

Specification for

Battery-operated electric fence controllers not suitable for connection to the supply mains

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- British Electrical and Allied Manufacturers' Association (BEAMA)
- British Electrotechnical Approvals Board
- British Railways Board
- Consumer Standards Advisory Committee of BSI
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- Department of Trade
- Electricity Supply Industry in England and Wales*
- Electronic Engineering Association
- Institution of Electrical Engineers
- Ministry of Defence
- United Kingdom Medical Equipment Industries Group

The organization marked with an asterisk in the above list, together with the following, was directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- British Electric Fence Unit Manufacturers' Association
- British Medical Association
- British Veterinary Association
- Department of Agriculture and Fisheries for Scotland
- Department of Energy
- Health and Safety Executive
- Ministry of Agriculture, Fisheries and Food
- National Farmers' Union
- National Institute of Agricultural Engineering

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Contents

	Page
Cooperating organizations	Inside front cover
Foreword	iii
1 Scope	1
2 References	1
3 Definitions	1
4 General requirements	3
5 General conditions for tests	3
6 Rated supply voltage	5
7 Classification	5
8 Marking	5
9 Protection against unintended electric shock	6
10 Output characteristics	8
11 Heating	10
12 Radio interference suppression	10
13 Resistance to atmospheric surges	10
14 Moisture resistance	11
15 Insulation resistance and electric strength	13
16 Operation in the event of defects	14
17 Mechanical strength	16
18 Construction	18
19 Components	20
20 Supply connections and external flexible cables, cords and leads	21
21 Terminals for external conductors	22
22 Screws and connections	26
23 Creepage distances and clearances: distances through insulation	29
24 Reliability	29
25 Resistance to heat, fire and tracking	29
26 Resistance to corrosion	30
Appendix A Test to establish whether a part is a live part	34
Appendix B Examples of suitable metals for current-carrying parts	34
Appendix C Installation and operation of battery-operated electric fences: information to be provided on the instruction sheet	34
Figure 1 — Standard test finger	7
Figure 2 — Test pin	7
Figure 3 — Circuit diagram for output measurement	9
Figure 4 — Output pulse energy limits for values of load resistance below 500 Ω	10
Figure 5 — Spray apparatus	12
Figure 6 — Splash apparatus	13
Figure 7 — Impact-test apparatus	17
Figure 8 — Pillar terminals	24
Figure 9 — Screw terminals and stud terminals	25
Figure 10 — Mantle terminals	26
Figure 11 — Ball-pressure apparatus	30
Figure 12 — Hot mandrel apparatus	32
Figure 13 — Scratch test for coated enclosures	33
Figure 14 — Siting of fence wires in relation to power lines	36

	Page
Table 1 — Output characteristics	8
Table 2 — Temperature rise	15
Table 3 — Torque values (cable or cord)	22
Table 4 — Torque values (screws)	27
Publications referred to	Inside back cover

Foreword

This British Standard for battery operated electric fence controllers has been prepared under the direction of the Light Engineering Standards Committee. An earlier standard for these devices, BS 1222:1945, was withdrawn in 1977.

This standard is based on the specification for battery-operated electric fence controllers issued by the International Commission for Conformity Certification of Electrical Equipment (CEE), Publication 5 (second edition) Supplement 1, which will be published shortly.

This standard is intended primarily to establish a satisfactory level of safety when the appliance is operated under normal conditions.

Mains-operated electric fence controllers are specified in BS 2632.

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 36, 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 standard specifies requirements for battery-operated electric fence controllers which are not designed for connection to the supply mains and having a rated supply voltage not exceeding 34 V d.c.

Electric fence controllers incorporating electronic circuits or electronic components, and those incorporating systems used for charging the battery other than by connection to the supply mains are within the scope of this standard.

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 standard the following definitions apply.

NOTE In this standard the terms “voltage” and “current” imply the r.m.s. values unless otherwise specified.

3.1

electric fence controller

an apparatus intended to deliver periodic voltage impulses to a fence connected to it

3.2

battery-operated electric fence controller

an electric fence controller drawing its energy solely from dry batteries, accumulators or other sources of energy, and not designed for connection to the supply mains

NOTE In the clauses that follow electric fence controllers are referred to as controllers.

3.3

supply mains

a power source that has a nominal voltage exceeding 24 V and is not solely used to supply a controller

3.4

fence

a barrier for animals that consists of one or more conductors, such as metal wires, rods or rails

3.5

fence circuit

all conductive parts or components of a controller connected or intended to be connected electrically to the output terminals

3.6

rated supply voltage

the supply voltage assigned to the controller by the maker

3.7

rated supply voltage range

the supply voltage range assigned to the controller by the maker, expressed by its lower and upper limits

3.8

rated input

the input, under normal operating conditions and at normal operating temperature, assigned to the controller by the maker

3.9

non-detachable flexible cable or cord

a flexible cable or cord that can only be removed from the controller with the aid of a tool

3.10

detachable part

a part that can be removed without the aid of a tool

3.11

basic insulation

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

NOTE 1 Basic insulation does not necessarily include insulation used exclusively for functional purposes.

NOTE 2 An electric shock from the output terminals of the controller is not considered to be an unintended electric shock.

3.12

supplementary insulation

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

3.13

double insulation

an insulation comprising both basic insulation and supplementary insulation

3.14

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 specification

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 insulation or basic insulation.

3.15

working voltage

the voltage to which the part under consideration is subjected when the controller is operating under normal operating conditions

3.16

creepage distance

the shortest path between two conductive parts, or between a conductive part and the bounding surface of the controller, measured along the surface of the insulating material

NOTE The bounding surface of the controller is the outer surface of the controller, considered as though metal foil were pressed into contact with accessible surfaces of insulating material.

3.17

clearance

the shortest distance between two conductive parts, or between a conductive part and the bounding surface of the controller, measured through air

3.18

pillar terminal

a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws. The clamping pressure may be applied directly by the shank of the screw or through the intermediate clamping member to which pressure is applied by the shank of the screw

NOTE Examples of pillar terminals are given in Figure 8.

3.19

screw terminal

a terminal in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping plate or antispread device

NOTE Examples of screw terminals are given in Figure 9.

3.20

stud terminal

a terminal in which the conductor is clamped under a nut. The clamping pressure may be applied directly or by a suitably shaped nut or through an intermediate part, such as a washer, clamping plate or antispread device

NOTE Examples of stud terminals are given in Figure 9.

3.21**mantle terminal**

a terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut. The conductor is clamped against the base of the slot by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut, or by equally effective means for transmitting the pressure from the nut to the conductor within the slot

NOTE Examples of mantle terminals are given in Figure 10.

3.22**tool**

a screwdriver, a coin or any other object that may be used to operate a screw or similar fixing means

3.23**live part**

a conducting part that may cause an electric shock

NOTE A test to establish whether a part is a live part is given in Appendix A.

3.24**rated input current**

the input current assigned to the controller by the manufacturer

3.25**supply source**

a power source that has a nominal voltage exceeding 34 V d.c. and is not solely used to supply a controller

4 General requirements

4.1 Controllers shall be so designed and constructed that in normal use they function reliably. They shall cause no danger to persons or surroundings, even in the event of a component failure, or such careless use as may occur in normal service. Particular requirements, with methods of test where appropriate, are given in clauses 6 to 26.

4.1.1 Test. In general, compliance shall be checked by carrying out all the tests specified, these tests being made under normal operating conditions as well as under simulated fault conditions (see clause 5).

5 General conditions for tests

5.1 Tests according to this standard are type tests.

5.2 The tests shall be made on two controllers as delivered, one being subjected to all the tests with the exception of that given in clause 24, and the other to the tests given in clause 10 and clause 24.

Controllers are considered not to comply with this standard if there is any failure in any of the tests specified, or if any of the tests result in the safety limits of clause 10 being exceeded.

NOTE 1 The testing of components may necessitate the submission of additional samples of these components. When the submission of such samples is necessary, they should be submitted together with the controllers.

NOTE 2 For the test given in 17.2.3 an additional sample may be necessary.

5.3 The tests shall be carried out in order of the clauses of this standard.

5.4 Unless otherwise specified, the measurements of voltages and currents shall be carried out with instruments that themselves do not appreciably affect the value to be measured.

5.5 Normal operating conditions shall include

- a) normal attitude of the controller;

NOTE The attitude of the controller is considered to be normal if the deviation from the attitude for which it is designed does not exceed 15°; if, however, the controller is provided with means for adjustment to the normal attitude, such as a spirit level, the controller should be adjusted within ± 2° to the normal attitude.

- b) an ambient temperature of 20 ± 5 °C, unless otherwise specified;
- c) the most unfavourable position of parts that are adjustable from the outside without the aid of a tool;
- d) application to the input terminals or terminations of the most unfavourable supply voltage between 0.55 and 1.1 times rated supply voltage, or 0.55 times the lower limit and 1.1 times the upper limit of the rated supply voltage range, if the controller can be used with dry batteries;

0.75 and 1.1 times rated supply voltage, or 0.75 times the lower limit and 1.1 times the upper limit of the rated supply voltage range, if the controller is designed for use with accumulators only; except that, for controllers for which the maximum discharged energy per impulse does not exceed 1.0 J at 1.1 times rated supply voltage or 1.1 times the upper limit of the rated supply voltage range, a supply voltage equal to 0.9 times rated supply voltage or 0.9 times the lower limit of the rated supply voltage range is applied for determining the output voltage and the duration of the intervals between the impulses.

NOTE For controllers with more than one rated supply voltage the most unfavourable rated supply voltage is chosen. If necessary, the values specified in the following table for the internal resistance per cell of the battery are taken into account.

Supply voltage	Internal resistance per cell	
	dry batteries	accumulators
	Ω	Ω
1.1 times rated supply voltage	0.08	0.0012
1.0 times rated supply voltage	0.10	0.0015
0.75 times rated supply voltage	0.75	0.0060
0.55 times rated supply voltage	2.00	—

For determining the internal resistance of a battery, two or more cells connected in parallel are considered to be one cell.

e) connection to earth of conductive coverings of supply wires, such as a conduit, lead sheath or armouring;

f) connection to earth of the earthing terminal of the fence circuit;

NOTE If the earthing terminal of the fence circuit is not indicated, the terminal that gives the most unfavourable result is earthed.

and, in addition to (a) to (f), the most unfavourable combination of the following conditions:

g) for controllers where the supply terminals or terminations have no indications of polarity, the choice of the polarity of the supply, giving the most unfavourable condition;

h) a load is connected to the output terminals, the load consisting of any combination of a resistor having a non-inductive resistance between 500 Ω and 1 M Ω in parallel

with a capacitor having a capacitance that can be varied between 0 μ F and 0.2 μ F.

NOTE 1 For the resistor, values of 500 Ω , and 2 k Ω , 10 k Ω , 50 k Ω , and 200 k Ω , and 1 M Ω are recommended.

NOTE 2 Whilst varying the value of the capacitance the possibility of resonance has to be taken into account.

5.6 Simulated fault conditions denote that, in addition to the normal operating conditions, each of the following conditions shall be applied in turn.

However, when the conditions specified in **5.6.1** to **5.6.10** are applied, the test is first made with each component, or combination of components forming a functional circuit, short-circuited or open-circuited in turn, and then repeated with every combination of two components, or group of components forming a functional circuit, short-circuited or open-circuited in turn.

5.6.1 The controller shall be placed in its most unfavourable attitude, even if it is not likely that the controller will be installed in this attitude in normal use.

5.6.2 Parts intended for adjusting the controller, other than those mentioned in **5.5 c)**, shall be adjusted to their most unfavourable position, even if those parts are not intended to be adjusted by the user, unless they are effectively sealed against further adjustment.

5.6.3 The controller shall be supplied at the most unfavourable supply voltage between 0 and 1.1 times the rated supply voltage or 1.1 times the upper limit of rated supply voltage.

5.6.4 The output terminals shall be short-circuited.

5.6.5 Switches, relay-contacts and the like that form part of the impulse device shall be short-circuited or open-circuited, whichever is the more unfavourable.

5.6.6 Discharging valves, fuses and thermal relays, as well as series spark gaps in the fence circuit, shall be short-circuited.

5.6.7 Rectifiers, semiconductor devices and other electronic components shall be short-circuited or open-circuited, whichever is the more unfavourable.

5.6.8 Resistors, inductors and capacitors, other than those which meet the special requirements of **19.2** and **19.3**, are short-circuited or open-circuited, whichever is the more unfavourable.

The fact that any short-circuit may be imperfect shall be taken into account if it is considered that this could lead to a dangerous situation. In this case, the component shall be shunted by a variable resistance which shall be adjusted to create the most unfavourable condition.

NOTE 1 Short-circuiting of resistors and inductors may comprise the whole resistor or inductor, or a part of it, whichever is the more unfavourable.

NOTE 2 Short-circuiting and open-circuiting tests need not be applied to resistors or inductors that comply with the requirements of **19.2** and **19.3** provided that the assembly, construction or subsequent use of the equipment is extremely unlikely to cause such a fault.

5.6.9 Thyristors, triacs and similar devices shall be operated at an accelerated rate unless suitable means are provided to prevent the production of an excessive pulse rate, even under any of the other fault conditions.

5.6.10 Supply terminals or terminations having an indication of polarity shall be connected to the opposite polarity, unless such a connection is unlikely to occur in normal use.

6 Rated supply voltage

6.1 The rated supply voltage shall not exceed 34 V d.c.

6.1.1 *Test.* Compliance shall be checked by inspection of the marking.

7 Classification

Controllers are classified according to degree of protection against moisture as

- a) splash-proof controllers;
- b) watertight controllers.

8 Marking

8.1 Controllers shall be marked with the following:

- a) rated supply voltage(s) or rated supply voltage range(s) in volts;
- b) rated input current in amperes;
- c) type of battery, unless the type is irrelevant to the operation of the controller;
- d) the number of this standard¹⁾ and information on output as follows:
either
 “J-low output” or “J-high output” (according to the classification in Table 1);
or
 the output in J of the controller;
- e) manufacturer’s name or trade mark;
- f) manufacturer’s model or type reference;
- g) symbol for degree of protection against moisture;
- h) DANGER — DO NOT CONNECT TO SUPPLY MAINS OR ANY MAINS OPERATED EQUIPMENT.

This warning shall be clearly visible when the controller is in use.

NOTE 1 Additional markings are allowed, provided they do not give rise to misunderstanding.

NOTE 2 For the type of battery marking, distinction should be made between dry batteries and accumulators.

NOTE 3 The warning marking shall be written in the official language of the country in which the controller is to be sold and operated.

8.1.1 *Test.* Compliance shall be checked by inspection.

¹⁾ Marking BS 6167 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer’s responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

8.2 If the controller can be adjusted to suit different rated supply voltages, the supply voltage to which the controller is adjusted shall be easily and clearly discernible.

8.2.1 Test. Compliance shall be checked by inspection.

8.3 When symbols are used, they shall be as follows.

volts	V
amperes	A
joules	J
splash-proof construction	 (one drop in a triangle)
watertight construction	 (two drops)
earth	

8.3.1 Test. Compliance shall be checked by inspection.

8.4 Unless the correct mode of connection is obvious, controllers shall be provided with a wiring diagram showing how the connection should be made.

8.4.1 Test. Compliance shall be checked by inspection.

8.5 Controllers shall be accompanied by instruction sheet(s) giving directions for the installation of the controller and the mounting of the fence wire. A list of the requirements for the installation and operation of electric fences and controllers which shall be included in the instruction sheet is given in Appendix C.

The instruction sheet shall also include the substance of the following warning.

KEEP COMBUSTIBLE MATERIALS AWAY FROM THE CONNECTION TO THE CONTROLLER.

8.5.1 Test. Compliance shall be checked by inspection.

8.6 Instruction sheet(s) shall be written in the official language(s) of the country in which the controller is to be sold.

Where symbols are used, they shall be those indicated in this standard.

8.6.1 Test. Compliance shall be checked by inspection.

8.7 The supply terminals or terminations shall be clearly indicated by the symbol + or the colour red if of positive polarity, and by the symbol – or the colour black if of the negative polarity, unless the polarity is irrelevant.

8.7.1 Test. Compliance shall be checked by inspection.

8.8 Marking shall be easily legible and durable. Marking specified in **8.1**, **8.2** and **8.7** shall be on the main part of the controller and shall be clearly discernible from the outside after the controller has been fixed as in normal use, but, if necessary, after removal of a cover.

NOTE Marking may be placed in or on a cover, provided this cover cannot be replaced by a cover having a different marking.

8.8.1 Test. Compliance shall be checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

After these treatments the markings shall be easily legible and shall show no tendency to curl.

8.9 It shall not be easily possible to remove marking plates.

8.9.1 Test. Compliance shall be checked by inspection.

NOTE A revision of the test for checking the durability of the marking is under consideration.

9 Protection against unintended electric shock

9.1 Controllers shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts other than the means for the connection of the fence even after the removal of detachable parts removable without the aid of a tool.

This requirement applies for all positions of the controller when it is wired and operated as in normal use, even after removal of detachable parts.

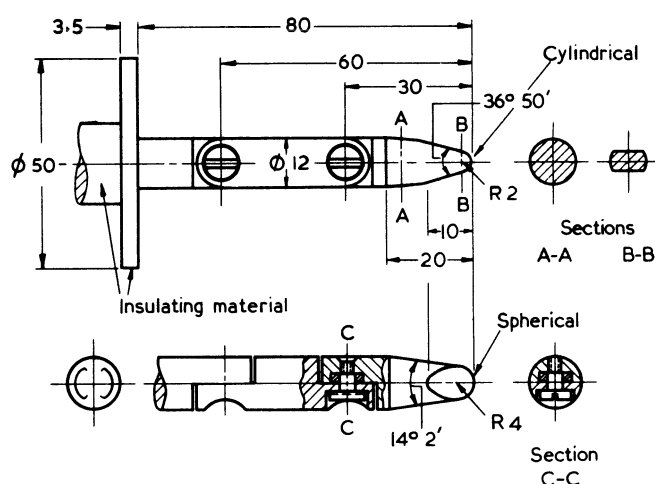
Enclosures shall have no openings giving access to live parts other than openings necessary for the use and working of the controller.

The insulating properties of lacquer, enamel, paper, cotton, oxide film on metal parts and sealing compound shall not be relied upon to give the required protection against accidental contact with live parts.

If, for starting or stopping the controller, the enclosure has to be opened, even with the aid of a tool, internal live parts shall be adequately protected against accidental contact when the enclosure is in the open position.

Parts in a battery compartment which become accessible when replacing batteries, even with the aid of the tool, shall not be live.

9.1.1 Test. Compliance shall be checked by inspection and by a test with the standard test finger shown in Figure 1. In addition, apertures shall be tested with the test pin shown in Figure 2. The test finger and the test pin shall be applied, without appreciable force, in every possible position.



Dimensions are in millimetres.

Tolerances

on angles: $\pm 5'$

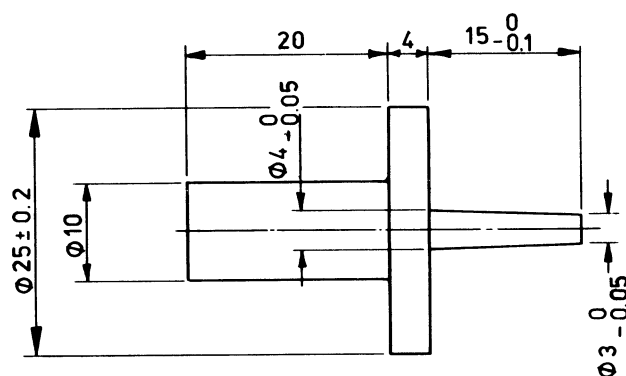
on linear dimensions:

0

less than 25 mm: -0.05

over 25 mm: ± 0.2

Figure 1 — Standard test finger



Dimensions are in millimetres.

Figure 2 — Test pin

9.1.2 Test. Apertures preventing the entry of the test finger shall be further tested by means of a straight unjointed test finger of the same dimensions, which is applied with a force of 30 N; if this finger enters, the test with the finger shown in Figure 1 shall be repeated, except that the force necessary to push the finger through the aperture shall be exerted. An electrical contact indicator shall be used to show contact.

It shall not be possible to touch with the test finger, bare live parts (other than the terminals of the fence circuit), or live parts protected by lacquer, enamel, paper, cotton, oxide film or sealing compound only, or metal parts separated from live parts by basic insulation only.

It shall not be possible to touch bare live parts, other than the terminals of the fence circuit, with the test pin.

NOTE 1 The standard test finger should be so designed that each of the jointed sections can be turned through an angle of 90° with respect to the axis of the finger in the same direction only.

NOTE 2 It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

9.2 Covers providing protection against unintended electric shock shall not be removable without the aid of a tool.

9.2.1 Test. Compliance shall be checked by inspection and by manual test.

9.3 Handles, levers and knobs, which are held or actuated in normal use, shall be either of insulating material or adequately covered by insulating material, if their shafts or fixings are likely to become live in the event of an insulation fault.

9.3.1 Test. Compliance shall be checked by inspection and by manual test.

9.4 Capacitors and their casings, if of metal, shall not be connected to accessible metal parts if one pole of the capacitor is connected to live parts other than those of the fence circuit.

9.4.1 Test. Compliance shall be checked by inspection and by the tests specified for supplementary insulation.

10 Output characteristics

10.1 Two sets of output characteristics are given: the first for low output controllers delivering energy levels of up to 1 J, and the second for high output controllers delivering energy levels of over 1 J and up to 5 J.

Controllers shall deliver impulses separated by intervals having a duration between 1 s and 1.5 s.

The output voltage, output current and other characteristics shall be within the limits shown in Table 1.

Table 1 — Output characteristics

Characteristic	Low output controllers with energy output up to 1 J	High output controllers with energy output 1 J to 5 J
Peak value of voltage	10 000 V (max.), 1 500 V (min.)	10 000 V (max.), 1 500 V (min.)
Peak value of current	10 A (max.), 150 mA (min.)	10 A (max.), 150 mA (min.)
Period for which the instantaneous value of current exceeds 300 mA	1.5 ms	1.5 ms
Maximum duration of impulse	—	0.1 s
Maximum quantity of electricity per impulse	2.5 mC	2.5 mC
Maximum discharged energy per impulse	1 J	5J ^a
^a This value applies to load resistance values down to 500 Ω. For load values below 500 Ω, the energy limit increases from 5 J at 500 Ω in a linear manner to 10 J at 50 Ω (see Figure 4).		

10.1.1 Test. Compliance shall be checked by the following measurements carried out under normal operating conditions and at rated battery voltage. For each measurement, the conditions are chosen so as to give the most unfavourable result.

- a) The peak value of the voltage shall be measured between the terminals of the fence circuit by means of an oscilloscope, the measuring arrangement having a non-inductive resistance of 1 MΩ in parallel with a capacitance of 100 pF.