ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

PARTICULAR SAFETY REQUIREMENTS FOR EQUIPMENT TO BE CONNECTED TO TELECOMMUNICATION NETWORKS

TR/35

January 1987

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European Computer Manufacturers Association
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BRIEF HISTORY

In September 1985, IEC published Guide 105, for use by technical committees responsible for equipment safety standards who wish to enhance their standards by adding harmonized requirements for telecommunication safety. Guide 105 is concerned only with safety aspects which arise when equipment is connected to a telecommunication network. However, it is not written as a standard for testing and approval purposes.

At about that time the need was seen for a standard for uniform application by CEPT Administrations in Europe when approving subscribers' equipment for attachment to their networks, and for purchasing purposes by the Administrations. This is to be a CEPT recommendation, the application of which is to be enforced as a NET (Norme Européennes de Télécommunications) in the countries of the European Community by a Directive and in the other European countries by voluntary association.

A working group with representatives from ECMA, CEPT and EUCATEL (now ECTEL), already in existence to write ECMA-83, was commissioned by CEPT to draft this NET. An observer from CCITT joined the group. Similar work began during 1986 in CENELEC and, on a world-wide basis, in IEC TC74/WG-7.

During 1986, ECMA members felt an urgent need for a published document, even if not fully complete and verified, and this ECMA Technical Report is the result. This will give the opportunity for design work to be based on a reasonably stable document, while also verifying the practicality of the proposed requirements. A number of matters require further consideration or confirmation, are mentioned in small type as follows: peak impulse test voltage, 4.3.2; maximum values of Telecommunication Signals, Appendix E; acoustic shock, Appendix G. When these have been resolved it is intended, after obtaining formal approval by CEPT and ECTEL as well as ECMA, that this Technical Report is superseded by an ECMA standard, simultaneously with an identical CEPT Recommendation.

This ECMA Technical Report is based, with the consent of the International Electrotechnical Commission, which retains the copyright, on IEC Guide 105. Where the text differs in detail from, or further elaborates, the text of Guide 105, the differences are being brought to the attention of the IEC.

This Technical Report was adopted by the General Assembly of ECMA of December 11, 1986.

TABLE OF CONTENT

	Page
1. SCOPE	1
2. REFERENCES	1
2.1 IEC Standards for the Safety of Electrical Equipment	1
2.2 Other related IEC Publications	1
2.3 Non-IEC Reference Documents	2
2.4 Revision of Publications	2
3. DEFINITIONS	2
3.1 Equipment	2
3.2 Telecommunication Network	2
3.3 Telecommunication Signal	3
3.4 Excessive Voltage	3
4. SAFETY REQUIREMENTS	3
4.1 Protection of the User from Hazards in Equipment	3
4.2 Protection of the Telecommunication Network from Hazards in Equipment	4
4.2.1 Protection from Excessive Voltage	4
4.2.2 Methods of Protection	4
4.2.3 Test for Single Fault Protection	5
4.2.4 Insulation in a Signal Transformer	6
4.2.5 Use of Protective Earth	6
4.2.6 Interconnected Equipment	6
4.2.7 Source of Protective Earth	7
4.3 Protection of the Equipment User from Voltages on a Telecommunication Network	7
4.3.1 Access to Network Conductors	7
4.3.2 Separation from Network Conductors	8
APPENDIX A - IMPULSE TEST GENERATOR	11
APPENDIX B - GUIDANCE ON INSULATION SPACINGS FOR SUB-CLAUSE 4.3.2	12
APPENDIX C - CALCULATION OF TS1 AND TS2	14
APPENDIX D - PORTS CONNECTED TO THE TELECOMMUNICATION NETWORK	18
APPENDIX E - CONTACT WITH TELECOMMUNICATION SIGNALS	20
APPENDIX F - RELIANCE ON "SINGLE FAULT" PRINCIPLE	21
APPENDIX G - ACOUSTIC SHOCK	22

Explanatory information, given in this small type, is not an integral part of this Technical Report.

1. SCOPE

This Technical Report specifies the safety requirements, under three headings, for equipment to be supplied for use at subscribers' premises and connection to a telecommunication network of the Public Telecommunications Operators in the CEPT countries, as follows :

- Protection of the equipment user from hazards in equipment (e.g. protection against hazards from the electrical mains supply).
- Protection to reduce adequately the risk of hazardous electrical conditions arising on a telecommunication network, owing to connection of the equipment to this network.
- Protection of the equipment user from voltages on a telecommunication network.

For equipment intended to be used in an environment not covered by the relevant safety standard, other requirements may apply.

The requirements of this Technical Report are also applicable to equipment to be connected to networks that are not available to the public.

Requirements for functional reliability of equipment exposed to overvoltages on lines (see CCITT Circular No 25) are not covered by this Technical Report.

2. REFERENCES

2.1 IEC Standards for the Safety of Electrical Equipment

Requirements for the safety of electrical equipment are contained in IEC Standards written by IEC Technical Committees and Sub-Committees responsible for such equipment. Examples relevant to this Recommendation are as follows :

Publication 65 : Safety requirements for mains operated electronic and related apparatus for household and similar general use.

Publication 335 : Safety of household and similar electrical appliances.

Publication 348 : Safety requirements for electronic measuring apparatus.

Publication 380 : Safety of electrically energized office machines.

Publication 435 : Safety of data processing equipment.

Publication 601 : Medical electrical equipment.

Publication 950 : Safety of Information technology equipment including electrical business equipment.

2.2 Other Related IEC Publications

Publication 364 : Electrical installations of buildings.

Publication 664 : Insulation co-ordination within low voltage systems including clearances and creepage distances for equipment.

Publication 664A: First supplement to Publication 664.

Guide 105 : Principles concerning the safety of equipment electrically connected to a telecommunications network.

2.3 Non-IEC Reference Documents

CEPT Rec. T/CD 1-1 : General Engineering requirements for data circuit terminating equipment for analogue and digital networks.

CEPT Rec. T/CD 04-03 (ECMA-83) : Safety requirements for DTE-to-DCE interface.

CCITT Rec. K.7 : Protection against acoustic shock.

CCITT Rec. K.11 : Principles of protection against overvoltages and overcurrents.

CCITT Rec. K.17 : Test on power-fed repeaters using solid-state devices in order to check the arrangements for protection from external interference.

CCITT Rec. P.36 : Efficiency of devices for preventing the occurrence of excessive acoustic pressure by telephone receivers.

CCITT Circular 25 : Trial application of draft Rec. X.Y-Resistibility of subscribers terminals to overvoltages and overcurrents.

2.4 Revision of Publications

In general, the edition of a publication which is applicable is the last one published. However, when a revision occurs, compliance with either the latest edition or the previous edition is acceptable during an interim period.

3. DEFINITIONS

For the purpose of this Technical Report the following definitions apply.

3.1 Equipment

Except as noted below, all equipment on a subscriber's premises, designed and intended for connection directly or indirectly (through other units of equipment) to a telecommunication network and forming part of a subscriber's installation, regardless of ownership and of responsibility for installation and maintenance.

Equipment which depends on the telecommunication network as its only source of electrical power for its operation, and passive devices requiring no source of electrical power, are included.

Components provided for connection purposes only, e.g. terminals or plugs and sockets, are not included.

3.2 Telecommunication Network

A metallic telecommunication circuit, outside the subscriber's premises, forming part of a telecommunication system available to the public.

The mains system for supply, transmission and distribution of electrical power, if used as a telecommunication circuit, is not included.

3.3 Telecommunication Signal

A steady state or varying amplitude voltage having a level identified by any one of the following (a), (b) or (c) :

(a) A voltage where the combination of d.c. and a.c. voltages of any frequency is such that :

$Udc + 3\ Uac \leq 150\ V$

where

Udc is the value of d.c. voltage (in volts)

Uac is the r.m.s. value of a.c. voltage (in volts).

When Udc = 0, Uac can be $\leq$ 50 V r.m.s.
When Uac = 0, Udc can be $\leq$ 150 V.

(b) A telephone ringing signal such that the values of TS1 and TS2 do not exceed the limits given in Appendix C.

(c) A telegraph signal of any frequency, of maximum voltage 96 V peak with respect to earth.

3.4 Excessive Voltage

An operating voltage not identified by any of 3.3 (a), (b) or (c).

4. SAFETY REQUIREMENTS

Requirements and tests in this clause are type tests.

4.1 Protection of the User From Hazards in Equipment

The Equipment is expected to comply with one of the relevant IEC equipment safety standards (see 2.1) or another equivalent standard, but compliance is not part of this Technical Report.

However, notwithstanding the accessibility requirements of such standards, parts and circuitry that are accessible in the meaning of the relevant equipment safety standard shall be permitted to carry Telecommunication Signals, provided that they cannot be touched by the test probe (Figure 1) applied with a force of 30 N.

Compliance shall be checked when the equipment is not connected to the telecommunication network, and when the Telecommunication Signals are applied to the port provided for connection of the telecommunication network conductors.

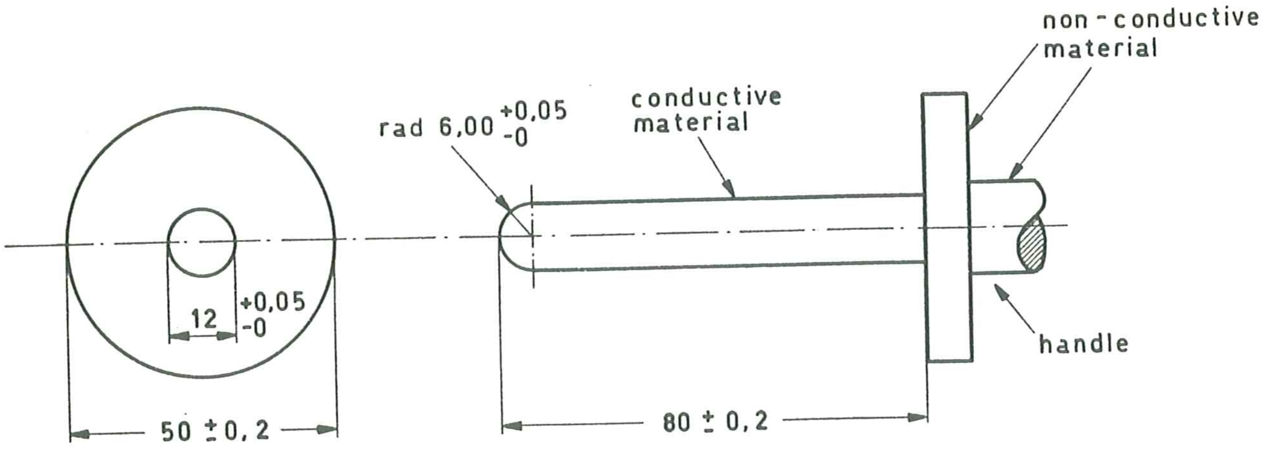


Figure 1 - Test Probe

4.2 Protection of the Telecommunication Network from Hazards in Equipment

4.2.1 Protection from Excessive Voltage

Circuitry which is to be connected to the telecommunication network shall not operate at an excessive voltage, and shall be protected from excessive voltages by double or reinforced insulation or by another method of protection. This applies whether or not the circuitry is accessible. This requirement includes circuitry which in any configuration could be connected to a telecommunication network (see Appendix D).

4.2.2 Methods of Protection

Protection from excessive voltages may be achieved by one or more of the following methods (a), (b), (c), (d), (e), (f), and (g) :

(a) by double or reinforced insulation complying with IEC Publication 950,

(b) by basic insulation complying with IEC Publication 950 between circuitry connected to the network and a source of excessive voltage, where the source is a limited current circuit complying with 2.4 of IEC Publication 950,

(c) by basic insulation complying with IEC Publication 950, together with protective screening connected to protective earth,

(d) by basic insulation complying with IEC Publication 950, together with connection of the circuitry to the protective earth,

(e) by basic insulation complying with IEC Publication 950 together with voltage limiting devices,

(f) by circuit design, where no isolation is possible between a circuit at excessive voltage and a protected circuit, such that the network is protected in the event of a single fault or component failure. The circuit at excessive voltage shall not be conductively connected to any primary circuit (including the neutral) within the equipment. (See Appendix F),

(g) any other method providing equivalent protection.

Due to local conditions some Administrations forbid or restrict the use of equipment that relies on protective earth to protect the network (but do not restrict the use of protective earth to protect the equipment user or for other purposes). Equipment employing only methods (a) and (b) above or other methods not relying on protective earth to protect the network are preferred, being suitable for the earthing conditions at any user site. Equipment that relies on protective earth to protect the network may be permitted by these Administrations in the following situation :

- for professionally installed equipment (such as large PABX) where the provision of an adequate, permanently connected protective earth can be assured,
- where an adequate protective earth is commonly available for pluggable equipment.

In respect of requirements for insulation for compliance with 4.2.2, equipment and components designed to comply with one of the following standards, instead of IEC Publication 950, are known to be satisfactory : IEC Publications 65, 380, 435, 601.

Where very high excessive voltages are generated in the equipment (e.g. the cathode ray tube EHT supply in a visual display unit) it is not necessary to design all components providing protection of the telecommunication network for such voltages. However, other methods should be employed to protect these components from the very high voltages, under normal conditions and in the event of a single breakdown of basic insulation or component failure.

4.2.3 Test for Single-Fault Protection

In addition to the requirements of 4.2.2, except where protection according to method (a) is employed, the following test shall be carried out. Breakdown of basic insulation or a component failure that is likely to occur shall be simulated. Such fault conditions shall be applied in turn and one at a time. The voltage between any two conductors or between any one conductor and earth at the connections to the network shall fall within the shaded area of Figure 2.

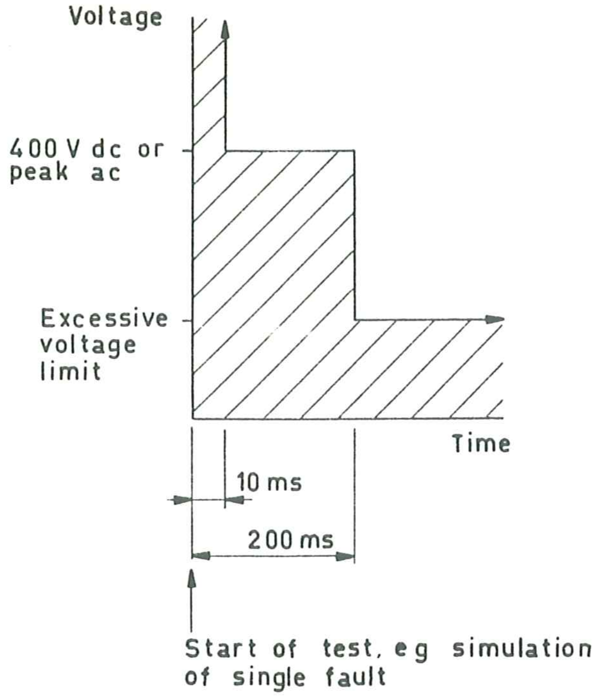


Figure 2 - Maximum Voltage after Single Fault

4.2.4 Insulation in a Signal Transformer

Where protection relies on the insulation between two windings of a signal transformer, the voltage between any two conductors or between any one conductor and earth at the connections to the network shall fall within the shaded area of Figure 2 when a single fault is simulated in the unprotected circuitry.

This test is concerned with the possibility that, due to a fault, a transverse mode voltage is applied to one winding and is transformed to an excessive voltage by the signal transformer. Suitable precautions to prevent this include the choice of a suitable ratio, saturation of the core material, intentional sacrifice of the transformer, or use of a voltage-limiting device with or without a fuse.

4.2.5 Use of Protective Earth

In equipment employing methods (c) or (d) of 4.2.2, or other methods relying on protective earth, the internal connection of the protective earth shall comply with 2.5.1 to 2.5.5 of IEC Publication 950. The protective earth connection to the equipment shall not be made through a plug and socket, unless the hazards are removed when the plug is removed from the socket.Such equipment shall be stated by the manufacturer in all relevant literature to rely on protective earth to protect the telecommunication network.

4.2.6 Interconnected Equipment

The equipment under test (equipment A in Figure 3) containing the circuitry that is to be connected to the telecommunications network(s) may also contain interface circuitry for connection to another equipment B. In such a case the interface circuitry in B, before connection to equipment A, should comply with 4.2.1.

In the case that equipment A is a DCE (Data Circuit-terminating Equipment) and equipment B a DTE (Data Terminal Equipment), attention is drawn to CEPT Rec. T/CD 04-03 (ECMA-83) for the interface between A and B.

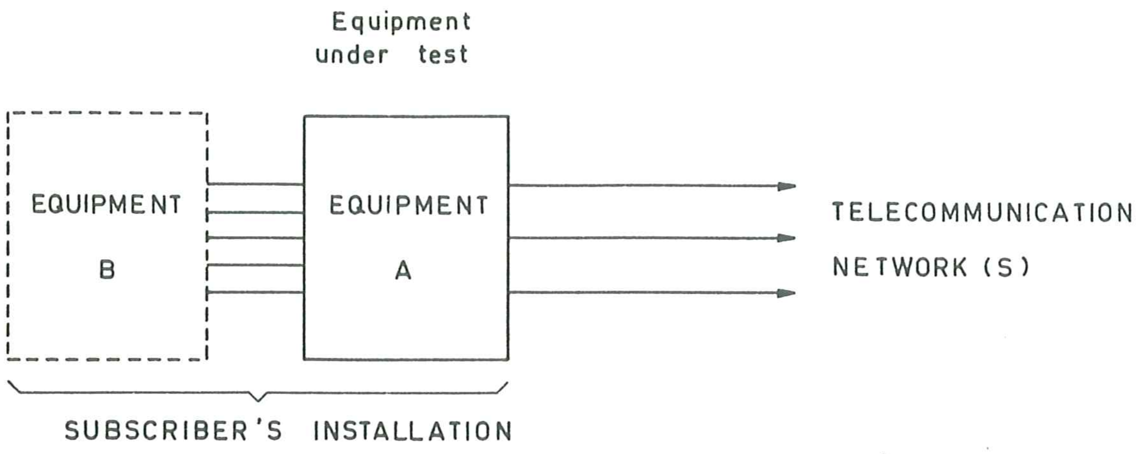


Figure 3 - Interconnected Equipment

If the interface circuitry in equipment B does not comply with 4.2.1 or if the safety characteristics of the circuitry in equipment B cannot be evaluated, suitable electrical separation as specified below shall be provided (e.g. in equipment A) between the interface circuitry in equipment B and the telecommunication network.

Where the interface circuits between equipment B and equipment A normally operate at an excessive voltage, double or reinforced insulation or another equivalent method of protection shall be provided. Where the interface circuits between equipment B and equipment A do not normally operate at an excessive voltage, at least supplementary insulation or another equivalent method of protection shall be provided.

Where the interface circuits do not operate at an excessive voltage, it may be assumed that basic insulation exists in equipment B but no further assumptions regarding the safety design of equipment B are necessary.

4.2.7 Source of Protective Earth

Where protective earthing of Class I equipment is prescribed in the relevant equipment safety standards, the protective earthing shall not rely on the telecommunication network to which the equipment is connected.

4.3 Protection of the Equipment User from Voltages on a Telecommunication Network

Sub-clause 3.3 is applicable only to equipment intended for connection directly to a telecommunication network (e.g. equipment A in Figure 3).

4.3.1 Access to Network Conductors

The user shall be protected from inadvertent contact with telecommunication signals. For this reason, it shall not be possible to touch with the test probe (Figure 1), applied with a force of 30 N, parts that are directly connected to the telecommunication network. Covers that can be removed without the use of a tool shall be removed during the test.

This requirement shall not apply to parts within a separate enclosed small compartment provided for access by a user, e.g. a battery compartment, where all the following conditions are met :

(a) with the cover in place, the parts cannot be touched by the test probe (Figure 1),

(b) the connection to the telecommunication network is made by a plug,

(c) the user is warned in the operating instructions to unplug the equipment from the network before opening the cover.

The accessibility requirements in respect of separate enclosed compartments relate only to parts directly connected to the telecommunication network. Access within the compartment to other circuits may be restricted by conformance with other safety standards or with legislation.

4.3.2 Separation from Network Conductors

The equipment shall provide electrical separation between:

- the port provided for connection of the telecommunication network conductors, including any conductor required by the network operator to be connected to earth, and
- each of the following, (a), (b), (c) and (d).

(a) unearthed conductive parts and nonconductive parts of the equipment expected to be held or touched during normal use,

(b) parts of the equipment connected to protective earth,

(c) parts and circuitry that are permitted by the relevant equipment safety standard to be accessible,

The purpose of this requirement is to ensure that parts and circuitry which are permitted to be accessible to touch by the user, e.g. SELV circuits, are adequately isolated from network voltages,

(d) circuitry connected to ports provided for the attachment of other equipment. This applies whether or not this circuitry is accessible. It does not apply to circuitry designed for direct connetion to the Telecommunication Network conductors.

Compliance shall be checked by applying to the electrical separation

- In case (a) : an impulse test according to Appendix A, where the value of Uc is 4 kV;
- In cases (b), (c) and (d) : an impulse test according to Appendix A, where the value of Uc is 2,4 kV.

For the test, all leads intended to be connected to the telecommunication networks shall be connected together (see Figure 4). Similarly, all leads intended to be connected to other equipment of a subscriber's installation shall be connected together. Exceptions to this rule may by appropriate in certain equipment, for example where a common connection or an earth connection would invalidate the result. Devices provided for surge suppression shall be disconnected if their presence would invalidate the result.

In the cases of nonconductive parts, metal foil shall be pressed against these parts with a pressure of approx. 5kPa.

During the test neither sparkover nor damage of insulation shall occur. This shall be assessed :

- for sparkover : by inspection (a test is under consideration),
- for damage of insulation, by an insulation resistance test where the insulation resistance shall be not less than 2 Mohm when measured at 500 V d.c. or, where surge suppressors are present, at 10 V less than the minimum striking voltage of the suppressor.

The 2,4 kV peak impulse test voltage is based on the assumption that due to faults in power distribution systems, transient voltages of this magnitude may occur.

It is to be verified whether the network may be assumed to limit these voltages to a level below 1,5 kV, in which case a 1,5 kV impulse test voltage could be specified.

For testing of unearthed conductive parts or non-conductive parts expected to be held or touched during normal use, an impulse test voltage of 4 kV peak is specified. This is based on reported difficulties of Administrations to guarantee installation and maintenance of surge suppression devices in all relevant places. It is to be verified that a 4 kV impulse test voltage does not place an unacceptable burden specifically on simple terminals (telephone-sets).

Comments are invited on these test voltages.

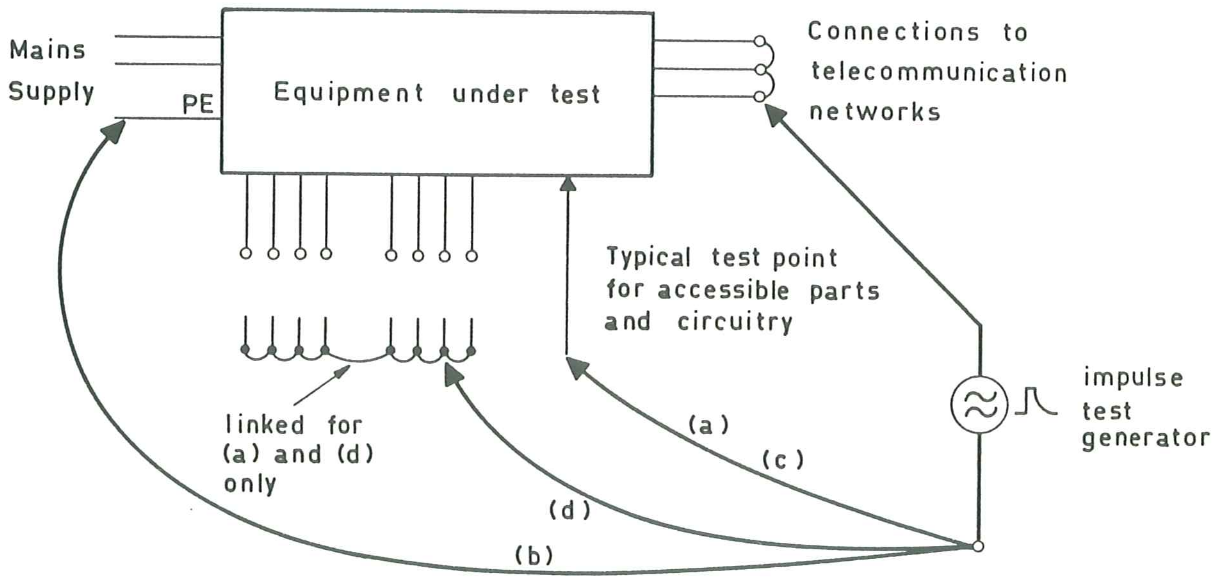


Figure 4 - Application Points of Test Voltage

Alternatively the test shall be applied to a component or assembly (for example, a signal transformer) which is clearly intended to provide the required separation. In this case the component or assembly shall not be bypassed by other components or wiring unless these components or wiring also meet the separation requirements specified in 4.3.2.

Guidance on minimum creepage distances, clearances and distances through insulation is given in Appendix B.

Public telecommunications Network Operator's equipment (exchange equipment, etc) will comply with the requirements of Section 4.2.

APPENDIX A

This Appendix is an integral part of the Technical Report

IMPULSE TEST GENERATOR

The following circuit is used to generate 10/700 µs impulses (10 µs virtual front time, 700 µs virtual time to half value), the 20 µF capacitor being charged initially to a voltage U_c.

Extreme care is necessary during these tests due to the high electrical charge stored in the capacitor.

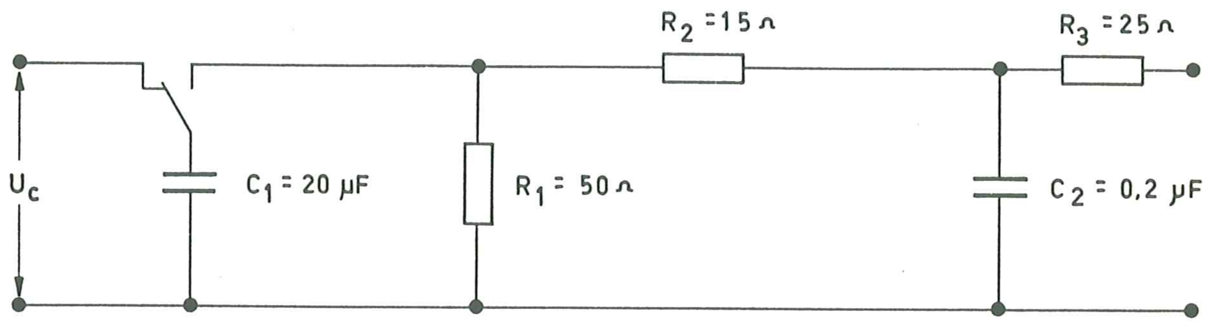


Figure A.1 - Impulse Generating Circuit

Ten impulses shall be applied with 60 s between consecutive impulses, the polarity being reversed after each impulse.

The impulse test circuit is that specified in CCITT Rec. K.17 to simulate lightning interference in the telecommunications network.

The tests also cover possible differences in earth potential due to power distribution faults; for this purpose the same impulse test waveform is considered to be adequate.

APPENDIX B

This Appendix is explanatory information and is not an integral part of the Technical Report

GUIDANCE ON INSULATION SPACINGS FOR SUB-CLAUSE 4.3.2

B.1 In 4.3.2 there are no insulation spacing requirements for separation from network voltages: compliance with electric strength tests (at two different voltage levels) is all that is required.

Guidance is given in this Appendix on insulation spacings which could be expected to survive the electric strength tests and to maintain the separation during the life of the product. Compliance with this Appendix is not a mandatory part of this Technical Report.

B.2 This guidance is based on IEC Publications 664, 664A and 950. Those publications were not written for the particular set of conditions to be found on a telecommunication network, but a selection has been made based on the following assumptions as to the voltages present.

B.2.1 50 V d.c. continuous.

B.2.2 Telephone ringing signals, occasional and temporary, maximum peak value 150 V between either line and earth.

B.2.3 Telegraph signals (but never in association with B.2.1 and B.2.2) maximum value + 100 V and - 100 V to earth.

B.2.4 Impulsive noise due to electrical power abnormalities, to lightning, or to earth potential difference; maximum value 2400 V peak.

B.2.5 As B.2.4 but 4000 V peak, where there is no effective surge suppression within the network.

B.2.6 250 V a.c. 50 Hz due to direct contact between network and power line.

B.2.7 Occasional and various PTT test conditions which, however, do not exceed the above.

B.3 The following minimum spacings are recommended.

B.3.1 Separation for 2,4 kV test

		see
Clearance Case A	1,5 mm	B.4
Clearance Case B	0,6 mm	B.4
Creepage distance	1,5 mm	
Coated printed boards	0,4 mm	B.7
Thickness	0,4 mm	B.6

B.3.2 Separation for 4 kV test

		see
Clearance Case A	3,0 mm	B.4
Clearance Case B	1,0 mm	B.4
Creepage distance	3,0 mm	
Coated printed boards	0,4 mm	B.7
Thickness	0,4 mm	B.6

B.4 Case A clearances are suitable for the relevant impulse test without special attention to the shape of the conductive parts (inhomogeneous field). Where care is taken during design to reduce the electric field stresses between conductive parts, a lower clearance will be suitable, but it should never be less than the case B value (homogeneous field).

B.5 It is expected that operators of public and other telecommunications networks will take adequate measures for surge suppression where necessary, for example in accordance with CCITT Rec. K.11. This reduces the risk that overvoltages presented to the equipment exceed 1,5 kV, and where it is done the conditions of B.2.4 apply and the 2400 V impulse test in Appendix A is suitable. To take care of a minority of sites where suitable surge arrestors have not been installed, or having been installed have become ineffective, the 4000 V test is used where personal injury could result from a sparkover in condition B.2.5. For other parts of the equipment, condition B.2.5 could cause sparkover of clearance distances complying with B.3.1 but not with B.3.2. Care should be taken in such cases to ensure that such sparkover does not occur across the surface of solid insulation, which could become damaged by repeated impulses.

B.6 Recommended thicknesses are for solid homogeneous insulation. Relaxations for multiple layers of thin material, as, for example, in IEC Publication 950, 2.9.4, would apply.

B.7 For the 0,4 mm spacing for coated printed boards to apply, the conditions of IEC Publication 950, 2.9.5 should be met.

APPENDIX C

This Appendix is an integral part of the Technical Report

CALCULATION OF TS1 AND TS2

For the purpose of 3.3 (b) (telephone ringing signal) the maximum values of TS1 (Telecommunications Signal type 1) and TS2 are defined as follows :

C.1 TS1 shall not exceed :

(a) for cadenced ringing ($t1 < \infty$), the value given by the curve of Figure C.2 at t1;

(b) for continuous ringing ($t1 = \infty$), 16 mA, or 20 mA where cadenced ringing becomes continuous as a consequence of a single fault;

where the value of TS1, in mA, is:

- for $t1 \leq 600$ ms $\quad TS1 = Ip/\sqrt{2}$

- for $600 \text{ ms} < t1 < 1200$ ms $\quad TS1 = ((t1-600)/600)Ipp/2\sqrt{2} + ((1200-t1)/600)Ip/\sqrt{2}$

- for $t1 \leq 1200$ ms $\quad TS1 = Ipp/2\sqrt{2}$

Ip is the peak current in mA, and

Ipp is the peak-to-peak current in mA,

both as defined in the relevant diagram of Figure C.3, flowing through a 5 kohm resistor between any two conductors or between one conductor and earth, calculated or measured for any single active ringing period t1 as defined in Figure C.1.

t1 is expressed in ms.

C.2 TS2 (for repeated bursts of a cadenced ringing signal) calculated for one ringing cadence cycle t2 (as defined in Figure C.1), shall not exceed 16 mA;

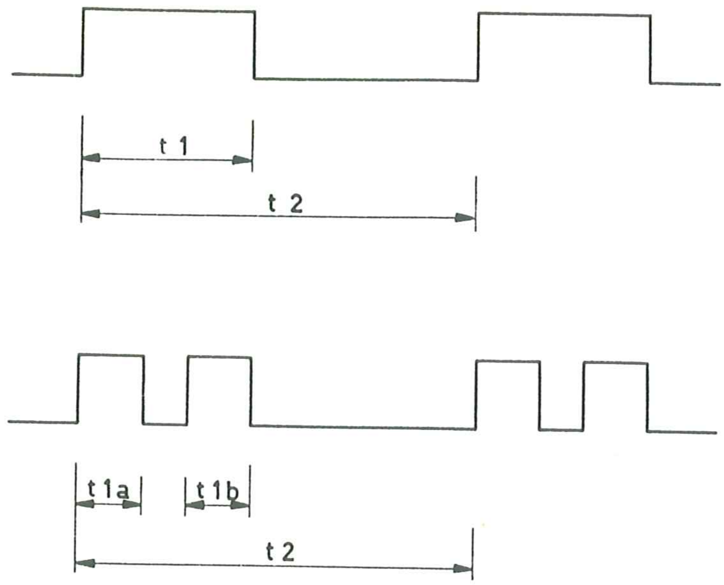
where the value of TS2 in mA, is:

$$TS2 = [(TS1^2(t1/t2) + (Idc/3{,}75)^2(t2-t1)/t2)]^{\frac{1}{2}}$$

TS1 is as given by C1,

Idc is the dc current in mA, flowing through the 5 kohm resistor during the non-active period of the cadence cycle;

t1, t2 are expressed in ms.

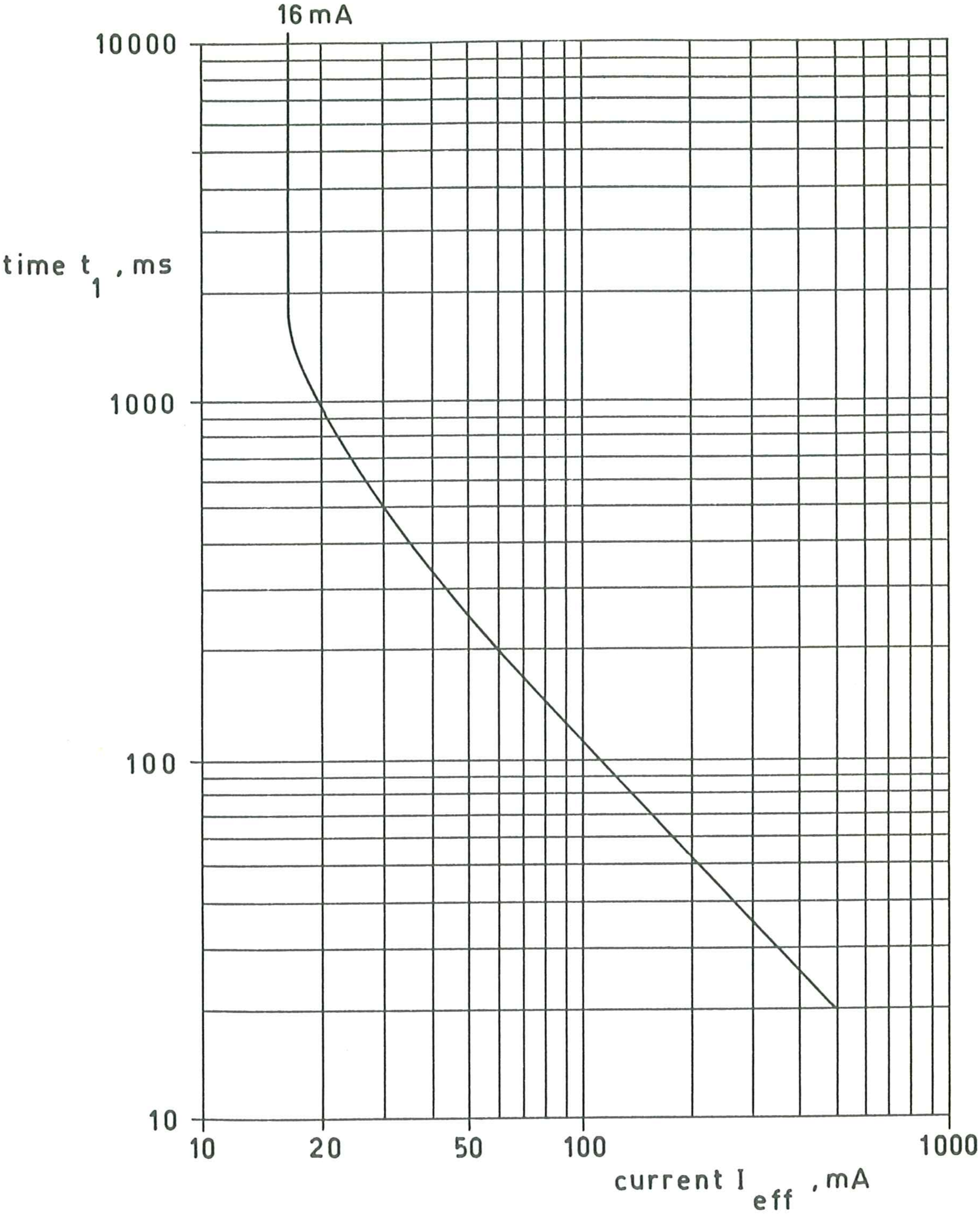


t2 is the duration of one complete cadence cycle

t1 is :

- the duration of a single ringing period, where the ringing is active for the whole of the single ringing period, or
- the sum of the active periods of ringing within the single ringing period, where the single period contains two or more discrete active periods of ringing, as in the second example for which t1 = t1a + t1b.

Figure C.1 - Definition of Ringing Period (t1) and Cadence Cycle (t2)



The curve is based on curve b of Figure 5 of IEC 479-1 (1984).

Figure C.2 - TS1 Limit for Cadenced Ringing Signal

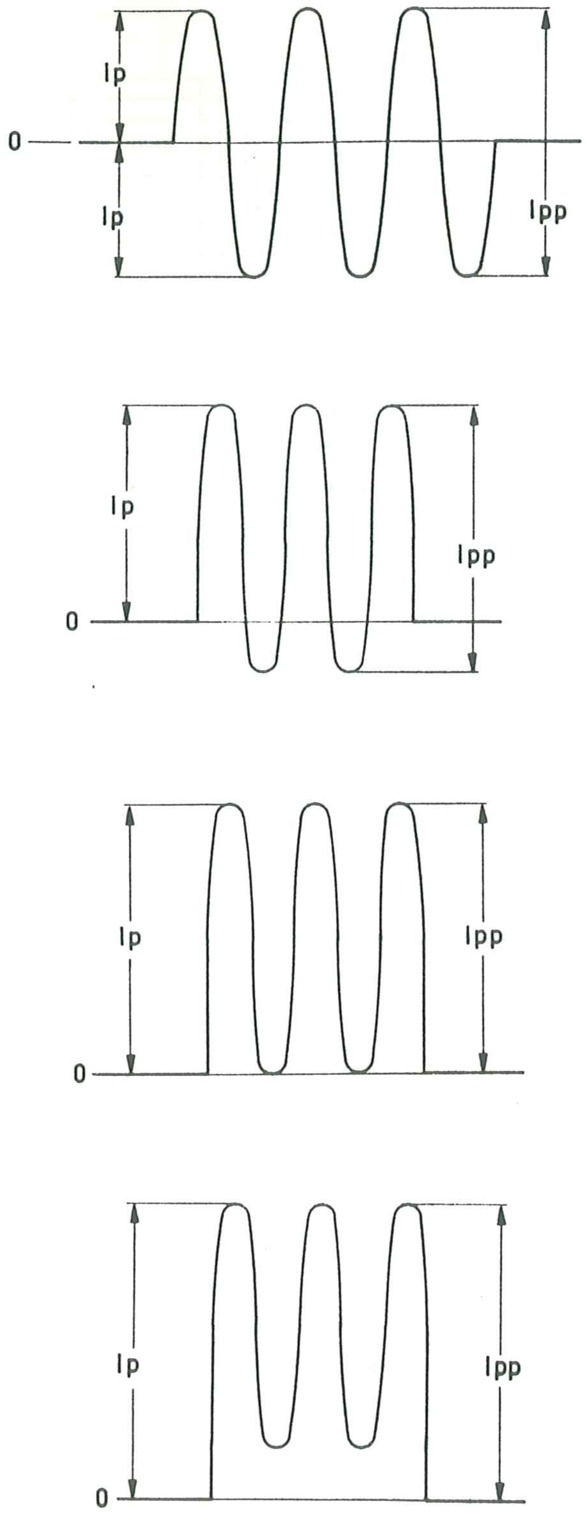


Figure C.3 - Waveforms of Alternating Currents with and without d.c. Components

APPENDIX D

This Appendix is explanatory information and is not an integral part of the Technical Report

PORTS CONNECTED TO THE TELECOMMUNICATION NETWORK

In 4.2.1 it is required that any circuitry which could be connected to a telecommunication network be protected from excessive voltages within the equipment. This not only includes circuitry designed to be directly connected to the network, but may also include circuitry designed for connection to other equipment.

An example of such a requirement is where the equipment under test (EUT) is a PABX. It has ports clearly designed for direct connection to the telephone network. It also has ports designed to be connected to extension telephones, however, these extensions may be in remote locations, connected to the PABX by leased telephone lines, which are another part of the network. These lines must also be protected from excessive voltages in the EUT, by treating extension ports that are capable of such use the same as ports designed for direct connection to the network.

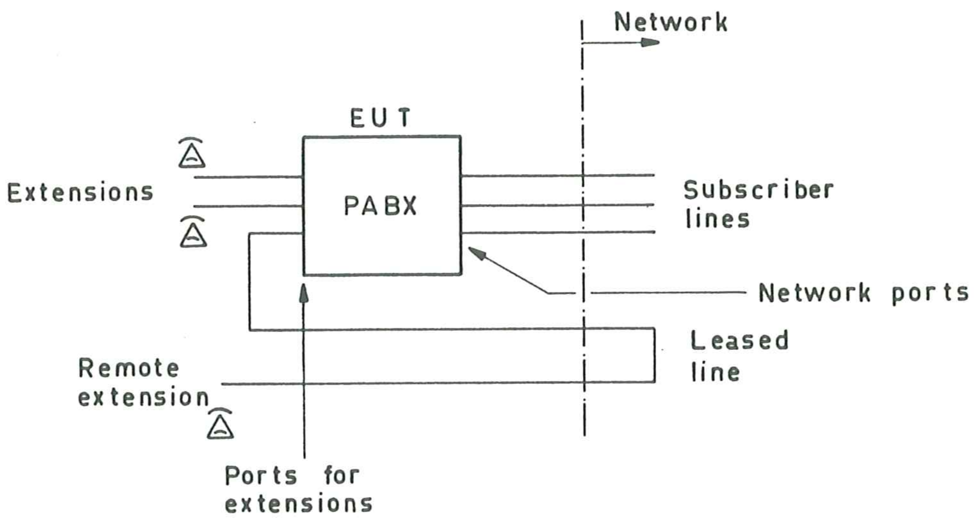


Figure D.1 - Example of PABX with Leased Line

Another example is a port on the EUT (PABX 1) designed for link to another PABX (PABX 2). The network lines to which PABX 2 is connected must also be protected from excessive voltages in PABX 1.

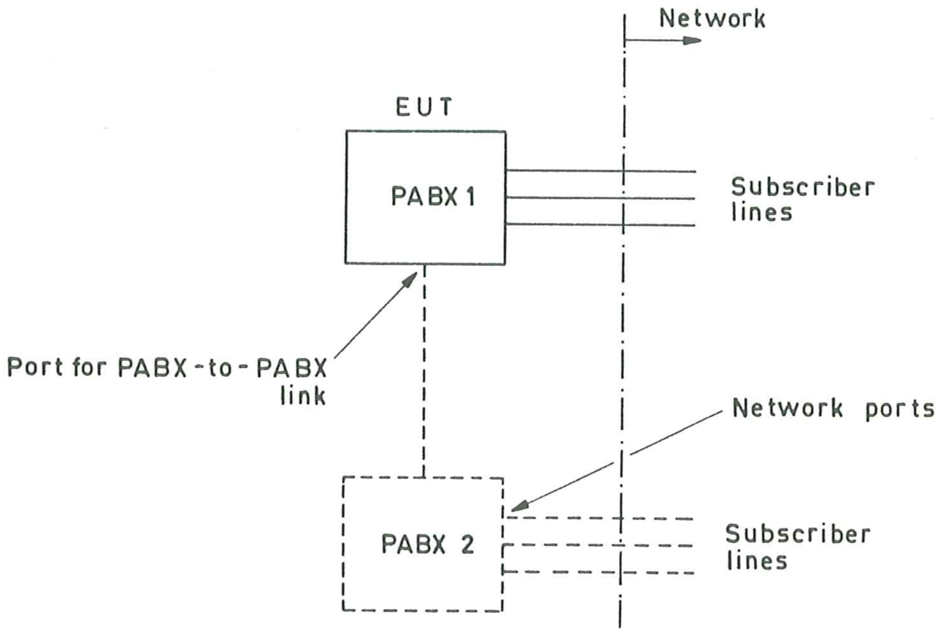


Figure D.2 - Example of Linked PABXs

APPENDIX E

This Appendix is explanatory information and is not an integral part of the Technical Report

CONTACT WITH TELECOMMUNICATION SIGNALS

Certain signals used in telecommunication practice are at voltage levels which exceed the maximum steady-state voltages conventionally sued in IEC standards and considered to be safe to touch. Experience has shown, however, that these signals, although not as fully enclosed as mains and other hazardous voltages, do not in fact cause personal injury (see Annex A to IEC Guide 105 for a discussion of this phenomenon).

In this Technical Report, 3.3 (b) and Appendix C define the maximum safe level of such signals, based on a small area of human contact. Access with the standard test finger to circuitry carrying such signals is permitted, provided that inadvertent access is unlikely. The likelihood of inadvertent access is limited by forbidding access with the test probe (Figure 1) which has a 6 mm radius tip, instead of 2 mm x 4 mm in the case of the standard test finger. This requirement ensures that

- contact by a large part of the human body, such as the back of the hand, is impossible;
- contact is possible only by deliberately inserting a small part of the body, less than 12 mm across, such as a finger-tip, which presents a high impedance to any body current;
- the possibility of being unable to let-go the part in contact does not arise.

This applies both to contact with signals arriving from the network (4.3.1) and to signals generated internally in the equipment, for example ringing signals for an extension telephone (4.1). By normal standards, these internally generated signals would exceed the voltage limits for accessible parts, but the 2nd paragraph of 4.1 states that limited access should be permitted under the above conditions.

The maximum values of Telecommunication Signals appearing in Section 3.3 and Appendices B and C are provisional. They are based on information from several countries.

Comments are invited on these maximum values.

APPENDIX F

This Appendix is explanatory information and is not an integral part of the Technical Report

RELIANCE ON "SINGLE FAULT" PRINCIPLE

In 4.2.2 (f), a method of protecting the network is given for cases where isolation from an excessive voltage is not possible owing to the need for a conductive connection. An example is a main transformer secondary winding operating at an excessive a.c. voltage (e.g. 60 V r.m.s.), feeding a bridge rectifier whose output is non-excessive, (e.g. 80 V d.c.).

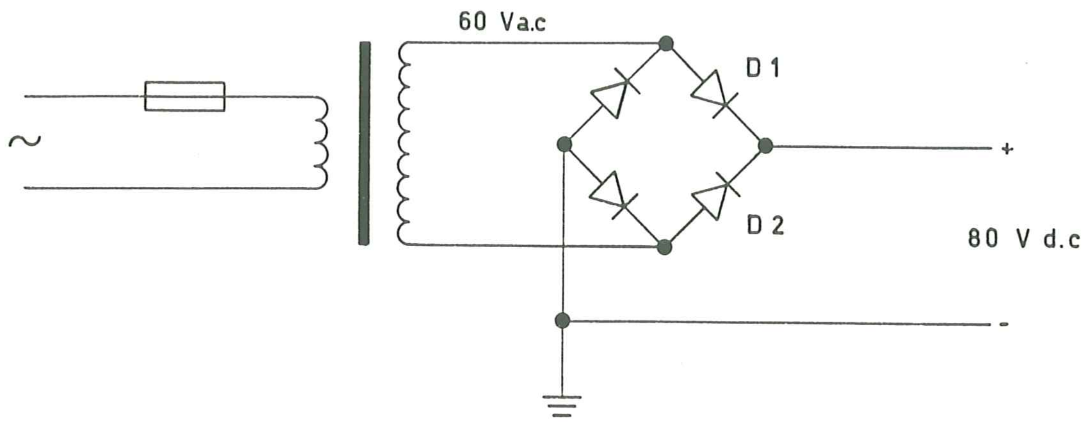


Figure F.1 - Example of Conductive Connection of Excessive Voltage to Protected Circuit.

As in most safety design, the principle can be applied that the equipment has to remain safe even in the event of a single fault. Likely faults, such as failure of a component or insulation, can be postulated and if necessary simulated in a test; any additional faults directly caused by the first fault have to be left in place and included as part of a single fault.

In the above example, a primary-to-secondary insulation fault in a transformer having only basic insulation could be expected to rupture a primary fuse. Any rectifier diode becoming open circuit would lower the output voltage. Any rectifier diode D1 (see figure F.1) becoming short circuit would cause the full secondary voltage to be applied to D2 with the effect of a "crowbar", and probably resulting in failure of D2 or rupture of the primary fuse, or both. In each case the output should remain non-excessive, except possibly for a transient deviation immediately after the occurrence of the fault. Such transient deviations are allowed for in the profile given in Figure 2.

APPENDIX G

This Appendix is explanatory information and is not an integral part of the Technical Report

ACOUSTIC SHOCK

In IT equipment incorporating telephone headsets or handsets, there is a possibility that in certain unfavourable (and exceptional) circumstances, sound pressure levels could be experienced of sufficient amplitude to cause damage to hearing.

Permissible levels and appropriate measurement methods are under consideration in CCITT, which has published Rec. K.7 and P.36.