

INTERNATIONAL STANDARD



3820

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Cinematography — Sprockets for 8 mm Type S motion-picture film — Dimensions and design

Cinématographie — Tambours dentés pour film cinématographique 8 mm type S — Dimensions et construction

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FOREWORD

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It has been approved by the member bodies of the following countries :

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United Kingdom

Cinematography — Sprockets for 8 mm Type S motion-picture film — Dimensions and design

1 SCOPE AND FIELD OF APPLICATION

This International Standard lays down the dimensions and specifies requirements for the design of sprockets used with 8 mm Type S motion-picture raw stock or processed film.

2 REFERENCE

ISO 1700, *Cinematography — 8 mm Type S motion-picture raw stock film — Cutting and perforating dimensions*.

3 DIMENSIONS AND CHARACTERISTICS

3.1 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.

3.2 The root diameter D is computed from the equation :

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

where

P is the perforation pitch;

N is the number of teeth;

T is the film thickness.

The root diameters in table 1B were derived using a value for T of 0,15 mm (0.006 in). If optimum working conditions are desired with film materials of other thicknesses, table 1B should be recomputed.

3.3 The minimum value of R_1 , as depicted in figure 1, has been chosen as 3,96 mm (0.156 in). 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 tooth 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 0,046 mm (0.001 8 in) measured at the pitch line [film thickness assumed to be 0,15 mm (0.006 in)], by the time the contact point between film and tooth has reached the assumed working height, H , of 0,66 mm (0.026 in) (measured radially from the root circle).

This analysis applies to the feed sprocket, for which the sprocket pitch is generally greater than the perforation 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 root surface is such as to assist the feed or the driving action. Of the total 0,046 mm (0.001 8 in) accommodation provided at each tooth for film slippage, approximately 0,013 mm (0.000 5 in) 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 0,008 mm (0.003 in) is allocated for, and corresponds approximately to, the distortion resulting from 0,58 N (56,7 gf) of contact loading. The remaining 0,25 mm (0.001 0 in) corresponds to 0,6 % of film shrinkage. It should be noted that a combination of 1,16 N (113,4 gf) of load and approximately 0,4 % shrinkage with pitch tolerances is about equivalent. By this procedure the values of X_T are determined. As shown in figure 3, 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 0,66 mm (0.026 in) above the root circle.

3.4 The minimum values of R_2 (see figure 1) have been computed for the same X_T and the same accommodation of 0,046 mm (0.001 8 in) assuming a displacement function proportional to the square of time (see annex, reference 2). These values of R_2 are set out in tables 1A and 1B. For the exit film paths corresponding to larger values of R_1 or R_2 including a straight tangent path, the accommodation of 0,046 mm (0.001 8 in) for film slippage takes place in less than 0,66 mm (0.026 in) 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.

3.5 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 3 and figure 4). If the first hob covers the range of N from 12 to 24, inclusively, and the second hob covers the range of N from 25 to 84, inclusively, no deviations in tooth shape from the ideal greater than 0,003 05 mm (0.000 12 in) will occur.

3.6 The tooth width at the base, dimension W , allows ample material for rounding off the tip while preserving the 0,66 mm (0.026 in) working height. In some instances some additional height is available. 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 of 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 1/4 pitch lengths without producing interference at the entering teeth of a drive sprocket if the film shrinkage does not exceed 0,8 %.

3.7 The lateral profile of the sprocket 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 is urged against the guide by a spring or other means, the lateral dimensions L of the tooth can be increased. If the sprocket teeth are to perform the function of side guiding, then their lateral dimension L may be increased to

$$0,902 - \overset{0}{0,013} \text{ mm } (0.0355 - \overset{0}{0.0005} \text{ in})$$

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 0,13 mm (0.005 in).

3.8 In order for the film guides to function properly, the sprocket eccentricity as mounted in operation should not exceed 0,025 mm (0.001 0 in) and the lateral weave or wobble measured at the root circle should not exceed 0,025 mm (0.001 0 in). Less eccentricity may be required for a special application such as a sound printer sprocket.

3.9 In some cases of large-scale layouts or critical comparisons, it may be more convenient to work with values of X_T than values of B .

NOTE — The inch dimensions in this International Standard have been converted from the specified metric dimensions, but have not been carried out to two more places as specified in ISO 370. They do, however, reflect the engineering practice in the countries using the Imperial system of units.

TABLE 1A — Sprocket dimensions, in millimetres

N	D_d	D_c	D_h	K	B	R_2	X_T
12	16,021	15,971	15,895	1,520	0,047	12,584	0,246 0
13	17,363	17,316	17,232	1,574	0,057	13,381	0,240 8
14	18,716	18,658	18,569	1,625	0,067	14,184	0,236 3
15	20,064	20,002	19,906	1,674	0,078	14,988	0,232 4
16	21,412	21,345	21,244	1,722	0,087	15,803	0,228 9
17	22,759	22,689	22,581	1,768	0,097	16,619	0,225 8
18	24,107	24,033	23,918	1,813	0,106	17,431	0,223 1
19	25,455	25,376	25,255	1,856	0,116	18,253	0,220 6
20	26,802	26,720	26,592	1,899	0,124	19,082	0,218 3
21	28,150	28,063	27,930	1,940	0,133	19,903	0,216 3
22	29,498	29,407	29,267	1,981	0,142	20,735	0,214 4
23	30,846	30,750	30,604	2,020	0,151	21,564	0,212 7
24	32,193	32,084	31,941	2,059	0,159	22,400	0,211 1
26	34,889	34,781	34,616	2,135	0,176	24,072	0,208 3
28	37,584	37,468	37,290	2,208	0,192	25,763	0,205 8
30	40,280	40,156	39,965	2,280	0,208	27,453	0,203 7
32	42,975	42,843	42,639	2,349	0,224	29,159	0,201 8
34	45,671	45,530	45,313	2,417	0,239	30,862	0,200 2
36	48,366	48,217	47,988	2,483	0,254	32,585	0,198 7
38	51,062	50,904	50,662	2,549	0,269	34,326	0,197 3
40	53,757	53,591	53,337	2,613	0,283	36,065	0,196 1
42	56,452	56,279	56,011	2,675	0,298	37,798	0,195 1
44	59,148	58,966	58,686	2,737	0,312	39,557	0,194 1
46	61,843	61,653	61,360	2,798	0,326	41,341	0,193 1
48	64,539	64,340	64,035	2,858	0,340	43,112	0,192 2
50	67,234	67,027	66,709	2,918	0,353	44,905	0,191 5
52	69,930	69,714	69,383	2,976	0,367	46,700	0,190 8
54	72,625	72,402	72,058	3,033	0,381	48,494	0,190 2
56	75,321	75,089	74,732	3,091	0,394	50,330	0,189 4
60	80,711	80,463	80,081	3,204	0,420	53,993	0,188 4
64	86,102	85,838	85,430	3,314	0,446	57,707	0,187 4
68	91,493	91,212	90,779	3,422	0,471	61,439	0,186 6
72	96,884	96,586	96,128	3,528	0,496	65,241	0,185 8
76	102,275	101,961	101,477	3,633	0,521	69,081	0,185 1
80	107,666	107,335	106,826	3,735	0,545	72,955	0,184 5
84	113,057	112,709	112,174	3,837	0,569	76,895	0,183 9

N = Number of teeth

D_d = Root diameter, $D + \begin{smallmatrix} 0,03 \\ 0 \end{smallmatrix}$ of drive sprocket of 4,234 pitch

D_c = Root diameter, $D + \begin{smallmatrix} 0,03 \\ 0 \end{smallmatrix}$ of combination sprocket of 4,221 pitch

D_h = Root diameter, $D - \begin{smallmatrix} 0 \\ 0,03 \end{smallmatrix}$ of hold-back sprocket of 4,201 pitch

Film thickness = 0,152. For other thicknesses :

$$\text{Root diameter} = N \times \frac{\text{pitch}}{\pi} - \text{thickness}$$

K = Circular arc radius for tooth shape, $\begin{smallmatrix} 0 \\ -0,05 \end{smallmatrix}$

B = Radial distance of arc centre inside root circle, $\begin{smallmatrix} +0,013 \\ 0 \end{smallmatrix}$

R_2 = Minimum radius of film path concave to sprocket

X_T = Offset of tooth at working height

Tooth working height, $H = 0,660$

Maximum pitch difference = 0,046

Minimum film path radius convex to sprocket, $R_1 = 3,962$

Numerical values in millimetres.