NEC Arc Flash Rules

September 1, 2011

REMA Line Superintendents' Conference

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National Electrical Code 2011

- Section 110.16 Arc-Flash Hazard Warning
  - Electrical equipment…in other-than-dwelling units…shall be field marked to warn qualified persons of potential electric arc flash hazards.[1]

[1]National Fire Protection Association, *National Electrical Code 2011*, (Delmar Cengage Learning, 2010), 70-37

NFPA 70E-2009

- Standard for Electrical Safety in Workplace
- Same Standard National Electrical Safety Code References in Directing Electric Utilities to Implement Arc Flash Safety Practices

Proper Equipment Labeling

- Panels or Cabinets in Other-Than-Dwelling Units Must Be Labeled
- Proper Label Communicates:
  - PPE (Category Level) OR
  - Incident Energy at Working Distance
- Facility *Owner* Responsibility

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Cooperative-Owned Equipment

- Meter Sockets
- Transition Cabinets
- Transformers

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Areas of Concern

- Are Electricians or Others Allowed to “Enter” Equipment Owned By Cooperative?
  - “Enter” = examination, adjustment, service, or maintenance
- Label Must Be Visible Before “Entering”

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Owner/Electrician Requests

- Electrician Should Ask Questions About Fault Current and Clearing Times
- General Practice—Point of Interconnection Somewhere Near Meter or Current Transformers
  - "Owner" or member responsible for secondary conductors between POI and first over-current device, generally the main service panel

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Owner/Electrician Requests

- Cooperative Must Provide Fault Current and Clearing Time
- Clearing Time Dependent Upon Fault Current
- Each Geographic Location Slightly Different Due to Source Impedance
- Source Impedance Includes Many Factors
  - Wire Size
  - Substation Size
  - Transmission System

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Fault Current Calculations

- Maximum Source
- Normal Source
- Alternate Source(s)

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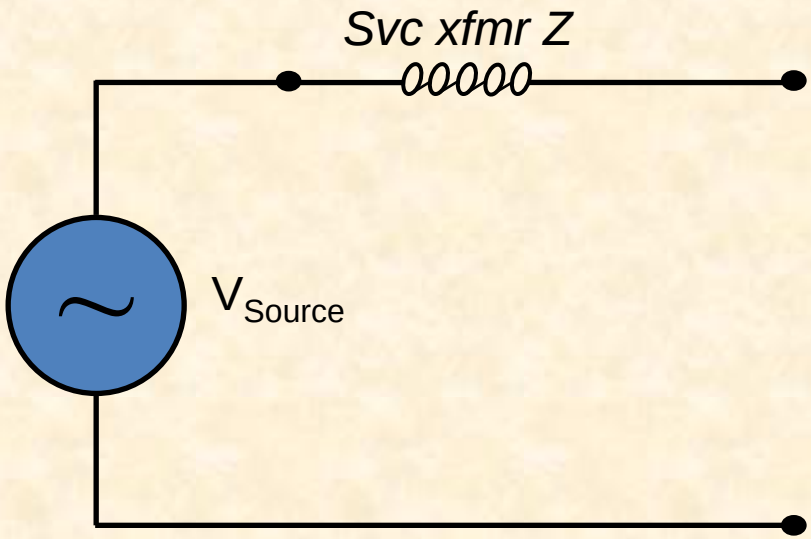
Maximum Source

- Calculations Assume Infinite Source Impedance
- Based Upon Service Transformer's Internal Impedance



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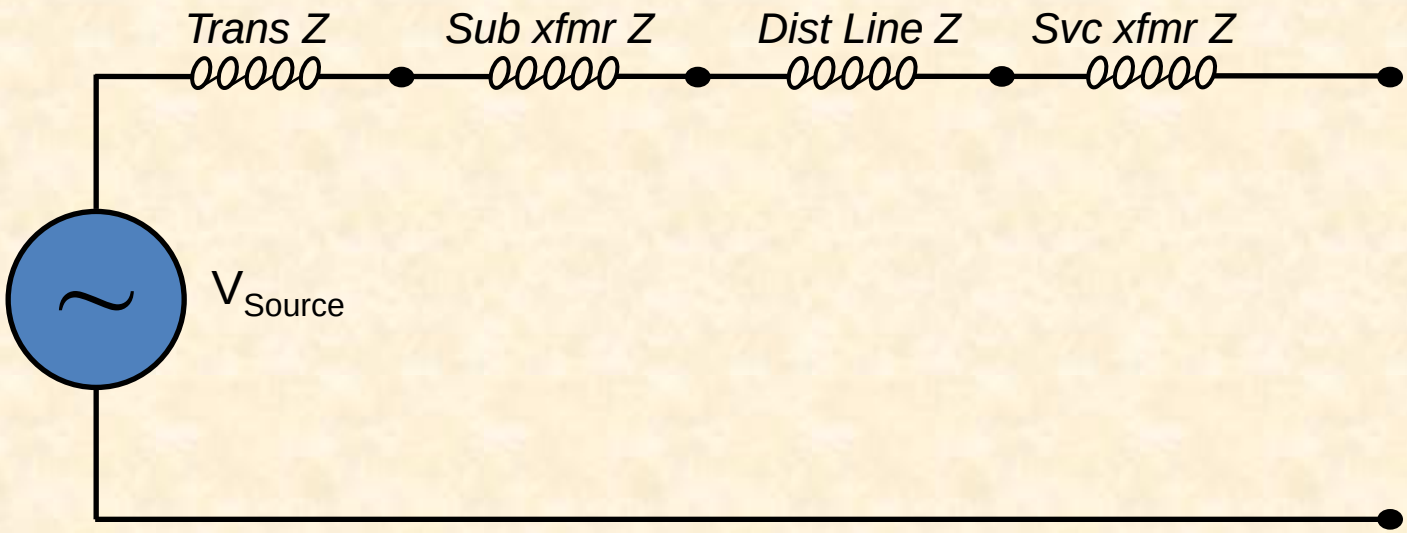
Normal Source

- Calculation Includes Normal Distribution and Transmission System Up Line From Service Transformer



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Alternate Sources

- Alternate Transmission Configurations
- Alternate Substation Transformers
- Alternate Distribution System Configurations
- Alternate Service Transformer Sizes – Upgrades and Emergency Replacements

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Equipment Ratings

- Full-Load Rating
- Short-Circuit Interrupt Rating
- As of 2002:
  - Arc Flash Standards applicable to anyone able to open panels in other-than-dwelling units
- Arc-Flash Exposure is Incident Energy
  - Current, time, and working distance

Cooperative-Provided Information

- Current Magnitude at Given Point (Generally the Point of Interconnection)
  - Maximum fault current
  - Minimum fault current based upon engineering judgment
- Fault Clearing Times for Both Conditions

Methods to Communicate

STAR ENERGY SERVICES TECHNICAL RECOMMENDATION

From: James Pachan (STAR)

Date: August 16, 2011

Re: Available Fault Current at New Pro-Fab Location 18.15.6B

The serial number for the new 500 kVA transformer to be installed at Pro-Fab is: 0650004321

Assuming an infinite bus, the maximum fault current level for the transformer is as follows:

$$FaultAmps = \left(\frac{Tx_{kVA}}{V_{L-L} * \sqrt{3} * Tx_{impedance}} \right) = \left(\frac{500{,}000VA}{480V * \sqrt{3} * .040} \right)$$

Fault Amps = **15,035**

The modeled available fault current considers impedance of the distribution system up to Pro-Fab's point of interconnection with Runestone Electric Association. Many changes and modifications to the distribution system occur frequently without the member's knowledge and any changes may affect the fault current. With the present configuration, the modeled maximum available fault current at this location, 18.15.6B is 11,545 amps.

Risks

- If Arc Flash Injury Occurs, OSHA May Investigate
- Key Items Could Be Labeling and Communication of Hazard
- Determination of Incident Energy May Be Examined
  - Fault current, clearing time, working distance
- Where Did the Numbers Come From?

Recommendations

- Registered Professional Engineer Should Perform Calculations
- Engineer Will Calculate Maximum Fault Current and "Normal" Current
- May Be a Third Current Value if Extended Network Reconfigurations are Common
- "Owner" is Responsible to Label and Communicate Hazards
- If Someone Other Than Cooperative Employee is Allowed to Enter Cooperative-Owned Equipment, Need Label With PPE Level or Incident Energy

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Questions?

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NESC Updates

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Quick Overview of Changes

- Helpful New Table Adds More Detail Regarding Voltages Less Than 1,000V
- Greater Than 1,000V, Follow Arc Flash Hazard Analysis Performed Under Previous Edition

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Clarification of Exposure—50V to 250V

- 4 cal/cm^2 (Category 1)
  - Self-contained meters/cabinets
  - Pad-mounted transformers
  - CT meters and control wiring
  - Pedestals/pull boxes/hand holes
  - Open air
  - All three-phase and single-phase panel boards

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Clarification of Exposure—251V to 600V

- 4 cal/cm^2 (Category 1)
  - Pad-mounted transformers
  - CT meters and control wiring
  - Open air

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Recommendations

- Implement Category 1 Table Guidelines
- De-Energized Work for:
  - Metal-clad switchgear and motor control centers
  - 480V self-contained meter/cabinets
  - 480V pedestals/pull boxes/hand holes
  - 480V panel boards

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Summary Points

- 50V to 250V Use Category 1
- 480V Wear Category 1 for CT Meters and Pad-Mounted Transformers
- De-Energize All Other 480 V Equipment

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