



BSI Standards Publication

Gears — Calculation of load capacity of worm gears

National foreword

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**Gears — Calculation of load capacity
of worm gears**

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



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Contents

Page

Foreword	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms, definitions and symbols	1
3.1 Terms and definitions.....	1
3.2 Symbols.....	2
4 General consideration	7
4.1 Worm gear load capacity rating criteria.....	7
4.2 Basis of the method.....	8
4.3 Concept of absolute and relative parameters.....	8
4.4 Applicability.....	9
4.5 Validity.....	10
4.6 System considerations.....	11
4.7 Calculation methods A, B, C.....	11
4.7.1 Generality on methods A, B and C.....	11
4.7.2 Notes on numerical formulae.....	12
4.7.3 Base conditions, interaction.....	12
4.7.4 Other notes.....	13
4.8 Standard reference gear.....	13
5 Required data for calculation	13
5.1 Input variable.....	13
5.2 Safety factors.....	15
6 Forces, speeds and parameters for the calculation of stresses	15
6.1 General.....	15
6.2 Tooth forces.....	15
6.2.1 Application factor.....	15
6.2.2 Dynamic factor.....	15
6.2.3 Load distribution factor.....	15
6.2.4 Tooth force components.....	16
6.3 Sliding velocity at reference diameter.....	17
6.4 Physical parameters.....	17
6.4.1 Generality on physical parameters.....	17
6.4.2 Parameter for the mean Hertzian stress.....	18
6.4.3 Parameter for the mean lubricant film thickness.....	19
6.4.4 Parameter for the mean sliding path.....	20
6.5 Calculation of mean contact stress.....	21
6.6 Calculation of mean lubricant film thickness.....	22
6.7 Calculation of the wear path.....	23
6.8 Calculation of the lubricant kinematic viscosity.....	23
7 Efficiency and power loss	23
7.1 General.....	23
7.2 Total efficiency.....	24
7.2.1 Method A.....	24
7.2.2 Method B.....	24
7.3 Total power loss.....	24
7.3.1 Methods of calculation.....	24
7.3.2 Idle running power loss.....	25
7.3.3 Bearing load power loss.....	25
7.3.4 Sealing power loss.....	25
7.3.5 Adaptation of the calculation procedure to a specific test.....	26
7.4 Gear efficiency.....	26

7.4.1	Efficiency calculation	26
7.4.2	Base coefficient of friction, μ_{OT} , of the standard reference gear	26
7.4.3	Size factor	28
7.4.4	Geometry factor	29
7.4.5	Material factor	29
7.4.6	Roughness factor	29
7.4.7	Adaptation of the calculation procedure to a specific test	29
7.5	Meshing power loss	30
7.5.1	Method A	30
7.5.2	Method B	30
7.5.3	Method C	30
8	Wear load capacity	30
8.1	General	30
8.2	Wear safety factor	30
8.3	Expected wear	31
8.3.1	Method A	31
8.3.2	Methods B, C	31
8.4	Permissible wear	35
8.5	Adaptation of the calculation procedure to a specific test	36
9	Surface durability (pitting resistance)	36
9.1	General	36
9.2	Pitting safety factor	36
9.3	Actual contact stress	37
9.3.1	Method A	37
9.3.2	Methods B, C	37
9.4	Limiting value of contact stress	37
9.5	Adaptation of the calculation procedure to specific test	38
10	Deflection	38
10.1	General	38
10.2	Deflection safety factor	39
10.3	Actual deflection	39
10.3.1	Method A	39
10.3.2	Method B	39
10.3.3	Method C	39
10.4	Limiting value of deflection	40
11	Tooth root strength	40
11.1	Safety factor for tooth leakage	40
11.2	Actual tooth root stress	40
11.2.1	Method A	40
11.2.2	Method B	40
11.2.3	Method C	40
11.3	Limiting value of shear stress at tooth root	42
11.3.1	General	42
11.3.2	Shear endurance limit, $\tau_{F \text{ lim } T}$	42
11.3.3	Life factor, Y_{NL}	42
11.4	Adaptation of the calculation procedure to a specific test	44
12	Temperature safety factor	44
12.1	Temperature safety factor for splash lubrication	44
12.1.1	General	44
12.1.2	Determination of oil sump temperature	45
12.1.3	Limiting values	46
12.2	Temperature safety factor for oil spray lubrication	46
12.2.1	General	46
12.2.2	Cooling capacity P_K	46
13	Determination of the wheel bulk temperature	47

13.1	Wheel bulk temperature with splash lubrication.....	47
13.1.1	General.....	47
13.1.2	Method A.....	48
13.1.3	Method B.....	48
13.1.4	Method C.....	48
13.2	Wheel bulk temperature with spray lubrication.....	48
13.2.1	General.....	48
13.2.2	Method A.....	48
13.2.3	Method B.....	48
13.2.4	Method C.....	48
Annex A (informative) Notes on physical parameters.....		50
Annex B (normative) Methods for the determination of the parameters.....		51
Annex C (normative) Lubricant film thickness according to the Elasto Hydrodynamic Lubrication (EHL) theory.....		56
Annex D (normative) Wear path definition.....		58
Annex E (informative) Notes on calculation wear.....		61
Annex F (informative) Notes on tooth root strength.....		62
Annex G (informative) Adaptation of formulae for the reference gear with results from testing.....		63
Annex H (informative) Life time estimation for worm gears with a high risk of pitting damage.....		66
Annex I (informative) Examples.....		68
Annex J (informative) Examples of limit load capacity in range of working conditions.....		84
Bibliography.....		87

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 1, *Nomenclature and wormgearing*.

This first edition cancels and replaces ISO/TR 14521:2013, which has been technically revised.

The main changes compared to the previous edition are as follows:

- the original [Clause 6](#) which focused on geometry has been deleted and ISO/TR 10828 has been referenced.

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.

Introduction

This document 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 document 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 document can apply to wormgearing with cylindrical helicoidal worms as defined in ISO/TR 10828 having the following thread forms: A, C, I, N, K.

Other than those mentioned in 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 worms and worm wheels be supplied by the same manufacturer.

In this document, 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 thermal limitation.

Consequently, the load capacity of a pair of gears is determined using calculations concerned with all criteria described in the scope and [6.4](#). The permissible torque on the worm wheel is the least of the calculated values.

Gears — Calculation of load capacity of worm gears

1 Scope

This document specifies formulae 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 document.

The load rating and design procedures are only valid for tooth surface sliding velocities, v_g , less than or equal to 25 m/s and contact ratios greater than 2,1. For wear, load rating and design procedures are only valid for tooth surface sliding velocities which are above 0,1 m/s. The rules and recommendations for the dimensioning, lubricants or materials selected by this document 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 document is intended for use by experienced gear designers who can make informed judgments concerning factors. It is not intended for use by engineers who lack the necessary experience. See 4.7.

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

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 1122-1, *Vocabulary of gear terms — Part 1: Definitions related to geometry*

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

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

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

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

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1122-1, ISO 1122-2 and the following apply.

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

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

actual gear

worm gear set designed by this document