Safety Related Changes from the NFPA 70 National Electrical Code

• First Revisions (proposed changes) to the NEC that are directly related to safety
Presenters

- Vince Saporita, Eaton
  - NEC CMP 10 and 11 and NFPA 70E

- Tim Crnko, Eaton
  - NEC CMP 13 and NFPA 70B
2017 NEC in Process

• First Draft, First Revisions:
  • Result of Code Panels considering Public Inputs

• These revisions are not final and subject to change: Public Comments, Second Draft, and remainder of Code making process.

• Public Comment Submittal Deadlines
  • Paper 8-21-15
  • Online 9-25-15
Article 440 Air-Conditioning and Refrigerating Equipment
I. General

440.9 Grounding and Bonding
Where multimotor and combination load equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed on outdoor portions of metallic raceway systems that use non-threaded fittings.
Article 450 Transformers
Part III. Transformer Vaults
450.43 Doorways
(C) Locks.
Doors shall be equipped with locks, and doors shall be kept locked, access being allowed only to qualified persons. Personnel doors shall swing out open in the direction of egress and be equipped with panic bars, pressure plates, or other devices that are normally latched but open under simple pressure listed panic hardware.
Three 2017 NEC First Revisions Related to Arc Flash Hazard

• 110.16 Arc Flash Hazard Warning

• Article 240 Overcurrent Protection
  – Part VII. Circuit Breakers
    • 240.87 Arc Energy Reduction (first introduced 2011 NEC)
  – Part VI Cartridge Fuses and Fuseholders
    • 240.67 Arc Energy Reduction (FR 2017 NEC)
110.16 Arc-Flash Hazard Warning

(A) General. Electrical equipment, such as switchboards, switchgear, panelboards, industrial control panels, meter socket enclosures, and motor control centers, that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized, shall be field or factory marked to warn qualified persons of potential electric arc flash hazards. The marking shall meet the requirements in 110.21(B) and shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2014 text becomes (A) General
110.16 Arc-Flash Hazard Warning  (continued)

(B) Service Equipment. In addition to the requirements in (A), service equipment shall contain the following information:

1) **Nominal system voltage**
2) **Arc flash boundary**
3) **At least one of the following:**
   a. **Available incident energy and the corresponding working distance**
   b. **Minimum arc rating of clothing**
   c. **Site-specific level of PPE**

Two Informational Notes remain as in 2014 NEC
FR 55 110.16 Arc-Flash Hazard Warning

• When 110.16 entered 2002 NEC: catalyst for change
  – Awareness of arc flash hazard for entire industry
• FR55 for 2017 NEC will be catalyst for change
  – Design for safety
  – Moving forward all service equipment will have information to select the proper arc flash PPE
• Panel member comments: include date of calculation
ARC ENERGY REDUCTION (1200A AND GREATER)

• 240 OVERCURRENT PROTECTION
  – VII. CIRCUIT BREAKERS
    • 240.87 ARC ENERGY REDUCTION (2011 NEC, FR NEC 2017)

– VI. CARTRIDGE FUSES AND FUSEHOLDERS
  • 240.67 ARC ENERGY REDUCTION (FR NEC 2017)
First Revision No. 2706-NFPA 70-2015 [ Section No. 240.87(B) ]

(B) Method to Reduce Clearing Time.
One of the following or approved equivalent means shall be provided:

1. Zone-selective interlocking
2. Differential relaying
3. Energy-reducing maintenance switching with local status indicator
4. Energy-reducing active arc flash mitigation system

5. An approved equivalent means - An instantaneous trip setting that is less than the available arcing current
6. An instantaneous override that is less than the available arcing current
7. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to “no intentional delay” to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2012 2015, Standard for Electrical Safety in the Workplace, and then to set the trip unit back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the circuit breaker or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2012 2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: An instantaneous trip is a function that causes a circuit breaker to trip with no intentional delay when currents exceed the instantaneous trip setting or current level. If arcing currents are above the instantaneous trip level, the circuit breaker will trip in the minimum possible time.

Informational Note No. 4: IEEE 1584-2002, IEEE Guide for Performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.
FR 2706 240.87(B) Arc Energy Reduction (CBs)

• 240.87 main paragraph remains same:
  – pertains to 1200A and greater circuit breakers
• 240.87(A) Documentation remains the same
• 240.87(B) Method to Reduce Clearing Time
  – Two methods added
    • An instantaneous trip setting that is less than the available arcing current
    • An instantaneous override that is less than the available arcing current
• Two new Informational Notes added
  – One explaining instantaneous trip
  – One referencing IEEE 1584 Guide for Performing Arc Flash Hazard Calculations as source to determine arcing fault current
This portion no change from 2014 NEC

240.87 Arc Energy Reduction. Where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200 A or higher, 240.(A) or (B) shall apply.

(A) Documentation. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).
(B) Method to Reduce Cleaning Time.
One of the following or approved equivalent means shall be provided:
(1) Zone-selective interlocking
(2) Differential relaying
(3) Energy-reducing maintenance switching with local status indicator
(4) Energy-reducing active arc flash mitigation system
(5) An approved equivalent means An instantaneous trip setting that is less than the available arcing current
(6) An instantaneous override that is less than the available arcing
(7) An approved equivalent means
Instantaneous trip setting that is **less** than the available arcing current

**10,000A Arcing Fault Current**

- **1200A CB**
- **0.85 cal/cm² @ 18” WD**
- **0.025 Sec**

Instantaneous trip setting that is **greater** than the available arcing current

**6,000A Arcing Fault Current**

- **1200A CB**
- **2783 cal/cm² @ 18” WD**
- Requires other Technology
Arc Reduction Maintenance Switching with Local Status Indicator

Technology option to comply since 2011 NEC 240.87

- Manually or automatically enables instantaneous pickup
- Limits arc flash energy available during maintenance
- ARMS technology implemented differently for various CBs (it matters)
Figure 9-23. Example 7: Arc Flash Maintenance Reduction System

46.5 cal/cm² without ARMS

3.7 cal/cm² with ARMS “on”

Courtesy of Electrical Training ALLIANCE, Electrically Safety Work Practices based on 2015 NFPA 70E
1200A Instantaneous Trip Circuit Breaker Equipped with ARMS

Without ARMS “on”
2783 cal/cm² @ 18” WD

With ARMS “on”
0.7 cal/cm² @ 18” WD

ARMS:
• Option new CBs
• Retrofit most existing CBs
**240.67** Arc Energy Reduction.
Where the ampere rating of the fusible switch is 1200 A or higher, **240.67(A)** and (B) shall apply. This requirement shall become effective January 1, 2020.

(A) Documentation.
Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the fusible switch(es).

(B) Method to Reduce Clearing Time.
One of the following shall be provided:

1. Differential relaying
2. Energy-reducing maintenance switching with local status indicator
3. Energy-reducing active arc flash mitigation system
4. A fuse that would open the circuit in 0.07 seconds or less, at or below the available arcing current
5. An approved equivalent means

Informational Note No. 1: An energy-reducing maintenance switch allows a worker to set a disconnect switch to reduce the clearing time while the worker is working within an arc-flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace, and then set the disconnect switch back to a normal setting after the potentially hazardous work is complete.

Informational Note No. 2: An energy-reducing active arc flash mitigation system helps in reducing arcing duration in the electrical distribution system. No change in the disconnect switch or the settings of other devices is required during maintenance when a worker is working within an arc flash boundary as defined in NFPA 70E-2015, Standard for Electrical Safety in the Workplace.

Informational Note No. 3: IEEE 1584, IEEE Guide for performing Arc Flash Hazard Calculations, is one of the available methods that provide guidance in determining arcing current.
FR 2707 240.67 Arc Energy Reduction (Fusible Switches)

• Entirely new section similar to 240.87 for CBs (Eff.1/1/2020)
• Pertains to 1200A and greater fusible switches
• 240.67(A) Documentation available
• 240.67(B) Method to Reduce Clearing Time
  – Differential relaying
  – Energy-reducing maintenance switching with local status indicator
  – Energy-reducing active arc flash migration system
  – A fuse that would open the circuit in 0.07 sec. or less, at or below the available arcing current
  – An approved equivalent means
• Three Informational Notes
1200A or Greater Fusible Switch where Fuse Opens the Circuit in 0.07 sec. or less, at or below the Available Arcing Current

ARMS will not be required
1200A Fusible Switch with ARMS
Available Arcing Fault Current Causes Fuse to Open > 0.07 Sec.

CURRENT IN AMPERES

1200A Switch with ARMS
1200A Fuse

Without ARMS
95 cal/cm² @ 18” WD
5 Sec fuse clears

With ARMS “on”
0.9 cal/cm² @ 18” WD
0.05 Sec ARMS clears

ARMS will be required (effective 1/1/2020)
1200A Fusible Switch with ARMS
Higher Available Arcing Fault Currents, Fuses are Faster

CURRENT IN AMPERES

TIME IN SECONDS

1200A Switch with ARMS
1200A Fuse

With ARMS “on”
4.4 cal/cm² @ 18” WD

Fuse faster than ARMS
0.9 cal/cm² @ 18” WD

0.05 sec. ARMS clears

Less than 0.01 sec. fuse clears

25,000A Arcing Fault Current
700 Emergency Systems
I. General
700.5 Transfer Equipment

(E) Documentation
The short-circuit current rating of transfer equipment, based on the specific overcurrent protective device type and settings protecting the transfer equipment, shall be field marked on the exterior of the transfer equipment.
ATS WCR Overview

Withstand and Closing (Close on) Rating

- Referred to as **WCR**
- Analogous to SCCR of an ATS
- Characterizes the magnitude of fault current a particular ATS can endure over a given period of time
- All ATSs require overcurrent protection, but protection levels can vary greatly by choice of protective device
# 400A ATS WCR Label Options Inside Enclosure

This transfer switch is intended for use with an upstream circuit breaker having a short-time rating not exceeding 30,000A at 480V, for 24 cycles (0.40 seconds).

<table>
<thead>
<tr>
<th>CB Option</th>
<th>RMS Sym Amps (kA)</th>
<th>Volts Max.</th>
<th>Circuit Breaker Manufacturer / Type</th>
<th>Amps Rating Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>30</td>
<td>480</td>
<td>24 cycles (0.40 seconds)</td>
<td>Per NEC®</td>
</tr>
</tbody>
</table>

When protected by type designated circuit breaker shown rated not more than amperes shown, this transfer switch is rated for use on a circuit capable of delivering not more than rms symmetrical amperes at volts maximum shown.

<table>
<thead>
<tr>
<th>RMS Sym Amps (kA)</th>
<th>Volts Max.</th>
<th>Circuit Breaker Manufacturer / Type</th>
<th>Amps Rating Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>480</td>
<td>Cutler-Hammer/HKD, CHKD, KDC HLD, CHLD, LDC, CLDC</td>
<td>400 600</td>
</tr>
<tr>
<td>50</td>
<td>480</td>
<td>General Electric/TBC4 SGL1, SGL4, SGP4</td>
<td>400 800</td>
</tr>
<tr>
<td>50</td>
<td>480</td>
<td>Siemens/ HJD, HJXD, SHLD MD, MXD</td>
<td>400 800</td>
</tr>
</tbody>
</table>

When protected by circuit breaker without a short-time delay, this transfer switch is rated for use on a circuit capable of delivering not more than _rms symmetrical amps at the _volts maximum shown. (This is for circuit breakers with an instantaneous trip.)

<table>
<thead>
<tr>
<th>CB Option</th>
<th>RMS Sym Amps (kA)</th>
<th>Volts Max.</th>
<th>Circuit Breaker Manufacturer / Type</th>
<th>Amps Rating Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>200</td>
<td>600</td>
<td>Class J</td>
<td>600</td>
</tr>
<tr>
<td>200</td>
<td>200</td>
<td>600</td>
<td>Class L</td>
<td>800</td>
</tr>
</tbody>
</table>

When protected by specified _amp maximum Class fuse shown, this transfer switch is rated for use on a circuit capable of delivering not more than _rms symmetrical amps and at _volts maximum shown.

<table>
<thead>
<tr>
<th>RMS Sym Amps (kA)</th>
<th>Volts Max.</th>
<th>Fuse Class</th>
<th>Amps Rating Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>600</td>
<td>Class J</td>
<td>600</td>
</tr>
<tr>
<td>200</td>
<td>600</td>
<td>Class L</td>
<td>800</td>
</tr>
</tbody>
</table>
ATS WCR

Withstand and Closing (Close on) Rating

- Manufacturer marks all WCRs on inside of equipment
- Mark the specific WCR selected and installed on exterior
- AHJ can verify the installation is correct
- Helps ensure future replacement of the overcurrent protective devices are correct
409 Industrial Control Panels

III. Construction Specifications

409.110 Marking

An Industrial control panel shall be marked with the following information that is plainly visible after installation.

...(3) Industrial control panels supplied by more than one power electrical source such that more than one disconnecting means is required to disconnect all power circuits within the control panel shall be marked to indicate that more than one disconnection means is required to de-energize the equipment. The location of the means necessary to disconnect all circuits 50-volts and over shall be documented and available.
110 Requirements for Electrical Installations
1. General, 110.24 Available Fault Current

110.24(A) Field Marking
Service equipment in at other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Informational Note: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment. NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.
110.24 Field Marking and Documenting Maximum Available Fault Current is Easy

Email label & documentation

Simple and Easy
### INFINITE PRIMARY SOURCE

**TRANSFORMER - T1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KVA</td>
<td>750</td>
</tr>
<tr>
<td>Voltage_{secondary}</td>
<td>480</td>
</tr>
<tr>
<td>%Z</td>
<td>5.00</td>
</tr>
<tr>
<td>%Z TOL</td>
<td>-10%  (Max Fault)</td>
</tr>
</tbody>
</table>

### FAULT - X1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{s.c. (L-L-L)}</td>
<td>20,047 AMPS</td>
</tr>
<tr>
<td>I_{s.c. motor cont.}</td>
<td>1,804 AMPS</td>
</tr>
<tr>
<td>I_{total s.c. (L-L-L)}</td>
<td>21,851 AMPS</td>
</tr>
<tr>
<td>Voltage (L-L)</td>
<td>480 V</td>
</tr>
</tbody>
</table>

### MOTOR CONTRIBUTION - M1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR_{VOLTAGE}</td>
<td>480 V</td>
</tr>
<tr>
<td>MOTOR_{FLA}</td>
<td>451 AMPS</td>
</tr>
<tr>
<td>MOTOR CONTRIBUTION</td>
<td>1,804 AMPS</td>
</tr>
</tbody>
</table>

### CONDUCTOR RUN - C1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td>25 FT</td>
</tr>
<tr>
<td>SIZE</td>
<td>300</td>
</tr>
<tr>
<td>QTY</td>
<td>3</td>
</tr>
<tr>
<td>TYPE</td>
<td>Three Single Conductors</td>
</tr>
<tr>
<td>CONDUIT</td>
<td>Steel</td>
</tr>
<tr>
<td>WIRE</td>
<td>Cu, 600 V</td>
</tr>
</tbody>
</table>

### FAULT - X2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{s.c. (L-L-L)}</td>
<td>19,403 AMPS</td>
</tr>
<tr>
<td>I_{s.c. motor cont.}</td>
<td>1,804 AMPS</td>
</tr>
<tr>
<td>I_{total s.c. (L-L-L)}</td>
<td>21,207 AMPS</td>
</tr>
<tr>
<td>Voltage (L-L)</td>
<td>480 V</td>
</tr>
</tbody>
</table>

110.24 Documentation

Eaton FC² Fault Current Calculator

Emails the documentation
110.24 Field Marking and Documenting Maximum Available Fault Current is Easy

- App for Apple and Android

- Run FC² web based version
  
  [www.cooperbussmann.com.fc2](http://www.cooperbussmann.com.fc2)
408 Switchboards, Switchgear, and Panelboards
I. General
408.3 Support and Arrangement on a Switchboard, Switchgear, or Panelboard

... (2) Service Panelboards, Switchboards and Switchgear. Barriers shall be placed in all service panelboards, switchboards and switchgear such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

Exception: This provision does not apply to service panelboards with provisions for more than one service disconnect within a single enclosure as permitted in 408.36, Exceptions 1, 2, and 3.
UL 67 Panelboards

1. Revisions to Accessibility of Live Parts on Line Side of Service Disconnect for Paragraphs 5.4.2 and 5.4.5 - Publish

RATIONALE

Proposal submitted by: Robert Osborne, UL LLC

Revisions to UL 67 adopted in 2014 included “New Requirements for Accessibility of Live Parts on Line Side of Service Disconnect”. The new text associated with this revision specifies that the requirement applies to “Panelboards including a single service disconnect”. The intent is that this requirement apply to “Panelboards with provisions for only a single service disconnect”, as actual inclusion of the disconnect within in the panelboard is dependent on the installation. An example of the need for this change is with a panelboard rated “Suitable for Use as Service Equipment” and capable of accommodating 6 service disconnects, but shipped from the factory with only one service disconnect. The requirement, as written, would require that panelboard to include the barriers; however, installing additional service disconnects would satisfy the requirement without barriers. The new wording aligns with the requirements under the adoption process for the 2017 NEC. The “load terminal” that is subject to possible servicing is also being clarified as a “field connected load terminal”. Lastly, an additional cross reference is being included to identify the associated marking requirement in 32.9.11.
Example of Panelboard Isolating Line Terminations
670 Industrial Machinery

670.6 Surge Protection

Industrial machinery with safety interlock circuits shall have surge protection installed.

Committee Statement, in part

The study, “Data Assessment for Electrical Surge Protective Devices” commissioned by the Fire Protection Research Foundation, ..., provides results of a 2013 and 2014 survey of facility managers concerning surge damage. It shows that 26% had damage to safety interlocking systems on machines due to surges. These safety interlocking systems are in place to protect workers from interactions with the machinery.
645 Information Technology Equipment

645.18 Surge Protection for Critical Operations Data Systems.
Surge protection shall be provided for critical operations data systems.

Committee Statement
This change correlates with 708.20(D) for Critical Operations Power Systems. Critical Operations Data Systems serve critical operations that deal with public safety, emergency management, national security, and business continuity. It is critical that protection is provided to ensure reliable power.

VI. Disconnecting Means and Control

620.51 Disconnecting Means

(E) Surge Protection.
Where any of the disconnecting means in 620.51 has been designed as supplying an emergency system load, surge protection shall be provided.

Committee Statement
The addition of surge protection for equipment designated as emergency equipment will add to reliability and safety.
695 Fire Pumps

695.15 Surge Protection
A listed surge protection device shall be installed in or on the fire pump controller.

Committee Statement
The surge protection device is necessary to provide protection for the fire pump controller. ...
409 Industrial Control Panels

II. Installation

409.23 Available Fault Current

When an industrial control panel is required to be marked with a short-circuit current rating in accordance with 409.110(4), the available short circuit current at the industrial control panel and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.
700 Emergency Systems

I. General

700.3 Tests and Maintenance

... (C) Battery Systems Maintenance

Where battery systems or unit equipment are involved, including batteries used for starting, control, or ignition in auxiliary engines, the authority having jurisdiction shall require periodic maintenance. Emergency system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

Committee Statement Excerpts

...The previous requirement for maintenance, which was limited to batteries, is expanded to include all emergency equipment. ... The required maintenance is outlined by the equipment manufacturers and applicable industry standards.
700 Emergency Systems, 700.3 Tests and Maintenance
(C) Battery Systems Maintenance
Where battery systems or unit equipment are involved, including batteries used for starting, control, or ignition in auxiliary engines, the authority having jurisdiction shall require periodic maintenance. Emergency system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

Rationale:
• Article 700 Emergency Systems: reliable power for life safety loads
• “700.1 Scope. The provisions of this article apply to the electrical safety of the installation, operation, and maintenance of emergency systems ...”
701 Legally Required Standby Systems

I. General

701.3 Tests and Maintenance

... (C) Battery Systems Maintenance

Where battery are used for control, starting, or ignition of prime movers, the authority having jurisdiction shall require periodic maintenance. Legally required system equipment shall be maintained in accordance with manufacturer instructions and industry standards.

• Same rationale as FR 3608 700.3(C)
445 Generators

445.11 Marking. Each generator shall be provided with a nameplate giving the manufacturer’s name, the rated frequency, the number of phases if of ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, the rated revolutions per minute, and the rated ambient temperature or rated temperature rise. Nameplates for all stationary generators and portable generators rated more than 15kW shall also give the power factor, the subtransient and transient impedances reactance's, the maximum short-circuit current, and the insulation system class, and the time rating. Stationary and portable generators shall be marked to indicate if the generator is protected against overload by inherent design, an overcurrent protective relay, circuit breaker, or fuse. Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to the generator frame. Where bonding of a generator is modified in the field, additional marking shall be required to indicate whether the generator neutral is bonded to the generator frame.
Committee Statement
...The generator is now required to be marked with the maximum short-circuit current to assist the inspector and installer when verifying proper overcurrent protection in the field. Newer generators are being manufactured with inverter based designs. Determining the fault current ratings for these generators is difficult and is best marked on the generator by the manufacturer. Marking would also be now required to indicate whether the generator is inherently designed to prevent overload or whether an overcurrent protective relay is provided. This information will assist the AHJ in determining compliance with 445.13.
480 Storage Batteries, 480.6 DC Disconnect Methods

(D) Notification.
The disconnecting means shall be legibly marked in the field. A label with the marking shall be placed in a conspicuous location near the battery if a disconnecting means is not provided. The marking shall be of sufficient durability to withstand the environment involved and shall include the following:
1) Nominal battery voltage
2) Maximum available short-circuit fault current derived from the stationary battery system
3) Date the fault current calculation was performed
4) The battery disconnecting means shall be marked in accordance with 110.16.

Informational Note No. 1: Battery equipment suppliers can provide information about short-circuit current on any particular battery model.

Informational Note No. 2: The available fault-current marking(s) addressed in 480.(D)(2) is related to required short circuit current ratings of equipment. NFPA 70E-2015, Standard for Electrical Safety in The Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.
480 Storage Batteries, 480.6 DC Disconnect Methods, (D) Notification.
Committee Comment: The maximum available fault current is a necessary value in determining the appropriate rating of the battery system disconnect. Using only the battery short circuit current rating may not provide an accurate system available fault current value. The new Informational Note No. 2 provides the user of the Code with necessary information related to arc flash risk assessments in NFPA 70E. The committee requests that the NEC Correlating Committee appoint a task group to correlate the use of the phrases “available short circuit current” and available fault current”.

Committee Member Comments bring forward interesting considerations
• Battery manufacturers provide available short-circuit current
• Phrase should be “available short-circuit current” rather than “fault current”
• Available short-circuit current needed for determining arc rated PPE (NFPA 70E), overcurrent protective device interrupting ratings, and equipment short-circuit current ratings (SCCR)
430 Motors, Motor Circuits, and Controllers
X. Adjustable-Speed Drive Systems

(A) Circuits Containing Power Conversion Equipment.
Circuits containing power conversion equipment shall be protected by a branch-circuit short-circuit and ground-fault protective device in accordance with the following:

1) ...  
4) Where an instantaneous trip circuit breaker or semiconductor fuses are permitted in accordance with the drive manufacturer’s instructions for use as the branch-circuit and ground-fault protective device for listed power conversion equipment, they shall be provided as an integral part of a single listed assembly incorporating both the protective device and power conversion equipment.

Committee Statement mentioned: will assure the proper devices are installed
Discussion Note: 430.52(C)(5) requires marking of replacement fuses adjacent to fuses
110 Requirements for Electrical Installations

III. Over 600 Volts, Nominal

110.41 Inspections and Tests

(A) Pre-energization and Operating Tests.
Where required elsewhere in this Code, the complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be tested when first installed on-site.

(A) Test Report.
A test report covering the results of the tests required in 110.41(A) shall be available to the authority having jurisdiction prior to energization and made available to those authorized to install, operate, test, and maintain the system.
III. Over 600 Volts, Nominal

110.41 Inspections and Tests

Committee Statement
A new section 110.41 generally requires pre-energization testing. The testing could include performance and safety testing. The new requirement is incorporated in Part III of Article 110 and correlates with the inspection and testing requirements contained in other NEC rules such as those in Article 225 and others. Acceptance testing is just as important for indoor and outdoor locations.

Reference 225.56 Inspections and Tests which covers Over 1000V Outside Feeders and Branch Circuits – has complete pre-energization requirements. Needed for indoor over 1000V?
Contact Information

• Vince Saporita, Eaton Bussmann Division
  – 636-527-1608 office
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