USER INPUT STATEMENT NEMA SG10

NEMA Standards Bulletin Section Page 1166 Date August 22, 2019

Submitted to the NEMA Codes and Standards Committee on behalf of Switchgear (08SG) (Subdivision).

Part 1 If user input has been identified in the formulation of this standard(s), explain how it was accomplished by one or more of the following:

a. Through formal participation of the following user groups:

b. Through survey(s), questionnaire(s), or correspondence undertaken by the NEMA Subdivision. (Summarize briefly.)

c. Through other channels identified as follows: The 8SG members work closely with their customers who provide user input. They also get input through the IEEE Switchgear.

Part 2 If it is proposed to process this standard(s) through further Committees having user participation (e.g., ANSI, ICEA, etc.), explain how: No

Part 3 If no user input was required for this particular standard(s) explain why

Part 4 Does the Subdivision intend to harmonize this standard(s) with comparable international standard(s)? Yes ______ No X____

If “yes”:  
a. List the comparable international standard(s):

b. Check one of the following comparing this standard to the listed international standard(s):

1. Technically equivalent.
2. NEMA has more severe requirements.
3. NEMA has less severe requirements.

If "2" or "3" are checked, list plan and schedule for harmonization:

---------------------------------- Carl Schneider ----------------------------------
SIGNATURE (Chairman of Subdivision or Technical Committee)  DATE June 4, 2020
TO: Voting Representatives and Alternates  
Of the Switchgear Section (8SG)  

Subject: Ballot to Approve Revision of SG 10-2019 “Guide to OSHA and NFPA 70E Safety Requirements When Servicing and Maintaining Medium-Voltage Switchgear, Circuit Breakers, and Medium-Voltage Controllers Rated above 1000 V”

Dear Member:

This ballot is to approve the revision SG 10-2019 “Guide to OSHA and NFPA 70E Safety Requirements When Servicing and Maintaining Medium-Voltage Switchgear, Circuit Breakers, and Medium-Voltage Controllers Rated above 1000 V”

Please consider this issue carefully and mark your response on the ballot. You may vote AFFIRMATIVE, NEGATIVE, or ABSTAIN. If you want a copy of the ballot for your files, click on “print” before clicking on “submit.” If you would like to submit comments, type them directly (or cut and paste from another document) into the comments template by clicking on the link provided in the ballot. Save the template as a Word document and email the completed form to Paul Crampton at Paul.Crampton@nema.org.

If you choose not to use the electronic voting system, you may email or fax your vote to Mr. Crampton, Administrative Assistant, at the address shown below. There is no ballot to return. Simply provide the following information:

- Voting Representative Name
- Member Company
- Title of Ballot
- Response – approve, disapprove, not voting
- Any comments you wish to be considered

Mr. Crampton is responsible for conducting all NEMA Standards Bulletin ballots. If you have any questions about the voting process, contact him. If you have any questions about the content of the standards, contact me.

Sincerely,

Gerard Winstanley- Program Manager
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Foreword

This guide was written to emphasize basic principles and guidance for safety when performing inspection, operation, and maintenance of medium-voltage switchgear, circuit breakers, and medium-voltage controllers rated above 1000 V. It also draws the reader’s attention to important OSHA and NFPA safety standards. Proposed or recommended revisions should be submitted to:

Vice President, Technical Services
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, VA 22209

This guide was developed by the Switchgear Section of the Power Equipment Division. Section approval of the guide does not necessarily imply that all section members voted for its approval or participated in its development. At the time this guide was approved, the Section was composed of the following members:

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Section 1
GENERAL

1.1 SCOPE
The main objective of this guide is to enhance electrical safety awareness and mitigate electrical hazards to members of the workforce assigned to servicing and maintaining switchgear, owners, and users of the equipment, and the public. The goal of this guide is to ensure the adoption of OSHA and NFPA 70E safety-related practices for electrical work and requirements of electrical safety.

Provisions contained herein are applicable to all members of the workforce who are engaged in testing, servicing, maintaining, and decommissioning switchgear, circuit breakers, and controllers rated above 1000 V.

This guide emphasizes OSHA and NFPA 70E safety requirements when servicing and maintaining:

This guide emphasizes OSHA and NFPA 70E safety requirements when servicing and maintaining equipment covered in, but not limited to, the following standards:

- a) Medium-voltage metal-clad switchgear assemblies (rated 1000 through 38,000 V) in accordance with ANSI/IEEE C37.20.2, Standard for Metal-Clad Switchgear
- b) Medium-voltage metal-enclosed switchgear assemblies (rated 1000 through 38,000 V) in accordance with ANSI/IEEE C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear
- c) Circuit breakers rated above 1000 V in accordance with ANSI/IEEE C37.04, Standard Rating Structure for AC High-Voltage Circuit Breakers
- d) Medium-voltage controllers in accordance with UL 347, Medium-Voltage AC Contactors, Controllers, and Control Centers
- e) Medium-voltage pad-mounted switchgear (rated 1,000 through 38,000 V) in accordance with IEEE C37.74, Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV.

For convenience, this equipment will be called switchgear assemblies. Switchgear assemblies and controller assemblies may contain, but are not limited to, devices such as power circuit breakers, contactors, interrupter switches, selector switches, power fuses, controls, instrumentation, metering, and other protective equipment. These assemblies may be part of unit substations.

1.2 PURPOSE
The provisions of the National Electric Code® (NEC), Standard for Electrical Safety in the Workplace, NFPA 70E, National Electric Safety Code (NESC), and OSHA standards contained in this guide should be complied with at all user-controlled premises. These guidelines have specific requirements that apply to installations, servicing, and maintaining switchgear regardless of when they were designed or installed and are considered essential for ensuring workplace safety.

1.3 GENERAL CONSIDERATIONS
Working on or around electrical equipment is potentially dangerous, and accidents in the course of maintaining and servicing electrical equipment can lead to death or other serious injury. These accidents do not have to happen. Almost all accidents can be avoided if OSHA and NFPA standards, as well as the operation and maintenance instructions for the equipment are carefully followed. Read and understand them fully before work is started! A few examples by which maintenance and service personnel might avoid serious injury or death when working around electrical equipment:
a) If you are tired or stressed, take a break from the work and avoid the risk of a serious accident that might be caused by worker fatigue or stress.

b) Do not assume that a conductor is de-energized. A false assumption can lead to serious injury or death. Confirm that a conductor is de-energized and grounded before working on electrical equipment.

c) Do not assume that electrical equipment is de-energized. Again, a false assumption can lead to serious injury or death. Review the entire operation sequence for disconnecting and grounding with a second knowledgeable person before doing the work, and make sure the entire sequence for disconnecting and grounding is followed. Failure to follow the entire operation sequence could lead to serious injury or death.

d) Do not rely on interlocks and other indicators to prevent an accident. Relying on interlocks and indicators is not a substitute for following the entire operation sequence for disconnecting and grounding electrical equipment in order to de-energize and avoid risk of death or serious injury. Interlocks are only a backup.

e) Follow the standards and recommended practices developed by OSHA and NFPA 70E.

The purpose of this guide is to alert operating and maintenance personnel who service and maintain switchgear assemblies to federally required safety procedures in OSHA 29 CFR Parts 1910 and 1926, and NFPA 70E. This guide is based on the versions of OSHA and NFPA 70E standards in effect at the time this guide was prepared (2013).

This guide DOES NOT include all of the requirements in the OSHA and NFPA 70E standards. Users of this guide are responsible for understanding all of the applicable requirements in these standards and in any other codes and standards in effect for their installations. This guide also does not address the tasks required during maintenance (e.g., removal of arc chutes, cleaning of insulation, lubrication, which are discussed in the instruction manuals for the specific equipment).

1.4 SAFETY

Always assume that hazardous voltage is present in switchgear assemblies unless proven to be in an electrically safe work condition as defined in NFPA 70E. This voltage can cause serious injury, such as shock or burn, or even death. Only qualified persons should be allowed to operate, inspect, or maintain switchgear assemblies.

Additional hazards that might be present include arc flash, acoustic shock, and toxic byproducts caused by an internal arcing fault and other sources of energy, such as mechanical energy.

OSHA and NFPA standards contain requirements for a continuing safety program, training personnel, and performing work safely. The manufacturer neither condones nor assumes any responsibility for practices that deviate from those requirements.

Appropriate warning signs should be displayed on the switchgear. These signs should follow ANSI and OSHA requirements for warning signs and typically provide the following information:

a) Alert personnel to the level of the hazard.

b) State the hazard clearly.

c) Describe the consequences.

d) Give instructions on how to avoid the hazard.

Inspection or maintenance on switchgear assemblies should be performed in accordance with safety procedures listed in OSHA 29 CFR 1910.333, NFPA 70E Chapter 2, NFPA 70B Chapter 6, and the manufacturer’s service instructions. The basic requirements include, but are not limited to, the following:

a) All sources of power to the equipment have been turned off, including possible back feed sources. See the note under Section 4.2.
b) All power sources have been locked out and tagged out.
c) Adequate visible grounding connections have been applied.

1.5 REFERENCES

The following normative documents contain provisions, which through reference in this text, constitute provisions of this Standards Publication. By reference herein, these publications are adopted, in whole or in part as indicated, in this Standards Publication. Use the latest version, including amendments.

American National Standards Institute (ANSI)
11 West 42nd Street
New York, NY 10036

ANSI C2-2012 National Electrical Safety Code

National Fire Protection Association (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471

ANSI/NFPA 70-2011 National Electrical Code®
ANSI/NFPA 70B-2013 Recommended Practice for Electrical Equipment Maintenance
ANSI/NFPA-70E-2012 Standard for Electrical Safety in the Workplace

IEEE
3 Park Avenue
New York, NY 10016-5997

ANSI/IEEE C37.20.2-1999 IEEE Standard for Metal-Clad Switchgear
ANSI/IEEE C37.20.3-2001 IEEE Standard for Metal-Enclosed Interrupter Switchgear
ANSI/IEEE C37.20.6-2007 IEEE Standard for Medium-Voltage Ground and Test Devices Used in Enclosures
ANSI/IEEE C37.74 IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems Up to 38 kV

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA 19428-2959

ASTM F855-2009 Specifications for Temporary Protective Grounds to be Used on De-energized Electric Power Lines and Equipment

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Occupational Safety and Health Administration (OSHA)
200 Constitution Avenue, NW
Washington, DC 20210

OSHA 29 CFR Part 1910 Occupational Safety and Health Standards
OSHA 29 CFR Part 1926 Safety and Health Regulations for Construction

Underwriters Laboratories
Comm-2000
1414 Brook Drive
Downers Grove, IL 60515

UL 347 Medium Voltage AC Contactors, Controllers, and Control Centers

U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

10 CFR 851 Worker Safety and Health Program
DOE O 440.1A Worker Protection Program for DOE (including the National Nuclear Security Administration), Federal Employees Guide for Use with
DOE O 440.1B Real Property Asset Management

In addition to the above documents, safety procedures and programs established by the owner of the facility, prime contractors, and equipment supplier’s recommendations should be coordinated in developing a safety program to which to adhere.
Section 2
DEFINITIONS

2.1 QUALIFIED PERSONS

OSHA 29 CFR 1910.399 defines a qualified person as "one who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and the hazards involved." NFPA 70E Article 100 defines a qualified person as "one who has demonstrated skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize, identify, and avoid the hazards involved and reduce the associated risks."

NFPA 70E Article 110 also states, "a qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. Such persons shall also be familiar with the proper use of special precautionary techniques; PPE - personal protective equipment; including arc-flash suit, insulating and shielding materials; and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but still be unqualified for others."

*Note: PPE - personal protective equipment; including arc-flash suit, insulating gloves, etc.

2.2 APPROACH BOUNDARIES

Refer to NFPA 70E Article 130.4 for specific requirements regarding distances from exposed energized electrical conductors and circuit parts that define approach boundaries.
Section 3
TRAINING

In accordance with 29 CFR 1910.332 and NFPA 70E Chapter 1, all personnel associated with maintenance or service of switchgear assemblies should be qualified. They should be trained in:

a) Safety-related work practices and procedural requirements necessary to provide protection from electrical hazards
b) The ability to identify and understand the relationship between electrical hazards and possible injury.
c) The skill and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment.
d) The skills and techniques necessary to determine the nominal voltage of exposed energized parts.
f) Decision-making process necessary to determine the extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

Qualified persons should also be trained in and familiar with:

a) Lockout/tagout procedures specified in 29 CFR 1910.147 and NFPA 70E Article 120.2.
b) Proper use of and maintenance of personal protective equipment as specified in NFPA 70E Article 130.7.
c) Proper use of test equipment.
d) Proper procedures to apply temporary protective grounds.
e) Electrical equipment in general, as well as the particular model of equipment involved.
4.1 JOB PLAN CREATION

Before servicing, maintaining, or performing diagnostic routines on switchgear assemblies, a job plan in accordance with NFPA 70E Chapter 1 is required. See Appendix A for an example. Established standards and regulations related to maintenance, operation, installation, and safety, including OSHA requirements, National Electric Safety Code (ANSI C2), National Electric Code® (NFPA 70), Recommended Practices for Electrical Equipment Maintenance (NFPA 70B), and Standard for Electrical Safety in the Workplace (NFPA 70E) should be available, closely studied, and followed.

4.2 JOB BRIEFING

The person in charge of servicing, maintaining, or diagnostic routines on switchgear assemblies should be qualified and responsible in accordance with NFPA 70E. That person should conduct a job briefing with all employees involved at the beginning of each day and each shift, and audit practices to assure conformance. The job briefing should include, but is not limited to:

- Tasks and objectives
- Electrical system parameters
- Voltages (line-to-line)
- Short-circuit current available at equipment
- Power sources and protective device(s) fault clearing time
- System single-line or three-line electrical diagrams
- Approach boundaries per NFPA 70E Chapter 1
- All sources of power, including back feed sources (see note below)
- Hazards
- Work procedures
- Energy source controls
- Personal protective equipment
- Testing and service equipment
- Safety grounding equipment
- Lockout and tagout procedures and materials
- Switchgear assembly information, including modifications after installation
- Manufacturer’s instruction books, recommended practices, and checklists
- Manufacturer’s outline, schematic and detail wiring drawings, including modifications after installation
- Nameplate data and information
- Review local safety procedures with responsible persons
- Review and understand consequences of actions (and failure to act) on other operations at facility

NOTE—“Back feed” refers to any possible source of energization of conductors from other than the normal source. This can include sources such as test equipment, generators, alternate sources, emergency sources, temporary connections, and many other sources of voltage (intentional or unintentional). Special precautions should be taken to isolate control and instrument transformers from their primary circuits prior to injection of any secondary test voltage.
Section 5
EMERGENCY PLAN

Emergency plans include the following items as a minimum:

a) Communications.
c) CPR per 29 CFR 1910.269(b)(1).
d) Medical services availability and evacuation plan per 29 CFR 1910-38(c)(2) and 29 CFR 1926 Subpart C.
Section 6
AREA SECURITY

Barricades (tapes, cones, fences, or metal structures) should be erected in the work area to provide warning and to limit access to a hazardous area. Refer to 29 CFR 1910.335 and NFPA 70E Chapter 1.
Section 7
REMOVING EQUIPMENT FROM SERVICE

The individual's correct sequence of actions while performing service or maintenance is essential to prevent accidents. Each person's knowledge, mental awareness, and planned and executed actions often determine whether an accident will occur.

Incorrect procedures, unplanned energization from potential sources of back feed, and/or equipment malfunctions, among other reasons, are causes of accidents around electrical equipment. Only a qualified person should be allowed to de-energize equipment and remove it from service. The following summarizes typical safety practices, including those required by OSHA and NFPA:

a) Assume all conductors are energized unless properly grounded.
b) Wear proper personal protective equipment.
c) Disconnect all primary sources of electrical power.
d) Disconnect all control power sources.
e) Isolate voltage transformers and control power transformers at the primary and secondary connections.
f) Lockout/tagout all sources of energy, including control power.
g) Test for absence of voltage using a testing device intended for the voltage. See Section 7.1.
h) Interlocks, position indicators, and visual inspection alone do not guarantee personal safety.
i) Apply temporary protective grounds in accordance with Section 7.2.
j) Have another qualified person conduct a safety check to ensure circuits are de-energized, tagged out/locked out, and properly grounded.

7.1 VOLTAGE DETECTION

Voltage detection should be performed only by a qualified person who is properly trained in accordance with 29 CFR 1910.333(b) (2) (iv) (B ) and NFPA 70E Chapter 1. The procedure below summarizes typical safety practices used when de-energizing circuits or equipment, including those required by OSHA and NFPA.

1) Test voltage detector operation against known voltage source (at the same voltage as the operating voltage of the circuit to be tested).
2) Test circuit to be serviced or grounded for absence of voltage.
3) Retest voltage detector operation against known voltage source (at the same voltage as the operating voltage of the circuit tested) to verify that the voltage detector has not failed.

Some equipment might have a built-in voltage detection system. This can be used provided the system can be tested to prove that it is in working condition. Follow items 1-3 above.

7.2 GROUNDING

Temporary protective grounding equipment should be applied. Refer to 29 CFR 1910.269.

The grounding conductors and connections should be in good condition and adequate to carry full fault current from all possible sources for the maximum duration required for the protective equipment to clear the circuit. Refer to NFPA 70E Chapter 1.

Some equipment might have built-in grounding switches. These can be used with, or in place of, temporary protective grounds.
7.3 LOCKOUT/TAGOUT PROCEDURES

Tags, by themselves, are not adequate to ensure that a circuit will remain de-energized. Lockout/tagout requirements are found in 29 CFR 1910, 147 and 1910, 333, and NFPA 70E Article 120.
Section 8
RETURNING EQUIPMENT TO SERVICE

Only a qualified person should be allowed to re-energize equipment and return it to service. The following points summarize typical safety practices, including those required by OSHA and NFPA:

a) Inspect equipment for tools, loose wires, test jumpers, temporary protective grounds, etc.
b) Test as required (e.g., power frequency withstand voltage test, megger).
c) Inform facility personnel of pending equipment energization.
d) Follow manufacturer’s instructions.
e) Clear area of personnel.
f) Wear proper personal protective equipment.
g) Remove temporary protective grounds or open grounding switches.
h) Remove lockout tags and locks.
i) Energize control circuits.
j) Secure all doors, covers, latches, and other points of access.
k) Restore equipment to operating configuration.
Section 9
Recordkeeping and Responsibilities of Individuals

9.1 RECORDKEEPING
All field testing records, including replacement of parts, repairs, equipment maintenance and inspection records, and personnel training records must be maintained.

9.2 RESPONSIBILITIES OF INDIVIDUALS
It is the responsibility of all levels in the organization, from management to members of the workforce, to ensure a safe workplace where the level of risk from electrical hazards that might cause injury, illness, or death is as low as reasonably achievable. Managers shall expect all personnel to comply with these regulations.

Members of the workforce are expected to report immediately to management any unsafe conditions and stop work until the condition is corrected.

Field supervision while the work is performed should be assigned to a qualified person who is given responsibility to observe the workers and operations being performed, prevent careless acts, quickly de-energize the equipment in emergencies, and alert emergency personnel, and who has completed CPR training.
Appendix A
JOB PLAN EXAMPLE
for Servicing and Maintaining Switchgear Assemblies

1. Voltage Level Involved
   Main circuit voltage (phase to phase) ________________
   Control voltage (max) ________________

2. Flash Protection required per NFPA 70E guidelines?
   YES   NO

3. Personal Protection (per OSHA, NEC & NFPA 70E)
   3.1 Approved type test equipment to be used:
      (a) Voltage sensing, Contact ____________ Non-contact ____________
      (b) Voltage measurement ____________ Current Measurement ____________
      (c) Thermographic ____________ Phasing ____________
      (d) Other ____________

   3.2 Type of hand shock protection (insulated gloves), voltage rated with protectors:
      (a) 500 V (“Class 00”)  (b) 1,000 V (“Class 0”)  (c) 7.5 kV (“Class 1”)
      (d) 17 kV (“Class 2”)  (e) 26.5 kV (“Class 3”)  (f) 36 kV (“Class 4”)
      (g) Other ____________

   3.3 Flash protection required; body part protection level:
      (a) Total Body Protection ____________
      (b) Eye Protection ____________
      (c) Hand ____________
      (d) Head Protection (face, neck, and chin) ____________
      (e) Foot and Leg Protection ____________
      (f) Ear Protection ____________
      (g) Other ____________

   3.4 Other protective equipment and considerations:
      (a) Guarded/Insulated Tools ____________
      (b) Insulate Worker from Ground ____________
      (c) Hard Hat/Safety Glasses ____________
      (d) Safety Grounds or Grounding Switches ____________
      (e) Discharge Grounds ____________
      (f) Fall Protection ____________
      (g) Non-Conductive Ladders ____________
      (h) Other ____________

   3.5 Securing work area:
      (a) Barricades ____________
      (b) Signs ____________
      (c) Person(s) ____________
      (d) Other ____________
4. Equipment on which work is to be performed
   (a) Location __________________________________________________________
   (b) Manufacturer ____________________________________________________
   (c) Model __________________________________________________________
   (d) Type: Metal-Clad Switchgear ________ Metal-Enclosed Interrupter Switchgear ________
       Circuit Breaker ________________________________________________
   (e) Voltage Class __________________________________________________
   (f) Year of Manufacture ____________________________________________
   (g) Serial Number _________________________________________________
   (h) Number of Cubicles, Sections or Circuit Breakers __________________
   (i) Indoor __________ Outdoor ________________
   (j) Condition _____________________________________________________
   (k) Visual Inspection Findings: Is there adequate:
       (l) Working space Yes ______ No ______
       (m) Lighting Yes ______ No ______
       (n) Access/Egress Yes ______ No ______

5. Verification of Information: References Used to Prepare the Plan
   (a) Single Line Diagram No. __________________________________________
   (b) Schematic Diagram No. __________________________________________
   (c) Manufacturer Manuals __________________________________________
   (d) Other documentation ____________________________________________
   (e) Are there any back feeds? Yes ______ No ______
   (f) Are there any external power sources? Yes ______ No ______

6. Step-by-Step Written Work Plan

7. Emergency Response Information
   (a) Nearest Telephone Location ______________________________________
   (b) Emergency Response Telephone Number __________________________
   (c) Fire Extinguisher Location ______________________________________
   (d) CPR Trained Person ____________________________________________
   (e) Other Communication Needs ______________________________________

8. Review and Authorization
   Name/Title ___________________________ Signature ______________________

9. Job Plan Review with Person(s) Performing Work
   Worker(s) signatures _______________________________________________

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