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U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON, D.C. 20234

NATIONAL BUREAU OF STANDARDS
REPORT OF TEST

182933

ZEISS-AEROTOPOGRAPH SURVEY CAMERA NO. 2146
Type RMK 15/23

Equipped with

Carl Zeiss Pleogon Lens No. 9864

Submitted by
Surdex Corporation
1709 Washington Avenue
St. Louis 3, Missouri

The lens contained in this camera has a nominal focal length of 6 inches and maximum aperture of f/5.6. All measurements were made at aperture f/8 because of limitations imposed by the apertures of the camera calibrator. These measurements were made with collimated incident light, using a K-3 filter, a tungsten source and Eastman Kodak spectroscopic emulsion Type V-F and Aerographic Plus-X on micro flat glass plates. Development was in D-19 at 68°F for three minutes with continuous agitation.

I. Focal Length

Equivalent focal length	152.79 mm
Calibrated focal length	152.79 mm

The probable errors of these determinations of focal length do not exceed ±0.10 mm.

II. Distortion

β	$\bar{D}_e$	$\bar{D}_c$	D_c for Azimuth Angle			
			0°	90°	180°	270°
Degrees	μ	μ	μ	μ	μ	μ
0	0	0	0	0	0	0
7.5	0	0	0	0	0	0
15	-2	-2	-2	1	-2	-3
22.5	-1	-1	-4	2	5	-7
30	2	2	-3	15	8	-13
37.5	3	3	-8	28	20	-27
45	-1	-1	-24	33	32	-45

Values of the distortion are measured for each of four radii of the

focal plane separated by 90° in azimuth. Values of the distortion based upon the equivalent focal length, D_e, are determined for points separated by 7.5° from the axis for each of the four radii. The average value of $\bar{D}_e$ is given and from these values a calibrated focal length is derived to minimize the average value distortion over the entire field. The average value of the distortion referred to the calibrated focal length is given under the heading $\bar{D}_c$. Values of the distortion D_c based on the calibrated focal length determined for each of the four radii are listed under the azimuth angles 0, 90, 180, and 270 degrees. The values of the distortion are given 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

Emulsion	0°	7.5°	15°	22.5°	30°	37.5°	45°
V-F							
Tangential	53	53	53	53	46	46	27
Radial	53	53	53	53	53	53	39
Plus-X							
Tangential	39	39	39	39	32	32	23
Radial	39	39	39	39	46	39	27

The values of the resolving power are given at 7.5° 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 test lines lying parallel to the radius.

IV. Principal Point of Autocollimation

The lines joining opposite pairs of collimation index markers intersect at an angle of 90° ± 1 minute, and their intersection indicates the location of the principal point of autocollimation with a probable error not exceeding ±0.03 mm.

V. Collimation Marker Separation

A - B	226.00 mm
C - D	226.00 mm

Markers A and B lie in the line of flight. The probable errors in these separations do not exceed ±0.02 mm.

VI. Tangential Distortion

0°	±22.5°	±30°	±37.5°	±45°
0	2	3	7	10

The values of the tangential distortion are measured in microns and indicate the displacement of the image from its distortion-free position. These values represent a displacement of the central image from a straight line connecting corresponding image points at equal but opposite angular separations from the axis. The probable error does not exceed ±5 microns.

The two surfaces of the B No. 15151 and D No. 15092 filters accompanying this camera are parallel to within ten seconds of arc.

VII. Magazine Platen

The platen mounted in Zeiss-Aerotopograph magazine type FK 24/120 No. 3609 does not depart from a true plane by more than ±0.0005 inch.

For the Director,

Francis E. Washer, Chief
Refractometry Section
Metrology Division

NBS Test No. 182933
November 4, 1964
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