1.0 Policy
Work activities involving electrical hazards shall be conducted safely.

2.0 Purpose
To establish the procedures that shall be followed in the safe performance of work activities involving general electrical hazards.

3.0 Scope
Applies to all Sunbelt Controls work sites.

4.0 Definitions
Approved – acceptable to the authorities

Authorized Person – a person approved or assigned by Sunbelt Controls to perform a specific duty or duties or to be at a specific location or locations at the jobsite.

Cabinet – an enclosure designed either for surface or flush mounting.

Competent Person – one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

Conductor (bare) – a conductor having no covering or electrical insulation whatsoever

Conductor (insulated) – a conductor encased within material of composition and thickness that is recognized as electrical insulation.

Defect – any characteristic or condition that tends to weaken or reduce the strength of the tool, object, or structure of which it is a part

Disconnect – a device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Enclosed – surrounded by a case, housing, fence or walls which shall prevent persons from accidentally contacting energized parts.

Enclosure – the case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage

Exposed (as applied to live parts) – capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated.

Guarded – covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects.

Isolated – not readily accessible to persons unless special means for access are used

Labeled – equipment or materials to which has been attached a label, symbol or other identifying mark of a qualified testing laboratory which indicates compliance with appropriate standards or performance in a specified manner

NEC – National Electric Code

Qualified – persons who are capable of working safely on equipment and are familiar with electrical properties, the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools

Receptacle – a contact device installed at the outlet for the connection of a single attachment plug; a single receptacle is a single contact device with no other contact device on the same yoke; a multiple receptacle is a single device containing two or more receptacles.

5.0 Requirements

5.1 General

All personnel must be trained in electrical safety awareness, preventive measures to avoid electrical hazards typically seen and lock-out tag-out as part of their initial orientation.

All personnel that will be working on live electrical systems must complete additional training in energized electrical work practices, PPE selection and compliance with ANSI Part 70E electrical arc flash requirements.

All feasible engineering and administrative controls shall be applied to mitigate or minimize the risk of injury and illness from exposure to electrical hazards. Where such hazards still exist after application of these controls, local 'hot work' procedures (see local Appendix A to this section) shall apply and personal protective equipment shall be utilized. Such addenda shall comply with NFPA
70E.

Where feasible, employees shall not perform live electrical work. If Sunbelt Controls engages in live work, we will indicate applicable safe work procedures, PPE, and equipment in Appendix A to this manual section. In existing installations, no changes in circuit protection shall be made to increase the load in excess of the load rating of the circuit wiring.

Worn or frayed electric cords or cables shall be removed from work areas for repair or disposal. Repairing cords shall be limited to shortening only by an authorized person, as determined by the Safety Manager.

Extension cords shall not be fastened with staples, hung from nails, or suspended by wire.

This section does not apply to power distribution or transmission lines. Refer to OSHA CFR Subpart "R" 1910.269 (servicing) and/or OSHA CFR Subpart "V" 1926.950 (construction) for overhead power transmission and distribution line requirements.

All wiring components and equipment in hazardous environments shall be maintained in a condition consistent with NEC requirements (e.g. no loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition).

Control equipment, utilization equipment, and bus-ways approved for use in dry locations only shall be protected against damage from the weather during building construction.

Metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware shall be of materials appropriate for the environment in which they are to be installed.

Electrical switches shall be labeled to indicate the system, equipment, service, or tool they control. This includes switch boxes, cabinets, motor control cabinets, stationary equipment, all control panels, and other such switches or disconnects.

Persons who perform electrical work shall wear hard hats that are proof tested to 20,000 volts and shall not wear clothing with or without PPE that could increase injury (100% cotton is better than blended materials).

In work areas where the exact location of underground electric power lines is unknown, employees using jackhammers, bars, or other hand tools that may contact a line shall be provided with insulated protective gloves. Gloves must be rated to (or exceed) the voltage for which they may be exposed. The gloves shall be inspected before use and tested within six months.

5.2 Energized Electrical Parts and Systems

Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

Live parts to which an employee may be exposed shall be de-energized before the employee works on or near them, unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. Live parts that operate at less than 50 volts to ground need not be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

If the exposed live parts are not de-energized (i.e., for reasons of increased or additional hazards or unfeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts. **These work practices will be covered in the Appendix A of this section.**

5.2.1 Working On or Near Exposed De-energized Parts

This section applies to work on exposed de-energized parts near enough to expose employee/s to an electrical hazard.

While an employee is exposed to contact with fixed electrical equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out in accordance with the Energy Control (lockout) section sixteen [16] of this manual.

The circuits and equipment to be worked on shall be disconnected from all electrical energy sources (and locked out). Control circuit devices, such as push buttons, selector switches, and interlocks, shall not be used as the sole means for de-energizing circuits or equipment.

Procedures for the release of stored electric energy shall be covered in Appendix 14-A to this policy section (as Hot Work Addendum).

When capacitors or associated equipment are handled, they shall be treated as energized.

Stored non-electrical energy in devices that could reenergize electrical parts shall be blocked or relieved to the extent that the parts could not be accidentally energized by the device.

5.2.2 Working On or Near Exposed Energized Parts

Every effort shall be made to preclude work on energized electrical parts. When this is not possible, the requirements of this section shall apply. Potential contact with live energized parts includes work performed on exposed live parts (involving either direct or indirect contact – by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.

Only qualified persons shall work on electrical equipment that has not been de-energized.

If work is to be performed near overhead lines, the lines shall be de-energized and grounded, or other protective measures shall be provided before work is started. If the lines are to be de-energized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to de-energize and ground them. If protective measures, such as guarding, isolating, or insulating are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

5.2.3 Overhead Electrical Lines

When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

- For voltages to ground 50kV or below, 10 ft. (305 cm) in distance;

- For voltages to ground over 50kV, 10 ft. (305 cm) in distance plus 4 in. (10 cm) for every 10kV over 50kV.

When an unqualified person is working on the ground in the vicinity of overhead lines, the person shall not bring any conductive object closer to unguarded, energized overhead lines than the distances given in the first paragraph above.

For voltages normally encountered with overhead power lines, objects which do not have an insulating rating for the voltage involved shall be considered to be conductive.

When a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground:

- The person shall not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown below:

Approach Distances for Qualified Employees - Alternating Current	
Voltage Range (phase to phase)	**Minimum Approach Distance**
300V and less	Avoid contact
Over 300V, not over 750V	1ft 0in
Over 750V, not over 2kV	1ft 6in
Over 2kV, not over 15kV	2ft 0in
Over 15kV, not over 37kV	3ft 0in
Over 37kV, not over 87.5kV	3ft 6in
Over 87.5kV, not over 121kV	4ft 0in
Over 121kV, not over 140kV	4ft 6in

- The person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage involved are considered to be insulation of the person from the energized part on which work is performed), or
- The energized part is insulated both from all other conductive objects at a different potential and from the person, or
- The person is insulated from all conductive objects at a potential different from that of the energized part

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10kV over that voltage. However, under any of the following conditions, the clearance shall be reduced:

- If a vehicle is in transit with its structure lowered, the clearance shall be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10kV over that voltage
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance

shall be reduced to a distance within the designed working dimensions of the insulating barrier

- If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the un-insulated portion of the aerial lift and the power line) shall be reduced to the distance given in the above table

Employees standing on the ground shall not contact the vehicle or mechanical equipment or any of its attachments, unless:

- The employee is using protective equipment rated for the voltage or the equipment is located so that no un-insulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted in this section
- If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding shall not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point

5.2.4 Illumination

Employees shall not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform tasks near exposed energized parts. Employees shall not reach blindly into areas which may contain energized parts.

5.2.5 Confined Space or Enclosed Space Work

When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized parts, protective shields, protective barriers, or insulating materials shall be used as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent swinging into an employee and causing the employee to contact exposed energized parts (reference the Confined Spaces section [12] of this manual).

5.2.6 Conductive Materials and Equipment

Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, a JSA (reference JSAs in the Safety Systems section [9] of this manual) shall be performed in advance.

5.2.7 Portable Ladders

Portable ladders shall have nonconductive side rails if they are used where the employee or the ladder could contact exposed energized parts (reference Ladder section [26] of this manual).

5.2.8 Conductive Apparel

Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) shall not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.

5.2.9 Housekeeping Duties

Where live parts present an electrical contact hazard, employees shall not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided. Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) shall not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact.

5.2.10 Interlocks

Only a qualified person following the requirements of this section may defeat an electrical safety interlock, and then only temporarily while working on the equipment. The interlock system shall be returned to its operable condition when this work is completed.

5.3 GFCI's and Assured Grounding Procedures

Ground Fault Circuit Interrupters (GFCI's) shall be used with all receptacles >15 amps up to and including 30 amps.

For all other applications, GFCI's shall be used in conjunction with portable electrical hand tools and outlets in use that are not part of a permanent wiring system. When this is not possible (feasible) the Assured Grounding procedures in this section shall apply and the Safety Manager shall include as the Appendix A to this policy section an Assured Grounding Program. The elements of this program shall include as a minimum:

- Written description of program
- Program coordinator
- Inspections
- Documented Testing
- Availability of Equipment
- Integrity of testing equipment (repairs/testing of test equipment)
- Handling of defective tools and equipment
- Who will perform tests, and repairs
- Recordkeeping
- How receptacles will be provided with GFCI's

The minimum requirements relative to the use of Ground Fault Circuit Interrupters are:

- Have a written maintenance program to ensure that GFCI's are inspected properly on a periodic basis
- Ensure that GFCI's that have insufficient load capacity, are improperly repaired, damaged or generally unsafe will be removed from the site and sent for repair or disposal Such GFCI's shall be tagged with a "Danger, Do Not Use" tag and stored in a secure place during the interim
- Provisions are defined for the proper use of GFCI's and employees are trained. This training shall include:
  - Double insulated tools
  - Defective cords and plugs
  - Heavy moisture, and wet conditions
  - Operation, selection, and use of GFCI's

The receptacles of temporary wiring systems shall be protected with a GFCI. Only qualified persons shall perform inspection and "color code" labeling of tools and equipment.

5.3.1 Equipment and Tools

Note: Portable equipment which is "double insulated" and endorsed by a nationally recognized testing facility need not have a grounding conductor, but is subject to the inspection requirements of this section.

Tools and equipment subject to inspection and testing include:

- Portable Electrical Tools such as grinders, drills and stapling guns
- Stationary tools such as table saws, drill presses, and jig saws
- Portable electrical extension cords
- Portable and Temporary lighting systems and cords

All receptacles shall be of the grounding type and their contacts shall be grounded by connection to the equipment grounding conductor of the circuit supplying that receptacle in accordance with the NEC.

5.3.2 Visual Inspections

Visual inspection of tools and equipment are required prior to each use and shall include:

- General condition
- Plugs and caps, and presence of ground prong
- Electrical cord sets
- External defects, and missing parts

Defective tools shall be tagged, taken out of service and placed in a secured location until they are repaired or destroyed.

5.3.3 Testing

The following tests shall be performed on all applicable equipment:

- All equipment grounding conductors shall be tested for continuity and shall be electrically continuous
- Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment-grounding conductor. The equipment-grounding conductor shall be connected to its terminal

All required tests should be performed as indicated below:

- Before first use
- Before being returned to service following any repairs
- Before being used, after any incident that can be reasonably suspected to have caused damage (for example, when a cord set is run over)
- At intervals not to exceed 3 months

Test equipment must be evaluated for proper operation immediately before and after tests are conducted.

5.3.4 Removal from Service

Any equipment failing any test shall be taken out of service, shall be tagged with a **"Danger, Do Not Use"** tag, secured and repaired or destroyed.

5.3.5 Color Code

The color code scheme for labeling tools and equipment (in the table below) and shall be the Appendix 14-A color scheme. Tools and equipment shall be color coded on a quarterly basis when inspected and marked according to the Quarterly Code. If inspections are conducted monthly, the Monthly Code should be used. For example "Red & Blue" means the inspection was conducted in the first quarter during February.

Tape Color Coding System	
Month	Quarterly Code
January February March	**Red** ↓
April May June	**Blue** ↓
July August September	**White** ↓
October November December	**Green** ↓

5.4 Temporary Wiring

This section applies to temporary electrical power and lighting wiring methods that may be of a class less than would be required for a permanent installation.

Temporary wiring shall be removed immediately upon completion of work and when the purpose for which the wiring was installed no longer applies.

5.4.1 General Requirements for Temporary Wiring

Feeders shall originate in a distribution center. The conductors shall be run as multi-conductor cord or cable assemblies or within raceways.

Branch circuits shall originate in a power outlet or panel board.

Conductors shall be run as multi-conductor cord or cable assemblies or open conductors, or shall be run in raceways. All conductors shall be protected by over current devices at their ampacity.

A mounted box (with a cover) shall be used wherever a change is made to a raceway system or a cable system that is metal clad or metal sheathed.

All non-metallic wiring system joints below seven foot (7') shall have mounted boxes and be covered. All exposed temporary joints shall have the wire nuts or other mechanical devices taped with black (electrical) tape to prevent them from falling off. All temporary joints including the ground wire shall have a mechanical connection.

Receptacles shall be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment-grounding conductor, and all receptacles shall be connected to the grounding system. Receptacles shall not be connected to the same ungrounded conductor of multi-wire circuits that supply temporary lighting.

Disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

All lamps for general illumination shall be protected from accidental contact or breakage. Metal-case sockets shall be grounded.

The electric cords shall not be used to suspend temporary lights unless cords and lights are designed for this means of suspension. All temporary lighting shall be properly supported.

Portable electric lighting used in wet and/or other conductive locations, as for example, drums, tanks, and vessels, shall be operated at 12 volts or less. However, 120-volt lights may be used if protected by a ground-fault circuit interrupter.

Flexible cords and cables shall be protected from damage. Sharp corners and projections shall be avoided. Flexible cords and cables may pass through doorways or other pinch points, if protection is provided to avoid damage. Cords and temporary wiring passing through walls shall be properly protected (e.g. sleeved).

Extension cord sets used with portable electric tools and appliances shall be of three-wire type and shall be designed for hard or extra-hard usage.

Flexible cords used with temporary and portable lights shall be designed for hard or extra-hard usage. See the NEC, ANSI/NFPA 70, in Article 400, Table 400-4 that lists various types of flexible cords, some of which are noted as being designed for hard or extra-hard usage. Note: SEU, SER or other similar cables cannot be laid on the floor despite their rating.

For temporary wiring over 600 volts, nominal, fencing, barriers, or other effective means shall be provided to prevent access of other than authorized and qualified personnel.

5.5 Batteries

5.5.1 General

Batteries of the unsealed type shall be located in enclosures with outside vents or in well-ventilated rooms and shall be arranged so as to prevent the escape of fumes, gases, or electrolyte spray into other areas.

Ventilation shall be provided to ensure diffusion of the gases from the battery and to prevent the accumulation of an explosive mixture.

Appropriate face shields, aprons, goggles and rubber gloves shall be provided for workers handling acids or batteries. Contact lenses are prohibited while working with batteries, unless using a type of goggle that will not allow the transference of gases.

Facilities for quick drenching of the eyes and body shall be provided within 25 feet of battery handling areas. Facilities shall be provided for flushing and neutralizing spilled electrolyte and for fire protection in the areas of battery use.

Battery charging installations shall be located in areas designated for that purpose. When batteries are being charged, the vent caps shall be kept in place to avoid electrolyte spray. Vent caps shall be maintained in a functioning condition.

All battery manufacturer guideline specifics detailed under sub-sections 5.5.2 – 5.5.4 of this policy section shall be met.

Smoking, eating or drinking in areas where batteries are being stored, charged or worked with is prohibited.

5.5.2 Handling and Transportation

Packaging, markings and transportation of batteries shall be in accordance with all Federal, State and local laws, regulations and standards. After the packaging is removed, batteries shall be inspected for defect, including, but not limited to:

- Bulging
- Cracking
- Leaking

Batteries shall not be forced into equipment/locations. Wherever feasible, old and new batteries shall not intermix.

5.5.3 Storage

- Batteries shall be kept in their original packaging until they are ready to be used.
- New and used batteries shall be kept separate for easier distinction.
- All batteries should be stored separate from combustibles and flammables and protected from being crushed, punctured or exposed to incompatible environmental conditions.
- Used batteries, not intended for re-use, shall be properly disposed.

5.5.4 Disposal

All batteries being disposed of shall be done so in accordance with all Federal, State and local laws, regulations and standards.

5.6 Clearances in the Work Place

Employees shall not be permitted to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by de-energizing the circuit and grounding it (if appropriate) or by guarding it effectively by insulation or other means.

Supervisors and/or Competent Person(s) shall ascertain by inquiry, direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. The supervisor/Competent Person shall post and maintain proper warning signs where such a circuit exists. The supervisor/Competent Person shall advise employees of the location of such lines, the hazards involved, and the protective measures to be taken.

Barriers or other means of guarding shall be provided to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of electrical equipment are exposed.

5.7 Fuses

Installing or removing fuses shall be considered as work with live electrical energy and shall be covered in the Appendix A to this policy section for operations conducting such activities.

Persons who perform work on high voltage fuses (over 600 volts) shall wear appropriate head, face, body flash suits, protective footwear and insulated gloves.

Insulating electrical gloves, sleeves, aprons, and other protective electrical clothing shall be tested for leaks and integrity prior to initial use and periodically.

These tests shall meet the requirements of OSHA Standard 29 CFR 1910.137.

Protector gloves shall be worn over insulating gloves, except as defined in the above referenced standard.

Only manufacturer-qualified personnel shall inspect and make repairs to electrical insulating protective clothing.

5.8 Work Space Clearances – 600 Volts, nominal, or less

5.8.1 Working Space About Electric Equipment

Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

5.8.2 Working Clearances

Except as required or permitted elsewhere in this section, the dimension of the working space in the direction of access to live parts operating at 600 volts or less and likely to require examination, adjustment, servicing, or maintenance while live shall not be less than indicated in the table below.

In addition to the dimensions shown in the following table, workspace shall not be less than 30 inches wide in front of the electric equipment.

Distances shall be measured from the live parts if they are exposed or from the enclosure front or opening if the live parts are enclosed. Walls constructed of concrete, brick, or tiles are considered to be grounded.

Working space is not required in back of assemblies such as dead-front switchboards or motor control centers where there are no renewable or adjustable parts such as fuses or switches on the back and where all connections are accessible from locations other than the back.

Minimum Depth of Clear Working Space in Front of Electric Equipment (feet)			
Nominal Voltage to Ground Conditions*	**(a)***	**(b)***	**(c)***
0-150	3	3	3
151-600	3	3 1/2	4
***Conditions (a), (b), and (c) are as follows:** (a) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by insulating material. Insulated wire or insulated bus bars operating at not over 300 volts are not considered live parts. (b) Exposed live parts on one side and grounded parts on the other side. (c) Exposed live parts on both sides of the workspace [not guarded as provided in Condition (a)] with the operator between.			
Note: For International System of Units (SI): one foot=0.3048m.			

Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space shall be guarded.

At least one entrance shall be provided to give access to the working space about electric equipment.

Where there are live parts normally exposed on the front of switchboards or motor control centers, the working space in front of such equipment shall not be less than 3 feet.

The minimum headroom of working spaces about service equipment, switchboards, panel boards, or motor control centers shall be 6 feet 3 inches.

5.8.3 Guarding of Live Parts

Except as required or permitted live parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact by cabinets or other forms of enclosures, or by any of the following means:

- By location in a room, vault, or similar enclosure that is accessible only to qualified persons
- By partitions or screens so arranged that only qualified persons will have access to the space within reach of the live parts. Any openings in such partitions or screens shall be so sized and located that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them
- By location on a balcony, gallery, or platform so elevated and arranged as to exclude unqualified persons

In locations where electric equipment could be exposed to physical damage, enclosures or guards shall be so arranged and of such strength to prevent damage.

Entrances to rooms and other guarded locations containing exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

5.9 Work Space Clearances - over 600 volts, nominal

Conductors and equipment used on circuits exceeding 600 volts, nominal, shall comply with all applicable provisions of this section and with the following provisions that supplement or modify those requirements. The provisions of paragraphs (5.9.2), (5.9.3), and (5.9.4) of this section do not apply to equipment on the supply side of the service conductors.

5.9.1 Enclosure for Electrical Installations

Electrical installations in a vault, room, and/or closet or in an area surrounded by a wall, screen, or fence, access to which is controlled by lock and key or other equivalent means are considered to be accessible to qualified persons only. A wall, screen, or fence less than 8 feet in height is not considered adequate to prevent access unless it has other features that provide a degree of isolation equivalent to an 8-foot fence. The entrances to all buildings, rooms or enclosures containing exposed live parts or exposed conductors operating at over 600 volts, nominal, shall be kept locked or shall be under the observation of a qualified person at all times.

5.9.2 Installations Accessible to Qualified Persons Only

Electrical installations having exposed live parts shall be accessible to qualified persons only and shall comply with requirements of this standard and applicable regulatory standards.

5.9.3 Installations Accessible to Unqualified Person(s)

Electrical installations that are open to unqualified persons shall be made with metal-enclosed equipment or shall be enclosed in a vault or in an area, access to which is controlled by a lock. Metal-enclosed switchgear, unit substations, transformers, pull boxes, connection boxes, and other similar associated equipment shall be marked with appropriate caution signs. If equipment is exposed to physical damage from vehicular traffic, guards shall be provided to prevent such damage. Ventilating or similar openings in metal-enclosed equipment shall be designed so that foreign objects inserted through these openings will be deflected from energized parts.

5.9.4 Workspace About Equipment

Sufficient space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment. Where energized parts are exposed, the minimum clear workspace shall not be less than 6 feet 6 inches high (measured vertically from the floor or platform), or less than 3 feet wide (measured parallel to the equipment). The depth shall be as required in the table below. The workspace shall be adequate to permit at least a 90-degree opening of doors or hinged panels.

The minimum clear working space in front of electric equipment such as switchboards, control panels, switches, circuit breakers, motor controllers, relays, and similar equipment shall not be less than specified in the following table, unless otherwise specified. Distances shall be measured from the live parts if they are exposed or from the enclosure front or opening if the live parts are enclosed. However, working space is not required in back of equipment such as dead front switchboards or control assemblies where there are no renewable or adjustable parts (such as fuses or switches) on the back and where all connections are accessible from locations other than the back. Where rear access is required to work on de-energized parts on the back of enclosed equipment, a minimum working space of thirty (30) inches horizontally shall be provided.

Minimum Depth of Clear Working Space in Front of Electric Equipment (feet)			
Nominal Voltage to Ground Conditions*	**(a)***	**(b)***	**(c)***
601 to 2,500	3	4	5
2,501 to 9,000	4	5	6
9,001 to 25,000	5	6	9
25,001 to 75 kV	6	8	10
Above 75kV	8	10	12
***Conditions (a), (b), and (c) are as follows:** (a) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by insulating materials. Insulated wire or insulated bus bars operating at not over 300 volts are not considered live parts. (b) Exposed live parts on one side and grounded parts on the other side. Walls constructed of concrete, brick, or tiles are considered to be grounded surfaces. (c) Exposed live parts on both sides of the workspace [not guarded as provided in Condition (a)] with the operator between.			
Note: For International System of Units (SI): one foot=0.3048m.			

5.9.5 Lighting Outlets and Points of Control

The lighting outlets shall be so arranged that persons changing lamps or making repairs on the lighting system will not be endangered by live parts or other equipment. The points of control shall be so located that persons are not likely to come in contact with any live part or moving part of the equipment while turning on the lights.

5.9.6 Elevation of Unguarded Live Parts

Unguarded live parts above working spaces shall be maintained at elevations not less than specified in the following table.

Elevation of Unguarded Energized Parts Above Working Space	
Nominal Voltage Between Phases	**Minimum Elevation**
601-7,500	8 feet 6 inches
7,501-35,000	9 feet
Over 35kV	9 feet+0.37 inches per kV above 35kV
Note: For SI units: one inch=25.4 mm; one foot=0.3048 m.	

5.9.7 Entrance and Access to Workspace

At least one entrance, not less than 24 inches wide and 6 feet 6 inches high shall be provided to give access to the working space about electric equipment. On switchboard and control panels exceeding 48 inches in width, there shall be one entrance at each end of such board where practicable. Where bare energized parts at any voltage or insulated energized parts, above 600 volts are located adjacent to such entrance, they shall be guarded.

6.0 References

OSHA 29 CFR 1910 Subpart R
OSHA 29 CFR 1910 Subpart S
OSHA 29 CFR 1926 Subpart K
OSHA 29 CFR 1926 Subpart V
National Electric Code
American National Standards Institute, Z89.2-1971