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Surge parameters of isolating transformers used in telecommunication devices and equipment

Recommendation ITU-T K.95

ITU-T

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Summary

Telecommunication devices and equipment can use non-linear limiting, linear attenuating, or both types of functions to mitigate surges occurring on services. Isolating transformers attenuate common-mode voltage surges on a service. Recommendation ITU-T K.95 gives test methods and preferred values for the isolating transformer surge parameters that are harmonized with established international standards on insulation coordination levels and test techniques.

History

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Surge parameters of isolating transformers used in telecommunication devices and equipment

1 Scope

This Recommendation sets terms, test methods, test circuits, measurement procedures and preferred result values for the surge parameters of isolating transformers used in telecommunication devices and equipment. Three types of isolating transformer are covered: mains, switched mode power supply and signal. The surge parameters of the isolating transformer insulation barrier covered by this Recommendation are:

- rated impulse voltage;
- input winding to output winding capacitance;
- insulation resistance.

Additional parameters for signal isolating transformers are:

- core saturation voltage-time product;
- rated input winding root mean square (rms) current for a given temperature rise.

This Recommendation does not cover the transformer parameters required to help ensure appropriate operation on the service, e.g., signal transformer return loss.

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 breakdown [b-IEC 61340-1]: Failure, at least temporarily, of the insulating properties of an insulating medium under electric stress.

3.1.2 clearance [b-IEC/TR 60664-2-1]: Shortest distance in air between two conductive parts.

3.1.3 creepage distance [b-IEC/TR 60664-2-1]: Shortest distance along the surface of a solid insulating material between two conductive parts.

3.1.4 electric screen [b-IEC 60050-151]: Screen of conductive material intended to reduce the penetration of an electric field into a given region.

3.1.5 hazard [b-IEC GUIDE 116]: Potential source of harm.

NOTE – The term hazard can be qualified in order to define its origin (e.g., electrical hazard, mechanical hazard) or the nature of the potential harm (e.g., electric shock hazard, cutting hazard, toxic hazard, fire hazard).

3.1.6 impulse withstand voltage [b-IEC/TR 60664-2-1]: Highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions.

3.1.7 insulation (electrical) [b-IEC 62477-1]: Electrical separation between circuits or conductive parts provided by clearance or creepage distance or solid insulation or combinations of them.

3.1.8 insulation coordination [b-IEC/TR 60664-2-1]: Mutual correlation of insulation characteristics of electrical equipment taking into account the expected microclimate and other influencing stresses.

3.1.9 insulation resistance [b-IEC 62631-1]: Resistance under specified conditions between two conductive bodies separated by the insulating material.

3.1.10 isolating transformer [b-IEC 60065]: Transformer with protective separation between the input and output windings.

3.1.11 pollution [b-IEC 60664-1]: Any addition of foreign matter, solid, liquid, or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation.

3.1.12 pollution degree [b-IEC 60664-1]: Numeral characterizing the expected pollution of the micro-environment

3.1.13 pollution degree 1 [b-IEC 61131-2]: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

3.1.14 pollution degree 2 [b-IEC 61131-2]: Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

3.1.15 pollution degree 3 [b-IEC 61131-2]: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation, which is expected.

3.1.16 overvoltage [b-IEC/TR 60664-2-1]: Any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions.

3.1.17 rated impulse voltage [b-IEC/TR 60664-2-1]: Impulse withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages.

3.1.18 thermal equilibrium [b-IEC 61810-1]: Variation of less than 1 K between any two out of three consecutive measurements made at an interval of 5 min.

3.1.19 thermal resistance [b-IEC 62590]: Quotient of the temperature difference between two specified points or regions and the heat flow between these two points or regions under conditions of thermal equilibrium.

NOTE – For most cases, the heat flow can be assumed to be equal to the power dissipation.

3.1.20 withstand voltage [b-IEC/TR 60664-2-1]: Voltage to be applied to a specimen under prescribed test conditions which does not cause breakdown and/or flashover of a satisfactory specimen.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 common-mode surge: Surge appearing equally on all conductors of a group at a given location.

NOTE 1 – The reference point for common-mode surge voltage measurement can be a chassis terminal, or a local earth/ground point.

NOTE 2 – Also known as longitudinal surge or asymmetrical surge.

3.2.2 component type: Identification number assigned to a component, based on an identification system used by a particular organization.

NOTE – Model number, product ID, product name, product number; product type, part number; part ID are used as synonyms to component type.

3.2.3 differential-mode surge: Surge occurring between any two conductors or two groups of conductors at a given location.

NOTE 1 – The surge source maybe be floating, without a reference point or connected to reference point, such as a chassis terminal, or a local earth/ground point.

NOTE 2 – Also known as metallic surge or transverse surge or symmetrical surge or normal surge.

3.2.4 guarded measurement (three terminal network): Measurement technique that allows the direct impedance between two terminals to be measured correctly by applying a compensating voltage to the third terminal that removes the shunting effects of any impedances to the third terminal.

3.2.5 microclimate: Climatic condition at the place where a component is installed in the product.

NOTE – Only the in product maximum air temperature (classes X1 to X7) and, optionally, the maximum air humidity class (classes Y1 to Y4) are taken into account.

3.2.6 rated winding d.c.: Maximum winding current that will not cause the winding conductor temperature to exceed a specified increase above the ambient temperature.

3.2.7 surge: Temporary disturbance on the conductors of an electrical service caused by an electrical event not related to the service.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

IR Insulation Resistance

RMS Root-Mean-Square

5 Conventions

This Recommendation uses the following symbols to represent the different transformer configurations.

Figure 5-1 shows the symbol for a two-winding transformer.

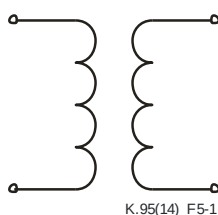


Figure 5-1 – Symbol for a two-winding transformer

Figure 5-2 shows the symbol for a two-winding transformer with instantaneous voltage polarity indicators.

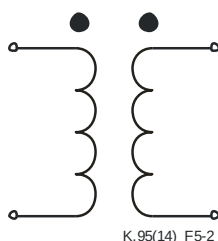


Figure 5-2 – Symbol for a two-winding transformer with polarity indication

Figure 5-3 shows the symbol for a two-winding transformer with an electric screen between the windings.