IEC 61558-2-10

Edition 1.0 2014-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 2-10: Règles particulières et essais pour les transformateurs d'isolement à enroulements séparés à niveau d'isolement élevé et pour les transformateurs d'isolement à enroulements séparés à tensions secondaires supérieures à 1 000 V

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SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

FOREWORD

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International Standard IEC 61558-2-10 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units, and combinations thereof.

This first edition cancels and replaces Chapter II Section Three of IEC 60989 published in 1991.

It constitutes a technical revision. The main changes consist of

a) updating this part in accordance with IEC 61558-1:2005, and
b) adding **power supply units** to the scope.

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

FDIS	Report on voting
96/407/FDIS	96/408/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.

This Part 2-10 is intended to be used in conjunction with the latest edition of IEC 61558-1 and its amendments. It is based on the second edition (2005) of that standard and its Amendement 1 (2009).

This Part 2-10 supplements or modifies the corresponding clauses in IEC 61558-1, so as to convert that publication into the IEC standard: *Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V*.

A list of all parts of the IEC 61558 series, under the general title: *Safety of transformers, reactors, power supply units and combinations thereof*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

When a particular subclause of Part 1 is not mentioned in this part, that subclause applies as far as is reasonable. Where this part states "addition", "modification" or "replacement", the relevant text of Part 1 is to be adopted accordingly.

In this part, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type*;
- explanatory matters: in smaller roman type.

In the text of this part the words in **bold** are defined in Clause 3.

Subclauses, notes, figures and tables additional to those in Part 1 are numbered starting from 101; supplementary annexes are entitled AA, BB, etc.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months from the date of publication.

The transitional period is not longer than 3 years after the publication of this standard.

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SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **separating transformers** with high **insulation level** and **separating transformers** with **output voltages** exceeding 1 000 V. **Transformers** incorporating **electronic circuits** are also covered by this standard.

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** covers **separating transformers with high insulation level** and **separating transformers** with **output voltages** exceeding 1 000 V a.c or 1 500 V d.c .

This Part 2-10 is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry-type transformers.** The windings may be encapsulated or non-encapsulated.

This standard is applicable to **transformers** and **power supply** (linear) with **internal operational frequencies** not exceeding 500 Hz.

This standard used in combination with Part 2-16 for **switch mode power supply units** (**SMPS**) is also applicable to power supplies with **internal operational frequencies** higher than 500 Hz. Where the two requirements are in conflict the most severe take precedence.

The **rated supply voltage** does not exceed 1 000 V a.c., and the **rated supply frequency** and the **internal operating frequency** do not exceed 500 Hz.

The **rated output** does not exceed:

– 25 kVA for single-phase **transformers;**
– 40 kVA for polyphase **transformers.**

This Part 2-10 is applicable to **transformers** without limitation of the **rated output** subject to an agreement between the purchaser and the manufacturer.

Where applicable the **no-load output voltage** or the **rated output voltage:**

– does not exceed 1 000 V a.c. or 1 500 V d.c. for **separating transformers with high insulation level;**
– does exceed 1 000 V a. c or 1 500 V d.c. and does not exceed 15 000 V a.c. or 15 000 V d.c. for **separating transformer** with **output voltage** exceed 1 000 V.

This Part 2-10 is not applicable to:

– **transformers** covered by IEC 60076-11;

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– neon **transformers** covered by IEC 61050 and

– **power supplies** and converters for use with or in products according to IEC 61347-2-10.

This Part 2-10 is not applicable to external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

Transformers covered by this Part 2-10 are used only in applications where **double or reinforced insulation** between circuits is not required by the installation rules or by the end product standard.

NOTE 2 Normally, the **transformers** are intended to be used with equipment to provide voltages different from the **supply voltage** for the functional requirements of the equipment. The protection against electric shock can be provided (or completed) by other features of the equipment, such as the **body**. Parts of **output circuits** can be connected to the **input circuits** or to **protective earth**.

This Part 2-10 is applicable to **transformers** associated with specific equipment, to the extent decided upon by the relevant IEC technical committees.

NOTE 3 Attention is drawn to the following:

– for **transformers** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) can be necessary;

– measures to protect the **enclosure** and the components inside the **enclosure** against external influences such as fungus, vermin, termites, solar-radiation, and icing can also be considered;

– the different conditions for transportation, storage, and operation of the can also be considered;

– additional requirements in accordance with other appropriate standards and national rules can be applicable to **transformers** intended for use in special environments, such as tropical environment.

NOTE 4 Future technological development of **transformers** can necessitate a need to increase the upper limit of the frequencies, until then this Part 2-10 can be used as a guidance document.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*
Amendment 1:2009

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

The third paragraph is not applicable.

3.1 Transformers

Addition:

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3.1.101
separating transformer with high insulation level
a **separating transformer** where the **output voltage** does not exceed 1 000 V a.c or 1 500 V d.c and does exceed 50 V a.c or d.c for **independent transformer**

Note 1 to entry: **The output winding(s)** are isolated from both, **input winding(s)** and **body** for a **working voltage** exceeding 1 000 V. a.c or 1 500 V d.c but not exceeding 15 000 V a.c or 15 000 V d.c.

3.1.102
separating transformer with output voltages exceeding 1 000 V
a **separating transformer** the **output circuits** of which are designed to give **voltages** exceeding 1 000 V a.c or 1 500 V d.c and not exceeding 15 000 V a.c or 15 000 V d.c

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

This clause of Part 1 is not applicable.

Replacement:

6.101 The **rated output voltage** is limited as follows:

For **separating transformers with high insulation level**:

– the **no-load output voltage** or the **rated output voltage** shall not exceed 1 000 V a.c. or 1 500 V d.c.;

for **independent transformers** the **rated output voltage** shall exceed 50 V a.c. or d.c. and this **output voltage** applies even when **output windings**, not intended for interconnection, are connected in series.

For **separating transformers with no load output voltages exceeding 1 000 V**:

– the **rated output voltage** shall exceed 1 000 V a.c. or 1 500 V d.c. and shall not exceed 15 000 V a.c. or 15 000 V d.c.;
– for **independent transformers** this **output voltage** limitations applies even when **output windings**, not intended for interconnection, are connected in series.

6.102 The **rated output** shall not exceed:

– 25 kVA for single-phase **transformers;**
– 40 kVA for polyphase **transformers;**

Transformers without limitation of the **rated output** shall be subject to agreement between the purchaser and the manufacturer.

6.103 The **rated supply frequency** and the **internal operating frequencies** shall not exceed 500 Hz.

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6.104 The **rated supply voltage** shall not exceed 1 000 V a.c.

Compliance with the requirements of 6.101 to 6.104 is checked by inspection of the marking.

7 Classification

This clause of Part 1 is applicable.

8 Marking and other information

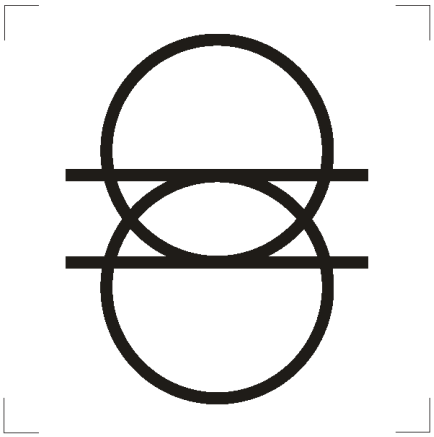
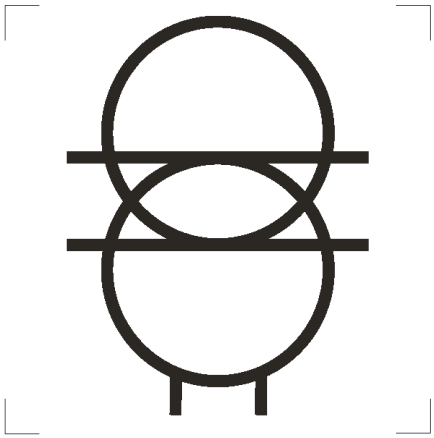
This clause of Part 1 is applicable except as follows:

8.1 h) *Replacement*:

Replace the first sentence by the following: relevant graphical symbols shown in 8.11 indicating the kind of **transformer**;

The voltage of the **insulation level**, expressed in kV is not a part of the symbol

8.11 *Addition:*

Symbol or graphical symbol	Explanation or title	Identification
	**Separating transformer**, high insulation level, general To identify the separating transformer with high insulation level, where the letter "F" may be used adjacent to the symbol to indicate a fail-safe function. The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol.	IEC 60417-6063
	**Separating transformer**, high insulation level, non-short-circuit-proof To identify the non-short-circuit-proof separating transformer with high insulation level. The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol	IEC 60417-6064

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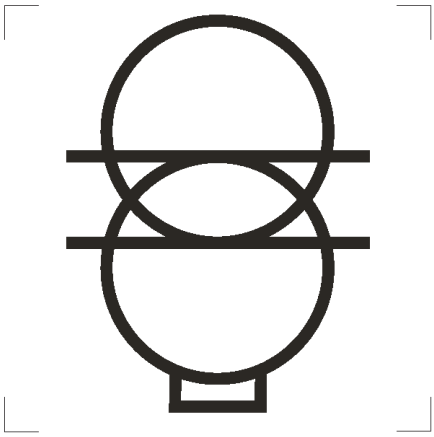
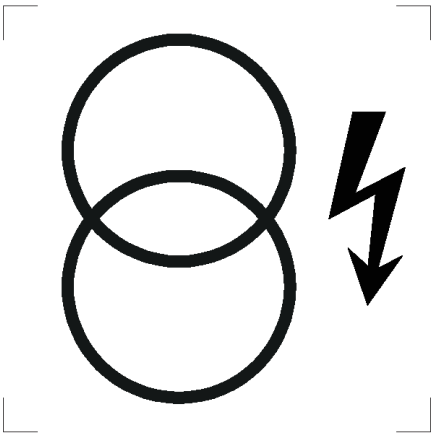
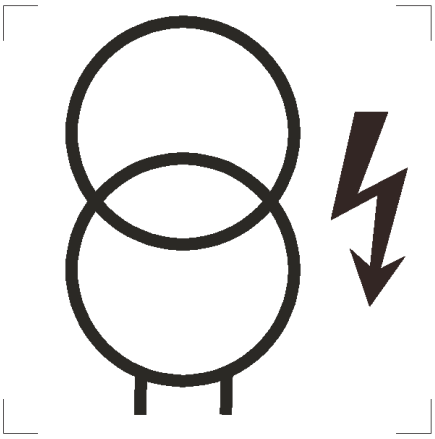
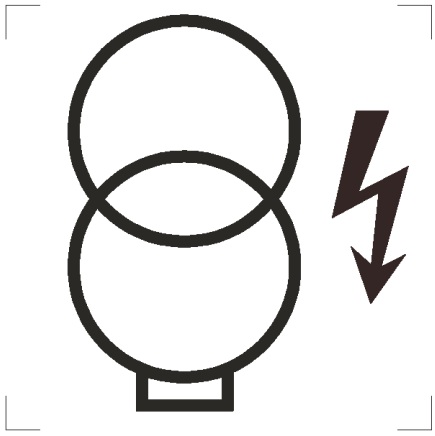
Symbol or graphical symbol	Explanation or title	Identification
	**Separating transformer**, high insulation level, short-circuit-proof To identify the short-circuit-proof (inherently or non-inherently) separating transformer with high insulation level. The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol.	IEC 60417-6065
	**Separating transformer**, output voltages exceeding 1 kV, general To identify the separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V, where the letter "F" may be used adjacent to the symbol to indicate a fail-safe function.	IEC 60417-6066
	**Separating transformer**, output voltages exceeding 1 kV, non-short-circuit-proof To identify the non-short-circuit-proof separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V.	IEC 60417-6067
	**Separating transformer**, output voltages exceeding 1 kV, short-circuit-proof To identify the short-circuit-proof (inherently or non-inherently) separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V.	IEC 60417-6068

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Addition:

8.101 Separating transformers with high insulation level shall be marked with the voltage of the **insulation level**, expressed in kV on the right side of the symbol.

9 Protection against electric shock

This clause of Part 1 is applicable.

10 Change of input voltage setting

This clause of Part 1 is applicable.

11 Output voltage and output current under load

This clause of Part 1 is applicable.

12 No-load output voltage

This clause of Part 1 is applicable except as follows:

Addition:

The **no-load voltage** is measured when the **transformer** is connected to the **rated supply voltage** at the **rated supply frequency** at ambient temperature.

12.101 For **separating transformers with high insulation level**:

– the **no load output voltage** shall not exceed 1 000 V a.c. or 1 500 V d.c. For **independent transformers** the **no-load output voltage** shall exceed 50 V a.c. or d.c. This limitation applies even when independent **output windings**, not intended for interconnection, are connected in series;

12.102 For **separating transformers with output voltages exceeding 1 000 V**:

– the **no-load output voltage** shall exceed 1 000 V a.c. or 1 500 V d.c. and shall not exceed 15 000 V a.c. or d.c. For **independent transformers** this limitation applies even when independent **output windings**, not intended for interconnection, are connected in series;

12.103 The difference between the **no-load output voltage** and the **output voltage** under load shall not be excessive.

The difference is expressed as a percentage of the latter voltage calculated according to the following formula:

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100 \quad [\%]$$

where $U_{\text{no-load}}$ is the **no-load output voltage** and U_{load} is the **output voltage** under load. The difference shall not exceed the values shown in Table 101.

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