Volume 03 | June 2014 | A Westex Publication

FLAME RESISTANT INSIGHTS℠

The source for arc flash and flash fire news

NFPA 70E® and OSHA Electrical Standards:

Who Do They Apply To?

By Wes Wheeler, Director of Safety, NECA

The Power of Knowledge:

WHY ONGOING SAFETY EDUCATION IS CRITICAL IN THE ELECTRICAL INDUSTRY

Walked Away Without Injury

2014 Hilgeman Group Arc Flash Incident Report with Security Camera Footage

PLUS:

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Welcome Letter

We are very proud to announce that Westex has recently been acquired by Milliken & Company. Milliken is a family-owned company and has been named one of the World's Most Ethical Companies by the Ethisphere Institute for eight consecutive years. This commitment to values and ethics will be the foundation from which we will continue to serve the FR industry.

Together, Milliken and Westex create an unprecedented ability to provide the most innovative flame resistant/arc-rated fabrics for the industry. As we look to the future, you will find that this acquisition gives us an even broader reach to help provide FR fabrics for the millions of global industrial workers who need protection from arc flash, flash fire and other thermal hazards.

Above all, this acquisition will benefit you, our customers. Milliken's vast resources and innovative R&D capabilities, coupled with Westex's long-standing, deep knowledge of the FR marketplace, will enable us to innovate faster and deploy even better products with added comfort, durability and protection.

This third edition of Flame Resistant Insights eZine continues our commitment to safety education and training. We are honored to be associated with industry partners that share this passion such as NECA, IBEW and NJATC, which are highlighted in this issue.

The first article highlights a real-life arc flash accident that resulted in a save. Fortunately, the worker was wearing the proper PPE, including flame resistant clothing, so he was able to return to his family at the end of the day.

We hope you enjoy this edition of Flame Resistant Insights and please do not hesitate to contact any of us here at Westex by Milliken if you have any questions.

Sincerely,

Michael P. Enright
Vice President Milliken FR Fabrics

Incident Report:

Walked Away Without Injury

LIVE ARC FLASH
CAUGHT ON CAMERA

By Nate McGarrh
Arc Flash Team Leader,
The Hilgeman Group, Inc.
www.thehilgemangroup.com

In 2010, a manufacturing company hired The Hilgeman Group, Inc. to implement their arc flash safety program. Our firm performed the hazard assessment and arc flash labeling of all of their electrical equipment. We also performed their qualified-level arc flash safety training for all maintenance and technical employees.

THE HILGEMAN GROUP

Based on the hazard assessment, we were able to assist the client in determining which personal protective equipment (PPE) was most appropriate for their specific needs. We recommended that the client provide FR/AR garments manufactured with Westex UltraSoft® fabric because of the comfort and reliability of the material. The garment worn by the employee involved in the arc flash incident was in fact manufactured with UltraSoft® fabric, which performed exactly as expected. The UltraSoft® fabric allowed the employee to walk away from the arc flash event without injury.

Note: Information from the report has been redacted to maintain confidentiality.

Industrial Arc Flash — Accident Investigation Report #21014

Company:
[redacted]

Industry Sector:
Plastic Components

Date of Accident:
February 5, 2014

Electrical Enclosure:
480V Control Panel

Employee(s) Involved:
Maintenance Employee (1)

Employee Info:
45-year-old Caucasian male. Employed at [redacted] since 2007.

Fatality:
No

Personal Injury:
No

Hospitalization:
No

Purpose of Investigation:
Legal/Risk Management

Description of Operations:
Light manufacturing operations. Company founded in 1975. Two production shifts per day. Currently employs approximately 150 full-time employees. The operations are contained to one facility, which is approximately 150,000 ft^2,including warehouse and office space.

continued on next page

Industrial Arc Flash — Accident Investigation Report #21014 *(continued)*

OSHA Involvement:
OSHA has visited the facility once since the incident. Their review of this incident is ongoing. No OSHA penalties are anticipated due to the fact that the client's Electrical Safe Work Practices program protected the employee from bodily injury.

Executive Summary:
On February 5, 2014, [redacted], a maintenance employee at [redacted], opened a 480V control panel in an effort to troubleshoot a performance issue with a piece of industrial equipment. The employee first proceeded to measure line-side voltage with his Fluke® digital multimeter. The line-side voltage measured 480V. The employee was then preparing to perform a series of troubleshooting tasks. However, prior to taking any additional voltage readings, an arc flash event occurred. Employees, who were in a neighboring department, heard the blast, but did not actually witness what the maintenance employee was doing at the time of the incident.

The incident energy produced by the arc flash, estimated to be approximately 5 cal/cm², hit the employee, who was approximately 20" away from the arc gap. While the employee was temporarily blinded from the intense light energy emitted from the flash, no tissue damage or burns occurred.

At the time of the arc flash event, the employee was wearing the required PPE, which consisted of Hazard Category 2 arc flash garments, arc rated hardhat with face-shield, balaclava, safety glasses, hearing protection and leather footwear.

The employee was also wearing class 00 voltage-rated electrician's gloves with leather protector gloves.

Our investigation determined that the root cause of this arc flash was the failure of a 30 amp fuse located in a common fuse housing. The fuse failure, and the accumulation of dust on the conductors, caused a cascading event across the entire fuse housing.

A formal recommendation has been made to the client to implement the following safety actions as soon as possible:

Ensure all knockouts and other openings are properly closed on all electrical enclosures to minimize the accumulation of dust, and

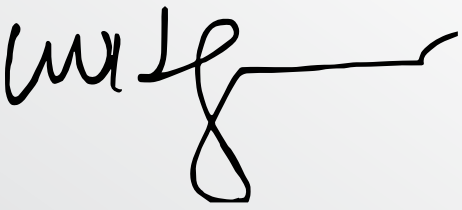
Ensure that the doors of the electrical enclosures properly close and latch, and

Ensure that all qualified employees, who perform live electrical tasks, establish an arc flash boundary (e.g. caution tape, etc.) to minimize the risk of injury to fellow employees.

Note: On the security camera image (above) the maintenance employee failed to establish an arc flash boundary.

The formal investigation report has been submitted to [redacted], Safety Director.

Respectfully submitted,



Larry W. Hilgeman, MSc
President
The Hilgeman Group, Inc.

"Our investigation determined that the root cause of this arc flash was the failure of a 30-amp fuse located in a common fuse housing. The fuse failure, and the accumulation of dust on the conductors, caused a cascading event across the entire fuse housing."

Arc Flash 7.1 cal — Slow-motion test footage depicts an arc flash similar in nature to the one described in this accident investigation report.

Incident Report Instruction:

A formal recommendation has been made to the client to implement the following safety actions as soon as possible:

- Ensure all knockouts and other openings are properly closed on all electrical enclosures to minimize the accumulation of dust
- Ensure that the doors of the electrical enclosures properly close and latch
- Ensure that all qualified employees who perform live electrical tasks establish an arc flash boundary (e.g., caution tape, etc.) to minimize the risk of injury to fellow employees

Note: On the security camera footage, the maintenance employee failed to establish such an arc flash boundary.

westex.com/where-to-buy/

WHEN YOU KNOW YOU WANT WESTEX, START HERE.

FLAME RESISTANT INSIGHTS™

Easier than ever to find garments made with the fabric you want

You know the importance of the right fabric in protecting your people from arc flash and flash fire hazards, so you start by specifying Westex. Now, our new “Where to Buy” page makes it easier than ever.

Discover which suppliers in your region use Westex fabrics, and see which garments they offer.

ASK WESTEX

"How many washes can FRC take before it is considered to have lost its rating?"

David, Massillion, Ohio

Answer: David, I assume by "rating," you are concerned about how long the garment will maintain its flame resistance. If so, the number of washes depends on which brand of flame resistant fabric was used to construct the garment. The flame resistance of some fabrics may be guaranteed for only a certain number of launderings such as 25, 50 or 100 industrial launderings. Other fabrics are guaranteed for the life of the garment, and some fabrics have no guarantee at all. With the increasing number of flame resistant fabrics in the marketplace, it is important to make sure that your garment is made with fabric guaranteed flame resistant for the life of the garment. It is also important that you properly wash your flame resistant clothing. Click here for the complete laundering guide for Westex brand fabrics.

Bill Rieth
Westex Northeast Market Manager

HAVE A QUESTION OF YOUR OWN?

Submit it to insights@westex.com
or contact the regional manager in your area.

"What FR fabric best prevents heat stress?"

Mark, Albuquerque, New Mexico

Answer: Mark, there is not a single layer, breathable woven or knit fabrics, FR or otherwise, that is a significant factor in heat illness. The primary causes of heat illness are poor hydration, lack of rest breaks, lack of shade, poor health and multi-layer or non-permeable fabric systems. With that said, NIOSH and OSHA both advise wearing light-colored, loose-fitting, breathable clothing such as cotton. Avoid non-breathing synthetic clothing. Notice it is light color — not light weight — that actually makes a big difference, as dark colors tend to be hotter.

Jeff DuLong
Westex Western Market Manager

"Can you use bug repellent with FR clothing?"

John, Houston, Texas

Answer: Great question, John. When applying insect repellents to garments, a waterborne, Permethrin-based insect repellent has been shown in testing to not have an adverse effect on flame resistance. However, Westex does not recommend the use of DEET or DEET-containing insect repellents on any flame resistant fabrics. DEET and DEET-containing insect repellents can be flammable, and therefore, have an adverse effect on the flame resistance of FR garments. It is important to note that DEET and DEET-containing insect repellents do not remove or destroy the flame resistance of fabrics, but they mask it. Once the garment is laundered and the DEET and DEET-containing insect repellents are removed, the flame resistance is still intact.

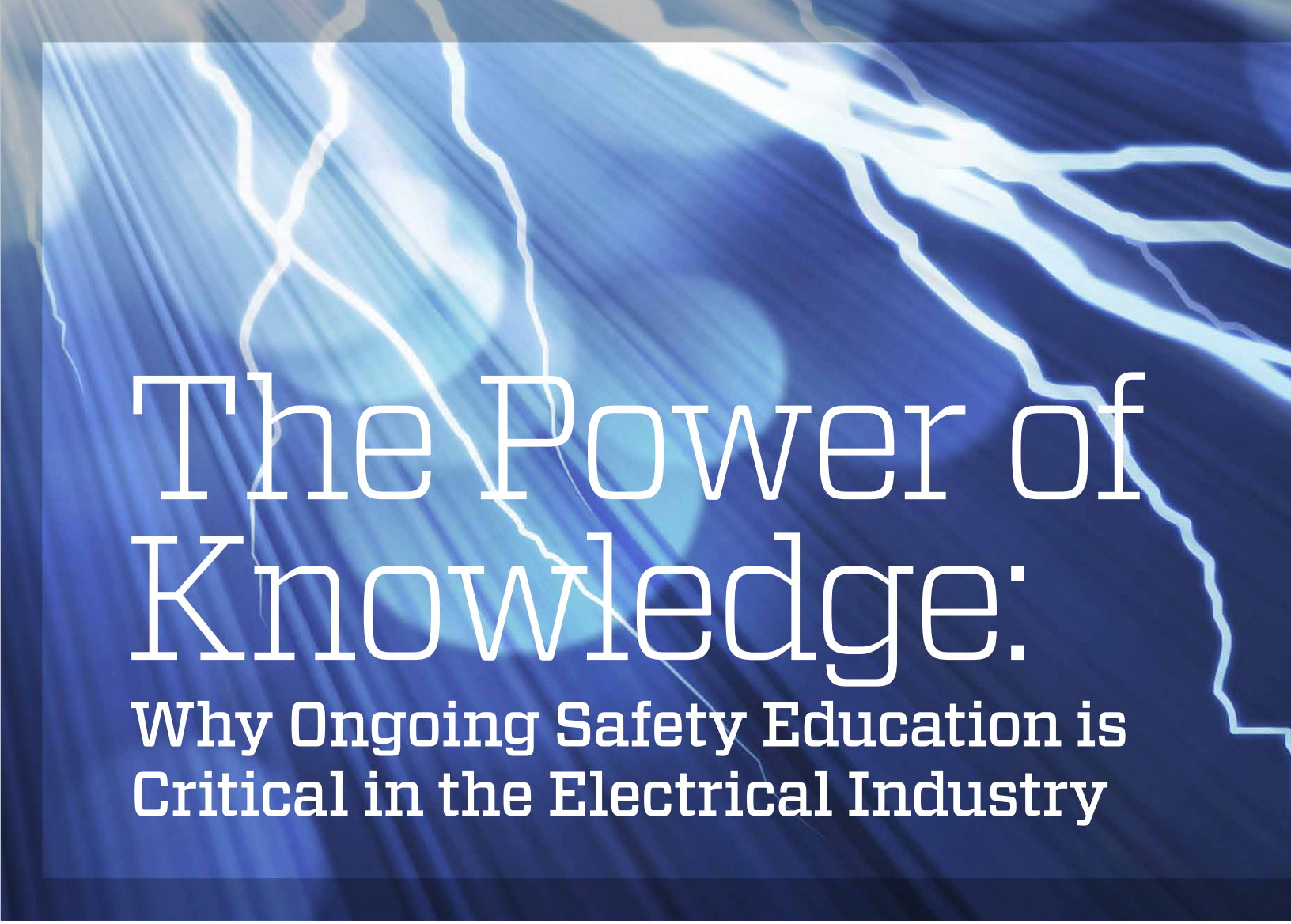
Howard Merner
Westex South Central Market Manager

In the third issue of Flame Resistant Insights, we wanted to focus on the electrical market and three organizations that are major contributors to the standards and best practices used in the industry today. The National Electrical Contractors Association (NECA), the International Brotherhood of Electrical Workers (IBEW), and the National Joint Apprentice Training Committee (NJATC) have been instrumental in the creation and continued development of standards like NFPA 70E, NESC and OSHA 1910.269. Their development of best safety practices and training has been shared globally, and has made a major impact on the safety of electrical workers everywhere.

Westex is proud to be in its sixth year as a Premier Partner of NECA, an eight-time Platinum Training Partner of the NJATC, and longtime Partner in Safety of the IBEW. All three organizations have been major consultants and collaborators in Westex's efforts to provide the best electrical hazard education and arc rated fabrics to the global market. There is still a tremendous amount of training and education to be done, and we look forward to following the lead of these world-class organizations as electrical safety continues to advance.

Please help us support the training efforts of America's current and future electrical workforce by "Liking" us on Facebook.

For every "Like" Westex receives, we will donate $5 to the NJATC.



The Power of Knowledge:

Why Ongoing Safety Education is Critical in the Electrical Industry

NECA

IBEW — NECA
SKILL
ATTITUDE
KNOWLEDGE
NJATC
FOR THE ELECTRICAL INDUSTRY
APPRENTICESHIP & TRAINING

AFFILIATED WITH
INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS
ORGANIZED NOV. 28, 1891
AMERICAN FEDERATION OF LABOR & CONGRESS OF INDUSTRIAL ORGANIZATIONS & CANADIAN LABOUR CONGRESS
REG. U. S. PAT. OFF.

FLAME RESISTANT INSIGHTS™

The electrical industry is constantly changing, developing and expanding. The term “electrical revolution” has been used to describe what the near future holds with advancements in renewable energies, new demands on electrical infrastructures and a shift in energy generation. In the U.S., electrical contracting is an industry made up of over 70,000 firms employing over 650,000 electrical workers. Three organizations at the core of the industry are the National Electrical Contractors Association (NECA), the International Brotherhood of Electrical Workers (IBEW) and the National Joint Apprentice Training Committee (NJATC).

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NECA/IBEW/NJATC handle all electrical needs, including power supply, fiber optics, telecommunications, security systems, wireless networks and lighting. Now all three are leaders in the development and implementation of solar and wind energy generation, building of the smart grid, charging stations for electric cars, and data centers. While the industry is changing and advancing, one core principal that all three organizations have been built upon and stand behind is safety.

Long involved in the creation of electrical standards and best practices, today, NECA/IBEW/NJATC are leading the way in the development and education of safety standards and best practices. This comes from the commitment of the leadership of all three organizations at the national, regional and local level to invest in the time, money and resources to develop the highest quality training and education for their members — and then share it with anyone with the best interests of worker safety globally.

What drives success in safety, just as in any other industry or business, is the ability to innovate and adapt to the current environments. NECA/IBEW/NJATC are doing that in many different ways by using traditional methods of education and training and then investing in the newest learning and training technologies. At the heart of this is the NJATC. The mission of the NJATC is to develop and standardize training to educate the members of the International Brotherhood of Electrical Workers and the

Additional Resources:

Electric TV:
NJATC Training Centers Benefit Unions and Customers

National Electrical Contractors Association. Over the past 70 years, the NJATC has used traditional methods of education such as classroom training, textbooks and workbooks, and hands-on learning to train hundreds of thousands of apprentices and journeymen.

The NJATC will be celebrating the 25th anniversary of the National Training Institute (NTI) this summer. NTI is an annual week of training that offers a variety of educational and training opportunities to meet the rapidly changing demands of the electrical industry. Started by the NJATC, NTI is one of the oldest training and safety conferences specific to the electrical industry.

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"It is an incredible atmosphere during the week of NTI. It is not simply the NJATC delivering train-the-trainer courses for the electrical industry, but it is also the camaraderie between 1500 NJATC instructors, training directors, contractors, committee members and training partners. The week of NTI is unmatched in any other venue of an electrical training conference. In addition to the many electrical trainers, nearly 35 professors (Ph.D. and Ed.D.) from various U.S. universities provide classes in the field of adult training. Each of these professors state that the energy the participants bring to NTI is at a level they have never experienced in any other training environment."

Michael Callanan, NJATC Executive Director

IBEW Hour Power: NTI 2013 — Blended Learning

Part of the success of NTI is the opportunity to understand the needs and challenges of training tomorrow's electrical workers. A solution to one of the challenges is blended learning — a mix of Internet-based instruction and traditional, face-to-face class time. It's the first of its kind in the nation, and it's turning the heads of owners who demand the very best from their labor force. Blended learning is a new, two-tiered approach to the training of IBEW apprentices. Including online tests, workbooks, flash-based animations and more, the program relies on Internet technology to bring students and instructors together across long distances, helping them learn at their own pace, and helping the instructor target lessons to get the maximum benefit out of class time.

"Blended learning is the new NJATC approach to training for this generation of electrical worker. Blended learning is a new active classroom approach with extensive media-enriched online homework. The instructors utilize system-generated reports of the student's online activities (including assessments), and each week, mold an exact lesson plan for classroom training. The BETA testing NJATC Training Centers have all agreed that the time in the classroom is greatly improved in efficiency, and now allows more time devoted to hands-on activities in the labs and with industry training partners."

Bill Ball, NJATC Director of Inside Curriculum and Electronic Media

NECA is building upon the success and momentum of NJATC's efforts to make sure NECA contractors have the tools and knowledge to successfully implement safety programs. Under the guidance of Michael Johnston, in just the last few years, NECA has bolstered the safety culture of the organization starting with the Safety Professionals Conference. The NSPC provides up-to-date information on regulation, compliance, management techniques and standards development that impact safety and health in the electrical construction industry. This conference not only offers the most current technical sessions, but also provides networking opportunities among peers in the business.

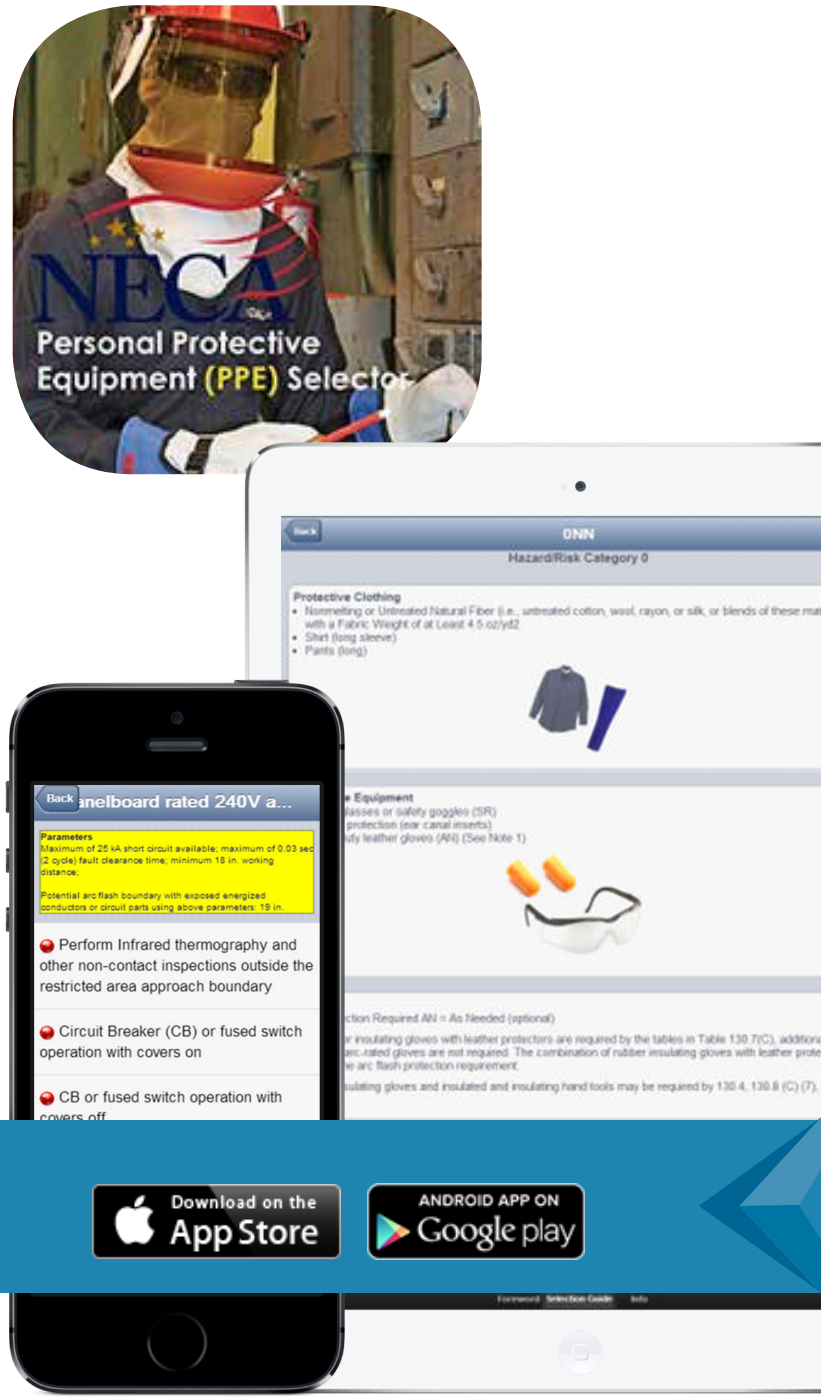
NECA is also using technology to help their contractors and IBEW workers. One is an old teaching method delivered in a new way — Q&A. NECA's Code Question of the Day (CQD) is Charlie Trout's flagship National Electrical Code® forum for NECA and the industry. The CQD continues to generate a lively dialogue and relative code-based and practical responses to an ever-increasing and interactive audience.

The National Electrical Code is the bedrock of the electrical construction business.

Do you know all the ins and outs of the code? NECA and Electrical Contractor magazine are pleased to present their daily online feature, "Code Question of the Day."

"Safety is a shared responsibility between employers and employees, and this is the foundation upon which NECA's safety policy is built. As electrical industry leaders, we have no greater responsibility than the safety of our people; they are our greatest asset. Whether it's electrical construction in buildings, or transmission and distribution work on the grid, NECA understands the value of a productive and safe workforce. In the last couple of years, NECA's Safety Awards program has doubled in volume this year and nothing pleases us more than to see our members being recognized for outstanding safety performance."

Michael Johnston, Executive Director of Standards and Safety for NECA



See the NECA Personal Protective Equipment (PPE) Selector App

Download on the App Store

ANDROID APP ON Google play

A newer use of technology is the launch of its latest mobile application, NECA Personal Protective Equipment (PPE) Selector, based on the 2012 edition of the National Fire Protection Association (NFPA) 70E Standard for Electrical Safety in the Workplace. The application:

- **Provides field and office personnel with safe work practices**
- **Helps determine proper PPE for your job.**

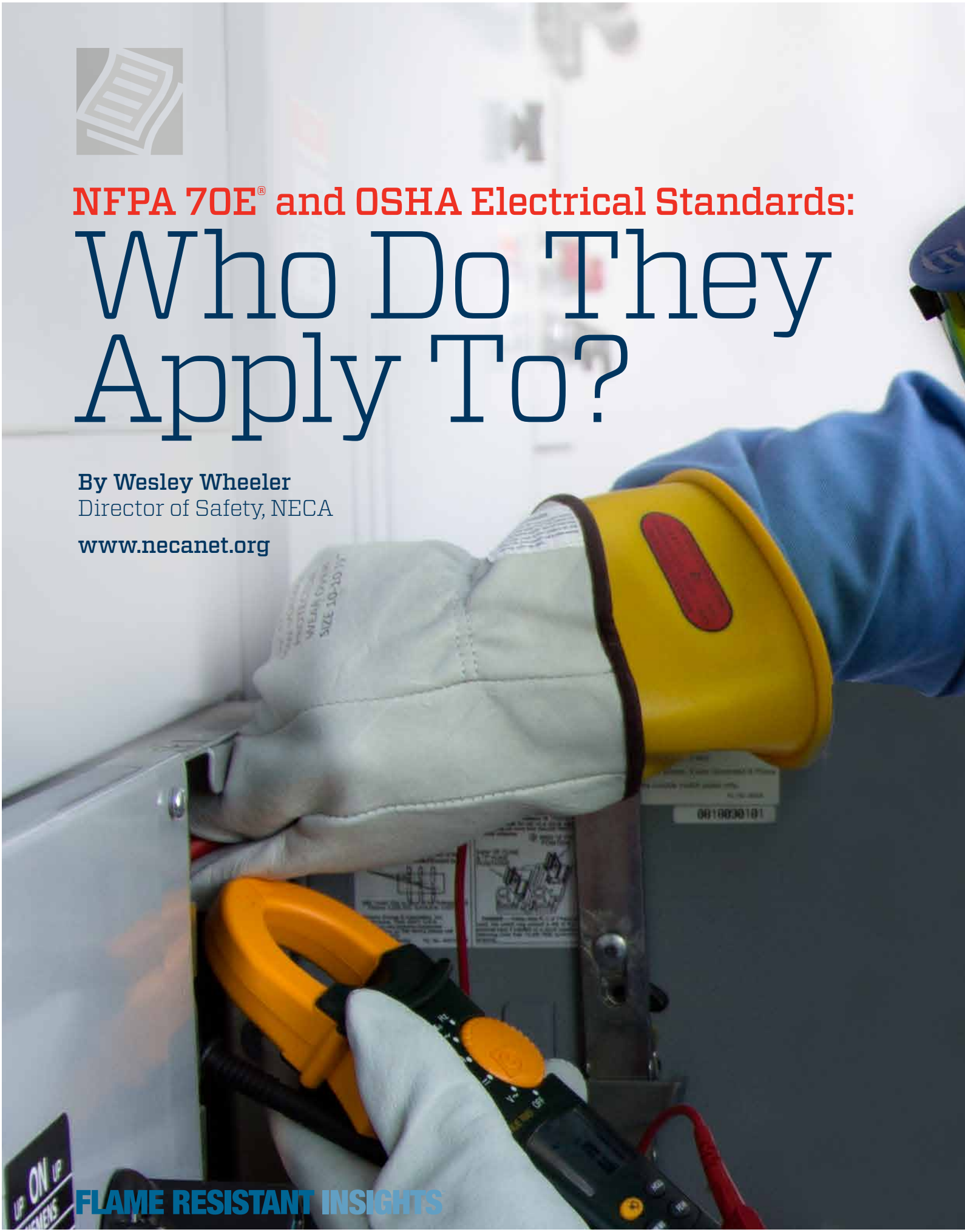
As the "electrical revolution" begins, NECA, the IBEW and NJATC are leading the way in the continued development of electrical standards, innovating on new training and teaching methods, and using technology to bring safety to the job site. Their influence on how the electrical industry operates today and in the future is unsurpassed.

NFPA 70E® and OSHA Electrical Standards:

Who Do They Apply To?

By Wesley Wheeler
Director of Safety, NECA

www.necanet.org



We often hear contractors, maintenance workers, HVAC technicians and residential electricians say, "NFPA 70E doesn't apply to me." The regulations that were developed by OSHA and the requirements developed by the consensus standard NFPA 70E® were created with all these trades in mind. OSHA applies to almost every worker in the USA, and NFPA 70E applies to nearly all people who perform electrical work such as installing, troubleshooting, testing and commissioning — except those specifically excluded in the scope.

Watch the webinar: NFPA 70E® Standard for Electrical Safety in the Workplace

Presented by Wes Wheeler, Mike Johnston, Jim Dollard and Joe O'Conner

Workers performing construction and maintenance on residential properties are not excluded from electrical regulations, including OSHA 29 CFR 1910 and 1926 Standards. As home designs and sizes increase, larger electrical services are needed to meet today's energy needs. It is no longer just about installing lights and receptacles in residential dwellings. Energy management systems, security and fire alarm controls, and larger heating and air conditioning equipment require additional training and safeguards for proper installation and operation. Electrical utilities that supply these homes now have larger capacities that result in higher fault currents, and thus both greater risk of arc flash, and higher incident energies when they occur. It's not just higher voltage commercial and industrial installations that pose hazards. Residential electricians should prepare and make sure they understand OSHA and NFPA 70E requirements, and diligently apply them no matter what they work on.

Many mechanical and HVAC technicians also think that they are excluded from these regulations and requirements since they are not specifically identified in OSHA and NFPA publications. Often, it is not until after an incident that they learn these rules are meant to protect all workers, *including* mechanical and HVAC techs, who could possibly work on energized electrical circuits or components. And even among those who understand that 70E applies to HVAC, very few technicians have been adequately trained in use of test equipment, determining appropriate personal protective equipment, or recognition of electrical arc flash hazards and electrical safety, sufficient to make them a "qualified person." If this training is not provided, they are what NFPA 70E defines as an "unqualified person."

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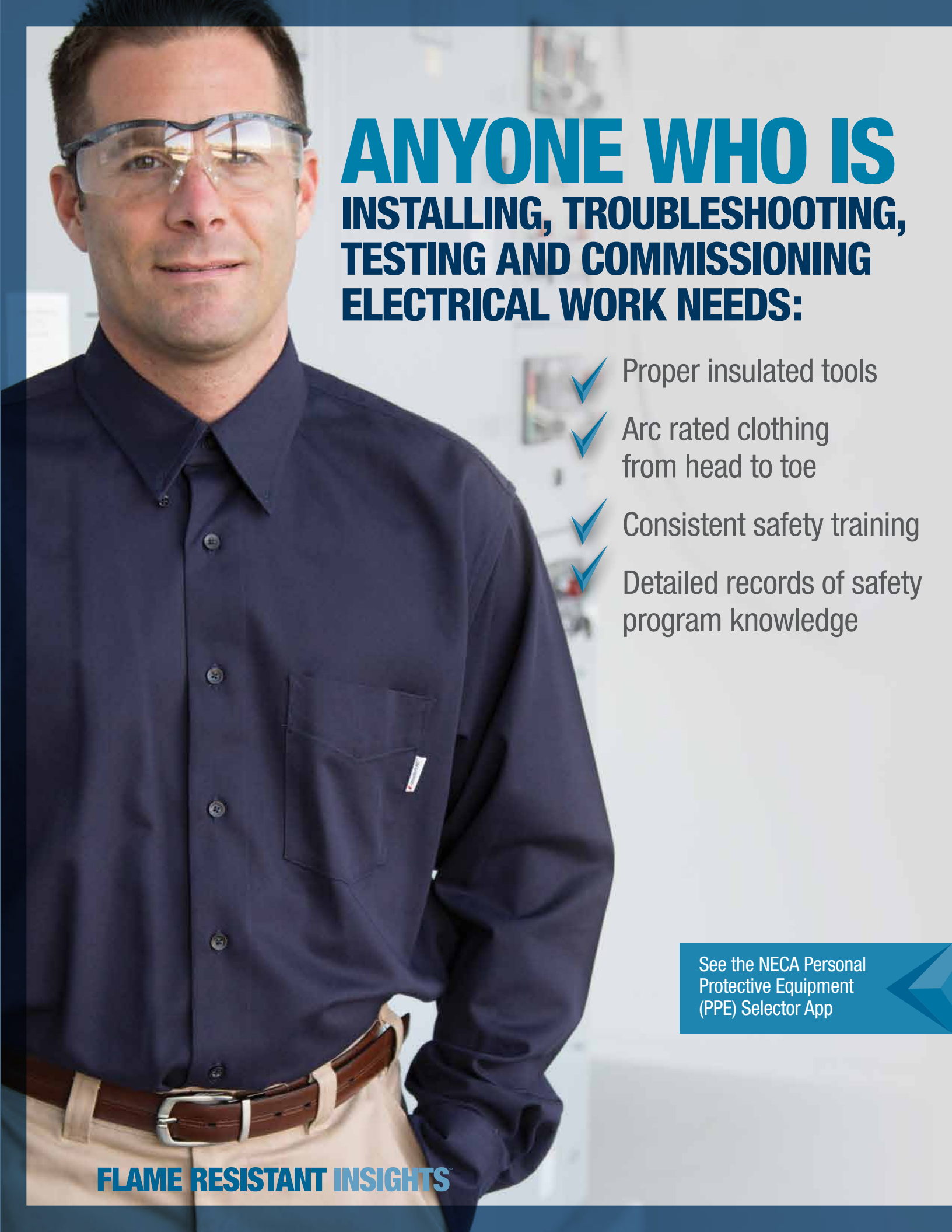


ANYONE WHO IS INSTALLING, TROUBLESHOOTING, TESTING AND COMMISSIONING ELECTRICAL WORK NEEDS:

- Proper insulated tools
- Arc rated clothing from head to toe
- Consistent safety training
- Detailed records of safety program knowledge

See the NECA Personal Protective Equipment (PPE) Selector App

FLAME RESISTANT INSIGHTS™

Another very common problem is that many of today's maintenance workers are not familiar with the increases in utility capacities and upgrades in efficiencies on transformers and overhead power lines, or have not been properly trained. These energy efficiency improvements often raise available fault currents to dangerous levels within the downstream facility. Additionally, improper fusing and equipment ratings add to the probability of an arc event occurring. Even the electrical contractor that claims his employees only work on de-energized circuits is neglecting the lockout, troubleshooting and testing phases of the work being performed. Unless it is new construction that has not yet been connected to the power grid, all work on "de-energized circuits" involves energized work to turn it off, confirm absence of voltage, and later turn it back on and confirm presence of voltage. Of course, most troubleshooting requires an energized circuit, as well.

There are many instances where justified energized work must be performed. NFPA 70E contains the requirements to help employers and employees share safety responsibilities and apply them for the desired result. If a technician has not completed the required training and demonstrated required proficiency in performing energized work, they often fall short of being a "qualified person." Even routine tasks require proper documentation. It is clear that anyone who works on electrical circuits (including troubleshooting using an electrical test meter) or who is unsure of the condition and maintenance of the electrical equipment, falls under the protection of OSHA whether it is in General Industry or Construction.

Proper PPE is a must, starting with insulated tools and quality arc rated clothing from head to toe.

Proper training, including safety-related work practices and documented experience, must be on file at the employer's establishment. Record-keeping is essential in the electrical business, especially when it comes to safety programs and policies that must align with OSHA regulations. Using workers that are inexperienced and lack the proper training is an accident waiting to happen. It is vitally important that both employers and employees attain the proper training to recognize and avoid hazards and understand the methods of protection that must be used when justified energized work is performed.

NFPA 70E and OSHA standards definitely DO apply:

HVAC technicians & residential electricians

Maintenance workers

Electrical contractors

International Focus:

Brazil

Cesar Vianna Moreira
Director of Health and Safety, Fundação COGE

Since the publishing of NFPA 70E in 2000, companies, organizations and countries around the world have used the standard as the benchmark for their workers' electrical safety, and Brazil is no exception. Starting over a decade ago, a contingency made up of public, private and government entities and organizations from Brazil began traveling to the United States to better understand US standards, testing and best practices. Over the past decade, American companies such as Consolidated Edison, Exelon companies PECO and Commonwealth Edison, along with NECA and the NJATC, have generously shared information and time in hosting and meeting with the group.

An important organization in Brazil that has helped lead the efforts is Fundação COGE. Fundacão Coge organizes "SENSE," which is the National Seminar of Health and Safety in the Brazilian Electrical Sector. Its main purpose is to create a forum for sharing experiences, knowledge and technical expertise on health and safety topics related to the electrical industry. Boasting approximately 500 attendees, this group includes representation of health and safety directors from the major electrical utility companies in Brazil, the major electrical unions with over 1 million members, the ministry of labor and electrical experts who have helped develop and guide Brazil's electrical standards and best practices.

View this article in Portuguese

SENSE 2013 Highlights: click to watch

NECA, the IBEW and NJATC have helped as key contributors to SENSE by sending keynote speakers to the most recent seminars. The NJATC's Palmer Hickman was the keynote speaker at SENSE No. 7 in 2011, speaking on the importance of cooperation between companies, employees and government in training the current and future workforce. In 2013, NECA's Executive Director of Safety and Standards Michael Johnston was the keynote speaker for SENSE No. 8. Mike spoke on the efforts of the NECA and ETD partnership to use data to help identify areas to focus on improving, along with reviewing lockout/tagout procedures.

ELECTRICAL TRANSMISSION & DISTRIBUTION PARTNERSHIP

The Electrical Transmission & Distribution Partnership is a formal collaboration of industry stakeholders, including IBEW and NECA, working together to improve safety for workers in the electric line construction industry. It is one of only a few national partnerships between employers and the Occupational Safety and Health Administration (OSHA).

Partnership goals:

1. Analyze accident and incident data to identify common causes for fatalities, injuries and illnesses suffered by linemen, apprentices and other appropriate job classifications.
2. Develop recommended Best Practices for each identified cause.
3. Develop implementation strategies for each Best Practice and promote these strategies among the partners.
4. Identify training criteria for foremen, general foremen, supervisors, linemen and apprentices, including training to create industry culture change to place value on safety and health.

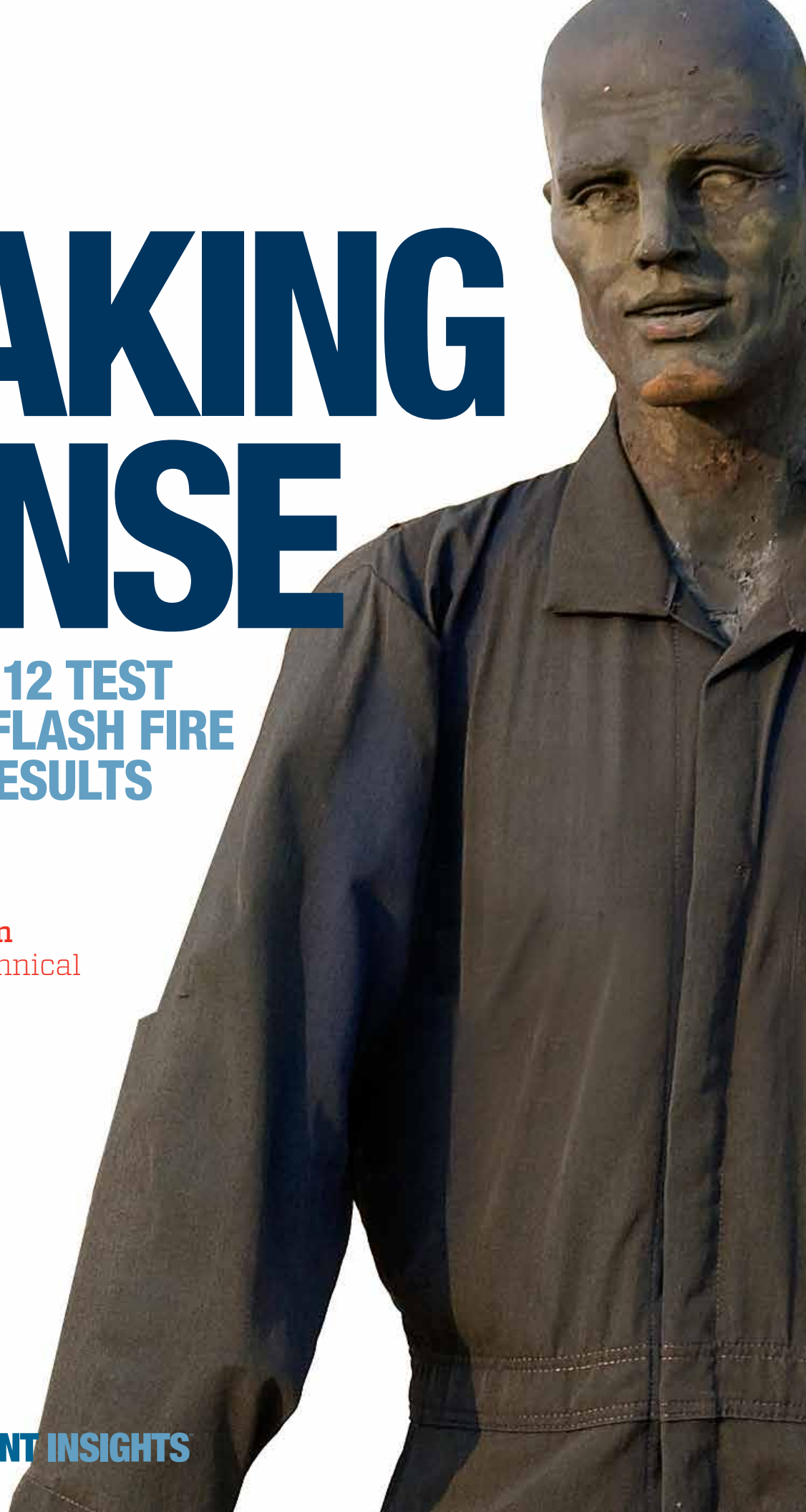
History of the Partnership

The Electrical Transmission & Distribution Partnership began in August 2004 with six members. Additional line constructors joined over time, and the partnership was renewed and expanded in 2006, and again in 2008. In 2011, the partnership grew by including two new members, increasing the total number of partners to 12. Today, the Electrical Transmission & Distribution Partnership covers an estimated 80 percent of total workers in the line construction industry.

MAKING SENSE

OF NFPA 2112 TEST DATA AND FLASH FIRE MANIKIN RESULTS

By Scott Margolin
International Technical Director, Westex



FLAME RESISTANT INSIGHTS™

Many people understand that they want NFPA 2112-compliant fabrics and garments, but very few understand what compliance really means, and perhaps more importantly, what it doesn't mean.

Westex® fabric after a 3-second manikin test

A "2112" fabric or garment is most commonly perceived to be one that has passed the manikin test. A very distant second in public awareness is the 100 industrial laundering test for flame resistant (FR) durability. However, there's a lot more to these tests than meets the eye, and a lot more tests in NFPA 2112. Many people who dig into the details are shocked by what they did not know or misunderstood. Below, we'll take a closer look at the manikin test, but before we do, it's vital to understand that the significant majority of NFPA 2112 testing (and other FR or arc resistant (AR) testing) rates performance of FR fabrics, as opposed to garments.

It is the fabric type, brand and weight that determine the vast majority of the most important characteristics of the finished PPE.

Properties determined exclusively by the fabric brand include manikin body burn test results, arc rating and flame resistance to laundering. The fabric brand is also a critical factor in the level of comfort, durability, wear, appearance and more. In addition, fabric is usually the single-largest cost component of the finished garment, so it plays a key role in pricing as well. As a result, most people choose to research and specify the fabric brand first and to monitor and enforce their specs over the life of the program.

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NFPA 2112 Manikin Testing Explained

The “manikin test” is, by far, the most well-known of the NFPA 2112 tests, and probably the most misunderstood. Let’s take a brief look at the equipment and the procedure. ASTM 1930 is a test method, thus it tells us how to conduct the testing, but not what results are acceptable. If the testing is done according to the standard, the results achieved in one lab should be the same — within the standard deviation (a few percent) — over time, and the same as that fabric tested at another lab. The test uses a life-size manikin with greater than 100 thermocouples evenly distributed over its surface, excluding the hands and feet (because these areas are not covered by garment-style PPE). The manikin is surrounded by propane torches which engulf it in flames at an average heat flux of 2 cals/cm²/second, a heat level very typical of hydrocarbon flash fires. The duration is computer-controlled, and the sensors on the manikin record how hot they get and how deeply the heat penetrates.

Data continues to be accrued for 60 seconds, even though the fire is over in just a few seconds at most. This is to ensure we capture all the stored energy burn potential in the heated fabric, air space and skin, because burn injury is a function of time as well as energy.

The computer then compares the individual sensor results to the Stoll curve, and predicts the exact extent, location and severity of body burn. Why is this vital information? Because there are two things FR clothing should do:

1) Not ignite and continue to burn, thus reducing the extent and severity of injury to survivable levels; evaluated well by vertical flame test

2) Insulate the wearer well enough to minimize second-degree and worse burns to the lowest level possible; measured thoroughly by the manikin test

The NFPA 2112 manikin test starts with this apparatus, then requires testing of three

Manikin Testing Photos (click for live videos)






standardized coveralls at three seconds fire duration and averages the results. The pass/fail bar is 50% or less total second- and third-degree burn. Three seconds was determined to be the upper limit of duration of a flash fire, since it is, by definition, a diffuse fuel (dust, gasses or vapor) suspended in air, with a rapidly moving flame front. For a test to be meaningful and impart information, it must be able to show significant differences between products. Most fabrics look the same up to a second or a second and a half, and again by about 3.5–4 seconds and above. Three seconds is the area of greatest difference for secondary protective apparel, and thus, the most scientific and informative test duration. 50% body burn (second- and third-degree combined) was selected as the upper limit because survivability rates are reasonably steady below fifty, but plummet with higher burn percentages.

Although what is tested and pictured in the silhouettes is a coverall, what's really being tested and what earns the rating, is the fabric brand and weight. An official, certified rating requires that identical garments be made to a standardized pattern with no double-layer areas (such as pockets, cuffs, collars, etc.), and once this rating is determined, it applies to any garments made from that specific fabric brand and weight.

Why three seconds and 50% burn?

- Three seconds is the practical upper limit of duration of a flash fire
- 50% body burn is the upper limit because survivability rates decrease dramatically with higher percentages

What Do the Results Mean?

Now that we understand how manikin testing is done, we can take a closer look at what it's really telling us. The good news is we have a solid, reliable scientific test which can be done at multiple independent labs across the globe. The bad news is that it's a pass/fail standard, and as a result, many manufacturers only report "pass" and many end-users only require compliance. However, a fabric can pass with 7% body burn or 50% body burn, and that's an enormous difference (7% is always included for the head). It's like passing a test in school — a student can pass with a 61% D- or a 100% A+. How many parents would accept the answer, "I passed," without asking their child, "passed with what?" It is critically important to look BEYOND mere compliance.

Be careful, because performance differs, not just between categories (such as meta-aramid vs. FR cotton), but also between brands within categories (such as one "88/12" vs. another; there are huge disparities among these fabrics because "88/12" refers only to the base fiber blend, before any FR engineering, softening, etc.).

continued on next page

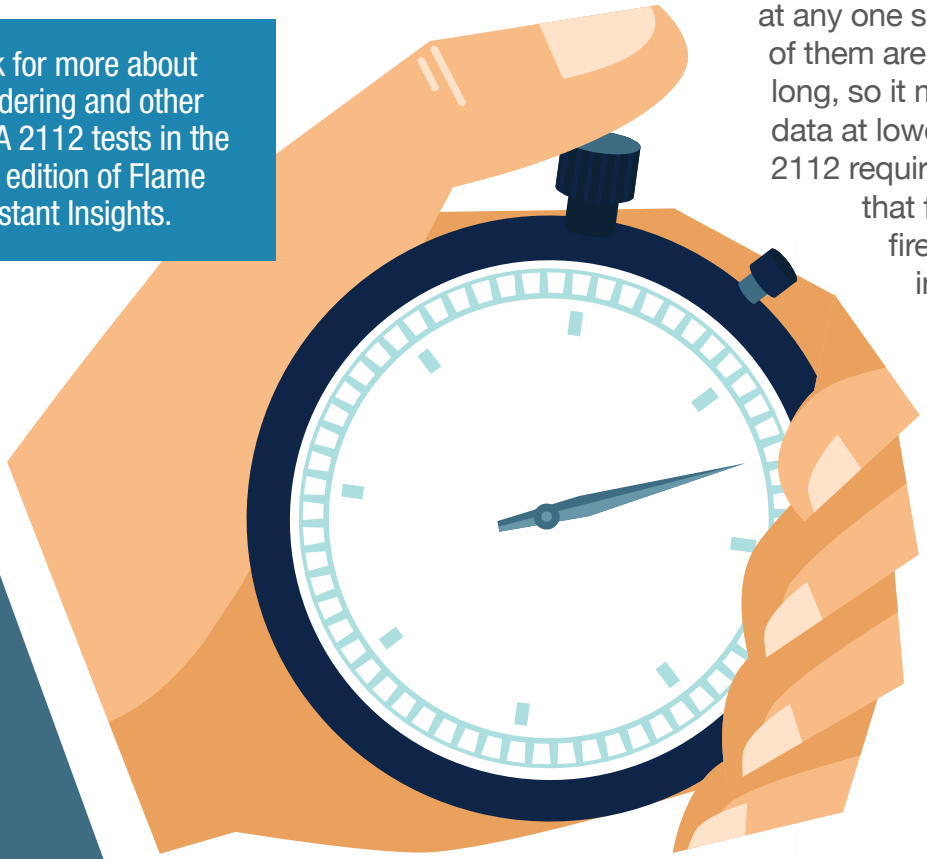
Here's another fact that might shock you: The NFPA 2112 standard requires test garments be laundered one time before testing. Thus, the test results do a great job of telling us the relative protection offered by one fabric vs. another when new, but nothing at all about the durability of the FR over time, or about the durability of the insulative performance over time.

Another important question to ask is, "What lab did the data come from?" If the answer is anything other than an independent lab, it's probably wise to disregard the information, especially if it differs notably from what's reported elsewhere. There are three manikin labs in North America, two of which are at independent universities. One of these labs is in Canada, and entirely independent of the FR garment value chain, while the other is in the USA, and was founded with some ties to the commercial FR sector. Wherever you get your information, please consider the source, and strongly consider seeking out independent confirmation of the data from other labs before making decisions.

What if the Test Duration I'm Being Shown is Not Three Seconds?

As discussed above, the NFPA 2112 standard uses three seconds because three seconds was defined by the committee as the upper limit of a flash fire. However, while not required, it is perfectly reasonable for manufacturers to test, and for end users to want, data at additional exposure times. For instance, it's true that flash fires last a maximum of three seconds at any one spot, but the vast majority of them aren't anywhere near that long, so it makes sense to want data at lower exposures than NFPA 2112 requires. And it's also true that fuel-fed fires occur (flash fires are fuel-limited), with indeterminate duration, so some people will look at exposure times beyond three seconds. While this seems to make sense superficially, it brings with it a whole host of additional issues that need consideration.

Look for more about laundering and other NFPA 2112 tests in the next edition of Flame Resistant Insights.



Protection and survival are not the same thing. Protection means little or no injury, and a return to work, family and the same lifestyle one enjoyed before the incident. Survival simply means, 'not dead.'

The only real goal of secondary PPE in a fuel-fed fire is to provide a few seconds escape time and limit the body burn percentage. Anyone in any secondary protective apparel who remains proximate to an ongoing fire beyond a few seconds will be catastrophically burned or fatally injured. In fact, most of the fabrics that record lower body burn data at four seconds and beyond (relative to their competition) record higher body burn percentages (relative to that same competition) at durations of three seconds and less. In other words, one must give up protection at the lower, and vastly more common energy levels, to gain protection at the longer, and much less common higher energy levels. And let's not overlook what "protection" is really being "gained." Limiting body burn to a small percentage is protection; limiting body burn to 45%, 55%, 60% or higher is not protection, it is survival. Most people who survive that level of burn will face severe challenges, both physically and psychologically, for the rest of their lives. They almost never return to the same work, or to remotely the same quality of life.

NFPA 2112 is an excellent standard, and the manikin test within it is, by far, the best process available to analyze and differentiate the protective performance of one FR fabric against another. It creates relevant, scientific, reproducible results, which quantify the relative protection of materials against real-world hazards. Similar data from different independent labs should give a high degree of confidence that the information is valid, and it is an excellent starting point from which to evaluate options.

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At Westex, we are excited to be joining Milliken & Company, an American enterprise guided by three values: ethics, excellence and leadership. Through innovation, sustainability and safety, Milliken is known as a world-class company. Milliken has long led the way for "knowledge-based" investment, employing over 100 Ph.Ds, and has accumulated over 2,200 U.S. patents — and more than 5,000 patents worldwide — since being founded in 1865. Just as important as product innovation is Milliken's commitment of responsibility to their employees, the environment and worker safety.

Milliken's best-in-class safety processes have earned the following recognitions and awards:

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- 17 of the 39 VPP STAR certifications given in South Carolina
- One of the few American companies in history to win both the Malcolm Baldrige and the TPM® Excellence Award

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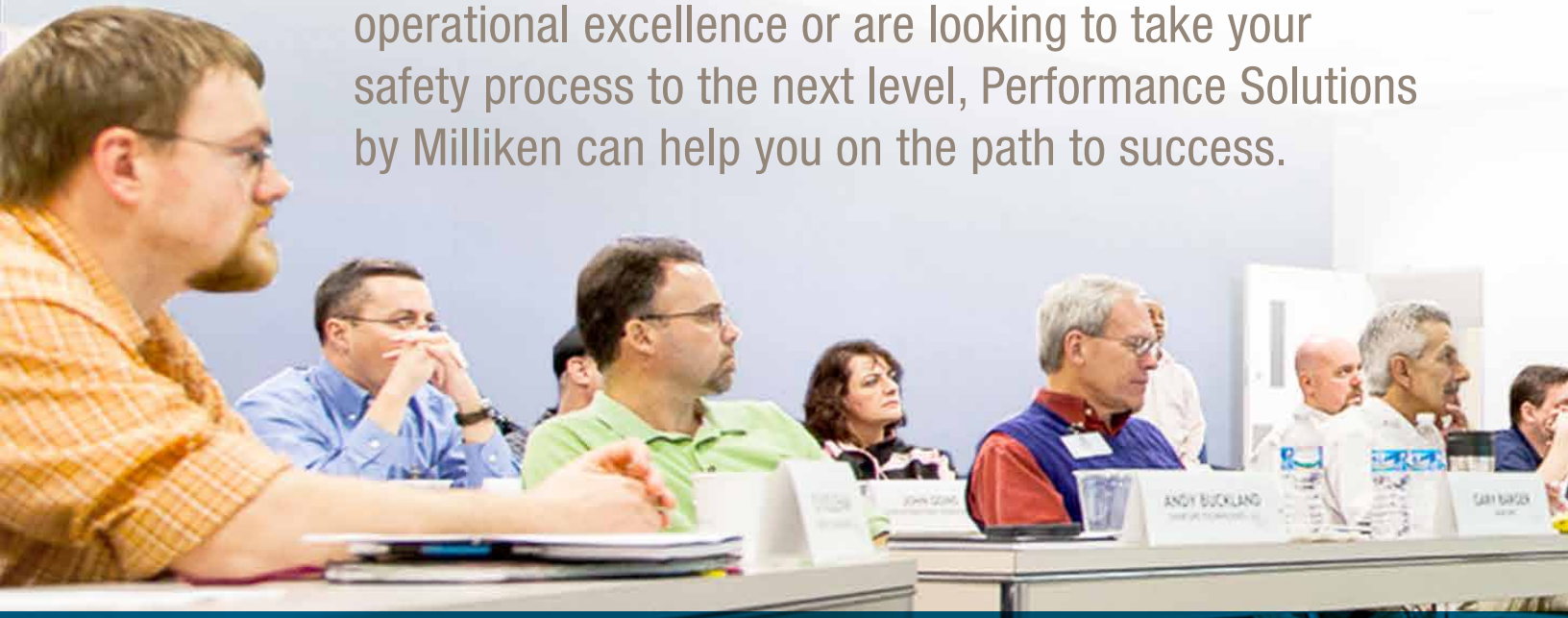
Whether you are at the start of your journey towards operational excellence or are looking to take your safety process to the next level, Performance Solutions by Milliken can help you on the path to success.



Conferences

Our Operational Excellence and Safety Conferences provide a 3-day experience focusing on educational overviews, benchmarking and networking opportunities with 50+ attendees. These conferences are a great introduction into what the Milliken Safety Way and the Milliken Performance System are, and attendees leave with practical knowledge they can use at their own facilities.

Bootcamps

These educational classes provide a deeper dive into the tactical elements of the processes and best practices within the categories of Safety and Operational Excellence. Our bootcamps focus on a single topic of learning, such as Maintenance & Reliability or Financial Breakthroughs, and class sizes are kept under 20 people.

Your Partner for Organizational Transformation

Our practitioners understand what it's like to implement change and create new processes, because Milliken isn't just a consulting company but a manufacturer. The systems and processes we help our clients implement are the same ones we use in our own facilities.

We are pleased to offer informative, robust conferences on the main Milliken Campus as well as classes covering a variety of operational and safety topics.

Upcoming Sessions on Safety:

June 3–4	Safety Bootcamp
October 7–9	Safety Conference
Nov 4–5	Safety Bootcamp

Upcoming Operational Excellence Sessions:

June 24–25	Financial Bootcamp
June 24–26	Daily Maintenance Bootcamp
September 16–18	Operational Excellence Conference

Please visit **PerformanceSolutionsByMilliken.com** for more information or to register online.

At Milliken & Company, headquartered in Spartanburg, S.C., safety is a priority. All Milliken locations are rated as Star sites in OSHA's Voluntary Protection Program (except those acquired in the last year) and is the first two-time winner of America's Safest Companies honors.

Milliken's safety process is driven and owned by the company's production associates and supported from the very top. Safety processes are part of the core value that drives Milliken's commitment to maintaining one of the lowest incident rates (TIR) in the textile industry. It is through this level of engagement that Milliken has been able to develop a safety process that is now part of the consulting business at Milliken. The Milliken Safety Way™ is a process that can be customized to fit any organization's existing safety process. The Milliken Safety Way is one of the services offered by the consulting business Performance Solutions by Milliken®.

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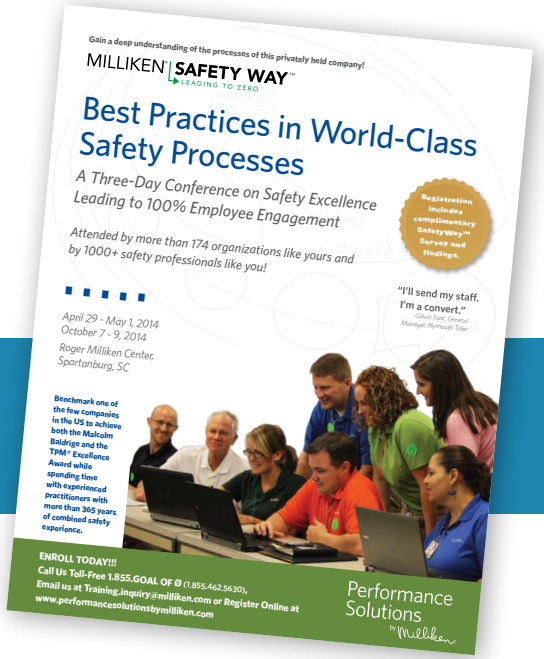

Download this informational brochure about Milliken's conference on safety excellence

Westex Events

End-User Flash Fire Seminar & Live Demonstration: April 30–May 1

Westex has brought flash fire seminars to the next level by creating live flash fire demonstrations for attendees to witness in person. April 30th and May 1st, Westex hosted an educational seminar where end users were able to learn from and interact with a series of industry experts. And with the help of TEEX Brayton Fire Training Field, attendees also witnessed incredible live flash fire demonstrations.

PSC Banff 2014: May 5–8

Westex exhibited at the Enform Petroleum Safety Conference in Banff, Alberta. Banff is Canada's premier oil and gas safety conference and tradeshow. Westex was pleased to showcase the new TrueComfort™ fabric at this informative tradeshow in addition to sponsoring the successful BBQ event.

May 19–21

Westex was proud to be a premier partner of NECA and the sponsor of the NECA safety professionals' conference in Chicago May 19th–21st for the electrical construction industry's premier annual safety event. The 2014 NSPC provided useful and up-to-date information on regulation, compliance, management techniques and standards development that impact safety and health in the electrical construction industry.

ASSE: June 9–11

Westex is proud to be a gold sponsor of ASSE and we are looking forward to another great show. Come see us at Booth #1143 at the ASSE Safety 2014 in Orlando — June 9th-11th. Scott Margolin, Westex International Technical Director, will be giving in-booth presentations on arc flash and flash fire hazards and you can feel the most comfortable FR fabric available — UltraSoft AC®. Register today.

NTI: July 26–August 1

Westex is excited to be a part of the 25th Annual National Training Institute in Ann Arbor, MI. NTI is an annual week of training, which offers a variety of educational and training opportunities to meet the rapidly changing demands of the electrical industry. Learn more.

Volume 04 Preview:

Be on the lookout for more FR tips, advice and insights in our next issue — coming in August.

Connect with Westex:

Have specific arc flash and flash fire concerns? Reach out to your regional manager for advice, or email insights@westex.com. We may feature your question in an upcoming edition of our eZine!

About Westex:

Established in 1919, Westex has over 50 years of experience manufacturing flame resistant fabrics. With a strong commitment to the FR clothing marketplace and a deep understanding of the needs of the FR supply-chain and end users, Westex has launched several successful brands over the years including UltraSoft®, UltraSoft AC®, Indura®, TrueComfort™, Moda-Quilt® and Vinex®. These brands are specified by many end users globally in the utilities, electrical maintenance, oil & gas and metals industries because of their proven track record of providing an excellent balance of protection, comfort and value. For more information, visit www.westex.com.

About Milliken:

Milliken is an innovation company that has been exploring, discovering, and creating ways to enhance people's lives since 1865. Our community of innovators has developed one of the largest collections of patents held by a private company. With expertise across a breadth of disciplines including specialty chemicals, floor coverings, and performance materials, we work around the world to add value to people's lives, improve health and safety, and help make the world more sustainable. For more information, visit www.milliken.com or www.millikenfr.com.

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For 25 years, Westex has proudly supported ASSE. We take pride in partnering with an organization that strongly emphasizes worker safety. Westex is dedicated to educating the industry on hazards such as arc flash, flash fire and combustible dust. While safety is our number one goal, we are focused on improving the future by providing new, innovative, high-quality products and testing.

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