Changes & Updates

Webinar
July 19, 2023

Who am I?  www.twbesc.ca
Check my LinkedIn Profile

• Terry Becker, P.Eng., CESCP, IEEE Senior Member.
• 31 Years experience in Electrical Engineering.
• Mobil Oil, DPH, PanCanadian Energy, EnCana, ESPS, Danatec, TW Becker Electrical Safety Consulting Inc..
• CSA Z462 Workplace electrical safety Standard, First-Past Vice Chair, Voting Member, Clause 4.1 & Annexes WG Leader.
• CSA Z463 Maintenance of electrical systems Standard, Founding Member, Voting Member [Canadian version of NFPA 70B].
• IEEE 1584 Guide for Arc Flash Hazard Calculations Standard. Voting Member. [Also IEEE 1584.1 Sub-Committee]
• 16 years specifically devoted to Electrical Safety Consulting.
Who am I? www.twbesc.ca
Check my LinkedIn Profile

• Implement External Electrical Safety Audits.
• Develop and implement Electrical Safety Programs.
• Develop and provide Electrical Safety Program Roll Out Orientation Training.
• SME and visionary of Electrical Safety Training System (ESTS) e-Learning.
• Develop and deliver 1 & 2 Day Low Voltage & High Voltage Arc Flash & Shock Training.
• Presented at Conferences and Workshops in Canada, USA, Australia, Italy and India on Electrical Safety, CSA Z462 and NFPA 70E.

Disclaimer

• The information presented is the technical seminar is the opinion and interpretation of the information presented by TW Becker Electrical Safety Consulting Inc., and Terry Becker, P.Eng., CESCP, IEEE Senior Member.
• TW Becker Electrical Safety Consulting Inc. and Terry Becker, P.Eng. accept no liability for the information provided.
• You are advised to consult the NFPA and the published 2024 Edition of NFPA 70E for specific formal interpretation.
• You are advised to consult CSA Group and the published 2024 Edition of CSA Z462 when it publishes (January 2024) for specific formal interpretation.
Disclaimer

• Not all potential changes will be reviewed.
• Information on the changes with respect to NFPA 70E 2024 Editions can be reviewed in a copy of NFPA 70E. You can consult NFPA’s website for specific First Revision and Second Revision reports and information provided.
• You can purchase a hard copy of NFPA 70E 2024 Edition from NFPA:
  • https://catalog.nfpa.org
• You can access a free online review copy of NFPA 70E 2024 Edition:

Disclaimer

• https://publicreview.csa.ca/Home/Search
Opening Statement

Continuous Improvement

1. PLAN

2. DO

3. CHECK

4. ACT
   Management, HSE & Supervisor Review. Budget Allocation. Track Changes to Regulations & Standards. Continuous Improvement. UPDATE DOCUMENTATION. EFFECTIVELY MANAGE CHANGE.

Understand
Peek into 2021 Editions
Opening Statement

Agenda

• Introduction.
• Introduction to NFPA 70E, NFPA.
• Introduction to CSA Z462, CSA Group.
• Interpretation and Application.
• Technical Harmonization.
• NFPA 70E 2024 Edition Changes & Updates.
• CSA Z462 2024 Expected Changes & Updates.
• Arc Flash & Shock Equipment Labeling.
• Conclusion.
• Questions.
Introduction

- Historically CSA Z462 has been technical harmonized with NFPA 70E.
- The 2024 Editions of NFPA 70E and CSA Z462 will have significant technical divergence.
- CSA Z462 2024 Edition will include changes that will not be included in NFPA 70E.

- Users of NFPA 70E should be aware and may consider the CSA Z462 2024 Edition changes valuable when developing and implementing an Electrical Safety Program.

Introduction NFPA 70E

- Public may not be aware of the processes followed.
- 1979, NFPA 70E Standard for Electrical Safety Requirements for Employee Workplaces.
- 2024 published early, May 13, 2023, is the 13th Edition of NFPA 70E.
Introduction NFPA 70E

- NFPA 70E 2024 Edition revision cycle:
  - 357 Public Inputs.
  - 166 First Revisions.
  - 168 Public Comments.
  - 73 Second Revisions.
- GOOD NEWS! The 2024 Edition doesn’t include substantial technical changes. Significant changes with content on electrical hazard classification, Chapter 3 submitted by USA DOE.

Introduction CSA Z462

- Harmonization of Standards for North America.
- NFPA 70E selected.
CSA Group – Request For Amendments Process

- Formal process.
- Not as structured as NFPA 70E process, website.
- All “Requests for Amendments” reviewed by CSA Z462 Technical Committee.
- Review NFPA 70E Public Comments for inclusion.

Interpretation & Application

- NFPA 70E and CSA Z462 are NOT adopted into OHSA or OH&S Regulations.
- Due diligence approach for application.
- Interpretation important.
- Requires Electrical Safety Program to be developed and implemented.
- Policy, elimination. Establish and Electrically Safe Work Condition (LOTO).
- Justification for energized electrical work.
Interpretation & Application

• Requires Electrical Safety Program to be developed and implemented.
• Risk Assessment Procedure.
  • Hierarchy or Risk Control Methods.
  • Human Performance/Error.
• Normal Operating/Equipment Condition.
• Energized Electrical Job Safety Plan documented.
• Work task based.
• Qualified Person.
• Energized Electrical Work Permit Policy.
• Arc Flash & Shock PPE, Tools & Equipment.
• Maintenance Requirements (recommended referencing NFPA 70B, 2023 now a Standard).
• Special Equipment.

Technical Harmonization

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NFPA 70E 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

- Global change: “shock” to “electric shock.”
- Global change: “leather protectors” to “protectors” (other gloves now approved for use).

- USA DOE Public Comments accepted related to Chapter 3 Safety Requirements for Special Equipment electrical hazard classification: batteries, lasers, power electronics.
  - Most significant changes related to this.

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NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

USA DOE Public Comments accepted related to Chapter 3 Safety Requirements for Special Equipment electrical hazard classification: batteries, lasers, power electronics.
NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 100 Definitions:
  • Scope updated [article number in parentheses following the definition indicates that the definition only applies to that article (e.g. need to different some definitions for capacitors to generic arc flash hazard definitions, (360)).
  • Added definitions related to Chapter 3 content e.g. Article 360 Safety-Related Requirements for Capacitors.
NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

Chapter 1, Article 100 Definitions:
- Cell (320).
- Cell, VLRA (320).
- Cell, Vented (320).
- Charge Transfer (360).
- Competent Person (350).
- Dielectric Absorption (360).

Discharge Time (360).
- Electrolyte (320).
- Field Evaluated (330, 350).
- Ground Stick (360).
- Grounding, Hard (360).
- Grounding, Soft (360).
• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 100 Definitions:
  • Hazard, Arc Blast (as applied to capacitors) (Arc Blast Hazard) (360).
  • Laboratory (350).
  • Laser (330).
  • Laser Energy Source (330).
  • Laser Radiation (330).
  • Laser System (330).

• Pilot Cell (320).
• Protective Barrier (330).
• Protector (was “leather protector” related to rubber insulating gloves).
• Radiation, Ionizing (340).
• Radiation, Non-Ionizing (340).
NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 100 Definitions:
  • Research and Development (R&D) (350).
  • Resistor, Bleeder (360).
  • Safeguarding (310).
  • Short Circuit Current Prospective (320).
  • Time Constant (360).
  • Voltage, Nominal (as applied to a cell or battery) (320).

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NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 110 General Requirements Electrical Safety-Related Work Practices:
  • Job Safety Planning.
    • Added requirement to document Emergency Response Plan.

• Chapter 1, Article 120 Establishing an Electrically Safe Work Condition:
  • In the 8-step procedure, Step 7 wording change “Use an adequately rated portable test instrument to test each phase conductor or circuit point at each point of work to test for absence of voltage.”
NFPA 70E 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

Chapter 1, Article 130 Work Involving Electrical Hazards:
- Table 130.5(C) updated Informational Notes 1 through 6.
- Incident Energy Analysis Method, Information Note:
  - "Changes that could affect the results of the incident energy analysis include
    changes made by utilities or other entities, such as transformer sizing, as well
    as modifications to protective devices or change to protective settings."
- Equipment Labelling:
  - "The label shall be of sufficient durability to withstand the environment
    involved."
- Hearing Protection:
  - "Employees inside the arc flash boundary shall wear hearing protection."

Updates to Shock Protection Approach Boundary Tables 130.4 (E)(a) and 130.4(E)(b), changed reference from IEEE 4 and IEEE 516 to OSHA 29 CFR 1910.269, Table R-6 for Column 4.
- E.g. new 751V to 5kV added.
- Reference updates to Annex C Limits of Approach, C.2.1
  General Statement, air insulation distances based on OSHA 29 CFR 1910.269, Table R-3.
NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 130 Work Involving Electrical Hazards:
  • Foot Protection:
    • Electrical hazard (EH) footwear can provide secondary source of electric shock protection under dry conditions.
  • Arc Flash PPE Category Method:
    • "For both ac and dc systems, the arc flash PPE category of the protective clothing and equipment is generally based on determination of the estimated exposure level."

NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Chapter 1, Article 130 Work Involving Electrical Hazards:
  • SIGNIFICANT CHANGE, DC abnormal arcing fault sustainability:
  • New data, cannot sustain for 125VDC, unless 17kA.
  • Table 130.7(C)(15)(b), New Informational Note:
    • Was two rows, not a single row.
    • OLD (two rows): ≥100V ≤250V and >250V ≤600V.
    • NEW (single row): >150 and ≤600VDC.
    • "Informational Note: “See the following references for dc voltages below 150 volts nominal.” New research."
NFPA 70E 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

- Chapter 2 Safety-Related Maintenance Requirements:
  
  - Major rewrite.
  - “Maintenance for Safety.”

NFPA 70E 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

- Chapter 3 Safety Requirements for Special Equipment:
  
  - Major content updates based on USA DOE Public Comments with respect to electrical hazard classification.
  - Most of new definitions relate to the changes in Chapter 3.
NFPA 70E 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

• Annexes:
  • Annex C – Limits of Approach, C.2.1 updated to reference OSHA 29 CFR 1910.269, Table R-6 instead of IEEE 4 and IEEE 516 (depending on nominal high voltage)
    • Updates to Tables 130.4(E)(a) and 130.4(E)(b).
  • NEW Annex S – Assessing the Condition of Maintenance

NFPA 70E 2024 Edition


• Jim Pollard, CESCP and Cindy Tedd.
CSA Z462 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.
- Single most significant change:

  - Deleting the term “arc flash PPE category.”
  - Renaming tables to “arc flash PPE table selection method.”
  - No reference to CAT #, deletes the incorrect reference of arc flash PPE by an HRC #, CAT #, Level "letter" etc..
  - All arc flash PPE selected based on its’ ATPV.
  - Two arc-rated arc flash PPE levels for incident energy analysis or when using the “arc flash PPE table selection method.” ATPV.

CSA Z462 2024 Edition

<table>
<thead>
<tr>
<th>Arc Flash PPE Category #</th>
<th>Arc-rating of Arc Flash PPE (ATPV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minimum 4 cal/cm², ESP Level 1 everyday wear/task wear arc flash PPE.</td>
</tr>
<tr>
<td>2</td>
<td>Minimum 8 cal/cm², ESP Level 1 everyday wear/task wear arc flash PPE.</td>
</tr>
<tr>
<td>3</td>
<td>Minimum 25 cal/cm², ESP Level 2 arc flash suit.</td>
</tr>
<tr>
<td>4</td>
<td>Minimum 40 cal/cm², ESP Level 2 arc flash suit.</td>
</tr>
<tr>
<td>5</td>
<td>Minimum 75 cal/cm², ESP Level 2 arc flash suit. Note arc flash suits are available with an ATPV of 140 cal/cm².</td>
</tr>
</tbody>
</table>

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CSA Z462 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.
- Single most significant change (is NFPA 70E Table 130.5(G):

| Incident energy exposure equal to 12 cal/cm² (5 lbf/in²) up to and including 12 cal/cm² (50 lbf/in²) |
| Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy |
| • Arc-rated long-sleeve shirt and pants or arc-rated coverall or arc flash suit (SR) |
| • Arc-rated face shield and arc-rated hood or arc flash suit hood (SR) |
| • Arc-rated outerwear (e.g., jacket, pant, rainwear, hard hat liner, high-visibility apparel) (AN) |
| • Heavy duty leather gloves, arc-rated gloves or rubber insulating gloves with protective (SR) |
| • Hard hat |
| • Safety glasses or safety goggles (SR) |
| • Hearing protection |
| • Leather footwear** |

Incident energy exposure greater than 12 cal/cm² (50 lbf/in²)

Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy

CSA Z462 2024 is deleting the term “arc flash PPE category.”
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Arc Flash PPE Two ATPV Levels

1.2 – 12.0 cal/cm² Arc Thermal Performance Value

> 12.0 to 140 cal/cm² Arc Thermal Performance Value

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CSA Z462 2024 Edition

• NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.
• Significant Divergence with NFPA 70E, 2024 Edition.
  • Clause 4.1 deleted descriptive justifications and replaced with “demonstrate that it is not practicable.”
  • Clause 4.1 Normal Equipment Condition is an element of the Risk Assessment Procedure.
  • Clause 4.3 Energized Electrical Work Permit, for Part II deleted detailed list of content, replace with content documented on Energized Electrical Job Safety Planning form.

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CSA Z462 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.
- Clause 4.3 Added additional exemptions for the Energized Electrical Work Permit (e.g. due to equipment design, isolation related).

4.3.2.3 Exemptions to work permit
Electrical work may be performed without an energized electrical work permit if a qualified person is provided with and uses appropriate safe work practices and PPE in accordance with Clause 4 under any of the following conditions:

a) testing, troubleshooting, or voltage or current measuring;
b) thermography, ultrasonic, or visual inspections if the restricted approach boundary is not crossed;
c) normal operation of electrical equipment;
d) access and egress to an area with energized electrical equipment if no electrical work is performed and the restricted approach boundary is not crossed; and

e) general housekeeping and miscellaneous non-electrical tasks if the restricted approach boundary is not crossed.

f) performance of tasks that do not involve repairs, modifications, or any alterations of the electrical equipment;
g) performance of tasks involved in establishing an electrically safe work condition, including the verifying absence of voltage and the installation of temporary protective grounding equipment; and
h) opening hinged covers for the purpose of inspection provided the restricted approach boundary is not crossed.

Table 2

<table>
<thead>
<tr>
<th>Task</th>
<th>Equipment condition</th>
<th>Likelihood of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

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CSA Z462 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.
- Clause 4.3 arc flash risk assessment, moved Table 2 (NFPA 70E, Table 130.5(C) to Annex F, new Table F.2).

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CSA Z462 2024 Edition

- NOT ALL POTENTIAL CHANGES WILL BE REVIEWED.

- CSA Z462 Clause 4.3.7.3.15 Arc flash PPE category method DELETED; content moved to NORMATIVE Annex V.
- Renamed to “Arc Flash PPE Table Selection Method.”
- CSA Z462 Table 6A, Table 6B relocated to Annex V Arc Flash PPE Table Selection Method, renamed Table V.2 and Table V.3.
- CSA Z462 Table 6C (NFPA 70E, Table 130.7(C)(15)(c)) DELETED.

- Terry Becker, P.Eng., CESCP, IEEE Senior Member.
Arc Flash & Shock Equipment Labeling

- Specification for compliant arc flash & shock equipment labels.

Arc Flash & Shock Equipment Labeling

- Examples of compliant arc flash & shock equipment labels.
Arc Flash & Shock Equipment Labeling

- Examples of compliant arc flash & shock equipment labels.

**WARNING**

<table>
<thead>
<tr>
<th>Arc Flash and Shock Hazard</th>
<th>Arc Flash PPE</th>
<th>Shock Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc Flash PPE</td>
<td>26.8 cal/cm²</td>
<td></td>
</tr>
<tr>
<td>Shock Protection</td>
<td>480 VAC</td>
<td></td>
</tr>
</tbody>
</table>

- Examples of compliant arc flash & shock equipment labels.

**WARNING**

<table>
<thead>
<tr>
<th>Arc Flash and Shock Hazard</th>
<th>Arc Flash PPE</th>
<th>Shock Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc Flash PPE</td>
<td>17.8 cal/cm²</td>
<td></td>
</tr>
<tr>
<td>Shock Protection</td>
<td>600 VAC</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

- NFPA 70E and CSA Z462 require interpretation and effective implementation, not adopted into OSHA or OH&S law.
- **PLAN-DO-CHECK-ACT!**
- **GOOD NEWS, 2024 NFPA 70E quantity and significance of changes is reduced. More clarity on electrical hazard classification.**
- CSA Z462 2024 Edition, 80 changes pending, and many are significant technical divergence from NFPA 70E 2024 Edition.
- NFPA 70E users should look to what has changed in CSA Z462, 2024 Edition.
Conclusion

• Employer’s need to audit their Electrical Safety Program and update them appropriately.
• Employer’s need to train their workers on their Electrical Safety Program and the changes reflected from NFPA 70E 2024 or CSA Z462 2024 (when published).

Closing & Questions

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Closing & Questions

• **THANK YOU for attending?**
• **Questions?**

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