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TOOTH TIPS

“The metal doesn’t lie,” and gear contact checks can detect profile and misalignment errors before they become a problem in production.

Most mechanics are familiar with the concept of checking gear contact on bevel gear sets to ensure that they are set up correctly, but many are unaware of the benefits of making contact checks on spur and helical gear sets. An old axiom used in failure analysis is that “the metal doesn’t lie,” and gear contact checks, when carefully done, can detect very small profile and misalignment errors.

No-load contact checks are used to monitor manufacturing and assembly quality, and the basic procedure is as follows:

- Clean both sides of the pinion and gear teeth that will be in contact during the check.
- Typical marking compounds used are Prussian blue and proprietary products. Proper consistency and application of the marking compound is critical to the success of interpreting the results. The marking compound must be applied uniformly and at a known thickness, typically in the range of 0.0004” (10mm). Whenever possible the thickness should be verified by intentionally misaligning the gear set a known amount and documenting the results.

- Apply a thin coating of marking compound to several teeth on the pinion using a paintbrush or your finger. Usually the marking compound is applied to the pinion teeth but can be applied to the gear teeth instead.


- Then roll the pinion teeth with marking compound back and forth through mesh with the gear teeth several times while putting some drag on the gear by hand.
- The marking compound on the pinion teeth will transfer to the gear teeth where they have direct contact and anywhere the gap between the teeth is less than the thickness of the marking compound.
- The results of the contact check can be recorded with photographs or tape impressions. I prefer tape impressions because they give you the results at full scale, can be measured, and are easier to interpret.
- To help outline the marked gear teeth, run the tip of a permanent black felt tip marking pen along the edges of the pro-

files at the tips and ends of the teeth before applying the tape.

- Place a piece of transparent tape that is slightly wider and longer than the gear tooth along the tooth that has the contact pattern you want to record. Firmly rub the tape with a finger along the entire length of the tooth.
- Carefully lift off the tape and then apply it to a piece of white paper. Make sure to document the results with the date, equipment ID, mesh location, and orientation of the tooth. Figure 1 is an example tape impression showing the contact of a ground gear set with a slight amount of misalignment and full circular crowning on the mating pinion.

Loaded contact checks are the final and ultimate test to verify that the alignment is correct when all of the gearbox components are running in their loaded and deflected position. The procedure is as follows:

- Clean off several teeth at four equally spaced locations around the gear.
- Apply a thin coat of red or blue layout fluid by brush or spray to both flanks of the cleaned teeth and let it dry. After the gear sets have run for a short period under their operating load, the layout fluid will be worn off the marked teeth in the areas where they contact. For most gear sets without significant lead or profile modifications, the contact pattern will be the inverse of the no load contact pattern done at assembly.
- Document the condition of the contact with sketches and photographs.
- The ideal contact pattern is to have all of the layout fluid removed for the entire face width and active profile.

Both of these contact checks should be part of the final assembly and startup process for both new and repaired gearboxes. 

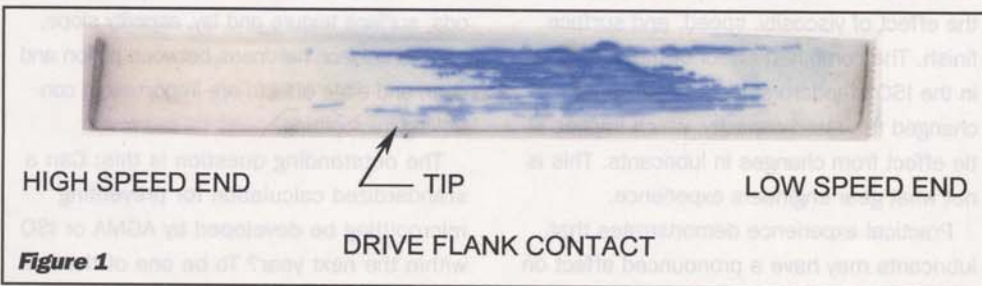


Figure 1

ABOUT THE AUTHOR:

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