

BRITISH STANDARD

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

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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This British Standard supersedes BS 3790:1995, which is withdrawn.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 The use of the term “pitch” used in previous versions of BS 3790 has been replaced by “datum” as used in international standards.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

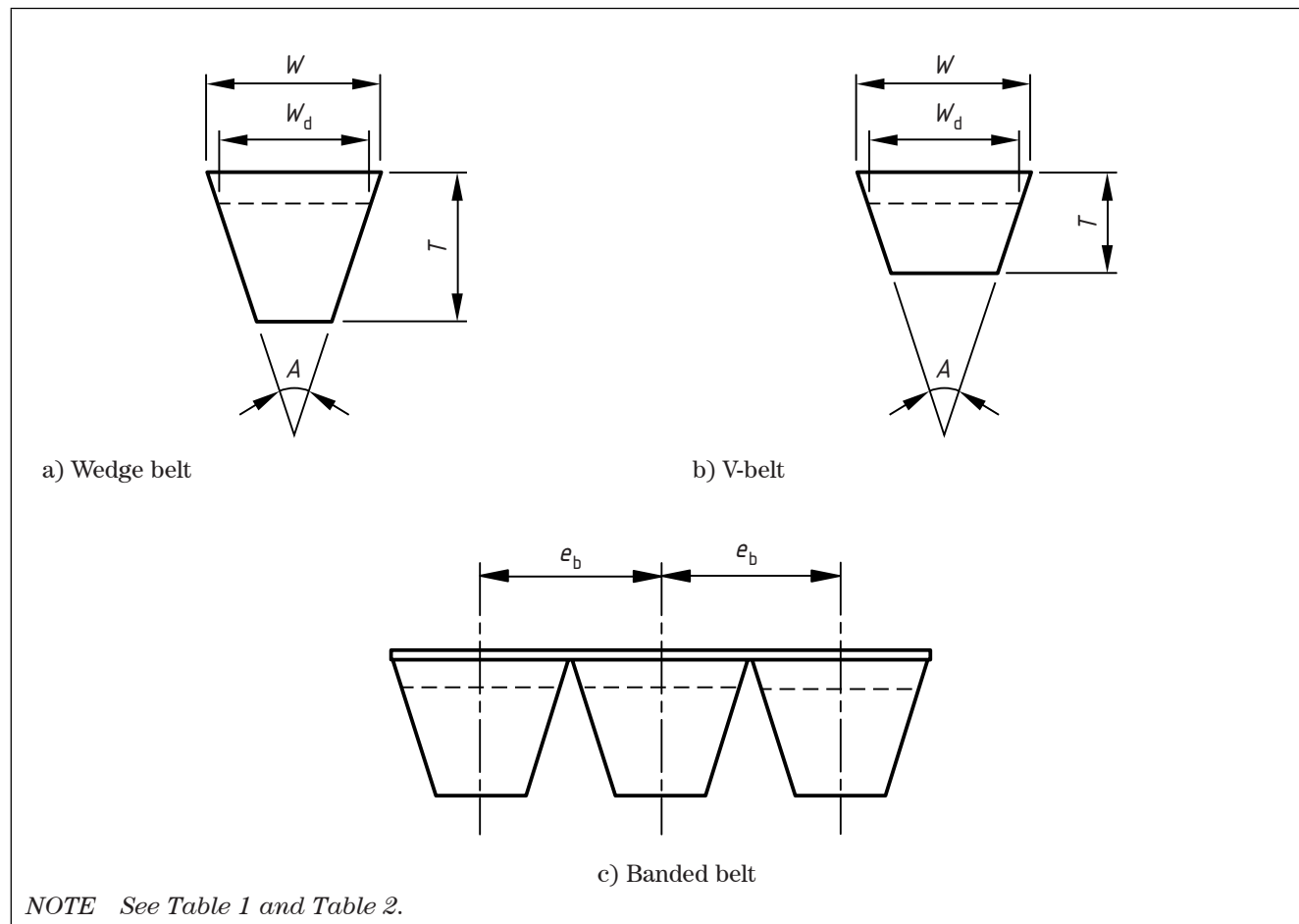


Table 1 Wedge belt and V-belt cross-section dimensions

Cross-section symbol	Datum width, W_d mm	Nominal top width, W mm	Nominal height, T mm	Nominal included angle, A degrees
<i>Wedge belts</i>				
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
<i>V-belts</i>				
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

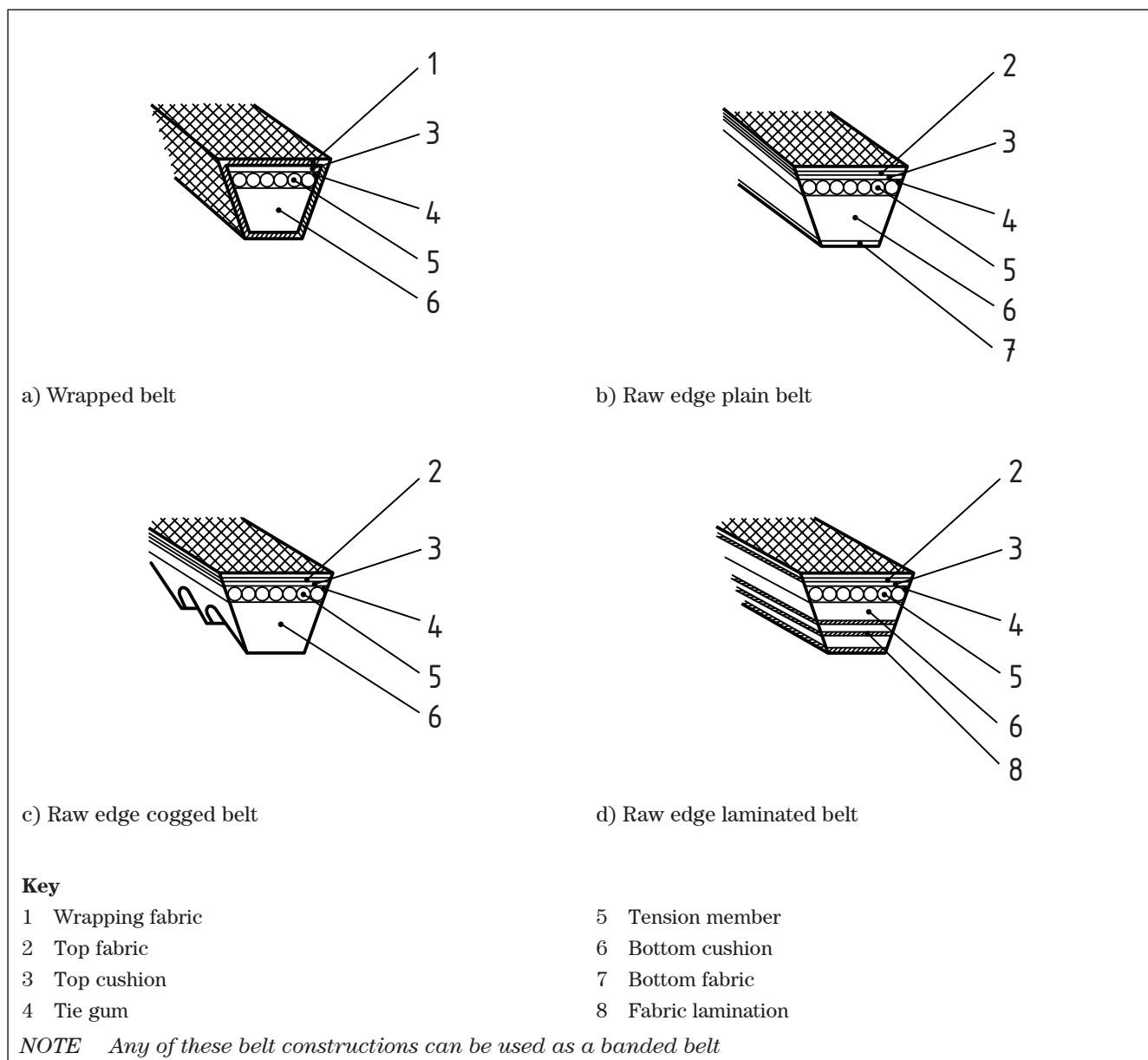
4.1 Materials and workmanship

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 $+60^{\circ}\text{C}$ 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



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	Position of top face of belt with respect to top of groove	
		Maximum mm	Minimum mm
N			
<i>Wedge belts</i>			
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
<i>V-belts</i>			
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
<i>Wedge belts</i>							
SPZ/XPZ	8.5	95.5	300	99.76 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	9.91 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	11.0	38 ± 0.25
SPA/XPA	11.0	143.2	450	149.13 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	12.96 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	14.0	38 ± 0.25
SPB/XPB	14.0	191.0	600	198.29 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	16.45 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	17.5	38 ± 0.25
SPC/XPC	19.0	318.3	1 000	328.26 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	22.35 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	23.8	38 ± 0.25
<i>V-belts</i>							
Y/YX	5.3	28.7	90	32.13 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	6.24 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	6.3	32 ± 0.25
Z/ZX	8.5	57.3	180	62.60 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	10.06 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	9.5	34 ± 0.25
A/AX	11.0	95.5	300	102.42 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	13.05 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	12.0	34 ± 0.25
B/BX	14.0	127.3	400	136.08 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	16.61 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	15.0	34 ± 0.25
C/CX	19.0	222.8	700	234.62 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	22.53 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	20.0	34 ± 0.25
D/DX	27.0	318.3	1 000	334.97 $\begin{smallmatrix} +0.00 \\ -0.06 \end{smallmatrix}$	32.32 $\begin{smallmatrix} +0.00 \\ -0.03 \end{smallmatrix}$	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:

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

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