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Laser Lenses

STANDARD BestForm LASER LENSES

OFR manufactures and maintains in stock its series of BestForm Laser Lenses. These are designed for minimum spherical aberration, and when not exceeding optimum beam diameter (see table below), will produce focal spots within diffraction-limit theory. These lenses can be used interchangeably for focusing, expanding or collimating.

Surface Quality

Polish exceeds 10-5 and sphericity better than 1/10-wave over the aperture at the design wavelength. All lenses are polished to the highest spherical figure and fineness consistent with optimum performance in all respects: minimum blur-circle, minimum wavefront distortion, minimum scattering loss, and maximum transmittance of energy.

Antireflection Coatings

All lenses are available with narrow-band or broadband antireflection coatings peaked for the major wavelength of operation, at which transmittance will exceed 99%. When ordering, add wavelength (in nm) as final dash number in Catalog Part Number. For example. LL-25-63-633, etc.

BestForm Laser Lenses are designed with minimum aberration ratio of the radii of both surfaces.

Mechanical Specifications

Diameter	+0,-0.1 mm
Thickness	± 0.1 mm
Bevels	0.3 mm x 45°
Radii	± 2%



Laser Lenses for 157 nm* and 193 nm

LASER LENSES, 193 nm

OFR manufactures 193 nm Laser Lenses in two excimer-grades, CaF_2 and fused silica. OFR feels that optical performance of either type should be equivalent. However, in spite of significant improvements in materials since the arrival of the ArF laser, limited performance data leave questions unanswered.

Therefore, the choice of CaF_2 or fused silica is open to interpretation. Please discuss with OFR.

LASER LENSES, 157 nm

The new F_2 lasers at 157 nm promise finer resolution. However, currently available materials, such as CaF_2 and MgF_2, may be limited in performance at this short wavelength. Consequently, materials producers are working diligently on improvements in order to meet growing demand.

Therefore, OFR is offering components, such as Laser lenses, in carefully selected materials. However, at this time, because of limitations not only in materials but also in methods of testing and verification, OFR will only supply components under strict terms and conditions. Please inquire.

LASER LENSES for ArF EXCIMER LASERS, 193 nm

Material Excimer Grade CaF_2
Design Wavelength 193 nm
Index at 193 nm 1.5045
CaF_2 transmits 130 nm-9.6 µm

Material Excimer Grade Fused Silica
Design Wavelength 193 nm
Index at 193 nm 1.5604
Fused Silica transmits 180 nm-2.3 µm

ANTIREFLECTION COATING Wavelength	Bandwidth	Average Reflectance	Power Rating*
193nm	±5 nm	<0.5%	400 MW/cm²

*Power rating based upon 20 n-s pulses, 20 Hz.

Catalog Number & Focal Length	Material	Size	Focal Length at 193 nm	Optimum Beam Dia.	Theoretical Focal Spot	R1 mm	R2 mm	Center Thickness
LLU-13-17-193	FS	½" dia.	17.4 mm	2.1 mm	2.0 µm	12.70	-38.89	3.5
LLU-13-17N-193	FS	½" dia.	-17.4 mm	2.1 mm	–	-12.70	44.62	2.5
LLV-13-20-193	CaF_2	½" dia.	20.2 mm	2.4 mm	2.0 µm	12.20	-55.80	3.5
LLV-13-20N-193	CaF_2	½" dia.	-20.0 mm	2.4 mm	–	-12.55	55.80	2.5
LLU-13-22-193	FS	½" dia.	21.8 mm	2.5 mm	2.2 µm	14.00	-79.99	3.5
LLU-13-22N-193	FS	½" dia.	-21.8 mm	2.5 mm	–	-14.60	79.99	2.5
LLV-13-25-193	CaF_2	½" dia.	25.1 mm	2.8 mm	2.2 µm	14.00	-121.45	3.5
LLV-13-25N-193	CaF_2	½" dia.	-25.1 mm	2.8 mm	–	-14.60	100.03	2.5
LLU-13-35-193	FS	½" dia.	34.8 mm	4.4 mm	2.4 µm	22.80	-121.45	3.5
LLU-13-35N-193	FS	½" dia.	-41.7 mm	4.4 mm	–	-22.80	141.32	2.5
LLV-13-40-193	CaF_2	½" dia.	39.9 mm	4.0 mm	2.7 µm	23.56	-132.50	3.5
LLV-13-40N-193	CaF_2	½" dia.	-40.3 mm	4.0 mm	–	-24.07	130.57	2.5
LLU-25-55-193	FS	1" dia.	54.8 mm	6.2 mm	2.7 µm	36.24	-192.73	5.5
LLV-25-63-193	CaF_2	1" dia.	62.5 mm	5.6 mm	2.9 µm	37.85	-184.35	6.0
LLU-25-70-193	FS	1" dia.	69.6 mm	7.3 mm	3.0 µm	45.59	-265.14	5.5
LLV-25-80-193	CaF_2	1" dia.	79.8 mm	6.6 mm	3.0 µm	47.65	-249.54	5.0
LLU-25-87-193	FS	1" dia.	87.0 mm	8.7 mm	3.1 µm	57.23	-326.28	5.0
LLV-25-100-193	CaF_2	1" dia.	100.4 mm	7.9 mm	3.3 µm	58.07	-385.44	4.5
LLU-25-122-193	FS	1" dia.	122.4 mm	11.1 mm	3.3 µm	79.99	-471.01	5.0
LLV-25-140-193	CaF_2	1" dia.	140.3 mm	10.1 mm	3.5 µm	81.50	-529.26	4.5
LLU-25-165-193	FS	1" dia.	165.3 mm	14.0 mm	3.6 µm	111.60	-529.26	5.0
LLV-25-190-193	CaF_2	1" dia.	189.4 mm	12.7 mm	3.8 µm	109.13	-760.00	4.0
LLU-25-261-193	FS	1" dia.	261.0 mm	19.7 mm	4.0 µm	169.63	-1061.04	4.5
LLV-25-300-193	CaF_2	1" dia.	300.5 mm	17.9 mm	4.3 µm	176.66	-1061.04	4.0

NOTE: Other diameters and focal lengths, and negative focal lengths, available on custom basis. Please inquire.
To order without AR coating, simply drop "-193". Thus, LLV-25-125, for example. Transmission of uncoated lens, 92%.

UV Laser Lenses

LASER LENSES for UV EXCIMER LASERS, 248 nm to 355 nm

Material UV Grade Silica
Design Wavelength 300 nm
Index at 300 nm 1.48779
UV fused silica transmits 180 nm-2.3 µm

Wavelength	Focal Length Correction
248 nm	-4%
300 nm	–
355 nm	+2%

Laser	λ
Nd:YAG	213 nm
KrF	248 nm
Nd:YAG	266 nm
XeCl	308 nm
HeCd	325 nm
N2	337 nm
XeF	351 nm
Nd:YAG	355 nm

NARROWBAND AR COATINGS

Specify λ between	Bandwidth at 5% of peak	Average Reflectance	Power Rating*
213-355 nm	~8%	< 0.2%	500 MW/cm²

*Power rating based upon 20 n-sec pulses, 20 Hz

BROADBAND AR COATINGS

Description	Bandwidth	Average Reflectance	Power Rating*
UVB	240 - 360 nm	<0.5%	200 MW/cm²
NUV	325 - 500 nm	<0.5%	200 MW/cm²

*Power rating based upon 20 n-s pulses, 20 Hz.

For AR coating when ordering, insert AR coating at λ, for example, LLU-25-100-UVB or LLU-25-140-248, see page OC-14.

Catalog Number & Focal Length	Size	Focal Length at 300 nm	Optimum Beam Dia	Theoretical Focal Spot	R1 mm	R2 mm	Center Thickness
LLU-13-20-λ	½" dia.	20.1 mm	2.6 mm	2.5 µm	12.70	-38.89	3.5
LLU-13-20N-λ	½" dia.	-20.1 mm	2.6 mm	—	-22.70	44.62	2.5
LLU-13-25-λ	½" dia.	24.7 mm	3.1 mm	2.6 µm	14.00	-79.99	3.5
LLU-13-25N-λ	½" dia.	-25.1 mm	3.1 mm	—	-14.60	79.99	2.5
LLU-13-40-λ	½" dia.	40.0 mm	4.4 mm	3.5 µm	22.80	-121.45	3.5
LLU-13-40N-λ	½" dia.	-40.0 mm	4.4 mm	—	-22.80	141.32	2.5
LLU-25-63-λ	1" dia.	63.0 mm	6.2 mm	3.9 µm	36.24	-192.73	5.5
LLU-25-63N-λ	1" dia.	-62.2 mm	6.2 mm	—	-36.24	192.73	3.0
LLU-25-80-λ	1" dia.	80.2 mm	7.3 mm	4.2 µm	45.59	-265.14	5.5
LLU-25-80N-λ	1" dia.	-79.5 mm	7.3 mm	—	-45.59	265.14	3.0
LLU-25-100-λ	1" dia.	100.2 mm	8.7 mm	4.3 µm	57.23	-326.28	5.0
LLU-25-100N-λ	1" dia.	-99.6 mm	8.7 mm	—	-57.23	326.28	2.5
LLU-25-125-λ	1" dia.	124.6 mm	10.2 mm	4.7 µm	73.10	-353.46	5.0
LLU-25-125N-λ	1" dia.	-123.8 mm	10.2 mm	—	-73.10	356.46	3.0
LLU-25-140-λ	1" dia.	140.5 mm	11.1 mm	4.8 µm	79.99	-471.01	5.0
LLU-25-140N-λ	1" dia.	-139.9 mm	11.1 mm	—	-79.99	471.01	3.0
LLU-25-160-λ	1" dia.	161.2 mm	12.3 mm	5.0 µm	90.13	-605.94	5.0
LLU-25-190-λ	1" dia.	189.3 mm	14.0 mm	5.2 µm	111.60	-529.26	5.0
LLU-25-240-λ	1" dia.	241.7 mm	16.6 mm	5.5 µm	136.75	-848.13	5.0
LLU-25-300-λ	1" dia.	300.1 mm	19.7 mm	5.8 µm	169.63	-1061.04	4.5
LLU-25-300N-λ	1" dia.	-299.3 mm	19.7 mm	—	-169.63	1061.04	4.5
LLU-25-380-λ	1" dia.	381.5 mm	23.5 mm	6.2 µm	225.49	-1061.04	4.5
LLU-25-475-λ	1" dia.	482.7 mm	23.5 mm	7.7 µm	235.56	Plano	4.5
LLU-25-610-λ	1" dia.	620.6 mm	23.5 mm	9.9 µm	302.85	Plano	4.5
LLU-25-760-λ	1" dia.	789.8 mm	23.5 mm	12.3 µm	385.44	Plano	4.5
LLU-25-l000-λ	1" dia.	965.2 mm	23.5 mm	16.2 µm	471.01	Plano	4.0
LLU-25-2000-λ	1" dia.	2174.3 mm	23.5 mm	32.4 µm	1061 04	Plano	4.0
LLU-51-150-λ	2" dia.	150.5 mm	11.9 mm	4.8 µm	84.82	-529.26	8.5
LLU-51-190-λ	2" dia.	189.5 mm	14.0 mm	5.2 µm	111.60	-529.26	7.0
LLU-51-240-λ	2" dia.	238.1 mm	16.6 mm	5.5 µm	136.75	-760.00	6.5
LLU-51-300-λ	2" dia.	300.2 mm	19.7 mm	5.8 µm	169.63	-1061.04	6.5
LLU-51-380-λ	2" dia.	381.2 mm	23.5 mm	6.2 µm	225.22	-1061.04	5.5
LLU-51-475-λ	2" dia.	475.1 mm	27.8 mm	6.5 µm	260.90	-2068.17	5.5
LLU-51-610-λ	2" dia.	611.6 mm	33.6 mm	6.9 µm	357.41	-1800.00	5.5
LLU-51-760-λ	2" dia.	762.7 mm	39.5 mm	7.3 µm	438.93	-2440.00	5.0
LLU-51-1000-λ	2" dia.	992.3 mm	48.5 mm	7.9 µm	484.25	Plano	5.0

NOTE: Other diameters and focal lengths available on custom basis. Please inquire.

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