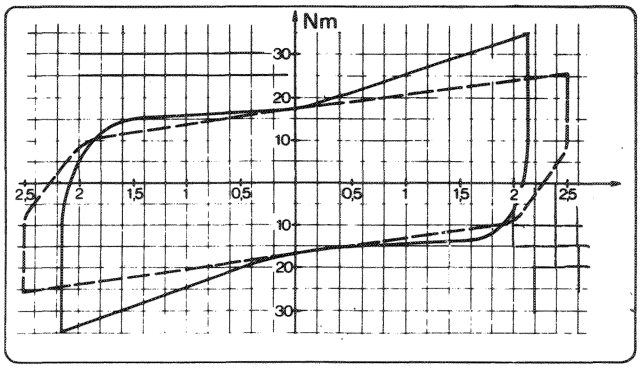
VARIABLE RATIO RACK-AND-PINION STEERING GEAR

Operation

The innovative characteristic of this steering system lies in the difference between the maximum effort applied to the steering wheel when the car is on a bend or executing manoeuves with high steering angles, and the minimum effort applied when the steering wheel is in the straight, or virtually straight, driving position.



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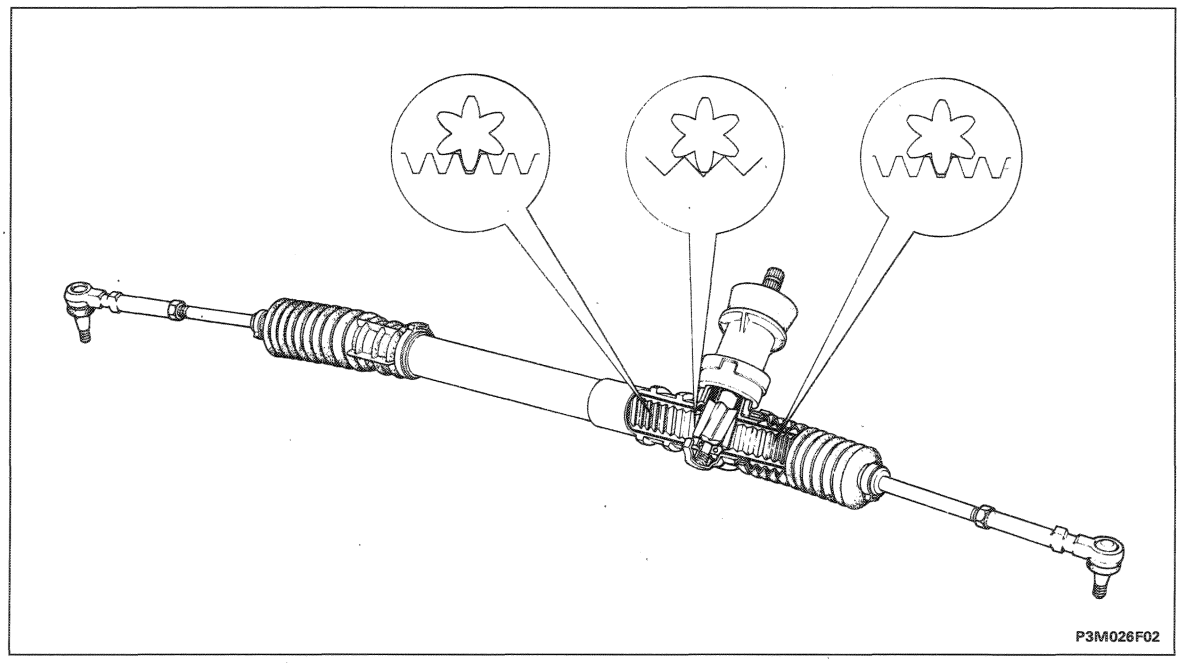
Graph showing the different efforts applied with a constant-ratio steering gear and a variable-ratio steering gear.

——— Constant-ratio steering gear

– – – – Variable-ratio steering gear

This characteristic is obtained thanks to the particular shape of the rack teeth, which can offer variable ratios between the force applied to the steering wheel and the force transmitted to the wheels, depending on the position assumed by the rack in relation to the pinion.
The rack teeth are cut with the pressure angle and modulus varying from the centre towards the ends, so the pinion engages with teeth of different pitch depending on the steering angle executed.
A more direct ratio is thus obtained when the pinion is working on the central part of the rack and a more demultiplied ratio is obtained as the pinion engages nearer the two ends of the rack during steering.
This leads to **higher sensitivity of the car on straight lines and greater comfort on bends and during manoeuvres**.



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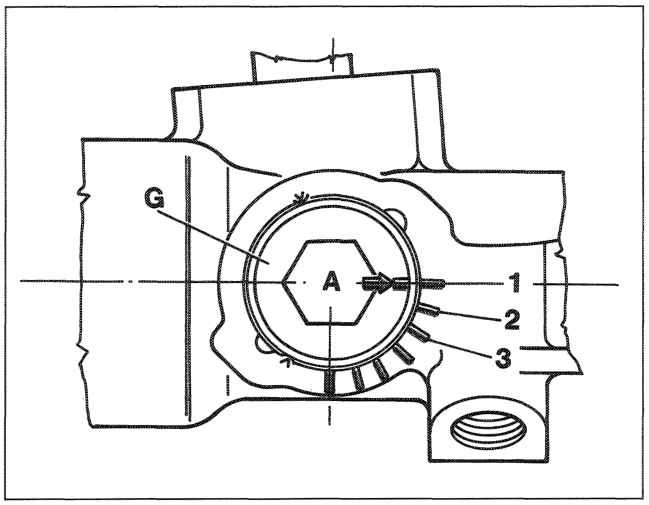
View of the variable-ratio steering gear with schematic representation of the rack teeth and pinion.

Adjustment

The particular tooth structure requires a certain precision of operation. If sporadic noise (knocking) occurs, adjust the steering gear as follows.



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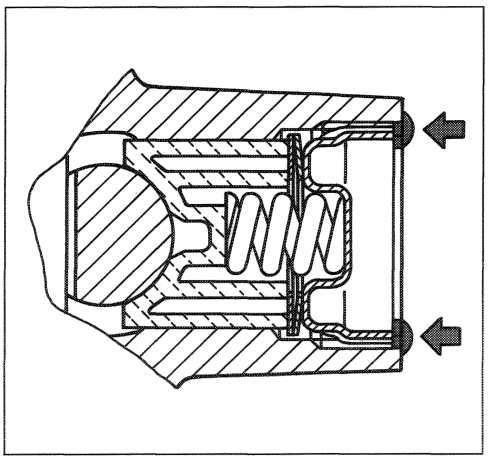
a – Mark the ring nut (G) with a paint mark (A) level with the 1st reference mark on the steering gear;

b – Turn the ring nut (G) so that the reference (A) painted on it lines up with the 2nd reference mark;

c – Then mark the ring nut **with a blue paint mark**;

d – Check by means of a road test that:
- the noise/knocking has disappeared
- the steering wheel returns to the central position spontaneously after turning manoeuvres
- there are no tight spots during the steering movement



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e – If the noise has disappeared, restore the hydraulic seal by applying LOCTITE 595 sealant on the surface indicated in the figure;

If the noise has not disappeared, repeat operations b - d turning the ring nut (G) and lining up the reference (A) on the ring with the 3rd reference mark.

If the noise disappears after the 2nd operation, repeat operations c – e, **this time marking the ring nut with a red paint mark**.

If the noise persists even after the 2nd adjustment, the complete steering gear will need to be replaced.
If the problem arises, before making the above-mentioned adjustment, the maximum attention must be given as to ***whether there are any blue or red paint marks.***

If there is a ***blue paint mark****, only one operation may be carried out, while the* ***red paint mark*** *does not permit any intervention and the steering gear must be replaced.*

A small number of steering gear assemblies mounted on the cars have no reference marks, so in order to be able to carry out the adjustment, the reference marks will have to be made on the steering gear. These marks must be drawn 5 mm apart.