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ITU-T K.20, K.21, K.45, K.82 – Additional criteria to protect telecommunication cabling during a power cross event

ITU-T K-series Recommendations – Supplement 3

ITU-T



Supplement 3 to ITU-T K-series Recommendations

ITU-T K.20, K.21, K.45, K.82 – Additional criteria to protect telecommunication cabling during a power cross event

Summary

Supplement to the ITU-T K-series Recommendations provides criteria that enable the implementation of power cross protection for telecommunication cabling connected to equipment compliant with ITU-T K.20, ITU-T K.21 and ITU-T K.45.

This supplement aims to:

- Provide current-time limitations to protect telecommunication cabling from fusing and wire insulation damage.
- Explain the evolution of physical wiring simulators and their drawbacks.
- Provide designers with the tools to extrapolate the supplement current-time limitations data to larger and smaller conductor sizes.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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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.

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Supplement 3 to ITU-T K-series Recommendations

ITU-T K.20, K.21, K.45, K.82 – Additional criteria to protect telecommunication cabling during a power cross event

1 Introduction

ITU-T equipment Recommendations [b-ITU-T K.20], [b-ITU-T K.21] and [b-ITU-T K.45] have power cross tests with prospective currents ranging from 0.23 A to 23 A. These power cross tests do not include an assessment of equipment feed cable heating. This Supplement provides information on the equipment overcurrent protector operate values to comprehend wiring current limitations.

Appendix I describes the tools and references a designer may use to define the overcurrent protector maximum time-current characteristic for specific wiring types. Appendix II covers the evolution of North American wiring simulators.

2 Wire current-time capability

Figure 1 shows a typical wire current-time characteristic. The current capability for short durations is governed by an adiabatic i^2t limitation, which results in the downward sloping portion current line. At longer durations (d.c.) a steady-state condition occurs resulting in a horizontal portion of the current line. This sort of curve is typically used to define the operate values of a single element fuse.

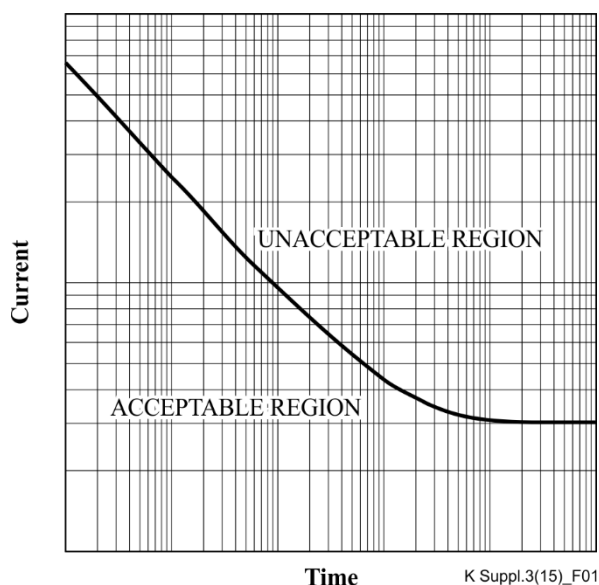


Figure 1 – Typical wire current-time curve

A current-time curve such as that in Figure 1 might be for wire conductor fusing or the onset of the wire insulation damage, or some intermediate condition. The performance requirement for the equipment overcurrent protector would be to operate in the acceptable area of the figure over the range of expected power cross current levels.

North America equipment standards have for many years included wiring simulators during a power fault event. These wiring simulators were developed to be part of a power fault test and are used as indicators of whether wiring would be damaged in an actual power fault event. Because of the country of origin of the wiring simulators, most of the data is referenced to American Wire Gauge (AWG) wire sizing. To relate the AWG to metric sizing, metric diameter equivalents are given in this supplement. For telecommunication cabling, for a given AWG, n , the wire diameter d mm can be calculated from:

$$d = 0.127 * 96^{(36-n)/39}$$

3 Wire current-time limits

3.1 Insulation damage

Figure 2 shows the limit curves for 0.4 mm and 0.2 mm diameter copper wire based on the [b-P-32-382] i^2t values and the [b-IEC 60950] equivalent DC values from Table I1 in Appendix I.

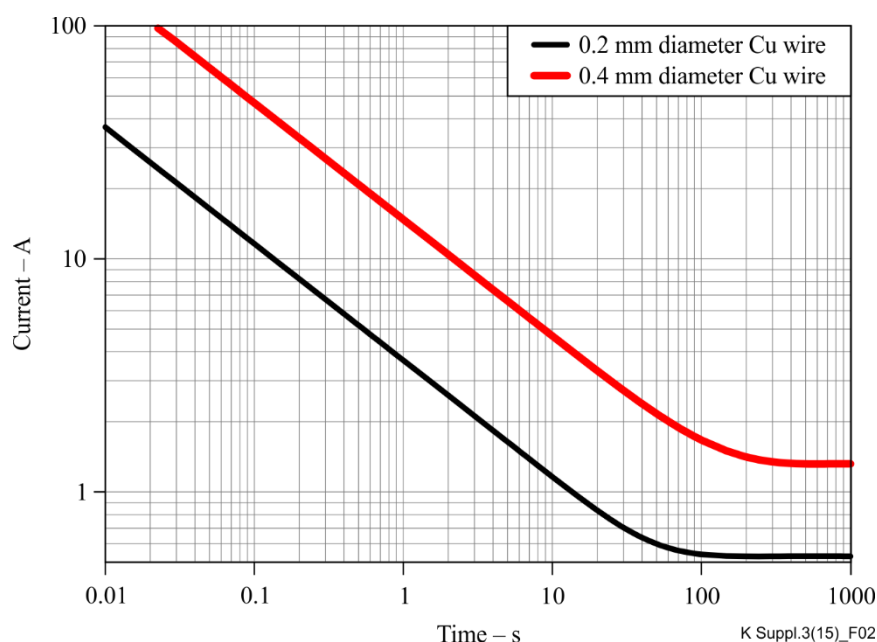


Figure 2 – Insulation damage limit current-time curve for 0.2 mm and 0.4 mm copper wire

In the steady state, long-term condition, the maximum allowed current for 0.4 mm diameter copper wire is 1.3 A and 0.2 mm wire is 0.53 A based on [b-IEC 60950] and [b-IEC 62368]. The ITU-T equipment Recommendations [b-ITU-T K.20], [b-ITU-T K.21] and [b-ITU-T K.45] power cross generator will only apply a maximum prospective current of 23 A.

3.2 North American wiring simulation

As shown in Appendix II, the wiring simulator used depends on the standard being complied with. Furthermore, the simulator that can be used may be a current-time curve, a physical simulation or both. A physical simulation can be a specified fuse or a length of AWG wire. None of the physical simulations are precision indicators, hence the move towards current-time templates. Any "universal" simulator curve should add a safety margin to cover the possible use of physical simulators. The biggest variability occurs in the steady state region [b-Lindquist].

The most popular wiring simulation fuse is the MDL-2. Here "2" indicates that the rated current is 2 A. In US standards, the MDL-2 fuse must conduct $1.1 * 2 = 2.2$ A for four hours [b-Lindquist]. Figure 3 shows the published MDL-2 curve adjusted down to 2.2 A from the typical 2.6 A at 1000 s.

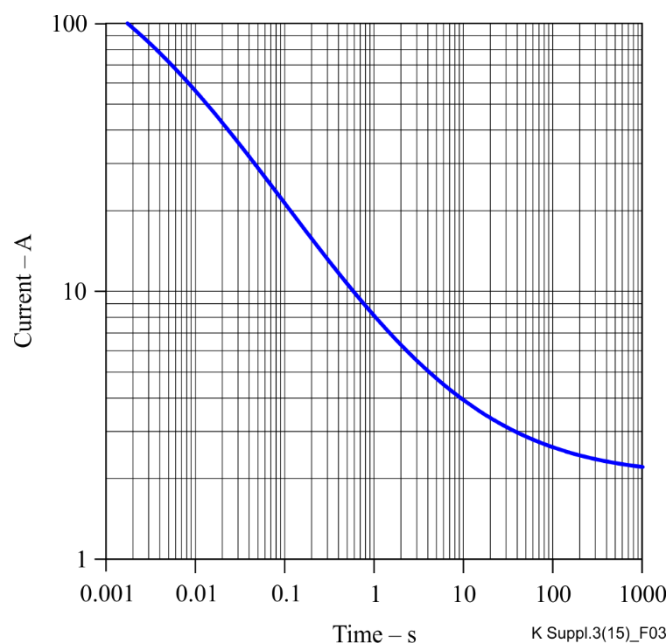


Figure 3 – MDL-2 limit current-time curve (derated to 85% of its typical value)

Points to note here are:

- The Figure 3 MDL-2 curve (derated to 85% of its typical value) falls below the 0.4 mm Figure 2 insulation damage curve for times less than 10 s. Conversely, for times greater than 20 s, the Figure 3 curve allows more current than the Figure 2 curve.
- The Figure 3 curve has a variable i^2t . At 0.01 s i^2t is 13 A²s, 0.1s is 45 A²s and 1 s is 65 A²s.