VOLTGARD®

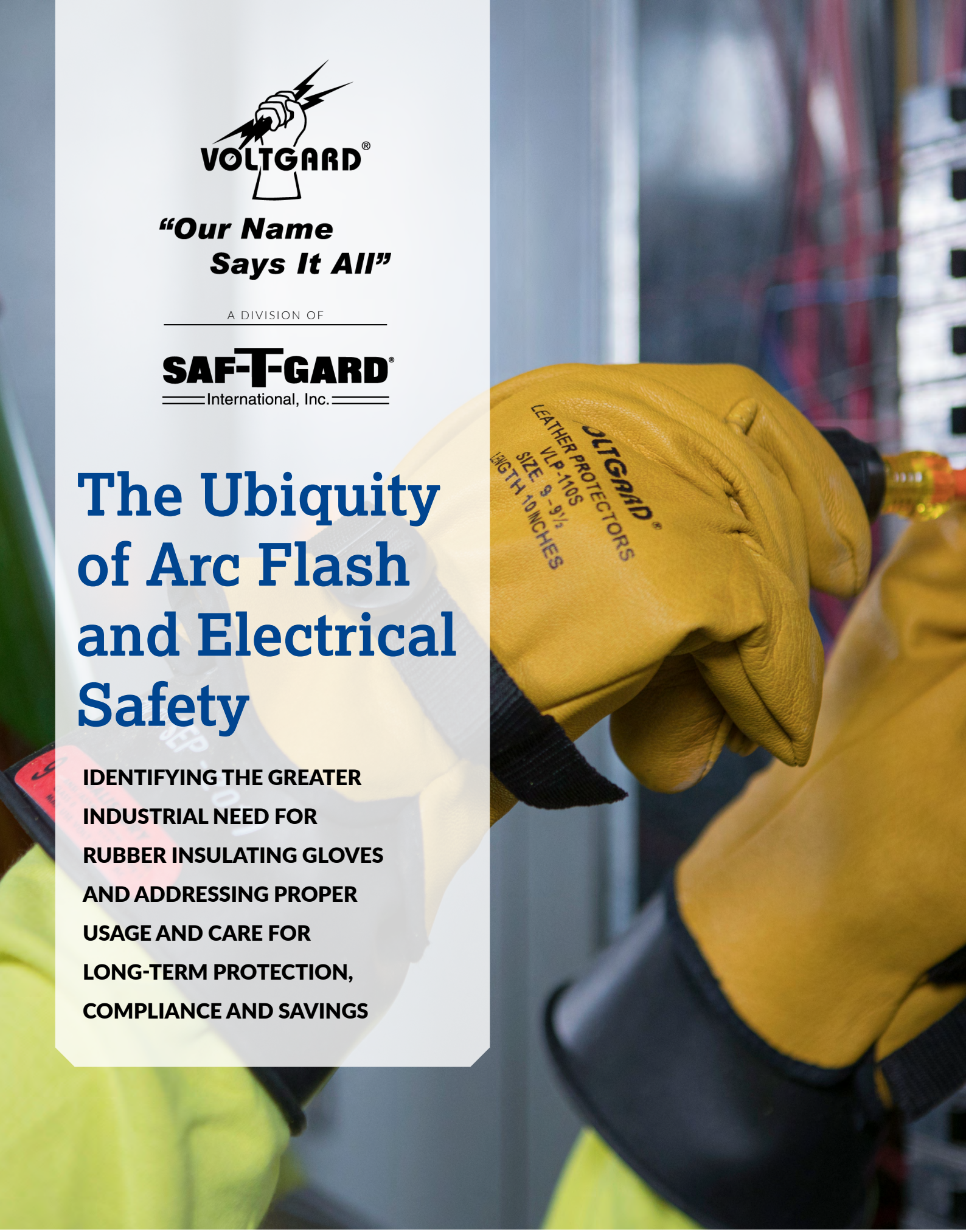
"Our Name Says It All"

A DIVISION OF

SAF-T-GARD® International, Inc.

The Ubiquity of Arc Flash and Electrical Safety

IDENTIFYING THE GREATER INDUSTRIAL NEED FOR RUBBER INSULATING GLOVES AND ADDRESSING PROPER USAGE AND CARE FOR LONG-TERM PROTECTION, COMPLIANCE AND SAVINGS



This electrical safety whitepaper is written and sponsored by Voltgard, a division of Saf-T-Gard International, Inc.

SafetyNetwork.me™ THE PARTNERSHIP THAT WORKS

safeopedia

Overview

Energy, as defined in its simplest terms, is the ability to do work or apply force to move an object. Electricity is the most versatile and easily controlled form of energy, and its use has grown from a simple convenience to a modern day necessity. Some might even argue that our survival depends on it, considering the physiological, social and economical impact it has on our daily lives. We get a better idea about the importance of electricity during power outages. While most are usually only a temporary annoyance, the long-term effects can be devastating as evidenced when the hurricanes struck Texas, Florida and the Caribbean in 2017.

The demand for electricity has been significantly high recently as a result of various factors, including economic growth, technological advancements and increase in population over the past few decades. And, while the need for reliable power delivery only continues to grow, so does the size of the electrical market, as well as the pool of workers on or near energized equipment, thereby also increasing the size of the electrical safety market. The global expansion of energy transmission and distribution networks and the trend of industrial automation and industrial safety regulations are the primary factors contributing to the growth of the electrical safety market. Moreover, the danger of workplace exposure to electrical hazards continues to increase as workers' responsibilities expand to include interaction with electrical equipment. In reality, almost every single facility has a need for electrical safety, whether the company is a larger facility with building engineers overseeing distribution or a smaller facility with maintenance staff working around floor or wall sockets. Large machines in factories are powered by electricity to produce essential items such as food, cloth, paper and many other things. As such, janitorial staff, facilities staff and equipment operators all risk exposure to electrical shock and arc flash.

These days, electrical safety is not only a concern for utility workers or electrical contractors. In fact, according to the Electrical Safety Foundation International (ESFI), the five occupational groups that account for nearly 80% of all fatal electrical accidents include construction trade workers (38%), installation, maintenance and repair operations (21%), grounds maintenance workers (7%), transportation and moving materials operations (6%) and other management occupations (4%). Consequently, awareness, education and training are crucial; not only about the requirements for use of electrical safety, but also about the requirements for testing/retesting rubber insulating goods.

Image courtesy of Salisbury by Honeywell

The Burning Issue

Arc flash and electrical shock injuries continue to pose a significant threat to workplace health and safety. The National Fire Protection Association (NFPA) defines arc flash as an electrical current that passes through the air when insulation or isolation between energized conductors is no longer sufficient to withstand the applied voltage. Arc flash can be initiated through accidental contact, equipment which is underrated for the available short circuit current, contamination or tracking over insulated surfaces, deterioration or corrosion of equipment and/or parts as well as many other causes. The arc produces an ionization of the air, and arc flash temperatures can reach as high as 35,000 degrees Fahrenheit. While the flash itself is immediate, the result of these incidents can cause severe injuries including burns, blindness, hearing loss, nerve damage, cardiac arrest and even death. According to statistics compiled by CapSchell, Inc., a Chicago-based research and consulting firm that specializes in preventing workplace injuries and deaths, there are five (5) to ten (10) arc explosions that occur in electric equipment every day in the United States. The NFPA reports that more than 2,000 people annually are treated in burn centers with severe arc flash injuries. Additionally, the National Safety Council (NSC) estimates that work-related injuries can cost businesses well over $30 million in fines, medical costs, litigation, lost business and equipment costs.

Most often, when there is an arc flash hazard there is also a shock hazard. OSHA estimates that 80% of electrically-related accidents and fatalities involving "Qualified Workers" are caused by arc flash/arc blast. The Bureau of Labor Statistics (BLS) ranks electrocution as the sixth leading cause of workplace fatalities in the United States. Almost 6,000 fatal electrical injuries occurred to workers in the United States between 1992 and 2013, according to "Occupational Injuries from Electrical Shock and Arc Flash Events," a report released by the Fire Protection Research Foundation in March 2015. BLS data also indicates that there were 24,100 non-fatal electrical injuries from 2003 through 2012, the most recent 10-year period for which data is available. Since the BLS counts arc flashes as burns rather than in its electrical shock statistics, the true rate of electrical shock injuries is even higher.

While the best way to prevent arc or electrical incidents from happening is to de-energize and, if possible, connect equipment to ground before beginning work, there are instances where turning off the power could create an even greater hazard. To that end, employers and facility owners must establish safe practices to protect their workers against arc flash and electrical incidents including the use of personal protective equipment (PPE). The NFPA along with the Occupational Safety and Health Administration (OSHA) mandates and enforces safer electrical work practices under the NFPA 70E standard. Numerous experts and training programs are available to provide guidance on how to keep workers safe and compliant in terms of conducting a proper hazard assessment and selecting the right PPE. However, one topic that is often not discussed in detail is the need for rubber insulating gloves where a shock hazard exists from exposure to energized equipment.

OSHA, ASTM, and NFPA 70E standards make the use of rubber insulating gloves mandatory when even the smallest probability of contact with 50 volts AC or higher exist. Regardless of the heavy fines, serious injuries and deaths that occur from arc flash and electrical incidents, compliance continues to remain an issue. Workers may receive mixed messages when organizational communications counsel them to follow safety procedures while also emphasizing the importance of keeping to production schedules or other factors that may contribute to them taking shortcuts and compromising safety. Many workers who experience electrical injury have insufficient training for working on or around energized electrical equipment, and employees and employers alike often mishandle, underestimate or ignore the use of personal protective equipment. What's even more surprising is that many do not know that they need arc and/or voltage protection and that they can (and should) retest in-service rubber insulating gloves (electrical gloves) for continued use instead of needlessly spending more money on a new pair. Fortunately, there are safety products and procedures that can help protect against arc flash and electrical shock injuries and possible death as well as citations and penalties when used and followed correctly.

Rubber Gloves to the Rescue

Rubber insulating gloves are the only protective gloves designed for constant contact with, and protection from, energized conductors and equipment. All of the other items are designed for protection from accidental, incidental or brush contact. Arc-rated work gloves alone offer no shock protection, and most arc flash hazards have a shock exposure hazard as well. Rubber insulating gloves (electrical gloves) are an essential element in protecting workers from shock. While shock protection is the primary benefit, rubber insulating gloves also provide significant burn protection in the event of an arc flash. Electrical gloves are manufactured using proprietary materials and manufacturing processes with 100% testing to provide the highest possible level of protection. To be effective, electrical gloves must incorporate high dielectric and physical strength, along with comfort, flexibility and durability. They must meet and/or exceed the requirements of ASTM D120 – Standard Specification for Rubber Insulating Gloves – to help ensure safety and performance.

According to the OSHA 29 CFR 1910.137 standard, rubber insulating gloves must be rated for the voltage to which a worker will be exposed (phase to ground or phase to phase) and marked to indicate that rating. For in-service use, the maximum use voltage must be above the actual exposure, but it is important to take note of the proof test voltage as well. All rubber insulating gloves are tested by the manufacturer at the specified proof test voltage. Manufacturers also perform a dielectric breakdown test at an even higher voltage to validate the dielectric strength of the rubber material. The result is a significant margin of safety between the test voltages and the maximum use voltage. Each specific hazard assessment will help in determining which class of gloves is appropriate for the application.

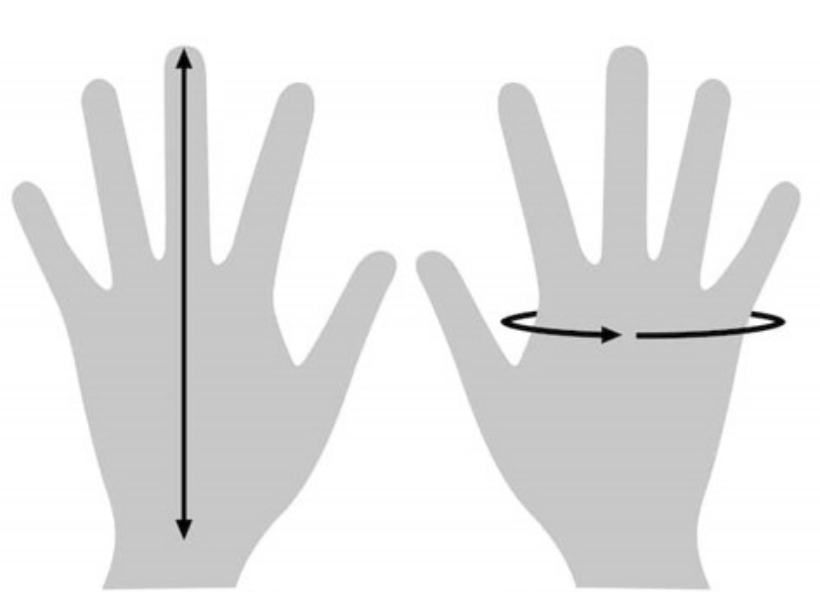
Take care to choose the correct rubber insulating glove for the task at hand and level of electrical exposure. Rubber insulating gloves are typically manufactured in sizes 8-12, often in half sizes, and some manufacturers also offer gloves as small as size 7 and as large as size 13. In addition, rubber insulating gloves are available in different cuff lengths of 11, 14, 16 and 18-inches depending on the glove class. Rubber insulating gloves are available in six specific voltage classes (Class 00 – Class 4) categorized by the level of voltage protection they provide. Electrical gloves must be permanently marked to indicate the voltage class and must also have a color-coded label identifying the voltage class. Voltage protection is broken down into the following classes:

Class Label Color	Proof Test Voltage AC / DC	Maximum Use Voltage AC / DC
00 Beige	2,500 / 10,000	500 / 750
0 Red	5,000 / 20,000	1,000 / 1,500
1 White	10,000 / 40,000	7,500 / 11,250
2 Yellow	20,000 / 50,000	17,000 / 25,500
3 Green	30,000 / 60,000	26,500 / 39,750
4 Orange	40,000 / 70,000	36,000 / 54,000

The ASTM standards also include DC test and maximum use voltages.

For gloves, ozone resistance is covered by the "Type" designation. A Type I glove is not ozone-resistant, while a Type II glove is ozone-resistant and is manufactured from a synthetic polymer that is also more resistant to many chemicals.

Proper fit will increase the likeliness that the workers will wear the gloves, as gloves that are too big or bulky can affect dexterity, while gloves that are too small can cause discomfort.



Hand Length

Measure tip of middle finger down to the base of your palm

Hand Circumference

Measure around the palm of your dominant hand just below your knuckles

The ASTM D120 standard specification provides the measurements of the diameter of the palm for manufacturers, measured at the midpoint of the palm, plus or minus ½-inch. Measure the hand by wrapping the tape all the way around the palm. This number would equate to the probable size of the glove to select. Personal preference for tightness and finger length will ultimately determine the size that the wearer will choose.

Test and Retest for Continued Safety, Compliance and Cost Savings

Testing is also a critical and required component to maintaining arc and electrical safety. Not only is it a factor in compliance, but it also helps increase savings. Rubber insulating gloves are costly, and many times these costs are unnecessarily increased by purchasing replacements for products that could have remained in service with the proper testing and recertification. To illustrate, a new pair of Class 2, 14-inch, black rubber insulating gloves costs approximately $200.00, whereas testing a pair of in-service Class 2, 14-inch rubber insulating gloves often costs less than $10.00/pair. Why spend so much more on a new pair of gloves when, if you take good care of your gloves, you can test and reuse them for far less without sacrificing safety or compliance? What's more, properly cared for rubber insulating gloves can sometimes last many years for continued savings.

ASTM Manufacturing and Acceptance standards mandate the testing of the rubber insulating gloves by the manufacturer or supplier prior to the first delivery to the end user. Users also have the option of performing or requiring an acceptance test within the first two months after receipt of the gloves and prior to placing rubber insulating gloves into service.

Once placed into service, there are periodic retest intervals as specified by ASTM standards. For gloves, the interval shall not exceed six (6) months except for industries such as telecommunications that utilize insulating gloves as precautionary protection, in which case the maximum interval may be increased to nine (9) months. Nevertheless, do not place rubber insulating gloves into service unless they have been tested electrically within the previous twelve (12) months. These in-service retest intervals are the MAXIMUM permitted. It is quite common for users, including power utilities and contractors, to specify shorter intervals.

Rubber insulating gloves that have passed the inspection and testing process are marked to identify the test voltage and can then be returned to service.

If you do not have the equipment required to perform electrical testing, there are independent testing facilities that can perform the acceptance and in-service testing on behalf of end users. At a minimum, ASTM in-service standards require that the inspection and testing process include the following steps:

1. Check-in
2. Removing previous testing marking
3. Washing using cleaning agents that will not degrade the insulating properties
4. Visual inspection of all surfaces (inside and out)
5. Electrical test
6. Final inspection
7. Recordkeeping
8. Marking
9. Packing in appropriate containers ("appropriate containers" means boxes, or similar sturdy packaging materials to prevent folding, creasing or similar loose storage that can cause stress on the rubber) for storage or shipment

When selecting a test lab, ensure that it is a NAIL-accredited test lab. The National Association of Independent Laboratories for Protective Equipment Testing, more commonly known as NAIL or NAIL4PET, incorporates the only Laboratory Accreditation for the electrical equipment test labs program in North America. These criteria include laboratory facility, equipment, training and knowledge of staff, quality control work procedures and more. NAIL4PET helps develop uniformity in testing and works in close association with the American Society of Testing Materials (ASTM International). NAIL-accredited laboratories are charged to promote service, candor, justice and the public welfare in society. Today, the NAIL program is recognized throughout the United States and Canada as an important asset to the credentials of a testing facility.

The Association of North American Independent Laboratories for Protective Equipment Testing

Organized 1978 - Incorporated 1980

This Certifies That

Voltgard Test Lab, Saf-T-Gard International, Inc.

has been approved as an Accredited Testing Laboratory to test the following Lineman's High Voltage Protective Equipment:

- Insulating Gloves
- Insulating Sleeves
- Insulating Blankets
- Insulating Line Hose
- Insulating Covers
- Dielectric Overshoe Footwear
- Insulating By-Pass Jumpers
- Portable Grounding Jumpers
- Insulating Plastic Guards
- Hot Sticks & Live-Line Tools
- Rubber Insulating Matting
- Insulated & Insulating Hand Tools

ACCREDITED NAIL for PET LABORATORY

Witness the signatures of its duly authorized officers affixed this 3rd day of March, 2017.

Certification Period 3/3/2017 thru 3/2/2020

Secretary

President

The End Goal is Worker Safety

The risks associated with shock and electrocution from inadvertent content with energized circuits and equipment have long been recognized as a threat to electrical workers, and they aren't going away anytime soon if ever. Electricity is one of the most dominant forms of energy that, when properly harnessed, powers the modern industrial age and enables us to function efficiently both at work and home. However, when neglected or not respected, electricity can cause serious personal injury and death - especially when your job requires exposure to its many hazards. Additionally, and even more importantly, electricity can be largely harmful when you don't realize there is an actual threat on your job. There are thousands of people, processes, policies and procedures that have resulted in today's workers having the safest rubber insulating gloves and work practices available. However, they can only be effective if the worker and employer realize the need for electrical gloves and use the proven safety industry standards for regular inspection, testing, and retesting. Nearly all industrial workplaces have a need for electrical gloves, and failure to comply can result in heavy fines, serious injuries and even death. Thankfully, there are strategies that you can easily implement into your safety program to prevent injuries, citations, penalties and superfluous spending. It starts with identifying the hazards and creating awareness of the need for electrical gloves and testing/retesting the rubber insulating gloves to the specified industry standards. Most importantly, these tactics should be employed with the same over-arching goal: getting workers home safely to their families at the end of every shift.

About the Voltgard Test Lab

The Voltgard Test Lab is a division of Saf-T-Gard International, Inc., a family-owned and operated manufacturer, distributor, importer, exporter and global supplier of personal protective equipment, electrical safety, facility safety and first aid. Based in suburban Chicago, Saf-T-Gard has been bringing workers home safely since 1936. The Voltgard project was launched in 1983 as a small test lab with the mission to develop the electrical testing and utility industry business by providing the testing of rubber insulating products to complement the sales of new products. Today, the Voltgard Test Lab is one of the largest, independent NAIL4PET-accredited test labs for rubber insulating products in the world, providing full-service testing and recertification of rubber gloves, sleeves, blankets, line hose, covers, dielectric footwear, jumper cables, grounding sets, plastic guards, hotsticks, matting, hoods and hand tools – all to applicable ASTM standards.

VOLTGARD®

"Our Name Says It All"

A DIVISION OF

SAF-T-GARD® International, Inc.

Bringing Workers Home Safely since 1936

VOLTGARD® TEST LAB