

CNC PROCESSING

		Standard-Quality	Precision-Quality
Dimensions [ISO 10110-1]			
Diameter	mm	8 - 300	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) RMSi < D; 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 – A (Power)	fringe (µm)	30 -10 (7.5 - 2.5)	3 (0.75)
Irregularity – 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 – RMS _i – D	fringe (µm)	3 - 1.2 (0.75 - 0.3)	0.3 (0.09)
Slope tolerance – F / G / H	arc sec/mm/mm	180 / 1 / 0.1	40 / 1 / 0.1
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	



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-phosphorus layers = Polycarbonate, PMMA = Silicon, germanium, zinc sulfide = IR lenses 	
Achievable optical component geometries	
<ul style="list-style-type: none"> = Aspheres = Spheres = Cylinders = Toroids = Microlenses = Fresnel structures = Diffractive optical elements = Freeforms 	

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) RMSi < D; slope < F; slope integration length = G; spatial sampling resolution = H; see also ISO 14999-4		
Tolerance of radius of curvature	%	± 0.02
Sagitta deviation – A (Power)	fringe (µm)	0.30 (0.08)
Irregularity – B (PV)	fringe (µm)	0.30 (0.08)
Rotational invariant irregularity – C	fringe (µm)	0.20 (0.05)
RMS irregularity – RMS _i – D	fringe (µm)	0.10 (0.03)
Slope tolerance – F / G / H	arc sec/mm/mm	12/ 1 / 0.1
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