SALISBURY

by Honeywell

ASTM F-18 & OSHA Sec. 1926.97
Electrical Protective Equipment
PARTNERS IN SAFETY

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SALISBURY
by Honeywell
National Consensus Standards & OSHA
National Consensus Standards & OSHA

• Created in 1970, OSHA’s main role was to establish safety and health standards in the Workplace.

• Face with an overwhelming task, OSHA turned National Consensus Standards for guidance and content.

• OSHA Regulations are written in general, and/or performance related terms; leaving the “How to Comply” to the Employer.

• The key, is to understand the purpose of each standard and the relationship between them and OSHA.
National Consensus Standards & OSHA

• A National Consensus Standard is defined as “a standard that is developed by the same persons it affects and then is adopted by a nationally recognized organization”.

• ASTM F-18 Committee – Electrical Protective Equipment for Workers
  • Defines the minimum Electrical, Chemical, Physical properties of PPE products.
  • Provide test methods, and detailed procedures by which these properties are to be determined”, and
  • Provide the in-service care, inspection, testing, and use voltage for rubber PPE
National Consensus Standards & OSHA

- The ASTM F-18 is currently composed of seven Technical Subcommittees:
  - F-18.15 – Worker Personal Equipment
  - F-18.25 – Insulating Cover-Up Equipment
  - F-18.35 – Tools and Equipment
  - F-18.45 – Mechanical Apparatus
  - F-18.55 – Test Methods for Aerial Devices
  - F-18.60 – Terminology, and
  - F-18.65 - Wearing Apparel
- With a total of 39 standards
The ASTM F-18 Consensus Standards can provide specific information on “How to Comply” with the OSHA performance regulations.

The Employer is expected to use Consensus Standards to help in the selection of the method to achieve compliance with the OSHA regulations.

- For example, OSHA requires gloves and sleeves placed in service shall be tested in intervals of 6 months.
- The employer would need to reference ASTM F-496 for in-service testing details.
National Consensus Standards & OSHA

• How Can OHSA Use NCS:
  - Select consensus standards can be incorporated by reference into various OSHA regulations.
    - This means a consensus standard identified as “incorporated” in a given OSHA regulation, has the same force and effect as any other regulation.
    - Provisions containing the word “shall” or other mandatory language for which an employer may be cited.
National Consensus Standards & OSHA

• How Can OSHA Use NCS:
  - OSHA may offer a National Consensus Standard as a Guide, to offer proof that a procedure exist for compliance.
    • When listed in a regulation in this manner, OSHA acknowledges there may be other means of compliance.
    • The focus of any citations issue would be on the language offered in the OSHA standard, not the consensus standard.
    • The consensus standard merely offers proof that procedures exist for compliance.
National Consensus Standards & OSHA

• How Can OSHA Use NCS:
  - The provisions of a National Consensus Standard can also be used as the basis for a citation for a violation of the General Duty Clause.
    - For example – In the event of an electrical accident, if OSHA determines that compliance with an ASTM F-18 Standard would prevent or lessen the injury, then the Duty Clause may be applied.
National Consensus Standards & OSHA

• What ASTM F18 doesn’t address:
  - Work Practices
  - Safety Rules
  - Training
  - Instructions, and
  - Regulations

• ASTM F-18 Significance and Use Statement, Section 4:
  - It is common practice and the responsibility of the user to prepare complete instructions & regulations to govern the correct and safe use of such PPE equipment.
Proposed Sec. 1926.97

• Proposed Rule Summary:
  • OSHA has proposed a new Sec. 1926.97 which has been derived from the ASTM Standards, but has been written in performance terms in order to allow alternative methods of compliance if they provide “comparable safety”.
  • OSHA has tried to use an approach that will accept new methods of protection that may appear in future editions of the ASTM standards.
  • Furthermore, an Employer who follows future versions of ASTM standards would likely be covered by OSHA’s de minims policy.
    • OSHA will also accept earlier versions of ASTM standards provided the equipment meets the edition that was in effect and the employer followed the use and care provisions in proposed Sec 1926.97(c), In Service requirements.
Sec. 1926.97 Electrical Protective Equipment

(a) Design Requirements:
Proposed Sec. 1926.97(a)

• (a) Design Requirements:
  - (1) - Blankets, matting, covers, line hose, gloves, and sleeves to be made of Natural or Synthetic rubber.
  - (1)(i) – Blankets, gloves, and sleeves to be manufactured without seams.
  - (1)(ii) - Included Class 00 glove
  - (1)(ii) - Each item shall be clearly marked with Class rating, e.g. Class 00 thru Class 4
    ◆ (a)(1)(iii) – Markings on PPE shall be non conducting.
    ◆ (a)(iv) - Markings on Gloves shall be confined to the cuff portion of the glove.
  - (1)(G) – Non Ozone resistant equipment other than matting shall be marked type I
  - (1)(H) - Ozone equipment other than matting shall be marked type I
### ASTM Classification of Rubber Insulating PPE

#### Protective Rubber Equipment Labeling Chart

- **For Salisbury Linemen’s Natural Rubber and SALCOR® Rubber Protective Equipment**

<table>
<thead>
<tr>
<th>Class</th>
<th>Color</th>
<th>Proof Test Voltage AC / DC</th>
<th>Max. Use Voltage* AC / DC</th>
<th>Rubber Molded Products Label</th>
<th>Glove Label</th>
<th>Rubber Dipped Sleeve Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Beige</td>
<td>2,500 / 10,000</td>
<td>500 / 750</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Red</td>
<td>5,000 / 20,000</td>
<td>1,000 / 1,500</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>White</td>
<td>10,000 / 40,000</td>
<td>7,500 / 11,250</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Yellow</td>
<td>20,000 / 50,000</td>
<td>17,000 / 25,500</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
<td>30,000 / 60,000</td>
<td>26,500 / 39,750</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Orange</td>
<td>40,000 / 70,000</td>
<td>36,000 / 54,000</td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

* Insulating Gloves and Sleeves must have a color coded label to meet appropriate ASTM Specifications.

* Max. Use Voltage when worn with leather protectors.
Proposed Sec. 1926.97(a)

(2) – Electrical Requirements:

(i) - Equipment shall be capable of withstanding the a-c proof-test voltage specified in Table E-1 or the d-c proof-test voltage in Table E-2.

B) - The Test voltage shall be applied for 3 minutes for equipment other than matting and shall continuously for 1 minute for matting.

(C)(ii) – When the a-c proof test is used on gloves, the 60 hertz proof-test current may not exceed values specified in Table E-1 at any time during the test period.

Gloves shall also be capable of withstanding the a-c proof-test voltage after a 16 hour water soak. Current values may not exceed 2mA of the values in Table E-1.
Proposed Sec. 1926.97(a)

- Electrical Requirements, 1910.97(a)(2)(i) – Table E-1

<table>
<thead>
<tr>
<th>Class of equipment voltage rms V</th>
<th>Maximum proof-test current, mA (gloves only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>267 mm (10.5 in.) glove</td>
</tr>
<tr>
<td></td>
<td>356 mm (14 in.) glove</td>
</tr>
<tr>
<td></td>
<td>406 mm (16 in.) glove</td>
</tr>
<tr>
<td></td>
<td>457 mm (18 in. gloves)</td>
</tr>
<tr>
<td>00</td>
<td></td>
</tr>
<tr>
<td>2,500</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>10,000</td>
<td>14</td>
</tr>
<tr>
<td>20,000</td>
<td>16</td>
</tr>
<tr>
<td>30,000</td>
<td>18</td>
</tr>
<tr>
<td>40,000</td>
<td>22</td>
</tr>
</tbody>
</table>

Note: Values in red indicate special testing conditions.
Proposed Sec. 1926.97(a)

- ASTM Design Test:
  - 13 – Sampling Requirements
    - Each glove in a lot or shipment shall be subjected to inspection and test to meet the requirements of Sections 7, 11.1, and 15.
    - An original sample of 1% of the lot or not less than 2 gloves from the lot of shipment, for the test requirements of 11.2, 11.3 and 8.
    - An original sample of 1% of the lot or not less than 2 gloves from the lot of shipment, for the test requirements of 10.1 and 10.3
Proposed Sec. 1926.97(a)

• Summery to 1926.97(a)(1)(i) - OSHA states “Because they are used when workers handle energized lines, gloves and sleeves are the only defense an employee has against electrical shock.

• Each ASTM F-18 Standard Specification contains a Scope and a Significance and Use statement, for example D-120 Rubber Insulating Gloves:
  • Scope – This specification covers manufacturing and testing of rubber insulating gloves for protection of workers from electrical shock.
  • Significance and Use: This specification covers the minimum electrical, chemical, and physical properties guaranteed by the manufacturer and the detailed procedures by which such properties are to be determined.
Proposed Sec. 1926.97(a)

- Electrical Protection afforded to users as noted in the Scope of each ASTM standard specification listed below.

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>ASTM STANDARD</th>
<th>INTENDED USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>ASTM D 120</td>
<td>Protection from Electrical Shock</td>
</tr>
<tr>
<td>Sleeves</td>
<td>ASTM D 1051</td>
<td>Protection from Electrical Shock</td>
</tr>
<tr>
<td>Blankets</td>
<td>ASTM D 1048</td>
<td>Protection from Accidental Contact</td>
</tr>
<tr>
<td>Line Hose</td>
<td>ASTM D 1050</td>
<td>Protection from Accidental Contact</td>
</tr>
<tr>
<td>Covers</td>
<td>ASTM D 1049</td>
<td>Protection from Accidental Contact</td>
</tr>
<tr>
<td>Matting</td>
<td>ASTM D 178</td>
<td>Floor Covering for Protection of Workers</td>
</tr>
<tr>
<td>Plastic Guards</td>
<td>ASTN F 712</td>
<td>Protection from Brush Contact</td>
</tr>
</tbody>
</table>

- This chart only pertains to standards found & referenced in proposed Sec. 1926.97 & updated 1910.137
• (3) – Workmanship and Finish:

- (i) - Equipment shall be free of harmful physical irregularities that can be detected by the tests or inspections required in this section.

- (ii) – Surface irregularities that may be present due to the imperfections on molds or inherent difficulties in the manufacturing process and may appear as indentations, protuberances, or imbedded foreign material are acceptable under the following conditions.

  - (ii)(A) - Indentations or protuberances blends into a smooth slope when stretched

  - (ii)(B) – Foreign material remains in place when folded or stretched with the material surrounding it.
Proposed Sec. 1926.97(c)

• (a) Design Requirements:
  - Note to paragraph (a) – Added ASTM F-819 Standard Terminology Relating to Electrical Protective Equipment for Workers.

  - arc duration, \( n \)—time duration of the arc(s).
  - arc energy (\( \int \text{dt} \)), \( n \)—sum of the instantaneous arc voltage values multiplied by the instantaneous arc current values multiplied by the incremental time values during the arc, (J).
  - arc gap—distance between the arc electrodes (inch).
  - blanket roll-up—a container made from fabric or similar material and specifically designed to protect the blanket from damage during storage or transportation.
  - breakdown, electrical—the electrical discharge or arc occurring between the electrodes and through the equipment being tested.
  - bulk storage—the storage of hose or covers together with one or more layers piled neatly, but without the benefit of spacers, supports, or special protective containers.
  - compatible—not injurious to or changing the physical or electrical characteristics of the blankets or affecting their application, use, or acceptability.
  - cover—an electrically insulated enclosure designed to be installed temporarily on various types of irregularly shaped electrical equipment to protect personnel and equipment working in close proximity.
  - (FRP) products manufactured so that the tubes and rods produced will meet the electrical and mechanical requirements in the standard.
  - gauntlet—the area of a glove between the wrist and the reinforced edge of the opening.
  - heat flux, \( n \)—the thermal intensity indicated by the amount of energy transmitted per unit area and time (cal/cm²s)(W/cm²)
  - hose—an electrical insulating tube with a longitudinal slit designed to be installed temporarily on energized electrical wires.
  - \( i^2t \), \( n \)—sum of the instantaneous arc current values squared multiplied by the incremental time values during the arc (A²s).
  - ignition, \( n \)—the initiation of combustion.
  - incident energy (\( E_i \)), \( n \)—the amount of energy (total heat, cal/cm²) received at a surface as a direct result of an electric arc discharge as measured by temperature rise on copper calorimeters.
  - insulated—separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current.
Proposed Sec. 1926.97(a)

- Note to paragraph(a) - “stating that rubber insulating equipment meeting the requirements of the listed ASTM F-18 standards for the equipment are considered as conforming to the requirement contained in Sec. 1926.97.(a)”.

- Summery to 1926.97 (a)/11\ - OSHA states “it should be noted that the listed consensus standards are the only ones with official recognition within the body of the regulation.
Proposed Sec. 1926.97(a)

American Society for Testing and Materials


ASTM D-1049-98e1, Standard Specification for Rubber Insulating Covers.


Sec. 1926.97 Electrical Protective Equipment

(b) Requirements for Other Types of Electrical Protective Equipment:
(b) Requirements for other types of electrical protective equipment:

- “The following requirements apply to the design and manufacture of electrical protective equipment that is not covered by paragraph (a) of this section”.

- (1) Voltage withstand. “Insulating equipment used for the protection of employees shall be capable of withstand, without failure, the voltages that may be imposed upon it.”
Proposed Sec. 1926.97(b)

• OSHA Table IV-1

<table>
<thead>
<tr>
<th>Class</th>
<th>Rating [phis]-kV [phis]</th>
<th>Maximum use [kV [phis]-g (60 Hz)]</th>
<th>Proof test withstand voltage (in service testing)</th>
<th>Duration min.</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>14.6</td>
<td>8.4</td>
<td>13</td>
<td>1.00</td>
<td>No flashover other than momentary as a result of too-close spacing of electrode.</td>
</tr>
<tr>
<td>3.</td>
<td>26.4</td>
<td>15.3</td>
<td>24</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>36.6</td>
<td>21.1</td>
<td>32</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>48.3</td>
<td>27.0</td>
<td>42</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>72.5</td>
<td>41.8</td>
<td>64</td>
<td>0.25</td>
<td></td>
</tr>
</tbody>
</table>

Table IV-1.--Withstand Voltage Proof Test
**Proposed Sec. 1926.97(b)**

- ASTM F-712

**Table 1: Withstand Voltage Proof Test**

<table>
<thead>
<tr>
<th>Class</th>
<th>Rating, kV</th>
<th>Max Use 60 Hz</th>
<th>Proof Test Withstand Voltage (in-service testing)</th>
<th>Duration, min</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>60 Hz</td>
<td>0-Ground kV 60 Hz DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14.6</td>
<td>8.4</td>
<td>13.0</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>26.4</td>
<td>15.3</td>
<td>24.0</td>
<td>34</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>36.6</td>
<td>21.1</td>
<td>32.0</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>48.3</td>
<td>27.0</td>
<td>42.0</td>
<td>60</td>
<td>0.5</td>
</tr>
<tr>
<td>6</td>
<td>72.5</td>
<td>41.8</td>
<td>64.0</td>
<td>91</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*Cover-up materials are tested at values greater than the maximum use phase to ground values. The maximum use phase to phase values relate to guarded phase to guarded phase. The units are not rated for bare phase to guarded phase potentials.*
Proposed Sec. 1926.97(b)

- Note to paragraph (b)(1) of this section; Such voltages include transient over voltages, such as switching surges, as well as nominal line voltage.
  - See appendix B to Subpart V of this part for a discussion of transient overvoltages on electric power transmission and distribution systems

- The Summary for Paragraph 1926.97(b)(1): OSHA states “Some of the equipment in Paragraph (b) is covered by consensus standards, for example ASTM F-712 Insulating Plastic Guard Equipment
Proposed Sec. 1926.97(b)

• (2) Equipment current.
  - (i) Protective equipment used for the primary insulation for employees from energized circuits parts shall be capable of passing a current test when subjected to the highest nominal voltage on which the equipment is to be used.
  - (ii) When insulating equipment is tested in accordance with paragraph (b)(2)(i) of this section, the equipment current may not exceed 1 microampere per kilovolt of phase to phase applied voltage.
  - It should be noted that ASTM F-712 Section 12, paragraph 12.1.3 Method C, Leakage Current Test, does not contain the proposed 1µA per kV requirement.
    - The 1 µa per kA, is found in IEEE Std 516
Proposed Sec. 1926.97(b)

- OSHA Table IV-2

<table>
<thead>
<tr>
<th>Class</th>
<th>Rating [phis]</th>
<th>Maximum use [phis]-g (60 Hz)</th>
<th>Minimum flashover test kV [phis]-g</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>14.6</td>
<td>8.4</td>
<td>14</td>
<td>20 No flashover other than</td>
</tr>
<tr>
<td>3</td>
<td>26.4</td>
<td>15.3</td>
<td>25</td>
<td>35 momentary as a result of</td>
</tr>
<tr>
<td>4</td>
<td>36.6</td>
<td>21.1</td>
<td>34</td>
<td>48 too-close spacing of</td>
</tr>
<tr>
<td>5</td>
<td>48.3</td>
<td>27.0</td>
<td>43</td>
<td>61 electrode.</td>
</tr>
<tr>
<td>6</td>
<td>72.5</td>
<td>41.8</td>
<td>67</td>
<td>95</td>
</tr>
</tbody>
</table>
Proposed Sec. 1926.97(b)

- ASTM F-712

<table>
<thead>
<tr>
<th>TABLE 2 Minimum Flashover Test&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Rating, kV</th>
<th>Max Use 60 Hz</th>
<th>Min Flashover Voltage Test φ-Ground kV</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0-Ground</td>
<td>60 Hz</td>
<td>DC</td>
</tr>
<tr>
<td>2</td>
<td>14.6</td>
<td>8.4</td>
<td>14.0</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>26.4</td>
<td>15.3</td>
<td>25.0</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>36.6</td>
<td>21.1</td>
<td>34.0</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>48.3</td>
<td>27.0</td>
<td>43.0</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>72.5</td>
<td>41.8</td>
<td>67.0</td>
<td>95</td>
</tr>
</tbody>
</table>

<sup>a</sup> Cover-up materials are tested at values greater than the maximum use phase to ground values. The maximum use phase to phase values relate to guarded phase to guarded phase. The units are not rated for bare phase to guarded phase potentials.
• ASTM F-712, note 1 – States:
  - Rubber insulating equipment is realistically limited to class 4 material in the design specifications.
  - Plastic guard equipment has been designed to go beyond these voltages and provide a satisfactory degree of worker protection.
  - Major differences exist in use criteria between rubber and the plastic guard equipment.
  - Each glove, sleeve, or other article of rubber insulating equipment has a given safety factor for the phase-to-phase voltage on which it may be used and the class or proof voltage at which it is tested.
  - “Plastic guard” equipment, however, is designed to provide a satisfactory safety factor only when used in a phase-to-ground exposure.
  - If exposure is Phase-to-Phase, then a satisfactory safety factor is only provided if the exposure is Covered phase-to-Covered phase.
Proposed Sec. 1926.97(b)

The Summary for Paragraph 1926.97(b) OSHA States:

- For types of equipment not addressed by any consensus standard, OSHA is considering accepting electrical protective equipment that is capable of passing an equivalent test to that described in “ASTM F-712”.

- Note to paragraph (b)(2); This paragraph applies to equipment that provides primary insulation of employees from energized parts. It is not intended to apply to equipment used for secondary insulation or used for brush contact only.

  - ASTM F-712 section 1; paragraph 1.1.5 “Plastic guard equipment covered by this specification is rated for momentary, or brush contact only.”
Sec. 1926.97 Electrical Protective Equipment

(c) In-Service Care and Use of Rubber Insulating Equipment:
• (c) In-Service care and use of rubber insulating equipment:
  - (1) Electrical protective equipment shall be maintained in a safe, reliable condition.
  - (2) Specific requirements apply to insulating blankets, covers, line hose, gloves, and sleeves.
  - (2)(i) Maximum use voltages shall conform to those listed in Table E-4
  - ASTM F-18; When authorizing the use of insulating equipment, a margin of safety shall be allowed between the max voltage on which they are used and the proof test at which they are tested.
Proposed Sec. 1926.97(c)

Table E-4 – Rubber Insulating Equipment Voltage Requirement

<table>
<thead>
<tr>
<th>Class of equipment</th>
<th>Maximum use voltage(^1) a-c - rms</th>
<th>Retest voltage(^2) a-c-rms</th>
<th>Retest voltage(^2) d-c-avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>500</td>
<td>2,500</td>
<td>10,000</td>
</tr>
<tr>
<td>0</td>
<td>1,000</td>
<td>5,000</td>
<td>20,000</td>
</tr>
<tr>
<td>1</td>
<td>7,500</td>
<td>10,000</td>
<td>40,000</td>
</tr>
<tr>
<td>2</td>
<td>17,000</td>
<td>20,000</td>
<td>50,000</td>
</tr>
<tr>
<td>3</td>
<td>26,500</td>
<td>30,000</td>
<td>60,000</td>
</tr>
<tr>
<td>4</td>
<td>36,000</td>
<td>40,000</td>
<td>70,000</td>
</tr>
</tbody>
</table>

1. The maximum use voltage in the a-c voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits. However, the phase-to-ground potential is considered to be the nominal design voltage.

   (1) If there is no multiphase exposure in a system area and if the voltage exposure is limited to the phase-to-ground potential, or

   (2) If the electrical equipment and devices are insulated or isolated of both so that the multiphase exposure on a grounded wye circuit is removed.

2. The proof-test voltage shall be applied continuously for at least 1 minute, but no more than 3 minutes,
Proposed Sec. 1926.97(c)

- (2)(i) Insulating equipment shall be inspected for damage each day’s use. Insulating glove shall be given an air test, along with inspection.

- Note to paragraph (c)(2) – **Added** ASTM F-1236 Standard Guide for Visual Inspection of Rubber PPE.
  - Provides methods and techniques for the visual inspection of electrical protective equipment made of rubber.
  - This guide also contains descriptions and photographs of irregularities that can be found in the equipment.
Proposed Sec. 1926.97(c)

FIG. 1 Abrasion

FIG. 2 Scratches

FIG. 3 Age Cracks

FIG. 4 Breakdown (Dielectric Failure)
Proposed Sec. 1926.97(c)

• (c)(2)(iii) - Insulating equipment with any of the following defects may not be used:
  ➢ Look For:
    ✔ Snags, tears, punctures, or cuts.
    ✔ Embedded foreign objects.
Proposed Sec. 1926.97(c)

- (c)(2)(iii) - Insulating equipment with any of the following defects may not be used:

- Look for:
  - Ozone checking or ozone cutting (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks).
  - Or electrical corona generated ozone
Proposed Sec. 1926.97(c)

- (c)(2)(iii)- Insulating equipment with any of the following defects may not be used:

  - Look for:

    ✓ Changes in texture, swelling, softening, hardening, or becoming sticky or inelastic.

    ✓ Petro Chemicals are a natural enemy of rubber. They should be removed with hot soapy water as soon as practical.
Proposed Sec. 1926.97(c)

- (2)(vii)(A) - Protector gloves shall be worn over insulating gloves.

  - ASTM F496:
  - 8.7 - The protectors gloves shall meet the Specification F 696 and shall be worn over insulating gloves to prevent mechanical damage, except as provided in 8.7.4.
  - 8.7.2 - The top of the cuff of the protector glove shall be shorter than the rolled top of the cuff of the insulating glove by at least the distance specified in Table 4.

<table>
<thead>
<tr>
<th>Class</th>
<th>Distance, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>0, 00</td>
<td>13</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
</tr>
<tr>
<td>4</td>
<td>102</td>
</tr>
</tbody>
</table>
Proposed Sec. 1926.97(c)

• 1926.97 (2)(vii)(A) Protector gloves need not be used with Class 0 or Class 00 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity.
  - Note to paragraph (c)(2)(vii)(A) of this section: Extra care is needed in the visual examination of the glove and in the avoidance of handling sharp objects.

• ASTM F-496 Sec 8 paragraph 8.7.4 states:
  - “Protector gloves may be omitted for Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity.
  - Under the same conditions, Class 00 may be used without protectors, but only at voltages up to and including 250 V ac!
Proposed Sec. 1926.97(c)

• (2)(c) – Insulating gloves that have been used without protectors gloves may not be reused until they have been tested under the provisions of Paragraphs (c)(2)(viii) and (c)(2)(ix) of this section.

• Electrical protective equipment shall be subjected to periodic electrical test.

• Test voltages and the maximum intervals between tests shall be in accordance with Table E- 4 and Table E – 5.
Proposed Sec. 1926.97(c)

• Electrical Requirements, 1910.97(c)(2) Table - 4

<table>
<thead>
<tr>
<th>Class of equipment</th>
<th>Proof-test voltage rms V</th>
<th>Maximum proof-test current, mA (gloves only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>267 mm (10.5 in.) glove</td>
</tr>
<tr>
<td>00</td>
<td>2,500</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>5,000</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>10,000</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>20,000</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>30,000</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>40,000</td>
<td></td>
</tr>
</tbody>
</table>
Proposed Sec. 1926.97(c)

- Electrical Requirements, 1910.97(c)(2) Table - 5

<table>
<thead>
<tr>
<th>Type of Equipment</th>
<th>When to Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber insulating line hose</td>
<td>Upon indication that insulating value is suspect.</td>
</tr>
<tr>
<td>Rubber insulating covers</td>
<td>Upon indication that insulating value is suspect.</td>
</tr>
<tr>
<td>Rubber insulating blankets</td>
<td>Before first issue and every 12 months thereafter (1).</td>
</tr>
<tr>
<td>Rubber insulating gloves</td>
<td>Before first issue and every 6 months thereafter (1)</td>
</tr>
<tr>
<td>Rubber insulating sleeves</td>
<td>Before first issue and every 12 months thereafter (1).</td>
</tr>
</tbody>
</table>

Footnote (1) if the insulating equipment has been electrically tested but not issued for service, it may not be placed in service unless it has been electrically tested within the previous 12 months.
Proposed Sec. 1926.97(c)

- Note to paragraph (c)(2)(ix) of this section:
- Standard electrical test methods considered as meeting this requirement are given in the following national consensus standards:
  - ASTM F 478-92, Standard Specification for In-Service Care of Insulating Line Hose and Covers.
  - ASTM F 479-95, Standard Specification for In-Service Care of Insulating Blankets.
  - ASTM F 496-02a, Standard Specification for In-Service Care of Insulating Gloves and Sleeves.
  - ASTM F 478-92, Standard Specification for In-Service Care of Insulating Line Hose and Covers.
  - ASTM F 479-95, Standard Specification for In-Service Care of Insulating Blankets.
  - ASTM F 496-02a, Standard Specification for In-Service Care of Insulating Gloves and Sleeves.
Proposed Sec. 1926.97(c)

- (2)(x) – Insulating equipment failing to pass inspections or Electrical test may not be used by employees, except as follows:
  - (A) Rubber insulating line hose may be used in shorter lengths with the defective portion cut off.
  - (B) Rubber insulated blankets may be salvaged by severing the defected area from the undamaged portion of the blanket. The resulting undamaged area may not be smaller than 22” X 22”.
  - (C) Rubber insulating blanket may be repaired using a compatible patch that results in physical and electrical properties equal to those of the blanket.
  - (D) Gloves & Sleeves, with minor physical defects can be repaired with a compatible patch. Such patch shall have the same physical and electrical properties equal to those of the glove or sleeve. Repairs to gloves are permitted only in the area between wrist to the cuff of the glove.

- (2)(D)(xi) – Repaired insulating equipment shall be retested before it may be used by employees.
Proposed Sec. 1926.97(c)

- The Summery for paragraph 1926.97(c)(2)(ix) States –
  - In forcing Sec (c)(2)(ix) the Agency would accept any test that meets the requirement of the OSHA Standard.
  - However, the proposal states explicitly that the listed ASTM test would be acceptable.
  - If the ASTM specifications are met, an employer has assurance that he or she would be in compliance.
  - If employer uses other test methods, the Agency will determine, on a case by case, whether or not they meet the Federal standard.
ASTM Testing Rubber of Insulating PPE
• Many thousands of dollars are wasted every year due to improper testing and storing of Rubber Insulating PPE.

• The ASTM guarantee paragraph requires:
  - The Manufacture, or Supplier shall replace, without charge, unused PPE which, at any time within a period of nine (9) months from the date of initial delivery that failed to pass the test in this specification.
  - This guarantee will be binding on the Manufacture, or Supplier only if the PPE have been properly stored and have not been subjected to more than an original acceptance and one retest.
    ♦ Total of 3 test before placed in service
  - Any acceptance test made by the purchaser, or an designee, shall be performed within the first two (2) months of the guarantee period.
ASTM Testing Rubber of Insulating PPE

• The goal is to test as much of the equipment as is possible at the specified ASTM ac/dc proof test voltage; without creating damage to the rubber protective equipment.

• Damage can come from several sources;
  • Condition of test equipment
  • Excessive voltage, voltages stress
  • Inadequate exhaust systems
  • Uneven water levels inside and outside the glove or sleeve
  • Contaminated dielectric fluid for testing sleeves
  • Testing rubber PPE stressed from its natural shape
  • Electrodes with Rough or sharp edges create ozone.
ASTM Testing Rubber of Insulating PPE

- ASTM 18.3.1, requires: that the test equipment is inspected annually to ensure that the general condition of the equipment is acceptable and to verify the characteristics and accuracy for the test voltages, within ± 1kV

- Water levels on both inside and outside of the glove / sleeve must be equal to avoid damaging the glove or sleeve during test.
ASTM Testing Rubber of Insulating PPE

- **ASTM 18.3.1.1**, requires
  - To eliminate damaging ozone and possible flashover along the cuff, there should be a sufficient flow of air into and around the glove and an exhaust system to adequately remove ozone from the test machine.
- Consistent ozone cutting and checking during the test procedure should be case to ascertain the adequacy of the exhaust system.
  - Ozone – A very active form of oxygen that is produced by corona, arcing, or ultraviolet rays
ASTM Testing Rubber or Insulating PPE

- Use mounting or supporting equipment that does not create stress or deforms the shape of the Gloves and Sleeves from their normal & relaxed shape.
- Hanging clips should not pinch, bind or distort the rubber product.
- ASTM F-496 Note 5 states; Use of this method may result in excessive breakdown failures when tested above 10,000 V ac or 50,000 dc if the test apparatus does not conform with 18.4.2.
  - This note is only used for those test methods that distort the sleeves from their natural relaxed shape.
ASTM Testing Rubber of Insulating PPE

- The edges & corners of the metal electrodes should be rounded and smooth so as to eliminate sharp nicks, protuberances, and point sources that are conducive to corona.
- Captive air spaces create and pocket ozone which damage rubber.

  - ASTM F-479 Note 1 – All blankets shall be in an unstressed physical condition prior to testing. Failure to achieve this may result in excessive breakdowns or damage.
ASTM Storing of Rubber Insulating PPE

• In General Rubber Insulating PPE Should Be Stored:
  • In a cool, dark, and dry as possible.
  • The location shall be as free as from practicable from ozone, chemicals, oils, solvents, and away from electrical discharges and sunlight.
  • Stored in their natural shape and not be folded, creased, inside out, or compressed.
  • Should not be stored when wet or dirty; if they must be stored in this condition they should be cleaned and dried at the first opportunity.
  • May be stored inside bags, boxes or container that is designed for and used exclusively for the products; and sleeves may be rolled lengthwise inside a sleeve roll.
  • Rubber Insulating PPE can be cleaned with warm water and a mild household soap. Dry thoroughly before storing.
    • If rubber insulating equipment has been stored for more than 90 to 120 days. They should be washed first in hot water, before testing, to relax the rubber from storage and retain there natural shape.
QUESTIONS

References:
2. ASTM F-18 Electrical Protective Equipment for Workers
4. National Safety Council, Data Sheet I-598 Rev. 91