



Mr. Charles Akrich, Secretary of SC60B and French National Committee member discusses a technical point with Fred Remley, U.S. National Committee member and ISO observer at the Paris SC60B meetings.



Dr. R. Wyman, U.S. National Committee member and Chairman of SC60C (far right) presents his review of the sub-committee meetings to the TC60 final meeting. At the table next to him is Dr. W. Bruch, Chairman of TC60 (center), Mr. W. H. J. Koeter, Secretary of TC60 (left), and Dr. J. J. Geluk (right).

Working Group 3, Electronic Learning Systems, is monitoring the developments in this field and looking for areas where international standardization seems appropriate. Generally these systems are in the developmental stage in most countries at the present time and are not now sufficiently developed to suggest standardization. The committee is studying digital controls, multiple projector systems, synchronization and timing codes, optical scanning systems and feedback systems.

Working Group 4, Equipment and System Safety, is studying IEC Publication 65 in terms of both electrical and mechanical safety problems that may be unique to equipment for education applications including special requirements for handicapped users. A Secretariat document is planned based on this work.

Working Group 5, Audio Cassette Systems, is dealing with the assignment of tracks and the recording and playback characteristics when the Compact Cassette is used for educational applications. The problems are a great deal more complex than the simple bidirectional cassette usage for home recorders when cassettes are used for applications such as language teaching laboratories. In addition to the teacher presentation, provision must be made for control cues and student response recording.

An IEC Document SC60C/WG5 (Secretary) 5 has been prepared which closely agrees with the draft of proposed ANSI Standard PH7.4 which is now under consideration in the United States. An effort is being made to resolve the differences so the USA and international standards will be in as close agreement as possible.

Working Group 6, Video and TV Systems, under the chairmanship of Lee Morris, is attempting to be sure that needs of education, as they may differ from other applications of video and TV systems, are properly considered. The present concern is with 1/2-in (12.7-mm) Cartridges and Cassettes and 3/4-in (19-mm) Cassettes. Reel-to-reel formats are not being considered at this time. This working group is attempting close cooperation with SC60B/WG5 to prevent duplication of effort and provide comment and endorsement where appropriate for their work related to educational applications.

Steering Committee: An ad hoc Working Group with Herbert Farmer as chairman, was assigned the task of dealing with the priority of the many items suggested for consideration by the various Working Groups. It was recommended and approved by TC 60 that this committee become the permanent Steering Committee of SC60C.

standards and recommended practices

Draft American National Standards

Two Draft American National Standards are published here for a trial period and public review: PH22.155, Specifications for Projector Usage of 8-mm Type S (Super 8) Motion-Picture Film, and PH22.156, Specifications for Camera Usage of 8-mm Type S (Super 8) Motion-Picture Film.

These revisions do not reflect a technical change from the original version, but have been updated and clarified to facilitate their use. The specifications have been expanded to standardize the current use of 18 frame-per-second use in non-professional areas.

Proposed SMPTE Recommended Practices

Two Proposed SMPTE Recommended Practices are published here for a trial period and public review: RP 61, Specifications for Magnetic-Type Azimuth Test Film for 8-mm Type S (Super 8) Sound Reproducers, and RP 62, Specifications for Magnetic-Type Flutter Test Film for 8-mm Type S (Super 8) Sound Reproducers. Test films made in accordance with these Recommended Practices are available from the SMPTE in both 24 and 18 frame-per-second formats.

Comments should be addressed to Alex E. Alden, *Staff Engineer*, at Society Headquarters prior to 1 October 1975. The

draft standards have been submitted to American National Standards Committee PH22. All comments received through *Journal* publication will be reviewed before conclusion of committee action. If no adverse criticism is received on the proposed practices, they will be submitted to the Board of Governors for final approval.

Approved International Standards

The International Organization for Standardization (ISO) recently approved three International Standards, the technical content of which are published here for your information. ISO 1019-1975, Cinematography — Spools, Daylight Loading Type for 16-mm Motion-Picture Cameras — Dimensions, is in complete agreement with PH22.174; ISO 3022-1975, Cinematography — 35-mm Motion-Picture Film Perforated 16-mm (1-3-0) — Cutting and Perforating Dimensions, is in complete agreement with PH22.171; and ISO 3047-1975, Cinematography — Spool, Daylight Loading Type for 35-mm Motion-Picture Cameras (Capacity 30 m — 100 ft) — Dimensions, is in complete agreement with PH1.35.

Complete copies of all International Standards are sold through the American National Standards Institute, 1430 Broadway, New York, NY 10018. — Alex E. Alden, *Staff Engineer*

Specifications for Projector Usage of 8-mm Type S (Super 8) Motion-Picture Film

PH22.155
Revision of
PH22.155:1967

1. Scope

This standard specifies the emulsion position, the projection frame rate and the orientation of the area to be projected for 8mm Type S (super 8) motion-picture film.

2. Emulsion and Film Position

- 2.1** The emulsion orientation of sound or silent prints or original camera films shall be toward the projection lens when the film is threaded for direct front projection, as shown in the figure.
- 2.2** The perforation used for the film-positioning device shall be two perforations above the perforation adjacent to the projected aperture when the positioning device is at the bottom of its stroke (the -2 position). This location coincides with that of the vertical positioning device required for super 8 camera original films and thereby improves steadiness through cancellation.

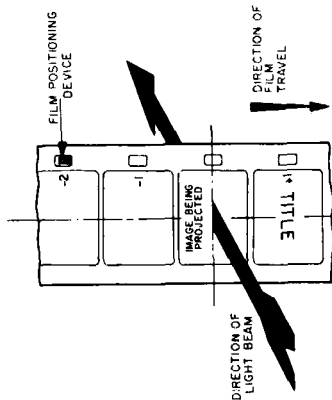
3. Projected Image Area

The dimensions and position of the projectable image area relative to the film-positioning perforation shall be as specified in American National Standard Dimensions of Projectable Image Area on Super 8 Motion-Picture Film, PH22.154-1969. It is customary to provide a framing movement of approximately 0.015 in (0.38 mm) above and below this position.

Appendix

The Appendix is not a part of this American National Standard, but is included for information purposes only.

Because of the increased intensity of illumination available in modern 8-mm projection systems, the industry has found it desirable to extend the flicker threshold by choosing as high a projection rate (and, therefore, as high a flicker frequency) as practicable. A projection



Film as Seen from Light Source in Projector

4. Projection Frame Rate

- 4.1** A projection frame rate of 24 frames per second shall be used for professional films containing a sound record which was recorded for 24-frame projection.
- 4.2** A projection frame rate of 18 frames per second shall be used for non-professional films containing a sound record which was recorded for 18-frame projection.

Specifications for Camera Usage of 8-mm Type S (Super 8) Motion-Picture Film

PH22.156
Revision of
PH22.156:1968

1. Scope

This standard specifies the emulsion position, the frame rate of exposure and the orientation of the area on 8-mm Type S (super 8) film being exposed in a motion-picture camera.

2. Emulsion and Film Position

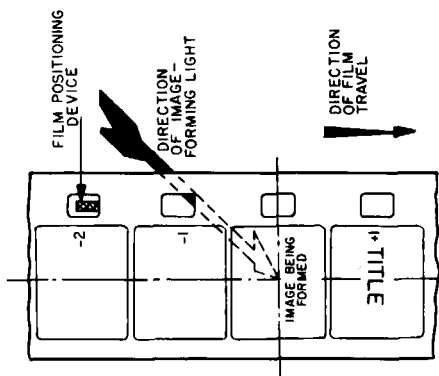
- 2.1** Except for special processes, the emulsion shall be toward the camera lens.
- 2.2** The perforation used for the film-positioning device shall be two perforations above the perforation adjacent to the image being formed when a positioning device is at the bottom of its stroke (the -2 position). This location coincides with that of the vertical positioning device required for the projected image and thereby improves steadiness through cancellation.

3. Exposed Image Area

The dimensions of the camera aperture image and its position relative to the film-positioning perforation shall be as specified in American National Standard Dimensions of Camera Aperture Image on Super 8 Motion-Picture Film, PH22.157-1971.

4. Exposure Frame Rate

- 4.1** A frame rate of 24 frames per second shall be used for films intended for (a) professional use with a sound record which was recorded for 24-frame projection, (b) 24-frame projection or (c) enlargement to 16-mm or other formats.



Film as Seen from Inside Camera Looking Toward Lens

- 4.2** A frame rate of 18 frames per second shall be used for non-professional films using single-system sound or post-processed magnetically-stripped film when the film is intended for projection at 18 frames per second.

NOTE: Professional films may be photographed at any rate from time-lapse to high-speed but are generally intended for projection at 24 frames per second, except when special study is desired.

SMPTE RECOMMENDED PRACTICE

RP 61

Specifications for Magnetic-Type Azimuth Test Film for 8-mm Type S (Super 8) Sound Reproducers

1. Scope

This recommended practice specifies two test films for use in aligning the azimuth of magnetic head gaps in 8-mm Type S (super 8) motion-picture sound reproducers, one operating at 20 ft (6.1 m) and another at 15 ft (4.6 m) per minute.

2. Test Film Signal

2.1 Recorded Frequency.

2.1.1 Type A Film. The sound record on the Type A film shall be an original recording which will reproduce at a frequency of 5000 ± 100 Hz when the linear velocity of the film is 24 frames per second or approximately 20 ft (6.1 m) per minute (4 in or 10.2 cm per second).

2.1.2 Type B Film. The sound record on Type B film shall be an original recording which will reproduce at a frequency of 5000 ± 100 Hz when the linear velocity of the film is 18 frames per second or approximately 15 ft (4.6 m) per minute (3 in or 7.6 cm per second).

2.2 Distortion. The total harmonic distortion of the recorded signal shall not exceed 1 percent.

2.3 Sound Record. The location and dimensions of the sound record shall be in accordance with American National Standard Position, Dimensions and Reproducing Speed of Magnetic Sound Record on 8-mm Type S (Super 8) Motion-Picture Film, PH22.164-1975.

2.4 Recorded Level. The recorded signal shall have a level of 6.0 ± 1.5 dB below the reference level of a frequency of 1000 Hz having an rms short-circuit flux per meter of track width of 200 nanowebers (0 dB). The signal level shall not fluctuate more than ± 0.5 dB within the test film length.

2.5 Flutter. The weighted peak flutter of the sound record shall not exceed 0.10 percent when measured in accordance with American National Stand-

ard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

2.6 Azimuth. The azimuth of the sound record shall be $90^\circ \pm 5'$ to the reference edge of the film.

3. Film Stock

The film stock shall be magnetic full-coat, splice-free, of the low-shrinkage, safety type in compliance with American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1967 (R1973) and cut and perforated in accordance with American National Standard Dimensions for 8-mm Type R (Regular 8) Motion-Picture Film Perforated 8-mm Type S (Super 8), IR, PH22.149-1973.

4. Identification

Each test film shall be identified by a suitable identification marking.

5. Calibration

5.1 Flux. The short-circuit flux on the test film shall be determined by means of the calibrated short-gap ferromagnetic core reproducer technique. This technique is described in American National Standard Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths, S4.6-1973.

5.2 Level. The signal level measurements specified in Sec. 2.4 shall be measured with a standard volume indicator conforming to American National Standard Volume Measurements of Electrical Speech and Program Waves, C16.5-1954 (R1961).

NOTE: Test films made in accordance with this recommended practice are available from the Society of Motion Picture and Television Engineers.

PROPOSED

SMPTE RECOMMENDED PRACTICE

RP 62

Specifications for Magnetic-Type Flutter Test Film for 8-mm Type S (Super 8) Sound Reproducers

1. Scope

This recommended practice specifies two test films for determining the presence of flutter in 8-mm Type S (super 8) motion-picture magnetic sound reproducers, one operating at 20 ft (6.1 m) and another at 15 ft (4.6 m) per minute.

2. Test Film Signal

2.1 Recorded Frequency.

2.1.1 Type A Film. The sound record on the Type A film shall be an original recording which will reproduce at a frequency of 3150 ± 25 Hz when the linear velocity of the film is 24 frames per second or approximately 20 ft (6.1 m) per minute (4 in or 10.2 cm per second).

2.1.2 Type B Film. The sound record on Type B film shall be an original recording which will reproduce at a frequency of 3150 ± 25 Hz when the linear velocity of the film is 18 frames per second or approximately 15 ft (4.6 m) per minute (3 in or 7.6 cm per second).

2.2 Distortion. The total harmonic distortion of the recorded signal shall not exceed 1 percent.

2.3 Sound Record. The location and dimensions of the sound record shall be in accordance with American National Standard Position, Dimensions and Reproducing Speed of Magnetic Sound Record on 8-mm Type S (Super 8) Motion-Picture Film, PH22.164-1975.

2.4 Recorded Level. The recorded signal shall have a level of 6.0 ± 1.5 dB below the reference level of a frequency of 1000 Hz having an rms short-circuit flux per meter of track width of 200 nanowebers (0 dB). The signal level shall not fluctuate more than ± 0.5 dB within the test film length.

2.5 Flutter. The weighted peak flutter of the sound record shall not exceed 0.10 percent when meas-

ured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

2.6 Azimuth. The azimuth of the sound record shall be $90^\circ \pm 5'$ to the reference edge of the film.

3. Film Stock

The film stock shall be magnetic full-coat, splice-free, of the low-shrinkage, safety type in compliance with American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1967 (R1973) and cut and perforated in accordance with American National Standard Dimensions for 8-mm Type R (Regular 8) Motion-Picture Film Perforated 8-mm Type S (Super 8), IR, PH22.149-1973.

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NOTE: Test films made in accordance with this recommended practice are available from the Society of Motion Picture and Television Engineers.

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ANNEX

For the purpose of choice of width, low-shrinkage film base is film base which :

- when coated with emulsion and any other normal coating treatment;
- perforated;
- kept in the manufacturer's normal commercial packings for 6 months at 18 to 24 °C (65 to 75 °F);
- exposed;
- processed;
- stored exposed to air for a period not to exceed 30 days at 18 to 24 °C and 50 to 60 % relative humidity;
- measured under like conditions of temperature and humidity.

This definition of low-shrinkage film stock has been found by experience to be useful as a guide to film manufacturers in slitting their film. Departure from this definition shall not be cause for rejection of the film. Note that this definition of shrinkage differs from the criterion applying to the choice of longitudinal pitch, where greater periods of time are involved and where short-time tests can be deceptive.

Allowance has been made in arriving at these values for the common tendency of film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design.

A.1 The dimensions given in this International Standard represent the practice of film manufacturers in that the dimensions and tolerances are for film stock immediately after cutting and perforating. (Except for dimensions A' and E which are for film after processing and slitting.) The punches and dies themselves are made to tolerances considerably smaller than those given, but since film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches, and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in changes in the dimensions during the life of the film. The change is generally uniform throughout a roll.

A.2 The uniformity of pitch, hole size, and margin (dimensions B, C, D and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next. Actually, it is the maximum variation from one perforation to the next within any small group of consecutive perforations that is important.

A.3 The width for 35 mm film is controlled by the shrinkage characteristics of the films involved. Thus, there have been standards for the width of 35 mm stock of the "usual" shrinkage and for stock of "low-shrinkage" characteristics. The purpose was to obtain films of approximately the same width regardless of the type of film base during their useful life. This International Standard is based on the values adapted to "low-shrink" film base since nearly all films now manufactured meet the definition given below :

Cinematography — 35 mm motion-picture film perforated 16 mm (1-3-0) — Cutting and perforating dimensions

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the cutting and perforating dimensions for 35 mm motion-picture raw stock with three rows of 16 mm perforations in positions 1-3-0, as well as the width of the 16 mm strip after processing and slitting the print stock.

2 REFERENCES

- ISO 69, *Cinematography — 16 mm motion-picture raw stock film — Cutting and perforating dimensions.*
- ISO/R 129, *Engineering drawing — Dimensioning.*
- ISO 543, *Cinematography — Motion-picture safety film — Definition, testing and marking.*

3 DIMENSIONS

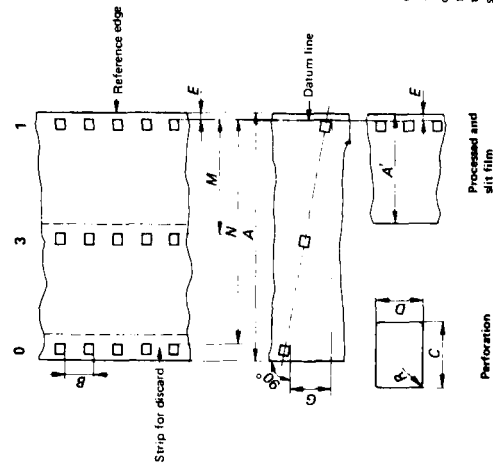
The dimensions and tolerances shall be as specified in the figure and table; they apply to safety raw stock film as defined in ISO 543, immediately after cutting and perforating.

If required by usage, the manufacturer should indicate the atmospheric conditions applied to the dimensional control at the time of cutting and perforating.

NOTE — The perforations in the 0 row are discarded after slitting two strips of nominal 16 mm width from the processed print stock. The 0 discard row of perforations should therefore be provided with a visual means of identification (such as ink or round holes). If round holes are used for identification, a 1,0 mm (0,04 in) nominal diameter is suggested and the frequency of occurrence should be between at least every fifth set of perforations.

Dimension	mm	in
A	34,975 ± 0,025	1,377 ± 0,001
A'	15,93 ± 0,05	0,627 ± 0,002
B	7,620 ± 0,010	0,300 ± 0,000 4
B'	7,605 ± 0,010	0,299 4 ± 0,000 4
C	1,830 ± 0,010	0,072 0 ± 0,000 4
D	1,270 ± 0,010	0,050 0 ± 0,000 4
F***	0,90 ± 0,05	0,035 5 ± 0,002 0
G	0,025 max.	0,001 0 max.
L**	762,0 ± 0,8	30,00 ± 0,03
L'***	760,5 ± 0,8	29,94 ± 0,03
M	15,95 ± 0,03	0,628 ± 0,001 0
N	31,34 ± 0,03	1,234 ± 0,001 0
R	0,25 ± 0,03	0,010 ± 0,001 0

* Dimensions B and L (strip perforation pitch) are provided to fulfil the requirements of continuous sprocket contact printing.
 ** Dimensions L and L' represent the length of any 100 consecutive perforation intervals.
 *** Dimension E, in inches, has been taken to one additional decimal place for greater accuracy. This is an optional dimension in the table for which the tolerances of parts are fixed by other tolerances, and where this occurs, the exclusion provided in sub-clause 1.2.5 of ISO/R 129 shall apply.



Cinematography — Spool, daylight loading type, for 35 mm motion-picture cameras (capacity 30 m — 100 ft) — Dimensions

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the dimensions and characteristics of the general purpose daylight loading spool with a nominal capacity of 30 m (100 ft) for use in 35 mm motion-picture cameras.

NOTE — The dimensions in this International Standard are in substantial agreement with corresponding dimensions for microfilm camera spools described in ISO/R 1116. (See the annex.)

2 REFERENCES

- ISO 491, *Cinematography — 35 mm motion-picture film — Cutting and perforating dimensions.*
- ISO/R 1116, *35 mm and 16 mm microfilms, spools and reels.*

3 DIMENSIONS

- The dimensions shall be as specified in the figures and tables.
- If the rivet heads or other fastening devices extend beyond the outer surface of the flange, they shall lie outside the K diameter area, but within the boundaries defined by the volume of rotation diagram.
- Dimension F represents a slot in the spool core for attaching film. The slot sides, starting immediately adjacent to each flange and running a minimum distance of 6,0 mm (0.24 in) from each flange toward the other, should be straight, parallel, and 0,7 to 1,5 mm (0,03 to 0,06 in) apart. The slot sides may diverge over the remaining (central) portions of the slot.
- Dimension J represents the thickness or effective thickness respectively of the spool within a K diameter area which is centred on the spindle hole axis of each flange.

3.5 A reference plane for each flange is defined by a plane perpendicular to the axis of the spindle and coincident with the surface of a flat 15,0 mm (0,59 in) diameter support which is in contact with the flange and centred on the spindle hole axis of the flange.

The dimension P is the distance measured outwardly from this reference plane (see note below) of rotation to the plane of rotation generated by the thickest and/or most eccentric point on the flange outside the K diameter area when the spool is rotated on an accurate, tight-fitting spindle. This includes rivets or other fastening devices, variations in flange thickness, flatness and lateral runout of the flanges.

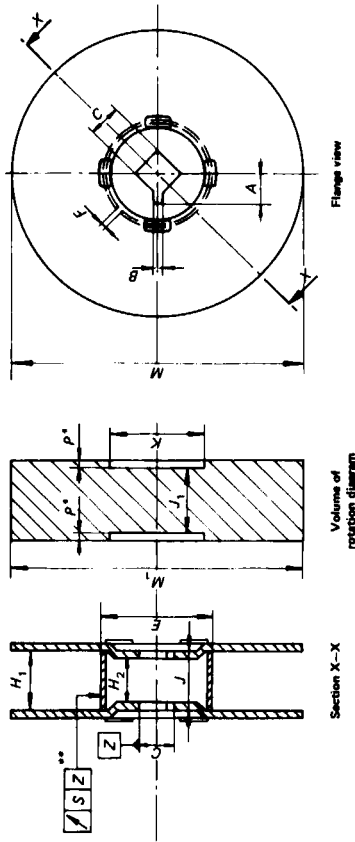
Selection of dimension P value is dependent upon the thickness of the material used for the flanges. According to the flange material thickness:

- the K diameter area may be depressed (with P greater than zero); or
- the outside surfaces of the flanges may be flat from spindle hole to periphery (with P equal to zero); or
- in the case of flanges made of very thin material, the K diameter area may be raised rather than recessed (effectively, P less than zero).

NOTE — The reference plane from which P is measured is not necessarily coincident with all points within the K diameter area, but only must be coincident with those points which are in contact with the reference support which has a diameter smaller than K .

3.6 The maximum effective thickness of spools (including all the characteristics mentioned in 3.5) outside the K diameter area has not been stated because it is a function of a spool's specific J value between the 15,0 mm (0,59 in) diameter reference zones on each flange. The largest such overall effective thickness, however, will be $J_{max} + 2P_{max} = 38,90$ mm (1,530 in).

3.7 The eccentricity of the core with respect to the spindle hole axis Z should not exceed a total radius variation (total indicator reading) of 1,0 mm (0,04 in) for all spool sizes.



• See 3.5 for explanation of P .
 •• See 3.7.

FIGURE — Daylight loading spools for 16 mm motion-picture cameras

TABLE — Dimensions for daylight loading spools for 16 mm motion-picture cameras

Dimension	Nominal spool size		mm	in
A	15 m	30 m	7,6 + 1,0 0	0,30 + 0,04 0
B	15 m	30 m	3,1 + 0,4 0	0,12 + 0,02 0
C (see 3.1)	15 m	30 m	8,06 + 0,15 0	0,317 + 0,006 0
E	15 m	30 m	32,0 ± 0,5	1,26 ± 0,02
F	15 m	30 m	54,0 ± 0,5	2,13 ± 0,02
M ₁	15 m	30 m	0,7 + 0,8 0	0,03 + 0,03 0
M ₂	15 m	30 m	16,06 + 0,35 0	0,632 + 0,014 0
J and J ₁	15 m	30 m	16,00 min.	0,630 min.
K	15 m	30 m	18,5 - 0,4	0,73 0 - 0,02
	15 m	30 m	25,5 min.	1,00 min.
M and M ₁	15 m	30 m	38 min.	1,5 min.
	15 m	30 m	71,5 0	2,81 0
P (see 3.5)	15 m	30 m	92,0 - 1,0	3,62 0 - 0,04
	15 m	30 m	126,0 0	4,96 0
S (see 3.7)	15 m	30 m	169,0 - 1,0	6,65 0
	15 m	30 m	0,50 max.	0,020 max.
			0,8	0,03

Spools for microfilm often employ offset drive holes and/or a drive slot as described in ISO/R 1116. Such holes are optional in spools described in this International Standard covering spools for motion-picture films. Manufacturers who might wish to make a single type of spool for both purposes would need to take the drive holes or slot into account when planning the size of fastening devices and the size of the *K* diameter area described in this International Standard. That is, the minimum diameter of the *K* area (and thus the circle described by the inner edges of fastening devices, if any) would have to be large enough (about 28,5 mm (1.12 in) minimum) to avoid interference with a drive slot.

Cinematography — Spool, daylight loading type, for 35 mm motion-picture cameras (capacity 30 m — 100 ft) — Dimensions

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the dimensions and characteristics of the general purpose daylight loading spool with a nominal capacity of 30 m (100 ft) for use in 35 mm motion-picture cameras.

NOTE — The dimensions in this International Standard are in substantial agreement with corresponding dimensions for microfilm camera spools described in ISO/R 1116. (See the annex.)

2 REFERENCES

ISO 491, *Cinematography — 35 mm motion-picture film — Cutting and perforating dimensions*.
 ISO/R 1116, *35 mm and 16 mm microfilms, spools and reels*.

3 DIMENSIONS

3.1 The dimensions shall be as specified in the figures and tables.

3.2 If the rivet heads or other fastening devices extend beyond the outer surface of the flange, they shall lie outside the *K* diameter area, but within the boundaries defined by the volume of rotation diagram.

3.3 Dimension *F* represents a slot in the spool core for attaching film. The slot sides, starting immediately adjacent to each flange and running a minimum distance of 6,0 mm (0,24 in) from each flange toward the other, should be straight, parallel, and 0,7 to 1,5 mm (0,03 to 0,06 in) apart. The slot sides may diverge over the remaining (central) portions of the slot.

3.4 Dimension *J* represents the thickness or effective thickness respectively of the spool within a *K* diameter area which is centred on the spindle hole axis of each flange.

3.5 A reference plane of rotation for each flange is defined by a plane perpendicular to the axis of the spindle and coincident with the surface of a flat 15,0 mm (0,59 in) diameter support which is in contact with the flange and centred on the spindle hole axis of the flange.

The dimension *P* is the distance measured outwardly from this reference plane (see note below) of rotation to the plane of rotation generated by the thickest and/or most eccentric point on the flange outside the *K* diameter area when the spool is rotated on an accurate, tight-fitting spindle. This includes rivets or other fastening devices, variations in flange thickness, flatness and lateral runout of the flanges.

Selection of dimension *P* value is dependent upon the thickness of the material used for the flanges. According to the flange material thickness:

- 1) the *K* diameter area may be depressed (with *P* greater than zero), or
- 2) the outside surfaces of the flanges may be flat from spindle hole to periphery (with *P* equal to zero); or
- 3) in the case of flanges made of very thin material, the *K* diameter area may be raised rather than recessed (effectively, *P* less than zero).

NOTE — The reference plane from which *P* is measured is not necessarily coincident with all points within the *K* diameter area, but only must be coincident with those which are in contact with the reference support which has a diameter smaller than *K*.

3.6 The maximum effective thickness of spools (including all the characteristics mentioned in 3.5) outside the *K* diameter area has not been stated because it is a function of a spool's specific *J* value between the 15,0 mm (0,59 in) diameter reference zones on each flange. The largest such overall effective thickness, however, will be $J_{max} + 2P_{max} = 38,90$ mm (1,530 in).

3.7 The eccentricity of the core with respect to the spindle hole axis, *Z*, should not exceed a total radius variation (total indicator reading) of 1,0 mm (0,04 in) for all spool sizes.

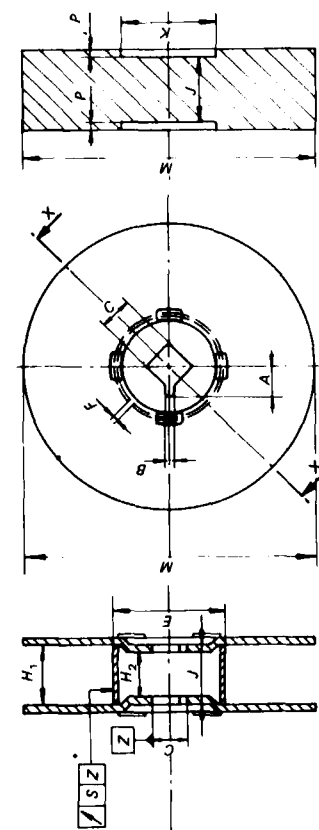


FIGURE 1 - Flange No. 1 (That which first engages the camera spindle)

FIGURE 2 - Volume of rotation diagram

Section X-X

Dimension	mm	in
A	7.6 +1.0 0	0.30 + 0.04 0
B	3.1 +0.4 0	0.12 + 0.02 0
C	8.05 + 0.15 0	0.317 + 0.006 0
D	5.40 min.	0.213 min.
E	32.0 ± 0.5	1.26 ± 0.02
F	0.7 - 0.8 0	0.03 + 0.03 0
H ₁	35.10 + 0.40 0	1.382 + 0.016 0
H ₂	35.00 min.	1.378 min.
J	37.9 0 - 0.8	1.49 - 0.03 0
K	25.5 min. ¹⁾	1.00 min.
M	92.0 0 - 1.0	3.62 0 - 0.04
P (see 3.5)	0.50 max.	0.020 max.
U	8.15 ± 0.15	0.321 ± 0.006
V	11.2 0 - 0.2	0.44 0 - 0.01

1) The metric dimension specified is not a direct conversion from the basic inch dimension, but has been chosen to reflect current engineering practice in metric countries using the metric system.

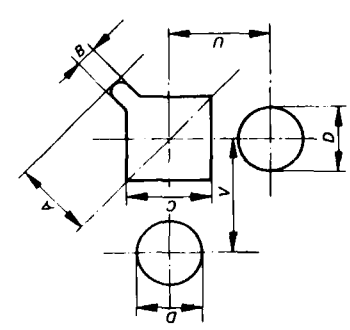


FIGURE 3 - Spindle and drive holes in flange No. 1 (see 4.2.3)

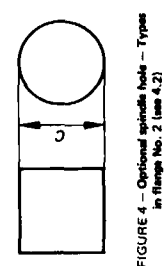


FIGURE 4 - Optional spindle hole - Types in flange No. 2 (see 4.2)

4. SPINDLE HOLE ALIGNMENT

4.1 The spindle holes provided in flanges 1 and 2 shall be of the shapes and combinations described in one of the following clauses.

4.2 When square holes are used in both flanges, the alignment of the sides of the squares in the two flanges shall be such that a test bar 8.03 mm (0.316 in) square may be passed completely through the spool.

4.2.1 (Recommended for future construction)

Flanges Nos. 1 and 2 as in the figures, additional optional features are:

- a) a second keyway opposite the keyway shown in flange No. 1,
- b) a single keyway in flange No. 2.

4.2.2 (Permissible)

Flange No. 1 - as in figure 1 (optional): a second keyway opposite the keyway shown

Flange No. 2 - round hole with diameter equal to the dimension C

4.2.3 If drive holes are provided in the flanges, they shall be as shown in figure 3 and the table, except that the following option concerning offset drive holes also is acceptable:

The offset drive holes may be located anywhere on the circles which are described by the radii U and V so long as both holes are rotated an equal amount, and in the same direction from the position shown in the figure.

NOTES

1. When the loaded camera is viewed from the side, with the lens to the left and the bottom of the housing downward (regardless of whether the spool loading mechanism is visible from the side), both the supply and take-up spools rotate in a clockwise direction.
2. Flanges shall be opaque and have low reflectance characteristics.

ANNEX

Spools for microfilm often employ offset drive holes and/or drive slot as described in ISO/R 1116. Such holes are optional in spools described in this International Standard covering spools for motion-picture films. Manufacturers who might wish to make a single type of spool for both purposes would need to take the drive holes or slot into account when planning the size of fastening devices and the size of the K diameter area described in this International Standard. That is, the minimum diameter of the K area (and thus, the circle described by the inner edges of fastening devices, if any) would have to be large enough, about 28.5 mm (1.12 in) minimum, to avoid interference with a drive slot.

* See 3.7. This symbol signifies the runout of the cylindrical surface of the core with respect to the Z axis in the manner prescribed in ISO/R 1101, Tolerances of form and position - Part 1: Generalities, symbols, indications on drawings.