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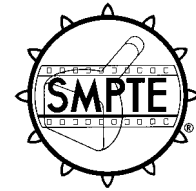
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8-mm Type S Sprocket Design



1 Scope

This practice provides the dimensions and specifications for the design and maximum pitch of sprockets used with 8-mm type S motion-picture raw stock or processed film.

2 Dimensions and specifications

2.1 The teeth shall be equally spaced at an index angle of $360/N$ degrees where N is the number of teeth. A suitable tolerance for the index angle is ± 1 minute of arc for sprockets having 12 to 24 teeth and ± 30 seconds of arc for sprockets having 25 to 84 teeth.

2.2 The root diameter is computed from the equation

$$D = N \times \frac{P}{\pi} - T$$

where P is the sprocket pitch, N is the number of teeth, and T is the film thickness. The different root diameters in tables 1A and 1B were derived using a value for T of 0.006 in (0.15 mm). If optimum working conditions are desired with different thickness film materials, tables 1A and 1B should be recomputed.

2.3 The minimum value of R_1 has been chosen as 0.156 in (3.96 mm). This is an arbitrary choice but seems appropriate for 8-mm equipment. The shape of the film path as the film leaves the root of the sprocket is determined by film stiffness, set, and tension as well as by the shape and location of rollers or guides.

For the specified tooth shape, the film has been allowed to slip back over the root circle a distance of 0.0018 in (0.046 mm), measured at the pitch line (film thickness assumed to be 0.006 in or 0.15 mm) by the time the contact point between film and tooth has reached the maximum assumed working height of 0.026 in (0.66 mm) (measured radially from the root circle).

This analysis applies to the feed sprocket for which the sprocket pitch is generally greater than the film pitch and the film must slip in the direction opposite to the direction of motion. The direction of the friction force between the film and the root surface is such as to assist the feed or the driving action. Of the total 0.0018-in (0.046-mm) accommodation provided at each tooth for film slippage, approximately 0.0005 in (0.013 mm) is allocated to the combined tolerance of perforation pitch and sprocket tooth pitch (shorter-than-average perforation pitch combined with longer-than-average tooth pitch). An additional 0.0003 in (0.008 mm) is allocated for and corresponds approximately to the distortion resulting from 2 oz (56.7 grams) of contact loading. The remaining 0.0010 in (0.025 mm) corresponds to 0.6% of film shrinkage. It should be noted that a combination of 4 oz (113.4 grams) of load and approximately 0.4% shrinkage with pitch tolerances is about equivalent. By this procedure, the values of X_T are determined.

2.4 The minimum value of R_2 has been computed for the same X_T and the same accommodation of 0.0018 in (0.046 mm) assuming a parabolic schedule (displacement function proportional to the square of time) of reduction versus time (reference 2). These values of R_2 are set forth in tables 1A and 1B. For exit film paths

corresponding to larger values of R_1 and R_2 , including a straight tangent path, the accommodation of 0.0018 in (0.046 mm) for film slippage takes place in less than 0.026 in (0.66 mm) of the working height (or more accommodation results at the same height). The accommodation takes place more slowly for the exit path defined by minimum values of R_2 ; therefore, these are recommended where maximum uniformity of motion is desired.

2.5 The desired tooth shape can be generated by a hob corresponding to the basic rack specified by K_H and B_H as tabulated (see table 2 and figure 4). If the first hob covers the range of N from 12 to 24, inclusively, and the second hob the range of N from 25 to 84, inclusively, no deviations in tooth shape greater than 0.00020 in (0.0051 mm) will occur.

2.6 The tooth width at the base, dimension W , allows ample material for rounding off the tip while preserving the 0.026 in (0.66 mm) or more of working height. The value chosen does not limit the angle of wrap on the sprocket as a wider tooth would. If the wrap length is defined as one half the sum of the number of pitch lengths in the arc of engagement, E , and the number of pitch lengths in the arc of contact, C (figure 1), then the wrap length may be as high as $9\frac{1}{4}$ pitch lengths without producing interference at the entering teeth of a drive sprocket if the film shrinkage does not exceed 0.8%.

2.7 The lateral profile has been derived on the assumption that the film is channel-guided at or near the sprocket. This guiding may be provided

by fixed guides, by the flanges of an adjacent roller at the entering position, or preferably, by flanges on the sprocket itself. When a fixed guide is needed at the perforated edge and the film urged against the guide by a spring or other means, the lateral dimension L of the tooth can be increased somewhat. If the sprocket teeth are to perform the function of side guiding, then their lateral width, L , may be increased to 0.0355 in + 0 in – 0.0005 in (0.902 mm + 0 mm – 0.013 mm) with special consideration given to tooth alignment, smoothness of the sides, and rounding or tapering at the tips.

When the sprocket teeth have been increased in width to perform the function of lateral guiding, the R_3 value, for the radius of the corners of the sprocket tooth, should be increased to comply with the radius of the perforation fillet, nominally 0.005 in (0.13 mm).

2.8 In order for the film guides to function properly, the sprocket eccentricity as mounted in operation shall not exceed 0.0010 in (0.025 mm) and the lateral weave or wobble measured at the root circle shall not exceed ± 0.0010 in (0.025 mm). Less eccentricity may be required for a special application such as a sound printer sprocket.

2.9 In some cases of large-scale layouts or critical comparisons, it may be more convenient to work with values of X_T than with values of B . As shown in figure 4, X_T is the distance measured perpendicular to the radial line intersecting the root of the tooth from a point on the tooth which is 0.026 in (0.66 mm) above the root circle.