
Synchronous belt drives — Pulleys

Transmissions synchrones par courroies — Poulies

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 5294 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

This third edition cancels and replaces the second edition (ISO 5294:1989), which has been technically revised.

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Synchronous belt drives — Pulleys

1 Scope

This International Standard specifies the principal characteristics of synchronous pulleys for use in synchronous endless belt drives for mechanical power transmission and where positive indexing or synchronization is required.

NOTE These drives have been known under various names in the past, for example: timing belt drives, positive belt drives, gear belt drives.

The principal characteristics include:

- a) tooth dimensions and tolerances;
- b) pulley dimensions and tolerances;
- c) quality specification.

As far as dimensions are concerned, the pulleys specified in this International Standard are used interchangeably with the belts specified in ISO 5296.

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2 Normative references (standards.iteh.ai)

The following referenced documents are indispensable for the application 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 254, *Belt drives — Pulleys — Quality, finish and balance*

ISO 1101, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 5296, *Synchronous belt drives — Belts with pitch codes MXL, XXL, XL, L, H, XH and XXH — Metric and inch dimensions*

3 Tooth dimensions

3.1 Involute teeth

3.1.1 The involute tooth profile results in different dimensions for each pulley diameter. Therefore, to specify the involute tooth dimensions would require a very voluminous table. For this reason, as well as because of the difficulty in specifying the curved side of an involute tooth, dimensions are specified for the generating tool rack required to produce the involute tooth.

3.1.2 Dimensions and tolerances for the generating tool rack for synchronous pulleys with involute teeth are given in Table 1 and Figure 1.

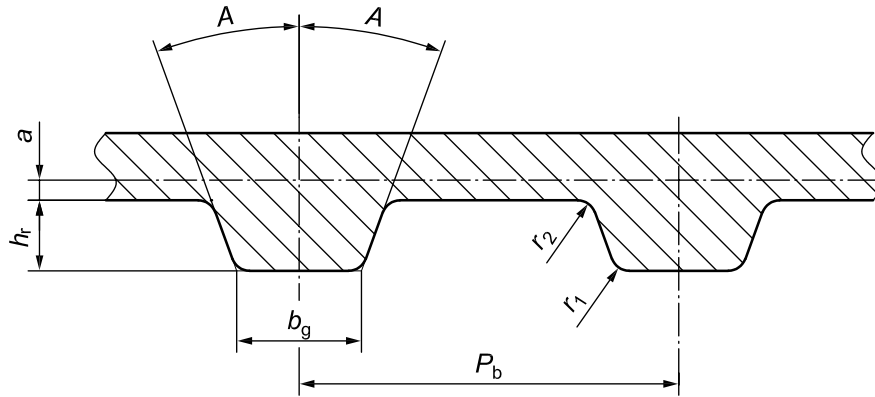


Figure 1 — Generating tool rack for pulleys with involute teeth

3.2 Straight-sided teeth

3.2.1 Involute teeth are normally recommended for synchronous belt drives. Since straight-sided teeth are in use, their specifications are also included.

3.2.2 Dimensions and tolerances for straight-sided teeth (see Figure 2) are given in Table 2.

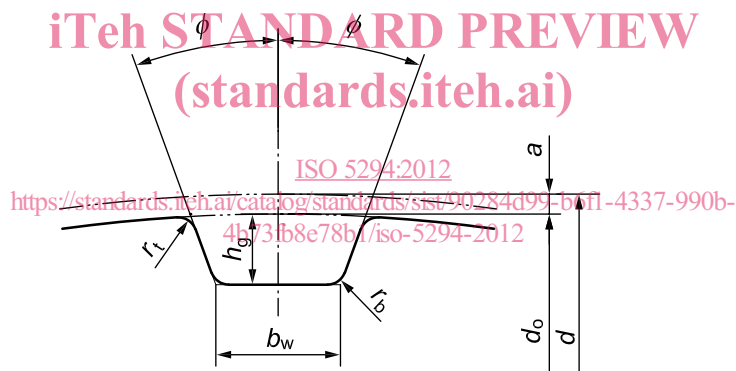


Figure 2 — Straight-sided teeth

3.3 Pitch-to-pitch tolerances

Tolerances on the amount of deviation of pitch between adjacent teeth, and on the summation of deviations within 90° arc of a pulley, are given in Table 3. This tolerance applies to the distance between the same point on either the right or left corresponding flanks of adjacent teeth.

Table 1 — Dimensions and tolerances for generating tool rack for pulleys with involute teeth

Pitch code	Number of teeth in pulley Z	P_b		A degrees $\pm 0,12$	h_r		b_g		r_1		r_2		$2a$	
		mm	in.		mm $+0,05$ 0	in. $+0,002$ 0	mm $+0,05$ 0	in. $+0,002$ 0	mm $\pm 0,03$	in. $\pm 0,001$	mm $\pm 0,03$	in. $\pm 0,001$	mm	in.
MXL	$10 \leq Z \leq 23$	$2,032$ $\pm 0,008$	$0,080$ $\pm 0,000\ 3$	28	0,64	0,025	0,61	0,024	0,30	0,012	0,23	0,009	0,508	0,020
	$Z \geq 24$			20			0,67	0,026 5						
XXL	$Z \geq 10$	$3,175$ $\pm 0,011$	$0,125$ $\pm 0,000\ 4$	25	0,84	0,033	0,96	0,038	0,30	0,012	0,28	0,011	0,508	0,020
XL	$Z \geq 10$	$5,080$ $\pm 0,011$	$0,200$ $\pm 0,000\ 4$	25	1,40	0,055	1,27	0,050	0,61	0,024	0,61	0,024	0,508	0,020
L	$Z \geq 10$	$9,525$ $\pm 0,012$	$0,375$ $\pm 0,000\ 5$	20	2,13	0,084	3,10	0,122	0,86	0,034	0,53	0,021	0,762	0,030
H	$14 \leq Z \leq 19$	$12,700$ $\pm 0,015$	$0,500$ $\pm 0,000\ 6$	20	2,59	0,102	4,24	0,167	1,47	0,058	1,04	0,041	1,372	0,054
	$Z \geq 20$										1,42	0,056		
XH	$Z \geq 18$	$22,225$ $\pm 0,019$	$0,875$ $\pm 0,000\ 7$	20	6,88	0,271	7,59	0,299	2,01	0,079	1,93	0,076	2,794	0,110
XXH	$Z \geq 18$	$31,750$ $\pm 0,025$	$1,250$ $\pm 0,001$	20	10,29	0,405	11,61	0,457	2,69	0,106	2,82	0,111	3,048	0,120

Table 2 — Dimensions and tolerances for pulleys with straight-sided teeth

Pitch code	b_w		h_g		ϕ degrees $\pm 1,5$	r_b max.		r_t		$2a$	
	mm	in.	mm	in.		mm	in.	mm	in.	mm	in.
MXL	0,84 $\pm 0,05$	0,033 $\pm 0,002$	0,69 $^0_{-0,05}$	0,027 $^0_{-0,002}$	20	0,25	0,010	0,13 $^{+0,05}_0$	0,005 $^{+0,002}_0$	0,508	0,020
XXL	0,96 $^{+0,05}_0$	0,038 $^{+0,002}_0$	0,84 $^0_{-0,05}$	0,033 $^0_{-0,002}$	25	0,35	0,014	0,30 $\pm 0,05$	0,012 $\pm 0,002$	0,508	0,020
XL	1,32 $\pm 0,05$	0,052 $\pm 0,002$	1,65 $^0_{-0,08}$	0,065 $^0_{-0,003}$	25	0,41	0,016	0,64 $^{+0,05}_0$	0,025 $^{+0,002}_0$	0,508	0,020
L	3,05 $\pm 0,10$	0,120 $\pm 0,004$	2,67 $^0_{-0,10}$	0,105 $^0_{-0,004}$	20	1,19	0,047	1,17 $^{+0,13}_0$	0,046 $^{+0,05}_0$	0,762	0,030
H	4,19 $\pm 0,13$	0,165 $\pm 0,005$	3,05 $^0_{-0,13}$	0,120 $^0_{-0,005}$	20	1,60	0,063	1,60 $^{+0,13}_0$	0,063 $^{+0,005}_0$	1,372	0,054
XH	7,90 $\pm 0,15$	0,311 $\pm 0,006$	7,14 $^0_{-0,13}$	0,281 $^0_{-0,005}$	20	1,98	0,078	2,39 $^{+0,13}_0$	0,094 $^{+0,005}_0$	2,794	0,110
XXH	12,17 $\pm 0,18$	0,479 $\pm 0,007$	10,31 $^0_{-0,13}$	0,406 $^0_{-0,005}$	20	3,96	0,156	3,18 $^{+0,13}_0$	0,125 $^{+0,005}_0$	3,048	0,120

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Table 3 — Pitch-to-pitch tolerances

Outside diameter d_o		Allowable deviation of pitch			
		Between any two adjacent teeth		Summation within a 90° arc	
mm	in.	mm	in.	mm	in.
$d_o \leq 25,4$	$d_o \leq 1$	0,03	0,001	0,05	0,002
$25,4 < d_o \leq 50,8$	$1 < d_o \leq 2$	0,03	0,001	0,08	0,003
$50,8 < d_o \leq 101,6$	$2 < d_o \leq 4$	0,03	0,001	0,10	0,004
$101,6 < d_o \leq 177,8$	$4 < d_o \leq 7$	0,03	0,001	0,13	0,005
$177,8 < d_o \leq 304,8$	$7 < d_o \leq 12$	0,03	0,001	0,15	0,006
$304,8 < d_o \leq 508,0$	$12 < d_o \leq 20$	0,03	0,001	0,18	0,007
$508,0 < d_o$	$20 < d_o$	0,03	0,001	0,20	0,008

4 Pulley dimensions

All geometric tolerancing references are as defined in ISO 1101.

4.1 Pulley width

The pulley width designation and the minimum actual pulley width required, b_f for flanged pulleys, and b_f' for unflanged pulleys (see Figure 3) are given in Table 4.

Users are advised that the values given for b_f apply also to pulleys with only one flange.

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Table 4 — Pulley widths

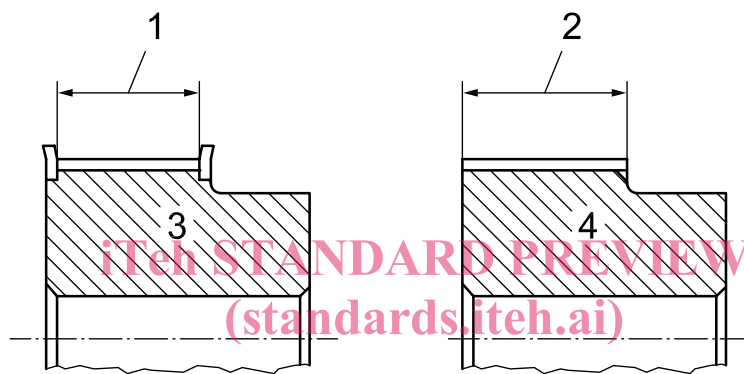
Pitch code	Pulley width designation		Minimum flanged pulley width b_f		Minimum unflanged pulley width b_f' ^a	
	Metric dimensions	Inch (Imperial) dimensions	mm	in.	mm	in.
MXL	3,2	012	3,8	0,15	5,6	0,22
	4,8	019	5,3	0,21	7,1	0,28
	6,4	025	7,1	0,28	8,9	0,35
XXL	3,2	012	3,8	0,15	5,6	0,22
	4,8	019	5,3	0,21	7,1	0,28
	6,4	025	7,1	0,28	8,9	0,35
XL		025	7,1	0,28	8,9	0,35
		031	8,6	0,34	10,4	0,41
		037	10,4	0,41	12,2	0,48
L		050	14,0	0,55	17,0	0,67
		075	20,3	0,80	23,3	0,92
		100	26,7	1,05	29,7	1,17
H		075	20,3	0,80	24,8	0,98
		100	26,7	1,05	31,2	1,23
		150	39,4	1,55	43,9	1,73
		200	52,8	2,08	57,3	2,26
		300	79,0	3,11	83,5	3,29

^a The minimum unflanged pulley width, b_f' , may be reduced when the alignment of the drive can be controlled, but shall not be less than the minimum flanged pulley width, b_f .

Table 4 (continued)

Pitch code	Pulley width designation		Minimum flanged pulley width b_f		Minimum unflanged pulley width b'_f ^a	
	Metric dimensions	Inch (Imperial) dimensions	mm	in.	mm	in.
XH		200	56,6	2,23	62,6	2,46
		300	83,8	3,30	89,8	3,54
		400	110,7	4,36	116,7	4,59
XXH		200	56,6	2,23	64,1	2,52
		300	83,8	3,30	91,3	3,59
		400	110,7	4,36	118,2	4,65
		500	137,7	5,42	145,2	5,72

^a The minimum unflanged pulley width, b'_f , may be reduced when the alignment of the drive can be controlled, but shall not be less than the minimum flanged pulley width, b_f .



Key

- 1 b_f
- 2 b'_f
- 3 flanged pulley
- 4 unflanged pulley

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Figure 3 — Minimum pulley width

4.2 Pulley diameter

4.2.1 Pulley diameters are given in Table 5.

Table 5 — (1 of 3)— Pulley diameters

Number of teeth ^a	Pulley diameter											
	Pitch code MXL				Pitch code XXL				Pitch code XL			
	Pitch diameter		Outside diameter		Pitch diameter		Outside diameter		Pitch diameter		Outside diameter	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
10	6,47	0,255	5,96	0,235	10,11	0,398	9,60	0,378	16,17	0,637	15,66	0,617
11	7,11	0,280	6,61	0,260	11,12	0,438	10,61	0,418	17,79	0,700	17,28	0,680
12	7,76	0,306	7,25	0,286	12,13	0,478	11,62	0,457	19,40	0,764	18,90	0,744
13	8,41	0,331	7,90	0,311	13,14	0,517	12,63	0,497	21,02	0,828	20,51	0,808
14	9,06	0,357	8,55	0,337	14,15	0,557	13,64	0,537	22,64	0,891	22,13	0,871
15	9,70	0,382	9,19	0,362	15,16	0,597	14,65	0,577	24,26	0,955	23,75	0,935
16	10,35	0,407	9,84	0,387	16,17	0,637	15,66	0,617	25,87	1,019	25,36	0,999
17	11,00	0,433	10,49	0,413	17,18	0,676	16,67	0,656	27,49	1,082	26,98	1,062
18	11,64	0,458	11,13	0,438	18,19	0,716	17,68	0,696	29,11	1,146	28,60	1,126
19	12,29	0,484	11,78	0,464	19,20	0,756	18,69	0,736	30,72	1,210	30,22	1,190
20	12,94	0,509	12,43	0,489	20,21	0,796	19,70	0,776	32,34	1,273	31,83	1,253
(21)	13,58	0,535	13,07	0,515	21,22	0,836	20,72	0,816	33,96	1,337	33,45	1,317
22	14,23	0,560	13,72	0,540	22,23	0,875	21,73	0,855	35,57	1,401	35,07	1,381
(23)	14,88	0,586	14,37	0,566	23,24	0,915	22,74	0,895	37,19	1,464	36,68	1,444
(24)	15,52	0,611	15,02	0,591	24,26	0,955	23,75	0,935	38,81	1,528	38,30	1,508
25	16,17	0,637	15,66	0,617	25,27	0,995	24,76	0,975	40,43	1,592	39,92	1,572
(26)	16,82	0,662	16,31	0,642	26,28	1,035	25,77	,015	42,04	1,655	41,53	1,635
(27)	17,46	0,688	16,96	0,668	27,29	1,074	26,78	1,054	43,66	1,719	43,15	1,699
28	18,11	0,713	17,60	0,693	28,30	1,114	27,79	1,094	45,28	1,783	44,77	1,763
(30)	19,40	0,764	18,90	0,744	30,32	1,194	29,81	1,174	48,51	1,910	48,00	1,890
32	20,70	0,815	20,19	0,795	32,34	1,273	31,83	1,253	51,74	2,037	51,24	2,017
36	23,29	0,917	22,78	0,897	36,38	1,432	35,87	1,412	58,21	2,292	57,70	2,272
40	25,87	1,019	25,36	0,999	40,43	1,592	39,92	1,572	64,68	2,546	64,17	2,526
48	31,05	1,222	30,54	1,202	48,51	1,910	48,00	1,890	77,62	3,056	77,11	3,036
60	38,81	1,528	38,30	1,508	60,64	2,387	60,13	2,367	97,02	3,820	96,51	3,800
72	46,57	1,833	46,06	1,813	72,77	2,865	72,26	2,845	116,43	4,584	115,92	4,564
84												
96												
120												
156												

^a Values for number of teeth in brackets are listed for information only and should be regarded as non-preferred sizes.