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ITU-T

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PROTECTION AGAINST INTERFERENCE

**PRINCIPLES OF PROTECTION AGAINST
OVERVOLTAGES AND OVERCURRENTS**

ITU-T Recommendation K.11

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation K.11 was revised by the ITU-T Study Group 5 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 6th of October 1993.

NOTE

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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CONTENTS

	<i>Page</i>
1 General considerations	1
1.1 Origin of dangerous overvoltages and overcurrents	1
1.2 Methods of protection	1
1.3 Types of protective devices	2
1.4 Residual effects.....	3
1.5 Assessment of risk	4
1.6 Decision on protection	5
2 Protection of lines	6
2.1 Protective measures external to the conductors themselves	6
2.2 Special cables.....	6
2.3 Use of protective devices.....	6
2.4 Installation of protective devices	7
2.5 Planning of works.....	7
2.6 Recommended policy	7
3 Protection of exchange and transmission equipment	7
3.1 Need for protection external to the equipment	7
3.2 Need for equipment to have a minimum level of electrical robustness	8
3.3 Effect of switching conditions	8
4 Protection of subscribers' terminal equipment.....	8
4.1 Degree of exposure	8
4.2 Dielectric strength.....	8
4.3 Use of protectors.....	8
4.4 Common bonding	9
4.5 High isolation technique	9
4.6 National regulations.....	9
4.7 High cost of maintenance of subscribers' installations.....	9
References	10
Annex A – Definition of terms associated with protection	10



INTRODUCTION

Current ITU-T documents recognize lightning and faults on nearby electrical installations as sources of dangerous disturbances in telecommunications lines, which may cause damage leading to interruptions in service and the need for repairs or even hazards to personnel.

The object of the present Recommendation is to set out principles which enable the frequency and seriousness of such disturbances to be limited to levels which take account of quality of service, operating costs and safety of personnel. These principles are applicable to all parts of a telecommunications system. More details on certain methods of protection and for certain parts of the system are given in the References and in the following Recommendations: K.5, K.6, K.9, K.12, K.15, K.16, K.17. Information about disturbing phenomena and protection techniques are given in [1] and [2] (see also Recommendation K.26).

This Recommendation deals principally with the local exchange, local loop plant and subscribers' equipment, but its contents may have wider application.

Annex A gives definitions of a number of terms used in connection with protection.

NOTE – The disturbing phenomena, when they appear, are relatively rare or of very brief duration (usually of the order of a fraction of a second) and in framing the present Recommendation, consideration has not been given to methods of avoiding interruption of the functioning of equipment during an actual disturbance. The ITU-T is pursuing the study of such methods.

Recommendation K.11**PRINCIPLES OF PROTECTION AGAINST OVERVOLTAGES
AND OVERCURRENTS***(Geneva, 1972; modified at Malaga-Torremolinos, 1984; Melbourne, 1988 and Geneva, 1993)***1 General considerations****1.1 Origin of dangerous overvoltages and overcurrents****1.1.1 Direct lightning strikes**

Such strikes may cause currents of some thousands of amperes to flow along wires or cables for some microseconds. Physical damage may occur and overvoltage surges of many kilovolts may apply stress to the dielectrics of line plant and terminal equipment.

1.1.2 Lightning strikes nearby

Lightning currents flowing from cloud to earth or cloud to cloud cause overvoltages in overhead or underground lines near to the strike. The area affected may be large in districts of high earth resistivity.

1.1.3 Induction from fault currents in power lines including electric traction systems

Earth faults in power systems cause large unbalanced currents to flow along the power line inducing overvoltages into adjacent telecommunications lines which follow a parallel course. The overvoltages may rise to several kilovolts and have durations of 200 to 1000 ms (occasionally even longer) according to the fault clearing system used on the power line.

1.1.4 Contacts with power lines

Contacts may occur between power and telecommunication lines when local disasters, e.g. storms, fires, cause damage to both types of plant or when the normal safeguards of separation and insulation are not followed. Overvoltages rarely exceed 240 V a.c., r.m.s. above earth in countries where this is the normal distribution voltage but may continue for an indefinite period until observed. Where higher distribution voltages, e.g. 2 kV, are used the power line protection arrangements usually ensure that the voltage is removed in a short time if a fault occurs. The overvoltage may cause excessive currents to flow along the line to the exchange earth causing damage to equipment and danger to staff.

1.1.5 Rise of earth potential

Earth faults in power systems cause currents in the soil which raise the potential in the neighbourhood of the fault and of the power supply earth electrode. (See also Recommendation K.9.) These earth potentials may affect telecommunication plant in two ways:

- a) Telecommunication signalling systems may malfunction if the signalling earth electrode is in soil whose potential rises by as little as 5 V with respect to true earth. Such voltages may be caused by minor faults on the power system which may remain undetected for long periods.
- b) Higher rises of earth potential can cause danger to staff working in the affected area or, in extreme cases, may be sufficient to break down the insulation of the telecommunications cable causing extensive damage.

1.2 Methods of protection

1.2.1 Some of the protective measures for lines which are described in clause 2 have the effect of reducing overvoltages and overcurrents at their source and so reduce the risk of damage to all parts of the system.