BRITISH STANDARD

BS 903C4: 1983
BS 2782-2: Methods 220 and 221:1983

Methods of testing vulcanized rubber —

Part C4: Determination of electric strength

Methods of testing plastics —

Part 2: Electrical properties — Method 220: Determination of electric strength: rapidly applied voltage method — Method 221: Determination of electric strength: step-by-step method

IMPORTANT NOTE. When using this method in order to test plastics, readers are reminded that the foreword, general introduction and instructions to BS 2782-0:1982 contain important information on the testing of plastics. However, it should be noted that the conditioning requirements given in clause 8 of this Part replace those in Part 0.

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Plastics Standards Committee (PLC/-) and the Rubber Standards Committee (RUC/-) to Technical Committee PLC/RUC/9 upon which the following bodies were represented:

British Plastics Federation
British Rubber Manufacturers' Association
Electrical and Electronic and Insulation Association (BEAMA)
Ministry of Defence
Rubber and Plastics Research Association of Great Britain
Telecommunication Engineering and Manufacturing Association (TEMA)

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Committee reference PLC/RUC/9
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Contents

Foreword

This revision of this Part of this British Standard which has been published under the direction of the Plastics Standards Committee and the Rubber Standards Committee supersedes the previous edition of BS 903-C4 and methods 201A to 201G of BS 2782, which are being withdrawn.

The standard includes information from IEC 243:1967.

In BS 2782:1970 only the step-by-step methods were described.

In preparing this standard to cover the testing of both vulcanized rubber and plastics, there was some difficulty in reconciling the requirements for the period of conditioning the test pieces prior to testing. The internationally agreed period for vulcanized rubber is a minimum of 16 h (see BS 903-A35) but for plastics a minimum of 88 h is used (see ISO 291). However, for most rubber and plastics, it is considered that 16 h is adequate in the climatic conditions prevailing in the UK.

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.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, 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.

0 Introduction

The electric strength measured in accordance with this standard is not the intrinsic electric strength, i.e. the electric stress at which the material will fail under ideal conditions, but a value which may be considerably less than this and which is usually controlled by such factors as the presence of discharges in the ambient gas or liquid or in gaseous inclusions in the material.

It is meaningless to quote the electric strength of a material without complete details of the test conditions, because the electric strength may be affected by many factors including:

a) the frequency, waveform and time of application of the voltage;

b) the thickness and homogeneity of the test piece and the presence of mechanical strain;

c) the ambient temperature, pressure and humidity;

d) the presence of gaseous inclusions, moisture or other contamination;

e) the dimensions and thermal conductivity of the test electrodes;

f) the electrical and thermal characteristics of the ambient medium.

The results given by different methods are not directly comparable and it should be noted that the electric strength of many materials decreases as the thickness of the test piece between the electrodes increases and with increasing time of voltage application.

Material with a high electric strength measured by the tests described in this standard will not necessarily resist long-term degradation processes such as erosion or chemical deterioration by discharges, or electrochemical deterioration in the presence of moisture, which may cause eventual failure in service at much lower stresses. On the other hand, if discharges in insulation are eliminated by appropriate design and construction, the values obtained by the tests described in the standard may be exceeded.

Thus, these tests are only of limited value to the insulation designer for comparative purposes although they are useful for routine and quality control tests, and as specification tests.

1 Scope

This Part of this British Standard gives two methods of determining the short-time electric strength (breakdown voltage) of insulating vulcanized rubber (including ebonite) and of solid plastics materials using a voltage with a nominal frequency of 50 Hz.

One method of determining electric strength is by rapidly increasing the voltage until breakdown occurs and the other is by a steady increase in the applied voltage step-by-step at 20 s intervals.

Test pieces and electrode systems are specified to provide tests on a variety of materials and forms of material. Tests are carried out normal and parallel to the planes of sheet materials and tubes and parallel to the axes of rods.

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
voltage

the peak value of the alternating voltage applied to the electrodes divided by $\sqrt{2}$

2.2
breakdown voltage

the voltage at which breakdown occurs in the rapidly applied voltage test or the highest voltage withstood for 20 s in the step-by-step method

2.3
electric strength

the breakdown voltage divided by the dimension of the test piece across which the voltage was applied

2.4
central value

the middle value of an odd number of results, or the mean of the middle two when arranged in order of magnitude

3 Identification of method

Methods are identified according to the mode of applying the voltage and the nature of the material under test as indicated in Table 1.

4 Form of test pieces

4.1 General. If applicable the test piece shall be prepared under the conditions specified in the relevant British Standard for the material. The dimensions shall be as specified in **4.2** to **4.8**; increases in the stated minimum dimensions may be necessary to avoid breakdown through the surrounding medium, i.e. flashover.

4.2 Test pieces for Methods C4.1A, C4.2A, 220A and 221A. The test piece shall be a disc not less than 100 mm in diameter or a square of side not less than 100 mm. Where the material is supplied in sheet form the thickness shall be the thickness of the sheet.