

Specification for

Endless wedge belt drives and endless V-belt drives

Committees responsible for this British Standard

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- British Gear Association
- British Rubber Manufacturers' Association Ltd.
- Society of Motor Manufacturers and Traders Limited

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Foreword

This British Standard has been prepared under the direction of the Engineering Sector Board. It is a revision of BS 3790:1981 which is withdrawn.

BS 3790 was first published in 1964 and dealt with wedge belts only; it was revised in 1973 and 1981. In 1981, BS 1440¹⁾ was amalgamated with BS 3790. BS 1440 was first published in 1948 and dealt with V-belts only; it was revised in 1962, 1968 and 1971. BS 1440 was withdrawn in 1981.

In the present revision the terms “pitch width of a belt”, “pulley groove pitch width” and “pitch length of a belt” have been retained but the correspondance of these terms with the datum system of ISO 1081 is explained. The detail on belts has been expanded to cover the four basic belt constructions in use. Power rating tables given in previous editions have been removed since they related to belt construction and are provided by manufacturers.

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

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

“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.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 28, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ BS 1440 *Endless V-belt drives sections Y, Z, A, B, C and D*.

1 Scope

This British Standard specifies the dimensions and certain other properties of endless wedge belts and V-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 A and Annex B. Recommendations on the storage of belts are given in Annex C.

This standard does not apply to industrial variable speed drives employing pulleys with movable flanges, or to drives specified in BS 3733 or BS AU 150b.

2 References

2.1 Normative references

This British Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on the inside back cover. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

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

3.1

wedge or V-belt drive

a drive that consists of one or more trapezoidal cross section belts mounted on grooved pulleys. 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 (also known as narrow V-belt)

a 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 $0.95 W_p$

NOTE See Figure 1 a) and Table 1.

3.3

V-belt (also known as classical V-belt)

a 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 $0.73 W_p$

NOTE See Figure 1 b) and Table 1.

3.4

pitch width of a belt (W_p)

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

NOTE See also 3.5.

3.5

pulley groove pitch width (W_{pg})

that width of the pulley groove which is dimensionally the same as the pitch width of the belt associated with the pulley

NOTE For a commentary on how the definitions given in 3.4 and 3.5 differ from those given in ISO 1081, see Annex D.

3.6

relative height

the ratio of the nominal height of the belt (T) to its pitch width (W_p)

3.7

pitch length of a belt (L_p)

the circumferential length of the belt at the pitch width

NOTE This is determined by the method specified in 4.4.

3.8

nominal height of a belt (T)

the height of the trapezium outlined on a cross section of the belt

NOTE See Figure 1.

3.9

nominal top width of a belt (W)

the larger width of the trapezium outlined on a cross section of the belt

NOTE See Figure 1.

3.10

angle of a belt (A)

the included angle obtained by extending the sides of the belt

NOTE See Figure 1.

3.11

pulley pitch diameter (d_p or D_p)

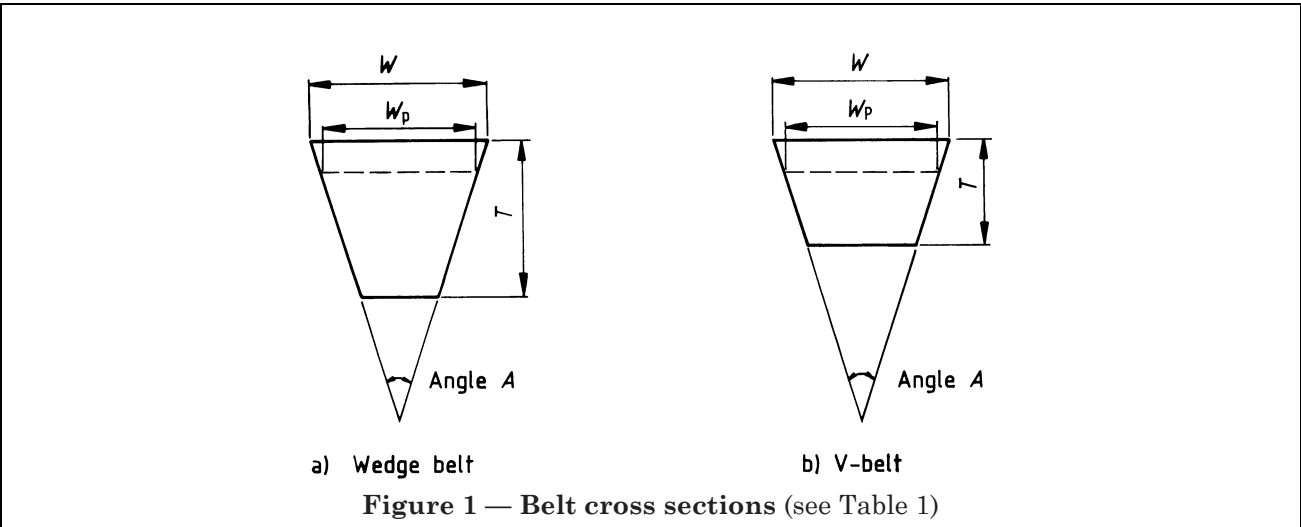
the diameter of the pulley measured at the groove pitch width

3.12

antistatic belt

a belt that conforms to specified maximum electrical resistance requirements

NOTE See 4.7.



3.13 power rating
the 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

Table 1 — Belt cross section dimensions
(see Figure 1)

Cross section symbol	Pitch width, W_p 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

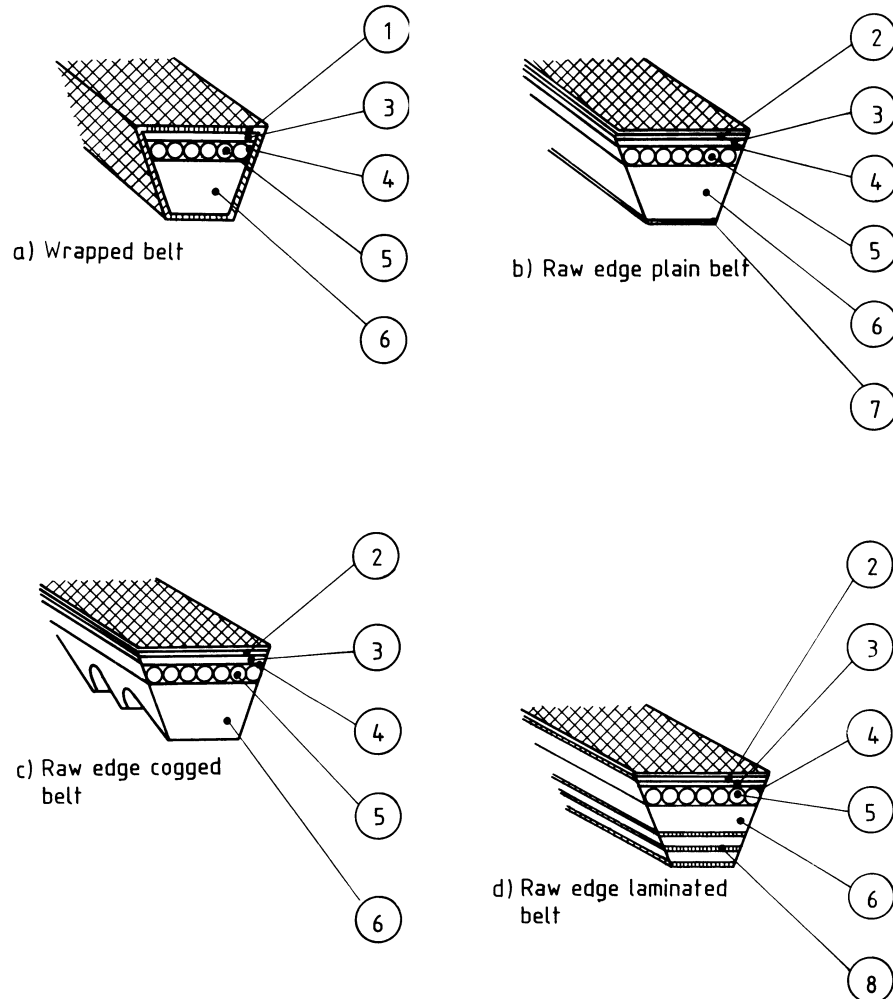
4 Wedge belts and V-belts

4.1 Materials and workmanship

Belts shall consist of a suitable 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 $-18\text{ }^{\circ}\text{C}$ and $+60\text{ }^{\circ}\text{C}$ 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.

**Key****No. Construction**

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

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 2 when mounted on two measuring pulleys made in accordance with Table 3.

Table 2 — 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
<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

4.4 Belt pitch length

When determined in accordance with Annex E, the belt pitch length and pitch length variation shall be as given in Table 4.

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 4.

NOTE 1 Age and storage conditions may alter a belt length (see Annex C).

NOTE 2 It is recommended that belts from different manufacturers should not be mixed on the same drive.

4.6 Belt fitting

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.

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

4.7 Electrical resistance

Where belts are required by the purchaser to be antistatic, every individual measurement of electrical resistance R in ohms, when measured by the method given in Annex F, shall be not greater than:

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

where

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

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

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

NOTE 1 See Figure 1.

NOTE 2 This maximum resistance refers to new complete endless belts. General information on electrical resistance of conductive and antistatic products made from flexible polymeric materials is given in BS 2050.

Table 3 — Dimensions of pulleys for measuring lengths of new belts (see Annex E)

Cross section symbol	Pitch width, W_p	Nominal pitch diameter, d_p	Nominal pulley circumference at pitch diameter	Outside diameter	Top width of groove, g	Minimum groove depth, d	Groove angle, A
	mm	mm	mm	mm	mm	mm	mm
<i>Wedge belts</i>							
SPZ	8.5	95.5	300	99.76 +0.00 -0.06	9.91 -0.00 +0.03	11.0	38 ± 0.25
SPA	11.0	143.2	450	149.13 +0.00 -0.06	12.96 -0.00 +0.03	14.0	38 ± 0.25
SPB	14.0	191.0	600	198.29 +0.00 -0.06	16.45 -0.00 +0.03	17.5	38 ± 0.25
SPC	19.0	318.3	1 000	328.26 +0.00 -0.06	22.35 -0.00 +0.03	23.8	38 ± 0.25
<i>V-belts</i>							
Y	5.3	28.7	90	32.13 +0.00 -0.06	6.24 -0.00 +0.03	6.3	32 ± 0.25
Z	8.5	57.3	180	62.60 +0.00 -0.06	10.06 -0.00 +0.03	9.5	34 ± 0.25
A	11.0	95.5	300	102.42 +0.00 -0.06	13.05 -0.00 +0.03	12.0	34 ± 0.25
B	14.0	127.3	400	136.08 +0.00 -0.06	16.61 -0.00 +0.03	15.0	34 ± 0.25
C	19.0	222.8	700	234.62 +0.00 -0.06	22.53 -0.00 +0.03	20.0	34 ± 0.25
D	27.0	318.3	1 000	334.97 +0.00 -0.06	32.32 -0.00 +0.03	28.0	36 ± 0.25

Table 4 — Nominal pitch lengths of wedge belts and V-belts and permitted tolerances

Pitch length range	Nominal pitch lengths										Maximum pitch length variation		
	Wedge belts				V-belts						Non-matched sets	Matched sets	
	SPZ	SPA	SPB	SPC	Y	Z	A	B	C	D		Allowable consecutive code numbers ^a	Maximum pitch length variation ^a
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm			mm
200 to 399					200 224 250 280 315 355						+8 −6	One length code number	2
400 to 529					400 450 ^a 500	405 475					+10 −6		
530 to 709	630					530 625 700	630 700				+12 −6		
710 to 899	710 800	800				780	790 890				+12 −8		
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			+14 −10		
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 −10		
1 600 to 1 899	1 600 1 800	1 600 1 800	1 800				1 750	1 690 1 760	1 760		+18 −12	Two length code numbers	4
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		+30 −16		
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	+34 −18		
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	+36 −18		

Table 4 — Nominal pitch lengths of wedge belts and V-belts and permitted tolerances

Pitch length range	Nominal pitch lengths										Maximum pitch length variation		
	Wedge belts				V-belts						Non-matched sets	Matched sets	
	SPZ	SPA	SPB	SPC	Y	Z	A	B	C	D		Allowable consecutive code numbers ^a	Maximum pitch length variation ^a
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm			mm
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	+38 -20	Three length code numbers	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	+46 -24		
5 000 to 5 999			5 000 5 600	5 000 ^a 5 600				5 370	5 380	5 400	+50 -28	Four length code numbers	8
6 000 to 6 999			6 300	6 300				6 070	6 100 6 860	6 100 6 840	+56 -32		
7 000 to 8 999			7 100 8 000	7 100 8 000					7 600	7 620 8 410	+66 -38		
9 000 to 9 990				9 000					9 100	9 140	+66 -38	Six length code numbers	12
10 000 to 12 499				10 000 11 200					10 700	10 700 12 200	+74 -44		
12 500 to 16 000				12 500						13 700 15 200	+90 -50	Seven length code numbers	14

^a See note 2 to 4.9.1