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The Flood Company Window Barrier Testing

HR Wallingford report on a The Flood Company Ltd flood barrier - non Kitemark

CAM7525-RT001-R01-00 August 2015

Document information

Document permissions	Confidential - client
Project number	CAM7525
Project name	The Flood Company Window Barrier Testing
Report title	HR Wallingford report on a The Flood Company ltd flood barrier - non Kitemark
Report number	RT001
Release number	R01-00
Report date	August 2015
Client	The Flood Company
Client representative	Luke Ruddiman
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Document history

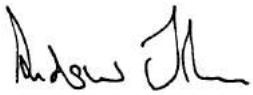
Date	Release	Prepared	Approved	Authorised	Notes
13 Aug 2015	01-00	NHN	AAJS	AJB	

Document authorisation

Prepared

Approved

Authorised



Summary

The following report gives the results from the testing of two 'The Flood Company Ltd' (the company) flood window barrier following the testing procedures laid out by the BSI PAS 1188-1:2014. The products are Type 1 building aperture product designed by the company. Testing was carried out between the 28/07/2015 and 05/08/2015 at the HR Wallingford facility.

This report contains:

1. Static test results in accordance with Section B.5.2 of PAS 1188-1:2014;
2. Wave test results in accordance with Section B.5.3 of PAS 1188-1:2014;
3. Current test results in accordance with Section B.5.4 of PAS 1188-1:2014.

Note 1: Stated leakage rates have a maximum error of ±1.2 %, calculated from the combined error of measuring devices and calibration systems used to measure leakage rates.

Note 2: The test procedure assigns the specimen tested with a unique product test code, in the form:

TFC-01-2P-01 – where 'TFC' indicates the product tested, i.e. The Flood Company. The first number refers to the test series, 2P is the type of product tested, in this case two products and the final number refers to the test part.

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1. Introduction

Tests have been carried out on two flood products which are designed to prevent water ingress during external flooding.

The products were a pair of windows, provided and fitted by the company and consisted of one outward opening window and a fixed closed window. Both were mounted together in a 1800mm x1200mm x90mm frame (Figure 1.1).

Figure 1.1: The Flood Company flood windows in the HR Wallingford test rig

The opening window can here be seen on the left, and the non-opening on the right.

A small aluminium drip tray was placed behind the products to capture any leaking water. This set up is shown in Figure 1.2 and Figure 1.3 for the opening and non-opening window respectively.

Figure 1.2: View from inside test rig showing drip tray and collection tank under the opening window.

Figure 1.3: View from inside test rig showing drip tray and collection tank under the non-opening window

Flood products installation

Luke Ruddiman from the company. installed the flood windows. The method of installation for the products was as follows:

1. Windows and panels were fitted to the frame before arrival onsite.
2. The Frame was fitted and sealed to HR Wallingford's flood test rig.
3. (Opening window only) To seal the window closed, ensure that the seal is clear of debris and in good condition. Close the window and turn each of the three handles ensuring they catch on the inner connection point, i.e. that they 'click' into place.

Item 3 above is required to be undertaken by the property owner when operating the product.

After installation of the product, the facility was filled to the first static test depth. Static water level, wave, and current tests were performed on the product following the test procedure in Section B.5.2 in PAS 1188-1:2014. The maximum test water depth was 600 mm (DMWD) above the product invert.

The leakage rate was recorded in terms of litres per metre of aperture width per hour. Any leakage was measured using calibrated scales and the weight was converted into volume by assuming a water density of 1,000 kg/m^3. The product aperture width used for calculating the leakage rate was assumed to be the distance between the uprights of the open window frame.

Photographs taken during each test series for the two products are shown in Appendices A and B. Results for all tests on this product are given in Appendix C. The maximum permitted leakage rate is 0.5 l/m/h.

2. Test Schedule

The test schedule followed Section B.5 of PAS 1188-1:2014 for reusable building aperture flood protection products. This schedule has been summarised in Table 2.1 below, giving details of the test type, test duration, water depth and the related sections in PAS 1188-1:2014.

The Test Series and Test Part numbers are taken from PAS 1188-1:2014 where a Test Series is defined as a complete set of tests between installation and removal of the flood products. A Test Part is a single test with a specified water depth and test duration.

Table 2.1: Test schedule

Test Series	Test Type	Test Part	Water depth above invert (mm)	Test duration (hours)
B.5.1.3	Static B.5.2	B.5.2.3	200	1.0
		B.5.2.4	400	1.0
		B.5.2.5	600	18.0
	Waves B.5.3	B.5.3.2	450	0.5
	Currents B.5.4	B.5.4.2	500	1.0
B.5.1.4	Static B.5.2	B.5.2.3	200	1.0
		B.5.2.4	400	1.0

Test Series	Test Type	Test Part	Water depth above invert (mm)	Test duration (hours)
		B.5.2.5	600	18.0
	Waves B.5.3	B.5.3.2	450	0.5
	Currents B.5.4	B.5.4.2	500	1.0
B.5.1.5	Static B.5.2	B.5.2.3	200	1.0
		B.5.2.4	400	1.0
		B.5.2.6	600	48.0

Source: BSI PAS 1188-1:2014

3. Test Series B.5.1.3

The product was installed by Luke Ruddiman on 27/07/2015. The sealant was then left to set for 24 hours before filling the basin and testing starting on 28/07/2015, Luke Ruddiman returned to the test facility on 28/07/2015 to view the testing but did not enter the rig itself. The installed products before testing are visible in Figure A.1, Figure A.2 and Figure A.3 in A.1.

3.1. Static Tests (PAS 1188-1:2014 B.5.2)

The static tests were performed in order of increasing water depth in accordance with PAS 1188-1:2014 Section B.5.2. Leakage rates for all static tests are given in Table 3.1 and Table 3.2 with further details of the leakage results given in Table C.1 and Table C.2 in Appendix C.

3.1.1. Opening Window Static Test Results

Test Part B.5.2.3 TFC-01-2P-01: 1/3 DMWD (200 mm)

The basin was filled to a depth of 200 mm above the invert of the window. A total volume of water passing through the seal of 0.010 litres giving a leakage rate of 0.012 l/m/h (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements of this test. A photograph for this test is shown in Figure A.4.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.4 TFC-01-2P-02: 2/3 DMWD (400 mm)

The basin was filled to a depth of 400 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/m/h (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test is shown in Figure A.5 in Appendix A.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.5 TFC-01-2P-03: 3/3 DMWD (600 mm)

The basin was filled to a depth of 600 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/m/h (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test is shown in Figure A.6 in Appendix A.

There was some moisture build up on the inside lower right corner of the window indicative of water seeping through the wood material during the test. There was not however enough to register on the scales. This seepage can be seen in Figure A.6 of Appendix A.

There was approximately 2.5mm displacement at the centre of the glass pane during this test.

Table 3.1: Test Series B.5.1.3 – Static Test Results Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.2.3	200	1.0	0.855	0.010	0.012
B.5.2.4	400	1.0	0.855	0.000	0.000
B.5.2.5 (First hour)	600	1.0	0.855	0.000	0.000
B.5.2.5 (Last hour)	600	1.0	0.855	0.000	0.000

Allowable leakage rate is 0.5 l/m/h

3.1.2. Non-Opening Window Static Test Results

Test Part B.5.2.3 TFC-01-2P-01: 1/3 DMWD (200 mm)

The basin was filled to a depth of 200 mm above the invert of the window. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements of this test. A photograph for this test is shown in Figure A.7.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.4 TFC-01-2P-02: 2/3 DMWD (400 mm)

The basin was filled to a depth of 400 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test is visible in Figure A.8.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.5 TFC-01-2P-03: 3/3 DMWD (600 mm)

The basin was filled to a depth of 600 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test can be seen in Figure A.9.

There was approximately 2.5mm displacement at the centre of the glass pane during this test.

Table 3.2: Test Series B.5.1.3 – Static Test Results Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.2.3	200	1.0	0.855	0.000	0.000
B.5.2.4	400	1.0	0.855	0.000	0.000
B.5.2.5 (First hour)	600	1.0	0.855	0.000	0.000
B.5.2.5 (Last hour)	600	1.0	0.855	0.000	0.000

Allowable leakage rate is 0.5 l/h/m

3.2. Wave Tests (PAS 1188-1:2014 B.5.3)

The wave leakage tests were performed using one of HR Wallingford's multi-element paddles. HR Wallingford's software (HR Merlin) was used to control the paddles and the wave data was recorded using an array of four calibrated twin wire wave gauges, which measured changes in the surface elevation of the water. These measurements were recorded using HR DAQ software, which is capable of calculating wave information such as the mean wave period and significant wave height.

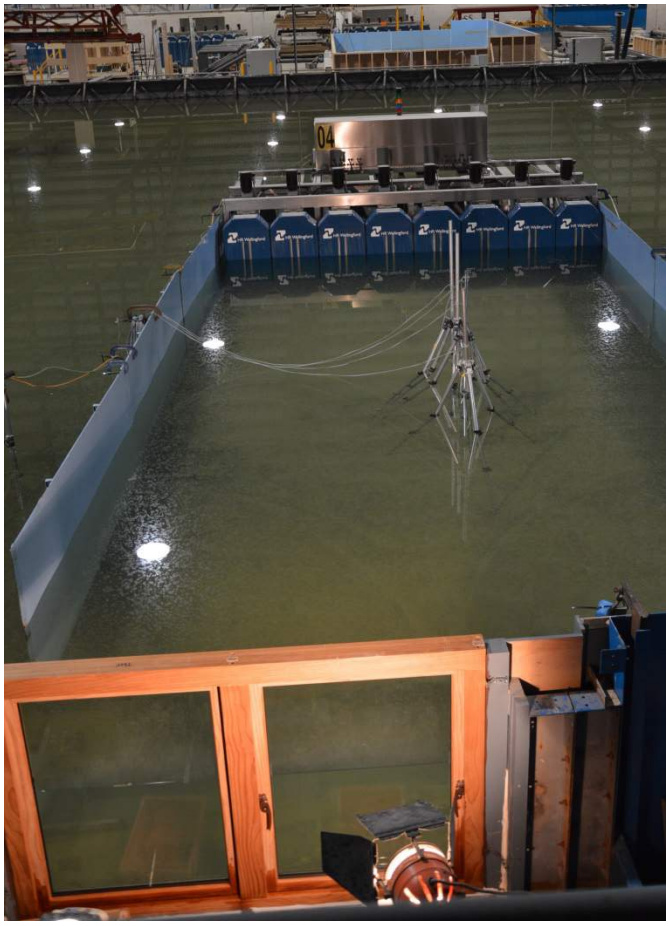

Figure 3.1: The wave testing setup prior to testing.

Opening window is on the right in this view.

Waves were measured by taking the average measured significant wave height at each of the four wave gauges and assuming 100 per cent reflections off the surface of the test rig in order to calculate the generated incident significant wave height from the paddles. The set-up of the basin for the wave tests is shown in Figure 3.1.

3.2.1. Opening Window Wave Test Results

Test Part B.5.3.2 TFC-01-2P-04 (440 mm)

The basin was filled to a depth of 440mm above the invert of the aperture and the waves with a JONSWAP spectrum with significant wave height 100±10mm and mean wave period of 1.03 s were generated at a direction perpendicular to the face of the building aperture. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test.

There was approximately 5mm displacement at the centre of the glass pane during this test with some fluctuations due to wave height variation.

Table 3.3: Test Series B.5.1.3 – Wave Test Results Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture Width (m)	Volume of water collected (l)	Leakage rate (l/m/h)
B.5.3.2	440	0.5	0.855	0.000	0.000

Allowable leakage rate is 1.0 l/h/m

3.2.2. Non-Opening Window Wave Test Results

Test Part B.5.3.2 TFC-01-2P-04 (440 mm)

The basin was filled to a depth of 440mm above the invert of the aperture and the waves with a JONSWAP spectrum with significant wave height 100±10mm and mean wave period of 1.03 s were generated at a direction perpendicular to the face of the building aperture. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test.

There was approximately 5mm displacement at the centre of the glass pane during this test with some fluctuations due to wave height variation.

Table 3.4: Test Series B.5.1.3 –Wave Test Results Non-Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture Width (m)	Volume of water collected (l)	Leakage rate (l/m/h)
B.5.3.2	440	0.5	0.855	0.000	0.000

Allowable Leakage rate is 1.0 l/h/m

3.3. Current Tests (PAS 1188-1:2014 B.5.4)

The current flows for the tests were generated via a pumping system and is controlled by in-house software. The software controls four pumps within the test facility, where the discharge from each pump can be controlled to produce the required flow velocity at the location of the test specimen.

To control the flow, guides were installed between the pump outlet and the test specimen to form a channel for the water to flow through. Two of the guides previously used to control the waves in front of the product were used to create the channel in front of the product as can be seen in Figure 3.2. In order to produce the required velocity at the test specimen, the channel width was narrowed near the test specimen to increase the flow velocity.

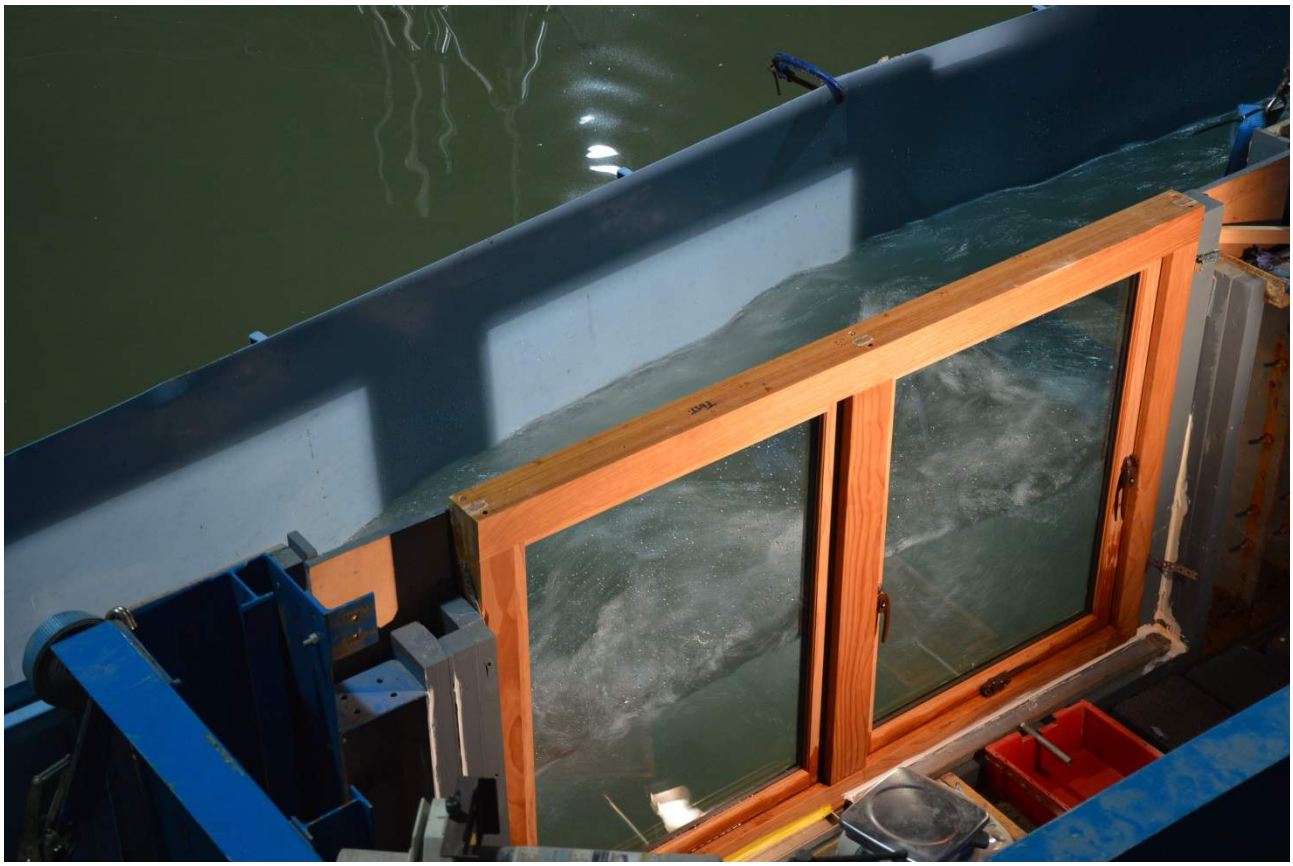

Figure 3.2: The Flood Company windows during current testing

Opening window seen on the right and non-opening on the left.

The current flow velocity was measured at the vertical centreline of the aperture, at mid depth above the invert, 150mm from the external face of the test specimen in accordance with PAS 1188-1:2014 Section B.5.4.2. The velocity was measured using a calibrated current meter, which was positioned in the water at the required location and recorded the rate of rotation of a propeller, expressed through a tachometer. This rate of rotation was converted into flow velocity using a calibration factor that had been determined prior to testing. The output from each pump was adjusted iteratively until the correct flow velocity of 1.0±0.1m/s was reached.

3.3.1. Opening Window Current Test Results

Test Part B.5.4.2 TFC-01-2P-05 (540 mm)

During the hour of testing, minimal leakage was measured so the product was successful at meeting the specified leakage standard. There was some seepage of water which appeared to be coming through the material itself rather than past the seal. The velocity was monitored throughout the test to ensure the required velocity of 1.0±0.1m/s was maintained.

There was no measurable displacement of the product during this test.

Table 3.5: Test Series B.5.1.3 - Current Test Opening Window

Test Part	Water Depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.4.2	540	1.0	0.866	0.000	0.000

Allowable leakage rate is 1.0 l/h/m

3.3.2. Non-Opening Window Current Test Results

Test Part B.5.4.2 TFC-01-2P-05 (540 mm)

During the hour of testing, minimal leakage was measured so the product was successful at meeting the specified leakage standard. There was some seepage of water which appeared to be coming through the material itself rather than through the seal. The velocity was monitored throughout the test to ensure the required velocity of 1.0±0.1m/s was maintained.

There was no measureable displacement of the product during this test.

Table 3.6: Test Series B.5.11.3 - Current Test Non-Opening Window

Test Part	Water Depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.4.2	540	1.0	0.866	0.000	0.000

Allowable leakage rate is 1.0l/m/h

4. Test Series B.5.1.5

4.1. Omission of Test Series B.5.1.4

The tests reported here were not being run as an official Kitemark test. Consequently the contract with The Flood Company only allowed for one sequence of static, wave and current tests, described in Section 3, before moving on to the longer term static head test sequence.

4.2. Static Tests (PAS 1188-1:2014 Section B.5.2)

The static tests were performed in order of increasing water depth in accordance with PAS 1188-1:2014 Section B.5.2. Leakage rates for all static tests are given in Table 4.1 and Table 4.2 with further details of the leakage results given in Table C.1 and Table C.2.

4.2.1. Opening Window Static Test Results

Test Part B.5.2.3 TFC-03-2P-01: 1/3 DMWD (200 mm)

The basin was filled to a depth of 200 mm above the invert of the window. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/m/h (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements of this test. A photograph for this test is shown in Figure B.1.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.4 TFC-03-2P-02: 2/3 DMWD (400 mm)

The basin was filled to a depth of 400 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/m/h (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test is shown in Figure B.2.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.6 TFC-03-SP-03: 3/3 DMWD (600 mm)

The basin was filled to a depth of 600 mm above the invert of the single door. A total volume of water passing through the seal of 0.002 litres in the first hour giving a leakage rate of 0.002 l/m/h (an aperture width of 0.855m was measured for this product). During the final hour of the test a total volume of 0.007 litres was found on the inside of the window giving a seepage rate of 0.008 l/h/m so the product was successful in meeting the requirements for passing this test.

During the last hour of the test in particular, the water appeared to not be coming through the seal but rather the material of the window frame itself as it was found to be stained brown. The seepage is shown in Figure B.3 and Figure B.4 respectively.

There was approximately 2.5mm displacement at the centre of the glass pane during this test.

Table 4.1: Test Series B.5.1.5 – Static Tests Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.2.3	200	1.0	0.855	0.000	0.000
B.5.2.4	400	1.0	0.855	0.000	0.000
B.5.2.6 (First hour)	600	1.0	0.855	0.002	0.002
B.5.2.6 (Last hour)	600	1.0	0.855	0.007	0.008

Allowable leakage rate is 0.5 l/m/h

4.2.2. Non-Opening Window Static Test Results

Test Part B.5.2.3 TFC-01-2P-01: 1/3 DMWD (200 mm)

The basin was filled to a depth of 200 mm above the invert of the window. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements of this test. A photograph for this test is shown in Figure B.5.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.4 TFC-01-2P-02: 2/3 DMWD (400 mm)

The basin was filled to a depth of 400 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m was measured for this product) so the product was successful in meeting the requirements for passing this test. A photograph for this test is shown in Figure B.6.

There was no observable deformation of the product at this water depth.

Test Part B.5.2.6 TFC-01-2P-03: 3/3 DMWD (600 mm)

The basin was filled to a depth of 600 mm above the invert of the single door. A total volume of water passing through the seal of 0.000 litres giving a leakage rate of 0.000 l/h/m (an aperture width of 0.855m) was measured for this product during both the first and last hours of the test so the product was successful in meeting the requirements for passing this test.

Photographs showing the test and the dampening of the inside of the window are shown in Figure B.7 and Figure B.8 respectively.

There was approximately 2.5mm displacement at the centre of the glass pane during this test.

As with the opening window, there was evidence of water seeping through the material of the frame as can be seen in Figure B.8.

Table 4.2: Test Series B.5.1.5 – Static Tests Non-Opening Window

Test Part	Water depth (mm)	Duration (hours)	Aperture width (m)	Volume of water collected (l)	Leakage rate (l/h/m)
B.5.2.3	200	1.0	0.855	0.000	0.000
B.5.2.4	400	1.0	0.855	0.000	0.000
B.5.2.6 (First hour)	600	1.0	0.855	0.000	0.000
B.5.2.6 (Last hour)	600	1.0	0.855	0.000	0.000

Allowable leakage rate is 1.0 l/h/m

5. Conclusions

A series of tests were carried out in accordance with the BSI PAS 1188-1:2014 to investigate the performance of two flood products designed by The Flood Company Ltd. Two test series were carried out, separated by the opening, cleaning and closing of the window (where applicable).

Test series B.5.1.3 tested the product under static water, waves, and currents at different water levels and test durations in accordance with the procedure laid out in section B.5.1.3 of PAS 1188-1:2014. The facility was drained after this test and the opening window was opened, inspected and dried where necessary; then reclosed. The next test series followed that of B.5.1.5 as agreed with The Flood Company which featured a set of static head tests ending with a 48 hour test at the design maximum water depth.

Both products passed all tests within the acceptable leakage rates for this standard. The largest amounts of water coming through were observed to be passing through the material of the window frame, rather than the seal between the window and the frame.

The maximum recorded leakages for each test type were:

- Opening Window
  - Static test 0.012 l/m/h – during Test Series B.5.1.3, Test Part B5.2.3 (200mm);
  - Static Test 0.008 l/m/h – during Test Series B.5.1.5 Test Part B.5.2.6.(last hour).

Some deflections of the window glass in both the opening and non-opening side were measured during testing. For both windows, the only deflection during the static head tests was measured during the 600mm sequence, where a 2.5mm deflection was noted in the centre of each window.

During the wave test (at 450mm water level), a maximum deflection of 5mm was noted although this was variable due to the fluctuating water pressure created by the waves on the glass.

Table C.1: Static leakage results for Opening Window

Product Information						
Test Sequence	**B.5.1.3**	**B.5.1.3**	**B.5.1.3**	**B.5.1.5**	**B.5.1.5**	**B.5.1.5**
Test Number / Test Part	**B.5.2.3**	**B.5.2.4**	**B.5.2.5**	**B.5.2.3**	**B.5.2.4**	**B.5.2.6**
Product test code	TFC-01-2P-01	TFC-01-2P-02	TFC-01-2P-03	TFC-03-2P-01	TFC-03-2P-02	TFC-03-2P-03
Date	28/07/2015	28/07/2015	28-29/07/2015	03/08/2015	03/08/2015	3-5/08/2015
Operator	NHN	NHN	NHN	NHN	NHN	NHN
Product	Opening Window	Opening Window	Opening Window	Opening Window	Opening Window	Opening Window
Description	1 hour static test at 200mm	1 hour static test at 400mm	18 hour static test at 600mm	1 hour static test at 200mm	1 hour static test at 400mm	48 hour static test at 600mm
Nominal freeboard (m)	0.197	0.401	0.599	0.199	0.402	0.600
Required master point gauge reading (m)	0.200	0.400	0.600	0.200	0.400	0.600
Actual depth of water above invert of opening (m)	0.197	0.401	0.599	0.199	0.402	0.600
Aperture Width (m)	0.855	0.855	0.855	0.855	0.855	0.855
Duration of test (h)	1	1	1	1	1	1
Increase in volume over 1st hour (litres)	0.0100	0.0000	0.0000	0.0000	0.0000	0.0020
Measured leakage rate over 1st hour (l/m/h)	0.012	0.000	0.000	0.000	0.000	0.002
Increase in volume over last hour (litres)	-	-	0.000	-	-	0.007
Measured leakage rate over last hour (l/m/h)	-	-	0.000	-	-	0.008
Maximum permitted leakage rate(l/m/h)	0.5	0.5	0.5	0.5	0.5	0.5
Meets specification?	True	True	True	True	True	True

Table C.2: Static Leakage Results for Non-Opening Window

Product Information						
Test Sequence	**B.5.1.3**	**B.5.1.3**	**B.5.1.3**	**B.5.1.5**	**B.5.1.5**	**B.5.1.5**
Test Number / Test Part	**B.5.2.3**	**B.5.2.4**	**B.5.2.5**	**B.5.2.3**	**B.5.2.4**	**B.5.2.6**
Product test code	TFC-01-2P-01	TFC-01-2P-02	TFC-01-2P-03	TFC-03-2P-01	TFC-03-2P-02	TFC-03-2P-03
Date	28/07/2015	28/07/2015	28-29/07/2015	03/08/2015	03/08/2015	3-5/08/2015
Operator	NHN	NHN	NHN	NHN	NHN	NHN
Product	Non-Opening Window	Non-Opening Window	Non-Opening Window	Non-Opening Window	Non-Opening Window	Non-Opening Window
Description	1 hour static test at 200mm	1 hour static test at 400mm	18 hour static test at 600mm	1 hour static test at 200mm	1 hour static test at 400mm	48 hour static test at 600mm
Nominal freeboard (m)	0.197	0.401	0.599	0.199	0.402	0.600
Required master point gauge reading (m)	0.200	0.400	0.600	0.200	0.400	0.600
Actual depth of water above invert of opening (m)	0.197	0.401	0.599	0.199	0.402	0.600
Aperture Width (m)	0.855	0.855	0.855	0.855	0.855	0.855
Duration of test (h)	1	1	1	1	1	1
Increase in volume over 1st hour (litres)	0.000	0.0000	0.0000	0.0000	0.0000	0.000
Measured leakage rate over 1st hour (l/m/h)	0.000	0.000	0.000	0.000	0.000	0.000
Increase in volume over last hour (litres)	-	-	0.000	-	-	0.000
Measured leakage rate over last hour (l/m/h)	-	-	0.000	-	-	0.000
Maximum permitted leakage rate(l/m/h)	0.5	0.5	0.5	0.5	0.5	0.5
Meets specification?	True	True	True	True	True	True

C.2. Wave Leakage Results

Table C.3: Wave test leakage results – Test Part B.5.3

Product Information	Opening Window	Non-Opening Window
Test Sequence	**B.5.1.3**	**B.5.1.3**
Test Number / Test Part	**B.5.3.2**	**B.5.3.2**
Product test code	TFC-01-2P-04	TFC-01-2P-04
Date	29/07/2015	29/07/2015
Operator	NHN	NHN
Product	Opening Window	Non-Opening Window
Description	0.5 hour wave test at 440mm	0.5 hour wave test at 440mm
Nominal freeboard (m)	0.442	0.442
Required master point gauge reading (m)	0.440	0.440
Actual depth of water above invert of opening (m)	0.442	0.442
Aperture width (m)	0.855	0.855
Duration of test (h)	0.5	0.5
Increase in volume over half hour (litres)	0.0000	0.0000
Measured leakage rate over 1st hour (l/m/h)	0.000	0.000
Maximum permitted leakage rate (l/m/h)	0.5	0.5
Meets specification?	TRUE	TRUE
Target significant wave height, Hs (m)	0.100	0.100
Target mean period, Tm (s)	1.030	1.030
Target peak period, Tp (s)	1.180	1.180
Measured significant wave height, Hs (m)	0.995	0.995
Measured mean period, Tm (s)	0.94	0.94
Measured peak period, Tp (s)	1.18	1.18

C.3. Current test Leakage Results

Table C.4: Wave test leakage results – Test Part B.5.4

Product information	Opening Window	Non-Opening Window
Test Sequence	**B.5.1.3**	**B.5.1.3**
Test Number / Test Part	**B.5.4.2**	**B.5.4.2**
Product test code	FC-01-2P-05	FC-01-2P-05
Date	29/07/2015	29/07/2015
Operator	NHN	NHN
Product	Opening Window	Non-Opening Window
Description	1 hour current test at 540mm	1 hour current test at 540mm
Nominal freeboard (m)	0.538	0.538
Required master point gauge reading (m)	0.500	0.500
Actual depth of water above invert of opening (m)	0.538	0.538
Actual length of seal below water (m)	0.855	0.855
Duration of test (hrs)	1.0	1.0
Increase in volume over 1st hour (litres)	0.0000	0.0000
Measured leakage rate over 1st hour (l/m/h)	0.000	0.000
Maximum permitted leakage rate (l/m/h)	0.5	0.5
Meets specification?	TRUE	TRUE
Target current (m/s)	1.0	1.0
Velocity of current (m/s) at start of test	Between 0.9 and 1.1	Between 0.9 and 1.1
Velocity of current (m/s) at middle of test	Between 0.9 and 1.1	Between 0.9 and 1.1
Velocity of current (m/s) at end of test	Between 0.9 and 1.1	Between 0.9 and 1.1

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