INTERNATIONAL STANDARD

ISO 5289

Third edition
2018-11

Agricultural machinery — Endless hexagonal belts and groove sections of corresponding pulleys

Machines agricoles — Courroies hexagonales sans fin et profils de gorges des poulies correspondantes

Reference number
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Contents

Page

Foreword

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This document was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 1, *Friction*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This third edition cancels and replaces the second edition (ISO 5289:1992), which has been technically revised. The main changes compared to the previous edition are as follows:

— in 5.1.3, the length tolerance and range of belts have been changed based on ISO 24035;

— in Table 1, the dimensions of measuring pulleys and measuring forces have been changed based on ISO 24035;

— in 6.2, the length measuring procedure and formula has been changed.

Agricultural machinery — Endless hexagonal belts and groove sections of corresponding pulleys

1 Scope

This document specifies the main dimensions of endless hexagonal belts intended for use on agricultural machinery (and, in particular, harvester-thresher machines), together with the groove section of the corresponding fixed-diameter pulleys.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1081, *Belt drives — V-belts and V-ribbed belts, and corresponding grooved pulleys — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1081 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Symbols and abbreviated terms

For the purpose of this document, the symbols and abbreviated terms given in ISO 1081 and the following apply. (see Table 1)

Table 1 — Symbols and abbreviated terms

Symbol	Designation	Unit
b_d	Correction factor	—
b_e	Effective line differential	—
C_e	Effective circumference of the measuring pulleys	mm
d_e	Effective diameter	mm
d_d	Datum diameter	mm
d_p	Pitch diameter	mm
E_{min}	Minimum centre distance measured during the measuring cycle	mm
E_{max}	Maximum centre distance measured during the measuring cycle	mm
F	Measuring force	N
h	Minimum groove depth	mm
L_e	Nominal effective length	mm
R	Speed ratio	—
T	Height	mm
w	Width	mm

Table 1 *(continued)*

Symbol	Designation	Unit
w_d	Datum width of the pulley groove	mm
w_e	Effective width	mm
w_p	Pitch width of the belt	mm
α	Groove angle	degree
HAA	Profile of the belt as defined in Table 2	—
HBB	Profile of the belt as defined in Table 2	—
HCC	Profile of the belt as defined in Table 2	—
HDD	Profile of the belt as defined in Table 2	—

5 Dimensions and tolerances

5.1 Belts

5.1.1 General

An endless hexagonal belt on agricultural machinery transmits a high degree of force per unit of section; when it approaches a groove pulley, its cross-section undergoes appreciable deformations. For this reason, the various dimensions specified in this document are to be taken as being those of the belt placed on the device used for the measurement of its length, and subjected to the force, *F*. The dimensions, *w* and *T*, are those relating to the parts of the belt when in contact with the measuring pulleys.

5.1.2 Cross-sections

The theoretical profile of these belts is a hexagon consisting of two equal isosceles trapezia joined at their wider base; the neutral axis, coinciding in practice with the transverse diagonal of this hexagon, is therefore located at half the height of the section (see Figure 1).

The dimensions of these cross-sections depending on profile are given in Table 2.

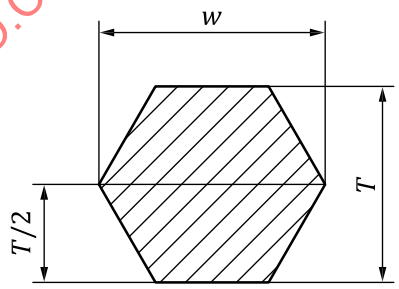


Figure 1 — Cross-section of a belt

Table 2 — Cross-section nominal dimensions depending on profile

Dimensions in millimetres

Parameter	Symbol	Cross-section nominal dimension depending on profile			
		HAA	HBB	HCC	HDD
Width	*w*	13	17	22	32
Height	*T*	10	13	17	25

5.1.3 Lengths

The range of effective lengths is that of the R 40 series of preferred numbers (see ISO 3) from 1 320 mm to 10 000 mm (see Table 3).

Table 3 — Standard length of belt and tolerance depending on profile

Dimensions in millimetres

Nominal effective length L_e	Tolerance	Standard sizes			
		HAA	HBB	HCC	HDD
1 320	±13	X	X	—	—
1 400	±13	X	X	—	—
1 500	±13	X	X	—	—
1 600	±13	X	X	—	—
1 700	±13	X	X	—	—
1 800	±13	X	X	—	—
1 900	±13	X	X	—	—
2 000	±13	X	X	—	—
2 120	±13	X	X	—	—
2 240	±13	X	X	X	—
2 360	±13	X	X	X	—
2 500	±13	X	X	X	—
2 650	±16	X	X	X	—
2 800	±16	X	X	X	—
3 000	±16	X	X	X	—
3 150	±16	X	X	X	—
3 350	±20	—	X	X	—
3 550	±20	—	X	X	—
3 750	±20	—	X	X	—
4 000	±20	—	X	X	X
4 250	±25	—	X	X	X
4 500	±25	—	X	X	X
4 750	±25	—	X	X	X
5 000	±25	—	X	X	X
5 300	±32	—	X	X	X
5 600	±32	—	X	X	X
6 000	±32	—	X	X	X
6 300	±32	—	X	X	X
6 700	±40	—	X	X	X
7 100	±40	—	X	X	X
7 500	±40	—	X	X	X
8 000	±40	—	—	X	X
8 500	±50	—	—	X	X

NOTE 1 Reduced tolerances on length can be used, for example, by agreement between the manufacturer and user.

NOTE 2 "X" is for "Standard size".

NOTE 3 For availability of belt size, consult the belt manufacturer.

Table 3 *(continued)*

Nominal effective length L_e	Tolerance	Standard sizes			
		HAA	HBB	HCC	HDD
9 000	±50	—	—	X	X
9 500	±50	—	—	—	X
10 000	±50	—	—	—	X
NOTE 1 Reduced tolerances on length can be used, for example, by agreement between the manufacturer and user.					
NOTE 2 "X" is for "Standard size".					
NOTE 3 For availability of belt size, consult the belt manufacturer.					

5.2 Grooved pulleys

5.2.1 Pulleys having parallel axes of rotation

The hexagonal belts can be used with pulley groove profiles for classical belt sections in accordance with ISO 4183 or ISO 5291 (see Table 4).

Table 4 — Groove profiles used for a belt profile

Hexagonal belt profile	Groove profile	
	ISO 4183	ISO 5291
HAA	A	AJ
HBB	B	BJ
HCC	C	CJ
HDD	D	DJ

5.2.2 Pulleys having axes of rotation which are not parallel

In such cases, it is often necessary to increase the outside diameter of the pulley in relation to the effective diameter, and sometimes the angle of the groove, in order to allow the belts to approach and leave the grooves without friction occurring at their edges.

It is not possible to determine an outline of groove which would suit all cases of transmission between shafts that are not parallel. However, local specifications define the geometrical characteristics that govern transmission between orthogonal shafts (known as quarter-turn drives) and particularly the special groove profile (known as a "deep groove") to be used in this case.

6 Measurement of lengths of belts

6.1 Measuring device

The device recommended, shown in sketch form in Figure 2, consists essentially of two grooved pulleys of similar functional dimensions, one of which is movable in the same plane as the belt by the measuring force, F (see Table 5).

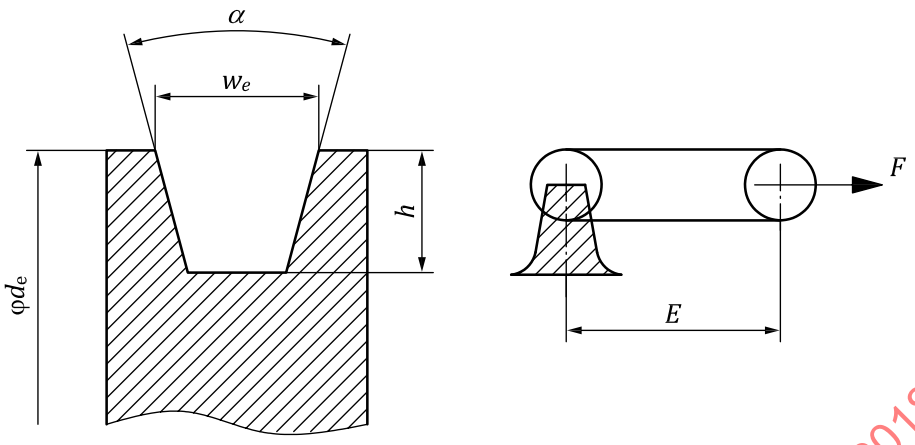


Figure 2 — Measuring device

Table 5 — Dimensions of measuring pulleys and measuring forces

Parameter		Symbol	Unit	Parameter values depending on profile			
				HAA	HBB	HCC	HDD
Effective width		w_e	mm	13	16,5	22,4	32,8
Minimum groove depth		h	mm	12	14	19	26
Effective diameter	±0,10	d_e	mm	95,5	143,2	222,8	318,3
Effective circumference		C_e	mm	300	450	700	1 000
Diameter of ball or rod	±0,01	d_B	mm	12,5	15,5	21,0	30,5
Diameter over ball or rods	±0,10	K	mm	108,2	157,7	242,2	346,6
Measuring force		F	N	300	450	850	1 800
Groove angle	±0,25	α	degree	34	34	34	36

6.2 Procedure

For the measurement of the effective length, set the belt up on two identical pulleys given in Table 5. The pulleys shall be mounted on parallel horizontal axes on a testing bench. Apply the measuring force indicated in Table 5 to the sliding pulley. Rotate the pulleys in order that the belt effects one to three rotations and, thus, sits properly in the pulley grooves. Measure the distance between the axes of the pulleys.

The effective length, L_e, of any belt is given by Formula (1).

$$L_e = E_{max} + E_{min} + C_e \quad (1)$$

where

E_{max} is the maximum centre distance measured during the measuring cycle, in millimetres;

E_{min} is the minimum centre distance measured during the measuring cycle, in millimetres;

C_e is the effective circumference of the measuring pulleys, in millimetres.

6.3 Groove section of measuring pulleys

Only the values of w_e, C_e and the angle of the groove, α, are of importance; the depth, h, given in Table 5 is for reference only.

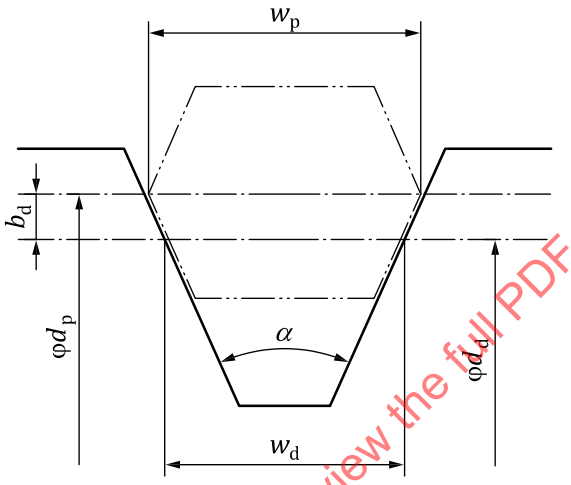
7 Calculation of speed ratio, R

7.1 General

For calculations of the speed ratio, R, knowledge of the pitch diameters, d_p, of the two pulleys in the drive is necessary. For approximate calculations the procedure given in 7.2 and 7.3 may be used.

7.2 Correction factor for the datum diameter, d_d, for pulley grooves according to ISO 4183 (datum system)

If hexagonal belts are used in pulleys with a datum diameter, d_d, as defined in ISO 4183, a correction factor shall be used to obtain the pitch diameter, d_p, for this unique belt section. See Figure 3.



Key

w_d datum width of the pulley groove

w_p pitch width of the belt

Figure 3 — Pulley diameters

The correction factor, b_d (the datum line differential as defined in ISO 1081), is used in Formula (2) to obtain the pitch diameter, d_P.

$$d_p = d_d + 2 \cdot b_d \tag{2}$$

The values of $2 \cdot b_d$ depending on groove angle, α, are given in Table 6.

Table 6 — Value of $2 \cdot b_d$ depending on groove angle

Dimensions in millimetres

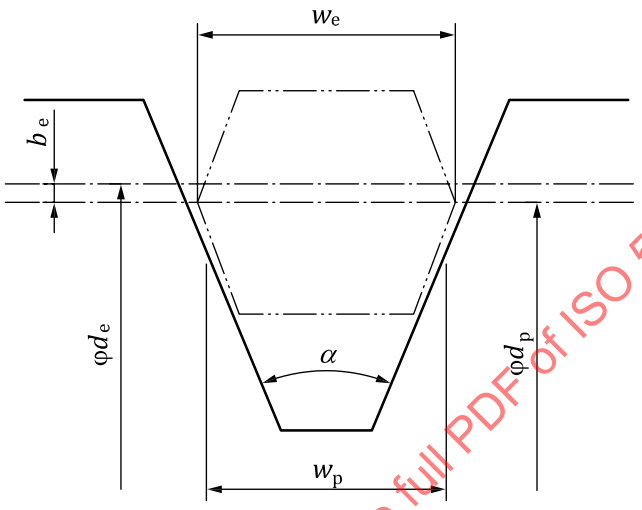
Belt profile	Groove profile	Value of $2 \cdot b_d$ depending on groove angle		
		34°	36°	38°
HAA	A	6,5	—	5,8
HBB	B	8,2	—	7,3
HCC	C	11,1	—	9,9
HDD	D	—	17,9	16,8

7.3 Correction factor for the effective diameter, d_e, for pulley grooves according to ISO 5291 (effective system)

Because of the unique belt section of hexagonal belts, the value, b_e (the effective line differential as defined in ISO 1081), can be considered to be zero.

Therefore, the pitch diameter, d_P, of such a drive is approximately equal to the effective diameter, d_e.

Figure 4 shows the pulley diameters.



Key

w_e effective width of the pulley groove

w_p pitch width of the belt

Figure 4 — Pulley diameters