

# Test Report

Applicant: GUANGDONG EAST POWER CO., LTD

Product: FULLY AUTOMATIC AC VOLTAGE REGULATOR

Brand Name: EAST

Model No: ZTY-5KVA, ZTY-500VA, ZTY-1KVA, ZTY-1.5KVA, ZTY-2KVA,  
ZTY-3KVA

Prepared by: Most Technology Service Co., Limited

**The safety testing has been performed on the submitted samples and found in compliance with the council LVD directive 2006/95/EC.**

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## TEST REPORT

**EN 61558-1: 2005+A1:2009**

**Safety of power transformers, power supplies, reactors and similar products — Part 1: General requirements and tests**

**EN 61558-2-14:2013**

**Part 2: Particular requirements and tests for variable transformers and power supply units incorporating variable transformers**

### Report

Report No. .... : MTS/DNY/T13090606

Tested by (name + signature)..... : Damon Yang

*Damon Yang*

Approved by (name + signature) ..... : Yvette Zhou

*[Signature]*

Date of issue ..... : September 12, 2013

**Testing Laboratory**..... : Most Technology Service Co., Ltd.

Address ..... : No. 5, 2nd Langshan Road, North District, Hi-tech Industry Park,  
Nanshan, Shenzhen, Guangdong, China

Testing location..... : Same as above

**Applicant's name** ..... : GUANGDONG EAST POWER CO., LTD

Address ..... : NO.6 NORTHERN INDUSTRY ROAD, SONGSHAN LAKE  
SCI&TECH INDUSTRY PARK, DONGGUAN, P.R.CHINA

### Test specification:

Standard ..... : EN 61558-2-14:2013 Used in conjunction with  
EN 61558-1:2005+A1:2009

Test procedure ..... : LVD

Non-standard test method..... : N/A

### Test item

Description ..... : FULLY AUTOMATIC AC VOLTAGE REGULATOR

Trademark ..... : EAST

Model and/or type reference..... : ZTY-5KVA

Rating(s) ..... : Input: 160-250Vac, 50/60Hz;  
Output: 210-230Vac, 50/60Hz, 18.1A Max;  
Capacity: 5KVA

Manufacturer ..... : GUANGDONG EAST POWER CO., LTD

Address ..... : NO.6 NORTHERN INDUSTRY ROAD, SONGSHAN LAKE  
SCI&TECH INDUSTRY PARK, DONGGUAN, P.R.CHINA

|   |   |           |   |          |  |
|---|---|-----------|---|----------|--|
| <b>Particulars: test item vs. test requirements</b>   |   |           |   |          |  |
| Protection electric shock.....:   | Class I equipment   |           |   |          |  |
| Short-circuit protection.....:  | --  |           |   |          |  |
| Protection against ingress of water .....   | IP20  |           |   |          |  |
| Equipment mobility .....  | Stationary  |           |   |          |  |
| Operation condition .....   | Continuous  |           |   |          |  |
| Intended use.....:  | Variable auto transformer   |           |   |          |  |
| Mass of equipment (kg) .....  | --  |           |   |          |  |
| <b>Possible test case verdicts:</b><br><br><div style="margin-left: 20px;">             – test case does not apply to the test object .....:    N/A<br/><br/>             – test object does meet the requirement .....:        P (Pass)<br/><br/>             – test object does not meet the requirement ...:        F (Fail)           </div>  |   |           |   |          |  |
| <b>General remarks:</b><br><br><p>The test results presented in this report relate only to the object tested.<br/>         This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.<br/>         "(see Enclosure #)" refers to additional information appended to the report.<br/>         "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p> <p>When determining for test conclusion, measurement uncertainty of tests has been considered.</p> <p>The test report only allows to be revised only within the report defined retention period unless standard or regulation was withdrawn or invalid.</p> <p>The test sample(s) was(were) provided by client.</p> <p>The clause which indicated with * is the subcontract test item. (if there is subcontracting test)</p> |   |           |   |          |  |
| <b>General Product Information</b><br><br><p>Mark 1: All modes were based on ZTY-5KVA;</p> <p>Mark 2: All models are the same except the power.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 20px;"> <tr> <td style="width: 20%; padding: 5px;">ZTY-500VA</td> <td style="padding: 5px;">Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 1.8A Max;<br/>Capacity: 500VA</td> </tr> <tr> <td style="padding: 5px;">ZTY-1KVA</td> <td style="padding: 5px;">Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 3.6A Max;<br/>Capacity: 1KVA</td> </tr> </table>   |   | ZTY-500VA | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 1.8A Max;<br>Capacity: 500VA | ZTY-1KVA | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 3.6A Max;<br>Capacity: 1KVA |
| ZTY-500VA   | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 1.8A Max;<br>Capacity: 500VA |           |   |          |  |
| ZTY-1KVA  | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 3.6A Max;<br>Capacity: 1KVA  |           |   |          |  |

|                |   |
|----------------|---|
| ZTY-1.5KV<br>A | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 5.4A Max;<br>Capacity: 1.5VA |
| ZTY-2KVA       | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 7.2A Max;<br>Capacity: 2KVA  |
| ZTY-3KVA       | Input: 160-250Vac, 50/60Hz; Output: 210-230Vac, 50/60Hz, 10.9A Max;<br>Capacity: 3KVA |

Copy of marking plate:

**FULLY AUTOMATIC AC VOLTAGE REGULATOR**

Model: ZTY-5KVA

Input: 160-250Vac, 50/60Hz;

Output: 210-230Vac, 50/60Hz, 18.1A Max;

Capacity: 5KVA

COS  $\Phi$ : 0.8 IP20 40°C For indoor use only

GUANGDONG EAST POWER CO., LTD



| EN 61558-2-14 |  |  |         |
|---------------|--|--|---------|
| Clause        | Requirement + Test   | Result - Remark                              | Verdict |
| 4.            | GENERAL REQUIREMENTS   |  | P       |
|               | The transformer shall cause no damager to persons or surroundings.   |  | P       |
| 5.            | GENERAL NOTES ON TESTS   |  | P       |
|               | The performed according to Cl. 5, e.g. nature of supply, sequence of testing, etc.   |  | P       |
| 6.            | RATINGS  |  | P       |
| 6.101         | The rated output voltage shall not exceed (EN61558-2-14)   |  | P       |
|               | – 1 000 V a.c. or 1 415 V ripple-free d.c. for variable auto- and separating transformers; (EN61558-2-14)  | Variable auto transformer: 210-230Vac        | P       |
|               | – 500 V a.c. or 708 V ripple-free d.c for variable isolating transformers; the rated output voltage may exceed these limits in order to be in accordance with the national wiring rules, however, it shall not exceed 1 000 V a.c. or 1 415 V ripple free d.c.; (EN61558-2-14) |  | N/A     |
|               | – 250 V a.c. for portable auto-transformers, portable separating transformers and independent isolating transformers; (EN61558-2-14)   |  | N/A     |
|               | – 50 V a.c. or 120 V ripple-free d.c. for variable safety isolating transformers. (EN61558-2-14)   |  | N/A     |
|               | The rated output voltage shall exceed: (EN61558-2-14)  |  | N/A     |
|               | – 50 V a.c. or 120 V ripple-free d.c. for variable independent auto- and independent separating transformers. (EN61558-2-14)   |  | N/A     |
| 6.102         | The rated output shall not exceed the following, (EN61558-2-14)  |  | P       |
|               | – 40 kVA for single-phase variable auto-transformers; (EN61558-2-14)   | Single-phase variable auto-transformer: 5KVA | P       |
|               | – 200 kVA for poly-phase variable auto-transformers; (EN61558-2-14)  |  | N/A     |
|               | – 1 kVA for single-phase variable separating transformers; (EN61558-2-14)  |  | N/A     |
|               | – 5 kVA for poly-phase variable separating transformers; (EN61558-2-14)  |  | N/A     |
|               | – 25 kVA for single-phase variable isolating transformers; (EN61558-2-14)  |  | N/A     |
|               | – 40 kVA for poly-phase variable isolating transformers; (EN61558-2-14)  |  | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|

|       |  |                   |     |
|-------|--|-------------------|-----|
|       | – 10 kVA for single-phase variable safety isolating transformers; (EN61558-2-14)   |                   | N/A |
|       | – 16 kVA for poly-phase variable safety isolating transformers. (EN61558-2-14)   |                   | N/A |
|       | Transformers without limitation of the rated output shall be subject to agreement between the purchaser and the manufacturer. (EN61558-2-14) |                   | N/A |
| 6.103 | The rated supply and internal operational frequencies shall not exceed 500 Hz. (EN61558-2-14)  | Not exceed 500 Hz | P   |
| 6.104 | The rated supply voltage shall not exceed 1 000 V a.c. (EN61558-2-14)  | 160-250Vac        | P   |

|     |  |                   |     |
|-----|--|-------------------|-----|
| 7.  | CLASSIFICATION   |                   | P   |
| 7.1 | Transformers are classified according to protection against electric shock: Class I, II, III |                   | P   |
| 7.2 | According to protection against abnormal use :   |                   | P   |
|     | -inherently short-circuit proof  |                   | N/A |
|     | -non-inherently short-circuit proof  |                   | N/A |
|     | -non-short-circuit proof   |                   | P   |
|     | -fail safe   |                   | N/A |
| 7.3 | According to protection against harmful ingress of water in according with IEC 529:          | IP20              | P   |
| 7.4 | According to their mobility:   | Fixed transformer | P   |
| 7.5 | According to their time of operation   | Continuous        | P   |
| 7.6 | According to their intended use:   | Associated        | P   |
| 7.7 | Optionally, $t_w$  |                   | N/A |
| 7.8 | According to the environmental conditions where they are intended to be used:                |                   | P   |
|     | normal environment   |                   | P   |
|     | special environments   |                   | N/A |

|     |  |            |     |
|-----|--|------------|-----|
| 8   | MARKING AND OTHER INFORMATION  |            | P   |
| 8.1 | Transformer marked with:   |            | P   |
|     | a) rated supply voltage or voltage range (V) .....:  | 160-250Vac | P   |
|     | b) rated output voltage range in volts or kilovolts; (EN61558-2-14)  | 210-230Vac | P   |
|     | For transformers incorporating a rectifier, the rated output voltage range after the rectifier shall be marked with the arithmetic mean value. If, however, the output voltage is given as an r.m.s. value, this shall be stated. (EN61558-2-14) |            | N/A |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark               | Verdict |
|--------|---|-------------------------------|---------|
|        | c) rated output (VA, kVA or W).....:  | 5KVA                          | P       |
|        | d) rated output current (A) .....   | 18.1A Max                     | P       |
|        | e) rated frequency (Hz).....:   | 50/60Hz                       | P       |
|        | f) rated power factor (if not 1) .....  | 0.8                           | P       |
|        | g) symbol or abbreviation AC for alternating current or DC for direct current output;   | AC                            | P       |
|        | h) Relevant graphical symbols shown in 8.11 indicating the kind of transformers; (EN61558-2-14)   |                               | P       |
|        | i) manufacturer's name or trademark   | GUANGDONG EAST POWER CO., LTD | P       |
|        | j) model or type reference  | ZTY-5KVA                      | P       |
|        | k) vector group according to IEC 60076-1 (for three-phase transformer if required);   |                               | N/A     |
|        | l) symbol for class II construction, for class II transformers only;  |                               | N/A     |
|        | m) symbol for class III construction, for class III transformers only;  |                               | N/A     |
|        | n) index IP (if not IP00) or ordinary transformer   | IP20                          | P       |
|        | o) rated max. ambient temperature $t_a$ (if not 25°C) :   | 40°C                          | P       |
|        | p) rated minimum ambient temperature $t_{amin}$ , if lower than + 10 °C and if a temperature sensitive device is used.                                |                               | N/A     |
|        | q) short-time operation or intermittent operation: rated operating and resting time   |                               | N/A     |
|        | r) for $t_w$ -marked transformers   |                               | N/A     |
|        | s) transformers to be used with forced air cooling where the fan is not a part of the transformer shall be marked with "AF" followed by the air speed |                               | N/A     |
|        | t) purchaser with the following information   |                               | N/A     |
|        | for stationary transformers with a rated output exceeding 1 000 VA, the short-circuit voltage expressed as a percentage of the rated supply voltage;  | Fixed transformer             | N/A     |
|        | the electrical function of the transformer  |                               | N/A     |
| 8.2    | Marking for transformers IP00 or for associated transformers: type and trademark, instruction sheets  |                               | P       |
| 8.3    | Adjusted voltage easily and clearly discernible   |                               | P       |
| 8.4    | For each tapping or winding: rated output voltage and rated output  | 210-230Vac                    | P       |
| 8.5    | Symbol for short-circuit proof transformers or non-inherently short-circuit proof transformers  | Non-short-circuit proof       | N/A     |
|        | Rated current (A or mA) and symbol for time current characteristics of the fuses for non-inherently   |                               | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
|        | short-circuit proof transformer with incorporated fuses and non-short-circuit proof transformer .....  |                 |         |
|        | Manufacturer's model or type reference and rating of the device for non-inherently short-circuit proof transformers with incorporated replaceable protective device (other than fuses) |                 | N/A     |
| 8.6    | Terminals for neutral: "N"   |                 | P       |
|        | Terminal for earthing  |                 | P       |
|        | Terminals of input and output windings shall be clearly identified.  |                 | P       |
|        | If any point of a winding or a terminal is connected to the frame or core, it shall be marked with the relevant symbol   |                 | N/A     |
| 8.7    | Clearly marking indicating the manner in which the transformer shall be connected;   |                 | P       |
| 8.8    | Instruction sheet for type X, Y, Z attachments   |                 | N/A     |
| 8.9    | Transformer for indoor use shall be marked on the label or in the instruction sheet with the words: "for indoor use only"  |                 | P       |
| 8.10   | Symbol for Class II construction not confused with maker's name or trademark   |                 | N/A     |
| 8.11   | Correct symbols are used   |                 | P       |
| 8.12   | Figures, letters or other visual means for different positions of regulating devices and switches  |                 | P       |
|        | OFF position indicated by figure 0   |                 | P       |
|        | Greater output, input etc. indicated by higher figure  |                 | P       |
| 8.13   | Marking not on screws or other easily removable parts  |                 | P       |
|        | Marking clearly discernible (transformer ready for use)  |                 | P       |
|        | Marking for terminals clearly discernible if necessary after removal of the cover  |                 | P       |
|        | Marking for interchangeable protective devices clearly discernible after removal of cover and protective device  |                 | N/A     |
| 8.14   | Special information for installation if necessary  |                 | N/A     |
| 8.15   | Marking durable and easily legible   |                 | P       |
| 8.101  | An instruction sheet showing the method of operation, use and maintenance shall be supplied with each transformer (EN61558-2-14)   |                 | P       |
|        | If the variable transformer is not short-circuit proof, the information shall be given in the instruction sheet for use. (EN61558-2-14)  |                 | P       |



# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
|        | The overload protection and short-circuit protective devices in the primary circuit of variable transformer cannot provide adequate overload protection in the secondary circuit. It is, therefore, always necessary to provide secondary circuit protection. (EN61558-2-14) |                 | P       |
| 8.102  | The short-circuit voltage at a certain position of the current collector shall be marked, when it is subject to an agreement between purchaser and manufacturer. (EN61558-2-14)  |                 | P       |

|           |   |  |     |
|-----------|---|--|-----|
| 9         | PROTECTION AGAINST ACCESSIBILITY OF HAZARDOUS LIVE PARTS  |  | P   |
| 9.1       | Protection against contact with hazardous live parts  |  | P   |
| 9.1.1     | A live part is not a hazardous live part if it is separated from the supply by double or reinforced insulation and the requirements of 9.1.1.1 or 9.1.1.2 are met when the transformer is supplied at rated supply voltage. |  | P   |
| 9.1.1.1   | The voltage shall not exceed 35 V a.c. peak or 60 V ripple free d.c.  |  | P   |
| 9.1.1.2   | Where the voltage exceeds 35 V (peak) a.c. or 60 V ripple free d.c., the touch-current shall not exceed: <ul style="list-style-type: none"> <li>for a.c.: 0,7 mA (peak)</li> <li>for d.c.: 2,0 mA.</li> </ul>               |  | N/A |
| 9.1.1.2.1 | The discharge shall not exceed 45 $\mu$ C for stored voltages between 60 V and 15 kV, or  |  | N/A |
| 9.1.1.2.2 | The energy of discharge shall not exceed 350 mJ for stored voltages exceeding 15 kV.  |  | N/A |
| 9.1.2     | Transformers shall be constructed to provide adequate protection against accessibility to hazardous live parts.   |  | P   |
|           | Class I and II transformers shall be so constructed and enclosed that there is adequate protection against accidental contact with hazardous live parts.  |  | P   |
|           | For class I transformers, accessible parts shall be separated from hazardous live parts by at least basic insulation.   |  | P   |
|           | Class II transformers shall be so constructed and enclosed that there is adequate protection against accessibility to basic insulation and to conductive parts separated from hazardous live parts by basic insulation only |  | N/A |
|           | Hazardous live parts shall not be accessible after removal of detachable parts except for: <ul style="list-style-type: none"> <li>lamps having caps larger than B9 and E10</li> <li>type D fuse-holders.</li> </ul>         |  | N/A |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | The insulating properties of lacquer, enamel, paper, cotton, oxide film   |                 | P       |
|        | openings in class II transformers, and openings in class I transformers other than those in conductive parts connected to a protective earth terminal   |                 | N/A     |
|        | It shall not be possible to touch bare hazardous live parts or hazardous live parts protected only by lacquer, enamel, paper, cotton, oxide film or sealing compound  |                 | P       |
| 9.1.3  | Non hazardous live parts of the output circuit isolated from the input circuit by double or reinforced insulation may be accessible under the following conditions:   |                 | P       |
|        | for no-load output voltages not exceeding 35 V peak a.c. or 60 V ripple-free d.c., both poles may be accessible.  |                 | N/A     |
|        | for no-load output voltages exceeding 35 V peak a.c. or 60 V ripple-free d.c. and not exceeding 250 V a.c., only one of the poles may be accessible.  |                 | P       |
| 9.2    | For transformers with a primary supply plug, the pins of the plug shall not be hazardous live measured 1s after withdrawal of the plug.   |                 | N/A     |
|        | For transformers without a primary supply plug, the terminals provided for connecting the transformer to the supply source shall not be hazardous live measured 5 s after disconnection of the supply source. |                 | P       |
|        | if the nominal capacitance across the pins does not exceed 0,1 $\mu$ F, no test is conducted.   |                 | N/A     |
|        | The primary supply switch of the transformer, if any, is in the off-position, unless it is more unfavourable in the on-position.  |                 | N/A     |
|        | The test shall be carried out 10 times or with a device used to switch off at the most unfavourable electrical angle of the supply voltage.   |                 | P       |
|        | The voltage is measured between the input terminals or between the supply leads or between the pins of the supply plug used for the connection to the supply source after 1 s or 5 s.                         |                 | P       |
|        | If the voltage exceeds 60 V ripple free d.c., the discharge is measured in the same conditions and shall not exceed 45 $\mu$ C.   |                 | N/A     |
| 10     | CHANGE OF INPUT VOLTAGE SETTING   |                 | N/A     |
|        | Voltage setting not possible to change without a tool   |                 | N/A     |
|        | Indication of input voltage when ready for use.   |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|

|        |  |  |     |
|--------|--|--|-----|
| 11     | OUTPUT VOLTAGE AND OUTPUT CURRENT UNDER LOAD   |  | P   |
| 11.1   | Difference from rated value (without rectifier; with rectifier):   |  | P   |
|        | a) inherently short-circuit proof transformers with one rated output voltage for output voltage: 10% ;   |  | N/A |
|        | b) inherently short-circuit proof transformers with one more than 1 rated output voltage for highest output voltage: 10%;  |  | N/A |
|        | c) different for other output voltages: 15%;   |  | N/A |
|        | d) other transformers for output voltages: 5%;   |  | P   |
|        | For transformers with rectifiers, the above percentage values are raised by 5.   |  | N/A |
| 11.101 | When the transformer is connected to the rated supply voltage, at the rated supply frequency, and loaded with the rated output current, at the rated power factor, the maximum output voltage shall not differ from the rated value by more than 10 % at the highest output voltage. (EN61558-2-14)  |  | P   |
|        | The output voltage is measured when the transformer is connected to the rated supply voltage, at the rated supply frequency, and loaded with the rated output current, at the rated power factor and with the current collector in a position which will produce the highest voltage drop in steady state condition. In case of variable auto-transformer, the measurement is made with the current collector in the middle of the input winding. (EN61558-2-14) |  | P   |
|        | The current collector should be placed in the most unfavourable position when tapplings or elevated voltage are included in the construction. (EN61558-2-14)   |  | N/A |

|        |  |  |     |
|--------|--|--|-----|
| 12     | NO-LOAD OUTPUT VOLTAGE (see supplementary requirements in Part 2)  |  | P   |
|        | The no-load output voltage is measured when the transformer is connected to the rated supply voltage at the rated supply frequency at ambient temperature. (EN61558-2-14)  |  | P   |
| 12.101 | The no-load output voltage shall not exceed: (EN61558-2-14)  |  | P   |
|        | – 1 000 V a.c. or 1 415 V ripple-free d.c for auto- and separating transformers; (EN61558-2-14)  |  | P   |
|        | – 500 V a.c. or 708 V ripple-free d.c for isolating transformers. The no-load output voltage and the rated output voltage may be up to 1 000 V a.c. or 1 415 V ripple free d.c. for special applications; (EN61558-2-14) |  | N/A |
|        | – 50 V a.c. or 120 V ripple-free d.c for safety isolating transformers(EN61558-2-14)   |  | N/A |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | For independent transformers, this output voltage limitation applies even when output windings, not intended for interconnection, are connected in series. (EN61558-2-14)   |                 | N/A     |
|        | The no-load output voltage shall exceed: (EN61558-2-14)   |                 | N/A     |
|        | – 50 V a.c. for variable independent auto- and variable independent separating transformers or 120 V ripple-free d.c.; (EN61558-2-14)   |                 | N/A     |
|        | – variable independent auto- and variable independent separating transformers and power supply units intended to be used by technically skilled or trained personnel are considered as associated transformers and associated power supply units and may have a rated output voltage less than 50 V a.c. (EN61558-2-14)                         |                 | N/A     |
| 12.102 | The difference between the no-load output voltage and the output voltage under load shall not be excessive. (EN61558-2-14)  |                 | P       |
| 13     | SHORT-CIRCUIT VOLTAGE   |                 | N/A     |
|        | If there is a short-circuit voltage marking corresponding to a certain position of the current collector, the measured short-circuit voltage shall not deviate from the marked short-circuit voltage by more than 20 %.(EN61558-2-14)   |                 | N/A     |
| 14     | HEATING   |                 | P       |
| 14.1   | Transformers and their supports shall not attain excessive temperature in normal use.   |                 | P       |
|        | The test and the measurements are made in a draught-free location having dimensions such that the test results are not influenced. If the transformer has a $t_a$ rating, the test is conducted at $t_a \pm 5^\circ\text{C}$  |                 | P       |
|        | Portable transformers are placed on a dull black painted plywood support. Stationary transformers are mounted as in normal use, on a dull black painted plywood support. The support is approximately 20 mm thick, and has dimensions which are at least 200 mm in excess of those of the orthogonal projection of the specimen on the support. |                 | N/A     |
|        | Transformers which are provided with integral pins intended to be introduced into fixed socket-outlets  |                 | N/A     |
|        | Transformers with a protection index other than IP00 are tested in their enclosure.   |                 | P       |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
|        | Transformers with terminals for type X attachment with a specially prepared cord and for type Y and type Z attachments shall have the connections subjected to a pull of 5 N immediately before the heating test is carried out. |                 | N/A     |
|        | Transformers are supplied at the rated supply voltage and loaded with an impedance producing the rated output, at the rated output voltage and, for a.c. current, at the rated power factor.                                     |                 | P       |
|        | Associated transformers are operated under the conditions occurring when the appliance or other equipment is operated under the conditions of normal use as indicated in the relevant specifications                             |                 | P       |
|        | The temperatures of windings are determined by the change of resistance method.  |                 | P       |
|        | At the beginning of the test, the windings shall be at ambient temperature.  |                 | P       |
|        | For transformers with more than one input or output winding, or a tapped input or output winding, the results to be considered are those showing the highest temperature.  |                 | N/A     |
|        | Other temperatures are determined by means of thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.  | Thermocouples   | P       |
|        | The temperature rise on the heating elements of protective devices touching insulating material shall also be measured   |                 | N/A     |
|        | During and after the test, the electrical connections shall not be loose, creepage distances and clearances shall not be reduced to less than the values specified   |                 | P       |
| 14.2   | Application of 14.1 or 14.3 according to the insulation system   |                 | P       |
| 14.2.1 | If the manufacturer has stated which class of insulation system has been used, the measured temperature of the winding shall not exceed the relevant value   |                 | N/A     |
| 14.2.2 | If the manufacturer has not stated which class of insulation system has been used the measured temperature of the winding shall not exceed the value   |                 | P       |
| 14.2.3 | If the manufacturer has not stated which class of insulation system has been used and the measured temperature of the winding exceeds the value  |                 | N/A     |
| 14.3   | Accelerated ageing test for undeclared class of insulation system  |                 | P       |
|        | The specimens are subjected to 10 test cycles  |                 | P       |
| 14.3.1 | Heat run   |                 | P       |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| 14.3.2 | Vibration <ul style="list-style-type: none"> <li>– duration: 30 min;</li> <li>– amplitude: 0,35 mm;</li> <li>– frequency range: 10 Hz, 55 Hz, 10 Hz;</li> <li>– sweep rate: approximately one octave per minute.</li> </ul> |                 | P       |
| 14.3.3 | Moisture treatment for two days (48 h)  |                 | P       |
| 14.3.4 | All the following measurements and tests are made and conducted before the cycling and after each complete cycle:   |                 | P       |
|        | – the no-load input current or its ohmic value  |                 | P       |
|        | – the insulation resistance   |                 | P       |
|        | – a dielectric strength test  |                 | P       |
|        | – the test for transformers with a rated supply frequency of 50 Hz or 60 Hz   |                 | P       |
|        | During the above tests, there shall be no breakdown   |                 | P       |
| 14.101 | The temperature of the winding at the winding/current collector point in its most unfavourable position is measured by the use of thermocouples or other suitable means and shall not exceed the values(EN61558-2-14)       |                 | P       |

|      |   |                                    |     |
|------|---|------------------------------------|-----|
| 15   | SHORT-CIRCUIT AND OVERLOAD PROTECTION   |                                    | P   |
| 15.1 | Transformers shall not become unsafe due to short circuits and overloads which may occur in normal use  |                                    | P   |
|      | 1,1 times the rated supply voltage or supply voltage between 0,9 times and 1,1 times the rated supply voltage for non-inherently short-circuit proof transformers | 1.1 times the rated supply voltage | P   |
|      | – for inherently short-circuit proof transformers, by the tests of 15.2;  |                                    | N/A |
|      | – for non-inherently short-circuit proof transformers, by the tests of 15.3;  |                                    | N/A |
|      | – for non-short-circuit proof transformers, by the tests of 15.4;   |                                    | P   |
|      | – for fail-safe transformers, by the tests of 15.5;   |                                    | N/A |
|      | – for transformers combined with a rectifier, the tests of 15.2 or 15.3 are carried out twice   |                                    | N/A |
|      | – for transformers with more than one output winding or a tapped output winding   |                                    | N/A |
|      | For the tests of 15.2, 15.3 and 15.4, the temperatures shall not exceed the values  |                                    | P   |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
|        | During the test, the transformer shall not emit flames, molten metal, poisonous or ignitable gas in hazardous amounts, and temperatures shall not exceed the values                      |                 | P       |
|        | After the tests, the insulation system, when it has cooled down to approximately ambient temperature, shall withstand the dielectric strength test                                       |                 | P       |
| 15.2   | For inherently short-circuit proof transformers short-circuit of the output terminals until steady-conditions.   |                 | N/A     |
| 15.3   | For non-inherently short-circuit proof transformers  |                 | N/A     |
| 15.3.1 | short-circuit or output terminals  |                 | N/A     |
| 15.3.2 | If protected by a fuse according to IEC 60 269-2 or IEC 60 269-3 or a technically equivalent fuse, transformer is loaded as in table 4.  |                 | N/A     |
| 15.3.3 | If protected by a fuse according to IEC 60 127 or ISO 8820 or a technically equivalent fuse, transformer is loaded as specified.   |                 | N/A     |
| 15.3.4 | If protected by a circuit-breaker according to IEC 60 898 or a technical equivalent circuit-breaker, the transformer is loaded as specified.   |                 | N/A     |
| 15.3.5 | If protected by a protecting device other than stated in 15.3.2, 15.3.3, 15.3.4, the transformer is loaded by a current equal to 0.95 times the value that causes the device to operate. |                 | N/A     |
| 15.3.6 | During test 15.3.2, 15.3.3, 15.3.4 the fuse-link is replaced by a link with negligible resistance.   |                 | N/A     |
| 15.4   | Non-short circuit proof transformers are tested as indicated in 15.3 with the current collector placed in the most unfavourable position.(EN61558-2-14)                                  |                 | P       |
| 15.5   | For fail-safe transformers:  |                 | N/A     |
|        | - Upri (V): 1,10 times rated supply voltage .....  |                 | N/A     |
|        | - Isec (A): 1,5 times rated output current .....   |                 | N/A     |
|        | - time until steady-state conditions t1 (h) .....  |                 | N/A     |
|        | - time until failure t2 (h): t1; 5h .....  |                 | N/A     |
|        | During the test:   |                 | N/A     |
|        | - no flames, molten material, etc.   |                 | N/A     |
|        | - temperature rise of enclosure 175 °C   |                 | N/A     |
|        | - temperature rise of plywood support 125°C  |                 | N/A     |
|        | After the test:  |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|

|  |  |  |     |
|--|--|--|-----|
|  | - electric strength (Cl. 18, 1 min, test voltage: 35% of specified value); no flashover or breakdown for primary-to-secondary only for safety isolating, isolating and separating transformer and for primary-to-body for all kinds of transformer |  | N/A |
|  | - bare hazardous live parts not accessible by test finger through holes of enclosure   |  | N/A |

|        |  |  |     |
|--------|--|--|-----|
| 16     | MECHANICAL STRENGTH  |  | P   |
| 16.1   | After tests of 16.2 and 16.3 and 16.4:   |  | P   |
|        | - no damage  |  | P   |
|        | - hazardous live parts not accessible by test pin according to 9.2   |  | P   |
|        | - no damage for insulating barriers  |  | P   |
|        | - handles, levers, etc. Have not moved on shafts   |  | N/A |
| 16.2   | For stationary and portable transformers: 3 blows, impact energy 0,5 Nm  |  | P   |
| 16.3   | For portable transformers: 100 falls, 25 mm  |  | N/A |
| 16.4   | Portable Transformers with integrated pins, the following tests are carried out:   |  | N/A |
|        | a) plug-in transformers: tumbling barrel test: 50 falls, ≤ 250g; 25 falls, > 250g  |  | N/A |
|        | b) torque test of the plug pins with 0,4 Nm  |  | N/A |
|        | c) pull force according to table 5 for each pin  |  | N/A |
| 16.101 | The transformer is loaded with an impedance producing the rated output current when the current collector is set at the maximum output voltage setting within the range.(EN61558-2-14) |  | N/A |

|      |   |  |     |
|------|---|--|-----|
| 17   | PROTECTION AGAINST HARMFUL INGRESS OF DUST, SOLID OBJECTS AND MOISTURE  |  | P   |
| 17.1 | Degrees of protection provided by enclosures (IP code)  |  | N/A |
|      | The enclosure of a transformer shall provide the degree of protection against ingress of dust, solid objects and moisture                   |  | N/A |
|      | Compliance is checked by the appropriate test specified in 17.1.1, and for other IP ratings by the appropriate test specified in IEC 60529. |  | N/A |
|      | Transformers shall be mounted and wired as in normal use  |  | N/A |
|      | Transformers not provided with an external flexible cable or cord are fitted with external wiring   |  | N/A |



# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | fixed transformer intended for mounting with its body in contact with a surface shall be tested on a board                                |                 | N/A     |
|        | Transformers with enclosure having provisions for draining water by means of drain holes shall be mounted with the lowest drain hole open |                 | N/A     |
|        | Portable transformers wired as in normal use shall be placed in the most unfavourable position of normal use                              |                 | N/A     |
|        | After completion of the tests, the transformer shall withstand the dielectric strength test specified in 18.3 and inspection shall show:  |                 | N/A     |
|        | a) no deposit of talcum powder inside enclosures for dust-proof transformers  |                 | N/A     |
|        | b) no deposit of talcum powder inside enclosures for dust-tight transformers  |                 | N/A     |
|        | c) no trace of water on live parts  |                 | N/A     |
|        | d) no accumulation of water inside the enclosures of drip-proof, spray-proof, splash-proof and jet-proof transformers                     |                 | N/A     |
|        | e) no water or trace of water entered inside the enclosure of a watertight transformer  |                 | N/A     |
|        | f) no entry into the transformer enclosure by the relevant test probe for solid-object-proof transformers                                 |                 | N/A     |
| 17.1.1 | Tests on transformers with enclosure  |                 | N/A     |
|        | A Solid-object-proof transformers (first characteristic IP numeral 2)   |                 | N/A     |
|        | B Solid-object-proof transformers (first characteristic IP numerals 3 and 4)  |                 | N/A     |
|        | C Dust-proof transformers (first characteristic IP numeral 5)   |                 | N/A     |
|        | D Dust-tight transformers (first characteristic IP numeral 6)   |                 | N/A     |
|        | E Drip-proof transformers (second characteristic IP numeral 1)  |                 | N/A     |
|        | F Drip-proof transformers (second characteristic IP numeral 2)  |                 | N/A     |
|        | G Spray-proof transformers (second characteristic IP numeral 3)   |                 | N/A     |
|        | H Splash-proof transformers (second characteristic IP numeral 4)  |                 | N/A     |
|        | I Jet-proof transformers)   |                 | N/A     |
|        | J Powerful jet-proof transformers   |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark    | Verdict |
|--------|--|--------------------|---------|
|        | K Water-tight transformers (second characteristic IP numeral 7)  |                    | N/A     |
|        | L Pressure watertight transformers (second characteristic IP numeral 8)  |                    | N/A     |
| 17.2   | Transformers shall be proof against humid conditions which may occur in normal use.  |                    | P       |
|        | The humidity treatment humidity maintained between 91 % and 95 %, 20 °C and 30 °C within 1 °C  |                    | P       |
|        | – two days (48 h) for transformers with protection index IP20, or lower;   |                    | P       |
|        | – seven days (168 h) for transformers with other protection index  |                    | N/A     |
|        | After this treatment and the tests of Clause 18, the transformer shall show no damage within the meaning of this standard.   |                    | P       |
| 18     | INSULATION RESISTANCE AND ELECTRIC STRENGTH  |                    | P       |
| 18 · 1 | The test specified in 18.2 to 18.4 is made immediately after the test of 17.2  |                    | P       |
| 18.2   | Insulation resistance according to table 7.  | See appended table | P       |
| 18.3   | Dielectric strength test according to table 8  | See appended table | P       |
| 18.4   | U pri (V): 2 times rated input voltage; no load; frequency (Hz): 2 times rated frequency; duration (min): 5 min .....  |                    | P       |
|        | No breakdown between:  |                    | P       |
|        | - turns of winding   |                    | P       |
|        | - input and output windings  |                    | P       |
|        | - adjacent input or output windings  |                    | N/A     |
|        | - windings and iron core   |                    | P       |
|        | During the test of insulation between winding it is allowed to isolate the current collector from the windings.(EN61558-2-14)  |                    | N/A     |
| 18.5   | Touch current and protective earth conductor current   |                    | P       |
|        | The touch current and protective earth conductor current are measured with the transformer loaded as described in Clause 14 and the measurements are made at steady state condition. |                    | P       |
| 18.5.1 | Touch current  |                    | P       |
|        | The touch-current is measured with the switch p in both position and the following combination of switches e and n:  |                    | P       |
|        | – switches n and e in the on position;   |                    | P       |

# EN 61558-2-14

| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|

|        |   |      |   |
|--------|---|------|---|
|        | – switch n in the off position and switch e in the on position;   |      | P |
|        | – switch n in the on position and switch e in the off position  |      | P |
| 18.5.2 | Protective earth conductor current  |      | P |
|        | The protective earth conductor current is measured with the transformer connected as described in Clause 14 | 0.1Ω | P |
|        | The protective earth conductor current (s) shall not exceed the values                                      |      | P |

|            |   |  |     |
|------------|---|--|-----|
| 19         | CONSTRUCTION  |  | P   |
| 19.1.1     | Variable auto-transformers(EN61558-2-14)  |  | P   |
| 19.1.1.1   | Plug connected auto-transformers where the rated input voltage is higher than the rated output voltage, shall not have any potential to earth at the output socket higher than the rated output voltage. (EN61558-2-14)   |  | N/A |
| 19.1.1.1.1 | Polarised input and output plug and socket-outlet system(EN61558-2-14)  |  | N/A |
|            | In this case, an instruction shall be given for not using such a transformer with a non-polarised plug and socket-outlet system. (EN61558-2-14)   |  | N/A |
| 19.1.1.1.2 | Polarity detecting device (for non polarised input and output plug and socket-outlet system) (EN61558-2-14)   |  | N/A |
|            | A polarity detecting device shall only energize the output circuit when the potential to earth at the poles of the output socket does not exceed the rated output voltage. The contact separation of the breaking device shall be at least of 3 mm in each pole. (EN61558-2-14)                 |  | N/A |
| 19.1.2     | Variable separating transformers (EN61558-2-14)   |  | N/A |
| 19.1.2.1   | The input and output circuits shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other conductive parts, except by deliberate action. (EN61558-2-14) |  | N/A |
| 19.1.2.2   | The insulation between the input and output winding(s) shall consist of at least basic insulation (rated for the working voltage). (EN61558-2-14)   |  | N/A |

# EN 61558-2-14

| Clause     | Requirement + Test  | Result - Remark | Verdict |
|------------|---|-----------------|---------|
| 19.1.2.3   | For transformers with intermediate conductive parts (e.g. the iron core) not connected to the body and located between the input and output windings, the insulation between the intermediate conductive parts and the input windings and between the intermediate conductive parts and the output windings, shall consist of at least basic insulation (rated for the working voltage). (EN61558-2-14)   |                 | N/A     |
| 19.1.2.3.1 | Parts of output circuits may be connected to protective earth. (EN61558-2-14)   |                 | N/A     |
| 19.1.2.3.2 | There shall be no connections between the output winding and the body, unless <ul style="list-style-type: none"> <li>for associated transformers - allowed by the relevant end product standard. (EN61558-2-14)</li> </ul>  |                 | N/A     |
| 19.1.2.4   | Protection against direct contact with the live parts (contact path and drive) shall be ensured. (EN61558-2-14)   |                 | N/A     |
| 19.1.3     | Variable isolating and safety isolating transformers(EN61558-2-14)  |                 | N/A     |
| 19.1.3.1   | The input and output circuits shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other conductive parts, except by deliberate action. (EN61558-2-14)   |                 | N/A     |
| 19.1.3.2   | The insulation between input and output winding(s) shall consist of double or reinforced insulation (rated for the working voltage). (EN61558-2-14)   |                 | N/A     |
| 19.1.3.3   | For transformers with intermediate conductive parts (e.g. the iron core) not connected to the body and located between the input and output windings the insulation between the input windings and any intermediate conductive parts shall consist of at least basic insulation, and the insulation between the output windings and any intermediate conductive parts shall consist of at least supplementary insulation (both basic and supplementary insulations rated for the working voltage). (EN61558-2-14) |                 | N/A     |
| 19.1.3.4   | For class I transformers not intended for connection to the mains supply by means of a plug (EN61558-2-14)  |                 | N/A     |
| 19.1.3.5   | There shall be no connection between output circuits and the protective earth, unless this is allowed for associated transformers by the relevant equipment standard. (EN61558-2-14)  |                 | N/A     |
| 19.1.3.6   | There shall be no connection between output circuits and the body, unless this is allowed for associated transformers by the relevant equipment standard. (EN61558-2-14)  |                 | N/A     |

# EN 61558-2-14

| Clause   | Requirement + Test   | Result - Remark           | Verdict |
|----------|--|---------------------------|---------|
| 19.1.3.7 | The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier which shall be of insulating material and permanently fixed to the transformer. (EN61558-2-14) |                           | N/A     |
| 19.1.3.8 | Portable transformers having a rated output not exceeding 630 VA shall be class II. (EN61558-2-14)   |                           | N/A     |
|          | In case of variable transformer intended to be used by technically skilled or trained personal, it is allowed to have a class I transformer. (EN61558-2-14)  |                           | N/A     |
| 19.1.3.9 | For transformers for connection to the mains by means of a plug of any type (incorporated or not), the alternative with basic insulation plus protective screening is not allowed. (EN61558-2-14)  |                           | N/A     |
| 19.2     | Fiercely burning material shall not used in construction.  |                           | P       |
|          | Wood not used as supplementary or reinforced insulation.   |                           | P       |
| 19.3     | Portable transformer: short-circuit proof or fail-safe   | Not portable              | N/A     |
| 19.4     | Class II transformers: contact between accessible metal parts and conduits or metal sheaths of supply wiring impossible  | No accessible metal parts | N/A     |
| 19.5     | Class II transformers: part of supplementary or reinforced insulation, during reassembly after routine servicing not omitted, or cannot be removed without being seriously damaged.  |                           | N/A     |
| 19.6     | Class II and I transformers: creepage distances and clearances over supplementary or reinforced insulation if wire, screw, nut, etc. become loose or fall out of position not 50% specified values (Cl. 26)  |                           | P       |
| 19.7     | Conductive parts connected to accessible conductive parts by resistors or capacitors shall be separated from the hazardous live parts by double insulation or reinforced insulation  |                           | N/A     |
| 19.8     | Resistors or capacitors connected between hazardous live parts and accessible metal parts consist of at least two separate components or one class Y1 capacitor.   |                           | N/A     |
|          | -Two resistors comply with 14.1 of IEC 60065   |                           | N/A     |
|          | -Two capacitors complying with IEC 60384-14, class Y2.   |                           | N/A     |
|          | -One capacitor complying with IEC 60384-14, class Y1.  |                           | N/A     |
| 19.9     | Insulation between input and output shall be resistance to ageing.   |                           | P       |

# EN 61558-2-14

| Clause  | Requirement + Test  | Result - Remark             | Verdict |
|---------|---|-----------------------------|---------|
|         | Creepage distances (if cracks) specified values (Cl.26)   |                             | N/A     |
| 19.10   | If contact against hazardous live part is ensured by an insulating coating, the insulating coating shall pass:                    |                             | N/A     |
|         | a) ageing test  |                             | N/A     |
|         | b) impact test  |                             | N/A     |
|         | c) scratch test   |                             | N/A     |
| 19.11   | Handles, levers, knobs shall be separated from hazardous live part by supplementary insulation                                    |                             | N/A     |
| 19.12   | Windings construction   |                             | P       |
| 19.12.1 | Precautions shall be taken to prevent:  |                             | P       |
|         | - undue displacement of input or output windings or turns thereof   |                             | P       |
|         | - undue displacement of internal wiring or wires for external connection  |                             | P       |
|         | - undue displacement of parts of windings or of internal wiring in the event of rupture of wire/connections.                      |                             | P       |
| 19.12.2 | If serrated tape is used as insulation, the reduced values of dti of table 13.C.1,D.1 may be used.                                |                             | N/A     |
| 19.12.3 | Insulated windings wires, shall meet the following requirements   |                             | N/A     |
|         | a) Winding wire with basic or supplementary insulation:   |                             | N/A     |
|         | - comply with Annex K   |                             | N/A     |
|         | - the insulation of the conductor: two layers   |                             | N/A     |
|         | b) Winding wire with double or reinforced insulation:   |                             | N/A     |
|         | - comply with Annex K   |                             | N/A     |
|         | - the insulation of the conductor: three layers   |                             | N/A     |
|         | - two adjacent insulated wires are considered to be separated by double insulation.   |                             | N/A     |
|         | c) Routine dielectric strength test by manufacturer:  |                             | N/A     |
|         | for insulating windings giving double or reinforced insulation the following additional test and requirements shall be fulfilled. |                             | N/A     |
|         | - thermal cycling test according to 14.3  |                             | N/A     |
|         | - test according to 27.3  |                             | N/A     |
|         | - Table 13, C.1,D.1, box 2) c), not applicable  |                             | N/A     |
| 19.13   | Handles, operating levers and the like shall be fixed in reliable manner, and not work loose                                      |                             | P       |
| 19.14   | Covers providing insulation, shall be fixed by two separate means.  | Enclosure is securely fixed | P       |

# EN 61558-2-14

| Clause  | Requirement + Test  | Result - Remark       | Verdict |
|---------|---|-----------------------|---------|
| 19.15   | Transformer with pins for fixed socket-outlets: no strain on socket-outlet  |                       | N/A     |
|         | Additional torque 0,25 Nm   |                       | N/A     |
| 19.16   | Portable transformer $\leq 200\text{VA}$ , shall be an ordinary transformer or IP 20 or higher.   |                       | N/A     |
|         | Ordinary transformer and transformer with IP X0 shall state in instruction sheet that the transformer is only for indoor use.   |                       | N/A     |
|         | Portable transformer $> 200\text{VA}$ but $\leq 2.5\text{ kVA}$ (single-phase) or $\leq 6.3\text{ kVA}$ (poly-phase), $\geq \text{IP X4}$   |                       | N/A     |
|         | Portable transformer $> 2.5\text{ kVA}$ (single-phase), or $> 6.3\text{ kVA}$ (poly-phase), $\geq \text{IP 21}$   |                       | N/A     |
| 19.17   | Transformers IPX1-IPX6 shall have a drain hole (diameter 5 mm or 20 mm <sup>2</sup> with width 3 mm); drain hole not required for transformer completely filled with insulating materials |                       | N/A     |
|         | Transformers IPX7 totally enclosed  |                       | N/A     |
| 19.18   | Transformers $\geq \text{IPX1}$ with a moulded, if any  |                       | N/A     |
| 19.19   | Class I transformers with a non-detachable flexible cable or cord with earthing conductor and a plug with earthing contact  |                       | N/A     |
| 19.20   | Live parts of SELV and PELV-circuits shall be electrically separated from each other and other circuits.  |                       | P       |
| 19.20.1 | Live part of SELV-circuits shall not be connected to:   |                       | P       |
|         | -Earth  |                       | P       |
|         | -Live part  |                       | P       |
|         | -Protective conductors forming part of other circuits   |                       | P       |
| 19.20.2 | Protection against PELV-circuits by insulation withstanding test as double or reinforced insulation according to table 8.   |                       | N/A     |
| 19.21   | Protection against FELV-circuits by insulation corresponding to the minimum test voltage required for the primary circuit.  |                       | N/A     |
| 19.22   | No earthing in Class II transformers  |                       | N/A     |
| 19.23   | No earthing in Class III transformers   |                       | N/A     |
| 20      | COMPONENTS  |                       | P       |
|         | Components such as switches, plugs, fuses, lampholders, capacitors and flexible cables and cords shall comply with the relevant IEC standard as far as it reasonably applies              | (see appended table ) | P       |

# EN 61558-2-14

| Clause   | Requirement + Test   | Result - Remark | Verdict |
|----------|--|-----------------|---------|
| 20.1     | Appliance couplers for mains supply shall comply with the IEC 60320 series for IPX0 transformers and IEC 60320-2-3 or IEC 60309 for other transformers.  |                 | N/A     |
| 20.2     | Automatic controls shall comply with IEC 60730 series and the appropriate parts 2 unless they are tested with the transformer  |                 | N/A     |
| 20.3     | Thermal-links shall comply with IEC 60691 as far as reasonable.  |                 | P       |
| 20.4     | Switches forming part of the transformer assembly shall comply with Annex F  |                 | N/A     |
| 20.5     | There shall be no unsafe compatibility between the socket-outlets in the output circuit and a plug intended for direct connection to a socket-outlet which could be used for the input circuit in relation to installation rules, voltages, and frequencies. |                 | N/A     |
| 20.6     | Thermal cut-outs, thermal links, overload relays, fuses and other overload protective devices shall have adequate breaking capacity.   |                 | N/A     |
| 20.6.1   | Fuses according to IEC 60127 and IEC 60269 are allowed to be continuously loaded by a current not exceeding 1,1 times the rated value  |                 | N/A     |
| 20.7     | Thermal cut-outs shall meet the requirements of 20.7.1.1 and 20.7.2, or 20.7.1.2 and 20.7.2.   |                 | N/A     |
| 20.7.1   | Requirements according to IEC 60730-1  |                 | N/A     |
| 20.7.1.1 | Thermal cut-outs when tested as separate components shall comply with the appropriate requirements and tests of IEC 60730-1  |                 | N/A     |
| 20.7.1.2 | A thermal cut-out when tested as part of a transformer shall:  |                 | N/A     |
|          | – have at least micro-interruption (type 1C or type 2C) or micro-disconnection (type 1B or 2B) according to IEC 60730-1;   |                 | N/A     |
|          | – be aged for 300 h  |                 | N/A     |
|          | – be subjected to a number of cycles of automatic operation  |                 | N/A     |
|          | The tests are carried out on three samples   |                 | N/A     |
|          | After the tests, there shall be no damage to the thermal cut-out and the transformer in the sense of this standard   |                 | N/A     |
| 20.7.2   | Thermal cut-outs shall have adequate breaking capacity   |                 | N/A     |
| 20.7.2.1 | A transformer with a non-self-resetting thermal cut-out is supplied at 1.1 times rated input voltage and the output terminals are short-circuited until the thermal cut-out operates   |                 | N/A     |



# EN 61558-2-14

| Clause   | Requirement + Test  | Result - Remark | Verdict |
|----------|---|-----------------|---------|
| 20.7.2.2 | A transformer with a self-resetting thermal cut-out is supplied at 1,1 times the rated input voltage with the output terminals short-circuited  |                 | N/A     |
| 20.7.2.3 | A PTC resistor of indirect heating type is considered to be a non-self-resetting thermal cut-out by this standard.  |                 | N/A     |
| 20.8     | Thermal-links shall be tested in one of the following two ways.   |                 | P       |
| 20.8.1   | The thermal-links, when tested as separate components, shall comply with the requirements and tests of IEC 60691  |                 | P       |
|          | - the electrical conditions   |                 | P       |
|          | - the thermal conditions  |                 | P       |
|          | - the ratings of the thermal-link   |                 | P       |
|          | - suitability of the sealing compounds, and impregnating fluids or cleaning solvents  |                 | P       |
| 20.8.2   | The thermal-links when tested as part of a transformer  |                 | N/A     |
| 20.9     | Self-resetting thermal protective devices shall not be used unless no mechanical, electrical, or other hazards occur from their operation during and after the tests of this standard |                 | N/A     |
| 20.10    | Thermal cut-outs intended to be reset by soldering operation shall not be used for overload protection  |                 | N/A     |
| 20.11    | Overload protective devices shall not operate when the supply voltage is switched on  |                 | P       |
| 21       | INTERNAL WIRING   |                 | P       |
| 21.1     | Internal wiring and electrical connections protected or enclosed  |                 | P       |
|          | Wireways smooth and free from sharp edges   |                 | P       |
| 21.2     | Openings in sheet metal: edges rounded (radius 1,5mm) or bushings of insulating material  |                 | P       |
| 21.3     | Bare conductors: distances adequately maintained  |                 | N/A     |
| 21.4     | When external wires are connected to terminal, internal wiring shall not work loose   |                 | P       |
| 21.5     | Insulation of heat-resistant and non-hygroscopic material for insulated conductors subject to temperature rise > limiting values given in 14.2  |                 | N/A     |
| 22       | SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CABLES AND CORDS  |                 | P       |
| 22.1     | Cables, cords and connecting means referred in clause 22 shall have appropriate ratings   |                 | P       |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| 22.2   | Input and output wiring inlet and outlet openings for external wiring: separate entries without damage to protective covering of cable or cord  |                 | N/A     |
|        | Input and output wiring inlet and outlet openings for flexible cables or cords: insulating material or bushing of insulating material   |                 | N/A     |
|        | Bushings for external wiring: reliably fixed, not such they are likely to be damaged.   |                 | N/A     |
| 22.3   | Fixed transformer:  |                 | P       |
|        | - possible to connect after fixing  |                 | P       |
|        | - Appliance inlets not allowed on permanently connected to fixed wiring.  |                 | N/A     |
|        | - fitting of cover without damage to conductors   |                 | P       |
|        | - contact between insulation of external supply wires and live parts of different polarity and live parts of output circuit not allowed   |                 | P       |
| 22.4   | Portable transformer other than direct plug-in shall have power supply cord.  |                 | N/A     |
|        | Length of cord 2 to 4 m, except for transformer that are allowed to have cross-sectional area of 0.5mm <sup>2</sup>   |                 | N/A     |
| 22.5   | Power supply cords of both transformers with protection index of IPX0 and transformers for "indoor use only" with protection index higher than IPX0, shall be as follows:   |                 | N/A     |
|        | - for transformers with a mass not exceeding 3 kg   |                 | N/A     |
|        | - for transformers with a mass exceeding 3 kg   |                 | N/A     |
| 22.6   | Power supply cords may be cord sets fitted with appliance couplers in accordance with IEC 60320, provided the transformers are single-phase portable transformers with input current not exceeding 16 A at the rated output |                 | N/A     |
| 22.7   | Nominal cross-sectional area (mm <sup>2</sup> ); input current (A) at rated output not less than shown in table 9 .....   |                 | N/A     |
| 22.8   | Class I transformer with Power supply cord: green/yellow core connected to earthing terminal  |                 | N/A     |
|        | Plug for single-phase transformer with input current at rated output 16 A according to IEC 60 083, IEC 60 906-1   |                 | N/A     |
|        | Plug for other portable transformers complying with IEC 60309   |                 | N/A     |
| 22.9   | Type X, Y, or Z attachments allowed   |                 | N/A     |
| 22.9.1 | For type Z attachment: moulding enclosure and Power supply cord cable do not affect insulation of cord  |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| 22.9.2 | Inlet openings or inlet bushing: without risk of damage to protective covering of Power supply cord   |                 | N/A     |
|        | Insulation between conductor and enclosure:   |                 | N/A     |
|        | - for Class I transformer: insulation of conductor at least basic insulation  |                 | N/A     |
|        | - for Class II transformer: insulation of conductor at least double or reinforced insulation  |                 | N/A     |
| 22.9.3 | Inlet bushings:   |                 | N/A     |
|        | - no damage to Power supply cord  |                 | N/A     |
|        | - reliably fixed  |                 | N/A     |
|        | - not removable without aid of tool   |                 | N/A     |
|        | - not be natural rubber, except as an integral part of cord for type X with a special cord and type Y and Z for class I transformer.                                  |                 | N/A     |
| 22.9.4 | For transformers with cords which are moved while operating:  |                 | N/A     |
|        | - cord protected against excessive flexing.   |                 | N/A     |
|        | -cord guard of insulating material  |                 | N/A     |
|        | -cord guard reliably fixed  |                 | N/A     |
|        | -flexing test as shown in figure 7, loaded with 10 N if cord area $\geq 0.75 \text{ mm}^2$ , 5 N for others, flexing 20000 times for Z attachments, 10000 for others. |                 | N/A     |
| 22.9.5 | Transformer for use with external flexible cable or cord shall have cord anchorage that relief from strain, twisting and abrasion.                                    |                 | N/A     |
|        | - glands in portable transformers not used unless possibility for clamping all types and sizes of cable   |                 | N/A     |
|        | - moulded-on designs, tying the cable into a knot and tying the end with string not allowed   |                 | N/A     |
|        | - labyrinths, if clearly how, permitted   |                 | N/A     |
|        | Cord anchorage for type X attachment:   |                 | N/A     |
|        | - replacement of cable easily possible  |                 | N/A     |
|        | - protection against strain and twisting clearly how  |                 | N/A     |
|        | - suitable for different types of cable unless only one type of cable for transformer   |                 | N/A     |
|        | - the whole flexible cable or cord with covering can be mounted into the cord anchorage   |                 | N/A     |
|        | - if tightened or loosened no damage  |                 | N/A     |
|        | - no contact between cable or cord and accessible or electrically connected clamping screws   |                 | N/A     |
|        | - cord clamped by metal screw not allowed   |                 | N/A     |
|        | - one part securely fixed to transformer  |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
|        | - screws do not serve to fix any other component unless if omitted or incorrectly mounted the transformer is inoperative or clearly incomplete; compliance or parts not removable without tool |                 | N/A     |
|        | - for Class I transformer: insulating material or insulated from metal parts   |                 | N/A     |
|        | - for Class II transformers: insulating material or supplementary insulation from metal parts  |                 | N/A     |
|        | Cord anchorages for type X, Y, Z attachments: cores of external flexible cable or cord insulated from accessible metal parts by:   |                 | N/A     |
|        | - basic insulation (Class I transformers)  |                 | N/A     |
|        | - supplementary insulation (Class II transformers)   |                 | N/A     |
|        | Cord anchorages for type X with special cord and Y attachments:  |                 | N/A     |
|        | - replacement of external flexible cable or cord does not impair compliance with standard  |                 | N/A     |
|        | -cable capable of being mounted into the cord anchorage  |                 | N/A     |
|        | -cord unlikely to be damaged when tightened and loosened.  |                 | N/A     |
|        | -cord not clamped by screws directly on cord   |                 | N/A     |
|        | -knots in cord not used.   |                 | N/A     |
|        | - labyrinths, if clearly how, permitted  |                 | N/A     |
|        | -protection against strain and twisting  |                 | N/A     |
|        | -not possible to push cable into transformer   |                 | N/A     |
|        | - test: 25 pulls of 1s, 1min torque:   |                 | N/A     |
|        | - mass (kg); pull (N); torque (Nm).....:   |                 | N/A     |
|        | -during test: cable not damaged  |                 | N/A     |
|        | - after test: longitudinal displacement 2 mm for cable or cord and 1 mm for conductors in terminals  |                 | N/A     |
|        | - creepage distances and clearances values specified in Cl. 26   |                 | N/A     |
| 22.9.6 | Space for supply cables or Power supply cord cable for fixed wiring and for type X, and Y attachments:   |                 | N/A     |
|        | - before fitting cover, possibility to check correct connection and position of conductors   |                 | N/A     |
|        | - cover fitted without damage to supply cords  |                 | N/A     |
|        | - for portable transformers: contact with accessible metal parts if conductor becomes loose not allowed unless for type X, Y attachments terminations of cords do not slip free of conductor   |                 | N/A     |
|        | For fixed wiring and for type X attachment and for connection to fixed wiring, in addition:  |                 | N/A     |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | - conductor easily introduced and connected   |                 | N/A     |
|        | - Access to terminal for external conductor only after removal of cover with aid of tool  |                 | N/A     |
| 23     | TERMINALS FOR EXTERNAL CONDUCTORS   |                 | N/A     |
| 23.1   | Transformers intended to be permanently connected to fixed wiring, and transformers other than those provided with external flexible cords with type Y or Z attachments shall be provided with terminals in which connection is made by means of screws, nuts or equally effective devices. |                 | N/A     |
|        | Terminals that are an integral part of the transformer shall comply with IEC 60999-1 under the conditions prevailing in the transformer.  |                 | N/A     |
|        | For transformers with type X attachment,  |                 | N/A     |
|        | For transformers with type Y and Z attachments  |                 | N/A     |
| 23.2   | Terminals for type X attachment with a special cord, and types Y and Z attachments shall be suitable for their purpose  |                 | N/A     |
| 23.3   | Terminals other than Y and Z attachment: the terminal not work loose, no stress on internal wiring, cr. cl not reduced below values in 26 during normal use.  |                 | N/A     |
| 23.4   | Terminals other than Y and Z attachment: clamped with sufficient contact pressure, and without damage to the conductor  |                 | N/A     |
| 23.5   | Terminals for fixed wiring and for type X attachment: located near the associated terminal for the different polarity and earthing terminal, if any   |                 | N/A     |
| 23.6   | Terminal blocks not accessible without the aid of a tool  |                 | N/A     |
| 23.7   | Terminals for X attachment: stranded conductor (8 mm) not in contact with accessible metal part ( class I transformer ) or metal part separated by supplementary insulation ( class II transformer)   |                 | N/A     |
| 23.8   | Terminals without pressure plate shall be provided with at least two clamping screws if the current exceeds 25 A  |                 | N/A     |
| 23.9   | Terminal screws, other than screws of terminals for the connection of protective earth conductors shall not come into contact with any accessible conductive parts  |                 | N/A     |
| 24     | PROVISION FOR PROTECTIVE EARTHING   |                 | P       |

# EN 61558-2-14

| Clause | Requirement + Test   | Result - Remark | Verdict |
|--------|--|-----------------|---------|
| 24.1   | Class I transformers: accessible parts connected to earthing terminal which may become live in the event of an insulation fault  |                 | P       |
|        | Class II transformers: no provision for earthing   |                 | N/A     |
| 24.2   | Protective earthing terminal for connection to fixed wiring and for type X attachment transformers: comply with Cl. 23, adequately locked, not possible to loosen without a tool |                 | N/A     |
| 24.3   | No risk of corrosion from contact between metal of earthing terminal and other terminal  |                 | P       |
|        | In case of earthing terminal body of Al, no risk of corrosion from contact between Cu and Al   |                 | P       |
|        | Body of earthing terminal or screws/nuts of brass or other metal resistant to corrosion  |                 | P       |
| 24.4   | Resistance of connection between earthing terminal and metal parts 0,1Ω with a min. 25A or 1,5times rated input current at 1min  |                 | P       |
| 24.5   | Class I transformers with external flexible cables or cords shall the current-carrying conductors becoming taut before the earthing conductor                                    |                 | N/A     |

|      |   |  |     |
|------|---|--|-----|
| 25   | SCREWS AND CONNECTIONS  |  | P   |
| 25.1 | Screwed connections withstand mechanical stresses   |  | P   |
|      | Screws transmitting contact pressure or likely to be tightened by the user or having a diameter < 2,8mm, shall screw into metal             |  | N/A |
|      | Screws of insulating material: not used for electrical connection   |  | P   |
|      | Screws not of insulating material if their replacement by metal screws can impair supplementary or reinforced insulation                    |  | P   |
|      | Screws to be removed (replacement etc. of cord) not of insulating material if their replacement by metal screws can impair basic insulation |  | P   |
|      | No damage after torque test: diameter (mm); torque (Nm); ten times .....  |  | P   |
|      | No damage after torque test: diameter (mm); torque (Nm); five times .....   |  | N/A |
| 25.2 | Screws in engagement with thread of insulating material:  |  | N/A |
|      | - length of engagement 3mm + 1/3 crew diameter or 8 mm  |  | N/A |
|      | - correct introduction into screw hole  |  | N/A |
| 25.3 | Electrical connections: contact pressure not transmitted through insulating material  |  | P   |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| 25.4   | In case of use of space-threaded (sheet metal) screws for connection of current-carrying parts: clamping and locking means provided   |                 | N/A     |
|        | Thread-cutting (self-tapping) screws used for the connection of current-carrying parts allowed if they generate a full form machine screw thread and if not operated by the user  |                 | N/A     |
|        | Space-threaded and thread-cutting screws used for earthing continuity allowed if at least 2 screws for each connection are used and it is not necessary to disturb the connection in normal use   |                 | N/A     |
| 25.5   | Screws for current-carrying mechanical connections locked against loosening   |                 | P       |
|        | Rivets for current-carrying connections subject to torsion locked against loosening   |                 | P       |
| 25.6   | After the test, the transformer and the glands shall show no damage   |                 | P       |
| 26     | CREEPAGE DISTANCES AND CLEARANCES   |                 | P       |
| 26.1   | Creepage distance, clearances and distance through insulation not less than specified in table 13   |                 | P       |
| 26.2   | Potting test if creepage distance per pollution degree 1.   |                 | N/A     |
| 26.3   | Distance through insulation shown in square brackets in box 2 and 7 of table 13, C1, D1 may be used if the insulation layer consists of at least three layers, fulfills thermal material classification per IEC60085 and IEC 60216 and pass the mandrel test. |                 | N/A     |
| 27     | RESISTANCE TO HEAT, ABNORMAL HEAT, FIRE AND TRACKING  |                 | P       |
| 27.1   | Resistance to heat  |                 | P       |
|        | All parts of the transformer made of insulating material shall be resistant to heat   |                 | P       |
|        | The test is not carried out for cables and small  |                 | N/A     |
| 27.1.1 | External accessible parts   |                 | N/A     |
|        | The test is carried out at a temperature of $(70 \pm 2) ^\circ\text{C}$ , or at a temperature of $(T + 15 \pm 2) ^\circ\text{C}$ where T is the temperature of the relevant part during the test of 14.2, whichever is higher                                 |                 | N/A     |
| 27.1.2 | Internal parts  |                 | P       |
|        | Internal parts of insulating material retaining current carrying parts in position shall be resistant to heat   |                 | P       |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark                           | Verdict |
|--------|---|---|---------|
|        | The test shall be performed at a temperature of $(125 \pm 2) ^\circ\text{C}$ , or at a temperature of $(T + 15 \pm 2) ^\circ\text{C}$ where T is the temperature of the relevant part during the test of 14.2, whichever is higher              | Connector : $125^\circ\text{C}$<br>1.24mm | P       |
| 27.2   | Resistance to abnormal heat under fault conditions  |   | P       |
|        | Transformers with protection index IP20 or higher, under fault conditions, shall not act as a source of ignition, and the insulation between the windings shall not result in breakdown; moreover, hazardous live parts shall not be accessible |   | N/A     |
|        | Compliance is checked by the tests of 27.2.1 and 27.2.2. This test is not required on fail safe transformers as they are covered by 15.5  |   | N/A     |
| 27.2.1 | Portable transformers shall be placed on a dull black painted plywood support   |   | N/A     |
|        | Stationary transformers, not designed to be built in, shall be mounted in the most unfavourable position under normal use   |   | N/A     |
|        | For this test, the input circuit shall be protected by a fuse or circuit-breaker with a rated current 10 times the rated current of the transformer, but at least 16 A  |   | N/A     |
|        | The transformer, with its protective devices when applicable, shall be tested as specified above for 15 days but without load   |   | N/A     |
|        | For transformers with self-resettable protective devices, all the protective devices are short-circuited  |   | N/A     |
|        | During the test, no flames shall occur, and the transformer shall not act as a source of ignition for the surroundings  |   | N/A     |
| 27.2.2 | After the test of 27.2.1 and after cooling down to ambient temperature, the following applies.  |   | N/A     |
|        | a) Transformers where a definitive interruption in the input circuit has occurred shall withstand a dielectric strength test, the test voltage being 35 % of the values according to Table 8a of Clause 18                                      |   | N/A     |
|        | b) Transformers where no definitive interruption has occurred after the cycling test shall withstand the test voltages according to Table 8a of Clause 18   |   | N/A     |
| 27.3   | Resistance to fire  |   | P       |
|        | All parts of the transformer made of insulating material shall be resistant to ignition and spread of fire.   |   | P       |
| 27.3.1 | External accessible parts   |   | N/A     |
|        | – $650 ^\circ\text{C}$ for enclosures   |   | N/A     |



# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | - 650 °C for parts retaining current carrying (keeping in position) parts in position and terminals for external conductors which carry a current up to 0,2 A during normal operation   |                 | N/A     |
|        | - 750 °C for parts retaining (keeping in position) current carrying parts in position and terminals for external conductors with fixed connection (e.g., soldering) which carry a current exceeding 0,2 A during normal operation           |                 | N/A     |
|        | - 850 °C for parts retaining (keeping in position) current carrying parts in position and terminals for external conductors with non-fixed connection which carry a current exceeding 0,2 A during normal operation                         |                 | N/A     |
| 27.3.2 | Internal parts  |                 | P       |
|        | - 550 °C for internal insulating material not retaining (not keeping in position) current carrying parts in position  |                 | N/A     |
|        | - 650 °C for coil formers (bobbins)   |                 | N/A     |
|        | - 650 °C for parts retaining (keeping in position) current carrying parts in position and terminals for external conductors which carry a current up to 0,2 A during normal operation   |                 | N/A     |
|        | - 750 °C for parts retaining (keeping in position) current carrying parts in position and terminals for external conductors with fixed connection (e.g., soldering) which carry a current exceeding 0,2 A during normal operation           |                 | N/A     |
|        | - 850 °C for parts retaining (keeping in position) current carrying parts in position and terminals for external conductors with non fixed connection which carry a current exceeding 0,2 A during normal operation                         | Connector       | P       |
| 27.4   | Resistance to tracking  |                 | N/A     |
|        | For transformers with an IP rating other than IPX0, insulating parts retaining current carrying parts in position shall have resistance to tracking corresponding to at least material group IIIa if they are exposed to pollution degree 3 |                 | N/A     |
|        | No flashover or breakdown between electrodes shall occur before a total of 50 drops has fallen  |                 | N/A     |

|    |   |  |     |
|----|---|--|-----|
| 28 | RESISTANCE TO RUSTING                   |  | N/A |
|    | Ferrous parts protected against rusting |  | N/A |

|    |                                   |  |   |
|----|-----------------------------------|--|---|
| A. | MEASUREMENTS OF CREEPAGE DISTANCE |  | P |
|----|-----------------------------------|--|---|

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
|        | Methods of measuring creepage distances and clearances  |                 | P       |
| B.     | TESTING A SERIES OF TRANSFORMER   |                 | N/A     |
|        | Methods have to pick out samples for testing a series.  |                 | N/A     |
| C.     | TABLE C.1 FOR MATERIAL GROUP II   |                 | N/A     |
|        | Clearance and creepage distance table for material group II ( $400 \leq CTI \leq 600$ )   |                 | N/A     |
| D.     | TABLES C.1 FOR MATERIAL GROUP I   |                 | N/A     |
|        | Clearance and creepage distance table for material group I ( $CTI \geq 600$ )   |                 | N/A     |
| E.     | GLOW-WIRE TEST  |                 | P       |
|        | Glow-wire test is carried out in accordance with IEC 659-2-1/0  |                 | P       |
| F.     | REQUIREMENTS FOR SWITCHES COMPLYING WITH IEC 61058  |                 | N/A     |
| F.1    | Test separately per IEC 1058  |                 | N/A     |
|        | Tested as a part of apparatus and withstand the test specified in F.2, F.3 and F.4,   |                 | N/A     |
| G.     | TRACKING TEST   |                 | N/A     |
|        | Test methods to specify the CTI index.  |                 | N/A     |
| H      | ELECTRONIC CIRCUITS   |                 | N/A     |
| H.5    | General notes on test:  |                 | N/A     |
| H.5.1  | All clause of part 1 apply to electronic circuits   |                 | N/A     |
| H.5.2. | To avoid accumulation of stress resulting from test, it may be necessary to replace components.   |                 | N/A     |
| H.15   | Short-circuit and overload protection   |                 | N/A     |
| H.15.6 | Electronic circuits shall be so designed and applied that it will not render the transformer to become unsafe during fault condition                    |                 | N/A     |
|        | During and after test: no high temperatures, and the transformer shall comply with clause 15.1  |                 | N/A     |
| H.15.7 | Fault conditions are not made on circuits that is a low-power circuit or the protection against electric shock does not rely on the electronic circuit. |                 | N/A     |

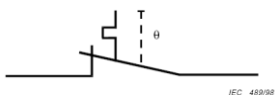
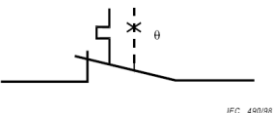

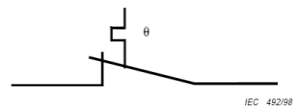
# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| H.15.8 | Fault condition on electric circuits:   |                 | N/A     |
|        | a) short-circuit if $cl, cr < \text{clause 29}$   |                 | N/A     |
|        | b) open circuit of a component  |                 | N/A     |
|        | c) short circuit of capacitor, unless they comply with IEC384-14  |                 | N/A     |
|        | d) short-circuit of any two terminals of an electronic component as specified   |                 | N/A     |
|        | e) any failure of an integrated circuit as specified  |                 | N/A     |
|        | During the test the transformer is supplied with 0.94-1.06 times the rated supply voltage   |                 | N/A     |
|        | The test is carried out until steady condition  |                 | N/A     |
|        | If the transformer is incorporate an electronic circuit that operates to ensure compliance with clause 15, the relevant test is repeated with a single fault simulated                                      |                 | N/A     |
|        | PTC and NTC is not short circuit if they is used within manufactured declared specification.  |                 | N/A     |
| H.15.9 | If a miniature fuse complying with IEC 127 secure the safety of the transformer the current shall be measured during fault condition  |                 | N/A     |
|        | - if current $< 2,1$ times rated current, the test is repeated with the fuse short circuit.   |                 | N/A     |
|        | - if current $< 2,75$ times rated current, the circuit is considered to be adequately protected.  |                 | N/A     |
|        | - if current $< 2,1$ times rated current, the test is repeated with the fuse short circuit for the time: 30 min for a quick acting fuse and 2 min for time lag fuse.  |                 | N/A     |
| H.26   | CREEPAGE, CLEARANCES AND DISTANCES THROUGH INSULATION   |                 | N/A     |
| H.26.1 | The distance on conductive pattern on printed circuit board between different polarity may be reduced if the track index of the PTC is at least material group IIIa to:-150 V/mm if protected against dirt. |                 | N/A     |
|        | The distance may be less if the transformer comlies with clause H.15 if the distance is short circuit.  |                 | N/A     |
| H.26.2 | Test is carried out at a temperature of 50K in excess of the maximum temperature measured in clause 14 and 15.  |                 | N/A     |

|       |  |  |     |
|-------|--|--|-----|
| K     | INSULATED WINDING WIRES FOR USE AS MULTIPLE LAYER INSULATION |  | N/A |
| K.1   | Wingding shall be insulated with two or more layers.         |  | N/A |
| K.2   | The wire shall pass the following five test K.2.1 to K.2.5   |  | N/A |
| K.2.1 | Dielectric strength test, test 13 of IEC 851-5 applies       |  | N/A |

# EN 61558-2-14

| Clause | Requirement + Test  | Result - Remark | Verdict |
|--------|---|-----------------|---------|
| K.2.2  | Adherence and flexibility, test 8 of IEC 851-3 applies followed by test K.2.1   |                 | N/A     |
| K.2.3  | Heat shock, test 9 of 3.1 or 3.2 of IEC 851-6 applies followed by test K.2.1  |                 | N/A     |
| K.2.4  | Retention of dielectric strength after bending, test 13 of 4.6.1 of IEC 851-5 applies followed by test K.2.1                  |                 | N/A     |
| K.2.5  | Resistance of abrasion, test 11 of IEC 851-3 is applicable.   |                 | N/A     |
| K.3    | Routine test, the wire shall be subjected by the wire manufacturer to 100% dielectric strength testing according to IEC 851-5 |                 | N/A     |

|         |  |  |     |
|---------|--|--|-----|
| V.      | SYMBOLS TO BE USED FOR THERMAL CUT-OUTS  |  | P   |
|         | Symbols, when used are placed on the transformer   |  |     |
| V.2.1.1 | Restored by manual operation<br>             |  | N/A |
| V.2.1.2 | Restored by disconnection of the supply<br> |  | N/A |
| V.2.1.3 | Thermal link<br>                            |  | P   |
| V.2.2   | Self-resetting thermal cut-out<br>          |  | N/A |

|              |   |                |              |                       |                             |  |
|--------------|---|----------------|--------------|-----------------------|-----------------------------|--|
| 11           | TABLE: output voltage and output current under load; no-load output voltage |                |              |                       |                             | P  |
| Clause       | 11  |                |              | 12                    |                             |  |
| rated output | rated voltage V   | sec. voltage V | delta Usec % | Usec V no-load output | delta Usec no-load output % | further information                                |
| 210-230Vac   | 160-250Vac  | 225            | -2.17%       | 291                   | 29.3%                       | CI11 required $\pm 10\%$<br>CI12 required $<100\%$ |

|   |                  |  |        |                  |
|---|------------------|--|--------|------------------|
| 14  | TABLE: heating   |  |        | P                |
|   | t1 (°C)          | 25.0                                   |        | --               |
|   | t2 (°C)          | 25.1                                   |        | --               |
|   | Test voltage (V) | 275VAC                                 |        | --               |
|   |                  | Winding temperature rise measurements: |        | P                |
| Parts   |                  | dT (K)                                 |        | Limited          |
| Metal enclosure   |                  | 4.3                                    |        | --               |
| AC connector  |                  | 9.7                                    |        | --               |
| Internal wire   |                  | 15.3                                   |        | 105-45=60        |
| PCB   |                  | 18.9                                   |        | 130-45=85        |
| Capacitor   |                  | 25.3                                   |        | 105-45=60        |
| Ambient   |                  | 25.0                                   |        | --               |
| Temperature rise dT winding   | R1(Ω)            | R2(Ω)                                  | dT (K) | Insulation class |
| Transformer winding   | 1347             | 1561                                   | 33.5   | A                |
| Note: The temperature rise limit is based on max. ambient operating temperature 40°C. |                  |  |        |                  |
| The sample is test on temperature ta+5°C.   |                  |  |        |                  |

|    |  |          |                  |           |         |                  |                            |
|----|--|----------|------------------|-----------|---------|------------------|----------------------------|
| 15 | TABLE: short-circuit and overload protection s.c.= short circuit, d.c.=disconnect circuit, MUL=most unfavourable load) |          |                  |           |         |                  | P                          |
|    | ambient temperature (°C) .....: 25°C   |          |                  |           |         |                  | —                          |
| No | Component No   | Fault    | Test voltage (V) | Test time | Fuse No | Fuse current (A) | result                     |
| 1  | Transformer  | s.c      | 275Vac           | 1 S       | ---     | --               | Unit shut down, no hazards |
| 2  | Transformer  | overload | 275Vac           | 4 H       | ---     | --               | No hazard.                 |

|                                  |   |       |               |
|----------------------------------|---|-------|---------------|
| 18.2                             | TABLE: INSULATION RESISTANCE ACCORDING TO TABLE 7 |       | P             |
| Insulation resistance R between: |   | R(MΩ) | Require R(MΩ) |
| Basic insulation                 |   | >50   | 2             |

|      |  |  |  |   |
|------|--|--|--|---|
| 18.3 | TABLE: DIELECTRIC STRENGTH TEST ACCORDING TO TABLE 8 |  |  | P |
|------|--|--|--|---|

|                               |                  |           |
|-------------------------------|------------------|-----------|
| Test voltage applied between: | Test voltage (V) | Breakdown |
| Basic insulation              | 2100             | No        |

| 20              | TABLE: COMPONENTS                      |                 |                          |                       | P |
|-----------------|--|-----------------|--------------------------|-----------------------|---|
| Object/part No. | Manufacturer/trademark                 | Type/model      | Technical data           | Mark(s) of conformity |   |
| Internal wire   | Various                                | 60227 IEC02(RV) | 0.75-4mm <sup>2</sup>    | TUV                   |   |
| Earthing wire   | Various                                | 60227 IEC02(RV) | 1.5-4mm <sup>2</sup>     | TUV                   |   |
| transformer     | Yueqing Hori Transformer Co., Ltd      | ZTY-5K          | 5KVA 230V                | CE                    |   |
| winding         | XUZHOU SHENGBAO INDUSTRY CO LTD        | QL(ZY/XY)       | 200°C                    | E194766               |   |
| bobbin          | CHANG CHUN PLASTICS                    | EE16            | 150°C, 94V-0             | UL E59481             |   |
| PCB             | Various                                | Various         | 130°C, V-0               | UL                    |   |
| Switch          | Shanghai yongxing electronic co., Ltd. | KCD2            | 16(4)A 250V              | CE                    |   |
| Switch          | WEALTH METAL FACTORY LTD               | MX-94-C-01      | 1A 250V                  | CE                    |   |
| Connector       | TEND TECHNOLOGY CO., LTD               | TBE-XN series   | 15-60A 10P<br>60-200A 4P | TUV R50148529         |   |

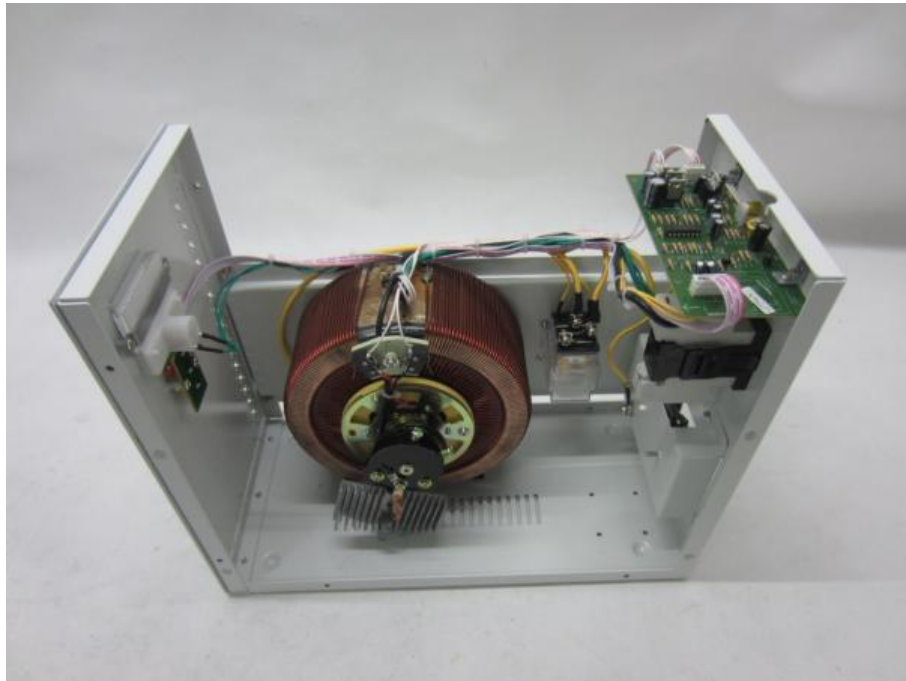
## **Appendix 1**

Whole Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-5KVA



## **Appendix 2**

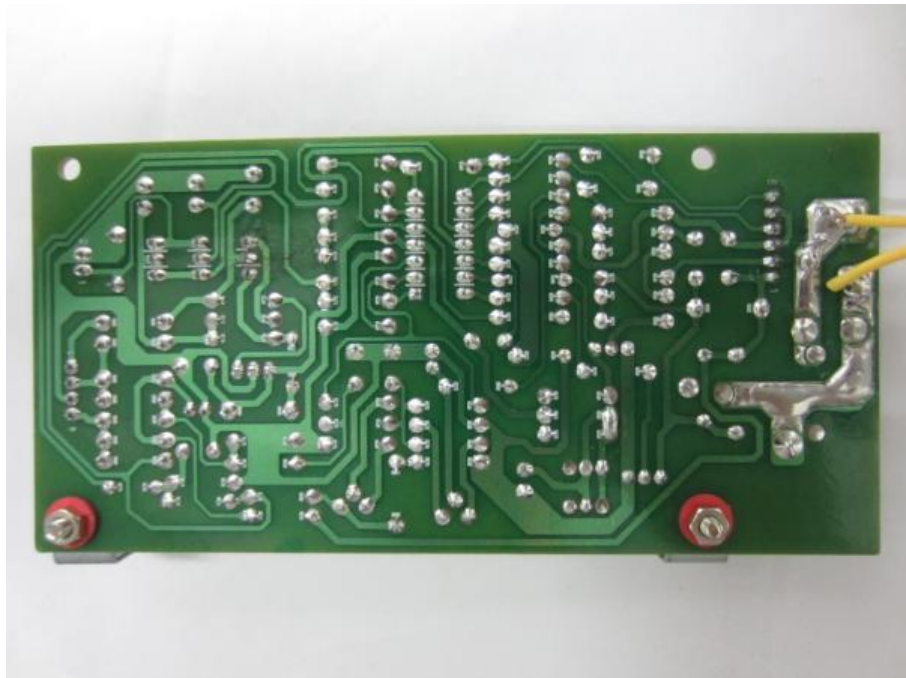
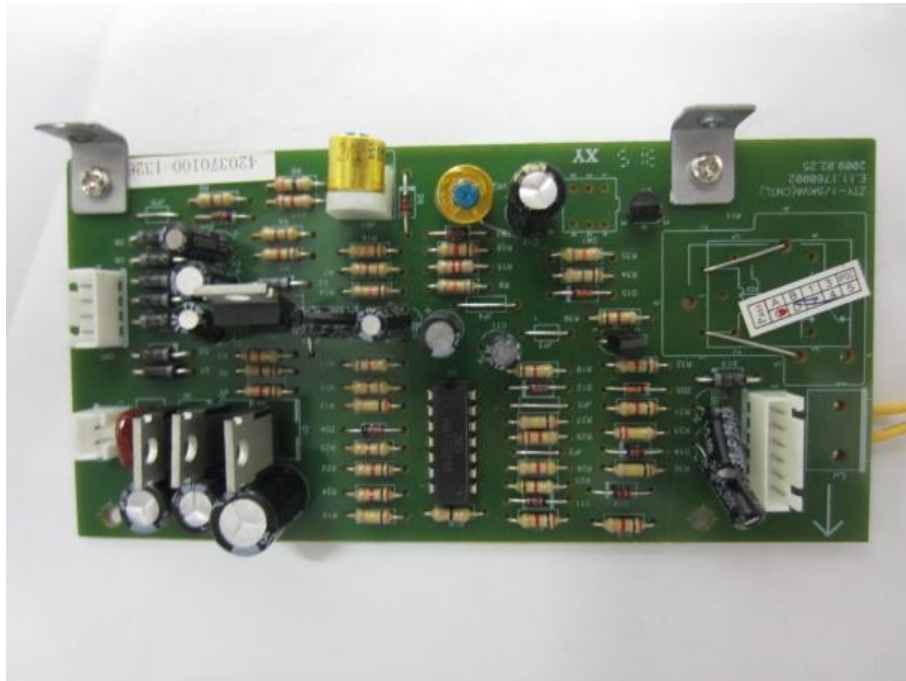
Inner Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-5KVA





## **Appendix 3**

### **PCB Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'** **Model: ZTY-5KVA**



## Appendix 4

Whole Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-500VA



## **Appendix 5**

Whole Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-1KVA



## Appendix 6

Whole Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-2KVA



## **Appendix 7**

Whole Views of 'FULLY AUTOMATIC AC VOLTAGE REGULATOR'  
Model: ZTY-3KVA



-- End of this report --