

# SPHERICAL LENSES



Spherical lenses are used to focus, form images, and to collimate or expand light. They are used in almost every optical system, from high power, deep-UV lasers to low-cost condensers delivering light to a detector. Our vast selection of lens shapes, materials and lens quality options will allow you to find the right balance between performance and cost for even the most demanding application.

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**Don't see exactly what you are looking for?** CVI Laser Optics specializes in prototype to volume production manufacturing! Give us a call and we will be honored to assist you with your custom needs.

**NOTES:**

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






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SELECTION GUIDE

PRODUCT TYPE	PRODUCT FEATURES	PLANO CONVEX	BICONVEX	PLANO CONCAVE	BICONCAVE
					
LASER GRADE N-BK7	<math>\lambda/10</math> surface figure 10-5 scratch-dig High damage threshold	<b>PLCX-C</b> 39	<b>BICX-C</b> 50	<b>PLCC-C</b> 46	<b>BICC-C</b> 52
IMAGE GRADE N-BK7	<math>\lambda/2</math> irregularity 60-40 scratch-dig	<b>LPX-C</b> 55	<b>LDX-C</b> 60	<b>LPK-C</b> 58	
LASER GRADE FUSED SILICA	<math>\lambda/10</math> surface figure 10-5 scratch-dig High damage threshold	<b>PLCX-UV</b> 35	<b>BICX-UV</b> 49	<b>PLCC-UV</b> 44	<b>BICC-UV</b> 51
IMAGE GRADE FUSED SILICA	<math>\lambda/4</math> irregularity 40-20 scratch-dig	<b>LUP-UV</b> 54		<b>LUK-UV</b> 57	
PRODUCT TYPE	PRODUCT FEATURES	PLANO CONVEX	PLANO CONCAVE	BESTFORM	ASPHERIC
					
LASER GRADE UV-GRADE $\text{CaF}_2$	<math>\lambda/10</math> surface figure 20-10 scratch-dig Wide VUV to IR transmission High laser durability	<b>PLCX-CFUV</b> 42			
LASER GRADE N-SF11	<math>\lambda/10</math> surface figure 20-10 scratch-dig High refractive index material Reduced spherical aberration	<b>PLCX-SF11</b> 43	<b>PLCC-SF11</b> 48		
LASER GRADE POSITIVE BESTFORM FUSED SILICA	<math>\lambda/10</math> surface figure 10-5 scratch-dig Minimized spherical aberration and coma Smallest spot size available in singlet lens High damage threshold			<b>BFPL-UV</b> 53	
IMAGE GRADE ASPHERIC CONDENSER LENSES CROWN GLASS	80-50 scratch-dig High collection efficiency for lighting applications				<b>LAG-C</b> 61

## LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV



### Specifications

Product Code: **PLCX-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Design Wavelength:** 266nm

**Diameter Tolerance:** +0/-0.1mm

**Center Thickness Tolerance ( $t_c$ ):**  $\pm 0.1$ mm

**Chamfer:**

$\varnothing_D \geq 50.8$ mm: 0.35mm leg width at 45° nominal

$\varnothing_D \geq 50.8$ mm: 0.65mm leg width at 45° nominal

**Centration:**

RoC  $\leq 400$ mm:  $< 1$  arc minute

RoC  $> 400$ mm:  $< 3$  arc minutes

**Radius of Curvature (RoC) Tolerance:**

RoC  $\leq 1.5$ m:  $\pm 0.2\%$

RoC  $> 1.5$ m:  $\pm 1.0\%$

**Edge:** Fine Grind

**S1 Surface Figure:**  $< \lambda/10$  p-v at 633nm before coating; after coating on select substrates

**S2 Surface Flatness:**  $< \lambda/10$  p-v at 633nm before coating; after coating on select substrates

**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):**  $\geq 85\%$  of central diameter

**\*Anti-reflection Coating:** Wavelength user specified

**Narrowband:**  $R \leq 0.25\%$  per surface

**Broadband:**  $R_{avg} \leq 0.5\%$  per surface

**Dualband:**  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

**\*Adhesion and Durability:** per MIL-C-48497a

**\*Damage Threshold:**

**Pulsed, Narrowband:** 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**Pulsed, Broadband:** 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**cw:** 1 MW/cm<sup>2</sup> at 1064nm

\* Applicable for wavelengths  $\geq 266$ nm

With a myriad of designs, the PLCX-UV product line spans from 15mm to 10,000mm in focal length amongst three diameter options. These laser-grade quality fused silica lenses are capable of meeting the most stringent customer requirements including high power/high energy laser applications as well as ultra-low light scattering optical systems.

- ▶ Diffraction limited focusing performance for most laser applications
- ▶ Low-loss, high energy AR coatings
- ▶ Other dimensions, tolerances, specifications, and coatings available in prototype and production quantities.

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm)
PLCX-25.4-51.5-UV	248

**EXAMPLE: PLCX-25.4-51.5-UV-248**

### CHOOSE FROM THE OPTIONS BELOW.

**1. PRODUCT CODE - SEE TABLES ON NEXT PAGE**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

## CONTINUED...LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	fb at 266nm	tc	(te)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	15	12.7	1.4	11.67	5.00	3.51	7.50	15	15.74	16.24	16.70	PLCX-12.7-7.5-UV
	20	12.7	1.9	16.66	5.00	2.28	9.99	20	20.99	21.65	22.27	PLCX-12.7-10.0-UV
	25	12.7	2.3	21.66	5.00	1.73	12.49	25	26.24	27.06	27.84	PLCX-12.7-12.5-UV
	25	12.7	2.3	22.4	4.0	2.3	12.9	25.8	27.1	28.0	28.7	PLCX-12.7-12.9-UV
	25	25.4	1.2	16.8	12.7	2.1	12.9	25.8	27.1	28.0	28.7	PLCX-25.4-12.9-UV
	30	25.4	1.4	23.64	9.53	2.50	14.99	30	31.49	32.47	33.41	PLCX-25.4-15.0-UV
	35	25.4	1.6	29.66	8.00	2.53	17.49	35	36.73	37.88	38.97	PLCX-25.4-17.5-UV
	40	25.4	1.9	35.33	7.00	2.45	19.99	40	41.98	43.30	44.54	PLCX-25.4-20.0-UV
	45	25.4	2.1	41.00	6.00	2.07	22.49	45	47.23	48.71	50.11	PLCX-25.4-22.5-UV
	50	12.7	4.6	47.33	4.00	3.18	24.98	50	52.48	54.12	55.68	PLCX-12.7-25.0-UV
	50	25.4	2.3	45.99	6.00	2.53	24.98	50	52.48	54.12	55.68	PLCX-25.4-25.0-UV
*	51.6	12.7	4.8	50.3	2.0	1.2	25.8	51.6	54.2	56.0	57.4	PLCX-12.7-25.8-UV
*	51.6	25.4	2.4	48.1	5.3	2.0	25.8	51.6	54.2	56.0	57.4	PLCX-25.4-25.8-UV
	55	25.4	2.5	50.99	6.00	2.89	27.48	55	57.72	59.53	61.24	PLCX-25.4-27.5-UV
	60	25.4	2.8	56.66	5.00	2.18	29.98	60	62.97	64.95	66.81	PLCX-25.4-30.0-UV
	65	25.4	3.0	61.66	5.00	2.41	32.48	65	68.22	70.36	72.38	PLCX-25.4-32.5-UV
*	67.4	12.7	6.2	65.4	3.0	2.4	33.7	67.4	70.8	73.1	75.0	PLCX-12.7-33.7-UV
*	67.4	25.4	3.1	64.1	5.0	2.5	33.7	67.4	70.8	73.1	75.0	PLCX-25.4-33.7-UV
	70	25.4	3.2	66.99	4.50	2.11	34.98	70	73.47	75.77	77.95	PLCX-25.4-35.0-UV
	75	12.7	6.9	72.33	4.00	3.46	37.48	75	78.71	81.18	83.52	PLCX-12.7-37.5-UV
	75	25.4	3.5	71.99	4.50	2.28	37.48	75	78.71	81.18	83.52	PLCX-25.4-37.5-UV
*	77.2	25.4	3.6	74.84	3.6	1.5	38.60	77.2	81.1	83.8	85.8	PLCX-25.4-38.6-UV
	80	25.4	3.7	76.99	4.50	2.43	39.97	80	83.96	86.59	89.08	PLCX-25.4-40.0-UV
	85	25.4	3.9	82.33	4.00	2.06	42.47	85	89.21	92.01	94.65	PLCX-25.4-42.5-UV
	90	25.4	4.2	87.32	4.00	2.17	44.97	90	94.46	97.42	100.22	PLCX-25.4-45.0-UV
*	92.9	25.4	4.3	89.5	5.0	3.2	46.4	92.9	97.5	100.7	103.2	PLCX-25.4-46.4-UV
	95	25.4	4.4	92.32	4.00	2.27	47.47	95	99.71	102.83	105.79	PLCX-25.4-47.5-UV
	100	12.7	9.3	97.32	4.00	3.59	49.97	100	104.95	108.24	111.35	PLCX-12.7-50.0-UV
	100	25.4	4.6	97.32	4.00	2.36	49.97	100	104.95	108.24	111.35	PLCX-25.4-50.0-UV
	100	50.8	2.3	93.64	9.53	2.59	49.97	100	104.95	108.24	111.35	PLCX-50.8-50.0-UV
*	103.1	25.4	4.8	100.4	4.0	2.4	51.5	103.1	108.2	111.8	114.5	PLCX-25.4-51.5-UV
	110	25.4	5.1	107.32	4.00	2.51	54.96	110	115.45	119.07	122.49	PLCX-25.4-55.0-UV
	120	25.4	5.6	117.32	4.00	2.64	59.96	120	125.94	129.89	133.62	PLCX-25.4-60.0-UV
	125	12.7	11.6	122.32	4.00	3.68	62.46	125	131.19	135.30	139.19	PLCX-12.7-62.5-UV
	125	25.4	5.8	122.32	4.00	2.70	62.46	125	131.19	135.30	139.19	PLCX-25.4-62.5-UV
	125	50.8	2.9	118.63	9.53	4.13	62.46	125	131.19	135.30	139.19	PLCX-50.8-62.5-UV
*	128.9	25.4	6.0	126.2	4.0	2.7	64.4	128.9	135.3	139.8	143.2	PLCX-25.4-64.4-UV
	130	25.4	6.0	127.32	4.00	2.75	64.96	130	136.44	140.71	144.76	PLCX-25.4-65.0-UV
	140	25.4	6.5	137.32	4.00	2.84	69.96	140	146.93	151.54	155.90	PLCX-25.4-70.0-UV
	150	12.7	13.9	147.32	4.00	3.73	74.95	150	157.43	162.36	167.03	PLCX-12.7-75.0-UV

\*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance +0/-0.25mm; Center Thickness Tolerance:  $\pm 0.25$ mm; Centricity:  $< 0.05$ mm); However, surface quality and surface figure/flatness values are maintained as listed.

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	fb at 266nm	tc	(te)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	150	25.4	6.9	147.32	4.00	2.92	74.95	150	157.43	162.36	167.03	PLCX-25.4-75.0-UV
	150	50.8	3.5	143.63	9.53	5.09	74.95	150	157.43	162.36	167.03	PLCX-50.8-75.0-UV
*	154.7	12.7	14.3	153.2	2.3	2.0	77.3	154.7	162.4	167.8	171.9	PLCX-12.7-77.3-UV
*	154.7	25.4	7.2	152.0	4.0	2.9	77.3	154.7	162.4	167.8	171.9	PLCX-25.4-77.3-UV
*	154.7	50.8	3.6	150.0	7.0	2.7	77.3	154.7	162.4	167.8	171.9	PLCX-50.8-77.3-UV
	160	25.4	7.4	157.32	4.00	2.98	79.95	160	167.92	173.19	178.17	PLCX-25.4-80.0-UV
	170	25.4	7.9	167.32	4.00	3.05	84.95	170	178.42	184.01	189.30	PLCX-25.4-85.0-UV
	175	25.4	8.1	172.32	4.00	3.07	87.44	175	183.67	189.42	194.87	PLCX-25.4-87.4-UV
	175	50.8	4.1	170.75	6.35	2.58	87.44	175	183.67	189.42	194.87	PLCX-50.8-87.4-UV
	180	25.4	8.3	177.32	4.00	3.10	89.94	180	188.91	194.84	200.44	PLCX-25.4-89.9-UV
	190	25.4	8.8	187.32	4.00	3.15	94.94	190	199.41	205.66	211.57	PLCX-25.4-94.9-UV
	200	12.7	18.5	197.31	4.00	3.80	99.94	200	209.91	216.48	222.71	PLCX-12.7-99.9-UV
	200	25.4	9.3	197.31	4.00	3.19	99.94	200	209.91	216.48	222.71	PLCX-25.4-99.9-UV
	200	50.8	4.6	195.75	6.35	3.07	99.94	200	209.91	216.48	222.71	PLCX-50.8-99.9-UV
*	206.0	12.7	19.1	203.4	4.0	3.8	103.0	206.1	216.4	223.6	229.1	PLCX-12.7-103.0-UV
*	206.0	25.4	9.5	203.4	4.0	3.2	103.0	206.1	216.4	223.6	229.1	PLCX-25.4-103.0-UV
*	206.0	50.8	4.8	201.8	6.4	3.2	103.0	206.1	216.4	223.6	229.1	PLCX-50.8-103.0-UV
	250	12.7	23.2	247.31	4.00	3.84	124.92	250	262.38	270.60	278.38	PLCX-12.7-124.9-UV
	250	25.4	11.6	247.31	4.00	3.35	124.92	250	262.38	270.60	278.38	PLCX-25.4-124.9-UV
	250	50.8	5.8	245.74	6.35	3.74	124.92	250	262.38	270.60	278.38	PLCX-50.8-124.9-UV
	300	25.4	13.9	297.31	4.00	3.46	149.90	300	314.86	324.73	334.06	PLCX-25.4-149.9-UV
	300	50.8	6.9	295.74	6.35	4.18	149.90	300	314.86	324.73	334.06	PLCX-50.8-149.9-UV
*	309.2	25.4	14.3	306.5	4.0	3.5	154.5	309.2	324.5	335.4	343.6	PLCX-25.4-154.5-UV
	350	25.4	16.2	347.30	4.00	3.54	174.89	350	367.33	378.85	389.74	PLCX-25.4-174.9-UV
	350	50.8	8.1	345.73	6.35	4.50	174.89	350	367.33	378.85	389.74	PLCX-50.8-174.9-UV
*	360.8	25.4	16.7	358.1	4.0	3.6	180.3	360.8	378.7	391.3	401.0	PLCX-25.4-180.3-UV
*	360.8	50.8	8.4	356.5	6.4	4.6	180.3	360.8	378.7	391.3	401.0	PLCX-50.8-180.3-UV
	400	25.4	18.5	397.30	4.00	3.60	199.87	400	419.81	432.97	445.41	PLCX-25.4-199.9-UV
	400	50.8	9.3	395.73	6.35	4.73	199.87	400	419.81	432.97	445.41	PLCX-50.8-199.9-UV
*	412.3	25.4	19.1	409.6	4.0	3.6	206.0	412.3	432.7	447.1	458.2	PLCX-25.4-206.0-UV
*	412.3	50.8	9.5	408.0	6.4	4.8	206.0	412.3	432.7	447.1	458.2	PLCX-50.8-206.0-UV
	500	25.4	23.2	497.29	4.00	3.68	249.84	500	524.76	541.21	556.77	PLCX-25.4-249.8-UV
	500	50.8	11.6	495.72	6.35	5.06	249.84	500	524.76	541.21	556.77	PLCX-50.8-249.8-UV
*	515.3	25.4	23.9	512.6	4.0	3.4	257.5	515.3	540.9	558.9	572.7	PLCX-25.4-257.5-UV
*	515.3	50.8	11.9	511.0	6.4	5.1	257.5	515.3	540.9	558.9	572.7	PLCX-50.8-257.5-UV
	600	25.4	27.8	597.28	4.00	3.73	299.81	600	629.72	649.45	668.12	PLCX-25.4-299.8-UV
	600	50.8	13.9	595.71	6.35	5.27	299.81	600	629.72	649.45	668.12	PLCX-50.8-299.8-UV
	700	25.4	32.4	697.27	4.00	3.77	349.78	700	734.67	757.69	779.48	PLCX-25.4-349.8-UV
	700	50.8	16.2	695.70	6.35	5.43	349.78	700	734.67	757.69	779.48	PLCX-50.8-349.8-UV
*	721.7	25.4	33.4	718.3	4.0	3.8	360.6	721.7	757.4	782.7	802.0	PLCX-25.4-360.6-UV

\*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance +0/-0.25mm; Center Thickness Tolerance: ±0.25mm; Centricity: <0.05mm); However, surface quality and surface figure/flatness values are maintained as listed.

continued on next page

## CONTINUED...LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	fb at 266nm	tc	(te)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	800	25.4	37.1	797.26	4.00	3.80	399.74	800	839.62	865.93	890.83	<b>PLCX-25.4-399.7-UV</b>
	800	50.8	18.5	795.69	6.35	5.54	399.74	800	839.62	865.93	890.83	<b>PLCX-50.8-399.7-UV</b>
	900	25.4	41.7	897.25	4.00	3.82	449.71	900	944.57	974.18	1002.18	<b>PLCX-25.4-449.7-UV</b>
	900	50.8	20.8	895.69	6.35	5.63	449.71	900	944.57	974.18	1002.18	<b>PLCX-50.8-449.7-UV</b>
	1000	25.4	46.3	997.24	4.00	3.84	499.68	1000	1049.53	1082.42	1113.54	<b>PLCX-25.4-499.7-UV</b>
	1000	50.8	23.2	995.68	6.35	5.70	499.68	1000	1049.53	1082.42	1113.54	<b>PLCX-50.8-499.7-UV</b>
*	1030.9	25.4	47.7	1028.1	4.0	3.8	515.1	1030.9	1082.0	1118.1	1145.6	<b>PLCX-25.4-515.1-UV</b>
*	1030.9	50.8	23.9	1026.5	6.4	5.8	515.1	1030.9	1082.0	1118.1	1145.6	<b>PLCX-50.8-515.1-UV</b>
	1500	25.4	69.5	1497.20	4.00	3.89	749.52	1500	1574.29	1623.63	1670.30	<b>PLCX-25.4-749.5-UV</b>
	1500	50.8	34.7	1495.63	6.35	5.92	749.52	1500	1574.29	1623.63	1670.30	<b>PLCX-50.8-749.5-UV</b>
	2000	25.4	92.6	1997.15	4.00	3.92	999.36	2000	2099.05	2147.48	2244.85	<b>PLCX-25.4-999.4-UV</b>
	2000	50.8	46.3	1995.59	6.35	6.03	999.36	2000	2099.05	2147.48	2244.85	<b>PLCX-50.8-999.4-UV</b>
*	2062.0	25.4	95.5	2058.9	4.0	3.9	1030.2	2061.7	2164.0	2236.1	2291.2	<b>PLCX-25.4-1030.2-UV</b>
*	2062.0	50.8	47.7	2057.3	6.4	6.1	1030.2	2061.7	2164.0	2236.1	2291.2	<b>PLCX-50.8-1030.2-UV</b>
	3000	25.4	139.0	2997.06	4.00	3.95	1499.04	3000	3148.58	3221.22	3367.28	<b>PLCX-25.4-1499.0-UV</b>
	3000	50.8	69.5	2995.50	6.35	6.13	1499.04	3000	3148.58	3221.22	3367.28	<b>PLCX-50.8-1499.0-UV</b>
	4000	25.4	185.3	3996.98	4.00	3.96	1998.72	4000	4198.11	4294.96	4489.71	<b>PLCX-25.4-1998.7-UV</b>
	4000	50.8	92.6	3995.41	6.35	6.19	1998.72	4000	4198.11	4294.96	4489.71	<b>PLCX-50.8-1998.7-UV</b>
	5000	25.4	231.6	4996.89	4.00	3.97	2498.40	5000	5247.64	5368.70	5612.13	<b>PLCX-25.4-2498.4-UV</b>
	5000	50.8	115.8	4995.32	6.35	6.22	2498.40	5000	5247.64	5368.70	5612.13	<b>PLCX-50.8-2498.4-UV</b>
	7500	25.4	347.4	7496.66	4.00	3.98	3747.60	7500	7871.46	8053.06	8418.20	<b>PLCX-25.4-3747.6-UV</b>
	10000	25.4	463.2	9996.44	4.00	3.98	4996.80	10000	10495.27	10737.41	11224.27	<b>PLCX-25.4-4996.8-UV</b>

\*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance +0/-0.25mm; Center Thickness Tolerance:  $\pm 0.25$ mm; Centricity:  $< 0.05$ mm); However, surface quality and surface figure/flatness values are maintained as listed.

## LASER GRADE N-BK7 PLANO-CONVEX LENSES: PLCX-C



### Specifications

Product Code: **PLCX-C**

Optical Material: N-BK7

Diameter Tolerance:  $+0/-0.25\text{mm}$

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05\text{mm}$

Radius of Curvature (RoC) Tolerance:

RoC  $\leq 1.5\text{m}$ :  $\pm 0.5\%$

RoC  $> 1.5\text{m}$ :  $\pm 2.0\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{\text{avg}} \leq 0.5\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

Damage Threshold:

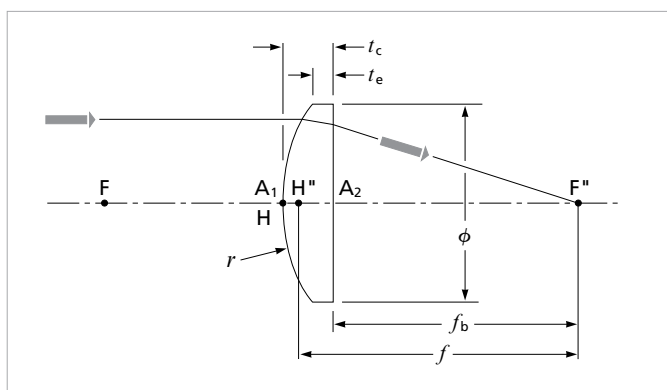
Pulsed, Narrowband: 15 J/cm<sup>2</sup>, 20ns, 20 at 1064nm

Pulsed, Broadband: 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

cw: 1 MW/cm<sup>2</sup> at 1064nm

With many designs, the PLCX-C product spans focal length from 15mm all the way to 10 m. These laser quality N-BK7 lenses can meet the most stringent customer requirements including high power / high energy laser applications as well as ultra low light scattering optical systems.

- ▶ Large selection of diameters and curvatures for all types of focusing requirements
- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ Low-loss, high-energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities



Plano-convex lens

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
PLCX-25.4-12.9-C	532

EXAMPLE: PLCX-25.4-12.9-C- 532

CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLES ON NEXT PAGE

#### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

## CONTINUED...LASER GRADE N-BK7 PLANO-CONVEX LENSES: PLCX-C

LASER GRADE N-BK7 PLANO-CONVEX LENSES											
$f$ (mm)	$\emptyset$ (mm)	$f/\#$	$f_v$ (mm)	$t_c$ (mm)	$t_g$ (mm)	$r$ (mm)	$f$ @ 532nm	$f$ @ 633nm	$f$ @ 1064nm	$f$ @ 1319nm	PRODUCT CODE
15.0	8.0	2.2	12.9	3.1	2.0	7.7	14.8	14.9	15.2	15.3	PLCX-8.0-7.7-C
20.0	12.0	2.0	17.4	3.9	2.0	10.3	19.8	20.0	20.3	20.5	PLCX-12.0-10.3-C
22.0	18.0	1.4	18.0	6.0	1.5	11.3	21.8	21.9	22.3	22.4	PLCX-18.0-11.3-C
25.0	10.0	2.9	22.4	4.0	3.0	12.9	24.8	25.0	25.5	25.6	PLCX-10.0-12.9-C
25.0	12.7	2.3	22.4	4.0	2.3	12.9	24.8	25.0	25.5	25.6	PLCX-12.7-12.9-C
25.0	25.4	1.2	16.6	12.7	2.1	12.9	24.8	25.0	25.5	25.6	PLCX-25.4-12.9-C
35.0	10.0	4.1	33.5	2.2	1.5	18.0	34.7	34.9	35.5	35.8	PLCX-10.0-18.0-C
35.0	25.4	1.6	30.2	7.2	2.0	18.0	34.7	34.9	35.5	35.8	PLCX-25.4-18.0-C
40.0	10.0	4.7	38.3	2.6	2.0	20.6	39.7	40.0	40.7	40.9	PLCX-10.0-20.6-C
40.0	25.4	1.9	36.5	5.3	0.9	20.6	39.7	40.0	40.7	40.9	PLCX-25.4-20.6-C
50.0	10.0	5.9	48.7	2.0	1.5	25.8	49.7	50.1	50.9	51.2	PLCX-10.0-25.8-C
50.0	12.7	4.6	48.7	2.0	1.2	25.8	49.7	50.1	50.9	51.2	PLCX-12.7-25.8-C
50.0	25.4	2.3	46.5	5.3	2.0	25.8	49.7	50.1	50.9	51.2	PLCX-25.4-25.8-C
60.0	8.0	8.8	58.6	2.1	1.8	30.9	59.5	60.0	61.0	61.4	PLCX-8.0-30.9-C
60.0	15.0	4.7	58.6	2.1	1.2	30.9	59.5	60.0	61.0	61.4	PLCX-15.0-30.9-C
60.0	25.4	2.8	57.2	4.2	1.5	30.9	59.5	60.0	61.0	61.4	PLCX-25.4-30.9-C
70.0	25.4	3.2	67.0	4.5	2.2	36.1	69.5	70.1	71.3	71.7	PLCX-25.4-36.1-C
75.0	8.0	11.0	73.7	2.0	1.8	38.6	74.3	74.9	76.2	76.7	PLCX-8.0-38.6-C
75.0	15.0	5.9	73.7	2.0	1.3	38.6	74.3	74.9	76.2	76.7	PLCX-15.0-38.6-C
75.0	25.4	3.5	71.6	5.2	3.0	38.6	74.3	74.9	76.2	76.7	PLCX-25.4-38.6-C
75.0	50.8	1.7	67.4	11.5	2.0	38.6	74.3	74.9	76.2	76.7	PLCX-50.8-38.6-C
100.0	10.0	11.8	98.3	2.5	2.3	51.5	99.1	100.0	101.7	102.3	PLCX-10.0-51.5-C
100.0	25.4	4.6	97.4	4.0	2.4	51.5	99.1	100.0	101.7	102.3	PLCX-25.4-51.5-C
100.0	50.8	2.3	93.4	10.0	3.3	51.5	99.1	100.0	101.7	102.3	PLCX-50.8-51.5-C
125.0	25.4	5.8	122.4	4.0	2.7	64.4	124.0	125.0	127.1	127.9	PLCX-25.4-64.4-C
125.0	38.1	3.9	121.4	5.5	2.6	64.4	124.0	125.0	127.1	127.9	PLCX-38.1-64.4-C
127.0	50.8	2.9	121.7	8.0	2.9	65.4	125.9	127.0	129.1	129.9	PLCX-50.8-65.4-C
150.0	10.0	17.6	148.7	1.9	1.7	77.3	148.8	150.1	152.6	153.5	PLCX-10.0-77.3-C
150.0	25.4	6.9	147.4	4.0	2.9	77.3	148.8	150.1	152.6	153.5	PLCX-25.4-77.3-C
150.0	38.1	4.6	146.7	5.0	2.6	77.3	148.8	150.1	152.6	153.5	PLCX-38.1-77.3-C
150.0	50.8	3.5	145.4	7.0	2.7	77.3	148.8	150.1	152.6	153.5	PLCX-50.8-77.3-C
170.0	25.0	8.0	167.3	4.1	3.2	87.6	168.6	170.1	172.9	174.0	PLCX-25.0-87.6-C
200.0	10.0	23.5	198.5	2.3	2.2	103.0	198.3	200.0	203.3	204.6	PLCX-10.0-103.0-C
200.0	25.4	9.3	197.4	4.0	3.2	103.0	198.3	200.0	203.3	204.6	PLCX-25.4-103.0-C
200.0	38.1	6.2	196.6	5.1	3.3	103.0	198.3	200.0	203.3	204.6	PLCX-38.1-103.0-C
200.0	50.8	4.6	195.8	6.4	3.2	103.0	198.3	200.0	203.3	204.6	PLCX-50.8-103.0-C
250.0	25.4	11.6	247.4	4.0	3.4	128.8	247.9	250.1	254.2	255.8	PLCX-25.4-128.8-C
250.0	38.1	7.7	247.0	4.5	3.1	128.8	247.9	250.1	254.2	255.8	PLCX-38.1-128.8-C
250.0	50.8	5.8	245.8	6.4	3.9	128.8	247.9	250.1	254.2	255.8	PLCX-50.8-128.8-C
300.0	25.4	13.9	297.4	4.0	3.5	154.5	297.4	299.9	305.0	306.9	PLCX-25.4-154.5-C
300.0	50.0	7.1	296.0	6.0	4.0	154.5	297.4	300.0	305.0	306.9	PLCX-50.0-154.5-C



## LASER GRADE N-BK7 PLANO-CONVEX LENSES

$f$ (mm)	$\varnothing$ (mm)	$f/\#$	$f_b$ (mm)	$t_c$ (mm)	$t_e$ (mm)	$r$ (mm)	$f$ @ 532nm	$f$ @ 633nm	$f$ @ 1064nm	$f$ @ 1319nm	PRODUCT CODE
350.0	25.4	16.2	347.4	4.0	3.6	180.3	347.1	350.0	355.9	358.1	PLCX-25.4-180.3-C
350.0	38.1	10.8	346.7	5.0	4.0	180.3	347.1	350.0	355.9	358.1	PLCX-38.1-180.3-C
350.0	50.8	8.1	345.8	6.4	4.6	180.3	347.1	350.0	355.9	358.1	PLCX-50.8-180.3-C
400.0	25.4	18.5	397.3	4.1	3.7	206.0	396.6	399.9	406.6	409.2	PLCX-25.4-206.0-C
400.0	38.1	12.4	396.7	5.0	4.1	206.7	397.9	401.3	408.0	410.6	PLCX-38.1-206.7-C
500.0	25.4	23.2	497.4	4.0	3.7	257.5	495.7	499.9	508.3	511.5	PLCX-25.4-257.5-C
500.0	38.1	15.4	496.7	5.0	4.3	257.5	495.7	499.9	508.3	511.5	PLCX-38.1-257.5-C
500.0	50.8	11.6	495.8	6.4	5.1	257.5	495.7	499.9	508.3	511.5	PLCX-50.8-257.5-C
600.0	25.4	27.8	597.4	4.0	3.7	309.1	595.0	600.1	610.1	614.0	PLCX-25.4-309.1-C
600.0	50.8	13.9	595.8	6.4	5.4	309.1	595.0	600.1	610.1	614.0	PLCX-50.8-309.1-C
700.0	25.4	32.4	697.4	4.0	3.8	360.6	694.2	700.1	711.8	716.2	PLCX-25.4-360.6-C
750.0	25.4	34.7	747.4	4.0	3.8	386.3	743.6	750.0	762.5	767.3	PLCX-25.4-386.3-C
750.0	50.8	17.4	745.8	6.4	5.6	386.3	743.6	750.0	762.5	767.3	PLCX-50.8-386.3-C
800.0	25.4	37.1	797.4	4.0	3.8	412.1	793.3	800.1	813.4	818.5	PLCX-25.4-412.1-C
800.0	50.8	18.5	795.8	6.4	5.6	412.1	793.3	800.1	813.4	818.5	PLCX-50.8-412.1-C
900.0	25.4	41.7	897.2	4.2	4.0	463.5	892.3	899.8	914.9	920.6	PLCX-25.4-463.5-C
900.0	50.8	20.8	895.8	6.4	5.7	463.5	892.3	899.8	914.9	920.6	PLCX-50.8-463.5-C
1000.0	25.4	46.3	997.4	4.0	3.8	515.1	991.6	1000.0	1016.7	1023.1	PLCX-25.4-515.1-C
1000.0	50.8	23.2	995.8	6.4	5.8	515.1	991.6	1000.0	1016.7	1023.1	PLCX-50.8-515.1-C
1500.0	25.4	69.5	1497.4	4.0	3.9	772.6	1487.3	1499.9	1525.0	1534.6	PLCX-25.4-772.6-C
1500.0	50.8	34.7	1495.8	6.3	5.9	772.6	1487.3	1499.9	1525.0	1534.6	PLCX-50.8-772.6-C
2000.0	25.4	92.6	1997.4	4.0	3.9	1030.2	1983.2	2000.0	2033.4	2045.8	PLCX-25.4-1030.2-C
2000.0	50.8	46.3	1995.8	6.4	6.1	1030.2	1983.2	2000.0	2033.4	2045.8	PLCX-50.8-1030.2-C
3000.0	25.4	139.0	2997.4	4.0	3.9	1545.0	2974.2	2999.5	3049.5	3068.8	PLCX-25.4-1545.0-C
4000.0	25.4	185.3	3997.4	4.0	4.0	2060.0	3965.6	3999.3	4066.0	4091.7	PLCX-25.4-2060.0-C
5000.0	25.4	231.6	4997.4	4.0	4.0	2575.0	4957.0	4999.1	5082.6	5114.6	PLCX-25.4-2575.0-C
7500.0	25.4	347.4	7497.4	4.0	3.9	3863.0	7436.4	7499.7	7624.8	7672.9	PLCX-25.4-3863.0-C
10000.0	25.4	463.2	9997.4	4.0	4.0	5151.0	9915.8	10000.2	10167.1	10231.2	PLCX-25.4-5151.0-C

## UV GRADE CAF<sub>2</sub> PLANO-CONVEX LENSES: PLCX-CFUV



### Specifications

Product Code: **PLCX-CFUV**

Optical Material: UV-grade CaF<sub>2</sub>, Random Axis

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t<sub>c</sub>): ± 0.25mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05mm

Radius of Curvature (RoC) Tolerance: ±0.5%

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure: < λ/10 p-v at 633nm before coating

Clear Aperture (CA): ≥ 85% of central diameter

Anti-reflection Coating: Wavelength user specified

Damage Threshold: 1 J/cm<sup>2</sup>, 8ns pulse at 248nm

UV-grade calcium fluoride offers a very wide transmission ranging from 150nm to 8 μm, with excellent ultraviolet transmittance. The high laser durability of CaF<sub>2</sub> makes it the material of choice for use in excimer laser optics.

- ▶ Short UV beam focusing with minimum fluorescence
- ▶ Suitable for both UV and NIR applications
- ▶ Low loss, high energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities

#### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
<b>PLCX-25.4-118.0-CFUV</b>	<b>193</b>

**EXAMPLE: PLCX-25.4-118.0-CFUV - 193**

#### CHOOSE FROM THE OPTIONS BELOW.

##### 1. PRODUCT CODE - SEE TABLE BELOW

##### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

<b>193</b>	<b>266</b>	<b>415-700</b>
<b>248</b>	<b>355</b>	<b>633-1064</b>
<b>248-355</b>	<b>355-532</b>	<b>1050-1600</b>

Please see page T-31 for Anti-Reflective Coating Traces.

#### UV GRADE CAF<sub>2</sub> PLANO-CONVEX LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>c</sub> (mm)	r (mm)	f @ 193nm	f @ 212nm	f @ 248nm	f @ 308nm	PRODUCT CODE
25.0	12.7	2.3	22.4	3.8	11.9	23.6	24.4	25.3	26.2	<b>PLCX-12.7-11.9-CFUV</b>
50.0	25.4	2.3	45.4	6.7	23.6	47.0	48.5	50.4	52.1	<b>PLCX-25.4-23.6-CFUV</b>
75.0	25.4	3.5	71.3	5.4	35.0	69.8	72.1	74.8	77.3	<b>PLCX-25.4-35.0-CFUV</b>
100.0	25.4	4.6	96.7	4.8	46.4	92.5	95.6	99.1	102.5	<b>PLCX-25.4-46.4-CFUV</b>
150.0	25.4	6.9	147.1	4.2	70.6	140.8	145.4	150.9	156.0	<b>PLCX-25.4-70.6-CFUV</b>
200.0	25.4	9.3	197.3	3.9	93.2	185.9	192.0	199.2	206.0	<b>PLCX-25.4-93.2-CFUV</b>
250.0	25.4	11.6	247.5	3.7	118.0	235.2	243.0	252.1	260.7	<b>PLCX-25.4-118.0-CFUV</b>
500.0	25.4	23.2	497.8	3.3	231.8	462.2	477.4	495.3	512.2	<b>PLCX-25.4-231.8-CFUV</b>

## LASER GRADE N-SF11 PLANO-CONVEX LENSES: PLCX-SF11



### Specifications

Product Code: **PLCX-SF11**

Optical Material: Schott N-SF11

Diameter Tolerance:  $\pm 0/-0.25$ mm

Center Thickness ( $t_c$ ):  $\pm 0.25$ mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05$ mm

Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{avg} \leq 0.75\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

Damage Threshold: 4 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

N-SF11 glass is a high refractive index material used to provide more optical power with less curvature. Singlet lenses made from N-SF11 exhibit reduced spherical aberration and achieve diffraction limited performances at lower focal ratios than N-BK7 and fused silica plano-convex lenses.

- ▶ High refractive index material
- ▶  $< \lambda/10$  surface figure, 20-10 surface quality
- ▶ Low loss, high energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities

#### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCX-15.0-19.1-SF11	1550

**EXAMPLE: PLCX-15.0-19.1-SF11 - 1550**

CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLE BELOW

#### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064	1064	1550
532	800	1050-1600	
633	1030	1064/532	

Please see page T-31 for Anti-Reflective Coating Traces.

#### LASER GRADE N-SF11 PLANO-CONVEX LENSES

f (mm)	Ø (mm)	t/#	$f_c$ (mm)	$t_c$ (mm)	r (mm)	f@780nm	f@800nm	f@1300nm	f@1550nm	PRODUCT CODE
25.0	15.0	2.0	22.9	2.3	19.1	24.7	25.0	25.5	25.6	PLCX-15.0-19.1-SF11
50.0	25.4	2.3	47.9	1.6	38.1	49.2	49.8	50.9	51.2	PLCX-25.4-38.1-SF11
76.0	25.4	3.5	73.9	2.4	58.2	75.1	76.1	77.7	78.1	PLCX-25.4-58.2-SF11
175.0	25.4	8.1	172.9	3.2	134.1	173.1	175.4	179.0	180.1	PLCX-25.4-134.1-SF11

## LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES: PLCC-UV



- ▶ Diverging lens for beam expansion
- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ Low-loss high-energy AR coatings

### Specifications

Product Code: **PLCC-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Diameter Tolerance:** +0/-0.25mm

**Center Thickness Tolerance (tc):**  $\pm 0.25$ mm

**Chamfer:** 0.35mm leg width at 45° nominal

**Concentricity:**  $\leq 0.05$ mm

**Radius of Curvature (RoC) Tolerance:**  $\pm 0.5\%$

**Surface Figure:**  $< \lambda/10$  p-v at 633nm before coating

**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):**  $\geq 85\%$  of central diameter

**Anti-reflection Coating:** Wavelength user specified

**Narrowband:**  $R \leq 0.25\%$  per surface

**Broadband:**  $R_{avg} \leq 0.5\%$  per surface

**Dualband:**  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

**Damage Threshold:**

**Pulsed Narrowband:** 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**Pulsed Broadband:** 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**cw:** 1 MW/cm<sup>2</sup> at 1064nm

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCC-25.4-25.8-UV	355

EXAMPLE: PLCC-25.4-25.8-UV - 355

### CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLE BELOW

#### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

### LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>c</sub> (mm)	t <sub>s</sub> (mm)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
-20.0	10.0	-2.4	-21.4	2.0	3.3	10.3	-20.6	-21.6	-22.4	-22.9	PLCC-10.0-10.3-UV
-22.0	12.7	-2.0	-23.4	2.1	4.1	11.2	-22.4	-23.5	-24.3	-24.9	PLCC-12.7-11.2-UV
-25.0	10.0	-2.9	-26.4	2.0	3.0	12.9	-25.8	-27.1	-28.0	-28.7	PLCC-10.0-12.9-UV
-25.0	15.0	-2.0	-26.4	2.0	4.4	12.9	-25.8	-27.1	-28.0	-28.7	PLCC-15.0-12.9-UV
-25.0	25.4	-1.2	-26.4	2.0	11.9	13.1	-26.2	-27.5	-28.4	-29.1	PLCC-25.4-13.1-UV
-40.0	19.1	-2.5	-41.3	2.0	4.3	20.6	-41.2	-43.3	-44.7	-45.8	PLCC-19.1-20.6-UV
-40.0	25.4	-1.9	-41.4	2.0	6.7	19.6	-39.2	-41.2	-42.5	-43.6	PLCC-25.4-19.6-UV
-50.0	12.7	-4.6	-51.3	2.0	2.8	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-12.7-25.8-UV
-50.0	15.0	-3.9	-51.4	2.0	3.1	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-15.0-25.8-UV
-50.0	25.4	-2.3	-52.1	3.0	6.3	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-25.4-25.8-UV
-75.0	15.0	-5.9	-76.3	2.0	2.7	38.6	-77.2	-81.1	-83.8	-85.8	PLCC-15.0-38.6-UV
-75.0	25.4	-3.5	-76.4	2.0	4.1	38.6	-77.2	-81.1	-83.8	-85.8	PLCC-25.4-38.6-UV
-100.0	15.0	-7.8	-101.4	2.0	2.5	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-15.0-51.5-UV
-100.0	25.4	-4.6	-101.4	2.0	3.6	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-25.4-51.5-UV

LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES											
$f$ (mm)	$\emptyset$ (mm)	$f/\#$	$f_c$ (mm)	$t_c$ (mm)	$t_e$ (mm)	$r$ (mm)	$f @ 266\text{nm}$	$f @ 355\text{nm}$	$f @ 532\text{nm}$	$f @ 1064\text{nm}$	PRODUCT CODE
-100.0	50.8	-2.3	-101.3	2.0	8.7	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-50.8-51.5-UV
-125.0	15.0	-9.8	-126.4	2.0	2.4	64.4	-128.9	-135.3	-139.8	-143.2	PLCC-15.0-64.4-UV
-125.0	25.4	-5.8	-126.4	2.0	3.3	64.4	-128.9	-135.3	-139.8	-143.2	PLCC-25.4-64.4-UV
-150.0	15.0	-11.8	-151.5	2.3	2.7	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-15.0-77.3-UV
-150.0	25.4	-6.9	-152.1	3.1	4.2	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-25.4-77.3-UV
-150.0	50.8	-3.5	-153.1	4.5	8.8	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-50.8-77.3-UV
-200.0	25.4	-9.3	-202.3	3.4	4.2	103.0	-206.1	-216.4	-223.6	-229.1	PLCC-25.4-103.0-UV
-200.0	50.8	-4.6	-203.3	4.8	8.0	103.0	-206.1	-216.4	-223.6	-229.1	PLCC-50.8-103.0-UV
-250.0	25.4	-11.6	-252.5	3.6	4.2	128.8	-257.8	-270.3	-279.6	-286.5	PLCC-25.4-128.8-UV
-250.0	50.8	45.8	-253.8	5.5	8.0	128.8	-257.8	-270.3	-279.6	-286.5	PLCC-50.8-128.8-UV
-300.0	25.4	413.9	-301.4	2.0	2.5	154.5	-309.2	-324.5	-335.4	-343.6	PLCC-25.4-154.5-UV
-300.0	50.8	46.9	-304.3	6.2	8.3	154.5	-309.2	-324.5	-335.4	-343.6	PLCC-50.8-154.5-UV
-350.0	25.4	416.2	-351.4	2.0	2.4	180.3	-360.8	-378.7	-391.3	-401.0	PLCC-25.4-180.3-UV
-350.0	50.8	48.1	-354.3	6.2	8.0	180.3	-360.8	-378.7	-391.3	-401.0	PLCC-50.8-180.3-UV
-400.0	25.4	-18.5	-401.4	2.0	2.4	206.6	-413.5	-434.0	-448.4	-459.5	PLCC-25.4-206.6-UV
-500.0	25.4	-23.2	-503.0	4.3	4.6	257.5	-515.3	-540.9	-558.9	-572.7	PLCC-25.4-257.5-UV
-500.0	50.8	-11.6	-504.8	7.0	8.3	257.5	-515.3	-540.9	-558.9	-572.7	PLCC-50.8-257.5-UV
-600.0	25.4	-27.8	-602.7	3.9	4.2	309.1	-618.6	-649.3	-670.9	-687.5	PLCC-25.4-309.1-UV
-1000.0	25.4	-46.3	-1001.4	2.0	2.2	515.1	-1030.9	-1082.0	-1118.1	-1145.6	PLCC-25.4-515.1-UV
-1000.0	50.8	-23.2	-1004.3	6.4	7.0	515.1	-1030.9	-1082.0	-1118.1	-1145.6	PLCC-50.8-515.1-UV
-1500.0	25.4	-69.5	-1501.4	2.0	2.1	772.6	-1546.2	-1622.9	-1677.0	-1718.3	PLCC-25.4-772.6-UV
-1500.0	50.8	-34.7	-1504.2	6.4	6.8	772.6	-1546.2	-1622.9	-1677.0	-1718.3	PLCC-50.8-772.6-UV

LASER GRADE N-BK7 PLANO-CONCAVE LENSES: **PLCC-C**



Specifications

Product Code: **PLCC-C**

Optical Material: N-BK7

Diameter Tolerance:  $\pm 0/-0.25$ mm

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25$ mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05$ mm

Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{avg} \leq 0.5\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

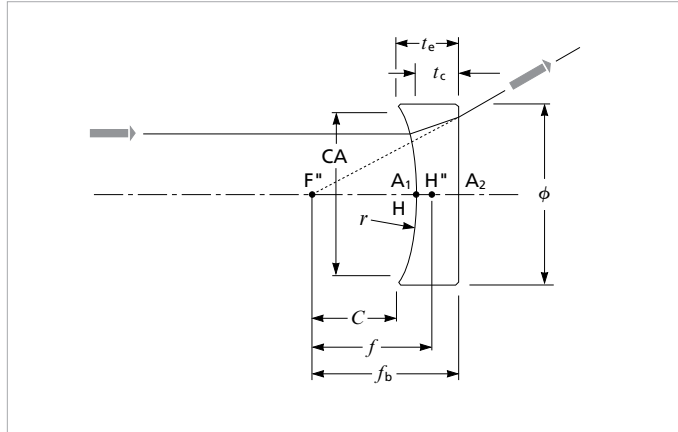
Damage Threshold:

Pulsed, Narrowband: 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

cw: 1 MW/cm<sup>2</sup> at 1064nm

- ▶ Diverging lens for beam expansion
- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ Low-loss high-energy AR coatings



Laser quality plano-concave lens

**BUILD YOUR PART NUMBER**

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>PLCC-25.4-25.8-C</b>	<b>633</b>

**EXAMPLE: PLCC-25.4-25.8-C - 633**

CHOOSE FROM THE OPTIONS BELOW.

**1. PRODUCT CODE - SEE TABLE ON RIGHT**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

## LASER GRADE N-BK7 PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>v</sub> (mm)	t <sub>e</sub> (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
-20.0	10.0	-2.4	-21.4	2.0	3.3	10.3	-19.8	-20.0	-20.3	-20.5	PLCC-10.0-10.3-C
-25.0	10.0	-2.9	-26.4	2.0	3.0	12.9	-24.8	-25.0	-25.5	-25.6	PLCC-10.0-12.9-C
-25.0	15.0	-2.0	-26.4	2.0	4.4	12.9	-24.8	-25.0	-25.5	-25.6	PLCC-15.0-12.9-C
-30.0	12.7	-2.8	-31.4	2.0	3.3	15.5	-29.8	-30.1	-30.6	-30.8	PLCC-12.7-15.5-C
-30.0	25.4	-1.4	-31.4	2.0	8.6	15.5	-29.8	-30.1	-30.6	-30.8	PLCC-25.4-15.5-C
-38.0	25.4	-1.8	-39.4	2.0	6.7	19.6	-37.7	-38.1	-38.7	-38.9	PLCC-25.4-19.6-C
-50.0	10.0	-5.9	-51.4	2.0	2.5	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-10.0-25.8-C
-50.0	12.7	-4.6	-51.4	2.0	2.8	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-12.7-25.8-C
-50.0	25.4	-2.3	-52.1	3.0	6.3	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-25.4-25.8-C
-75.0	15.0	-5.9	-76.4	2.0	2.7	38.6	-74.3	-74.9	-76.2	-76.7	PLCC-15.0-38.6-C
-75.0	25.4	-3.5	-77.1	3.0	5.1	38.6	-74.3	-74.9	-76.2	-76.7	PLCC-25.4-38.6-C
-100.0	15.0	-7.8	-101.4	2.0	2.5	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-15.0-51.5-C
-100.0	25.4	-4.6	-101.8	2.6	4.2	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-25.4-51.5-C
-100.0	50.8	-2.3	-101.4	2.0	8.7	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-50.8-51.5-C
-125.0	10.0	-14.7	-126.4	2.0	2.2	64.4	-124.0	-125.0	-127.1	-127.9	PLCC-10.0-64.4-C
-125.0	25.4	-5.8	-127.0	2.9	4.2	64.4	-124.0	-125.0	-127.1	-127.9	PLCC-25.4-64.4-C
-150.0	15.0	-11.8	-151.6	2.3	2.7	77.3	-148.8	-150.1	-152.6	-153.5	PLCC-15.0-77.3-C
-150.0	25.4	-6.9	-152.1	3.1	4.2	77.3	-148.8	-150.1	-152.6	-153.5	PLCC-25.4-77.3-C
-176.0	25.4	-8.2	-178.3	3.3	4.2	90.8	-174.8	-176.3	-179.2	-180.4	PLCC-25.4-90.8-C
-200.0	25.4	-9.3	-202.3	3.4	4.2	103.0	-198.3	-200.0	-203.3	-204.6	PLCC-25.4-103.0-C
-200.0	50.8	-4.6	-203.3	4.8	8.0	103.0	-198.3	-200.0	-203.3	-204.6	PLCC-50.8-103.0-C
-250.0	25.4	-11.6	-252.7	4.0	4.6	128.8	-247.9	-250.1	-254.2	-255.8	PLCC-25.4-128.8-C
-250.0	50.8	-5.8	-254.1	6.0	8.5	128.8	-247.9	-250.1	-254.2	-255.8	PLCC-50.8-128.8-C
-500.0	25.4	-23.2	-502.7	3.9	4.2	257.5	-495.7	-499.9	-508.3	-511.5	PLCC-25.4-257.5-C
-500.0	50.8	-11.6	-504.8	7.0	8.3	257.5	-495.7	-499.9	-508.3	-511.5	PLCC-50.8-257.5-C
-600.0	25.4	-27.8	-602.7	3.9	4.2	309.1	-595.0	-600.1	-610.1	-614.0	PLCC-25.4-309.1-C

LASER GRADE N-SF11 PLANO-CONCAVE LENSES: PLCC-SF11

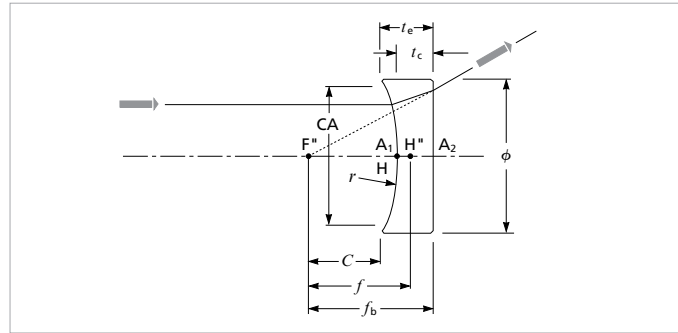


- ▶ Diverging lens for beam expansion
- ▶ High refractive index material providing more optical power with less curvature
- ▶  $< \lambda/10$  surface figure, 20-10 surface quality
- ▶ Low-loss high-energy AR coatings

Specifications

Product Code: **PLCC-SF11**

- Optical Material: Schott N-SF11
- Diameter Tolerance:  $+0/-0.25\text{mm}$
- Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25\text{mm}$
- Chamfer: 0.35mm leg width at 45° nominal
- Concentricity:  $\leq 0.05\text{mm}$
- Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$
- Surface Figure:  $< \lambda/10$  p-v at 633nm before coating
- Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b
- Clear Aperture (CA):  $\geq 85\%$  of central diameter
- Anti-reflection Coating: Wavelength user specified
- Narrowband:  $R \leq 0.25\%$  per surface
- Broadband:  $R_{\text{avg}} \leq 0.75\%$  per surface
- Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface
- Damage Threshold: 4 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm



Laser quality plano-concave lens

**BUILD YOUR PART NUMBER**

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>PLCC-10.0-7.7-SF11</b>	<b>1064</b>

**EXAMPLE: PLCC-10.0-7.7-SF11 - 1064**

CHOOSE FROM THE OPTIONS BELOW.

**1. PRODUCT CODE - SEE TABLE BELOW**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

415-700	633-1064	1064	1550
532	800	1050-1600	
633	1030	1064/532	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-SF11 PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>c</sub> (mm)	r (mm)	f @ 780nm	f @ 800nm	f @ 1300nm	f @ 1550nm	PRODUCT CODE
-10.0	10.0	-1.2	-11.1	3.8	7.7	-9.9	-10.1	-10.3	-10.3	<b>PLCC-10.0-7.7-SF11</b>
-15.0	10.0	-1.8	-16.1	3.1	11.5	-14.8	-15.0	-15.4	-15.4	<b>PLCC-10.0-11.5-SF11</b>
-100.0	25.4	-4.6	-101.1	3.1	76.3	-98.5	-99.8	-101.9	-102.5	<b>PLCC-25.4-76.3-SF11</b>
-150.0	25.4	-6.9	-151.1	2.7	114.6	-148.0	-149.9	-153.0	-153.9	<b>PLCC-25.4-114.6-SF11</b>



# LASER GRADE FUSED SILICA BICONVEX LENSES: BICX-UV



## Specifications

Product Code: **BICX-UV**

### Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25$ mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05$ mm

Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{avg} \leq 0.5\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

Damage Threshold:

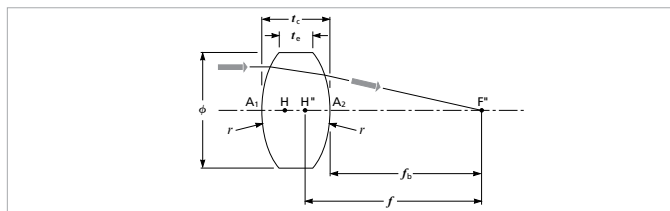
Pulsed, Narrowband: 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

cw: 1 MW/cm<sup>2</sup> at 1064nm

Spherical biconvex lenses are equiconvex: (i.e.  $r_1 = r_2$ ). Other dimensions and focal lengths are available for OEM applications.

- ▶ For 1:1 imaging applications, beam expanders, and beam relay applications
- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ Low-loss, high-energy AR coatings



Bi-convex lens

## BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>BICX-25.4-154.0-UV</b>	<b>355</b>

**EXAMPLE: BICX-25.4-154.0-UV - 355**

## CHOOSE FROM THE OPTIONS BELOW.

### 1. PRODUCT CODE - SEE TABLE BELOW

### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

<b>193</b>	<b>355-532</b>	<b>633-1064</b>	<b>1050-1600</b>
<b>248</b>	<b>400</b>	<b>700-900</b>	<b>1064/532</b>
<b>248-355</b>	<b>415-700</b>	<b>800</b>	<b>1550</b>
<b>266</b>	<b>532</b>	<b>1030</b>	
<b>355</b>	<b>633</b>	<b>1064</b>	

## LASER GRADE FUSED SILICA BICONVEX LENSES

f (mm)	Ø (mm)	f/#	f <sub>c</sub> (mm)	t <sub>c</sub> (mm)	t <sub>e</sub> (mm)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
15.0	12.7	1.4	13.0	5.9	2.9	14.4	15.5	16.2	16.7	17.1	<b>BICX-12.7-14.4-UV</b>
25.0	25.4	1.2	21.5	10.0	2.7	23.9	25.7	26.9	27.8	28.4	<b>BICX-25.4-23.9-UV</b>
50.0	25.4	2.3	48.3	5.1	1.9	50.6	51.5	54.0	55.8	57.2	<b>BICX-25.4-50.6-UV</b>
60.0	25.4	2.8	58.5	4.5	1.8	61.0	61.8	64.8	67.0	68.6	<b>BICX-25.4-61.0-UV</b>
65.0	25.4	3.0	63.0	6.0	3.5	64.4	65.5	68.7	70.9	72.7	<b>BICX-25.4-64.4-UV</b>
75.0	25.4	3.5	73.7	4.1	2.0	76.6	77.3	81.2	83.8	85.9	<b>BICX-25.4-76.6-UV</b>
100.0	25.4	4.6	98.6	4.2	2.6	102.4	103.2	108.1	111.9	114.5	<b>BICX-25.4-102.4-UV</b>
125.0	25.4	5.8	123.6	4.2	2.9	128.2	129.0	135.2	139.9	143.1	<b>BICX-25.4-128.2-UV</b>
125.0	50.8	2.9	122.7	7.2	2.1	127.5	128.8	135.1	139.6	143.0	<b>BICX-50.8-127.5-UV</b>
150.0	25.4	6.9	148.6	4.2	3.0	154.0	154.8	162.2	167.9	171.7	<b>BICX-25.4-154.0-UV</b>
200.0	25.4	9.3	198.6	4.2	3.4	205.6	206.4	216.4	223.9	229.1	<b>BICX-25.4-205.6-UV</b>
200.0	50.8	4.6	197.3	8.4	5.2	205.2	206.7	216.4	224.1	229.1	<b>BICX-50.8-205.2-UV</b>

## LASER GRADE N-BK7 BICONVEX LENSES: BICX-C



Spherical biconvex lenses are equiconvex: (i.e.  $r_1 = r_2$ ). Other dimensions and focal lengths are available for OEM applications.

- ▶ For 1:1 imaging and relay applications
- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ Low-loss, high-energy AR coatings

### Specifications

Product Code: **BICX-C**

Optical Material: N-BK7

Diameter Tolerance:  $+0/-0.25\text{mm}$

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05\text{mm}$

Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{\text{avg}} \leq 0.5\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

cw: 1 MW/cm<sup>2</sup> at 1064nm

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>BICX-25.4-102.4-C</b>	<b>1064</b>

**EXAMPLE: BICX-25.4-102.4-C - 1064**

### CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLES BELOW

#### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

<b>400</b>	<b>633</b>	<b>800</b>	<b>1050-1600</b>
<b>415-700</b>	<b>633-1064</b>	<b>1030</b>	<b>1064/532</b>
<b>532</b>	<b>700-900</b>	<b>1064</b>	<b>1550</b>

Please see page T-31 for Anti-Reflective Coating Traces.

### LASER GRADE N-BK7 BICONVEX LENSES

f (mm)	Ø (mm)	t/#	$f_b$ (mm)	$t_c$ (mm)	$t_e$ (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
20.0	15.0	1.6	18.3	4.9	1.9	19.7	19.8	20.0	20.3	20.4	<b>BICX-15.0-19.7-C</b>
25.0	12.7	2.3	23.9	3.3	1.7	25.2	24.8	25.0	25.4	25.6	<b>BICX-12.7-25.2-C</b>
25.0	25.4	1.2	21.4	10.0	2.7	23.9	24.8	25.0	25.4	25.2	<b>BICX-25.4-23.9-C</b>
40.0	25.0	1.9	38.0	5.9	1.9	40.2	39.7	40.0	40.7	40.9	<b>BICX-25.0-40.2-C</b>
50.0	25.4	2.3	48.3	5.1	1.9	50.6	49.6	50.0	50.8	51.1	<b>BICX-25.4-50.6-C</b>
50.0	50.8	1.2	44.9	14.6	0.4	48.9	49.6	50.0	50.8	51.1	<b>BICX-50.8-48.9-C</b>
75.0	25.4	3.5	73.6	4.1	2.0	76.6	74.4	75.0	76.3	76.7	<b>BICX-25.4-76.6-C</b>
100.0	25.4	4.6	98.6	4.2	2.6	102.4	99.3	100.1	101.8	102.1	<b>BICX-25.4-102.4-C</b>
150.0	25.4	6.9	148.6	4.2	3.2	154.0	148.9	150.2	152.7	153.6	<b>BICX-25.4-154.0-C</b>
150.0	50.8	3.5	147.2	8.3	4.2	153.4	148.8	150.0	152.5	153.5	<b>BICX-50.8-153.4-C</b>
200.0	25.4	9.3	198.6	4.2	3.4	205.6	198.5	200.2	203.5	204.8	<b>BICX-25.4-205.6-C</b>
250.0	25.4	11.6	248.6	4.2	3.6	257.1	247.9	250.0	254.2	256.7	<b>BICX-25.4-257.1-C</b>
300.0	25.4	13.9	298.7	4.0	3.5	308.5	297.3	299.8	304.8	307.1	<b>BICX-25.4-308.5-C</b>
300.0	50.8	6.9	297.2	8.3	6.3	308.5	297.6	300.2	305.2	307.8	<b>BICX-50.8-308.5-C</b>
400.0	50.8	9.3	397.7	7.0	5.4	411.5	396.7	400.0	406.7	409.1	<b>BICX-50.8-411.5-C</b>
500.0	50.8	11.6	497.7	7.0	5.7	514.6	495.9	500.1	508.4	511.5	<b>BICX-50.8-514.6-C</b>

## LASER GRADE FUSED SILICA BICONCAVE LENSES: BICC-UV



Spherical biconcave lenses are equiconcave: (i.e.  $r_1 = r_2$ ). Other dimensions and focal lengths are available for OEM applications.

- ▶ UV-grade fused-silica equiconcave singlet lenses
- ▶ Laser grade:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ High-energy, single-wavelength and broadband AR coatings

### Specifications

Product Code: **BICC-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Diameter Tolerance:**  $+0/-0.25\text{mm}$

**Center Thickness Tolerance ( $t_c$ ):**  $\pm 0.25\text{mm}$

**Chamfer:** 0.35mm leg width at 45° nominal

**Concentricity:**  $\leq 0.05\text{mm}$

**Radius of Curvature (RoC) Tolerance:**  $\pm 0.5\%$

**Surface Figure:**  $< \lambda/10$  p-v at 633nm before coating

**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):**  $\geq 85\%$  of central diameter

**Anti-reflection Coating:** Wavelength user specified

**Narrowband:**  $R \leq 0.25\%$  per surface

**Broadband:**  $R_{\text{avg}} \leq 0.5\%$  per surface

**Dualband:**  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

**Damage Threshold:**

**Pulsed, Narrowband:** 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**Pulsed, Broadband:** 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**cw:** 1 MW/cm<sup>2</sup> at 1064nm

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>BICC-25.4-206.4-UV</b>	<b>248</b>

**EXAMPLE: BICC-25.4-206.4-UV - 248**

CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
<b>193</b>	<b>355-532</b>	<b>633-1064</b>	<b>1050-1600</b>
<b>248</b>	<b>400</b>	<b>700-900</b>	<b>1064/532</b>
<b>248-355</b>	<b>415-700</b>	<b>800</b>	<b>1550</b>
<b>266</b>	<b>532</b>	<b>1030</b>	
<b>355</b>	<b>633</b>	<b>1064</b>	

Please see page T-31 for Anti-Reflective Coating Traces.

### LASER GRADE FUSED SILICA BICONCAVE LENSES

f (mm)	Ø (mm)	f/#	f <sub>0</sub> (mm)	t <sub>c</sub> (mm)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
-20.0	19.1	-1.2	-20.7	6.6	20.9	-20.6	-21.6	-22.3	-22.9	<b>BICC-19.1-20.9-UV</b>
-25.0	25.4	-1.2	-25.7	8.6	26.1	-25.8	-27.1	-28.0	-28.7	<b>BICC-25.4-26.1-UV</b>
-50.0	25.4	-2.3	-50.7	5.2	51.8	-51.5	-54.1	-55.9	-57.3	<b>BICC-25.4-51.8-UV</b>
-50.0	50.0	-1.2	-50.7	14.9	51.8	-51.5	-54.1	-55.9	-57.3	<b>BICC-50.0-51.8-UV</b>
-75.0	25.4	-3.5	-75.7	4.1	77.6	-76.7	-81.2	-83.2	-85.9	<b>BICC-25.4-77.6-UV</b>
-100.0	25.4	-4.6	-100.9	4.2	103.4	-103.0	-108.1	-111.8	-114.5	<b>BICC-25.4-103.4-UV</b>
-150.0	25.4	-6.9	-151.1	4.2	154.9	-154.5	-162.1	-167.6	-171.7	<b>BICC-25.4-154.9-UV</b>
-150.0	50.8	-3.5	-150.7	6.2	154.9	-154.5	-162.7	-167.8	-172.3	<b>BICC-50.8-154.9-UV</b>
-200.0	25.4	-9.3	-200.7	2.8	206.4	-206.2	-216.4	-223.7	-229.2	<b>BICC-25.4-206.4-UV</b>

LASER GRADE N-BK7 BICONCAVE LENSES: BICC-C



Specifications

Product Code: **BICC-C**

Optical Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.25$ mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity:  $\leq 0.05$ mm

Radius of Curvature (RoC) Tolerance:  $\pm 0.5\%$

Surface Figure:  $< \lambda/10$  p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 85\%$  of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband:  $R \leq 0.25\%$  per surface

Broadband:  $R_{avg} \leq 0.5\%$  per surface

Dualband:  $R \leq 0.3\%$  at 1064,  $R \leq 0.6\%$  at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

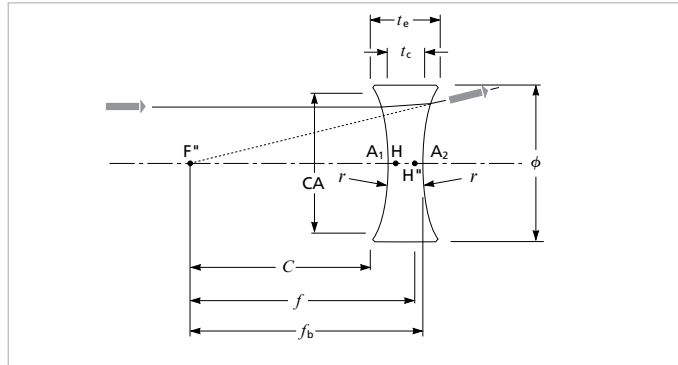
Pulsed, Broadband: 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

cw: 1 MW/cm<sup>2</sup> at 1064nm

Spherical biconcave lenses are equiconcave:  $r_1 = r_2$ .

Other dimensions and focal lengths are available for OEM applications. Contact CVI Laser Optics for pricing and delivery.

- ▶ Laser quality:  $< \lambda/10$  surface figure, 10-5 surface quality
- ▶ High energy, single wavelength and broadband AR coatings



Laser quality bi-concave lens

**BUILD YOUR PART NUMBER**

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>BICC-25.4-103.4-C</b>	<b>633</b>

**EXAMPLE: BICC-25.4-103.4-C - 633**

**CHOOSE FROM THE OPTIONS BELOW.**

**1. PRODUCT CODE - SEE TABLE BELOW**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

<b>400</b>	<b>633</b>	<b>800</b>	<b>1050-1600</b>
<b>415-700</b>	<b>633-1064</b>	<b>1030</b>	<b>1064/532</b>
<b>532</b>	<b>700-900</b>	<b>1064</b>	<b>1550</b>

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 BICONCAVE LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>c</sub> (mm)	t <sub>e</sub> (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
-5.0	5.0	-1.2	-5.7	2.0	3.2	5.5	-5.0	-5.0	-5.1	-5.1	<b>BICC-5.0-5.5-C</b>
-10.0	12.7	-0.9	-10.7	2.0	6.1	10.8	-10.1	-10.2	-10.3	-10.4	<b>BICC-12.7-10.8-C</b>
-12.0	12.0	-1.2	-12.7	2.0	5.0	12.7	-11.9	-12.0	-12.2	-12.3	<b>BICC-12.0-12.7-C</b>
-20.0	20.0	-1.2	-20.5	1.0	6.1	20.9	-20.0	-20.1	-20.5	-20.4	<b>BICC-20.0-20.9-C</b>
-25.0	25.0	-1.2	-25.7	2.1	8.4	26.4	-25.1	-25.3	-25.7	-25.9	<b>BICC-25.0-26.4-C</b>
-100.0	25.4	-4.6	-100.9	2.6	4.2	103.4	-99.1	-99.9	-101.6	-102.3	<b>BICC-25.4-103.4-C</b>
-150.0	25.4	-6.9	-151.1	3.2	4.2	154.9	-148.6	-149.8	-152.3	-153.3	<b>BICC-25.4-154.9-C</b>

## LASER GRADE POSITIVE BESTFORM LENSES: BFPL-UV



### Specifications

Product Code: **BFPL-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Diameter Tolerance:** +0/-0.25mm

**Center Thickness Tolerance (t<sub>c</sub>):** ±0.25mm

**Chamfer:** 0.35mm leg width at 45° nominal

**Concentricity:** ≤ 0.05mm

**Radius of Curvature (RoC) Tolerance:** ±0.5%

**Surface Figure:** < λ/10 p-v at 633nm before coating; after coating on select substrates

**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):** ≥ 85% of central diameter

**Anti-reflection Coating:** Wavelength user specified

**Narrowband:** R ≤ 0.25% per surface

**Broadband:** R<sub>avg</sub> ≤ 0.5% per surface

**Dualband:** R ≤ 0.3% at 1064, R ≤ 0.6% at 532 per surface

**Damage Threshold:**

**Pulsed, Narrowband:** 15 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**Pulsed, Broadband:** 10 J/cm<sup>2</sup>, 20ns, 20Hz at 1064nm

**cw:** 1 MW/cm<sup>2</sup> at 1064nm

Bestform lenses are biconvex lenses designed and manufactured to minimize coma and spherical aberrations by optimizing both radii of curvature. Positive bestform lenses are of exceptional performance and provide the smallest spot size available in a singlet lens per optimization of both spherical surfaces.

- ▶ Smallest spot size available in a singlet lens
- ▶ Low-loss, high-damage-threshold AR coatings

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>BFPL-25.4-75.0-UV</b>	<b>355</b>

**EXAMPLE: BFPL-25.4-75.0-UV - 355**

### CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
<b>193</b>	<b>355-532</b>	<b>633-1064</b>	<b>1050-1600</b>
<b>248</b>	<b>400</b>	<b>700-900</b>	<b>1064/532</b>
<b>248-355</b>	<b>415-700</b>	<b>800</b>	<b>1550</b>
<b>266</b>	<b>532</b>	<b>1030</b>	
<b>355</b>	<b>633</b>	<b>1064</b>	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE POSITIVE BESTFORM LENSES								
Standard Grade Corning 7980 1-D (Fused Silica)								
f (mm)	Ø (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	Input Diameter (mm)	Spot Size (µm)	t <sub>c</sub> (mm)	PRODUCT CODE
25.0	12.7	25.4	26.6	27.5	3.0	2.9	2.3	<b>BFPL-12.7-25.0-UV</b>
50.0	25.4	52.2	54.8	56.6	5.5	4.2	0.8	<b>BFPL-25.4-50.0-UV</b>
75.0	25.4	77.0	80.8	83.5	7.5	4.9	1.9	<b>BFPL-25.4-75.0-UV</b>
100.0	25.4	104.8	110.0	113.6	9.5	5.3	2.4	<b>BFPL-25.4-100.0-UV</b>
125.0	25.4	128.5	134.9	139.4	11.5	6.3	2.7	<b>BFPL-25.4-125.0-UV</b>
150.0	25.4	153.0	160.6	166.0	13.0	6.4	2.9	<b>BFPL-25.4-150.0-UV</b>
200.0	25.4	206.2	216.4	223.6	16.0	6.6	3.2	<b>BFPL-25.4-200.0-UV</b>

## IMAGE GRADE FUSED SILICA PLANO-CONVEX LENSES: LUP-UV



### Specifications

Product Code: **LUP-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Diameter Tolerance:** +0/-0.10mm

**Center Thickness Tolerance ( $t_c$ ):**  $\pm 0.2$ mm

**Chamfer:** 0.05 – 0.20mm at 45° nominal

**Centration:**  $\leq 3$  arc minutes

**Paraxial Focal Length:**  $f \pm 1\%$

**Surface Irregularity:**  $< \lambda/4$  p-v at 633nm per surface before coating

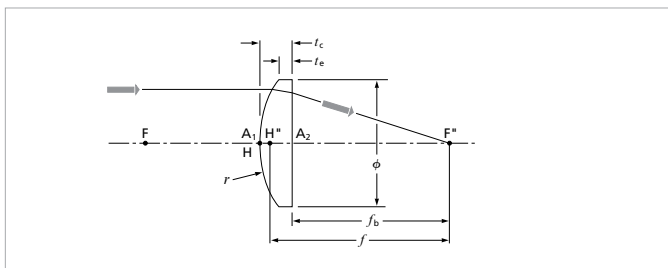
**Surface Quality:** 40-20 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):**  $\geq 90\%$  of central diameter

**Design Wavelength:** 404.7nm

**Anti-reflection Coating:** Wavelength user specified

The LUP product covers a wide range of focal lengths from 15mm to 1 m. These image grade plano-convex fused silica lenses are an economical alternative to laser grade lenses which are recommended for more demanding applications.



Plano-convex lens

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
LUP-12.5-11.7-UV	1064

**EXAMPLE: LUP-12.5-11.7-UV - 532**

### CHOOSE FROM THE OPTIONS BELOW.

**1. PRODUCT CODE - SEE TABLE BELOW**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

248-355	355-532	415-700	1064
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### IMAGE GRADE FUSED SILICA PLANO-CONVEX LENSES

f (mm)	Ø (mm)	f/#	f <sub>b</sub> (mm)	t <sub>c</sub> (mm)	t <sub>e</sub> (mm)	r (mm)	PRODUCT CODE
15.0	12.5	1.3	10.9	6.0	2.2	7.0	LUP-12.5-7.0-UV
20.0	12.5	1.8	16.6	5.0	2.6	9.4	LUP-12.5-9.4-UV
25.0	12.5	2.2	21.9	4.5	2.7	11.7	LUP-12.5-11.7-UV
30.0	12.5	2.7	27.3	4.0	2.5	14.1	LUP-12.5-14.1-UV
40.0	12.5	3.6	37.6	3.5	2.4	18.8	LUP-12.5-18.8-UV
50.0	25.0	2.2	45.2	7.0	3.4	23.5	LUP-25.0-23.5-UV
75.0	12.5	6.7	72.6	3.5	2.9	35.2	LUP-12.5-35.2-UV
75.0	25.0	3.3	70.9	6.0	3.7	35.2	LUP-25.0-35.2-UV
100.0	12.5	8.9	97.6	3.5	3.1	47.0	LUP-12.5-47.0-UV
100.0	25.0	4.4	96.6	5.0	3.3	47.0	LUP-25.0-47.0-UV
125.0	12.5	11.1	122.6	3.5	3.2	58.7	LUP-12.5-58.7-UV
125.0	25.0	5.6	121.6	5.0	3.7	58.7	LUP-25.0-58.7-UV
150.0	25.0	6.7	146.9	4.5	3.4	70.4	LUP-25.0-70.4-UV
200.0	25.0	8.9	196.9	4.5	3.7	93.9	LUP-25.0-93.9-UV
250.0	25.0	11.1	247.3	4.0	3.3	117.4	LUP-25.0-117.4-UV
300.0	25.0	13.3	297.3	4.0	3.4	140.9	LUP-25.0-140.9-UV
500.0	25.0	22.2	497.3	4.0	3.7	234.8	LUP-25.0-234.8-UV
1000.0	25.0	44.4	997.3	4.0	3.8	469.6	LUP-25.0-469.6-UV

# IMAGE GRADE N-BK7 PLANO-CONVEX LENSES: LPX-C



## Specifications

Product Code: **LPX-C**

Optical Material: N-BK7

Diameter Tolerance:  $+0/-0.1$ mm

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.2$ mm

Chamfer: 0.10-0.50mm at 45° nominal

Centration:  $\leq 3$  arc minutes

Paraxial Focal Length:  $f \pm 2\%$  ( $\pm 5\%$  for the LPX-4.0-3.1-C)

Surface Irregularity:  $< \lambda/2$  p-v at 633nm per surface before coating

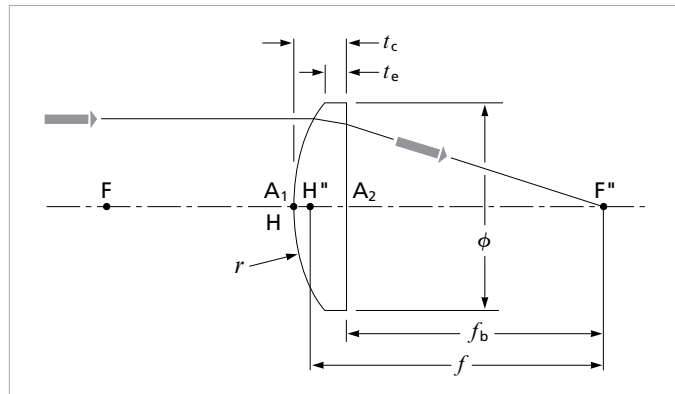
Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 90\%$  of central diameter

Design Wavelength: 546.1nm

Anti-reflection Coating: Wavelength user specified

The LPX product covers an extensive range of diameters in both metric and imperial sizes as well as focal length from 8mm to 500mm. These image grade plano-convex N-BK7 lenses can be used in a wide range of applications though not recommended for high power lasers.



Plano-convex lens

### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
<b>LPX-25.0-25.9-C</b>	<b>415-700</b>

EXAMPLE: LPX-25.0-25.9-C - 415-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

**415-700**

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

## CONTINUED...IMAGE GRADE N-BK7 PLANO-CONVEX LENSES: LPX-C

IMAGE GRADE N-BK7 PLANO-CONVEX LENSES							
$f$ (mm)	$\varnothing$ (mm)	$f/\#$	$f_b$ (mm)	$t_c$ (mm)	$t_e$ (mm)	$r$ (mm)	PRODUCT CODE
8.0	4.0	2.2	6.4	2.5	2.0	4.2	LPX-4.0-4.2-C
10.0	5.0	2.2	8.3	2.6	2.0	5.2	LPX-5.0-5.2-C
10.0	8.0	1.4	7.4	3.9	2.0	5.2	LPX-8.0-5.2-C
15.0	8.0	2.1	13.0	3.1	2.0	7.8	LPX-8.0-7.8-C
15.0	10.0	1.7	12.5	3.8	2.0	7.8	LPX-10.0-7.8-C
18.0	8.0	2.5	16.1	2.9	2.0	9.3	LPX-8.0-9.3-C
25.0	14.0	2.0	22.4	4.0	2.0	13.0	LPX-14.0-13.0-C
25.4	25.4	1.1	17.9	11.4	1.7	13.2	LPX-25.4-13.2-C
30.0	12.5	2.7	27.4	4.0	2.7	15.6	LPX-12.5-15.6-C
31.7	25.4	1.4	26.5	7.9	1.9	16.4	LPX-25.4-16.4-C
35.0	20.0	1.9	32.2	4.2	1.2	18.2	LPX-20.0-18.2-C
35.0	30.0	1.3	28.5	9.9	2.0	18.2	LPX-30.0-18.2-C
40.0	12.5	3.6	37.7	3.5	2.5	20.7	LPX-12.5-20.7-C
40.0	15.0	3.0	37.4	4.0	2.6	20.7	LPX-15.0-20.7-C
40.0	20.0	2.2	37.0	4.5	1.9	20.7	LPX-20.0-20.7-C
40.0	25.0	1.9	36.0	6.0	1.8	20.7	LPX-25.0-20.7-C
40.0	30.0	1.5	34.5	8.4	2.0	20.7	LPX-30.0-20.7-C
50.0	12.5	4.4	47.7	3.5	2.7	25.9	LPX-12.5-25.9-C
50.0	20.0	2.8	47.4	4.0	2.0	25.9	LPX-20.0-25.9-C
50.0	25.0	2.2	46.3	5.7	2.5	25.9	LPX-25.0-25.9-C
50.8	25.4	2.2	47.4	5.2	1.9	26.4	LPX-25.4-26.4-C
75.0	12.5	6.7	72.7	3.5	3.0	38.9	LPX-12.5-38.9-C
75.0	25.0	3.3	72.4	4.0	1.9	38.9	LPX-25.0-38.9-C
76.2	25.4	3.3	73.5	4.1	2.0	39.5	LPX-25.4-39.5-C
80.0	15.0	5.9	78.2	2.7	2.0	41.5	LPX-15.0-41.5-C
100.0	12.5	8.9	98.0	3.0	2.6	51.9	LPX-12.5-51.9-C
100.0	25.0	4.4	97.4	4.0	2.5	51.9	LPX-25.0-51.9-C
125.0	12.5	11.1	123.0	3.0	2.7	64.8	LPX-12.5-64.8-C
150.0	25.0	6.7	147.4	4.0	3.0	77.8	LPX-25.0-77.8-C
200.0	12.5	17.8	198.0	3.0	2.8	103.7	LPX-12.5-103.7-C
200.0	25.0	8.9	197.4	4.0	3.2	103.7	LPX-25.0-103.7-C
250.0	12.5	22.2	248.0	3.0	2.9	129.7	LPX-12.5-129.7-C
250.0	25.0	11.1	247.4	4.0	3.4	129.7	LPX-25.0-129.7-C
250.0	50.0	5.6	247.1	4.4	2.0	129.7	LPX-50.0-129.7-C
300.0	25.0	13.3	298.0	3.0	2.5	155.6	LPX-25.0-155.6-C
400.0	25.0	17.8	398.4	2.4	2.0	207.5	LPX-25.0-207.5-C
500.0	25.0	22.2	498.5	2.3	2.0	259.4	LPX-25.0-259.4-C



## IMAGE GRADE FUSED SILICA PLANO-CONCAVE LENSES: LUK-UV



UV-grade synthetic fused silica lenses extend transmission to below 200nm and have superior thermal and mechanical characteristics.

The LUK product line covers the focal length range from -10mm to -350mm with the most common diameters. These image grade plano-concave fused silica lenses are an economical alternative to laser grade lenses which are recommended for more demanding applications.

### Specifications

Product Code: **LUK-UV**

**Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

**Diameter Tolerance:** +0/-0.10mm

**Center Thickness Tolerance ( $t_c$ ):** ±0.2mm

**Chamfer:** 0.05 – 0.20mm at 45° nominal

**Flat Annulus Width ( $\Delta$ ):** 0.5 +0/-0.25mm

**Centration:** ≤ 3 arc minutes

**Paraxial Focal Length:**  $f \pm 1\%$

**Surface Irregularity:** <  $\lambda/4$  p-v at 633nm per surface before coating

**Surface Quality:** 40-20 scratch-dig per MIL-PRF-13830b

**Clear Aperture (CA):**  $\emptyset - 2\Delta$

**Design Wavelength:** 404.7nm

**Anti-reflection Coating:** Wavelength user specified

#### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
<b>LUK-12.5-7.0-UV</b>	<b>355-532</b>

**EXAMPLE: LUK-12.5-7.0-UV - 355-532**

CHOOSE FROM THE OPTIONS BELOW.

#### 1. PRODUCT CODE - SEE TABLE BELOW

#### 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

<b>248-355</b>	<b>355-532</b>	<b>415-700</b>	<b>1064</b>
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Please see page T-31 for Anti-Reflective Coating Traces.

IMAGE GRADE FUSED SILICA PLANO-CONCAVE LENSES							
$f$ (mm)	$\emptyset$ (mm)	$f/\#$	$f_b$ (mm)	$t_c$ (mm)	$t_e$ (mm)	$r$ (mm)	PRODUCT CODE
-10.0	6.3	-2.1	-11.4	2.0	2.8	4.7	LUK-6.3-4.7-UV
-12.5	6.3	-2.6	-13.9	2.0	2.6	5.9	LUK-6.3-5.9-UV
-15.0	12.5	-1.4	-16.4	2.0	5.0	7.0	LUK-12.5-7.0-UV
-25.0	12.5	-2.4	-26.7	2.5	4.0	11.7	LUK-12.5-11.7-UV
-30.0	12.5	-2.9	-32.0	3.0	4.2	14.1	LUK-12.5-14.1-UV
-37.5	25.0	-1.7	-40.9	5.0	9.7	17.6	LUK-25.0-17.6-UV
-50.0	25.0	-2.3	-53.4	5.0	8.3	23.5	LUK-25.0-23.5-UV
-75.0	25.0	-3.5	-78.4	5.0	7.1	35.2	LUK-25.0-35.2-UV
-100.0	12.5	-9.7	-102.7	4.0	4.4	47.0	LUK-12.5-47.0-UV
-100.0	25.0	-4.6	-103.4	5.0	6.6	47.0	LUK-25.0-47.0-UV
-125.0	25.0	-5.8	-128.4	5.0	6.2	58.7	LUK-25.0-58.7-UV
-150.0	25.0	-6.9	-153.4	5.0	6.0	70.4	LUK-25.0-70.4-UV
-250.0	25.0	-11.6	-254.1	6.0	6.6	117.4	LUK-25.0-117.4-UV
-350.0	25.0	-16.2	-354.1	6.0	6.4	164.4	LUK-25.0-164.4-UV

For the definition of the flat annulus width, see the standard plano-concave lens diagram page 286.

IMAGE GRADE N-BK7 PLANO-CONCAVE LENSES: LPK-C



Specifications

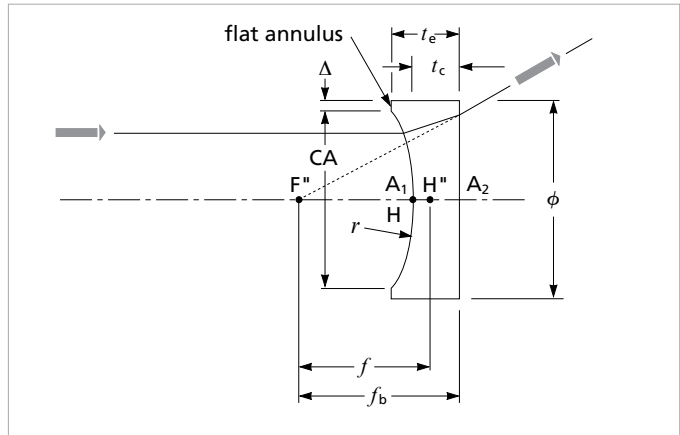
Product Code: LPK-C

- Optical Material: N-BK7
- Diameter Tolerance: +0/-0.10mm
- Center Thickness Tolerance ( $t_c$ ):  $\pm 0.2$ mm
- Chamfer: 0.05 – 0.20mm at 45° nominal
- Flat Annulus Width ( $\Delta$ ): 0.2mm for  $\phi \leq 40$ mm, 0.4mm for  $\phi > 40$ mm (+0/-70%)
- Centration:  $\leq 3$  arc minutes
- Paraxial Focal Length:  $f \pm 2\%$
- Surface Irregularity:  $< \lambda/2$  p-v at 633nm per surface before coating
- Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b
- Clear Aperture (CA):  $\phi - 2\Delta$
- Design Wavelength: 546.1nm
- Anti-reflection Coating: Wavelength user specified

Plano-concave lenses have one flat and one concave surface. They have a negative focal length and are often used to expand light or to increase focal lengths in optical systems.

Plano-concave glass lenses made from N-BK7 exhibit excellent transmissive properties from below 400nm to above 1  $\mu$ m.

These image grade plano-concave N-BK7 lenses can be used in a wide range of applications though not recommended for high power lasers or when high wavefront quality is required.



Standard plano-concave lens

**BUILD YOUR PART NUMBER**

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LPK-12.5-6.5-C	415-700

EXAMPLE: LPK-12.5-6.5-C - 415-700

CHOOSE FROM THE OPTIONS BELOW.

**1. PRODUCT CODE - SEE TABLE ON NEXT PAGE**

**2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

415-700	633-1064	1064
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Please see page T-31 for Anti-Reflective Coating Traces.

IMAGE GRADE N-BK7 PLANO-CONCAVE LENSES						
$f$ (mm)	$\varnothing$ (mm)	$f/\#$	$f_b$ (mm)	$t_e$ (mm)	$r$ (mm)	PRODUCT CODE
-12.5	12.5	-1.0	-13.8	6.2	6.5	LPK-12.5-6.5-C
-15.0	8.0	-1.9	-16.3	3.0	7.8	LPK-8.0-7.8-C
-15.0	12.5	-1.2	-16.3	4.9	7.8	LPK-12.5-7.8-C
-20.0	10.0	-2.0	-21.3	3.2	10.4	LPK-10.0-10.4-C
-20.0	12.5	-1.6	-21.3	4.0	10.4	LPK-12.5-10.4-C
-25.0	12.5	-2.0	-26.3	3.5	13.0	LPK-12.5-13.0-C
-25.0	25.0	-1.0	-26.3	10.9	13.0	LPK-25.0-13.0-C
-50.0	12.5	-4.0	-51.3	2.7	25.9	LPK-12.5-25.9-C
-50.0	25.0	-2.0	-51.3	4.6	25.9	LPK-25.0-25.9-C
-75.0	12.5	-6.0	-76.3	2.5	38.9	LPK-12.5-38.9-C
-75.0	25.0	-3.0	-76.3	4.0	38.9	LPK-25.0-38.9-C
-100.0	12.5	-8.0	-101.3	2.4	51.9	LPK-12.5-51.9-C
-100.0	25.0	-4.0	-101.3	3.5	51.9	LPK-25.0-51.9-C
-150.0	12.5	-12.0	-151.5	2.5	77.8	LPK-12.5-77.8-C
-150.0	25.0	-6.0	-151.3	3.0	77.8	LPK-25.0-77.8-C
-200.0	25.0	-8.0	-201.3	2.7	103.7	LPK-25.0-103.7-C
-250.0	25.0	-10.0	-251.3	2.6	129.7	LPK-25.0-129.7-C
-300.0	25.0	-12.0	-301.3	2.5	155.6	LPK-25.0-155.6-C
-500.0	25.0	-20.0	-501.3	2.3	259.4	LPK-25.0-259.4-C
-700.0	25.0	-28.0	-701.3	2.2	363.1	LPK-25.0-363.1-C
-1000.0	25.0	-40.0	-1001.3	2.2	518.7	LPK-25.0-518.7-C

## IMAGE GRADE N-BK7 BICONVEX LENSES: LDX-C



## Specifications

Product Code: LDX-C

Optical Material: N-BK7

Diameter Tolerance: +0/-0.10mm

Center Thickness Tolerance ( $t_c$ ):  $\pm 0.2$ mm

Chamfer: 0.25 – 0.50mm at 45° nominal

Centration:  $\leq 3$  arc minutesParaxial Focal Length:  $f \pm 2\%$  ( $\pm 4\%$  for LDX-5.0-4.3-C)Surface Irregularity:  $< \lambda/2$  p-v at 633nm before coating (applies to any 25mm diameter within CA for  $\varnothing > 25$ mm)

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA):  $\geq 90\%$  of central diameter

Design Wavelength: 546.1nm

Anti-reflection Coating: Wavelength user specified

Biconvex or equi-convex lenses have two convex surfaces with identical radii. They have positive focal lengths and form both real and virtual images.

They are recommended for virtual imaging of real objects and for positive conjugate ratios from approximately 0.2 to 5 (values are wavelength sensitive). Due to the symmetry, aberrations such as coma, distortion, and chromatic aberration almost exactly cancel out at unit conjugate ratio. Aberrations increase as conjugate ratios depart from unity.

## BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LDX-10.0-9.5-C	415-700

EXAMPLE: LDX-10.0-9.5-C - 415-700

## CHOOSE FROM THE OPTIONS BELOW.

## 1. PRODUCT CODE - SEE TABLE BELOW

## 2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064
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Please see page T-31 for Anti-Reflective Coating Traces.

## IMAGE GRADE N-BK7 BICONVEX LENSES

$f$ (mm)	$\varnothing$ (mm)	$f/\#$	$f_b$ (mm)	$t_c$ (mm)	$t_s$ (mm)	$r$ (mm)	PRODUCT CODE
4.5	5.0	0.9	3.8	2.0	0.4	4.3	LDX-5.0-4.3-C
7.0	5.0	1.4	5.9	3.0	2.0	6.7	LDX-5.0-6.7-C
10.0	5.0	2.0	9.1	2.6	2.0	9.9	LDX-5.0-9.9-C
10.0	10.0	1.0	8.3	4.8	1.9	9.5	LDX-10.0-9.5-C
15.0	14.5	1.0	12.9	5.9	2.0	14.5	LDX-14.5-14.5-C
20.0	15.0	1.3	18.3	4.9	2.0	19.9	LDX-15.0-19.9-C
20.0	25.0	0.8	15.6	11.8	2.1	18.5	LDX-25.0-18.5-C
25.0	25.0	1.0	21.9	8.9	2.0	24.3	LDX-25.0-24.3-C
30.0	30.0	1.0	26.4	10.3	2.0	29.3	LDX-30.0-29.3-C
38.1	38.1	1.1	33.8	12.4	1.9	37.3	LDX-38.1-37.3-C
40.0	50.0	0.8	31.9	22.2	2.9	37.3	LDX-50-37.3-C
50.0	25.0	2.0	48.3	5.1	2.0	51.0	LDX-25.0-51.0-C
50.0	50.0	1.0	44.5	15.8	2.1	49.0	LDX-50.0-49.0-C
75.0	25.0	3.0	73.7	4.0	2.0	77.1	LDX-25.0-77.1-C
75.0	50.0	1.5	71.1	11.5	3.0	75.8	LDX-50.0-75.8-C
88.9	25.4	3.9	87.6	3.8	2.0	91.6	LDX-25.4-91.6-C

## ASPHERIC GLASS CONDENSER LENSES: LAG-C



### Specifications

Product Code: **LAG-C**

**Optical Material:** Optical grade crown glass

**Diameter Tolerance:**  $\pm 0.4\text{mm}$

**Center Thickness Tolerance ( $t_c$ ):**  $\pm 7\%$  down to  $\pm 0.5\text{mm}$

**Paraxial Focal Length:**  $f \pm 7\%$

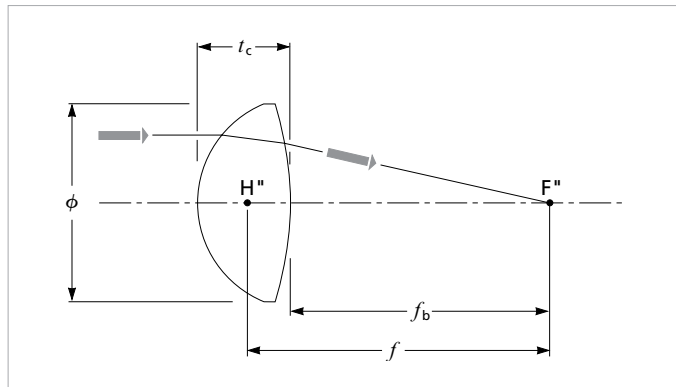
**Surface Quality:** Aspheric side precision molded, 80-50 scratch-dig. Flat or spherical side felt polished, 80-50 scratch-dig per MIL-PRF-13830b

**Maximum Service Temperature:**  $177^\circ\text{C}$  ( $350^\circ\text{F}$ )

**Anti-reflection Coating:** Optional Single-layer  $\text{MgF}_2$  (400-700nm)

Aspheric lenses provide better performance by reducing aberrations when used in low f-number, high-throughput applications. These lenses have one aspheric surface. The second surface is flat or spherical-convex.

- ▶ A flat second surface minimizes aberration.
- ▶ A spherical-convex second surface provides the lowest f-number and highest transmission because equal deviation of marginal rays is most closely approached.
- ▶ Only single-layer  $\text{MgF}_2$  (SLMF-400-700) coatings are recommended for these lenses owing to the steep curvature of the aspheric surface.



Aspheric glass condenser lenses

### Single vs Multi-layer Coatings

While  $\text{MgF}_2$  does not offer the same performance as multi-layer coatings, there are special circumstances where it is preferred. On lenses with very steep surfaces, such as our LAG series aspherics,  $\text{MgF}_2$  will actually perform better near the edge of the lens. This is because the performance of a coating shifts with angle of incidence; the shifted  $\text{MgF}_2$  will never be worse than an uncoated lens, but at very high angles, a multi-layer coating can actually be shifted to a region where its performance is worse than if there were no coating at all.

#### BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LAG-18.0-12.0-C	SLMF-400-700

EXAMPLE: LAG-18.0-12.0-C - SLMF-400-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

SLMF-400-700

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

ASPHERIC GLASS CONDENSER LENSES						
$f$ (mm)	$\varnothing$ (mm)	$f/\#$	NAS Shape*	$t_c$ (mm)	$f_b$ (mm)	PRODUCT CODE
8.5	12.0	0.71	CX	5.5	5.8	LAG-12.0-8.5-C
12.0	15.0	0.80	P	5.5	8.4	LAG-15.0-12.0-C
12.0	17.0	0.71	P	8.0	6.7	LAG-17.0-12.0-C
12.0	18.0	0.67	CX	8.8	6.9	LAG-18.0-12.0-C
15.5	18.0	0.86	P	7.0	10.9	LAG-18.0-15.5-C
17.0	19.0	0.89	P	7.0	12.4	LAG-19.0-17.0-C
18.0	24.0	0.75	P	10.0	11.4	LAG-24.0-18.0-C
23.5	32.5	0.72	CX	13.5	15.1	LAG-32.5-23.5-C
25.0	32.5	0.77	P	13.0	16.5	LAG-32.5-25.0-C
26.5	30.0	0.88	P	11.0	19.3	LAG-30.0-26.5-C
29.5	40.0	0.74	CX	15.5	20.9	LAG-40.0-29.5-C
34.5	38.0	0.91	P	12.0	26.6	LAG-38.0-34.5-C
35.0	35.0	1.00	P	11.5	27.4	LAG-35.0-35.0-C
39.0	60.0	0.65	CX	27.5	25.0	LAG-60.0-39.0-C
50.0	75.0	0.67	P	29.1	31.2	LAG-75.0-50.0-C
53.0	65.0	0.82	P	23.5	37.6	LAG-65.0-53.0-C

\*Shape of non aspheric side (NAS) is plano (P), or convex (CX)

## APPLICATION NOTE

### Aspheric Glass Condenser Lenses

The aspheric lens is designed to have a much shorter focal length than can be attained with a spherical glass lens of equal diameter and spherical aberration. These lenses have only one aspheric surface; the other surface is either plano, or spherical convex. A correctly formed aspheric lens surface cancels spherical aberration, or it reduces both spherical aberration and coma to insignificance, in which case the system is said to be aplanatic. Thus, more energy can be concentrated into a smaller area, such as the entrance pupil of a projection lens system or the sensitive area of a detector. Without the aspheric surface, marginal rays (which enter or exit the lens near its edge) may be severely aberrated and fail to illuminate the desired target. The aspheric surface puts marginal rays on target and allows the potential collecting area of the system to be fully utilized at  $f$ -numbers as low as 0.65.

Aspheric lenses are ideal for low  $f$ -number, high throughput applications, particularly where elements are adjacent to the light source, as in condensing, projecting, and illuminating systems. Other applications include optical communications equipment; smoke, fire

(turbulence), and intrusion alarms; pollution monitors; and chemical vapor alarms. They should be considered whenever highly efficient use of either sources or detectors is important, or whenever space is limited and short focal lengths or low  $f$ -numbers are advantageous. The schematic drawing of a typical projection system shows an aspheric lens used in combination with a plano-convex spherical lens. The aspheric surface faces the long conjugate (in this case, away from the source), making ray deviations at two surfaces nearly equal. This minimizes reflection loss. For this orientation, the aspheric surface contour minimizes the aberration of combined aspheric and plano-convex lenses, concentrating maximum power into the projection lens entrance pupil. Lens combination conjugate ratios can be adjusted, with aberration minimized, by changing the focal length of the spherical plano-convex element. For ratios near unity, the planoconvex lens should be replaced by a second aspheric element, oriented so that the aspheric surfaces face each other. For ratios much less than unity, the position of the aspheric and plano lenses should be interchanged.