

Guide for

Design, construction and maintenance of single-skin air supported structures

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- Department of the Environment (Building Research Establishment, Fire Research Station)
- Department of the Environment (Housing and Construction Industries)
- Fire Protection Association
- Greater London Council
- Incorporated Association of Architects and Surveyors
- Institution of Civil Engineers
- Institution of Fire Engineers
- Institution of Structural Engineers
- Ministry of Defence
- Scottish Development Department

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Foreword

This British Standard has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee and is based on Draft for Development DD 50 which is withdrawn.

The air supported structure is a significant current development both in home and export markets. There is at present no national code of practice dealing with these structures in this country, and there is a growing need for authoritative guidance for designers and users, for building and fire protection inspectorates and for manufacturers both of complete air supported structures and of special components such as membranes, anchorages, inflation systems and means of access.

This standard is based on DD 50 but has been updated where experience has indicated that it required amendment. Attention is drawn, in particular, to the following.

- a) The classification has been extended.
- b) The safety recommendations have been amplified.

Amendments will be made to the standard in the light of further experience in the use of air supported structures.

The bibliography (see Appendix F) has been extended to include later publications (see [1] to [4]). They contain important information which will be taken into account for amending or revising the standard.

NOTE Square brackets are used to denote the bibliographical references given in Appendix F.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard gives guidance covering the design, construction, operation and maintenance of uninsulated single-skin air supported structures up to 40 m × 120 m nominal size. Safety recommendations are included for the grading of such structures into distinct classes based on occupancy and use.

NOTE 1 A bibliography of the technical literature referred to in this standard is given in Appendix F.

NOTE 2 The titles of the British Standard publications referred to in this standard are listed on the inside back cover.

2 Definition

For the purposes of this British Standard the following definition applies.

2.1

air supported structure

a structure that has a space-enclosing single-skin membrane anchored to the ground and kept in tension by internal air pressure so that it can support applied loading. The membrane may or may not be restrained by trans-surface ropes or cables

3 Fundamental recommendations

Air supported structures, including foundations and all other components necessary to support the structures, should be designed and constructed such that:

- a) they safely sustain all forces imposed on them during construction and intended use;
- b) they perform adequately in normal use throughout their design life;
- c) the materials used have adequate durability (e.g. against biological and chemical attack, weathering, abrasion, etc.) and do not readily support combustion;
- d) they have an appropriate level of safety with regard to the consequences of failure;
- e) they give the occupants adequate time to escape from the structure in the event of deflation due to membrane damage, fan failure, etc.

The structures, including foundations and all other elements necessary for the safety of the occupants, should be inspected at regular intervals and should be adequately maintained (see Section 6).

4 Classification

As the risk of injury in the case of collapse or fire is influenced primarily by the number of occupants and by the travel distances to emergency exits, air supported structures are classified into eight categories based on their occupancy and use (see Table 1).

5 Operation and maintenance

The stability of an air supported structure depends on the internal air pressure, which in turn depends on the condition of the membrane and its anchorages, the efficiency of the inflation plant and the airtightness of access doors, emergency exits, etc. It is therefore necessary to inspect the structure and plant at regular intervals during their life and maintain them in good condition (see Section 6). It should be noted that underinflation and deflation for repair or movement to another site adversely affect the condition of the membrane and may significantly reduce its life.

6 Design life

An air supported structure should be designed to take into account any deterioration in strength or other properties of the membrane and its joints that could take place in time. The design life is that period from the date of manufacture over which it is assumed, for purposes of design, that, given proper maintenance, the membrane and its joints will have margins of tensile strength not less than those recommended in clause 17.

7 Extension of use beyond design life

The use of an air supported structure beyond its design life may be extended yearly if tests on membrane and joint samples indicate that the structure will have the required factor of safety and if there is no visible sign of membrane abrasion or deterioration or of corrosion or failure of the anchorages and foundations. In the initial assessment of the design life, the required strengths and design loads (e.g. wind, snow, etc.) appropriate to the extended life period should be used.

8 Identification

The manufacturer's name and reference number, the date of manufacture, the nominal size of the air supported structure and the maximum tensile stress to which the unsupported membrane should be subjected should be clearly marked on each separate part of the membrane in a complete structure.

Table 1 — Classification and safety provisions

Class	Use	Occupancy	Safety provisions ^a
1 A	Public and private assembly, factory, office and shop	over 100	a, b, c, d, e, f.
1 B	Swimming pool	over 50	a, b, c, d, e, f.
2 A	Public and private assembly and factory	25 to 100	a, b, c, d, e.
2 B	Office and shop	less than 100	
2 C	Swimming pool	25 to 50	a, b, c, d, e.
3	Public and private assembly, factory and swimming pool	less than 25	a, c, d, e.
4	Warehouse ^a	Unlimited	a, d, e.
5	Private domestic (including swimming pool) ^a	domestic use	a.

NOTE The safety provisions referred to in Table 1 are as follows:

- a) emergency exits (see clauses **20**, **21** and **22**);
- b) automatically operated standby fans and alternative power source, to operate under pressure loss and/or failure of the primary power source (see **12.2**);
- c) low-pressure alarm and audible warnings (see clause **25**);
- d) emergency lighting (see **22.2**);
- e) emergency exit signs (see **22.2**);
- f) emergency support systems (see clause **24**);

^a Where the public have access to air supported structures which satisfy occupancy and use classifications 4 and 5 the structures should be reclassified under the relevant classifications covering assemblies.

9 Location

In considering the siting of an air supported structure from the viewpoints of building legislation and fire service requirements, particular attention should be given to the possibilities of damage from heat radiation to and from adjacent structures, from movement of the structure in extreme conditions of wind, fire or collapse, and from contact with outside objects, either static or mobile.