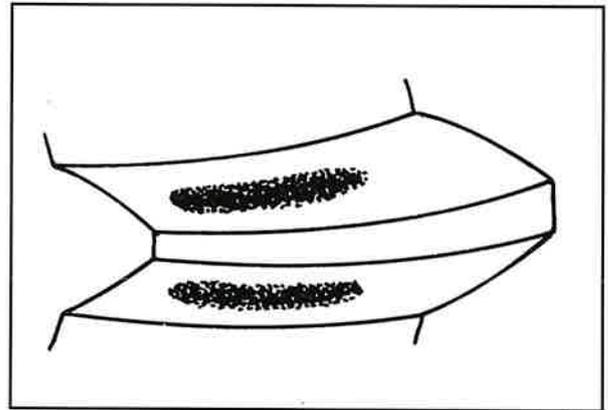


Fig. 18

Fig. 19 is showing the meshing performance at the tooth flank base.

CORRECTION: Moving pinion away from crown wheel axis = thicker adjusting shim.

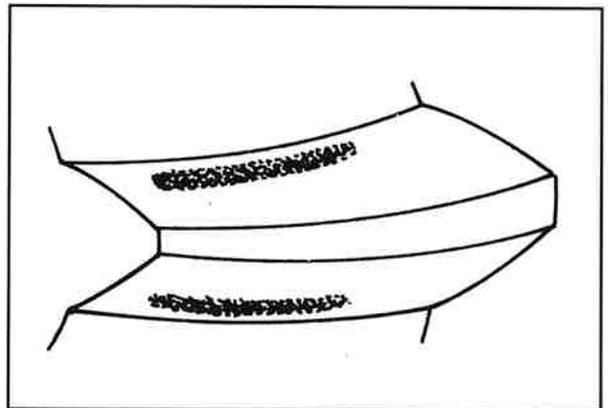


Fig. 19

Fig. 20 is showing the meshing performance at the tooth flank upper end.

CORRECTION: Moving pinion closer to crown wheel axis = thinner adjusting shim.

NOTE: Check backlash and meshing performance after each correction again.

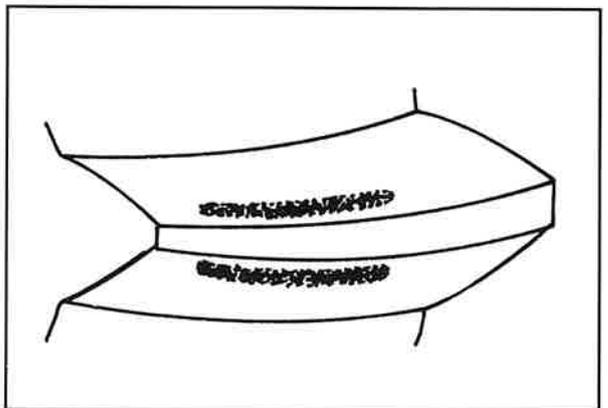


Fig. 20

2.3 Works at dismantled axle journal

Including:

Changing, removing and fitting axle journal (1) at front axle see group 091/section 2.3

Changing, removing and fitting axle journal (2) at auxiliary gearbox see group 093/section 1.8

Changing, removing and fitting axle journal (3) at first rear axle model 718 see group 093/section 1.9

Changing, removing and fitting axle journal (4) rear axle model 716 or second rear axle model 718 see group 093/section 1.10

Stripping/assembling axle journal see section 2.4

Tools:

press-on and press-off tool	905.3.33.201.0
drift punch for bearing bush	905.3.33.303.1
puller stopper	905.3.34.402.1
retainer	905.3.36.401.2
counter support Kukko no. 22-1	905.0.14.002.0
inside extractor Kukko no. 21-02	905.0.14.017.0
double-armed puller Kukko no. 20-10	905.0.14.022.0
puller hook, extended, Kukko no. 1-190-P	905.0.14.023.0

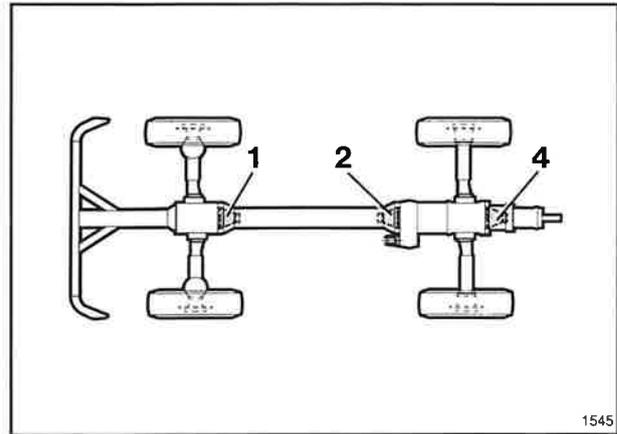


Fig. 1

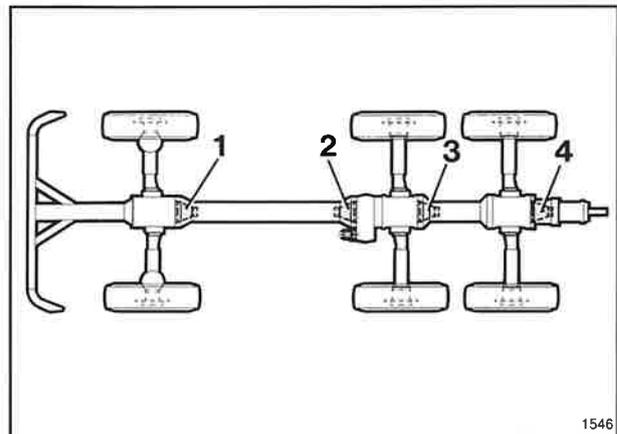


Fig. 2

2.3.1 Change, check driving shaft bearing bush - only auxiliary gearbox axle journal

NOTE: Bearing bush is mounted only in the axle journal which is screwed to the auxiliary gearbox.

Check bearing bush

specified value	= Ø 12.027 mm
wear limit	= Ø 12.3 mm

If a twist drill Ø 12.3 mm can be inserted into bearing bush with cylindrical shaft first (1), replace bearing bush.

Change bearing bush

Removing:

- 1 Pull out bearing bush with inside extractor Kukko no. 21-02 special tool pos. no. 905.0.14.017.0 and counter support Kukko no. 22-1 special tool pos. no. 905.0.14.002.0 (2).



Fig. 1



Fig. 2

Fitting:

- 2 Clean bore of bearing bush in driving shaft.
- 3 Grease bearing bush and press in with drift punch special tool pos. no. 905.3.33.303.1 (3).



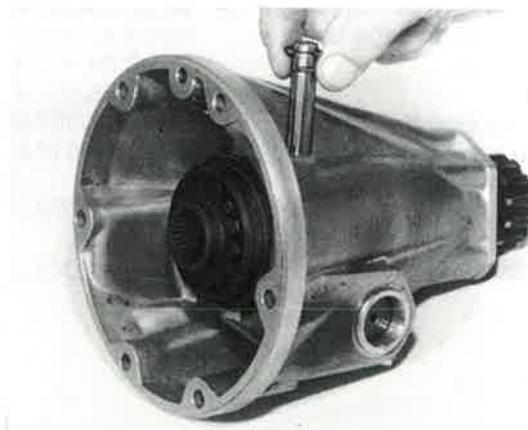
18 896/15

Fig. 3

2.3.2 Change spring-loaded bolt V-ring

Removing:

- 1 Lift gearshift fork axle at circlip groove with screwdriver and pull out (1).



18 845/2

Fig. 1

- 2 Remove operating sleeve with gearshift fork (2).



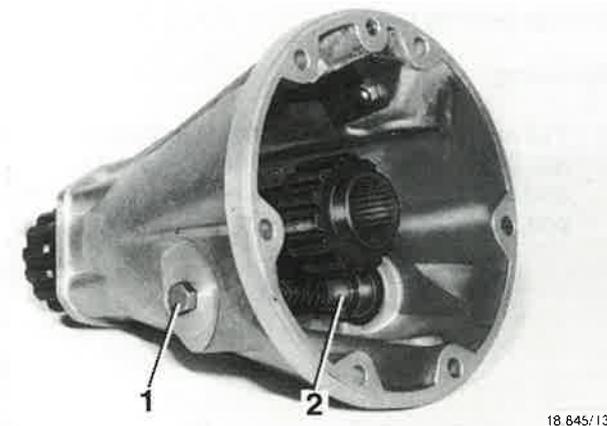
18 845/6

Fig. 2

- 3 Loosen guide screw (3/1) to spring-loaded bolt (3/2) and remove spring-loaded bolt with pull-back spring.

Checking:

- 4 Check all parts for reusability (visual check).



18 845/13

Fig. 3

Fitting:

- 5 Renew V-ring (4) and insert spring-loaded bolt with pull-back spring. Smear thread and head rest of guide screw (3/1) with Loctite 242 and tighten.
- 6 Fit gearshift fork see section 2.4/15-17.



18.897/13

Fig. 4

2.4 Strip/assemble axle journal

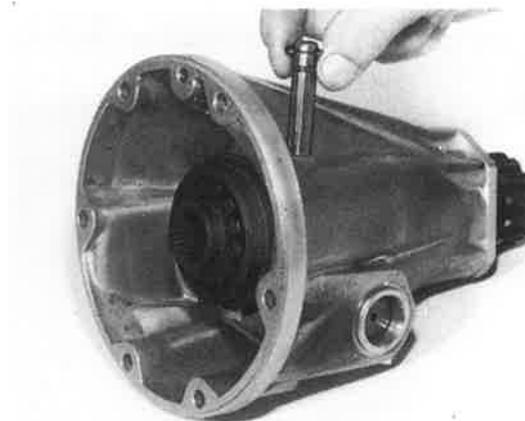
Including:

Checking gearshift unit see section 2.4.1
 Stripping/assembling driving shaft (brake shaft) section 2.4.2

Stripping:

NOTE: Model 716 features three and model 718 four axle journals with different driving shafts (see section 2.4.2) with the consequence of a slightly modified housing of the axle journal auxiliary gearbox. Stripping and assembling the axle journals remains the same in all variants.

- 1 Lift gearshift fork axle at circlip groove with screwdriver and pull out (1).
- 2 Remove operating sleeve with gearshift fork (2).



18.845/2

Fig. 1



18.845/6

Fig. 2

- 3 Clamp retainer special tool pos. no. 905.3.36.401.2 into vice, attach axle journal and unscrew axle journal cover (3).



18.845/15

Fig. 3

- 4 Drive out complete driving shaft (brake shaft) with a soft metal or plastic hammer (4).

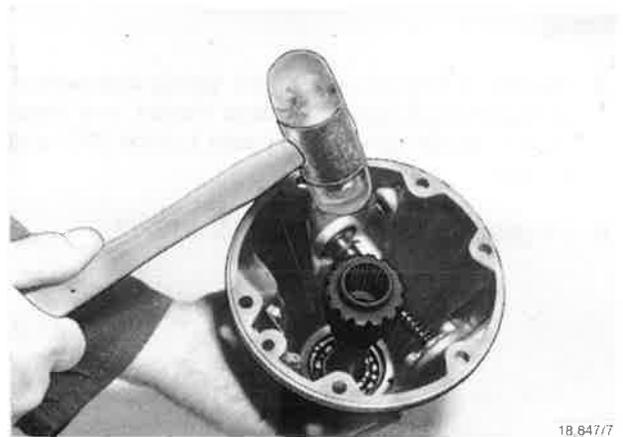


Fig. 4

18.847/7

- 5 Release circlip (5) and take shaft from housing.

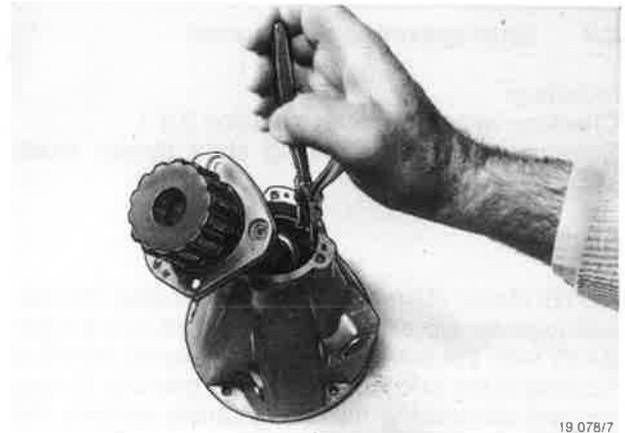


Fig. 5

19.078/7

- 6 Loosen guide screw (6/1) to spring-loaded bolt (6/2) and take out spring-loaded bolt with pull-back spring.

NOTE: Remove oil sheet (6/3) only when changing housing.

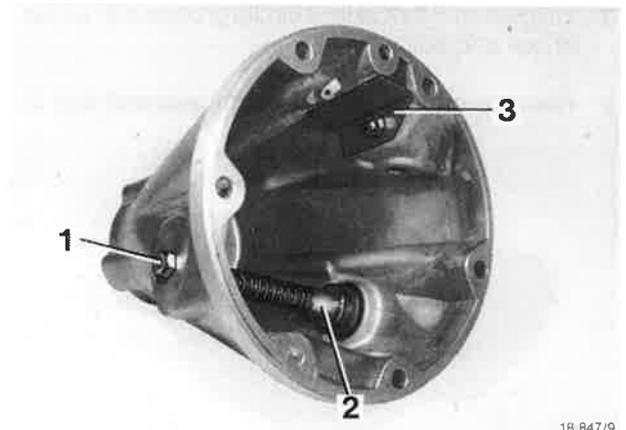


Fig. 6

18.847/9

Assembling:

- 7 Check sealing cover (7/1) and bush (8/2) for tight seat. If necessary, secure with Loctite 242, strut sealing cover additionally.
- 8 Fit oil sheet (7/2) closely - pretighten somewhat before mounting - and with a recess distance of abt. 0.5 mm to sealing surface. Secure fastening screw with Loctite 242 and seal.

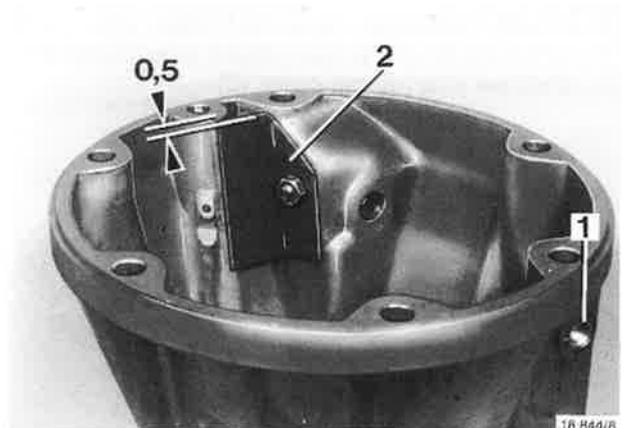


Fig. 7

18.844/8

WARNING: Check existence and tight seat of balls (8/1) in axle journal auxiliary gearbox and there must be no oil return bore at the modified axle journal resp.

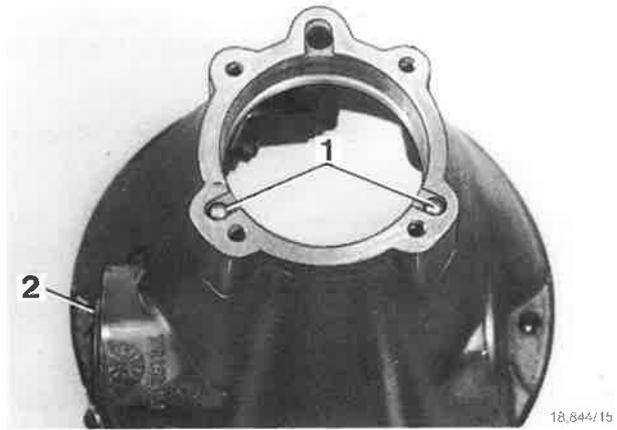


Fig. 8

9 Renew V-ring (9) to spring-loaded bolt.

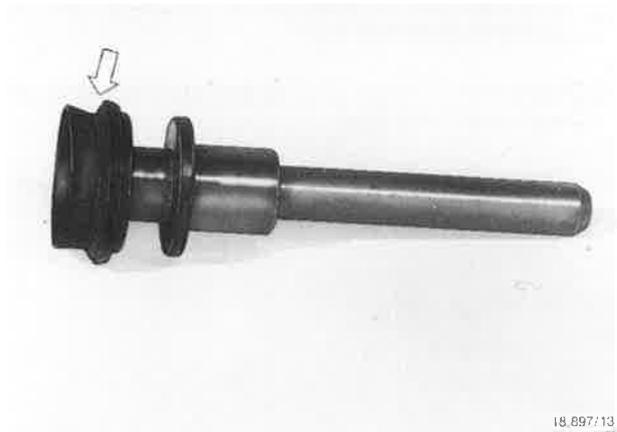


Fig. 9

10 Insert spring-loaded bolt with pull-back spring. Smear thread and head rest of guide screw with Loctite 242 and tighten (10).

11 Smear sealing surface of axle journal cover with Loctite 574.

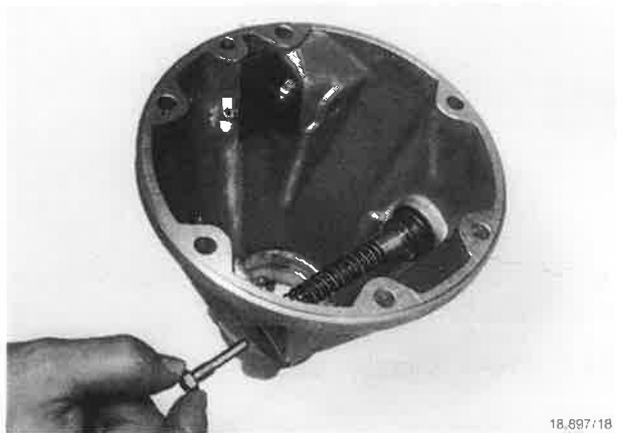


Fig. 10

12 Place housing with bearing bore first on heating plate, heat up to abt. 80°C and insert complete driving shaft (brake shaft) (11).



Fig. 11

- 13 Attach circlip (5) and insert or drive in resp. driving shaft (brake shaft) until stop of bearing at circlip.

NOTE: Take care to ensure correct position of cover to oil bore.

- 14 Clamp retainer special tool pos. no. 905.3.36.401.2 into vise and attach axle journal. Smear thread and head rest of cheese head screws to axle journal cover with Loctite 242 and tighten (3).

- 15 Insert sliding blocks into gearshift fork, insert operating sleeve with collar pointing upwards and slip on to coupling toothing of driving shaft that also shift pins of gearshift fork engage into the spring-loaded bolt (12).

- 16 Apply new O-ring (13/1) to gearshift fork axle, oil and insert until stop.

- 17 Check V-ring for correct position at the bush front face (13/2).

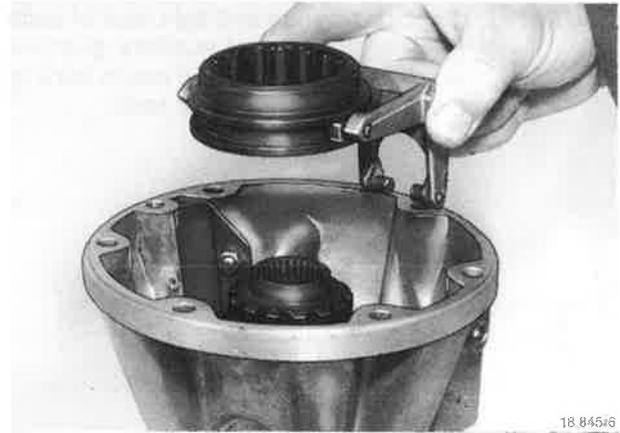


Fig. 12



Fig. 13

2.4.1 Check gearshift unit

- 1 Check operating sleeve toothing in meshing area. Teeth must not be damaged (1/1).
- 2 Check axial play of sliding blocks in operating sleeve (1/2).
Wear limit 0.5 mm.
Replace sliding blocks with worn or damaged hard-chromium surface.
- 3 Check bolts in gearshift fork for traces of wear and tight seat (1/3).
- 4 Check spring-loaded bolt and pull-back spring (1/4).
- 5 Check gearshift fork axle and pertinent bore for traces of friction (1/5).

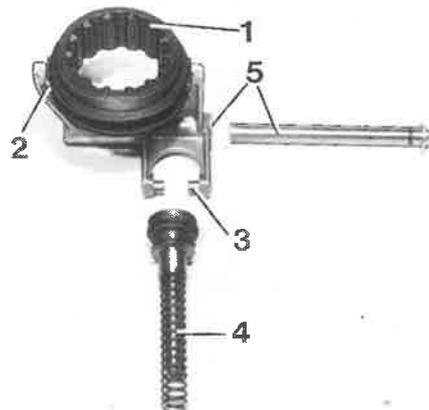


Fig. 1

2.4.2 Strip/assemble driving shaft (brake shaft)

NOTE: Model 716 features three and model 718 four axle journals with different driving shafts (see section 2.4.2) with the consequence of a slightly modified housing of the axle journal auxiliary gearbox. Stripping and assembling the axle journals remains the same in all variants.

Fig. 3 shows the essential features of the different driving shafts/brake shaft

Shaft	Denomination, features	mounted into axle journal
A	driving shaft 180 mm long, without oil bores	1
B	driving shaft 180 mm long, with oil bores for bearing bush	2
C	driving shaft to 2 nd rear axle, 594 mm long, with connection toothing number of teeth = 14	3
D	brake shaft, 216 mm long, with interrupted external spline for brake disk of parking brake	4

When fitting the driving shaft "B" also observe that only axle journal with closed oil return bores and one-sided covered deep groove ball bearing may be used.

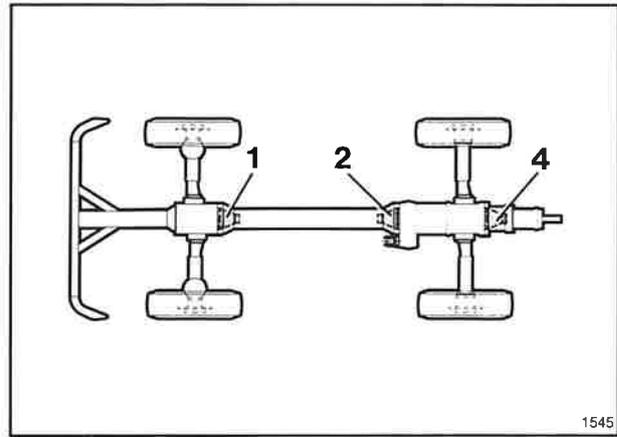


Fig. 1

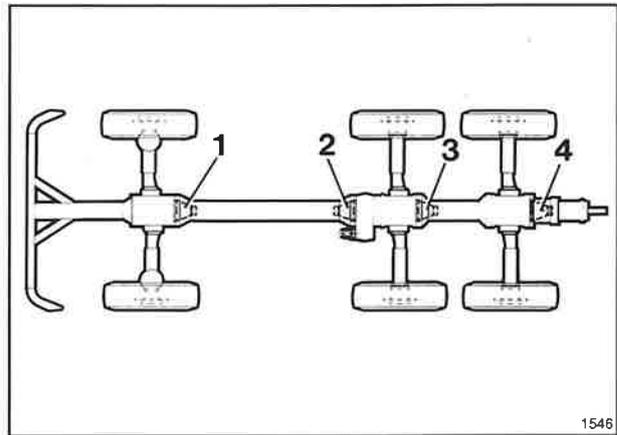


Fig. 2

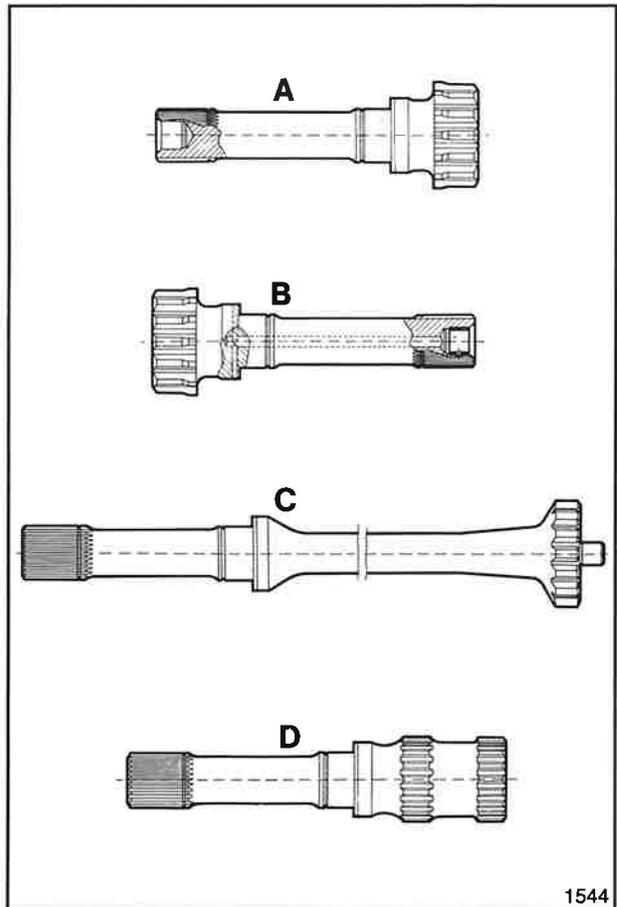


Fig. 3

Stripping:

- 1 Heat up coupling piece (4/1) to abt. 130 °C, insert into device (4/2) special tool pos. no. 905.3.33.201.0 in combination with part 8 (4/3) of mentioned device, insert suitable distance shim (4/4) - abt. Ø 27x75 mm - and press off driving shaft.

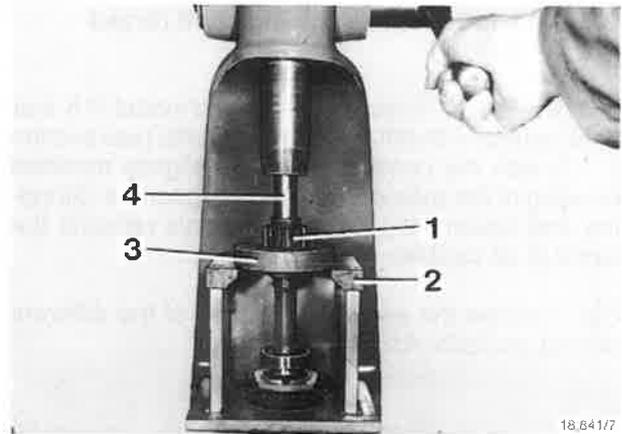


Fig. 4

- 2 Remove circlips (5/1, 5/2 and 5/3).

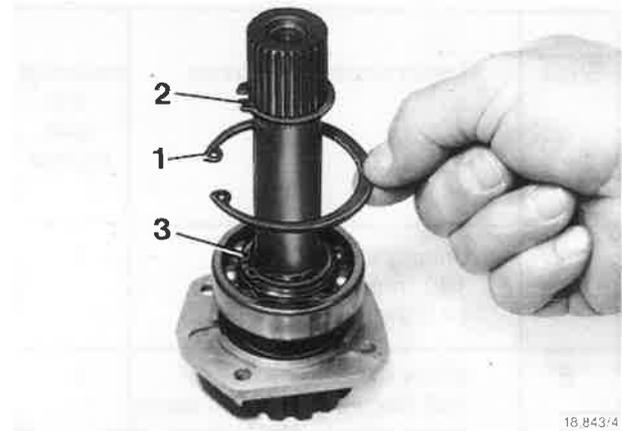


Fig. 5

- 3 Pull off deep groove ball bearing (6/1) with puller stopper (6/2) special tool pos. no. 905.3.34.402.1 and double-armed puller Kukko no.20-10 special tool pos. no. 905.0.14.022.0 and puller hook Kukko no. 1-190-P special tool pos. no. 905.0.14.023.0 from driving shaft/brake shaft (6/3).
- 4 Remove axle journal cover and press out rotary shaft seal ring.

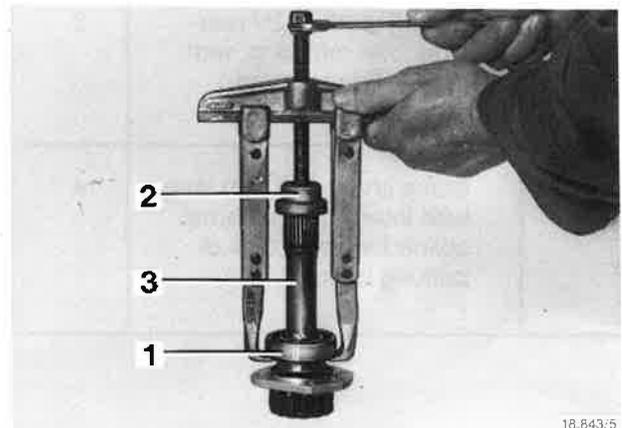


Fig. 6

Checking:

- 5 Check all parts for reusability (visual check). Remove Loctite residues at driving/brake shaft and remove coupling piece, check bearing bush see section 2.3.1.

Assembling:

- 6 Press in new rotary shaft seal ring flush into axle journal cover using a suitable drift punch. Oil sealing lip and attach axle journal cover (7).



Fig. 7

- 7 Heat up deep groove ball bearing to 80°C and slip on until stop. After cooling down check for play-free position, repress or reset resp. if necessary.

NOTE: At the axle journal auxiliary gearbox (1/2 and 2/2) only the one-sided covered bearing (8), covered side facing the axle journal cover, may be mounted.

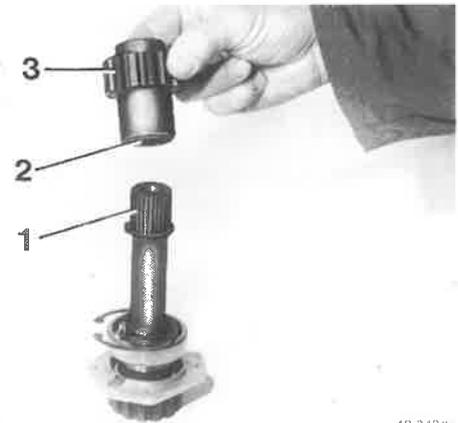
- 8 Attach circlip (5/3 and 5/2) or put on circlip (5/1) resp.
- 9 Smear cleaned external involute spline of driving shaft (9/1) and in coupling piece with Loctite 641. Slip coupling piece with external involute spline (9/3) pointing upwards until stop onto shaft.

NOTE: Apply Loctite 641 only in covering area. Remove excess Loctite after approx. half an hour. Observe hardening time of Loctite compound:
 hand firmness 10 - 20 min.
 final firmness abt. 10 hrs.



18.848/11

Fig. 8



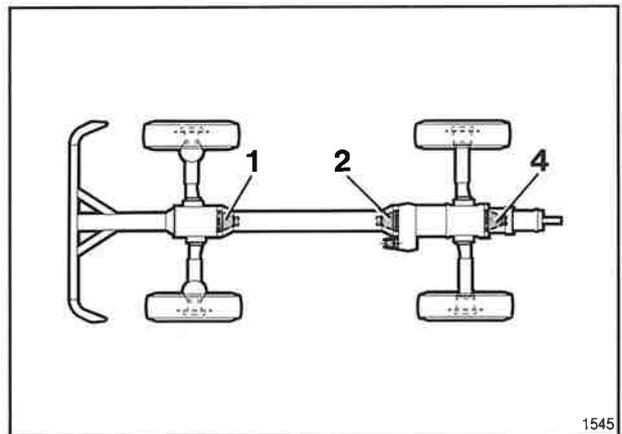
18.846/6

Fig. 9

2.4.3 Change rotary shaft seal ring and deep groove ball bearing to axle journal

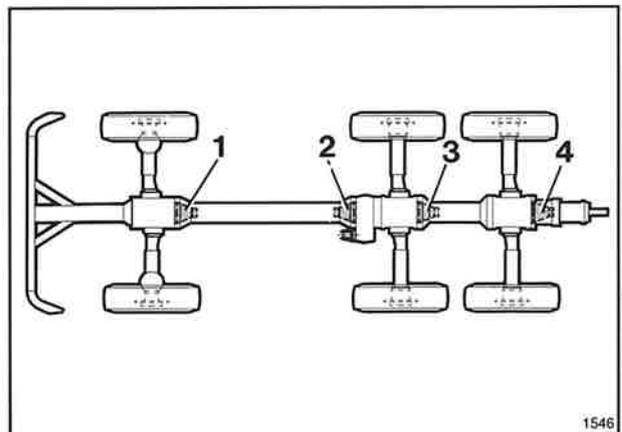
Includes:

- Changing, removing and fitting axle journal (1/1 and 2/1) at front axle see group 091
- Changing, removing and fitting axle journal (1/2 and 2/2) at auxiliary gearbox see group 093
- Changing, removing and fitting axle journal (1/3) at first rear axle model 718 see group 093
- Changing, removing and fitting axle journal (1/4 and 2/4) at rear axle model 716 or at second rear axle model 718 see group 093
- Stripping/assembling axle journal see section 2.4



1545

Fig. 1



1546

Fig. 2

