INTERNATIONAL STANDARD

ISO 5296-1

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1989-07-15

Synchronous belt drives — Belts —

Part 1:
Pitch codes MXL, XL, L, H, XH and XXH — Metric and inch dimensions

Transmissions synchrones par courroies — Courroies —

Partie 1: Symboles de pas MXL, XL, L, H, XH et XXH — Dimensions métriques et en inches

Reference number
ISO 5296-1 : 1989 (E)

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 5296-1 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts).*

The first edition of ISO 5296-1 cancels and replaces the first edition of ISO 5296 : 1978, as well as its Addenda 1 and 2 of 1982, of which it constitutes a technical revision.

ISO 5296 consists of the following parts, under the general title *Synchronous belt drives — Belts*:

— *Part 1: Pitch codes MXL, XL, L, H, XH and XXH — Metric and inch dimensions*

— *Part 2: Pitch codes MXL and XXL — Metric dimensions*

Annex A of this part of ISO 5296 is for information only.

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Synchronous belt drives — Belts —

Part 1:
Pitch codes MXL, XL, L, H, XH and XXH — Metric and inch dimensions

1 Scope

This part of ISO 5296 specifies the principal characteristics of synchronous endless belts for use in synchronous belt drives[1] for mechanical power transmission and where positive indexing or synchronization may be required.

The principal characteristics include

a) nominal tooth dimensions;

b) length and width dimensions;

c) tolerances on these dimensions;

d) length-measurement specifications.

This part of ISO 5296 applies to synchronous belt drives with pitch codes MXL, XL, L, H, XH and XXH and to 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*)	
	mm	in
MXL	2,032	0,080
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

*) Carried to third decimal place because belt pitch is a defined value.

3 Dimensions and tolerances

3.1 Tooth dimensions

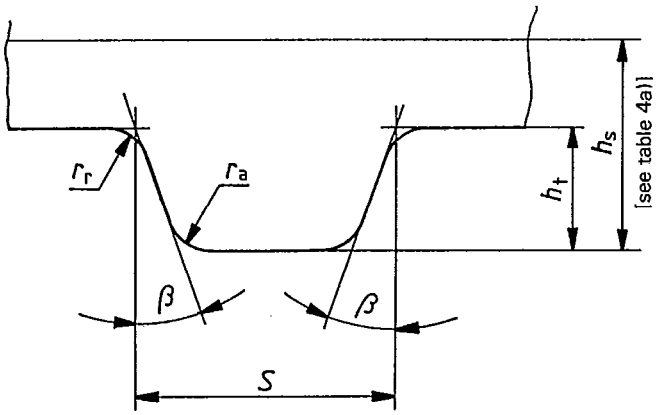
The nominal belt tooth dimensions are the same for one-sided and double-sided belts; they are given in table 2 and are shown in figures 1a), 1b) and 1c).

Two types of double-sided synchronous belts are standardized. type A [see figure 1b)] has symmetrical teeth and type B [see figure 1c)] has staggered teeth.

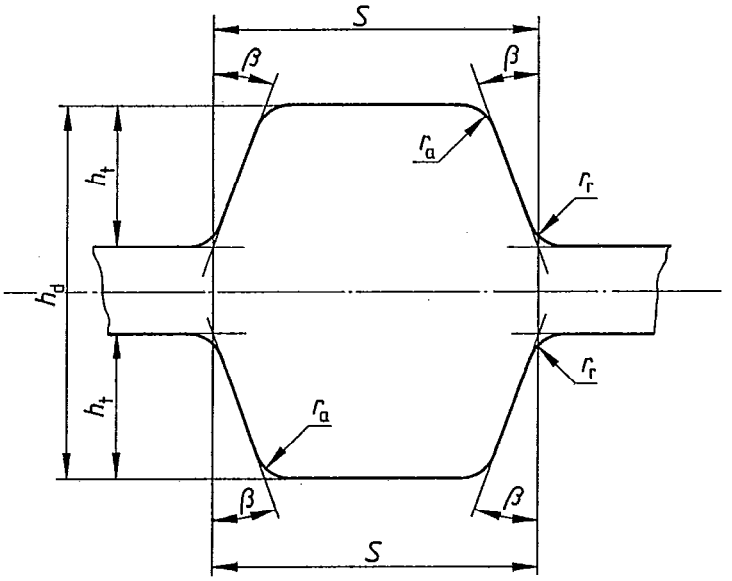
Table 2 — Nominal tooth dimensions

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
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	0,02	0,51	0,02
H	40	6,12	0,241	2,29	0,09	1,02	0,04	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	0,75	9,53	0,375	2,29	0,09	1,52	0,06

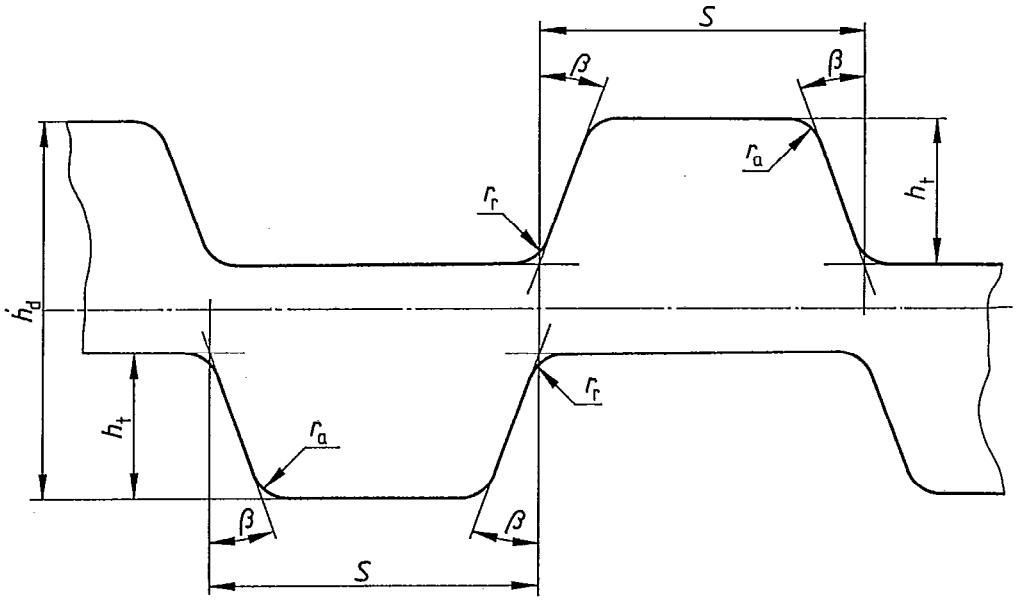
1) Synchronous belt drives have been known by various titles in the past: for example, timing belt drives, positive belt drives, gear belt drives.



a) One-sided synchronous belt



b) Double-sided synchronous belt — Type A, symmetrical teeth



c) Double-sided synchronous belt — Type B, staggered teeth

Figure 1 — Tooth profile

3.2 Lengths

The belt pitch lengths and tolerances are given in tables 3a) and 3b).

Table 3a) — Pitch lengths and tolerances

Belt length designation	Pitch length		Tolerance		Number of teeth				
	mm	in	mm	in	XL	L	H	XH	XXH
60	152,4	6	±0,41	±0,016	30				
70	177,8	7	±0,41	±0,016	35				
80	203,2	8	±0,41	±0,016	40				
90	228,6	9	±0,41	±0,016	45				
100	254	10	±0,41	±0,016	50				
110	279,4	11	±0,46	±0,018	55				
120	304,8	12	±0,46	±0,018	60				
124	314,33	12,375	±0,46	±0,018		33			
130	330,2	13	±0,46	±0,018	65				
140	355,6	14	±0,46	±0,018	70				
150	381	15	±0,46	±0,018	75	40			
160	406,4	16	±0,51	±0,02	80				
170	431,8	17	±0,51	±0,02	85				
180	457,2	18	±0,51	±0,02	90				
187	476,25	18,75	±0,51	±0,02		50			
190	482,6	19	±0,51	±0,02	95				
200	508	20	±0,51	±0,02	100				
210	533,4	21	±0,61	±0,024	105	56			
220	558,8	22	±0,61	±0,024	110				
225	571,5	22,5	±0,61	±0,024		60			
230	584,2	23	±0,61	±0,024	115				
240	609,6	24	±0,61	±0,024	120	64	48		
250	635	25	±0,61	±0,024	125				
255	647,7	25,5	±0,61	±0,024		68			
260	660,4	26	±0,61	±0,024	130				
270	685,8	27	±0,61	±0,024		72	54		
285	723,9	28,5	±0,61	±0,024		76			
300	762	30	±0,61	±0,024		80	60		
322	819,15	32,25	±0,66	±0,026		86			
330	838,2	33	±0,66	±0,026			66		
345	876,3	34,5	±0,66	±0,026		92			
360	914,4	36	±0,66	±0,026			72		
367	933,45	36,75	±0,66	±0,026		98			
390	990,6	39	±0,66	±0,026		104	78		
420	1 066,8	42	±0,76	±0,03		112	84		
450	1 143	45	±0,76	±0,03		120	90		
480	1 219,2	48	±0,76	±0,03		128	96		
507	1 289,05	50,75	±0,81	±0,032				58	
510	1 295,4	51	±0,81	±0,032		136	102		
540	1 371,6	54	±0,81	±0,032		144	108		
560	1 422,4	56	±0,81	±0,032				64	
570	1 447,8	57	±0,81	±0,032			114		
600	1 524	60	±0,81	±0,032		160	120		
630	1 600,2	63	±0,86	±0,034			126	72	
660	1 676,4	66	±0,86	±0,034			132		
700	1 778	70	±0,86	±0,034			140	80	56
750	1 905	75	±0,91	±0,036			150		
770	1 955,8	77	±0,91	±0,036				88	
800	2 032	80	±0,91	±0,036			160		64
840	2 133,6	84	±0,97	±0,038				96	
850	2 159	85	±0,97	±0,038			170		
900	2 286	90	±0,97	±0,038			180		72
980	2 489,2	98	±1,02	±0,04				112	
1 000	2 540	100	±1,02	±0,04			200		80
1 100	2 794	110	±1,07	±0,042			220		
1 120	2 844,8	112	±1,12	±0,044				128	
1 200	3 048	120	±1,12	±0,044					96
1 250	3 175	125	±1,17	±0,046			250		
1 260	3 200,4	126	±1,17	±0,046				144	
1 400	3 556	140	±1,22	±0,048			280	160	112
1 540	3 911,6	154	±1,32	±0,052				176	
1 600	4 064	160	±1,32	±0,052					128
1 700	4 318	170	±1,37	±0,054			340		
1 750	4 445	175	±1,42	±0,056				200	
1 800	4 572	180	±1,42	±0,056					144

Table 3b) — Pitch lengths and tolerances — Pitch code MXL

Belt length designation	Pitch length		Tolerance		Number of teeth
	mm	in	mm	in	
36,0	91,44	3,6	±0,41	±0,016	45
40,0	101,6	4	±0,41	±0,016	50
44,0	111,76	4,4	±0,41	±0,016	55
48,0	121,92	4,8	±0,41	±0,016	60
56,0	142,24	5,6	±0,41	±0,016	70
60,0	152,4	6	±0,41	±0,016	75
64,0	162,56	6,4	±0,41	±0,016	80
72,0	182,88	7,2	±0,41	±0,016	90
80,0	203,2	8	±0,41	±0,016	100
88,0	223,52	8,8	±0,41	±0,016	110
100,0	254	10	±0,41	±0,016	125
112,0	284,48	11,2	±0,46	±0,018	140
124,0	314,96	12,4	±0,46	±0,018	155
140,0	355,6	14	±0,46	±0,018	175
160,0	406,4	16	±0,51	±0,02	200
180,0	457,2	18	±0,51	±0,02	225
200,0	508	20	±0,51	±0,02	250

3.3 Widths and heights

The belt widths and tolerances are given in table 4a). The nominal heights for one-sided belts are also given in table 4a), while the nominal heights for double-sided belts are given in table 4b).

Table 4a) — Widths and heights

Pitch code	Nominal height [see figure 1a)] h_s		Widths			Tolerances 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 4,8 6,4	0,12 0,19 0,25	012 019 025	+0,5 −0,8	+0,02 −0,03	—	—	—	—
XL	2,3	0,09	6,4 7,9 9,5	0,25 0,31 0,37	025 031 037	+0,5 −0,8	+0,02 −0,03	—	—	—	—
L	3,6	0,14	12,7 19,1 25,4	0,5 0,75 1	050 075 100	+0,8 −0,8	+0,03 −0,03	+0,8 −1,3	+0,03 −0,05	—	—
H	4,3	0,17	19,1 25,4 38,1	0,75 1 1,5	075 100 150	+0,8 −0,8	+0,03 −0,03	+0,8 −1,3	+0,03 −0,05	+0,8 −1,3	+0,03 −0,05
			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 76,2 101,6	2 3 4	200 300 400	—	—	+4,8 −4,8	+0,19 −0,19	+4,8 −4,8	+0,19 −0,19
XXH	15,7	0,62	50,8 76,2 101,6 127	2 3 4 5	200 300 400 500	—	—	—	—	+4,8 −4,8	+0,19 −0,19

Table 4b) — Heights

Pitch code	Nominal height [see figures 1b) and 1c)] h_d	
	mm	in
MXL	1,53	0,06
XL	3,05	0,12
L	4,58	0,18
H	5,95	0,234
XH	15,49	0,61
XXH	22,11	0,87

4 Belt designation

4.1 One-sided belts

The belt designation includes, in order, the length designation according to tables 3a) and 3b), the pitch code according to table 1 and the width designation according to table 4a).

EXAMPLES

A synchronous belt of pitch length 7,2 in (182,88 mm), pitch 0,080 in (2,032 mm) and nominal width 0,19 in (4,8 mm) is designated:

72,0 MXL 019

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:

420 L 050

A 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:

980 XH 200

4.2 Double-sided belts

4.2.1 Type A — Symmetrical

The belt designation for type A belts corresponding to figure 1b) includes, in order, the letter D, for double-sided, the type designation, the length designation, the pitch code, and 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:

DA 420 L 050

4.2.2 Type B — Staggered

The belt designation for type B belts corresponding to figure 1c) is similar to 4.2.1 except that a B replaces the 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:

DB 980 XH 200

4.3 Designation of pitch length of non-standardized lengths

The length designation for belts in non-standardized lengths that are not contained in tables 3a) and 3b) shall be established from the pitch length in millimetres divided by 2,54. This number shall be rounded:

a) for belts with pitch code MXL to the first decimal: for example belt MXL with 102 teeth corresponding to pitch length 207,26 mm: length designation **81,6**;

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

5 Pitch length measurement

5.1 Measuring fixture (see figure 3)

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

5.1.1 Two pulleys of equal diameter as specified in table 5, of the proper pitch code, and having standard tooth space dimensions. These pulleys shall be made to the tolerances shown in table 5 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 2). 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.

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 allowed tolerances [tolerances for centre distance measurement will be one-half of the allowed length tolerances according to tables 3a) and 3b)].

5.2 Total measuring force

The total measuring force to be applied for measuring belts is given in table 6.

5.3 Procedure

In measuring the pitch length of a synchronous belt, the belt shall be rotated at least two revolutions to seat it properly and to divide the total force equally between the two strands of the belt.

The pitch length shall be calculated by adding the pitch circumference of one of the pulleys to twice the measured centre distance.

Check double-sided belts on both tooth faces.

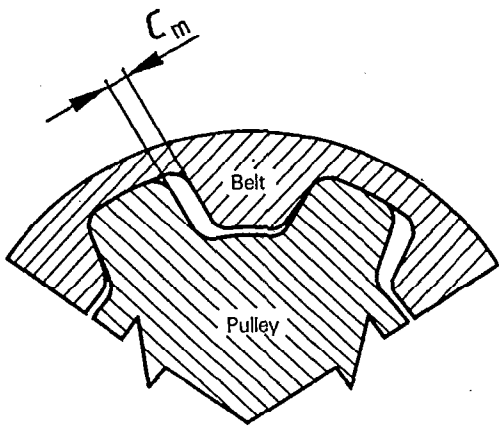


Figure 2 — Clearance between measuring pulley and belt

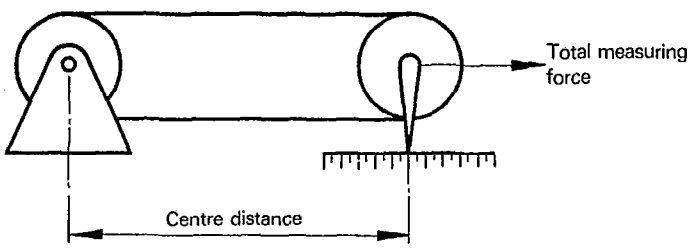


Figure 3 — Pitch length measuring fixture

Table 5 — Belt pitch length measuring pulleys

Pitch code	Number of teeth	Pitch circumference		Outside diameter		Radial run-out TIR [1]		Axial run-out TIR [1]		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	0,01
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

1) Total indicator reading (maximum)

Table 6 — Total measuring force

Belt width designation	Belt width		Measuring force for pitch code											
			MXL		XL		L		H		XH		XXH	
	mm	in	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf
012	3,2	0,12	13	3										
019	4,8	0,19	20	4,5										
025	6,4	0,25	27	6	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	2 000	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

Annex A
(informative)

Bibliography

ISO 5288 : 1982, *Synchronous belt drives — Vocabulary.*

UDC 621.85.052.44

Descriptors : synchronous transmission, belt drives, belts, power transmission belts, synchronous belts, dimensions, dimensional measurements, designation.

Price based on 8 pages