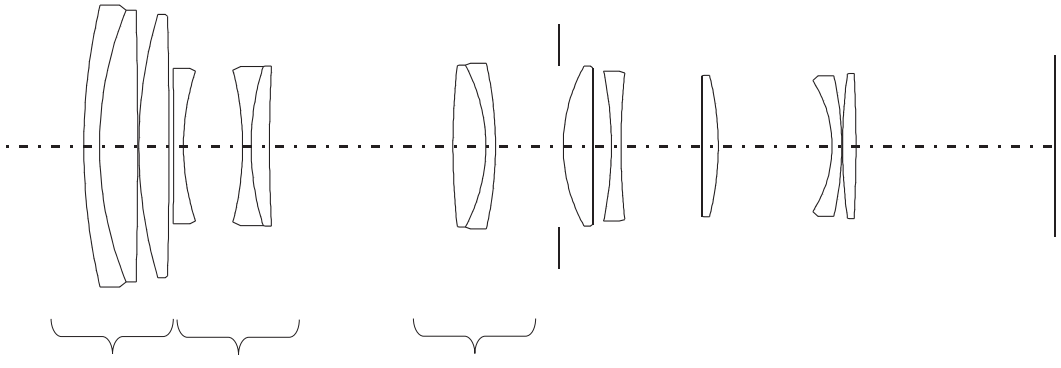
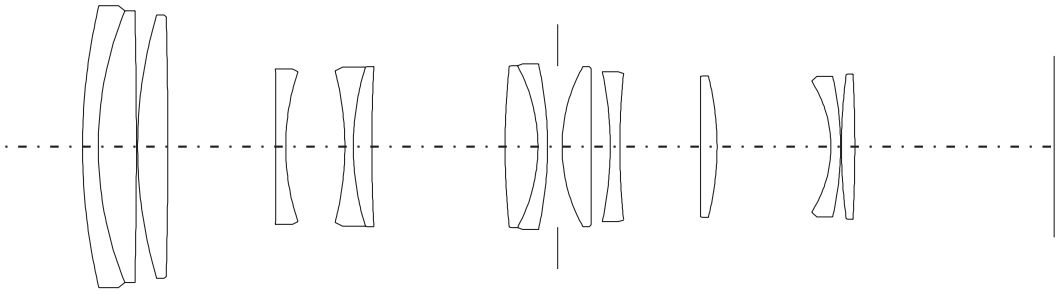
A particularly complex lens: The optical computation is based on 13 lens elements in 10 groups, using 12 different optical glasses – five of them being special glass with anomalous partial dispersion. The performance characteristics of this apochromatically corrected zoom lens with its high uniform speed of f/2.8 are comparable to those of Leica lenses with fixed focal lengths. This lens distinguishes itself in the high contrast and clear differentiation even of intricate color gradations at all focal length settings and across the entire picture area, all the way into the close-up range. Both coma and astigmatism are hardly detectable. As a result, the application possibilities of this zoom lens are virtually unlimited : Stationary subjects in fashion photography ; or for reportage, in which a fast, yet careful change of cropping is important. The rubber-armored pullout lens hood can be used to set the outfit down or to rest it on a rigid surface, and the large, rotating tripod base has special click stops for vertical and horizontal formats.

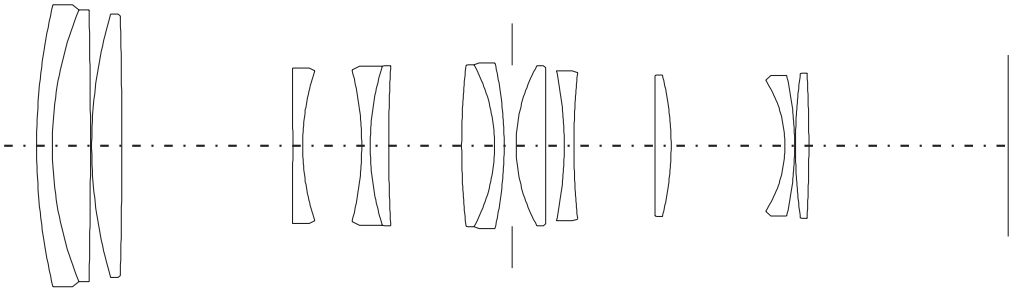
Lens shape 70 mm



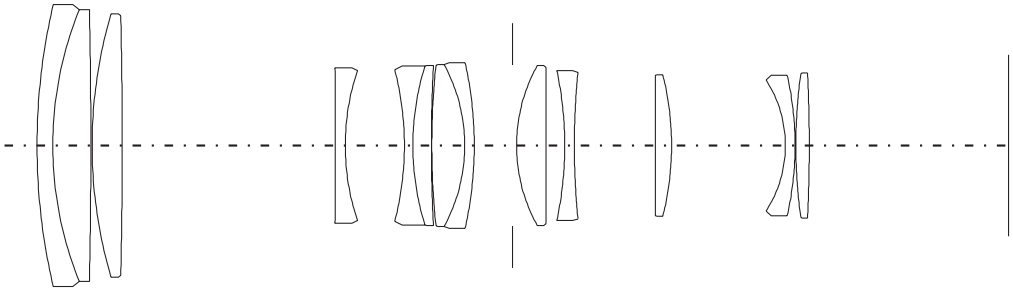
Linsenschnitt 100 mm



Lens shape 135 mm



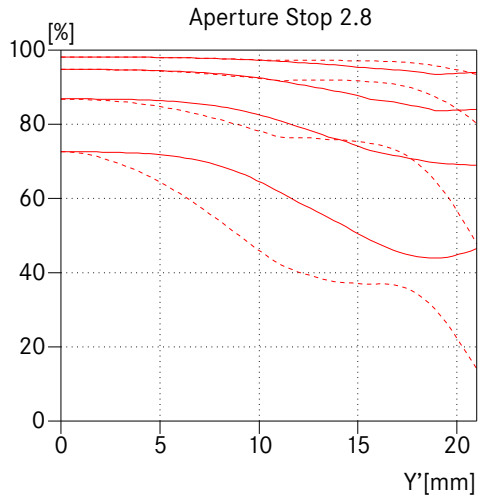
Lens shape 180 mm

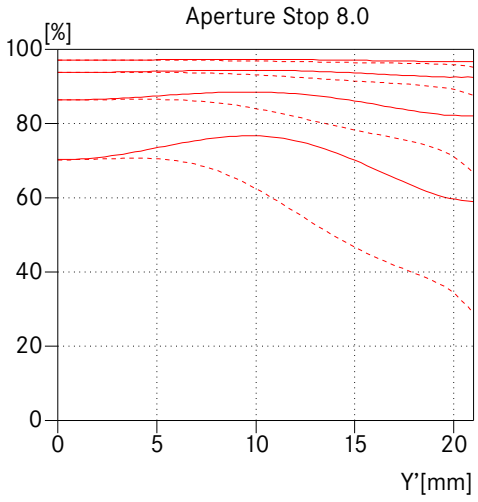


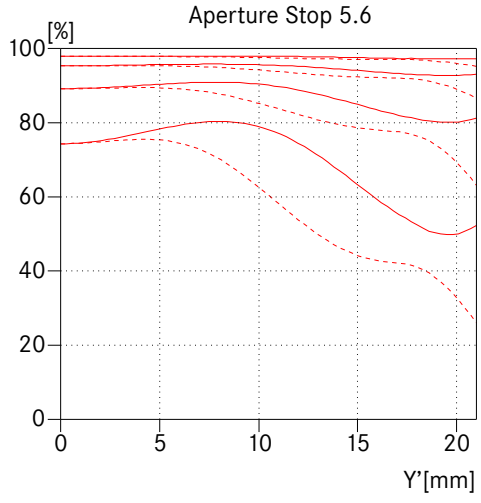
Engineering drawing

Technical Data	
Angle of view (diagonal, horizontal, vertical)	At 70 mm focal length: 34°, 29°, 19°, at 180 mm focal length: 13.7°, 11.4°, 7.6°
Optical design	**Number of elements / groups:** 13 / 10 **Focusing range:** 1.7 m to infinity
Distance setting	**Scale:** Combined meter/feet-increments **Smallest object field:** 70 mm focal length: 436 x 655 mm, 180 mm focal length: 175 x 263 mm **Highest reproduction ratio:** 70 mm focal length: 1:18, 180 mm focal length: 1:7.3
Diaphragm	**Setting / Type:** Preset diaphragm with clickstops (including half values), Fully automatic diaphragm **Smallest aperture:** f/22
Bayonet	LEICA R quick-change bayonet for LEICA R3 to LEICA R9 with mechanical, and, for LEICA R8/R9, additional electronic exposure control
Filter (type)	Internal thread for screw-in type filters E 77
Lens hood	Built-in, telescopic, rubber-armored
Dimensions and weight	**Length:** 189.5 mm **Largest diameter:** 89 mm **Weight:** approx. 1.870 g

MTF graphs 70 mm





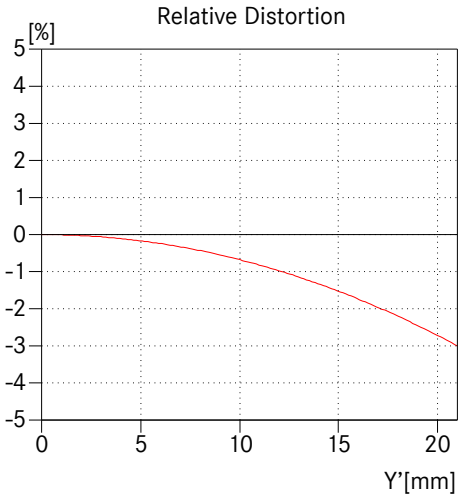


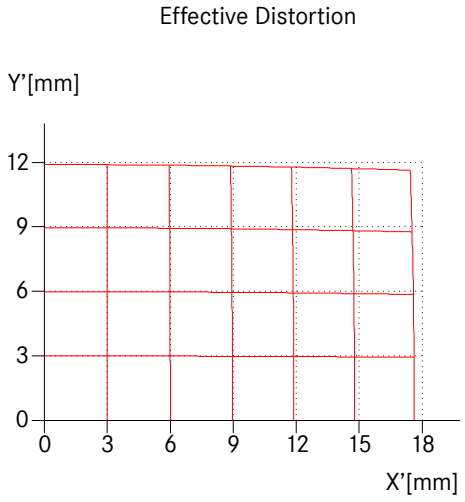
The MTF is indicated both at full aperture and at f/5.6 at long taking distances (infinity). Shown is the contrast in percentage for 5, 10, 20 and 40 lp/mm accross the height of the 35 mm film format, for tangential (dotted line) and sagittal (solid line) structures, in white light. The 5 and 10 lp/mm will give an indication regarding the contrast ratio for large object structures.The 20 and 40 lp/mm records the resolution of finer and finest object structures.

sagittal structures

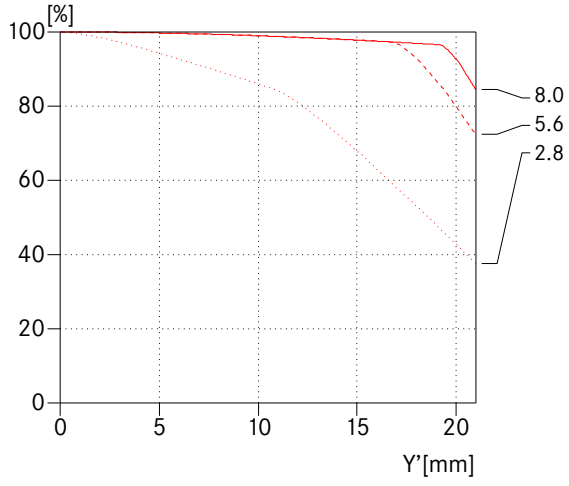
tangential structures

Distortion 70 mm





Vignetting 70 mm



Distortion is the deviation of the real image height (in the picture) from the ideal image height. The relative distortion is the percentage deviation. The ideal image height results from the object height and the magnification. The image height of 21.6mm is the radial distance between the edge and the middle of the image field for the format 24mm x 36mm. The graph of the effective distortion illustrates the appearance of straight horizontal and vertical lines in the picture.

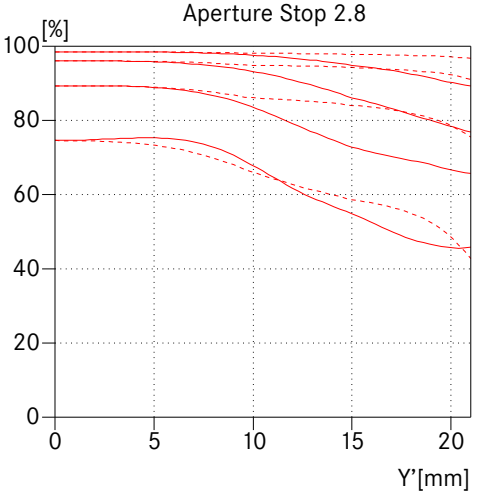
Vignetting is a continous decrease of the illumination to the edges of the image field. The graph shows the percentage lost of illumination over the image height. 100% means no vignetting.

sagittal structures

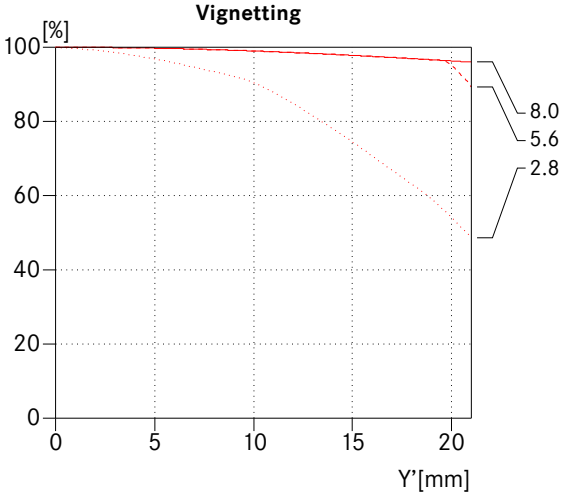
tangential structures

100 mm

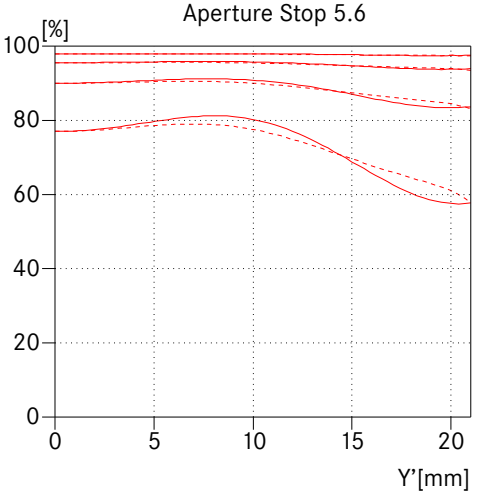
Aperture Stop 2.8



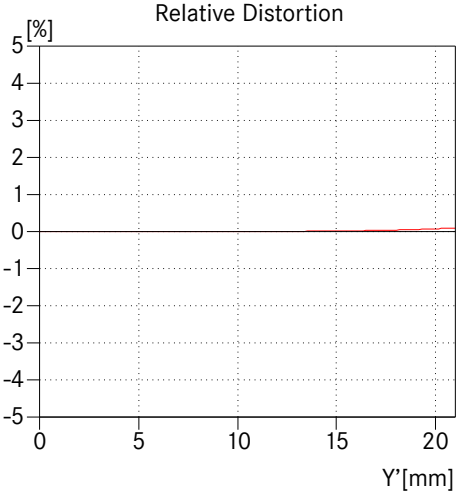
Vignetting



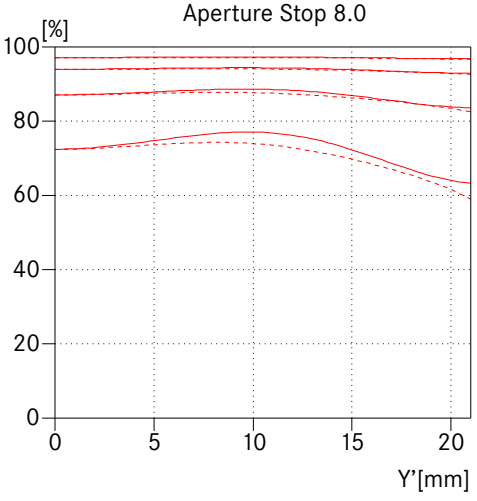
Aperture Stop 5.6



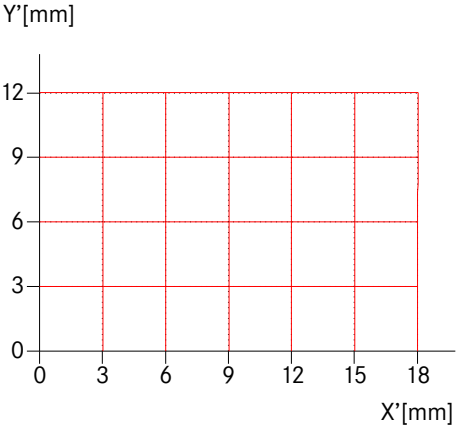
Relative Distortion



Aperture Stop 8.0

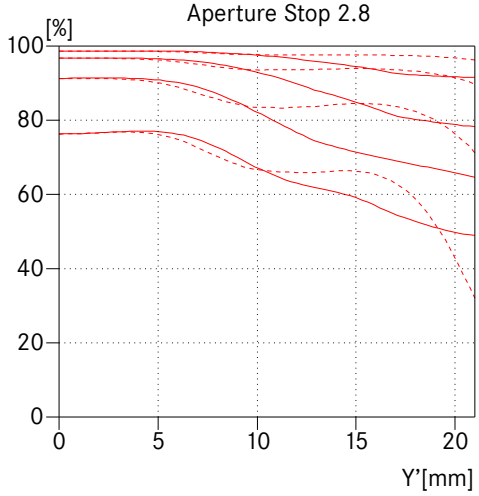


Effective Distortion

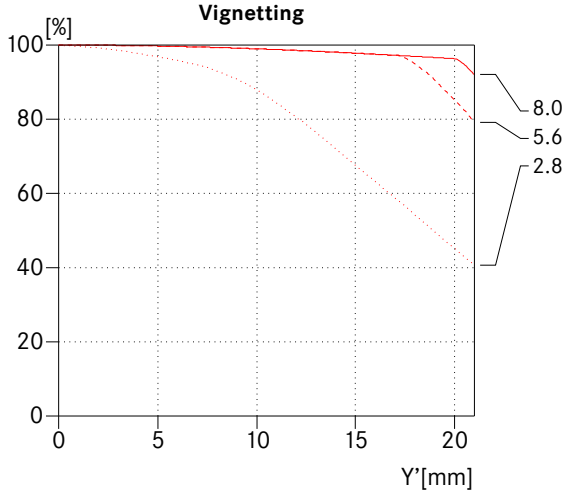


135 mm

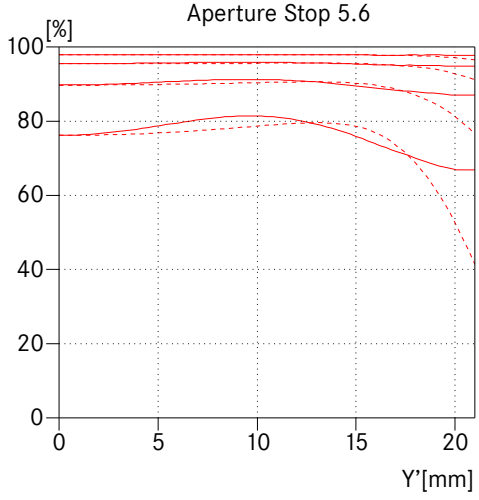
Aperture Stop 2.8



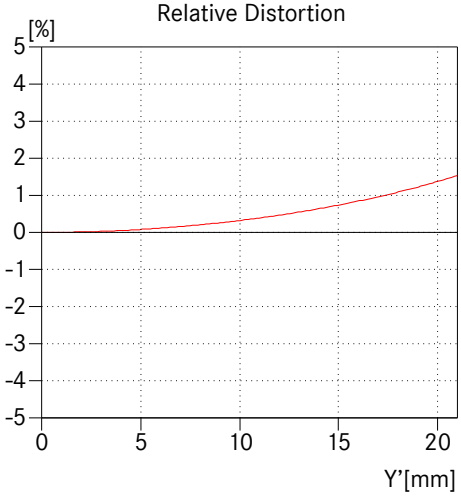
Vignetting



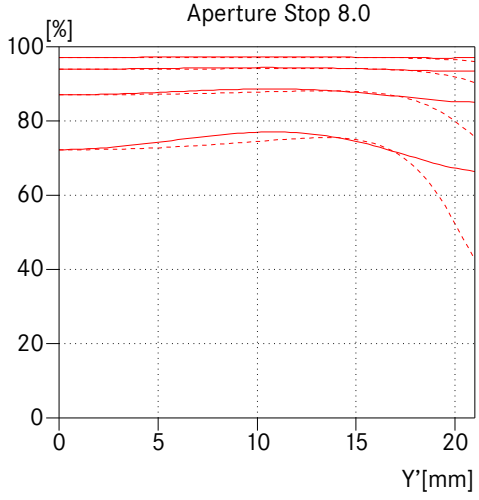
Aperture Stop 5.6



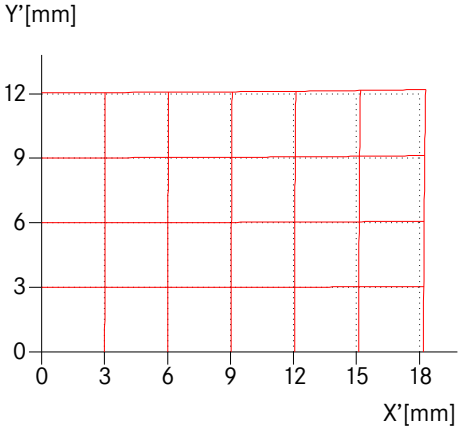
Relative Distortion



Aperture Stop 8.0

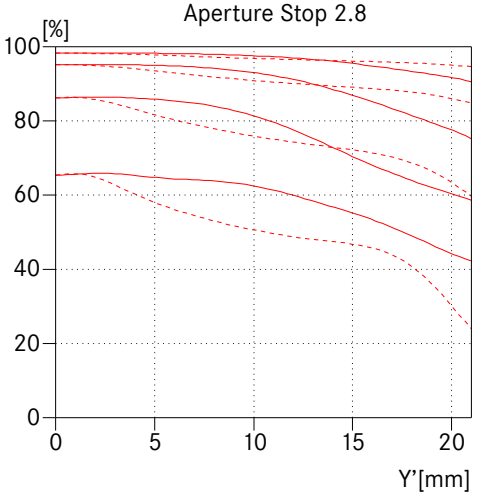


Effective Distortion

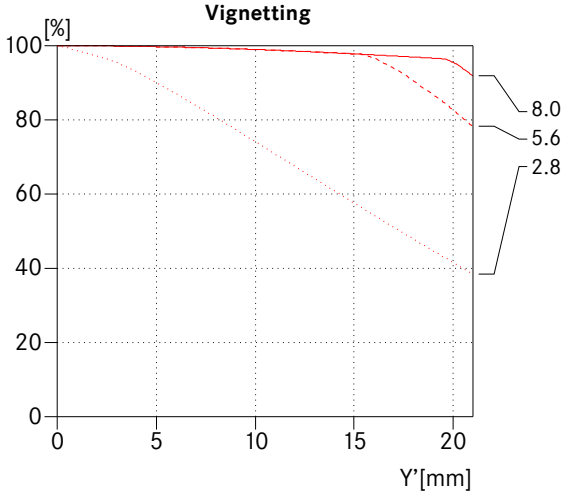


180 mm

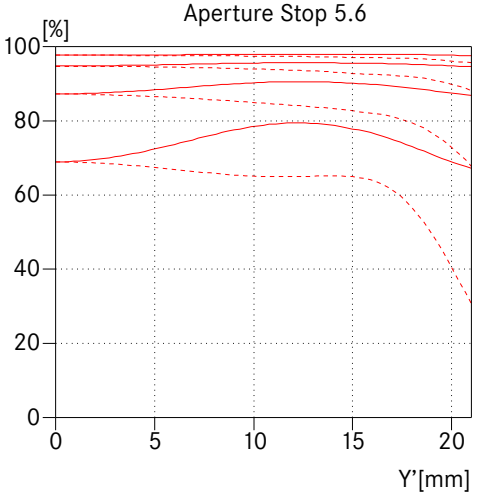
Aperture Stop 2.8



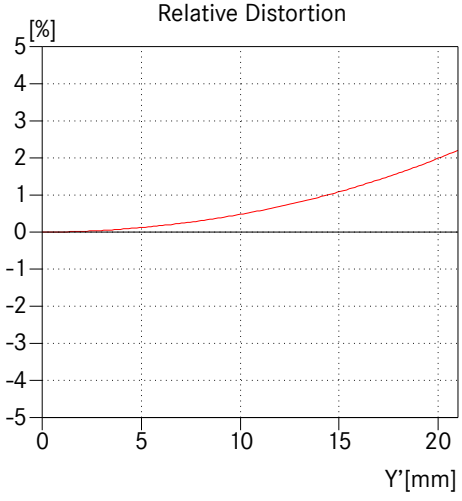
Vignetting



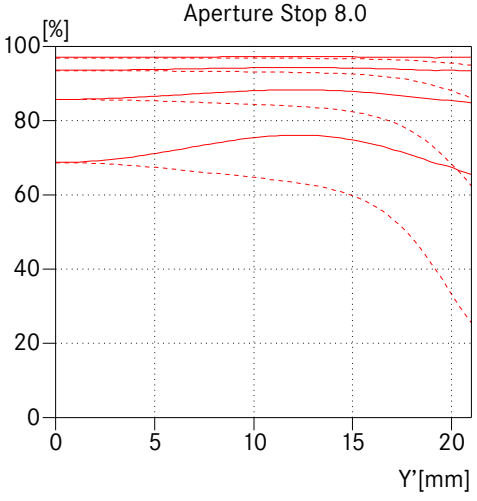
Aperture Stop 5.6



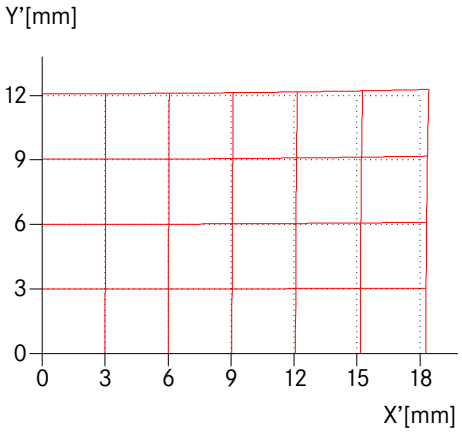
Relative Distortion



Aperture Stop 8.0

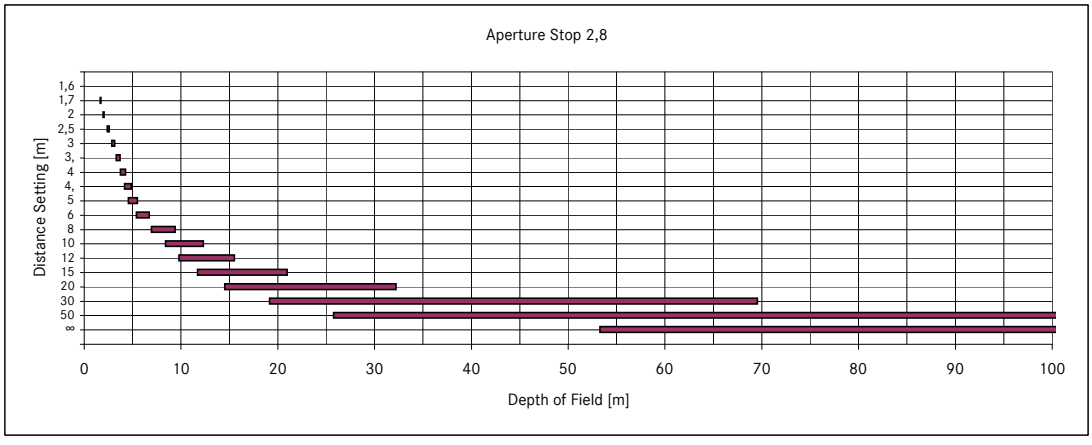


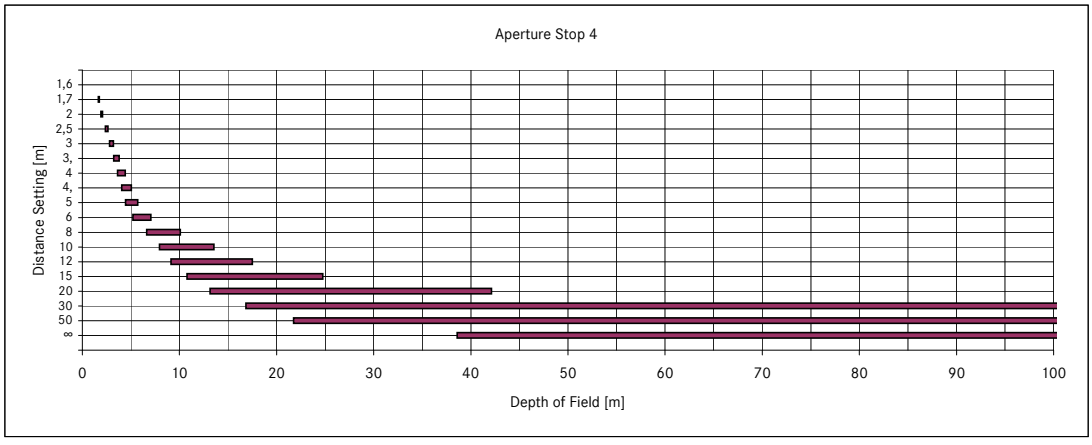
Effective Distortion

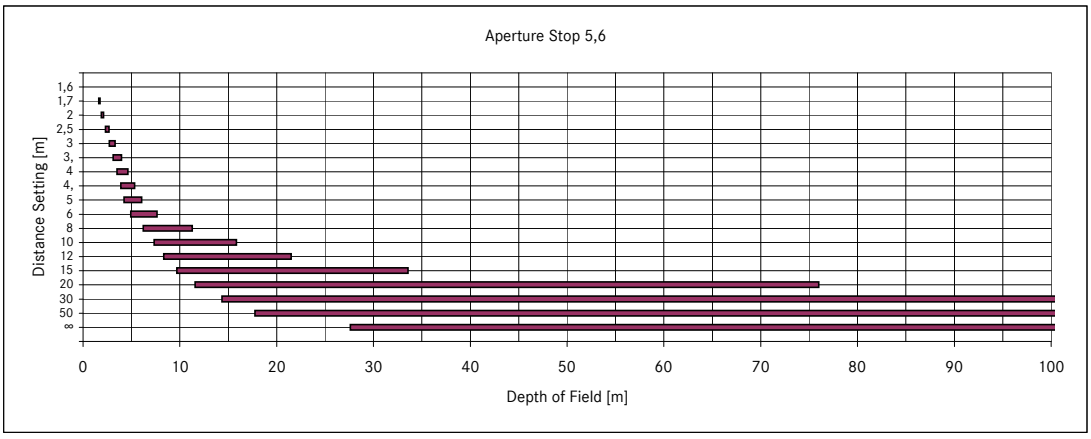


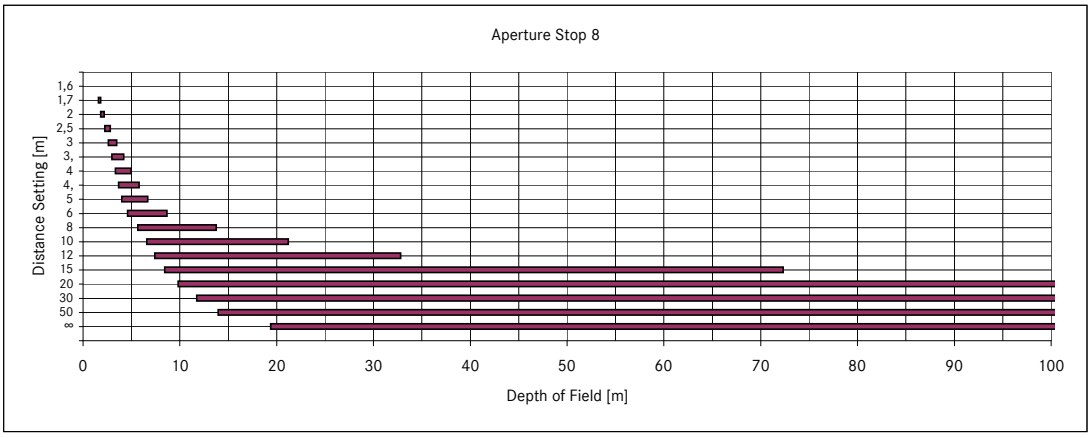
Depth of field table 70 mm

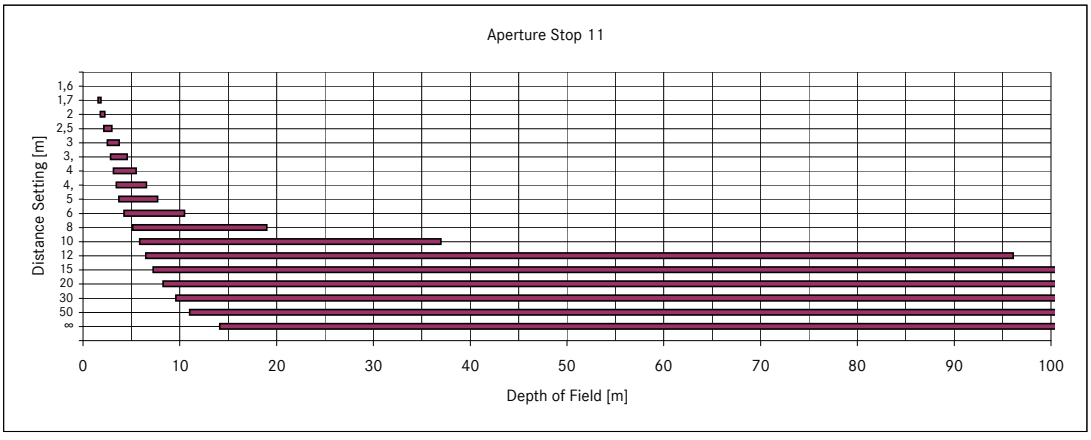
Distance Setting [m]	Aperture Stop 2,8	4	5,6	8	11	16	22	Magnification
1,6	1,561 - 1,642	1,546 - 1,658	1,526 - 1,683	1,496 - 1,721	1,461 - 1,772	1,407 - 1,864	1,347 - 1,990	1/19,9
1,7	1,655 - 1,748	1,639 - 1,767	1,615 - 1,795	1,582 - 1,839	1,542 - 1,898	1,481 - 2,007	1,414 - 2,156	1/21,4
2	1,936 - 2,069	1,913 - 2,096	1,880 - 2,137	1,834 - 2,203	1,779 - 2,291	1,695 - 2,456	1,606 - 2,692	1/25,7
2,5	2,397 - 2,612	2,361 - 2,658	2,310 - 2,727	2,237 - 2,839	2,153 - 2,993	2,028 - 3,292	1,896 - 3,748	1/32,9
3	2,850 - 3,168	2,797 - 3,237	2,724 - 3,343	2,622 - 3,516	2,504 - 3,762	2,332 - 4,262	2,156 - 5,082	1/40,1
3,5	3,295 - 3,734	3,223 - 3,832	3,124 - 3,985	2,988 - 4,238	2,835 - 4,607	2,613 - 5,395	2,391 - 6,812	1/47,3
4	3,731 - 4,313	3,638 - 4,446	3,512 - 4,655	3,339 - 5,009	3,146 - 5,539	2,872 - 6,737	2,603 - 9,137	1/54,5
4,5	4,159 - 4,904	4,043 - 5,078	3,887 - 5,355	3,674 - 5,834	3,440 - 6,574	3,112 - 8,354	2,796 - 12,45	1/61,6
5	4,580 - 5,508	4,439 - 5,731	4,249 - 6,089	3,994 - 6,722	3,717 - 7,733	3,334 - 10,35	2,972 - 17,56	1/68,9
6	5,400 - 6,755	5,202 - 7,097	4,941 - 7,661	4,597 - 8,703	4,230 - 10,50	3,737 - 16,06	3,284 - 45,13	1/83,2
8	6,956 - 9,424	6,627 - 10,11	6,203 - 11,32	5,663 - 13,79	5,110 - 19,01	4,400 - 52,31	3,777 - ∞	1/112
10	8,409 - 12,35	7,929 - 13,58	7,326 - 15,86	6,579 - 21,24	5,839 - 37,02	4,923 - ∞	4,151 - ∞	1/141
12	9,781 - 15,55	9,138 - 17,54	8,347 - 21,54	7,391 - 32,83	6,470 - 96,13	5,365 - ∞	4,462 - ∞	1/169
15	11,69 - 20,99	10,78 - 24,78	9,697 - 33,59	8,431 - 72,34	7,253 - ∞	5,893 - ∞	4,821 - ∞	1/211
20	14,52 - 32,25	13,15 - 42,15	11,57 - 76,02	9,816 - ∞	8,257 - ∞	6,541 - ∞	5,247 - ∞	1/281
30	19,16 - 69,58	16,85 - 140,9	14,35 - ∞	11,75 - ∞	9,584 - ∞	7,349 - ∞	5,756 - ∞	1/422
50	25,76 - 941,3	21,75 - ∞	17,76 - ∞	13,94 - ∞	11,00 - ∞	8,155 - ∞	6,240 - ∞	1/703
∞	53,26 - ∞	38,58 - ∞	27,60 - ∞	19,37 - ∞	14,13 - ∞	9,766 - ∞	7,146 - ∞	1/∞

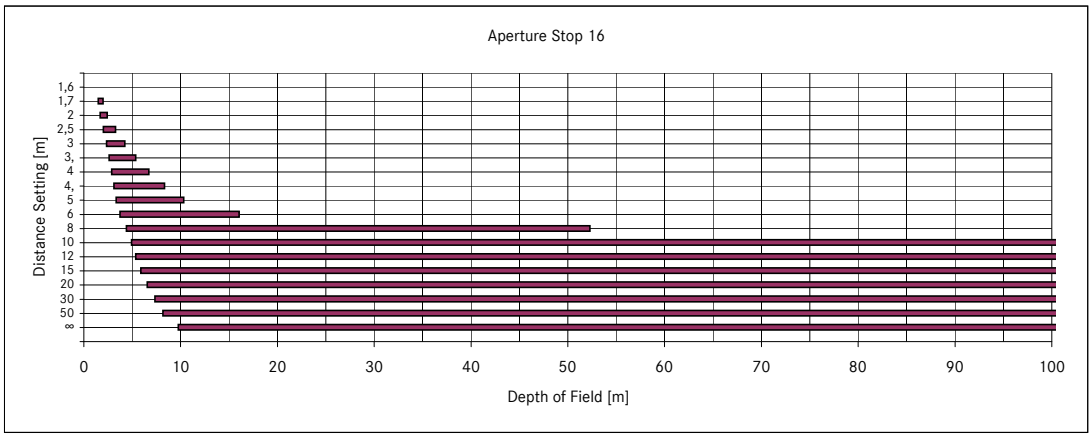


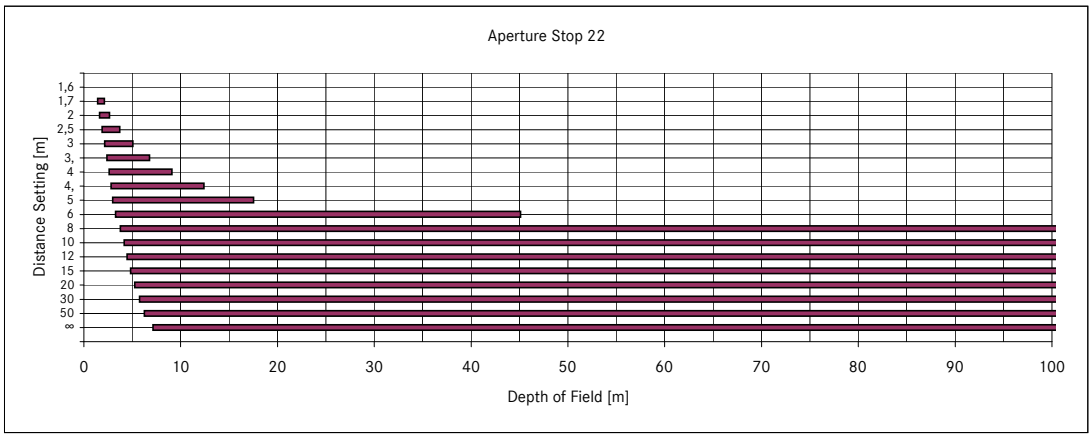



Aperture Stop 5,6
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]


Aperture Stop 8
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

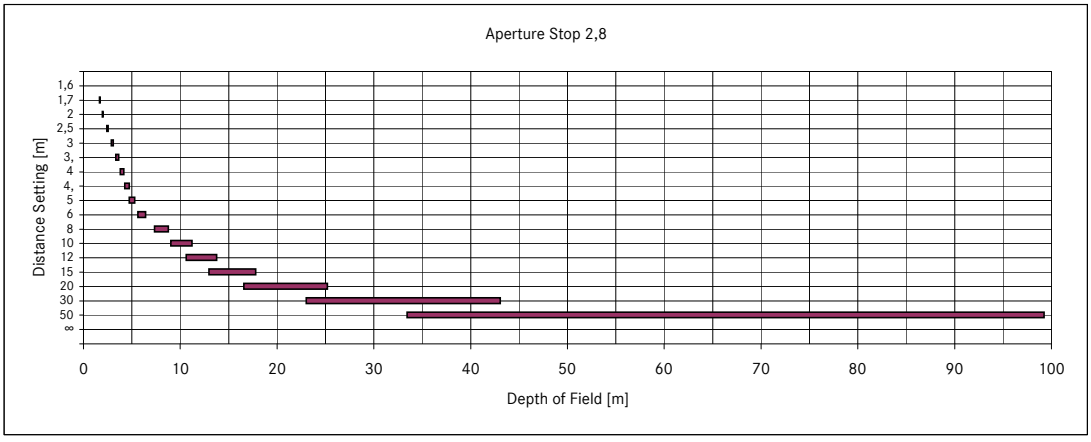

Aperture Stop 11
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

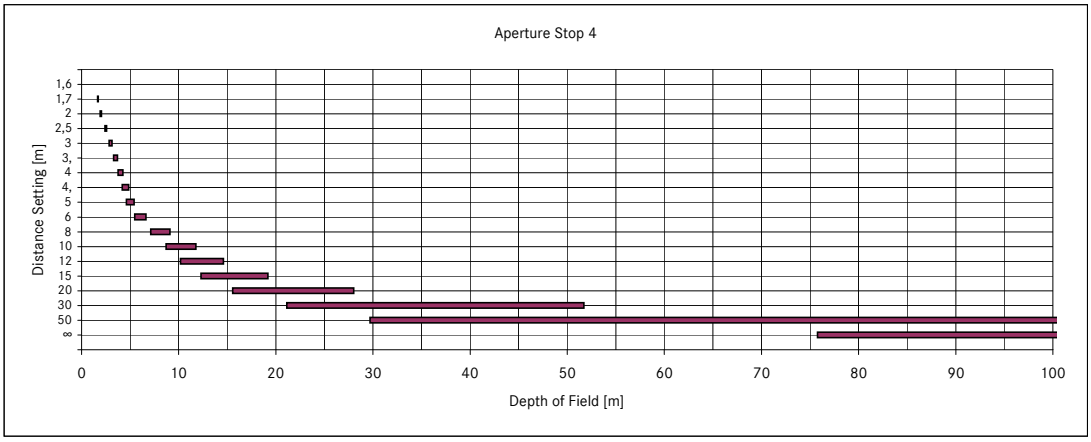

Aperture Stop 16
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

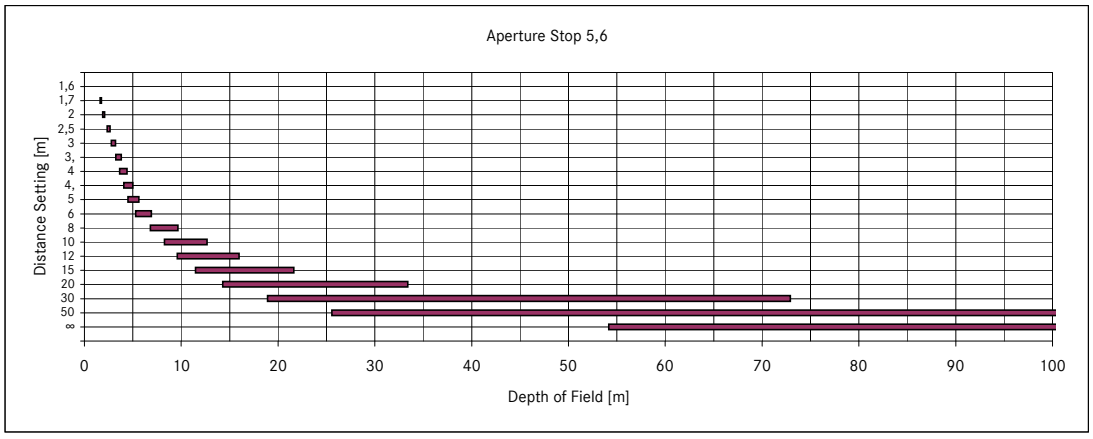

Aperture Stop 22
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

Depth of field table 100 mm

Distance Setting [m]	Aperture Stop 2,8	4	5,6	8	11	16	22	Magnification
1,6	1,565 - 1,637	1,552 - 1,652	1,533 - 1,674	1,506 - 1,708	1,474 - 1,752	1,424 - 1,833	1,368 - 1,940	1/19,1
1,7	1,660 - 1,742	1,646 - 1,758	1,625 - 1,783	1,595 - 1,821	1,560 - 1,871	1,504 - 1,962	1,442 - 2,085	1/20,3
2	1,947 - 2,057	1,927 - 2,079	1,900 - 2,113	1,860 - 2,165	1,812 - 2,235	1,739 - 2,362	1,659 - 2,537	1/23,6
2,5	2,420 - 2,586	2,391 - 2,620	2,350 - 2,672	2,291 - 2,753	2,222 - 2,863	2,116 - 3,068	2,003 - 3,358	1/29,1
3	2,889 - 3,121	2,848 - 3,170	2,792 - 3,243	2,712 - 3,361	2,618 - 3,520	2,476 - 3,825	2,326 - 4,271	1/34,4
3,5	3,353 - 3,661	3,300 - 3,727	3,226 - 3,827	3,122 - 3,987	3,001 - 4,208	2,820 - 4,639	2,631 - 5,294	1/39,7
4	3,812 - 4,208	3,745 - 4,293	3,653 - 4,423	3,522 - 4,634	3,372 - 4,929	3,149 - 5,517	2,919 - 6,445	1/45,0
4,5	4,268 - 4,760	4,185 - 4,868	4,072 - 5,032	3,913 - 5,302	3,731 - 5,685	3,465 - 6,465	3,193 - 7,750	1/50,3
5	4,719 - 5,318	4,620 - 5,451	4,484 - 5,655	4,295 - 5,993	4,080 - 6,478	3,768 - 7,493	3,452 - 9,241	1/55,5
6	5,609 - 6,451	5,473 - 6,643	5,287 - 6,941	5,032 - 7,444	4,746 - 8,186	4,338 - 9,827	3,934 - 12,96	1/65,8
8	7,341 - 8,792	7,117 - 9,138	6,817 - 9,691	6,412 - 10,66	5,970 - 12,19	5,357 - 16,03	4,771 - 25,88	1/86,4
10	9,012 - 11,23	8,685 - 11,79	8,252 - 12,71	7,679 - 14,38	7,067 - 17,22	6,241 - 25,72	5,476 - 63,55	1/107
12	10,63 - 13,79	10,18 - 14,62	9,602 - 16,02	8,847 - 18,72	8,057 - 23,72	7,016 - 42,91	6,079 - 1751	1/127
15	12,95 - 17,83	12,31 - 19,22	11,48 - 21,67	10,44 - 26,79	9,374 - 38,06	8,016 - 128,3	6,834 - ∞	1/157
20	16,57 - 25,23	15,55 - 28,04	14,29 - 33,43	12,73 - 47,00	11,21 - 95,64	9,356 - ∞	7,811 - ∞	1/208
30	23,02 - 43,10	21,14 - 51,75	18,91 - 72,95	16,34 - 189,7	13,96 - ∞	11,25 - ∞	9,125 - ∞	1/308
50	33,44 - 99,26	29,69 - 159,3	25,55 - 1288	21,13 - ∞	17,39 - ∞	13,43 - ∞	10,56 - ∞	1/509
∞	104,7 - ∞	75,79 - ∞	54,17 - ∞	37,95 - ∞	27,63 - ∞	19,03 - ∞	13,87 - ∞	1/∞






Aperture Stop 5,6
Distance Setting [m]
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1,7
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2,5
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80
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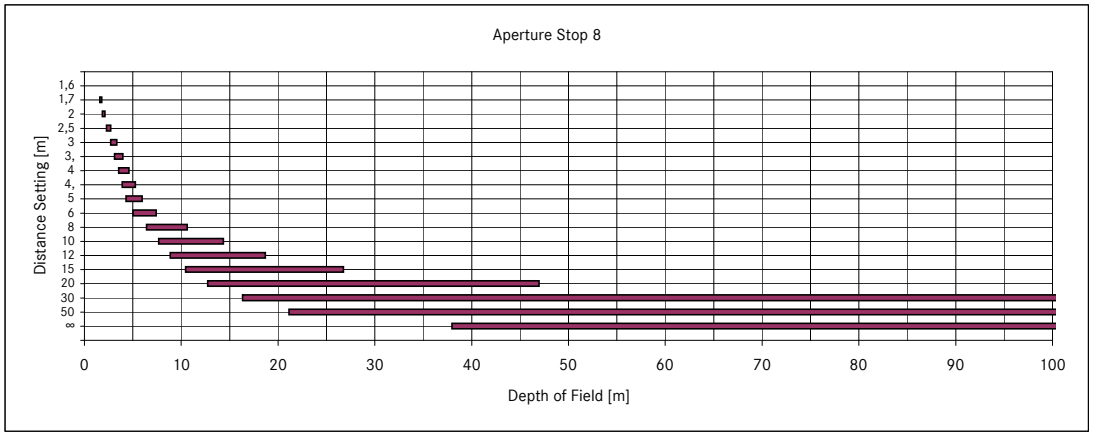
100
Depth of Field [m]


Aperture Stop 8
Distance Setting [m]
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2,5
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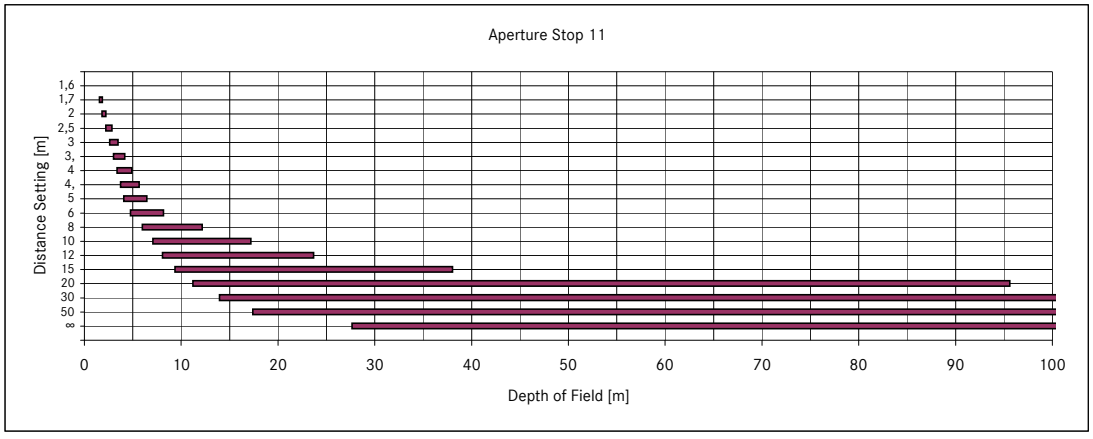
100
Depth of Field [m]


Aperture Stop 11
Distance Setting [m]
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2,5
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3,
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4,
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∞
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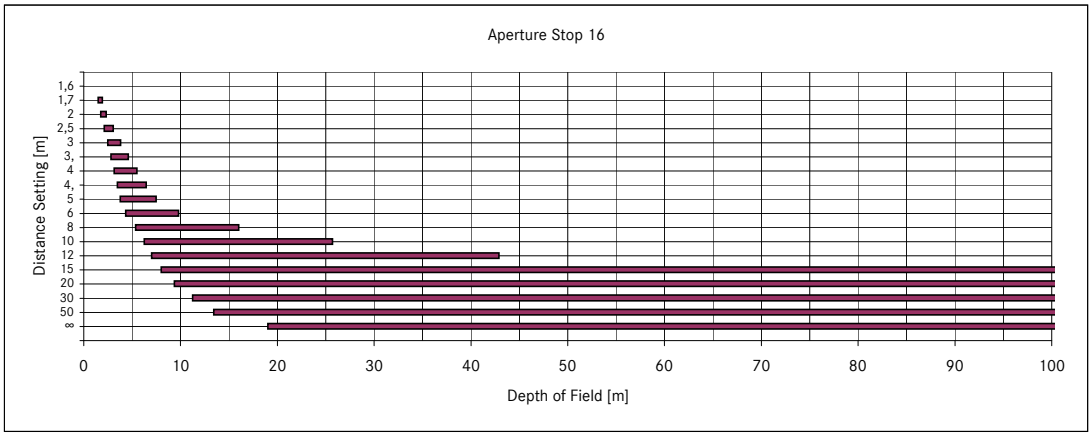
70
80
90
100
Depth of Field [m]


Aperture Stop 16
Distance Setting [m]
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1,7
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2,5
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3,
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4,
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∞
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10
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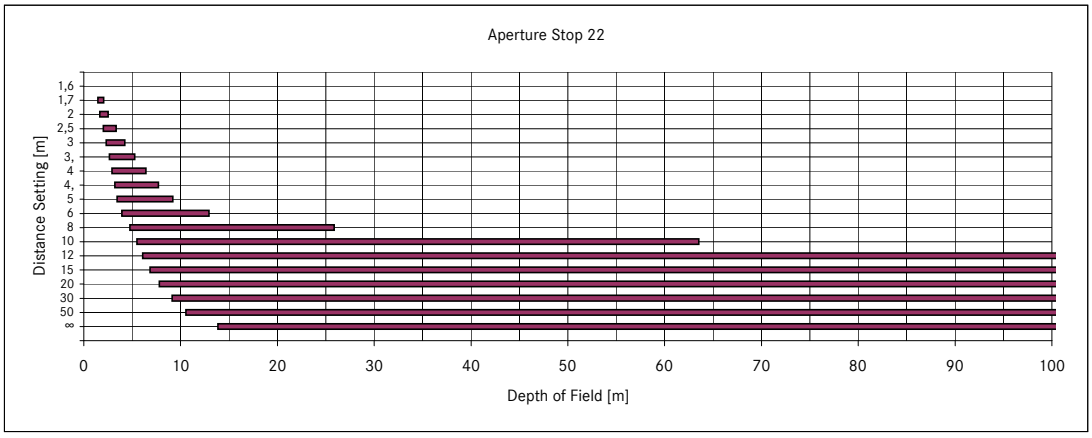
70
80
90
100
Depth of Field [m]


Aperture Stop 22
Distance Setting [m]
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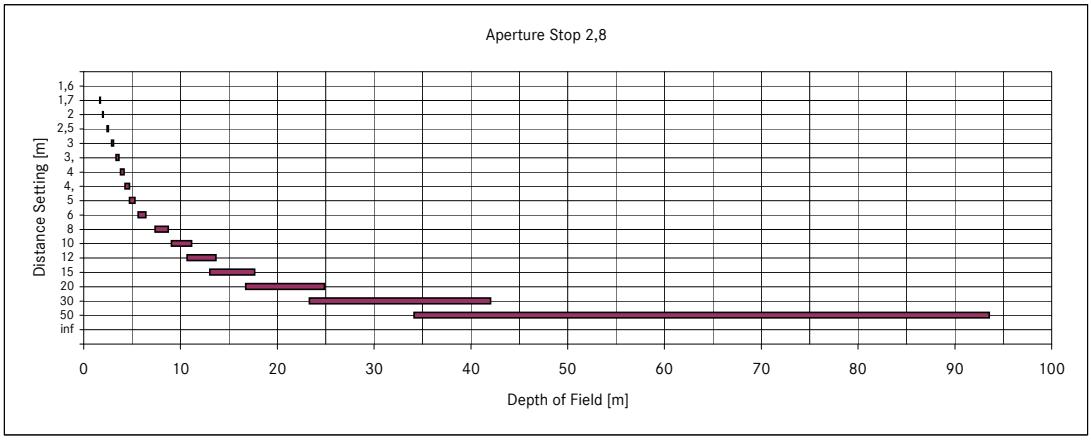
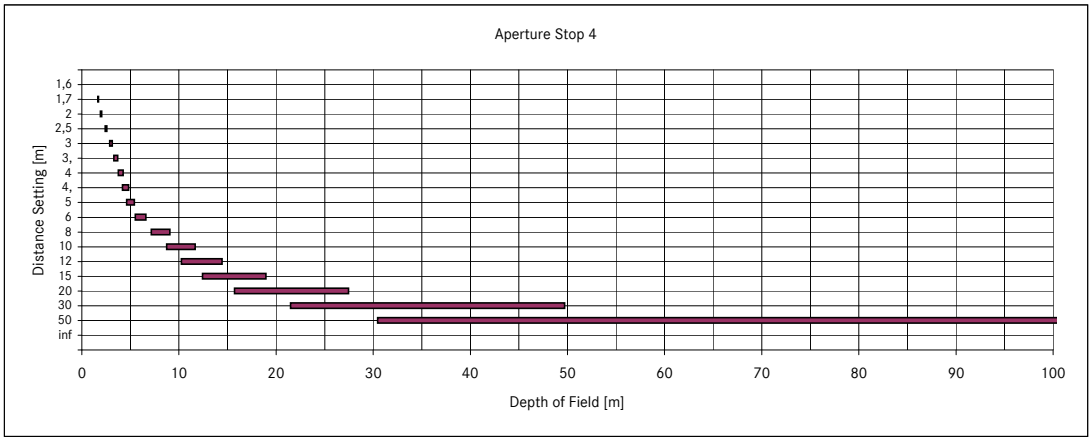
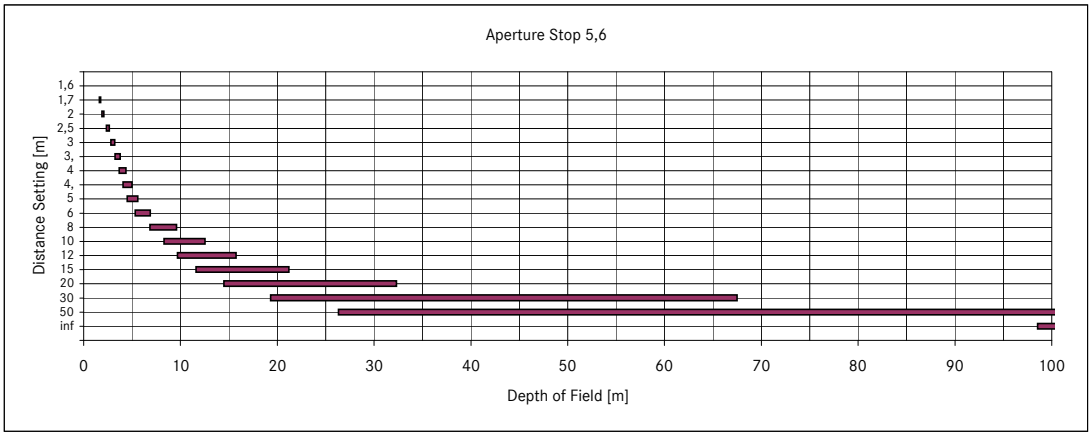
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

Depth of field table 135 mm

Distance Setting [m]	Aperture Stop 2,8	4	5,6	8	11	16	22	Magnification
1,6	1,565 - 1,637	1,552 - 1,651	1,534 - 1,673	1,507 - 1,706	1,476 - 1,750	1,426 - 1,828	1,371 - 1,934	1/19,0
1,7	1,661 - 1,741	1,647 - 1,757	1,626 - 1,781	1,597 - 1,819	1,562 - 1,868	1,506 - 1,957	1,446 - 2,077	1/20,1
2	1,948 - 2,055	1,928 - 2,078	1,901 - 2,110	1,862 - 2,162	1,815 - 2,230	1,743 - 2,355	1,664 - 2,525	1/23,4
2,5	2,422 - 2,584	2,393 - 2,618	2,353 - 2,668	2,295 - 2,748	2,227 - 2,854	2,123 - 3,053	2,011 - 3,333	1/28,7
3	2,891 - 3,118	2,852 - 3,165	2,796 - 3,237	2,718 - 3,351	2,626 - 3,506	2,486 - 3,800	2,338 - 4,229	1/34,0
3,5	3,356 - 3,657	3,305 - 3,721	3,233 - 3,818	3,130 - 3,973	3,012 - 4,187	2,834 - 4,601	2,647 - 5,225	1/39,2
4	3,817 - 4,202	3,752 - 4,285	3,661 - 4,411	3,534 - 4,614	3,386 - 4,898	3,167 - 5,460	2,941 - 6,338	1/44,4
4,5	4,274 - 4,752	4,194 - 4,856	4,083 - 5,015	3,928 - 5,275	3,750 - 5,642	3,488 - 6,384	3,219 - 7,589	1/49,5
5	4,727 - 5,308	4,630 - 5,436	4,498 - 5,632	4,313 - 5,957	4,103 - 6,420	3,796 - 7,380	3,484 - 9,004	1/54,6
6	5,621 - 6,435	5,488 - 6,619	5,308 - 6,905	5,059 - 7,384	4,779 - 8,088	4,377 - 9,621	3,978 - 12,47	1/64,7
8	7,363 - 8,759	7,146 - 9,090	6,854 - 9,615	6,460 - 10,53	6,026 - 11,95	5,423 - 15,45	4,843 - 23,85	1/84,7
10	9,049 - 11,18	8,732 - 11,71	8,311 - 12,57	7,752 - 14,12	7,152 - 16,72	6,337 - 24,15	5,578 - 52,00	1/105
12	10,68 - 13,70	10,25 - 14,48	9,686 - 15,79	8,949 - 18,27	8,173 - 22,75	7,144 - 38,54	6,210 - 236,4	1/124
15	13,03 - 17,68	12,41 - 18,97	11,61 - 21,23	10,59 - 25,83	9,540 - 35,49	8,193 - 94,57	7,010 - ∞	1/154
20	16,72 - 24,90	15,73 - 27,48	14,50 - 32,33	12,97 - 43,97	11,47 - 80,14	9,613 - ∞	8,057 - ∞	1/202
30	23,32 - 42,07	21,50 - 49,73	19,31 - 67,53	16,76 - 146,1	14,39 - ∞	11,65 - ∞	9,488 - ∞	1/300
50	34,13 - 93,60	30,44 - 140,5	26,33 - 511,8	21,90 - ∞	18,10 - ∞	14,05 - ∞	11,08 - ∞	1/493
inf	190,7 - ∞	138,0 - ∞	98,56 - ∞	69,02 - ∞	50,21 - ∞	34,54 - ∞	25,14 - ∞	1/∞






Aperture Stop 5,6
Distance Setting [m]
1,6
1,7
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inf
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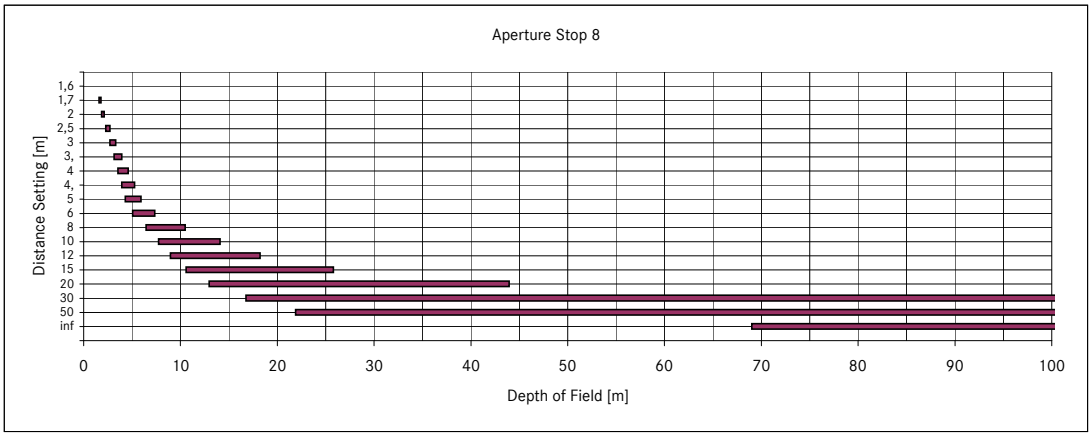
100
Depth of Field [m]


Aperture Stop 8
Distance Setting [m]
1,6
1,7
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2,5
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4,
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inf
0
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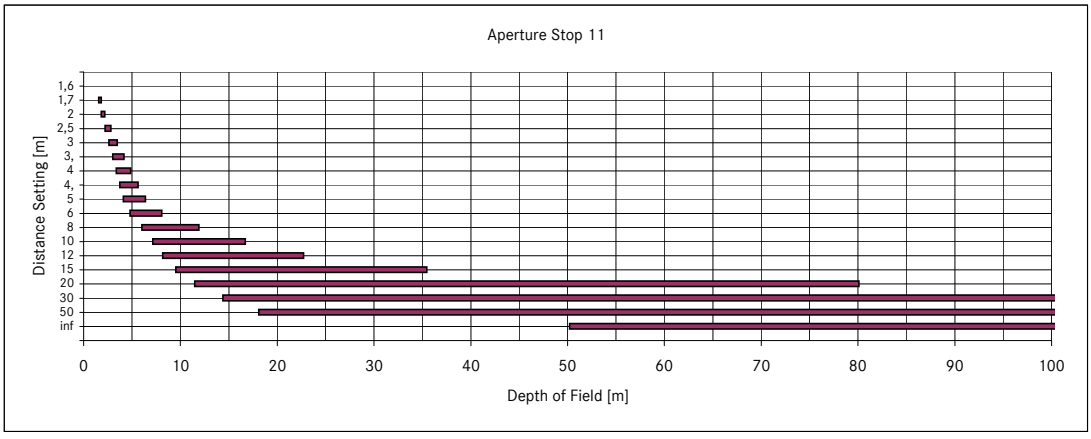
80
90
100
Depth of Field [m]


Aperture Stop 11
Distance Setting [m]
1,6
1,7
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2,5
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4,
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12
15
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inf
0
10
20
30
40
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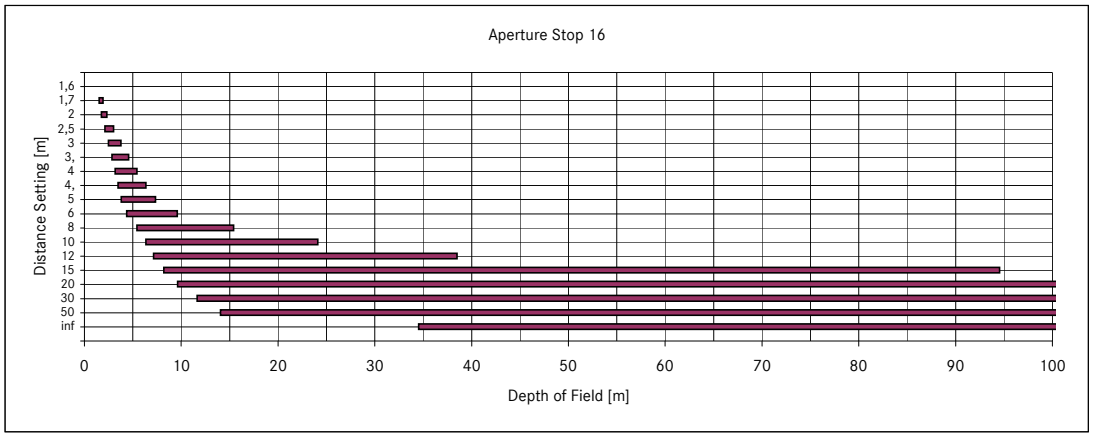
60
70
80
90
100
Depth of Field [m]


Aperture Stop 16
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
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4,
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8
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12
15
20
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50
inf
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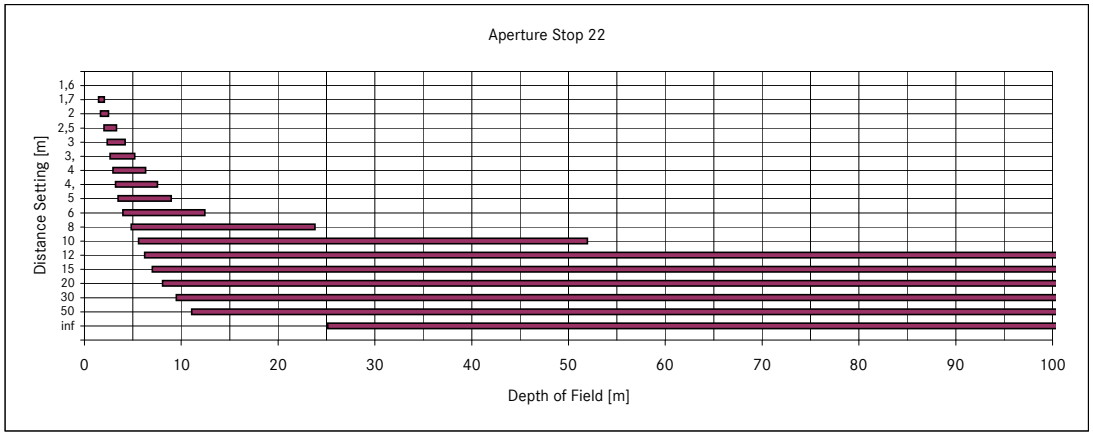
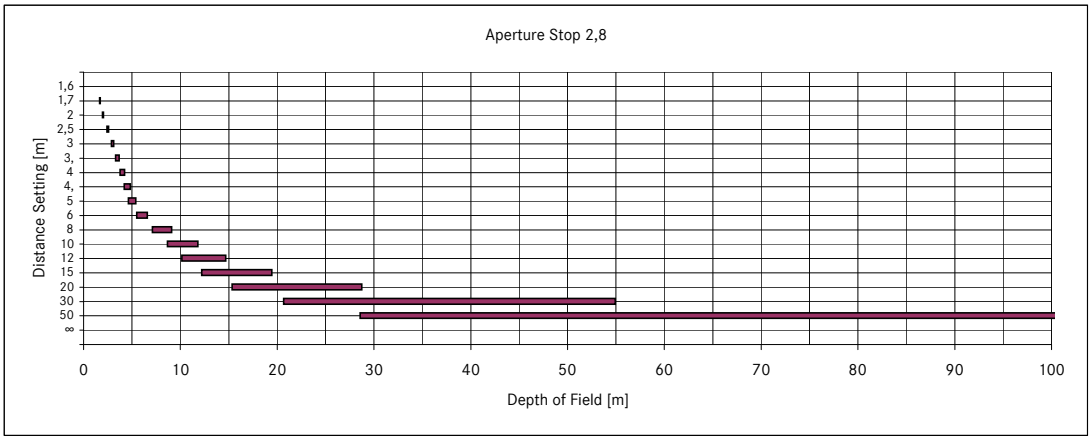
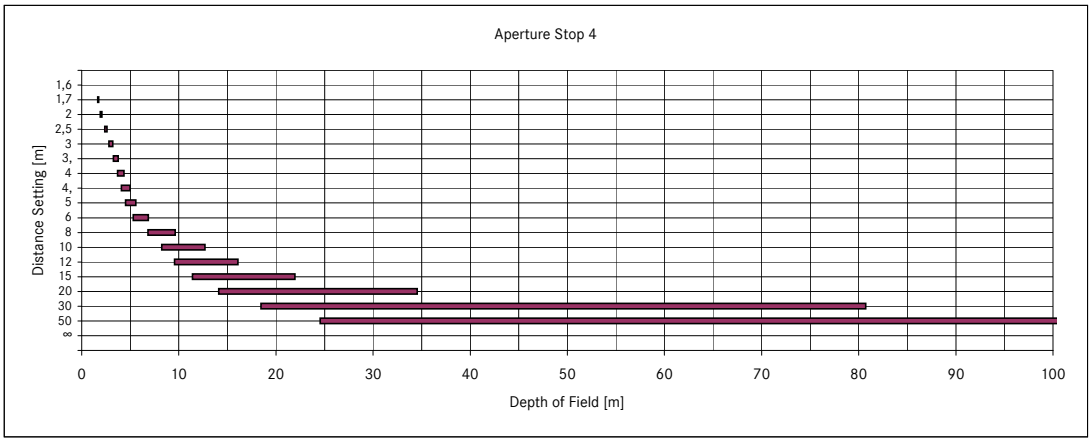
70
80
90
100
Depth of Field [m]

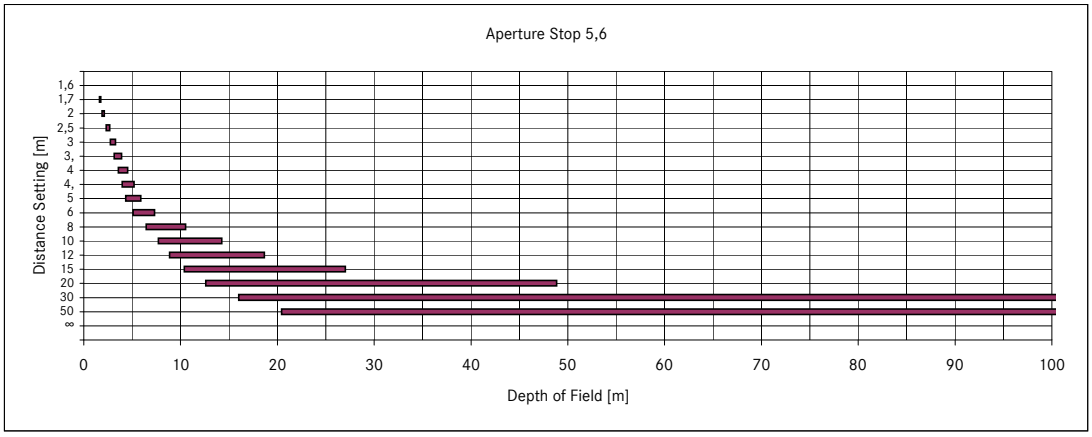

Aperture Stop 22
Distance Setting [m]
1,6
1,7
2
2,5
3
3,
4
4,
5
6
8
10
12
15
20
30
50
inf
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]

Depth of field table 180 mm

Distance Setting [m]	Aperture Stop 2,8	4	5,6	8	11	16	22	Magnification
1,6	1,558 - 1,644	1,543 - 1,662	1,522 - 1,688	1,491 - 1,729	1,454 - 1,784	1,397 - 1,883	1,334 - 2,021	1/20,8
1,7	1,653 - 1,750	1,636 - 1,770	1,612 - 1,799	1,577 - 1,846	1,536 - 1,908	1,473 - 2,023	1,404 - 2,181	1/22,1
2	1,936 - 2,069	1,913 - 2,097	1,880 - 2,138	1,833 - 2,204	1,778 - 2,292	1,694 - 2,458	1,604 - 2,694	1/26,0
2,5	2,402 - 2,607	2,366 - 2,651	2,317 - 2,717	2,247 - 2,823	2,166 - 2,968	2,043 - 3,248	1,915 - 3,668	1/32,4
3	2,861 - 3,154	2,811 - 3,218	2,742 - 3,314	2,646 - 3,471	2,535 - 3,691	2,370 - 4,130	2,200 - 4,825	1/38,8
3,5	3,313 - 3,710	3,248 - 3,797	3,157 - 3,932	3,030 - 4,153	2,887 - 4,468	2,676 - 5,121	2,463 - 6,223	1/45,1
4	3,760 - 4,274	3,676 - 4,390	3,561 - 4,569	3,402 - 4,868	3,223 - 5,304	2,964 - 6,242	2,706 - 7,944	1/51,4
4,5	4,200 - 4,848	4,096 - 4,997	3,954 - 5,229	3,760 - 5,621	3,544 - 6,207	3,235 - 7,521	2,932 - 10,12	1/57,7
5	4,634 - 5,431	4,508 - 5,617	4,338 - 5,911	4,106 - 6,415	3,851 - 7,184	3,491 - 8,994	3,142 - 12,94	1/64,0
6	5,484 - 6,626	5,310 - 6,903	5,077 - 7,348	4,765 - 8,136	4,427 - 9,402	3,961 - 12,73	3,520 - 22,25	1/76,6
8	7,117 - 9,139	6,829 - 9,668	6,453 - 10,55	5,962 - 12,24	5,447 - 15,30	4,764 - 26,38	4,146 - 214,6	1/102
10	8,665 - 11,83	8,246 - 12,72	7,707 - 14,29	7,022 - 17,53	6,322 - 24,51	5,426 - 73,83	4,643 - ∞	1/127
12	10,14 - 14,72	9,569 - 16,12	8,855 - 18,70	7,966 - 24,63	7,080 - 40,93	5,980 - ∞	5,046 - ∞	1/152
15	12,21 - 19,47	11,40 - 21,99	10,40 - 27,05	9,203 - 41,39	8,047 - 123,7	6,661 - ∞	5,528 - ∞	1/189
20	15,35 - 28,76	14,10 - 34,57	12,61 - 48,87	10,90 - 129,4	9,320 - ∞	7,518 - ∞	6,111 - ∞	1/252
30	20,66 - 54,96	18,46 - 80,75	16,01 - 252,1	13,36 - ∞	11,07 - ∞	8,629 - ∞	6,833 - ∞	1/377
50	28,57 - 202,7	24,55 - ∞	20,42 - ∞	16,31 - ∞	13,04 - ∞	9,788 - ∞	7,548 - ∞	1/627
∞	333,1 - ∞	240,9 - ∞	172,1 - ∞	120,5 - ∞	87,62 - ∞	60,25 - ∞	43,83 - ∞	1/∞






Aperture Stop 5,6
Distance Setting [m]
1,6
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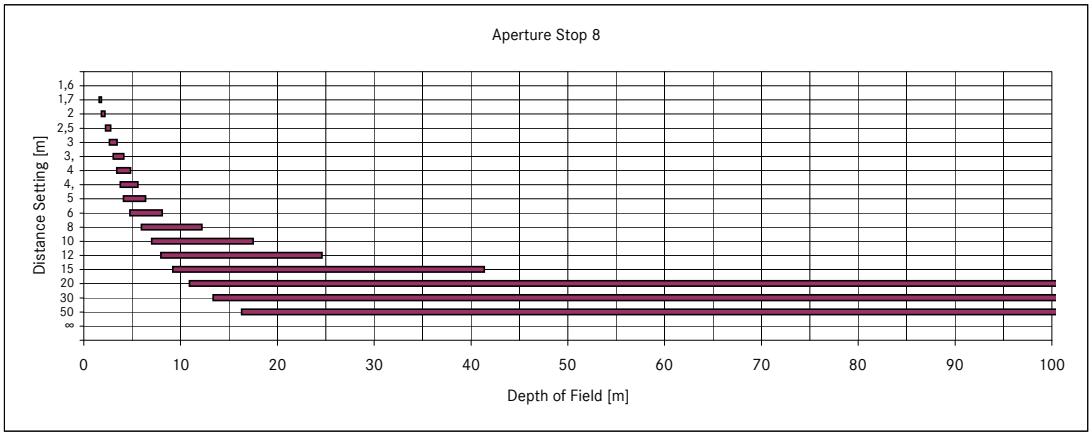
90
100
Depth of Field [m]


Aperture Stop 8
Distance Setting [m]
1,6
1,7
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2,5
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4,
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∞
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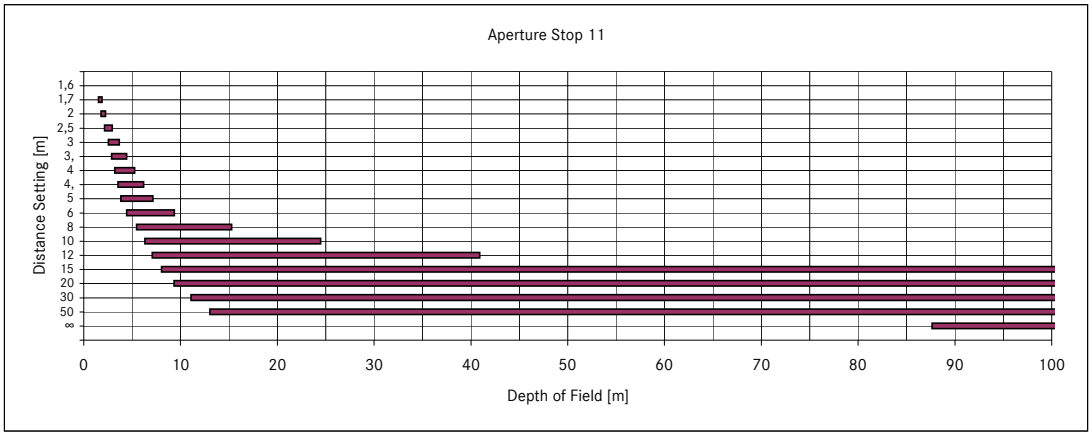
100
Depth of Field [m]


Aperture Stop 11
Distance Setting [m]
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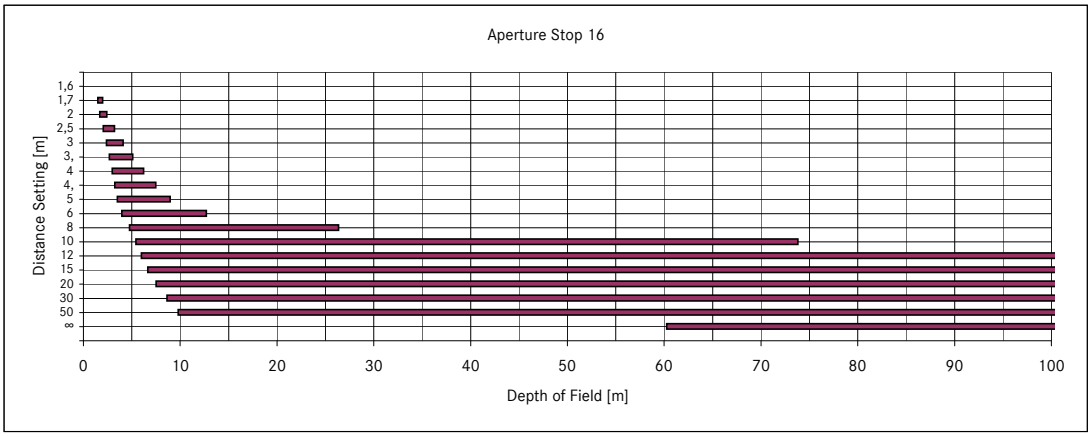
100
Depth of Field [m]


Aperture Stop 16
Distance Setting [m]
1,6
1,7
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2,5
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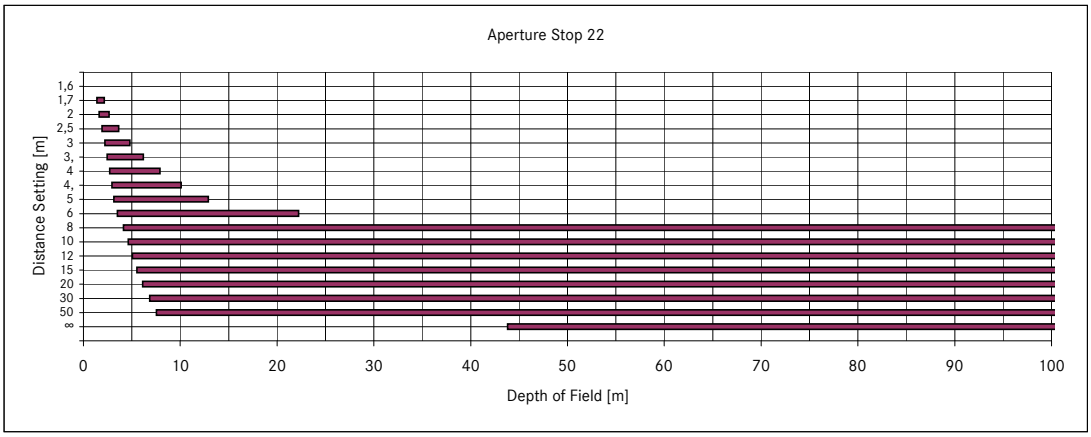
100
Depth of Field [m]


Aperture Stop 22
Distance Setting [m]
1,6
1,7
2
2,5
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3,
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4,
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∞
0
10
20
30
40
50
60
70
80
90
100
Depth of Field [m]