The Engineering Society
For Advancing Mobility
Land Sea Air and Space

A Product of the
Cooperative Engineering Program

SAE J1278 JUN86

SI (Metric) Synchronous Belts and Pulleys

SAE Standard
Reaffirmed June 1986

Submitted for Recognition as an American National Standard

The Engineering Resource For Advancing Mobility®
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

PARTS AND COMPONENTS STANDARD

Submitted for recognition as an American National Standard

SAE J1278

Issued Oct. 1980
Reaffirmed June 1986

Reaffirms J1278 OCT80

SI (METRIC) SYNCHRONOUS BELTS AND PULLEYS

1. SCOPE: Synchronous belt drives consist of a toothed belt which mates with grooved pulleys to provide a precise speed ratio between the driver and driven pulleys. This standard covers the synchronous belt and pulley sections currently in use in automotive applications such as camshaft, distributor, and other underhood drives that may require synchronization. It also provides for future sections to be added as usage develops. Table 1 lists the sections currently in use.

TABLE 1--PULLEY GENERATING TOOL RACK FORM DIMENSIONS (mm)

Pulley Section	Diameter Range (No. of Grooves)	P_b Pitch ±0.003	±0.25 deg	h_g +0.05 -0.00	b_g +0.05 -0.00	r_b ±0.03	r_t ±0.03	2 α
ST	10 and over	9.525	40	2.13	3.10	0.86	0.53	0.762
SU	14 thru 19	12.700	40	2.59	4.24	1.47	1.04	1.372
SU	over 19	12.700	40	2.59	4.24	1.47	1.42	1.372
STA	19 and over	9.525	40	2.13	3.10	0.86	0.71	1.372

2. BELT AND PULLEY SECTIONS: Synchronous belt and pulley sections are defined primarily by pitch, which is the linear distance between the axes of two consecutive teeth when the belt is loaded to the prescribed measuring force. Figs. 1 and 2 illustrate the location of the pitch line. A two- or three-letter designation is used to identify the standard sections. Two-letter designations identify a specific pitch, tooth form, and pitch line location. For example, an ST section has a pitch of 9.525 mm, while an SU section has a pitch of 12.700 mm. Since it is possible to have more than one section with the same pitch, a three-letter designation is used to identify a section that is a variation of a normal two-letter section. For example, an STA section has the same pitch as an ST section (9.525 mm) and the same tooth form as the ST section, but it utilizes the SU section pitch line location because of belt construction. As a result, STA section belts will not mesh properly with ST section pulleys even though the pitch and tooth forms are the same because it has a larger pitch line differential. Therefore, the STA section belt is a unique section and requires special pulleys designed for this particular section. Should another section with the ST (9.525 mm) pitch be standardized, it would have the section designation of STB.

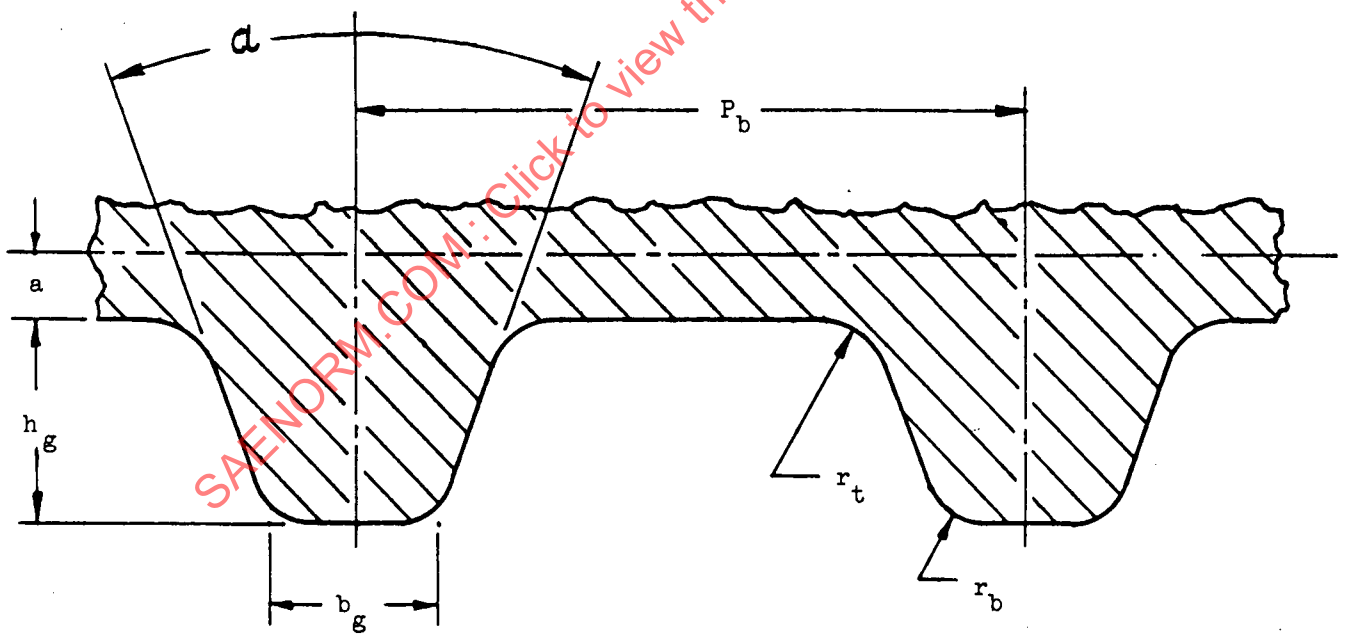


FIG. 1--PULLEY GENERATING TOOL RACK FORM

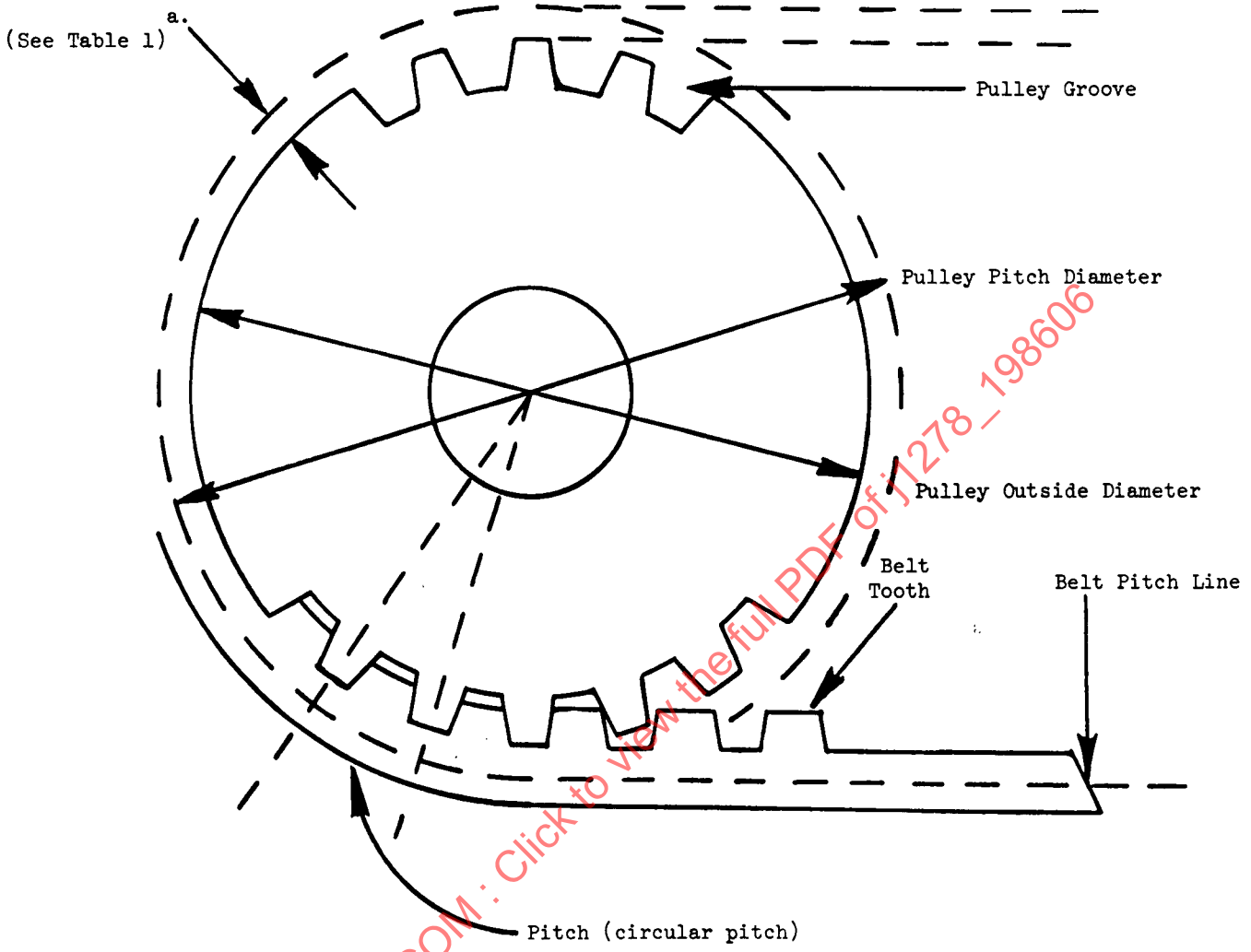


FIG. 2--PULLEY DIMENSIONS

3. PULLEYS:

3.1 Groove Profile: The groove profile is defined as the profile formed by the generating tool rack form described in Table 1 and Fig. 1. The relationship of pitch diameter to outside diameter is illustrated in Fig. 2.

3.2 Tolerances: Tolerances on pulleys shall conform to values shown in Table 2 and the accompanying footnotes.

3.3 Designation: Synchronous pulleys are identified by standard pulley numbers. The first digits in the number indicate the belt width the pulley is designed to accommodate. The letters indicate the section, and the numbers following the letters indicate the number of grooves in the pulley.

3.3 (Continued):

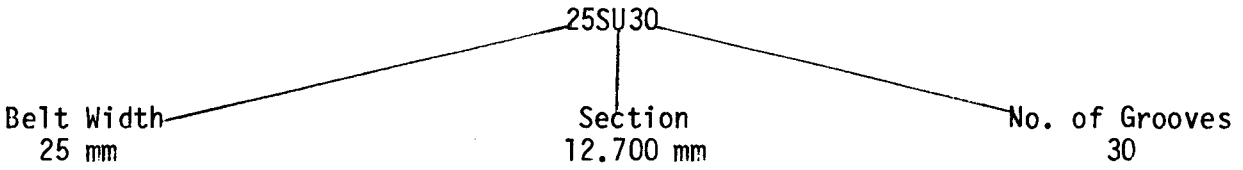


TABLE 2--PULLEY TOLERANCES (mm)

Outside Diameter Range	Pitch to Pitch Tolerance	
	Adjacent Grooves	Accumulative Over 90 deg
Up to 50, incl	±0.03	±0.09
Over 50 to 100, incl	±0.03	±0.11
Over 100 to 175, incl	±0.03	±0.13
Over 175 to 300, incl	±0.03	±0.15

Outside Diameter	Tolerance
Up to 50 mm, incl	+0.05 mm-0.00 mm
For each additional 25 mm or portion thereof	+0.025 mm-0.00 mm
Outside Diameter Runout[a]	
Up to 75 mm, incl outside diameter	0.08 mm (max)
For each additional 25 mm or portion thereof	0.01 mm (max)
Axial Runout[a] (Side Wobble)	
Up to 250 mm, incl outside diameter	0.02 mm per 25 mm of diameter
For each additional 25 mm outside diameter over 250 mm add 0.01 mm	add 0.01 mm
Diametrical Taper	
0.01 mm per 10 mm of face width	
Groove Helix	
0.01 mm per 10 mm of face width	

[a]Full indicator movement

4. BELTS:

4.1 Dimensions: Nominal dimensions of the synchronous belt sections are shown in Table 3 and Fig. 3.

TABLE 3--NOMINAL BELT DIMENSIONS (mm)

Belt Section	Pitch	h_b	2 β deg	h_t	b_t	r_{bb}	r_{bt}
ST	9.525	3.6	40	1.9	3.2	0.5	0.5
SU	12.700	4.1	40	2.3	4.4	1.0	1.0
STA	9.525	4.1	40	1.9	3.2	0.5	0.5

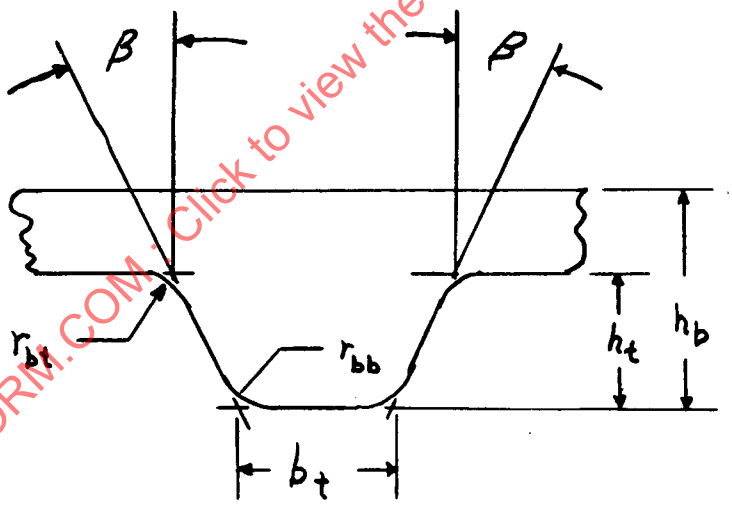


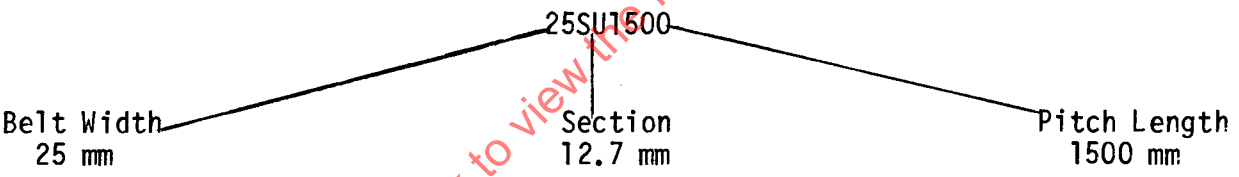
FIG. 3--BELT SECTION

4.2 Tolerances: Tolerances on width shall conform to values shown in Table 4.

TABLE 4--BELT WIDTH TOLERANCES (mm)

Belt Width	Belt Length Range	
	Up to 840, incl	Over 840 to 1680, incl
Up to 40, incl	+0.6 -0.6	+0.6 -0.6
Over 40 to 50, incl	+0.8 -0.8	+1.0 -1.0

4.3 Designation: Belt sizes shall be identified by standard belt numbers. The first digits in the number indicate the belt width in millimeters. The letters indicate the belt section (pitch) designation, and the numbers following the letters indicate the pitch length in millimeters. For example, the number 25SU1500 indicates a belt 25 mm wide, SU section (pitch) of 12.7 mm, and a pitch length of 1500 mm.



4.4 Length Determination: The pitch length of a synchronous belt shall be determined by placing the belt on a measuring fixture comprised of two pulleys of equal pitch diameter, a method of applying force and a means of measuring the center distance between the two pulleys. One of the two pulleys is in a fixed location while the other is movable along a graduated scale. The fixture is shown schematically in Fig. 4. Measuring pulley dimensions and measuring force are specified in Tables 5 and 6 and Fig. 5.

In measuring the length of a synchronous belt, the belt should be rotated at least two revolutions of the belt in order to (a) seat the belt properly in the pulley grooves, (b) divide equally the total force between the two strands of the belt, and (c) determine the midpoint of the center distance travel of the movable pulley, which shall define the center distance. The pitch length shall be calculated by adding the pitch circumference of one of the measuring pulleys to twice the measured center distance between the two pulleys.

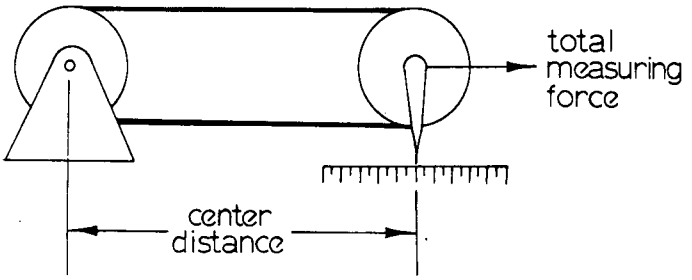


FIG. 4--DIAGRAM OF FIXTURE FOR DETERMINING BELT PITCH LENGTH

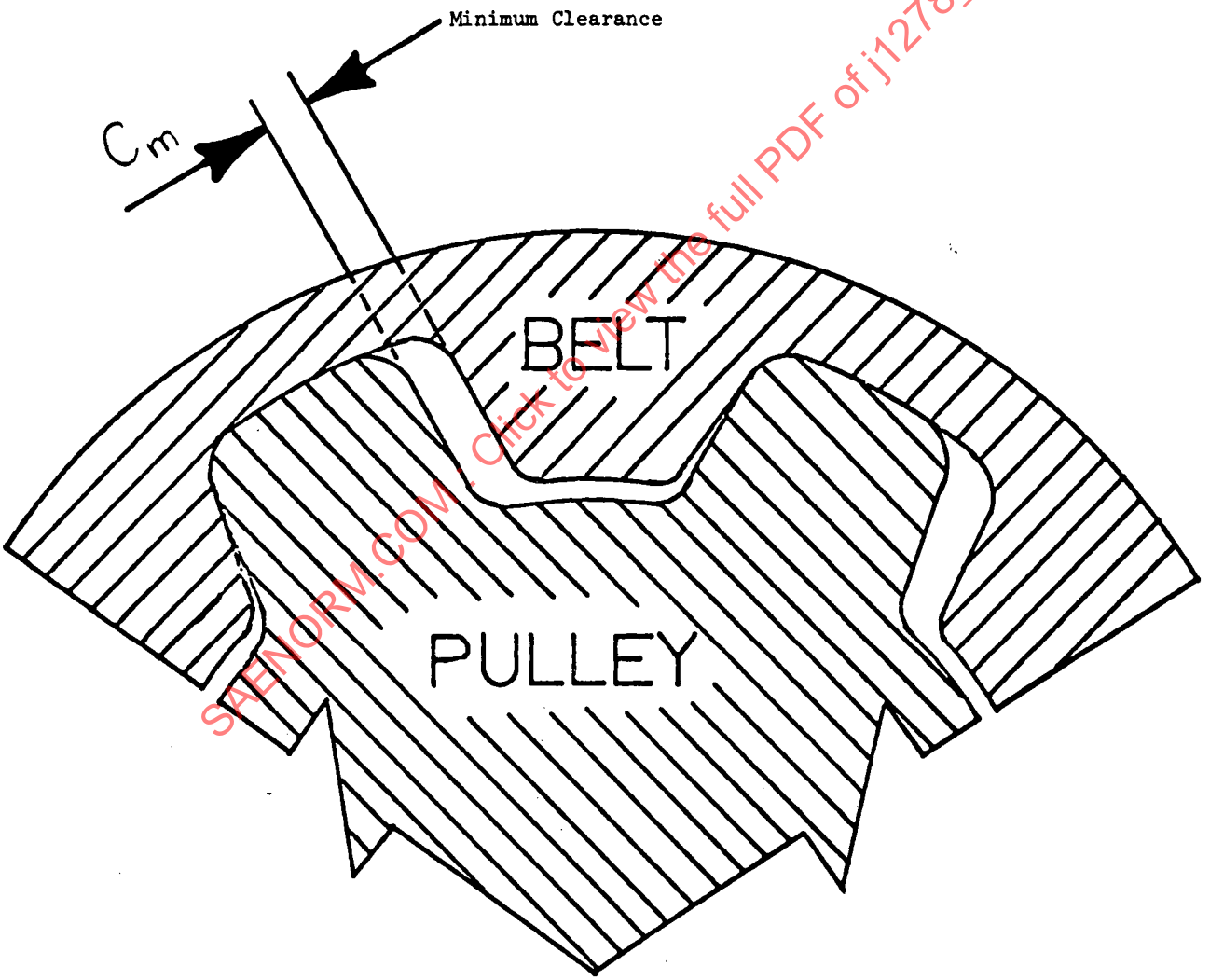


FIG. 5--CLEARANCE BETWEEN MEASURING PULLEY AND BELT

TABLE 5--MEASURING PULLEY DIMENSIONS (mm)

Belt Section	No. of Grooves	Pitch Circumference	Outside Dia ±0.013	Outside Dia Runout FIM[a], max	Axial Runout (Side Wobble) FIM[a], max	Min Clearance[b]
ST	16	152.40	47.748	0.013	0.025	0.33
SU	20	254.00	79.479	0.013	0.025	0.38
STA	20	190.50	59.266	0.013	0.025	0.33

[a]Full indicator movement
[b]See Fig. 5

TABLE 6--TOTAL MEASURING FORCE (N)

Belt Section	Belt Width (mm)																
	8	10	12	14	16	18	19	20	22	25	28	30	33	35	40	45	50
ST	55	75	100	125	145	165	175	185	210	240	275	295	330	355	410	470	530
SU	--	--	245	300	370	420	445	475	530	610	700	750	840	900	1050	1200	1350
STA	--	--	245	300	370	420	445	475	530	610	700	750	840	900	1050	1200	1350