



BSI Standards Publication

Calculation of load capacity of spur and helical gears

Part 30: Calculation examples for the application of ISO 6336 parts 1,2,3,5

National foreword

This Published Document is the UK implementation of ISO/TR 6336-30:2017.

The UK participation in its preparation was entrusted to Technical Committee MCE/5, Gears.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 98182 1

ICS 21.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 December 2017.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

TECHNICAL REPORT

ISO/TR
6336-30

First edition
2017-11

Calculation of load capacity of spur and helical gears —

Part 30: Calculation examples for the application of ISO 6336 parts 1,2,3,5

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

Partie 30: Exemples de calculs selon l'ISO 6336 parties 1, 2, 3 et 5



Reference number
ISO/TR 6336-30:2017(E)



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, 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
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	v
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 Worked examples	5
4.1 General	5
4.2 Qualifying comments	6
4.2.1 Calculation of base pitch deviation, f_{pb} , and its application to the running in allowances	6
4.2.2 Calculation of mesh stiffness, c_Y	6
4.2.3 Application of lubricant film Z_L , Z_V and Z_R , hardness Z_W and size Z_X influence factors	6
4.2.4 Application of work hardening factor, Z_W	6
4.2.5 Determination of R_z	6
4.2.6 Face width for calculations involving double helical gears	6
4.2.7 Calculation of ε_β for double helical gears	6
4.2.8 Calculation of $f_{H\beta 5}$ and $f_{H\beta}$	7
4.2.9 Helix tolerance $f_{H\beta 5}$ and $f_{H\beta}$ for double helical gears	7
4.2.10 Calculation of root diameter, d_f	7
4.2.11 Amendment to ISO 6336-3:2006, Formula (10) auxiliary value, E	7
4.2.12 Calculations for internal gears	7
4.3 Example 1: Single helical case carburized gear pair	8
4.4 Example 2: Single helical through-hardened gear pair	12
4.5 Example 3: Spur through-hardened gear pair	16
4.6 Example 4: Spur case carburized gear pair	20
4.7 Example 5: Spur gear pair with an induction hardened pinion and through-hardened cast gear	24
4.8 Example 6: Spur internal through-hardened gear pair	28
4.9 Example 7: Double helical through-hardened gear pair	32
4.10 Example 8: Single helical case carburized gear pair	36
Annex A (informative) Example 1 detailed calculation	40
Bibliography	60

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 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 the following URL: www.iso.org/iso/foreword.html.

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

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 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 (replaces: ISO/TR 13989-1)</i>		X	
<i>Part 21: Calculation of scuffing load capacity (also applicable to bevel and hypoid gears) — Integral temperature method (replaces: ISO/TR 13989-2)</i>		X	
<i>Part 22: Calculation of micropitting load capacity (replaces: ISO/TR 15144-1)</i>		X	
<i>Part 30: Calculation examples for the application of ISO 6336-1, ISO 6336-2, ISO 6336-3 and, ISO 6336-5</i>			X
<i>Part 31: Calculation examples of micropitting load capacity (replaces: ISO/TR 15144-2)</i>			X
NOTE At the time of publication of this document, some of the parts listed here were under development. Consult the ISO website.			

This document provides worked examples for the application of the calculation procedures defined in ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5. The example calculations cover the application to spur, helical and double helical, external and internal cylindrical involute gears for both high speed and low speed operating conditions, determining the ISO safety factors against tooth flank pitting and tooth root bending strength for each gear set. The calculation procedures used are consistent with those presented in ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5, unless qualifying comments are provided. Where qualifying comments have been included in this document, they reflect areas of the calculation procedures presented in the current standards where points of clarification are required or editorial errors have been identified. The changes defined within the qualifying comments will be

implemented in future releases of ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5. No additional calculations are presented here that are outside of the referenced documents.

Eight worked examples are presented with the necessary input data for each gear set provided at the beginning of the calculation. Calculation details are presented in full for one worked example, with all following examples having summarized results data presented in tabular format.

For all calculations in this document, the ISO accuracy grades according to ISO 1328-1:1995 are applied. Using the ISO tolerance classes of ISO 1328-1:2013 would lead to deviations of the calculation results.