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Health and safety in welding and allied processes — Transparent welding curtains, strips and screens for arc welding processes

Hygiène et sécurité en soudage et techniques connexes — Rideaux, lanières et écrans transparents pour les procédés de soudage à l'arc

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, Subcommittee SC 9, *Health and safety*.

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Official interpretations of TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This second edition cancels and replaces the first edition (ISO 25980:2014), which has been technically revised. The main changes compared to the previous edition are as follows:

— The hazard level G has been removed;

— Requirements regarding luminous and effective blue-light transmittance have been added.

Health and safety in welding and allied processes — Transparent welding curtains, strips and screens for arc welding processes

1 Scope

This International Standard specifies safety requirements for transparent welding curtains, strips, and screens to be used in workplaces where arc welding is taking place. They are intended to provide protection of workers against harmful levels of optical radiation and spatter who are in the vicinity of arc welding processes but not involved in the welding itself. They are intended to reduce the discomfort glare from the arc but also allow sufficient luminous transmittance to permit a view into the workspace behind. The transparent welding curtains may also be used in other applications as long as the UV- and blue-light emissions are less than in arc welding. They are designed to be used at a distance from the arc of at least 1 m.

Welding curtains, strips, and screens specified in this International Standard are not intended to replace welding filters. For intentional viewing of welding arcs other means of protection are used, see ISO 16321-1 and ISO 16321-2.

This International Standard is not applicable for protection against laser radiation for which ISO 19818-1 applies.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4007:2018, *Personal protective equipment — Eye and face protection — Vocabulary*

ISO 11664-2:2007, *Colorimetry — Part 2: CIE standard illuminants*

ISO 18526-2:2020, *Eye and face protection — Test methods — Part 2: Physical optical properties*

ISO 18526-3:2020, *Eye and face protection — Test methods — Part 3: Physical and mechanical properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4007 and the following apply.

3.1
transparent
characteristic of welding curtains, strips, and screens that permit visibility of the working place without implying to be glass clear

3.2
effective ultraviolet transmittance
τ_{UV}
normalized value of the spectral transmittance averaged between 200 nm and 400 nm weighted by the relative spectral effectiveness function for ultraviolet

Note 1 to entry: The effective ultraviolet transmittance is usually expressed as a percentage and calculate from Formula (1).

3.3
effective blue-light transmittance
τ_B
normalized value of the spectral transmittance averaged between 300 nm and 700 nm weighted by the relative spectral effectiveness function for blue-light

Note 1 to entry: The effective blue-light transmittance is usually expressed as a percentage and calculate from Formula (2).

3.4
luminous transmittance
τ_V
ratio of the luminous flux (3.4.4) transmitted to the incident luminous flux for a specified illuminant (3.2.6) and photopic vision

Note 1 to entry: The luminous transmittance is usually expressed as a percentage and calculated from Formula (3).

[SOURCE: ISO 4007:2018, 3.10.1.32]

4 Requirements

4.1 Transmittance

4.1.1 General

NOTE 1 The intensity of the infrared radiation from the welding arc at a distance of more than 1 m is too low to represent a hazard.

NOTE 2 Measurement of spectral transmittance at wavelengths below 250 nm create measurement problems with noise. Most plastic materials (e.g. PVC and PC) have a very high attenuation and provide sufficient protection in the wavelength range shorter than 250 nm.

4.1.2 Effective ultraviolet transmittance

When tested in accordance with 5.1.2 the weighted effective ultraviolet transmittance, τ_{UV}, in the wavelength range between 200 nm and 400 nm shall be less than 0,002 %.

4.1.3 Effective blue-light transmittance

When tested in accordance with 5.1.3 the weighted effective blue-light transmittance, τ_B, in the wavelength range between 300 nm to 700 nm shall be less than 1,0 %.

4.1.4 Luminous transmittance

When tested in accordance with 5.1.4 the classification based on the luminous transmittance can be expressed in the grades according to Table 1.

Table 1 — Luminous transmittance

Grade	Luminous transmittance, $\tau_{v,D65}$	
	Min	Max
Light	29,0	100,0
Medium	8,5	29,0
NOTE The maximum values are taken as equal or less than and the minimum values are taken as greater than.		
[a] Extra dark is normally intended for separation of adjacent operations.		

Table 1 *(continued)*

Grade	Luminous transmittance, $\tau_{v,D65}$	
	Min	Max
Dark	1,0	8,5
Extra dark [a]	0,02	1,0
NOTE The maximum values are taken as equal or less than and the minimum values are taken as greater than.		
[a] Extra dark is normally intended for separation of adjacent operations.		

4.2 Resistance to ultraviolet radiation

To ensure that the required protection is maintained and the discomfort glare protection is not markedly altered after exposure to UV radiation, the curtain shall be exposed to a xenon arc that has similar spectral characteristics to welding arcs.

After exposure to UV radiation due to the test specified in 5.2, the curtain shall remain compliant with 4.1.2 and 4.1.3 and the relative change in luminous transmittance shall not be greater than ± 20 %.

4.3 Resistance to flame spread

The welding curtain, strip, or screen material is considered to be satisfactory, if for all 3 samples

— the flame does not reach the test mark with the burner in position;

— the flame self-extinguishes after removal of the burner; and

— the material does not continue to glow for more than 3,0 s after removal of the burner.

4.4 Seam and eyelet strength

In case eyelets are used and when welding curtains with thickness of less than 0,5 mm are tested in accordance with 5.4 there shall be no tearing of any seam, tearing of any eyelet, and/or removal of any eyelet.

5 Test and calculation methods

5.1 Transmittance

5.1.1 General

After preparation, the test specimens shall be maintained at a temperature of (23 ± 5) °C and relative humidity of less than 70 % for a minimum of 16 h before testing.

The methods for measuring spectral transmittance are specified in ISO 18526-2:2020, Clause 6.

5.1.2 Effective ultraviolet transmittance

τ_{UV} is calculated by Formula (1):

$$\tau_{UV}(\%) = 100 \times \frac{\int_{200\,nm}^{400\,nm} \tau(\lambda) \cdot S(\lambda) \cdot d\lambda}{\int_{200\,nm}^{400\,nm} S(\lambda) \cdot d\lambda} \quad (1)$$

where

$\tau(\lambda)$ is the spectral transmittance in the range 200 nm to 400 nm;

$S(\lambda)$ is the spectral efficiency for UV radiation;

λ is the wavelength in nm.

5.1.3 Effective blue-light transmittance

τ_B is calculated by Formula (2):

$$\tau_B(\%) = 100 \times \frac{\int_{300\,nm}^{700\,nm} \tau(\lambda) \cdot B(\lambda) \cdot d\lambda}{\int_{300\,nm}^{700\,nm} B(\lambda) \cdot d\lambda} \quad (2)$$

where

$\tau(\lambda)$ is the spectral transmittance in the range 300 nm to 700 nm;

$B(\lambda)$ is the blue-light hazard function;

λ is the wavelength in nm.

5.1.4 Luminous transmittance

For the purposes of this document CIE illuminant D65 is used and calculated with Formula (3).

$$\tau_{v,D65}(\%) = 100 \times \frac{\int_{380\,nm}^{780\,nm} \tau(\lambda) \cdot S_{D65}(\lambda) \cdot V(\lambda) \cdot d\lambda}{\int_{380\,nm}^{780\,nm} S_{D65}(\lambda) \cdot V(\lambda) \cdot d\lambda} \quad (3)$$

where

$\tau(\lambda)$ is the spectral transmittance in the range 380 nm to 780 nm;

$V(\lambda)$ is the CIE 2° *spectral luminous efficiency function* for photopic vision (see ISO 11664-1);

$S_{D65}(\lambda)$ is the spectral distribution of the incident radiation of *CIE standard Illuminant* D65 (see ISO 11662-2);

λ is the wavelength in nm.

NOTE The values of the product $S_{D65}(\lambda) \bullet V(\lambda)$ are given in ISO 4007, Table A.3 and can be interpolated when necessary.

5.2 Resistance to ultraviolet radiation

To assure the stability of the spectral absorption properties of the curtain, a sample shall be tested in accordance with ISO 18526-3:2020, Clause 6.8.3 in a xenon arc test chamber for an exposure time of (100,0 ± 0,2) h. The spectral transmittance is then tested to assure that the curtain still meets the attenuation requirements of 4.1.2 and 4.1.3. Record the relative change in luminous transmittance as a percentage.

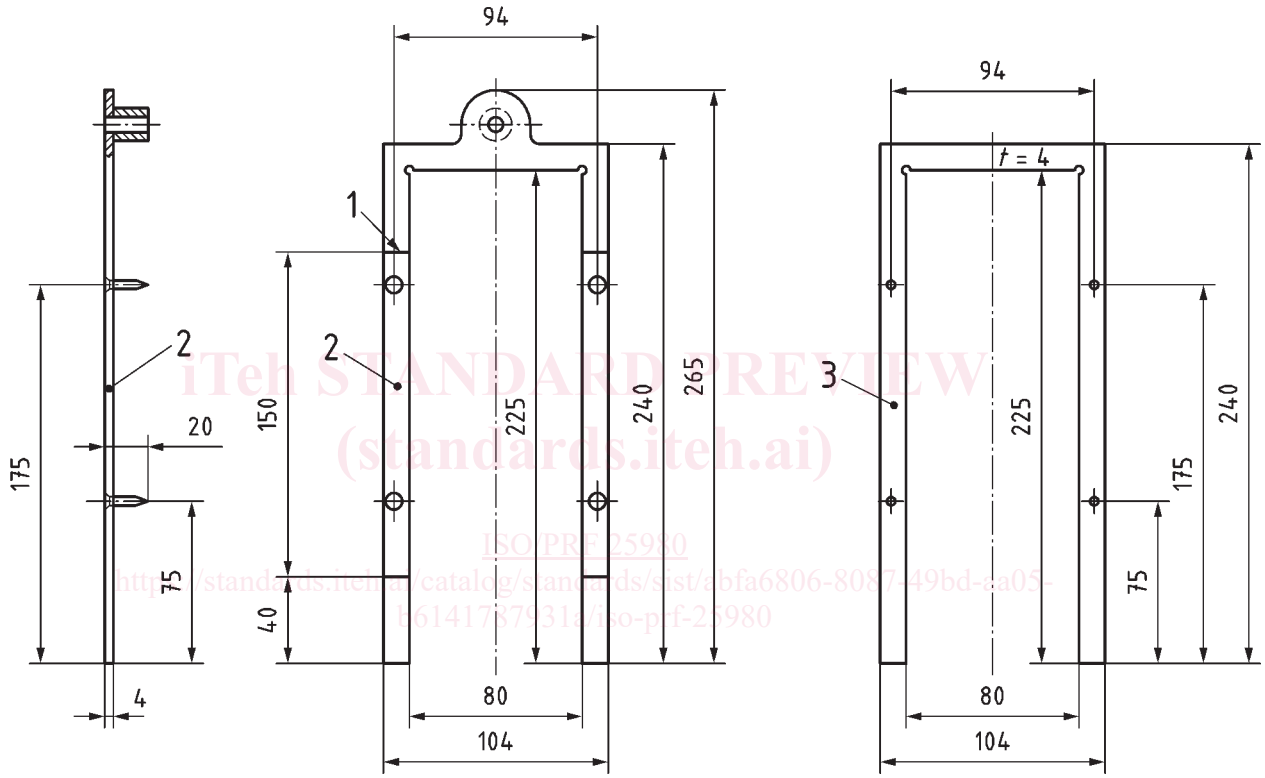
5.3 Resistance to flame spread

5.3.1 Test apparatus

The following apparatus is required.

a) Sample holder made of rigid metal or non-flammable material with the construction and dimensions shown in Figure 1. The test marks are on the front of part 1 and the locating pins project from the rear of part 1, see Figure 2.

Dimensions in millimetres



Key

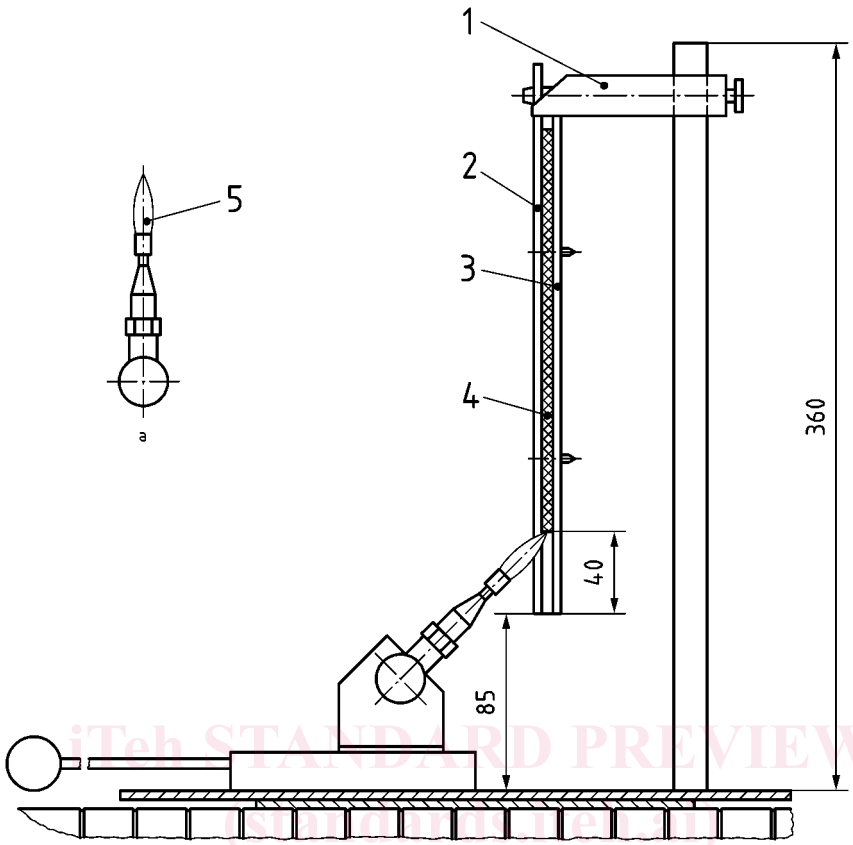
1 test mark
2 sample holder part I
3 sample holder part II
t thickness of sample holder

NOTE All dimensions have tolerances of ± 0,5 mm.

Figure 1 — Sample holder

b) A propane burner, having a nominal visible flame height of 20 mm when put in upright position (see Figure 2).

Dimensions in millimetres



Key

1 mounting device
2 sample holder part I
3 sample holder part II
4 sample
5 flame
a Position of the burner when setting the flame height.

NOTE All dimensions have tolerances of ± 0,5 mm.

Figure 2 — Burner and testing setup

5.3.2 Test specimens

There shall be 3 samples cut from the welding curtain, (190 ± 5) mm long and (90 ± 2) mm wide.

5.3.3 Test procedure

a) Testing shall be carried out at (23 ± 5) °C and relative humidity of less than 70 % and in a draught-free environment.

b) Clamp the sample between the two parts of the sample holder (see Figure 2). The lower end of the sample shall be (40 ± 2) mm above the lower end of the sample holder.

c) Suspend the sample and holder as shown in Figure 2.

d) Set the burner upright and allow to burn for at least 60 s.