

Templates

A collection of useful formats and tables to support your work

by Ralph W. Lambrecht

A considerable amount of scientific work and care has gone into the preparation of this book. All authors made an effort to take nothing for granted and challenged many photographic myths. To prove out these challenges, numerous tests were conducted, evaluated and archived. However, some material and processing conditions and their combinations are either not predictable, or depend entirely on the individual setup and material choices. Consequently, you may wish to conduct your own testing, which allows for individual calibration and provides you with the confidence and knowledge about your own materials and techniques. Testing should be kept to a minimum, after all the main purpose of our efforts is to create beautiful images. A few basic tests can however, save time, material and frustration in the long run, while improving and assuring quality results and making our photography more enjoyable.

The templates in this chapter are prepared to help you run a few experiments on your own photographic papers and films. Feel free to copy the individual pages from the book for your own test records and evaluation, but take care not to damage the book. Some templates are used as overlays and rely on being the same scale as the data sheets evaluated. Many tests rely on the availability of a reflection and transmission densitometer. Such an instrument can be regarded as a serious investment for any photographer, but its many uses will soon justify the purchase. They are often available from a friend or on the second hand market. If all else fails, every 1-hour photo-lab has one to calibrate their systems, and the owner may be willing to take a few readings for you.

Knowing the standard ISO paper grades generated by your contrast filters or your dichroic filter settings will allow you to compare results and make print records more meaningful for the future use.

Fig.1 includes two charts to record paper characteristic curves and fig.2 and fig.3 help to evaluate them. If possible, copy fig.3 onto transparent material, since it is used as an overlay, otherwise use it in combination with a light table or against a window. In any case, make sure that fig.1 and fig.3 are of the same scale.

A serious Zone System practitioner will want to calibrate his or her favorite film/developer combination to customized conditions. Once accomplished, most lighting conditions can be mastered with confidence and ease, rendering any negative a hassle-free printing assignment, while leaving paper grade latitude to imagination and providing maximum flexibility for creative interpretation. In 'Customizing Film Speed & Development' a detailed description of custom calibration was given, and figures 4, 5, 6 and 7 provide the charts required to record, develop and verify the information. Fig.4 is best copied on transparent material to be used as an overlay, and keeping figures 4 and 5 of the same scale is essential.

Keeping accurate exposure and printing records are bureaucratic tasks many photographers avoid due to the initial workload required to obtain them. They do, however, provide significant clues to the 'things gone wrong' and allow for a certain repeatability of the overall photographic process. 'Exposure & Print Records' explained how to take them, fig.9 provides the means to keep them.



Paper Characteristic Curves

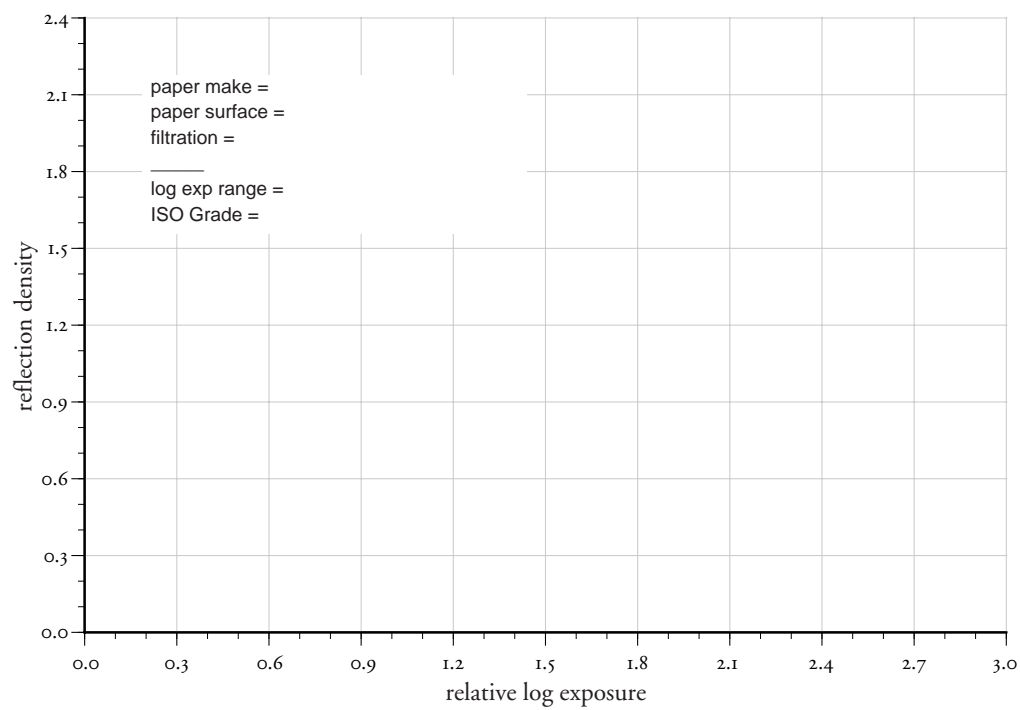
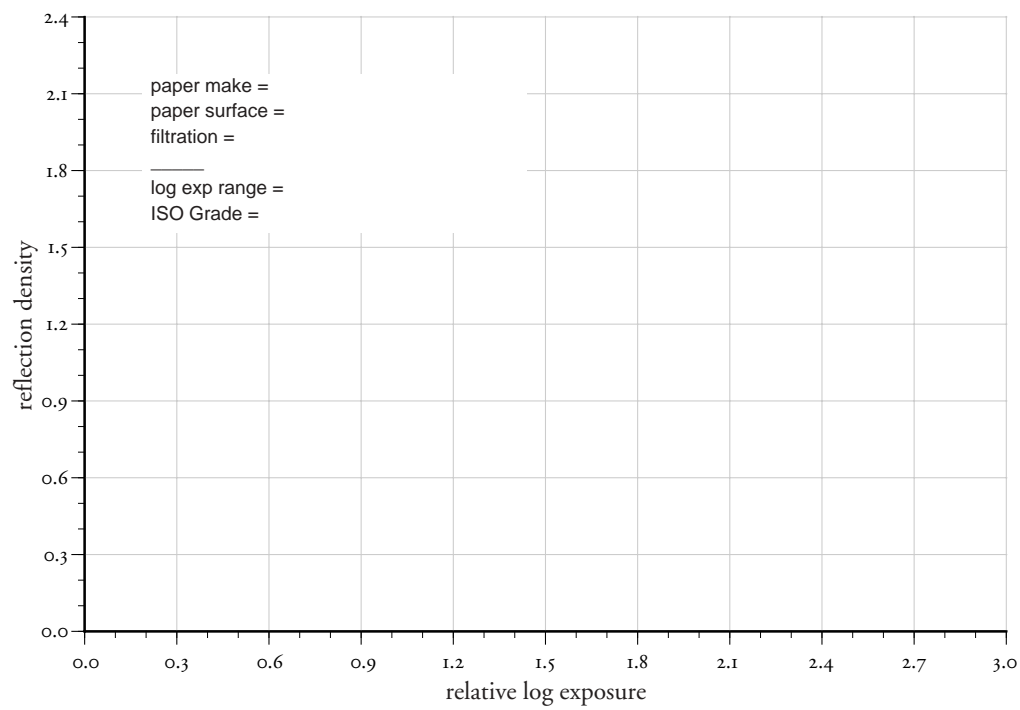


fig.1

log ER	ISO	log ER	ISO	log ER	ISO	ISO	log ER
0.50	5.50	0.90	2.85	1.30	0.87	0.000	1.55
0.51	5.45	0.91	2.79	1.31	0.83	0.125	1.51
0.52	5.38	0.92	2.73	1.32	0.80	0.250	1.47
0.53	5.32	0.93	2.67	1.33	0.76	0.375	1.43
0.54	5.25	0.94	2.58	1.34	0.72	0.500	1.40
0.55	5.18	0.95	2.50	1.35	0.68	0.625	1.37
0.56	5.11	0.96	2.46	1.36	0.65	0.750	1.33
0.57	5.04	0.97	2.42	1.37	0.61	0.875	1.30
0.58	4.97	0.98	2.38	1.38	0.58	1.000	1.27
0.59	4.90	0.99	2.32	1.39	0.54	1.125	1.24
0.60	4.83	1.00	2.27	1.40	0.50	1.250	1.21
0.61	4.76	1.01	2.21	1.41	0.47	1.375	1.18
0.62	4.69	1.02	2.16	1.42	0.44	1.500	1.15
0.63	4.63	1.03	2.10	1.43	0.40	1.625	1.13
0.64	4.56	1.04	2.05	1.44	0.37	1.750	1.10
0.65	4.50	1.05	2.00	1.45	0.34	1.875	1.08
0.66	4.43	1.06	1.95	1.46	0.30	2.000	1.05
0.67	4.35	1.07	1.90	1.47	0.27	2.125	1.03
0.68	4.28	1.08	1.85	1.48	0.24	2.250	1.00
0.69	4.21	1.09	1.80	1.49	0.20	2.375	0.98
0.70	4.14	1.10	1.75	1.50	0.17	2.500	0.95
0.71	4.08	1.11	1.70	1.51	0.14	2.625	0.94
0.72	4.02	1.12	1.65	1.52	0.10	2.750	0.92
0.73	3.94	1.13	1.60	1.53	0.07	2.875	0.89
0.74	3.87	1.14	1.55	1.54	0.04	3.000	0.87
0.75	3.81	1.15	1.50	1.55	0.00	3.125	0.85
0.76	3.74	1.16	1.46	1.56	-0.03	3.250	0.83
0.77	3.67	1.17	1.41	1.57	-0.06	3.375	0.81
0.78	3.61	1.18	1.37	1.58	-0.09	3.500	0.80
0.79	3.54	1.19	1.33	1.59	-0.12	3.625	0.78
0.80	3.50	1.20	1.28	1.60	-0.16	3.750	0.76
0.81	3.43	1.21	1.24	1.61	-0.19	3.875	0.74
0.82	3.35	1.22	1.20	1.62	-0.22	4.000	0.72
0.83	3.28	1.23	1.15	1.63	-0.26	4.125	0.70
0.84	3.22	1.24	1.11	1.64	-0.29	4.250	0.68
0.85	3.16	1.25	1.07	1.65	-0.33	4.375	0.67
0.86	3.09	1.26	1.03	1.66	-0.36	4.500	0.65
0.87	3.03	1.27	1.00	1.67	-0.40	4.625	0.63
0.88	2.97	1.28	0.96	1.68	-0.43	4.750	0.61
0.89	2.91	1.29	0.91	1.69	-0.47	4.875	0.59
0.90	2.85	1.30	0.87	1.70	-0.50	5.000	0.58

Paper log Exposure Range / Standard ISO Paper Grade

fig.2

Paper Range and Grade Meter

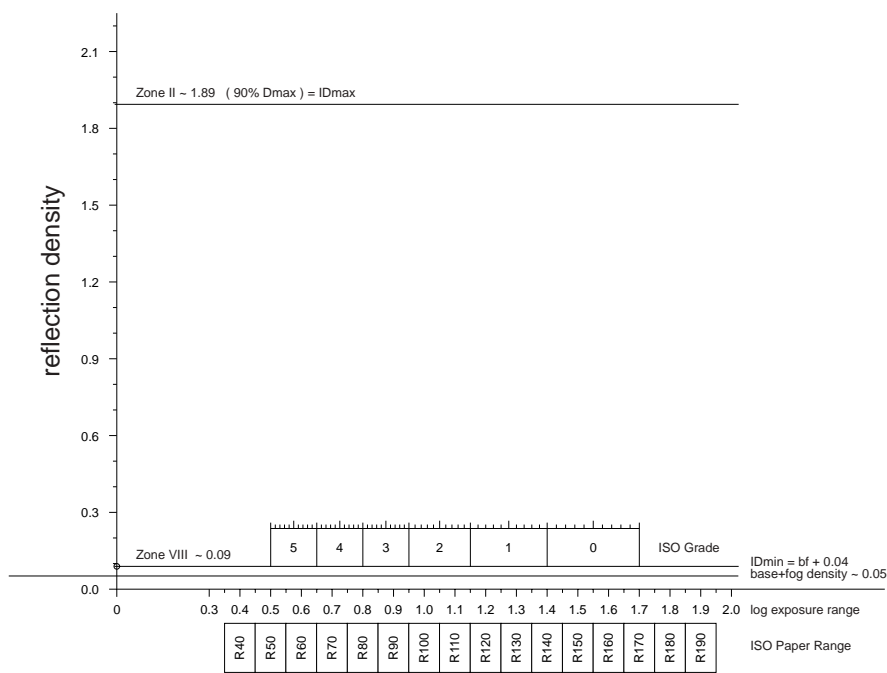


fig.3

Film Average Gradient Meter

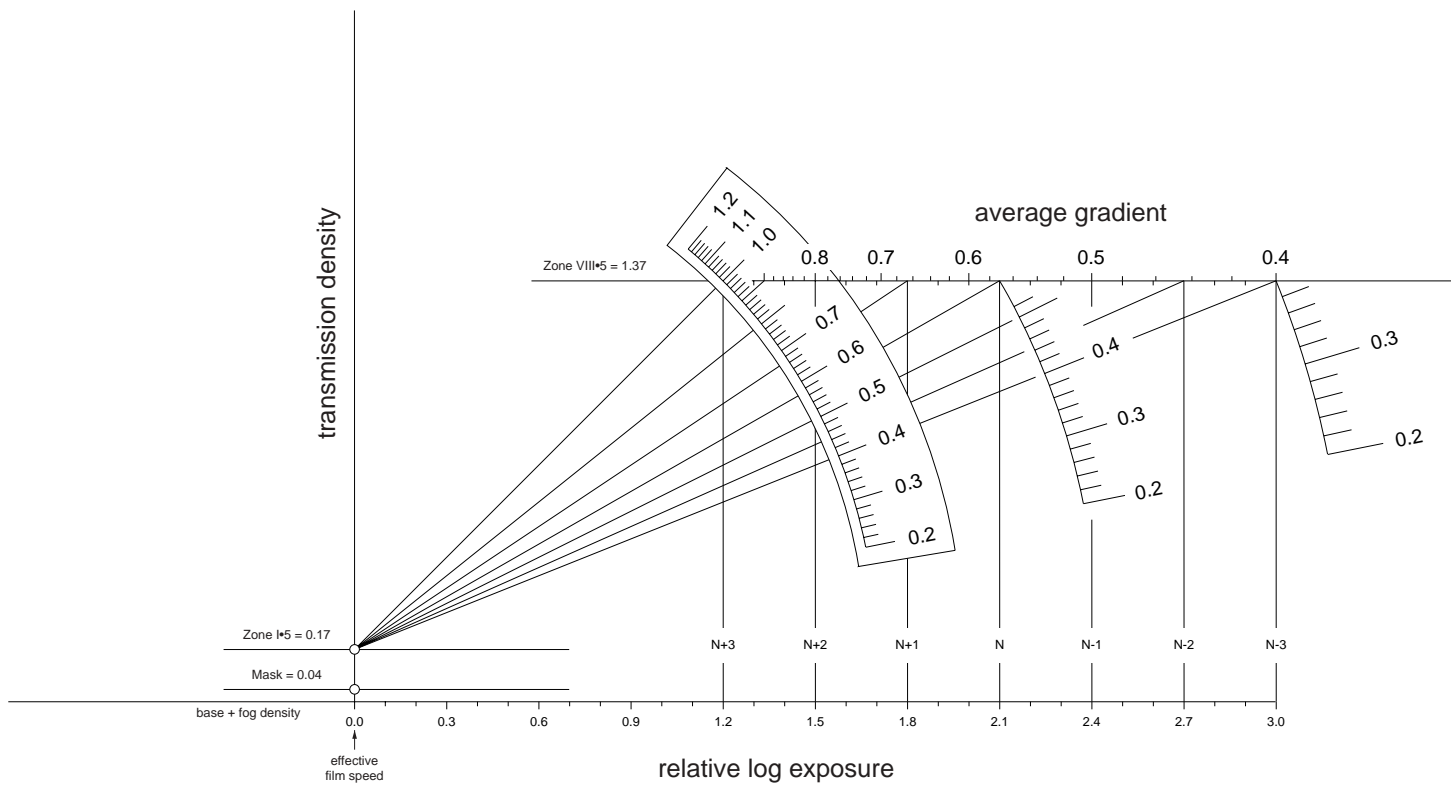


fig.4

Film Characteristic Curves

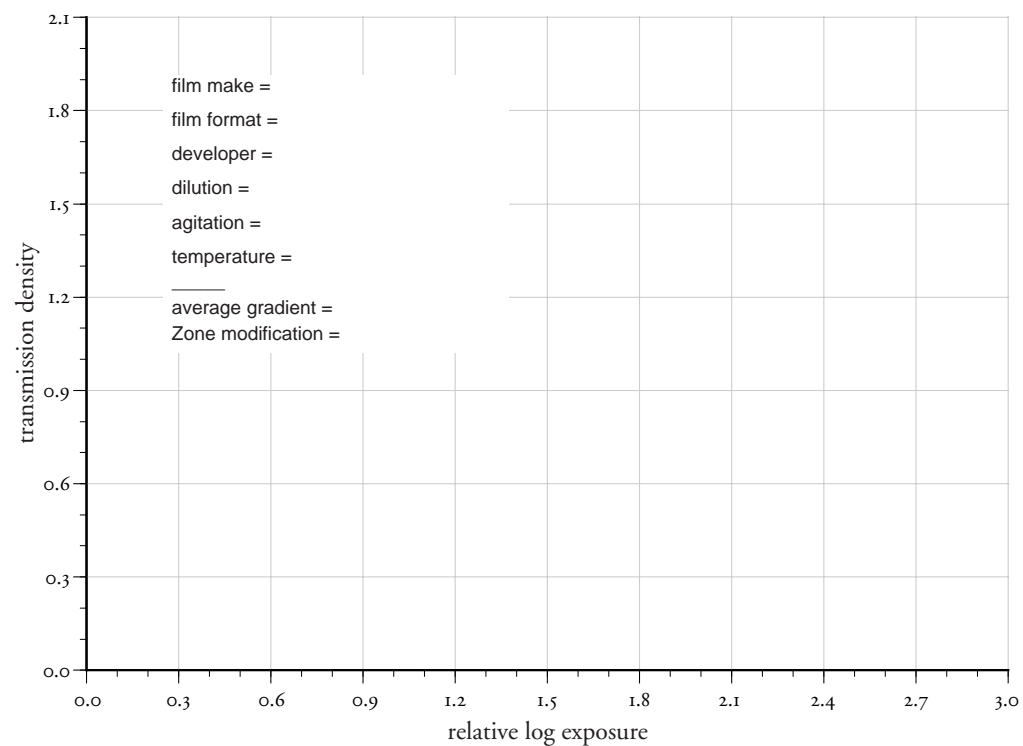
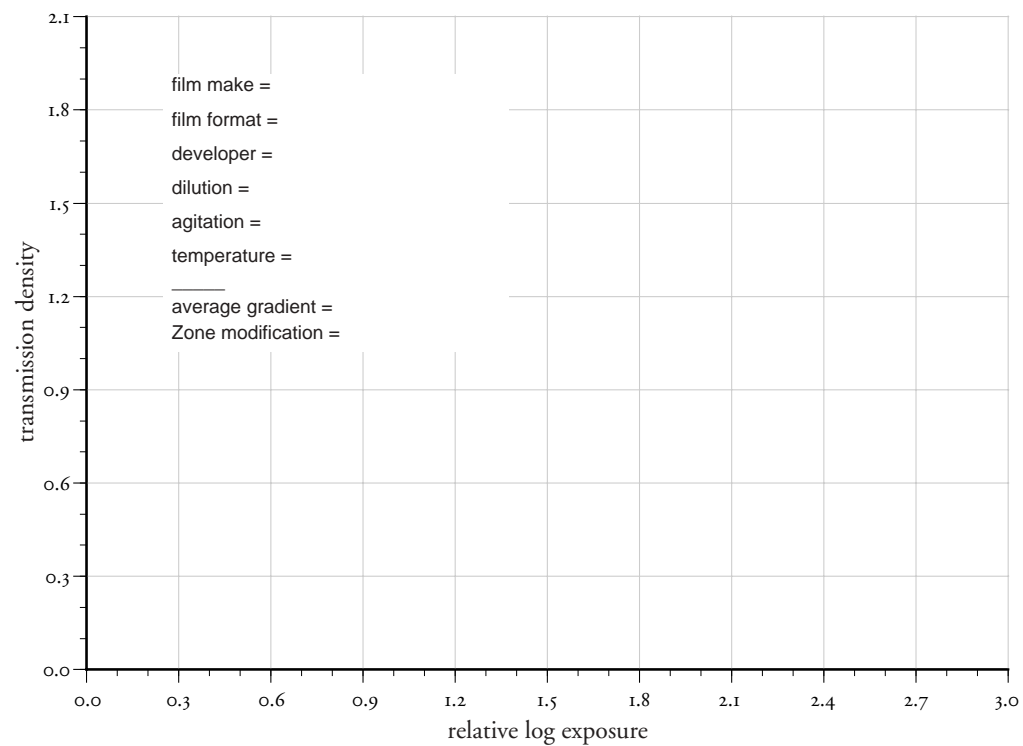


fig.4

Film Average Gradient, Zone System and Subject Brightness Range

avg gradient	N	SBR	avg gradient	N	SBR
0.400	-3.0	10.0	0.571	0.0	7.0
0.404	-2.9	9.9	0.580	0.1	6.9
0.408	-2.8	9.8	0.588	0.2	6.8
0.412	-2.7	9.7	0.597	0.3	6.7
0.417	-2.6	9.6	0.606	0.4	6.6
0.421	-2.5	9.5	0.615	0.5	6.5
0.426	-2.4	9.4	0.625	0.6	6.4
0.430	-2.3	9.3	0.635	0.7	6.3
0.435	-2.2	9.2	0.645	0.8	6.2
0.440	-2.1	9.1	0.656	0.9	6.1
0.444	-2.0	9.0	0.667	1.0	6.0
0.449	-1.9	8.9	0.678	1.1	5.9
0.455	-1.8	8.8	0.690	1.2	5.8
0.460	-1.7	8.7	0.702	1.3	5.7
0.465	-1.6	8.6	0.714	1.4	5.6
0.471	-1.5	8.5	0.727	1.5	5.5
0.476	-1.4	8.4	0.741	1.6	5.4
0.482	-1.3	8.3	0.755	1.7	5.3
0.488	-1.2	8.2	0.769	1.8	5.2
0.494	-1.1	8.1	0.784	1.9	5.1
0.500	-1.0	8.0	0.800	2.0	5.0
0.506	-0.9	7.9	0.816	2.1	4.9
0.513	-0.8	7.8	0.833	2.2	4.8
0.519	-0.7	7.7	0.851	2.3	4.7
0.526	-0.6	7.6	0.870	2.4	4.6
0.533	-0.5	7.5	0.889	2.5	4.5
0.541	-0.4	7.4	0.909	2.6	4.4
0.548	-0.3	7.3	0.930	2.7	4.3
0.556	-0.2	7.2	0.952	2.8	4.2
0.563	-0.1	7.1	0.976	2.9	4.1
0.571	0.0	7.0	1.000	3.0	4.0

fig.6

Zone II = 0.24 — Zone VIII = 1.29
Negative Density Range (I•5 – VIII•5) = 1.2
Subject Brightness Range = 2.1
speedpoint (0.8/1.3) = 0.615

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film make =
film format =
developer =
dilution =
agitation =
temperature =
date =

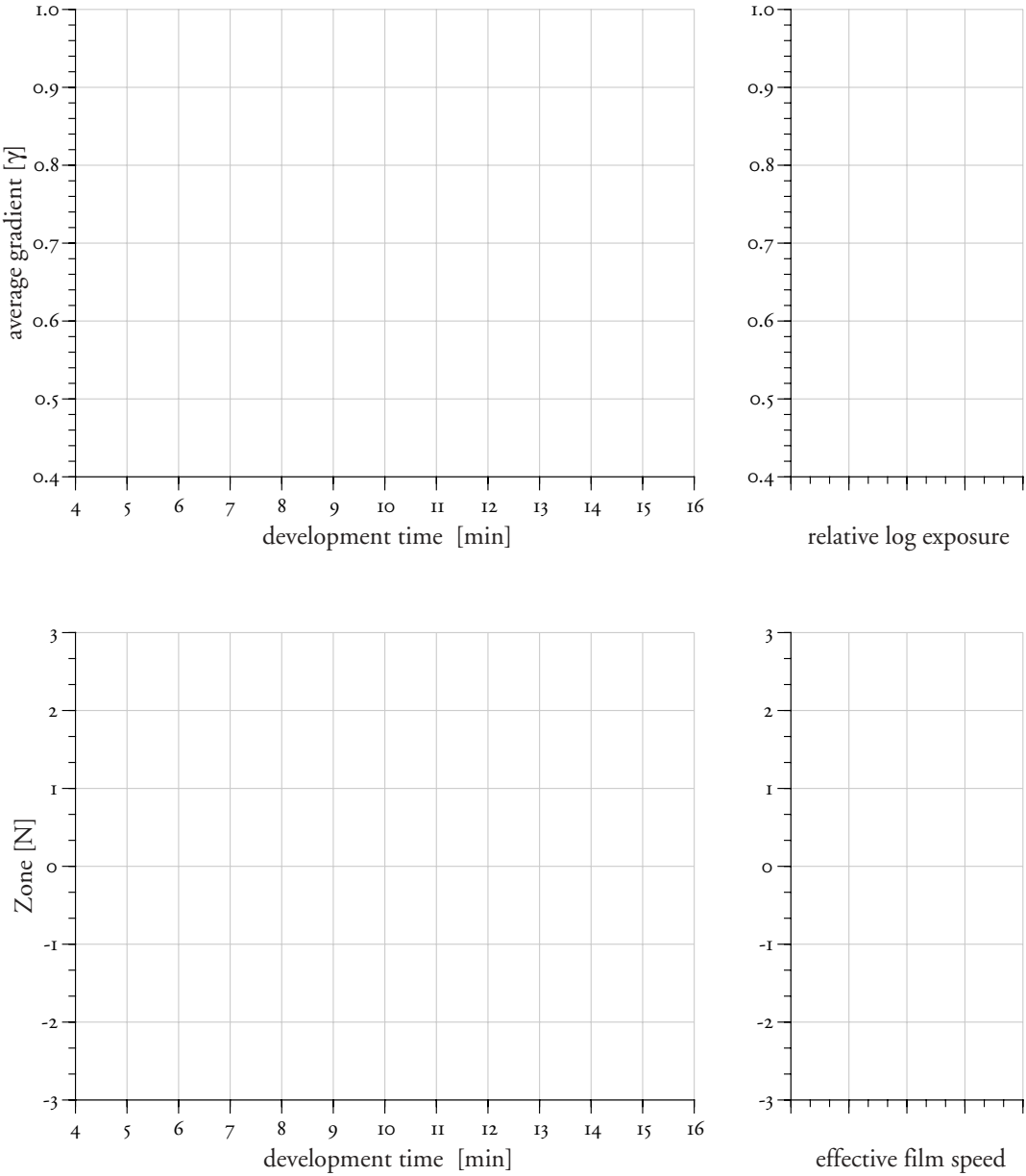


fig.7

Standard Densities for Negatives and Prints

Zone	Negative	Print
0	0.00	2.10
•	0.03	2.09
••	0.07	2.06
I	0.10	2.04
•	0.14	2.00
••	0.19	1.95
II	0.24	1.89
•	0.28	1.81
••	0.33	1.72
III	0.38	1.61
•	0.43	1.48
••	0.49	1.34
IV	0.54	1.19
•	0.60	1.04
••	0.66	0.89
V	0.72	0.75
•	0.78	0.62
••	0.84	0.50
VI	0.90	0.40
•	0.97	0.32
••	1.03	0.25
VII	1.10	0.19
•	1.16	0.15
••	1.22	0.12
VIII	1.29	0.09
•	1.35	0.08
••	1.42	0.07
IX	1.48	0.06
•	1.55	
••	1.61	
X	1.67	
•	1.73	
••	1.79	
XI	1.85	
•	1.91	
••	1.97	
XII	2.02	

fig.8 Standard values for relative negative transmission and absolute print reflection densities

Body

Lens

Filter

8 11 15 25

ND 0.3 0.6 0.9

Grad 0.3 0.6 0.9

Polarizer Soft Close-up

Negative Number

Negative Holder

Negative Development

Developer :

Dilution : 1+0 1+1 1+2 1+3

Temp [°C]: 18 19 20 21 22 23 24

Time [min]:

Special :

Print Development

Enlarging Lens [mm]: 50 80 105 150

Head Tilt [°]: 0 5 10 15

Negative to Paper Distance [mm]:

Grade : 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5

Range : 155 140 125 115 105 95 85 80 70 65 60

Paper Size : 8x10 11x14 12x16 16x20

Lens Tilt [°]: 0 1 2 3 4 5

Lens Shift [mm]: 0 5 10 15

Base Time [s]:

f/stop : 2.8 4 5.6 8 11 16 22 32 45

Zone

I

II

III

IV

V

VI

VII

VIII

IX

X

XI

EV

EI

8

10

12

16

20

25

32

40

50

64

80

100

125

160

200

250

320

400

500

640

800

1000

Basic Exposure

f/stop

Shutter

Final Exposure

f/stop

Shutter

Adjustments

Filter

Extension

Reciprocity

Total

⚡

💡

Templates 289

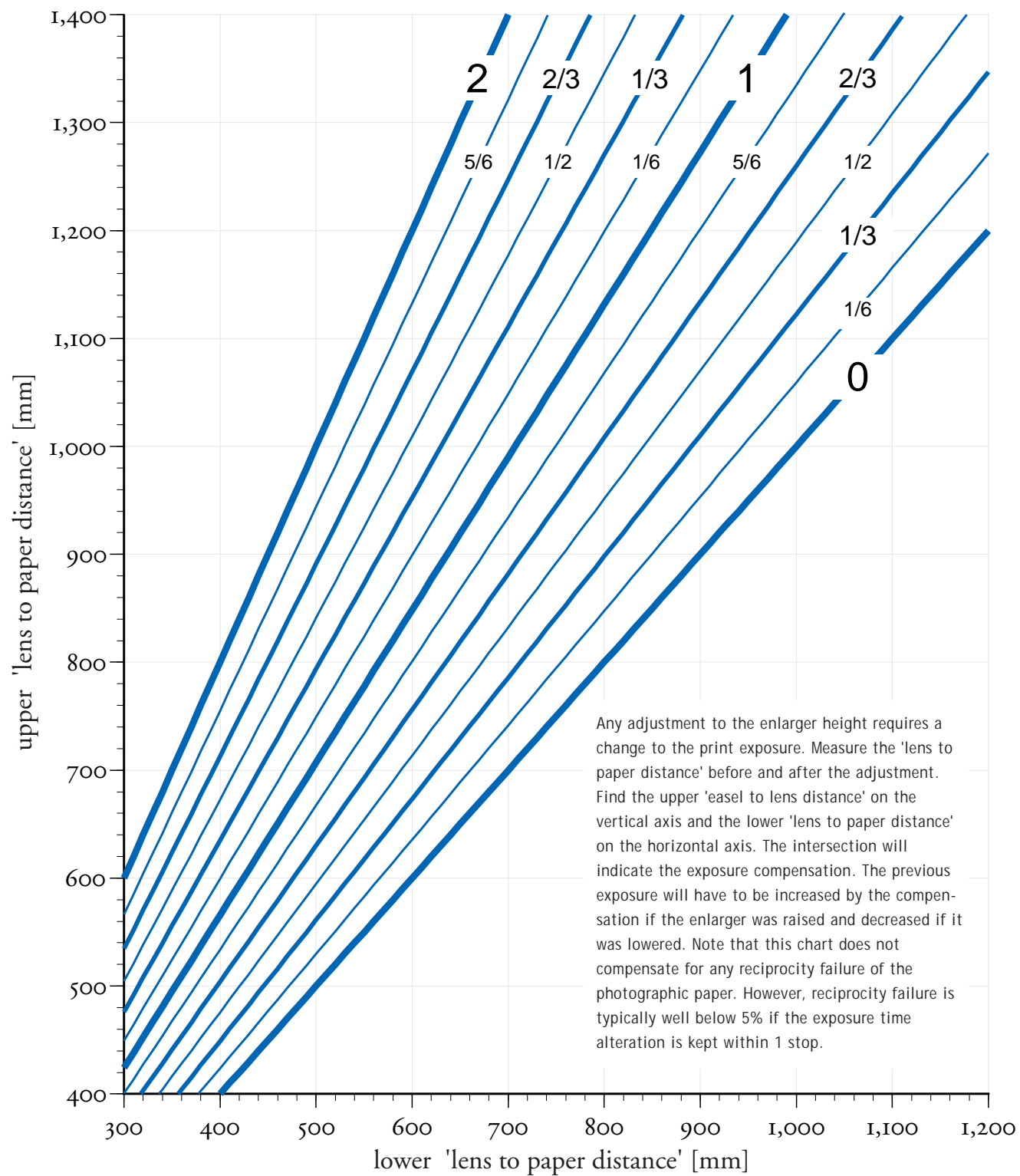
Exposure, Development and Printing Record

fig.9

f/stop Timing Table [s]

Dodging [f/stop]						Base Exp	Burning [f/stop]											
-1	-5/6	-2/3	-1/2	-1/3	-1/6		+1/6	+1/3	+1/2	+2/3	+5/6	+1	+1 1/3	+1 2/3	+2	+2 1/3	+2 2/3	+3
-4.0	-3.5	-3.0	-2.3	-1.7	-0.9	8	1.0	2.1	3.3	4.7	6.3	8.0	12.2	17.4	24.0	32.3	42.8	56.0
-4.2	-3.7	-3.1	-2.5	-1.7	-0.9	8.5	1.0	2.2	3.5	5.0	6.6	8.5	12.9	18.4	25.4	34.2	45.3	59.3
-4.5	-3.9	-3.3	-2.6	-1.9	-1.0	9.0	1.1	2.3	3.7	5.3	7.0	9.0	13.6	19.5	26.9	36.3	48.0	62.9
-4.8	-4.2	-3.5	-2.8	-2.0	-1.0	9.5	1.2	2.5	3.9	5.6	7.4	9.5	14.5	20.7	28.5	38.4	50.9	66.6
-5.0	-4.4	-3.7	-3.0	-2.1	-1.1	10.1	1.2	2.6	4.2	5.9	7.9	10.1	15.3	21.9	30.2	40.7	53.9	70.6
-5.3	-4.7	-4.0	-3.1	-2.2	-1.2	10.7	1.3	2.8	4.4	6.3	8.3	10.7	16.2	23.2	32.0	43.1	57.1	74.8
-5.7	-5.0	-4.2	-3.3	-2.3	-1.2	11.3	1.4	2.9	4.7	6.6	8.8	11.3	17.2	24.6	33.9	45.7	60.5	79.2
-6.0	-5.3	-4.4	-3.5	-2.5	-1.3	12.0	1.5	3.1	5.0	7.0	9.4	12.0	18.2	26.1	36.0	48.4	64.1	83.9
-6.3	-5.6	-4.7	-3.7	-2.6	-1.4	12.7	1.6	3.3	5.3	7.5	9.9	12.7	19.3	27.6	38.1	51.3	67.9	88.9
-6.7	-5.9	-5.0	-3.9	-2.8	-1.5	13.5	1.6	3.5	5.6	7.9	10.5	13.5	20.4	29.3	40.4	54.4	72.0	94.2
-7.1	-6.3	-5.3	-4.2	-2.9	-1.6	14.3	1.7	3.7	5.9	8.4	11.1	14.3	21.7	31.0	42.8	57.6	76.3	99.8
-7.6	-6.6	-5.6	-4.4	-3.1	-1.6	15.1	1.8	3.9	6.3	8.9	11.8	15.1	23.0	32.8	45.3	61.0	80.8	106
-8.0	-7.0	-5.9	-4.7	-3.3	-1.7	16	2.0	4.2	6.6	9.4	12.5	16.0	24.3	34.8	48.0	64.6	85.6	112
-8.5	-7.4	-6.3	-5.0	-3.5	-1.8	17.0	2.1	4.4	7.0	10.0	13.3	17.0	25.8	36.9	50.9	68.5	90.7	119
-9.0	-7.9	-6.6	-5.3	-3.7	-2.0	18.0	2.2	4.7	7.4	10.5	14.0	18.0	27.3	39.1	53.9	72.6	96.1	126
-9.5	-8.3	-7.0	-5.6	-3.9	-2.1	19.0	2.3	4.9	7.9	11.2	14.9	19.0	28.9	41.4	57.1	76.9	102	133
-10.1	-8.8	-7.5	-5.9	-4.2	-2.2	20.2	2.5	5.2	8.4	11.8	15.8	20.2	30.6	43.8	60.5	81.4	108	141
-10.7	-9.4	-7.9	-6.3	-4.4	-2.3	21.4	2.6	5.6	8.8	12.5	16.7	21.4	32.5	46.4	64.1	86.3	114	150
-11.3	-9.9	-8.4	-6.6	-4.7	-2.5	22.6	2.8	5.9	9.4	13.3	17.7	22.6	34.4	49.2	67.9	91.4	121	158
-12.0	-10.5	-8.9	-7.0	-4.9	-2.6	24.0	2.9	6.2	9.9	14.1	18.7	24.0	36.4	52.1	71.9	96.8	128	168
-12.7	-11.1	-9.4	-7.4	-5.2	-2.8	25.4	3.1	6.6	10.5	14.9	19.9	25.4	38.6	55.2	76.2	103	136	178
-13.5	-11.8	-10.0	-7.9	-5.6	-2.9	26.9	3.3	7.0	11.1	15.8	21.0	26.9	40.9	58.5	80.7	108	144	188
-14.3	-12.5	-10.5	-8.4	-5.9	-3.1	28.5	3.5	7.4	11.8	16.7	22.3	28.5	43.3	62.0	85.5	115	153	200
-15.1	-13.3	-11.2	-8.8	-6.2	-3.3	30.2	3.7	7.9	12.5	17.7	23.6	30.2	45.9	65.7	90.6	122	162	211
-16.0	-14.0	-11.8	-9.4	-6.6	-3.5	32	3.9	8.3	13.3	18.8	25.0	32.0	48.6	69.6	96.0	129	171	224
-17.0	-14.9	-12.5	-9.9	-7.0	-3.7	33.9	4.2	8.8	14.0	19.9	26.5	33.9	51.5	73.7	103	137	181	237
-18.0	-15.8	-13.3	-10.5	-7.4	-3.9	35.9	4.4	9.3	14.9	21.1	28.1	35.9	54.6	78.1	108	145	192	251
-19.0	-16.7	-14.1	-11.1	-7.9	-4.2	38.1	4.7	9.9	15.8	22.4	29.8	38.1	57.8	82.8	114	154	204	266
-20.2	-17.7	-14.9	-11.8	-8.3	-4.4	40.3	4.9	10.5	16.7	23.7	31.5	40.3	61.3	87.7	121	163	216	282
-21.4	-18.7	-15.8	-12.5	-8.8	-4.7	42.7	5.2	11.1	17.7	25.1	33.4	42.7	64.9	92.9	128	173	229	299
-22.6	-19.9	-16.7	-13.3	-9.3	-4.9	45.3	5.5	11.8	18.7	26.6	35.4	45.3	68.8	98.4	136	183	242	317
-24.0	-21.0	-17.7	-14.0	-9.9	-5.2	47.9	5.9	12.5	19.9	28.2	37.5	47.9	72.9	104	144	194	257	336
-25.4	-22.3	-18.8	-14.9	-10.5	-5.5	50.8	6.2	13.2	21.0	29.8	39.7	50.8	77.2	111	152	205	272	356
-26.9	-23.6	-19.9	-15.8	-11.1	-5.9	53.8	6.6	14.0	22.3	31.6	42.1	53.8	81.8	117	162	217	288	377
-28.5	-25.0	-21.1	-16.7	-11.8	-6.2	57.0	7.0	14.8	23.6	33.5	44.6	57.0	86.7	124	171	230	305	399
-30.2	-26.5	-22.4	-17.7	-12.5	-6.6	60.4	7.4	15.7	25.0	35.5	47.2	60.4	91.8	131	181	244	323	423
-32.0	-28.1	-23.7	-18.7	-13.2	-7.0	64	7.8	16.6	26.5	37.6	50.0	64.0	97.3	139	192	259	342	448

fig.10

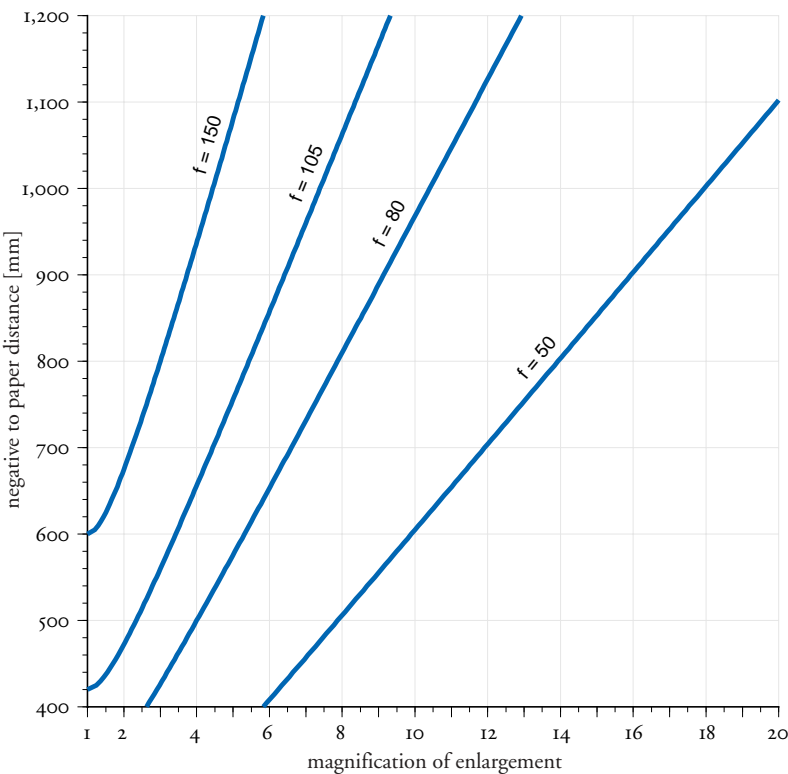


Enlarger Height Exposure Compensation

fig.11

fig.12 (right) Negative magnification during enlargement depends on the distance between negative and paper as well as the focal length of the enlarging lens. Measure the 'negative to paper distance' after focusing. Select this distance on the vertical axis and find its intersection with the focal length of the enlarging lens. Drop the intersection to the horizontal axis to find the 'magnification of enlargement'.

magnification	aperture				
	depth of field [mm]				
24x36 c = 0.022	4	5.6	8	11	16
5	5	7	11	15	21
8	13	18	25	35	51
10	19	27	39	53	77
12	28	38	55	76	110
16	48	67	96	132	192
20	74	104	148	203	296
6x6 c = 0.042	5.6	8	11	16	22
3	6	8	11	16	22
4	9	13	19	27	37
5	14	20	28	40	55
8	34	48	67	97	133
10	52	74	102	148	203
12	74	105	144	210	288
4x5 c = 0.089	5.6	8	11	16	22
1	2	3	4	6	8
2	6	9	12	17	24
3	12	17	24	34	47
4	20	29	39	57	78
5	30	43	59	85	118
6	42	60	82	120	165



When an enlargement at a specific negative magnification is desired, the required negative-to-paper distance 'a' is determined as follows:

$$a = \frac{f \cdot (m + 1)^2}{m}$$

where 'f' is the focal length of the enlarging lens and 'm' is the desired negative magnification. While image magnification is set by the negative-to-paper distance, image focus is achieved by adjusting the lens plane.

fig.13 (left) Similar to the depth of field surrounding the focal plane when taking a photograph, there is a depth of field surrounding the paper plane when enlarging the negative. It is determined as follows:

$$d = 2 \cdot c \cdot N \cdot \left(1 + \frac{1}{m}\right) \cdot m^2$$

where 'c' is the circle of confusion depending on film format, 'N' is the aperture of the enlarging lens in f/stops and 'm' is the negative magnification.