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

Transmissions synchrones par courroies — Courroies de symboles de pas MXL, XXL, XL, L, H, XH et XXH — Dimensions métriques et en inches

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Foreword

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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.

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ISO 5296 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

This second edition of ISO 5296 cancels and replaces the first editions of ISO 5296-1:1989 and ISO 5296-2:1989.

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

1 Scope

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

NOTE Synchronous belt drives have been known by various titles, for example timing belt drives, positive belt drives, and gear belt drives.

The principal characteristics include:

a) nominal tooth dimensions;

b) length and width dimensions;

c) tolerances on these dimensions;

d) length-measurement specifications.

This International Standard is applicable to synchronous belt drives with pitch codes MXL, XXL, XL, L, H, XH and XXH, in both metric and inch dimensions.

2 Pitch codes

The pitch codes and the corresponding belt pitches are given in Table 1.

Table 1 — Pitch codes

Pitch code	Belt pitch[a]	
	mm	in
MXL	2,032	0,080
XXL	3,175	0,125
XL	5,080	0,200
L	9,525	0,375
H	12,700	0,500
XH	22,225	0,875
XXH	31,750	1,250

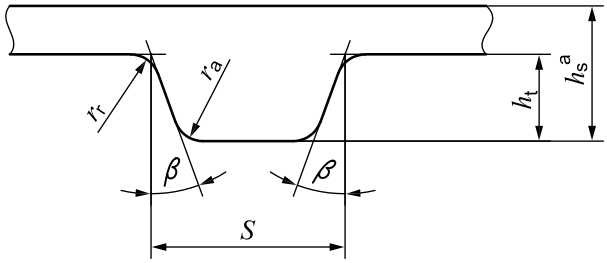
[a] Carried to the third decimal place because belt pitch is a defined value.

3 Dimensions and tolerances

3.1 Tooth dimensions

The nominal belt tooth dimensions are the same for one-sided and double-sided belts; they are given in Table 2 and are shown in Figures 1, 2 and 3.

Two types of double-sided synchronous belts are standardized. Type A (see Figure 2) has symmetrical teeth and Type B (see Figure 3) has staggered teeth.



[a] See Table 5.

Figure 1 — Tooth profile, one-sided

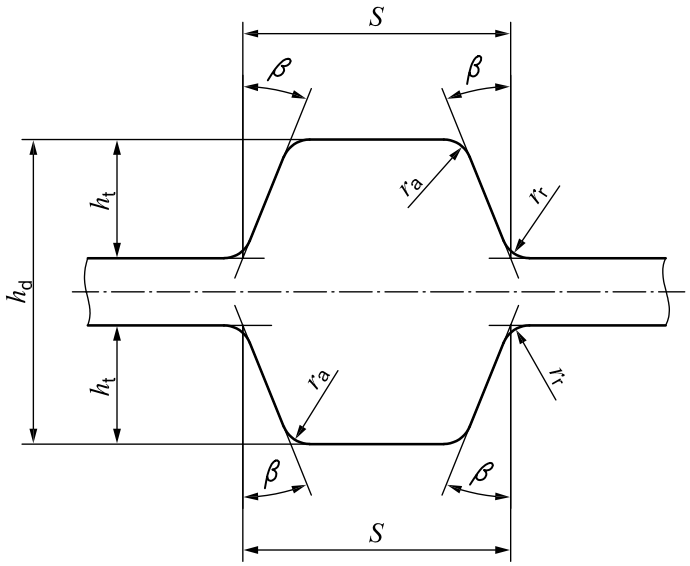


Figure 2 — Tooth profile, double-sided — Type A

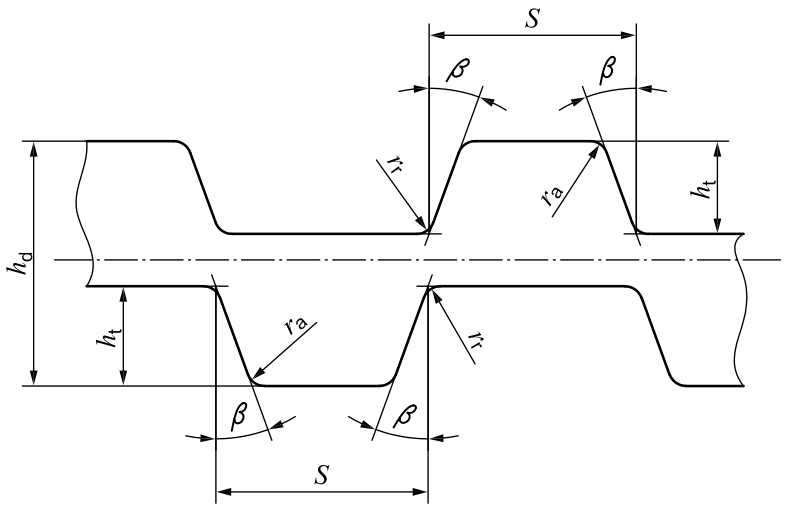


Figure 3 — Tooth profile, double-sided — Type B

Table 2 — Nominal tooth dimensions

Pitch code	2β degrees	s		h_t		r_r		r_a	
		mm	in	mm	in	mm	in	mm	in
MXL	40	1,14	0,045	0,51	0,02	0,13	0,005	0,13	0,005
XXL	50	1,73	0,068	0,76	0,03	0,2	0,008	0,3	0,012
XL	50	2,57	0,101	1,27	0,05	0,38	0,015	0,38	0,015
L	40	4,65	0,183	1,91	0,075	0,51	0,020	0,51	0,02
H	40	6,12	0,241	2,29	0,09	1,02	0,040	1,02	0,04
XH	40	12,57	0,495	6,35	0,25	1,57	0,062	1,19	0,047
XXH	40	19,05	0,750	9,53	0,375	2,29	0,090	1,52	0,06

3.2 Belt pitch lengths and tolerances

3.2.1 Single-sided belts

The belt pitch lengths and tolerances are given in Tables 3 and 4.

Table 3 — Pitch lengths and tolerances — XL, L, H, XH, XXH belt sections

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths				
	mm	in	mm	in	XL (0,200)	L (0,375)	H (0,500)	XH (0,875)	XXH (1,250)
60	152,40	6,000	±0,41	±0,016	30				
70	177,80	7,000	±0,41	±0,016	35				
80	203,20	8,000	±0,41	±0,016	40				
90	228,60	9,000	±0,41	±0,016	45				
100	254,00	10,000	±0,41	±0,016	50				
110	279,40	11,000	±0,46	±0,018	55				
120	304,80	12,000	±0,46	±0,018	60				
124	314,33	12,375	±0,46	±0,018		33			
130	330,20	13,000	±0,46	±0,018	65				
140	355,60	14,000	±0,46	±0,018	70				
150	381,00	15,000	±0,46	±0,018	75	40			
160	406,40	16,000	±0,51	±0,020	80				
170	431,80	17,000	±0,51	±0,020	85				
180	457,20	18,000	±0,51	±0,020	90				
187	476,25	18,750	±0,51	±0,020		50			
190	482,60	19,000	±0,51	±0,020	95				
200	508,00	20,000	±0,51	±0,020	100				
210	533,40	21,000	±0,61	±0,024	105	56			
220	558,80	22,000	±0,61	±0,024	110				
225	571,50	22,500	±0,61	±0,024		60			

Table 3 *(continued)*

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths				
	mm	in	mm	in	XL (0,200)	L (0,375)	H (0,500)	XH (0,875)	XXH (1,250)
230	584,20	23,000	±0,61	±0,024	115				
240	609,60	24,000	±0,61	±0,024	120	64	48		
250	635,00	25,000	±0,61	±0,024	125				
255	647,70	25,500	±0,61	±0,024		68			
260	660,40	26,000	±0,61	±0,024	130				
270	685,80	27,000	±0,61	±0,024		72	54		
285	723,90	28,500	±0,61	±0,024		76			
300	762,00	30,000	±0,61	±0,024		80	60		
322	819,15	32,250	±0,66	±0,026		86			
330	838,20	33,000	±0,66	±0,026			66		
345	876,30	34,500	±0,66	±0,026		92			
360	914,40	36,000	±0,66	±0,026			72		
367	933,45	36,750	±0,66	±0,026		98			
390	990,60	39,000	±0,66	±0,026		104	78		
420	1 066,80	42,000	±0,76	±0,030		112	84		
450	1 143,00	45,000	±0,76	±0,030		120	90		
480	1 219,20	48,000	±0,76	±0,030		128	96		
507	1 289,05	50,750	±0,81	±0,032				58	
510	1 295,40	51,000	±0,81	±0,032		136	102		
540	1 371,60	54,000	±0,81	±0,032		144	108		
560	1 422,40	56,000	±0,81	±0,032				64	
570	1 447,80	57,000	±0,81	±0,032			114		
600	1 524,00	60,000	±0,81	±0,032		160	120		
630	1 600,20	63,000	±0,86	±0,034			126	72	
660	1 676,40	66,000	±0,86	±0,034			132		
700	1 778,00	70,000	±0,86	±0,034			140	80	56
750	1 905,00	75,000	±0,91	±0,036			150		
770	1 955,80	77,000	±0,91	±0,036				88	
800	2 032,00	80,000	±0,91	±0,036			160		64
840	2 133,60	84,000	±0,97	±0,038				96	
850	2 159,00	85,000	±0,97	±0,038			170		
900	2 286,00	90,000	±0,97	±0,038			180		72
980	2 489,20	98,000	±1,02	±0,040				112	
1000	2 540,00	100,000	±1,02	±0,040			200		80
1100	2 794,00	110,000	±1,07	±0,042			220		

Table 3 *(continued)*

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths				
	mm	in	mm	in	XL (0,200)	L (0,375)	H (0,500)	XH (0,875)	XXH (1,250)
1120	2 844,80	112,000	±1,12	±0,044				128	
1200	3 048,00	120,000	±1,12	±0,044					96
1250	3 175,00	125,000	±1,17	±0,046			250		
1260	3 200,40	126,000	±1,17	±0,046				144	
1400	3 556,00	140,000	±1,22	±0,048			280	160	112
1540	3 911,60	154,000	±1,32	±0,052				176	
1600	4 064,00	160,000	±1,32	±0,052					128
1700	4 318,00	170,000	±1,37	±0,054			340		
1750	4 445,00	175,000	±1,42	±0,056				200	
1800	4 572,00	180,000	±1,42	±0,056					144

Table 4 — Pitch lengths and tolerances — MXL and XXL belt sections

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths	
	mm	in	mm	in	MXL	XXL
36,0	91,44	3,600	±0,41	±0,016	45	
40,0	101,60	4,000	±0,41	±0,016	50	
44,0	111,76	4,400	±0,41	±0,016	55	
48,0	121,92	4,800	±0,41	±0,016	60	
50,0	127,00	5,000	±0,41	±0,016		40
56,0	142,24	5,600	±0,41	±0,016	70	
60,0	152,40	6,000	±0,41	±0,016	75	48
64,0	162,56	6,400	±0,41	±0,016	80	
70,0	177,80	7,000	±0,41	±0,016		56
72,0	182,88	7,200	±0,41	±0,016	90	
80,0	203,20	8,000	±0,41	±0,016	100	64
88,0	223,52	8,800	±0,41	±0,016	110	
90,0	228,60	9,000	±0,41	±0,016		72
100,0	254,00	10,000	±0,41	±0,016	125	80
110,0	279,40	11,000	±0,46	±0,018		88
112,0	284,48	11,200	±0,46	±0,018	140	
120,0	304,80	12,000	±0,46	±0,018		96
124,0	314,96	12,400	±0,46	±0,018	155	
130,0	330,20	13,000	±0,46	±0,018		104
140,0	355,60	14,000	±0,46	±0,018	175	112
150,0	381,00	15,000	±0,46	±0,018		120
160,0	406,40	16,000	±0,51	±0,020	200	128
180,0	457,20	18,000	±0,51	±0,020		144
200,0	508,00	20,000	±0,51	±0,020	225	160
220,0	558,80	22,000	±0,61	±0,024	250	176

3.2.2 Double-sided belts

The nominal belt lengths for the double-sided belts are the same as those listed in Tables 3 and 4 for the single-sided belts. The positive length tolerance is equal to one and a half times the tolerance of the equivalent single-sided belt. The negative tolerance is equal to two times the tolerance of the equivalent single-sided belt.

3.3 Widths and heights

The belt widths and tolerances are given in Table 5. The nominal heights for single-sided belts are also given in Table 5, while the nominal heights for double-sided belts are given in Table 6.

Table 5 — Widths and heights — Single-sided belts

Pitch code	Nominal height[a] h_s		Width			Tolerance on width for belt pitch lengths					
			Dimension		Designation	Up to 838,2 mm (33 in) inclusive		From 838,2 mm (33 in) up to 1 676,4 mm (66 in) inclusive		Over 1 676,4 mm (66 in)	
	mm	in	mm	in		mm	in	mm	in	mm	in
MXL	1,14	0,045	3,2	0,12	012	+0,5 -0,8	+0,02 -0,03				
			4,8	0,19	019						
			6,4	0,25	025						
XXL	1,52	0,06	3,2	0,12	012	+0,5 -0,8	+0,02 -0,03				
			4,8	0,19	019						
			6,4	0,25	025						
XL	2,3	0,09	6,4	0,25	025	+0,5 -0,8	+0,02 -0,03				
			7,9	0,31	031						
			9,5	0,37	037						
L	3,6	0,14	12,7	0,5	050	+0,8 -0,8	+0,03 -0,03	+0,8 -1,3	+0,03 -0,05		
			19,1	0,75	075						
			25,4	1	100						
H	4,3	0,17	19,1	0,75	075	+0,8 -0,8	+0,03 -0,03	+0,8 -1,3	+0,03 -0,05	+0,8 -1,3	+0,03 -0,05
			25,4	1	100						
			38,1	1,5	150						
			50,8	2	200	+0,8 -1,3	+0,03 -0,05	+1,3 -1,3	+0,05 -0,05	+1,3 1,5	+0,05 -0,06
			76,2	3	300	+1,3 -1,5	+0,05 -0,06	+1,5 -1,5	+0,06 -0,06	+1,5 -2	+0,06 -0,08
XH	11,2	0,44	50,8	2	200			+4,8 -4,8	+0,19 -0,19	+4,8 -4,8	+0,19 -0,19
			76,2	3	300						
			101,6	4	400						
XXH	15,7	0,62	50,8	2	200					+4,8 -4,8	+0,19 -0,19
			76,2	3	300						
			101,6	4	400						
			127	5	500						

[a] See Figure 1.

Table 6 — Double-sided belts

Pitch code	Nominal height[a]	
	mm	in.
MXL	1,53	0,060
XXL	2,03	0,080
XL	3,05	0,120
L	4,58	0,180
H	5,95	0,234
XH	15,49	0,610
XXH	22,10	0,870

[a] See Figures 2 and 3.

4 Belt designation

4.1 Single-sided belts

4.1.1 General

Synchronous belts are identified by a standard number. The first digits specify the pitch length which, for the XL and larger pitch belts contained in this International Standard, is the calculated pitch length in inches (pitch length, in millimetres, divided by 25,4) times 10, rounded off to the nearest whole integer. For MXL and XXL belts, it is the calculated pitch, in inches (pitch length, in millimetres, divided by 25,4) times 10, rounded off to the nearest tenth. The pitch length is followed by the belt section (pitch) designation. The digits following the belt section designation represent the nominal belt width, in inches, times 100, rounded off to the nearest three digits.

EXAMPLE 1 An L section synchronous belt of pitch length 762 mm (30,000 in) and width 19,1 mm (0,750 in) is designated as follows:

300L075

EXAMPLE 2 An MXL section synchronous belt with 102 teeth, corresponding to a pitch length of 207,26 mm (8,16 in) and a width of 6,35 mm (0,25 in), is designated as follows:

81,6MXL025

4.1.2 Alternative method for MXL and XXL belts

The belt in accordance with this International Standard may be designated by the following:

a) the letter B (for belt);

b) the number of teeth;

c) the pitch code;

d) the width designation, in millimetres, rounded to the nearest tenth.

EXAMPLE An MXL section synchronous belt with 102 teeth and a 6,35 mm width is designated as follows:

B 102MXL6.4

4.2 Double-sided belts

4.2.1 Type A — Symmetrical

A belt of type A, corresponding to Figure 2, shall be designated by the following:

a) the letter D (for double-sided);

b) the type designation;

c) the length designation;

d) the pitch code,

e) the width designation.

EXAMPLE A type A synchronous belt of pitch length 42 in (1 066,8 mm), pitch 0,375 in (9,525 mm) and nominal width 0,5 in (12,7 mm) is designated as follows:

DA 420 L 050

4.2.2 Type B — Staggered

A belt of type B, corresponding to Figure 3, shall be similar to the type A designation in 4.2.1, except that the letter B replaces the letter A.

EXAMPLE A type B synchronous belt of pitch length 98 in (2 489,2 mm), pitch 0,875 in (22,225 mm) and nominal width 2 in (50,8 mm) is designated as follows:

DB 980 XH 200

4.3 Designation of pitch length of non-standardized lengths

The length designation for belts in non-standardized lengths, which are not contained in Tables 3 and 4, shall be established from the pitch length, in millimetres, divided by 2,54. This number shall be rounded as follows:

a) for belts with pitch code MXL or XXL: to the first decimal place; for example, for belt MXL with 102 teeth corresponding to a pitch length of 207,26 mm, the length designation is 81,6.

   An alternative method for belts with pitch code MXL or XXL consists of using the letter B (for belt) followed by the number of teeth, which gives the length designation B 102.

b) for belts with pitch codes XL to XXH: to the nearest integral number, where 0,5 is rounded down; for example, for belt L with 130 teeth corresponding to a pitch length of 1 238,25 mm, the length designation is 487.

5 Pitch length measurement

5.1 Measuring fixture

The pitch length of a synchronous belt shall be determined by placing the belt on a measuring fixture composed of the following elements (see Figure 5).

5.1.1 Two pulleys, of equal diameter, as specified in Table 7, corresponding to the proper pitch code and having standard tooth space dimensions. These pulleys shall be made to the tolerances shown in Table 7 and have the proper clearance, C_m, between the pulley tooth space and the theoretical belt tooth width, as specified in Table 5 (see Figure 4). One pulley shall be free to rotate on a fixed-position shaft, while the other shall be free to rotate on a movable shaft to permit the centre distance to change.

Table 7 — Belt pitch length measuring pulleys

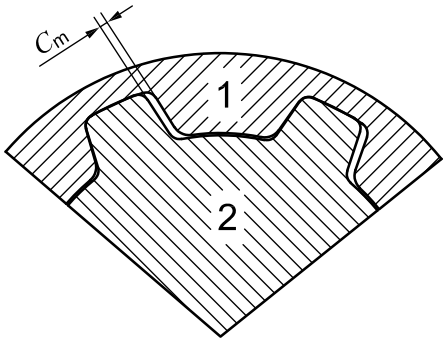
Pitch code	Number of teeth	Pitch circumference		Outside diameter[a]		Radial run-out FIM[b]		Axial run-out FIM[b]		Minimum clearance C_m	
		mm	in	mm	in	mm	in	mm	in	mm	in
MXL	20	40,64	1,6	12,428 ±0,013	0,489 3 ±0,000 5	0,013	0,000 5	0,025	0,001	0,25	0,010
XXL	16	50,8	2	15,662 ±0,013	0,616 6 ±0,000 5	0,013	0,000 5	0,025	0,001	0,3	0,012
XL	10	50,8	2	15,662 ±0,013	0,616 6 ±0,000 5	0,013	0,000 5	0,025	0,001	0,3	0,012
L	16	152,4	6	47,748 ±0,013	1,879 9 ±0,000 5	0,013	0,000 5	0,025	0,001	0,33	0,013
H	20	254	10	79,479 ±0,013	3,129 1 ±0,000 5	0,013	0,000 5	0,025	0,001	0,38	0,015
XH	24	533,4	21	166,992 ±0,025	6,574 5 ±0,001	0,013	0,000 5	0,051	0,002	0,53	0,021
XXH	24	762	30	239,504 ±0,025	9,429 3 ±0,001	0,013	0,000 5	0,076	0,003	0,64	0,025

[a] Pulleys outside the specified diameter tolerance range may be used, if the resulting belt length measurements are corrected for the actual pulley diameters used.

[b] FIM: full indicator movement

5.1.2 Means of applying a total measuring force to the movable pulley.

5.1.3 Means of measuring the centre distance between the two pulleys, with the necessary degree of accuracy to check the permitted tolerances (tolerances for centre distance measurement correspond to half the permitted length tolerances in accordance with Tables 3 and 4).

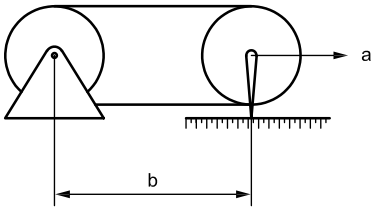


Key

1 belt

2 pulley

Figure 4 — Clearance between measuring pulley and belt



Key

a Total measuring force.

b Centre distance.

Figure 5 — Pitch length measuring fixture

5.2 Total measuring force

The total measuring force to be applied for the measurement of belts is given in Table 8.

Table 8 — Total measuring force

Belt width designation	Belt width		Measuring force for pitch code													
			MXL		XXL		XL		L		H		XH		XXH	
	mm	in	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf
012	3,2	0,12	13	3	14	3,2										
019	4,8	0,19	20	4,5	22	5,0										
025	6,4	0,25	27	6	31	7,0	36	8								
031	7,9	0,31					44	10								
037	9,5	0,37					53	12								
050	12,7	0,5							105	24						
075	19,1	0,75							180	40	445	100				
100	25,4	1							245	55	620	140				
150	38,1	1,5									980	220				
200	50,8	2									1 340	300	2000	450	2 500	560
300	76,2	3									2 100	470	3 100	700	3 900	875
400	101,6	4											4 450	1 000	5 600	1 250
500	127	5													7 100	1 600

Bibliography

[1] ISO 5288, *Synchronous belt drives — Vocabulary*

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