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ISO RECOMMENDATION

R 1604

ENDLESS WIDE V-BELTS FOR INDUSTRIAL SPEED-CHANGERS AND GROOVE PROFILES FOR CORRESPONDING PULLEYS

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BRIEF HISTORY

The ISO Recommendation R 1604, *Endless wide V-belts for industrial speed-changers and groove profiles for corresponding pulleys*, was drawn up by Technical Committee ISO/TC 41, *Pulleys and belts (including vee-belts)*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led to the adoption of Draft ISO Recommendation No. 1604 which was circulated to all the ISO Member Bodies for enquiry in May 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Austria	Israel	Sweden
Belgium	Italy	Switzerland
Brazil	Netherlands	Thailand
Czechoslovakia	New Zealand	Turkey
Denmark	Peru	U.A.R.
Finland	Portugal	United Kingdom
France	South Africa, Rep. of	U.S.S.R.
India	Spain	Yugoslavia

The following Member Body opposed the approval of the Draft :

Norway

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

ISO Recommendation | R 1604 | October 1970

ENDLESS WIDE V-BELTS FOR INDUSTRIAL SPEED-CHANGERS AND GROOVE PROFILES FOR CORRESPONDING PULLEYS

1. SCOPE

This ISO Recommendation specifies the principal dimensions of endless wide V-belts for *industrial speed-changers**, as well as the groove profile of corresponding fixed or variable diameter pulleys.

It does not concern speed-changer belts used either for the propulsion of self-propelled vehicles (motor-cycles, scooters, cars) or as parts of farm-machines (chiefly harvesters).

The wide V-belts are characterized by a "relative height" (ratio of the nominal height of the theoretical profile to its pitch width) of about 0.32.

2. DIMENSIONS AND TOLERANCES

2.1 Belt dimensions

The dimensions and the tolerances of the belts are given in millimetres in Table 1 and in inches in Table 2.

2.1.1 *Designation*. The proposed nine cross-sections are designated as follows :

– W 16 – W 20 – W 25 – W 31.5 – W 40 – W 50 – W 63 – W 80 – W 100

2.1.2 *Width*. Values for the *pitch width* l_p (expressed in millimetres) are nine consecutive terms from the R 10 series of preferred numbers.

Should this series of values be considered insufficient, it may be completed, outside the limits, with other terms from the R 10 series of preferred numbers.

* Due to the need for compactness of such types of speed-changers, it is necessary to minimize pitch diameters. At the present level of techniques, the values given for the minimum pitch diameter should be used on the notched V-belts.

2.1.3 *Belt height.* The nominal belt height T, equal to $0.32\,l_p$, is divided as follows on both sides of the pitch line :

– above $(B) = 0.08\,l_p$

– below $(H) = 0.24\,l_p$

TOLERANCES

(*a*) Belt ride out, in the conditions specified in section 3, should not exceed the value shown in the following table (round value of the expression $0.36\sqrt{l_p}$, where l_p is expressed in millimetres).

Designation of the sections	W 16	W 20	W 25	W 31.5	W 40	W 50	W 63	W 80	W 100
Ride out mm	1.2	1.8	1.8	1.8	2.4	2.4	3.0	3.0	3.6
Ride out in	0.047	0.071	0.071	0.071	0.094	0.094	0.118	0.118	0.142

(*b*) Height H should not exceed the value shown in the following table (round value of the expression $0.24\,l_p + 0.06\sqrt{l_p}$, where l_p is expressed in millimetres).

Designation of the sections	W 16	W 20	W 25	W 31.5	W 40	W 50	W 63	W 80	W 100
H max. mm	4.0	5.1	6.3	7.8	10.0	12.4	15.5	19.7	24.6
H max. in	0.157	0.201	0.248	0.307	0.394	0.488	0.610	0.776	0.969

NOTE. – The profile of the cross section of the free strand of the belt under tension is not imposed; in particular the angle of the sidewalls and their profile are left to the initiative of the manufacturers.

2.1.4 *Length.* Values for the *pitch length* l_p are multiples of the pitch width figures, the multiplier coefficients being eight consecutive terms (28 to 63 inclusive) from the R 20 series of preferred numbers.

Should the above range of lengths be considered insufficient, it may be completed

– upwards or downwards, with other terms from the R 20 series of preferred numbers;

– exceptionally, between two consecutive lengths from the table, with terms from the R 40 series of preferred numbers (especially for box-type speed-changers).

TABLE 1 – **Belt dimensions in millimetres**

Designation of the sections			**W 16**		**W 20**		**W 25**		**W 31.5**		**W 40**		**W 50**		**W 63**		**W 80**		**W 100**	
Approximate topwidth			16.6		20.7		25.9		32.6		41.5		51.8		65.3		82.9		103.7	
Pitchwidth l_p			16		20		25		31.5		40		50		63		80		100	
Belt height	Above the pitch line	B	1.3		1.6		2		2.5		3.2		4		5		6.3		8	
	Below the pitch line	H	3.8		4.8		6		7.5		9.6		12		15		19.2		24	
	Total	T	5.1		6.4		8		10		12.8		16		20		25.5		32	
Belt length (L_e = Approximate outside length; L_p = Pitch length)			L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p
			458	450 ± 10	570	560 ± 12	722	710 ± 14	916	900 ± 18	1140	1120 ± 22	1425	1400 ± 28	1832	1800 ± 36	2280	2240 ± 44	2850	2800 ± 56
			508	500 ± 10	640	630 ± 12	812	800 ± 16	1016	1000 ± 20	1270	1250 ± 24	1625	1600 ± 32	2032	2000 ± 40	2540	2500 ± 50	3200	3150 ± 62
			568	560 ± 12	720	710 ± 14	912	900 ± 18	1136	1120 ± 22	1420	1400 ± 28	1825	1800 ± 36	2272	2240 ± 44	2840	2800 ± 56	3600	3550 ± 70
			638	630 ± 12	810	800 ± 16	1012	1000 ± 20	1266	1250 ± 24	1620	1600 ± 32	2025	2000 ± 40	2532	2500 ± 50	3190	3150 ± 62	4050	4000 ± 80
			718	710 ± 14	910	900 ± 18	1132	1120 ± 22	1416	1400 ± 28	1820	1800 ± 36	2265	2240 ± 44	2832	2800 ± 56	3590	3550 ± 70	4550	4500 ± 90
			808	800 ± 16	1010	1000 ± 20	1262	1250 ± 24	1616	1600 ± 32	2020	2000 ± 40	2525	2500 ± 50	3182	3150 ± 62	4040	4000 ± 80	5050	5000 ± 100
			908	900 ± 18	1130	1120 ± 22	1412	1400 ± 28	1816	1800 ± 36	2260	2240 ± 44	2825	2800 ± 56	3582	3550 ± 70	4540	4500 ± 90	5650	5600 ± 110
			1008	1000 ± 20	1260	1250 ± 24	1612	1600 ± 32	2016	2000 ± 40	2520	2500 ± 50	3175	3150 ± 62	4032	4000 ± 80	5040	5000 ± 100	6350	6300 ± 120

TABLE 2 – **Belt dimensions in inches**

Designation of the sections			**W 16**		**W 20**		**W 25**		**W 31.5**		**W 40**		**W 50**		**W 63**		**W 80**		**W 100**	
Approximate topwidth			0.654		0.815		1.020		1.283		1.634		2.039		2.571		3.264		4.083	
Pitchwidth l_p			0.630		0.787		0.984		1.240		1.575		1.969		2.480		3.150		3.937	
Belt height	Above the pitch line	B	0.051		0.063		0.079		0.098		0.126		0.157		0.197		0.248		0.315	
	Below the pitch line	H	0.150		0.189		0.236		0.295		0.378		0.472		0.591		0.756		0.945	
	Total	T	0.201		0.252		0.315		0.394		0.504		0.630		0.787		1.004		1.26	
Belt length (L_e = Approximate outside length; L_p = Pitch length)			L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p	L_e	L_p
			18.03	17.72 ± 0.394	22.44	22.05 ± 0.472	28.43	27.95 ± 0.051	36.06	35.43 ± 0.709	44.88	44.09 ± 0.866	56.10	55.12 ± 1.102	72.13	70.87 ± 1.417	89.76	88.19 ± 1.732	112.20	110.24 ± 2.205
			20	19.69 ± 0.394	25.20	24.80 ± 0.472	31.97	31.50 ± 0.630	40.00	39.37 ± 0.787	50	49.21 ± 0.945	63.98	62.99 ± 1.260	80	78.74 ± 1.575	100	98.43 ± 1.969	125.98	124.02 ± 2.441
			22.36	22.05 ± 0.472	28.35	27.95 ± 0.551	35.91	35.43 ± 0.709	44.72	44.09 ± 0.866	55.91	55.12 ± 1.102	71.85	70.87 ± 1.417	89.45	88.19 ± 1.732	111.81	110.24 ± 2.205	141.73	139.76 ± 2.756
			25.12	24.80 ± 0.472	31.89	31.50 ± 0.630	39.84	39.37 ± 0.787	49.84	49.21 ± 0.945	63.78	62.99 ± 1.260	79.72	78.74 ± 1.575	99.69	98.43 ± 1.969	125.59	124.02 ± 2.441	159.45	157.48 ± 3.150
			28.27	27.95 ± 0.551	35.83	35.43 ± 0.709	44.57	44.09 ± 0.866	55.75	55.12 ± 1.102	71.65	70.87 ± 1.417	89.17	88.19 ± 1.732	111.50	110.24 ± 2.205	141.34	139.76 ± 2.756	179.13	177.17 ± 3.543
			31.81	31.50 ± 0.630	39.76	39.37 ± 0.787	49.69	49.21 ± 0.945	63.62	62.99 ± 1.260	79.53	78.74 ± 1.575	99.41	98.43 ± 1.969	125.28	124.02 ± 2.441	159.06	157.48 ± 3.150	198.82	196.85 ± 3.937
			35.75	35.43 ± 0.709	44.49	44.09 ± 0.866	55.59	55.12 ± 1.102	71.50	70.87 ± 1.417	88.98	88.19 ± 1.732	111.22	110.24 ± 2.205	141.02	139.76 ± 2.756	178.74	177.17 ± 3.543	222.44	220.47 ± 4.331
			39.69	39.37 ± 0.787	49.61	49.21 ± 0.945	63.46	62.99 ± 1.260	79.37	78.74 ± 1.575	99.21	98.43 ± 1.969	125.00	124.02 ± 2.441	158.74	157.48 ± 3.150	198.43	196.85 ± 3.937	250	248.03 ± 4.724

Approximate outside lengths L_e are computed by adding to pitch lengths the following values :

Designation of the sections	W 16	W 20	W 25	W 31.5	W 40	W 50	W 63	W 80	W 100
mm	8	10	12	16	20	25	32	40	50
in	0.31	0.39	0.47	0.63	0.79	0.98	1.26	1.57	1.97

TOLERANCE. The permissible deviation on the length shown in Table 1 is about ± 2 %.

Box-type speed changers need a closer tolerance, which can be complied with by printing a conventional length symbol on the external face of the belt after checking.

2.2 Profile dimensions of the pulley grooves

2.2.1 *Groove angle*. The groove angle α of pulleys should be 26 ± 1°.

NOTE. – Practice shows that most wide V-belts designed for a 26° groove angle can also be used with pulleys with groove angles between 22° and 30°; however, the value of this angle affects the maximum allowable tension in the driving side of the belt, and consequently the transmissible horsepower, as well as the characteristics of the tension device of the belt (for example the axial spring in a variable diameter pulley).

2.2.2 *Profile dimensions*. Radial dimensions shown in Figures 1 and 2, namely

– b : groove height above the pitch line,

– h : groove depth below the pitch-line,

– d_p : pitch diameter (minimum in the case of Figure 1),

should not be less, for any setting of the drive, than the corresponding values for b min., h min., d_p min. given in Tables 3 and 4.

Profile dimensions are given in millimetres in Table 3 and in inches in Table 4.

TABLE 3 – **Pulley dimensions in millimetres**

Designation of the sections		W 16	W 20	W 25	W 31.5	W 40	W 50	W 63	W 80	W 100
Symbol	Approximate formula									
l_p		16	20	25	31.5	40	50	63	80	100
b min.	0.080 l_p	1.3	1.6	2	2.5	3.2	4	5	6.3	8
h min.	0.335 l_p	5.3	6.7	8.5	10.6	13.2	17.0	21.2	26.5	33.5
d_p min.*	1.80 l_p	28	36	45	56	71	90	112	140	180
d_e min.	d_p min. + 2 b min.	30.6	39.2	49	61	77.4	98	122	152.6	196

TABLE 4 – **Pulley dimensions in inches**

Designation of the sections		W 16	W 20	W 25	W 31.5	W 40	W 50	W 63	W 80	W 100
Symbol	Approximate formula									
l_p		0.630	0.787	0.984	1.240	1.575	1.969	2.480	3.150	3.937
b min.	0.080 l_p	0.051	0.063	0.079	0.098	0.13	0.16	0.20	0.25	0.31
h min.	0.335 l_p	0.21	0.26	0.33	0.42	0.52	0.67	0.83	1.04	1.32
d_p min.*	1.80 l_p	1.10	1.42	1.77	2.20	2.80	3.54	4.41	5.51	7.09
d_e min.	d_p min. + 2 b min.	1.20	1.54	1.93	2.40	3.05	3.86	4.80	6.01	7.72

NOTE. – The value d_p min. = 1.80 l_p is nearly equivalent to 5.6 times the nominal height of the belt sidewalls.

* Due to the need for compactness of these types of speed-changers, it is necessary to minimize pitch diameters. At the present level of techniques, the values given for the minimum pitch diameter should be used on the notched V-belts.

3. MEASURING AND CHECKING PRACTICE

3.1 Preliminary note

When a wide V-belt under tension passes round a grooved pulley, its cross-section undergoes considerable distortion along the arc of contact. For this reason, the dimensions of such a belt can only be validly defined, and consequently checked, if the belt is placed under conditions as similar as possible to the average conditions for normal use.

3.2 Principle of checking

The recommended device, shown in Figure 3, consists basically of two pulleys of the same dimensions, one of which can be moved by translation in the plane of symmetry of the grooves, under the effect of the measuring force F (see Tables 5 and 6).

In addition, a gauge is provided in one of the pulleys to check the section.

The belt should be checked only after it has made three complete revolutions.

3.3 Dimensions of the checking device

The dimensions of the pulleys and of the gauge are given in millimetres in Table 5 and in inches in Table 6.

3.4 Checking belt cross-section

The method consists in checking the radial position of the belt in the gauge-pulley.

For this purpose (see Fig. 4), the rim of the gauge-pulley has two symmetrical radial slots, widening on the outside, which make it possible to locate the contact area between belt and groove.

When checking the radial position of the belt, the twin slots should first be located as shown in Figure 3.

It should then be checked

- that belt ride out is below the limit indicated in clause 2.1.3;
- that the theoretical edge of the internal base is outside the circumference H_2.

For this purpose, the intersection of this circumference with the slots is marked, on the level flanges, by a thin engraved line, parallel to the bottom of the slot; if necessary, these engraved lines may be filled with paint, so that they can be seen more easily.

3.5 Checking belt length

Check the belt length as follows :

(*a*) Calculate the pitch length L_p by the formula

$$L_p = 2E + C_p$$

where

E is the distance between axes, measured as specified in clauses 3.1 and 3.2;

C_p is the pitch circumference of the checking pulleys.

(*b*) Calculate the outside length L_e by the formula

$$L_e = 2E + C$$

where

E is the distance between axes, measured as specified in clauses 3.1 and 3.2;

C is the sum of the pitch circumference (C_p) of the checking pulleys and the relevant length given in the table in clause 2.1.4.