

CONFIRMED
DECEMBER 2007

BS 7068 : 1989

UDC 615.478.262/.264:
615.835:[615.478(075.6)] :
[-3.002.2.004.13] :620.1

British Standard Specification for Alternating pressure air mattresses

Matelas à air à variation de pression — Spécifications

Luftgefüllte Matratzen für Kranke

Foreword

This British Standard has been prepared under the direction of the Health Care Standards Policy Committee, following a request from the King Edward's Hospital Fund for London. It specifies requirements for alternating pressure air mattresses that are intended for the prevention and treatment of pressure sores of patients.

Pressure sores, of which bedsores are the commonest example, are localized areas of tissue necrosis caused by ischaemia resulting from pressure which has been maintained for an excessive period of time. These sores usually occur over bony prominences, where the pressures are highest, in patients who are unable to feel pain or who cannot move sufficiently to relieve pressure. Sick patients are less able to withstand pressure than healthy people and, for a very sick person, less than 30 min of ischaemia caused by pressure may be sufficient to occasion a sore.

Alternating pressure air mattresses have been employed for many years in the National Health Service as an aid to the prevention and treatment of pressure sores and, whilst clinical trials have demonstrated the major benefits of using them, certain problems with these mattresses have contributed towards their poor reputation with some experts. These problems include the poor reliability of some models which fail within a few months of service due to breakdown of motors and pumps, rupture of air cells, disconnection of air tubes, etc. and the tendency to set incorrectly the internal air pressure which, in most cases, needs to be adjusted to the size and weight of the patient. However, for the latter, a patient's body mass is not usually known with sufficient accuracy to enable the nursing staff to make the required fine adjustments of the controls.

To help overcome these problems, the King Edward's Hospital Fund for London set up a working group which recommended that a British Standard specification for alternating pressure air mattresses should be prepared with the aim of improving the reliability and performance of these mattresses.

In the preparation of this standard certain factors have been identified as requiring further investigation to develop fully the requirements for alternating pressure air mattresses. The principal factor still to be determined is the relationship between the inflation pressure and the interface pressure, with the possibility of realizing the ideal situation, from a control point of view, of a single inflation pressure to provide the correct range of interface pressures without the need for adjustment by nursing staff. The results of such investigations, when they become available, may form the basis of amendment or revision of this standard.

Meanwhile this standard includes a description of a method for measuring the interface pressures between an alternating pressure mattress and an indenter which has dimensions and loading that allow it to act as a representation of a test

body. This test method is applicable to all current types of alternating pressure air mattresses and requires the measurement of the minimum and maximum values of the interface pressure that are developed by the mattress under test. It is also suitable for the measurement of interface pressure developed between other types of mattress and the indenter.

Another factor considered by the responsible Technical Committee was the need to stipulate that, in a hospital ward environment, the 'A' weighted sound pressure level produced by an alternating pressure air mattress when operating in accordance with the manufacturer's instructions should not exceed 55 dB and, for more than 90 % of its running time, should not exceed 45 dB. (These limits are not incompatible with those specified in DHSS Health Notice HN(76)126.) However the committee had insufficient evidence to relate sound *pressure* levels to the sound *power* levels which would be measurable by reference to BS 4196. Moreover, there was little evidence to enable sound pressure limits to be specified for other environments. When such evidence becomes available, it will be considered as the basis for amendment of the standard.

This standard is directed at establishing adequate performance of alternating pressure air mattresses in use but, because of the need to ensure the electrical safety of the user, it also requires the pump unit to comply with BS 5724 : Part 1.

Experience has shown with many patients that alternating pressure air mattresses which comply with this standard can prevent pressure sores developing. However, these mattresses will not always do so, although the severity of sores will usually be reduced.

Interface and ischaemic pressures are normally expressed in millimetres of mercury (mmHg). To avoid confusion and the possible mis-setting of the mattress pressure, mmHg is used consistently in this standard but, for convenience, conversion of mmHg to the derived SI unit, the kilopascal (kPa), for pressure is given in appendix A.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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Specification

1 Scope

This British Standard specifies materials, construction and operation requirements for unheated alternating pressure air mattresses (APAM), manufactured from pre-formed sheet material, for use in health care premises and in the home. Two grades of APAM, grade A and grade B, are specified, differing only in the breaking strength of the mattress material.

The alternating pressure air mattresses specified in this standard are suitable for use with adult patients of mass not exceeding 95 kg, and are suitable for use with mattresses complying with BS 5223 : Parts 1 and 2 and with bedsteads complying with BS 4886.

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

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1 alternating pressure air mattresses (APAM). A mattress assembly with a pressure pad area, for use on a firm base, consisting of a system of cells in any formation which is intended by means of sequential air inflation and deflation to vary, in a controlled manner, the supporting points of pressure under a patient's body, so that no one point or set of points of contact with the body will produce ischaemic pressure of long enough duration to lead to tissue damage. The cells of the mattress are inter-connected (e.g. by means of side tubes), typically to form an alternating series. A switching arrangement permits air to be pumped firstly into one set of cells and then into the next, while the pressure in the first set is reduced, so that during a cycle each group of adjacent cells is inflated and then deflated to a pressure below that likely to cause tissue damage.

The term *alternating pressure air mattress*, as used throughout this standard, includes the entire equipment for this purpose: i.e. pressure pad area, protective covering, pump, motor, tubing, connectors, etc.

NOTE. Typical alternating pressure air mattresses are shown in figure 1.

2.2 grounding. The state where the pressure in the mattress is insufficient to support the test body or test subject, allowing it to rest on the underlying surface.

2.3 hammocking. The effect created by a load placed on to a flexible supported surface such that topographical distortion of the surface takes place until the equilibrium state is established at which the load is supported.

2.4 indenter. A simple model of part of a human body lying on its side, essentially comprising three hemispherical domes connected by two hemicylinders; the domes represent respectively the prominences of the shoulder, hip and knee and the cylinders the torso and the thigh (see figure 2).

2.5 maximum inflation pressure. The maximum pressure applied internally to the air cells of the mattress at their maximum distension.

2.6 interface pressure. The pressure that exists between the surface of the skin of the patient and a supporting surface.

2.7 pressure cycle. The change of pressure in an air cell from the point of maximum inflation pressure to deflation and back.

2.8 relief area. The area corresponding to those air cells of an alternating pressure air mattress at their lower levels of inflation whilst support is given to the patient principally by cells at a higher level of inflation.

2.9 lateral. Lying with the front of the body towards the side.

2.10 recumbent. Lying down with the body in the horizontal plane and the head supported by not more than two pillows.

2.11 semi-recumbent. Lying down with the upper part of the body supported at an angle to the horizontal (for example, by three or more pillows) but with the rest of the body in the horizontal plane.

2.12 supine. Lying with the front of the body uppermost.

3 Classification

APAM, for which compliance with this standard is claimed, shall be classified into the following grades:

Grade A, constructed of material having a breaking strength (see table 1) of not lower than 600 N/50 mm;

Grade B, constructed of material having a breaking strength (see table 1) of not lower than 200 N/50 mm.

4 Materials and construction

4.1 Dimensions and unsupported area

4.1.1 The pressure pad area of an alternating pressure air mattress shall be a minimum of 1.8 m long and a minimum of 0.75 m wide when inflated for normal use.

4.1.2 During a pressure cycle, the surface of each air cell (see figure 1) which is at its lowest pressure shall not exceed 120 mm in its shortest dimension and shall not exceed 900 mm in its longest dimension. These areas shall not be surrounded completely by an area at the highest pressure.

4.2 Air cells and protective coverings

4.2.1 Air cells and any protective covering supplied with the mattress shall be constructed from flexible material as specified in table 1. The tests referred to in table 1 and those described in 4.2.2 to 4.2.5 below shall each be carried out on separate pieces of the mattress material.

4.2.2 Joins and welded material shall have not less than 75 % of the values of breaking strength, tear strength and bursting strength given in table 1 when tested both along and across the joined section.

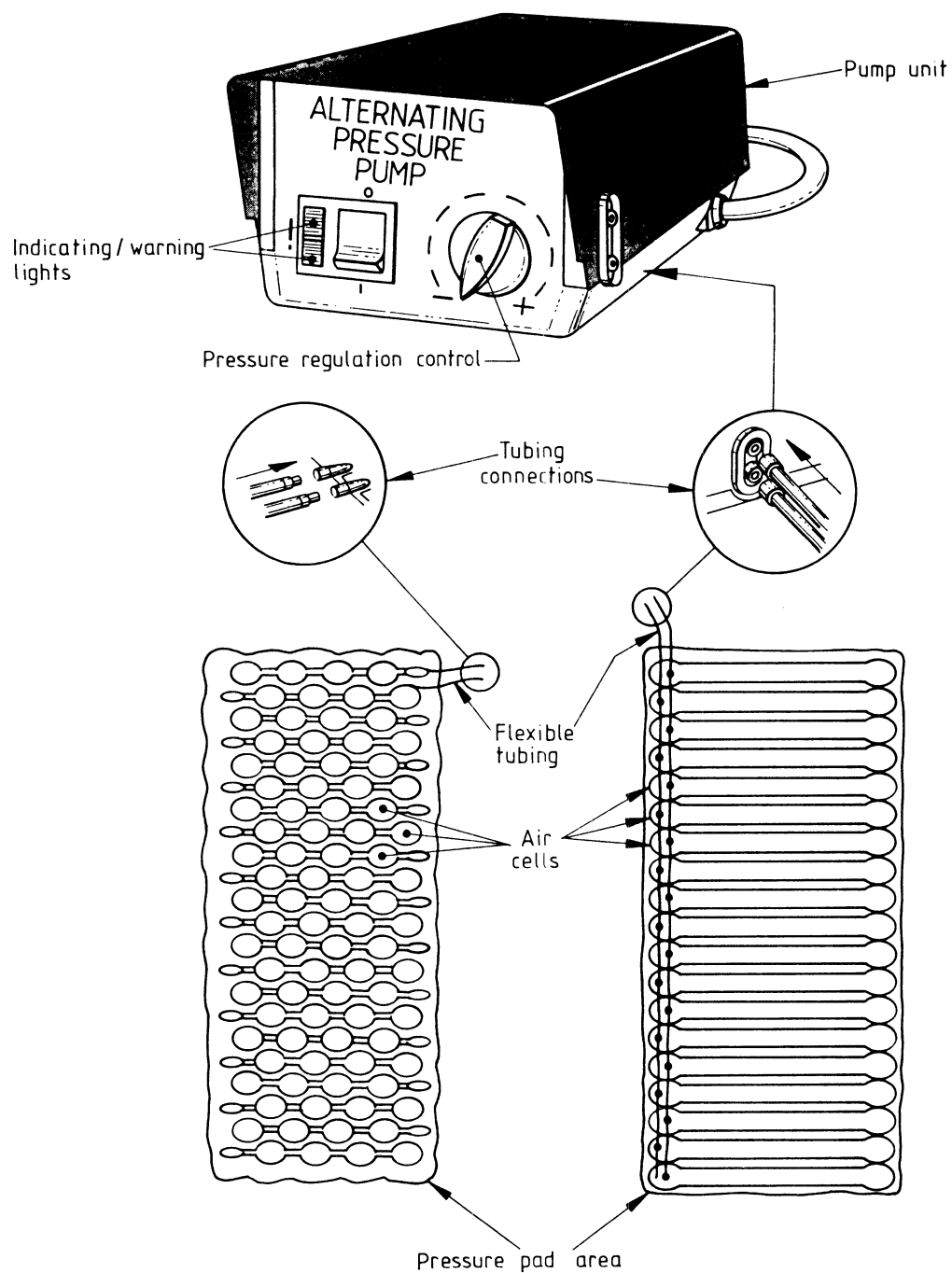


Figure 1. Typical alternating pressure air mattresses