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Synchronous belts -- Calculation of power rating and drive centre distance

Courroies synchrones -- Calculde la puissance transmissible et de l'entraxe

Ta slovenski standard je istoveten z: ISO 5295:1987
SIST ISO 5295:1997
https://standards.iteh.ai/catalog/standards/sist/eb0c7e43-54cd-41f6-88e2-

## ICS:

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SIST ISO 5295:1997
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# INTERNATIONAL STANDARD 

ISO

# Synchronous belts - Calculation of power rating and drive centre distance 

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## 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.

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 TANDARD PREVIEW International Standard ISO 5295 was prepared by (Technical Committee ISO/TC 41, 1 .
Pulleys and belts (including veebelts).

This second edition cancels and replaces the first edition (ISO 5295. 1981), table 2 of which has been revised technically.ttps://standards.iteh.ai/catalog/standards/sist/eb0c7e43-54cd-41f6-88e2-8a12456544a8/sist-iso-5295-1997

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

## Synchronous belts - Calculation of power rating and drive centre distance

## iTeh STANDARD PREVIEW

## 1 Scope and field of application

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This International Standard establishes formulae SIfor the ${ }^{5295: 1997}$
calculation of power ratingh and/centre distancé eafl standard 1 ds/sist/eb0c7e43-54cd-41f6-88e2- Table 1 synchronous belts on two pulley drives.

The numerical values of certain parameters used in the calculations depend upon the pitch and the construction of the belt and shall be specified by the belt manufacturer.

## 2 Definition

power rating : Power that a specified synchronous belt can transmit under specified geometrical and ambient conditions for a satisfactory period of time, provided that the drive has been installed and is maintained in a proper manner.

The power rating depends upon :

- the pitch of the belt and pulley teeth;
- the belt width;
- the mass of a linear metre of belt;
- the allowable working tension in the belt;
- the angular velocity of the smaller pulley;
- the number of teeth of the smaller pulley;
- the number of teeth in mesh on the smaller pulley.

| Symbol | Description | Units |
| :---: | :---: | :---: |
| $p_{\mathrm{b}}$ | pitch of the teeth of the belt and pulleys | mm |
| $b_{\text {s }}$ | width of the belt to be rated | mm |
| $b_{\text {so }}$ | base width of the widest standard belt of pitch $p_{\mathrm{b}}$ (see table 2) | mm |
| $m$ | linear mass of a belt having a width $b_{\text {so }}$ | $\mathrm{kg} / \mathrm{m}$ |
| $T_{\mathrm{a}}$ | allowable working tension of a belt having a width $b_{\text {so }}$ | $N$ |
| $\omega$ | angular velocity of the smaller pulley | $\mathrm{rad} / \mathrm{s}$ |
| $v$ | belt velocity | $\mathrm{m} / \mathrm{s}$ |
| $z_{1}$ | number of teeth of the smaller pulley |  |
| $z_{2}$ | number of teeth of the larger pulley |  |
| $z_{\mathrm{b}}$ | number of teeth of the belt |  |
| $z_{\mathrm{m}}$ | number of teeth in mesh on the smaller pulley |  |
| C | centre distance of the pulleys | mm |
| $P_{\text {o }}$ | power rating of a belt of base width $b_{\text {so }}$ | kW |
| $P$ | power rating of a belt of base width $b_{\text {s }}$ | kW |
| $k_{w}$ | width factor |  |
| $k_{z}$ | teeth in mesh factor |  |
| ent [ ] | integer part only of the expression following |  |

## 4 Basic power rating

The basic power rating of a belt of base width $b_{\text {so }}$ is given by the formula

$$
\begin{equation*}
P_{\mathrm{o}}=\frac{\left(T_{\mathrm{a}}-m v^{2}\right) v}{1000} \tag{1}
\end{equation*}
$$

where the belt velocity $v$ has the value :

$$
\begin{equation*}
v=\frac{\omega p_{\mathrm{b}} z_{1} \times 10^{-3}}{2 \pi} \tag{2}
\end{equation*}
$$

Formula (1) is valid only if the number of teeth in mesh $z_{\mathrm{m}} \geqslant 6$ (see clause 5 for $z_{\mathrm{m}}<6$ ).

The values of $T_{\mathrm{a}}$ and $m$ depend upon the construction and the type of belt; these shall be supplied by the belt manufacturer.

## 5 Power rating

The foregoing method according to formula (5) and (6) is valid in any case. However, it should not be used if the ratio $z_{2} / z_{1}$ is close to unity, because the expression for $C$ becomes the ratio of two small quantities. In this case, the method according to 6.2 is recommended.


### 5.1 Exact formula

## iTeh STANDARI PREVIIE Figure

The power rating of a belt of width $b_{\mathrm{s}}$, having $z_{\mathrm{m}}$ teeth in meshald s.itelh.ai)
on the smaller pulley, is given by the formula

$$
\begin{aligned}
& \text { 8a12456544a8/sist-iso-5295-1997 }
\end{aligned}
$$

See clauses 8 and 9 for $k_{\mathrm{z}}$ and $k_{\mathrm{w}}$ respectively.

### 5.2 Approximate formula

The power rating may be calculated approximately by simplification of formula (3) as follows :

$$
\begin{equation*}
P \approx k_{\mathrm{z}} k_{\mathrm{w}} P_{\mathrm{o}} \tag{4}
\end{equation*}
$$

## 6 Centre distance

### 6.1 Exact formula

Firstly, calculate the auxiliary angle, $\theta$, using the formula

$$
\begin{equation*}
\operatorname{inv} \theta=\pi \frac{z_{\mathrm{b}}-z_{2}}{z_{2}-z_{1}} \tag{5}
\end{equation*}
$$

where $\operatorname{inv} \theta=\tan \theta-\theta$; the value of $\theta$ (see the figure) can be determined by iteration or from involute tables.

The centre distance $C$ is then given by the formula :

$$
\begin{equation*}
C=\frac{p_{\mathrm{b}}\left(z_{2}-z_{1}\right)}{2 \pi \cos \theta} \tag{6}
\end{equation*}
$$

$$
\begin{equation*}
M=\frac{p_{\mathrm{b}}}{8}\left(2 z_{\mathrm{b}}-z_{1}-z_{2}\right) \tag{7}
\end{equation*}
$$

then the centre distance $C$ by the formula

$$
\begin{equation*}
C \approx M+\sqrt{M^{2}-\frac{1}{8}\left[\frac{p_{\mathrm{b}}\left(z_{2}-z_{1}\right)}{\pi}\right]^{2}} \tag{8}
\end{equation*}
$$

This method is to be avoided when the ratio $z_{2} / z_{1}$ is large. In this case, the method according to 6.1 shall be used.

## 7 Number of teeth in mesh

This number is given by the formula

$$
\begin{equation*}
z_{\mathrm{m}}=\text { ent }\left[\frac{z_{1}}{2}-\frac{p_{\mathrm{b}} z_{1}}{2 \pi^{2} C}\left(z_{2}-z_{1}\right)\right] \tag{9}
\end{equation*}
$$

in which $\frac{1}{2 \pi^{2}}$ may be replaced by $\frac{1}{20}$ for ease of calculation.

## 8 Factor $k_{\text {z }}$

$$
\begin{align*}
& \text { If } z_{\mathrm{m}} \geqslant 6, k_{\mathrm{z}}=1 \\
& \text { If } z_{\mathrm{m}}<6, k_{\mathrm{z}}=1-0,2\left(6-z_{\mathrm{m}}\right) \tag{10}
\end{align*}
$$

## 9 Factor $k_{w}$

## Table 2 - Base widths (millimetres)

The factor $k_{\mathrm{w}}$ is given by the formula

$$
k_{\mathrm{w}}=\left(\frac{b_{\mathrm{s}}}{b_{\mathrm{so}}}\right)^{1,14}
$$

where $b_{\text {so }}$ depends upon the pitch code as given in table 2.

The resulting calculation of $k_{w}$ being rounded off to two decimal places according to the usual convention.

| Pitch code | $b_{\text {so }}$ |
| :---: | :---: |
| $\mathbf{M X L}$ | , 4 |
| $\mathbf{X X L}$ |  |
| $\mathbf{X L}$ | 9,5 |
| $\mathbf{L}$ | 25,4 |
| $\mathbf{H}$ | 76,2 |
| $\mathbf{X H}$ | 101,6 |
| $\mathbf{X X H}$ | 127 |

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