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SMPTE 242-2003
Revision of
ANSI/SMPTE 242-1993

SMPTE STANDARD

for Motion-Picture Equipment (35-mm) — Universal Intermittent Sprockets

1 Scope

1.1 This standard specifies the dimensions of two types of 16-tooth intermittent sprockets for 35-mm motion-picture projectors. Other dimensions and definitions are given in annex A.

1.2 This standard is applicable to sprockets used in conjunction with film perforated in accordance with ANSI/SMPTE 139 (0.1870 in pitch) or SMPTE 102.

2 Sprocket tooth types

2.1 Type S is the standard square tooth that is used internationally and known as the CS sprocket tooth.

2.2 Type R is the round tooth that eliminates sharp corners on film contacting surfaces.

3 Dimensions

3.1 The dimensions shall be as specified in figure 1 and table 1.

3.2 The sprocket tooth pitch is measured at the midpoint of 0.006 in (0.15 mm) film thickness:

$$\frac{(\text{Diameter E} + 0.006\ \text{in})\ \pi}{\text{Number of teeth}}$$

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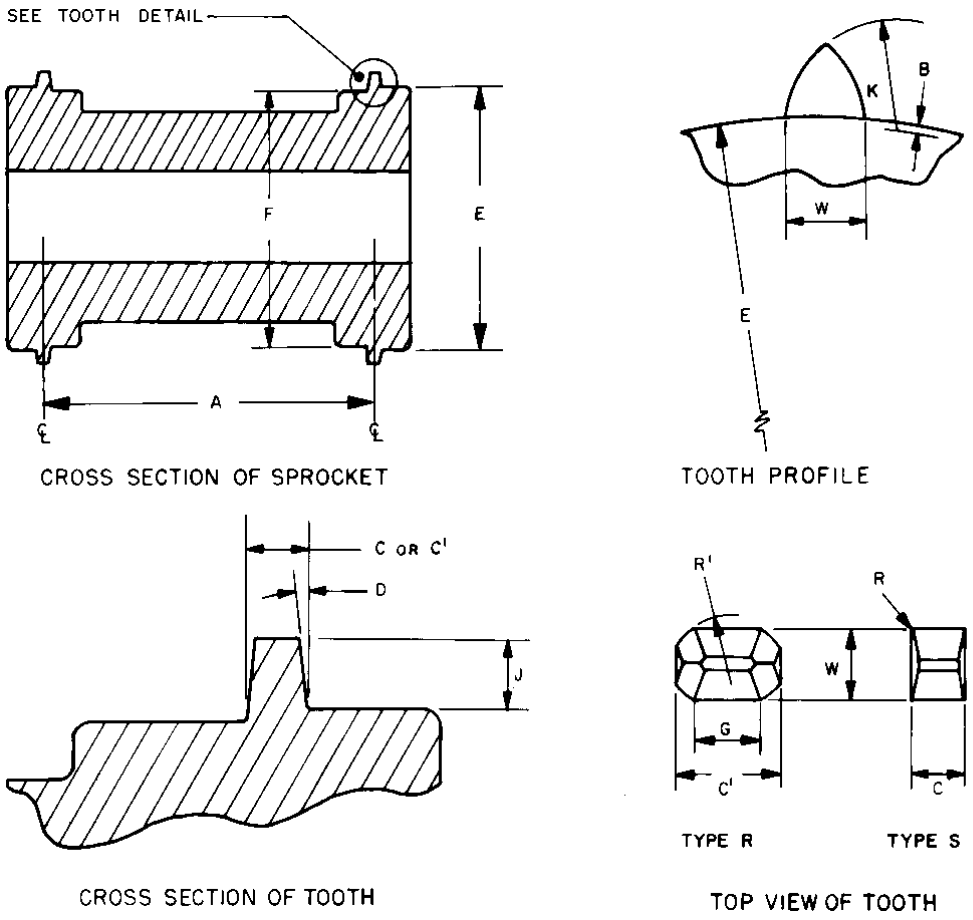

Figure 1 – Intermittent sprocket

Table 1 – Specifications

	Dimensions	Inches	Millimeters
A	Tooth centerline to centerline	1.125 ± 0.001	28.58 ± 0.03
B	Center point of tooth arc	0.004 – 0.001	0.10 – 0.03
C	Square tooth lateral width	0.040 + 0.001 – 0.002	1.02 + 0.03 – 0.05
C'	Round tooth lateral width	0.072 – 0.002	1.83 – 0.05
D	Lead angle at tooth sides	7º 30' max	
E	Root (film supporting) diameter	0.950 ± 0.001	24.13 ± 0.03
F	Inner diameter	0.010 less than E	0.25 less than E
G	Bearing surface	0.046 – 0.002	1.17 – 0.05
J	Tooth height above E	0.050	1.27
K	Tooth arc	0.077 + 0.002	1.96 + 0.05
R	Square tooth corner radius	0.005 max	0.13 max
R'	Round tooth corner radius	0.043 ± 0.001	1.09 ± 0.03
W	Horizontal tooth width	0.055 – 0.002	1.40 – 0.05

Annex A (informative)
Other dimensions and definitions

A.1 Figure 1 describes the tooth shapes which recognize the following factors: (1) smooth disengagement of sprocket teeth and transfer of driving forces from perforation to perforation; (2) shrinkage and dimensional changes in motion-picture film; and (3) elastic deformation of the perforation edge induced by the drive forces on the perforation edge.

A.2 In current practice, the upper sprocket is usually a feed sprocket while the lower sprocket may function as a holdback sprocket or simply as an idler. These sprockets have dimensional values identical to those shown in table 1 except for root diameter E. Diameter E is nominally 0.943 in (23.95 mm) on a 16-tooth feed sprocket or 0.940 in (23.88 mm) on those serving as holdback sprockets. E diameters for 24-tooth feed sprockets range from 1.413 in to 1.424 in (35.89 mm to 36.17 mm) and holdback sprockets are nominally 1.413 in (35.89 mm) with some variation from manufacturer to manufacturer.

A.3 As stated in 1.2, this standard specifies sprockets designed to accommodate films with either KS or CS perforations which have different specifications insofar as perforation size and positioning are concerned. This requirement affects the centerline-to-centerline dimension (A) and the tooth width (C). The tooth width specified in table 1 as dimension C (square tooth) is the dimension covered by the former standard, PH22.35. The value specified for C' (round tooth) is an alternative design permitting a greater tooth width and a relatively large break at each tooth corner which avoids contact of the tooth corner with the fillet radii in the perforation corners, thus limiting the possibility of the tooth damaging the film. Elimination of square tooth corners also minimizes abrasion of the perforation edge. In special instances where a projector is to be used only with films having one type of perforation, it may be advantageous to use sprockets made specifically for that type of perforation. For example, projectors to be used only with films having CS perforations might have a tooth centerline-to-centerline dimension (A) at 1.125 in (28.58 mm) and a tooth width dimension (C) of 0.048 in (1.22 mm) maximum driving face. A projector intended only for use with films having KS perforations might have sprockets with a tooth centerline-to-centerline at 1.109 in (28.17 mm) and a tooth width of 0.065 in (1.65 mm) maximum driving face.

A.4 Definitions

feed sprocket: A feed sprocket is used to advance the film against a restraining force. The force is applied to the leading edge of the film perforation (viewed in the direction of film motion). The sprocket rotates at a nominally constant velocity and tends to keep the film in motion. It is also called an advancing or drive sprocket and is usually lightly loaded.

intermittent sprocket: An intermittent sprocket is a feed sprocket used to advance the film periodically (frame by frame). The sprocket is usually completely at rest during the intervals between advances. It is normally heavily loaded during a portion of its motion since it must accelerate the film from zero velocity and achieve an average rate of film advance. The root diameter is usually larger than that of a feed sprocket because of greater perforation distortion.

holdback sprocket: A holdback sprocket is used to restrain the film against a tension force. The force is applied to the trailing edge of the film perforation (viewed in the direction of film motion) and the sprocket rotates at a nominally constant velocity. It is also called a retarding or restraining sprocket.

Annex B (informative)
Bibliography

ANSI/SMPTE 139-1996, Motion-Picture Film (35-mm) — Perforated KS

SMPTE 102-2002, Motion-Picture Film (35-mm) — Perforated CS-1870