

NAFLIC

National Association For Leisure Industry Certification

Standards & Related Documents Committee

TECHNICAL BULLETIN - JUNE 2000

203. Accidents involving Inflatables

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Three recent accidents involving inflatables have prompted us to produce a Technical Bulletin on the subject. In the first accident, four were injured as a result of an inflatable slide tipping over at a Texas fair in late March of this year. In the second case, on 31 May in Ottawa, a man died from head injuries he sustained in a fall from a "Rocky Mountain" inflatable amusement attraction. This inflates to a height of 25 feet. It is possible that this accident may not have been connected with the device being an inflatable.

The third accident occurred on Friday, June 2, 2000 at a fair at Sherwood Park in Alberta, Canada. Five teenagers were injured after an inflatable device collapsed. The ride, a portable, inflatable slide, is a replica of the Titanic. It allows riders to slide down what is made to look like the deck of the ship as it sank into the ocean. All five children were taken to a local hospital with non-life-threatening injuries.

In Great Britain, under the definition included in the Health & Safety at Work, etc., Act 1974 (as amended), inflatables are "fairground equipment". Sometimes (if being used on its own) the policing of safety of an inflatable will be the responsibility of the local authority. However, if an inflatable is on a site with another inflatable or other items of fairground equipment, the Health and Safety Executive is the enforcing authority.

Interim Guidance was recently issued covering the inspection requirements for inflatables under the ADIPS scheme. The text of this is reproduced on the following 2 pages. For the longer term there will be an Entertainment Sheet No. 7. This will replace Guidance Note PM 76 *Safe operation of passenger carrying amusement devices - Inflatable Bouncing Devices*. The current draft of Entertainment Sheet No. 7 is appended but please note that there could still be significant changes to this before it is adopted

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The Interim Guidance is as follows :-

Entertainment Section

Interim guidance for manufacturers, users and inspection bodies regarding all types of inflatables covered by PM76 (soon to be replaced by ETIS 7)

Background

A number of problems have been brought to the section's attention concerning inflatables on fairground sites being refused inspection reports by ADIPS inspection bodies because there is no proof of design review or assessment of conformity to design as required by HSG175.

The situation will be solved with the publication of ETIS 7; the extension of the ADIPS scheme to include new Quality Service Schedules for inspection bodies restricted to inflatables and the registration of these new inspection bodies.

In the interim a number of measures are necessary to allow new inflatables to be bought and second hand devices to be sold on to new owners.

Interim measures

1. The extension of the ADIPS scheme will be spread over a period of time to allow a catching up exercise for existing devices. We recommend that it is implemented as soon as possible but we will not expect full coverage until 1 January 2002. After that date any initial test of a new device or annual inspection of an existing device would need to be completed in accordance with the procedures of the agreed scheme.
2. A 21 month period of grace should allow the Service Quality Schedules to be agreed and up and running with sufficient numbers of inspection bodies registered.
3. If a Declaration of Operational Compliance (DOC) or Initial test report needs to be completed by a registered inspection body for an inflatable the sections on design review and assessment of conformity to design should be completed indicating that the reports will be completed by 1 Jan 2002 if the inspections have not yet been carried out.
4. As with the transitional arrangements for older fairground rides we do not suggest that administrative arrangements such as these should be used where there are serious matters which require inspection, for example a complex structure such as an inflatable assault course measuring over 70ft in length. They are more appropriate to simple bouncy castles and similar devices.
5. Whilst we can defer the operation of the ADIPS scheme we cannot change any existing legal requirements. Manufacturers need to provide sufficient information and instruction for the device to be safely used and any information regarding tests or research. The subjects which should be covered are those listed in PM76 or ETIS 7. This is a requirement of Section 6 of the Health and Safety at Work etc Act 1974.

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6. Owners or operators of devices will need to carry out risk assessment of their activities to determine the control measures to avoid risk or reduce risk to acceptable levels. This will be relatively easy to do using the manufacturer's information and instructions for safe operation. This is a requirement of the Management of Health and Safety at Work Regulations 1999.
7. Information sheet ETIS 7 will be amended to contain details of the transitional arrangements.



Safe use and operation of play inflatables, including bouncy castles

Entertainment Sheet No 7

INTRODUCTION

This information is written to provide guidance for those involved with the design, manufacture, importation, supply, inspection and safe use of inflatable play devices. It lists possible hazards and outlines the precautions that need to be taken to avoid them. It covers equipment known as inflatables used for bouncing and other purposes but not those used solely for protection. It does not cover water-borne inflatables used in swimming pools or other types not used by the public for entertainment purposes.

The information follows the principles in *Fairgrounds and amusement parks: Guidance on safe practice* (HSG 175) published by the Health and Safety Executive and prepared by the Fairgrounds Joint Advisory Committee (JAC) to improve health and safety standards.

Definitions:

Inflatable devices - fairground equipment consisting of air filled structures designed to allow users to bounce, slide or climb on them. They are made from flexible fabric, kept inflated by one or more blowers and rely on air pressure to maintain their shape.

Controller - the person, organisation or hirer (those who hire to others), having the overall control, including responsibility for maintenance, of the inflatable device.

Operator - the person appointed by the controller to be in charge of the immediate operation of an inflatable at any time when it is intended to be available for public use.

Attendant - any person appointed to work under the control and direction of an operator to assist in the operation of the inflatable device.

Inspection Body - an organisation, part of an organisation or individual with the appropriate competence to carry out one or more of the following inspections:

- design review;
- assessment of conformity to design;
- initial test;
- annual inspection.

Members of the Inflatable Play Manufacturers' Association (IPMA) and others will be able to carry out, in-house, design reviews, assessments of conformity to design and initial tests, if they can meet agreed Service Quality Schedules and procedures for inflatable devices under the Amusement Device Inspection Procedures Scheme (ADIPS). They will then use common report

forms which are similar to those used for other types of equipment covered by the ADIPS scheme.

In order to carry out these inspections, including annual inspections, IPMA members and others need to register with the ADIPS scheme, as Type B or Type C inspection bodies (see EN 45004 for definition), under the service quality schedules limited to inflatables.

To ensure consistency, this will be backed up by inspections at random intervals carried out by an inspection body registered under ADIPS as Type A, or Type C (which must be independent of inflatables). At these random visits to manufacturers or others the inspection body will audit their safety-related systems of inspection and see examples of products.

Members of the fairground and amusement parks industry associations have agreed only to accept reports issued by ADIPS registered inspection bodies. Non-members need to ensure that either inspections are carried out by an ADIPS registered inspection body or by a competent inspection body which can meet similar standards. In the latter case the non-member has the responsibility to verify the competence of the inspection body being used.

BUYING AND SELLING INFLATABLE DEVICES

Inflatable devices should not be bought or sold unless the following documentation is available:

- ◆ a report of design review;
- ◆ a report of assessment of conformity to design;
- ◆ a report of initial test.

These inspections should be carried out by inspection bodies as detailed above.

For equipment in use before full implementation of this scheme in January 2002 the above documentation may not be available. If a Declaration of Operational Compliance (DOC) or Initial test report needs to be completed by a registered inspection body for an inflatable the sections on design review and assessment of conformity to design should be completed indicating that the reports will be completed by 1 Jan 2002 if the inspections have not yet been carried out.

Owners or operators of devices will need to carry out risk assessment of their activities to determine the control measures to avoid risk or reduce risk to acceptable levels. This will be relatively easy to do using the manufacturer's information and instructions for safe

operation. This is a requirement of the Management of Health and Safety at Work Regulations 1999.

Owners or operators of inflatable devices are required by the Provision of Work Equipment Regs 1998 (PUWER) to carry out inspection at suitable intervals (annual recommended) to ensure that safe conditions are maintained, and, that any deterioration in the device is detected and remedial action taken in good time.

When the inspections have been satisfactorily completed, the inflatable device will be issued with a Declaration of Operational Compliance (DOC) by the inspection body issuing the report of the initial test. A DOC will normally be valid for up to one year.

The operations manual should contain all the above reports, a copy of this information sheet, and all relevant information, including full operating instructions, information on setting up, operating and maintaining the inflatable. It should also contain records of maintenance, details of any modifications, daily checks and annual inspections. The Operations Manual should be readily available. This should not mean that it is compulsory for it to be kept next to the equipment or for it to be written on paper. Computer storage systems may be acceptable for some information, provided that it can be easily accessed and a hard copy produced if required.

The duty to provide the above pre-use reports and information will fall to the manufacturer (if the device is manufactured in this country), or in the case of an imported ride whether new or second hand, the importer. For second hand or hired devices the duty will fall to the supplier.

The controller of a newly acquired second hand device should ensure that the Operations Manual is present and complete and arrange for the current DOC to be revised in respect of the new owner.

RECOGNISED HAZARDS

The following hazards have been known to occur:

- a) Instability and blowing away in windy conditions.
- b) Situations caused by loss of pressure as a result of:
 - i) failure of the fabric, zips and seams;
 - ii) failure or loss of power to the blower;
 - iii) disconnection of the blower;
 - iv) litter blocking the air intake.
- c) Falls from the structure.
- d) Tripping (particularly over anchorages).
- e) Injury to users caused by boisterous behaviour, overcrowding or not separating larger users from smaller ones.

- f) Access to dangerous (parts of) machinery (e.g. inadequately protected, or unguarded, blower units)
- g) Electrical hazards (e.g. shock or burns).
- h) Inadequate means of escape in case of fire.
- i) Lifting injuries caused by manual handling.
- j) Injury to users caused by wearing inappropriate clothes and shoes.
- k) Suffocation.
- l) Entrapment.

DESIGN CONSIDERATIONS

The designer or manufacturer should make sure that:

- there are no parts of the device or ancillary equipment within reach of users which will cause injury if contact is made with them e.g. sharp exterior angles or edges.
- there are no significant trapping points between adjacent surfaces.
- (for bouncy castles especially) the outside walls are high enough, strong enough and attached to the base to prevent users falling out, bouncing over or slipping through gaps in normal use or foreseeable misuse.

Note: As a general rule the height of users using an inflatable should not exceed the height of the outside walls when the user stands on the bouncing surface. Walls of 1.8m or higher measured from the bouncing surface are sufficient for users of any height.

- the number and the maximum size of users that the structure can safely contain at any one time is specified in the operations manual.
- on power failure the deflation time is sufficient to allow the structure to be safely evacuated.

Anchorage - Structures should be provided with an adequate anchorage and/or ballast system. The size, number and strength of anchorage points should be adequate for the structure and take into account likely wind loading. The designer/manufacturer should carry out or arrange for any research to be carried out to determine maximum wind speeds and specify the type of anchorage for each inflatable device to be safely used. This information should be kept available.

Access/egress - On any open side it should not be possible to fall through more than 750mm onto any hard surface. Such hard surfaces should, in any case, be covered by soft landing material such as dense gym mats or equivalent material of at least 25mm thickness but not more than 125mm, extending for a distance of at least

1.2m from any open side. Safety mats used indoors should be fire resistant.

When it is necessary to have anchorage points near to an entrance/exit, they should be effected in such a way to minimise the danger of tripping, abrasion or other injuries.

Blowers - Blowers should be suitably guarded at inlet and outlet (IP2X is satisfactory - see BS EN 60529). The structure shall be so designed that users cannot contact the blower unit. This may be achieved by ensuring the length of any inflation tube is at least 1.2 m when positioned on a walled side, and at least 2.5 m when positioned on an open side. Blowers should not be sited internally unless they are in a part of the structure not used for playing and out of possible contact by the user.

Special considerations for totally enclosed structures

In totally enclosed structures the following additional requirements should be satisfied:

- signs meeting the requirements of the Safety Signs Regulations should indicate exits;
- an independent support system should be provided for any lighting, emergency lighting and loudspeaker systems;
- the electrical installation should comply with the requirements of BS 7671;
- structures designed to accommodate more than 15 people should have more than one exit so that the inflatable can be evacuated quickly. Deflation time should be sufficient to allow the structure to be safely evacuated;
- emergency lights should be provided as a back up if a lighting system is installed. The discharge period for the lighting following supply failure should be sufficient to allow for the complete evacuation of the structure. Systems should be fully charged daily prior to use of the inflatable. Lighting should be proved each day before a totally enclosed inflatable is put into use;
- electrical cables should be adequately secured away from any users or spectators;
- electrical equipment exposed to the weather should be protected to BS EN 60529: 1992 *Specification of degrees of protection provided by enclosures* or be located inside a weatherproof hut or cabin.

Materials

Flexible fabrics used in the construction of inflatables need to be of adequate tear and burst strength and have sufficient air retention to enable the structure, when pressurised to the level specified in the operations manual, to maintain its shape and prevent the structure from distorting under load. In particular:

- fabrics should be flame resistant (see useful reading) and meet current fire safety standards;
- adhesives should provide a bond of equivalent strength to the fabric being bonded;
- threads used for sewing should be strong enough for the purpose;
- zips should be able to withstand the air pressures generated in the structure. Where they are used for emergency exits they need to be reliable, easy to use and openable from both sides;
- netting should not create additional risks to users;
- toxic decorative finishes should not be used.

INSPECTION, MAINTENANCE AND MODIFICATION

Once the design is complete it should be checked by an ADIPS registered inspection body and a report of design review prepared for the operations manual.

A subsequent inspection known as an assessment of conformity to design should be carried out by an ADIPS registered inspection body to ensure that the device as built conforms with the original specification which has undergone design review. A report of assessment of conformity to design should be prepared for the operations manual. For repeated manufacture of substantially the same model this inspection will amount to the manufacturer declaring conformity with the appropriate reviewed design.

The final inspection to establish initial integrity is initial test which should be witnessed by a registered inspection body and a report of initial test prepared for the Operations Manual.

Annual inspection

Each inflatable should be thoroughly examined annually or at least once in every 14 months. This procedure needs to be carried out by an ADIPS registered inspection body, as described earlier.

Annual inspection needs to include checks of the following:

- previous inspection reports and certificates where appropriate,
- provision of suitable guards at the air inlet and outlet of the blower,
- condition of blower impeller and fan casing,
- condition of blower electrical wiring,
- condition of all electrical installations,

- anchorage system for wear, rips or chafing,
- type and number etc. of ground anchors or ballast for consistency with design specification,
- structure for wear, or rips in the fabric,
- walls and towers (when fitted) are firm and upright,
- pressure is sufficient in the bouncing area and at the step/front apron to give a reliable and firm footing,
- internal ties for wear and tear, particularly at loose or exposed ends,
- bedseams, wall-to-bed seams and wall to tower connections,
- identification of the device.
- if used on a fixed site, the location.

Inspection of some of these features may need to be done inside the device. The above list is not exhaustive. Annual inspection needs to include any part of the inflatable and its ancillary equipment which may affect the safe operation of the device.

Daily Checks

Check to be carried out before the first use on any day using advice provided by the manufacturer in the operations manual. It should include checking that:

- the site remains suitable, with crowd control measures in place if appropriate.
- anchorages are intact, ropes not worn or chafed.
- anchor system secures the inflatable device to the ground.
- there are no significant holes or rips in the fabric or seams.
- the correct blower specified for the device is being used and the air pressure is sufficient to give a reliable and firm footing.
- there are no exposed electrical contacts; there is no wear on electric cables; and plugs, sockets and switches are not damaged.
- if an internal combustion engine is used, that the fuel cap is placed firmly on the fuel tank.
- bolts and screws of the blower are properly secured and that robust guards are secured over the air inlet and outlet.

- the blower / inflation tube connection is in good condition and is firmly fixed to the blower.
- the blower is positioned correctly, adequately protected or guarded and is not causing a tripping hazard.

The inflatable should not be used by the public until any defects identified in the daily check have been rectified.

Maintenance

The inflatable needs to be properly maintained. Where available, the instructions contained in the operations manual should be followed. Where such instructions are not available for equipment supplied before the implementation of this scheme, the controller, in conjunction with advice received from an inspection body / manufacturer / supplier, should specify the procedures required. Details of all maintenance work on the device should be recorded in the operations manual.

Modification

Where a safety critical modification is made (including the replacement of a component which departs from the original design specification) the modification needs to be subjected to a design review before the change is made. The report of the design review, and the results of any further testing and examination as might be required, i.e. report of assessment of conformity to design and report of initial test, should be filed in the operations manual.

Safety critical modifications are those where failure of the modified component or system would lead to a significant risk of injury to public or employees. They could include changes in the operating parameters of a device such as changing the height restriction of users. If in doubt take advice from a competent person.

SAFE OPERATION

It is essential for the safe operation of a device that the manufacturer's instructions regarding the use of anchorage points should be followed. On hard standing some equally effective method can be used e.g. attaching the anchor ropes to fittings already in the ground, or to sandbags or other weights, if these are capable of taking the load.

Inflatables can be tied to a vehicle or other movable machinery providing the vehicle or machinery is immobilised and under the control of the operator.

Inflatables should not be used when the wind is in excess of the maximum safe wind speed specified by the manufacturer. The industry recommends a maximum wind speed of Force 5 or 30 - 38 kph (19 - 24 mph). [Force 5 is a fresh breeze when small trees in leaf begin to sway, whereas Force 6 is a strong breeze with large branches in motion; whistling can be heard in telephone wires; and umbrellas can only be handled with difficulty.] Weather forecasts can be obtained from the Meteorological office.

The controller should ensure that the inflatable is sited well away from possible hazards such as overhead powerlines or other obstacles with hazardous projections (e.g. fences). If the ground surface is abrasive, oily or dirty, a ground sheet should be used to prevent wear and tear of the base material.

The controller should determine the minimum number of attendants (not less than 16 yrs old) needed to assist the operator (not less than 18 yrs old) to operate the device safely, and ensure that at least this number is on duty when the device is in operation. In deciding how many attendants are required the controller needs to consider matters such as the number of people using the device, the age of the users and the type of environment in which the inflatable is being used.

If risk assessment carried out by the controller shows that control measures are required to handle large crowds in the immediate vicinity of the inflatable then crowd control barriers (see figure 1) should be provided by the controller. Barriers should have the minimum dimensions shown at Figure 1.

They should be at least one metre high and be capable of withstanding people leaning on them, or being pushed against them. Where the public does not have access to the sides or back of the inflatable or crowd pressures are not anticipated then a lower standard is acceptable.

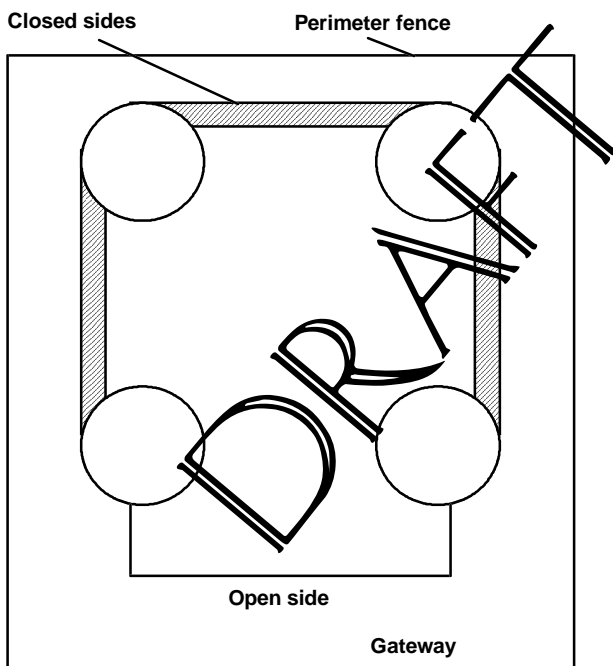


Figure 1 Showing perimeter fence, 1.8 to 2.5m from closed sides, and 3.5 to 4m from an open side. Gateway 1m wide.

The method of operation drawn up by the controller should ensure that users are admitted to the inflatable in a

controlled and safe manner. In particular the operator and attendants should:

- ensure that users remove their footwear (except socks) and any other hard, sharp or dangerous objects (such as buckles, pens, purses, badges, etc.) from their person. Glasses are best removed.
- prevent users from consuming food or drink or eating chewing gum on the device.
- prevent users from obstructing the entrance or exit of any inflatable device. Do not allow anyone to play on the step or front apron of a bouncy castle.
- prevent users from climbing or hanging onto the walls.
- prevent users who do not conform to height restriction from using the device.
- keep the entrance / exit areas clear of onlookers so that the operator or attendant has a clear view and can ensure that users enter / exit safely.
- keep users off the device when it is being inflated or deflated. Deflate the device when not in use.

The operator and attendants should watch the activity on the inflatable constantly. They should use a whistle or other signal and take action at the first sign of any misbehaviour. Somersaults and rough play should not be allowed.

It is the responsibility of the operator to ensure that the equipment is not overloaded with users. Larger, more boisterous users should be separated from smaller ones. The number of users at any one time should be limited to allow each user enough room to play safely.

TRAINING

The controller should ensure that all operators receive effective training in the working of the device including:

- the method of operating the device;
- safe entry / exit for users;
- safe methods of assembling / dismantling, where applicable;
- how to make a daily check;
- safe anchoring of the inflatable;
- crowd control measures and barriers;
- measures to be taken in the event of power failure;

- procedures for reporting accidents, defects or breakdowns.

information it contains is current at 06/00. Please acknowledge the source as HSE.

ACCIDENT REPORTING

Specified accidents which cause injury including acts of violence and certain dangerous occurrences should be reported to HSE by the "responsible person" who is likely to be either the controller or operator. Further information is given in the HSE's publication "A Guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995" (RIDDOR).

Deal with any casualties first but after the incident report the event.

If a defect could possibly lead to danger, do not allow the public to use the device until the cause has been identified and remedied. This may include checking all similar components. If there is any doubt about continued safety, do not allow the device to be used until an inspection body has confirmed that it is safe to do so. Keep records of all incidents in the operations manual and the action taken, because they may be needed to:

- give details to HSE, your trade association, insurers, the designer, manufacturer, importer or supplier,
- discuss the safety implications with an inspection body,
- provide a detailed accident history to a buyer.

USEFUL READING

Fairgrounds and Amusement Parks: Guidance on safe practice. HSG 175. HSE Books ISBN 0 7176 1174 4

BS EN 60204 - 1: 1992 Safety of Machinery - Electrical equipment of machines Part 1 : Specification for general requirements.

BS EN 60529: 1992 Specification for degrees of protection provided by enclosures (IP Code).

BS 7671: 1992 Requirements for electrical installation. IEE Wiring Regulations, 16th edition.

For further information on fire resistant materials refer to BS EN ISO 6940: 1995; BS EN ISO 6941: 1995; and BS EN 532: 1995

This information sheet supersedes PM76 and contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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