IEEE Standards

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(Amendment to
IEEE Std 1584-2002)

1584a™

IEEE Guide for Performing Arc-Flash Hazard Calculations—Amendment 1

IEEE Industry Applications Society

Sponsored by the
Petroleum and Chemical Industry Committee

IEEE

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Petroleum and Chemical Industry Committee
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Approved 23 September 2004

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Abstract: This amendment provides additions and corrections to IEEE Std 1584-2002.
Keywords: arc fault currents, arc-flash hazard, arc-flash hazard analysis, arc-flash hazard marking, arc in enclosures, arc in open air, bolted fault currents, electrical hazard, flash protection boundary, incident energy, personal protective equipment, protective device coordination study, short-circuit study, working distances

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Introduction

(This introduction is not part of IEEE Std 1584a-2004, IEEE Guide for Performing Arc-Flash Hazard Calculations—Amendment 1.)

This amendment to IEEE Std 1584-2002 offers guidelines on how to apply the document based on experience gained by users since its publication.

As defined by the IEEE operating procedures, a guide is a document in which alternative approaches to good practice are suggested, but no clear-cut recommendations are made. This guide is intended to be used only by qualified people. The complexities of electrical power system configurations and equipment dictate that, like short-circuit studies and protective-device coordination studies, an arc-flash hazard study should only be undertaken by experienced electrical power system engineers or other well-trained professionals. Those who are not this qualified are encouraged to use a table method to select personal protective equipment (PPE).

A set of cautions and disclaimers is provided in the guide and reproduced in the spreadsheet calculator to help users understand the limitations in the technology. Proper PPE based on arc-flash hazard calculations or tables is the last line of defense against arc-flash hazards. Other mitigation techniques, as in the following list, provide a much better defense. A facility owner and employees working on equipment should be aware of all the limitations. The warning labels in rated PPE help to do this. However, users should recognize that following codes, standards, guides, and recommended practices does not guarantee that all arc-flash injuries will be avoided.

De-energizing remains the first choice as a means of achieving an electrically safe working condition and reducing the possibility of injury, but that is not always possible. Also, incidents have occurred during the action of de-energizing equipment to create the safe working condition and during switching to reestablish power. For these occasions, an arc-flash hazard analysis and the institution of a PPE program provide great value in reducing the likelihood of injuries in an arc flash.

These studies may identify equipment where the possible incident energy levels are so high that PPE is not available or not recommended. In those cases, operating procedure or engineering design changes may need to be considered to reduce the exposure or incident energy levels. Developing these changes is an important part of implementing a study's results. Examples of some of these changes include the following:

- Changing operating procedures to eliminate or minimize the time that two sources of power are tied together
- Resetting or replacing existing protective devices to get faster fault clearing times
- Adding fast operating relays or current-limiting devices to reduce fault clearing times
- Adding remote racking and operating capability
- Installing arc-resistant switchgear

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

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IEEE Standards Project Editor

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IEEE Guide for Performing Arc-Flash Hazard Calculations—Amendment 1

NOTE—The editing instructions contained in this amendment define how to merge the material contained herein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strikethrough~~ (to remove all old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

5. Model for incident energy calculations

5.2 Arcing current

Change the last paragraph in 5.2 to the following:

For applications with a system voltage under 1000 V, calculate a second arc current equal to 85% of I_a, so that a second arc duration can be determined (see 9.10.4).

5.6 Current-limiting fuses

Insert the following sentence as the third sentence:

Where applicable, these formulae should be used as opposed to the formulae in 5.2 and 5.3.

5.7 Low-voltage circuit breakers

Add a sentence at the end of the first paragraph:

Where the time-current curves are available, the equations in 5.2 and 5.3 are preferred.

Where the time-current curves are available, the equations in 5.2 and 5.3 are preferred.

7. Comparison of arc-flash calculation methods

7.1 Table method in NFPA 70E-2004

Change 7.1, as shown in the following text:

~~The simplest~~ One method for determining PPE requirements for arc-flash protection is to use the tables in NFPA 70E-2004. These tables ~~give instant answers and require almost no field data~~ provide guidance for determination of hazard risk categories and PPE requirements for various common tasks. It should be noted that these tables are for specific fault currents and specific clearing times as stipulated in notes at the end of the tables. ~~and the tables do not cover all applications or installations of electrical equipment. While these tables are intended to be conservative for most applications, they may not enable the user to select adequate protection.~~

Arc-flash calculator (provided with IEEE Std 1584-2002 as a separate file embedded in a spreadsheet program)

Change the formula in the I24 cell of the data-normal sheet in the arc-flash calculator to the following, then repeat the change down the column for each row:

=IF(AND(B24<1,O24=0),(E24/C24)*POWER(10,X24),"Not required")

The formula, which found 85% of the arcing current, did not reflect the possible reduced current in the protective device. The ratio E24/C24 was missing.