INTERNATIONAL STANDARD

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Cinematography — 35 mm motion-picture film and magnetic film — Cutting and perforating dimensions

Cinématographie — Film cinématographique et magnétique de 35 mm — Dimensions de coupe et de perforation

Reference number
ISO 491:1995(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 491 was prepared by Technical Committee ISO/TC 36, *Cinematography*.

This fifth edition cancels and replaces the fourth edition (ISO 491:1988), of which it constitutes a technical revision.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

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Cinematography — 35 mm motion-picture film and magnetic film — Cutting and perforating dimensions

1 Scope

This International Standard specifies the cutting and perforating dimensions for 35 mm unexposed motion-picture film and 35 mm magnetic film, and the types of perforations used.

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 543:1990, *Photography — Photographic films — Specifications for safety film.*

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

3 Conditions for the measurement of dimensions

The dimensions and tolerances specified in this International Standard apply at the time of manufacture, measured under atmospheric conditions of (23 ± 1) °C and (50 ± 5) % relative humidity, as specified in ISO 554[1)]. A manufacturer may indicate other nominal temperatures and humidity under which dimensions apply.

4 Dimensions

4.1 Dimensions of motion-picture film

The dimensions shall be as shown in figures 1 and 2 and given in table 1 (in millimetres). They apply to unexposed motion-picture and magnetic film which conform to ISO 543. These specifications apply at the time of cutting and perforating.

4.2 Dimensions of magnetic film

With regard to 35 mm magnetic films, the dimensions which apply are those specified in table 1 under the designation "Type P" with a perforation pitch B and the length of any 100 consecutive intervals L.

1) All measuring instrument calibrations should be referred to a temperature of 20 °C (as specified in ISO 1[1]) and a relative humidity of 50 %.

Table 1

Dimensions in millimetres

Dimension	Type P	Type N	Type DH
A	34,975 ± 0,025	34,975 ± 0,025	34,975 ± 0,025
B	4,75 ± 0,01	4,75 ± 0,01	4,75 ± 0,01
B′	4,74 ± 0,01	4,74 ± 0,01	—
C	2,800 $^{+0,005}_{-0,015}$	2,800 $^{+0,005}_{-0,015}$	2,800 $^{+0,005}_{-0,015}$
D	1,98 ± 0,01	1,850 $^{+0,015}_{-0,005}$	1,850 $^{+0,015}_{-0,005}$
E	2,01 ± 0,05	2,01 ± 0,05	2,01 ± 0,05
F	28,17 ± 0,05	28,17 ± 0,05	28,17 ± 0,03
G	0,025 max.	0,025 max.	0,025 max.
H	—	2,08 nom.	—
R	0,500 $^{+0,025}_{-0,075}$	0,13 max.	0,33 ± 0,03
L	475,0 ± 0,4	475,0 ± 0,4	475,0 ± 0,4
L′	474,0 ± 0,4	474,0 ± 0,4	—

NOTES

1 While present usage is that type N perforations may be employed for camera and intermediate films and type P perforations for print films, the long-term objective should be for all 35 mm films to have type P perforations.

2 Dimensions *L* and *L′* represent the length of any 100 consecutive perforation intervals.

3 Dimensions *B′* and *L′* (short perforation pitch) are provided to fulfil the requirements of continuous sprocket contact printing.

4 See annex A for full information concerning the same dimensions expressed in inches.

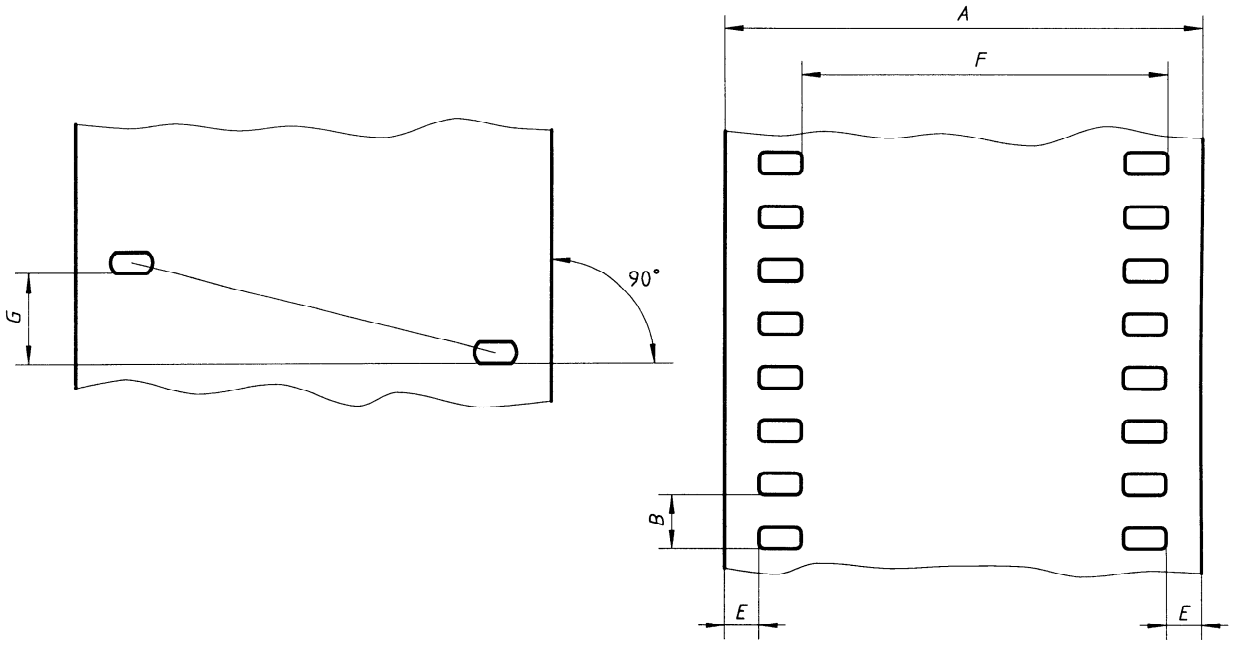

Figure 1 — Dimensions of 35 mm motion-picture film

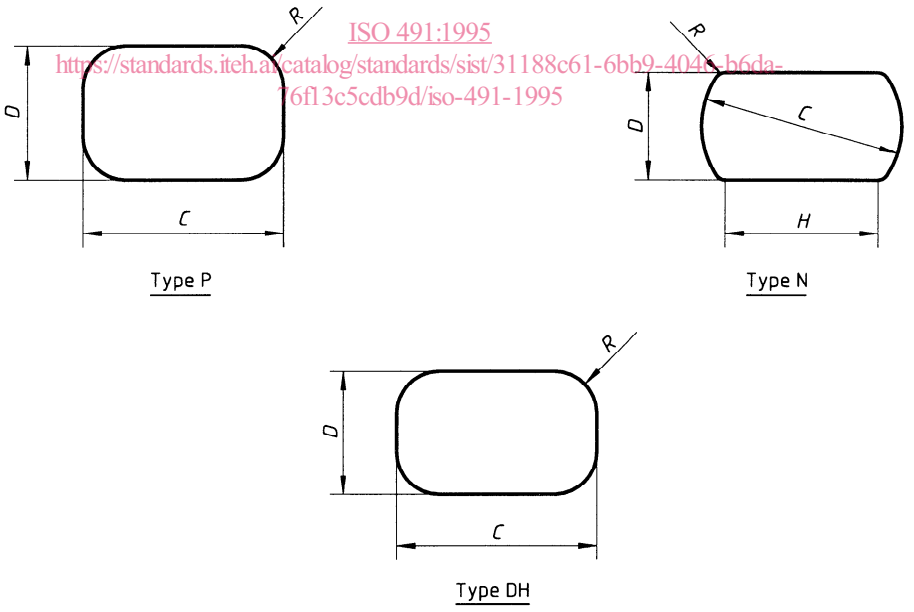

Figure 2 — Types of perforation

Annex A
(normative)

Dimensions in inches

The same dimensions as those in table 1 can be expressed in inch units. These dimensions shall be as shown in table A.1.

Table A.1

Dimensions in inches

Dimension	Type P	Type N	Type DH
A	1,377 ± 0,001	1,377 ± 0,001	1,377 ± 0,001
B	0,187 0 ± 0,000 4	0,187 0 ± 0,000 4	0,187 0 ± 0,000 4
B'	0,186 6 ± 0,000 4	0,186 6 ± 0,000 4	—
C	0,110 0 ± 0,000 4	0,110 0 ± 0,000 4	0,110 0 ± 0,000 4
D	0,078 0 ± 0,000 4	0,073 0 ± 0,000 4	0,073 0 ± 0,000 4
E	0,079 ± 0,002	0,079 ± 0,002	0,079 ± 0,002
F	1,109 ± 0,002	1,109 ± 0,002	1,109 ± 0,001
G	0,001 max.	0,001 max.	0,001 max.
H	—	0,082 nom.	—
R	$0{,}020\ ^{+0{,}001}_{-0{,}003}$	0,005 max.	0,013 ± 0,001
L	18,700 ± 0,016	18,700 ± 0,016	18,700 ± 0,015
L'	18,660 ± 0,016	18,660 ± 0,016	—

NOTE — The notes to table 1 apply.

Annex B
(informative)

Additional data

B.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. In fact, it is the maximum variation from one set of 4 perforations to the next within any small group of consecutive perforations that is the most important variable.

B.2 Dimensional stability

During its life, film can shrink or swell due to changes in temperature or to loss or gain in moisture content. In addition, triacetate-based film can shrink due to the loss of solvents or plasticizers. These changes may result in changes in the dimensions. The change is generally uniform through the roll.

B.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 exceeding 30 days 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 clause 3.

B.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 $\pm$ 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 $\pm$ 0,1) % shorter pitch.

B.5 Effect of humidity

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

Annex C
(informative)

Bibliography

[1] ISO 1:1975, *Standard reference temperature for industrial length measurements.*

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