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मानक

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IS 3142 (1993): Pulleys-V-Grooved Pulleys for Endless V-Belts Sections Z, A, B, C, D and E and Endless Wedge Belts Sections SPZ, SPA, SPB and SPC [PGD 31: Bolts, Nuts and Fasteners Accessories]



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“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

घिरनियाँ — सिराहीन V-बैल्ट, काट Z, A, B, C, D और E
तथा सिराहीन वेज बैल्ट, काट SPZ, SPA, SPB और
SPC के लिए V-खाँचेदार घिरनियाँ — विशिष्ट
(दूसरा पुनरीक्षण)

Indian Standard

PULLEYS— V-GROOVED PULLEYS FOR
ENDLESS V-BELTS SECTIONS Z, A, B, C, D AND E
AND ENDLESS WEDGE BELTS SECTIONS
SPZ, SPA, SPB AND SPC — SPECIFICATION

(Second Revision)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pulleys and Belts Sectional Committee had been approved by the Light Mechanical Engineering Division Council.

This standard was originally published in 1965 and was subsequently revised in 1982. The present revision has been done to include V-belt Z Section as well as endless wedge sections SPZ, SPA, SPB and SPC.

The clause on balancing of pulleys has been modified and formula to determine the dynamic balancing has also been incorporated.

In the preparation of this standard, assistance has been derived from the following:

ISO/R 254-1990 'Belt drives — Pulleys — Quality finish and balance'. International Organization for Standardization (ISO)

ISO 255-1990 'Belt pulleys — Pulleys for V-belts (system based on datum width) — Geometrical inspection of grooves'. International Organization for Standardization (ISO).

BS 3790-1981 'Specification for endless wedge belt drives and endless V-belt drives'. British Standards Institution (BSI).

ISO 4183-1989 'Belt drives — Classical and narrow V-belts — Grooved pulleys (system based on datum width)'. International Organization for Standardization (ISO).

Industrial V-belts (classical V-belts) have been covered in IS 2494 (Part 1) : 1993 'V-belts — Endless V-belts for industrial purposes — Specification : Part 1 General purpose (*second revision*)'. The specification for wedge belts is under preparation.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PULLEYS— V-GROOVED PULLEYS FOR ENDLESS V-BELTS SECTIONS Z, A, B, C, D AND E AND ENDLESS WEDGE BELTS SECTIONS SPZ, SPA, SPB AND SPC — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the general requirements both for V-grooved pulleys for Z, A, B, C, D and E section Industrial V-belts and for SPZ, SPA, SPB and SPC section wedge belts used for power transmission. Pulleys covered in the standard are of dual duty type and same pulley shall be used with industrial and wedge section V-belts except D and E section V-belts which are not dual duty type.

1.2 This standard does not cover the pulleys of special types for automotive fan-belts, fractional horse power V-belts and for variable speed belt drives.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	Title
210 : 1978	Specification for grey iron castings (<i>third revision</i>)
1030 : 1989	Carbon steel castings for general engineering purposes (<i>fourth revision</i>)
1500 : 1983	Method for Brinell hardness test for metallic materials (<i>second revision</i>)

3 TERMINOLOGY

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Neutral Axis

The line in the V-belts or wedge belts whose length remains unchanged when the belt is deformed under tension.

3.2 Pitch Width of Belt (l_p)

The width of the belt at its neutral axis.

3.3 Pulley Groove Pitch Width (l_p)

The width of the pulley grooves which is dimensionally the same as the pitch width of the belt associated with the pulley.

3.4 Pulley Pitch Diameter (d_p)

The diameter of the pulley measured at the groove pitch width.

4 MATERIALS AND MANUFACTURE

4.1 V-grooved pulleys shall preferably be made of grey cast iron conforming to Grade FG 200 of IS 210 : 1978. Alternatively, the pulleys may also be made from carbon steel casting conforming to IS 1030 : 1989.

4.2 If cast iron is used for pulleys, the casting shall be of close grain and free from porosity or blow holes in the groove faces after machining and free from contraction cracks and hollows in the spokes, centre plate and boss. Iron cement or other recognised filling medium may be used only to fill small defects in the rim, centre plate and boss.

4.3 If steel is used for pulleys, the groove surfaces shall have a Brinell hardness number not less than 130 BHN (*see* IS 1500 : 1983).

4.4 Machining of the face or periphery and of the bore shall be of fine finish and the sides of the grooves finished by a broad tool, so that no tool marks are visible and a polish is obtained. The top corners of all grooves shall be file broken. The outside diameter of the pulley shall be constant throughout the whole of the width. Chamfered bores are acceptable provided the width of the chamfer is not greater than one-third of the boss length.

The surface finish of the grooves unless otherwise specified shall be as follows:

Roughness value R_a — 6.3 microns

Roughness symbol — *See* figure in Table 1.

Against particular requirements a finish up to R_a — 3.2 microns could however, be considered.

4.5 The tolerances for side wobble and run-out (eccentricity) shall be as follows:

Pulley Diameter	Tolerances
Up to and including 500 mm	0.01 mm per mm of pulley diameter
Over 500 mm up to and including 1500 mm	0.0015 mm per mm over 500 mm pulley diameter
Over 1500 mm	0.002 mm per mm over 1500 mm pulley diameter

5 DIMENSIONS OF PULLEYS

5.1 Pulley faces and grooves shall conform to the dimensions and tolerances given in Table 1.

5.2 A list of recommended standard pulley pitch diameters is given in Table 2.

5.3 Recommendations for selection of pitch diameter are given in Annex A.

6 BALANCING OF PULLEYS

6.1 Static Balancing

Pulleys manufactured for stock shall be statically balanced in a balancing machine (see 7.3).

6.2 Dynamic Balancing

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

Determine the limiting speed n_1 in rev/min, by reference to Fig. 1 or by calculation using the formula

$$n_1 = \sqrt{\frac{1.58 \times 10^{11}}{l d}}$$

where

l is the pulley face width (mm), and

d is the diameter (pitch or effective) of the pulley (mm).

If $n \leq n_1$, static balancing is normally sufficient,

If $n > n_1$, dynamic balancing is normally necessary.

6.2.2 Dynamic balancing may be necessary for pulleys with large face widths or for pulleys revolving relatively quickly.

7 TESTS

7.1 Geometrical Inspection

Geometrical inspection of grooves shall be done in accordance with the procedure given in Annex B.

7.2 True Running

For testing the true running of the outside diameter and rim sides, a pulley shall be fitted to the respective size of shaft mandrel and shall be placed on lathe centres. The pulley shall be revolved slowly to find out the degree of inaccuracy as illustrated in Fig. 2.

NOTE — Testing at *A*, for true running of pulley diameter. Testing at *B*, for true running of rim sides of pulleys.

7.3 Static Balancing

Test for balancing shall be made in a balancing machine. Typical testing machine is illustrated in Fig. 3. The machine essentially consists of two supporting frames, each carrying levelled straight edge which has been carefully levelled.

8 INSPECTION AND TESTING FACILITIES

The manufacturer or supplier of pulleys shall afford at his own expense all reasonable facilities to the inspector to assure himself that pulleys have been manufactured fully in accordance with the requirements of this specification.

9 DESIGNATION

V-grooved pulleys complying with the requirements of this standard shall be designated by the IS No., number of grooves, type of groove section and the pitch diameter.

Example:

A V-grooved pulley having 4 grooves in section B and pulley pitch diameter 250 mm shall be designated as:

V-grooved Pulley IS 3142 4B250

OR

A V-grooved Pulley having 4 grooves in section SPB and pulley pitch diameter 250 mm shall be designated as:

V-grooved Pulley IS 3142 4SPB250

10 BIS CERTIFICATION MARKING

Details available with the Bureau of Indian Standards.

11 PRESERVATIVE TREATMENT

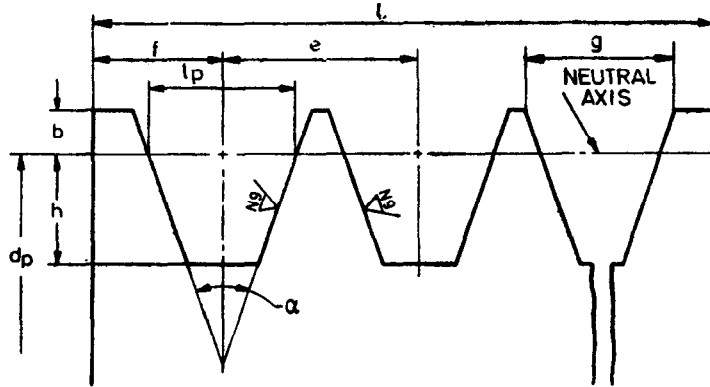
Pulleys shall be painted with anti-corrosive paint; temporary corrosion preventive shall be used on bore and the surfaces of the V-grooves.

12 PACKING

Pulley shall be supplied loose or in packages as agreed to between the purchaser and the supplier.

Table 1 Dimensions for Standard V-Grooved Pulleys
(Clause 5.1)

All dimensions in millimetres.



The maximum distance L between the outside edges of the pulley (face width) is equal to $(x - 1) e + 2f$, where x is the number of grooves

Groove Section	Pitch Width l_p	Min Height of Groove Above Pitch Line b Min	Min Depth of Groove Below Pitch Line h Min	Centre to Centre Distance of Grooves e	Edge of Pulley to First Groove Centre f	Groove Angle $\pm 30^\circ$ α	Pulley Pitch Diameter d_p	Min Top Width of Groove ± 0.13 g	Outside Diameter
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Z						34°	Up to 80	9.7	
SPZ	8.5	2	9	12 ± 0.3	8.0 ± 1.0	38°	81 and over	9.9	$d_p + 4.0$
A					+ 2	34°	Up to 118	12.7	
SPA	11	2.75	11	15 ± 0.3	$10 - 1$	38°	119 and over	12.9	$d_p + 5.5$
B					+ 2	34°	Up to 190	16.1	
SPB	14	3.5	14	19 ± 0.4	$12.5 - 1$	38°	191 and over	16.4	$d_p + 7.0$
C					+ 2	34°	Up to 315	21.9	
SPC	19	4.8	19	25.5 ± 0.5	$17 - 1$	38°	316 and over	22.3	$d_p + 9.6$
D					+ 3	36°	Up to 499	21.9	
	27	8.1	19.9	37 ± 0.6	$24 - 1$	38°	500 and over	22.3	$d_p + 16.2$
E					+ 4	36°	Up to 629	38.2	
	32	9.6	23.4	44.5 ± 0.7	$29 - 1$	38°	630 and over	38.6	$d_p + 19.2$

NOTES

1 Surface roughness R_a - 6.3 microns.

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

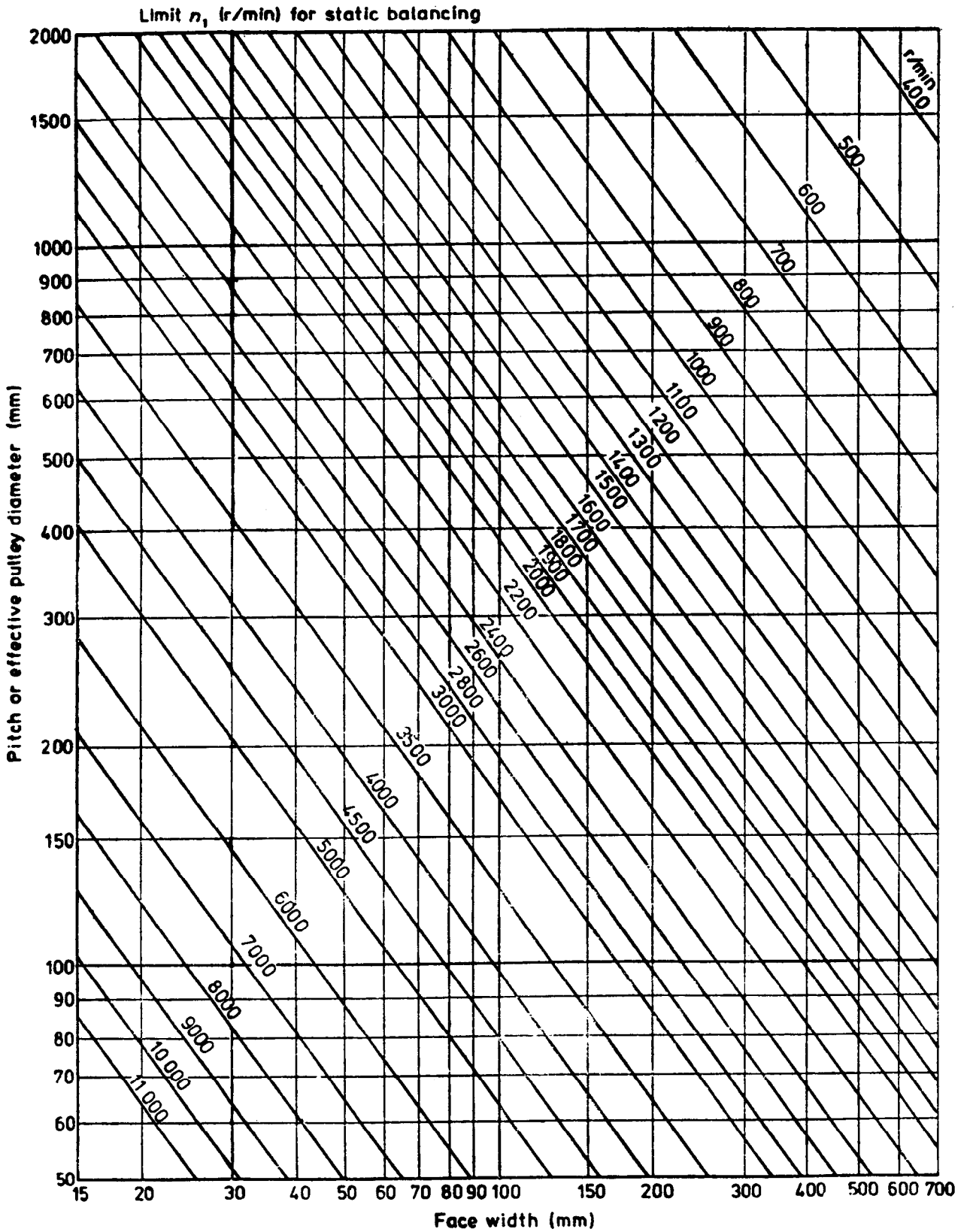


FIG. 1 PULLEYS REQUIRING DYNAMIC BALANCING

Table 2 Recommended Standard Pulley Pitch Diameters
(Clause 5.2)

All dimensions in millimetres.

Section Z		Section A		Section B		Section C		Section D	Section E
SPZ	Pitch Diameter	SPA	Pitch Diameter	SPB	Pitch Diameter	SPC	Pitch Diameter	Pitch Diameter	Pitch Diameter
—	50	—	75	—	125	—	200	355	500
—	53	—	80	—	132	—	212	375	530
—	56	—	85	—	140	—	224	400	560
—	60	—	90	—	150	—	236	425	600
—	63	—	95	—	160	160	250	450	630
67	67	100	100	170	170	265	265	475	670
71	71	106	106	180	180	280	280	500	710
75	75	112	112	190	190	300	300	530	750
80	80	118	118	200	200	315	315	560	800
85	85	125	125	224	224	355	355	600	900
90	90	132	132	250	250	375	375	630	1 000
95	95	140	140	280	280	400	400	710	1 120
100	100	150	150	300	300	450	450	750	1 250
112	112	160	160	315	315	500	500	800	1 400
125	125	170	170	355	355	530	530	900	1 500
140	140	180	180	375	375	560	560	1 000	1 600
160	160	190	190	400	400	600	600	1 060	1 800
180	180	200	200	450	450	630	630	1 120	1 900
200	200	224	224	500	500	710	710	1 250	2 000
250	250	250	250	530	530	750	750	1 400	2 240
315	315	280	280	560	560	800	800	1 500	2 500
400	400	300	300	600	600	900	900	1 600	—
500	500	315	315	630	630	1 000	1 000	1 800	—
630	630	350	350	710	710	1 120	1 120	2 000	—
800	800	400	400	750	750	1 250	1 250	—	—
—	—	450	450	800	800	1 400	1 400	—	—
—	—	500	500	900	900	1 600	1 600	—	—
—	—	560	560	1 000	1 000	—	—	—	—
—	—	630	630	1 120	1 120	—	—	—	—
—	—	710	710	—	—	—	—	—	—
—	—	800	800	—	—	—	—	—	—

NOTE — Tolerance on the pitch diameter shall be ± 0.8 percent.

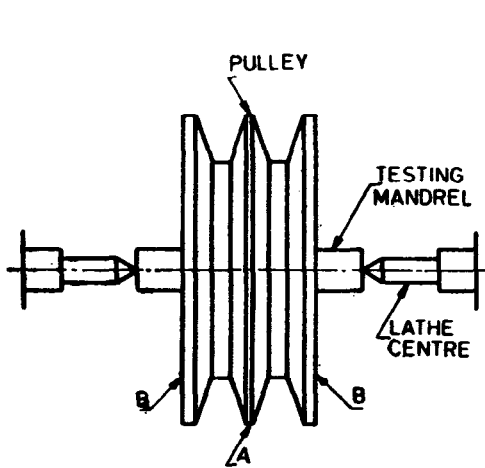


FIG. 2 TESTING DEVICE FOR TRUE RUNNING OF PULLEYS

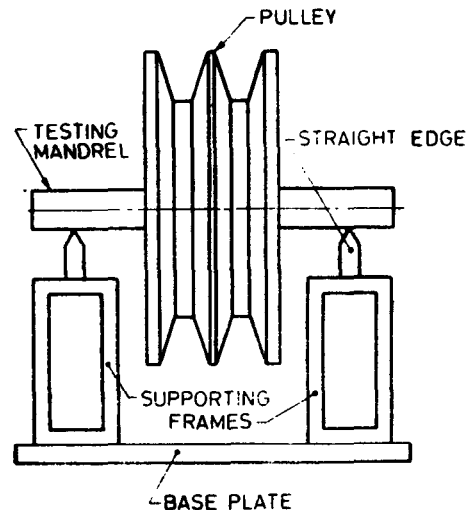


FIG. 3 TESTING DEVICE FOR STATIC BALANCING OF PULLEYS

ANNEX A
(Clause 5.3)

RECOMMENDATIONS FOR THE SELECTION OF PITCH DIAMETER

A-1 MINIMUM PITCH DIAMETERS IN RELATION TO SPEED RATIOS

A-1.1 For normal conditions, it is reasonably accurate to use the nominal pulley pitch diameter in calculating the speed ratios of V-belt drives. It is recommended that where extremely accurate speed ratios are required, the manufacturers shall be consulted as the pitch line of a V-belt under load may not correspond exactly to the nominal pitch line of the pulley.

A-2 MINIMUM PITCH DIAMETERS IN RELATION TO GROOVE ANGLES

A-2.1 Under average operating conditions, the pitch diameters of pulleys shall not be less than the minimum values shown in Table 3, in relation to a given groove angle.

Table 3 Minimum Pitch Diameter in Relation to a Given Groove Value

Groove Section	Minimum Pitch Diameter		
	When $\alpha = 38^\circ$ mm	When $\alpha = 36^\circ$ mm	When $\alpha = 34^\circ$ mm
Z	81	—	50
A	119	—	75
B	191	—	125
C	316	200	—
D	500	355	—
E	630	500	—
SPZ	81	—	67
SPA	119	—	100
SPB	191	—	160
SPC	316	—	224

ANNEX B
(Clause 7.1)

GEOMETRICAL INSPECTION OF V-GROOVES OF PULLEYS

B-1 INSPECTION OF GROOVE ANGLE

B-1.1 The deviation between the actual groove angle and the standard value of this angle shall not exceed ± 30 minutes for all the groove sections.

B-1.2 The groove angle shall be checked by means of a limit gauge on the lines of that shown diagrammatically in Fig. 4 and 5. It is necessary

to have one gauge for each of the standard groove angles ($\alpha = 38^\circ, 36^\circ$ or 34°).

B-2 INSPECTION OF PITCH DIAMETER

B-2.1 If the pulley has already been tested for true running (see 7.2) and the external diameter d_e determined by means of a good, precision instrument, the pitch diameter d_p may be determined by means of the depth gauge represented



FIG. 4 LIMIT GAUGE FOR GROOVE ANGLE

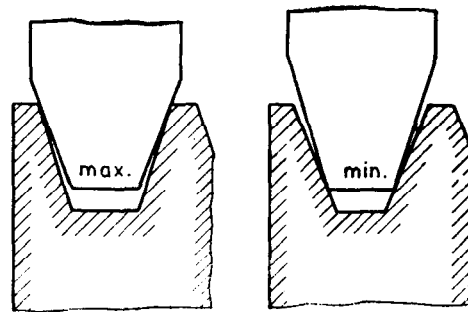


FIG. 5 METHOD FOR CHECKING GROOVE ANGLES

diagrammatically in Fig. 6. The mark on the sliding part makes it possible to read on the fixed part half the difference b between the external diameter and the pitch diameter.

B-2.1.1 The pitch diameter $d_p = d_e - 2b$.

B-2.1.2 If the pulley contains several grooves, all of these shall be checked separately.

B-2.2 If the pulley has not been tested for true running (see 7.2), use two cylindrical rollers of diameter d conforming to Table 4, in which the values for d have been determined for any groove profile, so that the simultaneous contact of the roller with the two sides is very closely made at the level of the pitch circumference.

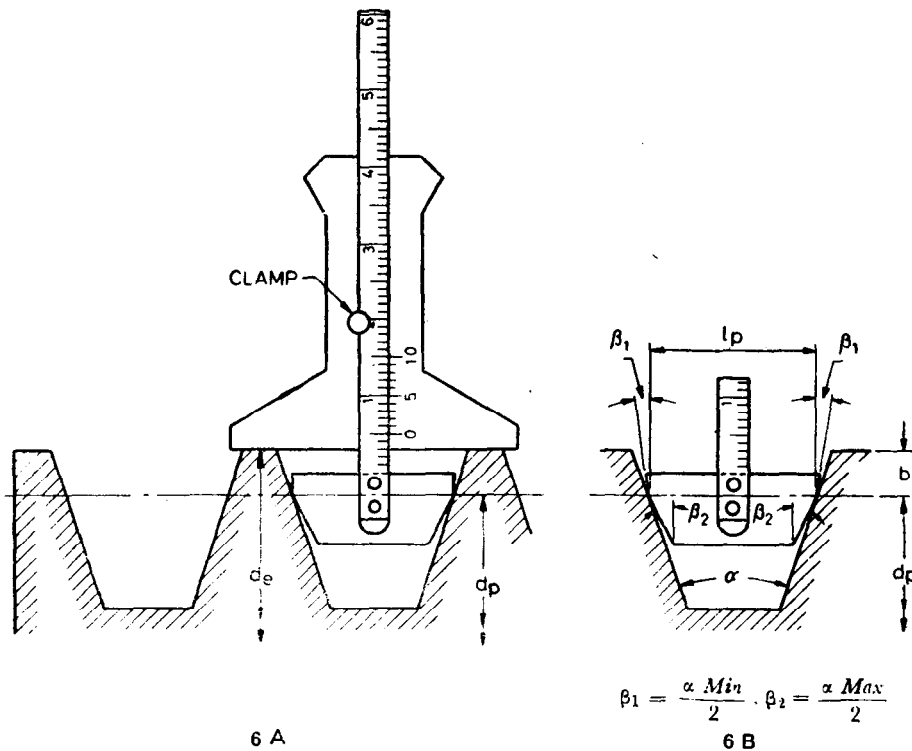
B-2.2.1 Place these two rollers in the groove to be checked, as shown in Fig. 7. Then measure the distance A of the externally tangent planes to the rollers and parallel to the axis of the pulley.

B-2.2.2 The pitch diameter d_p of the groove concerned is then given by the relation:

$$d_p = k - 2x$$

B-2.2.3 If the pulley contains several grooves, all of these shall be checked separately.

B-2.2.4 Table 4 shows the values for d and those for the correction $2x$ for different sections of standard groove profile.



$$\beta_1 = \frac{\alpha \text{ Min}}{2} \quad \beta_2 = \frac{\alpha \text{ Max}}{2}$$

FIG. 6 DEPTH GAUGE FOR MEASUREMENT OF PITCH DIAMETER

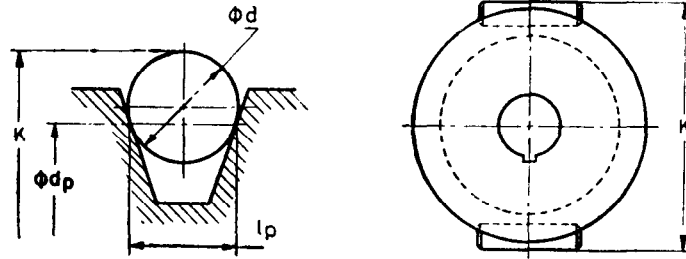


FIG. 7 MEASUREMENT OF PITCH DIAMETER BY USE OF TWO ROLLERS

B-2.2.5 The values of the correction $2x$ have been purposely rounded, as the knowledge of the deviations in pitch diameter between the groove of a single pulley is more important than that of the exact value of the pitch diameter of the different grooves.

B-3 INSPECTION FOR THE SUCCESSIVE GROOVES OF A SINGLE PULLEY OF HEIGHT OF GROOVE ABOVE PITCH LINE (Dimension b)

B-3.0 The following inspection method gives a measurement and not only an estimation. Inspection shall be carried out for each of the grooves in the pulley.

Table 4 Inspection of Pitch Diameter by Cylindrical Rollers
(Clauses B-2.2 and B-2.2.4)

Groove Section	Diameter of Roller, d mm	Correction $2x$ mm
(1)	(2)	(3)
Z and SPZ	9.0 — 0 — 0.036	12
A and SPA	11.6 — 0 — 0.043	15
B and SPB	14.7 — 0 — 0.110	19
C and SPC	20.0 — 0 — 0.130	26
D	28.5 — 0 — 0.130	37
E	33.8 — 0 — 0.160	44

B-3.1 Use the depth gauge as shown in Fig. 6A (the fixed part rests on the rims of the groove). The finger shall have the form shown diagrammatically in Fig. 6B.

B-3.2 The readings taken for the depth of the finger in the successive grooves of a single pulley shall not reveal any deviation greater than the value shown for each section in Table 5.

Table 5 Inspection for the Various Successive Grooves
(Clause B-3.2)

Groove Section	Maximum Deviation Dimensions mm
Z and SPZ	0.2
A and SPA	0.2
B and SPB	0.2
C and SPC	0.3
D	0.5
E	0.6

B-4 INSPECTION OF THE CONCENTRICITY OF THE PITCH CIRCUMFERENCE

B-4.1 The maximum permissible deviation between the extreme values found when measuring the dimension b is given in Table 6.

Table 6 Concentricity of the Pitch Circumference
(Clause B-4.1)

Pitch Diameter mm	Maximum Deviation Dimension, b mm
50 to 80	0.19
85 to 118	0.22
125 to 180	0.25
190 to 250	0.29
265 to 315	0.32
355 to 400	0.36
425 to 500	0.40
530 to 630	0.44
670 to 800	0.50
900 to 1 000	0.56
1 060 to 1 250	0.66
1 400 to 1 600	0.78
1 800 to 2 000	0.92
2 240 to 2 500	1.10

B-4.2 This deviation is given for meridian sections of the grooves of a single pulley, whether for sections for a single groove or of different grooves.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Telephone
323 76 17, 323 38 41

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola
CALCUTTA 700054

{ 337 84 99, 337 85 61
{ 337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022

{ 60 38 43
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Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113

{ 235 02 16, 235 04 42
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