SHORT CIRCUIT CHARACTERISTICS

OF

INSULATED CABLE

ICEA PUBLICATION # P-32-382-1999

April 1999

Fourth Edition

INSULATED CABLE ENGINEERS ASSOCIATION, Inc.

SHORT CIRCUIT CHARACTERISTICS OF INSULATED CABLE

Publication # P-32-382-1999

1st Edition - - 1958
2nd Edition - - 1969
3rd Edition - - 1994
4th Edition - - 1999

Published By
INSULATED CABLE ENGINEERS ASSOCIATION, Inc.
Post Office Box 440
South Yarmouth, Massachusetts 02664, U.S.A.

INSULATED CABLE ENGINEERS ASSOCIATION

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PREFACE

This publication is offered to enable the users of electric cable to determine the operability of cable under short circuit conditions. It may be used in the following ways:

1. To determine the maximum short circuit current permitted for a cable.
2. To determine the cable size necessary to withstand a particular short circuit load.
3. To determine the maximum time a cable may be subjected to a particular short circuit load without damage to the insulation.

A formula has been established for short circuit calculations with conductors of copper or aluminum. The insulations, which determine the maximum allowed short circuit temperatures, are described in ICEA Standards. The formula is based on the heat content of the conductor material and the temperature limit of the insulation with the assumption that the time interval is so short that the heat developed during the short circuit is contained in the conductor. At the time this document was originally published there was no standard mathematical method available to calculate heat flow from the conductor through the insulation at the cessesion of the short circuit load. It was necessary to enlist the aid and facilities of member laboratories and Massachusetts Institute of Technology to obtain in cooperation a solution to this problem so that safe temperature limits could be established for the various types of insulation. The solution is still a viable, conservative approach to the calculation of short circuit capacity.

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P-32-382

SHORT CIRCUIT CHARACTERISTICS OF COVERED WIRE & CABLE

Introduction.

This publication discusses factors for consideration in approximating the operability of insulated and/or covered wire and cable under the influence of uninterrupted short circuit currents encountered as a result of cable or other equipment faults. The duration of such a fault is considered to be up to approximately 2 seconds. Calculations for single short circuits of longer durations yield increasingly conservative results.

The following items must be considered in order to estimate the short circuit performance of a specific circuit:

1. The magnitude and duration of the fault current including any fault current division due to available conducting paths.

2. The capability of joints, terminations and other accessories in the affected circuit to withstand the thermal and mechanical stresses created by the fault.

3. The interaction between the faulting circuit and surrounding equipment, such as supports, ties and clamps.

4. The capability of the affected cable circuit, as installed, to withstand the electromagnetic forces created during the fault.

5. The maximum temperature that cable components can withstand without incurring damage due to heating caused by fault current flow.

6. Damage to adjacent equipment due to arcing at the site of the fault.

7. For limitations imposed on the short-circuit capacity of the cable by the fault capacity of the cable metallic sheath/shield, see ICEA Publication P-45-482, *Short Circuit Characteristics of Metallic Sheaths and Shields on Insulated Cable*.

An important simplifying assumption in the formula is the adiabatic nature of the heat generated, *i.e., the duration of the fault is so short that all the heat developed by the fault current during this time is assumed to be completely contained within the conductor.* The amount of heat dissipated from the conductor during continuous, single fault occurrences of relatively short duration is small. A significant amount of heat may be dissipated because of the relatively long