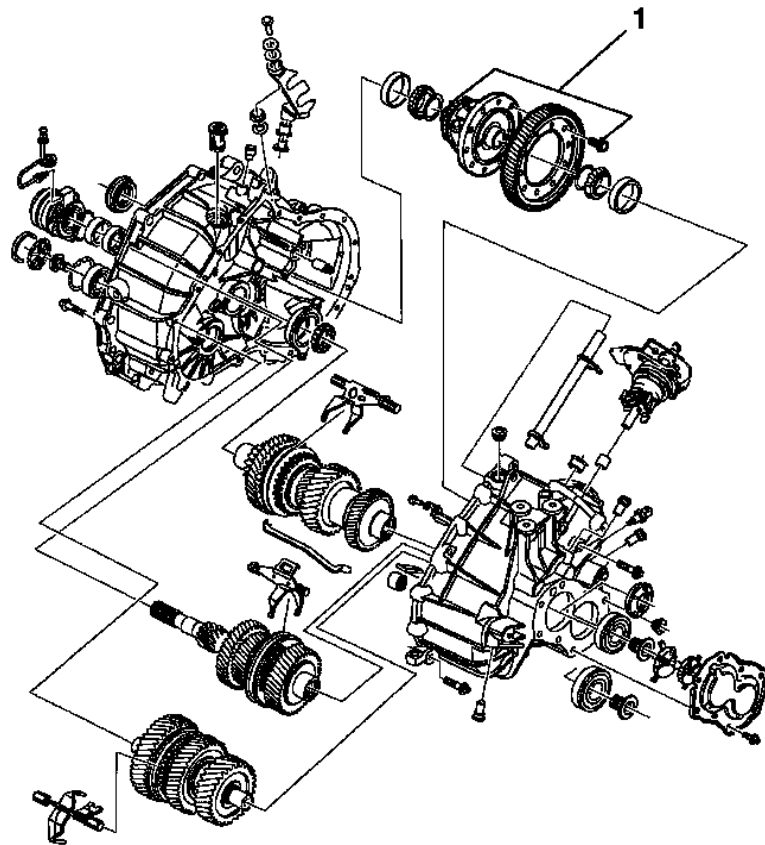


## Differential, Replace

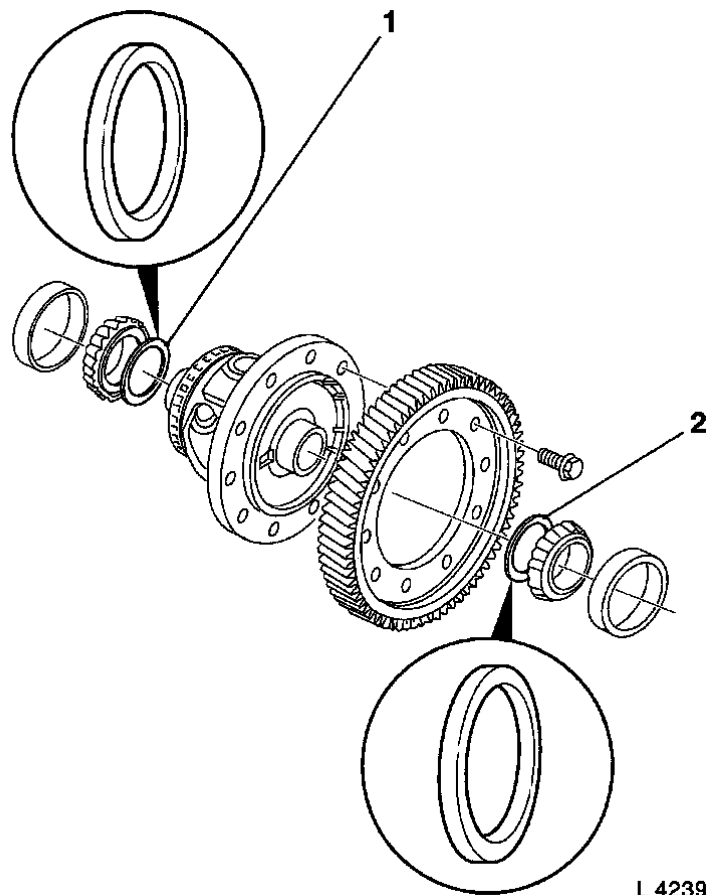
1. Illustration of differential
  1. Differential with ring gear



L 2628

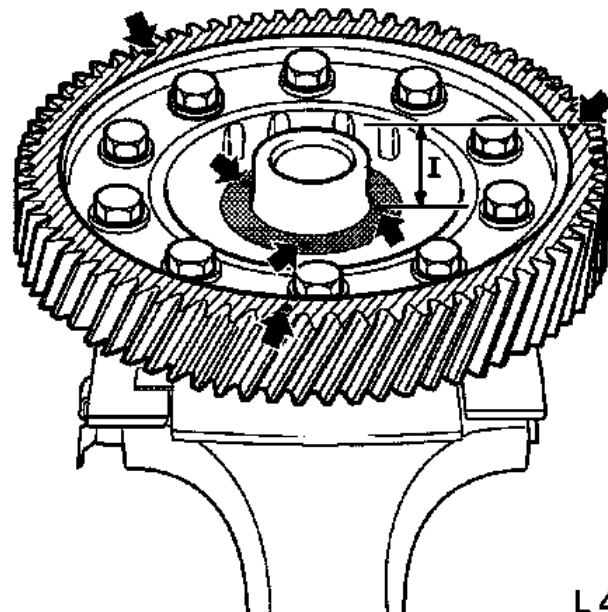
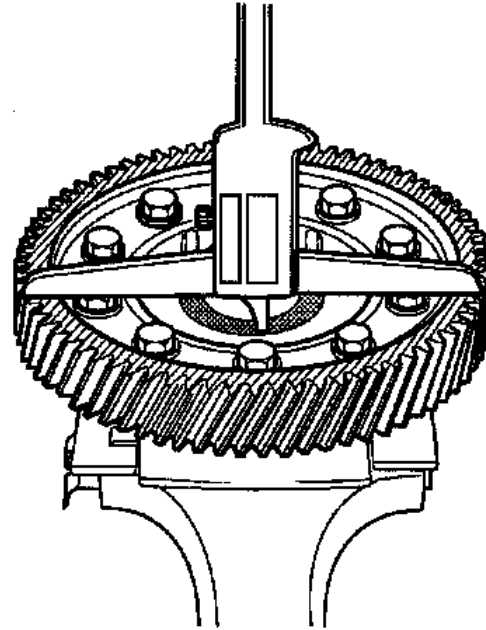
2. Remove transmission from vehicle - see operation "Transmission, Remove and Install"
3. Disassemble transmission - see operation "Transmission, Seal Completely"
4. Remove tapered roller bearings from differential - see operation "Tapered Roller Bearings, Differential, Remove and Install"
 

**Note:** When replacing differential, pressure comb adjustment must be determined and adjusted if necessary. For this purpose, tapered roller bearings must be removed from differential
5. For adjustment purposes, dimension of transmission housing side shim (2) is first determined. This is required for pressure comb adjustment. Subsequently, dimension of clutch housing side shim (1) is determined. This is required for adjustment of the bearing pre-tension for differential tapered roller bearings. For determination of shims for bearing pre-tension, priority is always given to determination on transmission side for adjustment of pressure comb



L 4239

6. Determine dimension (I) (height clearance of ring gear to differential tapered roller bearing seat - transmission housing side) using commercially available digital depth gauge (1) with measuring range of at least 250 mm and graduation of 0.01 mm
- Perform this measurement at three evenly spaced measurement points on the ring gear and differential (arrows)
  - Add measured values and divide sum by number of measurements
  - This calculation is illustrated in following table



L 4241

7. Purpose of following table is to explain pressure comb adjustment using an example calculation

- Table for example calculation for evaluation of measurement

1st measurement	15.02 mm	+
2nd measurement	15.06 mm	+
3rd measurement	15.05 mm	=
Total value	45.13 mm	:3=
Mean value	15.04 mm	

- Table for your evaluation of measurement; enter your measurement results in table (on a hard copy)

1st measurement		mm	+
2nd measurement		mm	+
3rd measurement		mm	=

Total value	mm	:3=
Mean value	mm	

8. Measurement is performed on old differential with old ring gear, then on new differential. This can be performed with new or old ring gear, depending on whether ring gear must also be replaced. For removal and installation of differential ring gear - see operation "Ring Gear, Differential, Replace"
9. If a value deviates by more than **0.08 mm** from other values of a particular measurement, measurement must be repeated as a measurement error has occurred
10. Mean value for old differential is then subtracted from mean value for new differential. If dimension difference between old and new differential is greater than **+ 0.02-0.06 mm**, pressure comb must be adjusted

• Table for example calculation of dimension difference

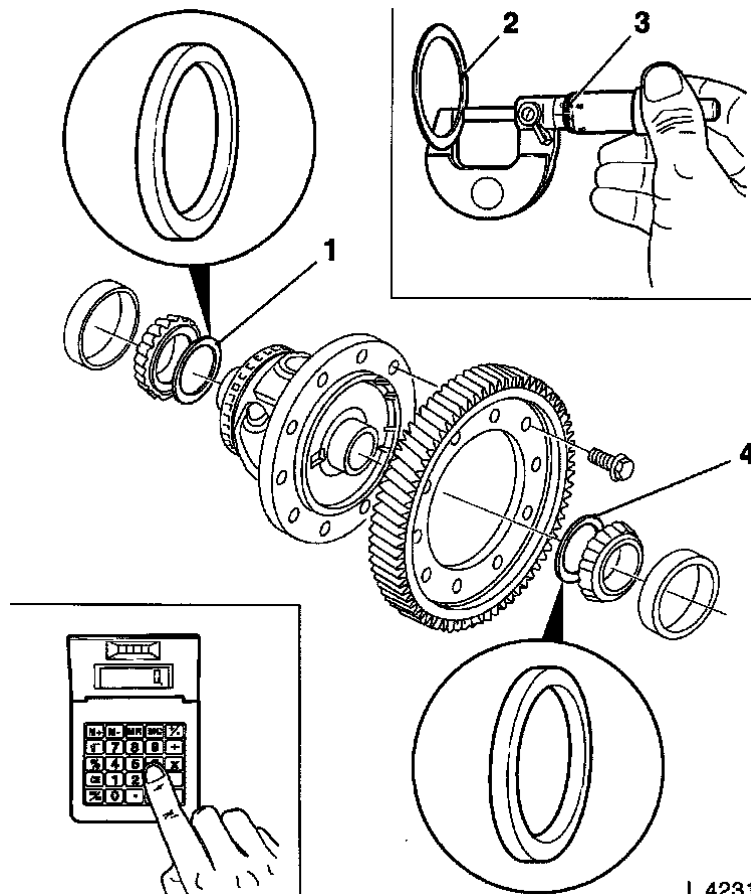
Mean value	New differential	15.16 mm	-
Mean value	Old differential	15.04 mm	=
		+ 0.12 mm	± Difference

• Table for your dimension difference calculation; enter your measurement results in table (on a hard copy)

Mean value	New differential	mm	-
Mean value	Old differential	mm	=
		mm	± Difference

11. Select shim

- If difference is positive (+), then the shim (transmission housing side) (4) must be selected to be thicker by same amount
- If difference is negative (-), then the shim (transmission housing side) (4) must be selected to be thinner by same amount
- If the shim (transmission housing side) (4) is thicker, the shim (clutch housing side) (1) must be selected to be thinner by same amount
- If the shim (transmission housing side) (4) is thinner, the shim (clutch housing side) (1) must be selected to be thicker by same amount



L 4231

- In other words, total thickness of the two shims remains same
- Corresponding shims can be obtained from "Aftersales" division. Actual dimension for shims (2) is determined using a micrometer (3) since shims are not labelled

12. Examples for using shims are listed in table below

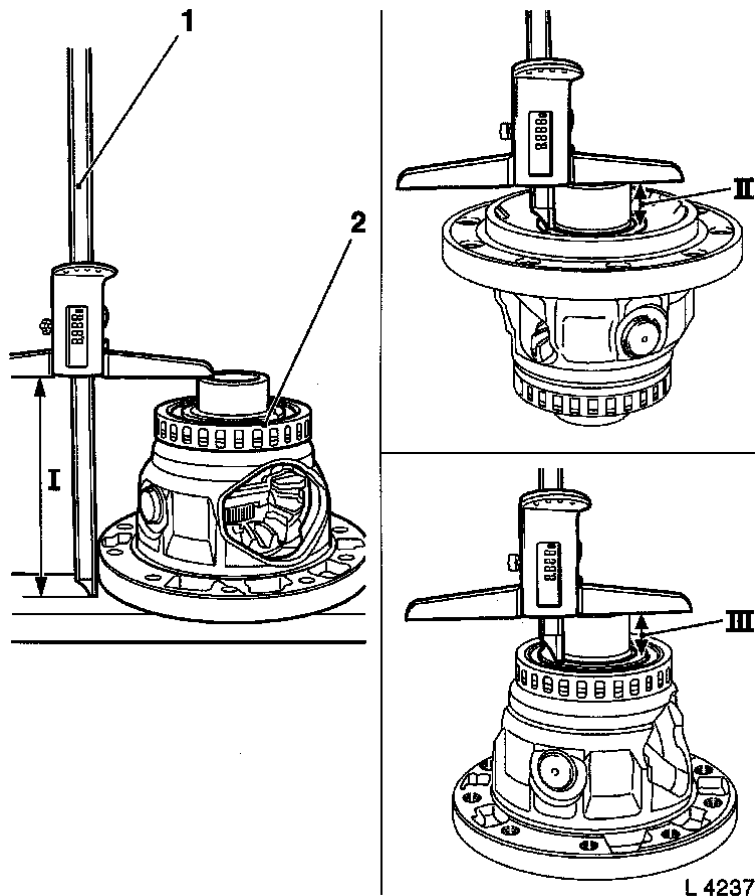
Difference dimension	Shim (transmission housing side)		Shim (clutch housing side)	
- 0.25 mm	Old 0.90 mm	New 0.65 mm	Old 0.75 mm	New 1.00 mm
+ 0.20 mm	Old 0.90 mm	New 1.10 mm	Old 0.75 mm	New 0.55 mm
+ 0.13 mm	Old 0.90 mm	New 1.05 mm	Old 0.75 mm	New 0.60 mm
+ 0.12 mm	Old 0.90 mm	New 1.00 mm	Old 0.75 mm	New 0.65 mm

13. Shims must be selected so that smallest possible tolerance is achieved during adjustment  
**Note:** Used shims can be re-used in subsequent adjustment operations provided that shims are not damaged
14. The shim (clutch housing side) is only altered in the subsequent adjustment of bearing pretension for differential regardless of the shim (transmission housing side)

**Important:** Next measurement is carried out on old and new differential (2) without differential tapered roller bearing and without ring gear. However, dimension for the shim (transmission housing side) that has already been determined must also be taken into account; this dimension must be given highest priority for adjustment operations on differential and must not be altered in subsequent adjustment

15. Measure dimensions I, II and III using a commercially available digital depth gauge (1) with a measuring range of at least 250 mm and graduation of 0.01 mm

16. Dimensions II and III are subtracted from dimension I. This calculation is illustrated in following table. This derived dimension IV



corresponds to  
distance between  
seats of differential  
tapered roller  
bearings

17. Purpose of following table is to explain pressure comb adjustment using an example calculation

- Table for example calculation of dimension difference

Dimension I	210.25 mm	-
Dimension II	18.25 mm	-
Dimension III	18.30 mm	=
Dimension IV	173.70 mm	

- Table for your dimension difference calculation; enter your measurement results in table (on a hard copy)

Dimension I		mm	-
Dimension II		mm	-
Dimension III		mm	=
Dimension IV		mm	

18. Perform this measurement at three evenly-spaced measurement points on differential. Add calculated dimension IV values and divide sum by the number of measurements. This calculation is illustrated in following table

- Table for example calculation for evaluation of measurement

1st measurement	Dimension IV	90.02 mm	+
2nd measurement	Dimension IV	90.06 mm	+
3rd measurement	Dimension IV	90.05 mm	=
	Total value	270.13 mm	:3=
	Mean value	90.04mm	

- Table for your evaluation of measurement; enter your measurement results in table (on a hard copy)

1st measurement	Dimension IV		mm	+
2nd measurement	Dimension IV		mm	+
3rd measurement	Dimension IV		mm	=
	Total value		mm	:3=
	Mean value		mm	

19. This measurement is performed in same way on new differential

- If height difference between old and new differential is greater than  $\pm 0.04$  mm, differential bearing pre-tension must be adjusted
- If height difference is less than  $+ 0.04$  mm, adjustment for differential bearing pre-tension is retained. Dimension of the shim (clutch housing side) is adapted to dimension of the shim (transmission housing side)
- This calculation is illustrated in following tables

Shim (transmission housing side) old	Shim (clutch housing side) old	Shim (transmission housing side) new	Shim (clutch housing side) new
0.90 mm	1.10 mm	1.00 mm	1.00 mm
1.25 mm	0.75 mm	1.10 mm	0.90 mm

20. Total thickness of two shims remains same as long as height of differential (dimension IV) does not change or deviation remains less than  $\pm 0.04$  mm. Determination of shims for adjustment of differential bearing pretension is described in table below

**Note:** Total dimension of shim + height of differential (dimension IV) = remains constant  $\pm 0.04$  mm, for new and old differential. This means that differential and shim assembly for new differential must have same dimension as that of old differential. Adjustment has then been performed correctly

## 21. Adjust shims

- If dimension IV for new differential is larger than dimension IV of old differential, the shim (clutch housing side) is thinner by difference of dimension IV
- If new differential is shorter than old differential, the shim (clutch housing side) is thicker by difference of dimension (IV). In doing so, previously determined dimension of the shim (transmission housing side) must not be altered
- A few examples for using shims are listed in table below

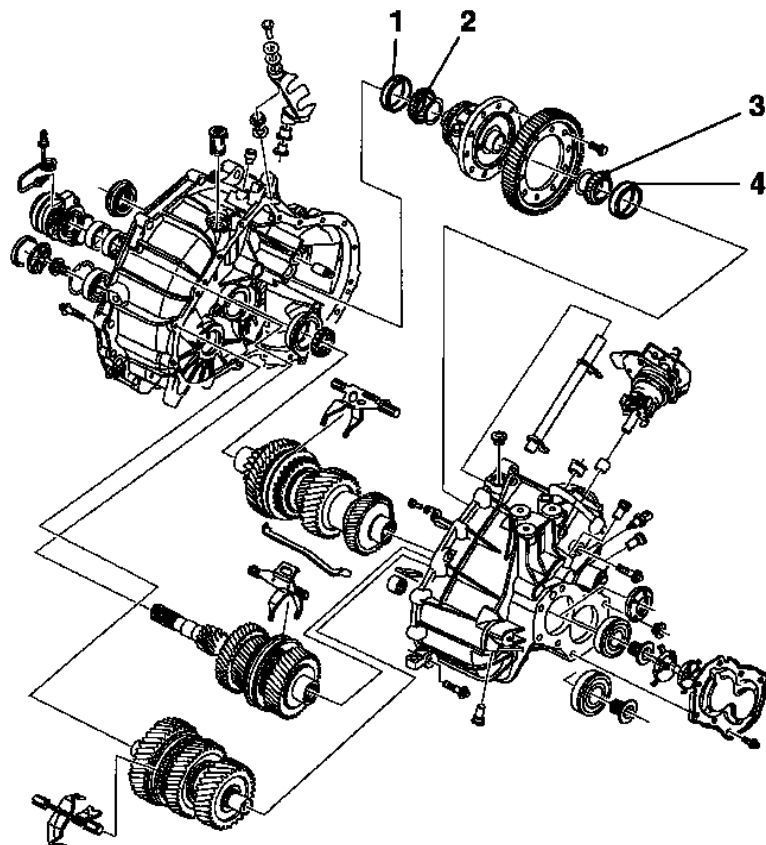
Dimension IV (old)	Shim (clutch housing side) old	Dimension IV (new)	Shim (clutch housing side) new
90.10 mm	0.75 mm	90.03 mm	0.80 mm
90.07 mm	0.85 mm	90.15 mm	0.75 mm
90.21 mm	0.90 mm	90.08 mm	1.05 mm

- Smallest possible tolerance is desirable for adjustment. In doing so, the shim (transmission housing side) must not be altered, since pressure collar adjustment has already been made

22. When replacing differential and re-using old inner races for tapered roller bearing (2, 3), these must be reinstalled - see operation "Tapered Roller Bearing, Differential, Remove and Install"

23. When using new inner races for differential tapered roller bearing, outer races for tapered roller bearing (1, 4) must also be replaced - see operation "Tapered Roller Bearing, Differential, Remove and Install"

24. Install differential ring gear - see operation "Ring Gear, Differential, Replace"



L 2629

25. Assemble transmission - see operation "Transmission, Seal Completely"

26. Install transmission to vehicle - see operation "Transmission, Remove and Install"