



Mechanical Contractors Association of America

Model Electrical Safety in the Workplace Program

(Based on parts of NFPA 70E – 2021)



MSCA
Mechanical Service Contractors of America

PCA
Plumbing Contractors of America

NCPWB
National Certified Pipe Welding Bureau

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Adding Value to Your Supply Chain

Model Electrical Safety in the Workplace Program

Introduction

In the mechanical service industry technicians are often required to perform troubleshooting work on energized electrical equipment. This necessary practice exposes them to potential electrical shock and arc flash hazards. The effects of electrical shock and arc flash on the human body can be devastating.

Fortunately, there are organizations like the National Fire Protection Association (NFPA) that help employers protect their workers from jobsite hazards. NFPA publishes the *National Electrical Codes*. An addendum to the codes, which is commonly referred to as NFPA 70E, is the current voluntary industry consensus standard for electrical safety in the workplace.

NFPA 70E – 2021 states that the employer shall implement and document an overall electrical safety program that directs activity appropriate to the risk associated with electrical hazards. This model program, which is based largely on information from NFPA 70E – 2021 articles 110 – *General Requirements for Electrical Safety-Related Work Practices*, 120 – *Establishing an Electrically Safe Work Condition*, 130 – *Work Involving Electrical Hazards*, and 360 *Safety-Related Requirements for Capacitors* will help you develop an electrical safety program that is specific to your company's needs.

CAUTION

This model program is for mechanical service companies whose technicians perform work on or near exposed energized electrical conductors and/or circuit parts of HVAC units/equipment that are pushing 480 volts or less. Work on units/equipment pushing more than 480 volts may require more stringent protective measures, and more sophisticated Personal Protective Equipment (PPE) than what is required at 480 volts or less. Protective measures for exposures at higher voltages can be found in NFPA 70E – 2021.

This model program is not intended to provide exhaustive treatment on electrical safety in the workplace as it pertains to the mechanical service industry, or any other industry. Further, it is not intended to provide legal advice. Employers must make independent determinations regarding the need for legal assistance.

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Instructions

This model program and the supplementary materials in the appendices are designed to be easily tailored for each company's specific needs. To tailor the program, carefully follow these instructions. If you have any questions that are not answered in this publication, please contact MCAA at 800-556-3563.

1. Read the model program. Obvious areas that require your attention are highlighted in yellow. However, it is critical that you:
 - Fully understand the electrical hazards and protective measures that your program needs to cover;
 - Delete everything that does not apply to your company's specific applications; and
 - Add whatever provisions are necessary to complete the program.
2. Be sure to follow the highlighted prompts and delete the highlights.
3. Be sure to personalize the program by including your company logo on the cover page.
4. Implement your company's Electrical Safety in the Workplace Program.

Company Name

Electrical Safety in the Workplace Program

(Last Evaluated and Revised Date)

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Model Electrical Safety in the Workplace Program

Applicability

This electrical safety program is applicable to all **Company Name** mechanical service technicians working on or near exposed, energized electrical conductors and/or circuit parts on HVAC units/equipment pushing 480 volts or less. ***This program is not applicable to work on units/equipment pushing more than 480 volts. Work on units/equipment pushing more than 480 volts may require more stringent safe work practices, and more sophisticated personal protective equipment, than what is described in this program.***

Purpose

The purpose of this program is to:

- | Make our mechanical service technicians aware of the potential electrical hazards associated with work on HVAC units/equipment pushing 480 volts or less;
- | Provide our technicians with the knowledge they need to protect themselves from electrical hazards while working on HVAC units/equipment pushing 480 volts or less;
- | Establish safe work practices and procedures for mechanical service technicians' work on HVAC units/equipment pushing 480 volts or less; and
- | Develop mechanical service technicians' self-discipline so that they will consistently follow the safe work practices and procedures established by this program.

General

This electrical safety program is part of **Company Name** overall occupational safety and health program. The program, which directs the company's activities appropriate to the risks associated with applicable electrical hazards, is currently being implemented and documented wherever it is applicable.

Inspection

All newly installed or modified electrical equipment or systems will be inspected to ensure that they comply with applicable installation codes and standards prior to being placed into service.

Condition of Maintenance

All applicable units/equipment and systems will be inspected to ensure that they

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have been properly maintained and are in good condition. Units/equipment/systems that are not in good condition/properly maintained will not be placed back into service.

Awareness and Self-Discipline

This program has been designed to provide affected workers with an awareness of the potential electrical hazards in their workplaces. It is intended to instill in all affected workers the self-discipline that is required for them to work safely. It does this by teaching appropriate safety principles and controls necessary to protect them from potentially hazardous sources of electrical energy.

Electrical Safety Program Principles

The electrical safety program principles that apply to this program are:

- | Make our mechanical service technicians aware of the potential electrical hazards associated with work on HVAC units/equipment pushing 480 volts or less;
- | Electrical safety inspection and evaluation of each applicable HVAC unit/equipment;
- | Maintenance of each unit's/piece of equipment's electrical insulation and the integrity of each unit's/piece of equipment's enclosure;
- | Planning for every job;
- | De-energizing of each unit/piece of equipment immediately after troubleshooting is completed and before repair work/maintenance begins;
- | Anticipation of unexpected events;
- | Identification and risk reduction of potential electrical hazards;
- | Mechanical service technician protection from shock, burn, blast, and other applicable hazards due to the work environment;
- | Use of tools that are appropriate for the job;
- | Assessment of the abilities of anyone who could be exposed to potential electrical hazards from repair or maintenance work on the HVAC units/equipment; and
- | Audits of the program's principles and procedures every three years to verify compliance.

Electrical Safety Program Controls

Company's Name has established the programs and procedures, including training, that are necessary to achieve electrical safety in its workplaces. All affected workers are required to apply them. The electrical safety program controls that apply to this program are:

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- | Before working on any applicable electrical equipment, all affected workers are to be trained to become “qualified” for work in an environment influenced by the presence of electrical energy.
- | The established procedures are used to identify the electrical hazards and to develop job safety plans to eliminate those hazards, or to control the risks for those hazards that cannot be eliminated.
- | Jobs to be performed within the limited approach boundary or arc flash boundary of exposed energized conductors or circuit parts are to be identified and categorized.
- | Precautions appropriate to the working environments are to be determined and implemented.
- | A logical approach is to be used to determine the associated risk of each job.
- | All affected technicians and their supervisors are responsible for ensuring that guards or protective measures are satisfactory for the conditions.
- | When lockout/tagout procedures are required, all affected technicians are required to consider every electrical conductor or circuit part to be energized until it is shut off, tested dead, and locked/tagged out.
- | All affected technicians are required to consider the actual process of de-energizing an electrical conductor or circuit part and making it safe to work to be a potentially hazardous task.
- | All affected technicians are required to avoid making bare-hand contact with exposed, energized electrical conductors and/or circuit parts.
- | All affected technicians are required to receive electrical safety training as described in this program. The training, in addition to their existing skills and knowledge related to the construction and operation of the electrical equipment, including installations, qualifies the technicians to work in the prescribed environment influenced by the presence of electrical energy.
- | All affected technicians are to be provided with a copy of this program.
- | All affected technicians are required to obtain answers to any questions they have about the program before they begin work.
- | All affected technicians are required to consistently implement this program.
- | All affected technicians are required to use the procedures described in this program to identify and categorize potential electrical hazards associated with their work on HVAC units/equipment and eliminate or control them.
- | Only troubleshooting procedures are permitted on exposed, energized electrical conductors and/or circuit parts, unless the unit/equipment being serviced has a built-in interlocking disconnect.
- | Where work is being performed on units/equipment with built-in interlocking disconnects, technicians are required to implement safe work practices, including use of the personal protective equipment required for work on all energized units/equipment with exposed, energized electrical conductors and/or circuit parts.

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- | All affected technicians are required to stay alert when working on or near the units/equipment.
- | All affected technicians are required to avoid performing work on the units/equipment while they are impaired by illness, fatigue, prescription drugs, nonprescription drugs, illegal drugs, alcohol, or other impairments.
- | All affected technicians are required to avoid reaching blindly into areas that could contain exposed, energized electrical conductors and/or circuit parts.
- | All affected technicians are required to ensure that their work areas are properly illuminated, so that their work can be performed safely.
- | All affected technicians are required to avoid wearing conductive articles of jewelry and/or clothing.
- | When any conductive objects are being carried by an affected technician, all affected technicians are required to handle the object in a manner that prevents accidental contact with exposed, energized electrical conductors and/or circuit parts.
- | Where an affected technician must work in a confined or enclosed workspace, all affected technicians are required to use protective barriers or insulating materials to prevent contact with exposed, energized electrical conductors and/or circuit parts.
- | Housekeeping is not permitted where there is a possibility of contact with exposed, energized electrical conductors and/or circuit parts, unless barriers or insulating equipment is used to prevent contact.
- | All affected technicians are required to identify and use the precautions that are appropriate for the work environment.
- | All affected technicians are required to use a logical approach in determining the associated risks of each job.
- | All affected technicians are to be provided with a copy of **Company Name** lockout/tagout program.
- | All affected technicians are required to consistently implement the lockout/tagout program whenever lockout/tagout applies to the job.

Training

All **Company Name** mechanical service technicians and supervisors are required to receive electrical safety training that is specific to work on HVAC units/equipment pushing 480 volts or less. The training is substantive so that, coupled with their skills and knowledge related to the construction, operation, and installation of the units/equipment, they will be considered “Qualified Persons.” (Company workers who are undergoing on-the-job training to become “Qualified Persons” will be considered Qualified Persons for specific duties when they are under the direct supervision of a qualified person and have demonstrated their ability to perform the specific duties safely.) Training is a combination of classroom and on-the-job training, which includes:

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- | How to use a logical approach in determining the risks associated with each job.
- | The contents of this electrical safety program, with emphasis on safe work practices, procedures, including the company's written procedure for discharging capacitors, the elements of the **Company Name** lockout/tagout program for electrical safety, and personal protective equipment requirements.
- | Identification and avoidance of electrical hazards associated with work on HVAC units/equipment pushing 480 volts or less.
- | Techniques necessary to distinguish exposed energized electrical conductors and/or circuit parts from other parts of electrical equipment.
- | Techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.
- | The company's established Qualified Person—Approach Boundary for protection from electrical shock and arc flash hazards (5 feet).
- | The decision-making process that is necessary to be able to do the following:
 - Perform the job safety planning;
 - Identify electrical hazards;
 - Assess the associated risks; and
 - Select the appropriate risk control methods from the hierarchy of controls:
1st Elimination, **2nd** Substitution, **3rd** Engineering Controls, **4th** Awareness, **5th** Administrative Controls, and **6th** Personal Protective Equipment.
- | Skills necessary to select an appropriate voltage meter and to demonstrate how to use it to verify the absence of voltage, including interpreting indications provided by the device, and its limitations.
- | Skills necessary to select properly rated tools.
- | Selection, inspection, and maintenance of personal protective equipment, including pre-use leak testing, and biannual dielectric testing of protective rubber gloves.

Additional Training and Retraining

Additional Training and Retraining will occur:

- | Anytime a supervisor or the results of an annual inspection indicate that a technician is not complying with the safety-related work practices.
- | Whenever new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those that a technician would normally use.
- | Anytime a technician will have to employ safety-related work practices that are

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not normally used during his or her regular job duties.
| At least once within every three-year period.

Personal Protective Equipment (PPE) Requirements

PPE Required for Work on or Near HVAC Units/Equipment with Exposed, Energized Electrical Conductors and/or Circuit Parts Pushing 480 Volts or Less

VOLTAGE	CLOTHING	GLOVES	OTHER PPE
480 Volts or Less	Arc-Rated (AR) 8 Calorie ATPV Long Sleeve Shirt & Pants or Coveralls, and Balaclava	Class 00 Rubber Gloves with Leather Protector Gloves	Safety Glasses, Class- E Hardhat with 8 Calorie ATPV Face Shield (with wrap around guarding), Ear Plugs, Leather, Dielectric, or Properly Tested Footwear

Protective Clothing – Technicians will wear *long sleeve shirts and pants or coveralls, and a balaclava made of Arc-Rated (AR) material*. The protective clothing will have a minimum Arc Thermal Protective Value (ATPV) of (8 cal/cm²). The ATPV will be displayed outside the clothing or on a tag inside.

Eye Protection – Standard *safety glasses* will be worn always by technicians while performing any mechanical service work. The safety glasses must be worn even while using an arc-rated face shield.

Head and Face Protection – Technicians will wear a *Class E hardhat* and an attached arc-rated face shield with wrap around guarding. The face shield will have a minimum Arc Thermal Protective Value (ATPV) of (8 cal/cm²).

Hearing Protection – Technicians will wear *ear canal inserts (ear plugs)*.

Hand Protection – Technicians will wear *Class 00 Rubber gloves* and *leather protector gloves* over the rubber gloves.

Rubber gloves will be dielectrically tested at a certified testing laboratory at least every six months. Technicians must field test their gloves before each use by trapping air inside each glove and looking/feeling for leaks. Gloves with leaks or any signs of damage will be destroyed and discarded immediately.

Leather protector gloves must be made entirely of leather and have a minimum thickness of 0.03 inches. If the gloves are lined, the liner must be a non-flammable and non-melting fabric.

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Foot Protection – Technicians will wear *leather, dielectric, or properly tested footwear*.

Footwear that is not leather or dielectric must be tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure or the minimum arc rating for the respective arc flash PPE category.

Risk Assessment Procedures

Technicians are to inspect and evaluate each unit/piece of equipment before starting work to identify electrical hazards and perform a risk assessment. The sequential risk assessment procedure is:

- | Look for obvious signs of damage to the unit/equipment, disconnects (where applicable), and conduit/wiring between service disconnects and the unit/equipment (where applicable).
- | Carefully look over the unit/equipment for common causes of arc flash such as:
 - Dust and other impurities that could provide a path for electrical current;
 - Corrosion, which can create impurities on insulating surfaces;
 - High humidity, rain or condensation that could result in water vapor on insulating materials, which can cause flashover to ground;
 - The potential for spark discharge caused by accidental contact between tools or spare parts and exposed, energized electrical conductors and/or circuit parts; and
 - Anything else that could cause arc flash.
- | Report any unusual findings/potential hazards to your supervisor before proceeding.
- | Consideration of Human Error:
 - The risk of human error and its negative consequences on people, processes, the work environment, and equipment relative to the electrical hazards in the workplace will be addressed.
- | Consideration of the Hierarchy of Risk Control Methods:
 - Preventive and protective risk control methods will be applied in accordance with the following hierarchy:
 1. Elimination
 2. Substitution
 3. Engineering Controls

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4. Awareness
5. Administrative Controls
6. Personal Protective Equipment

Job Safety Planning and Job Briefing

Before starting each job that involves exposure to electrical hazards, the service technician in charge will complete a job safety plan and conduct a job briefing with the workers involved. The job safety plan will:

- | Be completed by a qualified person.
- | Be documented.
- | Include:
 - A description of the job and the individual tasks;
 - Identification of the electrical hazards associated with each job;
 - A shock risk assessment in accordance with 130.4 for jobs involving a shock hazard;
 - An arc flash risk assessment in accordance with 130.5 for jobs involving an arc flash hazard; and
 - Work procedures involved, special precautions, and energy source controls.

The job briefing will:

- | Cover the job safety plan, and the information on the energized electrical work permit, if a permit is required.
- | Be provided again whenever changes occur during the course of the work that might affect the safety of affected workers.

Electrical Safety Program Procedures

The purpose of this task is to evaluate the equipment and perform maintenance and repairs as needed. All workers involved are considered by **Company Name** to be “qualified persons” based on the combination of their skills and knowledge related to the construction, operation and installation of the HVAC units/equipment, and their electrical safety training that is specific to work on HVAC units/equipment pushing 480 volts or less (see “Training” in the Electrical Safety Program Controls section of this program). Company workers who are undergoing on-the-job training to become “Qualified Persons” are considered qualified persons for specific duties when they are under the direct supervision of a qualified person and have demonstrated their ability to perform the specific duties safely. Prior to the start of the job/implementation of these procedures, all electrical hazards will be identified, and an appropriate risk assessment

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will be performed. The sequential electrical safety program procedures that apply to this program for work on HVAC units/equipment pushing 480 volts or less are:

For Supervisors

- | Ensure that all your technicians have received the proper electrical safety training as described in this program before you allow them to begin work. Ensure that they receive a copy of this program, the Company Name lockout/tagout program for electrical safety, and understand both program's principles, controls, specific electrical safety training requirements, and procedures. Assess their abilities by testing them on the knowledge they need to protect themselves from electrical hazards.
- | Perform audits at least every three years to ensure that all the electrical safety program principles established for Company Name are still appropriate. And perform field audits at least once each year to ensure that all the electrical safety program principles are being followed by the affected technicians.
- | Prior to the start of any new job where this program applies, complete a job safety plan, and present a job briefing that covers the plan, and the energized electrical work permit whenever applicable.
- | Present a new job briefing each time a change occurs that could affect the safety of affected workers.

For Mechanical Service Technicians

- | Carefully plan each job before you start the work. Make sure that you have all the proper tools, equipment and permits (if required). Think through the electrical safety program procedures so that you can easily incorporate them into the troubleshooting, maintenance and/or repair processes.
- | Anticipate unexpected events by thinking through all conceivable possibilities. Remain cognizant of possible unexpected events by giving your undivided attention/concentration to the job.
- | Never approach a unit/piece of equipment with exposed, energized electrical conductors and/or circuit parts closer than 5-feet (units/equipment pushing 480 volts or less) without following the safe work practices and personal protective equipment requirements described in this program. The 5-foot boundary is the greater of the two boundaries (limited approach, and arc flash boundaries) established for Qualified Persons for shock and arc flash protection. The 5-foot boundary applies to any conductive objects that you might be carrying as well.
- | Before opening the access-door or removing the panel to any energized unit/equipment, inspect/evaluate it to ensure that you know its voltage capacity. All HVAC units/equipment are required to be labeled. Labels applied before September 30, 2011 must show the available incident energy, or the

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required level of personal protective equipment. Labels applied on or after September 30, 2011 must show nominal system voltage, the arc flash boundary, and at least one of the following:

- The unit's/piece of equipment's available incident energy and the corresponding work distance, or the arc flash PPE category in Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b), but never both or
- The minimum arc rating of clothing, or
- The site-specific level of PPE.

- | If there is no label on the unit/equipment, report it in writing to the owner's representative and to your supervisor. Also, ensure that all visible parts appear to be in good condition. (If the unit/equipment is pushing more than 480 volts, this program does not apply. Before you proceed obtain and follow an electrical safety program established for units/equipment pushing the higher voltage of the unit/piece of equipment you will be servicing.)
- | Before opening the access-door, or removing the panel to any energized unit/equipment, put on the following personal protective equipment:

- 8-calorie Arc-rated (AR) long sleeve shirt and pants or coveralls, and balaclava;
- Ear plugs;
- Safety glasses;
- Class E hardhat and an attached 8 calorie arc-rated face shield with wrap around guarding;
- Class 00 rubber gloves;
- Leather protector gloves over the rubber gloves (leather protector gloves must be made entirely of leather and have a minimum thickness of 0.03 inches. If the gloves are lined, they must be lined with non-flammable and non-melting fabrics); and
- Leather, dielectric, or properly tested footwear.

- | Be sure to use only properly selected/rated voltage testers (multimeters) and ammeters to test electrical circuits. Visually inspect all testing equipment including the leads, cables, power cords, probes, and connectors before each use.
- | If you see any signs of damage do not use the equipment. Attach a "Danger – Do Not Use" sign to the equipment and take it out of service immediately. Give it to Designated Individual to Repair/Replace Equipment as soon as possible.
- | Use all testing equipment in conformance with the manufacturers' recommendations.
- | Only use the testing equipment that is provided by Company Name and never

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use any type of light-up testing equipment.

- | Before testing voltage on electrical conductors and/or circuit parts, test the meter on a known, live source. Then test the electrical conductors and/or circuit parts. Finish by testing the meter again on a known live source. If you detect any inconsistencies or discrepancies with the meter, take it out of service immediately as described above and repeat this process with a properly working/rated replacement meter.
- | Use only properly rated insulated tools to conduct troubleshooting as necessary to determine what is not working with the unit/equipment.
- | As soon as you have identified the problem, stand to one side of the external service disconnect. Shut off the power and lockout/tagout the disconnect supplying the unit/equipment when lockout/tagout procedures are required. When lockout/tagout is required, be sure to follow the **Company Name** lockout/tagout program for electrical safety (simple lockout/tagout procedures from the program are listed below). (This step does not apply to units/equipment with built-in interlocking disconnects.)
- | Test the unit/equipment to ensure that the power has been shut off.
- | Discharge the capacitors by carefully following the company's written *Procedure for Discharging Capacitors* to establish an electrically safe work condition. If you do not have a copy of the written procedure, ask your immediate supervisor to give you a copy.
- | Once the unit/equipment is "tested dead" and any stored electrical current has been discharged, you may remove your gloves, hardhat, arc-rated face shield, balaclava, and ear plugs. Also, if necessary due to extreme heat or other conditions, you may remove the arc-rated (AR) clothing. (This step does not apply to units/equipment with built-in interlocking disconnects. If you are working on a unit/equipment with a built-in interlocking disconnect, keep all your personal protective equipment on always throughout the troubleshooting and repair/maintenance process.)
- | Complete repairs/maintenance on the unit/equipment.
- | Remove all your tools and materials from inside the unit/equipment.
- | Close the access door or replace the panel.
- | Put on all the required personal protective equipment.
- | Remove the lockout/tagout device if applicable.
- | Stand to one side of the external service disconnect and start the power. (This step does not apply to units/equipment with built-in interlocking disconnects.)
- | Ensure that the structural integrity of the unit/equipment (enclosure) is in good condition.
- | If you encounter any unusual first-time procedures, write them down and report them to your supervisor. Give your supervisor a copy of your written procedures.
- | Do not allow "Unqualified Persons" to come within 10 feet of any unit/equipment that is not in an electrically safe work condition. The unit's/piece of

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equipment's door or panel must be closed and there must be no exposed energized electrical conductors and/or circuit parts for an unqualified person to safely approach the area.

Simple Lockout/Tagout Procedure

The Simple Lockout/Tagout Procedure is to be used in conjunction with the electrical safety program procedures. It will be used whenever a qualified person deenergizes only one set of conductors or circuit part source for the sole purpose of protecting workers from exposure to electrical hazards, and only when: (1) The technician will be performing minor maintenance, servicing, adjusting, cleaning, and/or inspecting; (2) The disconnect is adjacent to the conductor, circuit part source, and the equipment being serviced; (3) The disconnect is clearly visible to the technician; and (4) The work does not extend beyond one work period. The sequential steps for the simple lockout/tagout procedure are:

- | Notify all affected persons that the power to the unit/equipment you will be working on will be shut off and that access to the external service disconnect will be locked/tagged out.
- | Shut off the power supply to the unit/equipment.
- | Attach the proper lockout/tagout device and lock to the external service disconnect to prevent anyone from accidentally starting the unit/equipment while work is being performed.
- | Attempt to operate the external service disconnect to ensure that the lockout device is working properly.
- | Select the properly rated voltage detecting instrument and check it over carefully for visible damage.
- | Test the meter on a known, live source.
- | Test the equipment/unit/equipment for absence of voltage.
- | Test the meter again on a known live source. If you detect any inconsistencies or discrepancies with the meter, take it out of service immediately, and repeat the process with a properly working/rated replacement meter.
- | Discharge any stored energy such as the current in the capacitors.
- | Complete maintenance and/or repair on the unit/equipment.
- | Verify that the job is complete and remove all tools and materials from the unit/equipment.
- | Notify all affected persons that the lockout/tagout procedure has been completed and the electrical supply is being restored.
- | Instruct all affected personnel to stay away from the unit/equipment and the electrical supply.
- | Perform any necessary quality control tests or checks on the unit/equipment.
- | Remove the lock and lockout/tagout device.
- | Turn on the power supply to the unit/equipment.

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- | Notify all affected personnel that the electrical supply is ready to be returned to normal operation.

(Note: The Complex Lockout/Tagout Procedure, which is not typically needed for mechanical service work, is necessary when there is more than one energy source, more than one crew, more than one craft, more than one location, more than one employer, more than one disconnecting means, “particular job sequences,” and/or the job will continue for more than one work period. For more information on the Complex Lockout/Tagout Procedure, see NFPA 70E – 2021 Article 120.4(A)(5)—Complex Lockout/Tagout).

Incident Investigations

The electrical safety program will include elements to investigate electrical incidents. Electrical incidents include events or occurrences that result in, or could have resulted in, a fatality, an injury, or damage to health.

Auditing

This program will be audited to verify that the principles and procedures established herein comply with NFPA 70E – 2021. The audits will be performed at intervals that do not exceed 3 years.

The lockout/tagout program and procedures required by Article 120 will be audited at intervals not to exceed 1 year. The audit will cover at least one lockout/tagout in progress. The audit will be designed to identify and correct deficiencies in the following:

- | The lockout/tagout program and procedures
- | The lockout/tagout training
- | Worker execution of the lockout/tagout procedure.

Appendix A Energized Electrical Work Permit

Energized Electrical Work Permits are not required when the work is done by Qualified Persons performing jobs such as testing, troubleshooting and voltage measuring. However, at some point you may come across an owner who requires a permit. The sample permit on the following page may be tailored to help you comply with an owner's requirement that you establish a permit system.

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ENERGIZED ELECTRICAL WORK PERMIT FOR WORK ON HVAC UNITS/EQUIPMENT PUSHING 480 VOLTS OR LESS

Job/Work Order Number _____

Description of circuit/equipment/job location: _____

Description of work to be done: _____

Justification of why the circuit/equipment cannot be de-energized: _____

TO BE COMPLETED BY THE MECHANICAL SERVICE TECHNICIAN

Check When Complete

- Job description procedure to be used in performing the above detailed work:

☐

- Description of the safe work practices to be employed:

☐

- Necessary personal protective equipment to safely perform the assigned job:

☐

- Means employed to restrict the access of Unqualified Persons from the work area:

☐

- Evidence of completion of a Job Briefing including discussion of any job-related hazards:

☐

APPROVAL TO PERFORM THE WORK WHILE ELECTICALLY ENERGIZED

Company Representative: _____

Date: _____

Client Representative: _____

Date: _____

Safety Representative: _____

Date: _____

Mechanical Service Technician: _____

Date: _____

Once the work is complete, give this form to your immediate supervisor.

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Appendix B Personal Protective Equipment Identification

The personal protective equipment needed by mechanical service technicians for work on HVAC units/equipment pushing 480 volts or less is shown below.

8 cal/cm² Arc Rated Coveralls or Long Sleeve Shirt & Pants



Class E Hardhat



8 cal/cm² Arc-Rated Face Shield with Wrap Around Guarding



8 cal/cm² Balaclava



Class 00 Rubber Gloves



Leather Protector Gloves



Standard Safety Glasses



Ear Plugs



Leather, Dielectric, or Properly Tested Footwear



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Appendix C

Model Written Procedure for Discharging Capacitors (Based on NFPA 70E – 2021)

Company: Company Name

Facility: Facility Name

Facility Address: Address of the Facility

Equipment Description: Type of Affected Electrical Equipment

Contact: Name and Mobile Number of the Qualified Person

Application:

The following Company Name procedure for safely discharging capacitors applies to all affected employees when work on or near a conductor or circuit part, that is connected to a capacitor operating at or above the following thresholds, is performed:

- (1) Less than 100 volts and greater than 100 joules of stored energy;
- (2) Greater than or equal to 100 volts and greater than 1.0 joule of stored energy; or
- (3) Greater than or equal to 400 volts and greater than 0.25 joules of stored energy.

Worker Qualifications:

Only properly qualified employees trained in, and familiar with, the specific hazards and controls required for safe work are permitted to work on electrical equipment with capacitors that are operating at or above the thresholds described above.

Risk Assessment Results:

Identified Hazards: _____

Description of Risk(s):

Stored Energy Available: _____

Required Wait Time Following De-energization/Before Opening Enclosure: _____

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Circle Selected Risk Control(s):

Elimination – Substitution – Engineering Controls – Awareness – Administrative Controls – PPE

Procedure:

- Review and carefully follow all appropriate safe work practices;
- Use all appropriate personal protective equipment (PPE);
- Determine all possible sources of electrical supply to the specific equipment that you will be working on;
Review all applicable up-to-date drawings, diagrams, and identification tags;
After properly interrupting the load current, open the disconnecting device(s) for each source;
- Visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position;
Apply lockout/tagout devices in accordance with **Company Name** established and documented lockout/tagout program for electrical safety;
- If bleed resistors or automatic discharge systems are applicable, wait the prescribed time for the capacitors to discharge to less than the thresholds described in this procedure and go straight to verifying that the capacitors are properly discharged (skip to third bullet down at (Verify that the Capacitors are Discharged));
- For systems without bleed resistors or automatic discharge systems, discharge the capacitors with an adequately rated grounding device (e. g. ground stick);
Perform soft grounding above 1000 joules, and remote soft grounding above 100 kJ;
- Verify that the capacitors are discharged;
For capacitors less than 1000 joules, perform verification either by testing or by grounding;
- For capacitors between 1000 joules and less than 100 kJ, perform verification by testing or soft grounding, and hard grounding;
Above 100kJ, use an engineered and redundant system for remote testing and grounding. Use an adequately rated portable test instrument to test between each capacitor terminal and from each terminal to ground to assure that the capacitor is deenergized;
- Before and after each verification, determine that the test instrument is operating satisfactorily through verification on a known direct current voltage source. If voltage remains, determine, and correct the cause, and repeat the entire procedure to safely discharge the capacitors.
- Where recharging can occur due to dielectric absorption or induced voltages, ensure that all the capacitor terminals are connected together and grounded with bare or transparent-insulated wire;

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- For series capacitors ensure that the shorting wires are attached across each individual capacitor, and to case; and
- For single capacitors or for a parallel capacitor bank, the grounding device may be left attached to the capacitor terminals for the duration of the work (e. g., a ground stick).

Appendix D Model Lockout/Tagout Program (Based on NFPA 70E – 2021)

IMPORTANT

NFPA 70E – 2021 requires employers to establish a written lockout/tagout program. And, when complex lockout/tagout is required, employers are also required to establish a written complex lockout/tagout plan that is specific to each application. [MCAA's Model Lockout/Tagout Program for Electrical Safety](#) will help you meet both requirements when needed.

