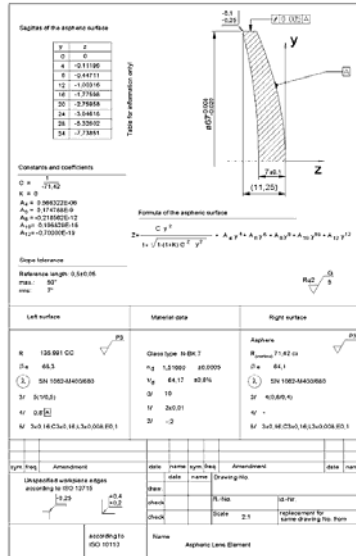# ISO 10110 Drawings

Optical Drawings provide a precise Definition of your optic for fabrication.

Standards allow for a common language to be used between you and the optician so there is no confusion regarding the features desired in the final part.

Advanced Optics Using Aspherical Elements
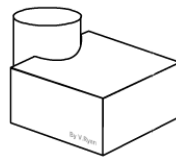By Bernhard Braunecker, Rüdiger Hentschel, Hans J. Tiziani

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ISO 10110

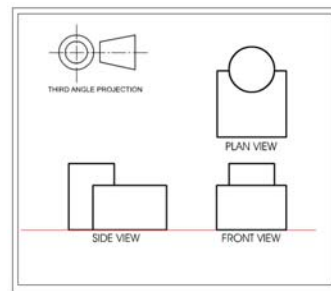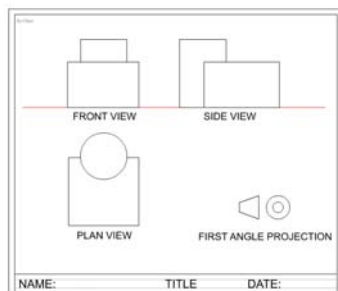| Part	Title	Indication
1	General	N/A
2	Material imperfections – Stress birefringence	0/
3	Material imperfections – Bubbles and Inclusions	1/
4	Material Imperfections – Inhomogeneity and Striae	2/
5	Surface form tolerances	3/
6	Centering Tolerances	4/
7	Surface Imperfection tolerances	5/
8	Surface Texture	√
9	Surface Treatment and coating	(λ)
10	Table representing data of a lens element	N/A
11	Non tolerance data	N/A
12	Aspheric surfaces	N/A
13	Laser irradiation damage threshold	6/

ISO 10110-1 General

- "Indications according to ISO 10110" appears on the drawing.
- The metric system for all linear dimensions is used, although the English system can be used as well, but needs to be indicated on the drawing. A comma is used instead of the decimal point.
- Standard language is English (UK). Note: centring instead of centering, colour instead of color, metre instead of meter.
- Anything described as "normative" in standard means "mandatory".
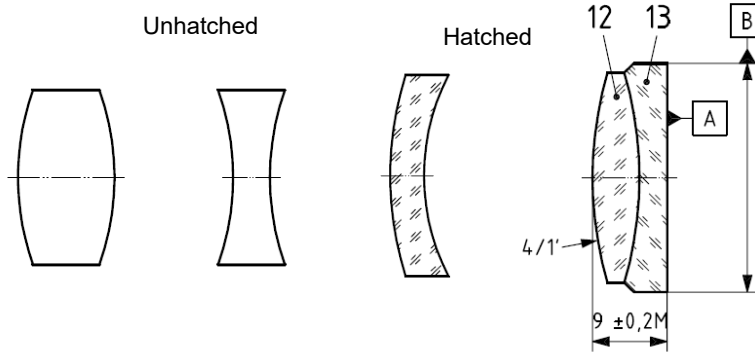- Reference wavelength = 546.07 nm Mercury e line.
- Temperature = 22 ± 2° C

ISO 10110-1 Projection

ISO 10110 Uses First Angle Projection. In US, Third Angle Projection is typically used.

ISO 10110-1 Hatching

Unhatched

Hatched

12   13   B

A

4/1'

9 ±0,2M
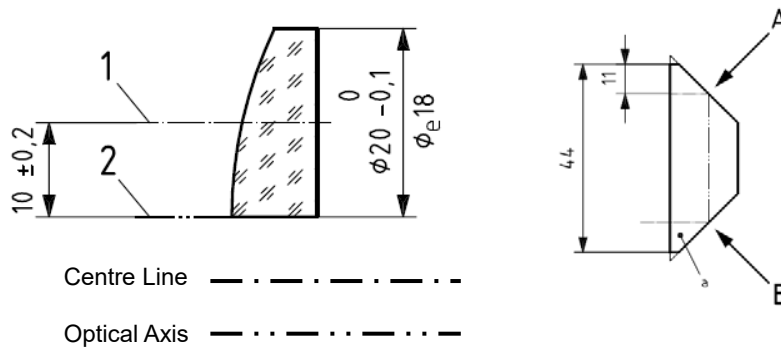
Optical Elements can be unhatched or have hatching (long line, with a short line on either side). Do not mix hatched and unhatched elements in same drawing. For multiple elements alternate orientation of hatching.
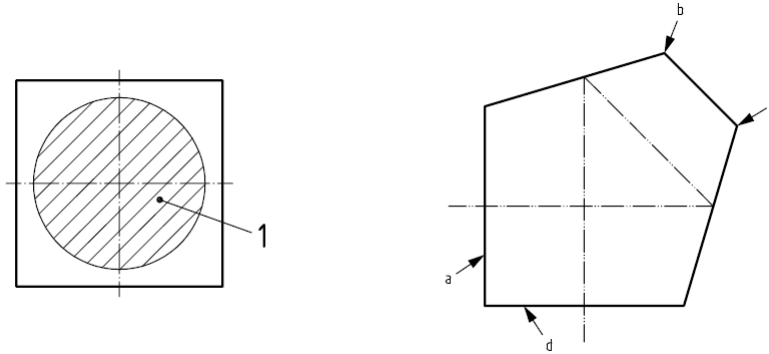
ISO 10110-1 Axes

1

2

$10 \pm 0,2$

$\phi 20 \, {}^{0}_{-0,1}$

$\phi_e 18$

11

44

A

B

Centre Line ⎯ · ⎯ · ⎯ · ⎯ ·

Optical Axis ⎯ · · ⎯ · · ⎯ · · ⎯

The center line is denoted by dash – dot line
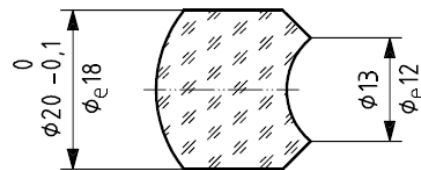The optical axis (and light path through prism) is denoted by dash-dot-dot line.

Often these are the same lines.
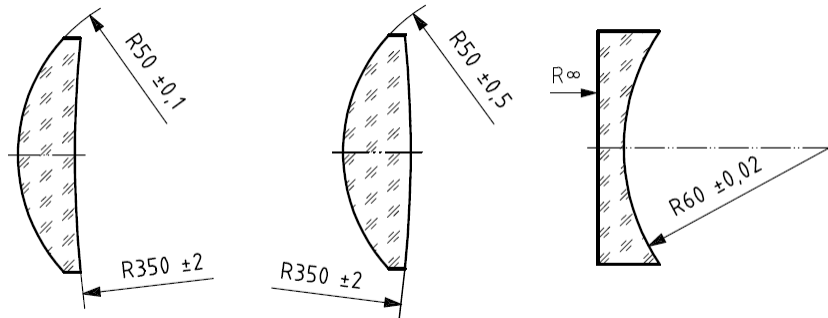
ISO 10110-1 Leader Lines

Leader lines to an area are terminated with a dot. Leader lines to a surface are terminated with an arrow.
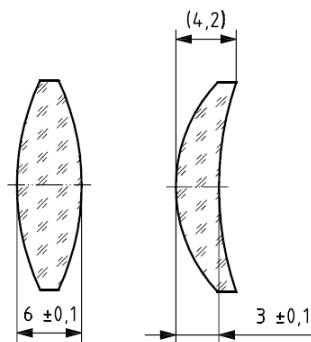
ISO 10110-1 Test Areas

Test regions or optically effective surfaces can be denoted on the part if the entire area does not need to meet some optical requirement. The diameter of circular test regions, the "effective diameter", is indicated by"Øe" .It defines the region of the component surface which has optical significance.
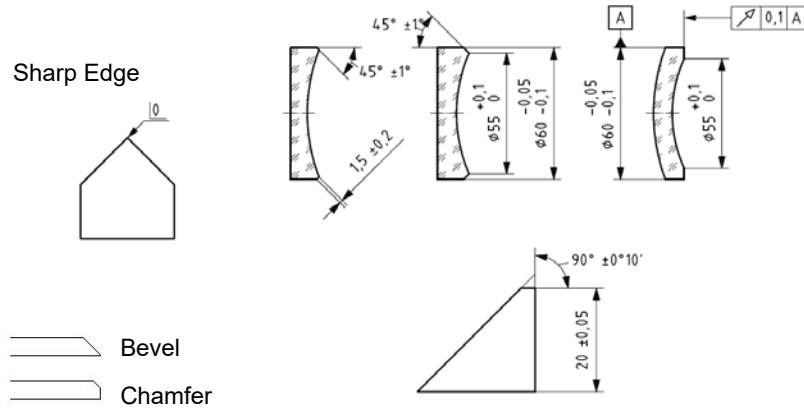
ISO 10110-1 Dimensioning

Spherical surfaces are defined by the radius of curvature with a dimensional tolerance . This tolerance indicates the range within which the actual surface is contained. The radius of curvature tolerance can also be defined by interferometry, but more on that later. For cylindrical surfaces, use Rcyl instead.
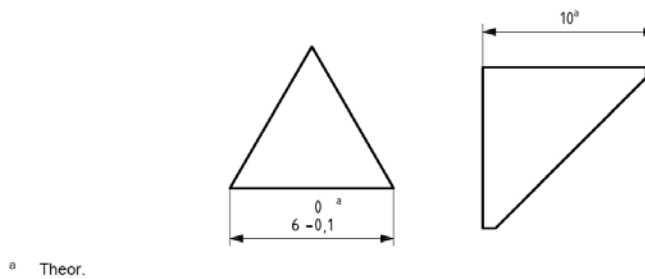
ISO 10110-1 Dimensioning

The thickness is indicated as a nominal size with a (preferably symmetrical) tolerance. In the case of lens elements having concave surfaces, the overall thickness should be indicated within parenthesis in addition to the axial thickness.
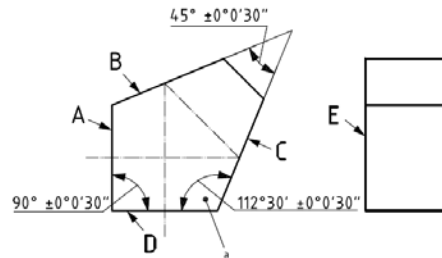
ISO 10110-1 Bevels & Chamfers

Sharp Edge

Bevel

Chamfer

ISO 10110-1 Dimensioning

a   Theor.

Parts specified to have protective chamfers or small bevels are dimensioned without regard to the chamfers or bevels, i.e. the dimensions refer to the theoretical intersection of the surfaces ("sharp edge condition"). Such dimensions shall be identified by appending "theor" to the indication.
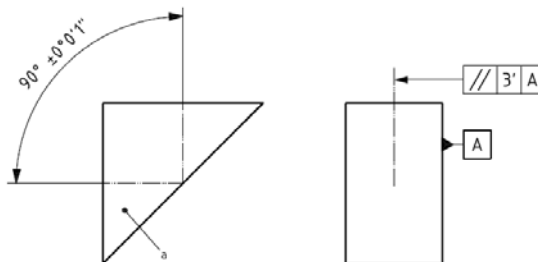
ISO 10110-1 Angles

∡ A, E = 90° ± 0° 10'
∡ D, E = 90° ± 0° 10'

∡ B, E = 90° ± 0° 3'
∡ C, E = 90° ± 0° 3'

Use capital Roman letters to indicate surfaces. The angles between surface E and the surfaces A, B, C and D are called "pyramidal angles".

ISO 10110-1 Angles

For prisms, the optical ray path and deflection angle may be shown. The deflection angle is the angle between the directions of the incident and emergent rays. Unless otherwise specified, the incident ray is perpendicular to the entrance surface. The deflection angle is given with a ± tolerance. An error in the ray deviation in the directions perpendicular to the plane of the drawing is known as "pyramidal deviation error".

ISO 10110-1 Materials Specs

The following information shall be given, as appropriate:

a) Indication of material, e.g.:

  manufacturer, glass type

  or international glass code number

  or refractive index and Abbe number, including an indication of the reference wavelength

  or chemical description (for example for crystalline material);

b) special properties of the material, such as:

  tolerances for refractive index, dispersion, transmission, homogeneity class, striae class, crystal properties (e.g. mono- or polycrystalline
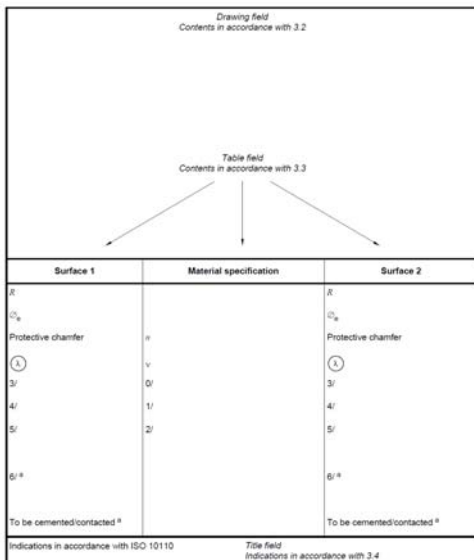
Material data		
P3		
	Glass type N-BK 7	
	n_d 1,51680 ±0,0005	
	v_d 64,17 ±0,8%	
	0/ 10	
	1/ 3x0,01	
	2/ -:2	
;E0,1		

ISO 10110-10 Properties

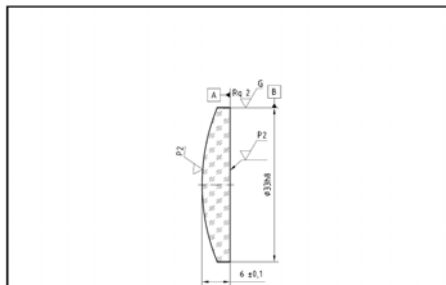**Table 1 — Properties to be listed**

Items	Description
Material	Type, name, identification number of the material
n / v	If appropriate, refractive index and Abbe number (and tolerances) in accordance with ISO 7944.
R	Radius of curvature with tolerance, if desired (see note below). The direction of curvature shall be indicated as follows: convex surface: CX concave surface: CC
$\varnothing_e$	Optically effective diameter
Protective chamfer	Minimum and maximum permissible widths of the protective chamfer
(λ)	Surface treatment and coating in accordance with ISO 10110-9
0/	Stress birefringence tolerance in accordance with ISO 10110-2
1/	Indication of permissible bubbles and other inclusions in accordance with ISO 10110-3
2/	Inhomogeneity and striae classes in accordance with ISO 10110-4
3/	Surface form tolerance in accordance with ISO 10110-5
4/	Centring tolerance in accordance with ISO 10110-6
5/	Surface imperfection tolerance in accordance with ISO 10110-7
6/	Laser irradiation damage threshold indication in accordance with ISO 10110-17 (if appropriate)
	If appropriate, the words "To be cemented" or "To be contacted" shall be added.
NOTE	Other ISO symbols are defined for the radius of curvature. In particular, ISO 129 uses "SR" as such a symbol.

Drawing Format

Drawing Example Singlet