BS 3790:2006

Incorporating Corrigendum No. 1

BRITISH STANDARD

Specification for belt drives – Endless wedge belts, endless V-belts, banded wedge belts, banded V-belts and their corresponding pulleys

ICS 21.220.10

British Standards

Publishing and copyright information

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16655 Corrigendum No. 1	September 2006	Correction to value in Table 2 (spacing for belt section D)

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 33 and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 28 April 2006. It was prepared by Technical Committee MCE/10, *Belts and pulley drives*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 3790:1995, which is withdrawn.

Relationship with other publications

This revision of BS 3790 is for all practical purposes technically related to the following standards prepared by the International Organization for Standardization (ISO):

BS ISO 155, BS ISO 254, BS ISO 5287, ISO 1081, ISO 1813, ISO 4183, ISO 4184, ISO 5292, ISO 9608.

NOTE See bibliography for full details of these standards.

"E" Section V-belts, which form part of ISO 4183 and ISO 4184, are excluded from this standard because of lack of demand in the United Kingdom.

Information about this document

This new edition represents a full revision of the standard, and introduces the following principal changes:

The test for fire resistance (BS 3790:1995, Annex G) has been deleted due to the fact that no test method currently exists that meets the requirements of the ATEX Directive [1] and BS EN 13463-5:2003, **7.2.**[1)]

Banded belts, i.e. belts joined across the top surface, have been included. The use of the term "pitch" used in previous versons of BS 3790 has been replaced by "datum" as used in international standards.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1) Currently under revision.

1 Scope

This British Standard specifies the dimensions and certain other properties of endless wedge belts, V-belts and equivalent banded belts and their corresponding grooved pulleys, when used for power transmission.

Recommendations and information on the design, selection and installation of drive assemblies are given in Annex C and Annex E. Recommendations on the storage of belts are given in Annex B.

This standard does not apply to industrial variable speed drives employing pulleys with movable flanges, or to drives specified in BS 3733 or BS ISO 5287.

2 Normative references

The following referenced documents are indispensable for the application 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.

BS 1913:1990, *Specification for soft soap*

BS ISO 254:1998, *Belt drives – Pulleys – Quality, finish and balance*

3 Terms and definitions

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

3.1 wedge or V-belt or banded belt drive

drive that consists of one or more trapezoidal cross-section belts mounted on grooved pulleys

NOTE The profiles of the belts and of the pulley grooves are such that the belts come into contact with only the sides of the pulley grooves and not with the base of the grooves.

3.2 wedge belt

narrow V-belt

belt in which the outline formed by the base, sides and top of the belt approximates to a trapezium characterized by a relative height of approximately 0.95 W_d

NOTE 1 Wedge belts are commonly known as narrow V-belts in international standards.

NOTE 2 See Figure 1a) and Table 1.

3.3 V-belt

classical V-belt

belt in which the outline formed by the base, sides and top of the belt approximates to a trapezium characterized by a relative height of approximately 0.73 W_d

NOTE 1 V-belts are commonly known as classical V-belts in international standards.

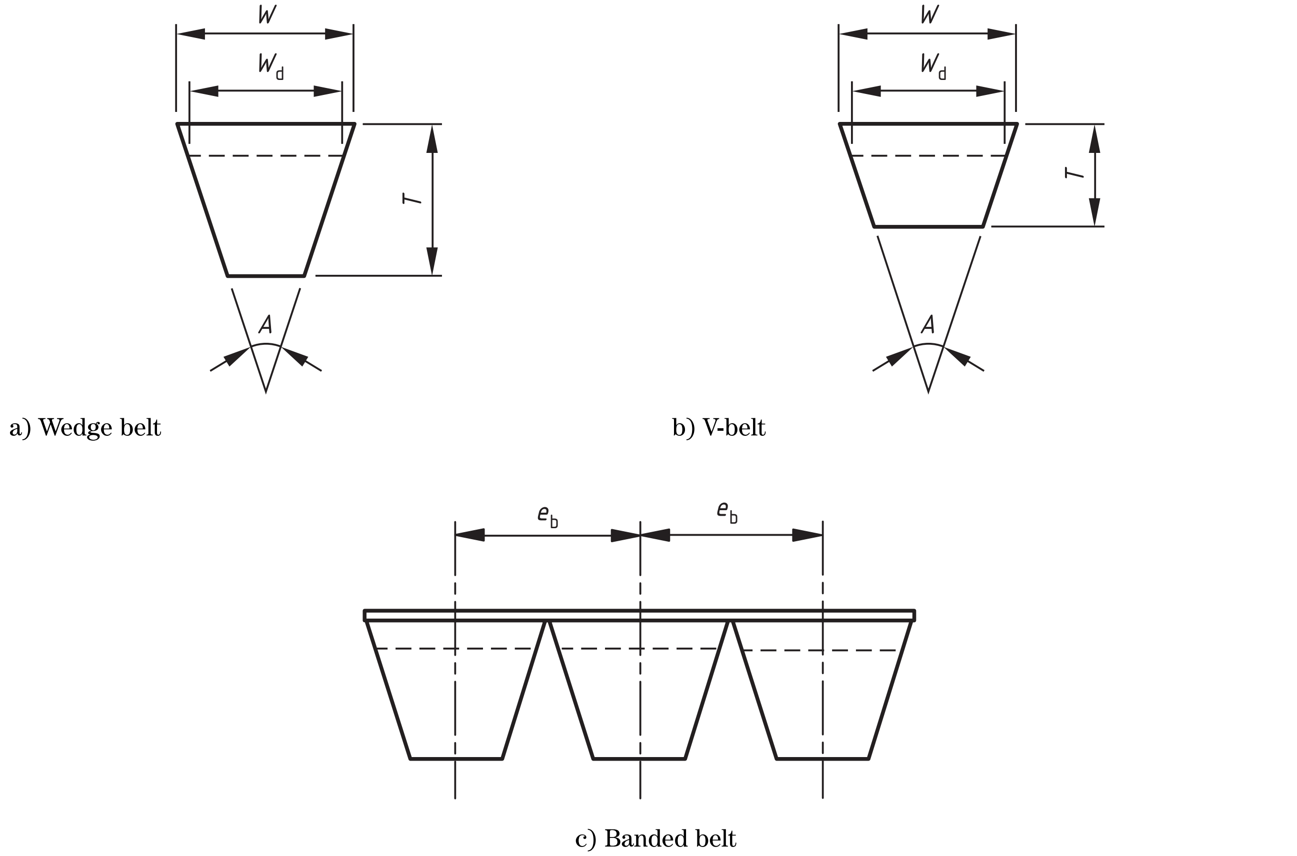
NOTE 2 See Figure 1b) and Table 1.

3.4 banded belt

belt made up from two or more wedge belts or V-belts joined across the top surface with a reinforced band of flexible material

NOTE See Figure 1c) and Table 2.

Figure 1 **Belt cross-sections**



NOTE See Table 1 and Table 2.

Table 1 **Wedge belt and V-belt cross-section dimensions**

Cross-section symbol	**Datum width,** W_d mm	**Nominal top width,** W mm	**Nominal height,** T mm	**Nominal included angle,** A degrees
Wedge belts				
SPZ	8.5	10.0	8.0	40
SPA	11.0	13.0	10.0	40
SPB	14.0	17.0	14.0	40
SPC	19.0	22.0	18.0	40
V-belts				
Y	5.3	6.0	4.0	40
Z	8.5	10.0	6.0	40
A	11.0	13.0	8.0	40
B	14.0	17.0	11.0	40
C	19.0	22.0	14.0	40
D	27.0	32.0	19.0	40

NOTE See Figure 1a) and Figure 1b).

Table 2 **Banded belts – belt spacing**

Belt section on band	**Belt spacing,** e_b mm	**Tol.,** [A] e_b	**Tol.,** [B] Σe_b	**Belt section on band**	**Belt spacing,** e_b mm	**Tol.,** [A] e_b	**Tol.,** [B] e_b
SPZ	12.0	±0.25	±0.5	A (RMA only) [C]	15.88	±0.3	±0.6
SPA	15.0	±0.30	±0.6	B	19.0	±0.4	±0.8
SPB	19.0	±0.40	±0.8	C	25.5	±0.5	±1.0
SPC	25.5	±0.40	±0.8	D (RMA only) [C]	36.53	±0.6	±1.2

NOTE See Figure 1c).

[A] Tolerance for the belt spacing between two adjacent belts.
[B] Tolerance for the belt spacing over all belts on the band.
[C] These belts are only suitable for use in pulleys to RMA (USA) standards.

3.5 datum width
W_d
basic dimension of standardization for the belt and for the corresponding pulley groove, considered as a whole

*NOTE 1 See also **3.6**.*

NOTE 2 The term "datum" replaces "pitch" used throughout earlier versions of this standard, but is essentially the same value. The term "datum" brings this standard into line with ISO standards.

3.6 pulley groove datum width
W_{dg}
width of the pulley groove which is dimensionally the same as the datum width of the belt associated with the pulley

3.7 relative height
ratio of the nominal height of the belt (T) to its datum width (W_d)

3.8 datum length of a belt
L_d
circumferential length of the belt at the datum width

*NOTE This is determined by the method specified in **4.4**.*

3.9 nominal height of a belt
T
height of the trapezium outlined on a cross-section of the belt

NOTE See Figure 1a) and Figure 1b).

3.10 nominal top width of a belt
W
larger width of the trapezium outlined on a cross-section of the belt

NOTE See Figure 1a) and Figure 1b).

3.11 angle of a belt
A
included angle obtained by extending the sides of the belt

NOTE See Figure 1a) and Figure 1b).

3.12 pulley datum diameter
d_d or D_d
diameter of the pulley measured at the groove datum width

3.13 antistatic belt

belt that conforms to specified maximum electrical resistance requirements

NOTE See ***4.7****.*

3.14 power rating

maximum power that a specific belt can transmit under specified geometrical and ambient conditions during a given period of time, provided the drive is installed and maintained following generally accepted rules for V-belt and wedge belt drives and gives a satisfactory service life

4 Wedge belts, V-belts and banded belts

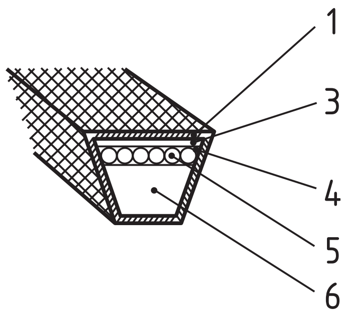
4.1 Materials and workmanship

Belts shall consist of a combination of fabric, cord and elastomeric compound(s), the whole being bonded together in a uniform manner and shaped in accordance with the best manufacturing practice. Belts shall be suitable for operating at ambient temperatures between –18 °C and +60 °C and shall not be adversely affected by the temperature under normal operating conditions within this range.

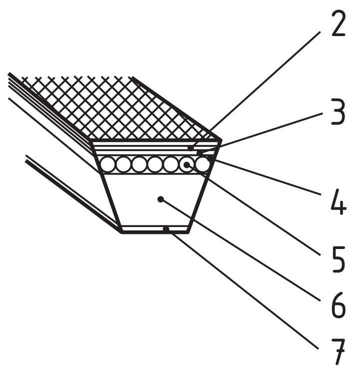
4.2 Construction

The construction of the belt shall be one of four basic belt constructions as illustrated in Figure 2.

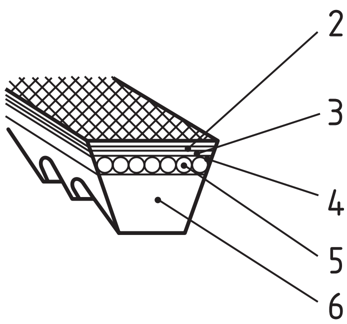
Figure 2 **Basic belt construction**



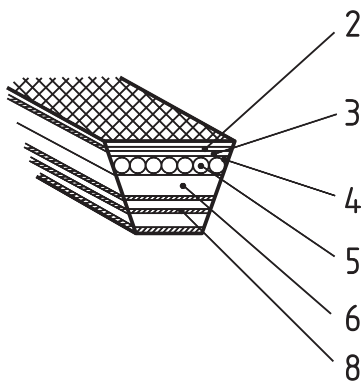
a) Wrapped belt



b) Raw edge plain belt



c) Raw edge cogged belt



d) Raw edge laminated belt

Key

1 Wrapping fabric
2 Top fabric
3 Top cushion
4 Tie gum
5 Tension member
6 Bottom cushion
7 Bottom fabric
8 Fabric lamination

NOTE Any of these belt constructions can be used as a banded belt

4.3 Cross-sectional dimensions

The nominal cross-sectional dimensions and the nominal included angle of belts shall be as given in Table 1; however, dimensions of belts made by individual manufacturers may vary slightly from the nominal values given in Table 1, provided that the belts fit pulley grooves within the limits given in Table 3 when mounted on two measuring pulleys made in accordance with Table 4.

Table 3 **Tolerances and force requirements when measuring new belts**

Cross-section symbol	Total force applied to belt, F N	Position of top face of belt with respect to top of groove Maximum mm	 Minimum mm
Wedge belts			
SPZ	360	+1.1	– 0.4
SPA	560	+1.3	– 0.6
SPB	900	+1.4	– 0.7
SPC	1 500	+1.5	– 1.0
V-belts			
Y	40	+0.8	– 0.8
Z	110	+1.6	– 1.6
A	200	+1.6	– 1.6
B	300	+1.6	– 1.6
C	750	+1.5	– 2.0
D	1 400	+1.6	– 3.2

Table 4 **Dimensions of pulleys for measuring lengths of new belts**

Dimensions in millimetres

Cross-section symbol [A)]	Datum width, W_d	Nominal datum diameter, D_d	Nominal pulley circumference at datum diameter	Outside diameter	Top width of groove, *g*	Minimum groove depth, *d*	Groove angle, *A*
Wedge belts							
SPZ/XPZ	8.5	95.5	300	$99.76^{+0.00}_{-0.06}$	$9.91^{+0.00}_{-0.03}$	11.0	38 ± 0.25
SPA/XPA	11.0	143.2	450	$149.13^{+0.00}_{-0.06}$	$12.96^{+0.00}_{-0.03}$	14.0	38 ± 0.25
SPB/XPB	14.0	191.0	600	$198.29^{+0.00}_{-0.06}$	$16.45^{+0.00}_{-0.03}$	17.5	38 ± 0.25
SPC/XPC	19.0	318.3	1 000	$328.26^{+0.00}_{-0.06}$	$22.35^{+0.00}_{-0.03}$	23.8	38 ± 0.25
V-belts							
Y/YX	5.3	28.7	90	$32.13^{+0.00}_{-0.06}$	$6.24^{+0.00}_{-0.03}$	6.3	32 ± 0.25
Z/ZX	8.5	57.3	180	$62.60^{+0.00}_{-0.06}$	$10.06^{+0.00}_{-0.03}$	9.5	34 ± 0.25
A/AX	11.0	95.5	300	$102.42^{+0.00}_{-0.06}$	$13.05^{+0.00}_{-0.03}$	12.0	34 ± 0.25
B/BX	14.0	127.3	400	$136.08^{+0.00}_{-0.06}$	$16.61^{+0.00}_{-0.03}$	15.0	34 ± 0.25
C/CX	19.0	222.8	700	$234.62^{+0.00}_{-0.06}$	$22.53^{+0.00}_{-0.03}$	20.0	34 ± 0.25
D/DX	27.0	318.3	1 000	$334.97^{+0.00}_{-0.06}$	$32.32^{+0.00}_{-0.03}$	28.0	36 ± 0.25

NOTE 1 See Annex A.

NOTE 2 The outside diameter of the pulleys include tolerances in order to make it simpler to manufacture the pulleys, however the key diameter for length identification and drive design is the datum diameter (D_d).

A) Descriptions of cross-section symbols are included in Table C.2.

4.4 Belt datum length

When determined in accordance with Annex A, the belt datum length and datum length variation shall be as given in Table 5.

Table 5 Nominal datum lengths of wedge belts and V-belts and permitted tolerances

Dimensions in millimetres

Datum length range	Nominal datum lengths										Maximum datum length variation	
	Wedge belts				V-belts						Non-matched sets	Matched sets
	SPZ	SPA	SPB	SPC	Y	Z	A	B	C	D		
200 to 399					200 224 250 280 315 355						+8 –4	2
400 to 529					400 450 500	405 475					+10 –6	
530 to 709	630					530 625 700	630 700				±7	
710 to 899	710 800	800				780	790 890				±9	
900 to 1 249	900 1 000 1 120	900 1 000 1 120				920 1 080	990 1 100	930 1 000 1 100 1 210			±13	
1 250 to 1 599	1 250 1 400	1 250 1 400	1 250 1 400 1 600				1 250 1 430 1 550	1 370 1 560	1 560		±16	
1 600 to 1 899	1 600 1 800	1 600 1 800	1 800				1 750	1 690 1 760	1 760		±19	
1 900 to 2 249	2 000	2 000 2 240	2 000	2 000 2 240			1 940 2 050 2 200	1 950 2 180	1 950 2 190		±23	4
2 250 to 2 799	2 240 2 500	2 500	2 240 2 500	2 500			2 300 2 480 2 570 2 700	2 300 2 500 2 700	2 340 2 490 2 720	2 740	±28	
2 800 to 3 149	2 800	2 800	2 800	2 800			2 910 3 080	2 870	2 880 3 080	3 130	±31	
3 150 to 3 699	3 150 3 550	3 150 3 550	3 150 3 550	3 150 3 550			3 290 3 540	3 200 3 600	3 310 3 520	3 330	±37	6
3 700 to 4 999		4 000 4 500	4 000 4 500	4 000 4 500				4 060 4 430 4 820	4 060 4 600	3 730 4 080 4 620	±50	
5 000 to 5 999			5 000 5 600	5 000 5 600				5 370	5 380	5 400	±60	8
6 000 to 6 999			6 300	6 300				6 070	6 100 6 860	6 100 6 840	±70	
7 000 to 8 999			7 100 8 000	7 100 8 000					7 600	7 620 8 410	±90	
9 000 to 9 999				9 000					9 100	9 140	±100	12
10 000 to 12 499				10 000 11 200					10 700	10 700 12 200	±125	
12 500 to 16 000				12 500						13 700 15 200	±160	14

4.5 Matched belts

In order to avoid uneven distribution of load, belts running on a multi-belt drive shall be matched belts and their lengths shall be within the tolerances given for matched sets in Table 5.

NOTE 1 Age and storage conditions might alter a belt length (see Annex B).

NOTE 2 Belts from different manufacturers should not be mixed on the same drive.

4.6 Belt fitting

It is essential that wedge belts and V-belts shall not be mixed on the same drive. If a drive is designed to be fitted with wedge belts, replacement belts shall always be wedge belts.

*NOTE 1 If a drive is designed to be fitted with V-belts with pulley groove profiles as specified in **5.5**, replacement belts may be either V-belts or wedge belts. If wedge belts are used, consideration should be given to minimum pulley diameters (see Table 9).*

NOTE 2 Further information on drive design, including a worked example, is given in Annex C.

4.7 Electrical resistance

Where belts are required by the purchaser to be antistatic, each belt shall be checked and every individual measurement of electrical resistance R in ohms, when measured by the method given in Annex D, shall be less than or equal to:

$$R \leq 6 \times 10^5 \times \frac{L}{l} \quad (1)$$

where

L is the distance between electrodes (in mm) (see Figure E.1);

l is the sum of the lengths of the two sloping sides of the belt (in mm); calculated from:

$$l = 2T_{\sec}\left(\frac{A}{2}\right) \quad (2)$$

NOTE 1 See Figure 1a) and Figure 1b).

NOTE 2 This maximum resistance refers to new complete endless belts. Information on electrical conductivity of antistatic belts is given in ISO 1813.

4.8 Marking

4.8.1 All belts shall be marked legibly and durably on the outer non-working face with symbols indicating the belt cross-section, the nominal datum length as given in Table 5 and, where appropriate, the antistatic marking specified in **4.8.2** and **4.8.3**.

NOTE X is included in the belt section designation to indicate a raw edge construction (see Table C.2).

EXAMPLES

SPA 900 Wrapped belt

XPA 900 Raw edged belt

4.8.2 Belts with antistatic properties having been tested to conform to the requirements of **4.7** shall be marked either with the word "antistatic" or with the letters "AS".

4.8.3 Banded belts are to be identified in the same way as single belts on the belts themselves but reference to the number of belts on the band should be made in any documentation, i.e. 3/SPA 2000.

5 Grooved pulleys

5.1 Materials

5.1.1 Pulleys shall be made of cast iron, steel, suitable alloys, or any material that can be shaped to the standardized dimensions and tolerances (see Table 8) and is capable of withstanding without damage the conditions of service (heating, mechanical stresses, abrasion, environment, etc.). The pulley material shall dissipate any significant heat which might be generated by the belts.

5.1.2 Cast or sintered pulleys shall consist of an appropriate material and shall be free of significant porosities or flaws and of shrinkage holes or voids in the arms, the web and the hub.

5.1.3 In the case of cast pulleys, superficial defects of the rim, boss and centre plate or web (excluding those in the spokes or arms) may be filled with a material homogenous with the original material in such a way as not to give rise to internal stresses.

Materials having only the appearance of metal shall not be used.

5.2 Finish

5.2.1 The surface finish of the working surfaces shall be measured in a plane parallel to the action of the belt and shall be not coarser than the value given in Table 6.

5.2.2 The edge of V-pulley grooves shall be chamfered or radiused to remove the sharp corners.

Table 6 **Surface finish of pulleys**

Working surface	**Surface of finish, R_a** [A] µm
V-pulley grooves	3.2
All pulley bores and rim	6.3

[A] R_a gives the arithmetical mean deviation of the profile as defined in BS 1134-1:1988.

5.3 Tolerances

The tolerances for side wobble and for run-out (eccentricity), in millimetres per millimetre of pulley diameter, shall be as follows:

pulley diameter $\leq$ 500 mm:	$\pm$0.0010
500 mm < pulley diameter $\leq$ 1 500 mm:	$\pm$0.0015
pulley diameter > 1 500 mm:	$\pm$0.0020

5.4 Balancing

5.4.1 General

The purpose of balancing a pulley is to improve its mass distribution so as to diminish the out-of-balance forces exerted as it revolves; such forces cannot be completely eliminated, but the remaining imbalance shall be not greater than the allowable limits specified in **5.4.2** or **5.4.3**.

NOTE As balancing is an expensive operation, the specified limit of the residual imbalance is given a value as large as the envisaged applications might allow.

Two classes of balancing are considered:

a) balancing in one plane, called static balancing (see **5.4.2**);

b) balancing in two planes, called dynamic balancing (see **5.4.3**).

Static balancing is usually sufficient; dynamic balancing might be necessary for pulleys with large face widths or for pulleys revolving relatively quickly (rim speeds greater than 30 m/s).

5.4.2 Static balancing

Pulleys manufactured for stock shall be statically balanced, their future conditions of use not being known at the time of manufacture.

Static balancing shall be done so as to leave on the datum diameter an eccentric residual mass in kilograms not exceeding the larger of the following two values:

a) $$0.002M_p \times \frac{7.2}{\rho} \qquad (3)$$

where

M_p is the mass of pulley and companion bush (in kg);

ρ is the density of pulley material (in g/cm^3).

NOTE 7.2 equates to the density of a cast iron pulley of 7.2 g/cm^3.

b) 0.005 kg.

5.4.3 Dynamic balancing

5.4.3.1 When the rotational speed n (r/min) of a pulley is known, the necessity for dynamic balancing shall be ascertained as follows.

The limiting speed n_1 (r/min) shall be determined by reference to Figure 3 or by calculation using the following formula:

$$n_1 = \sqrt{\frac{1.58 \times 10^{11}}{I d_d}} \qquad (4)$$

where

I is the pulley face width (in mm);

d_d is the datum diameter of the pulley (in mm).

NOTE If $n \leq n_1$, static balancing is normally sufficient. If $n > n_1$, dynamic balancing is normally necessary.

5.4.3.2 When required, dynamic balancing shall be carried out by the method specified in BS ISO 254 and, unless the user has specified a particular requirement, the G quality level shall be determined by the larger of the following two values:

a) $G_1 = 6.3$

b) $G_2 = 5\ v/M$ (5)

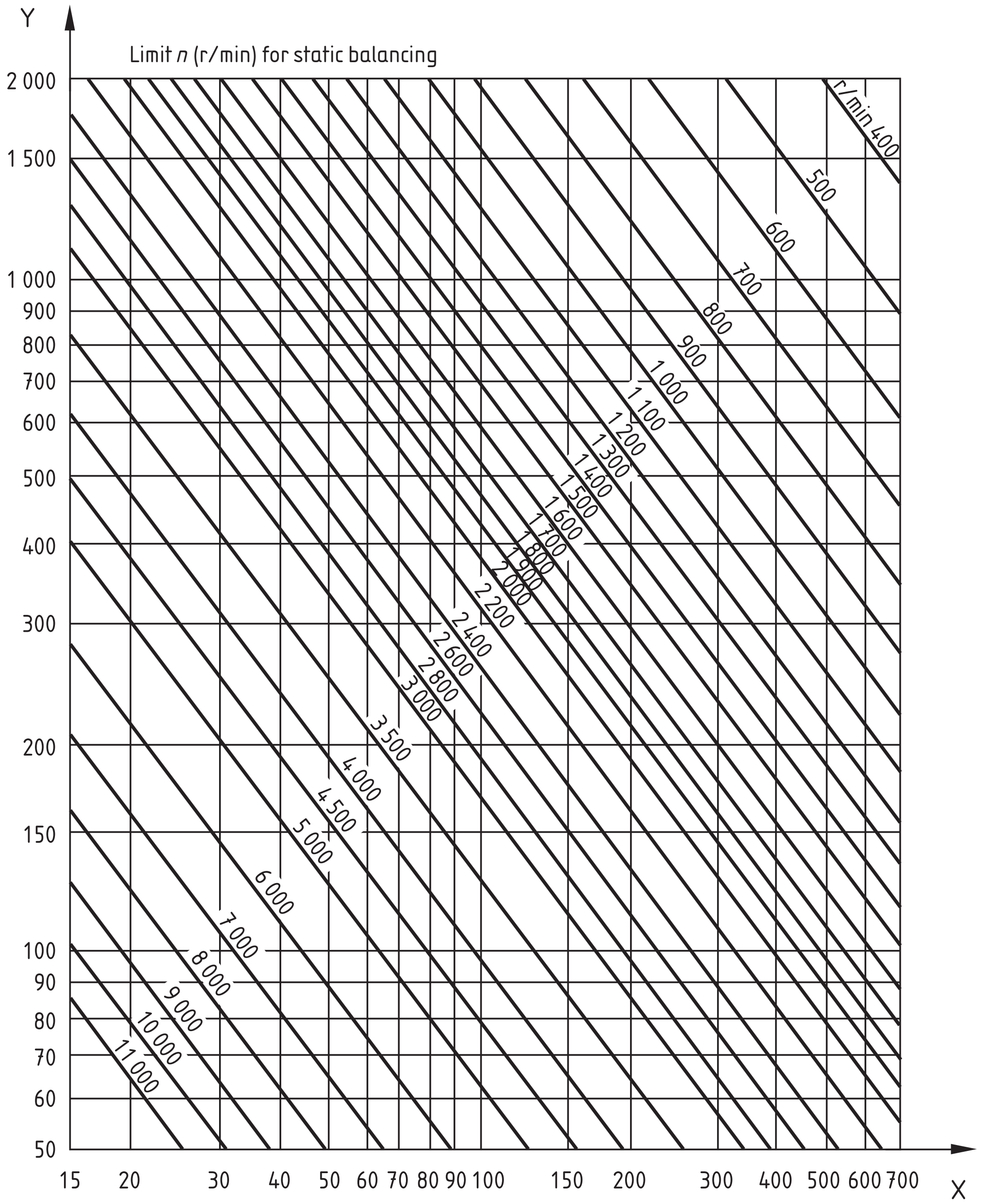
where

v is the circumferential pulley speed (in m/s);

M is its equivalent mass (in kg) taken as the mass of a geometrically similar pulley made of cast iron.

*NOTE The expression for G_2 derives from the definitions given in BS ISO 254 in relation to the smallest practical residual eccentric mass given in **5.4.2**b).*

Figure 3 **Pulley limiting rotational speed indicating limits for static or dynamic balancing**



Key

X Face width (mm)

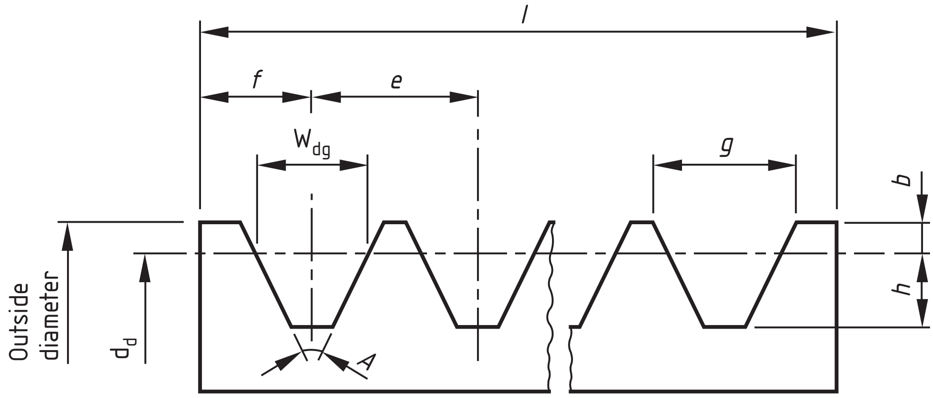
Y Pulley datum diameter (mm)

NOTE See ***5.4.3.1****.*

5.5 Standard dimensions of pulleys

Pulley faces and grooves shall conform to the dimensions and tolerances shown in Figure 4 and given in Table 7; preferred pulley diameters are given in Table 8; recommended minimum pulley datum diameters for raw edge moulded cog belts are given in Table 9.

Figure 4 **Multi-groove pulley cross-section**



NOTE The maximum distance I *between the outside edges of the pulley, i.e. the face width, is equal to (x – 1)*e + 2*f where x is the number of grooves.*

Table 7 **Dimensions of standard grooved pulleys for wedge and V-belt drives**

Dimensions in millimetres

Cross-section symbol	**Pulley groove datum width, W_{dg}**	**Minimum distance from outside diameter to datum diameter, *b***	**Minimum groove depth below datum diameter, *h* A)**	**Centre to centre of grooves, *e* B)**	**Edge of pulley to first groove centre, *f* C)**	**Datum diameter, d_d**	**Groove angle, *A***	**Minimum top width of groove, *g***
Y	5.3	1.60	4.7	8.0 ± 0.3	7.0 ± 0.5	Up to 60	32 ± 0.5	6.20
						60 and over	36 ± 0.5	6.33
Z } SPZ	8.5	2.00	9.0	12.0 ± 0.3	8.0 ± 0.6	Up to 80	34 ± 0.5	9.70
						Over 80	38 ± 0.5	9.90
A } SPA	11.0	2.75	11.0	15.0 ± 0.3	10.0 ± 0.6	Up to 118	34 ± 0.5	12.70
						Over 118	38 ± 0.5	12.90
B } SPB	14.0	3.50	14.0	19.0 ± 0.4	12.5 ± 0.8	Up to 190	34 ± 0.5	16.10
						Over 190	38 ± 0.5	16.40
C } SPC	19.0	4.80	19.0	25.5 ± 0.5	17.0 ± 1.0	Up to 315	34 ± 0.5	21.90
						Over 315	38 ± 0.5	22.30
D	27.0	8.10	19.9	37.0 ± 0.6	24.0 ± 2.0	Up to 475	36 ± 0.5	32.30
						475 and over	38 ± 0.5	32.60

NOTE 1 See Figure 4 for symbols.

NOTE 2 See Table 8 for preferred pulley datum diameters.

A) When the pulleys are to be used for V-belt sections Z, A, B or C only, dimension h may be reduced by 20%.

B) The tolerances on dimension e apply to the distance between the centres of any two grooves, whether adjacent or not.

C) It is recommended that the tolerances on dimension f be taken into account in the alignment of the pulleys.

Table 8 **Preferred pulley datum diameters**

Datum diameter mm	**Preferred diameters**					
	Y	**Z and SPZ**	**A and SPA**	**B and SPB**	**C and SPC**	**D**
20	*					
22.4	*					
25	*					
28	*					
31.5	*					
35.5	*					
40	*					
45	*					
50	*	*				
53						
56	*	*				
60		*				
63	*	*				
67		**				
71	*	**				
75		**	*			
80	*					
85		**	*			
		**	*			
90	*	**	*			
95		**	*			
100	*	**	**			
106			**			
112	*	**	**			
118			**			
125	*	**	**	*		
132			**	*		
140		**	**	*		
150		**	**	*		
160		**	**	**		
170				**		
180		**	**	**		
190				**		
200		**	**	**	*	

NOTE 1 * = *classical V-belts (Y, Z, A, B, C, D);*
** = *wedge belts (SPZ, SPA, SPB, SPC).*

NOTE 2 *The limits of tolerance on datum diameter should be ±0.8%.*

Table 8 **Preferred pulley datum diameters** *(continued)*

Datum diameter mm	**Preferred diameters**					
	Y	**Z and SPZ**	**A and SPA**	**B and SPB**	**C and SPC**	**D**
212				**	*	
224				**	**	
236				**	**	
250		**	**	**	**	
265					**	
280				**	**	
315		**	**	**	**	
355				**	**	*
375						*
400		**	**	**	**	*
425						*
450					**	*
475						*
500		**	**	**	**	*
530						*
560					**	*
630		**	**	**	**	*
710						*
800		**	**	**	**	*
900						*
1 000			**	**	**	*
1 250				**	**	*
1 600						*
2 000						*

NOTE 1 * = *classical V-belts (Y, Z, A, B, C, D);*
** = *wedge belts (SPZ, SPA, SPB, SPC).*

NOTE 2 The limits of tolerance on datum diameter should be ±0.8%.

Table 9 **Recommended minimum pulley datum diameters**

Section	**Raw edge, moulded, cogged** mm	**Section**	**Wrapped** mm
XPZ	56	SPZ	63
XPA	71	SPA	90
XPB	112	SPB	140
XPC	180	SPC	224
ZX	40	Z	50
AX	63	A	71
BX	90	B	112
CX	140	C	180
		D	355

5.6 Installation and take-up allowances

The limiting values for the adjustment of centres for the two transmission pulleys shall be as follows:

lower limiting value (slack-off):

$$= 2 \times W_d + 0.009L_d \quad (6)$$

higher limiting value (take-up):

$$= 0.02L_d \quad (7)$$

NOTE 1 The above limiting values should be regarded by the belt manufacturers as maxima and by the designers and makers of the machinery as minima.

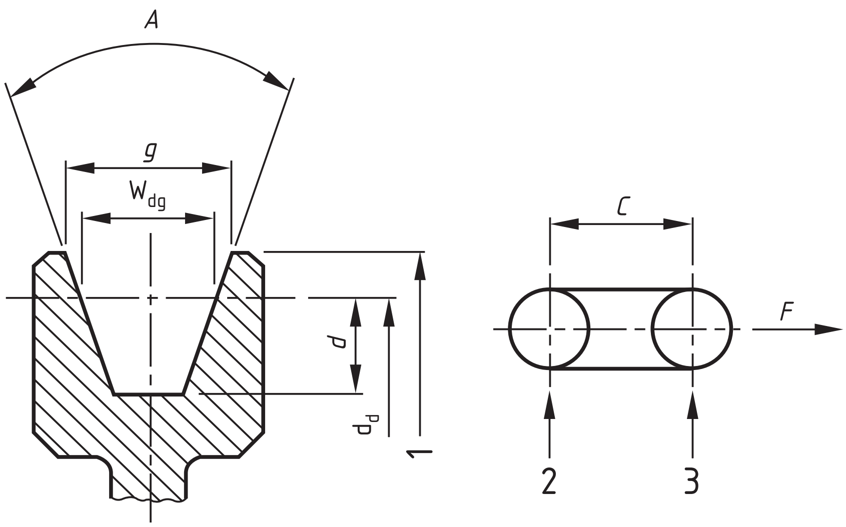
NOTE 2 Recommended practice for installation tension in drives and for calculation of the resultant force imposed on shafts is given in Annex E.

Annex A (normative) Determination of belt datum length

A.1 Apparatus

A.1.1 A pair of equal diameter measuring pulleys having dimensions in accordance with Table 4 mounted with one pulley having a fixed centre whilst the other can slide horizontally under the action of a tensioning force *F* applied horizontally through the sliding pulley centre (see Figure A.1).

Figure A.1 **Measuring pulley and apparatus for measuring belt length**



Key

1 Outside diameter

2 Pulley on fixed centre

3 Pulley on sliding centre

A.1.2 A means of accurately measuring the distance between pulley centres and the tensioning force.

A.2 Procedure

Mount the belt, whose datum length is to be measured, on the measuring pulleys and apply a total tensioning force with the belt positioned in the pulley grooves in accordance with Table 3. Rotate the belt drive through at least two revolutions to seat the belt properly and equalize the tensioning force between the two strands of the belt.

Measure the distance between the pulley centres, *C*. Calculate the belt datum length in millimetres from the following formula:

$$L_d = \pi d_d + 2C \qquad (A.1)$$

Subsequently rotate the belt system a further full revolution observing the variation in distance between measuring pulley centres and record the maximum and minimum values of the centre distance. Do not exceed a belt speed of 1 m/s. Calculate the variation of the distances between the centre of the measuring pulleys, ΔC, from the following formula:

$$\Delta C = C_{max} - C_{min} \quad \text{(A.2)}$$

Centre distance variation ΔC shall not exceed the values given in Table A.1.

Table A.1 **Centre distance variation ΔC on measuring fixture**

Dimensions in millimetres

Belt length		**Top width**	
Over	**Up to and including**	**≤25**	**> 25**
—	1 000	1.2	1.8
1 000	2 000	1.6	2.2
2 000	5 000	2.0	3.4
5 000	—	2.5	3.4

Annex B (informative) Storage of belts

B.1 General

Unfavourable storage conditions can lead to reduced belt life and to variations in belt length. This annex therefore makes recommendations on the more important criteria for good storage.

B.2 Storage environment

Belts should be stored out of direct sunlight, at an ambient temperature between –18 °C and +30 °C and at a relative humidity below 70%.

Belts should not be stored on the floor or near windows, radiators or airflow from heaters.

Some fibres used in strength members of belts are subject to shrinkage in storage, the amount depending on the relative humidity and storage time.

B.3 Equipment

During storage avoid excess weight on, and distortion of, belts. When hung on pegs, the longer belts should be coiled so that the loops are not greater than approximately 2 500 mm in circumference.

Pegs should be crescent-shaped and large enough to avoid compression set from corners or from acute bends of the belt.

B.4 Drive installation

It is recommended that a drive which is to stand for a prolonged period before use should have the belt tension relaxed to prevent the belt taking a permanent set on the pulleys. Before a drive is started up, it is essential that the belt is retensioned and checked (see Annex D).

B.5 Use of stored belts

Belts stored using the above guidelines have been determined to be in a usable condition within eight years. However, if there is any doubt as to the use of belts that have been in storage for 5 years or more, consult the belt manufacturer for advice.

Annex C (informative) Recommendations for drive design

C.1 Design power

The design power is the prime mover power in kilowatts multiplied by the service factor given in Table C.1 for the appropriate type of service, taking into account the operational hours per day.

C.2 Field of application

The following formulae are suitable for use with belt cross-sections covered in this standard.

In the case of multi-belt drives, the power ratings are applicable only to belts that are matched for length in accordance with Table 5.

C.3 Datum lengths of belts

The required datum lengths of belts corresponding to given pulley diameters and distance between pulley centres may be obtained by the following formula, using the same units throughout:

$$L_d = 2C + 1.57(D_d + d_d) + \frac{(D_d - d_d)^2}{4C} \quad \text{(C.1)}$$

where

L_d is the datum length of belt;

D_d is the datum diameter of larger pulley;

d_d is the datum diameter of smaller pulley;

C is the distance between pulley centres.

C.4 Distance between pulley centres

The required distance between pulley centres may be calculated from the following formula using the same units throughout:

$$C = X + \sqrt{(X^2 - Y)} \quad \text{(C.2)}$$

where

$$X = \frac{L_d}{4} - \pi\frac{(D_d + d_d)}{8} \quad \text{(C.3)}$$

$$Y = \frac{(D_d - d_d^2)}{8} \quad \text{(C.4)}$$

C is the distance between pulley centres;

D_d is the datum diameter of larger pulley;

d_d is the datum diameter of smaller pulley;

L_d is the datum length of belt.

C.5 Selection of belt cross-section

Selection of the most favourable belt section can be facilitated by use of Figure C.1 and Figure C.2. In borderline cases, alternative design calculations may be necessary to determine the best solution of a drive problem.

C.6 Pulley diameters in relation to speed ratios

It is the normal practice to use the pulley datum diameter in calculating the speed ratios of wedge belt and V-belt drives. Where very accurate speed ratios are required, the manufacturer should be consulted.

C.7 Power rating formulae

The power rating is a function of the belt cross-section, the datum diameter and angular velocity of the small pulley and may be determined in accordance with the following procedures and formulae, where correction terms or factors for speed ratio, angle of contact and belt length are introduced. The total power rating of the drive per belt, P_b in kilowatts, is given by the formula:

$$P_b = Q(P_1 + \Delta P_1 + \Delta P_2) \qquad \text{(C.5)}$$

where

$$Q = 1.25(1 - 5^{-\theta/\pi}) \qquad \text{(C.6)}$$

θ is the arc of contact on the small pulley, in radians.

NOTE 1 If θ is given in degrees, then π is replaced by 180° in equation C.6.

$$P_1 = d_d\omega\left\{C_1 - C_2\frac{1}{d_d} - C_3(d_d\omega)^2 - C_4\log(d_d\omega)\right\} \qquad \text{(C.7)}$$

$$\Delta P_1 = C_4\omega d_d\log\frac{2}{1 + 10^{\psi}} \qquad \text{(C.8)}$$

$$\Delta P_2 = d_d\omega C_4\log\frac{L}{L_o} \qquad \text{(C.9)}$$

where

$$\psi = \left\{\frac{C_2}{C_4}\frac{1}{d}\left(\frac{1}{S} - 1\right)\right\}$$

P_1 is the basic power rating (in kW);

ω is the angular velocity of the small pulley (in rad/s);

d_d is the datum diameter of the small pulley (in mm);

ΔP_1 is the add-on power for speed ratio (in kW);

ΔP_2 is the add-on power for length (in kW);

NOTE 2 Power ratings for banded belts are exactly the same as the individual belts on the band.

NOTE 3 Manufacturers' catalogues sometimes use a rating formula such that P_2 is used as a multiplier.

NOTE 4 The power rating formulae use a theoretical life under laboratory conditions of 25 000 hours as a benchmark.

L_o is the base belt length (in mm), see Table C.2;

L is the actual belt length (in mm);

NOTE 5 L_o and L are measured in the datum system.

S is the larger value of R or $1/R$, where R is the speed ratio;

C_1, C_2, C_3, and C_4 are parameters corresponding to a specific quality level of the belts and to a satisfactory period of time.

NOTE 6 These parameters can be different from one make of belt to another and/or from one grade of quality to another belt from the same manufacturer.

C.8 Example calculations for designing a belt drive system

NOTE 1 This example is for a wedge belt drive, but the method used is appropriate also to a V-belt drive.

It is required to design a wedge belt drive for a centrifugal pump that will absorb 17.5 kW at 2 400 r/min and be driven by a normal torque a.c. electric motor at 2 880 r/min. The centre distance is approximately 420 mm. The drive is to run 18 h per day.

1) Select service factor from Table C.1, class 1.	Service factor = 1.2
2) Calculate design power rating in **C.1**.	Design power rating = pump rating × service factor = 17.5 × 1.2 = 21.0 kW
3) Select belt section from Figure C.1.	Belt section indicated is SPZ
4) Calculate speed ratio.	Speed ratio $= \frac{2\,880}{2\,400} = 1.2$
5) On the basis of experience and of information supplied by the belt manufacturer, select from Table 7 preferred pulley diameters that give this ratio.	Standard pulleys of 125 mm and 150 mm datum diameter give the required speed ratio
6) Calculate belt length to give the required centre distance between pulleys of 420 mm from equation C.1 in **C.3**.	Belt datum length required is 1 272 mm
7) Choose the nearest nominal datum length from Table 4.	1 250 mm
8) Calculate pulley centre distance from equation C.2 in **C.4**.	Centre distance = 409 mm
9) Determine the total power rating per belt, P_b, either from the equations in **C.7** or from manufacturers' catalogues. *NOTE 2 Manufacturers' catalogues usually give tables of values rather than formulae in order to facilitate ease of calculation.*	
	For a wrapped belt section SPZ (see **4.2** and Figure 2) the following figures might apply:
a) basic power rating (equation C.7)	P_1 = 5.97 kW
b) add-on power for speed ratio (equation C.8)	ΔP_1 = 0.24 kW
c) add-on power for belt length (equation C.9)	ΔP_2 = – 0.24 kW *NOTE 3 This quantity is negative because L is less than L_o in equation C.9.*
d) arc of contact correction (equation C.6)	Q = 0.99 kW
e) therefore the total power rating per belt from (equation C.5)	P_b = 0.99 (5.97 + 0.24 – 0.24) = 5.91 kW per belt
10) Calculate the number of belts required by dividing the design power rating [(item 2)] by the corrected power rating per belt [(item 9e)].	Number of belts $= \frac{21}{5.91}$ = 3.55 (say four belts)

Summary of belt drive system requirements:

Smaller pulley fitted to electric motor shaft:	125 mm datum diameter with four grooves SPZ
Larger pulley fitted to pump shaft:	150 mm datum diameter with four grooves SPZ
Wedge belts required:	four SPZ section belts, 1 250 mm datum length

Table C.1 **Service factors for belt drives**

Type of driven machine		**Service factor** A), B)					
Class	**Examples**	**"Soft" starts** C)			**"Heavy" starts** D)		
		Hours of duty per day			**Hours of duty per day**		
		10 and under	**Over 10 to 16**	**Over 16**	**10 and under**	**Over 10 to 16**	**Over 16**
Class 1 (Light duty)	Agitators (uniform density) Blowers, exhausters and fans (up to 7.5 kW) Centrifugal compressors and pumps Belt conveyors (uniformly loaded)	1.0	1.1	1.2	1.1	1.2	1.3
Class 2 (Medium duty)	Agitators and mixers (variable density) Blowers, exhausters and fans (over 7.5 kW) Rotary compressors and pumps (other than centrifugal) Belt conveyors (not uniformly loaded) Generators and exciters Laundry machinery Lineshafts Machine tools Printing machinery Sawmill and woodworking machinery Screens (rotary)	1.1	1.2	1.3	1.2	1.3	1.4
Class 3 (Heavy duty)	Brick machinery Bucket elevators Compressors and pumps (reciprocating) Conveyors (heavy duty) Hoists Mills (hammer) Pulverizers Punches, presses, shears Quarry plant Rubber machinery Screens (vibrating) Textile machinery	1.2	1.3	1.4	1.4	1.5	1.6
Class 4 (Extra heavy duty)	Crushers (gyratory-jaw-roll) Mills (ball-rod-tube)	1.3	1.4	1.5	1.5	1.6	1.8

NOTE 1 The service factors in this table do not apply to light duty drives using section Y or Z belts; the belt manufacturer should be consulted.

NOTE 2 The use of an idler pulley on the outside of the belt is not recommended.

A) For speed-increasing drives of:
speed ratio 1.00 to 1.24: multiply service factor by 1.00;
speed ratio 1.25 to 1.74: multiply service factor by 1.05;
speed ratio 1.75 to 2.49: multiply service factor by 1.11;
speed ratio 2.50 to 3.49: multiply service factor by 1.18;
speed ratio 3.50 and over: multiply service factor by 1.25.

B) Special conditions.
a) For reversing drives, except where high torque is not present on starting, add 20% to the factors.
b) Idler pulley on slack side (internal), no addition to the factors.
c) Idler pulley on taut side (internal), add 0.1 to the factors.

C) Electric motors (a.c. start, delta start, d.c. shunt wound), internal combustion engines with four or more cylinders, all prime movers fitted with centrifugal clutches, dry or fluid couplings.

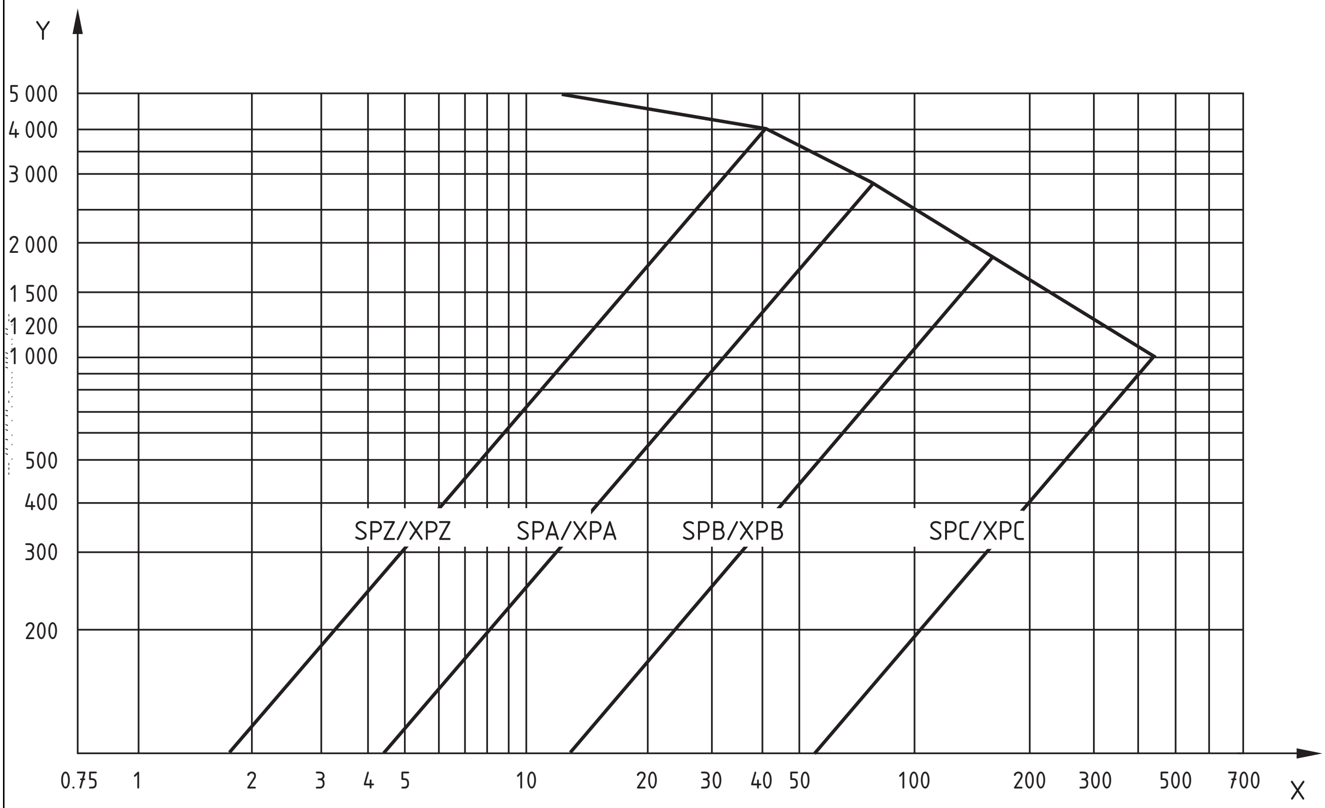
D) Electric motors (a.c. direct-on-line start, d.c. series and compound wound); internal combustion engines with less than four cylinders.

Table C.2 **Standard base lengths L_o for power rating formulae**

Belt type	**Cross-section symbol**	L_o
Wedge belts and banded wedge belts wrapped construction	SPZ	1 600
	SPA	2 240
	SPB	3 150
	SPC	5 600
V-belts and banded V-belts (except Y and Z sections), wrapped construction	Y	315
	Z	820
	A	1 730
	B	2 280
	C	3 800
	D	6 375
Wedge belts and banded wedge belts, raw edge construction, plain, cogged or laminated	XPZ	1 600
	XPA	2 240
	XPB	3 150
	XPC	5 600
V-belts and banded V-belts (except ZX section), raw edge construction, plain, cogged or laminated	ZX	820
	AX	1 730
	BX	2 280
	CX	3 800

*NOTE See **C.7**, equation C.9*

Figure C.1 **Selection of wedge belt cross-section**

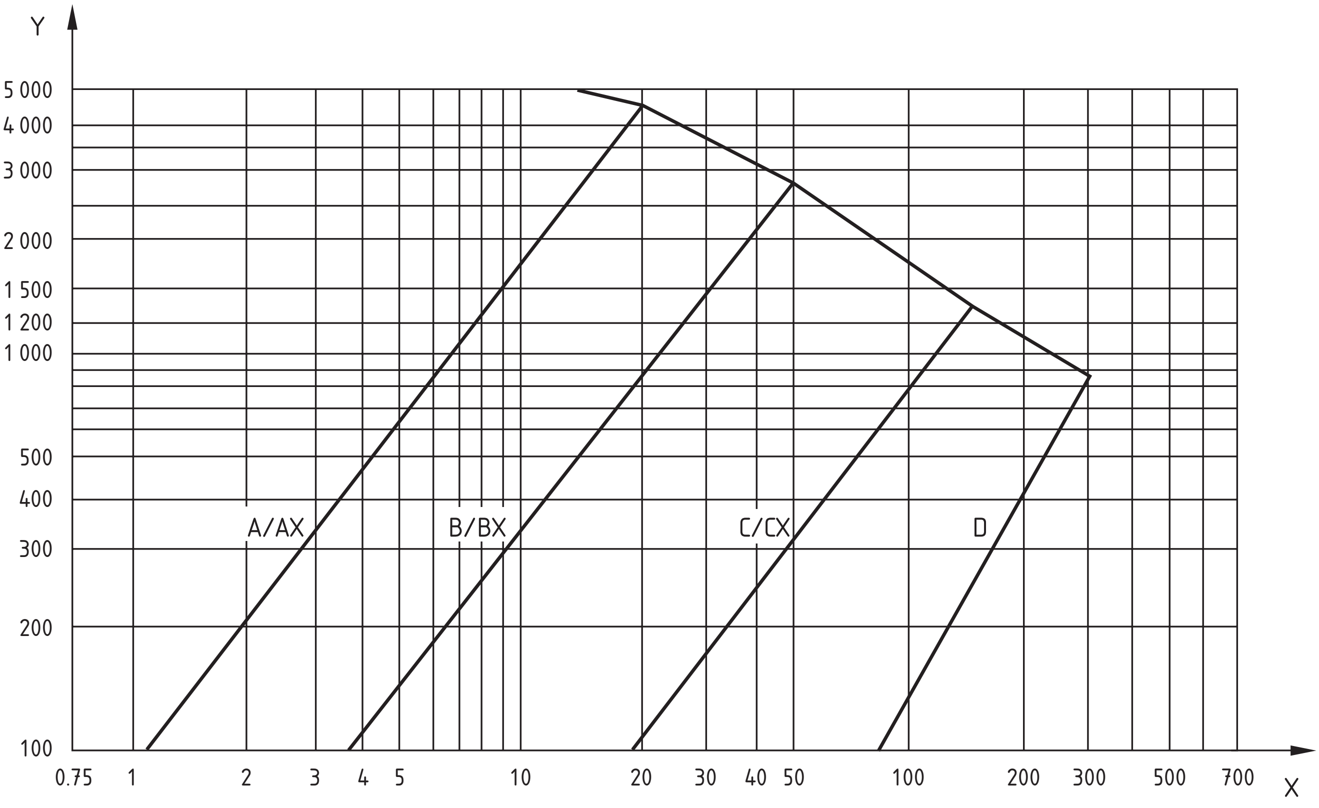


Key

X Design power (kW)

Y Speed of faster shaft (r/min)

Figure C.2 **Selection of V-belt cross-section**



Key

X Design power (kW)

Y Speed of faster shaft (r/min)

NOTE Y and Z section belts should be used for low power, small pulley diameter applications and should be selected only when pulley diameters are smaller than the recommended minimum for A section belts.

Annex D (normative) Tests for electrical resistance of belts

D.1 General

The purpose of these tests is to measure the electrical resistance per unit of belt length at a minimum of five representative sections along the whole belt length to assess whether the test belt can be classified as antistatic, as defined in **4.7**.

*NOTE Non-compliance with the maximum limit of resistance specified in **4.7** can be proved only at the specified upper limits of temperature and humidity. Compliance can be proved at any permissible testing temperature and humidity at which the resistance is below the specified limit.*

D.2 Apparatus

D.2.1 *Electrical insulation test meter*, with nominal open-circuit voltage of 500 V d.c. capable of applying a test voltage of not less than 40 V with a power of not more than 3 W in the belt section under test and capable of measuring the electrical resistance within an accuracy of 5%.

D.2.2 *Test rig*, see Figure D.1. Two clean, electrically conductive metal contacts (preferably brass), 25 mm wide and constructed to provide a V-groove of an appropriate included angle into which the test belt can be seated so that only the belt driving surfaces are in contact, arranged 100 mm ± 6 mm apart on an electrically insulated base. At each contact a suitable weight is provided so that a force of 1 N per millimetre of top belt width, W, can be applied to press the belt into the V-grooved contact to ensure good electrical contact without deforming the belt surfaces during insertion or testing.

D.2.3 *Electrical conducting liquid*, comprising:

anhydrous polyethylene glycol of relative molecular mass 600:	800 parts;
distilled water:	200 parts;
soft soap conforming to BS 1913:1990:	1 part;
potassium chloride:	10 parts.

D.3 Test procedure

D.3.1 After straining the new complete belt to be assessed under the conditions specified in **A.2** maintain it in an unstrained state at a temperature of between 15 °C and 25 °C for not less than 24 h. Immediately prior to carrying out the procedures outlined in **D.3.2** to **D.3.5** keep the test belt at a temperature of 20 °C ± 2 °C in air with a relative humidity of less than 70% for not less than 2 h.

D.3.2 Clean the test belt driving surface areas with dry fullers earth powder (BP grade) using a clean cotton pad. Remove all traces of powder and then wipe over with a pad moistened with distilled water. Rub dry with a clean cloth.

In all these procedures take care to avoid straining the belt.

D.3.3 After cleaning apply a coat of electrical conducting liquid as specified in **D.2.3** to both belt driving surface areas and the test rig metal contact areas that are to be brought into contact to provide a good electrical connection. Ensure these areas are completely wetted and remain so whilst the resistance of each sector of belt is being measured.

D.3.4 Place the rig retaining weights on the belt top surface to provide a contact surface pressure equivalent to 1 N per millimetre of top width of belt ensuring no belt distortion both during application and testing.

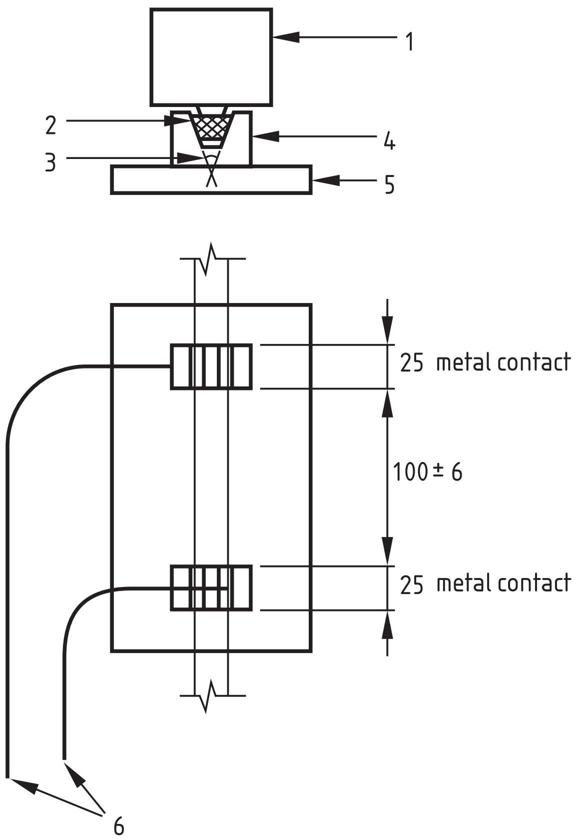
Measure and record the electrical resistance of the 100 mm ± 6 mm long belt sector using the insulation test meter, applying a test voltage of not less than 40 V with not more than 3 W of power.

Record the test ambient temperature and humidity.

D.3.5 Repeat **D.3.2**, **D.3.3** and **D.3.4** for each of a minimum of five different test sectors around the whole length of belt being assessed.

Figure D.1 **Apparatus for measuring the electrical resistance of belts**

All dimensions are in millimetres.



Key

1 Suitable weight which will exert at each metal contact a force of 1 N per millimetre of top width of belt
2 Belt
3 Angle to suit belt
4 Metal contact
5 Insulating base
6 Insulated leads to insulation test meter

Annex E (informative) Recommended practice for installation tension in belt drives and calculation of resultant force imposed on the shaft

E.1 Because of the high power ratings of wedge and V-belts, it is necessary to be able to measure belt tensions with sufficient accuracy to avoid belt slip or overloaded bearings or to meet particularly arduous conditions.

The procedure described in **E.2** to **E.5** is recommended for drives coming within the normal range for each belt section as defined in this British Standard.

E.2 Check that the pulley centres are fixed. Rotate the larger pulley at least four complete revolutions before making the following measurements. Use a matched set of belts (see **4.5**) on a multi-belt drive.

Measure the length of the belt span between pulleys in millimetres. For a two pulley drive system the span may be calculated using equation E.5. At the centre of the span apply a force with a spring balance in a direction perpendicular to the span, until the belt is deflected from its initial position (position 1 in Figure E.1) by an amount (position 2 in Figure E.1) equal to either:

a) 0.02 mm for every millimetre of span length if the span length is 500 mm or less (see Figure E.1, condition 1);

b) 0.01 mm for every millimetre of span length if the span length exceeds 500 mm (see Figure E.1, condition 2).

Note the force applied and compare it with the appropriate value of F given in Table E.1. For a multi-belt drive carry out this procedure for each belt and compare the average value of the forces on all the belts with the specified values of F in Table E.1. Adjust the belt tension as necessary so that the measured force falls within the values of F in Table E.1.

NOTE Due to the nature of banded belts it might not be possible to deflect the centre of the belt span as insufficient force can be applied. It might then be necessary to use another method of belt tensioning. The belt manufacturer should be consulted.

E.3 A measured force below the lower value of F in Table E.1 indicates undertensioning, whilst a measured force above the higher value indicates overtensioning. However, when starting up a drive with new belts, tension the drive to the higher value of F since belt tension falls rapidly in the early stages of running in.

Belt tensions towards the higher values of F may also need to be maintained on some more difficult drives, usually those having one or more of the following characteristics:

a) high belt speed;

b) low belt speed;

c) small arc of contact;

d) high overload on start-up;

e) frequent high torque start-up.

Carefully watch all belt drives during the running-in period after initial start-up. Retensioning should be carried out and checked periodically by the procedure described in **E.2**.

E.4 The total static hub load W_s, in newtons, imposed by the belts on the shaft is the vector sum of the tensions in the belts and it can be calculated with sufficient accuracy by the following formula:

where

$$W_s = 2\chi T_{stat} \sin\frac{\theta}{2} \quad \text{(E.1)}$$

χ is the number of belts;

T_{stat} is the static belt tension (in newtons) and is given by:

for condition 1 (see Table E.1)

$$= 12.5 \times F; \quad \text{(E.2)}$$

for condition 2 (see Table E.1)

$$= 25 \times F. \quad \text{(E.3)}$$

where

F is the belt deflection force (in newtons); as measured by the procedure in **E.2**;

θ is the arc of contact on smaller pulley (in degrees).

E.5 To determine the dynamic hub load W_r in newtons, a correction is made to the static tension to account for the effect of centrifugal force before the vectorial summation, so that:

$$W_s = 2\chi(T_{stat} - K)\sin\frac{\theta}{2} \quad \text{(E.4)}$$

where

$K = Mv^2$

where

M is the mass of belt per unit length (in kg/m);

v is the linear belt speed (in m/s).

NOTE Consult the manufacturer for information on belt mass.

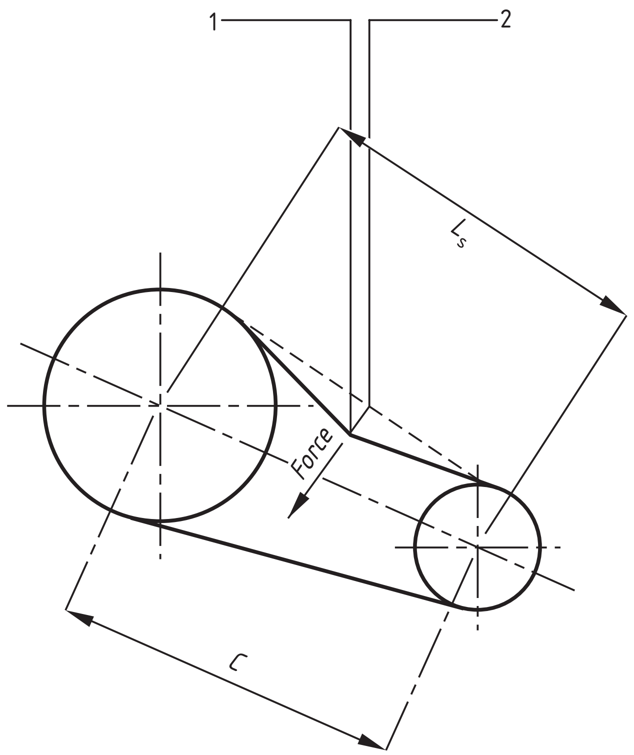
Table E.1 **Deflection force required for measuring installation tension in wedge and V-belt drives using single or multiple belts**

Cross-section symbol	Small pulley diameter range	Condition 1 Deflection of 0.02 mm per millimetre of span length if span length is 500 mm or less Required deflection force *F* at centre of span for belt speed of			Condition 2 Deflection of 0.01 mm per millimetre of span length if span length exceeds 500 mm Required deflection force *F* at centre of span for belt speed of		
		0 m/s to 10 m/s	10 m/s to 20 m/s	20 m/s to 30 m/s	0 m/s to 10 m/s	10 m/s to 20 m/s	10 m/s to 30 m/s
	mm	N	N	N	N	N	N
Wedge belts							
SPZ	67 to 95	16 to 24	13 to 20	10 to 18	8 to 12	6.5 to 10	5.5 to 9
	95 and above	24 to 34	20 to 32	18 to 28	12 to 17	10 to 16	9 to 14
SPA	100 to 140	28 to 40	24 to 34	19 to 28	14 to 20	12 to 17	9.5 to 14
	140 and above	40 to 62	34 to 52	28 to 44	20 to 31	17 to 26	14 to 22
SPB	160 to 265	50 to 72	40 to 64	36 to 54	25 to 36	20 to 32	18 to 27
	265 and above	72 to 92	64 to 82	54 to 74	36 to 46	32 to 41	27 to 37
SPC	224 to 355	92 to 132	76 to 116	64 to 104	46 to 66	38 to 58	32 to 52
	355 and above	132 to 170	116 to 152	104 to 140	66 to 85	58 to 76	52 to 70
XPZ	56 to 95	20 to 30	16 to 25	13 to 23	10 to 15	8 to 13	7 to 11
	95 and above	30 to 43	35 to 40	23 to 35	15 to 21	13 to 20	11 to 18
XPA	80 to 140	35 to 50	30 to 43	24 to 35	18 to 25	15 to 21	12 to 18
	140 and above	50 to 78	43 to 65	35 to 55	25 to 39	21 to 33	18 to 28
XPB	112 to 265	63 to 90	50 to 80	45 to 68	31 to 45	25 to 40	23 to 34
	265 and above	90 to 115	80 to 103	68 to 93	45 to 58	40 to 51	39 to 46
XPC	200 to 355	115 to 165	95 to 145	80 to 130	58 to 83	48 to 73	40 to 65
	355 and above	165 to 213	145 to 190	130 to 175	83 to 106	73 to 95	65 to 88
V-belts							
Z	56 to 100	8 to 12	7 to 9.5	6 to 7.5	4 to 6	3.5 to 5	3 to 4
	100 and above	12 to 17	10 to 14	9 to 12	6 to 8.5	5.5 to 7	4.5 to 6
A	80 to 140	16 to 24	13 to 19	10 to 16	8 to 12	6.5 to 9.5	5.5 to 8
	140 and above	24 to 35	19 to 28	16 to 24	12 to 18	9.5 to 14	8 to 12
B	125 to 200	32 to 48	26 to 38	20 to 32	16 to 24	13 to 19	10 to 16
	200 and above	48 to 70	38 to 58	32 to 48	24 to 35	19 to 29	16 to 24
C	200 to 400	62 to 92	52 to 76	40 to 62	31 to 46	26 to 38	20 to 31
	400 and above	92 to 140	72 to 116	62 to 92	46 to 70	38 to 58	31 to 46
D	355 to 600	124 to 180	164 to 152	84 to 124	62 to 90	52 to 76	42 to 62
	600 and above	180 to 268	152 to 230	124 to 180	90 to 134	76 to 115	62 to 90
ZX	40 to 100	10 to 15	9 to 12	7.5 to 9.4	5 to 7.5	4.4 to 6	3.7 to 5
	100 and above	15 to 21	12 to 18	11 to 15	7.5 to 11	7 to 9	6 to 7.5
AX	63 to 140	20 to 30	16 to 24	13 to 20	10 to 15	8 to 12	7 to 10
	140 and above	30 to 44	24 to 35	20 to 30	13 to 19	12 to 18	10 to 15
BX	90 to 200	40 to 60	33 to 48	25 to 40	20 to 30	16 to 24	13 to 20
	200 and above	60 to 88	48 to 73	40 to 60	30 to 44	24 to 36	20 to 30
CX	140 to 400	78 to 115	65 to 95	50 to 78	39 to 58	33 to 48	25 to 39
	400 and above	115 to 175	95 to 145	78 to 115	58 to 88	48 to 73	39 to 58

NOTE 1 For Y section tensioning values consult the manufacturer.

NOTE 2 The higher value of F is used when starting up a drive with new belts since belt tension falls rapidly in the early stages of running in.

Figure E.1 **Belt deflection measurement**



NOTE For a two pulley drive as shown, the span, L_s, in millimetres, may be calculated from the following formula.

$$L_s = C\left\{1 - 0.125\left(\frac{D_d - d_d}{C}\right)^2\right\} \qquad (E.5)$$

where

C *is the distance between pulley centres (in mm);*

D_d *is the datum diameter of larger pulley;*

d_d *is the datum diameter of smaller pulley.*

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