

Specification for

Components and filter units for electromagnetic interference suppression

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- British Radio Equipment Manufacturers' Association*
- British Steel Corporation
- Department of Energy
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- Electrical Contractors' Association
- Electrical Contractors' Association of Scotland
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- Electricity Supply Industry in England and Wales
- Electronic Components Board
- Electronic Engineering Association
- Engineering Equipment Users' Association
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- Oil Companies Materials Association
- Post Office
- Radio and Electronic Component Manufacturers' Association*
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The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Association of Manufacturers of Domestic Electrical Appliances
- Business Equipment Trade Association
- Electrical Installation Equipment Manufacturers' Association Ltd
- Home Office
- Lighting Industry Federation
- Portable Electric Tool Manufacturers' Association
- Transmission and Distribution Association

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Foreword

This British Standard has been prepared under the direction of the General Electrotechnical Engineering Standards Committee and is a revision of BS 613 “*Components and filter units for radio interference suppression*” which was first issued in 1935, revised in 1955 and further revised in 1967. It forms one of a series dealing with the abatement of radio interference.

The publication of BS 2135 made possible the deletion of the corresponding clauses relating to capacitors from this revision of BS 613. The section on capacitors is therefore mainly concerned with the maximum values to be used, bearing in mind safety requirements for leakage currents. The section on inductors has been revised so that it follows, in general, the layout of BS 2135. The section on filter units has been revised to make the requirements compatible with those for inductors.

The standard is not specifically intended to apply to circuits having a higher rating than 7 kVA, but many of its requirements will provide guidance in the construction of suppressors for such circuits.

General information about the generation, propagation and suppression of radio interference is given in CP 1006. In particular, attention is drawn to the safety aspects in the use of suppression components described in section seven of this Code of practice.

The following is a list of related British Standards and codes of practice:

BS 727, *Radio interference measuring apparatus for the frequency range 0.015 MHz to 1 000 MHz.*

BS 800, *Radio interference limits and measurements for equipment embodying small motors, contacts, control and other devices causing similar interference.*

BS 833, *Radio interference limits and measurements for the electrical ignition systems of internal combustion engines.*

BS 905, *Radio interference limits and measurements for television and VHF sound receivers.*

BS 1597, *Radio interference suppression on marine installations.*

BS 2135, *Capacitors for radio interference suppression.*

BS 4809, *Radio interference limits and measurements for radio frequency heating equipment.*

BS 5049, *Methods of measurement of radio noise from power supply apparatus for operation at 1 kV and above.*

BS 5260, *Code of practice for radio interference suppression on marine installations.*

BS 5394, *Radio interference limits and measurements for lighting equipment — Part 1: Luminaires for tubular fluorescent lamps — Part 2: Mercury and sodium discharge lighting equipment¹⁾ — Part 3: Illuminated signs¹⁾.*

CP 1002, *Abatement of radio interference from electro-medical and industrial radio frequency equipment.*

CP 1006, *General aspects of radio interference suppression.*

CP 1020, *The reception of sound and television broadcasting.*

In the list of the publications referred to in this standard (see the inside back cover) the latest (1977) title is given for BS 2011. In clauses 5 and 6 of this standard, however, the test identifications refer to the previous edition of BS 2011, now withdrawn, entitled “*Methods for the environmental testing of electronic components and electronic equipment*”. An amendment is in preparation to bring these references up to date.

¹⁾ In course of preparation.

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 to iv, pages 1 to 24, 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.

1 Scope

This British Standard specifies requirements and tests for components and filter units for electromagnetic interference suppression for use in electrical machines, appliances and apparatus rated at up to 7 kVA, operating from 50 Hz to 60 Hz electricity supplies above extra low voltage and up to and including 240 V single-phase or 415 V 3-phase. This standard also applies to d.c. rated components.

This standard does not apply to components or filter units that are subjected only to voltages less than 50 V under all normal operating conditions, with the exception of those for use in motor vehicles.

NOTE Suppression components for use in high-voltage ignition circuits are covered by BS 833.

2 References

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

3 Definitions

For the purposes of this British Standard the following definitions apply. Where the terms “voltage” and “current” are used, the r.m.s. values are implied unless otherwise stated.

NOTE Definitions of terms 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.10, 3.12 and 3.13 are the same as those given in IEC Publication 536 and/or in BS 2754.

3.1

functional insulation

the insulation necessary for the proper functioning of the equipment

3.2

basic insulation

insulation applied to live parts to provide basic protection against electric shock

3.3

supplementary insulation

independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of failure of basic insulation

3.4

double insulation

insulation comprising both basic insulation and supplementary insulation

3.5

reinforced insulation

a single insulation system applied to live parts that provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard

NOTE The term “insulation system” does not imply that the insulation has to be one homogeneous piece. It may comprise several layers that cannot be tested singly as supplementary or basic insulation.

3.6

all-insulated equipment (also known as insulation encased equipment)

equipment in which a durable and substantially continuous enclosure of insulating material envelopes all metal parts, excepting small parts such as nameplates, screws or rivets that are isolated from other metal parts by insulating material at least equivalent to reinforced insulation

NOTE A similar exemption of such items in earthed appliances is allowed by Regulation D4 of the 14th Edition of “Regulations for the Electrical Equipment of Buildings” published by the Institution of Electrical Engineers.

3.7

permanently earthed

an object is said to be permanently earthed when its electrical connection to an earthed electrode is rigidly and permanently secured throughout its whole length without the intervention of any circuit interrupting device and is protected from mechanical damage and corrosion, unless by its nature and construction such protection is unnecessary

NOTE Appliances earthed through the earth conductor of a flexible cable or cord terminating in a 3-pin plug are not regarded as permanently earthed.

3.8

live part

a conductor that has a voltage relative to earth exceeding 34 V peak

3.9

filter unit

an assembly of components intended to be connected in electric circuits for the purpose of reducing unwanted currents and voltages

3.10

extra low voltage (e.l.v.)

a voltage that does not exceed 50 V a.c., r.m.s. (see note 1) between conductors or between any conductor and earth

NOTE 1 The d.c. value is under consideration.

NOTE 2 The voltage limit should not be exceeded either at full load or no-load, but it is assumed, for the purpose of this definition, that any transformer or convertor is operated at its rated supply voltage.

NOTE 3 This definition is in accordance with that given in “Regulations for the Electrical Equipment of Buildings” published by the Institution of Electrical Engineers (as amended in April 1976).

3.11**rated system voltage (U_R)**

the maximum rated voltage on the supply to the apparatus in which the suppression component is intended to be fitted

3.12**class I equipment**

equipment in which protection against electric shock does not rely on basic insulation only but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation

NOTE For equipment intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

3.13**class II equipment**

equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as double insulation or reinforced insulation are provided, there being no provision for protective earthing or reliance upon installation conditions

NOTE Class II equipment may be provided with means for maintaining the continuity of protective circuits, provided that such means are within the equipment and are insulated from accessible surfaces in compliance with the requirements of class II.

3.14**lower category temperature**

the minimum temperature of the external surface for which the component or filter unit has been designed to operate

3.15**upper category temperature**

the maximum temperature of the external surface for which the component or filter unit has been designed to operate continuously

NOTE to 3.14 and 3.15. The terminations are considered to be part of the external surface.

3.16**rated current**

the current assigned by the manufacturer to a component when it is mounted in accordance with the manufacturer's specification

NOTE More than one value of rated current may be assigned to a component depending upon the heat dissipation characteristics of the specified mountings.

3.17**rated temperature**

the maximum ambient temperature at which a component or filter unit can carry its rated current

3.18**insertion loss**

the ratio of the voltages appearing across the line immediately beyond the point of insertion of a component or filter unit into a given transmission system, before and after the insertion. [This ratio is expressed in decibels (dB).]

4 General requirements

Suppression components and units shall be so designed and constructed that in normal use they function reliably and cause no damage or danger to persons or surroundings, even in the event of such careless use as may occur in normal service.

Suppression components and units shall have a rated temperature of not less than 40 °C.

Compliance for components and filter units other than those used on motor vehicles is checked by applying the tests specified in clauses 5 and 6.

Additional requirements for specialized components for use in marine applications are specified in BS 1597.

Compliance for components and filter units for use on motor vehicles is checked by applying the tests specified in clause 7.

Individual specifications for particular equipment or appliances may contain additional requirements with which the suppression components have to comply. Certain specialized applications may require variations from this standard.

5 Components**5.1 Capacitors**

5.1.1 Capacitors used for interference suppression, either independently or in unsealed filter units, shall comply with the requirements of BS 2135.

5.1.2 Maximum values of capacitance to be used for suppression in various circuit positions are, in general, limited by the leakage current allowed by the appropriate equipment specification. For general purpose components or filter units where the final application is not known, Table 1 shows maximum nominal values (allowing for temperature coefficient and tolerances) for a.c. and a.c.d.c. equipment. These values will give approximately 10 % of the usually permitted leakage current. No recommendations are given for maximum values of capacitors for equipment that can be used only on e.l.v. supplies (but see 5.1.6).

For equipment that has suppression capacitors connected to earth from points other than the line or neutral terminal, any such point that may have a voltage exceeding 30 V r.m.s. relative to earth, irrespective of the setting of any control, shall be considered to be the same as the line terminal for the purpose of determining the maximum values of these capacitors.

5.1.3 For equipment that may be utilized on either a.c. or d.c. supply circuits, the a.c. grade of capacitors shall be used.

5.1.4 Class Y capacitors (as specified in BS 2135) shall be used for double insulated equipment where the capacitors are connected between live parts and inner insulated casing or frame, because of the high test voltages specified for such equipment.

5.1.5 Capacitors shall not be connected to exposed metal parts of double insulated appliances.

5.1.6 If the discharge path for a capacitor is provided by an integral resistor, it shall comply with the voltage requirements of BS 2135 in addition to the requirements of 5.3.

NOTE Attention is drawn to the fact that use of suppression capacitors may give rise to the presence of residual voltage on the pins of mains connectors. Discharge means, such as resistors, may be necessary in order to comply with the requirements of the equipment specification (e.g. BS 3456).

5.2 Inductors

5.2.1 *Inductors for neon sign suppression.* Inductors used for neon sign suppression, having working voltages below 500 V, shall comply with the requirements of this standard. Those used in the high-voltage circuits of neon signs shall comply with the requirements of BS 559.

5.2.2 *Classification into categories.* Suppression inductors are classified into climatic categories according to the general rules given in BS 2011. The preferred categories may be taken from any combination of the following values for lower category temperature, upper category temperature and long term damp heat

Lower category temperature	– 10 °C, – 25 °C, – 40 °C
Upper category temperature	+ 70 °C, + 85 °C, + 100 °C, + 125 °C
Long term damp heat	4 days, 21 days, 56 days

5.2.3 *Preferred tolerances on nominal inductance.* Preferred tolerances on nominal inductance for single inductors are as follows:

± 25 %; – 25, + 50 %; – 25, + 100 %

5.2.4 *Preferred values of rated current.* The preferred values of rated current are as follows:

1, 2, 3, 5, 10, 15, 25, 35, 50 and 100 A.

5.2.5 *Marking.* The following marking information is required for inductors for general purpose use in the suppression of electromagnetic interference, when used separately and not in a filter unit:

- rated current;
- manufacturer's name (or trade mark) and type designation;
- rated system voltage;
- climatic category;
- week (or month) and year of manufacture (this may be in code form);
- the number of this British Standard, i.e. BS 613;
- nominal inductance;
- tolerance on nominal inductance.

The package shall be marked with at least items a) to f) inclusive. The inductor shall be clearly marked with the rated current and as many of the other markings as practicable, in the order of preference given above.

5.2.6 General requirements for tests and measuring methods

5.2.6.1 This standard specifies procedures for type tests only. The sample shall be representative of the range of values of the type under consideration.

The number of specimens in the sample shall be agreed between the supplier and the customer or supervising inspectorate, as appropriate.

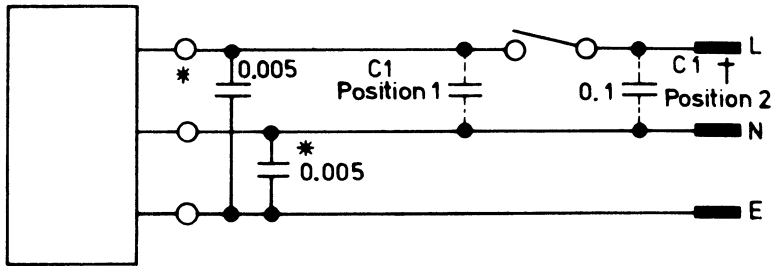
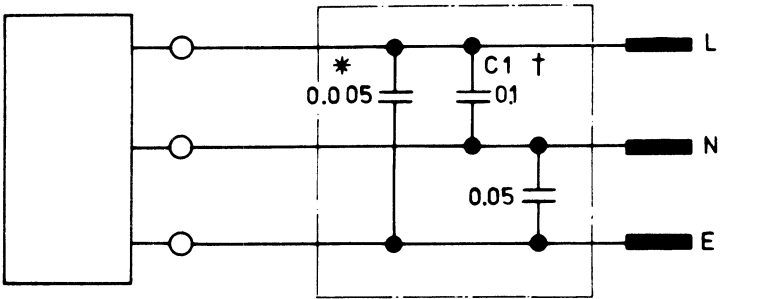
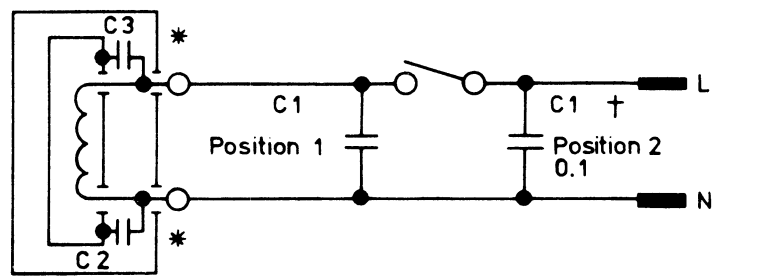
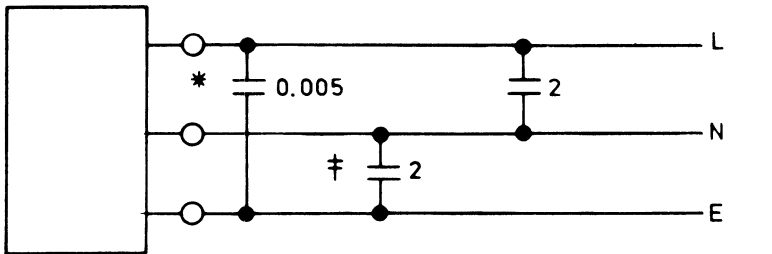
5.2.6.2 The number of specimens in the sample shall be so chosen that any lot subjected to a series of tests shall preferably be not less than five of a particular value, rating and type. Where it is specified in any test that the lot shall be subdivided into parts for different test procedures each part shall preferably contain not less than five specimens.

5.2.6.3 This British Standard does not specify the number of permissible failures, which is considered to be the prerogative of the authority giving type approval; nor does it specify routine tests since these are the prerogative of the manufacturer or supervising inspectorate.

5.2.6.4 Any specimen that has been subjected to the type tests, or to any part of them, shall not be used in equipment or returned to bulk supply.

NOTE Some or all of these tests may be required to be repeated from time to time on samples drawn from current production to confirm that the quality of the product still complies with the requirements of the specification.

Table 1 — Maximum nominal values of capacitance for general purpose components or filter units

Type of supply	Application	Maximum values of capacitance and their disposition. All in μF
SINGLE-PHASE	In or on a class I appliance connected to the supply mains by means of a plug and socket.	 C1 in position 1: no limit from safety aspect, but see 5.1.6.
	In the non-reversible 3-pin plug for a class I appliance.	 C1 in position 1: no limit from safety aspect, but see 5.1.6.
	In or on a class II appliance connected to the mains supply by means of a plug and socket.	 C1, C2 and C3 in position 1: no limit from safety aspect, but see 5.1.6.
	In or on a permanently earthed household apparatus.	 C1, C2 and C3 in position 1: no limit from safety aspect, but see 5.1.6.