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Calculation of load capacity of bevel gears —

Part 2:
Calculation of surface durability (pitting)

Calcul de la capacité de charge des engrenages coniques —

Partie 2: Calcul de la résistance à la pression superficielle (formation des piqûres)

Reference number
ISO 10300-2:2001(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 10300 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10300-2 was prepared by Technical Committee ISO/TC 60, *Gears*, Subcommittee SC 2, *Gear capacity calculation*.

ISO 10300 consists of the following parts, under the general title *Calculation of load capacity of bevel gears*:

— *Part 1: Introduction and general influence factors*

— *Part 2: Calculation of surface durability (pitting)*

— *Part 3: Calculation of tooth root strength*

Annex A of this part of ISO 10300 is for information only.

This corrected version of ISO 10300-2:2001 incorporates the following corrections:

equations (16) and (18), and the date of publication of ISO 10300-1 given in Clause 4, have been corrected.

Introduction

Parts 1, 2 and 3 of ISO 10300, taken together with ISO 6336-5, are intended to establish general principles and procedures for the calculation of the load capacity of bevel gears. Moreover, ISO 10300 has been designed to facilitate the application of future knowledge and developments, as well as the exchange of information gained from experience.

This part of ISO 10300 deals with the failure of gear teeth by pitting, a fatigue phenomenon. Two varieties of pitting are recognized: initial and destructive.

On the one hand, in applications employing low-hardness steel or through-hardened steel, corrective (non-progressive) initial pitting frequently occurs during early use and is not deemed serious. Initial pitting is characterized by small pits which do not extend over the entire face width or profile depth of the affected tooth. The degree of acceptability of initial pitting varies widely depending on the gear application. Initial pitting occurs in localized over-stressed areas, and tends to redistribute the load by progressively removing high contact spots. Generally, when the load has been redistributed, the pitting stops.

On the other hand, in applications employing high-hardness steel and case-carburized steel, the variety of pitting that occurs is usually destructive. The formulae for pitting resistance given in ISO 10300 are intended to assist in the design of gears that will be free from destructive pitting during their design life.

The basic formulae, first developed by Hertz for the contact pressure between two curved surfaces, have been modified to consider load sharing between adjacent teeth, the position of the centre of pressure on the tooth, the shape of the instantaneous area of contact, and the load concentration resulting from manufacturing uncertainties. The Hertzian contact pressure serves as the theory for the assessment of surface durability in respect of pitting. Although all premises for a gear mesh are not satisfied by Hertzian relations, their use can be justified by the fact that, for a given material, the limits of the Hertzian pressure are determined on the basis of running tests with gears, which include the additional influences in the analysis of the limit values. Therefore, if the reference points lie within the field of application range, Hertzian pressure can be used as a type of model theory to aid in the conversion of test-gear data to gears of various types and sizes.

NOTE In contrast to cylindrical gears, where the contact is mostly linear, bevel gears are generally manufactured with crowning: i.e. the tooth flanks are curved on all sides and the contact develops an elliptical pressure surface. This is taken into consideration when determining the load factors $K_{H\beta}$ and $K_{H\alpha}$ (see ISO 10300-1) by the fact that the rectangular pressure surface (in the case of linear contact) is replaced by an inscribed pressure ellipse. The conditions for bevel gears, different from cylindrical gears in their contact, are thus taken into consideration by the longitudinal- and transverse-load distribution factors. Therefore, the general equations for the calculation of Hertzian pressure are similar for cylindrical and bevel gears.