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SURFACE VEHICLE STANDARD

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Submitted for recognition as an American National Standard

(R) Glossary—Automatic Belt Tensioner

1. Scope—This glossary was written to provide a consistent and uniform definition of terms used in describing an automatic belt tensioner as it applies to an automotive accessory drive system.

2. References

2.1 Related Publication—The following publication is for information purposes only and is not a required part of this document.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J2436—Accessory Drive Tensioner Test Standards (Mechanical Rotary Type)

3. System Related Tensioner Characteristics

3.1 Tensioner Torque Requirement Curve—The torque required to control belt tension in the tensioner range of travel. (See Figure 1.)

3.2 Positive/Negative Rate Geometry—A positive/negative slope resulting from the linear approximation of the tensioner torque requirement curve. (See Figure 2.)

3.3 Tension/Torque Error Curves—The tension/torque curves representing calculated tensioner output as compared to the tensioner torque requirement curve. (See Figures 1 and 3)

3.4 Tensioner Pivot Location—The x,y coordinates of the tensioner pivot as compared to the center of the driver pulley at (0,0). (See Figure 4.)

3.5 Hub Load Angle—The angle between a line from the center of the tensioner pivot to the center of the tensioner pulley and the hub load vector at the tensioner pulley.

3.6 Tensioner Belt "Take-Up"—The amount of belt length change a tensioner will accommodate as a function of tensioner arm displacement within the tensioner operation range. (See Figure 2.)

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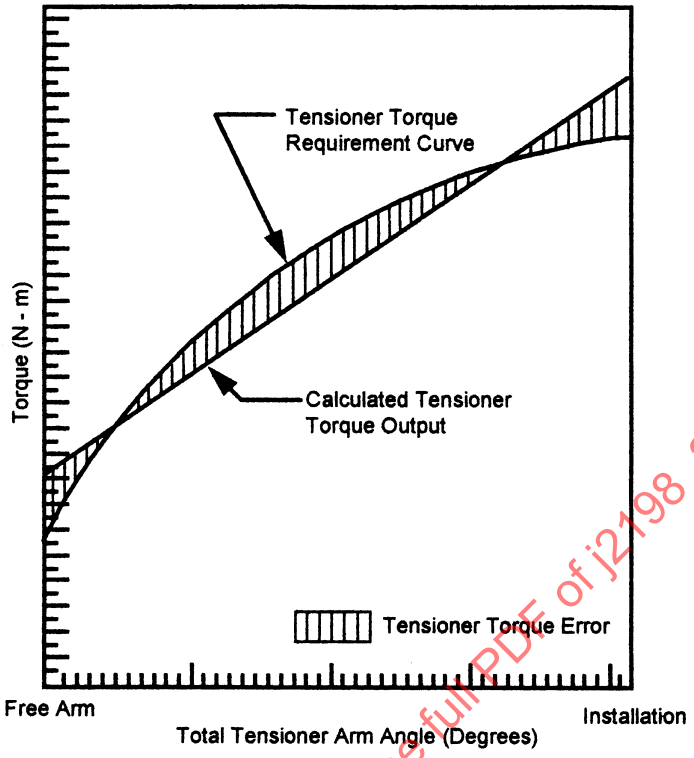

FIGURE 1—TENSIONER TORQUE ERROR CURVE

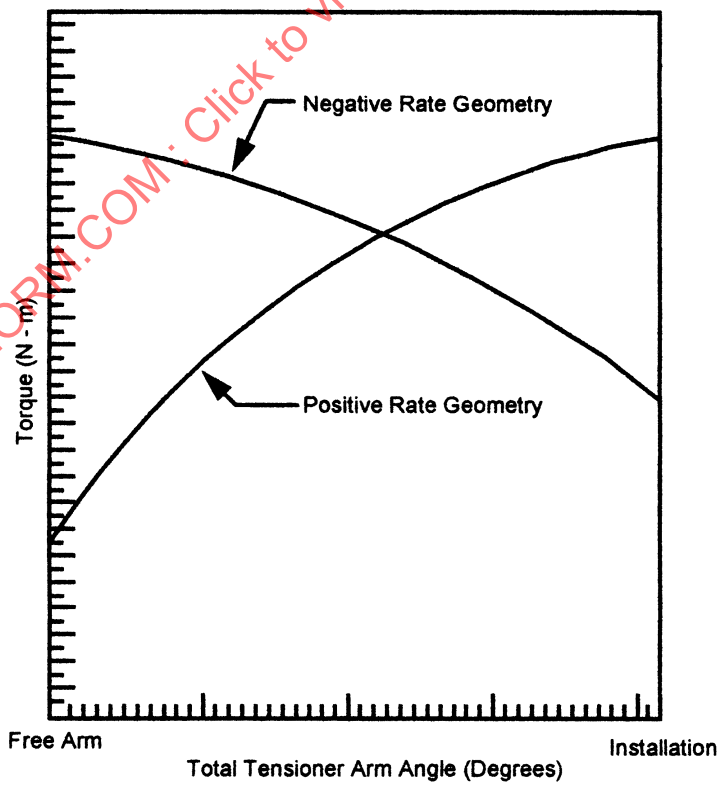

FIGURE 2—TENSIONER TORQUE REQUIREMENT CURVE

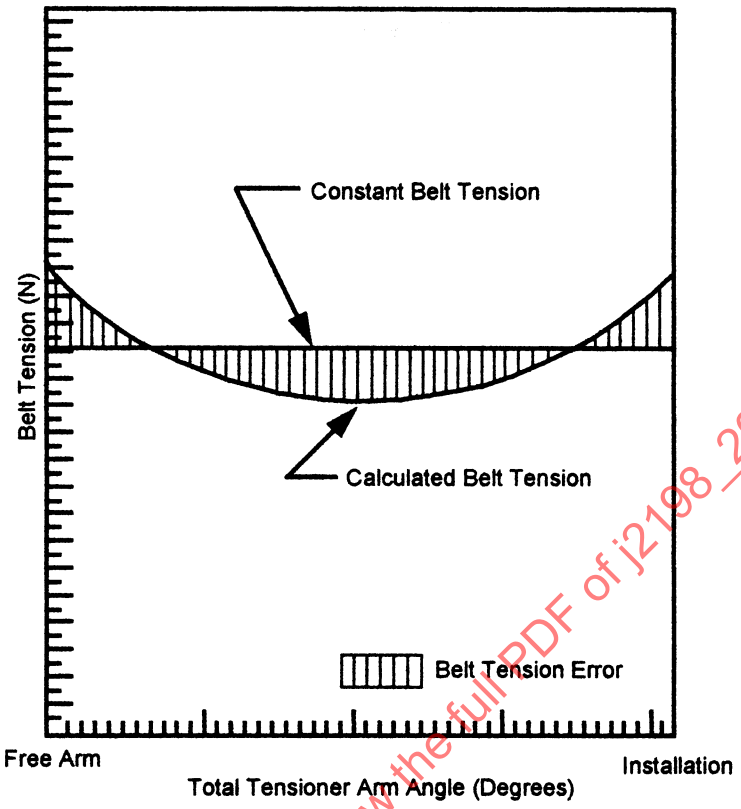

FIGURE 3—BELT TENSION ERROR CURVE

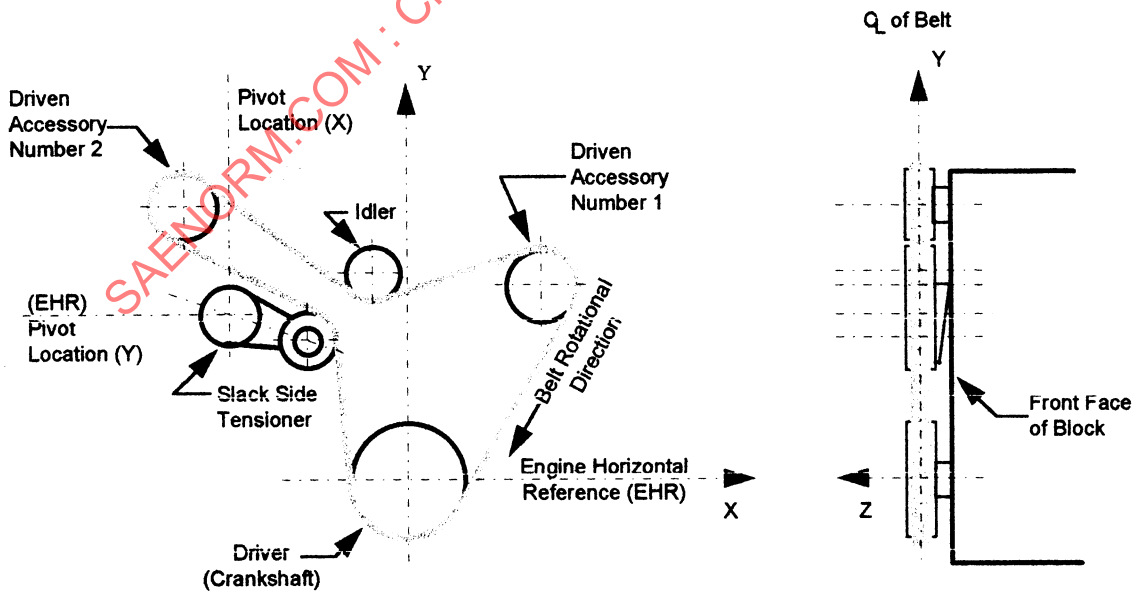

FIGURE 4—SYSTEM LAYOUT

3.7 Tensioner Arm Amplitude

3.7.1 MAXIMUM DYNAMIC TENSIONER ARM AMPLITUDE—Maximum Peak to Peak displacement at the pulley center of the tensioner arm in all dynamic (running) system conditions.

3.7.2 STEADY-STATE TENSIONER ARM AMPLITUDE—Maximum Peak to Peak arm amplitude at a constant engine speed. Various engine speeds and accessory load combinations except power steering should be evaluated to determine the worse case condition.

3.8 Slack Side Tensioner—The tensioner located between the driver pulley and the first load-carrying component in the direction of belt travel (routing idlers are not considered load-carrying components). (See Figure 4.)

3.9 Tight Side Tensioner—The tensioner located in any belt span other than the slack side of the driver pulley.

4. Tensioner Specific Design Characteristics

4.1 Tensioner Arm Angle—The angle of the line from the center of the tensioner pivot to the center of the tensioner pulley measured counter clockwise in accessory drive system polar coordinates where 0° = positive x-axis. (See Figures 4 and 5.)

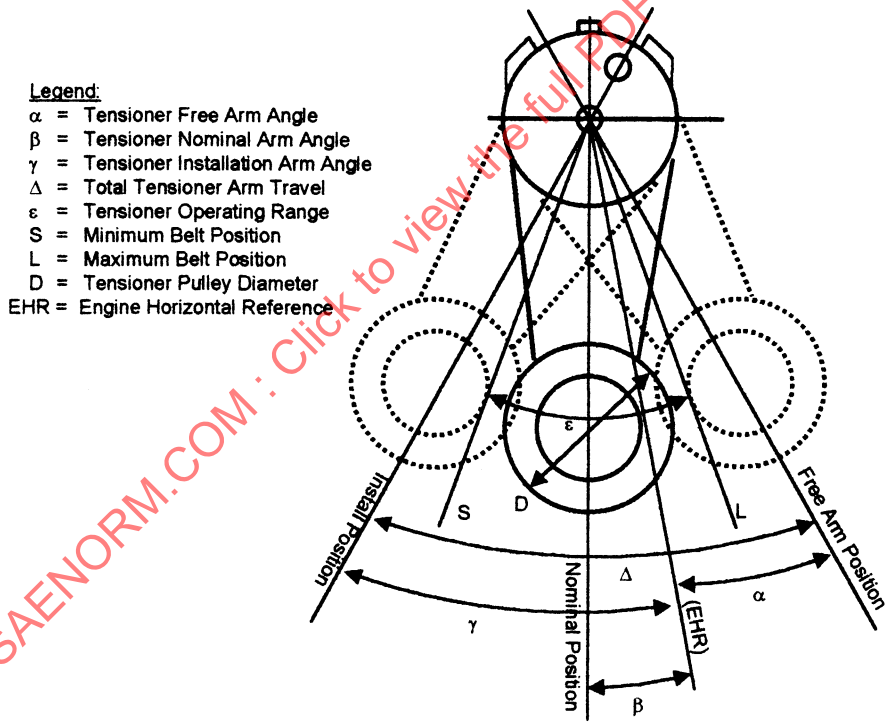

FIGURE 5—TENSIONER CHARACTERISTICS

4.1.1 TENSIONER NOMINAL ARM ANGLE—The tensioner arm angle which corresponds to the installed nominal length belt. (See β, Figure 5.)

4.1.2 TENSIONER FREE ARM ANGLE—The tensioner arm angle which corresponds to the free state of the tensioner, without the belt installed. (See α, Figure 5.)

4.1.3 TENSIONER INSTALLATION ARM ANGLE—The tensioner arm angle which corresponds to the stop feature of the tensioner arm to allow for belt installation. (See λ, Figure 5.)

4.1.4 TENSIONER MINIMUM NEW BELT ARM ANGLE—The tensioner arm angle which corresponds to an installed new minimum belt length used to ensure proper routing and belt length.

4.1.5 TENSIONER MAXIMUM NEW BELT ARM ANGLE—The tensioner arm angle which corresponds to an installed new maximum belt length used to ensure proper routing and belt length.

4.1.6 TENSIONER MAXIMUM ARM ANGLE—The tensioner arm angle at the longest belt length including stretch and wear.

4.2 Tensioner Arm Length—The distance between tensioner pivot location and tensioner pulley center. (See L, Figure 5.)

4.3 Tensioner Pulley Diameter—Diameter of the pulley attached to the tensioner arm as defined by SAE standard for groove side pulleys. SAE standard for backside pulleys is TBD. (See D, Figure 5.)

4.4 Tensioner Operation Range—The difference between the tensioner minimum new belt arm angle and the tensioner maximum arm angle. (See ε, Figure 5.)

4.5 Tensioner Torque Output Characteristics

4.5.1 TENSIONER TORQUE OUTPUT CURVE—Tensioner load output versus tensioner arm position (hysteresis curve). (See Figure 6.)

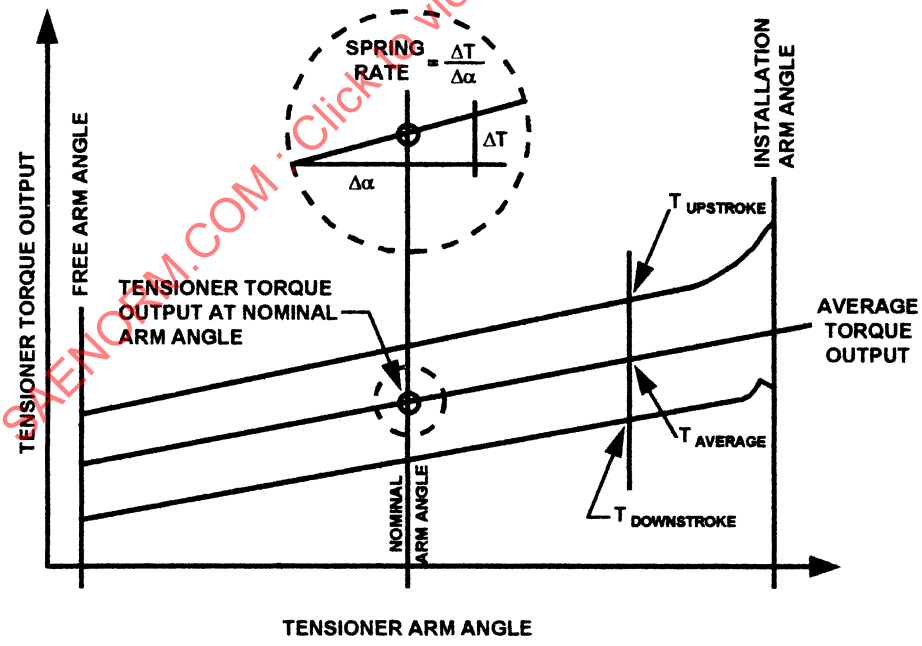

FIGURE 6—TENSIONER TORQUE OUTPUT

4.5.2 AVERAGE TORQUE OUTPUT—The average of tensioner up and down stroke torque values according to Equation 1 at each given arm position.

$$T_{average} = \frac{(T_{upstroke} - T_{downstroke})}{2} \quad \text{(Eq. 1)}$$

4.5.3 SPRING RATE—The rate of change in average torque output per degree of arm displacement.

4.5.4 SPRING SET—The change in tensioner torque output due to the initial stabilization of the various components in the tensioner assembly.

4.5.5 DAMPING (AT TENSIONER NOMINAL ARM ANGLE)—Hysteresis existing in the tensioner while operating at specified amplitude, frequency, and hub load angle. The procedure for calculating percent damping and work are shown in Equation 2 and 3 respectively.

$$\text{Percent Damping} = \frac{(T_{upstroke} - T_{average})}{T_{average}} \times 100 \quad \text{(Eq. 2)}$$

$$\text{Damping Work} = \int \frac{(T_{upstroke} - T_{downstroke})}{\text{Stroke}} \times 100 \quad \text{(Eq. 3)}$$

4.6 Tensioner Offset—The distance from tensioner mounting surface to theoretical centerline of belt. (See Figure 7.)

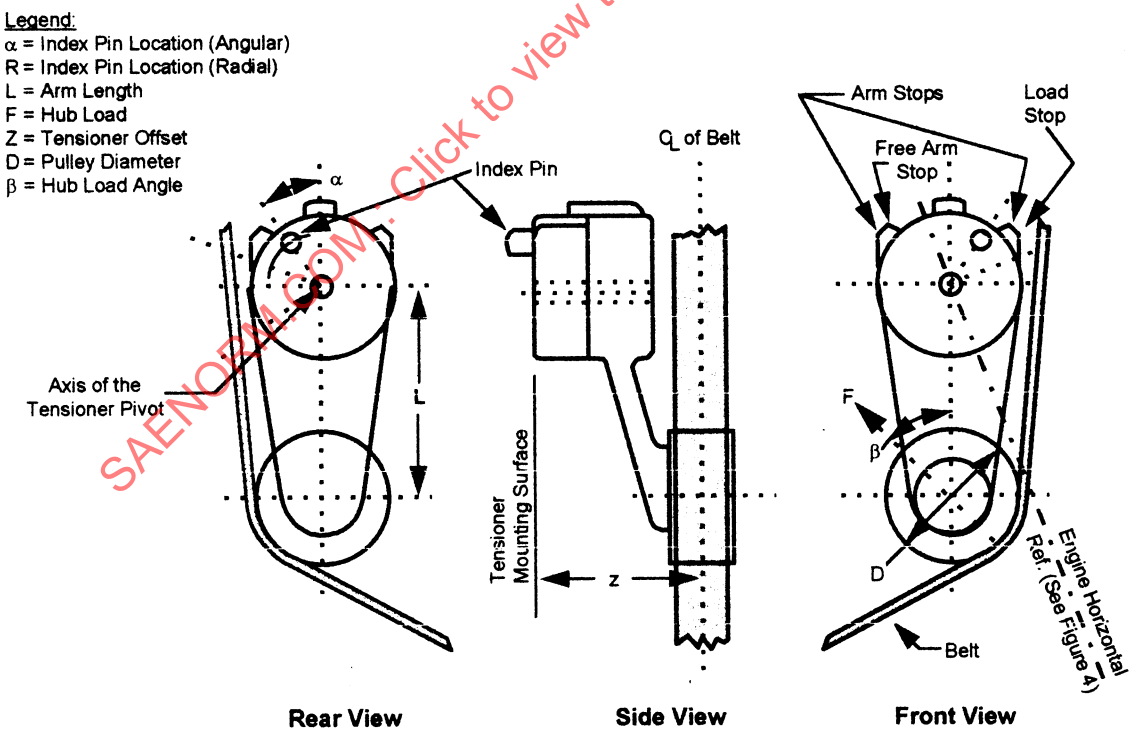

FIGURE 7—TENSIONER CHARACTERISTICS