



SLOVENSKI STANDARD SIST EN 379:2003

01-december-2003

Nadomešča:

SIST EN 379:1996

SIST EN 379:1996/A1:1999

Osebno varovanje oči – Samozatemnitveni filtri za varjenje

Personal eye-protection - Automatic welding filters

Persönlicher Augenschutz - Automatische Schweißerschutzfilter

Protection individuelle de l'œil - Filtres de soudage automatique

Ta slovenski standard je istoveten z: EN 379:2003

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ICS:

| | | |
|-----------|--|---|
| 13.340.20 | Varovalna oprema za glavo | Head protective equipment |
| 25.160.01 | Varjenje, trdo in mehko spajkanje na splošno | Welding, brazing and soldering in general |

SIST EN 379:2003

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English version

Personal eye-protection - Automatic welding filters

Protection individuelle de l'oeil - Filtres de soudage
automatiquePersönlicher Augenschutz - Automatische
Schweißerschutzfilter

This European Standard was approved by CEN on 1 August 2003.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 379:2003) has been prepared by Technical Committee CEN/TC 85 "Eye-protective equipment", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative annex ZA, which is an integral part of this document.

Annexes A and B are informative.

This document supersedes EN 379:1994.

In the revision of this European standard, and that of EN 169, which was performed concurrently, it was decided to remove from EN 379 welding filters with dual scale numbers and include them within EN 169.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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EN 379:2003 (E)**1 Scope**

This European standard specifies requirements for automatic welding filters which switch their luminous transmittance to a lower predetermined value when a welding arc is ignited (referred to as welding filters with switchable scale numbers). It also specifies requirements for automatic welding filters which switch their luminous transmittance to a lower value, where the lower value of luminous transmittance is set automatically in dependence on the illuminance generated by the welding arc (referred to as welding filters with automatic scale number setting).

The requirements of this standard apply if such a filter is to be used for continuous viewing of the welding process, (including gas welding and cutting), and if it is to be used only during the period when the arc is being ignited.

These filters are used in welders' eye protectors or are fixed to equipment.

If they are to be used in welders' eye protectors, other applicable requirements for these types of filters are given in EN 166. The requirements for the frames/mountings to which they are intended to be fitted are given in EN 175.

Guidance on the selection and use of these filters is given in annex A.

The specifications for welding filters without switchable luminous transmittance are given in EN 169.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 165:1995, *Personal eye-protection – Vocabulary*,
<https://standards.iteh.ai/catalog/standards/sist/cf720564-cc6f-46d8-a095-fcb6b5ad5b33/sist-en-379-2003>

EN 166:2001, *Personal eye-protection - Specifications*.

EN 167:2001, *Personal eye-protection - Optical test methods*.

EN 168:2001, *Personal eye-protection - Non-optical test methods*.

EN 169:2002¹⁾, *Personal eye-protection - Filters for welding and related techniques - Transmittance requirements and recommended use*.

ISO 9211-2:1994, *Optics and optical instruments -- Optical coatings -- Part 2: Optical properties*

ISO/CIE 10526:1999, *CIE standard illuminants for colorimetry*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 165:1995 and the following apply.

3.1**automatic welding filter**

a protective filter which automatically switches its scale number from a lower value (light state scale number) to a higher value (dark state scale number) when the welding arc is ignited

1) To be published

3.1.1

automatic welding filter with manual scale number setting

a protective filter which automatically switches its scale number from a lower value (light state scale number) to a higher value (dark state scale number) selected by the user when the welding arc is ignited.

3.1.2

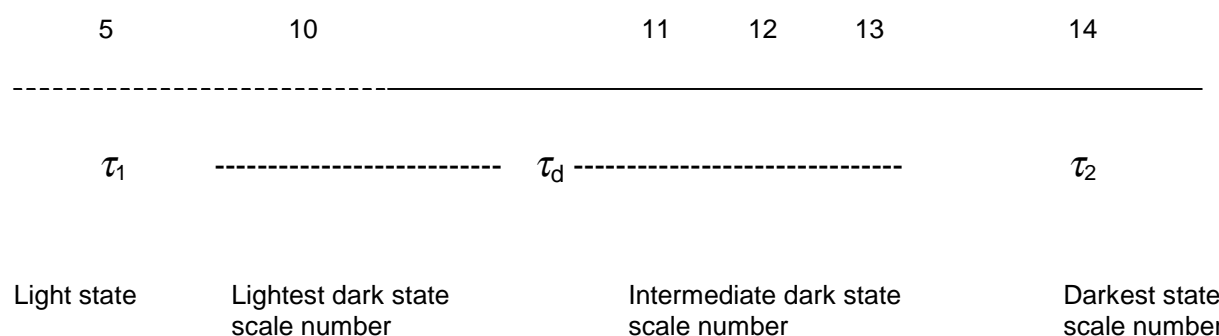
automatic welding filter with automatic scale number setting

A welding filter with switchable scale number, in which the dark state scale number depends upon the illuminance generated by the welding arc.

3.2

light state scale number

the scale number corresponding to the maximum value of luminous transmittance τ_1 (see Figure 1)



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Figure 1 - Example showing the meaning of the terms in the case of an automatic welding filter with a light state scale number of 5 and dark state scale numbers between 10 and 14

3.3

dark state scale number <https://standards.iteh.ai/catalog/standards/sist/cf720564-cc6f-46d8-a095-fbcb5c15e33/sist-en-379-2003>

the scale number corresponding to the value of the luminous transmittance τ_d reached after the ignition of the welding arc by an automatic welding filter (see Figure 1)

3.4

darkest state scale number

the highest scale number corresponding to the minimum value of luminous transmittance τ_2 of an automatic welding filter claimed by the manufacturer (see Figure 1)

3.5

switching time

the switching time t_s of an automatic welding filter is defined by the following integral:

$$t_s = \frac{1}{\tau_1} \int_{t=0}^{t=t(\tau(t)=3\tau_2)} \tau(t) dt$$

where

$t = 0$ is the time at which the arc ignites;

$\tau(t)$ is luminous transmittance at a time t after the ignition of the welding arc;

$t = t(\tau(t)=3\tau_2)$ is the time at which the luminous transmittance falls to 3 times the luminous transmittance in the darkest state.

NOTE In the case of short term exposure to light, the glare is approximately proportional to the product of the illuminance at the eye and time. The time relationship of the darkening process can be very different depending on the construction of the welding filter with switchable scale number. It is therefore appropriate to define the switching time as an integral of the luminous transmittance over time and not merely by the initial and final luminous transmittances.

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3.6

cut-off filter

a filter with a range of low spectral transmittance (cut-off band) followed by a range with high spectral transmittance (pass-band) or vice versa, with properties described according to ISO 9211-2:1994.

4 Requirements

4.1 General requirements

Automatic welding filters shall comply with requirements given in Table 1. These requirements shall be met for the highest possible scale number as may be set under either automatic setting (including manual offset) or manual setting.

Table 1 - General requirements

| Property | Requirement |
|---|---|
| Spherical, astigmatic and prismatic refractive powers | EN 166:2001, 7.1.2.1.2 |
| Luminous transmittance | EN 169:2002, Table 1 |
| Variations in luminous transmittance | 4.3.3 |
| Spectral transmittance | EN 169:2002, Table 1 |
| Diffusion of light | 4.3.6 |
| Quality of material and surface | EN 166:2001, 7.1.3 |
| Robustness of construction | EN 166:2001, 7.1.4 |
| Resistance to ultraviolet radiation | EN 166:2001, 7.1.5.2, but replacing 7.1.5.2 b) by 4.3.6 of this European standard |
| Resistance to ignition | EN 166:2001, 7.1.7 |

4.2 Particular requirements

Where a manufacturer wishes to claim compliance with particular requirements, these requirements shall be as specified in EN 166:2001, 7.2.2 to 7.2.8 and 7.3.

4.3 Additional requirements

4.3.1 Power off

When tested according to 5.1, automatic welding filters shall be no more than nine scale numbers lighter than the darkest state scale number.

4.3.2 Transmittance

4.3.2.1 The requirements of 4.3.2.2, 4.3.2.3 and 4.3.2.4 shall be satisfied when the transmittances are measured as described in EN 167:2001, 6, using standard illuminant A.

4.3.2.2 The minimum luminous transmittance in the light state shall be 0,16% when measured at both $(-5 \pm 2)^\circ\text{C}$ and $(55 \pm 2)^\circ\text{C}$.

4.3.2.3 The luminous transmittance requirements given in EN 169:2002, Table 1, shall apply to both light and dark states (τ_1 , τ_d and τ_2). The measurements shall be taken at both $(-5 \pm 2)^\circ\text{C}$ and $(55 \pm 2)^\circ\text{C}$.

4.3.2.4 The spectral transmittance in the ultraviolet and the mean transmittance in the infrared, as given in EN 169:2002, Table 1, and the additional requirements (a) to (d) of EN 169:2002, 5.2, required for the darkest state scale number, shall also apply to all other states. The measurements shall be taken at a temperature of $(23 \pm 5)^\circ\text{C}$.

4.3.2.5 In the case of welding filters with automatic scale number setting, this setting of the dark state scale number shall meet the following requirements:

- a) The dark state scale number $N(E_v)$ shall depend on the illuminance E_v as follows:

$$N(E_v) = 2,93 + 2,25 \log(E_v / \text{lx})$$

Some values calculated from this formula are given as examples in Table 2, for scale numbers between 8 and 14:

Table 2 - Dark state scale number

| Scale number N | Dark state scale number | | | | | | |
|------------------|-------------------------|-----|-------|-------|--------|--------|--------|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Illuminance / lx | 180 | 500 | 1 400 | 3 900 | 10 700 | 30 000 | 83 000 |

- b) The scale number set in dependence on the illuminance at the filter front shall not deviate by more than ± 1 scale number from the scale number given by the formula in (a).
- c) The range of the luminous transmittance of the welding filter shall be limited by design not to exceed the manufacturer's claimed darkest state scale number.
- d) A manual offset may be provided, which allows the automatically set scale number to be changed by ± 1 scale number. This shall be tested at both minimum and maximum settings.
- e) When tested using double the illuminance given by the formula in (a) for the darkest state scale number, the luminous transmittance shall correspond to the darkest state scale number claimed by the manufacturer.

4.3.3 Variations in luminous transmittance

When measured in accordance with clauses 7.1 and 7.2 of EN 167:2001 at a temperature of $(23 \pm 5)^\circ\text{C}$ the values of P_1 , P_2 and P_3 of welding filters with switchable scale number shall not exceed the values in Table 3 for the assigned class. The requirement shall apply to both light and dark states (τ_1 , τ_d and τ_2).

Table 3 - Classification of oculars according to the maximum value of P_1 , P_2 or P_3 as specified in 4.3.3

| Luminous transmittance | | Maximum value of P_1 or P_2 | | | Maximum value of P_3 | | |
|------------------------|----------|---------------------------------|---------|---------|------------------------|---------|---------|
| % | | % | | | % | | |
| max. | min. | Class 1 | Class 2 | Class 3 | Class 1 | Class 2 | Class 3 |
| 100 | 17,9 | 5 | 10 | 15 | 20 | 20 | 20 |
| 17,9 | 0,44 | 10 | 15 | 20 | 20 | 20 | 20 |
| 0,44 | 0,023 | 15 | 20 | 30 | 20 | 20 | 30 |
| 0,023 | 0,0012 | 20 | 30 | 40 | 20 | 30 | 40 |
| 0,0012 | 0,000023 | 30 | 40 | 60 | 30 | 40 | 60 |

4.3.4 Switching time

- 4.3.4.1** The switching times shall satisfy either 4.3.4.2 or 4.3.4.3 for the darkest state.

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4.3.4.2 The switching time shall be measured as described in clause 5.2 at temperatures of $(-5 \pm 2)^\circ\text{C}$ and $(55 \pm 2)^\circ\text{C}$. The switching time given in Table 4 shall not be exceeded at either of these temperatures.

4.3.4.3 The switching time shall be measured as described in clause 5.2 at temperatures of $(10 \pm 2)^\circ\text{C}$ and $(55 \pm 2)^\circ\text{C}$. The switching time given in Table 4 shall not be exceeded at either of these temperatures.

Table 4 - Maximum switching times

| Dark state scale number | Light state scale number | | | | | | |
|-------------------------|--------------------------|------|------|-----|------|----------------|----------------|
| | 1,7 | 2 | 2,5 | 3 | 4 | 5 | 6 |
| | Switching time ms | | | | | | |
| 7 | 300 | 400 | 500 | 700 | 1000 | No requirement | No requirement |
| 8 | 100 | 150 | 200 | 300 | 500 | 1000 | No requirement |
| 9 | 40 | 50 | 70 | 100 | 200 | 400 | 700 |
| 10 | 20 | 20 | 30 | 40 | 70 | 100 | 300 |
| 11 | 6 | 7 | 10 | 15 | 30 | 50 | 100 |
| 12 | 2 | 3 | 4 | 5 | 10 | 20 | 40 |
| 13 | 0,8 | 1 | 1,5 | 2 | 4 | 7 | 10 |
| 14 | 0,3 | 0,4 | 0,5 | 0,7 | 1 | 3 | 5 |
| 15 | 0,10 | 0,15 | 0,2 | 0,3 | 0,5 | 1 | 2 |
| 16 | 0,04 | 0,05 | 0,07 | 0,1 | 0,2 | 0,4 | 0,7 |

NOTE The values given in Table 4 are based on a 0,5 s duration of glare when the welding arc is ignited. (see: E. Buhr, E. Sutter: Dynamic Filters for Protective Devices, in: G. J. Müller, D. H. Sliney (Hrsg.): Dosimetry of Laser Radiation in Medicine and Biology, SPIE IS 5, 175-195, Washington, 1989)

4.3.5 Manual control of dark scale number

When a manual control of the dark scale number is provided, the means of control shall meet the following requirements:

- There shall be a digital indication of the scale number for each position of the manual control;
- With an illuminance of $(10^4 \pm 10^3)$ lx on the filter, the scale number in the dark states (τ_d and τ_2) shall not deviate by more than ± 1 from the set scale number;
- If the range of control is more than five scale numbers, it shall be divided into two sub-ranges with separate manual controls. Each manual control shall control a sub-range of no more than five scale numbers. In the case of automatic welding filters with manual control according to 4.3.2.5 e), the total scale number range shall not exceed seven scale numbers, (including the tolerance of 4.3.5 (b) and the provision of 4.3.2.5 e)).

4.3.6 Diffusion of light

The diffusion of light shall be measured in accordance with one of the reference methods described in EN 167:2001, 4.

The maximum value of the reduced luminance factor in the light or dark state shall determine the diffusion of light class of the welding filter as shown in Table 5.

Table 5 - Assignment of diffusion of light class

| Diffusion of light class | Maximum value of reduced luminance factor (cd/m^2)/lx |
|--------------------------|---|
| 1 | 1,0 |
| 2 | 2,0 |
| 3 | 3,0 |

4.3.7 Angle dependence of luminous transmittance (Optional requirement)

The luminous transmittance is measured at normal to the filter and at angles of incidence up to $\pm 15^\circ$ to the normal in order to establish the maximum and minimum transmittance. Then the ratios of the luminous transmittance values measured at any angle of incidence up to $\pm 15^\circ$ to the normal to the filter and the value of the luminous transmittance measured at normal incidence are calculated as well as the reciprocals of these ratios. The maximum of these ratios and their reciprocals as compared with the values in Table 6 determines the class of angle dependence of luminous transmittance.

Table 6 - Angle dependence of luminous transmittance

| Class for the angle dependence of luminous transmittance | Maximum transmittance ratio of the luminous transmittance values determined in accordance with 4.3.7 |
|--|--|
| 1 | 2,68 (corresponding to 1 scale number) |
| 2 | 7,20 (corresponding to 2 scale numbers) |
| 3 | 19,31 (corresponding to 3 scale numbers) |

4.4 Spectral sensitivity of welding filters with automatic scale number setting

The maximum spectral sensitivity of welding filters with automatic scale number setting shall occur at a wavelength of (555 ± 75) nm and the full bandwidth at half maximum of the spectral sensitivity curve shall be between 50 nm and 200 nm.

NOTE The spectral sensitivity should follow the eye sensitivity curve $V(\lambda)$ as closely as possible.

5 Test methods

5.1 Power off test

Measure the luminous transmittance with the device in the darkest state. Disconnect all power supplies. Repeat the measurement of the luminous transmittance.

5.2 Measurement of switching time

5.2.1 Test equipment

5.2.1.1 Switching light source

This consists of a high-pressure xenon lamp as a source of radiation, producing an illuminance of $(5 \times 10^3 \pm 0,5 \times 10^3)$ lx at the test specimen.