

MEASUREMENT REPORT

**ON-SITE MEASUREMENT TO DETERMINE
THE PERFORMANCE OF
UV LIGHT REDUCTION OF DES ENCLOSED BLIND**

2 April 2015

Prepared By



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Contents

1. INTRODUCTION	4
2. OBJECTIVE	4
3. DESCRIPTION OF THE SAMPLES	4
4. MEASUREMENT PROCEDURE	5
5. RESULTS	7
5.1 Sample No.1 (EB1)	7
5.2 Sample No.2 (EB2)	10
5.3 Sample No.3 (EB3)	13
5.4 Sample No.4 (DG4)	16
5.5 Sample No.5 (DG5)	19
5.6 Sample No.6 (DG6)	22
6. SUMMARY	25

1. INTRODUCTION

DES Building Innovate Sdn. Bhd. commissioned SIRIM Berhad to measure performance of the 6 enclosed blinds samples.

The measurements were carried out at DES Building Innovate Sdn. Bhd. (Address: 6, Jalan IKS Juru Jaya, Taman IKS Juru Jaya, 14100 Simpang Ampat, Pulau Pinang, Malaysia) testing cell on 22nd to 23rd January 2015.

2. OBJECTIVE

The objective of this measurement is to determine the performance of DES enclosed blinds UV light reduction.

3. DESCRIPTION OF THE SAMPLES

The six (6) samples are:

- I. Sample 1 (EB1) : 4mm tempered clear glass + 19mm air space with Enclosed Blind + 4mm tempered clear glass
- II. Sample 2 (EB2) : 4mm tempered clear glass + 19mm air space with Enclosed Blind + 5mm tempered light green glass
- III. Sample 3 (EB3) : 4mm tempered clear glass + 19mm air space with Enclosed Blind + 6.38mm laminated clear float glass
- IV. Sample 4 (DG4) : 4mm tempered clear glass + 19mm air space + 6.38mm laminated clear float glass
- V. Sample 5 (DG5) : 4mm tempered clear glass + 8mm air space + 6.38mm laminated clear float glass
- VI. Sample 6 (DG6) : 4mm tempered clear glass + 8mm air space + 4mm tempered clear glass

Refer Appendix 2 for detail of samples description.

4. MEASUREMENT PROCEDURE

Six (6) samples were arranged side-by-side and in-line under the sun light, as shown in Figure 4.1. Every sample was covered with box to avoid indirect light reflection from surrounding.

2 units of UV light meter (model UV-340; Serial No. AG.41232, AG.37524; Calibrated Date: 21 Oct 2014 and 17 Nov 2014), as shown in Figure 4.2 were used. Two readings (in $\mu\text{W}/\text{cm}^2$) were recorded simultaneously, one positioned outside and the other one positioned inside. The measurements were recorded every 30 minutes (from 9:00am to 5:30pm).

All measurements were taken with blind move or adjust to the top.



Figure 4.1 – Arrangement of the 6 samples (front and back view)



Figure 4.2 **UV Light Meter**

5. RESULTS

5.1 Sample No.1 (EB1)

4mm tempered clear glass + 19mm air space with Enclosed Blind + 4mm tempered clear glass

Table 5.1.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	180	81	99	MIN	55.00%	MIN
2	9:30 AM	244	116	128	61	52.46%	45.87%
3	10:00 AM	242	131	111	AVERAGE	45.87%	AVERAGE
4	10:30 AM	1414	631	783	247	55.37%	55.45%
5	11:00 AM	1065	496	569	MAX	53.43%	MAX
6	11:30 AM	927	371	556	783	59.98%	59.98%
7	12:00 PM	328	153	175		53.35%	
8	12:30 PM	566	243	323		57.07%	
9	1:00 PM	375	156	219		58.40%	
10	1:30 PM	455	189	266		58.46%	
11	2:00 PM	376	172	204		54.26%	
12	2:30 PM	357	150	207		57.98%	
13	3:00 PM	407	168	239		58.72%	
14	3:30 PM	266	110	156		58.65%	
15	4:00 PM	276	118	158		57.25%	
16	4:30 PM	188	84	104		55.32%	
17	5:00 PM	182	88	94		51.65%	
18	5:30 PM	111	50	61		54.95%	

Table 5.1.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	660	334	326	MIN	49.39%	MIN
2	9:30 AM	1031	534	497	78	48.21%	48.21%
3	10:00 AM	1053	512	541	AVERAGE	51.38%	AVERAGE
4	10:30 AM	1092	561	531	266	48.63%	55.17%
5	11:00 AM	967	445	522	MAX	53.98%	MAX
6	11:30 AM	642	306	336	541	52.34%	62.19%
7	12:00 PM	514	230	284		55.25%	
8	12:30 PM	408	185	223		54.66%	
9	1:00 PM	404	181	223		55.20%	
10	1:30 PM	339	146	193		56.93%	
11	2:00 PM	323	128	195		60.37%	
12	2:30 PM	320	121	199		62.19%	
13	3:00 PM	292	116	176		60.27%	
14	3:30 PM	252	115	137		54.37%	
15	4:00 PM	222	95	127		57.21%	
16	4:30 PM	198	81	117		59.09%	
17	5:00 PM	145	67	78		53.79%	
18	5:30 PM	132	53	79		59.85%	

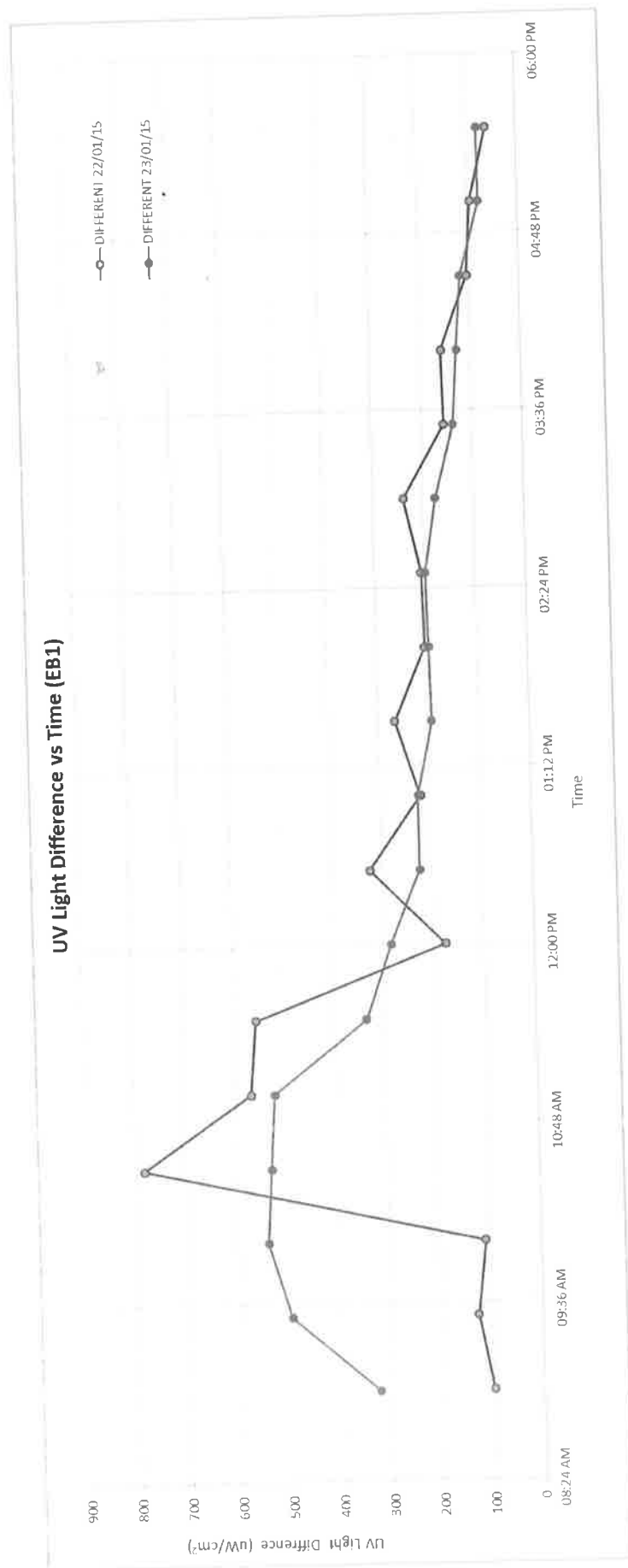


Figure 5.1.1.1 UV Light Difference vs Time (EB1)

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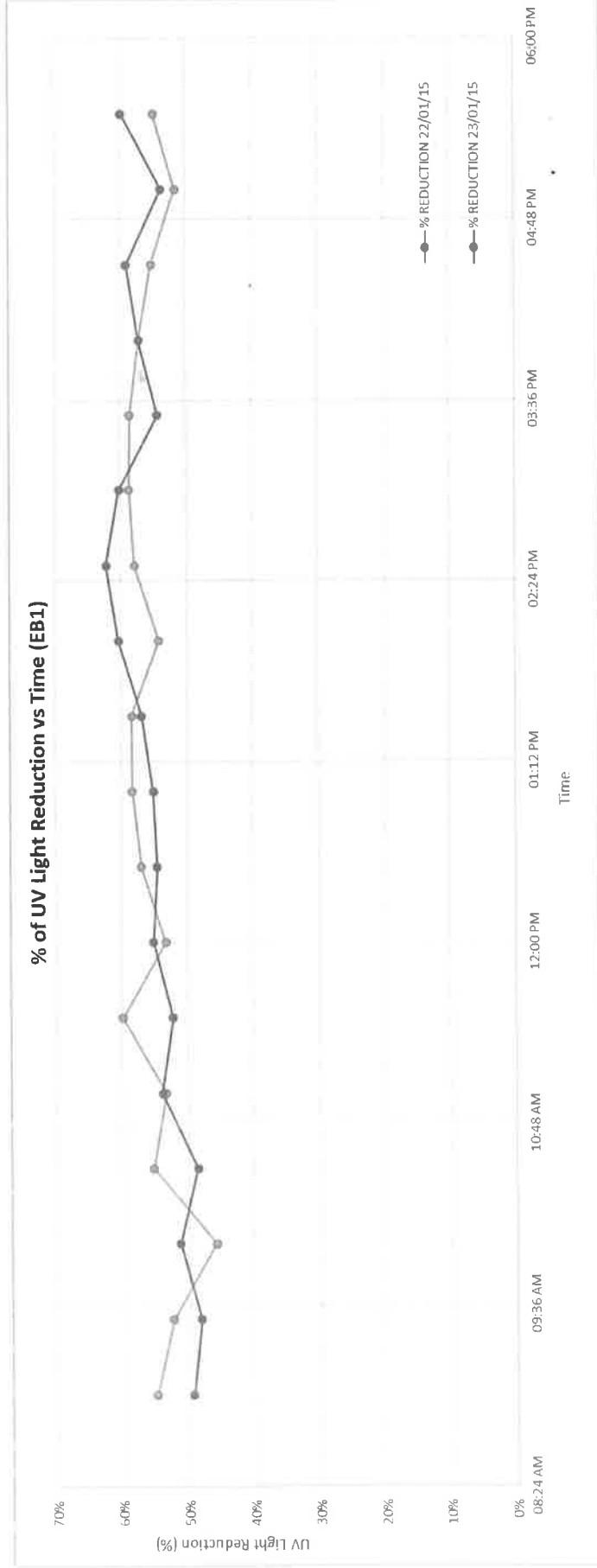


Figure 5.1.1.2 % of UV Light Reduction vs Time (EB1)

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5.2 Sample No.2 (EB2)

4mm tempered clear glass + 19mm air space with Enclosed Blind + 5mm tempered light green glass

Table 5.2.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	210	25	185	MIN	88.10%	MIN
2	9:30 AM	230	35	195	117	84.78%	84.78%
3	10:00 AM	390	56	334	AVERAGE	85.64%	AVERAGE
4	10:30 AM	1376	193	1183	394	85.97%	87.15%
5	11:00 AM	1124	145	979	MAX	87.10%	MAX
6	11:30 AM	816	116	700	1183	85.78%	90.00%
7	12:00 PM	328	43	285		86.89%	
8	12:30 PM	627	79	548		87.40%	
9	1:00 PM	413	49	364		88.14%	
10	1:30 PM	421	57	364		86.46%	
11	2:00 PM	364	50	314		86.26%	
12	2:30 PM	362	42	320		88.40%	
13	3:00 PM	396	50	346		87.37%	
14	3:30 PM	265	33	232		87.55%	
15	4:00 PM	280	35	245		87.50%	
16	4:30 PM	218	26	192		88.07%	
17	5:00 PM	219	28	191		87.21%	
18	5:30 PM	130	13	117		90.00%	

Table 5.2.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	705	128	577	MIN	81.84%	MIN
2	9:30 AM	1086	181	905	159	83.33%	81.84%
3	10:00 AM	1069	161	908	AVERAGE	84.94%	AVERAGE
4	10:30 AM	1129	183	946	467	83.79%	87.42%
5	11:00 AM	970	131	839	MAX	86.49%	MAX
6	11:30 AM	710	87	623	946	87.75%	92.36%
7	12:00 PM	576	44	532		92.36%	
8	12:30 PM	503	59	444		88.27%	
9	1:00 PM	417	52	365		87.53%	
10	1:30 PM	386	49	337		87.31%	
11	2:00 PM	406	46	360		88.67%	
12	2:30 PM	354	44	310		87.57%	
13	3:00 PM	317	38	279		88.01%	
14	3:30 PM	282	33	249		88.30%	
15	4:00 PM	245	27	218		88.98%	
16	4:30 PM	217	25	192		88.48%	
17	5:00 PM	182	20	162		89.01%	
18	5:30 PM	175	16	159		90.86%	

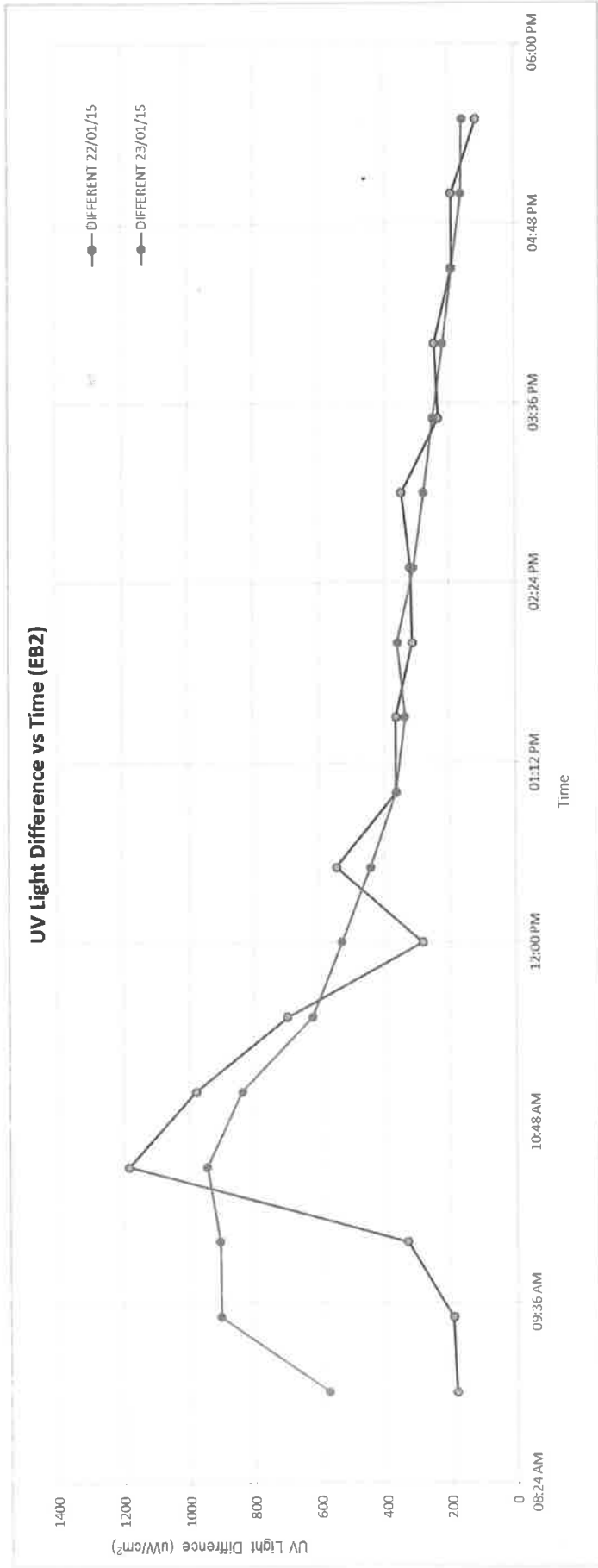


Figure 5.2.1 UV Light Difference vs Time (EB2)

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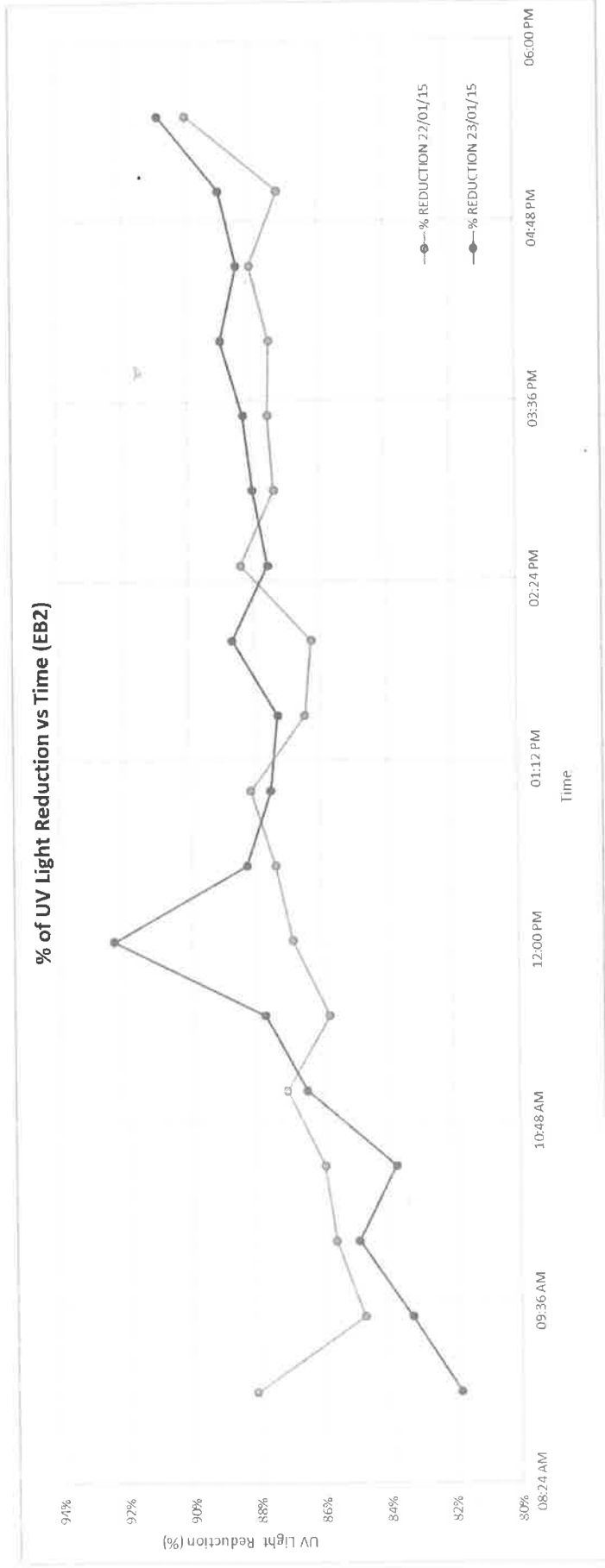


Figure 5.2.2 % of UV Light Reduction vs Time (EB2)

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5.3 Sample No.3 (EB3)

4mm tempered clear glass + 19mm air space with Enclosed Blind + 6.38mm laminated clear float glass

Table 5.3.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	193	0	193	MIN	100.00%	MIN
2	9:30 AM	223	1	222	122	99.55%	99.45%
3	10:00 AM	344	1	343	AVERAGE	99.71%	AVERAGE
4	10:30 AM	1183	6	1177	415	99.49%	99.69%
5	11:00 AM	923	4	919	MAX	99.57%	MAX
6	11:30 AM	682	3	679	1177	99.56%	100.00%
7	12:00 PM	319	1	318		99.69%	
8	12:30 PM	596	2	594		99.66%	
9	1:00 PM	362	2	360		99.45%	
10	1:30 PM	450	2	448		99.56%	
11	2:00 PM	383	1	382		99.74%	
12	2:30 PM	346	1	345		99.71%	
13	3:00 PM	438	2	436		99.54%	
14	3:30 PM	246	1	245		99.59%	
15	4:00 PM	279	1	278		99.64%	
16	4:30 PM	205	0	205		100.00%	
17	5:00 PM	205	0	205		100.00%	
18	5:30 PM	122	0	122		100.00%	

Table 5.3.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	707	5	702	MIN	99.29%	MIN
2	9:30 AM	970	6	964	146	99.38%	99.29%
3	10:00 AM	1058	4	1054	AVERAGE	99.62%	AVERAGE
4	10:30 AM	1089	0	1089	531	100.00%	99.71%
5	11:00 AM	966	4	962	MAX	99.59%	MAX
6	11:30 AM	656	0	656	1089	100.00%	100.00%
7	12:00 PM	562	0	562		100.00%	
8	12:30 PM	530	0	530		100.00%	
9	1:00 PM	444	2	442		99.55%	
10	1:30 PM	416	2	414		99.52%	
11	2:00 PM	403	2	401		99.50%	
12	2:30 PM	375	2	373		99.47%	
13	3:00 PM	335	2	333		99.40%	
14	3:30 PM	294	0	294		100.00%	
15	4:00 PM	241	0	241		100.00%	
16	4:30 PM	215	1	214		99.53%	
17	5:00 PM	185	0	185		100.00%	
18	5:30 PM	146	0	146		100.00%	

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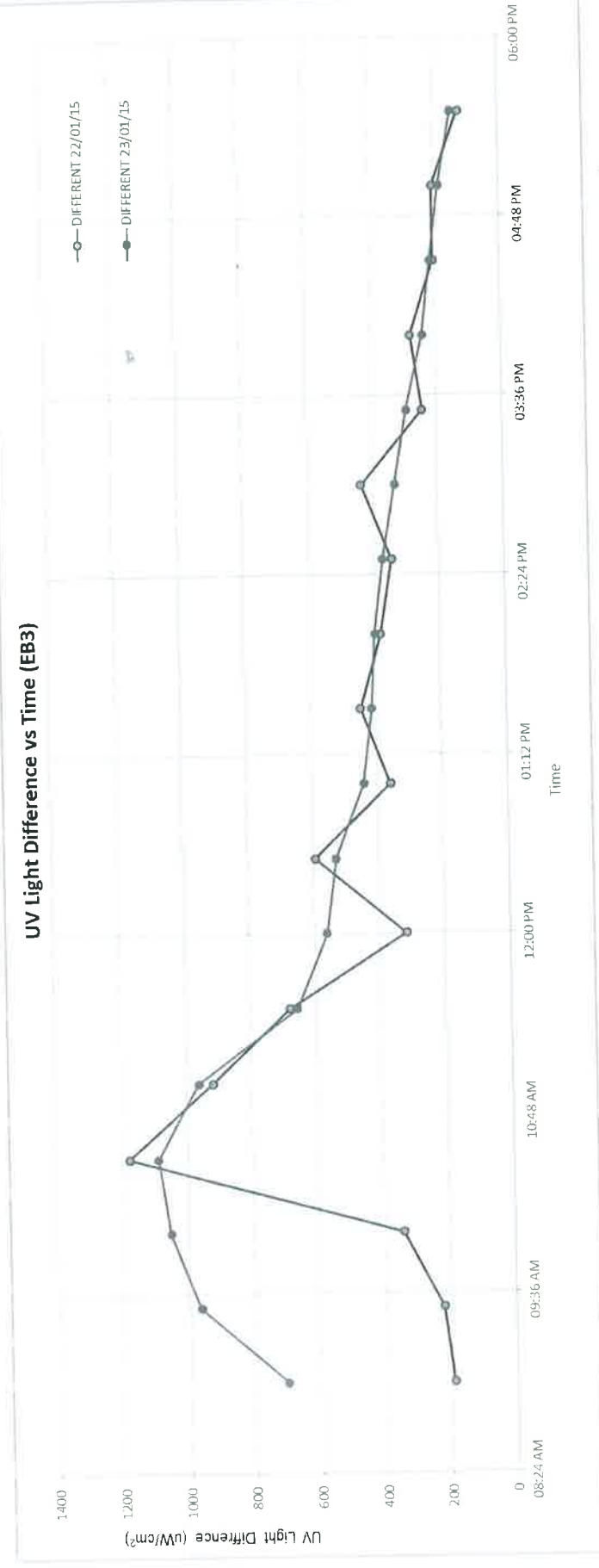


Figure 5.3.1 UV Light Difference vs Time (EB3)

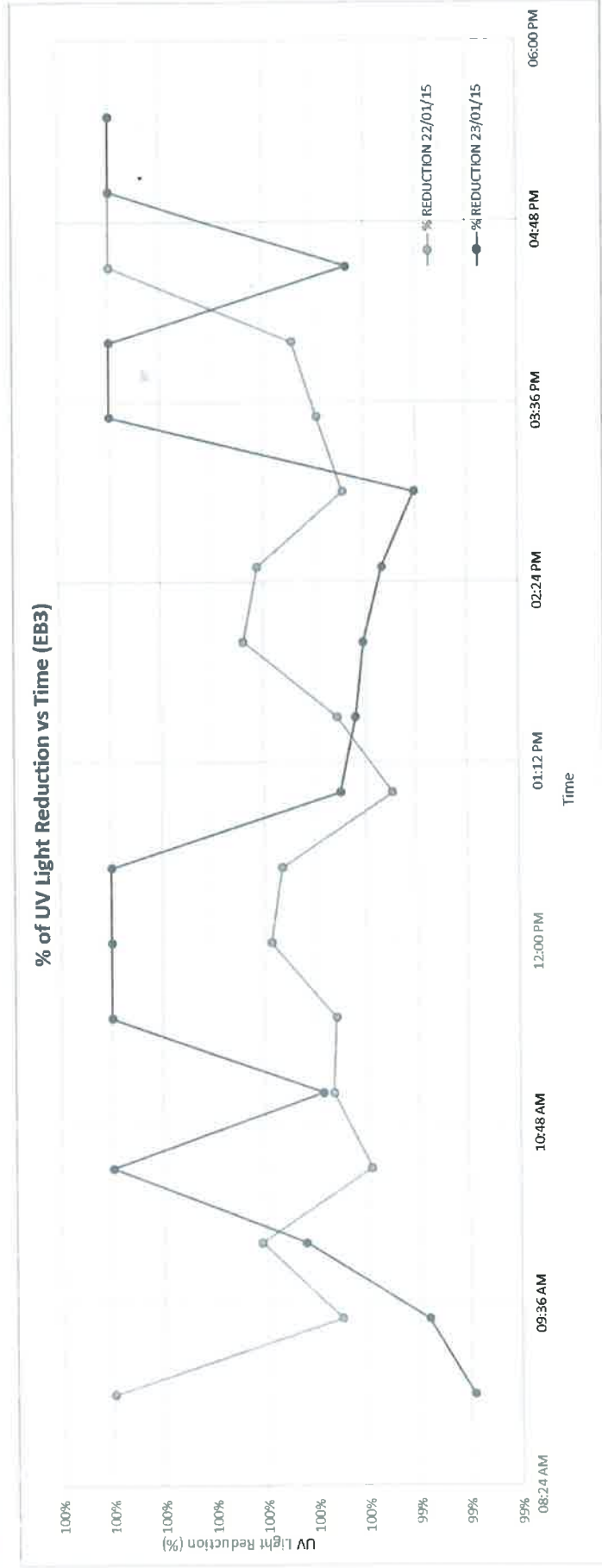


Figure 5.3.2 % of UV Light Reduction vs Time (EB3)

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5.4 Sample No.4 (DG4)

4mm tempered clear glass + 19mm air space + 6.38mm laminated clear float glass

Table 5.4.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	239	0	239	MIN	100.00%	MIN
2	9:30 AM	253	1	252	138	99.60%	99.54%
3	10:00 AM	393	1	392	AVERAGE	99.75%	AVERAGE
4	10:30 AM	1313	6	1307	469	99.54%	99.72%
5	11:00 AM	1069	4	1065	MAX	99.63%	MAX
6	11:30 AM	815	2	813	1307	99.75%	100.00%
7	12:00 PM	371	1	370		99.73%	
8	12:30 PM	738	3	735		99.59%	
9	1:00 PM	432	2	430		99.54%	
10	1:30 PM	474	2	472		99.58%	
11	2:00 PM	424	1	423		99.76%	
12	2:30 PM	377	1	376		99.73%	
13	3:00 PM	444	2	442		99.55%	
14	3:30 PM	260	1	259		99.62%	
15	4:00 PM	261	1	260		99.62%	
16	4:30 PM	231	0	231		100.00%	
17	5:00 PM	234	0	234		100.00%	
18	5:30 PM	138	0	138		100.00%	

Table 5.4.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	709	5	704	MIN	99.29%	MIN
2	9:30 AM	1113	6	1107	162	99.46%	99.29%
3	10:00 AM	1094	4	1090	AVERAGE	99.63%	AVERAGE
4	10:30 AM	1168	0	1168	562	100.00%	99.73%
5	11:00 AM	1022	4	1018	MAX	99.61%	MAX
6	11:30 AM	741	0	741	1168	100.00%	100.00%
7	12:00 PM	579	0	579		100.00%	
8	12:30 PM	524	0	524		100.00%	
9	1:00 PM	423	2	421		99.53%	
10	1:30 PM	427	2	425		99.53%	
11	2:00 PM	417	2	415		99.52%	
12	2:30 PM	387	2	385		99.48%	
13	3:00 PM	355	2	353		99.44%	
14	3:30 PM	313	0	313		100.00%	
15	4:00 PM	266	0	266		100.00%	
16	4:30 PM	240	1	239		99.58%	
17	5:00 PM	199	0	199		100.00%	
18	5:30 PM	162	0	162		100.00%	

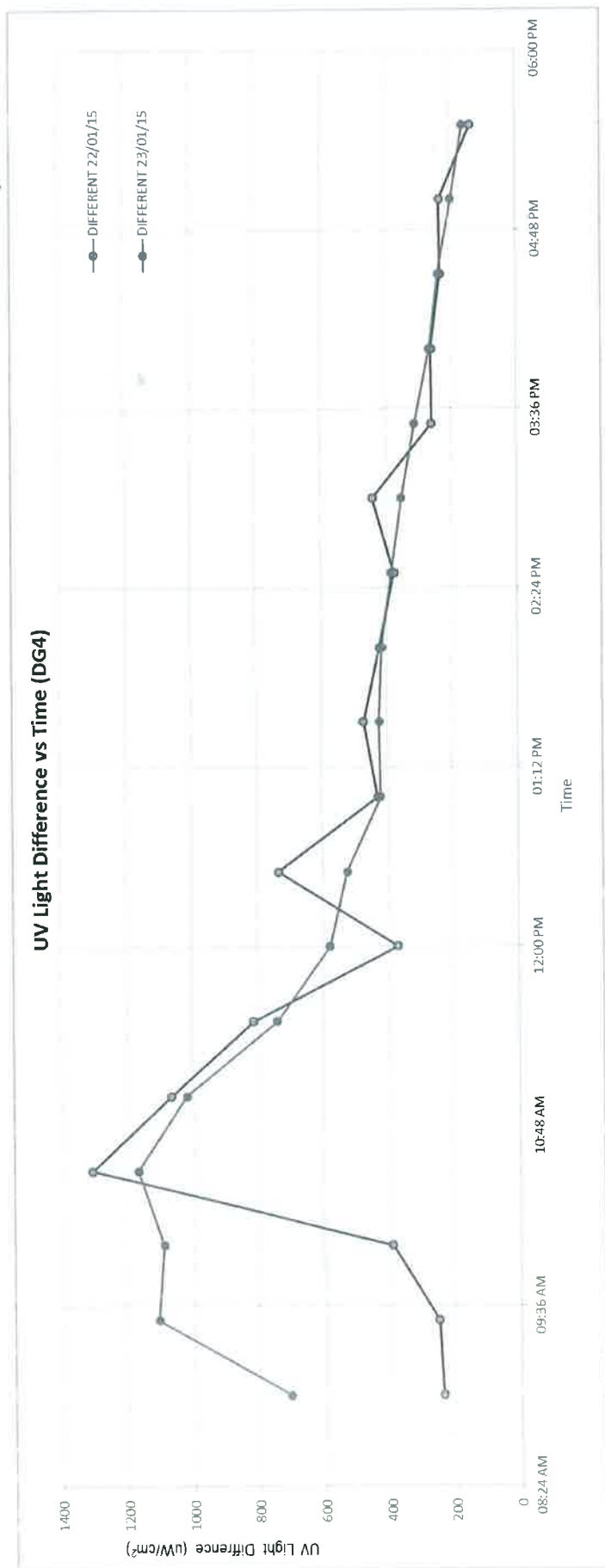


Figure 5.4.1 UV Light Difference vs Time (DG4)

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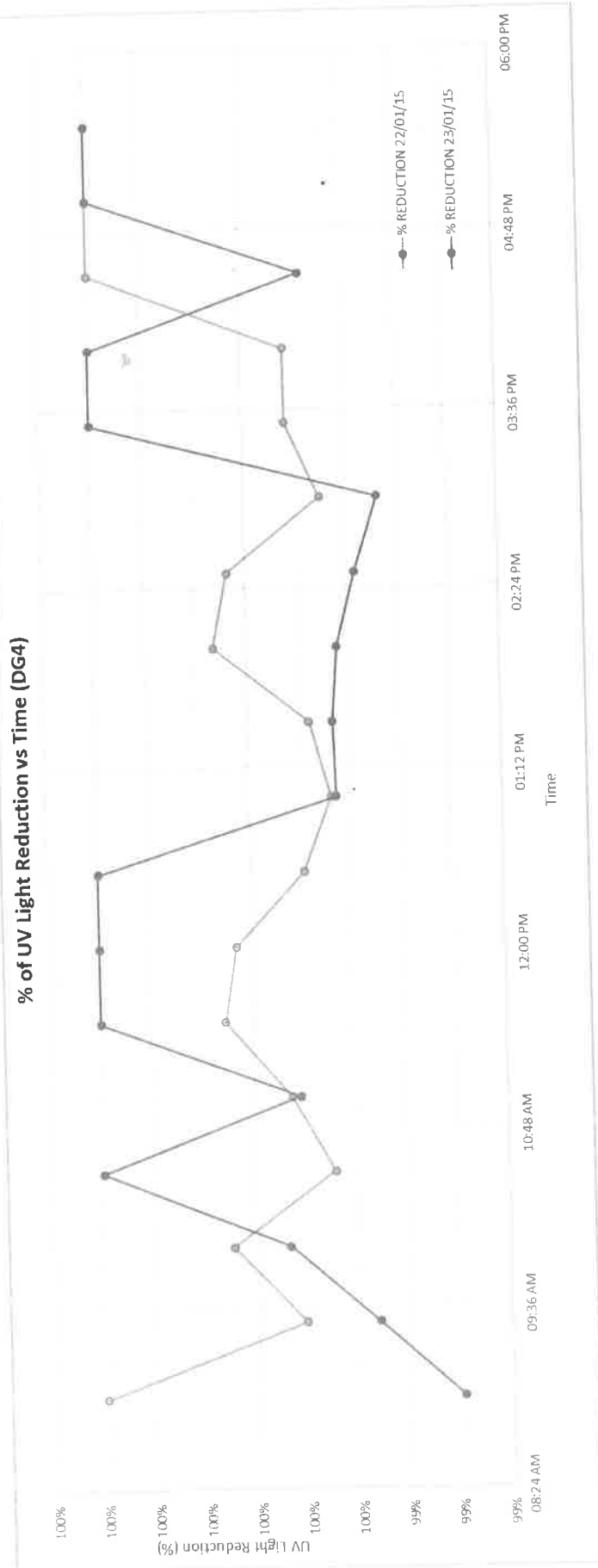


Figure 5.4.2 % of UV Light Reduction vs Time (DG4)

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5.5 Sample No.5 (DG5)

4mm tempered clear glass + 8mm air space + 6.38mm laminated clear float glass

Table 5.5.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	263	1	262	MIN	99.62%	MIN
2	9:30 AM	249	1	248	133	99.60%	99.48%
3	10:00 AM	400	1	399	AVERAGE	99.75%	AVERAGE
4	10:30 AM	1278	6	1272	456	99.53%	99.70%
5	11:00 AM	1007	4	1003	MAX	99.60%	MAX
6	11:30 AM	760	2	758	1272	99.74%	100.00%
7	12:00 PM	358	1	357		99.72%	
8	12:30 PM	648	3	645		99.54%	
9	1:00 PM	385	2	383		99.48%	
10	1:30 PM	496	2	494		99.60%	
11	2:00 PM	401	1	400		99.75%	
12	2:30 PM	399	1	398		99.75%	
13	3:00 PM	437	2	435		99.54%	
14	3:30 PM	266	1	265		99.62%	
15	4:00 PM	316	1	315		99.68%	
16	4:30 PM	206	0	206		100.00%	
17	5:00 PM	226	0	226		100.00%	
18	5:30 PM	133	0	133		100.00%	

Table 5.5.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	815	5	810	MIN	99.39%	MIN
2	9:30 AM	1128	6	1122	152	99.47%	99.39%
3	10:00 AM	1084	4	1080	AVERAGE	99.63%	AVERAGE
4	10:30 AM	1143	0	1143	557	100.00%	99.73%
5	11:00 AM	1002	4	998	MAX	99.60%	MAX
6	11:30 AM	710	0	710	1143	100.00%	100.00%
7	12:00 PM	576	0	576		100.00%	
8	12:30 PM	532	0	532		100.00%	
9	1:00 PM	413	2	411		99.52%	
10	1:30 PM	423	2	421		99.53%	
11	2:00 PM	404	2	402		99.50%	
12	2:30 PM	368	2	366		99.46%	
13	3:00 PM	340	2	338		99.41%	
14	3:30 PM	300	0	300		100.00%	
15	4:00 PM	247	0	247		100.00%	
16	4:30 PM	229	1	228		99.56%	
17	5:00 PM	189	0	189		100.00%	
18	5:30 PM	152	0	152		100.00%	

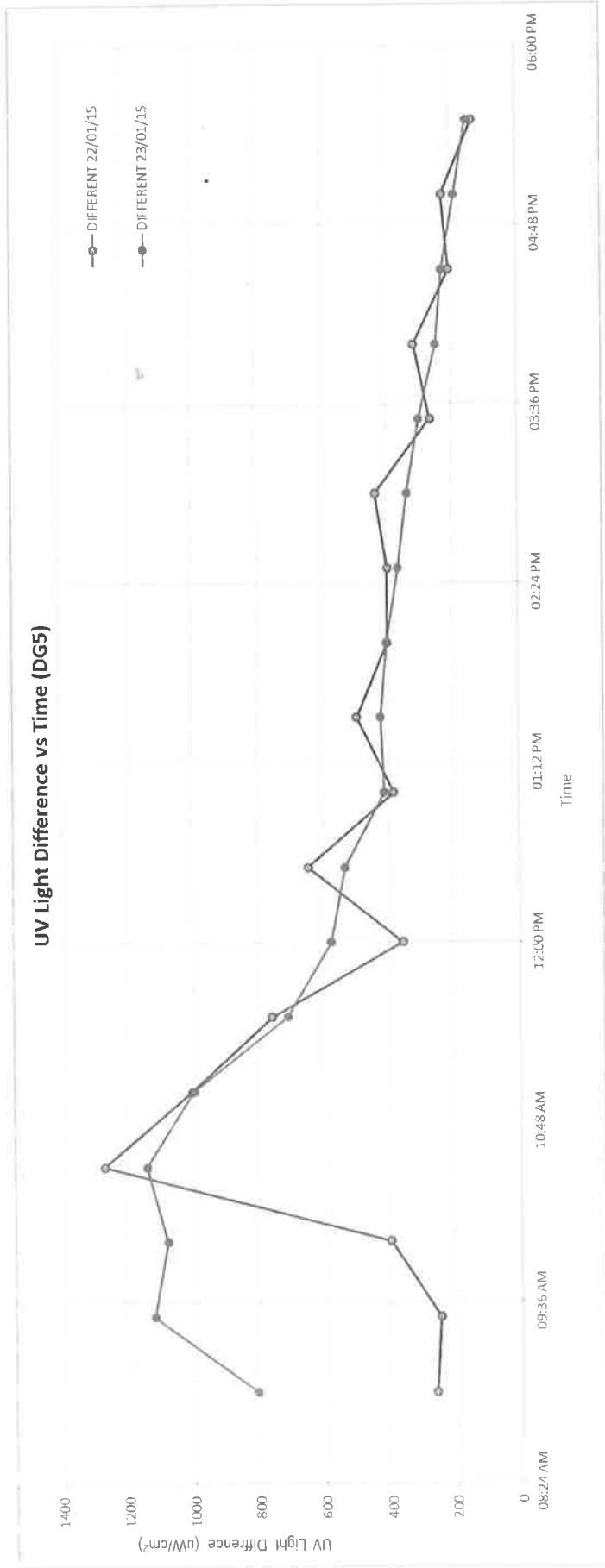


Figure 5.5.1 UV Light Difference vs Time (DG5)

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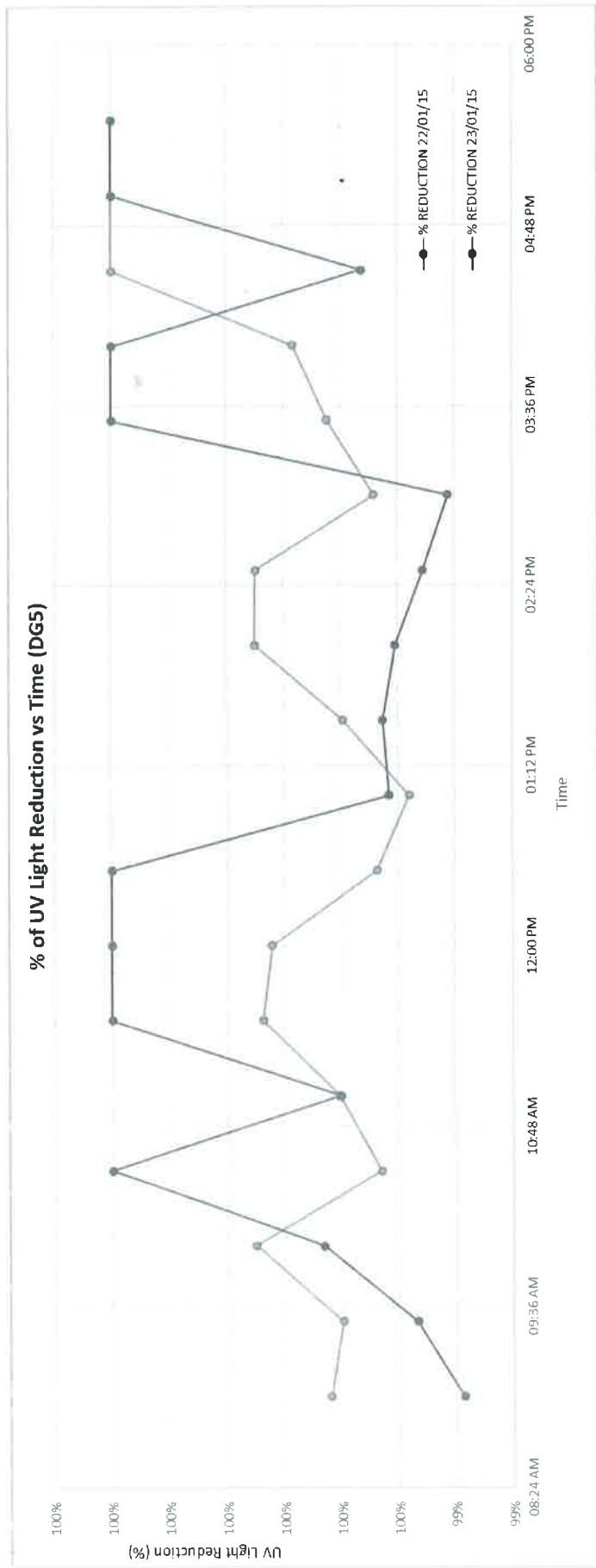


Figure 5.5.2 % of UV Light Reduction vs Time (DG5)

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5.6 Sample No.6 (DG6)

4mm tempered clear glass + 8mm air space + 4mm tempered clear glass

Table 5.6.1 Measurement taken on 22/01/2015

NO	TIME	IN	OUT	DIFFERENT 22/01/15		% REDUCTION 22/01/15	
1	9:00 AM	278	127	151	MIN	54.32%	MIN
2	9:30 AM	251	93	158	85	62.95%	52.70%
3	10:00 AM	413	163	250	AVERAGE	60.53%	AVERAGE
4	10:30 AM	1227	570	657	270	53.55%	59.52%
5	11:00 AM	1018	425	593	MAX	58.25%	MAX
6	11:30 AM	755	241	514	657	68.08%	68.08%
7	12:00 PM	382	164	218		57.07%	
8	12:30 PM	646	259	387		59.91%	
9	1:00 PM	309	136	173		55.99%	
10	1:30 PM	493	188	305		61.87%	
11	2:00 PM	415	146	269		64.82%	
12	2:30 PM	393	150	243		61.83%	
13	3:00 PM	458	167	291		63.54%	
14	3:30 PM	261	117	144		55.17%	
15	4:00 PM	280	118	162		57.86%	
16	4:30 PM	232	95	137		59.05%	
17	5:00 PM	222	105	117		52.70%	
18	5:30 PM	133	48	85		63.91%	

Table 5.6.2 Measurement taken on 23/01/2015

NO	TIME	IN	OUT	DIFFERENT 23/01/15		% REDUCTION 23/01/15	
1	9:00 AM	795	376	419	MIN	52.70%	MIN
2	9:30 AM	1103	521	582	99	52.77%	52.11%
3	10:00 AM	1074	496	578	AVERAGE	53.82%	AVERAGE
4	10:30 AM	1137	541	596	318	52.42%	58.82%
5	11:00 AM	952	403	549	MAX	57.67%	MAX
6	11:30 AM	692	298	394	596	56.94%	64.52%
7	12:00 PM	570	236	334		58.60%	
8	12:30 PM	520	200	320		61.54%	
9	1:00 PM	443	159	284		64.11%	
10	1:30 PM	427	155	272		63.70%	
11	2:00 PM	403	143	260		64.52%	
12	2:30 PM	365	135	230		63.01%	
13	3:00 PM	336	128	208		61.90%	
14	3:30 PM	310	127	183		59.03%	
15	4:00 PM	270	105	165		61.11%	
16	4:30 PM	244	90	154		63.11%	
17	5:00 PM	190	91	99		52.11%	
18	5:30 PM	169	68	101		59.76%	

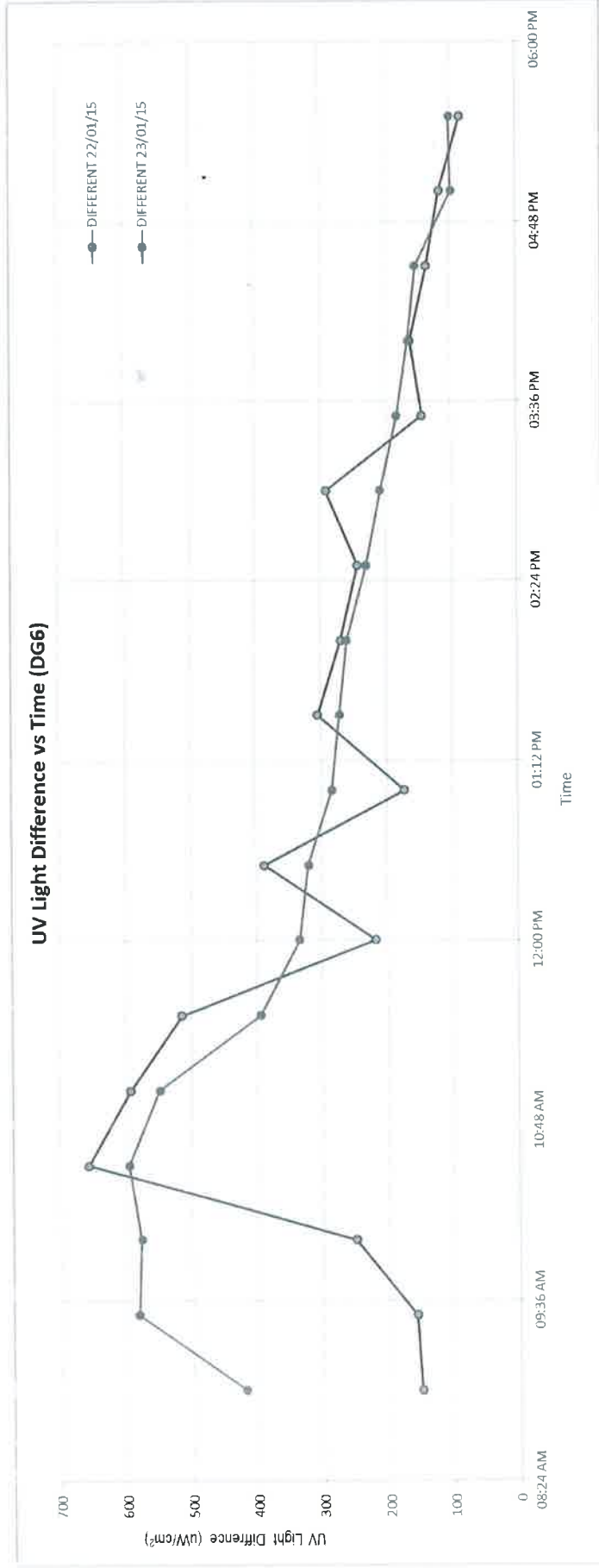


Figure 5.6.1 UV Light Difference vs Time (DG6)

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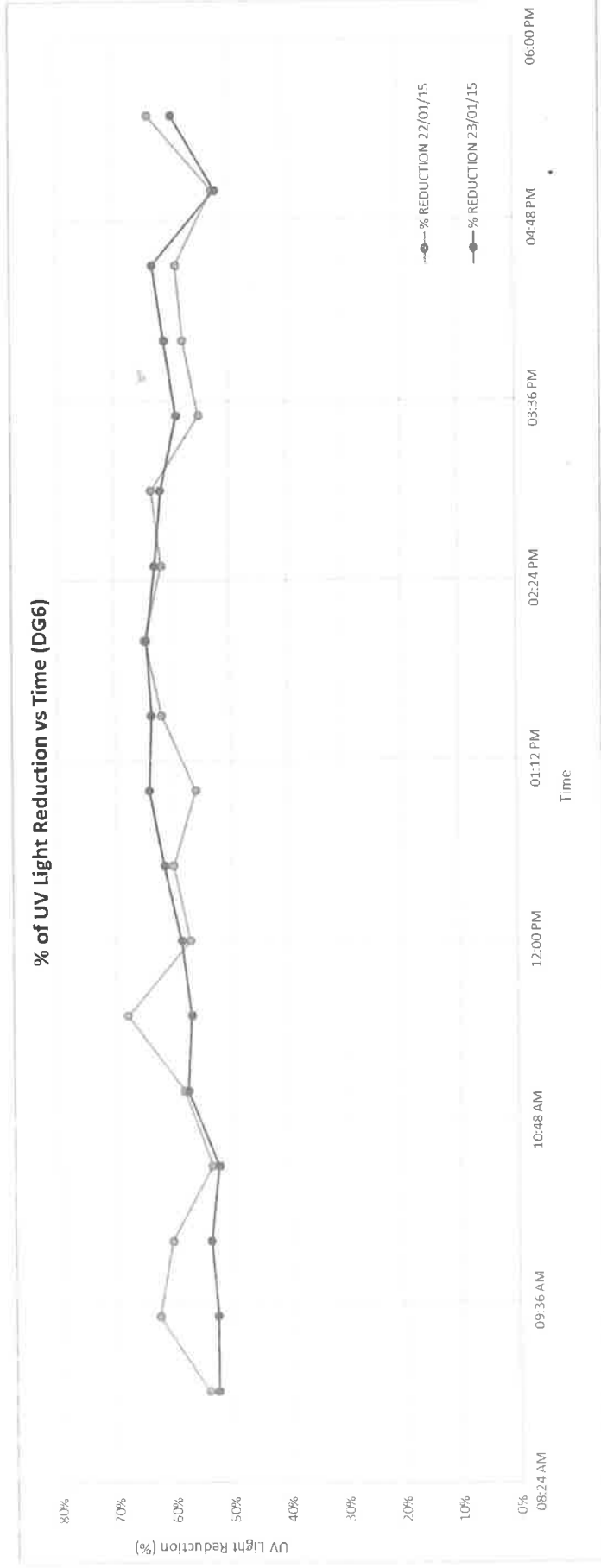


Figure 5.6.2 % of UV Light Reduction vs Time (DG6)

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6. SUMMARY

The min, average and max UV reduction are summarised in Table 6.1 below:-

Table 6.1 Summary of UV Reduction

No.	Date	Sample	Min Value (%)	Average (%)	Max Value (%)
1	22/01/2015	EB1	45.87	55.45	59.98
	23/01/2015		48.21	55.17	62.19
2	22/01/2015	EB2	84.78	87.15	90.00
	23/01/2015		81.84	87.42	92.36
3	22/01/2015	EB3	99.45	99.69	100.00
	23/01/2015		99.29	99.71	100.00
4	22/01/2015	DG4	99.54	99.72	100.00
	23/01/2015		99.29	99.73	100.00
5	22/01/2015	DG5	99.48	99.70	100.00
	23/01/2015		99.39	99.73	100.00
6	22/01/2015	DG6	52.70	59.52	68.08
	23/01/2015		52.11	58.82	64.52

Samples EB3, DG4 and DG5 have the best performance, with almost 100% reduction. These samples are 6.38mm laminated clear float glass which are capable of blocking UV light.

Sample EB2 which is a tempered light green colour glass is capable to reduce 87% of UV light.

Sample DG6 is able to reduce in average 59 to 60% of UV light and sample EB1 is able to reduce in average 55% of UV light.