

Gears and gear racks



STANDARDS

The listed ISO standards are, amongst others, the most relevant. Metric.

ISO 53 on Cylindrical gears for general and heavy equipment. Basic rack.

ISO 53 on Cylindrical gears for general and heavy engineering. Modules and diametral pitches.

ISO 677 on Straight bevel gears for general and heavy engineering. Basic rack.

ISO 678 on Straight bevel gears for general and heavy engineering. Modules and diametral pitches.

ISO 1122-1 on Glossary of gear terms.

ISO 1328 on Parallel involute gears.

BASIC PARAMETERS AND TERMINOLOGY*

Pinion: The smaller of the two gears in mesh, while the larger is known as the gear.

Ratio: The quotient of the number of teeth on the gear and the number of teeth in the pinion.

Pitch Circle Diameter (P_d): The virtual circle where the teeth of the pinion and gear mesh. The diameter of these circles are the respective pitch diameters.

Module (m): Used in the Metric system. The Pitch Diameter divided by the number of teeth hence, the higher the module, the larger the teeth. Meshing gears must be of the same module. The module represents the size of the tooth.

$$m = \frac{P_d}{z}$$

Diametral Pitch (D_p): Used in Imperial system, defined as the number of the teeth per inch of pitch diameter (Pd). The larger the number the smaller the teeth. Meshing gears must be of the same Diametral pitch.

$$D_p = \frac{z}{P_d}$$

This terminology is widely used in UK and USA. Both concepts of Module and Diametral Pitch are related by.

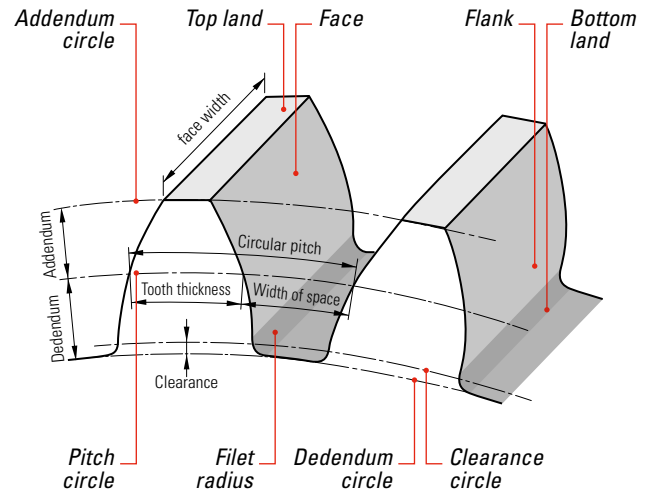
$$m = \frac{25,4}{D_p}$$

The nomenclature used on Metric or Imperial are identical with a major exception as the metric gears are based on the concept of Module, while the Imperial are based on the Diametral Pitch which are considered inverse terms.

Circular Pitch (p): The arc linear distance measured along the pitch circle line between two corresponding points of two adjacent teeth. Equals to the pitch-circle circumference divided by the number of teeth.

$$p = \frac{P_d}{z} = m \pi$$

There is not a plain equivalence between the pitches in metric and inches and consequently cannot be directly interchanged. Both systems establish their most common sizes, which are listed in the two tables below:

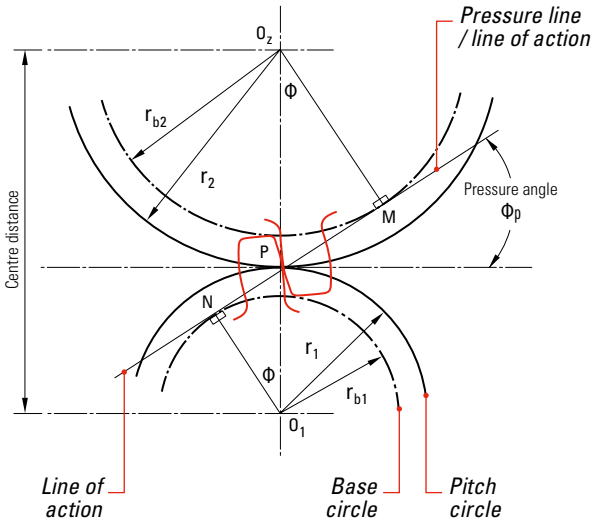


Circular Pitch (p): Modules vs Diameter pitch

MODULE m	DIAMETRAL PITCH D_p	MODULE m	DIAMETRAL PITCH D_p
0,2	127,000	2,822	9
0,212	120	3	8,467
0,25	101,600	3,175	8
0,265	96	4	6,350
0,3	84,667	4,233	6
0,318	80	5	5,080
0,353	72	5,080	5
0,397	64	6	4,233
0,4	63,500	6,350	4
0,5	0,508	8	3,175
0,529	48	8,467	3
0,6	42,333	10	2,540
0,7	36,286	10,160	2,500
0,794	32	12	2,117
0,8	31,750	12,700	2
1	25,400	16	1,588
1,058	24	16,933	1,500
1,25	20,320	20	1,270
1,270	20	25	1,060
1,5	16,933	25,400	1
1,588	16	32	0,794
2	12,700	33,887	1
2,117	12	40	0,635
2,5	10,160	50	0,508
2,540	10	50,800	0,500

* See page num. L25 through L32 on Gear calculation.

Pressure Angle: The slope of the tooth at the pitch circle. It is defined as the angle between to the line of action and the perpendicular to line of centers.



$O_1 N = r_{b1} =$ Base circle radius of Gear 1
 $O_1 P = r_1 =$ Pitch circle radius of Gear 1
 $O_2 N = r_{b2} =$ Base circle radius of Gear 2
 $O_2 P = r_2 =$ Pitch circle radius of Gear 2

The larger the pressure angle the smaller the base circle. The standard pressure angles used in gears are $14,5^\circ$ and 20° which can not mesh together, as the gears they must have the same pressure angles to mesh. The pressure angle of 20° is the most common in gears.

Addendum: The distance from the tip of the tooth to the pitch circle line.

Dedendum: The distance from the pitch center line to the root circle. Dedendum is bigger than addendum, the difference been the clearance.

Whole depth: The Addendum plus Dedendum.

Working depth: The whole depth minus the height of the radius at the base of the tooth.

Clearance: The whole depth minus the working depth. Equals the height of the radius at the base of the tooth.

Outside diameter: The outside diameter of the gear.

Base Circle diameter: The diameter on which the involute profile is generated.

Tooth face: The part of the tooth above the pitch line.

Tooth flank: The part of the tooth below the pitch line.

Line of action: The straight line passing through the pitch point tangent to base circles.

Tooth thickness: The tooth arc length measured on the pitch circle.

Space width: The space arc length between two adjacent teeth measured on the pitch line.

Backlash: The difference between the Space width and the Tooth thickness.

TYPES OF GEARS

We offer an ample range of gear types, which are, described hence-forward, of which some of them are produced regularly while others are made under MTO.

Nomenclature: We distinguish the different types of gears as under.

SG for Spur Gears

HG for Helical Gears

BG for Bevel Gears

MG for Miter Gears

WG for Worm Gears

IG for Internal Gears

GR for Gear Racks

Spur Gears

They are the most simple type of gears used to transmit power and motion between two parallel shafts. Here are their basic characteristics.

The teeth top is straight parallel to the axis of rotation.

The mating teeth contact is over the full face width what make the prone to produce noise.

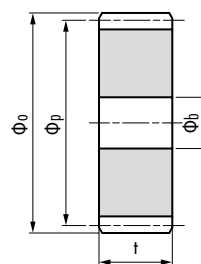
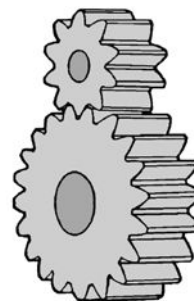
They mesh only with gears fitted to parallel shafts.

The speed ratios, as a general guide, are up to 8 for one step, up to 45 for two steps and up to 200 for three steps.

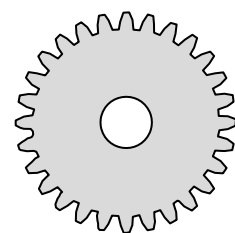
We offer two basic configurations of Spur Gears,

The Plain Spur Gear which we identify by the nomenclature SG-A plus the teeth number and module. As far as materials Steel, Casting and Nylon are the basic.

The Plain Hub Spur Gear which we identify by the nomenclature SG-B plus the teeth number and module, with different options, the Web type and the Spoke type. As far as materials, Steel, Casting and Nylon are the basic.



Type A



Plain Spur Gears. Type A. Pressure angle 20°

REFERENCE*	MODULE 1 PITCH 3,1416					MODULE 1,5 PITCH 4,7124				MODULE 2 PITCH 6,2832				MODULE 2,5 PITCH 7,854				
	n° Teeth	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t	
TL-SG-A60-	60	60	62	12	15													
TL-SG-A65-				12	15									162,50	162,50	20	25	
TL-SG-A70-	70	70	72	12	15									175,00	167,50	20	25	
TL-SG-A72-	72	72	74	12	15	108,00	111,00	20	17	144	148	20	20	180,00	180,00	20	25	
TL-SG-A75-	75	75	77	12	15	112,50	115,50	20	17	150	154	20	20	187,50	185,00	20	25	
TL-SG-A76-	76	76	78	12	15	114,00	117,00	20	17	152	156	20	20	190,00	192,50	20	25	
TL-SG-A80-	80	80	82	12	15	120,00	123,00	20	17	160	164	20	20	200,00	195,00	20	25	
TL-SG-A85-	85	85	87	12	15	127,50	130,50	20	17	170	174	20	20	212,50	205,00	20	25	
TL-SG-A90-	90	90	92	12	15	135,00	138,00	20	17	180	184	20	20	225,00	217,50	20	25	
TL-SG-A95-	95	95	97	12	15	142,50	145,50	20	17	190	194	20	20	237,50	230,00	20	25	
TL-SG-A100-	100	100	102	12	15	150,00	153,00	20	17	200	204	20	20	250,00	242,53	20	25	
TL-SG-A110-	110	110	112	12	15	165,00	168,00	20	17	220	224	20	20	275,00	280,00	20	25	
TL-SG-A114-	114	114	116	12	15	171,00	174,00	20	17	228	232	20	20	285,00	290,00	20	25	
TL-SG-A120-	120	120	122	12	15	180,00	183,00	20	17	240	244	20	20	300,00	305,00	20	25	
TL-SG-A127-	127	127	129	12	15	190,50	193,50	20	17	254	258	20	20	317,50	322,50	20	25	

* All sizes in mm unless otherwise mentioned.

REFERENCE*	MODULE 3 PITCH 9,4248					MODULE 4 PITCH 12,5664				MODULE 5 PITCH 15,708				MODULE 6 PITCH 18,8496			
	n° Teeth	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t	Φ _p	Φ _o	Φ _b	t
TL-SG-A30-	30													180,00	192	25	60
TL-SG-A32-	32									160	170	25	50	192,00	204	25	60
TL-SG-A35-	35									175	185	25	50				
TL-SG-A38-	38					152	160,00	25	40	190	200	30	50	220,00	240	25	60
TL-SG-A40-	40					160	168,00	25	40	200	210	30	50	240,00	252	25	60
TL-SG-A45-	45					180	188,00	25	40	225	235	30	50				
TL-SG-A48-	48	144	150	25	30	192	200,00	25	40	240	250	30	50				
TL-SG-A50-	50	150	156	25	30	200	208,00	25	40	250	260	30	50				
TL-SG-A52-	52	156	162	25	30	208	216,00	25	40	260	270	30	50				
TL-SG-A55-	55	165	171	25	30	220	228,00	25	40	275	285	30	50				
TL-SG-A57-	57	171	177	25	30	228	236,00	25	40	285	295	30	50				
TL-SG-A60-	60	180	186	25	30	240	248,00	25	40	300	310	30	50				
TL-SG-A65-	65	195	201	25	30	260	268,00	25	40	325	335	30	50				
TL-SG-A70-	70	210	216	25	30	280	288,00	25	40	350	360	30	50				
TL-SG-A72-	72	216	222	25	30												
TL-SG-A75-	75	225	231	25	30	300	308	25	40	375	385	30	50				
TL-SG-A76-	76	228	234	25	30	304	312	25	40	380	390	30	50				
TL-SG-A80-	80	240	246	25	30	320	328	25	40	400	410	30	50				
TL-SG-A85-	85	255	261	25	30	340	248	25	40	425	435	30	50				
TL-SG-A90-	90	270	276	25	30	360	368	25	40	450	460	30	50				
TL-SG-A95-	95	285	291	25	30	380	388	25	40	475	485	30	50				
TL-SG-A100-	100	300	306	25	30	400	408	25	40	500	510	30	50				
TL-SG-A110-	110	330	336	25	30	440	448	25	40	550	560	30	50				
TL-SG-A114-	114	342	348	25	30	456	464	25	40	570	580	30	50				
TL-SG-A120-	120	360	366	25	30							30	50				
TL-SG-A127-	127	381	387	25	30							30	50				

* All sizes in mm unless otherwise mentioned.

Hub Spur Gears

Hub Spur Gears. Type B. Pressure angle 20°

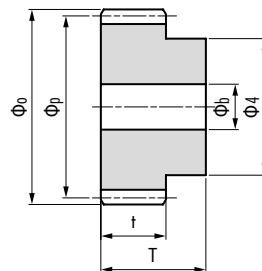
MODULE	T mm	t mm
1	25	15
1,5	30	17
2	35	20
2,5	40	25
3	50	30
4	60	40
5	75	50
6	80	60



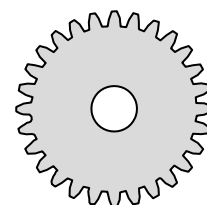
Hub Gear



Web type Hub Gear



Type B



REFERENCE*	MODULE 1 PITCH 3,1416					MODULE 1,5 PITCH 4,7124				MODULE 2 PITCH 6,2832				MODULE 2,5 PITCH 7,854			
	n° Teeth	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h
TL-SG-B12-	12	12	14	5	9	18,00	21,00	8	14	24	28	10	18	30,00	35,00	22	10
TL-SG-B13-	13	13	15	5	10	19,50	22,50	8	14	26	30	10	19	32,50	37,50	25	10
TL-SG-B14-	14	14	16	5	10	21,00	24,00	8	18	28	32	10	20	35,00	40,00	28	10
TL-SG-B15-	15	15	17	6	12	22,50	25,50	8	18	30	34	10	22	37,50	42,50	30	10
TL-SG-B16-	16	16	18	6	13	24,00	27,00	8	20	32	36	10	24	40,00	45,00	32	12
TL-SG-B17-	17	17	19	8	14	25,50	28,50	8	20	34	38	10	25	42,50	47,50	35	12
TL-SG-B18-	18	18	20	8	15	27,00	30,00	8	20	36	40	10	25	45,00	50,00	35	12
TL-SG-B19-	19	19	21	8	15	28,50	31,50	8	20	38	42	10	25	47,50	52,50	35	12
TL-SG-B20-	20	20	22	8	16	30,00	33,00	8	25	40	44	10	30	50,00	55,00	40	14
TL-SG-B21-	21	21	23	8	16	31,50	34,50	10	25	42	46	12	30	52,50	57,50	40	14
TL-SG-B22-	22	22	24	8	18	33,00	36,00	10	25	44	48	12	30	55,00	60,00	45	14
TL-SG-B23-	23	23	25	8	18	34,50	37,50	10	25	46	50	12	30	57,50	62,50	45	14
TL-SG-B24-	24	24	26	8	20	36,00	39,00	10	25	48	52	12	35	60,00	65,00	45	14
TL-SG-B25-	25	25	27	8	20	37,50	40,50	10	25	50	54	12	35	62,50	67,50	50	14
TL-SG-B26-	26	26	28	8	20	39,00	42,00	12	30	52	56	12	40	65,00	70,00	50	14
TL-SG-B27-	27	27	29	8	20	40,50	43,50	12	30	54	58	12	40	67,50	72,50	50	14
TL-SG-B28-	28	28	30	8	20	42,00	45,00	12	30	56	60	12	40	70,00	75,00	50	14
TL-SG-B29-	29	29	31	8	20	43,50	46,50	12	30	58	62	14	40	72,50	77,50	50	14
TL-SG-B30-	30	30	32	8	20	45,00	48,00	12	30	60	64	14	40	75,00	80,00	55	16
TL-SG-B31-	31	31	33	10	25	46,50	49,50	12	35	62	66	14	45	77,50	82,50	55	16
TL-SG-B32-	32	32	34	10	25	48,00	51,00	12	35	64	68	14	45	80,00	85,00	55	16
TL-SG-B33-	33	33	35	10	25	49,50	52,50	12	35	66	70	14	45	82,50	87,50	60	16
TL-SG-B34-	34	34	36	10	25	51,00	54,00	12	35	68	72	14	45	85,00	90,00	60	16
TL-SG-B35-	35	35	37	10	25	52,50	55,50	12	35	70	74	14	45	87,50	92,50	60	16
TL-SG-B36-	36	36	38	10	25	54,00	57,00	12	35	72	76	14	45	90,00	95,00	60	16
TL-SG-B37-	37	37	39	10	25	55,50	58,50	12	40	74	78	14	50	92,50	97,50	60	16
TL-SG-B38-	38	38	40	10	25	57,00	60,00	12	40	76	80	14	50	95,00	100,00	60	16
TL-SG-B39-	39	39	41	10	25	58,50	61,50	12	40	78	82	14	50	97,50	102,50	60	16
TL-SG-B40-	40	40	42	10	25	60,00	63,00	12	40	80	84	14	50	100,00	105,00	70	20
TL-SG-B41-	41	41	43	10	30	61,50	64,50	14	50	82	86	16	60	102,50	107,50	70	20
TL-SG-B42-	42	42	44	10	30	63,00	66,00	14	50	84	88	16	60	105,00	110,00	70	20
TL-SG-B43-	43	43	45	10	30	64,50	67,50	14	50	86	90	16	60	107,51	112,51	70	20
TL-SG-B44-	44	44	46	10	30	66,00	69,00	14	50	88	92	16	60	112,50	117,50	70	20
TL-SG-B45-	45	45	47	10	30	67,50	70,50	14	50	90	94	16	60	115,00	120,00	70	20
TL-SG-B46-	46	46	48	10	30	69,00	72,00	14	50	92	96	16	60	117,50	122,50	80	20

* All sizes in mm unless otherwise mentioned.

REFERENCE*	MODULE 1 PITCH 3,1416					MODULE 1,5 PITCH 4,7124				MODULE 2 PITCH 6,2832				MODULE 2,5 PITCH 7,854			
	n° Teeth	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh
TL-SG-B47-	47	47	49	10	30	70,50	73,50	14	50	94	98	16	60	120,00	125,00	80	20
TL-SG-B48-	48	48	50	10	30	72,00	75,00	14	50	96	100	16	70	122,50	127,50	80	20
TL-SG-B49-	49	49	51	10	30	73,50	76,50	14	50	98	102	16	70	125,00	130,00	80	20
TL-SG-B50-	50	50	52	12	30	75,00	78,00	14	50	100	104	16	70	127,50	132,50	90	20
TL-SG-B51-	51	51	53	12	40	76,50	79,50	14	60	102	106	20	70	130,00	135,00	90	20
TL-SG-B52-	52	52	54	12	40	78,00	81,00	14	60	104	108	20	70	132,50	137,50	90	20
TL-SG-B53-	53	53	55	12	40	79,50	82,50	15	60	106	110	20	70	135,00	140,00	90	20
TL-SG-B54-	54	54	56	12	40	81,00	84,00	15	60	108	112	20	70	137,50	142,50	90	20
TL-SG-B55-	55	55	57	12	40	82,50	85,50	15	60	110	114	20	70	140,00	145,00	100	20
TL-SG-B56-	56	56	58	12	40	84,00	87,00	15	60	112	116	20	70	142,50	147,50	100	20
TL-SG-B57-	57	57	59	12	40	85,50	88,50	15	60	114	118	20	70	145,00	150,00	100	20
TL-SG-B58-	58	58	60	12	40	87,00	90,00	15	60	116	120	20	70	147,50	152,50	100	20
TL-SG-B59-	59	59	61	12	40	88,50	91,50	15	60	118	122	20	70	150,00	155,00	100	20
TL-SG-B60-	60	60	62	12	40	90,00	93,00	15	60	120	124	20	70	155,00	160,00	100	20
TL-SG-B61-	61	61	63	12	50	91,50	94,50	15	70	122	126	20	80	157,50	162,50	100	20
TL-SG-B62-	62	62	64	12	50	93,00	96,00	15	70	124	128	20	80	162,50	167,50	100	20
TL-SG-B63-	63	63	65	12	50	94,50	97,50	20	70	126	130	20	80	167,50	172,50	100	20
TL-SG-B64-	64	64	66	12	50	96,00	99,00	20	70	128	132	20	80	175,00	180,00	100	20
TL-SG-B65-	65	65	67	12	50	97,50	100,50	20	70	130	134	20	80				
TL-SG-B66-	66	66	68	12	50	99,00	102,00	20	70	132	136	20	80				
TL-SG-B67-	67	67	69	12	50	100,50	103,50	20	70	134	138	20	80				
TL-SG-B68-	68	68	70	12	50	102,00	105,00	20	70	136	140	20	80				
TL-SG-B69-	69	69	71	12	50	103,50	106,50	20	70	138	142	20	80				
TL-SG-B70-	70	70	72	12	50	105,00	108,00	20	70	140	144	20	80				
TL-SG-B72-	72	72	74	12	50	144,00	111,00	20	80	144	146	20	80				

* All sizes in mm unless otherwise mentioned.

REFERENCE*	MODULE 3 PITCH 9,4248					MODULE 4 PITCH 12,5664				MODULE 5 PITCH 15,7080				MODULE 6 PITCH 18,8496			
	n° Teeth	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh	Φp	Φo	Φb	Φh
TL-SG-B12-	12	36	42	12	25	48	56	14	35	60	70	16	45	72	84	20	54
TL-SG-B13-	13	39	45	12	25	52	60	14	40	65	75	16	50				
TL-SG-B14-	14	42	48	12	30	56	64	14	45	70	80	20	55	84	96	20	65
TL-SG-B15-	15	45	51	12	35	60	68	14	45	75	85	20	60	90	102	20	70
TL-SG-B16-	16	48	54	15	38	64	72	15	50	80	90	20	65	96	108	20	75
TL-SG-B17-	17	51	57	15	42	68	76	15	50	85	95	20	70				
TL-SG-B18-	18	54	60	15	45	72	80	15	50	90	100	20	70	108	120	20	80
TL-SG-B19-	19	57	63	15	45	76	84	15	60	95	105	20	70				
TL-SG-B20-	20	60	66	15	45	80	88	15	60	100	110	20	80	120	132	20	90
TL-SG-B21-	21	63	69	15	45	84	92	20	70	105	115	20	80				
TL-SG-B22-	22	66	72	15	50	88	96	20	70	110	120	25	80				
TL-SG-B23-	23	69	75	15	50	92	100	20	75	115	125	25	90	138	150	25	110
TL-SG-B24-	24	72	78	16	50	96	104	20	75	120	130	25	90	144	156	25	110
TL-SG-B25-	25	75	81	16	60	100	108	20	75	125	135	25	90	150	162	25	110
TL-SG-B26-	26	78	84	16	60	104	112	20	75	130	140	25	100				
TL-SG-B27-	27	81	87	16	60	108	116	20	75	135	145	25	100				
TL-SG-B28-	28	84	90	16	60	112	120	20	75	140	150	25	100				
TL-SG-B29-	29	87	93	16	60	116	124	20	75	145	155	25	100				
TL-SG-B30-	30	90	96	16	60	120	128	20	75	150	160	25	100	180	192	25	110
TL-SG-B31-	31	93	99	20	70	124	132	20	80								
TL-SG-B32-	32	96	102	20	70	128	136	20	80	160	170	25	110				
TL-SG-B33-	33	99	105	20	70	132	140	20	80								
TL-SG-B34-	34	102	108	20	70	136	144	20	80								
TL-SG-B35-	35	105	111	20	70	140	148	20	80								
TL-SG-B36-	36	108	114	20	70	144	152	20	80	180	190	25	110				

* All sizes in mm unless otherwise mentioned.

NEXT >

REFERENCE*	MODULE 3 PITCH 9,4248					MODULE 4 PITCH 12,5664				MODULE 5 PITCH 15,7080				MODULE 6 PITCH 18,8496			
	n° Teeth	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h	Φ_p	Φ_o	Φ_b	Φ_h
TL-SG-B37-	37	111	117	20	80	148	156	20	80								
TL-SG-B38-	38	114	120	20	80	152	160	25	80	190	200	30	110				
TL-SG-B39-	39	117	123	20	80	156	164	25	80								
TL-SG-B40-	40	120	126	20	80	160	168	25	80	200	210	30	110	240	252	25	120
TL-SG-B41-	41	123	129	20	90												
TL-SG-B42-	42	126	132	20	90					210	220	25	120				
TL-SG-B43-	43	129	135	20	90												
TL-SG-B44-	44	132	138	20	90												
TL-SG-B45-	45	135	141	20	90	180	188	25	80								
TL-SG-B46-	46	138	144	20	90												
TL-SG-B47-	47	141	147	20	90												
TL-SG-B48-	48	144	150	20	100	192	200	25	80								
TL-SG-B49-	49	147	153	20	100												
TL-SG-B50-	50	150	156	20	100	200	208	25	80								
TL-SG-B51-	51																
TL-SG-B52-	52																
TL-SG-B53-	53																
TL-SG-B54-	54	168	162	20	100												
TL-SG-B55-	55	171	165	20	100					275	285	30	120				
TL-SG-B56-	56	174	168	20	100												
TL-SG-B57-	57	177	171	20	100												
TL-SG-B58-	58																
TL-SG-B59-	59																
TL-SG-B60-	60	186	180	20	100	240	248	25	100	300	310	30	120				
TL-SG-B62-	62	192	183	20	100												
TL-SG-B63-	63																
TL-SG-B65-	65	201	195	20	100	260	268	25	100								

* All sizes in mm unless otherwise mentioned.

Helical Gears

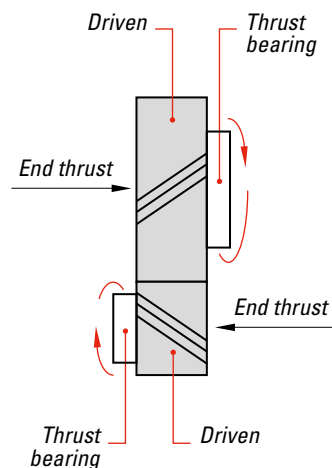
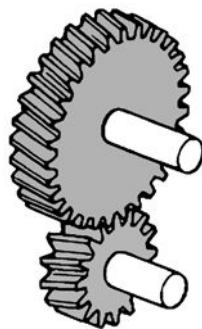
They have longer teeth than the equivalent pitch diameter spur gears hence the strength is greater and the load they can carry is higher.

The operation is quieter than that of the spur and can mesh and work in different configurations of shafts either parallel and non parallel.

The helical gears provoke thrust forces in the direction of the axis what has to be taken much into account when compounding the for-

ces in play. In Helical gears, the backlash is much reduced compared with that of the equivalent Spur gears, gives a continuous teeth engagement as, when a teeth pair engagement ends, begins the engagement of the next pair.

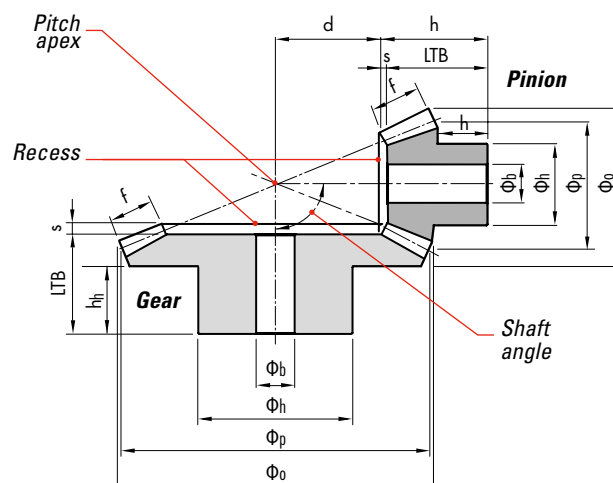
Thrust bearings must be used to withstand the axial forces. To cancel the effect of axial forces, a double helical gear or a herringbone¹ gear may be used.



¹ Herringbone gear. A double helical gear with V-shaped type of teeth. The side halves thrust compensate each other with the result that does not produce side load.

Bevel Gears. Straight and Spiral

Straight Bevel Gears. They transmit power and motion between intersecting shafts. Their teeth are tapered to the same direction of the cones apex frusta. The pitch diameter and tooth dimensions are referred to the outer limit. The tooth face goes all the way from the heel to the inner end or toe.



Bevel Gears. Pressure angle 20°. Pair 16-32

REFERENCE*	MODULE	N° OF TEETH	Φ _p	Φ _o	Φ _h	Φ _b	LTB	h	f	d	h _h	c
TL-BG-16-32-1.5	1,5	16	24,00	26,70	20,00	10,00	18,00	19,50	8,00	16,33	11,30	1,50
		32	48,00	49,30	32,00	12,00	17,00	20,00	8,00	7,45	10,00	3,00
TL-BG-16-32-2	2	16	32,00	35,60	26,00	10,00	21,00	23,00	10,00	22,41	12,20	2,00
		32	64,00	65,80	40,00	12,00	21,00	25,00	10,00	10,21	10,00	4,00
TL-BG-16-32-2.5	2,5	16	40,00	44,40	34,00	12,00	25,00	27,50	12,00	28,38	14,40	2,50
		32	80,00	82,20	50,00	15,00	20,00	26,00	12,00	13,10	10,00	6,00
TL-BG-16-32-3	3	16	48,00	53,40	40,00	15,00	25,00	28,00	15,00	33,64	11,60	3,00
		32	96,00	98,70	60,00	15,00	24,00	30,00	15,00	15,31	10,00	6,00
TL-BG-16-32-3.5	3,5	16	56,00	62,30	48,00	15,00	30,00	33,50	18,00	38,83	14,40	3,50
		32	112,00	115,10	70,00	20,00	24,00	31,00	18,00	17,77	10,00	7,00
TL-BG-16-32-4	4	16	64,00	71,10	50,00	20,00	32,00	36,00	20,00	44,81	13,40	4,00
		32	128,00	131,60	80,00	20,00	24,00	32,00	20,00	20,42	10,00	8,00
TL-BG-16-32-4.5	4,5	16	72,00	80,10	60,00	20,00	35,00	39,50	22,00	51,00	15,40	4,50
		32	144,00	148,00	90,00	25,00	27,00	36,00	22,00	23,21	10,00	9,00
TL-BG-16-32-5	5	16	80,00	88,90	60,00	20,00	45,00	50,00	25,00	56,06	21,10	5,00
		32	160,00	164,50	100,00	25,00	28,00	38,00	25,00	25,52	10,00	10,00

* All measures in mm unless otherwise indicated.

For other pairs, consult to our Commercial Department.

Bevel Gears. Pressure angle 20°. Pair 16-48

REFERENCE*	MODULE	N° OF TEETH	Φ _p	Φ _o	Φ _h	Φ _b	LTB	h	f	d	h _h	c
TL-BG-16-48-1.5	1,5	16	24,00	26,90	20,00	10,00	23,00	24,00	12,00	24,30	11,95	1,00
		48	72,00	72,90	50,00	15,00	17,00	20,00	12,00	7,27	10,00	3,00
TL-BG-16-48-2	2	16	32,00	35,80	26,00	12,00	27,00	28,50	15,00	33,26	12,40	1,50
		48	96,00	97,30	60,00	15,00	19,00	23,00	15,00	9,90	10,00	4,00
TL-BG-16-48-2.5	2,5	16	40,00	44,70	32,00	12,00	30,00	32,00	18,00	42,41	13,00	2,00
		48	120,00	121,60	70,00	20,00	21,00	26,00	18,00	13,23	10,00	5,00
TL-BG-16-48-3	3	16	48,00	53,70	40,00	15,00	30,00	32,00	18,00	54,25	12,10	2,00
		48	144,00	145,90	80,00	20,00	23,00	29,00	18,00	16,20	10,00	6,00
TL-BG-16-48-3.5	3,5	16	56,00	62,60	48,00	15,00	35,50	38,00	22,00	62,29	15,00	2,50
		48	168,00	170,20	90,00	20,00	24,00	31,00	22,00	18,48	10,00	7,00
TL-BG-16-48-4	4	16	64,00	71,60	55,00	20,00	38,50	41,50	25,00	71,23	15,20	3,00
		48	192,00	194,50	100,00	22,00	25,00	33,00	25,00	21,20	10,00	8,00
TL-BG-16-48-4.5	4,5	16	72,00	80,60	60,00	20,00	50,00	53,00	28,00	80,27	23,40	3,00
		48	216,00	218,60	100,00	25,00	40,00	49,00	28,00	23,93	18,00	9,00
TL-BG-16-48-5	5	16	80,00	89,50	60,00	20,00	57,00	60,00	35,00	85,61	22,50	3,00
		48	240,00	243,10	150,00	28,00	40,00	50,00	35,00	25,45	20,00	10,00

* All measures in mm unless otherwise indicated.

For other pairs, consult to our Commercial Department.

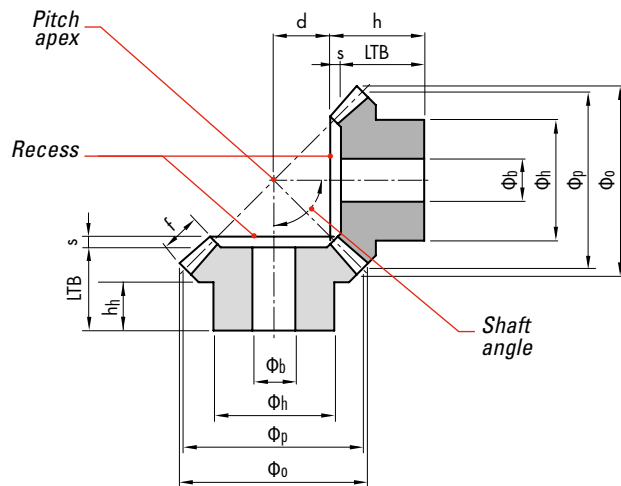
Bevel Gears. Pressure angle 20°. Pair 16-64

REFERENCE*	MODULE	N° OF TEETH	Φ_p	Φ_o	Φ_h	Φ_b	LTB	h	f	d	h_h	c
TL-BG-16-64-1.5	1,5	16	24,00	26,90	18,00	10,00	24,00	25,00	12,00	36,20	12,20	1,00
		64	96,00	96,70	70,00	15,00	19,00	22,00	12,00	8,53	10,00	3,00
TL-BG-16-64-2	2	16	32,00	35,90	25,00	12,00	23,00	24,00	15,00	49,07	8,17	1,00
		64	128,00	129,00	80,00	20,00	20,00	24,00	15,00	10,83	10,00	4,00
TL-BG-16-64-2.5	2,5	16	40,00	44,90	30,00	15,00	26,00	30,50	18,00	61,99	8,20	1,50
		64	160,00	161,20	90,00	20,00	24,00	29,00	18,00	13,77	10,00	5,00
TL-BG-16-64-3	3	16	48,00	53,80	40,00	15,00	32,00	34,00	22,00	74,05	11,00	2,00
		64	192,00	193,50	100,00	20,00	24,00	30,00	22,00	16,41	10,00	6,00
TL-BG-16-64-3.5	3,5	16	56,00	62,80	48,00	15,00	43,00	45,00	25,00	87,13	19,10	2,00
		64	224,00	225,70	100,00	25,00	43,00	50,00	25,00	19,32	22,00	7,00
TL-BG-16-64-4	4	16	64,00	71,70	50,00	20,00	48,00	50,00	30,00	98,21	18,50	2,00
		64	256,00	257,90	120,00	28,00	42,00	50,00	30,00	21,72	20,00	8,00
TL-BG-16-64-4.5	4,5	16	72,00	80,70	55,00	20,00	50,50	53,00	32,00	112,08	19,00	2,50
		64	288,00	290,10	130,00	30,00	44,00	53,00	32,00	24,83	23,00	9,00
TL-BG-16-64-5	5	16	80,00	89,70	60,00	20,00	55,50	58,00	35,00	125,06	20,60	2,50
		64	320,00	322,40	150,00	30,00	48,00	58,00	35,00	27,65	25,00	2,50

* All measures in mm unless otherwise indicated. For other pairs, consult to our Commercial Department.

Miter Gears

They consist of Bevel Gears with the same number of teeth on both faces, with the intersecting shaft axes at right angle. They are available in versions Straight and Spiral.



Miter Gears. Pressure angle 20°

REFERENCE*	MODULE	N° OF TEETH	Φ_p	Φ_o	Φ_h	Φ_b	LTB	h	f	d	h_h	c
TL-MG-16-1.5	1,5	16	24,00	26,10	20,30	8	16,90	18,90	6,00	7,10	12,00	2,00
TL-MG-20-1.5	1,5	20	30,00	32,10	22,00	10	18,00	20,00	10,00	7,40	8,50	2,00
TL-MG-22-1.5	1,5	22	33,00	35,10	25,00	10	18,00	20,00	10,00	8,75	8,25	2,00
TL-MG-25-1.5	1,5	25	37,50	39,60	28,00	10	21,00	23,00	10,00	11,09	12,00	2,00
TL-MG-30-1.5	1,5	30	45,00	47,10	30,00	12	22,50	25,00	12,00	13,35	12,00	2,50
TL-MG-16-2	2	16	32,00	34,80	25,30	10	20,50	23,50	8,00	9,50	14,00	3,00
TL-MG-20-2	2	20	40,00	42,80	32,00	10	22,00	25,00	12,00	10,78	12,00	3,00
TL-MG-22-2	2	22	44,00	46,80	36,00	10	22,00	25,00	12,00	12,70	11,70	3,00
TL-MG-25-2	2	25	50,00	52,80	40,00	12	25,00	28,00	14,00	14,28	12,30	3,00
TL-MG-30-2	2	30	60,00	62,80	50,00	12	27,00	30,00	16,00	17,78	12,80	3,00
TL-MG-16-2.5	2,5	16	40,00	43,50	30,30	12	24,60	28,10	10,00	11,90	15,00	3,00
TL-MG-20-2.5	2,5	20	50,00	53,50	40,00	12	27,00	30,50	12,00	15,43	16,00	3,50
TL-MG-22-2.5	2,5	22	55,00	58,50	45,00	12	27,00	30,50	12,00	17,80	15,90	3,50
TL-MG-25-2.5	2,5	25	62,50	66,00	50,00	15	30,00	33,50	15,00	19,48	16,00	3,50
TL-MG-30-2.5	2,5	30	75,00	78,50	55,00	15	32,00	35,50	18,00	23,63	16,00	3,50
TL-MG-16-3	3	16	48,00	52,20	40,30	15	27,70	31,70	12,00	14,30	18,00	4,00

* All measures in mm unless otherwise indicated. For different sizes, contact our Commercial department.

NEXT >

Miter Gears. Pressure angle 20°

REFERENCE*	MODULE	N° OF TEETH	Φ_p	Φ_o	Φ_h	Φ_b	LTB	h	f	d	h_h	c
TL-MG-20-3	3	20	60,00	64,20	45,00	15	31,00	35,00	18,00	16,00	13,60	4,00
TL-MG-22-3	3	22	66,00	70,20	50,00	15	31,00	35,00	18,00	19,00	13,00	4,00
TL-MG-25-3	3	25	75,00	79,20	55,00	15	34,00	38,00	20,00	22,00	16,00	4,00
TL-MG-30-3	3	30	90,00	94,20	60,00	20	36,00	40,00	22,00	28,00	17,00	4,00
TL-MG-16-3.5	3,5	16	56,00	60,90	45,30	15	31,90	36,40	14,00	16,60	20,00	4,50
TL-MG-20-3.5	3,5	20	70,00	74,90	55,00	15	36,00	40,50	22,00	18,13	17,00	4,50
TL-MG-22-3.5	3,5	22	77,00	81,90	60,00	15	36,00	40,50	22,00	21,50	18,00	4,50
TL-MG-25-3.5	3,5	25	87,50	92,40	65,00	20	39,00	43,50	26,00	23,97	18,00	4,50
TL-MG-30-3.5	3,5	30	105,00	109,90	70,00	20	43,50	48,00	30,00	30,02	19,00	4,50
TL-MG-16-4	4	16	64,00	69,60	50,30	15	39,30	44,30	15,00	19,70	25,00	5,00
TL-MG-20-4	4	20	80,00	85,60	60,00	18	38,00	43,00	25,00	20,74	18,00	5,00
TL-MG-22-4	4	22	88,00	93,60	65,00	18	38,00	43,00	25,00	24,70	18,00	5,00
TL-MG-25-4	4	25	100,00	105,60	70,00	20	40,00	45,00	28,00	28,50	18,00	5,00
TL-MG-30-4	4	30	120,00	125,60	80,00	25	43,00	48,00	32,00	35,67	16,00	5,00
TL-MG-16-4.5	4,5	16	72,00	78,30	55,30	18	40,30	46,30	18,00	21,70	25,00	6,00
TL-MG-20-4.5	4,5	20	90,00	96,30	65,00	20	42,00	48,00	28,00	23,41	18,00	6,00
TL-MG-22-4.5	4,5	22	99,00	105,30	70,00	20	42,00	48,00	28,00	27,80	18,00	6,00
TL-MG-25-4.5	4,5	25	112,50	118,80	75,00	20	44,00	50,00	32,00	31,76	18,00	6,00
TL-MG-30-4.5	4,5	30	135,00	141,30	90,00	25	47,00	53,00	35,00	40,82	17,00	6,00
TL-MG-16-5	5	16	80,00	87,00	60,30	20	42,40	48,90	18,00	25,10	24,19	6,50
TL-MG-20-5	5	20	100,00	107,10	70,00	20	44,00	50,50	30,00	26,86	18,50	6,50
TL-MG-22-5	5	22	110,00	117,10	80,00	20	44,00	50,50	30,00	31,70	18,50	6,50
TL-MG-25-5	5	25	125,00	132,10	90,00	20	47,00	53,50	34,00	36,36	18,00	6,50
TL-MG-30-5	5	30	150,00	157,10	110,00	30	50,00	56,50	38,00	45,97	18,00	6,50

* All measures in mm unless otherwise indicated.

For different sizes, contact our Commercial department.



Spiral Miter Gears



Straight Teeth Transfer Gearbox

Worm Gears

Used to connect shaft configurations of different angles, although the most common is 90°. As far as the tooth shape is concerned, the most used is the rack-type trapezoid for the worm and an involute shape in the center portion of the tooth in the worm gear.

The dimensions of the tooth, addendum, dedendum, pressure angle and other parameters use the same standards than those used with spur gears.

The worm acts like a helical gear with varying spiral angle which can reach up to 30° and more. The speed ratio of the pair is increased adding threads, starts, to the worm. The addition of starts to the worm the angles of the helix increase. A target ratio can be obtained by combining the number of teeth and the number of worm threads, thus a ratio of 10 may be obtained by pairs 20 by 2, 30 by 3 or 40 by 4. Or if fractional the number of threads of the worm is the denominator of the fraction, thus a ratio of 5,25 will use a four-thread-worm.

The most used pressure angle is 20° although 14,5° is used as well in US market, and in what refers to radial cylindrical modules these are the most typical

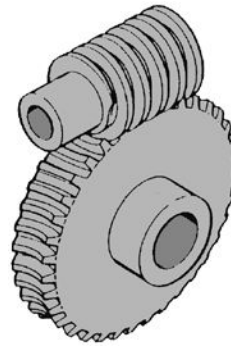
Worm gears allow very high ratios from 1:1 to 300:1. The number of worm threads have to be taken into consideration though, as a ratio of 50 is considered the maximum for a single threadworm.

They have a unique self-locking trait after the worm cannot be driven by the worm gear, thus the worm is always the driving unit of the pair.

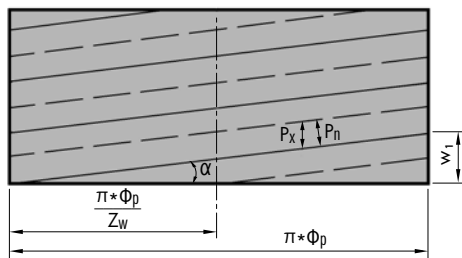
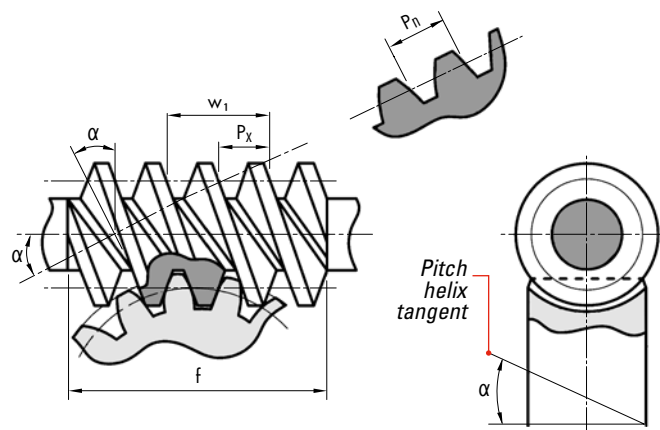
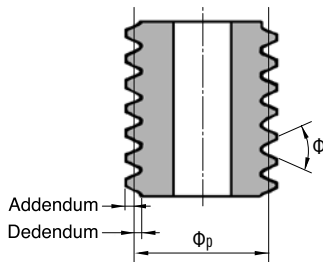
As the worm engages repeatedly the worm gear teeth, the friction action makes that the worm material has to be harder than the worm gear, which is made of brass or bronze alloy acting as a sacrificial unit of the pair.



One-start worm



Two-start worm



Φ_p : Pitch Diameter.

w_1 : Worm Lead.

P_n : Normal Pitch.

P_x : Axial Pitch.

α : Lead Angle.

f : Face length.

m_n : Normal Modul.

m_x : Axial Modul.

z_w : Number of threads (starts).
(2 in this figure)

m_n : $m_x \cos \alpha$.

P_x : πm_x .

w_1 : $\pi m_x z_w$.

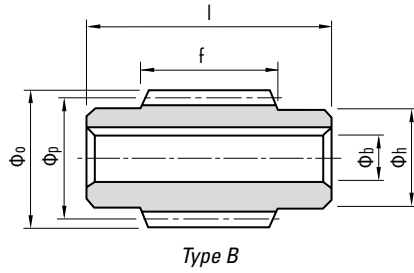
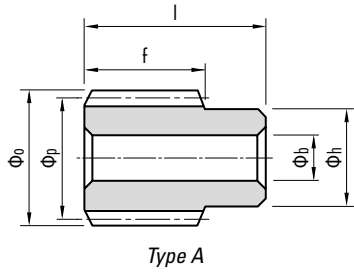
Worm. Pressure angle 20°

REFERENCE*	TYPE	STARTS	MODULE	OUTER DIA	PITCH DIA	HUB DIA	BORE DIA	FACE	LENGTH	LEAD ANGLE
				Φ_o	Φ_p	Φ_h	Φ_d	f	l	
TL-W-A1-1	A	1	1	18,00	16,00	15,85	6,00	15,50	32,00	3° 35'
TL-W-A2-1	A	1	1	18,00	16,00	15,85	6,00	15,00	32,00	7° 11'
TL-W-A1-2	A	2	2	35,00	31,00	25,00	12,00	35,00	50,00	3° 42'
TL-W-B1-2	B	2	2	35,00	31,00	25,00	14,00	41,00	65,00	3° 42'
TL-W-A2-2	B	2	2	35,00	31,00	25,00	14,00	41,00	65,00	7° 25'
TL-W-B2-2	B	2	2	35,00	31,00	25,00	14,00	41,00	50,00	7° 25'
TL-W-A1-3	A	3	3	50,00	44,00	36,00	16,00	50,00	70,00	3° 55'
TL-W-B1-3	B	3	3	50,00	44,00	36,00	20,00	55,00	85,00	3° 55'
TL-W-A2-3	A	3	3	50,00	44,00	36,00	16,00	50,00	70,00	7° 50'
TL-W-B2-3	B	3	3	50,00	44,00	36,00	20,00	55,00	85,00	7° 50'

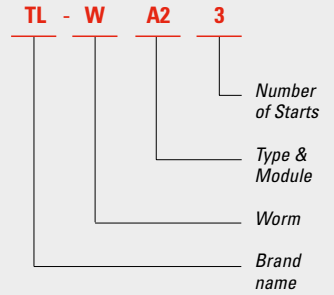
* All measures in mm unless otherwise indicated.

Right Hand direction of threads.

Meshing Gear has to match the hand sense and number of starts.



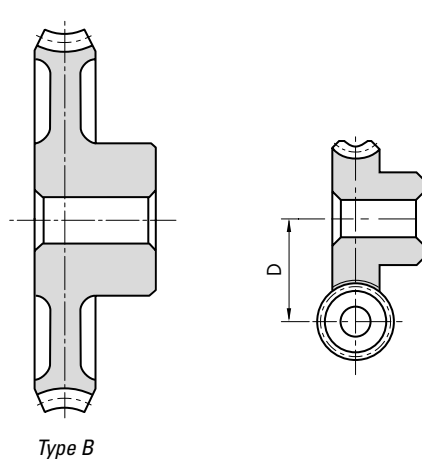
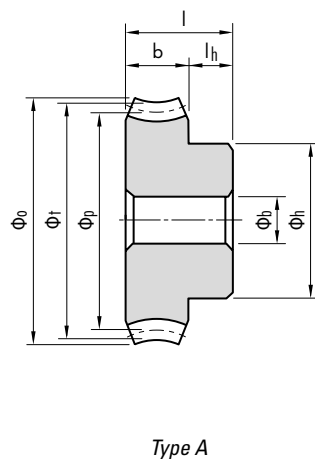
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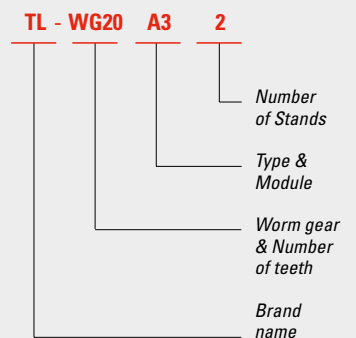
Worm Gear. Pressure angle 20°

REFERENCE*	TYPE	NUMBER OF TEETH	MODULE	PITCH DIA	GEAR RATIO	OUTER DIA	THROAT DIA	HUB DIA	BORE DIA	FACE	LENGTH	CENTER DISTANCE D
				Φ_p		Φ_o	Φ_t	Φ_h	Φ_d	f	l	
TL-WG30-A1	A	30	1	30	30	33	32	20	6	8	17	23
TL-WG40-A1	A	40	1	40	40	43	42	25	8	8	18	28
TL-WG50-A1	A	50	1	50	50	53	52	30	8	8	18	33
TL-WG60-B1	B	60	1	60	60	63	62	30	10	8	18	38
TL-WG80-B1	B	80	1	80	80	83	82	30	10	8	18	48
TL-WG100-B1	B	100	1	100	100	103	102	35	10	8	18	58
TL-WG20-A2	A	20	2	40	20	46,5	44	30	10	16	30	35,5
TL-WG20-A2-2	A	20	2	40	10	46,5	44	30	10	16	30	35,5
TL-WG25-A2	A	25	2	50	25	57	54	38	12	18	33	40,5
TL-WG30-A2	A	30	2	60	30	67	64	40	12	18	33	45,5
TL-WG30-A2-2	A	30	2	60	15	67	64	40	12	18	33	45,5
TL-WG40-B2	B	40	2	80	40	88	84	45	14	20	38	55,5
TL-WG50-B2	B	50	2	100	50	108	104	50	14	20	38	65,5
TL-WG60-B2	B	60	2	120	60	128	124	50	14	20	38	75,5
TL-WG80-B2	B	80	2	160	80	168	164	54	19	20	40	95,5
TL-WG100-B2	B	100	2	200	100	208	204	55	19	20	40	115,5
TL-WG20-A3	A	20	3	60	20	70	66	48	16	24	42	52
TL-WG20-A3-2	A	20	3	60	20	70	66	48	16	24	42	52
TL-WG25-A3	A	25	3	75	25	85	81	55	16	24	42	59,5
TL-WG30-A3	A	30	3	90	30	100	96	55	16	24	42	67
TL-WG30-A3-2	A	30	3	90	30	100	96	55	16	24	42	67
TL-WG40-B3	B	40	3	120	40	131	126	60	16	28	48	82

* All measures in mm unless otherwise indicated.
 Meshing worm has to match the hand sense and number of starts.



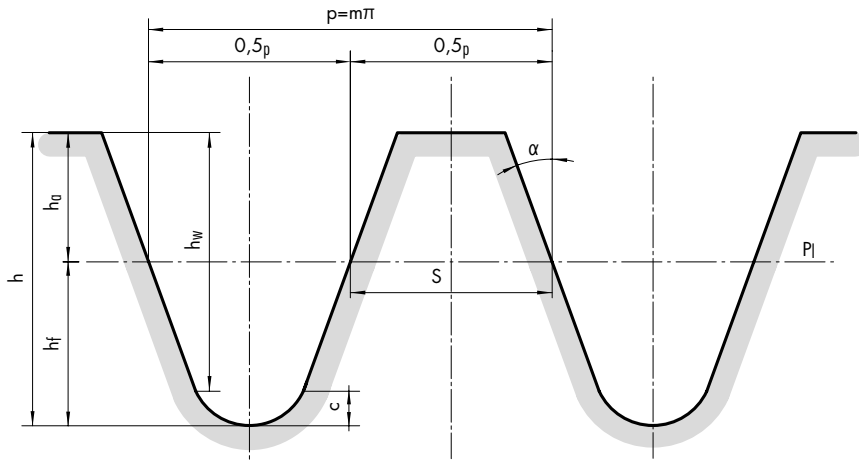
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GEAR RACKS

The internationally accepted standard for gear racks is the ISO metric. The Imperial system is based as in gears to the Diametral Pitch.

One can be converted into the other and can be used indistinctly.

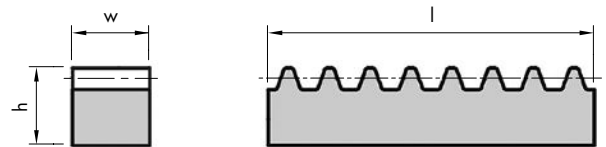


- Pj: Pitch Line.
- h₀: Addendum.
- h_f: Dedendum.
- h_w: Working Depth.
- p: Circular Pitch.
- h: Whole Depth.
- c: Clearance.
- r_f: Root Radii.
- s: Circular Tooth Thickness.

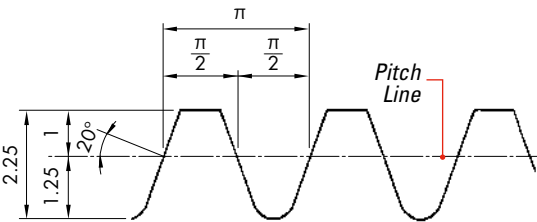
The basic metric rack is a rack with module 1, as defined in the Standard ISO 53 depicting its characteristics.

This basic rack tooth profile, normalized for module 1 looks as follows:

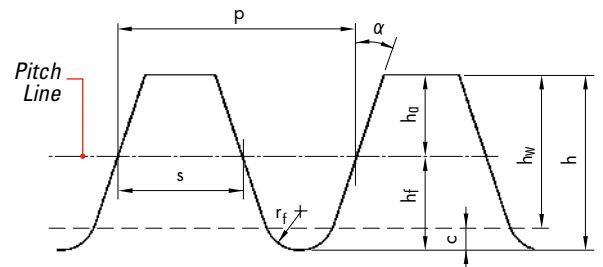
The tooth profile corresponds to an external gear with infinite number of teeth an infinite diameter:



- Addendum:** Equal to the module m or 1/p in the Imperial system.
- Dedendum:** Equal to 1,25 m, the same than Imperial system.
- Clearance:** 0,25 m.
- Pressure Angle:** 20°.
- Tooth form:** Straight side.



Basic Metric Rack, module 1



Basic Inch Diametral Pitch, Diametral Pitch 1

REFERENCE*	MODULE	PITCH	w * h	500		1000		2000		3000	
				N° teeth	l	N° teeth	l	N° teeth	l	N° teeth	l
TL-GR-15-1	1	3,1416	15 * 15	159	499,51	319	1002,17	637	2001,20	955	3000,23
TL-GR-17-1.5	1,5	4,7124	17 * 17	106	499,51	213	1003,74	425	2002,77	637	3001,8
TL-GR-20-2	2	6,2832	20 * 20	80	502,66	160	1005,31	319	2004,34	478	3003,37
TL-GR-25-2.5	2,5	7,854	25 * 25	64	502,66	128	1005,31	255	2002,77	382	3000,23
TL-GR-30-3	3	9,4248	30 * 30	53	499,51	107	1008,45	213	2007,48	319	3006,51
TL-GR-22-4	4	12,5664	22 * 22	40	502,66	80	1005,31	160	2010,62	239	3003,37
TL-GR-25-4	4	12,5664	25 * 25	40	502,66	80	1005,31	160	2010,62	239	3003,37
TL-GR-30-4	4	12,5664	30 * 30	40	502,66	80	1005,31	160	2010,62	239	3003,37
TL-GR-40-4	4	12,5664	40 * 40	40	502,66	80	1005,31	160	2010,62	239	3003,37
TL-GR-50-5	5	15,708	50 * 50	32	502,66	64	1005,31	128	2010,62	191	3000,23
TL-GR-60-6	6	18,8496	60 * 60	27	508,94	54	1017,88	107	2016,91		
TL-GR-80-8	8	25,1328	80 * 80	20	502,66	40	1005,31	80	2010,62		

* All measures in mm unless otherwise indicated. Standard lengths of 500, 1000 & 1500mm.



Our program covers straight tooting gear racks in modules of 1,5 to 6, 20° pressure angle and Helical tooting gear racks in modules from 1,5 to 6 with an angle of 19,528°, Right direction.

Under MTO we can deliver racks of 14,5° pressure angles, diametral pitch.

As far as materials, we offer Steel, Stainless Steel and Nylon.



Straight Spur Gear Rack



Helix Spur Gear Rack



Nylon Straight Spur Gear Rack

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