

PD ISO/TR 10828:2015



BSI Standards Publication

Worm gears — Worm profiles and gear mesh geometry

bsi.

...making excellence a habit.™

National foreword

This Published Document is the UK implementation of ISO/TR 10828:2015. It supersedes BS ISO TR 10828:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/5/-/7, Worm 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 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 85447 7

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 30 September 2015.

Amendments issued since publication

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

TECHNICAL
REPORT

PD ISO/TR 10828:2015

ISO/TR
10828

Second edition
2015-08-15

**Worm gears — Worm profiles and
gear mesh geometry**

*Engrenages à vis cylindriques — Géométrie des profils de vis et
des engrenements*



Reference number
ISO/TR 10828:2015(E)

© ISO 2015



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, 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	v
Introduction.....	vi
1 Scope	1
2 Normative references	1
3 Symbols and abbreviated terms	1
4 Formulae for calculation of dimensions	5
4.1 Parameters for a cylindrical worm.....	5
4.2 Parameters for a worm wheel	8
4.3 Meshing parameters.....	11
5 Generalities on worm profiles.....	12
5.1 Definitions	12
5.2 Conventions relative to the formulae of this document.....	12
6 Definition of profiles.....	13
6.1 Introduction.....	13
6.2 Type A.....	14
6.3 Type I	15
6.4 Type N.....	20
6.5 General formulae for A, I and N profiles	21
6.6 Type K.....	22
6.7 Type C.....	25
6.8 Algorithm to initialize the calculation.....	30
7 Section planes	31
7.1 Introduction.....	31
7.2 Axial plane.....	31
7.3 Offset plane.....	31
7.4 Transverse plane	31
7.5 Normal plane.....	31
7.6 Point of the worm surface in an offset plane: offset profile of worm	32
8 Pitch surfaces	34
9 Conjugate worm wheel profile	36
9.1 Introduction.....	36
9.2 Path of contact.....	36
9.3 Worm wheel profile conjugate with worm profile	38
9.4 Trochoid (or fillet) at root of the worm wheel	40
9.5 Equivalent radius of curvature in an offset plane.....	42
9.6 Singularities of worm gear mesh.....	44
10 Geometry of contact.....	48
10.1 General	48
10.2 Tangent plane at point of contact.....	49
10.3 Normal plane at point of contact	49
10.4 Zone of contact.....	50
10.5 Lines of contact.....	53
10.6 Contact ratio	56
10.7 Tangent vector to the line of contact	57
10.8 Normal plane at point of contact	58
10.9 Principal equivalent radius of curvature.....	59
10.10 Calculation of path of contact and zone of contact.....	60

10.11	Calculation of line of contact.....	60
11	Velocities at contact point	61
11.1	Velocity of a point of worm.....	61
11.2	Relative velocity between 2 conjugate flanks.....	61
11.3	Tangent to the path of contact	62
11.4	Velocity of the contact point along the path of contact.....	62
11.5	Velocity at the point of contact	63
Annex A	(informative) Settings and derivatives of formulae for A, I, N profiles.....	64
Annex B	(informative) Settings and derivatives of formulae for K and C profiles	70
Annex C	(informative) Algorithm to determine the point of generations of worm and worm wheel.....	76
Annex D	(informative) Comparison of different worm profiles.....	78
Annex E	(informative) Comparison of singularities for different worm profiles.....	82
Annex F	(informative) Comparison of gear mesh for different worm profiles	84
Annex G	(informative) The utilisation of existing tooling for machining of worm wheel teeth.....	92
Bibliography	95

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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 60, *Gears*, Subcommittee SC 1, *Nomenclature and wormgearing*.

This second edition cancels and replaces the first edition (ISO/TR 10828:1997), which has been technically revised.

This edition includes the formulation for the geometrical dimensions of the worm and worm wheel, and that for the determination of gear mesh geometry (path of contact, zone and lines of contact) with the details to determine the non-dimensional parameters used to apply load capacity calculations (radius of curvature, sliding velocities).

Introduction

Thread forms of the worms of worm gear pairs are commonly related to the following machining processes:

- the type of machining process (turning, milling, grinding);
- the shapes of edges or surfaces of the cutting tools used;
- the tool position relative to an axial plane of the worm;
- where relevant, the diameters of disc type tools (grinding wheel diameter).

This Technical Report introduces all the aspects concerning the gear mesh geometry to define conjugate worm wheel, path of contact, lines of contact and other associated geometrical characteristics.

Worm gears — Worm profiles and gear mesh geometry

1 Scope

In this Technical Report, thread profiles of the five most common types of worms at the date of publication are described and formulae of their axial profiles are given.

The five worm types covered in this technical report are designated by the letters A, C, I, K and N.

The formulae to calculate the path of contact, the conjugate profile of the worm wheel, the lines of contact, the radius of curvature and the velocities at points of contact are provided. At the end the application of those formulae to calculate parameters used in load capacity calculations are provided.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1122-2, *Vocabulary — Worm gears*

ISO 701, *International gear notations — Symbols for geometrical data*

ISO/TR 14521, *Worm gears — Load capacity of worm gears*

3 Symbols and abbreviated terms

For the purposes of this document, Tables 1 to 3 give the symbols the indices and the description.

Table 1 — Symbols for worm gears from Clause 4 of this document

Symbols	Description	Units	Figures	Formula number
A	distance from the worm axis to virtual point of the cutter (see ref.[1])	mm	Fig. A.4	
a	centre distance	mm	Fig. 3	41/42
a_0	refers to the worm/tool centre distance (length of the common perpendicular to the worm/tool axes)	mm	Fig. 18	54
a_1 to a_4	coefficient for A, I and N profile			
b_1	facewidth of worm	mm		24
b_{2H}	effective wheel facewidth	mm	Fig. 4	39
b_{2R}	wheel rim width	mm	Fig. 4	
c_1, c_2	tip clearance	mm		46/47