# Distribution Protective Cover-Up Insulate and Isolate

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**NSPC** 

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#### Overview

- Protective cover is taken for granted...
- Effective protective cover provides insulation
- Protective cover is not intended for direct, intentional contacts
- The best protection when working with energized lines is distance
- When line workers must enter the Minimum Approach Distance (MAD) to do their work, application of protective cover for insulation becomes a requirement



NEC



- Electricity a wonderous discovery bringing...
  - Darkness to light
  - Comfort during weather extremes
  - Limitless advances in tech and medicine
- Conductors
  - Copper, aluminum, gold, and silver
- Insulators
  - Air, plastic, glass, and rubber



### Preliminary Rules/Controls for Protective Cover



#### Preliminary Rules/Controls for Protective Cover



#### Only qualified employees may perform work on electrical lines. OSHA Standard 1926.950(b)(2) describes the training and competency needed for qualified employees. They include:

- Skills and techniques necessary to distinguish exposed live parts and determine the nominal voltage of those parts
- Knowledge of MAD specified in the regulation for voltages which they will be exposed
- Skills and techniques necessary to maintain MAD
- Skills for the proper use of special precautionary techniques, PPE, insulating and shielding materials, and insulated tools for working on or near exposed energized parts
- Recognition of electrical hazards to which they may be exposed and the skills

#### Preliminary Rules/Controls for Protective Cover

Minimum Approach Distance or MAD it calculated by engineering analysis the following factors must be considered:

- Nominal voltage
- Maximum anticipated per-unit transient overvoltage, phase-toground
- Altitude

	3,000 feet elevation or less Distance Distance Distance					
Nominal Voltage (KV) phase-to-phase	m	e-to-groun ft	ft-in	m	ft	ft-in
0.050 to 0.300 2	Avoid contact			Avoid contact		
0.301 to 0.750 2	0.33	1.09	1', 1"	0.33	1.09	1', 1"
0.751 to 5.0	0.63	2.07	2', 1"	0.63	2.07	2', 1"
5.1 to 15.0	0.65	2.14	2', 2"	0.68	2.24	2', 3"
15.1 to 36.0	0.77	2.53	2', 7"	0.89	2.92	3', 0"
36.1 to 46.0	0.84	2.76	2', 10"	0.98	3.22	3', 3"
46.1 to 72.5	1	3.29	3', 4"	1.2	3.94	4'. 0"

3,000 feet elevation or less								
	Distance							
ominal Voltage (kV)	Phase-to-ground exposure			Phase-to-phase exposure				
hase-to-phase	m	ft	ft-in	m	ft	ft-in		
2.6 to 121.0	1.13	3.71	3', 9"	1.42	4.66	4', 8"		
21.1 to 145.0	1.3	4.27	4', 4"	1.64	5.38	5', 5"		
45.1 to 169.0	1.46	4.79	4', 10"	1.94	6.36	6', 5"		
69.1 to 242.0	2.01	6.59	6', 8"	3.08	10.1	10', 2'		
42.1 to 362.0	3.41	11.19	11', 3"	5.52	18.11	18', 2'		
62.1 to 420.0	4.25	13.94	14', 0"	6.81	22.34	22', 5'		
20.1 to 550.0	5.07	16.63	16', 8"	8.24	27.03	27', 1		
50.1 to 800.0	6.88	22.57	22', 7"	11.38	37.34	37', 5'		

#### Preliminary Rules/Controls for Protective Cover



Without electrical protective equipment workers cannot be in position where they can reach into MAD. This includes:

- Working near exposed parts energized at more than 600 volts, but not more than 72.5 kilovolts
- Not wearing rubber insulating gloves
- Not protected by insulating equipment covering the energized part
- Performing work using live-line tools



- Performing live-line barehand work (see 1926.964(c))
- Breaching MAD is not just a matter of putting one's hands or arms inside that distance. No part of the body must enter MAD. Extended reach must be considered. Any conductive item, tool or material that enters MAD is a hazard. An unintentional movement, slip or fall placing the body or conductive item near an energized part can expose the worker.

### Electrical Protective Equipment

Inside MAD, OSHA requires:

- Employee is insulated from the energized part (rubber insulating gloves or rubber insulating gloves and sleeves) or
- Energized part is insulated from the employee and from any other conductive object at a different potential, or
- Employee is insulated from any other exposed conductive object in accordance with the requirements for live-line barehand work in § 1926.964(c).



# Electrical Protective Equipment Selection

Equipment is available and labeled as follo Class Max. AC Use V Max. DC Use V Gloves and Sleeves – Class 00 to Class 00 500 10.000 0 1,000 20,000 1 7,500 40,000 Line Hose – Class 0 to Class 4 2 17.000 50,000 3 60,000 26,500 Blankets – Class 0 to Class 4 4 36.000 70.000 Voltage Requirements ASTM



#### Electrical Protective Equipment Selection

Sleeves must be used with gloves unless:

- Exposed energized parts are insulated from the employee; and
- When installing insulation, employee installs from a position that does not expose his or her upper arm to energized parts.
- OSHA requires rubber insulating gloves and sleeves be:
- Put on before entering MAD; and
- Not removed until they are outside MAD





#### Electrical Protective Equipment Selection



- When using Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation need unusually high finger dexterity.
- If the voltage does not exceed 250 volts, AC, or 375 volts, DC, using Class 00 gloves, under limited- use conditions, where small equipment and parts manipulation need unusually high finger dexterity.
- Any class glove under limited-use conditions, where small equipment and parts manipulation need unusually high finger dexterity but only if the employer can demonstrate the possibility of damage to the gloves is small and the class of glove used is one class higher than required for the voltage involved.

#### Electrical Protective Equipment Selection



#### Electrical Protective Equipment Selection

#### Blanket Types

- I non-resistant to ozone, made from a high-grade cis-1,4polyisoprene rubber compound of natural or synthetic origin, properly vulcanized.
- II ozone resistant, made of any elastomer or combination of elastomeric compounds.

#### Blanket Styles

- A constructed of the elastomers indicated under Type I or Type II, shall be free of any reinforcement.
- B constructed of the elastomers indicated under

Type I or Type II, shall incorporate a reinforcement; this reinforcement shall not adversely affect the dielectric characteristics of the blankets.



### Electrical Protective Equipment Selection

#### Line Hose Types

- I non-resistant to ozone, made from a high-grade cis-1,4- polyisoprene rubber compound of natural or synthetic origin, properly vulcanized.
- II ozone resistant, made of any elastomer or combination of elastomeric compounds.
- III ozone resistant, made of any combination of an elastomer and thermoplastic polymers, elastic in nature.

#### Line Hose Styles



- A straight style with constant cross section throughout length.
- B connector end style, which is similar to straight style except it has a molded connector permanently
  affixed to one end.
- C extended-lip style with major outward extending lips.
- D extended lip style with major outward extending lips. Has molded connector permanently affixed to one end..

#### Electrical Protective Equipment Selection

Rubber examples:

- Insulator covers
- Cable end caps
- Meter lug covers

#### Polyethylene examples:

- Pole covers
- Pole top covers
- Cross arm guards
- Cross arm end covers



#### Inspection, Testing, and Repairs



Rubber Gloves, Sleeves and Blankets must be electrically tested.

- Rubber Gloves testing intervals not to exceed 6 months
- Rubber Sleeves and Blankets testing intervals not to exceed 12 months.
- · Last test or expiration date should be stamped on equipment .
- Equipment shall not be used past expiration date.

### Inspection, Testing, and Repairs

Equipment with any of the following defects may not be used:

- · A hole, tear, puncture, or cut;
- Ozone cutting or checking (interlacing cracks);
- An embedded foreign object;
- Swelling, softening, hardening, or sticky or inelastic;
- · Any other defect that damages the insulating properties.

Beyond visual inspection, rubber insulated gloves must be air tested to check for leaks. Some jurisdictions require water be used in addition to air during field testing.

- Manual Air Test
- Pinch the cuff closed
- Flip the glove over on itself several times to inflate.
- While holding the seal tight, hold glove against ear to listen for escaping air indicating a puncture or tear.



# Inspection, Testing, and Repairs



Insulating equipment failing to pass inspections or electrical tests may not be used by employees, except as follows:

- · Hose may be used in shorter lengths with defective portion cut off.
- Blankets may be salvaged by severing defective area from undamaged portion of blanket. The resulting undamaged area may not be smaller than 560 millimeters by 560 millimeters (22 inches by 22 inches) for Class 1, 2, 3, and 4 blankets.
- Blankets may be repaired using a compatible patch that results in properties equal to the original blanket.
- Gloves and sleeves with minor physical defects (cuts and punctures) may be repaired using a compatible patch.
- Gloves and sleeves with minor surface blemishes may be repaired with a compatible liquid compound.
- Repairs to gloves are permitted only in the area between the wrist and the reinforced edge of the opening.
- Repaired insulating equipment shall be retested before it may be used by employees.

### Care, Use, and Storage



- Insulating equipment shall be cleaned as needed to remove foreign substances.
- Do not secure with tape. Residue from adhesive backed tape will degrade equipment's dielectric properties.
- Only use nylon cable ties, clean and dry rope, or devices designed to secure equipment, such as clamp pins and buttons.
- Use a dedicated storage bag or container.
- Do not fold, crease or turn inside-out.
- Do not store gloves with wet protectors.
- Keep away from sharp objects and surfaces.



- Light, temperature extremes, excessive humidity
- Ozone or other damaging substances and conditions
- · Tools, materials, and oil, grease, and other contaminants.



#### Planning, Installation, and Removal



When bidding/evaluating work, the following questions need to be answered:

- Can cover be applied by aerial lift, or will the pole need to be climbed?
- Will the condition of adjacent structures and/or conductors support the weight of the protective cover and the force to install it?
- Can a planned outage be scheduled to eliminate the hazard?
- What protective equipment is needed?
- What methods will be used to apply the protective equipment?
- What team members are needed for the methods and cover selected?

### Planning, Installation, and Removal



Installation of protective cover should be performed in a methodical manner as follows:

- Begin by applying cover to the nearest current carrying conductor as the worker approaches, usually the neutral.
- Consider unpinning from spool shackle, lowering and securing to pole if there is vertical clearance
- Cover the first energized conductor. Always cover from Outside In unless standing on a pole, then cover inside conductors to outside phase conductors.
- Continue until all energized conductors in the work area are covered before installing cover on path to ground and differences of potential.
- Cover all paths to ground in work area.
- · While performing task, uncover only enough to do the work.
- Install a blanket over line hoses if likely to come in contact with any line hoses for a second layer of protection.

Review Questions
1. Which material is a conductor?
a. Air
b. Rubber
c. Copper

#### Review Questions

2. Which factor is NOT considered when calculating MAD?

a. The time of the year

b. Nominal Voltage

c. Altitude

#### Review Questions

- 3. What's the maximum interval at which rubber gloves should be electrically tested?
  - a. Intervals not to exceed 12 months
  - b. Intervals not to exceed 6 months
  - c. Intervals not to exceed 18 months

#### Review Questions

4. When planning, which is NOT a question that needs to be considered?

 $\ensuremath{\mathtt{a}}$  . Can cover be applied by aerial lift, or will the pole need to be climbed?

b. What color PPE is needed?

c. Can a planned outage be scheduled to eliminate the hazard?