INTERNATIONAL STANDARD

IEC 62052-21

First edition
2004-05

Electricity metering equipment (a.c.) – General requirements, tests and test conditions –

Part 21: Tariff and load control equipment

Reference number
IEC 62052-21:2004(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (www.iec.ch/online_news/ justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC 62052-21

First edition
2004-05

Electricity metering equipment (a.c.) – General requirements, tests and test conditions –

Part 21: Tariff and load control equipment

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE X

For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICITY METERING EQUIPMENT (AC) – GENERAL REQUIREMENTS, TESTS AND TEST CONDITIONS –

Part 21: Tariff and load control equipment

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62052-21 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

This standard, in conjunction with IEC 62054-11 and IEC 62054-21, cancels and replaces IEC 61038:1990, *Electricity metering – Tariff and load control – Particular requirements for time switches* and all amendments.This standard is to be used in conjunction with the relevant parts of the IEC 62054 and the IEC 62059 series.

The text of this standard is based on the following documents:

FDIS	Report on voting
13/1307/FDIS	13/1316/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2013. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

This standard distinguishes between protective class I and protective class II tariff and load control equipment.

The test levels are regarded as minimum values to guarantee the proper functioning of the equipment under normal working conditions. For special application, other test levels might be necessary and should be agreed on between the user and the manufacturer.

For information, the relevant parts of IEC 62052, IEC 62054 and IEC 62059 are listed:

IEC 62052-21 Electricity metering (a.c.) – General requirements, tests and test conditions – Part 21: Tariff and load control equipment

(*Replaces the general requirements of IEC 61037 and IEC 61038.)*

IEC 62054-11 Electricity metering (a.c.) – Tariff and load control – Part 11: Particular requirements for electronic ripple control receivers

(*Replaces the particular requirements of IEC 61037.)*

IEC 62054-21 Electricity metering (a.c.) – Tariff and load control – Part 21: Particular requirements for time switches[1]

(*Replaces the particular requirements of IEC 61038.)*

IEC 62059-11 Electricity metering equipment (a.c.) – Dependability – Part 11: General concepts

IEC 62059-21 Electricity metering equipment (a.c.) – Dependability – Part 21: Collection of meter dependability data from the field

IEC 62059-41 Electricity metering equipment (a.c.) – Dependability – Part 41: Reliability prediction[2]

---

[1] To be published.

[2] To be published.

ELECTRICITY METERING EQUIPMENT (AC) – GENERAL REQUIREMENTS, TESTS AND TEST CONDITIONS –

Part 21: Tariff and load control equipment

1 Scope

This part of IEC 62052 specifies general requirements for the type test of newly manufactured indoor tariff and load control equipment, like electronic ripple control receivers and time switches that are used to control electrical loads, multi-tariff registers and maximum demand indicator devices.

This standard gives no requirements for constructional details internal to the tariff and load control equipment.

In the case where tariff and load control functionality is integrated into multifunction electricity metering equipment, the relevant parts of this standard apply.

This standard does not cover the acceptance tests and the conformity tests. Nevertheless, an example of what could be an acceptance test is given in Annex F.

The dependability aspect is covered by the documents of the IEC 62059 series.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-300:2001 *International Electrotechnical Vocabulary (IEV) – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-75:1997, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer test*

IEC 60085:1984, *Thermal evaluation and classification of electrical insulation*

IEC 60269-3-1:1994, *Low-voltage fuses – Part 3-1: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Sections I to IV*

IEC 60417-2:1998, *Graphical symbols for use on equipment – Part 2: Symbol originals*
Amendment 1(2000)

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-2-10:2000, *Fire Hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedures*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60721-3-3:1994, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weather protected locations*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test.* Basic EMC publication

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test.* Basic EMC publication

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 62054-11, *Electricity metering (a.c.) – Tariff and load control equipment – Part 11: Particular requirements for electronic ripple control tariff and load control equipment* [3]

IEC 62054-21, *Electricity metering (a.c.)– Tariff and load control equipment – Part 21: Particular requirements for time switches* [3]

CISPR 22:1997, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO 75-2:1993, *Plastics – Determination of temperature of deflection under load – Part 2: Plastics and ebonite*

3 Terms and definitions

For the purposes of this document, the following definitions, together with those of IEC 60050-300, apply.

Where there is a difference between the definitions in the glossary and those contained in product standards produced by TC 13 then the latter shall take precedence in applications of the relevant standard.

---

[3] To be published.

3.1 General definitions

3.1.1
tariff and load control equipment
device intended to make or break or change over circuits controlling tariff devices of electricity meters or controlling electrical loads, based on a pre-determined time schedule and/or commands received from a control centre over suitable media and using suitable protocols

3.1.2
control element
functional element controlling the display and/or the operation indicator and the output element. In the case of ripple control receivers, it comprises the decoding element and may contain a timing element. In the case of time switches, it comprises the time-keeping element and the element comparing the actual date and time with the schedule stored in the time switch

3.1.3
reference voltage
U_n
value of the supply voltage in accordance with which the relevant performance of the tariff and load control equipment is fixed

3.1.4
reference frequency
f_n
value of the frequency of the supply voltage in accordance with which the relevant performance of the tariff and load control equipment is fixed

3.1.5
type
term used to define a particular design of tariff and load control equipment, manufactured by one manufacturer, having the same uniform construction of parts determining the functional, and, when applicable, the metrological properties. The type may have several values of reference voltage and frequency. Tariff and load control equipment are designated by the manufacturer by one or more groups of letters or numbers, or a combination of letters and numbers. Each type has one designation only

NOTE The type is represented by the sample tariff and load control equipment intended for type tests, whose characteristics are chosen from the values given in the tables proposed by the manufacturer.

3.2 Definitions related to electronic ripple control receivers

3.2.1
electronic ripple control receiver
device with an input and decoder circuit for the reception and interpretation of pulses of a single audio frequency superimposed on the voltage of an electricity distribution network and for the execution of the corresponding operations

3.2.2
standard receiver
receiver for mounting on equipment board, a meter board or an instrument rail (or which is a part of the meter)

3.2.3
special receiver
receiver intended for particular applications, for example, street lighting receivers

3.2.4
input element
functional element that separates the control signals from the supply voltage and transmits them to the decoding element

3.2.4.1
control voltage
U_s
audio-frequency voltage superimposed on the supply system voltage. Throughout this standard, its steady r.m.s. value is used and is expressed as a percentage of the rated supply voltage U_n of the receiver

3.2.4.2
reference control voltage
U_{ns}
value of the control voltage U_s in accordance with which the relevant performance of the ripple control receiver is fixed

3.2.4.3
operate voltage
U_f
minimum value of the control voltage that, under prescribed conditions, is sufficient to ensure correct operation of the receivers, the message being coded according to the system considered

3.2.4.4
non-operate voltage
U_{nf}
maximum value of the control voltage for which, under prescribed conditions, the receivers do not operate, the message being coded according to the system considered

3.2.4.5
maximum control voltage
U_{max}
maximum value of the control voltage that, under prescribed conditions, ensures correct operation of the receivers receiving a message coded according to the system considered

3.2.4.6
reference control frequency
f_s
value of the control frequency in accordance with which the relevant performance of the ripple control receiver is fixed

3.3 Definitions related to the ripple control code and to the control element

3.3.1
code
sequence of a given number of pulse positions having a specified cycle duration

NOTE 1 Examples of time diagrams for ripple control codes are given in Annex E of IEC 62054-11.

NOTE 2 Each pulse position is designated by a number.

3.3.2
decoding element
part of the control element that identifies from the signals received from the input element those corresponding to the commands for which it is programmed. For this purpose, the decoding element checks the presence and, possibly, the absence of information pulses at the positions for which it is programmed and passes on the information to the control element

3.3.3
timing element
part of the control element that, together with the decoding element, affects the operation of the output element based on the value of internal timers. The presence of a timing element allows the ripple control receiver to execute periodic or delayed switching operations even without the reception of ripple control messages

3.3.4
pulse position
position in the ripple control message where an information pulse may be present or absent

3.3.5
starting pulse
first pulse of the message, which is intended to start the decoding operation of the receiver

NOTE It is generally designated by the number 0.

3.3.6
information pulse
pulse present at one of the positions in the message after the starting pulse. It is designated by the number of its position

3.3.7
pulse interval
interval of time between the beginning of an information pulse and the beginning of the following information pulse in the ripple control message

NOTE A pulse interval comprises a pulse of a length according to the coding system, plus, possibly, an associated pause.

3.3.8
message
combination of the starting pulse and a certain number of information pulses representing one or more commands

3.3.9
command
instruction to those receivers programmed to that command to carry out a certain operation on the output element

NOTE It is generally characterized by the presence or absence of one or more information pulses.

3.3.10
cycle duration
interval of time between the beginning of the start pulse and the normal return of the receiver to its quiescent state

3.4 Definitions related to time switches

3.4.1
time switch
device which may be set to make or break or change over circuits at pre-determined times

3.4.2
synchronous time switch
time switch having as its main time base the network frequency

3.4.3
crystal-controlled time switch
time switch having as its main time base a crystal-controlled oscillator

3.4.4
time-based element
that part of the time switch which produces an output corresponding to the passing of the time

3.4.4.1
time-indication discrepancy
difference between the time displayed by the time switch and the actual time or, in the case of synchronous time switches, the difference between the time displayed by the time switch and the time determined by the network frequency

NOTE The actual time may be obtained using a reference clock.

3.4.4.2
time-keeping accuracy
increase or decrease in the time indication discrepancy within a specified time interval

3.4.4.3
variation of time-keeping accuracy due to an influence quantity
difference in time-keeping accuracy of a time switch when only one influence quantity assumes successively two specified values, one of them being the reference value

3.4.4.4
operation reserve
maximum period of time after switching off the power-supply voltage during which the time switch is capable to maintain correct time with a specified, relaxed time-keeping accuracy

3.4.4.5
reserve restoration time
period of time required for restoring the full operation reserve from the point where the operation reserve has been completely exhausted

3.4.5
setting and display elements

3.4.5.1
dial
analogue mechanical device for facilitating the setting and observation of the settings of the time switch and for the display of indicated time. The dials are designated according to their period of rotation (for example, the day dial has a period of rotation of 1 day)

3.4.5.2
digital display
electronic device for facilitating the setting and observation of the settings of the time switch and for the display of indicated time and possibly the status of the output elements

3.5 Definitions related to the output elements

3.5.1
output element
element comprising one or more electromechanical or static switches controlled according to the information provided by the control element of the tariff and load control equipment

3.5.2
load switch
part of the output element comprising the contacts, or their electronic equivalent, for switching loads, together with the parts directly operating the contacts

3.5.3
tariff register switch
part of the output element comprising the contacts, or their electronic equivalent, for switching tariff registers, together with the parts directly operating the contacts

3.5.4
maximum demand indicator switch
part of the output element comprising the contacts, or their electronic equivalent, for switching maximum demand indicators, together with the parts directly operating the contacts

3.5.5
low rating d.c. switch
part of the output element comprising the contacts, or their electronic equivalent, for switching low power d.c. circuits, together with the parts directly operating the contacts

3.5.6
rated breaking voltage
U_c
value of the voltage for which a switch is designed

3.5.7
rated breaking current
I_c
value of current for which a switch is designed and which it can close, carry continuously and break under specified conditions

3.5.8
maximum total current
I_{tot}
value of total current that all the output switches of a tariff and load control equipment can carry continuously at the same time under specified conditions

3.5.9
operation
pair of changes of state of an output element, closure followed by opening or vice versa

3.6 Definitions of mechanical elements

3.6.1
indoor tariff and load control equipment
tariff and load control equipment, which can only be used in areas offering additional protection against environmental influences (i.e. in a house or in a cabinet)

[IEV 314-07-20 modified]

3.6.2
base
back of the tariff and load control equipment by which it is generally fixed and to which are attached the electronic board(s), the output element(s), the terminals or the terminal block and the cover

[IEV 314-07-14 modified]

3.6.3
cover
enclosure on the front of the tariff and load control equipment, made either wholly of transparent or of opaque material provided with (a) window(s) through which the dial and/or display can be read

[IEV 314-07-16 modified]

3.6.4
case
set that comprises the base and the cover

[IEV 314-07-17]

3.6.5
accessible conductive part
conductive part, which can be touched by the standard test finger when the tariff and load control equipment is installed and ready for use

3.6.6
protective earth terminal
terminal connected to accessible conductive parts of the tariff and load control equipment for safety purposes

3.6.7
terminal block
support made of insulating material on which all or some of the terminals of the tariff and load control equipment are grouped together

[IEV 314-07-18 modified]

3.6.8
terminal cover
cover, which covers the tariff and load control equipment terminals and, generally, the ends of the external wires or cables connected to the terminals

[IEV 314-07-19 modified]

3.6.9
clearance
shortest distance measured in air between two conductive parts

3.6.10
creepage distance
shortest distance measured over the surface of insulation between two conductive parts

3.7 Definitions of insulations

3.7.1
basic insulation
insulation applied to live parts to provide basic protection against electric shock

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

3.7.2
supplementary insulation
independent insulation applied in addition to the basic insulation, in order to provide protection against electric shock in the event of a failure of the basic insulation

3.7.3
double insulation
insulation comprising both basic insulation and supplementary insulation

3.7.4
reinforced insulation
single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation

NOTE The term "insulation system" does not imply that the insulation should be one homogeneous piece. It may comprise several layers, which cannot be tested singly as supplementary or basic insulation.

3.7.5
insulating encased tariff and load control equipment of protective class I
tariff and load control equipment in which protection against electric shock does not rely on basic insulation only but which includes an additional safety precaution in that accessible conductive parts are connected 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 This provision includes a protective earth terminal.

3.7.6
insulating encased tariff and load control equipment of protective class II
tariff and load control equipment with a case of insulating material, in which protection against electric shock does not rely on basic insulation onl 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

3.8 Definitions of influence quantities

3.8.1
influence quantity
any quantity, generally external to the tariff and load control equipment, which may affect its working performances

3.8.2
reference conditions
appropriate set of specified values and/or ranges of values of influence quantities under which the working performances are specified

[IEV 311-06-02 modified]

3.8.3
electromagnetic disturbance
conducted or radiated electromagnetic interference or static discharge which may affect functionally or metrologically the operation of the tariff and load control equipment

3.8.4
reference temperature
ambient temperature specified for reference conditions

3.8.5
rated operating conditions
set of specified ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations or working performances of a tariff and load control equipment are specified and determined

3.8.6
specified operating range
range of values of a single influence quantity, which forms a part of the rated operating conditions

3.8.7
extended operating range
extreme conditions which an operating tariff and load control equipment can withstand without damage and without degradation of its characteristics when it is subsequently operated under its rated operating conditions. For this range, relaxed accuracy and operational requirements may be specified

3.8.8
limit range of operation
extreme conditions which an operating tariff and load control equipment can withstand without damage and without degradation of its characteristics when it is subsequently operated under its rated operating conditions

3.8.9
storage and transport conditions
extreme conditions which a non-operating tariff and load control equipment can withstand without damage and without degradation of its characteristics when it is subsequently operated under its rated operating conditions

3.8.10
normal working position
position of the tariff and load control equipment defined by the manufacturer for normal service

3.9 Definition of tests

type test
procedure according to which the series of tests is carried out on one tariff and load control equipment or on a small number of tariff and load control equipment of the same type having identical characteristics, selected by the manufacturer, to verify that the respective type of tariff and load control equipment complies with all the requirements of this standard

4 Standard electrical values

4.1 Standard reference voltage (U_n)

Standard values for U_n are 120 V and 230 V.

NOTE These values apply only to stand-alone equipment.

4.2 Standard reference frequency (f_n)

Standard values for f_n are 50 Hz and 60 Hz.

5 Mechanical requirements and tests

5.1 General mechanical requirements

Tariff and load control equipment shall be designed and constructed in such a way as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially

– personal safety against electric shock;
– personal safety against effects of excessive temperature;
– protection against spread of fire;
– protection against penetration of solid objects, dust and water.

All parts, which are subject to corrosion under normal working conditions shall be effectively protected. Any protective coating shall not be liable to damage by ordinary handling, or damage due to exposure to air, under normal working conditions.

Tariff and load control equipment shall have adequate mechanical strength and shall withstand the elevated temperature which is likely to occur in normal working conditions.

The components shall be reliably fastened and secured against loosening.

The construction of tariff and load control equipment shall be such as to minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of the wiring, screws, etc.

NOTE For tariff and load control equipment for special use in corrosive atmospheres, additional requirements shall be fixed in the purchase contract (for example, salt mist test according to IEC 60068-2-11).

5.2 Case

5.2.1 Requirements

Tariff and load control equipment shall have a case which can be sealed in such a way that the internal parts of the equipment are accessible only after breaking the seal.

The case shall be designed according to protective class I or II.

The cover shall not be removable without the use of a tool.

The case shall be so constructed and arranged that any non-permanent deformation cannot prevent the satisfactory operation of the tariff and load control equipment.

Unless otherwise specified, tariff and load control equipment intended to be connected to a supply mains where the voltage under reference conditions exceeds 250 V to earth, and whose case is wholly or partially made of metal, shall be provided with a protective earth terminal.

5.2.2 Mechanical tests

The case shall be subjected to the following tests.

NOTE The back-up power supply, if any, shall remain connected.

5.2.2.1 Spring hammer test

The mechanical strength of the tariff and load control equipment case shall be tested with a spring hammer (test Ehb, see IEC 60068-2-75).

The tariff and load control equipment shall be mounted in its normal working position and the hammer shall act on the outer surfaces of the tariff and load control equipment cover and on the terminal cover with a kinetic energy of 0,2 J ± 0,02 J.

The result of the test is satisfactory if the tariff and load control equipment case and terminal cover do not sustain damage, which could affect its function and if it is not possible to touch live parts. Slight damage, which does not impair the protection against indirect contact or the penetration of solid objects, dust and water is acceptable.

5.2.2.2 Shock test

The test shall be carried out according to IEC 60068-2-27, under the following conditions:

– tariff and load control equipment in non-operating condition, without the packing;
– half-sine pulse;
– peak acceleration: 30 g_n; (300 m/s^2);
– duration of the pulse: 18 ms.

After the test, the tariff and load control equipment shall show no damage or change of information and shall operate correctly in accordance with the requirements of the relevant standard.

5.2.2.3 Vibration test

The test shall be carried out according to IEC 60068-2-6, under the following conditions:

– tariff and load control equipment in non-operating condition, without the packing;
– frequency range: 10 Hz to 150 Hz;
– transition frequency: 60 Hz;
– f < 60 Hz constant amplitude of movement ±0,075 mm;
– f > 60 Hz constant acceleration 9,8 m/s^2 (1 g);
– single point control;
– number of sweep cycles per axis: 10.

NOTE Ten sweep cycles = 75 min.

After the test, the tariff and load control equipment shall show no damage or change of information and shall operate correctly in accordance with the requirements of the relevant standard.

5.3 Window

If the cover is not transparent, one or more windows shall be provided for reading the display and observation of the operation indicators if fitted. These windows shall be of transparent material, which cannot be removed without breaking the seals.

5.4 Terminals, terminal block(s), protective earth terminal

Terminals may be grouped in (a) terminal block(s) having adequate insulating properties and mechanical strength. In order to satisfy such requirements when choosing insulating materials for the terminal block(s), adequate testing of materials should be taken into account.

The terminal block shall be so constructed that the tariff and load control equipment during any deformation caused by rated operating conditions shall comply with the insulation requirements and the clearance and creepage distances within this standard.

The material of which the terminal block is made shall be capable of passing the tests given in ISO 75-2 for a temperature of 135 °C and a pressure of 1,8 MPa (Method A).

The holes in the insulating material, which form an extension of the terminal holes, shall be of sufficient size to accommodate also the insulation of the conductors.

The manner of fixing the conductors to the terminals shall ensure adequate and durable contact so that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixings, which may be loosened and tightened several times during the life of tariff and load control equipment shall screw into a metal nut.

For tariff and load control equipment with rated breaking currents up to 25 A, when screw-type terminals are used, it shall be possible to connect in each terminal either one conductor, the cross-section of which is at least 1,5 mm^2 or two conductors with a cross-section of 1,5 mm^2.

If a system other than screw-type terminals is used for connection of the conductors, this system shall retain its full efficiency after 20 connections and disconnections.

All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.

Electrical connections shall be so designed that contact pressure is not transmitted through insulating material.

Terminals with different potentials, which are grouped close together, shall be protected against accidental short-circuiting. Protection may be obtained by insulating barriers. Terminals of one output circuit are considered to be at the same potential.

The terminals, the conductor fixing screws or the external or internal conductors shall not be liable to come into contact with metal terminal covers.

The protective earth terminal, if any,

a) shall be electrically bonded to the accessible metal parts;
b) should if possible, form part of the tariff and load control equipment base;
c) should preferably be located adjacent to its terminal block;
d) shall accommodate a conductor having a cross-section at least equivalent to one of the output circuit of the highest rating;
e) shall be clearly identified by the earthing symbol (see IEC 60417-5019: Protective earth (ground)).

After installation, it shall not be possible to loosen the protective earth terminal without the use of a tool.

5.5 Terminal cover(s)

The terminals of a tariff and load control equipment, if grouped in a terminal block and if not protected by any other means, shall have a separate cover, which can be sealed independently of the tariff and load control equipment cover. The terminal cover shall enclose the actual terminals, the conductor fixing screws and, unless otherwise specified, a suitable length of the external conductors and their insulation.

When the tariff and load control equipment is panel-mounted, no access to the terminals shall be possible without breaking the seal(s) of the terminal cover(s).

5.6 Clearance and creepage distances

The clearance and creepage distances between

a) any terminal of a circuit with a reference voltage over 40 V; and
b) earth, together with terminals of auxiliary circuits with reference voltages below or equal to 40 V

shall not be less than stated in

- Table 1 for tariff and load control equipment of protective class I;
- Table 2 for tariff and load control equipment of protective class II.

The clearance and creepage distances between terminals of circuits with reference voltages over 40 V shall not be less than stated in Table 1.

The clearance between the terminal cover, if made of metal, and the upper surface of the screws when screwed down to the maximum applicable conductor fitted shall be not less than the relevant values indicated in Tables 1 and 2.

Table 1 – Clearances and creepage distances for insulating encased tariff and load control equipment of protective class I

Voltage phase-to-earth derived from rated system voltage V	Rated impulse voltage V	Minimum clearances mm	Minimum creepage distance mm
≤100	1 500	0,5	1,4
≤150	2 500	1,5	1,6
≤300	4 000	3,0	3,2
≤600	6 000	5,5	6,3

Table 2 – Clearances and creepage distances for insulating encased tariff and load control equipment of protective class II

Voltage phase-to-earth derived from rated system voltage V	Rated impulse voltage V	Minimum clearances mm	Minimum creepage distances mm
≤100	2 500	1,5	2,0
≤150	4 000	3,0	3,2
≤300	6 000	5,5	6,3
≤600	8 000	8,0	12,5

The requirements of the impulse voltage test shall also be met (see 7.3.2.2).

5.7 Insulating encased tariff and load control equipment of protective class II

Tariff and load control equipment of protective class II shall have a durable and substantially continuous enclosure made wholly of insulating material, including the terminal cover, which envelops all metal parts, with the exception of small parts, for example, name-plate, screws, suspensions, and rivets. If such small parts are accessible by the standard test finger (as specified in IEC 60529) from outside the case, then they shall be additionally isolated from live parts by supplementary insulation against failure of basic insulation or loosening of live parts. The insulating properties of lacquer, enamel, ordinary paper, cotton, oxide film on metal parts, adhesive film and sealing compound, or similar unsure materials, shall not be regarded as sufficient for supplementary insulation.

For the terminal block and terminal cover of such a tariff and load control equipment, reinforced insulation is sufficient.

5.8 Resistance to heat and fire

5.8.1 Requirements

The terminal block, the terminal cover and the case of the tariff and load control equipment shall ensure reasonable safety against spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.

5.8.2 Test

The test shall be carried out according to IEC 60695-2-10 and IEC 60695-2-11 with the following temperatures:

– terminal block: 960 °C ± 15 °C;
– terminal cover and tariff and load control equipment case: 650 °C ± 10 °C;
– duration of application: 30 s ± 1 s.

The contact with the glow wire may occur at any random location. If the terminal block is integral with the base of the tariff and load control equipment, it is sufficient to carry out the test on the terminal block only.

5.9 Protection against penetration of dust and water

5.9.1 Requirements

The tariff and load control equipment shall conform to the degree of protection IP51 as given in IEC 60529, but without suction in the equipment.

5.9.2 Tests

The test shall be carried out according to IEC 60529, under the following conditions.

NOTE The back-up power supply, if any, shall remain connected.

a) Protection against penetration of dust:
   – tariff and load control equipment in non-operating condition and mounted on an artificial wall;
   – the test should be conducted with sample lengths of cable (exposed ends sealed) of the types specified by the manufacturer in place;
   – the same atmospheric pressure is maintained inside the tariff and load control equipment as outside (neither under- nor over-pressure);
   – first characteristic digit: 5 (IP5X).

   Any ingress of dust must only be in a quantity not impairing the operation of the tariff and load control equipment. An insulation test according to 7.3.2 shall be passed.

b) Protection against penetration of water:
   – tariff and load control equipment in non-operating condition;
   – second characteristic digit: 1 (IPX1).

   Any ingress of water must be only in a quantity not impairing the operation of the tariff and load control equipment. An insulation test according to 7.3.2 shall be passed.

5.10 Void

This clause is intentionally left void.

5.11 Void

This clause is intentionally left void.

5.12 Marking of tariff and load control equipment

5.12.1 Nameplates

The marking shall be easy to read without removing the cover.

Every tariff and load control equipment shall bear the following information as applicable:

a) the designation "Ripple control receiver" or "Time switch" or another designation as appropriate;

b) the manufacturer's name or trade mark and, if required, the place of manufacture;

c) designation of type (see 3.1.5) and, if required, space for approval mark;

d) the serial number and year of manufacture. If the serial number is marked on a plate fixed to the cover, the number shall also be marked on the tariff and load control equipment's base or stored in the tariff and load control equipment's non-volatile memory;

e) the reference voltage: U_n;

f) the reference frequency in Hz: f_n;

g) the rated breaking voltage: U_c;

h) the rated breaking current: I_c;

i) the maximum permanent total current of the output element: I_{tot} (if this value is lower than the sum of the rated breaking current of all the output switches of the tariff and load control equipment);

j) if a maximum indicator switch is fitted, the integration time (t_m) and the detent time (t_o) or, if adjustable, the adjustment range;

k) the sign of double square ⧈ for insulating encased tariff and load control equipment of protective class II.

Additionally, in case of ripple control receivers:

l) the operate voltage (in % of U_n): U_f;

m) the reference control frequency: f_s.

Additionally, if a battery is fitted:

n) the operation reserve;

o) when appropriate, a space for battery change date.

5.12.2 Connection diagrams and terminal marking

Every tariff and load control equipment shall be indelibly marked with a diagram of connections. It is permissible to indicate the connection diagram by an identification figure in accordance with national standards.

If the tariff and load control equipment terminals are marked, this marking shall appear on the diagram.

6 Climatic conditions, requirements and tests

6.1 Temperature range

The temperature range of the tariff and load control equipment shall be as shown in Table 3. The values are based on IEC 60721-3-3, Table 1, with the exception of *m) Condensation* and *p) Formation of ice*. For testing, see 6.3.

Table 3 – Temperature range

Specified operating range	–10 °C to +45 °C (class 3K5 modified)
Limit range of operation	–25 °C to +55 °C (class 3K6)
Limit range for storage and transport	–25 °C to +70 °C (class 3K8H)
NOTE 1 For special applications, other temperature values can be used according to purchase contract i.e. for cold environment for indoor tariff and load control equipment -40 °C to +70 °C (class 3K7). NOTE 2 Storage and transport of the tariff and load control equipment should only be at the extremes of this temperature range for a maximum period of 6 h. NOTE3 The limit range for storage and transport may be unacceptable for batteries. In this case, the acceptable temperature should be clearly marked on the tariff and load control equipment.	

6.2 Relative humidity

Tariff and load control equipment shall be designed to withstand the climatic conditions defined in Table 4. For combined temperature and humidity testing, see 6.3.3.

Table 4 – Relative humidity

Annual mean	<75 %
For 30 days, these days being spread in a natural manner over one year	95 %
Occasionally on other days	85 %

The limits of relative humidity as a function of ambient air temperature are shown in Annex A.

6.3 Tests of the effect of the climatic environments

After each of the climatic tests, the tariff and load control equipment shall show no damage or change of information and shall operate correctly.

NOTE For all climatic tests, the back-up power supply, if any, should remain connected.

6.3.1 Dry heat test

The test shall be carried out according to IEC 60068-2-2, under the following conditions:

– tariff and load control equipment in non-operating condition;
– method Bb (with gradual change of temperature);
– temperature: +70 °C ± 2 °C;
– duration of the test: 72 h.

6.3.2 Cold test

The test shall be carried out according to IEC 60068-2-1, under the following conditions:

– tariff and load control equipment in non-operating condition;
– method Ab (with gradual change of temperature);
– temperature: –25 °C ± 3 °C;
– duration of the test: 72 h.

6.3.3 Damp heat cyclic test

The test shall be carried out according to IEC 60068-2-30, under the following conditions:

– voltage and auxiliary circuits energized with U_n;
– without any current in the output element(s);
– variant 1;
– upper temperature: +40 °C ± 2 °C;
– no special precautions shall be taken regarding the removal of surface moisture;
– duration of the test: 6 cycles.

Twenty-four hours after the end of this test, the tariff and load control equipment shall be submitted to the following tests:

a) an insulation test according to 7.3.2, except that the impulse voltage shall be multiplied by a factor of 0,8;
b) a functional test. The tariff and load control equipment shall show no damage and shall operate correctly.

The damp heat test also serves as a corrosion test. The result is judged visually. No trace of corrosion likely to affect the functional properties of the tariff and load control equipment shall be apparent.

7 Electrical requirements and tests

7.1 Supply voltage

7.1.1 Supply voltage range

The voltage range is given in Table 5.

Table 5 – Voltage range

Specified operating range	from 0,9 U_n to 1,1 U_n
Extended operating range	from 0,8 U_n to 1,15 U_n
Limit range of operation	from 0,0 U_n to 1,15 U_n
NOTE In the case of time switches, if the supply voltage is below 0,8 U_n for a time period longer than the operation reserve, then the time switch may need to be readjusted.	

7.1.2 Supply frequency range

Tariff and load control equipment shall be designed for a rated supply frequency of 50 Hz or 60 Hz.

They shall operate correctly for all values of frequency between 0,98 and 1,02 times the rated supply frequency.

7.1.3 Power consumption

7.1.3.1 Requirements

The active and apparent power absorbed by the tariff and load control equipment under reference conditions (see Annex B) shall be less than, or equal to, the values given in Table 6.

Table 6 – Power consumption

Type of equipment	Power consumption
Ripple control receivers	2 W, 5 VA inductive or 12 VA capacitive
Time switches	3 W, 5 VA inductive or 25 VA capacitive
NOTE 1 These values may be exceeded briefly during the change of state of a switch. NOTE 2 The above figures are mean values. Switching power supplies with peak power values in excess of these specified values are permitted. NOTE 3 If the tariff and load control function is integrated in multifunction metering equipment, then IEC 62053-61 applies.	

7.1.3.2 Test

The power consumption shall be determined for the reference values of the influence quantities given in Annex B by any suitable method. The overall precision shall be better than 5 %.

7.1.4 Voltage dips and short interruptions

For requirements and tests, see the relevant standard for particular requirements.

7.1.5 Long interruptions of supply voltage

For requirements and tests, see the relevant standard for particular requirements.

7.1.6 Operation reserve

7.1.6.1 Requirements

If tariff and load control equipment is equipped with a back-up power supply, this shall be designed to provide an operation reserve suitable for the application.

- If the operation reserve is provided by a spring (in case of time switches only), a rechargeable battery or a supercapacitor, the minimum operation reserve shall be 36 h.
- If the operation reserve is provided by a primary cell, the operation reserve shall be at least 10 000 h during a period of 5 years, after the primary cell is connected.

NOTE For other technologies, or for special applications, the supplier and the purchaser may agree in a different value.

If the operation reserve is provided by a spring, a supercapacitor, or a rechargeable battery, the maximum reserve restoration time shall be three times the value of the operation reserve.

7.1.6.2 Tests

See the relevant standard for particular requirements.

7.1.7 Life of back-up power supply

If the back-up power supply is provided by a supercapacitor, a rechargeable battery, or a primary cell, its life shall be at least 5 years, when the tariff and load control equipment is operated under normal operating conditions.

If the tariff and load control equipment is designed for a lifetime, which is longer than the life of the back-up power supply, then the back-up power supply shall be replaceable.

7.1.8 Back-up power supply replacement

Where the tariff and load control equipment is designed to enable replacement of the back-up power supply, it shall be designed in such a way that it does not lose the time during the replacement of the back-up power supply, even if a power outage occurs during this process. The time necessary for the replacement (with back-up power supply disconnected) shall be less than 5 min.

7.2 Heating

7.2.1 Requirements

Under rated operating conditions, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the tariff and load control equipment.

The insulation materials shall comply with the appropriate requirements of IEC 60085.

The temperature rise of the external surface of the equipment shall not exceed 25 K with the ambient temperature at 40 °C.

7.2.2 Test

The tariff and load control equipment under test shall be energized with a supply voltage, which shall be 1,15 U_n. All other influence quantities shall have their reference values as given in Annex B.

The output elements of the tariff and load control equipment shall carry the maximum total current (I_{tot}).

During the test, the duration of which shall be 2 h, the tariff and load control equipment shall not be exposed to draught or direct solar radiation.

After the test, the tariff and load control equipment shall show no damage and shall comply with the insulation tests of 7.3.2.

7.3 Insulation

7.3.1 Requirements

Tariff and load control equipment shall be such that it retains adequate dielectric qualities under normal conditions of use, taking account of the atmospheric conditions and different voltages to which the circuits are normally subjected.

Tariff and load control equipment shall withstand the impulse voltage test and the a.c. voltage test as specified in 7.3.2.

7.3.2 Test of insulation properties

7.3.2.1 General test conditions

The tests shall be carried out only on a complete tariff and load control equipment, with its cover (except when indicated hereafter) and terminal cover, the terminal screws being screwed down to the maximum applicable conductor in the terminals.

Test procedure in accordance with IEC 60060-1.

The impulse voltage tests shall be carried out first and the a.c. voltage tests afterwards.

During type tests, the insulation tests are considered to be valid only for the terminal arrangement of the tariff and load control equipment, which has undergone the tests. When the terminal arrangements differ, all the insulation tests shall be carried out for each arrangement.

For the purpose of these tests, the term "earth" has the following meaning:

a) when the tariff and load control equipment case is made of metal, the "earth" is the case itself placed on a flat conducting surface;

b) when the tariff and load control equipment case, or only a part of it, is made of insulating material, the "earth" is a conductive foil wrapped around the equipment touching all accessible conductive parts and connected to the flat conducting surface on which the equipment base is placed. Where the terminal cover makes it possible, the conductive foil shall approach the terminals and the holes for the conductors within a distance of not more than 2 cm.

During the impulse and the a.c. voltage tests the circuits which are not under test are connected to the "earth" as indicated hereafter.

After these tests, there shall be no change in the functioning of, and no mechanical damage to, the tariff and load control equipment.

In this subclause, the expression “all terminals” means the whole set of terminals of the input and output circuits having a reference voltage over 40 V.

These tests shall be made in normal conditions of use. During the test, the quality of the insulation shall not be impaired by dust or abnormal humidity.

Unless otherwise specified, the normal conditions for insulation tests are

– ambient temperature: 15 °C to 25 °C;
– relative humidity: 45 % to 75 %;
– atmospheric pressure: 86 kPa to 106 kPa.

If, for any reason, the insulation tests have to be repeated, then they may be performed on a new specimen.

7.3.2.2 Impulse voltage test

The test shall be carried out under the following conditions:

– impulse waveform: 1,2/50 impulse specified in IEC 60060-1;
– voltage rise time: ±30 %;
– voltage fall time: ±20 %;
– source impedance: 500 Ω ± 50 Ω;
– source energy: 0,5 J ± 0,05 J;
– test voltage: in accordance with Tables 1 and 2;
– test voltage tolerance: +0… –10%.

NOTE For areas where overhead supply networks are predominant, a higher peak value than the values given in Tables 1 or 2 may be required.

For each test, the impulse voltage is applied 10 times with one polarity and then repeated with the other polarity. The minimum time between the impulses shall be 3 s.

During the test no flashover, disruptive discharge or puncture shall occur.

7.3.2.2.1 Impulse voltage test for circuits and between circuits

The test shall be made independently on each circuit (or assembly of circuits) insulated from the other circuits of the tariff and load control equipment in normal use. The terminals of the circuits, which are not subjected to impulse voltage, shall be connected to earth.

During the test of the a.c. power-supply circuit, the terminals of the other circuits and one of the terminals of the power-supply circuit under test shall be connected to earth and the impulse voltage shall be applied between the other terminal of the power-supply circuit and the earth.

Output elements shall be tested in a closed state. The terminals of the other circuits shall be connected to the earth. The impulse voltage shall be applied between one of the terminals of the output element under test and the earth.

NOTE If the output element under test cannot be set to the closed state for the test, then its terminals shall be short-circuited.

7.3.2.2.2 Test for insulation of the tariff and load control equipment circuits from the "earth"

All terminals of the tariff and load control equipment shall be connected together. The terminals of the low rating d.c. switches shall be connected to the earth. The impulse voltage shall be applied between these terminals and "earth". During this test no flashover, disruptive discharge or puncture shall occur.

7.3.2.3 AC voltage test

The test voltage shall be substantially sinusoidal, of rated frequency, and be applied for 1 min.

A test voltage of 4 kV r.m.s. for protective class II tariff and load control equipment and 2 kV r.m.s. for protective class I equipment shall be applied between all the terminals connected together and "earth". During this test no flashover, disruptive discharge or puncture shall occur.

NOTE During the a.c. voltage test, the terminals of the low rating d.c. switches should be connected to the earth.

Furthermore, when the output circuits are not galvanically connected to the input element, a test voltage of 2 kV shall be applied between each electrically independent circuit and all other circuits, which shall be connected to "earth".

7.4 Output elements

7.4.1 Rated breaking voltage (U_c)

The switch or switches shall be designed for rated breaking voltages as indicated in Table 7 and operate correctly up to 1,15 times these rated voltages.

Table 7 – Rated breaking voltages

Rated breaking voltages			
30 V d.c.	120 V	230 V	400 V

The 30 V d.c. rating applies only to switches that are used to control low power circuits. The operating range of such a switch is 12 V to 34,5 V d.c. (30 V d.c. –60 % to +15 %). These switches can be of electromechanical or solid-state technology for use with d.c. current only.

7.4.2 Rated breaking current (I_c)

The switch or switches of which the rated currents are chosen from Table 8 shall be able to make, continuously carry and break under a voltage 1,15 U_c the currents shown in this table.

Table 8 – Rated breaking currents

Application	Low power control circuit switch	Load control switches							
Rated breaking current I_c (A)	--	2	10	16	25	31,5	40	80	100
Linear ohmic load Cos φ = 1: current (A)	--	2	10	16	25	31,5	40	80	100
Inductive load Cos φ = 0,4: current (A)	--	1	5	8	10	10	10	10	10
DC current (A)	0,03	--	--	--	--	--	--	--	--

The 30 mA d.c. rating applies only to switches that are used to control low power circuits. They can be used with loads of 30 V rated breaking voltage. These switches can be of electromechanical or solid-state technology for use with d.c. current only.

In the “make” state the low rating switches, submitted to a 30 mA d.c. current should cause a voltage drop not larger than 1 V.

The “break” state of the low rating solid state switches is characterized by the presence of a maximum d.c. current of 0,2 mA when submitted to 34,5 V (1,15 U_c).

7.4.3 Number of operations of the output element

7.4.3.1 Requirements

Each load switch shall be capable of carrying out correctly 30 000 operations under ohmic load conditions, or 30 000 operations under the inductive load conditions given in 7.4.2, or 75 000 operations under no load, compliance being verified by testing under each of the three conditions (see 7.4.3.2).

Maximum demand indicator switches shall withstand 400 000 switching operations at 20 VA and a power factor of 0,5 lagging, when the shortest programmable integration period is 15 min. The number of operations has to be increased proportionally when the period is shorter (i.e. 600 000 operations for an integration period of 10 min or 1 200 000 for 5 min).

7.4.3.2 Test of number of operations of a.c. switches

The output elements of the tariff and load control equipment shall be tested with the fully assembled equipment under reference conditions and shall be connected in a test circuit which comprises essentially a supply source, a protective device and a loading impedance.

For the test of tariff and load switches, the supply voltage to the test circuit shall be set to 1,15 times the rated breaking voltage and the loading impedance shall be adjusted to give the current indicated in 7.4.2.

For the tests with ohmic load, the loading impedance consists of a pure resistance and, for the test with inductive load (cos φ = 0,4), it consists of a resistance and inductance in series (if an air-core inductor is used a resistor passing at least 0,6 % of the coil current shall be connected in parallel with it).

Three tests shall be carried out with different output elements (or sets of switch contacts) in accordance with 7.4.3.1, namely

- 30 000 operations with ohmic load;
- 30 000 operations with inductive load;
- 75 000 operations with no load.

For the test of the maximum demand indicator switch contacts (or their electronic equivalent), the supply voltage to the test circuit shall be set to the rated breaking voltage. The loading impedance consists of a resistance and inductance in series in order to get a power factor of 0,5. The current in the test circuit has to be adjusted to such a value that, under rated breaking voltage, the apparent power obtained is 20 VA. The number of operations to be carried out is related to the shortest programmable integration period but has to be at least 400 000.

The time between the changes of state shall be set:

- for load switches and tariff switches with a frequency not exceeding 6 switching operations per minute;
- for maximum demand indicator switches with a frequency not exceeding 1 switching operation per second;

The test is passed if after these tests the power loss of the output elements under rated breaking current does not exceed 3 W or the voltage drop across the output elements does not exceed 1 V and the open contact can withstand an a.c. test voltage of 1 000 V r.m.s. for 1 min.

7.4.3.3 Test of number of operations of low rating d.c. switches (30 V, 30 mA)

The switch shall be tested with the fully assembled tariff and load control equipment under reference condition and shall be connected in a test circuit, which comprises essentially the supply source and a resistive load. The supply voltage to test the circuit shall be set at 34,5 V and the resistive load adjusted for a current of 30 mA.

The number of operations to be carried out has to be at least 400 000.

The changes of state shall be at the rate of one switching operation per second.

The test is passed if, after this test, the switch meets the requirements of 7.4.2.

7.4.4 Short-circuit performance

7.4.4.1 Requirements

The short-circuit performance of output elements shall be determined by the characteristics of the supply fuse so that

a) with a prospective short-circuit current of 7 kA r.m.s., cos φ 0,5, it ensures that the surroundings of the tariff and load control equipment are not endangered and that protection against indirect contact is assured in all cases;

b) with a prospective short-circuit current of 3 kA r.m.s., cos φ 0,8, the output element still operates under specified conditions.

The characteristics of the supply fuse are to be agreed upon case by case.

Protection against indirect contact must also be assured after the application of a short-circuit from a source with a prospective current of 7 kA r.m.s. through a supply fuse with a rating corresponding to the rated breaking current.

NOTE 1 The rated breaking current of the output element is often greater than the rated current of the supply fuse which gives the stated short-circuit performance. The user can use the switch contacts in one of two different ways:

– either according to the (higher) rated, breaking current, in which case damage may occur to the contacts as a result of a short circuit, although the probability of such damage is small in practice;

– or according to the short-circuit performance stated above.

NOTE 2 The short-circuit test is not applicable to the low rating d.c. switch (30 V, 30 mA) and for load switches up to a breaking current of 2 A.

7.4.4.2 Test of short-circuit performance

The output elements shall be tested in a test circuit comprising the series connection of the following elements:

– a current source with a prospective short-circuit current of

  7 kA r.m.s. with cos φ = 0,5

  or

  3 kA r.m.s. with cos φ = 0,8;

– a fuse;

– a switch closing at zero voltage crossover;

– the closed contact of the output switch.

The climatic conditions during the test shall have the reference values given in Annex B.

Stage 1: Test with a fuse corresponding to the rated breaking current.

(Fuse to conform to IEC 60269-3-1, with a rated current equal to, or immediately above, the rated breaking current of the switch)

Three short-circuit tests shall be carried out with a prospective short-circuit current of 7 kA r.m.s. The test is passed if the protection against indirect contact remains assured. The contacts may weld.

Stage 2: Test with a fuse corresponding to the ability to withstand short-circuits.

(Fuse characteristics to be agreed on)

Three short-circuit tests shall be carried out with a prospective short-circuit current of 3 kA r.m.s. The test is passed if the output switch can still be operated. This functional check shall be made with one of the programmable sequences with the reference values of Annex B.

NOTE 1 If during stage 1 the contacts do not weld, stage 2 need not be carried out.

NOTE 2 The short-circuit test is not applicable to the low rating d.c. switch (30 V, 30 mA)) and for load switches up to a breaking current of 2 A.

7.4.5 Accuracy of maximum demand indicator switch

7.4.5.1 Requirements

The actual integration time of a maximum demand indicator switch shall not differ by more than 1 % from the set value. The maximum demand indicator (MDI) switch shall be active for the reset of the MDI during a time greater than 0,8 % and smaller than 1,2 % of the integration time.

7.4.5.2 Test

The maximum demand indicator switch of the tariff and load control equipment is connected to a standard counter/chronometer. The test is performed on 100 cycles. The maximum error must be, under these conditions, and after 100 cycles, lower than one integration period (<1 %).

7.5 Functional requirements and tests

See the relevant standard for particular requirements.

7.6 Electromagnetic compatibility (EMC)

7.6.1 Immunity to electromagnetic disturbances

Tariff and load control equipment shall be designed in such a way that conducted or radiated electromagnetic disturbances as well as electrostatic discharges do not damage or substantially influence the equipment.

NOTE Considering the electromagnetic environment of tariff and load control equipment, the following phenomena are relevant:

- electrostatic discharges;
- radiated, r.f. electromagnetic fields;
- fast transient burst;
- conducted disturbances induced by r.f. fields;
- surges;
- voltage dips and short interruptions;
- d.c. magnetic fields;
- a.c. magnetic fields;
- harmonics;
- interharmonics (ripple control receivers only);
- disturbing pulses (ripple control receivers only).

7.6.2 General test conditions

Unless otherwise specified, for all these tests the tariff and load control equipment shall be in its normal working position with the cover and the terminal cover in place. All parts intended to be earthed shall be earthed. The value of influencing quantities shall be at their reference values as given in Annex B.

After these tests, the equipment shall show no damage and operate correctly as specified in the relevant standards.

7.6.3 Test of immunity to electrostatic discharges

The test shall be carried out according to IEC 61000-4-2, under the following conditions:

- tested as table-top equipment;
- tariff and load control equipment in operating condition:
  - circuits energized with U_n;
  - without any current in the output elements.
- contact discharge;
- test voltage: 8 kV;
- number of discharges: 10 (in the most sensitive polarity);
- if contact discharge is not applicable because no metallic parts are outside, then apply air discharge with a 15 kV test voltage.

NOTE For insulation class II equipment, to simulate a single ESD event (either by air or by contact discharge), the charge on the EUT should be removed prior to each applied ESD pulse.

For acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

After application of the electrostatic discharge the tariff and load control equipment shall show no damage.

7.6.4 Test of immunity to electromagnetic r.f. fields

The test shall be carried out according to IEC 61000-4-3, under the following conditions:

- tested as table-top equipment;
- tariff and load control equipment in operating condition:
  - circuits energized with U_n;
  - without any current in the output elements.
- cable length, exposed to the field: 1 m;
- frequency band: 80 MHz to 2 000 MHz;
- test signal 80% amplitude modulated with a 1 kHz sinewave

For test levels and acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.5 Fast transient burst test

The test shall be carried out according to IEC 61000-4-4, under the following conditions:

- tested as table-top equipment;
- tariff and load control equipment in operating condition;
  - circuits energized with U_n;
  - without any current in the output elements.
- cable length between coupling device and EUT: 1 m
- the test voltage shall be applied only to the supply terminals of the tariff and load control equipment according to Figure 6 of IEC 61000-4-4 with coupling/decoupling network of Figure 4.
- test voltage: 4 kV;
- duration of the test: 60 s at each polarity.

For details of the test and acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.6 Test of immunity to conducted disturbances, induced by r.f. fields

The test shall be carried out according to IEC 61000-4-6, under the following conditions:

- tested as table-top equipment;
- tariff and load control equipment in operating condition;
  - circuits energized with U_n;
  - without any current in the output elements;
- frequency range: 150 kHz to 80 MHz;
- voltage level: 10 V.

For details of the test and acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.7 Surge immunity test

The test shall be carried out according to IEC 61000-4-5, under the following conditions:

- tariff and load control equipment in operating condition;
  - circuits energized with U_n;
  - without any current in the output elements;
- cable length between surge generator and EUT: 1 m;
- tested in differential mode (line-to-line);
- phase angle: pulses to be applied at 60° and 240° relative to zero crossing of a.c. supply;
- test voltage on the input circuits only: 4 kV, generator source impedance: 2 Ω;
- number of tests: 5 positive and 5 negative;
- repetition rate: maximum 1/min.

For details of the test and acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.8 Test of immunity to voltage dips and short interruptions

See the relevant standard for particular requirements.

7.6.9 Test of immunity to d.c. magnetic fields

The continuous magnetic field may be obtained by using the electromagnet according to Annex C, energized with a d.c. current. This magnetic field shall be applied to all accessible surfaces of the EUT when it is mounted for normal use. The value of the magneto-motive force applied shall be 1 000 At (ampere-turns).

For acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.10 Test of immunity to a.c. magnetic fields

The test shall be carried out by placing the tariff and load control equipment inside a coil of 1 m diameter and 400 ampere-turns (0,5 mT).

For acceptable behaviour during and after the tests, see the relevant standards for particular requirements.

7.6.11 Test of influence of harmonics

See the relevant standard for particular requirements.

7.6.12 Test of immunity to interharmonics

See the relevant standard for particular requirements.

7.6.13 Test of immunity to disturbing pulses

See the relevant standard for particular requirements.

7.7 Radio interference suppression

7.7.1 Requirements

The tariff and load control equipment shall not generate conducted or radiated noise, which could interfere with other equipment.

7.7.2 Test

The test shall be carried out according to CISPR 22, under the following conditions:

- for class B equipment;
- tested as table-top equipment;
- for connection of the power-supply circuits, an unshielded cable length of 1 m to each connector shall be used;
- tariff and load control equipment in operating condition:
  - supply circuit energized with reference voltage.

The test results shall comply with the requirements given in CISPR 22.

8 Test conditions and type test

8.1 Test conditions

All tests are carried out under reference conditions given in Annex B unless otherwise stated in the relevant clause.

8.2 Type test

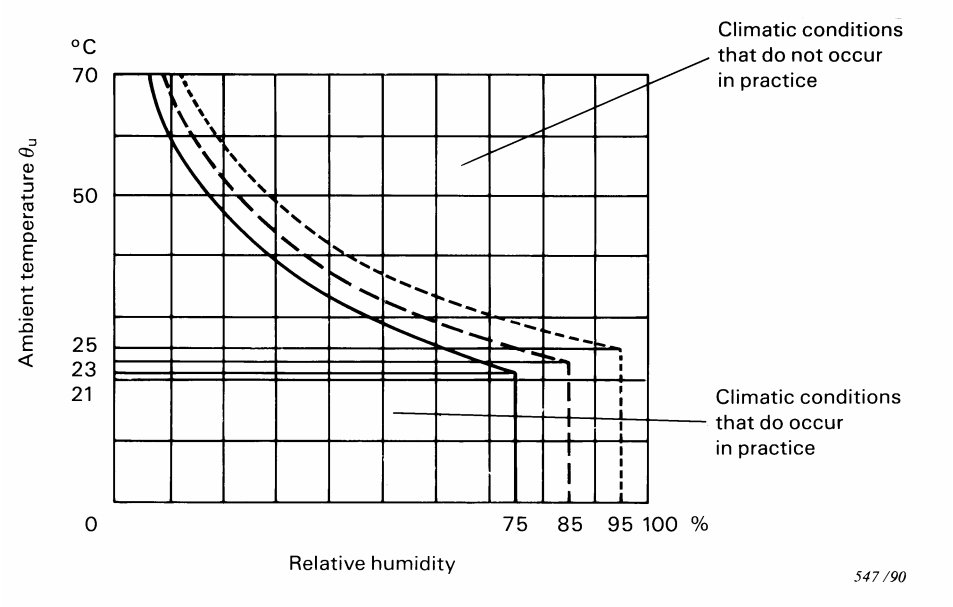
The type test defined in 3.9 shall be made on one or more specimens of the tariff and load control equipment, selected by the manufacturer, to establish its specific characteristics and to prove its conformity with the requirements of this standard.

A test schedule is given in Annex E.

In case of modifications to the tariff and load control equipment made after the type test and affecting only part of the equipment, it will be sufficient to perform limited tests on the characteristics that may be affected by the modifications.

Annex A
(normative)

Relationship between ambient air temperature and relative humidity



Limits for each of 30 days spread in a natural manner over one year

Limits occasionally reached on other days

Annual mean

Figure A.1 – Relationship between ambient air temperature and relative humidity

Annex B
(normative)

Reference and limiting values of the influence quantities

Table B.1 – Reference and limiting values

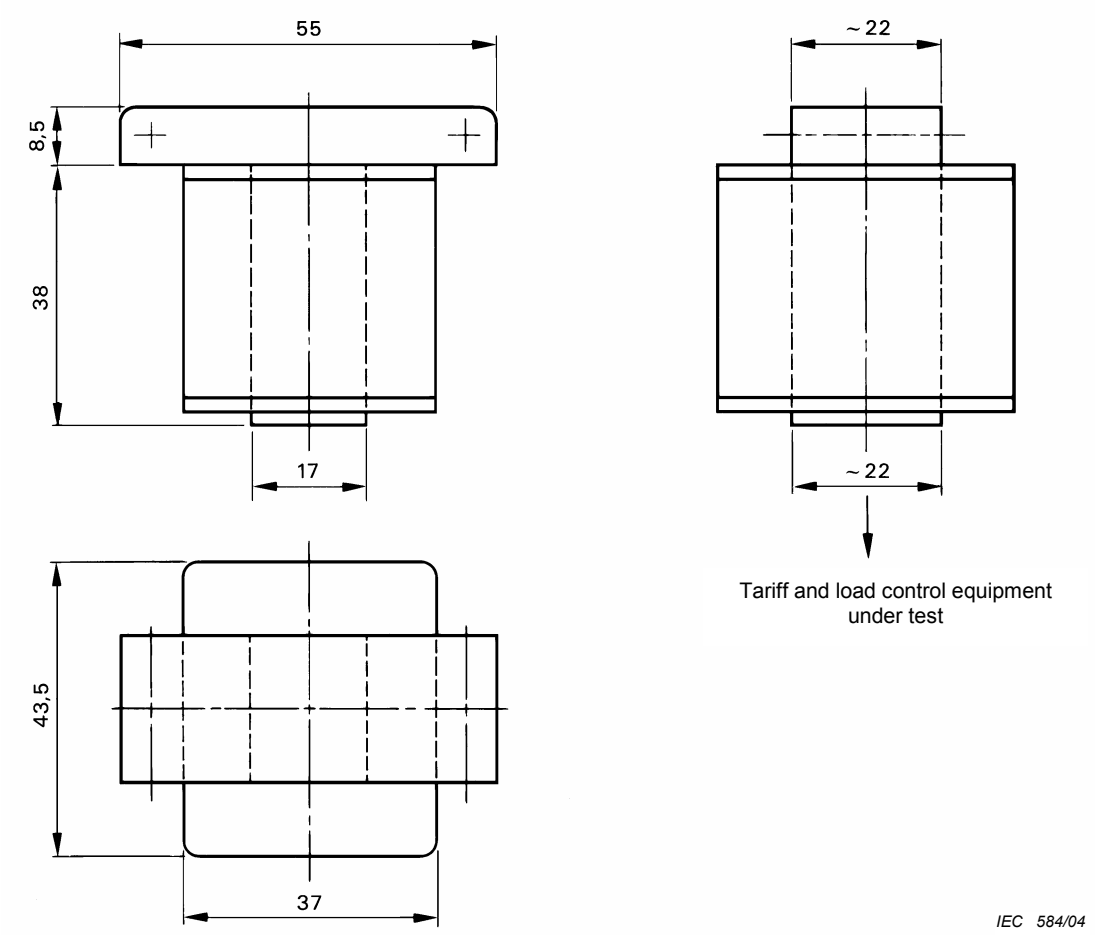
Influencing quantity		Reference value		Limiting values		
		Value	Tolerance [1]	Maximum value	Minimum value	Tolerance [1]
Supply voltage	[V]	U_n [1]	±1 %	1,15 U_n	0,80 U_n	± 1 %
Supply frequency	[Hz]	f_n [2]	±0,1	1,02 f_n	0,98 f_n	±0,1 %
Temperature	[°C]	+23	±3	+55	–25	±2
Relative humidity	[%]	65	±10 %	95 %		$^{0}_{-5}$ %

[1] U_n: the possible values of U_n are those stated in 4.1.

[2] f_n: the possible values of f_n are those stated in 4.2.

Annex C
(normative)

Electromagnet for testing the influence of externally produced magnetic fields



Dimensions in millimetres

Examples of winding : 500 turns 0,6 ∅ / 0,28 mm^2

or 1 000 turns 0,4 ∅ / 0,126 mm^2

Core laminations : 1,0 W/kg

Figure C.1 – Electromagnet for testing the influence of externally produced magnetic fields

Annex D
(informative)

Test set-up for EMC tests

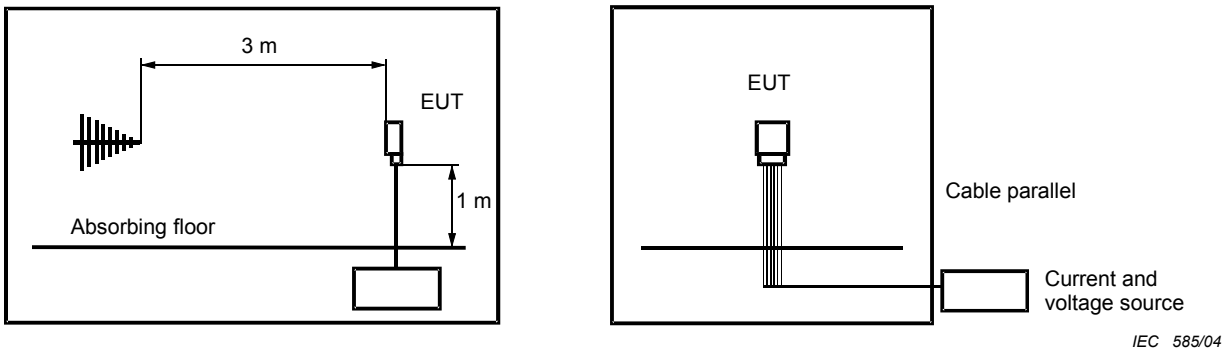
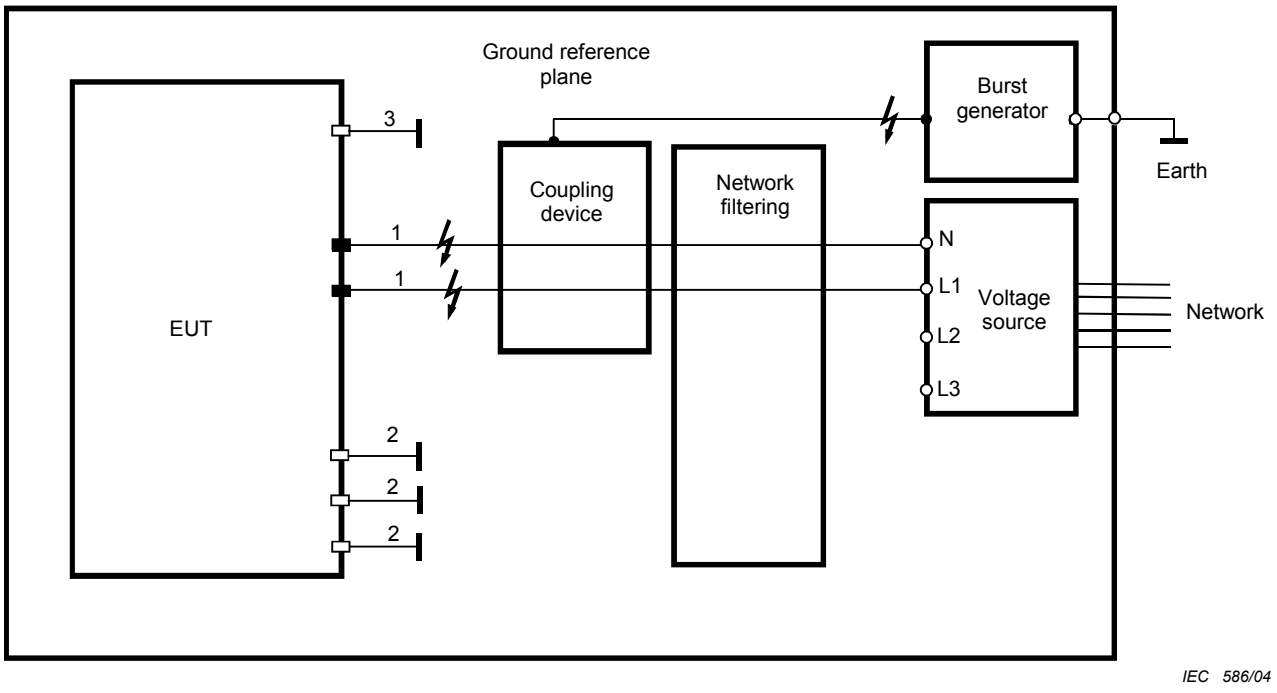


Figure D.1 – Test set-up for the test of immunity to electromagnetic r.f. fields

NOTE To obtain the test field strength of 30 V/m, it is possible to reduce the distance between antenna and EUT down to 1,5 m. In this case the adjustment of the amplifier must be controlled by a field sensor.



Key
1) Power-supply circuit
2) Output elements with a reference voltage above 40V
3) Output elements with a reference voltage below 40 V

Figure D.2 – Test set-up for fast transient burst test

Annex E
(informative)

Test schedule

Table E.1 – Test schedule

Nr.	Tests	Test of general requirements IEC 62052-21 Subclause	Test of particular requirements for ripple control receivers IEC 62054-11 Subclause	Test of particular requirements for time switches IEC 62054-21 Subclause
1	Tests of insulation properties			
1.1	Impulse voltage tests	7.3.2.2	X	X
1.2	AC voltage tests	7.3.2.3	X	X
2	Test of control performance requirements			
2.1	Operation	X	7.5.2.2	N.A.
2.2	Non-operation	X	7.5.3.2	N.A.
2.3	Correct operation within the tolerance of the message	X	7.5.5.2	N.A.
2.4	Variation of the supply frequency	7.1.2	X	X
3	Tests of time-keeping accuracy requirements			
3.1	Time switch supplied by mains	X	N.A.	7.5.2.3.2.1 7.5.2.3.3.1
3.2	Time switch on operation reserve	X	N.A.	7.5.2.3.2.2 7.5.2.3.3.2
3.3	Time-keeping accuracy with temperature	X	N.A.	7.5.2.3.3.3
4	Tests of electrical requirements			
4.1	Power consumption	7.1.3.2	X	X
5	Tests of output elements			
5.1	Number of operation of a.c. switches	7.4.3.2	X	X
5.2	Number of operation of low rating d.c. switches	7.4.3.3	X	X
5.3	Short-circuit performance	7.4.4.2	X	X
5.4	Accuracy of maximum demand indicator switch	7.4.5.2	X	X
6	Tests for electromagnetic compatibility (EMC)			
6.1	Radio interference suppression	X	7.7	7.7
6.2	Fast transient burst test	X	7.6.5	7.6.5
6.3	Immunity to electromagnetic r.f. fields	X	7.6.4	7.6.4
6.4	Immunity to conducted disturbances, induced by r.f. fields	X	7.6.6	7.6.6
6.5	Immunity to electrostatic discharges	X	7.6.3	7.6.3
6.6	Surge immunity test	X	7.6.7	7.6.7
6.7	Immunity to voltage dips and short interruptions	X	7.6.8	7.6.8
6.8	Immunity to d.c. magnetic fields	X	7.6.9	7.6.9
6.9	Immunity to a.c. magnetic fields	X	7.6.10	7.6.10
6.10	Immunity to harmonics	X	7.6.11	7.6.11
6.11	Immunity to interharmonics	X	7.6.12	N.A.
6.12	Immunity to disturbing pulses	X	7.6.13	N.A.

7	Tests of the effect of the climatic environments			
7.1	Dry heat test	6.3.1	X	X
7.2	Cold test	6.3.2	X	X
7.3	Damp heat cyclic test	6.3.3	X	X
8	Mechanical tests			
8.1	Vibration test	5.2.2.3	X	X
8.2	Shock test	5.2.2.2	X	X
8.3	Spring hammer test	5.2.2.1	X	X
8.4	Protection against penetration of dust and water	5.9.2	X	X
8.5	Resistance to heat and fire	5.8.2	X	X

X: The relevant test is defined in another part of the standard.

N.A.: Not applicable: the test is not relevant for the equipment which is subject to the standard.

Annex F
(informative)

Acceptance tests

F.1 General

The acceptance tests shall be carried out by the user or the supplier either as a 100 % test or as a sample test, as desired.

In a delivery batch of less than 50 tariff and load control equipment a 100 % test is preferable.

For sample tests, delivery batches of more than 1 200 tariff and load control equipment shall be subdivided into part batches of no more than 1 200 equipment each.

Acceptance tests shall comprise

a) functional tests as specified in the relevant standards for particular requirements;

b) a test of constructional requirements.

The following checks shall be made visually:

– design of the case;
– arrangements for electrical connections;
– creepage and clearance distances of the terminal block;
– indications to be shown on the tariff and load control equipment.

F.2 One hundred per cent test

The test referred to above shall be carried out on each tariff and load control equipment of the delivery batch.

Only the tariff and load control equipment without failures shall be accepted.

F.3 Sample tests

The tests referred to above shall be carried out on a sample of tariff and load control equipment chosen at random in the delivery batch.

The sample tests shall be carried out according to the rules of IEC 60410 with the following criteria:

– control level II (see Table I of IEC 60410);
– single sample plan (Table IIA); or
  double sample plan (Table IIIA);
– acceptable quality level (AQL) = 1,0 for each test separately.

Table F.1 – Single sample plan

Batch size	Sample size	Acceptance criterion	Rejection criterion
51 – 150	13	0	1
151 – 500	50	1	2
501 – 1 200	80	2	3

Table F.2 – Double sample plan

Batch size	Size of the first sample	Acceptance criterion for the first sample	Rejection criterion for the first sample	Size of the second sample	Acceptance criterion for the two samples together	Rejection criterion for the two samples together
51 – 150	13	0	1	–	–	–
151 – 500	32	0	2	32	1	2
501 – 1 200	50	0	3	50	3	4

Bibliography

IEC 60068-2-11:1981, *Environmental testing – Part 2: Tests – Test Ka: Salt mist*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 62053-61; 1998, *Electricity metering equipment (a.c.) – Particular requirements – Part 61: Power consumption and voltage requirements*

Standards Survey

The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!

Customer Service Centre (CSC)

International Electrotechnical Commission
3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC**/CSC at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

Nicht frankieren
Ne pas affranchir

Non affrancare
No stamp required

A Prioritaire

RÉPONSE PAYÉE

SUISSE

Customer Service Centre (CSC)
International Electrotechnical Commission
3, rue de Varembé
1211 GENEVA 20
Switzerland

Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.....

Q2 Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

purchasing agent ❑
librarian ❑
researcher ❑
design engineer ❑
safety engineer ❑
testing engineer ❑
marketing specialist ❑
other.....

Q3 I work for/in/as a: *(tick all that apply)*

manufacturing ❑
consultant ❑
government ❑
test/certification facility ❑
public utility ❑
education ❑
military ❑
other.....

Q4 This standard will be used for: *(tick all that apply)*

general reference ❑
product research ❑
product design/development ❑
specifications ❑
tenders ❑
quality assessment ❑
certification ❑
technical documentation ❑
thesis ❑
manufacturing ❑
other.....

Q5 This standard meets my needs: *(tick one)*

not at all ❑
nearly ❑
fairly well ❑
exactly ❑

Q6 If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

standard is out of date ❑
standard is incomplete ❑
standard is too academic ❑
standard is too superficial ❑
title is misleading ❑
I made the wrong choice ❑
other .....

Q7 Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

timeliness.....
quality of writing.....
technical contents.....
logic of arrangement of contents .....
tables, charts, graphs, figures.....
other .....

Q8 I read/use the: *(tick one)*

French text only ❑
English text only ❑
both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

ISBN 2-8318-7519-6

ICS 91.140.50

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND