

## II. Checking and Reconditioning

In the below table the most important single-joint rear axle specifications are given. It is understood that the tread is measured with rear axle tubes in horizontal position. When installing the rear axle keep in mind that the length of the two rear axle shafts is different.

Tread mm (in.)	Type of teeth	Number of teeth of bevel ring gear	Ratio	Oil capacity	Length of rear axle tube		Length and teeth of rear axle shaft	
					left-hand mm (in.)	right-hand mm (in.)	left-hand mm (in.)	right-hand mm (in.)
1,470 (57.87)	Gleason hypoid	9 : 37  10 : 41*	4.11 : 1  4.10 : 1*	2.25 litres (4.75 US pints, 4.0 Imp. pints)	599.5 ± 1.0 (23.60) ± 0.04	670.5 ± 1.0 (26.38) ± 0.04  to center of bushing (see Fig. H 3a/33)	693.0 (27.28) 28 x 25	676.0 (26.61) 28 x 25
Involute teeth								

\* From rear axle No. 5 505 082 on

### Rear Axle Housing:

The following table contains the specifications for the various bearing bores. In general it will not be necessary to check the bores and their angular accuracy in relation to each other.

The threaded ring in the rear axle housing has 12 grooves for tightening the bevel roller bearing and a thread M 90 x 1.5.

Dimensions in mm (in.)

Application and designation of bearing	Dia. of outer bearing race	Dia. of bearing seat in housing	Overlap (+) and play (—), resp.
Grooved collar bearing for rear axle shaft  183 981 00 25 6208 C 4 DIN 625	$\frac{79.987}{80.000}$ (3.14910) (3.14961)	$\frac{79.985}{80.004}$ (3.14902) (3.14977)	— 0.017 (0.00067) to + 0.015 (0.0006)
Inclined bearing for bevel drive gear  000 981 04 27	$\frac{79.987}{80.000}$ (3.14910) (3.14961)	$\frac{79.994}{80.013}$ (3.14937) (3.15012)	to — 0.026 (0.0010) to + 0.006 (0.00024)
Cylinder bearing for bevel drive gear WL 40 B  000 981 16 01	$\frac{79.987}{80.000}$ (3.14910) (3.14961)	$\frac{79.985}{80.004}$ (3.14902) (3.14977)	— 0.017 (0.00067) to + 0.015 (0.0006)
Bevel roller bearing on differential housing  30 208 DIN 720	$\frac{79.987}{80.000}$ (3.14910) (3.14961)	$\frac{79.985}{79.999}$ (3.14902) (3.14957)	— 0.012 (0.00047) to + 0.015 (0.0006)

### Ball Bearings:

In general ball or roller bearings may be reused when the running grooves or surfaces as well as the balls or rollers, resp. are free from visible defects. Before examining the bearings, clean them in gasoline or Tri until they are completely free from contaminations. A bearing is perfectly clean if it does not bind at any point when rotated in one's hand.

To check for quiet operation, provide the absolutely clean bearing with a few drops of engine or transmission oil. Note that bearings which have been used for a short period are much noisier than new bearings without, however, being unserviceable.

Under normal operating conditions the side play of anti-friction bearings should increase only slightly in the course of time. How long a bearing can be used depends on its service life. The average life expectancy of a normal anti-friction bearing is approx. 10 000 hours of operation. This means that part of the bearings will reach a substantially longer operating time without becoming defective.

In the case of a repair the bearings should be discarded after 100 000 km (65 000 miles), even if they seem fitted for reuse. The fact whether a bearing can be exchanged readily or only after extensive preliminary work will also be of importance in this respect.

To prevent that serviceable bearings are discarded, the bearings should only be examined by an experienced person.

### Dimensions and Tolerances of Ball and Roller Bearings in mm (in.)

Application	Designation	Inner dia.	Outer dia.	Side play	End play
Grooved collar bearing for rear axle shaft	183 981 00 25 Special bearing 6208 C 4 DIN 625	40.0 (1.58)	80.0 (3.15)	0.032–0.050 (0.0013–0.002)	approx. 0.32–0.50 (0.0013–0.002)
Inclined bearing with split inner race for bevel drive gear	000 981 04 27	35.0 (1.38)	80.0 (3.15)	—	approx. 0.01–0.035 (0.0004–0.0014)
Cylinder bearing for bevel drive gear	000 981 16 01 WL 40 B	40.0 (1.58)	80.0 (3.15)	0.018–0.031 (0.0007–0.0012)	—
Bevel roller bearing on differential housing	30208 DIN 720	40.0 (1.58)	80.0 (3.15)	adjustable	adjustable

**Note:** As stated above, the grooved collar bearing of the rear axle shaft has in new condition **an end play of up to 0.50 mm (0.02")**. Keep this in mind when examining these bearings to avoid that bearings are exchanged which are still serviceable.

Use only bearings (special type 183 981 00 25) that have a distance from edges of  $2 + 0.7$  mm ( $0.08 + 0.028$ " ), so that the bearing will fit snugly against the shoulder of the rear axle shaft (see Fig. H 3/03 on page H 3/7).

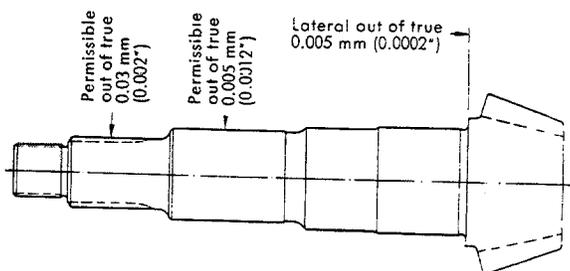


Fig. H 3a/22

#### Bevel Drive Gear with Universal Joint Flange:

22. First check the bevel drive gear for true run. The applicable tolerances will be seen from Fig. H 3a/22. Strictly adhere to the specified values, as otherwise rear axle noises may develop. If the bevel drive gear is unserviceable, it must by all means be exchanged together with the ring gear.

The ball bearing seat specifications are given in the following table. When pressing the bearings on the drive shaft be careful to avoid the formation of a chip. **Press against the inner bearing race only.**

Dimensions in mm (in.)

Designation of bearing	Dia. of inner bearing race	Dia. of bearing seat on bevel drive gear shaft	Overlap (+) and play (—), resp.
Cylinder bearing WL 40 B 000 981 16 01	$\frac{39.988}{40.000}$ (1.57433) (1.57480)	$\frac{40.002}{40.013}$ (1.57488) (1.57531)	+ 0.002 (0.00008) to + 0.025 (0.001)
Inclined bearing 000 981 04 27	$\frac{34.988}{35.000}$ (1.37748) (1.37795)	$\frac{34.995}{35.006}$ (1.37775) (1.37819)	— 0.005 (0.0002) to + 0.018 (0.0007)

When checked at the outer radius, the lateral out of true at the universal joint flange must not exceed 0.03 mm (0.0012"), otherwise the flange must be displaced on the splines. If necessary, regrind or exchange the flange.

If the sealing surface for the grease retainer on the three-arm flange has shrunk, the surface may be reworked up to 0.5 mm (0.02"). The standard size is 34.840 to 35.000 mm (1.37165 to 1.37795"). Excessively shrunk sealing surfaces may be restored to standard size by chrome-plating them. After the sealing surface has been reconditioned, it must again be provided with left-hand rifling (see Operation No. H 3a, cf. 29).

#### Differential:

23. Check the differential bolt bores (Fig. H 3a/23) as well as the bolt itself.

The specifications are given in the following table.

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

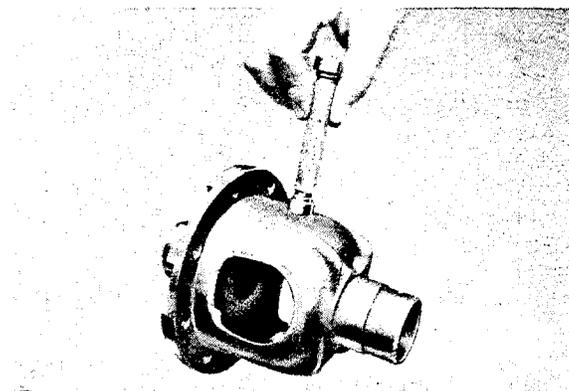


Fig. H 3a/23

Dimensions in mm (in.)

Selected size	Colour code	Dia. of differential bolt	Bore in differential housing	Overlap
I	White	$\frac{17.012}{17.023}$ (0.66976) (0.67020)	$\frac{17.000}{17.010}$ (0.66929) (0.66968)	+ 0.002 (0.00008) to + 0.023 (0.0009)
II	Blue	$\frac{17.023}{17.034}$ (0.67020) (0.67063)	$\frac{17.011}{17.021}$ (0.66972) (0.67012)	+ 0.002 (0.00008) to + 0.023 (0.0009)

The two differential bevel gears have a diameter of 17.07–17.12 mm (0.672–0.674") in the bore and hence a play on the differential pin of 0.036–0.108 mm (0.0015–0.0043"). The outer diameter of the rear axle shaft gears is 35.450–35.475 mm (1.39567 to 1.39665"), and the bore in the differential housing is 35.500–35.525 mm = 1.39763 to 1.39861" (play 0.025–0.075 mm = 0.001 to 0.003").

Replace all differential bevel gears, differential bolts, contact and ball washers that have run hot or seized.

24. The seat of the bevel roller bearings on the differential housing must be perfect, and the inner race of the bevel roller bearing must by no means turn on the housing.

Dimensions in mm (in.)

Designation of bearing	Dia. of inner bearing race	Dia. of bearing seat on differential housing	Overlap
Bevel roller bearing 30208 DIN720	$\frac{39.988}{40.000}$ (1.57433) (1.57480)	$\frac{40.014}{40.030}$ (1.57535) (1.57598)	+ 0.014 (0.00055) to + 0.042 (0.0016)

25. If a new ring gear is mounted on the differential housing, the bore of the ring gear and the seat on the differential housing must be carefully cleaned. Heat the ring gear to 60° C (140° F) and place on differential housing using the two pilot pins 1 and 2 (Fig. H 3a/25). If the ring gear does not fall

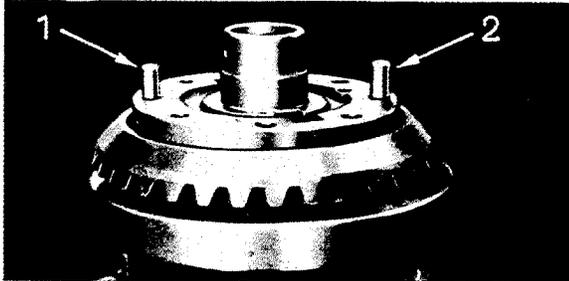


Fig. H 3a/25

into the differential housing, drive it in by tapping lightly with a rubber hammer. Be careful to avoid the formation of a chip. Before the new ring gear is installed, check lateral and vertical out of true of differential housing at ring gear surface.

Permissible lateral out of true  
0.005 mm (0.0002")

Permissible vertical out of true  
0.01 mm (0.004")

Strictly adhere to these specifications.

Tighten the ring gear fastening screws first till they abut and then to 7–8 mkg (50.5–58 ft.lb.). See Fig. H 3a/25a.

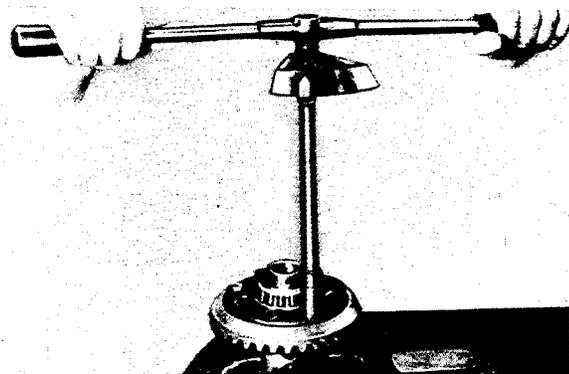


Fig. H 3a/25a

The fit of the ring gear on the differential housing is as follows:

#### Dimensions in mm (in.)

Diameter on differential housing	Bore in ring gear	Overlap
107.013 (4.21310)	107.000 (4.21259)	0.000 to + 0.035 (0.0014)
107.035 (4.21397)	107.013 (4.21310)	

#### Sliding Joint:

26. If the sliding joint is worn out, it is recommended to exchange the complete assembly.

Make sure that the sliding ways of the grooves in the outer fork and the splines on the sliding sleeve are not damaged. It must be possible to move the sliding sleeve on the rear axle shaft easily, but without play.

The cylinder rollers 4 x 4 DIN 5402 between sliding sleeve and fork are available in selected sizes ranging from — 0.016 mm (0.00063") to + 0.010 mm (0.0004"), the sizes varying from 0.002 to 0.002 mm (0.00008 to 0.00008"). Install rollers of the same size only. **Always exchange the complete set of rollers (132 pieces).** It is not permitted to replace single rollers.

The permissible overall play between sliding sleeve and fork with cylinder rollers installed is 0.01 to 0.05 mm (0.0004 to 0.002").

27. Check spider star and needle bearing bushings carefully.

For the fit of the needle bearing bushings and the bores in the forks see the table on page H 3a/11.

The specified overlap of the needle bearing bushing in the bore of 0.00 to 0.02 mm (0.0008") must be strictly adhered to.

The permissible overall play between spider star journal and needle bearing bushing with needles is 0.02 to 0.05 mm (0.0008 to 0.002").

Dimensions in mm (in.)

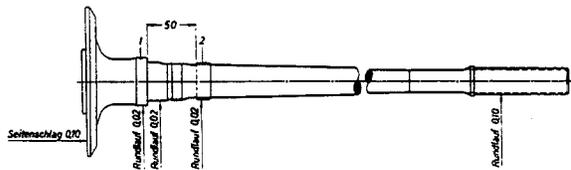
Selected size	Colour code	Outer dia. of needle bearing bushing	Bore in fork	Overlap	Inner dia. of needle bearing bushing	Dia. of spider star journal	Play
I	1 white dot	$\frac{29.515}{29.522}$ (1.16200) 1.16228)	$\frac{29.500}{29.510}$ (1.16141) (1.16180)	+ 0.005 (0.0002) to + 0.022 (0.00087)	$\frac{22.641}{22.620}$ (0.89137) (0.89055)	$\frac{17.600}{17.589}$ (0.69291) (0.69212)	0.02—0.05 (0.0008— 0.002)
II	2 white dots	$\frac{29.523}{29.528}$ (1.16232) (1.16251)	$\frac{29.511}{29.521}$ (1.16184) (1.16224)	+ 0.002 (0.00008) to + 0.017 (0.00067)			

The needles 2.5 x 11.8 DIN 617 are available in selected sizes ranging from — 0.009 to 0.000 mm (0.00035 to 0.00000"), the sizes varying from 0.003 to 0.003 mm (0.00012 to 0.00012").

- a) — 0.009 (0.00035") to — 0.006 mm (0.00024")
  - b) — 0.006 (0.00024") to — 0.003 mm (0.00012")
  - c) — 0.003 (0.00012") to ± 0.000 mm (0.00000")
- } in relation to nominal diameter of 2.5 mm (0.098)

Do not interchange needles of groups a), b) and c). **Always exchange the complete set of needles (100 pieces).** It is not permitted to replace single needles.

**Rear Axle Shafts:**



50 mm (1.97")  
Lateral out of true 0.10 mm (0.004")  
Runout 0.02 mm (0.0008")  
Runout 0.10 mm (0.004")

Fig. H 3a/28

28. If the rear axle shaft centering hole has been damaged on account of unskilled handling, it must be reground on a center grinding machine (Fig. H 3a/28a).

Then check shaft for true run (Fig. H 3a/28b); if necessary, straighten shaft and recondition flange. Be careful not to alter the diameter of the brake drum recess (66.954 to 67.000 mm = 2.63598 to 2.63779").

29. If the sealing surfaces for the grease retainers are shrunk and must be reconditioned, their diameter may be reduced by as much as 0.5 mm (0.02"). If the sealing surfaces are excessively shrunk, the original size of the outer sealing surface (1) may be restored by chrome-plating it. The inner sealing surface (2) must be turned down and a new ring must be shrunk on (see Fig. H 3a/28). Heat the new sealing ring (2) to 450° C (840° F).

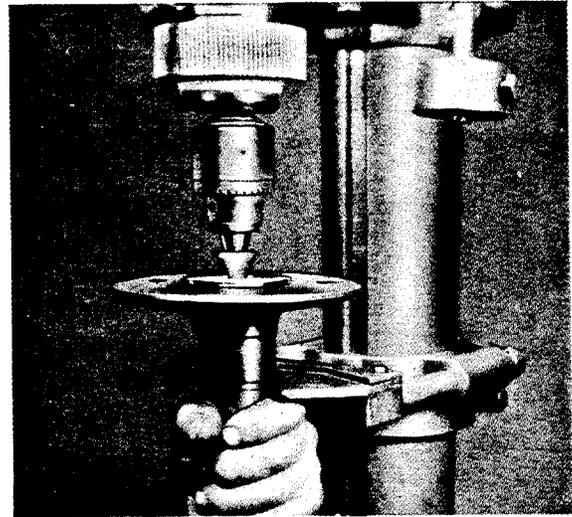


Fig. H 3a/28a

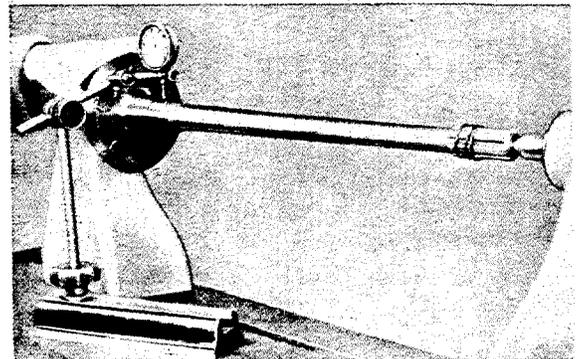


Fig. H 3a/28b

After the sealing surface has been reconditioned or a ring has been installed, rifle the sealing surface again. Provide the left rear axle shaft with right-hand rifling and the right rear axle shaft with left-hand rifling. The shafts must by no means be interchanged.

The rifling is produced with a piece of wood which has the shape of a flat file and is lined with No. 80 emery cloth. Hold the tool under 45° approximately and file in the direction indicated by the arrow, that is towards the splined end (Figs. H 3/29 and H 3/29a).

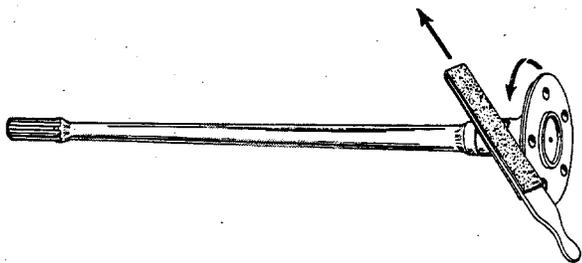


Fig. H 3a/29

Left rear axle shaft with right-hand rifling

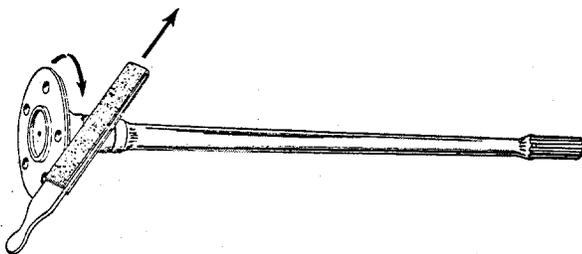


Fig. H 3a/29a

Right rear axle shaft with left-hand rifling

In either case the shaft is to be rotated towards the operator. To pronounce the rifling, place a soft rubber pad of about 3 mm (0.12") thickness between the piece of wood and the emery cloth. Run the lathe at a speed of approx. 150 r.p.m.

Before the rifling is produced, clean the shaft thoroughly of oil etc. The rifling must be done vigorously and steadily (about 80 strokes per minute). The surface finish of the rifled section should be 0.003–0.006 mm (0.00012–0.00024"). The grooves must run parallel and must not be interrupted by transverse lines.

30. The ball bearing seat should have an overlap of 0.01–0.015 mm (0.0004–0.0006"). If these specifications are not met, the ball bearing seat may be re-turned or reground and chrome-plated. The diameter of the ball bearing seat can be seen from the below table.

31. In the factory the wheel studs are upset at their seating face under great pressure. Analogously the wheel studs should be peened after the flange has been reconditioned and the studs have been pressed in. The wheel studs must fit absolutely tight.

#### Rear Axle Tubes:

32. Check flange for fastening the brake anchor plate for true run (Fig. H 3a/32).

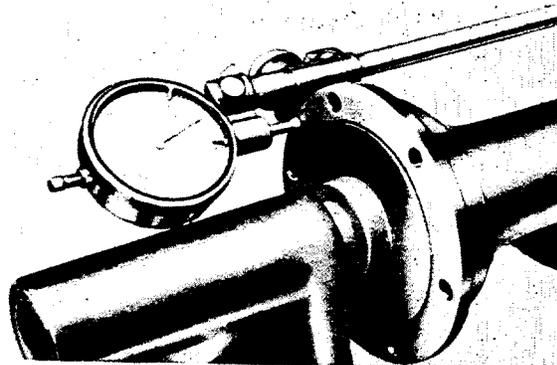


Fig. H 3a/32

#### Rear Axle Dimensions

in mm (in.)

Dia. of seat on rear axle shaft for sealing ring	Inner diameter of sealing ring	Overlap	Dia. of sealing surface 1	Dia. of sealing surface 2	Dia. of ball bearing seat
34.043 34.059 (1.34027) (1.34090)	34.000 34.025 (1.33858) (1.33956)	+ 0.018 (0.0007") to + 0.059 (0.0023")	49.840 50.000 (1.96220) (1.96850)	37.540 37.700 (1.47795) (1.48425)	40.002 40.013 (1.57488) (1.57531)

If the out of true at outer rim of flange is more than 0.1 mm (0.004"), the rear axle tube must be straightened.

When reconditioning the flange be sure to re-turn the depth of the ball bearing seat as well, so that a pressing-in depth for the ball bearing of  $20.00 \pm 0.1$  mm ( $0.79 \pm 0.004$ ") will be maintained.

Check the ball bearing seat by inserting a ball bearing. It must be easily possible to press the outer race in.

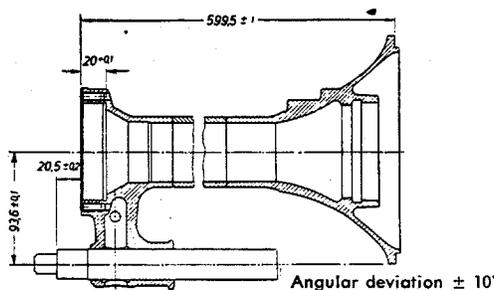
The permissible tolerances can be seen from the table given on page H 3a/7.

33. Measure supporting tube and bore in rear axle tube. Before the supporting tube is pressed in, rub it with tallow. When pressing in the tube, be careful not to damage the end

Dimensions in mm (in.)

Bore in rear axle tube	Outer dia. of supporting tube	Overlap
<u>26.000</u> <u>26.021</u> (1.02362) (1.02445)	<u>26.035</u> <u>26.048</u> (1.02500) (1.02551)	+ 0.014 (0.00055") to + 0.048 (0.0019")

of the pin (see Fig. H 3a/11). Strictly adhere to the dimension of  $20.5 \pm 0.2$  mm ( $0.807 \pm 0.008$ "). See Figs. H 3a/33 and 34.



$599.5 \pm 1$  mm ( $23.65 \pm 0.04$ ")  
 $20 \pm 0.1$  mm ( $0.79 \pm 0.004$ ")  
 $20.5 \pm 0.2$  mm ( $0.807 \pm 0.008$ ")  
 $93.6 \pm 0.1$  mm ( $3.685 \pm 0.004$ ")

Fig. H 3a/33

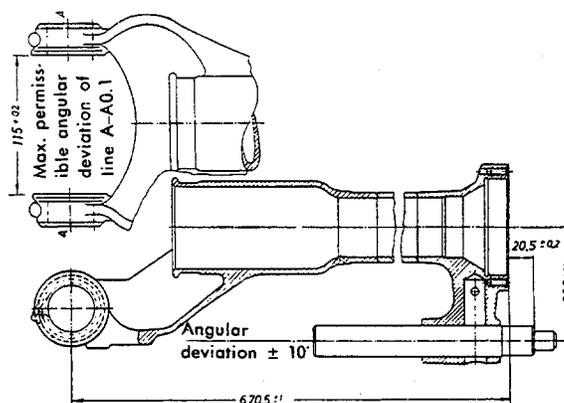
Left-hand rear axle tube

The threaded ring in the left-hand rear axle tube has 6 grooves (formerly 4 holes) for tightening the bevel roller bearing and a thread M 79 x 1.5.

**Right-hand Rear Axle Tube:**

34. Check the bushings provided in the right-hand rear axle tube. Replace bushings that

are worn out. When pressing in the new bushings be sure that the lubricating hole registers with the lubricating nipple bore.



$115 \pm 0.2$  mm ( $4.53 \pm 0.008$ ")  
 $93.6 \pm 0.1$  mm ( $3.685 \pm 0.004$ ")  
 $20.5 \pm 0.2$  mm ( $0.807 \pm 0.008$ ")  
 $670.5 \pm 1$  mm ( $26.40 \pm 0.04$ ")

Fig. H 3a/34

Right-hand rear axle tube

After the bushings have been pressed in, ream them to finished size. To this end center reamer 000 589 06 53 on the opposite side with a tapered sleeve (Fig. H 3a/34a).

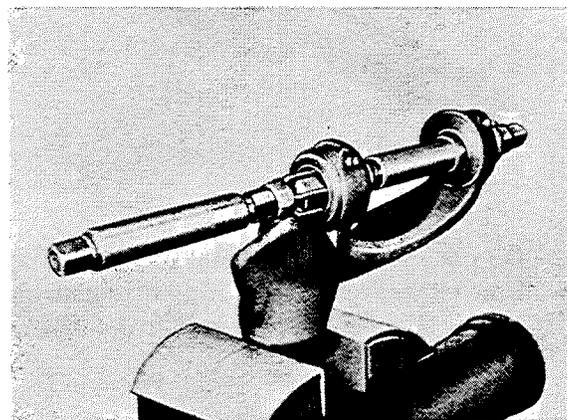


Fig. H 3a/34a

The dimensions of the bores and the pertaining bushings in the rear axle tube will be seen from the following table. Strictly adhere to the tolerances for reworking the bushings. Excessive play between bushings and sleeves on the connecting pin will result in metallic knocking noises during travel. On the other hand a too tight fit will result in rumbling, as the right-hand rear axle tube turns on the connecting pin with difficulty.

Dimensions in mm (in.)

Bushing in forked section of rear axle tube		Outer dia. of sleeve on connecting pin	Bore in forked section of rear axle tube	
Inner dia.	Outer dia.			
33.000 33.025 (1.29921) (1.30019)		32.950 32.975 (1.29724) (1.29823)		Play 0.025 to 0.075 (0.001 to 0.003)
	38.043 38.059 (1.49775) (1.49838)		38.000 38.025 (1.49606) (1.49704)	Overlap + 0.018 (0.0007") to + 0.059 (0.0023")

35. If the inner surfaces of the eyelets on the right-hand rear axle tube are damaged or shrunk, recondition them with end milling cutter 180 589 01 51 and pertaining milling arbor 180 589 00 66 (Fig. H 3a/35).

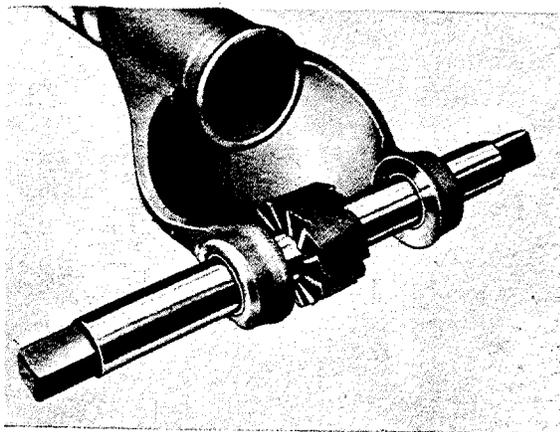


Fig. H 3a/35

Do not remove more than 0.3 mm (0.012") from either surface. The original dimensions will be seen from Fig. H 3a/35a.

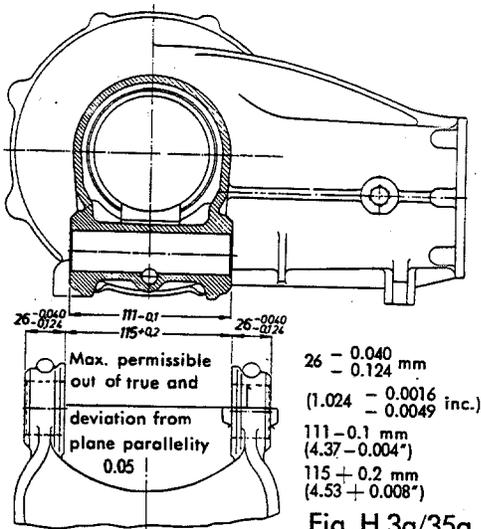


Fig. H 3a/35a

Mill the surfaces accurately. The permissible out of true and the deviation from the plane parallelity are 0.05 mm (0.002").

For checking the parallelity of the two surfaces and their angular accuracy in relation to the bores, use arbor with paint ring 180 589 04 21. Provide the ring with oil-thinned blue paint so that any unevenness of the surfaces will be better visible (Fig. H 3a/35b).



Fig. H 3a/35b

36. If the outer surface on the rear axle housing is damaged or shrunk, proceed as described under cf. 35. Use end milling cutter 180 589 02 51 with pertaining milling arbor 180 589 01 66 as well as arbor with paint ring 180 589 07 01.

**Connecting Pin:**

37. The connecting pin represents the fulcrum of the two axle halves. It connects the rear axle housing with flanged-on left-hand rear axle tube, the right-hand rear axle tube and the rear axle suspension support (see Fig. H 3a/67).

Replace all sleeves, adjusting washers and shims that have shrunk as well as all damaged rubber rings.

The pin itself must not be damaged. In addition check it for true run. When the pin is supported at the ends, the out of true must not be more than 0.10 mm (0.004").

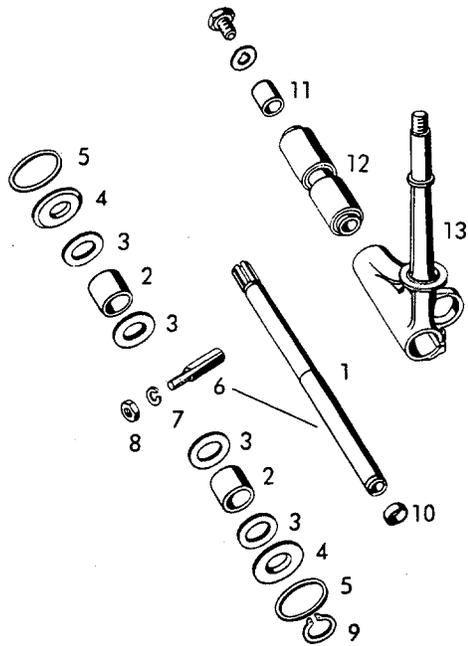


Fig. H 3a/37

- |                    |                                 |
|--------------------|---------------------------------|
| 1 Connecting pin   | 9 Lock ring                     |
| 2 Sleeve           | 10 Cover plate                  |
| 3 Adjusting washer | 11 Spacer sleeve                |
| 4 Shim             | 12 Silent block                 |
| 5 Rubber ring      | 13 Rear axle suspension support |
| 6 Wedge-type screw | 14 Lock plate                   |
| 7 Spring ring      | 15 Hexagonal screw              |
| 8 Hexagonal nut    |                                 |

The fit for the outer diameter of the connecting pin and the inner diameter of the sleeves, which are seated on the connecting pin, is specified in the below table.

Dimensions in mm (in.)

Selected size	Colour code	Outer diameter of connecting pin	Bore in sleeve	Overlap
I	White	$\frac{27.994}{28.000}$ (1.10212) (1.10236)	$\frac{27.983}{27.989}$ (1.10169) (1.10193)	+ 0.005 (0.0002") to
II	Blue	$\frac{27.987}{27.993}$ (1.10185) (1.10208)	$\frac{27.967}{27.982}$ (1.10142) (1.10165)	+ 0.017 (0.00067")

Any play between connecting pin and sleeve or excessive play between bushing in rear axle tube and the sleeve will result in metallic knocking noises during travel. Hence it is of utmost importance to adhere strictly to the tolerances given in the table.