16 V-Belts

V-BELTS AND PULLEYS—SAE J636c

SAE Standard

Report of Miscellaneous Division approved August 1915 and completely revised by V-Belt Committee July 1977. Editorial change January 1978.

1. Preface to 1977 Revision—This revision includes the addition of three sections to the standard to conform with existing use practices—0.250 (6A), 0.315 (8A), and 0.440 (11A).

2. Preface to 1970 Revision—In this standard the dimensioning and measuring practices for V-belts and pulleys have been unified. No change has been made in 0.380 (10A) and 0.500 (13A) sizes. The $\frac{5}{8}$ size (28 deg groove) has been dropped. On the other sizes $\frac{11}{16}$ (15A), $\frac{3}{4}$ (17A), $\frac{7}{8}$ (20A) and 1 in (23A), the new dimensions in Table 1 are designed to permit the same actual grooves as in the 1953 SAE Standard. The measuring of belts of SAE sizes is done in new pulleys having the following effects on belt measurements as compared with measurements in the previously specified notched pulleys:

Center Distances—The new measuring pulleys give 0.289 in (7.34 mm), 0.822 in (20.88 mm), and 0.181 in (4.60 mm) shorter center distances for $\frac{11}{16}$ (15A), $\frac{7}{8}$ (20A), and 1 in (23A) sizes respectively, and 0.035 in (0.89 mm) longer center distances on the $\frac{3}{4}$ (17A) size.

Ride-Out—Due to lowering the base for ride-out measurement, the new pulleys give approximately $\frac{3}{64}$ in (1.2 mm) more ride-out than shown by the notched pulleys for $\frac{11}{16}$ (15A), $\frac{3}{4}$ (17A), $\frac{7}{8}$ (20A), and 1 in (23A) sizes.

Belt Length Factor—With the notched pulleys the belt length factor was based on the corresponding outside diameter for each size, plus $\frac{1}{8}$ in (3.2 mm) to allow for the average ride-out of $\frac{1}{16}$ in (1.6 mm). With present measuring pulleys, the belt length factor is based on the effective diameter without allowance for ride-out.

3. Scope—This specification covers standard dimensions, tolerances, and methods of measurement of V-belts and pulleys for automotive V-belt drives.

4. V-Belt Types—Automotive V-belts are produced in a variety of constructions in a basic trapezoidal shape. The inside circumference of the V-belt can be a plain straight line or corrugated by means of cogs or notches for the purpose of increasing the belt(s) flexibility for use with pulleys in the lower proposed diameter. Belts are to be dimensioned in such a way that they are functional in pulleys dimensioned as described in subsequent sections.

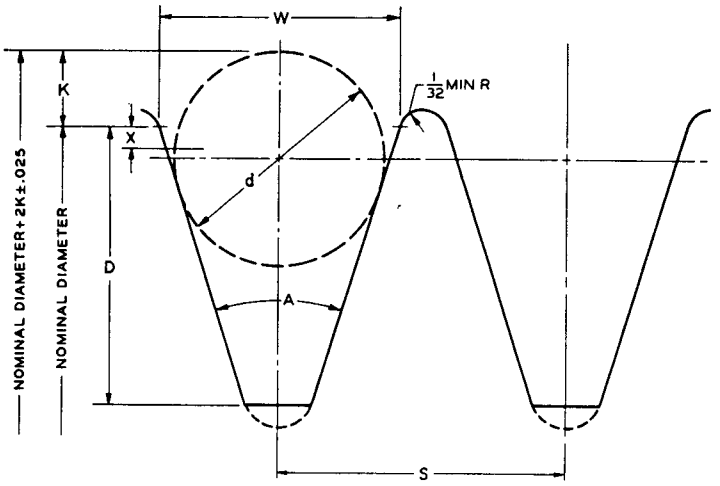
5. Pulleys—Pulleys are to conform to requirements of Fig. 1 and Table 1.

6. V-Belt Measurement—Belt length and SAE size are defined by using effective length and ride-out as measured in standard pulleys. These are determined by use of a measuring fixture comprised of two pulleys of equal diameter, a method of applying force, and a means of measuring the center distance between the two pulleys. One of the two pulleys is fixed in position while the other is movable along a graduated scale. The fixture is shown

TABLE 1A—V-BELT PULLEY DIMENSIONS, IN

SAE Size	Recommended[a] Min Effective Dia	A Groove Angle (deg) ±0.5	W Effective Groove Width	D Groove Depth Min	d Ball or Rod Dia (±0.0005)	2K 2x Ball Extension	2X[b]	S Groove[c] Spacing (±0.015)
0.250	2.25	36	0.248	0.276	0.2188	0.164	0.04	0.315
0.315	2.25	36	0.315	0.354	0.2812	0.222	0.05	0.413
0.380	2.40	36	0.380	0.433	0.3125	0.154	0.06	0.541
0.440	2.75	36	0.441	0.512	0.3750	0.231	0.07	0.591
0.500	3.00	36	0.500	0.551	0.4375	0.314	0.08	0.661
11/16	3.00	34	0.597	0.551	0.500	0.258	0.00	0.778
(0.600)	Over 4.00	36				0.280		
	Over 6.00	38				0.302		
3/4	3.00	34	0.660	0.630	0.5625	0.328	0.02	0.841
(0.660)	Over 4.00	36				0.352		
	Over 6.00	38				0.374		
7/8	3.50	34	0.785	0.709	0.6875	0.472	0.04	0.966
(0.790)	Over 4.50	36				0.496		
	Over 6.00	38				0.520		
1	4.00	34	0.910	0.827	0.8125	0.616	0.06	1.091
(0.910)	Over 6.00	36				0.642		
	Over 8.00	38				0.666		

[a] Pulley effective diameters below those recommended should be used with caution, because power transmission and belt life may be reduced.
[b] 2X is to be subtracted from the effective diameter to obtain "pitch diameter" for speed ratio calculation.
[c] These values are intended for adjacent grooves of the same effective width (W). Choice of pulley manufacture or belt design parameter may justify variance from these values. The S dimension shall be the same on all multiple groove pulleys in a drive using matched belts.



Notes:

1. The sides of the groove are to be 125 μin (3.2 μm) A. A. maximum.
2. Radial run-out is not to exceed 0.015 in (0.38 mm) full indicator movement (FIM). Axial run-out is not to exceed 0.015 in (0.38 mm) FIM. Run-out in the two directions is measured separately with a ball mounted under spring pressure to follow the groove as the pulley is rotated. Diameter, load, and overhang conditions may require or permit variations in the above specified run-out limits.
3. Bottom corner radii optional, but if used, it shall be below the depth, D.
4. In pulleys for use with belts in multiple on common centers, the diameters over the ball gages are not to vary from groove to groove in the same pulley more than 0.002 in/in (0.05 mm/25 mm) of diameter, with top limit of 0.012 in (0.30 mm) for diameters 6 in (152 mm) and above.
5. Centerline of groove is to be 90 ± 2 deg with pulley axis.
6. The X dimension is radial. 2X is to be subtracted from the effective diameter to obtain "pitch diameter" for speed ratio calculation.

FIG. 1—V-BELT PULLEY DIMENSIONS

TABLE 1B—V-BELT PULLEY DIMENSIONS, MM

SAE Size	Recommended[a] Min Effective Dia	A Groove Angle (deg) ±0.5	W Effective Groove Width	D Groove Depth Min	d Ball or Rod Dia (±0.013)	2K 2x Ball[d] Extension	2X	S Groove[c] Spacing (±0.38)
6A	57	36	6.3	7	5.558	4.16	1.0	8.00
8A	57	36	8.0	9	7.142	5.63	1.3	10.49
10A	61	36	9.7	11	7.938	3.77	1.5	13.74
11A	70	36	11.2	13	9.525	5.88	1.8	15.01
13A	76	36	12.7	14	11.113	7.99	2.0	16.79
15A	76	34				6.42		
	Over 102	36	15.2	14	12.700	7.02	0	19.76
	Over 152	38				7.56		
17A	76	34				8.21		
	Over 102	36	16.8	15	14.288	8.82	0.5	21.36
	Over 152	38				9.38		
20A	89	34				11.77		
	Over 114	36	20.0	18	17.463	12.42	1.0	24.54
	Over 152	38				13.02		
23A	102	34				15.67		
	Over 152	36	23.1	21	20.638	16.33	1.5	27.71
	Over 203	38				16.94		

[a] Pulley effective diameters below those recommended should be used with caution, because power transmission and belt life may be reduced.
[b] 2X is to be subtracted from the effective diameter to obtain "pitch diameter" for speed ratio calculation.
[c] These values are intended for adjacent grooves of the same effective width (W). Choice of pulley manufacture or belt design parameter may justify variance from these values. The S dimension shall be the same on all multiple groove pulleys in a drive using matched belts.
[d] 2K dimensions are calculated in millimetres.

schematically in Fig. 2. Specifications for measuring pulley dimensions are given in Table 2 and Fig. 3.

NOTE: The outside diameter and the effective diameter on the measuring pulley are one and the same.

6.1 Length—To measure the length, the belt is placed on the measuring fixture at the force shown in Table 3, and rotated around the pulleys at least two revolutions of the belt to seat the belt properly in the pulley grooves and to divide the total force equally between the two strands of the belt. The midpoint of the center distance travel of the movable pulley defines the center distance and will be measured through one revolution of the belt minimum after the two seating revolutions. The belt effective length is equal to two times the center distance plus the effective pulley circumference. Standard belt center distance tolerances are shown in Table 4.

6.2 Ride-Out—The ride-out standard and ride-out tolerance are shown in Table 3. The ride-out of a belt section is determined by measuring from a straight edge across the top of the belt to the rim of the measuring pulley, as shown in Fig. 4.

6.3 Matched Belt Sets—For V-belts used in sets of two or more for a general application, the difference in center distance between the belts cannot exceed the values shown in Table 5.

7. Standard Lengths—Standard lengths up to and including 80 in (2032 mm) are to be in ½ in (12.7 mm) increments. Standard lengths over 80 in (2032 mm) up to and including 100 in (2540 mm) are to be 1 in (25.4 mm) increments without fractions.

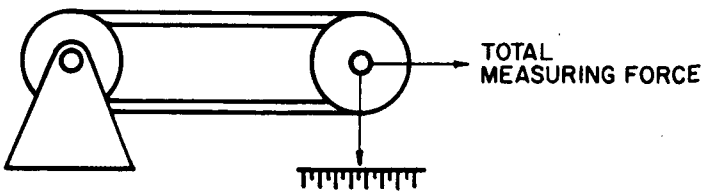


FIG. 2—DIAGRAM OF A FIXTURE FOR MEASURING V-BELTS

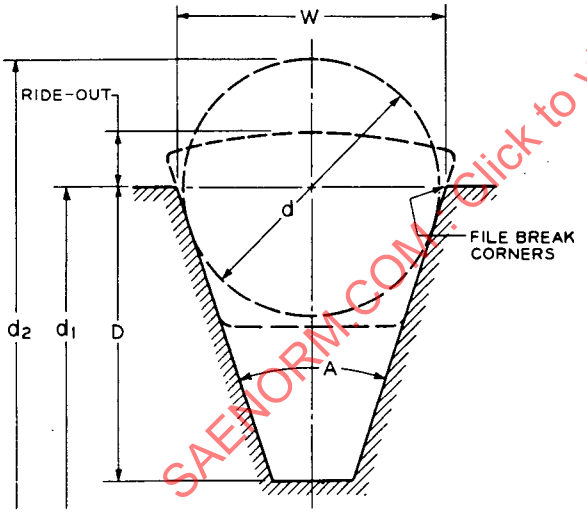
TABLE 2A—MEASURING PULLEY DIMENSIONS, IN

SAE Size US	d_1 Effective Dia (±0.002)	Effective Pulley Circum-ference	A Groove Angle (deg) ±0.15	W Effective Groove Width	D Groove Depth Min	d Ball or Rod Dia (±0.0005)	d_2 Dia Over Balls or Rods (±0.002)
0.250	3.820	12.000	36	0.248	0.276	0.2188	3.984
0.315	3.820	12.000	36	0.315	0.354	0.2812	4.042
0.380	3.820	12.000	36	0.380	0.433	0.3125	3.974
0.440	3.820	12.000	36	0.441	0.512	0.3750	4.051
0.500	3.820	12.000	36	0.500	0.551	0.4375	4.134
11/16 (0.600)	3.820	12.000	34	0.597	0.551	0.5000	4.078
3/4 (0.660)	3.820	12.000	34	0.660	0.630	0.5625	4.148
7/8 (0.790)	4.775	15.000	34	0.785	0.709	0.6875	5.247
1 (0.910)	4.775	15.000	34	0.910	0.827	0.8125	5.391

TABLE 2B—MEASURING PULLEY DIMENSIONS, MM

SAE Size	d_1 Effective Dia (±0.05)	Effective Pulley Circum-ference	A Groove Angle (deg) ±0.15	W Effective Groove Width	D Groove Depth Min	d Ball or Rod Dia (±0.013)	d_2 Dia[a] Over Balls or Rods (±0.05)
6A	97.03	304.8	36	6.3	7	5.558	101.18
8A	97.03	304.8	36	8.0	9	7.142	102.66
10A	97.03	304.8	36	9.7	11	7.938	100.80
11A	97.03	304.8	36	11.2	13	9.525	102.91
13A	97.08	304.8	36	12.7	14	11.113	105.02
15A	97.03	304.8	34	15.2	14	12.700	103.45
17A	97.03	304.8	34	16.8	16	14.288	105.24
20A	121.29	381.0	34	20.0	18	17.463	133.06
23A	121.29	381.0	34	23.1	21	20.638	136.96

[a] d_2 dimensions are calculated in millimetres.



NOTE: The outside diameter and the effective diameter on the measuring pulley are one and the same.

FIG. 3—MEASURING PULLEY DIMENSIONS

TABLE 3A—MEASURING CONDITIONS AND RIDE-OUT, U.S. CUSTOMARY UNITS

SAE Size in	Total Measuring Force lb	Ride-[a] Out in	Ride-[a] Out Tolerance in
0.250	50	0.031	±0.031
0.315	50	0.031	±0.031
0.380	60	0.060	±0.045
0.440	60	0.040	±0.045
0.500	60	0.060	±0.045
11/16 (0.600)	60	0.090	±0.045
3/4 (0.660)	80	0.090	±0.045
7/8 (0.790)	100	0.090	±0.045
1 (0.910)	120	0.090	±0.045

[a] The belt ride-out, as measured along the circumference of the belt, must fall within the specified tolerance at all points with the exception of measurements at points of dimension variations inherent to the manufacturing process or product such as material splices, belt identifications, etc.

TABLE 3B—MEASURING CONDITIONS AND RIDE-OUT, SI UNITS

SAE Size Metric	Total Measuring Force N	Ride-[a] Out mm	Ride-[a] Out Tolerance mm
6A	222	0.8	±0.8
8A	222	0.8	±0.8
10A	267	1.5	±1.1
11A	267	1.0	±1.1
13A	267	1.5	±1.1
15A	267	2.3	±1.1
17A	356	2.3	±1.1
20A	445	2.3	±1.1
23A	534	2.3	±1.1

[a] The belt ride-out, as measured along the circumference of the belt, must fall within the specified tolerance at all points with the exception of measurements at points of dimension variations inherent to the manufacturing process or product such as material splices, belt identifications, etc.