PAS 59:2014

Incorporating Corrigendum No. 1

BSI Standards Publication

Specification for collective fall arrest soft landing systems

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Contents

Summary of pages
This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 10, an inside back cover and a back cover.

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Foreword

Publishing information

This PAS was sponsored by Forest Safety Products Limited. Its development was facilitated by BSI Standards Limited and published under licence from The British Standards Institution. It came into effect on 31 January 2014.

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Health and Safety Executive

National Access and Scaffolding Confederation (NASC)

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 It will be withdrawn upon publication of its content in, or as, a British Standard.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This PAS supersedes PAS 59:2004, which is withdrawn.

Information about this document

Text introduced or altered by Corrigendum No. 1 is indicated in the text by tags [C1] 〈C1〉. Minor editorial corrections are not tagged.

It is intended that this PAS should provide the basis for product conformity certification schemes to provide assurance that collective fall arrest soft landing systems placed on the market have been independently tested and confirmed as being in accordance with the requirements of this PAS.

Users of this PAS are therefore advised to consider the desirability of third-party certification of products in conformance with this PAS.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to a competent person or persons for whose use it has been produced.

This specification is not intended to restrict new developments in design and materials and manufacturers of collective fall arrest soft landing systems may seek innovative provision of such systems provided their performance is in accordance with the requirements of this PAS.

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". Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

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

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- The Work at Heights Regulations 2005 [1];
- The Construction (Design and Management) Regulations 2007 [2];
- The Management of Health and Safety at Work Regulations 1999 [3];
- The Provision and Use of Work Equipment Regulations 1998 [4].

Introduction

Regulations concerning the use of work equipment at height (see Foreword), require employers to take suitable and sufficient measures to prevent any person falling and where fall prevention is impractical to take action to ensure that the height and consequences of a fall are minimised. Collective fall arrest soft landing systems should be considered in this context by virtue of their ability to reduce the free fall height and provide a suitable landing surface. In all cases, employers are required to ensure that work at height, including emergencies and rescue, is subject to a risk assessment, properly planned by a competent person, appropriately supervised and carried out in a safe manner.

1 Scope

This PAS specifies requirements for a collective fall arrest soft landing system intended for installation on a continuous, firm, level surface in order to restrict the deceleration of a person falling onto it to a maximum of 14 g, from a free fall height not more than the maximum free fall height for which the system has been tested.

This PAS includes performance requirements and related test methods, requirements for conformity marking and for the provision of installation and usage instructions.

This PAS is not applicable to air/gas filled systems that are designed to be inflated/deflated on site or to those that have individual cell volume greater than 0.5% of the volume of the module in which they are inserted.

This PAS is not applicable to fall arrest systems that are suspended.

This PAS is not applicable to personal protective equipment against falls from a height.

This PAS does not provide for the containment of falling debris.

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 amendment) applies.

BS 5852, *Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources*

BS 7479, ISO 9227, *Method for salt spray corrosion tests in artificial atmospheres*

BS EN 364:1993, *Personal protective equipment against falls from a height – Test methods*

BS EN ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

BS EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

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

3.1 boundary walls
rigid barriers defining the boundary of a protected area that prevent the modules of a constrained fall arrest system from moving from their designated location

3.2 collective fall arrest soft landing system
one or more fall arrest soft landing modules which when installed in accordance with the manufacturer's or supplier's instructions, provide an area of protection capable of dissipating the kinetic energy of one or more persons falling from not more than a specified height onto any part of its surface

NOTE The Health and Safety Executive describes "collective protection" as equipment which can protect more than one person and that once properly installed or erected does not require any action by them to make sure it will work.

3.3 competent person for inspection
person knowledgeable in the current inspection requirements, recommendations and instructions issued by the manufacturer or supplier in respect of the collective fall arrest soft landing system under inspection

[Adapted from BS EN 365:2004]

NOTE 1 This person should be capable of identifying and assessing the significance of defects and should have the responsibility to initiate the corrective action to be taken and should have the necessary skills and resources to do so.

NOTE 2 A competent person may need to be trained by the manufacturer or supplier or an authorised representative on specific equipment, e.g. due to its complexity or innovation, or where safety critical knowledge is needed in the dismantling, reassembly, or assessment of the equipment, and may need to have that training updated periodically due to modifications and upgrades.

3.4 constrained collective fall arrest soft landing system
one or more fall arrest soft landing modules with or without a means of Inter-connection, that to any extent rely on boundary walls to maintain their location in a continuous protected area around a vehicle or structure on which work is being undertaken at a free fall height not more than that for which the system has been tested

3.5 fall arrest soft landing module
cushioning device with specified impact absorbing characteristics capable of restricting the deceleration of a person falling onto it from a specified height, to a maximum of 14 g, as all or part of a collective fall arrest soft landing system

3.6 free fall height
vertical distance from the surface on which a person working at height will stand to the impact surface of an installed collective fall arrest soft landing system

NOTE The maximum free fall height for which a fall arrest soft landing system complying with this PAS has been tested will be marked on each module).

3.7 protected area
area covered by a collective fall arrest soft landing system installed in accordance with the manufacturer's or supplier's instructions

3.8 restrainable collective fall arrest soft landing system
one or more fall arrest soft landing modules provided with a means of connection to each other and to a vehicle or structure on which work is being undertaken at a free fall height not more than that for which the fall arrest soft landing system has been tested, to provide a continuous protected area beneath the area of work

4 System requirements

4.1 System configuration

4.1.1 Systems for constrained use only

Where designed for constrained use only, the modules of the collective fall arrest soft landing system shall be:

- free from sharp edges and projections likely to cause injury during use; and
- supplied with installation instructions that include requirement that any method of interconnection between modules be implemented and that the installed system extend to boundary walls at the periphery of the protected area.

NOTE Where the collective fall arrest soft landing system is to be used to provide protection in a constrained situation, the boundary walls may be presumed to provide positional retention provided the installed modules extend to the boundary walls on all sides.

4.1.2 Systems for general use

For all use situations other than "constrained use", the modules of the collective fall arrest soft landing system shall be:

- free from sharp edges and projections likely to cause injury during use;
- provided with a means of connection to adjacent modules in the system so as to preclude their unintentional separation under conditions of intended use;
- provided with a means of restraint capable of preventing the unintentional separation of the installed collective fall arrest soft landing system from the vehicle or structure on which work at a free fall height not more than the maximum free fall height for which the system has been tested, is being undertaken under conditions of intended use; and
- supplied with installation instructions that stipulate that a risk assessment be undertaken to determine the appropriate protected area for the particular situation of use and whether use of the means of restraint is required.

NOTE Where a means of attachment to structures is provided it should be of sufficient strength and stability to ensure the positional retention of modules under impact by a person falling onto them under conditions of intended use.

4.2 Dynamic performance for all system types

4.2.1 When tested in accordance with Annex A, the measured deceleration shall not exceed 14 g.

4.2.2 Should the recorded results from a series of three drops identify deceleration in excess of that specified in **4.2.1** on two or more of the required drops, the sample shall be judged to have failed.

4.2.3 Should the recorded results from a series of three drops identify deceleration in excess of that specified in **4.2.1** on any one of the required drops, the sample may be subjected to another series of three drops. Should deceleration in excess of that specified in **4.2.1** occur during any of this second series of drops, the sample shall be judged to have failed.

4.3 Environmental performance

4.3.1 Corrosion resistance

Where corrosion resistance is claimed, metallic components shall be resistant to corrosion such that, following immersion in salt spray in accordance with BS 7479 for 168 h at (35 ± 5) °C and then drying for 24 h, the components shall exhibit no base metal corrosion.

4.3.2 Resistance to ultra violet (UV) light

Where resistance to UV light is claimed, module components shall show no loss of integrity when exposed to light from UV-A340 fluorescent tubes operating continuously for 500 h at a black-standard temperature of (50 ± 5) °C giving a cycle of 8 h UV exposure and 4 h condensation darkness, in accordance with BS EN ISO 4892-3.

4.4 Flame retardance

4.4.1 Where flame retardance is claimed, the product shall meet requirements **4.4.2** to **4.4.4** of this PAS.

4.4.2 When tested in accordance with BS 5852, smouldering cigarette test, there shall be no visible evidence of flaming or progressive smouldering after 60 min.

4.4.3 When tested in accordance with BS 5852, butane flame test, there shall be no visible evidence of flaming or progressive smouldering.

4.4.4 When tested in accordance with BS 5852, wood crib test, using crib type 5 there shall be no visible evidence of flaming or progressive smouldering after 60 min.

NOTE Plastic products are combustible and should be kept away from flame and other sources of ignition.

5 Information to be provided with the product

5.1 Instructions for installation, operation and maintenance

Instructions containing at least the information identified in a) to f) of this clause and written in the language of the country of sale, shall be supplied with each collective fall arrest soft landing system or where sold separately, each module thereof:

a) The necessity for collective fall arrest soft landing systems to be installed by a competent person authorised by the user organization to do so.

b) Sufficient detail, supplemented by diagrams, to enable a competent person authorised by the user to correctly install the system including the necessity for securely interconnecting modules and thoroughly checking for voids between modules.

c) How to prevent the system separating from the work structure where identified as necessary by risk assessment, through boundary containment or use of the retention method provided.

d) Immediate replacement by a competent person, of modules that have arrested the fall of a person or been subject to other significant impact.

e) Visual inspection of units before each use and thorough inspection at intervals of not more than twelve months.

f) Immediate replacement of damaged modules identified during inspection e) or in use, including their removal from the work area and other action to prevent their unintended reuse.

5.2 General guidance documentation

Information containing the guidance identified in a) through h) below shall be provided with each fall arrest system or, where sold separately, each module thereof:

a) system limitations/capabilities, e.g. maximum free fall height; flame retardant, UV resistant and corrosion resistant, characteristics;

b) safe storage procedures;

c) safe transportation procedures;

d) safe lifting (including manual handling) procedures;

e) safe installation and removal procedures;

f) procedure to be followed after a fall or other impact on the system;

g) recommended date for submission to manufacturer's inspection or withdrawal;

h) information as to the long-term durability and design life of the product.

6 Warnings

6.1 Use warnings and conditions of use markings

Fall arrest modules intended for use in collective fall arrest soft landing systems shall carry the warnings a) through d) and conditions of use information e) and f), indelibly marked on or securely attached to, one surface of the module. In the case of modules for which orientation is critical (**6.2**), that surface shall be the one intended to be uppermost when in use.

a) "**WARNING:** The manufacturer's instructions shall be followed in the installation of this product and shall be undertaken by trained, competent personnel only";

NOTE In addition, a pictogram to indicate that users should read the information provided by the supplier may be used (see Figure 1).

b) "**WARNING:** keep away from flame and other sources of ignition";

c) for modules intended to be used in collective fall arrest soft landing systems for use in "constrained" situations only:

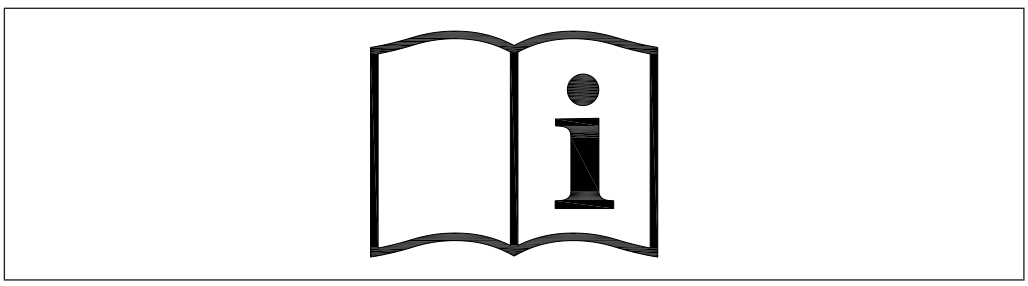
"**WARNING:** for constrained use only where the fall arrest system extends to boundary walls on all sides";

d) "**WARNING:** Check "year of manufacture" and "date of last recheck" for validity in accordance with manufacturer's instructions";

e) month and last two digits of the year of manufacture, e.g. 01/14 for January 2014 and from the time of first manufacturer's recheck, the date or visual indication of most recent re-check;

f) maximum free fall height for which it was tested and whether fire-retardant, UV resistant and or corrosion resistant characteristics are claimed.

Figure 1 **Pictogram used to denote "Read the information provided by the supplier"**

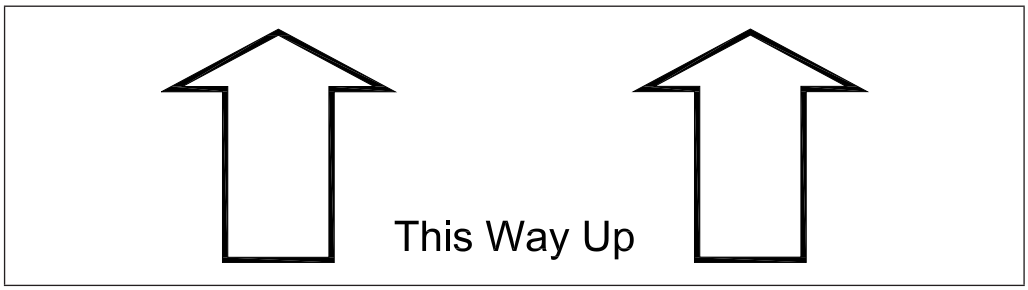


6.2 Orientation warnings

Where the module relies on correct orientation for its impact attenuation performance, unless the system includes a means of preventing incorrect module orientation, one of instructions specified in a), b) or c) below, shall be used.

a) Indication as in Figure 2 in at least 36-point print font, along each side of the module at intervals not exceeding 900 mm:

Figure 2 **Illustration of orientation warning**



b) in at least 48-point print font, on the top of the module: **THIS SIDE UP**

or

c) alternative and effective visual instruction preventing incorrect orientation.

7 Quality control

A quality management system providing traceability for manufacture and inspection shall be operated by the supplier.

NOTE It is recommended that the quality management system is operated in accordance with BS EN ISO 9001.

8 Conformity marking

A fall arrest system claimed to be in conformance with this PAS shall be clearly and permanently marked, by any suitable method not having a harmful effect on the materials, with the information specified in a) through c), below:

a) the number and date of this PAS, i.e. [C1] PAS 59:2014 incorporating Corrigendum No. 1 [C1];[1)]

b) the name or trademark of the supplier or their appointed agent;

c) where authorized, the product conformity mark of a third party certification body.

[1)] Marking [C1] PAS 59:2014 incorporating Corrigendum No. 1 [C1] on or in relation to a product represents a supplier's declaration of conformity, i.e. a claim by or on behalf of the supplier that the product meets the requirements of the specification. 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 (normative) Method of dynamic testing for a collective fall arrest soft landing system

A.1 Description of test method

A sample collective fall arrest soft landing system (the test sample) constituted of one or more fall arrest modules that together provide an area of protection not less than the manufacturer's recommended minimum, is installed in accordance with the manufacturer's/supplier's instructions under the test apparatus and subjected to a series of three impacts from a specified mass free falling from a height specified by the manufacturer/supplier or from (2.0 ± 0.05) m, whichever is the greater, onto the installed modules.

Where the sample under test is identified as being for use in constrained situations only, boundary walls are erected on the surface of the test area, to a height and dimension sufficient to contain the test sample such that the modules are in edge contact with the walls on all sides.

The signal emitted by an accelerometer in the mass during the impact is processed to yield a time/acceleration curve from which the maximum deceleration is identified.

A.2 Test facility

The test apparatus specified at **A.3** mounted on a structure of a height sufficient to permit test drops from 2m or more above the upper surface of the test sample, constructed on a firm level surface of length and breadth not less than that of the system under test.

A.3 Apparatus

A.3.1 *Drop weight*, consisting of a rigid steel mass (100 ± 1) kg in accordance with BS EN 364:1993, and incorporating an accelerometer. A disc of plywood (280 ± 5) mm diameter and (20 ± 5) mm thick shall be secured to the underside of the steel mass. The connection between the accelerometer and drop weight shall be rigidly homogeneous and free from voids over those areas where impacts may occur. The drop weight shall be provided with a rigid connection at the top from which it can be suspended.

A.3.2 *Triaxial accelerometer*, mounted in or attached to the drop weight.

A.3.3 *Acceleration measuring and recording instrumentation*, [C1⟩ capable of measuring the resultant acceleration vector at a logging rate of 600 samples per second, calibrated and traceable to an approved BS EN ISO/IEC 17025 calibration laboratory, together with facility to apply a 60 Hz low pass filter to the recorded data to remove high frequency noise. ⟨C1]

A.3.4 *Quick release device*, capable of releasing the drop weight with no initial velocity.

A.3.5 *Blocks or other rigid partitioning material* appropriate for building boundary walls for use in testing systems identified as "for use in constrained situations only".

A.4 Test sample

The test sample shall consist of one or more modules complying with **4.1.1** or **4.1.2** that will provide a minimum testable area not less than the manufacturer's recommended minimum protected area.

A.5 Preparation of gas/air filled system samples for testing

To simulate any potential loss of fill volume over time, gas/air filled modules submitted for test shall have their volume reduced by 10% from that specified by the manufacturer/ supplier for the product to be placed on the market.

A.6 Test procedure

A.6.1 Install the test sample in accordance with the supplier's instructions within the test facility, installing boundary walls when testing a system identified as for use in constrained situations only.

A.6.2 Raise the drop weight over the installed test sample such that the underside of the drop weight is at the maximum free fall height marked on the system modules above the top surface of the specimen, but not less than (2.0 ± 0.05) m. Retain in this position by means of the quick release device.

A.6.3 Release the drop weight to fall onto the test sample and record the time/acceleration curve during the arrest stage [C1⟩ using a logging rate of 600 samples per second and applying the 60 Hz low pass filter to the recorded data ⟨C1].

A.6.4 Repeat **A.6.2** and **A.6.3** twice with the impact being on a different part of the test sample at each drop. Where the system under test is made up of more than one module the module impacted shall be different for each drop with at least one drop being onto a point not more than 140 mm from an interconnection with an adjacent module.

A.7 Recording of results

Record the maximum deceleration for each drop and proceed in accordance with **4.2.2** and **4.2.3**

A.8 Test report

The test report shall include the information specified in a) through h) below:

a) unambiguous identification of the system tested including manufacturer and product name;

b) the number and date of this PAS, i.e. [C1⟩ PAS 59:2014 incorporating Corrigendum No. 1 ⟨C1];

c) the location of the test (laboratory or on site);

d) the conditions at the time of the test, including the temperature in degrees Celsius, and the weather conditions if testing is carried out on site;

e) the results from each dynamic performance test, giving drop weight, drop height and location, used;

f) the peak deceleration determined from the digital record. Where agreed between the test house and the manufacturer the report may include a time/deceleration curve to illustrate the history of the impact event;

g) the corresponding maximum deceleration;

h) whether or not the sample was subjected to re-test as specified in **4.2.3**.

A.9 Pass/fail assessment

The criteria for assessment of test outcomes shall be as specified in **4.2**.

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 EN 365:2004, *Personal protective equipment against falls from a height – General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging*

BS EN ISO 9001, *Quality management systems – Requirements*

Other publications

[1] GREAT BRITAIN. The Work at Height Regulations 2005, as amended. London: The Stationery Office.

[2] GREAT BRITAIN. The Construction (Design and Management) Regulations 2007. London: The Stationery Office.

[3] GREAT BRITAIN. The Management of Health and Safety at Work Regulations 1999. London: The Stationery Office

[4] GREAT BRITAIN. The Provision and Use of Work Equipment Regulations 1998. London: The Stationery Office.

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