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**Electricity metering (a.c.) –
Tariff and load control –**

**Part 21:
Particular requirements for time switches**



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Electricity metering (a.c.) – Tariff and load control –

Part 21: Particular requirements for time switches

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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



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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Standard electrical values	7
5 Mechanical requirements and tests	7
5.1 Dials.....	7
5.2 Digital display.....	7
6 Climatic conditions, requirements and tests	7
7 Electrical requirements and tests.....	7
7.1 Supply voltage.....	7
7.2 Heating	8
7.3 Insulation	8
7.4 Output elements	9
7.5 Functional requirements and tests – accuracy	9
7.6 Electromagnetic compatibility (EMC)	12
7.7 Radio interference suppression	15
8 Test conditions and type test.....	15
Annex A (informative) Acceptance tests	16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICITY METERING (AC) –
TARIFF AND LOAD CONTROL –****Part 21: Particular requirements for time switches**

FOREWORD

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International Standard IEC 62054-21 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

This standard, in conjunction with IEC 62052-21, 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 IEC 62052-21 and the relevant parts of the IEC 62059 series.

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

FDIS	Report on voting
13/1308/FDIS	13/1317/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.

IEC 62054 consists of the following parts, under the general title: *Electricity metering (a.c.) Tariff and load control*:

IEC 62054-11: Particular requirements for electronic ripple control receivers
(Replaces the particular requirements of IEC 61037.)

IEC 62054-21: Particular requirements for time switches
(Replaces the particular requirements of IEC 61038.)

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 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 below.

IEC 62052-21 Electricity metering equipment (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

(Replaces the particular requirements of IEC 61038.)

IEC 62059-11 Electricity metering equipment – Dependability – Part 11: General concepts

IEC 62059-21 Electricity metering equipment – Dependability – Part 21: Collection of meter dependability data from the field

IEC 62059-41 Electricity metering equipment – Dependability – Part 41: Reliability prediction¹

¹ To be published.

ELECTRICITY METERING (AC)– TARIFF AND LOAD CONTROL –

Part 21: Particular requirements for time switches

1 Scope

This part of IEC 62054 specifies particular requirements for the type test of newly manufactured indoor time switches with operation reserve that are used to control electrical loads, multi-tariff registers and maximum demand devices of electricity metering equipment.

The time switch keeps the real time, it may keep the date, it may be capable of handling leap years, it may support daylight saving, i.e. it modifies the deviation of local time to GMT according to the relevant regulations. The time switch may have a synchronization capability. The time switch also holds a schedule of switching actions, which may be specified in terms of time, day of the week, date within a month or a year. The time switch controls the output elements depending on the time and the schedule of switching actions stored.

This standard gives no requirements for constructional details internal to the time switch.

In the case where time switch functionality is integrated into multifunction electricity metering equipment, the relevant parts of this standard apply.

This standard covers time switches with analogue mechanical dials or electronic digital displays that are

- synchronous; or
- crystal-controlled.

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 A .

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

When using this standard in conjunction with IEC 62052-21, the requirements of this standard take precedence over those of IEC 62052-21 with regard to any item already covered in it.

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 62052-21:200X *Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 21: Tariff and load control equipment* ²

3 Terms and definitions

For the purposes of this document, the definitions of IEC 62052-21 apply.

² To be published.

4 Standard electrical values

The values given in IEC 62052-21 apply.

5 Mechanical requirements and tests

The requirements and tests specified in IEC 62052-21 and the following apply.

5.1 Dials

For time switches with analogue mechanical dials:

- the direction of rotation of the dials shall be marked by an arrow;
- the hour dial (if any) shall be capable of being read to the nearest minute;
- when required, the hours on the day dial and the days on the week dial should be marked in a different colour;
- all markings shall be indelible and easy to read.

5.2 Digital display

For time switches with electronic digital display:

- the display shall be easy to read. If the same display is used for displaying different values, then a code or other indication shall be displayed to enable each value to be identified;
- the display time of each displayed value shall be at least 6 s.

6 Climatic conditions, requirements and tests

The conditions, requirements and tests specified in IEC 62052-21 apply.

7 Electrical requirements and tests

7.1 Supply voltage

7.1.1 Supply voltage range

The values specified in IEC 62052-21 apply.

7.1.2 Supply frequency range

IEC 62052-21 applies.

7.1.3 Power consumption

IEC 62052-21 applies.

7.1.4 Voltage dips and short interruptions

See 7.6.8.

7.1.5 Long interruptions of supply voltage

7.1.5.1 Requirements

During an interruption of the supply voltage not exceeding the operation reserve, the time switch shall keep the time within the prescribed accuracy (see 7.5.2).

The output elements shall take up the position determined by the time switch programme within 5 s after the restoration of the nominal supply voltage.

If the length of the interruption of the supply voltage exceeds the operation reserve, the time may need to be re-adjusted. The time switch shall begin to execute the time switch programme within 6 h following the restoration of the supply. However, the user and the supplier may agree that, after a prolonged interruption of the supply voltage, the time switch does not restart, the outputs take up a pre-determined position and the time switch displays a special flag.

7.1.5.2 Test of effect of a long interruption of the supply voltage

For testing the time-keeping accuracy on operation reserve, see 7.5.2.3.

The test of the behaviour of the output elements consists of verifying that, after interrupting the supply voltage for an agreed length of time and when the supply is restored to the time switch, the output elements take up the position as determined by the time-switch programme, according to the indicated time.

This test shall be carried out for all possible positions of the output element(s).

The restoration of the supply voltage shall be made with the switching device free from bounce.

7.1.6 Operation reserve

7.1.6.1 Requirements

IEC 62052-21 applies.

7.1.6.2 Tests

For the test of time-keeping accuracy, see 7.5.2.

For the test of required behaviour of the output elements, see 7.1.5.2.

7.1.7 Life of back-up power supply

IEC 62052-21 applies.

7.1.8 Back-up power supply replacement

IEC 62052-21 applies.

7.2 Heating

IEC 62052-21 applies.

7.3 Insulation

IEC 62052-21 applies.

7.4 Output elements

IEC 62052-21 applies.

7.5 Functional requirements and tests – accuracy

7.5.1 Time setting and programming

7.5.1.1 Time switches with mechanical analogue dials

On a day dial, it shall be possible to set the time with an accuracy better than $\pm 7,5$ min. It shall be possible to programme the switching operations with a resolution of 15 min or smaller and it shall be possible to programme a minimum of two successive switching operations at least within 60 min.

On a week dial, it shall be possible to set the day of the week and the time with an accuracy better than 1 h. It shall be possible to programme the switching operations with a resolution of 2 h or smaller and it shall be possible to programme a minimum of 2 successive switching operations at least within 8 h.

On a year dial, it shall be possible to set the date and time with an accuracy better than 2 days. It shall be possible to programme the switching operations with a resolution of 4 days or smaller and it shall be possible to programme a minimum of 2 successive switching operations at least within 16 days.

7.5.1.2 Time switches with digital displays

It shall be possible to set the date and time (day, month, year, hours and minutes) with an accuracy of 5 s. The setting of the time shall reset the seconds to zero. If setting of the seconds is also available, then the setting of the time shall not reset the seconds to zero, but to the intended value.

NOTE In this case, it is preferable to display also the seconds.

If a daylight saving function is available, the time switch shall display the official time according to the regulations.

It shall be possible to set the switching operations with a resolution of 1 minute, 1 hour, 1 day, 1 month and 1 year.

7.5.2 Time-keeping accuracy

7.5.2.1 Requirements for synchronous time switches

Synchronous time switches shall have a time-keeping accuracy under normal operating conditions better than ± 5 s/30 days assuming that the supply frequency keeps its average on the nominal value.

On operation reserve, at reference temperature, the time-keeping accuracy shall be better than ± 120 s/day, if operation reserve is provided by a spring and better than ± 1 s/day if operation reserve is provided by a supercapacitor, rechargeable battery or primary cell.

7.5.2.2 Requirements for crystal controlled time switches

At reference voltage and reference temperature, crystal-controlled time switches shall have a time-keeping accuracy better than $\pm 0,5$ s/day. The variation of the time-keeping accuracy with the temperature shall be less than $(\pm 0,15$ s/ $^{\circ}\text{C}/24$ h).

On operation reserve, at reference temperature, the time-keeping accuracy shall be better than ± 1 s /day.

NOTE In applications where the time switch is used as part of a system providing time synchronization, the manufacturer and the purchaser may agree on relaxed time-keeping accuracy specifications for the time switch when it is operating in stand-alone mode. In this case, the system time is maintained by the time switch and the synchronization performed at the necessary intervals.

7.5.2.3 Test of time-keeping accuracy

7.5.2.3.1 General test conditions

Place the time switch under test in its normal operating position and, if necessary, in a climatic chamber, and supply it from an apparatus free of voltage dips and short interruptions. Unless otherwise indicated, the reference conditions shown in Annex B of IEC 62052-21 shall be maintained.

NOTE The manufacturer should provide a suitable means for testing the time-keeping accuracy. This could be, for example, an electrical or optical output, or, in the case of capacitor calibrated crystal-controlled time switches, an electromagnetic coupling picking up the signal from the crystal could be used.

7.5.2.3.2 Test of synchronous time switches

7.5.2.3.2.1 Test of synchronous time switches supplied by mains

The time switch under test is supplied together with and synchronised to a reference mains-controlled clock. After a testing period of 30 days, the time indication discrepancy between the reference clock and the time switch under test must be less than ± 5 s.

7.5.2.3.2.2 Test of synchronous time switches on operation reserve

The time switch to be tested is supplied together with, and synchronized to, a reference clock. Before the test, the time switch shall be powered for a suitable length of time, so that the operation reserve is fully available.

NOTE The manufacturer should specify the time necessary for keeping the time switch powered up before the test of operation reserve may commence.

The power supply of the time switch under test is switched off for 36 h. When the power supply is restored, the time-indication discrepancy between the reference clock and the time switch under test shall not be more than that calculated from the time-keeping accuracy on operation reserve multiplied by the length of the operating reserve.

NOTE Consequently, the time indication discrepancy should be less than

- ± 180 s for a spring reserve operated synchronous time switch;
- $\pm 1,5$ s for a battery, a primary cell or a supercapacitor reserve operated synchronous time switch.

The restoration of the voltage shall be made with the switching device free from bounce.

7.5.2.3.3 Test of crystal-controlled time switches

7.5.2.3.3.1 Test of crystal-controlled time switches supplied by mains

The time switch under test is supplied together with, and synchronized to, a reference crystal-controlled clock. After a testing period of 30 days, the time-indication discrepancy between the reference clock and the time switch under test must be less than ± 15 s.

7.5.2.3.3.2 Test of crystal-controlled time switches on operation reserve

The time switch to be tested is powered together with a reference clock. Before the test, the time switch shall be powered for a suitable length of time, so that the operation reserve is fully available.

NOTE The manufacturer should specify the time necessary for keeping the time switch powered up before the test of operation reserve may commence.

The power supply of the time switch under test is switched off for 36 h. When the power supply is restored, the time-indication discrepancy between the reference clock and the time switch under test shall not be more than that calculated from the time-keeping accuracy on operation reserve multiplied by the length of the operating reserve.

NOTE Consequently, the time indication discrepancy should be less than $\pm 1,5$ s.

The restoration of the voltage shall be made with the switching device free from bounce.

7.5.2.3.3.3 Test of time-keeping accuracy of crystal-controlled time switches with temperature

The time switch is placed in a climatic chamber and its time base is measured at $+23$ °C.

The temperature is set at $+45$ °C. After thermal equilibrium is obtained, the time-keeping accuracy shall be better than $\pm 3,3$ s/24 h plus the time-keeping accuracy measured at reference temperature (max. $\pm 0,5$ s/24 h).

NOTE The accuracy of the time base should not differ from the 23 °C measurement by more than $\pm 38 \times 10^{-6}$.

The temperature is then set at -10 °C. After thermal equilibrium is obtained the time-keeping accuracy shall be better than $\pm 4,95$ s/24 h plus the time-keeping accuracy measured at reference temperature (max. $\pm 0,5$ s/24 h).

NOTE The accuracy of the time base should not differ from the 23 °C measurement by more than $\pm 57 \times 10^{-6}$.

7.5.3 Switching accuracy

7.5.3.1 Time switches with dials

7.5.3.1.1 Requirements

On a day dial, the actual switching times shall not differ from the set times by more than $\pm 7,5$ min. The length of a full 24 h daily programme shall be 24 h \pm the time-keeping accuracy.

On a week dial, the actual switching times shall not differ from the set times by more than ± 60 min. The length of a full 168 h weekly programme shall be 168 h \pm the time-keeping accuracy.

On a year dial, the actual switching times shall not differ from the set times by more than ± 2 days. The length of a full 365 days yearly programme shall be 365 days \pm the time-keeping accuracy.

NOTE A non-cumulative variation of the length of the switching cycle resulting from the mechanical operation is acceptable.

The initial point of operation of a maximum demand indicator switch shall be manually adjustable, unless it is set automatically by the day dial.

7.5.3.1.2 Test

For testing the daily programme switching time accuracy, programme the time switch for a daily programme with at least 4 switching operations. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than $\pm 7,5$ min for each operation and that the length of the complete daily programme is 24 h \pm the maximum time-keeping accuracy.

For testing the weekly programme switching time accuracy, programme the time switch for a weekly programme with at least 4 switching operations. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than ± 60 min for each operation and that the length of the complete weekly programme is $168 \text{ h} \pm$ the maximum time-keeping accuracy.

For testing the yearly programme switching time accuracy, programme the time switch for a yearly programme with at least 4 switching operations. Advance the time and date to 2 days before the switching time. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than ± 2 days for each operation.

7.5.3.2 Time switches with digital displays

7.5.3.2.1 Requirements

The actual switching time shall not differ from the set times by more than ± 1 s.

If the time switch has a maximum demand indicator or load profile recorder control function, the start of the integration period shall be synchronized to an integer number of hours displayed.

7.5.3.2.2 Test

For testing the daily programme switching time accuracy, programme the time switch for a daily programme with at least 4 switching operations. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than ± 5 s for each operation and that the length of the complete daily programme is $24 \text{ h} \pm$ the maximum time-keeping accuracy.

For testing the weekly programme switching time accuracy, programme the time switch for a weekly programme with at least 4 switching operations. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than ± 5 s for each operation and that the length of the complete weekly programme is $168 \text{ h} \pm$ the maximum time-keeping accuracy.

For testing the yearly programme switching time accuracy, programme the time switch for a yearly programme with at least 4 switching operations. Advance the time and date to 1 h before the switching time. Observe that, during the execution of the programme, the difference between the actual switching time and the set time is less than ± 5 s for each operation.

7.5.4 Synchronization

If an external synchronization function is available, it shall be possible to synchronize the time switch to a system time with a maximum deviation of 5 s.

NOTE 1 Synchronization may be to the minute, to the integration period, or to a pre-set time. The synchronization may occur immediately or gradually, evenly spread during several integration periods.

NOTE 2 For testing, the manufacturer should provide a suitable test method.

7.6 Electromagnetic compatibility (EMC)

The requirements and values defined in IEC 62052-21 and the following apply.

7.6.1 Immunity to electromagnetic disturbances

IEC 62052-21 applies.

7.6.2 General test conditions

IEC 62052-21 applies.

7.6.3 Test of immunity to electrostatic discharges

In addition to IEC 62052-21, the following applies.

The application of the electrostatic discharge shall not produce any change in the time-indication discrepancy or in the position of the switch contact(s). It shall be verified that after the application of the static discharges, the programmed operations are correctly executed.

During the test, a temporary degradation or loss of function or performance is acceptable.

7.6.4 Test of immunity to electromagnetic r.f. fields

In addition to IEC 62052-21 the following applies.

- Field strength of the unmodulated signal 10 V/m

The application of the electromagnetic r.f. field shall not produce any change in the time displayed or in the position of the switch contact(s). The switching operations during the application of the electromagnetic r.f. field shall be performed correctly.

- Field strength of the unmodulated signal 30 V/m

During the test, a temporary degradation or loss of function or performance is acceptable. This could be a blinking display, unavailability of the setting controls, or a temporary change in accuracy. It can be also accepted that the switching operations do not occur during the disturbance. The time and the position of the outputs must be preserved.

It shall be verified that after the application and removal of the electromagnetic r.f. field, the programmed operations are correctly executed.

7.6.5 Fast transient burst test

In addition to IEC 62052-21, the following applies.

During the test, a temporary degradation or loss of function or performance is acceptable. This could be a blinking display, unavailability of the setting controls, or a temporary change in accuracy. It can be also accepted that the switching operations do not occur during the disturbance.

The time-indication discrepancy and the position of the outputs must be preserved. It shall be verified that after the test, the programmed operations are correctly executed.

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

In addition to IEC 62052-21, the following applies.

The application of the conducted r.f. disturbances shall not produce any change in the time displayed or in the position of the switch contact(s). The switching operations during the application of the conducted r.f. disturbances shall be performed correctly. It shall be verified that after the removal of the conducted r.f. disturbances, the programmed operations are correctly executed.

7.6.7 Surge immunity test

In addition to IEC 62052-21, the following applies.

The application of the surges shall not produce any change in the time displayed or in the position of the switch contact(s).

During the test, a temporary degradation or loss of function or performance is acceptable. This could be a blinking display, unavailability of the setting controls, or a temporary change in accuracy. It can be also accepted that the switching operations do not occur during the disturbance.

The time-indication discrepancy and the position of the outputs must be preserved. It shall be verified that, after the test, the programmed operations are correctly executed.

7.6.8 Test of immunity to voltage dips and short interruptions

7.6.8.1 Test of the effects of short interruptions and voltage dips

For these tests, the time switch is supplied together with and synchronized to a reference clock. A special equipment is inserted in the mains line of the time switch which will be able to submit the equipment under test to programmable short-supply interruptions and voltage dips without any bounce.

NOTE The manufacturer should provide a suitable means for testing the time-keeping accuracy. This could be, for example, an electrical or optical output or, in the case of capacitor calibrated crystal-controlled time switches, an electromagnetic coupling picking up the signal from the crystal could be used.

7.6.8.2 Effect of short-supply interruptions on synchronous time switches

The time switch under test is submitted to a sequence of 20 successive supply interruptions with at least 5 s intervals between these interruptions. The value of interruptions to be applied shall be 20 ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s and 2 s.

After each test, the time indication discrepancy between the time switch under test and the reference clock shall be less than the value shown in Table 1.

Table 1 – Maximum inaccuracies

Supply interruption length	20 ms	50 ms	100 ms	200 ms	500 ms	1 s	2 s
Maximum time indication discrepancy	400 ms	1 s	2 s	4 s	10 s	10 s	10 s

7.6.8.3 Effect of voltage dips on synchronous time switches

The time switch under test is powered by a supply voltage of 50 % of its rated value for 1 min.

After the test, the time-indication discrepancy between the time switch under test and the reference clock shall be less than 500 ms plus the inaccuracy due to working on operation reserve (± 1 ms for time switches with operation reserve provided by a primary cell, a supercapacitor or a battery and ± 125 ms for time switches with operation reserve provided by a spring).

7.6.8.4 Effect of short-supply interruptions on crystal-controlled time switches

The time switch under test is submitted to the same sequences of supply interruptions as described in 7.6.8.2. After each test, the time-indication discrepancy between the time switch under test and the reference clock shall be less than 400 ms.

7.6.8.5 Effect of voltage dips on crystal-controlled time switches

The time switch under test is powered as in 7.6.8.3. After the test the time-indication discrepancy between the time switch under test and the reference clock shall be less than 20 ms plus the inaccuracy due to working on operation reserve (1 ms).

7.6.9 Test of immunity to d.c. magnetic fields

In addition to IEC 62052-21, the following applies.

During the test the time switch must retain its operational capacities.

7.6.10 Test of immunity to a.c. magnetic fields

In addition to IEC 62052-21, the following applies.

During the test the time switch must retain its operational capacities.

7.6.11 Test of influence of harmonics

The time switch is supplied together with, and synchronized to, a reference clock. Ten per cent of the third harmonic is added to the power supply voltage of the time switch under test. The test is carried out over 30 days. At the end of the test, the time-indication discrepancy between the time switch under test and the reference clock shall be less than ± 7 s for synchronous time switches and less than ± 17 s for crystal-controlled time switches.

7.6.12 Test of immunity to interharmonics

This clause is not relevant for time switches.

7.6.13 Test of immunity to disturbing pulses

This clause is not relevant for time switches.

7.7 Radio interference suppression

IEC 62052-21 applies.

8 Test conditions and type test

IEC 62052-21 applies.

Annex A (informative)

Acceptance tests

The procedure described in IEC 62052-21 and the following apply.

Acceptance tests shall comprise

- a) a time-keeping accuracy test: rated supply voltage U_n , rated supply frequency f_n and at the reference values of the other influencing quantities (see Annex B of IEC 62052-21);
 - b) a test of setting accuracy;
 - c) a test of synchronization (if available).
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SUISSE

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International Electrotechnical Commission
3, rue de Varembe
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:

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