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**Loading and soft body
impact tests on Primera
Ltd 8WR window
restrictors**

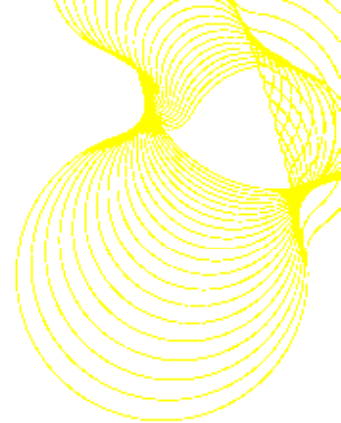
Prepared for: Mr. J. Smith

Director

Primera Ltd

10 January 2014

Test report number 291617-1



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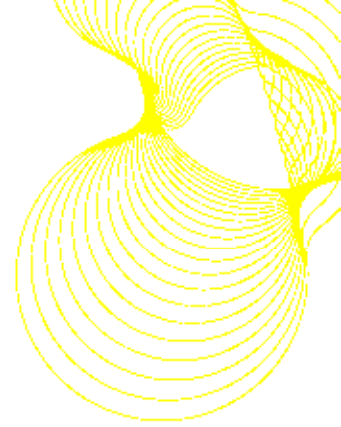
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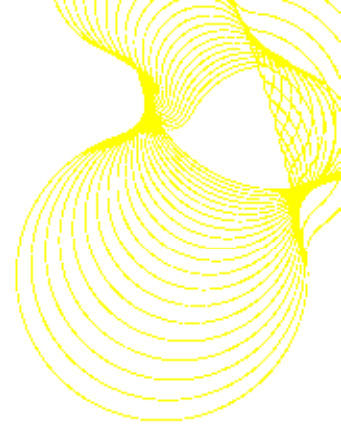
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1 Introduction

At the request of Mr. J. Smith, Director of Primera Ltd, Unit 8, Bankfield House, 250 Bristol Avenue, Blackpool, FY2 0JF, BRE issued proposal number 134673 on 21 October 2013. The proposal was accepted on 11 November 2013 and BRE tested specimen 8WR window restrictors on the 4 December 2013.

The primary purpose of the window restrictors tested was to limit the opening of the window beyond a set amount. The objective of the tests on the window restrictors was to determine how resistant to normal and abnormal loading the restrictors are. The tests measure the resistance to static loading and impacts of the specimen window restrictors with the window opened to engage with the window opening restrictor.

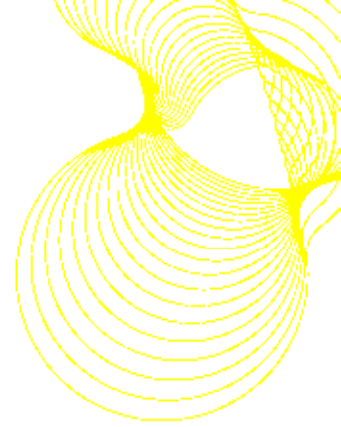
The window restrictors were tested on a top hung window mock-up.

The tests follow the principles of loading and impact resistance tests for safety devices (e.g. window opening restrictors) and windows respectively, in accordance with standards specified in BS 6375-2:2009¹. Reference is also made to BS EN 13126-5:2011² about devices that restrict the opening of windows and door height windows. However, the Department of Health's Health Building note 00-10 Part D³, recently published, that supersedes Health Technical Memorandum HTM 55 1998⁴, emphasises the need to test to values in excess of those in the two standards above. This is because it is recognised that window restrictors tested to current, relevant British and European Standards may be inadequate in preventing a determined effort to force a window open beyond the restriction provided by the restrictor hardware.

Classification of the test results was by comparison with performance criteria within BS 13049:2003⁵ and BS EN 14351-1:2006+A1:2010⁶ and also by reference to forces that adults can exert from a standing position in the Handbook of adult anthropometric and strength requirements⁷.

The tests described herein do not test the strength or resistance to loads of the window frame fixings that secure the frame to substrate. Guidance is given in BS 6180⁸ about such fixings, attachments and anchorages.

The tests on the window restrictors were carried out by Mr. M. C. Pound under the BRE Standard Terms and Conditions of Business for testing, as BRE Job number 291617 in project number CV6438.



2 Test specimens

The general details about the test specimens supplied by Primera Ltd for these tests are given below:

Restrictors

The window restrictors tested were all in the range 8WR. Four sizes of restrictors were tested:

8WR/225 225 mm long left (L) and right (R) hand restrictors
8WR/340 340 mm long left (L) and right (R) hand restrictors
8WR/450 450 mm long left (L) and right (R) hand restrictors
8WR/650 650 mm long left (L) and right (R) hand restrictors

These four sizes represent the 8WR range of sizes available and include the shortest and longest window restrictors with two sizes between. Other sizes exist as well as those listed above.

All of the restrictors tested were made from 3 mm thick mild steel in two parts. The amount that the window can open can be pre-set to one of five possible positions. The restrictors were tested set to the tightest position meaning that the window opening was restricted to the least amount of the five settings available.

The restrictors are fixed to the window frame at positions recommended in the manufacturer's instructions to give 40 mm overlap across the opening light frame. Fixings used were stainless steel countersunk head screws, gauge 10 screws (5 mm diameter) x 38 mm long. 8WR/225 and 8WR/345 have three fixing screws per restrictor while 8WR/450 has four screws and 8WR/650 has five screws.

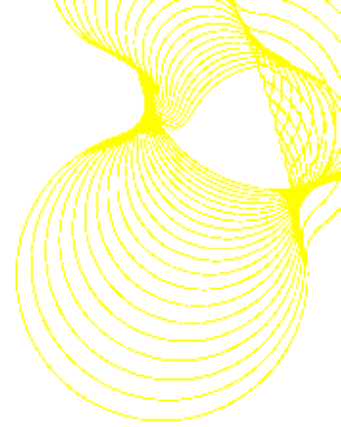
Mock-up window

The restrictors were tested mounted on a mock-up of a top hung window with a single outward opening light.

The window frame was made of 67 mm x 93 mm section solid timber members with mortice and tenon corner joints reinforced with 125 mm long angle metal plates fixed with six screws each. The overall size of the frame is 1185 mm wide x 1300 mm high.

The 1070 mm wide x 1160 mm high 'opening light' was represented by two sheets of 18 mm thick plywood, fixed together with wood screws and top hung on a heavy duty stainless steel piano hinge across the width of the window opening.

Steel plates are fixed to the opening light corresponding to the various loading points for the different sizes of restrictors tested.

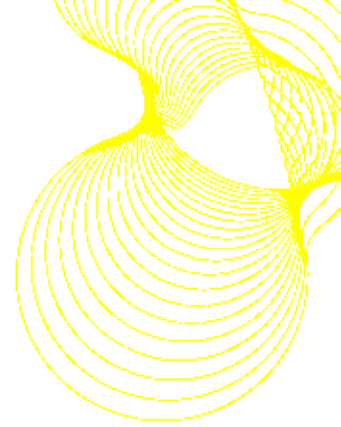


3 Details of tests carried out

The tests were primarily of the window restrictors and designed to investigate their ability to resist static and impact loads. To reduce the influence on results of possible weaknesses in a proprietary window a strong, rigid and adjustable mock-up window frame and opening light was constructed onto which the restrictors could be fixed securely for tests. The same mock up window was used throughout the loading and impact tests.

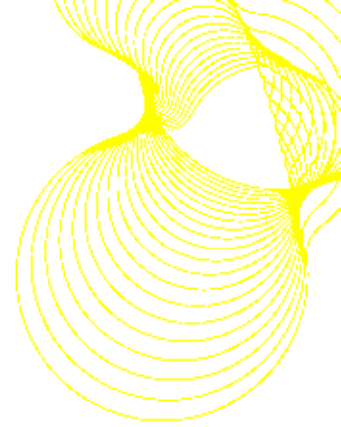
Loading tests

- A pair of window restrictors was fixed securely by the manufacturer to the mock-up window and the window opened so that it was bearing against the restrictors.
- Loads were applied according to BS 6375-2:2009¹ Clause 5.3 for load bearing capacity of safety devices using a hydraulic ram with calibrated load cell and display.
- Loads were applied to the indoor face at mid-width of the mock-up window's opening light in the direction that would open the window further. The height at which the load was applied to the light was according to which size restrictor was under test (see test results).
- Incremental loading was continued beyond the 350 N (Newtons) threshold strength in BS EN 14351-1:2006+A1:2010⁶ until the specimens were deemed to be no longer functioning as designed.
- With each load held for a minute the specimen was examined while under load and then the load reduced to zero at a constant rate to reduce dynamic effects. Any damage was recorded and then the next load applied until the specimens were deemed to be no longer functioning as designed.
- Typical loading sequences in Newtons, each increment held for one minute, were; 350, 600, 800, 1000, 1200, 1500, 1600, 1800 and 2000.
- The initial two test specimens were tested to the increments as above. The last two test specimens tested, 8WR/450 and 8WR/650, were subjected to an abbreviated test regime typically starting at 800 or 1200 N.
- All the load increments in a sequence were performed on one pair of new window restrictors until the test was completed and then another different sized pair was subjected to the same tests.



Soft, heavy body impacts

- A pair of window restrictors was fixed securely by the manufacturer to the mock up window and the window opened so that it was bearing against the restrictors.
- Impact loads were applied according to BS 6375-2:2009¹ Clause 5.4 and BS 13049:2003⁵ for windows.
- The impacts from a soft, heavy body simulate those that might reasonably be expected from accidental or deliberate impacts by human bodies.
- The impactor in this case is a 50 kg soft, heavy body consisting of two inflatable tyres on rims fixed around a central cylindrical shaped mass. It is suspended from a cable and can be raised to various drop heights to be released to strike the specimen with resultant theoretical impact energies in Newton Metres (Nm) or Joules (J).
- Impacts were applied at mid-width of the mock-up window's opening light in the direction that would open the window further. The height at which the impacts were applied to the light was according to which size restrictor was under test (see test results).
- The impacts were mostly carried out from a drop height of 450 mm (above the point of impact). This gave a calculated impact energy of 221 Nm or J. Exceptionally, one impact was carried out from a drop height of 700 mm (above the point of impact). This gave a calculated impact energy of 343 Nm or J
- A single impact was carried out per pair of restrictors.



4 Classification of results

Loading of 8WR window restrictors

Health building Note 00-10 Part D: Windows and associated hardware³ emphasises the need to test to values in excess of those in the two standards below.

BS EN 14351-1:2006+A1:2010⁶ Clause 4.8 states 'Safety devices (e.g. retaining and reversing catches, restrictors and fixing devices for cleaning procedures), if provided and engaged in accordance with the manufacturer's published instructions, shall be able to hold the leaf, casement or sash in place for 60 seconds when 350 N are applied to the leaf, casement or sash in the most unfavourable way (i.e. position, direction).'

BS 6375: Part 2: 1987 Performance of windows Part 2. Specification for operation and strength characteristics⁹, the preceding version of the current standard, had a test for restricted opening devices of 600 N applied for 5 seconds.

Soft, heavy body impacts on 8WR window restrictors

Upon completion of the impact tests in accordance with BS EN13049, classification criteria in BS EN 13126-5:2011² are:

- The restrictors shall remain engaged. In this case that would mean that the restrictors still remain engaged with the sash frame and restrict the window from opening significantly more than the set amount.
- The restrictor shall continue to function normally. In this case the restrictors are fixed and set to restrict opening to a particular distance. No parts of the restrictors move when opening the window.

Information:

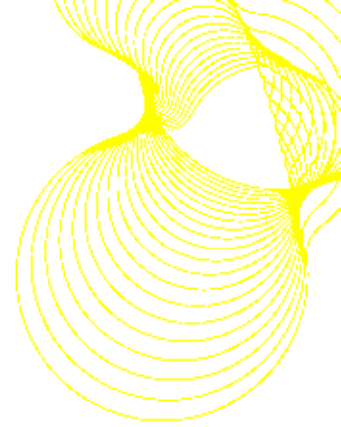
According to Adult Data Handbook of adult anthropometric and strength requirements⁷ forces that adults can exert from a free standing position* are in the order of:

870 Newtons using the shoulder

700 Newtons using the hands

Shoulder charges if applicable to an open window would exert about 220 Nm of impact energy.

*A free standing position assumes no structural support to brace against. In cases where such support exists then that increases the forces possible.

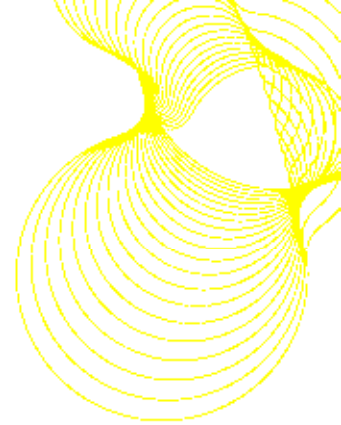


5 Test rig and preparatory procedures

The test specimen were stored and tested in a non-destructive environment within temperature and humidity ranges specified in the test standards of 15°C to 30°C and 25% to 75% RH respectively.

The mock-up top hung window specimen was secured in the BRE test rig with clamps each side. The opening light part was opened to lightly contact the restrictors under test and held there by props at the bottom edge.

Before each test a pre-load of 20 N was applied to take up slack in the hinges.



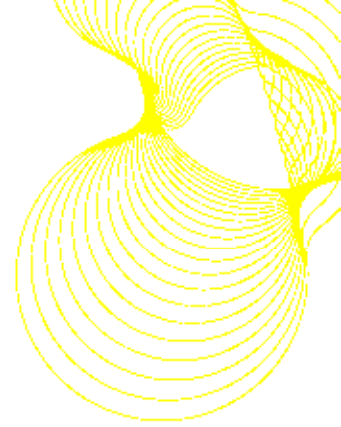
6 Test results

The test results are shown in Tables 1 to 5. Figures in the annex of this report show detail of the Primera Ltd 8WR window restrictors as described in Section 2 of this report.

8WR 225 mm long window restrictor - Loading tests

Loading tests and requirements	Load applied (Newtons, N) for 1 minute	Results and notes
Applied load to opening light at 485 mm down from the top of the light Withstand the load: <ul style="list-style-type: none"> Without the window opening beyond the restrictors Without the restrictor becoming disengaged 	350 N	Withstood the load
	600 N	Withstood the load
	800 N	Withstood the load
	1000 N	Withstood the load
	1200 N	Withstood the load
	1500 N	Withstood the load
	1800 N	Withstood the load. No distortion at position pre-set castellation's or fixings there. Restrictor plates bent at the foot where they fix to the window frame. Fixing screw heads bent

Table 1. Test results - Loads applied to top hung opening light with 8WR 225 window restrictors



8WR 340 mm long window restrictor - Loading tests

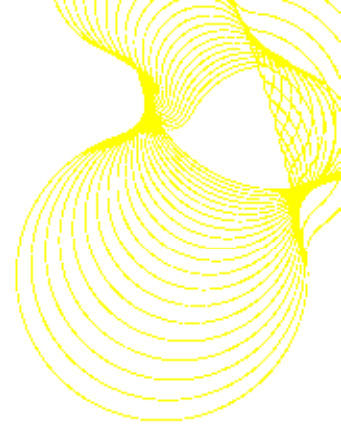
Loading tests and requirements	Load applied (Newtons, N) for 1 minute	Results and notes
Applied load to opening light at 685 mm down from the top of the light Withstand the load: <ul style="list-style-type: none"> • Without the window opening beyond the restrictors • Without the restrictor becoming disengaged 	800 N	Withstood the load
	1200 N	Withstood the load
	1600 N	Withstood the load. No distortion at position pre-set castellation's or fixings there. Restrictor plates bent at the foot where they fix to the window frame. Fixing screw heads bent.

Table 2. Test results - Loads applied to top hung opening light with 8WR 340 window restrictors

8WR 450 mm long window restrictor - Loading tests

Loading tests and requirements	Load applied (Newtons, N) for 1 minute	Results and notes
Applied load to opening light at 885 mm down from the top of the light Withstand the load: <ul style="list-style-type: none"> • Without the window opening beyond the restrictors • Without the restrictor becoming disengaged 	1200 N	Withstood the load
	1600 N	Withstood the load
	1800 N	Withstood the load
	2000 N	Withstood the load. No distortion at position pre-set castellation's or fixings there. Restrictor plates bent at the foot where they fix to the window frame. Fixing screw heads bent.

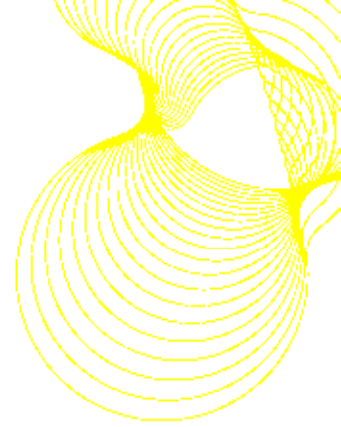
Table 3. Test results - Loads applied to top hung opening light with 8WR 450 window restrictors



8WR 650 mm long window restrictor - Loading tests

Loading tests and requirements	Load applied (Newtons, N) for 1 minute	Results and notes
Applied load to opening light at 1080 mm down from the top of the light Withstand the load: <ul style="list-style-type: none"> • Without the window opening beyond the restrictors • Without the restrictor becoming disengaged 	1200 N	Withstood the load
	1600 N	Withstood the load
	1800 N	Withstood the load
	2000 N	Withstood the load. No distortion at position pre-set castellation's or fixings there. Restrictor plates bent at the foot where they fix to the window frame. Fixing screw heads bent.

Table 4. Test results - Loads applied to top hung opening light with 8WR 650 window restrictors

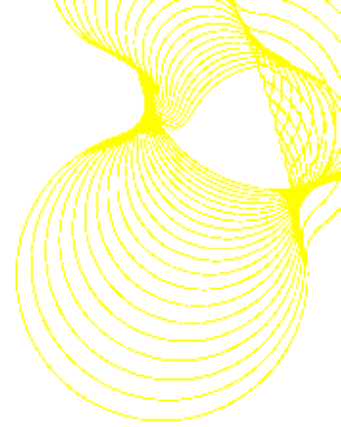


8WR 225, 8WR 340, 8WR 450 and 8WR 650 - Soft, heavy body impact tests

Soft, heavy body impacts tests and requirements	Impacts Newton metres (Nm) or Joules (J)	Results and notes
Applied impacts perpendicular to opening light Withstand the load: <ul style="list-style-type: none"> • Without the window opening beyond the restrictors • Without the restrictor becoming disengaged 	8WR 225 221 J at 485 mm down from top of opening light	Withstood the impacts Class 3 BS EN 13049
	8WR 340 221 J at 565 mm down from top of opening light	Withstood the impacts Class 3 BS EN 13049
	8WR 450* 221 J at 840 mm down from top of opening light	Withstood the impacts Class 3 BS EN 13049
	8WR 650* 221 J at 1105 mm down from top of opening light	Withstood the impacts Class 3 BS EN 13049
	8WR 650* 343 J at 1105 mm down from top of opening light	Restrictors bent by impact and the opening light forced past the restrictors.

*A nut and bolt fixing was used at the lowest fixing point on these restrictors and the screws as detailed in section 4 at the higher fixing positions.

Table 5. Test results - Impacts applied to a top hung opening light with 8WR window restrictors



7 Conclusions

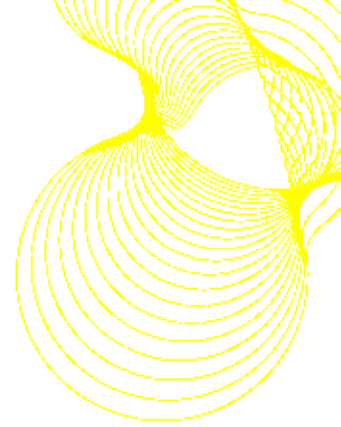
When specimens of Primera Ltd 8WR window restrictors (as described and configured in Section 2 of this report) were tested to the standards described herein they were found to be:

- Sufficiently resistant to applied loads generally up to 1800 N withstood for 1 minute and exceptionally up to 2000 N withstood for 1 minute.
- Sufficiently resistant to impacts from a soft, heavy body up to 221 J. This equates to Class 3 in BS EN 13049⁵.

These results demonstrate that Primera Ltd window restrictors 8WR sizes 225 mm, 340 mm, 450 mm and 650 mm:

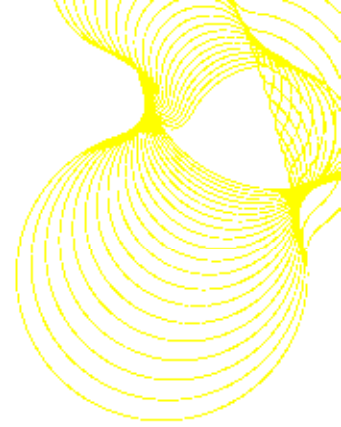
- Exceed the standard loading requirements for window restrictors of withstanding 350 N for 1 minute
- Fulfil requirements in Health building Note 00-10 Part D: Windows and associated hardware³ to withstand loads in excess of 350 N for 1 minute.
- Will withstand pushing forces applied by humans via shoulders or hands in the order of 880 N.

Based on the results herein sizes of the 8WR restrictors not tested here but within the maximum and minimum size range of 225 mm to 650 mm are expected to perform similarly to those tested if fixed and configured in a similar manner.



8 References

1. BS 6180:2011 Barriers in and about buildings – Code of practice. British Standards Institution, London
2. BS EN 13126-5:2011 Building hardware – Hardware for windows and door height windows – requirements and test methods. Part 5: devices that restrict the opening of windows and door height windows. British Standards Institution, London
3. Health Building Note 00-10 Part D: Windows and associated hardware: 2013. Department of Health.
4. Health Technical Memorandum 55 Building Components Series Windows 1998. Department of Health. The Stationary Office, London.
5. BS EN 13049:2003 Windows – Soft and heavy body impact – test method, safety requirements and classification. British Standards Institution, London.
6. BS EN 14351-1:2006+A1:2010 Windows and doors – Product standard, Performance characteristics. British Standards Institution, London
7. Adult data – The handbook of adult anthropometric and strength measurements – data for design safety. 1998. Department of Trade and industry
8. BS 6180:2011 Barriers in and about buildings – Code of Practise. British Standards Institution, London



ANNEX A



Figure A1. Manufacturer's diagram of 8WR Primera Ltd window restrictors showing pre-set details and general fixing arrangement on a top hung window

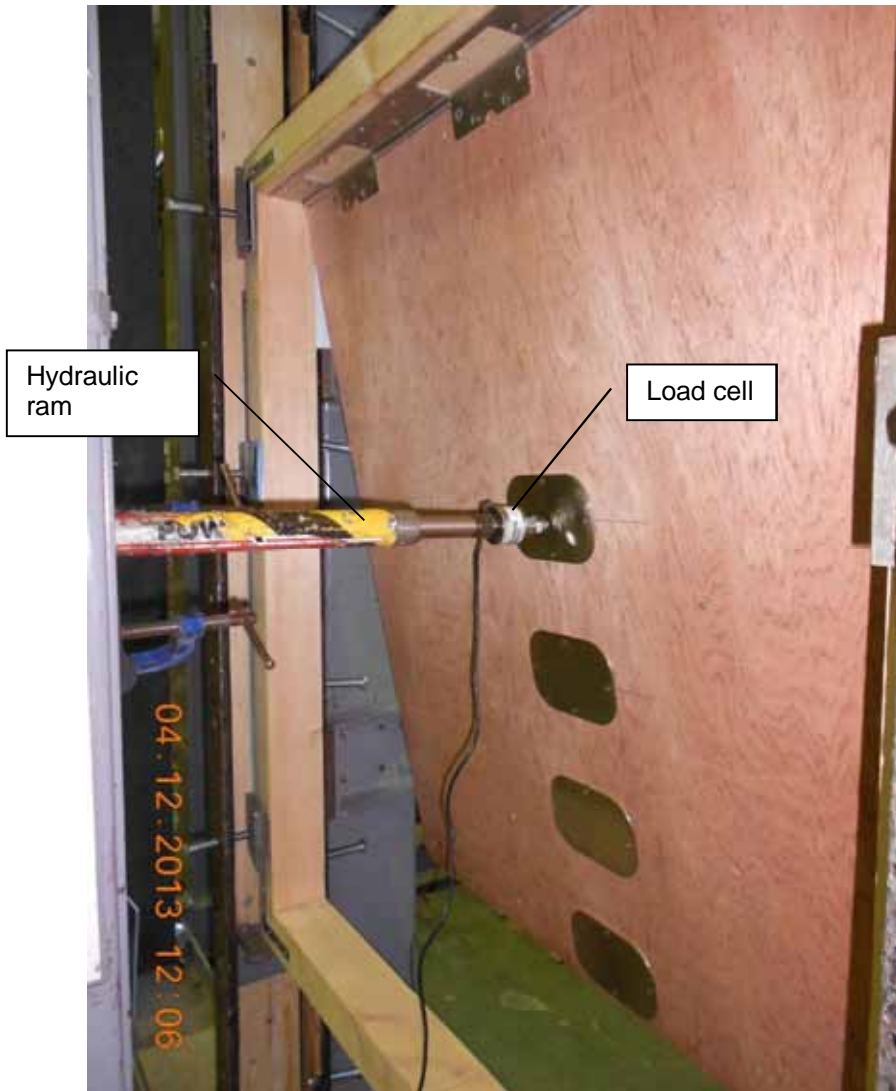
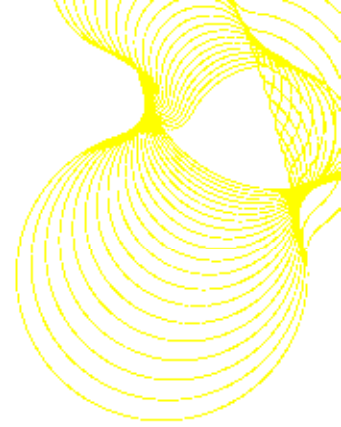
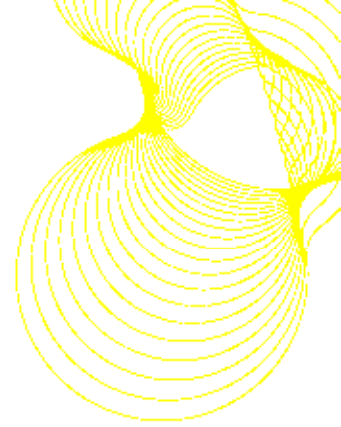


Figure A2. Typical loading test set-up



8WR 225 mm
long window
restrictors

Figure A3. Typical test set-up showing 8WR 225 mm long restrictors

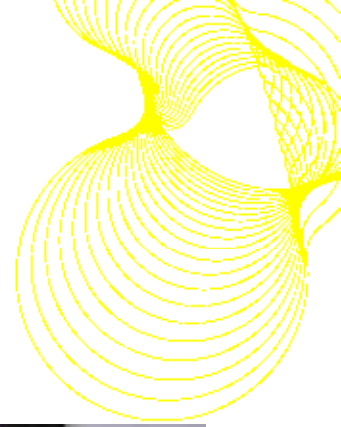


Figure A4. Typical test set-up showing 8WR 650 mm long restrictors

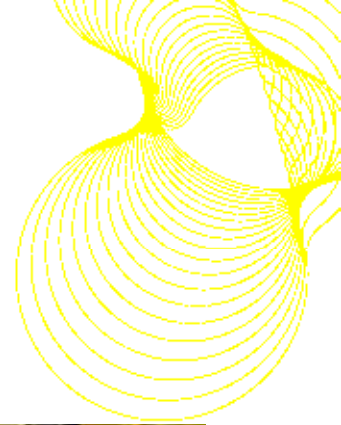


Figure A5. Typical test set-up for impact testing

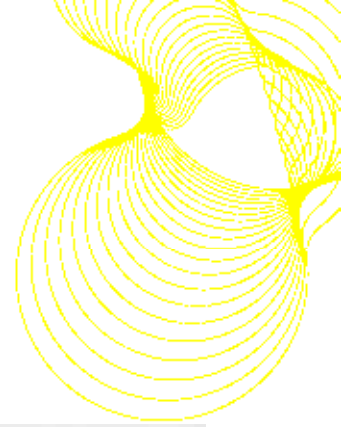


Figure A6. Damage to fixings caused by load testing

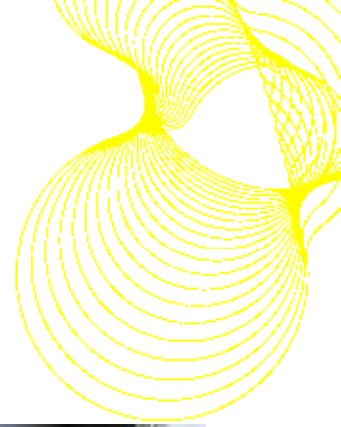


Figure A7. Typical deflection of window restrictors under load

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