



**International
Standard**

ISO 10828

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

*Engrenage à vis cylindriques — Géométrie des profils de vis et de
l'engrènement*

**First edition
2024-04**

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

[ISO 10828:2024](https://standards.iteh.ai/catalog/standards/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024)

<https://standards.iteh.ai/catalog/standards/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024>

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

[ISO 10828:2024](https://standards.iteh.ai/catalog/standards/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024)

<https://standards.iteh.ai/catalog/standards/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

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
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

| | Page |
|---|------------|
| Foreword | vi |
| Introduction | vii |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 1 |
| 4 Symbols and abbreviated terms | 2 |
| 5 Formulae for calculation of dimensions | 6 |
| 5.1 Parameters for a cylindrical worm..... | 6 |
| 5.1.1 Axial pitch..... | 6 |
| 5.1.2 Axial module..... | 6 |
| 5.1.3 Lead..... | 6 |
| 5.1.4 Unit lead..... | 6 |
| 5.1.5 Diameter quotient..... | 6 |
| 5.1.6 Reference lead angle..... | 6 |
| 5.1.7 Reference helix angle..... | 6 |
| 5.1.8 Normal pitch on reference cylinder..... | 6 |
| 5.1.9 Normal module..... | 7 |
| 5.1.10 Reference diameter..... | 7 |
| 5.1.11 Reference tooth depth..... | 7 |
| 5.1.12 Reference addendum..... | 7 |
| 5.1.13 Reference dedendum..... | 7 |
| 5.1.14 Tip diameter..... | 8 |
| 5.1.15 Root diameter..... | 8 |
| 5.1.16 Thread thickness coefficient s_{mx1}^* | 8 |
| 5.1.17 Reference thread thickness in the axial section..... | 8 |
| 5.1.18 Reference space width in the axial section..... | 8 |
| 5.1.19 Normal thread thickness..... | 8 |
| 5.1.20 Normal space width..... | 8 |
| 5.1.21 Profile flank form..... | 8 |
| 5.1.22 Normal pressure angle..... | 9 |
| 5.1.23 Base lead angle for profile type I..... | 9 |
| 5.1.24 Base diameter for profile type I..... | 9 |
| 5.1.25 Normal pitch on base cylinder..... | 9 |
| 5.1.26 Worm face width..... | 9 |
| 5.1.27 Right-hand helix and left-hand helix..... | 9 |
| 5.1.28 Right flank and left flank..... | 10 |
| 5.1.29 Flank definition..... | 10 |
| 5.1.30 Root form and tip form diameter for worm..... | 10 |
| 5.2 Parameters for a worm wheel..... | 11 |
| 5.2.1 General..... | 11 |
| 5.2.2 Reference diameter..... | 11 |
| 5.2.3 Transverse pitch..... | 12 |
| 5.2.4 Transverse tooth thickness at reference diameter..... | 12 |
| 5.2.5 Space width at reference diameter..... | 12 |
| 5.2.6 Profile shift coefficient..... | 12 |
| 5.2.7 Tooth reference addendum..... | 12 |
| 5.2.8 Tooth reference dedendum..... | 12 |
| 5.2.9 Tooth depth..... | 12 |
| 5.2.10 Outside addendum..... | 13 |
| 5.2.11 Root diameter..... | 13 |
| 5.2.12 Tip diameter..... | 13 |
| 5.2.13 Outside diameter..... | 13 |

| | | |
|-----------|---|-----------|
| 5.2.14 | Minimum and maximum outside diameter | 13 |
| 5.2.15 | Worm wheel face width | 13 |
| 5.2.16 | Throat form radius | 14 |
| 5.2.17 | Root form and tip diameter for worm wheel | 14 |
| 5.3 | Meshing parameters | 15 |
| 5.3.1 | Centre distance | 15 |
| 5.3.2 | Pitch diameter of worm wheel | 16 |
| 5.3.3 | Pitch diameter of worm | 16 |
| 5.3.4 | Worm gear ratio | 16 |
| 5.3.5 | Contact ratio | 17 |
| 5.3.6 | Tip clearance | 17 |
| 5.3.7 | Start of active profile (SAP) and end of active profile (EAP) diameters for worm and worm wheel | 17 |
| 6 | Generalities on worm profile types | 18 |
| 6.1 | Worm profile types, see Table 4 | 18 |
| 6.2 | Conventions relative to the formulae of this document | 18 |
| 7 | Definition of profile types | 19 |
| 7.1 | General | 19 |
| 7.2 | A worm profile type | 20 |
| 7.2.1 | Geometrical definition | 20 |
| 7.2.2 | Machining methods | 20 |
| 7.3 | I worm profile type | 21 |
| 7.3.1 | Geometrical definition | 21 |
| 7.3.2 | Machining methods | 22 |
| 7.4 | N worm profile type | 25 |
| 7.4.1 | Geometrical definition | 25 |
| 7.4.2 | Machining methods | 26 |
| 7.5 | General formulae for A, I and N profile types | 27 |
| 7.6 | K worm profile type | 28 |
| 7.6.1 | Geometrical definition and method | 28 |
| 7.7 | C worm profile type | 30 |
| 7.7.1 | Geometrical definition | 30 |
| 7.7.2 | General formulae for C and K profiles | 33 |
| 7.8 | General formula of the axial profile | 36 |
| 7.8.1 | General | 36 |
| 7.8.2 | Derivative of pressure angle for all profile types | 36 |
| 7.9 | Algorithm to initialize the calculation | 36 |
| 8 | Useful section planes | 37 |
| 8.1 | General | 37 |
| 8.2 | Axial plane and axial section | 37 |
| 8.3 | Offset plane and offset section | 37 |
| 8.4 | Transverse plane and transverse section | 38 |
| 8.5 | Normal plane and normal section | 38 |
| 8.6 | Point of the worm surface in an offset plane: offset profile of worm | 39 |
| 9 | Pitch surfaces | 40 |
| 10 | Conjugate worm wheel profile | 42 |
| 10.1 | General | 42 |
| 10.2 | Path of contact | 42 |
| 10.3 | Worm wheel profile conjugate with worm profile | 44 |
| 10.4 | Trochoid (or fillet) at root of the worm wheel | 46 |
| 10.5 | Equivalent radius of curvature in an offset plane | 48 |
| 10.5.1 | Curvature for the worm at a point in an offset plane | 49 |
| 10.5.2 | Curvature for the worm wheel at a point in an offset plane | 49 |
| 10.5.3 | Equivalent radius of curvature in an offset plane | 51 |
| 10.6 | Singularities of worm gear mesh | 51 |
| 10.6.1 | Point of zero pressure angle | 51 |

ISO 10828:2024(en)

| | | |
|-----------|--|------------|
| | 10.6.2 Loss of contact..... | 52 |
| | 10.6.3 Cusp..... | 53 |
| 11 | Geometry of contact..... | 55 |
| | 11.1 General..... | 55 |
| | 11.2 Tangent plane at point of contact..... | 56 |
| | 11.3 Normal plane at point of contact..... | 56 |
| | 11.4 Zone of contact..... | 57 |
| | 11.5 Lines of contact..... | 59 |
| | 11.6 Contact ratio..... | 63 |
| | 11.7 Tangent vector to the line of contact..... | 64 |
| | 11.8 Normal plane at point of contact..... | 66 |
| | 11.9 Principal equivalent radius of curvature..... | 66 |
| | 11.10 Calculation of the path of contact and zone of contact..... | 67 |
| | 11.11 Calculation of line of contact..... | 67 |
| 12 | Velocities at contact point..... | 68 |
| | 12.1 Velocity of a point of worm..... | 68 |
| | 12.2 Velocity of a point of worm wheel..... | 69 |
| | 12.3 Relative velocity between two conjugate flanks..... | 69 |
| | 12.4 Tangent to the path of contact..... | 69 |
| | 12.5 Velocity of the contact point along the path of contact..... | 70 |
| | 12.6 Velocity of the point of contact..... | 70 |
| | Annex A (informative) Parameters and derivatives of formulae for A, I, N profile types..... | 71 |
| | Annex B (informative) Parameters and derivatives of formulae for K and C profile types..... | 77 |
| | Annex C (informative) Algorithm to determine the point of generations of worm and worm wheel..... | 89 |
| | Annex D (informative) Comparison of different worm profile types..... | 91 |
| | Annex E (informative) Comparison of singularities for different worm profile types..... | 94 |
| | Annex F (informative) Comparison of gear mesh for different worm profile types..... | 96 |
| | Annex G (informative) Utilisation of existing tooling for machining of worm wheel teeth..... | 104 |
| | Annex H (informative) Interface for geometry for involute worms defined with ISO 21771-1..... | 107 |
| | Bibliography..... | 110 |

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 of ISO 10828 cancels and replaces the second edition of ISO/TR 10828:2015.

The main changes are as follows:

- conversion from a Technical Report to an International Standard and implementation of necessary editorial changes;
- incorporation of a new [Annex H](#) on interface for geometry for involute worms defined as cylindrical gear with ISO 21771-1.

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 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). 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, metal forming);
- 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).

The calculations developed in this document are relatively complex as they involved primary and secondary derivatives of mathematical expression. In order to facilitate the writing of equations, the numerators in the left part of formulae are often omitted; this is why several formulae have special symbols and are not written in a mathematical way:

Example in [Formula \(B.12\)](#) $\frac{d}{dy_G} \alpha_G (y_G)$ is written $d\alpha_G (y_G)$

Example in [Formula \(B.14\)](#) $\frac{d^2}{dy_G^2} \alpha_G (y_G)$ is written $d^2\alpha_G (y_G)$

In this document, the figures show a generic representation of worm profile types A, I, N, K, C. For the influence of different worm profile types, see [Annex E](#).

This document 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.

[ISO 10828:2024](#)

<https://standards.iteh.ai/catalog/standards/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024>

Worm gears — Worm profiles and gear mesh geometry

1 Scope

This document describes the thread profiles of the five most common worm profile types and provides formulae of their axial profiles.

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

This document provides 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. The application of those formulae to calculate parameters used in load capacity calculations are provided in [11.11](#).

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 701, *International gear notation — Symbols for geometrical data*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 701 and ISO 1122-2 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

mid plane of worm wheel

plane perpendicular to its datum axis containing the centre of virtual major torus radius generating tooth flanks

Note 1 to entry: See [Figure 26](#).

Note 2 to entry: It can be axially located by measuring the position of inflection point along the helix of the cylinder of the worm wheel defined by the measurement diameter for worm wheel. In hobbed worm wheel, the number of flutes can influence the tooth flank surface and consequently the mid plane detection.

3.2

axial plane of worm

plane containing the line of axis of the worm defined by its datum axis

Note 1 to entry: Diameters can be measured in this plane, but thread surfaces would require a theoretical sharpened edge measurement probe or correction in order to keep the contact point between the probe and the flank in this plane.

4 Symbols and abbreviated terms

Table 1 to Table 3 provide the symbols, the indices and the descriptions used in this document.

NOTE First and second derivatives symbols are not listed in Table 1 and Table 2.

Table 1 — Symbols for worm gears

| Symbols | Description | Units | Figure numbers | Formula numbers |
|----------------|--|-------|----------------|-----------------|
| A | distance from the worm axis to virtual point of the cutter (see Reference [4]) | mm | A.4 | — |
| a | centre distance | mm | 5 | 42 and 43 |
| a_0 | refers to the worm/tool centre distance (length of the common perpendicular to the worm/tool axes) | mm | 22 | 55 |
| a_1 to a_4 | coefficients for A, I and N profile | — | | See Table 5 |
| b_1 | facewidth of worm | mm | | 24 |
| b_{2H} | effective wheel facewidth | mm | 5 | 40 |
| b_{2R} | wheel rim width | mm | 5 | — |
| $b_{\phi 2}$ | face end chamfer depth | mm | 5 | — |
| c_1, c_2 | tip clearance | mm | — | 47 and 48 |
| d_{a1} | worm tip diameter | mm | 1 | 14 |
| d_{a2} | worm wheel tip diameter | mm | 4 | 36 |
| d_{b1} | base diameter of involute helicoid (for profile type I) | mm | — | 22 |
| d_{e2} | worm wheel outside diameter | mm | — | 38 |
| d_{e2max} | maximum worm wheel outside diameter | mm | — | 39 |
| d_{e2min} | minimum worm wheel outside diameter | mm | — | 38 |
| d_{f1} | worm root diameter | mm | 1 | 15 |
| d_{f2} | worm wheel root diameter | mm | 4 | 35 |
| d_{Fa1} | worm tip form diameter | mm | 3 | — |
| d_{Fa2} | worm wheel tip form diameter | mm | 6 | — |
| d_{FF1} | worm root form diameter | mm | 3 | — |
| d_{FF2} | worm wheel root form diameter | mm | 6 | — |
| d_{m1} | worm reference diameter | mm | 1 | 10 |
| d_{m2} | worm wheel reference diameter | mm | 4 | 25 |
| d_{Na1} | active worm tip form diameter | mm | 6 | — |
| d_{Na2} | active worm wheel tip form diameter | mm | 6 | — |
| d_{Nf1} | active worm root form diameter | mm | 6 | — |
| d_{Nf2} | active worm wheel root form diameter | mm | 6 | — |
| d_{w1} | worm pitch diameter | mm | — | 45 |
| d_{w2} | worm wheel pitch diameter | mm | 7 | 44 |
| e_{mx1} | worm reference tooth space width in axial section | mm | 1 | 17 |
| e_{n1} | worm normal tooth space width in normal section | mm | — | 19 |
| e_{m2} | worm wheel tooth space width in mid plane section | mm | — | 28 |
| h_1 | worm tooth depth | mm | 1 | 11 |
| h_2 | worm wheel tooth depth | mm | — | 33 |
| h_{am1} | worm tooth reference addendum in axial section | mm | 1 | 12 |
| h_{am2} | worm wheel tooth reference addendum in mid plane section | mm | 5 | 31 |
| h_{am1}^* | worm tooth reference addendum coefficient in axial section | — | — | 31 |

Table 1 (continued)

| Symbols | Description | Units | Figure numbers | Formula numbers |
|---------------|---|-------|---|---|
| h_{am2}^* | worm wheel tooth reference addendum coefficient in mid plane section | — | — | 32 |
| h_{e2} | worm wheel tooth external addendum | mm | — | 34 |
| h_{fm1} | worm tooth reference dedendum in axial section | mm | 1 | 13 |
| h_{fm2} | worm wheel tooth reference dedendum in mid plane section | mm | — | 32 |
| h_{fm1}^* | worm tooth reference dedendum coefficient in axial section | — | 1 | 13 |
| h_{fm2}^* | worm wheel tooth reference dedendum coefficient in mid plane section | — | — | 32 |
| h_{k1} | radial height of chamfer (of worm) | mm | 3 | — |
| h_{k2} | radial height of chamfer (of worm wheel) | mm | 7 | — |
| j_x | axial backlash | mm | — | 28 |
| m_n | normal module | mm | — | 9 |
| m_{x1} | axial module | mm | — | 2 and G.1 |
| n_1 | rotational speed of the worm | rpm | — | 144 |
| p_{bn1} | normal pitch on base cylinder (for profile type I) | mm | — | 23 |
| p_{n1} | normal pitch | mm | — | 8 |
| p_{t2} | transverse pitch | mm | — | 27 |
| p_{x1} | axial pitch | mm | 1 | 1 |
| p_{z1} | lead (of worm) | mm | — | 3 |
| p_{zu1} | unit lead (lead of worm per radian) | mm/rd | — | 4 |
| q_1 | diameter quotient | mm | — | 5 |
| R_{Ga} | outside radius of the grinding wheel (for profile type C and K) | mm | 22 | — |
| R_{Gm} | nominal or mean radius of the grinding wheel (for profile type C and K) | mm | 22 | 56 |
| r_{g2} | worm wheel throat form radius | mm | 5 | 41 |
| r_{b1} | base radius for involute profile (for profile type I) | mm | A.4 and A.5 | 22 |
| r'_{b1} | base radius of a notional base circle (for profile type N) | mm | A.4 and A.5 | — |
| r_{k1} | tip radius (of worm) | mm | 3 | — |
| r_{k2} | tip radius (of worm wheel) | mm | 7 | — |
| r_T | radius at cusp | mm | 34 | — |
| s_{m2} | tooth thickness at the reference diameter of the worm wheel | mm | 4 | 28 |
| s_K | rim thickness | mm | 16 | — |
| s_{mx1} | worm thread thickness in axial section | mm | 1 | 16 |
| s_{mx1}^* | worm thread thickness in axial section coefficient | — | — | — |
| s_{n1} | normal worm thread thickness in normal section | mm | — | 18 |
| u | gear ratio | — | — | 46 |
| x_2 | worm wheel profile shift coefficient | — | — | 30 |
| x_{Gm} | thickness of grinding wheel at nominal radius | mm | 22 and B.2 | B.9 |
| z_1 | number of threads in worm | — | — | — |
| z_2 | number of teeth in worm wheel | — | — | — |
| α_{0n} | tool normal pressure angle | ° | — | 20 |
| α_{0t} | tool transverse pressure angle for profile types A and I | ° | — | 20 |
| α_n | normal pressure angle | ° | — | 20 |
| β_{m1} | reference helix angle of worm | ° | — | 7 |

Table 1 (continued)

| Symbols | Description | Units | Figure numbers | Formula numbers |
|----------------|---|-------|---|---------------------|
| γ_{m1} | reference lead angle of worm | ° | — | 6 |
| γ_{b1} | base lead angle of worm thread (for profile type I) | ° | A.1 | 21 |
| γ'_{b1} | base lead angle of the notional base helix (for profile type N) | ° | A.4 and A.5 | — |
| ϕ_2 | face end chamfer angle | ° | 5 | — |
| ρ_{Gm} | radius of curvature of grinding wheel (for profile type C) | — | — | — |
| ω_{w1} | angular velocity of the worm | rad/s | — | 144 |
| ω_{w2} | angular velocity of the worm wheel | rad/s | — | 146 |

In calculation, when a radius is derived, the symbol d for diameter shall be replaced by r for radius.

Table 2 — Subscripts for worm gears

| Symbols | Description |
|---------|----------------|
| 0 | cutting tool |
| 1 | worm |
| 2 | wheel |
| G | grinding wheel |

Table 3 — Coordinate of remarkable points (units are mm for length and degrees for angles)

| Symbols | Description | Figure numbers | Formula numbers |
|--|---|--------------------|--|
| $\overline{b_D}(y_p, D)$ | normal vector to an offset plane | — | 140 |
| $c_1, c_2(y_G), c_3(y_G), \varepsilon(y_G)$ | parameters to determine generated point by the grinding wheel | — | 59 to 62 |
| $x_G(y_G), y_G, \alpha_G(y_G)$ | coordinates of a point on the tool flank when the origin is at the point of intersection of the tool axis and the tool median plane, with the x-axis as the tool spindle axis and the abscissa on the trace of the median plane for profile C and K | 22 | Table 8 |
| $x_x(y_R), y_x(y_R), \alpha_x(y_R)$ | coordinates of axial profile and axial pressure angle for A, I, N worm profiles | 25 | 49, 50, 54 |
| $x_x(y_G), y_x(y_G), \alpha_x(y_G)$ | coordinates of axial profile and axial pressure angle for K and C worm profiles | 25 | 67, 68, 78 |
| $x_D(y_p, D), y_D(y_p, D), \alpha_D(y_p, D), \delta_D(y_p, D)$ | coordinates of worm profile and pressure angle of worm profile in an offset plane, projection angle from axial profile | 27 | 80, 81, 82, 86 |
| $x'_D(y_p, D), y_{1D}(y_p, D)$ | coordinates of worm profile with origin at pitch point | 27 | 90, 81, 82 |
| $x_{1D}(y_p, D), y_{1D}(y_p, D)$ | coordinates of path of contact in an offset plane with origin on pitch axis | 27 | 91, 92 |
| $xR_D(y_p, D), yR_D(y_p, D)$ $r_{M2D}(y_p, D), \vartheta_D(y_p, D)$ | coordinates of conjugate worm wheel profile of the worm in an offset plane with origin on worm wheel axis and polar coordinates | 29 | 96, 97 |
| $xT_D(r_{t2D}, D), yT_D(r_{t2D}, D)$ | coordinates of trochoid profile of the worm wheel profile in an offset plane with origin on worm wheel axis | 30 | 101, 102 |
| $x_D(y_{cusp}, D), y_D(y_{cusp}, D)$ | coordinates of cusp point in an offset plane with origin on pitch axis | — | — |
| $C_{eq1D}(y_p, D)$ | curvature for the worm at a point in an offset plane | — | 103, 110 |

Table 3 (continued)

| Symbols | Description | Figure numbers | Formula numbers |
|--|--|----------------|-----------------|
| $C_{eq2D}(y_p, D)$ | curvature for the worm wheel at a point in an offset plane | 31 | 111 |
| $R_{eqD}(y_p, D)$ | equivalent radius of curvature in an offset plane | — | 113 |
| $r_{a2D}(D)$ | radius of worm wheel conjugate to point B, tip of the worm profile in the offset plane D | 28 and 34 | 10.6.2 |
| $r_{e2D}(D)$ | outside radius of the worm wheel in the offset plane D | — | 98 |
| $r_{f2D}(D)$ | root radius of the worm wheel in the offset plane D | — | 99 |
| $r_{wD}(D)$ | radius of cylinder crossing the pitch point of in an offset plane D | — | 87 |
| $\overline{M_1}(y_p, D)$ | coordinate of a point of contact for the worm | — | 126 |
| $\overline{M_2}(y_p, D)$ | coordinate of a point of contact for the worm wheel | — | 127, 149 |
| $\overline{TN1_{cont}}(y_p, D)$ | tangent unit vector to conjugate profile in the offset plane D | — | 134 |
| $\overline{n_D}(y_p, D)$ | normal vector to the worm and worm wheel profile in an offset plane | — | 139 |
| $\overline{NormalNxy}(y_p, D)$ | normal unit vector to the lines of contact at common point of contact | — | 124 |
| $\overline{NORMAL}(y_p, D)$ | normal unit vector to the lines of contact | — | 122 |
| $Req(y_p, D), Req_1(y_p, D)$ | radius of curvature along the line the contact | — | 143, 141 |
| $\overline{TD1}(y_p, D), \overline{TD2}(y_p, D)$ | normalized unit vectors of the common tangent plane at point of contact between the tooth flanks | — | 117, 121 |
| $\overline{t_D}(y_p, D)$ | tangent vector to the worm and worm wheel profile in an offset plane | — | 138 |
| $\overline{V_1}(y_p, D)$ | velocity of a point of the thread of the worm | — | 146 |
| $\overline{V_2}(y_p, D)$ | velocity of a point of the tooth flank of the worm wheel | — | 150 |
| $V_{cDn}(y_p, D)$ | velocity at the contact point along the path of contact | — | 160 |
| $V_{SUMn}(y_p, D)$ | sum of velocities at the point of contact for method B in ISO/TS 14521:2020 | — | 163 |
| $\delta_{DI}(D)$ | angle of the projection of the pitch point of the offset plane D in the axial plane | ° | 88 |
| $\Delta x_D(D)$ | axial translation for the projection of the pitch point of the offset plane D in the axial plane | — | 89 |
| $\overline{\omega_1}$ | angular velocity vector of the worm | — | 145 |
| $\overline{\omega_2}$ | angular velocity vector of the worm wheel | — | 148 |

5 Formulae for calculation of dimensions

5.1 Parameters for a cylindrical worm

5.1.1 Axial pitch

Axial pitch is given by [Formula \(1\)](#), (see [Figure 1](#)):

$$p_{x1} = \pi \cdot m_{x1} \quad (1)$$

5.1.2 Axial module

Axial module is given by [Formula \(2\)](#):

$$m_{x1} = \frac{p_{x1}}{\pi} \quad (2)$$

5.1.3 Lead

Lead is given by [Formula \(3\)](#), (see [Figure 1](#)):

$$p_{z1} = z_1 \cdot p_{x1} \quad (3)$$

5.1.4 Unit lead

Unit lead is given by [Formula \(4\)](#):

$$p_{zu1} = \frac{p_{z1}}{2 \cdot \pi} \quad (4)$$

5.1.5 Diameter quotient

Diameter quotient is given by [Formula \(5\)](#): <https://standards.iteh.ai/ISO 10828:2024/iso/c40373a0-0721-4850-be32-9789fd741283/iso-10828-2024>

$$q_1 = \frac{d_{m1}}{m_{x1}} \quad (5)$$

5.1.6 Reference lead angle

Reference angle is given by [Formula \(6\)](#):

$$\tan \gamma_{m1} = \frac{m_{x1} \cdot z_1}{d_{m1}} = \frac{z_1}{q_1} \quad (6)$$

5.1.7 Reference helix angle

Reference helix angle is given by [Formula \(7\)](#):

$$\beta_{m1} = 90^\circ - \gamma_{m1} \quad (7)$$

5.1.8 Normal pitch on reference cylinder

Normal pitch on reference cylinder is given by [Formula \(8\)](#):

$$p_{n1} = p_{x1} \cdot \cos \gamma_{m1} \quad (8)$$