A. General Information on Rear Axle

Gearing	Number of teeth drive pinion: ring gear	Gear ratio	Oil capacity	Length of axle tube		Length of rear axle shaft	
				left mm	right mm	left mm	right mm
Gleason Hypoid	10:41	1:4.10	2.25	599.5 ± 1.0 (see Fig. 35—5/17)	670.5 ± 1.0 to center line of bushing (see Fig. 35—5/17)	693.0	676.0 687.0*

* Rear axle shafts with lock for slip coupling slide unit.

B. Bearings

The following points must be taken into account when judging the serviceability of the bearings:

As a rule, a bearing can still be regarded as serviceable, if the raceways or contact surfaces and the balls or rollers show no visible signs of wear or damage. In order to form a really sound judgement, the bearing must previously be cleaned in gasoline or trichloroethylene until all traces of dirt have been rinsed out of the bearing. A bearing can be considered free from all traces of dirt if there are no binding spots when it is rotated by hand.

A few drops of engine oil or gear oil should be put on the cleaned bearing so that it can be tested for silent running. When this test is made, it should be remembered that even bearings which have only been in operation for a short period of time are appreciably noisier than new bearings but this does not necessarily mean that they are unserviceable.

In order to avoid unnecessary rejection of bearings which are still serviceable, assessment of bearing serviceability should only be done by an expert who is experienced in this work.

Under normal running conditions, the radial play of a bearing should only show a slight increase during its lifetime.

When repairs are being carried out on a vehicle which has covered 100,000 km, the bearings should automatically be rejected even if examination shows that they are still serviceable. This is because their further period of serviceability is an unknown factor. But the decision must depend on whether replacement of the bearings is easy, i. e., on whether it can be done without any considerable disassembly and reassembly work or whether replacement involves considerable preparation.

Dimensions and Tolerances of Bearings

in mm

Function	Designation	Internal diameter	External diameter	Radial play	End play
Annular grooved bearing for rear axle shaft	180 981 00 25 Special purpose bearing 6208 C 4 DIN 625	$\frac{39.988}{40.000}$	$\frac{80.000}{79.987}$	0.032—0.050	approx. 0.32—0.50
Angular contact bearing* with split inner race for drive pinion	000 981 04 27 000 981 07 27 (optional)	$\frac{34.988}{35.000}$	$\frac{80.000}{79.987}$	—	approx. 0.01—0.035
Cylindrical roller bearing for drive pinion	000 981 16 01	$\frac{39.988}{40.000}$	$\frac{80.000}{79.987}$	0.018—0.031	—
Taper roller bearing for differential	30208 DIN 720	$\frac{39.988}{40.000}$	$\frac{80.000}{79.987}$	adjustable	adjustable

* A number of rear axles were fitted with angular contact bearing 3307 DIN 628 with one-piece inner race.

Note: When new, the annular grooved bearing of the rear axle shaft has up to 0.50 mm end play, as indicated above.

When a bearing of this type is being examined for serviceability, the above fact must be taken into account to avoid any unnecessary replacement. In order to ensure that the bearing lies properly against the shoulder of the rear axle shaft, only bearings which have an edge-to-edge dimension of 2 + 0.7 mm must be used (Fig. 35 — 5/1). For this reason, only Special Bearings, Part No. 180 981 00 25, must be used.

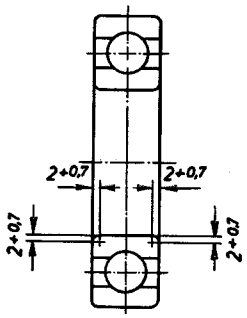


Fig. 35 — 5/1

C. Rear Axle Shafts

in mm

Rear axle shaft diameter for seal retainer	Seal retainer, internal diameter	Oversize	Rear axle shaft diameter		
			At sealing surface 1	At sealing surface 2	At seat of annular grooved bearing
$\frac{34.059}{34.043}$	$\frac{34.000}{34.025}$	+ 0.018 to + 0.059	$\frac{50.000}{49.840}$	$\frac{37.700}{37.540}$	$\frac{40.013}{40.002}$

1. Check the center bore of the rear axle shaft and, if necessary, grind on a center grinder (Fig. 35 — 5/2).

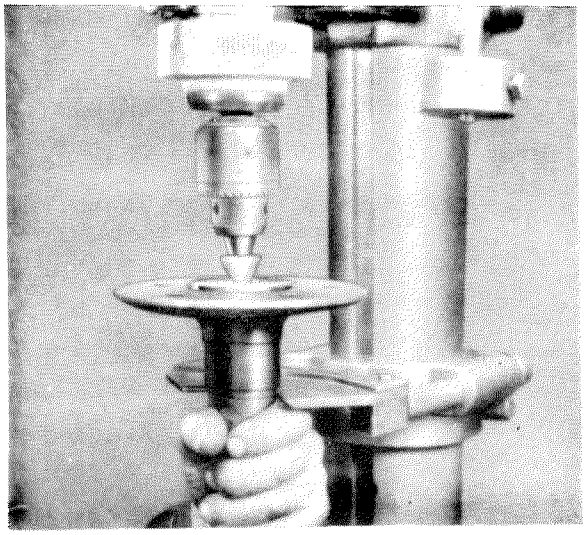


Fig. 35 — 5/2

2. Check the shaft for true run (Fig. 35 — 4/3) and, if necessary, straighten the shaft and re-turn the flange. In order to re-turn the flange, press out the wheel studs. Be careful not to damage the brake drum recess (diameter 66.954 to 67.000 mm) when doing this (Fig. 35 — 5/3).

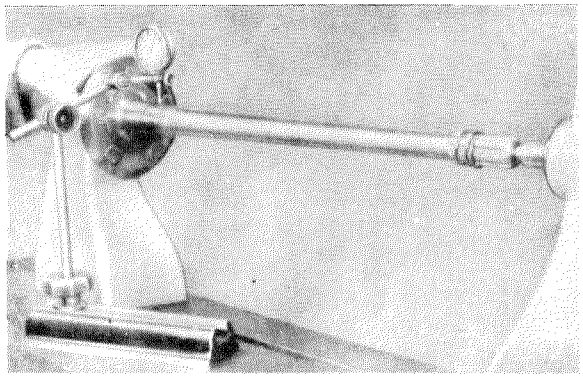


Fig. 35 — 5/3

Note: The permissible run-out at the individual points must not be exceeded (Fig. 35 — 5/4).

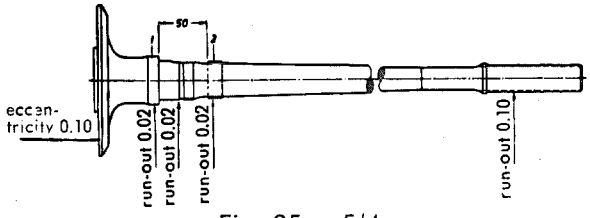


Fig. 35 — 5/4

1 Sealing surface for seal in retainer
2 Seal retainer, at the same time, sealing surface for seal in axle tube

3. Check the sealing surfaces (1) and (2). If they are worn, the diameter (measured from the dimension when new, see Table), may be reduced by 0.5 mm.

Note: The shrinking-on of a ring at the sealing surfaces should only be undertaken in an absolute emergency.

4. After reconditioning, turn a new thread-pattern on the sealing surfaces — a right-hand thread-pattern on the left rear axle shaft and a left-hand thread-pattern on the right rear axle shaft.

   Caution! Under no circumstances must there be any confusion of the thread-patterns.

5. The thread-pattern is made by means of a piece of wood which has the shape of a flat file and is faced with emery cloth No. 80.

   Hold the wood at an angle of approx. 45 to the shaft and file in the direction of the arrow — always toward the splined end. Lift the file (wood) for the return stroke (Fig. 35 — 5/5 and Fig. 35 — 5/6).

Left rear axle shaft with right-hand thread-pattern

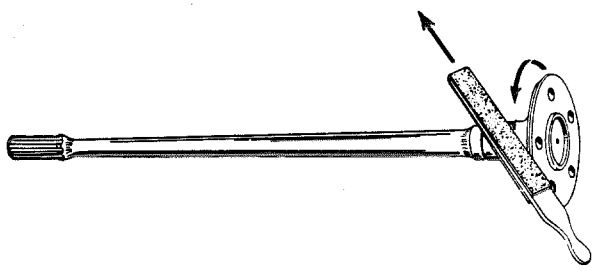


Fig. 35 — 5/5

Flange of rear axle shaft pointing to tailstock

Right rear axle shaft with left-hand thread pattern

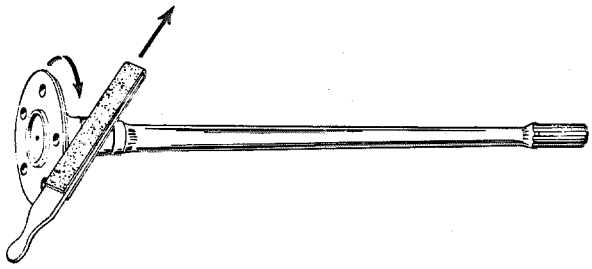


Fig. 35 — 5/6

Flange of rear axle shaft pointing to headstock

Note: The shaft must be rotated toward the lathe-operator in both cases. In order to

make the thread pattern more pronounced, a soft rubber pad of approx. 3 mm thickness is placed between the wood and the emery cloth. The lathe should be run at a speed of approx. 150 r. p. m.

Before turning the thread pattern, the shaft must be thoroughly cleaned of all traces of oil. The thread pattern must be made with smart, vigorous movements (approx. 80 file-strokes per minute). The surface-finish, or depth, of the thread pattern is 0.003 to 0.006 mm.

The grooves must run parallel and must not be interrupted by any transverse lines.

6. Check the seat of the annular grooved bearing on the rear axle shaft. If the diameter is smaller than the specified diameter (see Table on Page 35 — 5/2), the rear axle shaft must be replaced.

Note: The annular grooved bearing should be mounted on the rear axle shaft with an oversize of 0.01—0.015 mm.

7. If the wheel studs were pressed out, press new wheel studs in and stake.

   Caution: The wheel studs must make an absolutely tight fit.

D. Axle Tubes

1. Thoroughly clean the axle tube at the flange for fixing the brake anchor plate and also the ball bearing seat.

2. Fix the axle tube in a vise and use a suitable internal micrometer to measure the diameter of the annular grooved bearing seat for the rear axle shaft.

   The diameter must be 79.985—80.004 mm.

3. Check the depth of the annular grooved bearing seat in the axle tube, using a depth gage or a micrometer depth gage.

   The dimension should be 20.00 + 0.1 mm.

   When the outer race of the annular grooved bearing is installed, there must be no axial play between the bearing seat in the axle tube and the seal retainer.

   In order to check, place the seal (3) and the annular grooved bearing (2) on the seal retainer and use a depth gage or a micrometer depth gage to measure the distance between the outer race of the annular grooved bearing and the separating surface of the seal retainer (Fig. 35 — 5/7).

   If this distance is smaller than the dimension obtained above, the seal retainer must be re-turned at the separating surface (4). If the distance is greater, the seal retainer must be re-turned at the shoulder (5) for the annular grooved bearing.

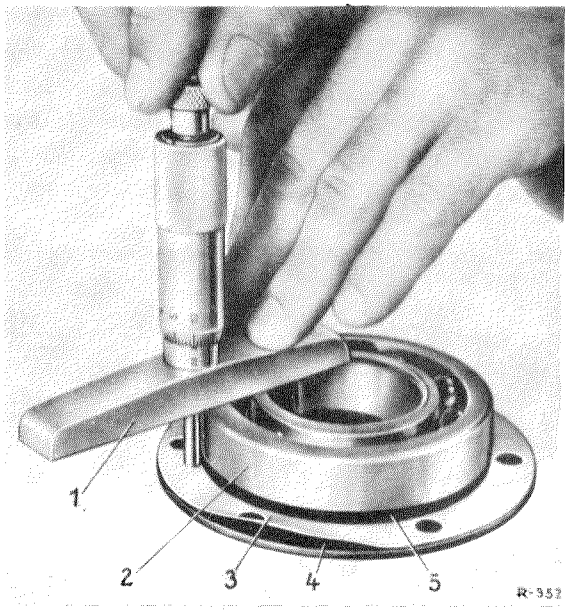


Fig. 35 — 5/7

1 Micrometer depth gage
2 Annular grooved bearing
3 Seal
4 Separating surface of seal retainer
5 Shoulder for annular grooved bearing

4. Check the parallelity of the axis of the axle tube and the center line of the supporting tube. To do this, insert the measuring spindle (2) of Axle Tube Checking Device 180 589 09 21 for Single-jointed Swing Axle in the bearing bore of the axle tube. The gage arm (1) of the checking device must slide onto the measuring spindle (2) and the supporting tube (4) without forcing (Fig. 35 — 5/8).

If the gage arm cannot be slid on or can only be slid on by forcing, the supporting tube must be replaced (see Para. 14).

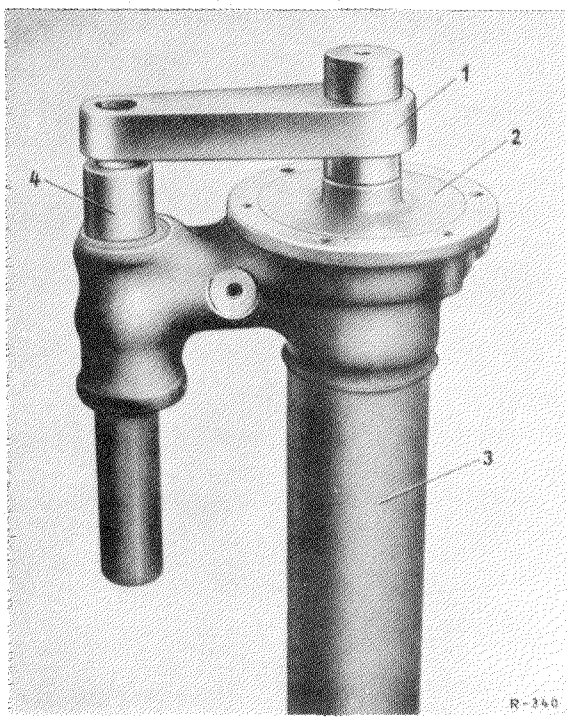


Fig. 35 — 5/8

1 Gage arm
2 Measuring spindle
3 Axle tube
4 Supporting tube

Note: The Axle Tube Checking Device 180 589 09 21 for Single-jointed Swing Axle consists of the following parts:

The holding fixture,
the gage arm,
the measuring spindle,
the dial gage holder, and
the measuring bolt.

5. Fix the left axle tube in a vise and use a suitable internal micrometer to measure the diameter of the differential taper roller bearing mounting.

   The diameter must be 79.985—79.999 mm.

Checking Axle Tubes for Distortion:

6. Set up the left axle tube on the holding fixture (1) of Axle Tube Checking Device 180 589 09 21 and mount the dial gage holder (2) with dial gage on the checking device. Run the feeler of the dial gage around the bolt hole circle of the flange and in this way test the parallelity of the two flanges (Fig. 35 — 5/9).

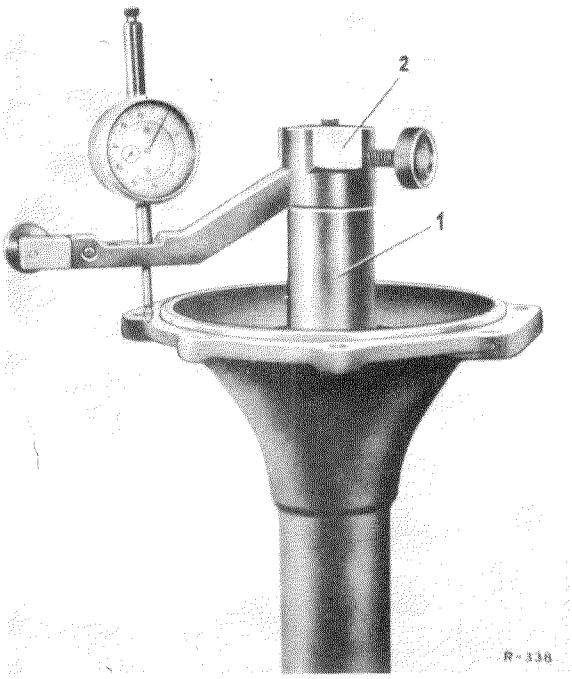


Fig. 35 — 5/9

1 Holding fixture
2 Dial gage holder

Note: The left axle tube can also be set up in a lathe with the aid of two turning arbors and the two flanges can be checked for true run (Fig. 35 — 5/9 a).

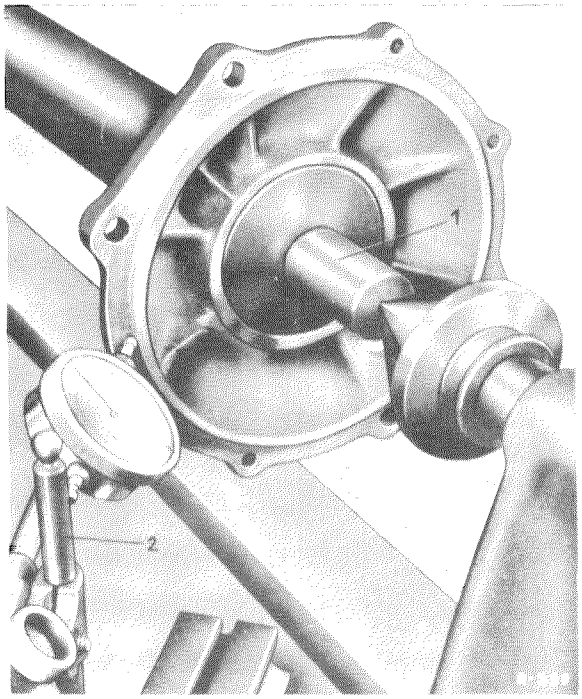


Fig. 35 — 5/9 a

1 Turning arbor
2 Holder with dial gage

A departure from parallelity of up to 0.1 mm is permissible.

If the departure from parallelity is between 0.1 mm and 1.0 mm, the axle tube must be straightened in a press.

If the departure from parallelity is greater than 1 mm, the axle tube must be replaced.

7. Press out the two bushings in the right axle tube (Fig. 35 — 5/10).

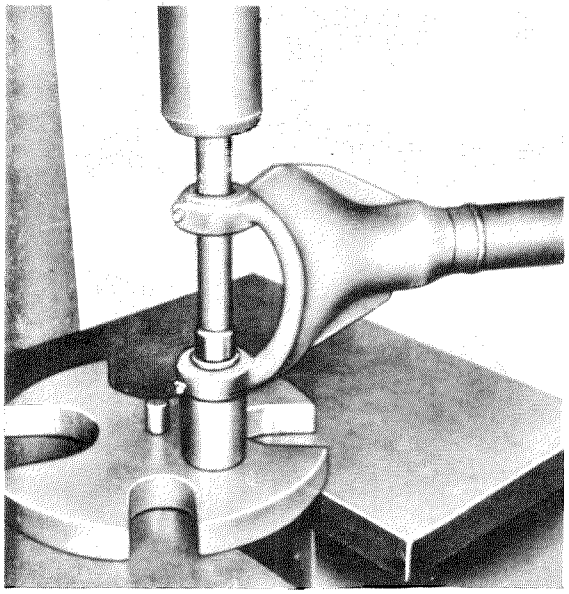


Fig. 35 — 5/10

8. Set up the right axle tube in the holding fixture (1) of Checking Device 180 589 09 21 (Fig. 35 — 5/11).

9. Push the measuring bolt (3) of the checking device through the base bores of the two eyes of the axle tube. Put the dial gage holder (2) on the holding fixture and ascertain the difference between the dimensions at the left and at the right.

Note: A difference of 0.2 mm is permissible. If the difference is up to 1 mm, the axle tube must be straightened in a press.

If the difference is greater than 1 mm, the axle tube must be replaced.

10. Press in new bushings, making sure that the bore in the bearing bushing and the bore for the pinion rim grease fitting correspond.

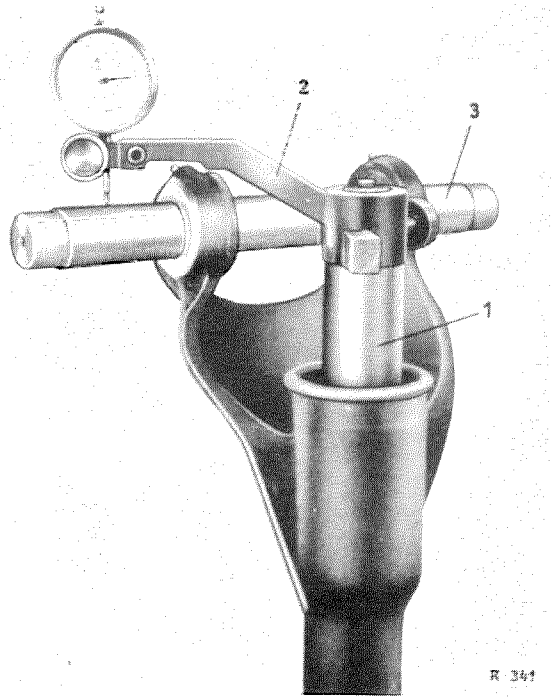


Fig. 35 — 5/11

1 Holding fixture
2 Dial gage holder
3 Measuring bolt

11. After pressing in the bushings, ream out to finished size if necessary, using Reamer 000 589 06 53.

Always center the reamer with a tapered sleeve on the opposite side (Fig. 35 — 5/12).

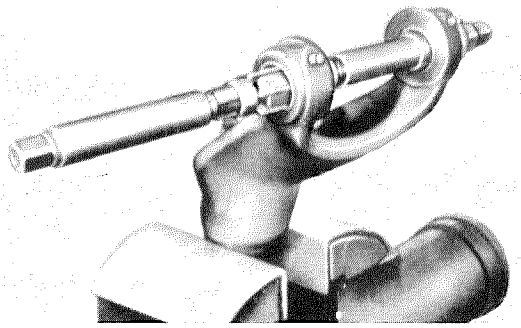


Fig. 35 — 5/12

Dimensions and Tolerances in mm

Base bore in fork diameter	Bushing in fork		Oversize
	External diameter	Internal diameter	
38.000 / 38.025	38.059 / 38.043	33.000 / 33.025	+ 0.018 to + 0.050

Note: The tolerances must be strictly maintained. The dimensions and tolerances of the connecting pin and the sleeve between the connecting pin and the bushing in the fork are indicated in Section "H. Connecting Pin".

12. If necessary, the inner surfaces of the eyes at the fork should be reconditioned, using End Milling Cutter 180 589 01 51 and the Cutting Arbor 180 589 00 66 which belongs to it (Fig. 35 — 5/13).

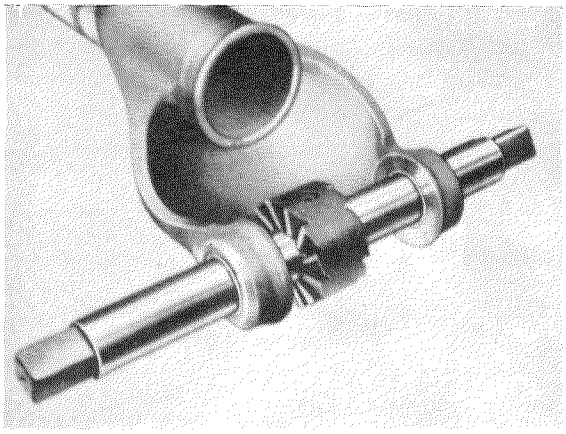
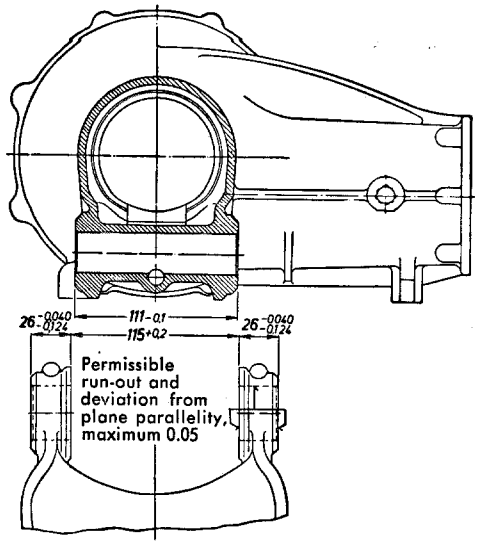


Fig. 35 — 5/13

The stock reduction at the inner surface must not be more than 0.3 mm at one side. For dimensions when new, see Fig. 35 — 5/14.

The surfaces must be accurately milled. The maximum permissible run-out and deviation from plane parallelity is 0.05 mm.



13. For checking the parallelity of the two surfaces and the angular accuracy of the surfaces in relation to the bores, Testing Plug Gage with Level Ring 180 589 04 21 should be used. Apply a little oil-diluted blue dye to the level ring so that any unevenness of the surface can be easily seen (Fig. 35 — 5/15).

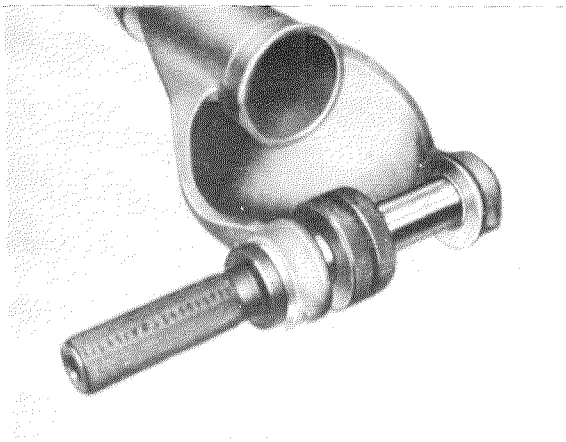


Fig. 35 — 5/15

14. Press the supporting tube out of the axle tube (Fig. 35 — 5/16).

Note: This procedure is only necessary if the supporting tube is damaged.

15. Measure the external diameter of the supporting tube and the bore in the axle tube.

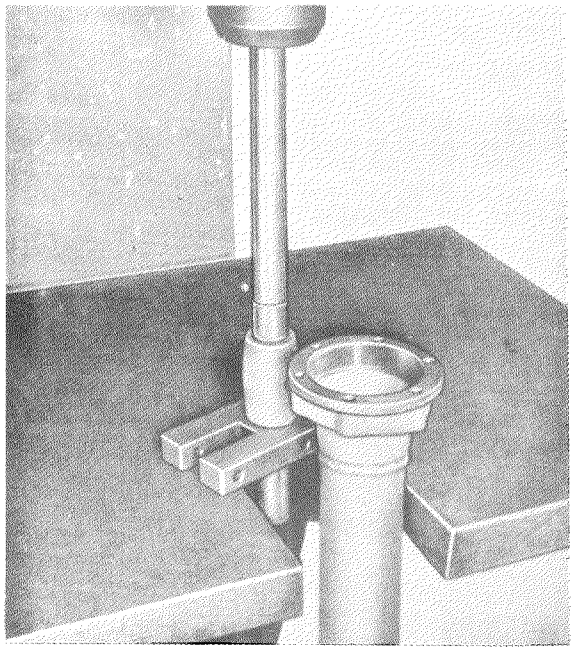
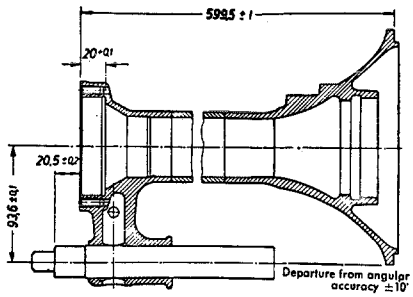


Fig. 35 — 5/16

Bore in axle tube diameter mm	Supporting tube external diameter mm	Oversize mm
26.000 / 26.021	26.048 / 26.035	+ 0.014 to + 0.048

16. Rub tallow on the new supporting tube and press the supporting tube in. When pressing in, care must be taken to ensure that the end of the bolt is not damaged (Figs. 35 — 5/16 and 35 — 5/17).

Left axle tube



Right axle tube

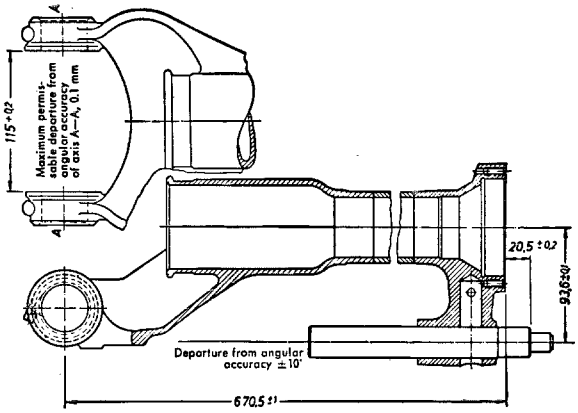


Fig. 35 — 5/17

17. Use Checking Device 180 589 09 21 to check the parallelity of the axis of the axle tube and the supporting tube which has been pressed in (see Section D. Axle Tubes, Para. 4).

E. Rear Axle Housing

Dimensions and tolerances of rear axle housing

in mm

Function	Designation	Outer race of bearing diameter	Bearing seat in housing diameter	Force-fit dimension (+) or clearance (—)
Angular contact bearing with split inner race for drive pinion	000 981 04 27 000 981 07 27 (optional)	80.000 / 79.987	79.994 / 80.013	— 0.026 to + 0.006
Cylindrical roller bearing for drive pinion	000 981 16 01	80.000 / 79.987	79.985 / 80.004	— 0.017 to + 0.015
Taper roller bearing for differential	30208 DIN 720	80.000 / 79.987	79.985 / 79.999	— 0.012 to + 0.015

1. Check the bores for pits or scoring. The bores must not be re-machined. If necessary, the rear axle housing must be replaced.

2. Check the contact surfaces for the eyes of the right axle tube at the rear axle housing. If the surfaces are damaged or worn, they should be reconditioned in the same way as the eyes of the right axle tube (see Section D and Fig. 35 — 5/13, Fig. 35 — 5/15 and Fig. 35 — 5/19).
   A stock reduction of up to 0.3 mm on each side is permissible. The diameter of the bore is 27.983—27.996 mm.

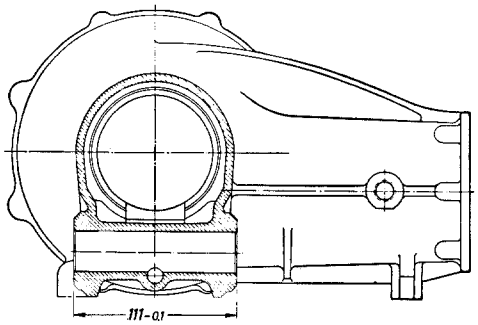


Fig. 35 — 5/19

F. Gear Train

Drive Pinion Shaft:

1. Check the drive pinion shaft for run-out. If the permissible run-out is exceeded at the various points (Fig. 35 — 5/20), the drive pinion shaft must be replaced.

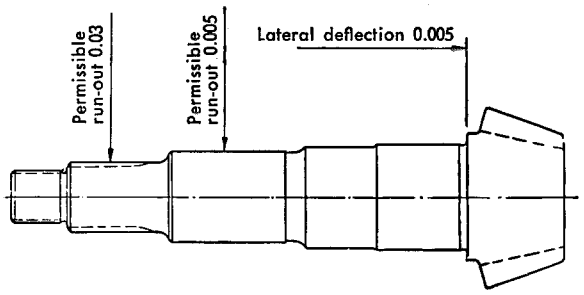


Fig. 35 — 5/20

Note: The drive pinion shaft must only be replaced together with the ring gear.

2. Check the bearing seats (dimensions and tolerances, see Table).

   When pressing the bearings onto the drive pinion shaft, be careful to avoid chipping.

   Pressure must only be exerted on the bearings at the inner race.

Dimensions and tolerances of drive pinion shaft in mm

Designation of bearing	Inner race of bearing diameter	Bearing seat on the drive pinion shaft diameter	Force-fit dimension (+) of clearance (—)
Cylindrical roller bearing 000 981 16 01	39.988 / 40.000	40.013 / 40.002	+ 0.002 to + 0.025
Angular contact bearing 000 981 04 27 000 981 07 27 (optional)	34.988 / 35.000	35.006 / 34.995	— 0.005 to + 0.018

Joint Flange:

3. Check the joint flange for lateral deflection. The deflection, measured at the outer diameter, must not be more than 0.02 mm.

   If, after repositioning on the splines, the deflection is still greater than 0.02 mm, the joint flange can be turned down to 5.7 mm thickness. Otherwise, the joint flange must be replaced. If the sealing surface for the seal at the joint flange is worn, the sealing surface can be reconditioned, removing up to 0.5 mm of stock. When the sealing surface is new, the diameter is 34.840 to 35.000 mm. After reconditioning, the sealing sur-

face should once more be marked with a left-hand thread pattern (see Section C, Fig. 35 — 5/6).

Differential:

4. Check the differential pinion shaft and the bores for the differential pinion shaft in the differential housing (Fig. 35 — 5/21).

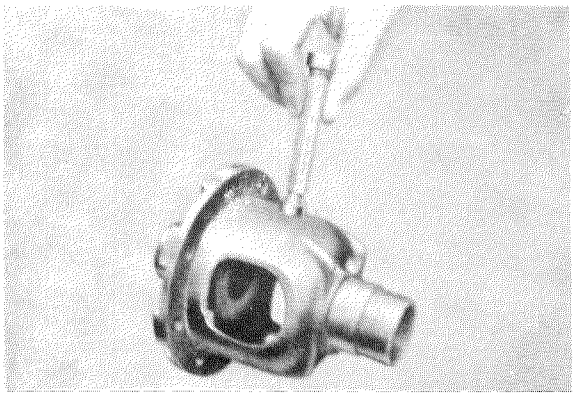


Fig. 35 — 5/21

If the bores in the differential housing are worn or damaged, the housing must be replaced.

5. Selective assembly is specified for the differential pinion shaft. The differential pinion shaft must be so selected that the specified force-fit dimension in the differential housing (0.002—0.023 mm) is obtained (see Table).

Dimension and tolerances for the differential pinion shaft in mm

Type	Color code	Differential pinion shaft diameter	Bore in differential housing	Force-fit dimension
I	white	17.023 / 17.012	17.000 / 17.010	+ 0.002 to + 0.023
II	blue	17.034 / 17.023	17.011 / 17.021	+ 0.002 to + 0.023

6. Check the differential pinions and the differential side gears and their bores in the differential housing.

Note: Differential pinion gears, thrust washers and dished washers which have been overheated or have become scored, must always be replaced.

The diameter of the bearing journals of the differential side gears is 35.450—35.475 mm and the bore in the differential housing 35.500 — 35.525 mm (clearance, 0.025 to 0.075 mm). The two differential pinion gears have a bore diameter of 17.07—17.12 mm which results in a play on the differential pinion shaft of 0.036 mm to 0.108 mm.

7. If the ring gear has to be replaced, check the seating on the differential housing and the ring gear bore (Dimensions and tolerances, see Table. Replacement, see Job No. 35 — 4, Section "E. Disassembly and Reassembly of Gear Train").

Dimensions and tolerances of seating and bore of ring gear in mm

Diameter, differential housing	Bore in ring gear	Force-fit dimension
107.035 / 107.013	107.000 / 107.013	0.000 to + 0.035

8. Measure the lateral and radial deflection of the differential housing at the contact surface for the ring gear.

Maximum permissible lateral deflection 0.005 mm

Maximum permissible radial deflection 0.01 mm

The permissible deflection must not be exceeded.

9. Check the seating of the taper roller bearings on the differential housing.

Under no circumstances must the inner race of the taper roller bearing turn on the differential housing (Dimensions and tolerances, see Table).

Dimensions and tolerances of seating and bore of taper roller bearings in mm

Designation of bearing	Inner race of bearing diameter	Bearing seating at differential housing diameter	Force-fit dimension
Taper roller bearing 30 208 DIN 720	39.988 / 40.000	40.014 / 40.030	+ 0.014 to + 0.042

G. Slip Coupling

1. Check the roller raceways in the outer yoke and also the sliding sleeve for any signs of wear or roller impressions.

Note: If the roller raceways show considerable signs of wear or roller impressions, the whole slip coupling assembly must be replaced.

2. Examine the serrations of the sliding sleeve which engage with the rear axle shaft for wear and burrs.

   The sliding sleeve must move easily, but without play, on the rear axle.

3. The cylindrical rollers must not be replaced individually. If a cylindrical roller is damaged, or has been lost, the whole set of rollers (132 in number) must be replaced.

4. Check the joint spider, the needle bearing bushings and their bores in the yokes for wear and burrs.

5. If new needle bearing bushings are used, care must be taken to ensure that the specified force-fit dimension is strictly adhered to (see Table).

Note: Selective assembly is specified for the needle bearing bushings (for further details. see Table).

6. The needles must not be replaced individually. If a needle is damaged or has been lost, the whole set of needles (100 in number) must be replaced.

Dimensions and tolerances of needle bearing bushings, yokes and joint spider in mm

Type	Color code	Needle bearing bushing, external diameter	Bore in yokes	Force-fit dimension (+) or clearance (—)	Needle bearing bushing, internal diameter	Trunnion diameter	Clearance
I	1 white dot	$\frac{29.502}{29.512}$ previously: $\frac{29.522}{29.515}$	$\frac{29.500}{29.510}$	— 0.008 to + 0.012 previously: + 0.005 to + 0.022	$\frac{22.641}{22.620}$	$\frac{17.600}{17.589}$	0.02 to 0.05
II	2 white dots	$\frac{29.513}{29.523}$ previously: $\frac{29.528}{29.523}$	$\frac{29.511}{29.521}$	— 0.008 to + 0.012 previously: + 0.002 to + 0.017			

H. Connecting Pin

1. Check the connecting pin, sleeves, compensating washers and backing washers, rubber rings and splined bolt for wear and damage.

   Worn sleeves, compensating washers and backing washers and also damaged rubber rings must always be replaced.

2. Check the connecting pin (2) for true run. If the pin is supported at the ends during this test, the run-out must not be more than 0.10 mm. Selective assembly is specified for the external diameter of the connecting pin and the internal diameter of the sleeves (11 a) and (11 b) which are fitted on the connecting pin (see Fig. 35 — 5/22 and Table).

Excessive play between the connecting pin and the sleeves or between the sleeves and the bushings in the eyes of the axle tube will result in metallic knocking noises when the car is travelling.
Inadequate play tends to cause rumbling of the rear axle.
It is therefore important that the tolerances indicated in the Table should be strictly adhered to.

Dimensions and tolerances of the connecting pin and the sleeve in mm

Type	Color code	Connecting pin, external diameter	Bore in the sleeve	Force-fit dimension
I	white	$\frac{28.000}{27.994}$	$\frac{27.983}{27.989}$	+ 0.005 to + 0.017
II	blue	$\frac{27.993}{27.987}$	$\frac{27.976}{27.982}$	

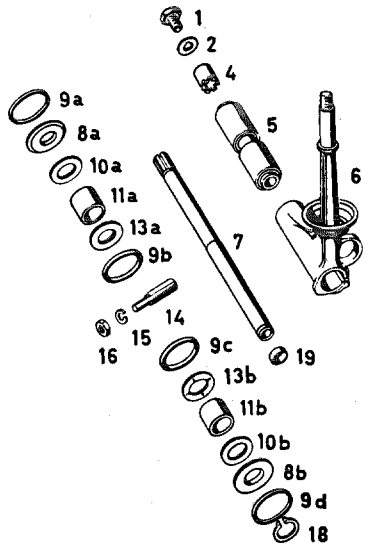


Fig. 35 — 5/22

1 Hexagon screw
2 Locking plate
4 Spacer sleeve
5 Buffer block
6 Support
7 Connecting pin
8a, 8b Backing washers
9a, 9b, 9c, 9d Rubber rings
10a, 10b Washers
11a, 11b Sleeves
13a, 13b Compensating washers
14 Splined bolt
15 Lock washer
16 Hexagon nut
18 Circlip
19 End plug

I. Support of Rear Axle Suspension

1. Check the buffer block in the support and if necessary, replace it.

   When pressing a new buffer block into the support, care must be taken to ensure that the end which protrudes 6 mm, is pointing toward the rear (Fig. 35 — 5/23).

2. Check the M 22 × 1.5 thread at the top of the support and if necessary, re-tap it.

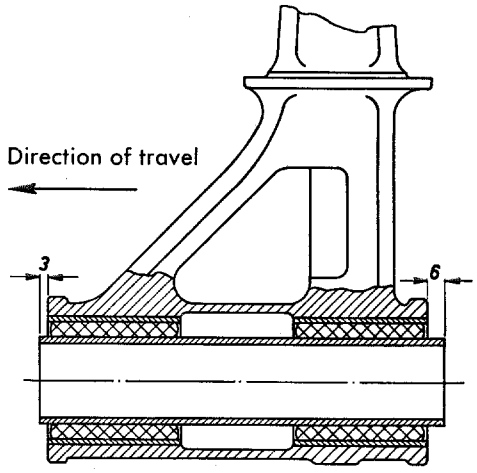


Fig. 35 — 5/23