International

ISO 10300-2

Calculation of load capacity of bevel gears —

Part 2: Calculation of surface durability (macropitting)

Calcul de la capacité de charge des engrenages coniques —

Partie 2: Calcul de la résistance à la pression superficielle (macro-écaillage)

Third edition
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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This document was prepared by Technical Committee ISO/TC 60, *Gears*, Subcommittee SC 2, *Gear capacity calculation*.

This third edition cancels and replaces the second edition (ISO 10300-2:2014), which has been technically revised.

The main changes are as follows:

— Table 1 has been inserted;

— Table 2 has been inserted;

— the term “pitting” has been replaced by “macropitting”;

— bevel gear factor, Z_K, for the calculation of the nominal value of the contact stress has been removed; instead, a new bevel gear factor, Z_{KP}, has been introduced for the calculation of the permissible contact stress;

— Formula (37) for the calculation of the length of action considering adjacent teeth has been modified;

— subclause 8.3 — work hardening factor, Z_W, has been updated and method A added;

— Figure 2 — load distribution in the contact area has been updated as the symbol for exponent e has been changed to e_{LS};

— Figure 6 — facewidth factor, Z_{FW} has been removed;

— Figure 7 — lubricant factor, Z_L, for mineral oils has been removed;

— Figure 8 — speed factor, Z_V has been removed;

— Figure 9 — roughness factor, Z_R has been removed;

— Figure 10 — work hardening factor, Z_W has been removed;

A list of all parts in the ISO 10300 series can be found on the ISO website.

This corrected version of ISO 10300-2:2023 incorporates the following corrections:

— formula (3) — α_{m1} is revised to β_{m1};

— A.5 — $X_{LS,Y,}$ is revised to $Z_{LS,Y,}$;

— formula (A.2) — $l_{b,Y}$ is revised to $l_{bm,Y.}$

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When ISO 10300:2001 (all parts) became due for its first revision, the opportunity was taken to include hypoid gears, since previously the series only allowed for calculating the load capacity of bevel gears without offset axes. The former structure is retained, i.e. three parts of the ISO 10300 series, together with ISO 6336-5, and it is intended to establish general principles and procedures for rating of bevel gears. Moreover, ISO 10300 (all parts) is designed to facilitate the application of future knowledge and developments, as well as the exchange of information gained from experience.

In view of the decision for ISO 10300 (all parts) to cover hypoid gears also, a separate clause: "Gear flank rating formulae — Method B2" has been included in this document, while the former method B was renamed method B1. It became necessary to present a new, clearer structure of the three parts, which is illustrated in ISO 10300-1:2023, Figure 1.

NOTE ISO 10300 (all parts) gives no preferences in terms of when to use method B1 and when to use method B2.

This document deals with the failure of gear teeth by macropitting, a fatigue phenomenon. Two varieties of macropitting are recognized, initial and destructive macropitting.

In applications employing low hardness steel or through hardened steel, initial macropitting frequently occurs during early use and is not deemed serious. Initial macropitting is characterized by small pits which do not extend over the entire facewidth or profile depth of the affected tooth. The degree of acceptability of initial macropitting varies widely, depending on the gear application. Initial macropitting occurs in localized overstressed areas and tends to redistribute the load by progressively removing high contact spots. Generally, when the load has been redistributed, the macropitting stops.

In applications employing high hardness steel and case carburized steel, the variety of macropitting that occurs is usually destructive. The formulae for macropitting resistance given in this document are intended to assist in the design of bevel gears which stay free from destructive macropitting during their design lives (for additional information, see ISO/TR 22849[5]).

The basic formulae, first developed by Hertz for the contact pressure between two curved surfaces, have been modified to consider the following four items: the 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 with respect to macropitting. Although all premises for a gear mesh are not satisfied by Hertzian relations, their use can be justified by the fact that, for a gear 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 is within the application range, Hertzian pressure can be used to convert test gear data to gears of various types and sizes.

NOTE Contrary to cylindrical gears, where the contact is usually linear, bevel gears are generally manufactured with profile and lengthwise 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 by the fact that the rectangular zone of action (in the case of spur and helical gears) is replaced by an inscribed parallelogram for method B1 and an inscribed ellipse for method B2 (see ISO 10300-1:2023, Annex A for method B1 and Annex B for method B2). The conditions for bevel gears, different from cylindrical gears in their contact, are thus taken into consideration by the face and transverse load distribution factors.