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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Synchronous belts — Calculation of power rating and drive centre distance

Courroies synchrones — Calcul de la puissance transmissible et de l'entraxe

Reference number
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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.

International Standard ISO 5295 was prepared by Technical Committee ISO/TC 41, *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.

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

1 Scope and field of application

This International Standard establishes formulae for the calculation of power rating and centre distance of standard 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.

3 Symbols

Table 1

Symbol	Description	Units
p_b	pitch of the teeth of the belt and pulleys	mm
b_s	width of the belt to be rated	mm
b_{so}	base width of the widest standard belt of pitch p_b (see table 2)	mm
m	linear mass of a belt having a width b_{so}	kg/m
T_a	allowable working tension of a belt having a width b_{so}	N
ω	angular velocity of the smaller pulley	rad/s
v	belt velocity	m/s
z_1	number of teeth of the smaller pulley	
z_2	number of teeth of the larger pulley	
z_b	number of teeth of the belt	
z_m	number of teeth in mesh on the smaller pulley	
C	centre distance of the pulleys	mm
P_o	power rating of a belt of base width b_{so}	kW
P	power rating of a belt of base width b_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_{so} is given by the formula

$$P_o = \frac{(T_a - m\,v^2)\,v}{1\,000} \qquad \ldots (1)$$

where the belt velocity v has the value :

$$v = \frac{\omega\, p_b\, z_1 \times 10^{-3}}{2\,\pi} \qquad \ldots (2)$$

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

The values of T_a and m depend upon the construction and the type of belt; these shall be supplied by the belt manufacturer.

5 Power rating

5.1 Exact formula

The power rating of a belt of width b_s, having z_m teeth in mesh on the smaller pulley, is given by the formula

$$P = \left(k_z\, k_w\, T_a - \frac{b_s\, m\, v^2}{b_{so}} \right) v \times 10^{-3} \qquad \ldots (3)$$

See clauses 8 and 9 for k_z and k_w respectively.

5.2 Approximate formula

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

$$P \approx k_z\, k_w\, P_o \qquad \ldots (4)$$

6 Centre distance

6.1 Exact formula

Firstly, calculate the auxiliary angle, θ, using the formula

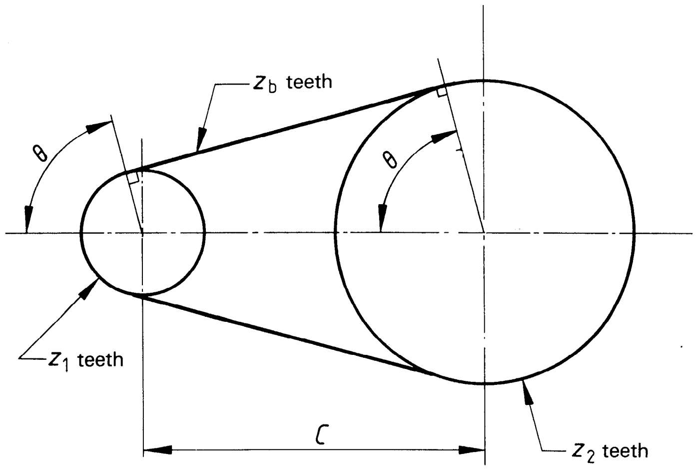
$$\text{inv}\,\theta = \pi\,\frac{z_b - z_2}{z_2 - z_1} \qquad \ldots (5)$$

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

The centre distance C is then given by the formula :

$$C = \frac{p_b\,(z_2 - z_1)}{2\,\pi\,\cos\theta} \qquad \ldots (6)$$

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.



Figure

6.2 Approximate formula

Firstly, calculate M by the formula

$$M = \frac{p_b}{8}\,(2\,z_b - z_1 - z_2) \qquad \ldots (7)$$

then the centre distance C by the formula

$$C \approx M + \sqrt{M^2 - \frac{1}{8}\left[\frac{p_b\,(z_2 - z_1)}{\pi}\right]^2} \qquad \ldots (8)$$

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

$$z_m = \text{ent}\left[\frac{z_1}{2} - \frac{p_b\, z_1}{2\,\pi^2\, C}\,(z_2 - z_1)\right] \qquad \ldots (9)$$

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

8 Factor k_z

If $z_m \geqslant 6$, $k_z = 1$

If $z_m < 6$, $k_z = 1 - 0{,}2\,(6 - z_m)$ $\qquad \ldots (10)$

9 Factor k_w

The factor k_w is given by the formula

$$k_w = \left(\frac{b_s}{b_{so}} \right)^{1,14} \qquad \ldots (11)$$

where b_{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.

Table 2 — Base widths (millimetres)

Pitch code	b_{so}
MXL	6,4
XXL	
XL	9,5
L	25,4
H	76,2
XH	101,6
XXH	127

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Descriptors : synchronous transmission, belt drives, belts, power transmission belts, synchronous belts, rated power, rules of calculation.

Price based on 3 pages