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

NATIONAL BUREAU OF STANDARDS
REPORT OF TEST 2.2/181053

on

Nineteen Photographic Objectives

Submitted by

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This report applies to nineteen Schneider-Kreuznach Xenotar lenses, nominal focal length 150 mm, maximum aperture f/28. They were tested at maximum aperture with the following filter and emulsion combinations.

Lens No.	Filter	Emulsion
7352360	1. 2B+35+38A	Plus-X Aerographic
8357680	"	"
7352342	2. 3+47+0.2ND	"
8357681	"	"
7352379	3. 15+65	"
8357682	"	"
7352370	4. 57+12+155/166	"
8357683	Balzer + 0.4ND	"
7352369	5. 90+24	"
8357684	"	"
7352364	6. 36+15+0.4ND	"
8357685	"	"
7352386	7. 89B+455/141	IV -R Infrared
8357676	Balzer + 1.5ND	"
7352346	8. 87C+0.4ND	"
8357677	"	"
7352354	9. 2.0ND	"
8357678	"	"
8357679	No Filter	Plus-X Aerographic

Focal Lengths

Lens No.	Back Focal Distance	Equivalent Focal Length
	mm	mm
7352360	108.60	150.39
8357680	108.79	150.49
7352342	108.50	150.16
8357681	108.91	150.48
7352379	107.77	149.89
8357682	108.33	150.15
7352370	108.16	150.10
8357683	108.40	149.86

Lens No.	Back Focal Distance	Equivalent Focal Length
7352369	108.42	150.07
8357684	108.64	150.18
7352364	108.72	150.19
8357685	108.57	150.27
7352386	110.06	150.56
8357676	109.02	150.69
7352346	108.86	150.71
8357677	108.40	150.33
7352354	108.45	150.38
8357678	108.83	150.42
8357679	108.47	150.10

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.

	Distortion					
Lens No.	5°	10°	15°	20°	25°	30°
7352360	0.00	0.00	-0.02	-0.13	-0.47	-0.34
8357680	0.00	0.00	-0.02	-0.12	-0.46	-0.34
7352342	0.00	0.00	-0.01	-0.10	-0.40	-1.27
8357681	0.00	0.00	-0.01	-0.10	-0.39	-1.16
7352379	0.00	0.00	-0.01	-0.09	-0.38	-1.14
8357682	0.00	0.00	-0.02	-0.10	-0.42	-1.17
7352370	0.00	0.00	-0.02	-0.11	-0.39	-1.26
8357683	0.00	0.00	-0.02	-0.14	-0.45	-1.24
7352369	0.00	0.00	-0.01	-0.10	-0.38	-1.17
8357684	0.00	0.00	-0.02	-0.11	-0.40	-1.17
7352364	0.00	0.00	-0.01	-0.09	-0.35	-1.14
8357685	0.00	0.00	-0.02	-0.11	-0.38	-1.12
7352386	0.00	0.00	-0.01	-0.09	-0.35	-1.05
8357676	0.00	0.00	-0.01	-0.08	-0.34	-1.06
7352346	0.00	0.00	-0.02	-0.10	-0.37	-1.07
8357677	0.00	0.00	-0.01	-0.08	-0.32	-0.99
7352354	0.00	0.00	-0.02	-0.13	-0.48	-1.39
8357678	0.00	0.00	-0.03	-0.15	-0.52	-1.40
8357679	0.00	0.00	-0.02	-0.10	-0.40	-1.14

The values of the distortion are measured in millimeters 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 ±0.01 mm.

Resolving Power

Lens No.	0°	5°	10°	15°	20°	25°	30°
7352360							
Tangential	27	27	23	16	16	11	14
Radial	27	23	27	19	23	32	23
8357680							
Tangential	23	23	19	16	16	14	11
Radial	23	23	27	27	23	32	14
7352342							
Tangential	19	19	16	14	16	14	10
Radial	19	19	19	14	16	23	11
8357681 Tangential	19	14	14	14	10	11	10
Radial	19	23	23	19	23	19	16
7352379							
Tangential	32	32	27	23	23	16	19
Radial	32	32	32	27	27	23	23
8357682							
Tangential	27	27	27	27	23	16	19
Radial	27	27	32	32	32	27	16
7352370							
Tangential	27	27	27	27	23	23	16
Radial	27	27	27	27	23	27	27
8357683							
Tangential	23	23	23	23	23	23	11
Radial	23	23	23	16	16	19	27
7352369							
Tangential	32	32	27	23	23	16	16
Radial	32	32	32	27	23	23	23
8357684							
Tangential	32	32	27	23	23	23	16
Radial	32	32	27	23	23	23	16
7352364							
Tangential	27	27	27	23	16	16	16
Radial	27	27	27	27	23	23	16
8357685							
Tangential	32	32	27	16	16	16	23
Radial	32	32	32	23	14	16	23

Lens No.		0°	5°	10°	15°	20°	25°	30°
7352386	Tangential	27	27	27	23	23	11	19
	Radial	27	27	19	16	14	23	23
8357676								
	Tangential	19	19	16	16	16	14	14
	Radial	19	19	19	16	23	19	10
7352346								
	Tangential	19	16	16	16	16	16	14
	Radial	19	19	19	16	23	23	11
8357677								
	Tangential	19	19	16	16	16	16	10
	Radial	19	19	19	19	19	23	16
7352354								
	Tangential	19	19	16	16	16	16	8
	Radial	19	19	23	16	16	16	11
8357678								
	Tangential	27	27	27	27	27	23	7
	Radial	27	27	27	27	27	27	16
8357679								
	Tangential	32	32	27	23	27	16	10
	Radial	32	32	32	27	27	32	11

The values of the 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 test lines lying parallel to the radius.

These measurements were obtained by a photographic method using the National Bureau of Standards precision lens testing camera. The test negatives were made with the indicated Eastman Kodak emulsions on selected flat glass plates with collimated light incident on the lens under test. The test targets were illuminated by tungsten light using Corning daylite filters No. 1-71. These filters change

the relative spectral energy distribution of the tungsten source to approximately that of a black body at 6500°K. Development was in D-19 at 68°F for three minutes with continuous agitation.

For the Director,

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Metrology Division

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