International Standard 4850

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Personal eye-protectors for welding and related techniques — Filters — Utilisation and transmittance requirements

Protecteurs individuels de l'œil pour le soudage et les techniques connexes — Filtres — 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 4850 was developed by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, and was circulated to the member bodies in May 1977.

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

Australia	Iran	Romania
Austria	Ireland	South Africa, Rep. of
Belgium	Israel	Spain
Bulgaria	Italy	Switzerland
Denmark	Japan	Turkey
Egypt, Arab Rep. of	Mexico	United Kingdom
France	New Zealand	USSR
Germany, F. R.	Norway	Yugoslavia
Hungary	Poland	

No member body expressed disapproval of the document.

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Personal eye-protectors for welding and related techniques — Filters — Utilisation and transmittance requirements

1 Scope and field of application

This International Standard specifies the numbering of, and transmittance requirements for filters intended to protect operatives performing manual work involving welding, braze-welding, arc gouging and thermal cutting. It also gives guidance on the selection and use of these filters.

Eye-protectors used with the above-mentioned techniques 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 are the subject of ISO 4854.

Non-optical test methods for eye-protectors are 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.*

3 Numbering of filters

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

The symbol for these filters includes only the class of protection corresponding to the filter, from 1.2 to 16 (see clause 4 below).

4 Transmittance requirements

4.1 General specification

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 in 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 in welding and related techniques are given in table 1.

Additional specifications :

a) Between 210 and 313 nm, the transmittance shall not exceed the value permitted for 313 nm.

b) Between 313 and 365 nm, the transmittance shall not exceed the value permitted for 365 nm.

c) Between 365 and 400 nm, the mean spectral transmittance shall not exceed the mean luminous transmittance τ_V.

NOTES

1 Luminous transmittance values are based on the spectral distribution of illuminant A of the CIE.

2 Minimum and maximum values of luminous transmittance may be exceeded by taking into account the limits of relative uncertainty given in table 2 of ISO 4854.

3 The transmittance IR values are determined by integration of the photometric data.

4.2 Special specification for filters for gas welding with a flux

When a flux is used in gas welding, the light emitted by the source is often very rich in monochromatic light of one or more wavelengths, which makes it very difficult to follow the work in good conditions. This is true, for example, of light from sodium which is rich in λ = 589 nm radiation, or lithium, which is rich in λ = 671 nm radiation.

It is recommended that filters, or combinations of filters, with a selective absorption for 589 nm and 671 nm lines be used in order to eliminate the inconvenience caused by this abundant emission of monochromatic radiation.

Filters which fulfil these conditions are indicated in table 2 of clause 5 by the letter "a". The transmittance of these filters, for the wavelengths mentioned above, shall be less than :

0,4 % for scale 4a

0,1 % for scale 5a

0,05 % for scale 6a

0,01 % for scale 7a

Moreover, these filters have the same characteristics as the filters which correspond to scales 4, 5, 6 and 7 in table 1.

5 Guidance on selection and use

Many factors are involved in selecting the opacity of a protective filter, in the visible range, which is suitable for welding or related techniques :

— For gas welding and related techniques such as braze-welding and thermal cutting, this International Standard refers to the flow rate of blow pipes.

However, in light alloy welding, account should be taken of the characteristics of the fluxes, which influence the spectral composition of the light emitted.

Table 1 — Transmittance requirements

Scale number	Maximum transmittance in the ultra-violet spectrum $\tau(\lambda)$		Luminous transmittance τ_V		Maximum mean transmittance in the infra-red spectrum τ_{NIR}	τ_{MIR}
	313 nm %	365 nm %	maximum %	minimum %	Near IR 1 300 to 780 nm %	Mid. IR 2 000 to 1 300 nm %
1.2	0,000 3	50	100	74,4	37	37
1.4	0,000 3	35	74,4	58,1	33	33
1.7	0,000 3	22	58,1	43,2	26	26
2.0	0,000 3	14	43,2	29,1	21	13
2.5	0,000 3	6,4	29,1	17,8	15	9,6
3	0,000 3	2,8	17,8	8,5	12	8,5
4	0,000 3	0,95	8,5	3,2	6,4	5,4
5	0,000 3	0,30	3,2	1,2	3,2	3,2
6	0,000 3	0,10	1,2	0,44	1,7	1,9
7	0,000 3	0,037	0,44	0,16	0,81	1,2
8	0,000 3	0,013	0,16	0,061	0,43	0,68
9	0,000 3	0,004 5	0,061	0,023	0,20	0,39
10	0,000 3	0,001 6	0,023	0,008 5	0,10	0,25
11	Value less than	0,000 60	0,008 5	0,003 2	0,050	0,15
12	or equal to	0,000 20	0,003 2	0,001 2	0,027	0,096
13	transmittance	0,000 076	0,001 2	0,000 44	0,014	0,060
14	permitted	0,000 027	0,000 44	0,000 16	0,007	0,04
15	for 365 nm	0,000 009 4	0,000 16	0,000 061	0,003	0,02
16		0,000 003 4	0,000 061	0,000 029	0,003	0,02

— For arc-welding, arc-gouging, and plasma arc cutting, the current is an essential factor in making an accurate choice possible.

In addition, in arc welding, the type of arc and the type of parent metal are also to be taken into consideration.

Other parameters have a significant influence, but it is difficult to evaluate their effect. These are, in particular :

— the position of the operator in relation to the flame or the arc. For example, depending on whether the operator leans over his work or adopts an arm's length position, a variation in opacity of at least one scale may be necessary;

— local lighting;

— the human factor.

For these various reasons, this International Standard only gives scales of protection which confirmed practical experience has shown to be valid in normal circumstances for the personal protection of operators with normal sight, carrying out work of a specified type manually.

The scale number of the filter to be used can be read from the tables, at the intersection of the column, corresponding to the gas flow rate or the current and the line specifying the work to be carried out.

These tables are valid for average working conditions, in which the distance from the welder's eye to the pool of molten metal is approximately 50 cm and the average illuminance is approximately 100 lx.

5.1 Scales of protection to be used for gas-welding and braze-welding

The scales of protection to be used for manual gas-welding and braze-welding are given in table 2.

5.2 Scales of protection to be used for oxygen cutting

The scales of protection to be used for manual oxygen cutting following a line on the workpiece are given in table 3.

5.3 Scales of protection to be used for plasma arc cutting

The scales of protection to be used for manual plasma arc cutting following a line on the workpiece are given in table 4.

Table 2 — Scales[1)] of protection to be used for gas-welding and braze-welding

Work to be carried out	l = flow rate of acetylene, in litres per hour				
		$l \leqslant 70$	$70 < l \leqslant 200$	$200 < l \leqslant 800$	$l > 800$
Welding and braze-welding of heavy metals		4	5	6	7
Welding with emittive fluxes (notably light alloys)		4a	5a	6a	7a

1) According to the conditions of use, the next greater or the next smaller scale can be used.

Table 3 — Scales[1)] of protection to be used for oxygen cutting

Work to be carried out	Flow rate of oxygen, in litres per hour		
	900 to 2 000	2 000 to 4 000	4 000 to 8 000
Oxygen cutting	5	6	7

1) According to the conditions of use, the next greater or the next smaller scale can be used.

NOTE — 900 to 2 000 and 2 000 to 8 000 litres of oxygen per hour, correspond fairly closely to the use of cutting nozzles diameters of 1 to 1,5 and 2 mm respectively.

Table 4 — Scales[1)] of protection to be used for plasma arc cutting

Work to be carried out	I = Current, in amperes		
	$I \leqslant 150$	$150 < I \leqslant 250$	$250 < I \leqslant 400$
Thermal cutting	11	12	13

1) According to the conditions of use, the next greater or the next smaller scale can be used.

5.4 Scales of protection to be used for electric arc welding or arc gouging

The scales of protection to be used for manual electric arc welding or arc gouging are given in table 5a) and 5b).

In table 5a), which deals with electric arc welding and arc gouging operations, the following abbreviations are used :

— the symbol MIG corresponds to the use of an arc protected by an inert gas, with an axial spray metal transfer;

— the symbol MAG corresponds to the use of an arc protected by carbon dioxide, either pure or in a mixture;

— the symbol TIG corresponds to the use of a tungsten electrode arc protected by an inert gas;

— arc-air gouging corresponds to the use of a carbon electrode and a compressed air jet used in gouging in order to remove the molten metal.

When reading the tables, the following should be borne in mind :

Column 1, "Use" indicates the work to be carried out by means of the stated process.

Columns 2, "Current in amperes" should be read : Lower limit $< I \leqslant$ upper limit.

For example, for shielded metal arc welding, a filter of scale number 11 is usable within the following limits : $80 < I \leqslant 175$ A.

5.5 Scales of protection to be used for welders' assistants

It is recommended that welders' assistants and other persons in the area of welding operations be protected : filters of scale numbers 1.2 to 4 should be used for this purpose.

Table 5a) — Scales[1] of protection to be used for electric arc welding or arc gouging

Use	I = Current, in amperes																					
	10	15	20	30	40	60	80	100	125	150	175	200	225	250	275	300	350	400	450	500		
Covered electrodes (shielded metal arc)				9		10			11					12				13				14
MIG on heavy metals[2]							10			11				12				13				14
MIG on light alloys							10			11			12			13			14			15
TIG on all metals and alloys	9			10			11				12				13			14				
MAG						10		11			12					13			14			15
arc-air gouging										10		11		12		13			14			15

Table 5b) — Scales[1] of protection to be used for plasma direct arc welding

Use	I = Current, in amperes																					
	0,5			1			2,5			5			9			15			30			
Microplasma arc welding				5			6			7			8			9			10			

1) According to the conditions of use, the next greater or the next smaller scale can be used.

2) The expression "heavy metals" applies to steels, alloy steels, copper and its alloys, etc.

NOTE — The hatched areas correspond to the ranges where the welding operations are not usually used in the current practice of manual welding.

6 Remarks

From the point of view of eye protection and hygiene during welding operations and use of related techniques, the following points should be taken into account :

a) The scales of protection given in this International Standard are applicable to a normal work programme and are derived from experience gained in the practical application of welding processes and related techniques.

b) For a scale number of protection corresponding to the work conditions specified in tables 2, 3, 4, 5a) and 5b), the protection in the ranges of ultra-violet and infra-red is sufficient, table 1 having been determined so that this should be the case. The use of a higher scale number would not provide practically greater protection and present, in return, the disadvantages indicated in 6d).

c) If the use of a filter selected from the tables produces a feeling of discomfort, the lighting conditions and eyesight of the operator should be tested.

d) It would be harmful to use a filter which was too opaque as this would force the operator to stand too close to the source of radiation and this would be a disadvantage from the point of view of respiratory hygiene.

e) For work carried out in the open air in strong natural light, it is usually possible to reduce the opacity of the protective filter by one scale because of the reduction in contrast.

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