

TECHSPEC® ASPHERIC LENSES



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PRODUCTS & CAPABILITIES

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UK: +44 (0)1904 788600 | **GERMANY:** +49 (0)721 6273730
sales@edmundoptics.eu | **FRANCE:** +33 (0)8 20 20 75 55

EO® **Edmund**
75 YEARS OF OPTICS

www.edmundoptics.eu/aspheres-17

CNC POLISHING CAPABILITIES



Edmund Optics® is a premier manufacturer of aspheric lenses, producing thousands of precision polished aspheres each month. Lenses are manufactured from a variety of Schott, Ohara, and CDGM glasses, fused silica, and a multitude of fluoride and crystalline materials.

Edmund Optics® utilizes state-of-the-art CNC equipment for coarse and fine grinding and polishing of aspheric lenses with convex or concave geometries. Deterministic figure correction through Magneto-Rheological polishing is available for the ultimate in precision (see MRF Polishing Capabilities).

ASPHERIC MANUFACTURING CAPABILITIES

	Commercial	Precision	High Precision
Diameter	10 - 150 mm	10 - 150 mm	10 - 150 mm
Diameter Tolerance	+0/-0,100 mm	+0/-0,025 mm	+0/-0,010 mm
Asphere Figure Error (P - V)	5 μm	0,632 - 1,5 μm	< 0,312 μm
Vertex Radius (Asphere)	$\pm 1\%$	$\pm 0,1\%$	$\pm 0,05\%$
Radius (Spherical)	$\pm 0,3\%$	$\pm 0,1\%$	$\pm 0,025\%$
Power (Spherical)	2λ	$\lambda/2$	$\lambda/10$
Irregularity (Spherical)	$\lambda/2$	$\lambda/4$	$\lambda/20$
Sag ²	25 mm max.	25 mm max.	25 mm max.
Typical Slope Tolerance ¹	1 $\mu\text{m}/\text{mm}$	0,35 $\mu\text{m}/\text{mm}$	0,15 $\mu\text{m}/\text{mm}$
Centering (Beam Deviation)	3 arcmin	1 arcmin	0,5 arcmin
Center Thickness Tolerance	$\pm 0,100$ mm	$\pm 0,050$ mm	$\pm 0,010$ mm
Surface Quality (Scratch Dig)	80-50	40-20	10-5
Aspheric Surface Metrology	Profilometry	Profilometry	Interferometry

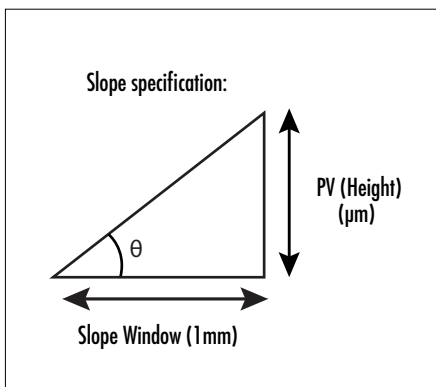


Figure 1: Slope error quantifies the rate of change of the aspheric figure error.

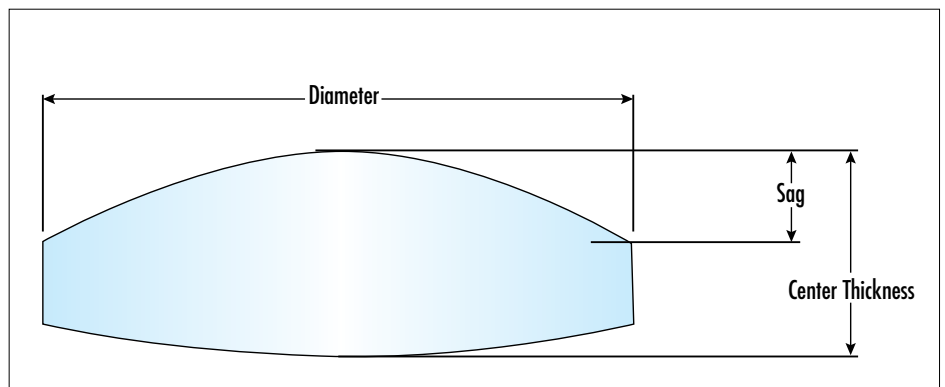


Figure 2: General geometry of an aspheric lens.

TO WATCH THE **MAKING OF AN ASPHERIC LENS VIDEO**, visit www.edmundoptics.eu/making-aspherics

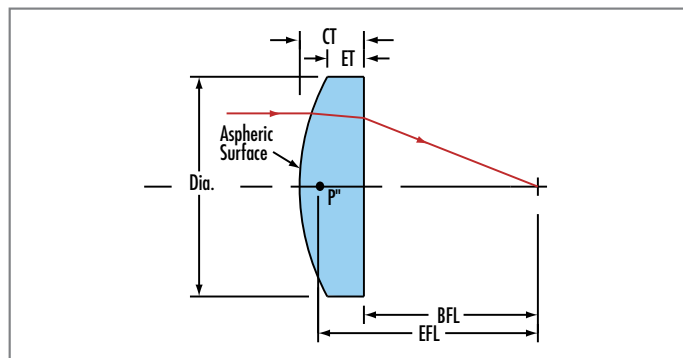
TECHSPEC® PRECISION ASPHERIC LENSES

- Designed and Manufactured by Edmund Optics®
- High Numerical Aperture Designs
- Generous Volume Discounts Available

TECHSPEC® Precision Aspheric Lenses are designed to focus light while eliminating spherical aberration from divergent light sources in applications including focusing the output of a laser diode. Aspheric surfaces can increase the numerical aperture of a lens while minimizing system aberrations. Aspheric lenses may also reduce the number of elements needed in a multi-element system. Aspheric lenses can reduce overall system weight while providing advantages such as increasing throughput or simplifying assembly. **Full Prescription Data is available online at www.edmundoptics.eu.**



Design Wavelength:	587,6 nm
Diameter Tolerance:	+0,0/-0,1 mm
Center Thickness Tolerance:	±0,1 mm
Clear Aperture:	90%
Asphere Figure Error:	0,75 µm RMS
Surface Quality:	60-40
Centering:	3 - 5 arcmin



TECHSPEC® PRECISION ASPHERIC LENSES

Diameter (mm)	EFL (mm)	Numerical Aperture	BFL (mm)	CT (mm)	ET (mm)	Glass Type	Stock No. Uncoated	Stock No. VIS Coated	Stock No. NIR Coated
10,0	7,5	0,67	4,51	5,00	2,21	N-SF5	#69-852	#69-856	#69-860
10,0	10,0	0,50	7,48	4,00	1,69	L-BAL35	#69-853	#69-857	#69-861
12,5	9,5	0,66	6,51	5,00	1,60	N-SF5	#69-854	#69-858	#69-862
12,5	12,5	0,50	9,35	5,00	2,11	L-BAL35	#69-855	#69-859	#69-863
15,0	9,0	0,83	4,81	7,00	1,35	N-SF5	#67-243	#67-250	#67-257
15,0	11,25	0,66	6,85	7,00	1,94	L-BAL35	#47-725	#49-097	#49-109
15,0	15,0	0,50	11,54	5,50	2,04	L-BAL35	#47-726	#49-098	#49-110
15,0	18,75	0,40	15,92	4,50	1,82	L-BAL35	#47-727	#49-099	#49-111
15,0	22,5	0,33	19,98	4,00	1,80	L-BAL35	#47-728	#49-100	#49-112
20,0	12,5	0,80	7,12	9,00	1,91	N-SF5	#67-244	#67-251	#67-258
20,0	15,0	0,66	9,16	9,60	3,05	L-BAL35	#66-309	#66-319	#66-329
20,0	20,0	0,50	15,19	8,00	3,44	L-BAL35	#66-310	#66-320	#66-330
25,0	15,0	0,83	8,42	11,00	1,64	N-SF5	#67-245	#67-252	#67-259
25,0	18,75	0,66	12,46	10,00	1,63	L-BAL35	#47-729	#49-101	#49-113
25,0	25,0	0,50	20,28	7,50	1,74	L-BAL35	#47-730	#49-102	#49-114
25,0	31,25	0,40	27,16	6,50	2,04	L-BAL35	#47-731	#49-103	#49-115
25,0	37,5	0,33	33,72	6,00	2,30	L-BAL35	#47-732	#49-104	#49-116
25,0	50,0	0,25	46,54	5,50	2,80	L-BAL35	#33-944	#33-945	#33-946
30,0	17,5	0,86	9,43	13,50	1,78	N-SF5	#67-246	#67-253	#67-260
30,0	22,5	0,66	13,73	14,40	4,57	L-BAL35	#66-311	#66-321	#66-331
30,0	30,0	0,50	22,99	11,70	4,81	L-BAL35	#66-312	#66-322	#66-332
40,0	25,0	0,80	15,73	15,50	1,49	N-SF5	#67-247	#67-254	#67-261
40,0	30,0	0,66	20,60	15,50	2,56	L-BAL35	#66-313	#66-323	#66-333
40,0	40,0	0,50	30,68	15,50	6,39	L-BAL35	#66-314	#66-324	#66-334
50,0	30,0	0,83	18,04	20,00	1,44	N-SF5	#67-248	#67-255	#67-262
50,0	37,5	0,66	25,74	19,40	3,23	L-BAL35	#66-315	#66-325	#66-335
50,0	50,0	0,50	38,33	19,40	8,01	L-BAL35	#66-316	#66-326	#66-336

MRF POLISHING CAPABILITIES



Deterministic Polishing with MRF

In addition to our substantial CNC polishing capacity, Edmund Optics® also offers extreme in aspheric correction with our Magneto-Rheological Finishing (MRF) capabilities. MRF Polishing provides a completely deterministic process with unparalleled accuracy and repeatability. Surface improvements with MRF include:

- Irregularity
- Slope Tolerance
- Surface Roughness
- Mid-Spatial Frequency (MSF) Content
- Laser Damage Threshold



TECHNICAL NOTE

PRECISION POLISHING OF ASPHERIC LENSES

For decades, machined aspheric lenses have been ground and polished one lens at a time. Although this process of individually producing machined aspheric lenses hasn't changed dramatically, significant fabrication technology advancements have elevated the achievable level of accuracy possible from this production technique. Aspheric shapes are achieved through grinding and polishing of small contact areas on the surface of the optic. These small contact areas are adjusted in space to form the aspheric profile (**Figure 1**). When higher quality polishing is

required, magneto-rheological finishing (MRF) is used to perfect the surface (**Figure 2**), using a similar small tool area that can rapidly adjust the dwell time to correct errors in the profile. MRF technology provides high performance finishing in less time than standard correction techniques because of its precise control of the removal location. While other manufacturing techniques generally require a special mold unique to each lens, precision polishing utilizes standard tooling which makes it an ideal manufacturing technique for prototyping as well as volume production.

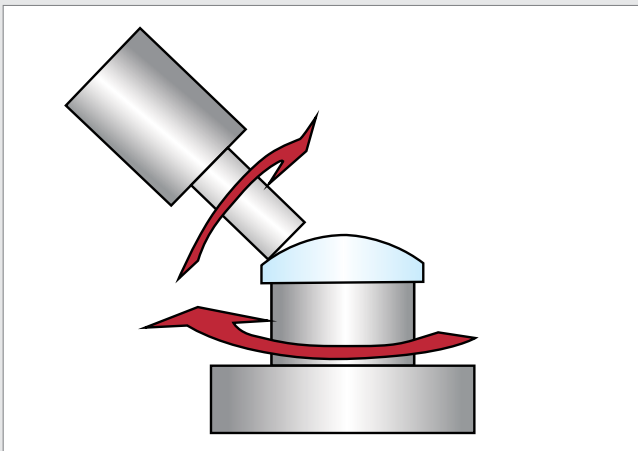


Figure 1: Computer Controlled Precision Polishing

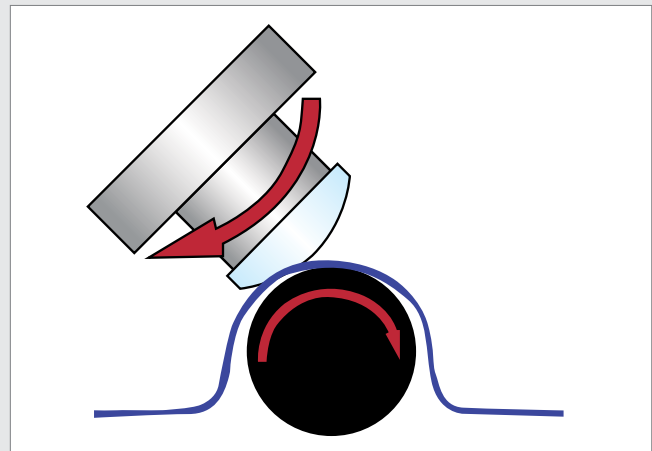


Figure 2: Magneto-Rheological Finishing (MRF)

TO VIEW THE FULL [TECHNICAL NOTE](http://www.edmundoptics.eu/all-about-aspheres), visit www.edmundoptics.eu/all-about-aspheres

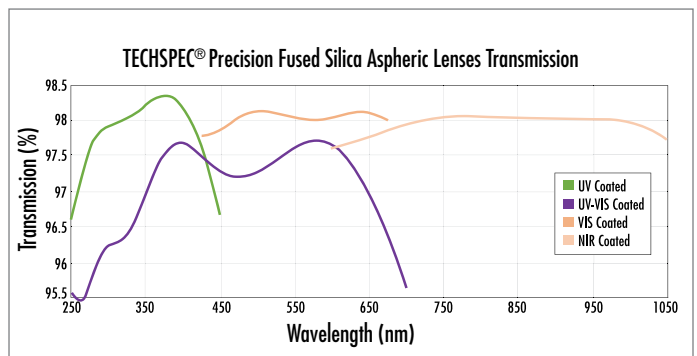
TECHSPEC® PRECISION UV FUSED SILICA ASPHERIC LENSES

- Low f/#s for Optimum Light Gathering
- Low Coefficient of Thermal Expansion
- Prescription Information Available



TECHSPEC® Precision UV Fused Silica Aspheric Lenses offer the benefits of an aspheric element combined with the manufacturing precision of state-of-the-art grinding and polishing equipment. With the available prescription data, these fused silica optics can be easily designed and integrated into complex optical systems. Featuring low f/#s for optimum light gathering and focusing performance, these fused silica lenses are computer optimized to eliminate spherical and minimize higher order aberrations. UV fused silica optics substrate offers a low coefficient of thermal expansion.

Design Wavelength:	587,6 nm
Clear Aperture:	90%
Diameter Tolerance:	+0,0/-0,1 mm
Center Thickness Tolerance:	±0,1 mm
Surface Accuracy:	0,75 µm RMS
Surface Quality:	60-40
Centering:	3 - 5 arcmin
Prescription Data:	See our internet site
Coating:	UV: $R_{avg} < 1,5\%$ @ 250 - 450 nm UV-VIS: $R_{avg} < 2,5\%$ @ 250 - 700 nm VIS: $R_{avg} < 1,5\%$ @ 425 - 675 nm NIR: $R_{avg} < 1,5\%$ @ 600 - 1.050 nm



TECHSPEC® PRECISION UV FUSED SILICA ASPHERIC LENSES										*DCX Lens Shape
Diameter (mm)	EFL (mm)	Numerical Aperture	BFL (mm)	CT (mm)	ET (mm)	Stock No. Uncoated	Stock No. UV Coated	Stock No. UV-VIS Coated	Stock No. VIS Coated	Stock No. NIR Coated
10,0	8,0	0,63	2,52	8,00	3,05	#87-973	#87-977	#87-981	#87-985	#87-989
10,0	10,0	0,50	5,89	6,00	2,77	#87-974	#87-978	#87-982	#87-986	#87-990
12,5	10,0	0,63	4,52	8,00	2,03	#87-975	#87-979	#87-983	#87-987	#87-991
12,5	12,5	0,50	8,39	6,00	1,98	#87-976	#87-980	#87-984	#87-988	#87-992
15,0	10,0	0,75	2,69*	11,40	3,70	#33-947	#33-951	#33-955	#33-959	#33-963
15,0	12,5	0,60	6,33	9,00	2,47	#67-264	#67-269	#84-334	#67-274	#67-279
15,0	15,0	0,50	10,03	7,25	2,43	#48-534	#49-693	#84-335	#49-587	#49-591
15,0	20,0	0,38	15,89	6,00	2,68	#48-535	#49-694	#84-336	#49-588	#49-592
15,0	25,0	0,30	22,01	4,36	1,79	#33-948	#33-952	#33-956	#33-960	#33-964
25,0	17,5	0,69	8,37*	14,38	2,85	#33-949	#33-953	#33-957	#33-961	#33-965
25,0	20,0	0,63	10,40	14,00	2,27	#67-265	#67-270	#84-337	#67-275	#67-280
25,0	25,0	0,50	18,32	9,75	1,75	#48-536	#49-695	#84-338	#49-589	#49-593
25,0	30,0	0,42	24,17	8,50	2,21	#48-537	#49-696	#84-339	#49-590	#49-594
25,0	50,0	0,25	46,50	5,13	1,61	#33-950	#33-954	#33-958	#33-962	#33-966
50,0	40,0	0,63	21,15	27,50	4,07	#67-266	#67-271	#84-340	#67-276	#67-281
50,0	50,0	0,50	36,63	19,50	3,49	#67-267	#67-272	#84-341	#67-277	#67-282
50,0	60,0	0,42	48,34	17,00	4,42	#67-268	#67-273	#84-342	#67-278	#67-283

ASPHERIC METROLOGY CAPABILITIES



At Edmund Optics®, we truly believe that you can't make it if you can't measure it. For that reason, we've invested in the latest aspheric metrology equipment, including 2D Profilometry and 3D Stitching Interferometry.

The Taylor Hobson® Talysurf utilizes a stylus to trace the aspheric profile, and measure deviations from the ideal-fit aspheric equation. Typically, measurements are made in 2 axes (0° and 90°) to measure any asymmetric errors in the aspheric polishing. Accuracy is highly dependent upon the geometry of the lens and length of the stylus, but Edmund Optics® routinely measures aspheric lenses with 1 mm surface figure requirements and up to 25 mm of Sag.

The Optipro Ultrasurf is a non-contact profilometer providing comprehensive 2D and 3D analysis of surface figure, radius of curvature, center thickness, and wedge in a single measurement. By incorporating multi non-contact optical sensors, the Ultrasurf is capable of measuring virtually any asphere.

The QED Technologies® Aspheric Stitching Interferometer (ASI™) provides a full aperture map of the asphere being tested, and is capable of measuring complex aspheres with more than 600 µm of aspheric departure. Edmund Optics® routinely measures complex asymmetric aspheric profiles and lenses with < 0,5 µm surface figure requirements with the ASI™.



METROLOGY SERVICES AND CAPABILITIES

- **First Article Inspection (FAI) Reports**
- **Part Serialization with Complete Tested Data Reports including:**
 - Dimensional Measurements
 - Centering / Total Image Runout
 - Surface Profiles
 - Surface Roughness
 - Coating Durability, Adhesion, and Abrasion per MIL-PRF-13830B
 - Damage Threshold per ISO-21254-1:2011
 - Unique or Functional Requirements, Including those Requiring Custom Metrology Solutions
- **Configuration Control, Change Control, and Copy Exact! (CE) Requirements**
- **FAR, DFAR, Quality Assurance Provisions (QAP), and Testing Requirements Flow-downs**

To learn more about our **Manufacturing Capabilities**, visit www.edmundoptics.eu/manufacturing

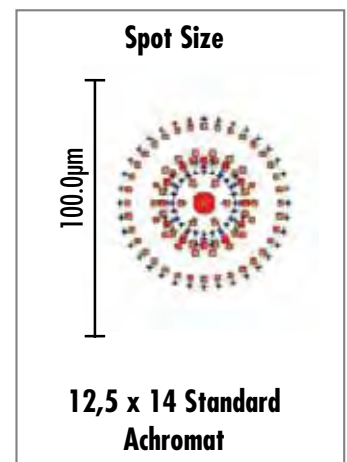
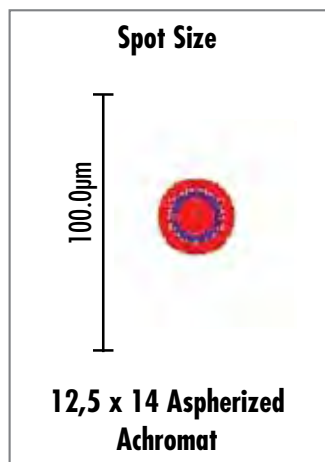
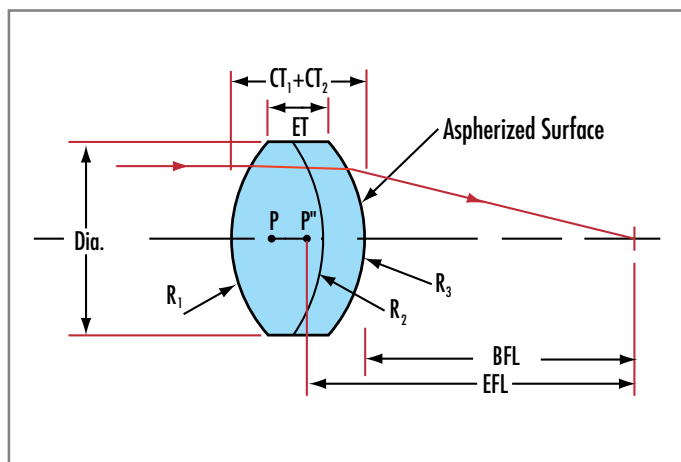
TECHSPEC® ASPHERIZED ACHROMATIC LENSES

- Low Cost, Color-Corrected Asphere
- Better Color Correction than Standard Achromatic Lenses
- Similar Spherical Aberration Correction to Machined Aspheres

TECHSPEC® Aspherized Achromats bridge the performance gap between color-corrected achromats and spherical aberration corrected aspheres, resulting in cost effective, color corrected aspheric components. The TECHSPEC® doublet lenses consist of two cemented elements that are matched for their color-correction ability and small RMS spot size. The back surface of the doublet is fused with a molded polymer aspheric surface. These molds create a stable aspheric contour, removing or reducing wavefront errors present in typical achromats, while boosting numerical aperture. Typical applications include fiber optic focusing or collimation, image relay, inspection, scanning, and high numerical aperture imaging.



Clear Aperture:	90%
Diameter Tolerance:	+0,0/-0,05 mm
Center Thickness Tolerance:	±0,2 mm
Surface Quality:	40-20
Centering Tolerance:	3 - 5 arcmin
Operating Temperature:	-20°C to 80°C
Design Wavelength:	587,6 nm
Coating:	VIS 0°



TECHSPEC® ASPHERIZED ACHROMATIC LENSES

Diameter (mm)	EFL (mm)	BFL (mm)	CT ₁ (mm)	CT ₂ (mm)	ET (mm)	Glass Type	Stock No.
9,0	12,0	8,16	4,50	1,50	4,66	N-LaK8/N-SF57	#49-656
9,0	18,0	14,30	4,50	1,50	4,98	N-LaK8/N-SF57	#49-657
12,5	14,0	9,89	6,50	1,50	4,28	S-FSL5/N-SF57	#49-658
12,5	20,0	16,07	5,00	1,50	4,62	N-LaK8/N-SF57	#49-659
12,5	25,0	21,69	4,00	1,50	4,28	N-LaK8/N-SF57	#49-660
25,0	30,0	23,21	9,00	2,50	7,11	N-LaK14/N-SF57	#49-662
25,0	35,0	28,14	9,00	2,50	7,90	N-LaK8/N-SF57	#49-663
25,0	40,0	33,53	9,00	2,50	7,54	N-SK14/N-SF57	#49-664
25,0	50,0	44,08	9,00	2,50	7,42	S-FSL5/S-TIH13	#49-665

SO MUCH MORE ONLINE...

TECHSPEC® PLASTIC ASPHERIC LENSES



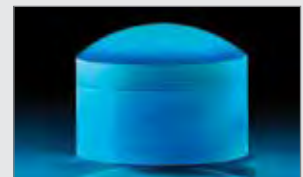
PRECISION MOLDED ASPHERIC LENSES



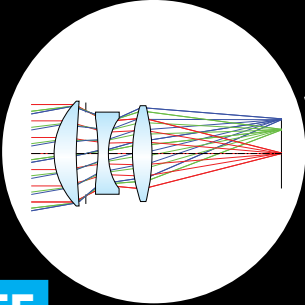
ASPHERIC CONDENSER LENSES



TECHSPEC® PRECISION ASPHERIZED ACHROMATIC LENSES



IMPROVE SYSTEM PERFORMANCE WITH STOCK AND CUSTOM ASPHERIC LENSES



FREE

DESIGN Consultation

Application, material selection, and design review for manufacturability at desired performance.



GLOBAL Manufacturing

Whether you need high precision or commercial finish, we've got you covered from 1 - 100,000 pieces.



PRECISION Figure Correction

Deterministic polishing for superior surface control while providing increased yield.



METROLOGY

2D and 3D testing methods to best fit your requirements.



AR COATINGS

Standard and custom single layer, V-Coat, and broadband AR coatings available.



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UK: +44 (0)1904 788600 | **GERMANY:** +49 (0)721 6273730
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75 YEARS OF OPTICS

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