



**International
Standard**

ISO 5288

**Synchronous belt drives —
Vocabulary**

Transmissions synchrones par courroies — Vocabulaire

**Fourth edition
2024-11**

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 document 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 of 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 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 fourth edition cancels and replaces the third edition (ISO 5288:2017), of which it constitutes a minor revision. The change is as follows:

- Inclusion of [Clause 4](#).

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.

Synchronous belt drives — Vocabulary

1 Scope

This document specifies the terms and definitions related to the use of synchronous belt drives for mechanical power transmission and where positive indexing or synchronization is required.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 General

3.1.1

synchronous belt drive

system composed of a *synchronous belt* (3.2.1.1) and at least one *synchronous pulley* (3.3.1.1)

Note 1 to entry: Synchronized motion and/or power is transmitted through the engagement of teeth on the belt with *grooves* (3.3.2.1) on the pulleys.

Note 2 to entry: This belt drive has been known in the past by various names such as “timing belt drive”, “positive belt drive” or “gear belt drive”.

3.1.2

centre distance

C

shortest distance between the axes of two *synchronous pulleys* (3.3.1.1) when the belt is under the prescribed measuring force

Note 1 to entry: See [Figure 1](#).

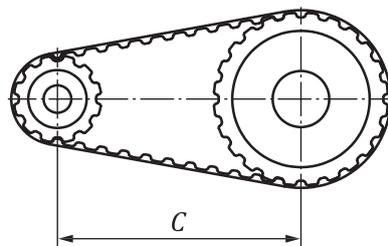


Figure 1

3.1.3

endless synchronous belt drive

synchronous belt drive (3.1.1) with applied endless synchronous belt

Note 1 to entry: See [Figure 2](#).

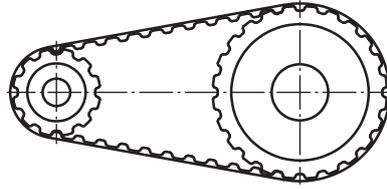


Figure 2

3.1.4

open synchronous belt drive

synchronous belt drive (3.1.1) with applied open synchronous belt

Note 1 to entry: See [Figure 3](#).

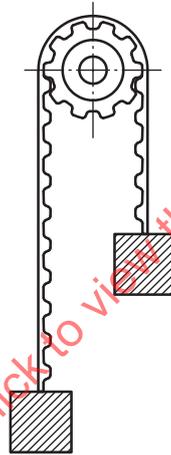


Figure 3

3.2 Synchronous belts

3.2.1 General

3.2.1.1

synchronous belt

belt with transverse teeth of rectangular or curvilinear cross-section extending from the base at regularly spaced intervals

Note 1 to entry: Consult synchronous belt dimensional standards for the full details of belt profiles.

3.2.1.2

tooth pitch

P_b
linear distance between the axes of two consecutive teeth in a section of belt loaded to the prescribed measuring force

Note 1 to entry: See [Figure 4](#).

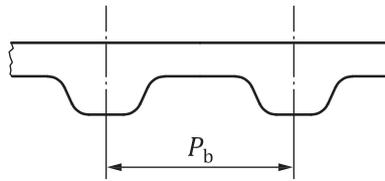


Figure 4

**3.2.1.3
pitch line**

circumferential line in the belt which keeps the same length when the belt is bent perpendicularly to its base

Note 1 to entry: See [Figure 5](#).

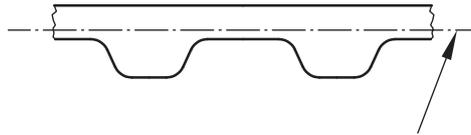


Figure 5

**3.2.1.4
pitch line differential**

a
<belts> radial distance between the *pitch line* ([3.2.1.3](#)) and the *root line* ([3.2.5.3](#))

Note 1 to entry: See [Figure 6](#).



Figure 6

**3.2.1.5
belt pitch length**

L_p
length of the *pitch line* ([3.2.1.3](#)) of a belt

**3.2.1.6
width**

b_s
transverse dimension of the back of the belt

Note 1 to entry: See [Figure 7](#).

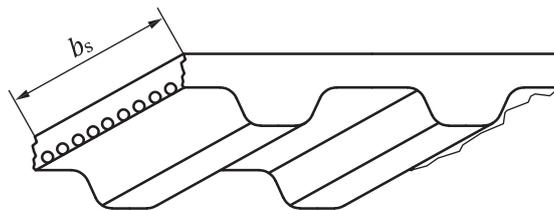


Figure 7

3.2.1.7

height

h_s/h_d

total height of a single-sided or double-sided belt

Note 1 to entry: See [Figure 8](#).

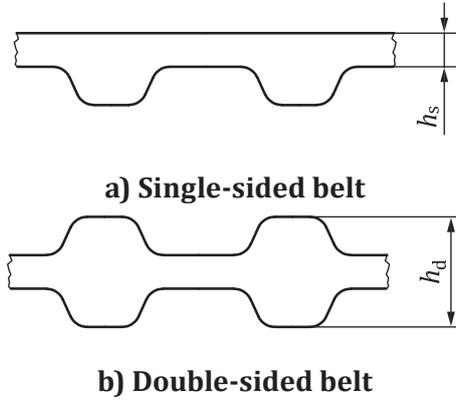


Figure 8

3.2.2 **Tooth profile**

3.2.2.1

trapezoidal profile

transverse *tooth* ([3.2.5.1](#)) profile formed by a *tooth flank* ([3.2.5.5](#)) and tip with only straight lines

Note 1 to entry: See [Figure 9](#).

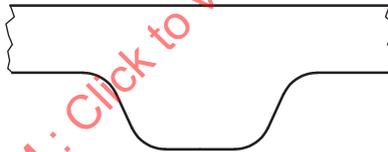


Figure 9

3.2.2.2

curvilinear profile

transverse *tooth* ([3.2.5.1](#)) profile formed by a *tooth flank* ([3.2.5.5](#)) or tip that contains curved lines

Note 1 to entry: See [Figure 10](#).

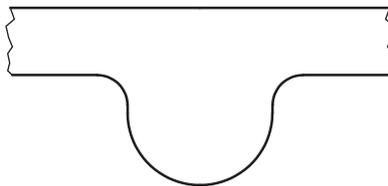


Figure 10

3.2.3 Type of belt drive

3.2.3.1

endless synchronous belt

closed *synchronous belt* (3.2.1.1)

Note 1 to entry: See [Figure 11](#).

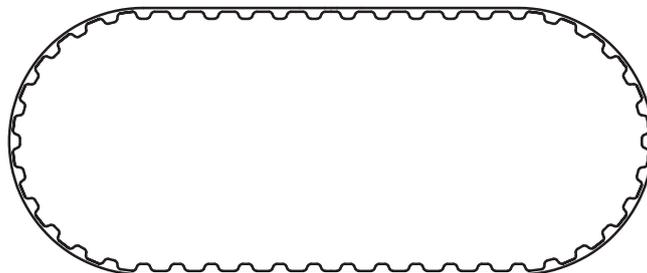


Figure 11

3.2.3.2

open synchronous belt

synchronous belt (3.2.1.1) with two ends

Note 1 to entry: See [Figure 12](#).



Figure 12

3.2.4 Structure

3.2.4.1

single-sided synchronous belt

synchronous belt (3.2.1.1) with teeth located inside of the *pitch line* (3.2.1.3) at regularly spaced intervals

Note 1 to entry: See [Figure 13](#).

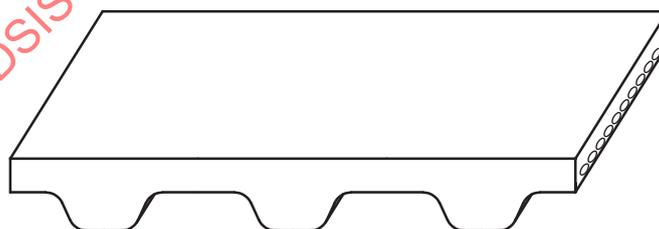


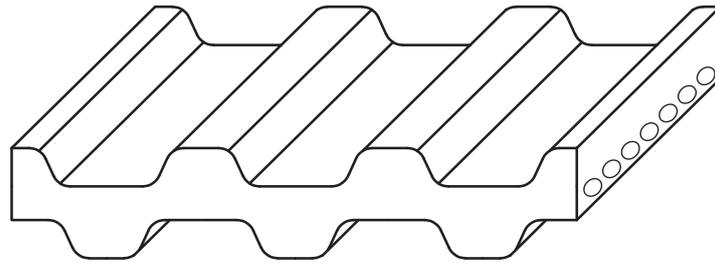
Figure 13

3.2.4.2

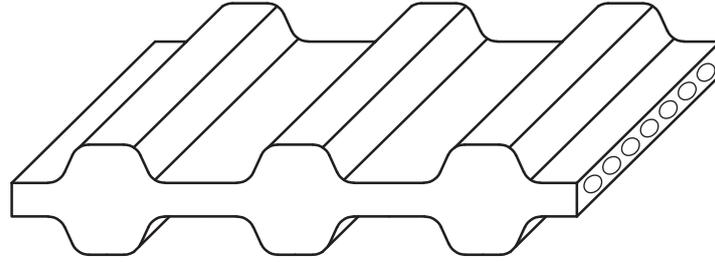
double-sided synchronous belt

synchronous belt (3.2.1.1) with teeth located on both sides of the *pitch line* (3.2.1.3) at regularly spaced intervals

Note 1 to entry: See [Figure 14](#).



a) Staggered double-sided synchronous belt



b) Symmetrical double-sided synchronous belt

Figure 14

3.2.5 Teeth

3.2.5.1 tooth

generally transverse element protruding from the root of the belt which have the profile necessary to mesh with the *grooves* (3.3.2.1) in a *synchronous pulley* (3.3.1.1)

Note 1 to entry: See [Figure 15](#).

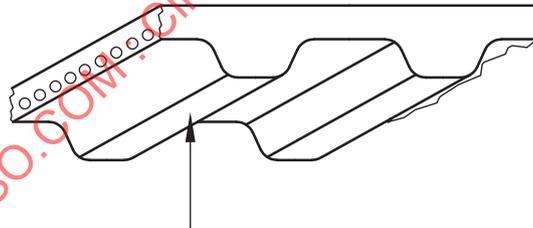


Figure 15

3.2.5.2 tip line

line joining the tips of the belt teeth

Note 1 to entry: See [Figure 16](#).



Figure 16

3.2.5.3

root line

line joining the roots between the belt teeth

Note 1 to entry: See [Figure 17](#).

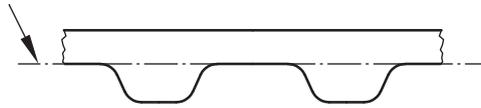


Figure 17

3.2.5.4

tooth height

h_t
distance between the *tip line* (3.2.5.2) and the *root line* (3.2.5.3)

Note 1 to entry: See [Figure 18](#).

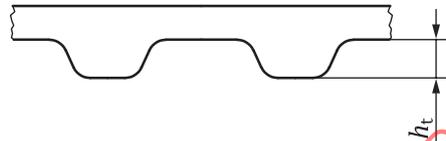


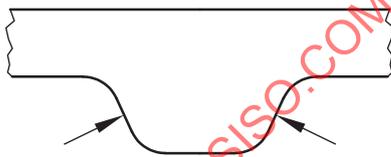
Figure 18

3.2.5.5

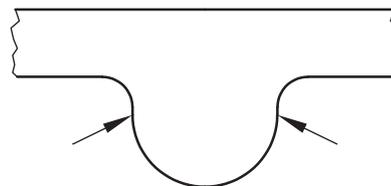
flank

area defined by the *width* (3.2.1.6) of the belt *tooth* (3.2.5.1) and the portion of the tooth section contained between the tooth tip radius and the tooth root radius or, if there is no tooth tip radius, contained between the *tip line* (3.2.5.2) and the tooth root radius

Note 1 to entry: See [Figure 19](#).



a) Timing tooth flank



b) Curvilinear tooth flank

Figure 19

3.2.5.6

working flank

<teeth> *flank* (3.2.5.5) of a belt *tooth* (3.2.5.1) in contact with the pulley groove flank when it is transmitting power

Note 1 to entry: See [Figure 20](#).

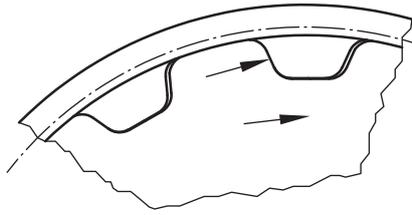


Figure 20

3.2.5.7

non-working flank

<teeth> flank (3.2.5.5) of the tooth (3.2.5.1) opposite the working flank (3.2.5.6)

Note 1 to entry: See [Figure 21](#).

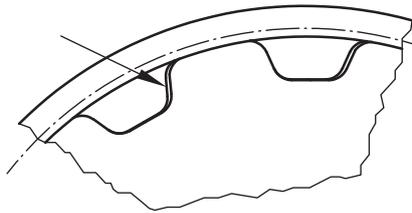


Figure 21

3.2.5.8

radius at tooth tip

r_a
radius of a generally curved section of a belt tooth (3.2.5.1) that connects the tooth flank (3.2.5.5) with the tip line (3.2.5.2)

Note 1 to entry: See [Figure 22](#).

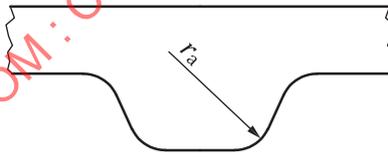


Figure 22

3.2.5.9

radius at tooth root

r_r
radius of a curve connecting the tooth (3.2.5.1) flank (3.2.5.5) with the root line (3.2.5.3)

Note 1 to entry: See [Figure 23](#).

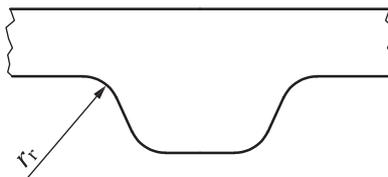


Figure 23

3.2.5.10
width at tooth root

S
 linear distance between the theoretical points of intersection of the *tooth* (3.2.5.1) *flanks* (3.2.5.5) with the *root line* (3.2.5.3) when the belt is straight

Note 1 to entry: See [Figure 24](#).

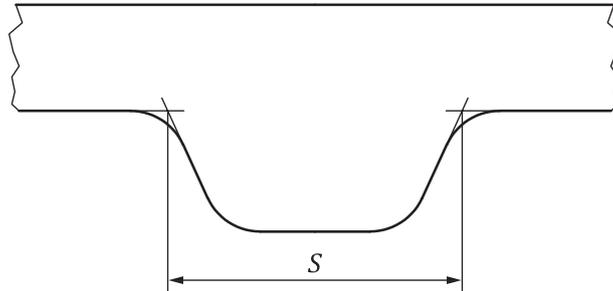


Figure 24

3.2.5.11
tooth angle

2β
 included angle between the *flanks* (3.2.5.5) of the belt *tooth* (3.2.5.1)

Note 1 to entry: See [Figure 25](#).

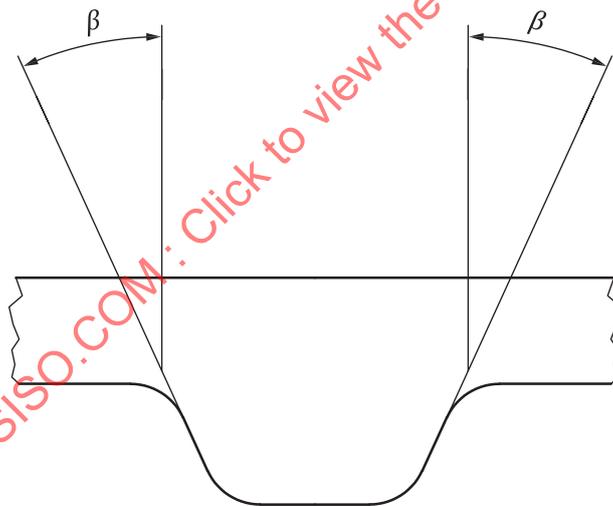


Figure 25

3.3 Pulleys

3.3.1 General

3.3.1.1
synchronous pulley

pulley with generally transverse *grooves* (3.3.2.1) equally spaced around its circumference

Note 1 to entry: See [Figure 26](#).

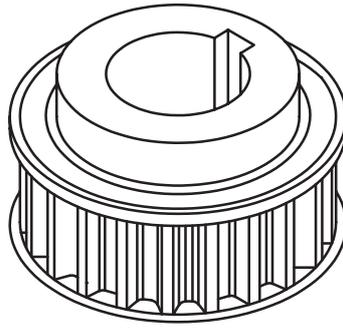


Figure 26

3.3.1.2

pitch reference cylinder

imaginary cylindrical surface, coaxial to a pulley, located at the point at which the circular pitch of the pulley is equal to the pitch of the belt it is used with

Note 1 to entry: See [Figure 27](#).

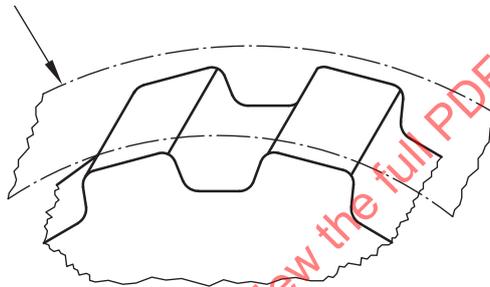


Figure 27

3.3.1.3

pitch circle

section of a *pitch reference cylinder* ([3.3.1.2](#)) with a plane perpendicular to the axis of the pulley

Note 1 to entry: See [Figure 28](#).

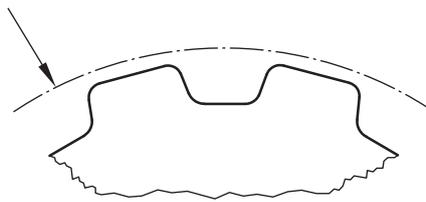


Figure 28

3.3.1.4

pitch diameter

d

diameter of the *pitch circle* ([3.3.1.3](#))

Note 1 to entry: See [Figure 29](#).

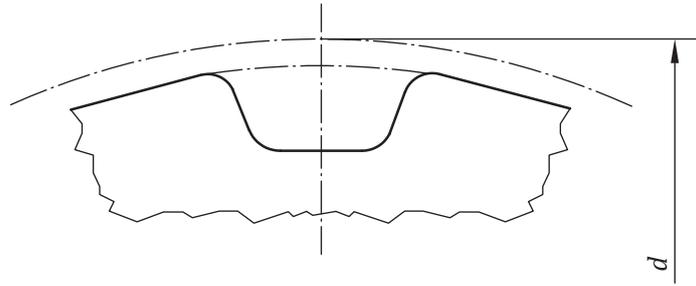


Figure 29

3.3.1.5
outside diameter

d_o
diameter of the *tip circle* (3.3.2.3)

Note 1 to entry: See [Figure 30](#).

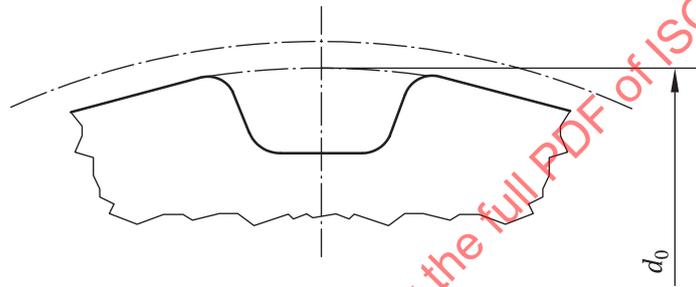


Figure 30

3.3.1.6
pitch line differential

a
<pullies> radial distance between the *pitch circle* (3.3.1.3) and the *tip circle* (3.3.2.3)

Note 1 to entry: See [Figure 31](#).

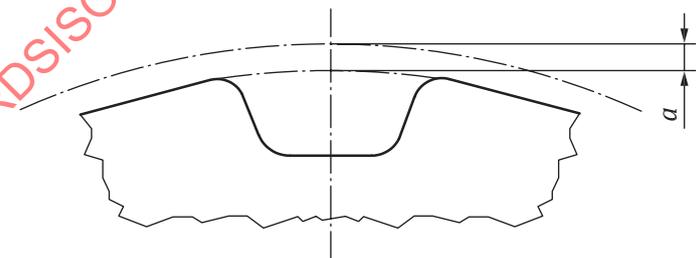


Figure 31

3.3.1.7
pitch

P_b
length of arc on the *pitch circle* (3.3.1.3) contained between the axes of two consecutive *grooves* (3.3.2.1)

Note 1 to entry: See [Figure 32](#).

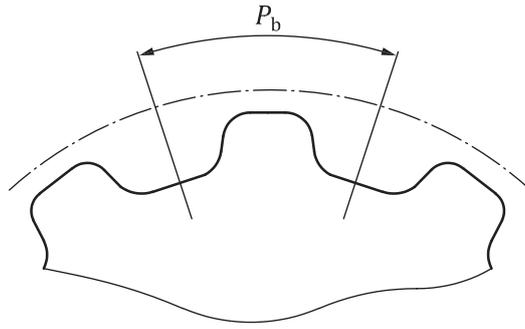
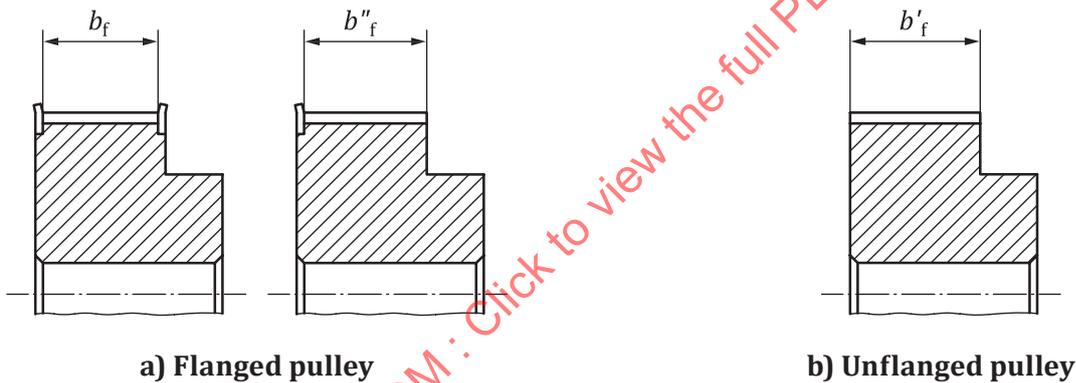


Figure 32

**3.3.1.8
minimum pulley width**

b_f
 b'_f
 b''_f
smallest lateral distance across the face of a pulley or between the *flanges* (3.3.1.11) of a flanged pulley or between the face of pulley and the flanges of a flanged pulley that can be used for a stated belt width (3.2.1.6)

Note 1 to entry: See [Figure 33](#).



a) Flanged pulley

b) Unflanged pulley

Figure 33

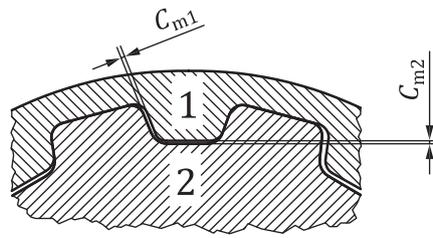
**3.3.1.9
measuring pulley**

pulley specifically machined or selected to permit precise length measurement of a *synchronous belt* (3.2.1.1)

**3.3.1.10
measuring pulley groove clearance**

C_m
shortest distance between the *non-working flanks* (3.2.5.7) of belt teeth and the *measuring pulley* (3.3.1.9) *grooves* (3.3.2.1), and between the belt *tooth* (3.2.5.1) tip and the pulley groove root, when the *working flanks* (3.2.5.6) of the pulley and belt are in contact

Note 1 to entry: See [Figure 34](#).



Key

- 1 belt
- 2 pulley

Figure 34

3.3.1.11

flange

flared, annular ring secured to (usually both) extremities of the working face of a pulley to guide the belt and operate within the working face of a pulley

3.3.2 Grooves

3.3.2.1

groove

equally spaced, generally transverse indentation with which the belt teeth mesh to provide a transfer of force between the belt and the pulley

Note 1 to entry: See [Figure 35](#).

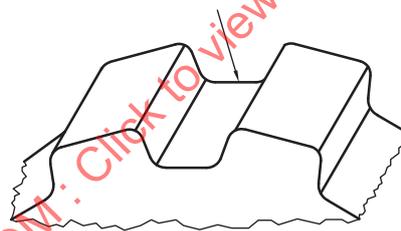


Figure 35

3.3.2.2

tip cylinder

surface coaxial with the pulley containing the crests between the *grooves* ([3.3.2.1](#))

Note 1 to entry: See [Figure 36](#).

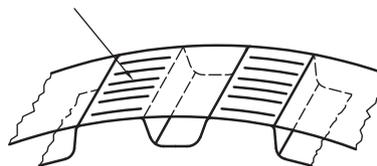


Figure 36

3.3.2.3

tip circle

section of the *tip cylinder* ([3.3.2.2](#)) where the plane is perpendicular to the axis of the pulley

Note 1 to entry: See [Figure 37](#).

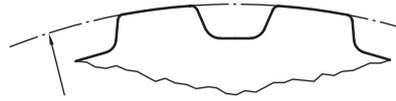


Figure 37

3.3.2.4

root cylinder

surface coaxial with the pulley containing the centre of bottom of the *grooves* (3.3.2.1)

Note 1 to entry: See [Figure 38](#).

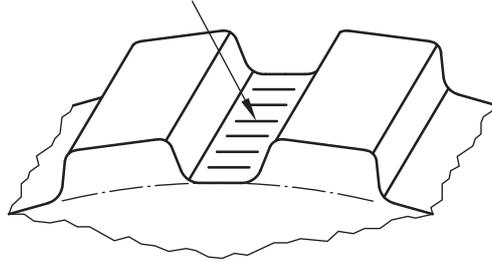


Figure 38

3.3.2.5

root circle

section of the *root cylinder* (3.3.2.4) where the plane is perpendicular to the axis of the pulley

Note 1 to entry: See [Figure 39](#).

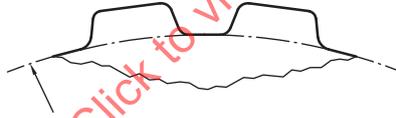


Figure 39

3.3.2.6

groove depth

h_g
radial distance between the *tip circle* (3.3.2.3) and the *root circle* (3.3.2.5)

Note 1 to entry: See [Figure 40](#).

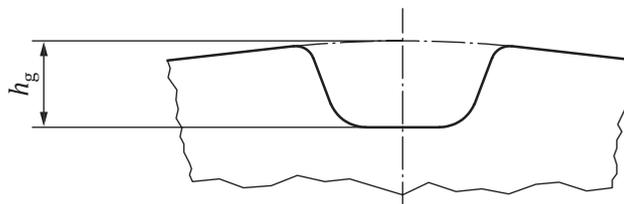


Figure 40

3.3.2.7

flank

area defined by the *width* (3.2.1.6) of the pulley and the portion of a pulley groove contained between the groove crest radius and the groove root radius or, if there is no groove root radius, contained between the groove crest radius and the *root circle* (3.3.2.5)

Note 1 to entry: See [Figure 41](#).

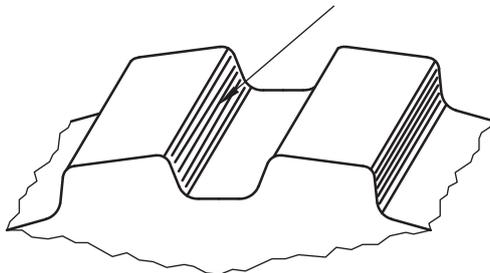


Figure 41

3.3.2.8

working flank

<grooves> *flank* (3.2.5.5) of the pulley in contact with the belt *tooth* (3.2.5.1) flank when the belt is transmitting power

Note 1 to entry: See [Figure 42](#).

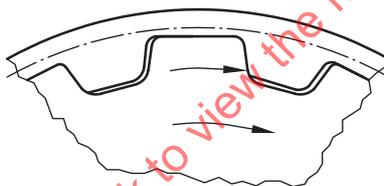


Figure 42

3.3.2.9

non-working flank

<grooves> *flank* (3.2.5.5) of the pulley groove opposite the *working flank* (3.3.2.8)

Note 1 to entry: See [Figure 43](#).

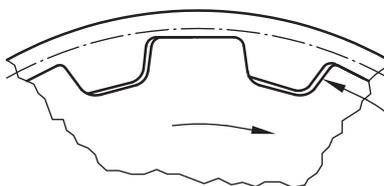


Figure 43

3.3.2.10

radius at the groove crest

r_t
radius of a curve connecting the groove *flank* (3.2.5.5) with the *tip circle* (3.3.2.3)

Note 1 to entry: See [Figure 44](#).

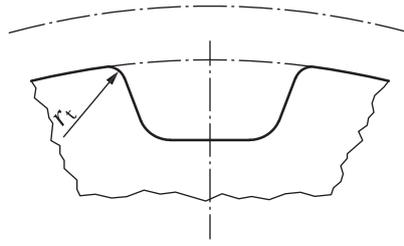


Figure 44

3.3.2.11
radius at the groove root

r_b
 radius of a curve connecting the groove flank (3.2.5.5) with the root circle (3.3.2.5)

Note 1 to entry: See [Figure 45](#).

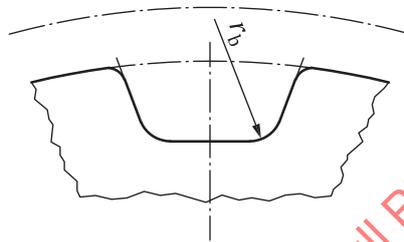


Figure 45

3.3.2.12
width at groove root

b_w
 linear distance between the theoretical points of intersection of the groove flanks (3.2.5.5) with the root circle (3.3.2.5)

Note 1 to entry: See [Figure 46](#).

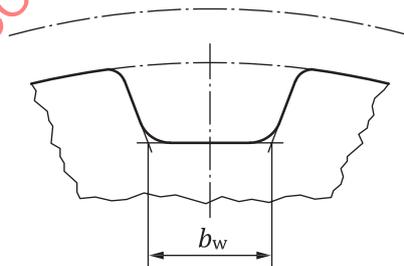


Figure 46

3.3.2.13
width at groove crest

b_r
 linear distance between the theoretical points of intersection of the groove flanks (3.2.5.5) with the tip circle (3.3.2.3)

Note 1 to entry: See [Figure 47](#).

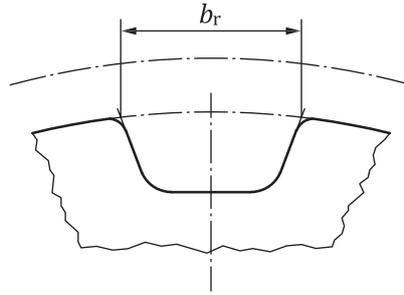


Figure 47

3.3.2.14

groove angle

2ϕ

included angle between the *flanks* (3.2.5.5) of the groove

Note 1 to entry: See [Figure 48](#).

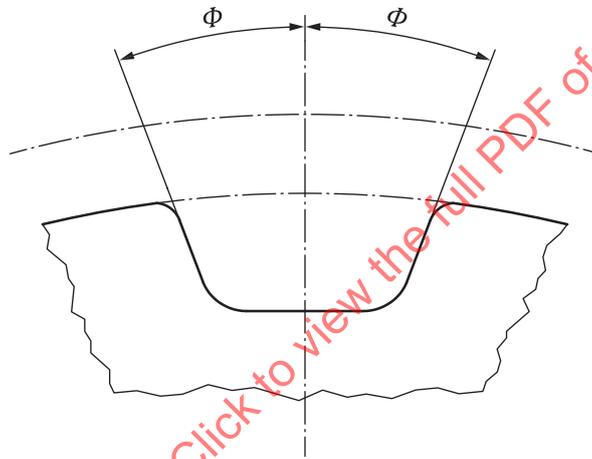


Figure 48

3.3.3 Groove-generating tools

3.3.3.1

rack form

definitive *tooth* (3.2.5.1) form used as a datum for defining the profiles for pulley groove-cutting tools

Note 1 to entry: See [Figure 49](#).

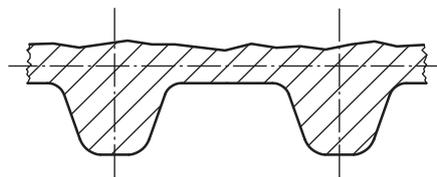


Figure 49

3.3.3.2

reference rack

rack where the profile is used as the base of a standardized system of pulleys having the same generating rack

3.3.3.3

reference rack pitch line

line with reference to which the *pitch* (3.3.1.7) of the rack teeth is defined

Note 1 to entry: See [Figure 50](#).

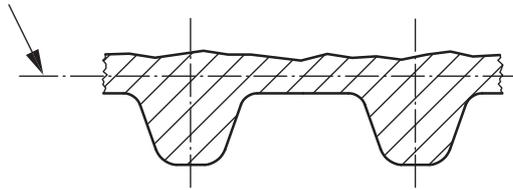


Figure 50

3.3.3.4

reference rack root line

line joining the roots between the teeth of a rack

Note 1 to entry: See [Figure 51](#).

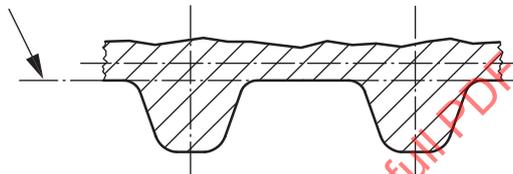


Figure 51

3.3.3.5

reference rack tip line

line joining the tips of the teeth of a rack

Note 1 to entry: See [Figure 52](#).

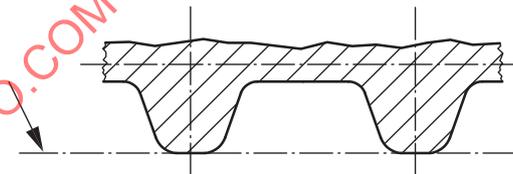


Figure 52

3.3.3.6

reference rack flank

portion of the rack *tooth* (3.2.5.1) contained between the rack tooth tip radius and the tooth root radius or, if there is no rack tooth tip radius, the area contained between the rack *tip line* (3.2.5.2) and the tooth root radius

Note 1 to entry: See [Figure 53](#).

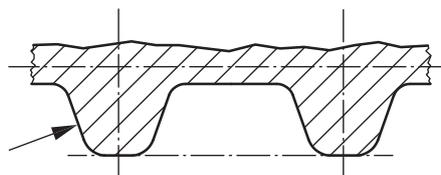


Figure 53

**3.3.3.7
reference rack pitch line location**

a
distance between the *pitch line* (3.2.1.3) and the *root line* (3.2.5.3) of the rack

Note 1 to entry: See [Figure 54](#).

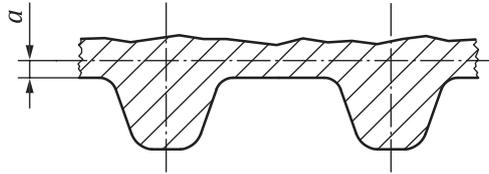


Figure 54

**3.3.3.8
reference rack pitch**

p_b
linear distance between the centre of two adjacent teeth on the rack

Note 1 to entry: See [Figure 55](#).

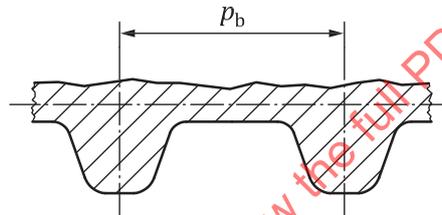


Figure 55

**3.3.3.9
reference rack tooth angle**

$2A$
included angle between the *flanks* (3.2.5.5) of the *tooth* (3.2.5.1) of the rack

Note 1 to entry: See [Figure 56](#).

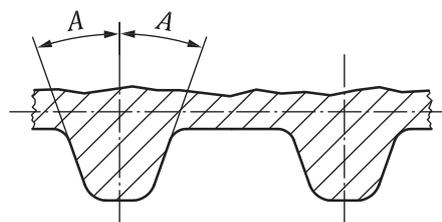


Figure 56

**3.3.3.10
reference rack tooth height**

h_r
distance between the *tip line* (3.2.5.2) and the *root line* (3.2.5.3) of the rack

Note 1 to entry: See [Figure 57](#).

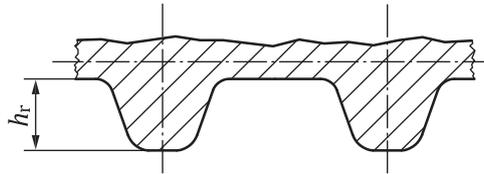


Figure 57

3.3.3.11

reference rack width at tooth tip

b_g
linear distance between the theoretical points of intersection of the *tooth* (3.2.5.1) *flanks* (3.2.5.5) with the *tip line* (3.2.5.2) of the rack

Note 1 to entry: See [Figure 58](#).

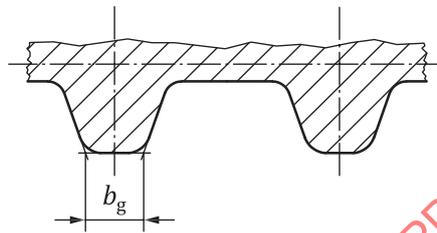


Figure 58

3.3.3.12

reference rack width at tooth root

b_t
linear distance between the theoretical points of intersection of the *tooth* (3.2.5.1) *flanks* (3.2.5.5) with the *root line* (3.2.5.3) of the rack

Note 1 to entry: See [Figure 59](#).

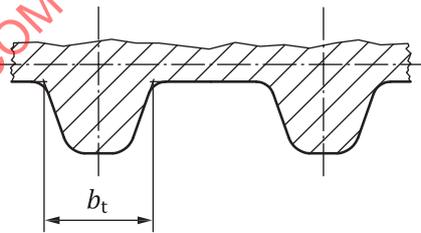


Figure 59

3.3.3.13

reference rack radius at tooth tip

r_1
radius of a curve connecting the *tooth* (3.2.5.1) *flank* (3.2.5.5) with the *tip line* (3.2.5.2) of the rack

Note 1 to entry: See [Figure 60](#).