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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TECHNICAL COMMITTEE NO. 108:

SAFETY OF ELECTRONIC EQUIPMENT WITHIN THE FIELD OF AUDIO/VIDEO,
INFORMATION TECHNOLOGY AND COMMUNICATION TECHNOLOGY

Interpretations of IEC 60065, 6th edition.

With reference to document 92/80/INF, the following common opinions on interpretation questions are made available.

Interpretations on the following sub-clauses are included:

- * Sub-clause 1.1.3
- * Sub-clause 2.8.11
- Sub-clause 4.3.1
- Sub-clause 4.3.3
- Sub-clause 4.3.10
- * Sub-clause 8.8
- * Sub-clause 10.3
- * Sub-clause 14.2.5
- * Sub-clause 14.5.1.1
- * Sub-clause 14.6.2
- * Sub-clause 14.6.6: test condition
- Sub-clause 14.6.6: relays
- Sub-clause 14.6.6: application of voltage / current limits
- * Sub-clause 14.10.2
- Sub-clause 14.11
- Sub-clause 15.2

This document replaces document 92/82/INF.

Note:

The interpretations given in document 92/82/INF (see items above marked with an asterix) are included in this document.

Sub-clause 1.1.3: Requirements for altitude - clearances

Question:

Have the factors given in IEC 60664-1, table A.2 to be applied for the determination of clearances at altitudes above 2000 m?

With respect to the altitude the following requirements are given:

IEC 60065, 5th edition: standard applies to 2000 m only.

IEC 60065, 6th edition: standard applies to 2000 m only, for higher altitudes special measures might be necessary.

IEC 60065, 7th edition: standard applies to 2000 m only, for higher altitudes reference is made to IEC 60664-1, table A.2.

Examples of distances (clearance) for reinforced insulation:

As an example an altitude of 3500 m is taken. From Table A.2 of IEC 60664-1 a factor of 1,21 is found.

230 V mains:

5th edition: 6 mm

6th edition: 6 mm x factor?

7th edition: 4 mm x 1,21 = 4,84 mm

SMPS with V_{peak} 600 V:

5th edition: 6 mm

6th edition: 6 mm x factor 1,21? = 7,26 mm

7th edition: 5 mm x 1,21 = 6,05 mm

Interpretation of the WG:

For determining the additional clearance in case of altitudes above 2000 m, the values based on the 7th edition are applicable.

Rationale:

The 6th edition only indicates that special measures might be necessary. Since the clearance values in the 6th edition are not based on IEC 60664-1 also the factors according to table A.2 of IEC 60664-1 do not apply in this case.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 2.8.11: Potential ignition sources

Questions:

The interruption of a connection may cause interruption or short circuit of, for example, a semiconductor device and as a consequence the protective devices operate or the power supply shut down. In this case the open circuit voltage drops immediately to 0 V.

- 1) What is the time frame for checking the steady-state open circuit voltage?
- 2) Which voltage has to be taking into account in the evaluation of the potential ignition source?

Interpretations of the WG:

- 1) WG1 decided that the measurement shall be done any time after 1 s after opening the circuit.
- 2) WG1 decided that the maximum voltage shall be measured not earlier than 1 s after the interruption is made.

Rationale:

A minimum time is needed to obtain steady state.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 4.3.1:**Question:**

There is an obvious contradiction between sub-clause 4.3.1/4.3.2 and clause 13.1.
The short circuit according to 4.3.1 and 4.3.2 seem to apply in all cases, however, in 13.1 an exception is introduced.
It is requested to clarify and modify in case this observation is correct.

Interpretation by TC 108/TT92/MT1:

The observation is correct.

Sub-clause 4.3.1 should read as follows:

Except for insulation between parts of different polarity DIRECTLY CONNECTED TO THE MAINS, short-circuit across CLEARANCES and CREEPAGE DISTANCES if they are less than the values specified in clause 13 for BASIC and SUPPLEMENTARY INSULATION.

Rationale:

Clause 4.3.1 of Ed. 5 has been split when producing Ed. 6. The first paragraph was kept in 4.3.1 but editorially modified; the rest was moved to clause 13.

Sub-clause 13.1 of Ed. 5 was reworded and moved to sub-clause 13.1.1 of Ed. 6.

Clause 4.3.1 is about short-circuiting CLEARANCE and CREEPAGE DISTANCE for BASIC INSULATION and SUPPLEMENTARY INSULATION.

Only clause 13.1.1 refers specifically to clause 4.3.1.

Except for insulation between parts of different polarity DIRECTLY CONNECTED TO THE MAINS the 3rd paragraph of 13.1.1 of IEC 60065 Ed. 6 allows for a smaller CLEARANCE. For those smaller distances 4.3.1, 4.3.2 and 11.2 are referenced.

Sub-clause 4.3.1 is not correctly formulated because the exception of 13.1.1 is not repeated here.

Action:

The interpretation above is proposed to be introduced in amendment 1 to IEC 60065, 7th edition.

Sub-clause 4.3.3:**Question:**

Is the NOTE to sub-clause 4.3.3 applicable to tubes with pressed-glass seals?

The first dashed item of 4.3.3 refers to 'heaters of electronic tubes' and the clause begins with a reference to 'short-circuit or, if applicable, interruption'. Interruption is, in fact, normally only applicable to heaters and the interruption of one heater in a chain of heaters connected in series can cause a hazard.

The application of test short-circuits to parallel-connected tube heaters in low-power equipment, if carried out, results in operation of the primary circuit fuse(s). However, in high-power audio amplifiers using tubes (for which there is a significant and growing market), this is not necessarily the case. The inclusion of fuses directly in the heater circuits results in unreliability due to the stresses on the fuse cause by the high inrush currents drawn by the heaters. These inrush currents last longer than those experienced in the primary circuits of electronic products.

Heater short-circuits could be caused in tubes with pinch-seals and moulded bases by failure of the bond between base and envelope and subsequent rotation of the envelope relative to the base, thus twisting the lead-out wires together inside the base.

Short-circuit failures of heaters in tubes with pressed-glass seals, which are used in the above-mentioned amplifiers, are of exceedingly rare occurrence, and test data with contrived short-circuits shows that such a short-circuit clears without hazard in a very short time.

Interpretation by TC 108/TT92/MT1:

The NOTE to this sub-clause is applicable to the short-circuiting of heaters of tubes with pressed-glass seals and for that reason no short-circuit test is needed.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 4.3.10:**Question:**

Experience has shown that testing in accordance with 4.3.10 has created problems.

Examples given in the dashed paragraphs have resulted in different interpretations with regard to performance of the testing.

It is requested to provide guidance on the testing.

Interpretation by 108/TT92/MT1:

MT1 is of the opinion that clause 4.3.10 should be understood as follows:

Surfaces having ventilation openings that are likely to be obstructed simultaneously shall be covered one at a time with a piece of semi-rigid sheet material and tested. No test is to be applied to sloped surfaces with an angle greater than 30° from the horizontal.

The following modification addresses this problem.

The top, sides and the back of an apparatus, if such surfaces have ventilation openings, shall be covered one at a time with a piece of card of 200 g/m² density with dimensions not less than each tested surface, covering all openings.

Openings on different surfaces on top of the apparatus (if any) are covered simultaneously by separate pieces of card.

Openings on top of the apparatus, on a surface inclined at an angle greater than 30 degrees to the horizontal, from which an obstruction is free to slide, are excluded.

On the back and the sides of the apparatus, the card is attached to the upper edge and allowed to hang freely.

Note There is no test for the bottom surface.

Rationale:

Complete obstruction of openings on the rear and both sides at the same time is not likely to occur. Moreover it is not likely that an object obstructing the ventilation will remain in place on a sloped surface.

Covering the openings on the top simultaneously by separate pieces of card is the possible way to ensure reproducibility of testing. In a case of the top having form of a "stairs" with for example two steps plus a slope (more or less than 30 degrees) use of one piece of card or material would inevitably lead to different results at different test houses.

Action:

The above modification is proposed to be introduced in amendment 1 to IEC 60065, 7th edition.

Sub-clause 8.8: Use of non-separable thin sheet insulation:

Question:

Current technology is utilising non-separable thin sheet insulation within transformers for the provision of supplementary and /or reinforced insulation.

How should such non-separable insulation be assessed for suitability in these applications?

Interpretation of the WG:

The current published requirements in the standard do not adequately address the use on non-separable thin sheet insulation.

The following amendment to the standard will be published to address this issue:

add to clause 8.8

For requirements for non-separable thin sheet insulation in two or more layers, see 8.xx

add new clause 8.xx

8.xx Requirements for non-separable thin sheet insulation in two or more layers

Three separate test specimens of the sheet, of 70 mm, width shall be supplied by the manufacturer.

The test is carried out by fixing a specimen on a mandrel made of steel, nickel plated, or brass with smooth surface finish as shown in figure x.

A metal foil (aluminium or copper) $0,035 \text{ mm} \pm 0,005 \text{ mm}$ thick shall be placed close to the surface of the specimen and submitted to a pull of 1 N. The metal foil shall be so positioned that its edges are 20 mm away from the edge of the specimen and, when the mandrel is in its final position, it covers the edges upon which the specimen is lying by at least 10 mm. The specimen is submitted to a pull of 150 N at its free end by an appropriate clamping device.

The specimen shall be slowly rotated forwards and backwards three times by 230° without jerks. If the specimen breaks at the clamping device during the rotation, the test is repeated. If one or more specimens break at any other place, the test is not fulfilled. While the mandrel is in its final position, within the minute following the final positioning, a test voltage of 1,5 times the value specified in table 5 is applied, as described in 10.3.2, between the mandrel and the metal foil.

No flashover or breakdown shall occur during the test; corona effects and similar phenomena being disregarded.

add new Figure x (Figure 6 of IEC 61558-1)

Rationale:

The test on thin foil according to the transformer standard IEC 61558-1 is considered to cover this kind of thin sheet sufficiently.

Action:

The above amendment is proposed to be introduced in amendment 1 to IEC 60065, 7th edition.

Sub-clause 10.3: Resistors bridging insulation.**Question:**

Subclause 10.3 requires an insulation resistance of 2 MOhm between parts of different polarity directly connected to the mains.

Is a discharge resistor with a value of less than 2 MOhm (for example 100 kOhm) across the mains acceptable?

Is disconnection of the resistor during the measurement of insulation resistance and dielectric strength test allowed in case the resistor complies with subclause 14.1?

Interpretation of the WG:

There is no requirement for the minimum value of such discharge resistor which, if in compliance with subclause 14.1, can be disconnected during the tests of subclause 10.3.

Rationale:

The standard does not prescribe minimum impedance of the parts connected to the mains.

In the case of a linear transformer connected to the mains, an impedance of 10 Ohm is possible.

The reason for the 2 MOhm requirement is related to insulation, such as printed boards, which could cause arcing and fire in case of becoming low resistance.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 14.2.5: Applicability**Question:**

Does sub-clause 14.2.5 apply in addition to the sub-clauses 14.2.1, 14.2.2 and 14.2.3?

Interpretation of the WG:

Sub-clause 14.2.5 applies to those capacitors not covered by 14.2.1, 14.2.2 and 14.2.3.

Rationale:

The above mentioned sub-clauses already include requirements for passive flammability by the reference to IEC 60348-14.

Action:

No action regarding the text in IEC 60065 is needed (will be covered by IEC 60065, 7th edition).

Sub-clause 14.2.5:**Question:**

After the short circuit of the capacitor the protective devices operate or the power supply shut down and current through the simulated short circuit decrease immediately to 0 A.

What is the time frame for checking the steady state short circuit current?

Interpretation of the WG:

WG1 decided that the measurement shall be done any time after 1 s after short circuiting the circuit.

Rationale:

A minimum time is needed to obtain steady state.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 14.5.1.1, 2nd dash:**Question:**

Sub-clause 14.5.1.2, 2nd dash states that the characteristics of the thermal link with regard to the circuit conditions (reference to IEC 60691, 6.2) shall be appropriate for the application in the apparatus.

Do we accept such thermal links in the transformer that are evaluated only resistively in IEC 60691?

Interpretation of the WG:

The assumption may not be correct, see also the 3rd paragraph. A resistive impedance of the secondary is transformed to the primary, especially under fault conditions. The resistive aspect is much more significant than the inductive aspect. Therefore, the text is taken to be correct. Inductive types of thermal links are more used for heavy motors.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 14.6.2: Application of switches**Question:**

Can we consider the below-described function as "capable of being switched-off automatically and without human intervention at the time of switching"?

Description:

The product's power consumption is more than 15W and no manually operated mechanical switch is applied.

The player consists of a CDR loader, CD changer and a hard-disc drive.

On this hard disc drive music can be stored in the MP-3 format.

Function: After down-loading a CD disc on the hard disc, the user may switch the player into the off/stand-by mode but the player will (or has to) complete first several MP-3 conversion activities on the hard-disc which take several minutes (might be up to 1/2 h). When the MP-3 conversion on the hard disc has been completed the player will automatically switch-off to the low power consumption/stand-by mode.

Because of this we cannot have a manually operated mechanical switch which is switching off the power, so we would like to make use of the exceptions as given in clause 14.6.2 of the IEC60065, 6th edition.

Interpretation of the WG:

No switch is required in this case.

Rationale:

In this case the switching-off is controlled by a data link. Data links can exist between apparatus as well as within one apparatus.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 14.6.6 a): test condition**Question:**

Subclause 14.6.6 a) gives the requirements for the switch as a separate component. Do we have to take into account the ambient rating for the switch when it is used in the equipment?

Interpretation of the WG:

The ambient temperature of the area of the switch has to be taken into account.

Action:

No action regarding the text in IEC 60065 is needed.

Sub-clause 14.6.6: relays**Question:**

Which flammability requirements apply to a relay operating at a maximum voltage of 250 V and intended to be mounted on a PCB.

In particular it is questioned if clause 20 of IEC 60065, 6th edition applies and if so, which sub-clause.

Interpretation by 108/TT92/MT1:

IEC 60065, 6th edition, sub-clause 20.1.1, states that in case no flammability requirements are given in clause 14, the flammability requirements according to 20.1.4 apply. This results in a flammability category of FH-3-40. In the 7th edition it would result in a flammability category of HB75 or V1 depending on the application in the end product.

In case we consider a relay to be a switch, the flammability requirement given in 14.6.6 would result in V0.

The interpretation of TC 108/MT1 is as follows:

The dust cap and the base of a mains relay have to fulfil the V0 requirements, except as provided in 20.1.a.

Rationale:

Pending a final proposal for the relays, the flammability requirements for mains relays should be the same as for mains switches.

Action:

A modification will be introduced in amendment 2 to IEC 60065, 7th edition.

Sub-clause 14.6.6: application of voltage / current limits**Question:**

The first paragraph after the note is not consistent with the requirements given under b). By changing this paragraph, the note becomes superfluous.

Interpretation by 108/TT92/MT1:

The first paragraph after the note should be interpreted as follows:

Manually operated mechanical switches which either

- control currents exceeding 0,2 A r.m.s a.c.. or d.c, or
 - have voltage across the open switch contacts exceeding 35 V (peak) a.c. or 24 V d.c.
- shall meet one of the following requirements:

Rationale:

To be in line with the note and the requirements under b).

Action:

This modification will be proposed for the amendment 1 to IEC 60065, 7th edition.

Sub-clause 14.10.2:**Question:**

Clause 14.10.2 states in part that an apparatus with a charging circuit that is provided with rechargeable batteries shall be provided with a special battery pack with special means provided to prevent the recharging of non-rechargeable cells.

- a) It is assumed that a "special" adaptor for standard sized (C, D, AA, etc) non-rechargeable batteries does not meet the intent of this requirement. Is this assumption correct?
- b) Is a special detection circuit accepted in lieu of a mechanical means as identified in the example in the requirement?

Interpretation of the WG:

The answer in both cases is yes.

Action:

No action regarding the text of IEC 60065 is needed.

Sub-clause 14.11: Optocouplers**Question:**

IEC 60065, 7th edition has deleted the note in 14.11 of the 6th edition and introduced an alternative for testing jointed insulation.
Does this apply to the 6th edition as well?

Interpretation by 108/TT92/MT1:

The modification in the 7th edition was made in order to align with IEC 60950.
MT1 is of the opinion that this modification should apply to the IEC 60065, 6th edition as well.

As an alternative for the compliance to 13.1.1, jointed insulation can be tested according to 13.1.2.

Action:

No action is needed since already covered by the 7th edition.

Sub-clause 15.2: Supply apparatus of Class I**Question:**

There is an obvious contradiction between sub-clause 15.2, 3rd paragraph and the requirements in IEC 60950.

Why does IEC 60065 not allow earthed secondary circuits of Class 1 supply apparatus, whilst IEC 60950 does allow it?

It is requested to clarify and modify in case this observation is correct.

Interpretation by 108/TT92/MT1:

The observation is correct.

The 3rd paragraph of 15.2 should not be applied and should be deleted.

Rationale:

- The IEC 60950 allows secondary circuits to be earthed, whilst the IEC 60065 explicitly states that earthing of the secondary circuit of a Class I supply apparatus is not allowed (3rd par. of 15.2).
- Application of this paragraph created difficulties and confusion to manufacturers and test houses, in case a PSU according to IEC 60950 is used for a product that is under the scope of IEC 60065.
- A Class I apparatus with earthed secondary parts is accepted by IEC 60065, so it is illogical not to accept a similar Class I product with separate supply apparatus.
- PELV circuits are earthed by definition.

Action:

The deletion of this paragraph will be proposed for the amendment 1 to IEC 60065, 7th edition.
