



Report  
3M: Anchored Safety Film Blast Tests

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## Executive Summary

Blast testing of anchored film glazing systems, under supervision of TPS, was undertaken at the Spadeadam Test Facility, MoD R5, Spadeadam, Gilsand, Cumbria CA36 7AT, England by Avantica Technologies Limited from the 13<sup>th</sup> to the 20<sup>th</sup> September 2007.

Glazing systems tested consisted of combinations of glazing, film type and anchoring mechanisms.

The object of the tests was to assess and compare the bomb blast resistance of a selection of systems to the International Organisation for Standards (ISO) and US General Services Administration (GSA) glazing. In particular, the hazard ratings and confidence levels for the ISO EXV 25, ISO EXV 33, ISO EXV 45 and GSA C standards. Each sample was tested using a single bomb blast. Note: to achieve full compliance with GSA, each sample would need to be tested 3 times.

The glazing systems were mounted three in each test structure, with two test structures per test. 6 tests were undertaken with 33 window systems tested in total. Each test structure contained an internal pressure transducer and, for the majority of the tests, a high speed video camera.

3 pressure transducers were mounted on an external gauge block to measure the reflected pressure from the blast and calculate the blast loads on the test samples. 3 Free field transducers were mounted in aerodynamic casings and used to measure the free field pressure used to assess the explosive strength of the blast.

The table on the following page summarises the windows tested and the results of the tests.

The systems tested provide a good sample for comparing different anchoring methods and film types and assessing the bomb blast protection capabilities. This information could be used to decide on which systems would undergo further tests to provide consistency in the results and confidence in the protection afforded by the anchored safety film.

### 3M: Anchored Safety Film Blast Tests

All tests were conducted on samples with four side attachment unless otherwise stated

Test	Location	Target Description	Blast Loading		%Difference to Test Standard		Rating Awarded	
			Pressure (PSI)	Impulse (PSI.mS)	Pressure	Impulse	GSA	ISO
Test 1 ISO EXV25	1A	Mono SH8CLARL DOW 995	14.1	68.6	21.6%	24.5%	5	High Hazard
	1B	IG Ultra600 +3M Caulk	14.1	70.8	21.6%	28.5%	2	Minimal Hazard
	1C	IG SH8CLARL DOW 995	14.1	68.6	21.6%	24.5%	5	Low Hazard
	2A	Mono SH14CLARL 3M Profile	14.1	68.6	21.6%	24.5%	5	Low Hazard
	2B	Mono SH14CLARL 3M Caulk	14.1	70.8	21.6%	28.5%	5	Low Hazard
	2C	IG SH7CLARL 3M Caulk	14.1	68.6	21.6%	24.5%	4	Low Hazard
Test 2 ISO EXV25	1A	IG SH14CLARL DOW 995	12.3	66.3	6.0%	20.3%	3b	Low Hazard
	1B	IG SH14CLARL DOW 995	12.3	68.5	6.0%	24.3%	3b	Low Hazard
	1C	IG SH8CLARL 3M Caulk	12.3	66.3	6.0%	20.3%	2	Minimal Hazard
	2A	none	12.3	66.3	6.0%	20.3%	n/a	n/a
	2B	none	12.3	68.5	6.0%	24.3%	n/a	n/a
	2C	none	12.3	66.3	6.0%	20.3%	n/a	n/a
Test 3 ISO EXV33	1A	Mono SH7CLARL 3M Caulk	8.4	44.3	15.1%	22.0%	5	Low Hazard
	1B	Mono Ultra Prestige PRS50 3M Caulk	8.4	46.5	15.1%	28.1%	3b	Very Low Hazard
	1C	Mono SH14CLARL Profile	8.4	44.3	15.1%	22.0%	3b	Very Low Hazard
	2A	IG Ultra Prestige PRS50 DOW 995	8.4	44.3	15.1%	22.0%	2	Minimal Hazard
	2B	Mono Ultra600 3M Caulk	8.4	46.5	15.1%	28.1%	3b	Low Hazard
	2C	Mono SH8CLARL 3M Caulk	8.4	44.3	15.1%	22.0%	2	Minimal Hazard
Test 4 ISO EXV33	1A	Mono SH7CLARL 3M Caulk	8	42.1	9.6%	16.0%	5	Low Hazard
	1B	Mono Ultra Prestige PRS50 3M Caulk	8	44.1	9.6%	21.5%	5	Low Hazard
	1C	Mono SH8CLARL 3M Caulk	8	42.1	9.6%	16.0%	3b	Low Hazard
	2A	Mono Ultra600 DOW 995	8	42.1	9.6%	16.0%	3b	Very Low Hazard
	2B	Mono Ultra Prestige PRS50 Profile	8	44.1	9.6%	21.5%	3b	Low Hazard
	2C	Mono Ultra Prestige PRS50 DOW 995	8	42.1	9.6%	16.0%	5	Low Hazard
Test 5 ISO EXV33	1A	Mono SH8CLARL Profile	7.7	41.2	5.5%	13.5%	3b	Low Hazard
	1B	Mono Ultra Prestige PRS50 DOW 995	7.7	43.5	5.5%	19.8%	3b	Low Hazard
	1C	IG Ultra Prestige PRS50 DOW 995	7.7	41.2	5.5%	13.5%	2	Minimal Hazard
	2A	Mono SH8 CLARL 3M Caulk	7.7	41.2	5.5%	13.5%	3b	Low Hazard
	2B	Mono SH7 CLARL 3M Caulk	7.7	43.5	5.5%	19.8%	5	High Hazard
	2C	IG Ultra Prestige PRS50 DOW 995	7.7	41.2	5.5%	13.5%	2	No Hazard
Test 6 GSA C	1A	IG Ultra600 Daylite	4.2	29.0	5.0%	3.6%	3b	Low Hazard
	1B	Mono SCLARL400 3M Caulk	4.2	29.4	5.0%	5.0%	2	Minimal Hazard
	1C	IG Ultra600 Daylite	4.2	29.0	5.0%	3.6%	3b	Low Hazard
	2A	Mono SCLARL400 3M Caulk 2 Side	4.2	29.0	5.0%	3.6%	3b	Low Hazard
	2B	Mono SH7CLARL 3M Caulk	4.2	29.4	5.0%	5.0%	3b	Low Hazard
	2C	IG Ultra600 Daylite	4.2	29.0	5.0%	3.6%	3b	Low Hazard