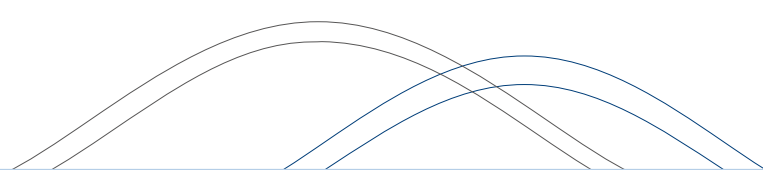


Technologies

CNC processing

		Standard	Precision
Dimensions [ISO 10110-1]			
Diameter	mm	8 - 250	4 - 250
Tolerance	mm	± 0.10	± 0.05
Center thickness	mm	2 - 60	2 - 60
Tolerance	mm	± 0.10	± 0.05
Surface form [ISO 10110-1; 12]		geometry dependent up to	
Radius of curvature – local cc	mm	15	
Clear aperture	% of Ø	95	90
Clear aperture surface slope	degree	75	50
Surface form tolerances (ISO 10110-5) and Aspheric surfaces (ISO 10110-12) 3/ A (B, C) RMSx < D; “lambda” = E; slope < F; slope integration length = G; spatial sampling resolution = H; see also ISO 14999-4			
Tolerance of radius of curvature	%	± 0.10	± 0.05
Sagitta deviation ¹ – A (Power)	fringe/ µm	30 - 10 (7.5 - 2.5)	3 (0.75)
Irregularity ² – B (PV)	fringe/ µm	10 - 4 (2.5 - 1)	1 (0.3)
Rotational invariant irregularity – C	fringe/ µm	4 - 1.5 (1.0 - 0.4)	0.5 (0.14)
RMS irregularity – RMSi – D	fringe/ µm	3 - 1.2 (0.75 - 0.3)	0.3 (0.09)
Slope tolerance ³ – F	arc sec/ mrad	180 (0.90)	40 (0.20)
Centration [ISO 10110-6] 4/ σ (L)			
Edge thickness variation (defines tilt angle)	µm	25	15
Tilt angle of the aspheric surface to the second surface – σ	arc min	2.50	1
Lateral displacement of the aspheric to the edge of the lens – L	mm	0.02	0.01
Lateral displacement of the aspheric to the second surface – L	mm	0.03	0.02
Surface imperfections [ISO 10110-7; 5/ N x A; L N “ x A”]			
Dig – N x A ¹		2 x 0.40	2 x 0.10
Scratches – L N “ x A” ¹		L2 x 0.10	L2 x 0.06
MIL – Scratch / Dig		40 – 20	20 – 10
Surface texture [ISO 10110-8]			
Surface roughness – Rq	nm	3.00	1.50
Measurement			
Full-surface interferometric measurement		optional	

1. Depends on the diameter. Listed values are for a diameter of 50 mm. Reference wavelength λ=546.07 nm.
 2. Often also called the PV - error of the measured surface. Means the total surface deviation corrected for Sagitta error (power).
 3. Depends on the diameter and the surface curvature. Normal measured length of 1mm.



Technologies

Diamond turning

Ultra-precise cutting using monocrystalline diamond is the key technology for manufacturing virtually any optical functional surface with the utmost precision. This enables the processing of non-ferrous metals, nickel-phosphorus coatings, plastics, crystals and IR lenses.

Manufacturing dimensions [ISO 10110-1]		
Achievable diameters	mm	1 - 420
Center thickness	mm	from 0.5 ¹
Surface shape [ISO 10110-1; 12]		up to
Irregularity – B (PV) ²	nm	100
RMS irregularity – RMSi – D	nm	20
Surface roughness – Rq	nm	1

¹ Depends on diameter and material

² Often also called the PV - error of the measured surface. Means the total surface deviation corrected for Sagitta error (power).

Available technologies	
<ul style="list-style-type: none"> = Diamond turning with 2 and 3 linear axes = Fly cutting = Slow tool servo 	
Processable materials	
<ul style="list-style-type: none"> = Copper, aluminum, brass, nickel silver, nickel = Nickel-phosphorus layers = Polycarbonate, PMMA = Silicon, germanium, zinc sulfide = IR lenses 	
Achievable optical component geometries	
<ul style="list-style-type: none"> = Aspheres = Spheres = Cylinders = Toroids 	<ul style="list-style-type: none"> = Microlenses = Fresnel structures = Diffractive optical elements = Freeforms



Technologies

High-End Finishing

Dimensions [ISO 10110-1]		
Diameter	mm	6 - 300
Tolerance	mm	± 0.03
Center thickness	mm	< 60
Tolerance	mm	± 0.01
Surface form [ISO 10110-1; 12]		geometry dependent up to
Radius of curvature - local cc	mm	15
Clear aperture	% of Ø	90
Clear aperture surface slope	degree	75
Surface form tolerances (ISO 10110-5) and Aspheric surfaces (ISO 10110-12)		
3/ A (B, C) RMSx < D; "lambda" = E; slope < F; slope integration length = G; spatial sampling resolution = H; see also ISO 14999-4		
Tolerance of radius of curvature	%	± 0.02
Sagitta deviation ¹ - A (Power)	fringe/ µm	0.30 (0.08)
Irregularity ² - B (PV)	fringe/ µm	0.30 (0.08)
Rotational invariant irregularity - C	fringe/ µm	0.20 (0.05)
RMS irregularity - RMSi - D	fringe/ µm	0.10 (0.03)
Slope tolerance ³ - F	arc sec/ mrad	12 (0.06)
Centration [ISO 10110-6] 4/ σ (L)		
Edge thickness variation (defines tilt angle)	µm	5
Tilt angle of the aspheric surface to the second surface - σ	arc min	0.35
Lateral displacement of the aspheric to the edge of the lens - L	mm	0.01
Lateral displacement of the aspheric to the second surface - L	mm	0.01
Surface imperfections [ISO 10110-7; 5/ N x A; L N " x A"]		
Dig - N x A ¹		2 x 0.04
Scratches - L N " x A" ¹		L2 x 0.04
MIL - Scratch / Dig		20 - 10
Surface texture [ISO 10110-8]		
Surface roughness - Rq	nm	0.50
Measurement		
Full-surface interferometric measurement		guaranteed

1. Depends on the diameter. Listed values are for a diameter of 50 mm. Reference wavelength λ=546.07 nm.
 2. Often also called the PV - error of the measured surface. Means the total surface deviation corrected for Sagitta error (power).
 3. Depends on the diameter and the surface curvature. Normal measured length of 1 mm.

