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Second edition
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Synchronous belt drives — Metric pitch — Tooth profiles T and AT endless and open ended belts and pulleys

Transmissions synchrones par courroies — Pas métrique — Poulies et courroies dentées sans fin ou à bout libre à dents de profil T ou AT

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, Subcommittee SC 4, *Synchronous belt drives*.

This second edition cancels and replaces the first edition (ISO 17396:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— root diameter specifications for AT series pulleys (Figure 6 and Table 12) have been added.

Synchronous belt drives — Metric pitch — Tooth profiles T and AT endless and open ended belts and pulleys

1 Scope

This document specifies the principal characteristics of synchronous endless and open belts and pulleys of the profile systems T and AT for use in synchronous belt drives for mechanical power transmission and where positive indexing or synchronization can be required.

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

The principal belt and pulley characteristics include

a) nominal belt tooth dimensions,

b) belt tooth pitch spacing,

c) belt length and width dimensions,

d) belt length measurement specifications,

e) pulley groove dimensions and tolerances,

f) pulley diameter and width dimensions and tolerances, and

g) pulley quality specification.

The belts of the profile systems T and AT are made of polyurethane with high-tension fine steel cord tension members in most cases. As far as certain forces are given in this document, these values are only valid for these kinds of belt. For polyurethane belts with different tensile cords, i.e. aramid or rubber belts reinforced with glass fibre, the values can be different. It is intended that the user and the manufacturer agree about suitable values. Open belts made of thermoplastic polyurethane can be spliced to work as endless belts in conveyor applications. In this case, the tolerances are not valid for the splicing area of the endless spliced belt.

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 254, *Belt drives — Pulleys — Quality, finish and balance*

3 Terms and definitions

No terms and definitions are listed in this document.

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 Belt profile systems

Eight belt profiles for synchronous drives are standardized.

Profile system T:

— profile T2,5

— profile T5

— profile T10

— profile T20

Profile system AT:

— profile AT3

— profile AT5

— profile AT10

— profile AT20

5 Belt nomenclature

A belt is designated by a combination of numbers and letters as follows:

a) the width, in millimetres;

b) the profile system;

c) the pitch, in millimetres;

d) the belt pitch length, in millimetres (and add the number of teeth in brackets, if required);

e) double-sided belts are designated by adding D_G or D_T before the profile system letter: D_G if the tooth position is opposite **G**ap; D_T if the tooth position is opposite **T**ooth;

f) open belts are designated by adding the letter “M” behind the length; for spliced belts, use the letter “V.”

EXAMPLE 1 A metric synchronous belt of 10 mm pitch, profile system T, 50 mm wide, and 1 400 mm in pitch length is designated as follows:

— for a single-sided belt: **50 - T10 - 1 400**;

— for a double-sided belt: **50 - D_G - T10 - 1 400** or **50 - D_T - T10 - 1 400**.

EXAMPLE 2 A metric synchronous belt of 5 mm pitch, profile system AT, 25 mm wide, and 500 mm in pitch length (number of teeth = 100) is designated as follows:

— for a single-sided belt: **25 - AT5 - 500 (100 t)**;

— for double-sided belt: **25 - D_G - AT5 - 500 (100 t)** or **25 - D_T - AT5 - 500 (100 t)**.

EXAMPLE 3 An open metric synchronous belt of 5 mm pitch, profile system AT, 25 mm wide, and 50 000 mm in pitch length is designated as

25 - AT5 - 50 000 - M.

6 Pulley profile systems

Eight pulley profiles for synchronous drives are standardized.

Profile system T:

— profile T2,5
— profile T5
— profile T10
— profile T20

Profile system AT:

— profile AT3
— profile AT5
— profile AT10
— profile AT20

7 Pulley nomenclature

A pulley for a synchronous drive is identified by the number of grooves, the groove pitch and profile, and the width. It is designated, as is the belt, by a combination of numbers and letters as follows:

a) the letter "P", which indicates a pulley;

b) the number of grooves;

c) the profile system;

d) the groove pitch, in millimetres;

e) the width, in millimetres.

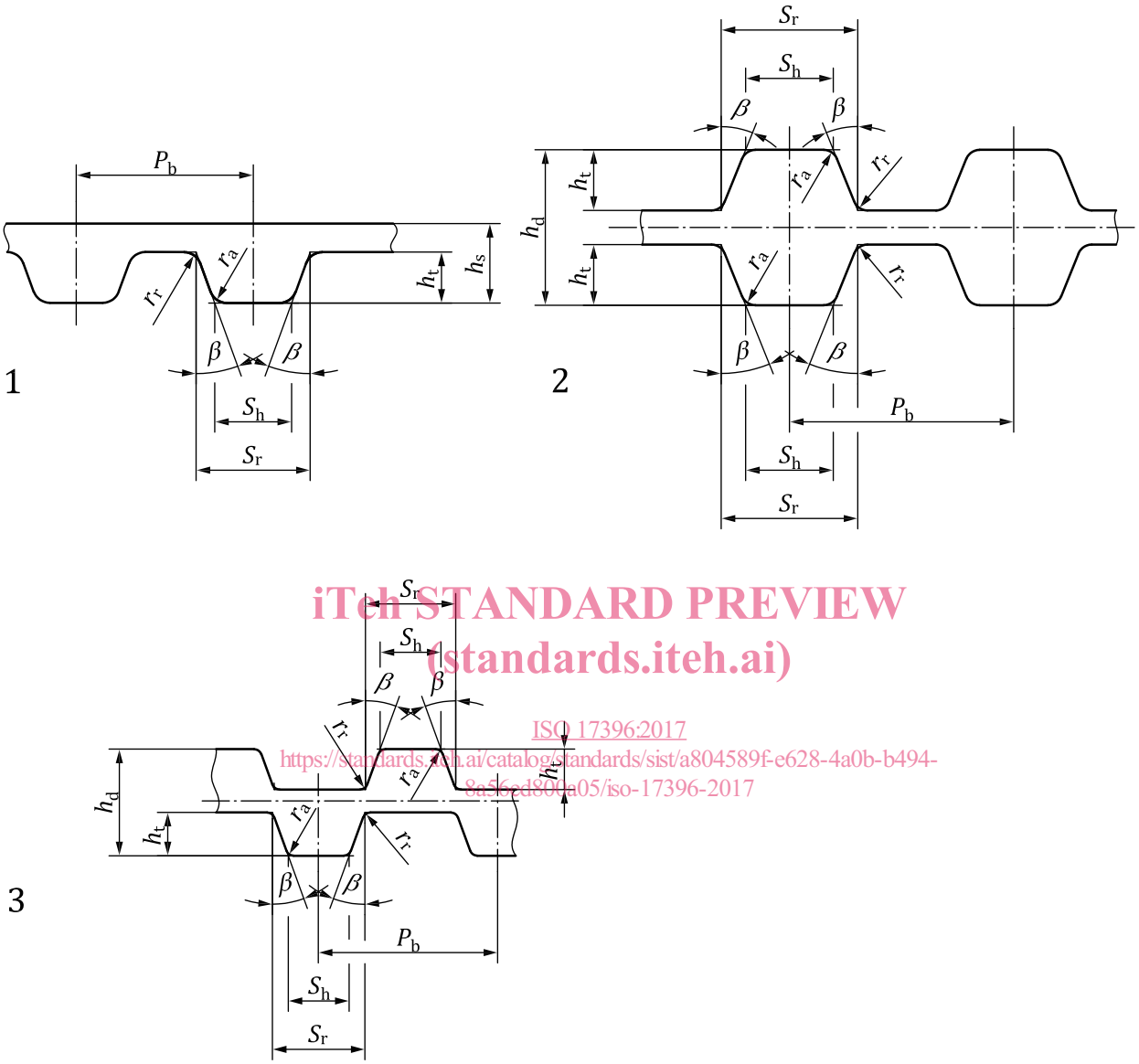
EXAMPLE A pulley for a metric toothed belt which has 20 mm pitch and 30 grooves with a nominal width of 50 mm is identified as follows:

— for T-profile system pulley: **P30 - T20 - 50**;

— for AT-profile system pulley: **P30 - AT20 - 50**.

8 Belt profile systems T and AT

8.1 Belt profile systems T and AT — General



Key

1 single-sided metric synchronous belt

2 symmetrical double-sided metric synchronous belt

3 asymmetric double sided metric synchronous belt

Figure 1 — Belt dimensions for profile systems T and AT

8.2 Profile system T — Belt tooth dimensions and tolerances

The nominal belt tooth dimensions are the same for single-sided and double-sided belts; they are given in Table 1 and shown in Figure 1.

Table 1 — Profile system T — Nominal tooth dimensions

Belt profile	Pitch P_b mm	Tooth angle 2β degrees	Root width S_r mm	h_s mm	h_d mm	h_t mm	r_a min. mm	$r_r \pm 0,1$ mm
T2,5	2,5	40 ± 2	1,50 ± 0,05	1,30 ± 0,15	1,90	0,70 ± 0,05	0,2	0,2
T5	5,0	40 ± 2	2,65 ± 0,05	2,20 ± 0,15	3,25	1,20 ± 0,05	0,4	0,4
T10	10,0	40 ± 2	5,30 ± 0,10	4,50 ± 0,30	6,80	2,50 ± 0,10	0,6	0,6
T20	20,0	40 ± 2	10,15 ± 0,15	8,00 ± 0,45	12,85	5,00 ± 0,15	0,8	0,8

NOTE The value of h_d can vary due to process-related adjustments of the manufacturer.

8.3 Profile system AT — Belt tooth dimensions and tolerances

The nominal belt tooth dimensions are the same for single-sided and double-sided belts; they are given in Table 2 and shown in Figure 1.

Table 2 — Profile system AT — Nominal tooth dimensions

Belt profile	Pitch P_b mm	Tooth angle 2β degrees	Head width S_h mm	h_s mm	h_d mm	h_t mm	r_a min. mm	$r_r \pm 0,1$ mm
AT3	3,0	50 ± 2	1,50 ± 0,05	1,90 ± 0,15[a]	n.a.	1,10 ± 0,05	0,3	0,1
AT5	5,0	50 ± 2	2,50 ± 0,05	2,70 ± 0,15[a]	3,05	1,20 ± 0,05	0,4	0,6
AT10	10,0	50 ± 2	5,00 ± 0,10	4,50 ± 0,30[a] (5,0)	6,50	2,50 ± 0,10	0,6	1,2
AT20	20,0	50 ± 2	10,00 ± 0,15	8,00 ± 0,45[a] (9,0)	12,15	5,00 ± 0,15	1,6	2,5

NOTE The value of h_d can vary due to process-related adjustments of the manufacturer.

[a] The thickness of the backside depends on the method of manufacturing.

9 Belt widths and tolerances

Belt widths and tolerances are given in Table 3.

Table 3 — Belt widths and width tolerances

Dimensions in millimetres

Belt profile	Nominal belt width				Tolerance
T2,5	—	4	6	10	±0,3
T5	6	10	16	25	±0,5
T10	16	25	32	50	±0,5
T20	32	50	75	100	±1,0
AT3	6	10	16	25	±0,3
AT5	6	10	16	25	±0,5
AT10	16	25	32	50	±0,5
AT20	32	50	75	100	±1,0

NOTE Tolerances for larger belt widths and closer tolerances to be confirmed between the user and the manufacturer.

10 Pitch length measurement

10.1 Endless belts manufactured in circular moulds

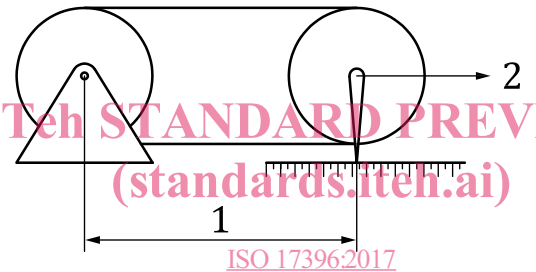
10.1.1 The pitch length of a synchronous belt shall be determined by placing the belt on a measuring fixture (see Figure 2) composed of the elements given in 10.1.2 to 10.1.4.

10.1.2 Two pulleys of equal diameter, as specified in Table 4, of the proper profile shown in Table 7. One pulley shall be free to rotate on a fixed-position shaft, while the other shall be free to rotate on a moveable shaft to permit the centre distance to change.

10.1.3 Means of applying a total measuring force to the moveable pulley, as given in Table 5.

10.1.4 Means of measuring the centre distance between the two pulleys with the necessary degree of accuracy for centre distance measurement.

NOTE The number of pulley teeth specified in Table 4 determines the recommended sizes for measuring the belt pitch length. Practicably, the other sizes of pulleys can be used provided they have the same number of teeth and meet the dimensional requirements of Table 4.



Key

1 centre distance

2 total measuring force

Figure 2 — Fixture for measuring the pitch length for endless belts manufactured in circular moulds

Table 4 — Belt length measuring pulleys

Dimensions in millimetres

Belt profile	Number of grooves	Pitch circumference	Outside diameter[a]	Radial runout	Axial runout
				FIM[a]	FIM[a]
T2,5	20	50	15,42 $_{-0,05}$	0,013	0,025
T5	20	100	30,99 $_{-0,05}$	0,013	0,025
T10	20	200	61,80 $_{-0,08}$	0,013	0,025
T20	20	400	124,47 $_{-0,08}$	0,013	0,050
AT3	20	60	18,69 $_{-0,05}$	0,013	0,025
AT5	20	100	30,61 $_{-0,05}$	0,013	0,025
AT10	24	240	74,57 $_{-0,08}$	0,013	0,025
AT20	25	500	156,33 $_{-0,08}$	0,013	0,050

[a] Full indicator movement.

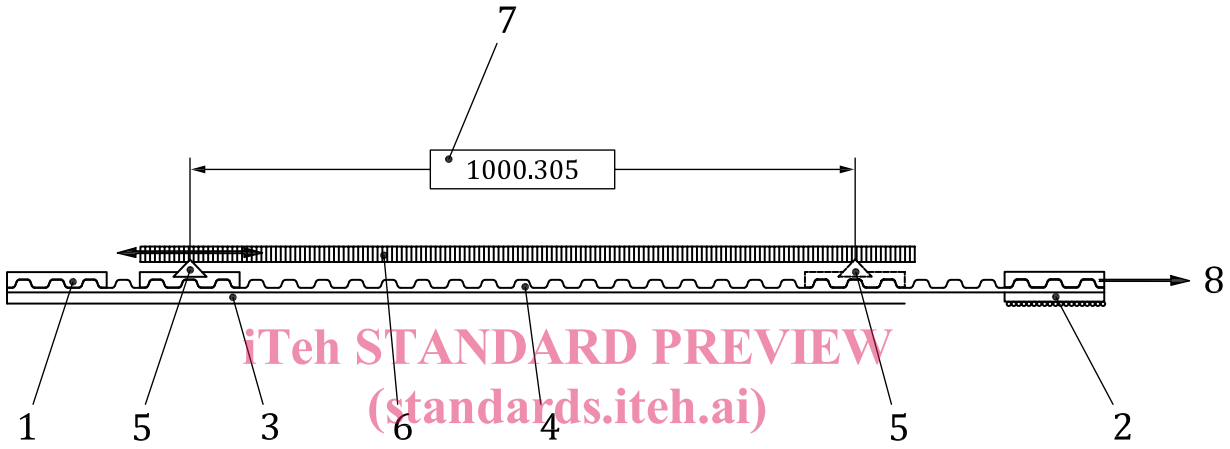
10.2 For very long endless belts and open belts

10.2.1 The pitch length of a synchronous belt shall be determined by placing the belt on a measuring fixture (see Figure 3) composed of the following elements given in 10.2.2 to 10.2.4.

10.2.2 Two identical toothed clamps, of the proper profile, covering three complete belt teeth in mesh, and having zero spacing tooth shape.

10.2.3 Means of applying a total measuring force to the moveable clamp, as given in Table 5.

10.2.4 Means of measuring the distance between the two clamps with the necessary degree of accuracy for distance measurement.



Key

1	fixed clamp	5	measuring plate
2	moveable clamp	6	scale
3	table	7	display
4	belt specimen	8	total measuring force

Figure 3 — Fixture for measuring pitch length of very long endless belts and open belts

10.3 Total measuring forces

The total measuring force that shall be applied for measuring belts is given in Table 5.

The given measuring forces are valid for the measurement according to 10.4.1; for 10.4.2, the measuring forces have to be bisected (50 % of given values). Forces for bigger belt width shall be confirmed between the user and the manufacturer.