INTERNATIONAL STANDARD

ISO 1007

Second edition
1995-11-01

Photography — 135-size film and magazine — Specifications

Photographie — Film et cartouche de format 135 — Spécifications

Reference number
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Contents

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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 1007 was prepared by Technical Committee ISO/TC 42, *Photography*.

This second edition cancels and replaces the first edition (ISO 1007:1979), which has been technically revised as explained below.

This edition of ISO 1007 includes the following significant additions and changes.

a) Addition of product features which are now referred to as "DX":

   — a latent-image digital bar-code, which can be used by photofinishers to optimize colour printing of developed colour negative films; to include optional frame number bar-code systems;

   — specifications for a bar-code on the magazine; this feature facilitates the photofinisher's presort operations by identifying the product and the number of exposures contained within the magazine;

   — specifications for an electrically readable binary code on the magazine (CAS code) to encode speed, number of exposures and exposure latitude;

   — specifications for an information panel on the magazine. The photographer can read the panel through a window on the camera, thereby identifying the camera's contents.

b) The manner of describing magazine dimensions has been reworked completely to a series of references from datum planes. A number of new dimensions have been added.

c) The film dimensions have also been referenced to a magazine datum plane:

   — a new dimension, Y_7, has been added to figure 1; this specifices the amount of film extending from the magazine when the film is in its initial position;

   — several new dimensions define corner-rounding requirements for the tip of the tongue;

   — all dimensions are in millimetres only. Both inch references and "number of perforation pitches" have been removed.

d) The specification for film pull-out force has been improved.

e) A new specification for film-spool attachment strength has been added.

f) The informative annexes have been expanded and improved.

Annexes A, B and C of this International Standard are for information only.

Photography — 135-size film and magazine — Specifications

1 Scope

This International Standard specifies the following.

a) Dimensions of four standard film lengths normally supplied. The film lengths provide, respectively, a nominal number of twelve, twenty, twenty-four or thirty-six 24 mm × 36 mm full-frame exposures or twenty-four, forty, forty-eight or seventy-two 18 mm × 24 mm half-frame exposures.

b) Latent-image frame numbering.

c) Latent-image digital bar-codes to identify the film product class and the individual film product, in the case of colour negative films.

d) Dimensions of daylight-loading film magazines for use in 35-mm still-picture cameras.

e) Magazine bar-codes to identify the film product and the nominal number of exposures in the roll.

f) Camera autosensing areas, which provide an electrically readable encodement of ISO speed, number of exposures and recommended exposure latitude setting for appropriately designed cameras.

g) Information panel on which the film identification, ISO speed and number of exposures are visible through a window in the back of the camera.

h) Film pull-out force specification.

i) Film-spool attachment strength specification.

This International Standard is not intended to apply to "bulk" 35-mm film for reloading into 135-magazines nor to the reloadable magazines themselves.

NOTE 1 It is not intended in this International Standard to specify the actual location of photographic images on film.

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

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

ISO 897:1988, *Photography — Roll films, 126, 110 and 135 size films — Identification of the image-bearing side.*

3 Conditions for measurement of dimensions

The dimensions and tolerances specified in this International Standard apply at the time of manufacture (except where specifically stated otherwise),

measured under atmospheric conditions of (23 ± 2) °C and (50 ± 5) % relative humidity, as specified in ISO 554[1].

4 Film and perforating dimensions

4.1 Film dimensions

The film shall conform to the dimensions shown in figure 1 and given in table 1 as well as figure 2 and table 2.

4.1.1 Leader

The leader length dimension ($Y_1 + Y_4$) is that part of the film that precedes full-frame number 1 and includes the tongue. It is used for threading the camera and protecting the picture area from unintentional exposure. The film manufacturer may utilize the portion of the leader extending from the magazine for identification purposes, provided that the identification technique causes no functional problems.

4.1.2 Tongue

The tongue is the narrow part of the leader, dimension Y_5 in width and dimension Y_4 in length, shaped to facilitate threading the camera. The profile at the corners of the extreme end of the film tongue shall be rounded within the limits shown in figure 1 b) and given in table 1. The corners shall have no stepped or sharp features. The cut across the end of the tongue shall not have steps that exceed 1,27 mm.

4.1.3 Trailer

The trailer, dimension Y_3 in length, is that part of the film that extends from the last full-frame number to the B datum plane when the film has been pulled out as far as possible from the magazine. The trailer shall be composed entirely of full-width film to assure proper rewinding into the magazine.

4.1.4 Width and perforating dimensions

The film width and perforations shall conform to the dimensions shown in figure 2 and given in table 2.

5 Latent-image frame numbering

Two sets of frame-number sequences, together with their location and orientation, are shown in figure 1 c).

The first set shall be provided on the edge nearest to the C datum plane (see figure 4). It shall be numbered in a half-frame series (1, 1A, 2, 2A, ..., 36, 36A), which increases in sequence from 1 to 12A (or 20A, 24A, 36A) interspersed at four-perforation intervals. A second set may be provided on the edge opposite the first set. If provided, it may be numbered either in a full-frame series (1, 2, ..., 36) which increases in sequence from 1 to 12 (or 20, 24, 36) at intervals of eight perforations or, if provided as part of the optional single-track latent-image frame number bar-code (see 6.2), it may be numbered in a half-frame series (1, 1A, 2, 2A, ..., etc.).

The image-bearing side of colour negative films shall be designated by an arrow, placed adjacent to each half-frame character (1A, 2A, 3A, etc.) and shall be oriented as shown in figure 1 c) in accordance with ISO 897. Use of the arrow for other than colour negative films is preferred, but not required.

Portions of the leader, the trailer, or both may be identified at full-frame or half-frame intervals, or both, at the manufacturer's discretion.

The numerals shall read correctly from the non-image-bearing side.

The position of the frame number is defined as the centre of each full-frame or half-frame identification (1, 1A, 2, 2A, etc.).

6 Latent-image digital bar-codes

A 23-bit, dual-track, latent-image bar-code, which identifies the manufacturer/film type, shall be located on the edge nearest the C datum plane adjacent to each full-frame and half-frame number on films designed for colour negative processing. After the film has been processed, the bar-code is visible. When processed film is used with an appropriate film code reader and an automatic printer, colour printing can be optimized for each specific film so identified.

Frame-number information may also be incorporated in different ways. One method is to expand the basic 23-bit, dual-track latent-image code by adding eight more bits for frame-number information. Another method would be to print a 13-bit single-track, modified 3-of-9 latent-image code on the film edge opposite the 23-bit (or expanded 31-bit) dual-track code.

Use of latent-image bar-codes on films other than colour negative films is optional.

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

The latent-image bar codes shall have the locations and the dimensions shown in figure 1, c) to h).

6.1 Dual-track latent-image bar-code

The dual-track bar-code consists of adjacent data and clock tracks, each with 23 equal-width bar elements (31 in the expanded code). Each bar element represents a digital binary bit, with exposed bars representing a 1 bit and unexposed bars representing a 0 (zero) bit.

6.1.1 Description of data track

6.1.1.1 Entry pattern

The 6-bit entry pattern is used by a bar-code reader to detect the beginning of a code sequence.

6.1.1.2 Identification array for film-product-class

This 7-bit array shall encode the specific combination code number specified in table 3 that has been assigned to the film-product-class under the procedure described in annex C. Any *individual* location assigned as part of the combination code number shall represent an exposed bar. A dash (—) in table 3 represents an unexposed bar. A manufacturer may use a single combination code number to identify several individual film products which may be developed in the same photographic process.

For convenience in referencing, the 128 possible combinations of the film-product-class array are systematically arranged in an ascending binary sequence in table 3. Bar position number 1 is part of the entry pattern and always remains unexposed. In the binary sequence, an exposed bar represents a 1-bit, with bar position number 2 representing the most significant bit, and bar position number 8 representing the least significant bit. Bar position number 1, since it is always unexposed, is not included in the binary bit string.

6.1.1.3 Unassigned bit

This unassigned bit shall be an unexposed bar.

6.1.1.4 Identification array for film specifier

This 4-bit array shall encode the specific combination code number in table 4 that has been assigned to the product under the procedure described in annex C. Any *individual* location assigned as part of the combination code number shall represent an exposed bar. A dash (—) in table 4 represents an unexposed bar.

The 16 possible combinations of the specifier array are coded as a 4-bit binary number, with bar position number 9 representing the most significant bit, and bar position number 12 representing the least significant bit.

The film-product-class array may be used independently, without employing the specifier array. The specifier array codes, however, shall not be used unless accompanied by the film-product-class array, because this could cause bar-code readers to misinterpret the array. Therefore, a specifier combination code number will not be assigned unless the manufacturer has already obtained an appropriate film-product-class code number for the film.

CAUTION — It is possible that the same specifier array may be combined with different film-product-class arrays to represent film products of different manufacturers. Therefore, it is the **combination** of the two arrays that is unique to any given product.

6.1.1.5 Identification array for frame number

This optional 7-bit array may be added to encode whole and half-frame numbers in accordance with the patterns specified in table 6. Bar positions 13 to 18 are a 6-bit binary representation of the frame number, with position number 13 representing the most significant bit, and position number 18 representing the least significant bit. Frame numbers prior to the zero frame number are derived by successive binary subtraction. Bar position number 19 is exposed in those arrays that encode half-frame numbers (half-frame flag).

6.1.1.6 Second unassigned bit

A second unassigned bit shall be included only if the optional frame number array is included. This second unassigned bit shall be an unexposed bar.

6.1.1.7 Parity bit

This shall be provided, using an exposed bar, to create even parity with data bits 1 to 12 inclusive. (The total number of exposed bars in data positions 1 to 12, plus the parity position, shall be an even number.) Under the optional, dual-track, frame numbering system, the parity bit is used to create even parity with data bits 1 to 19 inclusive.

6.1.1.8 Exit pattern

The 4-bit exit pattern is used by a bar-code reader to detect the end of a code sequence.

6.1.2 Description of clock track

The clock track shall be comprised of 23 bits if the data track does not contain optional frame number encoding, or 31 bits if frame number encoding is included in the data track. Each change in clock track density signifies the location of a data bit in the data track. [See figure 1 e) and f).]

6.1.3 Description of quiet zones

Quiet zones shall be provided on both ends of the bar-code, as shown in figure 1 d) and given in table 1.

6.2 Single-track latent-image frame number bar-code

The optional single-track frame number bar-code consists of seven bar elements interleaved with six space elements. Bar and space elements are either wide or narrow. Each element represents a digital binary bit, with wide elements representing a 1 bit and narrow elements representing a 0 bit.

6.2.1 Definition of data patterns

6.2.1.1 Entry pattern

The entry pattern consists of one wide bar followed by one narrow space. It is used by a bar-code reader to detect the beginning of a code sequence.

6.2.1.2 Frame number sequence

The frame number sequence consists of five bar elements interleaved with four space elements. There are three wide elements (3-of-9) and six narrow elements in each of the valid frame number sequences. The pattern of each of the valid frame number sequences is given in tables 5 and 6, where a number in the bit column designates a 1 bit (wide element) and a dash (—) designates a 0 bit (narrow element).

An optional end of roll sequence is provided for use at a location one full-frame pitch beyond the last full-frame number bar-code sequence (frame number E in table 5).

Alternative frame number sequences are provided for the last full-frame and half-frame numbers to indicate end of roll in 12, 20 and 24 exposure lengths. These alternative codes are marked with asterisks in table 5.

6.2.1.3 Exit pattern

The exit pattern consists of one narrow space followed by one narrow bar. It is used by a bar-code reader to detect the end of a code sequence.

6.2.2 Definition of quiet zones

Quiet zones shall be provided on both ends of the bar-code, as shown in figure 1 g) and given in table 1.

6.3 Density specifications

The status M red (640 nm) density of the unexposed bars (D min.) shall not exceed 0,50 and the delta density between an unexposed bar and an exposed bar shall be a minimum of 0,50.

The 690 nm density of the unexposed bars (D min.) shall not exceed 0,65 and the delta density between an unexposed bar and an exposed bar shall be a minimum of 0,90.

These conditions apply at the time of photofinishing, assuming the product has been kept under the manufacturer's recommended storage conditions and that the expiration date has not been exceeded.

7 Magazine dimensions

Magazine dimensions shall conform to those shown in figure 3 and given in table 7.

8 Magazine bar-code requirements

This is a machine-readable, interleaved 2-of-5 bar-code pattern, which provides a unique product identification number and the number of full-frame exposures contained within the magazine. This information is helpful, particularly to the photofinisher in presort operations.

8.1 Magazine bar-code requirements

The bar-code shall have the locations and the dimensions shown in figure 4 and given in table 8. The bar height is specified by dimensions W_5 and W_6, and the total bar-code width is specified by dimension W_4.

Quiet zones shall be provided on either side of the bar-code as shown in figure 4. The quiet zone is the area immediately preceding the start character and following the stop character. These quiet zones shall contain no markings.

The human-readable interpretation of the bar-code shall be located between the lip of the magazine and the edge of the magazine bar-code. It shall be nominally centred on the bar-code.

8.2 Bar-code print requirements

8.2.1 Reflectance

The minimum reflectance of the spaces shall be 35 %. The maximum allowable reflectance of the dark bars is related to the reflectance of the bar-code spaces and should be calculated from the following:

$$R_D = R_L/4$$

where

R_D is the maximum bar reflectance;

R_L is the space reflectance.

8.2.2 Contrast

The minimum print contrast signal (PCS) is 75 %. Symbol aberrations are acceptable if all or part of one imperfection is included in the following tests.

a) **Print contrast:** Minimum contrast specification shall be met.

b) **Space reflectance:** If the imperfection lies in a space, the minimum space reflectance specification shall be met.

8.3 Bar-code identification system

The bar-code provides six digits of information which identify the film and the number of exposures contained in the magazine.

Digit 1 is always 0.

Digits 2 to 5 yield a number which is the "film-product-class identification combination code number" multiplied by 16, plus the "film-specifier identification combination code number", as described in clause 6.

Digit 6 is the numerical equivalent assigned to correlate with the number of exposures (table 9).

CAUTION — New lengths not listed in table 9 are becoming more popular. Coding of digit 6 may vary in order to accomodate these new lengths.

9 Camera auto-sensing (CAS) areas

Camera auto-sensing utilizes a set of electrical probes, in an appropriately designed 135-size camera, that contacts a pattern of conductive or insulated areas on the magazine. The arrangement of these areas provides an electrically readable encodement of ISO speed or manufacturer's recommended exposure index, number of exposures and recommended exposure latitude.

9.1 Dimensions

Dimensions of the camera auto-sensing areas and the limits of the camera probe locations shall conform to the values shown in figure 5 and given in table 10. The areas limiting probe locations ($X_7 \times X_{14}$) are much smaller than the sensing areas on the magazine. This allows for variations in

a) dimensions of the magazine chamber in the camera,

b) dimensions of magazines from different manufacturers, and

c) alternative systems of seating magazines in different cameras.

Without this factor of safety, it would be possible for a probe to read the wrong block in the CAS area.

9.2 Location and code assignments

These are identified in figure 5 by the view "Typical magazine sensing area" and by tables 10 to 13. In each table, a number under the sensing area represents a conducting area; a dash (—) represents an insulated area. Numbers 1 and 7 are common/return contact areas. Sensing areas 2 to 6 encode the ISO speed or manufacturer's recommended exposure index, as assigned in table 11. Sensing areas 8 to 10 encode the number of exposures, as shown in table 12. Sensing areas 11 and 12 encode exposure latitude, as described in table 13.

9.3 DC electrical characteristics

Conductive areas are defined by the potential drop (V_{OL}) across the series combination of the common contacts and any other contact (see figure 6).

Insulated areas are defined by the insulation resistance (R_i). The insulation resistance is calculated as

$$R_i = V_{OL}/I_{DC}$$

where I_{DC} is the measured current through the contact series combination of the common contacts and any other contact.

Open current voltage is

V_{DC} = 1,5 V min. and 9,0 V max.

Limited current is

V_{DC}/R_{CL}) = 15 µA min. and 10 mA max.

where

V_{DC} is the DC voltage used in the power supply of the test circuit;

R_{CL} is the resistance of a current-limiting resistor used to limit current flow in the test circuit.

10 Information panel

This area displays key information about the film contained within the magazine. It is visible through a window in the back of any appropriately designed camera.

10.1 Location and dimensions

The information panel area shall be located on the magazine surface and shall have the dimensions shown in figure 7 and given in table 14.

10.2 Contents of the information panel

The human-readable data located within the information panel shall contain the following:

a) film identification;

b) ISO speed or manufacturer's recommended exposure index;

c) number of exposures.

If the ISO speed or exposure index is included in the film identification a), it need not be repeated to fulfil b).

11 Film pull-out force

The initial force to begin pulling the film out of the magazine lip shall be 5,0 N max. After 100 mm of film has been extracted from the magazine, this force shall not exceed 2,5 N throughout the balance of the roll. These specifications apply both at the time of manufacture and throughout the manufacturer's specified product life (when stored according to the manufacturer's recommendations for storage).

12 Film-spool attachment strength

A pulling force of 40 N on the film shall not break the film-spool attachment. The 40 N specification applies both at the time of manufacture and throughout the manufacturer's specified product life (when stored according to the manufacturer's recommendations for storage).

Table 1 — Dimensions of 135-size film and latent-image identification (see figure 1)

Dimensions in millimetres

Symbol	Min.	Basic	Max.	Remarks
Y_1	161,5		185,25	See note 1
Y_2				See note 2
		418		12 exposures
		722		20 exposures
		874		24 exposures
		1 330		36 exposures
Y_3	72,41		—	See note 3
Y_4	38,10		40,77	See note 4
Y_5	—		23	See note 5
Y_6				See note 6
	689,91		—	12 exposures
	993,91		—	20 exposures
	1 145,91		—	24 exposures
	1 601,91		—	36 exposures
Y_7	43,91		71,76	See note 7
Y_8	—		5	—
Y_9		3		—
Y_{10}	—		1,3	—
Y_{11}	0,8		—	—
Y_{12}	—		0,2	—
Y_{13}	6,35		—	See note 8
Y_{14}		11,43		See note 8
Y_{15}		38		See note 9
Y_{16}		19		See note 9
Y_{17}				See note 10
Y_{18}				See note 10
Y_{19}			0,5	See note 11
T_1	0,38		0,53	See note 12
T_2	0,75		1,26	—

Symbol	Min.	Basic	Max.	Remarks
T_3	2,06		2,60	—
T_4	0,38		—	Quiet zone
T_5	1,5		—	Quiet zone
T_6	0,95		1,11	Wide element
T_7	0,38		0,54	Narrow element

NOTES

1 Reference point for the dimensions is the full-frame number 1 (see clause 5).

2 Distance from the first designated full-frame number to the last designated full-frame number.

3 Distance from the last designated full-frame number to the B datum plane.

4 Distance from the end of the film to the leading edge of the first perforation in the full-width portion of the film.

5 The measurement of tongue width is made at the extreme end. The shape of the rest of the tongue is optional.

6 Reference dimension is the minimum total film length from the end of the tongue to the B datum plane when the film is fully extended from the magazine.

7 Distance from the end of the tongue to the B datum plane when the film is in initial position.

8 Dimensions Y_{13} and Y_{14} refer to dual-track latent-image bar-codes. Y_{14} includes quiet zones. Y_{13} is not specified under the optional frame-number bar-code system.

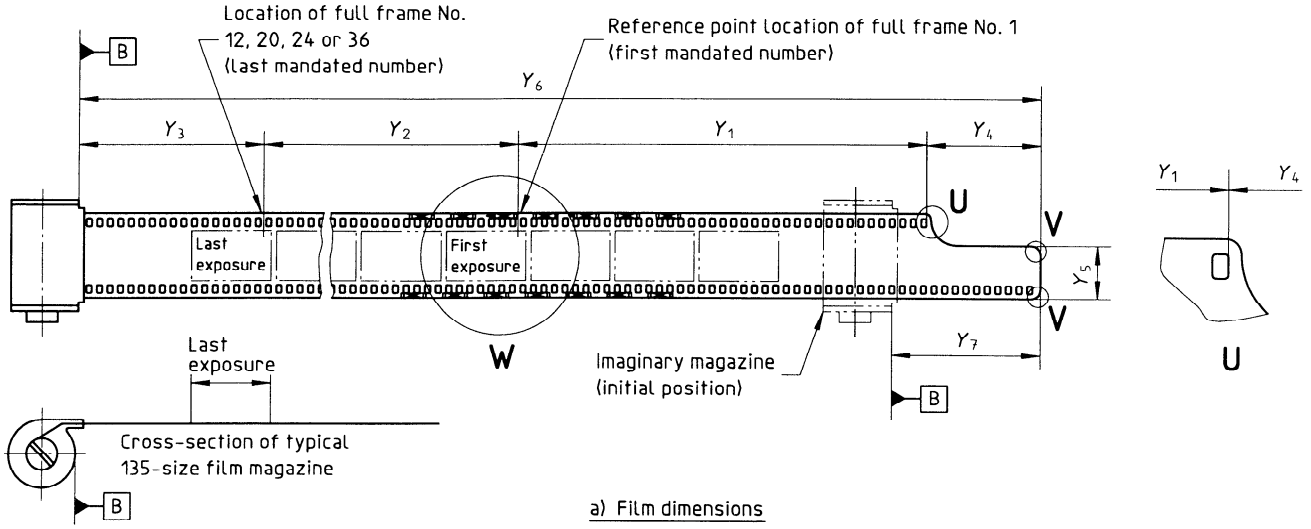
9 Full-frame (Y_{15}) and half-frame (Y_{16}) pitch are basic dimensions.

10 Y_{17} and Y_{18} are used to define the centreline of the eye-readable frame number.

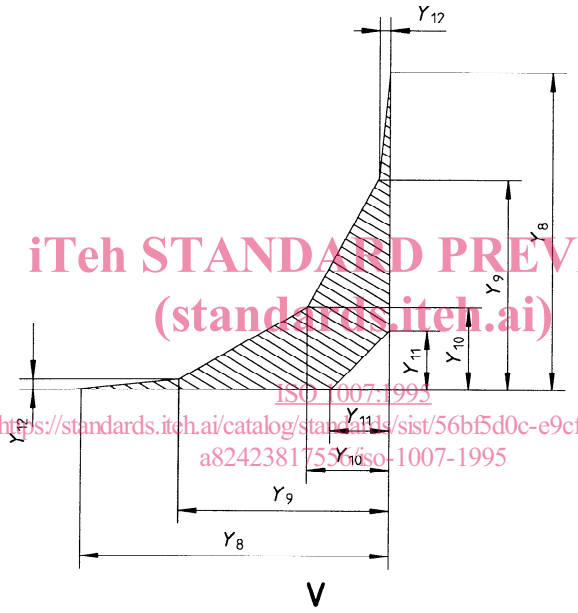
11 Y_{19} is always a positive number.

12 T_1 is the width of any bar (exposed or unexposed) in the clock track or data track, or both. In order to enhance the effectiveness of some bar-code readers, the edge of any bar in the data track should be linear with an edge of a bar in the clock track.

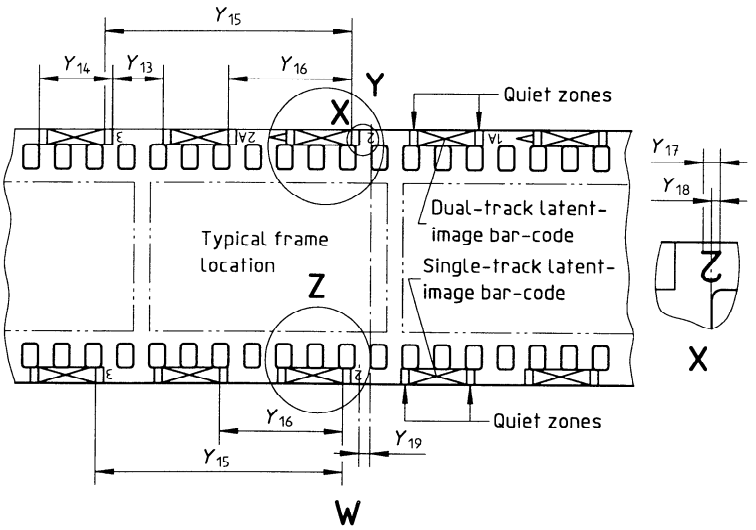
CAUTION — The measurement method for element width is critical. Technical experts are contemplating initiation of a study to improve the recommendations for element-width measurement and are considering modification to the specification for the minimum element width, such that narrower elements may be allowed.



a) Film dimensions



b) Limits of rounded corners on tongue



c) Bar-code location, frame number and arrow orientation

Figure 1 — Dimensions of 135-size film and latent image bar-codes *(continued)*