

Cinematography — 16 mm motion-picture and magnetic film — Cutting and perforating dimensions

1 Scope

This International Standard specifies the cutting and perforating dimensions for 16 mm motion-picture and magnetic films with one or two rows of perforations for the following two categories:

- 16 mm motion-picture and magnetic films;
- manufacturer-designated 16 mm professional motion-picture camera films with tighter tolerances.

This International Standard applies to safety raw stock film as described in ISO 543.

2 Normative references

The following standards contain provisions which through reference in this text constitute provisions of this International Standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 543:1974 *Cinematography — Motion-picture safety film — Definition, testing and marking*

ISO 554:1976 *Standard atmospheres for conditioning and/or testing — Specifications*

3 Dimensions

3.1 The dimensions and tolerances shall be as given in table 1 and in the accompanying figure 1 to figure 4, and apply to safety raw stock film as described in ISO 543. The dimensions shall apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1 °C and a relative humidity of (50 ± 2) %, which is the recommended

atmosphere for conditioning and/or testing with reduced tolerances specified in ISO 554.

NOTES

1 If required by usage, the manufacturer may indicate other atmospheric conditions which applied to the dimensional control and testing at the time of cutting and perforating.

2 This International Standard is based on values adopted for film defined as 'low-shrinkage'. See annex A, clause A.3 for definition of 'low-shrinkage'.

3.2 The dimensions and tolerances of 16 mm full-roast magnetic materials at the time of cutting and perforating shall be as specified by dimensions *B* and *I* in table 1.

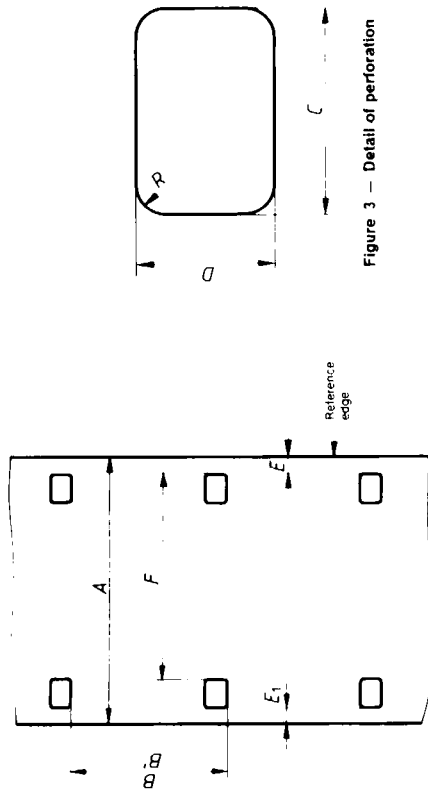


Figure 2 — Film with perforations along two edges (Type 2)

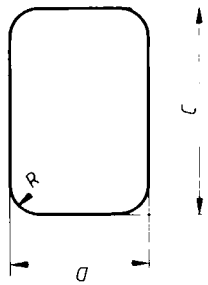


Figure 3 — Detail of perforation

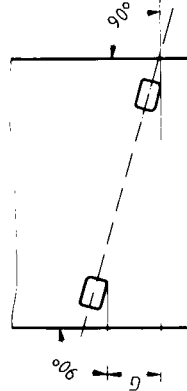


Figure 4 — Permissible alignment deviation of the rows of perforations (Type 2)

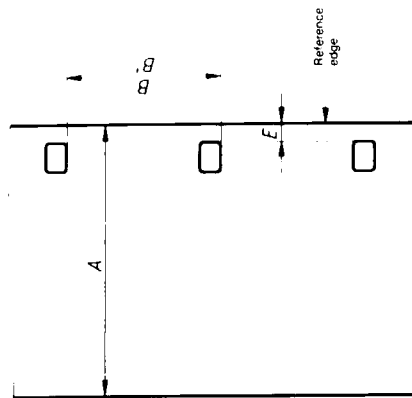


Figure 1 — Film with perforations along one edge (Type 1)

film. With the film wound emulsion-in, and the roll of film unwinding downwards toward the observer, the reference edge is along the right-hand side of the film (see figure 5)

4 Identification of reference edge for guiding
4.1 For film perforated along one edge, the edge adjacent to the perforation is the reference edge

4.3 The sequential edge numbers (key numbers or footage numbers) are exposed by the film manufacturer along the reference edge of the film

4.2 For film perforated along two edges, the reference edge shall be identified by the winding of the

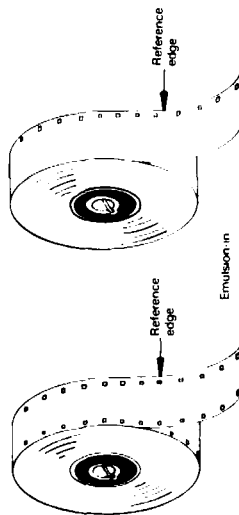


Figure 5 — Identification of reference edge

Table 1 — Dimensions and tolerances

Dimension	All films		Designated professional camera films (with tighter tolerances in bold type)		Notes
	mm	in	mm	in	
<i>l</i>	15.950 ± 0.025	0.6280 ± 0.0010	15.950 ± 0.025	0.6280 ± 0.0010	
<i>l</i> ₁ <i>R</i>	7.620 ± 0.010	0.3000 ± 0.0004	7.620 ± 0.010	0.3000 ± 0.0004	4 and 5
<i>l</i> ₁ <i>R</i> '	7.605 ± 0.010	0.2994 ± 0.0004	7.605 ± 0.010	0.2994 ± 0.0004	4 and 5
<i>l</i> ₂	1.830 ± 0.010	0.0720 ± 0.0004	1.830 ± 0.010	0.0720 ± 0.0004	4
<i>l</i> ₂ '	1.270 ± 0.010	0.0500 ± 0.0004	1.270 ± 0.010	0.0500 ± 0.0004	4
<i>l</i> ₃	0.900 ± 0.050	0.0355 ± 0.0020	0.900 ± 0.025	0.0355 ± 0.0010	4 and 5
<i>l</i> ₃ '	0.900 ± 0.050	0.0355 ± 0.0020	0.900 ± 0.050	0.0355 ± 0.0020	
<i>l</i> ₄	12.32 ref	0.485 ref	12.32 ref	0.485 ref	
<i>l</i> ₄ '	0.025 max	0.0010 max	0.010 max	0.0004 max	
<i>l</i> ₅	762.0 ± 0.8	30.00 ± 0.03	762.0 ± 0.8	30.00 ± 0.03	
<i>l</i> ₅ '	760.5 ± 0.8	29.94 ± 0.03	760.5 ± 0.8	29.94 ± 0.03	
<i>R</i>	0.25 ± 0.03	0.010 ± 0.001	0.25 ± 0.03	0.010 ± 0.001	

*l*₁*R* and *l*₁*R*' refer to long pitch
*l*₂*R*' and *l*₂' refer to short pitch

NOTES (applicable to all 16 mm films)

- Dimensions *l*₁ and *l*₂' represent the length of any 100 consecutive perforation intervals
- Dimensions *R*' and *R*' (short perforation pitch) are provided to fulfil the requirements of continuous-sprocket printing (see annex A, clause A.4)
- l*₃ is given as a reference dimension and typically represents manufacturing punch and die setup
- NOTES (applicable only to films designated by the manufacturer for professional camera use)
 In addition, the range of values measured in any 50 consecutive perforations shall not exceed 0.010 mm (0.0004 in) for dimensions *R*₁, *R*₂, *R*₃ and *R*₄, and 0.020 mm (0.0008 in) for dimension *l* (see annex A, clause A.1)
- In addition, the difference in dimensional value of *R*₁ or *R*₂ between any two consecutive perforation intervals shall not exceed 0.005 mm (0.0002 in). Between consecutive perforations, the difference in dimensional value of *l* shall not exceed 0.010 mm (0.0004 in) (see annex A, clause A.1)

Annex A
(informative)

Explanatory notes

A.1 Uniformity of perforating

The uniformity of pitch, hole size and margin (dimensions B or B' , C and D , and E) are important variables affecting image steadiness. Variations in these dimensions within a roll from one perforation to the next are more significant than variations from roll to roll. Actually, it is the maximum variation from one perforation to the next within any small group of consecutive perforations that is the most important variable.

A.2 Dimensional stability

During its life, film can shrink or swell due to changes in temperature or to loss or gain in moisture content. It can also shrink due to loss of solvent or plasticizer. These changes result in changes in the dimensions. The change is generally uniform through the roll.

A.3 Definition of low-shrinkage film

Low-shrinkage film is film which shrinks no more than 0.2 % from its original dimensions at the time of cutting and perforating, after the film has been

a) kept in the manufacturer's normal commercial packing for six months at recommended storage conditions,

b) exposed,

c) processed and dried as recommended by the manufacturer,

d) stored in roll form, exposed to air, for a period not to exceed 30 d at 18 °C to 24 °C and 50 % to 60 % relative humidity

The film is measured under the same conditions of temperature and humidity as defined in 3.1

A.4 Choice of longitudinal pitch

The choice of different pitch (B long pitch and B' short pitch) for original and print motion-picture films, depends on the necessity of printing and the type of printer used

In the most common type of printer, the original and print films move continuously over a printing sprocket. Consequently, the original film must be shorter in pitch than the print film in the approximate proportion of the thickness of the film to the radius of curvature of the printing sprocket. With current printing sprocket design the value for this pitch differential is 0.3 %, with experience showing that a tolerance of ± 0.1 % is acceptable.

With "low-shrinkage" film base, it is common manufacturing practice to set the aim for the pitch of original films at a value of 0.2 % shorter than that of the films on which they will be printed. The additional shrinkage that occurs in the original film because of processing and ageing before printing should result in the desired 0.3 ± 0.1 % shorter pitch.

A.5 Effect of humidity

It is the common tendency of the film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design.

A.6 Equipment design

In order to achieve optimum cancellation of dimensional variables, it is preferred that equipment (e.g. cameras, printers, telecines and projectors) position the film laterally using the reference edge. Optimum vertical steadiness results when the same perforation (with respect to the image) is used for vertical positioning in all equipment, and the +3 perforation is recommended as shown in figure A.1 (see ISO 25:1976, *Cinematography — Camera usage of 16 mm motion-picture film — Specifications*)

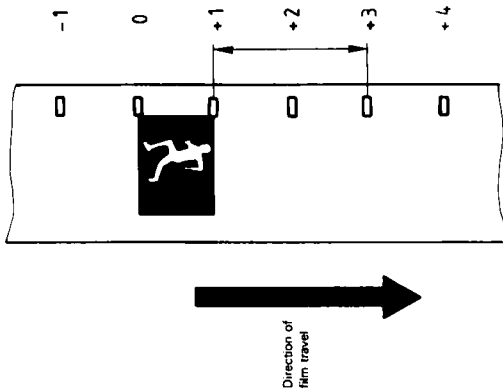


Figure A.1 — Standard image position reference