

**Short Circuit/Coordination &
Arc Flash Study Specifications**

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I. General Overview

This specification provides the requirements for engineering firms performing short circuit/coordination & arc flash studies for Delphi Facilities. This specification outlines the requirements for documentation, training, study option section in the SKM software, preferred one-line drawing color-coding, personal protective equipment (PPE) and Delphi warning and danger labels.

The short circuit/coordination and arc flash study software used for the Delphi Facilities will be the **SKM Power Tools -current version**. In the study option section of the SKM software, Delphi will select the **IEEE 1584 Standard**. This is the preferred method throughout the industry and is considered more accurate due to the extensive testing performed while creating this standard.

Delphi Personnel

It is imperative Delphi plant personnel be involved in reviewing the study so they understand the areas that need to be addressed. They need to understand the areas that are labeled “Dangerous” and the Safe Operating Procedures (SOP) required for work to be performed in these areas. Full cooperation and participation in reviewing this study will benefit the site as well as the safety of all plant personnel.

Delphi Personnel that should attend this review include the following:

- Electrical Facility Engineers
- Controls Engineers
- Safety Personnel
- Site Manager
- Supervisors – Maintenance, Engineering, etc.
- Electricians – Group Leaders
- Union Representatives

Delphi representative must approve any deviation from this specification.

II. Engineering Firm Requirements

A. Short Circuit/Coordination & Arc Flash Study:

- A **licensed/registered** Engineer with **5 years** minimum experience in power system studies
- Software model shall be developed starting with the incoming utility down through the 480V substations. The model shall include the plug-in bus duct system in the production areas. All facilities equipment, such as motor control centers, feeder breakers and air-handling equipment shall be included.
- It will be determined by the Delphi representative if additional equipment should be modeled and any if not all equipment on the plant floor.
- Where feasible, system drawings and existing protective devices and setting records shall be furnished by the Delphi representative. These items shall be distributed to the engineering firm with the understanding they will be responsible to verify existing conditions of the protective device settings.
- The study shall include the latest utility fault contribution from all sources and be evaluated for normal and alternate sources when applicable
- A complete coordination review of all relevant substations shall be performed for **“As Found”** over-current device settings
- A complete coordination review of all relevant substations shall be performed for **“As Recommended”** over-current device settings
- An arc flash evaluation shall be performed and provided for the **“As Found”** and **“As Recommended”** settings

B. Documentation:

- Engineering firm shall be responsible to present an oral technical report to the site upon completion of the work.
- All the information provided from the study will be issued on a CD unless otherwise directed by the Delphi representative.
- The Delphi representative shall determine the number of hard copies for their site.

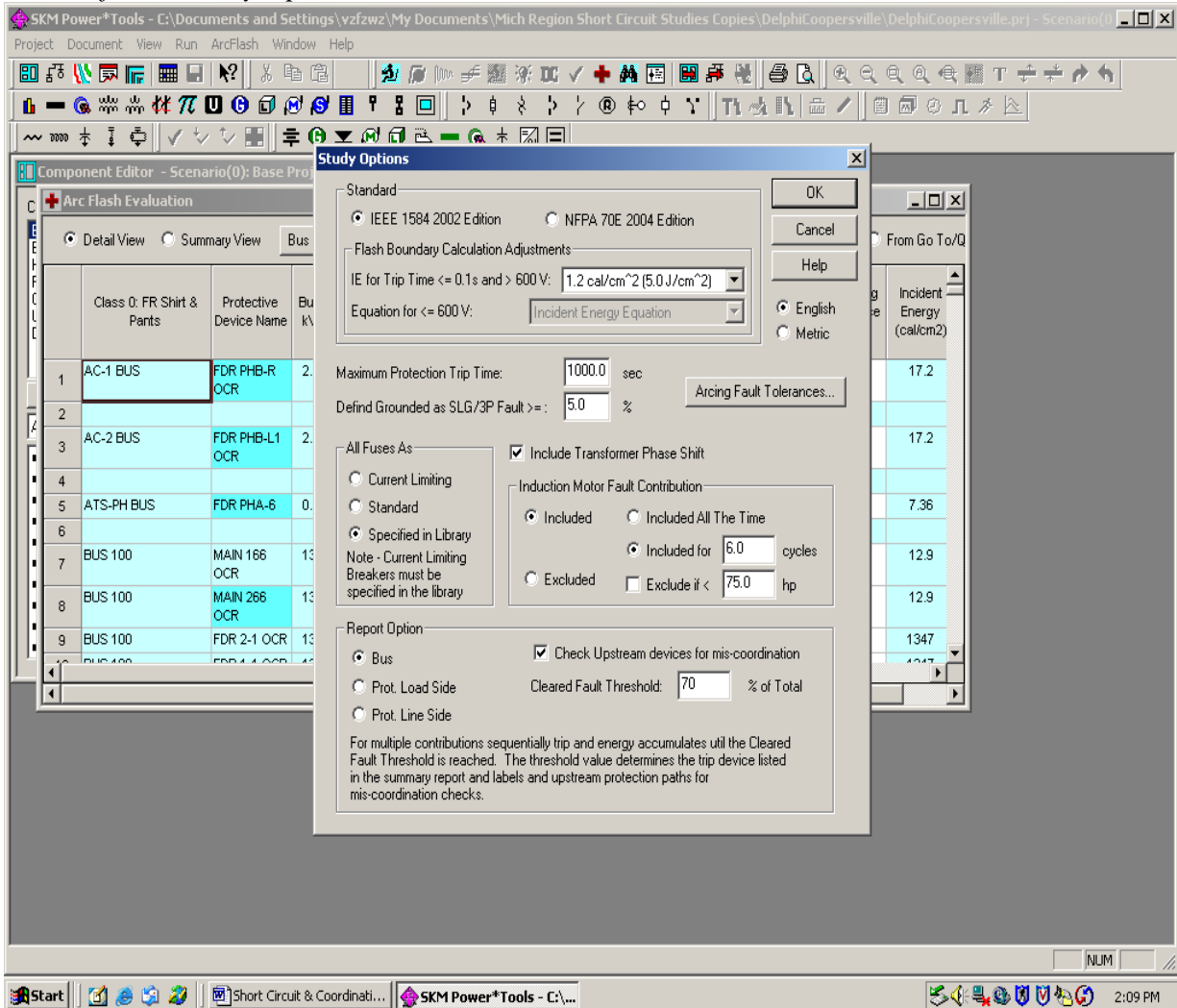
C. Training

- Should the Delphi representative elect to contract training services for the SKM software or if training is provided by the engineering firm the following guidelines should be followed. The training should not cover how to model an entire facility but include some of the following items:
 - Modeling production equipment on the floor
 - Moving equipment from one bus to another
 - Changes to breaker settings – *impact on the incident energy level and coordination when breaker settings are changed*
 - Time Current Curves (TCC) – *introduction to coordination when reviewing the curves*

III. SKM Study Option Section Requirements

The following parameters in the **Study Option Section** provided in the SKM software shall be used for all short circuit/coordination and arc flash studies for Delphi Facilities.

SKM Software Study Option Section:



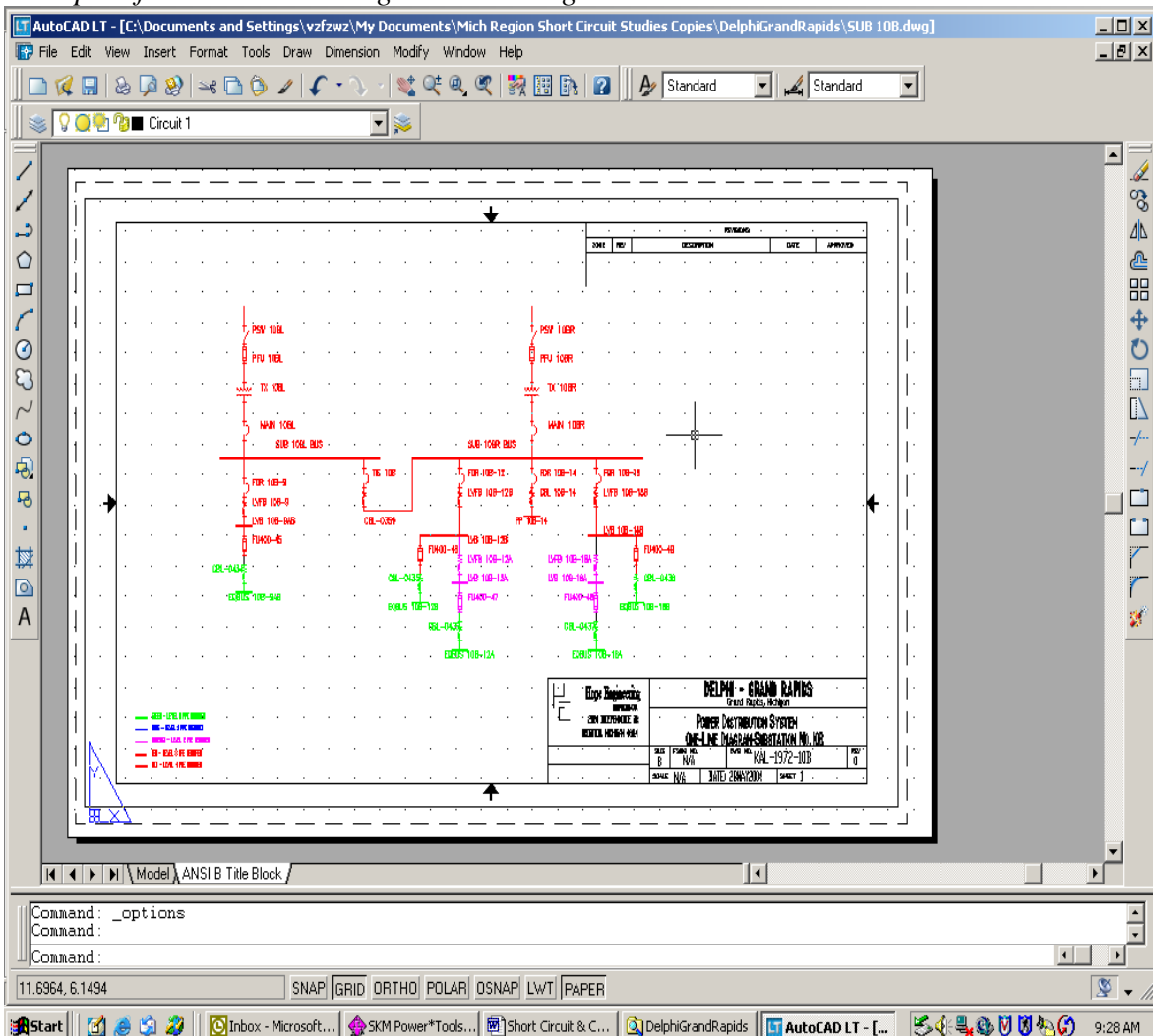
IV. Preferred One-Line Drawing Color Coding

The Delphi representative shall determine if they prefer to color code the one-line drawing based on the Hazard Risk Category.

Color Coding for One-Line Drawings preferred:

- HRC 0 – Green
- HRC 1 – Blue
- HRC 2 - Magenta
- HRC 3 & 4 – Red

Example of One-Line Drawing Color-Coding:



V. Personal Protective Equipment Clothing Requirements (PPE)

The chart below provides the PPE requirements for all Delphi facilities.

Hazard Risk Category	Incident Energy Level cal/cm²	Clothing Description
0	<1.2	Untreated Cotton*
1	1.2 to 4	FR Shirt & Pants + Hard Hat
2	4 to 8	Cotton Underwear + FR Shirt & Pant + Hard Hat + Face Shield + Leather Shoes Required
3	8 to 25	Cotton Underwear + FR Shirt & Pant + Double Layer Switching Suit + Hard Hat + Flash Hood + Leather Shoes Required
4	25 to 40	Cotton Underwear + FR Shirt & Pant + Double Layer Switching Suit + Hard Hat + Flash Hood + Leather Shoes Required

* Because most Delphi Sites are wearing Class 2 clothing as normal daily wear, they are changing the clothing description for Class 0 to “**FR Shirt & Pant**”. Delphi representatives may opt to change the **Class 0** clothing description to **FR Shirt & Pant**.

VI. Delphi Warning and Danger Label Requirements

The Delphi representative will determine if the engineering firm is to provide labels for the facility. This may include or may not include placing labels on the equipment.

Delphi requirement for labeling shall be as follows:

- Label size for Warning and Danger - **Width 4.5 inches X Height 6.5 inches**
- If labels are hung from the bus the spacing will be **40 feet** (*Same as piping standard*)
- Delphi has created a blanket with the Brady Corporation to provide the following
 - Pre-printed warning and danger label using laser material
 - Sealable pouches to hang the label from the bus
 - Generic label – plant floor
 - Brady Thermal Transfer Printer kit for pre-printed warning and danger labels
- Delphi will provide the file for the custom labels created on the SKM software if requested by the engineering firm so they can print directly from the SKM software. The following custom label file provides the following:
 - Pre-Printed Warning Label
 - Pre-Printed Danger Label
 - Complete Warning Label
 - Complete Danger Label
- Color-coding labels based on the hazard risk category will not be allowed.
- The Delphi representative must approve any deviation from this labeling requirement.

Example of Delphi Warning and Danger Label:

