

ISO 10828:2024-04 (E)

Worm gears - Worm profiles and gear mesh geometry

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

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