PAS 1188-1:2014

BSI Standards Publication

Flood protection products – Specification

Part 1: Building aperture products

bsi.

...making excellence a habit.™

Publishing and copyright information

Published by BSI Standards Limited 2014

ISBN 978 0 580 83755 5

ICS 91.120.99

Publication history

First published, May 2003
Second edition, April 2009
Third (current) edition, July 2014

Contents

Summary of pages
This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

Foreword

Publishing information

This PAS was sponsored by the Environment Agency. Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It came into effect on 31 July 2014.

Acknowledgement is given to the following organizations that were involved in the development of this PAS as members of the steering group:

- Association of British Certification Bodies (ABCB)
- AXA Insurance
- Department for Environment, Food & Rural Affairs (Defra)
- Environment Agency
- Flood Protection Association
- HR Wallingford
- Jacobs U.K. Limited
- JBA Consulting
- National Flood Forum
- Royal Institution of Chartered Surveyors (RICS)
- The University of Manchester

Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Supersession

This part of PAS 1188 supersedes PAS 1188-1:2009, which is withdrawn.

Relationship with other publications

PAS 1188, *Flood protection products – Specification*, is issued in four parts:

- *Part 1: Building aperture products;*
- *Part 2: Temporary products;*
- *Part 3: Building skirt and wall sealant systems;*
- *Part 4: Demountable products.*

Guidance is available from *Six steps to flood resilience: Guidance for local authorities and professionals* [1] and *Delivering benefits through evidence: Temporary and demountable flood protection guide* [2]. Other publications

on flood resistant and resilient construction are, *Preparing for floods: Interim guidance for improving the flood resistance of domestic and small business properties* [3] and, *Improving the flood performance of new buildings: Flood resilient construction* [4] and other recent relevant publications (see publications [5] to [8]).

Parallel guidance is available for property owners in, *Six steps to property level flood resilience: Guidance for property owners* [9] and, *SMARTeST Work package 2 – Report D2.3: Guidance for code of practice* [10].

Guidance is also available from the National Flood Forum (www.floodforum.org.uk) and Flood Protection Association (www.thefpa.org.uk) websites.

Attention is drawn to the need to consider the prevention of the ingress of flood water into buildings through building fabric (i.e. walls and floors), horizontal pipes, waste water fittings and floor gullies. Anti-flood devices for buildings are covered in BS EN 13564-1.

Information about this document

This is a full revision of PAS 1188-1:2009, and introduces the following principal changes:

- normative and informative references have been updated;
- foam products have been included;
- designated maximum water depths have been updated;
- subclause **4.4**, leakage test requirements have been changed;
- subclause **4.7**, marking, has been amended and updated with list items c), d) and g) moved to Annex C;
- Annex C has been updated to include a deployment guide and user manual;
- some editorial amendments have been undertaken.

Product certification. Users of this PAS are advised to consider the desirability of third-party certification of product conformity with this PAS. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Assessed capability. Users of this PAS are advised to consider the desirability of quality system assessment and registration against the appropriate standard in the EN ISO 9000 series by an accredited third-party certification body.

Test laboratory accreditation. Users of this PAS are advised to consider the desirability of selecting test laboratories that are accredited to EN ISO/IEC 17065 by a national or international accreditation body.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause **J.1.1**, which states, "Requirements should

be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all necessary considerations and specifications for the production of the relevant products. Users are responsible for their own compliance with all applicable laws, compliance with the industry practice and the correct application of this publication.

Compliance with a PAS cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations and associated documents:

- Statutory Rules of Northern Ireland 1991, Technical Booklet L [11];
- Statutory Rules of Northern Ireland 1994, Technical Booklet E [12];
- Statutory Rules of Northern Ireland 1994, Technical Booklet K [13];
- Statutory Rules of Northern Ireland 1994, Technical Booklet N [14];
- Statutory Rules of Northern Ireland 2000, Technical Booklet R [15];
- The Building Regulations (England and Wales) 1991, Approved Document B [16];
- The Building Regulations (England and Wales) 1991, Approved Document F [17];
- The Building Regulations (England and Wales) 1991, Approved Document H [18];
- The Building Regulations (England and Wales) 1991, Approved Document J [19];
- The Building Regulations (England and Wales) 1991, Approved Document M [20];
- The Building Regulations (England and Wales) 2006, Approved Document C [21];
- The Building Standards (Scotland) Regulations 1990, Technical Standard D [22];
- The Building Standards (Scotland) Regulations 1990, Technical Standard E [23];
- The Building Standards (Scotland) Regulations 1990, Technical Standard F [24];
- The Building Standards (Scotland) Regulations 1990, Technical Standard K [25];
- The Building Standards (Scotland) Regulations 1990, Technical Standard M [26];
- The Building Standards (Scotland) Regulations 1990, Technical Standard Q [27];
- The Disability Discrimination Act 1995 [28];
- The Fire Precautions Act 1971 [29];
- The Gas Safety (Installation and Use) Regulations 1998 [30].

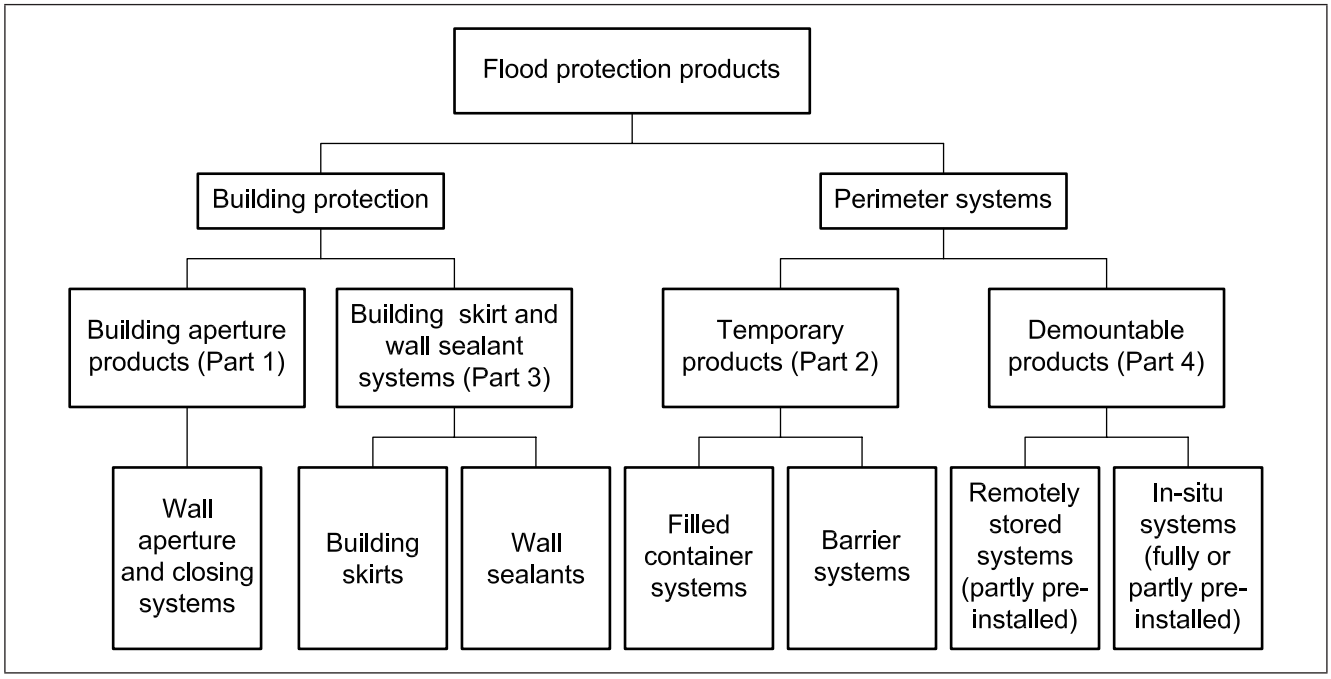
NOTE 1 For rooms containing gas appliances attention is drawn to the Gas Safety (Installation and Use) Regulations 1998 [30] and manufacturers' instructions regarding the free circulation of air both in and out of the building. In such instances special care may be taken with the use of air ventilation bricks.

NOTE 2 It is important that air vent flood protection covers are removed as soon as floodwaters have receded so that sub-floor ventilation is maintained.

0 Introduction

The general classification of flood protection products and the relationship between groups of products with each other is shown in Figure 1. Figure 1 also indicates which parts of the PAS 1188 series is relevant for each classification.

Figure 1 **Flood protection products: general classification**



NOTE 1 Attention is also drawn to the need to ensure a safe evacuation of persons in the event of an emergency and to access and egress for persons with impaired movement. This is particularly important for basements, where there is a risk that flooding could occur rapidly and to a depth sufficient to be a risk to life. In basement situations, consideration may be given to other measures such as water level alarm systems and automatic pumping systems.

NOTE 2 Other risks also need to be considered including gas safety, particularly if bottled gas is being used for temporary heating and cooking, and adequate ventilation of exhaust fumes from equipment, such as generators and pumps. Boilers with low level vents are not to be used during flooding if the vent has been covered.

NOTE 3 Maintaining the structural integrity of the building to which the product may be applied should also be considered in the design of the product, designated maximum water depth and its deployment to the building. Attention is drawn to the Construction Design and Management Regulations 2007 *[31] and parts relevant to the roles and responsibilities of designers.*

1 Scope

This PAS specifies requirements for the designation, testing, factory production control, installation documentation and marking for different types and configurations of flood protection products.

This PAS is applicable to flood protection products intended for use in the temporary sealing of building apertures and entrances to properties, including boards and flood doors, in the event of static flood water rising up to a level between 540 mm and 840 mm above aperture threshold level, except where they are designed to completely cover or replace small apertures, such as air-bricks or air vents. It covers wall aperture closure systems and foam products.

This PAS is intended for use in the UK or locations with similar exposures, i.e. where there is a temperate climate.

This PAS specifies the method of testing and an allowable leakage rate.

The range of building aperture sizes covered is a nominal width of up to 6 000 mm.

NOTE 1 The hydrostatic pressures exerted by floodwater can cause sudden or long-term structural damage and undermine the foundations of a building or cause leakage through the walls, floor or sub-floor, unless the building is specifically designed to withstand such stresses. The actual water level that can be safely retained by the external walls depends upon the construction, type, form, age and condition of the walls. It is advisable that a suitably qualified building surveyor, architect or structural engineer inspects the external walls, before any flood protection product for building apertures is installed.

NOTE 2 Flood protection products are not normally intended to prevent water more than 540 mm to 840 mm above the aperture threshold level from entering the building. An allowance of 60 mm has been assumed to allow for the aperture or entrance threshold against which the lower edge of the product seals.

NOTE 3 The PAS test conditions given in Annex B represent typical conditions that can be experienced during a flood. This includes testing the flood protection product for leakage under static water levels, waves up to 0.1 m high and parallel currents up to 1.0 m/s.

NOTE 4 This PAS does not cover testing with contaminated or saline water; however, product manufacturers are required to provide information about the performance of their products in these conditions (see Annex C).

NOTE 5 Flood protection products that conform to this PAS might not be suitable for all situations. Further guidance is set out in Delivering benefits through evidence: Temporary and demountable flood protection guide *[2],* Six steps to property level flood resilience: Guidance for property owners *[9], and guidance can also be obtained from the Flood Protection Association, National Flood Forum or Scottish Flood Forum or other qualified professional advisers.*

NOTE 6 Extreme loading conditions such as those resulting from turbulent water or static water head (above designated maximum water depth) or debris impact are not covered by testing in this PAS. If required in these locations, the flood protection product and system needs to be specifically designed and/or tested to withstand such stresses.

NOTE 7 The flood protection products described in this PAS are, with the exception of some systems such as foam products which provide passive protection, not intended for installations providing permanent flood protection. These flood protection products are installed or activated in the event of an imminent flood and removed or deactivated as soon as danger from flooding is over.

This PAS is not applicable to flood protection products for installation around buildings or other wall sealant systems. These are covered by PAS 1188-3.

This PAS is not applicable to temporary or demountable flood protection products which are designed to be installed away from and not attached to buildings, including flood protection products intended for installation across driveway entrances and gateways at property boundaries. These are covered by PAS 1188-2 and PAS 1188-4.

This PAS is not applicable to penstocks for use in water supply, sewage treatment and other liquid flow applications, which are covered by BS 7775.

This PAS does not cover flood resilience products designed to allow flooding but covers those that enable more rapid recovery from flooding. Products covered by this PAS are designated as flood protection products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 1996-1-2, *Eurocode 6 – Design of masonry structures – General rules – Structural fire design*

3 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

NOTE Definitions of flood protection product types are provided in Annex A.

3.1 building aperture
opening in the structure of a building which allows access and egress and/or ventilation to the building

NOTE Aperture size is always given by the horizontal width dimension.

3.2 designated maximum water depth (DMWD)
depth above the aperture threshold level for which the flood protection product is intended to physically retain water

NOTE 1 The DMWD is the water depth at which the flood protection is tested (see Annex B).

NOTE 2 For building apertures, the DMWD is restricted to a minimum of 540 mm and a maximum of 840 mm for testing purposes.

3.3 factory production control
permanent, internal control of production exercised either by the manufacturer or by their representative on the responsibility of the manufacturer

NOTE 1 Factory production control comprises operational techniques and all measures necessary to regulate and maintain the conformity of the product to the requirements of this specification.

NOTE 2 Requirements for factory production control are specified in Annex D.

3.4 flood protection product
material or equipment used to limit or restrict the flow of water, which when installed, forms part or all of the flood protection system

3.5 flood protection system
system that aims to reduce the risks of flooding to people and property

NOTE 1 A flood protection system includes all the constituent parts of the flood protection product and the operational environment, such as barriers, joints, foundations, end connections, interaction with the subsoil, and all operational activities required during installation, including flood risk plans.

NOTE 2 Flooding can be from any source.

NOTE 3 Groundwater flooding can occur for long periods possibly extending to weeks or months.

3.6 invert
bottom surface of the aperture

3.7 leakage
water passing through the flood protection product or any associated seal

3.8 overtopping
water passing over the flood protection product, driven by wave action when the static water level is below the top of the flood protection product

4 Requirements

4.1 Designation

4.1.1 Building aperture flood protection products shall include a water-resistant seal.

4.1.2 Building aperture flood protection products shall be designated for use for one or more of the following:

a) "doorway";

b) "window";

c) "air-brick/air vent";

d) "patio window";

e) "garage entrance"; or

f) other (to be described by the manufacturer).

4.1.3 Seals that form part of a building aperture flood protection product shall be designated as one of the following:

a) "sealant";

b) "gasket"; or

c) other (to be described by the manufacturer).

*NOTE Definitions of sealant and gasket are provided in **A.2**.*

4.1.4 Single use products shall be designated as "non-reusable".

4.2 Designated maximum water depth (DMWD)

The DMWD for building aperture flood protection products shall be not less than 540 mm and not more than 840 mm.

For small building aperture flood protection products, such as replacement and covers to air-bricks or air vents, the DMWD shall be 840 mm above aperture threshold level.

4.3 Installation and removal of a reusable flood protection product

A reusable flood protection product shall be designed such that it can be installed and removed in accordance with the manufacturer's guidance.

4.4 Leakage

When tested in accordance with Annex B, the recorded rate of leakage for any of the individual test measurements on each designated flood protection product shall not exceed 500 mL/h/m aperture width.

Where a change occurs in the design, construction, materials or dimensions of a flood protection product, the leakage tests set out in **B.5** shall be carried out on the new model.

NOTE Aperture size is always given by the horizontal width dimension.

4.5 Deployment guide and user manual

A deployment guide and user manual shall be provided with every flood protection product and shall, as a minimum, contain the information listed in Annex C.

4.6 Factory production control

A factory production control system shall be operated in accordance with Annex D.

4.7 Marking

Building aperture flood protection products shall be permanently marked with the following information:

a) the number and date of this PAS, i.e. PAS 1188-1:2014 [1)];

b) the name or trademark of the manufacturer or their appointed agent, where applicable;

c) symbols or instructions relating to the proper installation;

NOTE These may include, for example, front door, side door, arrows depicting right way up, and the placement of bolts.

d) for components of the flood protection product, the date of manufacturing and unique batch number of the component;

NOTE Marking on sealing components or foam products should be placed on the container.

e) where authorized and applicable, the product conformity mark of a third party certification body; and

f) website reference for a downloadable copy of the deployment guide and user manual and address from which a hard copy can be obtained.

[1)] Marking PAS 1188-1:2014 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Annex A (informative) Definitions of flood protection product types

NOTE *See also* Six steps to flood resilience: Guidance for local authorities and professionals *[1].*

A.1 Building aperture flood protection products

A.1.1 General

Building aperture flood protection products are units made up of one or more pieces, with or without a surrounding frame, that form a barrier to the passage of water through an aperture. They are commonly made of materials such as plastic composite, wood, aluminium or steel and range from factory pre-fabricated units to standard plywood sheets cut to size. They can include both re-useable and non-reusable products, including foam products.

A.1.2 Building aperture products with frame

Building aperture products are normally fixed around an aperture to provide a water-tight seal. After floodwater has receded they can then be removed, cleaned and stored for reuse. Frames, normally made of aluminium, plastic or steel, remain permanently fixed to the building. Often additional seals, of flexible rubber or similar material, are attached to either the panel or frame to ensure water-tightness. This category also includes doors that have been specially designed to provide flood protection.

A.1.3 Building aperture products without frame but with mechanical fixing

Building aperture products can be fitted with a mechanical device that enables its size to be adjusted or to operate automatically to fit tightly across an aperture. These types of products are often used in conjunction with a flexible waterproof cover and edge seal. The seals are normally only available from specialist manufacturers.

A.1.4 Building aperture products fitted directly to masonry surface of building

The building aperture products are fixed to the perimeter of an aperture either directly with a seal/foam or with a rubber-type gasket combined with screw/bolt fixings. Seals are normally supplied with the products.

A.1.5 Building aperture products with automatic operation

Building aperture products with automatic operation are permanently fitted across or adjacent to a building aperture and include components that operate automatically to prevent flooding. These include products that protect apertures through temporary self-closure, inflation or assembly.

A.2 Building aperture product sealants and gaskets

A.2.1 Sealant

A sealant is a material in an unformed state which, when applied to a joint, seals it by adhering to appropriate surfaces within the joint, preventing the passage of dust, moisture and gases. Sealants normally form part of a flood protection system that includes a panel or series of panels. However, in some instances they can be

applied directly between the frame and the door/window. They are designed to cure to a rubber-like water-repellent material to secure a panel to masonry or frame. They are normally only available from specialist manufacturers.

A.2.2 Gasket

A gasket is a packing material firmly held between contact surfaces on two components whose joint is to be sealed.

Annex B (normative) Method of test for leakage

B.1 General

B.1.1 The deployment guide and user manual (see Annex C) shall be assessed for usability prior to testing. Where the content of the deployment guide and/or user manual is unclear or the instructions cannot be physically implemented the deployment guide and/or user manual shall be updated for clarity.

NOTE The deployment guide and user manual should be checked to ensure that they are logical and that there are no ambiguities or contradictions in the text for installing, operating, removing, cleaning, drying and storing the flood protection product.

B.1.2 As part of the test, the test specimen shall be handled in accordance with the deployment guide and user manual for the following:

a) before the leakage test:
   1) preparation;
   2) deployment.
b) after the leakage test:
   1) removal;
   2) cleaning and drying.

*NOTE 1 Leakage is defined in this PAS (see **3.7**).*

NOTE 2 During testing there is a risk of the test specimen bowing and giving way due to high water pressure. Particular attention is drawn to the potential risk to persons standing behind the test specimen. Testing should be stopped immediately if there is any uncertainty regarding the safety of persons.

B.2 Principle

A test specimen of a building aperture flood protection product is installed in a test facility simulating static water, waves and currents, and the leakage rate is measured. The tests are carried out with non-saline, non-contaminated water. The leakage tests in **B.5.2**, **B.5.3** and **B.5.4** comprise three separate cycles incorporating 16 individual test measurements.

B.3 Test conditions

Carry out all tests at a water temperature of (15 ±14) °C.

B.4 Apparatus

B.4.1 *Test facility*, capable of accommodating the test specimen within a fair-faced masonry wall in accordance with BS EN 1996-1-2, with joints raked out to (10 ±1) mm depth, sealed to prevent the ingress of water, and creating the DMWD and nominal widths including up to 840 mm and up to 6000 mm.

B.4.2 *Test facility*, to create the following static water depths:

a) up to 840 mm above aperture threshold level for the static head leakage test (see **B.5.2**);

b) up to 540 mm above aperture threshold level for the wave leakage test (see **B.5.3**);

c) up to 740 mm above aperture threshold level for the current leakage test (see **B.5.4**).

NOTE Products may be tested up to any static water depth within the values stated above in mm.

B.4.3 *Equipment capable of generating currents of 1.0 m/s parallel to, and random waves of height (100 ±10) mm and mean wave period of 1.03 s perpendicular to, the face of the building aperture product.*

B.4.4 *Equipment designed to measure static water levels, water surface elevations (from which wave height is calculated) and current velocities*, to an accuracy of 1 mm, 1 mm and 0.01 m/s respectively.

B.4.5 *Equipment to measure leakage rate over a time period*, specified in **B.5**, to a tolerance of ±5% of the maximum allowable leakage rate (see **4.4**).

B.5 Test procedure

B.5.1 General

B.5.1.1 For small building aperture flood protection products, such as replacement covers to air-bricks or air vents, the flood protection product for apertures shall be installed at not more than 200 mm from test facility floor to the aperture invert to ensure that it is exposed to the maximum pressure head during testing.

B.5.1.2 For reusable building aperture flood protection products, carry out the tests set out in **B.5.1.3**, **B.5.1.4** and **B.5.1.5** on a test specimen representative of the designated type in order to obtain the leakage rate. Where a sealant is to be applied externally as part of the flood protection system for each use of the building aperture product, a set of standard products and finishes shall be selected, and the sealant tested for each one.

B.5.1.3 Install test specimen and carry out:

- a static head leakage test in accordance with **B.5.2.1** to **B.5.2.5**;
- a wave leakage test in accordance with **B.5.3**; and
- a current leakage test in accordance with **B.5.4**.

B.5.1.4 Remove the test specimen, reinstall the test specimen and then carry out:

- a static head leakage test in accordance with **B.5.2.1** to **B.5.2.5**;
- a wave leakage test in accordance with **B.5.3**; and
- a current leakage test in accordance with **B.5.4**.

B.5.1.5 Remove the test specimen, reinstall the test specimen and then carry out a static head leakage test in accordance with **B.5.2.6**.

B.5.1.6 For non-reusable building aperture flood protection products, including those with non-reusable seals, carry out the tests in **B.5.2.1**, **B.5.2.2** and **B.5.2.6** three times on a test specimen representative of the designated type in order to obtain the leakage rate.

NOTE 1 The deployment guide and user manual provided by the manufacturer should be followed regarding reuse of the flood protection product. Particular attention

should be paid to guidance (see Annex C) on whether the flood protection product should be allowed to dry out before being reused.

NOTE 2 For the repeat tests it is not necessary to remove and refit any components designed to remain fixed to the building.

B.5.2 Static head leakage test

B.5.2.1 Install a test specimen in the test facility in accordance with the deployment guide and user manual.

B.5.2.2 For each of the static head leakage tests in **B.5.2.3** to **B.5.2.6**, measure any horizontal movement of the test specimen by noting the position of the product before and after the tests. Take photographs of the test specimen before and after the test and record any test specimen deformation.

B.5.2.3 Fill the test facility to ±5 mm of one-third of the DMWD. Measure the total leakage over a period of 1 h and record the result. Maintain the depth of water to within ±10 mm for the duration of the test.

B.5.2.4 Following **B.5.2.3**, fill the test facility to ±5 mm of two-thirds of the DMWD. Measure the total leakage over a period of 1 h and record the result. Maintain the depth of water to within ±10 mm for the duration of the test.

B.5.2.5 Following **B.5.2.4**, fill the test facility to ±5 mm of the DMWD. Measure the total leakages over the first and last hours of an 18 h period and record both values. Maintain the depth of water to within ±10 mm for the duration of the test.

B.5.2.6 Carry out the tests described in **B.5.2.3** and **B.5.2.4**, then fill the test facility to ±5 mm of the DMWD. Measure the total leakages over the first and last hour of a 48 h period and record both values. Maintain the depth of water to within ±10 mm for the duration of the test.

NOTE The intermediate depth tests at one-third and two-thirds of the DMWD are to be carried out at appropriate points in the filling of the basin, rather than when the basin is being drained.

B.5.3 Wave leakage test

B.5.3.1 Install a test specimen in the test facility in accordance with the deployment guide and user manual.

B.5.3.2 Fill the test facility to ±5 mm of the wave testing depth in accordance with Table B.1 and apply random waves with a JONSWAP spectrum with significant wave height of (100 ±10) mm and mean wave period of 1.03 s, perpendicular to the face of the building aperture.

NOTE For further information on the JONSWAP spectrum see BS 6349-1.

B.5.3.3 Prevent water from overtopping the test specimen and entering the aperture, e.g. by sealing a temporary barrier to the top of the test specimen. Measure the total leakage over a period of 0.5 h and record the result. Ensure that the static water depth in the basin before and after the wave test is maintained to within ±10 mm.

B.5.3.4 Take photographs of the test specimen before and after each test, and record any test specimen deformation.

B.5.4 Current leakage test

B.5.4.1 Install a test specimen in the test facility in accordance with the deployment guide and user manual.

B.5.4.2 Fill the test facility to ±5 mm of the current testing depth in accordance with Table B.1 and apply a flow of water parallel to the face of the building

aperture to achieve a mean velocity of (1.0 ±0.1) m/s on the vertical centreline of the building aperture, at middepth above the invert level, 150 mm from the external face of the test specimen. Measure the total leakage over a period of 1 h and record the result. Ensure that the static water depth in the basin before and after the wave test is maintained to within ±10 mm.

Table B.1 **Wave and current testing depths above aperture threshold level**
Dimensions in mm

DMWD	Wave testing depth	Current testing depth
741 to 840	540	740
641 to 740	490	640
541 to 640	440	540
540	390	440

B.5.4.3 Take photographs of the test specimen before and after each test, and record any test specimen deformation.

Annex C (normative)

Deployment guide and user manual

C.1 A deployment guide shall be printed on water resistant paper and, as a minimum, include the following:

a) a statement that the product is designed for the temporary mitigation of flood risk and should be seen as part of a suite of measures to reduce the risk of flood water entering a property;

b) procedures for ensuring safe and effective installation, operation and removal of the flood protection product including health and safety advice on installation (including the mass of individual components and specialist lifting requirements if applicable), operation (including speed of deployment), access/egress (in all stages of the flood) and removal procedures;

NOTE 1 A manufacturer may provide a website address to an online demonstration video or provide a copy of the video.

NOTE 2 The instructions and guidance should be clear and understandable. This could be achieved by the use of pictorial diagrams and symbols.

c) advice on the suitability of products for different users;

NOTE For example, some products might not be suitable for use by older people, products only suitable for installation by adults and any hazards to children stated.

d) the time in minutes required to undertake full deployment of the flood protection product;

NOTE For multiple units forming a contiguous length of defence, this is the time in minutes to deploy each unit.

e) advice on cleaning, drying and storage procedures;

f) whether the product is designated to be "reusable" or "non-reusable" (see **4.1**);

g) possible failure mechanisms and advice on safety precautions to be taken whilst using the flood protection product;

h) product supplier or manufacturer's website or address and contact details/helpline number (if applicable); and

i) a statement advising that further important information relevant to use of the product is provided in the user manual.

C.2 A user manual shall be provided with the flood protection product and, as a minimum, include the following:

a) a statement on the need for a flood protection risk assessment to be carried out by a suitably qualified building surveyor, architect, structural engineer, civil engineer or those deemed competent prior to installation of the product to ensure the relevant routes for water entry have been identified and that the structural integrity of the building is not compromised by the flood protection product;

NOTE 1 The manual should include website addresses of the Environment Agency and other sources of advice, including the National Flood Forum and Scottish Flood Forum.

NOTE 2 Appropriate professional qualifications might include, for example, being a corporate member of the Chartered Institution of Water and Environmental Management, the Institution of Civil Engineers, or the Royal Institution of Chartered Surveyors, or similar professional body.

b) a statement of the flood protection products' use including appropriate installation locations, the types of flooding to which the flood protection product is applicable and the need for advance warning of flooding (see **3.5**);

NOTE The suitability of the product to protect against raised flood levels over long periods should be considered by the manufacturer and appropriate guidance given.

c) the relevant designation of the flood protection product;

NOTE For example, Building aperture product – Doorway or Building aperture product.

d) the designated maximum water depth (DMWD) and the maximum width in metres to which the flood protection product has been tested;

e) the leakage rate in mL/h/m aperture width per product;

f) a list of finishes suitable for the flood protection product to be fixed to;

NOTE For example, brick, timber, concrete, gloss paint over timber, render and other types of finishes.

g) maintenance procedures and the maximum number of uses or interval between services, whichever is reached first;

h) long-term durability and design life of the flood protection product and components;

NOTE For example, the period in years after which the flood protection product should be replaced, including advice on storage and inspection prior to reuse of components, such as gaskets.

i) the designation of "manual" or "automatic" (see **4.1**), where manual refers to the need for human intervention for its operation, and automatic refers to passive self-closing systems designed to operate without human intervention;

NOTE For example, the opening and closing of an automatic product can be triggered by water level or flow.

j) advice on the need for, frequency and procedure for in-situ testing of flood protection products;

k) advice on the suitability of a flood protection product for different types of buildings;

NOTE For example, domestic properties, commercial premises, schools, other public buildings and other categories of buildings.

l) advice on disposal of life expired, contaminated or failed flood protection products and components;

m) appropriateness for locations with saline or contaminated waters, indicating in particular, if at risk from pollutants such as hydrocarbons and solvents;

n) details on previous field trials and whether or not the flood protection product has been independently verified;

o) quick reference troubleshooting guide;

p) a website address to a downloadable copy of the deployment guide and user manual, and a postal address from which a hard copy can be obtained.

NOTE Offer, if relevant, an installation demonstration of the protection product on site, at the discretion of the manufacturer.

C.3 The following statement shall be presented clearly on accompanying literature:

> *This product has been tested against the standard set of tests as defined in PAS 1188-1:2014 which represent typical conditions that might be experienced during a flood in the UK. This includes testing the product for leakage under static water levels [state the DMWD] above aperture threshold level, waves up to 0.1 m high, and parallel currents up to 1.0 m/s. The testing undertaken under this PAS excludes all other components of the flood protection system.*
>
> *Conformance of the product to PAS 1188-1:2014 does not mean it is suitable for all buildings or locations. If the user has any uncertainty about the suitability of a product they should seek professional guidance.*

NOTE The instructions and guidance should be clear and understandable. This could be achieved by the use of pictorial diagrams and symbols.

Annex D (normative) Requirements for factory production control

D.1 Organization

D.1.1 General

Factory production control shall be operated in accordance with a documented system given in a quality manual.

D.1.2 Responsibility and authority

The responsibility, authority and the interrelationships between all personnel who manage, perform, or verify work affecting quality shall be defined.

NOTE This applies particularly to personnel who need the organizational freedom and authority to:

a) initiate action to prevent the occurrence of product nonconformity;

b) identify and record any product quality problems.

D.1.3 Management representative for factory production control

At every place of production, a representative, with detailed knowledge of the flood protection products being manufactured and production experience, shall be appointed by the manufacturer. They shall be responsible for managing and supervising factory production control procedures and for ensuring that the requirements of this annex are implemented and maintained.

D.2 Quality manual

The manufacturer's documentation and procedures shall define the production and process control used during the manufacturing of the product. The manufacturer shall provide the following details in a quality manual:

a) the quality aims and the organizational structure, responsibilities and authority of the management with regard to product conformity;

b) the procedures for specifying and verifying the raw materials and other constituent materials;

c) the manufacturer's production control and other techniques, processes and systematic actions to be used;

d) the inspections and tests to be carried out before, during and after manufacture, together with their frequency (see **D.3**) and possible retest procedures (see **D.4**);

e) the procedures for handling, storage, packaging, marking and labelling the product;

f) the procedures for all personnel to receive training in the activities affecting quality (see **D.7**).

D.3 Inspection and testing

D.3.1 General

All necessary facilities, equipment and personnel shall be available to carry out the inspections and tests. The manufacturer, or the manufacturer's representative, may employ, under contract, a subcontractor who has the facilities, equipment and personnel to carry out the inspection and tests on its behalf. The manufacturer shall be responsible for control, calibration, and maintenance of testing, measuring, and inspection equipment, whether owned by or on loan to the manufacturer or a subcontractor.

Inspection and testing shall be performed by competent personnel qualified for such tasks on the basis of documented, appropriate education, training and/or experience.

Equipment shall be used in a manner which ensures that any measurement uncertainty is not greater than the required measurement capability.

D.3.2 Production test equipment

Tests to demonstrate conformity of the finished product to the relevant product standard shall be performed using equipment in accordance with the test methods referred to in the relevant product standard.

The production test equipment shall be calibrated and/or checked against equipment traceable to relevant internationally or nationally recognized reference test standards. Where no such reference exists, the basis used for internal checks and calibration shall be documented. Test equipment shall be checked and/or calibrated in accordance with the manufacturer's documented procedures. The calibration records shall be maintained for a period of 10 years.

The manufacturer shall ensure that handling, preservation, and storage of test equipment is such that its accuracy and fitness for use is maintained.

When production is intermittent, the manufacturer shall ensure that test equipment which may be affected by the interruption is suitably checked and/or calibrated before use.

The calibration of all test equipment shall be repeated if any repair or failure which could upset the calibration of the test equipment occurs.

D.3.3 Inspection and testing of raw materials and other constituent materials

The manufacturer shall check that raw materials and other constituent materials conform to the requirements specified. In determining the checks required, consideration shall be given to the control exercised by the supplier and the documented evidence of conformity.

The manufacturer shall ensure that incoming raw materials and other constituent materials are used or processed only after they have been verified as conforming to the specified requirements. Where incoming material is released for urgent production purposes prior to verification it shall be identified and recorded in order to permit immediate recall in the event of nonconformity.

D.3.4 Inspection and testing during manufacture

In order to manufacture products that conform to the product standard, the manufacturer shall control their process and perform in-process inspection and tests as described in the quality manual.

D.3.5 Finished product inspection and testing

The manufacturer shall regularly inspect and, where appropriate, test the finished products in accordance with this PAS.

D.3.6 Inspection and test status

The inspection and test status of the products shall be identified by means which indicate the conformity or nonconformity of the product with regard to inspections and tests performed (e.g. passed, failed or due to be reclassified).

D.3.7 Inspection and test records

The results of finished products inspection and testing shall be recorded. The record shall include the product identification, the date and time of manufacture, and for each product the test methods, the test results, the required limits, the inspection result and the identification of the person carrying out the inspection.

Where products do not meet the requirements of the product standard, records shall include the remedial measures taken.

The manufacturer's log shall be kept for at least 10 years.

D.4 Actions in the case of nonconforming products

Where a nonconforming product is identified, the manufacturer shall immediately take the steps necessary to identify the cause and rectify the deficiency. Products that do not conform to the requirements of the product standard shall be marked accordingly. When the deficiency has been identified and rectified, the test or inspection in question shall be repeated without delay according to the quality manual, to provide evidence that the defects have been overcome.

In the event that products are dispatched before the result of the inspection is available, prompt notification shall be given to the customer to prevent any consequential damage and a record maintained of such notification.

D.5 Handling, storage, packaging, and marking of products

In accordance with the quality manual (see **D.2**) the manufacturer shall:

a) provide methods of handling that prevent damage or deterioration;

b) provide suitable storage areas or stock rooms to prevent damage to or deterioration of the product;

c) control the packaging, storage and the marking processes.

D.6 Traceability of products

Delivered individual products or product batches shall be identifiable and traceable with regard to their production origin.

D.7 Training of personnel

The manufacturer shall establish and maintain procedures for the identification of training needs and shall provide for the training of all personnel in activities affecting quality.

Personnel performing specific assigned tasks shall be competent and qualified on the basis of appropriate education, training and/or experience, as required.

Records of training shall be kept up-to-date.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 6349-1, *Maritime structures – Part 1: Code of practice for general criteria*

BS 7775, *Penstocks for use in water and other liquid flow applications – Specification*

BS EN 13564-1, *Anti-flooding devices for buildings – Part 1: Requirements*

PAS 1188-2, *Flood protection products – Specification – Part 2: Temporary products*

PAS 1188-3, *Flood protection products – Specification – Part 3: Building skirt and wall sealant systems*

PAS 1188-4, *Flood protection products – Specification – Part 4: Demountable products*

Other publications

[1] WHITE L, O'HARE P, LAWSON N, GARVIN S, and CONNELLY A. *Six steps to flood resilience: Guidance for local authorities and professionals*. Manchester: Manchester University, BRE, and Manchester Metropolitan University, 2013. Available from: http://www.smartfloodprotection.com/wp-content/uploads/2014/04/Six-Steps_Professionals-web.pdf [viewed July 2014].

[2] OGUNYOYE F, STEVENS R and UNDERWOOD S. *Delivering benefits through evidence: Temporary and demountable flood protection guide.* Environment Agency, 2011. Available from: http://publications.environmentagency.gov.uk [viewed July 2014].

[3] OFFICE OF THE DEPUTY PRIME MINISTER. *Preparing for floods: Interim guidance for improving the flood resistance of domestic and small business properties.* London, 2003. Available from: www.communities.gov.uk/publications/planningandbuilding/preparingfloods [viewed July 2014].

[4] DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT. *Improving the flood performance of new buildings: Flood resilient construction*. London: CLG, 2007. Available from: http://www.planningportal.gov.uk/uploads/br/flood_ performance.pdf [viewed July 2014].

[5] CIRIA. *Improving the flood Performance of new buildings – Flood resilient construction. Report Number WP2c – Review of existing information and experience (Final Report).* CIRIA, 2004. Available from: http://www.ciria.org.uk/flooding/flood_performance.htm [viewed July 2014].

[6] BOWKER. *Flood resistance and resilience solutions: An R & D scoping study*. London, 2007. Available from: http://archive.defra.gov.uk/environment/flooding/documents/manage/frrs-scope.pdf [viewed July 2014].

[7] BUILDING RESEARCH ESTABLISHMENT. *Flood resilient building Parts 1 and 2.* S Garvin. 2012.

[8] ENVIRONMENT AGENCY & JBA CONSULTING. *Evaluation of the Defra property-level flood protection scheme*. Environment Agency, 2012. Available from: http://nationalfloodforum.org.uk/wp-content/uploads/Evaluation-of-the-Defra-PL-Flood-protection-Scheme-25918.pdf [viewed July 2014].

[9] WHITE L, O'HARE P, LAWSON N, GARVIN S, and CONNELLY A. *Six steps to property level flood resilience: Guidance for property owners.* Manchester University, BRE, and Manchester Metropolitan University, 2013. Available

from: http://www.smartfloodprotection.com/wp-content/uploads/2014/04/Six-Steps-Property-owners_web.pdf [viewed July 2014].

[10] SEVENTH FRAMEWORK PROGRAMME. *SMARTeST Work package 2 – Report D2.3: Guidance for code of practice*. Seventh Framework Programme, 2013. Available from: http://www.floodresilience.eu/en/innovation-a-outcomes [viewed July 2014].

[11] Statutory Rules of Northern Ireland 1991, Technical Booklet L: Combustion appliances and fuel storage systems 2006. London: The Stationery Office.

[12] Statutory Rules of Northern Ireland 1994, Technical Booklet E: Fire safety 2005. London: The Stationery Office.

[13] Statutory Rules of Northern Ireland 1994, Technical Booklet K: Ventilation 1998. London: The Stationery Office.

[14] Statutory Rules of Northern Ireland 1994, Technical Booklet N: Drainage 1990. London: The Stationery Office.

[15] Statutory Rules of Northern Ireland 2000, Technical Booklet R: Access to and use of buildings 2006. London: The Stationery Office.

[16] The Building Regulations (England and Wales) 1991, Approved Document B: Fire safety 2006. London: The Stationery Office.

[17] The Building Regulations (England and Wales) 1991, Approved Document F: Ventilation 2006. London: The Stationery Office.

[18] The Building Regulations (England and Wales) 1991, Approved Document H: Drainage and waste disposal 2002. London: The Stationery Office.

[19] The Building Regulations (England and Wales) 1991, Approved Document J: Combustion appliances and fuel storage systems 2002. London: The Stationery Office.

[20] The Building Regulations (England and Wales) 1991, Approved Document M: Access to and use of buildings 2004. London: The Stationery Office.

[21] The Building Regulations (England and Wales) 2006, Approved Document C: Site preparation and resistance to contaminates and moisture 2006. London: The Stationery Office.

[22] The Building Standards (Scotland) Regulations 1990, Technical Standard D: Structural fire precautions. London: The Stationery Office.

[23] The Building Standards (Scotland) Regulations 1990, Technical Standard E: Means of escape from fire, facilities for fire-fighting and means of warning of fire in dwellings and enclosed shopping centres. London: The Stationery Office.

[24] The Building Standards (Scotland) Regulations 1990, Technical Standard F: Combustion appliance installations and storage of liquid and gaseous fuels. London: The Stationery Office.

[25] The Building Standards (Scotland) Regulations 1990, Technical Standard K: Ventilation of buildings. London: The Stationery Office.

[26] The Building Standards (Scotland) Regulations 1990, Technical Standard M: Drainage, sanitary facilities and sanitary facilities for the disabled. London: The Stationery Office.

[27] The Building Standards (Scotland) Regulations 1990, Technical Standard Q: Access and facilities for dwellings. London: The Stationery Office.

[28] The Disability Discrimination Act 1995. London: The Stationery Office.

[29] The Fire Precautions Act 1971. London: The Stationery Office.

[30] The Gas Safety (Installation and Use) Regulations 1998 (SI 1998, No. 2451). London: The Stationery Office.

[31] HEALTH AND SAFETY EXECUTIVE. Managing Health and Safety in Construction: The Construction (Design and Management) Regulations 2007. London. The Stationery Office.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™