

TSEWG TP-10: ARC FLASH LEVELS FOR FUSED VOLTAGE INPUTS TO ELECTRICITY METERS

INTRODUCTION.

NAVFAC Specification 26 27 13.00 20, *Electricity Metering*, requires fusing for the voltage input to an electricity meter and does not recommend the use of potential transformers for 480-volt applications. This Technical Paper discusses the typical arc flash level downstream of a fused input to a typical electricity meter.

For the purposes of analysis, two cases are considered:

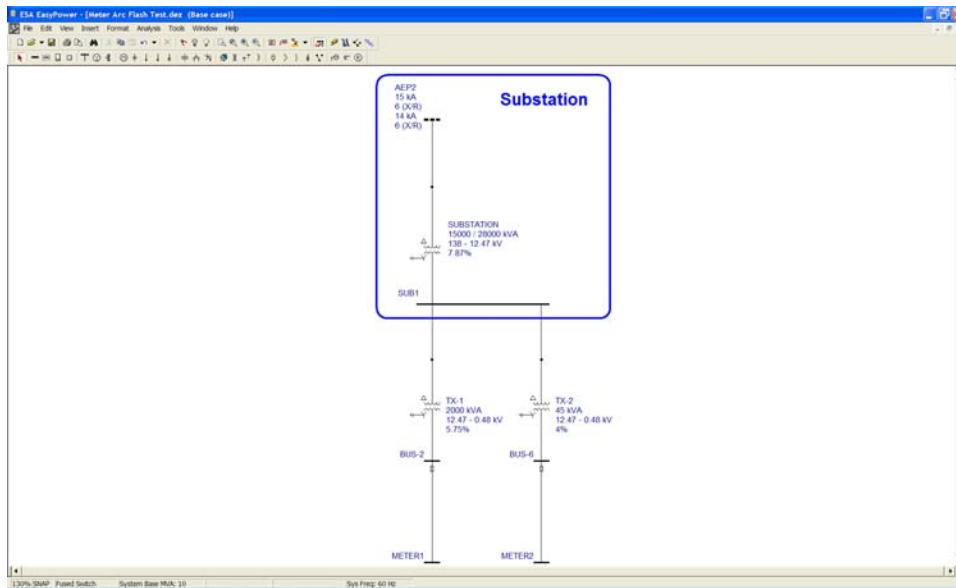
- A relatively large distribution transformer with a large available short circuit current on the secondary side.
- A relatively small distribution transformer with a small available short circuit current on the secondary side.

The above two cases likely bound typical installations.

ANALYSIS CONFIGURATION.

A simple EasyPower model was developed with two distribution transformers as shown in Figure 1. Transformer TX-1 is a 2000 kVA transformer and Transformer TX-2 is a 45 kVA transformer. The output of each transformer has 10 feet of #10 awg conductor representing the supply to the electricity meter. Each conductor is protected by a Class RK-5 600-volt fuse, which is a typical fuse type for this application.

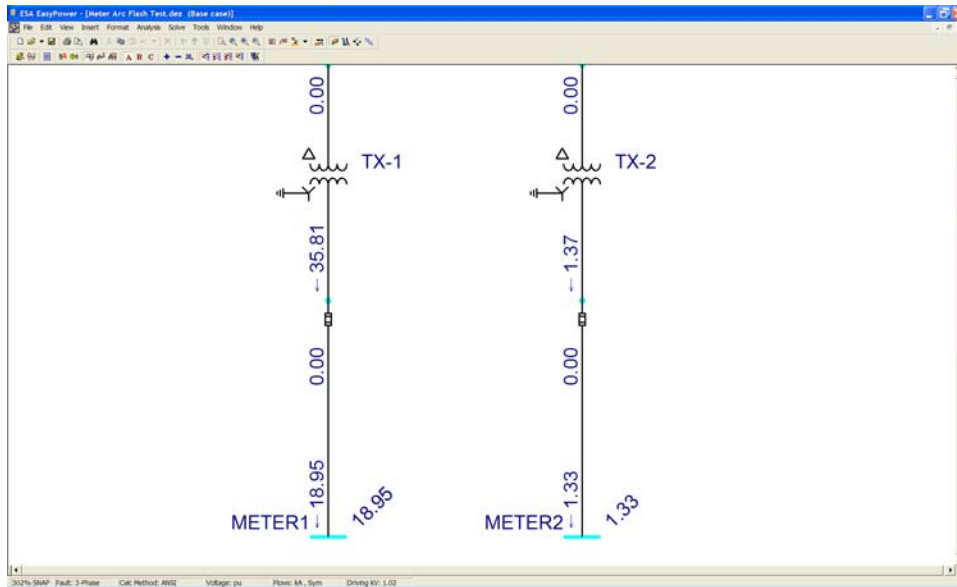
Figure 1 EasyPower Model



The available short circuit current (kA) for this configuration is shown in Figure 2. As shown, the large transformer has a short circuit current of about 36 kA and the small

transformer has a short circuit current of about 1.4 kA. Conductor resistance reduces the short circuit current available at the meter.

Figure 2 Short Circuit Current



ARC FLASH RESULTS.

Figure 3 shows a typical arc flash result for this configuration.

Figure 3 Arc Flash Level

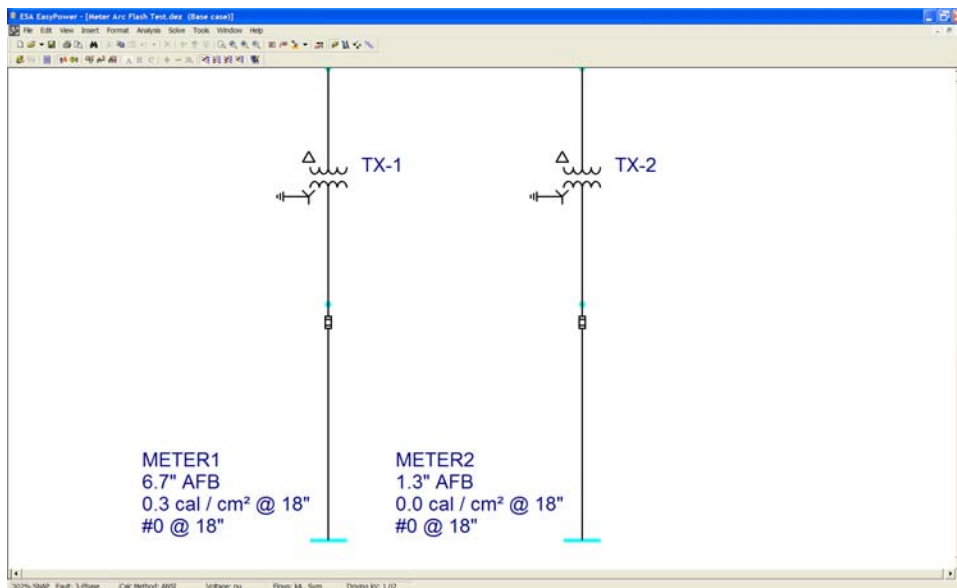


Figure 3 shows a Category 0 arc flash level; this particular result is based on 20 ampere fuses in each line. These results remain at Category 0 for fuse sizes up to 110 amperes. The results are based on the time-current response of the fuse. The lower short circuit current level of the smaller transformer eventually becomes limiting

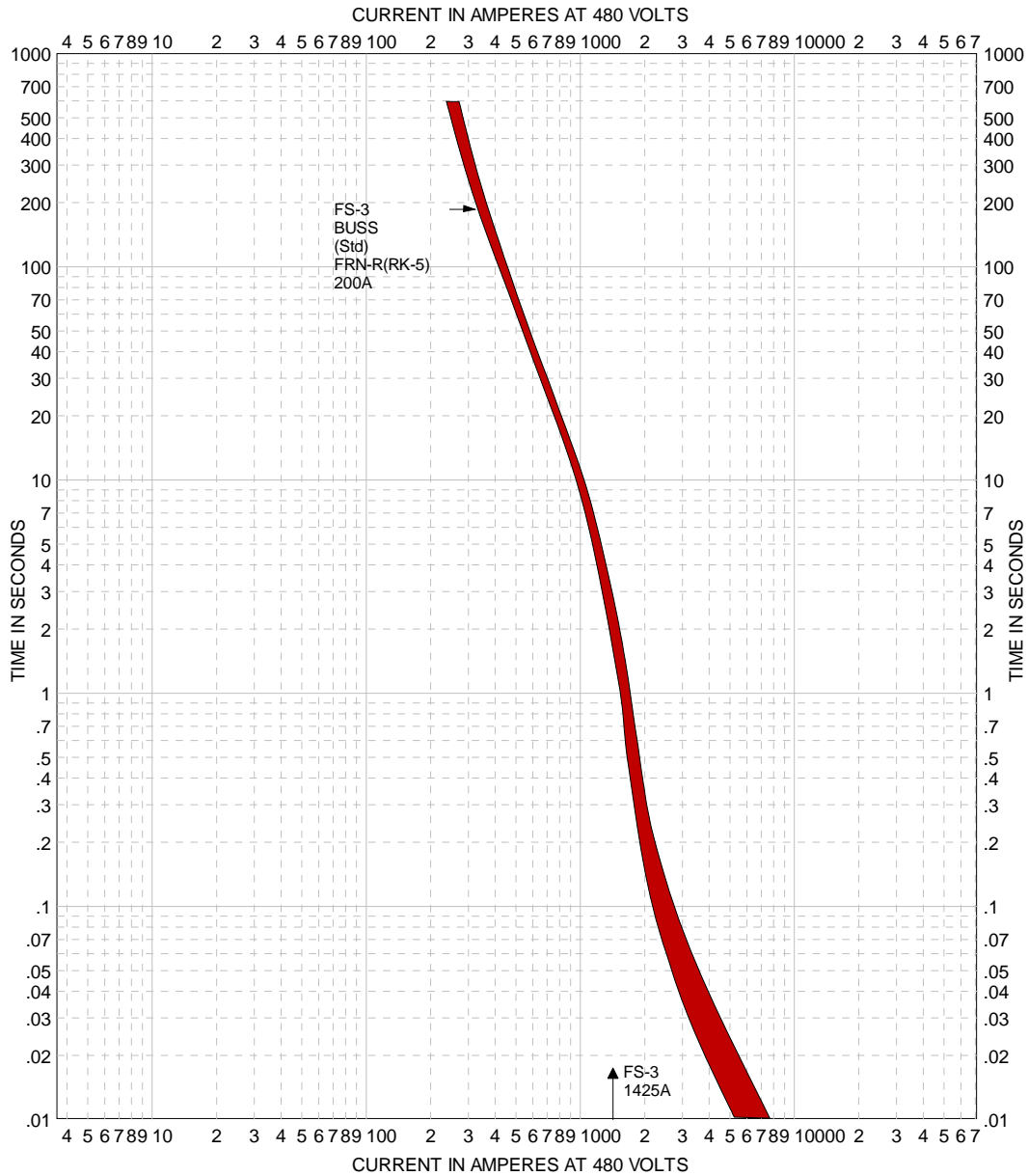
because of the longer fuse response duration for the lower short circuit current. Table 1 summarizes the results in terms of cal/cm² at a working distance of 18 inches.

Table 1 Arc Flash Levels as a Function of Fuse Size (cal/cm²)

Transformer	10 amp	20 amp	50 amp	100 amp	110 amp	125 amp	150 amp	200 amp
T-1 (2000 kVA)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
T-2 (45 kVA)	0.0	0.0	0.1	1.1	2.0	4.2	10.4	15.9

Figure 4 shows a coordination plot for the 200 ampere fuses protecting the meter on the 45 kVA transformer. The transformer secondary-side short circuit current of about 1.3 kA will take several seconds to clear.

Figure 4 Coordination Plot



In summary, fusing the voltage input to the electricity meter provides adequate arc flash protection. Although larger fuse sizes were evaluated here, the fuses used should typically be 20 amperes or less to provide conductor protection. Potential transformers should not be necessary for 480-volt applications.