

TITLE: 2930 MARK STANDIFER'S ELECTRICAL SAFETY BRIEFING

19 MINUTES

PRODUCTION YEAR: 2009

PROGRAM SYNOPSIS:

With nearly 40 years of experience as an electrician, Mark Standifer delivers powerful seminars on the shock and burn hazards associated with electrical work. As a survivor of an arc flash incident, Mark knows the pain and suffering associated with electrical and arc flash injuries. In this live presentation, he stresses the importance of thinking about what we are doing and being aware of all shock and burn hazards when performing electrical job tasks. Mark also makes the point that we must always wear the PPE and FR rated clothing required by the NFPA 70E to protect ourselves from any mistakes that we may make. Viewers will also learn unforgettable lessons about electrical safety from stories about Mark's incident and his friend's electrocution.

Topics include information found on arc flash/electrical hazard warning labels, the importance of wearing appropriate voltage rated gloves and FR rated clothing, the hazards of wearing cotton and synthetic clothing and why all jewelry must be removed when working on electrical equipment.

SHOOTING LOCATION: A studio where electrical equipment surrounds a stage and chairs for audience members

PROGRAM OBJECTIVES: After watching the program, the participant will be able to explain the following:

- What information is found on an arc flash/electrical hazard warning label;
- Why we must wear the appropriate voltage rated gloves and FR rated clothing when performing electrical work;
- Why we shouldn't wear cotton and synthetic clothing around electrical hazards;
- What mistakes were made that led to Mark's incident and his friend's death;
- Why all jewelry must be removed when working on electrical equipment;
- Why we must think about what we are doing when undertaking electrical job tasks.

INSTRUCTIONAL CONTENT:

AN ARC FLASH COULD CHANGE YOUR WHOLE WORLD IN THE BLINK OF AN EYE

- Personal protective equipment, PPE (that's what the acronym stands for), but it also stands for partially-protected employee.
- What he means by this, Mark says, is that you can wear all the equipment he discusses in this program and if you're involved in an arc flash, there's no guarantee you're going to walk away without having a burn.
- "We're not talking about a little, tiny arc," he adds. "We're talking about a tremendous arc that can come up to 36,000 degrees F in less than one-tenth of a second."
- "Basically, we'll look at in cycles; we're talking six cycles or less," says Mark. "So 60 cycles in a second, so we are talking about a very short period of time."
- "A blink of an eye—and in that blink of an eye, your whole world could what? Change," he says.

FIRST, SECOND & THIRD-DEGREE BURNS

- FR rated clothing, face shield and "all that stuff" is designed to prevent a third-degree burn, according to Mark. "You still may receive a burn, but hopefully it's second-degree or less."
- A second-degree burn is curable burn that is characterized by blisters, while a first-degree burn is a sunburn, he notes.
- "Third-degree is total destruction of the skin and you're going to need skin graft surgery," says Mark. "So all of this stuff (PPE) we have up here on the stage for you is designed to prevent that third-degree burn."
- "One calorie, 1.2 calories is enough to burn your skin, second-degree, in one-tenth of a second or six cycles. Now, that's a blink of an eye," Mark adds.
- When your skin's temperature is raised to 176 degrees F, you have a second-degree burn; 1.5 calories per centimeter squared is enough energy to burn you third-degree.
- A third-degree burns "raises your skin temperature to 205 degrees F in one-tenth of a second. It destroys the nerve endings, the sweat glands and you're facing skin graft surgery; and, you're fighting to survive."

ARC FLASH/ELECTRICAL HAZARD WARNING LABELS

- Mark shows members of the audience an arc flash/electrical hazard warning label that they "will see around the plant. Many of you are going to start seeing; some of you already have them done," he says.
- "Across the country," he continues, "there are companies actively involved in performing an arc flash study in accordance with the NFPA 70E and the IEEE Standard 84."
- As a requirement of the National Electric Code, these labels are put on the equipment "where a qualified person who has received safety training on the hazards involved can pick out what he or she needs to wear to prevent that third-degree burn," says Mark.

THE ARC FLASH HAZARD BOUNDARY

- The first thing to look at on the warning label when selecting FR rated clothing and PPE is the flash hazard boundary.
- In the first case Mark discusses, the boundary is three feet, four inches, which he says is not safe. "If I'm standing three feet, four inches away and there's an arc flash on a piece of equipment, I could still receive a second-degree burn on unprotected skin."
- He adds that any closer than three feet, four inches and that same unprotected skin will get a third-degree burn. "So I must have on the proper PPE, the FR rated shirts, or pants, or suit or whatever it might be in order to cross that flash protection boundary."
- "So when we look at these pieces of equipment that we're talking about, the coveralls, the shirt, the flash suits, we have to look inside and understand the labels that are in there are information labels to tell us what they're rated for," notes Mark.

PROTECTION REQUIRED AT A TYPICAL WORKING DISTANCE

- The next entry on the label indicates that there are 4.9 calories per centimeter squared of energy at 18 inches. "That 18 inches is a working distance, or from your chest to the equipment, and it doesn't consider any door that happens to be in the way," says Mark.

- "So if we get closer (than 18 inches), the calories would go up exponentially." He adds, "If we get further way, the calories go down exponentially."
- Mark asks the audience that if 1.5 was enough to burn us third-degree, what 4.9 could do. "So we have to wear clothing that says in the label of the clothing that it meets or exceeds that 4.9."
- "The NFPA 70E has set up categories for us where we know what the calorie ratings are based on the hazard risk category of the NFPA 70E and they've really made it quite simple for us to follow," he says.

WEARING GLOVES TO PREVENT ELECTRIC SHOCK

- The next section on the warning label lists the voltage level; in this case, it is 4.8 KV or 480 volts. Mark says that we must avoid shock and understand there are actually three hazards: the shock, the arc and the blast.
- The shock always comes first and while you can be burnt to a crisp and still live, if you're electrocuted, you're dead, according to Mark. "It might make a difference between open casket and a closed casket, but guess what? You're still where? At your funeral."
- To prevent us from being shocked, we must wear voltage rated gloves and use voltage rated tools, notes Mark. (Type 00 gloves are rated for 500 volts, type 0 for 1,000 volts, type 1 for 7,500 volts and type two for 17,000.)
- "These gloves must be tested every six months by an independent certified laboratory," Mark says, "and they must be tested and checked every time you use them for air leaks or any other kind of defects in the glove."
- The leather protector that is over the glove is not a work glove and must stay with the glove, according to Mark. It is not a work glove and you cannot go out and perform work with it on and then put it back on your rubber glove because it will contaminate it.
- "A small pinhole in this rubber glove will get you killed. Electricity will find it," continues Mark. "So we have to do a good job of inspecting the glove before we use them."

MARK'S FRIEND'S FAILURE TO WEAR GLOVES RESULTS IN HIS ELECTROCUTION

- Mark's friend was a mechanic who was cross-training to become an electrician. He was asked to hook up a cable to a portable generator that a contractor was going to use the following morning.
- "He went out and hooked up some cable to it and he didn't check back the motor control center, but back of the motor control center, the circuitry was telling him that there was a ground fault," Mark says. "And he had wired one of the phases to ground." He didn't check that, so he wasn't aware of it and went home.
- The next morning, when his friend went back to work, they asked him to go troubleshoot the generator because the contractor was complaining they were getting shocked off of it. So he did.
- "He took his two supervisors with him. He's got his voltmeter," adds Mark. "He's supposedly got on his PPE he's supposed to have on."
- "He's sticking the voltmeter everywhere he can possibly think of to get some kind of measurement, but he's getting pretty frustrated," Mark continues. "Once again, he doesn't have the training or the background."
- Possibly because his supervisors looking over him increased his frustration level, his friend grabbed the plug where the cable connected to the generator that was going to the motor control center and pulled it apart.
- "When he pulled it apart, that plug was energized; he became the new path, hand to hand. That's a very dangerous path because it goes where? Right through the heart," says Mark.
- His friend was electrocuted in front of the two supervisors, who could do nothing because the disconnect was too far away. He left three small, young children and a young wife.
- "Where was his gloves, you think?" asks Mark. "Right here on his belt. If he'd been wearing the voltage rated gloves, he'd still be with us. If he'd been wearing the voltage rated gloves, his family would still have who? Daddy still would've been here."
- Mark concludes, "It's a tragedy when we hear about stuff like that, and it's even more so when it hits home and it's somebody you know."

GLOVES MUST BE WORN TO PROTECT AGAINST MISTAKES

- Prior to his friend's death, Mark says he complained about wearing gloves because he had gone 22 years without wearing them. He stopped complaining after the accident and started wearing them no matter what.
- "I don't care if I'm sweating; I don't care if I can't handle the screw or not," he says. "I'm not leaving my children or my wife and I hope you don't either, like he did."
- His friend's gloves were found attached to his belt when they should have been on his hands, according to Mark. "Now you can't fix mistakes sometimes. Pulling the cannon plug apart, yes, that was a mistake."
- "What was he trying to do? Fix the problem, and in desperation he did that," Mark continues. "Had he had on the gloves, at least that would have protected him against what? The mistake that he made."
- If you can't handle wearing gloves because a wire's too small, you've lost too much dexterity, you don't like the sweat in your gloves or any other reason, then you need to shut the equipment down, says Mark. "When you've shut it down and proved that it's de-energized, you can then what? Take the gloves off and work it as a de-energized piece of equipment."

COTTON CLOTHING IS NOT ADEQUATE

- Over 80 percent of all electrical injuries are due to ignition or flash burn, arc flash, the ignition of flammable clothing—cotton, according to Mark. "I know you've heard, 'just wear 100 percent cotton. That's all electricians have to do.' One hundred percent cotton is not adequate."
- Cotton is only adequate for Category Zero, which is a minimum job task and minimum energy levels, Mark adds. "Once you get to the Hazard Category One, everything changes. Hazard Category One and above, we must have on FR rated clothing, not cotton."
- "You can have cotton on underneath, but the outside layers have to be FR rated," says Mark. "So, cotton itself is not that good of protection."

MELTED SYNTHETIC CLOTHING SEVERELY WORSENS SKIN BURNS

- We don't wear rayon, nylon, polyester, acetate or any other type of synthetic blend that will melt into our skin under an arc flash condition because that will worsen the damage to your body, Mark says.
- "Wearing a polyester shirt alone will cause a third-degree burn, even if the surrounding temperature is not that high of a level to create a third-degree burn," notes Mark, "because it dissolves into your skin and destroys everything."
- These materials have been strictly prohibited by OSHA since 1995, he adds. "I still travel around the country today, and here it is 2009, and we still have people who have never heard of what we're talking about. It's amazing."
- We can't wear the nylon windbreaker we got for a safety logo last year on the back of our shirts in the substation, says Mark. "That will get you what? Burnt severely; okay, so we can't do that."

BURN CENTERS ARE PAINFUL PLACES

- Arc temperatures reach temperatures of 35,000 degrees F, 20,000 degrees Kelvin. "And it does it how fast? One-tenth of a second," says Mark.
- "Over 2,000 people are admitted to burn centers with severe electrical burns each year," he notes. "As far as I'm concerned, that's 2,000 too many."
- "I don't know if you've ever been to a burn center, but it is one of the most painful places that you could possibly visit. Bless those people that work there, but I tell you what, you don't want to be there as a patient," Mark says.
- When he looks at the NFPA 70E, he does his best to follow it the best he can. "Will I make mistakes? Yes. Everybody here is capable and will make a mistake, but hope that when you make that mistake you are covered by the proper PPE so that mistake doesn't turn into a major tragedy," Mark adds.

SERIES OF MISTAKES LEADS TO MARK'S SEVERE INJURIES

- When showing a slide of Mark's own injuries that resulted from an arc flash incident, he advises audience members to "think about what you're doing; question about what you're doing; understand what you're doing. Know if you're doing it the right way or the wrong way. If you don't know, find out."
- Mark says he isn't there to share about some textbook with the audience; he's there to share with them from his heart what happened.
- "I was involved in a 7,200-volt arc flash on a high voltage switch...I was working on a job and it was my task to take care and get all that equipment up and running and I made a few mistakes, very costly mistakes," he says.
- The first mistake he made was opening the switch that morning without looking inside to verify all three blades were open, according to Mark. "As you can see, that equipment has windows where you can what? Look through."
- Not doing a zero-energy check was his second mistake, he notes. "Somehow, and I don't know how, my mind just blanked out, but somehow I got across 7,200 volts. It went in my right leg and blew out where I was sitting on my toolbox."
- Mark was wearing a 65 percent polyester, 35 percent cotton short sleeve shirt. "The down portion of my body was exposed and it was burned second-degree," he says. "Where the shirt was, was third-degree. So the polyester had melted into my skin or diffused in my skin and created the third-degree burns."
- His belt buckle got so hot from absorbing the heat energy that it burned a big hole in his stomach. "It was very difficult to get that patched up and get a skin graft done," he adds.
- Even though he wore a rubber watch, the metal back absorbed enough heat energy to burn a quarter-inch into his skin and required more skin grafts, according to Mark.
- "My wedding ring I had on, they were able to remove the wedding ring so I didn't have to lose my finger. It was just very fortunate I didn't," he concludes.

ALL JEWELRY MUST BE REMOVED WHEN WORKING ON ELECTRICAL EQUIPMENT

- "So when you go to work on electrical equipment, what are the number one rules we talk about?" asks Mark. "Remove all what? All jewelry; I mean that includes everything."
- While he used to just say remove your rings and watches, Mark says he now has to go through a whole list of stuff. "Now, it's earrings, nose rings, cheek rings, eyebrow rings, you know, tongue rings. I mean anywhere you've got a ring, take it off."
- Jewelry must be removed because it will absorb the heat energy, he adds. "It can be a conductor and cause a short, but the biggest part is it will absorb the heat energy. And then it's going to what? Dissipate that heat energy into your body...Your body is not capable of handling that."

MARK'S ARDUOUS RECUPERATION FROM HIS BURNS

- Mark was blown 45 feet away from the switch gear, wearing the polyester shirt. "I didn't get any part of that shirt back," he says. "Most of that shirt was inside my skin and on the door of the switch gear I was working on."
- The doctors had to scrape all melted polyester out of his skin when he got to the burn center, where he spent four months, according to Mark.
- "I spent a year at home recuperating, wearing job skins," he continues. "I learned a whole lot about skin I didn't know before. That's not a good way to learn about it."
- "Job skins are to help you out because all three layers of your skin are destroyed and your muscles will begin to knot up if they don't have some kind of structure to them," says Mark. "They give you job skins, which are like an ace bandage if you will, that I put on my upper torso every day for about a year, so my skin could recover and regain its strength once again and take over its job."
- He adds that all his nerve endings are gone. "Now, I could feel if somebody touched me, but I can't feel the hot or the cold. You could drop ice cream on my chest or a cigarette, but I wouldn't be able to tell you the difference."

WE HAVE TO THINK ABOUT WHAT WE'RE DOING

- Mark says that he's not telling his story so anyone will feel sorry for him. "In fact, I'm one of the very fortunate people. I travel around the country with men who have been hit with 7,200 volts and don't have arms and legs left."
- "I share this story as often as I can and I will continue because I want you to understand that we have to think about what we're doing," he notes.
- "You're not going to hurt somebody's feelings by asking them, 'Is this the right way? Are you sure she should be doing it? Show me the specifications; show me the drawings. I want to make sure what we're doing here is the right thing'," says Mark.
- "Nobody is going to laugh at you if you stand up for safety," he adds.
- Mark tells the audience that he hopes they have gotten something "really strong" out of the program. "That's my heart; that's what I hope. From the arc burns, the best advice I can give you is think about what you're doing."