
**Calculation of load capacity of spur
and helical gears —**

**Part 22:
Calculation of micropitting load
capacity**

*Calcul de la capacité de charge des engrenages cylindriques à
dentures droite et hélicoïdale —*

Partie 22: Calcul de la capacité de charge aux micropiqûres

Document Preview

[ISO/TS 6336-22:2018](https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018)

<https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 6336-22:2018](https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018)

<https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

| | Page |
|--|-----------|
| Foreword | v |
| Introduction | vi |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms, definitions, symbols and units | 1 |
| 3.1 Terms and definitions | 1 |
| 3.2 Symbols and units | 2 |
| 4 Micropitting | 4 |
| 5 Basic formulae | 5 |
| 5.1 General | 5 |
| 5.2 Safety factor against micropitting, S_λ | 6 |
| 5.3 Local specific lubricant film thickness, λ_{GFY} | 6 |
| 5.4 Permissible specific lubricant film thickness, λ_{GFP} | 7 |
| 5.5 Recommendation for the minimum safety factor against micropitting, $S_{\lambda, \min}$ | 8 |
| 6 Material parameter, G_M | 9 |
| 6.1 General | 9 |
| 6.2 Reduced modulus of elasticity, E_r | 10 |
| 6.3 Pressure viscosity coefficient at bulk temperature, $\alpha_{\theta M}$ | 10 |
| 7 Local velocity parameter, U_Y | 11 |
| 7.1 General | 11 |
| 7.2 Sum of tangential velocities, $v_{\Sigma, Y}$ | 11 |
| 7.3 Dynamic viscosity at bulk temperature, $\eta_{\theta M}$ | 12 |
| 7.3.1 General | 12 |
| 7.3.2 Kinematic viscosity at bulk temperature, $\nu_{\theta M}$ | 12 |
| 7.3.3 Density of the lubricant at bulk temperature, $\rho_{\theta M}$ | 12 |
| 8 Local load parameter, W_Y | 13 |
| 8.1 General | 13 |
| 8.2 Local Hertzian contact stress, $p_{\text{dyn}, Y, A}$, according to Method A | 13 |
| 8.3 Local Hertzian contact stress, $p_{\text{dyn}, Y, B}$, according to Method B | 14 |
| 8.3.1 General | 14 |
| 8.3.2 Local nominal Hertzian contact stress, $p_{H, Y, B}$ | 14 |
| 9 Local sliding parameter, S_{GFY} | 15 |
| 9.1 General | 15 |
| 9.2 Pressure viscosity coefficient at local contact temperature, $\alpha_{\theta B, Y}$ | 15 |
| 9.3 Dynamic viscosity at local contact temperature, $\eta_{\theta B, Y}$ | 15 |
| 9.3.1 General | 15 |
| 9.3.2 Kinematic viscosity at local contact temperature, $\nu_{\theta B, Y}$ | 16 |
| 9.3.3 Density of the lubricant at local contact temperature, $\rho_{\theta B, Y}$ | 16 |
| 10 Definition of contact point Y on the path of contact | 16 |
| 11 Load sharing factor, X_Y | 19 |
| 11.1 General | 19 |
| 11.2 Spur gears with unmodified profiles | 19 |
| 11.3 Spur gears with profile modification | 20 |
| 11.4 Local buttressing factor, $X_{\text{but}, Y}$ | 21 |
| 11.5 Helical gears with $\epsilon_\beta \leq 0,8$ and unmodified profiles | 22 |
| 11.6 Helical gears with $\epsilon_\beta \leq 0,8$ and profile modification | 23 |
| 11.7 Helical gears with $\epsilon_\beta \geq 1,2$ and unmodified profiles | 24 |
| 11.8 Helical gears with $\epsilon_\beta \geq 1,2$ and profile modification | 24 |
| 11.9 Helical gears with $0,8 < \epsilon_\beta < 1,2$ | 26 |

| | | |
|--|---|-----------|
| 12 | Local contact temperature, $\theta_{B,Y}$ | 26 |
| 13 | Local flash temperature, $\theta_{fl,Y}$ | 26 |
| 14 | Bulk temperature, θ_M | 27 |
| 14.1 | General..... | 27 |
| 14.2 | Mean coefficient of friction, μ_m | 28 |
| 14.3 | Load losses factor, H_V | 30 |
| 14.4 | Tip relief factor, X_{Ca} | 30 |
| 14.5 | Lubricant factor, X_S | 32 |
| Annex A (informative) Calculation of the permissible specific lubricant film thickness for oils with a micropitting test result according to FVA-Information Sheet 54/7 | | 33 |
| Annex B (informative) Guideline for reference values of λ_{GFP} | | 35 |
| Bibliography | | 38 |

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 6336-22:2018](https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018)

<https://standards.iteh.ai/catalog/standards/iso/733c53ec-cfb0-4f34-8fe7-019bcb20f497/iso-ts-6336-22-2018>

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 of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This first edition of ISO/TS 6336-22 cancels and replaces ISO/TR 15144-1:2014.

A list of all parts in the ISO 6336 series can be found on the ISO website. See also the Introduction for an overview.

Introduction

The ISO 6336 series consists of International Standards, Technical Specifications (TS) and Technical Reports (TR) under the general title *Calculation of load capacity of spur and helical gears* (see [Table 1](#)).

- International Standards contain calculation methods that are based on widely accepted practices and have been validated.
- TS contain calculation methods that are still subject to further development.
- TR contain data that is informative, such as example calculations.

The procedures specified in ISO 6336-1 to ISO 6336-19 cover fatigue analyses for gear rating. The procedures described in ISO 6336-20 to ISO 6336-29 are predominantly related to the tribological behaviour of the lubricated flank surface contact. ISO 6336-30 to ISO 6336-39 include example calculations. The ISO 6336 series allows the addition of new parts under appropriate numbers to reflect knowledge gained in the future.

Requesting standardized calculations according to ISO 6336 without referring to specific parts requires the use of only those parts that are currently designated as International Standards (see [Table 1](#) for listing). When requesting further calculations, the relevant part or parts of ISO 6336 need to be specified. Use of a Technical Specification as acceptance criteria for a specific design needs to be agreed in advance between manufacturer and purchaser.

Table 1 — Overview of ISO 6336

| Calculation of load capacity of spur and helical gears | International Standard | Technical Specification | Technical Report |
|---|------------------------|-------------------------|------------------|
| <i>Part 1: Basic principles, introduction and general influence factors</i> | X | | |
| <i>Part 2: Calculation of surface durability (pitting)</i> | X | | |
| <i>Part 3: Calculation of tooth bending strength</i> | X | | |
| <i>Part 4: Calculation of tooth flank fracture load capacity</i> | | X | |
| <i>Part 5: Strength and quality of materials</i> | X | | |
| <i>Part 6: Calculation of service life under variable load</i> | X | | |
| <i>Part 20: Calculation of scuffing load capacity (also applicable to bevel and hypoid gears) — Flash temperature method</i> (Replaces: ISO/TR 13989-1) | | X | |
| <i>Part 21: Calculation of scuffing load capacity (also applicable to bevel and hypoid gears) — Integral temperature method</i> (Replaces: ISO/TR 13989-2) | | X | |
| <i>Part 22: Calculation of micropitting load capacity</i> (Replaces: ISO/TR 15144-1) | | X | |
| <i>Part 30: Calculation examples for the application of ISO 6336 parts 1, 2, 3, 5</i> | | | X |
| <i>Part 31: Calculation examples of micropitting load capacity</i> (Replaces: ISO/TR 15144-2) | | | X |

At the time of publication of this document, some of the parts listed here were under development. Consult the ISO website.

This document provides principles for the calculation of the micropitting load capacity of cylindrical involute spur and helical gears with external teeth.

The basis for the calculation of the micropitting load capacity of a gear set is the model of the minimum operating specific lubricant film thickness in the contact zone. Many parameters can influence the occurrence of micropitting. These include surface topography, contact stress level, and lubricant chemistry. Whilst these parameters are known to affect the performance of micropitting for a gear set,