INTERNATIONAL STANDARD

ISO 1604

Second edition
1989-11-15

Belt drives — Endless wide V-belts for industrial speed-changers and groove profiles for corresponding pulleys

Transmissions par courroies — Courroies trapézoïdales larges sans fin pour variateurs de vitesse industriels et profils de gorge des poulies correspondantes

Reference number
ISO 1604 : 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 1604 was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts).*

This second edition cancels and replaces the first edition (ISO 1604 : 1976), of which it constitutes a technical revision.

Annex A of this International Standard is for information only.

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Belt drives — Endless wide V-belts for industrial speed-changers and groove profiles for corresponding pulleys

1 Scope

This International Standard specifies the principal dimensions of endless wide V-belts for industrial speed-changers, and the groove profiles of corresponding fixed or variable diameter pulleys.

It does not apply to speed-changer belts used either as parts of farm-machines (in particular harvesters), which are standardized in ISO 3410, or for the propulsion of self-propelled vehicles (motor-cycles, scooters, cars).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1081 : 1980, *Drives using V-belts and grooved pulleys — Terminology.*

ISO 9608:1988, *V-belts — Uniformity of belts — Centre distance variation — Specifications and test method.*

3 Definitions and symbols

For the purposes of this International Standard, the terms and symbols relating to drives using V-belts (i.e. belts and grooved pulleys) defined in ISO 1081 apply.

4 Belt designation

The belt designation consists of the letter W and the nominal pitch width of the belt.

The cross-sections are designated as follows:

W16 — W20 — W25 — W31,5 — W40 — W50 — W63 — W80 — W 100

The values of the pitch widths, w_p (expressed in millimetres), are nine consecutive terms from the R10 series of preferred numbers. Should this series of values be considered insufficient, it may be completed

— outside the limits, with other terms from the R10 series of preferred numbers;

— inside the limits, with terms from the R20 series of preferred numbers.

5 Dimensions and tolerances

5.1 Belts

5.1.1 Cross-sections (see figure 1)

The cross-section is characterized by a relative height, T/w_p, of about 0,32.

The pitch line is situated at approximately one-quarter of the height of the profile below the large base of the trapezium.

5.1.2 Dimensions (see figure 1)

The dimensions of the belt cross-sections are given in table 1.

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 belt manufacturer's option.

Table 1 — Dimensions of belt cross-sections

Dimensions in millimetres

Belt designation		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
w_p		16	20	25	31,5	40	50	63	80	100
w	nom.	17	21	26	33	42	52	65	83	104
T	nom.	6	7	8	10	13	16	20	26	32
B	nom.	1,5	1,75	2	2,5	3,2	4	5	6,5	8
H	nom.	4,5	5,25	6	7,5	9,8	12	15	19,5	24

NOTE — The approximate formulae are as follows:

- height, $T = 0{,}32\ w_p$
- height above pitch line, $B = 0{,}08\ w_p = 0{,}25\ T$
- height below pitch line, $H = 0{,}24\ w_p = 0{,}75\ T$

5.1.3 Belt ride position

The belt ride position under the conditions specified in 6.1.6 shall not exceed the values given in table 2.

Table 2 — Belt ride position

Dimensions in millimetres

Belt designation		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
Ride-in above H_1*) (see figure 6)	min.	0	0	0	0	0	0	0	0	0
	max.	1,2	1,8	1,8	1,8	2,4	2,4	3,0	3,0	3,6

*) The ride-in values relate to the checking pulley outer diameters given in table 7. The approximate value of ride-out above b_{min} of service pulleys (see table 5) is given by $0{,}12\sqrt{w_p}$.

5.1.4 Length

Values for the datum length, L_d, are multiples of the pitch width, the multiplier coefficients being eight consecutive terms from the R20 series of preferred numbers (28 to 63 inclusive). The belt lengths and their tolerances are given in table 3.

Table 3 — Belt length

Dimensions in millimetres

Datum length L_d	tol.	Belt designation								
		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
450	± 10	x								
500		x								
560	± 12	x	x							
630		x	x							
710	± 14	x	x	x						
800	± 16	x	x	x						
900	± 18	x	x	x	x					
1 000	± 20	x	x	x	x					
1 120	± 22		x	x	x	x				
1 250	± 24		x	x	x	x				
1 400	± 28			x	x	x	x			
1 600	± 32			x	x	x	x			
1 800	± 36				x	x	x	x		
2 000	± 40				x	x	x	x		
2 240	± 44					x	x	x	x	
2 500	± 50					x	x	x	x	
2 800	± 56						x	x	x	x
3 150	± 62						x	x	x	x
3 550	± 70							x	x	x
4 000	± 80							x	x	x
4 500	± 90								x	x
5 000	± 100								x	x
5 600	± 110									x
6 300	± 120									x

NOTES

1 The allowable deviation on the datum length is about ± 2 %.

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.

Should the range of datum lengths given in table 3 be considered insufficient, it may be completed

— outside the limits, with other terms from the R20 series of preferred numbers;

— exceptionally, between two consecutive lengths from table 3, with terms from the R40 series of preferred numbers (especially for box-type speed-changers).

5.1.5 Centre distance variations

Centre distance variations, ΔE, are given in relation to the belt section in table 4.

Table 4 — Centre distance variations

Dimensions in millimetres

Belt length		Belt section	
over	up to (inclusive)	⩽ 25	> 25
		ΔE	
—	1 000	1,2	1,8
1 000	2 000	1,6	2,2
2 000	5 000	2	3,4
5 000	—	2,5	3,4

5.2 Pulleys and grooves

5.2.1 Groove profile dimensions (see figures 2 and 3)

The dimensions of the pulley groove profiles are given in table 5.

Table 5 — Dimensions of groove profile

Dimensions in millimetres

Section designation		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
$\alpha°$	±0° 40′	24	26	26	26	26	28	28	30	30
w_d	nom.	16	20	25	31,5	40	50	63	80	100
b	min.	1,5	1,75	2	2,5	3,25	4	5	6,5	8
h	min.	6	7,2	8,5	10,6	13,2	17	21,2	26,5	33,5

NOTE — The approximate formulae are as follows :

— groove height above the pitch line, $b = 0{,}08\ w_d$;

— groove height below the pitch line, $h = 0{,}335\ w_d$.

5.2.2 Pulley diameters

The datum diameter, d_d (minimum in the case shown in figure 2), shall not be less than the values given in table 6 for any setting of the drive.

Table 6 — Pulley diameters

Dimensions in millimetres

Section designation		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
d_d [1]	min.	28	36	45	56	71	90	112	140	180

1) The minimum value for d_d is equal to approximately 5,6 times the nominal height of the belt sidewalls. Because of the need for compactness of these types of speed-changers, it is necessary to minimize datum diameters. At the present level of techniques, the given values for the minimum datum diameter should be used with notched V-belts only.

NOTE — The approximate value of the minimum datum diameter is $d_{d,min} = 1{,}8\ w_d$.

The pulley outer diameter is given by the formula

$$d_{o,min} = d_{d,min} + 2d_{min}$$

6 Measuring and checking

6.1 Checking of the belt

6.1.1 Preliminary remark

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 defined measuring conditions as similar as possible to the average conditions of normal use.

6.1.2 Checking device and procedure

The recommended device (see figure 4) 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 a measuring force F.

In addition, one of the pulleys comprises a gauge to check the section.

The dimensions of the measuring pulleys and of the gauge and the measuring force F are given in table 7.

The belt shall be checked only after it has made at least two complete revolutions to seat it properly.

Table 7 — Dimensions of checking pulley, and measuring force

Dimensions in millimetres

Section designation		W16	W20	W25	W31,5	W40	W50	W63	W80	W100
Pulleys	$\alpha°$ ±0° 20′	24	26	26	26	26	28	28	30	30
	w_d	16	20	25	31,5	40	50	63	80	100
	C_d	200	250	320	400	500	630	800	1 000	1 250
	d_d	63,7	79,6	101,9	127,3	159,2	200,5	254,6	318,3	397,9
	d_o	67,1	84	107,1	133,5	167,2	210,1	266,6	333,1	416,4
	h	6	7,2	8,5	10,6	13,2	17	21,2	26,5	33,5
Gauge	h_1	0,5	0,4	0,8	1,3	1,6	2,4	3	4,4	5,7
	h_2	4,5	5,25	6,3	7,8	10	12,4	15,5	19,7	24,6
	h_3	5,5	6,7	8	10	12,4	16	20	25	32
	u	2	2	2,5	3,2	4	5	6,5	8	10
F[1]	N	150	180	224	300	425	600	900	1 400	2 120

1) The tension on each strand of the belt shall be equal to one-half of the values given.

NOTE — The approximate formulae are as follows :

- datum circumference, $C_d = 12{,}5\ w_d$
- datum diameter, $d_d = \frac{12{,}5}{\pi} w_d \approx 4\ w_d$
- $h = 0{,}335\ w_d$
- $h_2 = 0{,}24\ w_d + 0{,}06\sqrt{w_d}$
- $h_3 = 0{,}32\ w_d$
- $u = 0{,}1\ w_d$
- measuring force, $F = 0{,}2\ w_d^2 + 100$ (rounded to the nearest preferred number in the R40 series)
- h_1 is given by

  $2\ h_1 = d_o - d_d - 2 \times$ ride-out

where ride-out is the maximum value given in table 2.

6.1.3 Checking belt length

The datum length of the belt, L_d, is given by the formula

$$L_d = 2E + C_d$$

where

E is the distance between axes, measured as specified in 6.1.2;

C_d is the datum circumference of the checking pulleys.

6.1.4 Checking centre distance variation

The centre distance variation shall be checked in accordance with the test method specified in ISO 9608.

6.1.5 Checking belt cross-section

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

For this purpose (see figure 5), 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. On the level flanges of the slot, thin lines H_1 and H_2 are engraved parallel to the bottom of the slot (see figure 5).

NOTE — If necessary, these engraved lines may be filled with paint, so that they can be seen more easily.

When checking the radial position of the belt, the two slots shall first be located as shown in figure 4.

It shall then be checked that the theoretical edge of the internal base of the belt is above the H_2 marking (see figure 6).

6.1.6 Checking belt ride position

In the position shown in figure 4, check that the top of the belt is between the outer diameter of the checking pulley and the H_1 marking (see figure 6).

6.2 Checking pulley groove diameter
(see figures 7 and 8)

Place two balls or rods, the diameters of which are given in table 8, in contact with the groove to be checked and separated by 180°.

NOTE — The diameters d have been determined so that the simultaneous contact of each ball or rod with the two sides of the groove is made approximately 0,025 w_d below the level of the datum width.

Measure the distance, K, between the external tangent planes to the balls or rods and parallel to the axis of the pulley.

The datum diameter, d_d, is given by

$$d_d = K - 2x$$

where the value of the corrective term $2x$ is given in table 8.

Table 8 — Checking of groove diameter

Dimensions in millimetres

Section designation	W16	W20	W25	W31,5	W40	W50	W63	W80	W100
d ±0,02	16,2	20,3	25,4	32	40,6	50,9	64,2	81,8	102,2
$2x$	18,8	23,9	30	37,8	47,8	60,8	76,9	99,3	123,9

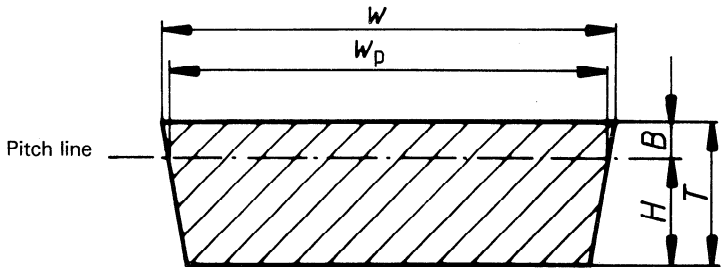

Figure 1 — Cross-section

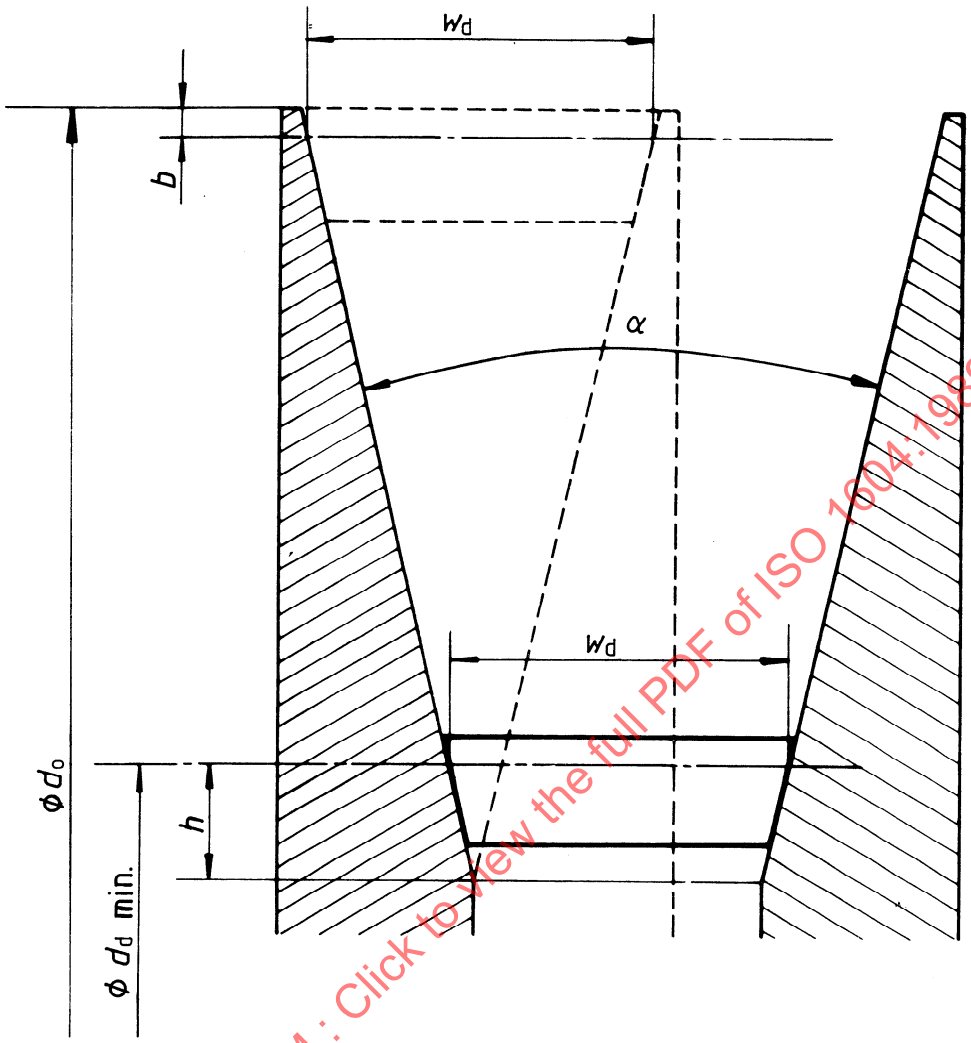

Figure 2 — Variable diameter pulley

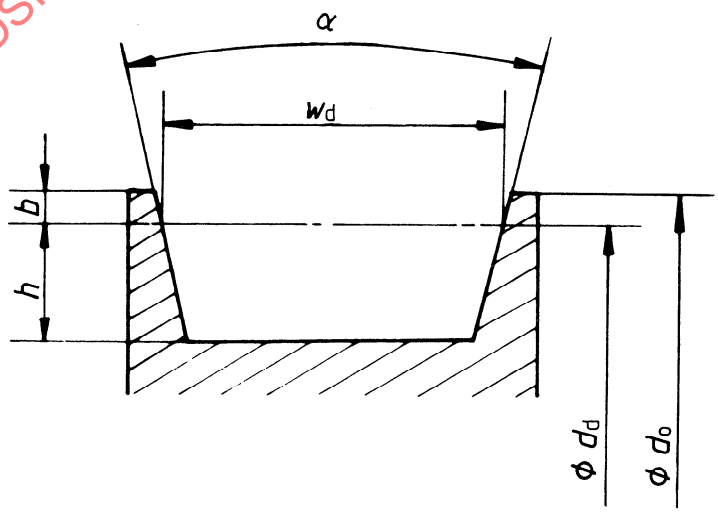

Figure 3 — Fixed diameter pulley