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Information technology equipment - Safety -

Part 21: Remote power feeding

(IEC 60950-21:2002, MOD)

信息技术设备 安全 第 21 部分:远程馈电

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Part 21: Remote power feeding

1 Scope

This Part of GB 4943 specifies safety requirements for remote feeding telecommunication circuit.

This Part is applicable to information technology equipment that is intended to supply and receive communication network power, and the voltage exceeds the TNV circuit limit.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 4943.1-2011, *Information technology equipment - Safety - Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB 4943.1-2011 as well as the followings apply.

3.1 Remote Feeding Telecommunication circuit

Inside the device, a secondary circuit that is scheduled to supply or receive DC power from the telecommunication network. The voltage limit of this telecommunication network is higher than the TNV circuit and may contain over-voltages from the telecommunication network.

3.2 RFT-C circuit

A properly designed and protected RFT circuit so that the current in the circuit does not exceed the specified value under normal operating conditions and single fault conditions.

NOTE: Current limits under normal operation and single fault conditions are specified in

Compliance is checked by inspection and measurement. In determining whether unintentional contact is likely to occur, consideration shall be given to whether maintenance personnel need to pass or approach these exposed parts when servicing other parts.

4.4 Protection of restricted accessible areas (see 2.1.3 of GB 4943.1-2011)

The equipment installed in restricted contact areas, in addition to allowing to use the exposed parts in the accessible RFT circuit referred by the test of Figure 2A in GB 4943.1-2011, shall meet the requirements of operator's accessible area. However, such parts shall be properly placed or protected so that it is impossible to reach them unconsciously.

The exposed parts involving energy hazards shall be properly placed or protected so that it is impossible for conductive materials to inadvertently bridge exposed parts.

Compliance is checked by inspection and measurement. In determining whether unintentional contact is likely to occur, consideration shall be given to the need to pass or approach these exposed parts.

4.5 Interconnection of equipment

4.5.1 Basic requirements (see 3.5.1 of GB 4943.1-2011)

The interconnected circuit still can meet the requirements for Clause 6 in RFT circuit after connection.

NOTE: If the interconnection circuit is isolated according to GB 4943.1-2011 and the requirements of this Part, it shall allow to use one interconnected cable to control more than one type of circuit (for example: SELV circuit, current limiting circuit, TNV circuit, ELV circuit, RFT or hazardous voltage circuit).

4.5.2 Interconnection between RFT circuits (see 3.5.2 of GB 4943.1-2011)

RFT-C circuits in power supply equipment can only be connected with RFT-C circuits in other equipment.

RFT-V circuits in power supply equipment can only be connected to RFT-V circuits in other equipment.

See 6.4e) for compliance.

5 Connection to telecommunication network

RFT circuits are allowed to be directly connected to telecommunication networks.

Compliance is checked by inspection and measurement.

6.2.2 Limits under single fault conditions

In the RFT-V circuit powered equipment, grounded or ungrounded conductors of RFT-V circuits connected to telecommunication networks under normal conditions, under a single fault condition (see 1.4.14 of GB 4943.1-2011):

- During the first 200ms, the output voltage between each conductor and ground and the output voltage between conductors shall not exceed the limit shown in Figure 2F of GB 4943.1-2011. Measure through a 5000 × (1 ± 2%)Ω resistor and disconnect all load circuits; and

- After 200ms, the limits shall meet the limits of 6.2.1.

When compliance is checked by inspection and measurement, it may have possible component and insulation failures in the simulation equipment.

6.2.3 Limits under single conductor grounding conditions

If a conductor of an RFT-V circuit connected to telecommunication network is grounded:

-- The open circuit voltage between other conductors and ground shall not exceed the maximum RFT-V circuit supply voltage after 200ms; and

-- For RFT-V circuits with open circuit voltage exceeding 140V DC, under normal operation conditions, the current between other conductors and ground measured through a 2000 × (1 ± 2%)Ω resistor, under any external load conditions, shall not exceed the relevant phase line to ground limits given in Figure 1 and this current shall not exceed 10mA DC after 10s.

Compliance is checked by inspection and measurement.

6.3 Isolation from other circuits and components

Inside the equipment, the RFT circuit shall be isolated from the followings:

-- Functionally insulated from other RFT circuits, provided that if this insulation is short-circuited and there are no circuits exceeding the 6.1 and 6.2 limits; otherwise, this circuit shall be isolated as a dangerous voltage.

-- Isolated from ELV circuit by additional insulation.

-- Isolated from grounded accessible parts, grounded SELV circuits and grounded TNV circuits by basic insulation.

-- For ungrounded accessible parts, ungrounded SELV circuits, ungrounded TNV circuits and hazardous voltage circuits, it shall meet at least one of

RFT circuit powered equipment and RFT circuit load equipment.

A.3 Safety considerations

Users shall not touch RFT circuits. RFT circuits that shall limit user access like secondary circuits at hazardous voltages to protect users from the danger of electric shock as specified in GB 4943.1-2011. However, considering that RFT circuits shall withstand over-voltages, higher clearance and insulation requirements are necessary.

Insulate these circuits by insulating them like secondary circuits at dangerous voltages to prevent maintenance personnel from touching the RFT circuit, and exposed parts of the RFT-V circuit in a large area.

If maintenance personnel touches both conductors of the RFT-C circuit, most of the current that powers RFT-C circuit load equipment or equipment (IRFT) shall pass through the human body. Therefore, in these cases, the IRFT shall not exceed the limits that cause harmful physiological effects, for example, considering the hand current through the human body (60mA).

When a maintenance person touches a conductor of the RFT-C circuit and flows through the ground through the foot, because the current flows near the heart, to protect maintenance personnel, the maximum allowable human current shall be reduced. Under normal operating conditions, the current from one conductor of the RFT-C circuit to ground is easily limited, and it shall not exceed the current that normally does not cause a reaction (2mA). If a conductor of an RFT-C circuit is accidentally grounded, and this person touches other conductors, the IRFT shall not exceed the limit (25mA) to avoid harmful physiological effects, for example, considering the hand-to-foot current through the human body. If the I_{RFT} exceeds this value, there shall be an unbalanced trigger mechanism caused by the fault to reduce the current to 25mA or lower.

The RFT-C circuit shall protect the maintenance personnel from electric shock to the human body caused by the discharge of the charging capacitor of the RFT-C circuit (see A.5.2) to meet the operational requirements and safety requirements.

Because the human body can generally withstand more DC current than AC current, if DC is used, the design shall meet the operating requirements and safety requirements with more flexibility. Therefore, this Part does not specify the requirements for AC remote feeding.

A.4 Remote power feeding principle

A.4.1 RFT-C circuit

Figure A.1 shows an example of a remote power feeding system. It consists of

current from hand to foot, which means that a current of 60mA (hand to hand) is unlikely to cause organ damage or harmful physiological effects.

Based on the above data, the following limits can be used:

Contact one conductor (hand-to-foot current) under normal operating conditions, it is 2mA and 25mA for the other conductor to ground.

Contact two conductors (hand to hand current) under any conditions, it is 60mA.

When contacting RFT-V circuits that are working at a current no higher than 140V, whether under normal conditions or after a single failure, as long as the contacting area is small, it shall be unlikely to be harmful. For example, in accidental contact under adverse conditions, the contact resistance can be as low as 2500Ω, which is half of the contact resistance value when it is dry, which shall cause 56mA of human current.

A.5.2 Human body resistance

When measuring the contact current, it simulates human contact. Human body resistance is critical to RFT-V circuits, therefore, restricting contact area is to maintain high human body resistance. It is not critical to simulate the human resistance of the RFT-C circuit because the circuit is a current-limiting circuit, but it shall use the worst-case value for testing. According to IEC 60479-1, the minimum value of human body resistance is 350Ω between one hand and the back of a person. Although in this application, this is not the exact path through which the current passes through the human body, it has been used as the worst case for measuring hand-to-hand contact current, so as to give the margin of ventricular fibrillation limit. For measurements from one hand to two feet (between a conductor and ground), use a conventional 2000Ω.

When calculating the maximum charging capacity (see A.5.3), a low value of body resistance is also used in IEC 60479-1.

A.5.3 Charging capacitor

In an RFT circuit, energy is stored in a capacitor in the circuit that is filled with a DC supply voltage URFT. If a person touches a circuit, energy shall be partially or completely discharged through the body. The relationship between the maximum voltage and capacitance is given in IEC 60479-2, and some data from IEC 60479-1 are also used.

The effective capacitance for this purpose is unknown during the type test of the equipment. It consists of the internal capacitance of the RFT circuit-powered equipment, plus the capacitance of the RFT circuit load equipment, and the capacitance of the communication network that connects them together. If several units of the load equipment share the power supply together, the

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