

1. Purpose

To establish minimum requirements to prevent injury to team members and contractors working on or near exposed energized parts of electrical equipment.

2. Scope

This procedure applies to Innovating Machining, LLC (IM) team members, vendors and outside contractors when working on energized building circuitry or parts greater than 50 volts.

3. Definitions

- 3.1 Arc Flash Boundary: The farthest point at which a shock hazard exists. Inside of this boundary a worker may receive a second degree burn to exposed skin, typically the neck, face and hands. The arc flash boundary is to be crossed only with appropriate personal protective equipment to protect against electrical arc flash. The arc flash boundary is nominally located at a distance from the energized parts where the incident energy from an anticipated arc is reduced to 1.2 cal / cm². Persons not considered electrically qualified (unqualified), as defined in this document, may enter the arc flash boundary but shall not be allowed to perform tasks within the arc flash boundary. Further, unqualified persons must not cross the arc flash boundary unless they are wearing appropriate personal protective clothing and are under the close supervision of a qualified person.
- 3.2 Electrically Safe Work Condition: A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked and tagged in accordance with IM’s lockout tagout program, SAF.147, tested to ensure the absence of voltage, and grounded if determined necessary.
- 3.3 Exposed: Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitably guarded, isolated, or insulated.
- 3.4 Limited Approach Boundary: A shock protection boundary to be crossed by only qualified persons (at a distance from a live part) which is not to be crossed by unqualified persons unless escorted by a “qualified person”.
- 3.5 Qualified Person – One who has demonstrated skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. Examples of safety training include, but are not limited to, training in the use of special precautionary techniques, personal protective equipment, including arc flash, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to

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certain equipment and methods but still are unqualified for others.

- 3.6 Restricted Approach Boundary: A shock protection boundary to be crossed by only electrically qualified persons which, due to its proximity to a shock hazard, require the use of shock protection techniques and equipment.
- 3.7 Unqualified Person: Those with little or no training working on, near, or with electrical components.
- 3.8 Working On (energized electrical conductors or circuit parts): Intentionally coming in contact with energized electrical conductors or circuits parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing. There are two categories of “working on”.

4. RESPONSIBILITIES

- 4.1 The President and Management Team
 - 4.1.1 Providing the resources necessary to implement this program, including delegating responsibility and authority to managers and supervisors.
- 4.2 Program Administrator (Shop Supervisors)
 - 4.2.1 Ensuring that the program is implemented.
 - 4.2.2 Ensuring the training of all unauthorized team members.
- 4.3 Purchasing Manager
 - 4.3.1 Ensuring that hired electrical contractors who may have to work on live electrical equipment are trained to the authorized level.
- 4.4 Human Resources
 - 4.4.1 Maintaining the training records of all team members.
- 4.5 Shop Superintendent
 - 4.5.1 Department Managers and Supervisors are responsible for ensuring that their team members do not work near or on energized electrical equipment over 50 volts.
- 4.6 Unqualified Team Members
 - 4.6.1 Do not work near or on energized electrical equipment over 50 volts.

5. EQUIPMENT

- 5.1 None.

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6. PROGRAM

6.1 General Electrical Safety

6.1.1 Extension cords

6.1.1.1 Extension cords must be UL listed and carry hard or extra-hard NEC designations, such as: S, ST, SO, STO, SJ, SJO, SJT, SJTO.

6.1.1.2 Extension cords should be a minimum of 12 gauge with 3 conductors.

6.1.1.3 Extension cords shall be inspected prior to use. If found to be damaged, they should be taken out of service and repaired by a qualified employee.

6.1.1.4 Extension cords shall not be used in place of permanent wiring.

6.1.1.5 Extension cords shall not be used in place of fixed wiring, attached to the surface of any building, run through holes in walls, ceilings or floors.

6.1.1.6 Extension cords must be rolled up and stored after each use.

6.1.2 Power Strips

6.1.2.1 Power strips shall be UL listed and appropriate for the environment.

6.1.2.2 Power strips shall not be daisy chained together unless approved by the manufacturer.

6.1.3 Tools Connected by Cord and Plug

6.1.3.1 All power tools will have three-pronged plugs unless double insulated. If grounding pins are missing, the plug and cord will be removed from service until repaired.

6.1.3.2 Each piece of equipment shall be visually inspected before each use. If any tool or plug and cord set failing the visual inspection they will be removed from service until repaired.

6.1.3.3 Tools shall not be carried by the cord.

6.1.3.4 Cords shall not be yanked from the wall outlet.

6.1.4 Ground Fault Circuit Interrupter (GFCI)

6.1.4.1 GFCI outlets or portable GFCI outlets shall be used for electrical work outdoors or indoors when working near water, potential water sources, etc.

6.1.4.2 GFCI's shall be inspected before use.

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6.1.5 Ladders

6.1.5.1 Fiberglass ladders will be used when working around or on electrical equipment or wires.

6.1.6 Guarding

6.1.6.1 All electrical distribution panels, breakers, disconnects, switches and junction boxes shall be completely enclosed.

6.1.6.2 Live parts to electrical equipment operating at 50 volts or more must be guarded to prevent contact and prevent damage.

6.1.6.3 All electrical receptacles and cover plates will be kept intact and in good condition.

6.1.6.4 All electrical panels will be easily accessible at all times and a minimum of three feet of clearance shall be maintained on all sides.

6.2 Arc Flash Policy

6.2.1 It is generally undesirable to work on live electrical parts and it is unacceptable to perform barehanded work on energized circuits. The preferred approach to working with electrical equipment is to de-energize the equipment before the work begins.

6.2.2 Only persons who have the skills, knowledge, and required training (including task specific training) are considered “qualified” and may work on or near any circuit parts or equipment that have not been de-energized. These qualified persons must:

6.2.2.1 Be capable of working safely on energized circuits.

6.2.2.2 Be familiar with the proper use of special precautionary techniques.

6.2.2.3 Know how to select, use, and inspect appropriate personal protective equipment.

6.2.2.4 Know how to use insulating and shielding materials.

6.2.2.5 Understand the proper selection and use of insulated tools.

6.2.3 IM must ensure that the electrical equipment and systems are properly maintained.

6.2.4 IM team members are not trained to the qualified level and are not authorized to work with or near live electrical equipment. This includes, but is

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not limited to entering panels, removing MCC buckets, and electrically troubleshooting equipment. The work is contracted out.

6.3 Selection and use of Safe Work Practices

6.3.1 Live electrical parts are to be put into an electrically safe work condition before a potentially exposed team member works on it. Exceptions include:

6.3.1.1 The employer can demonstrate that de-energizing introduces additional or increased hazards, including:

6.3.1.1.1 Deactivation of emergency alarms systems.

6.3.1.1.2 Shutdown of hazardous-location ventilation equipment.

6.3.1.1.3 Removal of illumination for an area.

6.3.1.2 The employer can demonstrate that de-energizing is infeasible due to equipment design or operational limitations. Examples of work that may be performed because of infeasibility include:

6.3.1.2.1 Diagnostics and testing (start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized.

6.3.1.2.2 Work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

6.3.1.3 Delaying maintenance until after the shift, during the weekend, shut down period, etc. should be considered as an option to prevent team members or contractors from working on live electrical parts.

6.3.2 De-energized parts require lockout/tagout in accordance with 29 CFR 1910.147, and IM’s Control of Hazardous Energy written program, SAF.147.

6.3.3 An electrically safe work condition will be achieved when utilizing energy control procedures and verified by the following process:

6.3.3.1 After properly interrupting the load current, open the disconnecting device(s) for each source.

6.3.3.2 Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawn out type circuit breakers are withdrawn to the fully disconnected position.

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- 6.3.3.3 Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground.
- 6.3.4 When test instruments are used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument must be verified on a known source before and after an absence of voltage test is performed.
- 6.3.5 Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being deenergized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.
- 6.4 Energized Work Permit
 - 6.4.1 If live electrical parts are not placed in an electrically safe work condition (i.e., for the reasons of increased or additional hazards or infeasibility) and work is within the restricted approach boundary or arc flash boundary, then work being performed shall be considered energized electrical work and shall be performed by written permit only (Energized Work Permit), see SAF.331.F1.
 - 6.4.2 Energized Work Permit Exemptions
 - 6.4.2.1 Work performed on or near live parts by qualified persons related to tasks such as testing, troubleshooting, and voltage measuring shall be permitted to be performed without an energized work permit, provided appropriate safety work practices and proper personal protective equipment are utilized.
 - 6.4.2.2 If the purpose of crossing the limited approach boundary is only for thermography and visual inspections and the restricted approach boundary will not be crossed, then an energized work permit shall not be required.
 - 6.4.2.3 Access to and egress from an area with energized electrical equipment if no electrical work is performed and the restricted approach boundary is not crossed.
- 6.5 Hazard/Risk Evaluation
 - 6.5.1 A documented hazard/risk assessment (See Attachment SAF.331.F2) must be

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completed and attached to the Energized Work Permit.

6.6 Personal Protective Equipment

6.6.1 When personnel are working within the restricted approach boundary, they shall wear PPE in accordance with NFPA 70E, 130.7).

6.6.2 Insulating equipment shall be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage.

6.6.3 Insulating gloves shall be given an air test before each use, along with the inspection.

6.6.4 Electrical protective equipment shall be tested with maximum intervals between tests as described below:

Rubber Insulating Blankets	Before 1st issue and every 12 months thereafter.
Rubber Insulating Gloves	Before 1st issue and every 6 months thereafter. Gloves maybe replaced every 6 months instead of tested.
Rubber Insulating Sleeves	Before 1st issue and every 12 months thereafter.

6.6.5 The minimum PPE that shall be worn while disconnecting electrical switches located on the outside of panels or circuit breakers inside of panels shall be safety glasses. The team member disconnecting the electrical switch or circuit breaker shall use the "Left Hand Rule" which includes the following:

6.6.5.1 Using the non-dominate hand, position hand/fingers on the switch or breaker.

6.6.5.2 Stand to the side of the switch or breaker

6.6.5.3 Turn their head away from the switch or breaker

6.6.5.4 Take a deep breath and hold it.

6.6.5.5 Move the switch or circuit breaker.

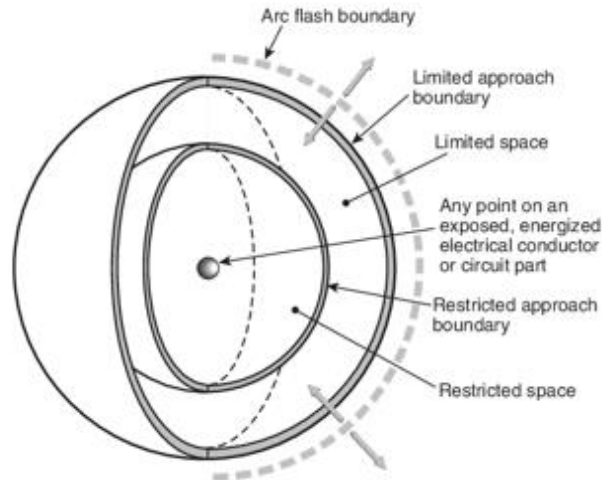
6.7 Safeguards for Personal Protection

6.7.1 Safety signs, labels, tags, barricades, and attendants shall be used as necessary to warn and protect team members from electrical hazards.

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- 6.7.2 Electrical equipment such as switchboards, panel boards, control panels, meter socket enclosures, disconnects, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized are required to be labeled to warn qualified persons of the potential shock and arc flash hazards. The labels must have the following information.
 - 6.7.2.1 Available incident energy and the corresponding working distance.
 - 6.7.2.2 Minimum arc rating of the clothing.
 - 6.7.2.3 Required level of PPE.
 - 6.7.2.4 Highest Hazard/Risk Category (HRC) for the equipment.
 - 6.7.2.5 Nominal system voltage.
 - 6.7.2.6 Arc flash boundary.
- 6.7.3 Working space required by other codes and standards shall not be used for storage. This space shall be kept clear to permit safe operation and maintenance of electrical equipment.
- 6.7.4 Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn within the restricted approach boundary or where they present an electrical contact hazard with exposed energized electrical conductors or circuit parts.
- 6.8 Limits of Approach
 - 6.8.1 Observing a safe approach distance from exposed energized electrical conductors or circuit parts is an effective means of maintaining electrical safety. As the distance between a person and the exposed energized conductors or circuit parts decreases, the potential for electrical accident increases.

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6.9 Accident Investigations

6.9.1 A formal accident investigation shall be completed for each electricity related incident.

6.10 Emergency Response

6.10.1 When live electrical work is performed, a first aid/CPR/AED trained employee shall be available in the event of an emergency.

6.11 Contractors

6.11.1 This section applies to all contractors, and critical subcontractors such as steel erectors, electrical, piping/HVAC, foundations, etc. Contractors shall be held to the standards outlined in this procedure.

6.11.2 IM responsibilities include informing the contractor of known hazards that they may encounter or that may not be recognized by the contractor.

6.11.3 While the contractor is on site they will be observed and any violations of this procedure will be reported to the contractor for correction.

6.11.4 The contractor shall ensure that each of their employees are instructed in the hazards communicated to them from IM. Live electrical work will require the contractor to complete an energized work permit and hazard risk evaluation.

6.11.5 The contractor will ensure that their team members follow the requirements outlined in this procedure.

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7. TRAINING

7.1 Qualified Team member Training

7.1.1 Team members shall be trained in and familiar with the safety-related work practices required by OSHA, the NFPA, and this written program.

7.1.2 They shall also be trained in and familiar with the skills, knowledge, and techniques related to construction and operation of electrical equipment/installations, able to distinguish exposed live parts from other parts of electric equipment, and able to determine the nominal voltage of exposed live parts.

7.1.3 This requirement can be met by prior work experience, education, demonstrated skill, or training.

7.2 Unqualified Team member Training

7.2.1 The inherent hazards of electricity, such as high voltage, electric current, arcing, grounding, lack of guarding, and contact release.

7.2.2 Team members shall receive unqualified person training initially upon assignment or during the new hire orientation process.

7.3 Retraining

7.3.1 Retraining is necessary when a change in job assignment occurs, a change in machines, equipment or processes that presents a new hazard or whenever there is a reason to believe that there are deviations from or inadequacies in the team member's knowledge of electrical hazards.

8. RECORDKEEPING

<u>Topic</u>	<u>Duration</u>	<u>Location</u>
Energized Work Permit	Maintain Current and Prior Year's Completed Forms.	Program Administrator
Hazard Risk Evaluation	Maintain Current and Prior Year's Completed Form.	Program Administrator
Training Records	Length of Employment.	HR Department

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Attachment SAF.331.F1, Energized Work Permit
See the Next Two Pages

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Attachment SAF.331.F2, Hazard Risk Evaluation
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