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Foreword

This ETSI Technical Report (ETR) has been produced by the Equipment Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETR provides guidance on the threat to equipment from Electrostatic Discharge (ESD) in telecommunications centres and recommends guidance for customer's premises. It describes measures which may be taken to reduce the problem of ESD. This ETR partly describes additional requirements and recommendations to EN 100 015/I [2].

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1 Scope

This ETSI Technical Report (ETR) specifies recommended methods, procedures and environmental improvements related to Electrostatic Discharge (ESD) for Public Telecommunications Operator (PTO) staff and their suppliers. It covers telecommunications centres, customer's premises and activities during manufacture, transport, storage, installation, operation and maintenance.

2 References

For the purposes of this ETR, the following references apply:

[1] IEC SC15D Draft (July 1993): "Test methods for the characterisation of the electrostatic behaviour of floor coverings and installed floors".

[2] EN 100 015/I 1st Edition (1991): "Harmonised System of Quality -Assessment for Electronic Components - Basic Specification: Protection of Electrostatic Sensitive Devices - Part I: General Requirements".

[3] ETS 300 019-1-1: "Equipment engineering; Environmental conditions and environmental tests for telecommunications equipment Part 1-1: Classification of environmental conditions Storage".

[4] ETS 300 019-1-2: "Equipment engineering; Environmental conditions and environmental tests for telecommunications equipment Part 1-2: Classification of environmental conditions Transportation".

[5] ETS 300 019-1-3: "Equipment engineering; Environmental conditions and environmental tests for telecommunications equipment Part 1-3: Classification of environmental conditions Stationary use at weatherprotected locations".

[6] ETS 300 119: "Equipment Engineering (EE); European telecommunication standard for equipment practice".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

Bonding: The connecting together of two or more elements by means of a conductor.

Earth Bonding Point (EBP): A dedicated point connected either directly or indirectly to ground to which an ESP material or tool can be connected.

Electrostatic Discharge (ESD): The transfer of an electrostatic charge between bodies at different electrostatic potentials.

Electrostatic Discharge Sensitive device (ESDS): A discrete device, integrated circuit or assembly that may be damaged by electrostatic potentials encountered in routine handling, testing and transit. Damage includes any degradation or malfunction in the performance of the device.

Electrostatic Protection (ESP): Measures taken to reduce or avert the threat of ESD and electrostatic fields.

Public Telecommunications Operator (PTO) premises: These are buildings, or parts of buildings, utilised by a public telecommunications operator for the provision of telecommunications services.

Tribo-charging: The electrostatic charge generation process which occurs when materials are pressed, rubbed or separated.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

EBP	Earth Bonding Point
ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive device
ESP	Electrostatic Protection
PCB	Printed Circuit Board
PTO	Public Telecommunications Operator
RH	Relative Humidity

4 EBP requirements

ESP EBPs may be fitted to work surfaces, ESP tools, equipment cabinets and racks. This Clause mainly concerns with the fitting to equipment racks. The definition of a rack is given in ETS 300 119 [6].

4.1 Construction

The ESP EBP connector should be of a suitable and safe construction.

A suitable type of connector is the recessed isolated and protected banana type, see figure 1. However, other suitable connectors may be specified, such as the 10 mm press stud.

Earlier types of banana socket, the mating plug of which can be inadvertently inserted into power outlet sockets, should not be used.

The socket should be connected to earth either by direct connection to the grounded rack structure, or via a resistor and/or wire.

Crocodile clamps should not be used.

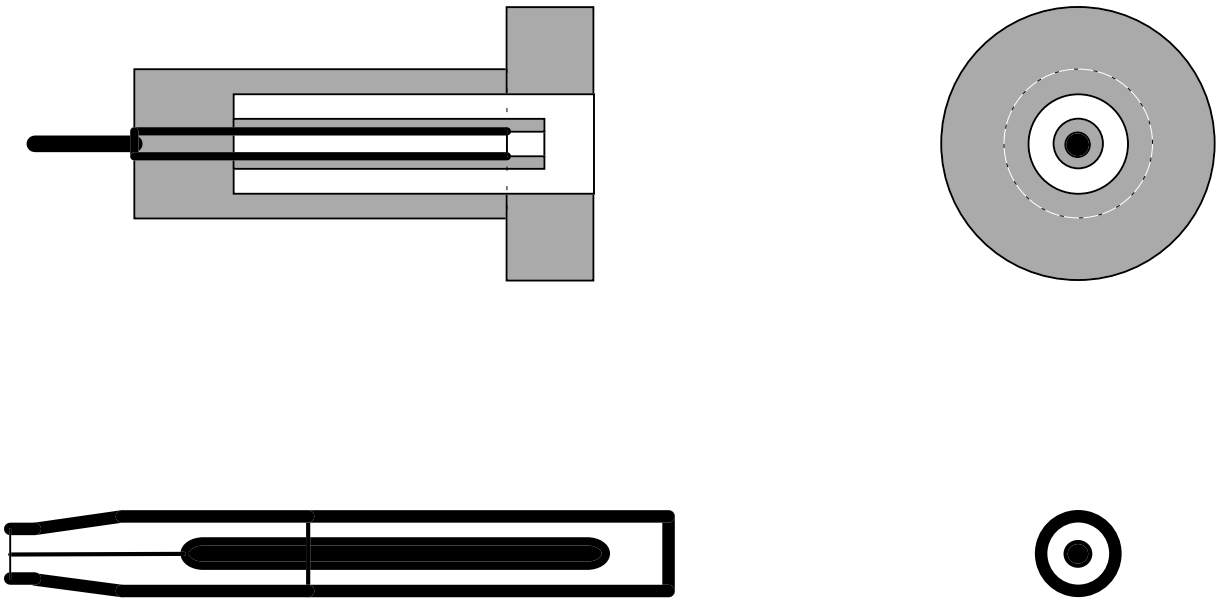

Figure 1: Recessed isolated and protected banana socket and plug

4.2 Location

The EBP should be fitted between 1,0 m and 1,5 m above the base of the cabinet or rack.

Depending the type of cabinet or rack the location of the EBP should be designed such that the banana plug of the wrist strap can be easily connected, before starting to handle ESDSs.

4.2.1 Racks

Preferably, the location of the EBP should be accessible on the front and/or the rear of the frame. In most cases one EBP per rack on the right side will be enough. If there is a need to connect a field service kit or an additional wrist strap, then more EBPs should be available.

4.2.2 Cabinets

For cabinets without doors, subclause 4.2.1 is applicable.

For cabinets with 1 or 2 doors or covers the EBP needs only to be accessible when the cabinet is opened. For cabinets wider than 600 mm more than 1 EBP is recommended. If there is a need to connect a field service kit or an additional wrist strap more EBPs should be available.

If there is a need to have an EBP accessible even when the cabinet is closed it should be located as defined in subclause 4.2.1. The second possibility is to set the EBPs on the top or on the bottom of the cabinet frame.

4.3 Electrical requirements

For the banana type socket there are two possible connection methods:

a) the protected banana type socket completely made out of metal is directly mounted on the cabinet or rack. So there is an electrically very low impedance between the rack and the socket's contact;

b) the protected banana type socket is insulated mounted on the cabinet or rack. So there is a need of a wire or a resistor from the socket contact to the grounded frame. Where a resistor is used, it and the socket should be of a type suitable to withstand a voltage for the specified environment class. The resistance to earth should be less than or equal to 1 MΩ.

4.4 Labelling

The labelling should follow EN 100 015/I [2].

5 Environments

For the purposes of this ETR, four different ESD environments have been defined. These are:

- uncontrolled;
- partially controlled;
- controlled;
- specially controlled.

The environmental conditions for normal operation in telecommunications centres need to fulfil either:

- class 3.1 (temperature-controlled locations); or
- class 3.2 (partly temperature-controlled locations); or
- class 3.3 (not temperature-controlled locations),

of ETS 300 019-1-3 [5], depending upon in which type of location the ESDS is installed.

For customer's premises, the classes 3.1 to 3.3 of ETS 300 019-1-3 [5] are recommended.

All values of resistance to ground should not contravene national safety regulations.

5.1 Uncontrolled

An uncontrolled environment is one where all types of material and levels of humidity are possible. Clothing and shoes are unspecified. There is a high risk of tribo-charging. Electrostatic charge voltages in excess of 8 kV are possible.

5.2 Partially controlled

A partially controlled environment is one where there are some restrictions in the use of materials with high tribo-charging properties. All levels of humidity are possible. The personnel should be trained. There is a moderate risk of tribo-charging. Normally charge voltages will not exceed 8 kV.

5.3 Controlled

A controlled environment is one where full control of materials is employed. The humidity might be controlled. Only trained personnel is allowed to work there. There will be a low risk of tribo-charging. Normally charge voltages will not exceed 4 kV.

5.4 Specially controlled

A specially controlled environment is one where full control of materials is employed. The humidity may be controlled. There will be a very low risk of tribo-charging. Additional ESP measures are taken. Only trained personnel are allowed to work there. Charge voltages should not exceed 0,2 kV. In some cases this voltage needs to be lower.

6 Mitigation measures

6.1 Uncontrolled environment

Since no mitigation measures are taken to reduce the electrostatic phenomena, the equipment should be designed with sufficient ESD immunity to ensure the performance meets the requirements.

A typical uncontrolled environment is a domestic premises.

A possible equipment to be operated in this environment is a network termination.

Where ESDS are handled they should be kept within their ESP packaging, and should only be removed when the ESP measures of the environment provide (locally) the same protection as a specially controlled environment. This may be achieved by using a complete field service kit, comprising: a mat; wrist strap; bonding and grounding cords; spare ESP packaging; and ESP tools.

6.2 Partially controlled environment

The use of materials with high electrostatic charging properties (e.g. untreated plastics) within the area should be avoided. Such materials are usually good electrical insulators, for example, polythene.

Where ESDS are handled they should be kept within their ESP packaging, and should only be removed when the ESP measures of the environment provide (locally) the same protection as a specially controlled environment. This may be achieved by using a complete field service kit, comprising: a mat; wrist strap; bonding and grounding cords; spare ESP packaging; and ESP tools.

Flooring should have a resistance to ground less than $10^9\ \Omega$ (see IEC SC15D [1] and EN 100 015/I [2]).

Typical examples of partially controlled environments are a power equipment room and a main distribution frame room.

A typical type of equipment would be a power equipment rack.

6.3 Controlled environment

The use of materials with high electrostatic charging properties (e.g. untreated plastics) is not allowed.

Where ESDS are handled they should be kept within their ESP packaging, and should only be removed when the ESP measures of the environment provide (locally) the same protection as a specially controlled environment. This may be achieved by using a complete field service kit, comprising: a mat; wrist strap; bonding and grounding cords; spare ESP packaging; and ESP tools.

The Relative Humidity (RH) can be monitored, and where possible controlled such that it does not fall below an agreed level, for instance 40 % RH.

Where the RH is not consistently sufficient throughout the year the flooring and footwear should have a resistance to ground of less than 10^8 Ω (see IEC SC15D [1] and EN 100 015/I [2]).

ESD warning signs should be placed at the entrance to and within the controlled area.

An example of a controlled environment is a telecommunications equipment room.

An example of a type of equipment is an exchange switching rack.

6.4 Specially controlled environment

Only the use of materials with very low electrostatic charging properties (e.g. anti-static treated material) is permitted.

The ESDS should enter and leave the area within an ESP package.

Regardless of the RH, special precautions should be taken for working with ESDS. The following list gives examples of different ESP material:

- wrist straps;
- bench/bench mats;
- tools, including soldering irons;
- seating;
- footwear;
- flooring, with resistance to ground of less than 10^7 Ω (see IEC SC15D [1] and EN 100 015/I [2]);
- trolleys;
- containers.

Additional measures which may be used, where necessary, include:

- air ionisers;
- ESP clothing.

An example of a specially controlled environment is a Printed Circuit Board (PCB) repair centre.

7 Checking of ESP measures and materials

Checks should be made regularly and recorded. Such checks should include, e.g.: wrist straps; bonding cords; packaging; footwear; furniture; and flooring.

8 Marking and labelling

It is necessary to mark devices and systems prone to ESD damage in order to draw attention to the problem, and to the need to take precautions.

It is recommended that the label is applied in the proximity of the device to be protected, or applied to protective packaging.

All ESP packaging and containers housing ESDS should be suitably marked.

Controlled and specially controlled environments should be identified by labelling.

9 Packaging

Materials which are generators of high electrostatic charge need to be prohibited from use in the packaging of ESDS.

All packaging materials which are in contact with ESDS should have suitable resistivity. This provides dissipation and control of electrostatic charges.

ESP packaging should provide shielding to protect the ESDS from electrostatic discharges and fields.

Exposed metal foils or other materials with low surface resistivity should be avoided.

Materials which depend on humidity for their electrostatic performance should not be used.

Materials for storage should have a sufficient shelf life.

The materials should maintain their performance, throughout normal usage.

ESP packaging does not only need to fulfil electrical requirements, but others, for example, mechanical requirements.

10 Storage and transportation

ESDS should be segregated from non-ESDS.

ESDS should be kept in their protective packaging, which should only be opened in a specially controlled environment.

The environmental conditions for storage need to fulfil class 1.1 (weather protected, partly temperature-controlled storage locations) of ETS 300 019-1-1 [3].

The environmental conditions for transportation need to fulfil class 2.2 (careful transportation) of ETS 300 019-1-2 [4].

11 Training

All personnel involved in the handling of the ESDS and working with equipment should be adequately trained in the correct procedures to be employed. Such persons may include cleaners and visitors. Re-training should be undertaken regularly. The training should include the procedures to be followed and the reasons why these procedures are necessary.

12 Auditing

Audits should be carried out on a regular basis to ensure ongoing integrity. The audit should check that all precautions are effective and that the correct procedures are being adhered to.

History

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March 1994	First Edition
January 1996	Converted into Adobe Acrobat Portable Document Format (PDF)