TC 42

INTERNATIONAL STANDARD

ISO 3029

Third edition
1995-02-01

Photography — 126-size cartridges — Dimensions of cartridge, film and backing paper

Photographie — Chargeur format 126 — Dimensions du chargeur, du film et du papier protecteur

Reference number
ISO 3029:1995(E)

Foreword

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

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

International Standard ISO 3029 was prepared by Technical Committee ISO/TC 42, *Photography*.

This third edition cancels and replaces the second edition (ISO 3029:1983), of which it constitutes a technical revision.

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

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Photography — 126-size cartridge — Dimensions of cartridge, film and backing paper

1 Scope

This International Standard specifies the dimensions of 126-size cartridges, as well as dimensions of film and backing paper. Certain desirable camera characteristics are given, for guidance, in annex A.

This International Standard also specifies the dimensions of a set of film identification notches which assigns a code number to a specific film at the request of the film manufacturer. Neither the assignment nor incorporation of film identification notches for particular film products is required by this International Standard. However, the procedure to be followed by film manufacturers in obtaining code numbers is given in annex B.

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.*

3 Conditions for measurement of dimensions

The dimensions and tolerances specified in this International Standard apply at the time of manufacture, measured under atmospheric conditions of 23 °C ± 2 °C and 50 % ± 5 % relative humidity, as specified in ISO 554 [1].

4 Dimensions and characteristics of cartridge and spool

4.1 The dimensions and characteristics of the cartridge and of the spool shall be as shown in figure 1 and as given in table 1.

4.2 Most cartridge dimensions are given with respect to a set of three mutually perpendicular datum planes U, S, T (see figure 1), which are coincident with the surfaces that engage mating camera parts in such a way as to ensure proper alignment of the cartridge in the camera.

4.3 In order to visualize the minimum space which needs to be reserved in cameras for the cartridge, all cartridge diagrams have been drawn employing the particular contours which result in a cartridge of maximum profile (see also 4.9).

4.4 For quality control purposes, the four areas of datum U are used for gauging the dimensions of the cartridge.

4.5 Figure 1 shows the spool or core, on which the film is wound, pushed to the uppermost limit in the cartridge.

4.6 The radius C_{25} shall be a single radius tangential to three planes, determined respectively by C_{12} max., C_{14} max., and a plane passing at an angle of C_{24} min. through the intersection of two other planes determined respectively by C_{15} min. and G_2 max. (see figure 1, detail O).

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 %.

Dimensions in millimetres

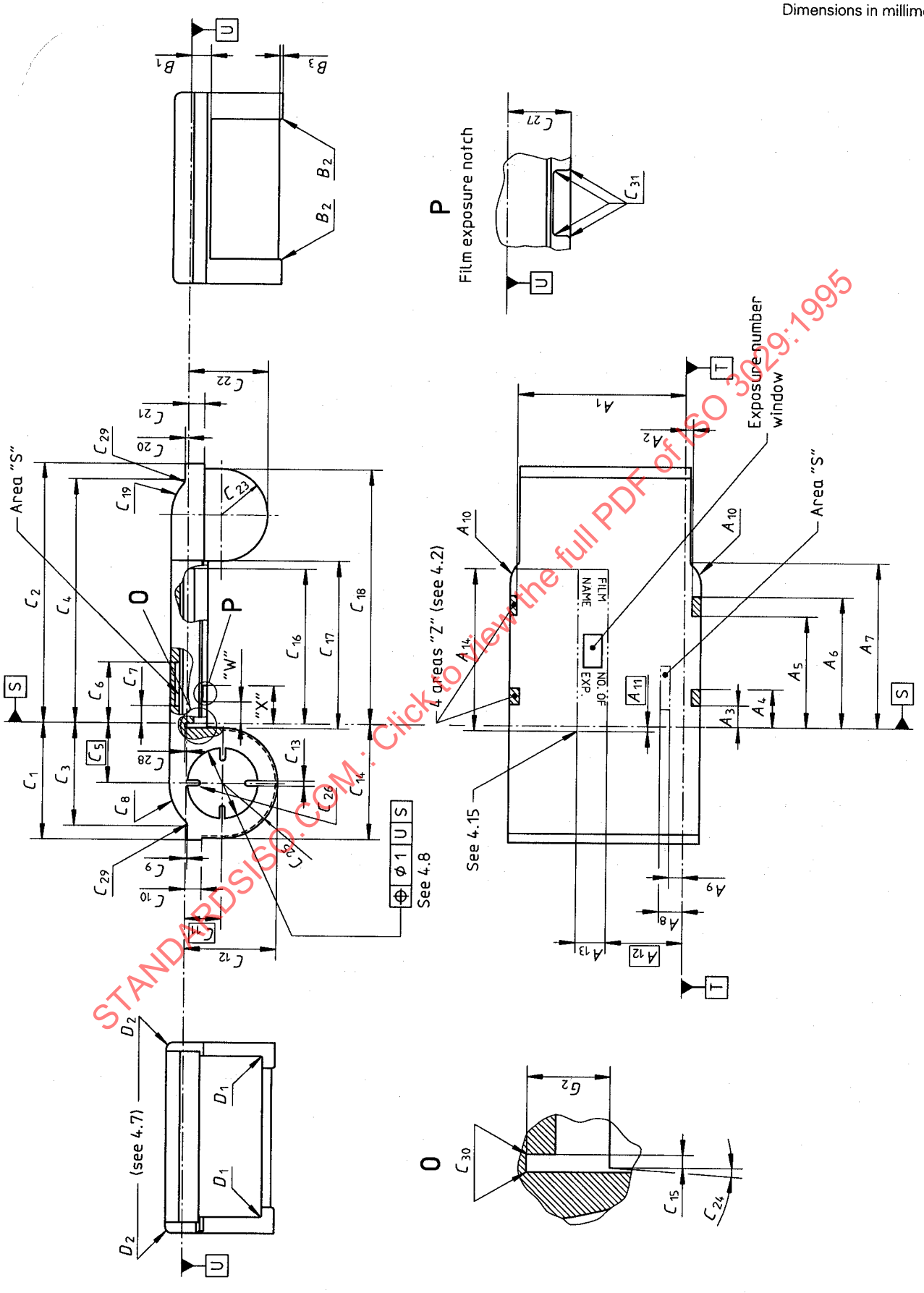

Figure 1 — Cartridge and spool

Dimensions in millimetres

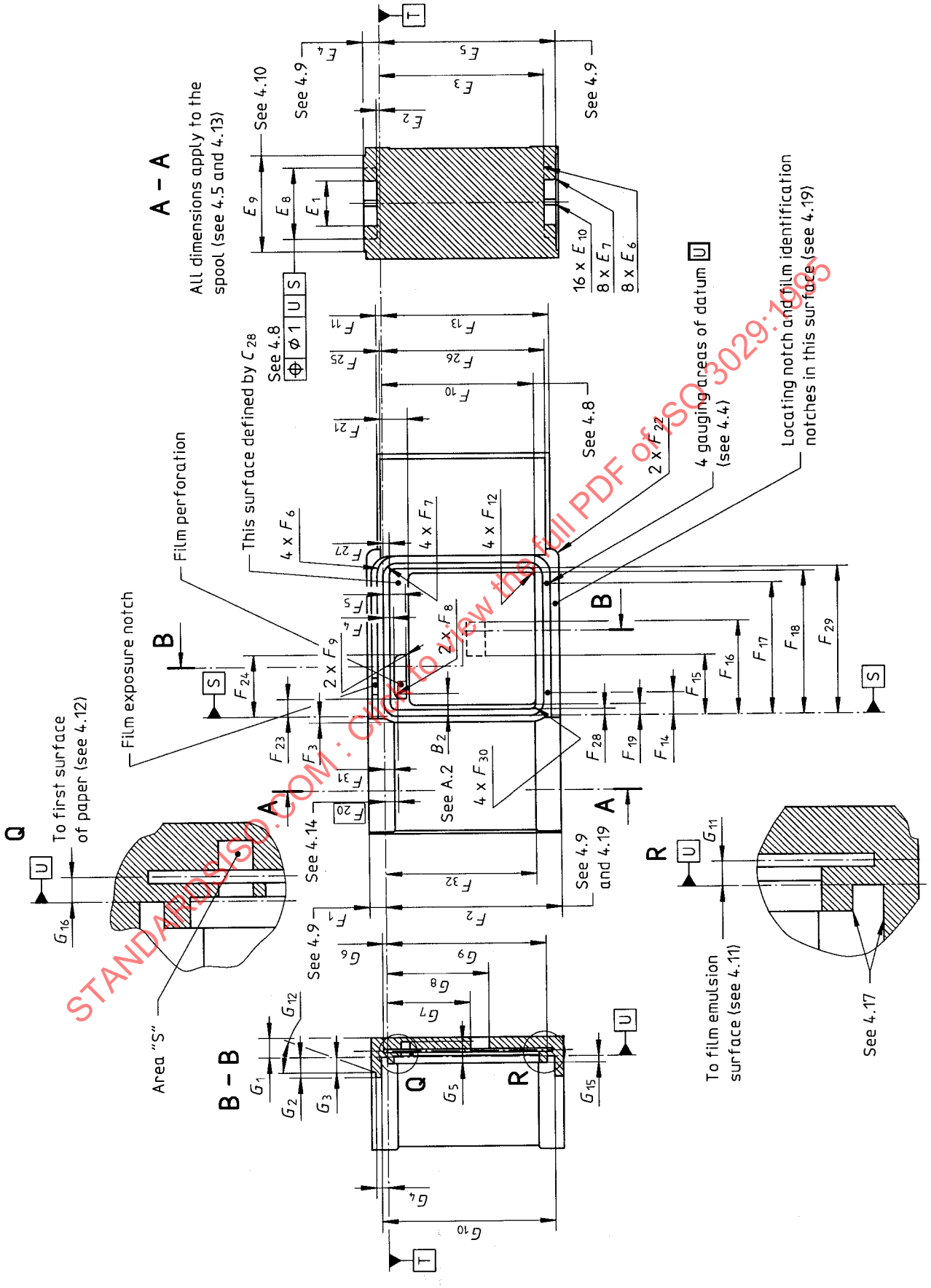

Figure 1 — Cartridge and spool *(concluded)*

Table 1 — Cartridge and spool dimensions

Dimension	Millimetres	
	min.	max.
A_1	39,37	
A_2	1,78	
A_3		5,08
A_4	8,89	
A_5		26,16
A_6	30,73	
A_7		38,35
A_8	5,59	
A_9		3,30
A_{10} radius	6,48	
A_{11} [1]	1,14	
A_{12} [1]	17,91	
A_{13} see 4.15		7,11
A_{14} see 4.15		38,10
B_1		4,32
B_2 radius	0,51	
B_3	0,25	
C_1		27,33
C_2		60,96
C_3		25,15
C_4		58,42
C_5 [1]	13,97	
C_6	14,30	
C_7		4,06
C_8 radius	12,45	
C_9	0,00	
C_{10}		3,81
C_{11} [1]	8,53	
C_{12}		21,46
C_{13}	1,14	1,40
C_{14}		26,92
C_{15}	0,89	
C_{16}	35,41	35,66
C_{17}	38,68	
C_{18}		59,79
C_{19} radius	10,80	
C_{20}		0,76
C_{21}		3,81
C_{22}		18,54
C_{23} radius	10,80	
C_{24} degrees	4°	
C_{25}	see 4.6	
C_{26} radius		1/2 width
C_{27}		3,68
C_{28}	0,03	
C_{29} radius		1,52
C_{30} radius		0,08
C_{31} radius		0,25
D_1 radius	0,51	
D_2 radius		1,52
see 4.7		
E_1 diameter	10,29	10,64
E_2		0,76
E_3		38,10
E_4	3,25	4,27
E_5	40,39	41,40
E_6 radius		0,38
E_7 radius		0,64
E_8 diameter	16,51	
E_9 diameter		2 × radius C_{25}
E_{10} radius		0,25
F_1		3,81
F_2 see 4.19		41,40
F_3	1,37	1,47
F_4		2,41
F_5	5,18	
F_6 radius		4,44
F_7 radius	3,18	
F_8 radius		1,65
F_9 radius		0,13
F_{10} see 4.18	35,05	35,46
F_{11}		1,27
F_{12} radius		1,27
F_{13}		38,86
F_{14}	4,88	5,89
F_{15}		13,84
F_{16}	21,72	
F_{17}	30,05	30,81
F_{18}	33,60	33,96
F_{19}	1,90	2,16
F_{20} see 4.14 [1]	3,18	
F_{21}	6,20	6,60
F_{22} radius		0,76
F_{23}		4,06
F_{24}	14,30	
F_{25}		0,51
F_{26}		37,85
F_{27}		1,52
F_{28}		1,52
F_{29}	34,29	
F_{30} radius		1,27
F_{31}		2,29
F_{32}	35,05	
G_1	4,32	4,83
G_2	4,57	4,83
G_3	3,30	3,81
G_4	2,54	3,05
G_5	3,56	
G_6	1,37	1,47
G_7		19,30
G_8	23,62	
G_9	36,93	37,19
G_{10}	40,26	
G_{11} nominal	1,45	
G_{12} degrees	20°	
G_{15}	1,40	1,65
G_{16}		1,98

1) Basic or true position dimension.

4.7 The radius D_2 applies only at the four areas "Z".

4.8 The axis of diameter E_8 (see figure 1) shall be capable of meeting its true position (as defined by C_5 and C_{11}).

4.9 Although the spool may extend beyond the cartridge housing when pushed in either direction, the sum of E_4 and E_5 shall be selected so that the total spool length will be capable of being completely contained within the cartridge housing dimension $F_1 + F_2$. It is important that the spool can shift freely to be contained in the cartridge housing.

4.10 Dimension E_9 represents the theoretical maximum spool flange diameter.

4.11 G_{11} (1,45 mm) is a nominal dimension from the gauging area of datum U to the film emulsion surface plane and applies only to a film load which has acquired "scroll set" at least equivalent to that expected at the earliest time it is anticipated that the film would be exposed by customers. Throughout the expected useful life of the film, dimension G_{11} represents the aim value for the film emulsion surface throughout the cartridge aperture. Since the design and adjustment of camera lenses, with respect to focal plane and depth of field, will be based on this value, control of this dimension within narrow limits by manufacturers of film-loaded cartridges is an important quality consideration.

4.12 G_{16} (1,98 mm) is the maximum dimension from the gauging area of datum U to the non-deflected first surface (black side, i.e. side contiguous with the film surface opposite the emulsion surface) of the backing paper within "Area S".

4.13 The take-up core diameter shall be 11,81 mm minimum.

4.14 "Film weave" shall not exceed ± 0,51 mm of the true position measured at a perforation as shown in figure 1.

4.15 If film data, such as film name and number of exposures in load, are to be provided, they shall be within the area shown.

4.16 Film-load cartridges should require no more than 50×10^{-3} N·m of torque to sustain film advance and no more than 85×10^{-3} N·m of torque to overcome momentary torque peaks; torques specified refer to measurements at the cartridge spool. Torque peaks can occur as a leading or trailing end of the film leaves the supply chamber of a cartridge and at each initiation of film movement. It is also important to note that torque measurement can be significantly affected by the age of the film and by severe jarring of the cartridge which might tend to clockspring the scroll of film against the cavity wall. Thus, simulated customer conditions shall be taken into account when checking maximum torque (see also annex A).

4.17 The two sets of dimensions, C_{16} and C_{17}, together with G_9 and G_{10}, describe the sides or walls of a rectangular channel which mates with a rail in the camera. Although the surfaces are shown as completely planar, they may be slightly depressed or relieved except in the four gauging areas. The tops of the resulting kinematic pips, or protrusions, however, should observe the dimensional limits.

4.18 Dimension F_{10} designates the wall nearest datum T of one side of a rectangular rail whose surface, although shown completely planar, may be stepped or chamfered, if desired.

4.19 The outside edge or wall of the rail containing the film-locating notch and identification notches is described by dimension F_2. This surface, although shown completely planar, may be stepped or chamfered similar to the cross-section of the film exposure rail, if desired.

5 Dimensions and location of film exposure notches

5.1 The film exposure notch enables the cartridge manufacturer to incorporate a specific notch which corresponds to the exposure which should be used for a particular film in the cartridge. This notch automatically presets some cameras to this exposure setting. The exposure may be different from that specified for film under the lighting conditions used. For example, film with an ISO speed of 100 may be notched for ISO 64 for use in fixed-exposure cameras to take advantage of the film's over-exposure latitude.

5.2 The dimensions and location of these notches are shown in figure 1 and given in table 2.

6 Dimensions, location and numbering of film identification notches and assignment of notch combination code number

6.1 The set of film identification notches represents a notch combination code number and may be incorporated by the cartridge manufacturer to provide a means for the film processor to identify the film.

Table 2 — Film exposure notches

Notch position	$W^{1)}$ mm	$X^{1)}$ mm	ISO speed in steps of 1/3 of an aperture stop	
			arithmetic	logarithmic
1	1,45	5,41	8	10°
2	2,39	6,35	10	11°
3	3,33	7,29	12	12°
4	4,27	8,23	16	13°
5	5,21	9,17	20	14°
6	6,15	10,11	25	15°
7	7,09	11,05	32	16°
8	8,03	11,99	40	17°
9	8,97	12,93	50	18°
10	9,91	13,87	64	19°
11	10,85	14,81	80	20°
12	11,79	15,75	100	21°
13	12,73	16,69	125	22°
14	13,67	17,63	160	23°
15	14,60	18,57	200	24°
16	15,54	19,51	250	25°
17	16,48	20,45	320	26°
18	17,42	21,39	400	27°
19	18,36	22,33	500	28°
20	19,30	23,27	640	29°
21	20,24	24,21	800	30°
22	21,18	25,15	1 000	31°
23	22,12	26,09	1 250	32°
24	23,06	27,03	1 600	33°
25	24,00	27,97	2 000	34°
26	24,94	28,91	2 500	35°
27	25,88	29,84	3 200	36°
28	26,82	30,78	4 000	37°
29	27,76	31,72	5 000	38°
30	28,70	32,66	6 400	39°
31	29,64	33,60	8 000	40°

1) Tolerance is ± 0,33 mm.

6.2 The assignment of the film identification notches to the particular film product is not within the scope of this International Standard. However, the code system is described in annex B.

6.3 Film identification notches, if used, shall be located in accordance with figure 2 and table 3.

6.4 The dimensions of the film identification notches are measured from a reference edge of a locating notch (dimension Z), which is intended to serve as a rapid means of positioning the cartridge in a fixed location with respect to the devices which will detect the film identification notches. The reference edge of the locating notch, in turn, is measured (dimension X) from datum S.

6.5 The minimum notch depth, dimension Y, applies to all film identification notch locations and to the locating notch.

6.6 The dimensions have been established in a manner which permits the forming of two or more adjacent notches with or without partition between them. When a partition is left between adjacent notches, its minimum width intentionally is not restricted by the dimensions given in table 3, but attention is called to the fact that any partition shall be of sufficient width to withstand normal handling without breaking.

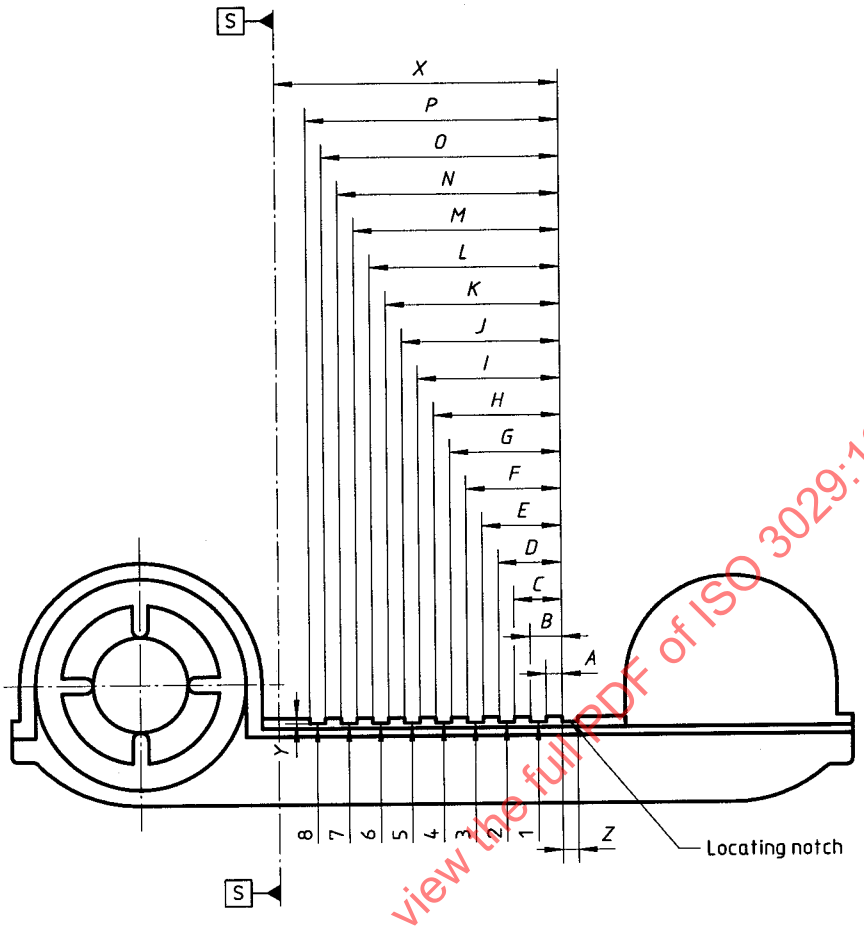

Figure 2 — Film identification notches

Table 3 — Film identification notches

Dimension	Millimetres	
	min.	max.
A	2,06	2,82
B	4,09	5,00
C	5,00	5,92
D	7,19	8,10
E	8,10	9,02
F	10,29	11,20
G	11,20	12,12
H	13,39	14,30
I	14,30	15,21
J	16,48	17,40
K	17,40	18,31
L	19,58	20,50
M	20,50	21,41
N	22,68	23,60
O	23,60	24,51
P	25,78	26,54
X	27,20	28,73
Y	0,76	—
Z	2,54	3,30

6.7 The film identification notch locations are numbered 1 to 8 from the locating notch for convenience in assigning combinations of notches.

6.8 For convenience in referring to the 255 possible notch combinations, they are systematically arranged by code number, as shown in table 4.

NOTE 1 Many general-purpose black-and-white negative films from various manufacturers can be processed satisfactorily in a universal process. Notch combination code number 1, therefore, has been reserved for such general-purpose black-and-white negative films and may be used by all manufacturers.

7 Dimensions and characteristics of film and backing paper

7.1 Dimensions of film and backing paper shall be as shown in figure 3 and as given in table 6.

7.2 The centreline of the paper perforation or equivalent hole shall align in the cartridge gate with the centreline of the film perforation within ± 3,18 mm.

Table 4 — Film identification notch combinations

Notch combination code number	Notch location number
	12345678
1[1)]	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	12
10	23
11	34
12	45
13	56
14	67
15	78
16	1 3
17	2 4
18	3 5
19	4 6
20	5 7
21	6 8
22	1 4
23	2 5
24	3 6
25	4 7
26	5 8
27	1 5
28	2 6
29	3 7
30	4 8
31	1 6
32	2 7
33	3 8
34	1 7
35	2 8
36	1 8
37	123
38	234
39	345
40	456
41	567
42	678
43	12 4
44	23 5
45	34 6
46	45 7
47	56 8
48	12 5
49	23 6
50	34 7
51	45 8
52	12 6
53	23 7
54	34 8
55	12 7
56	23 8
57	12 8
58	1 34
59	2 45
60	3 56
61	4 67
62	5 78
63	1 3 5
64	2 4 6
65	3 5 7
66	4 6 8
67	1 3 6
68	2 4 7
69	3 5 8
70	1 3 7
71	2 4 8
72	1 3 8
73	1 45
74	2 56
75	3 67
76	4 78
77	1 4 6
78	2 5 7
79	3 6 8
80	1 4 7
81	2 5 8
82	1 4 8
83	1 56
84	2 67
85	3 78
86	1 5 7
87	2 6 8
88	1 5 8
89	1 67
90	2 78
91	1 6 8
92	1 78
93	1234
94	2345
95	3456
96	4567
97	5678
98	123 5
99	234 6
100	345 7
101	456 8
102	123 6
103	234 7
104	345 8
105	123 7
106	234 8
107	123 8
108	12 45
109	23 56
110	34 67
111	45 78
112	12 4 6
113	23 5 7
114	34 6 8
115	12 4 7
116	23 5 8
117	12 4 8
118	12 56
119	23 67
120	34 78
121	12 5 7
122	23 6 8
123	12 5 8
124	12 67
125	23 78
126	12 6 8
127	12 78
128	1 345
129	2 456
130	3 567
131	4 678
132	1 34 6
133	2 45 7
134	3 56 8
135	1 34 7
136	2 45 8
137	1 34 8
138	1 3 56
139	2 4 67
140	3 5 78
141	1 3 5 7
142	2 4 6 8
143	1 3 5 8
144	1 3 67
145	2 4 78
146	1 3 6 8
147	1 3 78
148	1 456
149	2 567
150	3 678
151	1 45 7
152	2 56 8
153	1 45 8
154	1 4 67
155	2 5 78
156	1 4 6 8
157	1 4 78
158	1 567
159	2 678
160	1 56 8
161	1 5 78
162	1 678
163	12345
164	23456
165	34567
166	45678
167	1234 6
168	2345 7
169	3456 8
170	1234 7
171	2345 8
172	1234 8
173	123 56
174	234 67
175	345 78
176	123 5 7
177	234 6 8
178	123 5 8
179	123 67
180	234 78
181	123 6 8
182	123 78
183	12 456
184	23 567
185	34 678
186	12 45 7
187	23 56 8
188	12 45 8
189	12 4 67
190	23 5 78
191	12 4 6 8
192	12 4 78
193	12 567
194	23 678
195	12 56 8
196	12 5 78
197	12 678
198	1 3456
199	2 4567
200	3 5678
201	1 345 7
202	2 456 8
203	1 345 8
204	1 34 67
205	2 45 78
206	1 34 6 8
207	1 34 78
208	1 3 567
209	2 4 678
210	1 3 56 8
211	1 3 5 78
212	1 3 678
213	1 4567
214	2 5678
215	1 456 8
216	1 45 78
217	1 4 678
218	1 5678
219	123456
220	234567
221	345678
222	12345 7
223	23456 8
224	12345 8
225	1234 67
226	2345 78
227	1234 6 8
228	1234 78
229	123 567
230	234 678
231	123 56 8
232	123 5 78
233	123 678
234	12 4567
235	23 5678
236	12 456 8
237	12 45 78
238	12 4 678
239	12 5678
240	1 34567
241	2 45678
242	1 3456 8
243	1 345 78
244	1 34 678
245	1 3 5678
246	1 45678
247	1234567
248	2345678
249	123456 8
250	12345 78
251	1234 678
252	123 5678
253	12 45678
254	1 345678
255	12345678

1) Code number 1 is available for use, without registration, to identify general-purpose black-and-white negative films which can be processed satisfactorily in a universal process (see 6.8).

7.3 A greater range in the 14,2 mm to 15,2 mm dimension (location of backing paper number's centreline) necessitates a reduction in the 4,1 mm maximum numeral height.

7.4 Observe the film and backing paper leader and trailer dimensions plus the desired multiple of the film frame pitch dimension. See also table 5.

7.5 The preferred range for the width of the backing paper is 35,03 mm to 35,18 mm.

7.6 When held in such a way as to simulate the manner in which it would normally be held and restricted in the throat of a cartridge, unperforated backing paper shall not deflect from the reference surface of the test cavity shown in figure 4 by more than 0,89 mm when a load of 1,4 N (142 gf) is applied for 1 min by a pawl having a cross-sectional area of 0,76 mm by 3,18 mm (see figure 4), under the conditions of 32 °C and 90 % relative humidity.

Table 5 — Leader and trailer dimensions

Dimension		Number of exposures		
		12	20	24
A_1	min.	468,4	722,4	849,4
	max.	471,4	725,4	852,4
A_2	min.	863,6	1 121,2	1 205,2

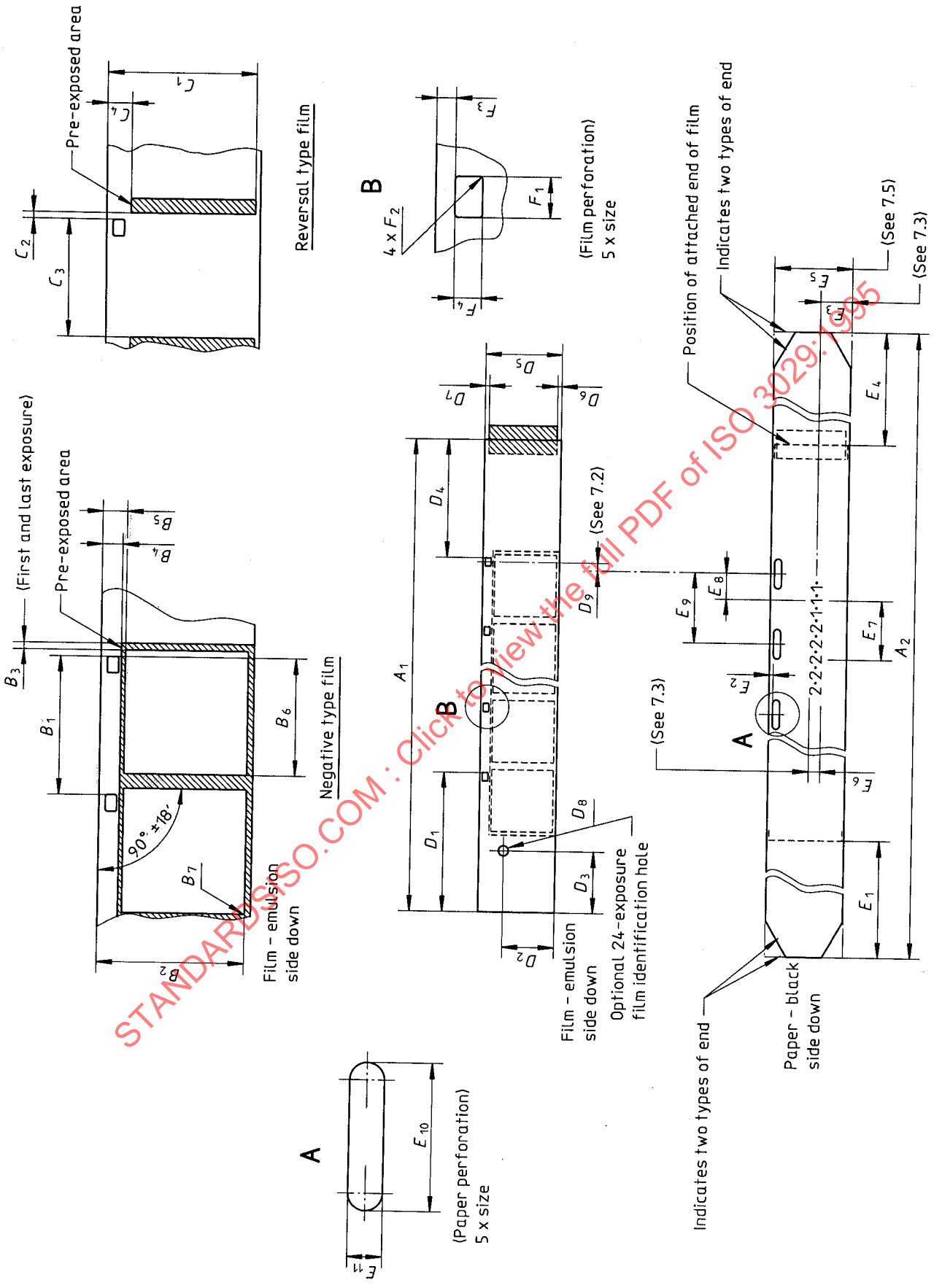

Figure 3 — Film and backing paper

Table 6 — Dimensions of film and backing paper

Dimension	Millimetres	
	min.	max.
B_1	31,67	31,83
B_2	33,55	33,86
B_3	1,60	
B_4		4,55
B_5	5,46	5,72
B_6	26,85	27,30
B_7 radius		0,25
C_1	33,86	
C_2	1,50	1,88
C_3	26,85	27,30
C_4		5,46
D_1	63,58	66,73
D_2	23,57	24,08
D_3	28,02	28,52
D_4	53,92	57,07
D_5	34,92	35,03
D_6		1,90
D_7		1,90

Dimension	Millimetres	
	min.	max.
Ø D_8	4,65	4,90
D_9	3,18	
E_1	177,80	
E_2	1,73	2,11
E_3	14,20	15,20
E_4	203,20	
E_5	35,03	35,38
E_6		4,10
E_7 nominal	32,21	
E_8	4,44	17,14
E_9 nominal	32,21	
E_{10}	13,50	
E_{11}	3,18	
F_1	3,78	3,84
F_2 radius		0,33
F_3	1,75	2,01
F_4	2,51	2,57

Dimensions in millimetres

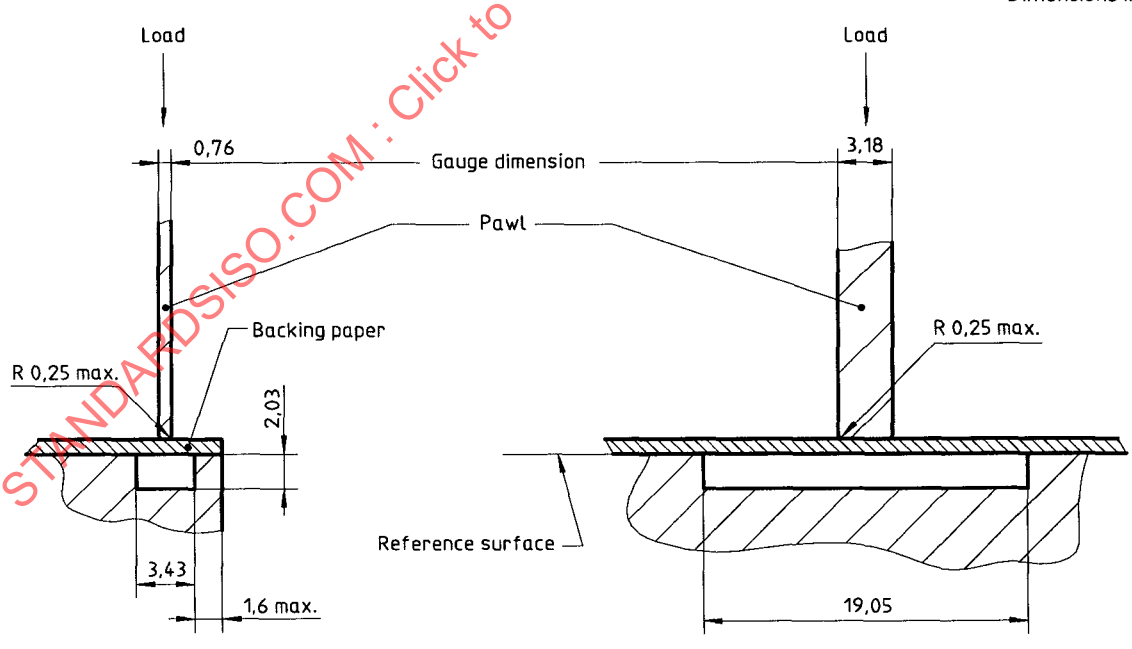

Figure 4 — Test cavity