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Synchronous belt drives — Imperial pitch trapezoidal profile system — Belts and pulleys

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National foreword

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Synchronous belt drives — Imperial pitch trapezoidal profile system — Belts and pulleys

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Foreword

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The committee responsible for this document is ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

INTERNATIONAL STANDARD ISO 19347:2015(E)

Synchronous belt drives — Imperial pitch trapezoidal profile system — Belts and pulleys

1 Scope

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

The principal characteristics includes the following:

a) belt nominal tooth dimensions;

b) belt length and width dimensions and tolerances;

c) belt length-measurement specifications;

d) pulley grooves dimensions and tolerances;

e) pulley dimensions and tolerances;

f) pulley quality specification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 specification (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

3 Profiles

Seven profiles for synchronous drives are standardized: MXL, XXL, XL, L, H, XH, XXH.

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

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

Table 1 — Profiles

Profiles	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 third decimal place because belt pitch is a defined value.

4 Belt dimensions and tolerances

4.1 Belt 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.

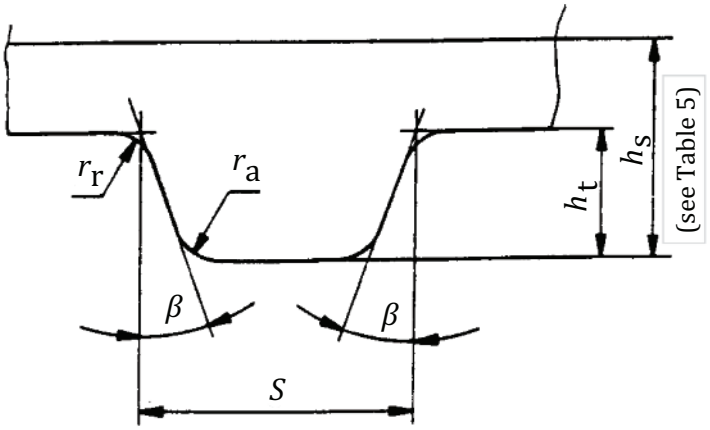


Figure 1 — Tooth profile, one-sided

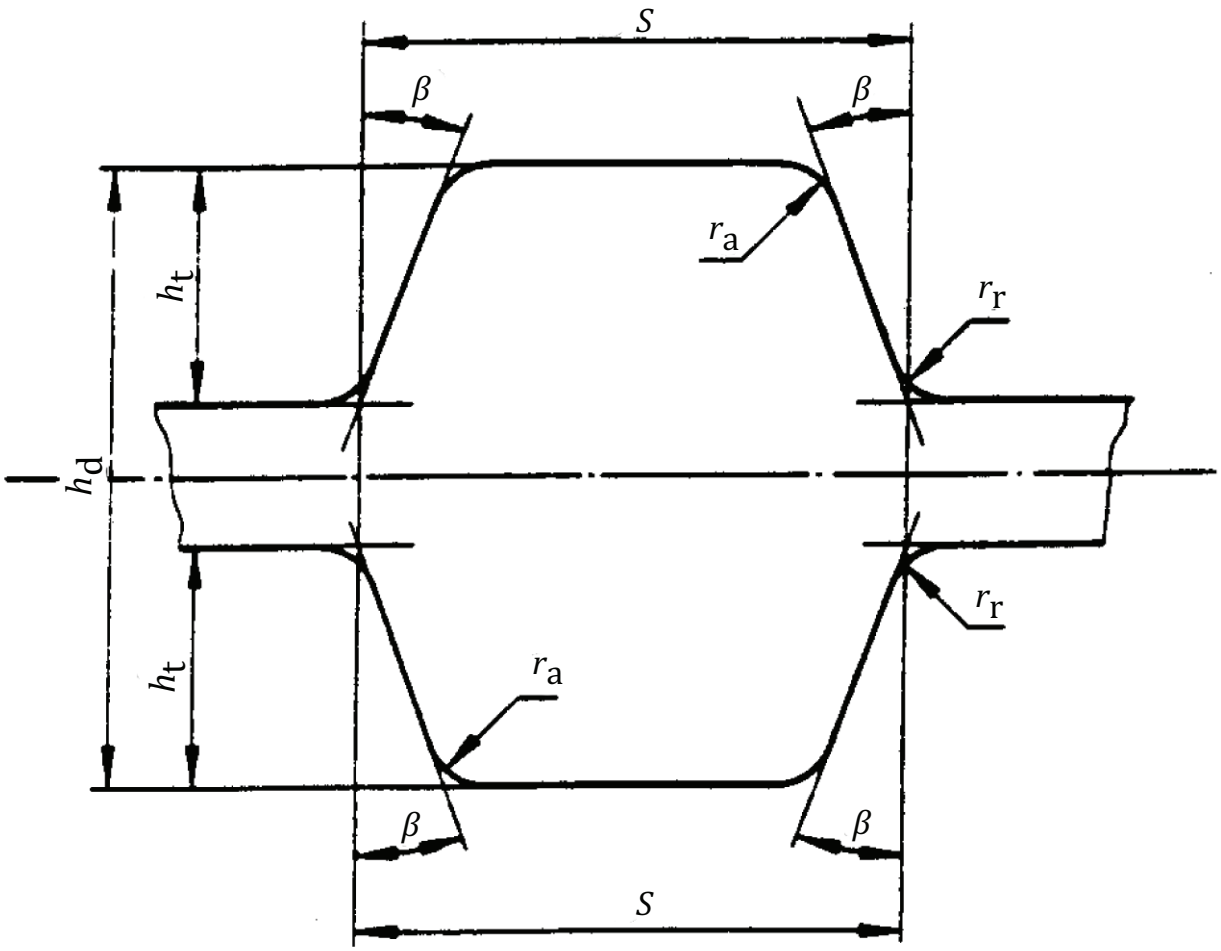


Figure 2 — Tooth profile, double-sided (Type A)

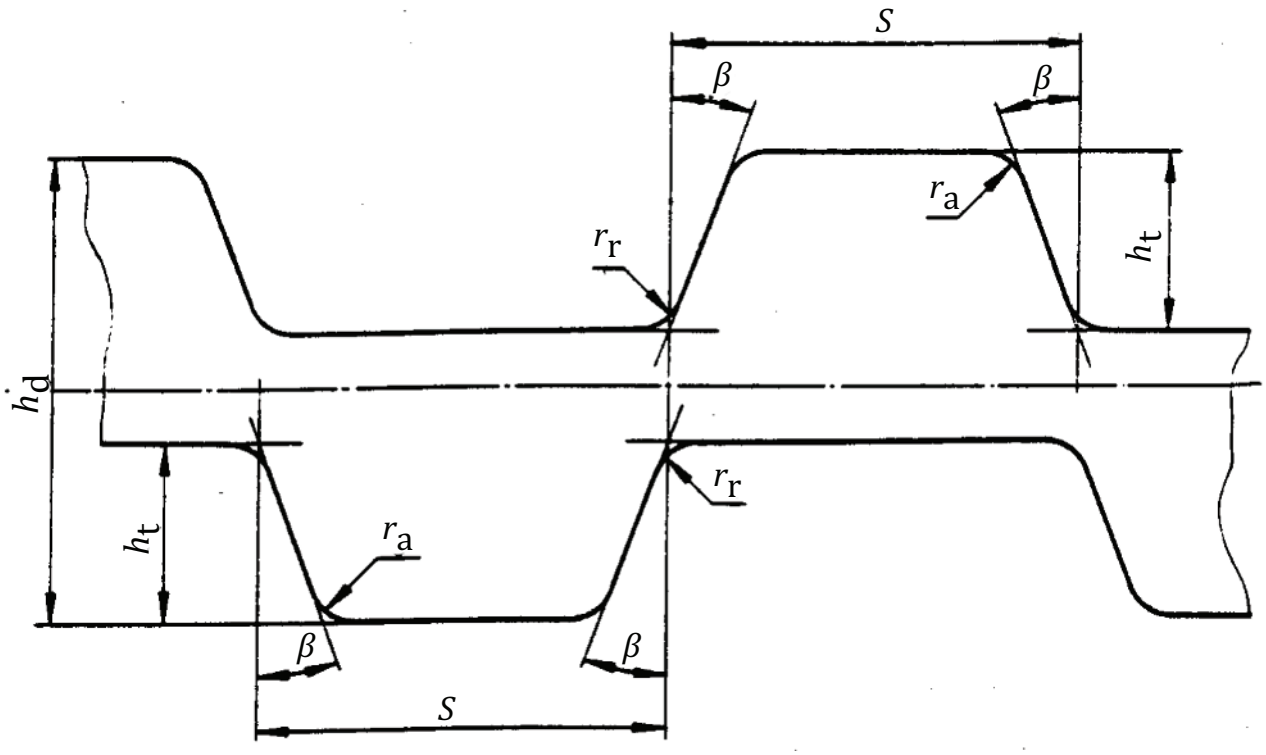


Figure 3 — Tooth profile, double-sided (Type B)

Table 2 — Nominal tooth dimensions

Profiles	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

4.2 Belt pitch lengths and tolerances

4.2.1 Single-sided belts

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

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

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths				
	mm	in	mm	in	XL	L	H	XH	XXH
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	56			
210	533,40	21,000	±0,61	±0,024	105				
220	558,80	22,000	±0,61	±0,024	110	60			
225	571,50	22,500	±0,61	±0,024					
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		

Table 3 *(continued)*

Belt length designation	Pitch length		Tolerance		Number of teeth for standard lengths				
	mm	in	mm	in	XL	L	H	XH	XXH
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	
1 000	2 540,00	100,000	±1,02	±0,040			200		80
1 100	2 794,00	110,000	±1,07	±0,042			220		
1 120	2 844,80	112,000	±1,12	±0,044			250	128	
1 200	3 048,00	120,000	±1,12	±0,044					96
1 250	3 175,00	125,000	±1,17	±0,046					
1 260	3 200,40	126,000	±1,17	±0,046				144	
1 400	3 556,00	140,000	±1,22	±0,048			280	160	112
1 540	3 911,60	154,000	±1,32	±0,052				176	
1 600	4 064,00	160,000	±1,32	±0,052					128
1 700	4 318,00	170,000	±1,37	±0,054			340		
1 750	4 445,00	175,000	±1,42	±0,056				200	
1 800	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		
112,0	284,48	11,200	±0,46	±0,018	140	88
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

4.2.2 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 1,5 times the tolerance of the equivalent single-sided belt. The negative tolerance is equal to 2 times the tolerance of the equivalent single-sided belt.

4.3 Belt standard widths and heights

The belt standard 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

Profiles	Nominal height (see Figure 1) h_s		Standard 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	0,125 0,190 0,250	012[a] 019 025	+0,5 −0,8	+0,02 −0,03				
XXL	1,52	0,06	3,2 4,8 6,4	0,125 0,190 0,250	012[a] 019 025	+0,5 −0,8	+0,02 −0,03				
XL	2,3	0,09	6,4 7,9 9,5	0,250 0,310 0,375	025 031 037[a]	+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

[a] Designations are 012 and 037 although the widths of belts is 0,125 in and 0,375 in.

Table 6 — Double-sided belts

Profiles	Nominal height (see Figures 2 and 3) h_d	
	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

5 Belt designation

5.1 Single-sided belts

5.1.1 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 standard is the calculated pitch length in inches (the 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 (the pitch length in millimetres divided by 25,4) times 10 rounded off to the nearest tenth. The pitch length is followed by the profiles designation. The digits following the profile designation represent the nominal belt width in inches times 100 rounded off to the nearest 3 digits.

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

300L075

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

816MXL025

5.1.2 Alternate method for MXL and XXL belts

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

a) letter B (for belt);

b) number of teeth;

c) profile;

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

EXAMPLE An MXL section synchronous belt of 102 teeth and 6,35 mm width is designated:

B 102MXL6.4

5.2 Double-sided belts

5.2.1 Type A — symmetrical

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

a) letter D (for double-sided);

b) type designation;

c) length designation;

d) profile,

e) 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

5.2.2 Type B — staggered

The belt designation for Type B belts corresponding Figure 1 c) 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

5.3 Designation of pitch length of non-standardized lengths

The length designation for belts in non-standardized lengths that 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 profile MXL to the first decimal: for example belt MXL with 102 teeth corresponding to pitch length 207,26 mm: length designation 816.

   An alternative method for belts with profile 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 profile 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.

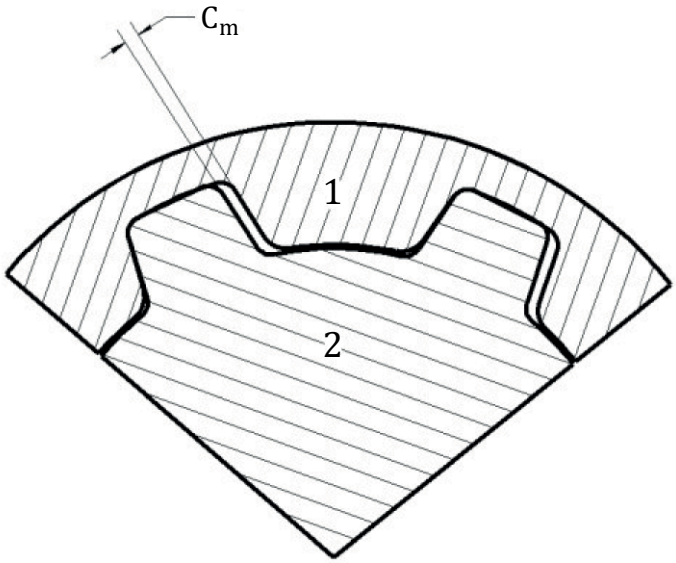
6 Belt pitch length measurement

6.1 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).

6.1.1 Two pulleys

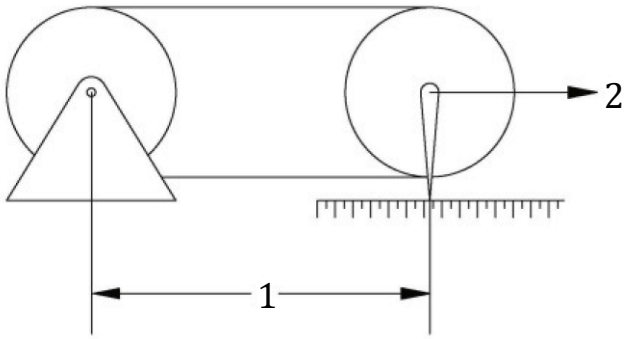
Two pulleys of equal diameter as specified in Table 7, of the proper pitch code, and having standard tooth space dimensions. These pulleys shall be made to the tolerances shown in Table 7 and have the proper clearance, C_m, between the pulley tooth space and the theoretical belt tooth width as specified in Table 7 (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.



Key

1 belt
2 pulley

Figure 4 — Clearance between measuring pulley and belt



Key

1 centre distance
2 total measuring force

Figure 5 — Pitch length measuring fixture

Table 7 — Belt pitch length measuring pulleys

Profiles	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 of 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.

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

6.1.3 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).

6.2 Total measuring force

The total measuring force to be applied for the measurement of belts is given in Table 8. Consult with belt manufacture for measuring force to be used with belts of non-standard width.

Table 8 — Total measuring force

Belt width designation	Belt width		Measuring force for profile													
			MXL		XXL		XL		L		H		XH		XXH	
	mm	in	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf	N	lbf
012 019 025 031 037	3,2 4,8 6,4 7,9 9,5	0,125 0,190 0,250 0,310 0,375	13 20 27	3 4,5 6	14 22 31	3,2 5,0 7,0	36 44 53	8 10 12								
050 075	12,7 19,1	0,5 0,75							105 180	24 40	445	100				
100 150 200	25,4 38,1 50,8	1 1,5 2							245	55	620 980 1 340	140 220 300	2 000	450	2 500	560
300 400 500	76,2 101,6 127	3 4 5									2 100	470	3 100 4 450	700 1 000	3 900 5 600 7 100	875 1 250 1 600

7 Pulley groove dimensions

7.1 Involute grooves

7.1.1 The involute groove profile results in different dimensions for each pulley diameter. Therefore, to specify the involute groove 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 groove, dimensions are specified for the generating tool rack required to produce the involute groove.

7.1.2 Dimensions and tolerances for the generating tool rack for synchronous pulleys with involute grooves are given in Table 9 and Figure 6.

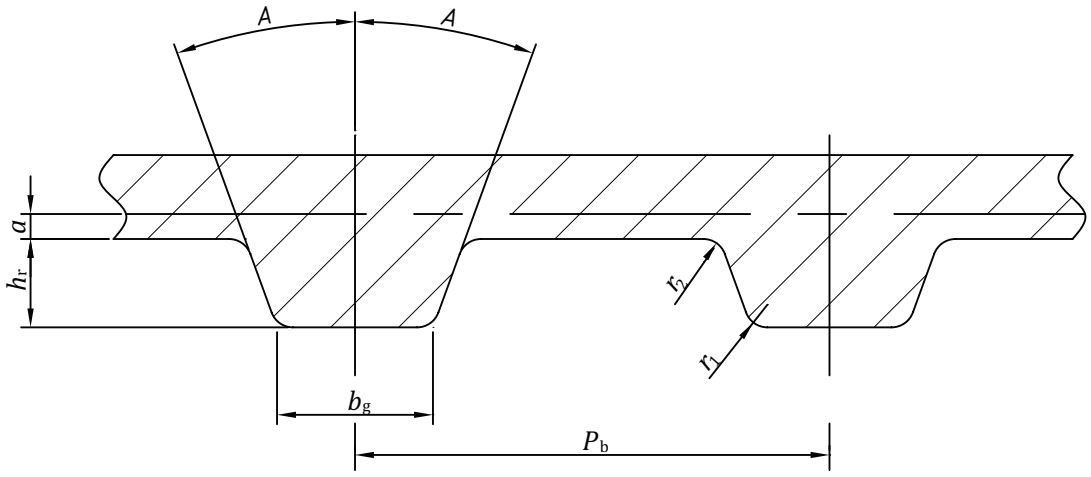


Figure 6 — Generating tool rack for pulleys with involute grooves

Table 9 — Dimensions and tolerances for generating tool rack for pulleys with involute grooves

Profiles	Number of grooves in pulley Z	P_b		A	h_r		b_g		r_1		r_2		$2a$	
		mm	in	degrees ±0,12	mm +0,05 0	in +0,002 0	mm +0,05 0	in +0,002 0	mm ±0,03	in ±0,001	mm ±0,03	in ±0,001	mm	in
MXL	10 to 23	2,032 ±0,008	0,080 ±0,000 3	28	0,64	0,025	0,61	0,024	0,30	0,012	0,23	0,009	0,508	0,020
	24 and over			20			0,67	0,026 5						
XXL	10 and over	3,175 ±0,011	0,125 ±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	10 and over	5,080 ±0,011	0,200 ±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	10 and over	9,525 ±0,012	0,375 ±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 to 19	12,700 ±0,015	0,500 ±0,000 6	20	2,59	0,102	4,24	0,167	1,47	0,058	1,04	0,041	1,372	0,054
	20 and over										1,42	0,056		
XH	18 and over	22,225 ±0,019	0,875 ±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	18 and over	31,750 ±0,025	1,250 ±0,001	20	10,29	0,405	11,61	0,457	2,69	0,106	2,82	0,111	3,048	0,120

7.2 Straight-sided grooves

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

7.2.2 Dimensions and tolerances for straight-sided grooves (see Figure 7) are given in Table 10.

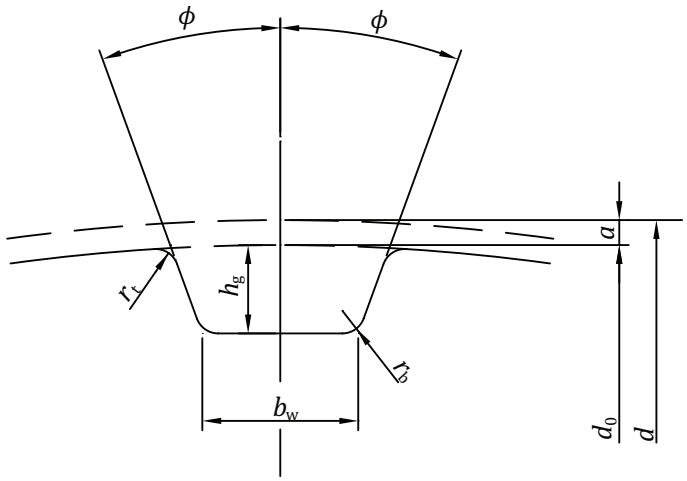


Figure 7 — Straight-sided grooves

Table 10 — Dimensions and tolerances for pulleys with straight-sided grooves

Profiles	b_w		h_g		ϕ	r_b max.		r_t		$2a$	
	mm	in	mm	in	degrees ±1,5	mm	in	Mm	in	mm	in
MXL	0,84 ±0,05	0,033 ±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 ±0,05	0,012 ±0,002	0,508	0,020
XL	1,32 ±0,05	0,052 ±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 ±0,10	0,120 ±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	0,030
H	4,19 ±0,13	0,165 ±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 ±0,15	0,311 ±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 ±0,18	0,479 ±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

7.3 Pitch-to-pitch tolerances

Tolerances on the amount of deviation of pitch between adjacent grooves and on the summation of deviations within 90° arc of a pulley are given in Table 11. This tolerance applies to the distance between the same point on either the right or left corresponding flanks of adjacent grooves.

Table 11 — Pitch-to-pitch tolerances

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

8 Pulley dimensions

All geometric tolerance references are as defined in ISO 1101.

8.1 Pulley width

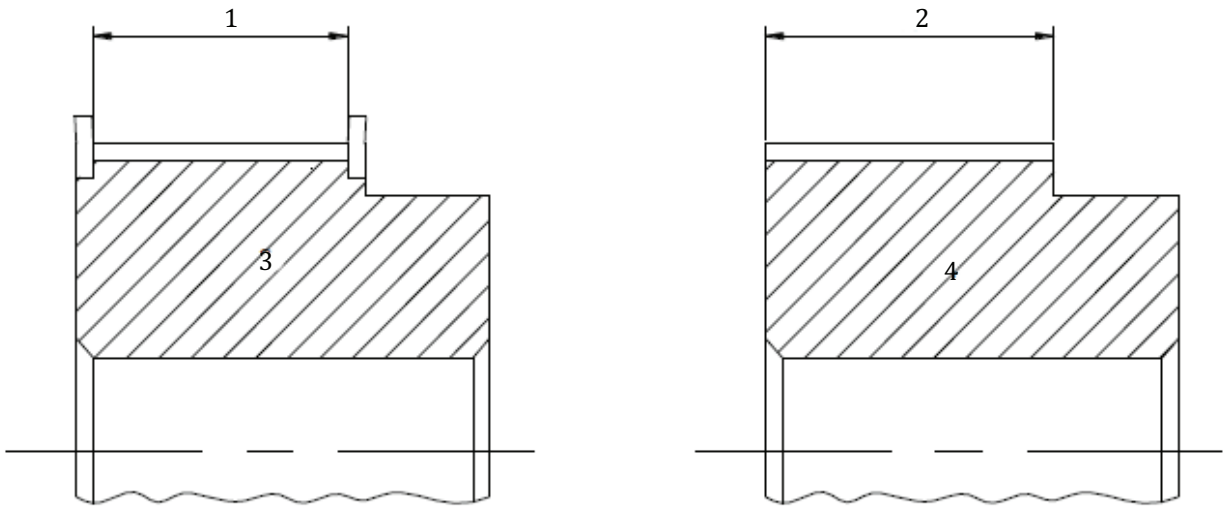
The pulley width designation and the minimum actual pulley width required, b_f for flanged pulleys and b_f' for flanged pulleys (see Figure 8), are given in Table 12.

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

Table 12 — Pulley widths

Profiles	Pulley width designation		Minimum flanged pulley width, b_f		Minimum unflanged pulley width, b_f'[a]	
	Metric designation	Inch designation	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
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 flanged pulley

Figure 8 — Minimum pulley width

8.2 Pulley diameter

8.2.1 Pulley diameters are given in Tables 13, 14 and 15.

Table 13 — Pulley diameters (MXL, XXL, XL)

Number of grooves[a]	Pulley diameters											
	MXL				XXL				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	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	17,60	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

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

Table 14 — Pulley diameters Pulley diameters (L, H, XH)

Number of grooves[a]	Pulley diameters											
	L				H				XH			
	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	30,32	1,194	29,56	1,164								
11	33,35	1,313	32,59	1,283								
12	36,38	1,432	35,62	1,402								
13	39,41	1,552	38,65	1,522								
14	42,45	1,671	41,68	1,641	56,60	2,228	55,22	2,174				
15	45,48	1,790	44,72	1,760	60,64	2,387	59,27	2,333				
16	48,51	1,910	47,75	1,880	64,68	2,546	63,31	2,492				
17	51,54	2,029	50,78	1,999	68,72	2,706	67,35	2,652				
18	54,57	2,149	53,81	2,119	72,77	2,865	71,39	2,811	127,34	5,013	124,55	4,903
19	57,61	2,268	56,84	2,238	76,81	3,024	75,44	2,970	134,41	5,292	131,62	5,182
20	60,64	2,387	59,88	2,357	80,85	3,183	79,48	3,129	141,49	5,570	138,69	5,460
(21)	63,67	2,507	62,91	2,477	84,89	3,342	83,52	3,288	148,56	5,849	145,77	5,739
22	66,70	2,626	65,94	2,596	88,94	3,501	87,56	3,447	155,64	6,127	152,84	6,017
(23)	69,73	2,745	68,97	2,715	92,98	3,661	91,61	3,607	162,71	6,406	159,92	6,296
(24)	72,77	2,865	72,00	2,835	97,02	3,820	95,65	3,766	169,79	6,685	166,99	6,575
25	75,80	2,984	75,04	2,954	101,06	3,979	99,69	3,925	176,86	6,963	174,07	6,853
(26)	78,83	3,104	78,07	3,074	105,11	4,138	103,73	4,084	183,94	7,242	181,14	7,132
(27)	81,86	3,223	81,10	3,193	109,15	4,297	107,78	4,243	191,01	7,520	188,22	7,410
28	84,89	3,342	84,13	3,312	113,19	4,456	111,82	4,402	198,08	7,799	195,29	7,689
(30)	90,96	3,581	90,20	3,551	121,28	4,775	119,90	4,721	212,23	8,356	209,44	8,246
32	97,02	3,820	96,26	3,790	129,36	5,093	127,99	5,039	226,38	8,913	223,59	8,803
36	109,15	4,297	108,39	4,267	145,53	5,730	144,16	5,676	254,68	10,027	251,89	9,917
40	121,28	4,775	120,51	4,745	161,70	6,366	160,33	6,312	282,98	11,141	280,18	11,031
48	145,53	5,730	144,77	5,700	194,04	7,639	192,67	7,585	339,57	13,369	336,78	13,259
60	181,91	7,162	181,15	7,132	242,55	9,549	241,18	9,495	424,47	16,711	421,67	16,601
72	218,30	8,594	217,53	8,564	291,06	11,459	289,69	11,405	509,36	20,054	506,57	19,944
84	254,68	10,027	253,92	9,997	339,57	13,369	338,20	13,315	594,25	23,396	591,46	23,286
96	291,06	11,459	290,30	11,429	388,08	15,279	386,71	15,225	679,15	26,738	676,35	26,628
120	363,83	14,324	363,07	14,294	485,10	19,099	483,73	19,045	848,93	33,423	846,14	33,313
156					630,64	24,828	629,26	24,774				

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

Table 15 — Pulley diameters (XXH)

Number of grooves[a]	Pulley diameters			
	XXH			
	Pitch diameter		Outside diameter	
	mm	in	mm	in
10				
11				
12				
13				
14				
15				
16				
17				
18	181,91	7,162	178,87	7,042
19	192,02	7,560	188,97	7,440
20	202,13	7,958	199,08	7,838
(21)	212,23	8,356	209,19	8,236
22	222,34	8,754	219,29	8,634
(23)	232,45	9,151	229,40	9,031
(24)	242,55	9,549	239,50	9,429
25	252,66	9,947	249,61	9,827
(26)	262,76	10,345	259,72	10,225
(27)	272,87	10,743	269,82	10,623
28	282,98	11,141	279,93	11,021
(30)	303,19	11,937	300,14	11,817
32	323,40	12,732	320,35	12,612
36	363,83	14,324	360,78	14,204
40	404,25	15,915	401,21	15,795
48	485,10	19,099	482,06	18,979
60	606,38	23,873	603,33	23,753
72	727,66	28,648	724,61	28,528
84	848,93	33,423	845,88	33,303
96	970,21	38,197	967,16	38,077
120	1212,76	47,746	1209,71	47,626

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

8.2.2 Tolerances on pulley outside diameter are given in Table 16.

Table 16 — Tolerances on outside diameter

Outside diameter, d_o		Tolerance	
mm	in	mm	in
$d_o \leq 25{,}4$	$d_o \leq 1$	+0,05 0	+0,002 0
$25{,}4 < d_o \leq 50{,}8$	$1 < d_o \leq 2$	+0,08 0	+0,003 0
$50{,}8 < d_o \leq 101{,}6$	$2 < d_o \leq 4$	+0,10 0	+0,004 0
$101{,}6 < d_o \leq 177{,}8$	$4 < d_o \leq 7$	+0,13 0	+0,005 0
$177{,}8 < d_o \leq 304{,}8$	$7 < d_o \leq 12$	+0,15 0	+0,006 0
$304{,}8 < d_o \leq 508{,}0$	$12 < d_o \leq 20$	+0,18 0	+0,007 0
$508{,}0 < d_o \leq 762{,}0$	$20 < d_o \leq 30$	+0,20 0	+0,008 0
$762{,}0 < d_o \leq 1016{,}0$	$30 < d_o \leq 40$	+0,23 0	+0,009 0
$1016{,}0 < d_o$	$40 < d_o$	+0,25 0	+0,010 0

8.3 Other pulley tolerances

8.3.1 Tolerances on pulley axial circular run-out are given in Table 17.

Table 17 — Axial circular run-out

Outside diameter range, d_o		FIM[a] max.	
mm	in	mm	in
$d_o \leq 25{,}4$	$d_o \leq 1$	0,05	0,002
$25{,}4 < d_o \leq 50{,}8$	$1 < d_o \leq 2$	0,08	0,003
$50{,}8 < d_o \leq 101{,}6$	$2 < d_o \leq 4$	0,10	0,004
$101{,}6 < d_o \leq 254{,}0$	$4 < d_o \leq 10$	0,001 mm per millimetre of outside diameter	0,001 in per inch of outside diameter
$254{,}0 < d_o$	$10 < d_o$	0,25 mm + 0,000 5 mm per millimetre of outside diameter $d_o > 254{,}0$	0,01 in + 0,000 5 in per inch of outside diameter $d_o > 10$

[a] Full indicator movement.

8.3.2 Tolerances on pulley radial circular run-out are given in Table 18.

Table 18 — Radial circular run-out

Outside diameter range, d_o		FIM[a] max.	
mm	in	mm	in
$d_o \leq 25{,}4$	$d_o \leq 1$	0,05	0,002
$25{,}4 < d_o \leq 50{,}8$	$1 < d_o \leq 2$	0,07	0,003
$50{,}8 < d_o \leq 101{,}6$	$2 < d_o \leq 4$	0,10	0,004
$101{,}6 < d_o \leq 203{,}2$	$4 < d_o \leq 8$	0,13	0,005
$203{,}2 < d_o$	$8 < d_o$	0,13 mm + 0,000 5 mm per millimetre of outside diameter $d_o > 203{,}2$	0,005 in + 0,000 5 in per inch of outside diameter $d_o > 8$

[a] Full indicator movement.

8.3.3 Tolerances on pulley parallelism are given in Table 19.

Table 19 — Parallelism

Standard pulley width designation		Tolerances	
Metric designation	Inch designation	mm	in
3,2 to 38,1	012 to 150	0,03	0,001 2
50,8 and 76,2	200 and 300	0,04	0,001 6
101,6 and 127	400 and 500	0,05	0,002 0

8.3.4 Tolerances on pulley cylinder are given in Table 20.

Table 20 — Cylindricity

Standard pulley width designation		Tolerances	
Metric designation	Inch designation	mm	in
3,2 to 12,7	012 to 050	0,02	0,000 8
19,1 to 38,1	075 to 150	0,04	0,001 6
50,8 and 76,2	200 and 300	0,08	0,003 1
101,6 and 127	400 and 500	0,12	0,004 7

9 Pulley quality specifications

The quality, finish and balance of pulleys shall comply with the requirements specified in ISO 254.

10 Pulley designation

10.1 Usual pulley designation

The pulley designation consists of the letter P (for pulley), the number of grooves, the profile and width designation.

EXAMPLE A synchronous pulley of 20 grooves, profile H (12,70 mm pitch) and pulley width 100 (25,4 mm) is designated:

P 20 H 100

10.2 Alternate method for MXL and XXL pulleys

The pulley designation consists of the letter P (for pulley), the number of grooves, the profile and width designation.

EXAMPLE A synchronous pulley of 20 grooves, profile XXL (3,175 mm pitch) and pulley width 6,4 (6,4 mm) is designated:

P 20 XXL 6,4

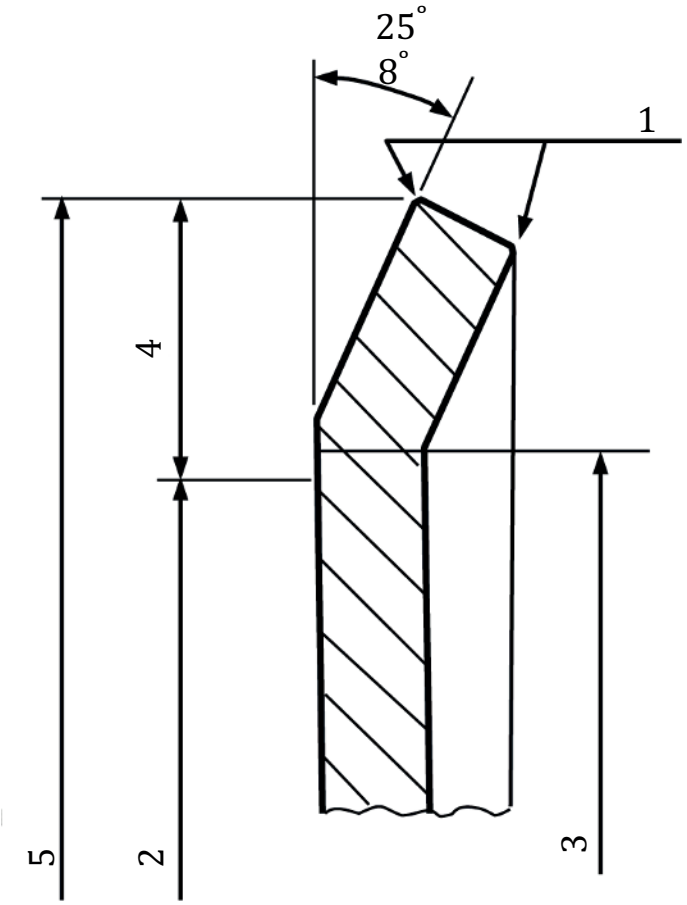
Annex A
(normative)

Flange dimensions

The pulley flange dimensions are given in Table A.1 and Figure A.1.

Table A.1 — Minimum flange height

Profile	Minimum flange height, *h*	
	mm	in
MXL	0,5	0,02
XXL	0,8	0,03
XL	1,0	0,04
L	1,5	0,06
H	2,0	0,08
XH	4,8	0,19
XXH	6,1	0,24



Key

1 break sharp corners
2 outside diameter, d_0
3 bend diameter, d_0 + 0,5 mm min
4 minimum frange height, h
5 flange outside diameter, $d_0 + 2h$

Figure A.1 — Flange dimensions

Bibliography

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

ICS 21.220.10
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