INTERNATIONAL STANDARD

**ISO
5294**

Second edition
1989-07-15

Synchronous belt drives — Pulleys

Transmissions synchrones par courroies — Poulies

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5294 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*.

The second edition cancels and replaces the first edition (ISO 5294 : 1979), of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

Synchronous belt drives — Pulleys

1 Scope

This International Standard specifies the principal characteristics of synchronous pulleys for use in synchronous endless belt drives[1] for mechanical power transmission and where positive indexing or synchronization may be required.

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, for pitch code MXL, may be used interchangeably with the belts specified in ISO 5296-1 and ISO 5296-2.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 254 : 1981, *Quality, finish and balance of transmission pulleys.*

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.

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1) These drives have been known under various names in the past, for example : timing belt drives, positive belt drives, gear belt drives.
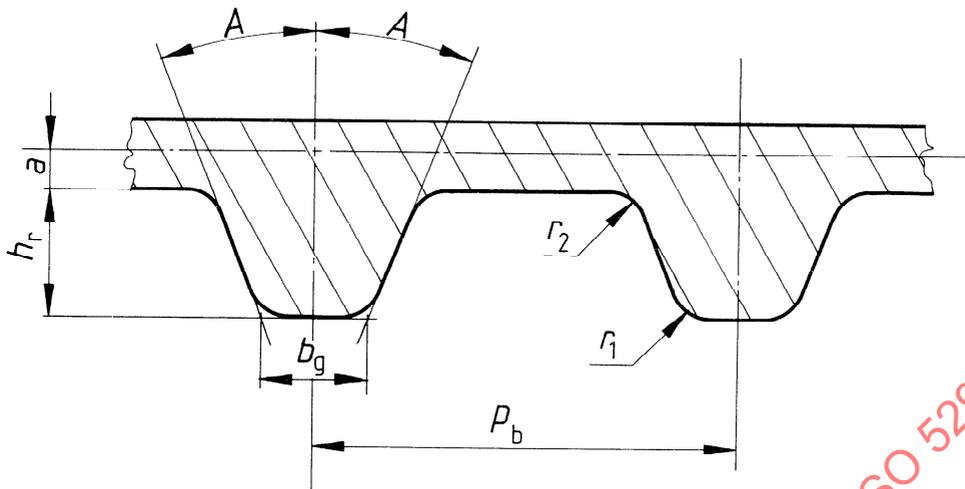
Figure 1 — Generating tool rack for pulleys with involute teeth

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

Pitch code	Number of teeth in pulley z	p_b mm ± 0,003	p_b in ± 0,000 1	A degrees ± 0,12	h_r mm +0,05/0	h_r in +0,002/0	b_g mm +0,05/0	b_g in +0,002/0	r_1 mm ± 0,03	r_1 in ± 0,001	r_2 mm ± 0,03	r_2 in ± 0,001	$2a$ mm	$2a$ in
MXL	$10 \leqslant z \leqslant 23$	2,032	0,08	28	0,64	0,025	0,61	0,024	0,3	0,012	0,23	0,009	0,508	0,02
	$z \geqslant 24$			20			0,67	0,026 5						
XXL	$z \geqslant 10$	3,175	0,125	25	0,84	0,033	0,96	0,038	0,3	0,012	0,28	0,011	0,508	0,02
XL	$z \geqslant 10$	5,08	0,2	25	1,4	0,055	1,27	0,05	0,61	0,024	0,61	0,024	0,508	0,02
L	$z \geqslant 10$	9,525	0,375	20	2,13	0,084	3,1	0,122	0,86	0,034	0,53	0,021	0,762	0,03
H	$14 \leqslant z \leqslant 19$	12,7	0,5	20	2,59	0,102	4,24	0,167	1,47	0,058	1,04	0,041	1,372	0,054
	$z > 19$										1,42	0,056		
XH	$z \geqslant 18$	22,225	0,875	20	6,88	0,271	7,59	0,299	2,01	0,079	1,93	0,076	2,794	0,11
XXH	$z \geqslant 18$	31,75	1,25	20	10,29	0,405	11,61	0,457	2,69	0,106	2,82	0,111	3,048	0,12

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.

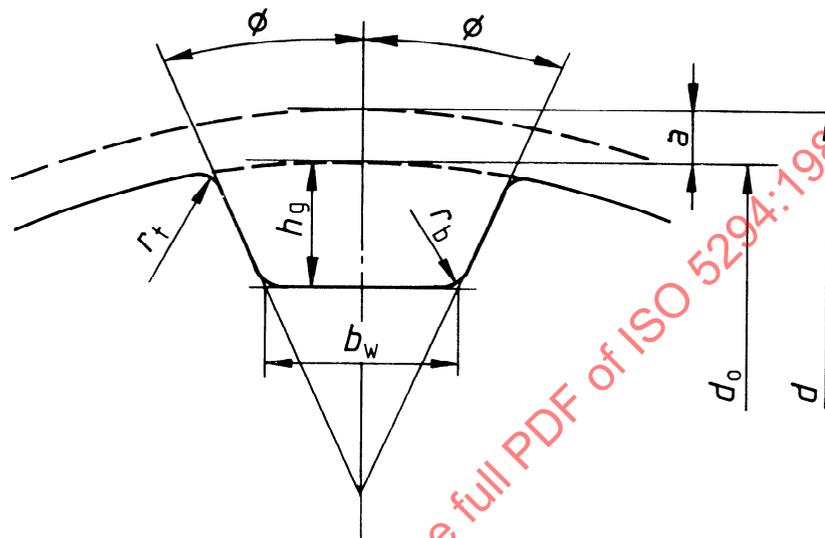**3.2.2** Dimensions and tolerances for straight-sided teeth (see figure 2) are given in table 2.

Figure 2 — Straight-sided teeth

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	0,01	$0,13 \, {}^{+0,05}_{0}$	$0,005 \, {}^{+0,002}_{0}$	0,508	0,02
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	$0,3 \pm 0,05$	$0,012 \pm 0,002$	0,508	0,02
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	0,02
L	$3,05 \pm 0,1$	$0,12 \pm 0,004$	$2,67 \, {}^{0}_{-0,10}$	$0,105 \, {}^{0}_{-0,004}$	20	1,19	0,047	$1,17 \, {}^{+0,13}_{0}$	$0,046 \, {}^{+0,005}_{0}$	0,762	0,03
H	$4,19 \pm 0,13$	$0,165 \pm 0,005$	$3,05 \, {}^{0}_{0,13}$	$0,12 \, {}^{0}_{-0,005}$	20	1,6	0,063	$1,6 \, {}^{+0,13}_{0}$	$0,063 \, {}^{+0,005}_{0}$	1,372	0,054
XH	$7,9 \pm 0,15$	$0,311 \pm 0,006$	$7,14 \, {}^{0}_{-0,13}$	$0,281 \, {}^{0}_{-0,005}$	20	1,98	0,078	$2,39 \, {}^{+0,13}_{0}$	$0,094 \, {}^{+0,005}_{0}$	2,794	0,11
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	0,12

3.3 Pitch-to-pitch tolerances

Tolerances on the amount of deviation of belt 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 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
$d_o \leqslant 25,4$	$d_o \leqslant 1$	0,03	0,001	0,05	0,002
$25,4 < d_o \leqslant 50,8$	$1 < d_o \leqslant 2$	0,03	0,001	0,08	0,003
$50,8 < d_o \leqslant 101,6$	$2 < d_o \leqslant 4$	0,03	0,001	0,1	0,004
$101,6 < d_o \leqslant 177,8$	$4 < d_o \leqslant 7$	0,03	0,001	0,13	0,005
$177,8 < d_o \leqslant 304,8$	$7 < d_o \leqslant 12$	0,03	0,001	0,15	0,006
$304,8 < d_o \leqslant 508$	$12 < d_o \leqslant 20$	0,03	0,001	0,18	0,007
$d_o > 508$	$d_o > 20$	0,03	0,001	0,2	0,008

4 Pulley dimensions

4.1 Pulley width

The pulley width designation, the nominal pulley width, and the minimum actual pulley width required, b_f for flanged pulleys, 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.

4.2 Pulley diameter

4.2.1 Pulley diameters are given in table 5.

Table 4 — Pulley widths

Pitch code	Pulley width designation	Nominal pulley width		Minimum flanged pulley width b_f		Minimum unflanged pulley width b_f'	
		mm	in	mm	in	mm	in
MXL	012	3,2	0,12	3,8	0,15	5,6	0,22
	019	4,8	0,18	5,3	0,21	7,1	0,28
	025	6,4	0,25	7,1	0,28	8,9	0,35
XXL	012	3,2	0,12	3,8	0,15	5,6	0,22
	019	4,8	0,18	5,3	0,21	7,1	0,28
	025	6,4	0,25	7,1	0,28	8,9	0,35
XL	025	6,4	0,25	7,1	0,28	8,9	0,35
	031	7,9	0,31	8,6	0,34	10,4	0,41
	037	9,5	0,37	10,4	0,41	12,2	0,48
L	050	12,7	0,5	14	0,55	17	0,67
	075	19,1	0,75	20,3	0,8	23,3	0,92
	100	25,4	1	26,7	1,05	29,7	1,17
H	075	19,1	0,75	20,3	0,8	24,8	0,98
	100	25,4	1	26,7	1,05	31,2	1,23
	150	38,1	1,5	39,4	1,55	43,9	1,73
	200	50,8	2	52,8	2,08	57,3	2,26
	300	76,2	3	79	3,11	83,5	3,29
XH	200	50,8	2	56,6	2,23	62,6	2,46
	300	76,2	3	83,8	3,3	89,8	3,54
	400	101,6	4	110,7	4,36	116,7	4,59
XXH	200	50,8	2	56,6	2,23	64,1	2,52
	300	76,2	3	83,8	3,3	91,3	3,59
	400	101,6	4	110,7	4,36	118,2	4,65
	500	127	5	137,7	5,42	145,2	5,72

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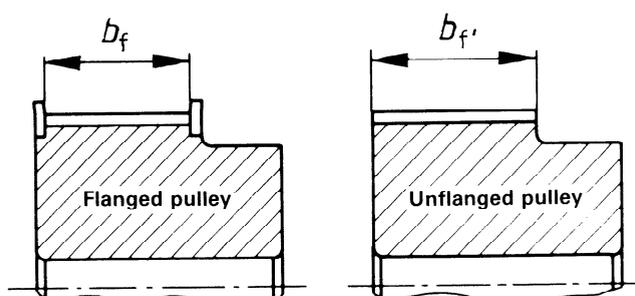

Figure 3 — Minimum pulley width

Table 5 — Pulley diameters

Number of teeth [1]	Pulley diameters											
	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	9,6	0,378	16,17	0,637	15,66	0,617
11	7,11	0,28	6,61	0,26	11,12	0,438	10,61	0,418	17,79	0,7	17,28	0,68
12	7,76	0,306	7,25	0,286	12,13	0,478	11,62	0,458	19,4	0,764	18,9	0,744
13	8,41	0,331	7,9	0,311	13,14	0,517	12,63	0,497	21,02	0,828	20,51	0,808
14	9,06	0,357	8,56	0,337	14,15	0,557	13,64	0,537	22,64	0,891	22,13	0,871
15	9,7	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	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	28,6	1,126
19	12,29	0,484	11,78	0,464	19,2	0,756	18,69	0,736	30,72	1,21	30,22	1,19
20	12,94	0,509	12,43	0,489	20,21	0,796	19,7	0,776	32,34	1,273	31,83	1,253
(21)	13,58	0,535	13,07	0,515	21,22	0,835	20,72	0,815	33,96	1,337	33,45	1,317
22	14,23	0,56	13,72	0,54	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	38,3	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	1,015	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	17,6	0,693	28,3	1,114	27,79	1,094	45,28	1,783	44,77	1,763
(30)	19,4	0,764	18,9	0,744	30,32	1,194	29,81	1,174	48,51	1,91	48	1,89
32	20,7	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	57,7	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	1,91	48	1,89	77,62	3,056	77,11	3,036
60	38,81	1,528	38,3	1,508	60,64	2,387	60,13	2,367	97,02	3,820	96,51	3,8
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												

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

Pulley diameters															
Pitch code L				Pitch code H				Pitch code XH				Pitch code XXH			
Pitch diameter		Outside diameter		Pitch diameter		Outside diameter		Pitch diameter		Outside diameter		Pitch diameter		Outside diameter	
mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
30,32	1,194	29,56	1,164												
33,35	1,313	32,59	1,283												
36,38	1,432	35,62	1,402												
39,41	1,552	38,65	1,522												
42,45	1,671	41,68	1,641	56,6	2,228	55,22	2,174								
45,48	1,79	44,72	1,76	60,64	2,387	59,27	2,333								
48,51	1,91	47,75	1,88	64,68	2,546	63,31	2,492								
51,54	2,029	50,78	1,999	68,72	2,706	67,35	2,652								
54,57	2,149	53,81	2,119	72,77	2,865	71,39	2,811	127,34	5,013	124,55	4,903				
57,61	2,268	56,84	2,238	76,81	3,024	75,44	2,97	134,41	5,292	131,62	5,182				
60,64	2,387	59,88	2,357	80,85	3,183	79,48	3,129	141,49	5,57	138,69	5,46	202,13	7,958	199,08	7,838
63,67	2,507	62,91	2,477	84,89	3,342	83,52	3,288	148,56	5,849	145,77	5,739	212,23	8,356	209,18	8,236
66,7	2,626	65,94	2,596	88,94	3,501	87,56	3,447	155,64	6,127	152,84	6,017	222,34	8,754	219,29	8,634
69,73	2,745	68,97	2,715	92,98	3,661	91,61	3,607	162,71	6,406	159,92	6,296	232,45	9,151	229,4	9,031
72,77	2,865	72	2,835	97,02	3,82	95,65	3,766	169,79	6,685	166,99	6,575	242,55	9,549	239,5	9,429
75,8	2,984	75,04	2,954	101,06	3,979	99,69	3,925	176,86	6,963	174,07	6,853	252,66	9,947	249,61	9,827
78,83	3,104	78,07	3,074	105,11	4,138	103,73	4,084	183,94	7,242	181,14	7,132	262,76	10,345	259,72	10,225
81,86	3,223	81,1	3,193	109,15	4,297	107,78	4,243	191,01	7,52	188,22	7,41	272,87	10,743	269,82	10,623
84,89	3,342	84,13	3,312	113,19	4,456	111,82	4,402	198,08	7,799	195,29	7,689	282,98	11,141	279,93	11,021
90,96	3,581	90,2	3,551	121,28	4,775	119,9	4,721	212,23	8,356	209,44	8,246	303,19	11,937	300,14	11,817
97,02	3,82	96,26	3,79	129,36	5,093	127,99	5,039	226,38	8,913	223,59	8,803	323,4	12,732	320,35	12,612
109,15	4,297	108,39	4,267	145,53	5,73	144,16	5,676	254,68	10,027	251,89	9,917	363,83	14,324	360,78	14,204
121,28	4,775	120,51	4,745	161,7	6,366	160,33	6,312	282,98	11,141	280,18	11,031	404,25	15,915	401,21	15,795
145,53	5,73	144,77	5,7	194,04	7,639	192,67	7,585	339,57	13,369	336,78	13,259	485,1	19,099	482,06	18,979
181,91	7,162	181,15	7,132	242,55	9,549	241,18	9,495	424,47	16,711	421,67	16,601	606,38	23,873	603,33	23,753
218,3	8,594	217,53	8,564	291,06	11,459	289,69	11,405	509,36	20,054	506,57	19,944	727,66	28,648	724,61	28,528
254,68	10,027	253,92	9,997	339,57	13,369	338,2	13,315	594,25	23,396	591,46	23,286	848,93	33,423	845,88	33,303
291,06	11,459	290,3	11,429	388,08	15,279	386,71	15,225	679,15	26,738	676,35	26,628	970,21	38,197	967,16	38,077
363,83	14,324	363,07	14,294	485,1	19,099	483,73	19,045	848,93	33,423	846,14	33,313	1212,76	47,746	1209,71	47,626
				630,64	24,828	629,26	24,774								