Adjusting the Mark: Working towards the ideal contact pattern

We sit and watch our plasma or LCD television sets to view a picture of our world. In the diff industry a "mark" serves the same purpose of providing the technician with a full picture of the state of the diff "setting". Prior to overhaul, the diff setting can provide a lot of information, including whether the diff is worn or serviceable and the cause of the wear.

To understand how the setting provides the information required to adjust the mark, it is important to understand the physical attributes of the gear-set we are working with.

In the modern differential, the gearset is usually a hypoid spiral bevel, the pinion is below centre of the crownwheel and the teeth are curved. Bevel means that the drive is transmitted at right angles to the source, in other words the drive comes down the tailshaft and is then directed to the left and right on to each axle. Having the pinion below centre enables the vehicle designer to lower the centre of gravity of the vehicle, thus making the vehicle safer on the road.

Curvature of the tooth is referred to as concave or convex. Concave means the curve bulges inwards, whilst the convex curves outwards. The design of a crownwheel and pinion can be compared to a dam holding water. The strength of the dam relies on the curve of the wall against the force of the water storage. In a motor vehicle the greatest force of power is applied when the accelerator is depressed and the vehicle drives forward. The convex side of the crownwheel tooth comes into play under these circumstances to prevent breakage of the gearset. In the industry these conditions are known as the "drive" side and the "overdrive" side of the tooth. We can also allocate a segment of the tooth in relation to performance of the mark. Looking at a single tooth, the inner end is called the toe, the outer end is called the heel, whilst the top and bottom are called addendum and dedendum.

Now, back to the "mark". When the gears turn, whilst in contact and during motion, they rub on each other's surface and if the surface were to be painted with a paste, the gears would leave a mark after turning. The "mark" is created when the paste is rubbed off the contacting surfaces. This mark tells all! It is important to understand the position and the movement of the mark in relation to performance of the crownwheel and pinion and how it will subsequently perform either on the road, farm or racetrack. In most circumstances the ideal mark is central horizontally and slightly favouring the toe on the drive side and the same with the overdrive side.

Sometimes it is not possible to obtain an ideal mark so various compromises have to be accepted. During operation, the mark does not stay in the same place. When the vehicle accelerates, the marked moves towards the heel and upwards (generally the opposite on the overdrive side) and this has to be considered when setting up the differential.

The paste used for marking is the consistency of toothpaste and is ideally white in colour. There are no guarantees when setting up differentials, because of the variety of possible mark locations and the subsequent result in performance. Generally speaking, if your pre-loads and backlash are correct, the marking is as close to ideal as possible, the differential will perform as it should.

This information is provided as a guide, please contact Diff Lapping and Repairs for further information advice relating to your specific situation – it's a free service!

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