
**Optics and photonics — Preparation
of drawings for optical elements and
systems —**

**Part 9:
Surface treatment and coating**

*Optique et photonique — Indications sur les dessins pour éléments et
systèmes optiques —*

Partie 9: Traitement de surface et revêtement



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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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 1, *Fundamental standards*.

This second edition cancels and replaces the first edition (ISO 10110-9:1996), which has been technically revised with the following changes:

- a) the referencing of optical coating standards ISO 9211-1 and ISO 9211-2;
- b) the description of functional coatings in tabular form as described in ISO 10110-1;
- c) a complete revision of all drawings;
- d) the addition of [Annexes A to D](#) which show examples for optical drawings and coating specification documents.

ISO 10110 consists of the following parts, under the general title *Optics and photonics — Preparation of drawings for optical elements and systems*:

- *Part 1: General*
- *Part 2: Material imperfections — Stress birefringence*
- *Part 3: Material imperfections — Bubbles and inclusions*
- *Part 4: Material imperfections — Inhomogeneity and striae*
- *Part 5: Surface form tolerances*
- *Part 6: Centring tolerances*
- *Part 7: Surface imperfection tolerances*
- *Part 8: Surface texture; roughness and waviness*
- *Part 9: Surface treatment and coating*

- *Part 10: Table representing data of optical elements and cemented assemblies*
- *Part 11: Non-toleranced data*
- *Part 12: Aspheric surfaces*
- *Part 14: Wavefront deformation tolerance*
- *Part 17: Laser irradiation damage threshold*
- *Part 19: General description of surfaces and components*

Optics and photonics — Preparation of drawings for optical elements and systems —

Part 9: Surface treatment and coating

1 Scope

ISO 10110 specifies the presentation of design and functional requirements for optical elements and systems in technical drawings used for manufacturing and inspection.

This part of ISO 10110 specifies rules for indicating the treatments and coatings applied to optical surfaces for functional and/or protective purposes.

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 128-24, *Technical drawings — General principles of presentation — Part 24: Lines on mechanical engineering drawings*

ISO 9211-1:2010, *Optics and photonics — Optical coatings — Part 1: Definitions*

ISO 9211-2, *Optics and photonics — Optical coatings — Part 2: Optical properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9211-1 and the following apply.

3.1 functional coating

thin film deposited to affect surface reflectance, to separate spectral wavelength regions, and/or to produce certain polarization or other special properties

Note 1 to entry: There is a wide variety of functional coatings, e.g. reflective, antireflective, wavelength selective, conductive or protective coatings. The different types of functional coatings are listed in ISO 9211-1:2010, Table A.1 (see [Annex A](#)).

3.2 protective surface treatment

paint or plating protection applied to optical surfaces, particularly rear surface mirrors, to prevent damage from handling, environmental effects and other causes

Note 1 to entry: Surfaces may also be painted or covered in certain areas to limit their optically effective apertures for stray light control.

4 General

ISO 10110-1 stipulates that all indications apply fundamentally to the finished product. Accordingly, the dimensions given in drawings which mention surface treatments or coatings refer to the dimensions after application of the treatments or coatings (see [Figure 1](#)). However, in certain cases, the dimensions

of a part before the application of surface treatments might be important. In such cases, it shall be explicitly indicated in the drawing that these dimensions refer to the untreated part.

5 Indications in drawings

5.1 General

The form of the specification for coatings is defined in ISO 9211-2.

When coating performance requirements are complex, they are described in separate specification documents, which shall be referenced in the drawings. If the specification is simple, it may be given directly on the drawing. In this case, the following symbols shall be used according to ISO 9211-1:

- $\tau(\lambda)$ for spectral transmittance;
- $\rho(\lambda)$ for spectral reflectance;
- $\alpha(\lambda)$ for spectral absorptance.

NOTE Wherever the Greek letters are mistakable, $T(\lambda)$, $R(\lambda)$ and $A(\lambda)$ can be used.

Wavelengths shall be given in nanometers.

5.2 Indication of functional coatings

For a suitable optical element, especially a lens element or a prism, the data may be given in tabular form as described in ISO 10110-1. The preferred field for the indication of functional coatings is the table field. An example is shown in [Annex B](#).

If the specification of a coating is too long to be included in the appropriate table field, it shall be given in the drawing field in a box as described below or in a separate coating specification document. An example is shown in [Annex C](#).

Functional coatings shall be indicated by λ . If functional coatings are specified in the table field, this symbol shall be located at the beginning of the specification. When functional coatings are specified in the drawing field, this symbol shall be located outside the element and tangent to the surface to be coated. Exceptions are elements in which the coating is protected by a protective layer and cemented (or optically contacted) subassemblies; in these cases, the coating symbol shall be placed inside the optical element (see [Figure 2](#) and [Figure 3](#)).

In drawings of a subassembly, the position of the coating symbol, λ , indicates to which of the two joined surfaces the coating is to be deposited: the coating symbol is placed inside the optical element that is to be coated prior to assembly (see [Figure 3](#)).

The coating symbol shall have a leader line to a box, containing the specification reference or specification.

Examples are given in [Figures 2](#) to [5](#).

The function of the coating shall be included in the box. Unless otherwise noted, the specifications shall refer to the indicated surface alone. In the case of functional coatings that are to be cemented, it shall be indicated whether the specification applies before or after cementing (see [Figure 3](#)).

Unless indicated otherwise, the coating shall extend at least over the optically effective surface. If necessary, toleranced dimensions shall be given for the area to be coated. In cases in which different zones of the same surface are to be coated differently, the zones shall be indicated by dimensioning (see [Annex D](#)).

5.3 Indication of protective treatments

Surface treatment such as protective treatments shall be indicated by a thick “chain” line (line type 04.2, ISO 128-24) adjacent to the surface. The length of this line indicates the region to be treated. If necessary, dimensions shall be given for this region.

The specification of the surface treatment shall be given in a box, which is connected to the thick “chain” line by a leader. Examples are given in [Figures 1](#) and [2](#).

6 Imperfections of functional coatings

ISO 10110-7 specifies the indication of an acceptability level for coating imperfections, which are described in ISO 9211-1.

7 Examples

Examples of functional coating and protective surface treatment indications are given in [Figures 1](#) to [5](#).

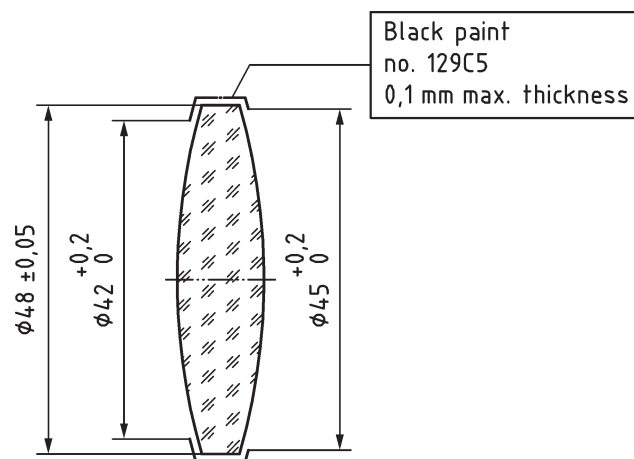


Figure 1 — Example of protective surface treatment indication (the outer diameter of 48 mm ± 0,05 mm refers to the part after painting)

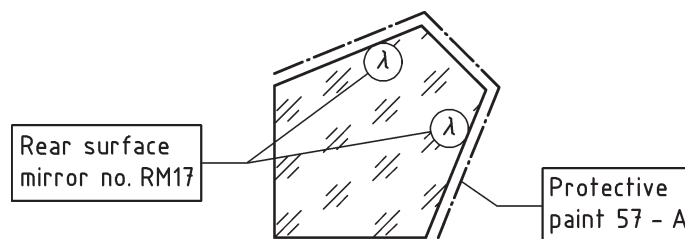


Figure 2 — Example of indication of a protective surface treatment combined with a functional coating

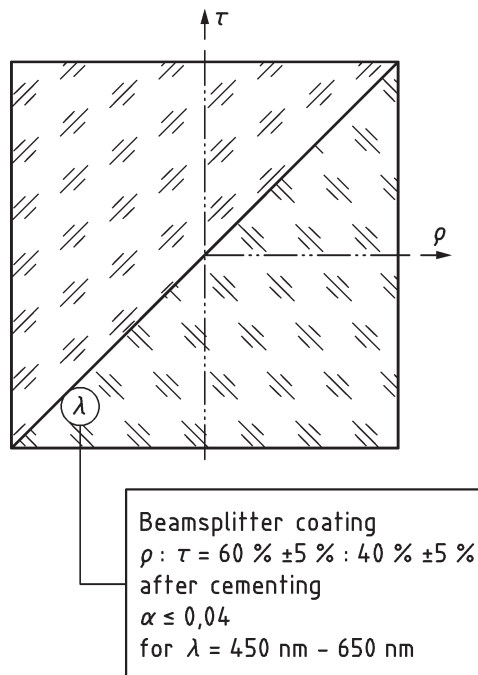


Figure 3 — Example of functional coating indication with optical characteristic specification

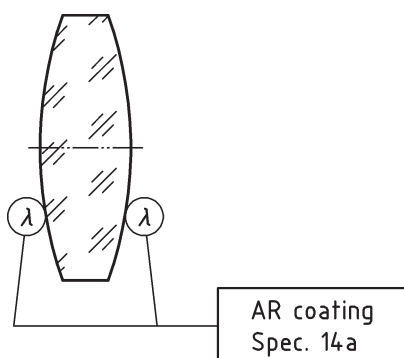


Figure 4 — Example of functional coating indication referencing separate specification

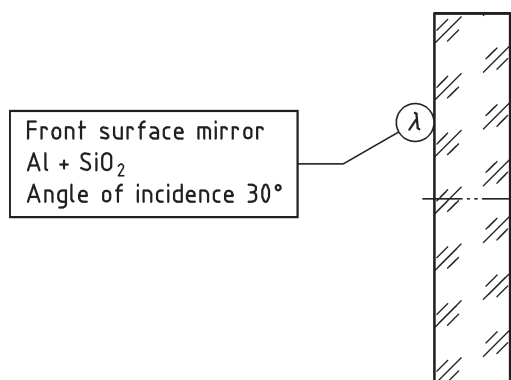


Figure 5 — Example of functional coating indication with specification of material

Annex A (informative)

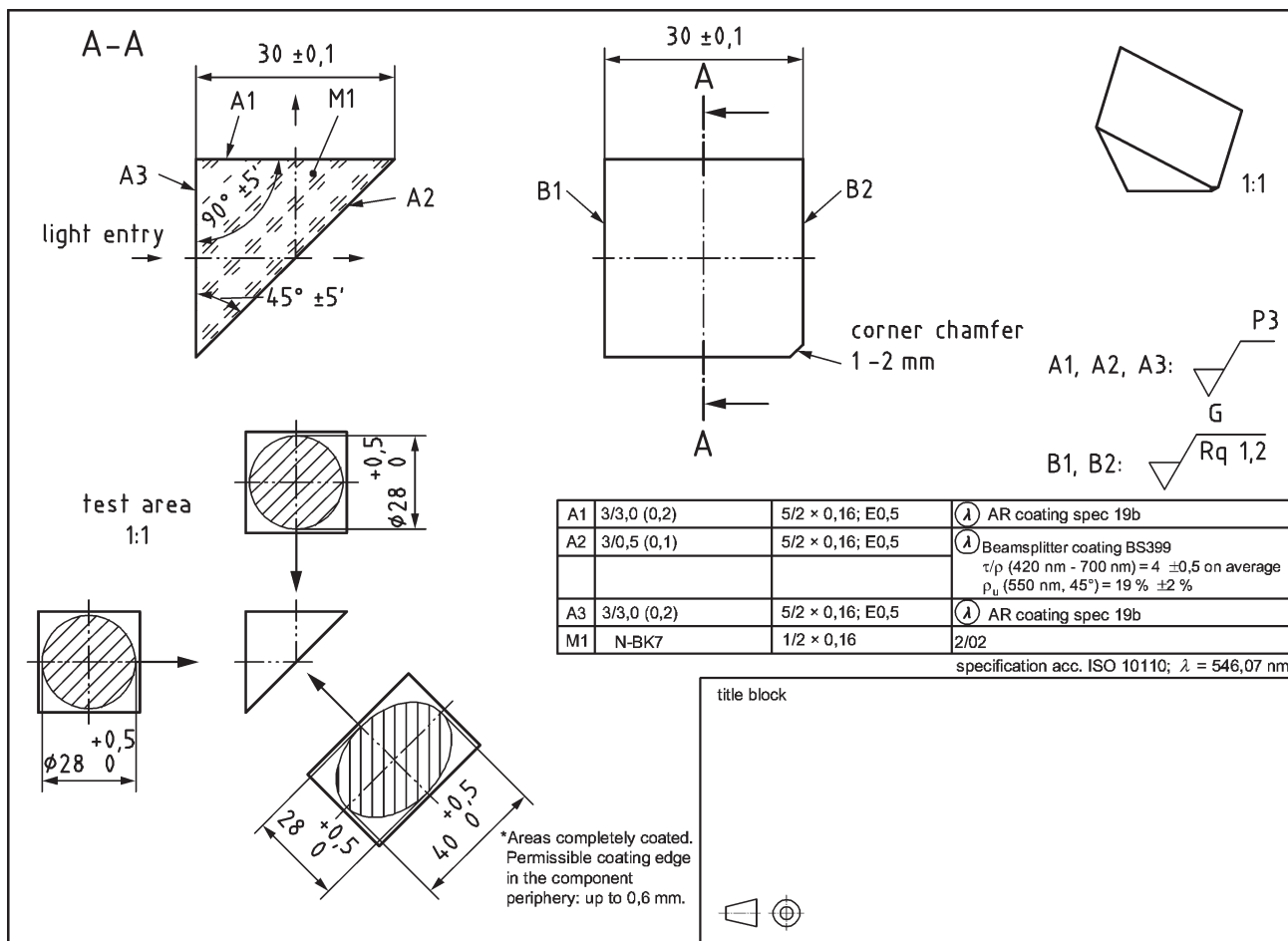
Functional coatings (from ISO 9211-1:2010)

Table A.1 — Functional coatings (from ISO 9211-1:2010)

Principal function	Code designation	Definition	Example of application
Reflecting	RE	Coating increasing the reflectance of an optical surface over a specified wavelength range.	Laser mirror
Antireflecting	AR	Coating reducing the reflectance of an optical surface over a specified wavelength range and usually increasing the transmittance.	AR coated lens
Beam splitting	BS	Coating separating the incident flux into two beams, one transmitted and the other reflected, the energy distribution of each beam reproducing the incident energy distribution in essentially a non-selective manner, over a specified wavelength range.	Neutral beam-splitter Partial reflector
Attenuating	AT	Coating reducing the transmittance in essentially a non-selective manner over a specified wavelength range.	Neutral density filter
Filtering a) Bandpass b) Band rejection	FI FI-BP FI-BR	Coating modifying the transmittance in a selective manner over a specified wavelength range.	Laser line selection filter Raman notch filter
Selecting or combining a) Long pass b) Short pass	SC SC-LP SC-SP	Coating dividing the incident radiation flux into two or more beams each one covering a limited spectral region and being propagated either by reflection or by transmission. The reverse path combines beams of different spectral regions.	Dichroic mirror Beam combiner Cold light mirror NIR cut filter
Polarizing	PO	Coating controlling the state of polarization of the emergent electromagnetic radiation, over a specified wavelength range.	Polarizer Non-polarizing beamsplitter
Phase changing	PC	Coating controlling the phase change of the emergent electromagnetic radiation relative to the incident radiation, and/or the phase difference between s and p vectors, over a specified wavelength range.	Phase retarder
Absorbing	AB	Coating absorbing a specified value of the incident flux over a specified wavelength range.	Light trap UV absorber
Supplementary	SU	Coating providing a non-optical property; this function is often combined with an optical function.	Electrical conductivity Chemical or mechanical protection

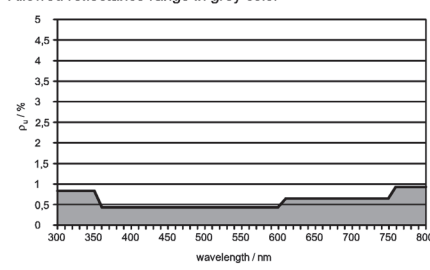

Annex B (informative)

Example for an optical drawing using the indication of functional coatings in tabular form



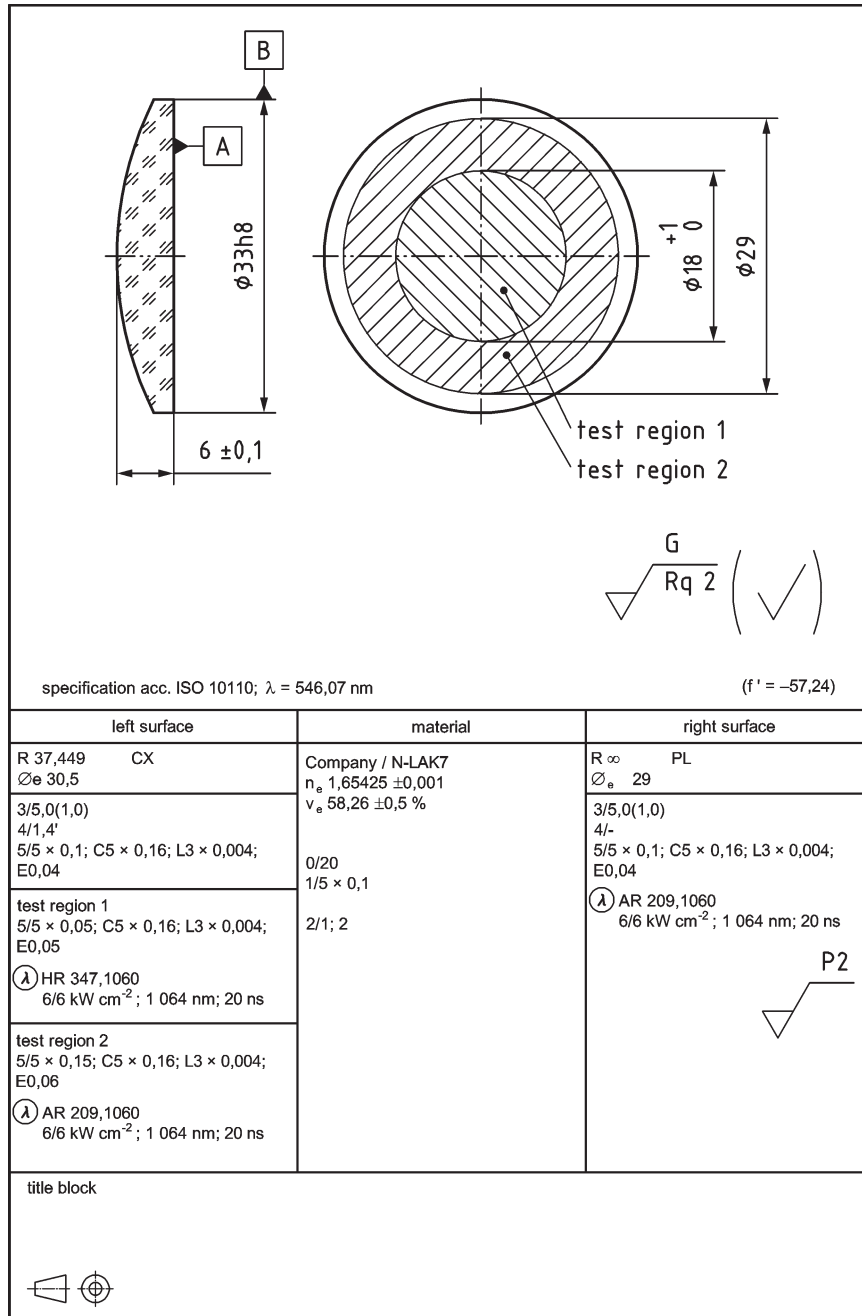
Annex C (informative)

Example for a coating specification document

Specification		765432-0001-000/98
<p><u>Specifications:</u> Optical Coating Broadband Antireflective Coating for NUV and VIS</p> <p>Comment:</p>	<p><u>Transmittance and Reflectance range:</u> Angle of incidence: 0° - 15°</p> <p>ρ_u(300 nm - 350 nm) <0,8 % ρ_u(350 nm - 360 nm) <0,8 % → 0,4 % ρ_u(360 nm - 600 nm) <0,4 % ρ_u(600 nm - 610 nm) <0,4 % → 0,6 % ρ_u(610 nm - 750 nm) <0,6 % ρ_u(750 nm - 760 nm) <0,6 % → 0,9 % ρ_u(760 nm - 800 nm) <0,9 %</p> <p>Spectral properties according to ISO 9211-1</p> <p>The color appearance in transmittance and reflectance is grey.</p>	
<p>$\rho_u = (\rho_s + \rho_p)/2$ ρ = reflectance</p> <p style="text-align: center;">Index s: perpendicular polarized p: parallel polarized u: unpolarized</p>	<p>Allowed reflectance range in grey color</p> 	
<p>Solubility, short-time resistance to: water, mild bases and acids, alcohol, acetone and alcoholic solvents, glass cleaners</p> <p>Resistance to humidity: ISO 9022-12-07, 55 °C, 93 % relative humidity, 16 hours</p> <p>Resistance of coating: ISO 9211-4-01-03 (Abrasion) ISO 9211-4-02-01 (Adhesion) ISO 9211-4-04-07 (Solubility)</p> <p>Specification of spectral properties in accordance with ISO 9211-2 (07/01) Specification of dimensions and tolerances of optical components and compilation of drawings and specifications of optical components in accordance with ISO 10110, ISO 8577 (12/01)</p>		
<p>title block</p>		
		

Annex D (informative)

Example of a functional coating indication showing two different coatings on the same surface



Bibliography

- [1] ISO 7944, *Optics and optical instruments — Reference wavelengths*
- [2] ISO 9211-3, *Optics and photonics — Optical coatings — Part 3: Environmental durability*
- [3] ISO 9211-4, *Optics and photonics — Optical coatings — Part 4: Specific test methods*
- [4] ISO 10110-1, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 1: General*
- [5] ISO 10110-7, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 7: Surface imperfection tolerances*

