Calculation of load capacity of spur and helical gears —
Part 5:
Strength and quality of materials

Calcul de la capacité de charge des engrenages cylindriques à
dentures droite et hélicoïdale —
Partie 5: Résistance et qualité des matériaux
Contents

Foreword iv
Introduction v
1 Scope 1
2 Normative references 1
3 Terms, definitions and symbols 2
4 Methods for the determination of allowable stress numbers 2
  4.1 General 2
  4.2 Method A 3
  4.3 Method B 3
  4.4 Method 3h 3
  4.5 Method 3k 3
  4.6 Method 3p 3
5 Standard allowable stress numbers — Method B 3
  5.1 Application 3
  5.2 Allowable stress number (contact), σ_H lim 4
  5.3 Bending stress number values for σ_F lim and σ_FE 5
     5.3.1 Nominal stress numbers (bending), σ_F lim 5
     5.3.2 Allowable stress number (bending), σ_FE 5
     5.3.3 Reversed bending 5
  5.4 Graphs for σ_H lim and σ_F lim and σ_FE 6
  5.5 Calculation of σ_H lim and σ_F lim 6
  5.6 Hardening depth of surface hardened gears in finished condition 23
     5.6.1 General 23
     5.6.2 Case depth of carburized and hardened gears 23
     5.6.3 Nitriding hardening depth of nitrided gears 25
6 Requirements for material quality and heat treatment 26
  6.1 General aspects 26
  6.2 Normalized low carbon or cast steel, plain carbon, unalloyed steels (see Figures 1 and 2) 27
  6.3 Black malleable cast iron (see Figures 3 a and 4 a) 27
  6.4 Other materials (see Figures 3 b, 3 c, 4 b, 4 c, 5 to 16) 27
  6.5 Coupon 40
  6.6 Mechanical cleaning by shot blasting 41
  6.7 Shot peening 41
     6.7.1 General 41
     6.7.2 Strength enhancement 41
     6.7.3 Salvage 41
Annex A (informative) Considerations of size of controlling section for through hardened gearing 43
Annex B (informative) Core hardness coefficients 46
Bibliography 47
ISO 6336-5:2016(E)

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO’s adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 60, Gears, Subcommittee SC 2, Gear capacity calculation.

This third edition cancels and replaces the second edition (ISO 6336-5:2003), which has been technically revised to reflect current practices throughout the industry.

A list of all parts in the ISO 6336 series can be found on the ISO website.
Introduction

This document, together with ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-6, provides the principles for a coherent system of procedures for the calculation of the load capacity of cylindrical involute gears with external or internal teeth. ISO 6336 is designed to facilitate the application of future knowledge and developments, as well as the exchange of information gained from experience.

Allowable stress numbers, as covered by this document, may vary widely. Such variation is attributable to defects and variations of chemical composition (charge), structure, the type and extent of hot working (e.g. bar stock, forging, reduction ratio), heat treatment, residual stress levels, etc.

Tables summarize the most important influencing variables and the requirements for the different materials and quality grades. The effects of these influences on surface durability and tooth bending strength are illustrated by graphs.

This document covers the most widely used ferrous gear materials and related heat treatment processes. Recommendations on the choice of specific materials, heat treatment processes or manufacturing processes are not included. Furthermore, no comments are made concerning the suitability or otherwise of any materials for specific manufacturing or heat treatment processes.
Calculation of load capacity of spur and helical gears —
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1 Scope

This document describes contact and tooth-root stresses and gives numerical values for both limit stress numbers. It specifies requirements for material quality and heat treatment and comments on their influences on both limit stress numbers.

Values in accordance with this document are suitable for use with the calculation procedures provided in ISO 6336-2, ISO 6336-3 and ISO 6336-6 and in the application standards for industrial, high-speed and marine gears. They are applicable to the calculation procedures given in ISO 10300 for rating the load capacity of bevel gears. This document is applicable to all gearing, basic rack profiles, profile dimensions, design, etc., covered by those standards. The results are in good agreement with other methods for the range indicated in the scope of ISO 6336-1 and ISO 10300-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 53, Cylindrical gears for general and heavy engineering — Standard basic rack tooth profile
ISO 642, Steel — Hardenability test by end quenching (Jominy test)
ISO 643:2012, Steels — Micrographic determination of the apparent grain size
ISO 683-1, Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Non-alloy steels for quenching and tempering
ISO 683-2, Heat-treatable steels, alloy steels and free-cutting steels — Part 2: Alloy steels for quenching and tempering
ISO 683-3, Heat-treatable steels, alloy steels and free-cutting steels — Part 3: Case-hardening steels
ISO 683-5, Heat-treatable steels, alloy steels and free-cutting steels — Part 5: Nitriding steels
ISO 1328-1, Cylindrical gears — ISO system of flank tolerance classification — Part 1: Definitions and allowable values of deviations relevant to flanks of gear teeth
ISO 2639, Steels — Determination and verification of the depth of carburized and hardened cases
ISO 3754, Steel — Determination of effective depth of hardening after flame or induction hardening
ISO 4948-2, Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics
ISO 4967, Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams
3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 1122-1 and the symbols and units given in ISO 6336-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at [http://www.iso.org/obp](http://www.iso.org/obp)

4 Methods for the determination of allowable stress numbers

4.1 General

Allowable stress numbers should be determined for each material and material condition, preferably by means of gear running tests. Test conditions and component dimensions should equate, as nearly as is practicable, to the operating conditions and dimensions of the gears to be rated.

When evaluating test results or data derived from field service, it is always necessary to ascertain whether or not specific influences on permissible stresses are already included with the evaluated data, e.g. in the case of surface durability, the effects of lubricants, surface roughness and gear geometry; in

1) American Society for Testing and Materials

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