INTERNATIONAL STANDARD ISO 4852

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Personal eye-protectors — Infra-red filters — Utilisation and transmittance requirements

Protection individuelle de l'œil — Filtres pour l'infrarouge — Utilisation et spécifications de transmission

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4852 was developed by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, and was circulated to the member bodies in April 1977.

It has been approved by the member bodies of the following countries :

Australia	Hungary	Romania
Austria	Iran	South Africa, Rep. of
Belgium	Ireland	Spain
Brazil	Israel	Switzerland
Denmark	Italy	Turkey
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Germany	Poland	Yugoslavia

No member body expressed disapproval of the document.

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Personal eye-protectors — Infra-red filters — Utilisation and transmittance requirements

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the numbering of, and the transmittance requirements for, filters for protection against infra-red radiation. It also gives guidance on their selection and use.

Eye-protectors used for protection against infra-red radiation shall meet the general requirements given in ISO 4849. The latter also deals with general considerations relating to eye-protectors, such as identification.

Optical test methods for eye-protectors form the subject of ISO 4854.

Non-optical test methods for eye-protectors form the subject of ISO 4855.

2 REFERENCES

ISO 4007, *Personal eye-protectors — Vocabulary.*

ISO 4849, *Personal eye-protectors — Specifications.*[1]

ISO 4854, *Personal eye-protectors — Optical test methods.*[1]

ISO 4855, *Personal eye-protectors — Non-optical test methods.*[1]

3 NUMBERING OF FILTERS

The complete table of numbering of filters is given in clause 3 of ISO 4849.

The symbol for infra-red filters includes code number 4, and the shade number corresponding to the filter, from 1.2 to 10 (see clause 4 below).

4 TRANSMITTANCE REQUIREMENTS

The definitions of transmittance are given in ISO 4007.

The determination of transmittance is described in clause 5 of ISO 4854.

The transmittance variations measured by the scanning of a light beam of 5 mm diameter over the entire area of the filter, except on a marginal area 5 mm wide, shall remain within the limits defined as "relative uncertainty" in table 2 of ISO 4854.

The transmittance requirements for filters used for protection against infra-red radiation are given in table 1.

TABLE 1 — **Transmittance requirements**

Scale number	Luminous transmittance, τ_V		Maximum mean transmittance in the infra-red spectrum	
	maximum %	minimum %	τ_{NIR} near IR 1 300 to 780 nm %	τ_{MIR} mid. IR 2 000 to 1 300 nm %
4 – 1.2	100	74,4	37	37
4 – 1.4	74,4	58,1	33	33
4 – 1.7	58,1	43,2	26	26
4 – 2	43,2	29,1	21	13
4 – 2a	43,2	29,1	0,20	0,20
4 – 2.5	29,1	17,9	15	9,6
4 – 2.5a	29,1	17,9	0,20	0,20
4 – 3	17,9	8,5	12	8,5
4 – 4	8,5	3,2	6,4	5,4
4 – 5	3,2	1,2	3,2	3,2
4 – 6	1,2	0,44	1,7	1,9
4 – 7	0,44	0,16	0,81	1,2
4 – 8	0,16	0,061	0,43	0,68
4 – 9	0,061	0,023	0,20	0,39
4 – 10	0,023	0,008 5	0,10	0,25

1) At present at the stage of draft.

Additional requirements :

a) Maximum transmittance in the UV spectrum for all scales :

$\tau(\lambda = 313 \text{ nm}) < 0{,}1\ \tau_V$

b) Between 210 and 313 nm, transmittance shall not exceed that specified for 313 nm.

NOTE – Luminous transmittance values, as shown in table 1, and chromaticity co-ordinates of infra-red filters shall be based on the spectral distribution for a full radiator 1 900 K and the CIE (1931) standard observer (2°) (see table 3 in the annex).

The tint representative point of an IR filter may lie within the area defined in the figure below.

The following limits are recommended :

a) Purple limit

$(x - 0{,}52)^2 + (y - 0{,}13)^2 = 0{,}263^2$
arc of a circle with radius of 0,263, the centre co-ordinates of which are $x = 0{,}52$, $y = 0{,}13$

b) Red limit

$y = 1{,}333\ x - 0{,}34$

c) Yellow limit

$y = 0{,}790 - 0{,}667\ x$

d) Yellow-green limit

$y = 0{,}440$

e) Green limit

$y = 0{,}836\ x + 0{,}090$

f) Blue limit

$x = 0{,}310$

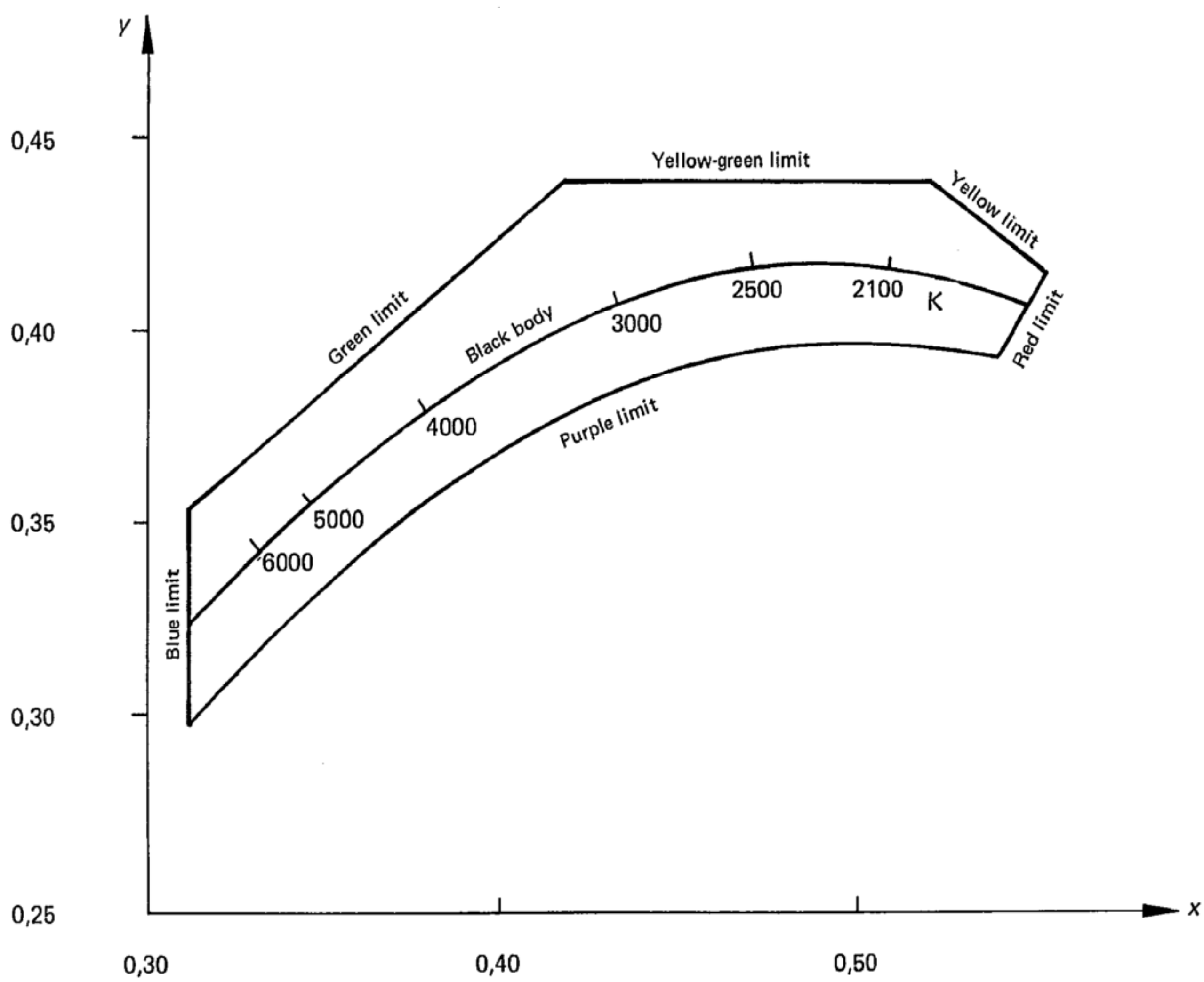

FIGURE – **Chromaticity limits for IR filters**

5 GUIDANCE ON SELECTION AND USE

TABLE 2 — **Numbering and typical applications**

Scale number	Typical application in terms of mean temperature sources, °C
4 – 1.2	up to 1 050
4 – 1.4	1 070
4 – 1.7	1 090
4 – 2	1 110
4 – 2.5	1 140
4 – 3	1 210
4 – 4	1 290
4 – 5	1 390
4 – 6	1 500
4 – 7	1 650
4 – 8	1 800
4 – 9	2 000
4 – 10	2 150
4 – 2a 4 – 2.5a	For protection against infra-red radiation from sources of large area where protection against glare is not essential, for example in rolling mills.

ANNEX

TABLE 3 – **Factors for the calculation of spectral transmittance and chromaticity co-ordinates of filters relative to a full radiator 1 900 K and the CIE (1931) standard observer (2°)**

λ nm	$S(\lambda)$	$S(\lambda)\,\bar{x}(\lambda)$	$S(\lambda)\,\bar{y}(\lambda)$	$S(\lambda)\,\bar{z}(\lambda)$
380	1,15	0,000	0,000	0,001
390	1,68	0,001	0,000	0,003
400	2,41	0,003	0,000	0,013
410	3,38	0,012	0,000	0,057
420	4,65	0,051	0,002	0,246
430	6,28	0,146	0,006	0,713
440	8,36	0,238	0,016	1,196
450	10,95	0,302	0,034	1,589
460	14,14	0,337	0,070	1,934
470	18,03	0,289	0,134	1,901
480	22,70	0,178	0,258	1,512
490	28,25	0,074	0,481	1,077
500	34,78	0,014	0,920	0,775
510	42,40	0,032	1,747	0,550
520	51,19	0,265	2,978	0,328
530	61,26	0,831	4,326	0,212
540	72,69	1,729	5,681	0,121
550	85,58	3,039	6,976	0,061
560	100,00	4,871	8,152	0,032
570	116,04	7,245	9,050	0,020
580	133,75	10,041	9,534	0,019
590	153,21	12,882	9,502	0,014
600	174,46	15,182	9,019	0,011
610	197,54	16,226	8,141	0,005
620	222,49	15,574	6,945	0,004
630	249,32	13,122	5,413	0,000
640	278,06	10,203	3,987	0,000
650	308,69	7,170	2,706	0,000
660	341,22	4,610	1,705	0,000
670	375,62	2,690	0,985	0,000
680	411,88	1,579	0,574	0,000
690	449,94	0,837	0,302	0,000
700	489,78	0,457	0,165	0,000
710	531,34	0,252	0,091	0,000
720	574,57	0,137	0,047	0,000
730	619,39	0,071	0,025	0,000
740	665,73	0,038	0,016	0,000
750	713,53	0,018	0,006	0,000
760	762,69	0,013	0,006	0,000
770	813,14	0,007	0,000	0,000
780	864,78	0,000	0,000	0,000

Constant $C_2 = 1{,}438\ 79 \times 10^{-2}$ m·K

$$\sum_{380}^{780} S(\lambda)\,\bar{y}(\lambda) \quad 100{,}000$$