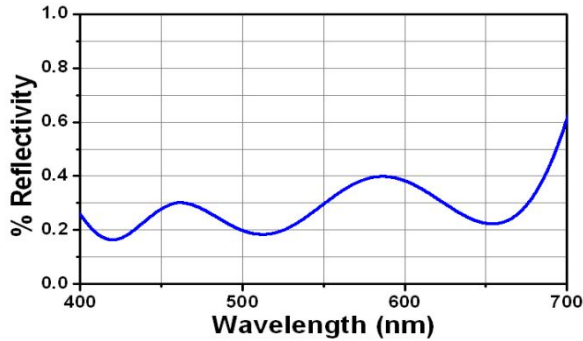
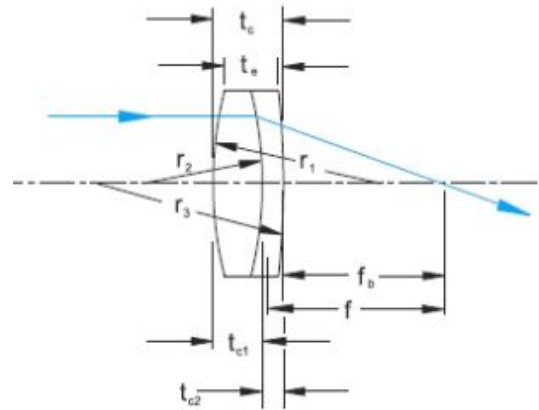


Specifications

Design Wavelength	: 486.1, 587.6, & 656.3
Dimensional Tolerance	: $\pm 0.00/-0.10$ mm
Focal Length Tolerance	: $\pm 1\%$
Surface Quality	: 40-20 scratch & dig
Centration	: ≤ 3 Arc Min
Clear Aperture	: $>90\%$ of Dia
Coating Range	: $R_{avg} < 0.5\%$ from 400-700nm
Operating Temperature	: -40°C to $+85^{\circ}\text{C}$



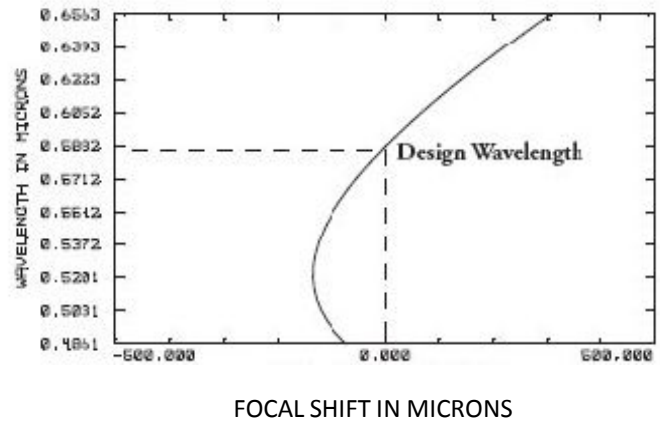
POSITIVE VISIBLE ACHROMATS: Infinite Conjugate Ratio

ITEM #	DIA (mm)	f (mm)	f _b (mm)	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	Materials
AC050-008-A1	5.0	7.5	5.2	5.25	-3.90	-17.06	2.8	1.7	3.7	BAFN10-SFL6
AC050-010-A1	5.0	10.0	7.9	6.55	-4.25	-15.42	2.5	1.9	3.7	BAK4-SF5
AC050-015-A1	5.0	15.0	13.6	12.54	-5.25	-12.05	2.7	2.1	4.3	BK7-SF2
AC060-010-A1	6.0	10.0	7.9	6.17	-4.61	-19.63	2.5	1.5	3.0	BAK4-SF5
AC064-013-A1	6.35	12.7	10.3	7.08	-5.94	-40.36	2.5	1.5	3.1	BAK4-SF5
AC064-015-A1	6.35	15.0	13.0	8.79	-6.55	-21.68	2.5	1.5	3.2	BK7-SF2
AC080-010-A1	8.0	10.0	6.7	7.08	-5.25	-22.66	4.5	2.0	4.9	BAFN10-SFL6
AC080-016-A1	8.0	16.0	13.9	11.02	-9.20	-46.77	2.5	1.5	3.1	BAFN10-SFL6
AC080-020-A1	8.0	20.0	17.8	11.08	-9.20	-34.83	2.5	1.5	3.0	BK7-SF2
AC127-019-A1	12.7	19.0	15.7	12.94	-11.04	-59.26	4.5	1.5	4.0	BAFN10-SFL6
AC127-025-A1	12.7	25.0	21.5	18.79	-10.59	-68.58	5.0	2.0	5.6	BAF10-SF10
AC127-030-A1	12.7	30.0	27.5	17.86	-13.53	-44.17	3.5	1.5	3.4	BK7-SF2
AC127-050-A1	12.7	50.0	47.2	27.36	-22.54	-91.83	3.5	1.5	4.0	BK7-SF2
AC127-075-A1	12.7	75.0	72.9	41.30	-33.96	-137.09	2.5	1.5	3.4	BK7-SF2
AC254-030-A1	25.4	30.0	22.9	20.89	-16.73	-79.80	12.0	2.0	8.8	BAFN10-SFL6
AC254-035-A1	25.4	35.0	27.3	23.99	-19.10	-102.09	12.0	2.0	9.6	BAFN10-SFL6
AC254-040-A1	25.4	40.0	33.4	23.66	-20.09	-57.68	10.0	2.5	7.4	BK7-SF5
AC254-045-A1	25.4	45.0	40.2	31.24	-25.94	-130.62	7.0	2.0	5.7	BAFN10-SFL6
AC254-050-A1	25.4	50.0	43.4	33.34	-22.28	-291.07	9.0	2.5	8.7	BAF10-SF10
AC254-060-A1	25.4	60.0	54.3	41.69	-25.88	-230.70	8.0	2.5	8.2	BAF11-FD10
AC254-075-A1	25.4	75.0	70.3	46.54	-33.91	-95.54	7.0	2.5	6.9	BK7-SF2
AC254-100-A1	25.4	100.0	97.1	62.75	-45.71	-128.33	4.0	2.5	4.7	BK7-SF2
AC254-150-A1	25.4	150.0	146.1	91.62	-66.68	-197.70	5.7	2.2	6.6	BK7-SF2
AC254-200-A1	25.4	200.0	194.0	77.40	-87.57	-291.07	4.0	2.5	5.7	SSKN5-LAFN7
AC254-250-A1	25.4	250.0	246.7	137.09	-111.51	-459.20	4.0	2.0	5.2	BK7-SF2
AC254-300-A1	25.4	300.0	297.0	165.20	-137.09	-557.40	4.0	2.0	5.4	BK7-SF2
AC254-400-A1	25.4	400.0	396.0	219.80	-181.55	-738.50	4.0	2.0	5.5	BK7-SF2
AC254-500-A1	25.4	500.0	499.9	337.30	-186.75	-557.40	4.0	2.0	5.6	BK7-SF2
AC300-050-A1	30.0	50.0	44.3	34.04	-29.38	-161.50	8.5	2.0	6.3	BAFN10-SFL6
AC300-080-A1	30.0	80.0	74.3	55.98	-44.17	-219.80	8.5	2.0	7.9	BAFN10-SFL6

Focal Shift vs. Wavelength

Aside from the specifications already listed in the tables below, detailed information regarding each of the achromatic doublets inquire of Qbic.

As an example the graph right shows the paraxial focal shift as a function of wavelength for the AC508-400-A1 which is a 400mm focal length, Ø50.8mm, visible achromatic doublet.



POSITIVE VISIBLE ACHROMATS: Infinite Conjugate Ratio

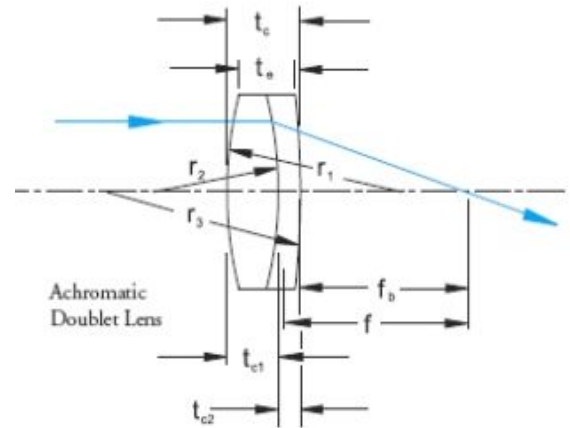
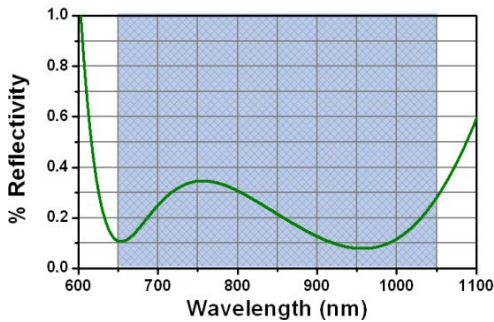
ITEM#	DIA (mm)	f (mm)	f _b (mm)	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	MATERIALS
AC300-100-A1	30.0	100.0	96.4	70.00	-57.02	-284.40	5.0	2.0	5	BAFN10-SFL6
AC508-075-A1	50.8	75.0	61.7	50.80	-41.69	-247.70	20.0	3.0	14.9	BAF11-SF11
AC508-080-A1	50.8	80.0	69.9	54.90	-46.40	-247.20	16.0	2.0	10.5	BAFN10-SFL6
AC508-100-A1	50.8	100.0	89.0	71.12	-44.17	-363.10	16.0	4.0	14.4	BAF10-SF10
AC508-150-A1	50.8	150.0	141.0	83.18	-71.12	-247.70	12.0	3.0	8.7	BK7-SF5
AC508-200-A1	50.8	200.0	193.7	109.86	-93.11	-376.25	8.5	2.0	6.7	BK7-SF2
AC508-250-A1	50.8	250.0	244.6	137.09	-111.69	-459.20	7.5	2.0	6.4	BK7-SF2
AC508-300-A1	50.8	300.0	295.4	161.50	-134.00	-580.80	6.0	2.0	5.4	BK7-SF2
AC508-400-A1	50.8	400.0	396.1	219.80	-186.75	-760.00	5.0	2.0	5.1	BK7-SF2
AC508-500-A1	50.8	500.0	495.8	272.90	-234.27	-970.00	5.0	2.0	5.5	BK7-SF2
AC508-750-A1	50.8	750.0	746.5	417.80	-336.00	-1330.50	4.5	2.0	5.5	BK7-SF2
AC508-1000-A1	50.8	1000.0	994.6	738.50	-398.10	-1023.30	4.0	2.0	5.2	BK7-SF2

NEGATIVE VISIBLE ACHROMATS: Infinite Conjugate Ratio

ITEM#	DIA (mm)	f (mm)	f _b (mm)	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	MATERIALS
ACN127-020-A1	12.7	-20.0	-22.3	-13.53	14.25	87.90	1.5	3.0	6.3	BAFN10-SFL6
ACN127-025-A1	12.7	-25.0	-27.0	-16.94	16.48	97.72	1.5	2.5	5.4	BAFN10-SFL6
ACN127-030-A1	12.7	-30.0	-32.2	-16.18	16.48	154.20	1.5	2.3	5.7	BAF4-SF5
ACN127-050-A1	12.7	-50.0	-52.3	-25.55	25.55	372.70	1.5	2.2	4.6	BAF4-SF5
ACN254-040-A1	25.4	-40.0	-43.6	-27.05	27.05	189.23	2	5.0	10.6	BAFN10-SFL11
ACN254-050-A1	25.4	-50.0	-53.2	-33.96	32.51	189.23	2	4.5	9.4	BAFN10-SFL6
ACN254-075-A1	25.4	-75.0	-78.8	-39.02	39.17	489.80	2	4.3	8.6	BAF4-SF5
ACN254-100-A1	25.4	-100.0	-103.6	-52.00	49.89	600.00	2	4.0	7.7	BAF4-SF5

General Specifications

Design Wavelength	: 706.5nm, 855nm, & 1015nm
Dimensional Tolerance	: $\pm 0.00/-0.10$ mm
Focal Length Tolerance	: $\pm 1\%$
Surface Quality	: 40-20 scratch & dig
Centration	: ≤ 3 Arc Min
Clear Aperture	: $>90\%$ of Dia
Coating Range	: $R_{avg} < 0.5\%$ from 650-1050nm
Operating Temperature	: -40°C to $+85^{\circ}\text{C}$



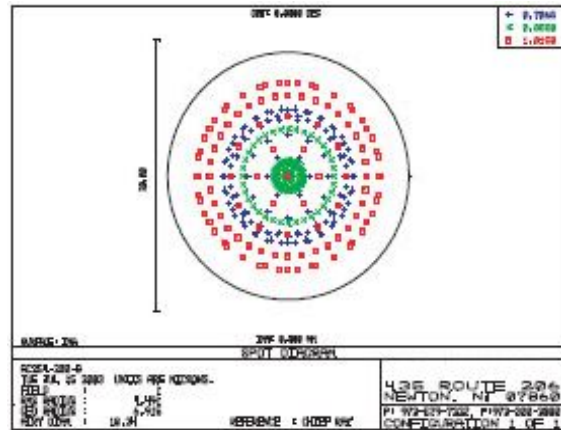
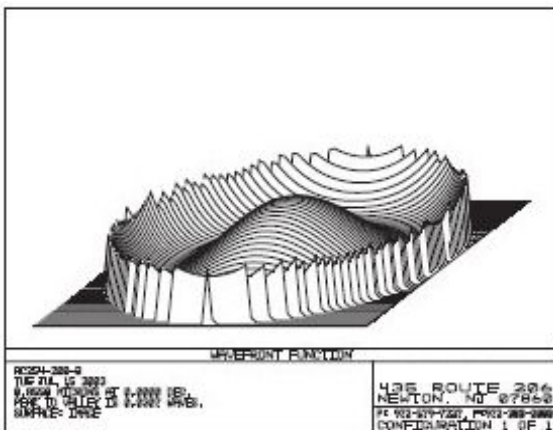
POSITIVE NEAR IR ACHROMATS: Infinite Conjugate Ratio

ITEM #	DIA (mm)	f (mm)	fb (mm)	r1 (mm)	r2 (mm)	r3 (mm)	tc1 (mm)	tc2 (mm)	te (mm)	Materials
AC050-008-B	5.0	7.5	4.8	4.61	-3.90	-35.95	2.8	1.8	3.8	BAFN10-SFL6
AC050-010-B	5.0	10	8.0	6.55	-5.25	-24.89	2.2	1.6	3.2	LANKN22-SFL6
AC050-015-B	5.0	15	13.0	10.28	-7.59	-32.14	2.3	1.7	3.6	LANKN22-SFL6
AC060-010-B	6.0	10	8.1	7.08	-5.25	-19.54	2.5	1.5	2.3	LANKN22-SFL6
AC064-013-B	6.35	12.7	10.7	8.60	-6.67	-28.97	2.5	1.4	3.1	LANKN22-SFL6
AC064-015-B	6.35	15	13.1	10.28	-7.75	-32.89	2.4	1.5	3.2	LANKN22-SFL6
AC080-010-B	8.0	10	7.0	7.55	-4.61	-30.62	4.5	1.3	4.4	LANKN10-SFL6
AC080-016-B	8.0	16	14.0	11.02	-8.60	-35.81	2.5	1.5	3.0	LANKN22-SFL6
AC080-020-B	8.0	20	18.2	13.53	-10.59	-47.75	2.3	1.3	2.8	LANKN22-SFL6
AC127-019-B	12.7	19	15.5	12.16	-10.59	-77.40	4.5	1.5	3.9	BAFN10-SFL6
AC127-025-B	12.7	25	21.1	16.18	-13.31	-68.54	5.0	2.0	5.4	LANKN22-SFL6
AC127-030-B	12.7	30	27.3	19.82	-16.18	-79.08	3.5	1.5	3.7	LANKN22-SFL6
AC127-050-B	12.7	50	46.2	24.20	-26.79	250.00	3.5	1.5	4.2	BAFN10-SFL6
AC127-075-B	12.7	75	72.0	36.22	-40.36	398.10	2.5	1.5	3.5	BAFN10-SFL6
AC254-030-B	25.4	30	23.0	21.09	-16.18	-79.08	12.0	1.5	8.2	BAFN10-SFL6
AC254-035-B	25.4	35	28.4	23.99	-18.62	-92.27	10.5	1.5	7.5	BAFN10-SFL6
AC254-040-B	25.4	40	32.8	26.12	-21.28	-137.09	10.0	2.5	8.6	BAFN10-SFL6
AC254-045-B	25.4	45	39.6	29.38	-25.05	-127.06	7.8	1.6	5.9	LANKN22-SFL6
AC254-050-B	25.4	50	45.0	33.55	-27.05	-125.60	7.5	1.8	6.2	LANKN22-SFL6
AC254-060-B	25.4	60	55.8	39.48	-33.00	-165.20	6.0	1.7	5.1	LANKN22-SFL6
AC254-075-B	25.4	75	69.9	36.90	-42.17	417.80	5.0	1.6	4.5	BAFN10-SFL6
AC254-100-B	25.4	100	97.1	66.68	-53.70	-259.41	4.0	1.5	4.0	LANKN22-SFL6
AC254-150-B	25.4	150	144.6	83.60	-89.33	-1330.50	4.0	3.5	6.5	LANKN22-SFL6
AC254-200-B	25.4	200	194.8	106.41	-96.61	2000.00	4.0	4.0	7.3	LANKN22-SFL10
AC254-250-B	25.4	250	237.5	52.00	-65.31	111.51	4.0	1.5	4.7	SF5-SFL6
AC254-300-B	25.4	300	290.0	62.40	-77.40	134.00	4.0	2.0	5.3	SF5-SFL6
AC050-400-B	25.4	400	391.1	83.60	-106.41	181.55	3.5	1.8	4.8	SF5-SFL6
AC254-500-B	25.4	500	480.8	60.60	-62.75	87.57	4.0	2.0	5.6	SF10-SFL6
AC300-050-B	30.0	50	42.9	30.76	-27.86	-272.90	9.5	2.0	7.2	BAFN10-SFL6
AC300-080-B	30.0	80	75.3	52.48	-42.69	-216.30	6.5	2.0	5.8	LANKN22-SFL6
AC300-100-B	30.0	100	94.0	49.09	-55.34	557.40	6.0	2.0	5.9	BAFN10-SFL6

Wavefront Error and Spot Size

Spherical doublet lenses have been corrected for various aberrations. One way of displaying the theoretical level of correction is through plots of wavefront error and ray traces to determine spot size. In the example chart shown below on the left, a plot of wavefront at the image plane reveals information regarding aberration correction. In the example lens the wavefront error is theoretically on the order of 3/100 of a wave. This tells us that the optical path length difference (OPD) is extremely small for rays going through the center of the lens and at nearly full aperture.

In the example chart shown below on the right, a ray trace for spot size at the image plane is shown. In the near IR achromat used in the example, 706.5nm, 855nm and 1015nm, the design wavelengths, have each been traced through the lens and are represented by different colors. The circle surrounding the distribution of ray intercepts represents the diameter of the Airy disk. If the spot is within the Airy disk the performance of the lens is typically considered to be diffraction limited. Since the spot size is drawn using geometric ray tracing, spots much smaller than the Airy disk are not achievable due to diffraction.



POSITIVE NEAR IR ACHROMATS: Infinite Conjugate Ratio

ITEM#	DIA (mm)	f (mm)	f _b (mm)	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	MATERIALS
AC508-075-B	50.8	75.0	65.7	51.80	-93.11	-291.07	12.0	5.0	9.2	LAKN22-SFL6
AC508-080-B	50.8	80.0	69.5	51.80	-44.60	-312.60	16.0	2.0	10.3	BAFN10-SFL6
AC508-100-B	50.8	100.0	91.5	65.77	-55.98	-280.55	13.0	2.0	8.7	LAKN22-SFL6
AC508-150-B	50.8	150.0	145.3	112.21	-95.94	-325.10	8.2	5.0	9.3	LAKN22-SFL6
AC508-200-B	50.8	200.0	193.2	134.00	-109.20	-515.20	8.2	5.0	10.1	LAKN22-SFL6
AC508-250-B	50.8	250.0	252.3	121.22	-146.14	1235.90	6.6	2.6	6.8	BAFN10-SFL6
AC508-300-B	50.8	300.0	295.1	201.80	-161.50	-760.00	6.6	2.6	7.2	LAKN22-SFL6
AC508-400-B	50.8	400.0	393.6	280.55	-208.00	-859.00	4.5	2.6	5.6	LAKN22-SFL6
AC508-500-B	50.8	500.0	497.0	346.70	-259.41	-1132.40	4.5	2.6	5.9	LAKN22-SFL6
AC508-750-B	50.8	750.0	744.8	376.80	-291.07	2910.00	4.2	2.5	6.0	BAFN10-SFL10
AC508-1000-B	50.8	1000.0	993.4	494.30	-398.10	3440.00	4.2	2.8	6.4	BAFN10-SFL10

NEGATIVE NEAR IR ACHROMATS: Infinite Conjugate Ratio

ITEM#	DIA (mm)	f (mm)	f _b (mm)	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	MATERIALS
ACN127-020-B	12.7	-20.0	-22.5	-12.34	14.03	152.76	1.5	3.0	6.4	BAFN10-SFL6
ACN127-025-B	12.7	-25.0	-27.7	-13.58	17.13	-859.00	1.5	2.8	5.9	BAFN10-SFL6
ACN127-030-B	12.7	-30.0	-32.0	-19.25	18.41	106.41	1.5	2.5	5.3	LAKN22-SFL6
ACN127-050-B	12.7	-50.0	-52.5	-24.43	30.41	-291.07	1.5	2.0	4.3	BAFN10-SFL6
ACN254-040-B	25.4	-40.0	-43.4	-24.43	27.86	332.30	2.0	4.0	9.8	BAFN10-SFL6
ACN254-050-B	25.4	-50.0	-53.8	-27.05	33.91	-1330.50	2.0	4.0	9.1	BAFN10-SFL6
ACN254-075-B	25.4	-75.0	-78.9	-37.15	46.40	-494.30	2.0	3.8	7.9	BAFN10-SFL6
ACN254-100-B	25.4	-100.0	-103.9	-48.75	59.02	-580.80	2.0	3.4	6.9	BAFN10-SFL6

Specifications

Design Wavelength	: 1016nm, 1330nm, & 1550nm
Dimensional Tolerance	: $\pm 0.00/-0.10$ mm
Focal Length Tolerance	: $\pm 1\%$
Surface Quality	: 40-20 scratch & dig
Centration	: ≤ 3 Arc Min
Clear Aperture	: $>90\%$ of Dia
Coating Range	: $R_{avg} < 0.5\%$ from 1050-1620nm
Operating Temperature	: -40°C to $+85^{\circ}\text{C}$

TELECOM ACHROMATIC DOUBLETS: Infinite Conjugate Ratio

ITEM #	DIA (mm)	f (mm)	f (mm) mm	r ₁ (mm)	r ₂ (mm)	r ₃ (mm)	t _{c1} (mm)	t _{c2} (mm)	t _e (mm)	Materials
AC050-008-C	5.0	7.5	5.2	4.61	-3.90	-23.88	2.5	1.5	3.1	LAKN22-SFL6
AC050-010-C	5.0	10.0	6.9	4.61	-4.61	35.95	2.5	1.5	3.3	LAKN22-SFL6
AC050-015-C	5.0	15.0	11.6	5.25	-5.45	15.24	2.0	1.3	2.9	BAFN10-SFL6
AC060-010-C	6.0	10.0	8.5	10.35	-3.64	-9.20	3.5	1.3	3.9	LAKN22-SFL6
AC064-013-C	6.35	12.7	11.4	13.15	-4.89	-12.42	2.8	1.3	3.3	LAKN22-SFL6
AC064-015-C	6.35	15.0	14.4	22.70	-4.89	-11.32	2.3	1.3	2.9	LAKN22-SFL6
AC080-010-C	8.0	10.0	7.1	7.08	-4.89	-20.89	4.2	1.3	3.9	BAFN10-SFL6
AC080-016-C	8.0	16.0	12.3	7.45	-7.75	68.54	3.5	1.3	3.8	LAKN22-SFL6
AC080-020-C	8.0	20.0	15.7	7.75	-8.60	31.92	3.3	1.3	3.7	LAKN22-SFL6
AC127-019-C	12.7	19.0	15.4	12.42	-10.01	-48.75	5.0	1.5	4.3	LAKN22-SFL6
AC127-025-C	12.7	25.0	20.3	12.00	-12.94	151.71	4.7	1.5	4.5	LAKN22-SFL6
AC127-030-C	12.7	30.0	24.5	12.42	-14.03	65.31	4.7	1.5	4.8	LAKN22-SFL6
AC127-050-C	12.7	50.0	43.5	15.95	-18.41	44.60	4.0	1.5	4.6	BAFN10-SFL6
AC127-075-C	12.7	75.0	69.7	23.23	-27.86	66.68	3.0	1.5	3.9	BAFN10-SFL6
AC254-030-C	25.4	30.0	22.2	21.09	-15.24	-71.12	13.0	1.8	9.4	BAFN10-SFL6
AC254-035-C	25.4	35.0	27.4	23.15	-17.87	-105.20	11.5	1.8	8.7	BAFN10-SFL6
AC254-040-C	25.4	40.0	32.8	24.43	-21.09	-143.92	10.0	1.8	7.7	LAKN22-SFL6
AC254-045-C	25.4	45.0	36.7	22.94	-23.66	900.00	9.6	1.8	7.7	LAKN22-SFL6
AC254-050-C	25.4	50.0	41.2	22.94	-25.88	194.54	9.0	1.8	7.4	LAKN22-SFL6
AC254-060-C	25.4	60.0	50.5	23.88	-28.12	112.08	8.3	1.8	7.2	LAKN22-SFL6
AC254-075-C	25.4	75.0	64.9	26.36	-29.38	84.92	7.6	1.8	7.1	BAFN10-SFL6
AC254-100-C	25.4	100.0	90.3	32.14	-38.02	93.54	6.5	1.8	6.6	BAFN10-SFL6
AC254-150-C	25.4	150.0	140.6	42.69	-52.00	111.51	5.0	2.5	6.3	BAFN10-SFL6
AC254-200-C	25.4	200.0	193.1	70.00	-95.94	274.31	4.0	3.0	6.1	LAKN22-SF10
AC254-250-C	25.4	250.0	235.3	43.95	-57.68	93.11	4.5	2.5	6.0	SF2-SFL6
AC254-300-C	25.4	300.0	285.9	52.48	-68.54	112.21	4.5	2.5	6.2	SF2-SFL6
AC050-400-C	25.4	400.0	386.8	70.00	-93.11	151.36	4.2	2.5	6.1	SF2-SFL6
AC254-500-C	25.4	500.0	486.9	87.90	-115.45	194.54	3.5	2.0	5.0	SF2-SFL6
AC300-050-C	30.0	50.0	44.7	41.69	-22.70	-75.68	10.0	2.0	7.7	BAFN10-SFL6
AC300-080-C	30.0	80.0	68.4	29.38	-33.91	97.72	9.5	2.0	8.5	BAFN10-SFL6
AC300-100-C	30.0	100.0	88.0	33.50	-39.17	100.69	8.5	2.2	8.3	BAFN10-SFL6
AC508-075-C	50.8	75.0	63.0	49.89	-39.09	-230.70	19.0	2.5	13.1	BAFN10-SFL6
AC508-080-C	50.8	80.0	66.9	47.21	-43.15	-640.70	18.0	2.5	12.6	BAFN10-SFL6
AC508-100-C	50.8	100.0	83.0	44.67	-48.31	259.40	17.0	2.5	12.8	BAFN10-SFL6
AC508-150-C	50.8	150.0	117.7	39.48	-49.89	83.60	18.0	5.0	17.7	LAKN22-SF6
AC508-200-C	50.8	200.0	182.7	67.14	-87.57	234.27	12.0	3.0	11.4	LAKN22-SF6
AC508-250-C	50.8	250.0	234.4	78.56	-95.94	230.70	10.0	3.0	10.2	BAFN10-SFL6
AC508--300-C	50.8	300.0	287.4	93.76	-112.21	280.55	8.5	3.0	9.1	BAFN10-SFL6
AC508--400-C	50.8	400.0	391.1	125.60	-161.50	376.25	6.5	3.0	7.8	BAFN10-SFL6
AC508--500-C	50.8	500.0	474.4	86.10	103.20	165.96	8.8	3.0	9.9	SF5-SFL6
AC508--750-C	50.8	750.0	711.0	91.62	-95.94	130.62	8.8	3.0	10.7	SF10-SFL6
AC508--1000-C	50.8	1000.0	990.5	172.98	-234.27	336.00	6.0	3.0	8.1	SF5-SFL6