Arc Flash Hazards Analysis vs. NFPA 70E Table

There are reasons to use either method for determining the potential hazards before performing electrical work. On the surface, when an electrical contractor walks into a new client's office, the table method appears the best approach to use. It's recognized that there are few options. Many owners of building, industrial plants, educational facilities, electric generating facilities and on and on have not taken the time to performed detain arc flash hazards analysis. So what does the electrical contractor do? The same applies to the electrical mai9ntenance technicians in the above listed facilities?

To make the choice y0ou need to understand the pros and cons of each method and then decide upon the level of risk you want to take.

I. NFPA 70E Table 130.7(C)(15)(A)(a)

Pros:

1. Simple to us
2. Low cost

Cons:

1. The reliability of the protection of personnel is questionable.
2. The necessary information needed to make the calculations required by NFPA 70E to use Table 130.7(C)(15)(A)(a) is not readily available.
3. Manual calculations on only a small part of an electrical system risk serious errors unless you consider operating conditions of the facility.
4. You cannot determine the operating time of an overcurrent protective device without the use of a time current curve. Are they available?
5. Performing the necessary calculations and analysis necessary to determine if the amount of short circuit current and the overcurrent protection device tripping time for all the major electrical panels in a facility will take almost as much time as doing an arc flash hazard analysis.

II. Arc Flash Hazards Analysis

Pros:

1. An arc flash hazards analysis required the use of up to date one-line (single-Line) diagrams. Verifying of one-line diagrams is a side benefit of the study.
2. An arc flash hazards analysis required a short circuit analysis be performed. This is also a side benefit and it is a good idea to review this data to insure that electrical equipment Has the required rating of maximum available short circuit data.

3. An arc flash hazards analysis required the collection of overcurrent protection device data.
4. An arc flash hazards analysis provided detail documentation of the facility's electrical system which is always a benefit.
5. An arc flash hazards analysis provided a software model which provides a great too for the future when facility expansion is considered.
6. An arc flash hazards analysis provides easy tools for the evaluation of arc flash hazard/risk mediation
7. Within minutes questions concerning the adjustment of overcurrent protective devices can be reviewed to determine if risk well increase.
8. When the electrical maintenance staff participates in the collection of the needed data for an arc flash hazards analysis, they begin to feel that the company cares.

Cons:

1. Cost.
2. Time.

III. Quantifying the reliability of NFPA 70E Table 130.7(C)(15)(A)(a)

A. Example 1

This example is for one of four locations in one plant.

2500 kVA Transformer

5.79 % Impedance

480 volts Secondary

Delta/Wye

3000 Amp Gould Shawmut class L Fuse, Model No. A4BQ

Short circuit current = 52.345 kA

Arc Fault Current = 24.999 kA

Incident Energy = 78.9 cal/cm^2 - by arc flash analysis > category 4, **Dangerous**

Table 130.7(C)(15)(A)(b) other 600-V class equipment , maximum of 65 kA short circuit current - **category 2**

This is a very dangerous situation where very serious injuries are likely. Table method will NOT protect, death is likely.

B. Example 2

Electrical blast burns 3 working at XXXXXXXXX hospital

By JIM ADAMS
The Courier-Journal

Two men were critically injured and a third suffered burns on his hands in an electrical explosion yesterday in the basement of

The men, employees of Electric Co., were doing routine maintenance work in a small room where the building's electrical panels are housed when the explosion occurred about 7:30 a.m., said Daniel Shaw, public-relations manager for Health System.

No patients were affected, Shaw said.

Two of the men were in critical condition yesterday afternoon at University of Louisville Hospital. The hospital would not release their names, at the request of their families, but the Louisville Fire Department identified them as and

Lt. Col. Keith Milliner of the fire department said seven workers were in the basement when touched something carrying a current with a metal-tipped ruler, causing an arc and an electrical flash.

suffered second-degree burns over 40 percent of his body and third-degree burns over another 20 percent, Milliner said. suffered second-degree burns over 20 percent of his body and third-degree burns over another 20 percent.

Shaw said the third injured worker was treated at and released. Milliner identified him as and said he suffered first- and second-degree hand burns.

The ages and addresses of the workers were not available.

The explosion knocked out power to the building, but emergency generators immediately kicked on. An alarm sounded, but Shaw said no patients were moved in the hospital, formerly

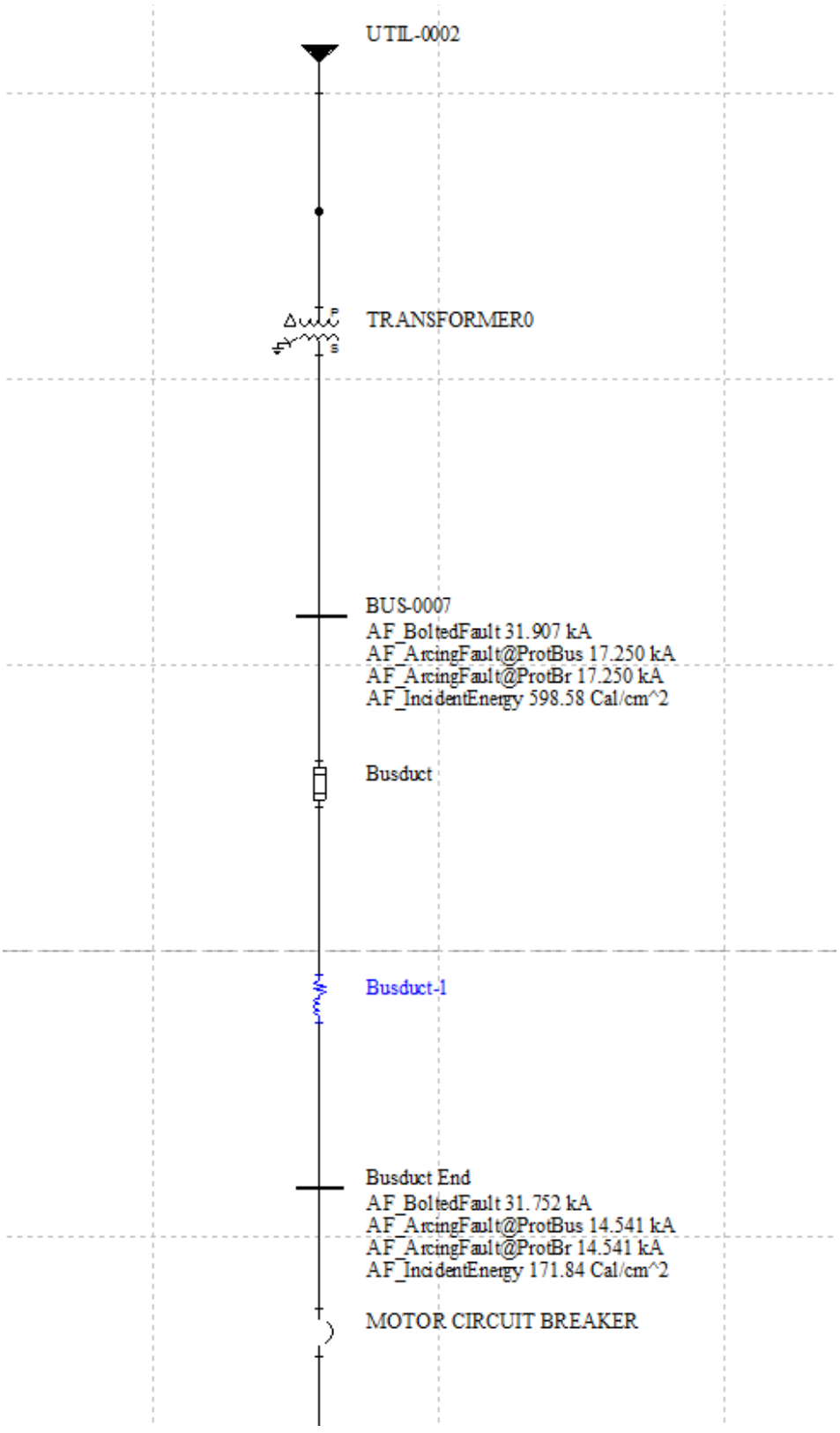
He said patients probably didn't notice anything was amiss unless they happened to see firefighters arrive.

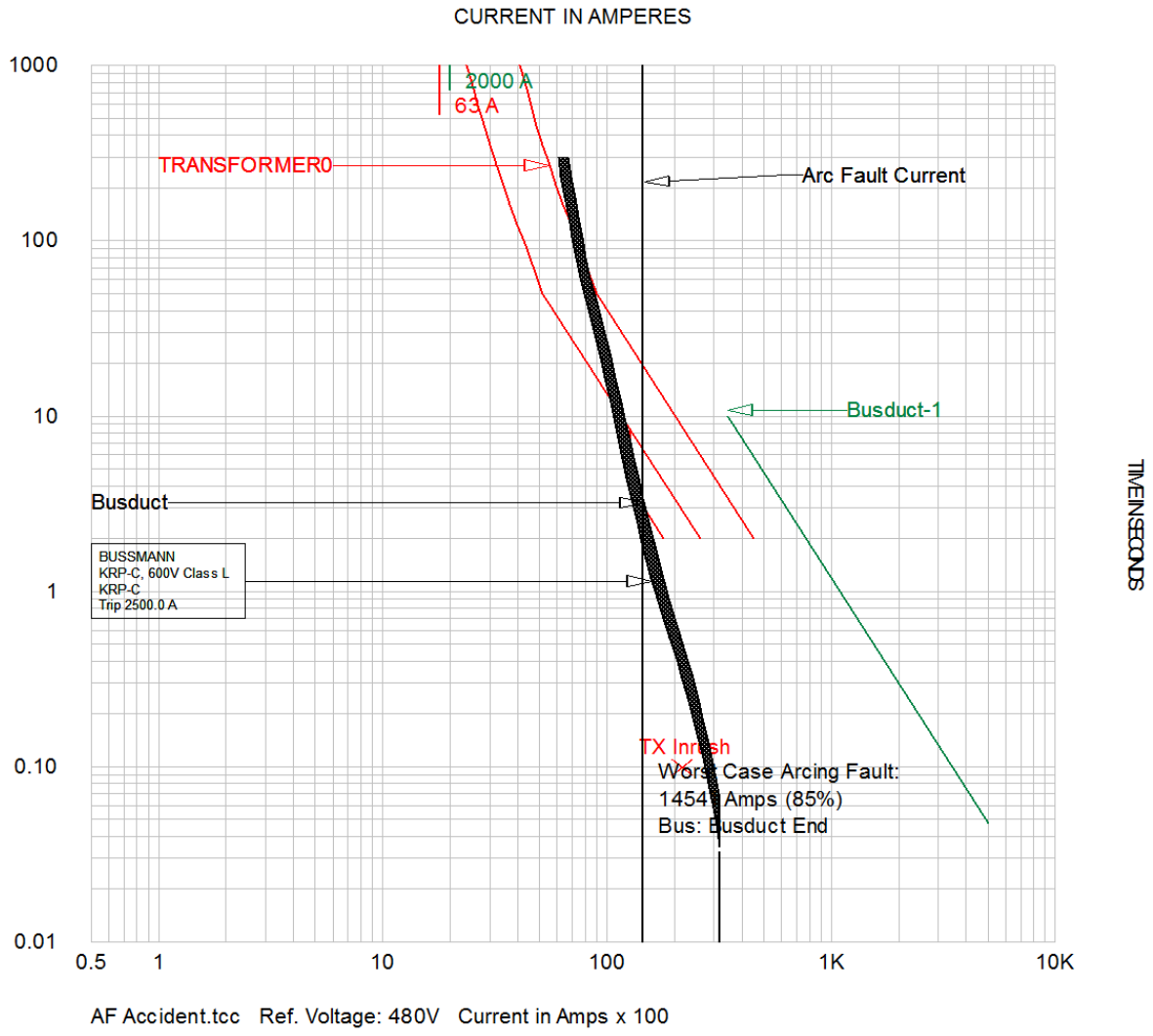
Fire crews found a haze of smoke but no fire in the basement, Milliner said. They spent about two hours trying to clear the basement of smoke.

Telephone calls yesterday to , were not returned.

- Louisville, August 4, 1996
- 3 electricians involved in an Arc Flash
- 2000 Amp busduct (1500 kVA Transformer, 1804 amps full load, 5.5%, 32,800 amps short circuit current)
- Protected by 2500 Amp current limiting fuse.
- I_{AF} = ~14,540 Amps (arc flash current)
- Bussmann KRP 2500
- Fuse clears the fault in 4 seconds (4000ms, but should have cleared in <4 ms)
- Incident Energy = 196 cal/cm^2 (open air)

One electrician dead after 11 days in hospital. Note, happened 1996 before the NFPA 70E standard included arc flash. Category 2 PPE per table method. Category 2 would not have provided a lot of protection against 129 cal/cm^2.


UTIL-0002
TRANSFORMER0
BUS-0007
AF_BoltedFault 31.907 kA
AF_ArcingFault@ProtBus 17.250 kA
AF_ArcingFault@ProtBr 17.250 kA
AF_IncidentEnergy 598.58 Cal/cm^2
Busduct
Busduct-1
Busduct End
AF_BoltedFault 31.752 kA
AF_ArcingFault@ProtBus 14.541 kA
AF_ArcingFault@ProtBr 14.541 kA
AF_IncidentEnergy 171.84 Cal/cm^2
MOTOR CIRCUIT BREAKER



Institute of forensic Electro-Pathology

http://www.vinita.biz/Electrical-Accidents.html