

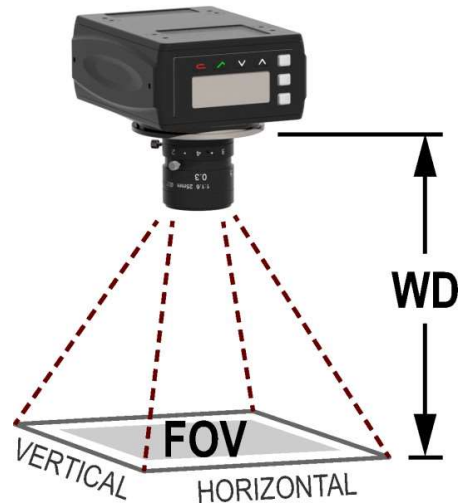
2MP Lens Charts

This paper offers information useful for selecting a C-mount lens for the VE Series 2MP smart camera.

Working Distance and Field of View

The two main variables involved when discussing a camera's lens choice are the **Working Distance** and the **Field of View** size. The Working Distance, or WD, is the distance from the camera to the target object. In the case of this collection of lens charts, the Working Distance is measured from the front surface of the threaded lens cover mount. The distance is not measured from the end of the lens because different lenses from different manufacturers, even with the same focal length, can vary in length.

The Field of View, or FOV, is the real world size of the picture the camera takes. This can also be broken down into a horizontal FOV size and a vertical FOV size. Note that the picture taken by a VE Series vision sensor is not square. The imager used in the 2MP VE sensor is 1600 x 1200 pixels, making a rectangular image where the vertical FOV is $\frac{3}{4}$ the size of the horizontal FOV.



The Working Distance and Field of View sizes are related by linear equations determined by the focal length of the lens. Choosing the correct lens for a given application might be a matter of selecting the desired size of the FOV, then seeing which of the options for focal length result in a good fit for camera Working Distance. The situation might also be reversed, where the desired mounting location of the camera is known (and thus the Working Distance is fixed) and the various focal length lenses give a range of FOV sizes to choose from. In all cases, only one of these two variables may be freely selected. The second variable then becomes a function of the first. This is the reason why we offer a broad range of lens focal lengths—to provide as many options as possible to suit different WD/FOV size requirements.

Multiple Manufacturers and Format Size

Banner does not manufacture any C-mount lenses used by our vision sensors. Instead we offer a range of lenses from different suppliers. Any C-mount lens will technically work in a VE Series vision sensor, but some lenses are better suited than others. Banner recommends using at least 2/3-inch format, or “megapixel”-rated, lenses. A lens of at least this format size ensures that the entire VE Series imager chip is used when taking pictures. These lenses are also better at resolving small features in the picture, allowing an inspection to make better use of the camera's resolution.

The lens charts which follow are divided into groups based on lens manufacturer.

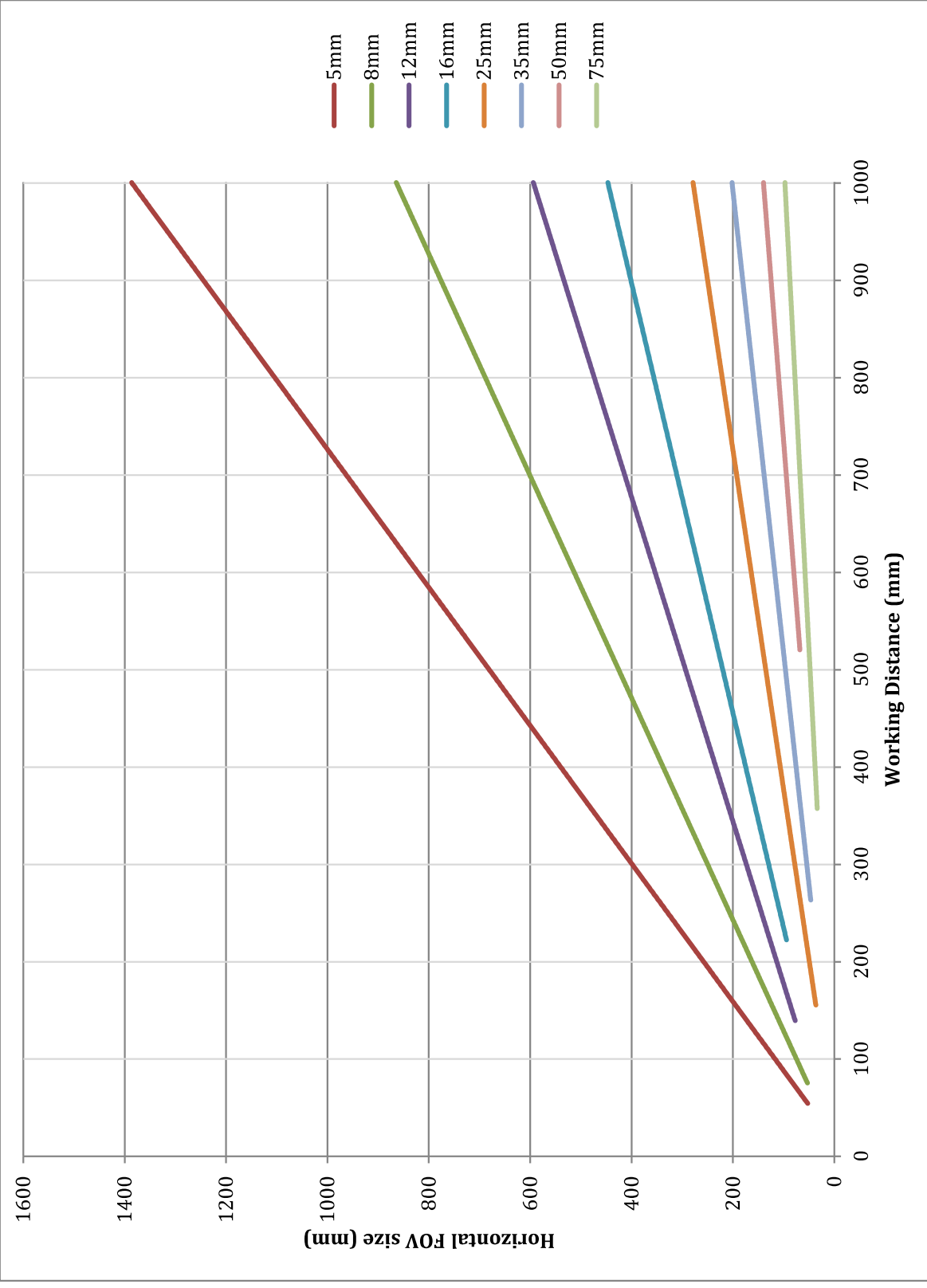
Imager Resolution: 1600 px (H) × 1200 px (V)
Pixel Size: 4.5 μm × 4.5 μm
Image Size: 7.2 mm (H) × 5.4 mm (V), 9 mm (diagonal)

Off the Charts

In the pages that follow, graphical views of the Working Distance versus Horizontal FOV relationships are shown, out to a maximum working distance of 1 meter. These graphs offer a quick and easy way to estimate the FOV size for a given Working Distance and lens focal length. Also provided are two tables with entries out to 1.5 meters. The first shows FOV size as a function of Working Distance and the second shows Working Distance as a function of FOV size. The mathematical equations that describe the relationship between these two variables are also provided, allowing for calculations beyond what the chart and tables offer.

Each lens has a natural minimum Working Distance. If a camera using this lens were to move closer to the target than this minimum distance, the image would be out of focus and the lens alone would not be able to fix it. This is where extension tubes and shims are used. Extension tubes allow a lens to come into focus at a Working Distance closer than the minimum. The relationship between Working Distance and FOV size remains in effect as extension tubes are added, and so extension tubes are usually used to generate very small FOVs. A microscope is basically a high focal length lens with a large amount of extension tubes applied.

Computar C-mount Lenses on 2 MP VE Series



Computer C-mount Lenses on 2 MP VE Series, FOV as a function of WD Chart

WD (mm)	FOV (mm)							
	5mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm
Minimum	53 x 40 @ 54mm	53 x 40 @ 75mm	77 x 58 @ 139mm	94 x 71 @ 222mm	37 x 28 @ 155mm	47 x 35 @ 263mm	68 x 51 @ 520mm	34 x 26 @ 357mm
20								
40								
60	61 x 46							
80	89 x 67	58 x 43						
100	118 x 88	75 x 56						
120	146 x 109	93 x 69						
140	174 x 130	110 x 83	78 x 58					
160	202 x 152	128 x 96	90 x 67		38 x 28			
180	230 x 173	145 x 109	102 x 76		44 x 33			
200	259 x 194	163 x 122	114 x 85		49 x 37			
220	287 x 215	180 x 135	126 x 94		55 x 41			
240	315 x 236	198 x 148	138 x 103	103 x 77	61 x 46			
260	343 x 257	215 x 162	150 x 112	112 x 84	67 x 50			
280	371 x 278	233 x 175	162 x 121	121 x 91	72 x 54	51 x 38		
300	400 x 300	250 x 188	174 x 130	130 x 97	78 x 59	55 x 41		
320	428 x 321	268 x 201	186 x 139	139 x 104	84 x 63	59 x 44		
340	456 x 342	286 x 214	198 x 148	148 x 111	90 x 67	63 x 47		
360	484 x 363	303 x 227	210 x 157	157 x 118	95 x 71	68 x 51		34 x 26
380	512 x 384	321 x 240	222 x 166	166 x 124	101 x 76	72 x 54		36 x 27
400	540 x 405	338 x 254	234 x 175	175 x 131	107 x 80	76 x 57		38 x 29
420	569 x 427	356 x 267	246 x 184	184 x 138	113 x 84	80 x 60		40 x 30
440	597 x 448	373 x 280	258 x 193	193 x 145	118 x 89	84 x 63		42 x 31
460	625 x 469	391 x 293	270 x 202	202 x 152	124 x 93	89 x 66		44 x 33
480	653 x 490	408 x 306	282 x 211	211 x 158	130 x 97	93 x 70		46 x 34
500	681 x 511	426 x 319	294 x 220	220 x 165	135 x 102	97 x 73		48 x 36
520	710 x 532	443 x 333	306 x 229	229 x 172	141 x 106	101 x 76	68 x 51	50 x 37
540	738 x 553	461 x 346	318 x 238	238 x 179	147 x 110	105 x 79	71 x 53	52 x 39
560	766 x 575	478 x 359	330 x 247	248 x 186	153 x 114	110 x 82	74 x 55	54 x 40
580	794 x 596	496 x 372	342 x 256	257 x 192	158 x 119	114 x 85	77 x 58	56 x 42
600	822 x 617	514 x 385	354 x 265	266 x 199	164 x 123	118 x 89	80 x 60	58 x 43
620	851 x 638	531 x 398	366 x 274	275 x 206	170 x 127	122 x 92	83 x 62	60 x 45
640	879 x 659	549 x 411	378 x 283	284 x 213	176 x 132	126 x 95	86 x 64	62 x 46
660	907 x 680	566 x 425	390 x 292	293 x 220	181 x 136	131 x 98	89 x 67	64 x 48
680	935 x 701	584 x 438	402 x 301	302 x 226	187 x 140	135 x 101	92 x 69	66 x 49
700	963 x 723	601 x 451	414 x 310	311 x 233	193 x 145	139 x 104	95 x 71	68 x 51
720	992 x 744	619 x 464	426 x 319	320 x 240	199 x 149	143 x 107	98 x 73	70 x 52
740	1020 x 765	636 x 477	438 x 328	329 x 247	204 x 153	148 x 111	101 x 76	72 x 54
760	1048 x 786	654 x 490	450 x 337	338 x 254	210 x 158	152 x 114	104 x 78	74 x 55
780	1076 x 807	671 x 504	462 x 346	347 x 260	216 x 162	156 x 117	107 x 80	76 x 57
800	1104 x 828	689 x 517	474 x 355	356 x 267	221 x 166	160 x 120	110 x 82	78 x 58
820	1133 x 849	706 x 530	486 x 364	365 x 274	227 x 170	164 x 123	113 x 85	80 x 60
840	1161 x 871	724 x 543	498 x 373	374 x 281	233 x 175	169 x 126	116 x 87	82 x 61
860	1189 x 892	741 x 556	510 x 382	383 x 288	239 x 179	173 x 130	119 x 89	84 x 63
880	1217 x 913	759 x 569	522 x 391	392 x 294	244 x 183	177 x 133	122 x 91	86 x 64
900	1245 x 934	777 x 582	534 x 400	402 x 301	250 x 188	181 x 136	125 x 94	88 x 66
920	1274 x 955	794 x 596	546 x 409	411 x 308	256 x 192	185 x 139	128 x 96	90 x 67
940	1302 x 976	812 x 609	558 x 418	420 x 315	262 x 196	190 x 142	131 x 98	92 x 69
960	1330 x 997	829 x 622	570 x 427	429 x 322	267 x 201	194 x 145	134 x 100	94 x 70
980	1358 x 1019	847 x 635	582 x 436	438 x 328	273 x 205	198 x 149	137 x 103	96 x 72
1000	1386 x 1040	864 x 648	594 x 445	447 x 335	279 x 209	202 x 152	140 x 105	98 x 73
1020	1415 x 1061	882 x 661	606 x 454	456 x 342	285 x 213	207 x 155	143 x 107	100 x 75
1040	1443 x 1082	899 x 674	618 x 463	465 x 349	290 x 218	211 x 158	146 x 109	102 x 76
1060	1471 x 1103	917 x 688	630 x 472	474 x 356	296 x 222	215 x 161	149 x 112	104 x 78
1080	1499 x 1124	934 x 701	642 x 481	483 x 362	302 x 226	219 x 164	152 x 114	105 x 79
1100	1527 x 1146	952 x 714	654 x 490	492 x 369	307 x 231	223 x 168	155 x 116	107 x 81
1120	1556 x 1167	969 x 727	666 x 499	501 x 376	313 x 235	228 x 171	158 x 118	109 x 82
1140	1584 x 1188	987 x 740	678 x 508	510 x 383	319 x 239	232 x 174	161 x 121	111 x 84
1160	1612 x 1209	1005 x 753	690 x 517	519 x 389	325 x 244	236 x 177	164 x 123	113 x 85
1180	1640 x 1230	1022 x 767	702 x 526	528 x 396	330 x 248	240 x 180	167 x 125	115 x 87
1200	1668 x 1251	1040 x 780	714 x 535	537 x 403	336 x 252	244 x 183	170 x 127	117 x 88
1220	1697 x 1272	1057 x 793	726 x 544	547 x 410	342 x 256	249 x 186	173 x 130	119 x 90
1240	1725 x 1294	1075 x 806	738 x 553	556 x 417	348 x 261	253 x 190	176 x 132	121 x 91
1260	1753 x 1315	1092 x 819	750 x 562	565 x 423	353 x 265	257 x 193	179 x 134	123 x 93
1280	1781 x 1336	1110 x 832	762 x 571	574 x 430	359 x 269	261 x 196	182 x 136	125 x 94
1300	1809 x 1357	1127 x 845	774 x 580	583 x 437	365 x 274	265 x 199	185 x 139	127 x 95
1320	1837 x 1378	1145 x 859	786 x 589	592 x 444	371 x 278	270 x 202	188 x 141	129 x 97
1340	1866 x 1399	1162 x 872	798 x 598	601 x 451	376 x 282	274 x 205	191 x 143	131 x 98
1360	1894 x 1420	1180 x 885	810 x 607	610 x 457	382 x 287	278 x 209	194 x 145	133 x 100
1380	1922 x 1442	1197 x 898	822 x 616	619 x 464	388 x 291	282 x 212	197 x 148	135 x 101
1400	1950 x 1463	1215 x 911	834 x 625	628 x 471	393 x 295	287 x 215	200 x 150	137 x 103
1420	1978 x 1484	1232 x 924	846 x 634	637 x 478	399 x 299	291 x 218	203 x 152	139 x 104
1440	2007 x 1505	1250 x 938	858 x 643	646 x 485	405 x 304	295 x 221	206 x 154	141 x 106
1460	2035 x 1526	1268 x 951	870 x 652	655 x 491	411 x 308	299 x 224	209 x 157	143 x 107
1480	2063 x 1547	1285 x 964	882 x 661	664 x 498	416 x 312	303 x 228	212 x 159	145 x 109
1500	2091 x 1568	1303 x 977	894 x 670	673 x 505	422 x 317	308 x 231	215 x 161	147 x 110

Computar C-mount Lenses on 2 MP VE Series, WD as a function of FOV Chart

FOV (mm)		WD (mm)								
		5mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm	
Minimum		53 x 40 @ 54mm	53 x 40 @ 75mm	77 x 58 @ 139mm	94 x 71 @ 222mm	37 x 28 @ 155mm	47 x 35 @ 263mm	68 x 51 @ 520mm	34 x 26 @ 357mm	
20 x 15										
40 x 30						167			420	
60 x 45		59	83			237	324		621	
80 x 60		73	106	144		307	419	600	823	
100 x 75		88	128	177	234	376	514	734	1025	
120 x 90		102	151	210	278	446	609	868	1226	
140 x 105		116	174	244	323	516	704	1001	1428	
160 x 120		130	197	277	367	586	799	1135	1630	
180 x 135		144	220	310	411	655	894	1268	1831	
200 x 150		158	242	344	455	725	989	1402	2033	
220 x 165		173	265	377	499	795	1084	1535	2234	
240 x 180		187	288	410	543	865	1179	1669	2436	
260 x 195		201	311	444	588	934	1274	1802	2638	
280 x 210		215	334	477	632	1004	1369	1936	2839	
300 x 225		229	356	510	676	1074	1464	2069	3041	
320 x 240		244	379	544	720	1144	1559	2203	3242	
340 x 255		258	402	577	764	1213	1654	2336	3444	
360 x 270		272	425	610	808	1283	1749	2470	3646	
380 x 285		286	448	644	852	1353	1844	2603	3847	
400 x 300		300	471	677	897	1423	1939	2737	4049	
420 x 315		315	493	710	941	1492	2034	2870	4251	
440 x 330		329	516	744	985	1562	2129	3004	4452	
460 x 345		343	539	777	1029	1632	2224	3137	4654	
480 x 360		357	562	810	1073	1702	2319	3271	4855	
500 x 375		371	585	844	1117	1772	2414	3404	5057	
520 x 390		385	607	877	1161	1841	2509	3538	5259	
540 x 405		400	630	910	1206	1911	2604	3671	5460	
560 x 420		414	653	944	1250	1981	2699	3805	5662	
580 x 435		428	676	977	1294	2051	2793	3938	5863	
600 x 450		442	699	1010	1338	2120	2888	4072	6065	
620 x 465		456	721	1044	1382	2190	2983	4205	6267	
640 x 480		471	744	1077	1426	2260	3078	4339	6468	
660 x 495		485	767	1110	1471	2330	3173	4472	6670	
680 x 510		499	790	1144	1515	2399	3268	4606	6871	
700 x 525		513	813	1177	1559	2469	3363	4739	7073	
720 x 540		527	835	1210	1603	2539	3458	4873	7275	
740 x 555		542	858	1244	1647	2609	3553	5006	7476	
760 x 570		556	881	1277	1691	2678	3648	5140	7678	
780 x 585		570	904	1310	1735	2748	3743	5273	7880	
800 x 600		584	927	1344	1780	2818	3838	5407	8081	
820 x 615		598	950	1377	1824	2888	3933	5540	8283	
840 x 630		612	972	1410	1868	2957	4028	5674	8484	
860 x 645		627	995	1444	1912	3027	4123	5807	8686	
880 x 660		641	1018	1477	1956	3097	4218	5941	8888	
900 x 675		655	1041	1510	2000	3167	4313	6074	9089	
920 x 690		669	1064	1544	2044	3236	4408	6208	9291	
940 x 705		683	1086	1577	2089	3306	4503	6341	9492	
960 x 720		698	1109	1610	2133	3376	4598	6475	9694	
980 x 735		712	1132	1644	2177	3446	4693	6609	9896	
1000 x 750		726	1155	1677	2221	3515	4788	6742	10097	
1020 x 765		740	1178	1710	2265	3585	4883	6876	10299	
1040 x 780		754	1200	1744	2309	3655	4978	7009	10501	
1060 x 795		769	1223	1777	2354	3725	5073	7143	10702	
1080 x 810		783	1246	1810	2398	3795	5168	7276	10904	
1100 x 825		797	1269	1844	2442	3864	5263	7410	11105	
1120 x 840		811	1292	1877	2486	3934	5358	7543	11307	
1140 x 855		825	1315	1910	2530	4004	5453	7677	11509	
1160 x 870		839	1337	1944	2574	4074	5548	7810	11710	
1180 x 885		854	1360	1977	2618	4143	5642	7944	11912	
1200 x 900		868	1383	2010	2663	4213	5737	8077	12113	
1220 x 915		882	1406	2044	2707	4283	5832	8211	12315	
1240 x 930		896	1429	2077	2751	4353	5927	8344	12517	
1260 x 945		910	1451	2111	2795	4422	6022	8478	12718	
1280 x 960		925	1474	2144	2839	4492	6117	8611	12920	
1300 x 975		939	1497	2177	2883	4562	6212	8745	13121	
1320 x 990		953	1520	2211	2927	4632	6307	8878	13323	
1340 x 1005		967	1543	2244	2972	4701	6402	9012	13525	
1360 x 1020		981	1565	2277	3016	4771	6497	9145	13726	
1380 x 1035		995	1588	2311	3060	4841	6592	9279	13928	
1400 x 1050		1010	1611	2344	3104	4911	6687	9412	14130	
1420 x 1065		1024	1634	2377	3148	4980	6782	9546	14331	
1440 x 1080		1038	1657	2411	3192	5050	6877	9679	14533	
1460 x 1095		1052	1679	2444	3237	5120	6972	9813	14734	
1480 x 1110		1066	1702	2477	3281	5190	7067	9946	14936	
1500 x 1125		1081	1725	2511	3325	5259	7162	10080	15138	

Computar Lens equations for VE Series 2 MP

H = horizontal FOV size, W = working distance



5 mm Megapixel lens

Banner model: LCF05LCMP (p/n 11381)

Computar model: H0514-MP

1/2-inch format, 43 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 1.41 \times W - 23.44 \text{ (minimum } W \sim 54 \text{ mm)}$$

W(H), mm

$$W = (H + 23.44)/1.41 \text{ (minimum } H \sim 53 \text{ mm)}$$



8 mm Megapixel lens

Banner model: LCF08LMP (p/n 74300)

Computar model: M0814-MP2

2/3-inch format, 30.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.88 \times W - 12.56 \text{ (minimum } W \sim 75 \text{ mm)}$$

W(H), mm

$$W = (H + 12.56)/0.88 \text{ (minimum } H \sim 53 \text{ mm)}$$



12 mm Megapixel lens

Banner model: LCF12LMP (p/n 74299)

Computar model: M1214-MP2

2/3-inch format, 30.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.5999 \times W - 6.0915 \text{ (minimum } W \sim 139 \text{ mm)}$$

W(H), mm

$$W = (H + 6.0915)/0.5999 \text{ (minimum } H \sim 77 \text{ mm)}$$



16 mm Megapixel lens

Banner model: LCF16LCMP (p/n 11382)

Computar model: M1614-MP2

2/3-inch format, 30.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.453 \times W - 6.1525 \text{ (minimum } W \sim 222 \text{ mm)}$$

W(H), mm

$$W = (H + 6.1525)/0.453 \text{ (minimum } H \sim 94 \text{ mm)}$$



25 mm Megapixel lens

Banner model: LCF25LCMP (p/n 11383)

Computer model: M2514-MP2

2/3-inch format, 30.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.2867 \times W - 7.8892 \text{ (minimum } W \sim 155 \text{ mm)}$$

W(H), mm

$$W = (H + 7.8892)/0.2867 \text{ (minimum } H \sim 37 \text{ mm)}$$



35 mm Megapixel lens

Banner model: LCF35LCMP (p/n 11384)

Computer model: M3514-MP

2/3-inch format, 30.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.2106 \times W - 8.3086 \text{ (minimum } W \sim 263 \text{ mm)}$$

W(H), mm

$$W = (H + 8.3086)/0.2106 \text{ (minimum } H \sim 47 \text{ mm)}$$



50 mm Megapixel lens

Banner model: LCF50LCMP (p/n 11385)

Computer model: M5018-MP2

2/3-inch format, 30.5 mm filter, minimum f/1.8, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.1498 \times W - 9.9533 \text{ (minimum } W \sim 520 \text{ mm)}$$

W(H), mm

$$W = (H + 9.9533)/0.1498 \text{ (minimum } H \sim 68 \text{ mm)}$$



75 mm Megapixel lens

Banner model: LCF75LCMP (p/n 11386)

Computer model: M7528-MP

2/3-inch format, 30.5 mm filter, minimum f/2.8, does not fit with a sealed lens cover

H(W), mm

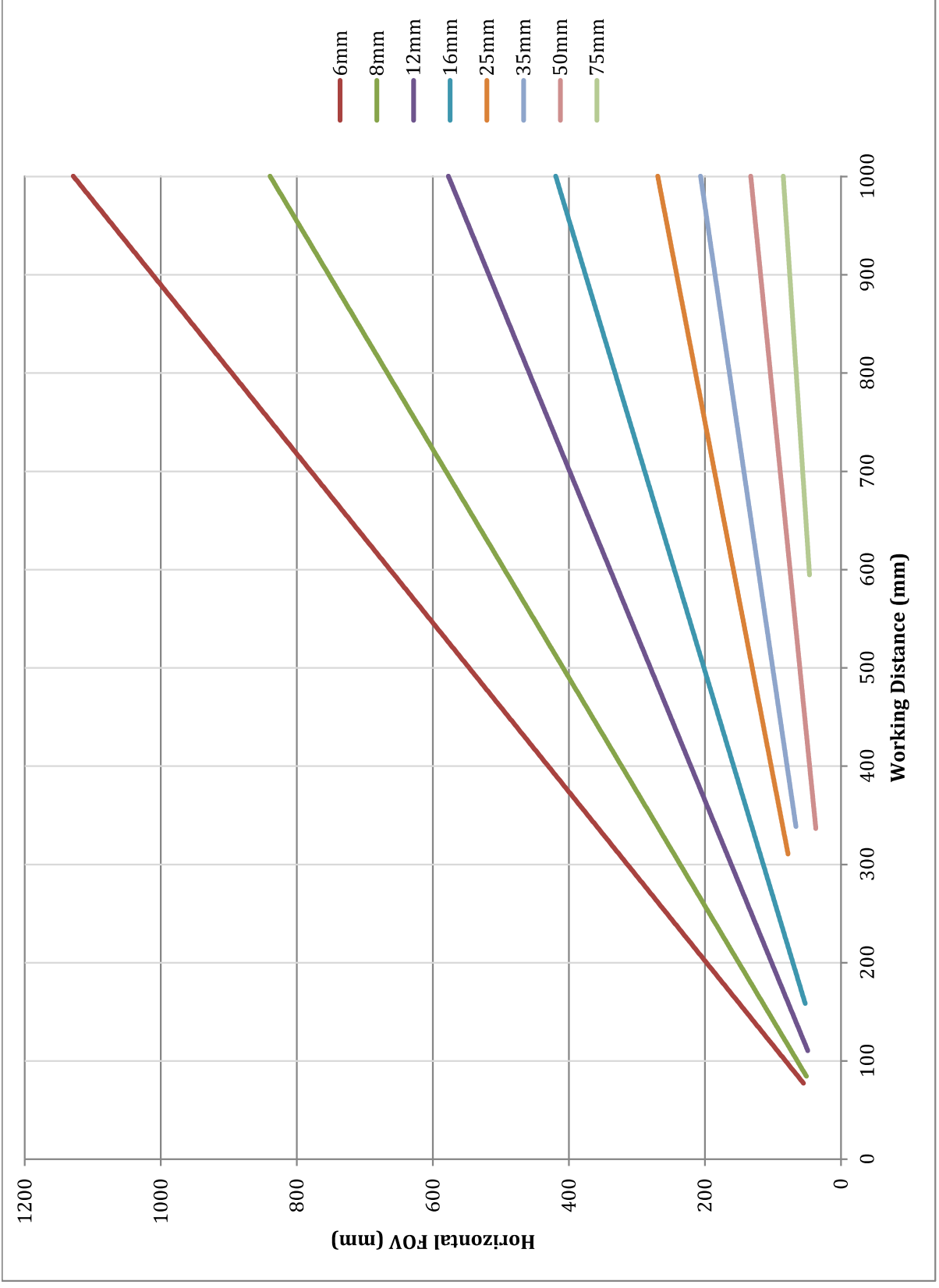
$$H = 0.0992 \times W - 1.6513 \text{ (minimum } W \sim 357 \text{ mm)}$$

W(H), mm

$$W = (H + 1.6513)/0.0992 \text{ (minimum } H \sim 34 \text{ mm)}$$

NOTE: The factory setting for the Focal Range is 0.3 m–1.2 m (0.98 ft–3.94 ft). The focus can be adjusted to infinity by removing the Focus Limit Screw.

Evetar C-mount Lenses on 2 MP VE Series



Evetar C-mount Lenses on 2 MP VE Series, FOV as a function of WD Chart

WD (mm)	FOV (mm)							
	6mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm
Minimum	55 x 41 @ 77mm	51 x 38 @ 84mm	49 x 37 @ 110mm	53 x 40 @ 158mm	78 x 59 @ 310mm	66 x 50 @ 338mm	37 x 28 @ 336mm	46 x 35 @ 594mm
20								
40								
60								
80	59 x 44							
100	82 x 61	64 x 48						
120	105 x 79	82 x 61	55 x 41					
140	128 x 96	99 x 74	67 x 50					
160	152 x 114	116 x 87	78 x 59	53 x 40				
180	175 x 131	133 x 100	90 x 68	62 x 47				
200	198 x 149	151 x 113	102 x 77	71 x 53				
220	221 x 166	168 x 126	114 x 86	80 x 60				
240	245 x 184	185 x 139	126 x 94	88 x 66				
260	268 x 201	202 x 152	138 x 103	97 x 73				
280	291 x 218	219 x 165	150 x 112	106 x 79				
300	315 x 236	237 x 178	162 x 121	114 x 86				
320	338 x 253	254 x 190	173 x 130	123 x 92	81 x 60			
340	361 x 271	271 x 203	185 x 139	132 x 99	86 x 65	67 x 50	37 x 28	
360	384 x 288	288 x 216	197 x 148	141 x 105	92 x 69	71 x 53	40 x 30	
380	408 x 306	306 x 229	209 x 157	149 x 112	97 x 73	75 x 56	43 x 32	
400	431 x 323	323 x 242	221 x 166	158 x 118	103 x 77	79 x 59	46 x 35	
420	454 x 341	340 x 255	233 x 175	167 x 125	108 x 81	84 x 63	49 x 37	
440	477 x 358	357 x 268	245 x 184	175 x 132	114 x 85	88 x 66	52 x 39	
460	501 x 375	374 x 281	257 x 192	184 x 138	119 x 90	92 x 69	55 x 41	
480	524 x 393	392 x 294	268 x 201	193 x 145	125 x 94	96 x 72	58 x 43	
500	547 x 410	409 x 307	280 x 210	202 x 151	131 x 98	100 x 75	61 x 45	
520	570 x 428	426 x 320	292 x 219	210 x 158	136 x 102	105 x 79	63 x 48	
540	594 x 445	443 x 333	304 x 228	219 x 164	142 x 106	109 x 82	66 x 50	
560	617 x 463	461 x 345	316 x 237	228 x 171	147 x 110	113 x 85	69 x 52	
580	640 x 480	478 x 358	328 x 246	236 x 177	153 x 115	117 x 88	72 x 54	
600	663 x 498	495 x 371	340 x 255	245 x 184	158 x 119	122 x 91	75 x 56	47 x 35
620	687 x 515	512 x 384	352 x 264	254 x 190	164 x 123	126 x 94	78 x 58	49 x 37
640	710 x 533	529 x 397	363 x 273	263 x 197	169 x 127	130 x 98	81 x 61	51 x 38
660	733 x 550	547 x 410	375 x 282	271 x 203	175 x 131	134 x 101	84 x 63	52 x 39
680	757 x 567	564 x 423	387 x 290	280 x 210	181 x 135	139 x 104	86 x 65	54 x 41
700	780 x 585	581 x 436	399 x 299	289 x 217	186 x 140	143 x 107	89 x 67	56 x 42
720	803 x 602	598 x 449	411 x 308	297 x 223	192 x 144	147 x 110	92 x 69	58 x 44
740	826 x 620	616 x 462	423 x 317	306 x 230	197 x 148	151 x 113	95 x 71	60 x 45
760	850 x 637	633 x 475	435 x 326	315 x 236	203 x 152	156 x 117	98 x 74	62 x 46
780	873 x 655	650 x 488	447 x 335	324 x 243	208 x 156	160 x 120	101 x 76	64 x 48
800	896 x 672	667 x 500	459 x 344	332 x 249	214 x 160	164 x 123	104 x 78	66 x 49
820	919 x 690	684 x 513	470 x 353	341 x 256	219 x 165	168 x 126	107 x 80	68 x 51
840	943 x 707	702 x 526	482 x 362	350 x 262	225 x 169	173 x 129	110 x 82	70 x 52
860	966 x 724	719 x 539	494 x 371	358 x 269	231 x 173	177 x 133	112 x 84	72 x 54
880	989 x 742	736 x 552	506 x 380	367 x 275	236 x 177	181 x 136	115 x 86	73 x 55
900	1012 x 759	753 x 565	518 x 388	376 x 282	242 x 181	185 x 139	118 x 89	75 x 56
920	1036 x 777	771 x 578	530 x 397	385 x 288	247 x 185	189 x 142	121 x 91	77 x 58
940	1059 x 794	788 x 591	542 x 406	393 x 295	253 x 190	194 x 145	124 x 93	79 x 59
960	1082 x 812	805 x 604	554 x 415	402 x 301	258 x 194	198 x 148	127 x 95	81 x 61
980	1106 x 829	822 x 617	565 x 424	411 x 308	264 x 198	202 x 152	130 x 97	83 x 62
1000	1129 x 847	839 x 630	577 x 433	419 x 315	269 x 202	206 x 155	133 x 99	85 x 64
1020	1152 x 864	857 x 643	589 x 442	428 x 321	275 x 206	211 x 158	136 x 102	87 x 65
1040	1175 x 882	874 x 655	601 x 451	437 x 328	281 x 210	215 x 161	138 x 104	89 x 66
1060	1199 x 899	891 x 668	613 x 460	446 x 334	286 x 215	219 x 164	141 x 106	91 x 68
1080	1222 x 916	908 x 681	625 x 469	454 x 341	292 x 219	223 x 168	144 x 108	92 x 69
1100	1245 x 934	926 x 694	637 x 478	463 x 347	297 x 223	228 x 171	147 x 110	94 x 71
1120	1268 x 951	943 x 707	649 x 486	472 x 354	303 x 227	232 x 174	150 x 112	96 x 72
1140	1292 x 969	960 x 720	660 x 495	480 x 360	308 x 231	236 x 177	153 x 115	98 x 74
1160	1315 x 986	977 x 733	672 x 504	489 x 367	314 x 235	240 x 180	156 x 117	100 x 75
1180	1338 x 1004	994 x 746	684 x 513	498 x 373	319 x 240	245 x 183	159 x 119	102 x 76
1200	1361 x 1021	1012 x 759	696 x 522	507 x 380	325 x 244	249 x 187	161 x 121	104 x 78
1220	1385 x 1039	1029 x 772	708 x 531	515 x 386	331 x 248	253 x 190	164 x 123	106 x 79
1240	1408 x 1056	1046 x 785	720 x 540	524 x 393	336 x 252	257 x 193	167 x 125	108 x 81
1260	1431 x 1073	1063 x 798	732 x 549	533 x 400	342 x 256	262 x 196	170 x 128	110 x 82
1280	1455 x 1091	1081 x 810	744 x 558	541 x 406	347 x 260	266 x 199	173 x 130	111 x 84
1300	1478 x 1108	1098 x 823	755 x 567	550 x 413	353 x 265	270 x 202	176 x 132	113 x 85
1320	1501 x 1126	1115 x 836	767 x 575	559 x 419	358 x 269	274 x 206	179 x 134	115 x 86
1340	1524 x 1143	1132 x 849	779 x 584	568 x 426	364 x 273	278 x 209	182 x 136	117 x 88
1360	1548 x 1161	1149 x 862	791 x 593	576 x 432	369 x 277	283 x 212	185 x 138	119 x 89
1380	1571 x 1178	1167 x 875	803 x 602	585 x 439	375 x 281	287 x 215	187 x 141	121 x 91
1400	1594 x 1196	1184 x 888	815 x 611	594 x 445	381 x 285	291 x 218	190 x 143	123 x 92
1420	1617 x 1213	1201 x 901	827 x 620	602 x 452	386 x 290	295 x 222	193 x 145	125 x 94
1440	1641 x 1230	1218 x 914	839 x 629	611 x 458	392 x 294	300 x 225	196 x 147	127 x 95
1460	1664 x 1248	1236 x 927	850 x 638	620 x 465	397 x 298	304 x 228	199 x 149	129 x 96
1480	1687 x 1265	1253 x 940	862 x 647	629 x 471	403 x 302	308 x 231	202 x 151	130 x 98
1500	1710 x 1283	1270 x 953	874 x 656	637 x 478	408 x 306	312 x 234	205 x 154	132 x 99

Evetar C-mount Lenses on 2 MP VE Series, WD as a function of FOV Chart

		WD (mm)								
FOV (mm)		6mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm	
	Minimum	55 x 41 @ 77mm	51 x 38 @ 84mm	49 x 37 @ 110mm	53 x 40 @ 158mm	78 x 59 @ 310mm	66 x 50 @ 338mm	37 x 28 @ 336mm	46 x 35 @ 594mm	
20 x 15										
40 x 30								358		
60 x 45		81	95	129	175			496	739	
80 x 60		98	118	163	221	318	403	635	949	
100 x 75		116	141	196	267	390	498	774	1160	
120 x 90		133	164	230	313	462	592	912	1370	
140 x 105		150	188	264	359	534	687	1051	1580	
160 x 120		167	211	297	405	606	781	1190	1791	
180 x 135		184	234	331	451	678	875	1328	2001	
200 x 150		202	257	365	496	750	970	1467	2211	
220 x 165		219	281	398	542	822	1064	1606	2421	
240 x 180		236	304	432	588	894	1159	1745	2632	
260 x 195		253	327	466	634	966	1253	1883	2842	
280 x 210		270	350	499	680	1038	1347	2022	3052	
300 x 225		288	373	533	726	1110	1442	2161	3263	
320 x 240		305	397	567	772	1182	1536	2299	3473	
340 x 255		322	420	600	818	1254	1630	2438	3683	
360 x 270		339	443	634	864	1326	1725	2577	3894	
380 x 285		356	466	668	910	1398	1819	2715	4104	
400 x 300		373	490	701	955	1470	1914	2854	4314	
420 x 315		391	513	735	1001	1542	2008	2993	4525	
440 x 330		408	536	769	1047	1614	2102	3132	4735	
460 x 345		425	559	803	1093	1686	2197	3270	4945	
480 x 360		442	583	836	1139	1758	2291	3409	5155	
500 x 375		459	606	870	1185	1830	2386	3548	5366	
520 x 390		477	629	904	1231	1902	2480	3686	5576	
540 x 405		494	652	937	1277	1974	2574	3825	5786	
560 x 420		511	675	971	1323	2046	2669	3964	5997	
580 x 435		528	699	1005	1369	2118	2763	4102	6207	
600 x 450		545	722	1038	1415	2190	2857	4241	6417	
620 x 465		563	745	1072	1460	2262	2952	4380	6628	
640 x 480		580	768	1106	1506	2334	3046	4518	6838	
660 x 495		597	792	1139	1552	2406	3141	4657	7048	
680 x 510		614	815	1173	1598	2478	3235	4796	7258	
700 x 525		631	838	1207	1644	2550	3329	4935	7469	
720 x 540		649	861	1240	1690	2622	3424	5073	7679	
740 x 555		666	884	1274	1736	2694	3518	5212	7889	
760 x 570		683	908	1308	1782	2766	3613	5351	8100	
780 x 585		700	931	1341	1828	2838	3707	5489	8310	
800 x 600		717	954	1375	1874	2910	3801	5628	8520	
820 x 615		735	977	1409	1919	2982	3896	5767	8731	
840 x 630		752	1001	1442	1965	3054	3990	5905	8941	
860 x 645		769	1024	1476	2011	3126	4084	6044	9151	
880 x 660		786	1047	1510	2057	3198	4179	6183	9362	
900 x 675		803	1070	1543	2103	3270	4273	6322	9572	
920 x 690		821	1094	1577	2149	3342	4368	6460	9782	
940 x 705		838	1117	1611	2195	3414	4462	6599	9992	
960 x 720		855	1140	1644	2241	3486	4556	6738	10203	
980 x 735		872	1163	1678	2287	3558	4651	6876	10413	
1000 x 750		889	1186	1712	2333	3630	4745	7015	10623	
1020 x 765		906	1210	1745	2378	3702	4840	7154	10834	
1040 x 780		924	1233	1779	2424	3774	4934	7292	11044	
1060 x 795		941	1256	1813	2470	3846	5028	7431	11254	
1080 x 810		958	1279	1846	2516	3918	5123	7570	11465	
1100 x 825		975	1303	1880	2562	3990	5217	7709	11675	
1120 x 840		992	1326	1914	2608	4062	5311	7847	11885	
1140 x 855		1010	1349	1947	2654	4134	5406	7986	12095	
1160 x 870		1027	1372	1981	2700	4206	5500	8125	12306	
1180 x 885		1044	1395	2015	2746	4278	5595	8263	12516	
1200 x 900		1061	1419	2049	2792	4350	5689	8402	12726	
1220 x 915		1078	1442	2082	2838	4422	5783	8541	12937	
1240 x 930		1096	1465	2116	2883	4494	5878	8679	13147	
1260 x 945		1113	1488	2150	2929	4566	5972	8818	13357	
1280 x 960		1130	1512	2183	2975	4638	6067	8957	13568	
1300 x 975		1147	1535	2217	3021	4710	6161	9095	13778	
1320 x 990		1164	1558	2251	3067	4782	6255	9234	13988	
1340 x 1005		1182	1581	2284	3113	4854	6350	9373	14199	
1360 x 1020		1199	1604	2318	3159	4926	6444	9512	14409	
1380 x 1035		1216	1628	2352	3205	4998	6538	9650	14619	
1400 x 1050		1233	1651	2385	3251	5070	6633	9789	14829	
1420 x 1065		1250	1674	2419	3297	5142	6727	9928	15040	
1440 x 1080		1268	1697	2453	3342	5214	6822	10066	15250	
1460 x 1095		1285	1721	2486	3388	5286	6916	10205	15460	
1480 x 1110		1302	1744	2520	3434	5358	7010	10344	15671	
1500 x 1125		1319	1767	2554	3480	5430	7105	10482	15881	

Evetar Lens equations for VE Series 2 MP

H = horizontal FOV size, W = working distance



6 mm Megapixel lens

Banner model: LCF06LEVMP (p/n 97345)

Evetar model: MV118FM06C

1/1.8-inch format, 34 mm filter, minimum f/1.6, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 1.16 \times W - 34.49 \text{ (minimum } W \sim 77 \text{ mm)}$$

W(H), mm

$$W = (H + 34.49)/1.16 \text{ (minimum } H \sim 55 \text{ mm)}$$



8 mm Megapixel lens

Banner model: LCF08LEVMP (p/n 97346)

Evetar model: MV118FM08C

1/1.8-inch format, 27 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.86 \times W - 21.62 \text{ (minimum } W \sim 84 \text{ mm)}$$

W(H), mm

$$W = (H + 21.62)/0.86 \text{ (minimum } H \sim 51 \text{ mm)}$$



12 mm Megapixel lens

Banner model: LCF12LEVMP (p/n 97347)

Evetar model: MV23FM12C

2/3-inch format, 27 mm filter, minimum f/1.6, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.59 \times W - 16.62 \text{ (minimum } W \sim 110 \text{ mm)}$$

W(H), mm

$$W = (H + 16.62)/0.59 \text{ (minimum } H \sim 49 \text{ mm)}$$



16 mm Megapixel lens

Banner model: LCF16LEVMP (p/n 97348)

Evetar model: MV23FM16CR1

2/3-inch format, 27 mm filter, minimum f/1.6, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.44 \times W - 16.3 \text{ (minimum } W \sim 158 \text{ mm)}$$

W(H), mm

$$W = (H + 16.3)/0.44 \text{ (minimum } H \sim 53 \text{ mm)}$$



25 mm Megapixel lens

Banner model: LCF25LEVMP (p/n 97349)

Evetar model: MV23FM25C

2/3-inch format, 27 mm filter, minimum f/1.8, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$H = 0.28 \times W - 8.39$ (minimum $W \sim 310$ mm)

W(H), mm

$W = (H + 8.39)/0.28$ (minimum $H \sim 78$ mm)

35 mm Megapixel lens

Banner model: LCF35LEVMP (p/n 97350)

Evetar model: MV23FM35C

2/3-inch format, 27 mm filter, minimum f/2.0, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$H = 0.21 \times W - 5.49$ (minimum $W \sim 338$ mm)

W(H), mm

$W = (H + 5.49)/0.21$ (minimum $H \sim 66$ mm)

50 mm Megapixel lens

Banner model: LCF50LEVMP (p/n 97351)

Evetar model: MV23FM50C

2/3-inch format, 30.5 mm filter, minimum f/2.6, fits with VELC85 lens cover

H(W), mm

$H = 0.14 \times W - 11.57$ (minimum $W \sim 336$ mm)

W(H), mm

$W = (H + 11.57)/0.14$ (minimum $H \sim 37$ mm)

75 mm Megapixel lens

Banner model: LCF75LEVMP (p/n 97352)

Evetar model: MV11FM75C

1-inch format, 34 mm filter, minimum f/2.8, does not fit with a sealed lens cover

H(W), mm

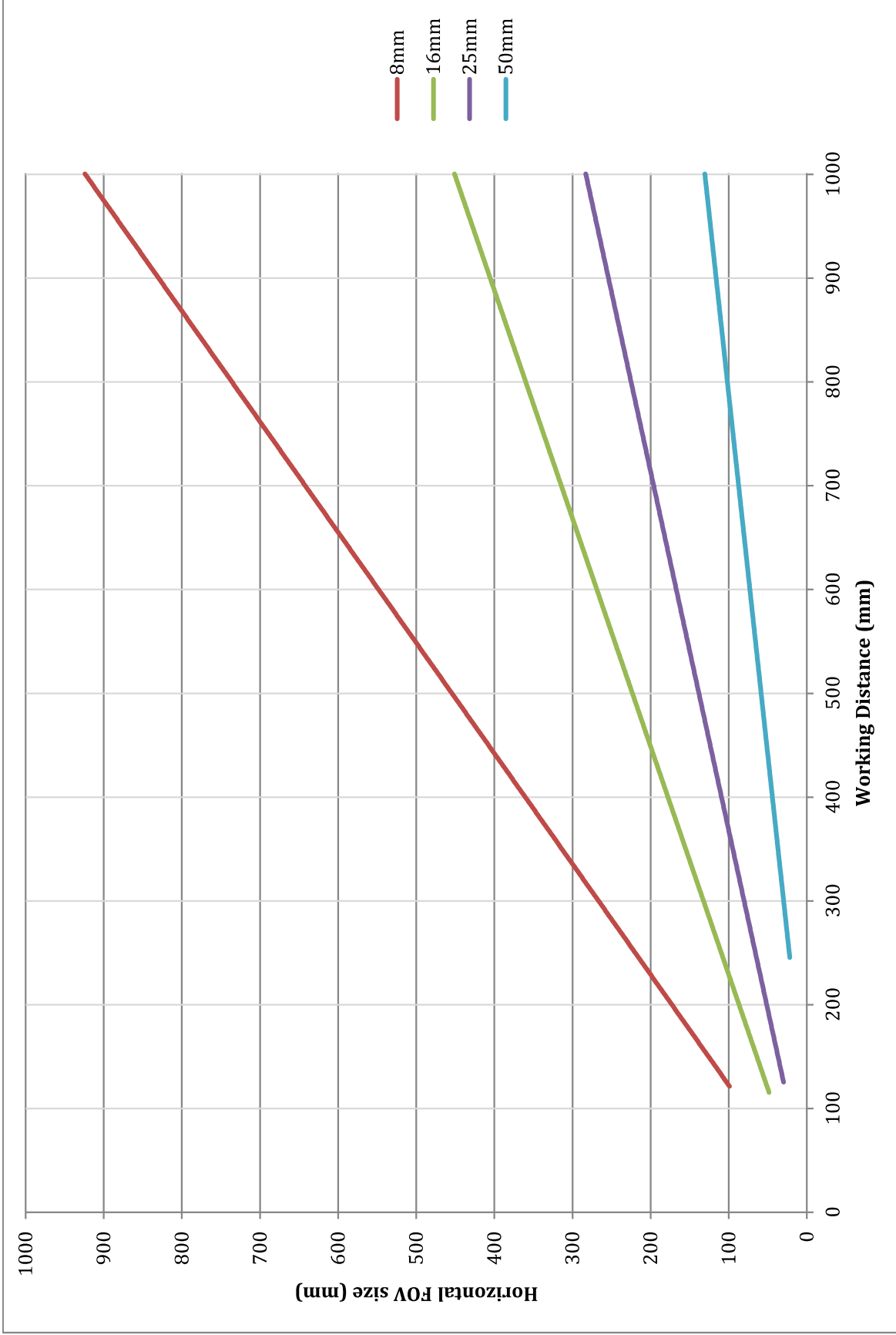
$H = 0.095 \times W - 10.28$ (minimum $W \sim 594$ mm)

W(H), mm

$W = (H + 10.28)/0.095$ (minimum $H \sim 46$ mm)



Tamron C-mount Lenses on 2MP VE Series



Tamron C-mount Lenses on 2 MP VE Series, FOV as a function of WD Chart

WD (mm)	8mm		16mm		25mm		50mm	
Minimum	53 x 40		94 x 71		37 x 28		68 x 51	
	@ 75mm		@ 222mm		@ 155mm		@ 520mm	
20								
40								
60								
80	61	x 45						
100	79	x 59						
120	98	x 74						
140	117	x 88						
160	136	x 102			40	x 30		
180	154	x 116			46	x 34		
200	173	x 130			52	x 39		
220	192	x 144			57	x 43		
240	211	x 158	105	x 79	63	x 47		
260	229	x 172	114	x 86	69	x 52		
280	248	x 186	123	x 93	75	x 56		
300	267	x 200	133	x 99	80	x 60		
320	286	x 214	142	x 106	86	x 65		
340	305	x 228	151	x 113	92	x 69		
360	323	x 243	160	x 120	98	x 73		
380	342	x 257	169	x 127	104	x 78		
400	361	x 271	178	x 134	109	x 82		
420	380	x 285	187	x 140	115	x 86		
440	398	x 299	196	x 147	121	x 91		
460	417	x 313	205	x 154	127	x 95		
480	436	x 327	214	x 161	133	x 99		
500	455	x 341	224	x 168	138	x 104		
520	474	x 355	233	x 174	144	x 108	61	x 46
540	492	x 369	242	x 181	150	x 112	64	x 48
560	511	x 383	251	x 188	156	x 117	67	x 50
580	530	x 397	260	x 195	161	x 121	70	x 53
600	549	x 411	269	x 202	167	x 125	73	x 55
620	567	x 426	278	x 209	173	x 130	76	x 57
640	586	x 440	287	x 215	179	x 134	79	x 59
660	605	x 454	296	x 222	185	x 138	82	x 61
680	624	x 468	305	x 229	190	x 143	85	x 63
700	643	x 482	315	x 236	196	x 147	87	x 66
720	661	x 496	324	x 243	202	x 151	90	x 68
740	680	x 510	333	x 250	208	x 156	93	x 70
760	699	x 524	342	x 256	214	x 160	96	x 72
780	718	x 538	351	x 263	219	x 165	99	x 74
800	736	x 552	360	x 270	225	x 169	102	x 76
820	755	x 566	369	x 277	231	x 173	105	x 79
840	774	x 580	378	x 284	237	x 178	108	x 81
860	793	x 595	387	x 291	243	x 182	110	x 83
880	811	x 609	396	x 297	248	x 186	113	x 85
900	830	x 623	406	x 304	254	x 191	116	x 87
920	849	x 637	415	x 311	260	x 195	119	x 89
940	868	x 651	424	x 318	266	x 199	122	x 91
960	887	x 665	433	x 325	271	x 204	125	x 94
980	905	x 679	442	x 331	277	x 208	128	x 96
1000	924	x 693	451	x 338	283	x 212	131	x 98
1020	943	x 707	460	x 345	289	x 217	133	x 100
1040	962	x 721	469	x 352	295	x 221	136	x 102
1060	980	x 735	478	x 359	300	x 225	139	x 104
1080	999	x 749	487	x 366	306	x 230	142	x 107
1100	1018	x 763	497	x 372	312	x 234	145	x 109
1120	1037	x 778	506	x 379	318	x 238	148	x 111
1140	1056	x 792	515	x 386	324	x 243	151	x 113
1160	1074	x 806	524	x 393	329	x 247	154	x 115
1180	1093	x 820	533	x 400	335	x 251	157	x 117
1200	1112	x 834	542	x 407	341	x 256	159	x 120
1220	1131	x 848	551	x 413	347	x 260	162	x 122
1240	1149	x 862	560	x 420	352	x 264	165	x 124
1260	1168	x 876	569	x 427	358	x 269	168	x 126
1280	1187	x 890	579	x 434	364	x 273	171	x 128
1300	1206	x 904	588	x 441	370	x 277	174	x 130
1320	1224	x 918	597	x 448	376	x 282	177	x 133
1340	1243	x 932	606	x 454	381	x 286	180	x 135
1360	1262	x 947	615	x 461	387	x 290	182	x 137
1380	1281	x 961	624	x 468	393	x 295	185	x 139
1400	1300	x 975	633	x 475	399	x 299	188	x 141
1420	1318	x 989	642	x 482	405	x 303	191	x 143
1440	1337	x 1003	651	x 488	410	x 308	194	x 145
1460	1356	x 1017	660	x 495	416	x 312	197	x 148
1480	1375	x 1031	670	x 502	422	x 316	200	x 150
1500	1393	x 1045	679	x 509	428	x 321	203	x 152

Tamron C-mount Lenses on 2 MP VE Series, WD as a function of FOV Chart

FOV (mm)		8mm	16mm	25mm	50mm
	Minimum	53 x 40 @ 75mm	94 x 71 @ 222mm	37 x 28 @ 155mm	68 x 51 @ 520mm
20 x 15					
40 x 30				160	
60 x 45		79		229	
80 x 60		101		298	649
100 x 75		122	229	368	788
120 x 90		143	273	437	926
140 x 105		165	316	506	1065
160 x 120		186	360	575	1204
180 x 135		207	404	644	1343
200 x 150		229	448	713	1482
220 x 165		250	492	782	1621
240 x 180		271	536	851	1760
260 x 195		293	580	920	1899
280 x 210		314	624	990	2038
300 x 225		335	668	1059	2176
320 x 240		356	712	1128	2315
340 x 255		378	756	1197	2454
360 x 270		399	800	1266	2593
380 x 285		420	844	1335	2732
400 x 300		442	888	1404	2871
420 x 315		463	932	1473	3010
440 x 330		484	976	1542	3149
460 x 345		506	1020	1612	3288
480 x 360		527	1064	1681	3426
500 x 375		548	1108	1750	3565
520 x 390		569	1151	1819	3704
540 x 405		591	1195	1888	3843
560 x 420		612	1239	1957	3982
580 x 435		633	1283	2026	4121
600 x 450		655	1327	2095	4260
620 x 465		676	1371	2164	4399
640 x 480		697	1415	2233	4538
660 x 495		719	1459	2303	4676
680 x 510		740	1503	2372	4815
700 x 525		761	1547	2441	4954
720 x 540		783	1591	2510	5093
740 x 555		804	1635	2579	5232
760 x 570		825	1679	2648	5371
780 x 585		846	1723	2717	5510
800 x 600		868	1767	2786	5649
820 x 615		889	1811	2855	5788
840 x 630		910	1855	2925	5926
860 x 645		932	1899	2994	6065
880 x 660		953	1942	3063	6204
900 x 675		974	1986	3132	6343
920 x 690		996	2030	3201	6482
940 x 705		1017	2074	3270	6621
960 x 720		1038	2118	3339	6760
980 x 735		1060	2162	3408	6899
1000 x 750		1081	2206	3477	7038
1020 x 765		1102	2250	3547	7176
1040 x 780		1123	2294	3616	7315
1060 x 795		1145	2338	3685	7454
1080 x 810		1166	2382	3754	7593
1100 x 825		1187	2426	3823	7732
1120 x 840		1209	2470	3892	7871
1140 x 855		1230	2514	3961	8010
1160 x 870		1251	2558	4030	8149
1180 x 885		1273	2602	4099	8288
1200 x 900		1294	2646	4169	8426
1220 x 915		1315	2690	4238	8565
1240 x 930		1337	2734	4307	8704
1260 x 945		1358	2777	4376	8843
1280 x 960		1379	2821	4445	8982
1300 x 975		1400	2865	4514	9121
1320 x 990		1422	2909	4583	9260
1340 x 1005		1443	2953	4652	9399
1360 x 1020		1464	2997	4721	9538
1380 x 1035		1486	3041	4790	9676
1400 x 1050		1507	3085	4860	9815
1420 x 1065		1528	3129	4929	9954
1440 x 1080		1550	3173	4998	10093
1460 x 1095		1571	3217	5067	10232
1480 x 1110		1592	3261	5136	10371
1500 x 1125		1613	3305	5205	10510

Tamron Lens equations for VE Series 2 MP

H = horizontal FOV size, W = working distance



8 mm Megapixel lens

Banner model: LCF08LTMP (p/n 81530)

Tamron model: M118FM08

1/1.8-inch format, 25.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.94 \times W - 14.59 \text{ (minimum } W \sim 75 \text{ mm)}$$

W(H), mm

$$W = (H + 14.59)/0.94 \text{ (minimum } H \sim 53 \text{ mm)}$$



16 mm Megapixel lens

Banner model: LCF16LTMP (p/n 81532)

Tamron model: M118FM16

1/1.8-inch format, 25.5 mm filter, minimum f/1.4, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.455 \times W - 4.03 \text{ (minimum } W \sim 222 \text{ mm)}$$

W(H), mm

$$W = (H + 4.03)/0.455 \text{ (minimum } H \sim 94 \text{ mm)}$$



25 mm Megapixel lens

Banner model: LCF25LTMP (p/n 81533)

Tamron model: M118FM25

1/1.8-inch format, 25.5 mm filter, minimum f/1.6, fits with either the VELC60 or VELC85 lens cover

H(W), mm

$$H = 0.29 \times W - 6.37 \text{ (minimum } W \sim 155 \text{ mm)}$$

W(H), mm

$$W = (H + 6.37)/0.29 \text{ (minimum } H \sim 37 \text{ mm)}$$



50 mm Megapixel lens

Banner model: LCF50LTMP (p/n 81534)

Tamron model: M118FM50

1/1.8-inch format, 25.5 mm filter, minimum f/2.8, fits with VELC85 lens cover

H(W), mm

$$H = 0.144 \times W - 13.4 \text{ (minimum } W \sim 520 \text{ mm)}$$

W(H), mm

$$W = (H + 13.4)/0.144 \text{ (minimum } H \sim 68 \text{ mm)}$$