

Specification for Oil-Field V-Belt

API SPECIFICATION 1B
SIXTH EDITION, JANUARY 1995

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005



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Exploration and Production Department

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CONTENTS

	Page
1 SCOPE	1
1.1 Coverage	1
2 V-BELTS	1
2.1 Quality.....	1
2.2 Workmanship.....	1
2.3 Surface	1
2.4 Static Conductivity.....	1
2.5 Cross Section	1
2.6 Lengths.....	2
2.7 Length Determination.....	2
2.8 Matched Belts	3
2.9 Nomenclature.....	4
2.10 Details for Dimensional Checking of Belts	4
3 MARKING.....	4
3.1 Other Name.....	4
3.2 Method	4
3.3 Marking.....	4
3.4	4
APPENDIX A—SHEAVES FOR V-BELTS	9
APPENDIX B—DESIGN PROCEDURE FOR POWER APPLICATION OF V-BELTS	17
APPENDIX C—RECOMMENDED PRACTICE FOR CARE AND USE OF V-BELTS	27
APPENDIX D—RECOMMENDED PRACTICE FOR MEASURING TENSION IN V-BELT-DRIVES	31
APPENDIX E—RECOMMENDED PRACTICE FOR CALCULATION OF LOAD IMPOSED BY A V-BELT DRIVE ON SHAFTS AND BEARINGS	33
APPENDIX F—MARKING REQUIREMENTS FOR API MONOGRAM LICENSEES.....	35
APPENDIX G	37
 Figures	
1—V-Belt Cross Sections.....	1
2—Diagram of a Vixture for Measuring V-Belts	3
3—Method for Measuring Sheaves.....	3
4—Measuring Belt Ride.....	4
A-1—Classical Groove Cross Section—Current Practice	9
A-2—Standard Classical Groove Cross-Section, Recommended Practice — Standard Narrow Groove Cross-Section	9
A-3—Deep Classical Groove Cross-Section, Recommended Practice — Deep Narrow Groove Cross-Section.....	9
A-4—Keyway Dimensions.....	9
A-5	15
A-6	16
A-7	16
B-1 —Guide for Selecting Classical V-Belt Cross Section.....	19
B-2 —Guide for Selecting Classical V-Belt Cross Section.....	19

B-3--Guide for Selecting Narrow V-Belt Cross Section	20
B-4--Guide for Selecting Narrow V-Belt Cross Section	20
C-1—Typical Usage of Idlers for Tensioning or Reducing Plan Vibration.....	28
D-1—Belt Deflection Measurement.....	31

Tables

1—Nominal Dimension of Cross Sections. Inches.....	1
2—Nominal Dimension of Cross Sections. Millimeters.....	2
3—Classical V-Belts Standard Datum Lengths —Inches	2
4—Classical V-Belts Standard Effective Lengths —Millimeters	3
5—Narrow V-Belts Standard Effective Lengths —Inches	5
6—Narrow V-Belts Standard Effective Lengths —Millimeters.....	6
7—Complete Measuring Conditions Using Diameter Over Ball Sheave Inspection for Classical Belts. Inches.....	
8—Complete Measuring Conditions Using Diameter Over Ball Sheave Inspection for Classical Belts. Millimeters.....	
9—Complete Measuring Conditions Using Diameter Over Ball Sheave Inspection for Classical Narrow Belts. Inches.....	
10—Complete Measuring Conditions Using Diameter Over Ball Sheave Inspection for Narrow Belts. Millimeters.....	8
A-1—Groove Deimensions for Classical V-Belt Sheaves.....	10
A-2—Groove Dimensions for Narrow V-Belt Sheaves.....	11
A-3—Groove Dimensions for Classical V-Belt Sheaves	12
A-4—Groove Dimensions for Narrow V-Belt Sheaves.....	13
A-5—Keyway Dimensions.....	14
A-&Keyway Dimensions.....	14
A-7—Keyway Dimensions.....	15
A-8—Tapered Keyway Dimensions Metric	15
B-1—Service Factors	17
B-2—Arc-Of-Contact Correction Factor.....	21
B-3—Length Correction Factors (Inches).....	21
B-4—Length Correction Factor (Metric).....	22
B-5—Classical V-Belt Center Distance Allowance for Installation and Take-Up Inches.....	23
B-6--Classical V-Belt Center Distance Allowance for Installation and Take-Up Millimeters.....	24
B-7—Narrow-V-Belt Center Distance Allowance for Installation and Take-Up Inches.....	24
B-8—Narrow-V-Belt Center Distance Allowance for Installation and Take-Up Millimeters.....	24
B-9—Power Rating (Horsepower)	25
B-10—Power Rating (Kilowatts)	25
B-11—Speed Ratio Constants (All Belts).....	25
C-1—Minimum Recommended Outside Idlers.....	29
D-1—Factors K_M and K_Y for Use in Tensioning Formulas (Inch-Pound Units).....	32
D-2—Factors K_M and K_Y for Use in Tensioning Formulas (Metric SI)	32
G-1—Narrow V-Belt Sheave Sizes Generally Available.....	37
G-2—Narrow V-Belt Sheave Sizes Generally Available.....	38

FOREWORD

This specification is under the jurisdiction of the API Committee on Standardization of Production Equipment.

The purpose of this specification is to provide specifications for V-belts and V-belt sheaves suitable for use in oil-field drilling and producing operations.

Much of the engineering material pertaining to V-belts and V-belt sheaves was taken from two standards published jointly by the Rubber Manufacturers Association, the Mechanical Power Transmission Association, and the Rubber Association of Canada. These standards are:

Specifications for Drives Using Narrow Multiple V-Belts - IP22 Latest Edition.

Specifications for Drives Using Classical Multiple V-Belts - IP20 Latest Edition.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

Specification for Oil-Field V-Belting

1 Scope

1.1 COVERAGE

This specification covers dimensional and marking requirements on V-belts and V-belt sheaves of both the narrow multiple and classical multiple type. This specification also includes recommended practices for:

- Design of V-belt drives.
- Care and use of V-belts
- Measuring tension in V-belt drives
- Calculating the load imposed by V-belts on shafts and bearings

This document does not include alternate belt types such as those listed below.

	RMA Standards	ISO Standards
• ISO V-Belts (I.E., SP Sections)	—	4183 & 4184
• Synchronous (timing)	IP 24	5294 & 5296
• V-Ribbed	IP 26	9982
• Flat	—	22, 63, 99, 100

However, these other forms of belt power transmission may be acceptable, provided that they are designed according to the belt manufacturer's recommendations and/or an existing industry standard.

2 V-Belts

2.1 QUALITY

V-belts furnished to this specification shall at least satisfy the power ratings formulae listed in Table B9 & B10 of Appendix B.

2.2 WORKMANSHIP

Belts shall give good service under normal working conditions and when operated within an ambient temperature range of -32°F (0°C) to 140°F (60°C).

2.3 SURFACE

The surface of the finished belts shall be so impregnated with vulcanizing material that the internal structure of the belt will not be unduly affected by moisture and oil, under normal operating conditions.

2.4 STATIC CONDUCTIVITY

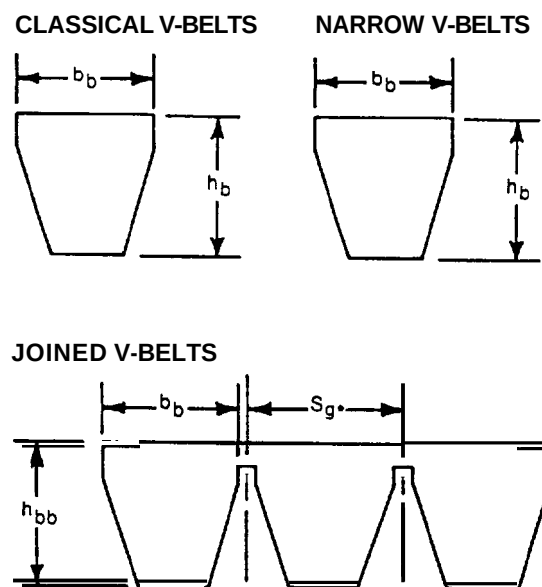
If Belts are to be static conductive, conductivity shall be measured using the method and value described in Rubber

Manufacturers Association (RMA) Bulletin IP 3-3.

WARNING: Operating environments should be reviewed to determine if additional special grounding techniques are required. Please refer to the NEC and API Recommended Practice 500.

2.5 CROSS SECTION

Nominal cross sectional dimensions for V-belts and joined V-belts are shown in Fig. 1 and Tables 1 and 2. (See Appendix C for the use of joined V-belts.) These dimensions along with cross-sectional shapes (also nominal), may vary for belts of the same belt section as made by different manufacturers. Standard V-belts, regardless of variations in dimensions and cross-sectional shapes shall be designed to operate on standard sheaves.



*S_g is sheave groove spacing dimension. Refer to Table 1.2.3 or 4.

Figure 1—V-Belt Cross Sections

Table 1—Nominal Dimension of Cross Sections, Inches

Belt Type	Cross Section	b _b	h _b	h _{bb} *	S _g +
Classical V-Belts	A, AX	0.50	0.31	0.41	0.625
	B, BX	0.66	0.41	0.50	0.750
	C, CX	0.88	0.53	0.66	1.000
	D	1.25	0.75	0.84	1.438
Narrow V-Belts	3V, 3VX	0.38	0.31	0.38	0.406
	5V, 5VX, 5VA	0.62	0.53	0.62	0.688
	8V, 8VA	1.00	0.91	1.00	1.125

*Classical and narrow V-Belts are also available in the joined belt configuration as illustrated in Fig. 2.1.

+S_g is specified sheave groove spacing (See Tables 1 and 2.)

Table 2—Nominal Dimension of Cross Sections, Millimeters

Belt Type	Cross Section	b _b	h _b	h _{bb} [*]	S _g ⁺
Classical V-Belts	13C, 13CX	13	8	10	15.9
	16C, 16CX	16	10	13	19.0
	22C, 22CX	22	13	17	25.4
	32C	32	19	21	36.5
Narrow V-Belts	9N, 9NX	9	8	10	10.3
	15N, 15NX, 15NA	15	13	16	17.5
	25N, 25NA	25	23	25	28.6

^{*}Classical and narrow V-Belts are also available in the joined belt configuration as illustrated in Fig. 2.1.

⁺S_g is specified sheave groove spacing (See Table 3 and 4)

26 LENGTHS

The standard lengths of classical and narrow belts are specified in Tables 3, 4, 5 and 6. Tables 3 and 5 represent current practice in inches. Datum length referenced in Table 3 identifies the length previously called pitch length. Tables 4 and 6 show belt **lengths** using metric (SI) dimensions. The classical belts have been changed to the "effective" or "**constant** top width" system used for narrow belts, when they are specified in metric (SI) dimensions.

2.7 LENGTH DETERMINATION

The belt length (effective and datum) shall be determined by placing the belt on a measuring fixture comprising: **two**

Table 3—Classical V-Belts Standard Datum Lengths—Inches

Standard Length Designation	Standard Datum Lengths				Permissible Deviations From Standard Datum Length	Matching Limits For One Set
	Cross Section					
	A, AX	B, BX	C, CX	D		
26	27.3				± 0.60	0.15
31	32.3				± 0.60	0.15
35	36.3	36.8			± 0.60	0.15
38	39.3	39.8			± 0.70	0.15
42	43.3	43.8			± 0.70	0.15
46	47.3	47.8			± 0.70	0.15
51	52.3	52.8	53.9		± 0.70	0.15
55	56.3	56.8			± 0.70	0.15
60	61.3	61.8	62.9		± 0.70	0.15
68	69.3	69.8	70.9		a 0.70	0.30
75	76.3	76.8	77.9		± 0.70	0.30
80	81.3				± 0.70	0.30
81		82.8	83.9		± 0.70	0.30
85	86.3	86.8	87.9		± 0.70	0.30
90	91.3	91.8	92.9		± 0.80	0.30
96	97.3		98.9		± 0.80	0.30
97		98.8			± 0.80	0.30
105	106.3	106.8	107.9		± 0.80	0.30
112	113.3	113.8	114.9		± 0.80	0.30
120	121.3	121.8	122.9	123.3		0.30
128	129.3	129.8	130.9	131.3	± 0.80	0.30
144		145.8	146.9	147.3	± 0.80	0.30
158		159.8	160.9	161.3	± 1.00	0.45
173		174.8	175.9	176.3	± 1.00	0.45
180		181.8	182.9	183.3	± 1.00	0.45
195		196.8	197.9	198.3	± 1.10	0.45
210		211.8	212.9	213.3	± 1.10	0.45
240		240.3	240.9	240.8	± 1.30	0.45
270		270.3	270.9	270.8	± 1.60	0.60
300		300.3	300.9	300.8	± 1.60	0.60
330			330.9	330.8	± 2.00	0.60
360			360.9	360.8	± 2.00	0.60
390			390.9	390.8	± 2.00	0.75
420			420.9	420.8	± 3.30	0.75
480				480.8	± 3.30	0.75
540				540.8	± 3.30	0.90
600				600.8	± 3.30	0.90
660				660.8	± 3.30	0.90

Note: AX, BX and CX may not be available in all lengths. Check with manufacturer for availability.

To specify belt size use the Standard Length Designation prefixed by the **letter** indicating cross Section; example: B90.

sheaves of equal diameter, a method of applying force, and a means of measuring the center distance between the two sheaves. One of the two sheaves is fixed in position while the other is movable along a graduated scale. The fixture is shown schematically in Fig. 2. Specifications for diameter and groove dimensions (including tolerances) of the measuring sheaves are given in Tables 7, 8, 9 or 10.

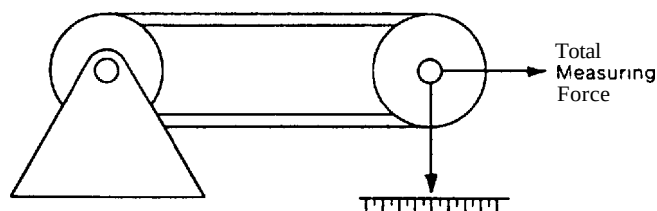


Figure 2—Diagram of a Fixture for Measuring V-Belts

- In measuring the length of a V-belt, the belt shall be rotated around the sheaves at least two revolutions of the belt: to seat the belt properly in the sheave grooves; to divide equally the total force between the two strands of the belt; and to determine the midpoint of the center distance travel of the movable sheave, which shall define the center distance.
- The V-belt length (effective or datum) shall be calculated by adding the appropriate circumference of one of the measuring sheaves to twice the measured center distance between the two sheaves. V-belts are not acceptable when the determined length varies from the standard length more than the values given in Tables 3, 4, 5 and 6.
- The belt ride shall not exceed the values given in Tables 7, 8, 9, and 10.

2.8 MATCHED BELTS

Belts indicated as matched belts shall not have length variations in any one set in excess of the limits given in Tables 3, 4, 5 or 6.

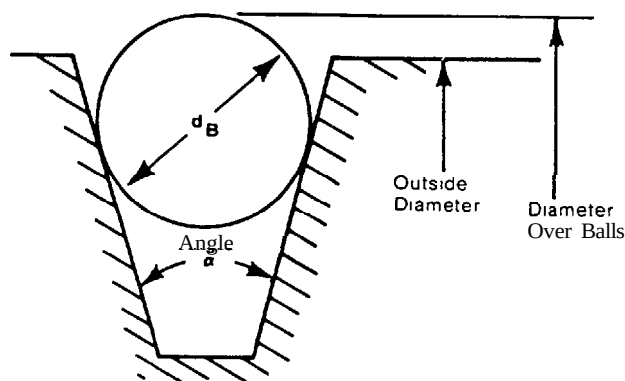


Figure 3—Method for Measuring Sheaves

Table 4—Classical V-Belts Standard Effective Lengths—Millimeters

Standard Effective Length				Permissible Deviations From Standard Length	Matching Limits For One Set
Cross Sections					
13C 13CX	16C 16CX	22C 22CX	32C		
710				+ 15	4
750				± 15	4
800				± 15	4
850				± 15	4
900				± 15	4
950	960			± 15	4
1000	1040			± 15	4
1075	1090			± 15	4
1120	1120			± 15	4
1150	1190			± 15	4
1230	1250			± 15	4
1300	1320			± 15	4
1400	1400	1400		± 15	6
1500	1500	1500		± 15	6
1585	1600	1630		± 15	6
1710	1700			± 15	6
1790	1800	1830		± 20	6
1865	1900	1900		± 20	6
1965	1980	2000		± 20	6
2120	2110	2160		± 20	6
2220	2240	2260		± 20	6
2350	2360	2390		± 20	6
2500	2500	2540		± 20	6
2600	2620	2650		± 20	6
2730	2820	2800		± 20	6
2910	2920	3030		+ 20	10
3110	3130	3150	3190	± 20	10
3310	3330	3350	3390	± 20	10
	3530	3550		± 20	10
	3740	3760	3800	± 25	10
	4090	4120	4160	± 25	10
	4200	4220	4250	± 25	10
	4480	4500	4540	± 25	10
	4650	4680	4720	± 25	10
	5040	5060	5100	± 30	10
	5300	5440	5480	± 30	10
	5760	5770	5800	± 30	10
	6140	6150	6180	± 30	16
	6520	6540	6560	± 40	16
	6910	6920	6940	± 40	16
	7290	7300	7330	± 40	16
	7670	7680		± 40	16
		8060	8090	± 40	16
		8440	8470	± 40	16
		8820	8850	± 40	16
		9200	9240	± 60	16
			10000	± 60	16
			10760	± 60	16
			11530	± 80	16
			12290	± 80	24

Note: 13CX, 16CX and 22CX may not be available in all lengths. Check with manufacturer for availability.

To specify belt size use the Standard Effective Length prefixed by the cross section; for example: 16C4200.

2.9 NOMENCLATURE

This standard covers Classical V-belts and sheaves (A, B, C and D cross sections) and Narrow V-belts and sheaves (3V, 5V and 8V) which are generally used in multiple sets for power transmission applications. Appropriate information is provided for the use of joined V-belts in these cross-sections. Power rating formulas and design information is also included for molded notch V-belts (AX, BX, CX, 3VX and 5VX) and V-belts with aramid tensile member (5VA and 8VA) which have greater power capacity than the conventional belts.

2.10 DETAILS FOR DIMENSIONAL CHECKING OF BELTS

The two methods of establishing the dimensions of measuring sheaves as specified in 2.7.A, 2.7.B and 2.7.C shall be by either:

- Fixing the outside diameter, the groove angle, and the groove top width.
- Fixing a diameter-over-balls or rods, and the outside diameter, and either the groove angle or groove top width. (See Figure 3).

The diameter-over-balls, groove angle dimensions are given in Tables 7, 8, 9 or 10. The diameter-over-balls, groove angle method is considered to be the most accurate way of fixing groove dimensions and is recommended. The cross section dimensions of the belt shall be checked by measuring the distance from the top of the belt to the top of the sheave groove (Figure 4). This measurement provides the "ride" of the belt with respect to the top of the groove which shall be within the limits given in Tables 7, 8, 9 or 10.

3 Marking

3.1 OTHER NAME

Belting made in accordance with this specification by an authorized manufacturer may be marked with the name of a jobber or distributor instead of the name of the manufacturer.

3.2 METHOD

Belting purchased to this specification shall be marked as specified hereinafter. Markings shall be applied on the side of the belt to be run away from the sheave. Markings shall be applied by vulcanizing, stamping, or stenciling. Markings shall be applied in such a manner that the belt is not damaged.

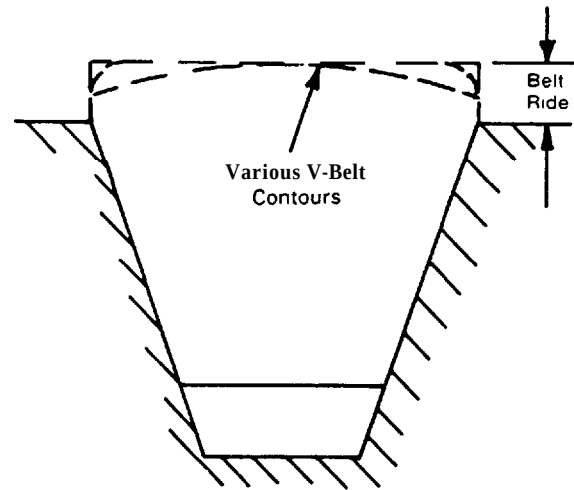


Figure 4—Measuring Belt Ride

3.3 MARKING

Markings for belting shall be as follows:

- Manufacturer's, Jobber's or Distributor's Name or Mark.
- Belt Cross Section. Belts shall be marked with the cross-sections as referenced in this standard.
- Standard Length. Belts shall be marked with the Standard length designation in Tables 3, 4, 5 and 6.

3.4 This section shall be superseded by Appendix F of this specification when applicable

Table 5—Narrow V-Belts Standard Effective Lengths-Inches

Standard Length Designation	Standard Effective Outside Length			Permissible Deviations From Standard Length	Matching Limits For One Set	
	Cross Sections				Normal Tensile Modulus	5VA, 8VA
	3V, 3VX	5V, 5VX 5VA	8V, 8VA			
250	25.0			± 0.3	0.15	0.08
265	26.5			± 0.3	0.15	0.08
280	28.0			± 0.3	0.15	0.08
300	30.0			± 0.3	0.15	0.08
315	31.5			± 0.3	0.15	0.08

Table 5—Narrow V-Belts Standard Effective Lengths—Inches

Standard Length Designation	Standard Effective Outside Length			Permissible Deviations From Standard Length	Matching Limits For One Set	
	Cross Sections				Normal Tensile Modulus	5VA, 8VA
	3V, 3VX	5V, 5VX 5VA	8V, 8VA			
335	33.5			± 0.3	0.15	0.08
355	35.5			± 0.3	0.15	0.08
375	37.5			± 0.3	0.15	0.08
400	40.0			± 0.3	0.15	0.08
425	42.5			± 0.3	0.15	0.08
450	45.0			± 0.3	0.15	0.08
475	47.5			± 0.3	0.15	0.08
500	50.0	50.0		± 0.3	0.15	0.08
530	53.0	53.0		± 0.4	0.15	0.08
560	56.0	56.0		± 0.4	0.15	0.12
600	60.0	60.0		± 0.4	0.15	0.12
630	63.0	63.0		± 0.4	0.15	0.12
670	67.0	67.0		± 0.4	0.30	0.12
710	71.0	71.0		± 0.4	0.30	0.12
750	75.0	75.0		± 0.4	0.30	0.12
800	80.0	80.0		± 0.4	0.30	0.12
850	85.0	85.0		± 0.5	0.30	0.12
900	90.0	90.0		± 0.5	0.30	0.12
950	95.0	95.0		± 0.5	0.30	0.12
1000	100.0	100.0	100.0	± 0.5	0.30	0.12
1060	106.0	106.0	106.0	± 0.6	0.30	0.12
1120	112.0	112.0	112.0	± 0.6	0.30	0.20
1180	118.0	118.0	118.0	± 0.6	0.30	0.20
1250	125.0	125.0	125.0	± 0.6	0.30	0.20
1320	132.0	132.0	132.0	± 0.6	0.30	0.20
1400	140.0	140.0	140.0	± 0.6	0.30	0.20
1500	150.0	150.0	150.0	± 0.8	0.30	0.20
1600		160.0	160.0	± 0.8	0.45	0.20
1700		170.0	170.0	± 0.8	0.45	0.20
1800		180.0	180.0	± 0.8	0.45	0.20
1900		190.0	190.0	± 0.8	0.45	0.20
2000		200.0	200.0	± 0.8	0.45	0.20
2120		212.0	212.0	± 0.8	0.45	0.20
2240		224.0	224.0	± 0.8	0.45	0.20
2360		236.0	236.0	± 0.8	0.45	0.20
2500		250.0	250.0	± 0.8	0.45	0.24
2650		265.0	265.0	± 0.8	0.60	0.24
2800		280.0	280.0	± 0.8	0.60	0.24
3000		300.0	300.0	± 0.8	0.60	0.24
3150		315.0	315.0	± 1.0	0.60	0.24
3350		335.0	335.0	± 1.0	0.60	0.24
3550		355.0	355.0	± 1.0	0.60	0.24
3750			375.0	± 1.0	0.60	0.24
4000			400.0	± 1.0	0.75	0.24
4250			425.0	± 1.2	0.75	0.24
4500			450.0	± 1.2	0.75	0.24
4750			475.0	± 1.2	0.75	0.24
5000			500.0	± 1.2	0.75	0.24

Note: 3VX, 5VX, 5VA and 8VA may not be available in all lengths. Check with manufacturer for availability. To specify belt size use the Standard Effective Length prefixed by the cross section; for example: 5V850.

Table 6—Narrow V-Belts Standard Effective Lengths—Millimeters

Standard Length Designation	Standard Effective Outside Length			Permissible Deviations	Matching Limits For One Set	
	Cross Sections				Normal Tensile Modulus	15NA 25NA
	9N 9NX	15N 15NX 15NA	25N 25NA			
630	630			± 8	4	2
670	670			± 8	4	2
710	710			± 8	4	2
760	760			± 8	4	2
800	800			± 8	4	2
850	850			± 8	4	2
900	900			± 8	4	2
950	950			± 8	4	2
1015	1015			± 8	4	2
1080	1080			± 8	4	2
1145	1145			± 8	4	2
1205	1205			± 8	4	2
1270	1270	1270		± 8	4	2
1345	1345	1345		± 10	4	2
1420	1420	1420		± 10	6	3
1525	1525	1525		± 10	6	3
1600	1600	1600		± 10	6	3
1700	1700	1700		± 10	6	3
1800	1800	1800		± 10	6	3
1900	1900	1900		± 10	6	3
2030	2030	2030		± 10	6	3
2160	2160	2160		± 13	6	3
2290	2290	2290		± 13	6	3
2410	2410	2410		± 13	6	3
2540	2540	2540	2540	± 13	6	3
2690	2690	2690	2690	± 15	6	3
2840	2840	2840	2840	± 15	10	5
3000	3000	3000	3000	± 15	10	5
3180	3180	3180	3180	± 15	10	5
3350	3350	3350	3350	± 15	10	5
3550	3550	3550	3550	± 15	10	5
3810		3810	3810	± 20	10	5
4060		4060	4060	± 20	10	5
4320		4320	4320	± 20	10	5
4570		4570	4570	± 20	10	5
4830		4830	4830	± 20	10	5
5080		5080	5080	± 20	10	5
5380		5380	5380	± 20	10	5
5690		5690	5690	± 20	10	5
6000		6000	6000	± 20	10	5
6350		6350	6350	± 20	16	6
6730		6730	6730	± 20	16	6
7100		7100	7100	± 20	16	6
7620		7620	7620	± 20	16	6
8000		8000	8000	± 25	16	6
8500		8500	8500	± 25	16	6
9000		9000	9000	± 25	16	6
9500		9500	9500	± 25	16	6
10160			10160	± 25	16	6
10800			10800	± 30	16	6
11430			11430	± 30	16	6
12060			12060	± 30	24	6
12700			12700	± 30	24	6

Note: 9NX, 15NX, 15NA and 25NA may not be available in all lengths. Check with manufacturer for availability. To specify belt size use the Standard Effective Length prefixed by the cross section; for example: 15N2160.

**Table 7--Complete Measuring Conditions Using Diameter Over Balls Sheave
Inspection for Classical Belts, Inches**

Cross Section	Outside Diameter ± 0.005 (inches)	Datum Circum- ference (inches)	Groove Angle α 20.33 (degrees)	b_g Groove Top Width (Reference) (inches)	d_c Ball Or Rod Diameter ± 0.005 (inches)	Diameter Over Balls Or Rods ± 0.005 (inches)	h_g Groove Depth (minimum) (inches)	Total Measuring Force per belt (pounds)	Maximum Ride Position Of Belt With Respect To Top Of Groove (inches)	
									Not Joined	Joined
A, AX	4.138	12.214	34	0.494	0.4375	4.456	0.460	50	+0.10	+0.18
B, BX	5.730	16.902	34	.637	0.5625	6.133	0.550	65	+0.10	+0.20
C, CX	7.958	23.744	34	0.879	0.7812	8.536	0.750	165	+0.10	+0.25

Note: Grooves of Master Inspection Sheaves shall be machined to tolerances shown in Table 7 and checked at least annually for wear and damage.

**Table 8—Complete Measuring Conditions Using Diameter Over Balls Sheave
Inspection for Classical Belts, Millimeters**

Cross Section	Effective Diameter ± 0.1 (mm)	Effective Circum- ference (mm)	Groove Angle α ± 0.25 (degrees)	b_g Groove Top Width (Reference) (mm)	d_B Ball Or Rod Diameter (mm)	Diameter Over Balls Or Rods ± 0.1 (mm)	h_g Groove Depth (minimum) (mm)	Total Measuring Force per belt (Newtons)	Maximum Ride Position Of Belt With Respect To Top Of Groove (mm)	
									Not Joined	Joined
13C										
13CX	95.5	300.0	34	13	12.5 $\pm$ 0.01	108.2	12	300	+2.5	+4.5
16C,										
16CX	143.2	450.0	34	16.5	15.5 $\pm$ 0.02	157.7	14	450	+2.5	+5.0
22C,										
22CX	222.8	700.00	34	22.4	21.0 $\pm$ 0.02	242.2	19	850	+2.5	+6.5
32C	318.3	1000.0	36	32.8	30.5 $\pm$ 0.02	346.6	26	1800	+3.0	+7.0

Note: Grooves of Master Inspection Sheaves shall be machined to tolerances shown in Table 8 and checked at least annually for wear and damage.

**Table 9--Complete Measuring Conditions Using Diameter Over Balls Sheave
Inspection for Classical Narrow Belts, Inches**

Cross Section	Outside Diameter ± 0.005 (inches)	Effective Outside Circum- ference (inches)	α Groove Angle ± 0.33 (degrees)	b_c Groove Top Width (Reference) (inches)	d_c Ball or Rod Diameter ± 0.005 (inches)	Diameter Over Balls Or Rods ± 0.005 (inches)	h_g Groove Depth (minimum) (inches)	Total Measuring Force per belt (pounds)	Maximum Ride Position Of Belt With Respect To Top Of Groove (inches)	
									Not Joined	Joined
3V, 3VX	3.820	12.000	38	0.350	0.3438	4.203	0.340	100	+0.10	+0.20
5V, 5VX, 5VA	7.958	25.000	38	0.600	0.5938	8.633	0.590	225	+0.12	+0.25
8V, 8VA	15.916	50.000	38	1.000	1.0000	17.083	0.990	500	+0.16	+0.30

Note: Grooves of Master Inspection Sheaves shall be machined to tolerances shown in Table 9 and checked at least annually for wear and damage.