Center for Energy Efficiency and Renewable Energy

C E E R E

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COMPARISON OF RESULTS FOR 104 GLAZING UNITS AT TWO DIFFERENT ORIENTATIONS NFRC 100-2002 (WINDOW5) vs. NFRC 100-97 (W4.1)

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INTRODUCTION

For the purpose of comparison of the current NFRC method (NFRC 100-97) and new proposed NFRC method (NFRC 100-2002), which fully is based on ISO 15099 (ISO 2002) document, 104 glazing systems were defined and calculations were done at two characteristic angles (90 and 20) using both methods.

The results for these 104 units are presented in tabular (Tables 1 and 2) and graphical form (Figures 1 through 9) on the following pages.

Table 1. U-Factor Results for Vertical Glazing Orientations Using WINDOW 4.1 and WINDOW 5

Vertical (90 deg)

ID	# Glazing Layers	Glazing			Air			Ar			Kr			
		Glass	emssivity	Configuration	W5	W4.1	Diff (%)	W5	W4.1	Diff (%)	W5	W4.1	Diff (%)	W5
1	Single Glazing	Un-Coated Glass	0.84	N/A	5.8783	6.2603	-6.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Double Glazing	Un-Coated Glass	0.84	4/6/4	3.1477	3.2461	-3.13	2.9022	3.0004	-3.38	2.5953	2.6625	-2.59	2.45
3				4/12/4	2.7293	2.7890	-2.19	2.5754	2.6363	-2.36	2.5252	2.5762	-2.02	2.51
4				4/20/4	2.7503	2.7938	-1.58	2.6140	2.6576	-1.67	2.5559	2.6202	-2.52	2.51
5		One Pane Coated (Surface # 2)	0.2	4/6/4	2.5897	2.6542	-2.49	2.2154	2.2844	-3.11	1.7274	1.7528	-1.47	1.53
6				4/12/4	1.9731	1.9900	-0.86	1.7325	1.7526	-1.16	1.6666	1.6745	-0.47	1.62
7				4/20/4	2.0476	2.0375	0.49	1.8201	1.8136	0.36	1.7081	1.7501	-2.46	1.62
8		One Pane Coated (Surface # 2)	0.1	4/6/4	2.4627	2.5204	-2.34	2.0542	2.1182	-3.12	1.5163	1.5338	-1.15	1.30
9				4/12/4	1.7966	1.8057	-0.51	1.5332	1.5464	-0.86	1.4614	1.4612	0.01	1.41
10				4/20/4	1.8861	1.8650	1.12	1.6333	1.6170	1.00	1.5052	1.5458	-2.70	1.41
11		One Pane Coated (Surface # 2)	0.04	4/6/4	2.3786	2.4320	-2.25	1.9465	2.0073	-3.12	1.3733	1.3860	-0.92	1.15
12				4/12/4	1.6790	1.6830	-0.24	1.3999	1.4078	-0.56	1.3233	1.3185	0.36	1.26
13				4/20/4	1.7789	1.7502	1.61	1.5084	1.4861	1.48	1.3686	1.4097	-3.00	1.26
14	Triple Glazing	Un-Coated Glass	0.84	4/6/4/6/4	2.1694	2.2134	-2.03	1.9475	1.9958	-2.48	1.6839	1.7129	-1.72	1.55
15				4/9/4/9/4	1.9144	1.9473	-1.72	1.7469	1.7831	-2.07	1.5725	1.5928	-1.29	1.54
16				4/12/4/12/4	1.7803	1.8022	-1.23	1.6477	1.6723	-1.49	1.5700	1.5885	-1.18	1.56
17		Two Panes Coated (Surface # 2 and # 5)	0.2	4/6/4/6/4	1.6737	1.6993	-1.53	1.3767	1.4110	-2.49	1.0155	1.0276	-1.19	0.84
18				4/9/4/9/4	1.3325	1.3461	-1.02	1.1031	1.1237	-1.87	0.8693	0.8742	-0.56	0.83
19				4/12/4/12/4	1.1538	1.1532	0.05	0.9709	0.9768	-0.61	0.8782	0.8799	-0.19	0.86
20		Two Panes Coated (Surface # 2 and # 5)	0.1	4/6/4/6/4	1.5688	1.5912	-1.43	1.2541	1.2864	-2.58	0.8693	0.8787	-1.08	0.68
21				4/9/4/9/4	1.2074	1.2176	-0.84	0.9629	0.9812	-1.90	0.7148	0.7181	-0.46	0.68
22				4/12/4/12/4	1.0180	1.0135	0.44	0.8229	0.8259	-0.36	0.7270	0.7263	0.10	0.71
23		Two Panes Coated (Surface # 2 and # 5)	0.04	4/6/4/6/4	1.5009	1.5213	-1.36	1.1743	1.2054	-2.65	0.7735	0.7818	-1.07	0.57
24				4/9/4/9/4	1.1259	1.1341	-0.73	0.8713	0.8882	-1.94	0.6134	0.6161	-0.44	0.58
25				4/12/4/12/4	0.9294	0.9225	0.74	0.7259	0.7274	-0.21	0.6280	0.6262	0.29	0.61
26	Quadruple Glazing	Two Panes Coated (Surface # 2 and # 5)	0.04	4/12/4/12/4/12/4	0.7916	0.7873	0.543	0.6294	0.6308	-0.222	0.5378	0.5338	0.744	0.52

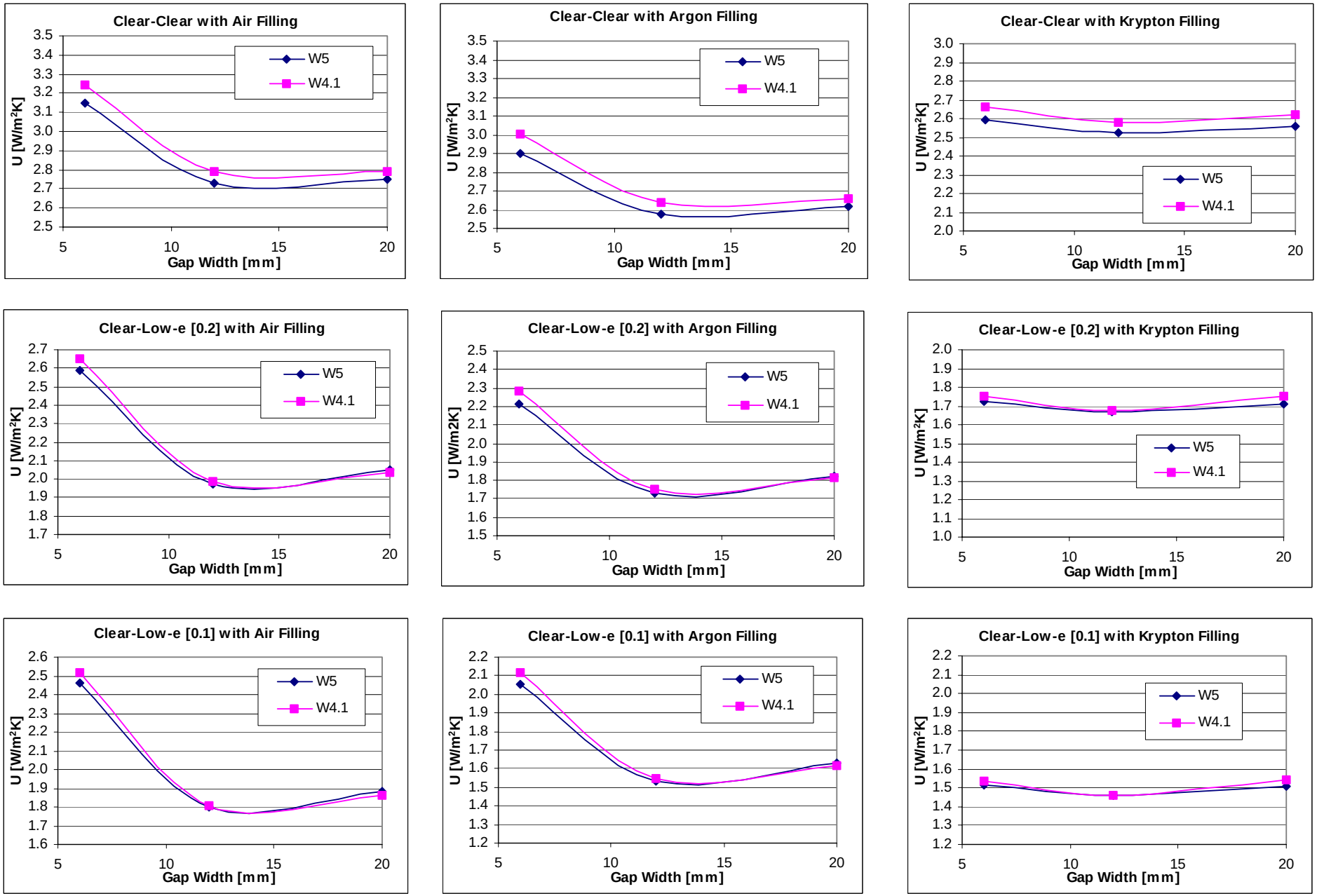

Figure 1. Double Glazed Clear-Clear and Clear Low-e (0.2 and 0.1) for Vertical Glazing

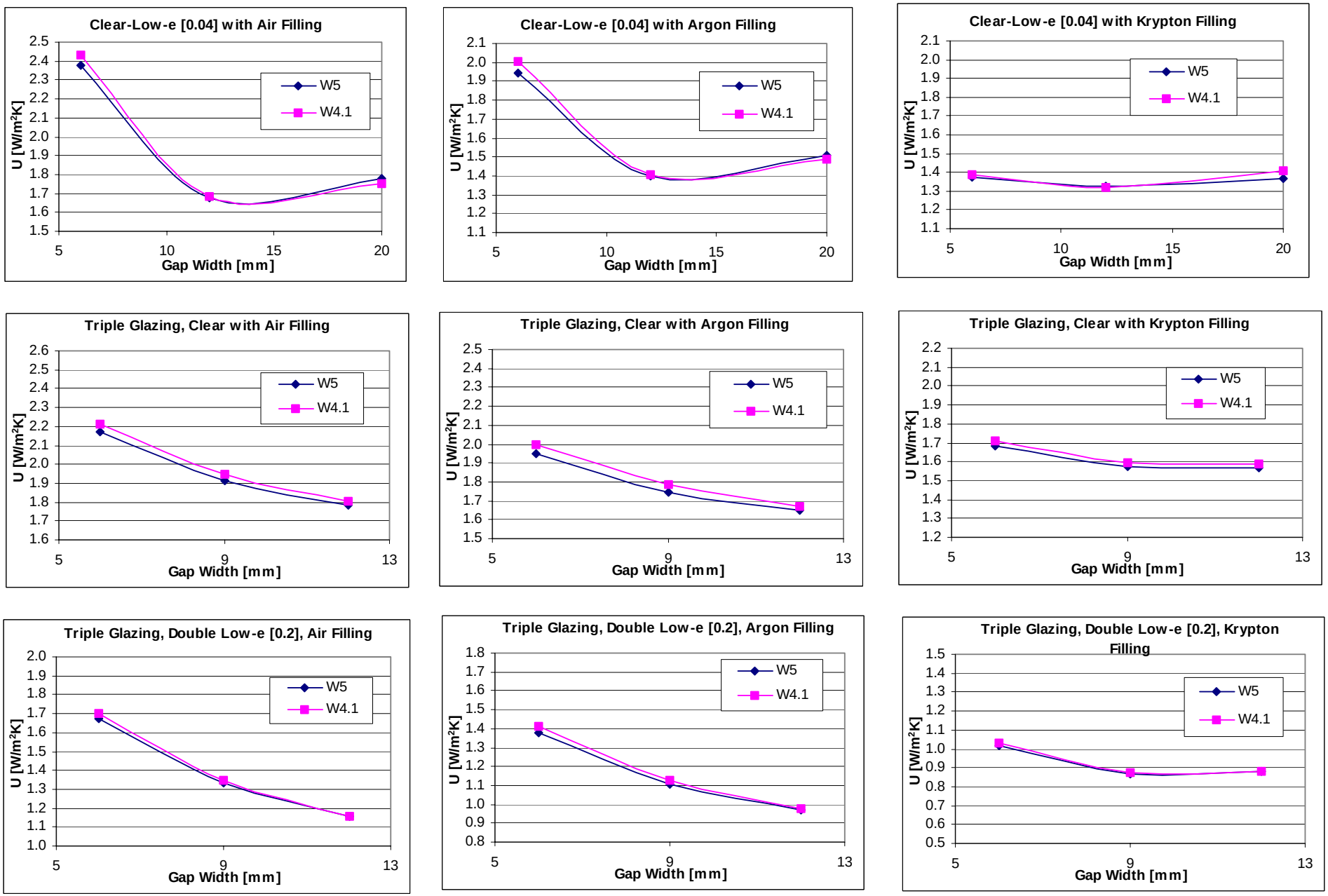

Figure 2. Double Clear Low-e (0.04) and Triple Glazed All Clear, and Double Low-e (0.2) for Vertical Glazing

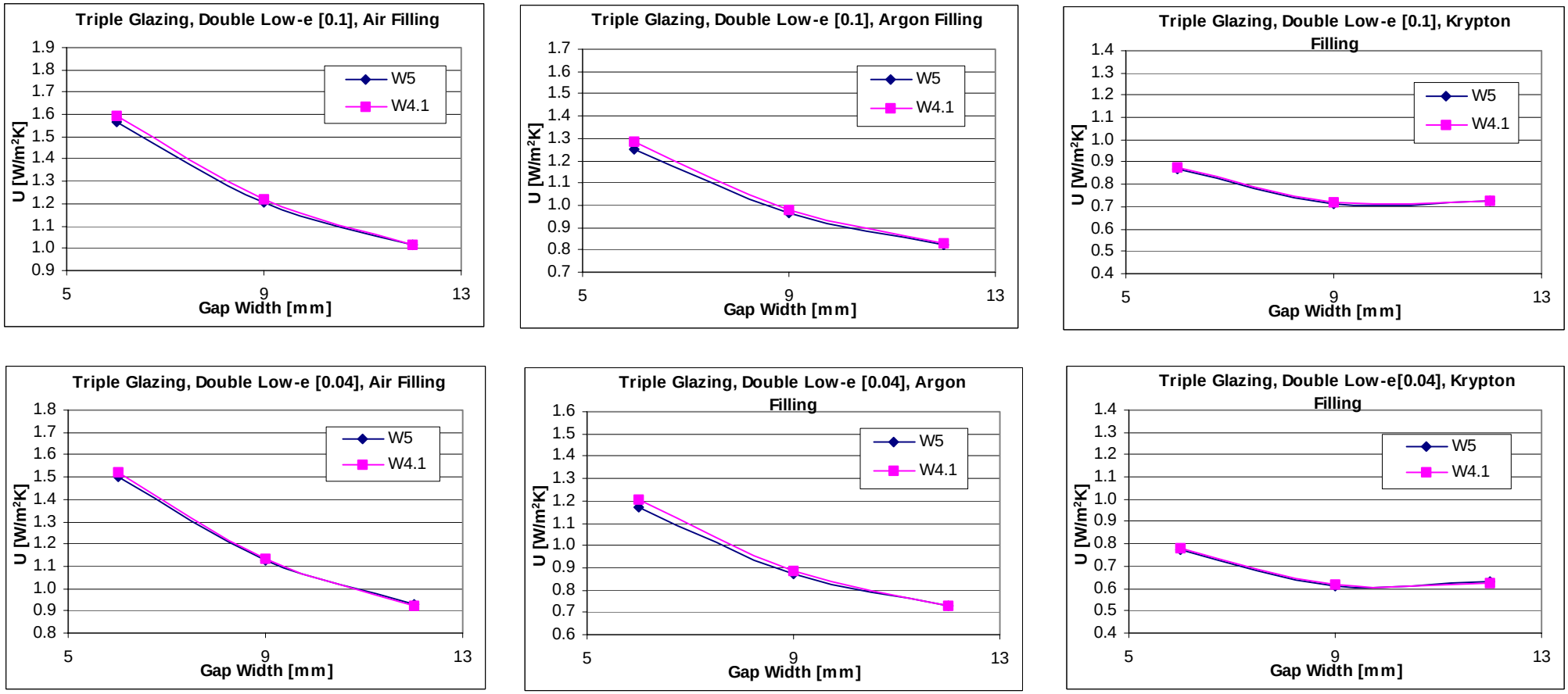

Figure 3. Triple Glazed with Double Low-e (0.1, and 0.04) for Vertical Glazing

Table 2. U-Factor Results for Sloped Glazing Orientation (20 deg) Using WINDOW 4.1 and WINDOW 5

ID	# Glazing Layers	Glazing			Air			Ar			Kr			
		Glass	emssivity	Configuration	W5	W4.1	Diff (%)	W5	W4.1	Diff (%)	W5	W4.1	Diff (%)	W5
1	Single Glazing	Un-Coated Glass	0.84	N/A	6.7091	6.9107	-3.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	Double Glazing	Un-Coated Glass	0.84	4/6/4	3.3176	3.4028	-2.57	3.0416	3.1337	-3.03	2.8378	2.9120	-2.61	2.8198
3				4/12/4	3.2166	3.2883	-2.23	3.0030	3.0773	-2.47	2.8756	2.9511	-2.63	2.7458
4				4/20/4	3.1834	3.2562	-2.29	2.9646	3.0409	-2.57	2.7796	2.8524	-2.62	2.6650
5		One Pane Coated (Surface # 2)	0.2	4/6/4	2.6922	2.7549	-2.33	2.2845	2.3579	-3.21	2.0751	2.1331	-2.80	2.0117
6				4/12/4	2.6045	2.6529	-1.86	2.3030	2.3493	-2.01	2.0750	2.1300	-2.65	1.8656
7				4/20/4	2.5426	2.5913	-1.92	2.2110	2.2659	-2.48	1.9206	1.9703	-2.59	1.7378
8		One Pane Coated (Surface # 2)	0.1	4/6/4	2.5525	2.6101	-2.26	2.1107	2.1803	-3.30	1.9030	1.9586	-2.92	1.8267
9				4/12/4	2.4695	2.5131	-1.77	2.1466	2.1897	-2.01	1.8915	1.9425	-2.70	1.6605
10				4/20/4	2.4008	2.4445	-1.82	2.0401	2.0910	-2.49	1.7214	1.7671	-2.65	1.5198
11		One Pane Coated (Surface # 2)	0.04	4/6/4	2.4605	2.5149	-2.21	1.9952	2.0625	-3.37	1.7893	1.8435	-3.03	1.7040
12				4/12/4	2.3809	2.4215	-1.71	2.0436	2.0845	-2.00	1.7698	1.8184	-2.75	1.5236
13				4/20/4	2.3078	2.3479	-1.74	1.9270	1.9755	-2.52	1.5886	1.6317	-2.71	1.3738
14	Triple Glazing	Un-Coated Glass	0.84	4/6/4/6/4	2.2371	2.2833	-2.07	1.9996	2.0524	-2.64	1.7284	1.7546	-1.52	1.7449
15				4/9/4/9/4	1.9627	2.0011	-1.96	1.8038	1.8282	-1.35	1.8010	1.8422	-2.29	1.7462
16				4/12/4/12/4	2.0315	2.0648	-1.64	1.8827	1.9194	-1.95	1.8032	1.8442	-2.27	1.7150
17		Two Panes Coated (Surface # 2 and # 5)	0.2	4/6/4/6/4	1.7084	1.7386	-1.77	1.3979	1.4377	-2.85	1.0579	1.0650	-0.67	1.0839
18				4/9/4/9/4	1.3582	1.3702	-0.88	1.1596	1.1614	-0.16	1.1622	1.1877	-2.19	1.0785
19				4/12/4/12/4	1.4859	1.5048	-1.27	1.2763	1.3013	-1.96	1.1580	1.1863	-2.44	1.0322
20		Two Panes Coated (Surface # 2 and # 5)	0.1	4/6/4/6/4	1.5981	1.6252	-1.70	1.2706	1.3082	-2.96	0.9123	0.9250	-1.39	0.9432
21				4/9/4/9/4	1.2339	1.2369	-0.24	1.0201	1.0263	-0.61	1.0265	1.0497	-2.26	0.9360
22				4/12/4/12/4	1.3727	1.3888	-1.17	1.1487	1.1718	-2.01	1.0210	1.0473	-2.58	0.8860
23		Two Panes Coated (Surface # 2 and # 5)	0.04	4/6/4/6/4	1.5269	1.5521	-1.65	1.1881	1.2243	-3.05	0.8167	0.8360	-2.36	0.8518
24				4/9/4/9/4	1.1532	1.1505	0.23	0.9338	0.9406	-0.73	0.9383	0.9613	-2.45	0.8434
25				4/12/4/12/4	1.2997	1.3142	-1.12	1.0661	1.0880	-2.05	0.9321	0.9572	-2.69	0.7909
26	Quadruple Glazing	Two Panes Coated (Surface # 2 and # 5)	0.04	4/12/4/12/4/12/4	1.0124	1.0126	-0.020	0.8523	0.8587	-0.751	0.7676	0.7863	-2.436	0.6677

Type of Gas Space (concentration = 90%)

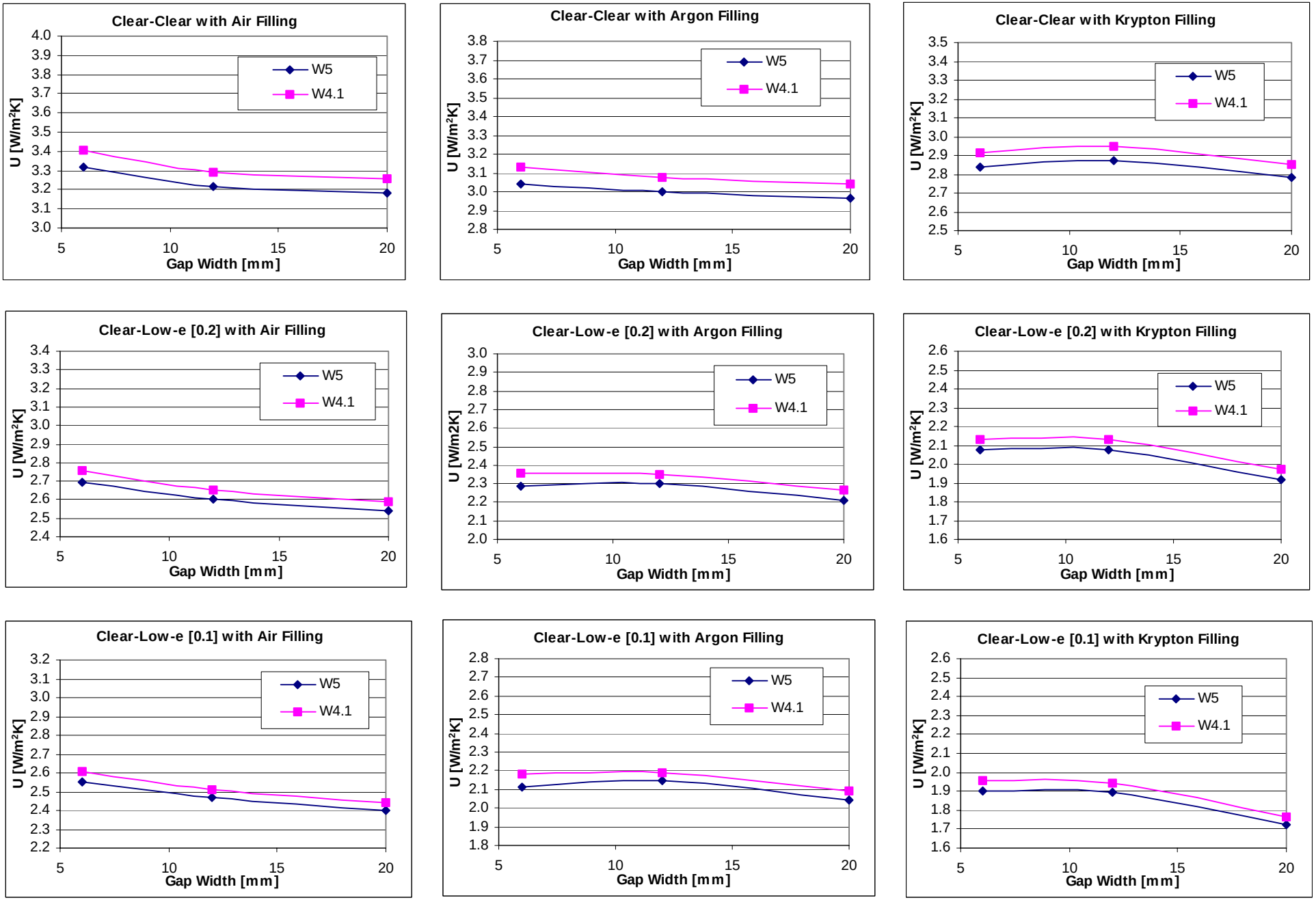

Figure 4. Double Glazed Clear-Clear and Clear Low-e (0.2 and 0.1) for 20° Slope

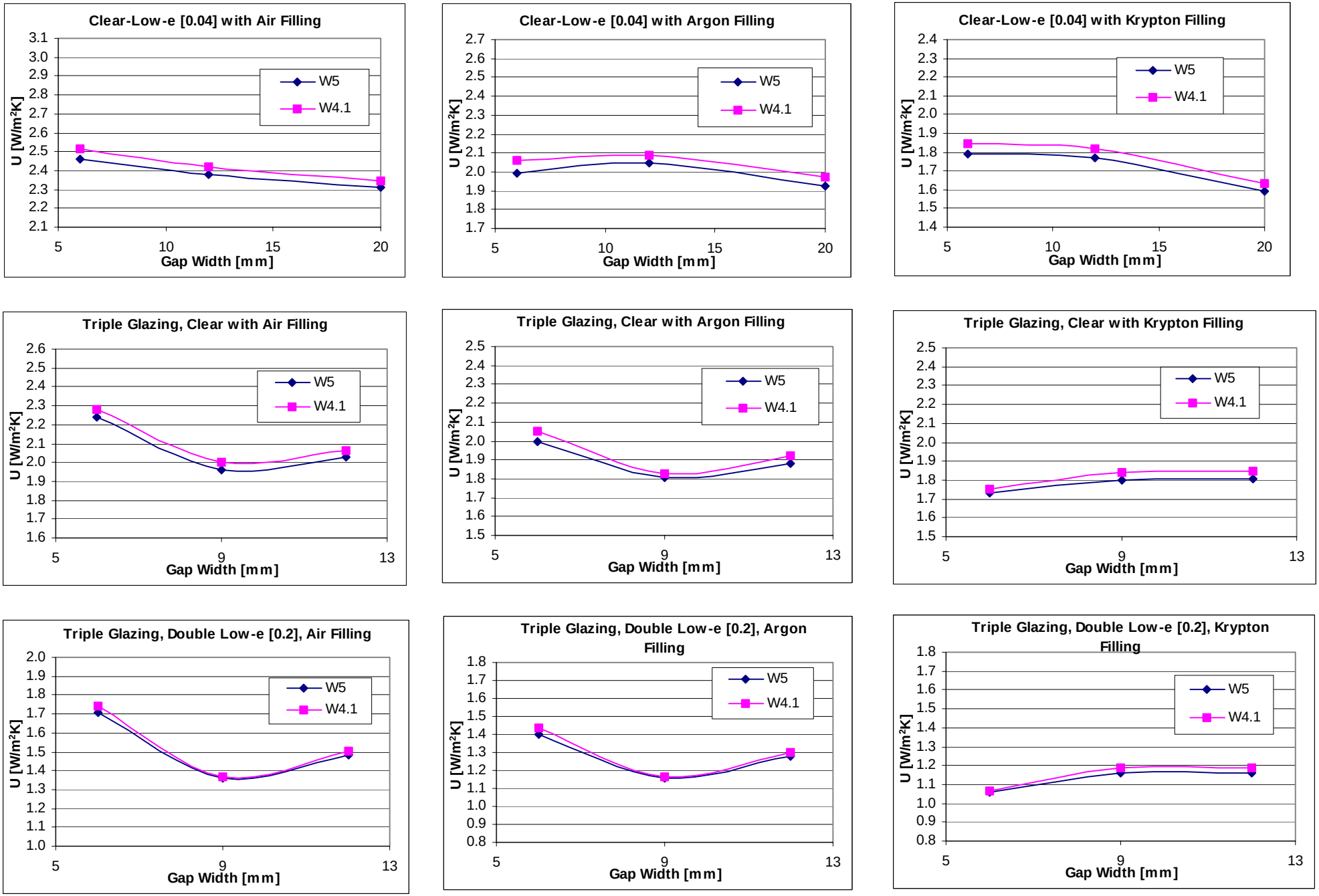

Figure 5. Double Clear Low-e (0.04) and Triple Glazed All Clear, and Double Low-e (0.2) for 20° Slope

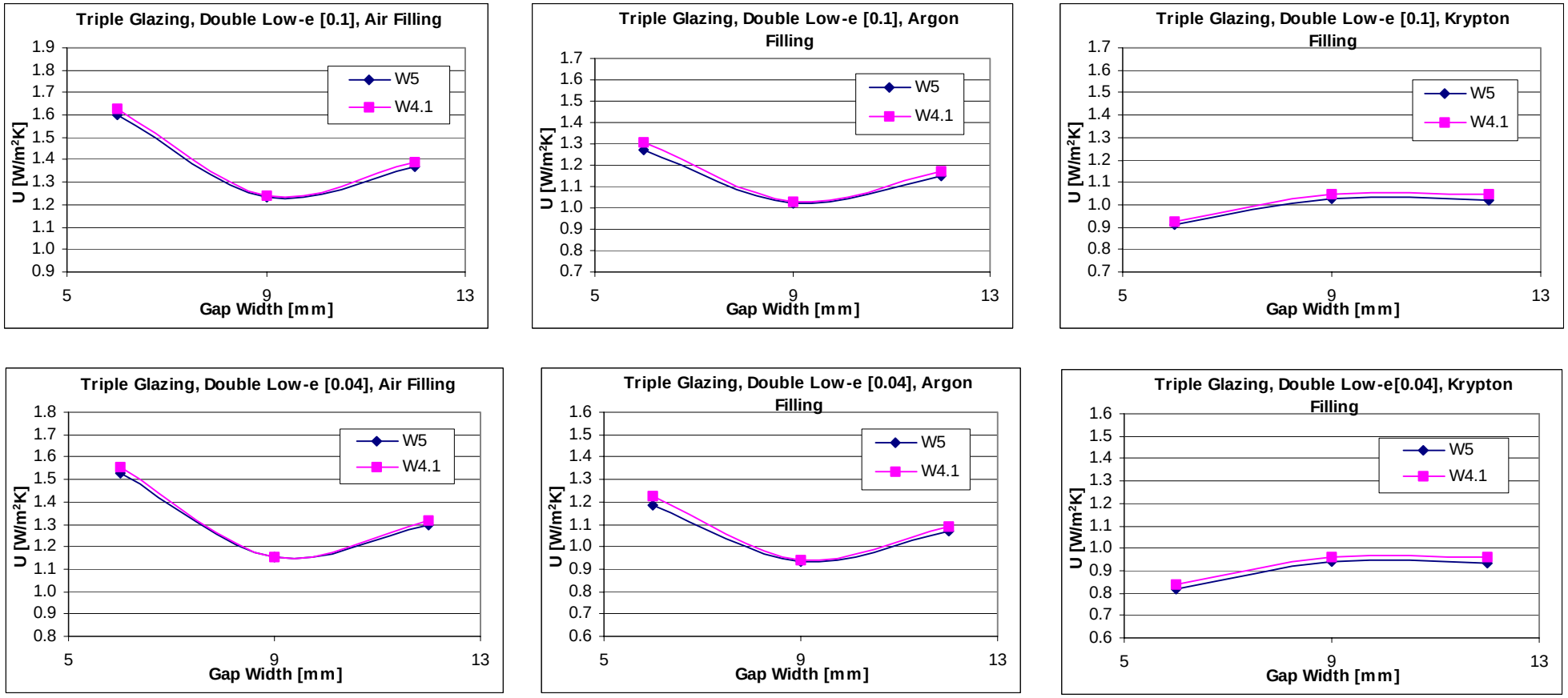

Figure 6. Triple Glazed with Double Low-e (0.1, and 0.04) for 20° Slope

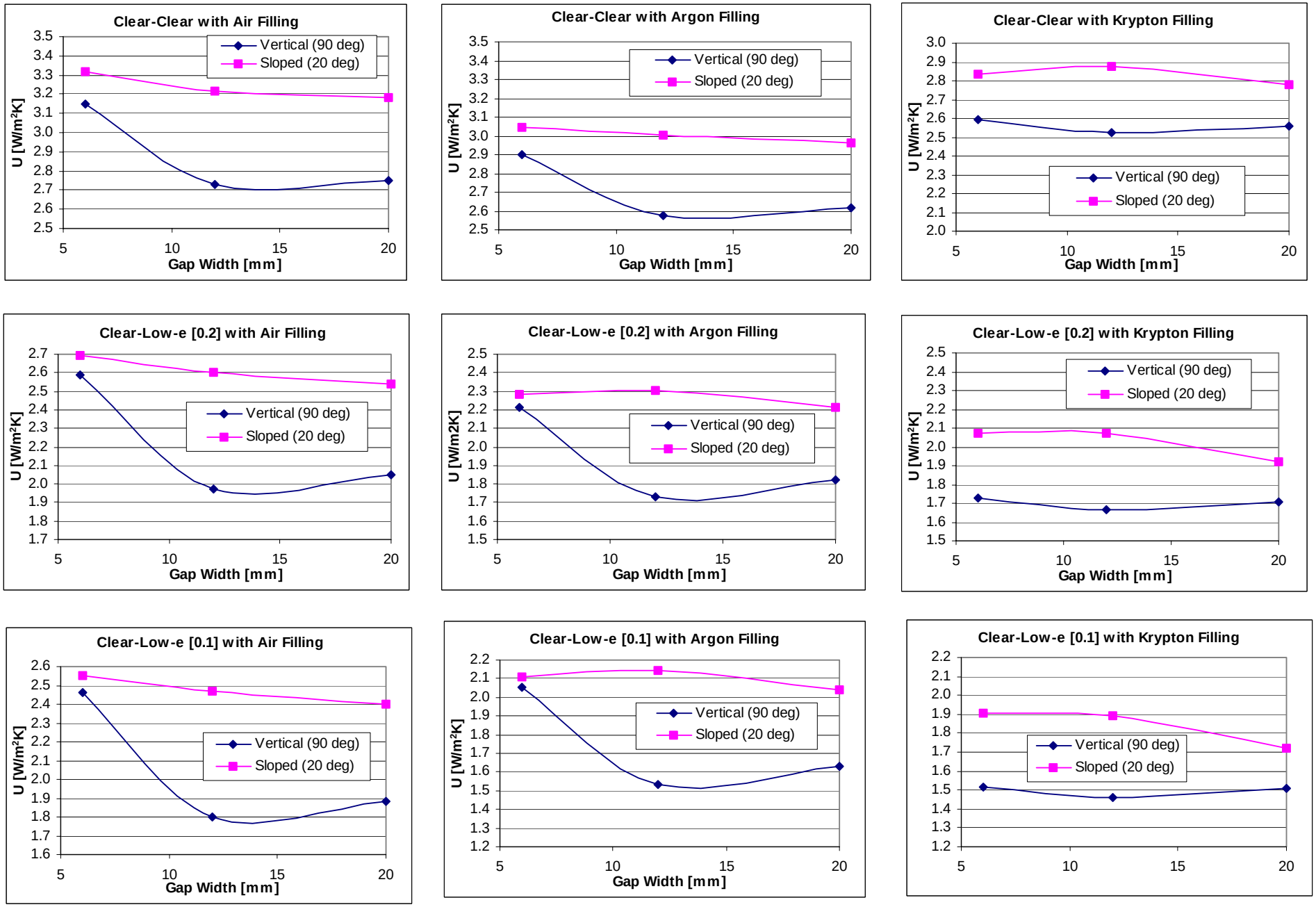

Figure 7. Double Glazed Clear-Clear and Clear Low-e (0.2 and 0.1) Vertical vs. 20° Slope

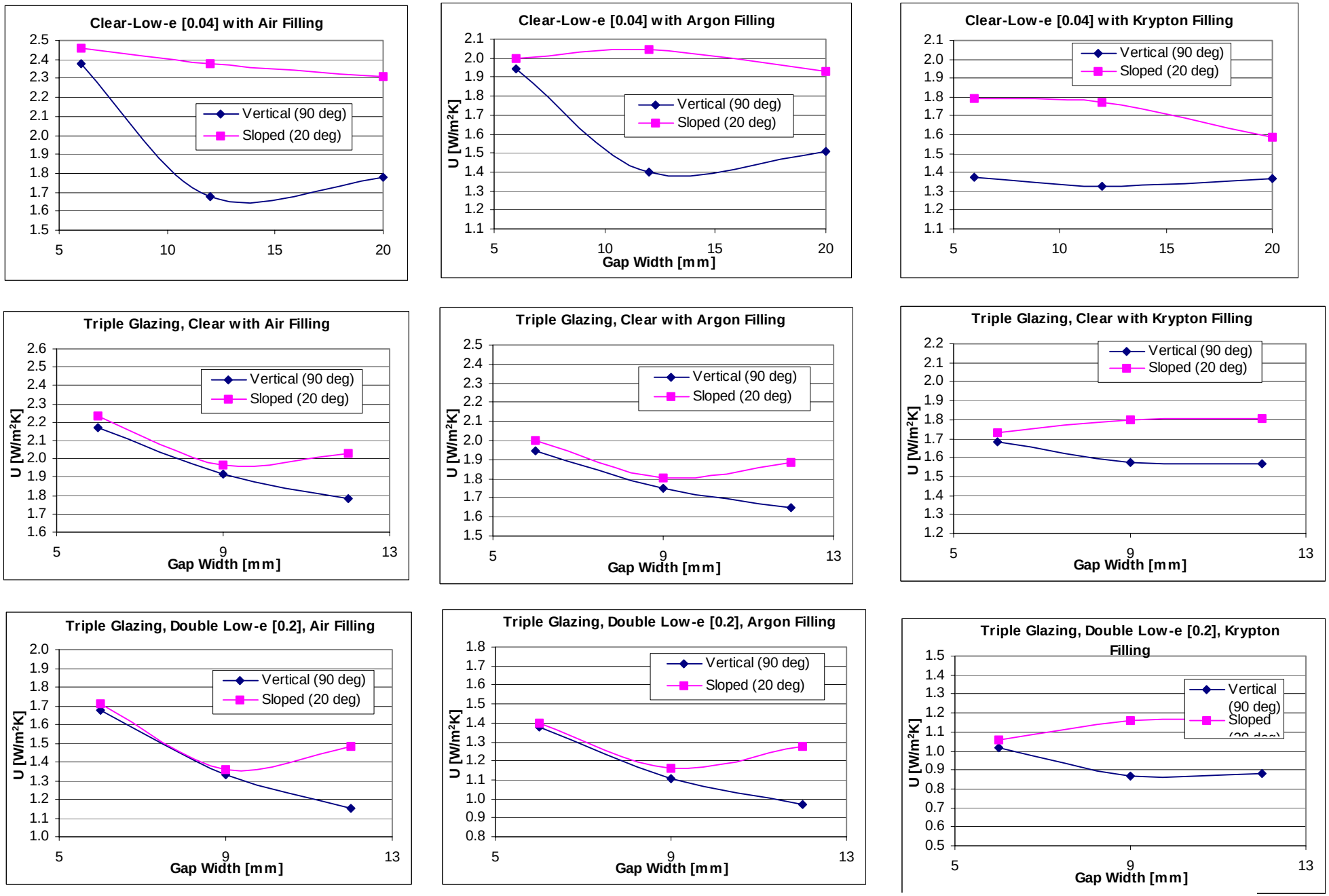

Figure 8. Double Clear Low-e (0.04) and Triple Glazed All Clear, and Double Low-e (0.2) Vertical vs. 20° Slope

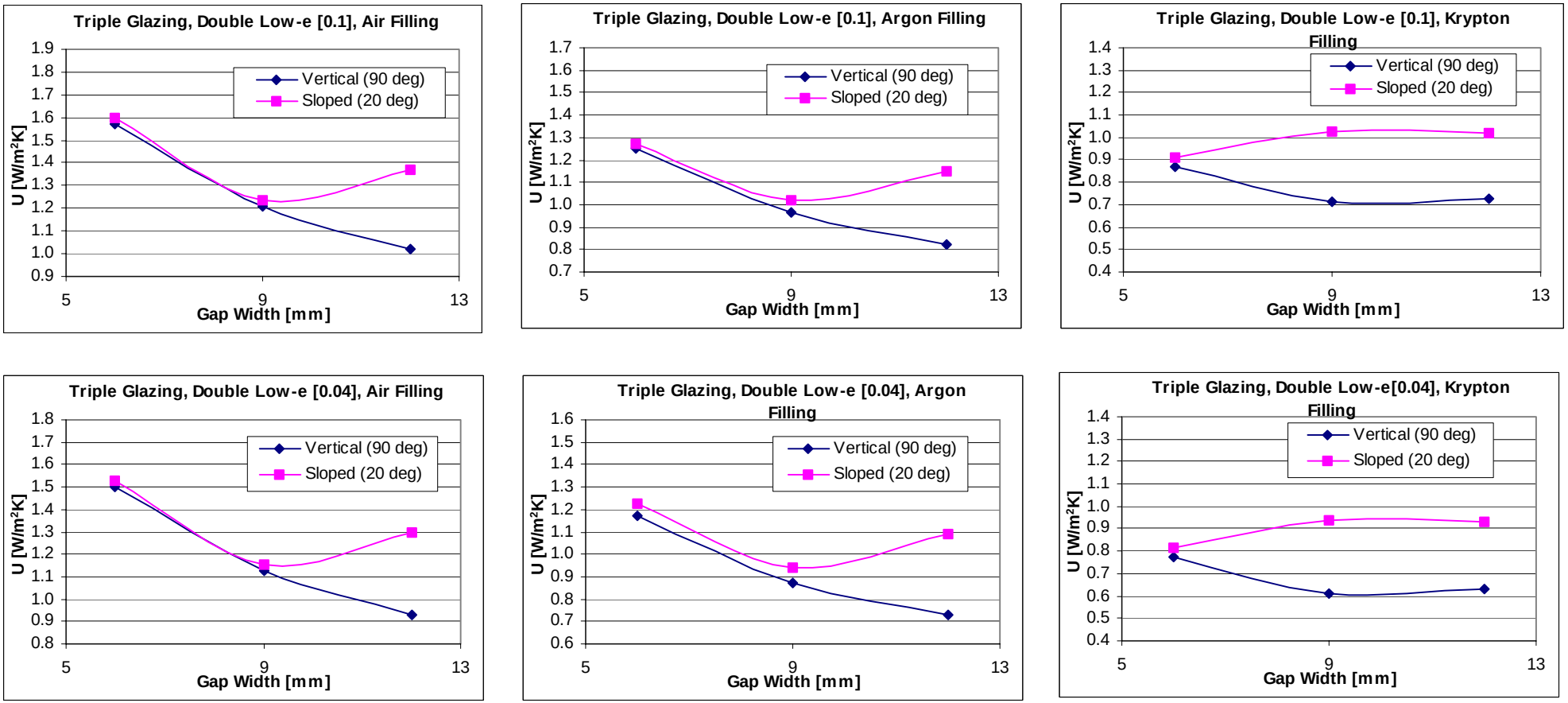

Figure 9. Triple Glazed with Double Low-e (0.1, and 0.04) Vertical vs. 20° Slope

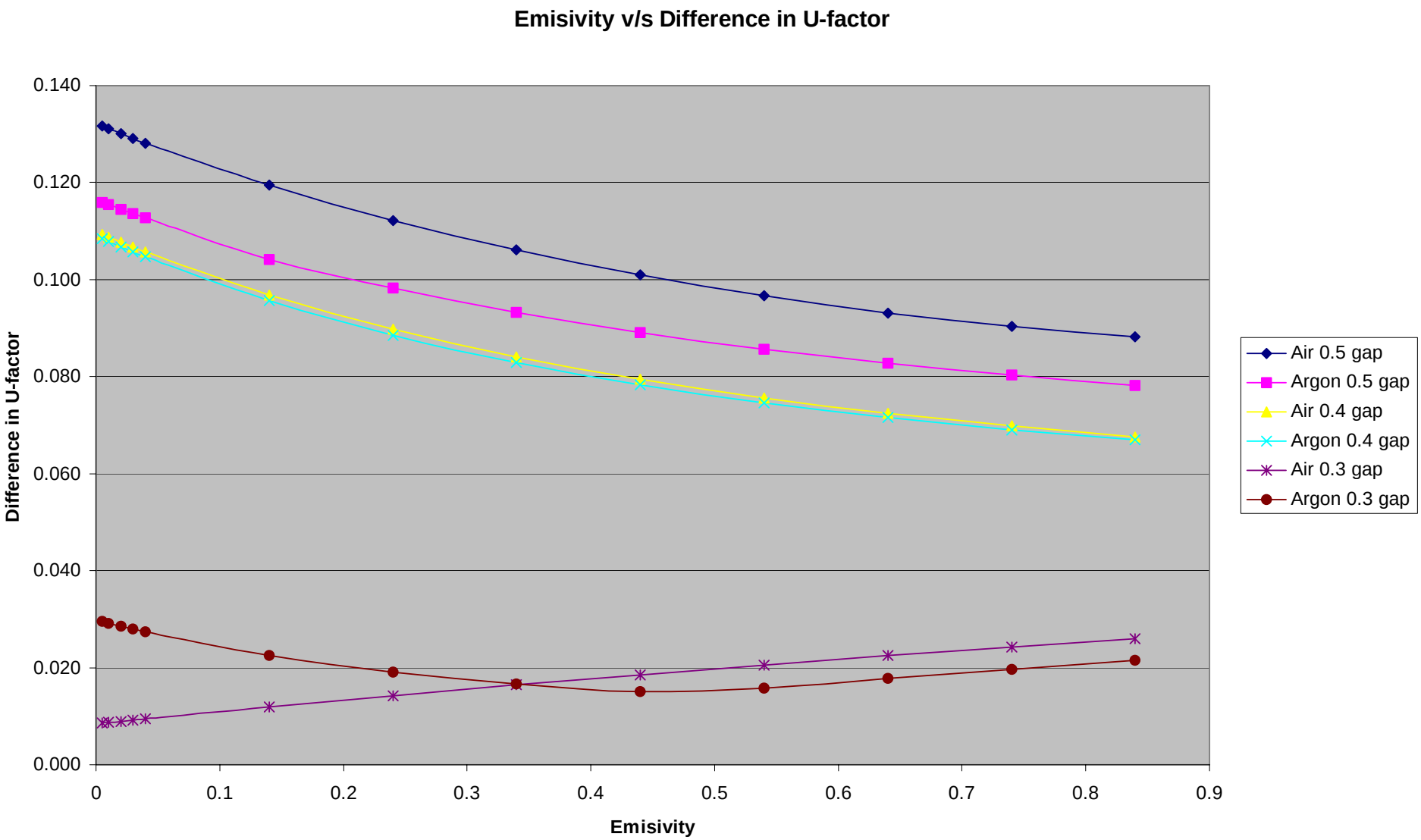

Figure 10. Emissivity vs. Difference in U-Factor for Three Typical Gap Spacings