
Gears — Calculation of load capacity of wormgears

Engrenages — Calcul de la capacité de charge des engrenages à vis



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Contents

Page

Foreword	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Symbols and terminology.....	2
4 Formulae for calculation of dimensions	10
5 General	17
6 Geometrical data to be known for calculation	22
7 Forces, speeds and parameters for the calculation of stresses	24
8 Efficiency and power loss	32
9 Wear load capacity	38
10 Surface durability (pitting resistance).....	43
11 Deflection	45
12 Tooth root strength	47
13 Temperature safety factor	51
14 Determination of the wheel bulk temperature	54
Annex A (informative) Notes on physical parameters.....	57
Annex B (informative) Methods for the determination of the parameters	58
Annex C (informative) Lubricant film thickness according to EHL - theory	62
Annex D (informative) Wear path definitions	64
Annex E (informative) Notes on calculation wear	67
Annex F (informative) Notes on tooth root strength	68
Annex G (informative) The utilisation of existing tooling for machining of worm wheel teeth	69
Annex H (informative) Adaptation of equations for the reference gear to own results of measurements	72
Annex I (informative) Life time estimation for worm gears with a high risk of pitting damage.....	75
Annex J (informative) Examples.....	77
Bibliography.....	88

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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.

ISO/TR 14521 was prepared by Technical Committee ISO/TC 60, *Gears*, Subcommittee SC 1, *Nomenclature and wormgearing*.

Introduction

This Technical Report was developed for the rating and design of enclosed or open single enveloping worm gears with cylindrical worms, and worm-gearred motors having either solid or hollow output shafts.

This Technical Report is only applicable when the flanks of the worm wheel teeth are conjugate to those of the worm threads.

The particular shapes of the rack profiles from tip to root do not affect the conjugacy when the worm and worm wheel hobs have the same profiles; thus worm wheels have proper contact with worms and the motions of worm gear pairs are uniform.

This Technical Report can apply to worm gearing with cylindrical helicoidal worms having the following thread forms: A, C, I, N, K.

Other than the requirements of the three preceding paragraphs, no restrictions are placed on the manufacturing methods used.

In order to ensure proper mating and because of the many different thread profiles in use, it is generally desirable that worm and worm wheel be supplied by the same manufacturer.

In this Technical Report, the permissible torque for a worm gear is limited by considerations of surface stress (conveniently referred to as wear or pitting) or bending stress (referred to as strength) in both worm threads and worm wheel teeth, deflection of worm or the final limitation.

Consequently, the load capacity of a pair of gears is determined using calculations concerned with all criteria described in the scope and 7.3. The permissible torque on the worm wheel is the least of the calculated values.

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Gears — Calculation of load capacity of wormgears

WARNING — Special attention is required when establishing the tooth geometry especially for C type gear profile.

1 Scope

This Technical Report specifies equations for calculating the load capacity of cylindrical worm gears and covers load ratings associated with wear, pitting, worm deflection, tooth breakage and temperature. Scuffing and other failure modes are not covered by this Technical Report.

The load rating and design procedures are valid for sliding velocities over tooth surfaces of up to 25 m/s and contact ratios equal to or greater than 2,1. For wear, sliding velocities over tooth surfaces are not below 0,1 m/s.

The rules and recommendations for the dimensioning, lubricants or materials selected by this Technical Report only apply to centre distances of 50 mm and larger. For centre distances below 50 mm, method A applies.

The choice of appropriate methods of calculation requires knowledge and experience. This Technical Report is intended for use by experienced gear designers who are able to make informed judgements concerning factors. It is not intended for use by engineers who lack the necessary experience. See 5.4.

The geometry of worm gears is complex, therefore the user of this Technical Report is encouraged to make sure that a valid working geometry has been established.

2 Normative references

The following referenced documents are indispensable for the application 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 701:1998, *International gear notations — Symbols for geometrical data*

ISO 1122-2:1999, *Vocabulary of gear terms — Part 2: Definitions related to worm gears geometry*

ISO 6336-6, *Calculation of load capacity of spur and helical gear — Part 6: Calculation of service life under variable load*

ISO/TR 10828:1997, *Worm gears — Geometry of worm profiles*

DIN 3974-1:1995, *Accuracy of worms and wormgears — Part 1: General bases*

DIN 3974-2:1995, *Accuracy of worms and wormgears — Part 2: Tolerances for individual errors*