INTERNATIONAL STANDARD

ISO 12222

Third edition
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Cinematography — Manufacturer-printed, latent image identification on 16 mm, 35 mm and 65 mm motion-picture film — Specifications and dimensions

Cinématographie — Identification d'image latente, imprimée par le fabricant, sur films cinématographiques 16 mm, 35 mm *et* 65 mm — *Spécifications et dimensions*

Reference number
ISO 12222:2000(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12222 was prepared by Technical Committee ISO/TC 36, *Cinematography*.

This third edition cancels and replaces the second edition (ISO 12222:1998), subclauses 3.1, clause 4, 5.1.1, 5.4.5, 5.4.6, 5.4.7, 6.1.3.3 b), 6.1.3.3 d), 6.4.7, 6.4.8 and 7.3, Figures 3, 6 and 8, and Tables 1, 4 and 5 of which have been technically revised. Subclause 5.4.8 was added.

INTERNATIONAL STANDARD ISO 12222:2000(E)

Cinematography — Manufacturer-printed, latent image identification on 16 mm, 35 mm and 65 mm motion-picture film — Specifications and dimensions

1 Scope

1.1 This International Standard specifies the position and dimensions of machine-readable identification numbers on 16 mm, 35 mm and 65 mm motion-picture film. These numbers are intended to be a machine-readable version of the latent image key number. This International Standard also specifies the encoding format to be used for these machine-readable numbers, as well as the area scanned and the spectral characteristics of the scanner.

1.2 This International Standard also specifies the position, dimensions and content of human-readable identification (key) numbers for use on 16 mm, 35 mm and 65 mm motion-picture films intended for original photography or intermediate printing which also include the machine-readable key number described in 1.1.

NOTE These numbers normally are exposed onto the film at the time of manufacture.

1.3 This International Standard further specifies an area that may be used for optional manufacturer-specific film-type identification information.

1.4 This International Standard also specifies an area on the film which is not to be exposed by the film manufacturer, thus leaving it available for customer data recording.

1.5 Finally, this International Standard specifies an optional frame line index mark for 35 mm and 65 mm film.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 69:1998, *Cinematography — 16 mm motion-picture and magnetic film — Cutting and perforating dimensions.*

ISO 491:1995, *Cinematography — 35 mm motion-picture film and magnetic film — Cutting and perforating dimensions.*

ISO 3023:1995, *Cinematography — 65 mm and 70 mm unexposed motion-picture film — Cutting and perforating dimensions.*

ANSI/AIM BC4-1995, *Uniform Symbology Specification — Code 128.*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
key number
edge number
footage number
identification number that is printed with ink or exposed onto the film at the time of manufacture

NOTE The numbers are placed at regular intervals, typically every 20 perforations for 16 mm film, 64 perforations for 35 mm film and 120 perforations for 65 mm film. For the purposes of this International Standard, the key numbers are latent-image exposed.

3.2
bar edge
⟨bar code⟩ that point where the transmittance is halfway between the maximum transmittance of the adjacent space and the minimum transmittance of the adjacent bar

3.3
scan transmittance profile
⟨bar code⟩ record of the transmittance measured as a function of distance along the entire bar code symbol

3.4
symbol contrast
SC
⟨bar code⟩ difference between the largest transmittance (T_{max}) and smallest transmittance (T_{min}) in a scan transmittance profile

3.5
minimum edge contrast
EC_{min}
⟨bar code⟩ minimum difference between a space transmittance (T_s) and the adjoining bar transmittance (T_b)

3.6
modulation
MOD
⟨bar code⟩ ratio of minimum edge contrast (EC_{min}) to symbol contrast (SC)

4 General format

The general format of the latent-image identification information shall be as shown in Figure 1 for 16 mm film, Figure 2 for 35 mm film, and Figures 3a) and 3b) for 65 mm film.

No latent information shall be placed along the upper edge of the film, as shown in Figures 1, 2 and 3. This area is reserved for data recording at the time of photography.

This identification information is intended to be exposed onto film cut and perforated in accordance with ISO 69, ISO 491 or ISO 3023.

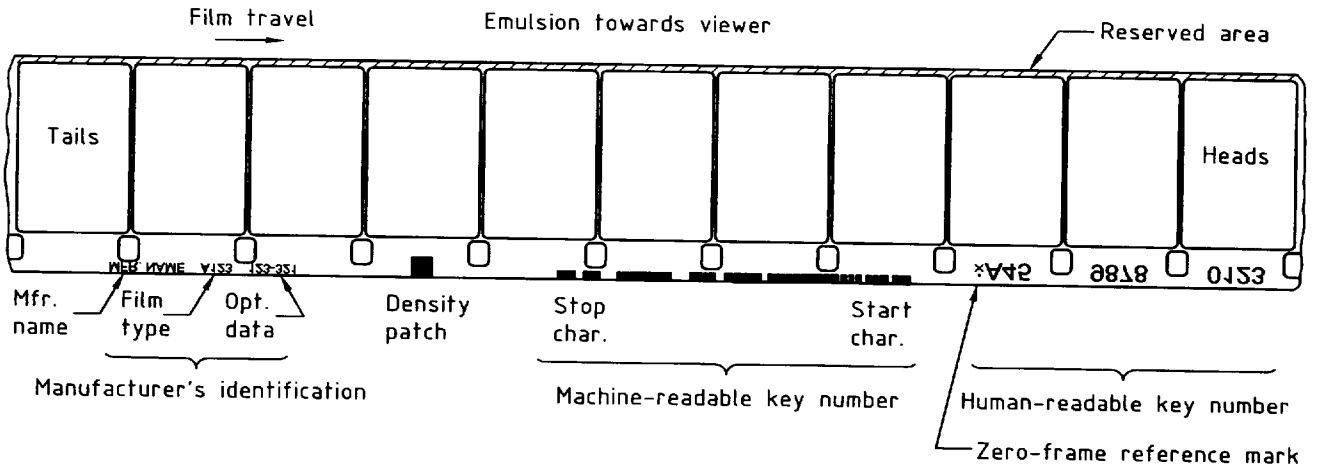


Figure 1 — General format on 16 mm film

5 Human-readable key numbers

5.1 Human-readable key number specifications applicable to 16 mm, 35 mm and 65 mm film

5.1.1 General

An incrementing, human-readable key number shall be printed onto the film at the time of manufacture. The film shall be supplied to the user with the lowest number at the outside of the roll unless the sales format of the unit shown states differently. The human-readable key number shall consist of two alphabetic characters and 10 numerical characters. For 16 mm film, this alphanumeric code shall be separated into three groups of four characters, as shown in Figure 1. For 35 mm and 65 mm film, this alphanumeric code shall be separated into groups of two alphabetic characters and two, four and four digits, separated by spaces, as shown in Figures 2, 3a) and 3b).

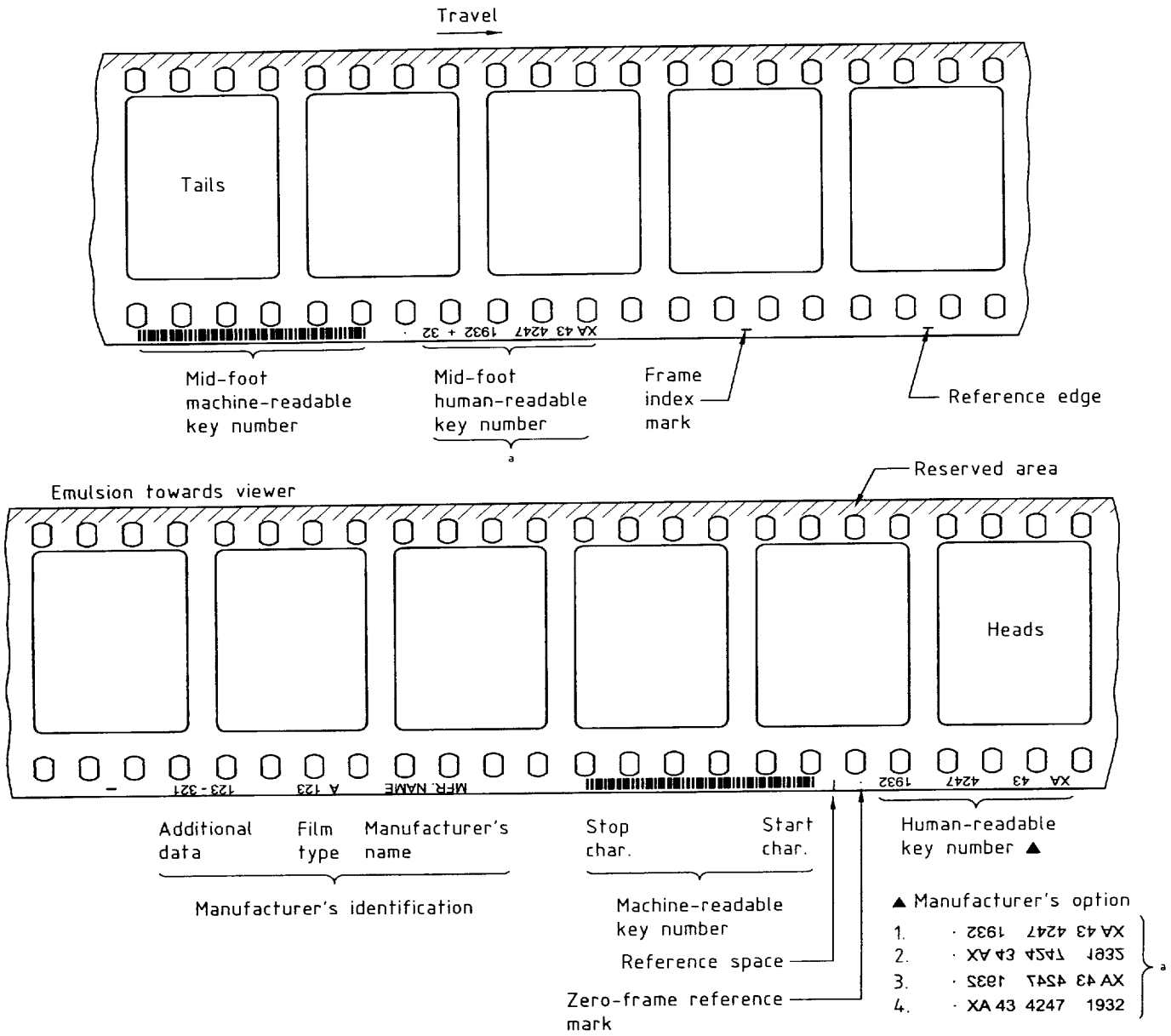
5.1.2 Alphabetic characters

The first two alphabetic characters of the key number identify the manufacturer and film type. The character set used shall be the normal upper-case letters A through Z.

The first alphabetic character shall identify the film manufacturer, according to Table 1. Other letters are reserved for future assignment by ISO/TC 36. The second character shall be a film-type identifier. The character is chosen at the discretion of the film manufacturer.

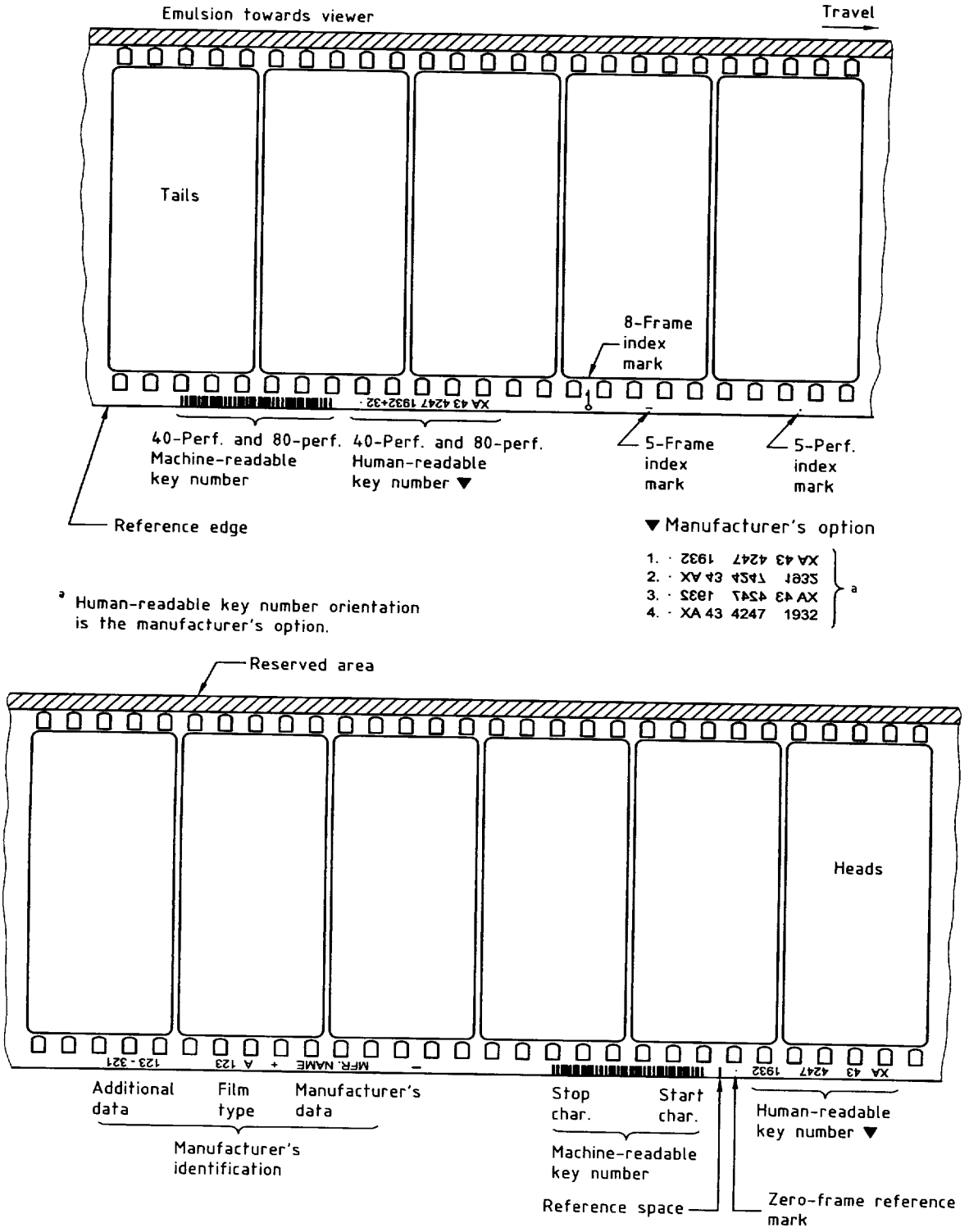
Table 1 — Manufacturer alphabetic codes

Manufacturer	Code
Agfa-Gevaert N.V.	A
Eastman Kodak Company	E, K
Fuji Photo Film Company	F
Ilford Limited	I
Other or nondesignated	(as assigned or blank)



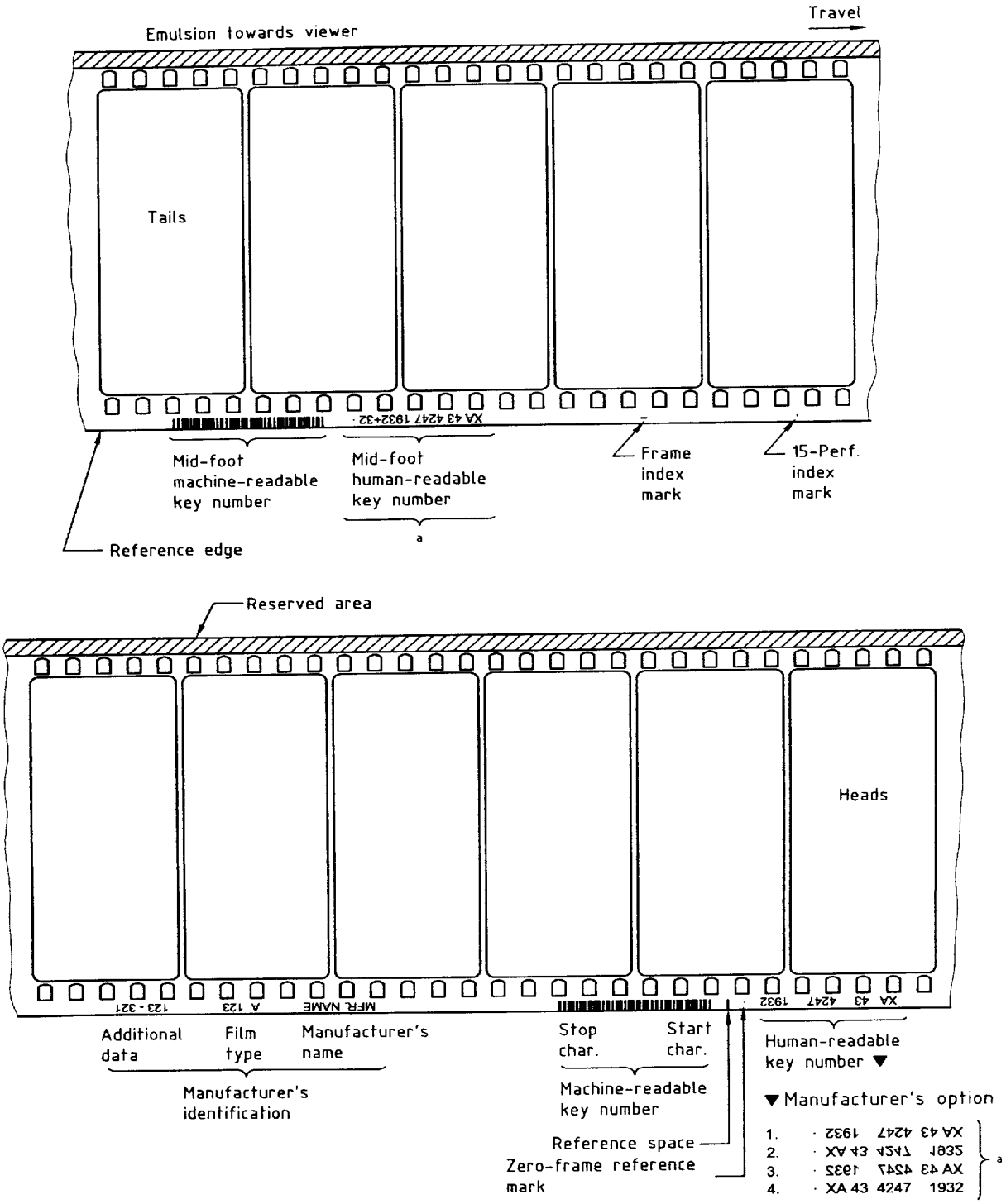
[a] Human-readable key number orientation is the manufacturer's option.

Figure 2 — General format on 35 mm film



a) General format on 65 mm film (format A)

Figure 3 — Formats A and B on 65 mm film



[a] Human-readable key number orientation is the manufacturer's option.

b) Special format on 65 mm film (format B)

Figure 3 — Formats A and B on 65 mm film

5.1.3 Numerical characters

For the 10 numerical characters of the key number, only the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 shall be used, and they shall be in normal counting sequence. It is recommended, although not required, that the "ten thousands" place should not be allowed to increment within a single roll of film.

5.2 Human-readable key number specifications applicable to 16 mm film only

5.2.1 Dimensions

The height and width of the human-readable key numbers shall be as specified in Figure 4 and Table 2. Note that the height of the first character is less than that of the others to allow for the reference mark specified in 5.2.2. The width of each human-readable character is left to the manufacturer's discretion, but it should be wide enough for good legibility, while still maintaining dimension *F*. A character height-to-width ratio of 14:10 and a space between characters of 2/14 of a character height is recommended.

5.2.2 Reference mark

A zero-frame reference mark shall be printed between the first human-readable key number and the edge of the film, as shown in Figure 1. This may be above or below the character, depending upon which of the possible orientations allowed in 5.2.6 is used. The zero-frame reference mark shall be a filled circle with a diameter as given by dimension B_3 of Table 2.

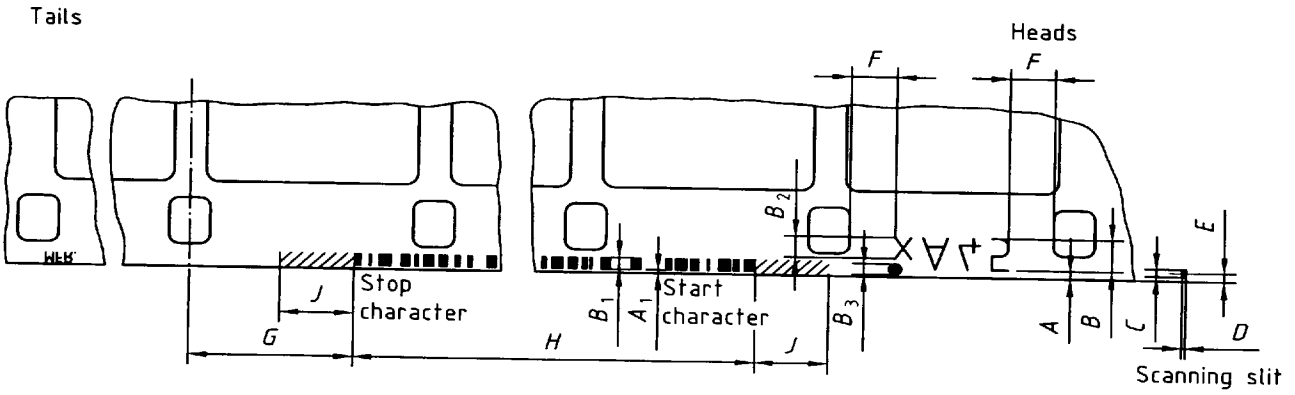


Figure 4 — Key number position and dimensions on 16 mm film

Table 2 — Key number dimensions on 16 mm film

Symbol in Figure 4	Parameter	Dimensions			
		Millimetres		Inches	
		nom.	tol.	nom.	tol.
A	Edge of film to bottom of characters	0,292	± 0,076	0,011 5	± 0,003 0
A_1	Edge of film to bottom of bars	0,10	± 0,08	0,004	± 0,003
B	Height of characters	1,334	± 0,076	0,052 5	± 0,003 0
B_1	Height of bars and manufacturer's information	0,478	± 0,076	0,018 8	± 0,003 0
B_2	Height of first character	0,84 min. to 0,99 max.		0,033 min. to 0,039 max.	
B_3	Height of zero-frame reference mark	0,46 min. to 0,61 max.		0,018 min. to 0,024 max.	
C	Scanning slit length	0,15	max.	0,006	max.
D	Scanning slit width	0,13	max.	0,005	max.
E	Edge of film to centreline of scanning slit	0,33	± 0,05	0,013	± 0,002
F	Key number to edge of perforation	0,76	min.	0,030	min.
G	Bar code displacement	4,78	± 0,51	0,188	± 0,020
H	Length of bar code	23,432	± 0,508	0,922 5	± 0,020 0
J	Quiet zone (no-print area)	2,54	min.	0,100	min.

5.2.3 Alignment with respect to perforations

The numbers shall be printed so that each of the three groups of four characters is centred between two perforations. To ensure visibility, the human-readable key numbers shall not be printed closer to the perforation than the distance specified as dimension F in Figure 4 and Table 2.

5.2.4 Frame identification

Since the key number is longer than one frame, the following rule shall be applied to frame identification.

— The frame immediately above the zero-frame reference mark is the one referenced by that key number. Other frames are specified by an offset which is written as (an) additional digit(s) separated from the key number by a plus sign. Figure 5 shows an example of this rule.

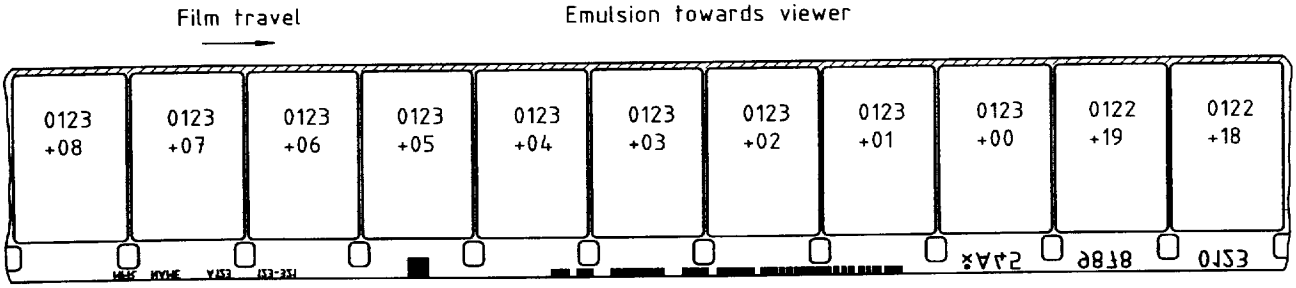


Figure 5 — Alignment of zero-frame reference mark on 16 mm film

5.2.5 Repeat frequency

The spacing from one key number to the next shall be 20 perforations.

5.2.6 Orientation

The key number may be placed in one of two orientations at the discretion of the film manufacturer. When the original negative film is held with the emulsion towards the viewer and the head towards the right, the numbers may be in either of the following orientations:

— right side up, reading from tail to head;

— upside down, reading from tail to head.

In all cases, regardless of the orientation, the dot shall be above the trailing character (closest to the tail), as shown in Figure 1. The human-readable key number shall precede the machine-readable key number, i.e. the human-readable key number shall be closer to the head of the roll.

5.3 Human-readable key number specifications applicable to 35 mm film only

5.3.1 Dimensions

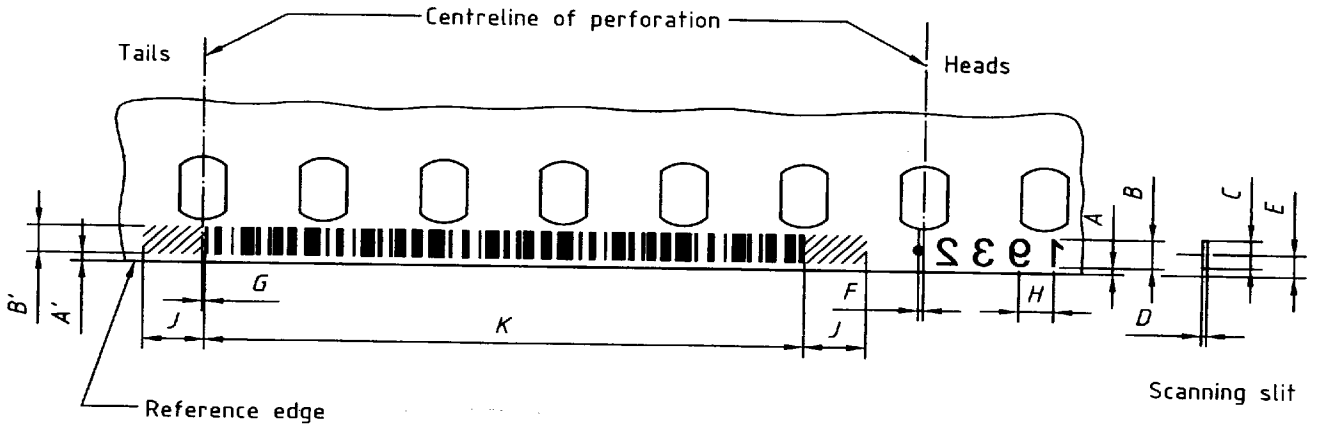
The height and width of the human-readable key numbers shall be as specified in Figure 6 and Table 3.

5.3.2 Reference mark

A zero-frame reference mark shall be printed adjacent to the digit of the human-readable key number that is closest to the tail of the film, as shown in Figure 2. The zero-frame reference mark shall be a filled circle with a diameter of 0,64 mm to 0,76 mm (0,025 in to 0,030 in).

5.3.3 Alignment with respect to perforations

The numbers shall be printed so that the centreline of the zero-frame reference mark is aligned with the centreline of a perforation, within the tolerance shown in Figure 6 and Table 3.



NOTE This drawing shows emulsion towards the viewer. Normal film travel is from left to right.

Figure 6 — Key number position and dimensions on 35 mm film

Table 3 — Key number dimensions on 35 mm film

Symbol in Figure 6	Parameter	Dimensions			
		Millimetres		Inches	
		nom.	tol.	nom.	tol.
A	Edge of film to bottom of characters	0,23	± 0,13	0,009	± 0,005
A′	Edge of film to bottom of bars	0,23	+ 0,13 − 0,23	0,009	+ 0,005 − 0,009
B	Height of characters	1,52	± 0,10	0,060	± 0,004
B′	Height of bars	1,52	+ 0,25 − 0,10	0,060	+ 0,010 − 0,004
C	Scanning slit length	0,97	max.	0,038	max.
D	Scanning slit width	0,13	max.	0,005	max.
E	Edge of film to centreline of scanning slit	0,89	± 0,05	0,035	± 0,002
F	Zero-frame reference mark displacement	0,0	± 1,0	0,00	± 0,04
G	Bar code displacement	0,0	± 1,0	0,00	± 0,04
H	Character-to-character spacing	1,52	(nom.)	0,060	(nom.)
J	Quiet zone (no-print area)	2,54	min.	0,100	min.
K	Length of bar code	23,432	± 1,016	0,922 5	± 0,040 0

5.3.4 Frame identification

The alignment specified in 5.3.3 is intended to facilitate frame identification with a minimum of confusion, even though the picture frame may have one of several positions relative to the key number. The following rule shall be applied to frame identification.

— The frame immediately above the zero-frame reference mark is the one referenced by that key number. Other frames are specified by an offset which is written as an additional digit(s) separated from the key number by a plus sign. Figure 7 shows an example of this rule.

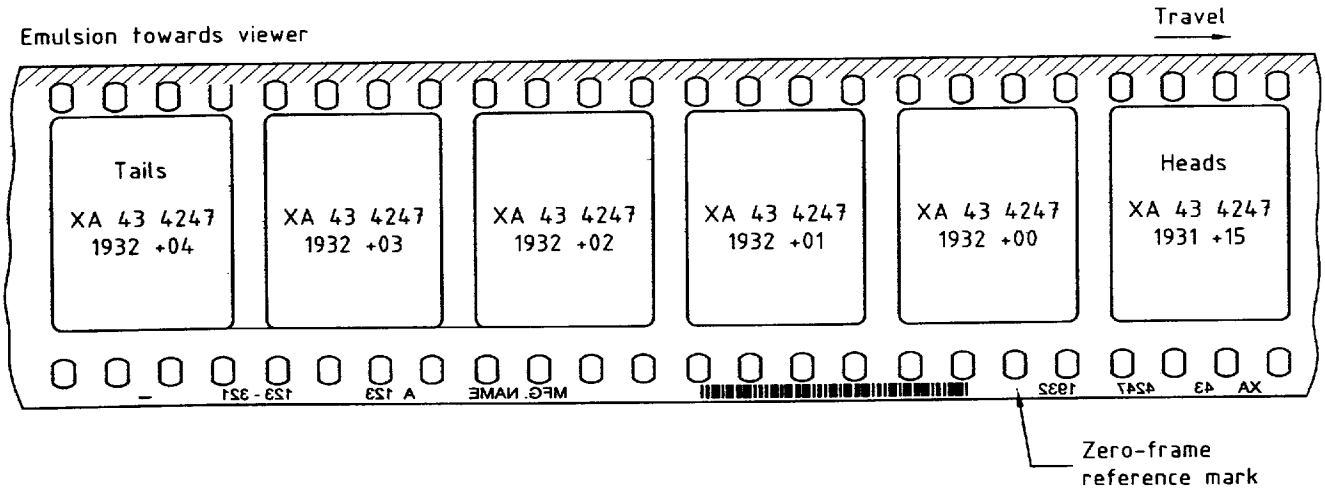


Figure 7 — Alignment of zero-frame reference mark on 35 mm film

5.3.5 Repeat frequency

The spacing from one key number to the next shall be 64 perforations.

5.3.6 Orientation

The number may be placed in one of several orientations at the discretion of the film manufacturer. When the original negative film is held with the emulsion towards the viewer and the head towards the right, the numbers may be in any one of the following orientations:

— right side up, reading from head to tail;

— upside down, reading from head to tail;

— right side up, reading from tail to head;

— upside down, reading from tail to head.

In all cases, regardless of the orientation, the dot shall be to the left (closer to the tail) and adjacent to the trailing (closest to the tail) character, as shown in Figure 2. The human-readable key number shall precede the machine-readable key number, i.e. the human-readable key number shall be closer to the head of the roll.

5.3.7 Mid-foot key number

A mid-foot key number, as shown in Figure 2, shall be placed halfway between each key number. The mid-foot key number shall have two parts: a mid-foot human-readable key number and a mid-foot machine-readable key number.

The mid-foot human-readable key number shall consist of a zero-frame reference mark, an adjacent key number that shall be nearer the head end of the roll, and an offset in perforations which shall always be 32. The mid-foot key number shall thus have the format "XA 12 3456 7890 + 32". The mid-foot key number shall have the same orientation as the standard human-readable key number (see 5.3.6). All characters shall be small in size (approximately half-size).

5.4 Human-readable key number specifications applicable to 65 mm film only

5.4.1 Dimensions

The height and width of the human-readable key numbers shall be as specified in Figure 8 and Table 4.

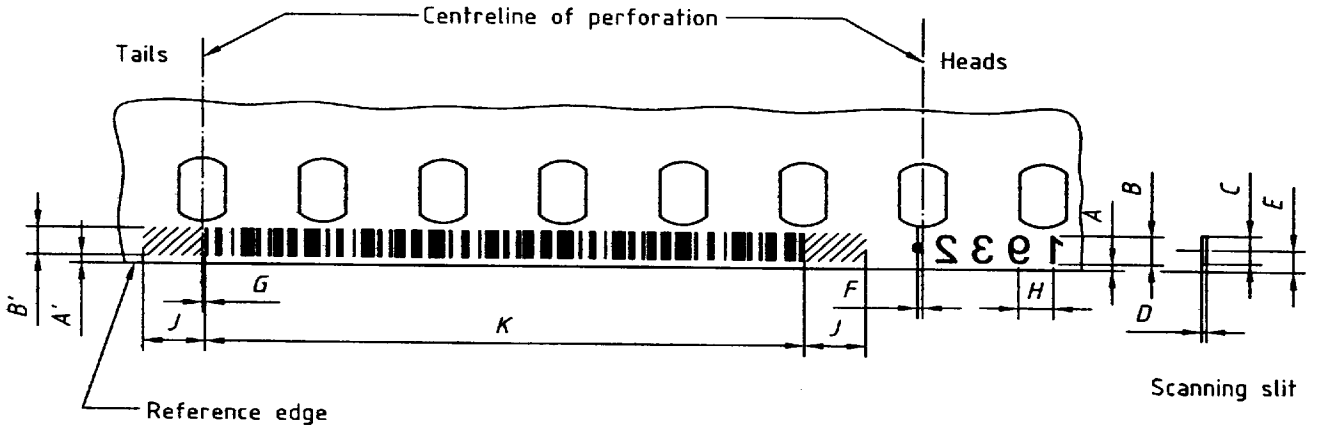


Figure 8 — Key number position and dimensions on 65 mm film, format A and format B

Table 4 — Key number dimensions on 65 mm film, format A and format B

Symbol in Figure 8	Parameter	Dimensions			
		Millimetres		Inches	
		nom.	tol.	nom.	tol.
A	Edge of film to bottom of characters	0,23	± 0,13	0,009	± 0,005
A′	Edge of film to bottom of bars	0,23	+ 0,13 − 0,23	0,009	+ 0,005 − 0,009
B	Height of characters	1,52	± 0,10	0,060	± 0,004
B′	Height of bars	1,52	+ 0,25 − 0,10	0,060	+ 0,010 − 0,004
C	Scanning slit length	0,97	max.	0,038	max.
D	Scanning slit width	0,13	max.	0,005	max.
E	Edge of film to centreline of scanning slit	0,89	± 0,05	0,035	± 0,002
F	Zero-frame reference mark displacement	0,0	± 1,0	0,00	± 0,04
G	Bar code displacement	0,0	± 1,0	0,00	± 0,04
H	Character-to-character spacing	1,52	(nom.)	0,060	(nom.)
J	Quiet zone (no-print area)	2,54	min.	0,100	min.
K	Length of bar code	23,432	± 1,016	0,922 5	± 0,040 0

5.4.2 Reference mark

A zero-frame reference mark shall be printed adjacent to the character of the human-readable key number that is closest to the tail of the film, as shown in Figure 3. The zero-frame reference mark shall be a filled circle with a diameter of approximately 0,64 mm to 0,76 mm (0,025 in to 0,030 in).

5.4.3 Alignment with respect to perforations

The numbers shall be printed so that the centreline of the zero-frame reference mark is aligned with the centreline of a perforation, within the tolerance shown in Figure 8 and Table 4.

5.4.4 Frame identification

The alignment specified in 5.4.3 is intended to facilitate frame identification with a minimum of confusion, even though the picture frame may have one of several positions relative to the key number. The following rule shall be applied to frame identification.

— The frame immediately above the zero-frame reference mark is the one referenced by that key number. Other frames are specified by an offset which is written as an additional digit(s) separated from the key number by a plus sign. Figure 9 shows an example of this rule.

5.4.5 Repeat frequency

The spacing from one key number to the next shall be 120 perforations for format A and 80 perforations for format B.

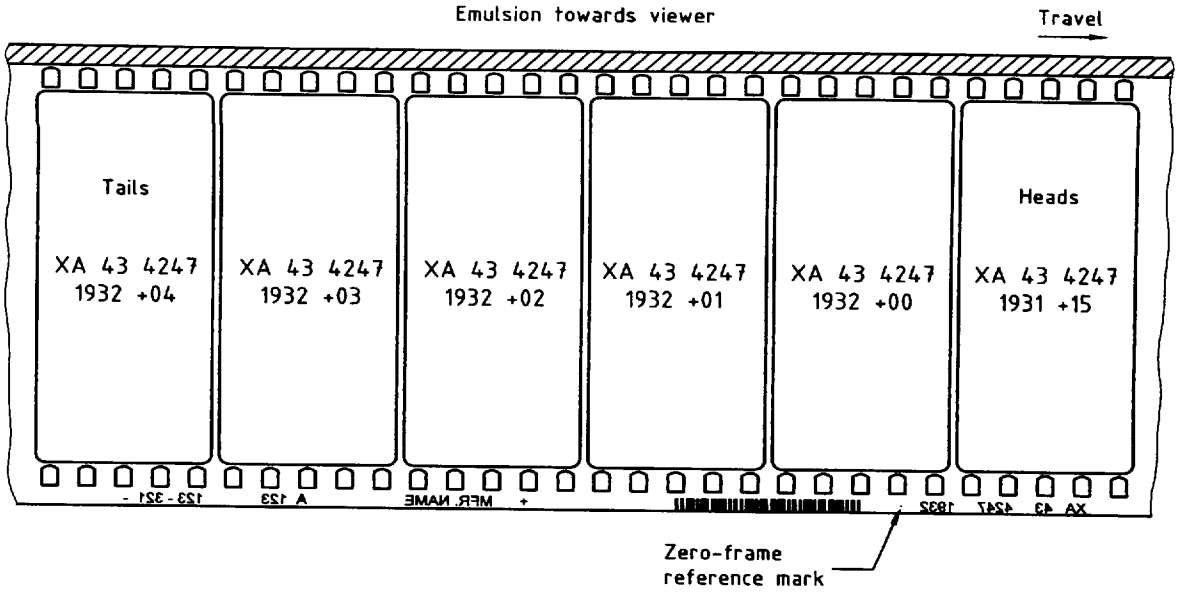


Figure 9 — Alignment of zero-frame reference mark on 65 mm film

5.4.6 Orientation

The number may be placed in one of several orientations at the discretion of the film manufacturer. When the original negative film is held with the emulsion towards the viewer and the head towards the right, the numbers may be in any one of the following orientations:

— right side up, reading from head to tail;

— upside down, reading from head to tail;

— right side up, reading from tail to head;

— upside down, reading from tail to head.

In all cases, regardless of the orientation, the dot shall be to the left (closer to the tail) and adjacent to the trailing (closest to the tail) character, as shown in Figures 3a) and 3b). The human-readable key number shall precede the machine-readable key number, i.e. the human-readable key number shall be closer to the head of the roll.

5.4.7 Mid-foot key number, format A

A 40-perf. intermediate key number, as shown in Figure 3a), shall be placed one-third of the way between each key number. The 40-perf. key number shall have two parts: a 40-perf. intermediate human-readable key number and a 40-perf. intermediate machine-readable key number.

An 80-perf. intermediate key number, as shown in Figure 3a), shall be placed two-thirds of the way between each key number. The 80-perf. key number shall have two parts: an 80-perf. intermediate human-readable key number and an 80-perf. intermediate machine-readable key number.

The intermediate human-readable key numbers shall consist of a zero-frame reference mark, an adjacent key number that shall be nearer the head end of the roll, and an offset in perforations which shall always be 40 for the 40-perf. intermediate key number and 80 for the 80-perf. intermediate key number. The 40-perf. intermediate key number shall have the format "XA 12 3456 7890 + 40." The 80-perf. intermediate key number shall have the format

"XA 12 3456 7890 + 80." Both intermediate key numbers shall have the same orientation as the standard human-readable key numbers (see 5.4.6). All characters shall be small in size (approximately half-size).

5.4.8 Mid-foot key number, format B

A mid-foot key number, as shown in Figure 3b), shall be placed halfway between each key number. The mid-foot key number shall have two parts: a mid-foot human-readable key number and a mid-foot machine-readable key number.

The mid-foot human-readable key number shall consist of a zero-frame reference mark, an adjacent key number that shall be nearer the head end of the roll, and an offset in perforations which shall always be 40. The mid-foot key number shall thus have the format "XA 12 3456 7890 + 40". The mid-foot key number shall have the same orientation as the standard human-readable key number (see 5.4.6). All characters shall be small in size (approximately half-size).

6 Machine-readable key numbers

6.1 Machine-readable key number specifications applicable to 16 mm, 35 mm and 65 mm film

6.1.1 General

Machine-readable key numbers are intended to be a machine-readable version of the immediately adjacent human-readable key numbers. The machine-readable key numbers shall consist of a series of bars and spaces of varying width that meet the bar code specification of USS 128. Code subset C of this specification, which allows double-density numerical digits, shall be used.

6.1.2 Repeat frequency

The machine-readable message shall be immediately adjacent to the human-readable key number and shall repeat at the same frequency.

6.1.3 Format

6.1.3.1 The data portion of the message shall be of fixed length and shall consist of 16 digits. Since code subset C encodes two digits per bar code character, this corresponds to eight bar code characters. In addition, quiet zones, a start character (for code C), a check sum character and a stop character shall be recorded. Including the start and stop characters, the entire message shall be 11 bar code characters.

6.1.3.2 The start character shall be nearest the head end of the film and the stop character shall be nearest the tail end of the film, regardless of the orientation of the human-readable characters, i.e. when the film is transported in the normal direction of travel past a fixed scanning position, the start character shall be read first.

6.1.3.3 The eight bar code characters (16 data digits) are defined as follows:

a) The first character shall be encoded with a two-digit manufacturer code. These codes shall be assigned in accordance with Table 5. Other codes are reserved for future assignment by ISO/TC 36.

b) The second character shall be a two-digit product specification code assigned at the discretion of the manufacturer. If the manufacturer does not wish to identify the product, the digits 00 shall be encoded.

Table 5 — Machine-readable manufacturer codes

Manufacturer	Code on 16 mm film	Code on 35 mm and 65 mm, format B film	Code on 65 mm, format A film
Agfa-Gevaert N.V.	11	01	21
Eastman Kodak Company	12	02	22
Fuji Photo Film Company	13	03	23
Ilford Limited	14	04	24
Other or nondesignated	10	00	20

c) The third through seventh characters shall be encoded with the 10 numerical characters of key number information. These shall provide the same information as in the immediately adjacent human-readable key number. The third character shall contain the most significant digits and the seventh character shall contain the least significant digits.

d) The eighth character shall be encoded with a two-digit offset in perforations from the zero-frame reference mark. This offset shall be 00 for 16 mm film. For 35 mm film, this offset shall be 00 for the key numbers described in c) and shall be 32 for the mid-foot key number described in 6.3.7. For 65 mm film, format A, this offset shall be 00 for the key numbers described in c), 40 for the 40-perf. intermediate key number, and 80 for the 80-perf. intermediate key number described in 6.4.7. For 65 mm film, format B, this offset shall be 00 for the key numbers described in c) and shall be 40 for the mid-foot key numbers described in 6.4.7.

e) The check sum is equal to the modulo 103 sum of the value of the start character and the weighted values of the eight data characters as specified in ANSI/AIM BC4 (USS 128).

6.2 Machine-readable key number specifications applicable to 16 mm film only

6.2.1 The dimensions and lateral location of the machine-readable identification numbers shall be as specified in Figure 4 and Table 2.

6.2.2 The nominal width of the narrowest bar or space shall be 0,190 mm (0,007 5 in). All other bars and spaces are to be integer multiples of the narrowest bar in accordance with ANSI/AIM BC4-1995, Code 128. The total bar code message, which consists of 123 elements (not counting the quiet zones), shall have a length given by dimension H of Table 2.

For measurement purposes, the width of the bar is the distance between two bar edges (see 3.2).

6.2.3 The recording shall be made so that the azimuth of the record is at an angle of 90° ± 1° to the reference edge of the film.

6.2.4 The lateral location, length and width of the scanned area shall be as specified in Figure 4 and Table 2.

6.2.5 The reproducing (scanning) slit image shall be positioned at an angle of 90° ± 1° to the reference edge of the film.

6.3 Machine-readable key number specifications applicable to 35 mm film only

6.3.1 The dimensions and lateral location of the machine-readable identification numbers shall be as specified in Figure 6 and Table 3.

6.3.2 The nominal width of the narrowest bar or space shall be 0,190 mm (0,007 5 in). All other bars and spaces are to be integer multiples of the narrowest bar in accordance with ANSI/AIM BC4-1995, Code 128. The total bar code message, which consists of 123 elements (not counting the quiet zones), shall have a length as given by dimension K of Table 3.

For measurement purposes, the width of the bar is the distance between two bar edges (see 3.2).

6.3.3 The message shall be printed so that the trailing edge of the last character (the stop character) is longitudinally aligned with the centreline of a perforation, that perforation being six perforations displaced from the perforation specified in 5.3.2, within the tolerance shown in Figure 6.

6.3.4 The recording shall be made so that the azimuth of the record is at an angle of 90° ± 1° to the reference edge of the film.

6.3.5 The lateral location, length and width of the scanned area shall be as specified in Figure 6 and Table 3.

6.3.6 The reproducing (scanning) slit image shall be positioned at an angle of 90° ± 1° to the reference edge of the film.

6.3.7 A mid-foot key number, as shown in Figure 2, shall be placed halfway between each key number. The mid-foot key number shall have two parts: a mid-foot human-readable key number and a mid-foot machine-readable key number.

The mid-foot machine-readable key number shall consist of a bar-coded message in exactly the same format as specified in 6.1.3. The offset-in-perforations digits shall be set to 32.

6.3.8 An optional frame index mark in the form of a hyphen may be placed on the film every four perforations, except where it would overlay some other edge information, as shown in Figure 2. The index marks shall be aligned midway between the perforations coincident with a possible position of the frameline.

The frame index mark shall be aligned longitudinally such that, were it to be printed, a mark would fall on the reference space, defined as the space between the perforation above the zero-frame reference mark and the perforation immediately to its left (towards the tail of the film).

6.4 Machine-readable key number specifications applicable to 65 mm film only

6.4.1 The dimensions and lateral location of the machine-readable identification numbers shall be as specified in Figure 8 and Table 4.

6.4.2 The nominal width of the narrowest bar or space shall be 0,190 mm (0,007 5 in). All other bars and spaces are to be integer multiples of the narrowest bar in accordance with ANSI/AIM BC4-1995, Code 128. The total bar code message, which consists of 123 elements (not counting the quiet zones), shall have a length as given by dimension K of Table 4.

For measurement purposes, the width of the bar is the distance between two bar edges (see 3.2).

6.4.3 The message shall be printed so that the trailing edge of the last character (the stop character) is longitudinally aligned with the centreline of a perforation, that perforation being six perforations displaced from the perforation specified in 5.4.2, within the tolerance shown in Figure 8 and Table 4.

6.4.4 The recording shall be made so that the azimuth of the record is at an angle of 90° ± 1° to the reference edge of the film.

6.4.5 The lateral location, length and width of the scanned area shall be as specified in Figure 8 and Table 4.

6.4.6 The reproducing (scanning) slit image shall be positioned at an angle of 90° ± 1° to the reference edge of the film.

6.4.7 For 65 mm format A, as shown in Figure 3a), a 40-perf. intermediate key number shall be placed one-third of the way between each key number, and an 80-perf. intermediate key number shall be placed two-thirds of the way between each key number. The 40-perf. and 80-perf. intermediate key numbers shall each have two parts: a human-readable key number and a machine-readable key number.

For 65 mm format B, as shown in Figure 3b), a mid-foot key number shall be placed halfway between each key number. The mid-foot key number shall have two parts: a mid-foot human-readable key number and a mid-foot machine-readable key number.

In format A, the 40-perf. intermediate machine-readable key number and the 80-perf. intermediate machine-readable key number shall consist of a bar-coded message in exactly the same format as specified in 6.1.3. The offset-in-perforations digits shall be set to 40 and 80 respectively.

In format B, the mid-foot machine-readable key number shall consist of a bar-coded message in exactly the same format as specified in 6.1.3. The offset-in-perforations digits shall be set to 40.

6.4.8 In format A and format B, an optional frame index mark in the form of a hyphen may be placed on the film every five perforations except where it would overlay some other edge information, as shown in Figure 3. The index marks shall be aligned midway between the perforations coincident with a possible position of the frameline.

The frame index mark shall be aligned longitudinally such that, were it to be printed, a mark would fall on the reference space, defined as the space between the perforation above the zero-frame reference mark and the perforation immediately to its left (towards the tail of the film).

In formats A and B, every third frame index mark, when printed, shall be a plus sign (+) rather than a hyphen. The purpose is to provide a 15-perforation frame index mark.

In format A, an optional frameline mark in the form of a key, as shown in Figure 3a), may be placed on the film every eight perforations, except where it would overlay some other edge information.

7 Optional manufacturer information (applicable to 16 mm, 35 mm and 65 mm film)

Additional manufacturer information may be printed along the edge of the film as shown in Figures 1, 2 and 3, and specified in Tables 2, 3 and 4. In the case of 35 mm and 65 mm film, this information shall be printed in small-size characters (approximately half-size). In the case of 16 mm film, the size of the characters shall be as specified by dimension B_1 of Table 2.

7.1 Recommended minimum information

7.1.1 Manufacturer's name

The first piece of information shall be the name of the manufacturer. This, in general, shall be an abbreviated name, rather than the full company name.

7.1.2 Film type

The second piece of information, separated from the manufacturer's name by a space, shall be the film type. Its form, whether numerical, alphabetical or mixed, shall be at the discretion of the manufacturer.

7.2 Optional information

The manufacturer may place additional information after the film type, if so desired. This may include batch numbers, for example. It is recommended that the length of this information be limited, so that the entire string of manufacturer-identification information is no more than three perforations long in the case of 16 mm film, and no more than 12 perforations long in the case of 35 mm and 65 mm film.

7.3 Repeat distance

The repeat distance of this information is at the discretion of the manufacturer, but the repeat distance shall be one of the following:

— for 16 mm film: 40, 80 or 120 perforations;

— for 35 mm film: multiple of 64 perforations with recommended maximum of 192 perforations;

— for 65 mm film, format A: multiple of 120 perforations with recommended maximum of 240 perforations;

— for 65 mm film, format B: multiple of 80 perforations with recommended maximum of 240 perforations.

8 Optional density measurement patch

8.1 General

A patch suitable for measurement of edgeprint density may be printed along the edge of the film as shown in Figure 1. A similar patch may optionally be included on 35 mm and 65 mm film.

8.2 Shape and size

The density patch may be either circular or square. Its height and width shall be no greater than the height specified for human-readable characters (dimension B in Table 2, Table 3 and Table 4 for 16 mm, 35 mm and 65 mm film respectively).

8.3 Colour and density

The density patch shall be exposed with the same colour and intensity of light used for the human-readable key numbers. If the intensity of red light used for the human-readable key numbers is not the same as that used for the machine-readable key numbers (bar code), then a second density patch, exposed with the same colour and intensity of light as the machine-readable key numbers, may be placed immediately adjacent to the first density patch. Optionally, separate patches may be exposed with red and green light.

8.4 Repeat frequency

The spacing from one density patch to another in 16 mm film shall be equal to or greater than 400 perforations, and shall be an integral multiple of 20 perforations. In 35 mm and 65 mm films, the spacing from one density patch to another shall be equal to or greater than 640 perforations and shall be an integral multiple of 32 perforations. This specification is intended to allow a density patch as infrequent as one per roll or none at all.

9 Bar code scanner and density specifications

9.1 Scanner spectral sensitivity

The peak or maximum response of the combination of the light source, filters and photoreceptor of the bar code scanner shall be at 680 nm ± 60 nm. In addition, the lower wavelength at which the response falls to 10 % of peak response shall be equal to or greater than 600 nm and the upper wavelength at which the response falls to 10 % of peak response shall be equal to or less than 760 nm. Notwithstanding these specifications, the spectral response of the scanning system shall be designed for good differentiation between bars and spaces with existing conventional colour and black-and-white films.

9.2 Quality of machine-readable messages

Subclauses 9.2.1 and 9.2.2 specify measurement techniques for the signal level of the machine-readable message and a minimum value for these measurements to ensure readability.

9.2.1 Measurement methodology

The measurement of bar code modulation is based on the analysis of the bar code scan transmittance profile. A scan is made with a particular aperture and wavelength. For the purposes of this International Standard, the wavelength shall be as specified in 9.1 and the scanning slit shall have the dimensions specified in Table 2, 3 or 4 as appropriate for the film size being measured. Figure 10 is a graphical representation of a scan transmittance profile. In Figure 10, the vertical axis shows percent transmittance and the horizontal axis represents linear position. The high transmittance areas on the left and right are the quiet zones. The high transmittance areas are spaces and the low transmittance areas are bars. The necessary measurements can be determined by manual graphical analysis or automatically by numerical analysis.

Figure 10 illustrates the measurement of T_{max} and T_{min}, the largest and smallest transmittances in the bar code scan transmittance profile, respectively. It also illustrates the measurement of EC_{min} which, for this particular example, is at edge 4. In general, it is necessary to determine edge contrast for each edge (each pair of bar and space) and then find the minimum of this set of edge contrasts.

Minimum edge contrast, symbol contrast and modulation are calculated using the definitions in clause 3.

9.2.2 Modulation specification

The edge print applied by the manufacturer shall be exposed so that, when the film is processed through the manufacturer's recommended process, the symbol contrast shall be equal to or greater than 0,40 and the modulation shall be equal to or greater than 0,40.

9.3 Density of printed machine-readable messages

When the machine-readable message is printed onto a conventional colour print film, it is recommended that the edge lights on the printer be controlled to produce status A red densities of 2,00 ± 0,30 for the bars and a maximum of 0,25 for the spaces.

When the machine-readable message is printed onto a conventional colour intermediate film, it is recommended that the edge lights on the printer be controlled to produce a status M red density D of D_{min} + (0,75 ± 0,10) for the bars.

10 Colour of edge print information

In order to increase the visual discrimination between the human-readable key number and other edge print information, it is recommended, but not required, that, on colour negative films, the following colours of exposing light be used for the various types of information:

— human-readable key numbers: red + green or red + blue;

— machine-readable key number (bar code): red;

— manufacturer's information: green.

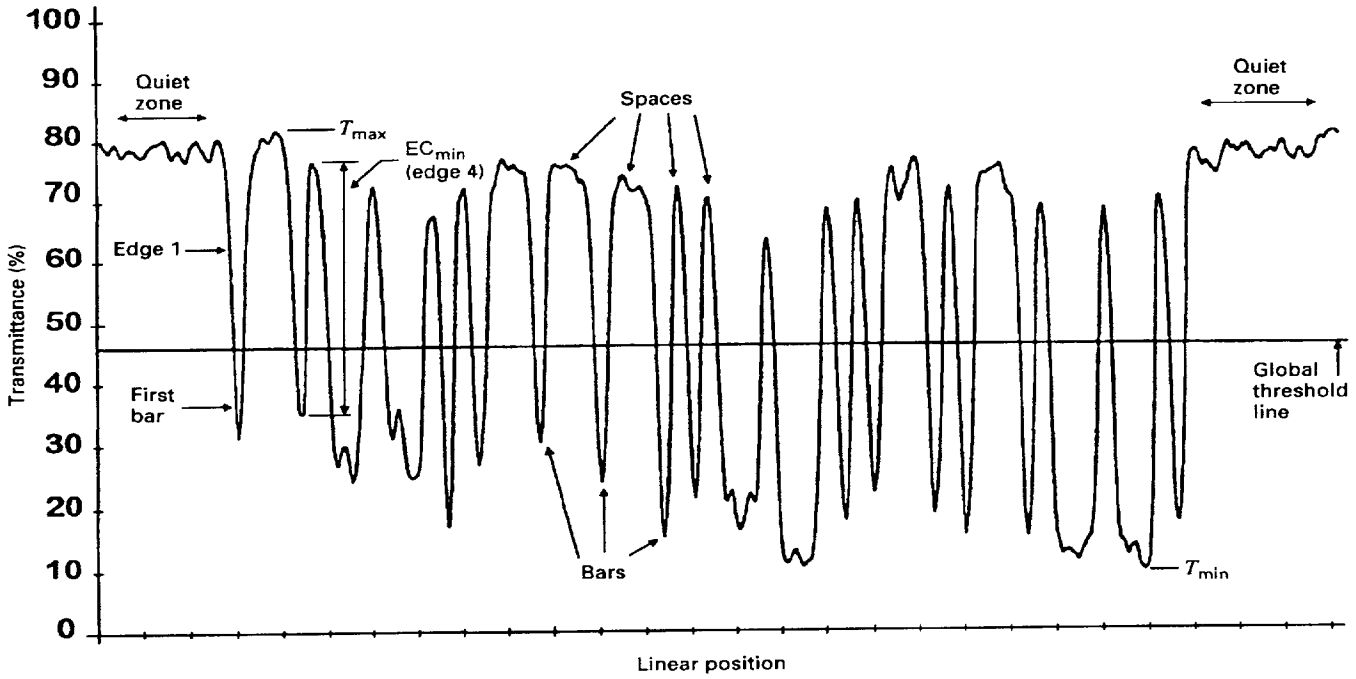


Figure 10 — Example of scan transmittance profile

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