Guidance for the Design, Procurement & Use of Inflatable Temporary Structures
A White Paper

Guidance for the Design, Procurement & Use of Inflatable Temporary Structures

The Events Industry has been a major contributor to the increase in demand for Temporary Inflatable Structures. Companies using events as part of their marketing strategy now have such structures at their disposal. Gary Bennett, Managing Director At Baconinflate Worldwide explains.

They appear unusual and rather unique, therefore succeeding in their objective; to create a complimentary environment in order to enhance their own product and/or service. This document has been produced to assist professionals who are formulating a summary of ideas and proposals (a brief) that require designs for Inflatable Temporary Structures (ITS).

In general terms, there are four definitions for the construction technique of Inflatable Temporary Structures (ITS):

1. Air beam, tubular or cellular wall construction, relying on a constant supply of air from an inflation fan to make self-supporting. Where appropriate, a canopy/cover is tensioned over the top. (E.g. The EventStation® & EventHaus® designs)

2. Combination of cellular wall (as defined above), but with the addition of supporting metal framework. This combination allows for a division of load bearing and the option of less air pressure in the cellular wall. (E.g. The Q-BIT designs)

3. A single membrane with pressurised internal environment or positive pressure. Airlock doorways are used to limit footfall and control entry and exit. (E.g. Sports Hall/ Tennis Court cover designs)

4. Air beam or tubular construction inflated, pressured and sealed. A canopy or tensioned cover is placed over the resulting framework. (E.g. Emergency Shelters, Instant Reception or Registration Booths).
It is assumed that each type of Inflatable Temporary Structures (ITS) described above, are to serve the purpose of providing shelter or enclosure for a specified number of people, whether combined with furniture and displays or not. Therefore, they should be designed and engineered to withstand outdoor operational forces such as wind, rain and, where appropriate, snow. In formulating a brief, the advantages and disadvantages of each should be considered.

Safety at Events

For any event that involves attendees being invited inside, whether public or private, the Inflatable Temporary Structures (ITS) should have been thoroughly tested and researched as to their suitability for purpose. Evidence of this should be documented and available for inspection. If the size and scope of the Inflatable Temporary Structure (ITS) demands, the services of an independent Structural Engineer should have been engaged, working in conjunction with the designers to validate operational parameters. If a client and supplier are to work on a new design, then the same process should be adhered to.

This White Paper

A white paper is an authoritative report or guide that helps solve a problem. White papers are used to educate readers and help people make decisions.

This White Paper on the design, procurement and use of inflatable temporary structures has been written to support the event industry in the safe practises from the initial brief through to safe activation for public use.

The White Paper is made up of two sections. The overview or desired thought process and secondly the necessary discussion points at each point.

This document is presented for information purposes only. It is not intended to replace a manufacturers Operational Manual.

№. Denotes a discussion point

> Identifies a point for consideration

About Baconinflate

Baconinflate Limited.

20 Osyth Close
Brackmills Industrial Estate
Northampton. NN4 7DY.
United Kingdom.

T: +00 44 (0) 1604 766 500
E: sales@baconinflate.com
W: http://www.baconinflate.com

1 Proposal/Brief

For the proposal/brief to be communicated effectively, the following key points should be considered and discussed. This will save time and avoid any misunderstandings and possible disappointments at a later date.

Areas for consideration;

> What primary function is the ITS to achieve? (E.g. Music Event, Product Launch, Presentation/Seminar)

> What type of ITS is being considered to achieve the objective? If there is some innovative input from creatives with regards to the design, however attractive, is it realistically feasible?

> How many people are to be in the ITS at any one time? Or is the need more of thru – put or access from all sides?

> Is the size or span of the ITS physically achievable within the limitation of the chosen inflatable medium?

> Where is the ITS being sited and on what surface? (E.g. Grass, hard-standing, snow)

> At this early stage, has the method of anchorage been considered? (E.g. ground anchors, tether lines and/or ballast weight)

> How long will the ITS be expected to be continually inflated in situ and what impact does this play when considering its suitability?

> If a budget has been set, is it realistic to ensure each process can be fulfilled without the supplier cutting corners and, in turn, risking safety issues?

2 Design

Is the design proposed at the concept stage? If this is the case, there may be areas needing to be addressed that require professional input as to feasibility.

Areas for consideration;

> Will the design provide a suitable number of clear exit points?

> Each should cater for emergency situations, with particular regard to the capacity of people envisaged and the internal layout of fixtures and furniture.

> Has the design taken The Disability Discrimination Act (DDA) into consideration?

> Does the design allow for the need to be anchored or ballast weighted?

> When the ITS is pressurized, a degree of rounding or “shaping” will take place. Therefore, 3D modeling is essential to ensure all angles and aspects of the design are properly assessed in relationship to the internal layout of the equipment etc.

> The tear strength of the selected fabric is of primary importance. It is also vital that any fabrics meet the necessary flame retardancy standards. (E.g. BS, DIN & NFP)

> If excessive low temperatures in operation are anticipated, the flexibility of fabric (cold crack) may need to be considered. Although not a safety issue, there are qualities which can be integral within a fabric that will assist the longevity and continued quality and appearance of the ITS.

> Anti-fungal additives and lacquer coatings are well worth consideration, however these come at a cost.

> What is the chemical makeup of the coating upon the selected fabric? With consideration to the disposal of the ITS at a later date, can the fabric meet the necessary environmental requirements that would enable the fabric to be recycled, thus avoiding landfill?

> If digital print is being applied, is the fabric’s profile designed to provide a decent adhesion level and does the chosen fabric have the necessary tensile qualities to construct a ITS?

3 Specification

Engineering
If a new design is being considered, will it be evaluated by a qualified structural engineer who is familiar with the medium of Inflatable Temporary Structures (ITS)?

Relevant calculations will need to be carried out in order to give validity to any assumptions that have been made within the design process. If the Inflatable Temporary Structure (ITS) is of hybrid form (metal structure and inflated pressurized wall sections), has the load bearing correlation between the two elements been assessed?

An Engineer's report would also need to include a definition as to what limitation of use the Inflatable Temporary Structures (ITS) would have with regard to public safety.

Anchorage of the Inflatable Temporary Structure (ITS) is of paramount importance. The Engineer's report should stipulate which weight/loads are required, giving clear directions as to where this weight is to be positioned and how (if at all) it can be dispersed. These details cannot be compromised.

Fabric
Suitable fabric will need to be specified to construct the Inflatable Temporary Structure (ITS), given the external wind forces applied to the outer surface. In addition, the tensile forces created within the Inflatable Temporary Structure (ITS), when pressurized, demand that the appropriate materials are selected.

Fans/Inflation Systems
Are the inflation fans (chosen to pressurize the ITS) suitable for external use, with the appropriate IP rating?

Areas for consideration;

> Will these fans be capable of meeting the operational time span envisaged for the life of the ITS? 20,000 hours should be a minimum.

> Will the fans require suitable sound-proofing enclosures in order to minimize any imposition on internal activities expected within the ITS?

> Will the overall inflation system cater for the failure of one or more fan units? Are audible alarms fitted to the fans to alert of a breakdown?

Branding
If detachable branding is introduced into the design, a suitable fixture(s) and fitting(s) would need to be put in place to ensure the branding doesn't separate from the Inflatable Temporary Structure (ITS) in adverse weather conditions.

Areas for consideration;

> Should the branding extrude the surface or footprint of the ITS?

> Connected elements should be analyzed as part of the overall designs, paying special attention to the connection method and load bearing capabilities of any fixture(s) or fitting(s). (E.g. Flags, banners and inflatable spheres)

> Has the durability of the print and/or branding method been considered and further, has the life expectancy been highlighted?

Additional Components
Is each component (such as steel rings, cam buckles, ratchets speed links etc) suitable for outdoor use? Have such components been tested as to suitability of load bearing?

Areas for consideration;

> Are any of the components affected by extremes of hot or cold conditions?

> If metalwork is being used in a load bearing capacity, has a specific thickness, dimension and gauge been properly specified with suitable protective coating? (Previously referred to under Engineering)

4 Manufacture

How will the Inflatable Temporary Structure (ITS) be fabricated, given the nature of use? Stitching, HF welding, hot air sealing and adhesive bonding all have a place. The size of seam, quality of thread and integrity of weld can be compromised if cost cutting is introduced to meet a budget.

Any type of cellular wall inflatable relies completely on the method of constraint, i.e. panel or single tie, holding each surface apart and, in turn, creating the thickness. Has this matter been given due consideration?

Areas for consideration;

> How will the air be fed into the ITS? A secure connection needs to be in place between the feeder tube and point of entry. Any manifold systems introduced need to have consideration for the mechanics of air movement as to avoid loss of pressure.

> Any specific load points detailed in the engineers report should be reinforced to avoid the possibility of tearing the membrane of the ITS.

> If the ITS has a metal framework, have the connection points between the inflatable and metalwork been clearly defined and reinforced suitably for the load applied?

Testing

Based on the computer model of a new design, has a theoretical load assessment been undertaken?

Areas for consideration;

> Once built, has the ITS undergone actual load testing to confirm the stipulated capabilities at the design stage mentioned above?

> Has the ITS been tested externally and exposed to quantifiable weather? E.g. Wind, rain and, if applicable, snow?

> During testing, has consideration been given to the install and de-rig procedure, to enable a Method Statement to be written?

5 Health & Safety

All parties should have a positive attitude towards health & safety and therefore contribute to a successful event. A cooperative relationship should be developed with venue management and security staff. Venue dates, staffing and accessibility requirements should be communicated at the earliest opportunity. The following points need due consideration:

A Site Survey should be completed well in advance by the company undertaking the install of the Inflatable Temporary Structure (ITS). An agreed scale/ plan of where the Inflatable Temporary Structure (ITS) is to be located should be produced prior to arrival on-site. A safe working environment needs to be established, with suitable clearance around the perimeter taken into account, for crew to work on install and de-rig.

- A Method Statement resulting from test procedures should be created, clearly explaining installation and dismantle procedures.
- A Risk Assessment should also be produced, detailing specifics relating to the site/ environment that the ITS is to be installed. Therefore, this cannot be generic in its compilation.
- A Safe Management Procedure to be put together and carried during the build, “Live Days” and de-rig of the ITS.

Particular attention should be paid to:
a) Fire/emergency exits
b) Relevant direction signs capable of backup power supply or self-illuminating
c) Clearly marked fire extinguishers showing test dates.

Awareness of the weather forecast prior to installation, supplied by the Met Office or the like. Monitoring of weather on-site via the use of an anemometer fitted with an audible alarm. The alarm should be set to go off at the chosen wind speed inline to the operational safety management produce.

In order to cover the eventuality of severe weather, a back-up plan would be advised. Such a plan may also take an alternative venue into account if dates cannot be moved.

6 Activation

The power supply should be established and either in place through the mains or generated on-site. Is there a secondary back-up electrical supply if the primary supply fails? Observing the site survey, is there a need to mark the underground cable location?

Areas for consideration;

> The crew used to install the ITS should be experienced, qualified and in possession of the necessary PPE equipment.

> The Crew Manager should possess all safety documentation, to include: proof of fabric FR Certification, structural engineer’s report and an operational manual available for referral by the activation team or inspection by any HSE representative.

On completion of the installation, a visual inspection should be carried out by an elected representative of the user and supplying company. When each party is in agreement and satisfied with the appearance and condition, particularly with regard to safety, a certificate of compliance should then be signed by both parties.

On-site Management
A check list should be formulated to ensure that, once the ITS is installed, it maintains the original integrity. This will include attention to the following (taken from the written Management Procedure):
Regular checks to the power supply; If a generator is used as a source of power, the condition of the

generator and fuel level would need to be checked to ensure it is sufficient for the duration of the installation.

Timely inspections to include the anchorage or connection of ballast to the Inflatable Temporary Structures (ITS), inflation fans and any fixture and fittings that rely on adjustment.
If a wind meter is sited, it is important to check that it is operating correctly and that the emergency audible alarm is functioning at the selected wind speed. This can be done through pre-arrangement with the client/ customer or prior to the live period.

Liaise with security companies to ensure staff will be on-site at agreed times (especially overnight), with duties clearly understood in cases of emergency.

Storage
As part of the care and maintenance, the following actions should be carried out:

Areas for consideration;
> The ITS should be wrapped and packed in a suitable manner and placed with the protective bag/valise supplied. This will avoid damage during transportation and storage.
> The ITS should be re–inflated and dried in situations where it is packed away wet or damp during the de-rig. This will ensure the condition, appearance and performance are not compromised.
> If any damage or structural fault has been reported by the on-site management team, such matters need immediate attention. If of a serious nature, a report should be logged and brought to the attention of the Technical Manager.
> With prior arrangement, the ITS should be stored in a dry secure environment away from direct sunlight and extremes of cold and heat. If insurance is to be in place, a clear understanding as to who is paying the premium, or part thereof, is required.
> If storage is part of the ongoing contract/agreement, terms of condition should be signed and adhered to, therefore avoiding undue inconvenience to the party storing the goods.
> All electrical equipment such as fans, units and distribution cables/box, should be checked after use and stored as mentioned above. Where appropriate, portable appliance testing (PAT) would be carried out and recorded as part of the ITS service record.
> A suitable budget is allocated to the case, bag, box, the ITS and relevant equipment, to ensure it is protected during storage, transport and handling.

7 Summary

Creativity and innovation are the ingredients for success in winning business in this market. Hopefully, the information detailed within this document will bring about a successful marriage of innovative design with safety and good operational practice.

The publications listed below provide a greater holistic reference for demountable temporary structures and should be considered in support to the guidance above.

- **MUTA Marq** - Code of Practice for Marquee Hiring Contractors & Code of Public Safety - Use and Operation of Marquees: Updated 2009
- **InstructE** - Temporary demountable Structures: Third Edition 2007
- **HSE** - The Event Safety Guide: Second Edition 1999