

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.

