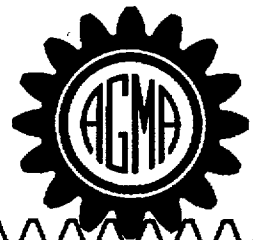


Comparison of Carburized Gear Materials in Pitting

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American Gear Manufacturers Association



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American Gear Manufacturers Association
1500 King Street, Suite 201
Alexandria, Virginia, 22314

October, 1992

ISBN: 1-55589-586-7



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COMPARISON OF CARBURIZED GEAR MATERIALS IN PITTING

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ABSTRACT :

This paper compares the pitting resistance of five different steels commonly used for case carburized gears. The comparison is based on the test results obtained on the CETIM gear benches. A presentation of the test bench capabilities and of the first results obtained was given in 1988 in New-Orleans at the Fall Technical Meeting. Since then new tests have been performed on several carburized steels and numerous results are now available.

The paper first describes how the tests were set up and how the test results were interpreted for each steel, representative curves of pitting performances were drawn. The comparison is based on the appearance of these curves and all the deviations encountered are discussed in details.

Introduction :

For more than ten years CETIM has been conducting experimental studies to determine the pitting resistance of case carburized gears. First there is a short discussion about the test benches and gears used in these studies. Then details are given on the method used to identify the typical surface aspects which are taken as references for pitting resistance evaluation. Next, the results of the test on the teeth of gears from five different materials are compared. The materials are :

- 20 MnCr5 (20MC5)
- XC 18
- 16 NC 6
- 17 CrNiMo6
- 18NCD6

The first one is a chromium manganese steel commonly used in Germany for case hardening. The fourth one is a chromium nickel and Molybdenum steel which is also very common in Germany for gear carburizing. The second one is a carbon steel, not alloyed and it can be carburized. The two others are steels for case hardening often used in France. The chemical composition of these steels is given in appendix 1.

1. Test benches

To perform tests for pitting endurance, CETIM built 4 test benches. These test benches have closed power circulation and the load application is either by mechanical or hydraulic means. A static torque is introduced in either direction on one of the two shafts placing the gears under load. The IDEFIX 400 test bench described below is made-up of two industrial gearboxes. One is located near the drive motor, is largely dimensioned and is used to close the loop. The other one is at the other end and houses the gear to be tested.

The two gearboxes are connected together on one side by a "U" joint and on the other side by a torque introduction device (rotating jack or torsional bar).

The torque measurement is made by strain gauges fitted on the "U" joint tube. The power supply of the gauge bridge and the torque signal are provided through a rotating transmitter fitted on the free shaft end of the loop gearbox. A schematic view of the bench is given on figure 1 and the main characteristics in the table 1.

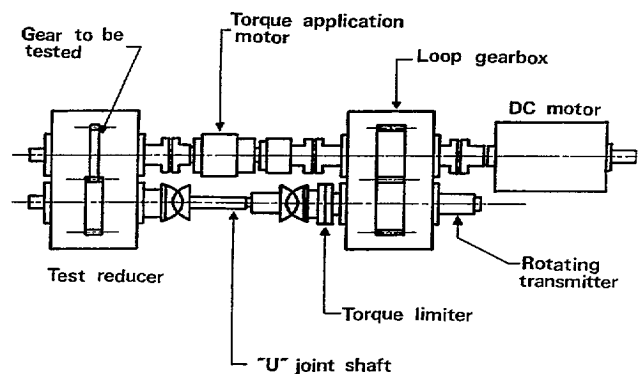


Fig. 1 : IDEFIX 400 Test bench