International Standard 5295

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Synchronous belts — Calculation of power rating and drive centre distance

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

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Foreword

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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.

International Standard ISO 5295 was developed by Technical Committee ISO/TC 41, *Pulleys and belts (including veebelts)*, and was circulated to the member bodies in December 1980.

It has been approved by the member bodies of the following countries :

Australia	Germany, F.R.	Spain
Austria	India	Sweden
Belgium	Iraq	United Kingdom
Canada	Italy	USA
Czechoslovakia	Japan	USSR
Egypt, Arab Rep. of	Romania	
France	South Africa, Rep. of	

No member body expressed disapproval of the document.

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 : The 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

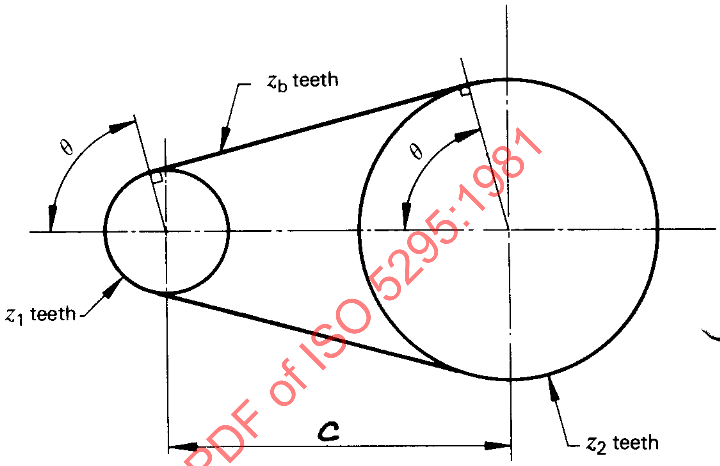
$$\text{inv}\,\theta = \pi\,\frac{z_b - z_2}{z_2 - z_1} \qquad \ldots (5)$$

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

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(Title) Synchronous belts – Calculation of power rating and drive centre distance

ERRATUM

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(Text)

In the figure, indicate the centre distance C ~~which is missing.~~ ~~or~~ above the dimension line at the bottom of the figure.

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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 the table.

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
XL	9,5
L	25,4
H	76,2
XH	101,6
XXH	127,0