FORM NBS-259
(REV. 4-11-63)

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D.C.

NATIONAL BUREAU OF STANDARDS

REPORT OF TEST

121996

on

FOUR PHOTOGRAPHIC OBJECTIVES

Submitted by
Aero Service Corporation
210 East Courtland Street
Philadelphia 20, Pennsylvania

I. Focal Lengths

Lens No.	Back Focal Length	Equivalent Focal Length	Calibrated Focal Length
	mm	mm	mm
191	82.23	152.24	152.23
242	82.08	151.93	151.90
251	81.97	151.58	151.60
319	81.79	151.57	151.54

The values of the focal lengths have been selected to give best average definition across the entire negative and do not necessarily correspond to those values of focal lengths which give best definition on the axis. The probable errors of these determinations of focal length do not exceed ±0.10 mm.

II. Distortion

1. Distortion referred to the equivalent focal length.

Lens No.	5°	10°	15°	20°	25°	30°	35°	40°	45°
191	0	0	2	-4	-12	-16	-11	-10	-24
242	0	0	0	-6	-12	-21	-17	-13	-44
251	2	4	12	8	2	4	10	16	7
319	0	0	-1	-6	-9	-15	-14	-8	-36

2. Distortion referred to the calibrated focal length.

Lens No.	5°	10°	15°	20°	25°	30°	35°	40°	45°
191	1	3	6	2	-4	-6	1	5	-7
242	3	5	8	5	2	-4	4	12	-14
251	1	1	8	3	-5	-5	0	3	-8
319	2	4	6	3	3	-1	4	12	-12

The values of the distortion are measured in microns and indicate the displacement of the image from its distortion-free position. A positive value indicates a displacement from the center of the plate. The probable error does not exceed ±10 microns.

III. Resolving Power

Lens No.	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
191										
Tangential	53	53	46	39	39	39	32	27	32	27
Radial	53	53	53	46	46	46	46	46	39	27
242										
Tangential	53	53	46	39	39	39	32	32	32	19
Radial	53	53	53	46	39	39	39	39	39	19
251										
Tangential	53	53	46	46	46	39	39	32	32	19
Radial	53	53	53	46	46	39	46	46	39	19
319										
Tangential	53	53	46	39	39	39	32	27	32	19
Radial	53	53	53	46	46	39	46	39	39	23

The values of resolving power are given at 5° intervals from the center of the field and are obtained by photographing suitable test charts comprised of patterns of parallel lines. The series of patterns of the test chart are imaged on the negative with the lines spaced in a geometric series of the fourth root of two lines to the millimeter. The row marked "tangential" gives the number of lines per millimeter in the image on the negative of the finest pattern of the test chart that is distinctly resolved into separate lines when the lines lie perpendicular to the radius drawn from the center of the field. The row marked "radial" gives similar values for the pattern of the test lines lying parallel to the radius.

This report applies to the four C. P. Goerz Planigon lenses Nos. 191, 242, 251, and 319, nominal focal length 6 inches, maximum aperture f/6.3. They were tested at maximum aperture. All measurements were made with collimated incident light using a K-3 filter, a tungsten source and Eastman Kodak spectroscopic emulsion Type V-F on selected flat glass plates. Development was in D-19 at 68°F for three minutes with continuous agitation.

The four filters mounted on these lenses have surfaces parallel to within ten seconds of arc.

For the Director,

Francis E. Washer, Chief
Refractometry Section
Metrology Division

NBS Test No. 181996
August 31, 1964

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