

BS EN 61558-2-20:2011



BSI Standards Publication

# Safety of transformers, reactors, power supply units and combinations thereof

Part 2-20: Particular requirements and tests  
for small reactors

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### **National foreword**

This British Standard is the UK implementation of EN 61558-2-20:2011. It is identical to IEC 61558-2-20:2010. It supersedes BS EN 61558-2-20:2001 which will be withdrawn on 2 January 2014.

The UK participation in its preparation was entrusted to Technical Committee PEL/96, Small transformers.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 March 2011.

### **Amendments issued since publication**

| <b>Amd. No.</b> | <b>Date</b> | <b>Text affected</b> |
|-----------------|-------------|----------------------|
|-----------------|-------------|----------------------|

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English version

**Safety of transformers, reactors, power supply units and combinations thereof -****Part 2-20: Particular requirements and tests for small reactors  
(IEC 61558-2-20:2010)**

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments -  
Partie 2-20: Règles particulières et essais pour les petites bobines d'inductance  
(CEI 61558-2-20:2010)

Sicherheit von Transformatoren, Drosseln, Netzgeräten und entsprechende Kombinationen -  
Teil 2-20: Besondere Anforderungen und Prüfungen an Kleindrosseln  
(IEC 61558-2-20:2010)

This European Standard was approved by CENELEC on 2011-01-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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## Foreword

The text of document 96/356/FDIS, future edition 2 of IEC 61558-2-20, prepared by IEC TC 96, Transformers, reactors, power supply units, and combinations thereof, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61558-2-20 on 2011-01-02.

This European Standard supersedes EN 61558-2-20:2000.

The main changes consist of updating this part in accordance with EN 61558-1:2005.

This part has the status of a group safety publication in accordance with IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2011-10-02
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2014-01-02

This part is intended to be used in conjunction with the latest edition of EN 61558-1 and its amendments. It is based on EN 61558-1:2005.

This part supplements or modifies the corresponding clauses in EN 61558-1, so as to convert that publication into the European standard: *Particular requirements and tests for small reactors*.

Where 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 adapted accordingly.

In this part, the following print types are used:

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

Annex ZA has been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 61558-2-20:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

|                     |   |
|---------------------|---|
| IEC 60289:1988      | NOTE Harmonized as EN 60289:1994 (modified).          |
| IEC 61347-2-8:2000  | NOTE Harmonized as EN 61347-2-8:2001 (not modified).  |
| IEC 61347-2-9:2000  | NOTE Harmonized as EN 61347-2-9:2001 (not modified).  |
| IEC 61558-2-16:2009 | NOTE Harmonized as EN 61558-2-16:2009 (not modified). |

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

*Annex ZA of Part 1 is applicable except as follows:*

*Addition:*

| <u>Publication</u> | <u>Year</u> | <u>Title</u>  | <u>EN/HD</u>                 | <u>Year</u>  |
|--------------------|-------------|---|------------------------------|--------------|
| IEC 61558-1        | 2005        | Safety of power transformers, power supplies, reactors and similar products -<br>Part 1: General requirements and tests | EN 61558-1<br>+ corr. August | 2005<br>2006 |

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

## Part 2-20: Particular requirements and tests for small reactors

### 1 Scope

#### *Replacement:*

This part of IEC 61558 deals with the safety of **small reactors** for general applications.

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** or **reactor** covers **small reactors**.

This part is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) general purpose **reactors** including alternating current, premagnetised and current compensated **independent** or **associated reactors**.

The **rated supply voltage** does not exceed 1 000 V a.c. or 1 500V ripple-free d.c., the **rated supply frequency** and the **internal operational frequencies** do not exceed 1 MHz.

The **rated power** does not exceed:

- 25 kVAR a.c. (25 kW d.c.) for single-phase **reactors**,
- 50 kVAR a.c. (50 kW d.c.) for poly-phase **reactors**.

This part is applicable to **reactors** without limitations of the **rated power** subject to an agreement between the purchaser and the manufacturer.

This part is applicable to **dry-type reactors**. The windings may be encapsulated or non-encapsulated.

This part does not apply to:

- **reactors** covered by IEC 60289;
- ballast for tubular fluorescent covered by IEC 61347-2-8;
- ballast for discharge lamps (excluding tubular fluorescent lamps) covered by IEC 61347-2-9.

NOTE 2 For **reactors** filled with liquid dielectric or pulverised material such as sand, additional requirements are under consideration.

NOTE 3 Attention is drawn to the following:

- for **reactors** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) may 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 should also be considered;
- the different conditions for transportation, storage, and operation of the **reactor** should also be considered;



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

NOTE 4 Normally, **reactors** are intended to be associated with equipment for functional requirements of the equipment or requirements by the installation rules or by other appliance specifications.

NOTE 5 **Reactors** incorporating **electronic circuits** and components are also covered by this standard.

NOTE 6 The protection against electric shock may be provided (or completed) by other parts or features of the equipment, such as the **body**.

NOTE 7 **Reactors** for particular applications will in the future be covered by complementary normative annexes.

NOTE 8 Future technological development of **reactors** may necessitate a need to increase the upper limit of the frequencies, until then this part may 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*

## 3 Terms and definitions

This clause of Part 1 is applicable, except as follows:

*Modification:*

Where Part 1 is applicable, the word "**transformer**", if used, shall be replaced by "**reactor**".

*Addition:*

### 3.1.101

#### **reactor**

arrangement comprising one or more windings with an impedance depending on the frequency, working in accordance with the principle of self-induction whereby a magnetising current generates a magnetic field through a magnetically effective core or through air

NOTE **Reactors** with toroidal core are also included in this definition.

### 3.1.102

#### **alternating current reactor**

**reactor** in which the magnetising current generates an alternating magnetic field, changing its polarity depending on the frequency

### 3.1.103

#### **premagnetised reactor**

**reactor** in which the magnetising direct current generates a magnetic field of only one polarity, while a superimposed alternating current alters the direct magnetic field depending on its strength and the frequency

### 3.1.104

#### **current compensated reactor**

**reactor** with at least two windings on a common core, where the magnetising currents are in opposite directions in order to reduce the magnetic flux

**3.1.105****overload proof reactor**

**reactor** in which the temperature does not exceed the specified limits when the **reactor** is overloaded and continues to meet all requirements of this standard after the removal of the overload

**3.1.105.1****non-inherently overload proof reactor**

**overload proof reactor** equipped with a protective device which opens the circuit, or reduces the current in the circuit when the **reactor** is overloaded, and which continues to meet all requirements of this standard after the removal of the overload and resetting or replacing of the protective device

NOTE 1 Examples of protective devices are fuses, **overload releases**, thermal fuses, **thermal links**, **thermal cut-outs**, PTC resistors, and automatic circuit-breakers.

NOTE 2 In case of protection by a device which cannot be replaced nor re-set, the wording "continues to meet all requirements of this standard after removal of the overload" does not imply that the **reactor** continues to operate.

**3.1.105.2****inherently overload proof reactor**

**overload proof reactor** not equipped with a device to protect the **reactor** and in which the temperature in the case of overload, by construction, does not exceed the specified limits and which continues to operate and meet all the requirements of this standard after the removal of the overload

**3.1.106****non-overload proof reactor**

**reactor** which is intended to be protected against excessive temperature by means of a protective device not provided with the **reactor** and which continues to meet all the requirements of this standard after the removal of the overload and resetting or replacing of the protective device

**3.1.107****fail-safe reactor**

**reactor** which, after abnormal use, permanently fails to function by an interruption of the failing circuit but presents no danger to the user or surroundings

**3.4 Circuits and windings**

This subclause of Part 1 is not applicable.

**3.5 Ratings**

This subclause of Part 1 is applicable, except as follows:

*Replacement:*

**3.5.4****rated current**

**rated current**, assigned to the **reactor** by the manufacturer including harmonics, if any, which influence the heating of the **reactor**

*Addition:*

**3.5.101****rated power**

sum of the products of the **rated voltage drop** and the **rated current** at the **rated frequency** for the different windings

**3.5.102****rated inductance**

**inductance** of the **reactor** designed by the manufacturer for the specified operating condition of the **reactor**

NOTE The specific operating conditions of d.c. **reactors** are determined by the d.c. component and the superimposed a.c. component.

**3.5.103****rated resistance**

d.c. **resistance** of a winding of a **reactor** designed by the manufacturer for the specified operating conditions of the **reactor**

**3.5.104****rated voltage drop**

voltage across a winding of the **reactor** at the **rated current** and the **rated frequency** assigned by the manufacturer

**3.6 No-load values**

This subclause of Part 1 is not applicable.

**3.7 Insulation**

This subclause of Part 1 is applicable.

**4 General requirements**

This clause of Part 1 is applicable.

**5 General notes on tests**

This clause of Part 1 is applicable.

**6 Ratings**

*Replacement:*

**6.1** The **rated supply voltage** shall not exceed 1 000 V a.c or 1 500 V ripple-free d.c..

**6.2** The **rated power** shall not exceed 25 kVAR a.c. (25 kW d.c.) for single-phase **reactors** and 50 kVAR a.c. (50 kW d.c.) for poly-phase **reactors**, except for **reactors** subject to an agreement between the purchaser and the manufacturer.

**6.3** The **rated supply frequency** and the **internal operational frequencies** does not exceed 100 MHz.

**6.4** The values of **rated inductance** and **rated resistance** shall be given at the rated ambient temperature, under no load conditions, and the tolerance shall be declared by the manufacturer.

*Compliance with the requirements of 6.1 to 6.4 is checked by inspection of the marking.*

## 7 Classification

This clause of Part 1 is applicable, except as follows:

### 7.1 Replacement:

According to their protection against electric shock:

- class I **reactors**;
- class II **reactors**;
- class III **reactors**.

NOTE **Incorporated reactors** are not classified; their degree of protection against electric shock is determined by the way in which the **reactors** are incorporated.

### 7.2 Replacement:

According to the protection against abnormal use:

- **inherently overload proof reactors**;
- **non-inherently overload proof reactors**;
- **non overload proof reactors**;
- **fail-safe reactors**.

## 8 Marking and other information

This clause of Part 1 is applicable, except as follows:

### 8.1 Replacement:

**Reactors** shall be marked with the following parameters:

- a) **rated supply voltage** in volts (V);
- b) **rated supply frequency** (ies) in Hertz (Hz);
- c) **rated voltage drop** in volts (V) only for a.c. reactors;
- d) **rated power** in VAR or kVAR for a.c., in watts (W) or kilowatts (kW) for d.c.;
- e) **rated current** and harmonics, if any, in amperes (A) or milliamperes (mA);
- f) symbol or abbreviation DC for nature of direct current, if applicable;
- g) symbol or abbreviation AC for nature of alternating current, if applicable;
- h) **rated inductance** of the winding(s) in henries (H) or millihenries (mH) for **reactors** followed by the appropriate tolerance;

NOTE 1 Only one of the values c), d) or h) needs to be marked, as the others can be calculated from the given values.

- i) the **reactor** shall be marked with one of the graphical symbol shown in 8.11;
- j) **rated resistance** of the winding(s) in ohms ( $\Omega$ ) or milliohms (m $\Omega$ ) followed by the appropriate tolerance;

NOTE 2 The marking j) may be given in the literature instead of being marked.

- k) model or type references;
- l) name or trademark of the manufacturer or responsible supplier;

- m) indication of the protection index IP, if other than IP00;
- n) rated maximum ambient temperature  $t_a$ , if other than 25 °C;

NOTE 3 It is recommended that the values of  $t_a$  are given in steps of 5 °C for  $t_a \leq 50$  °C and in steps of 10 °C for  $t_a > 50$  °C.

- o) **rated minimum ambient temperature**  $t_{amin}$ , if lower than +10 °C and if a temperature sensitive device is used;

NOTE 4 It is recommended that the values of  $t_{amin}$  are given in steps of 5 °C.

- p) duty cycle, if any, unless the operating time is limited by the construction of the **reactor** or corresponds to the operating conditions. The marking of **short-time duty cycle** or **intermittent duty cycle** shall correspond to normal use. The operating time for **reactors** with short-time duty shall be expressed in seconds (s) or minutes (min); the operating time and the resting time of **reactors** with **intermittent duty cycle** shall be expressed in seconds (s) or minutes (min), separated by an oblique stroke;
- q) switching frequency (ies) of the supplying frequency inverter;
- r) **reactors** to be used with forced air cooling where the fan is not a part of the **reactor** shall be marked with “AF” followed by the air speed, expressed in m/s;
- s) symbol for **class II** construction, for **class II reactors** only;
- t) symbol for **class III** construction, for **class III reactors** only.

NOTE 5 Additional markings are allowed provide they do not give rise to misunderstanding.

#### 8.4 Replacement:

**Reactors** with tapped or multiple windings shall be clearly marked in accordance with 8.1.

#### 8.5 Replacement:

**Reactors** which are declared to be **overload proof reactors** and comply with the requirements for such **reactors** shall be marked with the symbol for **overload proof reactors**.

**Non-inherently overload proof reactors** with incorporated fuses and **non overload proof reactors** designed to be protected by fuses shall, in addition, be marked with the **rated current** in amperes or milliamperes of the protecting fuse-link, followed or preceded by the symbol for the time current characteristics of the fuse in accordance with the relevant standard, if applicable.

**Non-inherently overload proof reactors** with incorporated replaceable protective devices other than fuses and **non overload proof reactor** designed to be protected with protective devices other than fuses shall, in addition, be marked with the manufacturer’s model or type reference of the device, and/or ratings of the device.

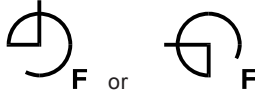
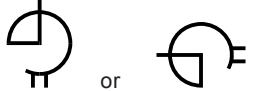
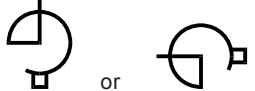
NOTE **Overload proof reactors** with non-replaceable devices need no additional marking regarding the protective device.

The marking shall be sufficient to ensure correct replacement of the protective device.

When replaceable protective devices other than fuses are used, appropriate information about their replacement shall be provided in an instruction sheet or the equivalent accompanying the **reactor**.

**Reactors** declared to be **fail-safe reactors** and comply with the requirements for such **reactors** shall be marked with the symbol for **fail-safe reactors**.

**8.11 Addition:**

| Symbol or graphical symbol  | Explanation or title   | Identification           |
|---|--|--------------------------|
| H <sup>a</sup>  | Henry  | –                        |
| Ω <sup>a</sup>  | Ohm  | –                        |
|  | <b>Fail-safe reactor</b>                                     | IEC 60417-5950 (2002-10) |
|  | <b>Non-overload proof reactor</b>                            | IEC 60417-5951 (2002-10) |
|  | <b>Overload proof reactor</b> (inherently or non-inherently) | IEC 60417-5952 (2002-10) |
| <sup>a</sup> Multiples or submultiples are allowed.                               |  |                          |

**9 Protection against electric shock**

This clause of Part 1 is applicable.

**10 Change of input voltage setting**

*Replacement of the entire clause by the following:*

**10 Change of voltage setting**

**Reactors** with more than one **rated supply voltage** or more than one **rated voltage drop** shall be so constructed that the voltage setting cannot be changed without the aid of a **tool**.

**Reactors** which can be set to different **rated supply voltages** and **rated voltage drops** shall be so constructed that the indication of the voltage to which the **reactor** is set for is discernible on the **reactor** when it is ready for use.

*Compliance is checked by inspection.*

NOTE As an example, the requirement concerning the voltage setting is met if a **tool** is needed to remove a cover before the voltage setting can be changed.

**11 Output voltage and output current under load**

*Replacement of the entire clause by the following:*

**11 Voltage drop**

**11.1** The voltage drop shall not differ by more than 25 % of the rated value.

For **premagnetised reactors** and **reactors** with additional components such as capacitors, rectifiers, etc., the voltage drop shall not differ by more than 30 % of the rated value.

*Compliance is checked by measuring or calculating the voltage drop when steady-state conditions are established, the reactor being at the **rated supply frequency** and the **rated supply current**.*

This requirement is valid for each **rated voltage drop** for **reactors** with multiple **rated voltage drops**.

For **reactors** with several windings, each winding group is loaded simultaneously if not stated otherwise.

11.2 Void.

## 12 No-load output voltage

This clause of Part 1 is not applicable.

## 13 Short-circuit voltage

This clause of Part 1 is not applicable.

## 14 Heating

This clause of part 1 is applicable, except as follows:

### 14.1 Modification:

*Replace the 10th paragraph starting by "**Transformers** are supplied..." by the following:*

*The **reactor** is supplied at **rated supply frequency** by a current equal to 1,1 times the **rated supply current**. After this current increase, no change is made in the supply circuit.*

*Replace the 16th paragraph starting by "For **transformers** with more than one **input** or **output winding**..." by the following:*

*For **reactors** with tapped windings, the results to be considered are those showing the highest temperatures.*

## 15 Short-circuit and overload protection

This clause of Part 1 is applicable, except as follows:

### 15.1 General

*Replace the first paragraph starting with "**Transformers** shall not become..." by the following:*

**Reactors** shall not become unsafe due to overloads which may occur in normal use.

*Compliance is checked by inspection and by the following tests carried out immediately after the test of 14.1 at the same ambient temperature, at the same current, and without changing the position of the **reactor**:*

– for **inherently overload proof reactors**, by the test of 15.2;

- for **non-inherently overload proof reactors**, by the test of 15.3;
- for **non-overload proof reactors**, by the test of 15.4;
- for **fail-safe reactors**, by the test of 15.5.

## 15.2 Inherently short-circuit proof transformers

*Replacement:*

**Inherently overload proof reactors** are tested at 1,06 times the **rated supply voltage** until steady-state conditions are reached.

## 15.3 Non-inherently short-circuit proof transformers

*Modification:*

**15.3 Non-inherently overload proof reactors** are tested as follows:

**15.3.1** This subclause of Part 1 is not applicable.

## 15.4 Non-short-circuit proof transformers

*Replacement:*

**Non-overload proof reactors** are tested as indicated in 15.3. The protective device specified by the manufacturer is connected to the relevant circuit.

Associated **non-overload proof reactors** are tested under the most unfavourable conditions of normal use with the correct protective device specified by the manufacturer connected to the circuit, and in the most unfavourable load conditions for the type of equipment or circuit for which the **reactor** is designed for.

NOTE Examples of load conditions are the following: continuous, short-time or intermittent duty.

## 15.5 Fail-safe transformers

*Replacement by the following:*

### 15.5 Fail-safe reactors

**15.5.1** Three additional new samples are used specifically for the following test. Each of the three specimens is mounted as in normal use on a 20 mm thick dull black painted plywood surface. Each **reactor** is operated at 1,5 times the **rated supply current** under 1,06 times the **rated supply voltage** until steady-state conditions are reached or the **reactor** fails (whichever occurs first).

If the **reactor** fails, it shall comply, during and after the tests, with the criteria in 15.5.2.

If the **reactor** does not fail, the time to reach steady state conditions shall be recorded. Then, the current is increased in steps of 50 % of the **rated supply current** each 10 min until the **reactor** fails. Each specimen shall be tested within a time duration for this part of the test no longer than the time necessary to obtain steady-state conditions. This time shall not exceed 5 h.

The **reactor** shall fail safely and comply, during and after the tests, with the criteria in 15.5.2.



*If the reactor does not fail, it is not considered as a **fail-safe reactor**.*

**15.5.2** The subclause 15.5.2 of Part 1 is applicable.

## **16 Mechanical strength**

This clause of Part 1 is applicable.

## **17 Protection against harmful ingress of dust, solid objects and moisture**

This clause of Part 1 is applicable.

## **18 Insulation resistance, dielectric strength and leakage current**

This clause of Part 1 is applicable.

## **19 Construction**

This clause of Part 1 is applicable, except as follows:

**19.1** This subclause of Part 1 is not applicable.

*Addition:*

**19.12.101 Reactors** shall withstand higher currents without displacement or deformation of core, winding and connections.

*Compliance is checked by the following test:*

*The reactor for a.c. shall be connected directly to a sinusoidal supply voltage at the **rated supply frequency**. The reactor for d.c. shall be connected directly to a half-rectified sinusoidal voltage at the **rated supply frequency**. The circuit shall be protected by a fuse rated 15 times the **rated supply current** of the reactor. The voltage is adjusted within 2 s until 15 times the **rated supply current** occurs, but not exceeding 1,06 of the **rated supply voltage**. To avoid thermal overload, the test shall be terminated after 2 s under full load.*

NOTE The supply conductors are allowed to be fixed.

*After the test, a visual inspection shall be conducted to ascertain that the electrical connections have not become loose, the **creepage distances** and **clearances** are not reduced to smaller values than those stated in Clause 26, and no deformation reducing the protection according to Clause 9 is observed. In case of doubt, measurements are made after dismantling the reactor if necessary.*

## **20 Components**

This clause of Part 1 is applicable, except as follows:

**20.7.3 Replacement:**

In this standard, a PTC resistor of the indirect heating type is considered to be a **non-self-resetting thermal cut-out**.

*Compliance is checked by the following test:*

*The **reactor** shall operate for 48 h (two days) at 1,1 times of the **rated supply voltage** and the **rated supply frequency**. The output shall be under 1,5 times of the **rated current**.*

*The PTC shall operate and stay in high impedance position until the supply is switched off.*

*If the PTC does not operate, the current is increased by steps in 10 % of the **rated current** in 15 min max 5 times of the **rated current**.*

*After 48 h, the **reactor** shall be allowed to cool down to approximately ambient temperature. This test shall be repeated five times at the maximum ambient temperature declared for the **reactor**.*

*At the end of the test, the **reactor** shall withstand the test of Clause 18, shall show no damage and shall operate correctly in the sense of this standard.*

## **21 Internal wiring**

This clause of Part 1 is applicable.

## **22 Supply connection and other external flexible cables or cords**

This clause of Part 1 is applicable.

## **23 Terminals for external conductors**

This clause of Part 1 is applicable.

## **24 Provision for protective earthing**

This clause of Part 1 is applicable.

## **25 Screws and connections**

This clause of Part 1 is applicable.

## **26 Creepage distances, clearances and distances through insulation**

This clause of Part 1 is applicable.

NOTE For values for frequencies above 30 kHz the values in IEC 61558-2-16 is applicable.

## **27 Resistance to heat, fire and tracking**

This clause of Part 1 is applicable, except as follows:

**27.2** This subclause of Part 1 is not applicable.

## **28 Resistance to rusting**

This clause of Part 1 is applicable.

## Annexes

Annexes A to V of Part 1 are applicable.

## Bibliography

The Bibliography of Part 1 is applicable except as follows:

*Addition:*

IEC 60289:1988, *Reactors*<sup>1</sup>

IEC 61347-2-8:2000, *Lamp controlgear – Part 2-8:Particular requirements for ballasts for fluorescent lamps*

IEC 61347-2-9:2000, *Lamp controlgear – Part 2-9:Particular requirements for ballasts for discharge lamps (excluding fluorescent lamps)*

IEC 61558-2-16:2009, *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*

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<sup>1</sup> This publication was withdrawn and replaced by IEC 60076-6 (2007).



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